SOLAR BASED CHARGING STATION FOR E-BICYCLE

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Keywords:

Solar panel, Electric vehicles, Renewable Energy, Solar charging station, Battery.

Introduction:

An electric bicycle is a motorized bicycle with an integrated electric motor used to assist propulsion. Many kinds of e-bikes are available worldwide, but they generally fall into two broad categories: bikes that assist the rider's pedal-power and bikes that add a throttle, integrating moped-style functionality. And this kind of bicycles need electricity to charge their batteries. In recent years, global warming and the depletion of fossil fuels due to mass consumption of energy resource has become an increasingly recognized world problem. To control these problems, the installation of renewable energy systems, which do not depend on fossil fuels is an effective countermeasure. A solar-powered charging station for electric bicycle, which offers a pollution-reducing alternative. Using electric e-bicycle is an environmentally friendly and sensible alternative for developing countries such as India to save their stored energy. As a tropical nation, India is well-known for its plentiful sun radiation. By utilizing this vast amount of renewable energy, we can solve the current power crisis. Although these bicycles appear to be environmentally beneficial, they contribute to pollution because they require grid power. In this case, establishing a Solar Charge Station for electric bicycle will be the ideal answer. Because it relieves additional strain on the grid by charging E-bicycles directly, it minimizes pollutants in the environment.

Objectives:

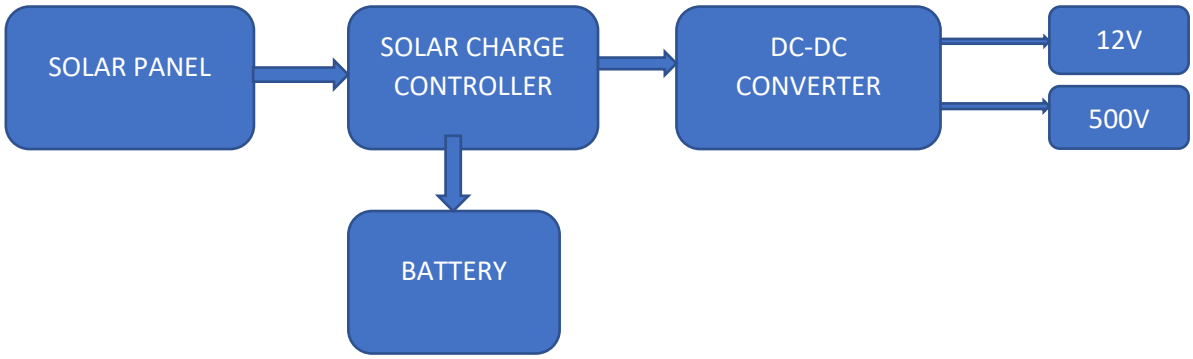
The aim of our project is to charge E-Bicycle using solar energy. And solar energy is widely available in Karnataka so it is preferable to use solar energy to charge the E-Bicycles which is the basic idea of this work. We are developing a prototype model of solar-powered charging station to charge the E-bicycle.

Component Description:

1. Battery :12V, 35Ah lead acid battery
2. Solar panel : 50 Watt, 12V
3. DC-DC converter :12V/500V
4. Solar charge controller : PWM , rated voltage 12V, rated current 10A

5. Load battery : 12V, 3.5Ah lead acid battery

Block diagram of proposed work:



Methodology:

- The solar PV array is the most important part of this project.
- Battery is used to store solar charge, in absence of sunlight the store charge from the battery will be fed to E-bicycle battery.
- Maintenance of DC battery charging system and DC load, is done using solar charge controller.
- The solar charge controller converts high DC voltage from sol panels down to the low voltage required to charge batteries.
- Photovoltaic module voltage and current values provided as PWM control inputs are heard on PV solar panels.
- The MPPP control consists of circuitry which is used to track the highest power area.
- Boost converter helps to match impedance between load and source.
- The converter is a bridge between the solar panel and the load, which helps to maintain the operating voltage at a high operating temperature and to discharge high power.

WORK CARRIED OUT

1. Open Circuit Voltage Test of solar panel

Open circuit voltage is a common term in solar cell application. Voc is the open circuit voltage that is available for drawing out from a solar cell, and occur at zero current. The open circuit voltage resembles the forward bias amount on the solar cell as a result of bias of the solar cell junction with light generated current . connect positive lead of multimeter to the positive terminal of solar panel and negative lead is connected to negative terminal pof the panel the multi meter will show the open circuit voltge of the solar panel.

Fig: Open circuit voltage test of solar panel with multimeter when sun radiation is high

Fig: Open circuit voltage test of solar panel with multimeter when sun radiation is low

Result:

- 22.6 when sun Radiation Is high
- 12.5 when sun Radiation Is Low

2. Output voltage test of battery

Output voltage is the voltage which was exhibited by the battery under normal conditions. The battery that used in this project is a lead acid battery which was shown above.

Fig: Output voltage test of battery

Output voltage test of battery is as follows: Connect the positive lead of the solar charge controller to the positive wire (or terminal) of the battery, and the negative lead of the solar charge controller to the negative wire (or terminal) of the battery. The Multimeter will show the output voltage of the battery.

Result:

- 12V DC under normal conditions

3**.** Input Voltage Test Of DC-DC Boost Converter

Input voltage is the voltage which was accepted by the boost converter under normal conditions. Input voltage test of DC-DC converter is as follows: Connect the positive lead of the multimeter to the positive wire (or terminal) of the boost converter, and the negative lead of the multimeter to the negative wire (or terminal) of the boost converter. The multimeter will now show the input voltage of the boost converter.

