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# Indigenous Automatic Shuttling Metro Train between Stations

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**ABSTRACT:** The Train Shuttle Project introduces a cutting-edge robotic car system designed to revolutionise train transportation. By incorporating advanced sensor technologies and alert mechanisms, the system aims to enhance safety, efficiency, and passenger convenience. Key components include an RFID reader for station detection, Ultrasonic sensor for Obstacle detection, and fire sensor for fire hazard detection within the train. Real-time station number display and timely alerts via LCD displays and buzzers ensure passengers are informed and secure throughout their journey. Traditional manual systems often face challenges in promptly detecting obstacles and managing fire incidents, leading to safety concerns and inconvenience for passengers. The proposed prototype mitigates these challenges by automating detection processes and providing immediate alerts, thereby improving overall safety and passenger experience. The project's potential impact extends beyond transportation sectors, offering scalable solutions for urban transit systems, industrial logistics, and passenger rail services. Through continuous innovation and refinement, the Train Shuttle Project aims to pave the way for a safer, more efficient future in train transportation.

**KEYWORDS:** Metro Train, ultrasonic Sensor, RFID Sensor, LCD, Flame Sensor, Arduino UNO, Android application.

## I. INTRODUCTION

The Metro Shuttling Project introduces an innovative approach to modernize train transportation systems, addressing critical safety and efficiency concerns prevalent in traditional setups. In today's fast-paced world, efficient and reliable public transportation is vital for facilitating the transport of people and goods. However, conventional train systems often grapple with challenges such as timely detection of obstacles, management of fire incidents, and provision of real-time station information, leading to compromised safety and passenger inconvenience.

The proposed prototype seeks to overcome these limitations by integrating state-of-the-art sensor technologies and alert mechanisms into a robotic car platform designed specifically for train shuttle operations. By leveraging advanced sensors like RFID readers, ultrasonic sensors, and fire sensors, the prototype can accurately detect stations, obstacles, and fire hazards within the train environment.

One of the system's primary objectives is to strengthen the passenger safety through proactive obstacle detection and rapid response to fire incidents. Upon detecting obstacles or fire hazards, the system triggers alert mechanisms such as LCD displays and audible alarms, ensuring passengers are promptly informed and appropriate action can be taken.

Moreover, the inclusion of real-time station number displays enhances passenger convenience by providing clear and accurate information about upcoming stops. This feature reduces uncertainty and streamlines the commuting experience for passengers, contributing to overall satisfaction and efficiency.

The Train Shuttle Project holds significant promise not only for improving existing train systems but also for shaping the future of transportation infrastructure. With its scalable design and potential applications across various sectors, including urban transit, logistics, and passenger rail services, the project stands poised to revolutionize the way people and goods are transported. Through continuous innovation and refinement, the project aims to set new standards for safety, efficiency, and passenger experience in train transportation, making journeys safer, more convenient, and more enjoyable for all.

The proposed prototype for the Train Shuttle Project is a technologically advanced robotic car platform designed to revolutionize train transportation. This system integrates cutting-edge sensor technologies, including RFID readers, ultrasonic sensors, and fire sensors, to enable accurate detection of stations, obstacles, and fire hazards within the train environment. Upon detection of obstacles or fire incidents, the system activates alert mechanisms such as LCD displays and a alarms to promptly notify passengers and facilitate appropriate action.

Additionally, real-time station number displays enhance passenger convenience by providing clear and accurate information about upcoming stops. By automating detection processes and providing timely alerts, the proposed system aims to significantly improve safety, efficiency, and passenger experience in train transportation. Its scalable design and potential applications across various sectors succeed it as a promising solution for modernizing existing train systems and shaping the future of transportation infrastructure.

