DESIGN AND IMPLEMENTATION OF HYBRID REGENARATIVE SMART BLDC MOTOR DRIVE ELECTRIC VEHICLE

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ABSTRACT

*Solar energy and wind energy are the two most viable renewable energy resources in the world. Good compensation characters are usually found between solar energy and wind energy. This paper recommends an optimal design model for designing hybrid solar–wind automobile and also using a regenerative motor for employing battery banks for calculating the vehicle optimum configurations and ensuring that the annualized cost of the vehicle is minimized while satisfying the custom required loss of power supply probability (LPSP)***.**

Keyword : - *SPV , LPSP BLDC Motor, Electric Vehicle..*

1. INTRODUCTION

The concept of "Low-carbon Environmental Protection" is well known to everyone. However, traditional car was driven by fossil fuel, the auto emissions include large amount of harmful gases, such as CO, SO. Therefore, the car, as an essential component for modern society, facing the Transformation due to its serious environmental pollution, and the research of green cars has become very popular. Because of its clean and pollution-free characteristics, the electric vehicle has been achieved widely attention in recent years. However, EV has its certain drawbacks, for example, short Continuous range and long charging time. This would require the use of other renewable energy to make up for the electric car's deficiencies.

The Solar and wind power comes as the gifts of nature, they are clean and powerful. These two kinds of energy could be used to generate electricity and stored in the battery because they are easier to obtain, they cost less and they have zero carbon emissions. But no matter the solar or wind power, are bound by the natural environment. Currently the wind and photovoltaic hybrid power are used to complement the shortage of the both. Using the solar energy to generate power during the day when the light is stronger, using the wind power when it is dominant advantage in the evening. Such complementarities, effective use of the green resources, but also increase the charge in a storage battery, in order to make up for the inadequacy of pure electric vehicles.

An electric motor typically is between 85% and 90% efficient. That means it converts that percentage of the electricity provided to it into useful work. The difference between the efficiency of the motor and the overall efficiency of an electric car is accounted for losses attributed to charging and discharging the battery and, for some charging (for some cars), converting AC to DC current and back again. In an attempt to make electric automobiles more efficient and reducing the power consumption cost on the longer run we are inducing a hybrid regenerative system in the automobile. Harnessing solar energy and tapping wind energy while the vehicle is on the run. Also utilizing regenerative braking mechanism. A greener goal towards a green future of the world.

2. PRINCIPLE OF OPERATION

Solar or wind power as a kind of clean energy, after recent years of booming development, its performance and reliability were greatly increased. The electric cars, gained vast popularity in recent years, have some quite mature power demand theories. Based on the existing vehicle simulation software advisor, add two modules of solar cells and wind turbines, we are going to make a simulation analysis of the vehicle's energy control system. The wind-solar photovoltaic hybrid generating system (WPGS) include wind turbine system, solar cell power generation system, energy storage system, energy management system and driving system. The structure diagram is shown in figure 1.The battery is supplied by solar cells and wind turbine energy through DC - DC converter. The battery can accept and store the electric current of solar, wind and electric supply. When the working condition of vehicle need high-power, the battery can supply energy for its drive system.

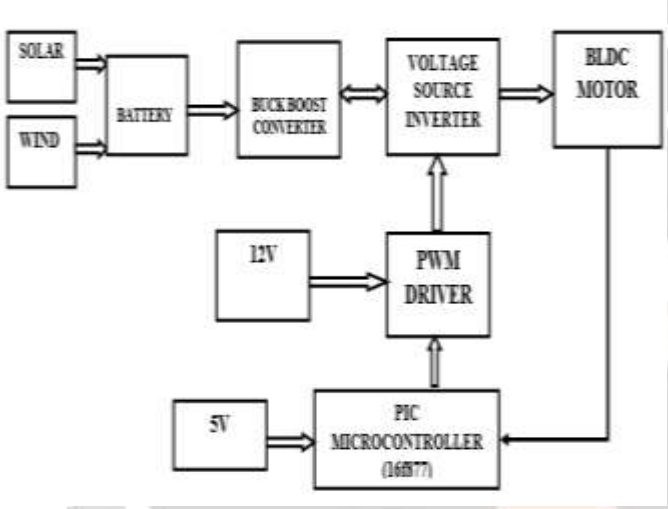

Fig 1: Block Diagram of Proposed Circuit.

