REVIEW ON SOLAR POWER REMOTE MONITORING AND CONTROLLING USING IoT

Dr.J.Geetha Ramani[1], S.Mohana Sowmiya[2], S.Mirunalinii[3], U. Nandha Kumar[4]

[1]Associate Professor, Department of ECE, SNS College of Technology, Coimbatore (India)
[2,3,4] Student, Department of ECE, SNS College of Technology, Coimbatore (India)

ABSTRACT - *The Internet of Things (IoT) has a vision in which the internet extends into the real world, which incorporates everyday objects. Solar power remote monitoring and controlling using IoT is to monitor and control the power in the solar panels from anywhere in the world. Using the Internet of Things Technology for supervising solar photovoltaic power generation can greatly enhance the performance, monitoring and maintenance of the plant. With advancement of technologies the cost of renewable energy equipments is going down globally encouraging large scale solar or photovoltaic installations. The solar tracking is used to increase the power consumption according to sun direction. The influence of contact thermal resistances is evaluated by the Open-Circuit Voltage (OCV) method used for the Maximum Power Point Tracking(MPPT).*

Keywords: Solar power, Thermal resistance, Open Circuit Voltage(OCV), Maximum Power Point Tracking (MPPT).

1. INTRODUCTION

With advancement of wired and wireless network technologies, internet-connected mobile devices such as smart phones and tablets are in more use. Thus resulting in a new concept, Internet of Things (IoT) was introduced and has received attention over the past few years. In general, IoT is actually an information sharing environment where objects in every-day life are connected to wired and wireless networks. Recently, it is used not only for the field of consumer electronics and appliances but also in other various fields such as a smart city development, healthcare, smart home concepts, smart car, energy system, and industrial security. At present, the solar PhotoVoltaic (PV) energy is one of the pivotal renewable energy sources. The solar energy is becoming a potential solution towards sustainable energy supply in future.

As more and more rooftop solar photovoltaic systems are getting integrated into the existing grid, there is a growing need for monitoring of real time generation data obtained from solar photovoltaic plants so as to optimize the overall performance of the solar power plant and to maintain the grid stability. As local monitoring is not possible for the installer therefore monitoring remotely is essential for every solar power plant. The remote monitoring eliminate the disadvantages associated with the traditional wired systems, make data measurement and monitoring process easier, cost effective and IoT based systems take a giant leap towards monitoring by intelligent decision making from web as well as controlling solar panels.

Sunlight has two components, first is the direct beam which carries about ninety percent of the sun energy, and second is the diffuse sunlight in atmosphere that carries the remaining. The diffused portion is the blue sky on a clear day which increases proportionately on cloudy days. As the majority of the energy from sunlight is in the direct beam, maximizing collection of energy requires the sun to be visible to the panels as long as possible. A typical solar panel converts only thirty to forty percent of the incident solar irradiation into electrical energy. To constantly rotate the solar panel towards the direction where the intensity of sunlight is maximum an automated system is required.

2. LITERATURE SURVEY

From all other available resources sun energy is the most copious and it's comparatively easy to convert it to electrical energy. Solar power remote monitoring and controlling using IoT is to monitor and control the power in the solar panels from anywhere in the world.The solar energy is becoming a potential solution towards sustainable energy supply in future.

Today traditional sources like coal, gas, nuclear power generators are used to generate most of electrical power. And nuclear energy is not preferable because of its toxic radiation effect on the mankind. After few years traditional sources will not be sufficient enough to satisfy the energy requirements of the mankind. With the continuously cost of decreasing PV power generation and further intensification of energy calamity, PV power generation technology obtains more and more application [2]. In advanced growing technologies IoT escort the work faster and smarter to implement. Each and every solar photovoltaic cell

of a solar panel needs to monitor to know its current status as for this is concern monitoring as well as diagonising in case of defect in solar cells of a panel and bring into practice the corrective measures to work in a good condition.
Using the Internet of Things Technology for managing sun based photovoltaic power era can incredibly upgrade the enforcing, checking and support of the plant. With upcoming of innovations the cost of renewable essential types of gear is going down all around empowering substantial scale sunlight based photovoltaic establishments. This huge size of sunlight based photovoltaic sending requires advanced frameworks for automisation of the plant checking remotely utilizing web based interfaces as dominant part of them are introduced in difficult to reach areas and in this way not able to be observed from a committed area. The talk in this paper depends on consumption of new practical procedure in view of IoT to remotely screen a sunlight based photovoltaic plant for execution test. This will motivate preventive support blame recognition, chronicled investigation of the plant in enlargement to constant inspection [4].

The components that are been used in this paper are discussed as follows. Maximum Power Point Tracking (MPPT) or sometimes just Power Point Tracking (PPT) is a technique used commonly with wind turbines and PhotoVoltaic (PV) solar systems to maximize power extraction under all conditions. PV solar systems exist in many different configurations with regard to their relationship to inverter systems, external grids, battery banks, or other electrical loads. 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.

A Liquid-Crystal Display (LCD) is a plane or other electronically attuned optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome.Pulse-Width Modulation (PWM), or Pulse-Duration Modulation (PDM), is a way of defining a digital (binary/discrete) signal that was developed through a modulation technique, which includes encoding a message into a pulsing signal. In addition, PWM is one of the two principal algorithms used in photovoltaic solar battery chargers, the other one is tracking.

