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Real Time Monitoring of Solar Panel Using IoT

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ABSTRACT

The Internet of Things (IoT) has a vision in which the internet extends into the real world squeeze everyday objects. We have described an effective implementation of an intelligent remote monitoring system of solar photovoltaic (PV) power conditioning unit (PCU). As Renewable energy grew at a rate faster than any other time in history during this period. The proposed system can be installed in solar PV PCU in order to solve management problem, maintenance and minimized the repairing time. The smart monitoring system displays the usage of renewable energy day by day and helps to analyze the usage of renewable energy.

Keywords: IoT, Photo Voltaic, ESP8266, Arduino, Thing speak, ATmega328

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I. INTRODUCTION

Internet of Things (IoT) is the technology that transform everyday physical objects into an ecosystem that would enrich our lives and make it simpler. IoT technology is carrying more and more day to day objects into the digital fold and making them smarter. The IoT allows objects to be sense or controlled remotely across existing network infrastructure, creating opportunity for more direct integration of the physical world into computer based system and resulting in improved efficiency, accuracy and economic benefit in addition to reduce human intervention.

The Internet of Things (IoT) is a system of related computing devices, mechanical and digital machines, objects, people that are provided with unique identifiers and also to transfer data over a network without requiring machine-to-machine or person-to-computer interaction. From the time when the birth of earth, almost each and every creature in the world cannot survive without the light and heat delivered by the sun. In olden days, humans did not dynamically study how to use solar energy better, just using solar energy passively.

II. EASE OF USE

Capable of monitoring the solar PV PCU

The solar PV PCU absorb the sunlight as a source of energy which convert into electricity by solar cells. Smart remote monitoring system using IoT that is capable of monitoring the solar PV PCU and stores data in the cloud database through an easy manageable web interface. The proposed system has a great flexibility by using GPRS technology to interconnect the solar PV PCU to remote server.

III. LITERATURE SURVEY

Jiju, K., et al.[1] describes the development of an online monitoring and control system for distributed Renewable Energy Sources (RES) based on Android platform. This method uses the WiFi interaction of pc server, as a communication link for data exchange with digital hardware of Power Conditioning Unit (PCU).

Author Kabalci, Ersan, Alper Gorgun, and Yasin Kabalci[2], introduces an instant monitoring infrastructure of a renewable energy generation system that is constituted with a wind turbine and solar panel arrays. The monitoring platform is depends on voltage measurements of each renewable energy sources. The related values are measured with the developed sensing circuits and processed by an 18F4450 microcontroller of Microchip. The processed parameters are then transmitted to a computer over universal serial bus (USB) to be saved in a database and to observe the system instantly. The monitoring software can manage the saved data to analyze daily, weekly and monthly values of each measurement separately.

Nkoloma, Mayamiko, Marco Zennaro, and Antoine Bagula. [3] are determine a novel monitoring, control system for achieving real time monitoring and control of a hybrid 'wind PV battery' for renewable energy system. The proposed system constitutes a supervisory control and data acquisition (SCADA) system, which employs campus network of National Cheng Kung University integrated with a programmable logic controller (PLC) and digital power meters. The extract system is capable of performing real time measurement of electrical data that can be effectively transferred to remote monitoring center using intranet. It can be concluded from the artificial and experimental results that the proposed monitoring and control system can achieve real time supervisory control and data acquisition of remote various forms of renewable energy system.

Nkoloma, Mayamiko, Marco Zennaro, and Antoine Bagula. [4] describes recent work on the development of a wireless based remote monitoring system for renewable energy plants in Malawi. The main goal was to develop a cost effective data acquisition system, which continuously presents remote energy yields and performance measures. The project output gives direct access, to generated electric power at the rural site through the use of wireless sensor boards and text message (SMS) transmission over cellular network. Preliminary experimental results reveal that the performance of renewable energy systems in remote rural sites can be evaluated efficiently at low cost.