## II. RELATED WORK

1. Anusha R, Chetan S, Saniya Kousar, Harish S V Proposed a “Automatic self-driven Metro with Disaster Management System”. In this paper they have applied the technology for metro movements which are used in most of the countries,empower the automatic moving of the metro from one terminal to another. They have proposed a system which is automatic and it terminates the need of driver. Thus, any human error will be ruled out. They have used microcontroller from 8051 family as a central processing unit. Whenever the metroarrivesat the station it stops automatically as sensed by an Zigbee sensor. Then the door opensautomatically so that passengers can enter inside the metro and closes after a specified time set in the controller by the programmer, the door closes when it reaches maximum occupancy level time allotted for the door to remain open. They have interfaced motor driverwith microcontroller ICfor the movement of the metro. The prototype includes a buzzer to alert the passengers before closing the door and also warn them before moving.Then the metroreaches the destination station.The process repeats by achieving the desired operation. It also provides fire detection system, if fire attacks in the train water is sprinkled automatically and the engine is dispatched and informs to the control station. The rank of the metro consists of parameters like expected arrivals and departure time etc.

2. Smita Vijayanand Bhosale, PansarePoojaBalaso, Shinde Pooja Sanjay, Prof. Sukesh Kumar Pandurang Borate Proposed a “RFID Based Metro Train System”. The main objective of this paper is to describe the technologiesused in metro movements, which are used in most of the countries. The metro is provided with a sensor that enables the metro for automatic stopping from station to station. And this paper presents the progress of a prototype for a driverless metro implemented using a PIC microcontroller. Simulation for the system's circuits is done with the aid of Proteus software. The hardware circuits, which are assembled on printed circuit boards (PCB), and they are connected with actuators and sensors for automation purposes. The hardware is assembled in a toy-like prototype train. The C programming language is used for programming the microcontroller.

3. Mandara. C.Y, Chandana S,Charan A,Ankitha V, Dr. M. Levy Proposed a “FULLY AUTOMATED METRO TRAIN WITH ENHANCED SAFETY”. In this Paper they are focused on adding features to the existing metro train system electronically and mechanically, which helps to achieve quick delivery without any traffic congestions. In order to overcome the drawbacks of existing system they are presenting Fully Automated Metro Train with enhanced safety features. The proposed system can provide comfortable travel to the passengers. Here Train runs between two predefined stations without having any driver inside in it. Since this prototype is fully, when implemented in real time system, it provides more safety against antisocial-activities such terrorist attacks. It helps to rescue the people from unexpected situations such as fire accidents and also provides medical alert, Theft alert and emergency alert to next station as well as control unit which is not present in current metro train system. It ensures the journey of the train on the tracks is safe by monitoring the tracks through monitoring unit. This fully automated metro system also makes efficient use of solar energy and piezoelectric energy. The LI-FI communication is used for announcements. Additional enhanced features are explained in further sections.

4. Mohamed elzeweidy, Bassant Sayed Proposed a “Smart Ticketing System in Metro Rail Using RFID Tag”. One of the bulkmodes of transportation in Egypt is the metro, particularly in Cairo, where it carries up to 3.6 million people each day. Beginning here is the concept of our project, which attempts to give an intelligent solution to the issue of line-ups at the ticket counter. This solution is constructing a mobile and web application that makes it simpler for users to purchase a metro ticket easing traffic at the ticket office to hasten citizen movement and save time, with an admin dashboard to monitor and manage this. To make this work effective, it is suggested to use RFID Tag with an embedded



system to empower smart ticketing in metro trains. This system outlines the placement of an RFID reader circuit in every metro train station to make it easier to calculate ticket prices. The corresponding cost is automatically taken from the user's account according to the distance (number of stations) travelled. An automated database system is used to carry out this activity, which makes the transactions quicker, simpler, and uncertainty-free.

5. Nikhil A Patil, Purushottam P Borse, Kapil Zirale, Nishant Vadgave, Vinod B Hiwase Proposed a “A Novel Approach for The Safety of Metro Train by Incorporating Smart Fire System”. This work proposes the “Smart Fire System Using IoT” in train by integrating IoT devices, including smoke and temperature detectors, Arduino, and other complementary equipment. The idea of the work is when a fire occurs, the Arduino is suggested to sense the surrounding for the occurrence of fire with the help of a fire and gas sensor. The development of smart fire system is built based on an Arduino board. The fire/flame is detected at an early stage by utilizing the temperature sensor and smoke sensor and there is a simple to advanced converter, which changes over the simple signs got at the sensor end to computerized and afterward transmits them to a smaller scale controller and to the Arduino Simultaneously, Arduino sends the information to the Wi-Fi module then the accompanying information to the IoT site. A water sprayer connected to an Arduino board is switched on to control fire. A door will automatically open during fire conditions which are controlled by Arduino. This prototype will help to improve their safety standards with immediate response by preventing major accidents.