The mean value of voltage (and current) given to the load is controlled by turning the switch between supply and load on and off at a rapid rate. The longer the switch is on compared to the off periods, the higher the total power given to the load.
Evolution of an online monitoring and control system for dispense Renewable Energy Sources (RES) based on Android platform. This method employs the Bluetooth interface of Android Tablet of Mobile phone, as a communication link for data interchange with digital hardware of power Conditioning Unit.

[8]Introduction to a rapid monitoring setup of renewable energy generation system that is composed with a wind turbine on current and voltage calculation of each renewable source.The Coded visual interface of monitoring software can control the saved data to analyses daily, weekly and monthly gainsof each measurement separately. [3]The solar power remote monitoring and controlling using IoTbasic schematic is shown in figure 1. It will work as elegant IoT based data investment system as well as it will give smart data analytics on obtained data and it will control panels as per given state. The data acquisition system will be able in acquiring the values for PV voltage, PV current, solar intensity and temperature.

The conceptual system in this paper isto evaluate the influence of contact thermal resistances on the Open-Circuit Voltage (OCV) method used for the Maximum Power Point Tracking (MPPT).Simulation results show that the OCV method tracks efficiently the maximum power point even when the contact thermal resistances in the Thermo Electric Generator (TEG) model, under constant temperature gradient conditions, are considered.

MPPT algorithms are used to extract the maximum power from a TEG during its operation. In the literature, the MPPT method relying on the OCV is the most widely used and suitable for TEGs. By using the IoT based remote monitoring system it will be easier to supervise the overall performance of a solar power plant controlling panel by a web based approach.

3. BLOCK DIAGRAM

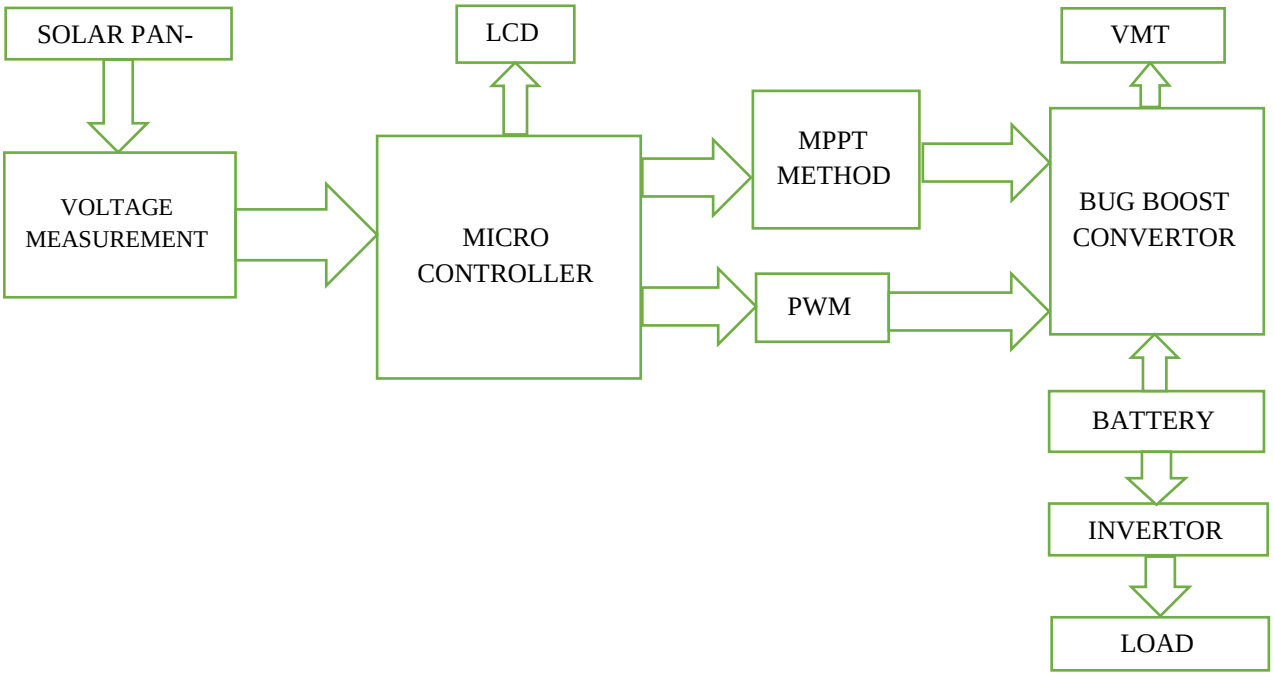

Figure 1: Schematic of solar power remote monitoring and controlling using IoT

IV. CONCLUSION

Utilization of IoT for monitoring of a solar power plant is a vital step as day by day renewable energy sources are getting incorporated into utility grid. Thus automation and intellectualization of solar power plant monitoring will intensify future decision making process for large scale solar power plant and grid integration of such plants. In this paper we suggested an IoT based remote monitoring system for solar power plant, the approach is studied, implemented and successfully attained. The remote transmission of data to a server for management. IoT based remote monitoring will upgrade energy effectiveness [4] of the system by making use of low power consuming advanced wireless modules thereby decresing the carbon foot print. Web Console based interface will reduce time of manual monitoring and aid in the process of scheming task of plant management. A provision of advance remotely manage the Solar PV plants of various operations like remote shutdown, remote management is to be integrated with this system later.

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