

Design and Fabrication of Portable & Foldable Mini-Forklift

Akhil C ¹, Harshad P², Mohammed Ameen K³, Muhammed Adhnan Vadakkan⁴, Rohith M Govindan⁵

Assistant Professor, Department of Mechanical Engineering, EKC Engineering College,

Manjeri, Kerala, India¹ Orcid Id: 0009-0006-1404-2553

U.G Student, Department of Mechanical Engineering, EKC Engineering College,

Manjeri, Kerala, India² Orcid Id: 0009-0007-5469-0181

U.G Student, Department of Mechanical Engineering, EKC Engineering College,

Manjeri, Kerala, India³ Orcid Id:0009-0002-1073-5927

U.G Student, Department of Mechanical Engineering, EKC Engineering College,

Manjeri, Kerala, India⁴ Orcid Id: 0009-0000-2742-4434

U.G Student, Department of Mechanical Engineering, EKC Engineering College,

Manjeri, Kerala, India⁵ Orcid Id: 0009-0000-5021-8554

ABSTRACT: In the present conditions, there is wide of forklift with variety specification are in practice for the lifting and transportation of goods. Here making/manufacturing a small forklift which can be used for either in homely purpose or in industrial purpose. Since it is an electrical forklift which is working with help of specified motor, it is more cost effective and energy saving in this model. Forklift is attached to the frame body end also, new lifting mechanism by lead screw which helps for the compact structure of equipment compared to existing design. For the easily handling, The fork lift equipment is designed as foldable type, So that it can be used in foldable type, So that it can be used in anywhere in homes and industries. For this transportation of goods and things vehicles and equipment are used. Forklift is one of such transportation equipment. Forklift can be described as a machine which is capable of lifting heavy weight that difficult for human being to carry or lift. It is almost similar to vehicle, but in addition, it is occupying two fork to lift the weight. Man effort can be greatly removed by using those forks which can lift heavy weights at the fingertip by switch on the respective button without any difficult. The operator just pushes the respective liver switch on the button, fork will the weight and up to a certain distance the weight is carried/lifted above and which is moved from the point to another as per the requirement for the easy handling of the forklift, it making as foldable so that it can be easily handled in homely purpose too.

KEYWORDS: Lead screw, Fork lift, Screw jack, Foldable, Fork, Lift.

I. INTRODUCTION

There are many industries globally in the fields of production, service and agriculture etc... In every industry it is essential/necessary to transfer goods, crops, materials from one point to another. For this transportation of goods and things vehicles and equipment are used. Forklift is one of such transportation equipment. Forklift can be described as a machine which is capable of lifting heavy weight that difficult for human being to carry or lift. It is almost similar to vehicle, but in addition, it is occupying two fork to lift the weight. Man effort can be greatly removed by using those forks which can lift heavy weights at the fingertip by switch on the respective button without any difficult. The operator just pushes the respective liver switch on the button, fork will the weight and up to a certain distance the weight is carried/lifted above and which is moved from the point to another as per the requirement for the easy handling of the forklift, it making as foldable so that it can be easily handled in homely purpose too. Designed it in a foldable format it can be consumed less space to keep it. In order to less space requirements this can be embed. In incant times the materials are transported

By putting with the help of animals. The pyramid is an earliest construction which designed by paying huge brick which is high weight. It is built of sun-dried mud brick, little remains of them the construction is on the belief that huge

stones or bricks were then dragged and lifting into position. They moved the blocks are lifted by huge animals like elephant they lifted these huge weight by setting a rolling materials like wood, stone etc.. Most Egyptologist acknowledge of leaving methods, there are to be lifted the block incrementally, as in repeatedly prying up alternating sides of block and inserting wood or stone shims to gradually move the stone up one course there are often methods that use larger lever to move the block up one course in one lifting procedure. This process requires more time to transport heavy loads.

After the invention of automobiles the loads can be easily transported from one place to another. Trucks are used to transport the heavy and bulk object. But it is very difficult to loading and unloading. So in the middle 19th century through the easily 20th century there saw the developments that lead to raise of forklift. It is designed for easily picking up the goods unloading the goods. There is no need of extra effort to load the goods. The lifting and transportation of goods are mutually coincided in the forklift. These are mainly designed for ware house purposes.

