International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Design and Fabrication of Pedal Operated Forklift

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ABSTRACT:

Forklifts are used to lift heavy goods in large scale and highly automated industries. Since the small-scale industries require repeated movement of load from one station to another, the use of these forklifts will not be economical. An attempt was made in this project to design a forklift which helps small-scale industries in transporting the load in an easy and cost-efficient way. The idea was to lift and shift the material on the shop floor where a very low frequency of shifting is required and the object being heavy enough for humans to shift. The lifting could be done by a crank provided in a convenient approachable place near the operator seat, and once the load is lifted by the fork, the vehicle could be propelled with the operator his pedaling effort just like a bicycle.

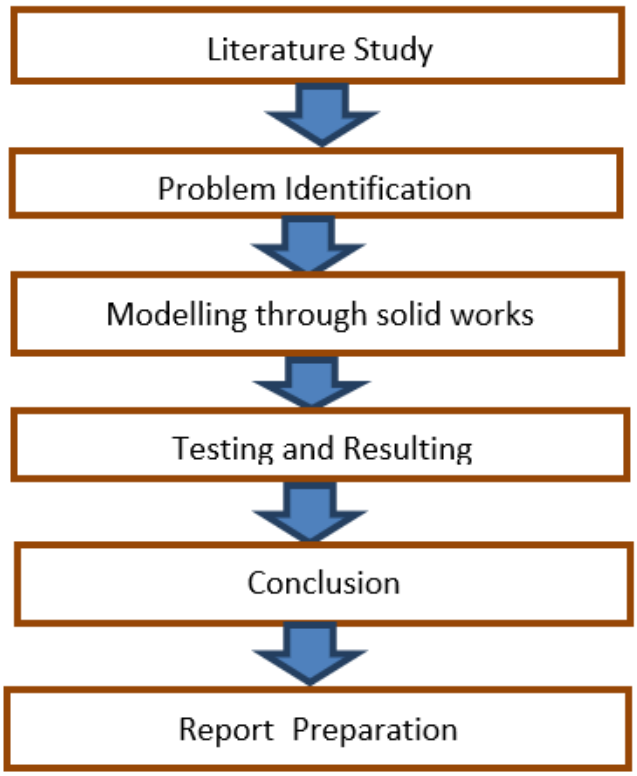
1. INTRODUCTION

A forklift is commonly used in warehousing and manufacturing and it consists of two metal forks at the front of the vehicle in order to lift and transfer the load. The way the load is lifted in case of forklift in such a way that the operator is going to move forward the vehicle until the two forks push under the cargo and then it is lifted by operating the forks. Sometimes forks are also known us blades and are made of steel and are capable of lifting a few loads. Even though there is gasoline and electricity to run forklift, we introduce the pedaling system with the help of man power to run forklift. Electrical forklift depends on battery to operate as compared to gasoline or propane forklift These gasoline or propane forklifts are much stronger or faster as compared to electric forklifts, but considered to be difficult to maintain, and it is also fuel efficient. Sachidananda [1]. A This study aims to analyze risk factors related to unsafe behavior in forklift operations using two representative human error analysis techniques, i.e.. SHERPA and HE-HAZOP it is known as systematic assessment tool used to identify and address potential hazards in industrial process before an incident occurs. that could affect the safety of people are assists while hindering productivity. Gyu cheol Ha [2]. Recently developed automatic transmission for forklift have various auxiliary functions such as creep, auto retardation, and automatic shift with excellent shift quality. This paper deals with the creep function which enables one to maneuver a forklift at the designated low speed by slip control of clutches. Gyuhong Jung [3]. Forklift trucksare generally operated with frequent accelerations and stops**,** reverse and operations of load handling**.** This way of operation increases the energy losses and consequently the need for reduction of fuel consumption from forklift customers**.** This study aims to build a model to replicate the performance of forklifts during real operations and estimate fuel consumption without building a real prototype. Hanchi Hong [4]. In this system, five DC motors, Arduino UNO, IR remote and IR receiver are used. Four DC motors are used for moving and one DC motor is used for lifting. Arduino UNO is mainly used to control the overall system. Arduino UNO will determine whether the motors have to rotate forward or backward. Motor directions are implemented by Arduino programming management. Therefore, the system will be a foundation in implementing of the industrial forklift. ZZ Mo e San, Aung Thike[5]. This paper presents a novel advanced driver assistance system for human-operated forklifts in logistical scenarios. The system helps the operator to pick up wooden pallets by performing a expected to be 10~ 15% cost reduction per components consisting the cabin. Jeong Min Kim[6] .

