Solar PV Array Fed Water Pumping System Driven by BLDCMotor Employing Quasi z Source Converter

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***ABSTRACT*: This project proposes an effortless, gainful, and proficient Brushless DC (BLDC) motor for Solar Photovoltaic (SPV) fed array water pumping system. It is utilized to extract the maximum amount power available from the (SPV)array by the quasi z source converter. In existing method, zeta converter is used. But the zeta converter has some voltage fluctuations, it does not increase the current level and also it has high charging time. So to overcome this drawback, the quasi z source converter is used. It has low voltage fluctuations and low charging time and high discharging time, soBLDCmotor continues to run a long time .It has high voltage boost capability and low switching losses. Additional control or circuitry is not used in the speed control of BLDC motor. This Quasi z-source converter offers soft starting of the BLDC motor. In this proposed work, the inverter is not an essential one, hence it is economic. The proposed system performance is superior unders dynamic conditions. At the same time, the voltage and current profiles have been boosted using MOSFET quasi z source converters and its performance output are realised using Proteus 8.6 Software.**

***KEYWORDS*: Photovoltaic array, Quasi z source converter, Zeta converter, BLDC motor, MOSFET.**

I. INTRODUCTION

Drastic reduction in the cost of power electronic devices and fossil fuels in near future invite to use the solar photovoltaic generated electrical energy in various applications. The demand of renewable energy has been increased significantly because the shortage of fossil fuel and greenhouse effect .Due to the rapid growth of the power electronics technique, the photovoltaic system has been used in power generation to increasing rapidly to the pv system. It has reliability to deliver continuous power supply. Traditionally, a substantial energy storage battery bank is used to deliver the reliable power and draw the maximum power from the SPV array.

The DC to DC converter with a high voltage gain have become usually required in many industrial applications such as the front end stage for clean energy sources, the DC backup energy system for uninterrible power supply, high intensity discharge lamps as a result is the increase voltage gain and efficiency increase.

The BLDCmotor and converter circuit does not provide any issues under dynamic condition .Since, the 5Volts charging from the panel is sufficient for entire operation. Hence, it reduces the charging and discharging time. TheBLDC motor has high reliability ,high efficiency ,high torque/interioratio, improved cooling ,low radio frequency ,no friction and noise and practical maintains is no required. This paper focuses on energy production system reliability, unit sizing, and cost analysis. A PV system along with battery is presented, in which both source are connected to a common DC-bus through individual power converters.

This project is mainly increasing the voltage and current by using the quasi z source DC - DC converter simultaneously using fivelimbMOSFET.Whenever the solar panel crosses the 5 volts at the time converter circuit on. Now the battery has started to charging and discharging due to the five limb MOSFET Converter existing in the circuit. This five limbMOSFEToutput voltage is varied, to manually set 5to 50v and hence current is also increases. This proposed work model, a constant 12 V voltage is set for this investigation.

The increasing of voltage level in the converter circuit results the increasing of current simultaneously. And it is used to running the BLDCmotor without any fluctuation. These techniques modify the charging time as lowest level and extend the discharging time duration. Hence, it results to run continuously without any variation in its speed.

II. LEAD ACID BATTERY

A. Theory of operation

The chemical reactions that occur in a lead-acid battery are represented by the following equations:

Positive Electrode

$$PbO_2 + H_2SO_4 + 2H_2e^- \underset{\text{Charge}}{\overset{\text{Discharge}}{\rightleftharpoons}} PbSo_4 + 2H_2O$$

Negative electrode

$$Pb + H_2SO_4 \underset{\text{Charge}}{\overset{\text{Discharge}}{\rightleftharpoons}} PbSO_4 + 2H_2e$$

Overall reaction

$$Pb + PbO_2 + 2H_2SO_4 \underset{\text{Charge}}{\overset{\text{Discharge}}{\rightleftharpoons}} 2PbSO_4 + 2H_2O$$