### III. METHODOLOGY

The design methodology of the Metro Shuttle Project encompasses a comprehensive approach to integrate hardware components and establish the operational workflow for the robotic car system. The project primarily utilises a microcontroller-based architecture to control and coordinate the function of various sensors and alert mechanisms. The hardware components utilized in the project include:

- a. Robotic Car Platform: Serving as the physical base for the system, the robotic car platform is provided with motors for locomotion and space for mounting sensors and display units.
- b. RFID Reader: Responsible for detecting station information encoded in RFID tags placed at each station along the track.
- c. Ultrasonic Sensor: Used for obstacle detection, the ultrasonic sensor measures distances from the train to surrounding objects to identify potential obstructions.
- d. Fire Sensor: This sensor detects the presence of fire or smoke within the train compartment, triggering immediate alerts to passengers and crew.
- e. LCD Displays: Installed inside the train, LCD displays provide real-time station information and alert messages to passengers.
- f. Buzzer: Audible alarms, such as buzzers, are activated in response to obstacle detection or fire incidents, alerting passengers and crew members.
- g. HC-05: The HC-05 is a class 2 Bluetooth module designed for transparent wireless serial communication. It is pre-configured as a slave Bluetooth device. It is connected to the Prototype For the real time updates of metro.

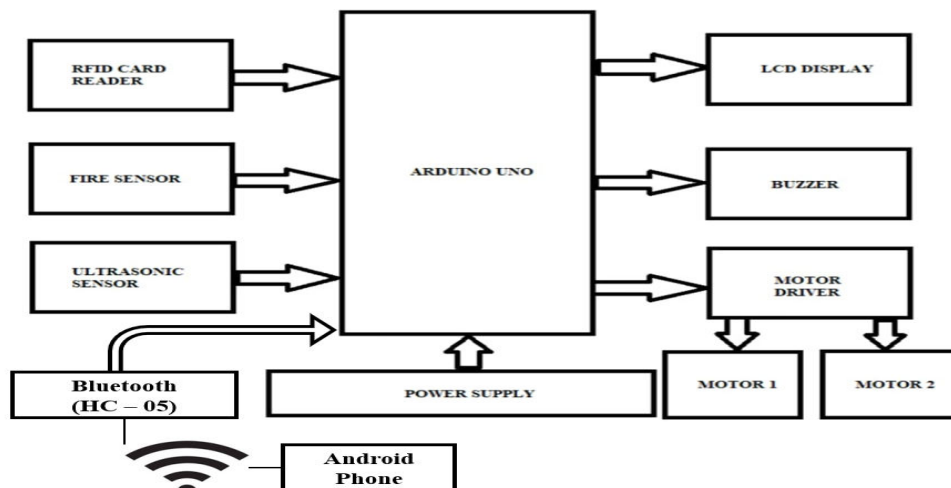


