

# Design and Fabrication of Stair Climbing Mechanism to Lift Load over Stair

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## ABSTRACT

*Stair lift is transportation technology with electrical mechanical equipment to assist vertical movements in buildings, and it is used specifically and individually by the elderly and people with disabilities. This paper has two objectives. The first is to optimize the ability of the existing stair lift structure by developing lighter stair lift designs and materials without reducing the capability of the stair lift. The second is to design a braking system on the stair lift. The optimization of a stair lift structural design is needed to ensure that the strength of the stair lift structure complies with the requirements of ASME standard 18.1. The methodologies of this study are redesigning and conducting numerical simulations with the finite element to get the optimum result. Numerical simulations on the guide rails were carried out on A36 steel and 6063 T5 aluminium materials by comparing 30° and 45° stair lift inclinations. The maximum load is 270.4 kg. The distance of support is 1000 mm. From the simulation results, the 6063 T5 aluminium profile can be used as a material substitution for guide rails. The chains for driving links need to be strengthened by adding the dimensions of the chain or increasing the number of chains. The maximum temperature distribution on the disc brakes is 130.56 °C. In this system, we use DC motor for changing the polarity of the power supply which will make the motor run in reverse direction. The carriage run towards upward or downward direction with the help of Toggle switches and push buttons. As guide wheel roller bearings are attached with carriage, the movement of the carriage is like a linear tracking system. In compared with the conventional hydraulic lift, there are some advantages like no civil structure and alteration is required, low cost, less bulkiness, less power, less maintenance requires, easy design, easy installations.*

**Keywords:** stair lift, Load, Material Handling, Civil Structure, Stair Case Lift, rail track.

## 1. INTRODUCTION

There are many old and physically disable peoples in the world and it is difficult for them to climb stairs as compared to normal persons. So to help them and to help the persons who cannot afford lift as their houses are small, the project is made. The most concern of this project is to fabricate a mechanism which will lift them up and put them down whenever they want and at very low budget. A stair with escalator is a mechanical device for lifting people up & down. Rail is mounted on the stairs on which a platform is attached. The platform is lifted by a simple mechanism of rope & pulley by it is lifted. Person gets on the platform is lifted when he/she switch on the plug the motor starts, after that the shaft of motor is connected to gearbox (speed reducer) by the Oldham's coupling. The outlet shaft of gearbox is connected to another Oldham's coupling which transmits the power to the spindle to wind or unwind the rope. Winding the rope will lift the platform up & unwinding will make the platform go down.

## 1.1. PROBLEM STATEMENT AND OBJECTIVES

### Problem Statement

1. To design a stair lift which is useful for lifting people having weight up to 120kg, up and down the stairs in desired time who may find it difficult in doing so themselves with the help of optimized driving mechanism for curved track, ensuring complete safety of passenger.
2. Most stair lifts are manufactured to be of the highest quality and standard. This means that you rarely have to worry about something going wrong with it.
3. However, this doesn't mean that they don't need regular maintenance. It's essential that you look after stair lifts so that they remain in perfect working condition.
4. If you or your family member relies on the stair lift to get around their home, a break down or problem can be a huge inconvenience.
5. Problems aren't just a consequence of not looking after the stair lift either; general wear and tear can happen over time.

### Objective

Stair case lift can be adapted for its stair use simplicity and economy. Therefore it can be widely used for home as well as industrial which ensures a promising future to the concept. A stair lift can be a good solution that allow users to safely move up and down through the Stair.

The work is design with aim and following objective:

1. To develop a lifting system which can be helpful for disabled and old people.
2. To introduce a lower cost solution for material handling to the upstairs.
3. To design a safe lifting system which can installed easily without changing the stair.
4. To give a solution for the old buildings where commercial lift cannot be installed.
5. To determine the working efficiency and beneficial working of the stair lift.
6. Stair lift having the heavyweight carrying capacity.

