ENERGY MANAGEMENT SYSTEM WITH MULTIPLE MAXIMUM POWER POINT TRACKERS FOR HYBRID SOLAR-WIND SYSTEM

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Abstract*: In this paper, we propose a energy management system with hybrid solar and wind. This system continuously receives the battery storage and power consumption after it checks the these value with default value if power consumption is exceeds default value means it turn off the loads. We are assigns the priority to the loads in order to overcome the user inconvenient. To increase PV module output MPPT is used. The existing system uses only boost converter in paper boost converter is combined with buck converter used because the PV module can produce high voltage than DC-bus voltage. Buck converter used to step down purpose. In this system on-line configuration check and buck-boost mode transition will be presented. Experimental results measured from three-string MPPTs with the maximum power level of 10 kW are used to verify the analysis and discussion.*

Keyword: Energy management system, Zigbee, Photovoltaic system, MPPT, Buck-Boost converter.

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1. Introduction

The gap between the generation of electricity and the demand for it is bound to widen. To produce the electricity we are using the non renewable energy source such as coal, Natural gas, Uranium. This non renewable resource producing the stable output in all weather condition. But these resources are polluting the environment then create health problem to human, animals. Now a day's power shortage is the big problem because lacking of these resource. To overcome these problems we are going to use renewable energy source. Some renewable resources are Solar, Wind, Tidal power, Wave power and Hydroelectricity. From these renewable source solar and wind are highlighted because their advantage compared with other resources. Some advantages of solar and wind turbines are no polluting particle emissions, no carbon dioxide emissions, and no fuel disposal issues. Atmospheric heating from transmission beam should be

less than 10% of heating from ground-based nuclear or fossil fuel power plants. So many of research and companies are focusing the generation of power using renewable energies and creation of innovative electronic components based on renewable energy. But they are not focusing on the energy efficiency that means proper utilization of input to produce an output without wasting energy. So energy should be managed in order to ensure the energy efficiency. The existing system uses the smart grid. But this method is only focus on power control not improve the energy efficiency. . However, it is not easy to be connected to commercial electricity in these kind of generating systems, because each type of renewable energy such as solar and wind power also solar and wind hybrid system used to produce sufficient in all the weather condition.World is to go ahead with industrialization and, if possible, more rapidly still, and to increase agricultural production, rural electrification is a must.

2.Problem

The renewable energy system cannot produce the stable output in all session. Solar panel produces the high energy during the middle of the day. But in morning and evening sunlight hits the panels at an acute angle and reduces the total amount of electricity which can be generated each day. Another one problem in solar system is produce the high power in summer. Wind mill produce the high power in winter session. And it produce the high energy in morning and evening compared with middle of the day. In smart grid method a high-efficiency inverter and a high-capacity energy storage system maintain the output voltage and frequency stably on equal terms with the power grid network. Therefore, high-efficiency inverters and the high-capacity energy storage systems are necessary to connect to the power grid. In this paper hybrid wind-solar system is used to produce the sufficient power in all the session. Since we can generate sufficient power by using hybrid system. In exiting system if PV module produce low power means boost converters are used to step up the PV module output. PV module may produce high output power to control the high power boost converter combined with buck converter.

3.Objective

Eco-friendly power generation is the best feature of renewable energy systems. Renewable energy systems emit no pollution into the atmosphere when they generate electricity. However, most power plants such as thermal power generation and nuclear power generation plants have produced most of the power supply. Thermal power plants emit the carbon dioxide into the atmosphere, and nuclear power plants have potential danger and discharge nuclear wastes. On the other hand, renewable energy systems are very clean. India has a vast supply of renewable energy resources. Solar energy can be captured by solar panels. These panels transform the solar radiation directly into electricity. The efficiency of solar photovoltaic cells with single crystal silicon is about 13 % - 17%. High efficiency cells with concentrators are being manufactured which can operate with low sunlight intensities. And wind mill produces the power from the wind. The energy consumed to manufacture and transport the materials used to build a wind power plant is equal to the new energy produced by the plant . Wind generation

systems with the capacity to produce up to 50 kW of electrical power. It has the lowest gestation period as compared to conventional energy. To improve the production of power by using the horizontal wind turbine. The main objective is to manage the power consumption to maximize the energy efficiency. Energy management system is used to monitor the weather condition and energy stored in battery system it manage the power consumption according to environmental condition and battery status. And then produce the sufficient energy in all the session. Next increase PV module output using MPPT it combines the boost converter and buck converter. This MPPT increase the PV module output upto 10KW.

