ISSN No:-2456-2165

Hybrid Solar-Wind Power Plant System using MPPT

Prof. C. S. Patil, Dhanashri Yashwant Bari
Shri. Gulabrao Deokar College of Engineering
North Maharashtra University Jalgaon-India

Abstract:- Renewable energy sources have become a popular alternative electrical energy source where power generation in conventional ways is not practical. In the last few years the photovoltaic and wind power generation have been increased significantly. In this study, we proposed a hybrid energy system which combines both solar panel and wind turbine generator as an alternative for conventional source of electrical energy like thermal and hydro power generation. A simple intelligent battery charging system which is also cost effective with a effective MPPT algorithm has been proposed to track and monitor the operating point at which maximum power can be coerced from the PV and wind turbine hybrid system under continuously changing environmental conditions. The entire hybrid system is described given along with comprehensive simulation results that discover the feasibility of the system. A hardware simulation model has been developed on a small scale to demonstrate our ideas.

Keywords:- *MPPT Technique, Solar Energy System, Hybrid System.*

I. INTRODUCTION

In the present scenario, renewable energy sources are incorporated along with the battery energy storage systems, which are mostly used for maintain the reliability of power. The number of renewable energy sources is increased as distribution sources; generally, to improve the power supply stability, and hence the power quality new strategies of operations are required. The common disadvantage of both wind and solar power plants are as these generate unreliable power1. In order to overcome this problem a new technique is implemented i.e. maximum power point tracking algorithm which is applicable to both wind and solar plants. Dynamic performance of a wind and solar system is analyzed. There are some previous works on hybrid systems comprising of wind energy, photovoltaic and fuel cell. A simple control method tracks the maximum power from the wind/solar energy source to achieve much higher generating capacity factors.

In this thesis, a wind-photovoltaic hybrid power generation system model is studied. A hybrid system is more advantageous as individual power generation system is not completely reliable. When any one of the system is shutdown the other can supply power.

II. THEORY

A. Working Principle of Mppt System

First, PV solar systems exist in many different configurations with regard to their relationship to inverter systems, external grids, battery banks, or other electrical loads. Regardless of the ultimate destination of the solar power, though, the central problem addressed by MPPT is that the efficiency of power transfer from the solar cell depends on both the amount of sunlight falling on the solar panels and the electrical characteristics of the load. As the amount of sunlight varies, the load characteristic that gives the highest power transfer efficiency changes, so that the efficiency of the system is optimized when the load characteristic changes to keep the power transfer at highest efficiency. This load characteristic is called the maximum power point (MPP) and MPPT is the process of finding this point and keeping the load characteristic there. Electrical circuits can be designed to present arbitrary loads to the photovoltaic cells and then convert the voltage, current, or frequency to suit other devices or systems, and MPPT solves the problem of choosing the best load to be presented to the cells in order to get the most usable power out.

B. Proposed Hybrid System

In this system we are converting supply form wind and solar modules and converting them to one single constant voltage output irrespective of variation in input voltage from the modules. This input from modules is fed to microcontroller which in turned determines the voltage level and accordingly switch a DPDT relay which is directly connected with the source. Microcontroller decides whether the input voltage level is higher or lower than preset values and accordingly relay switch between buck chopper or boost chopper for both the inputs respectively.

In next step we get a constant voltage output which is fed to a MOSFET which act like a chopper coupled with a current sensor. Chopper changes the voltage level to allow rated capacity current to flow into the battery which ensures Maximum power to be transferred. Tis hybrid system is so effective that it can also be used effectively when one of two source is working.

III. WORKING PRINCIPLE

The entire hybrid system comprises of PV and the wind systems. The PV system is powered by the solar energy which is abundantly available in nature. PV modules, maximum power point tracing systems make the PV energy system. The light incident on the PV cells is converted into electrical energy by solar energy harvesting means.

ISSN No:-2456-2165

Wind turbine, generator are included in the wind energy system. The wind turbine is used to convert wind energy to rotational mechanical energy and this mechanical energy available at the turbine shaft is converted to electrical energy using a generator. A system is developed to synchronize the voltage level from both system and output constant voltage at any condition. Then this voltage level is taken through a MPPT algorithm to provide maximum power at constant voltage. Then this power issued for battery charging..

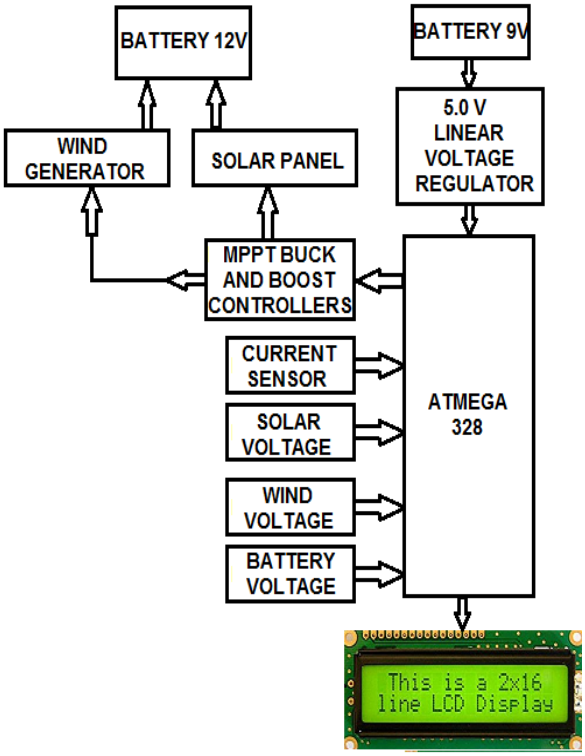

Fig. 1: Block Diagram

In this system we are converting supply from wind and solar modules and converting them to one single constant voltage output irrespective of variation in input voltage from the modules. This input from modules is fed to microcontroller which in turned determines the voltage level and accordingly switch a DPDT relay which is directly connected with the source. Microcontroller decides whether the input voltage level is higher or lower than preset values and accordingly relay switch between buck chopper or boost chopper for both the inputs respectively.

