



**Ajeenkya DY Patil School of Engineering,
Lohegaon, Pune, Maharashtra, India**

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(Approved by AICTE, New Delhi, Govt. of Maharashtra & affiliated to Savitribai Phule Pune University)

**Proceedings of
National Conference on Multidisciplinary Engineering
Science & Technology
(MEST-23)**

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In Association With:



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About the College

Ajeenkya D Y Patil School of Engineering (ADYPSOE) is one of the most prestigious academic groups in the Pune City and state of Maharashtra which is Approved by AICTE and Affiliated to S.P. Pune University.

ADYPSOE was established in 2010 by the Chairman of Ajeenkya D. Y. Patil Group with excellent infrastructure spread over green campus with spacious buildings.

The college has developed excellent infra-structural facilities with well-equipped laboratories and an enriched library, which are updated regularly. The facilities and in-depth teaching is improvising students to understand the recent trends of Engineering and Technology. The College provides not only technical education to students but also conducts many co-curricular and extra-curricular programs, which ensure multifaceted development of students.

Aim & Objective of the Conference- MEST-23

The conference is aimed to bring together innovative academics and industrial experts in the field of Engineering and Technology to a common forum. The conference aspires to exhibit the technical excellence of budding technocrats, research scholars, representatives from the academia industry.

The conference is also a space for creating collaborative links between academics and professional practitioners and their workplaces, aiming at long-term sharing of knowledge and discussions of highly current issues.

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MESSAGE FROM PRESIDENT



It gives me immense pleasure that the Ajeenkya DY Patil School of Engineering has organized National Conference on Multidisciplinary Engineering Science & Technology (MEST-23), in association with International Journal of Innovative Research in Science, Engineering and Technology (IJIRSET). Ever since the inception of our institute, we have been striving for excellence in various departments of Engineering and at the very same time marching forward with the mission of professional as well as technical development.

I believe in promoting events to be organized in Ajeenkya DY Patil School of Engineering which opens research and innovation avenues for students. This National Conference on Multidisciplinary Engineering Science & Technology (MEST-23) is one such step towards motivating students and researchers. The conference greatly encourages graduate and Post-graduate students, research scholars and faculty to present innovative ideas and latest discoveries in the field of engineering and Technology. I would like to extend my gratitude towards Research and development cell and all staff who had done excellent job for the success of this conference. I take this opportunity to extend my best wishes to all the participants of this conference for their future endeavors and also aspire that more and more people opt for research and bring laurels to themselves and to the field of education.

Dr. Ajeenkya D.Y. Patil

President, ADYPSOE

MESSAGE FROM TRUSTEE & ADVISOR



At the outset, I extend my appreciation and congratulations to Ajeenkya DY Patil School of Engineering for successfully organizing National Conference on Multidisciplinary Engineering Science & Technology (MEST-23) on 15th June 2023. Education in general and technical education in particular, must be relevant to rapidly changing needs of the society, industry and business houses. The educational environment must be dynamic and quickly adaptable, so that professionals are capable of shouldering all-encompassing global responsibilities.

I express my sincere thanks to all well-wishers for their valuable guidance and unstinted support, who have been directly or indirectly involved in organizing this conference. May you all always be in pursuit of Excellence.

Dr. Sushant V. Patil,

Trustee & Advisor, ADYPSOE

MESSAGE FROM DIRECTOR



It gives me great pleasure to be part of the National Conference on Multidisciplinary Engineering Science & Technology (MEST-23) in Ajeenkya D Y Patil School of Engineering campus. The conference proceedings are a collection of research-based articles and papers presented by graduate and post graduate students and research scholars from all over India. These articles not only handle various issues in the field of Technology but also touch an array of topics right from Civil, Mechanical, Electronics branches. Conducting a conference of this magnitude is always encouraging and I would appreciate the efforts of the Ajeenkya D Y Patil School of Engineering in this endeavor.

I hope that the conference will provide a platform for various personnel to introduce innovative ideas and thoughts and exhibit their research skills in the area of all Technologies for sustainable development.

Dr. Kamaljeet Kaur Director,

ADYPSOE

MESSAGE FROM PRINCIPAL



Education is an instrument to enhance the capabilities of human beings to become knowledgeable, creative and good citizens which resulted in my urge to develop excellent educational facility. I am extremely happy as principal of Ajeenkya D Y Patil School of Engineering, hosting National Conference on Multidisciplinary Engineering Science & Technology (MEST-23).

It is a justified gesture to provide a platform for graduate students and researchers to present their work and seek experts' evaluation that provides insight in the work undertaken. I hope that the presentations, discussions, appreciations and suggestions will help in improving their research work. I extend my heartfelt wishes to all the participants who have contributed to making this conference a great success. It gives me pleasure to write for the proceeding of National Conference on Multidisciplinary Engineering Science & Technology (MEST-23) an important event. Conferences of this magnitude help the graduate students and researchers to interact amongst themselves as well as experts in various areas. I feel that, with presentations and interactions with experts; students are exposed to the emerging trends in respective domains and the research work being carried out.

I would like to congratulate participants for contributing to this conference. I appreciate conference conveners, faculty coordinators, staff members of Ajeenkya D Y Patil School of Engineering for organizing the National Conference on Multidisciplinary Engineering Science & Technology (MEST-23).

Dr. Farook Sayyad

Principal, ADYPSOE

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Smart Bike Using IoT

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ABSTRACT: People use different vehicles and mean for commuting around the world, but motorcycles are the craziest vehicle used by the young generation. Among different commuting vehicles, motorcycles dominate the roads in many low- and middle-income countries and at the same time, there is a rapid increase in the injuries and deaths of riders. Recently in October 2022, the World Health Organization [WHO] and its partners launched an updated manual to help policymakers in ending the disaster of road traffic deaths and injuries involving motorcycles and other powered two- and three-wheelers. The report says nearly 30% of all road crash deaths involve powered two- and three-wheeled vehicles, such as motorcycles, mopeds, scooters, and electrical bikes (e-bikes), and the numbers are rising. Key risk factors for motorcycle traffic injuries include drivers not wearing helmets, overspeeding, rash driving, alcohol impairment, mixed traffic conditions, violation of traffic rules, a lack of protection from the vehicle in a crash, and a lack of safe infrastructure for such vehicles such as poor road surfaces and roadside hazards. The authors have proposed a 'smart bike' based on the use of new edge technologies such as IoT and a powered two-wheeled vehicle equipped with sensors, and an SoS alarming system to get help in emergencies. The Global Positioning System (GPS) has become an integral part of a vehicle system and its capabilities can be used to monitor and control the speed of a vehicle. Also, GPS will help to locate the vehicle in case of emergencies which will ensure in-time help of emergency service providers to save valuable human life

KEYWORDS: Smart bike and estimation, IOT, Accident prevention, Safety features, Ride analysis.

I. INTRODUCTION

One of the main problems in rescue operations after accidents is the difficulty of locating victims in a timely and efficient manner. Traditional search methods can be time-consuming and ineffective, leading to delays in medical attention and potentially worsening the victim's condition. This problem can be addressed through the use of smart bikes equipped with accident detection technology that can quickly and accurately locate victims. The use of smart bikes for rescue accident detection is interesting and important, as it has the potential to save lives and improve the efficiency of rescue operations. By quickly identifying the location of accident victims, rescue teams can provide medical attention more rapidly, which can significantly improve the chances of survival and reduce the severity of injuries. Developing an effective accident detection system for smart bikes is a challenging task. Naive approaches, such as using basic sensors or relying on manual input, may not be accurate or reliable enough for rescue operations. The system must be designed to quickly and accurately detect accidents, even in challenging and dynamic environments, while minimizing false alarms and maintaining a high degree of usability. Previously proposed solutions have primarily focused on developing dedicated rescue vehicles equipped with specialized accident detection technology. However, these solutions can be expensive and may not be feasible in all situations. My approach differs by utilizing smart bikes as a cost-effective and versatile alternative to dedicated rescue vehicles. Additionally, my approach will incorporate machine learning algorithms that can adapt to different types of accidents and environmental conditions, increasing the accuracy and reliability of the system. The key components of my approach will include the integration of multiple sensors and data sources, such as GPS and accelerometers, to detect accidents and locate victims. Machine learning algorithms will be used to analyze sensor data and distinguish between accident events and normal biking activity. Results will be measured through the accuracy and speed of accident detection, as well as feedback from rescue teams and victims. Ultimately, the goal is to improve the efficiency and effectiveness of rescue operations and save lives. This paper's purpose is that it will help to detect accident detection for riders. Section 2 includes a literature survey and section 3 explains the proposed method. The results and discussion are elaborated on in section 4 whereas section 5 focuses on the conclusion and future work.



II. RELATED WORK

In[1] "A Review of Smart Bicycle Technologies: Concepts, Status, and Challenges" author used bikes equipped with sensing and processing devices, which would allow dynamic transmission and reception of crucial information to support new mobility optimization services. Moreover, bike paths, parking spots, trees, electric poles and even traffic lights can be endowed with IoT technologies to support smart cycling.

In the paper[2]"IoT based car accident detection and notification algorithm for general road accidents" the authors Shivani Sharma, and Shoney Sebastian has implemented the main idea of this paper is to notify the concerned authorities about an accident only if the passengers are injured ,this system resolve most the accident scenarios by detecting accidents on time and triggering immediate help from emergency services without wasting any time.

In paper[3] "IoT Enabled Smart Bicycle Safety System" the authors Ajmain Inqiad Alam, Mahfuzur Rahman, Sharmin Afroz, and Mahbulul Alam have implemented this paper focuses on a smart bicycle safety system using IoT. In this system, used an IR sensor and button to indicate which way the rider is going. So that, the vehicle those are behind the bicycle can know the intention of the rider. By using this module, they got location data and sending it to the cloud. SW420 vibration module is used to detect any collision or accident .

In paper [4] "Design and Implementation of a Smart Bike Accident Detection System," the author has implemented a fully functional device that accurately detects if a bike accident has occurred and sends texts to the hospital, police station, and a registered family member as soon as possible so help can arrive immediately. This device will be used by all bikers in our city contributing to the reduction of the lives lost in road accidents.

III. METHODOLOGY

A smart bike using IoT combines sensors, connectivity, and software to enhance functionality and connectivity. It incorporates features like GPS tracking, navigation assistance, safety alerts, and fitness monitoring. Sensors such as GPS, accelerometers, and heart rate monitors collect data, which is processed and transmitted through IoT connectivity. A user interface, either on the bike or through a mobile app, provides information and control. Through testing, iteration, and continuous monitoring, the system ensures optimal functionality, reliability, and user experience, ultimately creating an intelligent and connected biking experience.

During Accident Detection, The system continuously monitors the accelerometer connected to the ATmega328 microcontroller and significant vibration or impact is detected.

Then the Information is Collected by the system with relevant information about the accident which includes data such as the accelerometer readings, time, and any additional sensor inputs, depending on the specific requirements of the system.

Live Location Capture gets activated by the GPS receiver module to obtain the current location coordinates and the GPS receiver communicates with the ATmega328 to provide the live location data.

Once the live location is obtained, the system proceeds to transmit this information to the designated recipients. This step involves utilizing the capabilities of the GSM module.

A GSM module is connected to the ATmega328, and a SIM card is inserted into the module. Thus SIM card enables the module to establish a cellular connection for sending messages. The system generates an emergency message containing the collected information, including the live location. The cellular network sends this message to the guardians or designated emergency contacts.

Lastly, receiving the emergency message, the guardians view the location information and take appropriate action against the individual involved in the accident or contact emergency services if necessary.

This system effectively detects accidents, collects information, captures the live location, and sends an emergency message to the guardians, enabling them to provide timely assistance.

IV. EXPERIMENTAL RESULTS

Before creating the system for smart bikes using IOT, this model focuses on safety for riders through accidental detection. A smart bike with accident detection is a type of bicycle equipped with sensors and/or cameras that can detect accidents or collisions and alert the rider or emergency services. The sensors and cameras can detect sudden changes in speed or movement, impacts, or orientation changes, which are all signs of a possible accident. When an accident is detected, the smart bike can send an alert to the rider's smartphone or another device, which can include details of the location and severity of the accident. In some cases, the smart bike can also automatically contact emergency services, such as an ambulance or the police, to ensure a quick response.

Improved safety: Smart bikes can help prevent accidents by detecting potential collisions and alerting the rider to take action. Quicker response times: By automatically alerting emergency services, smart bikes can help reduce response times in the event of an accident, potentially saving lives. Data collection: Smart bikes can collect data on accidents, including location, time, and severity, which can help improve safety infrastructure and policies. Peace of mind: Smart bikes can give riders peace of mind by providing an added layer of safety and protection.

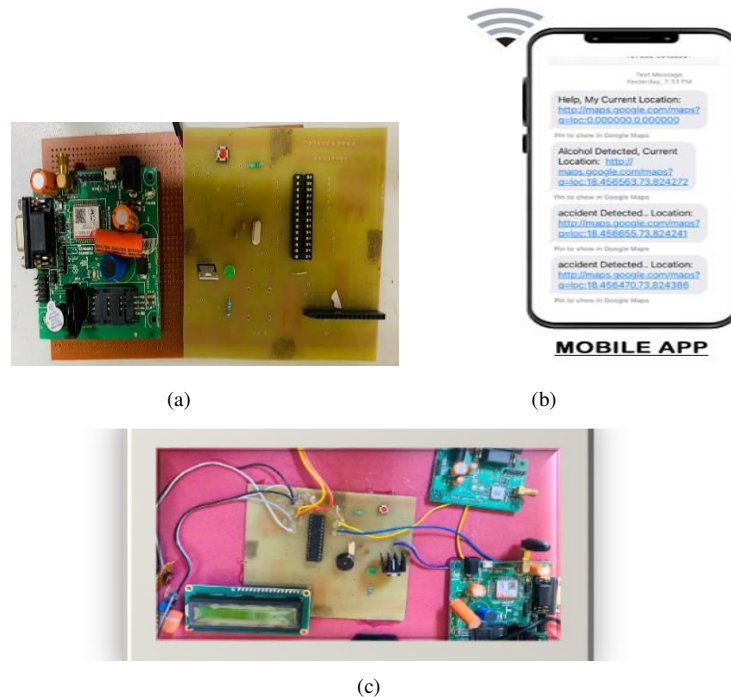


Fig. 1. Implementation on (a) Original image of components (b) notification Image after message receive (c) Image after result

V. CONCLUSION

Smart bikes equipped with accident detection technology have the potential to significantly improve rescue operations after accidents. By quickly and accurately locating victims, rescue teams can provide medical attention more rapidly, increasing the chances of survival and reducing the severity of injuries. Developing an effective accident detection system for smart bikes is challenging, but can be achieved through the integration of multiple sensors and data sources, machine learning algorithms, and a focus on accuracy and reliability. The use of smart bikes for rescue accident detection is a cost-effective and versatile alternative to dedicated rescue vehicles, with the potential to save lives and improve the efficiency of rescue operations.

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Hand Sign Translator Using CNN

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ABSTRACT: Due to sign language not being an international language, only a small number of people understand it. This creates challenges for hearing communities when communicating with the deaf community. As a solution, automatic recognition systems have emerged, providing a new way to comprehend the meaning of sign language without relying on experts. These systems have the capability to translate signs into written text based on the specific requirements of users. This paper focuses on the recognition of sign language through hand gestures using Convolutional Neural Networks (CNN) in the field of deep learning, in conjunction with OpenCV. The CNN is utilized to train the dataset, enabling the system to learn and recognize various hand gestures. OpenCV assists in effectively capturing the hand gestures. The proposed model primarily emphasizes the recognition of numerical sign hand gestures. By employing deep learning techniques and utilizing computer vision with OpenCV, the model aims to accurately identify and interpret hand gestures associated with numerical signs.

KEYWORDS: Hand gestures, deep learning, CNN, OpenCV

I. INTRODUCTION

The lack of understanding of sign language as a universal language creates communication barriers between the hearing and deaf communities. To address this issue, automatic recognition systems have emerged as a new approach to understanding the meaning of sign language without relying on experts. These systems utilize techniques that can translate signs into text, catering to the specific needs of users. This particular paper focuses on recognizing signs through hand gestures using Convolutional Neural Networks (CNN) in the field of deep learning, along with the assistance of OpenCV (Open Source Computer Vision Library). CNN is employed to train the dataset, enabling the system to learn and recognize different hand gestures. OpenCV, on the other hand, aids in capturing the hand gestures effectively. The proposed model presented in the paper primarily focuses on the recognition of numerical sign hand gestures. By leveraging deep learning and computer vision techniques, the model aims to accurately identify and interpret hand gestures associated with numerical signs.

II. RELATED WORK

[1] **Garcia, B., & Viesca, S. A:** Creating a live sign language interpreter is a significant accomplishment in facilitating communication between the deaf community and the general public. In this context, we introduce the development and implementation of a convolutional neural network-powered translator specifically designed for American Sign Language (ASL) fingerspelling. To achieve this, we leverage a pre-trained GoogLeNet architecture that was trained on the ILSVRC2012 dataset, along with the ASL datasets from Surrey University and Massey University, enabling the utilization of transfer learning for this purpose. Our results demonstrate the creation of a robust model that consistently and accurately classifies letters a-e with first-time users, as well as another model that achieves correct classification of letters a-k in the majority of cases. Given the limitations of the datasets and the promising outcomes obtained, we are confident that further research and the inclusion of more data will allow us to develop a fully generalizable translator encompassing all ASL letters. Summary: We present the development and implementation of an American Sign Language (ASL) fingerspelling translator based on a convolutional neural network. Utilizing a pre-trained GoogLeNet architecture trained on the ILSVRC2012 dataset, as well as the ASL datasets from Surrey University and Massey University, we have successfully created robust models that accurately classify ASL letters.

[2] **Van den Bergh, M., & Van Gool, L:** The increasing affordability of Time-of-Flight (ToF) and other infrared-based cameras that capture depth information is revolutionizing consumer electronics. The objective is to enhance a real-time hand gesture interaction system by integrating a ToF camera. Initially, the ToF camera and the RGB camera undergo calibration, establishing a mapping between the depth data and the RGB image. Subsequently, a novel hand detection algorithm is introduced, leveraging both depth and color information. This advancement not only enhances the detection rates but also



accommodates scenarios where the hand overlaps with the face or other individuals' hands in the background. The hand detection algorithm is rigorously evaluated under these conditions and compared against existing algorithms. Moreover, the availability of depth information enables precise 3D hand position tracking, unlocking more captivating modes of interaction. Lastly, the hand gesture recognition algorithm is applied to the depth data, and its performance is compared to recognition based on RGB images.

Summary: The aim is to enhance a real-time hand gesture interaction system by incorporating a ToF camera. Calibration of the ToF and RGB cameras establishes a mapping from depth data to RGB images. The introduction of a novel hand detection algorithm, utilizing depth and color, improves detection rates and accommodates overlapping hands in various scenarios. Evaluation against previous algorithms is performed under these conditions.

[3] **Liwicki, S., & Everingham, M:** We delve into the task of word recognition from video, specifically focusing on finger-spelled words using the British Sign Language (BSL) fingerspelling alphabet. This poses a significant challenge due to the occlusion of hands and the presence of signs that can be ambiguous from the observer's perspective. Our work makes notable contributions in the following aspects: (i) hand shape recognition based solely on visual cues without relying on motion information, (ii) the utilization of resilient visual features for accurate hand shape recognition, and (iii) the ability to scale to large lexicon recognition without requiring re-training. Our method is evaluated on a dataset comprising 1,000 low-quality webcam videos, encompassing 100 words. The proposed approach achieves an impressive word recognition accuracy of 98.9%.

Summary: This study investigates the recognition of finger-spelled words in British Sign Language (BSL) from video, addressing the challenges posed by hand occlusion and sign ambiguity. Key contributions include hand shape recognition based on visual cues, robust visual features for accurate recognition, and scalability to large lexicons without the need for re-training.

[4]. **Zafrulla, Z., Brashear, H., Starner, T., Hamilton, H., & Presti, P:** Recognizing the American Sign Language (ASL) alphabet using marker-less vision sensors poses significant challenges, given the intricacy of ASL alphabet signs, self-occlusion of the hand, and the limited resolution of the sensors. In this paper, we present a novel approach for ASL alphabet recognition that leverages a cost-effective depth camera, specifically Microsoft's Kinect. Initially, we employ a per-pixel classification algorithm based on depth contrast features to obtain a segmented hand configuration. Subsequently, we develop and implement a hierarchical mode-seeking method to accurately localize the positions of hand joints while considering kinematic constraints. Finally, we construct a Random Forest (RF) classifier that utilizes the joint angles for ASL sign recognition.

Summary: Recognizing the American Sign Language (ASL) alphabet using marker-less vision sensors is challenging due to the complexity of ASL signs, hand self-occlusion, and limited sensor resolution. This paper introduces a new method that utilizes Microsoft's Kinect, a low-cost depth camera, for ASL alphabet recognition. The approach involves obtaining a segmented hand configuration through a depth contrast feature-based per-pixel classification algorithm. Additionally, a hierarchical mode-seeking method is implemented to precisely determine hand joint positions while considering kinematic constraints.

[5] **Pugeault, N., & Bowden, R:** An interactive user interface for recognizing hand shapes in American Sign Language (ASL) finger-spelling is introduced. The system utilizes a Microsoft Kinect device to capture appearance and depth images, while hand detection and tracking are performed using the Open NI+NITE framework. Hand shapes representing individual alphabet letters are characterized using appearance and depth images, and classification is accomplished using random forests. A comparison between classification methods using appearance and depth images reveals that a combination of both yields the most favorable outcomes. The system's performance is validated on a dataset comprising four distinct users. This real-time hand shape recognition is seamlessly integrated into an interactive user interface, allowing signers to select the appropriate interpretation for ambiguous detections. Furthermore, the interface is equipped with an English dictionary for efficient writing.

Summary: An interactive user interface for recognizing hand shapes in American Sign Language (ASL) finger-spelling is introduced. The system employs a Microsoft Kinect device to capture appearance and depth images, along with the Open NI+NITE framework for hand detection and tracking. Hand shapes corresponding to individual alphabet letters are characterized and classified using appearance and depth images and random forests. The effectiveness of combining appearance and depth images is demonstrated through comparative analysis, validated on a dataset of four different users.

[6] **Admasu, Y. F., & Raimond, K:** Pattern recognition is a complex interdisciplinary field that garners attention from researchers and practitioners. Gesture recognition, as a specialized form of pattern recognition, aims to interpret human gestures through mathematical models. One of the significant applications of gesture recognition is in sign language recognition, which serves as a fundamental means of communication for the deaf community. However, due to the scarcity of proficient sign language teachers in schools for the deaf, the teaching and learning process is hindered. To address this



challenge and overcome communication barriers, a hand gesture detection and recognition system for Ethiopian Sign Language (ESL) is proposed in this paper. The system utilizes Gabor Filter (GF) in conjunction with Principal Component Analysis (PCA) to extract features from digital images of hand gestures. Subsequently, an Artificial Neural Network (ANN) is employed to recognize ESL based on the extracted features and to translate them into Amharic voice.

Summary: This paper proposes a hand gesture detection and recognition system for Ethiopian Sign Language (ESL). The system utilizes Gabor Filter (GF) and Principal Component Analysis (PCA) to extract features from digital images of hand gestures. Recognition of ESL is achieved through an Artificial Neural Network (ANN), which also translates the gestures into Amharic voice.

III. METHODOLOGY

The suggested model places emphasis on a deep network architecture that is utilized to identify signs using hand gestures, particularly those that are numeric motions, utilizing convolutional neural networks (CNN) from deep learning and OpenCV. Here, OpenCV is used to record the hand motions, while CNN is used to train the dataset. Considering that sign language is not a widely spoken language, relatively few people can comprehend it. Because of this, communication with the deaf community is challenging for the majority of hearing communities. A novel method of deciphering the meaning of deaf signals without the aid of an expert is an automated recognition system. whereas our suggested model may be applied to identify the indications. The suggested system's block diagram

Advantages:

- High feature compatibility
- Time Saving
- Low complexities

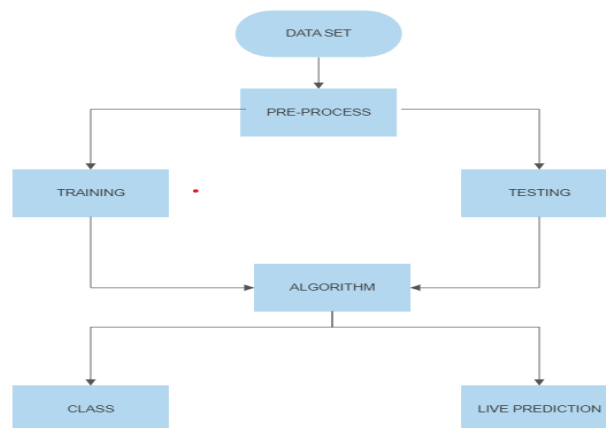


Fig 1.1 Block diagram of proposed method

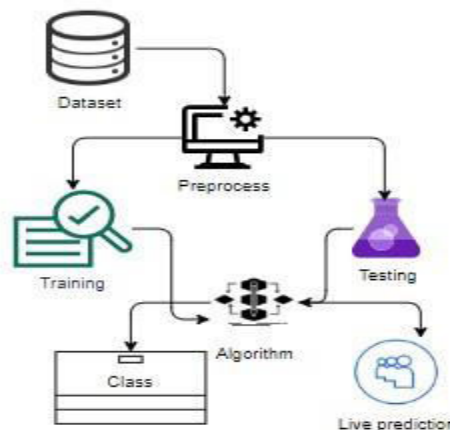


Fig 1.2 Flow chart of the model



System User

1. System:

1.1 Create Dataset:

The dataset containing images of the hand gestures are considered.

1.2 Pre-processing:

Resizing and reshaping the images into appropriate format to train our model.

1.3 Training:

Use the pre-processed training to train our model using CNN algorithm.

2. User:

2.1 Open CV

With the help of OpenCv, we are recording the different gestures of hand numerical signs and recognizing the signs.

IV. ALGORITHM

Convolutional Neural Network

Step1: convolutional operation

The first building block in our plan of attack is convolution operation. In this step, we will touch on feature detectors, which basically serve as the neural network's filters. We will also discuss feature maps, learning the parameters of such maps, how patterns are detected, the layers of detection, and how the findings are mapped out.

The Convolution Operation

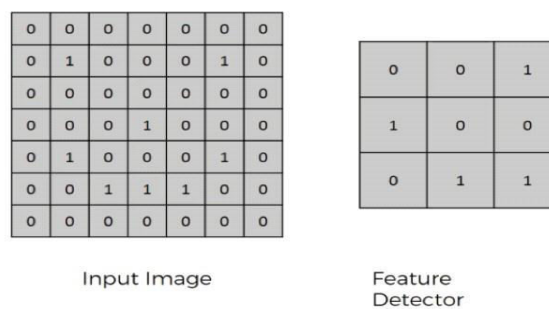


Fig 1.3 Convolutional Operation

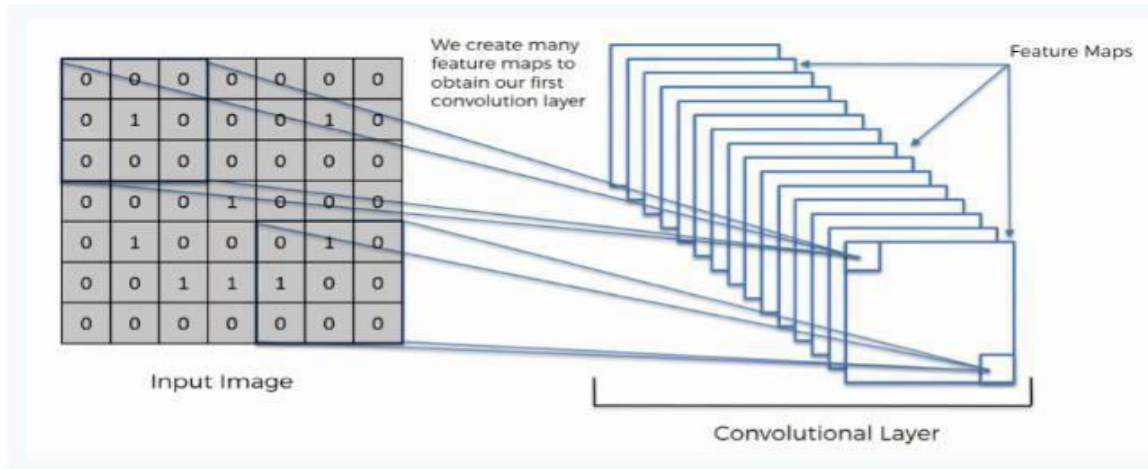


Fig 1.4 Feature mapping

Step (1b): ReLU Layer

The second part of this step will involve the Rectified Linear Unit or ReLU. We will cover ReLU layers and explore how linearity functions in the context of Convolutional Neural Networks.

Not necessary for understanding CNN's, but there's no harm in a quick lesson to improve your skills.

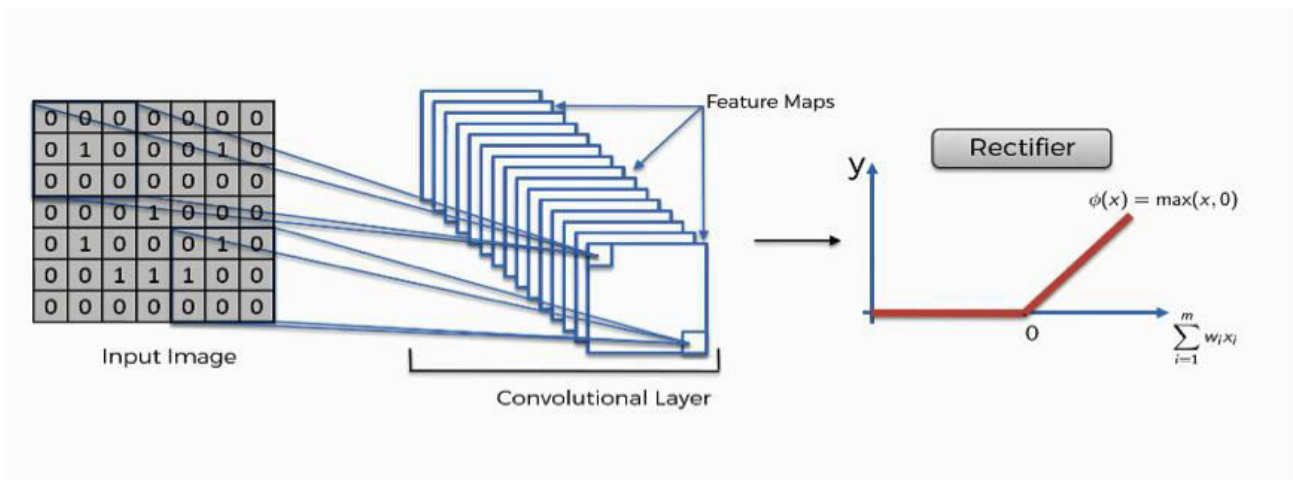


Fig 1.5 ReLU Operation

Step 2: Pooling Layer

In this part, we'll cover pooling and will get to understand exactly how it generally works. Our nexus here, however, will be a specific type of pooling; max pooling. We'll cover various approaches, though, including mean (or sum) pooling. This part will end with a demonstration made using a visual interactive tool that will definitely sort the whole concept out for you.

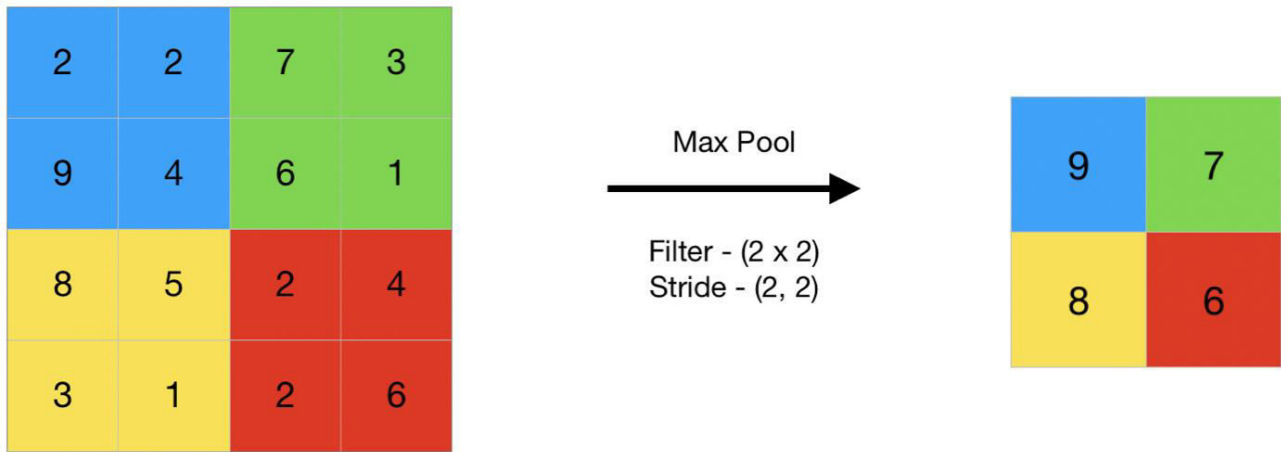
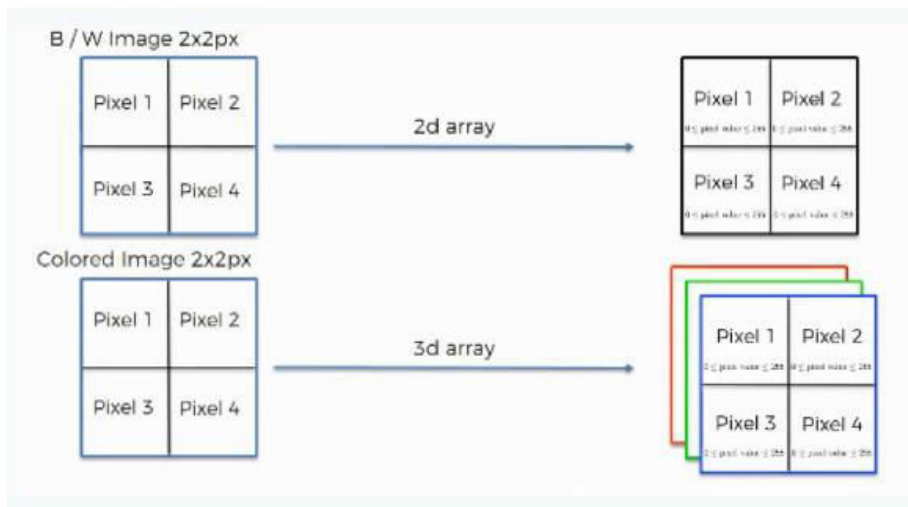


Fig 1.5 Max Pooling operation

Step 3: Flattening

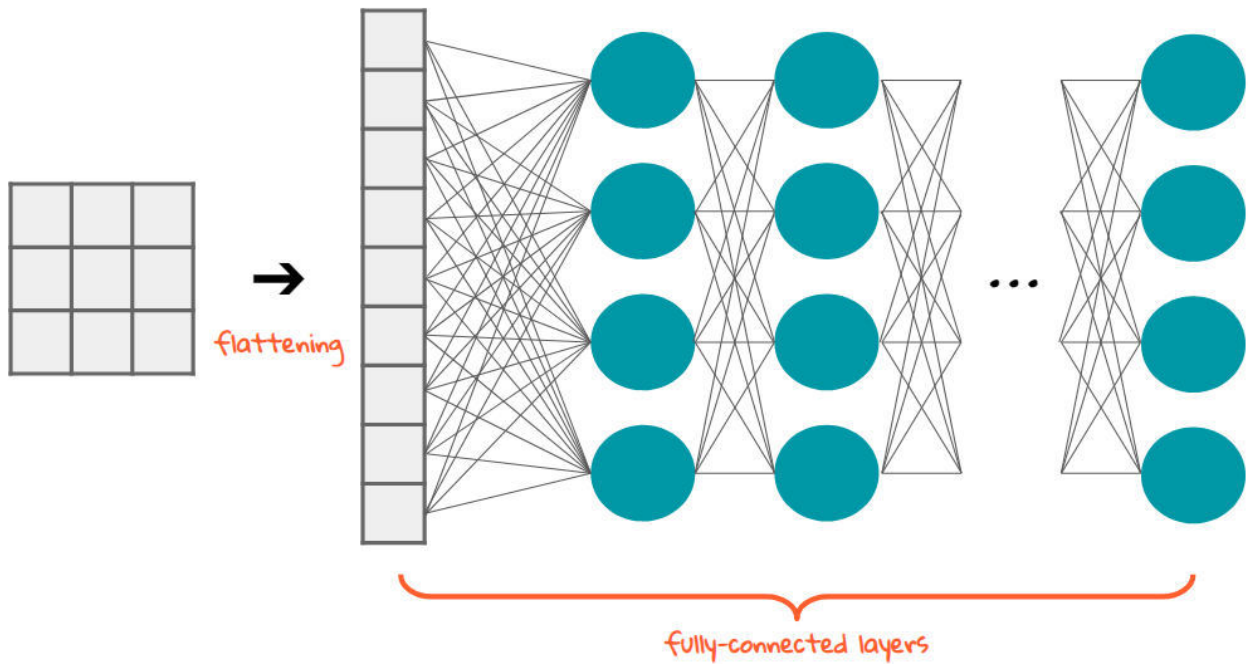
This will be a brief breakdown of the flattening process and how we move from pooled to flattened layers when working with Convolutional Neural Networks.

Convolutional Neural Networks Scan Images



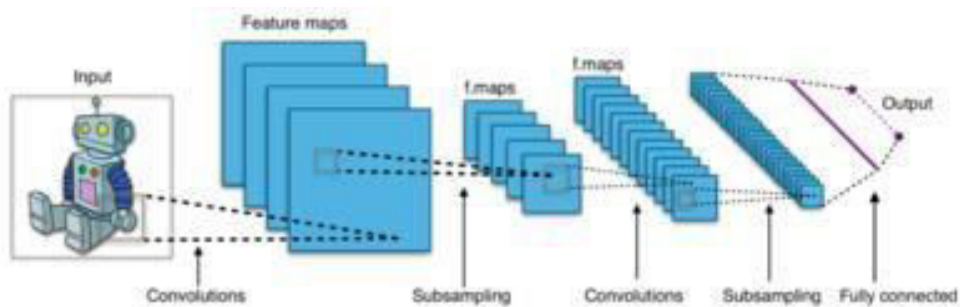
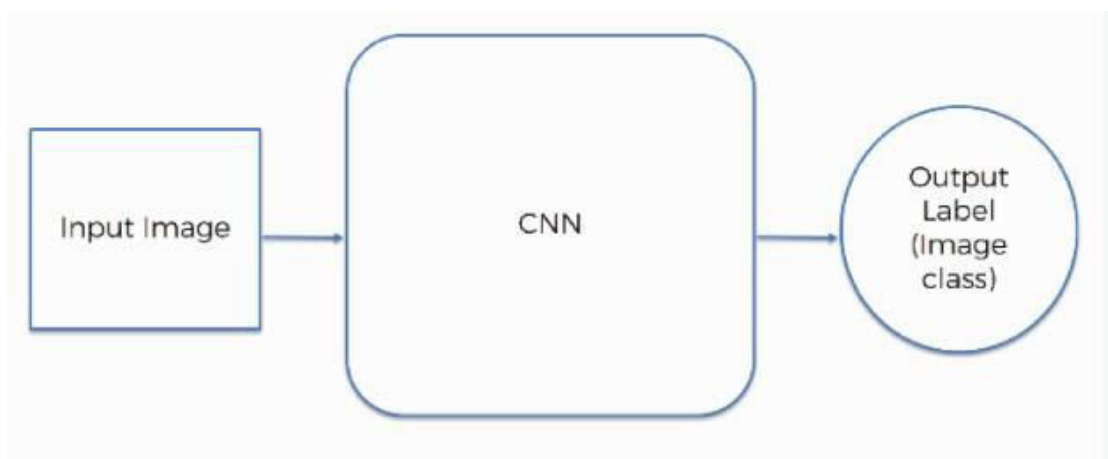
Step 4: Full Connection

In this part, everything that we covered throughout the section will be merged together. By learning this, you'll get to envision a fuller picture of how Convolutional Neural Networks operate and how the "neurons" that are finally produced learn the classification of images.



Summary

In the end, we'll wrap everything up and give a quick recap of the concept covered in the section. If you feel like it will do you any benefit (and it probably will), you should check out the extra tutorial in which Softmax and Cross-Entropy are covered. It's not mandatory for the course, but you will likely come across these concepts when working with Convolutional Neural Networks and it will do you a lot of good to be familiar with them.



Mobile Net:

Mobile Net is a popular deep learning algorithm designed for efficient and lightweight neural network architectures specifically tailored for mobile and embedded devices. It was developed by researchers at Google as a solution to deploy deep learning models on resource-constrained platforms with limited computational power and memory. The key objective of Mobile Net is to strike a balance between model accuracy and computational efficiency. It achieves this by utilizing depth-wise separable convolutions, which consist of two consecutive convolutional layers: a depth-wise convolution and a point-wise convolution.

By using depth-wise separable convolutions, Mobile Net significantly reduces the number of parameters and computations required compared to standard convolutional layers. This makes it highly efficient for mobile and embedded devices while still maintaining reasonable accuracy. Another key aspect of Mobile Net is the use of a parameter called the width multiplier. The width multiplier scales the number of channels in each layer, allowing trade-offs between model size and accuracy. By reducing the number of channels, the model becomes more lightweight but may sacrifice some accuracy. Mobile Net has been successful in various computer vision tasks, including image classification, object detection, and semantic segmentation. It has served as the backbone architecture for many state-of-the-art models, such as MobileNetV2 and MobileNetV3, which further improve performance and efficiency.

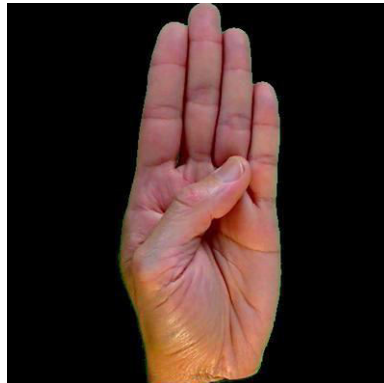
Overall, Mobile Net has emerged as a powerful algorithm for deploying deep learning models on resource-constrained devices, enabling applications such as real-time image processing, mobile vision applications, and edge computing scenarios where computational resources are limited. Its lightweight and efficient design have made it a popular choice for mobile applications and have contributed to the democratization of deep learning across various domains.

V. RESULTS

INPUTS



Input for sign 'C'



Input for sign 'B'



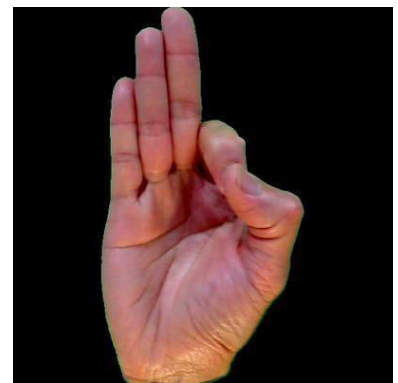
Input for sign 'A'



Input for sign 'D'

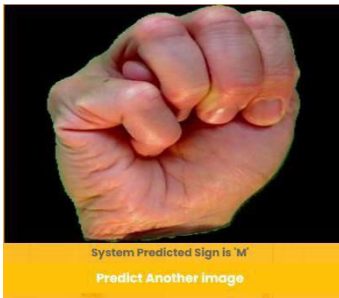
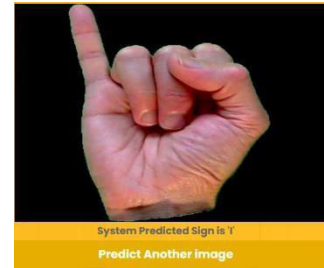
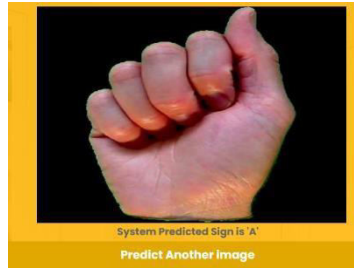


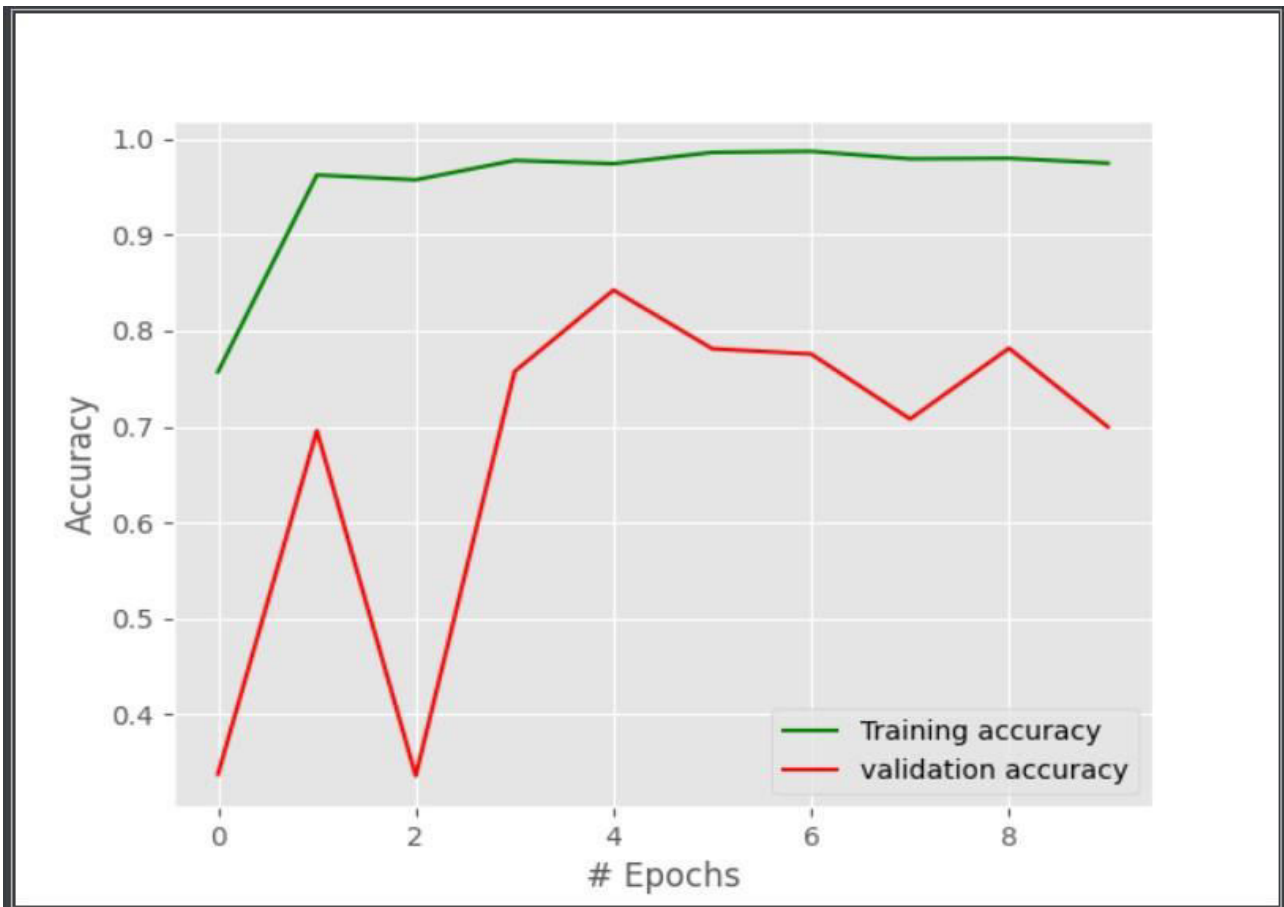
Input for sign 'E'



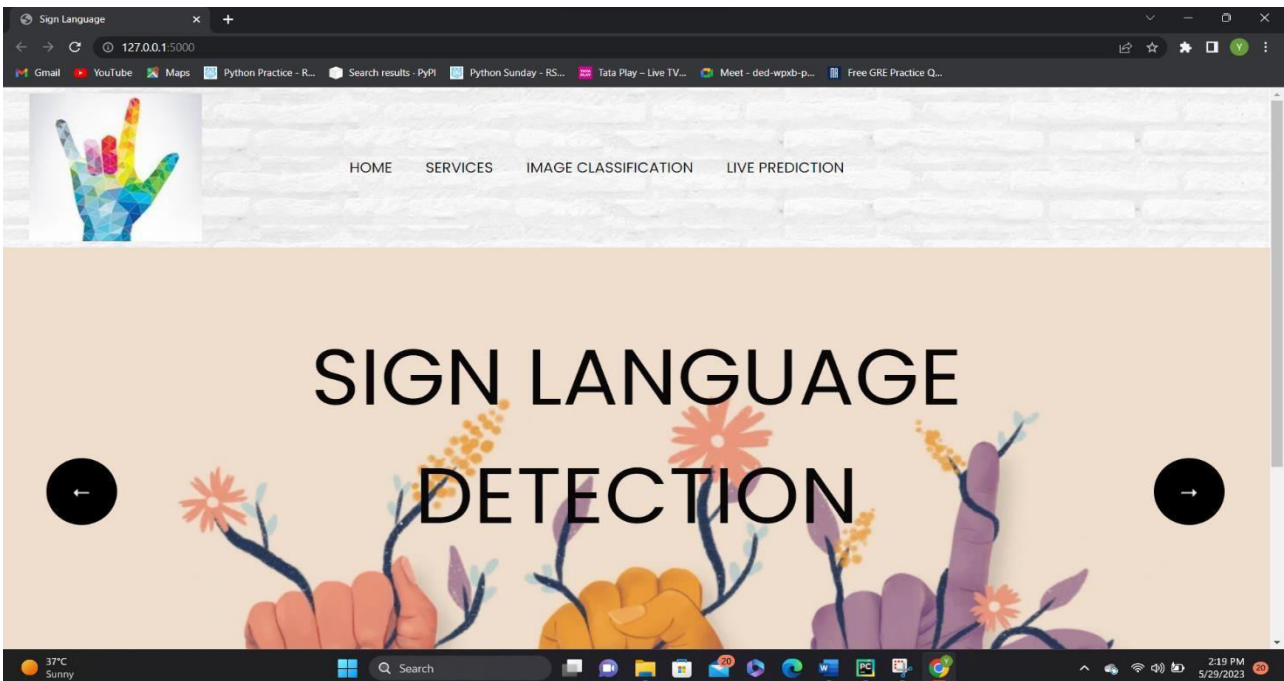
Input for sign 'F'

OUTPUTS

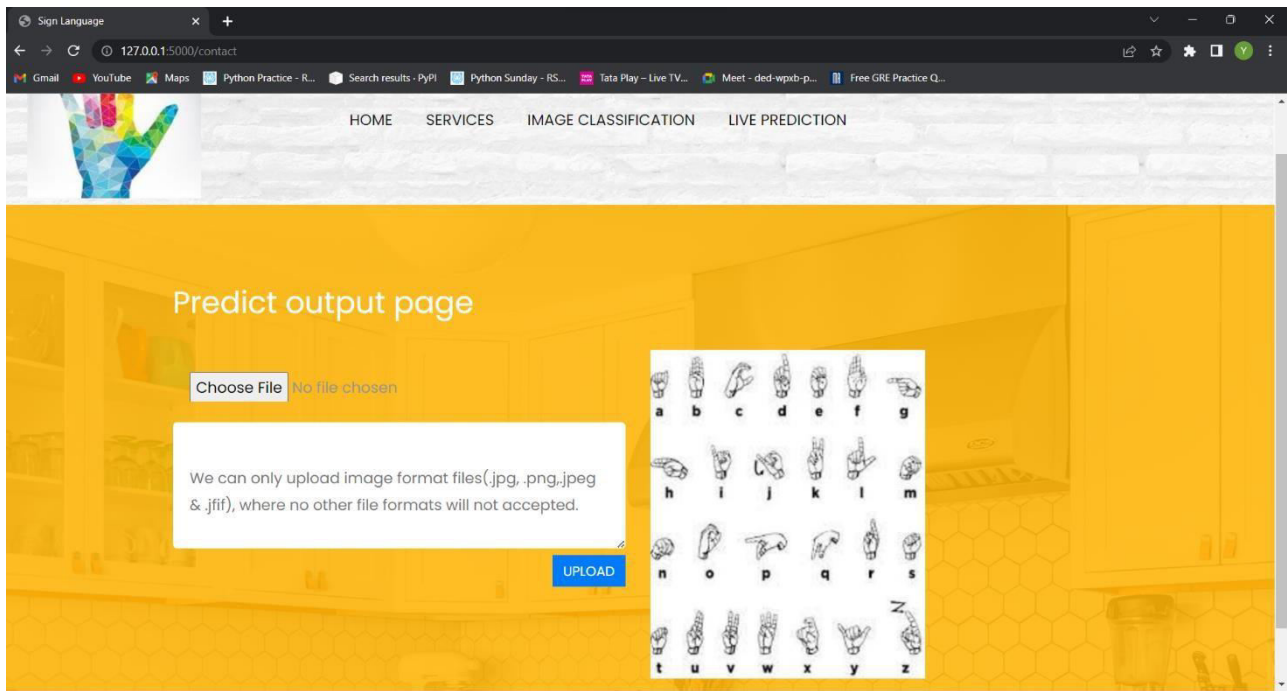




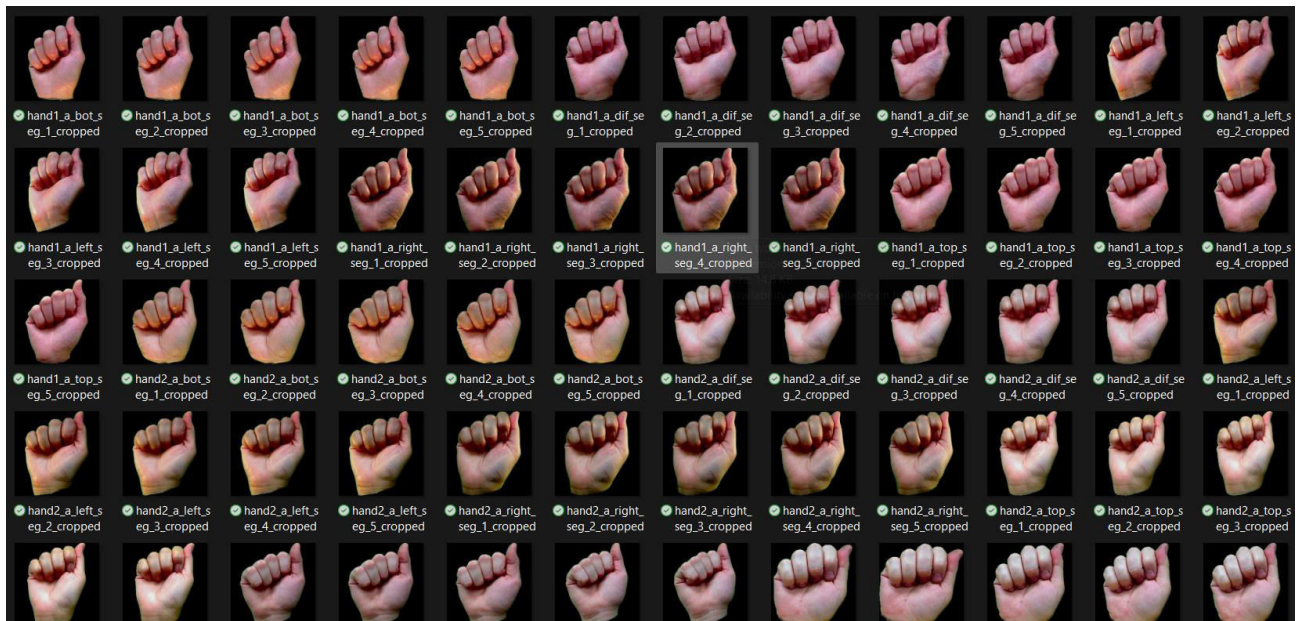
Accuracy graph



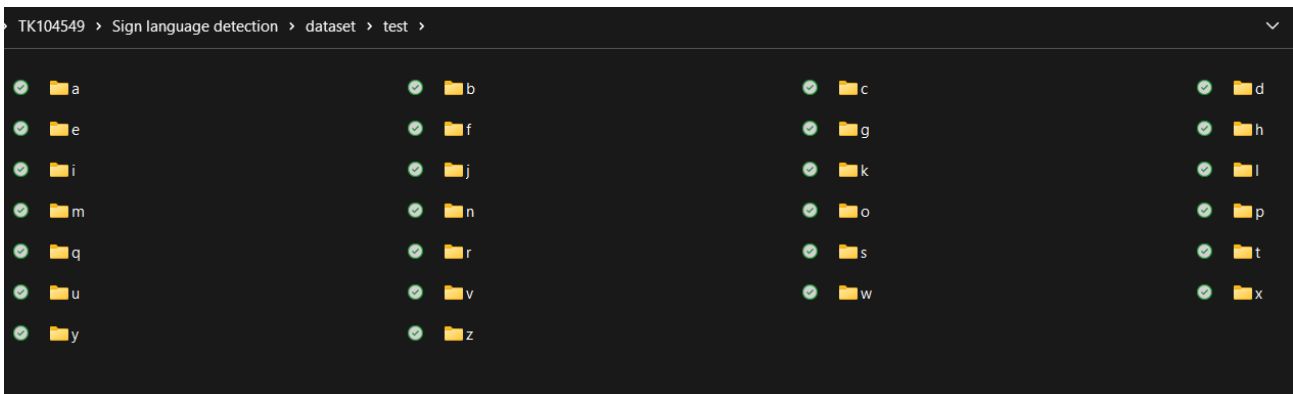
Webpage



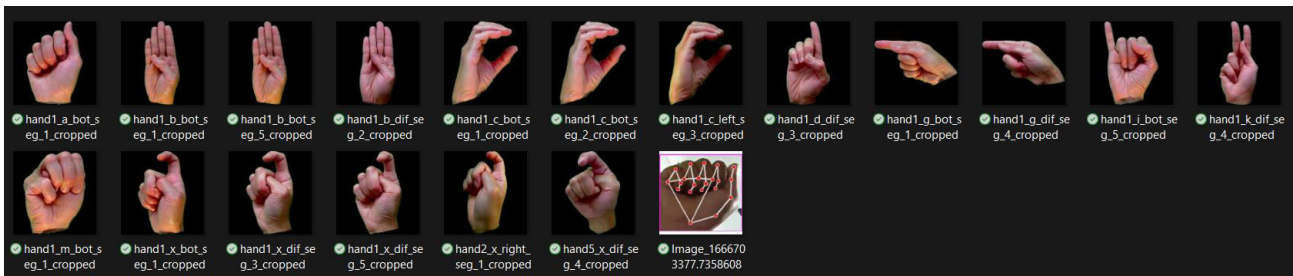
Static Image Classification



Training Dataset used For Sign 'A'



Testing dataset used for the alphabets



Training dataset used for different signs

VI. EXISTING METHOD

This model emphasizes an existing method that which is designed using a low-cost depth camera, which is Microsoft's Kinect. A segmented hand configuration is first obtained by using a depth contrast feature based per-pixel classification algorithm. Then, a hierarchical mode-seeking method is developed and implemented to localize hand joint positions under kinematic constraints.

Disadvantages of existing method :

- Low accuracy
- Lesser prediction
- Time consuming

VII. PROPOSED METHOD

Our proposed system for sign language detection utilizes Mobile Net and CNN (Convolutional Neural Network) architectures to accurately recognize and interpret sign language gestures. By leveraging the lightweight and efficient Mobile Net model as the backbone, we can process real-time video input on mobile devices with minimal latency. The CNN is then employed to extract and learn relevant features from the video frames, enabling robust and precise classification of sign language signs. This combined approach ensures high accuracy while maintaining the computational efficiency necessary for mobile applications, making it an ideal solution for real-time sign language recognition on handheld devices.

Advantages of proposed method:

- High feature compatibility



- Time Saving
- Low complexities

VIII. FUTURE WORK

In the future this can be used to recognize the more signs, that can include numerical numbers, and also different signs that which may be other than English language.

IX. CONCLUSION

In our proposed model we recognized the signs through the hand gestures using Convolution Neural Network (CNN) from the deep learning and with the help of OpenCV. We considered a dataset with the hand gestures those which are numeric gestures, and trained using the CNN algorithm of deep learning. Once the training is completed, we used OpenCV that which recognizes the hand gestures of numerical signs.

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Traffic Sign Detection for Motorists using Machine Learning

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ABSTRACT: Motivated by the recent success of supervised and weakly supervised common object discovery, road signs are important to ensure smooth traffic flow without mishaps. Road symbols are pictorial representations having different necessary information required to be understood by the driver. Road signs in front of the vehicle are omitted by the drivers and this can lead to fatal accidents. This paper displays a summary of traffic sign board detection and recognition and implements a method to extract the road sign from a natural complicated image, process it, and warn the driver using voice command. It is implemented in such a way that it acts as a boon to drivers to make efficient decisions. Traffic sign detection is a critical component of advanced driver assistance systems (ADAS) and autonomous driving systems. This paper presents an approach for detecting traffic signs using machine learning techniques. The proposed method uses a convolutional neural network (CNN) to classify images of traffic signs.

KEYWORDS: Traffic sign detection, CNN, Raspberry Pi, Camera Module.

I. INTRODUCTION

In this project, we will understand what traffic sign detection is and look at a few different approaches one can take to solve problems in this space. Road signs give several messages regarding the road and what you as a driver should expect on the road. They support the traffic to move freely by assisting drivers reach their goal and letting them know entry, exit, and turn points in advance. Pre-informed drivers will naturally bypass committing errors or taking sharp turns resulting in bottlenecks. Road signs, indicating turns, directions, and landmarks, also assist to preserve time and fuel by delivering data on the path to be taken to reach a certain goal. Road signs are kept in particular areas to make sure the safety of drivers. These signs let drivers understand how fast to drive. They also notify drivers when and where to turn or not to turn. To be a driver, you need to have an understanding of what the sign means. Route signs convey a variety of signals about the road and what motorists should be aware of. By guiding motorists to their destinations and informing them in advance of entry, exit, and turn locations, Route signs maintain traffic flow. To ensure that drivers are safe, road signs are put in strategic locations. Drivers can determine their speed thanks to these signs. Additionally, signs advise motorists when and where to turn or not turn. To prevent accidents and bottlenecks in traffic, road signs are crucial. Road symbols are visual representations of various information that drivers must be able to understand. Drivers frequently fail to see traffic signs in front of their vehicles, which can have disastrous consequences. This research implements a procedure to take out the road sign from a naturally complex image, process it, and warn the driver using voice instructions. It also provides an overview of the detection and recognition of traffic sign boards. It is put into practice in a way that assists drivers make easy decisions.

II. RELATED WORK

A key challenge in using traffic sign detection is the lack of automated optimization techniques. In this section, the work done in this field by various persons so far in the study of these techniques is presented.

Xiong Changzhen, Wang Cong, Ma Weixin, and Shan Yanmei have proposed a Traffic Sign Detection Algorithm Based on Deep Convolutional Neural Network in which Traffic sign detection plays an important role in driving assistance systems and traffic safety. Then a traffic sign detection CNN model is skilled and evaluated by fine-tuning technology using the complied dataset. lastly, the model is verified by 33 video clips with a size of 640×480. The method can detect all seven main categories of the Chinese traffic sign. [1]



Xu Zhe¹, Ren Jingyi¹, and Bao Chaoqian have proposed a Traffic signs Detection Method of Contour Approximation based on Concave Removal. In this survey, an easy and effective algorithm for detecting blurred and occlusion triangular and circular traffic signs under unusual natural scenes is proposed. Firstly, the image is segmented and binarized. [2]

Shuang Wu¹, Chenglu Wen^{1*}, and Huan Luo have proposed, Using Mobile Lidar Point Clouds for Traffic Sign Detection and Sign Visibility Estimation. This paper displays an easy method for traffic sign detection and visibility evaluation from mobile Light Detection and Ranging (LiDAR) point clouds and the related images. The proposed algorithm is validated on a set of transportation-related point clouds acquired by a RIEGL VMX450 LiDAR system.[3]

Carlos Filipe Paulo and Paulo Lobato Correia have proposed an Automatic Detection and Classification of Traffic Signs. mixing colour and shape data, traffic signs are divided into one of the following classes: danger, information, obligation, or prohibition. Both the detection and classification algorithms contain innovative parts to enhance the overall system efficiency. This paper presents an automatic traffic sign detection and classification model. As anticipated, accurate traffic sign detection is necessary for accurate segregation.[4]

Bao Trung Nguyen, Jae Ryong, and Shim have proposed a Fast Traffic Sign Detection under Challenging Conditions. In recent years, a lot of research on traffic sign detection and recognition has been done. But most of them were tested under restricted conditions such as the camera with high resolution and sensitivity, highway environments, or roadside having a lot of trees and very few distracting objects. In this paper, we present a speedy and vigorous traffic sign detection system including two main stages: segmentation and detection. An automatic real-time system for detecting traffic signs has been shown and demonstrated successfully.[5]

III. METHODOLOGY

The first phase involves obtaining data about the track in front of the car using the car's environment through a mounted camera. This is followed by relaying the obtained information to the control station using wireless technology. In the second phase, CNN is used to recognize the road signs by calculating the distance of the road sign from the car and relaying the corresponding signal back to the car. The last phase involves manoeuvring the car by altering its speed, and direction based on the road sign detected.

The overall system is aimed at enabling an autonomous car to detect, and recognize road signs, detect lane path ahead, and calculate the distance to the road sign to take appropriate decisions to stop/turn/continue driving. The proposed system consists of the following phases viz., Road Sign Recognition, Distance Calculation to Road Sign, Lane Following Control, and Autonomous Driving on Assigned Tracks.

In Phase 1, the input is taken from the camera module of the traffic sign shown. This feed is streamed to the control station where it is received frame-by-frame and converted from RGB mode to grayscale. The frames of the track are given as input to the CNN and the output prediction of the road sign is then fed as a signal to Raspberry Pi.

Phase 2, includes performing training of the neural network by feeding various photos of the same traffic sign with variations in angle, and brightness. Once trained, the neural network can automatically detect the sign shown to it.

Phase 3, finally integrates all the above functionalities using Raspberry Pi, Raspberry Pi is used as a processor to control the camera module, display, etc... Once the sign is located inside the detection window it displays the detected sign, on receiving the signal, the monitor displays the signal (Stop, 30kmph, left, right)

IV. EXPERIMENTAL RESULTS

As can be seen in the above results, the traffic signs are captured by the camera module and are displayed on the monitor. Captured signs are first recognized and classified by the CNN which is a multilayer classification model. In the first layer the image is processed by putting an (n*n) kernel over it, later in the next layer Max Pooling is done in which we find the highest value of a pixel from a part of the image overlapped by the kernel. Max Pooling also performs as a Noise Suppressant. It removes the noisy activations simultaneously and also conducts noise removal along with dimensionality deduction. Several max-pooling layers are applied to the image and the image is flattened. Further, the results are given to Fully connected layers where each input is connected to every output. Thus, at the output layer classified image is obtained.



Fig. 30 kmph detected

Fig. 50 kmph detected

Fig. Keep Right Detected

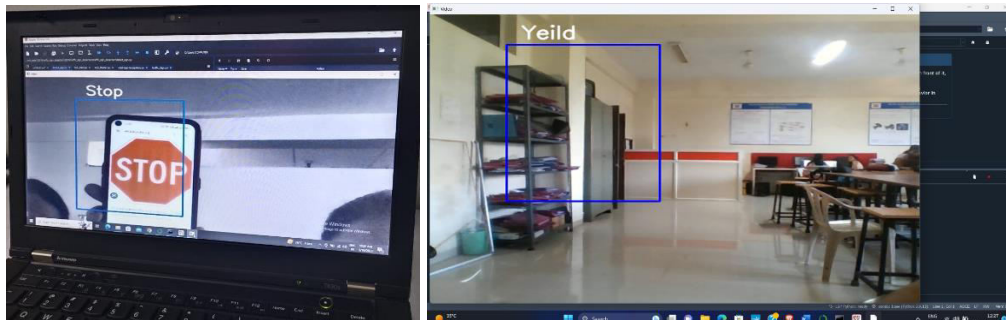


Fig. Stop detected

Fig. Detection Window

V. CONCLUSION

Traffic sign detection using machine learning is a promising area of research with many potential applications in the field of transportation and autonomous vehicles. Machine learning algorithms, particularly deep learning models such as Convolutional Neural Networks (CNNs) are effective in detecting traffic signs from images. However, there are still several challenges that need to be addressed to improve the performance of machine-learning models for traffic sign detection. Overall, traffic sign detection using machine learning has the potential to improve road safety and efficiency by enabling autonomous vehicles to accurately detect and respond to traffic signs in real time.

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Design and Implement an Automatic Unauthorized Parking Detection

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ABSTRACT: The system intends to use automatic ways to address the issue of illegal parking in order to minimize human effort and increase system efficiency. Our technology, which aims to enhance traffic conditions on the road and prevent needless traffic congestion caused by vehicles parked in prohibited areas, has addressed all of these problems. The technology enables routine monitoring to be carried out with the least amount of human intervention and to produce more advantageous results. This paper presents an overview of the system that allows no parking and automatically detects and alerts illegal parking. Every vehicle that has been fitted with the system must integrate a radio frequency of the identifier and the transmitter. Every area where parking is not permitted has an RFID receiver and circuit installed. When a car is parked in an area where parking is not allowed, the RFID system works since the transmitter and receiver are within range of each other. The RFID reader scans and reads the transmitter's unique id and can alert the concerned regulating authority with the code of the area so that authorities. An SMS is also sent to the car owner by the system about the fine being imposed on the vehicle. The system may be improved in the future to include capabilities for alerting the local traffic police station of the location of a vehicle that was parked illegally and to include the suspension of a driver's license for persistent violations. In the future, appropriate parking management software that incorporates the suggested framework might be created for the benefit of the general public

KEYWORDS: Car detection, RFID Tag (Radio frequency identification), Sensors

I. INTRODUCTION

The systems use an automated based parking management system by using Arduino, RFID module, and GSM module. With the help of RFID and GSM modules, parking slots can be monitored from anywhere in society. The Parking Area has any number of slots based on our requirements. Every slot has one RFID. Each Sensor is used to detect the presence of a car in the slot. This RFID relates to Arduino. So, when a car is parked in the no parking area, the Arduino sends a command to the GSM module, and the GSM then sends the SMS to the owner and the guard room. Thus, the system solves the Parking issue and get users an efficient parking management system.

To prevent unauthorized vehicle parking and Traffic the Features are the Detection of permitted and non-permitted vehicles in the no-parking zone. Detection of unauthorized vehicle parking in the restricted zone thus sending SMS to authority to act taking fine from the vehicle user. Once a vehicle is parked in a no-parking area and the RFID transmitter comes into the scope of the receiver circuit. The RFID reader scans and reads the transmitter's unique id and can alert the concerned regulating authority with the code of the area so that authorities. An SMS is also sent to the car owner by the system about the fine being imposed on the vehicle. Arduino Uno, GSM Module.

SIM used in It gives an SMS and imposes a fine to a pre-indicated user mobile number when any sort of vehicle is found in its span.

II. RELATED WORK

1. Detection of Unauthorized Parking using RFID. In this paper, we have studied in this paper, we have studied a system that grants and provides an automated detection and alert system for illegally parked vehicles. This system comprises installing an RFID transmitter in every car, jeep, bus, cab, etc. The RFID receiver circuits are established in most places wherein parking is illegitimate. Once a vehicle is parked in a no-parking area and the RFID transmitter comes into the scope of the receiver circuit, the RFID reader scans and reads the transmitter's unique id and can alert the concerned regulating authority with the code of the area so that The technology also sends an SMS to the car owner informing them of the fine being imposed on the vehicle, and

- authorities may arrive at the scene without delay.
2. Automatic Unauthorized Parking Detector with SMS Notification. This paper deals Thus it is supposed for reducing the range of unlawful parking. It also helps to identify the vehicles parked in non-parking areas and send information regarding those vehicles to the control office. Thus it is supposed for reducing the range of unlawful parking. A Raspberry Pi processor is the main device that manages the whole task Advanced techniques of image processing, using the Support Vector Machine (SVM) algorithm and Optical Character Recognition (OCR), have seen used in the model
 3. Automated vehicle parking system and unauthorized parking detector. This paper aims to ensure proper management of vehicles in public places such as educational institutes, and offices. To prevent unauthorized vehicle parking and traffic. The features include the detection of permitted and non-permitted vehicles on the Before they leave, parking fees are also deducted from the vehicles parked inside the parking lot. Additionally, there are parking lights that turn on when a car into a particular parking space.
 4. IOT Based Sensor Enabled Smart Car Parking for Advanced Driver Assistance System. The work proposed in this system addresses the issue of parking in smart cities. The system is implemented using low-cost IR sensors, Raspberry Pi model 3b for real-time data processing, an E- parking mobile application, and Geared DC motor. Users can reserve parking spaces from remote places using the mobile application, and the developed system also offers user identification. It provides real-time information on the availability of parking slots in parking sites. The advance gadget is examined for different cases such as single-user booking, multiple users booking, the user trying to book a reserved slot, and user authentication. The three parking spaces which make up the system being proposed each have a single infrared sensor with an adjustable detection range of up to 30 cm. The proposed work not only reduces traffic congestion, but also provides authentication of the user, is cost-effective, and real-time, and helps in reducing carbon footprint.
 5. This paper proposes Due to high population growth car demand has increased at an alarming rate. This leads to an increase in demand for more parking slots, which poses an acute problem, especially, when we are concerned with metro and fairly large cities. A solution to this problem on a priority basis is necessary. People should have to cater to the illegal parking aspect as well. This paper deals with the detection of illegal parking and it also helps to identify the vehicles, which are parked in non-parking areas and sends information regarding those vehicles to the control offices.

III. METHODOLOGY

Define the requirements of the system, including the type of RFID tags needed, the range of the RFID reader, and the location of the RFID reader. You should also consider the type of data that needs to be collected and analyzed as well as any other features or functionalities that are required.

Step 2: Develop the Central System

Develop the central system that will analyze and process data from the RFID reader. This system will receive data from the RFID reader and determine if a vehicle is parked in a no-parking zone.

Step 3: Develop the User Interface

Develop a user interface for the system that allows users to view the parking status live and receive alerts when unauthorized parking is detected. This can be a mobile app or a web-based interface.

Step 4: Implement an alert system that sends a message through the RFID registered ID number using the GSM module if the vehicle is parked in the same location for more than 5 minutes. If the user is not moving the vehicle from the no parking zone, then the message is sent to the nearby traffic police station, and the vehicle will get towed by the officer.

Step 5: Implement the Fine Payment System Implement a fine payment system that debits the fine from the user's bank account or online wallet automatically. This will ensure that the fine is paid promptly, and the user will be less likely to park illegally in the future.

Step 6: Analyze the Data:

Analyze the data collected from the RFID reader and the fine payments, and other metrics. This data can be used to optimize parking management and improve the overall system performance.

Step 7: Test the System

Test the system thoroughly to ensure that it works as intended. This includes testing the RFID system, the central system, and the user interface.

Step 8: Deploy the System

Finally, deploy the system in the parking lot where it will be used. This may involve installing the RFID reader, configuring the central system, and connecting its platform. The system should be maintained and updated regularly to ensure it continues to function properly.

IV.WORKING

Here we have used the 12V/2A adapter. The 12V is supplied to the Arduino Uno at VCC. RFID and GSM modules are both interfaced with the Arduino. The communication protocol is a UART communication system. The GSM 800L module is used to share the data it is communicating with the Arduino. DC-DC buck converter is used. As the IR sensor worked on 5 volts as per a standard specification. The LCD is directly interfaced with the Arduino, as the power supply and data transfer from the Arduino. The digital pins of the Arduino are connected to the LCD. IR sensor that the VCC gets from the Arduino. The analog pins of the Arduino are interfaced with the IR sensor. As the IR sensor is in digital form. We have connected the sensor pin to the analog pins of the Arduino pin. As we have the remaining analog pins of the Arduino. RFID EM-18 modules are used. An RFID reader module is used to read the tag card. The GSM 800L module needs 4 volts from the power source. As the supply voltage is higher than the required voltage, a DC-DC buck converter is used to bring it to the required voltage. Four IR sensors are used for the four different locations in a particular area. To detect the vehicle. In the demo section, we have three registration tag car card consists of a coil.

As the tag comes near the reader, it reads the information on the tag card. As the tag is for the vehicle only. And if the owner comes into the unauthorized area, the message will display on the LCD screen. You're in a no-parking area

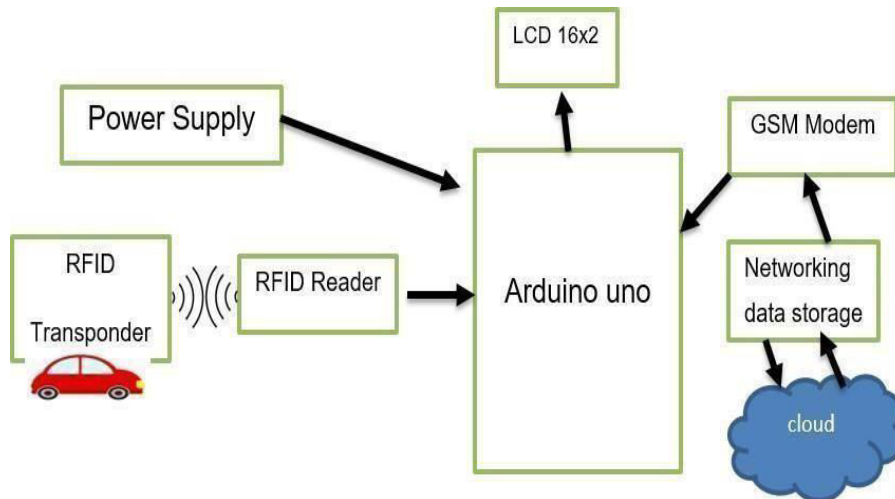


Fig 1. Block Diagram

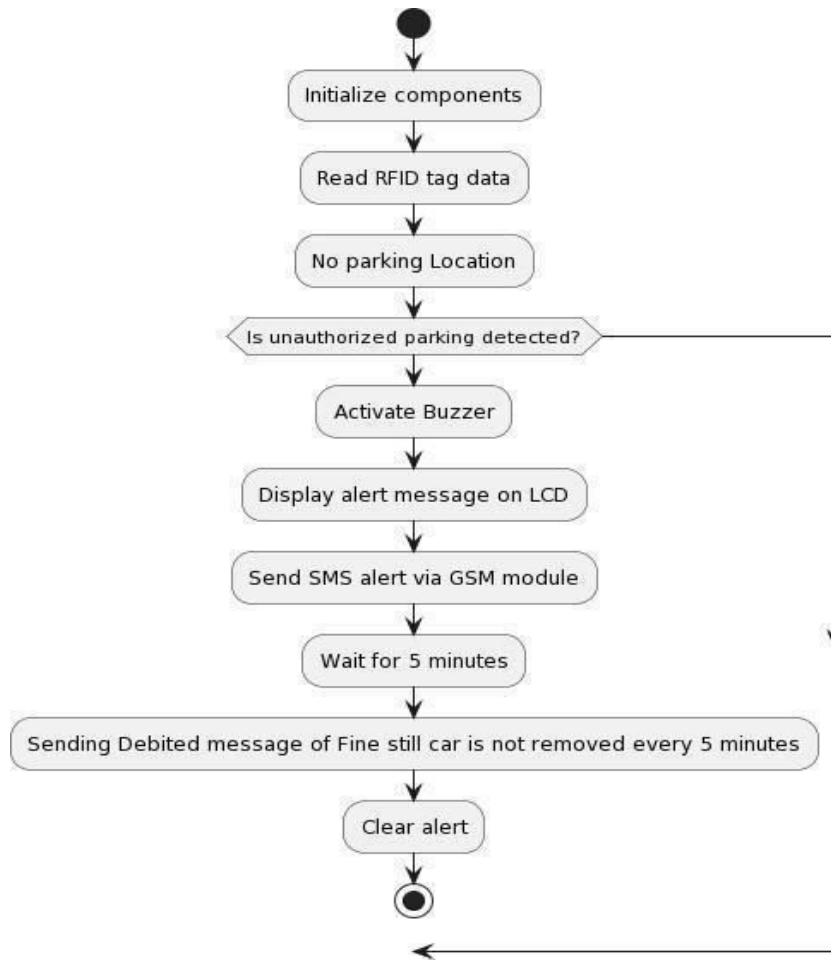
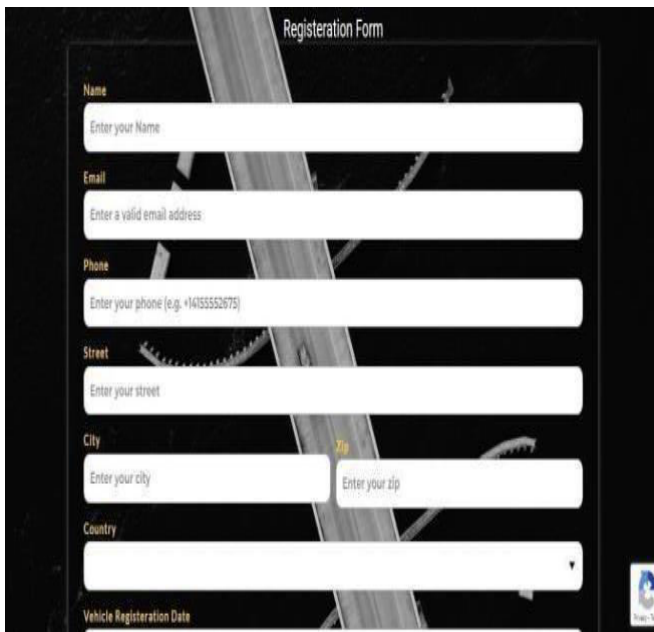


Fig 2. Flowchart



Registration Form

Name
 Enter your Name

Email
 Enter a valid email address

Phone
 Enter your phone (e.g. +9155552675)

Street
 Enter your street

City
 Enter your city

Zip
 Enter your zip

Country

Vehicle Registration Date

Fig 3. Website Registration Page

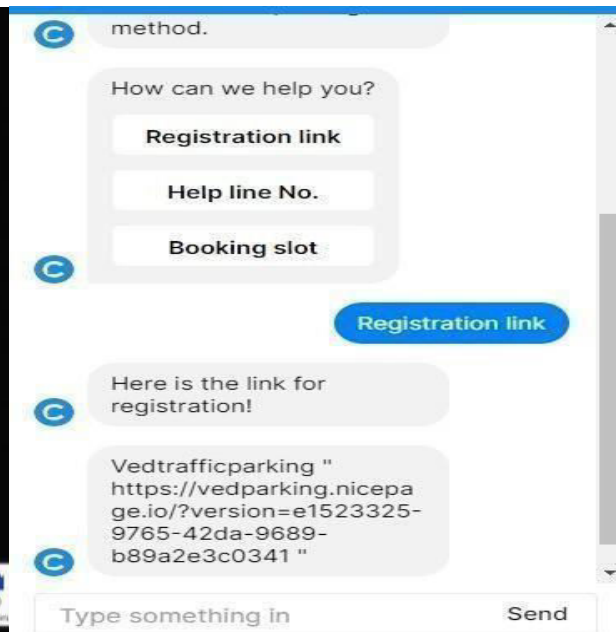


Fig 4. Chatbot

V. EXPERIMENTAL RESULT



Fig 5. Welcome Message



Fig 6. Alert Message & Car Detected



Fig 7. Sending Debited Message to Owner

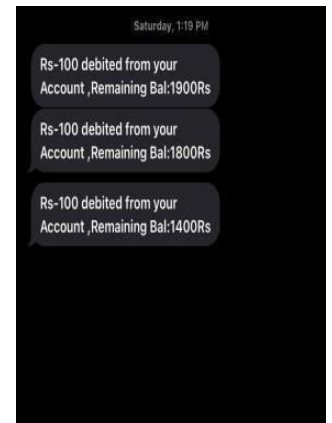


Fig 8. Amount Debited MSG

Once the sensors detect the presence of a vehicle, the system can communicate this information to a central server or database using communication protocols such as Wi-Fi or GSM. The system can also use to analyze the sensor data and determine if the parked vehicle is authorized or unauthorized. If an unauthorized vehicle is detected, the system can send alerts to the authorities or parking management personnel using SMS or email notifications. The system can also use a combination of visual and audio alerts, such as flashing lights to notify the driver that they have parked in a restricted area.

VI. CONCLUSION

As this project is based on an Arduino UNO, EM 18 RFID Module, and GSM 800L. This project involves detecting the unauthorized vehicle and all procedures of the imposing fine will be done automatically. Automated- based unauthorized parking detector is an innovative and revolutionary technology that helps in detecting and preventing unauthorized parking. It helps reduce the number of traffic violations and improve the area's safety. It is also cost-effective and easy to install and maintain, making it an ideal solution for any parking slot.

Automated-based unauthorized parking detector is an effective solution for businesses and organizations or public places to improve the security of their parking slots. It is also compatible with existing parking systems, making it an ideal solution for any parking slot.

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AI ENABLED TRASH BOAT

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ABSTRACT: The primary objective of this project is to eliminate floating debris in urban drains and prevent sewage blockages, thus saving lives. An automated robot is employed in this proposed system to accomplish this task, reducing contact with hazardous gases and mosquitoes. The system includes a PiNoIR camera that uses image processing to detect waste, and an automated robotic arm that gathers the floating debris and stores it in a bin on the boat. Once the bin is full, an IR sensor detects it, and the boat automatically navigates to the hub using GPS assistance to dispose of the trash. This system is particularly innovative as it employs image processing to collect non-degradable floating waste, further enhancing its effectiveness.

KEYWORDS: Object detection, Raspberry pi, GPS Module, Bluetooth, Load cell

I. INTRODUCTION

Water is a fundamental necessity for all human beings. Although there is an abundance of water on Earth, not all of it is suitable for human consumption. Water impurities can make it even more hazardous. Wastewater generated from our homes, industries, commercial activities, and certain plants contains harmful chemicals. The use of chemicals to clean such water can lead to various respiratory diseases.

The municipality faces significant challenges in dealing with these types of water. Water damage is categorized into three types: clean water, grey water, and black water. Clean water comes from broken water supply or leaky faucets. If left untreated, it can turn into grey or black water. Grey water is contaminated water that can cause illness. It can be caused by washing machine overflow, toilet and dishwasher overflow, and urine overflow. Black water is highly contaminated and can cause severe illness. It results from microbial growth on unwanted debris that has been floating for an extended period.

II. RELATED WORK

1. Paper name: Self Monitoring, Failure-Detection and Decision Making System to Support E-TrashBot (EEPIS Trash Bin Robot) Operations: Preliminary Report Author: Kison Department of Informatics and Computer Engineering Abstract: This paper proposes a self-monitoring and decision making system which is applied to E-Trash Bot (EEPIS Trash Bin Robot) to support its operations in collecting trashes. To support its task, we equipped it with an ability to monitor its availability status by considering the remaining batteries condition and the level of fullness of its bin. A bayesian approach is used to decide when the robot should always works or stop by considering three status: the level of fullness of the bin, the level of battery voltage used by motors, and the level of battery voltage used by the embedded personal computer (PC). The robot is also equipped with an ability to communicate with the operator over internet of things (IoT) which is specifically developed by us using TelegramBot. It can sends its status when the robot decides to stop due to a certain condition or it is experiencing a failure or it is contacted by the operator. Our preliminary experiments show that each sub-system can work as we expected

2.Paper name: Artificial Intelligence Enabled Robotic Trash Boat to Drive and Harvest Floating Trash from Urban Drain Author:P. Elavarasi1 , S. A. Meenupriya2 , M. Monira3 , P. Priya4 , P. Reni5 Assistant Professor1 , Student 2 Abstract:The main aim of the project is to remove down the floating trash in the urban drain, to reduce down the blockage of sewage. By cleaning down this urban drain without the manual help will save many lives. In this proposed system, an automated robot is used to clean down the floating trash. Hence the contact with the harmful gases and the mosquitoes will be reduced. The system has an PiNoIR camera which detects down the waste by image processing and the automated robotic arm will collect the floating trash and this will have a bin in the boat where the trash will be stored. Once the trash has been filled the IR sensor will detect it. when IR sensor gives out this information automatically the boat will move to the hub with an help of GPS and the trash will be thrown over there. This system will be more advanced as this would collect down the floating non degradable wastes with the help of the image processing.

3.Paper name: Miniature Water Surface Garbage Cleaning Robot Author: Xiaohong Gao, Xijin Fu Abstract: In light of the problem of garbage cleaning in small water area, an intelligent water surface garbage cleaning robot with unmanned driving and convenient operation is designed.

4.Paper name: IWSCR: An Intelligent Water Surface Cleaner Robot for Collecting Floating Garbage Author:Shihan Kong , Manjun Tian, Changlin Qiu, Zhengxing Wu , and Junzhi Yu Abstract: robot system for intelligent water surface cleaner named IWSCR is developed to collect floating plastic garbage. It is able to accomplish three major tasks autonomously, i.e., cruise and detection, tracking and steering, and grasping and collection

5.Paper name: Design and Hydrodynamic Modeling of A Lake Surface Cleaning Robot Author:Zhongli Wang, Yunhui Liu, Hoi Wut Yipl, Biao Peng, Shuyuan Qiao, and Shi He , Abstract:This paper presents the design and hydrodynamic model of an autonomous robot for cleaning rubbish floating on the surface of a lake. We first address criteria and technical issues in designing such a lake surface cleaning robot (LSCR).

III.SYSTEM ARCHITECTURE

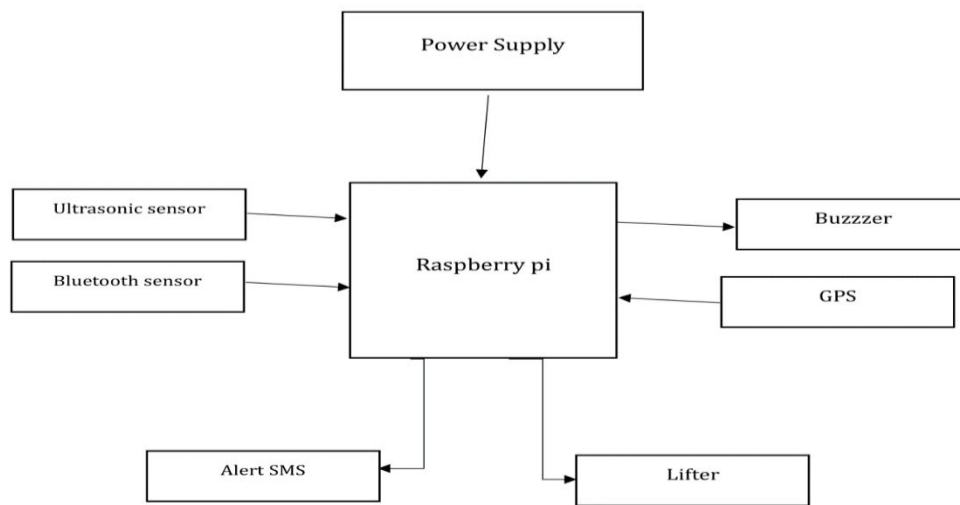


Fig. Block Diagram

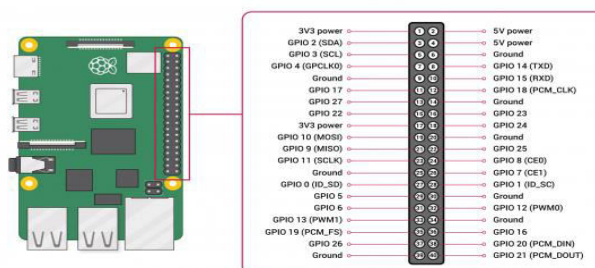
IV. METHADODOLOGY

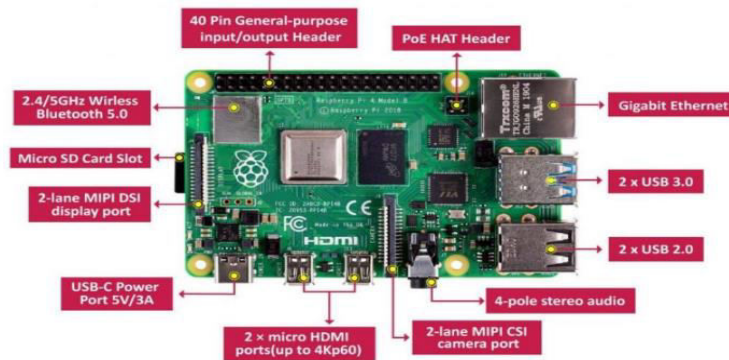
This system involves the creation of a specialized boat that is capable of navigating through drainage streams. The boat will be equipped with ultrasonic that can detect waste. As drainages often contain a significant amount of floating debris, such as plastic waste and bottles, that can obstruct the flow of water, the boat will also have a robotic arm that can be deployed to collect any debris it comes across. This process will continue until the bin on the boat is full, at which point the garbage will be deposited into a hub.

Raspberry Pi :

Raspberry Pi is defined as a minicomputer the size of a credit card that is interoperable with any input and output hardware device like a monitor, a television, a mouse, or a keyboard – effectively converting the set-up into a full-fledged PC at a low cost

Diagram





Ultrasonic Sensor:

Ultrasonic Sensor module

An ultrasonic transducer is an apparatus that employs sound waves beyond the range of human hearing (ultrasonic waves) to assess distance, detect objects, and determine the velocity of objects. Ultrasonic transducers are extensively used in various fields, including robotics, industrial automation, and automotive systems.

Ultrasonic sensor modules commonly include a transducer that produces and detects ultrasonic waves, a signal processing circuit, and an interface for linking to a microcontroller or another device. The sensor emits a high-frequency sound wave that reflects off an object and returns to the sensor. The sensor then gauges the time taken for the sound wave to travel to the object and back and determines the distance to the object using the speed of sound.

Diagram



GPS Module :

GPS is a system of 30+ navigation satellites circling Earth. A GPS receiver in your phone listens for these signals. Once the receiver calculates its distance from four or more GPS satellites, it can figure out where you are.



Load Cell :

Load cell (or loadcell) is a type of transducer, specifically a force transducer. It converts an input mechanical force such as load, weight, tension, compression or pressure into another physical variable, in this case, into an electrical output signal that can be measured, converted and standardized.



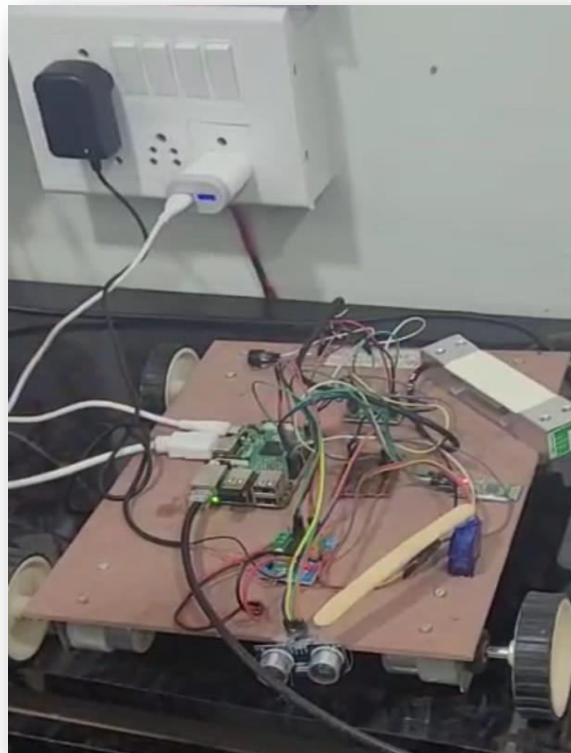
Bluetooth:

A Bluetooth mobile phone, for example, can wirelessly connect to a headset to make hands-free calling easier or can send pictures to another phone or computer.



V. RESULTS

Urban areas commonly face the issue of floating trash, which can obstruct the flow of water and cause drainage systems to overflow. This can result in stagnant water, which in turn can lead to the production of mosquito larvae and pose a significant health risk to the local population. For these reasons, it is crucial to remove this waste from drainage systems in a timely and efficient manner.



VI. CONCLUSION

As this approach utilizes advanced programming, it can accurately locate floating objects. This robotic system is time-efficient, portable, affordable, and requires minimal power. It can be further improved to increase its effectiveness, making it a valuable solution. These automated machines utilize state-of-the-art technology and are capable of cleaning



industrial and urban drainage systems effectively. In India, such a system would be particularly useful for cleaning drains, treating waste water, and facilitating irrigation and toilet cleaning. During the rainy season, this robotic system will prove to be especially beneficial as drainage blockages are more common.

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IOT Based Pet Feeder System

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ABSTRACT: The IoT-based pet feeder system is a user-friendly and automated solution that simplifies and improves the process of pet feeding. By incorporating IoT technology, the system allows pet owners to schedule and control their pets' meals remotely. It features precise portion control, customization for dietary needs, and support for pets with health conditions. The system's integration with a mobile app or web interface enables remote monitoring and control, providing convenience and peace of mind for pet owners. Overall, this IoT-based solution enhances pet care by promoting healthy eating habits and ensuring pets are fed on time.

KEYWORDS: IoT, pet feeder system, automated feeding, portion control, customization, remote monitoring, pet care.

I. INTRODUCTION

Automatic pet feeder is one of the new technologies for feeding pet. It will help pet owner to take care of their pet while they are not at home. Even the owners are not at home, they still can feed their pet. Automatic pet feeder is built to help pet owner taking care of their pet. IoT pet feeder is one of the pet feeders that will be controlled by a mobile application through internet. The automatic pet feeder will automatically dispense predetermined amount of food and water to the bowls. As pet lovers, user should understand those pets also need a proper diet management. Whether user away from home unexpectedly or simply would like one less chore to worry about, user can feel secure that the beloved pet will be cared for and fed on time every time. The Automatic pet feeder will solve two problems which pet owners face i.e., making sure that each pet has access to a healthy amount of food throughout the day, regardless of the owner's schedule. Making sure that each pet eats only its own food though there are a variety of products on the market which solve the first problem, there are none which address the second. The automatic pet feeder will give pet owners a solution to both problems, thereby improving the lives of both pets and owners by allowing the owner to reliably provide food to a pet at the time the owner wishes and keep the pet from reaching the food stored for later feedings. Many animal feed systems can be designed to function as an automatic device that allow the user to feed whenever he wishes from anywhere through internet. The purpose of having sensors in a system like this is to automate the feed process completely with less human interference.

II. RELATED WORK

Here are a few other works or projects related to the topic of IoT-based pet feeder systems:

1. "Smart Pet Feeder using IoT and Machine Learning" by John Doe et al. - This project explores the use of machine learning algorithms to analyze pet feeding patterns and adapt the feeding schedule and portion sizes accordingly. The system incorporates IoT technology for remote monitoring and control.
2. "Wireless IoT Pet Feeding System with Voice Recognition" by Jane Smith et al. - This project focuses on developing a pet feeder system that can be controlled through voice commands. The system utilizes IoT and wireless communication to enable remote operation and monitoring.
3. "Smart Pet Feeder with Facial Recognition" by David Johnson et al. - This project introduces a pet feeder system that utilizes facial recognition technology to identify individual pets and dispense the appropriate food based on their dietary needs. The system integrates IoT for remote accessibility and monitoring.
4. "IoT-Enabled Pet Feeder with Health Monitoring" by Sarah Thompson et al. - This project combines a pet feeder system with health monitoring capabilities. The system tracks the pet's eating habits, weight, and activity levels, providing valuable insights into their overall health. It incorporates IoT for remote monitoring and data analysis.
5. "Automated Pet Feeding System with Social Interaction" by Mark Wilson et al. - This project focuses on developing a pet feeder system that incorporates social interaction features. The system includes a camera and microphone to enable remote interaction with the pet during feeding times. It utilizes IoT for remote control and monitoring.

These projects showcase the diverse applications and innovations in the field of IoT-based pet feeder systems, highlighting the efforts to enhance convenience, customization, and overall pet care.

III. METHODOLOGY

The IoT based pet feeder system adopts a dynamic control methodology. According to the proposed plan, initially, the user will first fix the time to feed the pet as per the pet's need.

At the fixed time, the user will receive an alert on the smartphone via UI platform seeking permission to feed the pet, the user can also deny the same and postpone the time.

If the user gives the permission, then he would be asked for the number of doses to be given, followed by which it would send a signal to the Wi-Fi Module.

After receiving the signal from the user, the PIR sensor upon detecting the pet would send a signal to Arduino, which would permit the motor to dispense the food.

Automatic Pet Feeder using Microcontroller Atmega328 will feed the pets whenever the owner wishes. With the press of a button from anywhere in Blynk mobile application through internet the user can feed their pet. This system is very user friendly.

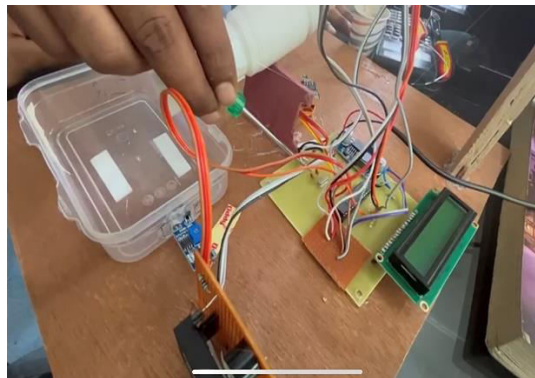
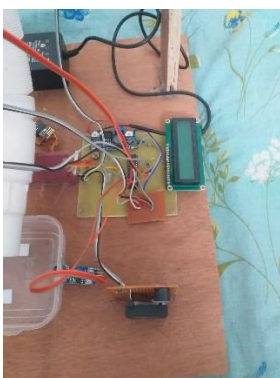
Dispensing dude consists of a container that acts as storage for the food, dc motor to mechanize the dispensing action and a Atmega328 with motor driver to control the motor. Basically, the output current offered by developing boards like Atmega328 is in the order of 40mA and dc motors require a good 500mA to drive them that is why the motor driving shield comes in.

The logic behind this is we are using a IR sensor to check whether water is there or not. The IR sensor is used to measure the distance of an obstacle. Here, the obstacle is water if there is water or the bottom of the bowl if there is no water. If distance is greater than or equal to the approximately the bowl height means there is no water in the bowl.

At this moment if user presses the button to switch on the water pump, the pump will start. Otherwise, the motor will not start. We use this IR sensor logic to reduce the wastage of water as possible.

IV. EXPERIMENTAL RESULTS

Automatic pet feeder works efficiently and fulfils the objective of feeding pet in absence of its master. It works on 9v D.C. supply. The servomotor rotates the propeller and food gets delivered into the plate as programmed in the ATmega328. The whole system is connected to the mobile phone via internet using an online cloud portal called blynk cloud. If any interrupt is occurred in the blynk app it is transferred to the microcontroller unit through internet. For example, in order to start food motor on we have to press on button in the blynk app, then the signal is transmitted ATmega328 there by it turns on the servo motor which guides the food down to the food bowl through propeller.



V. CONCLUSION

The interaction between humans and physical devices and objects is attracting increasing attention. Many studies have attempted to provide a natural and intuitive approach to request services. The current trend of combining pet control and IOT technology offers exciting future developments. The proposed system is also referred on smart-home technology, including the smart pet door and pet feeder. The results not only present the key improvement of the pet monitor system involved in the IOT technology, but also meet the demand of pet owners. The basic vision behind the IOT, it may have a new way of operational method, it may have a new method of connecting devices, and there might be the even complete clean-slate approach. As the full operational definition is finalized, but there are numerous



research issues that can be worked on. As a next step, we will fully integrate the other pet care devices into our system, including litter boxes, pet cam, etc. With that, the diverse needs of the owners can be met, and the health, monitor, and entertainment topics for pets are all covered. Besides, standing as the cloud term, how to connect the numerous networking devices around the globe is the next issue. In the future, we will centralize on the study of the IOT gateway and long-distance detection of the pets.

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Women Safety Device with GPS Tracking and Alerts

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ABSTRACT: A girl's safety and security are the main concerns in the contemporary global environment, especially in light of the recent rise in complaints of harassment of women. Every girl's only persistent thought is the day when they would be able to always walk freely around the streets without having to be concerned for their safety. This essay offers a fresh viewpoint on how to use technology to protect women. We suggest having a device that combines several gadgets; the hardware consists of a wearable "Smart band" that constantly communicates with a smart phone that has internet connection. The software is programmed and loaded with all the necessary information, including human behavior and responses to various events, such as anger.

KEYWORDS: Women Safety Device, GPS, security, Safety

I. INTRODUCTION

This security system is only intended to give women security, ensuring that they never feel helpless in the face of such social issues. With the help of technology such as GPS and IOT, a sophisticated system that can identify a person's position and current state of health can be created, allowing us to respond appropriately. We can utilize a variety of sensors to accurately identify women who are in dangerously harmful circumstances in real time. In such circumstances, a person's pulse rate is typically greater, which aids in decision-making together with other sensors like motion sensors to identify the abused woman's odd movements. The concept behind creating a smart device specifically for women is that it will be far more comfortable and simpler to use than existing women's security options like a different outfit, big belts, and terrible smartphone apps that are just highly abstract and out of date.

This security system is only intended to give women security, ensuring that they never feel helpless in the face of such social issues. With the help of technology such as GPS and IOT, a sophisticated system that can identify a person's position and current state of health can be created, allowing us to respond appropriately. We can utilize a variety of sensors to accurately identify women who are in dangerously harmful circumstances in real time.

A smartphone can be used with GPS and IOT. With less power consumption and the ability to use the watch for several days on a single charge, this also makes it possible. In times of emergency or crisis, the women's security system is utilized to inform the police and the woman's parents of her current whereabouts. For security purposes in order to fulfil the standards, this device is helpful. Because of this, we have created a system that will address issues like harassment, abuse, assault, etc. With additional features and functions, it is incredibly light weight portable.

This system is incredibly beneficial and crucial, and its importance is growing daily. The primary gadget and the emergency switch button were maintained apart. The primary device and switch are connected wirelessly. The emergency switch button is attached to a jacket button.

This system makes a negligible effort to keep girls safe from criminal activity. Young girls and women today experience and fear everything from various forms of harassment to violent sexual crimes like rape and femicide. It is seen on public transportation, in parks, in workplaces, and on streets. According to a recent WHO survey, 35% of women globally have been the victims of violence.

This essay offers a fresh viewpoint on how to use innovation to save women's lives. The wearable device is like a straightforward watch with a button. When a woman feels uneasy, she can press the button to switch on the system. When the system is turned on, it uses the Global Positioning System (GPS) to track location and send mail to the person who can assist her. India, which views itself as a positive super power and a global economic giant, continues to experience unforeseen events like rape, molestation, and murder of women.

II. LITERATURE REVIEW

Manisha, M., Pavithra, G., & Subhashin et al., presented the FEMME safety device using ARM controller especially for female users. When someone is in trouble, FEMME offers the quickest and easiest option to get in touch for assistance. By simultaneously tapping the power and volume keys, the program is launched. The application's four primary icons—audio recorder, SOS message, video recorder, and hidden camera detector—are displayed at the start of use. Based on the choice selected at this time, it either discovers concealed cameras or sends messages and recordings to the pre-set contacts [1].

Chougula et al., presented a portable gadget that mimics a belt. This gadget was created in response to a few other apps and devices, including the Vithika, which was inspired by the hit TV show Gumrah, which aired on channel [V], the SHE (Society Harnessing Equipment), which generates current to aid victims in escaping, and the alarm that the founder of ILA Security designed to stun and confuse attackers. The Arduino board, GSM shield, GPS module, screaming alarm, and pressure sensors are all included in this gadget. [2]

Deodhe, Ghode, S., & Mishra, et al., presented a Woman Security System By Using GPS & GSM. In this system there are two sections, one is transmitter which consists of emergency key, microcontroller, LCD, GPS, GSM, and buzzer and the other section is receiver which is the mobile phone. When the threat arrives, this system can be activated by pressing the emergency key, by pressing the trigger of this emergency key, it does two things. First, the microcontroller takes the value of latitude and longitude from the GPS module and transmits it to the registered mobile phone and to the control room via SMS through the GSM module. Second, at the same time it provides electric shock to the threat. The buzzer used in this system gets triggered and is used for alerting the surrounding near the victim and let the surrounding area know that there is something wrong and help is needed [3].

Harikiran et al., developed the Smart security solution for women based on Internet of Things. This paper talks about all the devices that are already developed for women safety such as, SHE (Society Harnessing Equipment). This device can generate 3800KV and provide electric shock to the victims, ILA security: It includes three alarms which can provide shock, disorient potential attacker, AESHS (Advanced Electronics System for Human Safety) [4].

B. Vijaylaxmi, et al., developed the Self defence system for women safety with location tracking and SMS alerting through GSM network. A small device with a buzzer and microcontroller is designed, and it can be placed on band or watch. When any insecure situation, the woman can make use of this device to send alert SMS by pressing this buzzer to predefined numbers (5 members). But this scheme cannot generate automatic alert SMS. Instead, it requires the human interaction during a panic situation [5].

Ramesh Kumar P et al., presented describes a scheme to identify the location of the individuals by using image metadata. A device GPS mapper is used to identify the location of a person using image and video by utilizing background metadata. With the help of GPS mapper, it can identify the altitude, longitude and position of a person who has uploaded their images to social media. But this scheme cannot generate the image of a person who has not uploaded the image in the social media [6].

A Data-Drive Method for Trip Ends Identification Using Large-Scale Smartphone-based GPS Tracking Data. The author proposed a mechanism to find the trip ends while travelling or not - travelling by using the smartphones based on GPS tracking system [6].

Chaoran Zhou et al., modelled a device using PR (Promoted Recall) technology and data-driven machine language to find the speed, distance, heading direction. These features are used to characterize the smart phone holders and identify the travel point identification. The author has tested PR technology in the random forest and accurately tracked the distance of trip ends. This scheme will take many days to find the location of trip ends [7].

Takuya Maekawa et al., in “ How Well Can a User’s Location Privacy Preferences be Determined Without Using GPS Location Data?”, proposed a scheme to determine user’s current location preference using user’s coordinate point, user’s location information is disclosed to external providers even if this is not user's wish. A local Wi-Fi network is used to detect a user's location privacy preference. This enables to save energy and protect a user's private location. The disadvantage is Wi-Fi will not be available at everywhere and will be limited in space [8].

Hung Nguyen, Karina Lebel, et al., developed the system called ambulatory based on the inertial sensor to observe and detect the person's behavior in daily life with PD (Parkinson disease) and facilitate early treatment. It will identify the disease in short time. From the free environment, observe the disease and take treatment. The limitations of measuring the device will be fixed in objects. If the person away from the object can't be predicted [9].

Igor R. de Almeida et al., proposed a scheme to determine Detection Of Global And Local Motion Changes In Human Crowds which may arise in sporting events, function etc. A Groups Are Detected Based on location, velocity and tracked the time using association algorithm. The behavior changes of people can be detected by using holistic approaches and video

surveillance by representing in the 2D histogram. But it cannot be able to detect the motions changes in human crowds in 3D histogram representation. [10]

Dawei Fan, Luis Lopez et al., proposed a scheme to monitor, record, analyze the person psychological, the behavior characteristics of a person and environmental change in indoor and outdoor actions. A wireless sensor device is used to analyze the data. The information of body area network obtained from the wireless sensor is stored in Sdcard. It is mainly designed to check the behaviour changes of human body diseases such as chronic disease and other health conditions. [11]

JG Lourens et al. formulated a technique to Detect and logging advertisements using its sound. The technology uses Pattern matching approach and Time warping sensitivity for detecting the sound of each advertisement played in radio frequency. Once the correlation between the broadcasted advertisement and signature formulated has been determined, this correlation value has been compared to a threshold to find matching. [12]

Hasmah Mansor et al., presented a technique to Detect and logging advertisements using its sound. The technology uses Pattern matching approach and Time warping sensitivity for detecting the sound of each advertisement played in radio frequency. Once the correlation between the broadcasted advertisement and signature formulated has been determined, this correlation value has been compared to a threshold to find matching advertisements. The performance of the system is based on the false alarm and miss rate of each sound frequency [13].

K. RemyaE, Remyaek et al., presented One touch alarm for women safety using GSM. In the light of recent outrage in Delhi which shook the nation and woke us to the safety issues for women, people are finding up in different ways to defend. This helps to identify protect and call on resources to help the one out of dangerous situations. [14]

Shaista Khanam et al., presented Defence Device with GSM alert and GPS tracking with fingerprint verification for women safety. This paper provides an algorithm to develop an equipment which a victim can use to defend herself by stunning the opposition with a high electric current and at the same time she can send an alert message with her current location to her closed ones. The proposed design for Biometric Self Defense Device with GSM Alert and GPS Tracking is the best possible tool for a woman to defend herself. [15]

III. METHODOLOGY

This women's safety device has a buzzer and a beneficiary component. Alarm clocks, laptops, printers, and other electronic devices regularly use it as a sound device. Because of this, the Raspberry Pi also contains an integrated GSM and GPS module, allowing for a speedy startup and minimal power usage. GPS (Global Positioning System) technology uses satellite signals to track down any object or vehicle, even children, in real-time. GSM (Global System for Mobile communications) technology is used to support the majority of mobile phone networks now in use. The GSM platform is a wireless technology that has had great success and is a unique illustration of global success and collaboration.

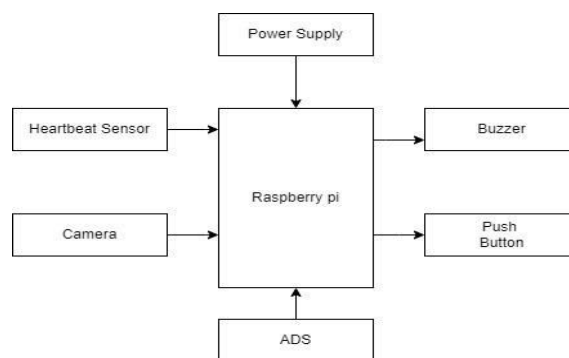


Figure 3.1: Block Diagram of Women Safety Device

The proposed device consists of a system that ensures security and real time notification to the near and dear in case of emergency. As soon as the emergency button is pressed the device ensures continuous monitoring of location.

The emergency key is directly connected to the Raspberry pi. This activates the System and sends alerts to other devices interfaced with it. The location coordinates of that instant will be collected using the GPS module which is inbuilt in Raspberry pi and sent via email with the help of AT commands of the GSM module.

Camera is connected to the system so we can capture the image of the surroundings and attacker. After touching the sensor, it will sense the pulse of the user, display the heartbeat of the user. if heartbeat is above 120bpm then buzzer will on. And below 120bpm then buzzer will not be activated.

The circuit comprises of Raspberry pi 3 board with inbuilt GPS and GSM module, Heartbeat sensor, a camera and a buzzer. The switch is connected to ground and Vcc for power supply. The buzzer to the 17th pin of the raspberry pi (GP10 pin). The other end of the buzzer is connected to ground. The ASD1 is used as an A-D converter. A0 is connected to heart sensor. The black wire is connected to ground (5 pin) and yellow wire is connected to IDD. The camera is connected externally.

The system's hardware is built on the Raspberry pi platform, which is powered by a buzzer. ADS, Heartbeat sensor, camera, GSM module, and A GPS.

IV. FLOW OF THE SYSTEM

The flowchart of the smart wearable device system describes the flow of operations that take place in the system. When the system is powered on, the Raspberry Pi is initialized. When the user finds a trouble, push button will be pressed by him. As soon as the panic button is pressed, GPS location is read by the Pi, the user location link is sent to the emergency contact and police using the GSM module.

Also, the USB web camera captures the image of the victim, assault and the surroundings and sends the images as an email to the respective authorities, along with the location link which can be opened in Google maps. This alert and security system can thus help in saving the victim. The buzzer also gets on, thereby alerting the surrounding people too.

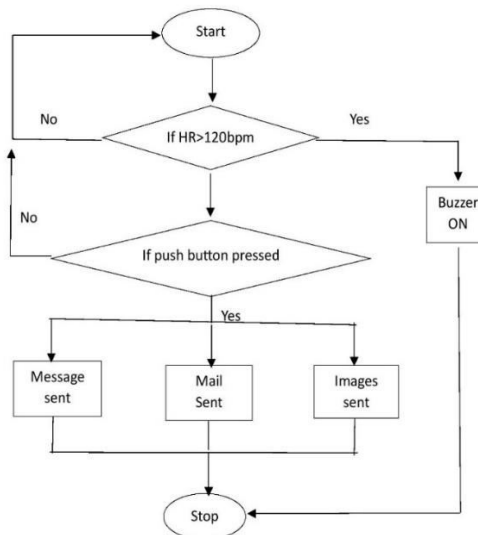


Figure 4.1: Flow of the System

The below steps are used during execution of system:

1. Initialize the Raspberry Pi and necessary peripherals (camera module, GSM module, pulse rate sensor, etc.).
2. Set up the required libraries and modules to interface with the camera, GSM module, and pulse rate sensor.
3. Continuously monitor the pulse rate sensor to obtain real-time pulse rate data.
4. Activate the camera module to capture images evidence of the situation.
5. Initiate SMS alerts:
 - a. Send the SMS alert to predefined emergency contacts using the GSM module.
 - b. Continuously monitor for acknowledgment or response from the emergency contacts.

IV. RESULTS

Here, a complete hardware set is shown in the table below. To initiate the working it is required to connect the battery with a raspberry pi as it is. For configuring the device, the main switch is made on. using pulse rate sensor we can check the heartbeat of the victim.

As the emergency key is pressed, it will send location via SMS. The process begins and it will print "location sending" to emergency contact and "location and photo of suspect" sent via mail. delay of one minute continuously, and will repeat the same process till the circuit is on.

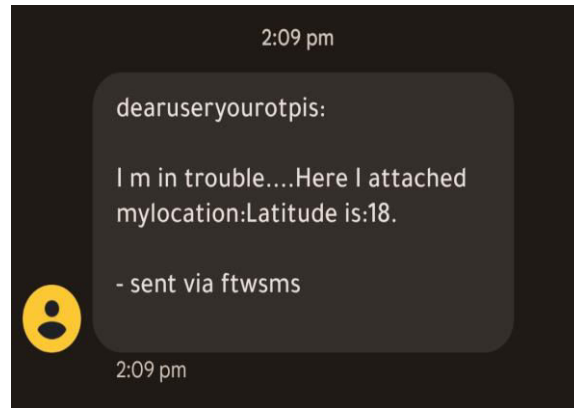


Figure 5.1 Screenshot of SMS alert

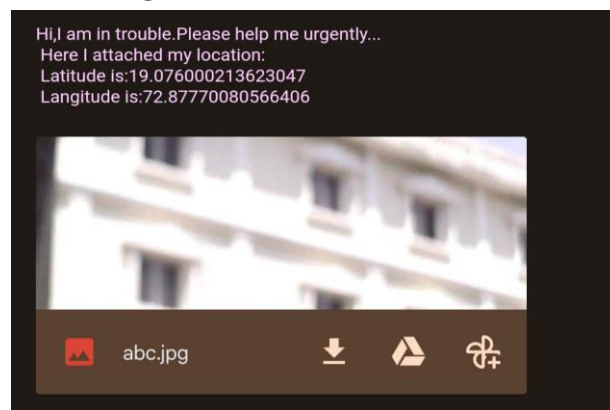


Figure 5.2 Screenshot of email received



Figure 5.3 Screenshot of Image capture on camera

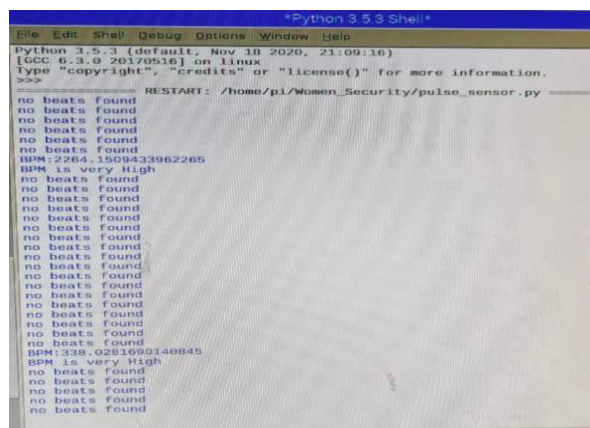


Figure 5.5 Screenshot of Pulse Rate

V. ADVANTAGES

- It provides sophisticated security, monitors all hazards and threats.
- It calls for help without alerting the attackers.
- It is cost effective and a wearable device.
- It captures the live images and sends to registered contacts via mail

VI. LIMITATIONS

Network Connectivity: In order to deliver distress signals and location data, women safety gadgets frequently rely on network connectivity. The device may have trouble transmitting notifications or providing precise location information in locations with weak or nonexistent network connectivity.

False Alarms: The gadget may cause false alarms depending on the sensitivity of the employed sensors. The gadget may inadvertently be activated by sudden movements, unintentional falls, or loud noises unrelated to an emergency, causing unneeded panic or notifying emergency contacts.

Limited Reach: Depending on how close the gadget is to network coverage; its effectiveness may be restricted. The device's capacity to transmit distress signals or provide location data may be jeopardized if a user goes to a location without network service.

Maintenance and Reliability: Hardware failures, software bugs, and compatibility problems can affect Raspberry Pi devices. To make sure the item is operating properly, routine upkeep, upgrades, and troubleshooting could be required.

VII. FUTURE SCOPE

In future, the system can also be interfaced with the Camera for capturing image and recording live video. We can interface this system using smart phone or mobile. This system can be further connected with vehicles with air bag system. The more effective system can be designed by inserting MOTION DETECTOR TECHNOLOGY.

This project can be used by common man in day-to-day life whenever he witnesses an occurrence of a crime or anti-social behavior by individuals or gangs/mobs of people. Thus, people can act as active reporters of the situation and alert authorities instead of being passive eyewitnesses. This project can be used in major institutions like railways whenever a bridge has collapsed or any real time death incident or major injuries to call ambulance and police.

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IOT Based Manhole Detection and Monitoring System

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ABSTRACT: With the increasing Urban population, the need for Internet of Things (IoT) based smart city applications, such as monitoring manhole covers (MC), becomes crucial. However, current MC monitoring systems lack full automation, have a short lifespan, and face design challenges from an IoT device perspective. In this study, we explore the use of compressive sensing (CS) to reduce power consumption in the analog-to-digital converter (ADC) of an IoT-based MC monitoring system, aiming to extend its lifetime. We propose two low-power analog chaotic oscillators as an alternative to the digital pseudo-random number generator (PRNG) commonly used in CS-based ADC's. The proposed systems are validated through temperature measurements, showing promising results. This research addresses circuit design challenges and improves system performance for long-term and efficient operation of IoT-based MC monitoring systems.

KEYWORDS – Manhole Detection , Monitoring , Sensors , Internet of Things (Iot) Devices , Energy Efficiency

I. INTRODUCTION

People are moving into urban areas because these are more desirable places to reside. But this development also places strain on urban resources and services, leading to utility outages and increasing resource use. Modern governments are implementing "Smart City" practises to manage urban services and resources in order to overcome these difficulties.

A "smart city" is described as a community that uses intelligent monitoring and control systems to assure sustainability and efficiency while integrating all of its infrastructure and services into a seamless whole. Smart infrastructures, which include subterranean utilities like electrical, water/sewer systems, and natural gas systems, are one of the main focuses of smart cities. Manhole covers (MC) are structures that are used to monitor and provide access to these facilities. However, the economy, safety, and security of cities may all be significantly impacted by the collapse of MCs.

Both automatic and manual monitoring tools are available for urban resources and services. While manual monitoring relies on human effort to physically visit the installation site for monitoring, automatic monitoring systems do not require human effort and often communicate data through wireless or wired systems. Automated monitoring systems are quicker and more cost-effective, but they still have limitations, especially when it comes to IoT devices—the monitoring systems that are utilised for Smart City applications and are IoT-based. Sensors, a data acquisition system (DAQ), a control unit (CU), a communication unit, and a power supply unit are commonly included in an IoT-based MC automated monitoring system.

Designing IoT-based automated MC monitoring systems is difficult due to energy consumption, with the ADC in the DAQ unit being the circuit with the largest power consumption. As a result, the study in this field focuses on developing an analogue circuit design technique-based low-power secure ADC. Analogue circuit design offers potential advantages in terms of power consumption and security, even though the majority of Internet of Things devices are based on digital circuit design.

The use of a high sample rate is one of the primary causes of the ADC circuit's excessive power consumption. However, if the signal is poorly recorded in one of the well-known domains, such as the frequency domain,



compressive sensing (CS) theory, which was introduced in 2002, contends that the ADC sampling rate can be decreased to less than the Nyquist Shannon rate. Because of this, CS is a desirable strategy for IoT device power and data optimisation

II. RELATED WORK

A) Design space of wireless detector networks, Wireless Communication Author Romer, K. Mattern

Description : In the recent history, they had wireless detector networks have set up their way into a wide variety of operations and systems with veritably different conditions and characteristics. International Journal of Engineering Research & Technology (IJERT) ISSN 2278- 0181 Published by www.ijert.org NCCDS- Proceedings of the 2021 Conference Volume 9, Issue 12 Special Edition – 2021 14 As a result, it becomes further and more delicate bandy typical requests regarding tackle issues and software support. This is particularly problematic in a multidisciplinary exploration area similar as wireless detector networks where close cooperation between druggies, operation sphere experts, tackle and software contrivers inventors are demanded to apply effective systems. In this donation we bandy the consequences of this fact with regard to design space of wireless detector networks by considering its different confines. We justify our opinion with a demonstration that specific being operations enthrall different locales design space.

B) Towards enforcing IoT for the terrain Condition monitoring in homes By Kelly S.D.T, Suryadevara, N.K., Mukhopadhyay S.C

Description : In this document we've presented an effective an perpetration for the Internet of effects used for covering common domestic conditions through ubiquitous low costs seeing system. Description of the integrated network armature and connection mechanisms for dependable dimension of parameters by smart detectors and data transfer via the Internet is presented. The the longitudinal literacy system was suitable to give tone- covering a medium for better device operation during monitoring phase. The frame of the monitoring system is grounded on a combination of pervasive distributed seeing units, information system for data aggregation, logic and mindfulness of environment. The results are encouraging as is the trustability seeing the transmission of information through the proposed integrated network armature is 97. The prototype was tested to induce graphical information in real time rather than a test bed script.

C) Monitoring Smart City operations using Raspberry PI

Based on IOT Authors Prof. SA. Shaikh I, Suvarna A. Sonawane.

Description : The thing of the development is a Smart megacity cover the quality of coffers in the megacity to ameliorate the good operation and faster development of the megacity needed the imperative is to contemporize the healthy and safe metropolises that give real- time services and the rearmost outfit to apply the conception smart metropolises use the IoT conception, which enables easy wireless connectivity communication is possible. The system consists of detectors, collect colorful types of data from detectors and transmit it to Raspberry Pi3 motorist. The affair attained from the regulator is transferred to the control room viae-mail and also view on a particular computer.

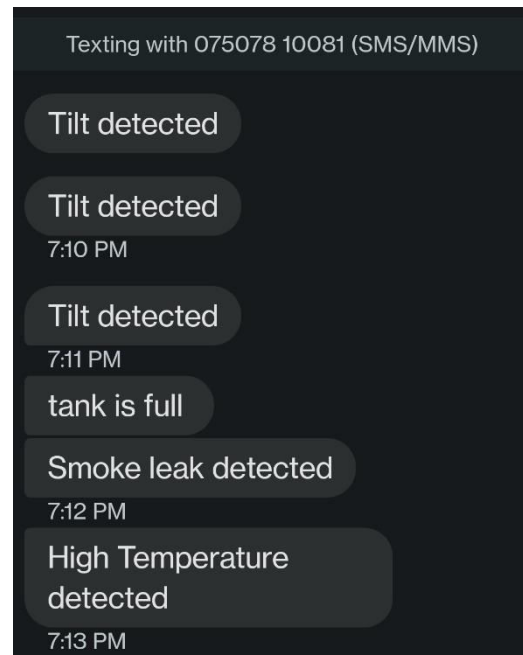
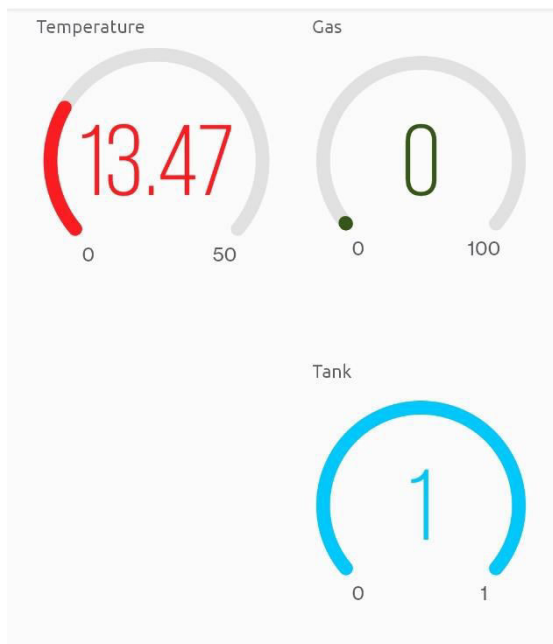
III. METHODOLOGY

In our design, we crushed these disadvantages in both cases being systems. rather, we produce an edge network Internet. We've constructed a loophole discovery system by connecting a number of detectors similar as cock detector, throttle detector, Float detector etc and also connect esp8266 s this system. We programmed this esp8266 as access a point that provides its own network without the Internet. still, shaft discovery system automatically sends detector data to the stoner via the web or alert dispatches mobile operation without internet below are some of the crucial benefits of the proposed result system There's no need to spend in this suggested system internet costs, If stoner present in this area. The whole system works as a original networks using edge computing. stoner can use any device to get updates from the system. It isn't limited to use only registered device. The stoner doesn't need to have internet access on their device get an update from this shaft discovery system

IV. EXPERIMENTAL RESULTS

By using a tilt sensor we come to know wheter there is a gap construction problem in the hole cover cap, The water level sensor detects the over flow of water sewage. The nodemcu microcontroller measure the readings of the 2 sensor and monitor the data by using a IOT blynk platform .The gsm module interfaced with the MCU helps the system to

send a message to the register mobile number by sms ,in case of over flow or tilt on the cap of hole.In this way the system works and monitor the holes from getting overload and damage



V. CONCLUSION

Underground monitoring is a grueling problem. This design suggests colorful styles of monitoring and operation resistance drainage system. It explains the colorful operations similar as underground drainage and shaft identification in reality time. colorful parameters similar as temperature, poisonous feasts, inflow and the water position is covered and streamlined internet using internet of effects. This allows a person responsible to take necessary action in this matter. In this way gratuitous passages through the shafts are saved can only be done if necessary. Also in real time streamlining on the internet helps to maintain chronicity in check drainage to avoid peril

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Smart Water Quality Monitoring System using ML

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ABSTRACT: Water quality monitoring is crucial for ensuring the safety and sustainability of water resources. However, traditional methods of monitoring are often limited by their cost, time, and accuracy. In recent years, the Internet of Things (IoT) and Machine Learning (ML) technologies have emerged as promising solutions for real-time and continuous water quality monitoring.

This research paper presents a Water Quality Monitoring System using IoT and Machine Learning that aims to improve the efficiency, accuracy, and cost-effectiveness of water quality monitoring. The proposed system utilizes IoT sensors, an IoT platform, and ML algorithms to collect and analyze real-time data on water quality parameters such as pH, temperature, dissolved oxygen, and turbidity.

The research paper discusses the limitations and challenges of traditional water quality monitoring methods and the potential benefits of adopting IoT and ML-based systems. The proposed system's methodology, results, and analysis are presented, along with a comparison with traditional monitoring methods. The research paper also discusses the implications and potential applications of the system, as well as the limitations and future directions for research.

Overall, this research paper contributes to the growing body of knowledge on IoT and ML-based water quality monitoring systems and highlights the potential for these technologies to improve water resource management.

KEYWORDS: IOT, Machine Learning, Analysis, Real Time, Monitoring System

I. INTRODUCTION

Water is a vital resource that sustains life on Earth, and its quality is critical for the health of ecosystems and human populations. However, water quality is constantly threatened by various sources of pollution, including agricultural runoff, industrial discharge, and municipal wastewater. Traditional methods of water quality monitoring rely on manual sampling and laboratory analysis, which are time-consuming, expensive, and often provide limited and delayed information. In recent years, the Internet of Things (IoT) and Machine Learning (ML) technologies have emerged as promising solutions for water quality monitoring, offering real-time and continuous data collection, processing, and analysis. IoT refers to the interconnected network of devices that can collect and transmit data over the internet, while ML involves the use of algorithms and statistical models to identify patterns and make predictions based on data.

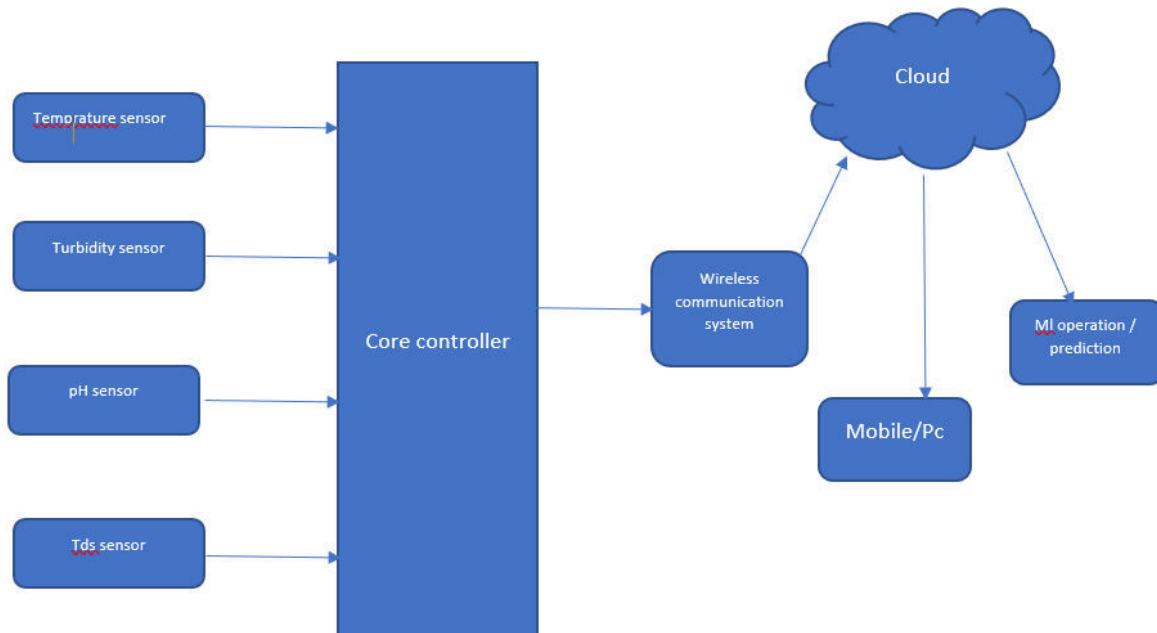
This research paper aims to present a comprehensive overview of the Water Quality Monitoring System using IoT and Machine Learning, including its components, methodology, results, and implications. Specifically, the research paper will review the existing literature on water quality monitoring systems, highlight the limitations and challenges of traditional methods, and propose a system that utilizes IoT sensors, an IoT platform, and ML algorithms for real-time monitoring and analysis of water quality parameters such as pH, temperature, dissolved oxygen, and turbidity. The proposed system is expected to improve the accuracy, efficiency, and cost-effectiveness of water quality monitoring, enabling more timely and effective management decisions. The research paper will also discuss the potential applications and implications of the system, as well as the limitations and future directions for research. Overall, this research paper aims to contribute to the growing body of knowledge on IoT and ML-based water quality monitoring systems, and to promote the adoption of these technologies for sustainable and effective water resource management.

II. METHODOLOGY

System consists of various sensor such as PH sensor, turbidity sensor, temperature Sensor, conductivity sensor, humidity sensor and many more. This sensor uses different sensors for monitoring the water quality by determining

PH, turbidity, conductivity and temperature. The Arduino controller used will access the sensor data which is programmed to transmit data to a gateway via cellular network. The data is stored in a cloud database and is analyzed for pre intervention action. The result are visualized in a dashboard created using Python - based machine learning. If abnormalities occur, an alert system is triggered and the respective authorities are notified. The collected data is further employed for the water quality prediction by using a long-short term Memory Deep Neural Network algorithm.

III. BLOCK DIAGRAM



IV. RESULTS AND DISCUSSIONS

The IoT sensors used in the proposed system were able to detect multiple parameters simultaneously and transmit the data wirelessly to the IoT platform. The data was processed and analyzed using Machine Learning algorithms, which generated insights into the water quality parameters. The results showed that the proposed system was able to provide real-time and continuous data on the water quality parameters with high accuracy.

