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Design and Implementation of Solar Charger for E-Vehicle

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ABSTRACT: This system proposed a simple, cost effective and effective EV brushless DC (BLDC) motor drive for solar photovoltaic (SPV) array fed EV system. A DC-DC motor is employed in order to prize the outside available power from the SPV array. The proposed control algorithm eliminates phase current detectors and adapts a abecedarian frequency switching of the Z source inverter (ZSI), therefore avoiding the power losses due to high frequency switching. No fresh control or circuitry is used for speed control of the BLDC motor. The speed is controlled through a variable DC link voltage of ZSI. An applicable control of DC-DC motor through the undo and bystander conductance maximum power point shadowing (INC-MPPT) algorithm offers soft starting of the BLDC motor. The proposed EV system is designed and modeled similarly so that the performance isn't affected under dynamic conditions. The felicity of the proposed system at practical operating conditions is demonstrated through simulation results using MATLAB/ Simulink followed by an experimental confirmation.

KEYWORDS: Solar PV modules, Buck Boost Converter, Renewable Energy Resources, BLDC Motor

I.INTRODUCTION

Presently, one of the topmost engineering issues to attack is the need for clean energy sources. The world is largely dependent on natural feasts and coal to produce electricity. Although this power source is abundant, it's shown to help in global warming. Likewise, birth styles similar to fracking are shown to have a mischievous effect on the terrain, videlicet earthquakes. One source of energy being heavily studied is solar energy. Until lately, the effectiveness of the solar panels, used in collection of solar energy, was too low for it to be a feasible option for replacing energy obtained from fossil energies. Advances in accouterments has paved the way for using solar energy as a renewable resource that's sluggishly meeting the energy demands that society has come habituated to do. An E-Vehicle is a machine that's propelled by one or further electric motors, using energy stored in batteries. Compared to Internal Combustion Engine (ICE) vehicles, electric buses have no exhaust emigrations, and lower emigration Overall. The total cost of power of recent electric vehicles is cheaper than that of original ICE buses, due to lower fueling and conservation costs. Charging an electric auto can be done at a variety of charging stations; these charging can be installed in both houses and public areas. The primary factors are motor, regulator, power source and transmission.

This vehicle uses a large traction battery pack to power the electric motor and must be plugged into a wall outlet or charging outfit, also called electric vehicle force outfit (EVSE). Because it runs on electricity, the vehicle emits no exhaust from the tailpipe and doesn't contain the liquid energy factors, similar to an energy pump, energy line, or energy tank. The disadvantage we're facing in the Electric Vehicle is that the charge in the battery which gives the force for the motor gets discharged and hence it should be stopped or situated in the area where the current should be fluently taken. But the biggest problem is that when the auto loses its full charge while driving in an area where the current couldn't be taken fluently. Hence, to change this problem PV is used to break it. Our main ideal in this system is to power up the Electric Vehicle with PV. It's powered fully by solar energy. Generally photovoltaic cells contained in solar panels convert the sun's energy directly into electrical energy. Then, the classic boost motor isn't a good choice for the high step-up conversion due to the following three reasons. Originally, an extremely high duty-cycle must be used to gain the conversion rate, which causes serious losses on the power bias

due to their parasitic parameters. Secondly, low on- resistance active switches and good performance diodes cannot be espoused due to the high voltage stress. Third, the rear- recovery problem of the affair diode is severe due to its short conduction time. All these three factors degrade the effectiveness and limit the power position. So, after the invention of power semiconductor bias these problems can be overcome. Accordingly, a large number of inverters are constructed but crucial factors in all these power electronic bias. Particularly in mongrel, electric, and energy cell vehicles, the Insulated Gate Bipolar Transistors (IGBTs), freewheeling diodes and advanced power module technology are used.

II. PROPOSED SYSTEM

A typical wind and solar panel converts only 30 to 40 percent of the incident wind and solar irradiation into electrical energy. Maximum power point tracking fashion is used to ameliorate the effectiveness of the wind and solar panel. According to Maximum Power Transfer Theorem, the power affair of a circuit is maximum when the venin impedance of the circuit (Source impedance) matches with the cargo impedance. Hence our problem of tracking in maximum power point reduces to an impedance matching problem. In the source side we're using a boost motor connected to a wind and solar panel in order to enhance the affair voltage so that it can be used for different operations like motor cargo. By changing the duty cycle of the boost motor, we can match the source impedance with that of the cargo impedance.

