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Autonomous Led Street Lights Based On Hybrid Renewable Sources

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Abstract - In this artical, the arrangement of solar photovoltaic (PV)/Wind energy system is used for power generation. During day time, solar radiation falls on the panel, and then the power can be produced. During night time, due to the Emission of photons from the vehicle headlight, the power is produced from the solar PV panel. The Wind Turbine is used to generate electricity from the rotation of the wind blade due to the movement of vehicles by Vertical Axis model. The output of the solar and wind system fed into Buck-Boost converter to high voltage level. The simple P&O control method is used to pathway the operating point of the system at which highest power can be obtained. The Power obtained from different sources is connected to the dc bus in parallel connection. Here the energy required for the load to be taken from the dc bus and excess power will be stored in a battery and also insufficient power, the battery will discharge the power to load. The model of a structure is developed in MATLAB-SIMULINK.

Index Terms: DC-DC Converter, Hybrid PV/Wind, P&O MPPT, Distributed power Generation

I. INTRODUCTION

In this paper, electricity is generated from solar and wind systems. During day time, the solar panel converts solar radiation directly into a direct current, and night time the ordinary lamp that is used in the vehicle is replaced with a xenon lamp.

The amount of photons emitted from the xenon lamp is high when compared to all other lamps. Finally, the photons from the headlight will strike the solar panel, as a result, the current will be generated.

According to the wind system, the power is generated from the rotation of the wind blade due to the crossing of vehicles. The harvest of solar and wind systems is fed to dc to dc converter.

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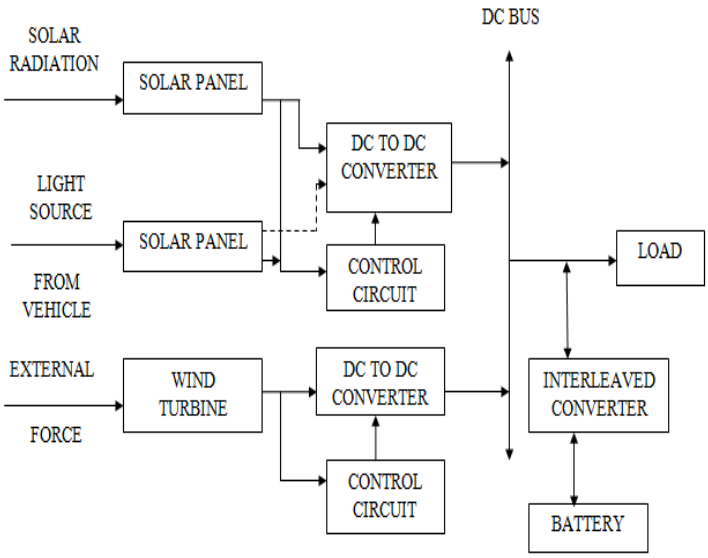

Fig.1. Distributed hybrid power Generation

Fig.1 show the solar panel and wind turbine output is given to dc to dc converter. The control circuit generates a gate pulse for the switching devices according to the input. Here MOSFET is used as a switching device, so the switching losses are less. The control circuit compares the reference value with the given value. The output of the compared value is higher than or less than zero means the voltage is reduced or increased by adjusting the duty cycle. The converter acts as a buck or boost converter based on duty ratio. During boost mode, the converter output is superior to the given input voltage. During buck mode, the converter output is less than the input value.

II. EXISTING METHOD

In the Literature Review, the existing method describes the Microcontroller-based Maximum power point tracking (MPPT) used [1]. In this, the photovoltaic array output power, irrespective of the irradiation and temperature conditions and the electrical load characteristics were discussed. The characteristics of shading effects in PV array study in [2]. This idea suggests that a module or a section of it's shaded, due to shaded cell potential different created between cells and the shaded cell act as low potential and non shaded act as high potential. Due to this phenomenon shaded cell act as a load. A bypass diode used here to protection the hot-spot problem. Change proposed an idea on the progress of a new simulator for wind turbine [9] by an inverter-controlled induction motor for energy conversion [3].

An idea of extract maximum power algorithm is proposed for inverter-based variable speed wind turbine systems [4].
A review of existing most wind generation extraction algorithms is bestowed during this paper, supported that associate intelligent most power extraction rule is developed by the authors to enhance the system performance and to facilitate the management implementation.The propose of several-input DC-DC converter for hybrid energy [5] system. The hybrid system consists of batteries, wind turbines and PV panels. Two separate DC-DC boost converters are use to manage the power flow towards the load. Simple and cost-effective control with DC-DC converter is used for MPPT.

III. PROPOSED METHOD

The SISO is replaced with MISO. The control scheme is made easy [7]. Here MOSFET is employed so that the switching losses get minimized or reduced.

