

# “DESIGN AND DEVELOPMENT OF INDUSTRIAL PORTABLE LOAD CARRYING ROBOT”

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## ABSTRACT

In the present scenario the application of robots is quite common to reduce the human effort in several areas. The stair climbing robots are used to climb the stairs for different applications up to now, but the main disadvantage of the rugged terrain robots is not adjustable according to the structure of the stairs. To overcome this, we have developed an adjustable stair climbing robot to climb the stairs up and down according to the dimensions of the staircase by using adjustable frame. The main features of the robot include the platform which is attached to the adjustable frame to carry the materials up and down as per the motor capacity. The main application of this robot is to run on stairs as well as on ground floor and also transfer about 50 kg of safe load with it.

**Keyword** – Adjustable frame, robot wheels, staircase,

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## INTRODUCTION

Industrial robots are programmable & multifunctional mechanical devices which are designed to move or shift material, parts, or specialized devices through variable programmed motions to perform a variety of performable tasks and operations. An industrial robot system includes not only industrial robots but also any other devices and/or sensors required for the robot to perform its different tasks as well as sequencing or monitoring communication interfaces. Robots are generally used to perform unsafe, hazardous, highly repetitive, and unpleasant tasks. They have many different types of functions such as material handling, assembly, machine tool load and unload functions, painting, spraying, etc.

Most robots are set up for an operation by the teach-and-repeat technique. In this mode, a highly trained operator or a programmer typically uses a portable control or a device (a teach pendant) to guide a robot to perform its task manually. Robot speeds during these tasks are slow. So it will reduce the workers effort.

So here we are going to develop a machine which will be helpful to everyone in case of shifting of heavy load.

As the name suggest the load carrying robot is a machine which will work and run on ground as well as climb on stairs without any issue and it will also transport load with it. Here we have to just place load which we want to shift or transport from one place to other through the ground surface. With the help of electric motor it will move on the ground surface as well as on stairs and also transport load with it. That will be easy for a worker who have to always transport heavy load through ground surface from one place to another place as well as through stairs.

A load carrying robot is one of its own kinds of machine like there are numerous robots, trolleys and machines are available for doing the same tasks.

As per design and calculation the load carrying robot will be a continuous tracked type machine and its capacity will be nearly 50 kg, we will try to make design safer and convenient.

## LITRATURE SURVEY

Author **Ananya Banerjee** have published the research paper on “**Robotics in Indian Industry**” -Future Trends in **2012** on the basis of that they have concluded “It is becoming possible to apply industrial robots to tasks that robot cannot easily be automated and thus rely heavily on human workers. In addition, robots work long hours and handle heavy objects without getting tired or making mistakes, leading to improved quality. ....[1]

Author **Md. Imran Khan & Saad Bin Siddique Nazmul Hassan, Md.Towhid Chowdhury** have published research paper on “**Automated Luggage Carrying System**” in **2013** on the basis that they have concluded using high powered motors and high powered battery so that the proposed automated luggage carrying system can go through any kinds of environment into such as stairs and unsmooth floor and carry a huge amount of loads so that the efficiency increases in an exponential way. ....[2]

Author **Jaber AL Rashid, Md.Abdul Kadir, Md.Belayet Chowdhury** have published research paper on “**An Autonomous Industrial Robot for Loading and Unloading Goods**” in **2014** on the basis of that they have concluded that used of robot as a trolley to carry heavy loads from one place to another to reducing risk of accidents that usually happen to labours while working in industries and carrying heavy goods on foot. Differential and a single Brushless DC motor usage has been the best choice instead of using two DC motors connected with two rear wheels because this robot has been able to make both right and left turn smoothly while carrying heavy loads. ....[3]

Author **Pradnya T. Chauhan<sup>1</sup> and Ganesh Rahate** have published research paper on “**An Autonomous Industrial Load Carrying Vehicle**” in **2014** on the basis of that they have concluded that an autonomous forklift which will navigate autonomously having ability to avoid obstacle while moving forward. It will be able to control its speed and work on priority base. It will detect the empty space in the rack, keep the load at its assign place and if a product is not available in the stock it will inform to the administrator. ....[4]