In next step we get a constant voltage output which is fed to a MOSFET which act like a chopper coupled with a current sensor. Chopper changes the voltage level to allow rated capacity current to flow into the battery which ensures Maximum power to be transferred. This hybrid system is so effective that it can also be used effectively when one of two source is working.

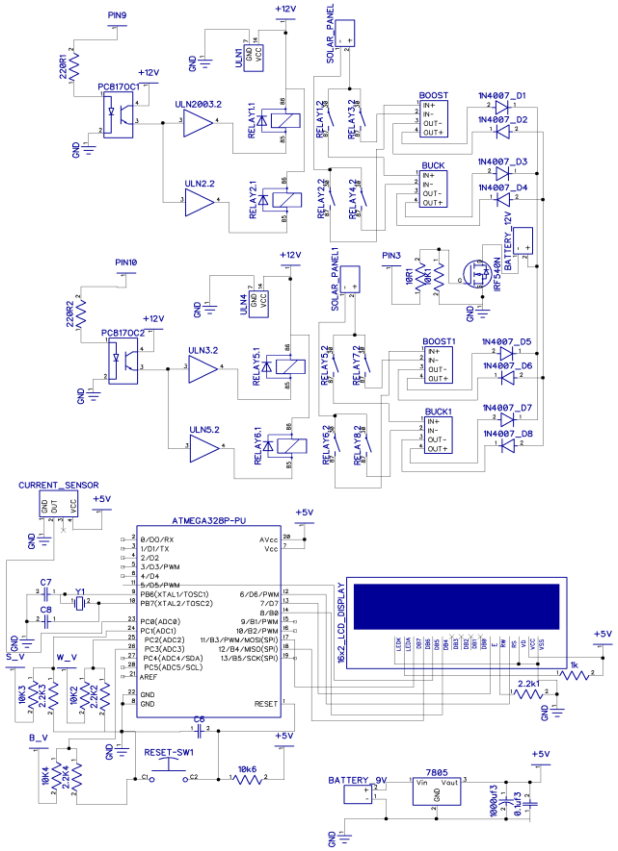

Fig. 2: Circuit Diagram

The major components in this project are microcontroller and MPPT controllers. In this project, we use analog to digital conversion process to display the voltage.

A. Analog to Digital Conversion:

In real world, mostly we find analog data. To manipulate this data using digital systems, we need to convert analog data to digital, so that microprocessor or microcontroller is able understand and manipulate the data.

B. Interfacing of Physical Quantity to Digital System

- Transducer: Transducer or sensor is used to convert the physical quantity to electrical energy. Light dependent resistor, temperature sensor, humidity sensor, gas sensor etc. are examples of transducers.
- ADC (Analog to Digital Converter): ADC converts the input electrical voltage to Digital value.
- Digital System: this system reads input digital data and displays the physical quantity on LCD for understanding purpose.

Here ADC of microcontroller convert analog value to digital value based on the input electrical voltage. The microcontroller displays it on LCD.

IV. CONCLUSION

It is found that project prototype captured the solar energy through solar panel and wind energy through fan induced on it. There are huge potential for producing electricity from renewable sources. This paper gives a clear idea about development of new technologies and researches in the hybrid solar wind renewable energy system which is successfully implemented using MPPT technique.

REFERENCES

[1.] https://rcciit.org/students_projects/projects/ee/2019/GR6.pdf (*references*)
[2.] T. Salmi, M. Bouzguenda, A. Gagtli, "modeling of solar photovoltaic cell," International journal of renewable energy research, vol.2, no.2, 2012.
[3.] S. Meenakshi, K.Rajambal, S. Elangovan "Intelligent controller for stand-alone hybrid generation system," IEEE, May. 2006.
[4.] M. G. Villalva, J. R. Gazoli, "Modeling and circuit based simulation of photovoltaic arrays," Brazilian power electronics conference (COBEP), 2009.
[5.] Marcelo Gradella Villalva, Jonas Rafel Gazoli, "Comprehensive approach to modeling and simulation of photovoltaic arrays," IEEE transaction on power electronics, vol.24, no.5, May 2009.
[6.] Hiren Patel and Vivek Agarwal, "Matlab based modeling to study the effect of partial shading on PV array characteristics," IEEE transaction on energy conversion, vol.23, no.1, March 2008.
[7.] Mohammed Abdulazeez, Ires Iskender, "Simulation and experimental study of shading effect on series and parallel connected PV modules," IEEE transaction on energy conversion, vol.27, no.2, March 2008.
[8.] SiyuGuo, Timothly Michael Walsh, "Analyzing partial shading of PV module by circuit modeling," IEEE 2011.