3.1 Solar PV System

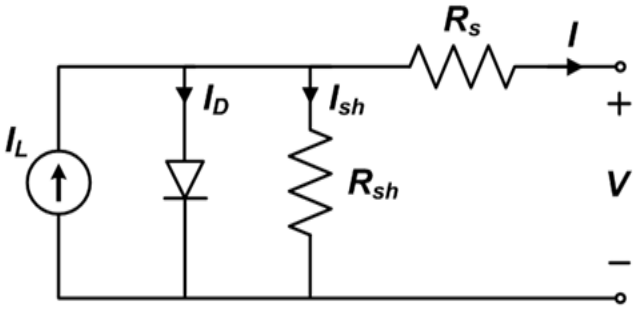

Fig2. Solar Equivalent Circuit

A current source circuit is used to design solar cell by using its characteristics equations

I = {Photo generator current} – {Diode saturation current} – {Shunt resistor current}

$$I = I_{sc} - I_o \exp\left[\frac{V + IR_s}{nkT}\right] - \left[\frac{V + IR_s}{R_{sh}}\right]$$

3.2 Wind Turbine

A vertical axis wind turbine utilizes the wind produced by moving vehicles to generate electricity [6]. These turbines will be placed along roadways that have a high volume of fast-moving traffic.

The kinetic energy [8] of any particle is equal to one half it's mass times the square of its velocity and the available wind power

$$Pa = (½\rho\pi D2V3)/4$$

3.3 Buck-Boost Converter

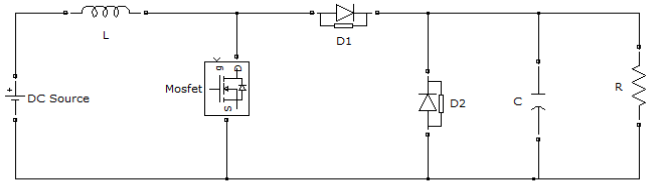

Fig3. Buck-Boost Circuit

The dc voltage is directly given to switch (MOSFET). During on-time the switch will be in a closed position, as a result, the load is isolated from the main supply. The amount produced voltage at the time will be very less for that the converter act like a buck converter. During off time, the switch will be in open position. The output voltage at the time will same as the dc voltage and the voltage across the inductor, for that the converter act as a boost converter. Here the duty ratio changes the output voltage. The Buck-Boost converter voltage equation is

The output voltage equation:

$$Vout=(Vin*D)/(1-D)$$

where duty cycle(D)=Ton/T

For inductor:

$$L=(1-D)2R/(2*F)$$

For capacitor:

$$C=D/(R*F*(Vo/Vin))$$

3.4 INTERLEAVED BOOST CONVERTER

The battery is a device to store the energy, that stores the surplus power generated and uses it to produce the load additionally to the generators once power is needed. each PV and wind energy systems are incorporated, i.e., common DC bus. Power flow of the battery is in both direction based on surplus and/or shortage of power.As power densities still rise, interleaved boost styles become a strong tool to stay input currents manageable and increase potency, whereas still maintaining smart power density. With mandates on energy savings a lot of common, interleaved construction is one of the ways to attain propose objectives.

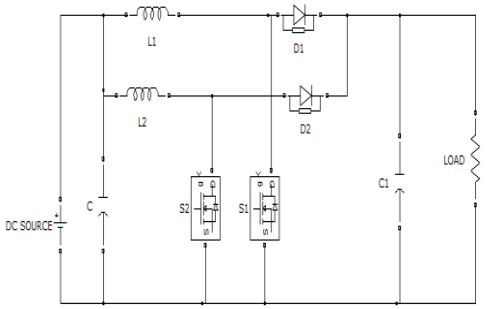

Fig4. Boost Converter with Interleaved concept

3.5 P&O MPPT Algorithm

The most basic style of perturbation and observation (P&O) algorithm operates by creating an adjustment to the operating voltage of a PV system and perceptive whether or not this yields and increase or decrease within the output power of the system.

If a rise is ascertained, the algorithmic rule continues to regulate the output voltage within the same direction. If a decrease is ascertained, the algorithmic rule adjusts the voltage within the other way.

the general result of this algorithmic rule, that is easy to implement, is that the output power of the system converges to near the MPP, with a little oscillation. From the flow chart MPP is altered by the duty cycle of the converter[10][11].