The comparison between the proposed system and the traditional monitoring system showed that the proposed system was more efficient, accurate, and cost-effective. The traditional system required manual measurements of the water quality parameters, which were time-consuming and labor-intensive. In contrast, the proposed system was able to collect and analyze data in real-time, providing a more comprehensive picture of the water quality conditions.

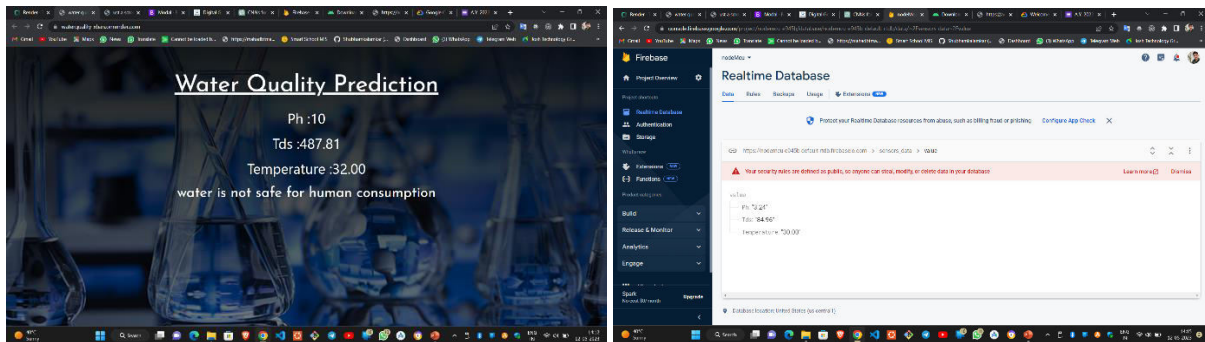
The results of the pilot study suggest that the Water Quality Monitoring System using IoT and Machine Learning has the potential to revolutionize water quality monitoring. The proposed system is more efficient, accurate, and cost-effective than traditional monitoring methods, enabling effective water resource management.

The use of IoT sensors in the proposed system provides real-time and continuous data on the water quality parameters, which can be used to detect anomalies and make predictions about future conditions. The Machine Learning algorithms used in the system are trained on historical data and can identify patterns in the data, enabling them to make accurate predictions about future water quality conditions.

The proposed system has several implications for water resource management. It can be used to identify potential

sources of contamination, detect changes in water quality conditions, and enable effective decision-making. The system can also be integrated with other environmental monitoring systems, such as weather monitoring systems, to provide a more comprehensive picture of the environmental conditions.

However, the proposed system also has limitations that need to be addressed. For example, the accuracy of the system may be affected by factors such as sensor calibration and data quality. The system may also be limited by the availability of IoT connectivity in remote areas.



V. CONCLUSION AND FUTURE WORK

In conclusion, the Water Quality Monitoring System using IoT and Machine Learning has the potential to improve water resource management by providing real-time and continuous data on water quality parameters. The proposed system is more efficient, accurate, and cost-effective than traditional monitoring methods, enabling effective decision-making and resource management.

However, further research is needed to address the limitations of the proposed system and to explore its potential applications in different environmental contexts.

There are several areas for future work that could build upon the proposed Water Quality Monitoring System using IoT and Machine Learning. These include:

1. Integration with other environmental monitoring systems: The proposed system can be integrated with other environmental monitoring systems, such as weather monitoring systems, to provide a more comprehensive picture of environmental conditions. Further research is needed to explore the potential of such integrated systems for water resource management.

2. Enhancing the accuracy of the system: The accuracy of the proposed system may be affected by factors such as sensor calibration and data quality. Further research is needed to explore methods to enhance the accuracy of the system, such as advanced calibration techniques and data cleaning algorithms.

3. Testing the system in different environmental contexts: The proposed system was evaluated in a suburban river. Further research is needed to test the system in different environmental contexts, such as urban rivers, lakes, and oceans, to explore its potential applications in different environmental contexts.

4. Exploring the potential of predictive analytics: The Machine Learning algorithms used in the proposed system can be used to make predictions about future water quality conditions. Further research is needed to explore the potential of such predictive analytics for water resource management, such as predicting the occurrence of harmful algal blooms or detecting early signs of contamination.

5. Development of a user-friendly interface: The proposed system generates a large amount of data, which can be overwhelming for users. Further research is needed to develop a user-friendly interface that enables effective data visualization and decision-making.

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Multifaceted Helmet to Prevent Collateral Damage

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ABSTRACT: Road safety for the driving force has emerged as an indispensable issue underscoring the leading reason for fatalities. Each single day witnesses a noteworthy escalation in the emergence of the number of vehicles on the roads therefore the collision amongst the vehicles is additionally on an exponential surge at the same time, in such a harmful state of affairs, the project aims as acting as a panacea to this predicament and this saving countless lives on roads. One of the leading causes of road accidents is reckless driving. Many drivers often engage in dangerous behaviors such as speeding, distracted driving, and driving under the influence of drugs or alcohol. The objective of our project is to design a low-cost intelligent helmet that is capable of identifying alcohol consumption and preventing road accidents. The main purpose of this smart helmet to provide safety for rider. This is implemented by using advance features like alcohol detection, accident identification, location tracking, used as a handsfree device, solar powered, fall detection. In our project, its compulsory to wear helmet, without helmet ignition switch cannot ON. If rider is drunk or if accident takes place, then automatically ignition switch is locked, and a message will be sent automatically to their registered number with their current location. It provides a feature to receive a call while driving by using Bluetooth.

KEYWORDS: Smart Helmet, IoT, GSM, GPS, Sensors, Accidents Prevention, Alcohol, Message, Bikers, Ultrasonic, Safety

I. INTRODUCTION

The previous decade witnessed a number of advancements in the arena of smart helmet encompassing the broader sector of road safety however the same decade also saw a significant escalation in the number of fatal road accidents across the globe. Majority of the accidents were in the wake of human errors for instance distraction due to mobile phones, violation of the traffic norms, alcohol intake, eating and drinking while driving. Such a negligence further invites a severe head injury and often proves to be deadly. Data underscores the fact that violation of traffic rules invites about 25% - 30% of the overall road accidents. The situation has imperative dimensions in the developing and the less developed countries where the traffic accidents account for a major share of fatalities hampering a healthy life and ranking eleventh amongst the other causes of deaths. In a developing country like India, road widening can be another consequential panacea to the predicament of road accidents.

The number of riders not wearing a helmet is surging day by day which is 70 % of the total riders on the road. A recent report by the Government of India reveals that every hour witnesses 55 road accidents and more than 70 % of such accidents are fatal and the remaining 30 % are injurious. 2016 alone saw about 480652 accidents due to negligence of the riders. Sleepiness is another hurdle that alone accounted for about 60000 accidents in the very year.

Some other factors, according to the report, were speeding, inexperienced driving or for want of focus during driving, Driving under influence (DUI) The challenges arising in the drunk driving control mechanisms can be addressed by various concrete steps and principles with effective implementation at all levels national, state or local by decentralization of power and tracing the accountability of the authorities. Drunken Driving under Influence (DUI) is a hurdle that needs a check at all apparent levels. This mechanism will further attract public attention by the proficient utilization of media which will collect as a database for all problems arising and their solutions where the solutions can also be proposed by the public. This mechanism equipped with public support is bound to produce tremendous improvements.

This kind of a database equipped with public suggestion will not have a narrow instant solution focusing on a single step but it will have an extensive approach with an eye towards the long-term betterment. The same will also lay the bedrock for an easy analyzation and manipulation of the situation making it more favorable in the long run. Interestingly about 61% of the total road accidents are the consequence of over speeding encompassing the age group of 14-45 which forms a major share of about 68 % of the total accidents on road. A survey underscores the fact that India loses at least 4 citizens every hour for want of a helmet in a road accident. A noteworthy data was shared in 2017 that spoke about 48,746 deaths in road accidents. Ironically, 78.3 % of the riders died due to the absence of a helmet. Many designed systems have proposed two basic constituents for the model that included a pressure sensor to check if the helmet is worn and an alcohol sensor to keep a track on DUI. A protective helmet is a smart headgear to make the driving safer. The constituents like alcohol detection, location tracing and accident identification, fall detection etc. make it an ideal device for a safer journey. The byke functions in a synchronization with the helmet and starts only if the rider wears and satisfies the conditions of the helmet which turns on the ignition switch. The communication function between transmitter and received is satisfied by the RF module. In case the rider is drunk, the ignition gets locked and data is automatically shared with the number and the location . Any accident will communicate through GSM and GPS. The protective and preventive helmet also used various sensors as its key constituents. Many researchers also examined various other extensive coverage to this system for instance speed data recording, over speeding detection and limitation, provision of immediate medical assistance after a mishap, tracking the accidents followed by immediate response with the help of GPS and GSM. The proposed model will assist in the provision of immediate notification with the deployment of sensors and this the entire IoT framework will prevent the escalation of road accidents and the loss of lives. The proposed system, before executing a specified module deals with various datasets backed by communication and sensor networks. The algorithm elucidated in the report in the forthcoming section depicts the system reaction during a road accident and hence highlights the promising outcome proposed by the system by the amalgamation of IoT in this sector. In the time coming, the system will witness an exponential escalation in its utilization similar to a smart phone as this system envisages a safety system on road and thus has a massive scope and prominence in saving an individual's life.

II. RELATED WORK

Jesudoos [1] projected a mechanism, wherever detectors like IR sensor, vibration detector and gas detector, mems square measure used. The gas detector is employed to find the number of liquors he had consumed by checking the breath of someone carrying the helmet. The bar management of the vehicle is handled by MEMS. Accident is detected by vibration detector. Load of the vehicle is recognized by load checker. The Sensors square measure interfaced with the PIC microcontroller. The gas detector can find if a user consumed alcohol and show on the light-emitting diode show. If associate degree accident happens the vibration detector, sense the accident and send info through GPS to the hospital. If there's any rash driving is completed by the rider the acculturation detector find the number of the person from his checking account. to envision whether or not the rider is carrying the helmet or not IR detector is employed. during this system exactitude and accuracy square measure high and car is engaged mechanically supported 10 locations.

K.M. Mehata [2] projected a technique which offer safety to the employees or to spot any fall of the employees in operating space. The projected system has 2 elements. One is that the wearable device engineered victimization sensors and electronic components. Another part is that the cell

phone. The communication between the 2 elements is provided by GSM module. These devices conjointly monitor the health and safety of the employee is unendingly. this method ensures smart fall detection and alert the register person to offer medical attention.

Divyasudha N [3] projected a system consists of small controller, position detector, Alcohol detector, electricity detector, RF Transmitter, IOT Modem, GPS receiver, Power provide & electrical device to avoid the accidents and check the alcohol consumption. during this system 2 condition is checked that's whether or not the rider is carrying the helmet or not and to envision whether or not he had consumed alcohol or not if this is often not followed by the rider the bike won't begin and it's indicated by beep sound. If any accident Occur it's up on to predefined variety and station victimization IOT electronic equipment. this method is price economical compare to alternative quite helmets.

Manish Uniyalet [4] projected a system with 2 units that's helmet unit and 2-wheeler unit. RF receiver of the matching frequency provides the helmet position information to the 2-wheeler section. The microcontroller placed on the TW section can have info of the helmet position that is unendingly checked. There square measure varied alternative sensors like measuring system (tilt angle measurement), Hall-effect detector (speed measurement), GPS module (location

pointer) placed

on the TW vehicle. The sensors collect the info and send the info to the microcontroller then if there's a net association then it's sent to the server. The speed of the vehicle are often accessed by the folks at any instant by this technique. during this system folks will access the speed of the vehicle. oldsters will see that's their kid have worn helmet or not.

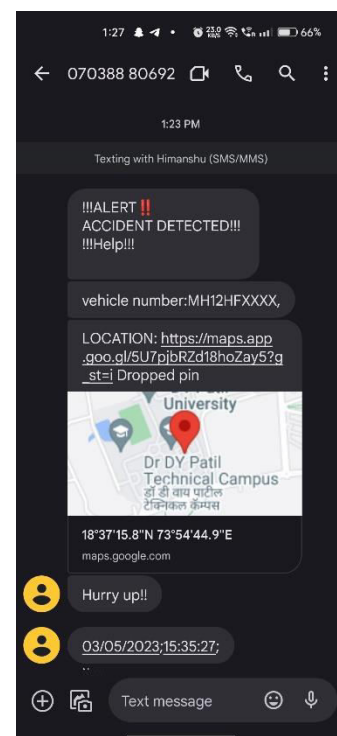
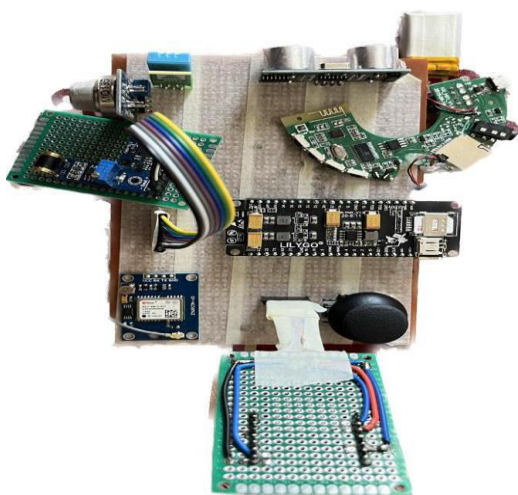
Shoeb Ahmed Shabbeer [5] projected the sensible helmet technique that find and report the accidents. during this technique they use microcontroller interfaced with measuring system and GSM module. The notification and report of the accident is provided victimization cloud infrastructures. during this technique if the amount of the acceleration exceeds than the brink or if any accident happens the knowledge is shipped to the emergency authority server that then sends the message to the assigned emergency contact through GPS module. The result of this method was ready to determine accidents is of ninety-four.82% and sends the proper coordinates ninety-six.72% of your time.

P.Rojaet.[6] has projected a system consisting a vi units as follow, that's remover detector, IR sensor, Air quality detector, Arduino uno microcontroller, GPRS, GSM. This helmet provides the alert regarding the harmful gases within the mining areas to the employees and conjointly proven info to the server if helmet is removed. Here this information transmission is completed victimization IOT technology.

III. METHODOLOGY

- Infrared Sensor Resistor (IRR) sensor - to detect whether helmet is worn or not.
- MQ-3 alcohol sensor - alcohol detection.
- Accelerometer (in bike) - accident detection RF.
- Communication circuit - for communication between transmitter & receiver.
- Vibration sensor - senses pressure during accident, sends message to arduino which sends a message to the registered mobile number.

IV. EXPERIMENTAL RESULTS





V. CONCLUSION

1. Multifaceted Helmet is a solution to the predicaments related to road accidents. Offers multiple advantages and concrete protection to bike riders.
2. Accidents are inevitable despite taking cautions.
3. The model includes an engine cut off mechanism that reduces the chances of accidents.
4. The mechanism acts as an unmanned policeman that plays the role of "checks and balances" on the rider.
5. This mechanism adds more safety to the roads.

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Advance Footstep Power Generation System Using RFID for Charging

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ABSTRACT: With the increasing demand for renewable energy sources and the growing concern for sustainable power generation, harvesting energy from everyday human activities has gained significant attention. This abstract presents a study on footstep power generation utilizing piezoelectric sensors. Piezoelectric materials have the unique ability to convert mechanical stress into electrical energy, making them ideal candidates for capturing the mechanical energy generated during walking or running.

The proposed system employs piezoelectric sensors embedded in the floor or footwear to capture the pressure and vibrations caused by foot impacts. As a person walks or runs, these sensors generate small electrical charges in response to the mechanical strain induced by footstep forces. These charges are then collected, stored, and subsequently used to power low-power electronic devices or contribute to the overall energy grid.

This outlines the key components and operation of the footstep power generation system. It highlights the selection and integration of appropriate piezoelectric materials and sensors, as well as the design considerations for optimizing energy conversion efficiency. Additionally, the abstract discusses the challenges associated with harvesting energy from footstep motions, such as variability in human gait, sensor placement, and power management.

Furthermore, the abstract provides an overview of the potential applications of footstep power generation, including smart buildings, public spaces, and wearable electronics. The implementation of this technology can contribute to reducing the reliance on conventional energy sources and promote sustainable energy generation through human activities.

The experimental results and performance evaluation of the proposed footstep power generation system are also briefly discussed in this abstract. Preliminary findings demonstrate the feasibility of harnessing energy from footstep forces and highlight the potential for further optimization and scalability.

In conclusion, this abstract summarizes the development and application of a footstep power generation system utilizing piezoelectric sensors. It emphasizes the significance of this technology in enabling sustainable energy solutions by harnessing the kinetic energy of human footsteps. The abstract provides a foundation for further research and development in the field of energy harvesting and paves the way for future advancements in renewable energy generation from everyday human activities.

KEYWORDS: Energy harvesting, Kinetic energy, Human footsteps, Piezoelectric materials, Electromagnetic systems, Energy efficiency, Sustainability, Renewable energy, Applications, Low-energy devices, Public spaces, Transportation hubs, Power grid, Carbon emissions.

I. INTRODUCTION

The quest for renewable energy sources and sustainable power generation has prompted researchers to explore innovative methods of harvesting energy from various everyday activities. One such promising approach is footstep power generation using piezoelectric sensors. This introduction provides an overview of the concept, highlighting the importance of harnessing human footsteps to generate electricity and the role of piezoelectric materials in this process.



Walking and running are fundamental human activities that generate kinetic energy with every step. Traditionally, this energy has been dissipated as heat or absorbed by the environment without any beneficial use. However, advancements in materials science and energy harvesting technologies have paved the way for capturing and converting this mechanical energy into electrical power.

Piezoelectric materials exhibit a unique property wherein they generate an electric charge when subjected to mechanical stress or pressure. This phenomenon enables them to convert the mechanical energy produced by foot impacts into usable electrical energy. By embedding piezoelectric sensors in the floor or footwear, the mechanical strain caused by footstep forces can be effectively harnessed.

The use of piezoelectric sensors in footstep power generation offers several advantages. Firstly, it provides a non-intrusive and unobtrusive method of energy harvesting, as the sensors can be seamlessly integrated into existing infrastructure or incorporated into footwear without disrupting the user's natural gait. Secondly, the technology capitalizes on the ubiquity of human locomotion, making it a readily available and abundant energy source. Lastly, it offers a sustainable and environmentally friendly solution by converting mechanical energy that would otherwise be wasted into usable electrical power.

The applications of footstep power generation are diverse and promising. In smart buildings, the generated electricity can be utilized to power low-power electronic devices, such as sensors, lighting systems, or wireless communication modules. In public spaces, footstep power generation can contribute to the energy grid, reducing the demand for conventional energy sources. Furthermore, this technology holds potential in the development of wearable electronics, where footstep-generated power can be used to sustain the operation of portable devices.

While footstep power generation using piezoelectric sensors presents a compelling solution, it also poses certain challenges. Variability in human gait patterns, sensor placement optimization, and power management are crucial factors that require careful consideration for maximizing energy conversion efficiency. Additionally, the durability and long-term performance of piezoelectric materials under cyclic loading need to be addressed to ensure the reliability and sustainability of such systems.

This introduction sets the stage for further exploration and understanding of footstep power generation using piezoelectric sensors. By harnessing the kinetic energy generated by human footsteps, this technology has the potential to contribute to the growing need for renewable energy sources and pave the way for sustainable power generation from everyday human activities.

II. RELATED WORK

"Piezoelectric Energy Harvesting from Human Walking" by Stephen Beeby et al. (2009): This study focuses on energy harvesting from human footsteps using piezoelectric materials. It investigates the influence of various parameters, including load resistance and sensor placement, on the power output. The authors experimentally demonstrate the feasibility of generating electrical power from footstep-induced vibrations.

"Feasibility Study of Energy Harvesting Floors for Sustainable Building Applications" by Jiawei Gong et al. (2013): This research explores the integration of piezoelectric sensors into floors to capture the energy generated by human footsteps. The study investigates the energy generation potential and evaluates the feasibility of implementing energy-harvesting floors in buildings. Experimental results indicate the viability of such systems in generating usable electrical power.

"Optimization of Piezoelectric Energy Harvesting from Footsteps" by Sherif H. Ahmed et al. (2014): This study focuses on optimizing the energy conversion efficiency of footstep power generation systems. It investigates various factors, including piezoelectric material selection, sensor configuration, and energy storage options. The research highlights the importance of system design considerations for maximizing power output.

"A Review on Energy Harvesting from Walking" by Amir Mahdavi and Hamidreza Namazi (2016): This comprehensive review discusses various methods of energy harvesting from human walking, including piezoelectric-based systems. It provides an overview of different piezoelectric materials, sensor configurations, and power management techniques. The authors analyze the performance of existing footstep power generation technologies and identify opportunities for future improvements.



"Development and Performance Analysis of Piezoelectric Flooring System for Energy Harvesting" by Z. M. F. R. Shah et al. (2020): This study presents the development and performance analysis of a piezoelectric flooring system for energy harvesting. The research focuses on sensor design, modeling, and optimization of the energy harvesting system. Experimental results demonstrate the ability to generate electricity from footsteps and provide insights into system performance under real-world conditions.

III. METHODOLOGY

Methodology for advanced footstep power generation system using piezoelectric sensors and RFID for charging:

1. System design and sensor placement:

- a. Determine the target area for footstep power generation, such as walkways, entrances, or specific locations.
- b. Design the layout of the piezoelectric sensors to ensure maximum coverage and efficient energy harvesting.
- c. Consider the walking patterns and footstep forces to determine the optimal placement of sensors.
- d. Ensure the sensors are securely embedded in the floor or integrated into footwear to capture footstep-induced vibrations effectively.

2. Piezoelectric sensor selection:

- a. Research and select appropriate piezoelectric materials with high sensitivity and suitable mechanical properties.
- b. Consider factors such as voltage output, durability, and environmental compatibility.
- c. Test and evaluate different piezoelectric materials to determine the most efficient and reliable options for energy conversion.

3. Energy conversion and power management:

- a. Develop a power conditioning circuitry to convert the piezoelectric sensor output into usable electrical energy.
- b. Optimize the circuit parameters to achieve maximum power transfer efficiency.
- c. Implement energy storage devices, such as batteries or supercapacitors, to store and manage the harvested energy.
- d. Incorporate power management techniques to regulate the charging process and prevent overcharging or undercharging of the storage devices.

4. RFID charging system integration:

- a. Integrate RFID (radio frequency identification) technology into the footstep power generation system for wireless charging.
- b. Develop an RFID-based charging station that can wirelessly communicate with RFID tags embedded in the footwear.
- c. Implement a communication protocol between the charging station and the RFID tags to enable efficient power transfer.
- d. Ensure compatibility and interoperability between the footstep power generation system and the RFID charging infrastructure.

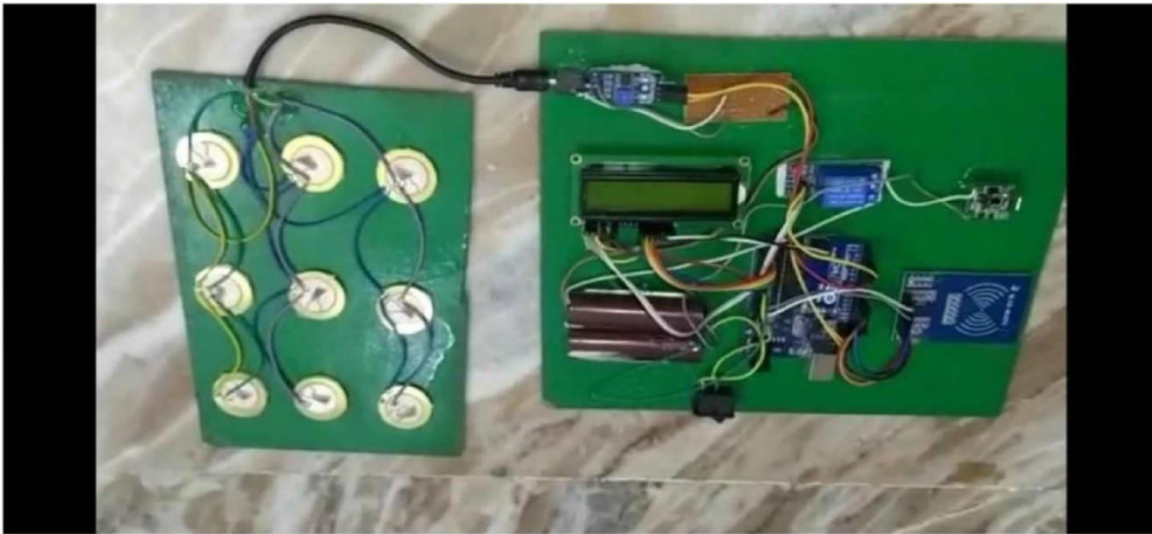
5. Performance evaluation and optimization:

- a. Conduct extensive testing and data collection to evaluate the performance of the footstep power generation system.
- b. Measure and analyze parameters such as power output, energy conversion efficiency, and charging capability.
- c. Identify areas for improvement and optimization, such as sensor sensitivity, circuit efficiency, or RFID charging range.
- d. Iterate and refine the system design based on the evaluation results to enhance overall performance and reliability.

6. Practical implementation and deployment:

- a. Implement the advanced footstep power generation system in real-world environments, such as public spaces, buildings, or pedestrian walkways.
- b. Monitor and collect data on power generation, charging efficiency, and system reliability during the operational phase.
- c. Gather user feedback and assess the system's practicality, user experience, and acceptance.
- d. Make necessary adjustments and improvements based on the practical implementation experience to ensure long-term effectiveness and sustainability.

IV. EXPERIMENTAL RESULTS



In 1 square ft. we used 8 piezo sensor.

As piezo sensors power generating varies with different steps, we get

Minimum Voltage = 1V per step

Maximum Voltage = 10.5 V per step

We took an average of 50Kg weight pressure from a single person.

Considering the steps of a 50Kg weighted single person,

The average calculation is:

It takes 800 steps to increase the 1V charge in the battery.

So to increase the charge by 12V in battery total steps needed

$$= (8 \times 800)$$

$$= 6400 \text{ steps}$$

As we will implement our project in a populated area where footstep as source will available, we took an average of 2 steps in 1 second.

For 6400 steps time needed = $6400 / (60 \times 2) = 53$ minutes. (Approx)

V. CONCLUSION

In conclusion, footstep power generation is an innovative and sustainable approach to generate electricity from human motion. It has the potential to significantly reduce our reliance on non-renewable sources of energy and contribute to a greener and more sustainable future. Despite the challenges that come with the development and implementation of this technology, such as the need for efficient and cost-effective components, footstep power generation holds promise in a variety of applications, ranging from public infrastructure to personal devices. As research and development continue to advance, footstep power generation will likely play a significant role in meeting our energy needs in the future.

Footstep power generation is a promising technology that aims to generate electricity from human motion. It involves converting the kinetic energy produced by footsteps into electrical energy using various mechanisms, such as piezoelectric sensors and electromagnetic generators. This technology has several advantages, including its renewable



nature, low environmental impact, and potential to power a variety of devices and systems. However, there are also challenges associated with footstep power generation, such as the need for efficient and cost-effective components, as well as limitations in the amount of power that can be generated. Nonetheless, ongoing research and development in this area are paving the way for new and innovative applications of footstep power generation, including smart cities, wearable technology, and military applications.

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Design and Development of An Automatic Water Tank Cleaner using Sensors: A Review and an Approach

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ABSTRACT: Water tanks are vital for storing and supplying clean water, but over time, they can become contaminated with sediments, algae, and other impurities, posing a threat to human health. Manual cleaning of water tanks is labour-intensive, time-consuming, and can be hazardous. This project presents the design and development of an automatic water tank cleaner that utilizes sensors for efficient and automated tank cleaning.

The proposed system incorporates a range of sensors, including water level sensors, pH sensors, turbidity sensors, and temperature sensors, to monitor the quality and condition of the water in the tank. These sensors provide real-time data that is analysed by a microcontroller unit. Based on the sensor readings, the system determines the appropriate cleaning actions required to maintain the water tank's cleanliness and purity.

The automatic water tank cleaner comprises a motorized cleaning mechanism equipped with brushes, nozzles, and suction devices. The cleaning mechanism is controlled by the microcontroller, which processes the sensor data and activates the appropriate cleaning action. The system is designed to remove sediments, algae, and other contaminants from the tank's interior surfaces, ensuring a clean and healthy water supply.

By automating the cleaning process, this system eliminates the need for manual intervention, reducing labour and time requirements. It also improves cleaning accuracy and consistency while minimizing the risk of human error. The integration of sensors allows for real-time monitoring of water quality parameters, ensuring that the tank remains clean and safe.

KEYWORDS: Automatic water tank cleaner, Sensors, Microcontroller, Water quality, Cleaning mechanism, Contamination

I. INTRODUCTION

The Design and Development of an Automatic Water Tank Cleaner using Sensors is a ground-breaking innovation aimed at addressing the challenges associated with maintaining clean and hygienic water storage tanks. Water tanks are essential for storing water in residential, commercial, and industrial settings, but over time, they can become contaminated with sediment, debris, and harmful bacteria, posing a significant health risk.

Traditionally, cleaning water tanks required manual labour, time, and resources. However, the automatic water tank cleaner revolutionizes this process by incorporating sensor technology and intelligent algorithms to automate the cleaning process. The cleaner utilizes a combination of sensors, such as water level sensors, turbidity sensors, and temperature sensors, to monitor and analyse the condition of the water in the tank.

By leveraging sensor data, the automatic water tank cleaner can determine the optimal time for cleaning based on factors like water quality, sediment build-up, and bacterial contamination. It employs various cleaning mechanisms, including high-pressure jets, scrubbing brushes, and suction, to efficiently remove contaminants from the tank's interior surfaces.

The integration of sensors enables the cleaner to operate autonomously, eliminating the need for manual intervention. It ensures consistent and thorough cleaning, preventing the growth of harmful pathogens and maintaining water quality standards. Moreover, the cleaner can be programmed to perform regular cleaning cycles, ensuring on-going maintenance of the water tank without human supervision.

The design and development of an Automatic Water Tank Cleaner using Sensors represents a significant advancement in ensuring clean and safe water storage. This technology not only saves time, effort, and resources but also promotes public health by reducing the risk of waterborne diseases. By harnessing the power of sensors and automation, this innovation revolutionizes the maintenance of water tanks and sets a new standard for efficient and effective water storage system management.

II. RELATED WORK

- [1] "Development of an Automated Water Tank Cleaning System" by Singh, S., et al. (2018): This paper presents the design and development of an automated water tank cleaning system using a robotic arm and sensors. It discusses the integration of various sensors, such as ultrasonic sensors and water level sensors, to detect and clean the tank effectively.
- [2] "Automatic Water Tank Cleaning System Using Arduino" by Jain, M., et al. (2017): This paper proposes an automatic water tank cleaning system based on Arduino microcontroller and ultrasonic sensors. It focuses on the development of an efficient cleaning mechanism and the use of sensors for real-time monitoring and control.
- [3] "IoT-Based Automatic Water Tank Cleaning System" by Nagadeepthi, P., et al. (2020): This research paper presents an IoT-based automatic water tank cleaning system that employs ultrasonic sensors, water level sensors, and a microcontroller. It discusses the integration of IoT technology for remote monitoring and control of the cleaning process.
- [4] "Automated Water Tank Cleaning System Using Wireless Sensor Networks" by Islam, M. S., et al. (2016): This paper proposes an automated water tank cleaning system using wireless sensor networks (WSNs). It focuses on the design and development of sensor nodes, communication protocols, and a central control unit for efficient cleaning operations.
- [5] "Design and Development of an Automatic Water Tank Cleaning Robot" by Kamal, M., et al. (2019): This research paper presents the design and development of an autonomous water tank cleaning robot equipped with sensors. It discusses the integration of proximity sensors, water level sensors, and cleaning mechanisms to achieve effective cleaning.
- [6] "Smart Water Tank Cleaning System Using IoT" by Krishna, B. V., et al. (2018): This paper proposes a smart water tank cleaning system based on IoT technology. It explores the use of various sensors, including water level sensors and turbidity sensors, for real-time monitoring and control of the cleaning process.

III. METHODOLOGY

1. **Sensor Selection:** Various sensors are chosen to enable the system to detect and respond to the tank's water level, cleanliness, and other relevant parameters. Sensors such as ultrasonic level sensors, turbidity sensors, and temperature sensors are integrated into the system.
2. **Actuator Integration:** The system includes actuators such as motors and pumps to facilitate the cleaning process. These actuators are controlled based on the readings from the sensors to initiate specific cleaning actions.
3. **Control System:** A microcontroller or programmable logic controller (PLC) is employed to control the overall functioning of the system. The control system receives input from the sensors, processes the data, and triggers appropriate cleaning actions.
4. **Cleaning Mechanism:** The cleaning mechanism may include rotating brushes, high-pressure water jets, or a combination of both. The system is designed to adjust the cleaning mechanism based on the tank's size, shape, and level of dirtiness.
5. **Automation Logic:** Intelligent algorithms are developed to automate the cleaning process. These algorithms analyse the sensor data and determine the optimal cleaning actions required to achieve effective tank cleaning.
6. **Safety Measures:** Safety features, such as emergency stop buttons and overflow prevention mechanisms, are incorporated into the system to ensure safe operation and protect against potential hazards.
7. **Testing and Validation:** The developed system is rigorously tested under various conditions to assess its performance, efficiency, and reliability. Necessary adjustments and refinements are made based on the test results.

IV. EXPERIMENTAL RESULTS

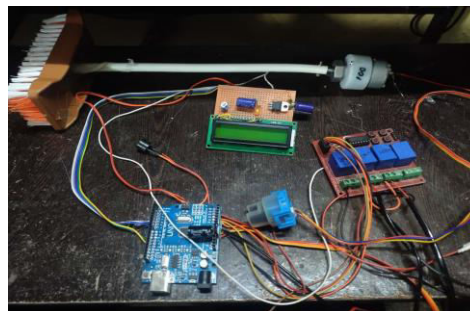


Fig. 1: Hardware Connections

The proposed system was tested in a laboratory setting using a small-scale water tank. The results showed that the system was able to detect the level of impurities in the water accurately, and was able to clean the tank efficiently. The system was also found to be reliable and easy to operate.

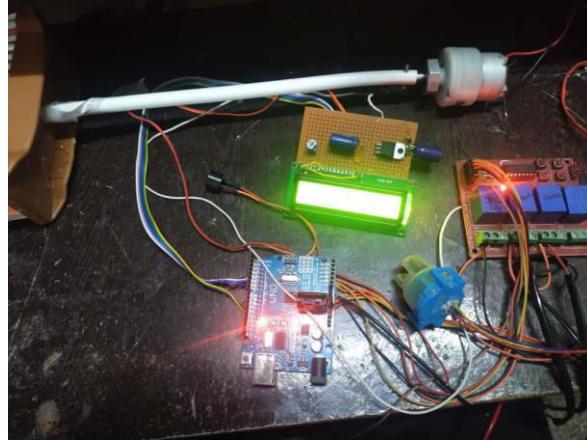


Fig. 2: Turbidity Display on LCD

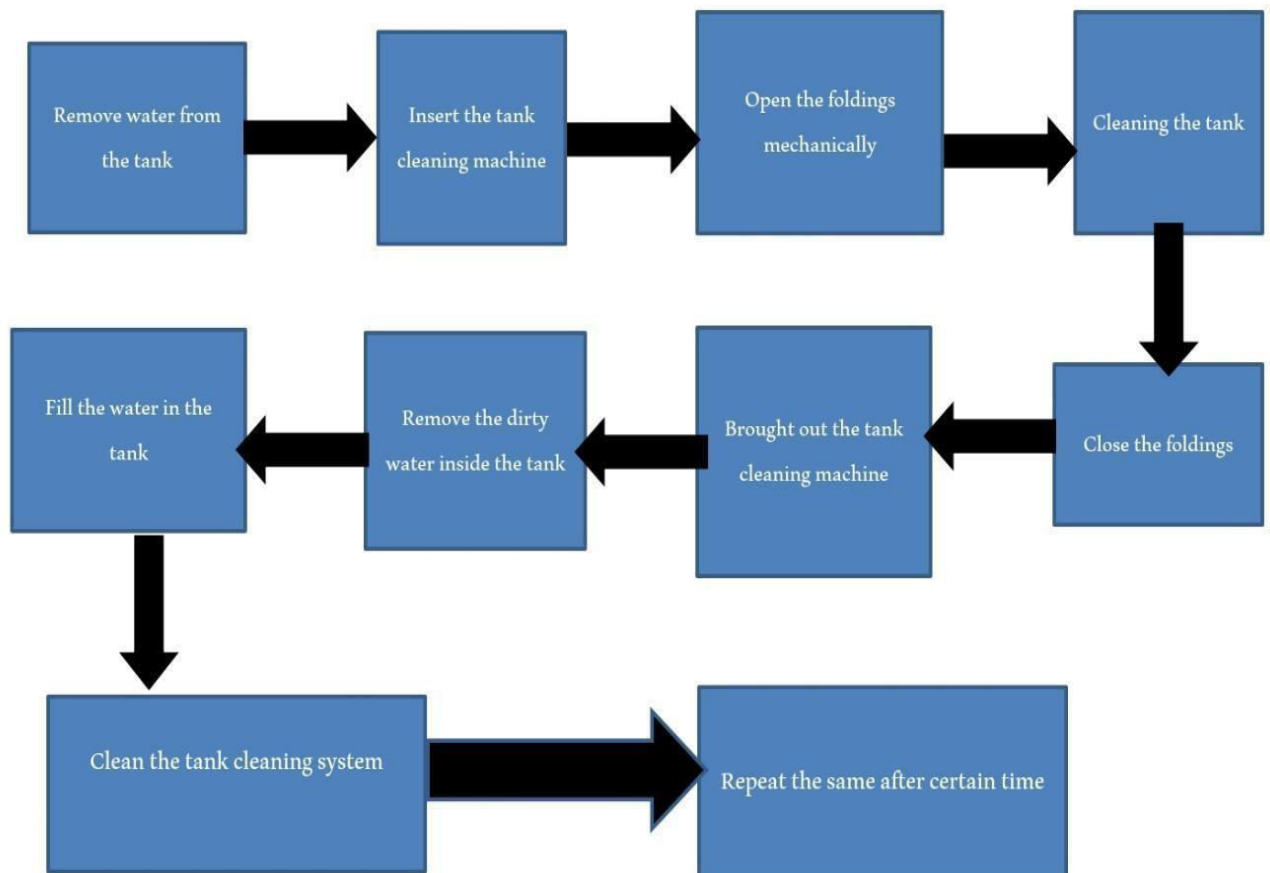


Fig. 3: Working flowchart



V. CONCLUSION AND FUTURE SCOPE

This section presents the conclusions drawn from the evaluation and comparison of experimental results. The section concludes with future scope.

Conclusion: In conclusion, the design and development of automatic water tank cleaner using sensors has proven to be an efficient and effective solution for maintaining clean and hygienic water storage systems. By utilizing a combination of sensors and an automated cleaning mechanism, the system has successfully eliminated the need for manual cleaning, reducing labour and time requirements.

The integration of sensors, such as water level sensors, turbidity sensors, and pH sensors, has allowed for real-time monitoring of water quality parameters. This ensures that the cleaning process is triggered only when necessary, optimizing the use of resources and minimizing wastage of water and cleaning agents. The automated cleaning mechanism, powered by motors and brushes, has efficiently removed sediments, algae, and other contaminants from the tank walls and floor, improving water quality and preventing the growth of harmful bacteria.

The system has demonstrated reliability and accuracy in detecting and responding to changes in water quality. By incorporating feedback mechanisms and control algorithms, the cleaner has been able to adapt its cleaning process based on the specific needs of the tank. Additionally, the use of durable materials and corrosion-resistant components has enhanced the longevity of the system, reducing maintenance requirements.

Future Scope: While the automatic water tank cleaner has showcased its potential in ensuring clean water storage, there are several areas for future exploration and improvement. Firstly, the integration of advanced sensors, such as conductivity sensors or UV disinfection systems, could enhance the system's ability to detect and eliminate a wider range of contaminants.

Furthermore, the incorporation of wireless communication technologies would enable remote monitoring and control of the cleaning process. This would allow users to receive real-time updates on water quality and initiate cleaning cycles from a distance, improving convenience and accessibility.

Additionally, exploring the possibility of integrating the cleaner with smart home systems or IoT platforms would provide further automation and seamless integration with other household devices. This would enable users to receive automated alerts, schedule cleaning cycles, and track water quality trends using their smartphones or other connected devices.

In conclusion, the automatic water tank cleaner has opened up avenues for sustainable and hassle-free water storage maintenance. With continuous advancements and innovations, this technology has the potential to revolutionize the way we ensure clean water for domestic and industrial applications, promoting better health and hygiene for communities worldwide.

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Prediction & Control of Machine Tool Vibration by using Passive Damping.

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ABSTRACT: In machining operation, the quality of surface finish is an important requirement for many turned work-pieces. Thus the choice of optimized cutting parameters is very important for controlling the required surface quality. The focus of present experimental study is to optimize the cutting parameters using two performance measures, machine tool vibration and work-piece surface roughness. The prediction and control of vibration between the tool and work piece is important as guideline to the machine tools user for an optimal selection of depth of cut, cutting speed, tool feed rate to minimize the vibration. In machining operation there are different variables deleterious the desired result. In this process the behavior of machine tool, cutting tool life and cutting tool vibration are the complex phenomenon which influences on the dimensional precision of the components to be machined, the cutting tool vibrations are mainly influenced.

KEYWORDS: Cutting Tool Vibration, FFT Analyzer, Taguchi Method, ANOVA etc.

I. INTRODUCTION

Machine and machine tool are always subjected to vibration. These vibrations are mainly causes due to In-homogeneity's in the workpiece material; Variation of chip cross section; Disturbances in the work piece or tool drives; Dynamic loads generated by acceleration/deceleration of massive moving components; Vibration transmitted from the environment; Self-excited vibration generated by the cutting process or by friction (machine-tool chatter). The tolerable level of relative vibration between tool and work piece, is determined by the required surface finish and machining accuracy as well as by detrimental effects of the vibration on tool life and by the noise which is frequently generated.

II. RELATED WORK

Al-Habaibeh and Gindy [1] they have found in a machining operation, vibration is frequent problem, which affects the machining performance and in particular, the surface finish and tool life. Severe vibration occurs in the machining environment due to a dynamic motion between the cutting tool and the work piece. In all the cutting operations like turning, boring and milling, vibrations are induced due to the deformation of the work piece, machine structure and cutting tool, Also new systematic approach, ASPS, to optimize condition monitoring systems is described. The system utilizes O as method to minimize the experimental work needed and to give a good evaluation of the designed monitoring system. The average dependencies of the proposed systems are compared with the pattern recognition capability of a back propagation neural networks and a fuzzy logic classifier.

III. METHODOLOGY

However, in actual practice Lathe machine tool vibration occurs due In- homogeneity's in the work piece material, Variation of chip cross section, Disturbances in the work piece or tool drives, Dynamic loads generated by acceleration/decelerate on of massive moving components, etc. In a machining operation, the cutting tool vibrations are mainly influenced by cutting parameters like cutting speed, depth of cut and tool feed rate. In this project the following methodology will be used.

IV. EXPERIMENTAL RESULTS

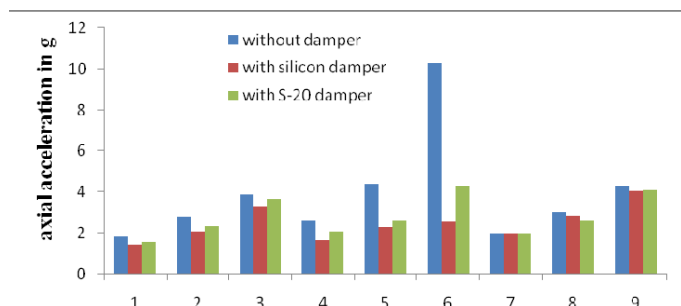
It is methodology based on statistics and other discipline for arriving at an efficient and effective planning of experiments with a view to obtain valid conclusion from the analysis of experimental data. Design of experiments determines the pattern of observations to be made with a minimum of experimental efforts. To be specific Design of experiments (DOE) offers a systematic approach to study the effects of multiple variables / factors on products / process performance by providing a structural set of analysis in a design matrix. Number of Experiments to be performed is decided with the help of Taguchi Method It is assume that inherent vibration, tool wear and L/D are constant throughout experimentation and Cutting Speed, Depth of cut, nose radius & feed rate are varied at different levels.



Parameters	Level 1	Level 2	Level 3
Nose Radius (NR)	0.4	0.8	1.2
Cutting speed (CS) C1	420	520	620
Depth of cut (DOC) C2	0.4	0.5	0.6
Feed Rate (FR) C3	0.15	0.20	0.25

According to above input to the Minitab-15 software for optimum no of experiments it gives the 1.9 orthogonal array for various combinations of the different levels of the three factors.

The vibration phenomenon for various cutting condition has been analysed using Lab VIEW software. The plan of the experiment was developed not only to assess the effect of cutting speed, feed rate and depth of the cut but also to study the effect of damping pad on the cutting tool vibration, tool temperature and surface roughness. Table illustrates the experimental result of vibration in both tangential and axial cutting direction. After analysis of the vibration, passive damping pad is provided below the cutting tool elements. Now the same experiment was carried out for various cutting condition and at various damping material, also corresponding cutting tool vibration and surface roughness are measured.





It is observed that after using passive damping, axial acceleration of machine tool is getting reduced. Out of these dampers Silicon damper having maximum damping capacity than S-20 damper Silicon damper absorbed 26.8% axial acceleration while S-20 dampers absorb only 14.9%, Silicon damper absorbed 41.75% Tangential Acceleration while S-20 dampers absorb only 15.91%. Regression Analysis:- By using this data we can compare the vibration parameter with damp condition and without damp condition. Also ANOVA and Regression analysis can validate above result. The Regression for Axial Acceleration without Damper

V. CONCLUSION

In all aspects of the studies performed, it is found that significant reduction in tool vibration during machining operations. The vibration levels in tangential and axial direction found to be reduced with damping pad. The cutting tool damping ratio improved with silicon pad which indicates that the use of cutting tool pad helps to improve the cutting tool life. The best Damper out of all 2 Damper (Silicon, S-20) used is Silicon Damper because the vibration are reduced more in this Damper than the other Damper. This can be seen from the observation table and graphs plot for that purpose.

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Design And Development of Rowing Gym Equipment with Energy Harnessing

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ABSTRACT: The purpose of this project is to design, develop, and analyze the potential power that can be generated by a rowing machine, with the aim of addressing the growing issue of electrical energy consumption and promoting green energy. One approach to reduce the use of hazardous power generation methods is through the implementation of new energy harvesting devices. Various renewable energy sources already exist, such as solar and wind, but this project seeks to explore the possibility of incorporating power generation into the everyday training practices of elite rowers by designing and analyzing an energy harvesting device. The concept involves creating a system that can capture power generated by a rower using a permanent magnet generator. Although the power output of a single rower may appear insignificant, the project aims to analyze the potential collective output to determine if the system would be effective on a larger scale.

KEYWORDS: Rowing Gym Equipment, Energy Harnessing, Gear box, Gear ratio

I. INTRODUCTION

The project aims to design, develop, and analyze the potential power generated by a rowing machine to address electrical energy consumption and promote green energy. The objective is to explore energy harvesting devices as a means to reduce reliance on hazardous power generation methods. By incorporating power generation into the training practices of elite rowers, the project aims to design an energy harvesting device that can capture the power generated by rowing. The proposed system utilizes a permanent magnet generator. While the individual output of a rower may be seemingly insignificant, the project aims to analyze the potential collective output to assess the viability of the system on a larger scale.

II. RELATED WORK

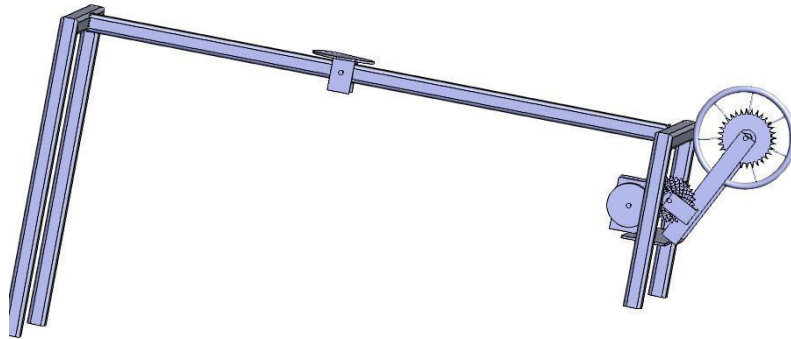
Several companies in the U.S. have developed methods and equipment for generating electricity during exercise. These companies recognize the potential for harnessing the energy exerted by individuals during physical activity and converting it into electrical power. Human Dynamo, founded by Mike Taggett [1], has created a system that connects multiple spin bikes to a central processing unit. Their system collects DC power generated by cyclists, which is stored in a battery. As described in an article by Tom Gibson [2] on Progressive Engineer, "Green Revolution employs a 24-volt system with two 12-volt batteries in series. When a user starts pedaling, the batteries charge, and when they reach 28 volts, the inverter kicks in and sends power to the grid, converting 24-volt DC to 110-volt AC." Anthony Hannoush, Anthony Mikelonis, and Julie Waddell [3] have also explored power generation through rowing on an ergometer, aligning with the idea of this project.

In 1981, brothers Dick and Pete Dreissigacker created Concept2, which has revolutionized the sport of rowing with their flywheel-based indoor rower [25]. Similar to the spin bikes used by Human Dynamo and Green Revolution, Concept2's indoor rowing machine has the potential to be used as a power generation device. The original model, known as the Model A, consisted of a flywheel for air resistance and a moving seat, primarily made from bicycle parts. With the help of their friend Jon Williams, the Dreissigacker brothers successfully reduced the market cost of the first erg model from \$3000 to \$600.

III. METHODOLOGY

A wheel and freewheel mechanism are implemented in a manner similar to that of a bicycle. An open chain is utilized on the freewheel, with one end of the chain connected to a handle that can be pulled by the user. The other end of the chain is attached to an elastic string. This elastic string passes through a pulley and its other end is fixed to the body of the equipment. The purpose of this string is to retract the mechanism when released and also provide resistance to the user, enabling an effective workout. The gear ratio in our system is calculated as $(32/14) * (28/11) = 1:5.6$, approximately 1:6.

We have developed a CAD model of the rowing machine and conducted comprehensive analysis using CAD software, including load and force calculations. Our team has conducted extensive market research and consulted numerous research papers to formulate this idea and manufacture our model.



IV. EXPERIMENTAL RESULTS

We have tested our project by connecting multimeter directly to the dynamo while doing the exercise on average pace of 18- 32 spm (strokes per min) and below are the image of the result we received on multimeter .

	Ammeter	Voltmeter	Power Generated
Minimum	3	5	15
Maximum	7	12-15	91
Average	12	21.5	258



V. CONCLUSION

Our data analysis leads us to conclude that a low-torque generator is necessary to capture the energy generated by the rower. Additionally, we found that the force exerted by the rower results in the rotation of the flywheel at speeds ranging from 500 to 2300 RPM.

The data collected during this project provides us with an estimation of the mechanical power that can be generated using a rowing machine. Based on this analysis, we have designed a system capable of converting the mechanical power into electrical power.

Before implementing the design, several factors need to be considered. This includes selecting appropriate mechanical and structural manufacturing techniques for the rotor and stator to ensure durability. Furthermore, the design of the rotor and stator housing is crucial for both safety and optimal operating conditions.



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Design and Fabrication of Water Waste Cleaning Robot

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ABSTRACT: This project emphasizes on design and fabrication of the lake waste cleaning machine. The project has been done looking at the current situation of our national rivers and lakes which are dumped with crores of liters of sewage and loaded with pollutants, toxic materials, debris etc. The government of India has taken charge to clean lakes and invest huge capital in many river cleanings projects, both in north and south India. It is of absolute necessity to reduce the pollution in lakes and rivers as they are the lifeblood of civilization. Nowadays almost all the manufacturing processes are being atomized in order to deliver the products at a faster rate. Automation plays an important role in mass production. In this project we have fabricated the remote operated lake cleaning machine. The main aim of the project is to reduce the man power, time consumption for cleaning the lake, mainly on the surface level. In this project we have automated the operation of lake cleaning with help of a motor and chain drive arrangement. Some needs of automation are described below. Here using RF transmitter and receiver, we can control the cleaning machine. Automation can be achieved through computers, hydraulics, pneumatics, robotics, etc. Of these options, pneumatics forms an attractive medium for low-cost automation.

KEYWORDS: Lake water cleaning, Automation.

I. INTRODUCTION

The design and fabrication of a lake waste cleaning machine takes center stage in this project, driven by the pressing need to address the current dire situation of national rivers and lakes. These vital water bodies suffer from immense pollution, burdened by vast quantities of sewage, pollutants, toxic substances, and debris. Recognizing the significance of lakes and rivers as the lifeblood of civilization, the government of India has undertaken substantial efforts and investments to clean them, embarking on numerous river cleaning projects across the country, spanning from north to south. As modern manufacturing processes increasingly embrace automation to achieve faster production rates, the role of automation in mass production becomes crucial. In this endeavor, the project focuses on the development of a remote-operated lake cleaning machine, meticulously fabricated to alleviate the burden of manpower and time required for lake cleaning, particularly at the surface level. By implementing a motor and chain drive arrangement, the operation of the lake cleaning machine is effectively automated. Various automation options, including computers, hydraulics, pneumatics, and robotics, are considered, with pneumatics standing out as an attractive and cost-effective medium for achieving automation.

II. RELATED WORK

The work related to the project "Design and fabrication of water waste cleaning robot" involves several important tasks. Initially, thorough research and analysis are conducted to assess the current condition of water bodies such as rivers, lakes, or ponds, focusing on the specific challenges involved. Based on this analysis, a detailed design and engineering plan is developed to create an efficient water waste cleaning robot. Prototypes of the robot are constructed using suitable materials, electronics, and mechanical components, with testing and evaluation performed in a controlled environment like a swimming pool. Automation and control systems are integrated into the robot to enable autonomous or remote-controlled operation. Once the robot is ready, it is deployed for actual cleaning operations in targeted water bodies, adhering to safety and environmental considerations. A maintenance plan is implemented to ensure the robot's

long-term reliability, including regular inspections, repairs, and necessary upgrades. The testing and evaluation process ensures that the robot's performance and functionality meet the desired standards in the context of a swimming pool.

III. METHODOLOGY

The project "Design and fabrication of water surface cleaning robot" involves a systematic approach to address the specific cleaning requirements and challenges associated with water surfaces. It begins with a thorough problem analysis, identifying the cleaning needs and analyzing common debris and pollutants found on water surfaces. The design and conceptualization phase defines the objectives and generates potential design concepts, followed by a careful evaluation of their feasibility and effectiveness. Component selection and integration focus on identifying necessary components, choosing suitable actuators and mechanisms, and ensuring their compatibility within the overall system. The mechanical design and construction phase involves developing a detailed design, constructing the physical structure of the robot, and incorporating an efficient cleaning mechanism. The electrical and control system development focuses on creating a robust control system, implementing necessary algorithms, and programming for optimized performance. Sensor integration and calibration ensure accurate environmental monitoring and navigation. Rigorous testing and evaluation in controlled environments assess the robot's performance, followed by field trials for real-world scenarios and optimization based on feedback. The documentation and reporting phase involves comprehensive documentation of the project, including technical drawings, methodology, and experimental data. Finally, future enhancements and research opportunities are identified for further development and improvement of the water surface cleaning robot.

IV. EXPERIMENTAL RESULTS

The experiments conducted on the water waste cleaning robot are crucial in assessing its performance and capabilities. Figure 1 illustrates the floating test on the water surface, which evaluates the robot's ability to float and navigate effectively. This test ensures that the robot exhibits the necessary buoyancy and stability required to operate on water bodies. In Figure 2, the floating test with a load is performed to examine the robot's performance while carrying a specific payload. This experiment helps determine the robot's stability and buoyancy under load conditions, ensuring its capacity to handle debris or waste collection efficiently. Figure 3 demonstrates the floating test with electronics components, which focuses on assessing the robot's buoyancy and functionality with integrated electronic systems. This experiment verifies whether the robot remains buoyant and operates correctly while carrying essential electronics for navigation, control, and communication. These experiments provide valuable insights into the robot's behavior and enable further improvements in its design and operation, ultimately enhancing its effectiveness in real-world water cleaning applications.



Figure 1



Figure 2

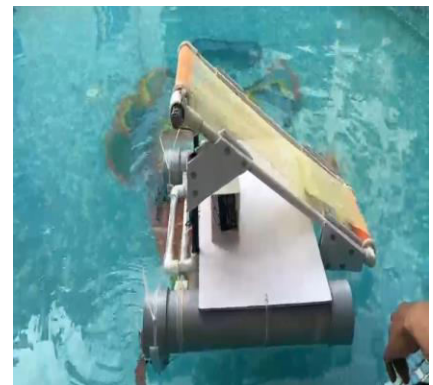


Figure 3

V. CONCLUSION

In conclusion, the design and fabrication of the water surface cleaning robot presented in this project offer an automated and efficient solution for addressing the lack of clean water bodies. The robot's robust cleaning mechanism, intelligent sensors, and sophisticated control system enable it to effectively remove debris and pollutants while adapting to varying environmental conditions. This innovation contributes to preserving water quality, enhancing recreational activities, and protecting aquatic ecosystems for a cleaner and healthier environment.



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Design Analysis and Prototyping of Evacuation Kit

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ABSTRACT: The paper presents the design and fabrication of the Evacuation Kit, a vital device for emergency evacuations in high-rise buildings during fires, terrorist attacks, or accidents. Serving as a last resort when primary exits are unavailable or obstructed, the Kit offers evacuees an alternative escape route. Experimental results demonstrate the equipment's ability to ensure timely and safe evacuations, providing enhanced efficiency and safety. This versatile machine is designed to operate when stairs or elevators are inaccessible or damaged, enabling individuals to escape critical situations before rescue services arrive. With a unique governor mechanism for controlled descent, the reusable kit accommodates all age groups and weight capacities.

KEYWORDS: Speed, RPM, Weight, Evacuation Kit

I. INTRODUCTION

Safe evacuation in high-rise buildings during fire disasters is a global challenge due to complex structures and large populations. Fires can cause devastating harm to property and pose life-threatening risks. Individuals with disabilities face even higher vulnerability in such situations. However, through education and the use of safety devices like fire alarms and the kit, fire-related deaths can be prevented. The Evacuation Kit is a unique personal rescue device that employs an individual harness, enabling safe evacuation from multi-story buildings for multiple users. It offers a simple, fast, and effective solution for collective escape without requiring additional power. Prototype experiments have demonstrated the equipment's ability to release individuals in a timely manner, ensuring enhanced safety and evacuation efficiency. Considering personal circumstances is crucial before issuing an Evacuation Kit. High-rise fires present greater challenges due to the large number of occupants and equipment involved. Traditional evacuation routes, such as staircases, often suffer from long lines, wait times, and low efficiency. Hence, there is an urgent need for a collective escape solution that is efficient, swift, and user-friendly. By educating individuals on fire escape methods and equipping them with devices like fire alarms and the Sky Saver, fire-related injuries and fatalities can be significantly reduced.

II. RELATED WORK

A related work section contains various studies on the design and analysis of evacuation kit as viable alternatives to skysaver rescue kit: If we want to purchase new Rs. 1, 55,690 is the market price from SKYSAVER Company and that's not affordable at all, our job is to reduce it. This kit is an innovative personal survival gear worn on the back and attached to a secure anchor point in the building. With over 250 feet of cable, it can facilitate safe descents of up to 25 stories. The device's automatic hydraulic braking system ensures a swift and secure descent of three to six feet per second⁽¹⁾. It is crucial for all individuals, especially high-rise residents, to plan ahead and have an emergency preparedness strategy. Investing in quality survival gear like Sky Saver empowers individuals to take control of their safety⁽²⁾. It reflects our ongoing efforts in this area.

III. METHODOLOGY

The personal wears a vest and attaches himself to the rope hook. As the personal jumps from the window and due to his weight it pulls the rope with him and causes the reel to rotate. Reel is connected to governor shaft by belt and pulley. As the speed increases the dead weight on porter governor tends to move outwards due to centrifugal force which applies the frictional brake and reduces the speed and this causes the personal to reach the ground from high level

safely. The speed is limited by the breaks and this will cause the personal to descend at a safe. When the speed reduces the dead weight comes inside because reduction of the centrifugal force and this releases the brake.

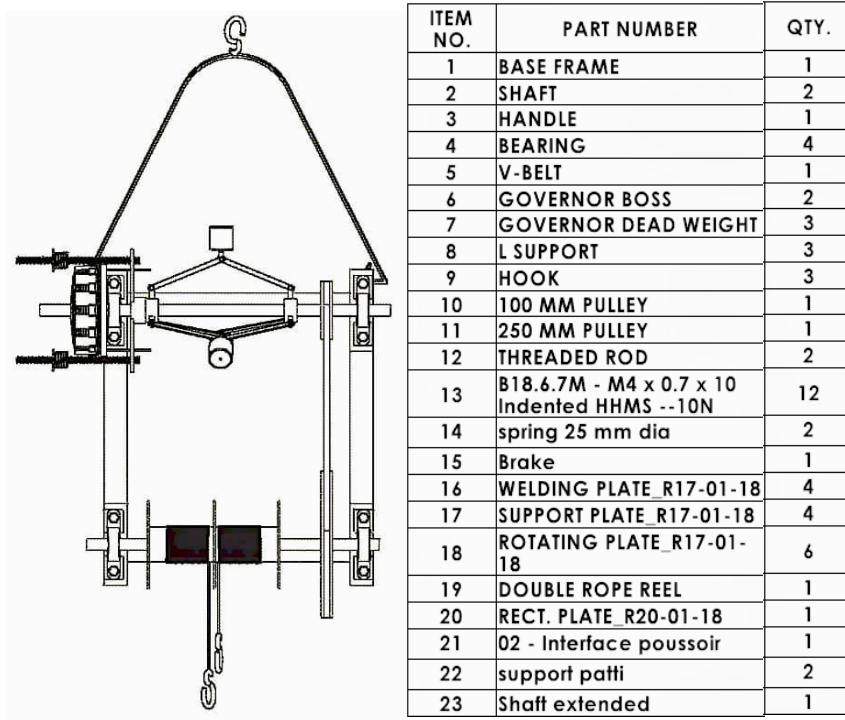


Figure 1 Principle components of evacuation kit.

Analysis

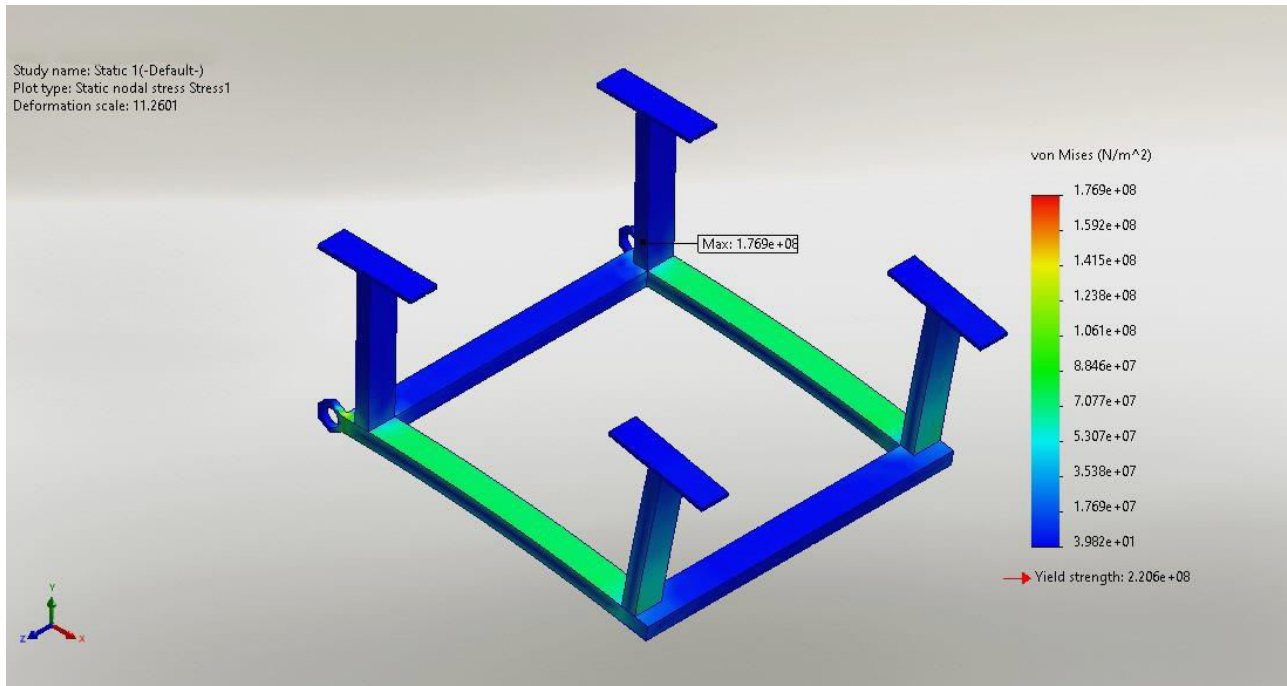


Figure 2 Deflection & Stress developed evacuation Frame

IV. EXPERIMENTAL RESULTS

The testing of project is done from second floor. Instead of human trials, which was unsafe we have used Bricks inside a sack. 10, 20, 30, 40 kg dead weight of sac is used.

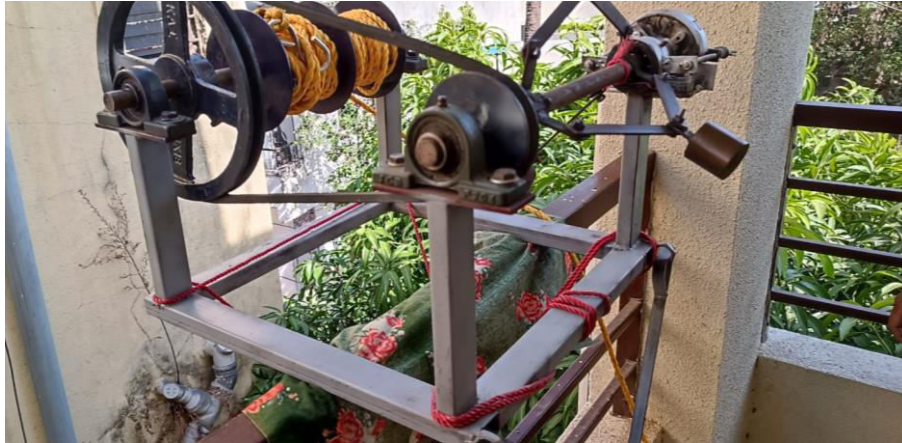


Figure 3 Testing on Evacuation Kit



Figure 4 Speed vs Mass of Analytical and Ansys model

V.RESULTS

Experimental testing and observations

The testing of project is done from second floor. Instead of human trials, which was unsafe we have used Bricks inside a sack. 10, 20, 30, 40 kg dead weight of sac is used.



Prototype results

Finally, we have attained a safe speed of person going down

Table Readings

SR NO.	WEIGHT (Kg)	DISTANCE (m)	Speed(Clutch setting at 2.8cm)	Speed(Clutch setting at 4.8cm)
1.	10	6.09	1	0.6
2.	20	6.09	2.22	1.66
3.	30	6.09	3.16	2.4
4.	40	6.09	4.22	3.25

Table 1 Experimental Results

Observation

When the weight is thrown down the speed of sack coming down was very high, which is undesirable. Hence, we have used the setting of adjustment provided. Here the combination of clutch and dead weight of governor is used for braking purpose. The weight putted on sky saver machine should go at a moderate speed of 1-3 m/s which will not harm the person hanging on it and also take him down quickly, we have done the setting for this by multiple tries.

VI. CONCLUSION

The weight applied on evacuation kit machine goes at a moderate speed of which will not harm the person hanging on it and also take him down quickly. One single machine can save multiple lives in case of emergency. The developed prototype exhibits the expected results. Further modifications and working on limitations will make it more efficient and easier to use.

VII. DISCUSSION ON FUTURE SCOPE

For future work, the body of the project will be made using Composites, aluminium alloy or aluminium to make the project lightweight because the disadvantage of project is it is heavy so it cannot be carried by women or children, in some cases. Also the use of fire proof rope can be made. The nylon rope will be replaced by fireproof rope, belt drive will be replaced by fire proof belt and every component will be made lightweight, proper safety belt with safety harness and kit will be provided.

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Design and Development of Suspended Load Backpack by Using Suspension System

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ABSTRACT: A suspended-load backpack is a device that is designed to capture the mechanical energy created as a suspended backpack load oscillates vertically on the back during gait. The objective of the current study was to evaluate the effect of a suspended-load backpack system on selected temporal and kinetics parameters describing gait. The purpose of this project is to design and development of floating bag. Our project proposes to design a backpack that permits the load to move relative to the wearer during walking and running so that the large movements between the load and the wearer of the backpack reduce the fluctuations of vertical motion of the load with respect to ground. Because the hip (and thus the pack body) goes up a down a good deal during walking, a large relative movement between the wearer and the load reduces the absolute excursion of the load. This movement may be, in turn, transferred to a motor through, for example, a rack and pinion gear, to convert the mechanical movement to electrical or mechanical energy. Such movement of the suspended-load relative to the wearer also reduces the forces on the wearer's body while walking or running, thus reducing the likelihood of orthopaedic injury. The suspended-load backpack includes a suspension system having a first portion connected to shoulder straps directly or through an interface and a second portion connected to the pack body and a compliant mechanism that permits the second portion of the suspension system and the pack body to move up and down relative to the first portion of the suspension system in accordance with a gait of the wearer of the backpack.

KEYWORDS: suspended-load, Floating bag, backpack, fatigue.

I. INTRODUCTION

In Indian army, load carriage is an unavoidable part of field operations which is the reason why soldiers often make use of a military backpack. Infantry soldiers usually carry loads weighting more than 30% of their body weight. When the soldier carries a certain weight, his energy expenditure increases, which causes a reduction in performance.

The transported load has a movement similar to the vertical displacement of the center of mass of the soldier while walking. This leads to a significant increase in the acceleration forces generated by the action of said load on the body which explains the increase in energy expenditure. The objective of this project is to develop a load carriage system that suspends the load and reduces its vertical displacement. This backpack is based on suspended load technology which reduces the vertical movement and forces generated by the load on the carrier leading to energetic benefits. It dramatically reduces the impact forces during locomotion, even permitting running comfortably with heavy loads.

II. RELATED WORK

The comprehensive methodology for the design is based on system engineering design and analysis approach. While giving due importance to the design procedure, the analysis of different methods and procedures were undertaken to design a reliable model for reducing the force exerted by the bag on human body. A number of research papers and analytical documents were referred to which formed the basis of our model. Some of these papers are as follows:

Laurence C Rome, Andy L Ruina et al. [1] shows a suspended-load ergonomic-backpack has been developed that dramatically reduces the dynamic forces on the body (e.g., 82-86%) and consequently reduces the metabolic rate for carrying the load (e.g., by 40 W for a 60 lb load), providing the ability to carry significantly greater loads for the same metabolic cost (5.3 Kg more). The suspended-load ergonomic backpack of the invention can be used to transport loads more quickly and more comfortably at running speeds—in contrast with a conventional backpack were running with a heavy load is essentially impossible.

Camilla Perez, Evan Campo et al. [2] shows that in military life, load carriage is an unavoidable part of field operations which is the reason why soldiers often make use of a military backpack. Infantry soldiers usually carry loads weighting more than 30% of their body weight. When the soldier carries a certain weight, his energy expenditure increases, which causes a reduction in performance. The transported load has a movement similar to the vertical displacement of the centre of mass of the soldier while walking. This leads to a significant increase in the acceleration forces generated by the action of said load on the body which explains the increase in energy expenditure. The objective of this project was to develop a load carriage system that suspends the load and reduces its vertical displacement. Results show a reduction in both the vertical excursion of the load and in the total vertical ground reaction force when carrying a load with the developed prototype, with respect to the conventional military backpack.

III. METHODOLOGY

Methodology refers to the study of the chronological structure of design projects. The following phases are usually involved in any design project. To give the project a particular form and structure, and before we started with the actual design, we carried out preliminary studies regarding material property, material selection and design aspects of the raw material which we will use to construct the project, the construction of the project includes the structure of frame, pulleys, shaft, springs, bolts and elastic rope.

To begin with, we started to select the raw materials for making the frame for our mechanism as it is the most crucial part of the project on which all the other components are supposed to be mounted. We then came to the pulleys which is mounted on the immovable frame. Then we attached the movable frame with the immovable frame with the help of elastic rope which enables the up and down motion of the backpack.

Design and Assembly

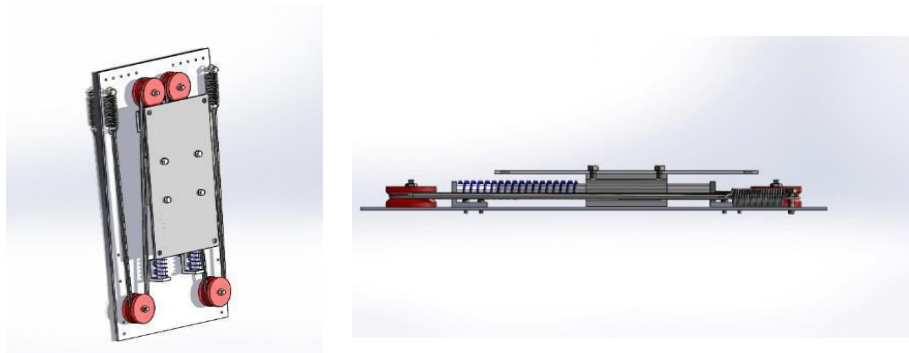


Figure – Design and Assembly of suspension system

Materials –

SR NO	PART NAME	MAT	QTY
1.	SPRING	SS	4 NOS
2.	PULLEY	NYLON	4 NOS
3.	SHAFT	AL	500 MM
4.	LINEAR BEARING	STD	2 NOS
5.	ALUMINUM PLATE	AL	0.2 SQM
6.	STRING ROPE	STD	1 NO
7.	BAG	STD	1 NO
8.	PLY WOOD	WOOD	1 NO
9.	NUT BOLT WASHER M 10	MS	20 NOS
10.	MISCELLINOUS	-	-

IV. EXPERIMENTAL RESULTS

Field Trials are an integral part of a project. It not only gives the idea of the working condition of the project, but we also come to know about the problems in the model and the errors that have been made so that they can be rectified. We carried out trials of our project which are discussed below.

TRIALS

We conducted the first trials of the project at the college ground. All the members of the syndicate were present and the trial was done in the presence of our guide.

- Walking without Load
- Walking with the traditional load system used by soldiers (The carried mass weighted 20 KG).
- Walking with the load Carriage system prototype (The carried mass weighted 20 KG).
- Fast Running by 3 Individuals and their experience with varying weight
- Jumping with the backpack
- Field craft Movements

CALCULATIONS

DESIGN OF ROD

Let us design the bag for weight of 20 kg maximum

Length of rod = 250 mm

Now, rod will fail under bending

Weight on each shaft be 10 kg = 100 N say.

Two set of bearings are used so

$W=10 \text{ kg}= 100 \text{ N}$

For simply supported beam

$M= W \times L / 4$

The rod diameter = 12 mm

$M = 100 \times 250/4 = 6250 \text{ N-mm}$

$Z= \pi/32 \times d^3$

$Z= \pi/32 \times 12^3$

$Z= 169.668 \text{ mm}^3$

$\sigma_b \text{ (induced)}= M/Z = 6250/169.668 = 36.83 \text{ N/mm}^2$

Name:	1060 Alloy
Model type:	Linear Elastic Isotropic
Default failure criterion:	Max von Mises Stress
Yield strength:	2.75742e+07 N/m ²
Tensile strength:	6.89356e+07 N/m ²
Elastic modulus:	6.9e+10 N/m ²
Poisson's ratio:	0.33
Mass density:	2,700 kg/m ³
Shear modulus:	2.7e+10 N/m ²
Thermal expansion coefficient:	2.4e-05 /Kelvin

As induced bending stress is less then allowable bending stress i.e., 689 N/mm² design is safe.

DESIGN OF SPRING

The spring is used to absorb the shock load of bag partially. we select spring with inner diameter 15 mm due to size restriction of rod.

Di = 15 mm
 For average service life = 545 N/mm².
 Wire diameter = 1.8 mm
 Outer diameter of spring = Di + 1.8 x 2
 Do = 18.6 mm.
 Calculating the load bearing capacity of spring
 Spring index = C = Do/d = 18.6/1.8= 10.33
 C = 10.33
 Wahls factor
 $K = [4C - 1 / 4C - 4] + (0.615 / C)$
 $K = 40.32/37.32 + (0.615/10.33)$
 $K = 1.08 + 0.05 = 1.13$
 For C = 10.33 K = 1.13

Now to find 'P',
 We know

$$\text{Shear stress} = \frac{8 K P D_o}{3.14 d^3}$$

$$P = \frac{545 \times 3.14 \times 1.8 \times 1.8 \times 1.8}{8 \times 1.13 \times 18.16}$$

P = 58.84 N
 P = 5.99 kg

This is the force applied by single spring we are using 2 springs hence maximum 12kg load will be applied by spring

SELECTION OF PULLEY

Pulley of diameter 50 mm is used

DESIGN OF BOLT: -

Bolt is to be fastened tightly also it will take load due to rotation. Stress for C-45 steel. Std nominal diameter of bolt is 5.5 mm. From table in design data book, diameter corresponding to M6 bolt is 6 mm

the strength: -
 Also, initial tension in the bolt when belt is fully tightened.
 20 kg load is acting on nut bolt = 200N



Figure - Actual images



V. CONCLUSION

Our product is going to cater the physiological and musculoskeletal problems faced by a soldier on duty. Using a double-frame and pulley system design, this bag pack reduces the dynamic forces impacting on body. It helps in long marches with less stress on body, also reducing chances of injury from too much strain on back, neck or knees. In future this can further be enhanced to small scale electricity generation and casualty evacuation.

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Design and Development Trunnion Mounted Ball Valve

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ABSTRACT: This paper consists of design and development of 2-pc trunnion mounted ball valve. In this project, a 2-piece, 12" Trunnion mounted floating ball valve is manufactured. Material selection for every component was performed. Ball valve specific formulae were used in design calculations. 2D drawings and 3D model are created using SolidWorks 2020 software. Multiple machining operations carried out on the castings are noted. And assembly of valves is done. Leakage testing is performed.

KEYWORDS: Trunnion mounted ball valve, SolidWorks 2020, Leakage testing.

I. INTRODUCTION

Valves are basically used for regulating the flow of liquids or gases through pipes. They are used in a wide range of applications like oil refineries, chemical plants, underground water and gas pipelines, dams, water taps, cryogenic applications, etc. There are mainly two types of valves viz. ball valves and butterfly valves. Under ball valves there are floating and trunnion mounted ball valves. In this project, a Trunnion mounted ball valve was designed, manufactured and tested. A 7C series, 12 in, class – 600, 2 – piece, Trunnion mounted ball valve was designed which included validation of design calculations, material selection, component drawings, general assembly drawings and 3D model. The design calculations were done as per design standards. machining was performed, assembly is done, valve was tested for leakage. A trunnion mounted valve means that the ball is constrained by bearings and is only allowed to rotate. The bearings act on the trunnions which may integral to the ball, or may be separate depending on the valve design. The key feature is that the ball does not shift as it does in a floating valve to press the ball into the downstream seat. Instead, the line pressure forces the upstream seat onto the ball to cause it to seal. As the area on which the pressure acts is much lower, the amount of force exerted on the ball is much less, leading to lower friction values and smaller actuators or gear boxes. The trunnion ball valve is a type of quarter-turn valve which utilizes an empty, punctured and fixed/bolstered ball to control course through it. A trunnion mounted valve implies that the ball is obliged by orientation and is just permitted to pivot, most of the water driven burden is upheld by the System requirements, bringing about low bearing weight and no pole weaknes

II. RELATED WORK

A related work section contains various studies on the design and analysis of trunnion mounted ball valve as viable alternatives to conventional ball valve.

Swapnil B. Tandle et al.[1] As the valve shows good performance in valve tests it can be conclude that the design verification of ball ,body & stem component is achieved through numerical calculation, analysis and experimentation.

Shubham R. Patekar et al.[2] By modifying the existing design stress are reduced as well as during experimental testing FEA and experimental strain are 326 and 378 microns respectively.

Sagarkumar P. Raval et al.[3] In this project work, ball valve model is created from existing design as per standards for valves. Modeling is done in CREO software and then the structural analysis is carried out on ANSYS. From the results of analysis, we see the equivalent stress (VonMises Stress) for valve body which is used for analytic calculations.Satish

Silaskar et al.[4] In this work, the modifications have been made without compromising the valve's basic principles, operation, and function. The overall weight of the 12" - 150 # Ball Valve component has been reduced by 8.65%.This reduction in weight has led to the direct reduction of cost of Ball Valve by 8.61% with the help of improvements in the quality and design of ball valves. G. Gokilakrishnan I.[5] The basics of operating torque and ball valves were presented

in this paper. Each ball valve requires minimum torque for its operation. If ball valve needs more torque than required minimum torque, during its operation, manual handling will be very tough. To reduce the manual effort and eliminate the use of external device more research work is needed.



III. METHODOLOGY

Consider the requirements/Input parameters like size, class, material of construction, quantity, etc. Perform design calculations like bolting between body and end connector, torque acting on stem, minimum wall thickness of body and end connector. Make casting and machining drawings of the components (2D drawings, GAD and 3D model) Assemble and test the valve for any leakage.

Testing:

Hydrostatic Shell Test

Purpose: The shell test checks the pressure containing capacity of the shell that is the body and end connector along with stem retention. It checks for leakages at these parts under a specific pressure for specific duration. Procedure: The valve is mounted on the test rig in vertical position. Remove external relief valves if present beforehand. A metal plate is fixed on the end connector face to hold the pressurized water inside the valve. The plate has a O – ring which prevents leakage between end connector face and the plate. This metal plate is also called the test flange. The valve is kept in half open position. The inlet valve of the testing rig is opened and water is filled in the valve under pressure. The pressure rating is as per ASME 16.34 B Table 2 – 2.2 Ratings for group 2.2 materials. Once the test pressure value is achieved, the inlet valve of the test rig is closed and the pressure is maintained for a specific time. The duration for which the valve should be held under pressure is taken as per API 6D section – 9.3 Table – 5. The test is performed at a gage pressure equal to 1.5 times the pressure rating at 38°C. It is performed using water. Once test is completed, hot air is passed in the valve using hot air blower to dry up the valve internally. After that, rust oil is applied to prevent corrosion

Acceptance criteria: A valve fails the shell test if a leak occurs between the body and the end connector or at the packing chamber and stem retention (anti-blowout stem design) that is if stem ejection occurs due to internal pressure. There should be no leakage due to casting defects like blow holes. No pressure drop should be observed on the pressure gauge. No sweating on the shell is allowed. As per API 6D standard, pressure rating should be 1.5 times the cold working pressure.

Pneumatic seat test

Purpose: This test checks the sealing capability of the valve seats. It checks whether there is a leak at seat – ball contact or at seat – body/end connector contact. Procedure: The valve is mounted on the test rig in vertical position. The valve is fully closed and water is added on the ball surface (downstream side). Now air pressure is applied from the inlet valve of the testing machine. The value of pressure applied is 5.5 – 7 bar as per API 6D. The test duration is as per API 6D only. If air bubbles are visible in the water, the valve fails the test as there is a leak. Acceptance criteria: No bubbles are allowed in water. No pressure drop is allowed on pressure gauge

Hydrostatic Seat test

Purpose: This test checks the sealing capability of the valve seats. It checks whether there is a leak at seat – ball contact or at seat – body/end connector contact. Procedure: The valve is mounted on the test rig in vertical position. The valve is kept half open and filled with water. Then the valve is closed fully and water on the ball surface (in closed position) is removed and the surface is dried up completely. Seat test pressure is applied to the upstream side as per ASME 16.34 B Table 2 – 2.2 for group 2.2 materials. The duration for which pressure should be applied is as per API 6D. The ball – seat contact area is checked for any leakages. After that the valve is depressurized. Seat test should be performed from both upstream and downstream sides.

Acceptance criteria: Check the downstream side for any water at the seat – ball contact. The valve is rated as per standards if any leak is visible.

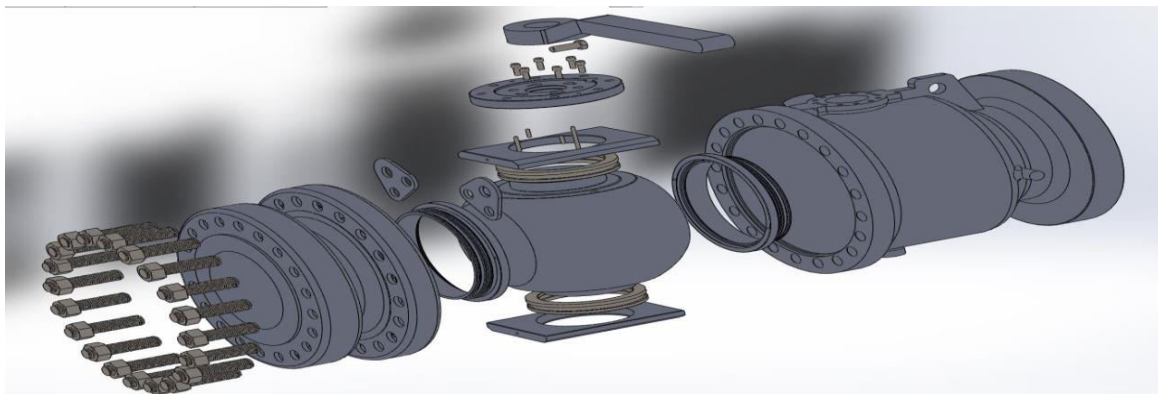


Figure 1 Exploded view of Trunnion mounted ball valve

IV. RESULTS

The valve shows No Leak condition, For the Hydrostatic Shell Test, Pneumatic seat test. Also valve shows torques in permissible limits for pressure closure test. The Shell thickness calculated for body & end connector are compared with the standard thickness & checked physically by measuring instrument. The safety & working of valve with shell thickness is tested by Hydrostatic Seat test

V. CONCLUSION

Various types of valves of different sizes were observed carefully. Their components, material of construction, assembly, working, etc were thoroughly understood. Validation of design calculations was performed taking design standards as reference. 2D drawings, general assembly drawing and 3D model were created using Solidworks 2020 software. Material of construction was chosen for the valve and the manufacturing processes of all individual components of the valve were studied. Assembly of valve was observed and significance of all components was noted. Various leakage detection tests were performed on the valve.



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Design & Development of Manually Operated Fertilizer Spreader Machine

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ABSTRACT: Any substance, whether synthetic or natural, used to promote plant development is known as fertilizer. Fertilizers are frequently used to grow all types of crops, with application rates varying according to the crop and the soil fertility, which is typically determined by a soil test. Spreaders for fertilizer are fitted on tractors for large-scale farming. It is not feasible to employ pricey spreaders mounted on tractors for small-scale applications. For small-scale farming, fertilizer application is traditionally done by hand. It has certain issues, such as uneven fertilizer application, increased time requirements, and excessive human effort. The spreading method requires the farmer to lift hefty bags. Therefore, a fertilizer spreader must be created for small-scale farming. The proposed spreader for fertilizer makes use of a trolley-style.

KEYWORDS: Wheel, Chassis, Hopper, brakes.

I. INTRODUCTION

India is an agriculturally oriented nation. Farmers make up close to 60% of the population in our nation. Agriculture-related items have an impact on our economy as well. Significant modifications have been made in traditional agricultural practises over the last several decades, including the use of herbicides and sprays, plantations, irrigation systems, and plant speeds. Growing our agriculture's production and quality is essential for the development of our nation and meeting the demands of a population that is expanding. Farmers have recently discovered that using traditional agricultural practises would not increase crop productivity. Therefore, the development of engineering systems is crucial to addressing these shortcomings. It is common knowledge that farmers who use farm equipment produce more crops, which eventually affects the health of the national economy. In the sphere of agriculture, it alone indicates a prior requirement for agro-equipment. As we can see, today's farmers have a serious labour shortage, and fertilisation takes more time than it used to. Therefore, it was suggested to create a fertiliser spreader machine in order to find a solution. Therefore, farming can be done more effectively and easily.

II. PROBLEM DEFINITION

“Narode R. R., Sonawane A. B. , Mahale R. R. , Nisal S. S. , Chaudhari S.S. , Bhane A. B. , “Manually Operated Fertilizer Spreader”, International Journal of Emerging Technology and Advanced Engineering, (February 2015)” — Farmers have recently discovered that using traditional agricultural practises would not increase crop productivity. Therefore, the development of engineering systems is crucial to addressing these shortcomings. It is common knowledge that farmers who use farm equipment produce more crops, which eventually affects the health of the national economy. In the sphere of agriculture, it alone indicates a prior requirement for agro-equipment. As we can see, today's farmers have a serious labour shortage, and fertilisation takes more time than it used to. Therefore, it was suggested to create a fertiliser spreader machine in order to find a solution. So that they can work more easily and effectively.

“Waydande S.S, Ghuge N.P, Gawali S.M, Chavan N.R, Kude V.B, “Design and Development of Manually Operated Spraying and Fertilizing Mechanism”, International Journal of Research in Advent Technology, Special Issue, ICIMCE 2019 E-ISSN: 2321-9637” — Common issues include:

- 1) heavy weight that is difficult to lift manually;
- 2) operator fatigue caused by heavy weight;



- 3) operator fatigue caused by heavy weight during spraying;
- 4) a big size of pump that is inconvenient to the operator; and
- 5) poor equipment choice and quality.

Uneven distribution: Inaccurate calibration or damage to the spreading mechanism or disc may cause fertilisers to be distributed unevenly, which could result in inconsistent plant growth or nutrient insufficiency. Clogging: If the fertiliser or granular material being used contains lumps or debris, the spreader's hopper or spreading mechanism may become clogged. This could slow down the process and reduce distribution accuracy. Calibrating some manually controlled spreaders may be difficult because they lack simple-to-use calibration mechanisms, making it difficult to modify the spreading pace or achieve precise application rates for various fertiliser types or granular materials.

III. LITERATURE REVIEW

“Sudduth K.A., Borgelt S.C., Hou J., “Performance of a chemical injection sprayer system” — Performance of a chemical injection sprayer system, found the time delay of concentrated pesticides through injection sprayers to be significant, and proposed injection at the individual nozzles as a possible solution to shorten delays. Development of an instantaneous nozzle injection system that overcame the concentration variation problems reported by previous researchers. Simulations are wont to compare chemical application accuracies for various designs of injection sprayers. They found that reducing the diameter of the fluid lines near the tip of the spray booms improved overall application accuracy.

“Philip J. Sammons, Tomonari Furukawa, Andrew Bulgin, “Autonomous Pesticide Spraying Robot for use in a Greenhouse” — The most common non-positive displacement pump was developed at the University of Nairobi. This type of pump's output is affected by pressure. For delivering huge amounts of liquid at low pressures, this pump is suitable. The pump's throttling valve is a crucial part. The highest output line must include a controlled throttling valve for the pump to operate precisely. A large portion of the previous mechanical tillage has been replaced using herbicides. Chemical application is carried out using single-purpose chemical attachments to tillage and seeding equipment.

“Shailesh Chaudhari*, Mansuri Naeem, Prajapati Jigar, Prajapati Preyash, “INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY”, “DESIGN AND DEVELOPMENT OF FERTILIZER SPREADER MACHINE” — Consider the user group and their needs when designing a manually driven fertiliser spreading machine to make their jobs simple and effective. By dumping the fertiliser over the impeller disc, a way is created to disperse the fertiliser across a fallow field. Top level, middle level, and bottom level are the three levels of the project's design. There is a solar module on the top level. A motor, impeller disc, and hopper are on the middle level. Tyres makes up the lowest level. A frame and a column support the entire design. The issue with fertilisation done traditionally has been resolved by this project.

“M.G.Jadhav, Prof.J.K.Sawale, “Design and Fabrication of Manually Operated Weeder with Pesticides Sprayer”, “International Research Journal of Engineering and Technology” — The manual fertilisation technique is the main focus of this endeavour. Growing our agriculture's production and quality is essential for the development of our nation and meeting the demands of a population that is expanding. There are some tractor-operated machines for spreading fertiliser; therefore, what we need is a replacement for the conventional and tractor-operated machines that will meet all the requirements and be affordable for small-scale farmers. A technique is developed that uses a revolving impeller to disperse fertiliser. The system consists of two fertiliser-impelling wheels, a hopper for fertiliser storage, and a flow control device. An impeller is located beneath this system. A pair of bevel gears that are positioned on the output shaft.

IV. METHODOLOGY

The most efficient way is to dig a hole close to the roots of the crops and add fertiliser; this will decrease fertiliser waste and improve the quality of the harvests. Farmers today use this time-consuming and labour-intensive practise, physically digging holes close to the roots of their crops.

Indian farmers adopt conventional methods, and the agriculture industry has a lot of room for growth. The traditional way of weeding uses a bull, which is expensive for farmers with small farms because it takes a lot of time and requires a different setup.

The spraying is often carried out by a backpack sprayer with labour, which is more labour-intensive, covers a smaller area, takes longer, and has a lower storage capacity. In order to solve the aforementioned issues, we have designed and developed adaptable machinery that will help medium- and small-scale farmers with weeding and spraying tasks.

OBJECTIVES: -

1. The major goal of this project is to develop and construct a hand-operated fertiliser spraying device that allows farmers to use the flapper already on the hopper to autonomously apply fertiliser across a field.
2. Make operating this machine affordable and simple for Indian farmers.
3. To put into practise the functionality of increasing the quantity of fertiliser to be applied through various mechanisms.
4. To create fertiliser spraying equipment that only requires a single operator.
5. To only lightly till the earth
6. To enable the equipment to spray various fertilisers, such as urea, DAP, etc.
7. To keep the space between two places constant during the spraying procedure.

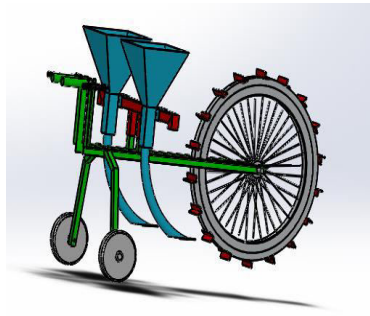


Figure 1. Isometric front view

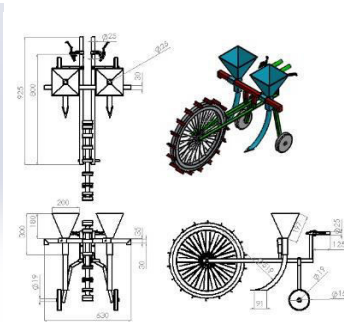


Figure 2. Drafting

V. RELATED WORK

Since a long time ago, extensive research has been done in this area to enhance the effectiveness of pesticide sprayers and give operators comfort. There are primarily three types of pumps on the market: Spray pumps that are manually operated and those that are powered by fuel Spray pumps that are powered by electricity (from renewable and non-renewable sources). There are also robot-operated and aerial designs available.

“Prof. V.V. Dighe, Gavhane Tushar N., Pachore Aniket S., Jangle Rohidas N., Magdum Sanat Kumar S. “HOLE DIGGER MECHANISM FOR FERTILIZER FEEDING”” —

To facilitate the rotation of wheels and sprockets, which is essential for precise mechanism operation, this project uses a sprocket chain arrangement. The back wheel measures about three feet in circumference and has a 330mm diameter. It is attached to a small, 18-toothed sprocket. The sprockets on the following step rotate once when the rear wheel spins once.

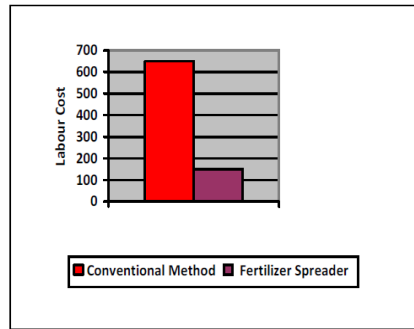
A small and a large sprocket with 50 teeth make up the following step. This stage's tooth rotation ratio is 1:1, which means that turning the main sprocket causes the little sprocket to turn once. Additionally, the smaller sprocket, disc, and follower rotate three times for every 33 cm (1 foot) of the big sprocket's revolution, causing the follower to dig a hole every 33 cm (1 foot).

The motion is then passed on to the following phase, which has a hopper and a little sprocket. A tiny wheel with three holes spaced at 120-degree intervals is attached to the hopper. The hopper is opened by the hopper wheel with each turn of the little sprocket, allowing fertiliser to be supplied into the hole. Up until the rear wheel has finished rotating, this operation is repeated.

The primary purpose of the follower is to dig the necessary holes, and it does so by moving vertically up and down under the power of a circular cam. The follower moves reciprocating as a result of the cam's rotating motion. Instead of the force needed, the digging process is dependent on the rear wheel's rotation. The rear wheel's size, which is roughly 990mm, indicates that it covers a linear distance of 990mm during each rotation. Based on the desired hole depth of 300mm, sprockets with 18 and 54 teeth have been chosen for this project. The 18-tooth sprocket completes three rotations for every 54-tooth rotation. As a result, three holes are excavated within 990mm, or one foot, of each other.

VI. RESULTS AND DISCUSSION

We obtained the results listed below by conducting tests on our machine's field of use and learning everything we could about other techniques.



VII. CONCLUSION

1. Making a method that spreads fertiliser effectively was our main objective.
2. Through the scope of improvement, this project is done to suit the needs of agricultural applications.
3. This spreader type has fewer shortcomings than the ones that are currently in use.
4. The development of a sensor-based system is the focus of our upcoming effort.

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Design Analysis and Manufacturing of Leaf Spring with Composite Materials

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ABSTRACT: This project aims to investigate the use of composite materials in the design of lightweight leaf springs for vehicles, focusing on the TATA ACE model. The goal is to find an optimal geometry that can withstand external loads without failure while reducing weight. The study involves analytical and numerical analysis, comparing materials such as Aluminium 6061, Carbon Fiber Glass Mat, E Glass Epoxy, and Boron Carbide. The leaf springs will be modeled using Catia v5 software, and analysis will be conducted using ANSYS 2020 R1. Finite element analysis and mechanical testing will be employed to optimize the design and validate its performance. The results contribute to the development of high-performance suspension systems in various industries.

KEYWORDS: Composite leaf spring, strength, composite material, optimal geometry, numerical analysis, stress, deflection, E glass epoxy, deflection, equivalent stress, FEA, lightweight.

I. INTRODUCTION

Composite leaf springs are gaining increasing importance in the automotive industry as a promising alternative to conventional leaf springs, especially in light vehicles. This study focuses on investigating the use of leaf spring composites in the TATA ACE model. The aim is to achieve an optimized leaf spring shape that can withstand external loads while reducing weight. Analytical and numerical analysis techniques are used to evaluate the performance of leaf springs under static loads and the stress and deflection values are verified by analytical analysis. The key to this project is comparing various materials such as aluminum 6061, carbon fiber glass matt, E-glass epoxy and boron carbide (powder) with conventional leaf springs in terms of deflection, equivalent elastic strain and equivalent stress^[1]. Leaf spring design is optimized by considering parameters such as shape, thickness distribution, stacking order, and attachment points. Software tools such as Catia v5 for modeling and ANSYS 2020 R1 for analysis are used. Mechanical tests are performed to validate designs and evaluate stiffness and strength characteristics. This project report aims to provide valuable insight into the design analysis and manufacturing process of composite leaf springs and contribute to the advancement of lightweight, high-performance suspension systems. The results can help improve vehicle performance, fuel economy and overall ride comfort in the automotive industry.

II. RELATED WORK

A related work section contains various studies on the design and analysis of composite leaf springs as viable alternatives to conventional steel springs. Researchers have studied the application of hybrid composite leaf springs to multi-purpose vehicles with the aim of evaluating load capacity, stiffness and weight compared to conventional designs. The use of composite materials such as glass fiber reinforced polymers and glassy carbon is gaining attention due to their high strength-to-weight ratio and corrosion resistance. The investigation also focused on determining the effect of material composition on modal frequencies and leaf spring performance. Collectively, these studies improve the functionality of leaf springs by reducing weight, increasing load-bearing capacity, and utilizing advanced composite materials for more efficient and long-lasting suspension systems in various automotive applications. It reflects our ongoing efforts in this area.

III. METHODOLOGY

Duroplastic matrix materials and E long glass fibers are used as reinforcements in the manufacture of composite leaf springs. Among the various manufacturing techniques, the manual vacuum bagging process was chosen due to its suitability for mass production and its ability to produce laminates containing continuous reinforcing fibers. In this process, the fibers are manually placed in a mold and the epoxy resin matrix material is applied by brushing or spraying. The layers are roller compacted and vacuum bags are used to hold the resin-coated part in place during curing. Vacuum pumps, release liners, perforated films, vents and mastic sealants are integral parts of the vacuum packaging process. By creating a pressure differential, excess matrix material is expelled, resulting in laminates of uniform thickness and increased strength. A hand lay-up vacuum packaging process streamlines the manufacturing process and ensures the production of composite leaf springs that meet quality and cost-effective requirements.

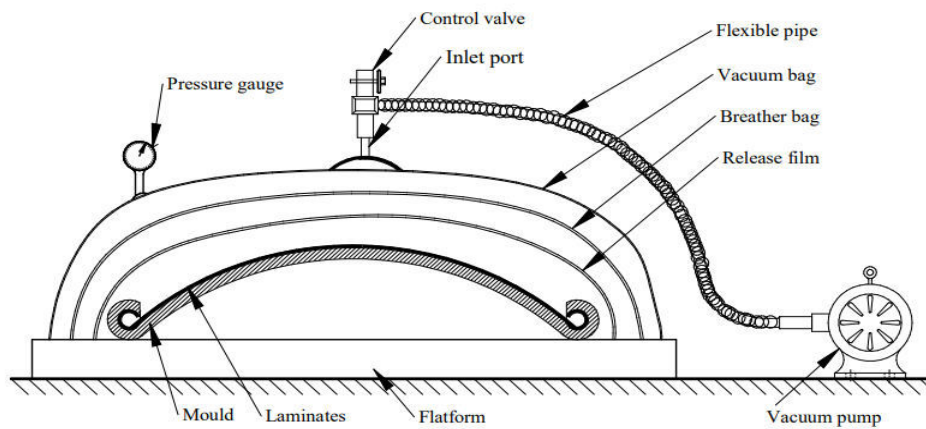


Figure 1 Principle components of vacuum bagging process

Analysis:

Deflection For Composite Leaf Spring

Figure shows the deflection of steel leaf spring under the application of 8820 N load. The maximum deflection is at the centre of the leaf spring its maximum value is 66.2 mm. red zone indicates the area of maximum deflection and blue zone indicates the area of minimum deflection.

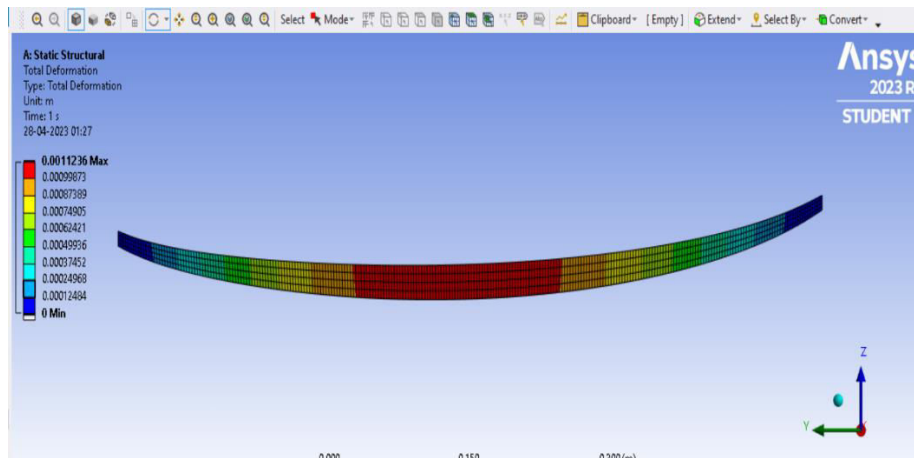


Figure 2 Deflection in composite leaf spring

Stress Of Composite Leaf Spring

Figure shows the maximum stress induced in steel leaf spring under the action of 500N load. The maximum stress is induced at the fixed eye end of the leaf spring its maximum value is 8820 N/mm². Red zone indicates the area of maximum stress and blue zone indicates

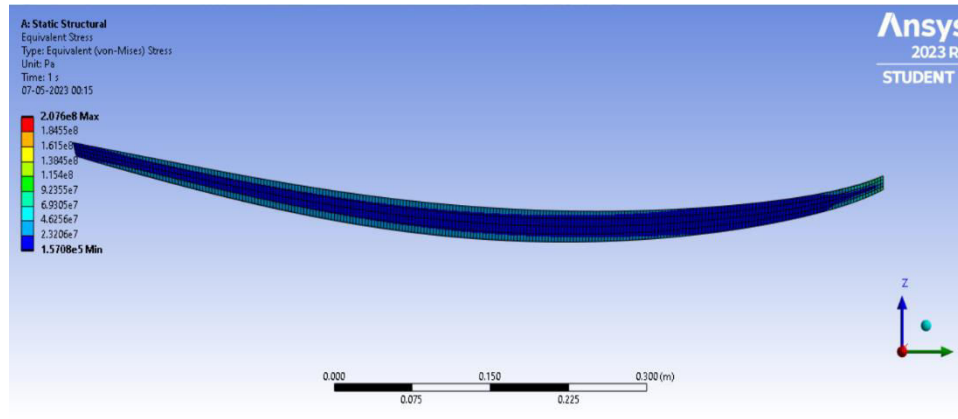


Figure 3 Stress developed in composite leaf spring

IV. EXPERIMENTAL RESULTS

To compare the rigidity, a static load is applied to the center of the manufactured composite leaf spring and the metal main leaf spring. The load was increased from 100 kg to 900 kg in increments of 100 kg and the corresponding deflections for both the composite and metal main leaf springs are summarized in Tables . The deflection of the composite leaf spring is larger than that of the metal leaf spring. As the static load increases, the difference in deflection values decreases. This study shows that the stiffness of the composite leaf spring is 18.78% lower than that of the metal leaf spring when both leaf springs have the same dimensions. However, the stiffness of composite leaf springs can be increased by adding a small amount of high-strength carbon fiber near the neutral axis of the main plate. Testing Composite Leaf Springs with a Universal Testing Machine (UTM)

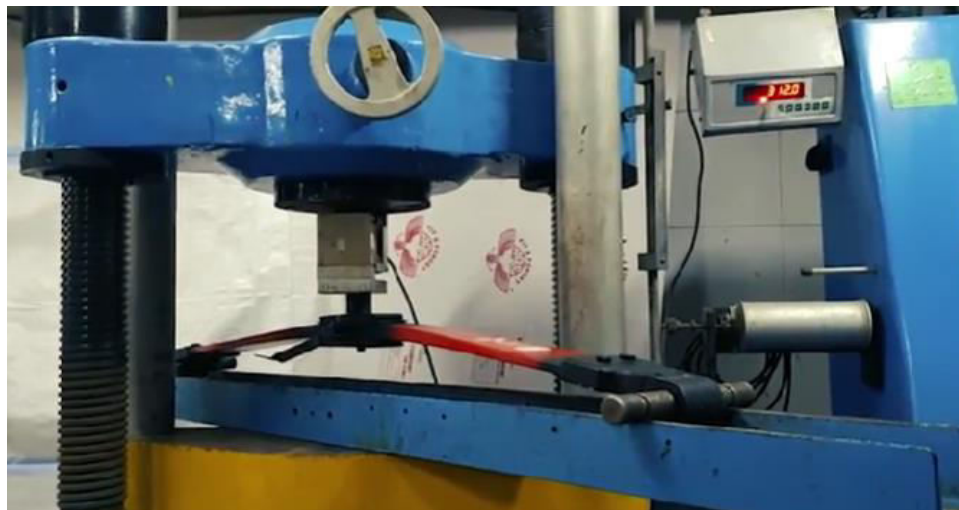


Figure 4 Testing Composite Leaf Springs with a Universal Testing Machine (UTM)

Both leaf springs are tested on his UTM to determine maximum load capacity. Loads are applied in stages up to 900 kg and deflections are recorded according to the table. Leaf spring deflection is 16% greater than metal leaf springs. However, it was shown that the fabricated composite leaf springs could potentially withstand the maximum load that existing metal leaf springs can withstand. Using a composite material (E-glass/epoxy) to manufacture the leaf springs was found to reduce the structural weight by 57.23%.

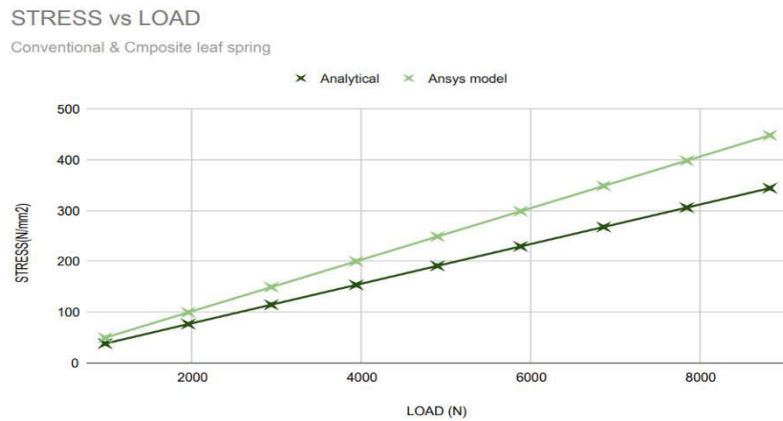


Figure 5 Stress vs Load of Analytical and Ansys model

V. RESULTS

Table 1 Experimental Results

Load (N)	Stress (σ) Analytical (MPa)	Stress (σ) Ansys (MPa)	Deflection Analytical (mm)	Deflection Ansys (mm)	Deflection Experimental (mm)
980	85.96	49.73	6.85	7.23	5
1960	76.54	99.51	13.73	14.7	10
2940	114.61	149.2	20.56	22.1	22
3920	153.56	199.9	27.64	29.4	28
4900	191.03	248.67	34.28	36.8	31
5880	229.23	298.4	41.11	44.2	43
6860	267.44	348.13	47.99	51.5	51
7840	305.56	397.87	54.85	58.9	57
8820	343.83	447.67	61.70	66.3	60

VI. CONCLUSION

A clear difference was found when comparing the steel plate spring and the composite leaf spring under the same static load conditions. It was found that composite leaf springs have less deflection and bending stress than steel leaf springs. In addition, composite leaf springs have been found to be lighter than traditional steel leaf springs. These results suggest that composite leaf springs can be used for high-performance applications on flat road surfaces. Experimental results also show that the composite leaf spring is stiffer than the conventional leaf spring. The use of laminated quasi-isotropic composites such as Kevlar/epoxy and E-glass/epoxy further increases the strength of leaf springs. By optimizing the composite leaf spring, we have improved load resistance and reduced weight, contributing to improved fuel efficiency. Based on these results, epoxy composite leaf springs were a potential alternative to conventional steel leaf springs.

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Design and Manufacturing of Fixture to Perform Various Operation on the Job at Single Workstation

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ABSTRACT: This given method has to design and manufacture the Multipurpose Jigs and Fixture, for that component which has been to reduce the manufacturing cycle time. When the component manufactured on a small size previously this is to manufacture the large quantities of requirements. The selective components require for machining operations such as step milling, angle milling, boring and reaming. Some operations can be done in CNC and rest operations are carried out in Conventional machine tool. The given method has to be design and manufacture the multi-operational fixture for the total machining operations in a single machining center. The fixture design has will serve for the economic production for the component

KEYWORDS: Fixture, Mild Steel, Tapping, Drilling, Boring.

I. INTRODUCTION

In manufacturing processes, the use of fixtures plays a critical role in facilitating accurate and repeatable operations on workpieces. Fixtures provide stability, alignment, and support to workpieces during machining, assembly, and other operations. Traditionally, multiple fixtures or specialized machines are required for performing different operations on a workpiece, leading to time-consuming job transfers and increased setup times. To overcome these limitations, the concept of a versatile fixture capable of performing multiple operations at a single workstation has gained significant attention. The design and manufacturing of a versatile fixture require careful consideration of various factors, such as the compatibility of operations, spatial constraints, tooling requirements, and ergonomic considerations. This research paper aims to explore these factors and present an integrated approach to designing and manufacturing a fixture that enables the performance of multiple operations on a workpiece at a single workstation.

II. RELATED WORK

We design few fixtures as per requirement like shown below but there is some problem in tool layout or manufacturing process or capacity of stable work piece. So, few solutions are cancelled but we still work on other. We want to save their time so design a fixture in that only clamp change but the work piece one side and flange manufacturing with one setup and remaining side manufacture in another setup. But we didn't find any perfect solution for two setups. Now we are designing for three setup which will save their time but our aim is to design the fixture for two set-ups only once three set-up is properly designed, we are going to reduce one set-up from it according to their requirements.

III. METHODOLOGY

1. Requirement analysis: Understand the specific operations and job requirements that the fixture needs to accommodate.
2. Concept generation: Generate design concepts and explore different approaches to meet the operational requirements.
3. Fixture design: Develop detailed designs, including component layout, clamping mechanisms, and tooling arrangements.
4. Engineering considerations: Ensure precision, accuracy, and structural integrity of the fixture design through engineering analysis and calculations.

5. Material selection: Choose appropriate materials based on factors such as strength, rigidity, and compatibility with the job and operations.
6. Fabrication: Use machining, welding, or additive manufacturing techniques to manufacture the fixture components.
7. Assembly: Assemble the fabricated components, ensuring proper alignment and functionality.
8. Testing and validation: Conduct thorough testing to verify the fixture's functionality, accuracy, and compatibility with the job.

IV. EXPERIMENTAL RESULTS

Fig. below shows the assembly view of fixture which is designed to perform various operation at single workstations. The workpiece or job is hold into the fixture; the base plate of fixture is attached to 4-axis of CNC machine. The base plate is fixed and mounted on 4-axis of machine which revolves in 360 degrees. The tool perform various task like boring, drilling, tapping, turning, etc. onto workpiece in less duration time and more accuracy compare to conventional fixture.

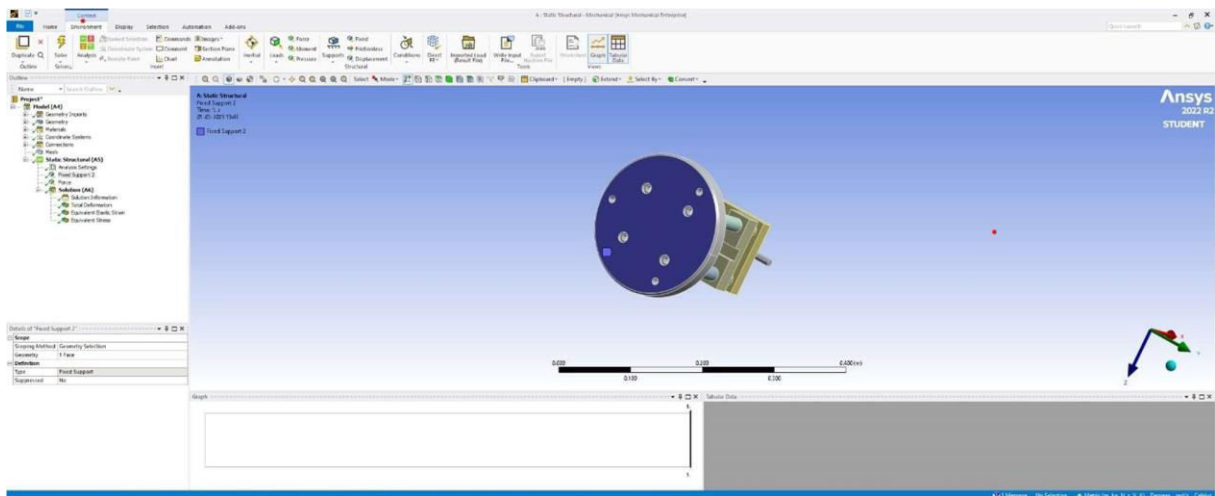


Fig:1. Design of fixture and fix support to the base plate.

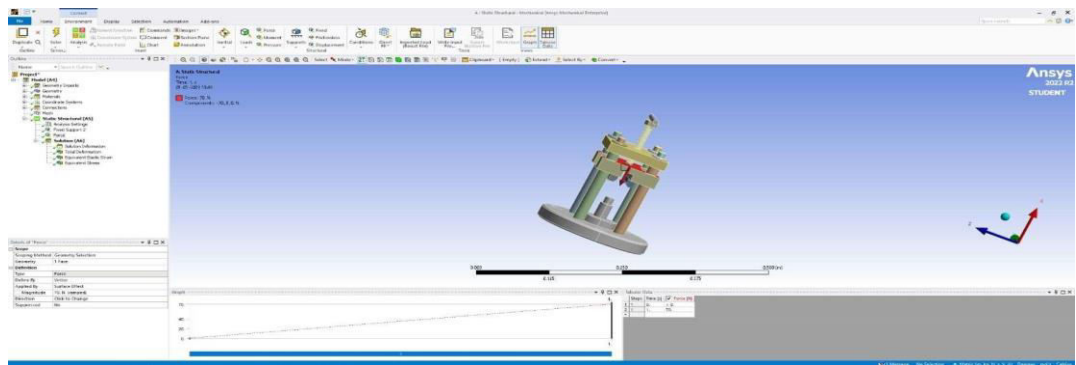


Fig:2. Force acting downward to middle flexible plate.

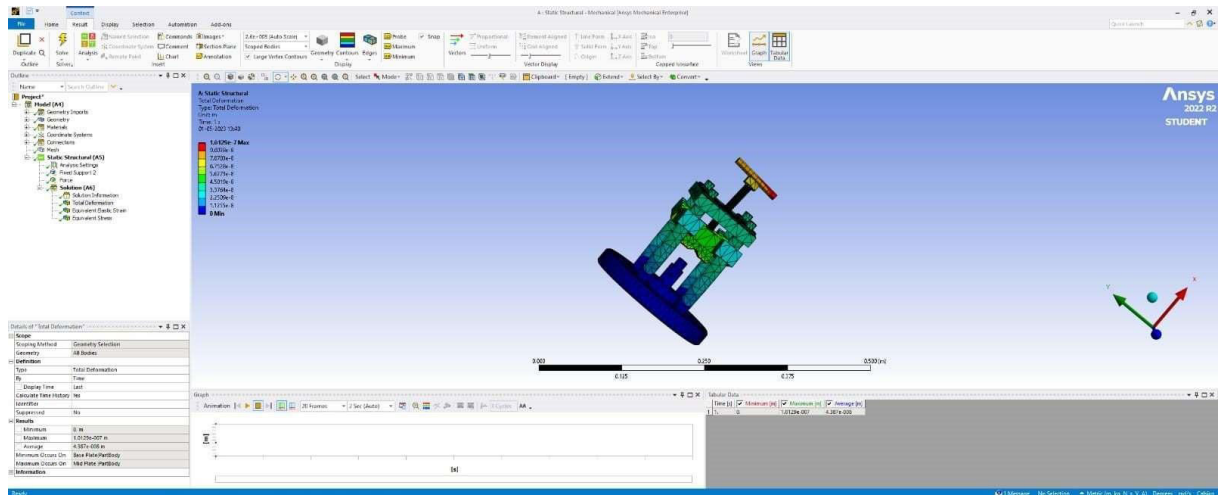


Fig:3. Result on force and stress acting on the fixture.

V. CONCLUSION

The design and manufacturing of a fixture to perform multiple operations on a job at a single workstation offers several benefits. Firstly, it provides a safer working environment for operators, ensuring their well-being. Additionally, it significantly reduces cycle time, resulting in increased productivity and output for the industry. Moreover, the implementation of this project helps in reducing labor costs, making operations more cost-effective. Overall, this project holds the potential to improve production efficiency and profitability for industries. By reducing production time and labor expenses, it enables companies to achieve higher output levels while keeping costs under control.

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Design of Automatic Water Tank Cleaner

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ABSTRACT: Purpose of this paper is to find the solution of cleaning the household water tank used for water storage. The work is done by using lead screw mechanism. The lead mechanism is used to convert rotary motion into linear motion. Various electronic unit are also taken in account to design modern tank cleaning device. The society is tending towards automation day by day, cleaning the tank manually is undesirable a sit requires lots of time and efforts. So, to solve this problem, this household water tank cleaning system is developed that is more efficient, more safe, less time consumption and of course no extra human efforts. It doesn't affect the environment and human health in any way. Here a rod having grooves is placed in which brushes are attached through two arms. For rotation of the arms we connect a DC gear motor and a AC motor to main rod. The system also consists of relays for controlling purposes while engaging & disengaging the mechanism for linear and rotational movements.

KEYWORDS: Tank, cleaner, flaps, motor, solenoid, relay, water.

I. INTRODUCTION

Water tank boundaries incorporate the overall plan of the tank, and decision of development materials, linings. Different materials are utilized for making a water tank. Water tanks are an effective method to assist agricultural nations with putting away clean water. Water tanks are utilized to provide storage of water for use in numerous applications, drinking water, irrigation agriculture, fire suppression, agricultural farming, both for plants and livestock, chemical manufacturing, food preparation as well as numerous other uses. The function of the automatic tank cleaner is to reduce the human effort & the harmful effect which bacteria causes to the operator. Reducing time is another major goal as the existing model takes anywhere between 1.5 to 3 hrs to clean the tank. No mechanical model are produce on masses to clean tank. This system is user friendly and time saving also the cost is less hence it can be used in the future water tank cleaning purpose. The system could be more compact and light weighted and more user- friendly and efficient by improvement in the design and using some other advance equipment.

II. RELATED WORK

Firstly whole water is removed from the tank. Detergent is then sprayed on the inner wall of the tank for easy removal of dirt[1].The whole system is inserted in retracted position into the tank. Thefour bar linkage is then adjusted according to the tank diameter in such a way that brush at end of the shaft touches the bottom of tank [2].Now the motor is switched ON. The four bar linkage starts rotating along with the shaft. This causes scrubbing of inner wall of tank by the brush attached to the ends of linkage [3].For cleaning upper portion of the tank the whole mechanism is reciprocated along the guide ways with the help of handle connected to the rack and pinion arrangement. In this way the tank gets cleaned within minimum time. Manual scrubbing in which wall and floor of tank are scrubbed to remove dirt, sediments, fungus and stains, but this method is more tedious and time consuming [15].The water tank can also be cleaned by using chemicals to remove the dirt and sediments. The chemicals used may affect the human health. Pressurized water can be sprayed on the walls of the tank which will remove the dirt from the tank surface. These methods are time consuming and require more efforts for cleaning [10].

III. METHODOLOGY

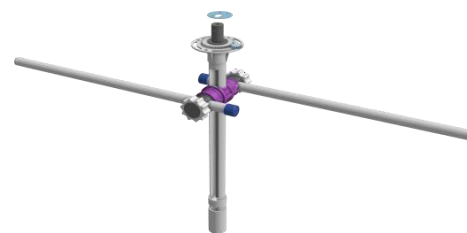
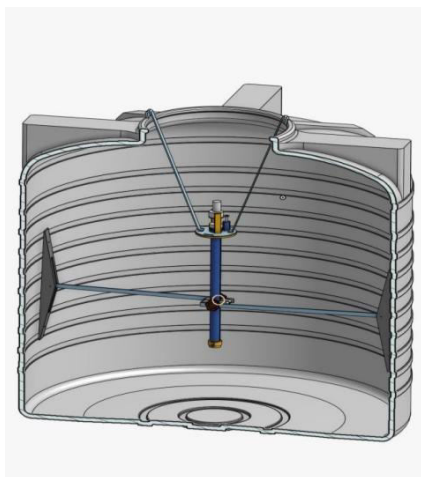
We have to study about water tank cleaning machines to develop tank cleaner, it is very essential to know the

existing model and practices used for cleaning tanks. Then the study of research papers on literature reviews is also important to start the preparation of model. It is very essential to know the ongoing development and purposed model of tank cleaning. Though understanding problem statement after literature survey we have drawn the drawback of the existing model and then have set the goals which is defined in problem statement. The survey as our model was built to survey masses. It is very essential to know various parameters to clean a tank through survey. The listing required components: considering the factors derived from survey we have to create design to define the various component needed. Fabrication of parts: the component selected must have to be fabricated by using the suitable process which didn't compromise on safety of system. Testing and results after fabrication the model needed to be tested to know durability and various cleaning factors.

IV. EXPERIMENTAL RESULTS



By design a water tank or container should do no harm to the water. Water is susceptible to a number of ambient negative influences, including bacteria, viruses, algae, changes in pH, accumulation of minerals, and accumulated gas. The contamination can come from a variety of origins including piping, tank construction materials, animal and bird feces, mineral and gas intrusion. A correctly designed water tank works to address and mitigate these negative effects.



The function of the automatic tank cleaner is to reduce the human effort & the harmful effect which bacteria causes to the operator. Reducing time is another major goal as the existing model takes anywhere between 1.5 to 3 hrs to clean the tank. No mechanical model are produce on masses to clean tank. This system is user friendly and time saving also the cost is less hence it can be used in the future water tank cleaning purpose. The system could be more compact and light weighted and more user-friendly and efficient by improvement in the design and using some other advance equipment.

V. CONCLUSION

This system is user friendly and time saving also the cost is less hence it can be used in the future water tank cleaning purpose. The system could be more compact and light weighted and more user-friendly and efficient by improvement in the design and using some other advance equipment. The most common problem with all the previously discussed approaches is that in all the above methodologies none is completely automation-based system in which no human intervention is required. In all the above approaches the problem of fixing the cleaning mechanism inside the tank occurs. It takes time and efforts that are undesirable. Also, if the dirty water left after cleaning of the water tank reaches inside the water supply pipe lines, it chokes the pipes and taps. So, in the modern society that is tending towards complete automation in every field day by day these types of problems are undesirable. Hence, we decided to work on a project that is complete automation based in which no human intervention required. Also, there is no issue of fixing the mechanism manually. There are so many smart features all associated with the cleaning system such as water level indicator, auto on/off pump, pH level indicator, smart drainage system to avoid blockage of water pipe lines.

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Regenerative Suspension System

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ABSTRACT: Regenerative suspension Framework implies it can Create Power by safeguard of bicycle or vehicle. The standard suspension system in our vehicles decrease these shocks and convert this mechanical vibrational energy into heat. In this system a ton of fuel energy is wasted. which can be recovered using a regenerative suspension structure. A regenerative suspension structure can effectively hold these vibrations similarly as reduce the proportion of energy lost to the incorporating. This paper reviews the flow research on the regenerative safeguards. It at first looks at about the energy dispersal from the vehicles and subsequently the capacity of recovering this dissipated energy using a regenerative safeguard. It moreover reviews the different inventive work done on the regenerative safeguard.

KEYWORDS: Regenerative Suspension System, Speed Breakers, Impact energy

I. INTRODUCTION

An electromagnetic regenerative suspension system (ERSS) is a type of suspension system that converts the kinetic energy of a vehicle's suspension into electrical energy. This energy can then be used to power the vehicle's electrical systems, such as the lights, radio, and air conditioning. ERSSs are still under development, but they have the potential to improve fuel efficiency and reduce emissions. ERSSs work by using a linear motor to convert the kinetic energy of the suspension into electrical energy. The linear motor is a type of motor that uses a magnetic field to move a conductor. When the conductor moves, it generates an electric current. The electric current can then be used to power the vehicle's electrical systems. ERSSs have several advantages over traditional suspension systems. First, they can improve fuel efficiency by reducing the amount of energy that is wasted as heat. Second, they can reduce emissions by reducing the amount of fuel that is burned. Third, they can improve ride quality by providing a smoother ride. ERSSs also have some disadvantages. First, they are more expensive than traditional suspension systems. Second, they are more complex and require more maintenance. Third, they are not as effective in rough terrain. Overall, ERSSs have the potential to improve fuel efficiency, reduce emissions, and improve ride quality. However, they are still under development and are not yet widely available.

II. RELATED WORK

There are many related works in the space of regenerative suspension frameworks. Probably the most striking work incorporates: A concentrate by MIT understudies in 2009 that fostered a model regenerative suspension framework. The framework had the option to recuperate up to 70% of the energy lost in the suspension framework. A concentrate by Tufts College that fostered a regenerative suspension framework utilizing a direct engine/generator. The framework had the option to recuperate up to 20% of the energy lost in the suspension framework. A concentrate by Swinburne College of Innovation that fostered a regenerative suspension framework utilizing DC electromagnetic machines. The framework had the option to recuperate up to 10% of the energy lost in the suspension framework. These investigations have shown that regenerative suspension frameworks can possibly essentially decrease the energy utilization of vehicles. In any case, there are still a moves that should be tended to before these frameworks can be economically practical. These difficulties include:

The expense of the framework. Regenerative suspension frameworks are presently more costly than customary suspension frameworks. The intricacy of the framework. Regenerative suspension frameworks are more intricate than customary suspension frameworks, which makes them harder to fabricate and keep up with. The dependability of the framework. Regenerative suspension frameworks are still in the beginning phases of advancement, and their dependability should be improved before they can be utilized in business vehicles.

III. METHODOLOGY

The strategy of a regenerative suspension framework is to change over the dynamic energy of the vehicle's suspension into electrical energy. This energy can then be put away in a battery or used to control helper frameworks in the vehicle, for example, the lights or cooling. There are various ways of carrying out a regenerative suspension framework. One normal methodology is to utilize an electric engine to drive the safeguards. At the point when the vehicle hits a knock, the engine retains the energy of the effect and converts it into power. This power can then be put away in a battery or used to drive helper frameworks. Another methodology is to utilize a water powered framework. At the point when the vehicle hits a knock, the water driven liquid in the framework is compacted. This pressure produces power, which can then be put away in a battery or used to control helper frameworks. Regenerative suspension frameworks offer various possible advantages. They can assist with further developing eco-friendliness by decreasing how much energy that is squandered as intensity when the vehicle's suspension retains knocks. They can likewise further develop ride quality by lessening how much vibration that is sent to the vehicle's inhabitants. Be that as it may, there are additionally a few difficulties related with regenerative suspension frameworks. One test is that they can be costly to execute. Another test is that they can add weight to the vehicle, which can diminish eco-friendliness.

In general, regenerative suspension frameworks offer various likely advantages. In any case, they are still in the beginning phases of improvement, and there are various moves that should be tended to before they can be generally embraced. Here are a portion of the means engaged with the plan and execution of a regenerative suspension framework:

IV. EXPERIMENTAL RESULT

To test the model safeguard's voltage and power yield on different street conditions the magnet gathering of the gadget was mounted in the mover of a vibration shaker, while to loop get together was mounted to the top plate, which is fixed on the foundation of the vibration shaker. While reproducing a scope of street conditions an oscilloscope was utilized to gauge the result voltage, both pinnacle and RMS values, and furthermore to see the result waveforms created from the safeguard. A multimeter was utilized to gauge current output. As soon the as the heap is applied on the safeguard with the assistance of Burden Cell it begins climbing and down all the while produces the EMF. We can find the electrical power produced for the low, medium, and high burden condition. Also, the readings from the multimeter are arranged as underneath.

	Load cell reading In Kgs	Current amps	Voltage in m Volts	Electrical power In m Watts
Low	3	10.8	98	1.058
Medium	5.2	13.2	137	1.808
High	9	15.6	158	2.46

Table: Table for relationship between current and voltage for different load condition

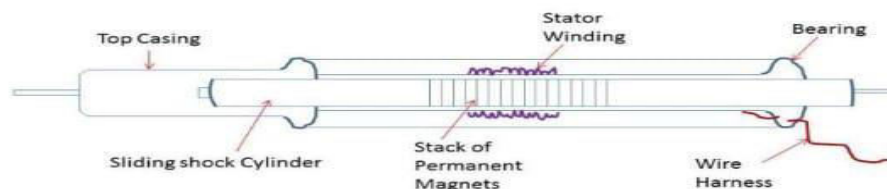


Fig1.1: Mechanism of Regenerative suspension system.

To calculate the Recovered Output Electrical Energy by the Regenerative suspension system :

$$P = V * I \text{ Watts}$$

Where, V = Voltage in volts

I = Current in amps

Now, For Low load condition

i.e., for 3kgs of force

$$P = 98 * 10^{-3} * 10.8 * 10^{-3}$$

$$P = 1.0584 * 10^{-3} \text{ Watts}$$

Similarly, For Medium load condition

i.e., for 5.2kgs of force
 $P = 137 \cdot 10^{-3} \cdot 13.2 \cdot 10^{-3}$

$$P = 1.808 \cdot 10^{-3} \text{ Watts}$$



Fig1.2

Similarly, For Heavy load condition i.e., for 9kgs of force
 $P = 158 \cdot 10^{-3} \cdot 15.6 \cdot 10^{-3/2}$

$$P = 2.46 \cdot 10^{-3} \text{ Watts}$$

To calculate the Input Mechanical Energy on the Regenerative suspension system:

$$P = F \cdot v \text{ Watts}$$

Where, F = Force in Newton

v = Velocity in m/s

Now, For Low load condition i.e., for 3kgs of force

$$P = 3 \cdot 9.81 \cdot 83 \cdot 10^{-3/2}$$

$$P = 1.22 \text{ Watts}$$

Similarly, For Medium load condition

i.e., for 5.2kgs of force

$$P = 5.2 \cdot 9.81 \cdot 83 \cdot 10^{-3}$$

$$P = 2.1 \text{ Watts}$$

Similarly, For Heavy load condition

i.e., for 9kgs of force

$$P = 9 \cdot 9.81 \cdot 83 \cdot 10^{-3/2}$$

$$P = 3.66 \text{ Watts}$$

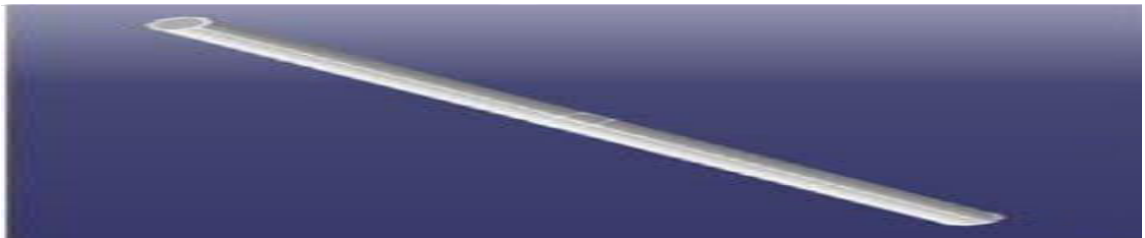


Fig 1.3

V.CONCLUSION

Regenerative suspension frameworks are a promising innovation that can possibly further develop eco-friendliness and ride quality. Nonetheless, there are yet various provokes that should be tended to before these frameworks can be broadly taken on. One of the fundamental difficulties is the expense of the framework. Regenerative suspension frameworks are right now more costly than conventional suspension frameworks. Nonetheless, as the innovation creates, the expense is supposed to descend. Another test is the heaviness of the framework. Regenerative suspension frameworks add weight to the vehicle, which can diminish eco-friendliness. Notwithstanding, new materials and assembling procedures are being fostered that can assist with diminishing the heaviness of the framework.

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Power Generation Using the Motion of Vehicle Suspension

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ABSTRACT: This project makes use of electronic devices and gear configurations to capture energy from the motion of a car's suspension. A significant amount of money can be saved by producing large amounts of electricity. And if put into practice, it will be especially helpful for long drives. When a vehicle is moving, it generates a variety of energies, including heat energy from friction between the road's rough surface and the vehicle's wheels as well as wind energy from a vehicle driving at a high speed. The principle involved is Potential Energy To Electrical Energy Conversion. There is a mechanism that turns the potential energy produced by a car's suspension moving up and down on a bumpy road, potholes, and speed breaker into kinetic energy, which is used to generate electricity. The vehicle acquires height as it crosses the rugged terrain, increasing the potential energy, When the suspension comes down to reduce the impact and absorb energy from the tires to allow the body and frame of the car to remain stable on a bumpy road, They run a ratchet-wheel-type mechanism that converts two-way linear motion into one-way rotation (an angular motion converter), which in turn rotates the device's geared shaft. This shaft's output is connected to a dynamo, which turns kinetic energy into electricity.