SPECIFICATIONS	RATING
Max Power	3W
Open Circuit Voltage	21.6V
Operating Voltage	17V
Operating Current	0.18A
Short Circuit Current	0.21A

Table-1 Specification of Solar Panel

The scope of the work is to regenerate energy. The main difference with a unidirectional DC/DC Converter is on the use of MOSFET or IGBT to switch the state of the current instead of all the diodes. The magnitude of the voltage and current as well as the placement of the energy storage items, the bi-directional DC-DC converter can either operate as a Buck converter by stepping down a higher voltage to a lower voltage or as a Boost converter by stepping up from a lower voltage to a higher voltage. Indeed, diodes do not allow current to flow in both directions, but with MOSFET the period of each position can be easily controlled. The kinetic energy is wasted as heat energy in previous methods whereas this method involves the conversion of kinetic energy into electric energy which is rectified and stored in a chargeable battery in automotive applications most DC/DC converters have to exchange power between two voltage sources To accomplish this power transfer the current must be able to go through the circuit in both directions.

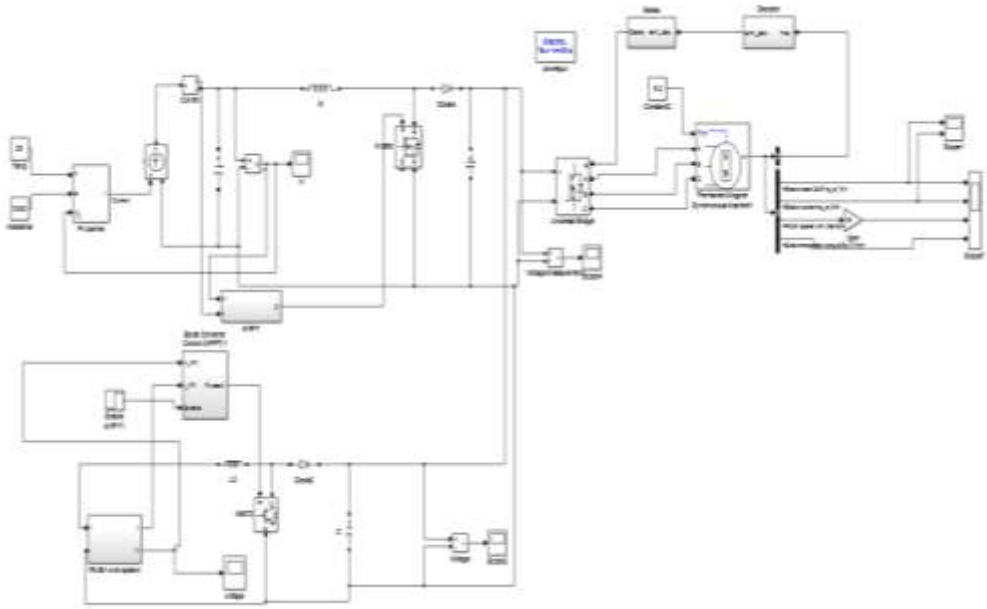

Fig 2 (a): Simulation model of proposed hybrid regenerative smart BLDC motor drive electric vehicle.