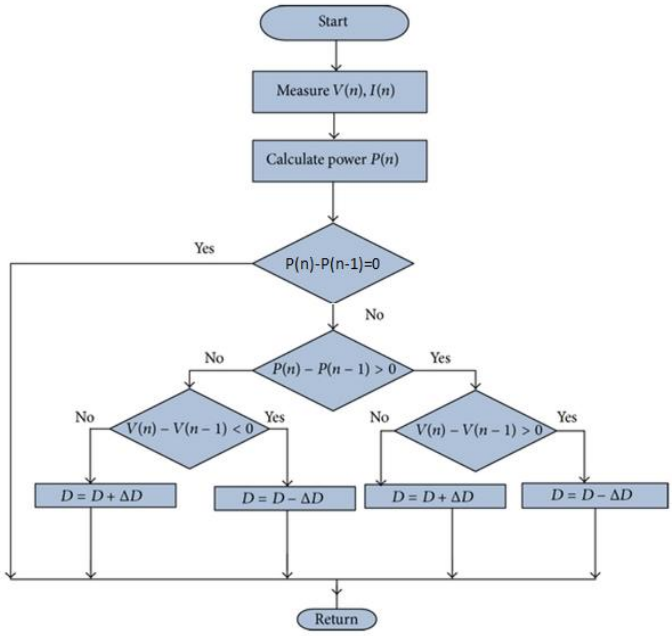

Fig 5. Flow chart for P & O Algorithm

IV. SIMULATION AND RESULTS

4.1 Solar system Simulation

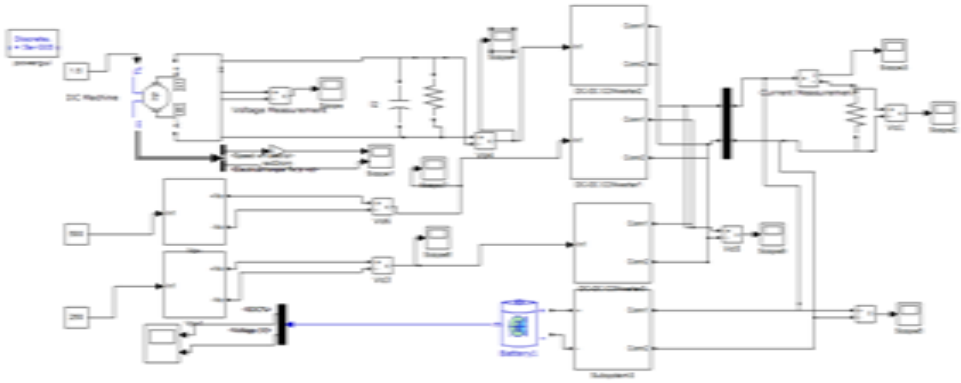

Fig6. Solar system- Simulink model

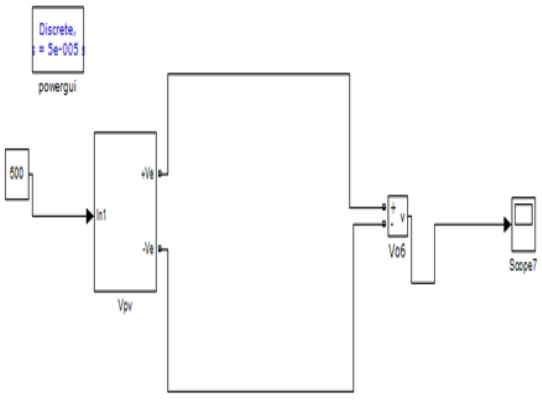

Fig7. Wind system- Simulink model

4.2 Wind system Simulation

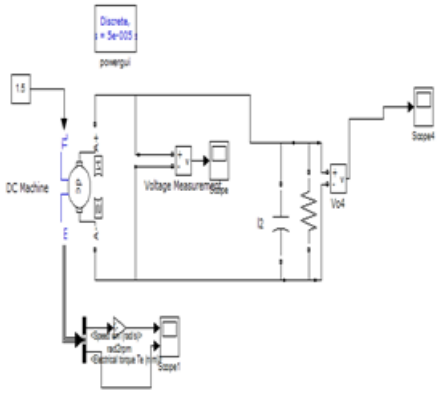

Fig8. Simulation Circuit of distributed power generation

4.3 Simulink Model for Distributed Generation

The proposed hybrid system simulated with various DC/DC converter along with a battery arrangement are show in the fig 8.