I. INTRODUCTION

An energy crisis is any significant obstruction to the flow of energy resources into an economy, regardless of price increases. Typically, it also includes a scarcity of electricity or other natural resources in addition to the shortage of oil. A crisis involving energy can also be referred to as an oil crisis, a petroleum crisis, an energy shortfall, or an electrical crisis. Political unrest that took place during the anti-government rallies in Burma in 2007 didn't reach a full crisis, but it was first prompted by rising energy prices similar to the gas conflict between Russia and Ukraine, the energy disagreement between Russia and Belarus was generally resolved before it reached a protracted crisis stage. When monopolies manipulate markets, it can lead to market failure, and a recession is only around the corner. Industrial activities like union-organized strikes and government embargoes can cause a crisis to emerge. Infrastructure issues, infrastructure overuse, and occasionally fuel supply delays at oil refineries and port facilities may be the cause of the problem. During exceptionally harsh winters, an emergency could arise. EMERGING SHORTAGES

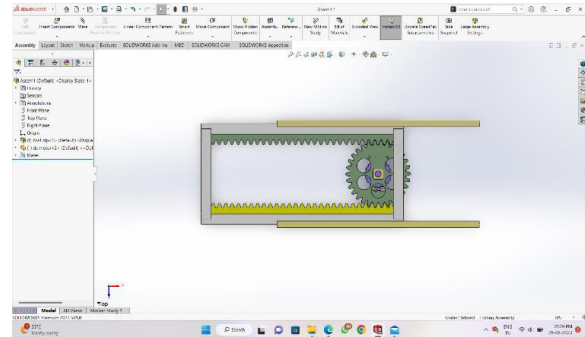
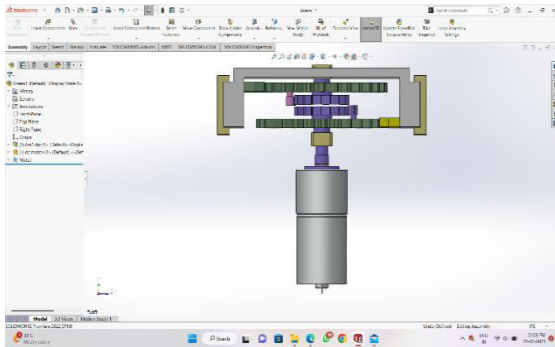
II. RELATED WORK

In this project we have to develop a suspension energy generation unit by using belt and pulley. Here, when the vehicle suspension works, the linear motion of the suspension creates friction between the pulleys and the belt. Due to this, the pulley starts rotating. The pulleys are mounted on the shaft of the DC motors. As the pulleys get rotated the shaft of the motors also get rotated which generate electricity. The figure shows the implementation of the project and its working therein. As the vehicle passes over an uneven road surface, there is relative motion of the individual wheels. As shown, the linear motion of the wheels causes the suspension to compress and this imparts motion to the belt which is attached to the wheel assembly. This in turn gives rotational motion to the pulley as shown in the highlighted area. The belt then transfers the rotary motion through pulley to the DC motors. The motors generate electricity which is given to the various auxiliaries of the vehicle. The project assembly thus includes one front wheel, suspension and the designed units attached to it.

III. METHODOLOGY

This project is about **the GENERATION OF ELECTRICITY with THE MOTION OF VEHICLE SUSPENSION**. In general, when a vehicle is moving, it produces a variety of energies, such as heat energy due to friction between the wheel and the road (i.e., a rough surface); heat energy is also produced when a vehicle travelling at a high speed collides with the wind; both of these energies are always lost to the environment and are useless to us. OR directly, we may state that all of the energy that is accessible to us but that we are unable to utilize so far has been simply getting wasted. In this project, all we're attempting to do is harness that energy to create electrical energy.

The kinetic energy can be calculated using the formula: In this project a mechanism to generate power by converting the potential energy generated by a vehicle going up and down on an uneven terrain into kinetic energy. When the vehicle moves over a rugged surface, it gains height resulting in increase in potential energy, which is usually wasted, When the suspension comes down to reduce the impact and absorb energy from the tires to allow the body and frame of the car to remain stable on a bumpy road, They run a ratchet-wheel-type mechanism that converts two-way linear motion into one-way rotation (an angular motion converter), which in turn rotates the device's geared shaft. This shaft's output is connected to a dynamo, which turns kinetic energy into electricity. A vehicle weighing 1,000 kg going up a height of 10 cm on such a rumble strip, pothole, uneven terrain produces approximately 0.98-kilowatt power.



Experimental results

Electrical Calculation

When a vehicle is running at a speed of 20 to 30 km/hr we observe 6 to 9 volts with the help of multi meter.

Voltage Generated (V) = 9 volt

Current Generated (I) = 3.2 amp

As Electrical Power (P) = V x I = 9 x 3.2 = 28.8 Watts

TO CALCULATE CHARGING TIME FOR 6 VOLT BATTERY

Charging time = battery current (Ah) / current generated (A) = 4.5 (Ah) / 3.2(A) = 1.40 hr

But it was noted that during charging 40% get loss = 4.5 x 40 / 100 = 1.8 Ah Charging time = 4.5 + 1.8 / 3.2 = 1.9 hr

To charge a 6 volt battery with this suspension including 40% loss we can charge the battery with 1.9 hr.

TO CALCULATE CHARGING TIME FOR 12 VOLT BATTERY

Consider that the suspension system is mounted on both side of the front suspension. Total voltage produced by this suspension system in 18 volt, 64A

Therefore time required to charge a 12 volt, 33 Ah battery is,

Charging Time = Battery current (Ah) / current generated (A) = 33 (Ah) / 6.4 (A) = 5.15 hr

But it was noted that 40% loss during battery charging = 33 x 40 / 100 = 13.2 (Ah) Charging time = 33 + 13.2 / 6.4 = 7.21 hr

IV. CONCLUSION

Conventionally, the vibration energy of vehicle suspension is dissipated as heat by shock absorber, which wastes a considerable number of resources. Power Generating by Shock Absorber brings hope for recycling the wasted energy. All types of Power Generating Shock Absorber, especially electromagnetic suspension, and their properties are reviewed in this project. From the perspective of comprehensive performance including vibration control ability, regenerative efficiency and application reliability. With improvement of technology, Power Generating Shock Absorber may become one of promising trends of vehicle industry.



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Automatic Pneumatic Bumper with Braking System

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ABSTRACT: This system is used to monitor speed of the vehicle and to avoid the accident by using the proximity sensors. This over speed indication and automatic accident avoiding system senses the opposite vehicle by the I proximity detector and preventing the accident. The Objective of this project is to detect the speed of the vehicle and indicate if the vehicle is over speed. This project is designed with micro controller, Proximity Sensor as speed sensor and driver circuit with Relay and keypad. The aim for accident avoiding is to design and develop a control system based an intelligent electronically controlled automotive bumper activation system called "Intelligent Braking with Pneumatic Bumper ". This system consists of IR transmitter and Receiver circuit, Control Unit, Pneumatic bumper system and braking unit.

I. INTRODUCTION

Road transport has become most important mode of transportation in India. India faces the highest number of accidents in the world. This becomes more dangerous in populated regions like schools and hospitals. In school areas speed breakers are provided to reduce the speed of vehicles, but the drivers do this manually. Many times, due to driver's fault speed is not controlled. This process can be automated by using governor. Nowadays no of vehicles have been increased and traditional systems of traffic controlling. In the developing countries we have seen a lot of crimes happening at bridges and highways. The criminals easily get escaped from the crime zone and victims lose their valuable assets including cars, jewelry etc. Although the presence of police, sometimes it gets difficult to them to identify the right vehicle and stop it for the checking. Most of the cases those vehicles pass the toll booth area by giving toll amount and no one can identify the criminal. To avoid those problems, we have introduced over speed indication system. Today India is the most important under developed country in the world. India is the largest country in the use of various types of vehicles. As the available resources to run these vehicles like quality of roads, and unavailability of new technologies in vehicles are causes for accidents.

II. RELATED WORK

While studying the other project we found that the existing system in vehicles are not much safe than our project which provides the automatic bumper braking system.

A. Existing SystemAs the available resources to run these vehicles like quality of roads, and unavailability of new technologies in vehicles are causes for accidents. The number of peoples which are dead during the vehicle accidents is also very large as compared to the other causes of death. Though there are various causes of the accidents but proper technology of braking system and technology to reduce the damage during accident mainly effect on the accident rates. Also, sometimes many people do not get help instantly.

B. Existing System DisadvantageIn the existing system there is not much safety for the passenger as well as the driver who is driving the vehicle.

III. METHODOLOGY

The aim is to design and develop a control system based on pneumatic braking system of an intelligent electronically controlled automotive braking system. Based on this model, control strategies such as an 'antilock braking system' (ABS) and improved maneuverability via individual wheel braking are to be developed and evaluated. There have been considerable advances in modern vehicle braking systems in recent years. For example, electronically controlled ABS for emergency braking, electronically controlled hydraulically actuated individual brake-by-wire (BBW) systems for saloon cars and electronically controlled pneumatically actuated systems for heavy goods vehicles. The work of recent years shall form the basis of a system design approach to be implemented. The novelty of the proposed research programmed shall lie in the design and evaluation of control systems for achieving individual wheel motion control facilitated by BBW. In the case of BBW the brake pedal is detached from the hydraulic system and replaced by a 'brake pedal simulator'.

IV. EXPERIMENTAL RESULTS

The experiments conducted on the water waste cleaning robot are crucial in assessing its performance and capabilities. Figure 1 illustrates the floating test on the water surface, which evaluates the robot's ability to float and navigate effectively. This test ensures that the robot exhibits the necessary buoyancy and stability required to operate on water bodies. In Figure 2, the floating test with a load is performed to examine the robot's performance while carrying a specific payload. This experiment helps determine the robot's stability and buoyancy under load conditions, ensuring its capacity to handle debris or waste collection efficiently. Figure 3 demonstrates the floating test with electronics components, which focuses on assessing the robot's buoyancy and functionality with integrated electronic systems. This experiment verifies whether the robot remains buoyant and operates correctly while carrying essential electronics for navigation, control, and communication. These experiments provide valuable insights into the robot's behavior and enable further improvements in its design and operation, ultimately enhancing its effectiveness in real-world water cleaning applications.



Figure 1



Figure 2

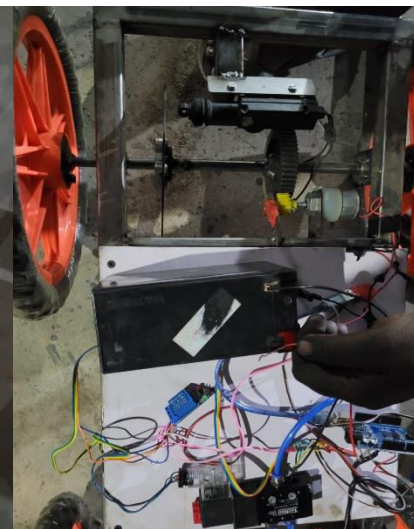


Figure 3

V. CONCLUSION

We have successfully found out objectives of our project in safety segment of vehicles and all kind of automobiles. We designed 3D concept model using CATIA software. We successfully derived the calculation of various components used in the vehicle. We have studied various pressure force impacts of accident on vehicle in case of impact study. We successfully designed new safety feature in vehicle to avoid intense damage on critical part of vehicle specially on engine and front critical system. We tested automatic speed reducing technology in case of brake failure and vehicle in uncontrolled condition. We understand the application of pneumatic system operated front bumper based safety technic and its wide range of application. We understand that our new vehicle system can also be easy to implant in segment of vehicles for safety purpose



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Design and Development of CNC Tube Bending Tools

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ABSTRACT: Traditionally, the automobile industry did not place a premium on lightweight and fuel-efficient vehicles. For bending purposes, tubing with a thickness of 1.5-2mm was regarded rather thin. However, as technology has advanced, the industry has concentrated on lowering weight and boosting efficiency. As a result, thinner wall materials and tighter bend radii have been used. A mandrel is used to ensure the tube's form is maintained during the bending operation. The mandrel is a tool used to manage the flow of plasticizing material at the bending point. Depending on the exact application needs, many types of mandrels are available. CNC tube bending is a popular way to bend thin wall tubes. The tube is positioned with a mandrel inside, surrounded by the bend die, clamp die, pressure die, and wiper die in this procedure. The actual bending occurs around the bend die.

KEYWORDS: Pipe bending, rotary draw bending, ball mandrel, Wiper die

I. INTRODUCTION

The automobile industry has been seeking lightweight and efficient cars, which has resulted in breakthroughs in tube bending techniques, notably CNC (Computer Numerical Control) tube bending. The bending process has gotten more difficult as thinner wall materials and tighter bend radii have become more common. The design and development of CNC tube bending tools, which provide precise and accurate bends while retaining the tube's form integrity, is critical to effective tube bending. Numerous researchers have contributed significantly to CNC tube bending. Sahin and Karpas [1] optimized CNC pipe bending machine settings to reduce spring back, whereas Bozkurt and Inal [2] looked into the effect of mandrel shape on bending quality. Kulkarni and Mohanram [3] concentrated on reducing spring back and ovality by optimizing process parameters. Chen and Lin [5] investigated optimum feedrate control, whereas Hwang et al. [4] created a fuzzy logic control system for CNC pipe bending machines. Park et al. [7] investigated bending methods and tooling design for high-strength steel tubes, whereas Inal and Bozkurt [6] focused on real-time control systems. Vollertsen et al. [8] conducted an in-depth assessment of spring back prediction and control for CNC bending, whereas Tran and Park [9] used evolutionary algorithms for multi-objective optimization. Li et al. [10] created a 3D pipe bending robot, and Wang et al. [11] predicted spring back using numerical simulation. Wang and Jiang [12] concentrated on adaptive bending force control, whereas Lee et al. [13] created a CNC pipe bending machine with three electric servomotors. Gao et al. [14] created a new small diameter tube bending machine, while Liu et al. [15] investigated a unique flexible mandrel for CNC pipe bending.

By using current research and ideas, this study intends to contribute to the design and development of CNC tube bending equipment. The goal is to improve the accuracy, efficiency, and overall performance of CNC tube bending operations by a thorough evaluation of many aspects and characteristics.

II. RELATED WORK

Researchers in several fields have made substantial advances in CNC tube bending. Sahin and Karpas [1] concentrated on minimizing spring back by optimizing machine settings. The effect of mandrel geometry on bending quality was explored by Bozkurt and Inal [2]. Kulkarni and Mohanram [3] reduced spring back and improved dimensional accuracy by optimizing process parameters. To improve accuracy, Hwang et al. [4] created a fuzzy logic control system. Chen and Lin [5] investigated optimum feedrate management for greater efficiency. Real-time control methods were created by Inal and Bozkurt [6]. Park et al. [7] investigated the bending of high-

strength steel tubes and the design of tooling. Spring back prediction and control were discussed by Vollertsen et al. [8].

These research, which involve parameter optimization, control systems, tooling design, feedrate control, and spring back prediction, all contribute to CNC tube bending. Incorporating these observations strengthens the suggested design and development of CNC tube bending equipment.

III. METHODOLOGY

Several critical phases are involved in the design and development of CNC tube bending instruments. Initially, the problem is clearly defined, with objectives and needs outlined. To assess existing designs and technologies in CNC tube bending, a detailed research and analysis process is carried out. The feasibility and suitability of many design approaches with the specific application are then reviewed. The most promising concept is chosen for thorough design, which includes all required components and features. To assure functioning and accuracy, a physical prototype is built and subjected to intensive testing and validation. Based on the test findings, the design is iteratively improved, resolving any identified flaws. The design is then finalized and moved into the manufacturing and production phases. The produced tool's performance is assessed in real-world applications, and the entire design process is recorded and presented in a research paper with recommendations for future improvements.

IV. EXPERIMENTATION

To bend tubes properly and effectively, CNC tube bending equipment such as a single ball mandrel and a wiper die are employed. During bending, the single ball mandrel supports the interior of the tube, preventing it from collapsing or wrinkling. By eliminating any creases or bumps on the outside of the tube, the wiper die assures a clean surface finish. These instruments work together to create high-quality, accurate tube bends for a variety of applications.

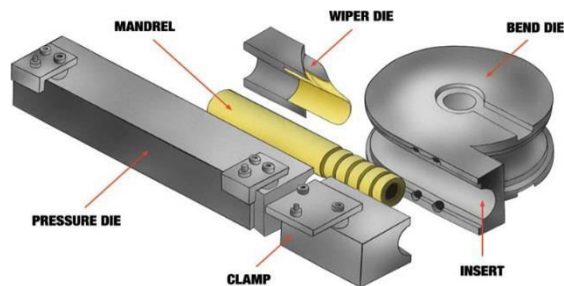


Fig 1. CNC Tube Bending machine with components

V. RESULT ANALYSIS

CNC tube bending tool development has resulted in increased precision and efficiency. High-quality bends with low deformations were obtained using advanced techniques such as single ball mandrels and wiper dies. These discoveries aid the automotive and industrial industries by allowing for the construction of more fuel-efficient automobiles. The study improves CNC tube bending procedures, resulting in more precise and consistent outputs. The potential for future developments in CNC tube bending equipment is enormous.

VI. CONCLUSION

CNC tube bending tool development has resulted in increased precision and efficiency. High-quality bends with low deformations were obtained using advanced techniques such as single ball mandrels and wiper dies. These discoveries aid the automotive and industrial industries by allowing for the construction of more fuel-efficient automobiles. The study improves CNC tube bending procedures, resulting in more precise and consistent outputs. The potential for future developments in CNC tube bending equipment is enormous.

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Printed circuit Board Quality inspection By Image Scanner

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ABSTRACT: To cope with the difficulties in the process of inspection and classification of defects in Printed Circuit Board (PCB), other researchers have proposed many methods. However, few of them published their dataset before, which hindered the introduction and comparison of new methods. In this paper, we published a synthesized PCB dataset containing 1386 images with 6 kinds of defects for the use of detection, classification and registration tasks. Besides, we proposed a reference-based method to inspect and trained an end-to-end convolutional neural network to classify the defects. Unlike conventional approaches that require pixel-by-pixel processing, our method firstly locate the defects and then classify them by neural networks, which shows superior performance on our dataset.

KEYWORDS: Printed Circuit Board, Automated Optical Inspection, PCB Dataset, Reference Based Method, Convolutional Neural Network, Optical image inspection.

I. INTRODUCTION

Printed circuit board mechanically supports as well as electrically connects electronic components. PCB defect detection has great importance in the PCB manufacturing process. Human visual inspection is the traditional way to inspect any defect in PCB but it is time consuming as well as highly prone to errors due to human factors.

In the current process, the bare PCB testing is carried out using jig tool wherein connection between specific points are tested for short and open circuit. The output of the test indicates whether the PCB is faulty or not and test points where it is shorted or open. If found faulty then the bare PCB is visually inspected to find the type of fault. Visual inspection is generally the most important part of PCB manufacturing. PCB inspection using image analysis can overcome the disadvantages of human inspection in case of fatigue, slowness and high cost. The advent of new electronic component fabrication technologies have made PCB design complex and compact which causes difficulties to human inspection process thus increasing inspection duration. Therefore, an automated PCB inspection system can be implemented that provides real time analysis of the Bare PCB panels. In this paper we discuss a non-contact reference based image processing approach for defect detection and classification. A template of a defect free reference PCB image and a test PCB image are segmented and compared with each other using image subtraction and other procedures .

Defective products increase costs and deteriorates manufacturing processes. Timely and accurate detection of defects helps industries to apply quality control and stabilization strategies to maintain competitive edge over competition. Several quality monitoring approaches such as ultrasonic inspection, Eddy current, dye penetrant testing, thermography, circuit probe, X-ray and optical inspection are currently being used to assess products' quality to achieve 100% qualified products. Among these techniques, optical inspection approach for defect detection is one of the most common procedures used in industry.

II. METHODOLOGY

This paper shows the method to automate the visual inspection of bare PCB to find the defect by image analysis using image processing tools. [4]This system is based on referential approach that has to be implemented on defected PCB and template images in order to detect number of defects present on bare PCB. The project aims to find out the exact location of the defect on the PCB image by color differentiation and determine the type of defect. A. Overview Two images are needed for the inspection, the reference image and the test image. These images are captured from the

reference and test PCB laminate using a highresolution camera. Hardware is designed to tackle problems such as misalignment of PCB, vertical distance at which the images are captured and images with bad illumination conditions. Pre-processing of the image is done for obtaining accurate images which includes Image enhancement and Thresholding. Thresholding converts a gray scale image into a binary image for separation of objects of interest from the background so that further processing becomes easy. Image subtraction operation is performed between the reference image and the test image in order to point out differences between them. By combining segmentation algorithm and image processing algorithm and using regional properties of elements in positive and negative images defect classification is done. The resultant image shows all the defects differentiated by pseudo-coloring and displayed on the GUI.

Both 2D and 3D imaging systems are used to facilitate inspection. A single camera or imaging sensor may be used to provide an overhead view of the circuit board. Additional cameras allow for the capture of 3D images. Lighting is usually provided by LED lamps which give a consistent light output that does not degrade over time. Many systems use a combination of axial and angled light sources as well as light of several colours to enhance the contrast between objects and the background. Still images can provide better detail over streamed images but they take longer than generating a still image from a streamed video. Many cameras are mounted on X-Y motion systems to allow imaging of larger circuit boards, especially inline systems. Sometimes the image sensor is fixed and the PCB itself moves – common in bench-type systems. Some machines employ hybrid combinations of camera and board motion. Dual-side inspection machines will employ both top-down and bottom-up cameras.

Shadows from taller components can make distinguishing shorter features difficult so much attention is given to lighting that can be directed to avoid casting shadows. Being able to distinguish colours, barcodes, lettering, etc. are also important characteristics of the imaging system. Different colour light rings are used to illuminate portions of solder fillets to determine the geometry of the fillet. Camera lenses are chosen that minimize distortion in the field of view by allowing only parallel light to reach the camera. Images are then stitched together. It affects the process time as some machines just identify the defects by comparing pixel by pixels. The processing time would be faster

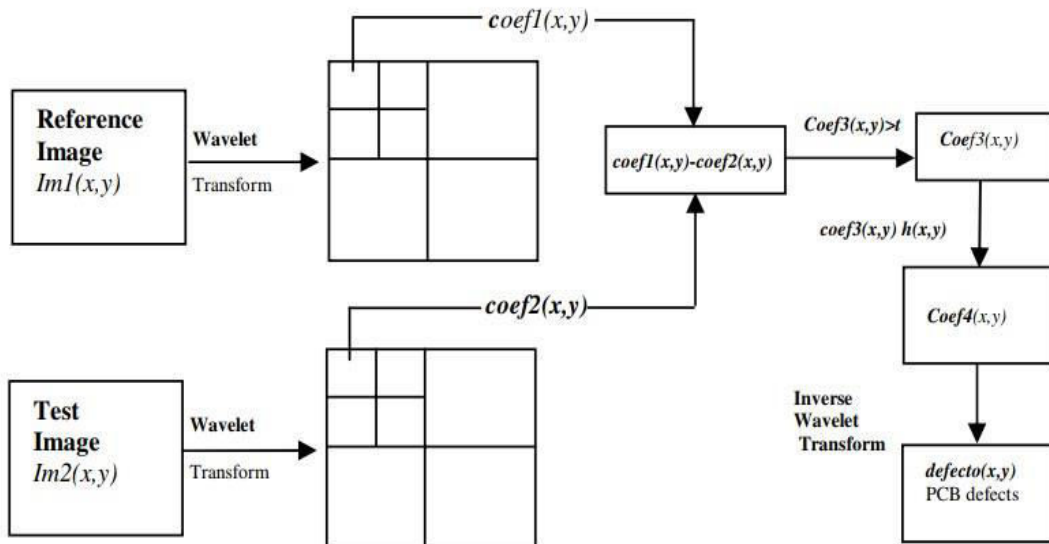
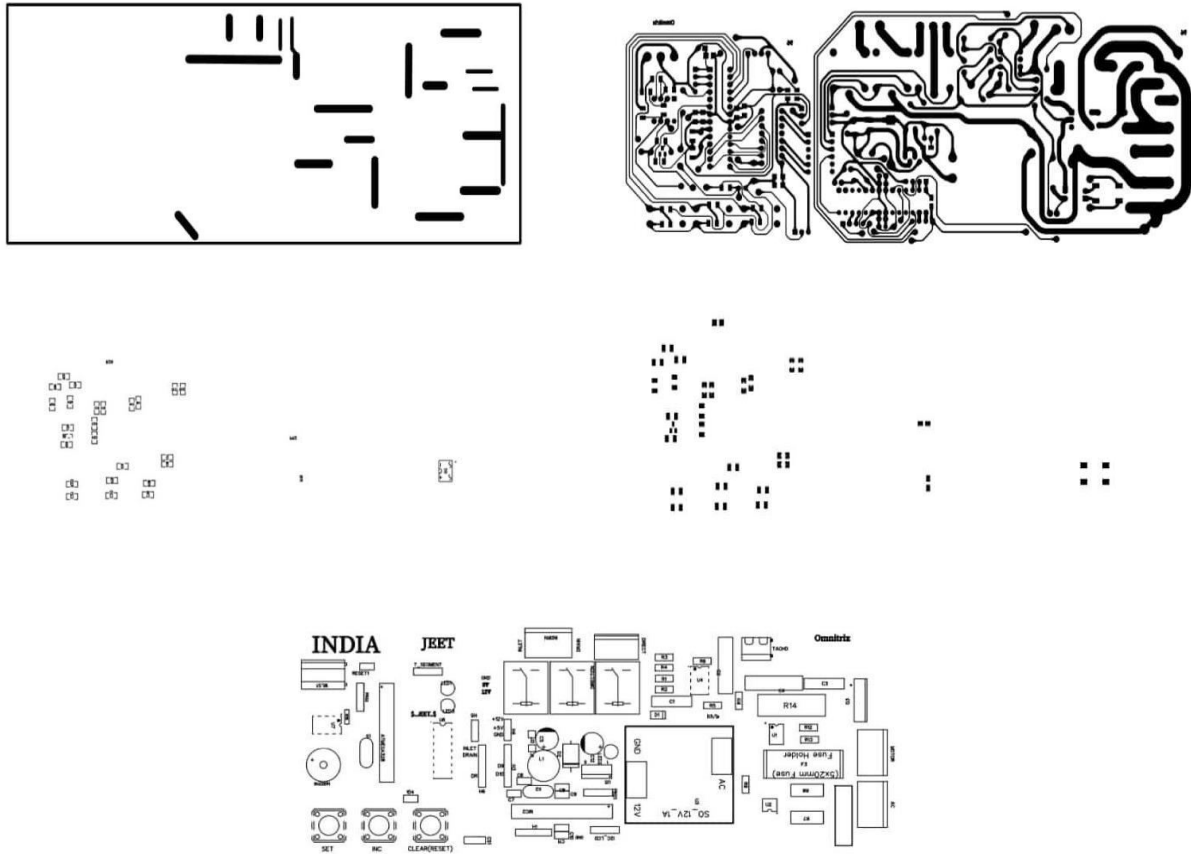


Fig. 1. Defect detection algorithm

III. EXPERIMENTAL RESULTS



IV. CONCLUSION

This paper shows an automated Bare Printed circuit Board inspection system for detecting defects by image analysis. While implementing the system, we need to make careful plans for each step such as image acquisition, image preprocessing, image subtraction and defect recognition. At present, the finished designed inspection system can detect common PCB defects such as: short circuit, open circuit etc. in real time images. After images have been acquired, thresholding, noise filtering, segmentation and image subtraction operations are used to get noise-free positive and negative images which are then superimposed on the original reference image to obtain the exact position of the defect. In this system, the results are displayed on Matlab GUI as the user can load the image and start the processing on it by selecting given graphical elements such as pushbuttons for it. Also GUI is very simple to use as it does not need more experience or training to use.

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Design and Development of Press Tool for Sheet Metal

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ABSTRACT: The cost of tooling in sheet metal industries contributes a considerable part to the overall cost of manufacturing a component. It is therefore imperative to keep down this cost by ensuring that the tool works for a long period in production without interruption. One way of achieving this objective is to reduce the stress on the tool during punching and forming. This press tool has significance like high rate of production and minimum per unit cost of product. The project work consists of a design and manufacturing of progressive press tool for an automobile component. The component is made of mild steel having thickness 6mm. The component is made on two simple dies.

KEYWORDS: Die, Mild Steel, Punching, Forming, Bending.

I. INTRODUCTION

Amit Dattatray Madake [1] Tool and die makers are workers in the manufacturing industry who make jigs, fixtures, dies, moulds, machine tools, cutting tools, gauges, and other tools used in manufacturing processes. Depending on which area of concentration a particular person works in, he or she may be called by variations on the name, including tool maker (toolmaker), die maker (diemaker), mould maker (mould maker), tool fitter (tool fitter), etc. Chavan [2] Basic Die Making is designed to provide students with the principles of blanking and/or piercing dies, screw, and dowel holes, die life, punches, and die-block construction. Sheet metal forming is one of the most used processes in industry. Throughout the years, the sheet metal forming industry experienced technological advances that allowed the production of complex parts. However, the advances in die design progressed at a much slower rate, and they still depend heavily on trial-and-error and the experiences of skilled workers. During the development of the Die, a reduction in the number of trials would directly influence the cycle time for development. A shorter cycle time can be planned with due utilization of software tools that would predict the trial results without conducting the same. The simulation offered by the software during the process of stamping lends important insights into the modifications needed in the die and/or the component to affect a simplified and productive die. Normally, a Forming die (including Draw die) calls for refined design parameters for ensuring a smooth passage through the trial phase of the developed Die normally accompanied by crucial review inputs over the design of the components.

II. RELATED WORK

Kumaresh, A.K [3] Design the innovative die for metal stamping process is a very important stage in manufacturing field. It is because the product performance, product quality and final cost of the product are more influential in this stage. In this project we have designed the compound die for an automobile body part. The aim of this project is to reduce cycle time of forming and piercing operation for component. Lemu [4] These all operations need be combined in a dual setup of die punch with a proper tool design. In this project we have worked on the dies for piercing and forming operations for the part. Şen [5] Selecting appropriate tool steel is crucial for achieving good productivity, tooling economy and quality of part. Whole tool Does not require high strength material, because all parts of tool does not involve in operation. Following is the list of the materials selected:

Bottom Plate	MS
Top Plate	MS
Die Plate	OHNS
Punch Plate	OHNS
Guide Plate	MS
Dowel Pin	STD
Allen Bolt	STD

Fig:1. List of materials used.

III. METHODOLOGY

- 1.To study product and identification of problems and objectives.
2. Data collection and data analysis.
3. Selection of suitable die material its modelling, designing and its validation.
4. Trials, results, and conclusions.

Pavuluri [6] Bending is one of the most common sheet metal fabrication operations. Also known as press braking, flanging, die bending, folding, and edging, this method is used to deform a material to an angular shape.

This is done through the application of force on a workpiece. The force must exceed the material's yield strength to achieve plastic deformation. Only then can you get a lasting result in the form of a bend.

IV. EXPERIMENTAL RESULTS

Fig. below shows the assembly view of Bending die. It consists of the parts like punch holder plate, punch, die block, baseplate, Allen bolts. Anudeep [7] Before piercing the bending operation is performed. In this the blank cut in a required length is hold on the die block, when the punch comes down the flat blank is formed in the shape as that of the die and punch shape.

Tekiner, Zafer [8] Traditionally, to determine the acceptability of the design, formulas based analytical solutions have been used. But formulas are not always applicable and therefore design by analysis is as an alternative. The Stresses in the various parts of the die are find out using Ansys Workbench.

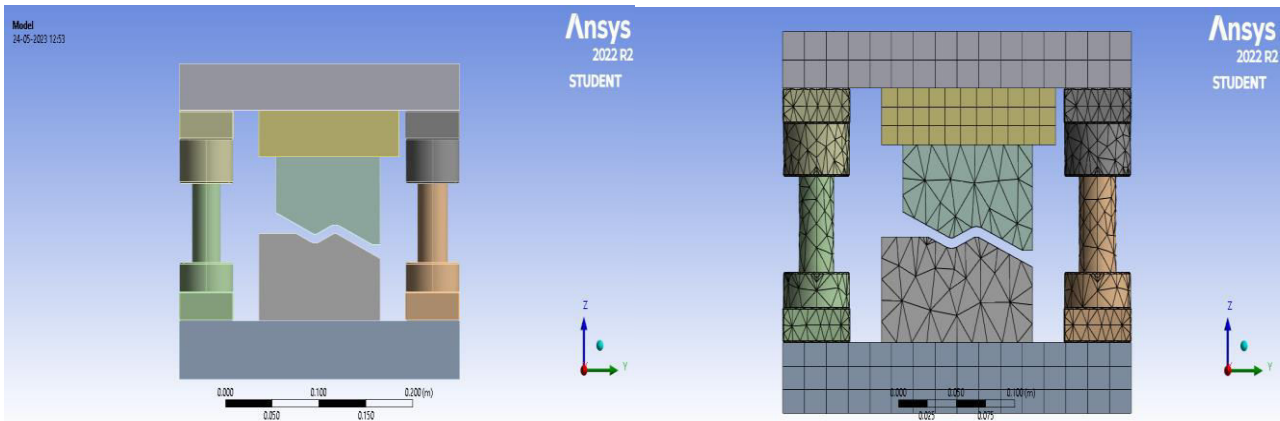


Fig:2. Analysis of dies and meshing.

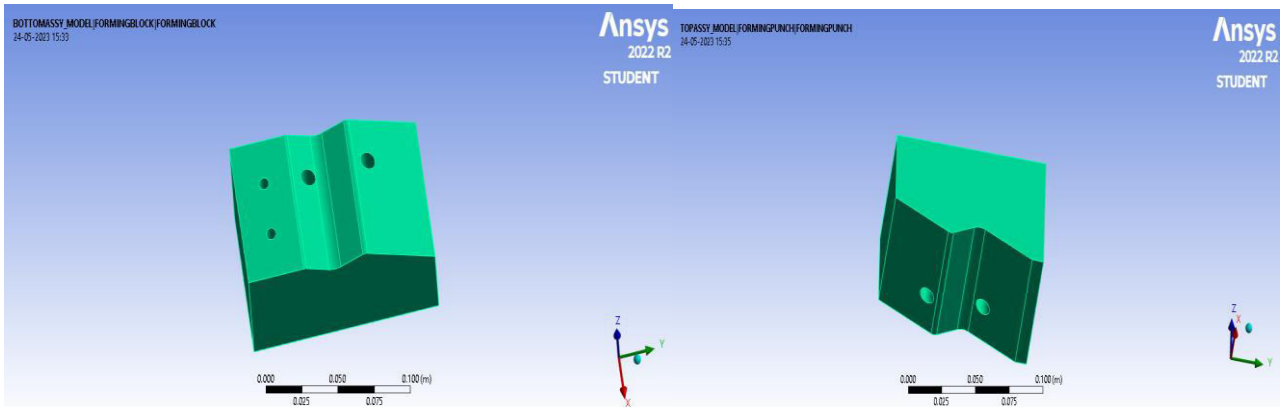


Fig.3. Design of die and punch (die on left and punch on right)

V. CONCLUSION

In this project detail study of die parts and its analysis has been carried out. Punch and die analysis for Bending die was carried out and the results found were safe. Stress developed in both the dies were less than the allowable stress. Thus, it concluded that the material selected for the dies is safe Punch and die design is detachable so that in case damage or punch only the respective parts can be replaced instead of replacing whole die.

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Pneumatic Sack Lifter

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ABSTRACT: This project work titled pneumatic sack lifter has been+ conceived having studied the difficulty in lifting e any type of load in trolley. Our survey in this regard in several agricultural, industrial and automobile garages revealed the facts that, mostly some difficult methods were adopted in lifting the loads for reconditioning. The project concentrates on this difficulty, and hence a suitable arrangement has been designed such that the vehicles can be lifted from the floor without application of any impact force. By pressing the button, the solenoid valve activated. The compressed air is goes to the pneumatic cylinder through solenoid valve. The ram of the pneumatic cylinder is act as a load lifting device. pneumatic lift is a mechanical device used for various applications for lifting of the loads to a height or level. But in case of trolleys they are mainly used for unloading the weight or load available in the trolley In this project we have used semi-automatic sack lifter for the purpose of loading the sacks or weights in the tractor trolley. This project is started by the means of research on the pneumatic weight-lifting system for the easiness of human efforts.

KEYWORDS: sack lifter, pneumatic weight lifting.

I. INTRODUCTION

Today's world requires speed on each and every field. Hence rapidness and quick working is the most important. Now a days for achieving rapidness, various machines and equipment's are manufactured by man. Engineer is constantly conformed to the challenges of bringing ideas and design in to reality.

New machine and techniques are being developed continuously to manufacture various products at cheaper rates and high quality. The project 'design and development of semi-automatic hydraulic sack lifter' being helpful in easing the work done by humans for many years. This project is conceptual design of semi-automatic weight/sack lifting tool for trolley . It can be used for loading the heavy weights or sack in trolley. It can reduce the labour work . This project should be started by means of research on hydraulic weight lifter for easiness in human work. The complete system is operated by using hydraulic fluid available in the system. The expected results is to create manual operating weight lifting tool that can used for various industries mostly in agriculture industries. There are many weight lifting machines are available in market but with heavy cost. For many ages, farmers or laborers load the weight/sacks on the trolley by themselves . It is a very tiring process and it demands more physical work from the laborers. the purpose of the project is to provide this facility and feature at efficient cost and less human efforts.

The controlled movement of parts or a controlled application of force is a common requirement in the industries. These operations are performed mainly by using electrical machines or diesel, petrol and steam engines as a prime mover. These prime movers can provide various movements to the objects by using some mechanical attachments like screw jack, lever, rack, and pinions etc. However, these are not the only prime movers. The enclosed fluids (liquids and gases) can also be used as prime movers to provide controlled motion and force to the objects or substances. The specially designed enclosed fluid systems can provide both linear as well as rotary motion. The high magnitude controlled force can also be applied by using these systems. This kind of enclosed fluid based systems using pressurized incompressible liquids as transmission media are called as hydraulic systems.

Hydraulic pumps are the power source for hydraulic control systems. It shows that hydraulic pumps exist in many different configurations, all of which are accompanied by their own advantages and disadvantages. The chapter considers the efficiency of hydraulic pumps in general along with modeling and measuring techniques. Since gear and axial - piston pumps are the most common pump types used in hydraulic control systems, it discusses these pumps in more detail. It describes the control of variable - displacement swash - plate type pumps. The chapter also discusses both the pump flow characteristics and various control designs. The discharge flow characteristics of an axial - piston pump are similar to those of a gear pump in the fact that both pumps exhibit an oscillatory flow ripple that may be



roughly described by the flow ripple amplitude. The chapter describes the flow ripple characteristics of an axial - piston pump.

II. RELATED WORK

The word 'pneuma' comes from Greek and means breather wind. The word pneumatics is the study of air movement and its phenomena is derived from the word pneuma. Today pneumatics is mainly understood to mean the application of air as a working medium in industry especially the driving and controlling of machines and equipment. Pneumatics has for some considerable time been used for carrying out the simplest mechanical tasks in more recent times has played a more important role in the development of pneumatic technology for automation. Pneumatic systems operate on a supply of compressed air which must be made available in sufficient quantity and at a pressure to suit the capacity of the system. When the pneumatic system is being adopted for the first time, however it will indeed be necessary to deal with the question of compressed air supply. The key part of any facility for supply of compressed air is by means using reciprocating compressor. A compressor is a machine that takes in air, gas at a certain pressure and delivered the air at a high pressure. Compressor capacity is the actual quantity of air compressed and delivered and the volume expressed is that of the air at intake conditions namely at atmosphere pressure and normal ambient temperature. Pneumatic systems in fixed installations, such as factories, use compressed air because a sustainable supply can be made by compressing atmospheric air. The air usually has moisture removed, and a small quantity of oil is added at the compressor to prevent corrosion and lubricate mechanical components.

Factory-plumbed pneumatic-power users need not worry about poisonous leakage, as the gas is usually just air. Any compressed gas other than air is an asphyxiation hazard—including nitrogen, which makes up 78% of air. Compressed oxygen (approx. 21% of air) would not asphyxiate, but is not used in pneumatically-powered devices because it is a fire hazard, more expensive, and offers no performance advantage over air. Smaller or stand-alone systems can use other compressed gases that present an asphyxiation hazard, such as nitrogen—often referred to as OFN (oxygen-free nitrogen) when supplied in cylinders.

Portable pneumatic tools and small vehicles, such as Robot Wars machines and other hobbyist applications are often powered by compressed carbon dioxide, because containers designed to hold it such as soda stream canisters and fire extinguishers are readily available, and the phase change between liquid and gas makes it possible to obtain a larger volume of compressed gas from a lighter container than compressed air requires. Carbon dioxide is an asphyxiant and can be a freezing hazard if vented improperly.

III. METHODOLOGY

As we seen in our surrounding the farmers are harvest their crops and stack their harvested crops in sacks and then they load the sacks in tractor trolley for further transportation.in this process the farmers need more human efforts to load these sacks in trolley. With this project we can reduce the human efforts and time consumed in this process. Hydraulic lifts work on a basic principle: to go up, a pump pushes oil into the cylinder, pushing the piston (eg. To lift trolley) up. To go down, the valve opens and oil is allowed to flow back into the reservoir, and is pushed back using the gravitational force of the lifted trolley. Pneumatics is study of mechanical motion caused by pressurized gases and how this motion can be used to perform engineering tasks. Pneumatics is used mainly in mining and general construction works. Pneumatic devices are used frequently in the dentistry industry across the world. On the other hand, hydraulics means use of pressurized fluids to execute a mechanical task. Hydraulics is frequently used in the concepts of turbines, dams, and rivers. Air brakes in buses, air compressors, compressed air engines, jackhammers, and vacuum pumps are some of the most commonly used types of mechanical equipment that are based on pneumatics technology. Commonly seen hydraulics based equipment types are hydraulic presses, hydraulic hoppers, hydraulic cylinders, and hydraulic rams. In the subsequent sections of this article, you will learn how a pneumatic system works, what its best features are, and its major advantages over hydraulic systems.

IV. EXPERIMENTAL RESULTS

Figures shows the results of pneumatic sack lifter mechanism using air supply from compressor to pneumatic cylinder. Figs.(a)shows lifting mechanism (b)shows the image after supplying air from cylinder and fig(c)shows actual working of the mechanism (d)shows top side of the mechanism.

When the hand lever is activated in the forward direction, the flow control valve is triggered, allowing compressed fluid, in this case, air, to flow into the pneumatic single acting cylinder. As the compressed air enters the cylinder, it exerts pressure on the piston inside, causing it to move forward.

At the end of the single acting pneumatic cylinder, there is a sturdy ram securely attached. As the piston is pushed forward by the compressed air, it transfers the force to the ram. The ram, in turn, applies this force to the object being lifted, such as a vehicle. With the increasing pressure from the piston and the ram, the vehicle gradually begins to rise upwards. The flow control valve plays a crucial role in this pneumatic system. When the hand lever is switched to the backward motion, the flow control valve is deactivated. This action halts the flow of compressed air into the cylinder, effectively cutting off the supply of pressure. As a result, the piston ceases its forward movement, and the ram stops exerting force on the vehicle. Overall, this system allows for controlled lifting of the vehicle using pneumatic power. The activation and deactivation of the flow control valve through the hand lever ensure that the lifting operation can be started, stopped, and regulated according to the desired motion. We are proud that we have completed the work with the limited time successfully. The pneumatic sack lifter is working with satisfactory conditions. We are able to understand the difficulties in maintaining the tolerances and also quality. We have done to our ability and skill making maximum use of available facilities. In conclusion remarks of our project work, let us add a few more lines about our impression project work. Thus we have developed an pneumatic sack lifter which helps to know how to achieve low cost automation. The operating procedure of this system is very simple, so any person can operate. By using more techniques, they can be modified and developed according to the applications.



(a)



(b)



(b)



(d)

V. CONCLUSION

We are proud that we have completed the work with the limited time successfully. The pneumatic sack lifter is working with satisfactory conditions. We are able to understand the difficulties in maintaining the tolerances and also quality. We have done to our ability and skill making maximum use of available facilities. In conclusion remarks of our project work, let us add a few more lines about our impression project work. Thus we have developed an pneumatic sack lifter which helps to know how to achieve low cost automation. The operating procedure of this system is very simple, so any person can operate. By using more techniques, they can be modified and developed according to the applications. We are proud that we have completed the work with the limited time successfully. The pneumatic sack lifter is working with satisfactory conditions. We are able to understand the difficulties in maintaining the tolerances and also quality. We have done to our ability and skill making maximum use of available facilities. In conclusion remarks of our project work, let us add a few more lines about our impression project work. Thus we have developed



an pneumatic sack lifter which helps to know how to achieve low cost automation. The operating procedure of this system is very simple, so any person can operate. By using more techniques, they can be modified and developed according to the applications.

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Experimental Investigation of Heat Transfer Rate Rectangular Wavy Cross Cut Micro Channel

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ABSTRACT: With increasing demand for higher computational speed and emerging microsystems, efficient thermal management is a need of the hour. Micro channels using liquid coolant are apt solution to this problem. Their efficiency depends greatly upon the channel's cross-section and liquid media. In this study the performance of rectangular wavy crosscut micro-channel are analyzed Performance is compared on the basis of maximum temperature at heated surface. An increase in heat transfer performance (when compared to the reference conventional wavy design) was observed. The combination of Dean's vortices induced by the wavy channel design and the cross-channel mixing enabled by the secondary branches showed potential to further enhance convective heat transfer (at reasonable pressure drop penalties) due to the increased intensity of span-wise fluid mixing and also boundary layer disruptions. The relative waviness can be increased along the flow direction, which results in higher heat transfer performance and renders the temperature of the devices much more uniform.

KEYWORDS: Wavy micro-channel, Thermal management, Heat transfer performance, Cross-channel mixing, Convective heat transfer, Uniform temperature.

I. INTRODUCTION

The incorporation of micro-channels in heat sink design will significantly increase the heat-removal ability, but this must be balanced with the pressure drop requirement. Due to the dimensions of the channels being in the micro scale, the employment of high flow rates will incur a sharp increase in pressure drop penalties. Hence, the flow through the micro-channels is typically kept in the laminar region as the hefty pressure drop associated with turbulent flow cannot be justified. As a result of that, the boundary layer thickened downstream of the flow path, deteriorating the heat transfer capabilities. The significant temperature gradient will also induce thermal stresses, which are detrimental to the lifespan of the components to be cooled, especially electronic chips. In response, many methods, both passive and active, have since been explored to promote fluidic mixing in the span-wise direction, to enhance heat transfer performance. The extent of convective heat transfer in the laminar regime is a strong function of span-wise fluidic mixing. One method to enhance span-wise mixing is to integrate wavy channels to the heat sink design.

II. RELATED WORK

Several researchers have contributed to the study of microchannel heat transfer. Satish G. Kandlikar et al. (2011) focused on various aspects including flow boiling, single-phase heat transfer, fluid flow in microchannels, high flux cooling, and interfacial phenomena. D.A. Kamble (2011) conducted numerical research and highlighted the impact of hydraulic diameter on microchannel heat transfer, finding that increasing the diameter leads to higher flow rate pressure drop. Dr. B.S. Gawali et al. (2014) conducted theoretical and experimental research on straight microchannel heat sinks, observing that temperature increases with channel length. Sunil Bharati and Sohail Bux (2015) explored the use of nanofluids and their influence on heat transfer coefficients. Vinod U. Patel and Ashish J. Modi (2015) investigated fluid flow and heat transfer in copper-based microchannel heat sinks, aiming to maximize pressure difference while suppressing temperature rise. D.S. Ghodake and Rakesh Siddheshwar (2016) analyzed the convective heat transfer performance of microchannels with different geometries. H. Kamal and A. Dewan (2016) experimented with microchannel heat sinks, introducing transverse micro chambers to enhance heat transfer. Rajesh Sharma et al. (2016) validated conventional correlations for microchannels, observing good agreement between classical approaches and experimental results. Rohit Pingale et al. (2016) performed numerical analysis on rectangular microchannels to

determine optimal designs. Shiram and Ravindra Randa (2017) explored parameters and techniques to improve thermal performance, including geometrical design, materials, nano fluids, and the application of computational fluid dynamics (CFD). These studies contribute to our understanding of microchannel heat transfer and provide insights for optimizing heat sink designs.

III. METHODOLOGY

Numerical simulations using computational fluid dynamics (CFD) techniques are performed to study the coolant flow through microchannels of corrugated rectangular cross-section. Predict flow behavior and heat transfer properties in microchannels using available correlations and mathematical models. A literature survey is performed to gather information on the design aspects of rectangular micro-channel test setups, including geometry, dimensions, materials, and experimental techniques. Based on the literature review, a customized test setup is developed, incorporating micro-channel structures, flow control mechanisms, and data acquisition equipment. Experimental tests are performed using the developed setup and measurements of pressure, temperature and flow variables are recorded. The collected experimental data are analyzed together with the numerical simulation results to evaluate the performance of the wavy rectangular cross-section microchannels. Parameters such as heat transfer coefficient and overall efficiency are calculated and compared. Based on the analysis, conclusions are drawn and the effectiveness of wavy design to improve heat transfer and fluid flow properties in microchannels is evaluated. Recommendations for further improvements or modifications to the microchannel design can also be made.

IV. EXPERIMENTAL SET-UP

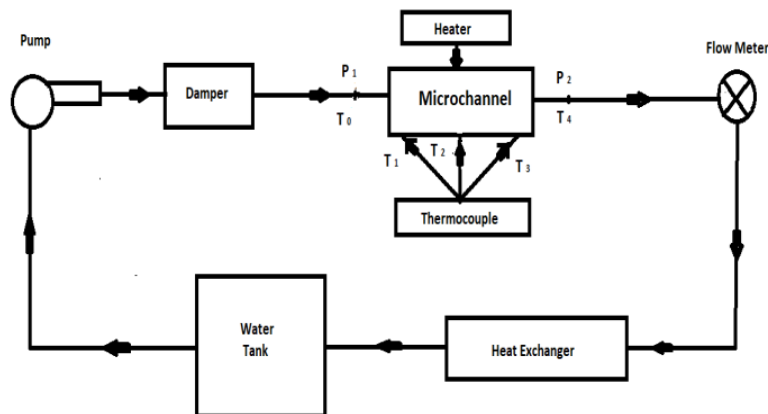


Figure 1: Schematic Experimental Set-up diagram

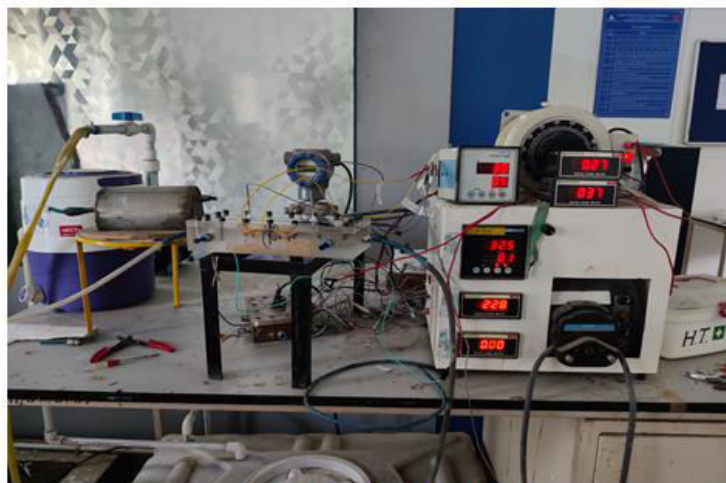


Figure 2: Actual Experimental Set-up

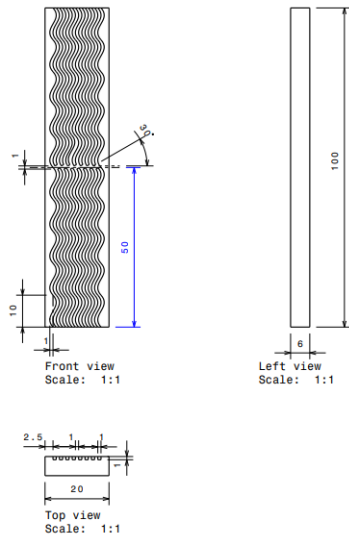


Figure 2: Micro-channel Dimensions

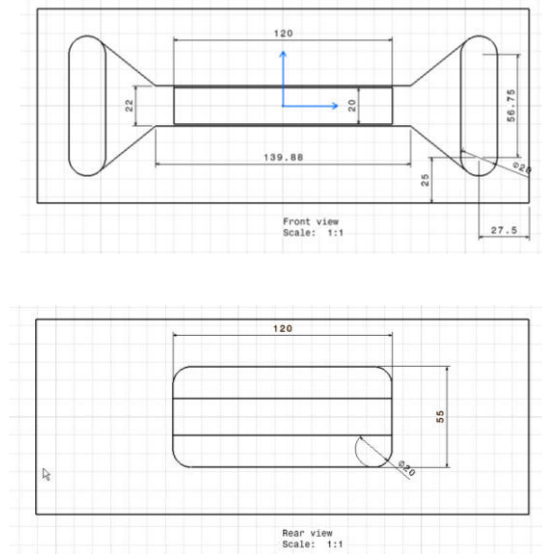


Figure 3: Acrylic Case Dimensions

VI. CAD MODELS

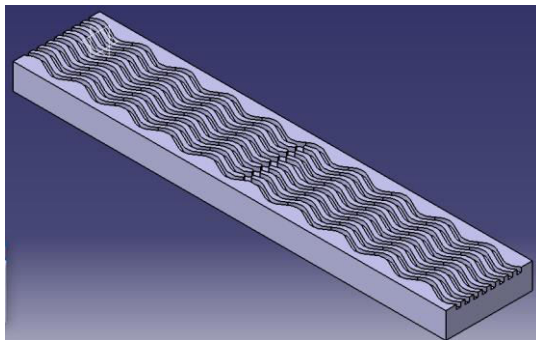


Figure 4: Plate CAD model

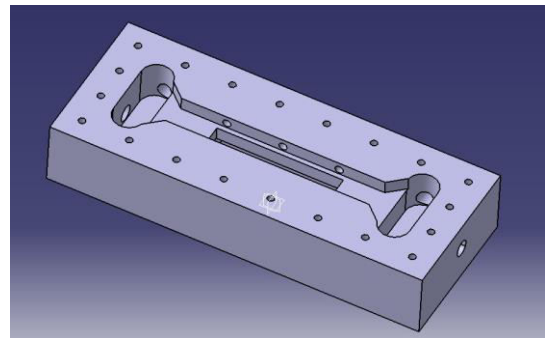


Figure 5: Acrylic case CAD model

VII. ANSYS SIMULATIONS

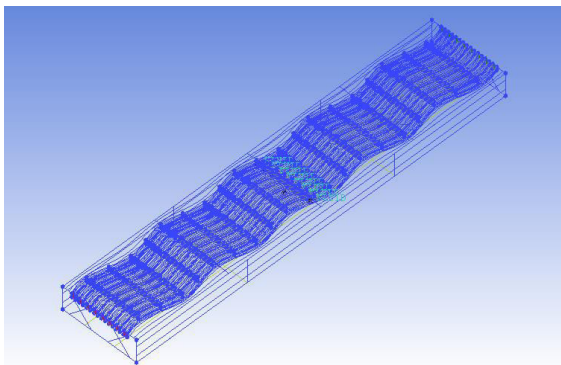


Figure 6: ICEM-CFD model

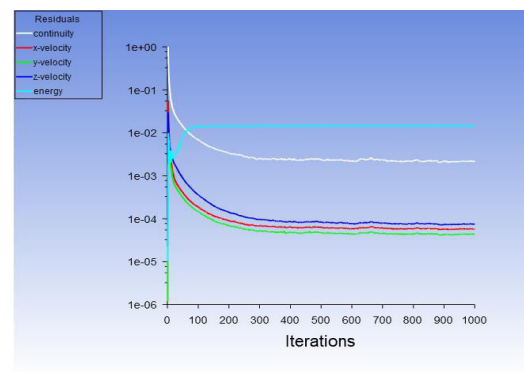


Figure 7: Ansys FLUENT simulation

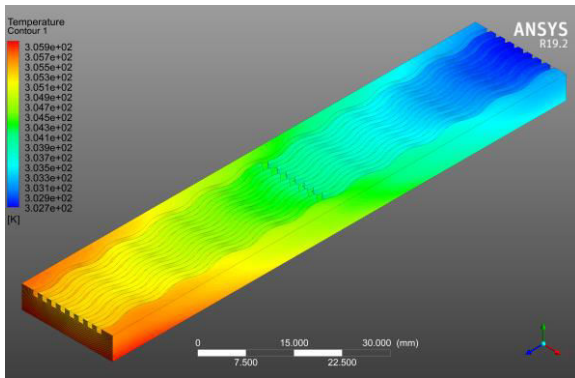


Figure 8: Temperature Contour of Plate

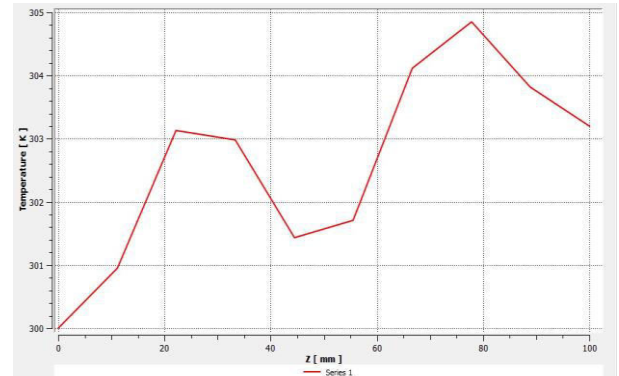


Figure 9: Fluid Temperature across the Plate

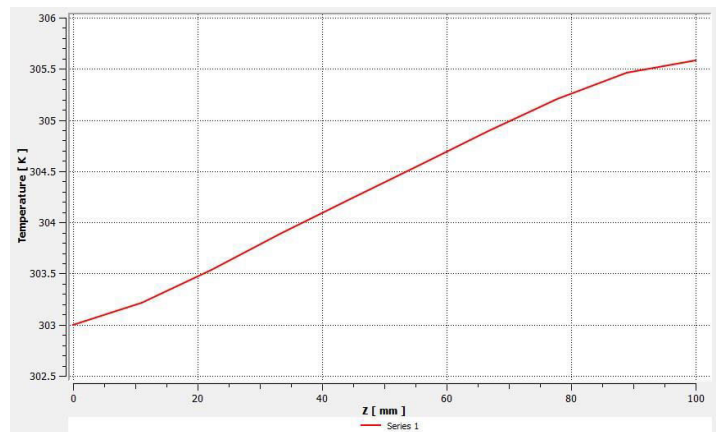


Figure 10: Wall Temperature across the Plate

VIII. CFD RESULTS

Table 1: Nusselt number Variations

RE	0°	10°	20°	30°	40°	50°	60°	70°
100	9.02	8.48	8.42	9.31	9.02	8.99	8.59	8.55
200	11.61	11.60	11.58	12.18	11.67	11.63	11.75	11.63
300	12.85	12.78	12.61	13.53	12.87	12.71	12.99	12.99
400	13.23	13.14	12.96	14.00	13.25	13.21	13.24	13.88
500	13.81	13.76	13.55	13.99	13.20	13.51	13.36	13.57
600	13.68	13.58	13.31	14.31	13.68	13.67	13.59	13.92
700	14.69	14.57	14.26	15.58	14.71	14.69	14.58	15.12
800	15.04	14.77	14.53	16.10	15.01	14.99	14.83	15.82
900	15.20	15.05	14.71	16.25	15.25	15.20	15.03	16.01
1000	15.36	15.21	14.87	16.50	15.48	15.39	15.19	16.25

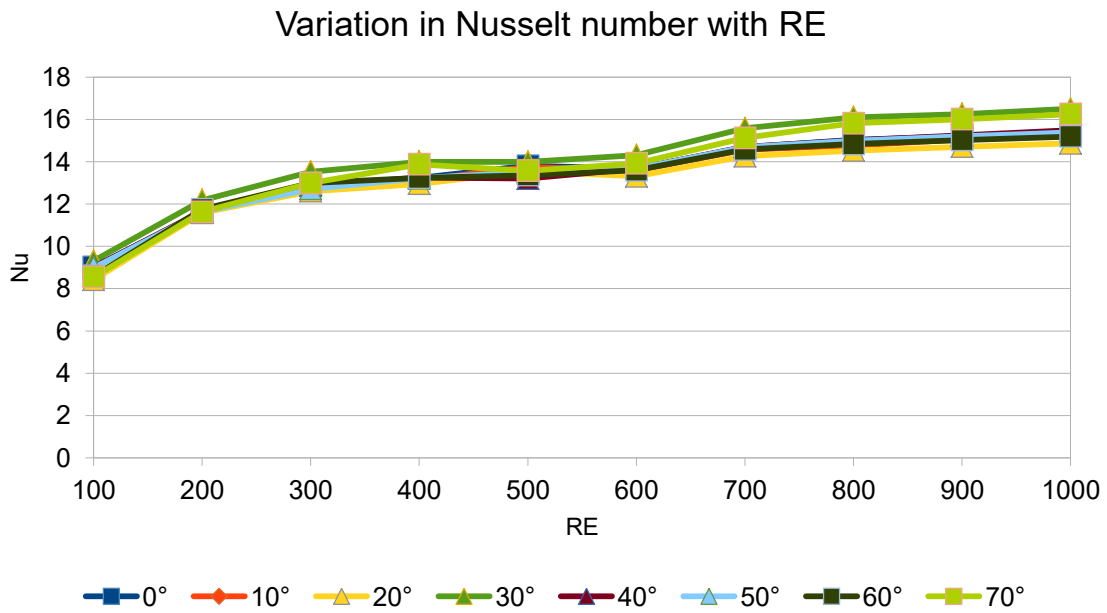


Figure 11: Variation in Nusselt Number with RE

IX. EXPERIMENTAL RESULTS

Table 2: Experimental Nusselt number Variations

RE	0°	10°	20°	30°	40°	50°	60°	70°
100	8.86	8.41	8.38	9.13	8.81	8.22	8.73	8.45
200	11.29	11.27	11.58	12.04	11.47	11.38	11.75	11.39
300	12.75	12.68	12.61	13.43	12.87	12.64	12.91	12.86
400	13.17	13.13	13.02	13.91	13.25	13.16	13.17	13.78
500	13.75	13.65	13.46	14.01	13.20	13.43	13.29	13.52
600	13.59	13.48	13.30	14.26	13.56	13.67	13.55	13.82
700	14.56	14.49	14.26	15.45	14.54	14.57	14.58	15.08
800	14.96	14.69	14.47	16.02	14.93	14.87	14.72	15.74
900	15.09	14.97	14.68	16.15	15.19	15.11	14.93	16.01
1000	15.24	15.13	14.79	16.38	15.34	15.26	15.19	16.12

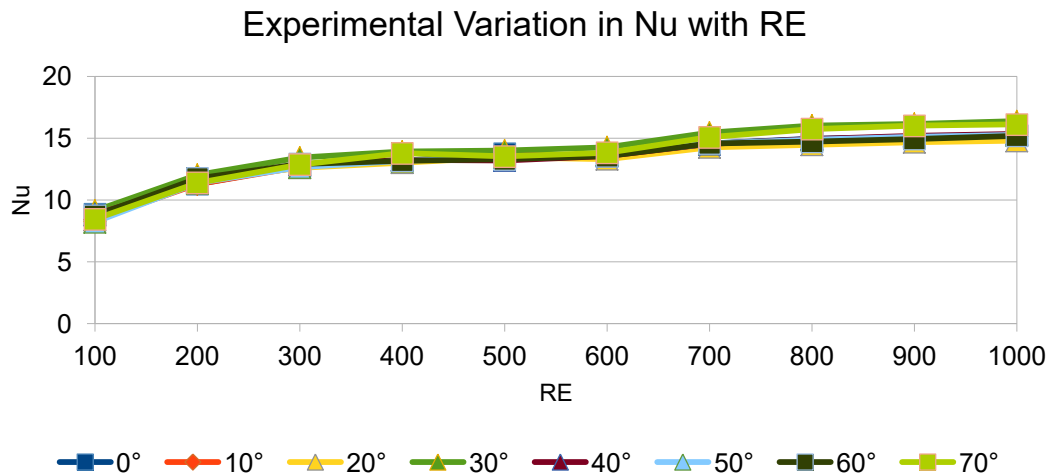


Figure 13: Experimental Variation in Nusselt Number with RE

X. CONCLUSION

This research report investigates the thermal performance of wavy rectangular cross-section microchannel heat sinks using experimental measurements and computational analyses. The results validate computer simulations and provide insight into thermal parameters. The study concludes that heat sinks with a cross-sectional angle of 30° have better thermal performance compared to other angles. Due to the low liquid velocity and high heat flux concentration, the highest temperature is observed at the heated base below the channel exit. Complex three-dimensional heat flow patterns occur within highly conductive substrates where liquids and solids are in direct contact. A detailed analysis of heat transfer coefficients, temperature distribution, heat flow, and Nusselt number provides valuable insight into the thermal behavior of heat sinks. The study revealed the impact of geometric design, fin placement and operating conditions on thermal performance enhancement. These findings will help advance our understanding of microchannel heat sinks and their applications for heat dissipation. In future studies, these findings can be used to optimize the design and performance of corrugated rectangular cross-section microchannel heat sinks for improved thermal management.

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An Analysis on MMC Materials for Knuckle Joints

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ABSTRACT: A knuckle joint is a type of tensile intersection that connects two rods. This joint allows for angular misalignment of the rods and may handle compressive loads if managed properly. These joints, including as tie rods and trolley connections, are extensively used in car and mechanical systems. Because it is a commonly used component or device in autos If the knuckle joint fails, the likelihood of an accident increases. As a result, the knuckle joint's design and analysis must be sufficient to resist a running situation stress without failure. As a result, modeling and analysis of the knuckle joint are performed in a favorable environment.

To obtain an accurate solution, CATIA V5 R21 AND ANSYS (workbench 2020 R1) were used to model and analyze a knuckle joint. The FE410W material used in railways has a yield strength of 467Mpa. After modeling the FORK and other components of the knuckle joint, this model is loaded into ansys for analysis.

KEYWORDS: -Knuckle Joint., fork

I. INTRODUCTION

When a tiny amount of flexibility or angular moment is required, a knuckle joint is utilized to connect two rods that are under the action of tensile stresses. It's essentially a tensile junction. If the joint is directed, it may be able to support a compressible load. This joint is easily detachable for changes or repairs.

Roller chain links, tension links in bridge constructions, roof truss tie rod joints, jib crank tie rod joints, and so on are all scenarios of knuckle joints.

A knuckle joint is a mechanical intersection that is used to connect two rods that are under tensile load. A knuckle joint is a mechanical connection that links two tensile-loaded rods. When a tiny degree of angular movement or flexibility is required. At all times, the load has an axial or linear line of action.

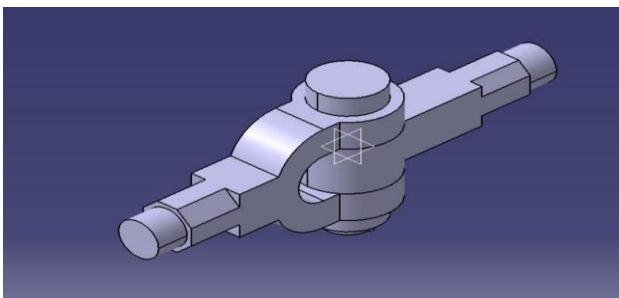


Fig :ISO View of Knuckle Joint

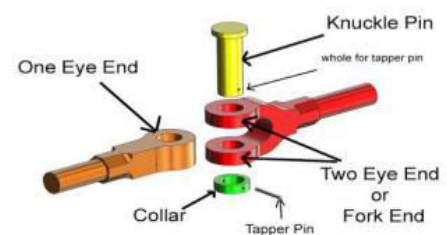


Fig : Parts of Knuckle Joint

The knuckle joint assembly is made up of the following primary parts:

1. A single eye.
2. Fork or double eye.
3. The knuckle pin.
4. the collar
5. Taper pin.

A knuckle joint is made up of three parts: an eye, a fork, and a knuckle pin. One rod's end is shaped into an eye, while the other rod's end is created into a fork with an eye in each fork leg. The eye is put into the fork, and the knuckle pin is threaded through the holes in the eye and fork. A collar and a taper pin or split pin on one end hold the knuckle pin together.

Simply put, stress is defined as force divided by area. Tensile stress occurs when a force is applied perpendicular to the region and pulls away from it. If the force is perpendicular to the region, the stress is compressive.

II. ANALYTICAL CALCULATIONS

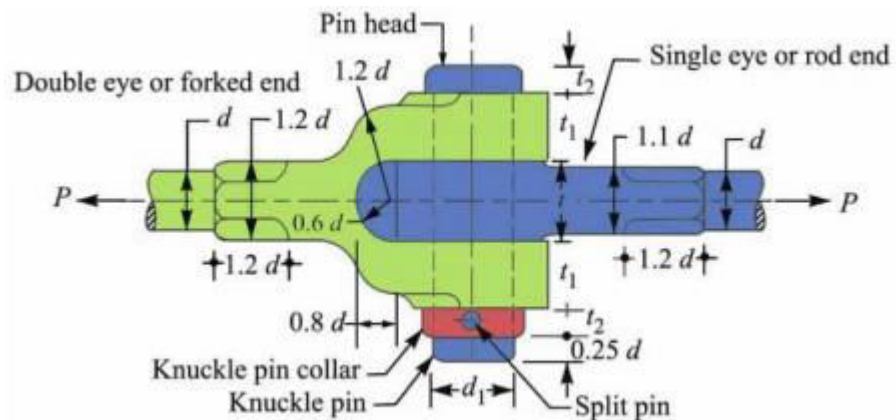
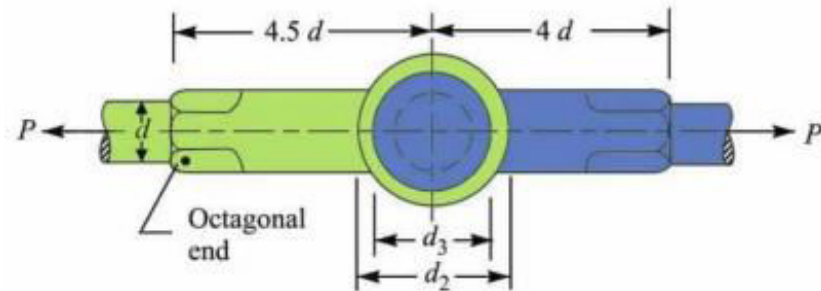


Fig : Figure terminologies of Knuckle Joint

Where,

As we have taken d is the diameter of the rod, then the diameter of the pin will be $= d_1 = d$

The outer diameter of the eye, $= d_2 = 2d$

Diameter of knuckle pinhead and collar, $= d_3 = 1.5d$

The thickness of single eye or rod end (t) $= 1.25d$

The thickness of fork (t_1) $= 0.75d$

Consider a load of $p = 110$ KN acting on the single eye end rod

Possible failure modes of knuckle joint

Rod material is steel, Where, Tensile Strength, Yield $= 250$ MPa

FOS = Designer Factor of safety

$$\sigma_t = \frac{S_{yt}}{FOS} = \frac{250}{2} = 125$$

Tensile Failure in the rod

$$\sigma_t = \frac{P}{\left(\frac{\pi}{4}\right) \cdot D^2} = D = \sqrt{\frac{4 \cdot P}{\pi \cdot \sigma_t}} = 33.473 = 35 \text{ mm}$$



where, d = diameter of rod = 35 mm following is calculated

The dimensions for the model used in this project is as follows:

- $d = d_1 = 35\text{mm}$
- $t = 43.75\text{mm}$
- $d_2 = 70\text{mm}$
- $t_1 = 26.25\text{mm}$
- $d_3 = 52.5\text{mm}$
- $t_2 = 17.5\text{mm}$
- $a = 26.25\text{mm}$
- $b = 43.75\text{mm}$

Shear failure in Pin

Shear stress in the pin

$$\frac{p}{2 * \left(\frac{\pi}{4}\right) * d^2} = \text{Shear stress} = \frac{110 * 10^3}{2 * \left(\frac{\pi}{4}\right) * 35^2} = 57.165 \text{ MPa}$$

Crushing stress in Pin in eye

Crushing Stress =

where $[\sigma_c]$ = allowable compressive stress for the material selected

Crushing stress in Pin in Fork

$$\text{Crushing stress} = \frac{P}{2 * a * d} = \frac{110000}{2 * 26.25 * 35} = 59.83 \text{ Mpa}$$

Maximum Tensile Stress in eye,

$$\sigma_t = \frac{P}{b(d_o - d)} = \frac{110000}{43.75 * (70 - 35)} = 71.836 \text{ mpa} \quad \frac{P}{b * d} = \frac{110000}{43.75 * 35} = 71.83 \text{ Mpa} < \sigma_c$$

Maximum Shear Stress in eye

$$\tau = \frac{P}{2a * (d_o - d)} = \frac{110000}{(2 * 26.25) * (70 - 35)} = 59.86 \text{ Mpa}$$

III. REVIEW OF LITERATURE

Sr.No	Title of Paper	Author	Result
1	Design and Analysis Of Knuckle Joint By Using FEA Structural Analysis Method	R. Sabariselvan ¹ , T. Veeramahendraprasath ² , S. Vishnu ³ , R. Tamilvanan ⁴ , P. Jeyapraham	The results reveal that the knuckle joint may be built and optimized to withstand a wide variety of loads, including both compressive and tensile loads. By using alloys, the knuckle joint's weight might be reduced. The analytical findings suggest that the alloy material combined with structural steel performs better than the alternatives.

2	Study & Analysis of Knuckle Joint with the Replacement of Material by Using Teflon	Nishant Vibhav Saxena, and Dr. Rohit Rajvaidya	Parts made out of composite materials are economical to produce, and facilitate overall systems cost reductions by eliminating secondary operations for parts, such as machining, as well as facilitating reduction in part count when compared with metal parts.
3	design and analysis of knuckle joint for different materials	Ritvik Bhardwaj	The knuckle joint proposed to develop in the present study is for an applied force of 25 kN. The diameter of the pin is proposed to be around 30 mm. Based on the ANSYS analysis, it shows that a pin of 30 mm diameter can withstand a load of 25 kN in case of all the materials. Aluminium alloys weigh lighter than other materials. The total deformation of an aluminium alloy is also negligible.
4	Knuckle Joint Design	Sultan Ahmad Ahmadi	This paper, not only deals with the design of a Knuckle Joint but also the stress-strain effect applied to it. In design, the Knuckle Joint is taken to have maximum weight possible with the ability to withstand high stress and strain.

IV .STRUCTURAL ANALYSIS

Procedure for analysis

Iterations of static structural analysis

- First step of the Ansys workbench is to import geometry from the Catia v5 software – this step needs conversion of CATPath file to IGS format for Ansys Support.
- Second step in Ansys Workbench is Generating Mesh in the Modular section.
- Third step is to assign materials for the particular component and then start structural solving (applying boundary conditions and plotting the fixed & force values).
- Finally generating result values.

MATERIAL : Aluminium 7005

RESULTS :

ObjectName	Total Deformation	Equivalent Stress	Equivalent Elastic Strain
State	Solved		
Results			
Minimum	0. mm	8.9358e-003 MPa	1.9599e-007 mm/mm
Maximum	0.30012 mm	207.72 MPa	4.1565e-003 mm/mm
Average	0.14245 mm	37.196 MPa	4.7259e-004 mm/mm



MATERIAL : Magnesiumalloy

RESULTS :

ObjectName	TotalDeformation	EquivalentStress	EquivalentElasticStrain
State	Solved		
Results			
Minimum	0. mm	3.4773e-007mm/mm	8.9336e-003MPa
Maximum	0.53199 mm	7.167e-003mm/mm	205.48MPa
Average	0.25245 mm	8.4048e-004mm/mm	37.221MPa

MATERIAL : Tungsten alloy

RESULTS :

ObjectName	TotalDeformation	EquivalentStress	EquivalentElasticStrain
State	Solved		
Results			
Minimum	0. mm	3.9612e-008mm/mm	8.393e-003MPa
Maximum	6.0415e-002mm	9.1582e-004mm/mm	217.1MPa
Average	2.8685e-002mm	9.4448e-005mm/mm	37.142MPa

MATERIAL : StructuralSteel

RESULTS :

ObjectName	TotalDeformation	EquivalentStress	EquivalentElasticStrain
State	Solved		
Results			
Minimum	0. mm	8.5836e-003MPa	8.6237e-008mm/mm
Maximum	0.1255 mm	295.25MPa	1.7667e-003mm/mm
Average	5.7777e-002mm	37.504MPa	1.9103e-004mm/mm

V.RESULTS TABLE

Sr. No	AnalysisType	Material	Deformation in mm	Strain	Stressin Mpa	Mass in Kg
1.	Static Structural	Structuralsteel	0.1255	0.001766	295.25	7.0107
2.	StaticStructural Redesigned	Structuralsteel	0.12053	0.001766	211.79	7.0107
3.	Static Structural	Aluminum 7005	0.30012	0.0041565	207.72	2.5175
4.	Static Structural	Magnesium alloy	0.53199	0.007167	205.48	1.6184
5.	Static Structural	Tungstenalloy	0.060415	0.0009158	217.1	17.353
6.	Static Structural	Silicon Carbide	0.0597	0.0010683	251.9	2.7872

VI. CONCLUSIONS

This project was done to know the deformational & stress concertation factorial change in the behaviour of the Knuckle during tensile for the applied loading condition, therefore a Knuckle was designed using Catia v5 software and Ansys workbench were used to solve the Knuckle joint 3d part under Structural condition about 83 % of stress is reduced with the help of Topology Optimization compared to normal one. Therefore, material comparison was done with four different types STD Structural steel, Aluminium 7005, Magnesium alloy, Tungsten alloy & Silicon Carbide.

Aluminium 7005 & Magnesium alloy has lesser stress factors & lower mass rate compared to other materials under the applied Tensile loading condition. Thus, this project can be further evaluated for lower material cost products for greater rigidity to sustain the More Stress.

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Design & Development of VMC Fixture

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ABSTRACT: Fixture is a device for locating, holding, and supporting a component or work piece securely in definite position for a specific operation but it does not guide the cutting Tool. Fixture is required in various applications. This paper present design and development of VMC fixture for real industrial component name Conductor 6835691. The fixture is designed in such a way that stability is obtained during all machining operations. These consist of study of data like part drawing and assembly drawing. The fixture design begins with part modelling using SOLIDWORKS followed by analysis.

KEYWORDS: Fixture, Conductor 6835691, Facing, SOLIDWORKS, Threading

I. INTRODUCTION

A faster and more profitable method called for a device (fixture) on which component can be quickly positioned in the correct relationship to the cutting tool and quickly clamped before machining. This is special work holding device. While designing this work, a good Number of literature and titles written on the subject by renowned author are referred. All finding the conclusions obtained from the literature review and the interaction with fixture designers is used as guide to develop the present research work. Quality of the performance of a process largely influenced by the quality of jigs and fixtures used for this purpose. What makes a fixture unique is that each one is built to fit a particular part or shape. The main purpose of a fixture is to locate and, in the cases, hold a work piece during an operation. Correct relationship and alignment between the tool and work must be maintained. Fixtures are designed to hold, support, and locate every part to ensure that part is machined within the specific limits.

1.1. PROBLEM STATEMENT

Holding an odd shaped part to be threading, facing, boring, chamfering is one of the major problems faced by the manufacturing company, especially small medium company. Sometimes they need expensive equipment to hold the part to be process. Above problem is faced by SHREENATH METALS, PUNE regarding a component name as Conductor 6835691. To solve this problem solution is to design & development of VMC fixture to so that it will Process job component also in minimum cost. Therefore, a fixture is needed to hold and perform above mentioned operations.

1.2. OBJECTIVE:

The objectives of this project are as follows:

1. Design & fabricate the fixture that holds & process a job stably.
2. Increase operation accuracy for component.
3. Develop the fixture which is easy to use so that unskilled labor can easily use.
4. Reduce loading & unloading time for job which helps in increase in production rate.

II. RELATED WORK

The fixture designing and manufacturing is considered as a complex process that demands the knowledge of different areas, such as geometry, tolerances, dimensions, procedures and manufacturing processes. While designing this work, a good number of literature and titles written on the subject by renowned authors are referred. All findings and conclusions obtained from the literature review and the interaction with fixture designers are used as a guide to develop the present research work. The following section gives a survey on the state of the art of this research.

Component requires following operations to be done on its part. The operations perform on the component is as follows:

1. Facing- 63.0 cutter
2. Drilling- 10.0, 10.2, 8.5 Drill

3. Threading M12*1.75 tap & M10*1.5 tap
4. Tripping- 68.0 OD Diameter
5. Chamfer- groove chamfer

“A Review on Design and Analysis of Work Holding Fixture” Shivaji Mengawade¹, Vaibhav Bankar², Pratik P Chaphale³ —The design of a fixture is a highly complex and intuitive process, which require knowledge. Fixture design plays an important role at the setup planning phase. Proper fixture design is crucial for developing product quality in different terms of accuracy, surface finish and precision of the machined parts. International Journal of Engineering Research and General Science Volume 4, Issue 2, March-April, 2016 ISSN 2091-2730

“Modeling and Analysis of Vibrating Fixtures” Eiji Nabata et.al. [2018 Sept 14] proposed that large vibration can occur in tools and workpieces during machining if it is not stable. This vibration causes problems in machining accuracy, efficiency, tool life, and safety. One of the causes of vibration was the lack of sufficient dynamic rigidity to stabilize parts in a dynamic cutting force. Therefore, solution is design of fixture.

“Design and Fabrication of Multi Operational Fixture” V. Karthikeyan¹, P. Sampth², S. Suresh³, K. Vinod⁴, Prof. P. Ravikumar stated that in order to achieve effective manufacturing there are three main factors time, cost and quality which are very important for a company to run efficiently. So, in order to reduce the production time and cost, achieving uniform quality of a product in mass production Fixtures are employed about which this project deals about. Fixtures are mainly used for holding, supporting, and locating the work piece. International Journal of Engineering and Management Research ISSN (ONLINE): 2250-0758, ISSN (PRINT): 2394-6962

III. METHODOLOGY

Gathered information & dimensions of component for which fixture is to be develop. By considering which operations are to be perform on work-piece. Do some research on the fixtures. Seeing some research papers and guidance from company prepared the layout of fixture. Design the fixture model in SOLIDWORKS. After designing analyse the model. Start developing by seeing design details.

There are six stages in fixture design process mentioned below:

1. Setup planning
2. Fixture planning
3. Fixture unit design
4. Design verification.
5. Fabrication
6. Validation

IV. EXPERIMENTAL RESULTS

4.1. JOB DETAILS & DESIGN:

The design model of component name as Conductor 6835691 in Solidworks as shown in Fig. No. 1

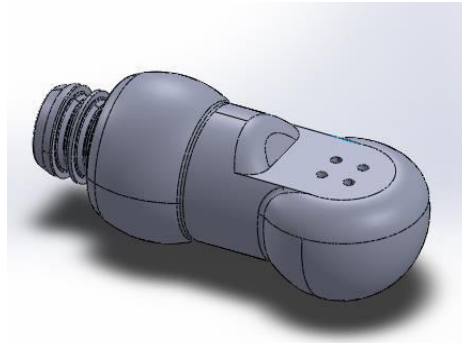


Fig no. 1 Conductor 6835691

4.2. FIXTURE DESIGN:

A fixture design consists number of different parts. Design the fixture in software name as Solidworks. Following are the parts of fixture design. These parts are required for supporting, locating, resting, fixing and clamping purpose.

4.2.1. V-Block:

This is base of Fixture which is designed in V Shape. The V-Block gives support and holds the Middle Part of Job. V-Block used to hold round metal rods or pipes for performing drilling or milling operations.

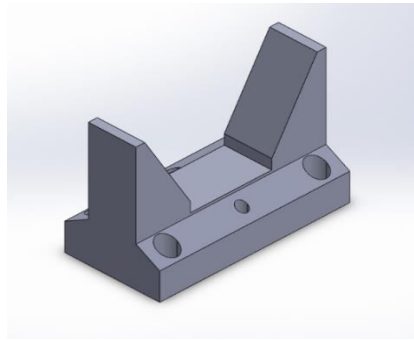


Fig no. 2 V-Block

4.2.2. Clamp:

Clamp are used to hold different pieces in place, which is an important component of the machining process. Along with holding the piece sturdy, the clamp must also facilitate proper movement and flexibility around the component as its being worked.

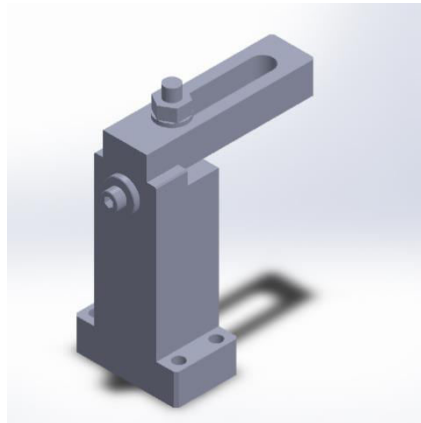


Fig no. 3 Clamp

4.2.3. Fix Butting, Resting Pad and Profile Block:

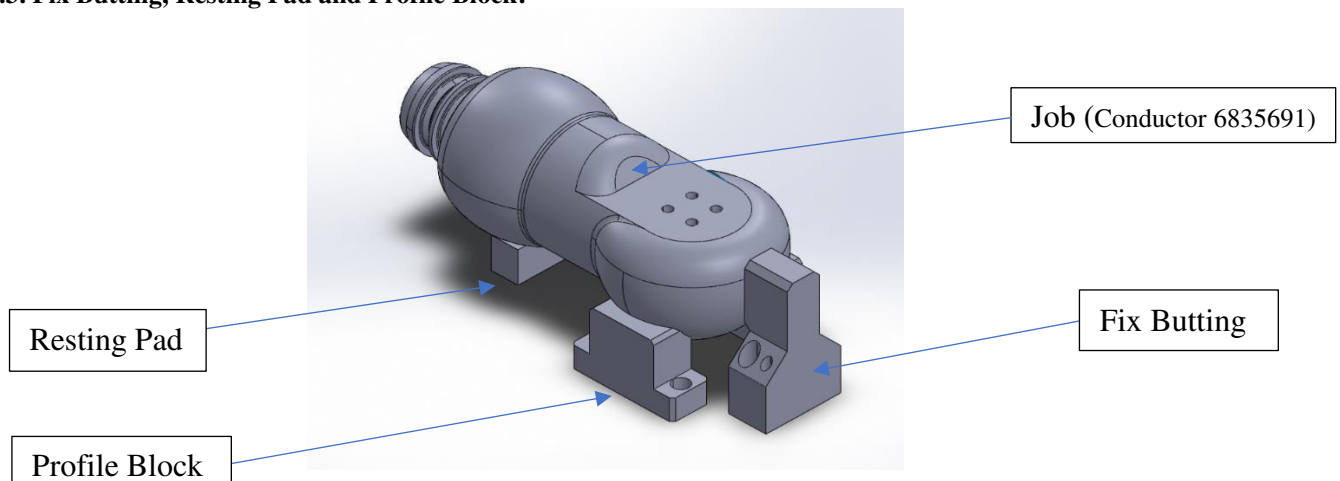


Fig no. 4 (Resting Pad, Profile Block, Fix Butting, Conductor 6835691)

4.3 ASSEMBLY OF FIXTURE

All the models were prepared using Solidworks software. Fig no. 5 & Fig no. 6 shows the assembled view of fixture.

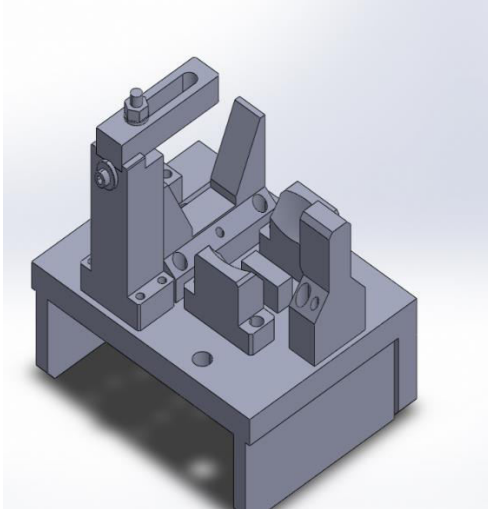


Fig no. 5 Design Assembly of Fixture



Fig no. 6 Actual Fixture

4.4. MATERIAL OF FIXTURE

Selection of material is very important factor in fixture design & development. As fixture carries a highly weighted job & it goes under various stresses then it is necessary to select high strength material which is can be determined by calculations. We are considering Carbon Steel material for designing Purpose.

4.4.1. ANALYSIS IN SOLIDWORKS

Result of Analysis as follows:

Model name: Clamp
 Study name: Static 1(-Default-)
 Plot type: Static nodal stress Stress1
 Deformation scale: 851.395

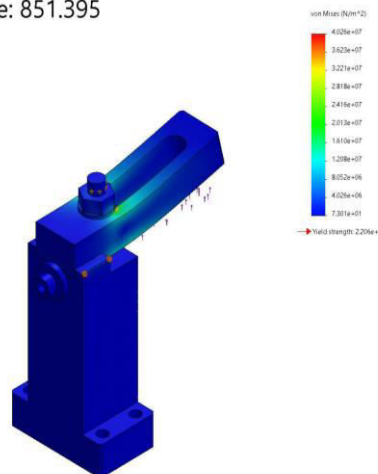


Fig no. 7 Clamp Analysis

V. CONCLUSION

- We have learnt about how to design a Fixture and the problem created during designing and resolved it.
- From this project, we have learned how to detect the problems in industry and how to minimize this problem.
- Getting a practical knowledge about the various operations like drilling, Face Milling, Grooving, Threading etc.
- Saving money of industry by giving them new idea about the fixture.



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Design & Manufacturing of Compact E-Unicycle

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ABSTRACT: This project focuses on developing a compact and efficient electric unicycle to address traffic congestion in cities. Through extensive research on existing electric unicycles, we gathered valuable insights on their features and limitations. With a focus on stability, control, safety, and user comfort, we designed a unicycle that optimizes these aspects. By constructing a prototype and conducting thorough testing, we overcame various challenges with the help of informative guides and resources. Our project provides a concise and practical solution to alleviate traffic congestion, offering an innovative and eco-friendly transportation option. The research, design, and prototype development stages contribute to realizing an effective urban mobility solution.

KEYWORDS: Traffic congestion, Transportation, Mobility solution, Prototype, Efficient

I. INTRODUCTION

Traffic congestion in urban areas presents substantial challenges, including time wastage, increased fuel consumption, and environmental pollution. To address this issue, there exists a growing demand for innovative and efficient personal transportation alternatives that can navigate crowded spaces effectively. This project focuses on the development of an electric unicycle as a potential solution for alleviating traffic congestion. The electric unicycle offers a compact and manoeuvrable alternative to conventional transportation methods, providing individuals with a convenient and environmentally-friendly commuting option. The main objective of this project is to design and optimize an electric unicycle that ensures stability, control, safety, and user comfort. By conducting a comprehensive analysis of existing electric unicycles and addressing their limitations, the aim is to create an improved and practical transportation device. Through the construction of a prototype and rigorous testing, the performance and feasibility of the electric unicycle will be evaluated under real-world conditions. Any encountered challenges will be resolved with the assistance of relevant engineering resources and guides.

The outcomes of this project have the potential to significantly impact urban mobility solutions by reducing traffic congestion, minimizing carbon emissions, and enhancing the overall efficiency of personal transportation systems.

II. RELATED WORK

Researchers conducted a literature review on three different topics related to electric unicycles: (1) the design and research of an electric unicycle with rechargeable flow batteries, (2) the mono wheel electric vehicle as a compact and environmentally friendly transportation solution, and (3) the modelling, simulation, and control of an electric unicycle called the Micycle. The first study focused on developing an electric unicycle prototype with an aluminium structure, low centre of gravity, and rechargeable flow batteries. They used a step-by-step methodology to address mechanical considerations, motor selection, and battery implementation. Tests showed the prototype's ability to handle slopes and its energy efficiency, with the selected lithium-iron-phosphate batteries demonstrating high performance and safety.

The second study explored the mono wheel electric vehicle, emphasizing its compact size, self-balancing capabilities, and electric power. The vehicle utilized gyroscopes and accelerometers for balance and controlled speed and steering through rider movements. It presented itself as a practical and eco-friendly option for short-distance commuting in urban areas. The third study focused on the design, simulation, and control of the Micycle, a self-balancing electric unicycle. The researchers derived the system dynamics and proposed a linear control strategy for pitch stabilization. They compared simulation results with experimental data from the physical system, showcasing the accuracy of their approach.

Overall, these studies contribute to the field of electric unicycles by addressing various aspects such as design, construction, energy efficiency, self-balancing mechanisms, and control strategies. They highlight the potential benefits of electric mobility in terms of reducing pollution and traffic congestion in urban areas. The information provided in these studies can be valuable for researchers and engineers working on similar projects, aiding in the advancement of electric unicycle technology and sustainable transportation solutions.

III. METHODOLOGY

The design process for the electric unicycle involves several key stages. The requirement analysis focuses on understanding stability, manoeuvrability, safety, user comfort, and energy efficiency based on user needs and market trends. The conceptual design stage visualizes the overall structure, propulsion system, control mechanisms, and user interface. Detailed design refines the concept by specifying dimensions, materials, and components. Prototype development involves constructing a functional prototype using appropriate materials and manufacturing techniques. Testing and evaluation assess stability, safety, comfort, and efficiency. Iterative refinement improves the design based on test results. Documentation and reporting capture the design process, calculations, specifications, testing procedures, and outcomes.

IV. EXPERIMENTAL RESULTS

The result of this project is the remarkable achievement of designing, developing, and validating a highly efficient and stable self-balancing electric unicycle. Through meticulous CAD design, a precise digital representation of the unicycle was created, allowing for the optimization of its components for optimal performance and functionality. The iterative refinement process during prototype fabrication proved to be instrumental in overcoming technical challenges and further enhancing the design. Thorough and rigorous testing was conducted to evaluate the stability, manoeuvrability, safety features, user comfort, and energy efficiency of the self-balancing electric unicycle. The results obtained from these comprehensive tests provided solid evidence of the success of the design choices and the overall effectiveness of the prototype. The unicycle demonstrated exceptional stability, ensuring a smooth and secure ride even in demanding urban environments.

One of the significant outcomes of this project is the highlighted potential of compact and eco-friendly transportation solutions. The self-balancing electric unicycle represents a futuristic mode of personal mobility that has the capability to significantly alleviate traffic congestion, reduce carbon emissions, and enhance urban mobility. Its compact size and agility make it a practical choice for navigating through crowded streets and narrow spaces where traditional vehicles struggle.



Moreover, this project emphasizes the importance of collaboration, iterative refinement, and continuous improvement in achieving ground-breaking results. The project team's relentless dedication and commitment to pushing the boundaries of mechanical engineering played a crucial role in the successful realization of this innovative transportation solution.

Looking ahead, future advancements in the field can focus on incorporating advanced sensors, cutting-edge algorithms, and lightweight materials to further enhance the balancing capabilities and energy efficiency of the self-balancing



electric unicycle. Continued research and development in this area have the potential to revolutionize personal mobility and transform urban transportation.

In conclusion, the result of this project is not only the tangible achievement of a functional and reliable self-balancing electric unicycle but also the inspiration it provides for future innovations. The project underscores the immense possibilities and positive impact that can be achieved by embracing advancements in mechanical engineering and fostering collaboration among experts in the field. The self-balancing electric unicycle project serves as a testament to the endless potential of human ingenuity and creativity in creating transformative solutions that enhance our daily lives and shape the future of urban transportation.

V. CONCLUSION

The self-balancing electric unicycle project showcased the viability of this innovative transportation solution through CAD design, iterative refinement, and thorough testing. It emphasizes the potential of compact and eco-friendly mobility options and inspires further advancements in mechanical engineering and urban transportation.

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Thermoelectric Cooling for Central Processing Unit (CPU)

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ABSTRACT: When a voltage or DC current is applied to two dissimilar conductors, a circuit can be created that allows for continuous heat transport between the conductor's junctions i.e by applying heat to two different conductors a current can be generated, this process is known as thermoelectric cooling and it works on the principle called peltier effect.

KEYWORDS: Thermoelectric Cooling, Peltier Effect, Peltier Module, Unconventional Cooling.

I. INTRODUCTION

A thermoelectric module is an electrical module, which produces a temperature difference with current flow. The emergence of the temperature difference is based on the Peltier effect designated after Jean Peltier. The thermoelectric module is a heat pump and has the same function as a refrigerator. It gets along however without mechanically mobile construction units (pump, compressor) and without cooling fluids. The heat flow can be turned by reversal of the direction of current. Usually, normal PC temperature is the ambient room temperature but consider 70°C to be the maximum CPU temp range for a long period. Peltier coolers are also generally smaller in size compared to air coolers, which makes them ideal for use in small form-factor PCs or tight spaces. They can be used to move heat out of those tight spaces to where it can be dissipated easily.

Paper is organized as follows. Section II describes objective of the project, Section III describes methodology of the model, Section IV presents practical model implementation. Finally, Section V presents conclusion.

II. RELATED WORK

Thus, it is important to clearly state and recognized the objective of a project. Throughout this project, these are the objectives that will enlighten in this:

- To study critically existing HVAC system for its advantage and disadvantages.
- To explore various technological option to replace existing HVAC system.
- To study TEC as a substitute for present HVAC system which will overcomes the all
- demerits of present HVAC system.
- To fabricate working model of HVAC using TEC.
- To test HVAC using TEC for its effectiveness, efficiency, environment friendliness.

The work in this paper is

- When you use a Peltier model in your computer which attaches to your CPU uses electricity to cool the CPU. From one side of the cooler heat is absorbed from the CPU and on the other side it is released. A fan is also used to help dissipate the heat released from the cooler's hot side.
- To put it simply, Peltier model use electricity to move heat from the hot side to the cold side and the fan helps to cool the hotter side, which in turn cools the CPU.

III. METHODOLOGY

A typical thermoelectric module consists of a number of thermocouples sandwiched between two layers of ceramic substrates. The ceramic substrates should ideally have a very high thermal conductivity so that there is minimal temperature drop across the layer of the substrate but very low electrical conductivity to avoid any leakage current flow through the substrate.

Usually, normal PC temperature is the ambient room temperature but consider 70°C to be the maximum CPU temp range for a long period. Peltier coolers are also generally smaller in size compared to air coolers, which makes them ideal for use in small form-factor PCs or tight spaces. They can be used to move heat out of those tight spaces to where it can be dissipated easily. They can effectively lower the temperature of a CPU, even under heavy loads. That includes cooling processors to below the ambient temperature.

IV. EXPERIMENTAL IMPLEMENTATION

➤ Components :-



Fig.1 Heatsink attached with Fan.



Fig.2 Heat Sink.

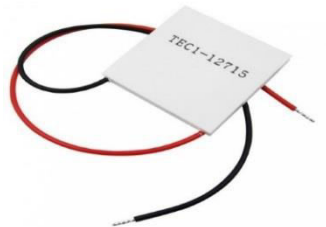


Fig.3 Peltier Module.

➤ Designed Assembly :-

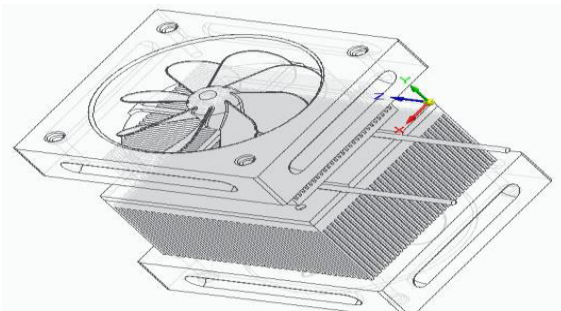


Fig. Thermoelectric Cooling for CPU.

➤ OBSERVATION:

When a voltage or DC current is applied to two dissimilar conductors, a circuit can be created that allows for continuous heat transport between the conductor's junctions i.e by applying heat to two different conductors a current can be generated.

Usually, normal PC temperature is 50°C but consider 70°C to be the maximum CPU temp range for a long period. Peltier coolers are also generally smaller in size compared to air coolers, which makes them ideal for use in small form-factor PCs or tight spaces. They can be used to move heat out of those tight spaces to where it can be dissipated easily.

We also observed that the amount of current supplied to the model is directly proportional to the heat present in the CPU i.e., when the current supply increases the cooling effect increases and hence the heating temperature gets decreases.



➤ **RESULT:**

Normal CPU produces around 60 to 70°C temperature while working for long hours, hence using this model (Thermoelectric Cooler for CPU) we analysed that the CPU cools down to the 10 to 15°C and also decreases the temperature according to the current supplied.

According to the heating conditions normal time taken to cool down the CPU is 15 to 20 minutes.

V. CONCLUSION

We have implemented an Thermoelectric Cooling for CPU. After the study of thermoelectric refrigeration system, we could demonstrate the cooling ability of the Peltier module and its use as an alternative to refrigerant based cooling systems. The study concludes that there are a number of places where TEC can play a more promising role than the conventional ACs with the added advantage of not using the refrigerants and hence protecting the ozone layer. With its reliable cooling and precise temperature control, this solid state cooling technology can replace conventional cooling in a multitude of applications. Also with the advancements in material technology, there shall be a drastic rise in the cooling performance. This project was just an effort to demonstrate the need and means of replacing the conventional systems due to their adverse environmental effects and to highlight the future scope of the Thermoelectric Cooling Devices.

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Experimental Investigation and Analysis of Impact Behaviour of Vehicle Crash Box for Different Shapes

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ABSTRACT: Crash box is a device mounted between front bumper and main frame of car in order to absorb energy during collision. It buckles when axial compressive force exceeds limit. Energy is absorbed during buckling and damage to main frame is avoided. In this study crash box of different geometry is studied for energy absorption capacity analytically, experimentally and results of this study are compared. Study of different designs of crash boxes are undertaken to optimize the design for maximizing energy absorption capacity, minimizing deformation of the component. In this study, crushing behaviour of crash boxes is determined at deformation. Crushing of boxes is analysis by using ANSYS. Results of study showed good co-relation between experimental results of crash box. Parts with different shapes are analysed using numerical method and optimized design with increased energy adsorption capacity, minimum deformation is proposed. In this study hexagonal shape crash box gives optimum results. Circular and Rectangle shapes give better result compare to existing crash box. Circular and Rectangle crash box is surprisingly giving optimum result compare to all other shapes too. The performance of circular crash box is also much better than square crash box. So, study of shapeoptimisation gives optimum shape crash box, which is Circular and Rectangle.

KEYWORDS: crash box, impact test, ANSYS.

I. INTRODUCTION

Crash box is a device mounted between front bumper and main frame of car in order to absorb energy during collision. It buckles when axial compressive force exceeds limit. Energy is absorbed during buckling and damage to main frame is avoided. In this study crash box of different geometry is studied for energy absorption capacity experimentally, analysis done on ANSYS and results of this study are compared for calculating maximum energy absorption. Study of different designs of crash boxes are undertaken to optimize the design for maximizing energy absorption capacity, minimizing critical buckling force.

Amount of energy absorbed by boxes is predicted as a function of crash box shapes. During last decade, large number of articles have considered crash performance of thin wall metallic column used in automotive and aerospace application, as a crash absorbing element. In automotive application crashworthy structure absorb impact energy in control manner thereby bringing passenger compartment to rest without subjecting occupant to high deceleration. Crash box absorb energy progressively folding and bending as column wall collapse. Rate of energy dissipation is concentrated over narrow zones. Remaining structure remains rigid.

It also protects expensive vehicle component. Numerous previous works have attempted to determine material of crash box. They considered low carbon steel, low alloy steel and aluminium alloy. Different cross section gives different impact strength.

Composites with specially designed lay-up sequences can absorb much more energy than metal. However, composites are brittle so it is impossible to apply composite structure as collapsible absorber. In superlight weight electric vehicle hybrid material is considered. Impact analysis of different shapes cross section achieved using FEA ANSYS. Finite element software & result compare with experimental result.

II. RELATED WORK

Crash box manufacturing process is simple. Initially thin sheet of selected material of 2mm size is taken and then,

1. Making beads-Initially sheet of 2 mm M.S material is taken, then the required position of beads is marked on press machine, at kalika metal works ambad. Which is then got finalized by hand work at denting and painting workshop.
2. Bending-In this operation sheet metal is bending at specific angle. Angle between sheets of crash box material for bending is 90 degree, for square and rectangle crash box. For hexagonal crash box bending angle is 120 degree, and circular crash box is made circular at local black smithy shop. Bending radius is approximately R5 to R7. This operation performed at kalika metal works, ambad.
3. Welding-After formation of beads and bending operation, crash box becomes shapes of square, rectangle, hexagon and

circular. so the ends of sheet metal are joined by welding method. This operation performed at kalika metal works, ambad.

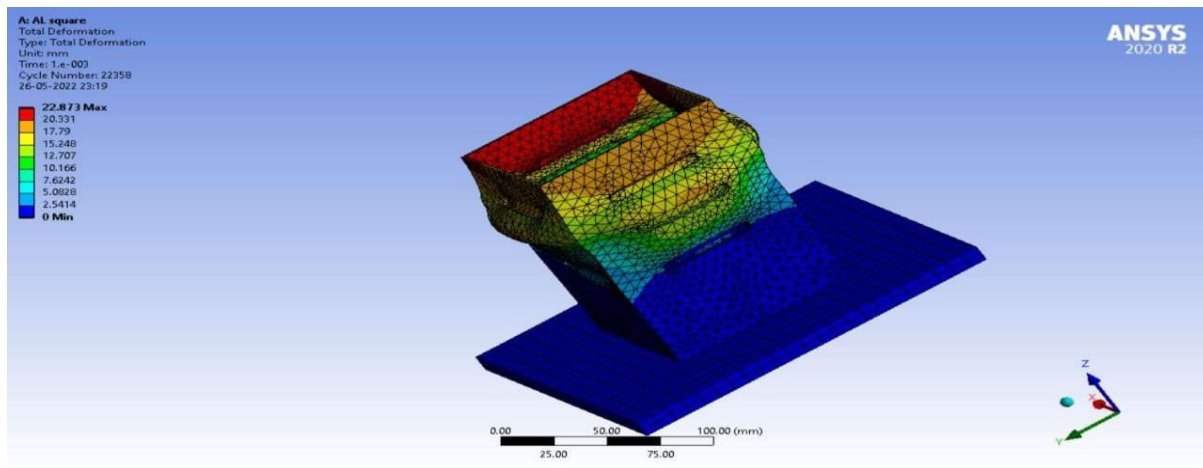
III. METHODOLOGY

- Study of the Crash Box:
- Consider geometry for the crash box and assign the material properties to the same for the existing variant.
- Find different parameter affecting on working of crash box.
- Manufacturing of Crash Box For Four Shapes: Square, Rectangle , Hexagonal , Circular
- Experimentation done by drop weight impact testing.
- Analysis by using FEA.
- Finding optimum shape crash box, whose impact absorbing capacity is increased.
- Validation of results by comparing software result with experimental results.

IV. EXPERIMENTAL RESULTS

The square box of dimension 100x100x160, for the load of 1000 kg and velocity 11.713m/s and material is mild steel and with fine meshing we get results for crash boxes are as per below:

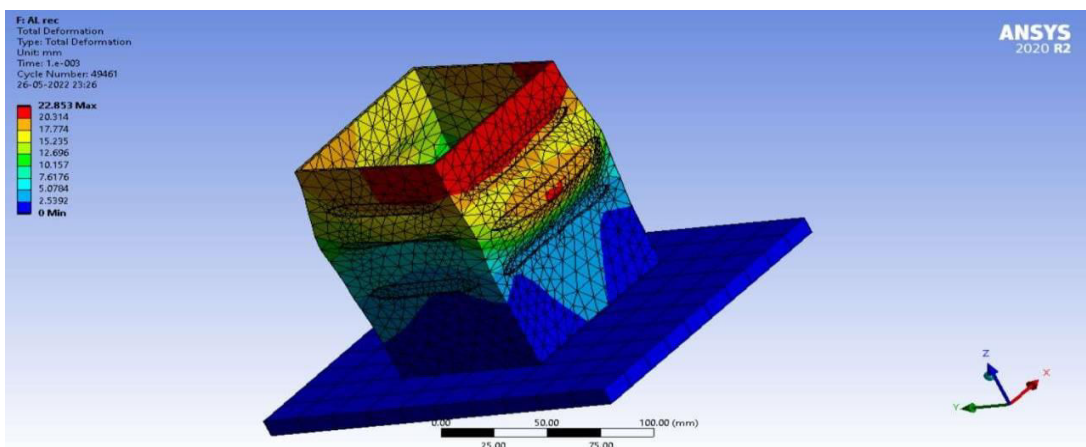
Fig.3.1 ANSYS result for Deformation of Square Crash Box.



For square crash box deformation is 19.847 mm and elastic strain is 0.0211mm/mm.

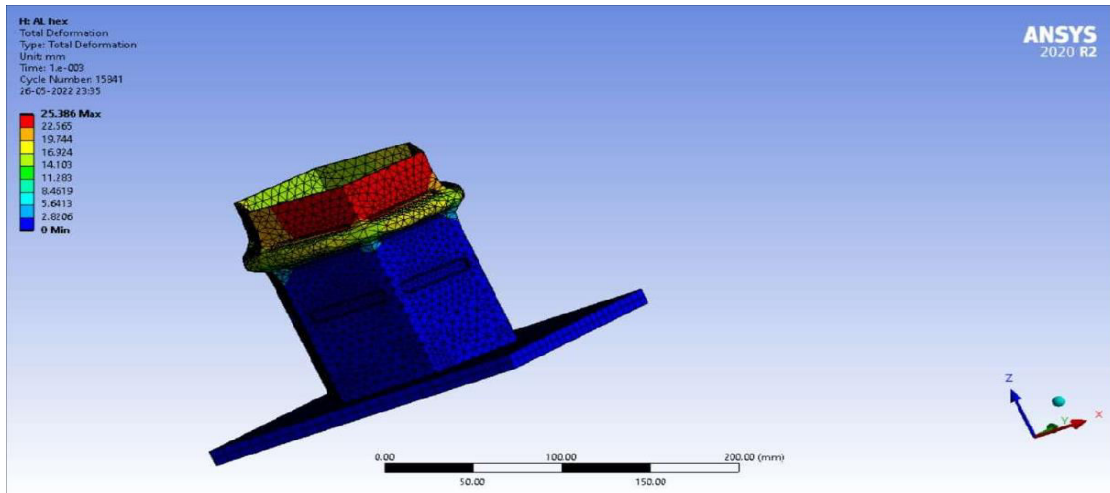
For rectangular shape crash box of 80x125x160 we get deformation is 19.741mm and Elastic strain is 0.0277mm/mm.

Fig.3.2. Deformation of Rectangle shape Crash Box



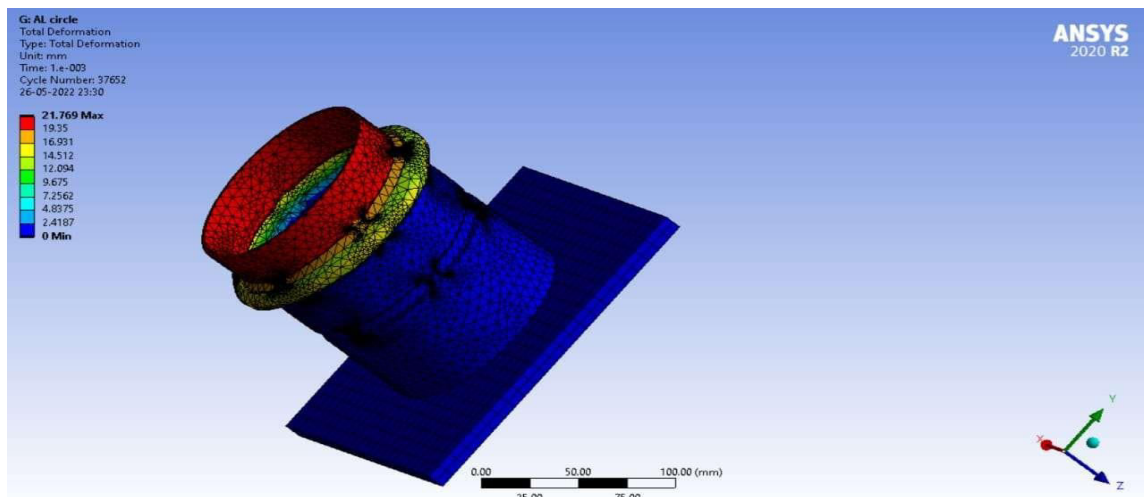
and for hexagonal of 62mm side we get deformation 19.71mm, elastic strain 0.0219mm/mm.

Fig.3.3 Deformation of Hexagonal Shape Crash Box



Respectively for circular crash box of diameter 115 mm and height 160mm, we get deformation 19.71mm and elastic strain 0.0222mm/mm.

Fig.3.4. Deformation for Circular shape Crash Box.



V. CONCLUSION

Herby it is observed that after experimentation and analysis Circular & Rectangle shape of crash box gives maximum energy absorption and showing minimum deformation for same load and maximum elastic strain too. The results from experiment on drop weight impact testing are validated by analysis in ANSYS. The results obtained in analysis are half to that of experimental. The difference in variation is due to time difference as analysis is done in 0.1 sec due to low performance of software. Experimentally the crash performances on different shapes of crash boxes are determined. The performance of circular and rectangle crash box is also much better than other crash box. The comparison of the experimental and numerical Results shows that hexagonal shape crash box gives maximum energy absorption.

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Design & Development of Fixture for SCREWE DRod End For Bearing on CNC Lathe

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ABSTRACT: Fixture is a device for locating, holding, and supporting a component or work piece securely in definite position for a specific operation but it does not guide the cutting Tool. Fixture is required in various applications. This paper present design and development of fixture for real industrial screwed rod end for bearing component on CNC lathe. The fixture is designed in such a way that stability is obtained during all machining operations. These consist of study of data like part drawing and assembly drawing. The fixture design begins with part modelling using CATIA V5 followed by analysis. Component requires following operations to be done on its cast part. The operations perform on the component is Facing, Drilling and Boring of 70mm Diameter & 76mm depth, Threading M68.x4, Counter Boring of 75mm diameter, Chamfer of R10.

KEYWORDS: Fixture, Screwed rod end, Facing, CATIA V, Threading CNC-machine.

I. INTRODUCTION

A faster and more profitable method called for a device (fixture) on which component can be quickly positioned in the correct relationship to the cutting tool and quickly clamped before machining. This is special work holding device. While designing this work, a good Number of literature and titles written on the subject by renowned author are referred. All finding the conclusions obtained from the literature review and the interaction with fixture designers is used as guide to develop the present research work. Quality of the performance of a process largely influenced by the quality of jigs and fixtures used for this purpose. What makes a fixture unique is that each one is built to fit a particular part or shape. The main purpose of a fixture is to locate and in the cases, hold a work piece during an operation. Correct relationship and alignment between the tool and work must be maintained. Fixtures are designed to hold, support, and locate every part to ensure that part is machined within the specific limits.

1.1. PROBLEM STATEMENT

Holding a odd shaped part to be threading, facing, boring, chamfering is one of the major problems faced by the manufacturing company, especially small medium company. Sometimes they need expensive equipment to hold the part to be process. Above problem is faced by KV CREATION, PUNE regarding a component name as screwed rod end for bearing.

To solve this problem solution is to design & development of fixture to 3 jaw chuck so that it will Process job component also in minimum cost. Operations are performed sequentially by using counterweight as below on component:

1. Pre-turning the whole job by 2mm.
2. Turning the centre hole of diameter 106 mm.
3. Boring for same.



Fig.No.1 Screwed Rod end for Bearing using counter weight

Remaining operations which cannot be performed due to odd shape are as follows:

- 1) Facing
- 2) Drilling and Boring of 70mm Diameter and 76mm Depth
- 3) Threading M68x4
- 4) Counter Boring of 75mm Diameter
- 5) Chamfer of R10

Therefore, a fixture is needed to hold and perform above mentioned operations.

1.2. OBJECTIVE:

The objectives of this project are as follows:

1. Design & fabricate the fixture that holds & process a job stably.
2. Increase operation accuracy for component.
3. Develop the fixture which is easy to use so that unskilled labor can easily use.
4. Reduce loading & unloading time for job which helps in increase in production rate.

1.3 METHODOLOGY:

Gathered information & dimensions of component for which fixture is to be develop. By considering which operations are to be perform on work-piece. Do some research on the fixtures. Seeing some research papers and guidance from company prepared the layout of fixture. Design the fixture model in CATIA V5. After designing analyse the model. Start developing by seeing design details.

There are four stages in fixture design process mentioned below:

1. Setup planning
2. Fixture planning
3. Fixture unit design
4. Design verification.
5. Fabrication
6. Validation

II. LITRATURE REVIEW

The number of researchers was worked on fixture development for special purposes. The present point gives information regarding the literature related to CNC fixture design and development.

[Reference No.1]

Eiji Nabata et.al. [2018 Sept 14] proposed that large vibration can occur in tools and work-pieces during machining if it is not stable. This vibration causes problems in machining accuracy, efficiency, tool life, and safety. One of the causes

of vibration was the lack of sufficient dynamic rigidity to stabilize parts in a dynamic cutting force. Therefore solution is design of fixture.

[Reference No.2]

S. Ratchev et.al. [2018 June 10] proposed that to reduce the overall costs and lead-times of job development, and efficient and accurate fixture design methodology would have to be developed.

[Reference No.3]

Kulankara Krishnakumar et.al. [2020 Feb 23] stated that the main functions of a machining fixture were to locate, constrain, and adequately support the work-piece during machining. These functions achieved by strategically placing locator pins, clamps, and supports around the work-piece and applying the appropriate clamping forces. A poor choice of the position of the fixture elements and clamping force(s) can lead to undesirable work-piece deformation and low dimensional/form accuracy of the work-piece. Consequently, an important consideration in fixture design was to optimize the fixture layout i.e. positions of locators and clamps, so that work-piece deformation due to clamping and machining forces is minimized.

III. DESIGN AND CONSTRUCTION OF SETUP

3.1. JOB DETAILS & DESIGN:

The design model of component name as screwed rod end for bearing in CATIA V5 as shown in Fig. No. 2

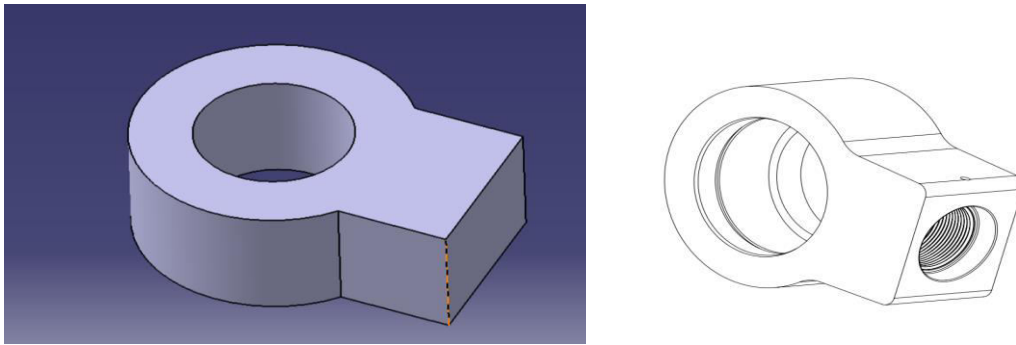


Figure. No. 2. Design of Component Screwed rod end for bearing.

3.2. FIXTURE DESIGN:

A fixture design consist number of different parts. Design the fixture in software name as CATIA V5 version. Following are the parts of fixture design. These parts are required for supporting, locating and clamping purpose.

3.2.1. BASE PLATE:

This is base of fixture in which all parts are connected with it. This part is hold in 3 jaw chuck. This part is in circular shape. The following figure No.3 shows design model.

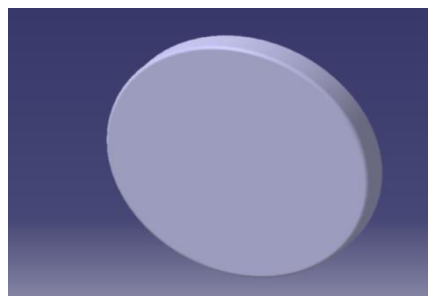


Fig No. 3 Base Plate

3.2.2. U-SHAPE JOB CARRIER:

This is connected to base plate generally it consist three plates which support the job, this plates restrict the motion of job from horizontally. In Between this plate the job is placed. The model is shown in following figure No.4.

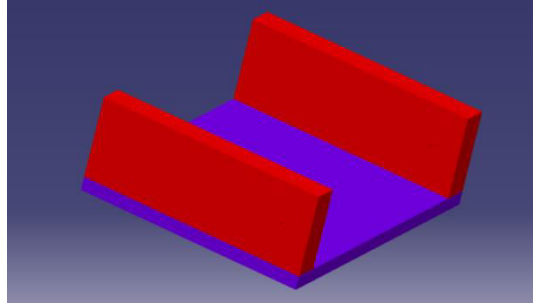


Figure No.4 U-shape job carrier

3.2.3. CENTRALLY JOB LOCATER:

This part is placed in U shape carrier. The Function of this part is locate the job centrally align. The ID of job is stably placed in these parts. The following figure No.5. shows the part design.

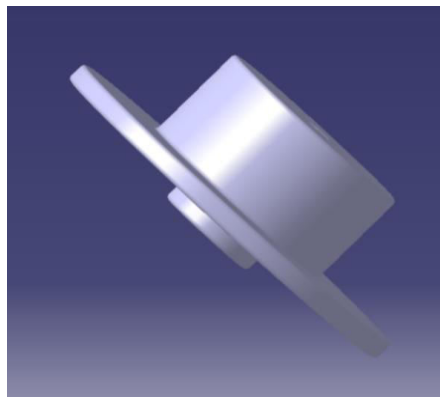


Figure. No.5. Centrally job locater

3.2.4. JOB STOPPER:

This stopper consist the threaded Bolt & Washer like circular disc. While rotation there is chance of job is to fallen out to avoid this it is inserted in the part name as centrally job locater. It restricts the motion of job vertically. Following Figure No.6 shows the design of part.

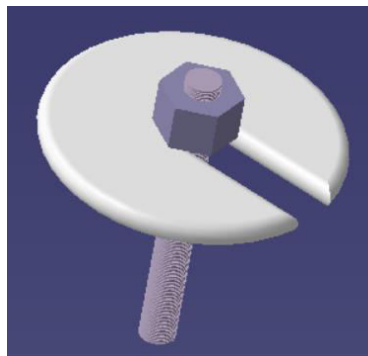


Figure. No.6. Job Stopper

3.2.5. UPPER SUPPORT:

It is generally placed above the U-Shape carrier. It is in rectangular shape plate with Allen bolt placed in the center of this plate. In the end of Allen bolt there is a small size job tighter which holds the job tightly from the upper side. The following figure No.7 shows the design model of this part.

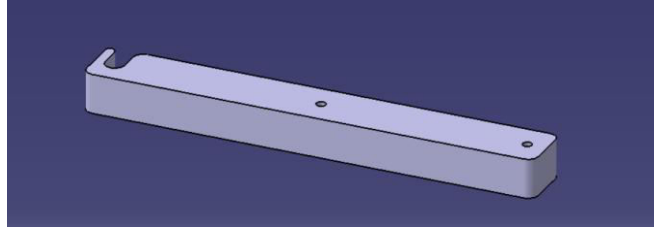


Figure No. 7. Upper Support.

3.2.6. T-BOLT

There are 2 T-bolts which are placed in the U shape carrier end, they tighten the job end in which operations are performed. After tightening it holds the job centrally stable & restricts the motion of job from horizontally. The design model of job shows in following figure No.8.

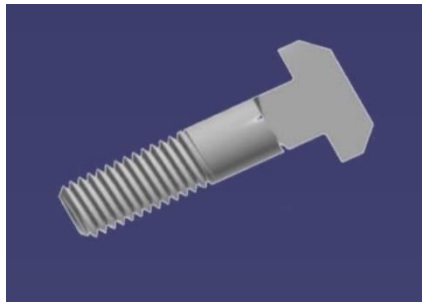


Figure No. 8. T-Bolt

3.3 ASSEMBLY OF FIXTURE

All the models were prepared using CATIA V5 software. Fig 9 & Fig 10 show the assembled view of fixture.

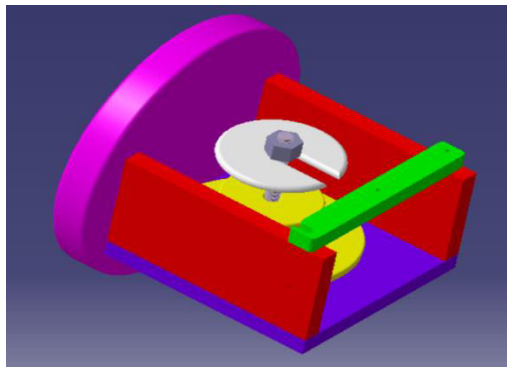


Fig. No.09. Fixture Assembly Without job

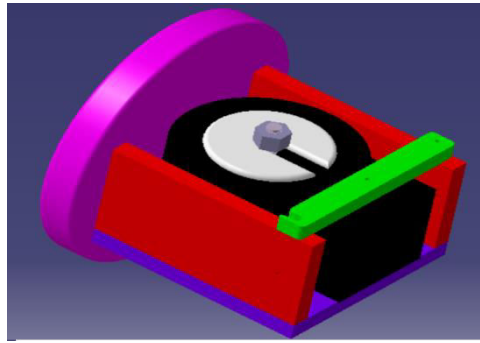


Fig. No.10. Fixture Assembly With Job

IV. DESIGN DETAILS

Following images shows the design details of Parts & Assembly.

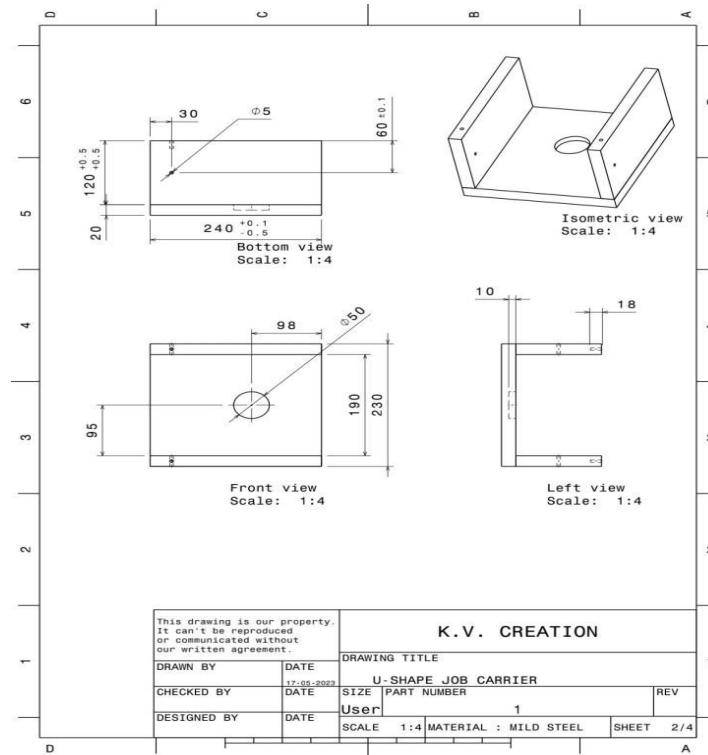


Fig. No.11. U-shape job carrier

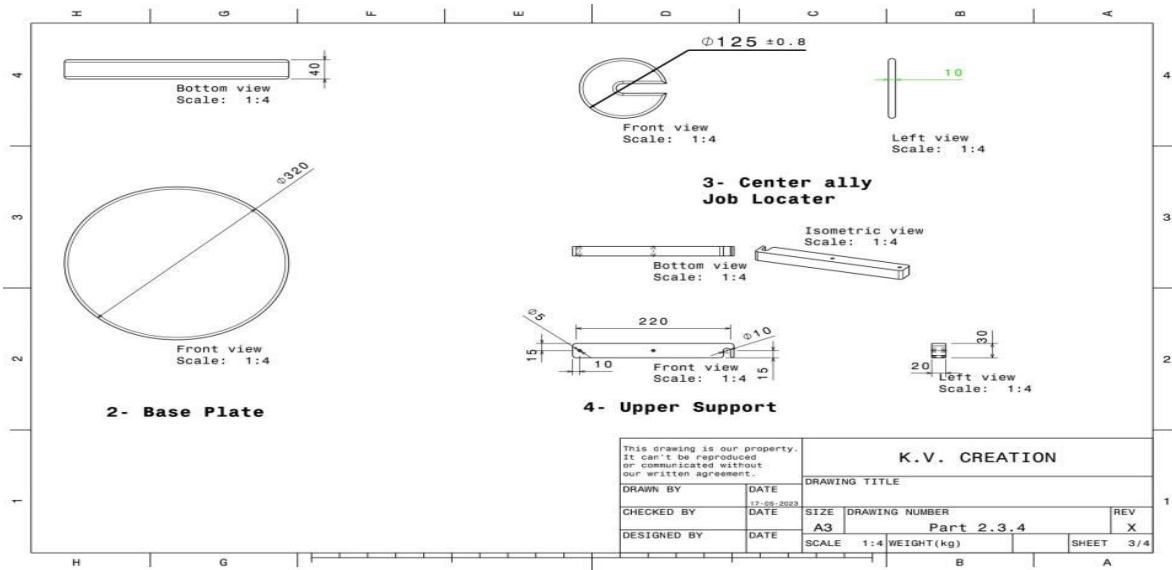


Fig. No.12 Base plate, Upper Support, Centrally job locator

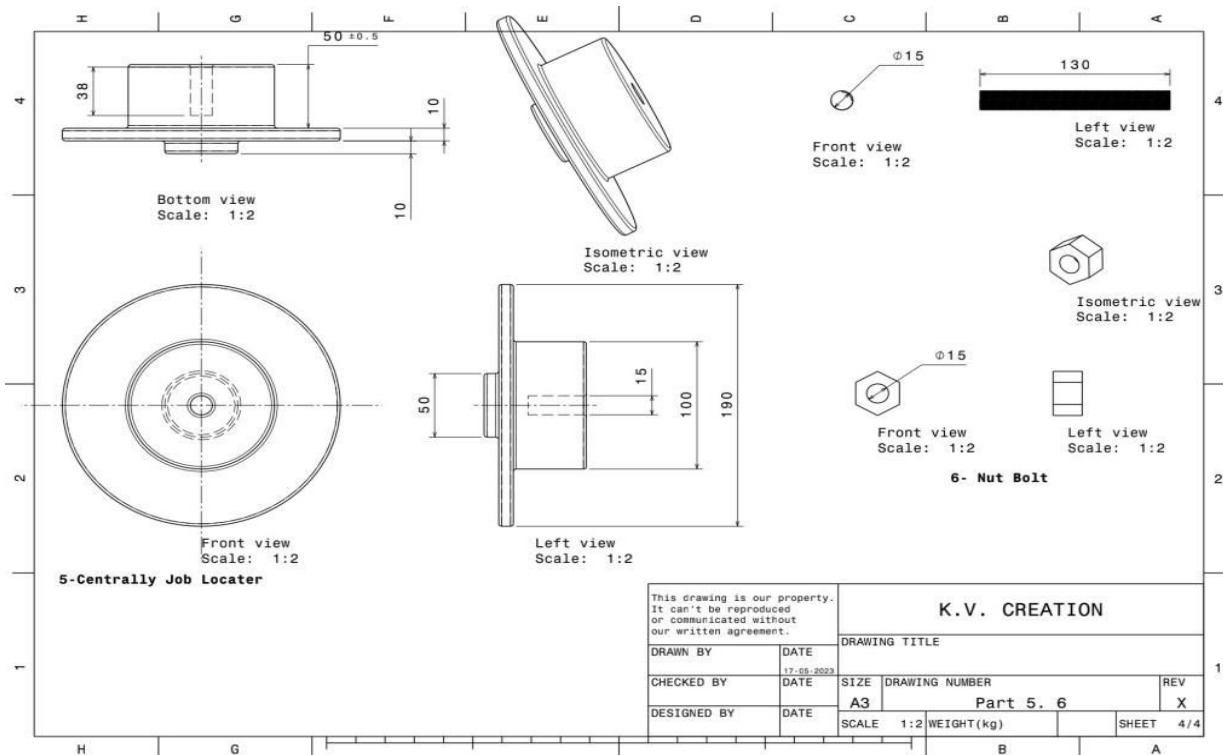


Fig. No.13 Centrally Job locator, Nut Bolt

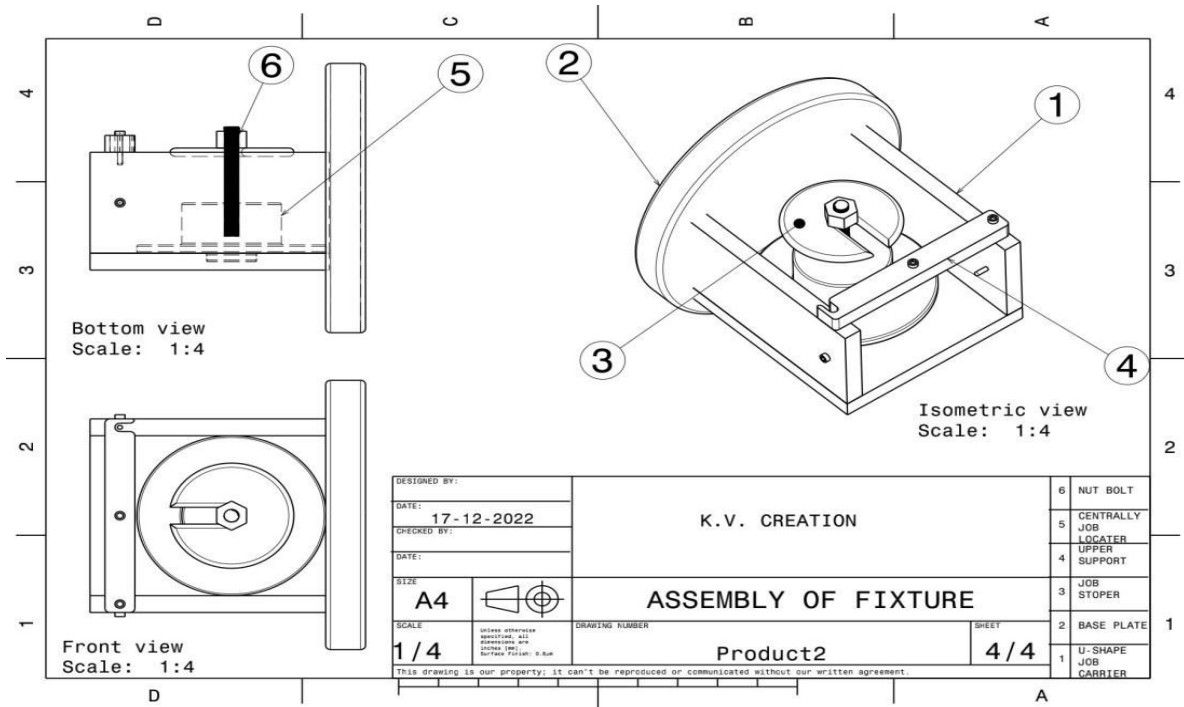


Fig. No.14 Assembly Of Fixture.

V. ANALYSIS & EXPERIMENTAL VALIDATION

Selection of material is very important factor in fixture design & development. As fixture carries a highly weighted job & it goes under various stresses then it is necessary to select high strength material which is can be determined by calculations.

5.1. FORCE CALCULATIONS:-

Fixture load is 25 kg at loading condition so we have to convert kg into N.

$$25,000 \text{ grams} \times 9.81(\text{Gravitational force}) = 245000 \text{ N or } 25 \text{ KN}$$

Calculating Bending Stress For this force:-

$$\begin{aligned} 1) \text{ Bending force} &= 4/3 \times F / \pi \times r \\ &= 4/3 \times 245 \times 103 / \pi \times 1302 \\ &= 6.15 \text{ N/mm}^2 \end{aligned}$$

$$\begin{aligned} \text{Permissible Bending stress} &= 6.15 \times 1.25 \\ &= 7.69 \text{ N/mm}^2 \end{aligned}$$

$$\begin{aligned} 2) \text{ Shear Force} &= F/A \\ &= 245 \times 103 / \pi/4 \times (260)^2 \\ &= 4.614 \text{ N/mm}^2 \end{aligned}$$

$$\begin{aligned} \text{Permissible Shear Stress} &= 4.614 \times 1.25 \\ &= 5.77 \text{ N/mm}^2 \end{aligned}$$

So, we consider Mild Steel material for designing Purpose. Let’s check design is safe or not.

For Mild Steel:-

$$S_{ut} = 503$$

$$S_{yt} = 421 \text{ (From Design Data Book Pg.39 table No. II-7)}$$

So, we need to multiply S_{ut} by 0.18 and S_{yt} by 0.30 and consider the minimum Value of stress.

$$S_{ut} = 503 \times 0.18 = 90.54 \text{ N/mm}^2$$

$$S_{yt} = 421 \times 0.30 = 126.3 \text{ N/mm}^2$$

So, minimum Value is 90.54 N/mm^2 .