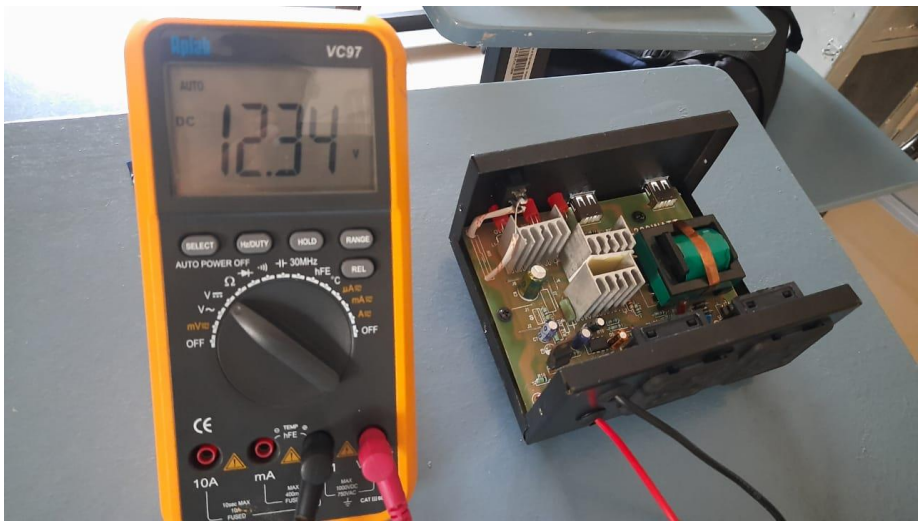


Fig: Input voltage test of dc-dc boost converter with multimeter

4. Output Voltage Test Of DC-DC Boost Converter

Output voltage is the voltage which was exhibited by the boost converter under normal conditions. Output voltage test of DC-DC boost converter is as follows: Connect the positive lead of the multimeter to the positive wire (or terminal) of the boost converter, and the negative lead of the multimeter to the negative wire (or terminal) of the boost converter.

Fig: output voltage test of dc-dc boost converter with multimeter

The multimeter will now show the output voltage of the boost converter.

5. Complete Circuit Of DC Charging

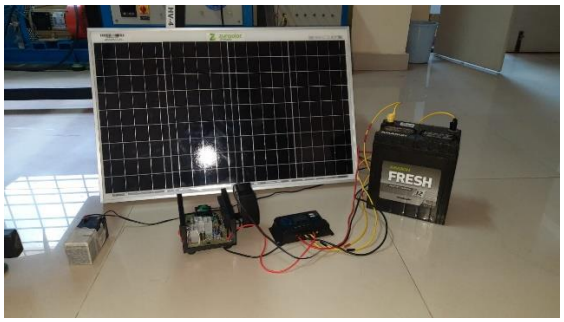


Fig: Circuit of DC charging

6. Bicycle battery charging

Fig: Bicycle Battery voltage before charging

Fig: Bicycle battery voltage when Charging

7. Output voltage test of Charging station

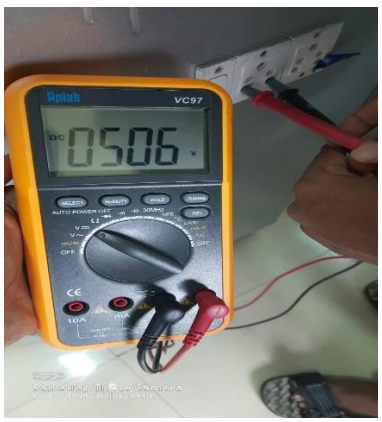


Fig: 500V DC Charger

Fig: 12V DC Charger

7. Cabinet of Project

Fig: Solar based charging station

Calculations:

- Angle of inclination = latitude(12.29)*0.87
  = **10.7 degree**

Let consider battery 12V, 35Ah lead acid battery discharged to 50%

- Maximum charge current output = solar panel watt / battery voltage
  = 4.166A

- Solar panel current = maximum charge current * current by rule of thumb system losses*charge controller efficiency

  = 4.166*(1-20%)*75% = 2.50A

- Time takes to charge battery = battery capacity / current = 13.1hrs
- Time taken = charge time *depth of discharge = 13.4*50%

  = **6.55 hrs**

It takes about 7 hours to charge 12V, 35Ah battery with 50 watt solar panel

- Charging time of bicycle battery= Battery Ah / Charging current

  = 9 Ah / 2A

  = **4.5 hrs**

Result And Conclusion:

Using solar charge we can able to charge E- bicycle battery. We have used 12V 35Ah battery in our charging station. Using Solar panel and solar charge controller we can able to charge charging station battery. By using DC to DC converter we can charge E- bicycle. This project is to make every individual to feel comfortable as it was movable and portable. So, in order to feed the electric bicycles this project that is charging station helps a lot to the public in the way of economic and also helps in instant charging where one can't be able to find the electric grid. The final conclusion of this project is to use renewable energy resources to the maximum extent and to promote the electric bicycles as they are eco-friendly so that there may be a chance of reduction in pollution in future. So, this model provides that electricity which is required by the vehicles to be get charged. As our designed charging station is movable and portable, each individual can use it even in the absence of grid.

Scope of future work:

In future, the rate of charging station will increases. This confirm that an increase of E-bicycles charging stations is very necessary within public parking, and along highways, to ensure full coverage and increased appeal for the user. E-bicycles charging should be as simple as possible and should be build in parking facilities, near shops, sports and leisure facilities. When the electric bicycles will park in the bicycle parking area, the parking is made with solar panel ,with the help of this people's will charged electric vehicle in rest position. An increase of charging stations is not only necessary on the road but also private parking. With research of electric charging has no higher chance of bursting into flames as compare to a daily car chargers. Charging stations are tested before production. Whether private or public, all parking will important to increase the quantity of E-bicycles charging stations.