

# Automated Wheelchair Convertible Stretcher

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**Abstract** - The challenges faced during transferring the patients exist from ancient times. People who get seriously injured or ill were carried by others by means of wooden stretcher with cloth or leather tied to it. Afterwards they were carried on wheels which reduced the effort of the people carrying the patients. Although we have evolved in the field of healthcare and technology we are not yet able to address this problem efficiently. Adopting various kinds of research methods helped us to obtain more information about hospital mobility aids and for data collection. Mobility aids are used for transportation of patients. Wheelchairs and stretchers are the most commonly used mobility aids for the movement of patients. Transferring the patients from wheelchair to stretcher or to the medical bed or vice versa is always an issue for the attendant or nurse. There is a revolution of wheelchairs available today driven by needs and desire of man.

Hence we propose a design of Automated Wheelchair Convertible Stretcher which is a boon to the medical field. It is so made that it could be maintained and operated easily either by the patient or by the attendant according to the comfort of the patient. Our study shows that it is possible to save 50% space by the Automated Wheelchair Convertible Stretcher design. The product will thus likely be an efficient mobility aid in hospitals.

**Key Words:** Wheelchair, Stretcher, Wheelchair convertible stretcher, Mobility aid, Healthcare.

## 1. INTRODUCTION:

In simple words a wheelchair can be described as a structure having a set of wheels attached to a chair. Wheelchair is a device which can empower and enable a person with a disability to live a normal and independent life.

Over the years wheelchairs have evolved rapidly from the manual wheelchairs to the powered wheelchairs. But still these wheelchairs have not been able to satisfy the needs of the disabled people. It is therefore critical that the problems of disabled be understood and accordingly wheelchairs are developed fulfilling their needs.

In India number of disabled individuals is increasing every year. Mobility aids are useful for patients for transportation. Wheelchairs & stretchers are the most commonly used medical equipment for the transportation of patients. So we

have designed a multipurpose wheelchair that can work as wheelchair as well as a Stretcher.

The **Automated Wheelchair Convertible Stretcher** facilitates the disabled patients' mobility & provides novel medical equipment for use in the Indian hospitals. The purpose of this design is to reduce the effort of the caretaker & provide a safer transfer for the patients in hospitals.

Its construction is so easy and can be operated and maintained easily. We have used simple mechanism which is powered electrically to achieve the required motion. This project is the result of a design and development of a multi-functional Wheelchair that would perform all the required functions.

**Automated Wheelchair Convertible Stretcher** is so made that it can be maintained & operated easily either by the patient or the operator according the comfort of the patient.

## 1.1 OBJECTIVES OF OUR INTENDED WORK:

- To reduce precluding exertion of the patient.
- To carry out the transformation process with utmost safety.
- To decrease the cost by using gear mechanism instead of hydraulics, pneumatics or electronics.
- To reduce the noise considerably during operation.
- To attenuate space efficiently.
- To consolidate the concept of wheelchair and stretcher.

## 2. REVIEW OF LITERATURE:

The author in [1] gives us various concepts regarding wheelchair convertible stretcher. Concept 1 enlightens us about a sliding tubular frame which is attached to the back rest of the wheelchair. A handle is provided in the back rest so that the user can pull it easily and can convert it into stretcher. Concept 3 gives us an insight to the hydraulic scissor lifter mechanism, so that the height can be adjusted according to the user's convenience. A hydraulic scissor lifter mechanism lifts the entire wheelchair into stretcher. Concept

5 is based on the gear mechanism. According to the rotation of the middle wheel, the front and back seats are rotated in opposite direction and stretcher arrangement is achieved.

The authors in [2] utilizes electric power to showcase the conversion of wheelchair into a temporary bed. A new type of electric wheelchair which can support bedridden patients. The wheelchair used in this study was an electric wheelchair made by Kawamura Cycle Co., Ltd. (model KE15). A joystick controls the velocity, and the motor rated output is 192 W (24 V).

The authors in [3] gives us an insight into how we can utilize a mechanism for the aforesaid conversion. The paper gives us an insight into the utilization of mechanism based concepts. Concept 1 in this concept the person can move to the bed using the leg support pad which is extended by a pneumatic cylinder. Concept 2 in this concept the person moves onto bed by a conveyor mechanism which pushes him forward. The chair has guides and can revolve about itself giving the user 360 degree accessibility. Concept 3 in this concept the wheelchair has a movable and extendable board. The person can transfer himself from this board to the bed. Concept 4 this wheelchair has the provision of moving the backrest and resting it onto the bed. The person can slide over the backrest to the bed in backward direction.

The authors in [4] have utilized pneumatic power for the conversion of wheelchair into stretcher or vice versa. The authors in [5] have used the concepts of electronics in their paper. The authors in [7] gives an insight into the use of hydraulic based mechanism to get the aforementioned motion (conversion).