Author **Hasan Ghorabi & Yaser Maddahi** have published research paper on “**Design & Experimental Tests Of A Pick & Place Robot**” in **2014** on the basis of that they have concluded that design, modelling and manufacturing of a 4DOF pick and place robot were investigated. Three different approaches were done on a fabricated robot in order to obtain the amount of maximum load capacity of robot. ....[5]

Author **A S Shriwaskar and S K Choudhary** have published research paper on “**Synthesis, modeling, analysis and Simulation of stair climbing mechanism**” in **2014** on the basis of that they have concluded that single slider crank mechanism, double slider crank mechanism, four bar mechanism can be used to simplify and design for climbing robot. So chair with three mechanisms like, star wheel and simple driving mechanism will help to prepare a chair that will be able to climb chair without anyone’s assistance or with assistance. This chair will helpful to climb chair with a particular height and width. ....[6]

Author **K. Narendra Kumar** have published research paper on “**Design and development of adjustable stair climbing robot**” in **April-2013** on the basis of that they have concluded that adjustable design is more appropriate than rugged design. Adjustable stair climbing robot for providing the service to replace the human in many fields like office, military tasks, hospital operations, industrial automation, security systems and dangerous environment. ....[7]

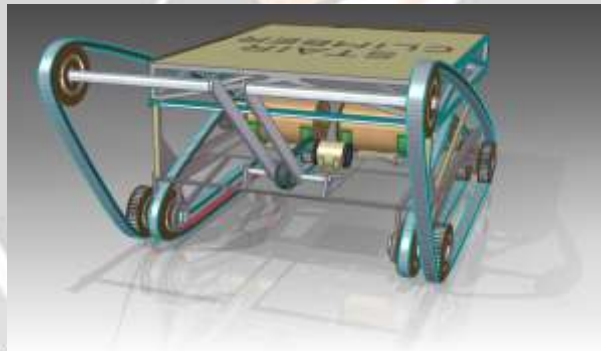
Author **Sandeep H.Deshmukh** have published research paper on “**Development of stair climbing transporter**” in **December 2007** on the basis of that they have concluded that stair climbing transporter can be used to shift heavy load through stairs. The attempt of making SCT as an AGV is successful and practically more significant. The design of SCT with the techniques of artificial intelligence to trace map. ....[8]

Author **Faieza AA\***, **Johari RT**, **Anuar AM**, **Rahman MHA** and **Johar A** have published research paper on “**Review on Issues Related to Material Handling using Automated Guided Vehicle**” in **December 2011** on the basis of that they have concluded that they successfully pointed out and discussed several main issues and factors when dealing with AGVs in the computer applications manufacturing industries. The main issue here can be categorized into three which are navigation, control and supervisory. It is hoped by pointing out these issues, future research and development can be done to improve the problems facing by AGVs users especially in the manufacturing industries. ....[9]

Author **Koustoumpardis, N.A. Aspragathos** have published research paper on “**A Review of Gripping Devices for Fabric Handling**” in **December 2015** on the basis of that they have concluded that the evaluation literature shows that there is a need for intelligent and adaptable grippers. These demands can be fulfilled with artificial intelligent methods applied in the evaluation of the properties/characteristics of the fabrics and the handling tasks as well as in the gripper’s design steps. The present research investigation is carried out for the project XPOMA-Handling of non-rigid materials with robots. ....[10]

Author **Neeti Malik**, **Neetu Rani**, **Alpana Singh**, **Pratibha**, **Srishti Pragya** have published research paper on “**Serving Robot New Generation Electronic Waiter**” in **December 2013** on the basis of that they have concluded that system allows customers to order food by LCD module surface which is programmed by embedded c, which is wirelessly connected to the counter via RF module. A line following robot is used to carry meal from counter to customer. We have tried to implement the robot waiter from the existing appliances which could be use by elderly people or disabled people for house service. Such types of robot system can work in different areas of human societies like hospitals, libraries and restaurants with small change in programming areas. ....[11]

