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Design And Fabrication Of Wheel Chair Cum Bed

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Abstract*: In India the number of handicapped people expanding each year. Probability help are valuable for patient for transportation and trade for strolling particularly in indoor and open air condition. Exchanging the quiet from wheel chair to stretcher or to the therapeutic bed is dependably on issue for attendant. Understanding the different issue with respect to mobility equipment and presenting a superior structure will be benefit for the medical field and assistance for incapacitated people. Here we are building up frame work which fit for different position manually. This is achieved by direct actuator. This is cost decreasing task which causes chiefly handicapped individual to do their day by day thing.*

I- INTRODUCTION

Wheel chair has become a boon for most of the movement of physically challenged individuals. Many times during epidemics or when there is a sudden rise in no. of patients in hospital shortage of beds occurs. In order to overcome this problem we have designed wheel chair cum bed. At such times this designed wheel chair cum bed can converted in wheel chair or bed as required. The disabled patients resting on their bed for long duration of time often wheel loneliness & mentally sick. A wheelchair cum bed to facilitate the disabled patient's mobility and to provide noble medical equipment for use.

II- OBJECTIVES

The objective of this project is to analyze and prototype an automated wheel chair cum bed, based on an existing smart wheel chair with extensive facts finding an research on existing models, technology used market scenario and customer requirement. It improves the balance and postural stability of old age people .it can convert sleeping position from sitting position easily. Specific service to the human in a safe and comfortable manner. Easy movement from one place to another place. Converts sleeping position from sitting position easily. Would be a great care for people with persistent vegetative state , paraplegia, stroke and spinal cord injuries. Focusing on mobility assistance for bedridden persons.

III- METHODOLODGY

- The course of our work begins with the planning phase involving initial research, literature survey and background study.
- It is followed by concept generation phase that includes evaluating existing wheel chair, customer requirement and concept design.
- Prototyping the wheel chair into complete bed using linear actuator by means of 24v DC current and we progress towards testing a feasible model.
- Collection of all equipments and material required for overall fabrication of wheel chair cum bed enhancement setup.
- Forming of a light weight wheel chair cum bed structure which would carry up to 100-120 kg.
- Implementation of linear actuator, which would convert the wheel chair to bed as requirement.

IV- CONSTRUCTION

The wheelchair cum bed consist of following components:-

1. **Backrest** : backrest of wheelchair cum bed is made up of rectangular cross section (2"x 1") and flat mild steel plate are welded in it. It is attached to the base with hinges.

2. **Seat** : the seat is made up of mild steel of rectangular cross section (2"x 1") and flat mild steel plate are welded in the frame. It is directly connected to the base of the wheelchair cum bed.

3. **Leg rest** : leg rest of the wheel chair cum bed is also made up of mild steel rectangular cross section (2"x 1") and flat mild steel plates are welded in the frame. It is attached to the seat (base) by means of hinges.

4. **Foot rest** : the foot rest is made up of the mild steel square cross section by bending its edges and is welded at the bottom of the leg rest.

5. **Linear actuator :** The linear actuator is rigidly attached to the seat and backrest by means of nut and bolt. This actuator helps in locking of backrest and leg rest at some specific angle.

6. **Mechanical linkages :** There are two linkages out of which one is welded at backrest and base and another welded at leg rest and base.

7. **Hinges :** These are most important part of wheel chair cum bed. It is connected in between backrest and seat and in between seat and leg rest.

8. **Caster wheel :** The caster wheel are used for smooth travelling of wheel chair cum bed and are attached at the bottom of base of wheel chair cum bed.

V- WORKING

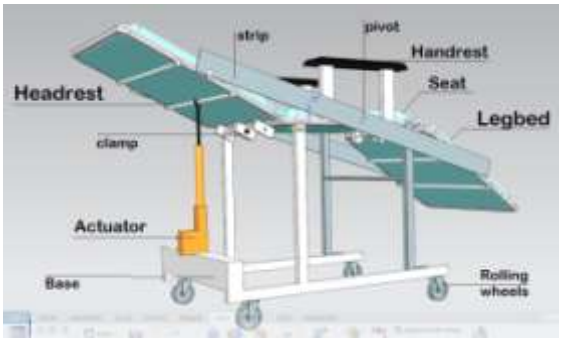
- Initial position of the wheel chair cum bed is in bed position. The patient can be placed in sleeping position and carried to desired position.

