Electrosun Mobility Vehicle

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***Abstract*—Paper deals with the usage of solar panel for the purpose of transportation called as electrosun mobility vehicle where electrosun mobility vehicle means combination of electrical and solar energy are used for motion of vehicle. The vehicle can be charged by supplying electricity directly from the domestic AC supply as well as from the solar panels.**
The solar energy has many applications, it can be converted into other forms of energy. The main aim of this paper is to reduce the emissions of air pollutants by avoiding the use of engine vehicles. The important components required to build this paper are rechargeable lead acid battery, solar panel, bldc motor, motor controller, and throttle. Most of the peoples are not fascinated to use these vehicles because of lack of charging stations and service centers. The prime advantage of this vehicle is that, it can be charged even in the absence of electricity by using solar energy which is converted into electricity by solar panels.

Keywords:- Brushless DC Motor, Battery, Charge controller, electronic control unit, solar panel, throttle.

I. INTRODUCTION

The main aim of paper is to replace the heavily polluting internal combustion engine vehicles by a solar come battery powered vehicle to reduce pollution and to make ecofriendly vehicle. Since the non-renewable source are using today getting exhausted so the renewable energy sources are very important for today' s world. One of the steps in saving these non-renewable energy sources is the use of bike that utilizes solar energy. Solar come battery powered is dominant because it reduces the emission of carbon dioxide, it is pollution free and produce less noise [1]

It includes PV panel, controller, charger, battery and BLDC motor. The basic principle of this vehicle is the motor runs when the energy is stored in the batteries. The charging of the battery is taken from domestic supply and also solar panels. Here the BLDC motor is better than dc motor because it has low maintenance, low weight, efficiency is high and has long life span and even the construction is compact. Whereas the conventional DC motor cost is high, and due to the presence of brushes and commutator, its maintenance is more. [2]

II. WHY E-VEHICLE NEED AT PRESENT DAYS

At present, demand of natural resources like fuel, coal etc. is increasing and hence the dealers of these resources are struggling to meet the demand. The motor vehicle are dominating the transport medium. These are being dominated by the fuel. Because of this, the non-renewable resources are being quashed by the producers and dealers to satisfy the need which is responsible for the uncertain future with having the scarcity of minerals energy consumption cannot be sustained much longer.[3]

III. SYSTEM OVERVIEW AND METHEODOLOGY

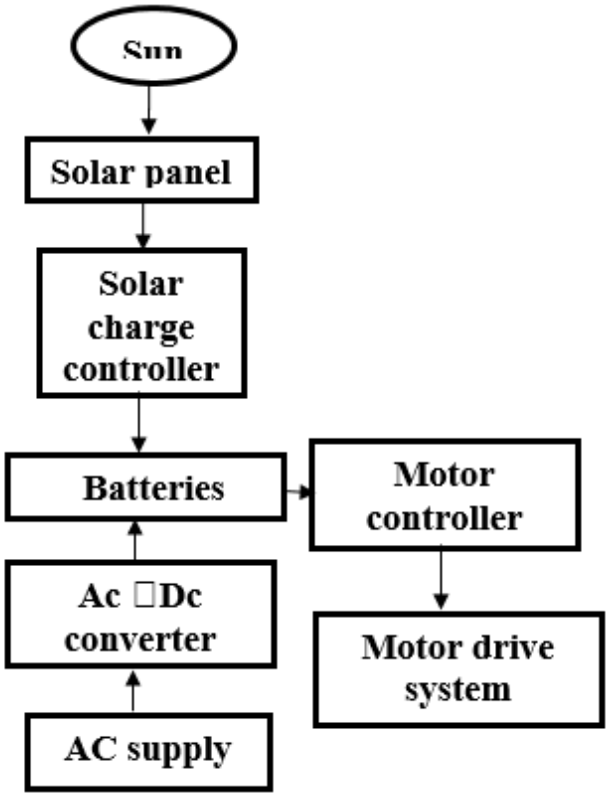

Figure 1. Block diagram of electrosun mobility vehicle

The methodology or working of solar powered vehicle can be understand easily by referring block diagram. The motor drive system of electrosun mobility vehicle is run by using the battery power. The batteries connected to the motor through the electronic control unit which helps the vehicle to run. [8]
The charging of the batteries is done by using both the sources, one is taken from domestic supply, i.e. Ac supply is converted to dc using ac-dc converter and another one is taken from the solar panel is works according to principle of photovoltaic effect, it converts the solar energy into electrical energy. Using of these two sources can charge batteries and then runs vehicle. [9]

A. Solar cell

Photovoltaic panel are built with the combination of building blocks of solar cell. Either series or parallel connections of solar cells are used to generate the solar power. The circuit shown below is a model of single solar cell which includes saturation current of cell at Tr denoted by Ior, shunt and series resistances are denoted by Rsh and Rs. The voltage and current across the photovoltaic diode is represented by Vd and Id respectively.

