Journal of Nonlinear Analysis and Optimization Vol. 15, Issue. 1, No.15 : 2024 ISSN : **1906-9685** 



#### Paper ID: ICRTEM24\_124

**ICRTEM-2024 Conference Paper** 

# DESIGNANDDEVELOPMENTOFFORKLIFTIN MANUFACTURING

# <sup>#1</sup>P. Bhaskar Rao, Assistant Professor, <sup>#2</sup>K. Polaiah, Assistant Professor, <sup>#3</sup>V. Venkatarami Reddy, Assistant Professor,

#### SAISPURTHI INSTITUTE OF TECHNOLOGY, SATHUPALLI, KHAMMAM.

**ABSTRACT:** Plant organization is an important, but costly, consideration. Autonomous cars have the potential to reduce the physically demanding work of driving trucks. Expenses would be reduced, and the labor would be liberated. This topic is relevant to our current conversation. This article provides a detailed study of the complex process of creating a fully operating prototype for both an autonomous loader and an autonomous industrial robot. The lifter is propelled by two DC motors, while the entire box is propelled by four encoder DC motors. This approach works by expanding the chain, which forces the fork ahead. The object's body is made of iron and metal. The robot can move smoothly thanks to its propulsion system, which consists of tank wheels or a continuous track. A camera can help spot bags that need to be repositioned. The Raspberry Pi microprocessor simplifies the integration of the camera and gadget, allowing them to function as a single system. Companies waste financial resources, valuable time, and critical assets, while employees are subjected to hazardous situations by being forced to drive vehicles or conform to rigid scheduling. Implementing autonomous fork lifter robots is the best solution to this challenge. The versatility of this robot's visual processing is incredible. Transporting baggage between locations has become a major challenge for many businesses today. This robot can efficiently solve the problem in retail stores and other commercial settings. The robot's autonomous navigation and three-dimensional environmental identification capabilities allow it to transfer things between places with ease. As the robot reaches its destination, the act of building a map in real time increases its level of safety.

 $K\!EYWORDS: Forklift, design, material handling system$ 

## **1.INTRODUCTION**

A forklift is a very useful piece of machinery that is frequently used to transport huge loads weighing several hundred tons or more. A forklift is a tiny truck-like vehicle that moves around using two adjustable metal poles. When utilized, it causes objects to move. As a result, the driver of the forklift will continue to move in this direction until the forks strike the products. Following that, the hooks are utilized to increase the weight to the desired level. The vast majority of blades are composed of steel, which can support a significant amount of weight. They are sometimes known as tines or blades.

Depending on the model, forklifts can run on gasoline, electricity, or a combination of both. Batteries offer the power that electric automobiles require to operate. In terms of strength and speed, gasoline and propane-powered vehicles outperform electric trucks. Alternatively, the first option may cost more in terms of both operation and repair. Electric or hydraulic forklifts are preferable to gas-powered ones since they emit less odor. Forklifts, or powered industrial vehicles, come in a variety of shapes, sizes, and layouts. Other names for these vehicles are fork trucks, lift trucks, rider trucks, and pallet trucks. On the other hand, its primary purpose is to ensure that a single person can securely and conveniently transport large goods. It is significantly easier to load and transport large objects over long distances using a hydraulic hand pallet, as it is often known. A pallet crane is a compact forklift-like machine that was recently developed. These tools are used in storage spaces to move objects ranging in weight from heavy to light. A forklift is propelled by an electric motor, allowing things to be transported on the back of an industrial truck. These objects come in a variety of sizes and are mostly used to provide directions.

Similar to various types of automobiles. Hydrostatic cranes do not require gasoline, electricity, or oil to operate; they can accomplish everything on their own. This purpose is achieved through the use of hydrostatic force transfer. The forklift's hydraulic pump makes it easier to move large, heavy objects. Typically, the barrel is linked to the bottom of the fork. While it is true that not every car is designed to be driven inside. There are numerous types of outdoor instruments that can be utilized. Off-road vehicles use oil as their primary fuel, but diesel and natural gas can also be used. Still, rough-terrain forklifts last the longest. Every single one of them has incredible strength and can move huge objects. In addition, their truck-like tires allow them to go over rocky and mountainous terrain. Because of the utilization of cranes, warehouse workers now have to undertake a variety of tasks.

person was provided assistance to do their challenging task on their own. Forklifts can move and lift anything swiftly and safely if they are operated and maintained properly. In a broad sense, this image appears to depict a typical truck. "Powered industrial trucks" are often cars that can be distinguished by their primary characteristics. Turret trucks, reach trucks, cranes, and container **JNAO** Vol. 15, Issue. 1, No.15 : 2024

handling trucks are just a few examples. Forklifts have been extremely useful in a variety of industries since their inception. Statistics on industrial deaths and injuries around the world demonstrate that the risks of forklifts have increased as technology has advanced and more freight is carried.

