Fabrication of Solar Powered Tricycle for Handicapped Person

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Abstract

Solar plays a very important role in our day to day life. We have developed the solar tricycle especially for the handicapped person. In this paper it is discussed that how solar power is utilized for providing the power to the tricycle, which will reduce the efforts of the handicapped person. The solar tricycle mainly consists of Solar panel, Brushless DC motor, Battery, Charge controller and Throttle. This paper includes all the information regarding the solar powered tricycle and its main components used in it.

Keywords: Tricycle, solar panel, Brushless DC motor, Battery

I. INTRODUCTION

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.

As what had been mention earlier, there are several types of tricycle that can be categories that I 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.

II. OBJECTIVES

To overcome the problem and the weakness, this project need to do some research and studying to develop better technology. To make it success there are several thing that we need to know such as what will be the prime mover, how to stored it and the advantages of this new vehicle. In that case, these are the list of the objective to be conduct before continue to proceed on this project:

- To develop a vehicle that use renewable energy, environmentally friendly and cheap.
- To develop an electrical tricycle that can charge the battery when it is not in used.
- To develop low speed tricycle, but for a longer distance.

III. CONSTRUCTION

The tricycle will consist of following components:

- Solar Panel
- Brushless DC motor
- Battery
- Charge Controller
- Throttle.

The following components are shown on the block diagram provided below:

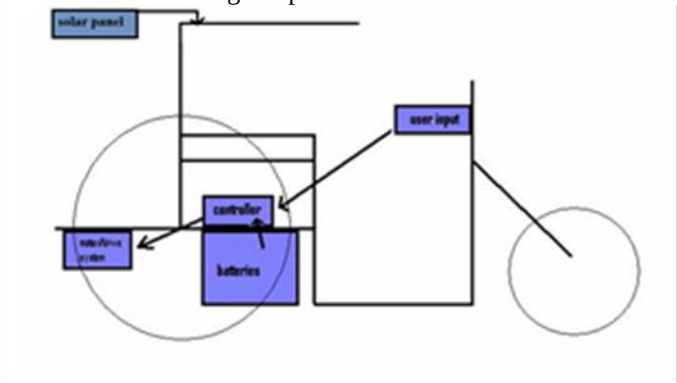

Fig. 1 Block Diagram

The above mention block diagram gives us a detail about the positioning of the components on the body of the tricycle. 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.

A. Solar Panel:

Solar PV panels are designed to generate/collect desired energy required by the solar tricycle. Power needed to run the solar tricycle is indirectly supplied from solar panel. Basically this solar panel when exposed to the sunlight produces DC current (solar electricity) which is stored in a battery and used by motor as per the requirement, as and when required basis.

The solar panel consists of solar cells. The amount of power output of a solar cell depends on solar cell efficiency and solar cell area. Usually 30~36 solar cells connected in series are laminated together to make a so-called solar PV module.

B. Brushless Dc Motor:

The prime mover to be used in this solar tricycle is a permanent magnet D.C. motor. The main reason for using this motor is that it is highly efficient and the flux density does not decrease with time. It's performance characteristics suite very well to the requirement of our solar tricycle.

Brushless DC motors use a rotating permanent magnet or soft magnetic core in the rotor, and stationary electrical magnets on the motor housing. A motor controller converts DC to AC. This design is simpler than that of brushed motors because it eliminates the complication of transferring power from outside the motor to the spinning rotor. Advantages of brushless motors include long life span, little or no maintenance, and high efficiency.

C. Battery:

Given the current market, lead-acid is the only viable battery technology for electric vehicle conversion. The following is a list of criteria to use in selecting an electric vehicle battery.

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.

IV. 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.

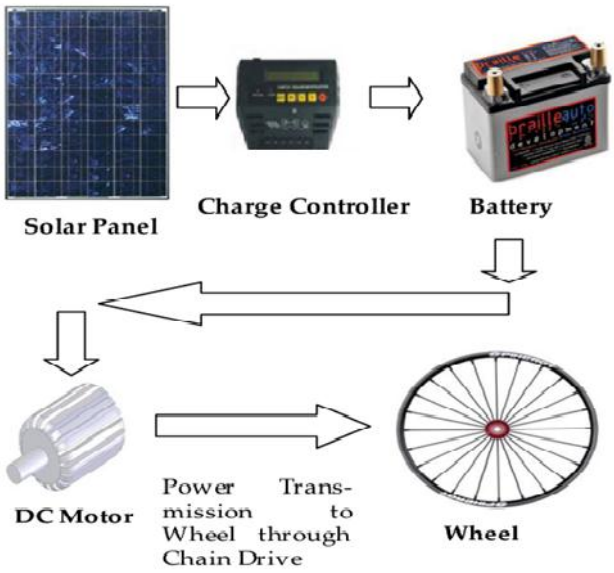

Fig. 2: Diagram of the solar power system.