PV array has the capacity of about 0.25A/12v.The power generated from the array is given to quasi-z-source converter. The PWM pulse are adjusted to provide the suitable gate pulse to the quasi z source converter .thus the voltage is stepped -up to 3A/50v by the converter. Thus the battery is charged using the charging unit .battery used is lead acid battery .it has the charging time is 1.5 hours and discharging time is 23 hours. The battery will supply the BLDC motor which turns the agriculture pump. Duringmid-night time, the system can be operated with the help of focusing light

III.BLOCK DIAGRAM

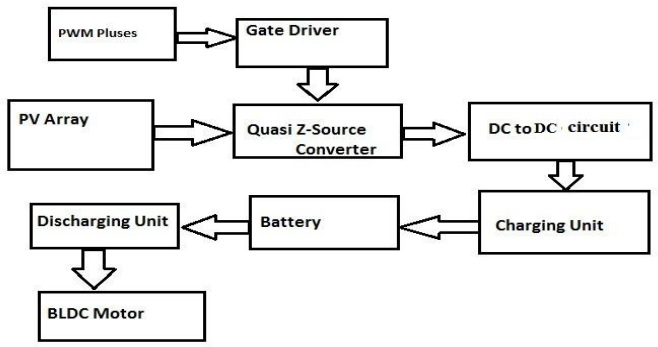

Fig .1 Proposed block diagram

The PV array also called as solar panel, it collects the energy from sun light and it converts it into DCcurrent, andthe PWM pulse is generated to operate the quasi z source DC - DC converter .PIC micro controller is used for producing the PWM pulses in hardware.

IV. CIRCUIT DIAGRAM

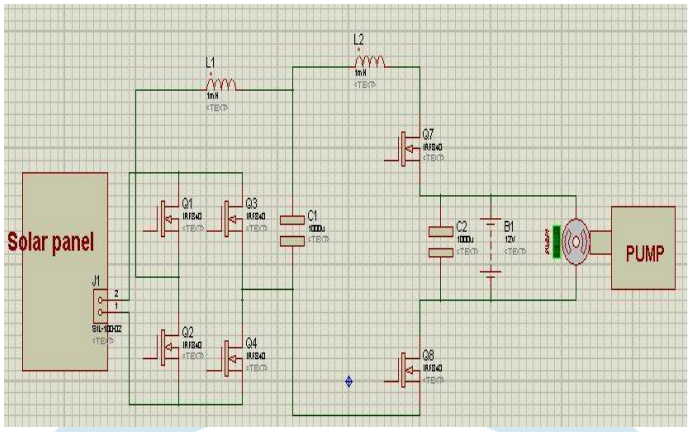

Fig . 2 proposed circuit diagram

Solar panel is also collecting the sun rays and MOSFET get using also charging and discharging .4 MOSFET also using charging purpose and 1 MOSFET using discharging structure.The two capacitor one is acting the input capacitor another one is reduce the fluctuation .and inductor get acting voltage storage device.Pump is a mechanical device when motor running at the time water flow in the pump as used for agriculture purpose**.**

V. CALCULATION

The solar panel is designed for the proposed system to fed quazi z source dc- dc converter. The solar panel specifications are

Solar panel:

3Watt, 12volt

Current=watts/volt

I=3/12

I=0.25amps

Power=voltage*current

P=0.25*12

P=3watts

Charging time:

From the solar panel energy is getting stored in the battery this time is called charging time

Battery amps/converter amps

Charing time=5/3

Charging time=1.5 hours

Discharging time:

From the battery the energy getting used to the load this time is called is discharging time

Battery amps/load amps

Discharging time=5/0.2

Discharging time=25 hours

VI. UNTAKEN SYSTEM.

Earlier system uses ac motors for which DC-AC converter is required which is most expensive. Inverter is required for such system. The present day system uses DC motors which require the battery. Battery poses many disadvantages in the operation and lifetime of the existing system. One main factor in battery usage is the other system has long charging time and low discharging time. These are the disadvantages of the system. This problem can be overcome by using proposed system.

