

# FABRICATION OF DC MOTOR OPERATED STAIRS CLIMBING WHEELCHAIR

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**Abstract:-** One of the basic problems of user on manual wheelchair is overcoming architectural barriers stairs etc. on its way. Even though many research studies have been reported in different fields to increase the independence of wheelchair users, this reduces the user's human effort and force to drive the wheels for wheelchair. The question of overcoming obstacles by a wheelchair always remains as topic of discussion for many researchers. In our project a motor operated stair climbing wheelchair concept which can overcome the architectural barriers to a considerable extent has been developed. This project involves the design of an ergonomically designed battery powered wheel chair for multipurpose use. Stair climbing functionality is embedded in the design through its structure and mechanism. All the design parameters of wheelchair were based on the standard design of the stairs in India. Major part of the project focuses on the proposed design concept and concludes by discussing upon the physical working model developed for the proposed design solution.

**KeyWords:** DC Motor, belt, cast iron frame, gear, 12V battery

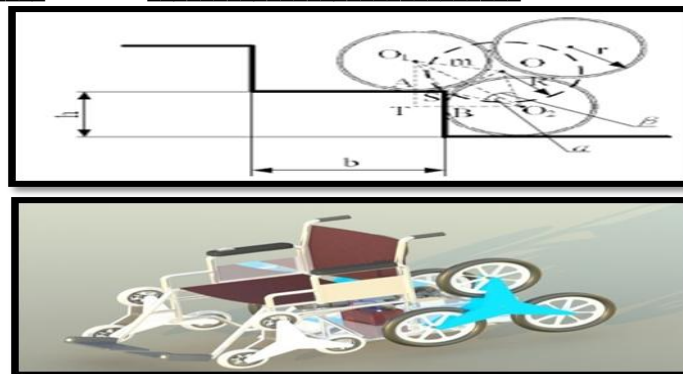
## 1. INTRODUCTION

Disabilities have affected thousands of families in the world. As of today 650 million people are suffering from disability. Their disabilities can be empowered and enable them to live a normal and independent life with the help of wheelchair. New and modified wheelchairs can satisfy the need of disable people rather than the old and conventional ones. To help the disabled person various design changes have been done. One is by introducing a detachable defecation system to it. It provides ease to the patients and the staffs. Engineers are continuously applying their ideas to make these products more and more sophisticated so as to facilitate the doctors, patients and staffs more. Wheelchair is one of the easiest modes which serves the purpose of transportation for patient and is considered as basic necessities in hospital. Studies showed that 40% of the helpers who helped physically challenged person for the translation from bed to chair and vice versa are suffering from the back and joint pains. To tackle this problem many people have designed wheelchairs with various applications which could be converted into a bed or visa-versa using mechanical linkages or with the help of an electrical motor. A slipping mechanism or pulling mechanism is used for lowering the back portion. Then the implementation of hydraulic and pneumatic improved the efficiency as well as eliminated the need of external help but it had a drawback as it created noise and it was bulky. To overcome the problem, the new proposed work came which uses an electrically driven conversion system for the disabled patients. This is even helpful when the patient want to take a nap/sleep by converting the wheelchair to an easy chair where the person can stop the chair at a particular position where they would feel comfortable. The driving and conversion mechanism is both based on the electric motors.

There are 2 concepts of mechanism through which wheel chair can uplift on the stairs:

Concept -1

Manual



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## Concept-2

Automatic

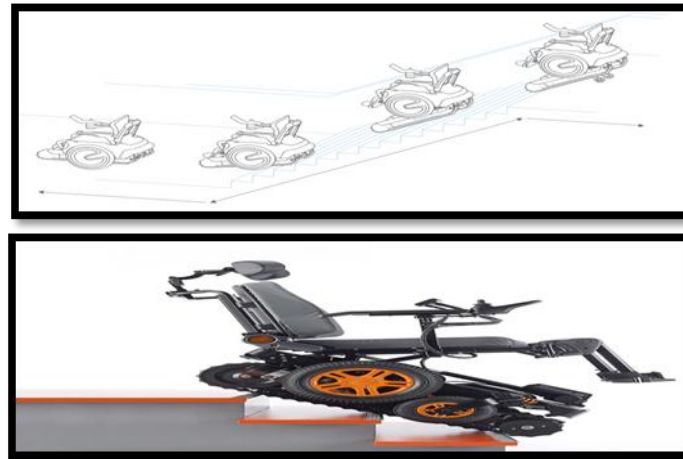


Fig. 1 Basic concept of upstairs climbing chair

**2. LITERATURE REVIEW:**

Siddique (2017): discussed design a wheel chair that is to be used by Quadriplegics (handicaps unable to use their four limbs). The wheel chair is based on the concept of the head tilt movement which enables the user to move from place to place easily. There are various sensors used in the entire wheel chair to reduce the errors and malfunctions which could take place. This wheel stress on level of comfort, easy mobility, maintenance of gradual and balanced speed based on head tilt movement.