Fig.1. Block Diagram of the system

IV. FLOW CHART

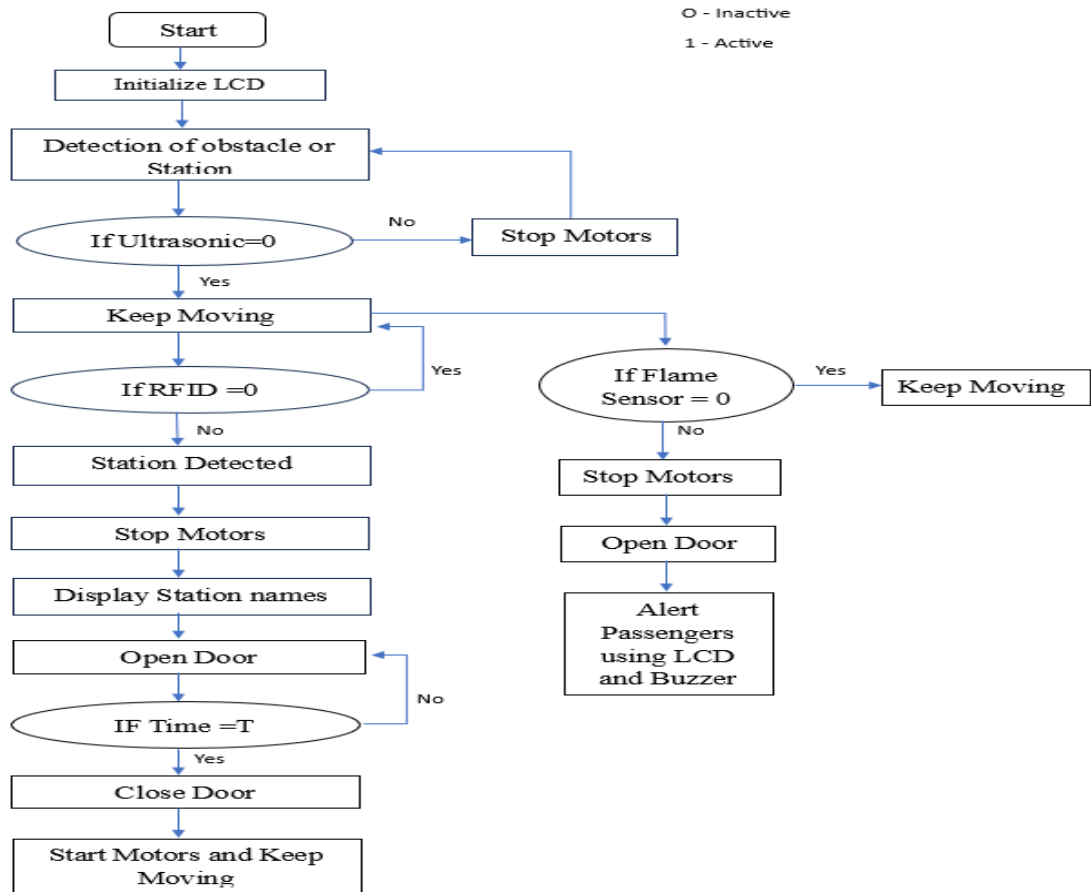


Fig.2. FlowchartofCompleteProcess

The workflow of the system involves the following steps:

1. Initialization: The microcontroller initialises all sensors and alert mechanisms upon system startup.
2. RFID Station Detection: As the metro approaches a station, the RFID reader scans for station information encoded in RFID tags, determining the train's current location.
3. Ultrasonic Obstacle Detection: The ultrasonic sensor continuously scans the surrounding for obstacles. If an obstruction is detected within a predefined range, the system activates alert mechanisms to notify passengers and halt the train.
4. Fire Hazard Detection: The fire sensor monitors the train compartment for any signs of fire or smoke. Upon detection, the system triggers immediate alerts and initiates appropriate emergency protocols.
5. Alert Mechanisms: LCD displays and buzzers are activated to convey station information, obstacle warnings, and fire alerts to passengers, ensuring their safety and facilitating a smooth travel experience.

V. RESULTS

The designed automatic self-driven metro train prototype with enhanced safety system is shown in below figure. Which provides a comprehensive results like obstacle and station detection, fire hazard detection, real time updates of metro for subscribers. The metro prototype provides a controller, that enables automatic moving of the Metro from one Station to another Station. The proposed Prototype is indigenous Metro and which eliminates the need of driver. Thus, human error will be ruled out.