## 2. LITRATURE REVIEW

In this chapter we have studied different research paper and analysed there limitation and developed our model on pneumatic jacks which uses air as a source. From studies and searches we have got following types of Mechanisms. EGPR Team developed a Stair climber using Pneumatic Jacks with the collaboration of company NIKO Železniki in 2006. There were 48 students from 5 partner Universities participating in the project that started on 13 February 2006. The project task was to develop and prototype concepts for a device, which should be able to transport the goods by climbing up and down the stairs, Reference [1]. P.Jey Praveen Raj , P.M.Mohamed Fuge , R.Paul Caleb , G.Natarajan Designed and Fabricated a Stair Climbing Trolley on 5 May, 2016.The main objective of the project is to find an efficient and user friendly method of carrying various objects through stairs using minimum effort from the user and to also provide a smooth movement while climbing the stair. They manufactured a stair climber with tri lobed wheel frames at both sides of the climber, Reference [2]. In 2002 Carstens, Bernt was design a motor-driven stair climbing device to carry equipment and goods, more particularly wheel chairs with disabled persons. The wheel chair can be detachably fixed to the stair climber and essentially comprises a stable frame with an energy source, a drive shaft, a drive control, feelers, sensors and a lifting mechanism to climb the steps, Reference [3]. MichaelHinderer, PetraFriedrich and BernhardWolf studied in University of Applied Sciences Kempten, Bahnhofstr. 61, 87435 Kempten, Germany and Heinz Nixdorf Chair of Medizinische Elektronik at Technical University Munich, Theresienstr. 90, 80333 Munich, Germany developed an autonomous stair climbing wheelchair. Leg are provided to propel the apparatus horizontally whereby through the extension and/or retraction of selected pairs of jacks and the propulsion of the apparatus in the horizontal direction, the apparatus can ascend or descend a stair flight, Reference [9]. In Sep 1993 Watkins, Baxter R worked on Electronic control stair climbing vehicle. The electronic control system determines from the sensor data whether the slope has an acceptable incline for traversing. If it is not acceptable, the vehicle will be prevented from entering onto the stairway or slope. A seat for a user is tilted in accordance with electronic controls to keep the user approximately vertical with respect to gravity as the vehicle traverses

the stairs. The allowed operation of the vehicle is controlled via parameters which can be changed by removable memory which configures the vehicle for a particular user or group of users, Reference.

## 1. SEARCH METHODOLOGY

The literature survey has been conducted through Google, different website, articles, journals, government publish paper and some type of review papers to developed present study.

## 3. DESIGN

Staircase a motor is mounted which is associated with the g-gearbox. On the output of the gearbox mounted a chain drive. This output shaft of the gearbox is also used to rotate the sprocket with the help of which these stair case lift can move upward and downward. As motor and gearbox along with the platform, chair are mounted on the suitable platform which can be slide on the rails the entire unit starts moving upwards then human / goods can be motivated very easily. Reversing the supply to the DC motor on changing the polarity of the power supply will make the motor run in reverse direction connected with the earlier, while the later will form the entire assembly run to in downward direction then by making the entire /single must be used for the future purposes. Stair lifts can easily installed into any situation where the condition of the stair tread is good. A chair lift for stairs can be both battery operated and AC power operated. The concept of stair case lift is mead for transportation of human, goods across stair case hence it needs something like transported. This system involves a motor, a gearbox, sprocket and a chain drive. Bearings are attached to the edge of the rail and the bearing shafts are connected to the staircase