VII. PROPOSED SYSTEM

Solar panel is used to produce dc supply for BLDC motor fed pump for agricultural usage. It consists of battery and quasi z source DC to DC Converter. The purpose of battery is to store excess charge .Quasi z source DC-DC Converter is used to step-up the voltage. The converter gets switch on when it reaches the minimum voltage level of 5V.TheQuazi z source dc-dc power modulator is used for drive the BLDC motor

VIII.BLDC MOTOR

Brushless DC Motor ,also known as BLDC motor ,are synchronous electric motor which move around the ,or are commutated electrically with dc current powering magnets that moves the rotor around within the stator .BLDC motor a step motor controller to create that rotor turns electrical energy into mechanical energy

aBLDC motor tend to to be more realible,last longer, and to be more efficient, in BLDC motor life excepentance is over 10.000 hours.

TheBLDC motor characteristics is compare to induction motor is BLDC motor speed torque characteristics is flat natural. output power frame size is high and rotor inertia is low.

X.FUNDAMENTAL OF BATTERY

Batteries operate by converting chemical energy into electrical energy through electrochemical discharge reactions. Batteries are composed of one or more cells, each containing a positive electrode, negative electrode, separator, and electrolyte. Cells can be divided into two major classes: primary and secondary. Primary cells are not rechargeable and must be replaced once the reactants are depleted. Secondary cells are rechargeable and require a DC charging source to restore reactants to their fully charged state.

XI. SIMULATION RESULT

The proposed system is implemented with quazi z source converter in proteussoftware. The Simulation diagram of the entire system is shown in **3**

The comparative working of the proposed system and existing system in terms of charging time discharging time and output voltage is shown in Table 1.

Table: I Battery Charging /Discharging Levels

Level	**Battery charging**	**Battery discharging**	**Output voltage**
Proposed System	1.5 Hours	23 Hours	50 Volt
Existing System	20 Hours	5Hours	15 Volt