II. RELATED WORK

According to S.liawatiena [1] he published journal “ a mini fork lift robot” This paper presents the design of a mini forklift robot that can store and pick up object to/ from specified storage slot from/ to a base using line follower and RFID. Cameron chan [2] Composite materials are engineered by combining two or more constituent materials with significantly different physical or chemical properties. The purpose of this project is to design and construct a composite structure for an electrically-powered hover board designed for human flight. P. Naveen Kumar [3] introduced the product varieties in different shapes and different packaging of goods for loading and unloading has always been a heavy process during transportation by fork lifts were naturally inverted and became the solution to this problem they save time and space. Jayesh Yadav [4] describes forklift powered by an electric motor instead of the IC engine using rechargeable batteries and aims to making the electric system into a forklift to make it electrically powered which lift to 1 ton kg and elevated up to 8 feet. According Saurabh s shah & Pramit s jain [5] the forklift can be vehicle but an addition of two forks to lift the weight makes the difference. In this project the development of Mechanical forklift assures the ergonomically comfort to the operator or worker and to reduces time required for manual lifting and handling. V.M.Magar [6] aim this paper is to develop a zero turning vehicle. Instead of operating by gear system, it using pneumatic system for operation of this vehicle. Mohankumar M [7] conceived having studied the difficulty in lifting and loading the any type of materials. The project has mainly concentrated on this difficulty, and hence a suitable device has been designed. The project by Sarvind Kumar [8] is about 360-degree rotating vehicle. This vehicle moves in all directions. This makes the vehicle suitable for operation in narrow paths and sharp corners. Florian Wahl [9] held a project the shift to I4.0 is happening. This proposes a lightweight system to hail forklifts in a production facility of a medium-sized enterprise. Lili Cheng [10] proposed paper that presents the power system structure of electric forklift and the battery–supercapacitor hybrid energy management method of electric forklift truck.

III. METHODOLOGY

The forklift machine aims to reduce the workforce increase the profit and reduce the time consumption. It is a machine that mainly works on rechargeable power by means of battery, the major working is lead screw driven by a motor. First, we finalized the best design for the project. Then we decided on the material for the manufacturing of the project. We started fabrication and decided the best carrying and lifting mechanism needed. It decided the motor needed for the project, fabricated all the parts required separately and finally assembled all fabricated parts and tested the whole mechanism. We consider that the load carried is up to 80 kg.

To obtain information collection of journals based related to forklift, 360° rotating vehicles, analysis based on overboard etc. are researched. Obtain the idea to develop a mini forklift which can be folded by reducing occupying spaces. This is mainly provided purposes in household works, industrial purpose etc. The next stage is design Designed a mini forklift for narrow spaced areas which can be drive easily without any effort. The design is designed by using solid works 2020. The tool is used for design is extrude, extrude cut, trim, assembly, etc. In this phase many designs will be developed as per requirements. Then material selection the suitable material was selected by the basis of the study. The cost, strength, efficiency is main character for the selecting materials. This will be further estimated. In this phase the different conceptual design will be considered and best among conceptual design will be selected and finalized. The next stage is the fabrication The given design and selected material are used to fabrication. the fabrication has many works that's are welding, forging, riveting, cutting, etc. in this phase the detailed design for the selected concept will be furnished. Then the last stage is testing the given fabricated model is tested and analysed by

using software Ansys. In Ansys select materials and mark fixed end given load on another end. Stress, strain and deformation. Also test in normally by adding load on fork and get result.

IV. EXPERIMENTAL RESULTS

Now a days there are so many problems facing in the society based on the transporting of goods and other components from one place to another place. It should be the health problems that faced to humans while over working and taking overload for some time. It causes fatigue, body pain, fracture, strain etc. It is very difficult to aged and weak person to load a heavy weight. So, to solve this problem we mainly used an equipment to overcome this defect. Forklift is a machine or powered industrial truck used to lift and move material over short distance. Electric forklift is considered as one of the effective logistic transportation tools for transporting heavy goods without any effort. This forklift which is designed suitable for restricted areas which is capable for easy mobilization while carrying loads It has the scope in household works for lifting goods without using any manpower. To solve the problem of utilizing the man power we are using forklift. It reduces the space to keep the equipment in a room, because this is foldable. With this equipment we can work in restricted space. This can be rotated in 360° at any instant. This is portable in all places like a trolley bag. The mechanism is screw jack, so that we can provide self-locking. The advantages of screw jack are the lifting capabilities of can be utilized in applications for small loads of just a few kg up to 80kg. Height for lifting 0.5 meter.