4.Proposed system

The proposed is uses the energy management system The most important purpose of the energy distribution management system is to determine how efficiently generated power from solar panels can be used. For this purpose, system checks the status of a solar batteries charge and infers future power consumption by using specific methods to use solar power. This system decides the time to use stored energy in a battery by using power information, the residual amount of stored energy, and web information. For example, Considers weather, which affects the efficiency of photovoltaic panels, and power consumption, which is changing every hour, and decides the best time to use the stored energy. In this paper, we propose a energy management system with hybrid solar and wind.

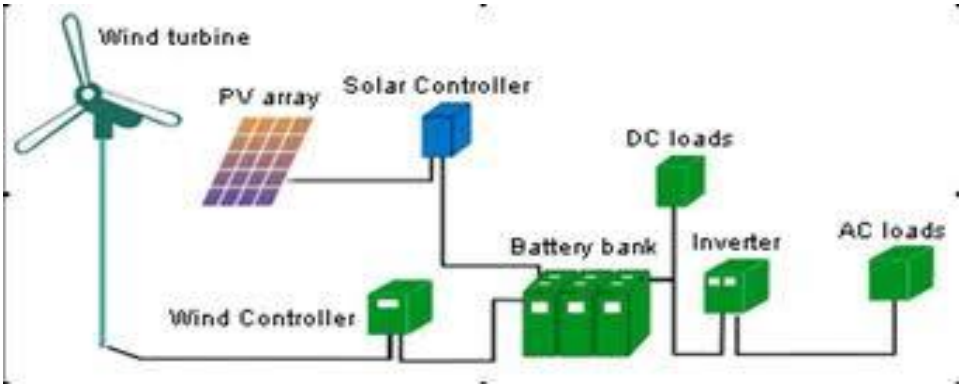

Figure.1:Hybrid Solar and Wind System.

sThis system continuously receives the battery storage and power consumption after it checks the these value with default value if power consumption is exceeds default value means it turn off the loads. We are assigns the priority to the loads in order to over come the user inconvenient. To increase PV module output MPPT is used. The existing system uses only boost converter in paper boost converter is combined with buck converter used because the the PV module can produce high voltage than DC-bus voltage. Buck converter used to step down purpose. In this system on-line configuration check and buck-boost mode transition will be presented. Experimental results measured from three-string MPPTs with the maximum power level of 10 kW are used to verify the analysis and discussion.

5.Block diagram

5.1 Energy Management System:

Wind and solar hybrid system used to produce sufficient energy in the winter session. Wind speeds are often low in summer, when the sun resources are at their best. The wind is often stronger in winter seasons when there are less sun resources. Solar and wind produced the DC power then stored in battery then converted into AC power by using inverter then applied to the load.

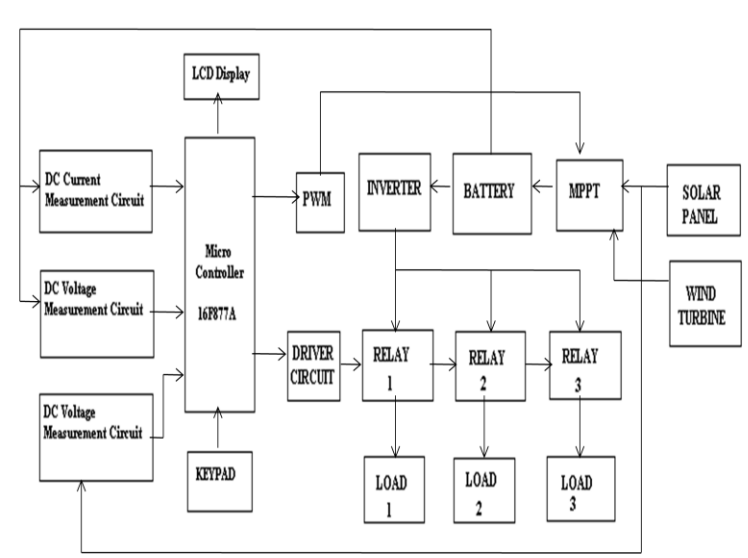

Figure.2:Energy Management System with MPPT

The micro controller continuously receives the power consumption and battery status using DC voltage and DC current measurement. Then these values are send to the PC using zigbee. PC is checks the these value with default value if power consumption is exceeds default value means it turn off the loads. We are assigns the priority to the loads in order to over come the user inconvenient.