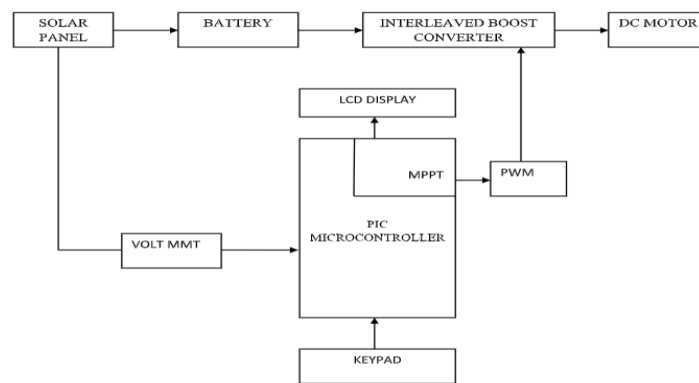


Figure 1: Block Diagram of Proposed Method

Control Scheme of the Boost DC-DC Converter Interfacing PV Array. The boost conversion stage is used to regulate the voltage from the PV panel and prize the maximum power. The PV panel voltage and the input current are tasted constantly.

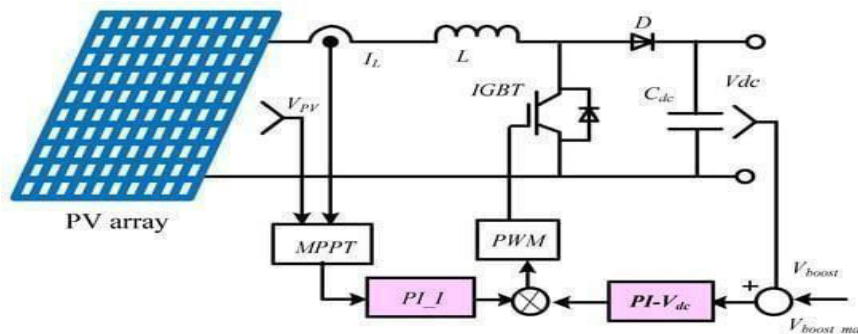


Figure 2: Maximum Power Point Tracker (MPPT) Control of Boost DC-DC Converter

Also the MPPT control algorithm utilizes these two values and calculates the reference power that the PV panel requires to be operated at MPP conditions. The MPPT is achieved using an inner current circle and an external voltage circle, as shown in figure. By adding the current drawn from the boost motor, results in reducing the panel affair voltage. Thus, the external voltage compared with a reference value and feedback is regulated using PI

regulator earnings. Hence, the affair voltage is averted from exceeding the acclimated value. On the other hand, the performing signal from the MPPT regulator is regulated using a PI regulator. Also the affair of the internal circle is compared with the reference current produced by the external circle to induce the PWM signal.

Solar Panel:

A solar cell, or photovoltaic cell, is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect. It is a form of photoelectric cell, defined as a device whose electrical characteristics, such as current, voltage, or resistance, vary when exposed to light. Solar cells are the building blocks of photovoltaic modules, otherwise known as solar panels. Solar cells are described as being photovoltaic irrespective of whether the source is sunlight or an artificial light.



Figure 3: Solar Panel

They are used as a photo detector (for example infrared detectors), detecting light or other electromagnetic radiation near the visible range, or measuring light intensity.

The operation of a photovoltaic (PV) cell requires 3 basic attributes:

- The absorption of light, generating either electron-hole pairs.
- The separation of charge carriers of opposite types.
- The separate extraction of those carriers to an external circuit.

In contrast, a solar thermal collector supplies heat by absorbing sunlight, for the purpose of either direct heating or indirect electrical power generation from heat. A "photo electrolytic cell" (photoelectrochemical), on the other hand, refers either to a type of photovoltaic cell (like that developed by Edmond Becquerel and modern dye-sensitized solar cells), or to a device that splits water directly into hydrogen and oxygen using only solar illumination.

BLDC Motor:

Position and Speed Control of BLDC Motors Using Sensors:

PM motor drives bear a rotor position detector to duly perform phase dicker and/ or current control. For PMAC motors, a constant force of position information is necessary; therefore a position detector with high resolution, similar to a shaft encoder or determinedness, is generally used. For BLDC motors, only the knowledge of six phase- dicker jiffies per electrical cycle is demanded; thus, low- cost Hall- effect detectors are generally used. Also, electromagnetic variable disinclination (VR) detectors or accelerometers have been considerably applied to measure motor position and speed. The reality is that angular stir detectors grounded on glamorous field seeing principles stand out because of their numerous essential advantages and seeing benefits.