A lateral stability layered control method based on Takagi–Sugeno (T–S) fuzzy neural network is proposed, divides the forklift lateral stability control into the upper identification layer, the middle control layer and the lower executive layer[7]. Simulation and real vehicle test results indicate that the forklift lateral stability control method based on the T–S fuzzy neural network can effectively identify the forklift driving state, reduce the forklift rollover possibility and improve forklift safety under limited working conditions [8]. Jiacheng Li This work presents a virtual simulator for forklift training, developed with a graphic motor and haptic control interfaces specially designed for machine control: steering wheel and flight joystick (both with force feedback), and Oculus Rift. Operational tests showed that the simulator correctly represents the main functionalities and characteristics of a real forklift. Daniel Valente de Macedo [9]. The results of the field evaluation indicated that the at least curvature continuous course and limiting vehicle parameters, such as a limited steering angle. Benjamin Molter. A new concept of a forklift truck design was proposed. The final design concept (including the modular cabin) consisted of a number of functional components such as overhead guard, engine/battery hood, hydraulic control, steering compartment, operator seat, etc. By modularizing new backrest improved comfort during both static and driving tasks by~ 10% and 23%, respectively. The results of objective metrics showed a reduction in the mean torso and the maximum center of pressure change of locations by 300 and 6 mm, respectively, for the new design. Further, the change in movement during the trials as assessed by the deviation in center of pressure measure was decreased (12%, p-value= 0.32) for the new design, compared to the increase of 47% (p-value= 0.0078) for the original design, suggesting that new backrest performed better over time. Based on these findings, the new design was further improved [10].

2. METHODOLOGY:

Methodology is a type of work plan. The methodology used for design and fabrication of pedal operated forklift is as follows.



3. COMPONENT SELECTION:

3.1 PEDAL:

Input to the shaft that enables the gear to rotate inside the gear box is achieved through pedaling. The pedals are made of steel as shown in figure 1. It situated such that operator, comfortable to operate. The pedal usually consists of a spindle that threads into the end of the crank, and a body that is attached to a foot rest, which is free to rotate on the bearings in relation to the spindle. Pedals where initially attached to cranks connecting directly to the driven wheel. Your paper must be in two column formats with a space of 4.22mm (0.17") between columns.

Figure 1.

3.2 SPROCKET:

These are used to transmit rotatory motion between two shafts where gears are unstable are to in part linear motion to a track as shown figure 2. In which the pedal shaft carries a large sprocket wheel, which drives a chain which in turn drives a small sprocket on the axle of the rear wheels. Sprocket typically do not have any flange.

Figure 2.

3.3 CHAIN:

The chain used in this forklift is known as roller chain. It is used to transfer power from the pedal to the drive wheel. The material used is nickel plate chain as shown figure 3.

Figure 3.

3.4 D.C MOTORS:

Electric energy is converted into mechanical energy by a motor as shown figure 4. It works on the principle of Fleming's left-hand rule that mechanical force is experienced when a current carrying conductor is placed in a magnetic field.

Figure 4

3.5 FORKLIFT BATTERY:

To provide a power source to the forklift as shown figure 5. The lesser-known function is to provide mass as a counterweight, which aids the forklift's lifting capacity. The most common forklift batteries are lead acid, but there is a tendency to use lithium iron phosphate replacement batteries due to the advantages of higher capacity, safety and more cycles, etc. Lead-Acid battery: Heavier (70kg and 80kg per kWh of usable capacity). The full capacity of a lead acid battery is achieved by applying a charge, followed by discharge and recharge. The factory starts the process, which is completed in the field as part of regular use.

Figure 5.

4. DESIGN DETAILS:

- Length=1016mm.
- Breath=609.6mm.

- fork length=330.2mm.
- Fork breath=368.3mm.
- Lift height=635mm.
- Back wheel diameter=160mm.
- Front wheel diameter=120mm.
- Pedal to back wheel distance=533.4mm
- Shaft=12mm.
- Surface to pedal distance=482.6mm.
- Battery=12v.
- Motor teeth=9.
- Spur gear teeth=54.

5. DESIGN PROCEDURE:

Given:

n1=30rpm

Z1=54

P=18 w.

Assume i =2.5

To find:

n2=?

Z2=?

m =?

Solution:

i=n1/n2 =30/2.5

n2=12rpm

i=Z2/Z1 =2.5*54

Z1=Z2*i

d1=m*z1.

m=160 /30 = 5.32

C=(d1 +d2) /2

=120+160/2

C=40mm.

T=(P*60)/(2*3.14*N)

=(18*60)/(2*3.14*30)

=5.72Nm.

=5.72*10^3Nmm.

5.1 ABBREVIATION:

n1, n2=No of revolution.

z1, z2 =no of teeth.

M=module.

P=power.

T=Torque.

6. RESULT AND MODEL:

A bicycle foot paddle, bicycle wheels, sprocket, chain, seat, steering system, rope are used in experimental setup as shown figure 7.A fork is made in front to lift up to 18 Kg. Forklift are rated for loads at a specified maximum weight and specified towards center.as the results shown in table 6.1.

Table 6.1

LOAD /KG	UP AND DOWN TIME/SEC
0	85.66
5	85.66
10	96.21
15	101.31
18	105.82

Figure 7.

7. CONCLUSION:

In this research work, design and fabrication of pedal operated forklift have been studied.

1. The design forklift has the ability to carry a maximum load of 18kg.
2. The forklift designed works on a pedal operation.
3. From the analysis it can be concluded that the designed forklift is able to with stand the load and is economical, reliable and environmentally friendly.
4. The specifications of the motor driving the forklift is calculated based on desired load.
5. From this research it can be stated that the forklift has been successfully designed and fabricated and a prototype model have been developed.

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