Fig 2 (b): Prototype proposed hybrid regenerative smart BLDC motor drive electric vehicle Model

3. Working of prototype hardware

The solar panel will charge the battery on the day time. The circuit attached to the battery will protect the battery from damages the sunlight intensity is more in the summer the solar panel passes more amount of voltage than required by the battery and this leads to the battery damage so for stabilizing the voltage the circuit will be installed between the solar and the battery. As there is no one in the electric car we can install the carburettor fan and the fan will be attached to the generator and the vehicle is in moving position even in the night time when the solar panel will not work the battery will be charged through the wind energy that is from the fan with dynamo attached and the battery will be charged. Clips are attached so that the user can change power source for charging the battery from solar to wind when required.

The vehicle model mainly includes the power module, the wheel module, battery module, accumulator module, control module and the marked wind and solar complementary power generation system module. Each module delivered and transformed the corresponding torque requirements. It also delivered and transformed the torque and speed which can be reached actually. The wind and solar complementary power generation module is mainly used for storing the electric energy in storage battery, and then recharge the battery as it was consumed. It can maintain the best working status of the battery and prolong the service life.

3a. Conversion of Wind Energy in to Electric Energy

In this prototype the wind capturing device is a fan. Fan is mounted on the front side of the chassis with the truncated cone in front of it. Fan will get rotated by the wind blown by the blower which will get directed toward the fan due to cone where in actual it will be the wind around the vehicle when vehicle is in running condition. Rotating fan will convert the captured kinetic energy of wind into mechanical energy .The centre shat motor which is connected to battery will convert this mechanical energy into electric energy which is going to store in the battery.

3b. Conversion of Solar Energy in to Electric Energy

Solar panel is situated on the top of battery in the prototype. Where in actual vehicle it will be mounted on the upper body of chassis of four wheeler. While the vehicle in running position or stand still and have a sufficient solar energy the solar panel will trap that energy and due to the photovoltaic effect of solar panel, it will convert this solar energy into electric energy which will get stored into the battery.

3c.Regenerative Braking of Electric Vehicle

In a regenerative braking system, motor runs backwards using vehicle's momentum as the mechanical energy that puts the motor into reverse. Momentum is the property that keeps the vehicle moving forward once it's been brought up to speed. Once the motor has been reversed, the electricity generated by the motor is fed back into the batteries, where it is utilized again.