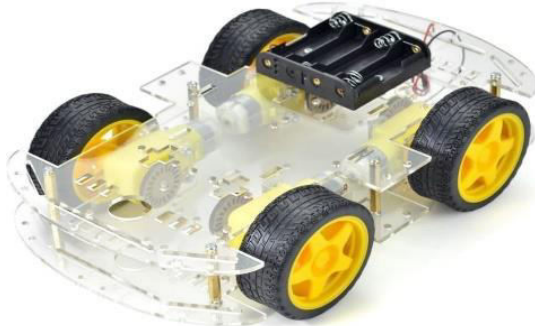


Fig.3. prototype kit

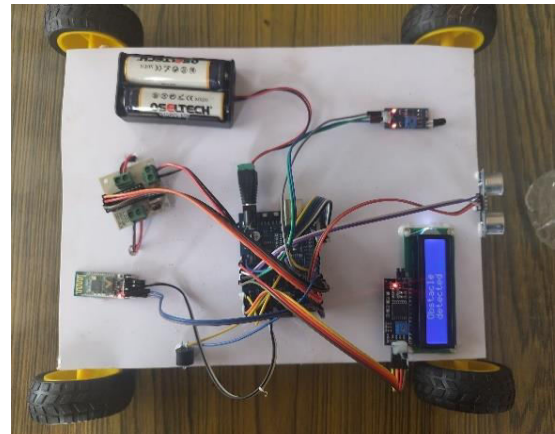


Fig.4. Final Prototype Model

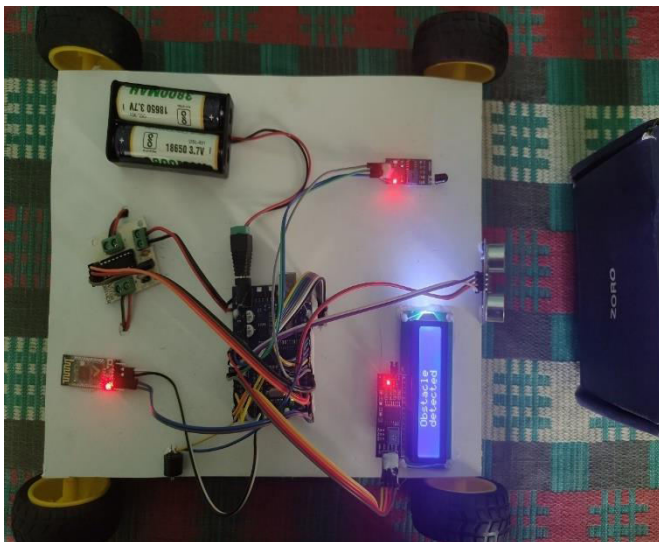


Fig.5. Obstacle is detected by Ultrasonic sensor

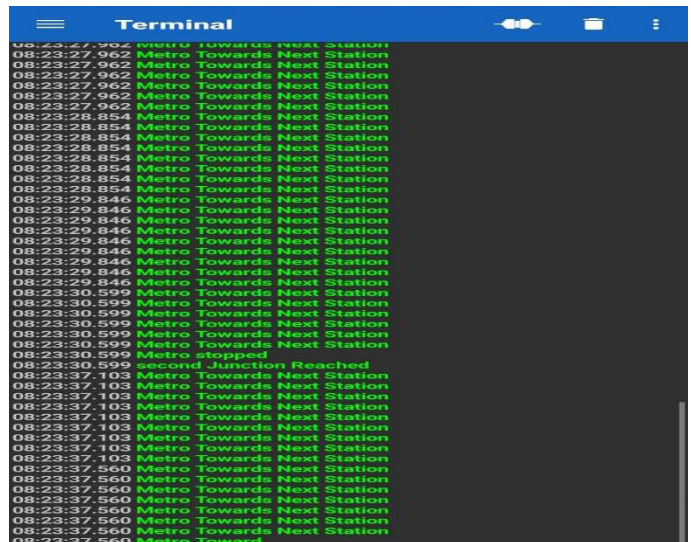


Fig.6. Real-time Updates of Metro on the application

## VI. CONCLUSION

The Train Shuttle Project presents a promising solution to enhance the safety and efficiency of train operations. By leveraging advanced sensor technologies and automated alert mechanisms, the system addresses key challenges faced in traditional train systems. With further development and integration, the project holds potential to revolutionise the future of train transportation, ensuring safer and more convenient journeys for passengers.

This project report outlines the conceptual framework, design methodology, and potential implications of the Train Shuttle Project. Through continuous refinement and innovation, the project aims to contribute to the advancement of transportation systems globally.

### Advantages:

- Enhanced Safety:** Integration of advanced sensors enables proactive detection of obstacles and fire hazards, reducing the risk of accidents and ensuring passenger safety.
- Improved Passenger Convenience:** Real-time station information displayed on LCD screens and audible announcements keep passengers informed about upcoming stops and facilitate seamless travel experiences.
- Automation and Efficiency:** Automation of routine tasks such as obstacle detection and station identification reduce reliance on manual intervention, improving operational efficiency and reducing labour costs.

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