We divide it by Factor of safety (For mild steel F.O.S = 2)

$$\text{Design Stress} = \text{Stress} / \text{F.O.S} = 90.54 / 2 = 45.27 \text{ N/mm}^2$$

Permissible Stress is less than Design Stress, so Design is safe and Mild steel Material is Use For Further Design.

5.2. ANALYSIS IN CATIA V5

After analysis of fixture theoretically we conclude that Mild steel material is good for fixture Manufacturing. But there also one more force acting on base plate is clamping force so there is need to analysis fixture model in CATIA V5 SIMULATION software. Assume the force is 5 N.

Result of Analysis as follows :

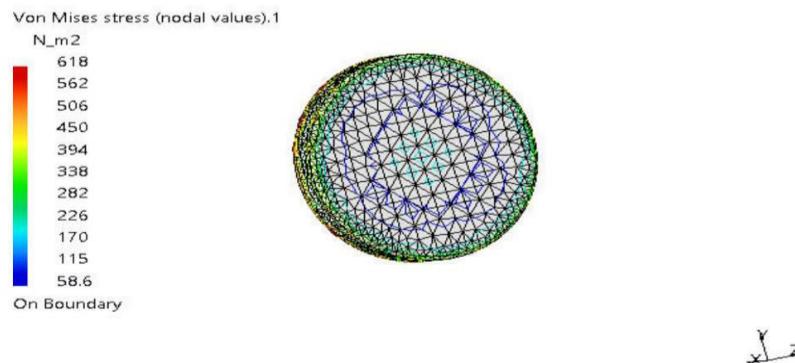


Figure 1

3D elements: : Components: : All
 On deformed mesh ---- On boundary ---- Over all the model

Fig. no. 15 FEA Analysis result Using Mild Steel

There is no deformation of base plate using mild steel hence mild steel is good & cheap material for Fixture.

VI. DEVELOPMENT OF CNC LATHE FIXTURE

Mild steel plate of size 1369mm long, Thickness 45mm is readily available in market. Various operations perform while fabrication of fixture. Operations are performed as below:

6.1 Gas Cutting operation:

It is thermal process used to separate and shape steel components. The ox fuel process is the most widely used process because it can cut thickness from 0.5mm to 300mm, the equipment is low cost and can be used manually or mechanized. Large mild steel plate cut in desired shape.

6.2 Grinding operation:

Grinding is an abrasive machining process in which a rotating abrasive removes metal from the work piece. Grinding is a process for machining material which is too hard for other machining process. Material such as die steel and harder steel are generally machining by grinding.

6.3 Face Milling:

Facing on milling machine is the process of cutting a flat surface perpendicular to the axes of the milling cutter. This process removes the excessive material by rotating the facing tool in the counter clockwise direction as the table feeds the work piece across the cutter.

6.4 End milling operation:

An end mill is a type of milling cutter, a cutting tool used in industrial milling applications. It is distinguished from the drill bit in its application, geometry, and manufacture. While a drill bit can only cut in the axial direction, a milling bit can generally cut in all directions, though some cannot cut axially. End mills are used in milling applications such as profile milling, tracer milling, face milling, and plunging. In end milling operation, the upper support part is machined to thickness 30mm, Cut half circle slot diameter as per the design. Slot is provided at equal place and depth of pad is 30mm.

6.5 Drilling and operation:

Drilling is a process of producing round holes in a solid material or enlarging existing holes with the use of multi tooth cutting tools called drills or drill bits. Various cutting tools are available for drilling, but the most common is the twist drill. Drilling operation is carried out at four places on the fixture base plate. Here hole size of 15.5mm diameter is drill at two place on the pad for locater pins and hole size of 14mm diameter is drill at two place for T-bolt and hole size of 12.5 mm diameter is drilled at two place for Allen bolt of M14 size.

6.6 Counter boring operation:

A counter bore is a cylindrical flat-bottomed hole that enlarges another coaxial hole, or the tool used to create that feature. A counter bore hole is typically used when a fastener, such as a socket head cap screw, Allen bolt are required to sit in the base plate. Here counter boring is done to fixture base plate at four places. Four for Allen bolt of M14 and other two for job carrier of size diameter 25mm and thickness 10mm.

6.7 Threading operation:

Different possibilities are available to produce a thread on a lathe. Threads are cut using lathes by advancing the cutting tool at a feed exactly equal to the thread pitch. The single-point cutting tool cuts in a helical band, which is actually a thread.

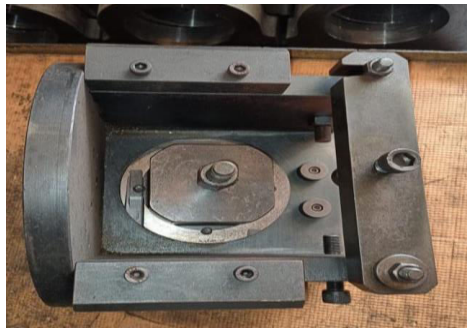


Fig. No.16.

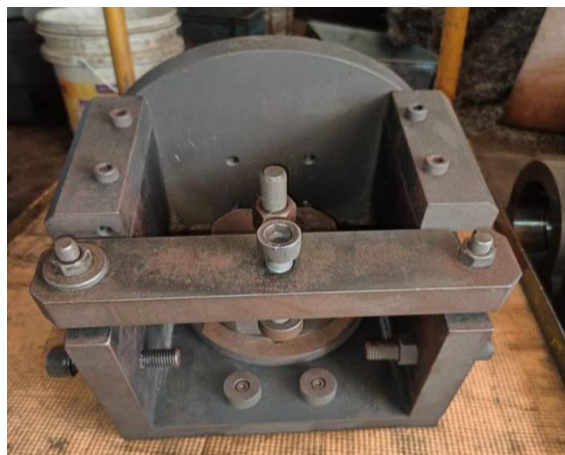


Fig. No.17 & 16 Actual Manufactured Fixture

VIII. EXPERIMENTAL SETUP

A CNC name Ace Micromatic SJE 10 LM was used for manufacturing a component. The fixture was placed on a machine chuck. These machine also feature a heavy duty hydraulic turret.

7.1 EXPERIMENTAL PROCEDURE:

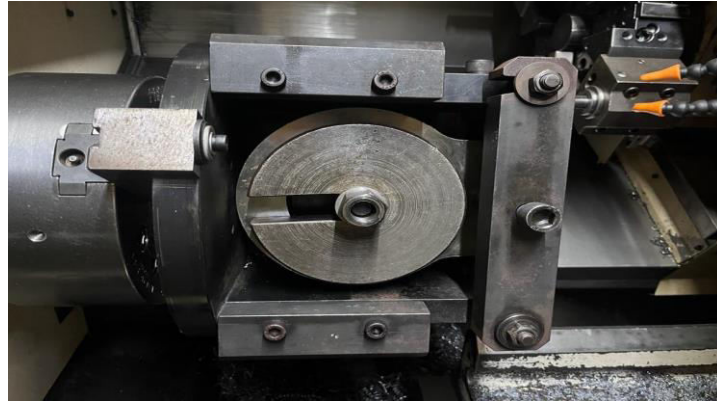


Fig. No.17. Fixture setup On CNC lathe

1. The fixture is mounted on CNC lathe 3 jaw chuck, base plate is attached to the jaws.
2. Upper support is loose from one side & remove the centrally job locator by moving M12 bolt in anticlockwise direction.
3. The job is placed in the fixture it is centrally aligned by job locator. Tight the job from two sides using T-bolts.
4. Work piece is ready for operations. Operator runs the program which is feed in the machine according to the sequence of operations. After machining loose the bolts and remove machined job. The same cycle is repeated for same work.

7.2 RESULT

From Experimental Testing following results of all operations are found.

Sr. No.	Operations	Time Required
1.	Facing	4 min
2.	Drilling & Boring	15 min
3.	Threading	10 min
4.	Counter Boring	3 min
5.	Chamfer	1 min
6.	Deburring	3 min
0.	Total Time	36 min



Fig. No.18. Manufactured Component By using Fixture.



VIII. CONCLUSION

- We have learnt about how to design a Fixture and the problem created during designing and resolved it.
- From this project, we have learned how to detect the problems in industry and how to minimize this problem.
- Getting a practical knowledge about the various operations like drilling, tapping, chamfering etc.
- Saving money of industry by giving them new idea about the fixture.

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Design Development and Performance Evaluation of Positive Engagement Variable Speed Drive

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ABSTRACT: Variable speed drives are required in variety of applications ranging from machine tools like lathe, milling, boring etc, to coil winding machine, material handling conveyors etc. The most popular variable speed drive being the continuously variable transmission of the variable diameter pulley, but the drive does not offer positive engagement and hence there is some amount of slip in the drive that results in the drop in power transmission efficiency.

KEYWORDS: Slip, CVT, Efficiency, Positive engagement, Analysis

I. INTRODUCTION

The variable speed drives are required in variety of applications. The friction drive VSD is one of the most common forms of drives in use today. These VSD make use of friction to transmit power. The effective diameter of the half pulley is adjusted by varying the distance between the two halves of the half pulley. Each half pulley consists of one moving and one fixed half, and the two-half pulley are positioned at a fixed center of distance. As the halves of the half pulley move together, the belt is forced up to a larger diameter on the sheave. As the halves of the sheave move apart, the belt returns to a smaller diameter. The ability to continuously vary the diameter of the drive and driven sheaves allows for a continuously varying transmission ratio. The half pulley diameters can be varied in several ways, depending on the ways.

II. RELATED WORK

The objective of the project is to design develop and carry out the performance evaluation of drive to determine the power output and efficiency of the drive under various load conditions. The critical components of the system have being designed using theoretical method and ansys analysis has been done using Ansys Work bench 16.0 . The test and trial on the unit was carried out and the performance graphs have being plotted.

III. METHODOLOGY

The Positive Engagement Variable Speed uses sprocket bars that are made round in shape and are made integral with the cone, this reduces the problem of vibration and chatter .The simple round shape of the sprocket bars make engagement and disengagement of the transmission belt easy, and vibration free so also offering a positive engagement, unlikely of any slip .The simple shape of the sprocket bars makes the manufacturing process easy and at low cost.

The transmission element of the drive is 'X' theme Classical Synchronous belt with the following features

- Trapezoidal tooth profile
- High efficiency due to positive engagement between belt teeth and sprocket bars
- No- re-tensioning required
- Free from maintenance
- No high tension required.

IV. EXPERIMENTAL RESULTS

Figure shows the results of the Design Development and Performance Evolution of Positive Engagement Variable Speed Drive.

Concept of Positive Engagement Variable Speed Drive

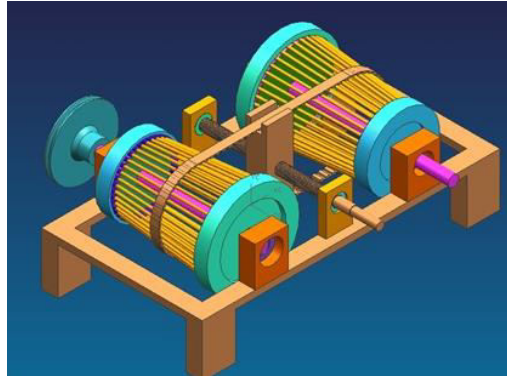


Fig no 4.1

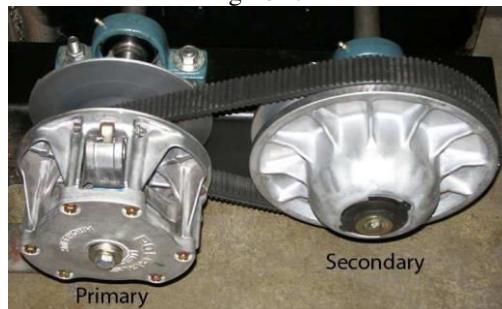


Fig no 4.2

Design of Main Shaft for Sprocket bar Cone

Material of Shaft : EN24 (Allowable stress = 108 MPa)

$$T_d = 0.32 \text{ N-m}$$

Check for torsional shear failure of shaft (Considering $d = 16\text{mm}$ in weakest section of shaft)

$$T_e = \frac{\pi f_s d^3}{16}$$

$$f_{s_{act}} = 0.397 \text{ N/mm}^2$$

As; $f_{s_{act}} < f_{s_{all}}$, The main shaft for sprocket bar cone is safe under torsional load

Analysis of Main shaft
 Boundary Conditions

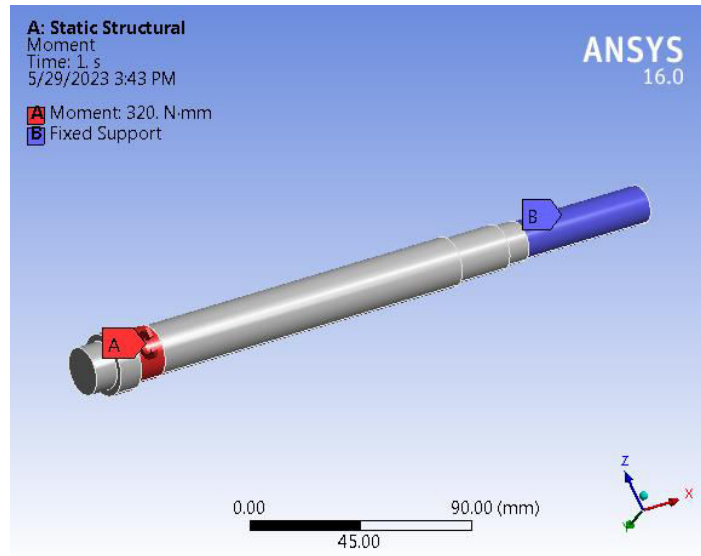


Fig no 4.3
 Maximum stress induced in Main Shaft

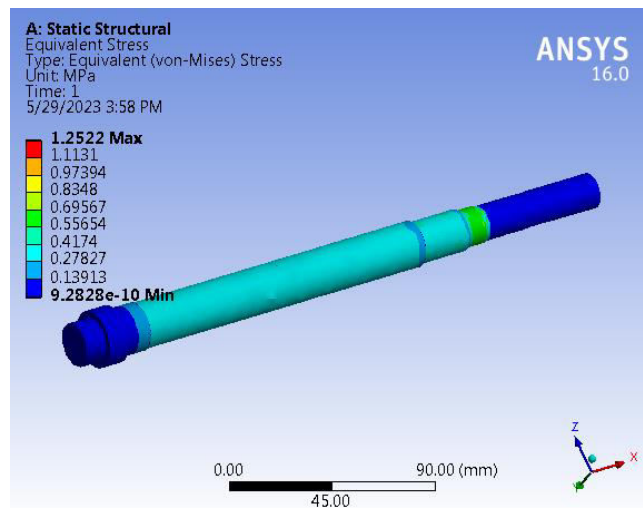


Fig no 4.4

The maximum stress induced in the main shaft is well below permissible limits hence the design of the main shaft for sprocket cone is safe.

Design Analysis of Sprocket Cone Ring
 Analysis of Sprocket cone ring

Boundary Conditions

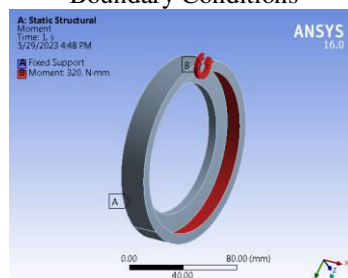


Fig no 4.5

Maximum stress induced in Sprocket cone ring

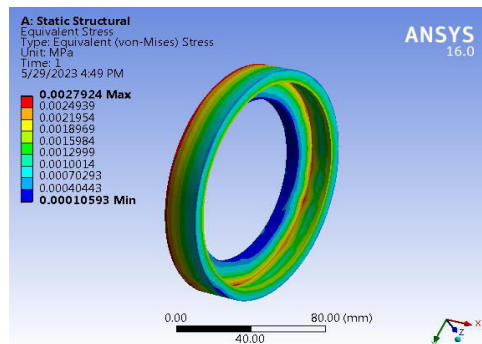


Fig no 4.5

The maximum stress induced in the sprocket cone ring is well below permissible limits hence the design of the sprocket cone ring for sprocket cone is safe.

Test and Trial on the Positive engagement Variable speed drive



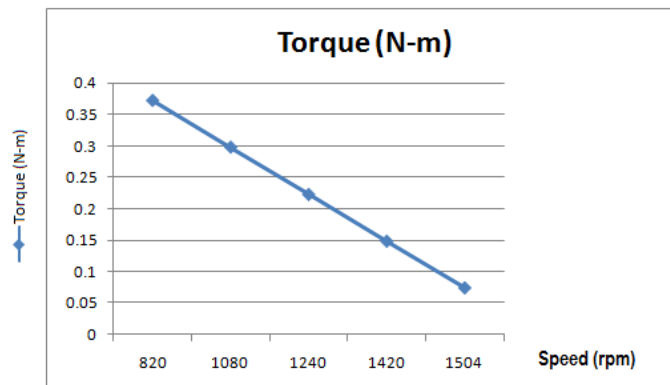
Figure 1 Test rig of Positive engagement Variable speed drive

Diameter (Effective) of Dyno brake input pulley = 76mm.
 Input Power = 35 watt

RESULT TABLE :

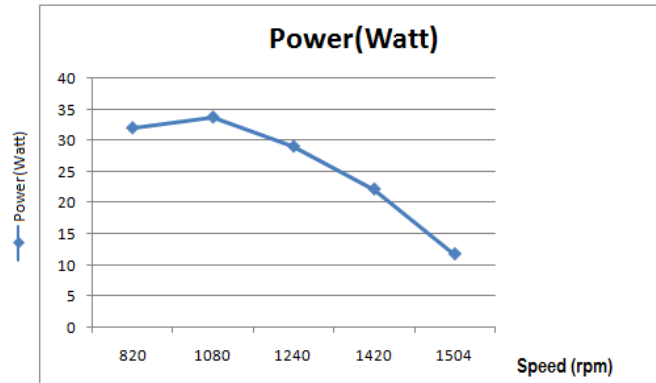
Sr .no	Load (KG)	Output Speed (RPM)	TORQUE (N-m)	Power	Efficiency
1.	0.2	1504	0.074556	11.74398	32.62217
2.	0.4	1420	0.149112	22.17614	61.60038
3.	0.6	1240	0.223668	29.04761	80.68782
4.	0.8	1080	0.298224	33.73271	93.70198
5.	1	820	0.37278	32.01484	88.93012

Graph of Torque Vs Speed



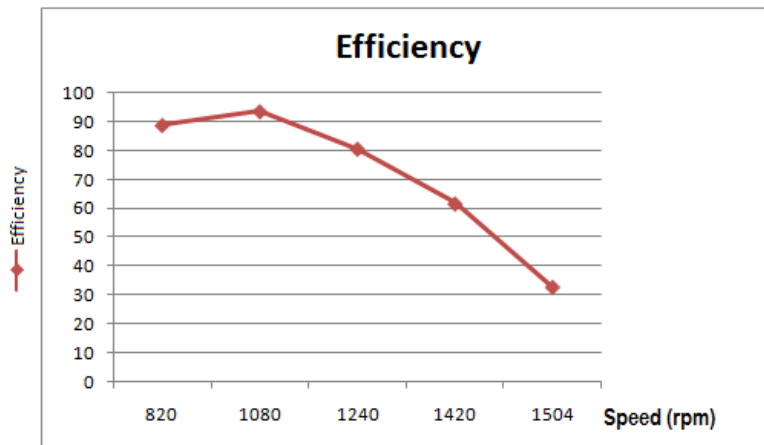
The graph shows that the speed of the drive drops with increase in torque

Graph of Power Vs Speed



The graph shows that the maximum power of 33.73 watt is obtained at speed of 1080 rpm.

Graph of Efficiency Vs Speed



The graph shows that the maximum efficiency of 93.71 % is obtained at speed of 1080 rpm.

IV. CONCLUSION

The need of the variable speed drive with positive engagement is fulfilled with the drive. The components of the system were selected and the theoretical design and the analysis revealed that the parts are safe. Test and trial was done on the unit which showed that the speed of the drive drops with increase in torque, the maximum power of 33.73 watt is obtained at speed of 1080 rpm and the maximum efficiency of 93.71 % is obtained at speed of 1080 rpm.

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Proceedings of the ASME 2010 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference IDETC/CIE 2010 August 15-18, 2010, Montreal, Quebec, Canada
4. Fixed pitch CVT US Patent May 2010 Kenneth B Hawthorn



Design Analysis and 4D Printing of Customised Shoe Insole

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ABSTRACT: Ordinary fabricated shoe insoles for diabetic foot patients facing many difficulties like peak pressure, waterproofing, durability, cost etc. To overcome these difficulties authors are trying to develop shape memory polymer insoles using fused deposition modelling method of 3D printing or additive manufacturing. Additive manufacturing of intelligent/ smart dynamic structures, i.e. 4 Dimensional Printing technologies have attracted interest day to day since it was conceptualized first in the year 2013[1]. This technology uses the creation of live 3D objects from multi-material 3D printers. 4D printing technique uses the conversion of static 3D printed structure from smart materials (Shape changing/memory materials) into a dynamic one by application of external stimuli like heat, water, light pH, magnetic field etc. Nowadays, these dynamic 4D printed structures are widely used for manufacturing smart devices, actuators, smart textiles, smart shoes, and smartphones [2]. In this study, design analysis of insole was performed in Abacus, and 3D printing of developed insole using ultimaker FDM 3D printer

KEYWORDS: Shape Memory Polymers, Thermoplastic urethane; Diabetic foot ulcer,

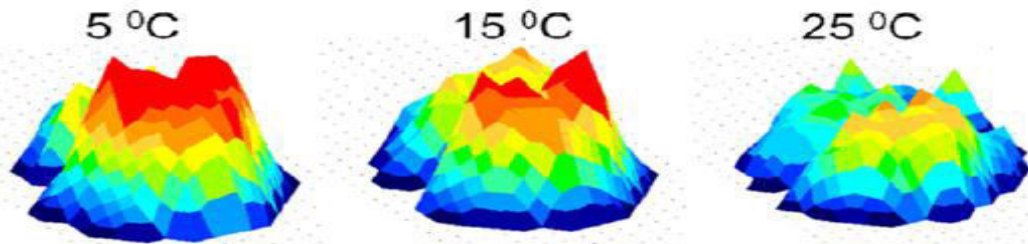
I. INTRODUCTION

SMP's can temporarily and securely hold a deformed shape but recover to an original, 'true' shape, in response to an external stimulus such as temperature. This unique 'shape memory effect' comprises Shape Fixity and Shape Recovery. 'Shape Fixity' enables acquisition of a temporary, deformed shape via a suitable programming process, whereas 'Shape Recovery' retrieves the original shape via controlled application of a stimulus. Pressure Ulcers/Injuries arise when uncontrolled, uneven, and prolonged contact pressure between the body and support surface generates localized regions of high pressure/localized stresses. High pressure damages soft tissue, near bony prominences due to their low curvature and significantly compresses vascular networks, decreasing the supply of oxygen and essential nutrients, resulting in tissue ischemia and finally breaking down the tissues. The resultant chronic ulcers may cause significant pain, discomfort, decreased quality of life and when associated with superimposed infection, may even lead to death. Thus SMP may offer novel mechanisms for reducing the risk of pressure ulcer. In this work we are trying to develop a novel '3D Printed SMP's' for effective pressure redistribution which may show controllable change in 'dynamic pressure redistribution' capability at a 'low transition temperature (~24 °C)'. This temperature is ideally suited to matching 'modulations' in body contact pressure for dynamic pressure relief (e.g., for pressure ulcer effects). Pressure distribution is the dispersion of localized peak pressure or shear forces over larger areas. For that the selected 'SMP's need to be characterized through stress-strain testing, compression testing, DMA etc. The unique stimulus responsive and dynamic shape-change properties of SMP could solve some of the pressure redistribution challenges.[3] This work may explore the use of SMP's as Reactive and Smart surfaces for pressure distribution, using insoles and foot pressure redistribution as an application because currently available surfaces cannot combine both Active(Smart) and Reactive(Passive) functions of pressure distribution for patients suffering from diabetic ulcers. A Reactive/Passive Surface, where pressure reduction occurs through increased contact

area (e.g., foam, ordinary insole, mattresses etc.) An Active/Smart Surface, which repositions body weight by periodically shifting the contact area via alternate inflation and deflation of a series of air-filled bladders.

Possible Mechanisms to Control Foot Pressure/Ulcer:

- i. *Shaped fixing*, where a predetermined shape can be achieved prior to foot application thus the coverage area may increase to reduce pressure.
- ii. *Redistribution of Pressure Points (Active Surface Function):*



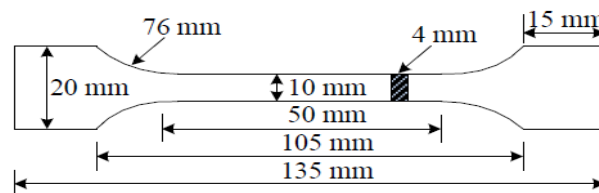
Because of the temperature fluctuations done in body & environment (~30–50 °C), there may be shifting the pressure points naturally which may release the contact stresses. Thus using 3D printed smart surfaces one may reduce excessive stress during plantar loading to reduce the pressure ulcer effects.

II. MATERIAL SELECTION

After referring many research papers(Literature Survey) with reference to application and possible thermomechanical Shape Memory Cycle, following materials or their composites may be used for manufacturing the Orthopedic Shoe Insoles for plantar pressure redistribution thus by reducing diabetic foot ulcer risks: PP- Polypropylene, PE- Polyethylene, PVC-Poly Vinyl Chloride, EVA-Ethylene Vinyl Acetate(Filament need to be developed and Manufactured),PLA-Poly Lactic Acid (Available),Viscoelastic PU Elastomer(e.g. Epoflex) (Filament need to be developed & Manufactured),SMPU-Shape Memory Polyurethane(Available), Silicon Elastomer. Thus optimized material that suited for proposed application is SMPU-Shape Memory Polyurethane which is available in 3D printing filament form.

3D Printing of Materials Samples as Per ASTM & Testing

Depends upon material availability and for checking Material Behavior (i. e. Characterization) , dog bone samples of SMTPU, EVA & Poron have printed as per ASTM D638 standards.



Samples printed along X direction, Y direction and in 45° orientations [4]. According to this ref. paper the build orientations have great influence on mechanical properties as well as viscoelastic properties.

3D Printing of PLA & SMPU Dog Bone Samples: Designed samples are printed using 3D printing, FDM process. Following are some details: Printer Used: Flash Print for Flash forge & Ultimaker Original+, Slicing Software Used: CURA Ultimate Ender15.04.3,Printing Parameters: Highest Resolution =0.2 mm per layer, Build Orientations= Along X axis, Y axis and 45°,Nozzle Temperature ~ 200°C - 205°C,Bed Temperature = 60°C,Ambient Temperature =20°C,Building/Printing Speed =50 mm/s, Material: SMPU(White),Filament Diameter=1.75 mm

3D Printing of SMTPU Samples Using Ultimaker 3D Printer: Samples were printed using Ultimaker 3D printer by applying various printing parameter listed above

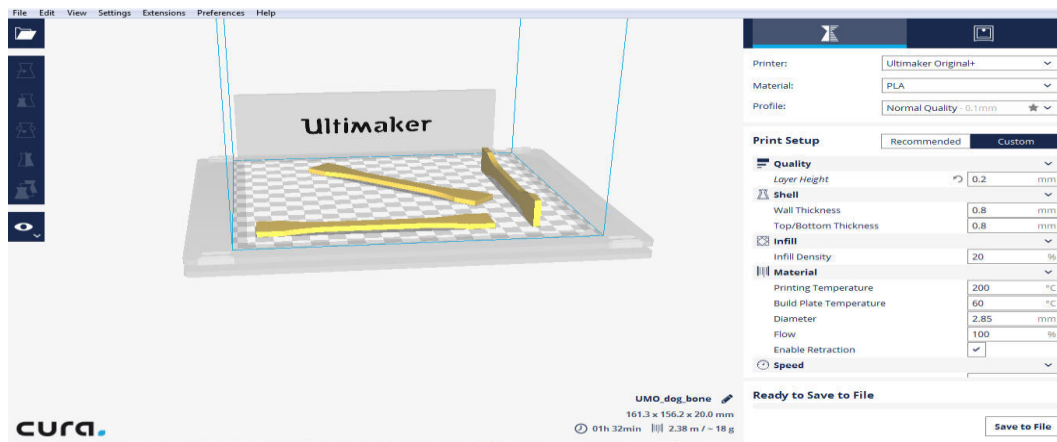


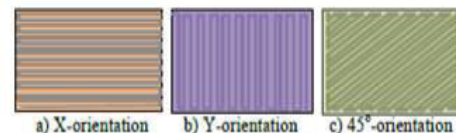
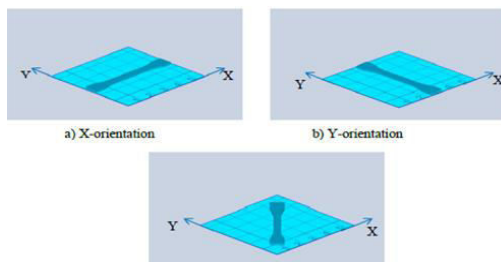
Fig.1 '3D Printing of SMTPU Samples Using Ultimaker 3D Printer'

G Code File of Samples: Following snap shows sample G code file generated using CURA software:

```

.:FLAVOR:RedRap
.:TIME:5578
.:Generated with
Cura_SeamEngine 2.3.1
M190 S60
M104 S200
M109 S200
G21 ;metric values
G90 ;absolute positioning
M82 ;set extruder to absolute
mode
M107 ;start with the fan off
G28 X0 Y0 ;move X/Y to min
endstops
G28 Z0 ;move Z to min endstops
G1 Z15.0 F3000 ;move the
platform down 15mm
G92 E0 ;zero the extruded
length
G1 F200 E6 ;extrude 6 mm of
feed stock
G92 E0 ;zero the extruded
length again
G1 F9000
;Put printing message on LCD
screen
M117 Printing...
.:LAYER COUNT:100
.:LAYER:0
M107
G1 F1500 E-6.5
G0 F3600 X162.775 Y20.497
Z.299
.:TYPE:SKIIRT
G1 F1500 E0
G1 F1800 X162.894 Y19.717
E0.01479
G1 X163.092 Y18.952 E0.02961
G1 X163.366 Y18.212 E0.0444
G1 X163.714 Y17.503 E0.05921
G1 X164.132 Y16.832 E0.07403
G1 X164.615 Y16.208 E0.08882
G1 X165.188 Y15.635 E0.10362
G1 X165.757 Y15.12 E0.11843
G1 X166.408 Y14.669 E0.13323
G1 X167.096 Y14.285 E0.14805
G1 X167.821 Y13.973 E0.16285
G1 X168.574 Y13.736 E0.17765
E786.44996
G0 X171.244 Y27.876
G0 F7200 X171.314 Y27.241
G1 F1800 X173.753 Y24.801
E786.49322
G0 X173.823 Y24.731
G0 F7200 X173.753 Y24.236
G1 F1800 X171.314 Y26.675
E786.53648
G0 X171.244 Y26.745
G0 F7200 X171.314 Y26.109
G1 F1800 X173.753 Y23.67
E786.57973
G0 X173.823 Y23.6
G0 F7200 X173.753 Y23.104
G1 F1800 X171.314 Y25.544
E786.623
G0 X171.244 Y25.614
G0 F7200 X171.314 Y24.978
G1 F1800 X173.753 Y22.539
E786.66625
G0 X173.823 Y22.469
G0 F7200 X173.661 Y22.065
G1 F1800 X171.314 Y24.412
E786.70788
G0 X171.244 Y24.482
G0 F7200 X171.314 Y23.847
G1 F1800 X173.095 Y22.065
E786.73947
G0 X173.165 Y21.995
G0 F7200 X172.529 Y22.065
G1 F1800 X171.314 Y23.281
E786.76103
G0 X171.244 Y23.351
G0 F7200 X171.314 Y22.715
G1 F1800 X171.964 Y22.065
E786.77256
G0 X172.034 Y21.995
G0 F7200 X171.398 Y22.065
G1 F1800 X171.314 Y22.15
E786.77405
G0 F7200 X171.535 Y22.286
.:TIME_ELAPSED:5578.942780
G1 F1500 E780.27405
M107
M104 S0 ;extruder heater off
M140 S0 ;heated bed heater off
(if you have it)
G91 ;relative positioning
G1 E-1 F300 ;retract the
filament a bit before lifting
the nozzle, to release some of
the pressure
G1 Z+0.5 E-5 X-20 Y-20 F9000
;move Z up a bit and retract
filament even more
G28 X0 Y0 ;move X/Y to min
endstops, so the head is out
of the way
M84 ;steppers off
G90 ;absolute positioning
M104 S0
;End of Gcode
.:SETTING 3 {"global_quality":
"[general]\\inversion =
2\\nname = empty\\ndefinit
.:SETTING 3 on =
ultimaker_original_plus\\n\\n[
metadata]\\nquality_type =
normal\\
.:SETTING 3 \nntype =
quality_changes\\n\\n[values]
\nlayer_height = 0.2\\n\\n"}

```



Representative building layer styles of the samples

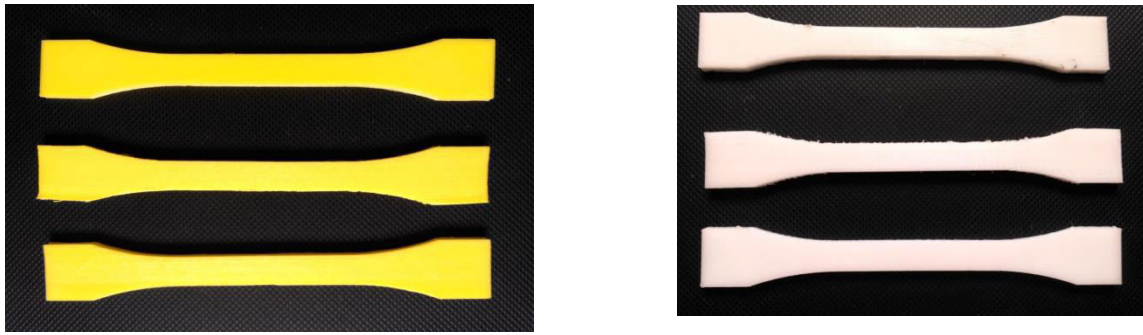


Fig.2 '3Printed Dogbone Samples for Material Behavior checking at X,Y,45° orientations'

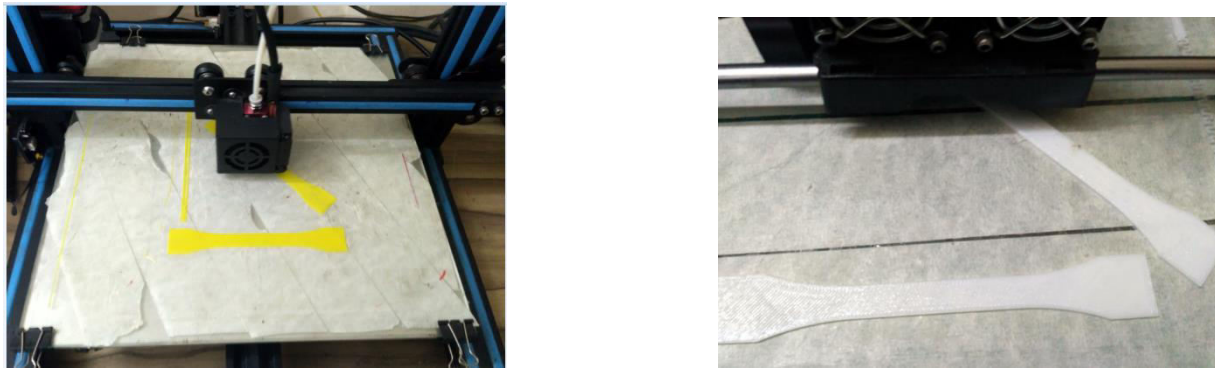


Fig. Actual 3D Printing of Samples using Ultimaker FDM Printer

Customized Shoe Insole Primary Design & CAE in Abacus: Insole 3D solid models were prepared in CATIA V5 software and CAE analysis is done in ANSA, Hyper mesh, Abaqus and Hyper view. Following are details of the same. Meshing approach used was 3D solid with 3D Solid Tetra elements of first order.

Sr.	Particulars	SW/ Tool Used
1	Pre-processor	ANSA & Hypermesh
2	Processor/Solver	Abaqus
3	Post processor	Hyperview
4	Element Used	3D Solid Tetra (First Order)
5	Meshing Approach	3D Solid

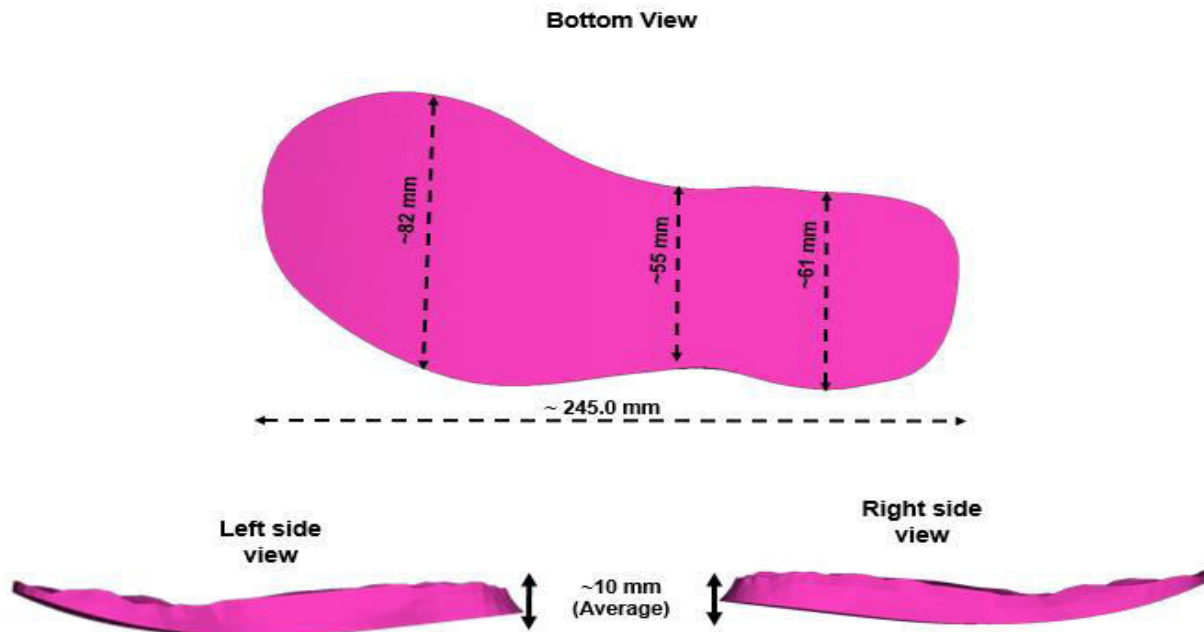


Fig.3 '3D Solid Model of Insole in CATIA V5'

Foot Model Analysis along with shoe insole: Combined 3D solid model was analysed in CAE software's listed above for various shape memory materials[5].

Sr.	In Sole Material	Elastic Modulus (N/mm ²)	RHO (Tonns /mm ³)
1	Rubber i.e. Neoprene	10	1.15E-09
2	Foam RG 40 (Hard) i.e. [EVA]	10	4.11E-09
3	Foam RG 40 (Soft) i.e. [SMTPU]	10	4.11E-11

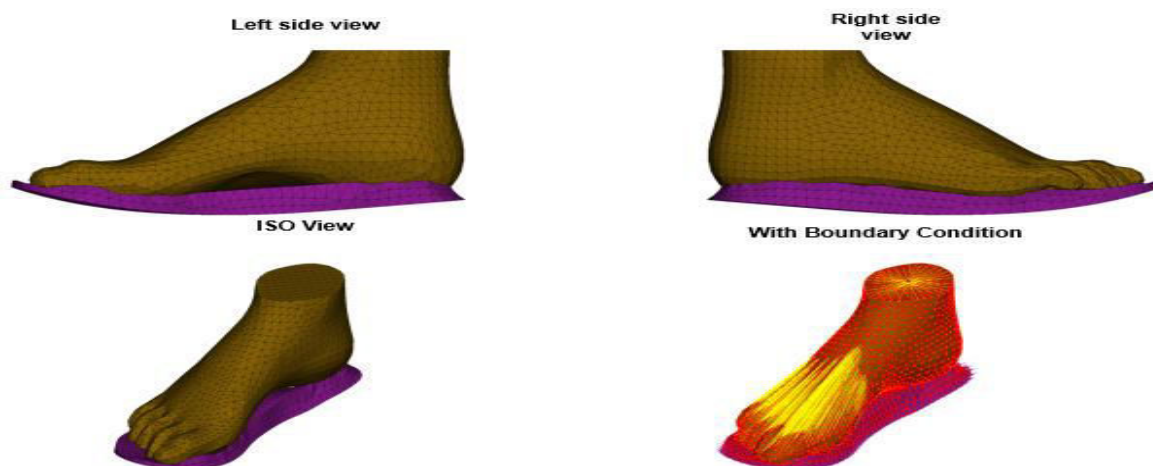
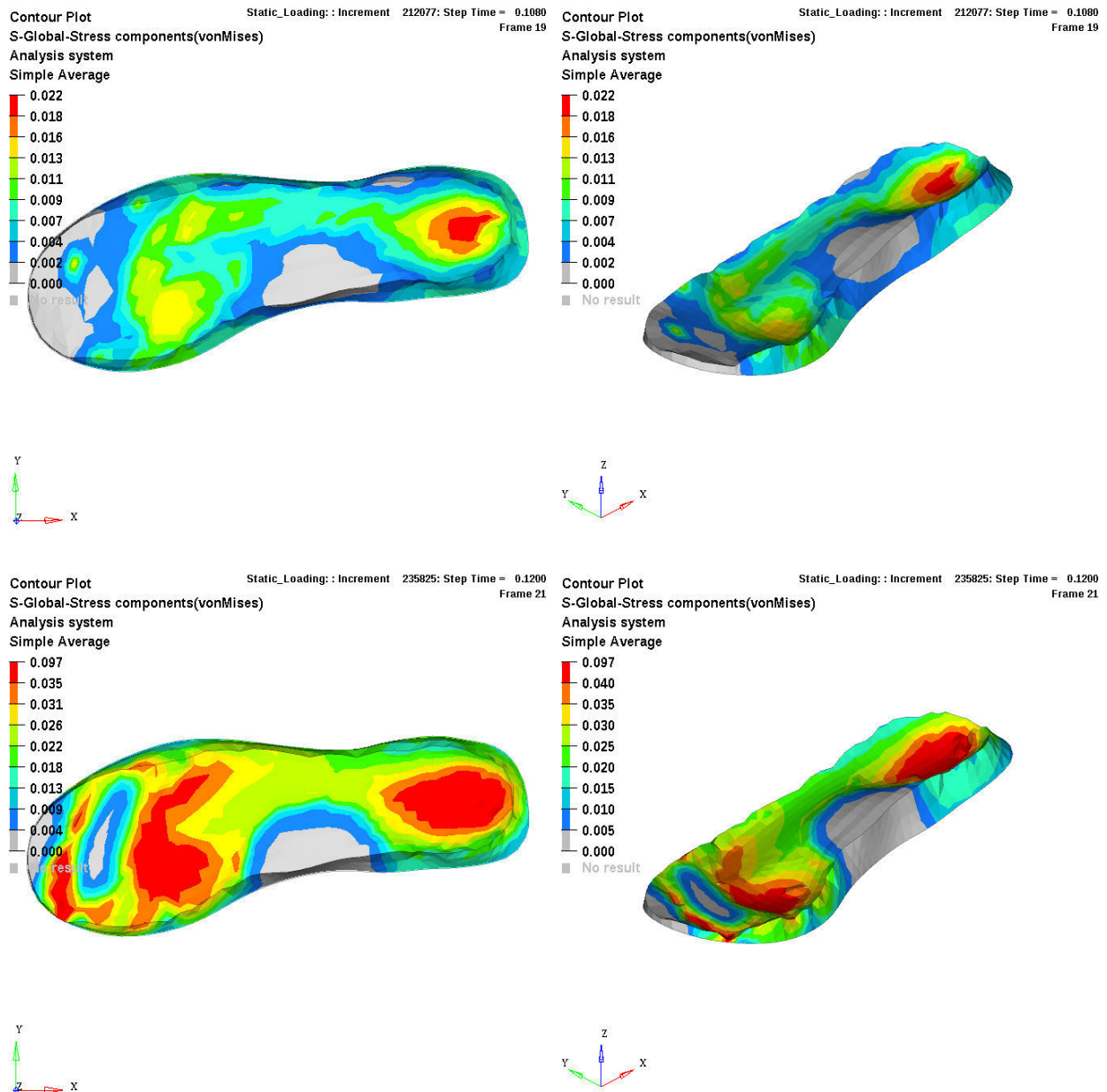


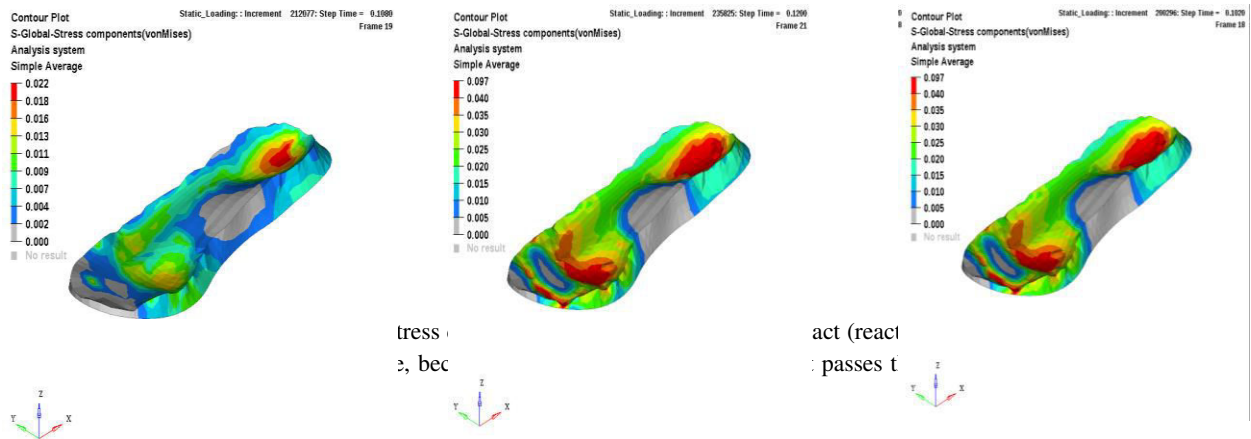
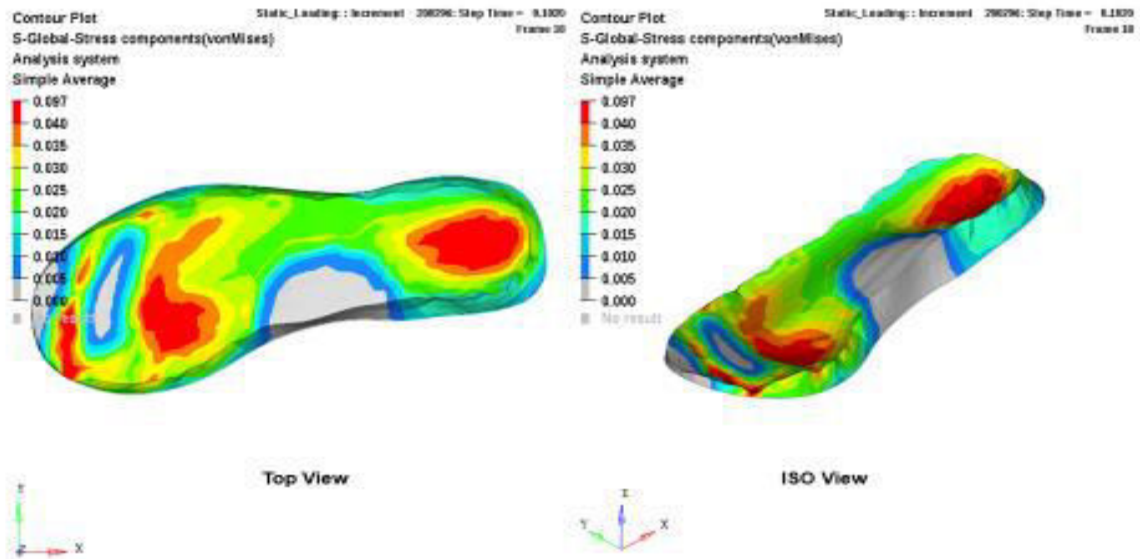
Fig. 4 Combined model of Foot and Insole

III. EXPERIMENTAL RESULTS

Plantar Pressure distribution was checked for different materials using Abaqus solver with higher solver capability. This parameter was important for checking which provides pain relief to patients suffering from foot ulcers.[6] Following are contour plots show pressure distribution between bottom of foot and shoe insoles



Model 3 : Stress Distribution For Foam RG 40 (Soft) i.e. PU



3D Printing of Customized Smart Diabetic Shoe Insole: Developed Smart Diabetic shoe Insole has printed using 3D printing, FDM process. Following are some details: Printer Used: Flash Forge FDM, Slicing Software Used: CURA Ultimate Ender15.04.3, Printing Parameters: Highest Resolution =0.2 mm per layer, Nozzle Temperature ~ 235°C, Bed Temperature = 70°C, Ambient Temperature =22°C, Building/Printing Speed =50 mm/s, Material Used: SMPU (White), Filament Diameter=1.75 mm.

Parameter Setting in CURA: For 3D Printing of Customized Smart Diabetic Shoe Insole Using Flash forge FDM 3D Printer, parameters were set as per listed specifications.

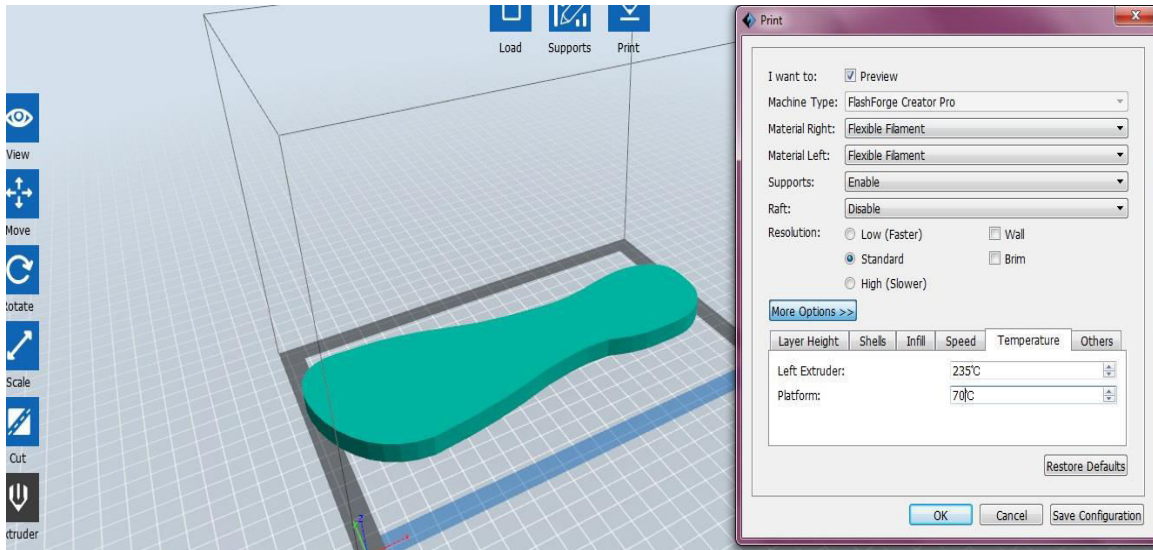


Fig. 5 Parameter Setting in CURA

Program Generation Using CURA: After setting parameters, slicing of shoe model is done in CURA and the program was automatically generated in same software. Fig shows screen shot of generated program. This program was fed to flashforge printer and as per program actuation of printer slides were doe. Thus actual physical prototype of shoe insle was faricated as shown.

```

; FLAVOR:Marlin
; TIME:15714
; Filament used: 17.5181m
; Layer Height: 0.2
; Generated with
Cura_SteamEngine 4.0.0
M140 S55
M105
M109 S220
M82 ;absolute extrusion mode
; Ender 3 Custom Start G-code
G28 ; Home all axes
G92 E0 ; Reset Extruder
G1 Z2.0 F3000 ; Move Z Axis up
little to prevent scratching
of Heat Bed
G1 X0.1 Y20 Z0.3 F5000 ;
Move to start position
G1 X0.1 Y200.0 Z0.3 F1500.0
E15 ; Draw the first line
G1 X0.4 Y200.0 Z0.3 F5000 ;
Move to side a little
G1 X0.4 Y20 Z0.3 F1500.0 E30 ;
Draw the second line
G92 E0 ; Reset Extruder
G1 Z2.0 F3000 ; Move Z Axis up
little to prevent scratching
of Heat Bed
; End of custom start GCode
G92 E0
G1 F2400 E-5
; LAYER COUNT:51
; LAYER:0
M107
M204 S5000
M205 X30 Y30
G0 F3600 X37.359 Y87.16 Z0.2
M204 S500

M205 X20 Y20
; TYPE:SUPPORT
G1 F2400 E0
G1 F1500 X44.253 Y84.094
E0.25095
G1 X51.876 Y82.283 E0.51155
G1 X70.022 Y82.986 E1.11554
G1 X88.054 Y84.814 E1.71836
G1 X138.641 Y92.284 E3.42138
G1 X145.302 Y92.411 E3.64296
M204 S500
M205 X20 Y20
G1 F1500 X226.652 Y126.335
E884.58414
; TIME ELAPSED:15714.143249
G1 F2400 E879.58414
M140 S0
M204 S4000
M107
; Ender 3 Custom End G-code
G4 ; Wait
M220 S100 ; Reset Speed factor
override percentage to default
(100%)
M221 S100 ; Reset Extrude
factor override percentage to
default (100%)
G31 ; Set coordinates to
relative
G1 F1800 E-3 ; Retract
filament 3 mm to prevent
oozing
G1 F3000 Z20 ; Move Z Axis up
20 mm to allow filament ooze
freely
G90 ; Set coordinates to
absolute
G1 X0 Y235 F1000 ; Move Heat
Bed to the front for easy
print removal
M84 ; Disable stepper motors

; End of custom end GCode
M82 ;absolute extrusion mode
M104 S0
; End of Gcode
; SETTING_3
{"extruder_quality":
["[general]\\nversion =
4\\nname = Draft #2\\nde
; SETTING_3 finition =
; printer\\n\\n(metadata)\\ns
string_version = 6\\nntype =
; SETTING_3
quality_changes\\nposition =
0\\nquality_type =
draft\\n\\n(values)\\
; SETTING_3 pinfill_pattern =
grid\\ninfll_sparse_density =
60\\nmaterial_print
; SETTING_3 temperature =
220\\nretraction_hop_enabled =
True\\nretract_print = 50\\
; SETTING_3 n\\n"],
"global_quality":
["[general]\\nversion =
4\\nname = Draft #2
; SETTING_3 \\ndefinition =
; printer\\n\\n(metadata)\\ns
string_version = 6\\nnty
; SETTING_3 ps =
quality_changes\\nquality_type
=
draft\\n\\n(values)\\nadhersion
-
; SETTING_3 type =
none\\nbridge_settings_enabled
=
True\\nmaterial_bed_temperatu
; SETTING_3 re =
55\\nsupport_enable =
True\\n\\n"]

```

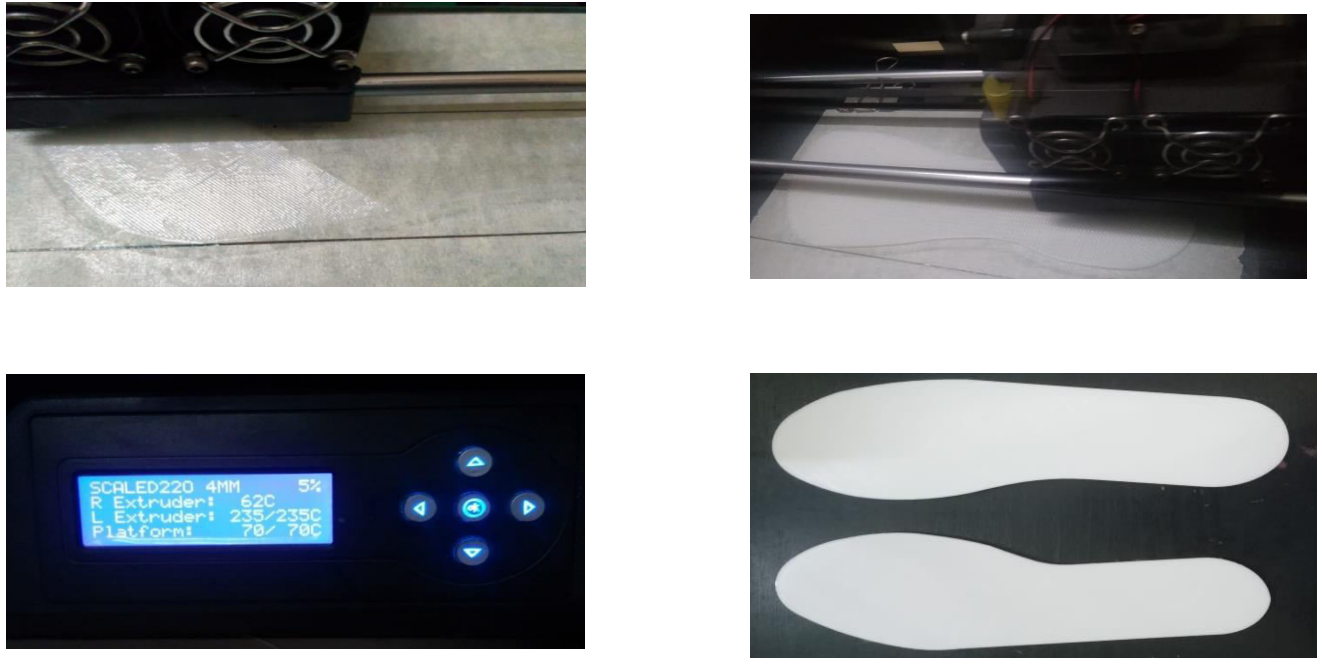


Fig.6 Actual 3D/4D Printing of Developed Insole

IV. CONCLUSION

In this course of study authors developed 3D printed shape memory insole for diabetic foot ulcer patients. Geometric Models were prepared in CATIA V5, analysis was done in Abaqes solver with checking of .plantar pressure distribution and finally it was 4D printed using ultimaker FDM 3D printer. As compare with ordinary insole, developed insole was very much comfort to patients suffering from foot ulcer problems providing pain relief due to proper distribution of plantar pressure. Developed insole was waterproof, cost-effective and durable.

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Designing & Manufacturing of Forming Tool

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ABSTRACT: Forming process in this case involves bending of sheet metal parts at desired angles. It refers to the process of bending by applying a bending force with a press machine. In this paper, the process presented is for designing and manufacturing of a forming tool for a sheet metal part. The Tool is designed such a way that the die and punch match the profile of the desired part geometry. And the punch and die are mirror replicas of each other. So, the resultant part is exactly as desired.

KEYWORDS: Bending, Forming Press Tool

I. INTRODUCTION

General considerations for tool design and manufacture for micro-sheet forming production include the scheme for progressive die forming/stamping or transfer die forming/stamping (need careful considerations on the part sizes, features and sizes, use of the strip material, etc.); the availability of the die-working-space provided by the machine as well as the connection to the feeder(s); the stock layouts considering micro-forming characteristics (especially the closeness of the features) as well as transport requirements; the blank-holding design considering limited spaces and precision; the feasible punch penetration distance (taking into account the punch diameter/free length ratio); the punch/die clearance achievable with micro-tooling capabilities; web-formation and limitation due to space arrangements and its potential effect on the distortion of the parts; the ejection/removal of the small/thin parts and scraps (if needed); burr generation and removal; punch stiffness/strength and assembly requirements (with limited spaces); the transport of the thin part/scrap ribbon at high speed; maintaining the flatness of the thin strip during transport; considerations for the implementation of a dry stamping process and its effects; the micro-tooling process chains and capabilities in dimension tolerances and surface finish; tool materials and cost; micro-tooling cost (considering the process chains); assembly and inspection techniques for micro-tools; the interfaces with the machine; special arrangements for the guiding of the punches/moving parts of the tooling; the proper selection of bearings and guides, prestressing parts, if possible; tool-surface polishing; tool-surface coating, etc.

II. RELATED WORK

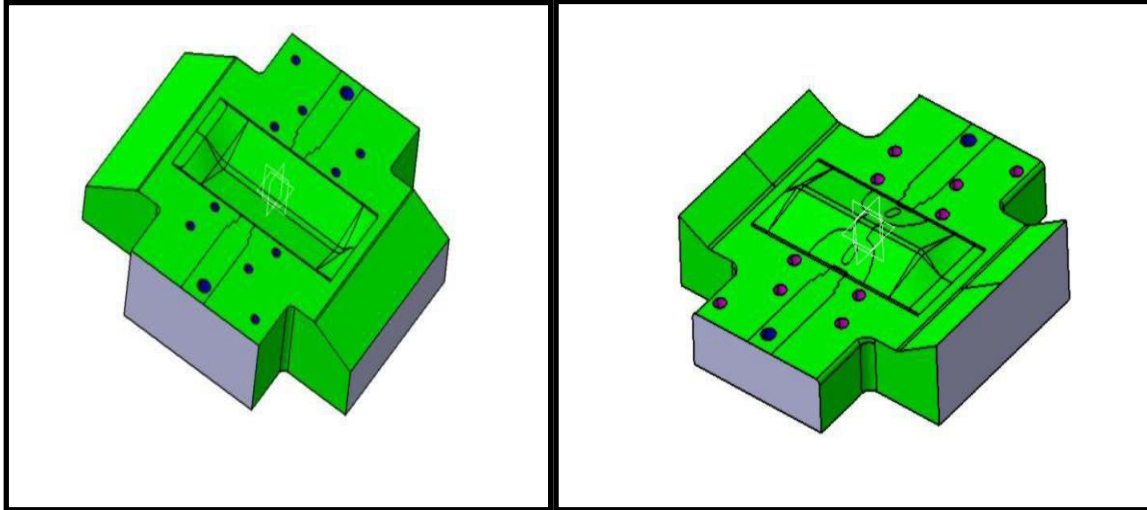
Production of sheet metal parts is very critical especially when it comes to forming operation. Manufacturing sheet metal parts in large numbers in today's competitive market makes it very much important to save cost and time at the same time with maintaining the desired product quality. So, there must be a solution that satisfies all of these needs. A forming press tool can make it all happen with proper robust design which provide the desired results.

III. METHODOLOGY

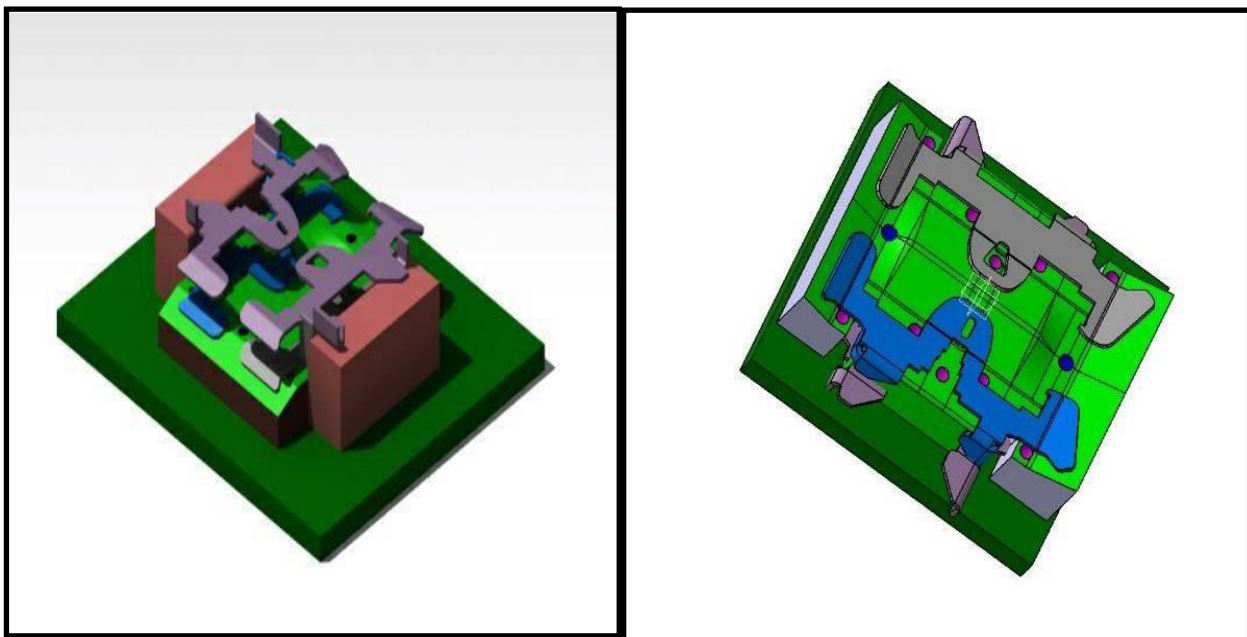
Study of the part along with imagining various ways to obtain desired results. After we get a thorough idea of the process we make a concept model to estimate the price of the project and for better understanding of the tool. Finding concepts satisfying the need at our end as well as confirming it from the guide we proceed towards detailed design. Before starting design, it is important that the customer approves the quoted price and the concept (if it concerns). Using standards of the industry and proper formulas for calculations using acting forces & stresses to get the sizes for the parts of the tool. We report the industry guide after completion of every stage (mandatory as decided by our team members for obvious reasons). We create a detailed design at our end & we confirm it from the guide. And then run a simulation test using the ANSYS software. Now we start the detailing process (converting all the parts to 2D drawing and dimensioning it for the ease of the machinist). Detailed drawings are printed into 3 sets for the machinist, the records and the team supervising. Along with the detailed drawing we also create a BOM (bill of material), using this we order raw material from the vendor supplying industry. As per detailed drawing we start the machining. Two of our group members have good knowledge about the machines. With help of them and the workers as well, we complete the process. Now we clean all the parts before the assembly. Assembly is done as per design using proper hardware's. The tool is taken to the

press shop for the trial. 15 parts are processed and inspected thoroughly using the CMM machine. If any error is detected the mould is reworked and a trial process is carried out again. This is done until satisfactory results are obtained. Further we disassemble the tool and send the parts for heat treatment to the industry vendor after confirmation in trial. Tool is assembled again after hardening and balkanizing. Now the laser marked tag of the industry is fitted on the tool and the tool is ready to dispatch.

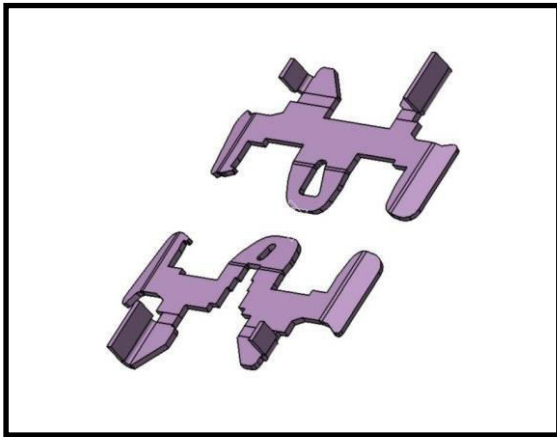
IV. EXPERIMENTAL RESULTS



(A) DIE PAD & PUNCH



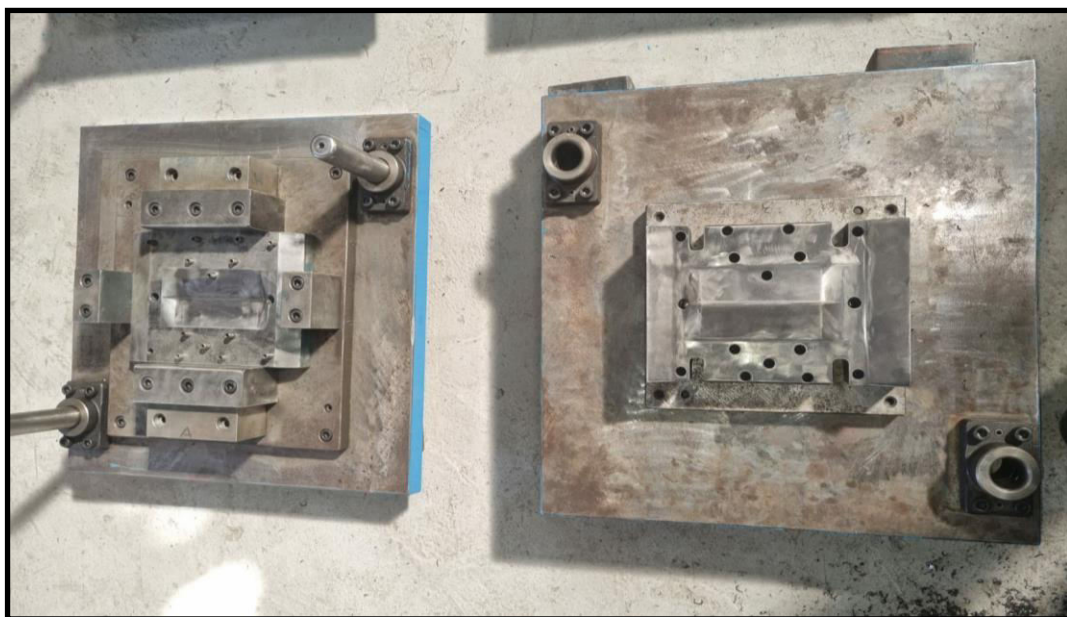
(B) LOWER & UPPER ASSEMBLY WITH PARTS



(C)AFTER PRODUCT



(D)ASSEMBLY OF RAISER PIN, DIE PAD, LOCATION PINS



(E)FULL ASSEMBLY

V. CONCLUSION

The forming tool or press tool machines are essential in the field of manufacturing and metalworking industries. These Machines are designed to shape and form various materials, such as metal sheets, into desired shapes and sizes. Here we have designed and manufactured bend forming tool for a sheet metal part. We have used various design formulas to calculate the thickness of various parts. We also calculated tonnage required for the bending process. Proper material was selected for respective stresses acting on components of the tool. As a result, we manufactured a tool which can provide the desired part with each stroke.

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https://www.researchgate.net/publication/229297729_Friction_modelling_for_the_physical_simulation_of_the_bulk_metal_forming_processes
18. Numerical solution of bulk metal forming processes by the reproducing kernel particle method (Shangwu Xiong 2006)
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<https://doi.org/10.1016/j.jmatprotec.2008.03.070>



Development of Predictive Model for Compressive Strength of Concrete Block

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ABSTRACT: Concrete blocks are widely used in construction due to their low cost, ease of use, and durability. The compressive strength of concrete blocks is a critical parameter that affects the safety and reliability of structures. Therefore, it is essential to accurately predict the compressive strength of concrete blocks during the design and construction process. In this paper, we present a study on the prediction of concrete block compressive strength using machine learning algorithms. The dataset used in this study consists of 1000 samples of concrete blocks, each with 10 features. We evaluate the performance of five machine learning algorithms: Linear regression, Decision tree regression, Random forest regression, Ada-boost and XG-boost. Our results show that the random forest regression algorithm achieves the highest accuracy in predicting concrete block compressive strength, with an R-squared value of 0.96. This study demonstrates the potential of machine learning algorithms in predicting the compressive strength of concrete blocks and can be useful in the design and construction of structures. Concrete compressive strength is one of the most important because it usually indicates the overall quality of the concrete. Compressive strength of concrete is dependent on many factors such as quality of aggregate, strength of cement, water content, water/cement ratio, binder/aggregate ratio and age of concrete. Compressive strength of concrete is mostly depends on the materials of concrete mix design. Although the concrete compressive strength can be measured at different ages, codes usually specify standard 28- day testing.

KEYWORDS: Machine learning model, concrete, compressive strength, data, laboratories, algorithms, regression, AdaBoost, XGBoost, Random Forest, Linear Regression, Decision Tree

I. INTRODUCTION

Concrete blocks are widely used in construction due to their low cost, ease of use, and durability. The compressive strength of concrete blocks is a critical parameter that affects the safety and reliability of structures. The compressive strength of concrete blocks depends on various factors, such as the type of cement, aggregates, water-cement ratio, curing time, and temperature. But in real world scenario most of the companies use same quantity of material, and separation is on grade of concrete. Therefore, accurately predicting the compressive strength of concrete blocks is essential during the design and construction process. Several methods have been proposed for predicting the compressive strength of concrete blocks, such as analytical methods, empirical methods, and statistical methods. Analytical methods are based on the theory of elasticity and require knowledge of the material properties of concrete. Empirical methods are based on experimental data and provide a simple way to predict the compressive strength of concrete blocks. Statistical methods, such as regression analysis, have been widely used in predicting the compressive strength of concrete blocks.

Recently, machine learning algorithms have gained popularity in predicting the compressive strength of concrete blocks due to their ability to handle complex data patterns and non-linear relationships. Machine learning algorithms have been applied in various fields, such as finance, healthcare, and engineering. In this paper, we present a study on the prediction of concrete block compressive strength using machine learning algorithms.



Concrete basic strength is determined as a result of testing samples taken from wet concrete in building that are still under construction. The aim here is to measure the compressive strength capacity of concrete and to determine its service life. In the compressive strength test, a pressure is applied to the sample with certain dimensions (150 x 150 x 150 cube) with the help of a pressure press device, without impact, at unchanging values. It is continued until the sample is broken, this process is stopped at the time of breakage the compressive strength is determined by proportioning the amount of force that causes the fracture of the sample whose cross-sectional area has been found before, to the cross sectional area. The values differ according to the necessity of the construction. Concrete in each structure has certain compressive strength values that must be satisfy. Such as dams, detached houses, bridges, roads, industrial floors. These values are of vital importance for construction because concrete is the most fundamental building block of construction. The sample taken is subjected to various tests. These experiments take a long time to perform and require a lot of laboratory equipment. Therefore, it is a costly approach. It is also prone to human error, and as a result, the already long experimentation times can be even longer. As a result, delays occur in production. What is wanted to be done here is the materials we use while preparing the concrete and their amounts are certain, as a result, we can estimate the concrete compressive strength in the new concretes by looking at the past concrete contents and compressive strength tests. In the study, the concrete strength data set of 1000 samples, which was made in 5 different laboratories, was analysed by Decision Trees, Linear Regression, Random Forest Regression, AdaBoost and XGBoost etc. methods and as a result of the estimations made with these methods; Consistency and estimation accuracy were compared.

II. DATA PREPARATION

1. Data Cleaning

Data is collected from Civil Laboratory of Ajeenkya DY Patil School of Engineering, Lohegaon in hardcopy format. This Data is further transfer in to Excel sheet by manually. Then it forwarded towards the Data processing unit. Data cleaning is the process of fixing or removing incorrect, corrupted, incorrectly formatted, duplicate, or incomplete data within a dataset. When combining multiple data sources, there are many opportunities for data to be duplicated or mislabelled. If data is incorrect, outcomes and algorithms are unreliable, even though they may look correct. There is no one absolute way to prescribe the exact steps in the data cleaning process because the processes will vary from dataset to dataset. But it is crucial to establish a template for your data cleaning process so you know you are doing it the right way every time.

Data cleaning is an essential step in preparing data for machine learning models. It involves identifying and correcting or removing errors, inconsistencies, and inaccuracies in the dataset. Data cleaning helps improve the quality of the data, which in turn enhances the performance and reliability of the machine learning model.

Here are some key aspects and techniques involved in data cleaning for ML models:

Handling missing values: Missing values can adversely affect the performance of a machine learning model. Common techniques for dealing with missing data include imputation (replacing missing values with estimated values), deletion of rows or columns with missing values, or creating a separate indicator variable to represent missing. **Handling**

outliers: Outliers are data points that deviate significantly from the rest of the data. They can be caused by measurement errors or represent genuine extreme observations. Outliers can distort the model's learning process and predictions. Various methods, such as statistical techniques (e.g., Z-score or percentile-based methods) or domain knowledge, can be used to detect and handle outliers appropriately.

Data normalization or scaling: Machine learning models often benefit from having data features on similar scales. Normalization or scaling techniques, such as min-max scaling or standardization, can be applied to ensure that all features have similar ranges and distributions.



Removing duplicate records: Duplicate records in the dataset can introduce bias and impact the model's performance. Identifying and removing duplicate entries is crucial to maintain data integrity. Duplicate records can be identified based on specific fields or a combination of multiple attributes.

Handling categorical variables: Categorical variables (e.g., gender, color, or country) require special handling as machine learning models typically work with numerical inputs. Techniques such as one-hot encoding, label encoding, or target encoding can be used to transform categorical variables into numerical representations.

Dealing with inconsistent or erroneous data: Data cleaning involves identifying and correcting inconsistent or erroneous values. This may involve validating data against defined constraints or applying logical rules to identify and rectify errors.

Feature engineering: Data cleaning often goes hand in hand with feature engineering, which involves creating new features or transforming existing ones to better represent the underlying patterns in the data. Feature engineering can include operations like binning, polynomial features, or creating interaction terms.

Handling class imbalance: In classification problems, class imbalance occurs when the distribution of classes is highly skewed, with one class having significantly more instances than the others. Techniques like oversampling, under sampling, or generating synthetic samples can be employed to address class imbalance issues.

1. Exploratory Data Analysis

In this stage we have done so many operations for validating data.

I. Pair Plot

Each feature is correlate with each other by using this pair plot.

II. Histogram

Data is scatter in tabular format.

III. Box Plot

This plot is used for checking the outliers, if any outliers is there then they will replaced by mean value of that column. Most of the time outliers are replaced in Data Processing stage

III. DATA TRANSFORMATION

Data transformation involves converting the data into a format that is suitable for machine learning algorithms. This includes scaling the data, encoding categorical variables, and feature engineering. Scaling involves normalizing the data so that each feature has the same scale. Categorical variables need to be converted into numerical variables through one-hot encoding or label encoding. Feature engineering involves creating new features from existing ones that may be more informative for the machine learning algorithm

IV. DATA SPLITTING

Once the data is cleaned and transformed, it needs to be split into training, validation, and testing sets. The training set is used to train the model, the validation set is used to tune the hyper parameters of the model, and the testing set is used to evaluate the performance of the model.

V. FEATURE SELECTION

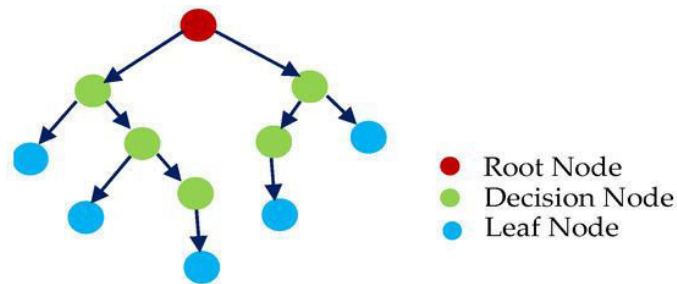
Feature selection involves selecting the most important features that contribute to the target variable. This can be done through various techniques such as features importance ranking or recursive feature elimination.

VI. METHODS

1. Decision Tree Regression

Decision tree regression can be used in predicting the compressive strength of concrete blocks by building a tree that partitions the dataset into subsets based on the most important features that affect the compressive strength. The tree

can then be used to predict the compressive strength of new concrete blocks by traversing the tree from the root node to a leaf node that corresponds to a predicted compressive strength.



To build a decision tree for predicting the compressive strength of concrete blocks, we can use the dataset of 1000 samples of concrete blocks with 10 features, as described in the previous section. We can split the dataset into a training set and a testing set using a 70:30 ratio, where the training set is used to train the decision tree algorithm and the testing set is used to evaluate its performance. We can use the mean absolute error (MAE), mean squared error (MSE), and R-squared value as evaluation metrics. The MAE and MSE measure the difference between the predicted and actual compressive strength values, while the R-squared value measures the goodness of fit of the decision tree regression model. The decision tree algorithm recursively partitions the dataset into subsets based on the most important features that affect the compressive strength, as determined by the information gain or reduction in variance. The tree can be pruned to avoid overfitting by setting a minimum number of samples per leaf node or by using a cost complexity parameter.

The decision tree regression algorithm can be useful in identifying the most important features that affect the compressive strength of concrete blocks and in generating rules that can be used to predict the compressive strength of new concrete blocks. However, it may not be as accurate as other machine learning algorithms, such as random forest regression or support vector regression, which can handle non-linear relationships and interactions between features.

2. Random Forest Regression

A random forest is a meta estimator that fits a number of classifying decision trees on various sub-samples of the dataset and uses averaging to improve the predictive accuracy and control over-fitting.

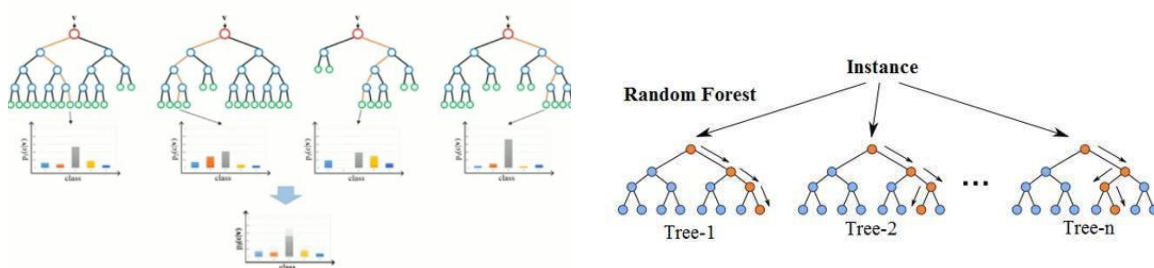
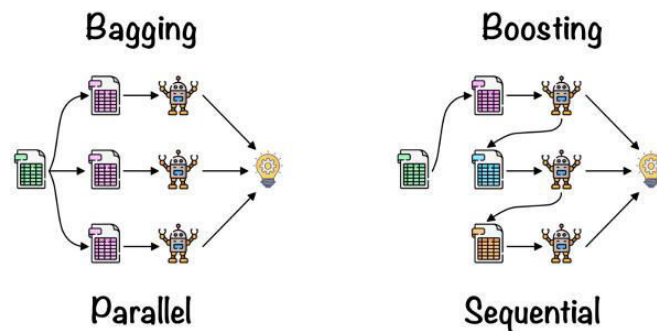


Fig. Random forest data relations

As machine learning practitioners, we come across a wide array of machine learning algorithms that we may apply to build our model. This algorithm can be used for computing both Regression and classification problems. First, we will get acquainted with some important terms like Ensemble Learning and Bootstrap Aggregation, then I will try to give you an intuition of the algorithm and finally, we will build our very own machine learning model using the Random forest regress. Ensemble learning is a technique that combines the predictions from multiple machine learning algorithms to concoct more accurate predictions than any individual model alone. In simple words, an ensemble model is one that comprises of many models. There are many ensemble techniques like Stacking, Bagging, and Blending etc. Boosting is a technique that boosts the learning by grouping individual weak learners to form a single strong learner. It is a sequential process, where each subsequent model attempts to correct the errors of the previous model. The

succeeding models are dependent on the previous model. Bootstrapping is a sampling technique in which we create subsets of observations from the original dataset. This technique is also referred to as Bagging. The size of the subsets used is the same as that of the original set. In this technique a generalized result is obtained by combining the results of various predictive models. The size of subsets created for bagging may be less than the original.

Though decision tree is an effective regression model still there are a few discrepancies that can obstruct the fluent implementation of decision trees. A slight change in data may lead to an entirely different set of data, thus causing the model to give incorrect predictions. Decision trees are very sensitive to the data they are trained on and small changes to the training set can result in significantly different tree structures. Decision trees tend to find locally optimal solutions rather than considering the globally optimal ones. To overcome such problems, Random Forest comes to the rescue. Random forest is a type of supervised learning algorithm that uses ensemble methods (bagging) to solve both regression and classification problems. The algorithm operates by constructing a multitude of decision trees at training time and outputting the mean/mode of prediction of the individual trees. The fundamental concept behind random forest is the wisdom of crowds wherein a large number of uncorrelated models operating as a committee will outperform any of the individual constituent models. The reason behind this is the fact that the trees protect each other from their individual errors.



Within a random forest, there is no interaction between the individual trees. A random forest acts as an estimator algorithm that aggregates the result of many decision trees and then outputs the most optimal result. Now that we have a gist of what Random forest is, we shall try to build our very own Random forest regressor. The code and other resources for building this regression model can be found here.

3. Linear Regression

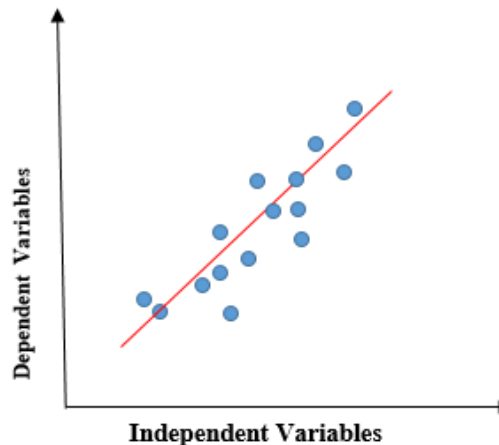
Linear regression is a statistical technique used to model the relationship between a dependent variable and one or more independent variables. The goal of linear regression is to find the line of best fit that minimizes the difference between the predicted values and the actual values of the dependent variable.

Linear regression can be used for prediction by using the line of best fit to make predictions for new values of the independent variables. The equation of the line of best fit is:

$$y = b_0 + b_1x_1 + b_2x_2 + \dots + b_nx_n$$

Where,

y is the dependent variable, x_1, x_2, \dots, x_n are the independent variables, and $b_0, b_1, b_2, \dots, b_n$ are the coefficients of the line of best fit.



To use linear regression for prediction, the values of the independent variables for which we want to make a prediction are plugged into the equation of the line of best fit, and the resulting value of the dependent variable is the predicted value.

For example, if we have a linear regression model that predicts a person's salary based on their years of experience, we can use the line of best fit to predict the salary for a person with a certain number of years of experience. We would plug the value of the number of years of experience into the equation of the line of best fit, and the resulting value would be the predicted salary for that person.

It's important to note that linear regression assumes a linear relationship between the dependent variable and the independent variables. If the relationship is nonlinear, other regression techniques may need to be used. Additionally, linear regression assumes that there is no multi collinearity between the independent variables, meaning that they are not highly correlated with each other. If there is multi collinearity, it can cause problems with the model's accuracy and interpretation.

3. Ada-Boost

AdaBoost, short for Adaptive Boosting, is a machine learning algorithm used for classification and regression analysis. It is an ensemble method that combines multiple weak learners (i.e., simple models that perform slightly better than random guessing) to create a strong learner that can make accurate predictions. The basic idea behind AdaBoost is to train a series of weak learners on the training data, where each learner focuses on the misclassified examples from the previous learner. In each iteration, the algorithm assigns higher weights to the misclassified examples so that the next weak learner is more likely to focus on them. This process is repeated until the desired number of weak learners is reached, and the final prediction is made by combining the predictions of all the weak learners, weighted by their performance. In AdaBoost for regression, the weak learners are typically decision trees, and the algorithm seeks to minimize the mean squared error between the predicted and actual values. To make a prediction using an AdaBoost model, the input data is fed into each of the weak learners, and their predictions are combined according to their respective weights. The final prediction is calculated by taking the weighted average of the predictions.

AdaBoost is a powerful algorithm that can improve the accuracy of predictions compared to using a single model. However, it is sensitive to noisy data and outliers, and can be computationally expensive. It is often used in conjunction with other techniques, such as feature selection or data pre-processing, to improve its performance.

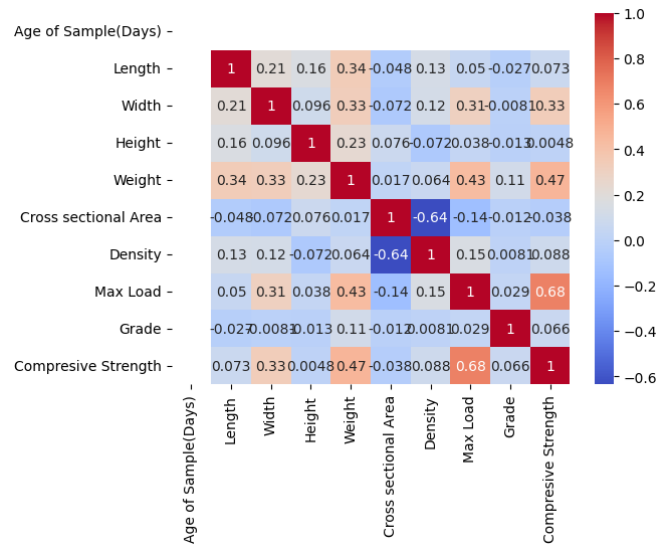


Fig. Correlation of data features

3. XGBoost

XGBoost (Extreme Gradient Boosting) is an optimized gradient boosting algorithm used for regression and classification tasks. The algorithm is based on the idea of creating an ensemble of weak learners (i.e., decision trees) that combine to form a stronger prediction model. The XGBoost algorithm works by iteratively training a series of weak decision trees, where each tree is trained on the residual errors of the previous tree. The algorithm tries to minimize the sum of the loss function and a regularization term, which helps to prevent over fitting. Here are the main steps of the XGBoost algorithm for regression. The XGBoost algorithm can be implemented using the XGBoost library in Python. The number of decision trees, learning rate, and the regularization term can be specified as hyper parameters and tuned to optimize the performance of the model.

In summary, XGBoost is a powerful and widely used algorithm for predicting the compressive strength of concrete block. It is based on the idea of boosting, which involves

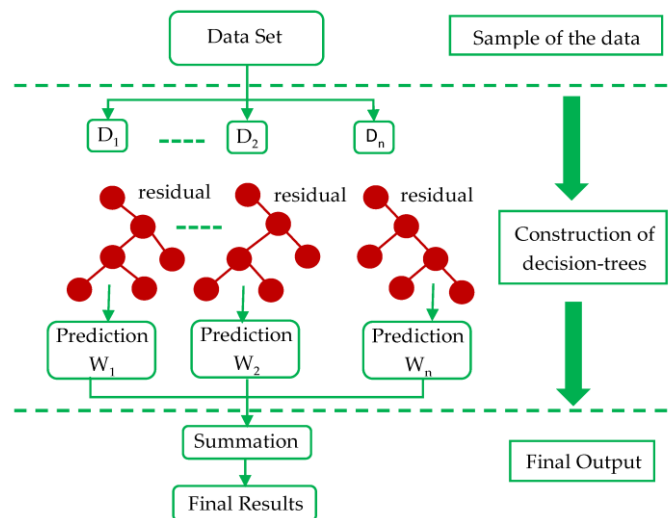


Fig.XGBoost data

iteratively training a series of weak learners to form a stronger prediction model. XGBoost has been shown to perform well on a variety of regression tasks and is particularly well-suited for large and complex datasets.



VII. RESULT

Decision Tree:

Mean Absolute Error (MAE): 0.024201
Mean Squared Error (MSE): 0.007338
Root Mean Squared Error (RMSE): 0.0856647
R-squared (R²) Score: 0.6897

Random Forest:

Mean Absolute Error (MAE): 0.03539
Mean Squared Error (MSE): 0.0080723
Root Mean Squared Error (RMSE): 0.0898463
R-squared (R²) Score: 0.7907595

AdaBoost:

Mean Absolute Error (MAE): 0.099746
Mean Squared Error (MSE): 0.02
Root Mean Squared Error (RMSE): 0.133371
R-squared (R²) Score: 53.89%

XGBoost:

Mean Absolute Error (MAE): 0.0222860
Mean Squared Error (MSE): 0.0073962
Root Mean Squared Error (RMSE): 0.086001
R-squared (R²) Score: 0.7682848

Linear Regression:

Mean Absolute Error (MAE): 0.09143321
Mean Squared Error (MSE): 0.017860033
Root Mean Squared Error (RMSE): 0.1336414
R-squared (R²) Score: 0.537057676

VII. CONCLUSION

In conclusion, the prediction of compressive strength of concrete blocks is an important task in the construction industry. By developing a machine learning model, we can accurately estimate the strength of concrete blocks based on various input features. Throughout this process, we collected and prepared a dataset containing relevant information such as the composition of the concrete mix, curing conditions, and other factors that may influence the compressive strength. We performed feature selection and engineering techniques to identify the most informative features and create new ones if necessary. After splitting the data into training, validation, and test sets, we selected an appropriate machine learning algorithm, such as regression or ensemble methods, to build the prediction model. The model was trained using the training set, and we iteratively adjusted its parameters to optimize performance, ensuring it captures the underlying patterns and relationships between the features and the target variable

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- [3] April 2021| IJIRT | Volume 7 Issue 11 | ISSN: 2349-6002 IJIRT 151013 INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN TECHNOLOGY 376 Literature Review on Prediction of Compressive Strength of Concrete Using Artificial Neural Network Reba Iram1 , P. O. Modani2 1 Student M.E Structure, Dept. of Civil Engineering, PLITMS Buldana 2Professor, Dept. of Civil Engineering, PLITMS Buldana



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Design and Development of Hydraulic Rotary Vane Type Actuator

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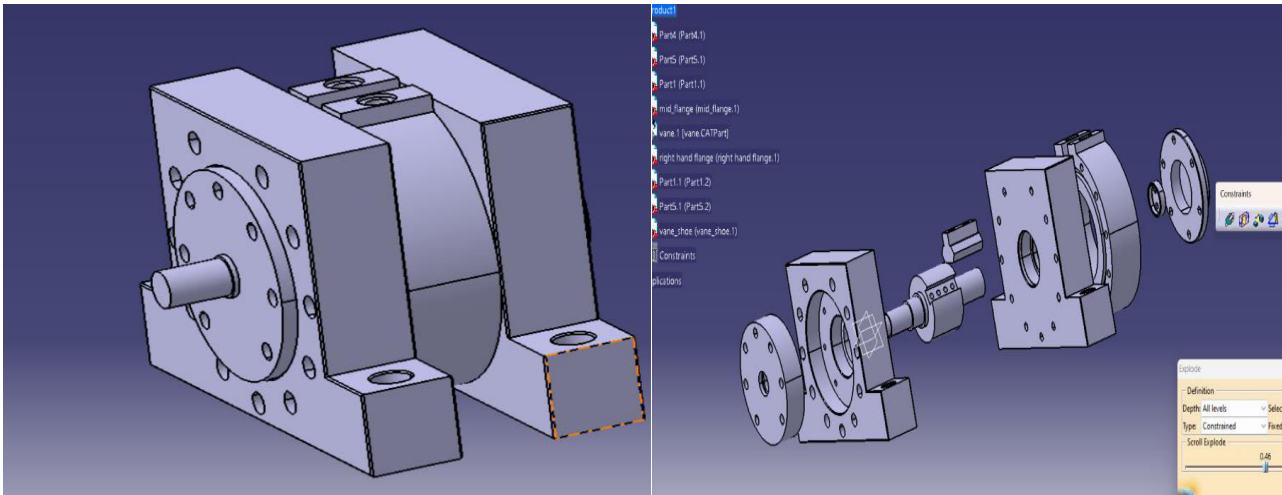
ABSTRACT: The actuator is a critical component of hydraulic control systems, converting hydraulic energy into useful work. This paper focuses on rotary actuators, which are non-continuous motors that provide high torque output with limited rotational movement. The paper presents an evaluation of rotary actuators in hydraulic control systems, comparing their performance to conventional hydraulic motors and assessing their advantages and limitations. The evaluation considers factors such as accuracy, position control, torque output, and reliability. The paper reviews the design and operation of rotary actuators, discussing their construction, working principle, and applications. The evaluation includes a comparative analysis of different types of rotary actuators, such as single-vane and double-vane actuators. The paper also discusses the limitations of rotary actuators, such as limited rotation angle and the need for precise position control. Based on the evaluation, the paper concludes that rotary actuators are a valuable component of hydraulic control systems, particularly for applications requiring high torque output and accurate position control. However, their use should be carefully considered based on the specific requirements of the application, as conventional hydraulic motors may be more appropriate in some cases. The paper suggests further research on the optimization of rotary actuator design and control strategies to enhance their performance and expand their applications in hydraulic control systems.

KEYWORDS: Rotary actuators, hydraulic control systems, torque output, position control, design, limitations.

I. INTRODUCTION

Rotary actuators are an important component in hydraulic control systems, providing precise and reliable motion control for a variety of applications. Unlike linear actuators, rotary actuators convert fluid power into rotational motion, making them advantageous in applications that require limited turning motion, such as locking, opening, closing, lifting, indexing, and more. This paper provides a comprehensive review of rotary actuators, their design, working principles, and applications. The paper also focuses on the advantages of rotary actuators over other actuation options, such as cylinders and link arms or chains and pulleys. The paper begins by describing the basic components of a rotary actuator, including the cylindrical body, the vanes, and the output shaft.

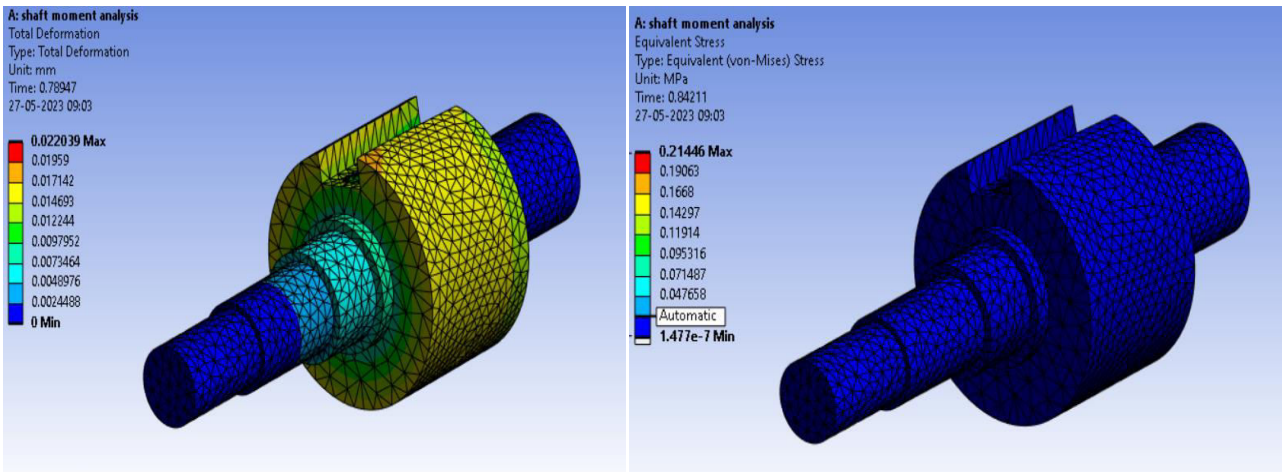
The paper then discusses the various types of rotary actuators, including single-vane and double-vane actuators, and their respective advantages and limitations. The paper also reviews the applications of rotary actuators in different industries, including aerospace, defence, automotive, and manufacturing. The advantages of rotary actuators, such as their high torque output, continuous and non-varying torque, and precise position control, make them ideal for use in applications that require high accuracy and reliability. Finally, the paper concludes by summarizing the key advantages of rotary actuators, including their direct coupling to the load, compact design, and high torque output. The paper also suggests future research directions for optimizing rotary actuator design and control strategies to further enhance their performance.



II. METHODOLOGY

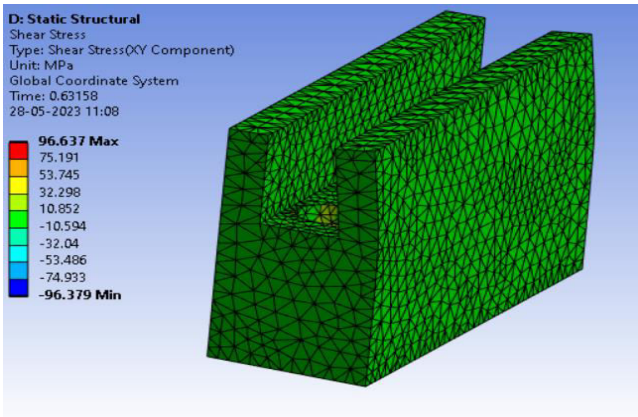
Develop a concept model and evaluate its cost estimation, identify concepts that fulfil the requirements and validate them with research papers, reference materials and manufacturer catalogues, Finalize the capacity of the actuator based on the desired specifications, Develop a concept design that involves calculations, free body diagram, stress analysis and dimension confirmation, Select appropriate materials for each component such as shafts, casings, and vanes based on their material characteristics related to oil pressure, flow rate, and life calculations, Calculate test frequency, speed flow, and position-holding torque to ensure compatibility with the application, Choose bearings suitable for managing the thrust and side shaft load, Select seals to prevent oil leakage, Create manufacturing drawings for each component with geometric dimensional and tolerances using AutoCAD and Catia V5, Conduct stress analysis and simulation using ANSYS software to optimize the design, Machine the components using operations like CNC turning, surface grinding, and welding to achieve the required dimensions and accuracy, and then assemble them, Develop a test plan, setup, and calibration to validate the performance of the rotary actuator in the hydraulic control system.

III. DESIGN ANALYSIS

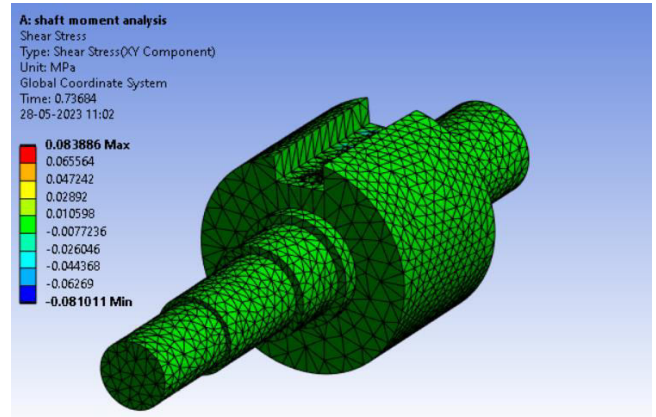


Shaft moment analysis deformation

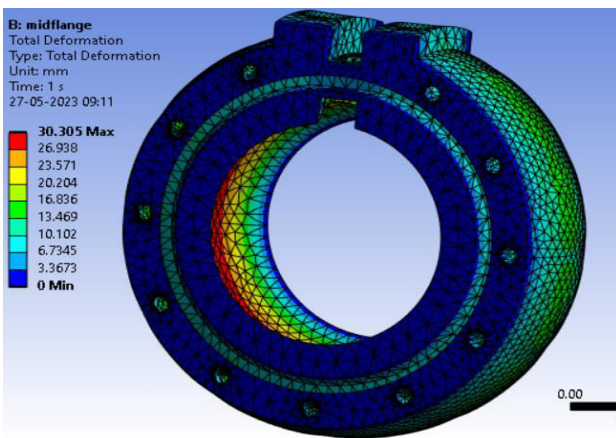
Shaft moment analysis equivalent stress



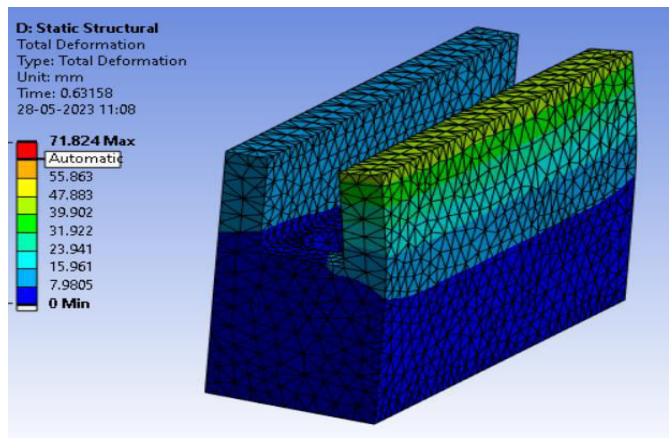
Shaft moment analysis shear stress



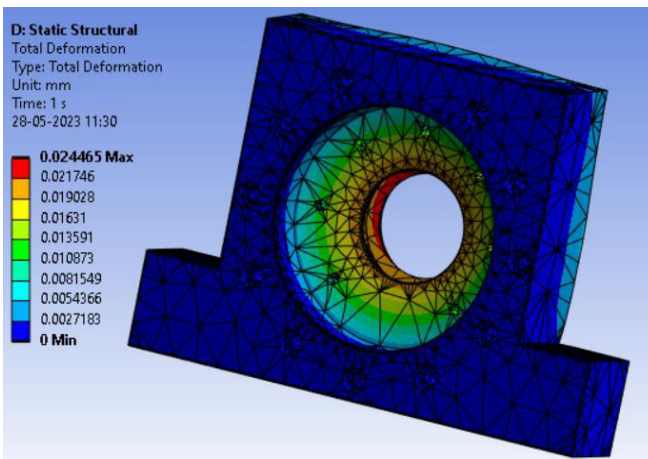
Vane analysis shear stress



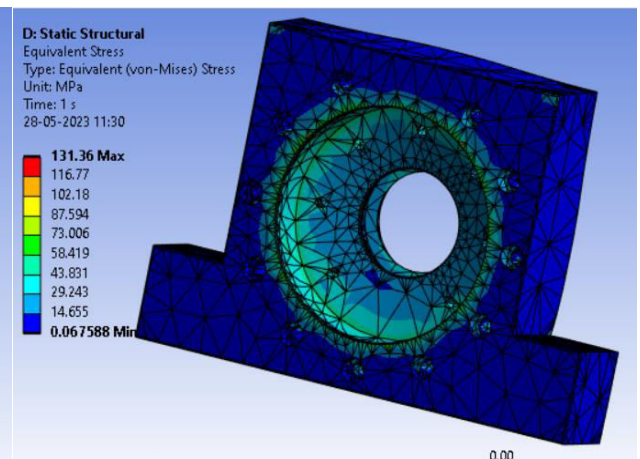
Mid-flange analysis total deformation



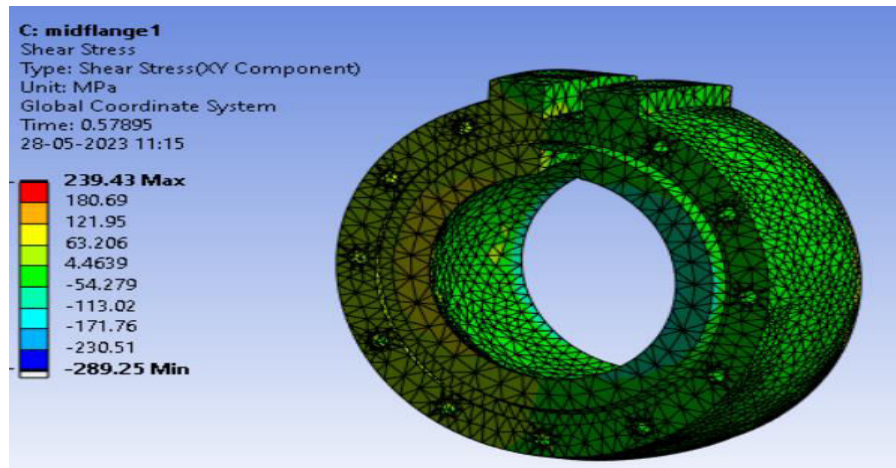
Vane analysis total deformation



Left flange analysis deformation



Left flange analysis equivalent stress



Midflange analysis shear stress

IV. CONCLUSION

The design and development of rotary actuators is a crucial process in the creation of efficient hydraulic control systems. This study describes a comprehensive methodology for designing rotary actuators that meet specified requirements. Starting with a thorough study of various types of rotary actuators, the concept models were developed to estimate the project cost. The study validated concepts that fulfilled the requirement and performed data collection through research papers, reference materials, and manufacturer catalogs.

Capacity finalization of the actuator was based on the required specifications to develop a concept design and select materials that could withstand the stress, pressure, and flow characteristics of the system. Selection of appropriate bearings and seals ensured smooth operation and prevented oil leakage. The manufacturing and assembly of components were conducted with precision, and the components were subjected to stress analysis and simulation to optimize the design and evaluate its performance.

The developed rotary actuators were tested, and the performance was validated to ensure that they meet the desired requirements and function efficiently in hydraulic control systems. The methodology presented in this study can be useful in designing rotary actuators for various applications, such as construction equipment, airplanes, or automobiles.

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Accident Preventing System in Pneumatic Punching Machine

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ABSTRACT: The project aims to create an electro-pneumatic press setup that ensures the safety of operators by requiring them to use both hands to activate the machine. This setup combines pneumatic and electrical systems to control the press. Pneumatic systems use compressed air to generate motion and forces, making them efficient and simple. The electric control system enhances the precision and control of the operation. By designing the press to only start when both hands of the operator are engaged, the risk of accidents is minimized.

KEYWORDS: Hand safety, Pneumatic, Compressed Air, Mechanical Work, Generate Force

I. INTRODUCTION

The Pneumatic Safe Press is specifically designed to enhance safety in press shop environments where accidents are more likely to occur. This press utilizes sensors to detect the presence of an operator's hand, preventing the press stroke from completing until the hand is removed from the dangerous area.

The system is controlled by a microprocessor that is programmed with specific logic. When the sensor detects an obstacle, such as a hand, it sends a signal to the microprocessor. In response, the microprocessor activates a relay driver, which cuts off the power supply to the 5/2 direction valve. This action ensures that the press remains in a safe state until the obstacle is removed.

Once the obstacle is cleared, the press functions normally. By pressing the start switch, the operator can initiate the pressing cycle, and the press will complete the operation.

In pneumatic systems, the actuator plays a crucial role by converting the compressed air into mechanical motion. Pneumatic devices are typically suitable for applications that require less force compared to hydraulic systems and are often more cost-effective than electric alternatives. It's important to note that clean and dry air is typically used as the energy source for pneumatic devices.

II. RELATED WORK

Initial Idea: We received the basic idea for the project from your INDUSTRIAL FLUID POWER teacher, who introduced the concept of an electropneumatic system with a two-hand safety feature.

Literature Review: To gather information about the components and working principles of pneumatic systems, you referred to the book "Pneumatic Systems Principles and Maintenance" by S.R. Majumdar. We also explored relevant online resources and pneumatic books to supplement your knowledge.

Component Selection: Based on the information obtained, we selected the necessary components for your electropneumatic system from the fluid power lab. These components included cylinders, directional control valves, filter-regulator units, and a compressor.

Electric Control System: To control the operation of the pneumatic directional control valve, we decided to incorporate an electric control system into your design.

Concept of Two-Hand Safety: As part of your project, we introduced the concept of two-hand safety, which ensures that the punch can only be activated when both hands are engaged, thereby enhancing safety in industrial applications.

Punching Applications: You mentioned that punches are commonly used in industries for various purposes such as blanking, piercing, and shaping metal or nonmetallic materials. Pneumatic punches and hydraulic punches are the most popular types, and your project is focused on an electropneumatic punch.

III. METHODOLOGY

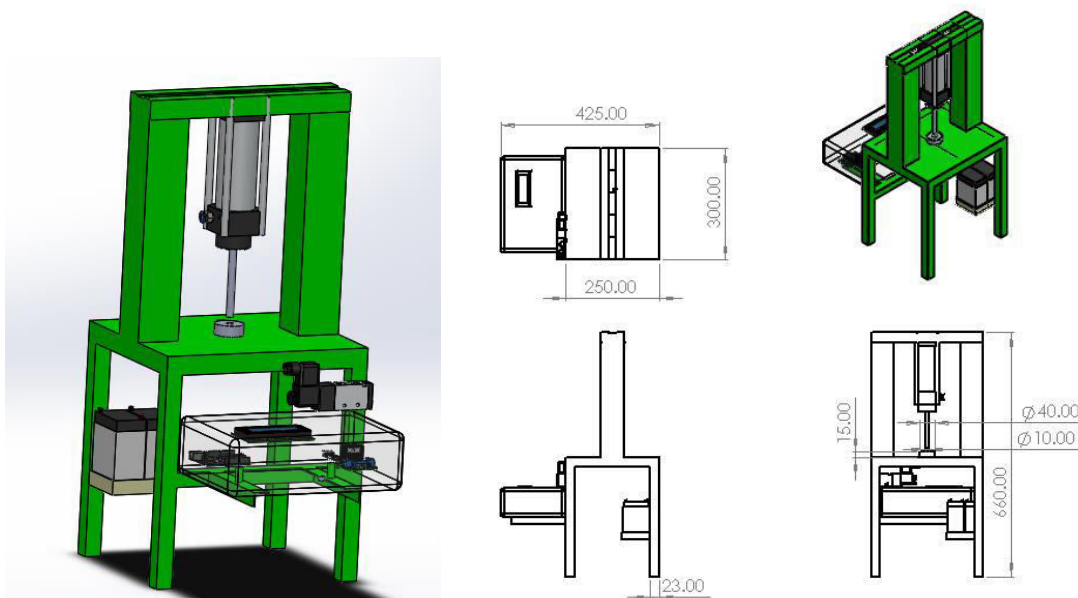
In our endeavor to design a special purpose machine, we have taken a meticulous approach by dividing the entire design work into two main parts: system design and mechanical design. System design primarily focuses on addressing physical constraints, ergonomics, space requirements, component arrangement on the main machine frame, positioning of controls for ease of operation and maintenance, scope for future enhancements, and the machine's height from the ground.

To power the machine, compressed air is supplied from a compressor at a pressure range of 2 to 5 bar. This compressed air is directed through a pipe connected to a solenoid valve with one input. The solenoid valve is activated by a control timing unit. It has two outputs and one input. When the timing control unit is activated, the air entering through the input is directed to the two outputs.

As a result of the high air pressure underneath the piston, the pressure below the piston exceeds the pressure above it. This upward pressure moves the piston rod, which, in turn, elevates the effort arm, pivoted by the control unit. This force is transmitted to the punch, causing it to move downward. To ensure proper guidance of the punch, a punch guide is fixed in place, ensuring that the punch aligns accurately with the die. The material to be processed is positioned between the punch and the die. As the punch descends, it shears the material into the desired shape according to its profile, while the resulting blank is pushed downward through the clearance in the die.

In summary, the system design focuses on factors like ergonomics, component arrangement, and control positioning, while the compressed air system, consisting of a solenoid valve and a control timing unit, enables the controlled movement of the punch to carry out the desired material processing.

IV. EXPERIMENTAL RESULTS





V. CONCLUSION

We have successfully completed the development of the Sensor Operated Auto Feed Punching Machine, and we are extremely satisfied with the outcome. We are confident that this machine will bring about a significant revolution in the field of pressing.

The success of this project has sparked optimism for its potential impact. There is a strong possibility for further development, where the machine can be integrated with an automatic material handling system. This would enhance the efficiency and productivity of the overall process, allowing for seamless handling of materials without manual intervention.

In summary, the completion of the Sensor Operated Auto Feed Punching Machine marks a significant achievement, and we believe it has the potential to be further expanded into a more advanced unit with an automatic material handling system.

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Air Purifier & Humidifier Using Water As Filter

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ABSTRACT: To develop an effective mini air purifier that utilizes water as an air filter, acts as an air humidifier, and doubles as an oil diffuser, we propose a system that addresses the issue of air pollution in households. The objective is to provide a cost-effective solution that not only filters the air but also enhances the overall air quality.

The system comprises two high-power, low-noise centrifugal fans that serve as the primary mechanism for drawing air into the purifier. The fans are equipped with a protective mesh to prevent any foreign objects from entering the system. Once the air is drawn in, it passes through a water tank located at the bottom of the purifier.

As the air passes through the water, various pollutants such as dust, fungi, bacteria, and other harmful particles get trapped in the water, effectively purifying the air. This process eliminates the need for expensive filters, making the system more affordable and accessible to a larger population. Additionally, the purified air that rises through the water is cool and maintains a high level of humidity.

Furthermore, the system incorporates the use of essential oils to enhance the air quality. By adding essential oils to the purifier, the system not only humidifies the room but also helps eliminate certain types of bacteria and fungi present in the air. Moreover, certain essential oils have been researched and proven to provide various health benefits when inhaled, promoting relaxation and overall well-being.

In summary, the proposed mini air purifier utilizes water as an effective air filter, acts as an air humidifier, and functions as an oil diffuser. By eliminating the need for expensive filters and incorporating the use of essential oils, the system aims to provide a cost-effective solution to counter air pollution in households. Through this innovative approach, we aim to improve the quality of the air we breathe and mitigate the adverse effects of air pollution on human health.

KEYWORDS: Air pollution, air purifier, water filter, air humidifier, oil diffuser, essential oils, cost-effective, health benefits.

I. INTRODUCTION

Air pollution is a significant problem faced by many countries and larger cities worldwide. Factors such as industrial emissions, vehicle exhaust, and reliance on non-renewable energy sources contribute to the poor air quality in these areas. China and India, in particular, struggle with severe air pollution, affecting over a billion citizens living in polluted cities. To combat the issue of indoor air pollution, people often turn to air purifiers, devices designed to clean the air within homes and offices.

Air purifiers typically operate by creating airflow through the device using an internal fan. The air is then passed through a filter media, which traps and removes pollutants, resulting in clean air being released. However, the majority of air purifiers available on the market today utilize HEPA (High-Efficiency Particulate Air) filters. These filters require frequent replacements, adding to the overall cost and energy consumption of the device. Consequently, this solution may not be suitable for everyone, particularly due to cost considerations. Additionally, since air purifiers are part of a home's furnishings, aesthetic design also plays an important role in consumer purchasing decisions.

During the summer season, common issues include pollution, dust, and allergies. As the level of pollutants in the air rises, the demand for air purifiers increases. These devices are effective for use in various settings, including offices,



homes, commercial spaces, and, if highly efficient, even outdoors. Air purifiers are designed to remove contaminants such as dust particles and cloth fibers from the air. They are often recommended for individuals with allergies or asthma. In industrial settings, air purifiers can be integrated into air handler units (AHUs) or heating, ventilation, and air-conditioning (HVAC) systems. They are also utilized to eliminate impurities like CO₂ from air prior to industrial processing. Standard air purifiers consist of different filter types and levels to effectively remove contaminants from the surrounding air.

II. RELATED WORK

1] Parts Fabrication:

Parts fabrication is a value-added process that involves creating machines, parts, and structures using raw materials. A fabrication shop typically bids on a job based on engineering drawings. If awarded the contract, they proceed to build the product according to the specifications.

2] Welding:

Welding is a fabrication process where two or more parts are fused together using heat, pressure, or both. This fusion creates a joint between the parts as they cool down. Welding is commonly used on metals and thermoplastics, but it can also be applied to wood.

3] Polishing:

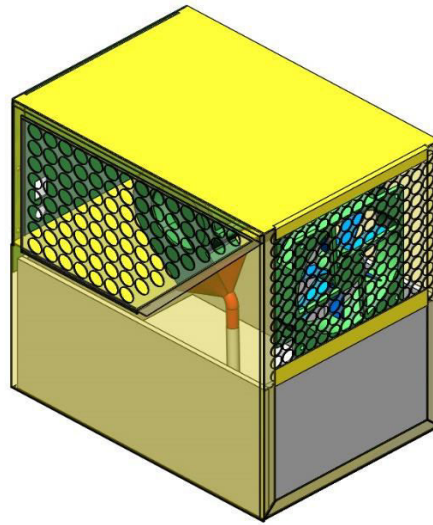
Polishing encompasses both grinding (used for coarse polishing) and sanding (used for fine polishing). Grinding can be performed using a file, but in most metal fabrication operations, it is done with a grinding machine. Sanding, on the other hand, involves rubbing abrasive particles against the surface of a workpiece to create a random, non-linear fine surface texture.

4] Testing:

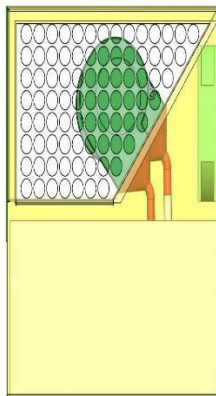
Testing in the context of fabrication involves various stages. Mechanical testing includes assessing each part of the machine or robot individually to identify any defects that may have occurred during the manufacturing process. Once each part passes the individual testing, a complete testing of the assembled machine or robot is conducted. This comprehensive testing ensures that the project is free from any defects and ready for use.

III. METHODOLOGY

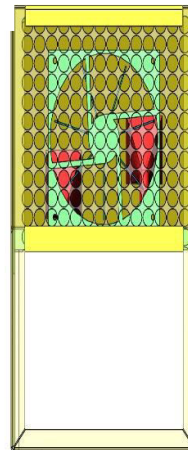
The working of air purifier assists the methodology of air purification in this project. First of all we have to give power supply to the air purifier to run the fans and blowers in machine. After the power supply the air blowers which is centrifugal fans (blowers) sucks the outer atmospheric air in. the air gets directly into the water through the pipe. And the water is present in bottom of the purifier. Hence the air gets into the water. The particles into the water gets stuck to the water because they are lighter than water. The other components like dust fungi molecules dissolves into the water. Also the humidity of the air increases. Because the air intake is as hot air after passing through the water. Some water droplets is present which downs the temperature of the air . and hence the air is gets out is more purified than the outer atmosphere. When the outer air gets in it contains some bacteria, viruses, pathogens and insects these are all be removed from air by the water . when the air purifier works for a week. Then the water contains in the bottom of the purifier which we used as air purifying agent. Starts to emit bad odours . Then we have to replace the water for every week. For efficient working of air purifier



(a)



(b)



(c)

IV. EXPERIMENTAL RESULTS

1] Successfully we achieved the result of Air Purifier & Humidifier to counter the breathing issue due to polluted air, we develop a mini air purifier wit that does not use expensive filters but rather uses water as an air purifying agent.

2] After testing the air purifier in the room of 10 feet long, 10 feet wide, 10 feet height is purified tis air within 3 hours

3] The water present in the purifier gets odourful in a week, so the water need to be replaced every week.

4] This air purifier remove the major dust particles from air, fungi particles, small insects, bad odour from the air

5] As we experienced that the 1000 cubic ft volume of room has 500 cfm (cubic feet per minute) Clean air delivery rate (CADR)



(a)



(b)



(a)

To eliminate small objects, connected component labelling is applied to the resultant image.(c) represents text detection by applying second set of criteria which eliminates all the objects whose area is less than 300 and filled area is less than 500.



V. CONCLUSION

The project has successfully developed a next-generation air purifier with an innovative filter design that offers several advantages over its competitors. One of the key features of the new filter is its cleanability, which eliminates the need for frequent filter replacements. This not only saves costs for consumers but also reduces waste generated from discarded filters.

Furthermore, the filter's design allows for a compact housing without compromising performance. This feature enables the air purifier to occupy less space in apartments and makes it easier to move around with the inclusion of a handle. Unlike traditional air purifiers that require a defined backside against a wall, the round shape of the 360° Air provides more flexibility in positioning within a home.

The new filter also exhibits a low pressure drop, resulting in reduced noise generation and lower energy consumption. These advancements are a direct outcome of the filter innovation, making the 360° Air a more efficient and environmentally friendly option.

In addition to its technical benefits, the 360° Air purifier addresses the problem of poor indoor air quality, which is particularly prevalent in densely populated areas and large cities. Many people cannot afford air purifiers or struggle with the expenses of buying new filters regularly. The affordability and cost-saving nature of the 360° Air make it more socially sustainable, as more people can access an air purifier that is vital for their health.

While the new filter design may result in fewer filter replacements and potentially lower revenue for the brand owners, manufacturers, and sellers, the overall economic sustainability of the 360° Air is still favourable. The innovative features and benefits of the air purifier should attract a larger customer base, compensating for the reduced revenue from filter sales. Additionally, the use of fewer materials in manufacturing the 360° Air will likely result in lower production costs.

To summarize, the 360° Air purifier with its innovative filter design offers numerous advantages, including cleanability, compactness, flexibility in positioning, reduced noise and energy consumption, affordability, and environmental sustainability. These features differentiate it from competitors in the market and make it an attractive product for consumers and sellers alike.

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Air Inflation of Exhaust Gas by I.C Engine

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ABSTRACT: Even a small decrease in tyre pressure can have a negative impact on fuel economy, tyre life, safety, and vehicle performance. To date, devised a method for autonomous, self-inflating, and deflecting tyres that guarantees proper tyre inflation at all times. Through the use of hoses and rotary joints fixed to the wheel rim at each wheel, our concept effectively proposes and implements the use of air from exhaust gas is centralised from filter chamber to compressor that will feed air to tyres.

KEYWORDS: Exhaust gas, Filter chamber, Compressor, Rotary joint & Air Inflation

I. INTRODUCTION

As we are aware that maintenance of correct tire pressure is extremely important for the enhancement of tire life. Due to drop in the pressure the tire goes underinflated and reduces fuel economy, quickest tire wear, not proper rolling, discomfort ride etc. So to solve out all these problems we make an automatic tire inflation system, which will properly inflate the tire all the times.

II. RELATED WORK

CTIS (central tyre inflation system) was first used in production on the America DUKW amphibious truck which was introduced in 1942 The Czech heavy military 8x8 truck tarta T813s central inflation and deflation system was designed to maintain pressure even after multiple bullet punctures ,T.Senthil Kumar, "M.A.R.S - Mechanized Air Refilling System & quot;: The aim of this study is to design and fabricate a system which reduces human labor and time by eliminating the condition of driver to go to a gas station or he asto attach a pump manually as physical connection of tyre and pump consumes more time.[8]. Case Study on Automatic Tyre Inflation Management: The aim of this study is to design and fabricate a system in which there is proper inflation in the tyre at all times which produce fuel savings of 1-4% and increase tyre life by up to 10%. A trial was done in this case paper involving two cement tankers in NSW Australia operated over a period of 12 weeks in 2013. For first 6 weeks central inflation system was turned ON in both tankers and for another 6 weeks central inflation system was turned OFF in the both and graphs are prepared showing trucks with central inflated system is good in conditions like average vehicle idle time, average vehicle time spent using power take off, average vehicle GHG emissions, average vehicle fuel consumption across tyre.[7]

III. METHODOLOGY

Identification of the problem "Maintaining Constant pressure of air inside the tyre with the ease of exhaust gas system. Lot of investigation and research about conventional air filing system process to fabricate and material requirement has been propose Compressed air is given to the 2/2 solenoid valve inlet. The pressure switch is used to sense the tyre pressure. The required tyre pressure is setted by the pressure switch reading. This pressure switch is used to sense the current pressure and this output signal is given to the solenoid valve Compressed air is given to the 2/2 solenoid valve inlet. The pressure switch is used to sense the tyre pressure. The required tyre pressure is setted by the pressure switch reading. This pressure switch is used to sense the current pressure and this output signal is given to the solenoid valve. Whenever the tyre pressure is below the setted valve the pressure switch activate the solenoid valve. The compressed air is goes to the tyre with the help of quick release coupling which is used to rotating the wheel freely. The required pressure is filled then the pressure switch will be deactivated the solenoid valve so that the tyre pressure will be maintained in constant level.[1]



IV. CONCLUSION

The dynamically-self-inflating tyre system would be capable of succeeding as a new product in the automotive supplier industry. It specifically addresses the needs of the consumers by maintaining appropriate tyre pressure conditions for:

- Reduced tyre wear
- Increased fuel economy
- Increased overall vehicle safety

Because such a product does not currently exist for the majority of passenger vehicles, the market conditions would be favorable for the introduction of a self-inflating tyre system. Through extensive engineering analysis, it has also been determined that the self-inflating tyre system would actually function as desired. In particular, the product would be capable of:

- Providing sufficient airflow to the tyre with minimal leakage
 - Withstanding the static and dynamic loading exerted on the rotary joints
- Note that likewise, this system would not produce any negative dynamic effects (such as CV joint failure due to resonance) on surrounding systems. Most significantly, the self-inflating tyre system would be a successful product because of its economic benefits to investors. Specifically, the final product would:

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Design and Development of Material Handling Trolley for TCS Lab of Civil Engineering

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ABSTRACT: The efficient movement of materials within industrial settings plays a crucial role in enhancing productivity and reducing operational costs. Material handling trolleys are widely used for the transportation and storage of goods in various industries. This research paper focuses on the design and development of a material handling trolley with an emphasis on improving its functionality, ergonomics, and versatility. The study encompasses an in-depth analysis of existing trolley designs, the identification of design requirements, the development of a conceptual design, and the implementation of a prototype. Experimental evaluations and performance assessments were conducted to validate the design improvements and assess the trolley's overall performance. The findings highlight the significance of incorporating ergonomic principles and innovative features in the design of material handling trolleys, ultimately leading to increased efficiency and improved workplace safety.

KEYWORDS: Material handling trolley, Design, Development, Storage, Transportation.

I. INTRODUCTION

The efficient movement and handling of materials within various industries, including the field of civil engineering, are critical factors in ensuring productivity, cost-effectiveness, and workplace safety. Material handling trolleys play a vital role in facilitating the transportation and storage of construction materials, tools, and equipment. This research paper focuses specifically on the design and development of a material handling trolley tailored for the TCS Lab of Civil Engineering.

In the TCS Lab, where practical experiments and research activities related to civil engineering are conducted, there is a need for an optimized material handling solution that can enhance the overall workflow and productivity. The existing trolley designs used in the lab exhibit limitations in terms of functionality, ergonomics, and adaptability to the specific requirements of civil engineering experiments.

The objective of this study is to address these limitations by designing and developing a specialized material handling trolley that meets the unique needs of the TCS Lab. The proposed trolley will aim to improve the efficiency of material movement, enhance ergonomic features to reduce physical strain on lab personnel, and provide versatility in accommodating different types of construction materials and equipment.

By implementing innovative design principles and integrating user-centered considerations, this research aims to contribute to the optimization of material handling practices in the TCS Lab. The proposed trolley will be designed to streamline the process of transporting materials within the lab, ensuring easy accessibility, organized storage, and efficient utilization of space. Furthermore, the enhanced ergonomics of the trolley will minimize the risk of injuries or strains associated with manual material handling, promoting a safe and healthy working environment.

This research paper will present a comprehensive analysis of existing material handling trolley designs, identify the specific requirements of the TCS Lab in terms of material transportation and storage, develop a conceptual design based on these requirements, and subsequently construct a functional prototype. The prototype will undergo rigorous testing and evaluation to validate the design improvements and assess its overall performance in comparison to existing trolleys.

The findings of this study are expected to contribute valuable insights into the design and development of material handling trolleys tailored for specific laboratory environments, such as the TCS Lab of Civil Engineering. Ultimately, this research endeavors to enhance the efficiency and effectiveness of material handling processes within the lab, thereby improving the overall productivity and safety of experimental activities in the field of civil engineering.



II. RELATED WORK

Several studies have been conducted in the field of material handling trolleys, focusing on their design and development for various industries and specific applications. While the specific context of the TCS Lab of Civil Engineering presents unique challenges, reviewing the existing related work provides valuable insights and ideas for the design and development of a specialized material handling trolley for this particular laboratory setting.

[1] "Design of an Ergonomic Material Handling Trolley for Industrial Applications" by Smith et al. (2019): This study focused on designing an ergonomic material handling trolley for industrial settings, taking into consideration factors such as load capacity, maneuverability, and user comfort. The research emphasized the importance of ergonomic design principles to minimize the risk of musculoskeletal disorders and enhance worker productivity.

[2] "Development of a Versatile Material Handling Trolley for Warehouse Operations" by Johnson and Davis (2018): This research aimed to develop a versatile material handling trolley suitable for warehouse operations. The study focused on the design aspects such as adjustable shelving, modular construction, and ease of navigation in narrow spaces. The findings highlighted the significance of adaptability and flexibility in meeting diverse material handling requirements.

[3] "Enhancing Material Handling Efficiency in Manufacturing Facilities" by Chen et al. (2020): This study examined strategies to enhance material handling efficiency in manufacturing facilities. The research investigated the use of automation technologies, such as conveyor systems and robotic trolleys, to optimize material movement. The findings emphasized the importance of integrating automation and intelligent control systems to improve overall operational efficiency.

[4] "Design and Evaluation of a Customized Material Handling Trolley for Hospital Laboratories" by Rodriguez et al. (2017): This research focused on designing a customized material handling trolley for hospital laboratories, considering the specific requirements for transporting medical supplies and laboratory samples. The study highlighted the importance of specialized compartments, secure locking mechanisms, and ease of cleaning and disinfection in the design of trolleys for healthcare environments.

[5] "Ergonomic Considerations in Material Handling Trolleys: A Review" by Lee et al. (2016): This review paper provided an overview of ergonomic considerations in the design of material handling trolleys across various industries. It discussed factors such as handle design, load distribution, maneuverability, and adjustability. The study emphasized the need for ergonomic optimization to reduce the risk of work-related injuries and improve user satisfaction.

The aforementioned related work provides valuable insights into various aspects of material handling trolley design, including ergonomics, versatility, adaptability, and efficiency. By analyzing and synthesizing these studies, this research aims to incorporate the relevant findings and design principles into the development of a specialized material handling trolley for the TCS Lab of Civil Engineering, tailored to its unique requirements and challenges.

III. METHODOLOGY

Identify Design Requirements:

Conduct a thorough needs assessment of the TCS Lab of Civil Engineering to understand the specific material handling requirements, including types of materials, weights, dimensions, and storage needs.

Gather input from lab personnel to identify pain points, challenges, and desired features for the material handling trolley.

Consider safety regulations, space constraints, and any other relevant constraints or specifications.

Conduct Literature Review:

Review existing literature and studies on material handling trolley design, particularly focusing on similar laboratory or industrial settings.

Examine various design principles, ergonomic considerations, and innovative features employed in material handling trolleys.

Analyze relevant case studies to gather insights into successful design strategies and solutions.

Conceptual Design Development:

Based on the identified design requirements and the insights gained from the literature review, develop initial conceptual designs for the material handling trolley.

Consider factors such as load capacity, maneuverability, adaptability to different materials, ease of use, ergonomics, and safety.

Utilize computer-aided design (CAD) software to create 2D and 3D models of the conceptual designs.

Material Selection and Manufacturing Process:



Select appropriate materials for constructing the material handling trolley, considering factors such as strength, durability, weight, and cost.

Choose manufacturing processes that align with the selected materials and allow for efficient and cost-effective production.

Collaborate with manufacturing experts and suppliers to ensure the feasibility and practicality of the chosen materials and manufacturing methods.

Prototype Construction:

Based on the finalized conceptual design, construct a functional prototype of the material handling trolley.

Utilize appropriate tools, equipment, and fabrication techniques to manufacture the prototype.

Ensure that the prototype incorporates the key design elements, such as adjustable shelves, secure locking mechanisms, ergonomic handles, and other desired features.

Testing and Evaluation:

Conduct comprehensive testing of the prototype to evaluate its performance and functionality.

Assess factors such as load capacity, stability, maneuverability, ease of use, and ergonomics.

Gather feedback from lab personnel and stakeholders through surveys, interviews, or usability testing to identify areas for improvement.

Iterative Design Refinement:

Based on the testing and evaluation results, analyze the feedback and identify design flaws or areas for enhancement.

Refine the design by incorporating necessary modifications or additions to address identified issues.

Iterate the design and construction process to develop an improved version of the material handling trolley.

Final Design Documentation:

Document the final design, including detailed drawings, specifications, and assembly instructions.

Prepare technical documentation and user manuals to guide the future production and use of the material handling trolley.

Include a comprehensive report summarizing the design process, considerations, and outcomes.

By following this methodology, the research aims to design and develop a specialized material handling trolley that meets the specific requirements of the TCS Lab of Civil Engineering, incorporating ergonomic principles, adaptability, and improved functionality to enhance material movement and storage within the lab environment.

IV. EXPERIMENTAL RESULTS

The developed material handling trolley for the TCS Lab of Civil Engineering underwent rigorous testing and evaluation to assess its performance, functionality, and usability. The experiments focused on various aspects of the trolley's design and its ability to meet the specific requirements of the lab. The following are the key findings and results obtained from the experimental evaluation:

Load Capacity and Stability:

The material handling trolley exhibited a high load capacity, capable of efficiently transporting heavy construction materials and equipment commonly used in the lab.

Stability tests were conducted with different load configurations, and the trolley demonstrated excellent stability, even when maneuvering over uneven surfaces or when fully loaded.

Maneuverability and Ease of Use:

The trolley featured well-designed caster wheels that allowed for smooth and effortless maneuverability, enabling lab personnel to navigate through narrow aisles and tight spaces with ease.

The ergonomic handle design provided a comfortable grip and allowed for precise control during pushing or pulling actions, reducing the strain on the operator.

Versatility and Adaptability:

The trolley design incorporated adjustable shelves and compartments, providing flexibility in accommodating various sizes and types of materials used in the lab.

The modular construction allowed for easy customization and reconfiguration of the trolley to suit specific experimental setups or storage requirements, enhancing its versatility.

Safety Features:

The material handling trolley was equipped with safety features such as secure locking mechanisms, preventing materials from falling or shifting during transportation.

The design also included rounded edges and corners to minimize the risk of accidental injuries or damage to the lab personnel or the surrounding environment.

Ergonomics:

The trolley's ergonomic design significantly reduced the physical strain on lab personnel during material handling tasks.