Hall- Effect Detectors:

These kinds of bias are grounded on the Hall- effect proposition, which states that if an electric current-carrying captain is kept in a glamorous field, the glamorous field exerts a transverse force on the moving charge carriers that tends to push them to one side of the captain. A figure-up of charge at the sides of the operators will

balance this glamorous influence producing a measurable voltage between the two sides of the captian. The presence of this measurable transverse voltage is called the Hall- effect. Unlike a brushed DC motor, the dicker of a BLDC motor is controlled electronically. To rotate the BLDC motor the stator windings should be amped in a sequence. It's important to know the rotor position in order to understand which winding will be amped following the Amping sequence. Rotor position is tasted using Hall- effect detectors bedded into the stator. Most BLDC motors have three Hall detectors inside the stator on the non- driving end of the motor. Whenever the rotor glamorous poles pass near the Hall detectors they give a high or low signal indicating the N or S pole is passing near the detectors. Grounded on the combination of these three Hall detector signals, the exact sequence of dicker can be determined.

Hall detectors are bedded into the stationary part of the motor. Bedding the Hall detectors into the stator is a complex process because any misalignment in these Hall detectors with respect to the rotor attractions will induce an error in determination of the rotor position. To simplify the process of mounting the Hall detectors onto the stator some motors may have the Hall detector attractions on the rotor, in addition to the main rotor attractions. Thus, whenever the rotor rotates the Hall detector attractions give the same effect as the main attractions. The Hall detectors are typically mounted on a published circuit board and fixed to the quadrangle cap on the non-driving end. This enables druggies to acclimate the complete assembly of Hall detectors to align with the rotor attractions in order to achieve the stylish performance.

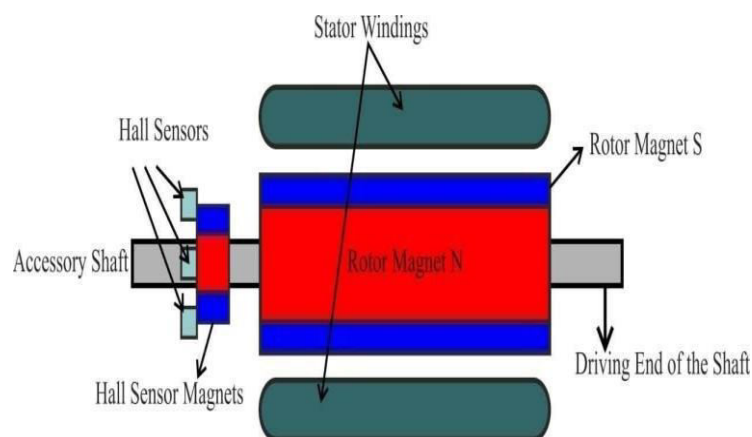


Figure 4: BLDC motor transverse section

Currently, because miniaturized EV brushless motors are introduced in numerous operations, new position detectors are being developed, similar as a three branches perpendicular Hall detector depicted in Figure. The connecting principle between the EV brushless motor and this detector is evocative of the miniaturized glamorous angular encoder grounded on 3-D Hall detectors. An endless attraction is fixed at the end of a rotary shaft and the glamorous detector is placed below, and the attraction creates a glamorous field parallel to the detector face. This face corresponds to the sensitive directions of the glamorous detector. Three- phase EV brushless motors need three signals with a phase shift of 120° for control, so a unrestricted- circle regulation may be used to ameliorate the motor performance. Each branch could be interpreted as a half of a perpendicular Hall detector and are rotated by 120° in comparison to the other. Only a half of a perpendicular Hall detector is used since little space is available for the five electrical connections (two for the force voltage and three to prize the Hall voltages).

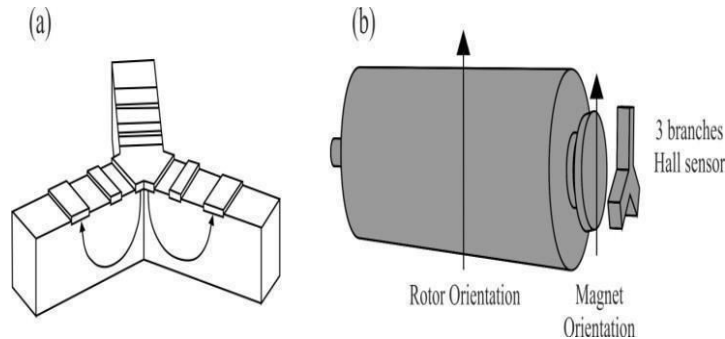


Figure 5: Schematic representation of a three branch Hall sensor.

