

Design and Fabrication of Solar Wheelchair

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Abstract:-A wheelchair is a device that is used for/by physically disabled people who have either lost their legs or cannot use them. It helps the patient to move from one place to another and is mostly useful for covering short distances thereby reducing their reliability on others. Basically wheelchairs are either manually driven with human force or are driven by motors and can be fully or partly automated. In solar wheelchair the power used to drive motors is obtained from solar energy.

I. INTRODUCTION

In current world a large number of people are suffering from some severe physical disability. Hence they require means of artificial locomotion to go from one place to another. The numbers of people undergoing accidents and suffering from physical disabilities are increasing day by day. This arises a need of artificial locomotives for disabled people who require means of locomotion that work effectively, and are sophisticated and cost effective as well as to improve their quality of life and facilitate their life style.

In this project we are going to design and fabricate a wheelchair consisting of solar components which are capable of producing enough electrical energy to drive the wheelchair. The chassis of the wheelchair will have the structure to carry the solar components.

A solar wheelchair will mainly consist of solar panel, charge control, 12V lead acid battery, DC motor and speed controller. Solar panel collects solar energy from the sun and stores it in the battery. This battery supplies current to dc motors which are coupled to driving wheels of wheel chair. Motors convert the electrical energy into mechanical power which drives both the wheels that drives the wheelchair. A voltage controller is used to control the rate of charging preventing over charging and also a DC motor speed controller is used to control speed of wheelchair. A toggle switch is used to drive the wheelchair i.e. to start or stop. By charging the battery completely using the solar energy, this wheelchair can work continuously for nearly 2 hours.

II. LITERATURE

There are different mobility solutions available in the market. There are chairs which can climb stairs, obey voice commands (Scott Elshout et al, 2007) or even respond to human thoughts. The costs range from a couple of thousand dollars to tens of thousands of dollars, which comes to be around one to ten lakh Indian rupees or more. The bulk of the market is in a basic design which can provide mobility for a

person on indoor level surfaces. It is assumed that the user can see where he is going and can press a few switches and operate a joystick control. Most machines have the capability to go up a short ramp, and some to climb up the steps (stair chair). All conventional powered wheelchairs have two motors; one each; driving one of the main wheels on either side of the vehicle, as in manual wheelchairs. All man work required is to vary the relative speed of rotation of the wheels on either side. This is technically called “Differential Steer”. In motor wheelchairs the differential steer is achieved by properly controlling the speed ratio of the two motors (Kazuhiko Morimoto et al). The electronics circuit has to interpret the two components of the joystick displacement and control the motor speeds accordingly. Apart from the main pair of driven wheels there has to be pair of castor wheels for support. These align automatically to roll in whichever direction they are pushed. ^[1]

A. Self Propelled Wheel Chair

A young disabled watchmaker called Stephen Farfler built a three-wheeled vehicle to transport himself. This was the first self-propelled wheelchair. The next major step forward took place in Bath with the imaginatively named Bath chair. This was invented in 1783. These wheelchairs came in a number of different guises – they could be open or shut, and pushed or pulled. However, in one respect they were a step back from Farfler’s invention – none of them were self-propelled. By nineteenth century wheelchair users were propelling themselves by pushing at the outer rim of the wheelchair. Of course, this means getting their hands dirty. ^[2]

B. Electric Wheel Chair

The first electric chair was invented in 1890 in US, designed to kill criminals through the application of electric shock. Britain engineers are working on a chair with a different purpose in mind, and the first motorized wheelchair was invented in 1916 which was heavy and expensive. Until 1930’s, the wheelchair was rather cumbersome device. They were bulky and while a lightweight wicker wheelchair had been built, even this could not be easily transported, making travelling very difficult for many wheelchair users. ^[3]

C. Modern Wheel Chair

The modern wheelchair began to take shape during late 19th century to early 20th century with the advent of push rims for self-propulsion and slings for seat and backrests. Harry Jennings and his disabled friend Herbert Everest, both

mechanical engineers, invented the first light weight, steel, collapsible wheelchair in 1933. Mr. Everest broke his back in a mining accident. The two saw the business potential of the invention and went on to become the first mass-manufacturers of wheelchairs, Everest and Jennings. Their "x-brace" design is still in common use, with updated materials and other improvements. ^[4]

