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Hybrid Solar-Wind Power Plant System using MPPT

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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.

➢ *Different Methods of MPPT*

The different ways to implement MPPT are: -

- Perturb and Observe (P&O).
- Incremental Conductance.
- Fuzzy Logic.
- Constant voltage MPPT
- Constant current MPPT

B. Algorithm

Two algorithms have been used in our MPPT modeling. The basics of algorithms are given below.

[1] One algorithm used to ensure constant output voltage of 15 V irrespective of variation of input voltage from input source/s.

- When both input from Wind and Solar input is less than 15 V, both supplies passes through a boost converter which step up their voltage level to 15 V.
- When both input from Wind and Solar input is greater than 15 V, both supplies passes through a buck converter which step down their voltage level to 15 V.
- When one input from Wind or Solar input is less than 15 V, and other is greater than 15 V then the input greater then 15 V from source passes through buck converter and

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get step down to 15 V and other source which is less than 15 V get step up to 15 V.

- When one of the supply is 15 V then it can be passes through any of the buck or boost module, in our case which is buck module as buck module is connected to NC contacts of relay.
- [2] Second algorithm ensures that maximum output power to be delivered to load by switching a MOSFET
- 15 V constant voltage output is obtained from chopper modules it is passes through a current sensor and a MOSFET. Current sensor measures the load current and MOSFET used to switch the duty cycle to obtained maximum power.
- A duty ratio of 50% is taken reference and power this duty is taken as reference power.
- A algorithm is design based on Perturb And Observe method which switches duty cycle which is on time to the time period ratio and takes power output samples at each duty cycle. It checks if a unit increment in duty cycle increases the current output power sample or not if it increases the current output power sample then in next step it increases the duty cycle by a unit again and this loops.
- If at any point unit increment in duty cycle resulted in decrement in a current output power sample from previous output power sample then it decreases the duty cycle by one unit. And this cycle continues and Maximum power point oscillate around actual MPP

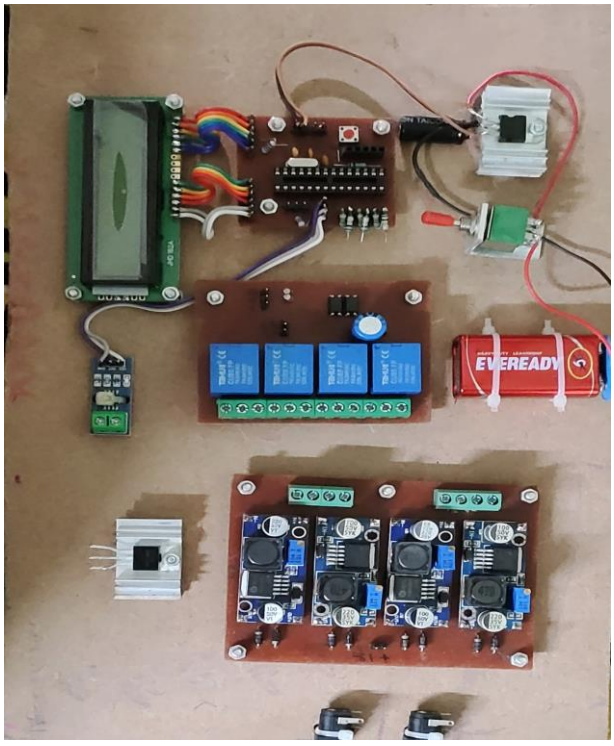

Fig 1:- Module

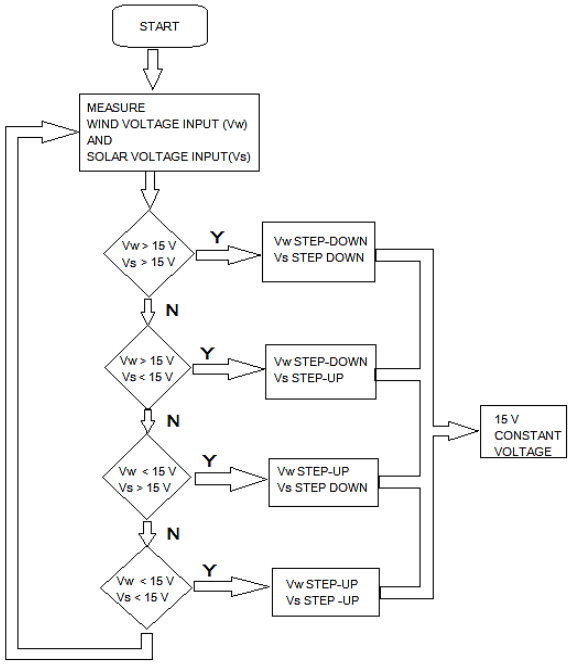

Fig 2:- Algorithm of implemented MPPT-1

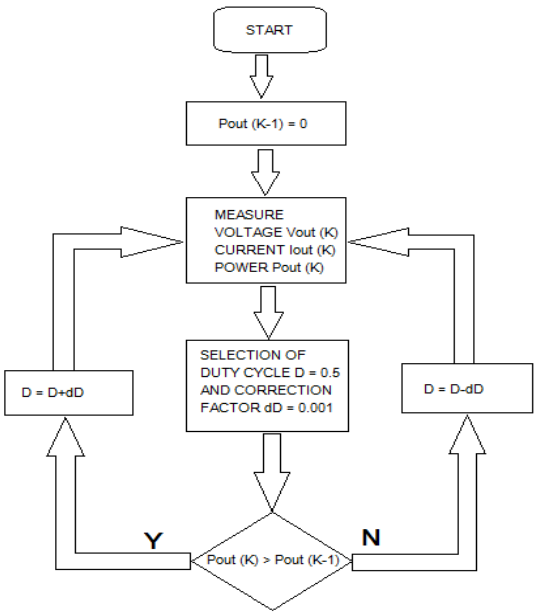

Fig 3:- Algorithm of implemented MPPT-1

III. 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.

- MPPT Tracking Algorithm is implemented successfully.
- Variation of duty cycle is observed as MPPT is being tracked from the model on Digital Storage Oscilloscope.

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- Output from each stages are observed.
- Feasibility of tem del has been studied.
- So, we can conclude that this project can be implemented in real life.

DISCUSSION

Project have been successfully built, tested and implemented. Various parameters are observed and found to be providing faithful results under error limits. This project is physically feasible and economically viable for real world implementation.

- *Future Scope in Advancement of Current Model*

In India we have a huge potential

- To increase the limit of voltage and current of system for use in domestic application
- To design this system for large scale commercial use implementation.
- To implement a smart system algorithm which can be used for Variable voltage source of large range, like we will be able to charge batteries of 3V, 6V, 9V, 12V with a 15V MPPT module. In such cases maximum current limit will be determined by the controller and accordingly maximum current limit will be set so that batteries does not get damaged during charging.
- Our aim is to implement this Solar-Wind intelligent MPPT system with grid such that power generated for the system can be fed to grid and excess power can be used in batteries which will be coupled with load also via a bidirectional converter.
- To design a system with a wind energy converter build in which will convert AC supply of Wind mill to DC supply to be fed in the system

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