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Review IJETA

Green Wheels: Solaris Campus Cruiser in Action

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Abstract

The publicly funded transportation system has become expensive due to the growing trends of industry and global economic growth, which have resulted in fluctuating gas prices and other price increases. Innovation can be used to solve any of these issues. Improving the usage of renewable energy sources, such as solar power, in place of fossil fuels is one of the most practical ways to address the problems. The aspiration of all people to possess a solar car that may be used for commerce is gradually coming true. Affordable electric automobiles are now accessible. This chance is used to design a four-wheeler driven by solar energy. The vast and intricate facets of many different disciplines are covered in the multidisciplinary field of renewable energy the design of vehicles. The photovoltaic system in the car is its power source, and the produced voltage it stores in its battery feeds the Continuous The magnet DC motor, which turns the vehicle's rear wheels.

Keywords: Permanent Magnet D C Motor, Maximum Power Point Tracking, Electric Vehicle, Lead Acid Battery, Solar Charge Controller

INTRODUCTION

The search is never-ending for a fuel that is sustainable, safe, clean, and good to the environment. The carbon based fuels, like the fossil fuels that are widely used nowadays are unsustainable and unsafe. They represent a severe risk to the ecosystem. Renewable energy sources including the sun, wind, floods, hydropower, and biomass represent the best substitutes for these. Solar energy is the most desirable of them since it has the potential to produce the cleanest, most environmentally conscious energy for the greatest period of time—at all for the next few billion years. The Solar Electric Vehicles are cutting edge technology that combines Solar power to create more sustainable and more energy-efficient form. The Solar electric Vehicle can also play a pivotal role in reducing carbon emission and their significance in achieving a Green Campus. We aims to create a cleaner, more efficient and ecofriendly mode of transportation that not only reduces our carbon foot print but also sets a new standard for the future of mobility.This work focuses on making an solar powered four wheeler vehicle for College Of Engineering Muttathara which will be beneficial for staffs, peons, security etc aiming to tackle the issues that are related to pollution and shortage of fuel. The main aim is to reduce carbon emissions within our college campus and make our campus a Green Campus [1].

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OBJECTIVES

To introduce our "SOLARIS" to College of Engineering Muttathara to provide a sustainable and efficient form of transportation for teachers and non-teaching staffs within our college. To make our campus a complete Eco-friendly and Green Campus and reduce carbon emission within our campus area. To increase understanding of the advantages of using energy from plants for commuting [2].

EXISTING WORK

- Mode of Charging-Solar Panel only
- Charging time-30+hr

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- Motor type-DC Hub Motor
- Battery Capacity-7.5 Ah
- Motor Power-0.33 Hp
- System Voltage-48V
- Battery type-Lead Acid battery

PROPOSED WORK

The proposed system exhibits a better performance due to both Solar and Electric Charging method. The use of PMDC which provide longer life span and increased efficiency. With an introduction of a 100W solar panel and DC-DC converter which increases charging efficiency. Then we use the Lead acid battery. Also the proposed system is Weather Independent [3].

COMPONENTS

Solar Panel

The proposed system contains two 12V 250W Solar panels connected in series which gives a panels system of 24V 500W [4]. The output current is 20.83A (Figure 1).

Battery

Two 12V 35Ah lead acid battery is being used in series which totally gives a system of 24V 35Ah System[5]. With a 24V 500W motor as load in the system with peak current requirement of 20.83A, the proposed battery system gives a minimum running time of at least 1.68 hr at maximum load (Figure 2).

Solar Charge Controller

The Solar Charge Controller helps to manage the non-constant DC from solar panel to constant DC which is ideal for our load. Also, the Solar Charge controller acts as a safety device for battery by preventing over charging and discharging of battery. Charge controllers are a crucial component of almost all battery-powered renewable energy systems (Figure 3). They act as a voltage or current regulator to prevent batteries from being overcharged. Their goal is to maintain the long-term safety and appropriate feeding of those deep cyclic batteries [6].

