Self-Assisted Solar operated Wheelchair

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ABSTRACT

Personal mobility means freedom for physically challenged. One of the best inventions in the medical field that helped both the elderly and handicapped is the mobility vehicle. The fact that they are no longer depending on someone else to perform daily duties is a big step forward. This is a mobility vehicle which uses conventional energy for recharging. This paper aims a wheelchair which is solar operated and gives a provision to the user to shift from bed to chair without any external assistance.

Keywords:- *caster, mobility, solar panel, toggle jack, wheelchair.*

1. INTRODUCTION

On the journey to mobility and freedom, motorized scooters and wheelchairs are the tools to finish that journey. With scooters and wheelchairs, there is a small inconvenience to mobility independence. The addition of some devices enables persons with physical disabilities a comfortable travel beyond their own homes. Technological advances in mobility scooter have led more options available. In the past, many people disliked the idea of a mobility scooter because of low-life of the battery. Nowadays, batteries have improved and they allow much longer periods of driving without the need for a recharge. People started to purchase a mobility scooter in order to lead a more comfortable and independent existence.

The incredible capacity to adapt to difficult circumstances has led to wonderful inventions, particular beneficial to individuals with mobility problems.Mobility scooters have changed the way in which people in wheelchairs are able to maneuver.[3]

1.1 PROBLEM DEFINITION:

A wheelchair has been developed years ago. But the user near about always requires external assistance to carry himself from bed to chair or vice versa for different base height.

1.2 OBJECTIVE:

To develop a Self-assisted Solar Operated lifting wheel chair.

The First Wheelchair

No one really knows when the first wheelchair was invented, although there are plenty who are willing to hazard a guess. What interesting is that wheelchairs weren't always invented for the right reason especially where the Romans were concerned. Some believe it was the ancient Egyptians who were the first to use wheelchairs. These were, however, simple handcarts used to push people around nothing like the sophisticated chairs of today[7,9]. The Chinese also invented chariotlike wheelchairs around this time, although they were pulled rather than pushed. The Romans, as one could imagine, were not inclined to equal rights for disabled people. Instead they treated disabled people almost as bad as a certain US deputy in Florida. The Romans invented wheelchairs not to extend people's mobility, but so that they could push disabled to the fields to work. They weren't all bad, though. Both Greek and Roman physicians prescribed transport for the sick. After a long time in Spain, Philip II fabricated a wheelchair complete with foot rests, enabling him to enjoy a daily wheel around the gardens.[1,6]

2.Component

A. **Frame:**

Function: It supports the whole assembly of model.

B. **Toggle Jack:**

It consist of frame, coupling nut, rivet, power screw, etc.
Function: It is used to lift the chair in vertical direction as per requirement.
Capacity: 1tonne

Figure1..Toggle Jack

C. **Caster**

Function: A caster is a wheeled device typically mounted to a large object that enables relatively easy rolling movement of the object

Figure2. Caster

D. **PMDC Motor**

Electric DC motor is used. It works on the principle of electromagnetism.
Voltage : 12 Volt
Speed : 60 rpm
Torque : 200 Kg-cm

Figure3. Motor

E. **Battery:**

Capacity : 12V battery
Rated current : 7.2 Amp
Capacity-42.25Amph
Long life and chargeable (7 hrs.)

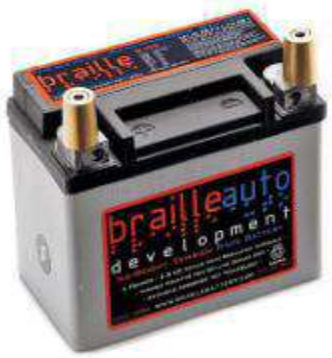

Figure4. Battery

F. **Solar Panel**

Function: **Solar panel** refers to a panel designed to absorb the sun's rays as a source of energy for generating electricity or heating.

