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Solar Powered Brushless Dc (Bldc) Motor Driven Electric Vehicle

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Abstract
This paper provides an overview of the recent work of vehicle in the region. The paper describes the development and the comparison of different part of components the major components in solar panel, dynamo battery, BLDC motor, charger design In earlier days the when the electric cars were designed, they went through various losses and were less efficient. Thus there was a decrease on demand of electric cars/ vehicle which almost made the concept of electric cars as not efficient. So for increasing the efficiency as well as in automobiles markets, we are using BLDC motor operation cars.

Keywords*: BLDC, Photo Voltaic, Battery, Solar energy*

INTRODUCTION

This project is about the usage of solar energy to power up the vehicle. In order to achieve the required voltage, the Photo Voltaic (PV) Module may be connected either in parallel or series, but it's costlier.

In many developing nations like India petroleum is imported at very large scale and very excessive subsidy is furnished by using authorities to the people, which purpose losses of cost-effective growth. A proper energy management system is needed to control the energy uses, every single watt of stored energy have importance in electrical vehicle. The voltage is then boosted up using the boost power converter, ultimately running the BLDC motor which is used as the drive motor for our vehicle application [1]. In the course work, the characteristic features of the components; solar panel, charge controller, battery, power converter and BLDC motor required for the vehicle application were studied in real time and also were modelled individually using PROTEUS 8.5 software and the complete hardware integration of the system is tested to meet up the application's requirement.

Purpose

By including the solar powered BLDC motor there are no losses, as the motor is brushless .this reduces the use of electrical energy as the BLDC motor which is used here is operated on solar energy .this solar energy .This solar energy is freely available in nature Also an alternator is used in addition to solar panel to run the BLDC motor .This increases the generation of energy as well as the efficiency of motor.

Working

Solar module is use to convert the light energy into electrical energy. Than this electrical energy is given to the charge controller [2]. Then this supply is given to the battery. The boost converter is use to boost up the voltage. The electrical energy is given to the BLDC motor and the motor start running. Alternator is use to increases the efficiency of motor.

BLOCK DIAGRAM

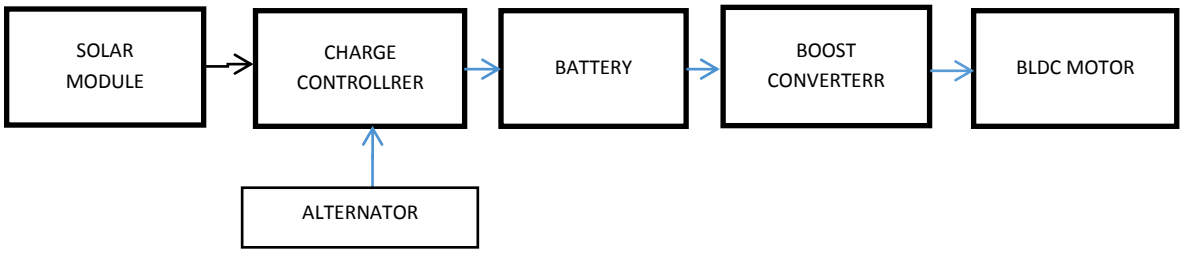

Figure 1: *Solar Powered Vehicle Prototype*

The integration of the whole system evolves as the Solar Motor Driven Electric Vehicle. The powered BLDC prototype of the vehicle was designed with just forward and backward movement which was able to achieve a speed of 23Kmph.The rear axle of the vehicle is connected to the driving shaft of the BLDC motor through the fly wheel. With the exchange in motor, which has high Torque, the automobile would be succesful of been driven with heavy load [3]. The modern from the batteries flows to the controller, which controls the complete control device of the vehicle. With respect to the motion of the accelerator, the controller sends forth the current, thereby growing or decreasing the speed of the vehicle[2].

Specifications and use

- Models: 12 W / 14 V
- Dimensions;(Length*Width*Thickness in mm): 420 X 260 X 17 MM
- Maximum Power: 12 W
- Open Circuit Voltage (V -in Volts): 21
- Short Circuit Current (in Amps): 0.65
- Voltage at Max. Power Point (In Volts): 17

Figure 2: *Charging the Batteries through the Charge Controllers*

Charge Controller limits the rate at which electric current is added to or drawn from the electric batteries. The prime purpose of using the Charge Controller is to prevent against overcharging and deep discharging of a battery. For the 12V/42Ah battery, 12V/6A solar charge controller is an ideal choice [4]. According to the rating of the battery and solar module the selection of the charge controller is done. Two charge controllers are connected between the solar modules (35W and 40W) and the batteries individually [5]. As the next step, the battery is studied.

The battery is modeled using a simple controlled voltage source in series with a constant resistance. This model assumes the same characteristics for the charge and discharge cycles. The open voltage is calculated with non-linear equation based on the actual State of Charge (SOC) of the battery [6].

- Lead acid battery 12V 24W
- Voltage(V): 12V
- Technology: Lead
- Other Information: 24W

OPERATION OF BLDC MOTOR

SPECIFICATION OF THE BLDC MOTOR:

- Volt - 24v
- Power-50W
- Current-50A
- Speed -1000RPM

Figure 3: *Bldc motor*

The operation of a BLDC is based on the force interaction between the permanent magnet and the electromagnet.