Speed Controller

MOSFETs, or metal oxide material field effect transistors, make up the speed controller. The controller determines the rotor position and regulates the commutation of the stator windings based on input from sensors, such as encoders or Hall effect sensors [7]. The fundamental function of an electric bike controller is to regulate the motor’s speed and consumption by altering the average motor supply voltage through intermittent power delivery, provided that battery’s voltage remains essentially unchanged (Figure 4).

Digital Thermometer

A Digital Thermometer is used to monitor the temperature of the system and detect in advance of any temperature spikes to avoid any accidents due to overheating (Figure 5).

Battery Charge Detector

To monitor the voltage of the battery system to maintain the system in a safe voltage range (Figure 6).

Foot Throttle

A foot throttle provides more area for a long magnet which provides a better control over voltage through the Hall Way Sensor which drawn across the magnet [8]. When the throttle is closed, the sensor output voltage is lowered; when the throttle is opened, the sensor output voltage rises. The Position or Hallway sensor movement along with magnet with higher and lower magnetic intensity region will regulate the voltage and thus helps in controlling the speed of the motor. A throttle has mainly 3 wires, Positive , Negative and Signal Wire (Figure 7).

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PMDC Motor

Permanent Magnet DC Motor 24V, 500 W, 2500 RPM Cost Efficient (Figure 8)

Figure 1. Solar Panel.

Figure 2. Lead Acid Battery.

Figure 3. Solar Charge Controller.

Figure 4. Speed Controller.

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Figure 5. Digital Thermometer.

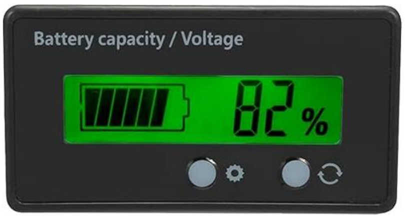

Figure 6. Battery Charge Detector.

Figure 7. Throttle.

Figure 8. PMDC Motor.

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LITERATURE REVIEW

- Power Management System for Hybrid and Solar Electric Vehicles Mohamed A. El-Sharawy and Mohamed A. Yaqoot MTC, Egypt,

This paper mainly discusses about the need of renewable source of energy because all sources of energy will run out, especially in the field of automotive engineering, Scientists look for alternatives for internal combustion engine vehicles. This paper also deals about the advantages and disadvantages of EV [9].

EVs have many advantages:

- They are more efficient.
- They produce low emissions,
- They require less maintenance.

They have also many disadvantages:

- They have a high production cost.
- Needed to be charged for long periods.
- Move for a short distance.
- Christen Roger, Solar E Cycles empowering people project 2014-2019

This paper mainly discusses about providing an affordable, clean transportation vehicle for individuals in sub-Saharan Africa. With increasing stress from climate change and a growing need for transportation services and electricity the products such as the Solar-E-Cycle will allow individuals to access important services while leaving minimal carbon footprints.

The 2018 International Conference on Emerging Trends and Innovations in Engineering and Technological Research Proceedings include a paper on solar chargers for electric vehicles [10].

The primary topic of this essay is whether using solar energy to recharge an electric car’s battery is the most environmentally responsible way to do so.. To optimize the power output from solar panel the Lithium Ion on board electric vehicle battery needs to be charged while maintaining the voltage level as specified. We employ the constant voltage (CV) and constant current (CC) ways of charging for this.

- Designed and developed a hybrid vehicle with adjustable tilt angle that runs on solar or electric power Mohamed A. Yaqoot MTC, Egypt; Ibrahim Mohamed, Mohamed Sabry, and Mohamed A. El-Sharawy The design and development of a solar-powered electric auto with adjustable tilt angle is described in this work. Here, we’ve designed a car that runs on solar power and can also be charged using an AC current adaptor. There is tilt adjustment for the solar plates. When the earth spins, the sun’s radiation changes for us on Earth. Assuming the sun is in its typical position, the solar PV cells will produce the most power possible. Consequently, various mathematical as well as automatic processes are used all over the world to tilt the alignment of the solar collectors so that they remain normal to the sun. Block Diagram Of Solar Powered Electric Vehicle (Figure 9)

PROPOSED 2D MODEL

This is the proposed 2D model of our vehicle.

