

## DESIGN AND FABRICATION OF SOLAR TRICYCLE FOR PHYSICALLY CHALLENGED PERSONS

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### ABSTRACT

Solar plays a vital role in our day to day life. We have developed the solar tricycle especially for handicapped person. In this paper it is discussed that how solar tricycle will help to reduce the effort of handicapped person. All the designs specification considered after analyzing the problems from the handicapped person. Comfort of the person in the tricycle is an important and we have given importance to it. The main content of the tricycle is Solar PV panel, Brushless PMDC motor, Charge controller and battery. This paper will discuss about the main idea of this project and to get a larger picture on what is the problem in the current technologies, what that I want to achieve in this project and the area that will cover on this project. This paper is divided into some categories

that are project background to describe the reasons to do this project, problem statement to inform about the problem or weakness of the existing technology, objective to make sure what actually this project must achieve and scope of this project to specify what will be used in this project.

### INTRODUCTION OF ELECTRIC VEHICLES

Electric vehicles, which use 100% electric power, use electric motors instead of an internal combustion engine to provide motive force. Solar-powered vehicles (SPVs) use photovoltaic (PV) cells to convert sunlight into electricity. The electricity goes either directly to an electric motor powering the vehicle, or to a special storage battery. PV cells produce electricity only when

the sun is shining. Without sunlight, a solar powered car depends on electricity stored in its batteries.

Since the 1970s, inventors, government, and industry have helped to develop solar-powered cars, boats, bicycles, and even airplanes. In 1974, two brothers, Robert and Roland Boucher, flew an extremely lightweight, remote-controlled, pilotless aircraft to a height of 300 feet. It was powered by a PV array on the wings. (The U.S. Air Force funded the development of these aircraft with the hope of using them as spy planes.) The first totally solar-powered car was built in 1977. It was small, lightweight, and cost relatively little. Experimental SPV's, equipped with advanced technology, have been built with the backing of major auto manufacturers, including General Motors, Ford, and Honda.

There will be a big area at the aggie campus wardha when it is fully built and operates. So students need a vehicle to move from one side to another. In state of using car or motorcycle that are costly, student will be prefer to used tricycle as their vehicle. There several types of tricycle that can be chosen such as paddle tricycle, motorized tricycle and

electric tricycle. But there are some weaknesses about that type of tricycle. To overcome the weakness this project will develop a better tricycle. Because of India is located in the topic of Capricorn area, this project will make used the energy of the sun that rarely used in India to generate the tricycle.

As what had been mention earlier, there are several types of tricycle that can be categories that is paddle tricycle, motorized tricycle, and electric tricycle. The weakness of the tricycle make people do not like to used tricycle. First, paddle tricycle needs a lot of energy to paddle the tricycle. The user will surely be tired after used the tricycle. This will not suitable for student to use to go to the class because they will be tired when they are in the class and will lost their concentration while hearing the lecture.

Next, motorize tricycle that used fuel as it prime mover. The tricycle use fuel that is costly. As a student, their allowance is limited and only can be used for their study material and for their food to survive at the campus. Besides that, motorize tricycle will make pollution that can be very bad for our environment especially in this period that global

warming happen to the earth. Lastly, electric tricycle that generate by battery can be only be sufficient for about an hour. The user needs to find power supply to recharge the battery or else they need to paddle the tricycle that used more energy compare to the normal tricycle because of the weight.

In this we are discussing about the various component which we will use. As we know that there are different types of components are available in market. The components we are using are brushless DC motor, Solar panel, Battery, charge controller throttle. Hand-powered tricycles are presently being used to provide mobility for disabled persons. With this project we designed and manufactured a system to convert the hand powered tricycle to an electric motor powered version. Solar-powered vehicles (SPVs) use photovoltaic (PV) cells to convert sunlight into electricity. The electricity goes either directly to an electric motor powering the vehicle, or to a special storage battery. PV cells produce electricity only when the sun is shining. Without sunlight, a solar powered car depends on electricity stored in its batteries.

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#### **COMPONENTS USED:**

- Solar panel
- D.C. motor
- Battery
- Metal frame
- Tricycle

#### **METAL FRAME:**

The metal frame is generally made of **mild steel** bars for machining, suitable for lightly stressed components including studs, bolts, gears and shafts. It can be case-hardened to improve wear resistance. They are available in bright rounds, squares and flats, and hot rolled rounds.