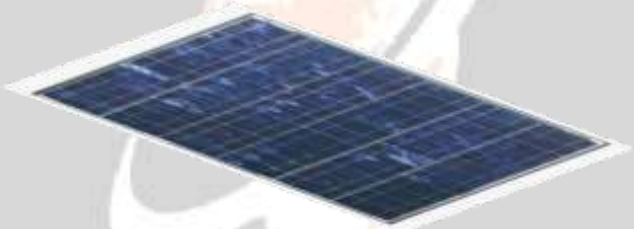

Figure5. Solar Panel

Voltage : 12 Volt
Power : 20 Watt
Silicon plate
Size : 470*300 mm
Rated current : 1.666 A

G. Charger

Function: One of the problems with solar power is that the output of the solar panel is variable. These solar charge controllers are designed to extract the maximum amount of power available from the solar panels and deposit it in the battery

Figure6. Charger

3.DESIGN CALCULATION:

The designer can improve the functions of a certain product or make the product more users friendly. When designing for people with disabilities, consideration of his/her relationship to the product or environment is of utmost importance.

Weight for which is designed: 100 kg = 981N.

Factor of safety:- 3

The material for toggle jack will be designed completely using plain carbon steel.

Material properties at 25˚C low-medium carbon steel.

Density = 7845kg/m3,

Young's modulus (E) =200 *e^3 MPa,

Poisson's Ratio (μ>0.3),

Ultimate shear strength = 342.4 MPa approx. 66% of the UTS (518.8 MPa),

Yield strength= 353.4 MPa.

Friction angle (ϕ):

$(\emptyset) = \tan^{-1}(\mu')$

$= \tan^{-1}(0.154)$

$\therefore(\emptyset) = 8.80^{\circ}$

$$T_f = (\frac{W \times d_m}{2}) \times \tan(\emptyset + \lambda)$$

$$\frac{1401.01 \times 18.25}{2} \times \tan(8.80 + 2.496)$$

$\therefore(T_f)$= 2553.61 N-mm

Efficiency of threads (η),

$$\eta = \frac{tan\alpha}{\tan(\emptyset+\alpha)} = 21.83\%$$

$$\eta = 21.83\%$$

Hence satisfies condition for self-locking.

Actual torque required, $(T)=\frac{Tf}{\eta}$

$\therefore$ $=\frac{2553.61}{0.7346}$ (Tf) = 3476.19 N-mm

=3.54 Kg-cm

4.WORKING:

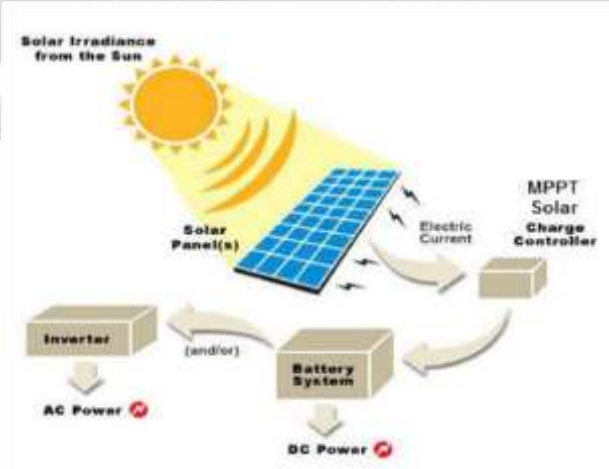

Figure7. Working Mechanism

Model:

5.Conclusion

To provide an economical mobility vehicle for the physically challenged, a solar powered wheel chair is fabricated with the indigenous materials like steel bars, PMDC motor, casters. The wheel chair is powered by the rechargeable battery of capacity 12V. The speed is limited to 3km/hr for safety and to avoid vibration of the solar frame. And by using the toggle jack the seat adjustment is done, which has the capacity of lifting load of 100kg.

6.Future Scope

The design of the chair if modified, can accommodate a mechanism for climbing the stairs.

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