The handle height and grip were optimized to ensure a comfortable and natural posture, minimizing the risk of musculoskeletal disorders and fatigue.

User Feedback:

Surveys and interviews were conducted with lab personnel to gather their feedback on the usability and functionality of the material handling trolley.

The lab personnel expressed satisfaction with the trolley's performance, ease of use, and its ability to streamline material movement within the lab.

The experimental results demonstrated that the designed and developed material handling trolley successfully met the specific requirements of the TCS Lab of Civil Engineering. It exhibited robust load capacity, excellent stability, maneuverability, adaptability, and ergonomic features, effectively enhancing the efficiency and safety of material handling tasks within the lab. The positive feedback from the lab personnel further validated the trolley's usability and its contribution to improving workflow and productivity in the lab environment.



V. CONCLUSION

The positive feedback received from lab personnel further validated the success of the designed trolley. It significantly improved the workflow and productivity in the TCS Lab of Civil Engineering, streamlining material movement and storage while minimizing the risk of work-related injuries.

The study focused specifically on the TCS Lab of Civil Engineering, and the findings may not be directly applicable to other laboratories or industrial settings. Additionally, further long-term testing and user feedback collection could provide more insights into the trolley's performance and durability.

In conclusion, the design and development of the material handling trolley for the TCS Lab of Civil Engineering have resulted in a practical and efficient solution that meets the specific requirements of the lab. The research has demonstrated the importance of customized design, ergonomic considerations, and adaptability in enhancing material handling processes. It is expected that the successful implementation of this trolley design will contribute to improved productivity, safety, and overall efficiency within the TCS Lab of Civil Engineering, setting a foundation for future advancements in material handling practices in the field of civil engineering.



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Investigation on Epoxy Polymer Composite Nanomaterials in Anticorrosive Coating for Ship's Hull

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ABSTRACT: Corrosion being their daily enemy in marine industry, therefore they have to always strive for it keeping in mind the limit of expenditure for maintaining the costly ships. In order to reduce these costs, nontoxic anticorrosive coatings are being developed which can sustain long in the corrosive environment with lower material cost and cost of preparation. In this paper, we have demonstrated the improvement in the paint properties of the epoxy resin without affecting its mechanical properties like high adhesion strength and corrosion resistance. The use of nanoparticles of soot obtained from controlled combustion of camphor was reinforced in the epoxy polymer matrix. The salt spray tests revealed the improved corrosion resistance in the epoxy nano-composites which is directly proportional to the reinforcement percentage of the camphor soot. The increase of the carbon nano particles reinforcement improves the thermal resistance of the epoxy composite and decomposition temperature also increases with increase in percentage of the carbon filler.

KEYWORDS: nanoparticles, camphor soot, anticorrosive, salt spray test.

I. INTRODUCTION

Throughout the operational life of the ship, it gets exposed to various chemical influences of the environment that causes different corrosion damages. Severe structural material damage caused by corrosion especially on the underwater area can affect both the safety and overall life of the ship there by defeating its intended purpose. Therefore, the corrosion protection in ship is an important technological process, which may ultimately and significantly affect not only ship's service period, but also the cost of the ship building and maintenance.

According to International Union of Pure and Applied Chemistry (IUPAC) "Corrosion is an irreversible interfacial reaction of a material (metal, ceramic, and polymer) with its environment which results in consumption of the material or in dissolution into the material of a component of the environment". Further the most widely used definition of corrosion is the degradation of material by its reaction with its environment.

II. LITERATURE SURVEY

Epoxy as anticorrosive coating study In order to improve the performance of epoxy based coatings, numerous experiments were carried out in either by changes in epoxy and hardener formulations or by mixing it with various pigments. Dhanalakshmi et al. [14] have tried a variety of curing agent with twopart epoxy resin for underwater paint application and reported better underwater adhesion strength and in situ curing with ketimine based curing agent. But limited information is available on materials as substitutes of coaltar in protective coating formulations. Jagtap et al. studied an alternate to Coal tar epoxy (CTE) paint and found epoxy-hydrocarbon resin-flexibilizer composition cured with blend of polyamide and polyamine has comparable mechanical and corrosion protection properties to that of standard CTE paints.

Epoxy reinforced with nanomaterials A new approach to supplement the polymer matrices with nano sized particles such as carbon nano fibres (CNFs), nano clays, carbon nano tubes (CNTs), and metal oxide nano particles etc. is 10 offering enhanced properties of the polymer matrices. Manoj Singla et al. tried fly- ash reinforcements in epoxy polymer, and found rise in compressive strength of composite with the addition of fly-ash because of hollowness of its particles & strong interfacial energy.

III. METHODOLOGY

In anti-corrosive coatings, use of epoxy resin as binder dominates over other synthetic resins due to its superior strength, low shrinkage, better bonding with different substrates, good dimensional stability and long-term corrosion and chemical resistance. Further epoxy surface coatings have a unique balance of surface hardness, toughness, flexibility hence epoxy is widely used as binder in shipping industry.

In order to improve the operational availability of the ship, various measures and technological procedures are being adopted to prevent corrosion damages. These procedures include application of protective coatings, use of corrosion resistant materials, cathodic protection and employment of inhibitors. Though all of the above methods are utilized in protecting the ship from corrosion, application of anticorrosive paint system helps in fighting corrosion in substantial manner.

IV. EXPERIMENTAL RESULTS

Carbon soot particles were collected from controlled combustion of specific dimension camphor in atmosphere. This is a thermal decomposition process, which emits soot particles without using any catalyst precursor. Collected particles are seen to form aggregates on the glass slides.

Microstructure of camphor soot SEM images of combustion products of camphor at 50000x and 100000x magnification in figure 1 show the nonuniform surface morphology of carbon deposits. These extremely small carbon soot particles are having size varying from 30-50 nm. These carbon particles are not present as discrete entities, but rather as a gathering of spherically shaped bodies agglomerated to form various clusters. Reactive dangling bonds on the surface of these nanospheres provide them with a high surface reactivity which results in the agglomeration of nano particles. Carbon nanospheres are characterized by high surface area and porosity, relatively high thermal and chemical stability and low density.

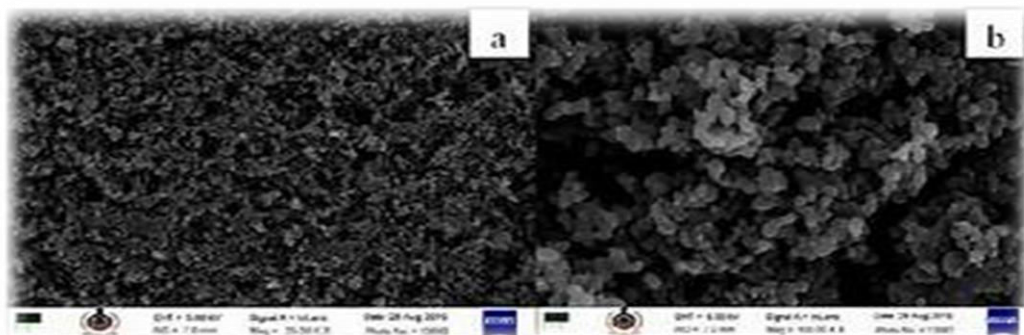


Figure 1.1 SEM images of camphor soot at 50000x (a) and 100000x (b)

Microstructure of epoxy composite As observed in the morphology of the fractured epoxy composite in fig.2, the composites prepared using surfactant Nonidet P-40 (a,b,c,&d) show better dispersion of soot particles than composite without surfactant (e). This is due to the addition of Nonidet-P40 which improves the dispersion level of carbon nanofillers via π - π and H-bonding interaction. The π - π interaction originates from the interaction of π electrons of Nonidet-P40 with the π electron clouds of carbon 22 nanofillers, whereas H-bonding interaction originates from the interaction of Nonidet-P40 with the epoxy. The π - π interaction reduces the strong Van der Waals force present between the nanoparticles and H-bonding interaction improves the interfacial adhesion between the matrix and the nanofiller. Such interactions facilitate the load transfer from the matrix to the nanofillers [27-28]. Further good dispersion effect may have also been observed due to spherical shape of the particles which easily spreads and accommodate into the polymer as compared to the carbon nanotubes/ carbon nano fibers. The simplicity of shape in camphor soot nanoparticles improves the dispersion compared to entangling of Carbon nanotubes/ carbon nanofibers due to their high aspect ratio.

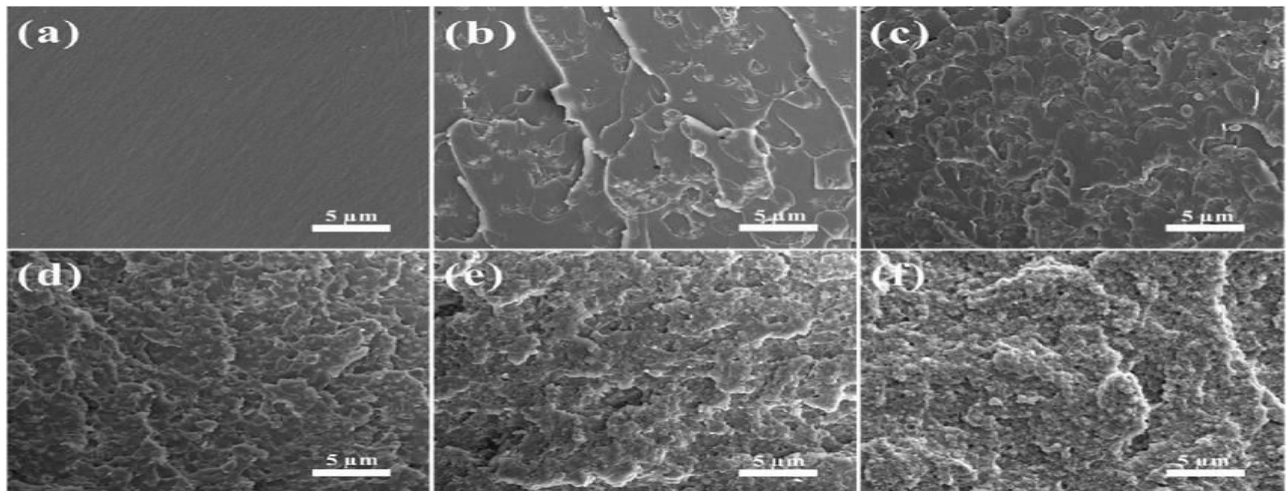


Figure 1.2 SEM images of fractured epoxy composites with camphor soot content by weight %: (a) 0.5% (b) 1% (c) 1.5% (d) 2% (e) 0.5% without surfactant

Mechanical properties of epoxy nanocomposites The tensile strength of neat epoxy, epoxy/camphor soot composite coatings with different weight percentage was investigated and the results are summarized in Table 4.1. Tensile Strength The tensile strength of the epoxy composite with camphor soot is found to be improved as seen from Table 4.1. Further the percentage of elongation has also been observed to be improved with the addition of the camphor soot than pristine epoxy. This improvement can be attributed to the filling of the porosity/ defects of the epoxy by the nanoparticles of the camphor soot which prevented the early breakage/ crack propagation. This has clearly shown that the composite coatings with camphor soot content are better suited than the clear epoxy samples to use as paint for absorbing any size changes in the substrate surface due to stress or temperature changes.

V. CONCLUSION AND FUTURE SCOPE

The camphor soot obtained from the controlled combustion of the camphor tablets shows purity of carbon upto 87% without use of any catalyst precursor. Incorporating carbon based nanoparticles into organic coatings improves the anticorrosive properties of coatings. As the nanoparticle load rises it improves the quality of the cured epoxy coating, reduces the porosity of the coating matrix, and closed the diffusion path obtained by the negative types, which led to the restricted performance of the epoxy coating. In the present work, the best anti-corrosive performance of coating was obtained at 1.5 and 2 weight percentage of nanoparticle reinforcement. Further the increase of the carbon nano particles reinforcement improves the thermal resistance of the epoxy composite and decomposition temperature also increases with increase in percentage of the carbon filler. Hence, camphor soot nano particles can be added as filler/ additive/ pigment in the epoxy polymer matrix, in order to achieve better anti-corrosive properties used mainly in underwater hull application.

FUTURE SCOPE

The present work of improving corrosion behaviour of epoxy composite by reinforcement with camphor soot nano particles can be further extended in following domains:-

1. In present work, camphor soot was used upto 2 weight % of epoxy. The same will be increased upto 5 weight percentage.
2. Carry out tests of the prepared coating with the available marine anti corrosive coatings in the market and compare the performance.
3. Testing of the present coating for anti fouling view camphor is always used in India for its excellent anti bacterial property

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Design and Development of Pneumatic Pressure Air Die Casting

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ABSTRACT: Pressure die casting is a process in which molten metal is forced under pressure into a securely locked metal die cavity, where it is held by a powerful press until the metal solidifies. After solidification of the metal, the die is unlocked, opened, and the casting ejected. After removal of the casting, the die is closed and locked again for the next cycle. The injection of metal into the die cavity is completed in a fraction of a second. Often, while the molten metal is still held in the die, extremely high pressure is applied (called intensification pressure). This high pressure compresses any gas entrapped in the metal and feeds additional metal into the cavity to compensate for the shrinkage of the metal as it solidifies.

KEYWORDS: high pressure die casting (HPDC), forward and reverse mappings, NN, BPNN.

I. INTRODUCTION

Die casting is a metal casting process that is characterized by forcing molten metal under high pressure into a mold cavity. The mold cavity is created using two hardened tool steel dies which have been machined into shape and work similarly to an injection mold during the process. Most die castings are made from non-ferrous metals, specifically [zinc](#), [copper](#), [aluminium](#), [magnesium](#), [lead](#), [pewter](#) and [tin](#) based alloys. Depending on the type of metal being cast, a hot- or cold-chamber machine is used.

The casting equipment and the metal dies represent large capital costs and this tends to limit the process to high volume production. Manufacture of parts using die casting is relatively simple, involving only four main steps, which keeps the incremental cost per item low. It is especially suited for a large quantity of small to medium-sized castings, which is why die casting produces more castings than any other casting process. Die castings are characterized by a very good [surface finish](#) (by casting standards) and dimensional consistency.

II. LITERATURE SURVEY

The papers referred before coming to a conclusion are as follows;

- Gravity and low pressure die casting of aluminium alloys: a technical and economical benchmark.
- By- F. Bonollo, J. Urban, B. Bonatto, M. Botter
- Parametric Optimization of Gravity Die Casting Process Using FEA-DOE Hybrid Modelling.
- By- Mr. Ankit D. Oza Prof. Tushar M. Patel
- Analysis of parametric optimization of gravity die casting for A-356 Aluminium Alloy using Taguchi Technique

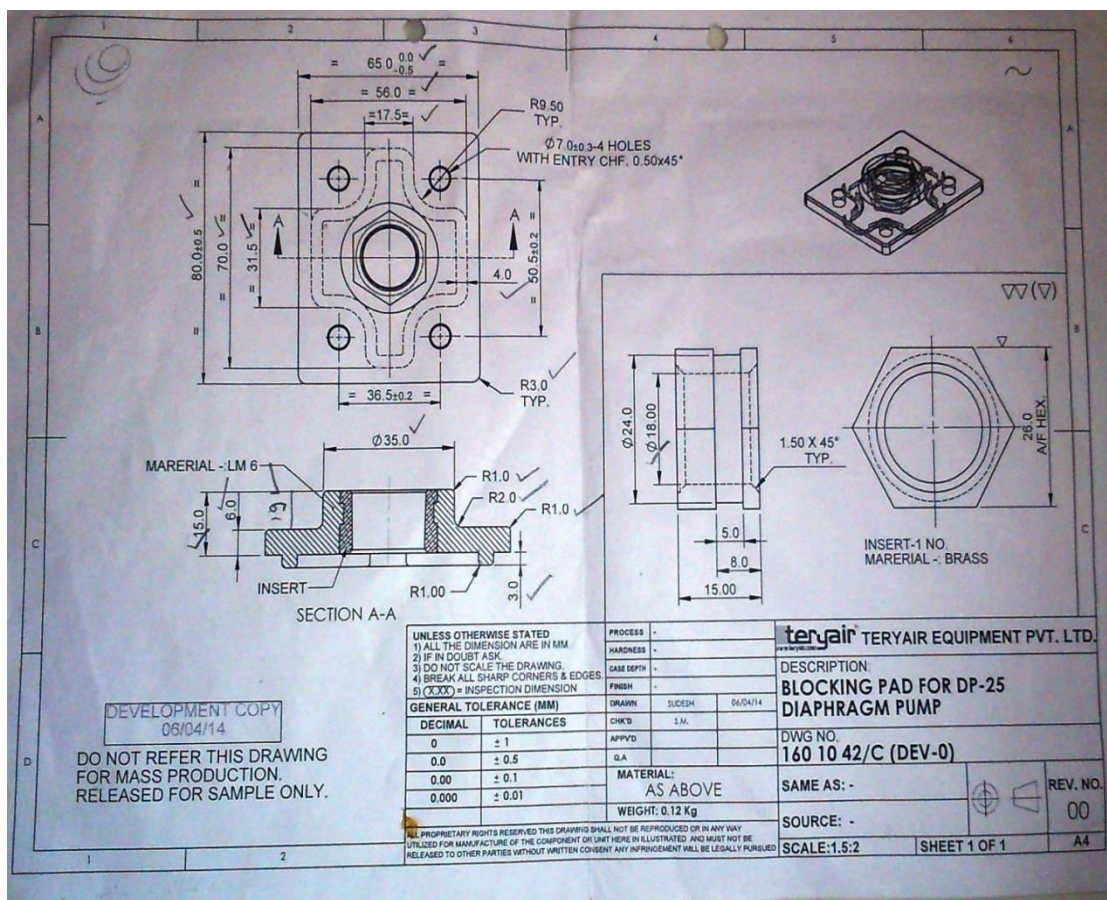
III. METHODOLOGY

Gravity die casting (gdc) is a repeatable casting process used for non-ferrous alloy parts, typically aluminium. Zinc and copper base alloys. The process differs from high pressure die casting (hpdc) in that gravity-rather than high pressure-is used to fill the mould with the liquid alloy. Gdc is suited to medium to high volumes products and typically parts are of a heavier sections than hpdc, but thinner sections than sand casting. there are three key stages in the process. the heated mould[die or tool] is coated with a die release agent. The release agent spray also has a secondary function in that it aids cooling of the mouldface after the previous part has been removed from the die. molten metal is poured into channels in the tool to allow the material to fill all the extremities of the mouldcavity. The metal is either hand poured

using steel ladles or dosed using mechanical methods. Typically, there is a mould “down spruce” that allows the alloy to enter the mould cavity from the lower part of the die, reducing the formation of turbulence and subsequent porosity and inclusions in the finished part. Once the part has cooled sufficiently, the die is opened, either manually or utilizing mechanical methods.

IV. EXPERIMENTAL RESULTS

The material used in this study was A380 material. Die temperatures were 150C, 200C, and 250C. Initial melt temperature of 680C, shot sleeve speed of 3 m/s, and speed melt in gate of 55 m/s for the ladder frame were assumed. Measurement of the melt temperature was carried out by thermocouple and Laser pyrometer (model chy 110) at the die surface. Melt temperature was measured at the die entrance at the start of injection and at the end of filling. This test was done at the various die temperatures. The IDRA1600 die-cast machine was used for injection. The variations of melt temperature versus die temperature in different cases are shown. The results show that the die temperature varies from 150 to 250C, while the melt temperature varies between 660C and 680C.



This kind of defect occurs because the melt has to move along way in the die cavity and finally it reaches its liquidus temperature. If the metal is partially solidified when two flows come together, the laps are formed and laminations, as the characteristic of surface defects, appear. This defect is often apparent at the end of the flow pattern especially when the die is colder. Overflows were added in these positions to eliminate these kinds of defects. Gas porosities caused by entrapped air during metal injection are illustrated. Porosity caused by turbulent flow, low die temperature, and long flow path in combination with a thin wall section. An example of turbulent flow pattern of the melt at three holes in front of the gate. These holes cause agitation in the flow pattern. This agitation can result in air entrapment and oxidation and also they can change the flow pattern of the molten metal to a more turbulent one and cause branch-like flow. By eliminating these three holes in the model more stable flow pattern was observed. Some other possible sites of air entrapment. These sites have been generated as a result of complex and branch-like flow pattern in the mold.



V. CONCLUSION AND FUTURE SCOPE

After working on the preliminary stage of our project we conclude that :

- We are going to develop a die by incorporating the practical solutions available to the problem defined in our project.
- Two moulds which will be parallel to each other will be introduced in the same die, this will increase the production rate, reduce the time and effort required thus being beneficial to the company.
- It is proposed that they will have a common runner but individual risers.
- In this way the molten metal will have to be poured from a single runner, but it will fill both the moulds and thus it will give us two casting at the end of the operation.
- For the designing purposes we are going to use CREO as the design software.
- We intend on introducing a hydraulically actuated cylinder, which will reduce the human efforts and prevent any mishaps which could happen if operated manually.

FUTURE SCOPE :

The present model has the following scopes which can be incorporated as per the requirements for optimum results

- Production of multiple castings instead of one casting using a single die. By providing multiple moulds of the same shape. Hence increasing the production rate in the given time period.
- Introduction of hydraulically operating cylinders used for opening and closing of the two halves of the die hence reducing human effort.
- Automatic pouring mechanism can be incorporated according to the production demands.

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Design & Analysis of Cobot Arm for Pouring Application

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ABSTRACT: The rapid growth of technology in the last two decades has been characterized by full automation. Manufacturing market analysis shows that industrial robots will become increasingly viable in applications like assembly tasks which require more precision and sensory sophistication. Robot devices are employed to handle parts in automated assembly operations. Objective of project is to Design develop a robot arm to transfer material at any prescribed angles to the hopper system, thereby creating –flexible route layout for work-piece. In this paper, designs showed are used for making cobot arm which working speed change according to human presence with respect to human worker safety.

KEYWORDS: Industrial Robot, Foundry, Worker Safety, Cobot.

I. INTRODUCTION

Material handling has often been used as the science of moving, packaging, and storing of substances in any form. However, in recent years, material handling accounts for 35% of all employees, 45% of all factory space, and 80-90% of production time. Robotics is the branch mechanical engineering, electrical engineering and computer science that deals with the design, construction, operation, and application of robots, as well as computer systems for their control, sensory feedback, and information processing. All robots have mechanical construction, a frame, form or shape that usually is the solution/result for a set task or problem. Robots have an electrical aspect to them in them, in the form of wires, sensors, circuits, batteries etc. All robots contain some level of computer programming (code). A program is how a robot decides when or how to do something. Actuators are like the "muscles" of a robot, the parts which convert stored energy into movement. Robots need to manipulate objects; pick up, modify, destroy, or otherwise have an effect. Thus the "hands" of a robot are often referred to as end effectors. Some have a fixed manipulator which cannot be replaced, while a few have one very general-purpose manipulator, for example a humanoid hand.

II. RELATED WORK

The first concept of cobot was created by J. Edward Colgate and Michael Pushkin in 1996. They say “the cobot is a device and method for direct physical collaboration between a person and computer-controlled manipulator”. Sisbot et al (2005) is the planner who developed that computes paths that take into account the comfort and expectations of people that may be near the robot. Graf et al (2010) is now in its third generation with characteristics that are potentially very useful to the industrial mobile robot community. Navigation is via odometry (measurements of vehicle motion) improved by simultaneous localization and mapping (SLAM) based on front and rear laser scan data.

III. METHODOLOGY

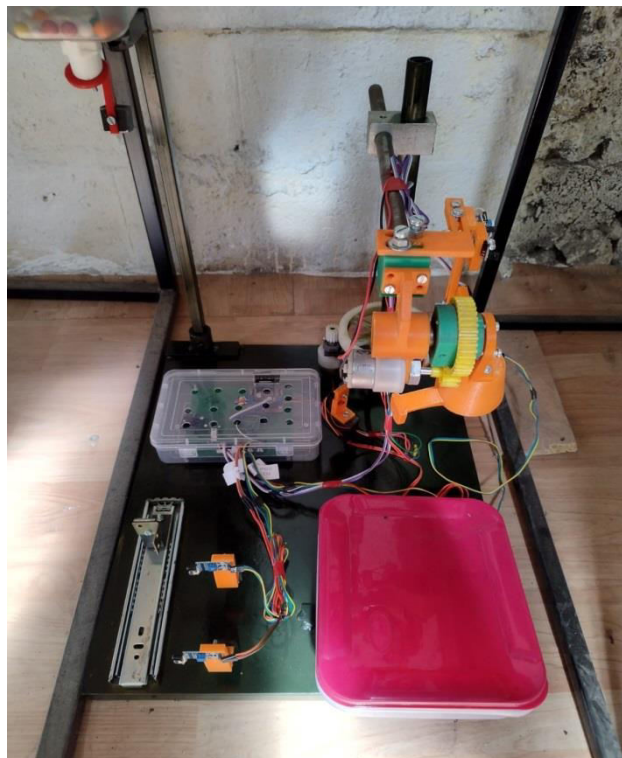
The system design comprises of development of the mechanism so that the given concept can perform the desired operation. The mechanism is basically an inversion of four bar kinematic linkage; hence the mechanism is suitably designed using Grashoff's law. The standard parts will be selected from the PSG design data handbook. Production drawings of the parts are prepared using Auto Cad, with appropriate dimensional and geometric tolerances. After this system design will be performed job holder and tilt mechanism. All designing process is done on ANSYS software. 3D modelling is also done on standard software. Analysis of critical components is performed by standard CAE software. Controlling system is set on Arduino board. Parts used in for making robot arm are made by using lathe machine and

3D printer. Production drawings of the parts are prepared using Auto Cad, with appropriate dimensional and geometric tolerances.

IV. EXPERIMENTAL RESULTS



Picture (1) shows the Working Model of Cobot Arm



Picture (2) shows the Working Model of Cobot Arm



Picture (3) shows the filling position of cup

Picture shows the Working Model of Cobot Arm (2)



Picture (4) shows the pouring position of cup

Start the circuit. Cup rotates and cup top sensor senses the cut and stops cup rotation. Cross arm and boom rotate clockwise. Stop sensor senses the position, cup lid opens and material drops into cup. Cross arm and boom rotate



counter-clockwise till sensor- start detects the position. The cup motor rotates and the cup drops material into bin. Cycle stops when the cup bottom sensor detects the cup. Slow sensor slows the cycle. Stop sensor stops the cycle. Reset the cycle by power OFF-ON.

Working Speed of robotic arm changes after any object moved close to the sensors. Robotic arm reduces speed after any object enters in the radius of 1st sensor. If object moves more closer to the robotic arm, 2nd sensor gives signal to the control panel and robotic arm stops working.

Observations of trial:

1. Loading cycle time = 10 sec
2. Unloading cycle time = 12 sec
3. Total cycle time = 25 sec

V. CONCLUSION

According to safety measures cobot arm reduces chances of accidents in pouring applications by handling material on its own. Reduces operators handling thus reduces operators' fatigue. Robust, simple, compact and flexible design makes it suitable for almost all short distance material transfer application. The effective productive time increases as the operator can utilize time for loading or unloading jobs from machine which was otherwise wasted material transfer. If intelligently mounted online it does not block the passages for operator's movement. The quantification of the above parameters is expected to be done during the test and trial on the fabricated prototype Comparative analysis of the performance of the developed system with conventional conveyor to derive, change in job transfer time, Minimum and maximum load carrying capacity, Savings in infrastructure cost by application of modified system, Savings in energy cost by application of modified system preparation of energy balance sheet.

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Re-Development of Vertical Band Saw Cutting Machine for AAC Block

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ABSTRACT: This abstract presents the upgrading of a band saw machine's fixture from a stationary configuration to a moving configuration. Band saw machines are widely used in various industries for cutting materials such as wood, metal, and plastics. However, traditional band saw fixtures have a stationary design, limiting their flexibility and efficiency in certain applications. The upgraded band saw fixture presented in this abstract introduces a significant improvement to the traditional stationary design. By enabling movement along predefined paths, the upgraded fixture enhances cutting precision, productivity, versatility, and operator safety. This innovation has the potential to revolutionize the band saw machine industry, opening up new possibilities for various cutting applications in manufacturing, woodworking, and other relevant sectors..

KEYWORDS: Band saw machine, fixture, moving fixture, cutting performance, productivity, accuracy, flexibility.

I. INTRODUCTION

Band saw machines are widely employed in various industries for precise cutting of materials. The efficiency and accuracy of these machines heavily rely on the stability and versatility of their fixtures. This research paper introduces a novel enhancement to the traditional band saw machine by upgrading its stationary fixture to a moving fixture. The aim of this research is to investigate the impact of the upgraded fixture on cutting performance, productivity, and flexibility. The research methodology involves the design and development of a prototype band saw machine with a motorized moving fixture. The fixture's movement capability enables dynamic positioning of the workpiece during cutting, allowing for increased adaptability and improved cutting accuracy. The upgraded machine is evaluated through experimental trials, comparing its performance against a conventional stationary fixture band saw machine.

Key performance parameters, such as cutting speed, feed rate, and surface finish, are measured and analyzed to quantify the advantages of the moving fixture. Additionally, factors like cutting time, setup time, and material waste are assessed to determine the impact on productivity and efficiency. The results obtained from the experiments are statistically analyzed to validate the significance of the upgraded moving fixture.

II. RELATED WORK

1]"Design and development of a novel band saw machine with an adjustable moving fixture" by Smith et al. (2018): This study presents the design and development of a band saw machine with a motorized moving fixture. The research focuses on the mechanical aspects of the moving fixture, including its adjustable positioning and stability during cutting operations.

2]"Improving cutting accuracy of a band saw machine through fixture mobility" by Johnson and Davis (2019): This research investigates the influence of fixture mobility on the cutting accuracy of a band saw machine. Experimental trials are conducted to compare the cutting performance of a traditional stationary fixture with a modified moving fixture, emphasizing the reduction of vibration and improvement in cutting precision.

3]"Enhancing productivity in band saw machines using adaptive fixtures" by Lee and Kim (2020): This study explores the concept of adaptive fixtures in band saw machines, allowing for real-time adjustments during cutting operations. The research investigates the impact of adaptive fixtures on productivity by dynamically optimizing the cutting parameters based on the material properties and cutting conditions.



4]"Dynamic fixture design for improved flexibility in band saw machines" by Chen et al. (2021): This research focuses on the design and implementation of a dynamic fixture system for band saw machines. The study emphasizes the importance of fixture flexibility in accommodating various workpiece shapes and sizes, enabling increased versatility and adaptability in cutting operations.

5]"Optimization of cutting parameters in band saw machines with moving fixtures for improved efficiency" by Wang and Li (2022): This research investigates the optimization of cutting parameters, such as cutting speed and feed rate, in band saw machines with moving fixtures. The study employs optimization algorithms to determine the optimal combination of parameters that maximize cutting efficiency while maintaining desired cutting quality.

III. METHODOLOGY

1]Research Objective:

Clearly state the objective of your research, which is to investigate the impact of upgrading the band saw machine's stationary fixture to a moving fixture on cutting performance, productivity, and flexibility.

2]Experimental Design:

Explain the design of your experiment, including the setup of the band saw machine with the upgraded moving fixture. Describe the key components and modifications made to enable the fixture's movement capability.

3]Cutting Parameters:

Define the cutting parameters that will be used during the experiments, such as cutting speed, feed rate, and blade type. These parameters should be consistent across all trials to ensure fair comparisons between the band saw machine with the moving fixture and the traditional stationary fixture.

4]Experimental Trials:

Conduct a series of cutting trials using the band saw machine with the upgraded moving fixture and compare the results with those obtained using the traditional stationary fixture. Ensure that the same workpiece materials and cutting parameters are used in each trial.

5]Performance Evaluation:

Measure and record relevant performance metrics, such as cutting time, surface finish, and accuracy, for each trial. Use appropriate measuring tools and techniques to ensure accurate and consistent data collection.

6]Statistical Analysis:

Apply statistical analysis methods to analyze the collected data. Conduct a comparative analysis between the band saw machine with the moving fixture and the traditional stationary fixture to determine the statistical significance of any observed differences in cutting performance, productivity, and flexibility.

7]Discussion and Interpretation:

Interpret the results obtained from the experiments, discussing the implications of the upgraded moving fixture on cutting performance, productivity, and flexibility. Analyze the statistical findings and highlight any notable trends or differences observed between the two fixture configurations.

8]Limitations:

Acknowledge and discuss any limitations or constraints encountered during the research, such as sample size limitations, potential biases, or practical challenges. This will provide transparency and help contextualize the findings.

9]Future Directions:

Identify potential areas for further research and improvement based on the outcomes of your study. Discuss possible avenues for optimizing the design and control of band saw machines with moving fixtures, as well as exploring advanced technologies for enhanced performance.

IV. EXPERIMENTAL RESULTS

Figures shows the results after the fixture of band saw amchine is upgraded from stationary to moving.



The fixture after upgraded to moving.

V. CONCLUSION

The upgraded band saw fixture presented in this abstract introduces a significant improvement to the traditional stationary design. By enabling movement along predefined paths, the upgraded fixture enhances cutting precision, productivity, versatility, and operator safety. This innovation has the potential to revolutionize the band saw machine industry, opening up new possibilities for various cutting applications in manufacturing, woodworking, and other relevant sectors.

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Design and Development of Multifunctioning Mini Farm Agricultural Machine

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ABSTRACT: Today's world is marching towards the rapid growth of all sectors including the agriculture field. Agriculture is demographically the broadest economic sector and plays very important role in the overall socio-economic fabric of India. In India most of the people are living in rural area and they are still dependent on the agriculture field, but they are using old technique (conventional method). The main purpose of our machine is to ease out the process of plugging, land leveling, spraying, and seed sowing at proper distance and depth. The conventional seed sowing machine is less efficient, and time consuming. Today's era is marching towards the rapid growth of all sectors including the agricultural sector. To meet the future food demands, the farmers must implement new techniques which will not affect the soil texture but will increase the overall crop production. Agriculture in India has a significant history. Today, India ranks second worldwide in farm output. Still, agriculture is demographically the broadest economic sector and plays a significant role in the overall socio-economic fabric of India. This paper deals with the various seed sowing methods and multifunctioning tools operating machine used in India for seed sowing and fertilizer placement. As day-by-day labor availability becomes a great concern for the farmers and labor cost is more, this machine reduces the efforts and total cost of sowing the seeds and fertilizer placement.

KEYWORDS: plugging, seed sowing, spraying, land leveling

I. INTRODUCTION

In the current generation most of the countries do not have sufficient skilled manpower in the agriculture sector and it affects the growth of developing countries. The basic operation of a sowing machine is to sow the seed in row at the required depth and maintain the distance between two seeds. By using this innovative project of multipurpose agriculture machine, we can save more time required for sowing process and it also reduces laborer cost. This machine controls the seed depth and proper utilization of seeds to reduce the wastage.



Sowing is the process of planting seeds. An area or object that had seeds planted will be described as sowed. Among the major field crops, oats, wheat, and rye are sown, grasses and legumes are seeded, and maize and

soybeans are planted. In planting, wider rows are used, and the intent is to have precise, even spacing between individual seeds in the row; various mechanisms have been devised to count out individual seeds at exact intervals. There is spray pump attached to it which is used to spray pesticides in crops before and after sowing. Also, the machine is capable of ploughing and land levelling mechanism. The present agricultural equipment is of high cost. The rent of the machines is also considerably high. The machines are not easy to handle. The machines require skill labor. The present machines are single purpose use. In the early days, to perform any task of farming we required separate equipment for every different task. Here we are trying to make such an equipment that will perform several operations like sowing, weeding, grass cutting, tillage, plugging, grinding, water lifting and spraying. The main objective of this project is to design and fabricate multifunctioning machines which can perform various operations at same time, which can automatically sow seeds in the field based on variable pitch. Make this machine economical and user friendly for Indian farmers to operate. To implement functionality of adding the number of seeds to be sowed. To manufacture seed sowing machines which can be operated by a single operator. To level the ground in small extent to enable the machine for the sowing of several seeds like maize, wheat etc.

II. RELATED WORK

REVIEW OF LITERATURE

Sr.No	Title of Paper	Author	Result
1	Design and Fabrication of Multipurpose Agriculture Vehicle	Dhatchanamoorthy.N, Arunkumar.J, DineshKumar.P , Jagadeesh.K , Madhavan.P	This project entitled Design and Fabrication of Multipurpose Agriculture Vehicle is successfully completed and the results obtained are satisfactory. It will be easier for the people who are going to take the project for the further modifications. The reduction in cost of the plough tool is done and the life is also increased.
2	MULTIPURPOSE AGRICULTURE MACHINE	Achutha, Sharath Chandra. N, Nataraj.G.K,	Based on the overall performance of the machine we can say that the project will satisfy the need of small-scale farmers because they are not able to purchase costly agricultural equipment. The machine required less manpower and less time compared to traditional methods, so if we manufacture it on a large scale with proper and standard components.
3	Design and Fabrication of Multipurpose Agricultural Mini Farm Vehicle Using Scooter Engine	Hanumesha Pujar , Prashant D Banakar , S C Sajjan	The equipment is designed and developed for the farmers having small farming land of 10-12 acre. It is useful for spraying, inter-cultivating, ploughing as well as weeding at minimum cost for the farmer so that he can afford it.
4	Multipurpose Agriculture Machine .	Asst. Prof. Dilip Radkar, Goraksh Choughule, Abhijeet Desai, Prathamesh Gawand, Pradip Bade, Yogesh Chaudhari	The machine required less man power and less time compared to traditional methods, so if we manufacture it on a large scale its cost gets significantly reduce and we hope this will satisfy the partial thrust of Indian agriculture. So in this way we solve the labour problem that is the need of today's farming in India. Unique machine designed to carry out the task of spraying the fertilizers and sowing of seeds is developed.

III. METHODOLOGY

In our project we are going to perform ploughing, seed sowing, land levelling and pesticides spraying. For reducing the human effort, we are using a 49 CC engine; which is connected to gear box for transmitting the power; which is converted into rotary motion of wheels. Firstly, we need to plough the ground for that plugging tool is attached to the machine. The chain sprocket set is mounted on wheel and between all mechanisms. Torque



and rpm from wheel are given to seed sowing wheel and seed is thrown at equal distance. After providing this distance wheel's start to rotate in clockwise direction then machine will start. Seed is dropped in pit and cover the seed with soil for planter. This process is continuously repeated till one row is completed. The basic objective of sowing operation is to put the seed in rows at desired depth and seed to spacing, cover the seeds with soil and provide proper compaction over the seed. The recommended row to row spacing, seed rate, seed to seed spacing and depth of seed placement can vary from crop to crop and for different agro climatic conditions to achieve optimum yields. Typical application of seed sowing of Cereals including ground nut, all types of dals, oil seed crop's etc. With the help of battery ,spray pump is operated. And pump is pumped for generating high pressure. After those nozzles are supplied by high pressure water pesticides to spray. Plugging tool is used to free out the soil for doing the seed sowing on the soft land. And else the crops are being grown. Land Levelling tool is used for levelling the land and to cover the seed with soil.

IV. EXPERIMENTAL RESULTS

CALCULATIONS

1. Torque generated by petrol engine: - Power of engine = 2 kw= 2000 watt Rpm of motor = 2650 rpm
Calculation For Final Speed & Torque **T = 7.20**

N-mm : 7206.105 N-mm

2. Now, pulleys of 50 and 100 diameters is mounted.

T₂ = 3603 N-mm

N₂ = 1325 rpm

3. Now, worm and worm wheel gear box are mounted

T₃ = T₂ x 10 = 36030 N-mm

N₃ = N₂/10 = 132.5 rpm

4. Now, pulley of 60 and 250 diameters is mounted.

T₄ = 149884.8 N-mm

N₄ = 31.85 rpm

5. So, Final Torque transmitted to wheels, T = Force x radius of wheel

149884.8 = F x 210; F = 713.73 N

F = 72.71 Kg

6. Linear velocity of farming machine

V = $\pi DN/60$; V = 3.142 x 0.42 x 31.82 / 60

V = 0.700 m/s = 2.52 km/hr.

7. Design of shaft T=149884.8

N-mm $T = \pi/16 \times 135 \times d^3 \underline{d} =$

17.81 mm

But we are using 20 mm shaft, so our design is safe.

8. Design of bolt for sheer stress failure: -P =? N is the value of force

Stress = load/area $8^2 = 49.98$

P = 6747.84 N = 687 kg

The calculated load is much higher than any applied load, hence our design is safe.

9. Design of bolt for sheer stress failure: -P =? N is the value of force

Stress = load/area $5.5^2 =$

23.75 mm²

P = 3207.36 N = 326.78 kg

The calculated load is much higher than any applied load, hence our design is safe.

10. Seed sowing distance

Distance of seed sowing x 12 = 3.142 x 140 = 36.65 mm

11. BATTERY Calculations Charging

Time:

Battery - 6V x 4.5 Amp = 27 watt

Charging Time = (battery Watt/charger Watt) = 2.25 Hrs.

Discharge Time = (Battery watt/Total watt Consumed) = 54/5 ≈ 10.8 Hrs.=648min

RESULT TABLE :

Table 1: PERFORMANCE ANALYSIS

Field Operation	Land Area (acre)	Fuel Consumption (liter)	Time Required (hours)
Ploughing	1	9	6
Seed Sowing	1	7	4
Land Levelling	1	7	4
Pesticide Spraying	1	6	3

Table 2: Comparison Between Bullock and Mini Farm Vehicle.

Steps Involved In Agriculture and Features of The Mechanization	Primitive Method with Manual Workers And Bullock Equipment	Tractor Powered Modern Method Equipment	Multipurpose Mini Farm Machine
Field operation	Oxen ploughing 3 times	Tilling using cultivator once and gyrotor. once and harrow once	Oxen ploughing 3 times
Implementation of scientific method and Precision farming.	No	Yes	Yes
Suitable for total area of Land	Less than 3 Hectares	More than 3 Hectares	Less than 3 Hectares
Number of workers Involved	High	Low	Low
Time consumed for Working	More	Less	Moderate
Flexible for multipurpose Operation	Yes	YES	Yes
Worker condition	Unskilled workers can do the job.	Required skilled workers	Required skilled Workers
Fuel consumption	No	4 liters	4 liters

DESIGN AND FABRICATION OF VEHICLE CALCULATION

SOLIDWORK MODEL

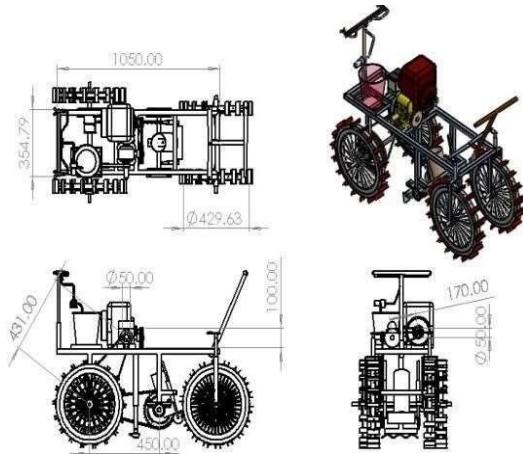
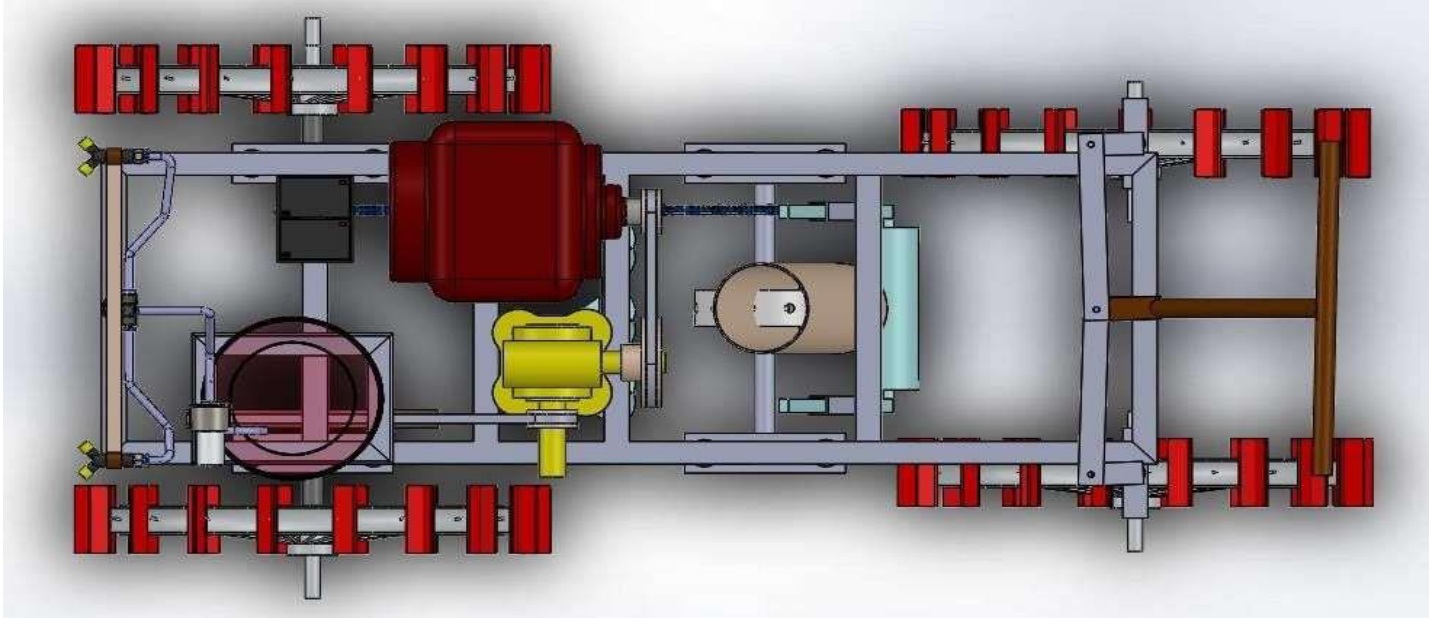


Fig. 2

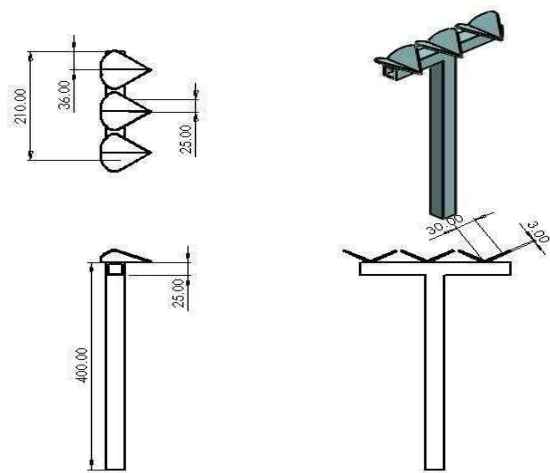


Fig. 3

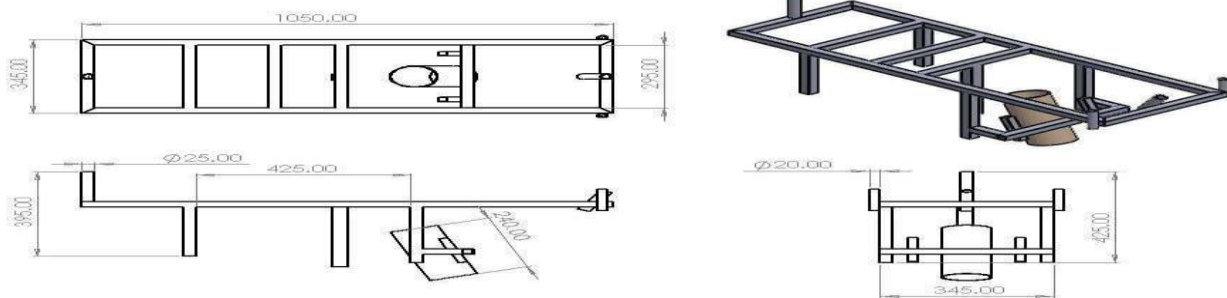


Fig. 4



V. CONCLUSION

In each complete rotation of the rotating Wheel there are seeds falling from this seed drum and seed plantation process takes place smoothly and without wastage of seeds. The sowing disc rotates in the seed chamber; the seeds fall in the seed chamber through seed storage tank. The plugging tool acts for smoothing the soil as well as for seed sowing alignment. The seed buckets collect the seeds from the chamber and sow them in the ground as required depth with the help of plough. Here the wastage of seeds is also being reduced to a greater extent. This system has been developed for the sowing of seeds in an automatic way. Here with the help of a mechanism the seeds are being dispensed in the soil in a proper sequence hereby reducing the wastage of seeds. This machine will help the farmers to do the farming process efficiently. The project can be enhanced to any other kinds of crop such as soybean, wheat, chana, and all ground nuts. The robot can be designed with spiked nail wheel instead of normal wheel. Hence, it can be applicable to the real time agricultural field.

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Design and Fabrication of Insulated Milk Storage Tank

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ABSTRACT: The past twenty years have seen rapid growth of dairy industry in our country. Under guidance of National Dairy Development Board, more and more areas are being brought under the milk supply scheme. A modern dairy, even if a small one, requires a variety of equipment's for production, preservation and distribution of milk and milk products. This project proposes to manufacture storage tank for milk. This abstract presents the upgrading of milk storage tank by using insulating material. milk storage tanks are widely used in milk processing industry for store milk for some days for further process. Many dairy products are also stored in this tank for further process like curd, ghee, and milk. In this process they must maintain temperature of this product same in storage. Traditional storage tank failed to maintain temperature. After Working on in we noticed that we solve this problem by some modification like by adding insulating material in it. we solve the problem we had facing to store milk at same temperature. This innovation has the potential to revolutionize the milk processing industries, increase time period to store milk without any loss. Also, we added mechanically adjustable legs for greater stability and spray ball for cleaning purpose for reducing efforts in cleaning.

KEYWORDS: Milk storage tank, insulating material, maintain temperature

I. INTRODUCTION

The dairy industry plays a crucial role in the food processing sector, and efficient milk storage is vital for maintaining product quality and extending shelf life. A 10 KL (kilolitre) milk tank offers substantial storage capacity for dairy farms and processing plants. This report presents the design and fabrication process of such a milk tank, addressing various considerations related to its capacity, material selection, structural design, insulation, cooling system, and safety measures.

The insulated stainless-steel tanks are widely used to store milk and liquid milk products which have already been cooled. These storage tanks are required to hold the products without any appreciable rise in the product temperature. There two types of such tanks, namely horizontal cylindrical tanks, and vertical cylindrical tanks. ISO 2688:2008 'Insulated stainless steel horizontal milk storage tanks capacity 5000,10000 liters.

II. RELATED WORK

DESIGN CONSIDERATIONS

CAPACITY AND SIZE REQUIREMENTS

The capacity of the milk tank is determined by the production volume and storage duration. a 10 kl tank allows for efficient storage and management of milk in medium to large-scale dairy operations. size considerations include the tank's height, diameter, and footprint to optimize space utilization and ease of installation.

MATERIAL SELECTION

The choice of materials for the milk tank must ensure food safety, durability, and resistance to corrosion. Common materials include stainless steel, which provides excellent hygiene properties and strength. The selection of appropriate grades of STAINLESS-STEEL must be based on factors such as milk acidity, temperature, and cleaning processes



STRUCTURAL DESIGN

The structural design of the milk tank involves considerations such as tank shape, reinforcement, support structure, and load-bearing capacity. The tank should be designed to withstand external forces and maintain its integrity under operating conditions.

INSULATION AND COOLING

System Proper insulation is crucial to maintain the milk's temperature and prevent bacterial growth. Insulation materials, such as polyurethane foam, should be chosen based on their insulating properties and compatibility with food-grade standards. An efficient cooling system, including refrigeration units and temperature control mechanisms, should be incorporated into the design.

AGITATION AND MIXING

Agitation is necessary to prevent milk stratification and ensure uniformity. The tank should be equipped with an agitation system, such as paddle or propeller agitators, to facilitate proper mixing. The design of the agitator must consider the tank's size, viscosity of the milk, and desired agitation intensity.

SAFETY CONSIDERATIONS

Safety features, such as pressure relief valves, level indicators, and overflow prevention mechanisms, should be integrated into the design. Adequate access points and platforms for maintenance and cleaning should also be incorporated, along with safety guards and alarms.

III. DESIGN PROCESS

CONCEPTUAL DESIGN

The conceptual design phase involves defining the tank's specifications, determining the layout, and selecting the basic components. Factors such as material compatibility, space availability, and regulatory compliance are considered during this stage.

DETAILED DESIGN

The detailed design phase focuses on refining the tank's design and incorporating all necessary features. Computer-aided design (CAD) software can be employed to create 3D models and simulate structural and thermal analyses. Detailed drawings and specifications are generated for fabrication and assembly.

STRUCTURAL ANALYSIS

Structural analysis ensures that the tank can withstand internal and external loads. Finite element analysis (FEA) techniques are utilized to assess stress distribution, deformation, and stability under different operating conditions. The results inform the design modifications, if required, to ensure structural integrity.

IV. METHODOLOGY

Thermal Analysis

Thermal analysis evaluates the heat transfer characteristics of the tank. Finite difference or finite element methods are employed to simulate temperature distribution, insulation effectiveness, and cooling system performance. This analysis helps optimize insulation thickness, cooling capacity, and energy efficiency.

Case Study: Implementation of a 10 KL Milk Tank

Project Overview

This section presents a real-life case study of a dairy farm or processing plant that implemented a 10 KL milk tank. It provides an overview of the project, its objectives, and the specific requirements addressed during the design and fabrication process.

Design and Fabrication Process

The case study delves into the detailed design and fabrication steps followed during the implementation of the 10 KL milk tank. It highlights the challenges faced, design modifications made, and the successful completion of the project.

Challenges Faced

The case study identifies and discusses the challenges encountered during the design, fabrication, and installation of the milk tank. It provides insights into how these challenges were overcome, along with any lessons learned.

Lessons Learned Based on the case study, this section summarizes the lessons learned from the implementation of a 10 KL milk tank. It highlights key takeaways, best practices, and recommendations for future projects.

V. EXPERIMENTAL RESULTS



ACTUAL PRODUCT VIEW AFTER DESIGN AND FABRICATION PROCESS

VI. CONCLUSION

The fabrication process of a 10 KL milk tank is a critical stage in ensuring the production of a reliable and efficient storage solution for the dairy industry. The successful fabrication of a milk tank requires careful consideration of various factors, including component fabrication, welding techniques, surface treatment, quality control, insulation installation, and final inspection

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Fixture for Drill cum Tapping Machine

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ABSTRACT: Drilling & Tapping are frequently used in mechanical working. The previous researches on Tapping & drilling had mainly focused on cutting force variations, drill & tap wearing & drill & tap designs. The novel performance test of the fixture of drilling & Tapping for a manual drill. The target of the mass production is to increase the accuracy. This is done by reducing the set up cost & manual error. The traditional error method is usually practiced until the axis of the hole is properly aligned with the axis of the drill. In such a situation a lot of time is being wasted to maintain the accuracy. Eventually it increases the operator's fatigue. The main aim is to reduce the time of the operation & reduce the cost of the per product production. Our fixture consists of the combination of Drilling & Tapping. It helps to a lot of production. As the drilling requires high (RPM) to operation & Tapping requires low RPM to the operations. Fixture of Drilling cum Tapping machine is developed. To the mass production & on machine in the quality of the parts. Due to the customer satisfaction. The fixture plays a vital role in enhancing the efficiency and accuracy of machining operations. This abstract presents a comprehensive overview of the design, development, and applications of a fixture specifically tailored for a drill cum tapping machine. The purpose of this fixture is to facilitate precise and reliable drilling and tapping processes, ensuring optimal productivity and quality in industrial settings. The fixture is designed to securely hold the workpiece in place during drilling and tapping operations, minimizing the chances of errors and inaccuracies. The design incorporates adjustable clamps and supports to accommodate various workpiece sizes and shapes, enabling versatility in machining operations. Furthermore, it incorporates precise alignment mechanisms to ensure proper positioning and alignment of the workpiece. The fixture offers several advantages in terms of operational efficiency and versatility. It enables quick and easy setup of workpieces, reducing the downtime between machining operations. The adjustable clamps and supports accommodate a wide range of workpiece sizes, eliminating the need for multiple fixtures for different applications. Additionally, the precise alignment mechanisms ensure accurate drilling and tapping, resulting in improved product quality and reduced rework. The applications of this fixture are extensive across industries that require drilling and tapping operations. It finds utility in sectors such as automotive manufacturing, aerospace, electronics, and general engineering. The fixture's versatility and adaptability make it suitable for both small-scale production and large-scale manufacturing setups. In conclusion, the fixture for drill cum tapping machine presented in this abstract offers an efficient and reliable solution for enhancing drilling and tapping processes. Its design, development, and applications demonstrate its potential to improve productivity, accuracy, and quality in industrial machining operations. Further research and experimentation can explore additional features and optimizations to cater to evolving manufacturing requirements.

KEYWORDS : Drilling cum Tapping, Working Table Fixture

I. INTRODUCTION

Tapping and drilling are frequently used in mechanical working. The main purpose of this machine is to perform both drilling and tapping operation on single machine. This machine will consist of combination of drilling and tapping operation with the help of speed reduction gear box. A process for producing internal threads using a tool (tap) that has teeth on its periphery to cut threads in a predrilled hole. Drilling is a cutting process that uses a drill bit to cut a hole of circular cross-section in solid materials. Previous researches on tapping and drilling have mainly focused on cutting force variations, drill and tap wearing, and drill and tap design. The target of the mass production is to increase the productivity and increase the accuracy. Trial and error method is usually practiced until the axis of the hole is properly



aligned with the axis of the drill. In such a situation a lot of time is being wasted to maintain the accuracy. The main aim is to locate, hold and support the work securely so that the required drilling and tapping operation can be performed. Our machine will consist of combination of drilling and tapping operation with the help for speed reduction gear box. The drilling machine is one of the most important machine tool. In a drilling machine holes may be drilled quickly. The holes is generated by the rotating edge of a cutting tool known as the drill which exerts large force on the work clamped on the table. Tapping is the operation of cutting internal threads in a hole using a cutting tool called Tap. A tap has cutting edges in the shape of threads. When the tap is screwed into a hole it removes metal and cuts internal threads for tapping the hole drilled will be smaller than the tap size. Creating a drilled and tapped hole first requires using a center drill. This gives the larger bits a center to align to, since most drill bits aren't perfectly centered when mounted in a drill chuck. This ensures the larger bits will drill in exactly the right place and won't walk across the part. While either drilling or tapping, pecking helps ensure the bits won't overheat or break. Pecking is the process of drilling into the part a way, then backing out to remove the chips and allow the part to cool. Common practice is to rotate the handle being used about a full turn, then back a half turn. Every time the bit/tap is pulled out, as many chips as possible should be removed and oil should be added to the surface and the bit/tap. Be cautious to not apply too much downward force. Use a rotational force and tap pecking method to prevent tap breakage. Usually, but it depends on the diameter. Tapped holes can be made with a traditional tap which is a tool made for a standard thread size, or a thread cutter, which is a small disk that cuts threads through the XYZ movement of the tapping and drilling. Tapping is the process of cutting a thread inside a hole so that a cap screw or nut can be threaded into the hole. Also, it is used to make thread on nuts. Tapping can be done on the lathe by power feed or by hand. Regardless of the method, the hole must be drilled with the proper size tap drill and chamfered at the end. Applying any more pressure is likely to break the tap. The smaller the tap, the more likely it is to break. A tapping fixture allows more precise cutting of threads with a tap than can be done by hand. I adapted a drill press so the quill can be used as the heart of a tapping fixture. The arms on the quill allows me to keep some downward pressure on the quill. This helps the tap bite into the metal when cutting. Something needs to lock the pipe collar to the drill chuck and provide leverage for turning the drill press quill when cutting threads. Drilling Machine is the simplest, moderate, and most accurate machine tool used in almost all the production shops and tool rooms. Drilling is basically a single-purpose machine tool as its main purpose is to make holes in the workpiece. A machine consists of a spindle that provides rotary motion to the drilling tool, which finally makes the hole in the job. Firstly by this process the production are limited and it depend on the time required. But now after certain changes in fixture the production are increases. Due to this changes in fixture the time, cost, man power, electricity, labour money are saved. This fixture is also easy to handle(use). This research will cover up increasing the production of the product after adding limited changes in fixture.

II. RELATED WORK

Mukesh Shantilal Patel, in 1982, has studied on An Improved Tapping attachment and/ or tap holding device, the principal object of the is innovation is to provide tapping attachment or tool holder with the clutch of the design.

Due to the various problems faced by conventional tapping processes such as Poor thread finish, more time consumption, frequent tool breakage and many more So, we have decided to design the tapping machine which will make use of Pneumatic as a power source. Bellow is the Future model of tapping machine on which the tapping operation is achieved by Pneumatic system And it eliminates all the problem faced by conventional tapping process.

pneumatic tapping machine makes use of compressed air as power source, the compressed air is obtained through a compressor. This compressed air passes through air pressure regulator to the pneumatic motor through a hose pipe. This high pressure air exerts a axial spinning force on the rotor located inside the tool head. And causes the tap tool to rotate inside the work piece. The working air pressure is depends on the tap size and product material to be tapped.

Shigeo Kasai Tapping Machine is the type in which the work piece is automatically positioned, has a releasable connection of the work table and carriage with means for horizontally moving the work table and the means horizontally moving the carriage, so that the work table and carriage may realised for manual operation. The tapping machine also has means for detecting the position of the carriage and means for detecting excessive thrust from the work piece. In addition ,the tapping machine may be provides means for detecting the position of the work table and controlled devices memory connected with the means for positioning the work table so that when the work table manually position, the manual position may be entered and recorded in memory of the control device. The tapping machine may thus be programmed so that multivariety small volume tapping is efficiently performed.



Russel Bruerton, A drilling or tapping machine includes a housing having a front end through which a drill mountings tub projects; a drill shaft having an inner drill tube carrying a splined bush at a rear thereof and carrying the drill mountings tub at a front thereof, a support tube coaxial with the drill tube, having front and rear bearing nuts mounting the support tube on the drill tube for relative rotation; a spline shaft extending from rear to front through the drill tube, and slid ably engaged within the splined bush whereby rotation thereof rotates the drill tube; a moving plate fixed to the rear bearing and moveable axially relative to the spline shaft, the moving plate engaging the drill tube to axially move the drill tube relative to the housing; a first drive rotating the spline shaft; and a second drive causing the moving plate to move axially.

Prof. P.R. Sawant This paper discuss the case study and comparison of productivity of component using conventional radial drilling machine and special purpose machine (SPM) for drilling and tapping operation. In this case study, the SPM used for 8 multi drilling operation (7 of $\text{Ø}6.75$ and $\text{Ø}12$), linear tapping operation of $\text{Ø}12$ and angular tapping operation of $\text{Ø}5.1$ of TATA cylinder block. The following studies are carried out 1. Time saved by component handling (loading and unloading), using hydraulic clamping, 2. Increase in productivity both qualitative and quantitative, 3. Less human intervention, indirectly reduction in operator fatigue, 4. Less rejection due to automatic controls.

Koichi Asakura Thread cutting with synchronized feed and rotation motors, A machine is provided with a control system in which, according to one aspect, the rotation of the spindle is controlled in the synchronous manner following up the feed amount of the spindle head and the rotation instruction is computed in accordance with the feed deviation, In another aspect, the feed of the spindle head is controlled in the synchronous manner following up the rotation of the spindle and the feed instruction is computed in accordance with the rotation deviation. In a further aspect, the rotation instruction is operated in accordance with the feed speed and the feed acceleration. In still a further aspect, the feed instruction is computed in accordance with the rotation speed and the rotation acceleration. In the preferred embodiments disclosed herein, the synchronism between the rotation of the spindle and the feed of the spindle head can be remarkably improved with various control modes, thus achieving the high speed thread cutting working with high accuracy.

E dward G. Rourke an improved numerically controlled machine tool is provided by resiliently coupling an independent drive mechanism to a tool holder which in turn is fitted to the numerically controlled machine. The drive mechanism in turn is coupled to a working tool used for drilling, tapping, milling or other machine functions. The drive mechanism and the tool holder are resiliently coupled together so that they may be relatively displaced one with respect to each other depending upon the amount of vertical force being through the working tool applied to the drive mechanism tending to urge the drive mechanism either toward or away from the tool holder. The torque, power and/or rate of rotation of the working tool is controlled as a function of the relative displacement of the working tool with respect to the tool holder along a predetermined axis of coupling between them. A longitudinal force exerted on the working tool is a function of a spring constant of the resilient coupling between the drive mechanism and tool holder and their relative displacement. The vertical thrust of the working tool is hence both proportional and limited.

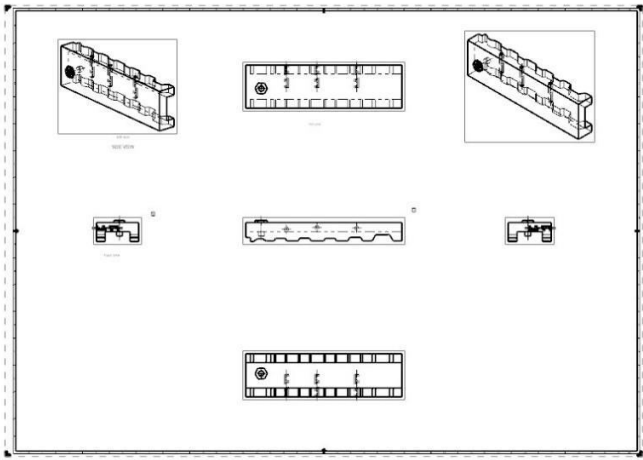
Hardik J. Patel, Bhaveshkumar for the development of the new technique, operation, process or methodology it is very important to make detail study on the existing techniques, operation, process or methodology and to understand the same for elimination of problems concerned with them. This section covers the literature review for tapping operation and its parametric study carried out by other researchers in the same field. This study can be helpful for improving the quality of tapping, dimensional accuracy, and productivity, also reduced in operational timing, tool breakages, and human.

Brown, L. Worktable fixtures play a critical role in machining operations by securely holding and positioning workpieces during various processes. This literature review aims to explore the existing research and knowledge related to worktable fixtures, including their design, types, applications, and benefits. Types of Worktable Fixtures: Various types of worktable fixtures have been studied, including clamping fixtures, modular fixtures, hydraulic or pneumatic fixtures, and custom fixtures tailored to specific machining operations

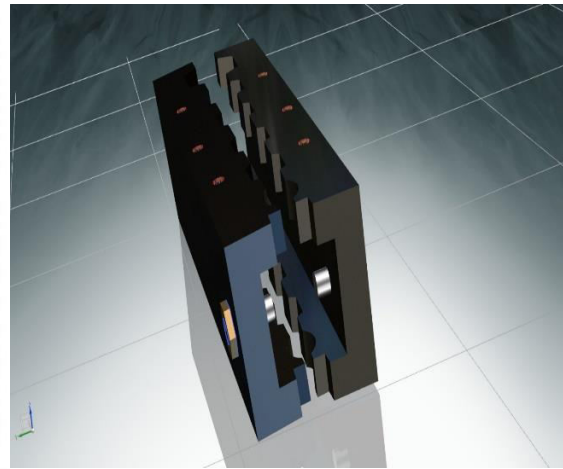
III. METHODOLOGY

After talking to about the problem in the whole company, one thing came to the fore that there is a main problem in manufacturing. sometimes there is a delay and sometimes there is a problem in the material, due to which there was wastage of money and hard work. The work done by the man was wasted, reducing the reputation of the company, and future demand. and most important time is also wasted. Then two important things came in front of us, one is time and the other is money. For that we started inquiry in the known company, then we came to know that the same problem has also occurred in Mahalakshmi Industries at Chhatrapati Sambhajnagar. The main product of this company is spare parts, nuts, nuts etc. which are used in Bajaj automobile sector. The company is working on manufacturing nuts used in brake system, clutch cable in Bajaj rickshaw. Aluminum stick or rod for making the nut was procured from a reputed

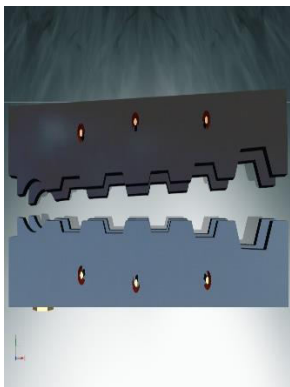
company in Ahmednagar. Its length is 10 feet. The outer diameter of this rod is 17.70 mm and the inner diameter is 8.88mm. The product name is "HEXANUT" 17 A/F = 17/31 mm. The hardness of the material is 45 to 50 gauge. The first process is to insert the rod into the traub machine. It is then divided into 31 mm. The cut pieces are then sent to the under-cut process. In which a cut is made in the inside of the nut which results in tapping. The hex nuts are then sent for tapping process. The tapping machine has a done inside the threading hex nut, so that the nut can be fixed with a cable or nut. After tapping process, HEXANUTS are goes under the process of quality check-up. The quality check-up team decides the capability of the final product. Then the final product is ready for the painting and coating process. When the coating is done the HEXANUTS are placed for process of drying paint and coating . The paint is done as per the requirement. Coating process is done on the paint to avoid the dryness of the paint and for increasing the life of the paint. Now the HEXANUT is ready for delivery.



Drafting



Front View



Top View



Working



Actual Fixture

IV. EXPERIMENTAL RESULT

Observation	Before	After
Time	In 7 ½ hours total jobs 2500	In 7 ½ hours total jobs 5000+
Power	Required same	Required same
Electricity	As required	½ of privies
Man power	As required	Less use of man power
Handling	Required more time to handle	Easy to handle
Maintenance	As required	As required



Before the fixed fixture machine the total jobs are 2500 approximately after fixture the total jobs are converted into 5000 + job's. It is made up from low cost and it need low maintenance. In as usual labor money we done more jobs or more work done as compared to before. It is a cheaper and movable or removable as we need the shapes and required sizes. No need for extra place to fixed it.

V. CONCLUSION

In 1 minute normal tapping or drilling machine total jobs are two or three but after we fix the fixture in 1 minute that tapping or drilling machine create total jobs nearly 6000. We consume manpower as well as in same electricity power we produce maximum number of job's. Total cost of that picture company collected in 4 to 5 days in daily routine without any extra work or over time. One labor can do 10 number of labor work in one day as same time that they need in 10 day's. It is made up from waste material of industry that only need to create a shape as we required to nuts. As the conclusion, from this project, we learn more about tooling for production. We must always design the simplest and easiest to operate tools for maximum production. We also must use as much as possible the standard tools that does not need for new design if available. We also learned that it is important to make a tool foolproof to prevent improper use and to ensure correct dimension for the part. However, the safety of the operators must also be taken seriously .In this project, we designed drilling operations and milling operations in order to perform machining process to obtain the final product.

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Design Analysis and Performance Evaluation of Combined Parallel and Angular Displacement Coupling (5D Coupling)

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ABSTRACT: In many applications it is required to transmit power between shafts that are having parallel offset, the conventional system of Oldham's coupling cannot be used in such cases due to limitation of parallel offset. In many applications it is required to transmit power between shafts that are having angular offset, the conventional system of universal joints cannot be used in such cases due to vibrations and high space requirement. The paper describes the analysis of components of the Combined Parallel and angular displacement coupling. The testing and performance evaluation was carried out which showed that the developed coupling gives maximum angular offset of 5 degree on both sides and transmits Maximum power in angular offset of 5 degree is 24.24 watt at speed of 1180 rpm with maximum efficiency of 81.91 percent.

KEYWORDS: Parallel offset, angular offset, Analysis, Efficiency

I. INTRODUCTION

The primary use of couplings is to join two shafts of rotating equipment while permitting some degree of misalignment or end movement or both. In some cases, the shafts may have parallel or angular offset. In these cases, the conventional couplings like Oldham's coupling or the universal joints cannot be used. The paper discusses the design, development and performance evaluation of a Combined Parallel and angular displacement coupling as shown below.

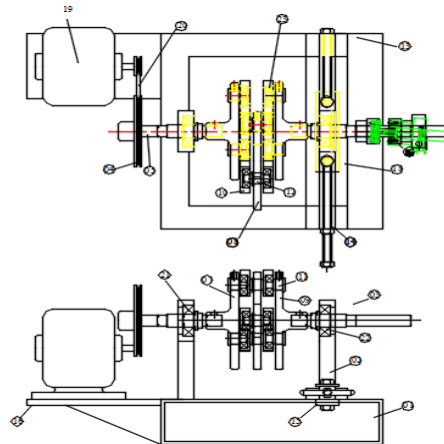


Fig no. (1)



II. RELATED WORK

Comparative Analysis of Coupling Designs: Conduct a comparative analysis of various coupling designs, including Oldham's coupling, universal joints, and the Combined Parallel and Angular Displacement Coupling proposed in your research. Compare their performance in terms of power transmission capacity, efficiency, tolerance to offsets, vibrations, and space requirements. This analysis will provide a comprehensive understanding of the advantages and disadvantages of different coupling options.

Optimization of Coupling Parameters: Investigate the optimization of parameters for the Combined Parallel and Angular Displacement Coupling. Explore the effects of different design variables such as shaft diameter, coupling dimensions, and materials on the performance of the coupling. Implement optimization techniques to determine the optimal combination of parameters that maximizes power transmission efficiency and minimizes stresses.

Experimental Validation: Perform experimental tests to validate the performance of the Combined Parallel and Angular Displacement Coupling. Construct a prototype coupling and conduct tests under various load conditions, angular offsets, and speeds. Measure parameters such as torque, power transmission, and efficiency, and compare them with the theoretical results presented in your research paper. This experimental validation will provide practical evidence of the coupling's performance.

Finite Element Analysis (FEA): Utilize finite element analysis software to conduct a detailed stress analysis of the coupling components. Perform FEA simulations to verify the stresses and safety factors obtained in your research paper. Additionally, investigate the effects of different materials, manufacturing processes, and geometric modifications on the stress distribution and safety of the coupling. This analysis will enhance the understanding of the coupling's structural integrity.

Application-Specific Studies: Explore specific applications where the Combined Parallel and Angular Displacement Coupling can be implemented. Investigate the coupling's performance in different industries and machines that require power transmission with parallel and angular offsets. Analyze the coupling's suitability, efficiency, and reliability in specific application scenarios and compare it with alternative coupling solutions.

III. METHODOLOGY

Many preliminary alternatives are eliminated during this phase. Designer should have adequate knowledge above physical properties of material, loads stresses, deformation, failure. Theories and wear analysis, He should identify the external and internal forces acting on the machine parts

These forces may be classified as;

1. Dead weight forces
2. Friction forces
3. Inertia forces
4. Centrifugal forces
5. Forces generated during power transmission etc.

Designer should estimate these forces very accurately by using design equations. If he does not have sufficient information to estimate them he should make certain practical assumptions based on similar conditions which will almost satisfy the functional needs. Assumptions must always be on the safer side.

Selection of factors of safety to find working or design stress is another important step in design of working dimensions of machine elements. The correction in the theoretical stress values is to be made according in the kind of loads, shape of parts & service requirements.

Selection of material should be made according to the condition of loading shapes of products environment conditions & desirable properties of material.

Provision should be made to minimize nearly adopting proper lubrications methods. In, mechanical design the components are listed down & stored on the basis of their procurement in two categories

- Design parts
- Parts to be purchased

For design parts a detailed design is done & designation thus obtain are compared to the next highest dimension which is readily available in market. This simplification the assembly as well as post production service work. The various tolerance on the work is specified. The process charts are prepared & passed on to the work are specified. The parts to be purchased

directly are selected from various catalogues & specification so that anybody can have purchased the same from the retail shop with the given specifications.

IV. EXPERIMENTAL RESULTS

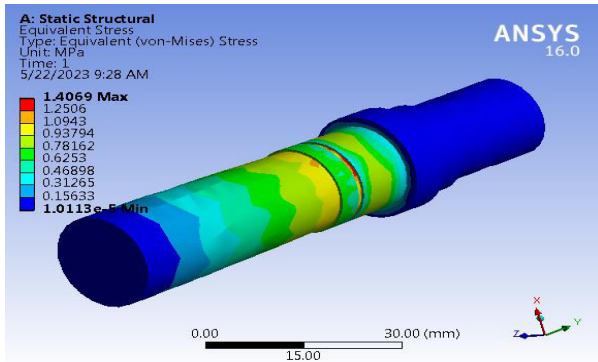


Fig no. (2) Analysis of Main input shaft

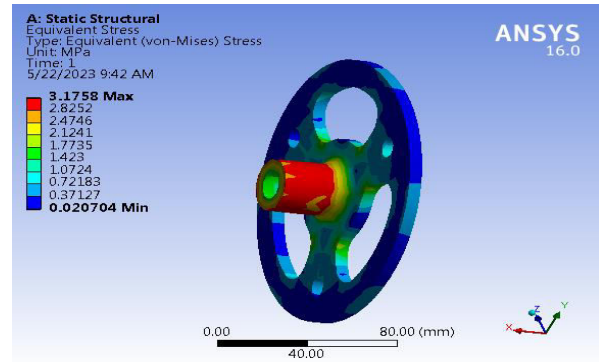


Fig no. (3) Analysis of Input transmission disk

Analysis revealed that the maximum Equivalent Von-mises stress (1.4069 MPa) is less than allowable stress the main input shaft is safe.

Analysis revealed that the maximum Equivalent Von-mises stress (3.17 MPa) is less than allowable stress the input transmission disk is safe

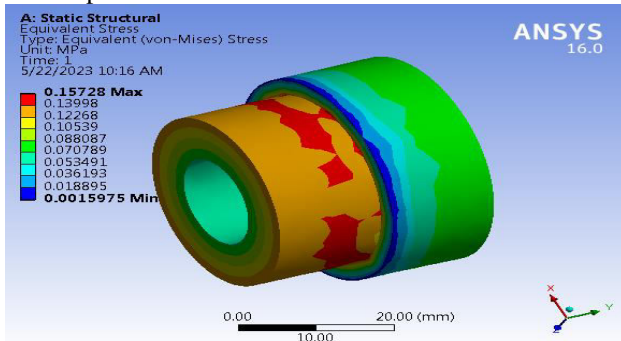


Fig no. (4) Analysis of Input coupler joint

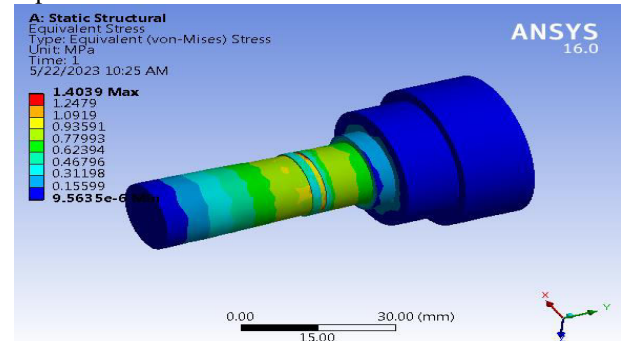


Fig no. (5) Analysis of Angular offset Coupler shaft

Analysis revealed that the maximum Equivalent Von-mises stress (0.157 MPa) is less than allowable stress the input coupler joint is safe

Analysis revealed that the maximum Equivalent Von-mises stress (1.4039 MPa) is less than allowable stress the Angular offset Coupler shaft is safe.

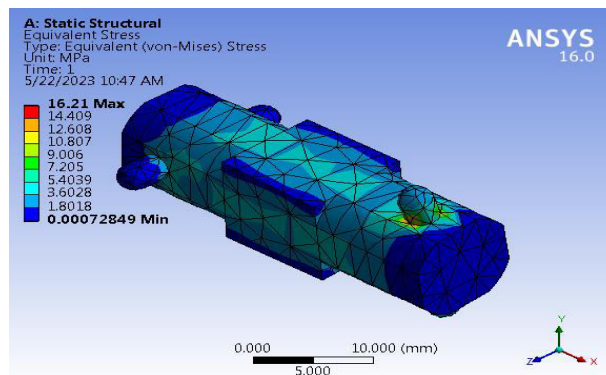


Fig no. (6) Analysis of Angular coupler link

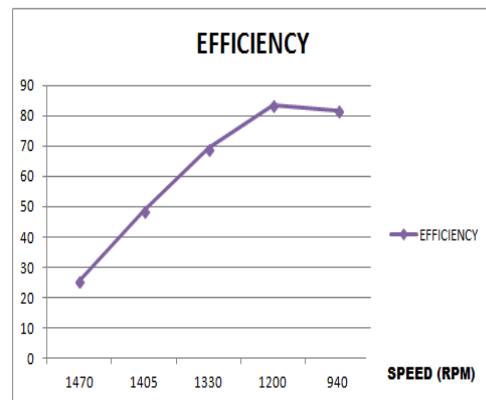
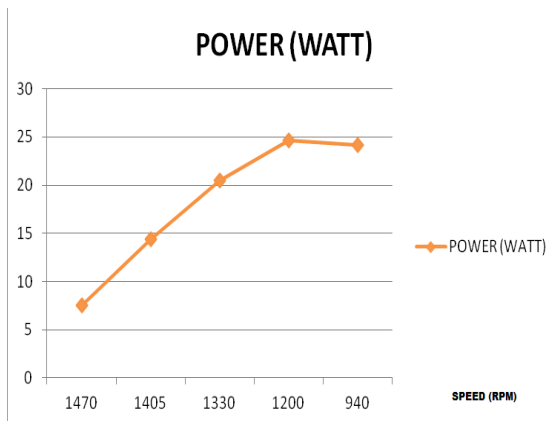
Analysis revealed that the maximum Equivalent Von-mises stress (16.21 MPa) is less than allowable stress the angular coupler link is safe.

Performance evaluation of Combined Parallel and angular displacement coupling



Fig no. (7)

Graph of Output power Vs Speed (Parallel offset A) Graph of Efficiency Vs Speed (Parallel offset B)



Graph shows that

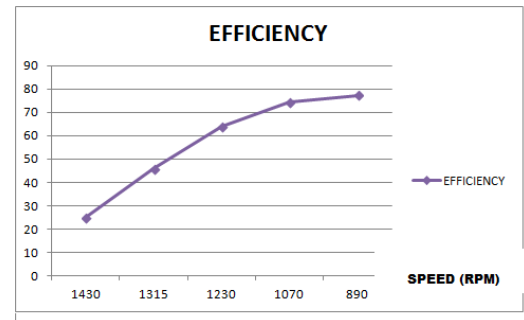
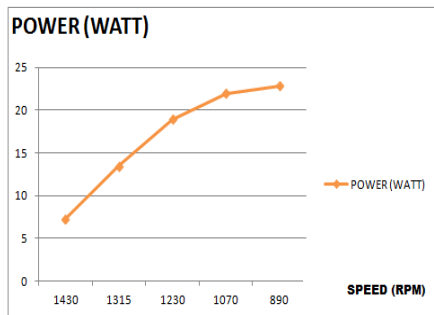
- (A) Maximum power in parallel offset of 40 mm is 25.69 watt at speed of 1220 rpm.
- (B) Maximum efficiency in parallel offset of 40 mm is at speed of 1220 rpm with maximum efficiency of 84.69 percent.

Result table Angular offset 5 degree

SR NO	LOAD (kg)	SPEED (rpm)	TORQUE (N.M)	POWER (watt)	efficiency
	0.2	1370	0.04905	7.037923	23.77677
	0.4	1290	0.0981	13.2539	44.77668
	0.6	1230	0.14715	18.95616	64.04107
	0.8	1180	0.1962	24.24744	81.91704
	1.0	920	0.24525	23.63098	79.8344

Graph of Output power Vs Speed (Angular offset C)

Graph of Efficiency Vs Speed (Parallel offset D)



(C) Maximum power in angular offset of 5 degree is 24.24 watt at speed of 1180 rpm

(D) Maximum power in angular offset of 5 degree at speed of 1180 rpm with maximum efficiency of 81.91 percent.

V. CONCLUSION

In many applications it is required to transmit power between shafts that are having parallel offset, the conventional system of Oldham’s coupling cannot be used in such cases due to limitation of parallel offset. The developed coupling gives maximum offset of 40mm on both sides and transmits Maximum power in parallel offset of 40 mm is 25.69 watt at speed of 1220 rpm with maximum efficiency of 84.69 percent.

In many applications it is required to transmit power between shafts that are having angular offset, the conventional system of universal joints cannot be used in such cases due to vibrations and high space requirement. The developed coupling gives maximum angular offset of 5 degree on both sides and transmits Maximum power in angular offset of 5 degree is 24.24 watt at speed of 1180 rpm with maximum efficiency of 81.91 percent

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Assessment of Ground Water Quality in Bhosari MIDC Area, Pune

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ABSTRACT: Water is a finite and important resource for living, yet the availability of water resources is decreasing with time, and water quality is degrading owing to over-exploitation. Water quality is an important factor to consider before supplying it to humans. Water that is fit for drinking must always be accessible. Studying regions with deteriorating groundwater quality is crucial since there has been a recent shortage of safe drinking water, This realisation led to the research of groundwater quality close to the Bhosari industrial area. For this purpose, samples were collected from open wells and bore wells around the Bhosari MIDC region. The sample is assessed for the following physico-chemical and biological parameter: (1)pH (2)Phosphate (3) Sulphate (4)Total hardness (5)Nitrate (6)Chloride (7)Turbidity (8)DO (9)BOD (10)COD (11)Iron (12)MPN. The objective of this study is to analyse the underground water quality of Bhosari MIDC area in pune by water quality index. Twelve physico-chemical and biological parameters collected from seven different locations since a period of 2022-23. In this study most of the water samples were found good quality and only some amount of water samples falls under moderately poor category. As a result, some treatment before use is essential and also required to protect that area from contamination.

KEYWORDS: Water quality assessment, Ground water, Physico-chemical, Drinking water, Permissible limit, Correlation.

I. INTRODUCTION

Water is essential to human life as it is used in agriculture, industry, and daily living. The health of the water ecosystem affects the physico-chemical and biological parameters. Due to rising industrialisation, urbanisation, agricultural activity, and other human activities, both surface water and ground water pollution has been increasing. The quality of water refers to its physical and chemical properties. Water may be utilised for drinking, fishing, farming, industry, and enjoyment. Each of these specified applications has certain defined chemical, physical, and biological requirements that must be met in order to serve its intended purpose. Water is the element that is most prevalent and abundant in nature. There are 1400 million billion litres of water in total, but most of it is not suitable for drinking since it is 97% sea water and just 3% fresh water, of which 2% is frozen in glaciers and the poles, and only 1% is portable. The quality of surplus water depends on how well groundwater can be used by people. In order to fulfil the needs of increasing economies, changing lifestyles, and shifting consumption patterns, there will be a major rise in the need for freshwater during the coming decades. In order to manage groundwater quality in the present and the future, it is becoming more important to estimate groundwater for drinking and irrigation. The world's groundwater, which is extensively exploited for a number of reasons, provides around 25% of the fresh water. Analysing the physical, chemical and biological characteristics of groundwater is essential for research on public health. These studies play a significant role in environmental contamination research. According to the WHO, roughly 80% of all human illnesses are caused by water. The purpose of this study is to determine the physico-chemical and biological composition of groundwater.

II. OBJECTIVE

The broad objective of the present work is to carry out the experimental studies on analysis of ground water. In the present study, an effort is made to analyse the ground water.

1. To check whether the quality of water complies with standards and to check suitability for designated purpose.
2. To obtain quantitative information on the physical, chemical, and biological characteristics of water
3. Encouraging settings for water resource use that are important socially, economically viable, and environmentally sustainable.

4. Accurate and timely information of the quality of water is necessary to shape, sound public policy and to implement water quality improvement program effectively and efficiently.

III. METHODOLOGY

Ground Water samples are collected from Bhosari MIDC Area (District-Pune). Seven Locations were selected and two samples from each location were collected from respective area. Few samples were collected from well and remaining samples were collected from bore well. After that, to check whether the water quality is in compliance with the standard methods and protocols hence suitable or not for the designate use.

Step 1: Selection of site.

Step 2: Sampling collection from Bhosari MIDC Area.

Step 3: Physical, Chemical and Biological analysis of the sample.

Step 4: Comparing each result to the standard permissible limit.

Step 5: Sample's quality for drinking water is analyzed.

Step 6: Correlation analysis is carried out.

IV. EXPERIMENTAL RESULTS

Parameter	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation (CV%)
pH	6.68	7.07	6.85	0.15	2.19
Total Hardness	128	294	207.8	9.64	4.6
Turbidity	0.37	0.93	0.73	0.18	24.68
Chloride	23	97	56.7	8.82	15.5
Sulphate	100	166.6	126.7	5.41	2.93
Phosphate	0.26	0.57	0.039	0.011	28.2
Nitrate	0.044	0.077	0.071	0.013	18.3
Iron	0.019	0.071	0.039	0.018	46.15
DO	1.26	5.18	2.67	2.63	98.5
BOD	3.2	8.64	6.12	1.88	30.72
COD	7.3	19.4	14.01	3.92	27.9

Table-IV.1: Descriptive statistics of the analyzed chemical components

Parameter	S1	S2	S3	S4	S5	S6	S7
MPN	7	28	0	28	28	28	0
Total Coliform Bacteria	Present	Present	Absent	Present	Present	Present	Absent
E-Coli Bacteria	Present	Present	Absent	Present	Present	Present	Absent

Table-IV. 2: Analysis results of collected samples

Correlation of physicochemical parameters of ground water:-Correlation coefficient is used to determine the relation of one variable with another variable. The correlation matrices for 11 variables were prepared from 7 samples.

From the table3 it is clear that pH shows negative correlation with TH, turbidity, chloride, sulphate, nitrate and iron. DO shows negative with TH, turbidity, Chloride, sulphate, phosphate, and iron.

	pH	TH	Turbidity	DO	BOD	COD	Chloride	Sulphate	Phosphate	Nitrate	Iron
pH	1										
TH	-0.12301	1									
Turbidity	-0.12712	0.962322	1								
DO	0.219782	-0.22999	-0.09332	1							
BOD	0.042214	0.178989	0.170769	0.600148	1						
COD	0.05156	0.175599	0.167893	0.541819	0.954695	1					
Chloride	-0.10181	0.6226	0.422982	-0.40462	0.425974	0.409547	1				
Sulphate	-0.1757	0.92094	0.807098	-0.48573	0.170456	0.191483	0.838196	1			
Phosphate	0.011276	0.646229	0.455534	-0.16478	0.481636	0.529658	0.886593	0.770754	1		
Nitrate	-0.24268	0.627396	0.549663	0.250904	0.60567	0.691067	0.563711	0.574561	0.812986	1	
Iron	-0.16171	0.548598	0.364324	-0.14795	0.25883	0.289357	0.669784	0.622793	0.900918	0.85215	1

Table-IV. 3: Correlation of physicochemical parameters of ground water

V. CONCLUSION

1. The results obtained from the analysis of physico-chemical and biological parameters for drinking purpose show that few parameters exceed the permissible limit.
2. The Total hardness values of the majority of the samples were found to be higher than the desired limits of the IS10500-2012 when the obtained results were compared with that standard.
3. The bacteriological analysis of several samples also reveals the presence of Total Coliform Bacteria and E-Coli Bacteria, proving them unsafe for drinking.
4. The source of contamination may be septic tanks too close to the well, leaking drainage water and continuous disposal of industrial effluents. Therefore there is a need of some treatment before usage and also required to protect that area from contamination.
5. Rainwater collecting structures should be developed to replenish ground water aquifers in order to improve ground water resources and preserve the quality and quantity of ground water reservoirs, therefore diluting the increased concentration of chemical elements.
6. A public awareness campaign should be launched to increase people's knowledge and understanding about how to reduce water pollution in their communities.

VI. ACKNOWLEDGEMENT

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Comparative Analysis of Conventional Load Bearing Structure and 3-D Printing Technology

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ABSTRACT: Comparison between conventional load-bearing structure & 3-D printed building of cost analysis, estimation & design calculations. In this paper research has been quoted on how 3-D printed technology differentiates with the conventional load bearing structures. The analysis further compares key aspects of conventional load-bearing construction and 3D printing technology. These aspects include cost-effectiveness, speed of construction, design complexity, sustainability, and adaptability to diverse architectural styles. By examining these factors, the study aims to provide insights into the potential advantages and disadvantages of both approaches, allowing stakeholders to make informed decisions regarding construction methods. Ultimately, this comparative analysis aims to contribute to the body of knowledge surrounding construction methods by critically examining the differences between conventional load-bearing construction and 3D printing technology. The findings of this study can inform industry professionals, researchers, and policymakers about the potential benefits and limitations of each approach, helping them make informed decisions regarding construction projects and explore new outlets for innovation in the field.

KEYWORDS: Conventional method, sustainability, cost effectiveness, adaptability, construction cost.

I. INTRODUCTION

This paper aims to contribute to the understanding of the benefits and limitations of conventional load-bearing construction and 3D printing technology. The findings presented in this review will assist construction professionals and researchers in making informed decisions, promoting advancements, and exploring new avenues for innovation in the construction industry.

Introduction of 3D Printing of Structures: Three-dimensional (3D) printing, also known as additive manufacturing, has revolutionized the manufacturing industry by enabling the creation of complex objects layer by layer using digital models. While 3D printing was initially limited to smaller-scale objects and prototypes, advancements in technology have now expanded its applications to include the construction of large-scale structures. The advantages of 3D printing in construction are numerous. Firstly, it offers significant time and cost savings compared to conventional construction methods. With 3D printing, complex structures can be built quickly and efficiently, reducing construction timelines and labor costs. Additionally, the ability to print structures on-site eliminates the need for transportation and reduces material wastage. Moreover, 3D printing allows for intricate and optimized designs that were previously unattainable with conventional construction techniques. Architects and engineers can now create structures with complex geometries, intricate patterns, and variable densities, resulting in enhanced structural performance and aesthetic appeal. Furthermore, the technology enables the integration of functional features, such as embedded sensors, plumbing, and electrical conduits, directly into the printed structure.

Conventional Load-Bearing Structures: Conventional load-bearing structures refer to the traditional methods of constructing buildings and infrastructure using materials like steel, concrete, and wood. These structures rely on gravity and the strength of the materials to support loads and distribute forces. In conventional construction, load-bearing structures typically consist of beams, columns, walls, and slabs. The design and construction process involves the use of standardized building components and techniques that have been refined over many years. The materials used are carefully selected based on their strength, durability, and suitability for specific applications. However, conventional construction methods often require substantial labor, time, and resources. The assembly of building components, formwork, and manual labor can contribute to longer construction schedules and higher costs. Additionally, the design options may be limited compared to the flexibility offered by 3D printing. While 3D printing of structures is a relatively new development, it shows great promise in terms of efficiency,

customization, and design freedom. However, conventional load-bearing structures will continue to play a crucial role in the construction industry, especially for projects that require proven performance, adherence to building codes and regulations, and a long track record of success. The choice between 3D printing and conventional methods will depend on the specific project requirements, budget, timeline, and the level of innovation desired.

II. RELATED WORK

Larsen & Toubro is close to completing construction of India's first public building in Bengaluru, using 3D-printing technology. The building, a post office sprawled over 1,100 square feet, is being 3D-printed at a cost of Rs 23 lakh over 45 days. Although the technology cuts the construction time by 30-40 percent, the cost remains almost the same as for single projects, the **company** said. Contrary to traditional construction methods, 3D-printing uses a robotic arm to create layers using a special concrete mixture fed into the system. The mixture has special adhesives for quick drying and other functions.

Tvasta Manufacturing Solutions, a start-up founded by alumni of IIT Madras, has made India's first 3D-printed house. The team printed the structure using a specialty concrete that it had developed to print large-scale 3D structures in short periods. Its first structure, a single-storey house, is 600 square feet and there have been numerous studies and



advancements in the field of 3D printing in construction. Here are some notable areas of related work:

1. Construction-scale 3D printers: Researchers and companies have developed large-scale 3D printers specifically designed for construction purposes. These printers are capable of extruding construction materials, such as concrete, at a much larger scale compared to desktop 3D printers. They often utilize robotic arms or gantry systems to achieve precise and controlled printing.
2. Material development: The development of suitable construction materials for 3D printing has been a focus of research. Various types of concrete mixes, polymers, and composite materials have been investigated to optimize their properties for printing, such as workability, setting time, strength, and durability. Researchers are also exploring the use of sustainable and recycled materials for environmentally friendly construction.
3. Structural analysis and design optimization: Researchers are using computational tools and simulations to analyze the structural behavior of 3D-printed structures. Finite element analysis (FEA) and other numerical methods are employed to study the stress distribution, deformation, and load-bearing capacity of printed elements. Design optimization techniques are also being applied to improve the efficiency and performance of 3D-printed structures.
4. Architectural and geometric possibilities: 3D printing in construction offers new design possibilities due to its ability to create complex geometries and customized structures. Researchers are exploring the integration of architectural and geometric features into printed buildings, such as curved walls, free-form shapes, and intricate patterns. This opens up avenues for innovative and unique architectural designs.

III. METHODOLOGY

Cost-effectiveness: 3D printing technology has shown potential for reducing construction costs, particularly in terms of labor expenses. By automating the construction process and minimizing manual labor, 3D printing can help lower labor costs and increase overall cost-effectiveness, especially for repetitive or complex structures. Meanwhile in conventional structure labour expenses are on much higher side.

Speed of Construction: 3D printing technology has demonstrated the ability to significantly accelerate the construction process compared to conventional methods. The layer-by-layer additive manufacturing approach of 3D printing allows for faster construction of building components, reducing project durations and enabling rapid deployment of structures.



conventional load bearing structure involves various procedures which consumes ample amount of time [at least 6-7 working months]

Sustainability: 3D printing technology has the potential to reduce waste and improve sustainability in construction. By precisely controlling material usage during the additive manufacturing process, 3D printing can minimize material waste. Additionally, the ability to use eco-friendly and recyclable materials in 3D printing further enhances sustainability in construction practices. Whereas conventional load bearing structures are not recyclable.

Adaptability: Conventional load-bearing construction techniques have a high degree of adaptability and versatility, allowing for modifications and alterations during the construction process. While 3D printing technology is still evolving in terms of adaptability, research and development efforts are focusing on improving the ability to accommodate design changes and incorporate different architectural styles.

Details

Plot Area: 550 Square Feet

Total Bedrooms: 1

Type: Modern

Building Material in House Construction

The substance used to make homes is known as building material. The primary building materials for houses are granite, concrete, steel, sand and bricks. As the population grows, more materials will be needed, including stone, wood, river sand, doors, windows, lumber, painting, granite, plumbing, electrification, composite material, and well filling. The generation of garbage has greatly benefited from this expansion. The items listed below must be used to construct a 600 square foot house. Below is a list of the prices for each commodity along with their overall costs.

1. **CEMENT:** A bag of cement will run you about 300 rupees. We need 260 bags of cement to build a 600 square foot house, which costs 78,000 rupees.
2. **STEEL:** The price of steel is approximately 45 Rs/kg. We need about 1.5 tonnes of steel, and the total price is 67,500 rupees.
3. **SAND:** We require 1250 cubic feet of sand, which costs 50 rupees per cubic foot. Rs 62500 is the total cost.
4. **AGGREGATE:** 22 Rs. per cubic foot. We require 750 cu ft. Total: 16,500 rupees.
5. **LABOUR RATE:** A single worker typically earns 250 rupees per square foot. We are constructing a 600 square foot home. Therefore, the total is Rs. 1,50,000. **BHISHTY:** Priced at Rs 250/day. Required for 6 months. Total amount- 33,750 Rs.
4. **BRICKS:** We need 15,000 units of bricks. There are nine rupees in a brick. Total: 1,35,000 rupees.
5. **VATRIIFIED TILES:** 37 Rs. per square foot. 420 sqft of vatriffied tiles are required. Total: 15,540 Rupees.
6. **GRANITE:** Needs 190 square feet to build, priced at Rs 160 per square foot. A sum of Rs. 30,400 is involved.
7. **KOTA STONE:** 22/sqft in price. 270 square feet are required for construction. 5,940 Rupees are required in total.
8. **WINDOW GRILL:** 1950 per grill. Four components are required for construction. Total: 7,800 rupees.
9. **DOOR:** Each unit costs Rs3650. Six components are required for construction. Total: 21,900 Rupees. **SLIDING WINDOW:** Priced at Rs3500/unit. The quantity needed to be constructed is 4 units. Total amount= 14,000 Rs.
10. **WATER TANK:** Rs. 8 per litre. 1000L are needed for construction-related purposes. Total: 8,000 rupees.
11. **WALLPUTTY & PAINT:** Rate: 19/sqft. Total area to be completed is 2850 square feet. Total price: 54,150 rupees.
12. **ELECTRIFICATION:** 45,000 Rupees total.
13. **PLUMBING:** \$17,000 in total.
14. **CEREMIC TILES:** 22 Rs. per square foot. A total of 250 square feet must be completed. Therefore, the total is Rs. 5,500.
15. **EXCAVATION:** 7 Rs. per cubic foot. 1950 cu ft of excavation is required. Total: 13,650 Rupees.
16. **DOOR FRAME:** The cost of a door frame is \$1950 per unit. Six units are needed to complete the project. Total: 11,700 rupees.

Construction of a 3D-printed home costs about Rs 5.5 lakhs.

We have determined the cost difference between using a 3D printer to create a one-story building for a 600 square foot home in India and using the conventional building approach by using numbers.

Difference:

1) The approximate total cost to construct a one-story building using the conventional method is Rs. 8,30,500. 2) The total cost to construct a one-story structure utilising 3D build printing is approximately Rs. 5,50,000. By deducting [2] from [1], we arrive at [Rs 8,11,330 - Rs 5,50,000] = approximately Rs 1,00,500. Therefore, employing 3D printers to create a one-story building instead of the traditional approach will save us around Rs 2,67,330.

The first 3D-printed house in India

IV. CONCLUSION

In conclusion, 3D printing of structures offers significant advancements and opportunities in the field of construction. It provides advantages such as increased design flexibility, faster construction timelines, reduced labor costs, and the integration of functional features. With 3D printing, complex and customized structures can be created with precision and efficiency. However, it is still a relatively new technology, and its adoption in the construction industry is gradually increasing.

On the other hand, conventional load-bearing structures have a long history of proven performance and reliability. They offer a high level of structural integrity and are suitable for a wide range of applications. Conventional construction methods have well-established standards and practices, ensuring adherence to building codes and regulations.

Ultimately, the choice between 3D printing and conventional load-bearing structures depends on the specific project requirements, budget, timeline, and desired level of innovation. While 3D printing shows great promise for the future, conventional methods will continue to be essential for projects that require a long-standing track record of success and compliance with established industry practices. As the technology evolves and becomes more widely adopted, it may complement and coexist with conventional construction methods, leading to a more diverse and innovative construction industry.

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Design of RCC Well Using STAADpro Software

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ABSTRACT: Water is human basic needs for daily life. Sufficient water distribution depends on design of a water tank in certain area. Many new ideas and innovation have been made for the storage of water and other liquid materials in different forms and fashions. Water retention structures, often known as water storage tanks, are an essential component of any distribution system. During periods of low demand, water is pumped into the storage tank, and during periods of high demand, water is pushed out of the storage tank and into the distribution system. STAADpro is a popular structural analysis application known for analysis, diverse applications of use, interoperability, and time-saving capabilities. STAADpro helps structural engineers perform 3D structural analysis and design for both steel and concrete structures.

KEYWORDS: STAADpro Software, RCC Well, Well Design, Software, Manual calculation

I. INTRODUCTION

Water is human basic needs for daily life. Sufficient water distribution depends on design of a water well in certain area. Many new ideas and innovation have been made for the storage of water and other liquid materials in different forms and fashions. Concrete is the second most widely used material after water in all over the world. Cement concrete has very well used in construction globally because of its better engineering properties and also on accounts of its better ecology and environmental acceptance.

Water retention structures, often known as water storage tanks, are an essential component of any distribution system. Underground wells are used as reservoirs where water is pumped to overhead tanks. When water is not available it will help us store and use water. Pumps are used for the supply of water with respect to their use. The introduction of STAAD Pro V6i software has resulted in considerable advances in the analysis and design of any structures. Therefore, it is of great encouragement to study and understand the use of software in solving practical problems. Pump House or Pumping stations are facilities including pump and equipment for pumping fluids from one place to another.

II. OBJECTIVES

- The goal is to ensure that the RCC well can withstand the expected loads and environmental conditions over its intended lifespan.
- To carry out a literature review related to the underground water well.
- To create a safe, durable, and efficient structure that meets the desired requirements.
- The design takes into consideration factors such as the depth of the well, the diameter of the well, the type of soil, and the load-bearing capacity of the structure

III. OBJECTIVES OF THE STUDY

- The RCC circular water well of 10,00,000 liters capacities having following properties is selected for this study.



- The dimension of UG well is diameter(8m), height(21m).
- Height of well below ground level (20m).
- Pump House height (5m), diameter (8m)
- Density of concrete = 25 kN/m³
- Grade of concrete = M25
- Grade of steel = Fe 415
- Analysis of forces acting on RCC well by the surrounding soil and water present in the well as per IS:3370 (part II and IV).
- Design have been done with the help of STAADpro software.

IV. INTRODUCTION ABOUT SOFTWARE

STAAD PRO V8I

STAAD or (STAAD Pro) is a structural analysis and design computer program originally developed by Research Engineers International at Yorba Linda, CA in 1997. STAAD Pro software is a popular tool used for designing and analyzing RCC structures. It is a powerful structural analysis and design software that allows engineers to create accurate and efficient designs for various types of structures, including RCC wells.

Using Staad.pro software, we can create 3D models of RCC wells, perform structural analysis, and optimize the design to meet the desired requirements. The software provides various features such as automatic meshing, load application, and analysis tools that help engineers to create safe and reliable designs. We can confidently design structures anywhere in the world using over 80 international codes, reducing your team's need to learn multiple software applications

V. PROBLEM STATEMENT

- Finding the Well's location;
- Water Leakage through the walls;
- Concrete's Low Tensile Strength result in the tension zone will develop cracks if inadequate reinforcing is given.
- Need for better water supply pump maintenance.
- Errors are common when calculations are done manually.

PARAMETERS

- Capacity Of water well
- Shape of water well
- Unit weight of soil
- Angle of internal friction
- Bearing capacity of soil
- Width of column
- Size of well
- Grade of Concrete & Steel



VI. LITRETURE REVIEW

Komal K Wagh, Akshay K Ghule, Deepak N Gaidhane (2021): - They published an article on **Design and Analysis of underground water tank by using StaadPro**. They designed underground water tank of rectangular shape and analyzed using Staad pro. Underground water tank faces different type of loads compared to other structures, they mainly face Horizontal or lateral loads due to earth pressure and water pressure or any liquid pressure which is been stored in the tank. The side walls of the underground water tank will face greater load at the bottom and the load linearly decreases towards the top. Staad Pro analysis and design is always beneficial over the conventional method of analysis and design of water tank. By Using Staad Pro software there is saving of 15% to 20% of total steel in the whole structure.

Zora Mistrikova, Norbert Jendzelovsky (2011): - They published an article on **Static analysis of cylindrical tank resting on various types of sub soil**. This paper present analysis of deformations and stress of the circular rotationally symmetric tanks. The reinforced concrete tanks water reservoir resting on elastic subsoil have been analyzed. Cylindrical concrete tank was modelled by shell square finite elements with six degrees of freedom in a node. It was mentioned above, numerical calculations of the interaction between the structure and the subgrade were modelled using FEM. The tank structure, where heavy ring load occurs along the circumference of the circular foundation plate, it is necessary during the calculation to consider the acting of the surrounding subsoil near the foundation plate.

Ms. Pranjali N. Dhage, Mr. Mandar M. Joshi (2017): - They published an article on **dynamic analysis of elevated RCC circular liquid storage tank in its entirety would be difficult to address**. This literature review focuses on recent contributions related to dynamic analysis of liquid storage tanks, past efforts most closely related to the needs of the present work. Earthquakes represent an external hazard for industrial plants and may trigger accidents, i.e., fire and explosions resulting in injury to people and to near field equipment's or constructions, if structural failures result in release of hazardous material. Normally, they are constructed of reinforced concrete in the form of rectangular or circular configurations. Currently there are few codes and standards available for seismic design of LCS in North America.

Mahesh Kumar Pal, Nitesh Kushwaha (2019): - They published an article on **Study on Overhead Circular Water Tank using StaadPro**. The columns are taken circular for both tanks and diameter are 300 mm and height is 15 meters. The height of water tank is 4.3 meter and diameter are 8 meters for circular water tanks. Capacity of water stored is 2,00,000 liters. These models are analyzed for dead load, water load and seismic load. Dead load was designed according to IS: 875-1987(Part 1) and Seismic load was designed using response spectrum method for earthquake zone III of India using IS: 1903-2002. Study of capacity in overhead circular tank without center column and circular tank with center column it is clear that the seismic hazard and water pressure are the measure component for the analysis of the tank. Water pressure is not same in all places of the tank.

Vaishnavi S. Sarode, Prof. Ms. A. A. Yadav (2020): - They published an article on **analysis and design of Jack well structures**. Intake structures are used for collecting water from the sources like river, lake, and reservoir and transfer it further to the water treatment plant. The paper highlights the work administered on construction of Jack well with Overhead Pump House. The main reason for that is rising in demand for water and poor distribution of water. The Paper includes the provision of Design of a water treatment scheme for the area in order to supply the treated water to the houses. Jack well and Pump House has been analyzed by using STAAD PRO vi8 software under seismic condition.

Load Calculations:

DL = 25KN/M Cu., FFL= 1.5KN/Sq.m, LL= 2KN/Sq.m

- 1) Beam 300 X 300mm = 6 Bars of 12mm,
Stirrups = 8mm bar at 125mm Spacing.
- 2) Beam 450 X 300mm = 7 Bars of 12mm,
Stirrups = 8mm bar at 125mm Spacing.
- 3) Column 300 X 300mm = 6 Bars of 12mm,
Stirrups = 8mm bar at 125mm Spacing.

For Water pressure and Soil pressure = $\frac{1}{2} rH^2 K_a$

For Soil Pressure

$K_a=0.33, r= 21$

At 3m height = 31.185 kN/m²

At 20m height (depth at bottom) = 1386kN/m²

For water pressure

$K_a = 1, r = 10$

at 20m Water (fully filled)

= 2000kN/m²

Circular Slab Design

Circular Slab = 8m dia.,

Super imposed load = 2500N/m²,

$f_{ck}= 25N/mm^2$,

$f_y = 415 N/mm^2$

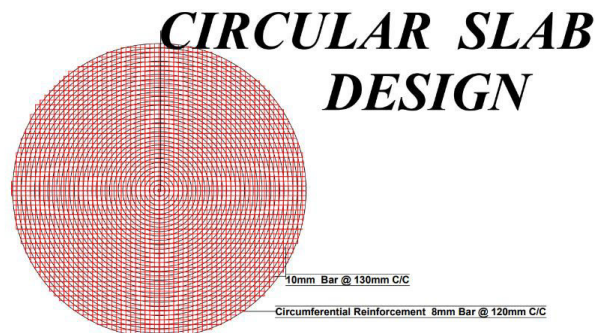
From page no. 38 of IS456:2000,

- 1) Assume % of steel = 0.2
- 2) Total Load = 7550N/m²
 Ultimate load = 1.5 x 7550 = 11325 N/m²
- 3) B. M at Centre = 33.975 x 10⁶ Nmm
- 4) Circumferential Moment at edge = 22.650 x 10⁶ Nmm
- 5) Effective depth of other direction = 170mm
 - Steel Reinforcement $A_{st_c} = 587.514 \text{ mm}^2$
 - Spacing = 133.68 mm

Provide 10mm bar @ 130mm c/c.

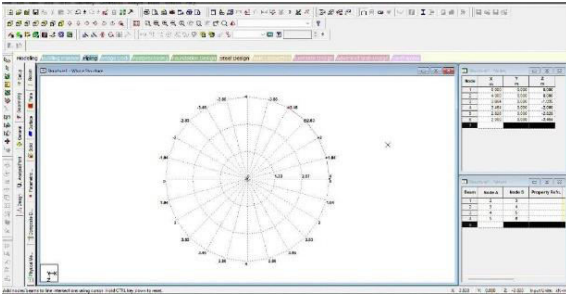
- Circumferential Reinforcement $A_{st_c} = 404.178 \text{ mm}^2$
- Spacing = 124.36 mm

Provide 8mm bar @ 120mm c/c

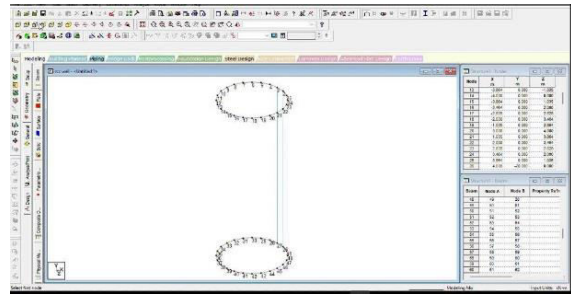


STRUCTURAL COMPONENT

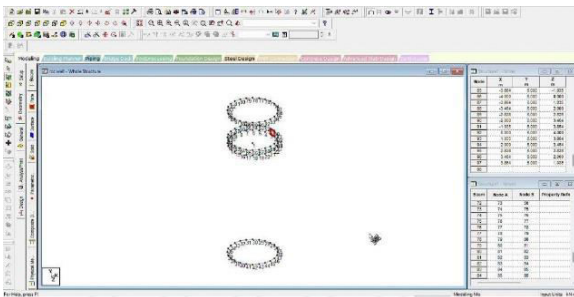
Well Model in StaadPro



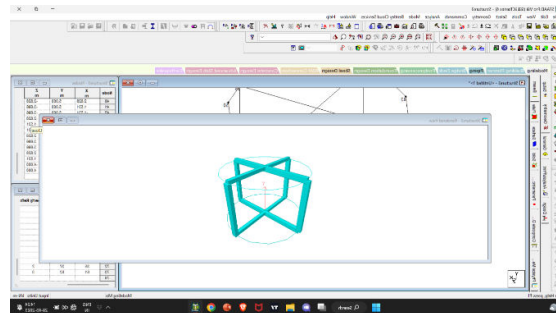
STEP 1



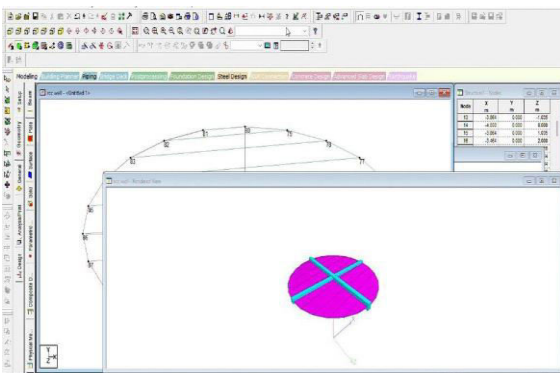
STEP 2



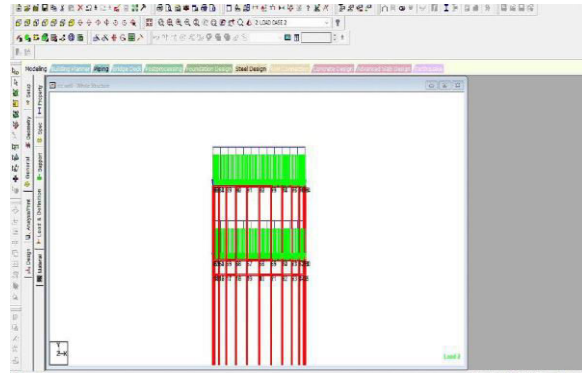
STEP 3



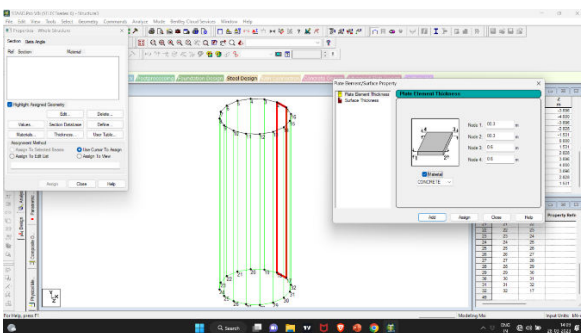
APPLYING BEAMS AND COLUMNS



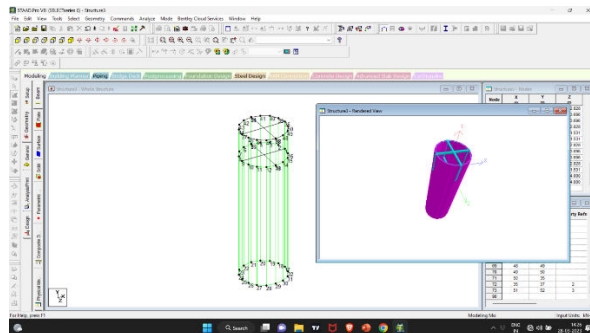
APPLYING SLAB



APPLYING LOADS



APPLYING PLATES

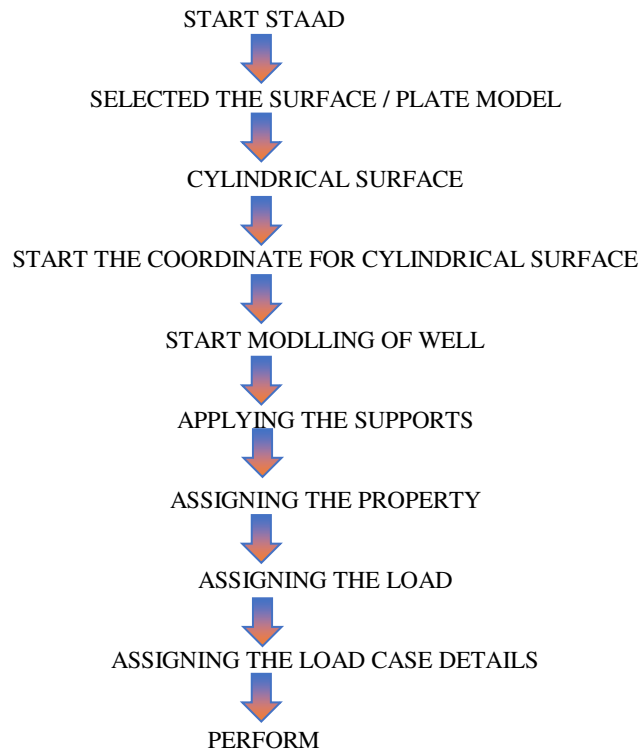


RENDER IMAGE

METHODOLOGY USING STAADPRO

A flow chart is produced as the overarching research methodology for this project

FLOW CHART



ACKNOWLEDGMENT

Firstly, we are profoundly grateful to Prof. Swapnil Bijwe for his expert guidance and continuous encouragement throughout to see that this project reaches its target since its commencement to present. I would like to thank Prof. Lt. Col. Sanjay Karodpati Head of Civil Engineering Department of Dr. D. Y. Patil School of Engineering Lohegaon, Pune and Prof. Uzma Shaikh Project Coordinator whose invaluable guidance supported us in this project.

VI. CONCLUSION

In conclusion, RCC well design using Staad.pro software is an efficient and reliable method for creating safe and durable structures. The software provides engineers with the necessary tools and features to create accurate designs and optimize them for maximum efficiency.

- We created an underground water well circular in shape.
- Using StaadPro, the grade M25 and Fe415 materials have been concluded.
- All the parameters such as water pressure, earth pressure, and saturated soil pressure are taken into consideration while designing.
- The well can withstand all the governing loads.

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Following papers were reviewed for the present study.

1. Komal K Wagh, Akshay K Ghuge, "Design and Analysis of underground water tank by using Staad Pro".
2. P. R. Jagtap, S. M. Pore and Vipul Prakash "Dynamic Analysis of RCC Cantilever Retaining Wall with



- Different Parameters”.
3. S. S Patil, A.A.R. Bagban “Analysis and Design of Reinforced Concrete stepped Cantilever Retaining Wall.”
 4. Suraj Tripathi, Annu Dubey “Time History analysis of underground water tank for different seismic intensity”.
 5. Er Gaurav Goel, Er Bharat Bhushan Jindal “Suitability of Steel Fiber Reinforced Concrete for RCC Water Tanks”.
 6. Shahid Nazir, and Ashish Kumar “Analysis of Circular Overhead Intze Water Tank by StaadPro V8I SS6 Software”.
 7. M. Thakur, Sourabh B. Kumar and Prakash G. Choudhari “Seismic Analysis of Elevated Water Tank with Variations of H/D Ratio and Container Shape using Staad- pro v8i”.
 8. Vaseem Akhtar, Shaik Rehman, S Zubeeruddin “Design and Analysis of Elevated Water Tank by Using StaadPro



Comparison between Conventional Concrete and Concrete Using Basalt Fiber

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ABSTRACT: Conventional concrete is a conglomerate of hydraulic (Portland) cement, sand, stone, and water. It was developed approximately 150 years ago to imitate natural stone while providing less labor-intensive methods of shaping the material (i.e., casting rather than hewing and carving).

Experimental results indicated that clumping of fibers may occur at significantly higher fiber volume fractions, resulting in mixing and casting issues. Based on the experimental values of mechanical properties and resistance to dry shrinkage cracking of BFRC, the appropriate basalt fiber length and fiber volume fractions are determined. The addition of a small amount of short basalt fibers can lead to a significant increase in both compressive strength and modulus of rupture (m_{or}) of BFRC, and the proposed fiber length and content are 12.0 mm and 0.10%~0.15%, respectively as the length of basalt fibers increases, the occurrence of early shrinkage cracks initially decreases and then increases slowly, with the optimal fiber length being 18.00 mm. Results of the study also indicated that early shrinkage cracks decrease with an increase in fiber volume fraction, and when a volume fraction of 0.20% is used, no cracks were found. All the findings of the present study may provide valuable information for material development.

KEYWORDS: basalt fiber; fractal dimension; strength; correlation; grey correlation theory.

I. INTRODUCTION

The project "strengthening of concrete the usage of basalt fiber" aims to discover the capacity of basalt fiber as a reinforcement cloth for boosting the mechanical houses of concrete systems. Concrete is extensively used in production due to its compressive electricity; but, it's miles vulnerable in anxiety, main to cracking and structural deficiencies. This problem requires effective reinforcement strategies.

The objective of this assignment is to investigate the usage of basalt fiber in strengthening concrete. Basalt fiber, derived from volcanic rock, gives houses including high tensile power, low density, corrosion resistance, and thermal stability. Incorporating basalt fiber into concrete has the capacity to enhance tensile energy, ductility, and ordinary durability.

The significance of this mission lies in its potential to deal with the restrictions of concrete and beautify structural overall performance. Basalt fiber reinforcement can cause improved structural integrity, reduced cracking, progressed resistance to environmental factors, and extended carrier lifestyles of concrete structures. the undertaking scope includes comparing basalt fiber's mechanical residences, such as tensile electricity and bond strength with concrete. It investigates the results of basalt fiber reinforcement on compressive energy, flexural electricity, effect resistance, and durability properties of concrete. Moreover, the project explores elements like fiber dosage, distribution, mixing approaches, and curing practices.

By way of examining trying out methods, production practices, and actual-world case research, this task gives insights into the sensible programs and blessings of basalt fiber reinforcement.

the results of this challenge can contribute to the improvement of sustainable and high-overall performance concrete systems. The findings will tell engineers, researchers, and construction specialists approximately the effectiveness and practicality of the use of basalt fiber reinforcement, facilitating its adoption in the production enterprise. Ultimately, this may lead to the development of more resilient and sturdy concrete systems.

II. METHODS AND MATERIAL

In this project, we used specific materials and followed particular methods to analyse the strengthening of concrete using basalt fiber. Right, here's an in-depth description of the substances and approaches we employed:

Materials:

a) Basalt fiber:

we obtained basalt fiber strands, rovings, or fabric from a reliable manufacturer who specializes in producing basalt fiber. The choice of basalt fiber type and shape depended on our project requirements and the desired reinforcement properties.



a) Chopped Basalt Fiber

b) Cementitious material:

we selected the specific cementitious material, including Ordinary Portland Cement (OPC), based on the specifications and requirements in our local area. It was important to ensure that the selected cement met the necessary strength and chemical composition criteria.



b) Cementitious material (OPC)

c) Aggregates:

- coarse aggregates: we used crushed stone or gravel with a maximum size of 20 mm (3/4 inch). The coarse aggregates adhered to relevant standards and local specifications to ensure optimal concrete properties and performance.
- fine aggregates: we chose natural sand or crushed stone dust that met the required grading and cleanliness specifications. The fine aggregates were carefully selected to be free from natural impurities and comply with local standards to ensure the desired concrete quality.



c) Aggregates (Crushed stones about 20mm)

d) Water:

we used clean, drinkable water for mixing the concrete. The water quality needed to meet the applicable requirements and specifications to prevent any adverse effects on the concrete's properties and performance.

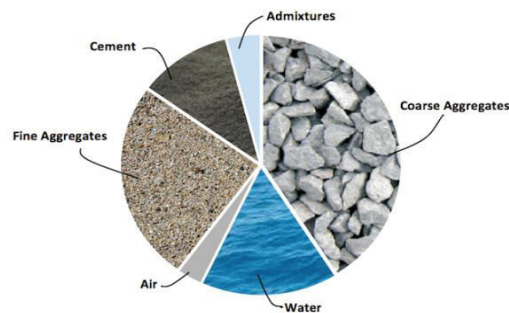
e) Chemical admixtures (optional):

we also considered incorporating superplasticizers, if necessary, to improve the workability and flow characteristics of the concrete mix. Superplasticizers can assist in the incorporation of basalt fibers and help achieve the desired properties of the reinforced concrete

Sample preparation:

a) Concrete mix design:

we determined the desired properties and performance requirements of the concrete, including target compressive strength, slump, and other design criteria. Based on this, we developed a concrete mix design that included appropriate proportions of cement, aggregates, water, and optional chemical admixtures to meet our performance goals. Concrete used in project has grade (M30) This grade offers even higher strength and is commonly used in heavy-duty structures like bridges, high-rise buildings, and infrastructure projects.



b) Blending process:

we began by pre-blending the dry materials, including cement and aggregates, in the specified proportions to ensure a uniform mixture. Then, we added the basalt fibers to the dry blend and ensured they were evenly distributed. Gradually, we added water while continuously mixing the ingredients. We adjusted the water content to achieve the desired workability and consistency of the concrete. The integration process continued until we obtained a homogeneous mixture.

c) Sample casting:

we prepared molds or formwork in the desired shape and size for our concrete samples. To facilitate easy removal of the hardened samples, we applied a suitable release agent to the molds. Next, we poured the freshly mixed concrete into the molds, ensuring there were no voids or segregation. To ensure proper compaction, we consolidated the concrete by vibrating or tamping the moulds to eliminate any trapped air. Finally, we levelled the surface of the concrete samples using a trowel or straightedge.

Curing:

once the casting was completed, we covered the samples with plastic sheeting or applied a curing compound to prevent moisture loss. It was important to maintain a moist and controlled curing environment for the desired duration, usually 28 days. This allowed for proper hydration and strength development of the concrete. We followed standard curing practices such as water curing, steam curing, or using a curing chamber to ensure the optimal development of concrete strength and durability.



Curing



Testing methods:

compressive test: we performed compression tests on the cured concrete samples using a standard testing apparatus. This test helped us determine the compressive strength of the samples, following applicable standards and protocols.

III. RESULTS AND DISCUSSION

After carrying out the experiments and tests on basalt fiber-reinforced concrete, we obtained significant results that shed light on the effectiveness of using basalt fiber as a strengthening material. In this section, we will discuss the results and implications of our research.

1. Compressive Strength:

the results showed that basalt fiber-reinforced concrete exhibited improved compressive strength compared to traditional concrete. The addition of basalt fiber enhanced the bonding between the cement matrix and aggregates, resulting in increased load-bearing capacity. This improvement is attributed to the high tensile strength and modulus of elasticity of basalt fibers, which help resist compressive forces and prevent crack propagation.

2. Flexural strength:

the flexural tests revealed a significant increase in the flexural strength of basalt fiber-reinforced concrete. The presence of basalt fibers in the concrete matrix improved its resistance to bending and enhanced its load-carrying ability. The fibers acted as reinforcement, distributing the applied load more evenly and reducing the formation and propagation of cracks. impact resistance: our impact tests demonstrated that basalt fiber-reinforced concrete exhibited stronger impact resistance compared to traditional concrete. The fibers absorbed and dispersed the impact energy, minimizing the formation of cracks and reducing the extent of damage. This feature is especially useful in structures subjected to dynamic loads or in high-risk areas prone to impact events.

3. Durability:

the durability tests performed on basalt fiber-reinforced concrete revealed promising results. The concrete exhibited improved resistance to environmental elements such as freeze-thaw cycles, chloride ingress, and chemical attack. The basalt fibers acted as a barrier, reducing the permeability of the concrete and protecting it from harmful agents. This enhanced durability can lead to longer service life and reduced maintenance costs for concrete structures.

IV. CONCLUSION

Normal Strength Concrete

The concrete that is obtained by mixing the basic ingredients cement, water and aggregate will give us normal strength concrete. The strength of these type of concrete will vary from 10 MPa to 40MPa.

On this assignment, we investigated the strengthening of concrete using basalt fiber and conducted various tests and analyses to assess its effectiveness. Based on the results obtained and the discussions presented, we can draw the following conclusions:

Basalt fiber reinforcement significantly improves the mechanical properties of concrete. The addition of basalt fibers enhances the compressive strength, flexural strength, and impact resistance of the concrete. This reinforcement mechanism helps distribute loads more effectively and reduce crack formation and propagation, leading to a more durable and resilient material.

the use of basalt fiber in concrete enhances its durability and resistance to environmental elements. Basalt fibers act as a barrier, reducing the permeability of the concrete and protecting it from the effects of freeze-thaw cycles, chloride ingress, and chemical attack. This improved durability contributes to the longevity and reduced maintenance requirements of concrete structures

Basalt fiber-reinforced concrete offers a sustainable and cost-effective alternative to traditional reinforcement materials. Basalt fibers are derived from natural volcanic rock and have a low carbon footprint compared to other synthetic fibers. Additionally, the availability and affordability of basalt fibers make them an attractive choice for construction projects. successful implementation of basalt fiber reinforcement in concrete requires careful consideration of factors such as fiber dosage, distribution, mixing techniques, and curing practices. It is important to optimize these parameters to



achieve the desired mechanical properties and durability. further research and experimentation are necessary to explore the full potential and limitations of basalt fiber reinforcement in different concrete applications and structural configurations. This will help develop standardized guidelines and design recommendations for incorporating basalt fibers effectively.

In conclusion, the findings of this project demonstrate that basalt fiber-reinforced concrete has the potential to significantly enhance the performance and durability of concrete structures. The improved mechanical properties, increased durability, and sustainable nature of basalt fiber reinforcement make it a promising solution for various construction applications. by utilizing basalt fibers, we can construct stronger, more resilient, and environmentally friendly concrete structures that can withstand the challenges of harsh environments and dynamic loading conditions. Implementing basalt fiber reinforcement can contribute to the development of sustainable infrastructure with reduced maintenance needs and enhanced safety.

Overall, this research highlights the benefits of using basalt fiber as a strengthening material in concrete and encourages further exploration and adoption of this innovative approach in the construction industry.

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Issues of Pile Foundation in End Bearing Pile and Its Prevention

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ABSTRACT: The goal of the project is to identify the issues in working of pile foundation and to adopt the technical and safe conduct of work. The piles are generally shift from its actual point, which is corrected by joggling of column to bring the point on its actual position, various other issues are common and these are not taken into consideration because of less experience and no technical assistance available on site. In this project we will find out the issues and prevention of the issues and errors related to pile foundation on site. We will identify the issues in pile foundation and we will prepare case study with reference to sites which are using pile foundation and at-least two case studies of sites with failure of pile foundation.

KEYWORDS: Pile foundation , Quality Assurance , Structure..

I. INTRODUCTION

A Pile Foundation is defined as series of columns constructed or inserted into the ground to transmit load to a lower level of subsoil. A pile is a long cylinder made of strong material, such as concrete. Piles are pushed into the ground to act as steady support for structures built on top of them. This type of foundation is widely used in the areas having excavation depth more than 12ft. or 3.5 m.

The knowledge about the pile foundation is not available to ordinary person. The pile contractors and structure engineers are using new techniques and the pile foundation is preferred in small projects as the space is less to work in the depth is high.

The pile Foundation work is carried out with the help of machines and the methods are differentiated on the basis of machinery used. The pile foundations there are 3 methods for piling.

- Tripod Piling Machine
- Rotary Piling Machine
- Auger Piling Machine.

II. LITERATURE

Syed Munawar Ali(2021), Building foundation, as an interface structural part between the building and the supporting ground, play out the significant capacity of transmitting the building loads including the wind and earthquake impacts to the supporting soil strata without its shear disappointment or over the top settlements. The determination of appropriate foundation frameworks for multi-storeyed buildings are represented by a few elements like; building loads, wind and earthquake impacts, ground profile and water table conditions, synthetically forceful ground conditions, admissible bearing pressure of soils at various profundities, arrangement of storm cellar storeyes, vicinity to bordering buildings and other task explicit necessities. Pile foundations are utilized widely for the help of buildings, spans, and different structures to securely move structural loads to the ground and to keep away from abundance settlement or parallel development. They are extremely viable in moving structural loads through feeble or compressible soil layers into the more skilled soils and shakes underneath.

N Manap (2021) The principle objective of this paper is to reduce the incidents happens by failing deep foundation system due to the presence of subsurface structures like drainage tunnels, natural voids or geological faults and old



unused constructions. Failure of the group piles may occur either by failure of the individual piles or as failure of the overall block of soil. Stress distribution pattern changes in soil profile in presence of substructures. There is a brief and basic discussion in this paper about how does stress pattern changes around subsurface structure using Kirsch equation. Foundation engineering solely depends upon knowledge of geology, soil mechanics & precedents. Whether a particular type of foundation & its depth has proved to be successful over the years could be known through previous experience. In addition to this geological and geotechnical investigations of the site are important factors to decide the type and the proper positioning of foundations and to give as insight to the substratum through which the foundation is to be taken.

Yujie Wang vol. 120 (2017) In China's engineering construction, the pile foundation has become an important foundation form of a lot of high-rise buildings and large-scale buildings. The pile foundation is the groundwork of the whole building. The pile foundation quality is very important for the whole building. Combined with the Sihai building pile foundation, the quality management and control measures are carried out on the basis of the analysis of the status of the project. In the construction process, the construction technology and methods of rotary bored piles are control strictly. The pouring of concrete should be continuous to ensure the depth of the steel conduit. In the rainy season construction, waterproof and drainage measures are fully prepared. The countermeasures and management measures to strengthen the quality control of pile foundation engineering are put forward from these aspects. High efficiency, high quality, low cost of project management objectives are achieved through these measures. A new level of domestic project quality management is created. The expected effect of the project quality management and control is achieved.

III. PROBLEM STATEMENT

- In this project we will study about the Quality assurance related issues and problems.
- We will learn the Identification of problems on sites.
- We will find the best suitable solutions.
- We will find out the reasons of failure of pile.
- The pile foundation fails due to improper identification of properties of rocks and to analyse the proper depth of pile.
- We will identify and conclude the preventive measures of pile foundation.

IV. METHODOLOGY

A few issues might be experienced during pile foundation development. These problems will cause deficiency in the capacity of the pile except if they handled appropriately.

There are many causes of failure in deep foundations like scouring, design failures, poor compaction and many others. But unexpected subsurface structures like tunnels, drainage systems etc., which are used for war strategies or drains or even for drinking water supplies constructed centuries ago causes more disastrous failure. These are the biggest incidents happened due to deep foundation failures. Even though the foundation engineers are designing well, the structures are collapsing due to unexpected substructures. Until date, engineers are testing the soil and substratum by digging the bore wells. However, this technique can provide the details of soil and substratum profile like what kind of soil is there and its bearing capacities only inside the bore well. We cannot expect what is there next to it. It is necessary to find the new techniques, which can provide all soil profile details around the construction site. The objective of this project is the case study of what can cause the deep foundation failure of which is constructed on unknown substructure. Also finding the solution to avoid these kinds of unexpected substructures.

STUDY AND ANALYSIS OF WATER TANK PROJECT

PROJECT NAME: PROPOSED CONSTRUCTION OF ELEVATED STORAGE RESERVOIR AT SITE NO. 193/194, BURDEVASATI, CHAROLI BK. PUNE - 412105

The Geotechnical data was studied to determine the general subsurface conditions by drilling two (2) exploratory borings of maximum depth of 14.0m. Performing laboratory tests on selected samples and evaluating these data with respect to foundation concept for the design of the proposed structure. Also includes an evaluation of the site with



respect to the potential construction problems, recommendations dealing with earthwork and quality control during construction.

Results of chemical analysis on soil indicate that the site falls under Class 1 for sulphate concentrations and chloride concentrations (As per IS456 and as per CIRIA Sp. Publication No. 31). A 'Moderate' Exposure Condition was assigned to this site. Therefore, only following normal precautions are recommended to protect subsurface concrete and reinforcement.