6. Perturbation and Observation Method

Designing efficient PV systems heavily emphasizes to track the maximum power operating point. This work develops a novel three-point weight comparison method that avoids the oscillation problem of the perturbation and observation algorithm which is often employed to track the maximum power point.Flowchart of the perturbation and observation method. The controller will first determine the recent operation mode of the proposed MPPT. When the MPPT is operated in boost mode, inductor current *iLM* is equal to PV-panel output current *iPV* , so the output power of PV panel can be expressed as follows:

***PPV_boost(n) = VPV(n) × iLM(n)* (1)**

On the other hand, when the proposed MPPT is operated in buck mode, inductor current *iLM* is equal to output current *iO*, so the output power of PV panel can be

expressed as follows:

Figure.3: Perturbation and Observation Method

***PPV_buck(n) = VO(n) × iLM(n)* (2)**

Since the output power of PV panels can be determined properly, the proposed controller can track the maximum power point with the algorithm of perturbation and observation method more correctly and effectively.

7. On-line PV string configuration check

The tool allows you to save all the data and information of your configuration: location, temperatures, mounting method, solar panel type and data (including data entered manually),This feature is allowing you to resume typical configurations and quickly modify it according to the specific need. In order to track the maximum power point correctly and effectively, A flowchart of the check algorithm is shown in flowchart. First, the MPPT will check if there does any PV string exist. If there exists a PVcell, the MPPT will check *VPV* five times continuously to make sure *VPV* being higher than 150V.

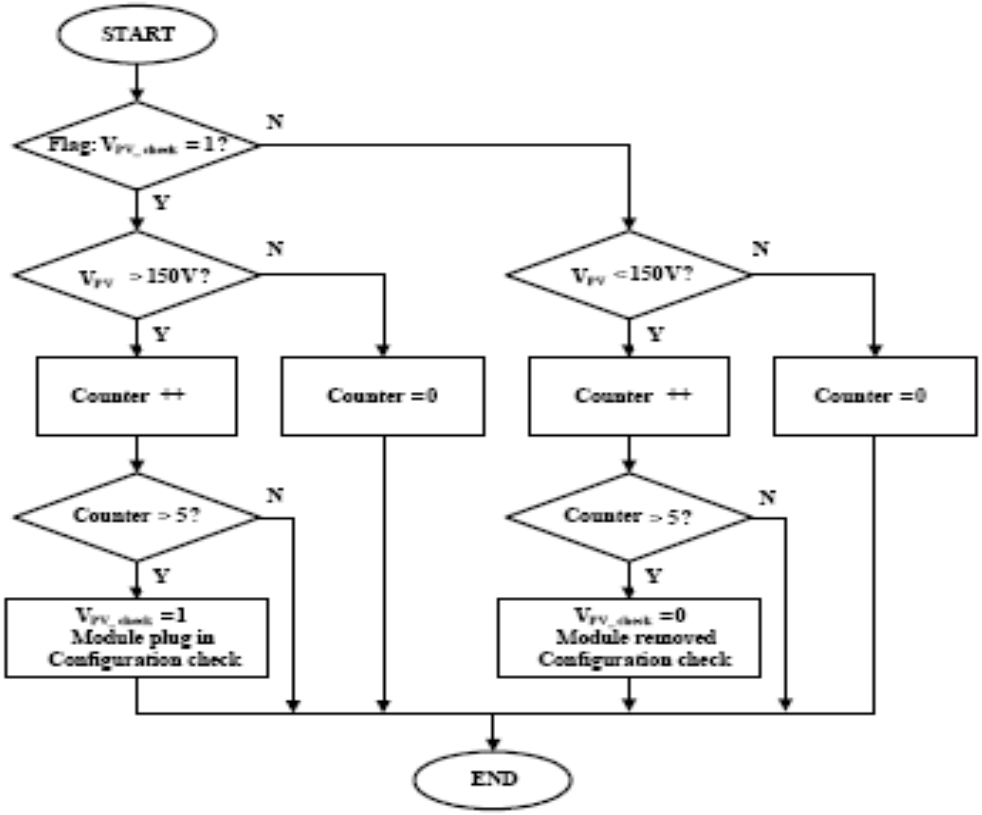

Figure.4:Flowchart of On-line PV string Method

If *VPV* is higher than 150V, the controller will determine that a new PV module plugs in. On the other hand, if there is no PV string, the MPPT will check *VPV* five times continuously to make sure *VPV* being lower than 150V, and determine that a PV module is removed

