

# Design and Fabrication of Automatic Convertible Wheelchair

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**Abstract-** *Wheelchair is basically a chair with wheels. Wheelchairs are most commonly used medical equipment in indoor and outdoor environment. Transferring patients from wheelchair to bed and vice versa is difficult task for both the patient as well as person transferring the patient. Caretakers even need special training to do this task. So there is a need of an alternate to this problem. This Project focuses on designing and manufacturing a automated wheel chair which can be driven using joystick and can be converted into bed. The Design uses linkage mechanism to convert the Wheelchair into bed and vice versa. Usages of linkages make the construction and assembly very simple and low cost. Chair is also automated by providing a joystick to drive the wheelchair using Arduino.*

**Keywords –** *Wheelchair, Arduino, Convertible Wheelchair, Automatic Wheelchair, Joystick Controlled.*

## I. INTRODUCTION

The number of physically disabled or weak peoples in India is increasing day by day. As per Census 2011 there are about 2.68Cr people are disabled. Wheelchairs help these people with disabilities to become productive with their life. Wheelchairs are used by injured, physically disabled people or elderly people as an assistive device to move around. They are commonly used in hospitals, old age homes etc.

As over the year wheelchairs have been improving from manual to electric. Most of the wheelchairs available in market are still manually operated wheelchairs. While these wheelchairs are of low cost it takes a lot of physical strength to operate a wheelchair for a long period of time. There are some power wheelchairs which have electric motors but they cost high amount of money in current market and they are still unable to satisfy the need of the disabled people. While wheelchairs can be very helpful in moving people from place to place, transferring people to wheelchair from bed or to bed from wheelchair is very hard task and is an issue for patients, nurses as well as family members. It has to be done by proper technique in order to avoid any accidents. For people using wheelchairs it is almost impossible to get out of the chair without any help.

### 1.1 Aim of Project

This Project hence focuses on creating a Multipurpose Wheelchair which is not only automatic but also convertible. The study was done to understand and the needs of the people and to provide an affordable yet quality solution. The conversion is manually operated by using linkages and electric motors with joystick controller are used to control movement of wheelchair.

### 1.2 Problem Definition

Wheelchair serves the purpose of transporting a person/patient from one location to another. People may feel uncomfortable and require moving due to reasons such as getting fresh air, Wheelchair serves this purpose as it is cheap and most efficient device available. However person who is incapable to move his legs has to manually drive wheelchair by his hands which brings restriction to the movement as it is exhausting. Many times patients with physical disability have to assign a caretaker to move them around which in case of hospitals etc. takes up resources that can be used differently. Moving from wheelchair to bed and vice versa by himself is not possible for a person. Even for some other person such as care taker or family member it is difficult to move a person from wheelchair to bed and is detrimental to health of helper as well as patient. Even though there are power assisted wheelchairs and recliner wheelchair they have high cost. Also the numbers of multifunctional options available are very low. Hence for hospitals or charity homes it is not affordable to give such services to their patients. To eliminate all this problems and to provide patients comfort of moving around a wheelchair was created which can be converted into bed and vice versa.

## II. METHODOLOGY

The process of making the project to achieve the aim included following steps

### 2.1 Initial Research

Initial research was conducted to find about needs of people, already available products their cost and reach to people etc. Also data required for the design as well as manufacturing stage was collected. This includes body weight and height average of population, best sitting posture and sleeping posture etc. from design aspects. For manufacturing material, availability ratings of motors, manufacturing resources etc. were found out.

### 2.2 Selection of Mechanism

Different mechanisms were studied and analyzed to find out the most convenient method for lifting the foot rest to convert the chair into the bed. Finally Linkage mechanism was selected.

A mechanical linkage is an assembly of no. of bodies joined together to transmit the force or motion. A simple linkage mechanism is easy to manufacture and install and can be operated manually by the person sitting in chair. Hence after looking at various options a linkage mechanism based on four bar mechanism was selected for conversion of chair into the bed and vice versa.

### 2.3 Rough Design

After selecting the mechanism, a rough sketch of design was created based on initial research to get started with the design procedure.

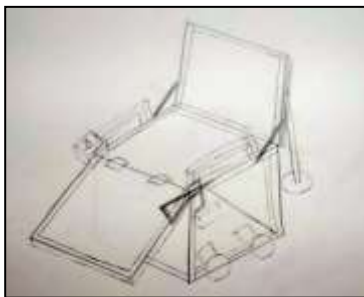


Fig.1 Rough Design of Chair

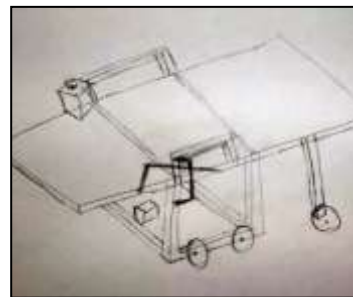


Fig.2 Rough Design of Bed

### 2.4 Construction and Working

The control of motors will be done by a joystick which will operate motor through a microcontroller the block diagram of circuit is given in Fig.3

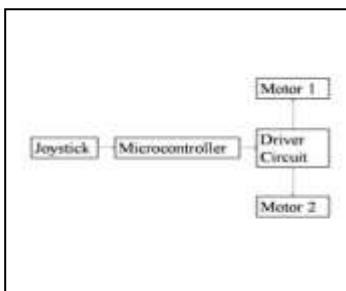


Fig.3 Circuit Diagram



Fig.4 Linkages

Linkages were designed by considering a four bar mechanism.

The calculated Dimensions of linkages are as follows:

Length of Rocker (Handle): 609mm

Length of Coupler: 250mm

Length of Rocker (Leg Rest): 240mm

Length of Fixed Link (Seat): 380mm

Length of Support link (Back): 320mm

Minimum Transmission angle: 46.31 °

Minimum Transmission angle: 84.22 °

## 2.5 Final Design

Based on the calculations and rough design a solid model was done on Solidworks software with scaling 1:1 to get actual dimensional drawings of various parts, Few changes were made to Design as some assembly issues became known during modeling. The design was confirmed and a Solid model was built for visualization and manufacturing reference.



**Fig.5 Solid Model of Chair**



**Fig.6 Solid Model of Bed**

## III. CONCLUSION

The Wheelchair designed in this project gives a comfortable and affordable solution to the physically disabled and elderly people. The linkage mechanism makes it easier to convert it into bed. By using Joystick controller the chair can be moved around with no fatigue by the person sitting in the chair. The trouble in handling patient to both helper and patient can be reduced by using this chair. This product thus can be very helpful in old age homes and hospitals.

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