It includes Top View, Side View and Basic Component Connection Diagram.

PROPOSED MODEL SPECIFICATION

In Figures 10, 11 show the Proposed 2D and 3D Model

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Maximum speed of vehicle = 30 kph

Battery Capacity = 35 Ah

Vehicle Weight = 70-80 Kg

Vehicle Power = 0.7 hp

Vehicle Top Speed = 30kmph

Vehicle Running Time = 2 hr

Vehicle Charging Time = 68 hr

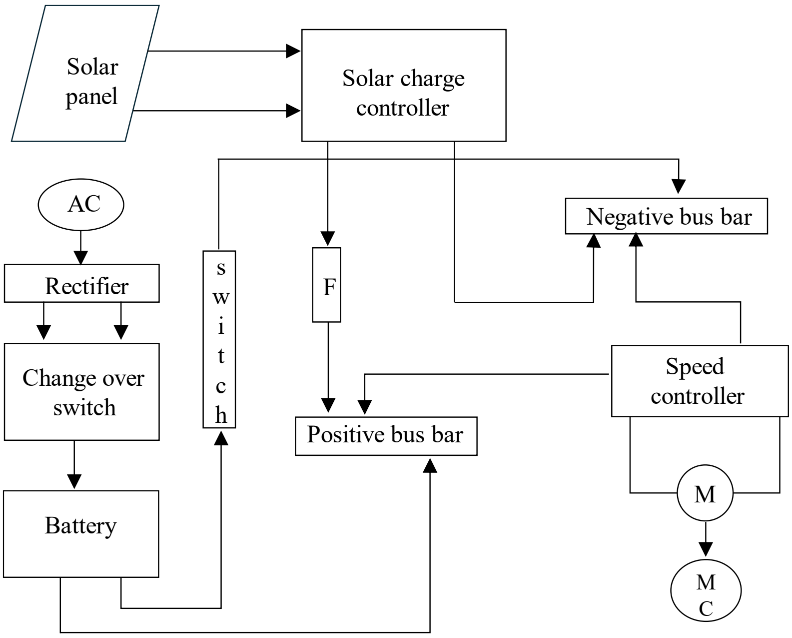

Figure 9. Block Diagram of Solar Powered Electric Vehicle.

SIMULATION RESULTS

Here we designed a Boost Converter circuit.

Input Voltage Vs = 18V

Output Voltage Vo= 24 V

An electrical circuit called a boost converter is used to increase voltage levels. It changes the lower input voltage into the greater voltage that emerges. When a switches in a boost converter is closed, energy is stored in an inductor and released when the switch is opened. A higher output voltage than the input voltage is possible with this procedure. It is frequently utilized in many different applications, including DC-DC converters, battery chargers, and LED drivers. A DC-DC converter circuit that raises the input voltage to a higher output voltage level is called a boost converter, sometimes referred to as an a step up converter (Figure 12).

EXPECTED GRAPH

In Figures 13, 14 Input and Output Voltage Waveform and Graph of Dc Motor Showing Speed, Voltage, Current