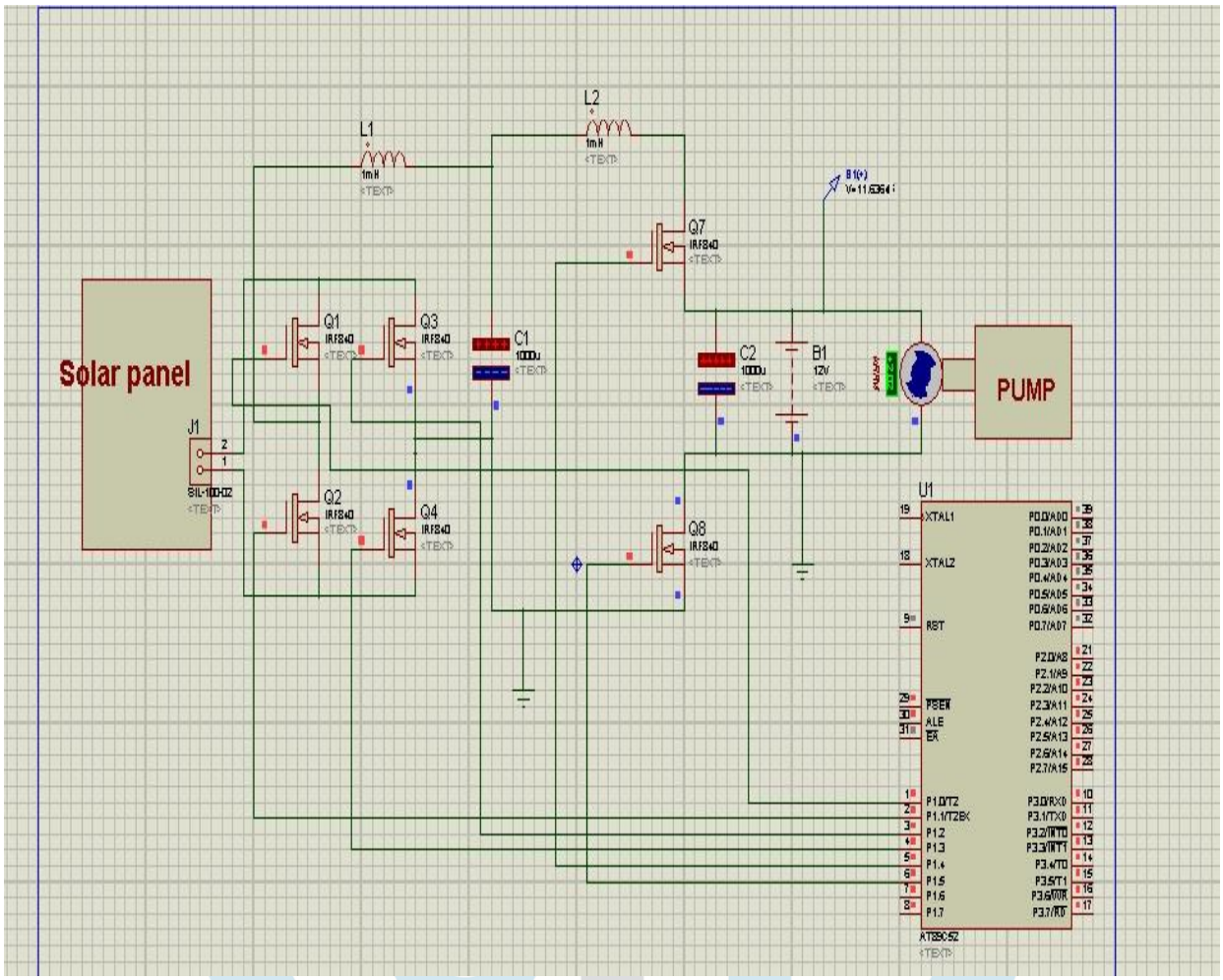

Fig . 3 Simulation Result

- The circuit consist of solar panel, battery, quasi z source converter, charging unit.
- The solar panel unit has the capacity of 0.25a/12v
- Quasi z source converter will turned on when the voltage is above 5vThe battery is charged using the quasi z source converter
- The gate pulse to the converter is generated by using the PIC controller .the charging unit is controlled by using the converter thus, the battery supply the BLDC motor

XII. HARDWARE CIRCUIT

This solar panel collecting energy in 5 volt across crossing converter circuit on. converter circuit varying to use of pulse regulator .the battery is 6 volt and 5 amps connected by series .MOSFET is using surface mountain technique so 0.25 amps increase in 3 amps in output. And charging time is low discharging time high so motor run at continuously.

The hardware implementation diagramfor the proposed systemis shownin fig 4. Hardware circuit consist of solar panels, Quasi z source converter PIC microcontroller, drive circuit BLDC motor and charging and discharging of purpose using this lead acid battery. Solar panel is used to convert solar radiation into electrical energy. Quasi z source dc to dc converter is used to boost the input voltage. The solar panel gives 5 volt dc as input to the quazi Z source dc-dc converter.