DANIEL DOURTE, DAVID SANDBERG, TOLU OGUNDIPE, present a paper on "ELECTRIC TRICYCLE: APPROPRIATE MOBILITY

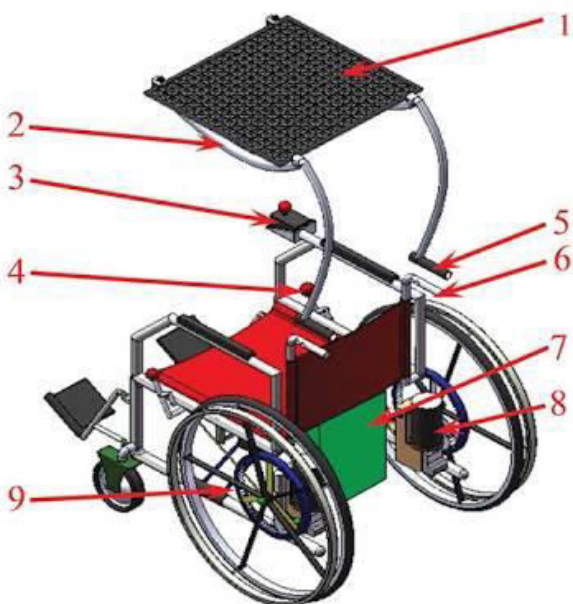
The aim of this project is to add an electric power train and control system to the current hand-powered tricycle to provide tricycle users with improved levels of mobility. The design objectives required a simple and affordable design for the power train and controls, a design that needed to be reliable, sustainable, and functional. The design of the Electric Tricycle is adaptable to the current hand-powered tricycles with little modification. The design consists of an electric motor, a drive system, motor and steering controls, and a power supply. ^[5]

III. OBJECTIVE

1. The project aims at designing a solar wheelchair for disabled person for transportation.
2. To design an energy efficient and fabricate an energy efficient vehicle for its performance.
3. To provide more options for disabled persons for their transportation needs.
4. To help society move one step closer to solar energy.
5. To provide cost efficient and energy efficient device to increase mobility without sacrificing maneuverability.

IV. COMPONENTS

Fig. below shows all components of solar wheelchair.



1. Solar panel: It is a photovoltaic module which is an assembly of photovoltaic cells. The solar cells capture solar energy and convert it into electrical energy. Output of a solar panel is usually stated in watts, and the wattage is determined by multiplying the rated voltage by the rated ampere rating. So for example, a 12 volt 60 watt solar panel measuring about 65 X 39 inches has a rated voltage of 30V and a rated 8 ampere rating. $V \times A = W$, 30 volts times 8 amps equals 240 watts. Since the intensity of sunlight contacting the solar panel varies throughout the day, we use the term "peak sun hours" as a method to smooth out the variations into a daily average. Early morning and late in the-day sunlight produces less power than the mid-day sun. Naturally, cloudy days will produce less power than bright sunny days as well.
2. Frame of panel: It is the frame which carries solar panel fitted in it. It is fixed at the top of wheelchair. It must be rigid enough to sustain weight of solar panel and vibrations produced. Also the dimensions should be just a larger than so that the panel could be properly fixed in it. It also prevents the user from severe rain and high sunlight.
3. Toggle switch: It is the switch that is used to start or stop the motor thereby starting or stopping the wheelchair.
4. Lever: It is used to change the direction of wheelchair with help of small wheels known as castor wheels present in front of wheelchair.
5. Handle of frame: It is used to join frame of panel to chassis of wheelchair.
6. Chassis: Chassis is the internal frame that supports the manmade object in its construction and also provides protection to battery and other components.
7. Battery: Battery is source of power to motor. It is charged via power provided by solar panel and delivers power to drive motor. A 12V 30-40A lead acid battery is required. This is same as a car battery.
8. Motors: Two dc motors are used that are coupled with two driving wheels that drives the wheelchair. Basically, motor is a machine or an actuator that converts electrical energy into mechanical energy.
9. Driving wheels: These wheels are known as wheel hub motor since motor is incorporated in wheel. They are available in various sizes and of various materials such as nylon, rubber, Plastic, aluminium, or stainless steel.

V. CONCLUSION

By using above components and proper knowledge we can design and fabricate a solar wheelchair. The recharge capacity of solar panels and power supplied by battery would be sufficiently high. Thus, the solar wheelchair can be

designed for required conditions and performances or according to different demands.

VI. ADVANTAGES

1. It provides effortless means of transport for disabled peoples.
2. Solar energy is available free of cost so charging is costless.
3. Partly automated.
4. Less maintenance cost.
5. Solar energy is used so process is clean and pollution less.

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