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# DESIGN & DEVELOPMENT OF STRETCHABLE WHEEL CHAIR

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ABSTRACT –

The main aim of our project is to build a wheelchair cum stretcher model which acts as both wheelchair and when as stretched it can be used as a bed. The wheelchair cum stretcher model is a mechanism which is used for moving the bed up and down. This is used for handicapped people to lead a normal life as other people do. For making the handicapped person's job easy (i.e., they can move bed up and down). Two-way switche use to control the wheel chair. The wheelchair is particularly used for the physical disabled persons. It can be used for taking books from the shelf, taking dress from the self's and this also can be used for cooking. The stretching movement of the wheelchair is done by rack and pinion mechanism. This arrangement is fixed in the wheelchair bed. The power supply to the motor is given by using battery.

## 1. INTRODUCTION :

In this the first wheelchair which was identified was for moving the bed manually or by the other person. At present, it is need for advanced in this type because physical disabled person cannot depend on mostly others to help him. They have adapted to moving in this. But to find a change in this system we have introduced our projects the requirements are fulfilled in our project thus the requirement of the handicapped is solved through this project. That is why we have chosen the wheelchair cum bed for handicapped as our project. The project which we have selected is to reduce the human needs for the physical disabled person. For the person sitting on the chair should have to move bed in the constant speed. By using the wheelchair cum bed, we can move bed the handicapped person easily. The cost this wheel chair costs a little bit higher than the wheel chair has facility of moving bed.

## 2. Literature Survey :

Assistive devices play a critical role in improving the quality of life for individuals with mobility challenges. Wheelchairs and adjustable beds have been widely used in healthcare and homecare settings. However, these devices often function independently, creating challenges for caregivers and users in transitioning between sitting and lying positions. Recent advancements in mechatronics and mechanical engineering have paved the way for integrated solutions such as semi-automatic wheelchair-bed systems.

Existing Wheelchair and Bed Designs

**Manual Wheelchairs**

- Traditional wheelchairs are manually operated and offer no transformable functionality.
- Limitations include difficulty in transferring patients to beds, especially for caregivers with limited physical strength.

**Motorized Wheelchairs**

- Powered wheelchairs incorporate electric motors for mobility but lack the capability to transition into a bed.
- These are more suitable for outdoor and independent mobility but fall short in patients care scenarios.

**Adjustable Hospital Beds**

Common in healthcare, these beds allow reclining and height

- adjustments.
- However, they are stationary and do not address mobility needs, requiring the use of additional equipment like patient hoists.

Integrated Wheelchair-Bed Systems

Research and development have focused on combining wheelchair and bed functionalities into a single device. Several studies and prototypes have explored mechanisms and control systems for these integrated devices.

Mechanisms in Use

- Rack-and-Pinion system: Rack-and-pinion mechanisms are popular for their simplicity and efficiency in converting rotational motion to linear motion. Studies highlight their reliability in achieving controlled motion in assistive devices.

- Example: A study by [Author/Year] demonstrated the use of rack-and-pinion systems for reclining functions in convertible chairs.
- Hydraulic and pneumatic system: Some designs utilize hydraulics for smooth and powerful motion. While effective, these systems are costlier and require more maintenance compared to mechanical alternatives.
- Actuation Methods
- DC gear motors: Widely used for their ability to provide precise control over speed and torque, DC gear motors are a preferred choice in semi-automatic systems.

## 3. OBJECTIVE :

I. **Enhance Mobility and Independence**: To enable users with mobility impairments to transition seamlessly between wheelchair and bed configurations without external assistance.
II. **Improve Comfort and Ergonomics**: To provide ergonomic support through adjustable components, such as backrests, leg rests, and headrests, ensuring user comfort during prolonged use. To minimize the risk of pressure sores by incorporating pressure-relief features.
III. **Ensure Ease of Operation**: To design a semi-automatic mechanism that allows simple and intuitive operation, requiring minimal physical effort from the user or caregiver.
IV. **Focus on Affordability**: To create an economically viable solution by optimizing material usage, manufacturing processes, and reducing production costs.
V. **Promote Safety and Stability**: To integrate safety features such as anti-tipping mechanisms, locking systems, and robust frame construction to ensure user safety during transitions and usage.
VI. **Address Medical Needs**: To cater to medical requirements by providing features such as adjustable height and posture settings to aid therapy, reduce strain, and improve blood circulation.
VII. **Facilitate Portability and Storage**: To design a compact and foldable model for ease of transport and storage, enhancing usability in various environments.

## 4. STANDARD COMPONENTS :

- Wheelchair model
- Rack and pinion arrangement
- PMDC motors
- Lead acid battery
- Bearings and caps
- Shafts
- Toggle switch
- Spur gears
- Nylon wheels
- MS angular frame
- MS sheet

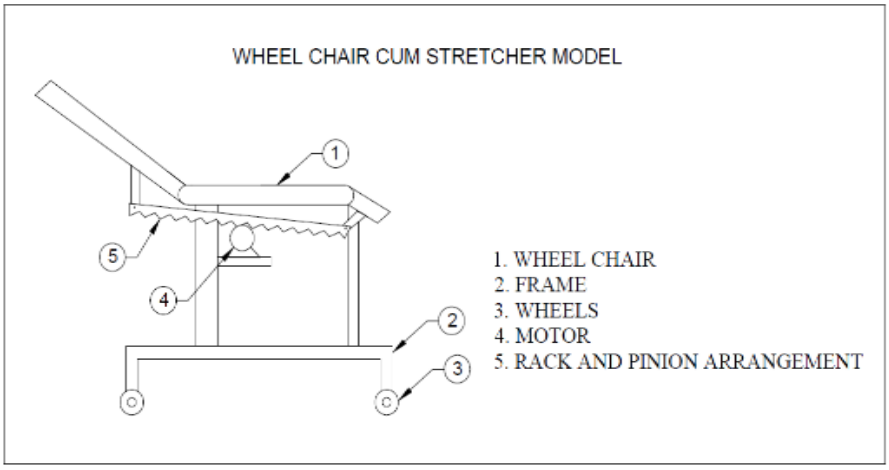
## 5.WORKING :

The **Design & development of stretchable wheel chair** is a multifunctional assistive device designed to enhance mobility and comfort for individuals with limited mobility. It integrates the functionality of a wheelchair and a stretcher into a single unit, allowing seamless transformation between sitting and lying positions.

