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A review on Design and Implementation of wireless Fault Monitoring System for Solar Power Plant

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ABSTRACT

In this paper we survey on design and implementation of µ-controller based wireless PV modules performance testing system. The tenacity of this system is to find out PV modules that operate in non- supreme conditions that may be affected from temperature rises of solar cell, cloud effect and modification of PV modules & Max. Power Point Tracker (MPPT) performance. Thus, it is needed to display the performance of each PV modules. In this paper we survey to monitor output records of PV modules from a host PC which then can be used to examine performance of each PV modules. Theo/p current of PV modules measured using Hall Effect current sensor (ACS712). The brain of the system is PIC µcontroller which will obtain analog data from sensors, transform to digital values and transmission of the data wirelessly to the host PC. Graphic User Interface (GUI) of the system established using visual Studio software for real time monitoring of the PV outputs. The input current, voltage and power from the PV modules are also composed, logged and analyzed in order to fix the performance of each PV modules.

Key words: PV module, Graphic User Interface (GUI), Maximum Power Point Tracker

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INTRODUCTION

Energy harvesting has been the subject of core scientific attention for many years now. Renewable energy was first targeted toward industrial projects where it was solely applied atthe macro level. However, harmful fossil fuels emissions and extravagant oil prices increased the public awareness greatly. That caused a potential turning point where green energy became a major focus in several market sectors that directly impact the consumers. Solar energy has been particularly researched and utilized in multiple areas such as domestic power production. Solar energy proved to be a great alternative in terms of power cost reduction and energy sustainability. On the other hand, such system requires regular maintenance to insure its proper operation. Seemingly insignificant factors suchas dust and shading could lower the output power of one cell, thus reducing the power output of the entire photovoltaic system. Periodic inspections of individual components wiring isalso recommended to reduce the chance of failure of the photovoltaic system.

Several products have emerged in the market to monitor the power generated by photovoltaic systems to lower the number of necessary onsite inspections. These products could be classified in two distinct groups: traditional string inverter power sensors and smart micro-inverters. The former technology suffers from a lack of precision because it ignores the health condition of every solar panel and instead conveys the information about the total string. Although this may still be helpful, pinpointing the fault will require potential onsite inspections. On the other hand, smart micro-inverters monitor the power of every panel in the system. Being fairly new to the market, this technology is very

expensive and seems to be outof reach for most individuals. The high cost is explained by the necessity of placing an inverter for each solar panel and the complex software package that delivers the service.

This project presents the proof of concept of a solution to this problem. The developed unit is a customized wired communicator that logs the voltage data of every single module of the system along with the total voltage and current and makesthem available within the Wide Area Network. This solution compared to prior arts is a less expensive alternative that may inthe future enable any household to enjoy the advantages of solarenergy to the fullest.

The project presents about PV monitoring system by a single centralized monitoring PC. A system needs to be developed to monitor the solar panel activities, such as reading the output power from multiple solar panels and transmit the output wirelessly using wireless module to a centralizes PC. The PV module performance is recorded by a PV module recorder connected on each of the solar panels. The purpose of this paperis to find PV module that operates in non-ideal condition, during variations of solar radiation. In this paper, a simple PV monitoring system developed for multiple solar panels beenplaced on building rooftop. Each PV modules integrated with PV module monitoring system. By monitoring all PV modules performance wirelessly using Zigbee module to a centralized PC, analysis can be done easily, in order to determine the performance of each solar panel. Analysis was conducted for a period of 2 months.

LITERATURE SURVEY

T. Asha Rakshana [1], The author of IOT Based Solar Panel Fault Monitoring and Control by using Wi-Fi Modem,explained, **Kian Jazayeri** developing an intelligent systemwhich provides real time monitoring and fault detection forsolar panels. Utilizing artificial neural network technology. **Yuji Higuchi** report various methods for classifying the Arduino microcontroller. **Nehali Datar** [3], discussed Solar Power Monitoring system using IOT. Smart Remote monitoring system using IOT that is capable of monitoring the Solar power conditioning unit which consist of solar charge controller andprovides the facility to charge the battery bank either throughsolar or grid and stores data in the cloud database through aneasy manageable web interface. The publisher IEEE **Rahul Kumar Sah; Sushant Ghising** [4], published WirelessMonitoring of Photovoltaics Panels based on RF module.Published in 2017 International Conference on Networking andNetwork Applications (NaNA). **M. Reyasudin Basir Khan** [5]**,**described Wireless PV module performance monitoringsystem, the proposal of the paper, a system to monitor outputdata of PV modules from a host PC which then can be used to analyze performance of each PV modules. Published on: http://www.researchgate.net/publication/2581067 34 faults that use the data of string measurement devices used for continuously monitoring solar power panels remotely. **Amaize Peter Aigboviosa** [2], introduces in Arduino Based Solar Tracking System For Energy Improvement of PvSolar Panel. The solar tracking system comprises of a solar panel, Arduino microcontroller and sensors. For this system tooperate there must be emission of light through the sun. The LDRs serve as the sensors to detect the intensity of lightentering the solar panels.