Specification of The Proposed Tricycle Components:

- Solar panel: 12 Volt, 75 W = 2 Nos.
- Brushless DC motor: 24 Volt, Power rating is 250 W, 300 rpm.
- Battery: 12 Volt = 2 Nos.
- Maximum load capacity: 90 kg.

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 coverts 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.

A. Consideration & Calculations:

The total weight of the tricycle is 120 kg (including person).

1) *Motor :*

How much power do we need in watts?

Power (watts) = Total weight x g x speed x gradient

Where,

Total weight = 120 kg

Speed = 25 kmph = 25 x 5/18 m/s

Gradient = slope (assume 3%)

Power = 120 x 9.81 x 25 x 5/18 x .03
= 245.25 watt
Therefore power required approximately is 250 watt.
Thus a 24 Volt, 250 W motor will be enough for tricycle

2) *Battery :*

System voltage 24 Volt,
Load current = 250w/24v= 10.41 A
Estimate 2 hours of tricycle running per day
Load current = 2 x 10.41 x 1.2 = 25 Ah/day
Assume 20% overall losses,
Size of battery = 25 x 1.2 = 30 Ah/day
Energy required for 250 W motor = 30 Ah x24 V
=864 Wh/day.
Therefore 30 Ah/day, 24 Volt power is required for the system which can be supplied with the help of two 12 Volt batteries of 30 Ah/day.

3) *Solar Panel :*

Commercially available single solar cells normally have the dimensions of (3"× 6"), (10 cm ×10 cm) etc. A (10 cm ×10 cm) solar cell's electricity output is likely rated at 0.50 to 0.55 volts with 3 to 3.3 amps. Here, in the module, 36 cells are connected (in series) together so that in all operating conditions a PV module gives well above 12 volts, which is the required to charge a 12 V battery.

B. Diagram:

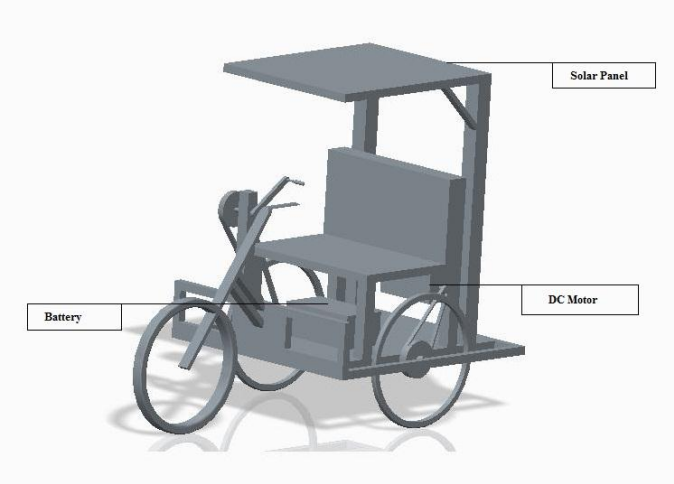

Fig. 3: Proposed Design of the solar tricycle.

V. ADVANTAGES

- Solar energy creates absolutely no pollution. This is perhaps the most important advantage that makes solar energy so much more practical than fuel.
- Solar panels and solar lighting may seem quite expensive when you first purchase it, but in the long run you will find yourself saving quite a great deal of money. After all, it does not cost anything to harness the power of the sun. Unfortunately, paying for oil is an expensive prospect and the cost is still rising consistently.
- It will reduce the efforts of the handicapped person.
- It is very cheap as compared to the other motorized vehicles, for handicapped person, in the market.

VI. APPLICATIONS

- The main application of the project is to provide a tricycle which required less or no effort to ride.
- The solar tricycle is ecofriendly and thus causes no pollution.
- Covers more distance due to the power of the solar energy.
- It is cheap, simple, and low maintenance.

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