Solar panels are attached on top of the vehicles. Solar panels generates DC electricity as sunlight, stimulates electrons move through solar cells. Solar cells are inbuilt into the solar panels. Solar Panels helps in absorbing solar energy convert it into electrical energy. Solar panel contains photovoltaic cells, which helps to generate electricity from sunlight by photovoltaic effect. These cells are made up of semi-conductive material which helps in electrical imbalance required to set up electric field. Photovoltaic cells are like modules that can be made by the connection of 32, 36, 48, 60, 72 and 96 solar cells. Solar panels helps in reducing greenhouse effect and global warming. [7]

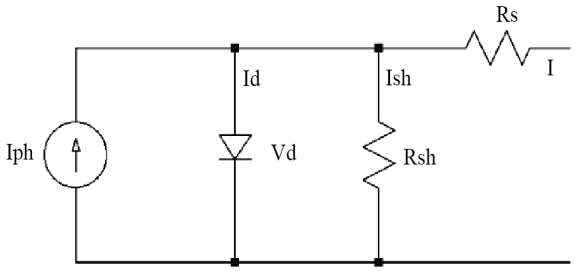

Figure2. A single solar cell circuit model

The mat lab Simulink model of the solar cell photovoltaic panel is as shown in the figure2. During low values of operating voltage the PV cell acts as the constant current source. Similarly it acts as the constant voltage source at the minimum values of operating current. [2]

The specifications/ratings of the selected PV panel are as below.

Maximum power output - 40.0 watt

Rated current- 2.4amps

Rated voltage- 17 Volts

Open circuit voltage (Voc) - 21.8Volts

Short circuit current (Isc) - 2.6amps

Minimum bypass diode current- 4amps

Maximum series fuse current- 8 amps

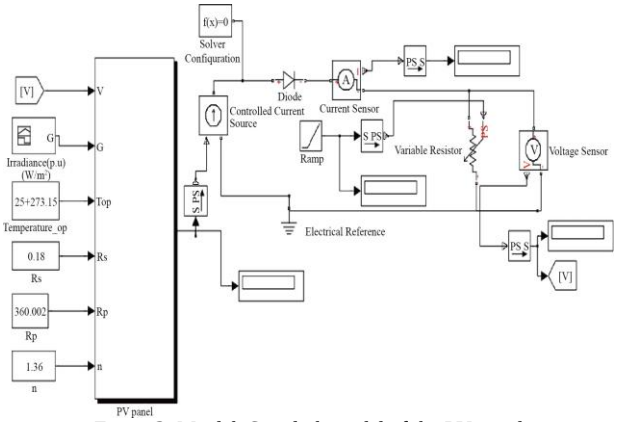

Figure 3. Mat lab Simulink model of the PV panel

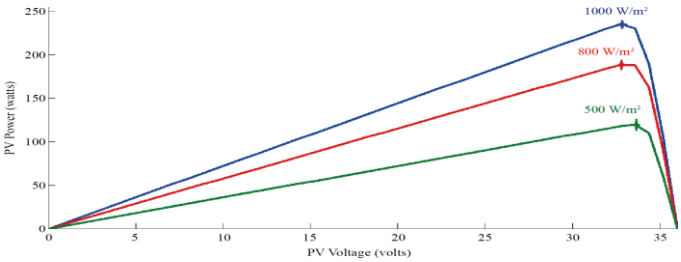

Figure 4. Variation of PV characteristics for change in solar irradiance of PV module

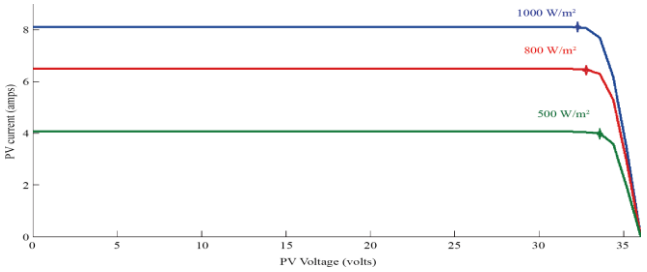

Figure 5. Variation of I-V characteristics for change in solar irradiance of PV module

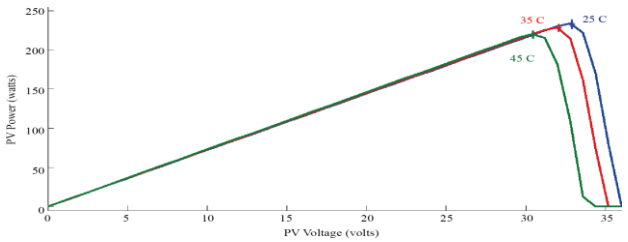

Figure 6. Variation of PV characteristics for change in temperature of PV module.