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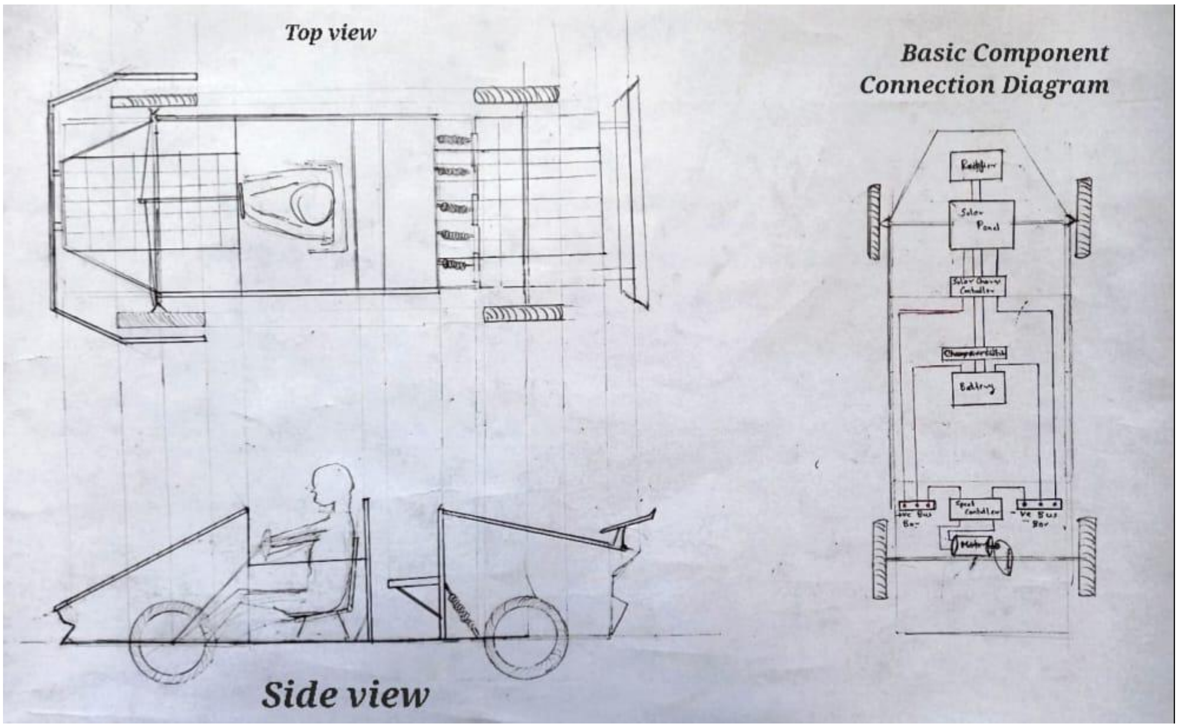

Figure 10. 2D Model.

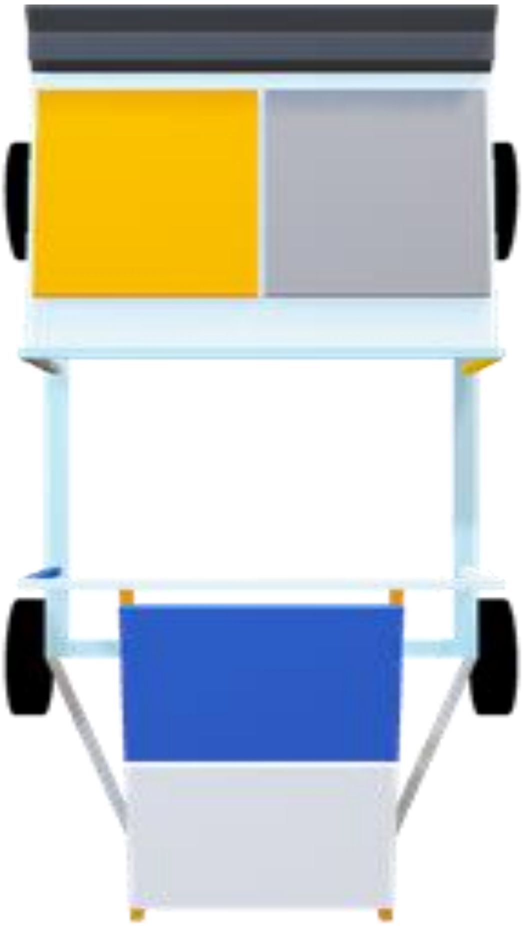

Figure 11. Proposed 3D Model.