4. Simulation result Proposed Hybrid regenerative smart BLDC motor drive electric vehicle

4.1 Back Emf of BLDC Motor

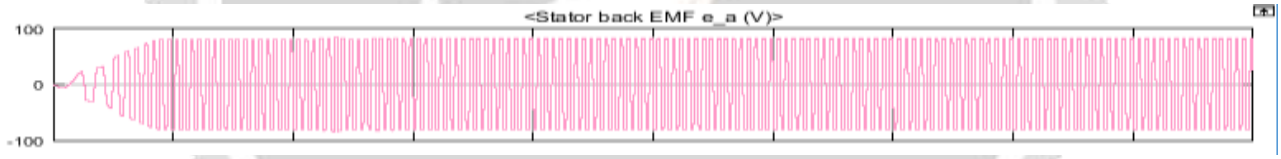

Fig4.1 Waveform of back EMF in Volts

4.2 Stator Current of BLDC Motor

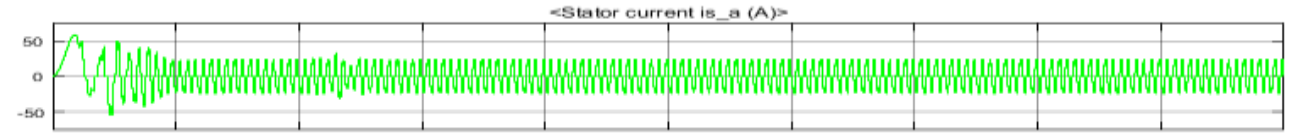

Fig 3.2 Waveform of stator current in Ampere

4.3. Speed of BLDC Motor

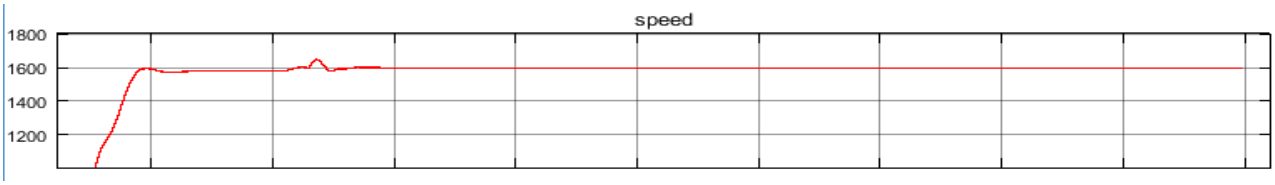

Fig 4.3 Waveform of Motor Speed in RPM

4.4 Torque of BLDC Motor

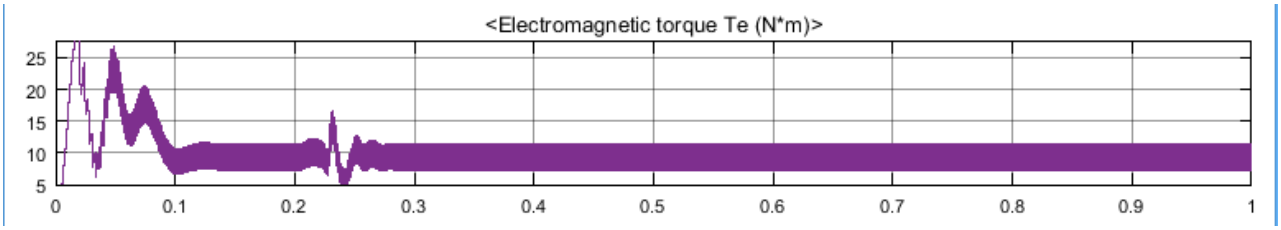

Fig 4.4 Waveform of Motor Torque in Nm

5. CONCLUSION

In this proposed project after making project it is found that project is in working condition. It is found that prototype captured the solar energy through solar panel and wind energy through turbine induced on it. There is huge potential for producing electricity from renewable sources. This paper gives a clear idea that vehicle powered with the help of solar energy and wind energy is more effective than fuel vehicle.

REFERENCES

[1] Lin, Chang-Hua, Hom-Wei Liu, and Chien-Ming Wang."Design and implementation of a bi-directional power converter for electric bike with charging feature." Industrial Electronics and Applications (ICIEA), 2010 the 5th IEEE Conference on.IEEE, 2010.

[2] Rajan Kumar, Bhim Singh, "Buck-Boost Converter Fed BLDC Motor Drive for Solar PV Array Based Water Pumping" IEEE International Conference on Power Electronics, Drives and Energy Systems(PEDES), P.P 1-6, Dec 2014.

[3] Bhajana, V. V., and PavelDrabek. "A novel ZCS bidirectional buck-boost DC-DC converters for energy storage applications."Industrial Technology (ICIT), 2015 IEEE International Conference on.IEEE, 2015.

[4] Atul Kumar, Dr. Prerna Gaur "Bidirectional DC/DC Converter for Hybrid Electric Vehicle" IEEE Transactions on Advances in Computing, Communications and Informatics (ICACCI),P.P 839-843,sep 2014.

[5] Kumar, V. Vijaya, V. Udayakumar, and J. Muruganandham. "Speed control of BLDC motor for four quadrant operation without loss of power."Computation of Power, Energy Information and Commuincation (ICCPEIC), 2015 International
Conference on.IEEE, 2015.

[6] Awaze, Sneha K. "Four quadrant operation of BLDC motor in MATLAB/SIMULINK." Computational Intelligence and Communication Networks (CICN), 2013 5th International Conference on. IEEE, 2013.

[7] Vinatha, U, Pola, S. ; Vital, K.P. "simulation of four quadrant operation & speed control of BLDC motor on MATLAB/SIMULINK"TENCON, P.P 1-6,2008

BIOGRAPHIES

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