Once cranes were constructed, the emphasis switched from just carrying objects from one location to moving multiple enormous items at once. Putting these systems in place was intended to increase productivity while reducing the dangers associated with undertaking physical activity at work. Because there wasn't enough of it, a niche market developed to offer certain tools and equipment. As a result, there were far too many additional dangers in the job. Many workplace deaths and significant accidents have occurred as a result of pedestrian workers and forklift operators being unable to communicate. These outcomes can be observed in a variety of settings, including businesses and stores. Several technological and management adjustments are required to reduce the existing dangers. The predicted consequences of these improvements extend beyond simply making things cleaner and more efficient. It is critical that they try to incorporate plans for improved automotive technology and self-driving vehicles.

# **2. METHODOLOGY**

Currently, the majority of research is focused on improving the intelligence and functioning of forklifts through the use of modern technology. As a result, the business has grown to include applications that demand small footprints, lower fuel use. and easier maintenance access. Ergonomics were thoroughly examined at all stages of the production process. The basic goal of ergonomics is to eliminate static muscle strain and vibrations, which affect the whole body. The validation of higher efficiency promises by this physical property needs the commitment of research funds. However, major improvement was only realized after the development of the technology of Active Stability (SAS), а sophisticated technology.This component

monitors and adjusts the back axle to prevent overturning.

To maintain a steady load, the mast and forks must be precisely synchronized. The active mast control capability allows for this. Caterpillar's most current tricycles provide increased comfort and functionality with the use of electric balancing lift mechanisms. This functionality boosts user productivity by giving easy access and plenty of storage space. Improve your capacity to control the journey's trajectory by using an automated reverse/forward transfer. Implementing this strategy can cause your trajectory to change practically instantly. It may also improve load stability and gear shift smoothness by using double-coned synchromesh gears. Implementing hydrostatic steering will minimize operating costs, improve product efficiency, and reduce maintenance requirements. The addition of the bending support system completed another part of the design. When supporting oscillating objects, the mast increases structural stability by 30%. The LLC variants come with a configurable joystick control for easy adjustment of the electrical load. It allows you to manipulate all hydraulic operations with just one finger.

### **3. WORKINGPRINCIPLE**

Figure 1 shows a loader, a tool used to transfer things. The motor and wheel shaft are inextricably coupled. The car travels forward thanks to this motor. The battery and motor are connected. The motor's torque can be increased by using a worm gear. A bearing block connects the motor with the wheel, propelling the car forward. The motor must be controlled by the control unit. This car produces no hazardous emissions, making it environmentally beneficial. The mounting system for the forklift is located at the front. The lead screw raises the fork so that it can travel vertically. When building a vehicle, safety must always be the priority. The forklift has three points of contact: two front wheel drives and a securely attached rear wheel contact axle. As a result, the loading system and motion stability have improved. The forklift material handling system includes tires, cables, mounts, fixtures, fasteners, a

**JNAO** Vol. 15, Issue. 1, No.15 : 2024 supporting frame, switches, a Raspberry Pi, a lifter motor, lifter sliders, support rods, a chain, and sprockets.



Fig.3.1.Forkliftmaterialhandlingsystem Figure 2 shows Pi as it really is. A group called the Raspberry Pi Foundation was created in the UK to help teach basic computer science in schools and developing countries. They made the Raspberry Pi line of low-cost single-board computers. People who weren't really interested in robot uses bought the first model, which became a huge hit, much bigger than anyone thought it would be. It is now widely used in study projects, especially those that focus on weather monitoring, because it is cheap and easy to carry around. There are no keyboards, mice, or other accessories in the package. Some extras were in both permitted and unapproved bundles. The Raspberry Pi's hardware has been updated several times, and each version has a different CPU, memory, networking. and interaction with other devices.



Fig.3.2.RaspberryPi

## 4. RESULTSANDDISCUSSION

The forklift is powered by four 4.5 volt direct current (dc) motors. While the other two lift

anything, the other two drive the forklift itself. Direct current motors are fueled by three 12-volt batteries. Each piece of equipment features fork hands that measure 30 mm long and 7 mm wide. It can therefore hoist weights ranging from 5 to 7 kg. The forklift's integrated proximity monitor detects objects and informs the operator. Ensure that no employees or other vehicles are involved in a crash. Although most people think that utilizing a forklift in an industrial setting is exceedingly dangerous, there isn't much statistical evidence to back up this assumption.