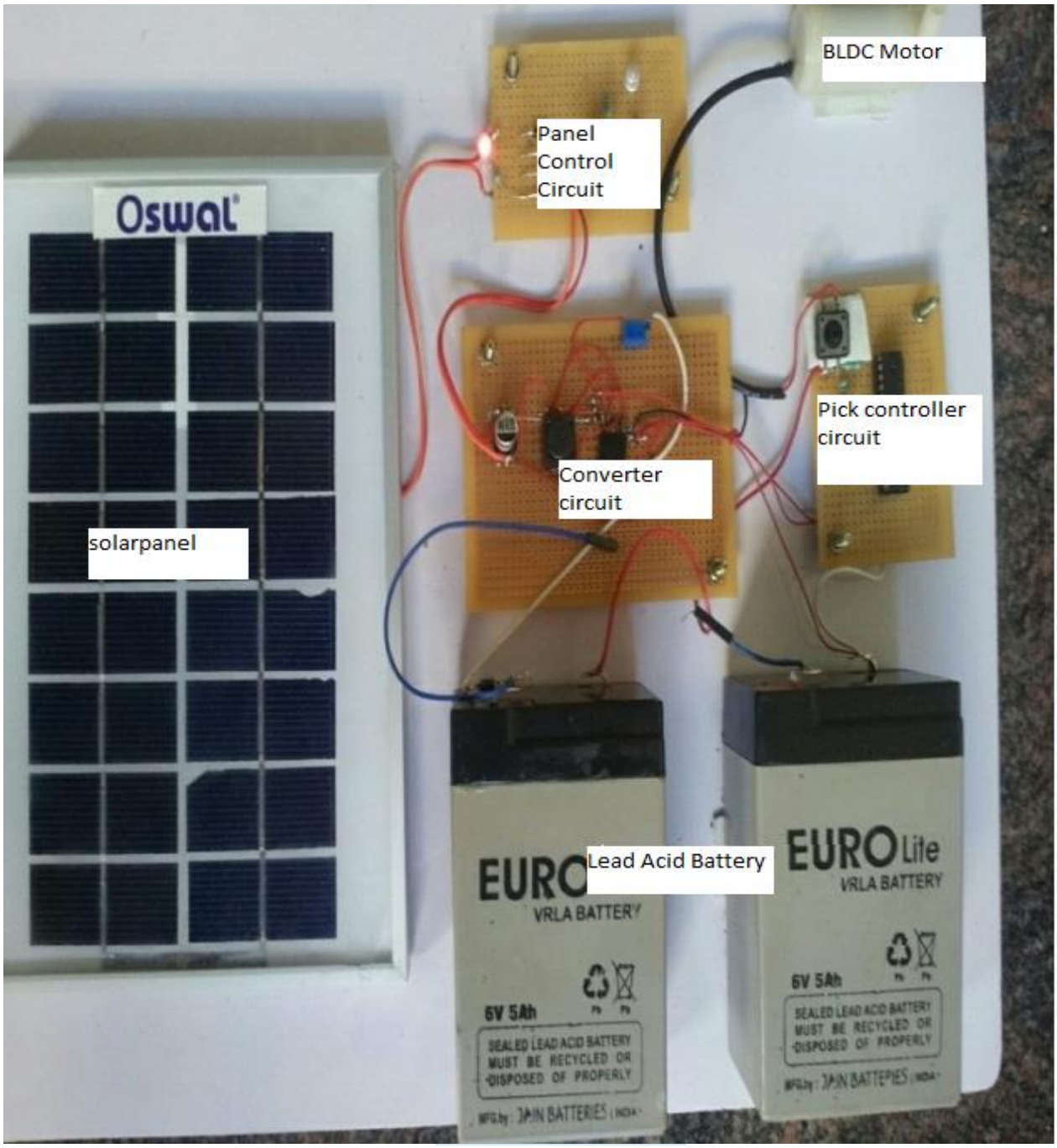

Fig .4 Hardware Circuit

The hardware is operated in real time. The charging time is low 1.5hours and the discharging time is high 25 hours which is the advantage of proposed system when compared to the existing system. This advantage makes the motor to run continuously and the results are verified.

XIII. CONCLUSION

Fossil fuels and artificial sources get reduced day by day so solar panel is used to obtain electrical energy from the solar radiation. Existing solar array fed pump system with zeta converter and other power modulators has more losses and fluctuation and have lower efficiency. In this work quasi z source dc to dc converter topology is used as voltage boost converter to fed the BLDC motor drive. By using solar panel dc output of 12 V quazi z source converters is operated to fedthe BLDC motor. Due to use of quasi z source converter battery charging time becomes low and battery discharging time is high. The BLDC motor is made to run continuously even under less illumination because of high discharging time and pump is operated efficiently for agricultural purposes. The efficiency and consumption of electricity is better when compared to the existing methods. The experimental results of the proposed system are verified.

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