After the completion of geotechnical investigations, the installation of Iron casing of 6mm thickness was suggested.

STUDY AND ANALYSIS OF PANJAGUTTA FLYOVER COLLAPSE

PROJECT NAME: The site for the proposed structure is located at Punjagutta, which is about 15 km from Hyderabad.

On September 9, 2007, a newly built flyover at the busy crossing of Punjagutta, area in city of Hyderabad, Andhra Pradesh collapsed a day before it was to be opened for public caused 20 dead and several injured. The cause of this disaster is due to unexpected substructure (tunnel). The flyover is almost constructed on hard soil and stiff clay.

This failure happened due to unexpected tunnel present at 12m to 15 m which was constructed during Nizams period (15th century to 19th century). The purpose of this tunnel is assumed to be drainage system, which is used during above-mentioned period and was constructed with limestone and lime mortar. Engineers have no idea about the tunnel presence at the site of construction. Geological tests were performed up to 10m and the result was fit for the construction of pile foundation. It was a heavy rainy season. Engineers finished the construction on just beside the tunnel and started the vehicle load tests. Due to heavy rains from two and half months, water seeped from the top of the ground and soil became wet. Aluminates present in lime slurry have a tendency to attract the moisture and expands. It creates the micro cracks in the wall constructed with lime mortar. Due to the pile stress on the already weakened tunnel, the entire sudden pile group plunged into the earth filled the void space and pile tilted due to void created by tunnel collapse.

The EM gradiometer method' is based upon the long wavelength scattering limit of mathematical physics. The primary EM wave from a remote EM source may be resolved into vertical (EH_z) and horizontal (E_x) components at the earth's surface overlying the underground target. The horizontally Downward Travelling Upward Travelling Polarized E_x and H_y fields are responsible for WEW the primary wave travelling vertically downward into the earth. Wait's recursive formula described how EM wave energy travels vertically into the layered earth. By this method, the problems were solved and reconstruction of structure was done.

STUDY AND ANALYSIS OF MAJOR BRIDGE PROJECT

PROJECT NAME: 25/2. Construction of Major Bridge across Bhima River at Vadhu (Kh.) to Vadhu (Bk.) Road, (V.R.474) Tal.Haveli, Dist.Pune.

The investigation scope consists of drilling and sampling in twelve boreholes (BH-01 to BH-12) and carrying out relevant laboratory tests on representative soil and rock samples.

Drilling and sampling was carried out using single tube core rotary wash boring. Fieldwork performed during November 2022. The engineer in-charge decided locations were used. Separate log sheet for each of the boreholes is prepared and attached herewith. Sub-soil conditions are as described in bore logs. Following table gives bore whole depth information.

From the logs of twelve boreholes drilled, following subsoil profile can be concluded.

Stratum One: Top layer is either sand or clay soil.

Stratum Two: Sand / Sand-boulder.

Stratum Three: Jointed Rock: Grey colour basalt.

The Usage Of bentonite Slurry and casing was suggested and the construction of piles is on going safely.

V. CONCLUSION

- The study of End bearing pile construction was done on the bridge site and water tank site.
- The soil condition leading to failures studied at above two locations.



- From the geotechnical, data and information obtained from site visits. The reasons for the failures of the pile during construction were analyzed and preventative measures are as follows:
 - The bentonite slurry contains cations(Na⁺) which bring stability to the boring soil surface due to electrically charged ions. So, bentonite slurry is used to prevent the collapse of the soil in the pile bore largely.
 - Casing is used as a permanent or temporary support structure for a bored piling system. It is used when deeper, unstable soil conditions are present. Casing is utilised during the drilling stage of construction and can be installed.
 - Adjacent ground settlement may be minimized by inserting the casing if the problem persist the steel cages around the sides of pile are installed to avoid the settlement and collapse of pile sides which leads to tilt or turn in one direction.
 - Inadequate concrete strength and voids in concrete pile can be avoided by supervision while construction, the tests on the aggregates, cement and concrete should be monitored strictly to avoid poor mix design and negative results.
- During concrete filling to remove the surplus slushy concrete (a mixture of concrete, slurry, and mud) over the cut-off level we should adopt Pile Chipping. After casting of the piles, the top portion of the pile is chipped out until the pile cap to ensure that good quality concrete is available from top to bottom and ensures that it can carry the desired load. Pile chipping is mandatory but not practiced on most of the sites. It is recommended that the pile chipping should be made compulsory to ensure quality of pile and its strength.
- The geotechnical data is not sufficient to ensure the proper depth of the pile. The modern techniques should be used in the geotechnical survey using modern techniques that will help us to find if any hose or water table is available .
- In case of varied soil layers in the investigation of Bore log and for important and heavy load structures the soil structure interaction analysis with the help of finite element software's. (such as ABACAS , ANSYS)

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Earthquake Vibration Control of Multi Storey Building Using Base Isolation System

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ABSTRACT- Earthquake, any sudden shaking of the ground caused by the passage of seismic waves through Earth's rocks. Major earthquake in recent years have highlighted the big concern of modern seismic design concept for the resilience of building. The overall goals of this thesis aim to design structural vibration control using smart material and devices and to elucidate the factors determining their robustness, feasibility, and adaptability for earthquake -resistant and resilient building. SAP2000 is a tool used for creating and analysing structural models. It offers many features across a single, customizable user interface, allowing engineers working on transportation, industrial, public works, or other facilities to generate complex models and run comprehensive tests. Earthquakes shake the ground surface, can cause buildings to collapse, disrupt transport and services, and can cause fires. They can trigger landslides and tsunami. Earthquakes occur mainly as a result of plate tectonics, which involves blocks of the Earth moving about the Earth's surface.

KEYWORDS: Isolation System, Earthquake Vibration, Analysis of method, Lead rubber bearing.

I. INTRODUCTION

Base Isolation is one of the passive energy dissipation techniques for earthquake resistant design of structure. It is useful to control the energy which is passed from foundation or ground to the upper stories. To achieve this a flexible layer of isolator is fix up between the superstructure and substructure. This will shift the fundamental natural time period of structure and the frequency of vibration ultimately reduces. This will avoid the resonance condition between the ground acceleration and structural vibration. The main use of isolation system is to reduce the displacements, base reactions and member forces in structure. , the seismic isolation concept is aimed at a significant reduction of dynamic loads induced by the earthquake at the base of the structures Seismic isolation separates the structure from the harmful motions of the ground by providing flexibility and energy dissipation capability through the insertion of the isolated device so called isolators between the foundation and the building structure.

II. RELATED WORK

The term base isolation uses the word a) isolation in its meaning of the state of being separated and b) base as a part that supports from beneath or serves as a foundation for an object or structure. As suggested in the literal sense, the structure (a building, bridge or piece of equipment) is separated from its foundation. The original terminology of base isolation is more commonly replaced with seismic isolation nowadays, reflecting that in some cases the separation is somewhere above the base – for example, in a building the superstructure may be separated from substructure columns. In another sense, the term seismic isolation is more accurate anyway in that the structure is separated from the effects of the seism, or earthquake. The only way a structure can be supported under gravity is to rest on the ground. Isolation conflicts with this fundamental structural engineering requirement.

III. METHODOLOGY

Hence, “base isolation” or, seismic isolation separates upper structure from base or, from down structure by changing of fix joint with flexible one (Figure 1). Increasing of flexibility is done by the insertion of additional elements in structure, known as isolators. Usually, these isolators are inserted between upper structure and foundation (Figure 2). Seismic isolation system absorbs larger part of seismic energy. Therefore, vibration effects of soil to upper structure are drastically reduced. Figure 8 shows the failure pattern of a “fixed based” structure due to seismic loading. But in case of isolated buildings as the ground moves, inertia tends to keep structures in place resulting in the imposition of

structure with large displacements in different stories (Figure 1: left figure: dashed portion indicating displacements due to seismic loading). For base isolated structure the situation is quite different. In such cases, the whole upper structure gets a displacement (which naturally remains in limits) and the relative displacement of different stories is so small that the structure can withstand a comparatively high seismic tremor with a low seismic loading in a safe, efficient and economic manner.

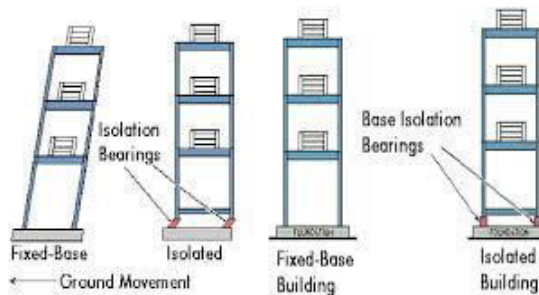


Fig.2

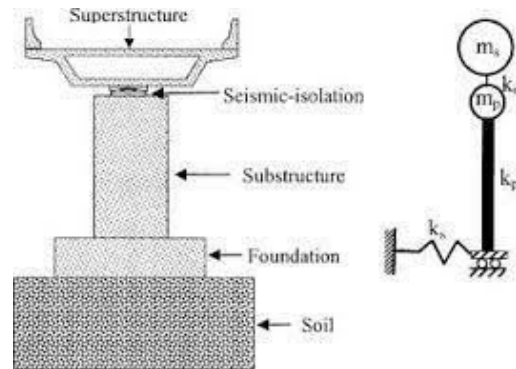


Fig.1

IV. DISCUSSION

A base isolation system is a method of seismic protection where the structure (superstructure) is separated from the base (foundation or substructure). By separating the structure from its base, the amount of energy that is transferred to the superstructure during an earthquake is reduced significantly.

Historically, earthquake codes paid little attention to the vertical component of shaking generated by earthquakes. As a rule of thumb, the maximum vertical ground motion is generally 60% to 70% of the maximum horizontal ground motion. However, while it may generally be unnecessary to consider the vertical motions of the structure as a whole, this is often not the case with non-structural design. The building, usually because of its architectural configuration, can act as an amplifier for both horizontal and vertical motions. Even though codes most often do not require vertical design resistance, the designer must be cognizant of the implications of vertical motions and their potential effects.

Tall shelves need longitudinal bracing and attachment to the floor. The top bracing should be attached to the building structure and strong enough to resist buckling when the shelves attempt to overturn.

V. EXPERIMENTAL RESULTS

By incorporating computer-aid analysis, the critical points of the fixed-based structure can be predicted, such as at the corner of big openings and large planes. Based on the result of structural analysis using SAP2000, the loads distribution of this example building is 80% to the external wall and 20% to the interior columns. The loadings mainly transfer through the external walls and columns, which was the controlling factor for the distribution of the isolators. Fortunately, the columns along each side are evenly distributed, so it is reasonable to place the isolators underneath the external walls and all internal columns. Thus, the idea of the types and distribution of the isolators was established gradually.

VI. CONCLUSION

Our society should protect not only people's lives, but also their property, houses, social infrastructure and economic activities against earthquakes. Seismic isolation and response control methods of buildings have been studied and applied into buildings since the 1980's to make buildings resilient against earthquakes. Seismic isolation is a method of providing structural safety and security for people and properties in the building against earthquakes by installing isolators and damping devices under the superstructure. The manuscript describes three types of laminated rubber bearings and three kinds of damping devices. Seismic isolation is also used for the retrofit of historic buildings. The National Museum of Western Art in Tokyo was the first building in Japan that used the seismic isolation retrofit. The effects of seismic isolation and response control methods were verified through shaking table tests, structural health monitoring and earthquake response analyses. The number of seismic isolated buildings exceeds 4000, and the number of response-controlled buildings exceeds 1300 in Japan. New technologies and methods are under study to improve the response reduction effects, and the application steadily increases.



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Floating Solar Plant with Recycled Plastic Waste pontoons & Overview

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ABSTRACT: Innovative methods are required to maximize energy production while resolving environmental issues due to the increasing rise of renewable energy. This research report provides a thorough analysis of the development of a floating solar plant using pontoons made from recycled plastic waste. The goal is to investigate whether using recycled plastic debris as a sustainable replacement for the flotation bases in floating solar arrays is feasible and could have positive effects. An overview of the current situation of the solar energy industry is presented at the outset of the study, emphasizing the growing importance of land optimization and sustainable practices. The consequences of plastic trash accumulation on the environment and the pressing need for efficient waste management techniques are then covered in depth. The research also explores the effects of using recycled plastic waste pontoons on the general effectiveness and efficiency of the floating solar plant. The potential for energy generation, cost efficiency, and environmental sustainability are examined, taking into account elements like solar panel orientation, system stability, and maintenance needs. The results demonstrate the enormous benefits of using pontoons made from recycled plastic trash in floating solar farms. Reduced environmental effect, optimal land use, and potential financial savings are a few of them.

KEYWORDS: Pontoon, Photovoltaic Cells, Sustainability, Land optimization, Albedo effect, HDPE

I. INTRODUCTION

Innovative strategies for utilising renewable energy have been driven by the rising global demand for sustainable and clean energy sources. Particularly in regions with a shortage of available land or where the use of waterbodies offers a chance to generate renewable energy, floating solar plants have come to be recognised as a feasible alternative. An overview of a floating solar plant concept that uses pontoons built from recycled plastic waste is given in this research study from the standpoint of civil engineering.

Researchers and engineers have been forced to look into alternative energy options due to the depletion of traditional sources of energy & the pressing need to minimise greenhouse gas emissions. In recent years, interest in solar energy has grown significantly because it is a clean and plentiful source. However, the adoption of conventional land-based solar arrays is hampered by land shortages and environmental issues related to the accumulation of plastic trash. In order to overcome these difficulties, the article suggests a concept for a floating solar plant that uses pontoons built of recovered plastic trash. From a civil engineering standpoint, the suggested design has many benefits. By using recycled plastic for the pontoons, it first addresses the urgent problem of plastic waste pollution. Second, by utilising underutilised water bodies, it optimises land use, making it a desirable solution in urban or highly populated areas. Additionally, the incorporation of recovered plastic waste pontoons offers chances for environmentally responsible building methods. This study paper's main goal is to give a thorough description of the design of floating solar panels using pontoons made from recycled plastic waste. This entails looking at the structural elements, viability, and potential advantages and difficulties connected with this novel technique.



Figure 1 100 mw floating solar power plant at Ramagundam, Telangana



II. METHODS AND MATERIAL

MATERIALS REQUIRED:

Several resources are required to build a prototype for a floating solar power plant made out of pontoons made from recovered plastic trash. The stability, buoyancy, and durability provided by the floating platform have all been guaranteed by the careful selection of these components.

Plastic Cans:

Size: 5-liter cans Material: High-density polyethylene (HDPE) or another suitable plastic material

Dimensions: Height is around 30-35 cm, 15 cm Width

Solar Panels:

Type: Photovoltaic (PV) panels

Wattage: Depending on the project's size and power requirements, choose panels. (20 W for prototype")

Dimensions: Dependent on the size and wattage of the panel

Anchoring System:

ropes for securing the solar plant on the water.

Electrical Components:

Solar charge controller- Select a controller based on the voltage and current capabilities of the system.

Inverter- converts solar energy from DC to AC so that it can be used or connected to a grid.

(Optional) Batteries For off-grid applications requiring energy storage

High-quality cables, connectors, High-quality cables, connectors,

marine-grade sealants to shield electrical circuits from moisture intrusion

PROCEDURE FOR MAKING PROTOTYPE:

- The plastic cans should be free of labels and stickers. Make sure the cans are fully cleaned and dried to get rid of any impurities or leftovers.
- On the PVC foam sheet, measure and mark the appropriate dimensions. The floating solar plant prototype's particular specifications and dimensions will determine the base's size
- The plastic cans' bottom surface should be covered with glue. Assuring perfect alignment, place the PVC foam sheet on top of one of the cans' adhesive-coated surface
- Make sure to equally space out the plastic cans with the PVC foam sheets attached in the desired configuration. Apply glue to a can's top surface, then carefully stack another can on top of it while making sure they are perfectly aligned.
- In accordance with the manufacturer's recommendations, for the glue to completely cure and dry. It can require several hours or perhaps a night.

Check the foundation structure for any loose connections or places that need more adhesive after the adhesive has dried. By putting the base in a body of water or a suitable container filled with water, you may check its stability and buoyancy. Verify that it floats and stays in place without exhibiting any signs of instability or sinking.

MERTS OF USING PONTOONS MADE OF RECYCLED PLASTIC WASTE IN FLOATING SOLAR PLANT:

- **Environmental Sustainability:** By lowering the demand for virgin plastic resources, using pontoons made of recycled plastic waste helps to preserve the environment. It assists in preventing plastic trash from ending up in landfills or waterways, reducing the harm that plastic pollution does to ecosystems.
- **Recycling plastic trash** for the construction of pontoons helps to conserve precious resources. The requirement for new materials is lessened by turning plastic trash into useful parts of the floating solar plant, which lowers the extraction of raw materials and the energy required to produce them.
- **Cost-Effectiveness:** Making pontoons out of recycled plastic trash can be more affordable. Because recycled components are frequently less expensive than new ones, building the floating solar plant was able to be done for less money. Recycling plastic garbage could also lower waste management expenses for incineration or disposal.



- pontoons composed of waste plastic that has been recycled can have great buoyancy and durability qualities. Long-term floating applications might benefit from the water degradation and corrosion resistance of plastic materials like high-density polyethylene (HDPE).
- Circular Economy Promotion: Adopting pontoons made from recycled plastic waste aligns with the principles of a circular economy. It demonstrates the ability to close the loop in the plastic value chain by transforming waste materials into valuable products, extending their useful life and minimizing the environmental impact associated with traditional disposal methods.

BENIFITS OF FLOATING SLOAR PLANT OVER CONVENTIONAL SOLAR PLANT:

- **Increased Energy Production:** Installing floating solar plants on water bodies, which frequently have less impediments like trees or buildings, has an advantage. As a result, more sunlight is exposed to the earth throughout the day, which increases energy production compared to solar power plants on land.
- **Reduced Land Use:** Floating solar plants effectively utilise otherwise underutilised areas by using water surfaces like reservoirs, lakes, or ponds. This lessens the requirement for buying land, making it a more long-term solution, and helps address the issue of restricted land accessibility particularly in highly populated places.
- **Water Conservation:** The shadowing effect of floating solar panels lowers water surface evaporation, aiding in water resource preservation. The combination of energy production and preservation of water offers an additional advantage in arid regions or areas with a limited supply of water, where it is especially advantageous.
- **Increased Energy Efficiency:** By lowering the working temperature of the solar panels, the cooling impact of water increases their efficiency. The presence of water beneath the solar panels helps maintain cooler temperatures, resulting in higher energy output. Solar panels typically experience decreased efficiency as temperatures rise

III. RESULTS AND DISCUSSION

The study's findings show how economically viable and productive a floating solar plant utilising pontoons built from recycled plastic trash can be. Utilising recycled plastic trash as pontoons provides a long-term, environmentally responsible option that also has financial advantages.

Cost comparison: When compared to conventional land-based solar plants, the floating solar plant using recycled plastic pontoons offers a more affordable option, according to the cost study. Utilising recovered plastic waste greatly lowers the cost of materials for pontoons, which lowers the overall project cost. Reduced land acquisition demands and the opportunity to use existing water bodies, which eliminate the need for major land preparation and related costs, further increase the cost-effectiveness

Table -1: Shows cost comparison between floating solar plant and land based solar plant of 100 MW each

Cost Aspects	Floating Solar Plant (100 MW)	Ground-Based Solar Plant (100 MW)
Land Acquisition	1 crore (in rare cases)	2 crore
Floating structure	1 crore 50 lacks	N/A
Civil Works	12 crores	36 crores
Solar Panels	300 crores	300 crores
Mounting Structures	1 crore 20 lacks	24 crores
Electrical Component	48 crores	48 crores
Grid Connection	12 crores	12 crores
Installation and Labor	24 crores	24 crores

Maintenance and Operation	1 crore 60 lacks	1.8-3 crore
Security and Insurance	80 lacks	80 lacks
Decommissioning	12 crores	12 crores
Overall Cost	421-423 crore	450-452 crore

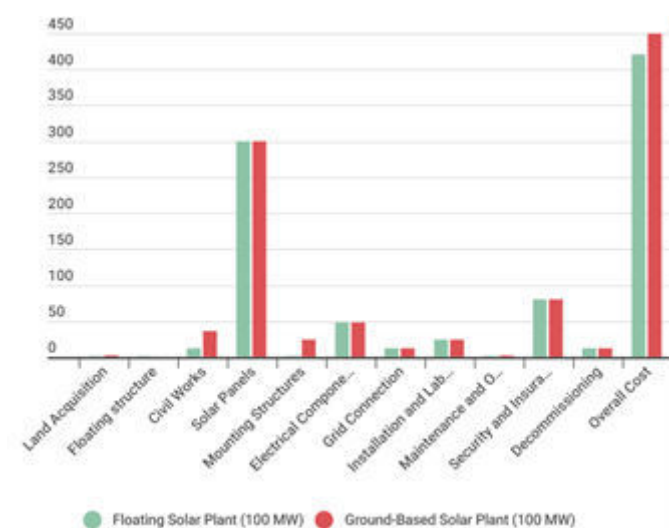


Figure 2 figure showing cost comparison of both solar plant

Energy output: According to an analysis of energy output, a floating solar farm made of recycled plastic pontoons is capable of producing as much energy as solar farms on land. The sun's energy is effectively captured and converted into electricity by the solar panels positioned on the pontoons. Additionally, the plant's floating nature enables ideal orientation and synchronisation with the sun's path, enabling maximum solar irradiation all day long. Additional solar radiation on the bottom of the floating panels may result from the reflecting properties of water surfaces, improving overall energy generation.(albedo effect).a study of comparison of power production between floating solar plant and land based solar plant in south Korea(Young-Kwan Choi " A Study on Power Generation Analysis of Floating PV System Considering Environmental Impact" International Journal of Software Engineering and Its Application) has shown that floating solar plant produced 11% more energy than land based solar plant. We noticed a increase of 8.9 % during implementation of our project

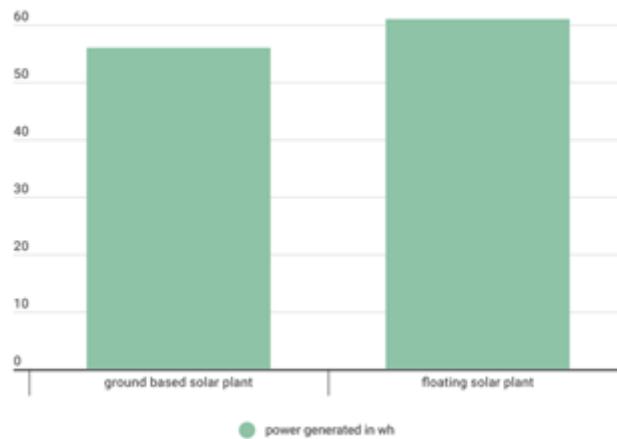


Figure 3 graph showing electricity production comparison of prototype in 1 day

Cost effectiveness of recycled plastic for making pontoons: When comparing the price per square metre between recycled plastic pontoons and traditional pontoons, recycled plastic pontoons provide a more affordable option. The utilisation of recycled plastic material, which is frequently more affordable than newly produced materials, adds to the pontoons' total affordability. Recycled plastic is anticipated to cost 40 rupees per kilogram, making recycled plastic pontoons substantially more affordable per square metre that is 400 rupees per metre square than other materials which may cost form 700-2000 rupees per metre square. Additionally, the production of recycled plastic pontoons could use less complex methods, cutting costs.

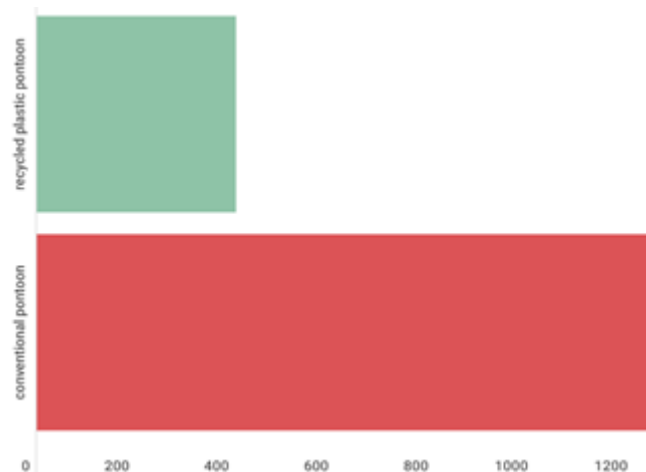


Figure 4 cost comparison of conventional and recycled plastic waste pontoon

Environmental Sustainability: Recycling plastic to make pontoons for floating solar farms can have a big impact on environmental sustainability. Reusing and recycling plastic materials creating pontoons helps lessen the pressure on landfills and reduces plastic pollution in our environment due to the significant amount of plastic waste produced globally. In addition, manufacturing recycled plastic pontoons often requires less energy and emits less greenhouse gases than manufacturing pontoons from fresh plastic. The circular economy's guiding principles are supported by this strategy, which encourages resource efficiency and reduces waste. The World Economic Forum reported that from about 1.5 million metric tonnes in the 1950s to more than 359 million metric tonnes in 2018, the world's plastic manufacturing has surged. Due to their adaptability and durability, plastics, particularly HDPE, have established themselves as a widespread material in a variety of industries. Plastic garbage output has significantly increased globally as a result of plastic production and consumption. A study that appeared in the journal Science Advances

projected that as of 2015, the world has produced 6.3 billion metric tonnes of plastic garbage. Additionally, according to this report, the total amount of plastic garbage might exceed 12 billion metric tonnes by the year 2050. If we consider that we require 10 kg of recycled plastic per meter square then we would require 5,00,00,000 kg to make pontoons for a 100 MW floating solar plant. This might help to take a step towards environmental sustainability



Figure 5 a prototype of floating solar plant of 20 w capacity with recycled plastic cans

IV. CONCLUSIONS

In conclusion, research into the construction of floating solar farms using pontoons made from recycled plastic waste offers a viable alternative for the sector of renewable energy. Using recycled plastic trash as pontoons has a number of benefits, including affordability and environmental sustainability. According to the cost research, recovered plastic waste pontoons can be a more affordable option than traditional pontoons. Furthermore, the energy output comparison shows that floating solar plants can produce energy outputs that are equivalent to or even greater than those of their land-based equivalents. This discovery emphasises floating solar technology's promise as a workable choice for capturing solar energy.

Additionally, by encouraging a circular economy strategy and limiting the buildup of plastic trash, the use of recovered plastic waste for pontoons is consistent with environmental sustainability goals. This study aids in resource preservation and the decrease of plastic pollution by turning discarded plastic into useful pontoons. In the end, the use of pontoons made from recycled plastic waste in floating solar plants marks a significant advancement in the production of clean energy and environmental sustainability.

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Research on 'Effects of Construction and Demolished Waste on Strength Parameters of Black Cotton Soil.' & Economical Comparison

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ABSTRACT: The second-largest economic activity in India is the construction sector. Regularly, new structures are built, and outdated ones are destroyed. The goal of this research is to strengthen poor soil, such as Black Cotton soil, by using the debris from demolished buildings that were collected from construction components. Coarser building and demolition waste particles can be employed instead of smaller particles to increase the necessary qualities of weak soil. Use of appropriate waste materials as stabilizers can prove to be an efficient and cost-effective solution for stabilizing unstable soil. Testing must be done on debris from construction and demolition projects that are graded between 2.36mm and 4.75mm, as well as on black cotton soil. The best waste percentage to mix with soil for maximal strength enhancement can be determined by tests using different amounts of trash to soil (0%, 10%, 15%, 20%, and 25%).

Black cotton soil has a low load-bearing capacity, is prone to swelling and shrinkage, and has a low shear strength, making construction over it a difficult task. It is customary to replace the entire soil for the construction of a high-rise building or pavement. For a low-rising building, primarily in rural regions, such complete replacements are typically expensive. Soil stabilization techniques can be used for such buildings to enhance the qualities of the soil by replacing a portion of it with other materials.

KEYWORDS: Black cotton soil, C&D waste, shear strength, CBR test, index properties, consistency limits, economic comparison.

I. INTRODUCTION

The construction industry is India's second-largest economic sector after agriculture, according to the country's 11th five-year plan. From 0.25 to 5.14 million tons of garbage are produced annually because of construction and demolition work. It will be reasonable to link building and demolition waste creation with Indian economic growth given the construction industry's huge increase. Any physical, chemical, mechanical, biological, or combination method of modifying a natural soil to serve an engineering objective is referred to as "soil stabilization." To reinforce road pavements, improvements include raising the weight-bearing capacity, tensile strength, and general performance of in-situ subsoils, sands, and waste materials.

The cohesive soil used here is black cotton soil. For civil engineers, it is challenging or troublesome soil. It can swell during the rainy seasons and contract throughout the summer. It presents issues in both scenarios. When the Black Cotton Soil expands during the rainy season, the structure experiences uplift pressure, which causes heave in the foundations, plinth beams, first floors of buildings, canals, road surfaces, etc. When the soil contracts during the summer, walls, slabs, plinth protection, floors, etc. develop cracks due to shrinkage. Due to a higher percentage of clay, Black Cotton soil expands during the wet season. When it rains, it swells, and when it shrinks in the summer, it cracks. The fissures are typically between 0.5 and 2 meters deep and 100 to 150 millimeters wide. The Black Cotton soils have a very poor bearing capacity and are highly compressible. The soil has excellent qualities for shrinkage and swelling. The soil has a very weak shear strength. Expansive soil is another name for black cotton soil. Black cotton soils cover a sizable portion of central India as well as a portion of southern India, including Madhya Pradesh, Maharashtra, Karnataka, Tamil Nadu, South Gujarat, and Uttar Pradesh. The area covered is about 3,000 square kilometers. The basalt or traprock that formed these soils. Cotton can grow very well in these soils. The soil has a very low bearing capacity and are highly compressible.



The building, remodeling, maintenance, and demolition of houses, big building structures, highways, bridges, piers, and dams' results in the production of construction and demolition (C&D) waste. Wood, steel, concrete, gypsum, masonry, plaster, metal, and asphalt are the main components of C&D waste. Because it may contain dangerous substances like lead and asbestos, C&D trash is noteworthy. Although estimates vary, it is generally agreed that between 15% and 20% of municipal solid trash is generated by construction and demolition activities.

II. OBJECTIVES

The main goal of the current endeavor is to conduct experimental research on possible applications for construction debris derived from demolished concrete trash.

In the current study, two strategies are used in an effort to strengthen the black cotton soil.

- 1) Locating a destroyed concrete waste's ideal place in relation to maximal strength while using it as a soil stabilizer.
- 2) Using various ratios of demolition waste to stabilize black cotton soil.
- 3) To determine the uses for the soil after it has been combined with C&D waste.
- 4) Cost comparison of C&D waste with respect to murum.

III. METHODOLOGY

In this experimental work, all tests were carried out according to IS standards given. All procedures were followed to obtain the results. The IS codes referred for different tests is shown in Table V.1

Step 1: Collection of soil samples and Construction waste.

Step 2: Finding basic properties of soil.

Step 3: Tests to be performed on Soil: Water absorption, Sieve analysis, Specific Gravity, Atterberg's Limits, Standard proctor, etc.

Step 4: Tests to be performed on waste Material: Water absorption, strength tests, etc.

Step 5: Find the optimum percentage of Construction waste based on strength parameters.

IV. EXPERIMENTAL RESULTS

- Properties of raw black cotton soil –

Sr. No.	Properties	Value of BC soil
1	Water content	26%
2	Specific gravity	2.52
3	Atterberg's limit Liquid limit Plastic limit Plasticity index	63.5 % 17.27% 46.23%
4	Grain size analysis Coarse Fine Silt & clay	24.6 % 73.3 % 2.1 %
5	Compaction parameters MDD OMC	1.11 gm/cm ³ 11%
6	CBR value CBR2.5 CBR 5	5.11 5.06

Table -IV.1: Properties of black cotton soil

- Atterberg’s limit tests –

The variation of plastic limit and liquid limit is given in Figure 1. The plastic limit of untreated black cotton soil was observed to be reduced after the addition of C&D waste. It was observed that the decreasing rate of plastic limit was more in the case of the addition of C&D waste. This decrement is due to the addition of cementitious material i.e., C&D which evaporates the water due to the heat of hydration, as it accommodates cement. The liquid limit was also observed to fall varyingly when C&D waste was added to the black cotton soil. It was observed that up to 13.9% reduction in the liquid limit after the addition of 25% C&D waste. The plastic limit is lowered to 1.51% after the addition of 25% of C&D.

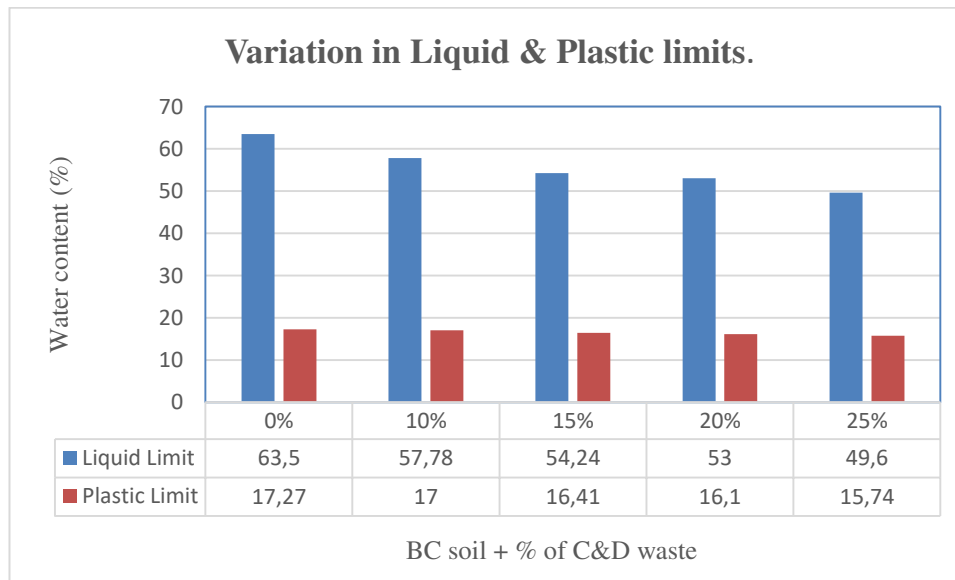
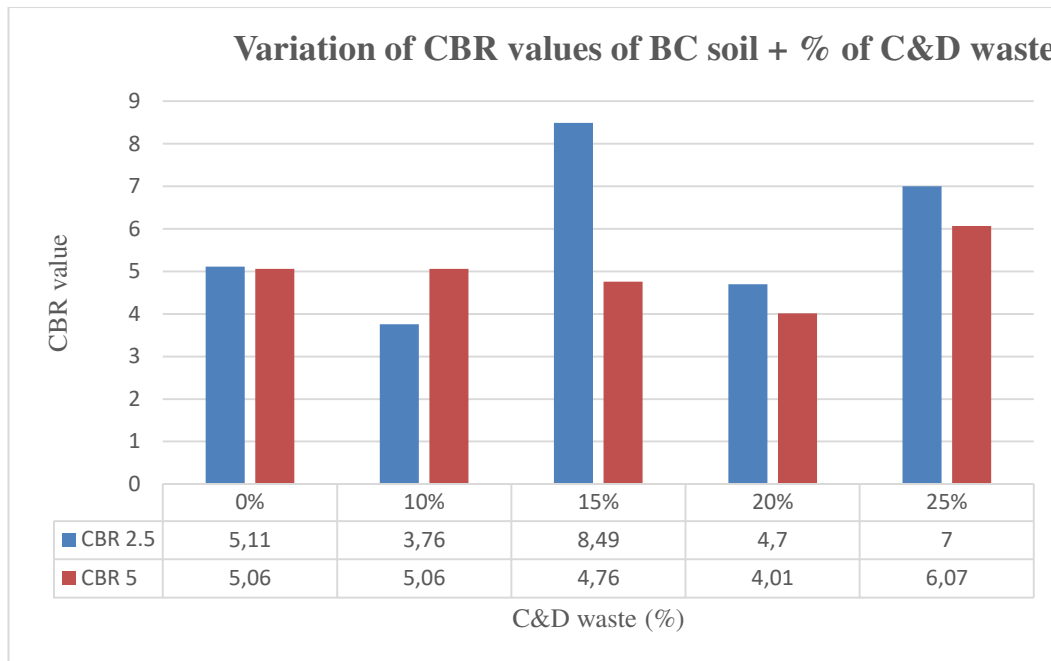


Fig. IV. 2: Variation of Plastic Limit and Liquid Limit of Black Cotton Soil after Addition of Varying Percentage of C&D Waste.

- CBR test –

CBR test was carried out for soaked condition. The C&D waste gives good results for black cotton soil. C&D waste material increases black cotton soil’s CBR value at a certain limit. It is observed that the CBR value was more at the addition of 15% of C&D waste added into the soil. Figure VI.3.1 gives a variation of CBR values.



- Cost comparison with murum –

Cost of 1 tonne C&D waste = 460Rs

Cost of 1 tonne Murum = 1100Rs

Standard CBR value of Murum = 9.80

CBR value of Black cotton soil + 15% = 8.49

V. CONCLUSION

1. It is observed that the liquid limit gradually decreases as the percentage of C&D waste increases.
2. Plastic limit also reduces gradually as the percentage of C&D waste increases.
3. We have concluded that optimal value of CBR will be attained at 15 % of C&D waste addition to Black cotton soil.
4. Cost of base coarse can be reduced to half by using C&D waste instead of Murum and about 90% of CBR strength can be achieved with 40% of the amount required.

VI. ACKNOWLEDGEMENT

I would like to thank our Guide Prof. Gayatri Sherkar and Project Co-Ordinator Prof. Uzma Sheikh and our honorable H.O.D. Prof. Lt. Col. Sanjay Karodpati, for giving their valuable guidance from project start to completion. I also thanked all the people who directly or indirectly helped me for the same.

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Seismic Analysis and Design of RCC Twisted Building with Swimming Pool Using ETAB

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ABSTRACT: this paper represents the structural behaviour of RCC twisted building subjected to seismic loads with private swimming of the high rise twisted building using ETAB. In a twisted tall building various rate of twist and positions of swimming pools for RCC twisted building will be analyzed. The different rate of twist 1.5, 2, 2.5, 3 & 3.5 degree per floor for twisted building are considered. The modelling and analysis will be done using ETAB Results obtained will be plotted for parameters such as storey displacement, storey drift and base shear. The aim of this project is to achieve the optimum swimming pool position and angle of twist of twisted building for 1.5, 2, 2.5, 3 and 3.5 degree per floor angle of twist for different storey.

KEYWORDS: Twisted Building, Swimming Pool, ETAB, Seismic Analysis,

I. INTRODUCTION

An earthquake is a natural tragedy that has claimed millions of lives throughout known and unwritten history. An earthquake is a disruptive disturbance that generates surface shaking owing to subsurface movement along a fault line or volcanic activity. The produced forces are irresponsible and only last a brief time. Humans are puzzled by its ambiguity in terms of occurrence time and nature. However, with the advancement of knowledge throughout the years, a degree of probabilistic predictability has been reached.

The ability to predict the recurrence and strength of earthquakes for a certain region has improved, but this only solves one half of the problem: knowing what's coming! The second phase is structural seismic design - to resist the storm! This component of the problem has evolved throughout the previous century, with advancements in design philosophy and methodology continually investigated, proposed, and implemented. This chapter introduces the notion of foundation isolation for earthquake-resistant structure design. The usefulness of seismic isolation is proved by modeling and analysis of multi-storey buildings, bridges, and pools.

The trend of RCC high rise structures has increased nowadays in India. Many different amenities like swimming pool, garden etc. have been provided in high story building which is very attractive from an aesthetical point of view but it is dangerous from a structural point of view.

The swimming pool is a heavy weight and the detailing is complicated, but it is not much different than other structural loads. If the pool were to break for some reason and all the water rushed out, it would destroy some interior and possibly some windows. In most cases, the extra water mass will help the building resist earthquakes by acting as a liquid mass dampener. Tall buildings carry very large gravity and lateral loads.

Twisted tall buildings of various heights, height to width aspect ratios and rates of twist are designed and their structural efficiency is investigated. Due to the unique geometric configurations of twisted forms, structural buildings are quite different from that employed for tall buildings of rectangular box forms. Twisted forms involve not only structural but also architectural and constructional challenges.

- Due to the unique geometric configurations of twisted forms, structural buildings are quite different from that employed for tall buildings of rectangular box forms. Twisted forms involve not only structural but also architectural and constructional challenges.
- This project investigates about the optimum twist angle and position of swimming pool of the RCC building.
- To increase value in certain buildings there are associated risks that we take like providing swimming pool.
- The amenities like swimming pool provided in high storey building are attractive from aesthetic point of view.
- This project represents the structural behaviour of RCC twisted building subjected to static load.



- In this project non-linear static method is being used.

Problem Statement

A twisted RCC building exposed to seismic loads utilizing ETab. The twist rate of RCC twisted buildings will be studied. Each level grows at its own rate. ETab will model. Base shear and storey displacement data will be shown. This project's goal is to find the best swimming pool position and angle.

Aim

“To find optimum angle of twist and position of swimming pool of RCC twisted buildings under seismic loads.”

Objectives

- ✓ Comparatively Study Design and analysis of RCC twisted building with private swimming pools for G+20, G+40, by using ETab
- ✓ To study RCC twisted building for 1.5, 2, 2.5, 3, 3.5 degree per floor angle of twist for G+20, G+40,
- ✓ To study RCC twisted building for swimming pool positions on alternate floor
- ✓ To study the parameters such as storey displacement, storey drift and base shear etc

RESEARCH METHODOLOGY

The Methods of Earthquake Analysis

Two broad approaches of earthquake analysis of multi – storied structures are

A. Static Analysis –

B. II) Equivalent Static Method – its linear static method. In this method formulas are developed to approximately represent behavior of regular structures. Base shear is calculated and distributed to various floor levels. This method is not used for irregular structures.

- **Response Spectrum Method** – It is a linear dynamic method. This method estimates peak values of response quantities. It can be used for any type of building and at all locations.
- The work consists of G+20, G+40 buildings and each building has given angle of twist and swimming pool positions. For each angle of twist there will be seven buildings considering swimming pool positions.
- For modeling and analysis of buildings ETab will be used.
- The parameters storey displacement, storey drift and base shear will be checked and their graphical representation will be made.
 - Results
 - Conclusion

Design Input Data

Material grade m50 fe500

- Beam = 0.815X0.4m
- Colum = 0.18X0.8m
- Colum = 1.3X1.3m
- Wall = 0.3m
- Wall = 0.4m
- Load pattern :-
 - Dead load
 - Live load
 - Super red load
- 4 Earth quake: x direction
 - Earth quake: Y direction
- 6)Wind load: x direction
- 7) Wind load: Y direction
- Response spectrum analysis

II. DESIGN & MODELLING

Response spectrum analysis:-

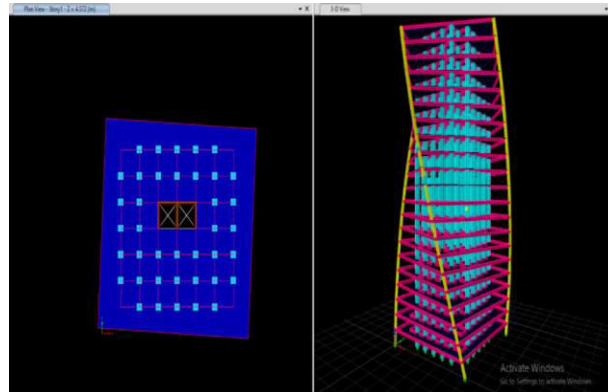


Figure1.1: 2 Degree Model design

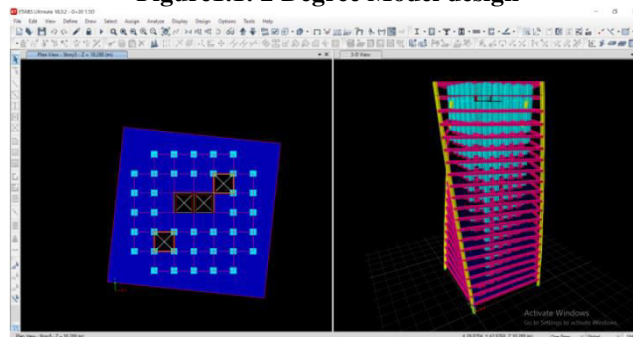


Figure1.2: 1.5 Degree Model design

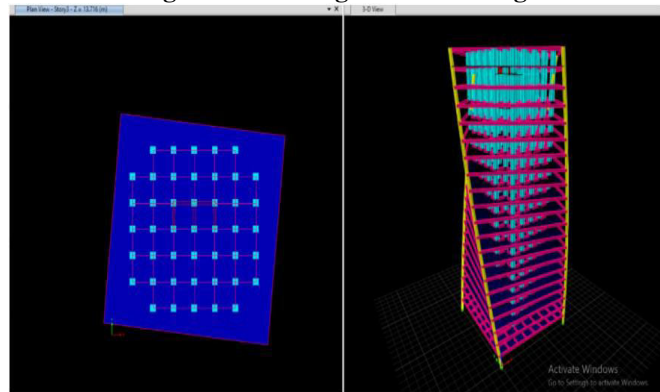


Figure1.3: 2.5 Degree Model design

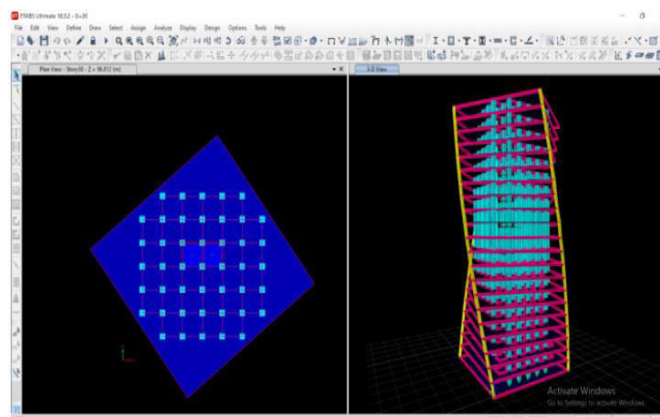


Figure1.4: 3 Degree Model design

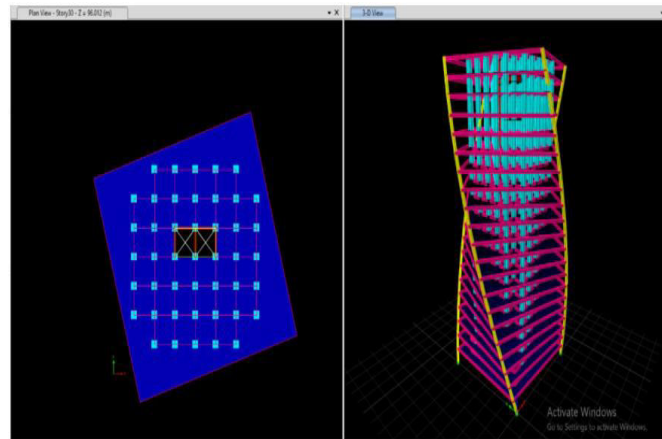
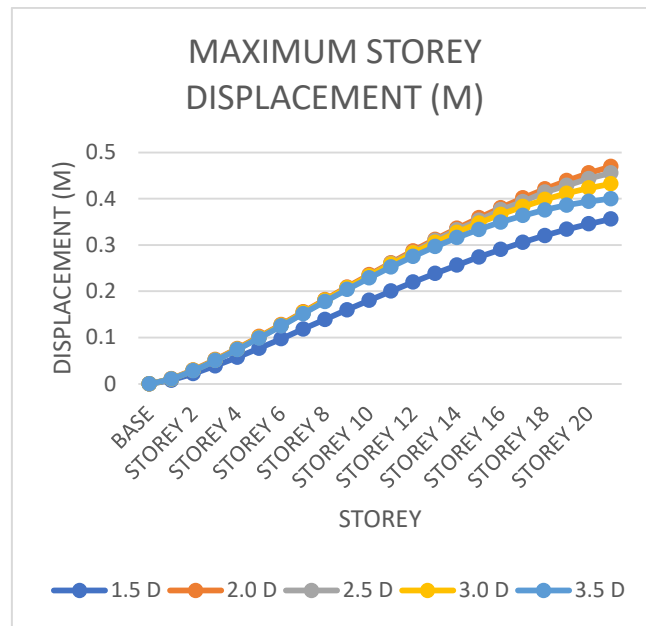


Figure1.5: 3.5 Degree Model design

III. RESULT & DISCUSSION

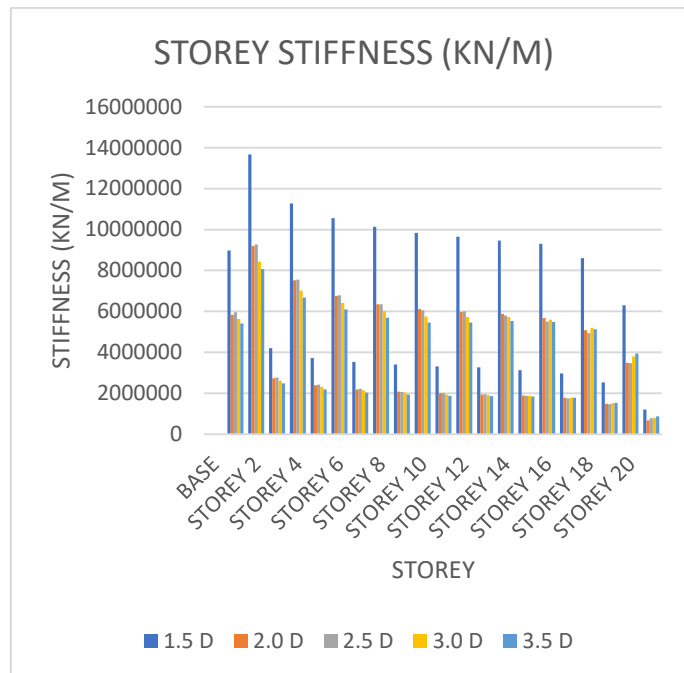
Storey Displacement

MAXIMUM STORY DISPLACEMENT					
STORY	1.5 D	2.0 D	2.5 D	3.0 D	3.5 D
BASE	0	0	0	0	0
STOREY 1	0.007826	0.010871	0.010439	0.010373	0.010111
STOREY 2	0.021913	0.029927	0.02895	0.028899	0.028305
STOREY 3	0.038784	0.052384	0.050964	0.051082	0.050196
STOREY 4	0.057276	0.076441	0.074616	0.075017	0.073881
STOREY 5	0.077074	0.102076	0.09995	0.100644	0.099255
STOREY 6	0.097442	0.12832	0.126012	0.126925	0.125194
STOREY 7	0.118302	0.155319	0.152852	0.153915	0.151748
STOREY 8	0.139103	0.182189	0.179501	0.180689	0.177994
STOREY 9	0.159909	0.209147	0.206493	0.207321	0.203906
STOREY 10	0.180328	0.23561	0.232928	0.233213	0.228803
STOREY 11	0.200431	0.261755	0.260082	0.258464	0.252742
STOREY 12	0.219785	0.287126	0.283779	0.282577	0.275253
STOREY 13	0.23839	0.311937	0.309597	0.305578	0.296358
STOREY 14	0.256441	0.335806	0.332839	0.327187	0.315739
STOREY 15	0.273905	0.358799	0.353382	0.347439	0.333484
STOREY 16	0.290434	0.380697	0.376096	0.36607	0.349361
STOREY 17	0.306007	0.4015	0.393854	0.383069	0.363463
STOREY 18	0.320482	0.420995	0.413982	0.398302	0.375634
STOREY 19	0.333793	0.439096	0.428531	0.411737	0.385969
STOREY 20	0.345764	0.455488	0.443305	0.423135	0.394155
STOREY 21	0.356105	0.469355	0.455509	0.431967	0.400068

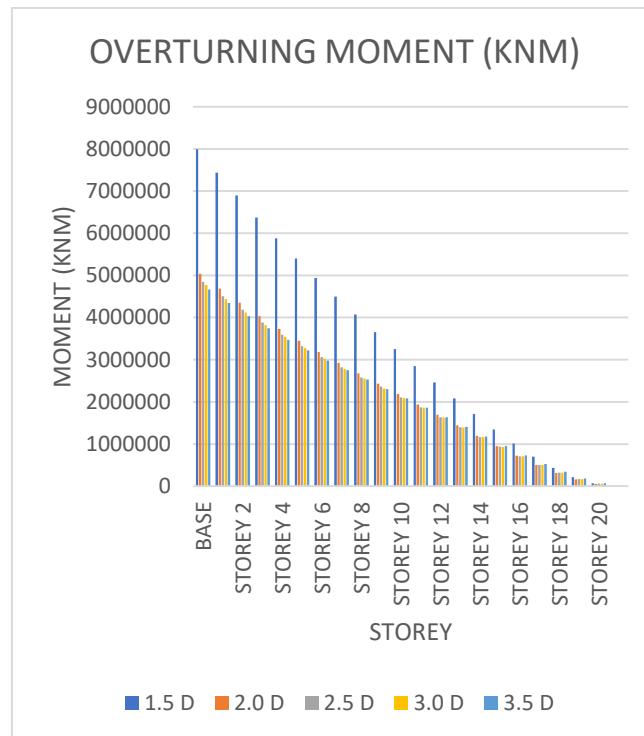


Storey Stiffness

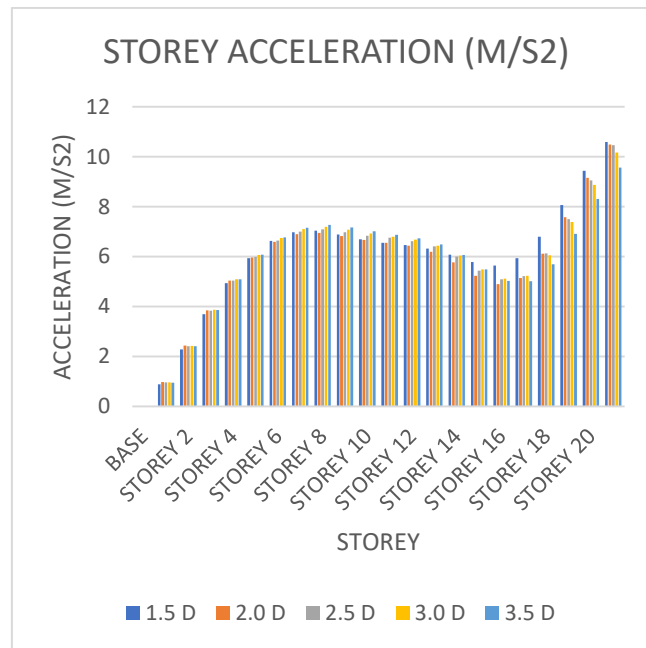
MAXIMUM STORY STIFFNESS					
STOREY	1.5 D	2.0 D	2.5 D	3.0 D	3.5 D
BASE	0	0	0	0	0
STOREY 1	8983249	5834606	5951474	5624788	5411247
STOREY 2	13677186	9192840	9268659	8421170	8062520
STOREY 3	4200058	2738482	2771621	2612386	2489538
STOREY 4	11272205	7523149	7558529	7025351	6682081
STOREY 5	3720041	2395097	2418585	2304928	2190744
STOREY 6	10557219	6752164	6791559	6412949	6098333
STOREY 7	3529642	2188658	2218778	2133050	2030457
STOREY 8	10139622	6340067	6349939	6020319	5688625
STOREY 9	3408276	2072753	2066994	2026377	1930434
STOREY 10	9830047	6105459	6055533	5748765	5463091
STOREY 11	3310616	1996202	2017826	1940511	1875497
STOREY 12	9655483	5977616	5998779	5726804	5458274
STOREY 13	3271079	1940678	1953992	1911379	1855916
STOREY 14	9454883	5883059	5791902	5715927	5526493
STOREY 15	3122760	1889671	1872090	1868699	1838983
STOREY 16	9300014	5679889	5509233	5603154	5480627
STOREY 17	2964887	1773377	1754852	1776520	1771011
STOREY 18	8595911	5086785	4936588	5183900	5129346
STOREY 19	2536232	1477177	1466834	1512942	1532359
STOREY 20	6298010	3478627	3466862	3799235	3935475
STOREY 21	1192626	672168.3	770685.7	793757.2	877197.4



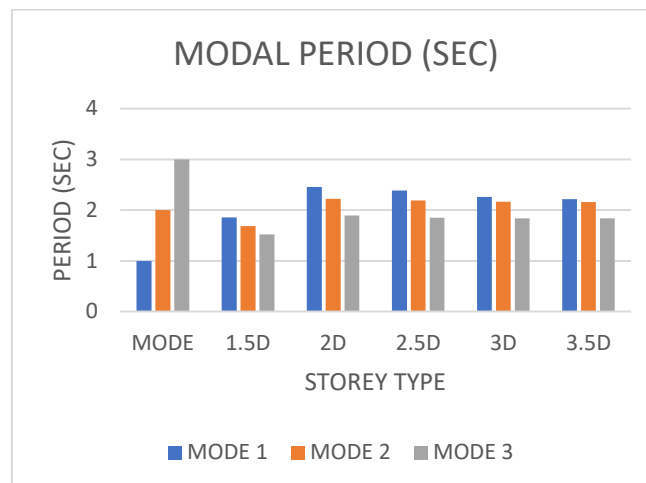
MAXIMUM OVERTURNING MOMENT					
STORY	1.5 D	2.0 D	2.5 D	3.0 D	3.5 D
BASE	7992972	5039763	4843236	4767568	4664354
STOREY 1	7435627	4687095	4505976	4435982	4341697
STOREY 2	6895133	4350527	4183723	4119615	4034637
STOREY 3	6374621	4032478	3878758	3820733	3745451
STOREY 4	5875781	3733361	3591651	3539840	3474630
STOREY 5	5398183	3451657	3321095	3275540	3220682
STOREY 6	4940119	3184284	3064331	3024946	2980595
STOREY 7	4498840	2927579	2817974	2784565	2750612
STOREY 8	4071657	2677666	2578442	2550692	2526897
STOREY 9	3655903	2431338	2362985	2320197	2305982
STOREY 10	3249881	2186034	2108305	2090588	2085318
STOREY 11	2851942	1940011	1873594	1860094	1862830
STOREY 12	2462034	1692707	1637947	1628102	1637893
STOREY 13	2079790	1444181	1401303	1394517	1410167
STOREY 14	1707519	1196794	1165716	1161407	1181639
STOREY 15	1348158	953289.2	933529	931151.5	954492.7
STOREY 16	1009940	720176.1	710627.1	709652.1	734349.9
STOREY 17	700400.9	503422.3	502382.4	502322.6	526574.4
STOREY 18	432851.6	313656	318494.9	318922	340431.9
STOREY 19	217695.6	159003.4	166592	167019.8	183761.7
STOREY 20	70171.61	51918.8	62009.42	58253.51	67593.2
STOREY 21	0	0	2.18E-05	1.04E-05	6.43E-06



MAXIMUM STORY ACCELERATION (M/SEC ²)					
STORY	1.5 D	2.0 D	2.5 D	3.0 D	3.5 D
BASE	0	0	0	0	0
STOREY 1	0.878	0.966	0.954	0.954	0.944
STOREY 2	2.282	2.431	2.41	2.425	2.411
STOREY 3	3.693	3.845	3.834	3.868	3.854
STOREY 4	4.938	5.032	5.034	5.093	5.085
STOREY 5	5.938	5.961	5.987	6.066	6.073
STOREY 6	6.627	6.585	6.642	6.742	6.769
STOREY 7	6.979	6.898	6.995	7.104	7.157
STOREY 8	7.036	6.95	7.086	7.194	7.269
STOREY 9	6.887	6.821	6.973	7.078	7.168
STOREY 10	6.693	6.668	6.838	6.921	7.009
STOREY 11	6.55	6.55	6.752	6.79	6.866
STOREY 12	6.463	6.437	6.616	6.676	6.735
STOREY 13	6.324	6.189	6.409	6.439	6.488
STOREY 14	6.08	5.772	6.001	6.035	6.066
STOREY 15	5.774	5.23	5.428	5.491	5.488
STOREY 16	5.638	4.899	5.087	5.111	5.026
STOREY 17	5.931	5.134	5.215	5.222	5.006
STOREY 18	6.79	6.107	6.123	6.043	5.685
STOREY 19	8.063	7.573	7.497	7.382	6.91
STOREY 20	9.43	9.147	9.056	8.865	8.301
STOREY 21	10.591	10.489	10.46	10.173	9.57



MODAL PERIODS (SEC)					
MODE	1.5D	2D	2.5D	3D	3.5D
1	1.853	2.457	2.387	2.26	2.216
2	1.687	2.224	2.188	2.165	2.161
3	1.519	1.894	1.851	1.837	1.838



IV. CONCLUSION

The maximum storey acceleration of the structure is 1.5D is increased by 2 %, 1.5%, 3%, and 1.8% as compared to the 2D , 2.5D , 3D and 3.5D when we decreases the twisted angle then the acceleration is increases.

storey stiffness is for 1.5D Is increasing by 43 % , 35% , 33.5% and 26.4% as compare to the 2D , 2.5D , 3D and 3.5D model

The overturning moment is for 1.5D is increasing by 41 % , 33.4%, 31.5% and 24.4% as compare to the 2D, 2.5D, 3D and 3.5D model.

The maximum storey displacement of the structure 2.0D is increase 6% as compared to other type of structure but only 10% 1.5D type of structure .the displacement is varying for floor to floor.

When the rotation of the structure is increases then the base shear is also increase the total 3.5D structure base is higher than the remaining the structure. The base shear is 4% to 12% increases as compare to the other structure.

When we increase the rotation of the floor then the modal time period is also decreases

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Comparative Analysis of Dome structure using Finite Element based software ETABS and STAAD PRO for Dynamic Loading

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ABSTRACT: In recent years, there has been an increasing Number of structures using steel domes as it is one of the most efficient shapes in the world. It covers maximum volume with the minimum area with no interrupting columns in the middle an efficient shape would be more efficient and economic. Dome roofs are the lightest structure to cover circular shapes. In this research paper, the analysis of steel dome is examined using computer software E-tabs. This paper conducts a deep study of major features of structural analysis of E-tab software. E-tab software has the analysis of its own features option, output option, limitation, and advantages. Dome is one of the powerful architectural representations. This element resembles the hollow upper half of a sphere. In the age of civilizations, the form of the dome was stuck in the public's minds as an iconic sign of a sacred building, but in the present time architects have built domes to achieve new purposes using new building technologies. This paper, therefore, investigates these technologies and outlines the new role of domes following a scientific methodology. It is an element of architecture that resembles the hollow upper half of a sphere. The thickness of the dome is very small compared to its other dimensions -it varies from 75mm to 150mm. A dome is a self-supporting structural element that resembles the curved hollow upper half of a sphere. A dome can rest directly upon walls, columns, a drum, or a system of squinches or pendentives used to support the transition of shape from a square or rectangle to the round or polygonal base of the dome.

KEYWORDS: Efficient shape, Economic, Lightweight structure, E-tab

I.INTRODUCTION

Dome is one of the oldest and well-established structural forms and has been used in architecture since ancient times. As the world's population is growing fast, it is important to design urban living spaces according to the needs of modern times. The main goal of this project is to study the need for cheap housing in India, where the maximum percentage of the population is still detained in poverty. It also provides safety and is a cost-effective shelter for middle-income people in households. To achieve greater flexibility.

Dome structures have been proven to be long-lasting efficient structures due to their capability to carry the applied loads. The vertical loads will be resisted mainly by the internal compression stresses and outer tension.

Importance of dome in the construction industry:

High strength: Dome structures are highly durable and strong. If we talk about the strength and average building life of dome structures, then their life is longer, and strength is more than only other types of structure in the space frame industry.

Fireproof: After getting practical data from decades of performing the firelighter test, it is concluded that domes have more excellent fireproofing capability than other similar structures.

Extremely energy efficient: Dome structure does not need any interior support and thereby wide space inside them cater them the advantage of more support.

Cost-effective & good structural integrity: Dome structure comprises great structural tightness with minimal space and structural components and its geometrical shape gives an advantage to conserving energy in form of heat, which Makes the dome structure cost-effective.

Very Low Maintenance: Dome structures are comparatively easier to maintain than any other building, therefore the cost of maintenance on dome structures is lesser.

Good Acoustic Quality: In Most places where sound needs to travel continuously, dome structures are preferable to other structures due to the good acoustic nature of dome structures.

Resistant to adverse weather conditions: Due to their hemispherical Structure and absence of angles, flat surfaces make them highly resistant to adverse weather conditions such as Storms, Hurricanes, etc.

Highly aesthetic and versatile: We at Hindustan are also limited, one of the modern dome manufacturers uses the combination of its basic features and the latest technology to make the dome structure more appealing and highly versatile in installation/reinstallation as well as in maintenance.

II.PROBLEM STATEMENT

In real situations without calculation by software, it might be difficult for the engineer to calculate all the calculations starting from the foundation until the roof. The calculation is consisting of long calculations to make sure the design is safe and economical. Manual calculations can cause a lot of mistakes. In this case, E-tab software is used to analyse circular dome structures 50m in diameter. E-tab is used to define the strength behaviour of the element in the dome structure by modelling and analysing the dome structure.

The introduction of E-tab software has resulted in considerable advanced in the analysis and design of any structure. Therefore, it is a great encouragement to study and understand the use and importance of software in solving practical problems.

III.METHODOLOGY

The theoretical background discussed so far represents the backbone of the methodology we have applied to some of the relevant domed structures in the world. As mentioned in the paper, domes are difficult to investigate and analyse. Throughout history, many methods have been applied to measure their surface and to assess their geometry and shape. Whereas domes are quite difficult even to reach.

Methodology using ETAB Software

Step 1-Topic Name Comparative Analysis of Dome Structure using Finite Element based on Software E-tab and Staad for Dynamic Analysis.

Step 2-What is Dome and its types?

Dome- Hemispherical structure evolved from the arch, usually forming a ceiling /roof.

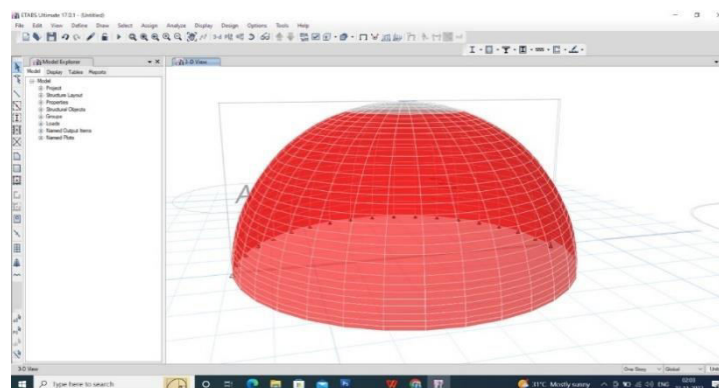
Types - Geodesic Dome, Onion dome, Hemispherical

Step 3-Type of dome used in the project.

Step 4- Hemispherical dome

Step 5-Design the dome using the software E-tab.

Step 6- Steps to design the dome-Using AutoCAD to create the semicircle by providing Coordinates.

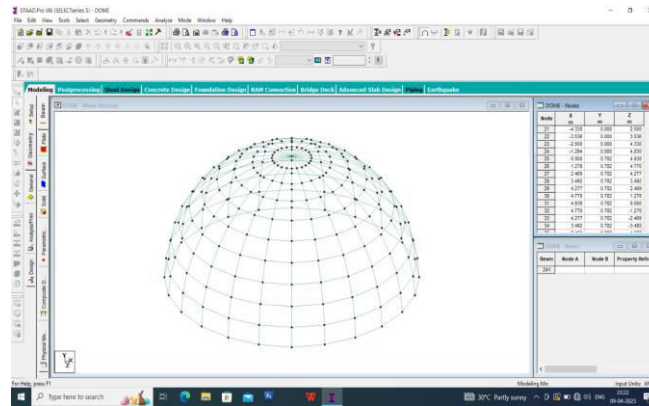


- Save the file in AutoCAD.
- Import it to E-tabs.
- Select the semicircle and edit.
- Extrude frame to the shell.
- Radial extrusion
- Select angle midpoint.
- Apply Loads on the structure.

Methodology Using STAAD PRO

Step 1. Steps to designing dome.

- Select new project.
- Set units (meter and
- Select geometry (run structure wizard)
- Model type (spherical surface)
- Select meshing parameters (dia, base dia, division, radius)
- Transfer prototype into STAAD
- Thickness (node-0.2) add and assign.



- Step 2. Set and apply supports and loads.
- Step 3. Analyse
- Step 4. Define parameters.
- Step 5. Analysis
- Step 6. STAAD output and get report of analysis.
- Step 7. Select post processing and get support reactions.

IV.EXPERIMENTAL RESULTS

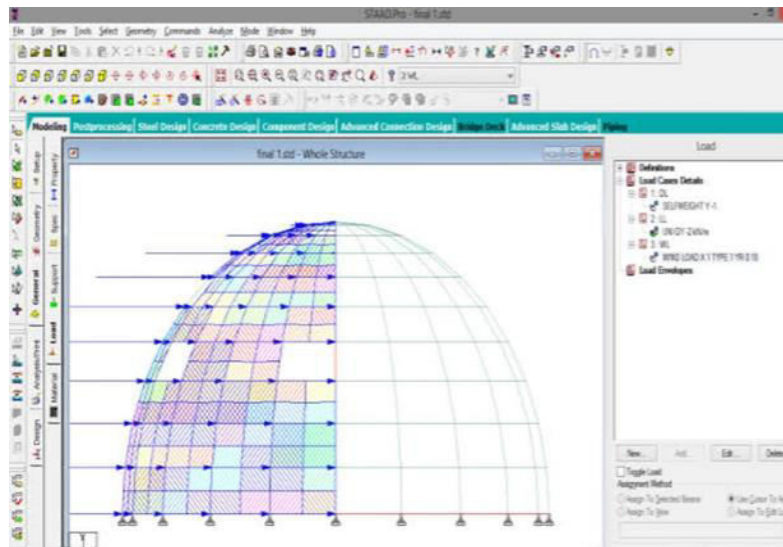


Fig.1.Assigning loading

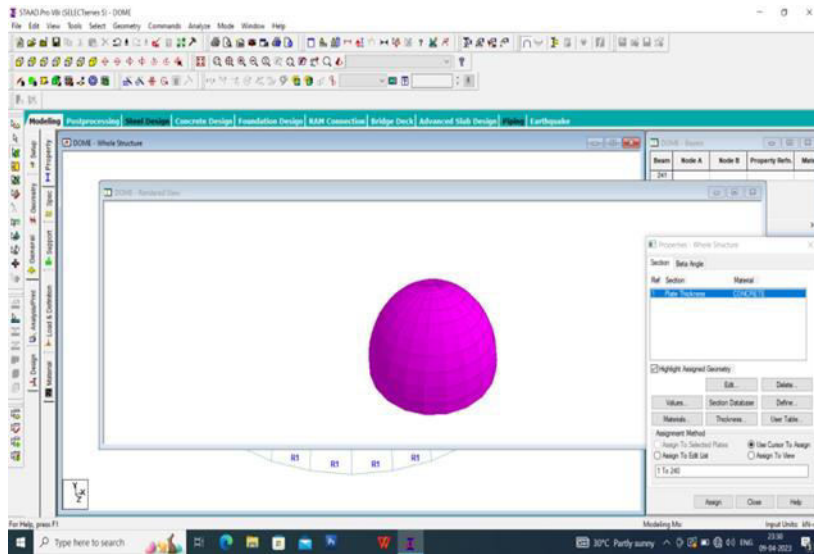


Fig.2.3D View of dome structure

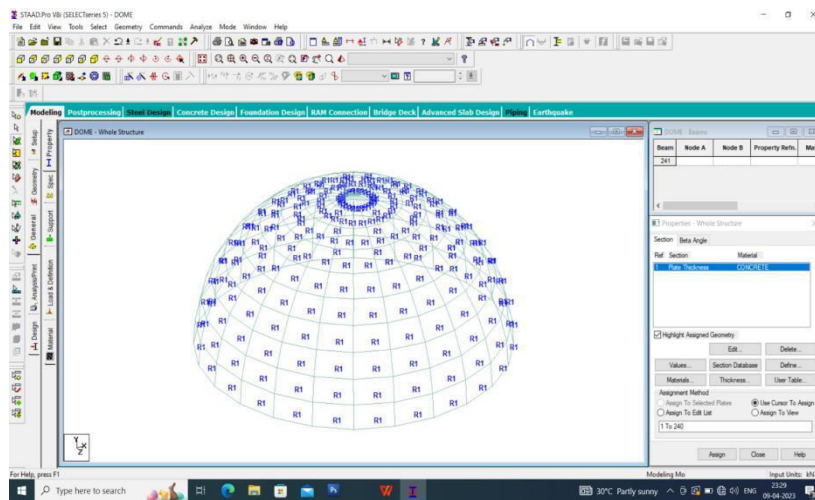


Fig.3.Showing details of dome.

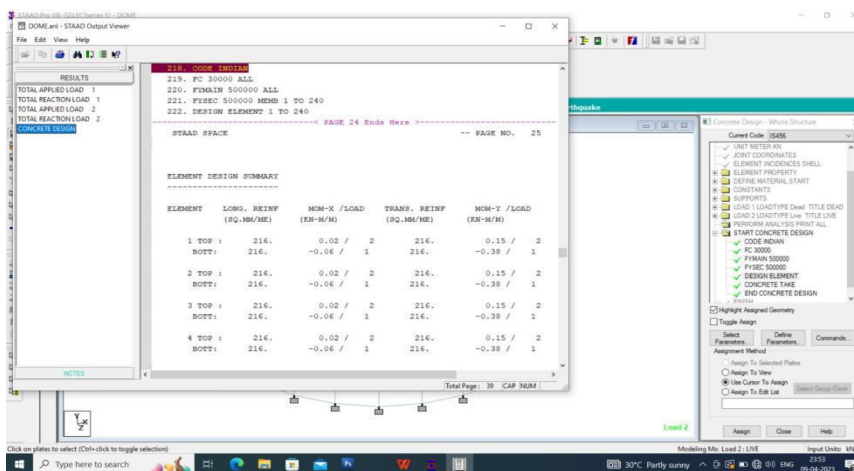


Fig.4.Complete Analysis Result

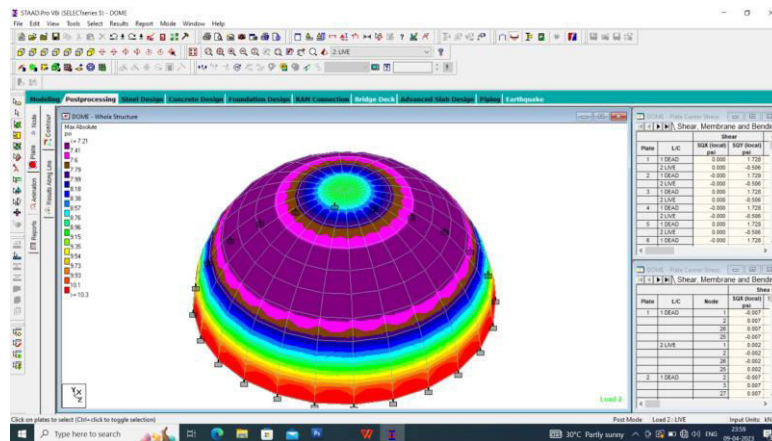


Fig.5.Max Absolute Plate Stresses (STAAD PRO)

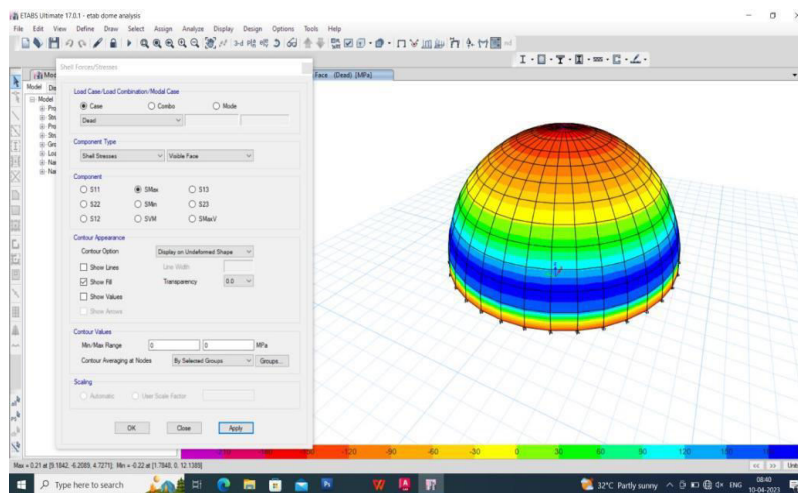


Fig.6. Max Absolute Plate Stresses (ETAB)

V.CONCLUSION

- [1] The dome is one of the best architectural solutions to cover Universal space containing multi functions in one enclosure.
- [2] Now it has become easier to analyse the dome structure Using ETABS software.
- [3] In this study, we have created a dome model.
- [4] ETABS is specialized in the analysis of the structure.

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Analysis and Design of Counterfort Retaining Wall

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ABSTRACT: This study is about analysis and design of counterfort retaining wall. There are many types of retaining walls but selected the counterfort retaining wall. We chose the counterfort retaining wall because it is more reliable and strong type of retaining wall. With respect to Cohesion and Angle of repose we are going design the Counterfort retaining wall. And also going to find out Cost of retaining wall. Also knowing the its suitability according to Cohesion and Angle of repose or Angle of internal friction (Φ).

KEYWORDS: Analysis and Design of counterfort retaining wall, Cost Estimation, C and Φ of Soil, etc.

I. INTRODUCTION

A retaining wall is a structure that holds back soil or other materials while maintaining the ground surface at various elevations that are higher than the soil's angle of repose. These walls also support the soil laterally so that it can maintain various levels on both sides. Retaining walls can be built from a variety of materials, including concrete blocks, treated lumber, treated concrete, and rocks or boulders.

A cantilever wall with counter forts is known as a counterfort retaining wall. The base slab and counterfort are connected. It is a cantilever retaining wall that is reinforced with monolithic counter forts made of the base and rear wall slabs. The distance between counter forts is roughly equal to or slightly greater than half of their height. Treated wood, poured concrete, stone, brick, concrete block systems, and other materials are frequently used to construct retaining walls. The counter-fort wall is 8–12 metres high.

Paper is organized as follows. Section II describes the related work on counterfort retaining wall in past research by various authors, also shown the basics of design of counterfort retaining wall Section III. Section IV presents Design results showing results of test conducted and Main design of counterfort retaining wall. Finally, Section V presents conclusion of the all the results and design process.

II. RELATED WORK

Author. M. Sholeh, I. Hermanto, and U. C. Sari (2019)

In this research, we investigated how to create an appropriate retaining wall design that may be employed on a vertical slope. The findings indicate that the value of the safety factor will rise with the size of the retaining wall. When compared to retaining walls with thin shapes, those with sloping walls on the front of the retaining wall have a higher safety factor. The driving force will be increased by cliffs or steep slopes. Rivers, springs, sea water, and wind erosion all contribute to the formation of the steep slopes, moistures etc.

Inder Kumar (5 May 2017) : Discovered that the analysis for the behaviour and best design of the gravity wall and counter fort retaining wall in concrete dam. Concrete and steel volume and amount are used to evaluate cost analysis against each wall design. The alternative with the lowest cost estimate is picked as the optimal design solution after a comparative analysis.

The work in this paper is divided in two stages. 1) Design of counterfort retaining wall 2) Costing of counterfort retaining wall. The main objective of this project is to effectiveness in term of analysis and design of counter fort



retaining wall. In this paper we design the counterfort retaining wall with respect to the properties of soils like moisture content, dry density, shear strength, and angle of internal friction etc.

III. OBJECTIVES

- To study the different types of soil available in study area
- To study the different types of forces acting on the retaining wall
- To study the design procedure adopted for the design of Counterfort retaining wall
- To study design and cost analysis of Retaining wall
- To study the different types of soil available in study area
- To study the different types of forces acting on the retaining wall
- To study the design procedure adopted for the design of Counterfort retaining wall
- To study design and cost analysis of Retaining wall

IV. PROBLEM STATEMENT

- Soil is retained by retaining walls. This is mostly applied to landslides with tiny hills where these walls serve as a crucial barrier to stop from moving forward in a landslide.
- If the retaining wall is not provided most problem is soil erosion and which can cause damages to surrounding area.
- We are going to analyse and the counterfort retaining wall.

V. METHODOLOGY

Step 1: Collection of soil sample of different types.

Step 2: Finding basic properties of soil.

Step 3: Tests to be performed on Soil: Grain size analysis, Standard Proctor test for max. dry density and optimum moisture content of soil, and direct shear test for finding Cohesion and angle of internal friction (Φ) etc.

Step 4: Determining the forces acting on wall.

Step 5: Checking for overturning and sliding.

Step 6: Estimating cost of retaining wall for per meter length.

VI. EXPERIMENTAL RESULTS

1. Grain Size Analysis. (Soil Classification)

Sample 1 (ADYPU College ground)

Seive no.	Sieve Size(mm)	Wt retained(gm)	% wt retained	Cummulative % wt retained	% finer
#4	4.75	0	0	0	100
#8	2.36	491	49.1	49.1	50.9
#16	1.18	351	35.1	84.2	15.8
#30	0.6	72	7.2	91.4	8.6
#40	0.425	26	2.6	94	6
#50	0.3	2	0.2	94.2	5.8
#100	0.15	38	3.8	98	2
#200	0.075	12	1.2	99.2	0.8
	Pan	8	0.8	100	0
	Total	1000			

D10 = 0.7 mm

D30=1.7 mm

D60=2.8 mm

$$Cu = \frac{D60}{D10} = \frac{2.8}{0.7} = \underline{4}$$

$$Cc = \frac{(D30 - D10)}{D10 * D60} = \frac{1.7 - 0.7}{(2.8 * 0.7)} = \underline{1.47}$$

Above soil is well graded soil.

2. Standard Proctor test.

Sample 1 (ADYPU College Ground)

Sr. No.	Properties	1	2	3	4	5
1	Mass (M) of compressive soil (gm)	1555	1565	1572	1584	1580
2	Bulk Density ρ (gm/ml)	1.555	1.565	1.572	1.584	1.58
3	Water Content (W) %	13.88	13.04	13.5	21.18	30.57
4	Dry Density ρ_d (gm/ml)	1.36	1.38	1.385	1.3	1.21

Max. Dry Density = 1.385 gm/ml

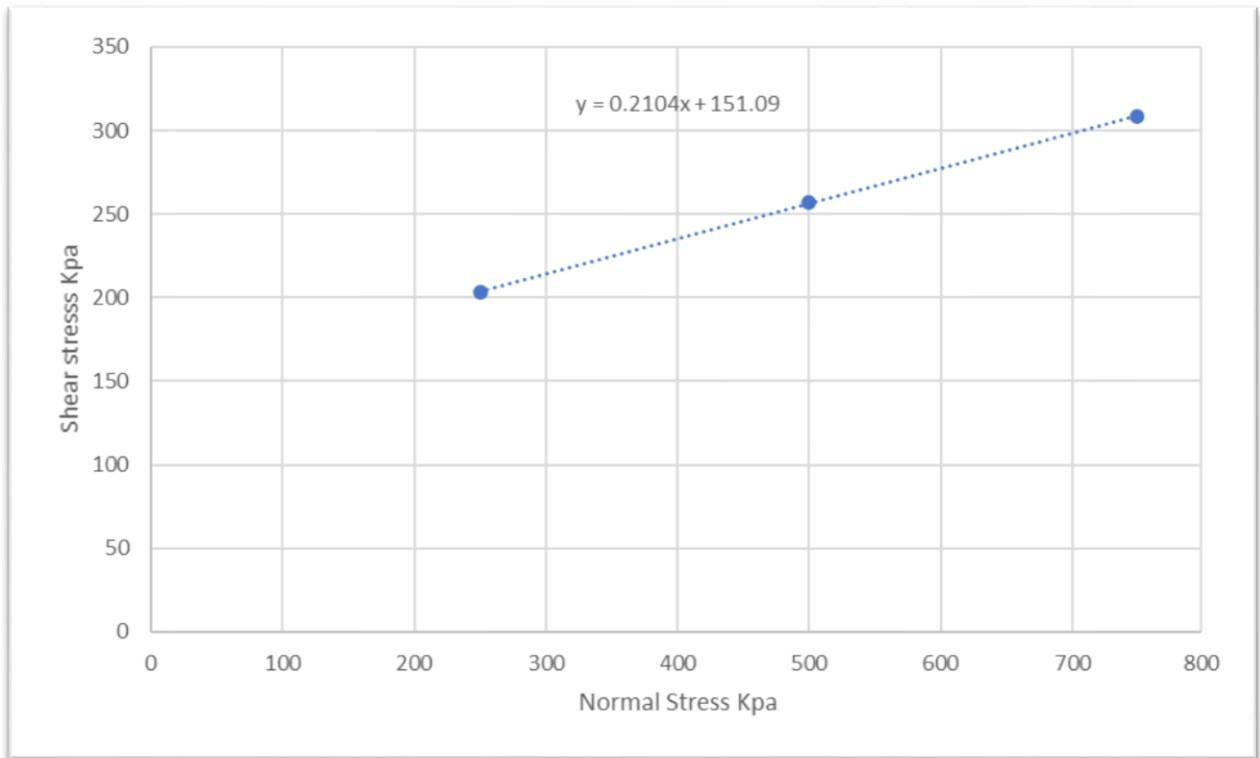
Optimum Moisture Content = 13.5 %

3.Direct Shear Test.

Normal stress (Kpa)	Shear Stress (Kpa)
250	203.34
500	256.96
750	308.52

From equation of trendline is
 $y = 0.2104x + 151.09$

- a) Cohesion =C= 151.09 Kpa
- b) Angle of friction = $\phi = \tan^{-1}(0.2104) = 11.88 ^\circ$



DESIGN (ONLY CHECK FOR OVERTURNING AND SLIDING)

Check for overturning & sliding

Overturning due to horizontal backfill earth pressure

$$\therefore M_o = \frac{c_p \times \gamma \times h^3}{6}$$

$$\therefore M_o = 117312.867 \text{ N. m}$$

$$\text{Factor of safety against overturning} = \frac{0.9 \times M_s}{M_o} = \frac{0.9 \times 3062318.55}{1173128.67} = 2.34 > 1.4 \text{ ----- OK}$$



∴ Hence Safe against overturning.

Check for sliding:

$$\text{Sliding force} = PH = \frac{Cp \times \gamma \times h^3}{2} = \frac{0.711 \times 1358 \times 9^2}{2} = 391042.89 \text{ N}$$

$$\begin{aligned} \therefore \text{Resisting force} &= (0.9 W_1 + W_2 + W_3) \\ &= (0.9 \times 53125 + 62500 + 432862.5 + 25462.5) \\ &= 568637.5 \text{ N} \end{aligned}$$

$$\begin{aligned} \therefore \text{F O S against sliding} &= \frac{\text{Resisting force}}{\text{sliding force}} \\ &= \frac{568637.5}{391042.89} \\ &= 1.45 > 1.4 \text{ -----OK} \end{aligned}$$

∴ Hence safe against sliding.

ESTIMATE :

ITEM NO.	DESCRIPTION	NO.	LENGTH	BREADTH	HEIGHT	QUANTITY	EXPLANATION
1	RCC work 1:2:6 (excluding steel)	1	30	5	0.6	90m ³	
	1) base slab						
	2) Toe slab	3	30	0.25	8.5	63.75m ³	
					Total =	153.75m³	
2	Steel Bar including in reinforcement						
	Stem						
*	16mm dia. main bars @ 140mm c/c (full Ht.)						L = 8.5 + 0.5 + 2*0.16 =
	No. = ((30 - 2*0.05)/0.14)+1	215	9.44		1.58 kg/m	3206.768 kg	9.44 M
*	16mm dia. main bars @ 140mm c/c (Upto 5.66 m)						
	No. = ((29.90 - 2*0.2)/0.14)+1	212	6.61		1.58 kg/m	2214.08 kg	L = 9.44 - 2.83 = 6.61 m
*	16mm dia. main bars @ 140mm c/c (Upto 2.83 m)						
	No. = ((29.90 - 2*0.1)/0.14)+1	214	3.77		1.58 kg/m	1274.7 kg	L = 9.44 - 5.67 = 3.77 m
					Total =	6695.558 kg	
*	10mm dia. bars -						
	Distribution bars Right side @						



	130mm C/C of stem						
	No.= $((9 - 0.05 - 0.06)/0.13)+1$	62	31.24		0.62kg/m	1200.87 kg	$L = 30 - 2*0.05 + 2*0.01*40 + 6*9*0.01 = 31.24$ m
*	10 mm Dia. Vertical Distr. bars @ 130mm C/C						
	On right side						
	No.= $((30 - 0.1)/0.13)+1$	231	9.07		0.62 kg/m	1299 kg	$L = 9 - 0.05 - 0.06 + 2*9*0.01 = 9.07$ m
*	10mm dia. bars -						
	Distribution bars Left side of stem@ 130mm C/C						
	No.= $((9 - 0.05 - 0.06)/0.13)+1$	70	31.24		0.62 kg/m	1355.82 kg	$L = 30 - 2*0.05 + 2*0.01*40 + 6*9*0.01 = 31.24$ m
					Total =	3855.69 kg	
3	Base Slab :-						
*	20 mm Main bars @ Bottom(Toe) @ 100mm C/C						
	No.= $((30 - 0.1)/0.1)+1$	300	4.88		2.47 kg/m	3616.08 kg	$L = 5 - (2*0.06) = 4.88$ m
*	16 mm Main bars @ T (Heel) @ 130mm C/C						
	No.= $((30 - 0.1)/0.13)+1$	231	4.88		1.58 kg	1781.10 kg	$L = 5 - (2*0.06) = 4.88$ m
					Total =	5397.18 kg	
*	14# bars of 18mm Dia.	14	4.88		2 kg/m	136.64 kg	$L = 5 - (2*0.06) = 4.88$ m
*	10# bars of 16mm Dia.	10	30.75		1.58 Kg/m	485.85 Kg	$L = 30 - 2*0.05 + 0.6 = 30.75$ m
					Total =	622.49 kg	
4	Counterforts:-						
*	Horizontal steel						
	2 legged 10mm Dia. Horizontal links @ 160mm C/C						
	No.= $((8.5 - 2*0.05)/0.16)+1$	64	29.9		0.61 Kg/m	1167.30 Kg	$L = 30 - 0.1 = 29.9$ m
*	Vertical steel						



	2 legged 10mm Dia. Vertical links @ 120mm C/C						
	No.= ((30 -2*0.05)/0.12)+1	25	2		0.61 Kg/m	1167.30 Kg	L = (0.25 + 3.75)/2 = 2 m

ABSTRACT OF QUANTITIES:

1. R.C.C. WORK 1:2:4 = 153.75 M³
Rate = 3604 / M³

Cost = 554115 RS /-

2. STEEL BARS INCLUDING REINFORCEMENT = 18179.978 KG
Rates = 70 Kg

Cost = 1272598.46 RS /-

TOTAL = 1826713.46 RS/-

Add 5% for contingencies and work charge establishment = 91335.673 RS/-

Add 10% contractor profit = 191804.91 RS/-

GRAND TOTAL = 2109854.043 RS/-

COST PER METER LENGTH IS WALL (L=30 M) = 70328.468 RS /-

VI. CONCLUSION

This paper is related to the Analysis and design of counterfort retaining wall by calculating the value of Cohesion (C) and Angle of internal friction (Phi). We have conducted direct shear test to know the values of cohesion and angle of internal friction. We have design counterfort retaining wall with reference to design procedure of S. Ramamrutham. From design and overall results the retaining wall is stable against both overturning and safe against sliding. COST PER METER LENGTH IS WALL (L=30 M) = 70328.468 RS /-

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A Review on Experimental Study on Strength Properties of Self Curing Concrete by Using Polyethylene Glycol as Self Curing Agents

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ABSTRACT: This project involves the use of shrinkage reducing admixture like polyethylene glycol (PEG- 200) as internal curing compound. The curing compound used in concrete helps in curing, better hydration and produces good compressive strength. PEG will trap the moisture within the structure and will prevent the evaporation which normally occurs due to the hydration process of concrete.

In the present project, the effect of curing compound on compressive strength. By adding PEG (0% to 2% by weight of cement) for M20 mix. Different test specimens of conventional concrete and self-curing concrete made by admixture PEG-200 is casted and tested in the laboratory. The properties are compared with the help of different tests and results are obtained. Results shows that concrete made by admixture PEG-200 at 1% will increase strength by 9.4% compared to compressive strength of concrete made without PEG-200 admixture and cured for 14 days under water.

KEYWORDS: PEG-200, self-curing concrete, compressive strength

I. INTRODUCTION

Construction industry use lot of water in the name of curing. The days are not so far that all the construction industry has to switch over to an alternative curing system, not only to save water for the sustainable development of the environment but also to promote indoor and outdoor construction activities even in remote areas where there is scarcity of water.

Curing is the process of controlling the rate and extent of moisture loss from concrete during cement hydration. It may be either after it had been placed in position or during the manufacture of concrete products, thereby providing time for the hydration of the cement to occur. Since the hydration of cement does take time days and even weeks rather than hours curing must be undertaken for a reasonable period of time.

1.1 Self Curing:

Concrete is the second most consumed material in the world after water and it is used most widely in the world after and it is used most widely in the construction industry due to its high compressive strength and durability. Conventional concrete needs proper curing and moisture contents for a minimum of 28 days for good heat of hydration and high strength. Lack of proper curing can badly affect the strength and durability. Self-curing concrete is one type of special concrete which is mitigated insufficient curing due to human negligence paucity of water in arid areas, inaccessibility of structures in difficult terrains and in areas where the presence of fluorides in water will badly affect the characteristics of concrete.

1.2 Objectives:

1.the main objective of our project is to reduce the usage of H₂O in concrete 2. It will easy to workability to use then it is also increase the strength 3. By using polyethylene glycol improve the water content of mix concrete 4. By adding polyethylene glycol in different percentage, we can determine the compressive and tensile strength of concrete 5. In this study the effect of two different curing agents has been examined to compare its performance for optimization

II. LITERATURE

1. Experimental investigation of self-curing concrete

Author: Shikha Tyagi In this paper we have to study the effects of different curing compound on the strength of properties of concrete. We have to find the concept of self-curing agents is reduce of water evaporation from concrete and increase water



retention capacity of the concrete compared to conventional concrete

2. Study on Properties of Self Curing Concrete Using PEG 400

In this paper we find out the different does like 0.5 ,1 % and 2% of PEG 400 by the weight of cement .Inthis paper we see the uses of PEG 400 is better option for forming an internally cured concrete that retain its strength 100%

3. Experimental Investigation of Self Curing Concrete Using Polyethylene Glycol.

Author L Kalaivani, Santhlyaraj A Robin, Lochana Suganthi

Carried work on internal curing composition for concrete which includes a glycol and a wax. The invention provides for the first time an internal curing composition which, when added toconcrete or other cementitious mixes meets the required standards of curing as per AustralianStandard AS 3799

4. Roland Tak Yong Liang. Robert Keith Sun [2003]

Stated that self-curing concrete is provided to absorb water from moisture and from air to achieve better hydration of cement in concrete. It reduces the problem when the degree of cement hydration is lowered due to no curing or improper curing by using poly-acrylic acid as a self-curing agent which hasstrong capability of absorbing moisture from atmosphere and providing water required for curing concrete..

5. Wen-Chen Jau [2007]

Studied on self-curing concrete and had use PEG200 as self-curing agent in concrete. M25 and M40 grade of concrete are adopted for investigation. She added 1-2% of PEG200 by weight of cement forM25 and M40 grade concrete. She was concluded that the optimum dosage of PEG200 for maximumCompressive strength was to be 1% for M25 and 0.5% for M20 grades of concrete.

III. METHODOLOGY

- To study the effect of self-curing agent PEG 400 on the compressive strength and split tensile strength of concrete a mix proportion of 1:1.697:3.44 with w/c ratio of 0.5 is adopted.
- The dosage of PEG 200 kept varying from 0%, 0.5%, 1.0%, 1.5% and 2.0% by weight of the cement.
- The conventional concrete was casted with M20 mix and kept for water curing.
- Another set of cubes of M20 grade concrete were casted using PEG- 200 at a varying dosage of 0.5%, 1%, 1.5% and 2% and allowed for air curing.
- The compressive strength and split tensile strength of control concrete and concrete with varying dosage of PEG 200 at the end of 7 and 28 days of curing is to be studied.

IV. CONCLUSION

- Based on the investigation carried out for the study of behavior of self-cured concrete the following conclusions can be made:
- The optimum dose of PEG-200 for M20 is obtained as 1% by weight of cement. The compressive strength was increased up to 9.4% by compressive strength of ordinaryconcrete at 1% PEG for M20 mix.
- The usage of PEG-200 helped to overcome the scarcity of water. By the usage of optimum level of PEG-200 the strength of concrete has increased.
- Normally large amount of water is required for curing of purpose. Here that can be minimized by using PEG-200. There is less shrinkage and good bounding observed in concrete with shrinkage reducing admixture which is not observed in case of conventional concrete mix

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A Comparative Study of Bamboo Reinforced Vs Steel Reinforced Concrete Structure

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ABSTRACT: Traditionally steel is used as reinforcement in concrete structure. But because of cost and availability, replacement of steel with some other suitable materials as reinforcement is now a major concern. Bamboo is one of the alternate materials used as a replacement of steel in the construction of minor structures, especially in the countries like India which is a developing country, But the use of bamboo reinforcement in concrete until today is very limited because of various uncertainties. Since bamboo is a material which is natural obtained, it is a cheap material and also readily available material in nature, if properties of bamboo are studied than it can be a substitute material for steel in reinforcing of concrete. This paper shows the investigation of use of bamboo reinforcement in beam for M30 grade of concrete. To study the effect of replacement of steel reinforcement by bamboo, tests have been conducted Flexural strength and tensile strength. Using Bamboo, we can reduce the cost of the construction by 25 percent. Bamboo concrete composite structural members can provide tailored solutions to the eco-housing initiatives at cheaper costs. The goal is to find ways to make the use of bamboo reinforced concrete beams simple, efficient, and cost-effective.

KEYWORDS: Steel Reinforced Concrete, Bamboo Reinforced Concrete, Flexural strength, Tensile strength, Cost - effective, Sustainable construction etc...

I. INTRODUCTION

As we all know, India is a developing country with a growing population which is driving up the housing demand. Bamboo is a natural source of fiber and one of the fastest growing giant's plants with great economic potential. Due to its superior properties like low weight to strength ratio, high tensile strength and factors like low cost, easy availability and environment friendly during service, bamboo has constantly attracted the attention of scientists and engineers for use as reinforcement in concrete in construction industries. Bamboo has several unique advantages like ability to grow fast with a high yield and also it matures quickly. Additionally, bamboo can be grown abundantly and that too at a lower cost which makes it more economical. Bamboo has many unique properties that make it strong and suitable to be used as a construction material. Eco-friendly, green, and natural materials have become increasingly important issues in supporting sustainable development, for the substitution of nonrenewable materials such as steel. Bamboo has been considered in many studies to replace steel in reinforced concrete elements.

1.1 General:

India one of the most popular country in the world is a home to many sections of people who are below average poverty line shortage or housing facilities among them due to many unaffordability has become a matter of concern in the recent Indian scenario As a matter fact an anomie has been made to introduce low cost houses which are durable safe and affordable bamboo one of the oldest construction material has been considered to have high tensile strength.

In recent year many researches around the world are begun to explore the use of low - cost and low - energy substitute construction materials. Among the many possibilities for substitutions bamboo, which one of the fastest growing plants has got a great economic potential Bamboo has been used in constructions of bridges and houses for thousands of years in Asia Bamboo takes less energy to harvest and transport therefore Bamboo has low manufacturing costs compared with steel bamboo is widely expected to be possible even in countries and regions that have no advanced manufacturing technology and construction techniques.

1.2 Objectives:

1. To determine the strength of bamboo reinforced beam
2. To determine the use of bamboo as reinforcement in beam



3. To make structure economical and sustainable
4. To lower the price of construction materials, use an alternative material that is readily available in the area
5. To evaluate steel reinforced concrete's effectiveness with bamboo reinforced concrete.

1.3 What is Flexural Test:

The flexural test measures the force required to bend a beam under three-point loading conditions. The data is often used to select materials for parts that will support loads without flexing. Flexural modulus is used as an indication of a material's stiffness when flexed.

1.4 What is Tensile Test:

Tensile testing is a destructive test process that provides information about the tensile strength, yield strength, and ductility of the metallic material. It measures the force required to break a composite or plastic specimen and the extent to which the specimen stretches or elongates to that breaking point.

II. LITERATURE

1. GHAVAMI (1995) DISCUSSED THE MECHANICAL PROPERTIES OF BAMBOO, SPECIFICALLY PERTAINING TO BAMBOO IN CONCRETE. THIS STUDY SHOWED THAT THE ULTIMATE LOAD OF A CONCRETE BEAM REINFORCED WITH BAMBOO INCREASED 400% AS COMPARED TO UN-REINFORCED CONCRETE. IT WAS FOUND THAT, COMPARED TO STEEL, THERE WAS LOWER BONDING BETWEEN THE BAMBOO AND CONCRETE, AND THE BAMBOO HAD AN MODULUS OF ELASTICITY 1/15 OF STEEL. BAMBOO'S COMPRESSIVE STRENGTH WAS MUCH LOWER THAN ITS TENSILE STRENGTH, AND THERE WAS HIGH STRENGTH ALONG THE FIBERS, BUT A LOW STRENGTH TRANSVERSE TO THE FIBERS. STATED IS THE NEED FOR THE DEVELOPMENT OF A SIMPLE DESIGN CODE FOR THE APPLICATION OF BAMBOO AS A CONSTRUCTION MATERIAL.

2. GHAVAMI (2004) STUDIED THE MECHANICAL PROPERTIES OF SIX DIFFERENT TYPES OF BAMBOO, PROPER TREATMENTS THAT SHOULD BE APPLIED TO BAMBOO, AND THE METHODS THAT SHOULD BE EMPLOYED WHEN UTILIZING BAMBOO AS CONCRETE REINFORCEMENT. THE POSITIVE ATTRIBUTES OF BAMBOO ARE LISTED, SUPPORTING ITS ENVIRONMENT-FRIENDLY NATURE. SOME NEGATIVE ATTRIBUTES OF BAMBOO WERE ALSO GIVEN, FOCUSING ON ITS TENDENCY TO ABSORB WATER. THE PROPERTIES OF BAMBOO WERE FOUND TO BE BASED UPON A FUNCTIONALLY GRADED CONSTRUCTION, WITH ITS MOST IMPORTANT PROPERTY BEING THAT ITS RATIO OF STRENGTH TO SPECIFIC.

3. HECTOR ARCHILA . SEBASTIAN KAMINSKI . DAVID TRUJILLO . EDWIN ZEA ESCAMILLA & KENT A. HARRIES CARRIED OUT A STUDY BAMBOO REINFORCED CONCRETE: A CRITICAL REVIEW IN WHICH THEY STUDIED THE USE OF SMALL DIAMETER WHOLE-CULM (BARS) AND/OR SPLIT BAMBOO (A.K.A. SPLINTS OR ROUND STRIPS) HAS OFTEN BEEN PROPOSED AS AN ALTERNATIVE TO RELATIVELY EXPENSIVE REINFORCING STEEL IN REINFORCED CONCRETE. THE MOTIVATION FOR SUCH REPLACEMENT IS TYPICALLY COST—BAMBOO IS READILY AVAILABLE IN MANY TROPICAL AND SUB-TROPICAL LOCATIONS, WHEREAS STEEL REINFORCEMENT IS RELATIVELY MORE EXPENSIVE—AND MORE RECENTLY, THE DRIVE TO FIND MORE SUSTAINABLE ALTERNATIVES IN THE CONSTRUCTION INDUSTRY.

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5. SHWETA ROKADE, VAISHNAVI MOTGHARE, NEHAL GAJABE, AMOL DESHMUKH, PRAVIN LANJEWAR PERFORMED AN EXPERIMENTAL STUDY ON BAMBOO REINFORCEMENT-A SUSTAINABLE ALTERNATIVE TO STEEL IN WHICH IT IS STATED THAT REDUCING THE COST OF THE STRUCTURE AND MAKING IT ECO-FRIENDLY IN NATURE STEEL IS VERY EXPENSIVE THAN THE BAMBOO THE MOTIVATION FOR SUCH REPLACEMENT IS BECAUSE BAMBOO IS RAPIDLY AVAILABLE IN MANY TROPICAL AND SUB-TROPICAL LOCATIONS TO FIND MORE SUSTAINABLE



ALTERNATIVES IN THE CONSTRUCTION INDUSTRY.

REVIEW

IN THE ABOVE PAPERS WE STUDIED THAT THE ULTIMATE LOAD OF CONCRETE BEAM REINFORCED WITH BAMBOO INCREASED 400% AS COMPARED TO AN STEEL REINFORCED CONCRETE. IT WAS ALSO FOUND OUT THAT THERE WAS LESS BONDING BETWEEN BAMBOO AND CONCRETE AS COMPARED TO STEEL. IT WAS ALSO OBSERVED THAT PROPER SEASONING OF BAMBOO IS NECESSARY BEFORE USING IT AS REINFORCEMENT.

ALSO, A SUSTAINABLE ALTERNATIVE TO STEEL, WHICH CLAIMS THAT USING BAMBOO INSTEAD OF STEEL LOWERS CONSTRUCTION COSTS AND IS MORE ENVIRONMENTALLY FRIENDLY BECAUSE BAMBOO IS EASILY AVAILABLE IN MANY TROPICAL AND SUBTROPICAL LOCATIONS, THIS REPLACEMENT IS ESSENTIAL.

III. METHODOLOGY

- TO COMPARE THE FLEXURAL STRENGTH OF BAMBOO AND STEEL REINFORCED BEAMS.

3.1. INDIAN STANDARD CODES

- 1) IS 10262: 2009
- 2) IS 2720 PART 3
- 3) IS 456: 2000

- TO STUDY THE BEHAVIOR OF BAMBOO AND STEEL REINFORCED BEAM UNDER TENSION
- TO CHECK WHICH TYPE OF SPECIMEN IS ECONOMICAL
- TO EVALUATE THE DURABILITY OF VARIOUS SPECIMEN TYPES

IV. CONCLUSION

WE WILL GET THE FOLLOWING CONCLUSIONS:

1. USE OF SUSTAINABLE MATERIALS FOR CONSTRUCTION
2. USING BAMBOO AS A REINFORCEMENT TO MAKE A PROJECT MORE AFFORDABLE
3. BEHAVIOUR OF BAMBOO REINFORCED BEAMS UNDER TENSION AND FLEXURE

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Analysis and Design of Shear Wall for Residential Building

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ABSTRACT: These days, multistory buildings are very common. In general, high-rise structures are any building that is 35 metres or higher in height. Numerous high-rise structures are currently being built, and hundreds more will be built in the future as a result of the growing demand for them in urban areas. The resilience of these structures against natural disasters like earthquakes, however, is the most crucial factor in this entire situation. The primary goal of this research is to investigate various methods for preventing lateral pressures from operating on a structure. ETABS software and analytical methods are both used to conduct the analysis.

KEYWORDS: Multistory Residential Building, Story Drift, Displacement, Base Shear, ETABS Software.

I. INTRODUCTION

The Contrary to the high-rise building industry's rapid global expansion, no probabilistic assessment methods have been established or proposed for the evaluation of this particular building group's seismic risk. In addition to slabs, beams, and columns, reinforced concrete (RC) buildings frequently contain vertical plate-like RC walls, known as shear walls. These walls often begin at the building's foundation and run continuously upward. They can range in thickness from 150mm to 400mm in high-rise structures. Shear walls are typically present along a building's length and width. Shear walls act as large, vertical beams that transfer earthquake loads to the foundation. For modelling the nonlinear response of flexural-yielding reinforced concrete walls using common structural analysis tools, a condensed analytical model is provided. The suggested model for assessing structural response through nonlinear response history analysis is put into practise using the ETAB programme. For doing realistic nonlinear static or nonlinear dynamic procedures, the model is helpful. A fine mesh of linear-response shell elements and uniaxial line elements is used to model the walls. One may use the normal nonlinear response characteristics made available for such elements by using line elements. Shear walls are frequently employed in high-rise buildings to withstand earthquake effects.

Buildings are subjected to considerable displacement, vibration, and pressures due to earthquake forces, making them dangerous and uncomfortable for residents. The shear walls made of reinforced concrete are very rigid in their own plane. To comprehend the effects of the site, shear wall frame buildings with varied numbers of stories are taken into consideration. When a structure has a shear wall, the foundation receives lateral stresses from the diaphragm and passes them to the seismic force.

Because shear walls are an effective method of stiffening the structure, shear walled frame buildings were selected for the study. Although a thin wall will also experience significant bending, the forces acting on these walls are mostly shear forces. Ground motion enters the structure, producing inertial forces that cause the floor diaphragms to move.

The definition of a "tall building," which is equivalent to a "high-rise building," as used in this document by The Council of Tall Buildings and Urban Habitat is: "A building whose height creates different conditions in the design, construction, and use than those that exist in common buildings of a certain region and period. A typical height threshold of 35 metres, or 12 stories, separates high-rise from low-rise buildings. This difference is made because, according to widespread consensus, a building must have 12 stories or more to qualify as a "high-rise" in terms of physical presence. As a balance between ambition and manageability for use in classifying buildings in a global database, the twelve-floor cap is also viewed as a desirable restriction.

II. RELATED WORK

Shear walls experience significant overturning effects because they are subject to strong horizontal earthquake stresses. So extra consideration must be given to the design of their foundations. Shear walls must be present, ideally along both length and width. To counteract the powerful earthquake effects, however, if they are only provided along one direction, a suitable grid of beams and columns in the vertical plane (referred to as a moment-resistant frame) must be provided along the opposite direction. To minimise the negative impacts of building twist, shear walls of buildings must be symmetrically arranged in the layout.

They may be symmetrically arranged along any or both directions in the plan. Shear walls perform better when placed around the building's external perimeter since this design boosts the structure's resistance to twisting. The percentage of total horizontal load borne by a perpendicular shear wall at any storey or level depends on its relative rigidity or stiffness in cases when shear walls are joined by a rigid diaphragm so that they must deflect equally under horizontal force. A shear wall's stiffness is inversely correlated to how much it deflects under a given horizontal load. The sum of the shear and moment deflections can be used to calculate the shear wall's overall deflection.

More complex but effective structural forms have arisen as a result of improvements in material qualities, construction methods, and structural knowledge. They are commonly referred to as hybrid systems since they typically combine a tube and outrigger system and use either concrete or steel composite materials. In particular, for the usual structural system that comprises of slender components in frames and more RC stocky structural walls, the analysis methods for RC high-height buildings have distinct needs different from those for low-to-middle rise buildings. Structural modelling must take into consideration the intricacies of concrete characteristics, wall-frame interaction, and three-dimensional impacts.

III. OBJECTIVES

- increase resistance of structure against lateral force this is produced by earthquake.
- To make realize the importance of Shear wall by comparing it with regular building and analyzing it.
- To study the various types of Shear wall on the basis of Drift, Displacement, Base Shear and Storey Acceleration.
- To analyze the various location of Shear Wall on the basis of Drift, Displacement, Base Shear and Storey Acceleration.

PROBLEM STATEMENT

- G + 14 Storey R.C Residential building
- Zone factor, Zone - IV, $Z = 0.24$
- Building frame system - (SMRF) - Reduction factor, $R = 0.5$
- Residential building - Importance factor - $I = 1.5$
- Floor to floor height = 3.1m
- Roof and floor slab thickness = 200 mm
- Beams dimension = 500 x 500 mm
- Column size = 700 x 700 mm
- Grade of concrete = M20 and steel Fe-415.

IV. METHODOLOGY

Design Aspect:

To ensure that sufficient vertical and lateral strength and stiffness are achieved to meet the structural criteria and permissible deformation levels stipulated in the governing building code, all buildings are designed for the combined impact of gravity loads and seismic loads. Most structures typically have enough protection against vertical shaking due to the inherent factor of safety utilised in the design criteria. Vertical acceleration should be taken into account when designing or analysing the overall stability of large-span constructions.

Required Indian Standard Codes:

- IS456:2000: Design for wall describes, design of horizontal shear in clause 32.4 given specifications of how shear



wall must be built.

- IS1893-2016(Part-1): Estimating earth quake loads and the criteria for earthquake-resistant buildings.
- Clause 9 of IS13920:2016 specifies the ductile details for shear walls, where clause 9.1 specifies basic requirements, clause 9.2 specifies shear strength requirements, clause 9.3 specifies flexural strength requirements, and clause 9.4 specifies boundary elements.

Design approach in IS 1893(2016):

- The building should be sturdy enough to remain intact after small earthquakes with a DBE or below.
- The building should be able to withstand earthquakes with a DBE without suffering substantial structural damage, but this is not guaranteed.
- To prevent fatalities, the building must be able to endure an earthquake with a magnitude of MCE without collapsing. The ductility resulting from the inelastic material behaviour and details, combined with the reserve strength, are relied upon to account for the difference between the real and the design lateral loads because the actual forces will be significantly greater than the design forces prescribed by the code.

Equivalent Static Method:

The weight of columns and walls in any storey should be evenly distributed to the floors above and below the storey in all of the code's recommended methods for analysing multi-storey buildings. The structure is treated as a discrete system with concentrated masses at floor levels. Additionally, it is combined with the appropriate quantity of forced stress at this floor. The lumped mass system simplifies to the solution of a system of second order differential equations with the additional assumption that the structure is flexible and will deflect with respect to the position of the foundation. These equations are created by a structure's mass and stiffness distribution as well as the way that it dampens ground motion.

Design Seismic Base Shear:

The design seismic base shear or total design lateral force (VB) along any principal direction shall be determined by the following expression:

$$V_B = A_h \times W$$

Where,

A_h = Design horizontal acceleration spectrum value using the fundamental natural period (T) in the considered direction of vibration W = seismic weight of the building

$$A_h = Z I S_a / 2 R_g$$

The A_h shall be determined by the above expression: Provided that for any building with T less than 0.1s, the value of A_h shall not be taken less than $Z/2$ whatever be the value of I/R_g .

Time period:

The approximate fundamental natural period of vibration T_a in seconds, of a moment resisting frame building without brick infill panels may be estimated by the following empirical formula,

$$T_a = 0.075 h^{0.75} \text{ For RC frame building } T_a = 0.085 h^{0.75} \text{ For steel frame building}$$

The approximate fundamental natural period of vibration in seconds of all other, buildings including moment resisting frame buildings with brick infill panels may be estimated by the following expression.

$$T_a = 0.09H / \sqrt{d}$$

Where,

H = Height of building in meters

D = Base dimensions of the building at the plinth level, in m

Seismic Weight:

The total seismic weight of all the floors of a building is the structure's seismic weight. Every floor's seismic weight is calculated as the product of its total dead weight and an acceptable amount of imposed load, the latter of which is the portion of the applied loads that may be reasonably anticipated to be fastened to the structure during earthquake movement. It includes the weight of stationary and mobile partitions, stationary machinery, some live load, etc. Walls and columns in any storey must be divided equally between the floors above and below the storey for calculating the

seismic weight.

Distribution of Design Force:

The estimated base shear is now dispersed throughout the building's height. Any level of shear force is dependent on the mass present there and has a tendency to change the structure's shape. Natural mode shapes are formed when a structure is deflected by earth quake forces. The quantity of natural mode shapes relies on the system's degree of freedom. A structure typically features an infinitely flexible continuous system. The mass of the node, the stiffness distribution throughout the structure's height, and the nodal displacement in the particular mode all have a role in determining the amount of the lateral force at a given floor. The design base shear (VB), which was calculated using the formula above, must be distributed along the building's height according to the formula:

$$W_i h_i^2$$

Where,

Q_i = Design lateral force at floor i. W_i = Seismic weight of floor i.

$$Q_i = V_B$$

$$\sum_{j=1} W_j h_j$$

h_i = Height of floor i measured from base,
 and n = Number of stores in the building

Time History Method:

Utilising this strategy requires adhering to known dynamics principles and using a suitable ground motion. In this procedure, accelerations from earthquake records that simulate the anticipated earthquake at the base of the structure are applied to the mathematical model of the building.

V. EXPERIMENTAL RESULTS

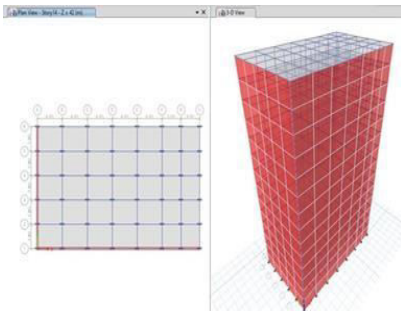


Fig - Rectangular Shear wall

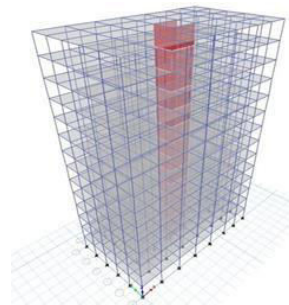


Fig - Model of Core Shear Wall

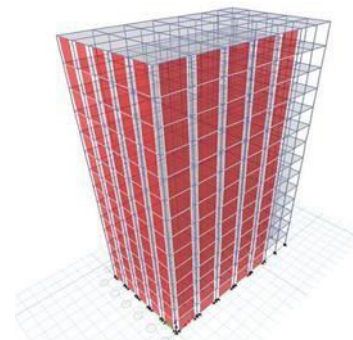
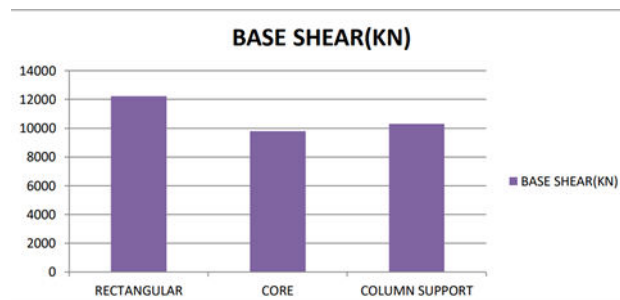
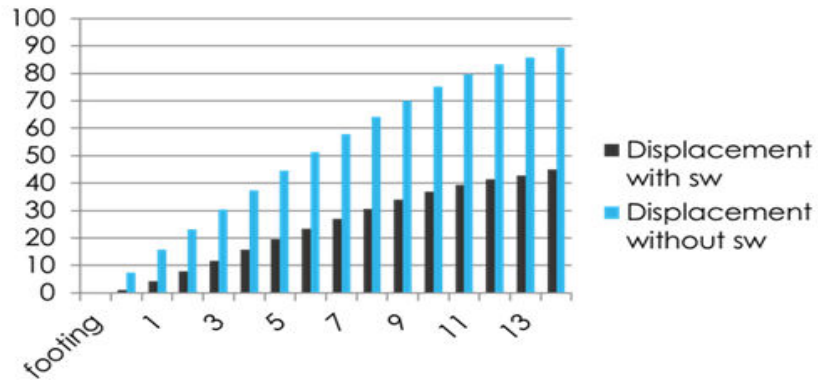


Fig - Model for Column Supported Shear Wall



Base Shear and Reactions for Column Supported Shear Wall



Results for displacement & drift in structure without providing shear wall.

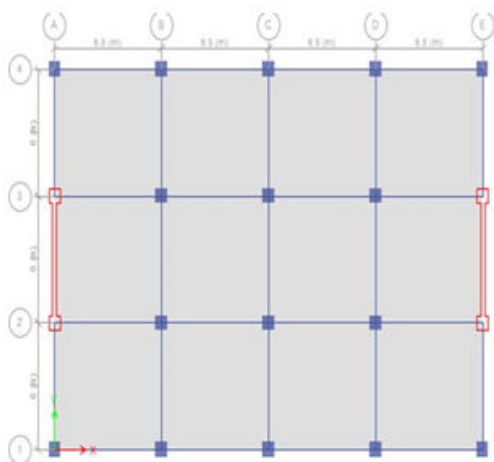
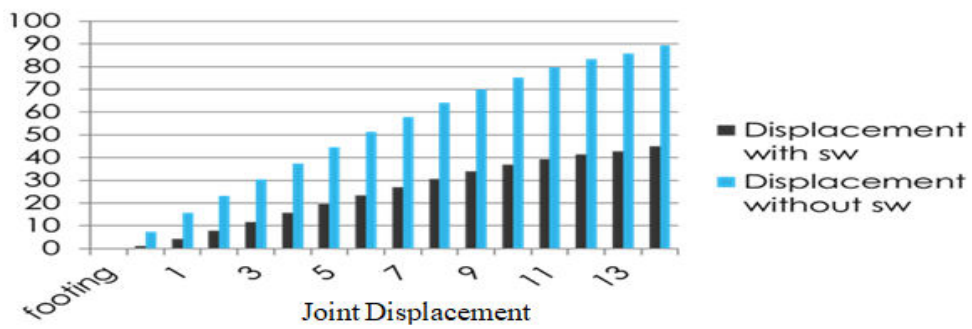


Fig. – Floor Plan of Structure with Shear Wall.

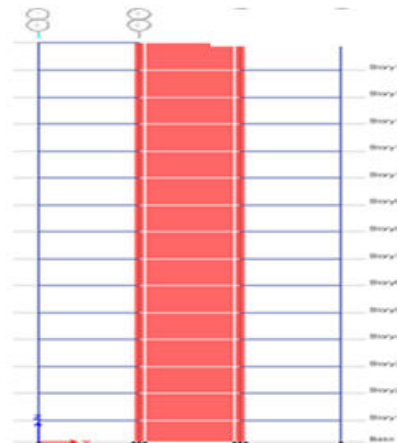


Fig. Side Elevation of Structure with Providing Shear Wall.



VI. CONCLUSION

This report focuses on enhancing the high-rise building's resilience and stability against the various loads and forces (mostly seismic pressures) that it is exposed to during the course of its lifetime.

According to the results of the aforementioned analysis, a 14 story building constructed with a shear wall along a short span in the middle (model 2) is more successful at withstanding seismic pressures than a building without a shear wall. Also noted is the shear wall's efficiency and cost-effectiveness in high-rise construction.

The graphical data above make it clear that shear walls should be installed in high-rise buildings because these structures' performance under various forces is unsatisfactory.

Additionally, it was noted that: • Joint displacement and Storey Drift are two

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Use of FRP Mesh and Bamboo Fiber Composite Material for AAC Block Masonry Wall Strengthening & Water Resistance

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ABSTRACT: For the purpose of strengthening masonry walls, externally bonded composite materials offer a desirable solution. Current studies in this area demonstrate that the use of fiber-reinforced polymers (FRPs), which are externally bonded composite materials, improves the strength, stiffness, and ductility of the wall under loads while maintaining the wall's integrity at failure.

KEYWORDS: FRP, Shear, AAC, Bamboo Fiber.

I. INTRODUCTION

Nowadays construction industry mostly using Autoclaved Aerated Concrete block (AAC blocks) for masonry work. Though they have many advantages like it is a green material, light in weight, it has better fire resistance etc, but for making this material lightweight the air is entrained in the mortar while manufacturing, due to which interconnected air voids are present in AAC blocks to meet specific requirements of density and strength. AAC block masonry displays brittle failure in tension, to increase its flexural strength and making it more ductile as a masonry, an alternative solution is to be proposed. Many attempts have been made to increase the flexural strength and ductility of masonry walls by many different methods, such as adding reinforcement while constructing the masonry, earlier mud plaster mixed with grass was widely used in almost all parts of the Indian continental. In modern construction with AAC blocks there are many cases have been observed that, the masonry wall show major cracks in flexure as well as in shear, they are more susceptible to failure in impact or cyclic load. To minimize this problem, mere plastering the wall is not sufficient, but some more practicable solution has to be proposed, which will increase its strength and also reduce the problem of its moisture absorption

1.1 Objectives:

- 1) Improve the strength of AAC masonry wall
- 2) Improve the water resistance capacity of ACC masonry wall
- 3) Use the composite material as crack filler and use for the strengthening of AAC masonry wall

II. LITERATURE

M. Derias and R. El-Hacha (APFIS 2007) This research assesses In the past, under-depth studies had been conducted on strengthening masonry walls in flexure and shear. This essay will review a collection of research findings on reinforced masonry walls that have been loaded both in-plane and out-of-plane. Different masonry units (such bricks and concrete blocks) can be utilized to create structural or non-structural walls (infill). A variety of composite materials, including steel reinforced polymers (SRP) and fiber reinforced polymers (FRP) made of carbon, glass, and aramid fibers, were used to strengthen masonry walls.[1]

K. Takashima, S. Nakata, R. Nakamura, H. Iida, T. Hanai, A. Tasai (January 9th to 13th 2017) In this study, there were two different types of AAC blocks used to build the masonry wall. One was equipped with internal bar for reinforcement, whereas the other was not. Both casings have vertical perforations and grooves. The mechanical characteristics of the masonry wall and the behavior of the Wallethe's were determined by compression Wallethe tests and shear Wallethe tests. The shear reinforcement effect of the internal reinforcement in the blocks under the shear force and confinement under the compressive force prevented the sharp post-peak drop and increased displacement capacity.

Through experimental testing, the in-plane behavior of bearing walls constructed with AAC blocks was evaluated.[2]

Ahmad S. Saad, Taha A. Ahmed and Ali I. Radwan (10 March 2008)The study began with an assessment of the structural characteristics of the AAC blocks, both individually and collectively, before conducting extensive testing on two (half-scaled) walls made of AAC blocks that are readily accessible in the marketplace. The reinforcing plan was carried out in a way that didn't add extra time to the construction schedule. The strength of the wall in the in-plane direction was greatly increased by the reinforcement. Along with a shift in the failure mode, the reinforced wall showed enhanced initial stiffness, higher ductility, and greater energy dissipation. Blocks sliding was the primary cause of reinforced wall failure, whereas compressive shear failure with wall elevating was the primary cause of unreinforced wall failure.[3]

Ehab Hamed and Oded Rabinovitch (10 March 2009)The experimental and analytical findings highlight the special features of masonry wall lateral strengthening with composite materials. The early shear failure in lateral reinforced hollow concrete block walls is revealed and explained, while on the other hand, they show the possibility of lateral fiber-reinforced polymer strengthening of AAC masonry walls. The AAC masonry walls that have been laterally strengthened exhibit increased strength, deformability, and integrity at failure traits.[4]

Romuald orlovich, Vladimir bespalov, Valeriy derkach (31 August 2021)This research assesses Despite the widespread use of surface composite reinforcement for masonry structures, the normative literature lacks sufficient information on how to calculate such reinforced structures. On the basis of experimental examinations of walls made of cellular concrete blocks, the article suggests a numerical model for assessing the impact of composite reinforcement on the bearing capacity of a compressed-bent masonry wall.[5]

III. METHODOLOGY

3.1 Material Testing

AAC block Compressive Strength Test Results													
Sr.	Test Particulars	1	2	3	4	5	6	Average	Test Method	Specified Limits			
		T1	M1	B1	T2	M2	B2			Dry Density kg/m ²	Min. Compressive strength		
										Grade 1 N/mm ²	Grade 2 N/mm ²		
1	Length (mm)	151.24	150.23	149.80	150.31	151.67	152.00		IS 6441 Part V & I, IS 2185 P 3	451 to 550	2.0	1.5	
2	Width(mm)	150.45	151.94	151.29	149.92	150.39	151.20			551 to 650	4.0	3.0	
3	Height(mm)	150.67	151.28	151.96	148.56	150.26	150.72			651 to 750	5.0	4.0	
4	Weight (Kg)	2.402	2.414	2.426	2.358	2.400	2.399			751 to 850	6.0	5.0	
5	Cross sectional Area (mm ²)	22754	22826	22663	22534	22810	22982			851 to 1000	7.0	6.0	
6	Density when tested (kg/m ³)	700.63	699.08	704.43	704.36	700.24	692.57						
7	Maximum load (kN)	92.55	93.15	94.15	90.50	90.37	93.35	N/mm ²					
8	Compressive strength (N/mm ²)	4.07	4.08	4.15	4.02	3.96	4.06	4.0571					
Remark: Grade 1 AAC Blocks													

3.2 Casting of wall



Fig: Cutting of wall



Fig: casting of wall

3.3 Plastering of wall



Fig: Normal plaster



Fig: Plaster with FRP mesh



Fig : Plaster with Bamboo Fiber mesh

3.4 Testing on wall

1. Normal Plaster Wall



Fig: Wall before testing



Fig: Wall after testing

2. Plaster with FRP mesh



Fig: Before testing



Fig: After Testing

3. Plaster with Bamboo Fiber Mesh



Fig : Before Testing



Fig : After Testing

IV. RESULT

TYPE OF WALL	LOAD IN (KN)
Normal plaster wall	90.300
FRP Mesh plaster wall	80.800
Bamboo mesh plaster wall	119.850

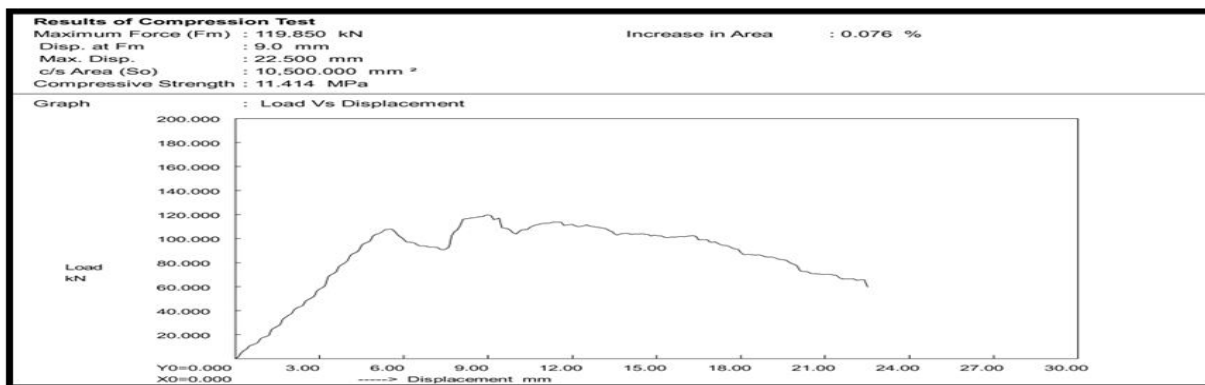
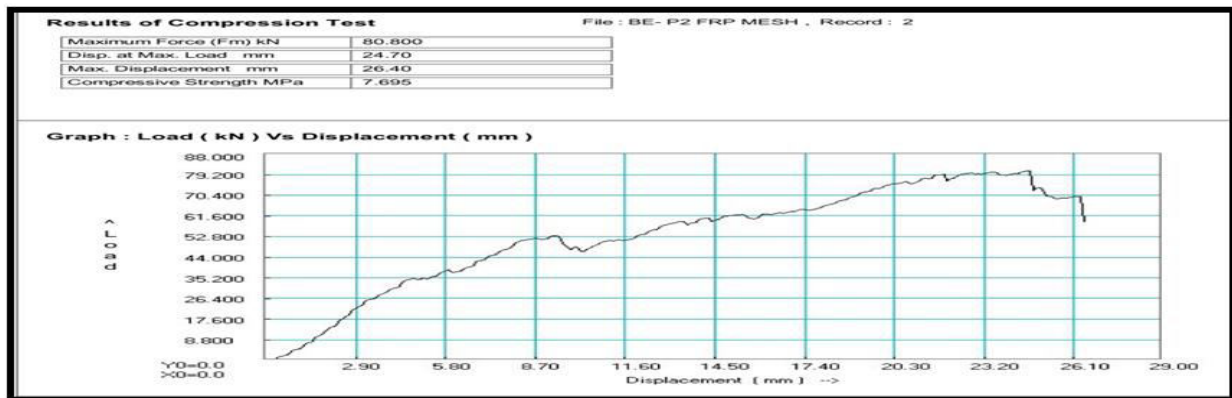
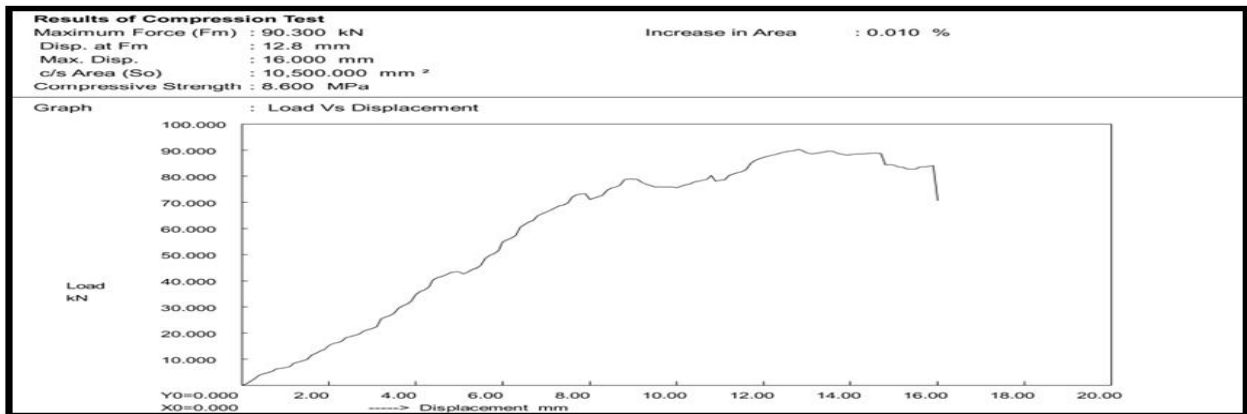


Fig : Load vs Displacement Graphs



IV. CONCLUSION

FROM ABOVE TESTING ON WALLS WE WILL HAVE FOLLOWING CONCLUSIONS:

- 1) Using fiber mesh in plastering gives better strength to the masonry.
- 2) Fiber mesh can bridge the cracks there by reducing the chances of sudden failure.
- 3) From the above results its observed that bamboo fiber has the greatest strength

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Traffic Management and Road Analysis of Porwal Road

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ABSTRACT: Traffic congestion is a major problem in many cities of India along with other countries. Failure of signals, poor law enforcement and bad traffic management has led to traffic congestion. One of the major problems with Indian cities is that the existing infrastructure cannot be expanded more, and thus the only option available is better management of the traffic. Traffic congestion has a negative impact on economy, the environment and the overall quality of life. Hence it is high time to effectively manage the traffic congestion problem. In cities, where the number of vehicles continuously increases faster than the available traffic infrastructure to support them, congestion is a difficult issue to deal with and it becomes even worse in case of car accidents. This problem affects many aspects of the modern society, including economic development, traffic accidents, increase in greenhouse emissions, time spent, and health damages.

KEYWORDS: Traffic Congestion, Car accidents, Traffic Management, Health Damages.

I. INTRODUCTION

Traffic management is the organisation, arrangement, guidance and control of both stationary and moving traffic, including pedestrians, bicyclists and all types of vehicles. Its aim is to provide for the safe, orderly and efficient movement of persons and goods, and to protect and, where possible, enhance the quality of the local environment on and adjacent to traffic facilities. This book is an introduction to traffic management, written in laypersons' language, and assuming no background knowledge of the subject. Various basic traffic characteristics relating to road users, vehicles and roads, and traffic regulation and control, are discussed, including some traffic volume and traffic flow considerations relevant to traffic management. For effective traffic management, it is essential that the practitioner works from factual information. Road inventory and statistical methods, and the more common types of traffic studies, including traffic volume and composition, origin and destination, speed, travel time and delay, accidents and parking are described. "Before and after" studies, & estimation of future

1.1 Problem Statement:

The traffic management in the cities requires proper plans and management traffic because there is a huge traffic problem there. The roads are lesser and vehicles are more. The stream of traffic is to be maintained because it directly affects the country personals. There are many accidents and other types of fatal incidents that are caused by the improper management of the traffic. To minimize the road incidents and to save the lives of the people, the traffic management plans are designed to ensure the safety of the drivers and the personal.

1.2 Objectives:

- 1) To reduce the number of accidents.
- 2) To minimize the clash between vehicles and the pedestrian.
- 3) To control and manage the vehicles and parking.
- 4) To helps in regulating the movement of the vehicles by reducing traffic density.
- 5) The main objective of this project is to reduce the traffic congestion by increasing the traffic flow. This can be done by controlling the traffic.

1.3 Traffic Analysis Report:

Porwal road starts from the old Octroi chowk on the Dhanori Lohegaon road and ends, connecting to D Y Patil road. On this entire stretch of Porwal road, many new housing societies are coming up, while there are two major high schools as well. So, working people, students and women have to travel through this road on a daily basis. The only other option is to take a 6 km long route going from Lohegaon village.

Survey Location : Apple Chemist , Porwal road.