8. Configuration and Operation of MPPT Modules

The proposed MPPT module, of which its converter topology is a boost converter combined with a buck converter and with a shared inductor to cover a wide input voltage range from 0 V to 850 V. The proposed controller can check the PV strings either connected independently or in parallel every switching cycle. There are two circuit diagrams attached one is the basic Buck-Boost circuit and the other is the gate drive circuit which will drive the FET gate

at a certain input voltage from a separate source. The converter will be tested over the entire range of the input and output voltages

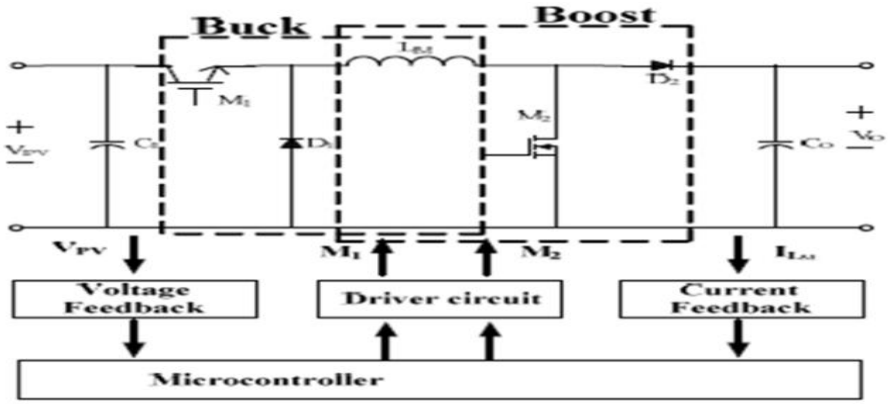

Figure.5:Circuit Diagram for MPPT

If the PV strings are connected independently, the MPPTs will calculate their PV output power and vary their active-switch duty ratios individually. On the other hand, if the PV strings are connected in parallel, the MPPTs will sum up their PV currents to determine the PV output power for MPP tracking and to distribute their currents to the MPPTs equally based on an average current control

9. Result

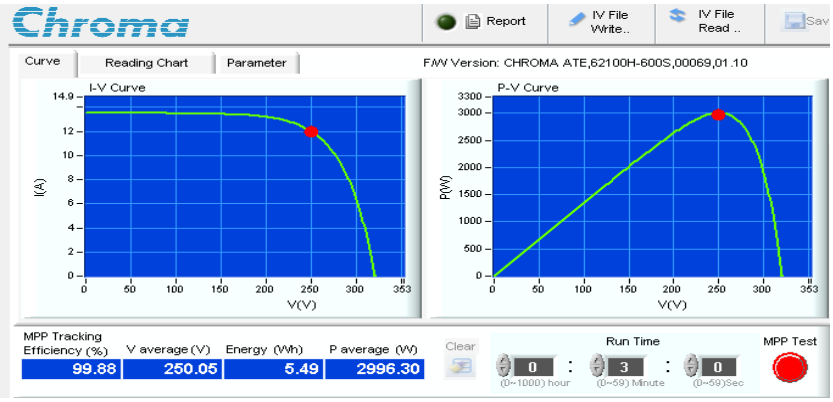

Figure.6:Measured tracking accuracy of the proposed MPPT under 3 kW

10. Conclusion

In this paper, the proposed system gave improved energy efficiency compared with a normal utility interactive system.If the limited storage capacity and the number of solar panels are improved, the iEDM shows better performance. Furthermore, more environmental factors are not included in this paper for the sake of verification. Improving the PV module output power upto 10kw using multi power point trackers by combining the boost converter and buck

converter with on line checks. The conversion efficiency of the MPPT is higher than 98.25% in both buck- and boost-mode operations, and its tracking.

11. References

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