Hassan (2012): proposed the design tricycle specifically for the person who can independently move from one place to another place with comfort. The main aim of the project design is to ease mobility for the physically challenged and also provide adequate comfort they desire. Existing tricycles for the disables requires the disabled person to dismount from the wheelchair onto the tricycle. This wheel chair can easily convert into tricycle from wheel chair and vice versa.

Ahmed (2015): The aim of the author to make automatic wheelchair system which facilitates the users. The proposed wheelchair has been implemented with design, simulation and construction of the whole body. Due to high sustainable stress, low cost and availability, Mild steel has been chosen over Aluminum, Cast iron, Stainless steel for frame material. In this project author try to make automatic wheel chair at low price as much as possible

S. Hande in (2017): propose a design of wheelchair whose backrest and a footrest can be controlled through a switch by the patient which will convert the wheel chair into a stretcher. This helps the patient to rest without getting shifted to a bed. This will also eliminates the efforts of assistant required for handling of handicap patients by providing an arrangement of desk with wheelchair

Kura T Sunny (2018), discuss the design a wheel chair by combining scooter and 2 back wheel of wheel chair and make wheel chair accessing mechanism for scooter, for use by handicapped and old aged people. The person on the wheelchair can drive himself into the scooter, and thereby the wheelchair functions as the driver seat. To achieve this, a motor controlled rear ramp and a wheel chair arrester is embedded in the design.

**2.1 Research Gap**

Wheel chair is very useful for paraplegic people continuous research on wheelchair is going on for improving the life of paralyzed person. Some are mention above. Today the price of fully automatic wheel chair is very high everyone can't afford that. But if we talk about manual operating is difficult mainly when architectural barriers come in between like stairs etc. So our aim was that to make manual wheel chair but we have overcome the architectural barrier by providing belt motor mechanism due to which a single person can climb the wheel chair on stairs very easily. We have not made fully automatic wheel chair for making it cost effective. So a poor can afford that wheel chair. None of the researcher talks about semi automatic wheel chair only about fully automatic due to which cost is very high. To reduce the cost we have design a semi automatic wheel chair.

**2.2 Principle Parts**

The wheel chair consists of following principle parts,  
Chair, wheels, rubber belt, motor, battery, Transmission system

- Chair

The chair is one of the main parts of the wheelchair. The chair is fitted on to the wheel of the wheelchair. The frame of chair is made by wood and from of the chair of iron. For human comfort a form is applied to wood and covered by leather fabric. For human comfort a form with a lather fabric is applied to chair.

## Dimension of chair

|                           |        |
|---------------------------|--------|
| Height of seat from floor | 500mm  |
| Height of back            | 450mm  |
| Length of seat            | 400mm  |
| Bredth of seat            | 350mm  |
| Hight of leg              | 450 mm |



Fig. 2 proposed design of chair

- Wheels

Wheel is one of the main part of the wheel chair which is fitted with the legs of chair to provide smooth movement to chair. Wheel is made by steel coated with rubber for better grip.

## Dimension of wheel

|                               |         |
|-------------------------------|---------|
| Thickness of wheel            | 50-80mm |
| Dia of wheel                  | 300mm   |
| Dia of ball bearing for shaft | 15mm    |



Fig. 3 proposed design of wheels

- Rubber belt

rubber belt is used in automatic stair case climbing wheelchair. Rubber is rotated with the help of motor fitted on the end of rubber belt which provide the torque to rubber belt in order to climb the stairs.

## Dimension of rubber belt

|                   |        |
|-------------------|--------|
| Length of belt    | 1000mm |
| Width of belt     | 100mm  |
| Thickness of belt | 50 mm  |

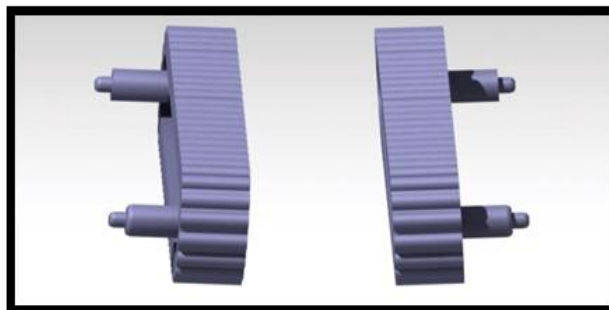


Fig. 4 proposed design of belt

- Motor

motor are used in order to make automatic wheel chair which moves with the help of motor fitted on wheels.