The information is critical for guidance or regulation. This is consistent with the idea that operators should get education and training to improve forklift safety standards. The simple solution of relying solely on training to mitigate the risks connected with forklifts is unlikely to be effective. The forklift's technology will be the most significantly altered, but other administrative measures such as better logistical planning and training may also be advantageous. This would address concerns about proximity, security, and zoning. The only way to significantly impact the industry as a whole and minimize the number of forklift-related accidents is to develop а comprehensive forklift safety policy.

Understanding your forklift's stability limits will help you keep it from tipping over. This is owing to the fact that varied models perform differently in dynamic situations and take different forms. Despite its versatility, the forklift can pose certain concerns. When a driver is not given timely and accurate information about how a specific action may affect the vehicle's load and stability, it may result in unsafe behavior. This way of developing safe operating procedures is superior to using the load chart, which is now attached to the forklift. The vehicle's on-board computer may store speed limits for certain areas, such as a proximity system, which is an important part of logistics planning. The development of computer-based 3D models has made it possible to detect problems before they occur. To assure everyone's satisfaction, a strategy covering all potential uses would be useful. Due to the company's quick expansion, there are numerous outstanding software solutions

**JNAO** Vol. 15, Issue. 1, No.15 : 2024

available. Over the next few years, these transactions are expected to improve. To make forklifts safer, manufacturers and the government must take considerable steps. Organizations may need to take a broader approach to forklift safety in order to address safety issues at both the planning and operational levels.

# **5. CONCLUSION**

There is a variety of credible information supporting the notion that forklifts are consistently and negatively connected with workplace accidents. Various factors have a considerable impact on all fields of study, making it an issue of global importance. So far, research on forklift safety has primarily focused on workplace hygiene, ergonomics, and training. Over the last few years, little progress has been made toward establishing effective risk-reduction methods. Enhancement of forklift stability is required, and SAS systems must become the rule rather than the exception. It is also recommended that the staff be evaluated for their ability to transfer duties. Configuring adequate load controls for forklifts is critical in commercial situations to provide optimal stability. These labor protection devices are appropriate for a wide range of applications. The concurrent adoption of these restrictions is predicted to result in a 20% decrease in death rates. Forklift operators in factories and warehouses are vulnerable to a variety of injuries due to inadequate design. This type of accident is more likely to happen when the roads are congested and the forklift is operating at full capacity. As a result, it is critical that you continuously and closely monitor the vehicle and immediately report any problems that may arise. The combination of an on-board proximity control system and logisticsbased speed zoning could significantly minimize the number of fatalities caused by various sorts of accidents.

## REFERENCES

 CollinsJW,SmithGS,BakerSP&WarnerMetal., "Injuriesrelatedtoforkliftsandotherpoweredind ustrialvehiclesinautomobilemanufacturing". American Journal of Industrial Medicine, 628

1999 Nov, 36 (5),1999, pp. 513-21

- 2. Hughesetal., "Intelligenttransportationsystem". MechanicalEngineering,NewYork,1999
- Larsson,TJ&Rechnitzer,Getal.,"Forklifttrucks

alysisofsevereandfataloccupationalinjuries,cri ticalincidentsandprioritiesforprevention". Safety Science 17,1994, pp. 275-289.

- JLambert et al., "Forklift StabilityandOtherTechnicalSafetyIssues" AccidentResearchCentreMonash UniversityVictoria3800Australiaaninitiative funded by WorkSafe, Victoria. April 2003.
- M. Seelinger and J. D. Yoder et al., "Automatic visual guidance of a forklift engaging a pallet," Robotics and Autonomous Systems, Vol. 54,no. 12, December 2006, pp. 1026–1038.
- G. Devita and G. Iannaccone et al., "Design criteria for the RFsectionofUHFand microwave passive RFID transponders," IEEE Transaction son Microwave Theory and Techniques, Vol. 53, September 2005, pp. 2978–2990.
- Collins JW, Landen DD, Kisner SM, Johnston JJ, Chin SF & Kennedy RD et al., "Fatal occupational injuries associated with forklifts", UnitedStates, American Journal of Industrial Medicine, Nov, 36 (5),1999, pp. 504-512.
- Rangaswamy, T, Vijayrangan, S.etal., "Optimal sizingandstackingsequenceofcompositedrives hafts", Materialsscience, Vol.11No2.2005, pp.1 23-128.
- 9. Amboji Sudhakar R,Humane Yogesh A,Chavan Rohan R.,Patil Jyotsna C,Kshirsagar Prashant R. et al., "Design and Fabrication of Three Way Tipper Mechanism".International Journal of Research in Advent Technology, Vol.2, No.4, April 2014. pp. 261-265.
- CollinsJW,SmithGS,BakerSP,LandsittelDP& Warneretal., "Acasecontrolstudyofforkliftandotherpoweredindustr ialvehicleincidents". American Journal of

Industrial Medicine, Nov, 36 (5), 1999, pp. 522-531