SYSTEM ARCHITECTURE

Figure 1 shows overview of the system. The main components of the system are current sensor (ACS712), PIC microcontrollerand communication modules. Microcontroller acts as the brain ofthis system, it will receive data from the input sensor, perform analog to digital conversion and transmit the data to the host PC.

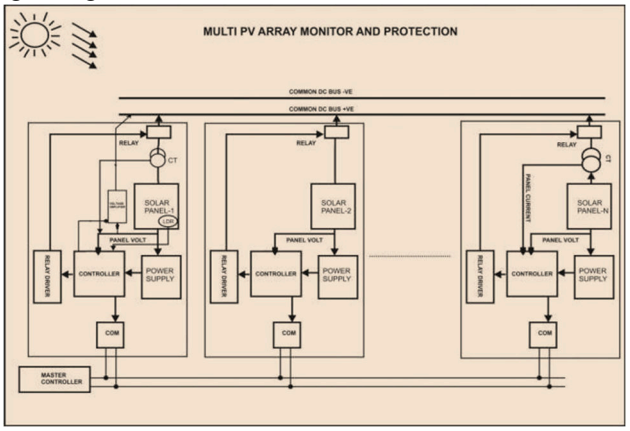

Fig. 1 Overview of the system

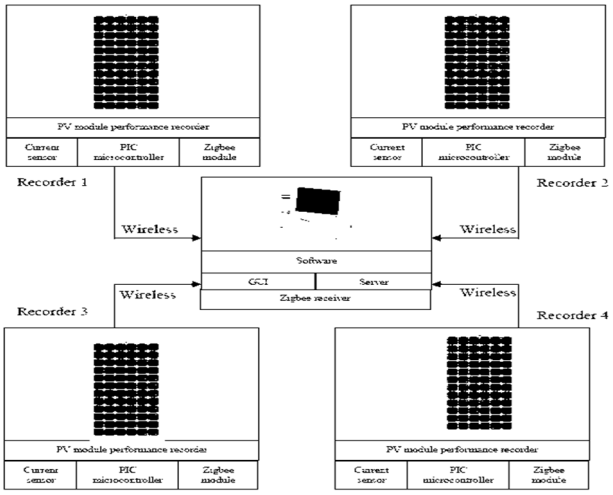

Fig. 2 Overall diagram for this project

Figure 2 shows the overall diagram for this project. There are several PV module performance recorder used for the PV monitoring system, which connected wirelessly to the centralized monitoring PC. For each PV module performance recorder, it consists of a current sensor, a PIC microcontroller, LCD and a Zigbee module. The monitoring PC act as a server which consists of GUI, and the data acquisition device. The data collected on the PV module performance recorder will be transferred wirelessly using the Zigbee module that been placed on both recorder and host PC.

METHODOLOGY

PV module performance recording system which consists of microcontroller, current sensor and serial PC Interface module connected to the PV module. The current sensor capable to measure current up to 5A. This is sufficient for this systemsince the short circuit current, ISC is 4.75A. PIC microcontroller will received data from current sensor, execute analog to digital conversion (ADC). Since ACS712 sensitivity is 0.185V/A and supply voltage, Vcc is 5.17V and ADC reference voltage, Vref = Vcc, the relationship between current, I and ADC values is: **ADC = 1024/Vcc x (Vcc/2 + 0.185 x I).** Microcontroller will collect sample of current values and take the average for better accuracy. The output current will be transmitted to the host PC via serial communication. Each PC interface module is designated with their own node and network addresses to ensure that the data transmission is not interrupted by external sources. The data transmitted from PV module to host PC using serial communication. PV output values will be displayed on LCD and transmitted to the host PC. The output data will be displayed in PC via Visual Studio software. The output data will be displayed in PC via Visual Studio software. The software will read values from selected serial port anddisplay on GUI. The Visual Studio software will analyse the received data from each module and perform analysis to determine whether the PV module functioning properly or faulty. The data also will be displayed in graphical format in order to show the variation of PV module output throughout the day. The collected data will be logged in text file for future references.

FUTURE WORK

- In this paper, a PV module performance monitoringsystem introduced.
- A GUI developed using Visual Studio.
- NET environment to monitor several PV module outputs.
- The system currently in development stage and will undergo several tests to increase accuracy and efficiency.
- The system will be improved in future such as integrating solar battery charging system.
- The system currently powered by batteries which will be depleted in few weeks.
- To encounter this problem, solar battery charging system that utilizing solar power to charge the battery will be implemented.

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