Suitable machining allowances should therefore be added when ordering. It does not contain any additions for enhancing mechanical or machining properties. Bright drawn mild steel is an improved quality material, free of scale, and has been cold worked (drawn or rolled) to size. It is produced to close dimensional tolerances.

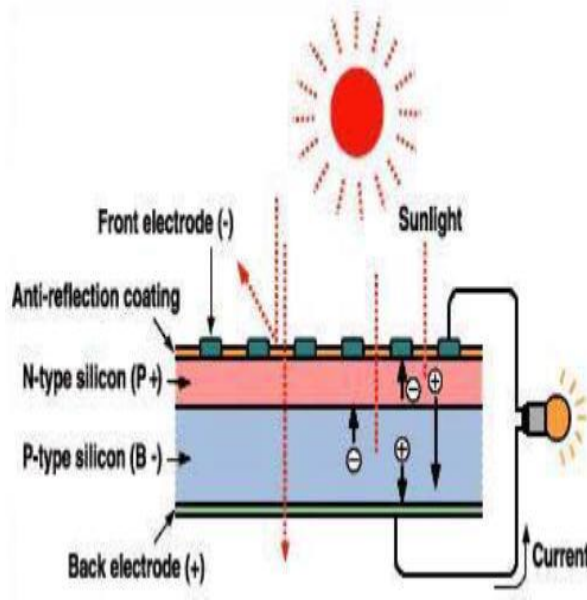
### **SOLAR PANEL:**

A solar cell works on the principle of photo-voltaic principle, the photo-voltaic solar energy conversion is one of the most attractive non-conventional energy sources of proven reliability from the micro to the Mega watt level. Photovoltaic's is the field of technology and research related to the devices which directly convert sunlight into electricity. The solar cell

is the elementary building block of the photovoltaic technology. Solar cells are made of semiconductor materials, such as silicon.

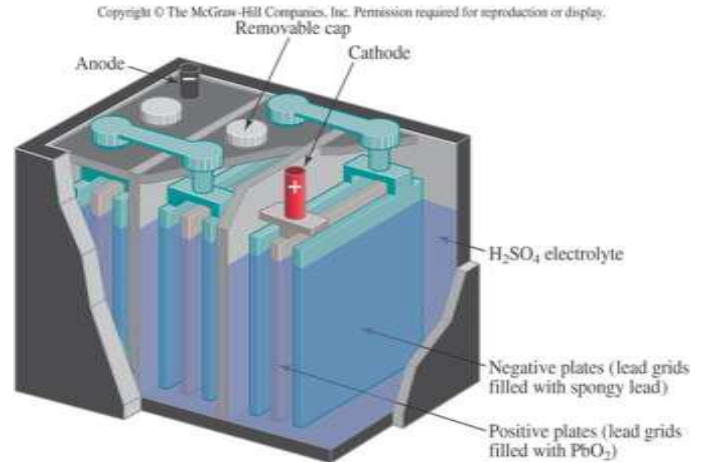


When photons of light fall on the cell, they transfer their energy to the charge carriers. The electric field across the junction separates photo-generated positive charge carriers (holes). From their negative counterpart (electrons). In this way an electrical current is extracted once the circuit is closed on an external load. There are several types of solar cells. However, more than 90 % of the solar cells currently made worldwide consist of wafer-based silicon cells. They are either cut from a single crystal rod or from a block composed of many crystals and are correspondingly called mono-crystalline or multi-crystalline silicon solar cells. Wafer-based silicon solar cells are approximately 200  $\mu\text{m}$  thick.



## BATTERY:

In isolated systems away from the grid, batteries are used for storage of excess solar energy converted into electrical energy. The only exceptions are isolated sunshine load such as irrigation pumps or drinking water supplies for storage. In fact for small units with output less than one kilowatt. Batteries seem to be the only technically and economically available storage means. Since both the photo-voltaic system and batteries are high in capital costs. It is necessary that the overall system be optimized with respect to available energy and local demand pattern. To be economically attractive the storage of solar electricity requires a battery with a particular combination of properties.