The construction of the mini foldable fork lift is the material used the aluminum alloy the aluminum alloy is the lightweight and high strength to reducing the overall weight of the forklift by using the aluminum alloy. The material used for the mild steel it is the high strength and ductility it is high life span and reduce the fatigue of the fork. In this mini fork lift, there is three dc motor is used and use the three separate switches are used for each motor the one dc motor is connected in lead screw it is lift the fork. And other two dc motor is connecting each frond wheel for motion and the direction change (left or right). the fork has three-wheel one rear and the two-wheel front wheel. the rear wheel is use to control stability and reduce the arc of circle for changing direction. The platform is the GI (galvanized iron) sheet is used.it is also weightless. the 12-v lead acid battery is used for working of each dc motor. the battery is 14 hours at single charge.



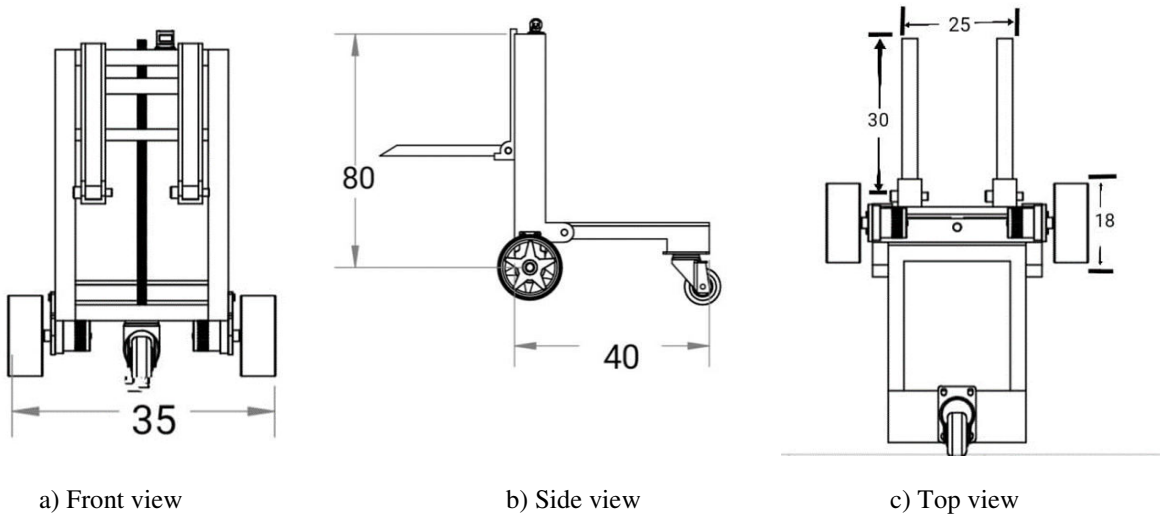
Fig (1) 3D view of forklift



Fig (2) 3D view of foldable forklift



Fig (3) 3D view of forklift



All Dimensions are in cm
Fig (3) Dimensions of forklift

V. CALCULATION

(1) DESIGN OF FORKS:

Here we provide to indicate the performance of forklift in the entire operation.

Length=300mm
Diameter=25mm

(a) Inertia of hollow square pipe = $(DB^3 - db^3)/12$

Where, $D=B=25$ mm

$d=b=23$ mm

then,

$$I(1) = (25^4 - 23^4) / 12$$

- $=9232 \text{ mm}^2$
- (b) Total inertia, $I=I(1)+I(2)+I(3)+I(4)$
 $=9232+9232+9232+9232$
 $=36928 \text{ mm}^2$
- (c) Load per mm
 $W/\text{mm}=W/L$
 $=200/300$
 $=0.66 \text{ N/mm}$
- (d) For uniformly distributed load, bending moment
 $M=(-W \times L^2)/2$
 $=(-0.66 \times 300^2)/2$
 $=-29970 \text{ Nmm}$
- (e) Deflection in the fork
 $Y_{\text{max}} = (W \times L^4)/(8EI)$
 $= (0.66 \times 300^2)/(8 \times 2.1 \times 10^5 \times 36928)$
 $=0.0869 \text{ mm}$

(2) BATTERY CALCULATION:

We provide sealed lead acid battery which has a volt of 12v having a current of 7Ah. It has a characteristics of 34 Watt per cell.

W=Total load =34 Watt per cell (consider the maximum of 80 kg can be lifted to drive the motor)
 H = Time taken in hours =6 hrs
 V =Battery voltage =12 Volt
 Load = 34 Watt
 $=\text{total load} \times \text{backup time in hrs} / \text{voltage}$
 $=34 \times 6 \times 6 / 12$
 $=102 \text{ AH}$

VI. CONCLUSION

We introduced this mini forklift which can be used for lifting heavy weight objects. It is working with help of 12v DC motor (wiper motor). It can be use in homely purposes and small-scale industries to shift objects from one point to another. This will help to reduce man effort and excess time consumption for transportation of objects. Also, this forklift is most favorable since it is foldable and helps for space reduction.