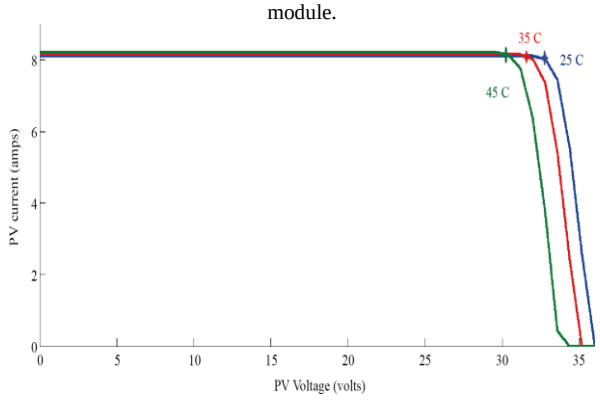

Figure 7. Variation of I-V characteristics for change in temperature of PV module.

The figures 4-7 shows the PV module output in mat lab Simulink with respect to solar irradiation and temperature for parameters like power, voltage and current. [2]

B. Motor

A brushless DC motor is also a synchronous electric motor, it can be made to run by direct current electricity. BLDC motor is electronically controlled commutation system, not a mechanical commutation system which is based on brushes and commutators. In those motors, torque, current, voltage and rpm are directly proportional. Brushless DC motor has advantages like higher efficiency, reliability, reduced noise and long life span. There is no requirement of airflow inside the motor for cooling. One of the disadvantages of this motor is that, it is more expensive. [5]

Figure8. BLDC Hub Motor

C. Battery

Battery is device which store the electrical energy in the form of chemical energy at charging time and again converts it into chemical energy to electrical energy at discharge time. Batteries provide stable power to DC motors and as the result, the motor will work more efficiently without any interruptions. The different types of batteries which can be used in electric vehicles. Some of them are lead acid, lithium ion and nickel iron batteries.

Lead Acid Battery It is a common automobile secondary battery. It contains cathode of lead oxide, anode of lead plate and electrolyte of sulfuric acid. Lead oxide helps in oxidation of lead plate. Lead acid cells are arranged in the form of grid which helps in producing and equally distributing electric current. These are the cheapest rechargeable batteries. [7]

D. Solar charge controller

The output of solar panel is variable and this is one of the problems associated with solar power. The maximum amount power present in the solar panel can be taken out and stored it in the battery with help of solar charge controllers.

Figure 9. Solar Charge Controller

E. Electronic control unit

Controller is a device or group of devices that can be arrange in a predetermined manner the performance of electric motor, Electronic control unit might include a manual or automating means for starting and stopping the motor, selecting forward and reverse rotation, selecting and regulating or limiting the speed and protecting against overload and electrical fault. Electronic controller controls all the component of electric vehicle and also provide required voltage and current from the battery to the motor. [8]

IV. POWER OF MOTOR

Energy required for movement (KE) =M*Δ *V^2

Power developed by means of Electricity=V*I*T

K.E= Motor Voltage (Vm)* amount of current*time to accelerate

Development of Eclectic power for change in acceleration= (Energy required for movement) / (time to accelerate)

K.E=Power of motor = [(1/2)*m*V^2)] / t

i.e. [(1/2)*130*(6.94) ^2] / 5 =626.1268 watts.

m= Total weight (mass) of Vehicle including the Rider in KGs;

V= Required variation of velocity in terms of m/s

T= Acceleration time from initial position in terms of seconds

During the experimentation, when the acceleration time is 8Sec the power developed at motor is 391 watts for the initial propulsion. Similarly when the acceleration time is 13 Sec the power developed at motor is 250 watts. .

- *Current drawn by motor*

Motor power = voltageof battery * current of battery

P = V*I:

626.126 watts = 48 V*I

Therefore

I = 13 amperes

P = Motor power in watts

V = Rated voltage of battery (48V)

I = Current drawn from battery [5]

TABLE I. POWER REQIUREMENT OF THE MOTOR

Sl. No.		Name and Units				
	Time to acceleration(sec)	***Δvelocity***	***Voltage available(v)***	***Mass kgs***	***Current required(amps)***	***Power consumed(watts)***
1	5	30k mph	48	130	13	626.12
2	8	30k mph	48	130	8.14	391
3	13	30k mph	48	130	5.2	250

The above table is the evident of the work carriedout, which shows the time required for the acceleration with respect to the capacity of the motor along with speed of the vehicle interms of kmph. Also the table shows the voltage rating and corresponding current for the power developed with repect to the masss of the vehicle including the rider.

CONCLUSION

The purpose of this paper is to design and develop the less expensive electrosun mobility vehicle. Which runs with both ac supply and solar power as the main sources. The design is done using low power requirement components and it is the evident of low cost electric vehicle as explained in the table. The results in the table gives the clear cut idea about the rating and mass of the vehicle. The main advantage of this paper is the idea of minimum time required for charging as well as nature friendly. This vehicle can be used as an ecofriendly vehicle in economically growing countries due to less cost and its effect on nature.

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