

FABRICATION OF STAIR CLIMBER MATERIAL HANDLING SYSTEM FOR SMALL SCALE INDUSTRY

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Abstract - This work gives details about the stair climber material handling System, which can climb stair or move along very rough surface. The components uses in stair climber material handling System are gear motor, wiper motors, batteries, tri-wheels, microcontroller circuit, remote and trolley. Initially the power is given to the motors through battery, the motors are run simultaneously. The vehicle has four set of wheel arrangement to support its weight. Each wheel frame consists of three sub-wheels attached directly to the motor in clamp through nut and bolt. Using this vehicle, the labor cost can be reduced as well as huge amount of loads can be transferred uniformly with less power consumption. The technical issues in fabricating this vehicle are the stability and speed of the vehicle while climbing stairs. The uses of this special vehicle are in the frequent lift of goods such as books for library, medicine for hospital, regular mails for any institutes or transportation any toxic material for industries.

Keywords: set of wheel, Stair climbing vehicle and wheel frame, gear motor, microcontroller circuit.

I. INTRODUCTION

In everyday life we may have to carry so many goods of various quantities through stairs especially in offices, schools, colleges, hotels, industries, apartments etc. where the lifts may not be available, may be full with the people or under repair. It is very tiresome to carry the various objects through stairs manually for higher floor for so many times. In most of building lifts are not installed so there only human labor is solution for caring material. Labor is becomes costly as well as time consuming, where growth rate is getting negative. This problem can be solved if a trolley can lift loads while traveling through stairs.

The project introduces a new option for the transportation of the loads over the stair. The vehicle is designed in such a way that it has three wheels on each side. They are set in triangular pattern. This work focuses on the maximum ergonomically beneficial to human being. The present project related to load carrying equipment of a type that is automatically operated of moving upwardly and downwardly on flight of stairs. Load carrier is a wheeled mechanism device, is generally used to carry a loads. It is use to reduce human efforts.

The various applications may be carrying bundles of answer sheets in a school or a college, carrying furniture n different building ,in hospitals, carrying electronic items in houses and offices .So there should be a way to carry the object through the stair in a more comfortable and tireless manner without forcing the user to apply more force. Here comes the application of stair climber material handling.

II. OBJECTIVE

- To transport material on stair case and rough surface.
- To improve facilities utilization by using stair climber wheel mechanism.
- To transport material in dangerous environment.
- To improve material handling without any damage to material.
- The main objective is to reduce human efforts, pains to the joints of body and severe problems caused during the climbing of stairs at malls, industries etc.

III. SELECTION OF MOTORS:

- Motor for stair case:

Voltage $V = 24$ v

Current $I = 19.5$ A

Power $P = 350$ w

Speed $S = 300$ rpm

$$\begin{aligned} \text{Torque } T &= (P \cdot 60) / (2 \cdot \pi \cdot N) \\ &= (350 \cdot 60) / (2 \cdot \pi \cdot 300) \\ &= 11.14 \text{ N-mm or } 111.4 \text{ kg cm.} \end{aligned}$$

2. Motor for flat surface:

$$\begin{aligned} \text{Voltage } V &= 12 \text{ v} \\ \text{Current } I &= 6 \text{ A} \\ \text{Power } P &= 14 \text{ w} \\ \text{Speed } S &= 50 \text{ rpm} \\ \text{Torque } T &= (P \cdot 60) / (2 \cdot \pi \cdot N) \\ &= (14 \cdot 60) / (2 \cdot \pi \cdot 50) \\ &= 2.63 \text{ N-mm or } 26.3 \text{ kg cm.} \end{aligned}$$

There are four wheels are in contact with flat surface

$$\begin{aligned} \text{Hence, Total Torque } T &= 4 \cdot 2.63 \\ &= 10.52 \text{ N-mm or } 105.2 \text{ kg cm.} \end{aligned}$$

IV. Fabrication:

The fabrication of stair climbing trolley is begins with the fabrication of Tri-Star setup. The Tri-Star is made up of mild steel plates with 5 mm thickness. The various links are joined together using welded and bolted joints.

f. Fabrication of Tri-Star Setup:

For the fabrication of Tri-Star setup the various processes are required that are:

- I. Cutting
- II. Grinding
- III. Drilling
- IV. Boring

The Tri-Star clamp is used for connecting the wheels together. While climbing the stairs it is difficult to climb with a single wheel. Here, the wheels are connected to each of the arms of the clamp and while climbing the stairs Tri-Star setup rotates when it hits the edge of the stairs. The Tri-Star is fabricated using cutting process. The wheels are placed between the two clamps and the motors are mounted on one side the clamp with the help of the nuts and bolts.



Fig.1: Tri-wheel set up with wheels.

g. Fabrication of frame and trolley:

The fabrication of frame assembly is carried out as follows. The frame is fabricated from hollow square pipes of mild steel having 25 mm side. The length of the frame is about 36 inch and width is 26 inch. The frame is adjustable that is we can change the length of frame according to the size of stairs up to 42 inch. The frame is mounted on the shafts of 20 mm diameter by collar bearing. Then the pair of Tri-Star wheel setups is fixed at the ends of the shaft.

The trolley is fabricated with the mild steel angle of length 28 inch and width 21 inch. The trolley having taper shape that is the height is 12 inch in front side and 15 inch in back side. Two sides are cover by mild steel net and two sides by mild steel sheet.



Fig.2: Parts of frame



Fig.3: Assembly of frame.

h. Final assembly of project:

The side view of the final assembled trolley and frame is shown in the fig.5. In this view, we can infer that the chain drive connects the smaller sprocket (fixed to the motor shaft) and the larger sprocket (fixed to the hollow shaft). The frame and trolley are connected with the help of nut and bolt. The length of system is 44 inch, width is 30 inch, height is 31 inch.



Side view

Front View

Fig.4: Assembly of project.

V. CONSTRUCTION AND WORKING OF STAIR CLIMBER MATERIAL HANDLING SYSTEM:

First of all the worker have to put the material in the trolley up to the given capacity of trolley. Initially the power is given to the motors through battery, the motors are run simultaneously. While climbing on stair, when first wheel touches the stair simultaneously the upper wheel climb on stair. All four wheels work same. The motors are run according to the input given. The whole system is controlled by microcontroller circuit with the help of remote control .While climbing up on stair the system is run in forward direction and when it comes to down it run reverse. Because the trolley is design in such a way that, material should not come out from the trolley while Climbing on stair i.e. the height of trolley is more than front side shown in figure. And all movement of machine is control by remote control through microcontroller.

VI. CONCLUSION:

- In this work, concept of stair climber material handling system which provide the service to reduce the human efforts in many fields like offices, colleges and industries for handling material on stair case.
- It provide service to replace man in dangerous environment to transfer material on stairs and flat surface, like underground storage godown where oxygen is in less amount.
- Reduction in human efforts, pains to the joints of body and severe problems caused during the climbing of stairs at malls, hospitals etc.

VII. REFERENCES:

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