4.4 Simulation result of distributed generation

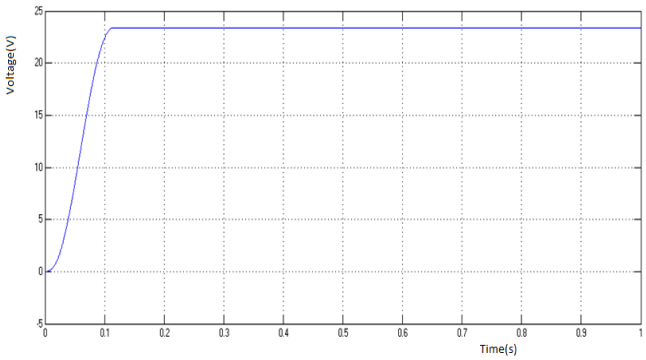

Fig9. Simulation Result of output voltage

V. HARDWARE IMPLEMENTATION

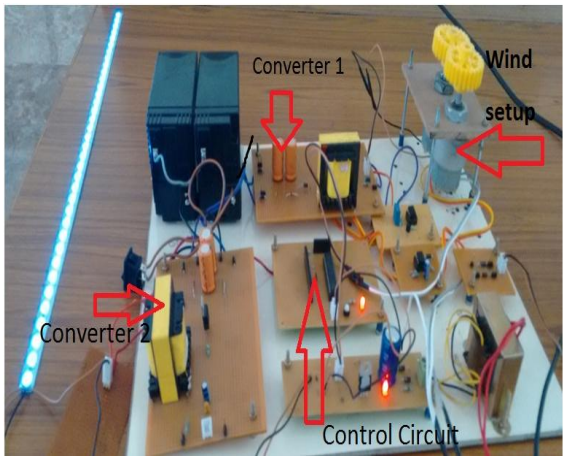

Fig10. Hardware Photography

VI. RESULTS AND DISCUSSION

The 12 volt is given as an input for dc to dc converter as a result of the converter act as a boost converter and gives the output of 23.63 volt. The converter

output during buck operation. The 26 volt is given as an input for dc to dc converter. As a result, the converter act as a buck converter and gives the output of 23.74 volt. Here Microcontroller takes 12 volts as reference voltage, which is compared with present value that is 26 volt. The difference between the values is greater than zero, so the Microcontroller reduces the voltage by reducing the duty cycle. The main advantage of this project is the easy control scheme

VII. CONCLUSION

In this paper, the buck-boost converter was successfully developed, and high efficiency was achieved using the control algorithm. The proposed converters consist of MOSFET as a switching device, thus reducing switching losses. PV and wind systems are simulated, and various irradiance and speed of the wind is studied. The P&O algorithm is used to track MPP. For battery charging and discharging, integrated hybrid system is used. In future, different algorithms are used for MPP.

REFERENCES

1. Eftichios Koutroulis, Kostas Kalaitzakis (2001), "Development of a Microcontroller-Based, Photovoltaic Maximum Power Point Tracking Control System", IEEE Transactions on power electronics, Vol. 16, No. 1, pp. 46-54.
2. Hiren Patel and Vivek Agarwal (2008), "Matlab based modeling to study the effect of partial shading on PV array characteristics", IEEE transaction on energy conversion, Vol.23, No.1, pp. 302-310.
3. Hossein Madadi Kojabadi, Liuchen Chang (2004),"Development of a Novel Wind Turbine Simulator for Wind Energy Conversion Systems Using an Inverter-Controlled Induction Motor", IEEE Transactions on energy conversion, Vol. 19, No. 3, pp. 547-552.
4. Quincy Wang (2004), "An Intelligent Maximum Power Extraction Algorithm for Inverter-Based Variable Speed Wind Turbine Systems", IEEE Transactions on power electronics, Vol. 19, No. 5, pp. 1242-1249.

5. Solero. L, Lidozzi. A, and Pomilio. J. A (2011), "Design of multiple-input power converter for hybrid vehicles", IEEE Transaction on Power Electronics, Vol. 20, No. 5, pp. 1007–1016.
6. Uehara. A, Pratap. A, Goya. T, Senjyu. T, Yona. A, Urasaki. N, and Funabashi. T (2011), "A coordinated control method to smooth wind power fluctuations of a PMSG-Based WECS", IEEE Transaction on power electronics, Vol. 26,No. 2, pp. 550–558.
7. Kobayashi. K, Matsuo. H, Sekine. Y, Novel (2006), "Solar-cell power supply system using a multiple-input DC–DC converter", IEEE Transactions on Industrial Electronics, V ol. 53 , No. 1, pp. 281-286.
8. Khan. A, Chen. Y, Pillary. P (2005), "PM wind generator topologies", IEEE Transaction on Industrial Application, Vol. 41, No. 6, pp. 1619–1626.
9. Nichita. C, Diop. A. D, Elhache. J, Dakyo. B, and Protin. L (1998), "Control structures analysis for a real wind system simulator", IEEE Transactions on power electronics, Vol. 22, No. 6, pp. 275–286.
10. Roger Gules, Juliano De pellegrin Pacheco (2008), "Maximum power point tracking system with Parallel connection for PV stand-alone application", IEEE transaction on industrial electronics, Vol.55, No.7, pp. 2674-2683.
11. Surendar V, & Ragupathy U S,(2019) 'Implementation of new high efficient input parallel output series partial power DC-DC converter for solar photovoltaic partial shading conditions', Journal of Vibroengineering, vol. 21, no. 3, pp. 760 -775,

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