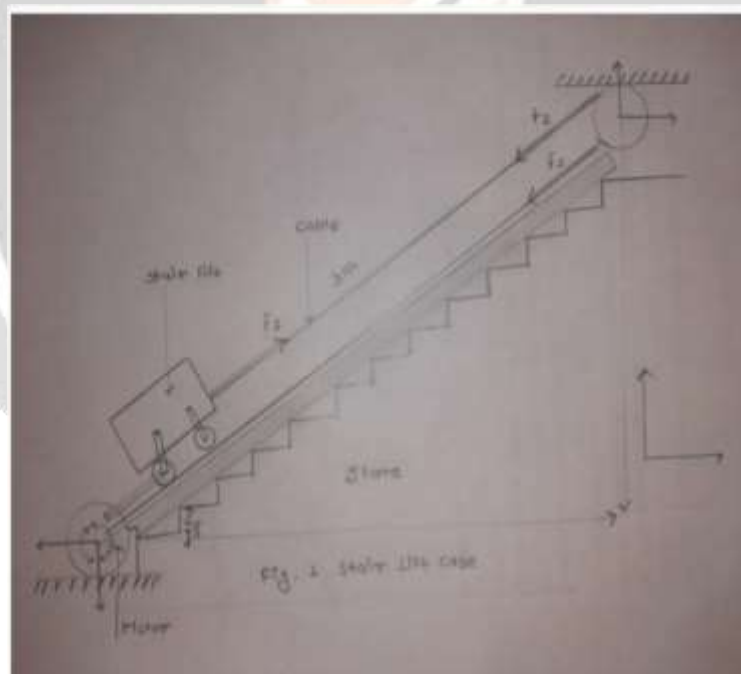


Fig 1.1 Working Diagram

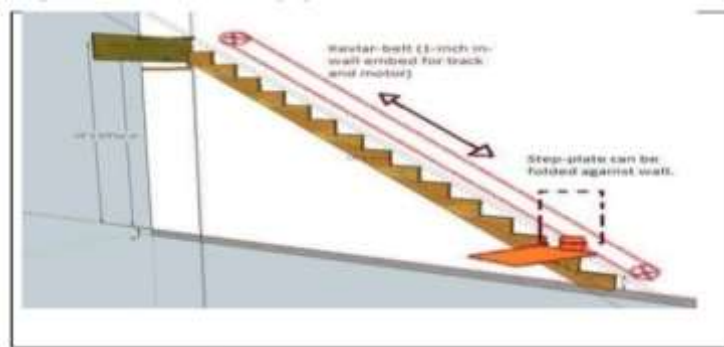


fig 1.2 Stair case Lift

#### 4. PERPOSED WORK

The working principle of an elevator or lift is similar to the pulley system. Stair Lifts Work a stair lift is basically a chair that travels along and rail or track that is mounted to a stairway. There is a motor within the base of the chair that is usually powered by a battery also within the base of the chair. The stair lift motor turns a gear that is meshed into a geared strip on the track or rail. In this project, the final design was an outcome of a sequential analysis and modification of stages. Stair lifts are easily installed into any situation where the condition of the stair tread is good as the railing that the chair lift uses is attached to the stair tread. A chair lift for stairs can be both battery operated and AC power operated.

We find best way to climbing stair through stair lift which is more helpful for old age and handicapped person. We have developed this stair lift which should be affordable and easily operated in hospital apartment, old age homes etc. the design of our stair lift will be easily transporting and handling by a person. It should available in very low price and also low maintenance charge. While in our design if the platform is added a seat having more comfort and safety possible. Our design easily fitted in small houses and big also without damage the stair. This system involve motor, chain sprocket, pulling cable wheels and pulley. In our stair lift a motor is mounted which is associated with the gearbox. On the output of the gearbox is mounted a chain drive. This output shaft of the gearbox is also used to rotate the sprocket with the help of which these stair case lift can move upward and downward.

#### 5. ASSEMBLY

The Mounting Such As One Platform The Mounting Platform Pulley Bridge Rollers Are Mounted On The Stairs To Live Human Things Are Very Heavy Material Platform Is Attached With 4 Roller Which Provide The Sliding Movement In Between Two Metals Strip So That They Can Allow Move In Forward And Reverse Direction There Are Two You Group Police Of 3 Diameter Which Are Attached To That Of Stairs And On The Front Side Of Platform The Rope Is Fixed On Both The Police From Where Its Fix In Bridge Which Winds Or Unwind The Rope The Winding And Unwinding Of Rope Lift The Platform Up And Down. The Mechanism Consists Of Motor Coupling Gear Reducer Pedestal Bearing Bridge Where The Supply Is Given To The Motor The Motor Shaft Rotates Clockwise And The Output Shaft Of Motor Is Connected To Motor Shaft Rotates Clockwise And The Output Shaft Of Motor Is Connected To Old Hams Coupling Which Connect To Mrs Line Shaft And Platform Is Lifted Upward. Working Of Fabricated Stairs The Working Of Steering Is Very Easy Process In This Process Simple Rope And Pulley Mechanism Is Used And The Process Is Based On 3 Basis Principle Action Potential Energy Diameter Of Shaft Supply Current To Single Phase Induction Motor Of Half Horsepower It Rotates At 1400 Rpm The Output Shaft Of The Motor Is Given To Speed Producer Of 1 Horsepower Which Reduces The Speed Of Motor In Its 28 Ratio And Makes It 200 At 72 Rpm The Output Shaft Of The Gear Reduces Is Given To The Wrench Which Wind Rope Attached To The Wrench The Other The Other End Of Rope Is Connected To The Platform And Is Passed Over The Pulley As The Brain Starts Winding The Rope The Platform Gets Lifted And The Person Gets Transported From Ground Level To First

Floor. Similarly When We Reverse The Supply Of Motor Starts Rotating Anticlockwise Which Makes The Bridge To Unwind The Rope And The Platform Comes Down Slowly So That The Person Get Transported From First Floor To Ground Floor This Is. Continuous Process. The Time Taken To Lift Person Of 80 Kg Is 21.5 Seconds And That Of And That To Leave The Person Down Is 24 Seconds Which Conclude That The Rivers Action Take Much More Time Than The And That To Lift The Person Down Is 24 Seconds Which Conclude That The Rivers Action Take Much More Time Than The Forward Action.

## 6 .CONCLUSION

Stair case slider can be adapted for its sheer use simplicity and economy. In our projects making a cost friendly Stair lift which is having some limitations but more advantage, it was a good and challenging project for us. Making a stair lift with roller bearing is not a complicated process and all the components are available in market we purchased it. DC motors with control box which is manufactured for auto rickshaw and this can be directly used in the stair lift. During the test run of this project, it was realized that it would capable of carrying heavy load without any difficulty and any deformation. Though the initial cost of the project seemed to be a little bit higher but it is accurate. Manufacturing would shorten this. Stair lift has distinguished advantages and benefits. In this case no one has alter the civil structure for installation thereafter shortest cost for installation procedure as compared to that of lift. So, future of such lifting system seems to be very bright.

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