**3. METHODOLOGY:**

The following methodology was followed:

- Problem Identification
- Literature Survey
- Market Survey
- Selection of Mechanism
- Design and Analysis
- 2D modelling
- Fabrication
- Testing
- Minor rectification
- Final product

**4. DESIGN REPORT:**

Sr. No.	Part Name	Dimensions / Specifications	Unit
1	Back Rest <sup>[1]</sup>	L = 24 ; W = 18	Inches
2	Main Rest <sup>[1]</sup>	L= 18 ; W = 18	Inches

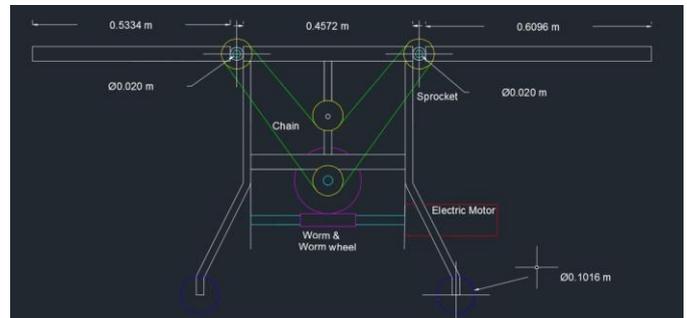
3	Leg Rest <sup>[1]</sup>	L = 21 ; W = 18	Inches
4	Heel to Popliteal <sup>[1]</sup>	L = 21	Inches
5	Stretcher Length	L = 63	Inches
6	Stretcher Height <sup>[1]</sup>	H = 25	Inches
7	Cross - Section of frame	L = 20 ; l = 16 ; W = 40 ; w = 36	Millimeters
8	Arm Rest <sup>[14]</sup>	H = 8	Inches
9	Shaft	ds = 25 ; l = 830	Millimeters

**Table -1: Design Report.**

**5. CONSTRUCTION:**

There are three sections in Wheelchair/ Stretcher. These sections are as follows:

- 1) Back Rest
- 2) Main Rest/ Seat
- 3) Leg Rest



**Fig -1: Construction.**

Out of these back rest and leg rest are movable, whereas the main rest is stationary. The back rest and the main rest are held together by means of shafts and bushes. The same is the case with leg rest and main rest. A sprocket is rigidly fixed on each of these shafts.

The positions of the back rest and leg rest are not exactly perpendicular to the main rest but at an angle of 110° and 80° respectively <sup>[1]</sup>.

The panels (back rest, main rest and leg rest) have been made out of stainless steel. The idea behind using the stainless steel material is that it is aesthetically pleasing moreover there is no rust deposition on the same.

The main rest is directly fixed onto the supporting frame. The mechanism used for the purpose of conversion is installed inside this frame. It is so installed that it can be maintained easily.

The electric motor is coupled directly to the worm below the main rest. The worm wheel is mounted on a shaft which is at right angle to the worm and supported at the ends by Plummer blocks.

On the shaft of the worm wheel two sprockets are mounted which provides motion to the back rest and to the leg rest. An idler sprocket is provided at both sides of main rest to maintain the tension in the chain.

Electrical switch board is provided at one side of the main rest which operates the electric motor.

### 6. WORKING:

The working of automated wheelchair convertible stretcher is so simple that the patient feels comfortable during the transformation from wheelchair to stretcher and vice versa.

Suppose the wheelchair is to be converted into stretcher the operation starts by pressing the push button (symbolizing stretcher). When the button is pressed the motor starts rotating in counter clockwise direction (when viewed from rear end).

The worm being directly coupled to the electric motor rotates in the same direction as that of the motor. The rotation of the worm causes the worm wheel to rotate at a reduced speed. As per the palliative care considerations, the speed at which the transformation should take place must be less than 5 RPM. Thus a velocity ratio of 12 is taken into consideration so that the output RPM is within the given limits.

The sprockets, which are mounted on either ends of the worm wheel shaft, rotate in the same direction as that of worm wheel. Further, these sprockets transmit the motion to back rest and leg rest simultaneously via a chain drive.

Stoppers are provided so that the back rest does not go beyond the stretcher position (0° or 180°). The transformation continues till the push button is pressed. As soon as the push button is released it gets locked at that position. Different positions can be achieved in between transformation according to the comfort of the patient.

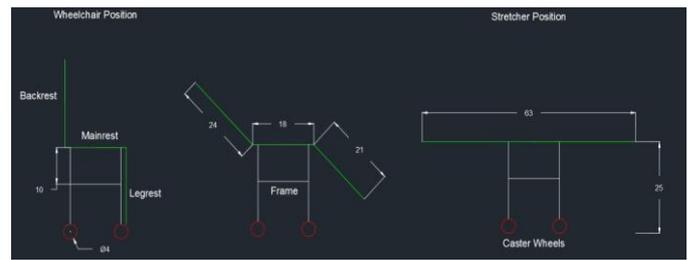


Fig -2: Transformation process.

For converting the stretcher into wheelchair, the push button (symbolizing wheelchair) is to be pressed. This causes the motor to rotate in clockwise direction (when viewed from the rear end).

### 7. SUMMARY AND CONCLUSION:

The present study was intended to develop a concept for an automated wheelchair convertible stretcher, with the motivation of saving space and precluding exertion by the patient. Adopting various methods helped us identify the various issues of the topic, importance of safety and significance of materials and manufacturing process involved in the whole product. From the identified needs ergonomic design, mechanism and safety were prioritized by us.

The conversion feature of this device makes patient transfer easier. This device combines the concept of patient mobility and patient transfer. This is an excellent choice for a person seeking for two features, rather than going for two different products, he can choose our automated wheelchair convertible stretcher integrated with two different features.

It reduces the cost, the floor space and complexity of having two individual products for individual needs without compromising the original products comfort. Our study shows that it is possible to save 50% space by our project design. The product will thus likely be an efficient mobility aid in hospitals.

Though the advantages of the fabricated device are multifold, there is still room for improvement as far as fabrication is concerned.

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