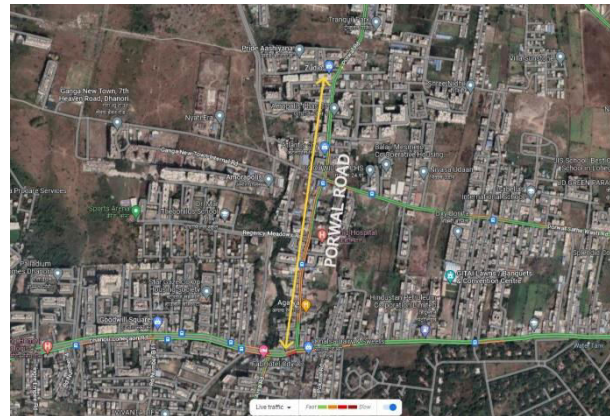
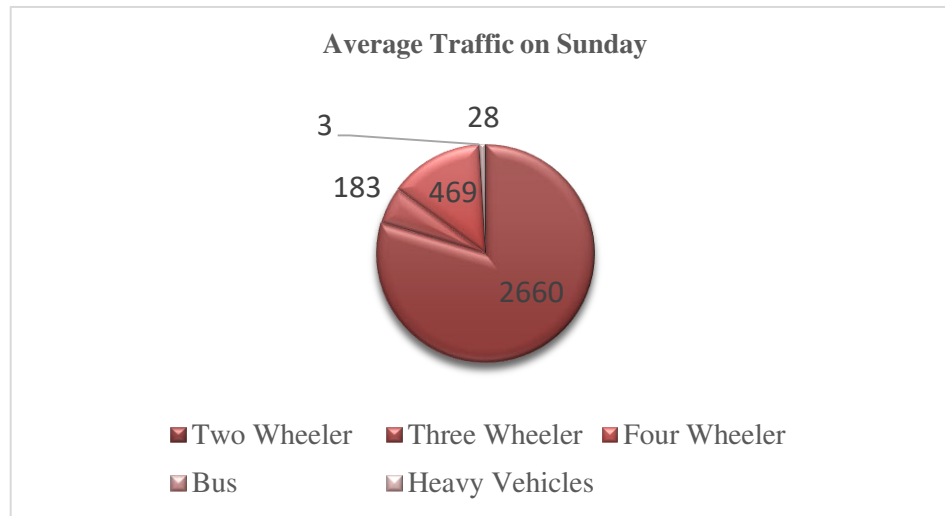


TABLE 1: PCU FACTORS

Type of Vehicle	PCU Factor
Two-Wheeler	0.5
Three-Wheeler	0.7
Car / Taxi	1
LCV	1.5
Govt bus / Private bus	3
Truck	3
Multi-Axle	4.5

Sr no	Vehicles	Sunday (23/3/2023)	Next Sunday (30/03/2023)	Average Traffic
1	Two Wheeler	2984	2336	2660
2	Three Wheeler	194	172	183
3	Four Wheeler	430	508	469
4	Bus	2	4	3
5	Heavy Vehicles	34	23	28
6	Total	3644	3043	3343

PIE DIAGRAMS



1.4 Observations:

1. Due to parking issues, visitors or customers park beside the road.
2. Due to heavy traffic, two-wheelers were overtaking four-wheelers and heavy vehicles.
3. At Apple Chemist, the road becomes narrow, and there are four roads connected. as a result of which the traffic problem occurs

1.5 Questionaries”:

Problems faced by Auto drivers, Shopkeepers & Locals.

1. What kind of problems faced by people due to traffic?
2. How much time do you required to pass the crossover due to traffic?
3. What kind a problem you face due to traffic?
4. Did any accident happened with you recently?
5. Did any customer faced problem because of traffic?
6. What kind a problem you face due to traffic?
7. How much time it will take to resolve the traffic?

II. LITERATURE

1. **NASSER R. SABAR(2017)** THE MOVEMENT OF TRAFFIC ON URBAN STREETS BY DETERMINED THE APPROPRIATE SIGNAL TIMING SETTINGS. PROPOSED ALGORITHM WAS BASED ON THE SO-CALLED MEMETIC ALGORITHM THAT COMBINES THE STRENGTHS OF THE GENETIC ALGORITHM AND LOCAL SEARCH IN AN ADAPTIVE MANNER. IN THAT USED TWO IMPORTANT TECHNIQUES FOR IMPROVING THE PERFORMANCE OF TRADITIONAL MEMETIC ALGORITHMS. FIRST, A SYSTEMATIC NEIGHBORHOOD BASED SIMPLE DESCENT ALGORITHM WAS EMPLOYED AS A LOCAL SEARCH TO EFFECTIVELY EXPLOIT THE SEARCH SPACE. SECOND, AN INDICATOR SCHEME WAS PROPOSED TO CONTROL THE LOCAL SEARCH APPLICATION BASED ON THE QUALITY AND DIVERSITY OF THE SEARCH PROCESS. THE PROPOSED ALGORITHM WAS CODED IN THE COMMERCIAL MICROSCOPIC TRAFFIC.
2. **GUSTAV NILSSON (2017)** GIACOMO COMO FOCUSED ON A CLASS OF DYNAMIC FEEDBACK TRAFFIC SIGNAL CONTROL POLICIES THAT ARE BASED ON A GENERALIZED PROPORTIONAL ALLOCATION RULE. THERE RESULTS IN A DIFFERENTIAL INCLUSION FOR WHICH THERE PROVE EXISTENCE AND, IN THE SPECIAL CASE OF ORTHOGONAL PHASES, UNIQUENESS OF CONTINUOUS SOLUTIONS VIA A GENERALIZATION OF THE REFLECTION PRINCIPLE. STABILITY IS THEN PROVED BY INTERPRETING THE GENERALIZED PROPORTIONAL ALLOCATION CONTROLLERS AS MINIMIZES OF A CERTAIN ENTROPY-LIKE FUNCTION THAT IS THEN USED AS A LYAPUNOV FUNCTION FOR THE CLOSED-LOOP SYSTEM.
3. **MOHIT RAJ (2019)** FOR THE RIGHT FUNCTIONING OF THE ROADWAY SYSTEM CONTROLLING DRIVING SPEED IS TAKEN INTO ACCOUNT TO BE AN EFFICIENT APPROACH OF IMPROVING DRIVING SAFETY, DRIVING VELOCITY OF VEHICLE PLAYS A VITAL ROLE IN ACCIDENT INCIDENCE, HIGHER VELOCITY OF VEHICLE CAN CAUSE ACCIDENT CHANCES(8). ROAD SAFETY IS ONE IN EVERY OF THE FOREMOST NECESSARY PROBLEMS CONCERNING LOSS OF LIFE. FOR THE REDUCTION OF VELOCITY OF VEHICLES AS WELL AS SEVER ACCIDENTS NUMEROUS TRAFFIC

ENGINEERING MEASURES ARE USED (20). ONE OF THE FOREMOST COMMON STRATEGIES USED IS THAT THE PLACEMENT OF TRAFFIC CALMING DEVICES IS SPEED HUMPS” AND „SPEED BUMPS“. THESE SPEED HUMPS AND SPEED BUMPS ARE THE BARRIERS THAT ARE PLACED ACROSS NUMEROUS ROADS TO LESSEN THE VELOCITY OF INCOMING MOTORS.

4. **DARIO BABIC (2020)** AS PART OF THE TRAFFIC CONTROL PLAN, ROAD MARKINGS FORM THE TRAFFIC SURFACE AND PROVIDE VISUAL GUIDANCE FOR ROAD USERS. SINCE THEIR FIRST APPLICATION TO THE PRESENT DAY, ROAD MARKINGS HAVE BECOME A COMMON ELEMENT OF ROAD INFRASTRUCTURE AND ONE OF THE BASIC LOW-COST SAFETY MEASURES. *E AIM OF THIS PAPER IS TO PROVIDE A SYSTEMATIC REVIEW OF THE MOST SIGNIFICANT ACADEMIC ACTIVITIES TO DATE REGARDING THE INFLUENCE OF LONGITUDINAL AND TRANSVERSE ROAD MARKINGS AS WELL AS ROAD MARKINGS FOR HAZARD LOCATIONS (CURVES, INTERSECTIONS, AND RURAL-URBAN TRANSITIONS) ON DRIVER’S BEHAVIOR. .
5. **SEKIHAN ERIKSEN(2017)** ET AL [3] SUGGESTED A NEW METHOD FOR DESIGNING TRAFFIC SIGNAL TIMING AT OVERSATURATED INTERSECTIONS WAS EXPRESSED “THE ELIMINATION PAIRING SYSTEM”. AN OBJECT FUNCTION WITH VEHICLE DELAY AND STOP-START NUMBERS HAS BEEN GENERATED. TOTAL COST VALUE HAS BEEN CALCULATED ACCORDING TO THE OBJECT FUNCTION. OBTAINED RESULTS WERE COMPARED WITH WEBSTER AS A TRADITIONAL TRAFFIC SIGNAL TIMING DESIGN METHOD AND TRANSIT 14 SIGNAL TIMING SOFTWARE. WHILE WEBSTER GIVES EXAGGERATED RESULTS, TRANSIT 14 AND ELIMINATION PAIRING SYSTEMS PROVIDED BETTER RESULTS. AS A RESULT OF THAT STUDY, THE ELIMINATION PAIRING SYSTEM COULD BE USED FOR OPTIMIZING THE TRAFFIC SIGNAL TIMINGS.

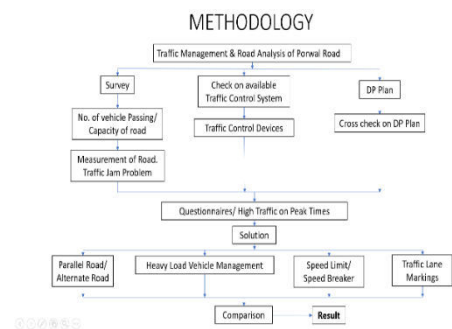
III. REVIEW

IN THE ABOVE PAPERS WE STUDIED THAT THE MOST OF THE TRAFFIC PROBLEM OCCURS DUE TO IMPROPER TRAFFIC MANAGEMENT. TRAFFIC MANAGEMENT REFERS TO THE COMBINATION MEASURES THAT SERVE TO PRESERVE TRAFFIC CAPACITY AND IMPROVE THE SECURITY, RELIABILITY OF THE OVERALL ROAD TRANSPORT SYSTEM.

THE NUMBER OF ROAD CRASHES IS SIGNIFICANTLY GROWING WORLDWIDE. IN THE TRANSPORTATION SECTOR, ACCIDENT OUTCOMES ARE USUALLY THE LOSS OF LIVES AND INJURIES. ROAD TRAFFIC ACCIDENTS ARE CONSIDERED THE MOST IMPORTANT GENERAL HEALTH CONCERN, AS IT RESULTS IN NUMEROUS INJURIES AND DEATHS WORLDWIDE. INDIA IS ONE AMONG THE DEVELOPING NATION WHICH EXPERIENCES THE HIGHEST RATE OF SUCH ACCIDENTS. THUS, THE TRAFFIC AGENCIES AND PUBLIC CONCENTRATES AT THE MEASURES TO REDUCE SUCH ACCIDENT SEVERITY IN ORDER TO REDUCE THE FATALITY RATE. THIS PAPER REVIEWS VARIOUS FACTORS AND STATISTICS RELATED TO ROAD ACCIDENTS OCCURRED IN VARIOUS COUNTRIES AND ALSO STUDIES DIFFERENT SAFETY MEASURES SUGGESTED BY RESEARCHERS.

IV. METHODOLOGY

- THE PROJECT FOCUSED ON THE TRAFFIC MANAGEMENT AND ANALYSIS OF ANY ROAD NEAR BY
- WE CONDUCTED A FOUR-DAY SURVEY ON THE PORWAL ROAD TRAFFIC
- WE CONDUCTED A FOUR-DAY SURVEY ON THE PORWAL ROAD TRAFFIC
- VISITED THE PUNE MUNICIPAL CORPORATION FOR THE DP SANCTION PLAN.
- COMPARISON AND ANALYSIS OF TRAFFIC SURVEY OF TWO DAYS.
- FOUND THE ALTERNATIVE ROAD FOR THE HEAVY AND LOW TRAFFIC FLOW



V. CONCLUSION

FROM ABOVE WE WILL HAVE FOLLOWING CONCLUSIONS:

1. DP ROAD IS UNDER CONSTRUCTION FOR HEAVY LAOD VEHICLES TO AVOID THE TRAFFIC ON PORWAL ROAD.
2. MAJOR STRECTCH OF 2 KM IS READY, 300 M PATCH IS STUCK FOR LAND ACQUITIOSN.
3. LENGTH OF ROAD IS 3 KM AND WIDTH IS 30 M SO THAT IS SUITABLE ROAD FOR HEAVY ROAD VEHICLES AND IT WILL HELPS MINIMIZE THE TRAFFIC ON PORWAL ROAD.
4. IMPLEMENT TRAFFIC FLOW MANAGEMENT SYSTEMS: INTELLIGENT TRAFFIC MANAGEMENT SYSTEMS CAN BE USED TO REGULATE TRAFFIC FLOW BY DETECTING TRAFFIC CONGESTION AND ADJUSTING TRAFFIC LIGHTS, TRAFFIC SIGNS, AND OTHER TRAFFIC CONTROL DEVICES ACCORDINGLY.



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Earthquake Analysis of RCC Structure by using Pushover Analysis

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Assistant Professor, Dr. D.Y. Patil School of Engineering & Technology, Lohegaon, Pune, India^{5,6}

ABSTRACT: In this paper we are going to discuss analysis on the RCC structure. i.e., PUSHOVER analysis is a nonlinear static procedure using simplified nonlinear technique to estimate seismic structural deformations. In this technique a computer model of the building is subjected to a lateral load. To conduct performance-based design modelling of reinforced structure with provision material is essential. In this report we had studied to investigate the structural performance during earthquake considering Pushover analysis. We have analysed and designed building in seismic zone

III. The lateral forces were obtained as per, IS 456:2000 and applied to the building. Non-linear static method of analysis is used. For modelling of RCC structures, Etabs software is used and also results are compared. It is found that designed structure is found to be economical.

KEYWORDS: Pushover analysis & design, Seismic load, stability, Story drift, story displacement.

I. INTRODUCTION

The movement of lithosphere plates, causing the vibrations on the surface of earth these vibrations on the surface of earth are known as earthquake. In that, the place in the crust where the movement starts are called as focus. And the place on the surface above the focus is called as Epicentre. Vibrations travels outward from the epicentre as wave. Seismic waves are the energy that travels through the earth and record on seismograph or seismometer. Now-adays information about the earth interior has been obtained from the study of the propagation of the seismic waves through the earth. In this project work, behaviour of regular high-rise G+05, G+10, G+15, G+20 story building in seismic zone III. Structures are analysed in the Etabs software. The results are obtained for Base shear, story displacement and story drift. The seismic analysis is done according to IS 1893:2016 IS 875(Part I) by using nonlinear static analysis method. We have taken seismic zone III for study. The lateral damage of structure during the earthquake occurs. For that, we studied and compared the results to avoid the failures.

1.1 General:

Now-a-days, failure of the structure when earthquake occurs is very common. But to avoid this structure should build very carefully and in proper manner with latest techniques. So, for that analysis of the RCC structure is necessary. In this project we analyzed the four structures, their drift and displacement, so we can develop new techniques. Main focus in this study to prevent the collapse of the structure. And understanding the weak parts of the structure. We studied pushover analysis by using Etabs. Pushover analysis is the best and accurate method. And through pushover method the comparison has been done between Story Drift and also Story displacement.

1.2 Objectives:

1) To study the seismic behavior of multistorey regular structures when subjected to earthquake force in earthquake zone III. 2)To perform non-linear static analysis on multistorey building i.e., performing non-linear static analysis by using Pushover method. 3)The behavior of four models is checked for Story Drift and Story displacement at each and every story are carried out for seismic forces. 4)To check & design of the seismic response of multistoried building using ETABS. 5)Analysis of G+05, G+10, G+15, G+20 by using pushover method in ETABS software

1.3 Types of Earthquakes:

1) Tectonic Earthquake- The most common earthquake 2)Volcanic Earthquake-A special class of tectonic earthquake is sometime recognized as volcanic earthquake. However, these are confined to area volcanoes. 3)Collapse Earthquake-In the area of mining activity sometimes the roofs of underground mines collapse causing minor tremors. 4)Explosion Earthquake-Ground shaking may also occur due to the explosion of chemical or nuclear devices, such tremors are called as explosion earthquakes. 5)reservoir induced earthquake- The earthquakes that occur in the area of



large reservoirs are referred to as reservoir induced earthquake.

1.4 Push-over Analysis:

Pushover analysis is a non-linear static procedure using simplified nonlinear technique to estimate seismic structural deformations. It is an incremental static analysis. Analysis involves applying of horizontal loads intensity of the lateral load is slowly increased & the sequence of cracks, yielding, plastic hinge formation & failure of various structural components is recorded in it. The advantages of using pushover analysis are the simplicity efficiency in modelling and low computational time. It is to estimate the seismic capacity of exist or non-exist structures & look several recent guidelines for retrofit seismic design. Useful for performance-based design for new and old building rely on ductility. In pushover analysis magnitude of lateral load increased monotonically be maintain a predefined distribution pattern along the height of the building structure. Structure is displaced till the target displacement or structure collapse. Relation between base shear and displacement is plotted for pushover analysis.

1.5 Earthquakes affect building:

Ground shaking is the primary cause of earthquake damage to man-made structures. Many factors to influence the strength of earthquake shaking at a site including the earthquake's magnitude, the site's proximity to the fault, the local geology, and the soil type. More than 250 structures throughout the United States have been outfitted with seismic sensors by the USGS National Strong Motion Project (NSMP) to improve the overall understanding of earthquakes and their effects on the built environment. The instrumentation and monitoring of structures by NSMP is only one part of USGS effort to protect people's lives and property from earthquake hazards in all of the Nation's seismically active regions.

1.6. Structure Description:

The building used for analysis is a non-existing structure which is G+05, G+10, G+15 and G+20 storied RCC structure with the floor-to-floor height of 3m. The building is assumed to be located at seismic zone III. The structure is designed as a frame model with fixed for the ground story column. The building details are given below: No. of bays along X-axis: 8

No. of bays along Y-axis: 6 Spacing along X and Y-axis :8m Thickness of slab: 150mm

Grade of steel: Fe500 Grade of Concrete: M30

Design Details of building are given below:

Live load: 3kN/m² Dead load: 2kN/m²

Earthquake load: As per IS 1893 (Part I):2016

II. LITERATURE

1) ALI KADHIM SALLAL (2018) "DESIGN AND ANALYSIS TEN STORIED BUILDING USING ETABS SOFTWARE-2016" VOLUME 4; ISSUE 2; MAY 2018; PAGE NO. 21-27... THE MAIN PURPOSE OF THIS SOFTWARE IS TO DESIGN AND ANALYSIS MULTI-STORIED BUILDING IN A SYSTEMATIC PROCESS. THIS PAPER PRESENTS A BUILDING WHERE DESIGNED AND ANALYZED UNDER EFFECT OF EARTHQUAKE AND WIND PRESSURE BY USING ETABS SOFTWARE. IN THIS CASE, (18M X 18M) AND EIGHT STORIES STRUCTURE ARE MODELED USING ETABS SOFTWARE. TEN STORY IS TAKEN AS (3M) HEIGHT AND MAKING THE TOTAL HEIGHT OF THE STRUCTURE (31M)

2) PUSHKAR RATHOD, RAHUL CHANDRASHEKAR "SEISMIC ANALYSIS OF MULTISTORIED BUILDING FOR DIFFERENT PLANS USING ETABS 2015" VOLUME: 04 ISSUE: 10 | OCT -2017 PUSHKAR RATHOD AND RAHUL CHANDRASHEKAR

(2017): WITH THE HELP OF SEISMIC ANALYSIS, THE STRUCTURE CAN BE DESIGNED AND CONSTRUCTED TO WITHSTAND THE HIGH LATERAL MOVEMENT OF EARTH'S CRUST DURING AN EARTHQUAKE. ANY TYPE OF BASIC OR A HIGHLY ADVANCED STRUCTURE WHICH MAYBE UNDER STATIC OR DYNAMIC CONDITIONS CAN BE EVALUATED BY USING ETABS. ETABS IS A COORDINATED AND PRODUCTIVE TOOL FOR ANALYSIS AND DESIGNS, WHICH RANGE FROM A SIMPLE 2D FRAMES TO MODERN HIGH-RISES WHICH MAKES IT ONE OF THE BEST STRUCTURAL SOFTWARE FOR BUILDING SYSTEMS.

3) ANIKET A. KALE (2020): INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT)ISSN: 2278- 0181HTTP://WWW.IJERT.ORG PUBLISHED BY: VOL. 9 ISSUE 03, MARCH-2020 CARRIED OUT THE WIND & SEISMIC ANALYSIS 15, 30 & 45 STORIED BUILDINGS OF FOUR DIFFERENT SHAPES OF SAME AREA BY USING ADVANCE SOFTWARE CSI ETABS. RESPONSE SPECTRUM METHOD WAS USED TO FIND THE DYNAMIC EFFECTS. THE COMPARISON HAS BEEN DONE BY CONSIDERING THE PARAMETERS SUCH AS STORY DISPLACEMENT, STORY DRIFT, BASE SHEAR, OVERTURNING MOMENTS, ACCELERATION & TIME PERIOD. IT HAS BEEN CONCLUDED THAT



FOR MAXIMUM EARTHQUAKE STRUCTURE OF 15-STOREY IS MOST STABLE STRUCTURE & FOR MAXIMUM WIND EFFECT TRIANGULAR STRUCTURE OF 15-STOREY IS MOST STABLE. FOR 45-STOREY CIRCULAR & RECTANGULAR SHAPE BUILDING IS MOST STABLE FOR MAXIMUM EARTHQUAKE & WIND EFFECT RESPECTIVELY. WIND EFFECT IS CRITICAL FOR 45 STORY BUILDING & ON THE OTHER HAND SEISMIC IS CRITICAL AT 15 STORY & 30 STORY BUILDING. WIND EFFECT IS MORE CRITICAL THAN EARTHQUAKE.

*FOLLOWING ARE THE MAJOR FINDINGS FROM ABOVE PAPER: - A. ANALYSIS WAS DONE BY USING ETABS SOFTWARE AND SUCCESSFULLY VERIFIED MANUALLY AS PER IS 456-2000. B. ETABS IS THE PERFECT USEFUL SOFTWARE FOR THIS PROJECT WHICH REDUCE THE TIME FOR ANALYSIS AND DESIGN.

4) **DR. K. CHANDRASEKHAR REDDY1 & G. LALITH KUMAR2** INTERNATIONAL JOURNAL OF TECHNICAL INNOVATION IN MODERN ENGINEERING & SCIENCE (IJTIMES) IMPACT FACTOR: 5.22, EISSN: 2455-2585 VOLUME 5, ISSUE 03, MARCH-2019. IN THIS STUDY, 3D ANALYTICAL MODEL OF G+30 STORIED BUILDINGS HAVE BEEN GENERATED FOR SYMMETRIC AND ASYMMETRIC BUILDING MODELS AND ANALYZED USING STRUCTURAL ANALYSIS TOOL ETABS SOFTWARE. MASS AND STIFFNESS ARE TWO BASIC PARAMETERS TO EVALUATE THE DYNAMIC RESPONSE OF A STRUCTURAL SYSTEM. THIS PAPER IS CONCERNED WITH THE EFFECTS OF VARIOUS VERTICAL IRREGULARITIES ON THE SEISMIC RESPONSE OF A STRUCTURE.

5) **DHARANYA A, GAYATHRI S AND DEEPIKA M**, "COMPARISON STUDY OF SHEAR WALL AND BRACINGS UNDER SEISMIC LOADING IN MULTI- STORY RESIDENTIAL BUILDING", INTERNATIONAL JOURNAL OF CHEM TECH RESEARCH, 2017, VOL.10(8), PP. 417-424 DHARANYA ET. AL. (2017) PROVIDED THE IMPROVEMENT OF REINFORCED CONCRETE FRAME STRUCTURE AGAINST LATERAL LOADING BY PROVIDING SHEAR WALL AND CROSS BRACING. IN THIS STUDY, A G+4 STOREY RESIDENTIAL RC BUILDING WITH SOFT STOREY HAS TO BE ANALYZED WITH CROSS BRACINGS AND SHEAR WALL. THIS ANALYSIS WAS MADE AS PER IS 1893:2002 CODAL PROVISION BY USING ETABS SOFTWARE. THE CROSS BRACINGS SUCH AS X BRACING ARE TO BE PROVIDED AT THE OUTER PERIPHERY OF THE COLUMN AND THE SHEAR WALLS ARE PROVIDED AT THE CORNERS OF THE BUILDINGS. THE BUILDING MODEL ARE ANALYZED BY EQUIVALENT STIFFNESS METHOD USING ETABS SOFTWARE. THE MAIN PARAMETERS COMPARED ARE LATERAL DISPLACEMENT, BASE SHEAR, STOREY DRIFT, AXIAL FORCE, SHEAR FORCE AND TIME PERIOD.

III. REVIEW

In the above papers we studied that the most structural failures occurred due to inadequate stiffness, irregularities of structure. To record the results of story drift and story displacement mostly pushover analysis is used as it is more accurate than other methods. With the help of seismic analysis, the structure can be designed and constructed to withstand the high lateral movement of earth's crust during an earthquake. Any type of basic or a highly advanced structure which maybe under static or dynamic conditions can be evaluated by using etabs.

3D analytical model of storied buildings has been generated for symmetric and asymmetric building models and analyzed using structural analysis tool etabs software. etabs is the perfect useful software for this project which reduce the time for analysis and design.

3.1. INDIAN STANDARD CODES

III. THE ESTIMATE OF EARTHQUAKE LOADS AND THE IS 1893-2016 (PART-1) CRITERIA OF EARTHQUAKE RESISTANT BUILDINGS PART.

IV. IS 875 (PART-1)

V. IS 456:2000



IV. METHODOLOGY

- THIS PROJECT IS PRIMARILY SOFTWARE-BASED, AND IT IS ESSENTIAL TO UNDERSTAND THE SPECIFICS OF THESE SOFTWARE
- TO STUDIED ABOUT EARTHQUAKE, I.E., SEISMIC ZONES, WAVES.
- TO STUDIED PUSHOVER ANALYSIS, NONLINEAR STATIC ANALYSIS.
- MAKE G+10, G+15 STRUCTURE AND DETAILED STUDY ON IT.
- COMPARISON & ANALYSIS STRUCTURE, STUDY ON WEAKNESS, PREMATURE FAILURE.
- ESTABLISHED IN REAL-WORLD, AND PROVIDE SAFETY STRUCTURE.

V. CONCLUSION

FROM ABOVE WE WILL HAVE FOLLOWING CONCLUSIONS:

- 1) PUSHOVER ANALYSIS IS AN IDEAL METHOD TO EXPLORE THE NONLINEAR BEHAVIOUR OF STRUCTURE.
- 2) A HIGH-RISE BUILDING OF G+05, G+10 SUBJECTED TO SEISMIC, WIND AND LIVE LOADS WERE ANALYSED USING ETABS SOFTWARE.
- 3) BEHAVIOUR OF THE HIGH-RISE BUILDING WAS SHOWN CLEARLY USING THE GRAPHS AND LATERAL DISPLACEMENTS.
- 4) BETTER ACCURACY OF THE ANALYSIS CAN BE OBTAINED BY USING THIS ETABS SOFTWARE.

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7. Gomasa Ramesh, "Repair, Rehabilitation and Retrofitting of Reinforced Concrete Structures" International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 NCACE-EWIT2020 Conference Proceedings.
8. Kuldeep Kumar, Devika Nayal, "Retrofitting the Existing Requirements and the Associated Existing Services for an Institutional Building to Enhance the Functionality of the Built Environment" International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-Vol. 9 Issue 03, March-2020
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Comparative Study of Ground Water Level Map for Pune Industrial Area Using GIS Technique

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ABSTRACT: The primary goal of the study was to do a comparative study of Ground Water Level Map for Pune Industrial area using GIS technique. Data on groundwater levels were obtained from the Groundwater Survey and Development Agency in Pune. The effects of geology, soil types, topographic elevation, and land-use changes were critically examined, and it was discovered that these factors control Ground water level. Furthermore, the author visited the Groundwater Survey and Development Agency in Pune, Maharashtra, in the study area, to learn about the water levels in the Region. Remote sensing (RS) and Geographic Information Systems (GIS) are two accurate methods for identifying and monitoring observations wells. The expanding population, as well as industrial enterprises, demand enormous amounts of water, especially groundwater. The study also created a novel, inexpensive approach for quickly assessing groundwater variations.

Nowadays ground water is decreasing and therefore there is an increase in demand of water. Ground water is one of the major sources that contribute to the total annual supply. The objective of this paper is to comparative study of Ground Water Level Map by using GIS techniques. Several methods are used for mapping of ground water zones. The parameters that are used for controlling groundwater zones are soil, drainage density, land use/land cover, geology, geomorphology, rainfall, slope, and contour. Groundwater mapping techniques are described and derived from satellite remote sensing and additional data sources. This groundwater potential information will be useful for effective identification of appropriate locations for extraction of water and for conventional uses.

KEYWORDS: Covid-19, Fluctuation, Ground water level fluctuation map, GIS, Pune Industrial area, Arc-GIS software.

I. INTRODUCTION

The Pune Region of Maharashtra, which is predominately an industrial area, is where this study is being conducted. The purpose of this study is to comprehend groundwater level fluctuations and their geographical mapping utilising a geostatistical modelling approach that is GIS-based. The factors that affect groundwater level changes are examined closely, and the effects of those factors on groundwater supply are investigated. This is the first preliminary study of its kind in the study area, and it will be helpful for managing groundwater in the future.

Groundwater is the one of the most natural resource that supports human health and ecological diversity. Protecting it from contamination and carefully managing its use will ensure its future as an important part of ecosystems and human activity. Groundwater is the source for irrigation and domestic purpose. In which 80% of the rural areas are use groundwater for domestic purpose and 50% of the urban areas use the groundwater for domestic purpose. Due to more dependent on usage of groundwater for domestic purpose and irrigation and for other sectors may results in exploitation of groundwater resources. The data and thematic maps such as satellite images, soil data, geology data, drainage data and rainfall data, are helpful for mapping of groundwater potential zones. Remote sensing data combined with Geographical Information System (GIS) technique is very efficient in identification of groundwater potential of any region. The study results that the integration of thematic maps prepared from conventional and remote sensing techniques using GIS gives more and accurate results. Groundwater table reduces when pumping rate is more than the rate of usage. Hence, it can be concluded that areas of high withdrawal rates may lead to reduction of groundwater zones. This may lead to reduced water level in wells, lakes and streams.



Remote sensing is one of the major sources for surface feature information of groundwater such as land use, land forms and drainage density. These data can be easily input in GIS to identify the groundwater zones. According to World Bank report, India may be in water stress zone by 2025 and water scarce zone by 2050. This is due to improper education in groundwater exploitation, improper maintenance of water, failure of government schemes for rural areas may lead to groundwater and drinking water problems in India. The advantage of GIS and remote sensing of spatial, spectral and manipulation of earth surface and subsurface data cover with a short time having a great groundwater potential for accessing, processing and monitoring the groundwater resources. The use of remote sensing and GIS techniques increases for identifying groundwater zones gives with accurate results. Many methods are available for mapping of potential zones such as Weighted Linear Combination.

II. RELATED WORK

[1] In the present study, long-term trend detection and spatiotemporal variation of groundwater levels were analysed using Geographical Information System (GIS) and performing statistical tests for the Lower Bhavani River basin, Tamil Nadu, India. For this purpose, 32 years long-term groundwater-level data (1984–2015) of 57 observation wells spread over the study area were collected from the government departments. [2]The objective of this paper is to assess the parameters which have significant impact on groundwater level fluctuation in West Bokaro coalfield by using remotesensing, GIS, and field-based water level data for two seasons. The objective is achieved by preparation of thematic maps of parameters which have significant impact on groundwater level fluctuation viz. geology, drainage map, soil map, slope map, and elevation map using digital elevation model and Survey of India Toposheet in GIS and analysed with respect to field-collected groundwater level data to determine the overall water level situation of the study area. [3]In this study, an attempt has been made to relate the fluctuation of groundwater level with hydrogeological factors. The various hydrogeological factors that have been considered here which can affect the aquifer recharge are geomorphology, geological structures, geological formations, soil types, and elevation. These hydrogeological factors have been analysed for 65 monitoring wells and frequency plots between different hydrogeological parameter classes and water level fluctuation have been used to assess the relative impact of different hydrogeological subclasses on aquifer recharge. [4] This review paper is focused on groundwater level monitoring using levellogger and the importance of long-term groundwater level data. The levellogger provides an inexpensive and convenient method to measure level, temperature and conductivity all in one probe. [5] Groundwater levels in the Dharapuram region exhibited drastic seasonal changes. Hydrogeochemical analysis were performed on the groundwater samples collected during January (post-monsoon) and July (pre-monsoon) in 2009 to understand the chemical changes and related process encountered during the fluctuated water table.

III. METHODOLOGY

Getting data from the GSDA in the excel format for whole Pune district month wise. From GSDA data we Extracting the groundwater level data for study region and then Converting the excel data in CSV file. By the help of DIVA-GIS website downloading the shape file of Pune district and Adding the CSV file in ArcGIS software, then Set the co-ordinate system to WGS_1984. Now go to Arc toolbox > Data management tools > Projection and Transformation > Raster > Set co-ordinate system as WGS_1984_UTM_ZONE_43N. Now go to Arc toolbox > Spatial Analysis Tools > Interpolation > IDW (Inverse distance weightage). Then select the z axis a month of interest and keep the processing extent up to shape file of study area and click Ok and Groundwater level map for a month is created. Similarly repeat the procedure for other months.

IV. EXPERIMENTAL RESULTS

From the related work and experimental work following results are obtained for the study analysis of Ground water Level Map.

1. January Month Result

Figure. No: 1 (A) - Ground Water Level Map January 2019 (Before Covid-19)

Figure. No: 1 (B) - Ground Water Level Map January 2022 (After Covid-19)

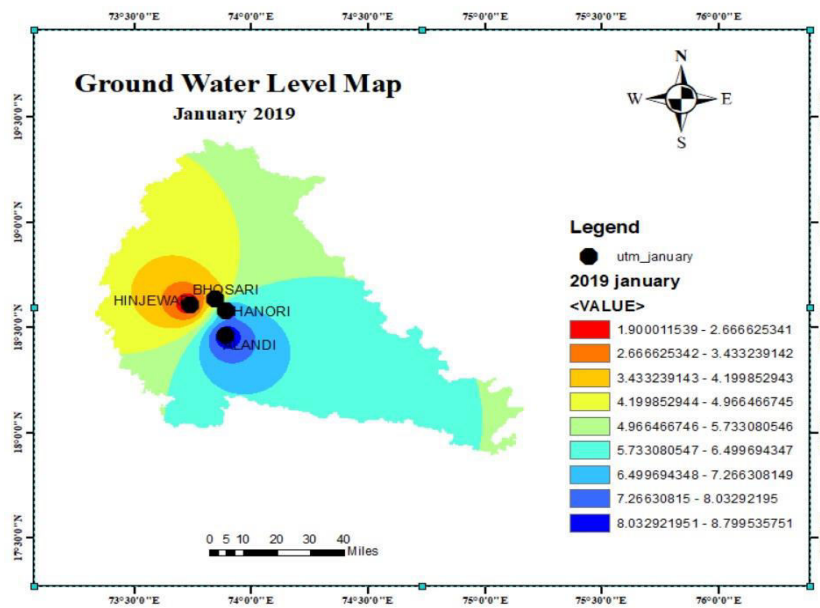


Figure. No: 1 (A) - Ground Water Level Map January 2019 (Before Covid-19)

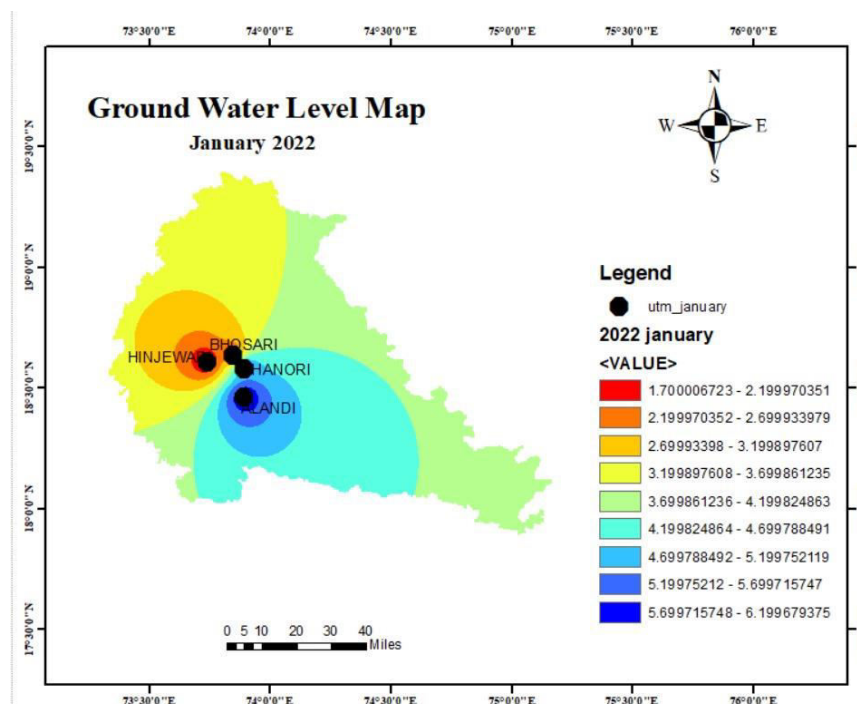


Figure. No: 1 (B) - Ground Water Level Map January 2022 (After Covid-19)

2. March Month Result

Figure. No: 2 (A) - Ground Water Level Map March 2019 (Before Covid-19)

Figure. No: 2 (B) - Ground Water Level Map March 2022 (After Covid-19)

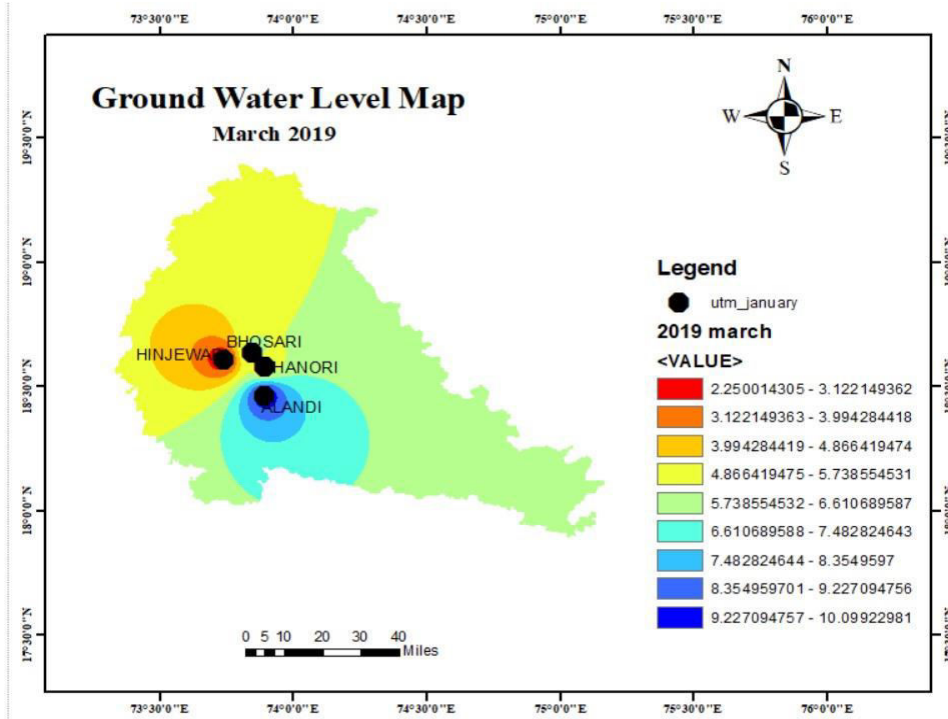


Figure. No: 2 (A) - Ground Water Level Map March 2019 (Before Covid-19)

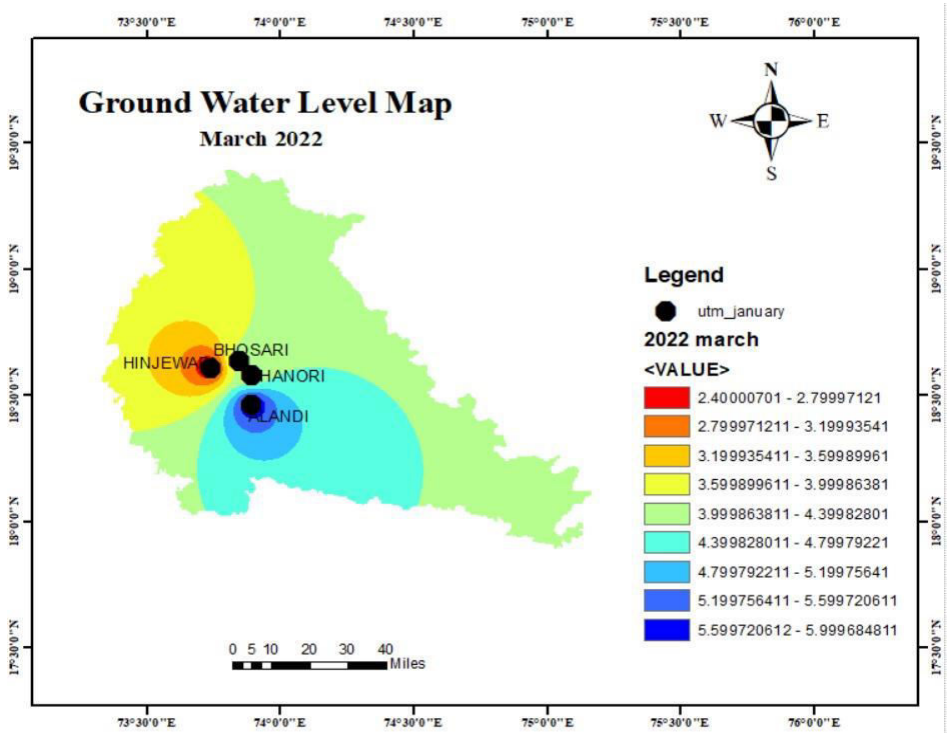


Figure. No: 2 (B) - Ground Water Level Map March 2022 (After Covid-19)

3. May Month Result

Figure. No: 3 (A) -Ground Water Level Map May 2019(Before Covid-19)

Figure. No: 3 (B) - Ground Water Level Map May 2022(After Covid-19)

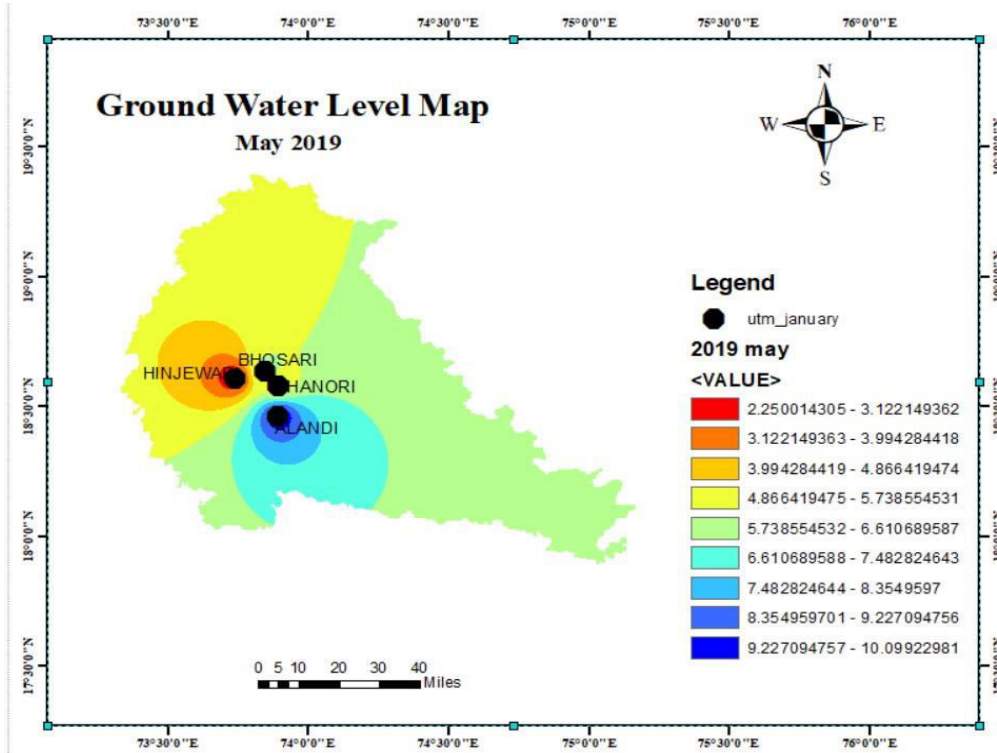


Figure. No: 3 (A) - Ground Water Level Map May 2019 (Before Covid-19)

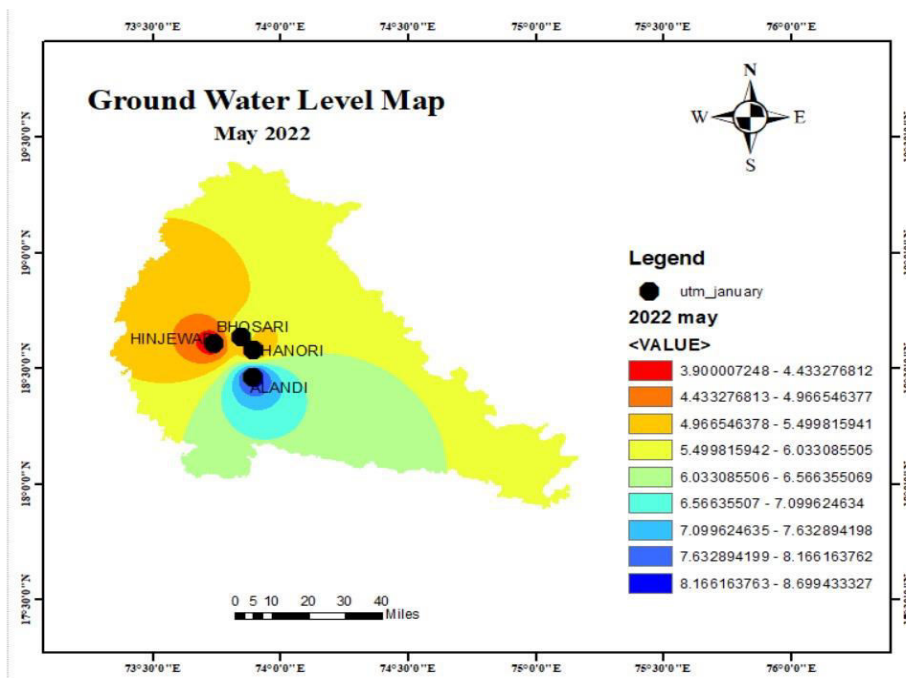


Figure. No: 3 (B) - Ground Water Level Map May 2022 (After Covid-19)

4. October Month Result

Figure. No: 4 (A) - Ground Water Level Map October 2019 (Before Covid-19)
 Figure. No: 4 (B) - Ground Water Level Map October 2022 (After Covid-19)

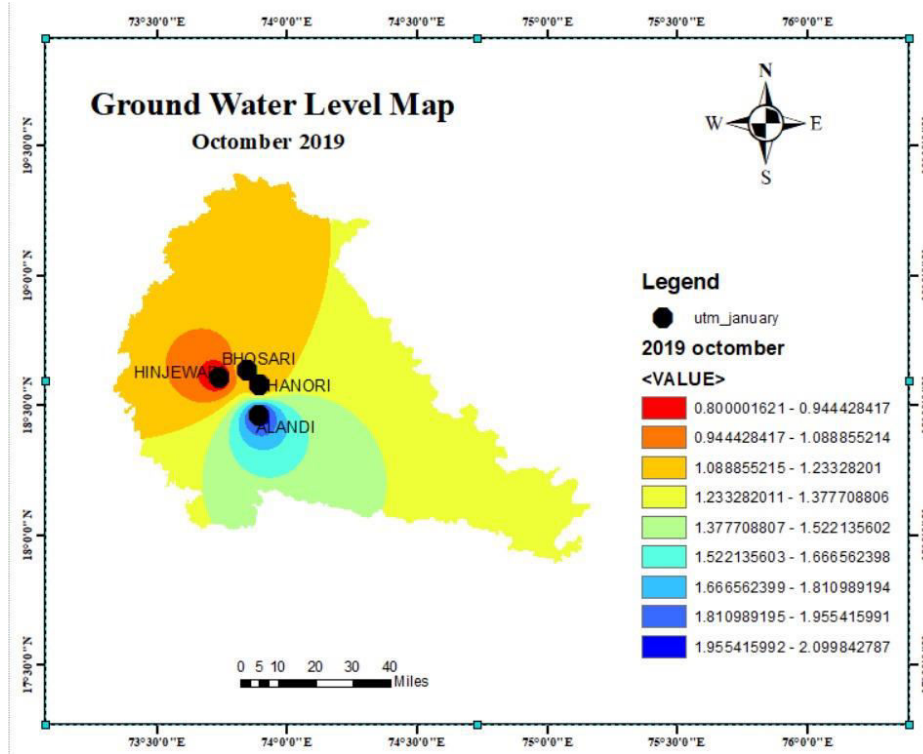


Figure. No: 4 (A) - Ground Water Level Map October 2019 (Before Covid-19)

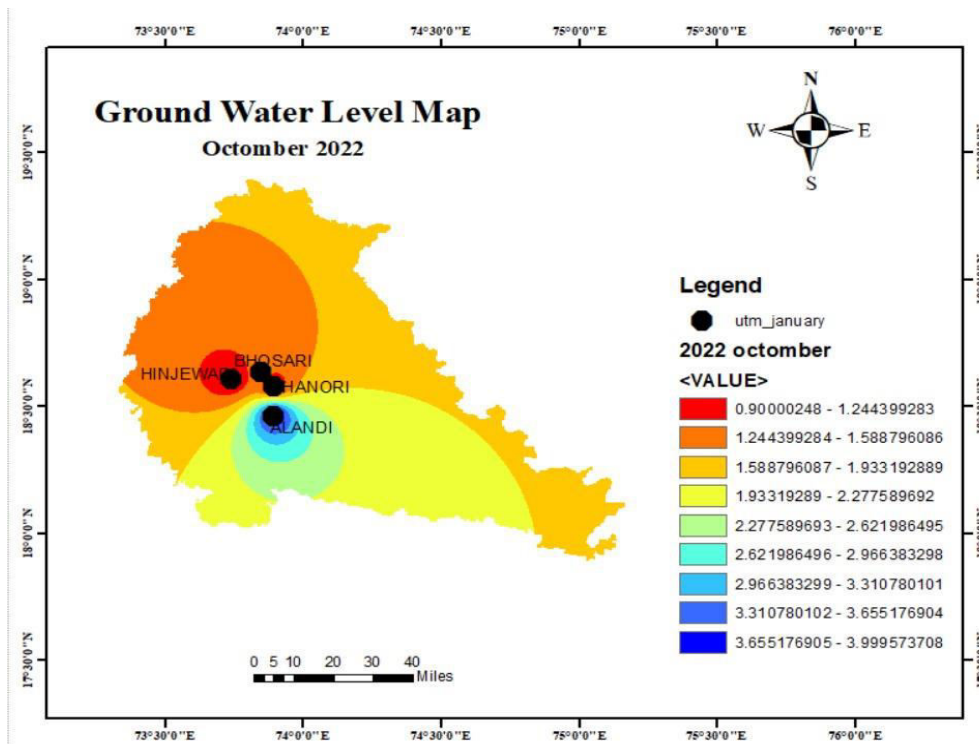


Figure. No: 4 (B) - Ground Water Level Map October 2022 (After Covid-19)



V. CONCLUSION

This review has shown that Arc GIS 10.8 is useful to identify the Groundwater levels in many ways. Several methodologies are used to mapping of ground water level. Some methods are very easy and give accurate results. Some of the methods require more data and time-consuming process. Each technique having their advantages and their disadvantages in doing process. Satellite images are useful for mapping of groundwater level using different parameters. Comparative Study of Ground Water Level Map for Pune industrial area are studied using hydrogeological and GIS mapping methods. The spatial map of water table fluctuation was a convenient tool for demarcating the potential zones. The highest is recorded from the Alandi region, and a moderate level of fluctuation was observed at the Dhanori before Covid 19 but after Covid 19 Dhanori region falls into Sub- Critical Zone. Hinjewadi and Bhosari were found to be overexploited. The major factors controlling the water level are geology, soil, elevation, and land-use pattern. This study recommends quarterly qualitative monitoring to adequate groundwater management.

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Analysis and Design of Pre-Stressed Concrete Bridge by SAP2000 Software

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ABSTRACT: This paper presents a comprehensive analysis and design of a PSC (prestressed concrete) box girder bridge using SAP2000 software. The purpose of this study is to provide an overview of the design process, highlighting key considerations, and demonstrating the capabilities of SAP2000 in bridge analysis and design. The analysis and design process involves several steps, including the creation of a 3D model, load definition, prestress design, and reinforcement detailing. The SAP2000 software is utilized to perform structural analysis, considering both static and dynamic loadings. The material properties, such as concrete and steel, are defined in the model, and the appropriate code provisions are applied to ensure compliance with safety standards. The design process incorporates factors such as live loads, dead loads, temperature effects, and construction stages. The prestressing forces are carefully determined to provide the required structural capacity and minimize deflections. Moreover, SAP2000 offers a user-friendly interface, facilitating efficient modelling, analysis, and design iterations.

KEYWORDS: box girder bridge, SAP2000, analysis, design, prestressing, structural modelling

I. INTRODUCTION

PSC (prestressed concrete) box girder bridges are widely used in modern infrastructure projects due to their structural efficiency, durability, and aesthetic appeal. The analysis and design of these bridges require careful consideration of various factors to ensure their safety and performance. The analysis and design process for the PSC box girder bridge involves several crucial steps. Firstly, a detailed 3D model of the bridge is created, incorporating the geometry, materials, and boundary conditions. SAP2000 offers a user-friendly interface that simplifies the modelling process, allowing engineers to accurately represent the bridge's geometry and components. Once the model is created, various loads are applied to simulate real-life conditions. These loads may include dead loads, live loads, temperature effects, and prestressing forces. SAP2000 facilitates the accurate application of these loads and provides the necessary tools to calculate their effects on the bridge structure. Prestressing design is a vital aspect of PSC box girder bridge construction, as it helps to counteract the tensile stresses and control deflections. SAP2000 enables engineers to optimize the prestressing forces by considering factors such as material properties, design codes, and construction stages. The software's analysis capabilities assist in evaluating the bridge's performance under different loading conditions and ensuring compliance with safety standards. Additionally, SAP2000 offers powerful visualization tools that aid in the interpretation of analysis results. Engineers can examine deflection patterns, stress distributions, and other key parameters to assess the structural behaviour of the PSC box girder bridge.

A. BASIC CONCEPT OF PRESTRESSING

Prestressing is the process of applying an initial load to a structure to help it sustain the stresses brought on by future loads while it is in operation. The response of the bicycle's spokes when it is loaded is another example of prestressing, which has been used since ancient times.

Prestressed concrete is essentially concrete that has had internal stresses of the right amount and distribution added to it in order to counteract the stresses brought on by external loads to the required extent. Steel reinforcement is frequently used as prestress in reinforced concrete structures.

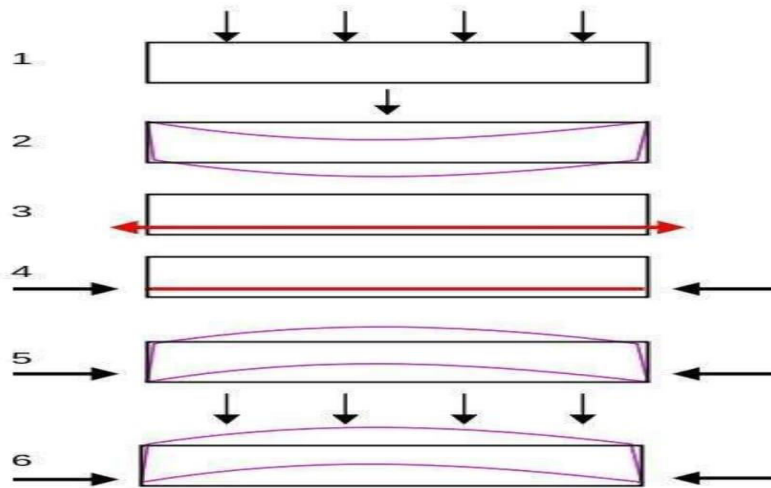


Fig:- Pre-stressed Concrerting

Pre-tensioning requires a minimum grade of concrete of M40, while post-tensioning requires a minimum grade of M35. Concrete's tensile strength is in order 8–14% of its compressive strength.

B.BEHAVIOUR OF BOX GIRDER

A box girder is a beam with a hollow box form. And a bridge with box-shaped main beams is known as a box girder bridge. A box girder is often built of prestressed concrete, structural steel, or a steel-reinforced concrete composite. It might have a rectangular or trapezoidal cross section.

Box girder bridges are used for highway flyovers as well as new elevated light rail transit structures. The box girder is suitable for portal frame bridges, arch bridges, cable-stayed bridges, and suspension bridges of various types. Box girder decks are cast-in-place modules that may be built to follow any desired alignment in plan, allowing for the construction of straight, skew, and curved bridges of various forms on the highway system. Because of their excellent torsion resistance, box girders are ideal for building bridges with substantial curvatures.

Because of its high torsion stiffness, box girders are ideal for curved or skewed bridge systems. High torsion stiffness allows box girders to successfully resist the torsion deformations experienced in curved thin-walled beams. There are several different types of box girder cross-sections.

1. Circular c/s
2. Rectangular c/s
3. Trapezoidal c/s

Box girder webs can be vertical or inclined, which minimises the width of the bottom flange. Curvature effects on bending, shear, and torsion shear stresses in bridges with light curvature can be neglected if they are within acceptable limits. One way for simplifying the analysis and design procedure is to treat horizontally curved bridges as straight bridges with specific limits. However, higher level research are now possible due to the availability of large capacity computer equipment. These bridges must be examined using finite element analysis with varying skew angles (i.e. closed box girders).

The design concerns for a skewed I-girder bridge differ from those for a skewed box girder bridge. Because the I-girder is an open portion with little torsion resistance. The I-girder's twisting causes large normal stresses in the flanges. The closed box girder outperforms the I-section in terms of torsion resistance.

C. SAP2000 Software Introduction:

SAP2000 is a powerful software tool widely used in the field of structural analysis and design. One of the key strengths of SAP2000 lies in its ability to handle complex structural systems. It supports the analysis of multi-story buildings, long-span bridges, and intricate structural configurations. Furthermore, it allows for the consideration of various design codes and standards, ensuring compliance with industry regulations and specifications.

An engineer can conduct the following functions when designing a bridge using SAP2000:

- Modelling
- Material
- Definition Load
- Definition Analysis
- Prestressing Design
- Reinforcement Design



- Design Code Compliance
- Results Visualization

D. Problem Identification

- 1) For the manual design of prestressed bridges, some traditional procedures are employed. However, these procedures are time-consuming and inconvenient. In order to save time and money, simplified methods should be devised. Consequently, it takes longer to obtain data.
- 2) It takes a lot of time, effort, and cost to perform a manual computation.
- 3) We desired experienced, skilled individuals to perform manual calculations.
- 4) There is also the possibility of not receiving accuracy.

E. Future and Scope

It is crucial to construct large structures using technologically advanced methods in today's cutting-edge scientific and technological environment. Economic awareness will encourage study on bridges at the academic and curricula levels. New design ideas are frequently lacking because of the resources and infrastructure that are frequently available; nonetheless, these aspects shouldn't be a roadblock to a nation's advancement. The utilisation of multidimensional sectional design alternatives is required for large-scale public buildings.

II. LITERATURE REVIEW

Study by Al-Khafaji and Al-Ani (2019)[1] This study investigated the behavior and design optimization of prestressed concrete box-girder bridges using SAP2000 software. The authors explored different parameters, such as span length, pre-stressing force, and section dimensions, to optimize the bridge design in terms of structural efficiency and cost-effectiveness. The study demonstrated the effectiveness of SAP2000 in analyzing and optimizing prestressed concrete bridges, considering both serviceability and ultimate limit states.

Research by Wei et al. (2018)[2] Wei et al. conducted a comparative study on the analysis and design of prestressed concrete bridges using both manual calculations and SAP2000 software. The study focused on a continuous prestressed concrete bridge and examined various design parameters, including tendon layout, pre-stressing losses, and section properties. The results showed that SAP2000 provided accurate analysis results and facilitated efficient design iterations, leading to improved design optimization.

Study by García-Castillo and Flores-Jiménez (2017)[3] In this study, the authors investigated the behavior of prestressed concrete bridges subjected to seismic loads. They utilized SAP2000 software to model and analyze various bridge configurations, considering different seismic design parameters. The study highlighted the ability of SAP2000 to accurately predict the dynamic response of prestressed concrete bridges, enabling engineers to assess their seismic performance and implement appropriate design modifications to enhance their structural robustness.

Research by El-Metwally et al. (2016)[4] El-Metwally et al. conducted a comprehensive study on the behavior of prestressed concrete bridges with different support conditions using SAP2000 software. The authors compared the response of simply supported and continuous prestressed concrete bridges under various loading conditions. The study demonstrated the capability of SAP2000 to analyze and predict the structural behavior of different bridge types accurately, providing valuable insights into their deflection, stresses, and ultimate capacities.

Study by Lin et al. (2014)[5] Lin et al. focused on the design and optimization of long-span prestressed concrete cable-stayed bridges using SAP2000 software. The authors investigated various design parameters, including cable arrangements, pylon heights, and pre-stressing forces, to achieve an optimal bridge design in terms of both structural performance and aesthetics. The study showcased the capabilities of SAP2000 in efficiently analyzing and designing complex prestressed concrete bridge systems, considering both geometric and material nonlinearities.

III. METHODOLOGY

Designing and analyzing a prestressed concrete bridge is part of the study method. The following are the steps involved in this process:

1. Designing a concrete bridge that is 30 meters long with an 8-meter clear path in accordance with IRC standards from IRC 5, IRC 6, IRC 18, IRC 21, and additional supplements.
2. Calculate the maximum bending moments and shear forces in the bridge and check for the safety against these failures.
3. Analyze the bridge using SAP2000 software for BM distributions, SF distributions and deflections. Also, check for deflections against moving loads.



4. Compare the output from software versus manual computation.

1. Design Process

1. Load Determination:

The design loads for the bridge are determined based on the anticipated traffic, environmental conditions, and relevant design codes. Dead loads, live loads, wind loads, and seismic loads are considered to ensure the bridge's safety and serviceability.

2. Material Selection:

The selection of materials is critical for the design of PSC box girder bridges. High-strength concrete, pre-stressing tendons, and reinforcement are carefully chosen based on the project requirements and specifications. The properties of these materials are defined in SAP2000.

3. Pre-stressing Design:

The pre-stressing design involves determining the pre-stressing forces, tendon layout, and anchorage details. SAP2000 provides tools to calculate the pre-stress losses, tendon forces, and stress distribution in the box girder, optimizing the bridge's performance.

2. Structural Analysis using SAP2000:

2.1 Structural Modeling:

The PSC box girder bridge is modeled in SAP2000, considering the geometric configuration, material properties, and cross-sectional details. The software allows for the creation of a 3D finite element model, accurately representing the bridge's structural components.

2.2 Load Analysis:

The designed loads are applied to the model, and SAP2000 performs a comprehensive load analysis. The software calculates the internal forces, displacements, stresses, and deflections within the bridge, enabling engineers to assess its structural behavior under various load combinations.

2.3 Pre-stressing Analysis:

The pre-stressing analysis involves simulating the behavior of the pre-stressing tendons and their effect on the bridge's structural response. SAP2000 provides tools to calculate the pre-stress losses, tendon forces, and stress distribution in the box girder, optimizing the bridge's performance.

2.4 Results and Evaluation:

The analysis results obtained from SAP2000 are reviewed and evaluated. Various parameters, including maximum stresses, deflections, and factor of safety, are considered to ensure that the bridge meets the required design criteria. The effectiveness of SAP2000 in accurately predicting the behavior of the PSC box girder bridge is assessed.

IV. FORMULATION

Calculation of Ultimate Strength

The following equations shall be used to compute the ultimate moment resistance of sections under these two alternate failure scenarios, and the lower of the two values shall be used as the ultimate moment of resistance for design:

i. Failure By Yield Of Steel (Under-Reinforced Section)

$$M_{ult} = 0.9dbA_s f_p$$

Where,

A_s = Area of High Tensile Steel

f_p = The Ultimate Tensile Strength For Steel Without Definite Yield Point

db = The Depth Of The Beam From The Maximum Compression Edge To The Centre Of Gravity Of The Steel Tendons.

Failure by crushing concrete

$$M_{ult} = 0.176bd^2 f_{ck}$$

Where,

b = the width of rectangular section or web of beam.

f_{ck} = characteristics strength of concrete

G. Calculation of Section un-cracked in flexure.

b = width in the case of rectangular member.

d = overall depth of the member.

f_{cp} = compressive stress at centroidal axis due to pre-stress taken as positive.

$$V_{co} = 0.67bd\sqrt{f_t + 0.8f_{cp}f_t}$$

Where,

f_t = maximum principal tensile stress given by

$$f_t = 0.24\sqrt{f_{ck}}$$

ANALYSIS AND DESIGN OF PRE-TENSIONED DECK TYPE BOX-GIRDER BRIDGE

A pre-tensioned deck type Box – Girder

Bridges with a clear span of 30m and a roadway width of 7.5m. Assume Live Load as per IRC: 6-2000 vehicle is passing over deck given in table no. 4.2. The following are the results of the bridge analysis for various L/d ratios, ranging from 15 to 20, with various L/d ratios taken into consideration:

Case 1 L/d= 19, d = 1.6

Case 2 L/d =18, d = 1.7

Case3 L/d = 17, d = 1.8

Case4 L/d= 16, d= 1.9

Case5 L/d= 15, d=2.0

Preliminary data Clear span = 30m

Width of roadway = 7.5 m

Overhang from face of girder = 1.2m Deck thickness = 0.2 m

Bottom slab thickness = 0.2 m Girder thickness = 0.3 m

Considered to be parabolic in nature is the tendon profile.

As per IRC:18-2000

$f_{ck} = 50$ Mpa, $f_{ci} = 0.8f_{ck} = 40$ Mpa,

$f_{ct} = 0.5f_{ci} = 20$ Mpa, $f_{cw} = 0.33f_{ck} = 16.5$ Mpa $f_{t} = 1/10f_{ct} = 2.0$ Mpa, $f_{tw} = 0$

As per IS:1343-1980

$E_c = 5700f_{ck}^{1/2} = 40.30$ kN/m²

$f_p = 1862$ Mpa, $n = 0.85$, $E = 2 \times 10^5$ Mpa

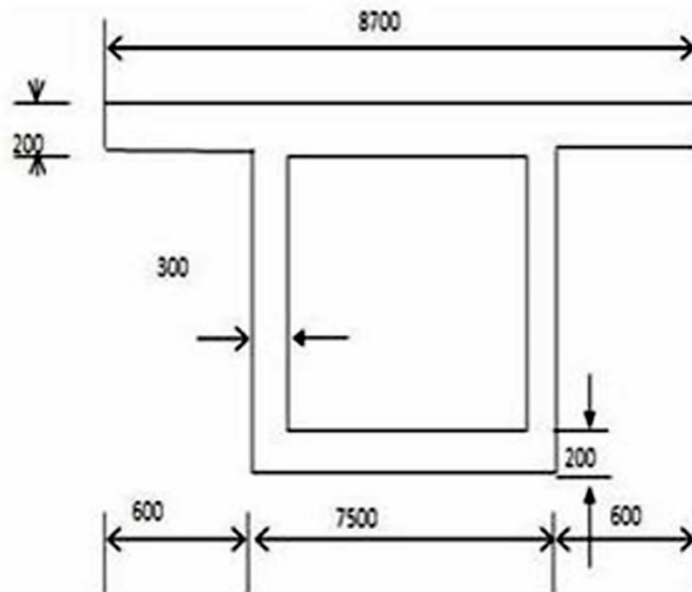


Fig :-Details of box girder section (All Dimension are in mm)

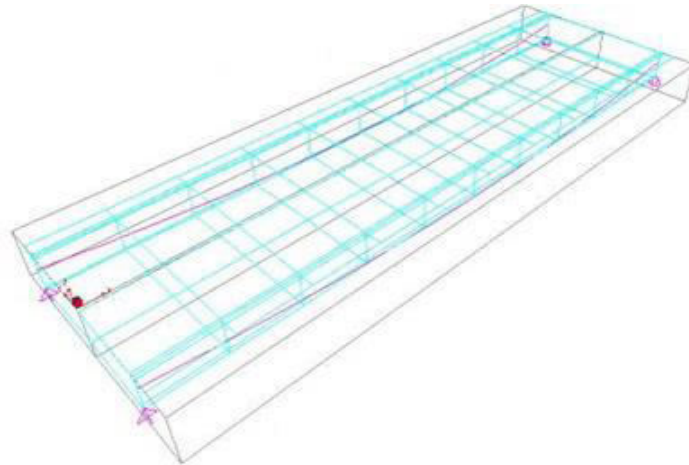


Fig :-Mathematic modelling of bridge

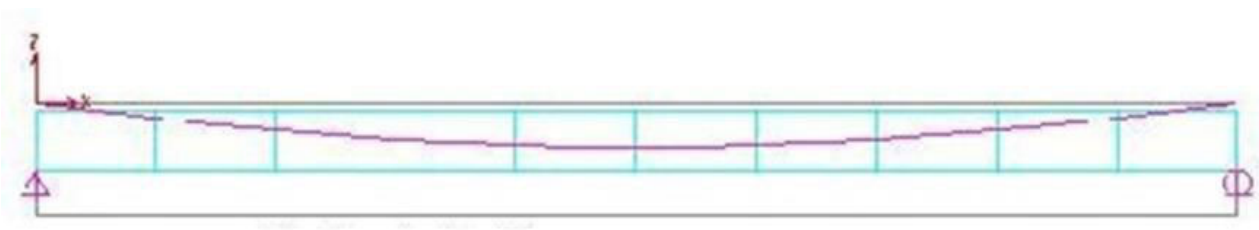


Fig :-Tendon profile

V. VALIDATION OF RESULTS

The results of SAP 2000's bending moment, shear force, and deflection.

Calculations of the bending moment and shear force take into account various loading conditions, including dead load, live load, and superimposed load. the same as the deflection calculation. The Case:1 outcomes are shown here.

Table 1 Deflection

Load Case	DL + SIDL	Live Load	Pre-stressing Force
Deflection (at midspan)	30.8 mm	25.2mm	-14.36 mm

Table.2 Bending Moment (t m)

Span (m)	0.0L	0.1L	0.2L	0.3L	0.4L	0.5L
DL	0.00	352.51	618.56	834.98	944.84	982.12
LL	0.00	217.72	371.66	444.10	562.85	547.82
SIDL	0.00	52.46	97.04	125.74	144.57	146.50
Total	0.00	622.69	1087.26	1404.22	1652.26	1676.44

Table.3 Shear Force (t)

Span (m)	0.0L	0.1L	0.2L	0.3L	0.4L	0.5L
DL	120.9	105.7	78.65	51.4	26.4	0.0
LL	31.92	24.29	14.55	8.42	2.5	0.0
SIDL	19.70	15.72	10.88	7.62	3.65	0.0
Total	172.52	143.9	104.7	67.7	32.8	0.0

Table.4 Calculation of Prestress Force.

Moment of DL+SIDL (Mg)	1130.63 t.m	Using Frevssinet System Anchorage Type 7-15, 2mm in 100mm cables duct (IS:6006-1983)	Force In Each Cable = No. Of Cables =10 Nos.
Total Maximum Moment (Mt)	1718.45 t m		
Prestressed in Concerte developed at top fibers (fs up)	-3.2		
Prestressed in Concerte developed at top fibers (fs up)	10.34 MPa		
Prestressed forces (P)	1648.41 t		

Table.5 Calculation of Eccentricity

Eccentricity (mm)	Prestressing Force (kN)	The eccentricity which give minimum prestressing force (e) = 731mm
440	21617.96	
548	19380.69	
650	17655.06	
731	16489.15	

Table.6 Calculation of Pre-stress Losses (As per IS:1343-1)

Span (m)	ΔS	ΔC	ΔE	ΔA	ΔF	ΔR	Total	N
0.0L	8E-05	0.0	0.0	0.0	0.0	90	90	0.95
0.1L		2.6	2.3	78	9.7	90	182.6	0.9
0.2L		2.6	2.4	39	22	90	155.8	0.91
0.3L		2.6	2.4	26	36.7	90	157.7	0.91
0.4L		2.7	2.5	20	54.3	90	169.0	0.9
0.5L		9.1	8.3	16	171	90	294.0	0.85

Where,

ΔS = Shrinkage

ΔC = Creep

ΔE = Shortening of concrete

ΔA = Slip in anchorage

ΔF = Friction

ΔR = Relaxation n= Efficiency

After Losses, effective Pre-stressing Force (P) = P (1-Losses) = 14011.51 KN

Table.7 Calculation of Stresses at top and bottom fiber

Span (m)	At Transfer		At Service Load	
	Top Fibre	Bottom fibre	Top fibre	Bottom Fibre
0.0L	4.16	4.16	4.16	4.16
0.1L	2.98	5.48	6.35	0.00
0.2L	1.91	6.67	8.37	0.00
0.3L	2.112	6.44	7.46	0.00
0.4L	2.24	6.29	6.88	0.00
0.5L	3.00	6.24	6.42	0.00

Compressive Stress at

Transfer = 6.66 < 0.5 f_{cj} = 20 mpa

Service = 8.367 < 0.33 f_{ck} = 16.5 mpa

Tensile stress at

Initial Stage = 2.979 < 3mpa

S

(As per IS:1343 – 1980)

Working Stage = No tensile stress

Table.8 Calculation of Ultimate Flexure Strength

Span (m)	Ultimate Moment $M_u = (1.5DL + 2.5 LL)$ (kN.m)	Failure by yielding of steel (kN.m)	Failure by crushing of concrete (kN.m)
0.0L	0.00	340578.53	5970560
0.1L	11574.43		
0.2L	20394.85		
0.3L	26598.28		
0.4L	30402.45		
0.5L	31654.88		

Table.9 Calculation of Ultimate Shear strength

Span (m)	Ultimate Moment $V_u = (1.5DL + 2.5 LL)$ (kN.m)	Shear capacity V_{cw} (kN)	Balance Shear (kN)	Spacing (mm)
0.0L	3084.27	363.85	2720.43	55
0.1L	2391.35	419.97	1971.38	75
0.2L	1713.50	432.54	1280.96	100
0.3L	1089.90	470.56	619.34	200
0.4L	517.85	492.95	24.90	300
0.5L	0.00	0.00	0.00	0

VII. BEHAVIUR OF BOX GIRDER DUE TO VARIOUS LOAD

The graph below shows the variance in bending moment for a 30 m, 40 m, and 50 m bridge model, demonstrating that the variation in BM is highest in 50 m span bridges and minimum in 30 m.

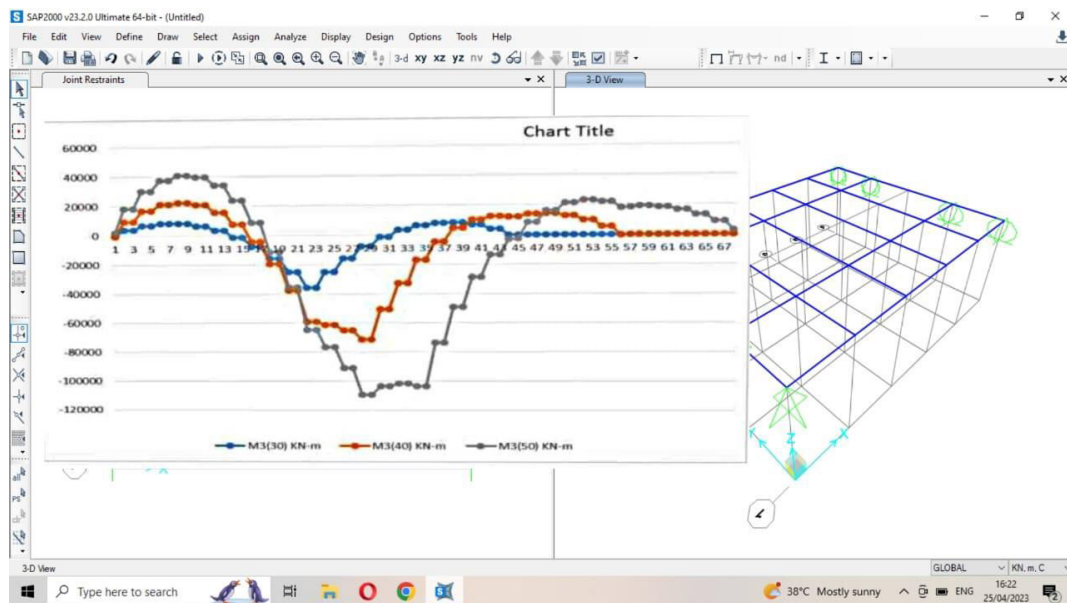


Fig :- Result Comparison for Dynamic load and Vehicle load

The graph represents the shear force fluctuation for various bridge spans. The graphs below show bridge spans of 30 meters. The analysis of the figures below reveals that the shear force rises linearly as the span increases.

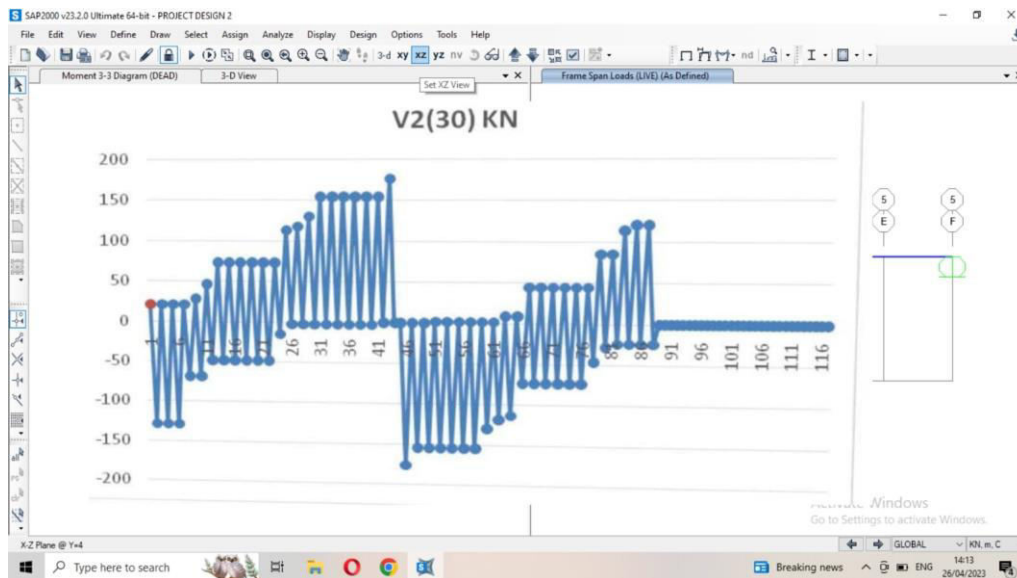


Fig :- Shear force variation

VIII. CONCLUSION

In the articles mentioned above that have been studied, several different types of software and procedures are used for bridge design and analysis. Bridge designs are compared with design codes from various nations. The research depicts the distribution of various loads utilizing a variety of load combinations and box girder sections. Then, using SAP2000 software, execute and finish the usage of sections subject to circumstantial loading.. The manual design process is covered in the previous works. The numbers were then shown in several design software programmes. Finally, the outcomes of manual design and software analysis are contrasted. Once manual findings are compared to those of software analysis, it is found that manual results are lower than those of software analysis.. Software called SAP2000 is used to analyse the structure. It works especially well when assessing a structure under different loads. The results that this programme generates are quite accurate.

IX. ACKNOWLEDGMENT

Firstly, we are profoundly grateful to Prof. Manoj. U. Deosarkar for his expert guidance and continuous encouragement throughout to see that this project reaches its target since its commencement to present. I would like to thank Prof. Lt. Col. Sanjay Karodpati Head of Civil Engineering Department of Dr.D.Y.Patil School of Engineering Lohegaon , Pune and Prof. UzmaShaikh Project Coordinator whose invaluable guidance supported us in this project.

REFERENCES

This study presents an analysis and design of a bridge structure. There has been a lot of study on bridge design and analysis, but comparatively little of it has addressed the issue of integrating human design with software analysis. References from numerous already completed studies are needed for this project; they are briefly detailed below:

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Carbon Inventory of Ajeenkya Dr Dy Patil Campus and Carbon Neutralization

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ABSTRACT: Carbon neutrality is an essential goal for mitigating climate change and reducing greenhouse gas emissions. Educational institutions are among the significant sources of carbon emissions, which require attention and prompt action. Ajeenkya D Y Patil Campus is a premier educational institute in India and is committed to achieving carbon neutrality. The purpose of this paper is to provide an overview of the ongoing process of carbon neutralization at Ajeenkya D Y Patil Campus and the future steps required for achieving complete carbon neutrality. The paper also evaluates energy management techniques and strategies implemented by the campus to reduce energy consumption and improve energy efficiency

KEYWORDS: Ajeenkya, DY Patil, campus, education, carbon, neutralization, energy, global.

I. INTRODUCTION

Climate change is one of the most pressing issues facing the world today, and reducing carbon emissions is crucial to mitigate its impact. Educational institutions have an important role to play in this regard, given their large carbon footprints. Ajeenkya D Y Patil Campus, a leading educational institution in India, has taken significant steps towards reducing its carbon emissions and achieving carbon neutrality.

This paper aims to provide an overview of the ongoing process of carbon neutralization at Ajeenkya D Y Patil Campus and the future steps required for achieving complete carbon neutrality. The paper will evaluate the energy management techniques and strategies implemented by the campus to reduce energy consumption and improve energy efficiency. It will also examine the potential of renewable energy sources such as solar, sun light, wind, and biomass for meeting the energy requirements of the campus and achieving carbon neutrality.

Moreover, the paper will highlight the importance of carbon offsetting and the role it can play in achieving carbon neutrality. It will discuss various carbon offsetting options available to the campus, such as afforestation, renewable energy projects, and energy efficiency projects.

Finally, the paper will outline the future steps required for the campus to achieve its carbon neutrality goals. It will emphasize the need for continued efforts towards energy management and the adoption of renewable energy sources. The paper will also highlight the importance of monitoring and reporting of carbon emissions and the need for stakeholder engagement in the carbon neutralization process.

II. RELATED WORK

Carbon inventory

Carbon emissions from transportation

Average distance travel by per person per day for college is 40Km, Average of bikes 40Km/liter

Average No. of bikes enter campus gate = 3000 units, Collage working days = 220 days per year

One liter petrol produces approximately 2.3 Kg of carbon dioxide

Per day fuel consumption is 40/40 that is One liter per day

Total carbon emissions = $3000 * 220 * 2.3 * 1 = 1518000$ Kg or 1518 Ton of Co₂



For four wheelers

Average distance travel by per person per day for college is 40Km, Average of four wheelers 15Km/liter

Average No. of four wheelers enter campus gate 350 units, per day fuel consumption is 40/15 that is 2.67 liter per day, one liter diesel produces approximately 2.6 Kg of carbon dioxide

Total carbon emissions = $350 \times 220 \times 2.67 \times 2.6 = 534534$ Kg or 534.534 Ton of Co₂

Total carbon emissions of transportation by campus activities per year = 1518+535 = 2053 Ton of Co₂

Total consumption of electricity

Meter Serial Number (Solar meter)					TOTAL GENERATION	MSEB READING	Convert KW TO MW	Total CONSUMPTION	% of green energy	Carbon Emissions MSEB READING*0.81
Date	555- X1448813	055- X1375986	055- X1375987	055- x1375988						1MW=0.81 TCo ₂
3/31/2023	10355	46986	17386	8690	83417	78347	78.347	161764	51.56709775	63.46107
2/28/2023	8855	50262	15396	6356	80869	77080	77.08	157949	51.19943779	62.4348
1/31/2023	10270	46190	13929	5997	76386	80365	80.365	156751	48.7307896	65.09565
12/31/2022	8070	40182	13342	5991	67585	89736	89.736	157321	42.95993542	72.68616
11/30/2022	11040	49144	15469	7013	82666	73258	73.258	155924	53.01685436	59.33898
10/31/2022	14755	33287	14850	7069	69961	69967	69.967	139928	49.99785604	56.67327
9/30/2022	8225	38030	11217	5712	63184	85582	85.582	148766	42.47207023	69.32142
8/31/2022	10720	39127	12811	5763	68421	69759	69.759	138180	49.51584889	56.50479
7/31/2022	6920	33422	9507	4965	54814	74200	74.2	129014	42.48686189	60.102
6/30/2022	7795	38957	14061	6618	67431	69745	69.745	137176	49.156558	56.49345
5/31/2022	7060	45320	15940	1604	69924	78505	78.505	148429	47.10939237	63.58905
4/30/2022	5050	39080	15056	32	59218	83494	83.494	142712	41.49475867	67.63014
TOTAL	109115	499987	168964	65810	843876	930038		1773914		753.33078

Carbon emissions by food court

hostel canteen, dental canteen, and laboratories

Take shop is 3 shops use LPG gas cylinders and monthly consumption is 16 cylinders, Hostel canteen monthly consumption is 28 cylinders, Dental canteen monthly consumption is 10 cylinders, Laboratories use 2 cylinders per month, Weight of commercial gas cylinder is 19 Kg, Total cylinders consume by campus per month is 55 to 56 cylinders and yearly 672 cylinders, 1.5 Kg carbon dioxide emitted by 1KG LPG

Yearly carbon emissions by LPG are $672 \times 19 \times 1.5 = 19152$ Kg or 19.152 Ton

Carbon sequestration trees

Tree planted in campus area

Palme Trees: School Parking =125, Dental Area = 54, Football Ground = 58, DG = 8, Staff Area =27, Bambu =5

Total = 277

Trees: School Parking = 135, Out Gate = 167, Oval ground = 92, Dental = 93, Football Ground = 271, DYP University and DG = 168, DG College = 37, Near Mandir = 16, Boundary Wall = 297, Water Lake = 204, Technical Campus = 210 Staff Area = 180

Total = 2147

Shrubs = 1095



Over one year a mature tree will take up about 22 Kilograms of Carbon dioxide and Shrubs carbon sequestration is 10 Kg per year $2147 \times 22 = 47234$ Kg or 47.234 Ton carbon dioxide capture by trees and $1095 \times 10 = 10950$ Kg or 10.950 Ton carbon dioxide capture by Shrubs, Total carbon sequestration = $47.234 + 10.950 = 58.18$ TON

The overall Carbon emissions by electricity, transportation, and another activities = 753.33 Ton by MSEB electricity + 2053 Ton by transportation + 19.152 Ton by LPG = 2825.482 Ton per year

And only 58 TON per year carbon sequestration by trees and up to 45% of electricity is generated by solar system. A potential up to 100% renewable energy by solar adaptation and battery storage technology

III. METHODOLOGY

There are several methods to make an institute carbon neutral, which are as follows:

- 1. Renewable Energy Sources:** The Ajeenkya DY Patil University can shift to renewable energy sources like solar, wind, and biomass energy to reduce carbon emissions. A study conducted by Yang et al. (2021) on the feasibility of solar energy in higher education institutions found that solar energy can reduce energy costs and carbon emissions. The study suggests that higher education institutions can adopt solar energy as a feasible solution to achieve carbon neutrality. The Ajeenkya DY Patil University can also consider installing wind turbines of small size and biomass plants to provide clean energy and reduce dependence on non-renewable energy sources.
- 2. Energy Efficiency Measures:** The Ajeenkya DY Patil University can adopt energy-efficient technologies like LED lighting, smart thermostats, and energy-efficient appliances to reduce energy consumption. A study conducted by Balaras et al. (2018) on the energy-efficient retrofit of buildings found that energy-efficient measures can significantly reduce energy consumption and carbon emissions. The study suggests that energy-efficient buildings can save up to 40% of energy and lead to significant reductions in carbon emissions. The Ajeenkya DY Patil University can also consider implementing building automation systems that can optimize energy use.
- 3. Carbon Offset Projects:** The Ajeenkya DY Patil University can invest in carbon offset projects like afforestation and renewable energy projects. A study conducted by Arvin et al. (2020) on the impact of renewable energy on carbon reduction found that renewable energy projects can significantly reduce carbon emissions. The study suggests that renewable energy projects can offset the institute's carbon footprint and help in achieving carbon neutrality.
- 4. Waste Reduction:** The Ajeenkya DY Patil University can reduce its waste production by implementing measures like waste segregation, composting, and recycling. A study conducted by Das et al. (2018) on the impact of waste management practices on carbon emissions found that waste management practices can significantly reduce carbon emissions. The study suggests that waste reduction measures can significantly reduce the amount of waste that goes to landfills and reduce the carbon footprint of the institute.
- 4. Sustainable Transportation:** The Ajeenkya DY Patil campus can encourage sustainable transportation methods like cycling, carpooling, and using electric vehicles to reduce carbon emissions from transportation. A study conducted by Li et al. (2020) on the impact of electric vehicles on carbon emissions found that electric vehicles can significantly reduce carbon emissions.
- 5. Education and Awareness:** The institute can educate students, staff, and faculty members on the importance of carbon neutrality, sustainability, and environmental protection. Creating awareness and involving the entire community can help in achieving carbon neutrality goals.
- 6. New technologies can be used such as the light duct and Urban Sky Tree, also known as the Futuristic Tree, is an innovative structure designed to help reduce air pollution and improve air quality in urban areas. It is a man-made, tree-like structure that uses a combination of moss, algae, and other materials to absorb pollutants and convert them into clean air.**

The Urban Sky Tree was developed by a team of researchers at the University of Applied Sciences in Dresden, Germany. The team was inspired by the natural ability of plants to absorb carbon dioxide and other pollutants from the air, and they set out to create a technology that could replicate this process in an urban environment.

The structure of the Urban Sky Tree consists of a series of vertical cylinders, each containing a layer of moss and algae. The moss and algae are able to absorb pollutants such as carbon dioxide, nitrogen dioxide, and particulate matter

from the air through a process called phytoremediation. This process involves the absorption of pollutants by the roots of the plants, which are then broken down and converted into clean air through photosynthesis.

In addition to its air-purifying capabilities, the Urban Sky Tree also has other benefits for urban environments. Its structure provides shade and helps to regulate temperatures in urban areas, which can help to reduce energy consumption and improve overall environmental conditions. The structure is also designed to be self-sustaining, requiring minimal maintenance and input from humans.

The Urban Sky Tree has been installed in several cities around the world, including Berlin, Paris, and Hong Kong. It has been shown to be an effective tool for reducing air pollution and improving air quality in urban environments. It has also sparked interest in other similar technologies, such as green walls and living roofs, which use plants to help purify the air and improve environmental conditions in urban areas.

In conclusion, the Urban Sky Tree is a promising technology that has the potential to significantly improve air quality and reduce air pollution in urban areas. Its innovative design and use of natural materials make it a cost-effective and sustainable solution for improving environmental conditions in cities around the world.

Achieving carbon neutrality is a significant challenge, but it is necessary for mitigating climate change and reducing carbon emissions. The above-mentioned methods can help an institute to reduce its carbon footprint and achieve carbon neutrality.



(Artificial tree to clean air or removal of Co₂)



bioreactors use microalgae to remove carbon dioxide from the air | Photo source [Liquid3](#)

the use of light pipes in Ajeenkya Dr. DY Patil campus can be a great way to reduce energy consumption and make the campus more sustainable. Light pipes are designed to capture natural daylight from the roof and redirect it into interior spaces, thereby reducing the need for artificial lighting during the daytime.

By installing light pipes in appropriate locations throughout the campus, natural light can be used to illuminate hallways, classrooms, offices, and other areas, reducing the amount of energy consumed by electric lighting. This can not only reduce the carbon footprint of the campus but also save on energy costs.

Furthermore, the use of natural light can have a positive impact on the well-being of students and staff, by providing a more natural and comfortable environment. The implementation of light pipes is a relatively low-cost and easy-to-install solution that can contribute to the overall sustainability and energy efficiency of Ajeenkya Dr. DY Patil campus.

Using Solar tube technology in corridors is cost saving and reduces carbon footprint as follows

Total no. of bulbs is 45 and all bulbs have 20 Watts per hour

No. of floors of soe building is 6

Working hours of college 12 hour a day

Total consumption per hour $45 * 20 * 6 * 12 = 64800$ watts

= 64.800 KW

Working day of college is 220 days

Therefore, total year consumption = $64.800 * 220$

= 14256 KW



Electricity charges per unit is 13 rupees then total cost per year is 185328 rupees



(Sun light concentrator)



(Fibre optic cable)



(Light distribution in corridors)

7. Maintenance of solar panels: Time-to-time inspection, cleaning & taking care of your solar panels, ensuring ample sunlight is available, examining the components on a regular basis, keeping a check on energy usage

IV. CHALLENGES

Making a campus carbon neutral is a complex and challenging process that involves significant changes to energy consumption and production, as well as a shift in attitudes and behaviours among students, faculty, and staff. Some of the key challenges that may arise during this process include:

1. **Financial Constraints:** The transition to carbon neutrality often requires significant investments in new technology, infrastructure, and energy-efficient systems. These investments can be costly, and it can be challenging to secure the necessary funding, especially for smaller institutions.
2. **Energy Generation:** In order to become carbon neutral, campuses must generate their energy through renewable sources such as wind, solar, or geothermal. However, these sources can be inconsistent and unpredictable, and it can be challenging to ensure a reliable and consistent supply of energy.
3. **Behaviour Change:** Becoming carbon neutral requires a significant shift in attitudes and behaviors among students, faculty, and staff. This includes changes in energy use, transportation, and waste management. Getting buy-in from all stakeholders can be challenging, and it can be difficult to sustain these changes over time.
4. **Limited Space:** Many campuses have limited space to install renewable energy systems or to implement energy-efficient measures. This can make it difficult to achieve carbon neutrality without significant alterations to existing buildings or infrastructure.
5. **Technological Limitations:** While renewable energy technologies are rapidly advancing, there are still limitations to their efficiency and scalability. This can make it challenging to generate enough energy to meet the demands of a campus community.
6. **Regulatory Hurdles:** There may be regulatory hurdles to overcome, such as building codes or zoning restrictions, that can limit the implementation of renewable energy systems or energy-efficient measures.

In order to overcome these challenges, campuses may need to develop innovative solutions that involve partnerships with local communities, businesses, and government entities. Additionally, it may be necessary to develop comprehensive strategies that address not only energy use but also transportation, waste management, and other areas that contribute to carbon emissions. Finally, continued research and investment in renewable energy technologies will be essential to achieving carbon neutrality on a larger scale.



V. EXPERIMENTAL RESULTS

Based on the suggested measures for carbon neutralization and energy conservation in Ajeenkya Dr. DY Patil campus, Pune, several positive outcomes can be expected.

Firstly, the campus is likely to reduce its carbon footprint significantly, thus contributing to the overall efforts to combat climate change. This reduction can be achieved by implementing various measures, such as using renewable energy sources, reducing energy consumption through energy-efficient buildings and appliances, and promoting sustainable transportation options.

Secondly, the campus can expect to save significant costs in the long run by reducing its energy consumption and reliance on non-renewable energy sources. The cost savings can be further enhanced by implementing measures such as energy-efficient lighting, HVAC systems, and building insulation.

Thirdly, the campus can promote environmental sustainability and awareness among its students, faculty, and staff. This can lead to a culture of sustainability that can be carried forward beyond the campus into the larger community.

Overall, the suggested measures for carbon neutralization and energy conservation in Ajeenkya Dr. DY Patil campus can result in a positive impact on the environment, cost savings, and the promotion of sustainable practices.

VI. CONCLUSION

In conclusion, the paper has highlighted various measures that can be implemented to make Ajeenkya Dr. DY Patil campus carbon neutral and energy-efficient. The suggested measures include the use of renewable energy sources, energy-efficient buildings and appliances, sustainable transportation options, and promoting a culture of sustainability among students, faculty, and staff.

By implementing these measures, the campus can significantly reduce its carbon footprint and contribute to the global efforts to combat climate change. The cost savings resulting from reduced energy consumption and the use of renewable energy sources can also have a positive impact on the campus's finances.

Furthermore, the promotion of sustainable practices among students, faculty, and staff can lead to a culture of sustainability that can be carried forward beyond the campus and into the larger community. This can have a significant impact on the environment and promote a more sustainable future.

In conclusion, the implementation of the suggested measures for carbon neutralization and energy conservation can have a positive impact on the environment, the campus's finances, and the promotion of sustainable practices. Therefore, it is imperative to continue exploring and implementing measures to make Ajeenkya Dr. DY Patil campus carbon neutral and energy-efficient.

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Analysis of Bituminous Concrete with Fly Ash and Reinforced with Sisal Fibre

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ABSTRACT: The major goal of this study was to ascertain the advantages of using SISAL fibre, a naturally occurring fibre, as an additive in bituminous concrete. Modified asphalt is one method for enhancing the performance of a pavement. Hot mix asphalt is a mixture of bituminous materials that has undergone high-temperature mixing, placement, and compaction. Bituminous concrete is another name for asphaltic concrete. In order to examine the advantages of using natural fibre and environmentally sustainable design, SISAL fibre had been employed in bituminous mixtures.

Drain Down testing and the typical Marshall Mix design test were carried out. Extension of the sisal and fly fibres beyond what could be kept and sifted through 0.075 microns should also improve the blend's characteristics. The evaluation and promotion of top-notch bituminous mix for road improvement is the audit's key goal. Examining evidence of a modified bituminous blend is necessary for this audit.

KEYWORDS:- Asphalt, bitumen concrete, Sisal fibre, Fly ash, Marshall test, natural

I. INTRODUCTION

It is crucial to the growth of the nation and the development of transportation, and it plays a significant role. Since flexible pavement has more advantages over rigid pavement, it is widely employed in India. And in this case, SISAL fiber—which is naturally occurring and locally accessible in India—displays both its positive traits and economic benefits. A precise engineering design could result in significant financial savings and reliable functioning of the in-service highway. The mix design factors are connected to the current investigation. A properly designed bituminous mix should be sufficiently (i) strong (ii), durable (iii), resistant to wear and permanent deformation (iv), environmentally friendly (v), economical (v), and so on. The length and diameter of the SISAL fibre used to prepare the sample were determined to be 6mm to 18mm and 0.2mm to 0.06mm, respectively. The aggregate was graded in accordance with IS: 107-2386 Grade 1 and Ministry of Road Transportation and Highway specifications.

II. MATERIAL

Material used :-

1. Aggregate

Stone chips with both coarse and fine total portions were used for this review. Fractions extending from 26.5 mm to 0.3 mm were used. Base debris and fly debris were only used to the degrees of 9 and 5% by weight of the absolute blend for lower sections of fine totals and mineral filler. These material syntheses were chosen, paying particular attention to the base debris with reference to the total evaluating chosen, taking into consideration the available amounts in the anticipated size divisions.

2. Bitumen

At first, expected blend arrangements and test conditions, two bitumen grades like VG-30 and VG-10 (Viscosity Grade) endeavoured with intended for concentrate on the Marshall qualities of blends.

2.2.1 IS code used for following test.

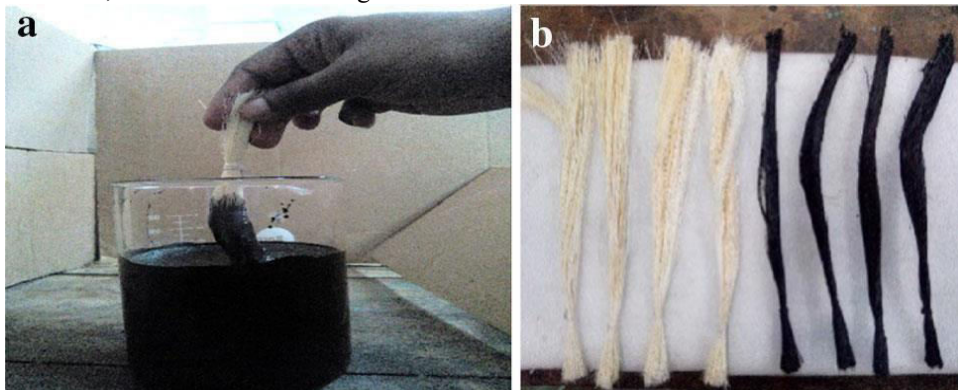
Sr.no.	Physical properties	IS code
1	Penetration at 25o c /100 gm/5s, 0.01mm	IS:1203-1978
2	Softening Point (46.5o C)	IS:1205-1978
3	Specific gravity (at 27)	IS:1203-1978

3. Sisal Fibre

Sisal fibre, a naturally occurring and locally available material made from a plant, has been used as a settling added element to enhance the design capabilities of ordinary thick assessed bituminous blend (DBM). In this pilot study, sisal fibre was coated with SS-1 (slow setting emulsion) and left in a hot air oven for 24 hours at 110 °C. Emulsion coating caused the material's regular consideration to be pondered. Sisal fibre is a cellulose fibre with a delicate yellowish variety. It is resilient, static-resistant, and recyclable.

4. Emulsion

Blend of at least two fluids that are regularly immiscible (un mixable or rigid) inferable from fluid stage division is an emulsion. An emulsion is important for a more broad class of two stage frameworks of the matter called colloids. Various sorts of emulsions can be framed by two fluids. HINCOL Cationic Bitumen Emulsion is utilized, which is a Slow Setting Emulsion.



2.1 Deep in Emulsion (by own camera)



2.2 Cutting the fibre(by own camera)



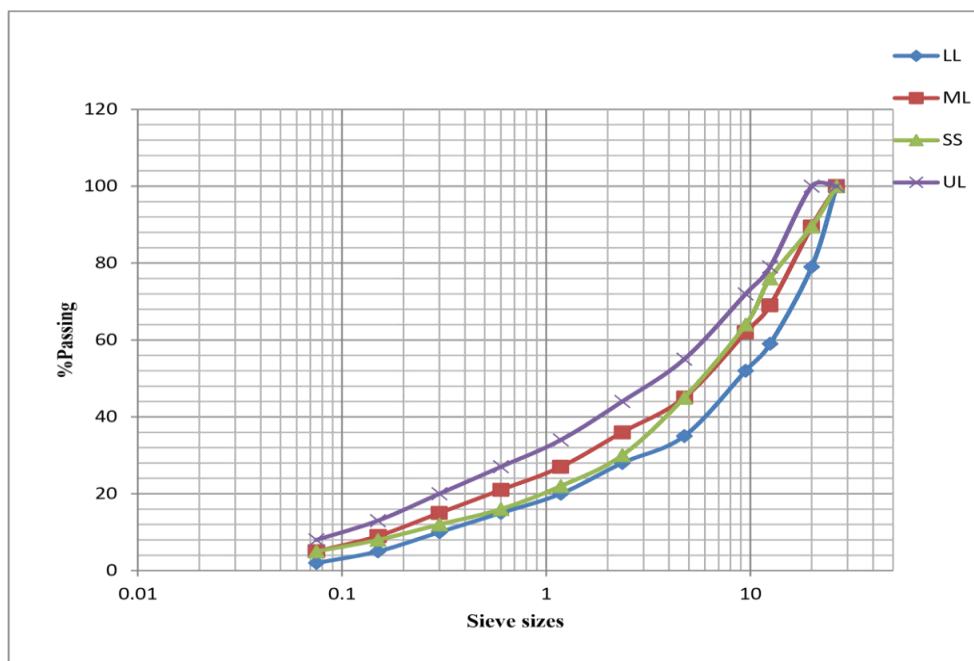
2.3 Mixing (by own camera)

III. RESULT

3.1. Gradation of Aggregate

Sieve size (mm)	LL % passing	ML % passing	UL % passing	SS % passing	Cum % retained	% Weight retained	Weight retained (gm)
26.5	100	100	100	100	0	0	0
20	79	89.5	100	89.5	10.5	10.5	126
12.5	59	69	79	76	24	13.5	162
9.5	52	62	72	64	36	12	144
4.75	35	45	55	45	55	19	228
2.36	28	36	44	30	70	15	180
1.18	20	27	34	22	78	8	96
0.6	15	21	27	16	84	6	72
0.3	10	15	20	12	88	4	48
0.15	5	9	13	8	92	4	48
0.0075	2	5	8	5	95	3	36
0	0	0	0	0	100	5	60
						TOTAL	1200

3.2. Gradation curve



IV. CONCLUSION

- When sisal fibre was introduced as a binding material, we discovered that a 0.25% sisal fibre content between the range of 17–20 KN provided the best stability.
- When using fly ash as a filler, we discovered that a 15mm fibre length and a 0.50% fibre content in the 50–60 range provided the best stability.
- When sisal fibre was introduced as a binding material, we discovered that a 20mm length of fibre with a 0.25% sisal fibre content within in the range of 17-19 KN provided the best flow value.
- When fly ash is used as a filler, we discover that 10mm of fibre with a 0.25% fibre content in the 20–25 range provides the best stability.
- When sisal fibre was introduced as a binding material, we discovered that 10mm lengths of fibre with a 0.25% sisal fibre content between the range of 8-10 KN produced the best Air Voids.
- When using fly ash as a filler, we discovered that a 15mm fibre length and 1% fibre content between 12 and 15 showed the best stability.

V. FUTURE SCOPE

- Many properties of SMA and BC mixes such as Marshall properties, drain down characteristics, tensile strength characteristics have been studied in this investigation. Only 60/70 penetration grade bitumen and a modified natural fibre called sisal fibre have been tried in this investigation.
- However, some of the properties such as fatigue properties, moisture susceptibility characteristics, resistance to rutting and dynamic creep behaviour can further be investigated. Some other synthetic and natural fibres and other type of binder can also be tried in mixes and compared.
- Sisal fibre used in this study is a low-cost material, therefore a cost-benefit analysis can be made to know its effect on cost of construction. Moreover, to ensure the success of this new material, experimental stretches may be constructed and periodic performances monitored.
- To determine optimum binder content and optimum fibre content in bitumen mix with addition of SISAL fibres of various length and quantity.

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A Study Paper on Water Pollution in Rivers of the City

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ABSTRACT: The availability and quality of water resources has an impact on the political, social, and economic development of a society. Water is deemed dangerous to human and aquatic life when it is contaminated by unexpected chemicals. This water is referred to as being polluted. Water pollution results from many factors. Natural factors include the biodegradation of plant and animal parts in clear water, siltation caused by riverbank erosion, and others. Water pollution caused by humans includes things like fertilisers, household garbage, and industrial waste. Maharashtra's surface water contamination is at an alarmingly high level. Water is essential for all living things, thus there is no need to elaborate. For physiologic purposes, they either directly or indirectly consume water. If the water being consumed is contaminated, harm will undoubtedly result. The worst aspect is that this spreads via the food chain to other people. As a result, we need to be aware of the harmful effects that contaminated water may have on us. One of the fundamental resources required for humanity to survive on Earth is water. The Ganga, Yamuna, and Sabarmati rivers are revered by the Indian population, while the Mithi River is significant for its biodiversity. It is customary to drink from and bathe in the sacred rivers. However, a number of contaminants, including pesticides, heavy metals, organic waste, chemical waste, and sewage discharge, impair the water quality of these rivers. The water is no longer safe for human consumption, raising the risk of disease outbreak. Due to the direct exposure of people and other life forms to hazardous substances and heavy metals through contaminated river water, there is a danger of developing several fatal diseases. This study's goal is to investigate the sources of water contamination in significant Indian rivers and its potential health risks. Although we cannot completely stop water pollution today, reduction is crucial. It's time we started working on it by taking some action.

KEYWORDS: Water resources, Water pollution, Contaminated water, Industrial waste, Household garbage, Sewage discharge

I. INTRODUCTION

Living things require water as a critical resource. Water is a fundamental element of all living things since it is involved in the majority of biochemical events that occur throughout the metabolism and growth of living things. Since no life can exist on this planet without water, it is known as "Natural liquid Gold." Since practically all inorganic substances dissolve in water, it is frequently referred to as the "universal solvent." 71% of the surface of the globe is covered by water, but only 3% of that water is fresh water, which is found in the form of ice caps, glaciers, rivers, lakes, ponds, streams, and ground water supplies.

The river is the most significant and sensitive freshwater system and is essential to the survival of all species. Freshwater systems' sustainability is under risk due to the deteriorating water quality, which offers grounds for concern. Indian environmental researchers recently described the state of India's freshwater resources and how they are managed as a serious environmental issue, with major effects such as nutrient enrichment, acidification, and toxic substances identified in household waste, agricultural waste, sewage, and industrial effluents. According to a study, biological, organic, and inorganic pollutants have contaminated about 70% of India's surface and ground water resources.

The wastewater pollutants are harmful to environment and public health. The biological decomposition of organic compounds could result in killing of fishes and generation of foul odors. There are many pollutants that could exhibit toxic effects on aquatic life and the public health. Water borne diseases are also eliminated through proper wastewater treatment. The wastewater treatment is removal of contaminants from water. The chemical contamination of water sources due to certain industries or from natural sources. High turbidity can inhibit the effects of disinfection against micro-organisms and enable bacterial growth. Drinking water should be colorless, since drinking water coloration may be due to the presence of colored organic matter. Although scents can be caused by a variety of things, including



biological activity, industrial pollutants, and microbial diseases that pose health risks, they mostly originate from organic molecules. Increased human population, industrialization, the use of fertilisers in agriculture, and human activity all contribute to water pollution. The existence of water constituents at their ideal levels, which support the growth of plants and animals, is referred to as the water quality. The growth of living organisms in the water body depends on a number of critical parameters, including temperature, turbidity, nutrients, hardness, alkalinity, dissolved oxygen, etc. The relationship between all hydrological characteristics, such as the physical, chemical, and biological characteristics of the water body, is referred to as water quality. Physico-chemical, biological, and other types of data are therefore analysed to determine the quality of water.

II. LITERATURE REVIEW

Ahmed Shabbir Khan, Ankur Anavkar, Ahmad Ali, Nimisha Patel and Hina Alim [1] in this paper author said that It is urgent to survey the water quality of rivers including the Ganga, Yamuna, Sabarmati, and Mithi. River water quality is obviously subpar according to WHO and BIS norms. Due to the rising pollution load in the rivers, aquatic and biodiversity habitats close to riverbeds are more at risk. As the output of chemicals and petrochemicals has expanded over time, so has the volume of effluents emitted. Many people have died as a result of the flooding, which has also contributed significantly to the spread of other diseases. By dry weight, the brick did not absorb more water than 20%.

Priyank Pravin Patel, Sayoni Mondal, Krishna Gopal Ghosh [2] In this paper, author examined how the lockdown significantly affected the Yamuna's water quality throughout the Delhi NCT stretch, as seen by improved WQI ratings and a marked decrease in BOD and COD levels. However, the FC had risen at a few locations, perhaps as a result of animal waste and domestic sewage outflows (which remained generally unabated). Similar decreases in pollutant loads were also seen in drain effluents, and the most polluted drains in this reach were identified. The turbidity and SPM of the river had significantly decreased as well. The analyses carried out were limited by several data restrictions, but it was nonetheless possible to verify that the Yamuna's water quality had improved. However, despite these advancements, the WQI status was unable to reach the required CPCB standards.

Nutan Maurya [3] In this study Author has clearly demonstrated that even while the Yamuna River's water quality falls short of that of a healthy river, it nevertheless plays a crucial role in the lives of many people. For the majority of people, the river serves as a reflection of their youth. The majority of responders described the river as a dirty waterscape with a miraculous character. Despite the flow of dirty water through the river, they hold to the notion that it is inherently sacred. This extended human interaction with the river aids in the creation of local ecological knowledge, such as variations in native fish species, seasonal variations in water quality, peak pollution discharge timing, effects of pollution on aquatic flora and fauna, and changes in river topography and hydrology over time, etc. Grey infrastructure and recreational areas are more likely to grow in and around the river due to the management of the urban portion of the river. The ongoing sewage drain discharge into the river hasn't been totally controlled, though. Participating riverine communities in the river cleaning programme may serve to raise general public awareness of broader environmental concerns, which will then increase pressure for adherence to environmental laws and regulations.

Bagul V. R., Shinde D. N., Chavan R. P., Patil C.L. [4] The following conclusions were reached by author after analysing the data and information in this review paper: No truly clean water can be found. Some chemicals naturally combine with water. Once more, certain natural contaminants were automatically removed. Both natural and man-made sources, such as factories and agricultural chemicals, heavily pollute rivers. People's unconsciousness is another factor in water contamination. Teaching that applying too many pesticides and fertilisers does not increase agricultural output is especially important for rural populations. Humans and aquatic plants may be harmed directly or indirectly by polluted water. That is, the ecology is impacted by water contamination. Through water consumption, toxic compounds immediately harm living things. Some poisonous substances build up in the body and eventually manifest their pollution.

Quy-Toan Do, Shareen Joshi, Samuel Stolper [5] This paper by the author provides empirical evidence that 1987 Supreme Court decision in the Mehta versus Union of India case mandating, among other things, tanneries in the district of Kanpur to shut down, indeed induced a drop in infant neo-natal mortality and that the reduction in industrial pollution is the main channel of impact. We find that both the effects on pollution and infant mortality are localized to the few district where the ruling applied, but are found to be long lasting.

Chandra, Sameer [6] In pre monsoon season, the concentration of pollutants in Gomti river found higher than post monsoon season in studied years 2009, 2010 and 2011. Most of the populated sites are situated in the locality nearby the area whereas untreated sewage, effluent and domestic drains disposal sites are located, whereas sites situated in rural areas are less affected. As the river flow through the city from upstream to downstream the concentrations of the pollutant are increased. Studied site's sediments are found unpolluted from metals ions i.e. As, Fe, Cu and Cd, whereas the concentration of Fe and Cu was found above the MAL in water at most of the studied time at sites Laxaman mela, Hanuman setu and Shaheed park. Concentration of nitrate, nitrite, ammonium, phosphates, chloride and sulphate are found in high concentration. However, nitrate and phosphate were found 2-4 folds, 10-20 folds respectively higher than MAL in studied season of the years 2009, 2010 and 2011.

Panigrahi AK, Pattnaik S [7] The following conclusions were reached to the author after analysing the data and information in this review paper: Solid wastes should be disposed after treatment and must be banned plastic bags. Industrialists should responsible that water must be treated before falling into river. Increase Community awareness programme. Before reaching the pollutants into river the drainage water should be treated and proper management requires those drains directly enter into the river. Must be installed sewage treatment plant and after treatment this water should be used for domestic purpose. For evaluation of contamination quality of waste water effluent must be checked time to time. Proper disposal of toxic chemicals should be maintained.

Pratap Kumar Panda, Rahas Bihari Panda, Prasant Kumar Dash [8] The present work by the author's concludes them that the river water in India and abroad is largely polluted with respect to physically, chemically and bacteriologically due to the entry of pollutants from various sources such as industry, mines, agriculture, urban, domestic and medicals. Besides, this work establishes a relationship among different physico-chemical parameters. The DO is related with temperature, photosynthesis, respiration and turbidity. The pH is related with temperature, photosynthesis, dissolved carbon dioxide and chloride. Further, the work found that, the value of DO is lower during summer season due to high temperature and higher during winter season due to low temperature. Hence temperature and DO are inversely related. It is also found that in certain cases, the value of DO increases during rainy season due to flood and aeration. The review also finds that the DO and BOD are reciprocally related with certain deviation. The deviation highlights that DO and BOD increase due to simultaneous rise of concentration of pollutants and dissolved oxygen.

III. METHODOLOGY

A flow chart is produced as the overarching research methodology for this project.

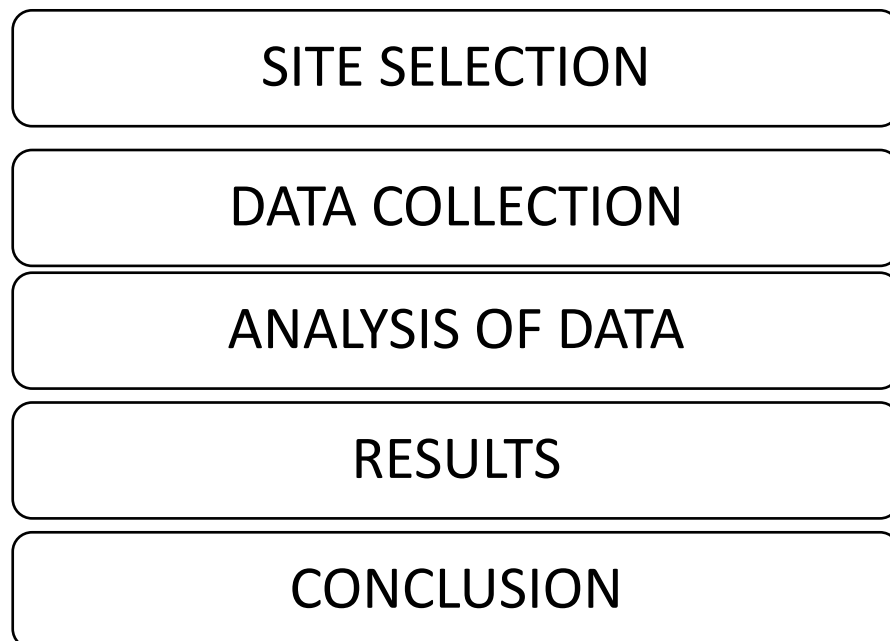


Fig:- Schematic Diagram of Methodology



IV. CONCLUSION

The river water pollution is a gigantic problem not only in India but also for the entire world. Both developed and developing countries are suffering from river water pollution, though the gravity of pollution differs from place to place. The present work concludes that the river water in India and abroad is largely polluted with respect to physically, chemically and bacteriologically due to the entry of pollutants from various sources such as industry, mines, agriculture, urban, domestic and medicals. Besides, this work establishes a relationship among different physico-chemical parameters.

Thus, the review work gives an overall picture on river water pollution in India and interrelationship among different physico-chemical parameters so as to study and check the water pollution for the benefit of the society as a whole.

Pollution affects whole biodiversity on aquatic ecosystems. Many fishes are died due to effects of heavy metals pollution on river. Due to discharge of heavy metals contamination eutrophication occurred. Many species of river are extinct due to pollution and ultimately it leads to loss of biodiversity. Plantation of trees on the bank of river is the effective solution to reduce river pollution. To overcome river pollution plastic should be banned as it affects food chain. If we not aware about river pollution in future it will seriously affect human population.

V. ACKNOWLEDGMENT

Firstly, we are profoundly grateful to Dr. Pallavi Kharat for her expert guidance and continuous encouragement throughout to see that this project rights its target since its commencement to present. I would like to thanks Prof. Lt. Col. Sanjay Karodpati Head of Civil Engineering Department of Dr.D.Y.Patil School of Engineering & Technology Lohegaon , Pune and Prof. Manoj. U. Deosarkar Project Coordinator whose invaluable guidance supported us in this project.

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Upcycling Plastic Waste for Road Construction

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ABSTRACT :- This paper explores the concept of upcycling plastic waste for road construction as a sustainable solution to address the environmental challenges posed by plastic waste accumulation. The study investigates the potential of utilizing plastic waste materials, such as discarded bottles and packaging, in road construction processes. It examines the technical feasibility, environmental impact, and economic viability of incorporating plastic waste into asphalt mixtures and other road construction applications. The research evaluates the mechanical properties and performance characteristics of plastic-modified road materials through laboratory testing and field trials. The findings of this study shed light on the benefits and limitations of upcycling plastic waste for road construction, providing valuable insights for policymakers, engineers, and environmentalists interested in promoting sustainable waste management practices.

KEYWORDS: Upcycling, plastic waste, road construction, sustainable solutions, environmental impact, asphalt mixtures, mechanical properties, performance characteristics, laboratory testing, field trials, waste management.

I. INTRODUCTION

The flexible pavements are preferred in India. These are economical about both initial construction cost and maintenance costs. Bituminous binders commonly used in surface courses are unmodified binders' bitumen (depending on the climatic conditions hot or cold) and modified binders by polymers (PMBs). Polymer-modified bitumen can improve fatigue life, temperature susceptibility and resistance to permanent deformation. The term Rheology is the study of flow of fluids and deformation of solids under the presence of stress and strain. Rheology has become a very useful tools in characterization of the bitumen performance on the pavement. Viscoelastic properties of bitumen binder can be described by rheological properties; they are phase angle (δ) & complex shear modulus (G^*). complex shear modulus (G^*) is the measurement of total resistance of a material to deformation under the repeated action of shear stress, whereas phase angle (δ) is angle made by a complex modulus with horizontal axis.

Generally, the Rheological behavior of bitumen is very complex phenomenon which varies from purely viscous to elastic depending on the time of loading and temperature. A viscoelastic material, bitumen plays a very prominent role in determining the various aspects of road performance, for example, bituminous pavement need to be stiff at high temperature to prevent rutting and also needs to be flexible enough at low temperature to prevent cracking of pavement. These functional properties are required to enable pavement to accommodate the increasing traffic loading in varying climatic environment conditions. But unfortunately, due to the increased performance related to the requirement on the bituminous pavements, conventional bitumen does not always perform as it expected. The scope of this study is to improve Viscosity, Marshall Stability, Penetration value and softening point of the Bitumen, to utilize waste materials as a pavement ingredient, to improve the binding property and water resistance of the bitumen and Reduction in construction coast of road pavement.



Fig.1.1 Plastic Waste for Road Construction

1.2 Plastic – The Binder

Bitumen is a useful binder for road construction. The steady increase in high traffic intensity in terms of commercial vehicles, and the significant variation in daily and seasonal temperature demand improved road characteristics. Any improvement in the property of the binder is needed. Waste plastics on heating soften at around 130°C. Thermo gravimetric analysis has shown that there is no gas evolution in the temperature range of 130-180°C. Moreover, the softened plastics have a binding property.

1.2 Waste Plastic Low Density Plastic (LDPE)

The production of plastic in India is increasing day by day. LDPE can be used mostly in packaging industry. Milk pouches are generally made up of LDPE. Most of the garbage that generates in household is due dairy product packages like milk pouches, yogurt pouches, buttermilk pouches. Also there are around 40 to 50 milk pouches generated in every tea stall. This plastic can be recycled but if it does not reach the recycling unit then it can create problems. So here plastic is also used for stabilization process.



Figure No.1.2 LDPE Waste Plastic

1.3 Role of plastic in the pavement

Plastic has been used in pavement applications for many years due to its durability and ability to withstand heavy loads. It is commonly used as a reinforcing material in asphalt concrete, which helps to improve the strength and durability of the pavement. Recently, there has been an increased interest in the use of recycled plastic or Plastic in pavement applications. The use of recycled plastic in pavement construction helps to reduce waste plastic, and it has been shown to improve the durability and performance of the pavement. The modification of Plastic can also help to make it more compatible with asphalt and improve its performance as a reinforcing material. This can be achieved by adding additives to the Plastic, which can improve its adhesion to asphalt and reduce its susceptibility to cracking. Another advantage of using modified Plastic in pavement applications is its ability to reduce the temperature of the pavement surface. The modified Plastic can reflect more sunlight than traditional asphalt, which helps to reduce the heat island effect in urban areas and improve the comfort of pedestrians and cyclists. The modification of Plastic is a necessary step towards finding sustainable solutions to reduce plastic waste and minimize its impact on the environment. The use of modified Plastic in pavement applications is a promising area for research and development, and it has the potential to significantly improve the performance and sustainability of pavement construction.

D. **B. Eme et.al (2019)** Plastic or water sachet is a major environmental pollutant, a no biodegradable material. The usefulness of this pollutant (Plastic) in the highway industry was investigated by studying its effects on some selected properties of Hot Mix Asphalt, such as, bulk density, stability and flow of the asphalt concrete mix.

II. LITERATURE REVIEW

Specimen preparation was done using Marshall Mix design procedure. The optimum binder content was determined as 5.20% and three samples each for five variations of Plastic content (2%, 4%, 6%, 8% and 10%) by weight of optimum binder content. It was observed from the study, that the stability and density of asphalt increased with Plastic content, while a linear reduction in the flow and penetration values was observed with Plastic content.

Neetu Rani et.al (2018) Bituminous concrete is a composite material mostly used in construction projects like roads surfacing, airports, parking lots etc. It consists of asphalt or bitumen and minerals aggregate which are mixed together & laid down in layers then compacted. Various percentage of Plastic is used for preparation of mixes with a selected aggregate grading as in the given in the IRC code. The role of the Plastic in the mix is studied for various engineering properties by preparation Marshall Samples of BC mixtures with and without Plastic. Marshall Properties such as stability, flow value used to determine optimum Plastic content for given grade of bitumen (80/100). Plastic is used in bitumen in this work by 0 to 5%.

A.I. Al-Hadidy et.al (2020) The present study investigates the potential use of pyrolysis low density Plastic (LDPE) as a modifier for asphalt paving materials. Five different blends including conventional mix were subjected to binder testing such as rheological tests, as well as to some other tests related to the homogeneity of the system. Further, its effect on the moisture sensitivity and low temperature performance of stone matrix asphalt (SMA) mixtures was studied. Research results indicate that modified binders showed higher softening point, keeping the values of ductility at minimum range of specification of (100+ cm), and caused a reduction in percentage loss of weight due to heat and air (i.e. increase durability of original asphalt). The results indicated that the inclusion of LDPE in SMA mixtures can satisfy the performance requirement of high-temperature, low temperature and much rain zone.

Jyoti Prakash Giri et.al (2018) Recycling or waste utilization in transportation construction industry is important for sustainability. Keeping this in mind, an attempt has been made in this study to explore the use of waste materials such as recycled concrete aggregates (RCA) and waste milk packaging Plastic in bituminous paving mixes. In this study, dense bituminous macadam mixes were prepared with RCA as coarse aggregates and two different types of filler, i.e. cement and stone dust. For the purpose of comparison, paving mixes were also prepared using natural aggregate and other materials as above. It was observed that all the mixtures prepared with various combinations satisfy the requirements in terms of Marshall test parameters and moisture susceptibility specified by Ministry of Road Transport and Highways, India. Further, the use of waste Plastic generally improves the engineering properties especially at a higher temperature, in terms of dynamic moduli value and rutting behaviour of mixtures.

Chalachew Nigussie et.al (2019) Increasing urbanization and industrialization have contributed for increased plastic generation in Ethiopia. Unsafe disposal of waste plastic is a serious environmental problem. The application of waste plastics to modify bitumen for asphalt of roads can possibly minimize those problems since the Plastic modified roads showed superior resistance to environmental stresses in countries if the technology has been implemented. PET plastic bottle is generated daily in Bahir Dar city and released as a waste after usage. Releasing them to the environment, they pose negative impact to the environment. So to overcome such problem reducing solid disposal there is an idea to utilize waste PET bottle plastic in bitumen modification for asphalt road construction pavement using wet process technology. The conditions used were: plastic content (0%, 2%, 3.5%, 5%, 6.5%, and 8%) by mass of bitumen, plain bitumen content in testing of its maximum stability (4.5%, 5%, 5.5%, and 6.5%) by mass of aggregates.

III. RESEARCH METHODOLOGY

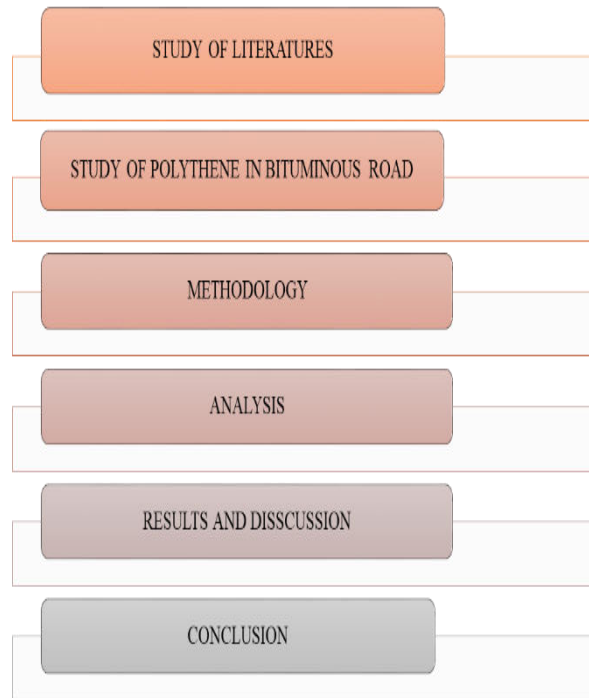


Figure No.3 Methodology Flowchart

The use of Plastic in bituminous roads is a method of improving the performance and durability of roads by incorporating plastic waste in the construction process. The following methodology can be used for the implementation of this technique:

1. Collection of Plastic

Collect Plastic waste from various sources such as households, commercial establishments, and industries. The collected Plastic should be cleaned and sorted according to their quality.

2. Shredding:

The Plastic collected needs to be shredded into small pieces using a shredding machine. The size of the shredded pieces should be such that they can be easily mixed with the bitumen.

3. Mixing with Bitumen

The shredded Plastic needs to be added to the bitumen mix during the construction process. The amount of Plastic added to the bitumen mix should be carefully determined so as to not affect the desired properties of the bitumen.

4. Preparation of Mix

The bitumen mix is prepared by heating the bitumen to a certain temperature and adding the required amount of aggregates. The shredded Plastic is then added to the mix and thoroughly mixed to ensure a uniform distribution of the plastic waste.

5. Laying the Road

The prepared bituminous mix is then laid on the road surface using a paving machine. The thickness of the bituminous layer should be carefully controlled to ensure proper compaction.

6. Compaction

The laid bituminous layer is then compacted using a roller to ensure proper bonding between the bituminous layer and the road surface.



7. Quality Control

The quality of the constructed road should be tested to ensure that it meets the desired specifications. The durability, stability, and strength of the road should be assessed.

8. Maintenance

Regular maintenance of the road should be carried out to ensure its longevity and durability. The use of Plastic in the bituminous mix can increase the lifespan of the road by reducing the formation of cracks and potholes.

the use of Plastic in bituminous roads is an effective way to improve the performance and durability of roads while also reducing plastic waste. The above methodology can be used for the implementation of this technique.

3.1 Tests on Aggregate

1. Sieve Analysis of Aggregate
2. Impact Value Test
3. Impact Value Test (Aggregate + Plastic)
4. Abrasion Test
5. Crushing Value Test

3.2 Test on Bitumen

1. Penetration Test
2. Ductility Test
3. Softening Point Test

3.3 Test on Bituminous Mix Design

1. Marshal Stability Test

IV. RESULTS AND DISCUSSION

4.1 Sieve Analysis for 4.5% Bitumen

Table No.1 Percentage Gradation of Aggregate for 4.5% Bitumen

Sieve Size	Desired Range	Passing % for mix	Retained Wt. in %	Retained Wt. in gm
16	100	100	0	0.0
12.5	90-100	100	0	0.0
9.5	70-88	76	24.0	275.0
4.75	53-71	53	23.0	263.6
2.36	42-58	42	11.0	126.1
1.18	34-48	34	8.0	91.7
0.6	26-38	26	8.0	91.7
0.3	18-28	18	8.0	91.7
0.15	12-20	12	6.0	68.8
0.075	4-10	4	8.0	91.7
Pan		0	4	45.8
Total			100	1146

As shown in above Table, Gradation given for 4.5% bitumen addition where stone aggregate retained on 4.75mm sieve partially replaced with Plastic of size 4.75mm proportion is 2%, 4%, and 6% respectively.

4.2 Sieve Analysis for 5% Bitumen

Table No.2 Percentage Gradation of Aggregate for 5% Bitumen

Sieve Size	Desired Range	Passing % for mix	Retained Wt. in %	Retained Wt. in gm
16	100	100	0	0.0
12.5	90-100	100	0	0.0
9.5	70-88	76	24.0	273.6
4.75	53-71	53	23.0	262.2
2.36	42-58	42	11.0	125.4
1.18	34-48	34	8.0	91.2
0.6	26-38	26	8.0	91.2
0.3	18-28	18	8.0	91.2
0.15	12-20	12	6.0	68.4
0.075	4-10	4	8.0	91.2
Pan		0	4	45.6
Total			100	1140

Gradation shown in Table 4. for 5% bitumen addition where aggregate retained on 4.75mm sieve partially replace with Plastic of size 4.75mm of proportion is 2%, 4%, and 6% respectively.

4.3 Sieve Analysis for 5.5% Bitumen

Table No.3 Percentage Gradation of Aggregate for 5.5% Bitumen

Sieve Size	Desired Range	Passing % for mix	Retained Wt. in %	Retained Wt. in gm
16	100	100	0	0.0
12.5	90-100	100	0	0.0
9.5	70-88	76	24.0	272.0
4.75	53-71	53	23.0	261.1
2.36	42-58	42	11.0	124.9
1.18	34-48	34	8.0	90.8
0.6	26-38	26	8.0	90.8
0.3	18-28	18	8.0	90.8
0.15	12-20	12	6.0	68.1
0.075	4-10	4	8.0	90.8
Pan		0	4	45.4
Total			100	1135.2

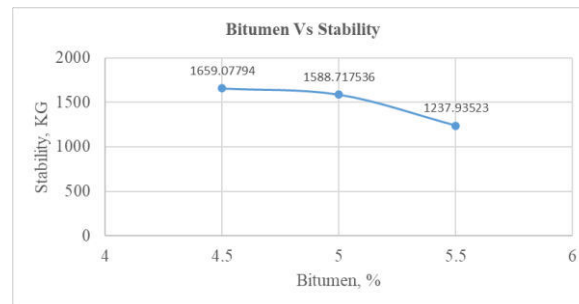
Gradation given for 5.5% bitumen given in Table 5. addition where aggregate retained 4.75mm aggregate partially replaced with Plastic of size 4.75mm of proportion is 2%, 4%, and 6% are respectively.

4.4 Marshal Test Result of Conventional Mix Specimen

Marshal test is conducted on conventional mix of 4.5%, 5%, 5.5 % bitumen to get flow and marshal stability value. To determine optimum binder content following results obtain from test:

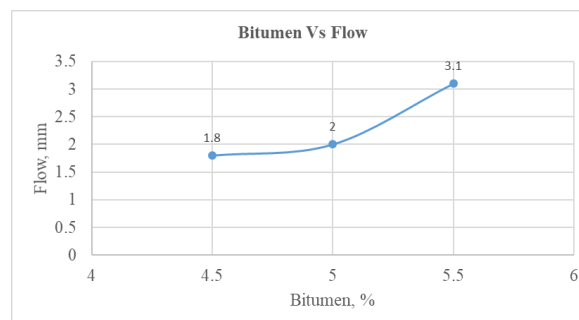
Table No.4 Marshal Test Result of Conventional Mix Specimen

Bitumen	Bulk density (gm/c)	V _r (%)	VMA	VFB	Stability (KG)	Flow
4.5	2.457	7.23	17.42	58.49	1659.078	1.8
5	2.468	5.60	17.52	66.34	1588.718	2
5.5	2.420	4.28	17.53	75.58	1237.935	3.1



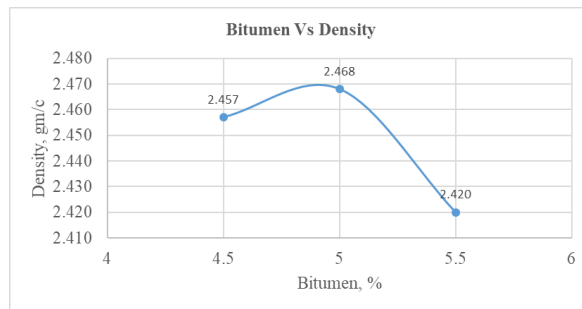
Graph No.1 Bitumen Vs Stability for Conventional Mix

Stability vs bitumen graph is plotted to get the bitumen content corresponding to maximum stability value with reference to above table at 4.5, 5 and 5.5% bitumen Content. With reference to above table, at 4.5% maximum stability shows.



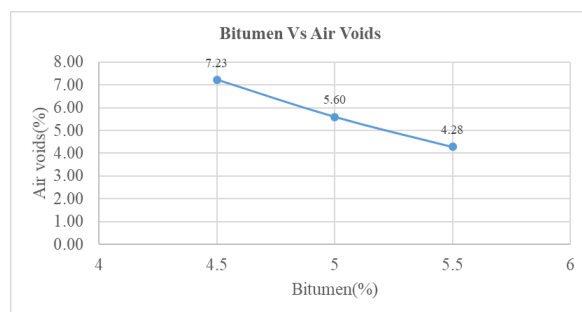
Graph No.2 Bitumen Vs Flow for Conventional Mix

Bitumen Vs Flow graph is plotted to get the bitumen content corresponding to flow value with reference to above table at 4.5, 5 and 5.5% bitumen Content.