1. **Voltage.** Batteries are available in both 6V and 12V units. Most standard, wet-cell, golf cart batteries are 6V units. Most sealed batteries are 12V units.
2. **Amp-hour rating.** The capacity of a battery is rated in amp-hours. This rating must be specified with a given discharge rate.
3. **Discharge rate.** The discharge rate of a battery is the minimum length of time during which the battery must be discharged in order to meet the specified amp hour rating.
4. **Watt-hour rating.** The watt-hour rating is a true indication of the energy Capacity of a battery, like the amp hour rating, this rating must be specified with a discharge rate. The watt-hour rating of a battery is the amp-hour rating multiplied by the specified voltage of the battery.

5. **Energy density.** Energy density is the energy capacity of the battery, in watt-hours, divided by the weight of the battery, in kilograms. This is a critical factor in selecting an electric vehicle battery-the amount of energy a battery carries per unit weight.

6. **Cycle-life.** Cycle-life is the number of times a battery can be fully discharged before replacement. However, in most real applications, a lead-acid battery will exceed its specified cycle-life, since the battery will not be fully discharged every time it is used.

## DC MOTOR



A **DC motor** relies on the fact that like magnet poles repels and unlike magnetic poles attracts each other. A coil of wire with a current running through it generates

an electromagnetic field aligned with the centre of the coil. By switching the current on or off in a coil its magnetic field can be switched on or off or by switching the direction of the current in the coil the direction of the generated magnetic field can be switched  $180^\circ$ . A simple *DC motor* typically has a stationary set of magnets in the stator and an armature with a series of two or more windings of wire wrapped in insulated stack slots around iron pole pieces (called stack teeth) with the ends of the wires terminating on a commutator.

The armature includes the mounting bearings that keep it in the centre of the motor and the power shaft of the motor and the commutator connections. The winding in the armature continues to loop all the way around the armature and uses either single or parallel conductors (wires), and can circle several times around the stack teeth. The total amount of current sent to the coil, the coil's size and what it's wrapped around dictate the strength of the electromagnetic field created. The sequence of turning a particular coil on or off dictates what direction the effective electromagnetic fields are pointed. By turning on and off coils in

sequence a rotating magnetic field can be created. These rotating magnetic fields interact with the magnetic fields of the magnets (permanent or electromagnets) in the stationary part of the motor (stator) to create a force on the armature which causes it to rotate.

In some DC motor designs the stator fields use electromagnets to create their magnetic fields which allow greater control over the motor. At high power levels, DC motors are almost always cooled using forced air.

The commutator allows each armature coil to be activated in turn. The current in the coil is typically supplied via two brushes that make moving contact with the commutator. Now, some brushless DC motors have electronics that switch the DC current to each coil on and off and have no brushes to wear out or create sparks.

Different number of stator and armature fields as well as how they are connected provides different inherent speed/torque regulation characteristics. The speed of a DC motor can be controlled by changing the voltage applied to the armature. The introduction of variable resistance in the armature circuit or field circuit allowed speed control. Modern DC motors are often controlled by power

electronics systems which adjust the voltage by "chopping" the DC current into on and off cycles which have an effective lower voltage.

Since the series-wound DC motor develops its highest torque at low speed, it is often used in traction applications such as electric locomotives, and trams. The DC motor was the mainstay of electric traction drives on both electric and diesel-electric locomotives, street-cars/trams and diesel electric drilling rigs for many years. The introduction of DC motors and an electrical grid system to run machinery starting in the 1870s started a new second Industrial Revolution. DC motors can operate directly from rechargeable batteries, providing the motive power for the first electric vehicles and today's hybrid cars and electric cars as well as driving a host of cordless tools. Today DC motors are still found in applications as small as toys and disk drives, or in large sizes to operate steel rolling mills and paper machines.

If external power is applied to a DC motor it acts as a DC generator, a dynamo. This feature is used to slow down and recharge batteries on hybrid car and electric cars or to return electricity back to the electric grid

used on a street car or electric powered train line when they slow down. This process is called regenerative braking on hybrid and electric cars. In diesel electric locomotives they also use their DC motors as generators to slow down but dissipate the energy in resistor stacks. Newer designs are adding large battery packs to recapture some of this energy.

## CONSTRUCTION

The tricycle will consist of following components:

1. Solar Panel
2. Brushless DC motor
3. Battery
4. Charge Controller
5. Throttle.

The motor which is a prime mover of the tricycle is placed at the bottom of the seat which is connected to the axle of the cycle through chain drive.