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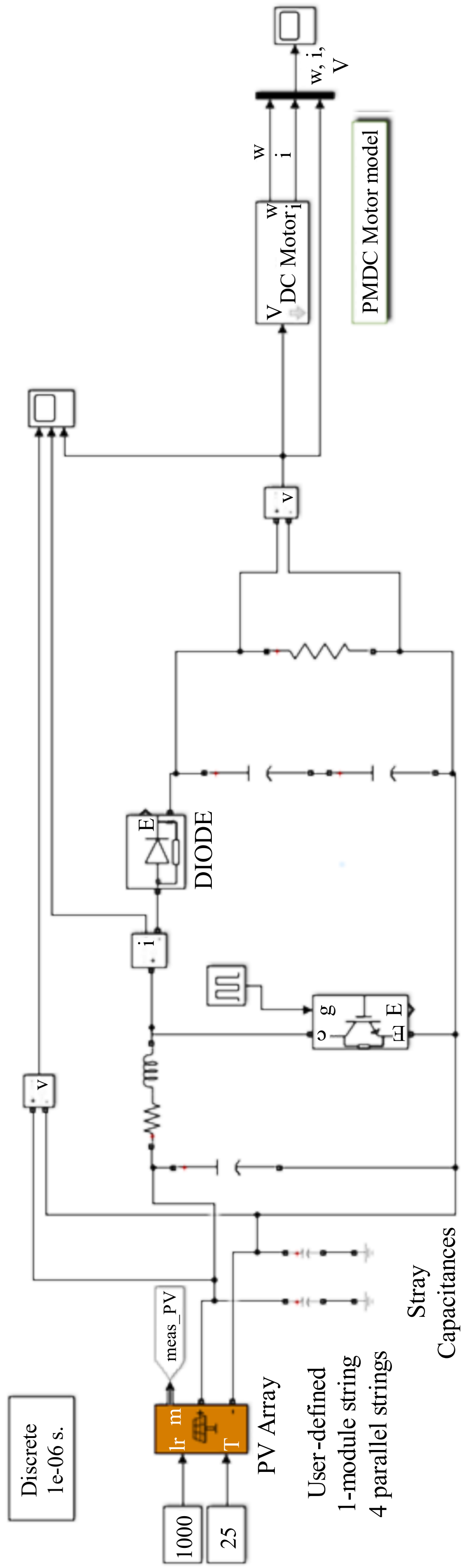

Figure 12. Simulink Diagram.

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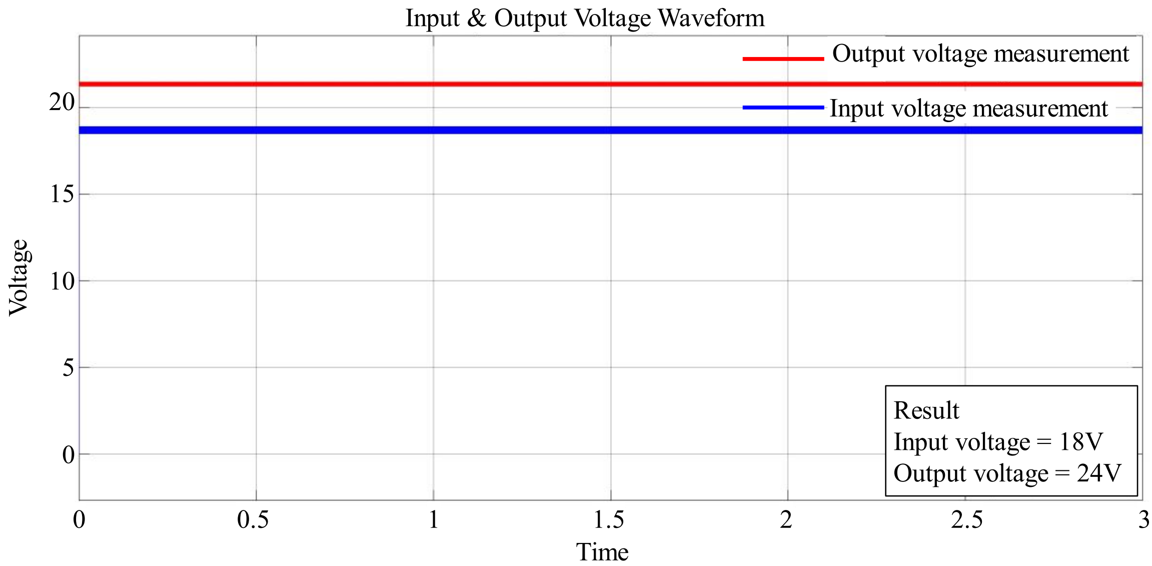

Figure 13. Input and Output Voltage Waveform.