**Key Features:**

1. **Dual Functionality**
    - Operates as a wheelchair for mobility.
    - Converts into a bed for resting or medical purposes.
2. **Rack and Pinion Mechanism**
    - Facilitates smooth linear motion to adjust the backrest and leg sections.
    - Driven by a **Permanent Magnet DC (PMDC) Motor** for precision and efficiency.
3. **User-Friendly Controls**
    - Equipped with a toggle switch to enable easy operation.
    - Allows users or caregivers to operate the transformation with minimal effort.
4. **Power Supply**
    - Powered by a **lead-acid battery**, ensuring portable and reliable energy for the motorized components.

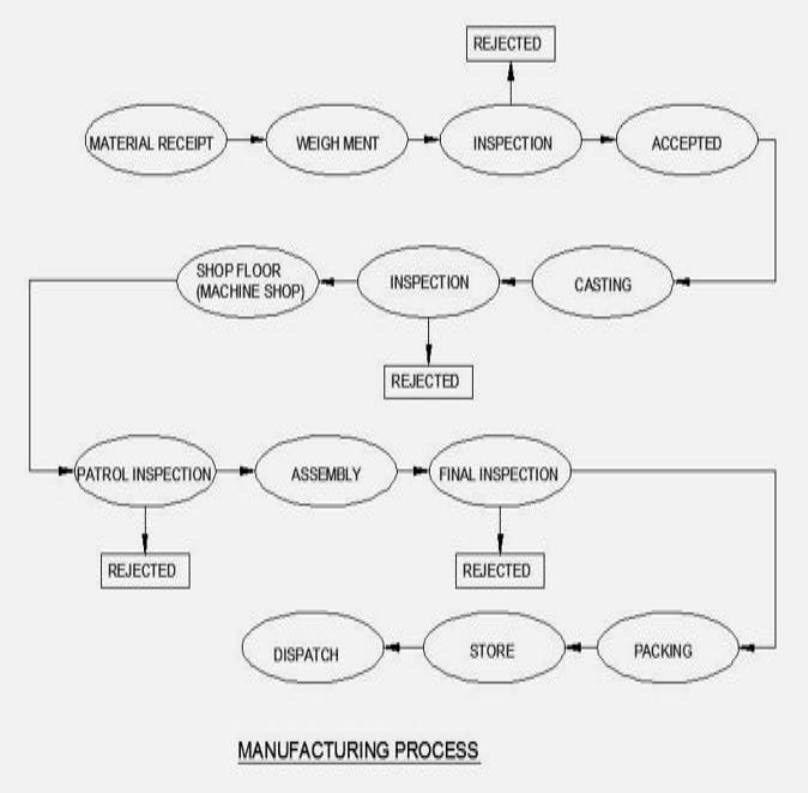
5. **Robust Construction**
    - Built using **MS angular frames** and **MS sheets** for structural strength and durability.
    - Includes **nylon wheels** for smooth mobility and stability locks for safety.
6. **Additional Components**
    - **Bearings and shafts**: Enable smooth rotation and motion.
    - **Spur gears**: Transmit torque efficiently within the me



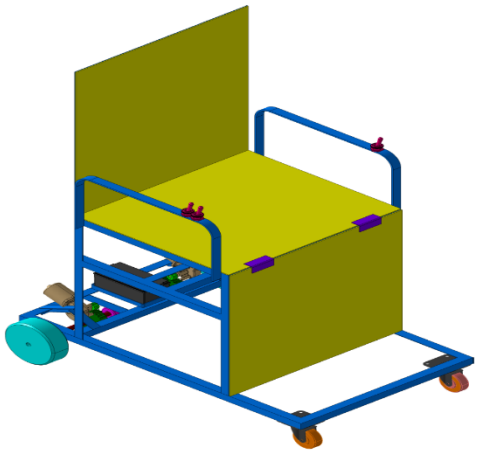

**2D Model of stretchable wheel chair**

## 6.METHODOLOGY :

The methodology for designing and implementing a design & development of stretchable wheel chair involves a systematic approach combining mechanical design, electrical integration, and user-centric testing.



## 7. DESIGN OF CAD MODEL :



## 8. ASSEMBLY OF THE PHYSICAL PROTOTYPE :

## 9. FUTURE SCOPE AND CONCLUSION :

- Incorporation of IoT for remote operation and monitoring.
- Fully automatic models with AI-powered sensors for obstacle detection.
- incorporation of solar power, rechargeable batteries, and low-power consumption technologies for extended battery life.
- Use of eco-friendly and recyclable materials to reduce environmental impact.

- Reduction in production costs through mass manufacturing and cost-effective materials, making the device more affordable for low-income and rural areas.
- Integration of telemedicine features for remote monitoring and adjustments by healthcare professionals, benefiting users in remote or underserved areas.

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