The motor gets the power from the battery which is rechargeable either from the main source of electricity or from the solar panels, which are kept on the top of the tricycle. The solar panel is a module which contains number of solar cells

which are connected either in series or in parallel, thus it converts the solar energy into electric energy to charge the battery.

Since the electricity generated by the solar panel is fluctuating therefore it requires a DC charge controller which converts the fluctuating current or electric power into a constant electric supply which is the provided to charge the batter by the charge controller.

## WORKING

On body we fixed seat, battery support and panel supporting rods. For solar panel, battery and seat support we used angular rods. Total weight of the loaded solar tricycle (with a person) is 120 kg.

As a transport for the physically disabled people the overall safety, stability, reliability, control, comforts etc. are a very much important and taken in to consideration while designing it. However, the general points of consideration during the designing of the solar three-wheeler are: simplicity, strength, stability, safety, corrosion and wear, weight, size, flexibility, ease of control, modularity, efficient extraction of solar energy, effective use of solar energy and energy storage, all terrain

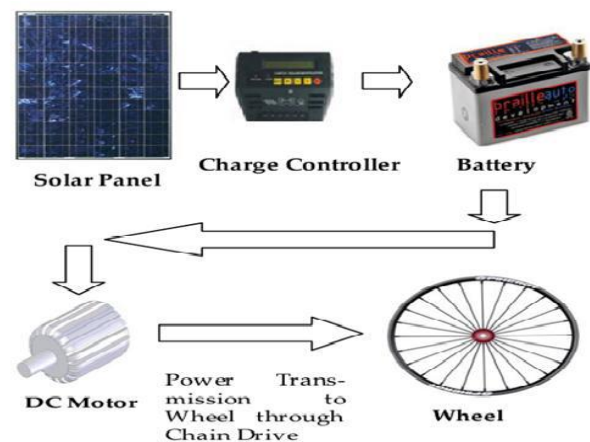


tires for all terrain traffic ability/mobility.

Solar panels transfer energy to 12 volt deep cell batteries located on the bike's frame just below the chair. From there, a small brushless dc motor between the front wheel hubs powers the bike. The whole system is on a continuous feedback loop, enabling the bike to partially recharge while in use thus extending the bike's range. A dc motor located in front wheel is controlled by the speed controller and throttle. The rider can switch from pedal power to solar power easily, and when not in use, the solar panels continue to recharge the batteries. The motor's maximum is 250 w.

The block diagram of the solar power system used in the project gives the overall working structure of the system. Initially the solar panel is placed on the top of the tricycle, which converts the solar energy to electrical energy, is connected to the battery in order to charge it with the help of a charge controller, the charge controller converts the fluctuating/pulsating flow of electric charge into constant flow of electric charge which can be supplied to the battery to charge it.

Now, the battery supplies the required amount of power to the DC motor, which is connected to the axle of the wheel. A throttle is provided to control or maintain the speed of the tricycle.



## ADVANTAGES

1. Solar energy creates absolutely no pollution.
2. This is perhaps the most important advantage that makes solar energy so more practical than oil.
3. Oil burning releases harmful greenhouses gases, carcinogens and carbon dioxide into our precious air.
4. After all, it does not cost anything to harness the power of the sun.
5. Unfortunately, paying for oil is an expensive prospect and the cost is still rising consistently.

6. Solar energy is a completely renewable resource.
7. This means that even when we cannot make use of the sun's power .
8. Solar powered panels and products are typically extremely easy to install.
9. Wires, cords and power sources are not needed at all, making this an easy prospect to employ.
10. Solar power technology is improving consistently overtime, as people begin to understand all of the benefits offered by this incredible technology.
11. As our oil reserves decline, it is important for us to turn to alternative sources for energy.

## APPLICATIONS

1. Travel for free with the power of the sun.
2. Provides free, 'green' transportation for short distances(<10 miles), thus it must never plug into a wall socket, or emit any pollutants.
3. Charges while at work
4. Is cheap, simple, and low maintenance.

## CONCLUSION

This project is made with pre planning, that it provides flexibility in operation. This innovation has made the more desirable and Economical. This project "Design and fabrication of solar tricycle for physically challenged persons" is designed with the hope that it is very much economical and help. This project helped us to know the periodic steps in completing a project work. Thus we have completed the project successfully.

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