### DESIGN OF ROBOT



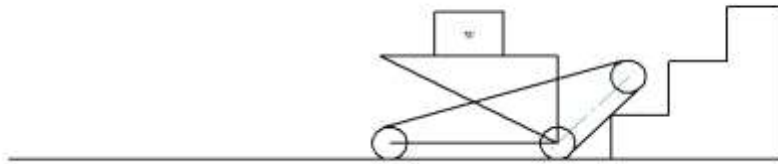
### COMPONENTS OF LCR

Sr no	NAME	Material	Quantity	Size
1	Metal plate	aluminum	2	600x500
2	Timing belt	rubber	2	2m
3	Metal pulley	aluminum	8	100mm
4	Motor	-	2	30kg.cm
5	Fasteners	ms	100	8mm

6	Screw driver	-	1	8mm
7	Round metal bar	aluminum	6	12mm dia
8	Square bar	MS	6	5x5 mm
9	Ball bearing	-	6	12mm bore

**WORKING OF STAIR LIMBING ROBOT**

**RUN ON GROUND AND APPROCHING THE STAIRS:**



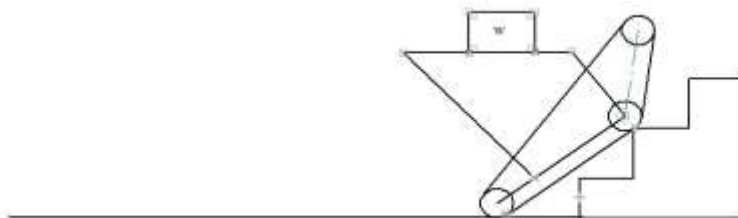
As shown in the fig the stair climber which in the left side will first run on the ground till it approaches to the stairs then the first step of the stair will work as an obstruction for it and the stair climber will start climbing on the stairs.

**APPROCHING THE STAIRS AND START CLIMBING:**



As shown in the fig the stair climber will approach to the stairs and first step of the stair will work as an obstruction for it and it will start climbing on the stairs.

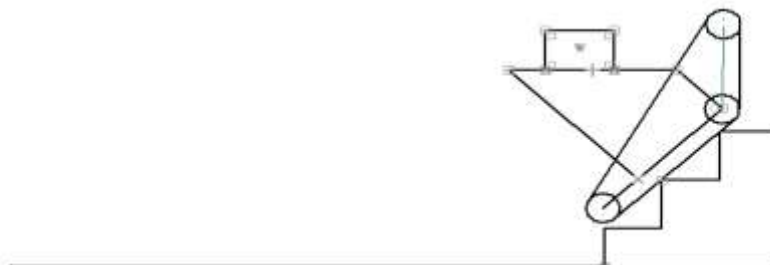
**ADJUSTING UPPER PLATE AS PER ANGLE OF STAIRS:**



The adjustment of the upper plate at an angle of stairs is needed because the upper plate is loaded with load so if we won't change the angle of upper plate then the load will fall off from the upper plate. This adjustment can be done by sliding the lever slightly towards left side as shown in the

figure and then the upper platform will remain parallel to ground floor.