Three branches vertical Hall device mounted as angular position sensor for EV brushless motor control. This alignment will allow the motion information for the motor and the information about its shaft angular position.

III.RESULT & DISCUSSION

In the software sector, Matlab version 7.10 and Windows XP operating system are used. For technical computing MATLAB is a high performance language which integrates with computation, visualization and programming. It is an interactive system in an array and it does not require dimensioning. It allows us to solve many technical computing problems.

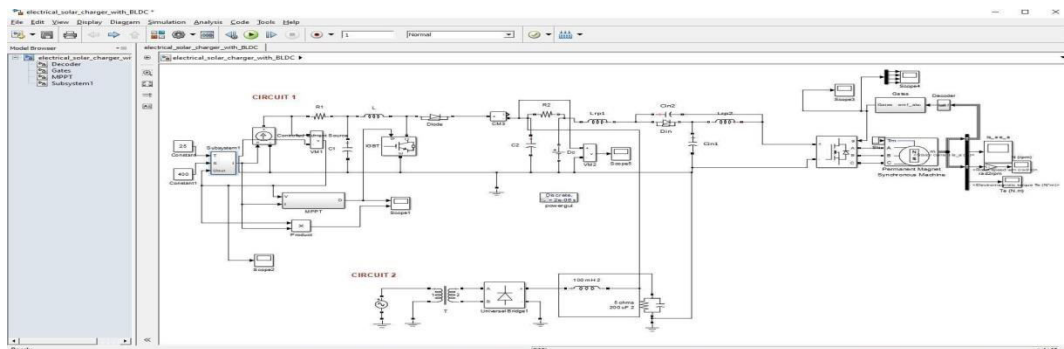


Figure 6: Simulation Screenshot of Hybrid Charger for E-Vehicle

IV.HARDWARE IMPLEMENTATION

The BLDC motor is driven by an electronic drive which switches the force voltage between the stator windings as the rotor turns. The rotor position is covered by the Hall Effect detector which supplies information to the electronic regulator and grounded on this position, the stator windings to be amped is determined. These electronic drives correspond to IGBTs (2 on each phase) which operate motor drives. For carrying the rotor position a Hall Sensor is bedded on the stator. As the motor rotates, the hall detector senses the position and develops a high or low signal, depending on the poles of attraction. Control voltage is enforced by microelectronic devices and has several high-tech choices. This may be enforced using a microcontroller. Speed control of the BLDC motor is essential for making the motor work at the asked rate. Speed of the BLDC motor can be controlled by the input DC voltage. The higher the voltage, the further is the speed. When the motor works in normal mode or runs below rated speed, input voltage of architecture is changed through the PWM model.

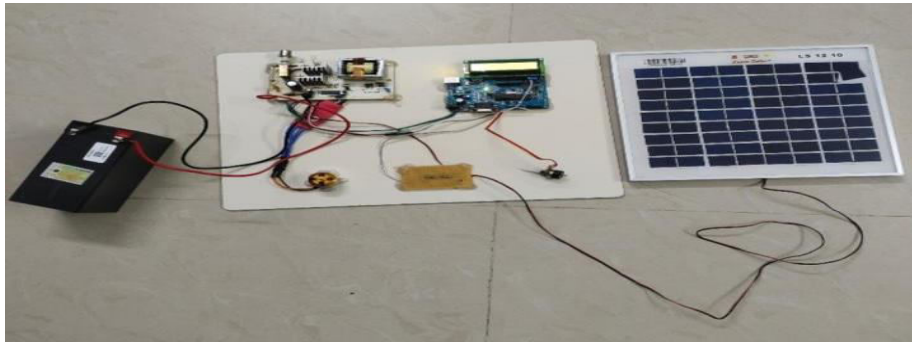


Figure 7: Hardware Implementation to charge Electric vehicle from Solar Panel

V.CONCLUSION

The operation and status of the PV-EV charging system. It also provides the information on the EV fundamental, batteries and a brief overview on the PV. To ascertain the specialized and the provident feasibilities of the PV grid and the PV-standalone charging, a case study is carried out by benchmarking them with the grid-only charging. It's a plan that the PV-grid charging could be profitable. On the other hand, the PV-standalone may not be economically feasible because of the limited PV and the battery capacity. Also, with regard to the intermittency of the PV, it might not be suitable to meet the demand of the druggies. The system also provides several recommendations and the unborn exploration works that can be accepted in this area.

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