The main advantages are Low maintenance cost, Human effort is reduced, Less time consumption and increased productivity and No pollution. The main disadvantages are Battery needs to be charged periodically, It is not ideal for long travel and It is not applicable for heavy loads. Then the applications are Used industries to carrying loads or tools in narrow work place, household works for transport gas cylinders, Rice sacks and labs to carry brittle materials.

REFERENCES

- [1] P. Naveenkumar Asst. Professor ,Department of Mechanical Engineering , Hindusthan Institute of Technology , Coimbatore-32.N.Ashok, J. Dinesh Kumar,S. Mohamednizarudeen Ug Scholar ,Department of Mechanical Engineering , Hindusthan Institute of Technology , Coimbatore-32. International Journal of Engineering Research & Technology (IJERT)ISSN: 2278-0181Published by, www.ijert.orgETEDM - 2018 Conference Proceedings.
- [2] Saurabh S Shah, Mohd Husain A Sunasara,Prमित S Jain , Zohaib Shirgaonkar Department of Mechanical Engineering Rizvi College of Engineering Bandra (W) , Mum-50, Maharashtra, IndiaSaurabh S Shah1, Mohd Husain A Sunasara2,Prमित S Jain3 , Zohaib Shirgaonkar4Department of Mechanical Engineering Rizvi College of Engineering Bandra (W) , Mum-50, Maharashtra, India.



- [3] S. Liawatimena, B.T. Felix, A. Nugraha, R. Evans Computer Engineering Department, Computer Science Faculty Bina Nusantara University, 9 KH Syahdan Street. Jakarta. Indonesia. 11480 Tel: (62)21 534 5830, Fax: (62)21 530 0244 s.liawatimena@iee.org, Member, IEEE {trooan_102000, b05nanta, Rheza.Evans} @yahoo.com International Journal of Engineering and Industries(IJEI) Volume2, Number4, December 2011 doi : 10.4156/ije. vol2.issue4.6
- [4] Cameron Chan¹, Jason Cortez¹ and Jay Lopez¹ California Polytechnic State University Aerospace Engineering Department, San Luis
- [5] O Jayesh Yadav, Manish Vishwakarma, Siddiqui Mohd Shakir, Sanoj Yadav, Yusuf Rehman Student, Assistant Professor, Department of Mechanical Engineering, Theem College of Engineering, Boisar 401501 bispo, CA, 93407 International Journal for Research in Applied Science & Engineering Technology (IJRASET) ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538 Volume 10 Issue IV Apr 2022- Available at www.ijraset.com
- [6] V. M. Jothi Prakash¹, S. Venu Gopal², G. Chakravarthi³, Dr. S. Prasana Raj Yadav⁴ Asst. Professor, Dept. of M.E, Easwari Engineering College, Ramapuram, Chennai, Tamil Nadu, India^{1,3} Asst. Professor, Dept. of M.E, VELS University, Chennai, Tamil Nadu, India² Associate Professor, Dept. of M.E, Easwari Engineering College, Ramapuram, Chennai, Tamil Nadu, India⁴ DOI:10.15680/IJIRSET.2019.0801046 www.ijirset.com
- [7] Prof. V.M. Magar Project Guide Department of Mechanical Engineering Shivajirao S. Jondhale College of Engineering Mumbai, Maharashtra, India IJRST –International Journal for Innovative Research in Science & Technology | Volume 3 | Issue 11 | May 2017 ISSN (online): 2349-6010
- [8] Mohankumar M, Jawahar P, Narendran B SNS College of Engineering, Department of Mechanical Engineering, Coimbatore May 2020 |IJIRT | Volume 6 Issue 12 | ISSN: 2349-6002
- [9] Sarvind Kumar Anurag Ranjan Ujjawal Kumar, Divakar Kumar, Dhruv Kumar, UG Student, UG Student, UG Student, UG Student, Assistant Professor Deptt. Of mechanical engineering, Jims engineering management technical campus, greater Noida, Uttar Pradesh-201308 2020 IJCRT | Volume 8, Issue 6 June 2020 | ISSN: 2320-28820
- [10] Lili Chenga, Dingxuan Zhaob,*, Tianyu Lia, Yao Wangc School of Mechanical and Aerospace Engineering, Jilin University, Changchun 130012, China School of Mechanical Engineering, Yanshan University, Qinhuangdao 066004, China School of Mechanical Engineering, Beihua University, Jilin 132013, China Received 8 February 2022; accepted 8 March 2022 Available online 30 March 2022 www.elsevier.com/locate/egyr