In this condition, when the coil A is energized, the opposite poles of the rotor and stator are attracted to each other (the attractive force is shown in green arrow).Asa result the rotor poles move just about the energized stator coil. the stator has a coil arrangement [6]. These windings can be arranged in either star or delta. the stator coil should be chosen with the proper rating of the voltage looking on the ability provide capability. For robotics, au motive and small actuating application, 48V or less voltage BLDC motors are prefered.For industrial application and automation system. 100V or higher rating motors are used.

The load test directly reflects to the speed of the vehicle with respect to the load [7]. For a vehicle, irrespective of the driver; the wind force, friction, incline or decline movement, and the weight of vehicle (for a solar powered vehicle; the solar modules, batteries, controllers and motor) are the parameters that affect the speed of the motor, there by affecting the speed of the vehicle .The permanent magnet creates rotor flux and stator creates electromagnetic poles [8]. The rotor is attracted by the energized stator phase generating a rotation.

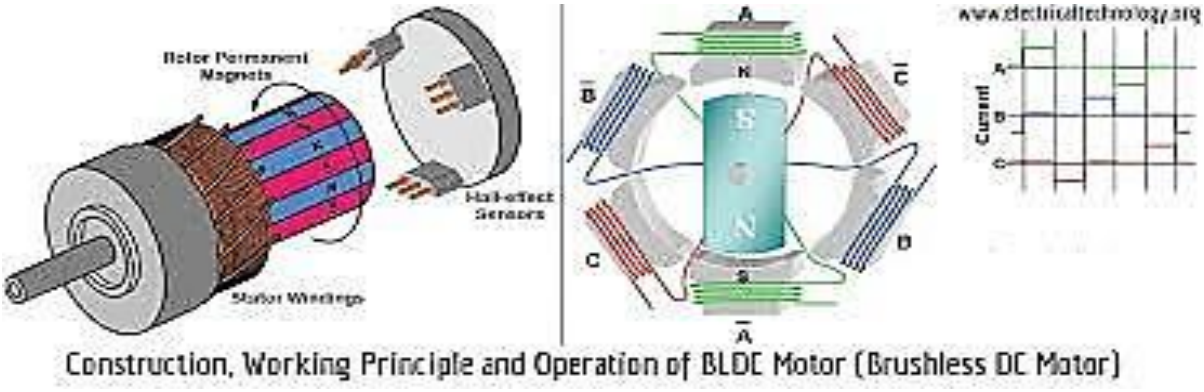

Figure 4: *Working of BLDC Motor*

Driving the Motor

The Brushless DC (BLDC) motor is used as the drive motor for the vehicle. The specification of the BLDC motor is given the reason for opting for the BLDC motor is because of its efficiency, noiseless operation, dynamic response and high torque to weight ratio.

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BLDC motor requires an inverter and a position detector to perform commutation. BLDC motor is electronically controlled and requires rot The load test directly reflects to the speed of the vehicle At various speed conditions, the input current for the converter from the battery were noted [8]. The starting current of the motor was observed to be 1.7Amps in no-load condition. From the observations at various speeds tabulated in Table 7 we can see that as the speed of the motor is been increased, the current drawn from the battery also increases. It's observed that the motor draws 1.1Amps of current from the battery, which means; theoretically the battery can supply the motor for approximately 38hours.In the next step of the work, the 52.5Watts BLDC motor is been run using the batteries whose (connected in series and thereby supplying 24V) output voltage is been boosted up to48V using the boost converter, while the batteries are been charged by the solar modules concurrently. Input Current for Boost Converter from the Battery reduces the use of electrical energy as the BLDC motor which is used here is operated on solar energy.

By including the solar powered BLDC motor there are no losses, as the motor is brushless .this this solar energy [9].This solar energy is freely available in nature. Also an alternator is used in addition to solar panel to run the BLDC motor .This increases the generation of energy as well as the efficiency of motor [9].

Application & Advantages

- Noiseless and no fuel is required, hence pollution less operation.
- Low maintenance.
- With the help of natural resources electric vehicle is driven.
- It is ecofriendly.
- Using BLDC motor so, there are less losses as compared to other motors.

RESULT

Hence by using the BLDC motor with hybrid system the electric vehicle is run.

CONCLUSION

In this project we have to studied and implement the electric vehicle and it run successfully. An alternator is used in addition to solar panel to run the BLDC motor. This increases the generation of energy as well as the efficiency of motor. This reduces electricity costs as well as increases the efficiency of drives.

The importance of making shift in the source of energy which is made cost effective was put forth, and utilization of solar power in vehicle application was implemented. The objective of selecting the appropriate components for the application was studied, and the various components for the same is subjected to various tests which was cross check with simulation results tool .The designing of the whole system depends on the application for which it shall be used, and accordingly the components are been chosen starting from the motor to the solar modules. It was observed that according to the application, the motor was chosen first. From the rating of the motor, the battery which could satisfy its starting current and full load current was been selected, and then according to the rating of the battery, the solar charge controllers and the solar modules were selected. Finally the BLDC motor mounted upon the frame realized the prototype.

Figure 5: *Hardware of project.*

Future Scope

- We can use wind mill in front of vehicle to charging the battery.
- In order to achieve the required voltage, the photo voltalic (PV) module may be connected either in parallel or series, but it's costlier.

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