Specification of motor

|         |               |
|---------|---------------|
| Motor   | DC gear motor |
| Voltage | 24V           |
| Current | 7.5 A         |
| Duty    | S1            |
| Speed   | 1440 rpm      |



Fig. 5 diagram of electric motor

- Battery

The battery are used to give required voltage to motor. The battery availability in the market is of 12V, so to provide the required voltage for the motor two batteries are connected in series to make 24V

Specification of battery

|              |             |
|--------------|-------------|
| Battery type | Dry battery |
| Voltage      | 12 volt     |
| current      | 7.5 ah      |



Fig. 6 diagram of battery( 12V)

- Transmission system

The transmission component of the wheelchair design is responsible for allowing the operator to change gears between forward, neutral, and reverse movement.

The transmission system consists of the motor and chain-sprocket system. The motor with the reduction box is directly mounted on the centre shaft with the help of mountings from the frame to hold the motor in place. Therefore the motor is mounted rigidly, so that all the torque produced is completely transferred to the wheels. Now the drive from the centre shaft is transferred to the front and back shafts with the help of the chain sprocket arrangement. The front and back shafts drive the wheels which climbs the stairs.

Assembly and Fabrication of Final assembly



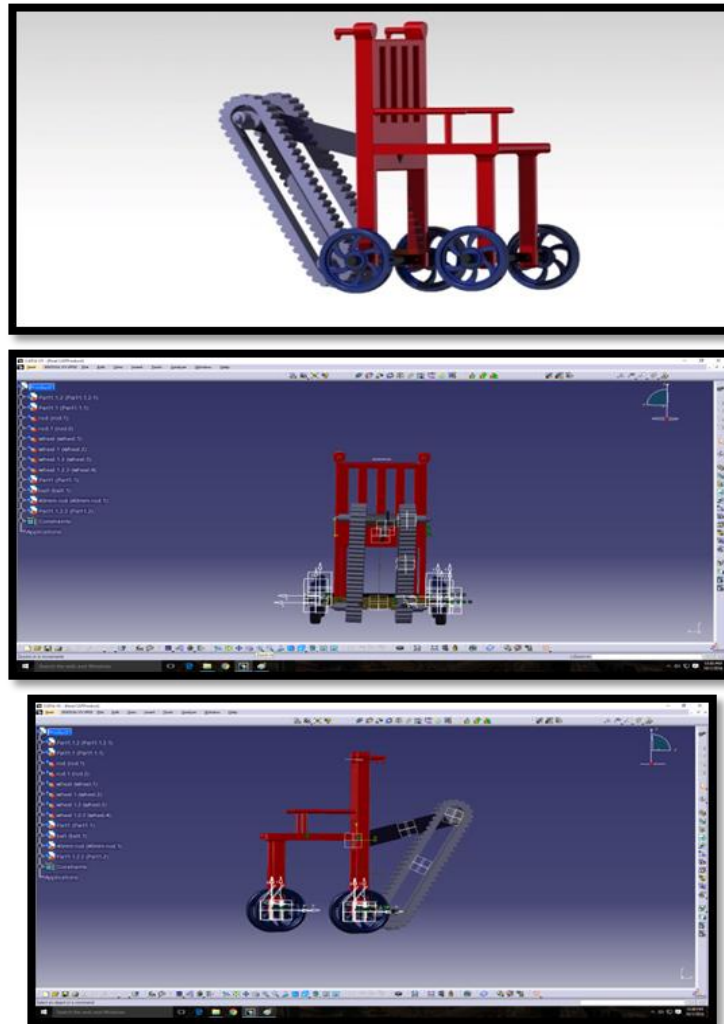


Fig. 7 Final proposed design on solid works

### 3. CONCLUSION:

The design of wheel chair is done semi-automatic because to reduce the manufacturing cost to high extend so a lower class people also afford that and make the life easy and can easily use the wheel chair on stairs. The cost of the wheel chair is approximately equal to manual wheel chair available in market. In this wheel chair the lifting of wheel chair on stairs is automatic while running in normal condition on the floor is manual due to which only a one person can operate the wheel chair even on architectural barrier. For lifting up wheel chair a back arm is given which operate with the help of dc motors and the movement of arm is manual it's done at 45 degree when use for stairs climbing. The frame of the chair is made up of iron and wood and covers with fabric and form. Wood is used to reduce the manufacturing cost. Our main aim was to build the wheel chair for the lower class people who can't afford fully automatic wheel chair for their ease but can afford semi-automatic wheelchair.

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