- When we need to change the position from bed to wheel chair, the switch is turn on, 24 volt electric supply from batteries to linear actuator is given.

- The linear actuator start to displaced from initial position 0mm to 400mm final extreme position. A flat plate is pivoted at its center to the center of base. One end of the plate is connected to the back rest and other to leg rest.

- As actuator results in angular displacement of backrest to upward simultaneously the plate attached to backrest moves up and other end of plate moves down due to central pivot and leg rest moves down.

- When required to change position wheel chair to bed reverse the polarity of batteries by reverse switch and actuator moves from extreme position to initial position.



3D Model of wheel chair cum bed

VI- CALCULATIONS

- **Load calculation:**

  Mass of body = 35kg

  Weight of body (Newton) = 35*9.81=343.43N

  Weight of human = 120*9.81=1177.2N

  Total weight = 343.43+1177.2 = 1532.4N

  Weight on each wheel = 1532.4/4 =383.1N

- **Load on backrest:**

  Link inclination = 30 degree.

  Human mass = 60 kg

Mass of frame = 10 kg

Force on backrest = (60+10cos(30))*9.81 = 673.55N

- **Load on leg rest:**

Link inclination = 30 degree

Human mass = 30 kg

Mass of frame = 10 kg

Force = (30+10cos(30))*9.81 = 379.25N

- **Load on base:**

Force = (15+40)*9.81 = 539.55N

- **Buckling:**

For medium column (10<l/k<90)

Outer diameter (Do) = 2.52 cm = 25.2 mm

Inner diameter (Di) = 25.2mm -6mm =19.2 mm

Length of actuator shaft = 150mm

n = 0.25 (one end fixed other free)

a = 1600 (assume)

K (radius of gyration) = ((Do+Di)^0.5)/4 = 98.46 mm

Slenderness ratio (L/K) = 150/98.46 = 1.52

Syt = 240MPa

Area = 209.23 mm^2

By using rankine's formula

Syt = Fcr/A (1+(1/an*(L/K)^2))

240 = Fcr/209.23(1+(1/((1600*0.25)*(1.25^2))))

Fcr = 49.926 KN

Since,

Fcr<F

49.29KN<1.53KN

Hence design is safe.

- **Design of shank pin:**

Assume material as SAE1035

Assume for safe design, mass acting on pin (m) = 120kg

Weight on pin = 120*9.81 =1177.2N

Assume factor of saftey = 2

For SAE 1035

Sys = 183.5 Mpa (from design and data book)

Shear stress, T = Sys/F.O.S. = 91.75 Mpa

Assume diameter of shank pin, d = 10mm

Failure of pin in double shear:

P = 2*((3.14/4)*d^2)*Tact

Shear stress, Tact = 7.5 Mpa

Tact<T

Thus design is safe in double shear

No slack between pin and eye hence bending is neglected.

VII- ADVANTAGES

- It requires less space and easily handles.
- As compare to early pneumatic design, ratchets mechanism design it's working is smoother and easy.
- At a time it can be used either as a wheel chair or stretcher by switching mode.
- The design eliminates the steps of shifting patients from wheelchair to stretcher or vice versa.
- Maintenance cost is less.
- Our design will thus be an efficient mobility for medical field.

VIII- CONCLUSION

- We conclude that, on basis of our hospital, old age home and market survey, we made a best design of wheel chair and bed for disabled people.
- The mechanism is designed and developed in order to reduce the human fatigue.
- Wheelchairs are now considered not only means of transportation but also as a way to allow user to express their individuality.

- Also allow the helper or nurse to easily handle the patient.
- The stresses which are developed in body of patients while transferring from wheelchair to bed or vice versa are reduced or eliminated.
- There are many scope for future improvements.

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