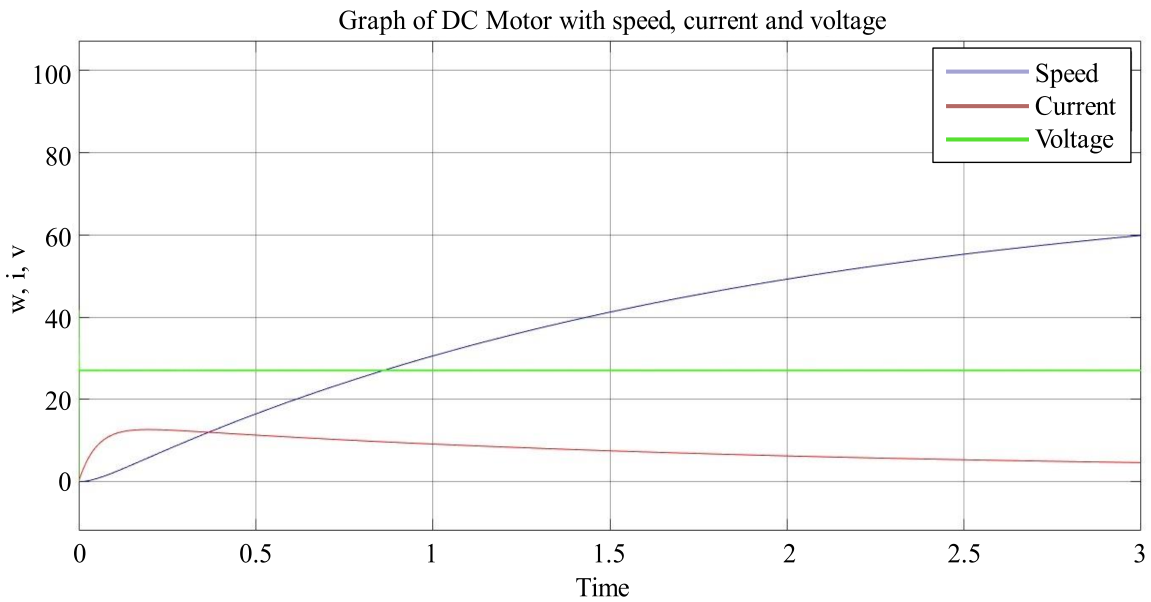

Figure 14. Graph of DC Motor Showing Speed, Voltage, Current.

DESIGN

- Vi = 18V
- Vo = 24V
- Duty Ratio D = $\frac{Vo-Vi}{Vo} = \frac{24-18}{24} = 0.25$
- $I_L = \frac{Vi}{(1-D)2\times R} = \frac{18}{(1-0.25)2\times R} = 3.2\text{A}$
- Let switching Frequency fs = 20 kHz
- $\Delta\, i_L = 20\%\ I_L = 0.64$ A
- $L = \frac{DVi}{fs\times\Delta i\ L} = \frac{0.25\times18}{20000\times64} = 351\ \mu\text{H}$
- **C** $= \frac{D}{Rfs(\frac{\Delta Vo}{V})} = \frac{0.25}{10\times20\times1000\times0.04} = 31.25\ \mu\text{F}$

In Table 1 show the Components Specification

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Table 1. List of components used.

S.N.	Components	Specification
1	Motor	24V, 500W, 2500 RPM
2	Speed Controller	24V, 500W
3	Battery	24V, 35 Ah
4	Busbar	24V, 60A
5	Solar Charge Controller	24V,40A
6	Battery Charger	24V
7	Battery Charge Detector	12V–48V
8	Solar Panel	12V, 250W
9	Digital Thermometer	

CONCLUSIONS

The presented results as well as the design for a solar powdered vehicle makes the usage of these vehicles feasible and practicable in developing countries. The solar powered electric vehicle using a PMDC motor is a good choice for the Indian market. The solar powered electric vehicle stands with higher safety, high performance as well as remains cost efficient. Use of Charge Controller and Speed Controller in the vehicle improves the efficacy of power system. The presented eco-friendly solar powered electric vehicle can be a good choice for future generations.

Acknowledgments

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