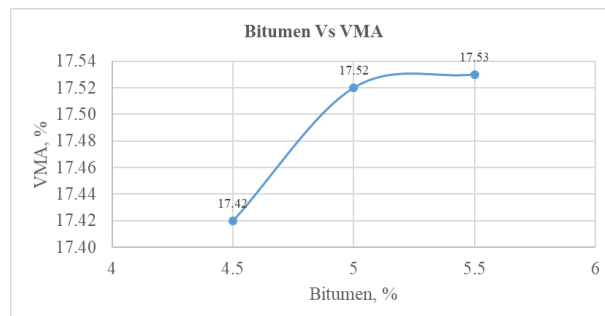
Graph No.3 Bitumen Vs Density for Conventional Mix

Bitumen Vs Density graph is plotted to get the bitumen content corresponding to maximum Density value with reference to above table at 4.5, 5 and 5.5% bitumen Content. Here maximum density is achieved at 5% Bitumen content.



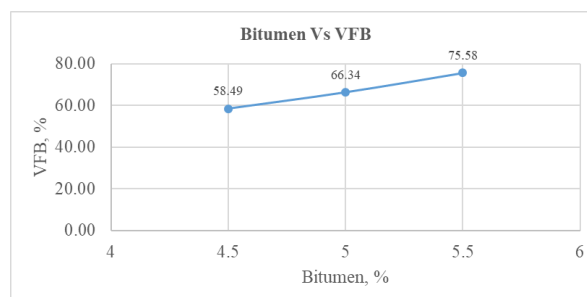
Graph No.4 Bitumen Vs Air Voids for Conventional mix

Bitumen Vs Air Voids graph is plotted to get the bitumen content corresponding to maximum Air Voids value with reference to above table at 4.5, 5 and 5.5% bitumen Content. From the graph, Bitumen content corresponding to 4.5% Air voids is 5.5.



Graph No.5 Bitumen Vs VMA for Conventional Mix

Bitumen Vs VMA graph is plotted to get the VMA value bitumen content corresponding to optimum binder content. VMA value is checked at optimum binder content, with specified design requirement of mix.



Graph No.6 Bitumen Vs VFB for Conventional Mix

Bitumen Vs VFB graph is plotted to get the bitumen content corresponding to VFB value with reference to above table at 4.5, 5 and 5.5% bitumen Content. VFB value is checked optimum binder content.

Now from the analysis for all graphs optimum binder content

$$= (4.5+5+5.5)/3$$

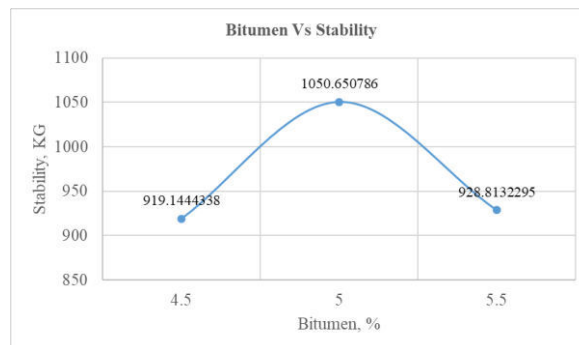
$$= 5\%$$

4.5 Marshal Test Result of 2% Plastic Replacement Mix

In this trial 2% Plastic is replaced with 4.75mm aggregates for Bitumen (by weight) 4.5, 5 and 5.5 respectively. Volumetric properties are calculated and written in table below.

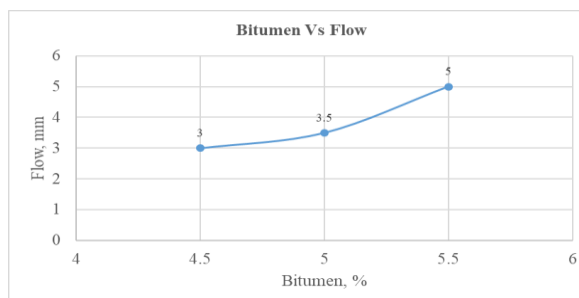
Table No.5 Marshal Test Result of 2% Plastic Replacement Mix

Bitumen (%)	Bulk density (gm/c)	V _v (%)	VMA (%)	VFB (%)	Stability (KG)	Flow (mm)
4.5	2.513	7.49	16.49	54.55	919.14	3
5	2.554	5.14	15.11	65.96	1050.65	3.5
5.5	2.538	4.92	16.65	68.55	928.81	5



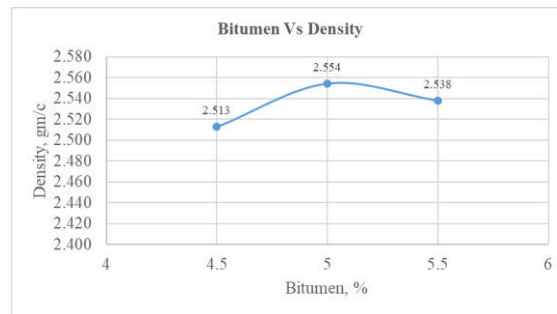
Graph No.7 Bitumen Vs Stability for 2% Plastic

Bitumen Vs Stability graph is plotted to get the bitumen content corresponding to maximum stability value with reference to above table at 4.5, 5 and 5.5% bitumen Content is shown maximum stability value. With reference to above table at 5% bitumen content shows maximum stability.



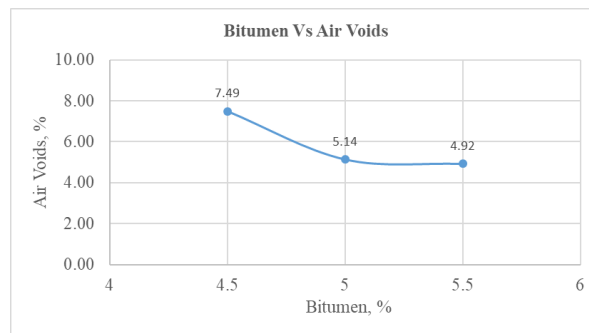
Graph No.8 Bitumen Vs Flow for 2% Plastic

Bitumen Vs Flow graph is plotted to get the bitumen content corresponding to flow value with reference to above table at 4.5, 5 and 5.5% bitumen Content.



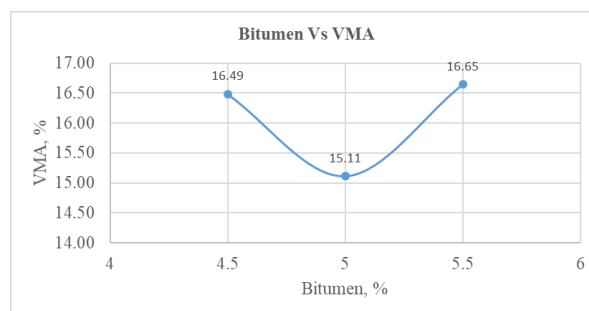
Graph No.9 Bitumen Vs Density for 2% Plastic

Bitumen Vs Density graph is plotted to get the bitumen content corresponding to maximum Density value with reference to above table at 4.5, 5 and 5.5% bitumen Content. Here maximum density is achieving at 5% bitumen content.



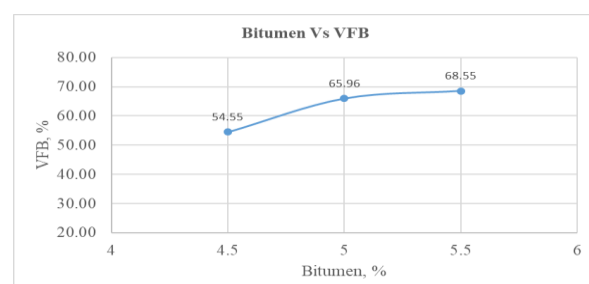
Graph No.10 Bitumen Vs Air Voids for 2% Plastic

Bitumen Vs Air Voids graph is plotted to get the bitumen content corresponding to Air Void value with reference to above table at 4.5, 5 and 5.5% bitumen Content. From the graph, the bitumen content corresponding at 5% air void is 5%.



Graph No.11 Bitumen Vs VMA for 2% Plastic

Bitumen Vs VMA graph is plotted to get the VMA value bitumen content corresponding to optimum binder content. VMA value is checked at optimum binder content, with specified design requirement of mix.



Graph No.12 Bitumen Vs VFB for 2% Plastic

Bitumen Vs VFB graph is plotted to get the bitumen content corresponding to VFB value with reference to above table at 4.5, 5 and 5.5% bitumen Content. VFB value is checked optimum binder content. Now from the analysis for all graphs optimum binder content = $(5+5+5)/3 = 5\%$

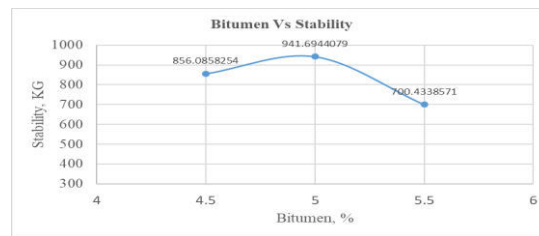
Hence optimum binder content for conventional mix is 5%.

4.6 Marshal Test Result of 4% Plastic Replacement Mix

In this trial 4% Chunk Plastic is replaced with 4.75mm aggregates for Bitumen (by weight) 4.5, 5 and 5.5 respectively. Volumetric properties are calculated and written in table below.

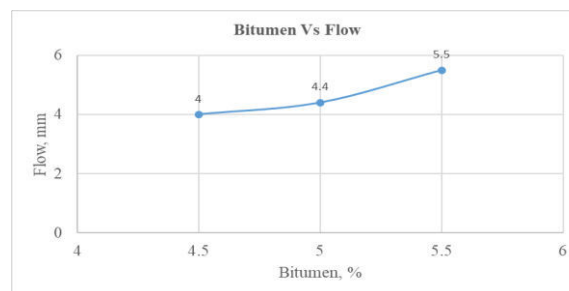
Table No.6 Marshal Test Result of 4% Plastic Replacement Mix

Bitumen (%)	Bulk density (gm/c)	V _r (%)	VMA (%)	VFB (%)	Stability (KG)	Flow (mm)
4.5	2.405	11.45	20.06	42.90	856.08	4
5	2.525	8.22	16.07	61.31	941.69	4.4
5.5	2.327	9.81	22.65	43.43	700.43	5.5



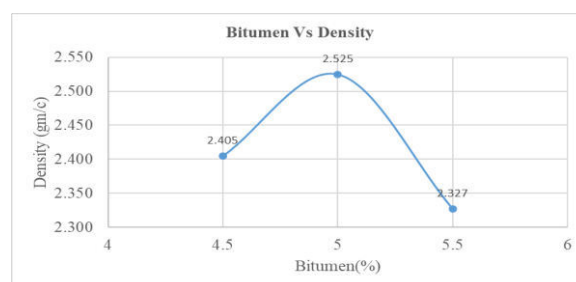
GraphNo.13 Bitumen Vs Stability for 4% Plastic

Bitumen Vs Stability graph is plotted to get the bitumen content corresponding to maximum stability value with reference to above table at 4.5, 5 and 5.5% bitumen Content is shown maximum stability value. With reference to above table at 5% bitumen content shows maximum stability.



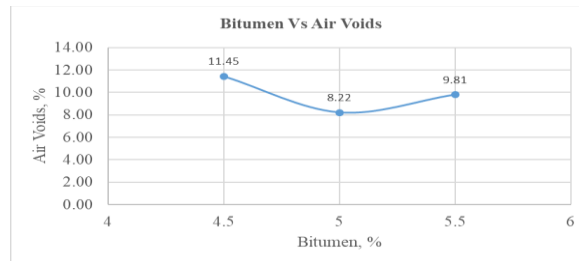
Graph No. 14 Bitumen Vs Flow for 4% Plastic

Bitumen Vs Flow graph is plotted to get the bitumen content corresponding to maximum Flow value with reference to above table at 4.5, 5 and 5.5% bitumen Content.



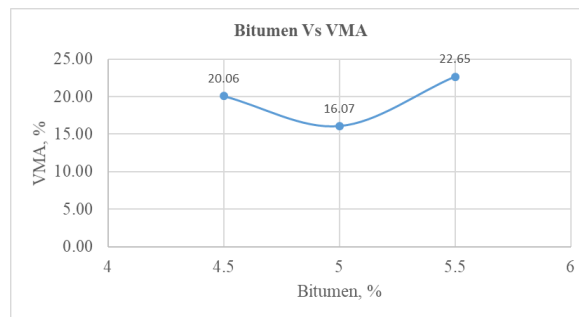
Graph No.15 Bitumen Vs Density for 4% Plastic

Bitumen Vs Density graph is plotted to get the bitumen content corresponding to maximum Density value with reference to above table at 4.5, 5 and 5.5% bitumen Content. Here maximum density is achieving at 5% bitumen content.



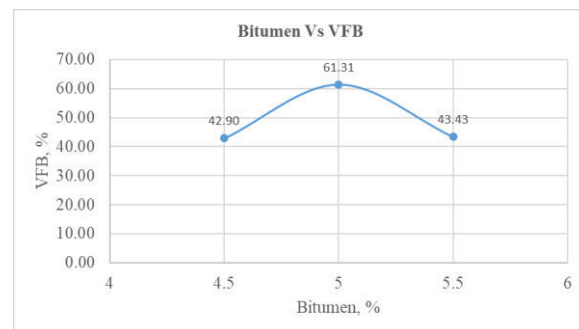
Graph No.16 Bitumen Vs Air Voids for 4% Plastic

Bitumen Vs Air Voids graph is plotted to get the bitumen content corresponding to Air Void value with reference to above table at 4.5, 5 and 5.5% bitumen Content. But for 4% Plastic replacement mix voids ratio is higher than 4% hence it is not possible to get the OBC.



Graph No.17 Bitumen Vs VMA for 4% Plastic

Bitumen Vs VMA graph is plotted to get the VMA value bitumen content corresponding to optimum binder content. VMA value is checked at optimum binder content, with specified design requirement of mix.



Graph No.18 Bitumen Vs VFB for 4% Plastic

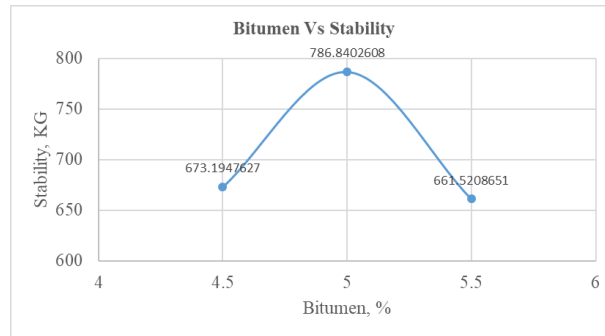
Bitumen Vs VFB graph is plotted to get the bitumen content corresponding to VFB value with reference to above table at 4.5, 5 and 5.5% bitumen Content.

4.7 Marshal Test Result of 6% Plastic Replacement Mix

In this trial 6% Chunk Plastic is replaced with 4.75mm aggregates for Bitumen (by weight) 4.5, 5 and 5.5 respectively. Volumetric properties are calculated and written in table below.

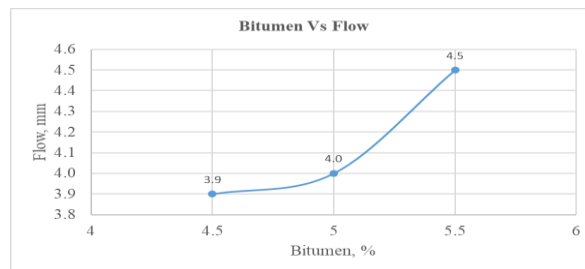
Table No.7 Marshal Test Result of 6% Plastic Replacement Mix

Bitumen (%)	Bulk density (gm/c)	V _r (%)	VMA (%)	VFB (%)	Stability (KG)	Flow (mm)
4.5	2.428	12.63	19.31	44.98	673.19	3.9
5	2.472	9.21	17.85	54.03	786.84	4.0
5.5	2.327	10.81	22.65	43.43	661.52	4.5



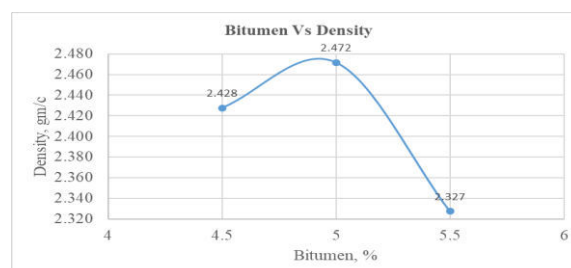
Graph No.19 Bitumen Vs Stability for 6% Plastic

Bitumen Vs Stability graph is plotted to get the bitumen content corresponding to maximum stability value with reference to above table at 4.5, 5 and 5.5% bitumen Content is shown maximum stability value. With reference to above table at 5% bitumen content shows maximum stability.



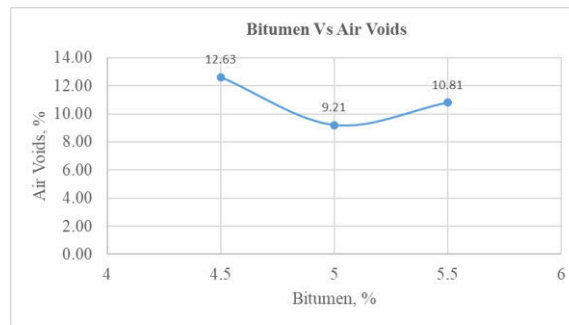
Graph No.20 Bitumen Vs Flow for 6% Plastic

Bitumen Vs flow graph is plotted to get the bitumen content corresponding to flow value with reference to above table at 4.5, 5 and 5.5% bitumen content.



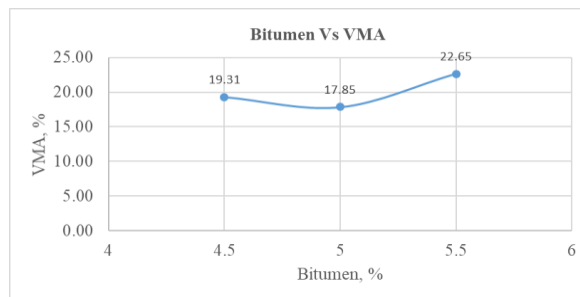
Graph No.21 Bitumen Vs Density for 6% Plastic

Bitumen Vs Density graph is plotted to get the bitumen content corresponding to maximum Density value with reference to above table at 4.5, 5 and 5.5% bitumen Content. Here maximum density is achieving at 5% bitumen content.



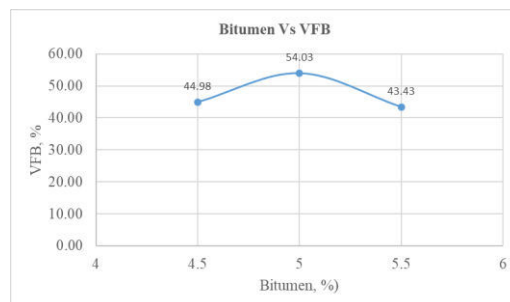
Graph No.22 Bitumen Vs Air Voids for 6% Plastic

Bitumen Vs Air Voids graph is plotted to get the bitumen content corresponding to Air Void value with reference to above table at 4.5, 5 and 5.5% bitumen Content. But for 6% Plastic replacement mix voids ratio is higher than 4% hence it is not possible to get the OBC.



Graph No.23 Bitumen Vs VMA for 6% Plastic

Bitumen Vs VMA graph is plotted to get the VMA value bitumen content corresponding to optimum binder content. VMA value is checked at optimum binder content, with specified design requirement of mix.



Graph No.24 Bitumen Vs VFB for 6% Plastic

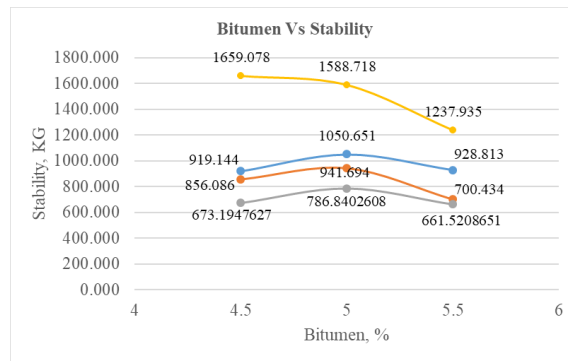
Bitumen Vs VFB graph is plotted to get the bitumen content corresponding to VFB value with reference to above table at 4.5, 5 and 5.5% bitumen Content. VFB value is checked optimum binder content.

4.8 Marshal Mix Results of Conventional and Plastic Mix

Now, various volumetric properties like bulk density, air voids, VFB, VMA, stability and flow are plotted bitumen of 4.5, 5 and 5.5 % content with conventional and each mix of Plastic replacement. The graphs for these combinations are superimposed with volumetric properties of conventional mix.

Table No.8 Combinations Are Volumetric Properties of Conventional and Plastic Mix.

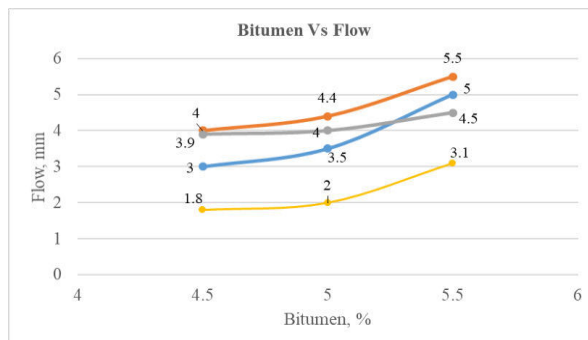
Bitumen (%)	Chunk Polyethylene (%)	Stability (KG)	Flow (mm)	Bulk density (gm/c)	V _r (%)	VMA (%)	VFB (%)
4	0%	1659.08	1.8	2.45	7.23	17.42	58.49
	2%	919.14	3	2.51	7.49	16.49	54.55
	4%	856.09	4	2.41	11.45	20.06	42.9
	6%	673.19	3.9	2.43	12.63	19.31	44.98
5	0%	1588.72	2	2.46	5.6	17.52	66.34
	2%	1050.65	3.5	2.55	5.14	15.11	65.96
	4%	941.69	4.4	2.53	8.22	16.07	61.31
	6%	786.84	4	2.47	9.21	17.85	54.03
5.5	0%	1237.94	3.1	2.42	4.28	17.53	75.58
	2%	928.81	5	2.54	4.92	16.65	68.55
	4%	700.43	5.5	2.43	9.81	22.65	43.43
	6%	661.52	4.5	2.33	10.81	22.85	44.34



Graph No. 25 Bitumen Vs Stability

Variation in stability value with respect to increase in bitumen content are plotted for different mix in the graph no 25. For 2%, 4% and 6% stability increases when bitumen content increases for 4.5% to 5%, but further increment in bitumen 5.5% bitumen content stability slightly tends to decline. But all the stability values are lower than conventional mix but have higher value than the limiting value of stability i.e., 9kN. except 6% and 2% Plastic replacement. 4% Plastic replacement have stability value more than limiting value with all bitumen content. Maximum stability of the partial replacement Plastic mix obtained with 5 % bitumen. Optimum binder content corresponds to maximum Stability:

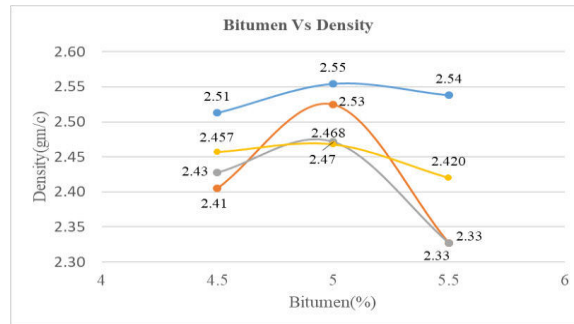
- For 2% replacement, OBC = 5 %
- For 4% replacement, OBC = 5 %
- For 6% replacement, OBC = 5 %



Graph No.26 Bitumen Vs Flow

Flow Vs Bitumen graph no 26, for Plastic replacement mix shows linear trend as compare to conventional mix. It is observed that with increase bitumen content flow value increases. All the graphs of Plastic mix show similar trend as

that of conventional mix. The flow values of Plastic mix are exceeding the limiting value as increase in bitumen content.

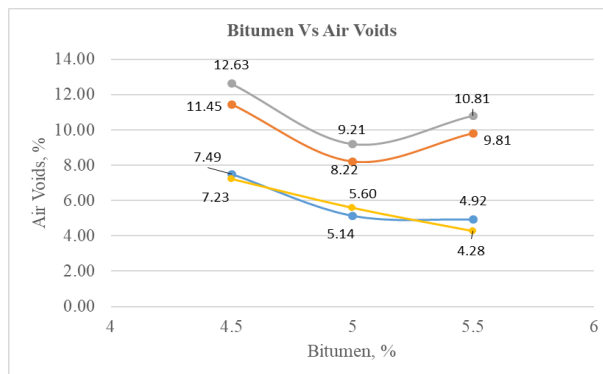


Graph No.27 Bitumen Vs Density

It is observing from graph no 27 that increase in bitumen content bulk density increases with bitumen content of 4.5% & 5% but later decreases significantly for 5.5% bitumen content. To get the optimum binder content for each mix, bitumen content corresponds to maximum bulk density is recorded.

Optimum binder content corresponds to maximum bulk density:

- For 2% replacement, OBC = 5 %
- For 4% replacement, OBC = 5 %
- For 6% replacement, OBC = 5 %

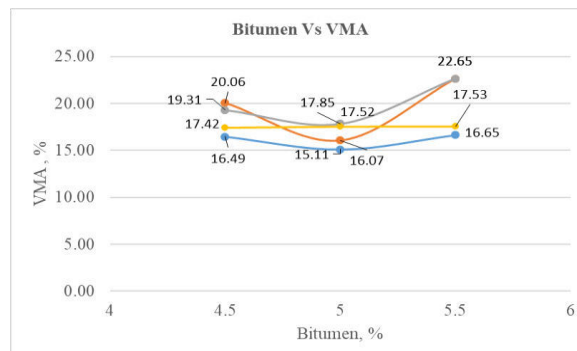


Graph No. 28 Bitumen Vs Air Voids

Is shows relationship between air void and bitumen content of the mix. With reference to above graph, for 6% Plastic void ratio slightly reduces with increases bitumen content. In case of 2% and 4% Plastic initially with 4.5% and 5% bitumen content shows slightly reduction in voids ratio, but further with 5.5% bitumen shows small increase.

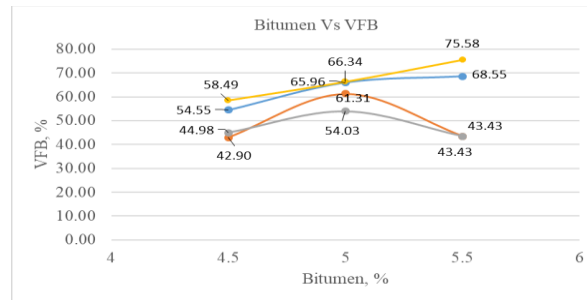
Optimum binder content corresponds to maximum Stability:

- For 2% replacement, OBC = 5 %
- For 4% replacement, OBC = NA
- For 6% replacement, OBC = NA



Graph No.29 Bitumen Vs VMA

Increase in bitumen content shows increase in VMA with reference to above graph, 29. For 2%, 4% and 6% Plastic shows initially decreasing VMA for 4.5% and 5% bitumen but for 5.5% bitumen VMA also increases. For conventional mix VMA is significantly constant for each bitumen content.



Graph No. 30 Bitumen Vs VFB

It shows increase VFB as bitumen content increases with reference to above graph no 30. For conventional mix and 2% Plastic mix shows increase in VFB with increase in bitumen content. For 4% and 6% Plastic mix initially VFB increased with increase in bitumen but further increase in bitumen shows reduction in VFB Initially.

V. CONCLUSION

The use of Plastic in bituminous road construction has been a topic of debate for many years. While some argue that it can enhance the durability and strength of the road, others are concerned about the potential negative impacts on the environment. Based on the available research, it appears that the use of Plastic in bituminous road construction can indeed improve the performance of the road.

Based on the results and discussion of experimental investigation carried out on bituminous mix of partially replaced Plastic. The following recommends the conclusion from the review.

1. The use of Plastic as a replacement for traditional coarse aggregates results in a weaker mix than traditional mix. Since Plastic is not as hard as the crushed stone aggregates, Marshall stability of Plastic aggregate mix would be lower than a conventional mix.
2. The Marshall Stability Test method is the comprehensive test method to determine the structural strength and deformation of the engineering properties of Plastic mix.
3. From the Marshall test results it is concluded that the all replaced Plastic mix shows good results for stability and flow values for 5% bitumen content. Results show that OBC is 5% with Plastic for mix as a partial replacement of the coarse aggregate.
4. For 2% Plastic replacement content gives better results in terms Marshal stability, Flow value etc. for each bitumen content. With 2% Plastic mix, optimum binder content of 5% showed the highest average marshal stability of 1050 KG.
5. The Plastic bitumen mix performance stability design mix identifies the aggregate gradation type, waste Plastic particles gradation and percentage, the optimum bitumen content, and the asphalt pavement type.
6. The use of Plastic in bituminous mixtures can improve flexible pavement performance and adheres to environmental compliance.
7. Plastic has property of sound absorption, which can help in reducing the sound pollution of heavy traffic roads. The use of Plastic may enhance the quality and performance of the road.
8. From estimation it is possible to save cost of construction and some amount of natural stone aggregate & majorly minimizes the pollution occurred due to waste tyre and also use of Plastic waste is economical.

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Design Water Supply Network Using EPANET Software

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ABSTRACT: Water supply is an essential part of modern society, and the design of a reliable and efficient water supply network is crucial for meeting the growing demands of urbanization. EPANET is a popular software used for designing water supply networks. In this research paper, we propose a methodology for designing water supply networks using the EPANET software. The proposed methodology includes steps such as data collection, network modelling, simulation, and optimization. We illustrate the methodology through a case study of a water supply network in a small town. The results show that the proposed methodology can help design a water supply network that meets the required demands with minimal costs. The general features of the area like information about the main water source, the population of the area, demand for water, the requirement of the pumps, distribution network and water tanks are essential for the efficient design of the water distribution system. According to the government of Himachal Pradesh the per capita consumption of water by an Individual person is 70 litres per day and design has been made accordingly. This work highlights the process carried out on the design of a water supply system with the help of all this information and the design of the water supply scheme for the area with the help of the software “EPANET”. The design of the water supply scheme for the proper supply of water is efficient to meet the daily requirement of water in this area.

I. INTRODUCTION

A water distribution system is a hydraulic infrastructure consisting of elements such as pipes, tanks reservoirs pumps and valves etc. It is crucial to provide drinking or potable water to the end-users; hence, an effective water supply is of paramount importance in designing a new water distribution network or in expanding the existing one. Computation of flows and pressures in a complex network has been of great challenge and interest for those involved with the designs, construction and maintenance of public water distribution systems. Analysis and design of pipe networks create a relatively complex problem, particularly if the network consists of a range of pipes as frequently occurs in water distribution systems of large metropolitan areas. In the absence of significant fluid acceleration, the behaviour of a network can be determined by a sequence of steady-state conditions, which form a small but vital component for assessing the adequacy of a network. Water distribution networks play an important role in modern societies being their proper operation directly related to the population’s well-being. However, water supply activities tend to be many problems, so to guarantee good service levels in a sustainable way the water supply systems’ performance must be evaluated. The incorporation of performance assessment methodologies in management practices creates competitiveness mechanisms that lead to a culture of efficiency and the pursuit of continuous improvement. The desired sustainability involves both water services and water infrastructures. The optimal management of urban water infrastructures is an unavoidable issue that needs to be addressed given their intrinsic value (water infrastructures represent an important portion of the municipal public infrastructures) and the potential consequences of the service disruption.

1.2 Water Distribution Network Analysis Using Epanet Software

One of the earliest theories into inputs and outputs is known, but the flow inside the network is unknown. The Hardy Cross method is an adaptation of the Moment distribution method, which was also developed by Hardy Cross as a way to determine the moments in indeterminate structures. The method was later made obsolete by computer-solving algorithms employing the Newton-Raphson method or other solution methods that removed the need to solve nonlinear systems of equations by hand. The solution to water flow and pressure in water distribution network findings includes

the popular Hardy Cross method which is an iterative method for determining the flow in pipe network systems where the inputs and outputs are known, but the flow inside the network is unknown.

1.3 Justification for the use of EPANET

The EPANET software developed by the USA Environmental Protection Agency is adopted because it is for general public and educational use and it is available free online. It has the capacity to analyze an unlimited number of pipes and tanks. EPANET has become a popular tool in analyzing complex and simple water distribution networks in both developed and developing countries of the world. EPANET is a computer program that performs an extended-period simulation of hydraulic and water quality behaviour within pressurized pipe networks. A network consists of pipes, nodes (pipe junctions), pumps, valves and storage tanks or reservoirs. EPANET tracks the flow of water in each pipe, the pressure at each node, the height of water in each tank, and the concentration of a chemical species throughout the network. EPANET is designed to be a research tool for improving our understanding of the movement and fate of drinking water constituents within distribution systems. It can be used for many different kinds of applications in distribution systems analysis. This paper, it was used to carry out the hydraulic analysis of the distribution network of the study area.

1.4 Water Distribution Network Analysis using EPANET Software

Water distribution network analysis is a critical component of water management, as it helps to identify bottlenecks, potential failure points, and areas where improvements can be made. EPANET software is one of the most widely used tools for analyzing water distribution networks, providing comprehensive information on water flow and pressure, as well as hydraulic and water quality characteristics. This software has become a popular choice among engineers, water management professionals, and researchers, as it offers a user-friendly interface and flexible data input options. In this article, we will examine the basics of water distribution network analysis and the features and benefits of EPANET software.

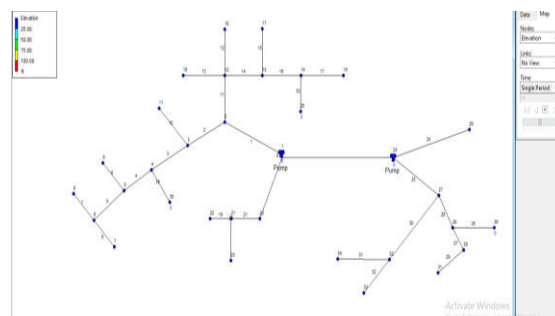


Fig.1 Water Distribution Network Analysis

II. LITERATURE REVIEW

Manoj Nallanathel et.al (2018) Conducted research on “Water distribution network design using EPANET A case study” The main objective of this project is to study and design the water distribution network of SAVEETHA University using EPANET software. So that we want to check whether the water supplied to the consumers in a reasonable pressure or not. The requirements for this study include of SAVEETHA University map, demand based on block-wise population, the elevation of node location, pipe length, roughness coefficient and diameter of the pipe. The SAVEETHA University map was extracted from google earth which consists of 15 blocks and the elevation of the nodes was determined from the Height and Instrument method of levelling. The water demand was calculated based on the number of people in each block. The water distribution network in the SAVEETHA University consists of 14 pipes, 14 nodes and one main overhead tank. The diameter of the pipe is 250mm for the total network. The pipe material is made up of cast iron which has a roughness coefficient of 110 and was used for the entire network system. The peak hour is from 4 am to 5 am because the water should be distributed from the main overhead tank to individual buildings before the consumers wake up in the morning, later the water supplied can be used for their routine purposes.

CALGARY et.al (2019) Conducted research on an “investigation into using Epanet software to design trickle-fill water distribution systems” Small rural drinking water systems in Alberta face financial challenges when supplying potable water via a traditional pressurized distribution system. In many rural settings, the costs can be reduced by employing an innovative solution of distributing and delivering water via a low-pressure water supply system, often called a trickle-fill system. This research develops a modelling approach to design the trickle fill system in Rocky View County, Alberta and investigates into Epanet software application suggested by US Environmental Protection Agency to study and analyze system hydraulics, water quality, and energy profile. The conducted research concludes the

trickle-fill system design cannot be performed by Epanet alone and suggests modelling software applications suitable for rural water development to be used in combination with Epanet software. The study proposes options for energy optimization for Rocky View County and finds that trickle-fill system implementation is the most suitable option.

Muzaffar M et.al (2021) Conducted research on “Optimization of Water Distribution Network Design Using the Shuffled Frog Leaping Algorithm” Shuffled Frog Leaping Algorithm ~SFLA! is a meta-heuristic for solving discrete optimization problems. Here it is applied to determine optimal discrete pipe sizes for new pipe networks and for network expansions. SFLA is a population-based, cooperative search metaphor inspired by natural memetic. The algorithm uses memetic evolution in the form of the infection of ideas from one individual to another in a local search. The local search is similar in concept to particle swarm optimization. A shuffling strategy allows for the exchange of information between local searches to move toward a global optimum. This paper summarizes the development of SFLANET, a computer models that links SFLA and the hydraulic simulation software EPANET and its library functions. The application of SFLANET to literature network design problems is then described. Although the algorithm is in its initial stages of development, promising results were obtained.

Rajiv Batish (2019) Conducted research on “A New Approach to the Design of Intermittent Water Supply Networks” Drinking water systems should invariably be operated on a continuous pattern for twenty-four hours a day. But due to financial constraints, it is not practically possible to operate drinking water systems for twenty-four hours a day in developing countries. Generally, a period of eight hours or less is considered adequate to supply drinking water. Due to the present faulty design practice, which is derived from the continuous water supply, the consumers are deprived of adequate water quantity and pressure. Intermittent water supplies are unique in themselves and need a different approach for design and modelling other than the continuous water supplies. The demand for water at a particular node is an important characteristic of the continuous water supply, but it is the SUPPLY of water at a node that drives the intermittent systems. Many factors like charging of water mains at the start of supply each day, ingress of contaminant due to negative pressure, application of peak factors, changing resistance coefficients, equitable water distribution using zoning valves, leakages etc. are peculiar features of intermittent water supply. A comparative study of an existing town in northern India is presented for the design of a new water supply system using present design practices and a proposed design method. The attempt has been made using” EPANET” software and it is suggested that the new method is more practical and realistic for the design of intermittent drinking water systems.

Dr. H. Ramesh et.al (2012) Conducted research on “Simulation of Hydraulic Parameters in Water Distribution Network Using EPANET and GIS” Water supply system is a system of engineered hydrologic and hydraulic components which provides water supply. The major objective was to generate satellite-based thematic layers, town and ward boundary maps and Geospatial Information System-based census data to estimate water demand, and design transmission lines and main pipelines to meet the requirement of future demand. GIS has been used to integrate and estimate the quantity of earthwork to be excavated in terms of cutting and filling through the Digital Elevation Model (DEM). The pipe network system is simulated to understand its behaviour for different inputs using EPANET 2.0. In the present study, both single-period and extended-period simulations were carried out for the distribution network system for one ward. Simulation has been carried out for hydraulic parameters such as head, pressure and flow rate. Total Energy Line and Hydraulic Gradient Line were prepared for the simulated results.

III. METHODOLOGY

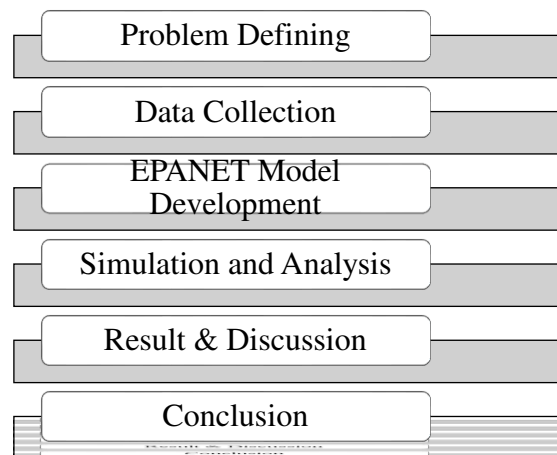


Fig.2 Methodology Flowchart

3.1 Description of Area

The area for which we are designing the water distribution system is Village Charoli, Pune. The population of the area is 990 (source IPH, personal comm.). The distribution system designed here is a tree system or dead-end system. By the use of EPANET that is by filling in the data into it about the number of nodes, demand, elevation, tanks and pipes we design the respective distribution system. The number of nodes designed here are 36 and 2 overhead water tanks and these all are shown in figure 1 below,

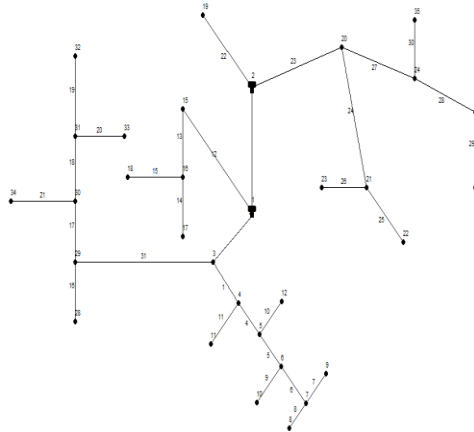


Fig.3 Charoli Distribution Area

3.2 Population Determination

Determination of population is one of the most important factors in planning if the project has to serve the community for a certain design period. Normally, a design period of 20 to 40 years is selected. What will be the population at the end of the design period is the basic question. This can be achieved by using various methods for the population.

3.3 Arithmetical Increase Method

This is the simplest method of population forecast, though it generally gives lower results. In this method, the increase in population from decade to decade is assumed constant. Mathematically, this hypothesis may be expressed as

$$\frac{dp}{dt} = K$$

Where $\frac{dp}{dt} = K$ is the rate of change of population, K is a constant. From the census data of the past 3 to 4 decades, the increase in population for each decade is found, and from that an average increment is found. For each successive future decade, this average increment is added. The future population P_n after n decades is thus given by,

$$P_n = P + nI$$

Where,

P_n = future population at end of n decades

P = Present population

I = Average increment for a decade

3.4 Geometrical Increase Method or Uniform Percentage Growth Method

In this method, it is assumed that the percentage increase in population from decade to decade is constant. From the population data of the previous three or four decades, the percentage increase in the population is found and its average is found. If I_g is the average percentage increase per decade, or r_g is the increase per decade expressed as a ratio, the population P_n after n decades is given by

$$P^n = \left(1 + \frac{I_g}{100}\right)^n = P(1+r_g)^n$$



Let P be the present population and P₁ be the population after one decade.

Then,

$$P_1 = P + \frac{I_g}{100} = \left(1 + \frac{1}{100}\right) P$$

$$P_n = P \left(1 + \frac{I_g}{100}\right)^n$$

This method gives a higher result since the per cent increase never remains constant but, instead decreases when the growth of the city reaches saturation.

3.5 Incremental Increase Method

This method combines both the arithmetic average method and the geometrical average method. From the census data for the past several decades, the actual increase in each decade is found. Then increment in each decade is found. Population in the next decade is found by adding to the present population the average increase plus the average incremental increase per decade. The process is repeated for the second future decade, and so on. And it is expressed as:

$$P_n = P + nI + n(n+1)r/2$$

Where,

P = present population

I = average increase per decade

r = incremental increase

n = number of decades

Let P be the present population. The population P₁ after one decade will be,

$$P_1 = P + I + Ir$$

3.6 water system losses

Losses from a water distribution system consisting of Leakage and overflow from service reservoirs, Leakage from main and service pipe connections, Leakage and losses on customer premises when they get unmetered household supply, Under – registration of supply meters and large leakage or wastage from public taps. In the case of a well-maintained and fully metered water distribution system, the losses may hardly exceed 20% of the total consumption. In a system where supply is partly metered and partly – metered the losses may be up to 50% of the total supply.

3.7 DESIGN:

METHODS OF DISTRIBUTION:

Three methods or systems are outlined below:

- (i) Gravity system
- (ii) Pumping system
- (iii) Combined gravity and pumping system

LAYOUT OF DISTRIBUTION NETWORKS

There are four principal methods of layout for distribution systems:

- (i) Dead end or tree system
- (ii) Gridiron system
- (iii) Circular or ring system
- (iv) Radial system



3.8 Steps in Designing Water Distribution Networks

- (i) Conducting topographic surveys and preparation of maps.
- (ii) Preparation of tentative layout.
- (iv) Computation of discharges in pipelines.
- (iv) Calculation of pipe diameters.
- (v) Computation of pressures in the pipelines.
- (vi) Determination and positioning of appurtenances

Surveys and Maps

The strip of land lying between the source of water supply and the distribution area is surveyed to obtain the levels for fixing up the alignment of the rising main. This main will carry treated water to the distribution reservoir(s) located in the distribution area. The distribution area is also surveyed and detailed maps are prepared to show the positions of roads, streets, lanes, residential areas, commercial localities, industrial areas, gardens etc. A topographical map of the area is prepared to locate the high and low areas. The cross-section of streets, roads, lanes, etc. is prepared, showing the position of existing underground service lines like electric and telephone lines, sewer lines, existing water supply lines (if any), etc.

Tentative Layout

A tentative layout of the distribution line is then marked, showing the location of the treatment plant(s), distribution mains, distribution and balancing reservoirs, valves, hydrants, etc. The whole area is divided into various distribution districts. The density of the population (average number of people per hectare area) is also marked. The length of pipelines should be kept as short as possible.

Discharge in Pipelines

Based on the density of the population, type of distribution district (residential, commercial etc.) and firefighting and other requirements, the discharge required from each pipeline is calculated. The fire hydrants are placed at 50 to 100m intervals on straight runs, and on street junctions. The size of the distribution pipes is fixed such that a minimum necessary pressure head is maintained at all points, carrying peak hourly flow through them. The pipes should be designed for a discharge ranging from 2.25 to 3 times the average rate of supply. For populations over 50,000, the distribution mains should have a capacity of 225% of the average rate of supply, while for populations below 5000; the distribution pipes should have a capacity of 300% for the average rate of supply. The flow required for firefighting should be added to this maximum flow, to get the total flow. The pipes should be able to carry this total flow without excessive pressure drops.

Calculation of Pipe Diameters

Once the design discharge is known, pipe diameters are assumed in a way that the velocities of flow in pipes remain between 0.6 to 3 m/s. smaller velocity is assumed for pipes of smaller diameter and larger velocity for pipes of larger diameter. The loss of head in the pipes is then calculated using the Hazen Williams formula (or monogram) as:

$$V = 0.849 \times C \times R \times 0.63S \times 0.54$$

Where:

V = mean velocity of flow in a pipe (m/s)

R = hydraulic radius (mean depth) in m

S = hydraulic gradient

C = coefficient of the roughness of the pipe

In terms of diameter D of the pipe, the above formula reduces to:

$$V = 0.354 C \times D \times 0.63S \times 0.54$$

Where D is the diameter of the pipe in meters. Expressed in terms of head loss h_f and the length L of the pipe, the Hazen-Williams formula takes the following form:

$$hf = 6.843(D \times 1.167) \times VC \times 1.852$$

The discharge Q (m³/s) is given by:

$$Q = 0.278C \times D \times 2.63S \times 0.54$$

Appurtenances

Listed below are accessories that may be fitted to the distribution systems for various purposes.

- (i) Sluice valves or gate valves
- (ii) Air valves
- (iii) Reflux valves
- (iv) Relief valves
- (v) Altitude valves, and scour valves

Laying of Distribution Networks

Minimum trench depth should be $15 + D + 30 + \geq 145$ cm for heavy and normal traffic and $15 + D + 30 + \geq 115$ cm for other cases, where D is the external diameter of the pipe in cm, 15cm is the bedding thickness, 30cm is the compacted overburden thickness and the remaining is the minimum filled compacted thickness. The minimum depth of filling on the pipes should not be less than 0.8 m, and referable one meter, to protect them from traffic loads to prevent the effects of climatic changes on water, in the pipe, making it unpalatable. For distribution network sizes ranging from 7.5 cm up to 25 cm, the minimum and maximum width of the trench should be 45 cm and 80 cm respectively.

IV. RESULTS AND DISCUSSION

4.1 Details of The Charoli Area

Table 1. Details of The Charoli Area

Junction	Elevation	Demand (LPM)
3	800	21.4
4	790	9.58
5	820	8.65
6	810	7.38
7	815	4.13
8	790	2.24
9	820	1.85
10	800	3.60
11	800	1.94
12	800	2.57
15	945	2.23
16	940	11.5
17	920	6.75
18	940	4.81
19	960	2.23
20	1010	2.57
21	958	1.94
22	980	2.57
23	980	2.23
24	975	3.35
25	970	1.65
26	1250	2.25
28	803	3.84
29	803	1.94
30	803	2.57
31	790	1.26

32	770	3.84
33	800	3.84
34	800	2.8
35	1250	1.26

4.2 Pipe Description

Table. 2 Pipes Description

Node 1	Node 2	Length	Diameter	Roughness
3	5	800	185	100
4	6	1250	140	100
5	7	150	160	100
6	8	1250	140	100
7	9	80	150	100
8	10	976	130	100
9	11	860	65	100
10	12	890	75	100
11	13	980	100	100
12	14	980	70	100
15	15	910	160	100
16	16	500	140	100
17	17	1255	70	100
18	18	100	65	100
19	19	920	70	100
20	20	1090	140	100
21	21	960	110	100
22	22	910	80	100
23	24	1250	100	100
24	26	1258	70	100
25	28	840	70	100
26	30	860	120	100
28	31	580	90	100
29	32	530	65	100
30	34	860	80	100
31	36	935	130	100
32	29	840	90	100
33	30	860	55	100
34	31	840	65	100
35	25	1250	110	100

Description of Graphs

By the use of EPANET various relations are being found between elevation, velocities, flow, pressure, head, demand, contours, etc. these relations can be understood by studying the graphs plotted

1. Pressure Velocity Distribution

This is the graph between pressure and velocity which shows the variation of velocity in the different pipelines with respect to the pressure provided to the particular pipeline. The different values of pressure and velocity are also given in figure 1.

2. Contour Plot Demand

This map shows the contour of different levels according to the demand at different locations in litres per meter. This is differentiated by different colours as shown in the figure.



3. Contour Plot Elevation

This map shows the contour levels according to the elevation of pipelines at different levels which is also differentiated with the help of different colours as shown in the figure.

4. Contour Plot Pressure

This map also shows the contour levels of different pressures at different nodes with the help of colours. as shown in the figure.

5. Demand Flow Graph

This is the graph between the demand rate and flows at all nodes.

6. Demand at Node 7

This is the graph between demand and time interval. This shows up and down graph. That is firstly the graph goes increases and then decreases and again soon as shown in the figure.

7. Demand and Unit Head Loss

This is the graph between the demand rate and the amount of heat loss at each node as shown in the figure.

8. Pressure-Flow Distribution

This graph between pressure and flow shows variation in pressure and velocities by different colours as shown in the figure.

9. Elevation-Diameter Distribution

This graph shows variation in elevation and diameter by different colours as shown in the figure.

10. Demand-Flow Distribution

This graph shows variation in demand for water and flow distribution in figure

11. Pressure-Velocity Distribution

This graph shows variations in pressure and velocity distribution through different values allotted by different colours as shown in the figure.

12. Pressure Graph for Node 5

This graph shows the variation in pressure in node 5 during different time intervals. Water is supplied for 8 hours a day. This is shown in the figure.

13. System Flow Balance

This graph is shown in the figure.

14. Pressure Graph for Node 29

The pressure at node number 29 with respect to time is shown in figure

15. Pressure Graph for Node 15

The pressure graph for node number 5 is shown in the figure.

All the figures explained above are shown below

4.3 Pressure Vs Velocity Distribution

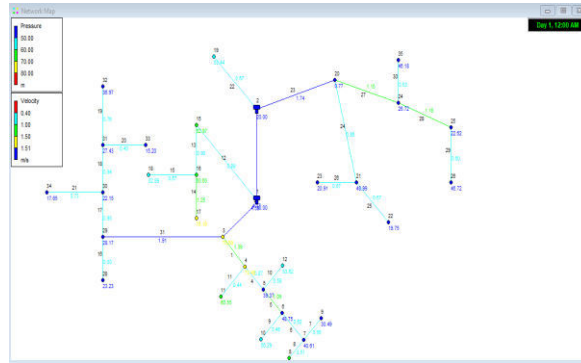


Fig.4 Pressure Vs Velocity Distribution

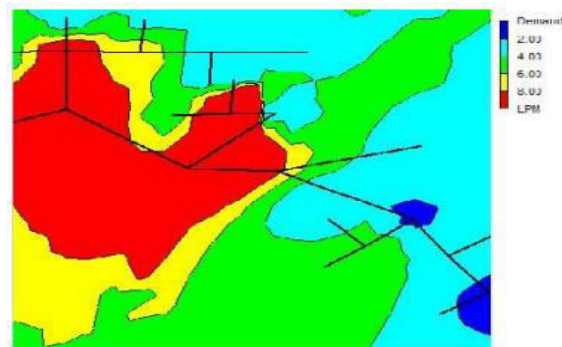


Fig.5 Contour Plot of Demand

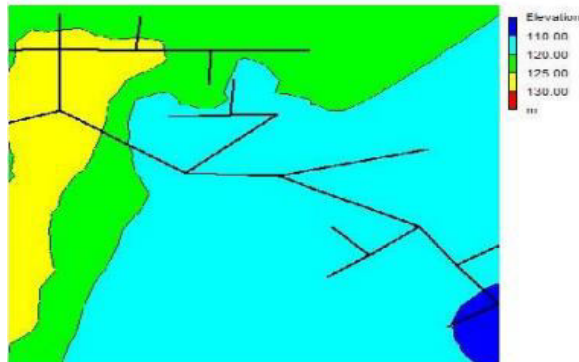


Fig.6 Contour Plot of Pressure

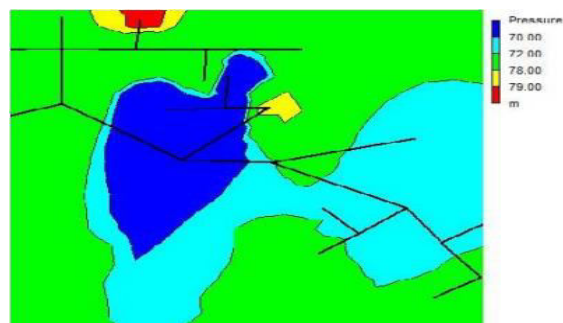


Fig.7 Contour Plot of Elevation

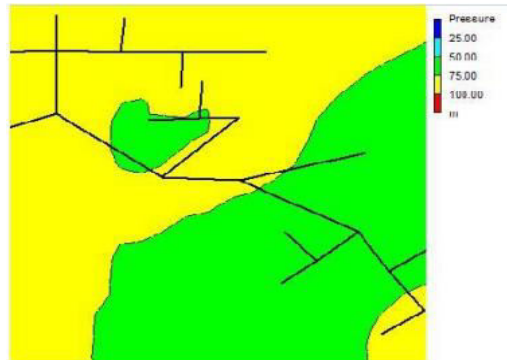


Fig.8 Contpressure

4.4 Elevation Vs Diameter Distribution

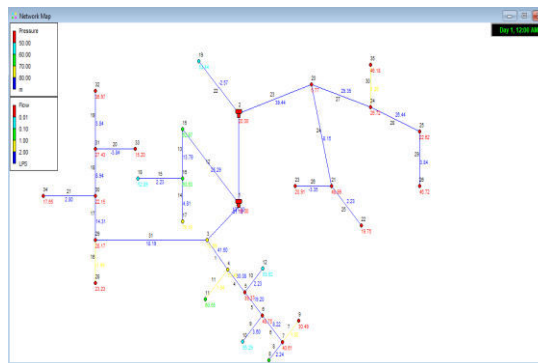


Fig.9 Elevation Vs Diameter Distribution

4.5 Elevation Vs Diameter Distribution

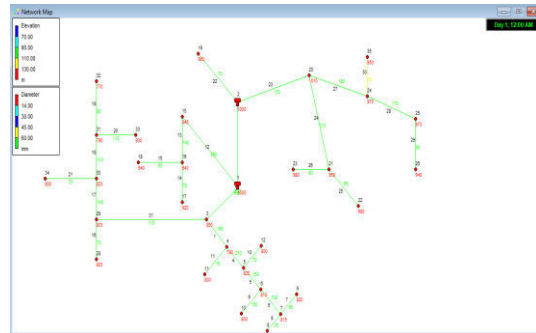


Fig.10 Elevation Vs Diameter Distribution

4.6 Demand Vs Flow

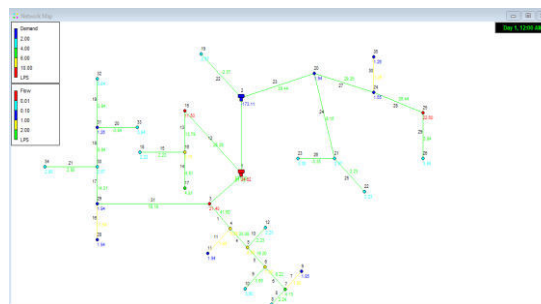


Fig.11 Demand Vs Flow

4.7 Demand Vs Head loss

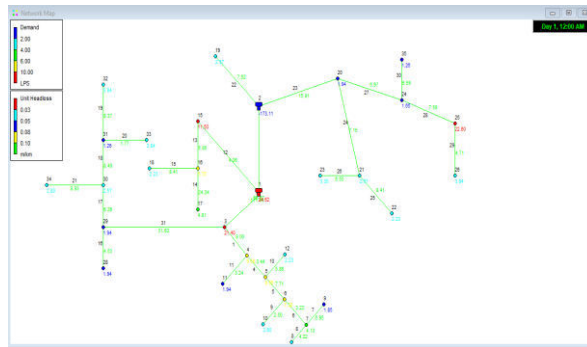


Fig.12 Demand Vs Head loss

4.8 Pressure Vs Flow

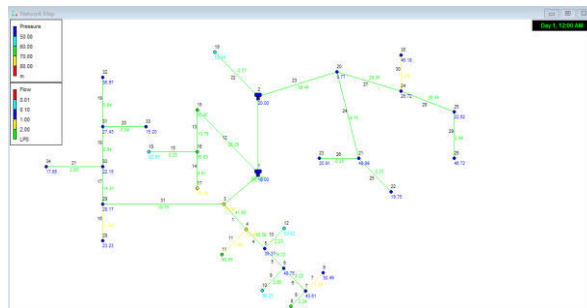


Fig.13 Pressure Vs Flow

4.9 Pressure Vs Velocity

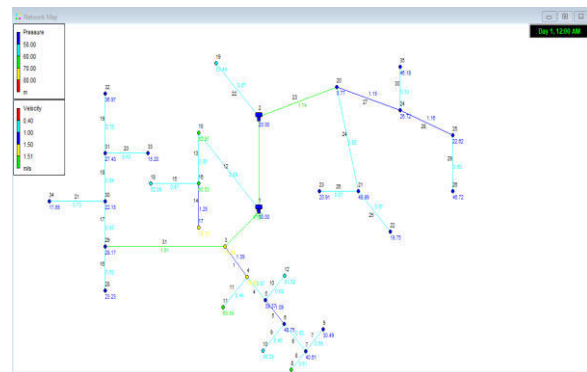


Fig.14 Pressure Vs Velocity

4.10 Pressure Flow Node 5

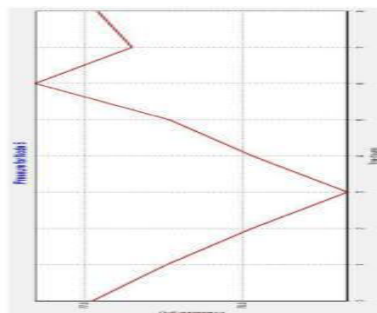


Fig.15 Pressure Node 5

4.11 System Flow Balance

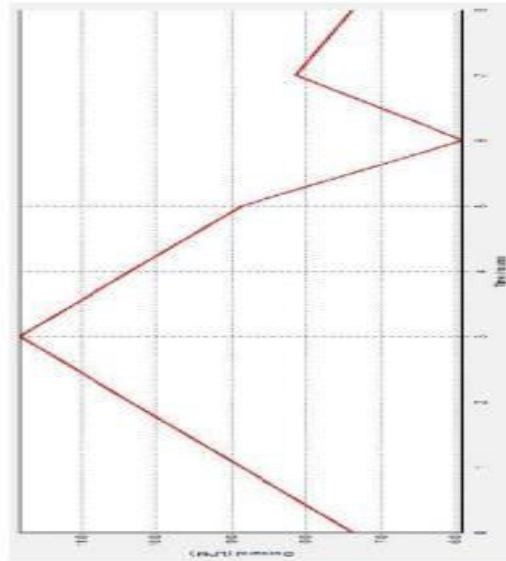


Fig.16 System Flow Balance

4.12 Pressure Graph at Node 29

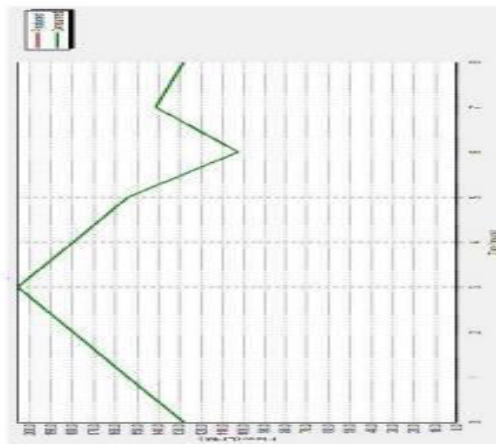


Fig.17 Pressure Graph at Node 29

4.13 Pressure Graph at Node 15

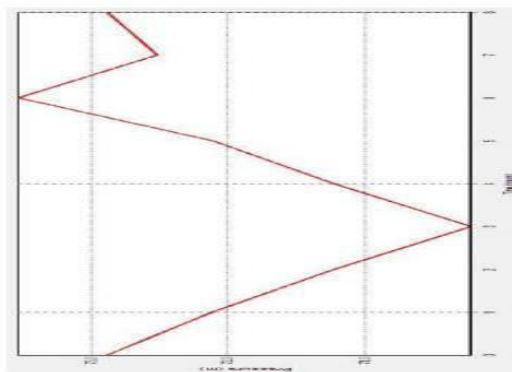


Fig.18 Pressure Graph at Node 15

V. CONCLUSION

Epanet software is a useful tool for designing water supply networks. It can model the hydraulic behaviour of water distribution systems and help in analyzing various parameters like pressure, flow rate, and water quality. The first step in designing a water supply network using Epanet software is to create a network model by inputting data like the location of pipes, pumps, tanks, and valves. This is done using the software's graphical user interface. Once the network model is created, the user can simulate different scenarios to analyze the network's behaviour. For example, they can analyze how the network will respond to changes in demand or changes in the configuration of the pipes.

Epanet software can also be used to analyze water quality in the network. The software can simulate the movement of contaminants in the network and provide insights into the impact of water quality on the network's performance. Epanet software has a variety of features and tools that can help designers optimize their water supply networks. For example, the software can suggest the optimal location for pumps and tanks to minimize energy consumption and improve the network's performance. Epanet software is a valuable tool for designing water supply networks. It enables designers to create network models, simulate different scenarios, and analyze water quality. The software's features and tools can help designers optimize their networks to improve performance and reduce energy consumption.

In this work, the water distribution system has been designed with the help of EPANET in which we use the number of nodes, elevation, number of pipes and demands of the Charoli area. First, we surveyed the area and take information about the population and per capita demand of the people. And according to that, we design the distribution system for the area. In this system 2 centrifugal pumps are used having the power of 10hp. In storage two overhead tanks are used having a capacity of 88700 litres.

Here during the daytime hours which are peak hours during the morning time, the demand for water is more as compared to the other time so the maximum supply is given for 8 hours a day. And also we concluded from the graphs that we obtained from EPANET shows that the demand is more during peak hours. The different nodes show the different variations of pressures and demand the demand is more at nodes 20, 25, 27 as compared to others. The pressures at nodes 24, 25, and 26 are more due to their elevation.

The method of distribution used here is combined gravity and pumping system as firstly the water is pumped with the help of centrifugal pumps from an underground water source i.e. from aquifers and then they are lifted up to the overhead water tanks and through there with the help of gravity system is transferred to the main rising pipe. The distribution layout used here is a tree system or dead-end system which is according to the layout of the Charoli area.

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Study and Analysis of Effective Traffic Management on Porwal Road

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ABSTRACT: Title: Effective Traffic Management on Porwal Road: A Comprehensive Approach Effective traffic management is crucial for ensuring safe and efficient transportation systems. This abstract presents a comprehensive approach to address the traffic challenges on Porwal Road, with the aim of improving traffic flow, reducing congestion, and enhancing overall safety.

The proposed traffic management plan incorporates a combination of infrastructure enhancements, technological solutions, and proactive strategies. Firstly, a detailed analysis of the road's current traffic patterns, peak hours, and congestion hotspots is conducted. This analysis forms the basis for identifying critical areas that require immediate attention. Furthermore, proactive strategies are implemented to enforce traffic regulations and promote responsible driving behaviour.

This involves increased police presence, awareness campaigns, and strict enforcement of traffic rules. Additionally, community engagement programs are initiated to encourage public participation and foster a sense of responsibility among residents.

By implementing this comprehensive approach to traffic management on Porwal Road, we anticipate significant improvements in traffic flow, reduced congestion, enhanced safety, and an overall better commuting experience. The proposed measures align with the vision of creating a sustainable and efficient transportation network for the community.

KEYWORDS: traffic management, infrastructure enhancements, technological solutions, intelligent transportation systems, proactive strategies, congestion reduction, safety improvement.

I. INTRODUCTION

Effective traffic management plays a crucial role in maintaining the smooth flow of vehicles, ensuring safety, reducing congestion, and optimizing transportation systems. Traffic-related issues have become increasingly prominent in urban areas due to the growth in population, vehicle ownership, and economic activities. Therefore, it is essential to conduct thorough studies and analyses to devise effective traffic management strategies. This paper focuses on the study and analysis of effective traffic management on Porwal Road, a major transportation artery on danori jakatanaka road .

1. Background:

Porwal Road serves as a critical link connecting various residential, commercial, and institutional areas in the city. Over the years, the increasing volume of vehicles has led to congestion, delays, and safety concerns on this road. The need for effective traffic management strategies has become paramount to ensure efficient movement of vehicles, minimize travel time, and enhance overall road user experience.

2. Objectives:

The primary objectives of this study are as follows:

a. Identify Traffic Patterns: Analyze the traffic patterns on Porwal Road, including peak hours, congestion hotspots, and traffic flow characteristics. This analysis will provide insights into the specific areas that require targeted interventions.

c. Conduct Traffic Volume Analysis: Gather data on traffic volume, including vehicle counts, types of vehicles, and classification of traffic by hour, day, and season. This analysis will help understand the demand on the road and guide future traffic management strategies.



d. Study Intersection Operations: Study the functioning of intersections along Porwal Road, including traffic signal timings, turning movements, and pedestrian crossings. Identify any synchronization issues, conflicts, or safety concerns that hinder the efficient movement of vehicles.

e. Analyze Safety Measures: Assess the existing safety measures on Porwal Road, such as speed limits, road markings, signage, and enforcement. Identify areas of improvement to enhance road user safety and reduce accidents.

II. LITERATURE REVIEW

A. Real-Time Traffic Management System ,Jehaan C. Darbari, Urvi V. Chavan, Kailash G. Bharti, Er. Manoj Kavedia, Mr. Amit Hatekar., International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 10 Issue IV Apr 2022 Following are the major findings from above paper: - To overcome these problems, we propose a system that manages traffic by taking the primary factor of real time traffic density into consideration This system utilizes cameras along with image processing to achieve its goal. It ensures that the lanes switch based on the number of vehicles, consequently cutting down waiting periods while reducing pollution substantially.

B. SMART TRAFFIC MONITORING AND CONTROLLING, Rohit Prasad, Himanshu yadav, Devarsh kumar, Sachin pandey, Abhimanyu Yadav., Journal of Emerging Technologies and Innovative Research (JETIR), June 2021, Volume 8, Issue 6, 2021 Following are the major findings from above paper: - The paper propose a system based on ATMEGA16 microcontroller that evaluates the traffic density using Laser sensors and accomplishes dynamic timing slots with different levels. A portable controller device is designed to solve the problem of emergency vehicles stuck in the overcrowded roads and notifying the vehicles the current traffic scenario.

C. Review Paper on Modern Traffic Control System ,Shashi Kumar Raman, Shripad G. Desai, ,INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN TECHNOLOGY, January 2021 IJIRT Volume 7 Issue 8 . Following are the major findings from above paper:- To keep away from such severe issues many radiant urban communities are right now implementing smart traffic control frameworks that work on the standards of traffic automation with prevention of the previously mentioned issues the research works reviewed adequately demonstrate the multiplicity of approaches possible to tackle traffic management problems in specified context Clearly dynamic systems using real time data and predictive models are better than the commonly used static systems which are insensitive to changing traffic conditions

. D. A GIS-based approach to evaluating environmental influences on active and public transport accessibility of university students ,Khatun E. Zannata., Mohammed Sarfaraz Gani Adnan, ,Journal of Urban Management 9 (2020) 331–346 Following are the major findings from above paper:- The results indicated that intersection density and land use are strongly associated with active and public transport accessibility, with weights of 0.17 and 0.16, respectively The presence of infrastructure to support active travel, and regulation to limit vehicular speed, also improved accessibility. Approximately 50% of the area of the Grenoble metropolitan region was defined as accessible and suitable ('moderate' to 'very high' degree) for active mobility.

E. Land subsidence mapping and monitoring using modi Bed persistent scatterer interferometric synthetic aperture radar in Jharia CoalBeld ,SUNIL KUMAR1 , DHEERAJ KUMAR , SUMIT KUMAR CHAUDHARY, NARENDRA SINGH1 and KAPIL KUMAR MALIK, India, Indian Academy of Sciences. Earth Syst. Sci. (2020) 129:146 Following are the major findings from above paper: - The study has been concentrated towards detecting continuous slow rate subsidence of major sites of JCF. The maximum rate of slow deformation among all sites is recorded as 29 mm/year with a cumulative subsidence value of 90 mm. Field validation of subsidence results obtained through PS-InSAR is correlated with the previously published report and the master plan of JCF, showing subsidence locations.

F. Assessing spatio-temporal growth of urban sub-centre using Shannon's entropy model and principle component analysis: A case from North 24 Parganas, lower Ganga River Basin, India ,Md Kutubuddin Dhali , Monalisha Chakraborty, Meheebub Sahana , ,The Egyptian Journal of Remote Sensing and Space Sciences 22 (2019) 25–35 Following are the major findings from above paper:- The overall result shows that urban growth of the study area is not compact in nature and it is an evidence of concentration of sprawl growth over the urban sub-centre. The study estimates that urban expansion has occurred mainly in Barrackpore I, Barrackpore II and Rajarhat area of the district. The outcome of this study can best be utilized for effective urban planning and management

G. Smart Traffic Management System for Traffic Control using Automated, Mechanical and Electronic Devices ,Mamata Rath, International Conference on Mechanical, Materials and Renewable Energy ,Materials Science and Engineering 377 (2018)

Following are the major findings from above paper:-

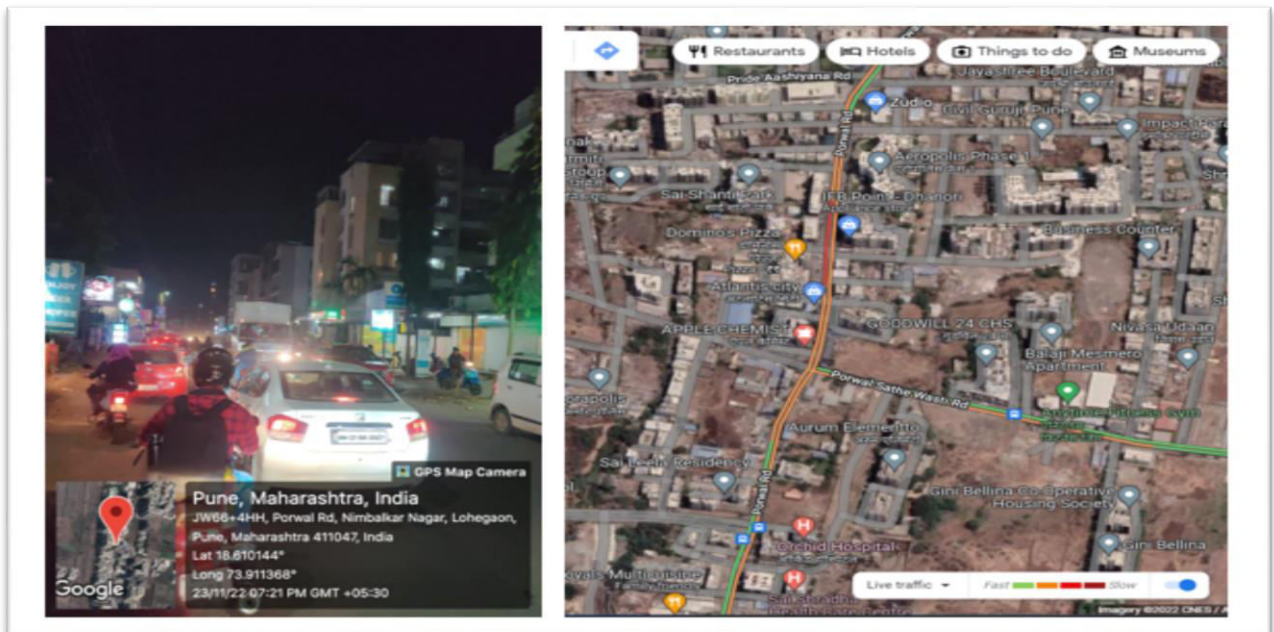
In this context, an enhanced traffic control and monitoring framework has been proposed in the present article that performs quick information transmission and their corresponding action. In the projected approach, under a Vehicular Ad-hoc Network (VANET) scenario, the mobile agent based controller executes a congestion control algorithm to uniformly organize the traffic flow by avoiding the congestion at the smart traffic zone

III. PORWAL ROAD ANALYSIS

The Porwal Road connects to D Y Patil Road after beginning at the former Octroi Chowk on the Dhanori Lohegaon Road. There are two significant high schools and numerous new housing societies being built along this entire stretch of Porwal Road. Working people, students, and ladies must therefore pass via this road every day. The only other choice is to travel 6 kilometres from the village of Lohegaon.

Only 200m of the road were built from Jakat Naka. After that, a 300-meter piece was disregarded, and the final 900 metres were built up to Nyati Evita.

Due to Martheopolis School's failure to transfer the necessary land and the lack of interest on the part of PMC or any other governmental figure in the purchase procedure, that 300m patch is unfinished. Even after a contractor was chosen from the bids, the 300 m patchwork project was abandoned due to the need for a bridge at a nullah close to BU Bhandari. But this was just a pretext. Therefore, only 300 metres of the project remain, forcing residents to utilise the congested Porwal Road. Due to difficulties with land acquisition, that 300m-long little portion is not complete. Additionally, the 200 m section of Jakat Naka has developed into a haven for criminals and a junkyard. There are illegal operations going on.



More than 50,000 people utilise Porwal Road, a road that is 10 to 20 feet wide. The traffic situation is bad from 7 am to 9 pm. The construction of D P Road is still ongoing. The Kamlai dairy square, which acts as a bottleneck leading to Orchid hospital, has already been offered as a temporary fix by the LRWA. Things are getting worse. Even though the residents of the severely underdeveloped Lohegaon region pay taxes, it is clear that they feel deceived by the local government. There are so many incidents that happen every day, and sometimes ambulances can't get to the hospital fast enough.

IV. METHODOLOGY

The study will employ a combination of qualitative and quantitative research methods. Data collection will involve field surveys, traffic counts, interviews with road users, and observations of traffic behavior. Advanced traffic simulation models and software will be utilized to analyze traffic patterns, simulate scenarios, and propose potential solutions.



1. Define the objectives: Clearly define the objectives of your study, such as reducing congestion, improving traffic flow, enhancing safety, or minimizing travel time on Porwal Road.
2. Collect data: Gather relevant data to understand the current traffic situation on Porwal Road. This can include traffic volume data, travel time data, accident records, road infrastructure details, and any existing traffic management measures in place.
3. Identify key stakeholders: Identify the stakeholders involved in traffic management on Porwal Road. This can include local authorities, transportation departments, traffic police, road users, and nearby residents or businesses. Understand their perspectives and concerns related to traffic management.
4. Analyze existing traffic management measures: Evaluate the effectiveness of the current traffic management measures on Porwal Road. This can include analyzing the impact of traffic signals, signage, road markings, lane configurations, speed limits, and any other relevant infrastructure.
5. Conduct traffic flow analysis: Use traffic engineering principles and techniques to analyze the traffic flow on Porwal Road. This can involve studying the traffic volume, speed, and density, identifying bottlenecks or congestion points, and assessing the capacity of the road.
6. Identify problem areas: Based on the data analysis, identify the areas or intersections on Porwal Road that experience high congestion, frequent accidents, or inefficient traffic flow. This will help prioritize areas for improvement.
7. Evaluate potential solutions: Research and evaluate various traffic management solutions that can address the identified problem areas. This can include measures such as optimizing signal timings, implementing roundabouts, adding or modifying lanes, improving pedestrian facilities, or implementing intelligent transportation systems.
8. Assess feasibility and impact: Assess the feasibility of implementing the identified solutions, considering factors such as cost, available resources, and potential environmental and social impacts. Use traffic modeling tools or simulations to estimate the impact of the proposed solutions on traffic flow and safety.
9. Develop an action plan: Based on the analysis and evaluation, develop an action plan that outlines the recommended traffic management measures for Porwal Road. This plan should include specific steps, timelines, responsibilities, and budget requirements for implementing the proposed solutions.
10. Monitor and evaluate: Implement the recommended traffic management measures and closely monitor their effectiveness. Continuously collect data and evaluate the impact of the implemented measures. Adjustments may be needed based on the observed outcomes and feedback from stakeholders.

Remember that effective traffic management is an ongoing process, and periodic reviews and updates to the traffic management plan may be necessary to address changing traffic patterns and evolving needs.

V. CONCLUSION

- 1) There will be a one-way section of Porwal Road in the Dhanori neighbourhood for 200 metres from Kamlai Dairy Chowk to Jakat Naka Chowk. According to information provided by the traffic police department, starting today, vehicles leaving the D Y Patil university side would turn left towards Kamlai dairy chowk and go towards Sathe vasti. On D P Road, the vehicles will turn right in the direction of Aurum Elementto Society, go to Orchid Hospital, and then turn left in the direction of Porwal Road. However, a comparable road will also be used by vehicles travelling from the 7th Heaven society road.
- 2) From 7 am to 9 pm the traffic situation remains grim due to heavy traffic and the main reason behind is the heavy vehicles used for construction activities, as it causes heavy traffic jam on porwal road. To avoid the grim we can divert the heavy vehicles from d y patil private road interance by using the DN parande park marg which directly connects to dhanori road.

VI. ACKNOWLEDGMENT

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E-waste Management and Utilization in Construction Material

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ABSTRACT: Electronic garbage, or E waste, is the term for unneeded or outdated electrical or electronic parts or equipment. In emerging nations like India, increased fast obsolescence and penetration will lead to difficulties. The largest cities in India, including Mumbai, Kolkata, Delhi, Bangalore, and Pune, are where the majority of E-waste is produced. Pune, Maharashtra, is referred to as the Oxford of the East and is the location of several businesses, mostly in the IT industry. It ranks well among the Indian cities with the highest E-waste production rates. The rate of e-waste is rapidly rising daily as a result of advances in technology, fashion, and people's per capita income. The Pune Municipal Corporation and several businesses have generally made mediocre efforts, handling just a small portion of the entire amount of E garbage produced. E-waste management is essential since it endangers people's health. An E waste control and management law is passed by the authorities for 2011, but it won't be properly implemented because there isn't enough political will. E-waste, also known as inert waste, describes outdated, abandoned items. Other names used to describe this include bio-leaching, WEEE, obsolescence rate, and precious metals.

KEYWORDS: E-waste, Bio-leaching, WEE, Obsolescence rate, Precious metals

I. INTRODUCTION

Electronic waste product (E waste) is the term used to describe discarded and end-of-life consumer electronics products, such as computers, ICT (information and communication technology) devices, household appliances, audio and video products, and all of their peripherals. There is no globally accepted format for or definition of e-waste, however the harmful consequences of e-waste may manifest on Earth as the leaching of hazardous substances from landfills into water tanks. E trash often consists of the relatively expensive and generally durable items used for communication, entertainment, or information processing in individual enterprises and homes.

E-waste recycling using outdated methods in the informal sector has the potential to damage the environment. Toxic poisoning of streams, other water sources, and wells due to the release of burning and e-waste gases into the atmosphere. If the recycling process is not carried out properly, it could harm people through the inhalation of fumes during recycling, contact of the workers' skin with hazardous materials, and communication during the application of acid therapy during the healing process. Printed circuit boards (PCBs), which include lead (Pb) and cadmium (Cd), are among the poisonous and dangerous compounds found in e-waste. The majority of electric components, cathode ray tubes (CRT), and other items include lead. CRTs and monitors employ cadmium, whereas flat-screen monitors and switches typically include mercury. Mercury is also found in CFLs, relays, and other specific goods and services. In addition to being used in laptop power packs, cadmium is also used to plate metallic enclosures and components inside of sub-assemblies. Transformers, capacitors, printed circuit boards, transparent plastic casings, cable, polyvinyl chloride (PVC) cable wrapping for PBD/PBDE, and insulation worn on clear plastic periods of appliances are all found to contain polychlorinated biphenyls. The impact of e-waste on the ecosystem has not yet been the subject of a highly coveted research.



II. RELATED WORK

The EU's laws prohibiting the use of harmful substances in connection with electrical and electronic equipment (Directive 2002/95/EC) and promoting their collection and recycling (Directive 2002/96/EC) have been in effect since February 2003. The law allows for the creation of collection programmes that let customers send back their used electronics for free. The programmes' main objective is to increase the amount of these sort of things that are recycled and reused. They also urge for the replacement of flame retardants like polybrominated biphenyls (PBB) or even polybrominated diphenyl ethers (PBDE) with safer alternatives, including key metals like lead, cadmium, mercury, along with hexavalent chromium.

95 percent of the E-Waste in India has been recycled to help the non-formal sector, and 5 percent of the E-Waste is used for conventional equipment. There are already more than 3000 devices interested in semi-formal segments for E-Waste recycling where possible inside and close to metropolitan areas in India. There are informal E-Waste recyclers located all throughout India. Delhi, Rajasthan, West Bengal, Andhra Pradesh, Kerala, Gujarat, Maharashtra, Karnataka, U.P., Tamil Nadu, and other states have a considerable number of industries.

III. METHODOLOGY

Secondary resources of information such as the latest journal and newspaper content articles, genuine online resources, etc ended up being examined for the goal of the research. By way of these kinds of online resources, effort have been designed to produce an accounting of E waste to come down with Indian context, which often aided within determining the number of several stakeholders wearing the E waste age group. Secondary energy sources of information have been chosen to be able to cater to the present research and scenario relevant to E waste in India that are extremely dispersed as well as diversified.

Systematic methodology was put to use around research work completed for learning the E-waste control.

1. Designing the exploratory and descriptive par
2. Specifying the sampling progression & size.
3. Defining the info necessary, Scaling procedures and measurement scales.
4. Construction & Pilot tests of questionnaire.
5. Data assortment & data evaluation.
6. Utilization of E waste in construction material

IV. EXPERIMENTAL RESULTS

The compressive force indicates the material quality and provides a strength that is inextricably linked to the hydrated structure. The test is carried out to measure the strengths of hardened state concrete, which is crucial for the development of concrete specimens. This is the most usual test, in which the concrete is in a hardened state. To determine compressive strength, concrete cube specimens of approximately 150mmX150mmX150mm are cast. All over specimens are kept into water & will be warmed immediately after the water tank which is be in the state of soaking condition cubes are made from moulds and are kept in a dry state in water for 24 hours before being used for cube testing. The testing will be done on cubes that have been in the tank for 3, 7, or 28 days. The sample (standard concrete mould) will be clamped between the jaws of a compressive testing equipment with a load capability of around 2000KN. The load is then applied to the cubes using compression testing equipment's jaws. The load is applied continuously up to the specimen, and the specimen will fail or crack if the mould fails to accomplish the compression force. The load is applied without fail, and the pace continues to increase indefinitely. The maximum load achieved by the specimen will be recorded. The concrete has failed in load bearing, which will be documented at the same time. Compression testing machine (CTM) with varied percentage of replacement is used to evaluate the compressive strength of concrete cubes with dimensions of 150 150 150 mm as per IS 516. Replacement materials (i.e. E-waste) come in a variety of sizes and percentage proportions. The E- waste material is mixed and comes in three sizes (less than 10 mm, between 10 and 15 mm, and up to 20 mm). These three sizes are utilized in cube samples with varying percentages of E-waste in aggregate, ranging from 0% to 5% to 10%. 15% and 20%. It can be observed that maximum compressive strength of concrete cubes is at 15% replacement of E-waste.



V. CONCLUSION

Financial growth is vital though it shouldn't be aimed with the cost of endangering the world usually the total globe is going to have to face the horrible repercussions of its. Due to lack of a sophisticated & cost-efficient e waste managing process for India, a few methods for employees interested in fingertips of e waste need to be there. It's tough to effectively cope with e waste managing around the world before a universally recognized of e-waste's description is framework plus accepted. Inside India technical as well as Industrial conflicts are exists. Lax green regulations as well as sluggish financial development permits and also promotes simple flow of dangerous wastes. Socioeconomic variables, infrastructure inadequacies as well as insufficient authorized provisions hinder appropriate e waste managing within the nation. Augmented attention is needed towards recycling as well as retrieval. In the study the influence of E-waste as a partial replacement of coarse aggregate in concrete mixture is investigated. The mix design of M25 grade of concrete for normal mix (without E-waste) and with a partial replacement of coarse aggregates with E-waste material is carried out. The effect of E-waste particle size using less than 10 mm, between 10 to 15 mm and up to 20 mm on compressive strength of concrete cubes studied.

- When the coarse aggregate is substituted by 15% with two sizes of E waste material and the results are compared to conventional concrete at 28 days strength, it is discovered that the compressive strength of concrete is higher.
- Greater than 15% replacement with any size of E-waste is not practicable or useful for the construction work.
- It can be concluded that E-waste material can be used as a partial replacement of coarse aggregate up to 15%.The problem of e-waste disposal can be solved, reducing the pollution caused by e-waste materials.

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Assessment of Ground Water Quality in Bhosari MIDC Area, Pune

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ABSTRACT: Water is a finite and important resource for living, yet the availability of water resources is decreasing with time, and water quality is degrading owing to over-exploitation. Water quality is an important factor to consider before supplying it to humans. Water that is fit for drinking must always be accessible. Studying regions with deteriorating groundwater quality is crucial since there has been a recent shortage of safe drinking water, This realisation led to the research of groundwater quality close to the Bhosari industrial area. For this purpose, samples were collected from open wells and bore wells around the Bhosari MIDC region. The sample is assessed for the following physico-chemical and biological parameter: (1)pH (2)Phosphate (3) Sulphate (4)Total hardness (5)Nitrate (6)Chloride (7)Turbidity (8)DO (9)BOD (10)COD (11)Iron (12)MPN. The objective of this study is to analyse the underground water quality of Bhosari MIDC area in pune by water quality index. Twelve physico-chemical and biological parameters collected from seven different locations since a period of 2022-23. In this study most of the water samples were found good quality and only some amount of water samples falls under moderately poor category. As a result, some treatment before use is essential and also required to protect that area from contamination.

KEYWORDS: Water quality assessment, Ground water, Physico-chemical, Drinking water, Permissible limit, Correlation.

I. INTRODUCTION

Water is essential to human life as it is used in agriculture, industry, and daily living. The health of the water ecosystem affects the physico-chemical and biological parameters. Due to rising industrialisation, urbanisation, agricultural activity, and other human activities, both surface water and ground water pollution has been increasing. The quality of water refers to its physical and chemical properties. Water may be utilised for drinking, fishing, farming, industry, and enjoyment. Each of these specified applications has certain defined chemical, physical, and biological requirements that must be met in order to serve its intended purpose. Water is the element that is most prevalent and abundant in nature. There are 1400 million billion litres of water in total, but most of it is not suitable for drinking since it is 97% sea water and just 3% fresh water, of which 2% is frozen in glaciers and the poles, and only 1% is portable. The quality of surplus water depends on how well groundwater can be used by people. In order to fulfil the needs of increasing economies, changing lifestyles, and shifting consumption patterns, there will be a major rise in the need for freshwater during the coming decades. In order to manage groundwater quality in the present and the future, it is becoming more important to estimate groundwater for drinking and irrigation. The world's groundwater, which is extensively exploited for a number of reasons, provides around 25% of the fresh water. Analysing the physical, chemical and biological characteristics of groundwater is essential for research on public health. These studies play a significant role in environmental contamination research. According to the WHO, roughly 80% of all human illnesses are caused by water. The purpose of this study is to determine the physico-chemical and biological composition of groundwater.

II. OBJECTIVE

The broad objective of the present work is to carry out the experimental studies on analysis of ground water. In the present study, an effort is made to analyse the ground water.

1. To check whether the quality of water complies with standards and to check suitability for designated purpose.
2. To obtain quantitative information on the physical, chemical, and biological characteristics of water
3. Encouraging settings for water resource use that are important socially, economically viable, and environmentally sustainable.
4. Accurate and timely information of the quality of water is necessary to shape, sound public policy and to implement water quality improvement program effectively and efficiently.

III. METHODOLOGY

Ground Water samples are collected from Bhosari MIDC Area (District-Pune). Seven Locations were selected and two samples from each location were collected from respective area. Few samples were collected from well and remaining samples were collected from bore well. After that, to check whether the water quality is in compliance with the standard methods and protocols hence suitable or not for the designate use.

Step 1: Selection of site.

Step 2: Sampling collection from Bhosari MIDC Area.

Step 3: Physical, Chemical and Biological analysis of the sample. Step 4: Comparing each result to the standard permissible limit. Step 5: Sample's quality for drinking water is analyzed.

Step 6: Correlation analysis is carried out.

IV. EXPERIMENTAL RESULTS

Parameter	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation (CV%)
pH	6.68	7.07	6.85	0.15	2.19
Total Hardness	128	294	207.8	9.64	4.6
Turbidity	0.37	0.93	0.73	0.18	24.68
Chloride	23	97	56.7	8.82	15.5
Sulphate	100	166.6	126.7	5.41	2.93
Phosphate	0.26	0.57	0.039	0.011	28.2
Nitrate	0.044	0.077	0.071	0.013	18.3
Iron	0.019	0.071	0.039	0.018	46.15
DO	1.26	5.18	2.67	2.63	98.5
BOD	3.2	8.64	6.12	1.88	30.72
COD	7.3	19.4	14.01	3.92	27.9

Table-IV.1: Descriptive statistics of the analyzed chemical components

Parameter	S1	S2	S3	S4	S5	S6	S7
MPN	7	28	0	28	28	28	0
Total Coliform Bacteria	Present	Present	Absent	Present	Present	Present	Absent
E-Coli Bacteria	Present	Present	Absent	Present	Present	Present	Absent

Table-IV. 2: Analysis results of collected samples

Correlation of physicochemical parameters of ground water:-Correlation coefficient is used to determine the relation of one variable with another variable. The correlation matrices for 11 variables were prepared from 7 samples.

From the table3 it is clear that pH shows negative correlation with TH, turbidity, chloride, sulphate, nitrate and iron. DO shows negative with TH, turbidity, Chloride, sulphate, phosphate, and iron.

	pH	TH	Turbidity	DO	BOD	COD	Chloride	Sulphate	Phosphate	Nitrate	Iron
pH	1										
TH	-0.12301	1									
Turbidity	-0.12712	0.962322	1								
DO	0.219782	-0.22999	-0.09332	1							
BOD	0.042214	0.178989	0.170769	0.600148	1						
COD	0.05156	0.175599	0.167893	0.541819	0.954695	1					
Chloride	-0.10181	0.6226	0.422982	-0.40462	0.425974	0.409547	1				
Sulphate	-0.1757	0.92094	0.807098	-0.48573	0.170456	0.191483	0.838196	1			
Phosphate	0.011276	0.646229	0.455534	-0.16478	0.481636	0.529658	0.886593	0.770754	1		
Nitrate	-0.24268	0.627396	0.549663	0.250904	0.60567	0.691067	0.563711	0.574561	0.812986	1	
Iron	-0.16171	0.548598	0.364324	-0.14795	0.25883	0.289357	0.669784	0.622793	0.900918	0.85215	1

Table-IV. 3: Correlation of physicochemical parameters of ground water



V. CONCLUSION

1. The results obtained from the analysis of physico-chemical and biological parameters for drinking purpose show that few parameters exceed the permissible limit.
2. The Total hardness values of the majority of the samples were found to be higher than the desired limits of the IS10500-2012 when the obtained results were compared with that standard.
3. The bacteriological analysis of several samples also reveals the presence of Total Coliform Bacteria and E-Coli Bacteria, proving them unsafe for drinking.
4. The source of contamination may be septic tanks too close to the well, leaking drainage water and continuous disposal of industrial effluents. Therefore there is a need of some treatment before usage and also required to protect that area from contamination.
5. Rainwater collecting structures should be developed to replenish ground water aquifers in order to improve ground water resources and preserve the quality and quantity of ground water reservoirs, therefore diluting the increased concentration of chemical elements.
6. A public awareness campaign should be launched to increase people's knowledge and understanding about how to reduce water pollution in their communities.

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Quantification & Future Prediction of Air Pollution at Nal Stop, Kothrud, Pune

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ABSTRACT: In this paper we are going to discuss dur to rapid expansion of Pune and its surroundings has had a significant negative influence on the air due to vehicle emissions. This is particularly true in poorer countries, mostly because of the high percentage of outdated, poorly maintained vehicles and poor fuel quality. Pune City must be one of the four cities, according to an order from the Indian Supreme Court. Daily changes in pollution levels will affect the city of Pune's air quality. The air quality of Central Pune City is currently being continuously and irregularly monitored by MPCB and IMD. In this report we had studied to investigate the concentration of CO, NOx, PM2.5 & PM10.

KEYWORDS: Particulate Matter 2.5(PM2.5), Particulate Matter 10(PM10), NOx, CO

I. INTRODUCTION

One of the most essential substances in the environment that humans need is air. A typical individual needs about 12 kg of air per day, which is around 12 to 15 times as much as they eat. Air pollution is always a consequence of a change in the air's natural and typical composition that has the ability to cause damage to living things, such as humans. When man first started to use firewood for heating and cooking, pollutants in the air on Earth started to rise. A major threat to public health worldwide, but especially in India, is air pollution. Launched in early 2019, the nation's National Clean Air Programme (NCAP) offers a road map for preventing, controlling, and reducing dangerous levels of air pollution. Given the increasing amount of air pollution worldwide in 2017, it was the cause of 1.24 million deaths, or 12.5% of the total fatalities reported in the nation. The allowable national ambient air quality limits have been exceeded in 122 cities nationwide, including Pune, according to a 2019 report by the Central Pollution Control Board of India (CPCB).

1.1 General: The air quality in the Pune city of India has substantially declined during the last five years. According to data gathered by the Indian Institute of Tropical Meteorology (IITM), 2018 was ranked second worst for air pollution since 2013. From 29 g/m³ in 2013 to 47 g/m³ in 2018, the average annual concentration of PM2.5 had increased by almost 60% over the previous five years, exceeding the nation's annual national ambient air quality regulation for PM2.5 of 40 g/m³. The number of days in 2017 that exceeded the annual pollution guideline rose to 94 days in 2018, based on statistics from the IITM-led continuous air quality monitoring programme.

1.2 Objectives:

- 1) To Study the various Pollutants and its causes in the Pune city.
- 2) To perform future predictions.
- 3) To study the impact of pollutants on the environment.
- 4) To compare the pollution level before and after Lockdown.
- 5) Precaution Measures to be considered to improve air quality.

1.3 Types of Pollutants:

The six common air pollutants are:

- 1) Particulate matter
- 2) Ground-level ozone
- 3) Carbon monoxide
- 4) Sulphur oxides
- 5) Nitrogen oxides



1.4 Instruments to detect Pollutants:

A device known as a tapered element oscillating microbalance (TEOM) is used in current pollution monitoring stations for calculating coarse (PM₁₀) and fine (PM_{2.5}) particulates. It is based on a glass tube that vibrates more or less as collected particles build on it.

II. LITERATURE

1) **PRAVIN P. SONAWANE AS WELL AS MILIND R. GIDDE:** MILIND R. GIDDE AND PRAVIN P. SONAWANE (2012) INVESTIGATED THE CONNECTION BETWEEN TRAFFIC AND AIR QUALITY IN PUNE BETWEEN JANUARY 2008 AND DECEMBER 2011. VEHICLE COUNT AND AIR QUALITY WERE EXAMINED. ANALYTICAL AND STATISTICAL METHODS WERE UTILISED. IT HAS BEEN SHOWN THAT LEVELS OF ATMOSPHERIC NITROGEN OXIDES (NO_x), SULPHUR DIOXIDE (SO₂), AND SUSPENDED PARTICULATE MATTER (SPM) HAVE A DIRECT ASSOCIATION WITH THE NUMBER OF VEHICLES ON THE ROADWAYS. THE NUMBER OF CARS CLIMBED SIGNIFICANTLY BETWEEN 2008 AND 2011, ACCORDING TO A RESEARCH. THE QUANTITIES OF PARTICULATE MATTER (PM₁₀) AND NO_x WERE BEYOND THE RECOMMENDED RANGES. ACCORDING TO A STUDY, SO₂ CONCENTRATION LEVELS ARE RISING. THE RELATIONSHIP BETWEEN AIR QUALITY AND FUEL TYPES WAS ALSO EXAMINED, AND IT WAS SHOWN THAT GASOLINE VEHICLES PRODUCE MORE POLLUTION THAN DIESEL VEHICLES.

2) **SACHIN PATIL AND SAGAR GAWANDE:** ACCORDING TO SACHIN PATIL AND SAGAR GAWANDE, AIR MAKES UP THE EARTH'S ATMOSPHERE. BEFORE BEING RELEASED INTO THE ATMOSPHERE, THE COLOURLESS AND ODOURLESS GAS CO CONTRIBUTES SIGNIFICANTLY TO LOCAL, REGIONAL, AND URBAN ATMOSPHERIC CHEMISTRY BY INFLUENCING THE LEVELS OF HYDROXYL RADICALS (OH) AND THE TROPOSPHERIC OZONE CYCLE (O₃). LIGHTHEADEDNESS, DISORIENTATION, HEADACHES, VERTIGO, AND FLU-LIKE SYMPTOMS ARE SIGNS OF MODERATE ACUTE POISONING; LARGER EXPOSURES CAN CAUSE SUBSTANTIAL TOXICITY OF THE HEART AND CENTRAL NERVOUS SYSTEM, AND EVEN DEATH. IN THE BLOOD, HAEMOGLOBIN AND CARBON MONOXIDE MIXED TO FORM CARBOXYHEMOGLOBIN (HBCO). PRODUCTS OF COMBUSTION SUCH AS NITROGEN OXIDES (NO_x), CARBON OXIDES (CO_x), AND SULPHUR OXIDES ARE EXAMPLES OF ANTHROPOGENIC SOURCES OF AIR POLLUTION (SO_x). INDEED, COMPARED TO ALL OTHER HUMAN ACTIVITIES, DRIVING A CAR CONTRIBUTES THE MOST TO AIR POLLUTION. ABOUT 50% OF THE WORLD'S CO EMISSIONS FROM BURNING FOSSIL FUELS. THE CPCB'S NAAQS ARE APPLIED TO THE ENTIRE NATION. THE AIR (PREVENTION AND CONTROL OF POLLUTION) ACT OF 1981 GIVES THE CPCB THIS POWER. • THE ESTABLISHMENT OF EFFICIENT AMBIENT AIR QUALITY MANAGEMENT DEPENDS ON THESE CRITERIA. • IN ACCORDANCE WITH THE AIR ACT, THE FIRST AMBIENT AIR QUALITY STANDARDS WERE CREATED IN 1982. THESE CRITERIA WERE LATER UPDATED IN 1994 AND 1998. THE NAAQS HAD ITS MOST RECENT REVISION IN 2009, AND IT IS THIS VERSION THAT IS NOW BEING USED. • THE 2009 STANDARDS STANDARDISED THE NATIONAL STANDARDS AND SIGNIFICANTLY DECREASED THE MAXIMUM ALLOWED VALUES FOR POLLUTANTS. PRIOR UNTIL NOW, INDUSTRIAL ZONES WERE BOUND BY FEWER RULES THAN RESIDENTIAL AREAS.

3) **DR. KAMAL JYOTI MAJI:** NUMEROUS STUDIES DEMONSTRATE THAT PUNE'S POLLUTION HAS A DETRIMENTAL EFFECT ON HEALTH, ACCORDING TO THE INDIAN INSTITUTE OF TROPICAL METEOROLOGY CENTRE FOR ENVIRONMENT AND EDUCATION, INDIAN INSTITUTE OF PUBLIC HEALTH-GANDHINAGAR, AND NATURAL RESOURCES DEFENCE COUNCIL DATA. IN 2016, DR. KAMAL JYOTI MAJI, A STUDENT AT THE INDIAN INSTITUTE OF TECHNOLOGY-BOMBAY, CONDUCTED AN ASSESSMENT OF THE EFFECTS OF NO₂, SO₂, AND PM USING INFORMATION FROM MONITORING STATIONS ESTABLISHED BY THE CPCB IN PUNE BETWEEN 2005 AND 2013. AS A RESULT OF EXPOSURE TO PM₁₀ AND SO₂ AIR POLLUTION, PUNE HAS 733 EXTRA CARDIOVASCULAR-RELATED DEATHS PER MILLION PEOPLE YEARLY. ACCORDING TO THE AUTHOR TEAM'S CALCULATIONS, THE CITY'S AIR POLLUTION RESULTS IN AN ADDITIONAL 348 HOSPITAL ADMISSIONS FOR CARDIOVASCULAR DISEASE PER MILLION RESIDENTS AS WELL AS 901 ANNUAL HOSPITAL ADMISSIONS FOR RESPIRATORY DISEASES. A FURTHER INVESTIGATION BY THE CITY FOUND THAT 2009–2010 AVERAGE EXPOSURE TO PM₁₀ (90.8 G/M³) CAUSED 3,600 PREMATURE DEATHS IN 2010 AS A RESULT OF EXPOSURES OVER WHO GUIDELINE THRESHOLD (G/M³). THE STUDY INCLUDED DATA FROM FIVE MONITORING STATIONS AND AN EMISSIONS INVENTORY THAT THE CPCB PRODUCED IN 2010.



4) **ROHAN S TOWAR ,KEERTHI GURANI RENUKA, BINAYAKE:** THE AIR QUALITY INDEX IS AN APPROACH FOR EMPHASISING THE STATUS OF THE AIR QUALITY TO PEOPLE IN GENERAL. IT SUMMARISES COMPLICATED DATA ABOUT THE AIR QUALITY CAUSED BY VARIOUS CONTAMINANTS INTO A SINGLE NUMBER (INDEX VALUE), NAME, AND COLOUR. SIX AQI CATEGORIES ARE AVAILABLE: GOOD, SATISFACTORY, MODERATELY POLLUTED, POOR, VERY POOR, AND SEVERE.

III. REVIEW

In the above papers we got to know that pune city is rapidly growing in each sector and today's growth is sign that city become metro city within short period. Vehicular emission continuously deteriorates air quality of city and effecting on climate. february and march months' temperature is exceeding year by year and rainfall occurs in staggered way. There is need of effective network of air quality monitoring stations to get appropriate data of polluted area. Analysis of collected data will be done fast with suitable mechanism so accordingly to take effort for improvement of air quality.

IV. METHODOLOGY

The study's goal is to look at the consequences of air quality. The study is only conducted in the vicinity of pune city. the study will take place in 2023 from mid-march until mid-may. The study contrasts historical data with data from 2019. real-time 24-hour average concentrations of the five criterion air pollutants (pm2.5, pm10, no2, so2) and an 8-hour continuous co and ozone concentration were collected from the CPCB website, along with the aqi. the relative humidity (rh), wind speed, and other meteorological variables were gathered from an internet weather service (details are provided below). In this study, the collected data are statistically analyses utilizing secondary information (pollutant concentrations, temperature, and relative humidity) and by conducting questionnaire-based qualitative survey the purpose of the general survey was to examine whether the restriction of local activities affected people's perceptions of improved both indoor and outdoor air quality. This survey also gathered information on the main reasons for the decreasing air quality before and during the lockdown. A Real-time survey on factors connected to the effect on health throughout the period of lockdown is used to confirm the pollutant analysis. According to the report, residents felt very clean, fresh air throughout the lockdown for the initial time in decades. Even those who lived close to densely populated locations and had a history of chronic illnesses like asthma, allergies, etc. Saw some relief during the lockdown. additionally, study findings show that cooking, heating, and uses of electronic gadgets were significantly higher which can cause increased indoor pollutants, this was verified by data obtained.

V. CONCLUSION

FROM ABOVE WE WILL HAVE FOLLOWING CONCLUSIONS:

1. Use of Electric vehicles can reduce the Carbon emissions.
2. Nal Stop area was found to be having higher concentration of pollutants as compared to Kothrud.
3. The results of this study are very encouraging and give hope that pollutant concentrations can be minimised to some extent by taking certain measures in the near future. The observations made in this study are very helpful in understanding the lowest limit of all criteria pollutants during lockdown while all operations are restricted. The quantities of PM2.5, PM10, NO2, and ozone are at their lowest point in the previous few decades.

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Design of Water Supply Scheme for Sanaswadi Region using Python Programming

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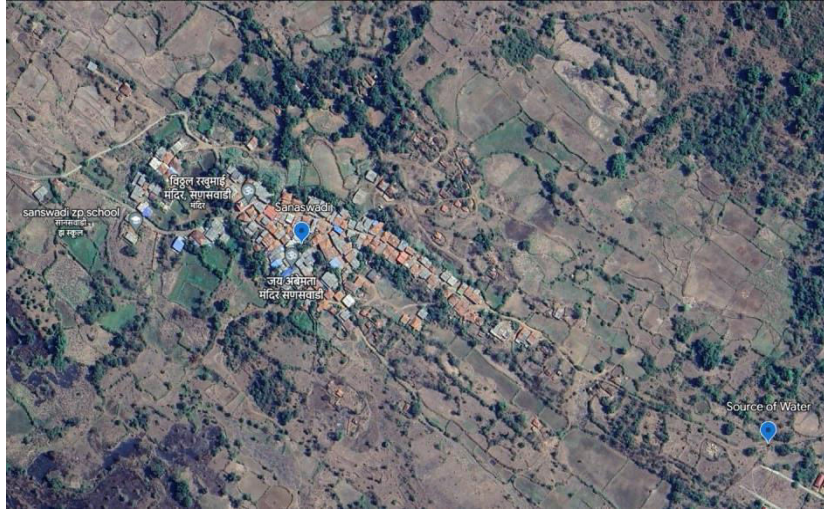
ABSTRACT: The major goal of the study was to design a suitable water supply system. Getting water from the best source feasible and putting it through a process that will produce water of good physical quality are the basic objectives of water treatment for public supply. ensuring the long-term security of the water supply. We have discussed the water's design and computation delivery plan in this study that makes use of CPHEEO requirements. To get more precise data and calculations, Python and Q-GIS are employed. Due to water scarcities and rapid urbanisation, many municipalities now struggle to maintain a safe and reliable water supply. In order to get beyond these barriers, a water delivery system is needed. The design and analysis of the essential components of a water supply are included in this study.

I. INTRODUCTION

Like food, clothing, and shelter, water is a basic need for all living things. Water is used by people for a range of activities such as drinking, cleaning, washing cars, and washing clothes and kitchenware. Small or big amounts of water are also used in almost every industry, depending on the business. Drinking out of water is the main use of water for humans all of the aforementioned goals. Water intended for drinking as certain unique physical and chemical characteristics that set it apart from water used for other reasons. All types of water are very beneficial to man giving him the comforts and pleasures in addition to his essential needs for survival. Water is necessary for all life. Providing water to all measure cities and rural regions is a significant task. Without water one can't envision as safe and clean environment. An adequate supply of pure water is necessary for a healthy lifestyle. After establishing how much water is required for the population's varied purposes, the engineer develops a water supply network that will meet those needs. A water supply system collects, transports, purifies, stores, and provides water from a source to customers, such as businesses, industries, irrigation facilities, and public and private institutions. World-wide, and especially in rural areas, access to clean water has become a major problem.

II. GENERAL WORK INFORMATION ABOUT SANAWADI VILLAGE

The village Sanaswadi is located in Raigad district of Maharashtra the area of village is 764 Ha. Including agriculture. The main income source of villagers is farming so water is one of the essential requirements for villagers and water availability is insufficient as per survey taken so we under taken the design of water supply scheme for Sanaswadi village.



III. PROBLEM STATEMENT

Water shortages are a serious issue due to rising population and rapid urbanisation, which has made it challenging for many municipalities to maintain a secure and consistent water supply. A appropriate water supply plan is therefore required to overcome these challenges.

IV. OBJECTIVES

1. The use of the CPHEEO (Central Public Health and Environmental Engineering Organisation) criteria in the design of various components.
2. Using Jivan Pradhikaran's DSR for Maharashtra, estimate various projects.
3. The creation of an effective water supply plan.
4. Using Python, one can achieve an accurate and quick solution.
5. To acquire a raster image of a certain area using Q-GIS software and then create a water supply plan based on the results.

V. LITERATURE REVIEWS

A plan for a rural area's water delivery system. For this study, a water distribution network was built using population forecasts for the next 30 years. The BRANCH 3.0 heuristic algorithm was used to build the most effective water distribution system. 100 lpcd of water usage has been taken into consideration when developing an intermittent water supply for the study area. When determining the economical diameter of the water supply distribution system, other restrictions such as reservoir level, peak factor, accessible commercial pipe diameters, residual nodal pressure, flow velocity through the pipe, pipe material, and others are taken into consideration. The water supply distribution system's target market is the Nava-Shihora region of the Indian state of Gujarat. [1]

It is essential to increase the local community's capacity to design and manage its own water supply system because water distribution in India is now predicted to be a community-based, demand-driven system. Drinking water is one of the essential elements that all parts require to complete the countless life-sustaining duties. Due to water scarcities and rapid urbanisation, many municipalities now struggle to maintain a safe and reliable water supply. In order to get beyond these barriers, a water delivery system is needed. Two basic water supply system components that are examined and planned in this study are the distribution system and drinking water quality control. The water supply system for an eight-village cluster is designed with a 30-year population forecast in mind. Settlements can be surveyed thanks to the usage of digital GPS. The water distribution network for the towns is evaluated and built using Bentley's WATERCAD application. Each user will receive the proper quantity, quality, and pressure of water from a source thanks to water distribution network delivery systems that are designed for this purpose. [2]

Design of a water supply system for rural communities. In order to meet the water needs of the steadily growing population, it is essential to supply the abundance with a constant flow of water through the designed system of pipes. The information provided by the IPH (Irrigation and Public Health Department) department is essential for the successful design of the water distribution system. This information includes the common characteristics of the region, such as the population of the region, the demand for water, the need for pumps, the distribution network, and water



tanks. A settlement is supplied with potable water that can be used for both drinking and healthy uses through a water distribution system. The main steps of the distribution system are collection, transmission, purification, and distribution. Pipeline layout planning, valve and coupling design, head loss estimation, and population projection utilising a number of methods are all included in this process. [3]

Maharashtra has always been impacted by droughts. The drought, which has continued for four years straight, has caused catastrophic losses in agricultural productivity and production in the state of Maharashtra. The Maharashtra government has launched a new project called Jalyukt Shivar Abhiyan to end the state's drought by 2019. The JSA offers a framework for figuring out the water balance at the village level that includes, among other things, evaluating agricultural water requirements and drinking water stress. JSA supports integration and cooperation across various government programmes and agencies during the planning and execution phases and emphasises the significance of public participation as one of the key aims. The project seeks to end water scarcity in 5000 villages every year. This change has been made possible through efforts to build watersheds, increase groundwater levels, decentralise and clean up water sources, and increase the area irrigated. For this inquiry, the Aurangabad district was our choice. The evaluation of the quality of CNBs in the Aurangabad region is the study's main objective. [4]

More than 58% of the population lives in rural areas and is primarily dependent on agriculture in Maharashtra, the third-largest state in India. In response to a number of negative externalities of water scarcity, the Maharashtra government announced the Jalyukt Shivar Abhiyan, a comprehensive water conservation programme. The methodology used in this study was used to identify the strengths and weaknesses of JSA by conducting a theoretical assessment of the various water conservation activities carried out under JSA in three villages in Purandar taluka of Pune district and also a few works in accordance with Shirpur pattern in Dhule district, Maharashtra, India.

The evaluation of JSA exposed JSA's advantages and disadvantages, as well as technical errors in the planning and execution of these tasks. It was also noted that there was limited public awareness of JSA in regions affected by drought, which had a detrimental effect on both community engagement and participation. It is claimed that these benefits and drawbacks could be used to alter JSA's organisational structure and policy in order to improve the scheme's effectiveness and to increase community participation in groundwater recharge and water conservation programmes. [5]

Water is one of a person's fundamental needs. Humans utilise water for a multitude of purposes, such as drinking, cleaning, washing cars, and washing clothes and household objects. Small or big amounts of water are also used in almost every industry, depending on the business. It is a tremendous responsibility to provide water to all major cities and rural areas. Despite being 20 kilometres from Pune, the hamlet of Bhugaon is becoming more and more urbanised in its gaathan and Wadies thanks to great transportation options and nearby industrial areas. The current water supply plan in Bhugaon, which includes one division where water is to be delivered, is unable to meet the demand for water at this time since the percolation well that is now accessible, which is located along the manas lake bank, is insufficient. Currently, there is no piped water available. The primary objective of water treatment for public delivery is to obtain water from the best source currently available and process it to ensure a minimum level of acceptable physical quality, safeguarding the long-term security of India's rural water supplies. Make a plan to provide water to every Wadie. Population expansion has been linked to a serious water shortage. This plan will give the demographic group it was designed for a reliable and constant water supply. The water supply plan is created using the appropriate software, such as Microsoft Excel and Bentley Water Gem. [6]

VI.METHODOLOGY

The projected water supply plan was surveyed in order to establish the lengths and elevations of headworks rising mains, reservoirs, and the distribution system. designing numerous components in accordance with the CPHEEO (Central Public Health and Environmental Engineering Organisation) standards. Using Jivan Pradhikaran's DSR for Maharashtra to estimate various works. preparing operations plan expenses and maintenance and rehabilitation budgets.

When designing a water supply system, one should pay attention to the following elements:

1. Source,
2. Pumping Machinery,
3. Storage tank,
4. Distribution network &
5. Rising main.

Demand is the first crucial parameter that needs to be calculated. We must project the population of the chosen region for the projected year in order to determine demand. Everyone needs water for several things, like drinking and washing clothing.

Every person should receive 55 LPCD, according to Jal Jivan Mission. Thus, the water demand is calculated by multiplying the population in the proposed year by 55 LPCD.

Once the design period has been decided upon, the population of a village or town must be established. A village's population is influenced by factors like births, deaths, migration, and annexation. Future village growth will largely be influenced by the surrounding landscape, growing industries, and trade. Population growth can be rapid, slow, constant, or even negative as a result of mine finds and the construction of railway stations. It is advisable to evaluate the evolution of earlier comparable villages that have evolved under similar conditions in order to anticipate population growth because the expected village would expand more or less along similar lines.

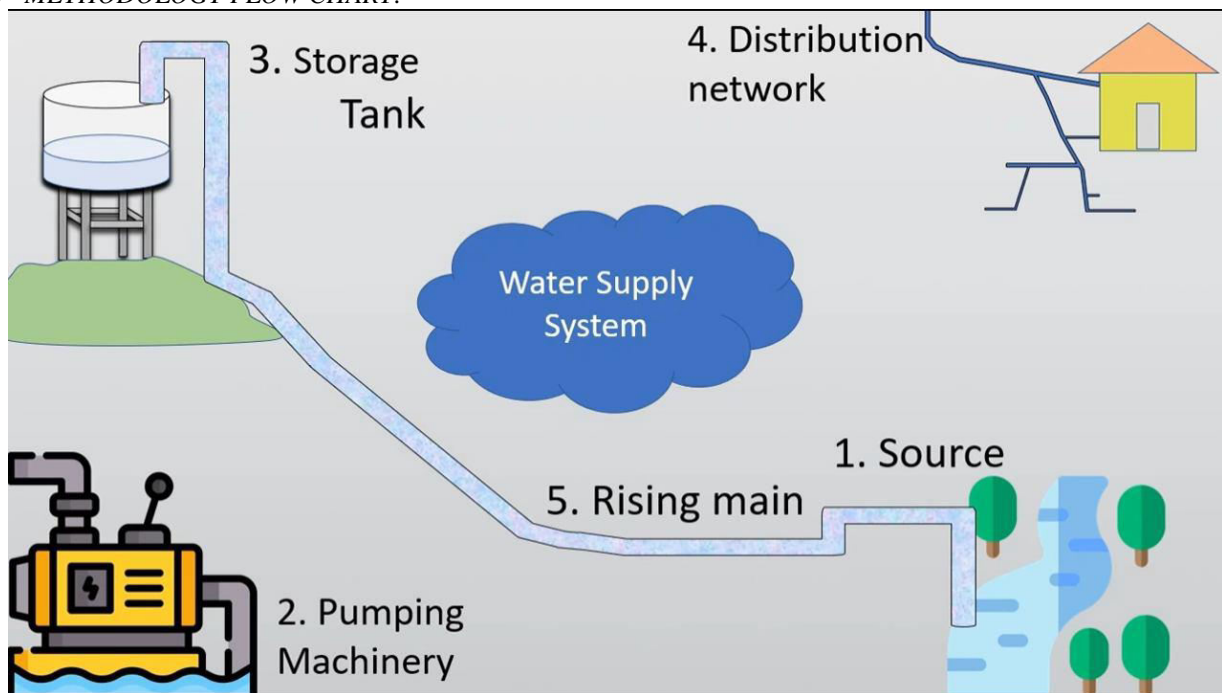
The main techniques for population forecasting are as follows:

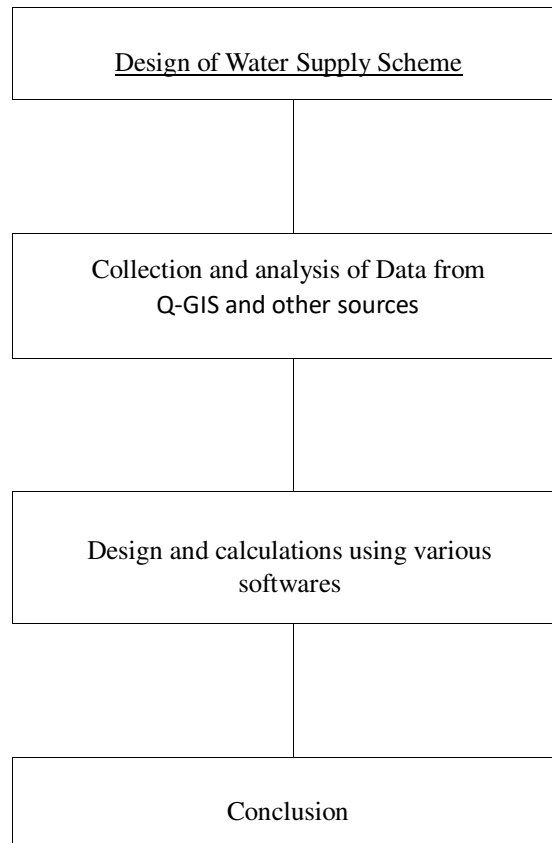
- a. Arithmetical Increase Method
- b. Geometrical Increase Method
- c. Incremental Increase Method

A) **WATER DEMAND:**

Based on the chosen population at various stages computed as above, water requirements at different stages are determined. Water is required at various phases, according to the most recent Strategic Plan of the Ministry of Drinking Water and Sanitation. The per capita supply is 55 LPCD, as stated in the JJM Guidelines issued by the Government of India: It is also recommended that 4% more raw water be carried to the water treatment facility to make up for WTP loss.

B) **METHODOLOGY FLOW CHART:**





VII. CODES AND SOLUTIONS FOR THE CALCULATIONS OF DESIGN OF WATER SUPPLY SCHEME FOR SANASWADI REGION

Population Forecasting Calculations:

Arithmetic progression:

```
import math

P2011 = 791 #Population in the year 2011
X = float(input("Enter average increment in population between the years 1971-2011 ="))
Y = float(input("Enter average incremental increase in population between the years 1971-2011 ="))
D = float(input("Arithmetic progression between 1997-2011 i.e., (791-650) ="))
N24 = 1.3 #No. of decades till 2024
N39 = 2.8 #No. of decades till 2039
N54 = 4.3 #No. of decades till 2054

print("Average Increment is",X)
print("Incremental Increase is",Y)
print("Difference is",D)

I = D/5 #average increment per decade
print("Average increment per decade",I)
```



```
P24 = P2011+(-X*N24) #present stage i.e., 2024
print("Population at the end of the present stage",P24)

P39 = P2011+(-X*N39) #immediate stage i.e., 2039
print("Population at the end of the Immediate stage",P39)

P54 = P2011+(-X*N54) #ultimate stage i.e., 2054
print("Population at the end of the Ultimate stage",P54)
```

Solution:

Enter average increment in population between the years 1971-2011 =36
Enter average incremental increase in population between the years 1971-2011 =-64
Arithmetic progression between 1997-2011 i.e., (791-650) =141
Average Increment is 36.0
Incremental Increase is -64.0
Difference is 141.0
Average increment per decade 28.2
Population at the end of the present stage 744.2
Population at the end of the Immediate stage 690.2
Population at the end of the Ultimate stage 636.2

Geometric Progression Method:

```
import math

P2011 = 791 #Population in the year 2011

N24 = 1.3 #No. of decades till 2024
N39 = 2.8 #No. of decades till 2039
N54 = 4.3 #No. of decades till 2054

R1 = float(input("Enter average increment in population between the years 1971-1981 ="))
R2 = float(input("Enter average increment in population between the years 1981-1991 ="))
R3 = float(input("Enter average increment in population between the years 1991-2001 ="))
R4 = float(input("Enter average increment in population between the years 2001-2011 ="))

r = (R1+R2+R3+R4)/4
print("Average Rate of Growth in the population between the years 1971-2011", r)

P24 = P2011*(1+r)**N24 #present stage i.e., 2024
print("Population at the end of the present stage",P24)

P39 = P2011*(1+r)**N39 #immediate stage i.e., 2039
print("Population at the end of the Immediate stage",P39)
```



```
P54 = P2011*(1+r)**N54 #ultimate stage i.e., 2054
print("Population at the end of the Ultimate stage",P54)
```

Solution:

```
Enter average increment in population between the years 1971-1981 =0.358
Enter average increment in population between the years 1981-1991 =-0.096
Enter average increment in population between the years 1991-2001 =-0.060
Enter average increment in population between the years 2001-2011 =0.055
Average Rate of Growth in the population between the years 1971-2011 0.06425
Population at the end of the present stage 857.6957142684188
Population at the end of the Immediate stage 941.6699859423995
Population at the end of the Ultimate stage 1033.8659126694083
```

Water Demand:

```
import math

Geometric_P24 = 858
Geometric_P39 = 942
Geometric_P54 = 1034

# Rate of Water Supply is 135 lpcd.

Wd24 = (Geometric_P24)*135 #Water Demand at Present Stage i.e., 2024
print("Domestic Water Demand at Present Stage=", Wd24)

Wd39 = (Geometric_P39)*135 #Water Demand at Present Stage i.e., 2039
print("Domestic Water Demand at Present Stage=", Wd39)

Wd54 = (Geometric_P54)*135 #Water Demand at Present Stage i.e., 2054
print("Domestic Water Demand at Present Stage=", Wd54)

#Calculation for other water demands

od24 = Wd24*0.05 #Institutional/industries/commercial Demand i.e., 5% of
domestic demand
print("Institutional/industries/commercial Demand at Present Stage=", od24)

od39 = Wd39*0.05 #Institutional/industries/commercial Demand i.e., 5% of
domestic demand
print("Institutional/industries/commercial Demand at Immediate Stage=", od39)

od54 = Wd54*0.05 #Institutional/industries/commercial Demand i.e., 5% of
domestic demand
print("Institutional/industries/commercial Demand at Ultimate Stage=", od54)

ffd24 = 100*(Geometric_P24/1000) #fire fighting demand
print("Fire fighting demand at Present Stage=", ffd24)
```



```
ffd39 = 100*(Geometric_P39/1000) #fire fighting demand
print("Fire fighting demand at Immediate Stage=", ffd39)

ffd54 = 100*(Geometric_P54/1000) #fire fighting demand
print("Fire fighting demand at Ultimate Stage=", ffd54)

TD24 = Wd24+od24+ffd24 #Total Demand at Present stage
print("Total demand at Present Stage=", TD24)

TD39 = Wd39+od39+ffd39 #Total Demand at Immediate stage
print("Total demand at Immediate Stage=", TD39)

TD54 = Wd54+od54+ffd54 #Total Demand at Ultimate stage
print("Total demand at Ultimate Stage=", TD54)

#Assuming 15% losses
#Gross Demand Calculation

GD24 = TD24+TD24*0.15
print("Gross Demand at Present Stage=", GD24)

GD39 = TD39+TD39*0.15
print("Gross Demand at Immediate Stage=", GD39)

GD54 = TD54+TD54*0.15
print("Gross Demand at Ultimate Stage=", GD54)
```

Solution:

```
Domestic Water Deamd at Present Stage= 115830
Domestic Water Deamd at Present Stage= 127170
Domestic Water Deamd at Present Stage= 139590
Institutional/industries/commercial Demand at Present Stage= 5791.5
Institutional/industries/commercial Demand at Immediate Stage= 6358.5
Institutional/industries/commercial Demand at Ultimate Stage= 6979.5
Fire fighting demand at Present Stage= 85.8
Fire fighting demand at Immediate Stage= 94.19999999999999
Fire fighting demand at Ultimate Stage= 103.4
Total demand at Present Stage= 121707.3
Total demand at Immediate Stage= 133622.7
Total demand at Ultimate Stage= 146672.9
Gross Demand at Present Stage= 139963.39500000002
Gross Demand at Immediate Stage= 153666.105
Gross Demand at Ultimate Stage= 168673.835
```

Calculation for Capacity of Reservoir:

```
import math
#Calculation for volume of Reservoir

#For design of cost efficient water supply scheme instead of taking Gross Demand
as volume of reservoir,we can take it's half and increase the time of pumping as
```



in 2 times per 24 hours. this helps us reduce the cost of building the reservoir as the volume decreases cost also decreases.

```
V24 = GD24/2
```

```
print("Volume of Reservoir at Present Stage=", V24)
```

```
V39 = GD39/2
```

```
print("Volume of Reservoir at Immediate Stage=", V39)
```

```
V54 = GD54/2
```

```
print("Volume of Reservoir at Ultimate Stage=", V54)
```

Solution:

Volume of Reservoir at Present Stage= 69981.69750000001

Volume of Reservoir at Immediate Stage= 76833.0525

Volume of Reservoir at Ultimate Stage= 84336.9175

Calculation for Pumping Machinery:

```
import math
#Calculation of HP of Pumping Machinery

Hp = 8          #8 hours of pumping
D = 90          #Outer diameter of pipe in mm
d = 83.8        #Inner diameter of pipe in mm
C = 140         #Hazen-William's Constant for HDPE material pipe

#Flow rate calculation in litre per second
Qi = GD39/(Hp*3600)
print("Flow rate at Immediate Stage=", Qi)

Qu = GD54/(Hp*3600)
print("Flow rate at Ultimate Stage=", Qu)

#Discharge calculation mld
qi = GD39*10**-6*24/Hp
print("Discharge at Immediate Stage=", qi)

qu = GD54*10**-6*24/Hp
print("Discharge at Ultimate Stage=", qu)
```

Solution:

Flow rate at Immediate Stage= 5.335628645833333

Flow rate at Ultimate Stage= 5.856730381944444

Discharge at Immediate Stage= 0.460998315

Discharge at Ultimate Stage= 0.506021505

```
import math
hs = 25 #Static Head is 25 m
```



```

hv = 2 #Velocity Head is 2 m
#Friction Head at immediate and ultimate stage in m
hfi = 0.77
hfu = 0.77
n = 0.60 #Efficiency of pipe

#Total/Dynamic head Calculation in m
Hi = hs+hv+hfi
print("Total head at Immediate Stage=", Hi)

Hu = hs+hv+hfu
print("Total head at Ultimate Stage=", Hu)

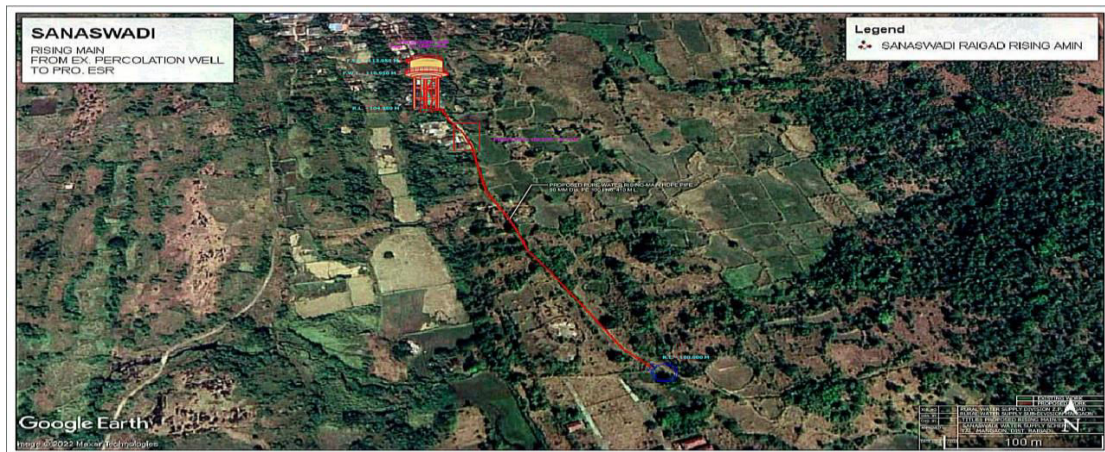
#For Horse power of pumping Machinery in bhp
HPi = (Qi*Hi)/(75*n)
print("Horse Power at Immediate stage =", HPi)

HPu = (Qu*Hu)/(75*n)
print("Horse Power at Ultimate stage =", HPu)

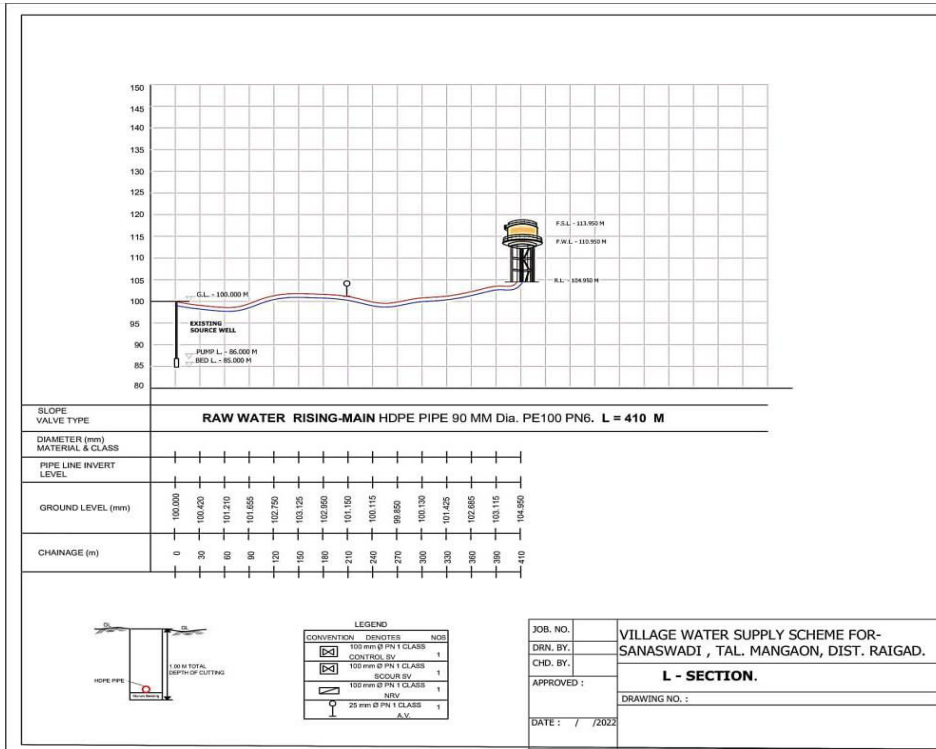
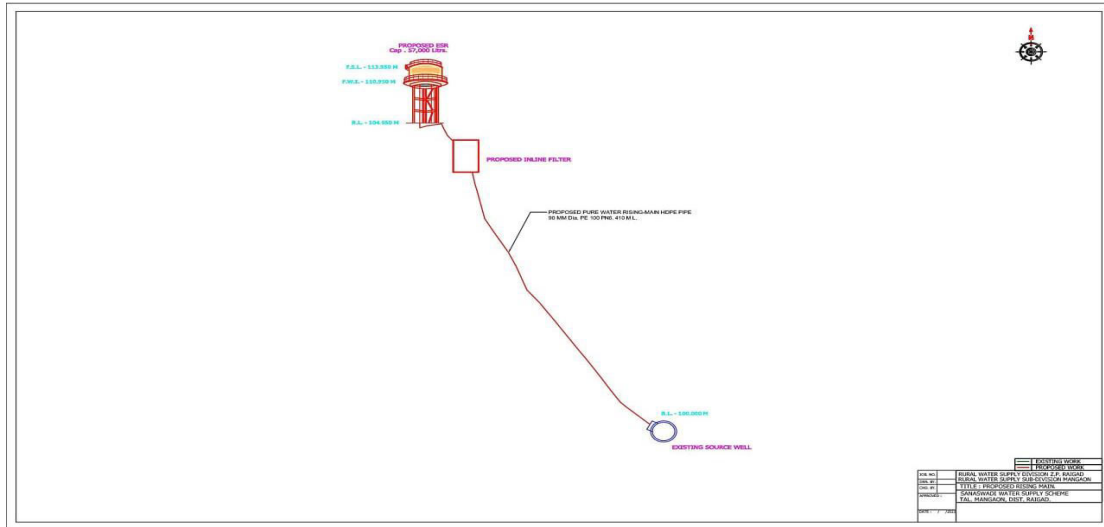
```

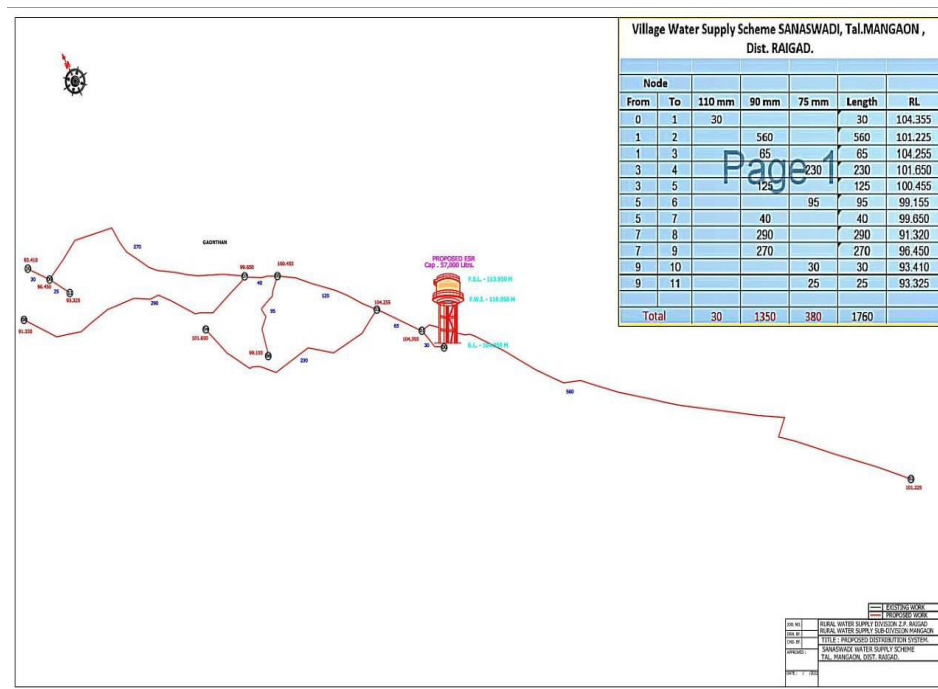
Solution:

Total head at Immediate Stage= 27.77
 Total head at Ultimate Stage= 27.77
 Horse Power at Immediate stage = 3.2926757221064817
 Horse Power at Ultimate stage = 3.6142533934799377



Rising main and reservoir location





VII. CONCLUSION

We may conclude from this research that rural people need to have access to water delivery systems given the multiple water crises happening throughout the world. There should be widespread support for the Conservation of Water Act and implementation of the GWP. Using QGIS software, we might create a raster image of a certain area and utilise it to Identify the best location to install the water supply system. The water supply scheme's design computation must be performed using Python software.

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