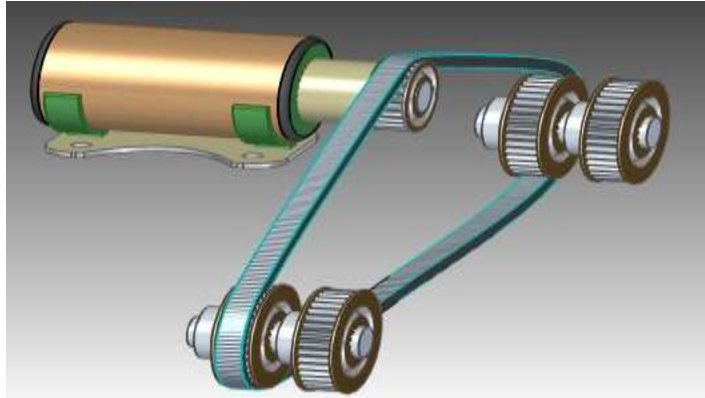
**FURTHER CLIMBING STAIRS:**



As shown in the fig after adjusting the upper plate it will further climb

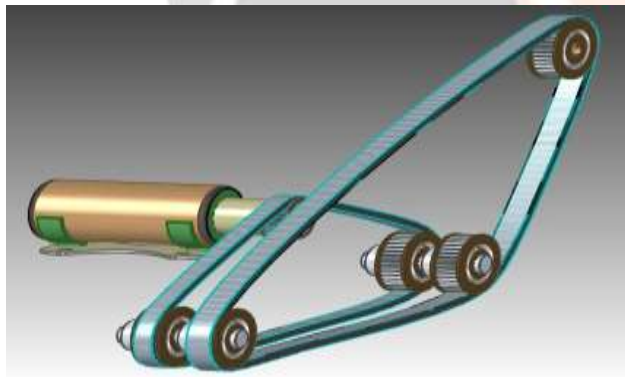
the stairs without any issue and the load on its upper plate won't fall off because the upper plate now is in parallel with the ground floor as shown in the fig.

### DRIVING MECHANISM OF THE STAIR CLIMBER



Driving mechanism is very important for driving the stair climber as shown in fig we can see there is a motor which is connected with two inside bottom pulleys.

So, when we start the motor that motor will drive the pulleys attached to it by belt and those pulleys we can see are connected to outer pulleys with the same shaft on which inner pulleys are connected so when inner pulley will rotate the outer pulley will also start rotating.



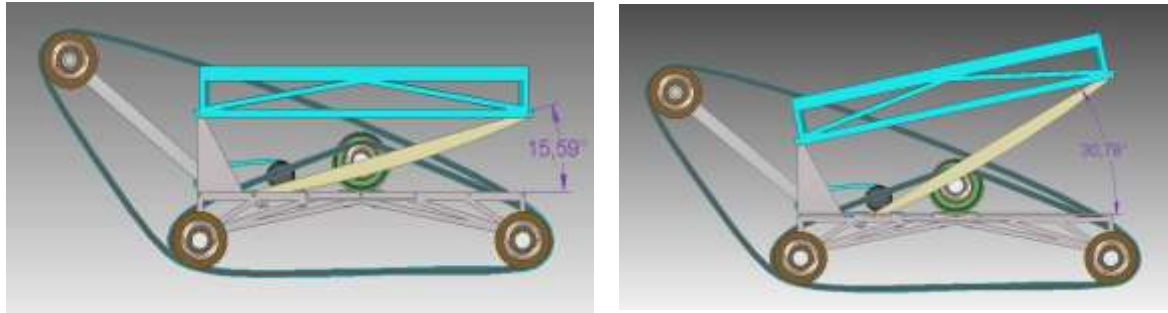
As illustrated in the above figure the outer wheel will start rotating due to the rotation of the inner wheels by the motor.

A long double code timing belt is attached to outer wheels as same as inner wheel attached to the motor, the outer belt will start rotating on the outer wheel and due to rotation of the outer belt the whole assembly will move forward.

This same driving mechanism is on other side too so we can get proper power and steering for the stair

climber.

### ANGULAR ADJUSTMET MECHANISM OF THE UPPER PLATE



As shown in the fig the angular adjustment of the upper plate is quite simple, the fig A indicates ground position and fig B indicates angular position.

When it is required to set the upper plate at an angular position then we could set it by sliding the lever to the right side, as we do such then the upper plate will slightly move at an angle as shown in the fig B. When the angle of the lever with the ground floor will become the same as the angle of the stairs then the upper plate will remain parallel to the ground floor and the load placed on the upper plate won't fall off. That's how angular adjustment mechanism of the upper plate works.

### FUTURE SCOPE

As per our design and calculations we can say that the design is safer in loading conditions but we don't know about its behaviour on stairs so as per our thinking we have got some problem that might come in the real situation and we will try to solve them.

- 1) Reducing jerks that might come while climbing.
- 2) Trying to simplify the design.
- 3) Trying to make upper plate angular mechanism more accurate and easy.
- 4) Reducing the self-weight of the stair climber.
- 5) Prepare working model.
- 6) Reducing twisting moment which will be act on stair climber due to load.

### CONCLUSION

We conclude that adjustable design is more appropriate than rugged design. Adjustable frame increase the flexibility of the robot up to certain limit. It will used as a trolley to carry heavy loads from one place to another to reducing risk of accidents that usually happen to labors while working in industries and carrying heavy goods on foot. It will surely provide a strong platform for us to build on a sustainable, clean and green future.

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