IV. PROPOSED WORK

The important aim of this proposed work is to Power of the system can be monitor using the voltage value sensed by the arduino. The monitor of the solar energy system shows the power and energy usage. This system helps to implement in smart grid for efficient usage.[4]

V. METHODOLOGY

In this article we present the system design of the Solar panel Monitoring System.

A. System Design:

The proposed system is for monitoring of solar energy using IoT. Solar panel helps to store the energy in the battery. Battery has the energy which is useful for the electrical appliances. Battery is connected to the Arduino. Arduino is a micro controller which is used to read the sensor values. Voltage sensor is connected to the Arduino.

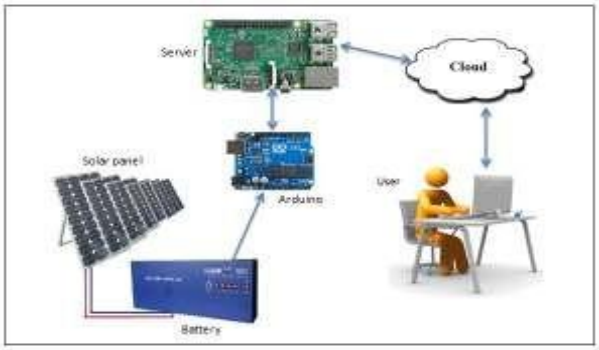

Fig.1. System Design

Arduino:

Keeping in mind the economic constraints and the simplicity of the system, Arduino Uno has been used which abates the programming complexity. Arduino sense the current and voltage value through Analog pins. With the help of these values, Arduino programing calculates the power and energy.

Fig.2. Arduino Uno

B. Voltage Sensor

Fig. 3.Voltage Sensor

Description:

This module is based on resistance points pressure principle, and it can make the input voltage of red terminal reduce 5 times of original voltage.

The maximum Arduino analog input voltage is 5 V, so the input voltage of this module should be not more than 25 V (if for 3.3 V system, the input voltage should be not more than 16.5 V).

C. Cloud Setup

ThingSpeak is an open platform of IoT application and API to store and find the data from things using the HTTP protocol over the Internet or via a Local Area Network. ThingSpeak enables the developing of sensor logging applications, location tracking applications with status updates.

The user should create the account first. The account contains channels which are separate for different projects. Channel has the fields which are different for different parameter in the monitoring system. After assigning the parameter the system upload the values to it. The cloud has built-in functions in it which represent the values in the form of graphs.

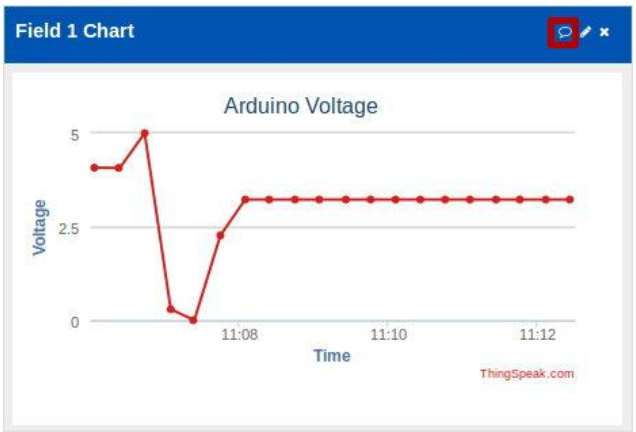

Fig.4.Voltage-time graph

D. Raspberry Pi :

Raspberry Pi is used in the project as a central monitoring system. As raspberry pi board is a portable and low cost, it reduces the system cost. Raspberry pi has inbuilt WiFi. With the internet RPi displays the data on the web page and stores the data on the cloud. The cloud has public access so the user can access the monitoring. The user can estimate the usage and available of the battery.

VI. IMPLEMENTATION

A. Work Flow

Following fig.5 represents the process of proposed system from solar panel to monitoring system. The flow chart of solar energy monitoring system in the form of following steps:

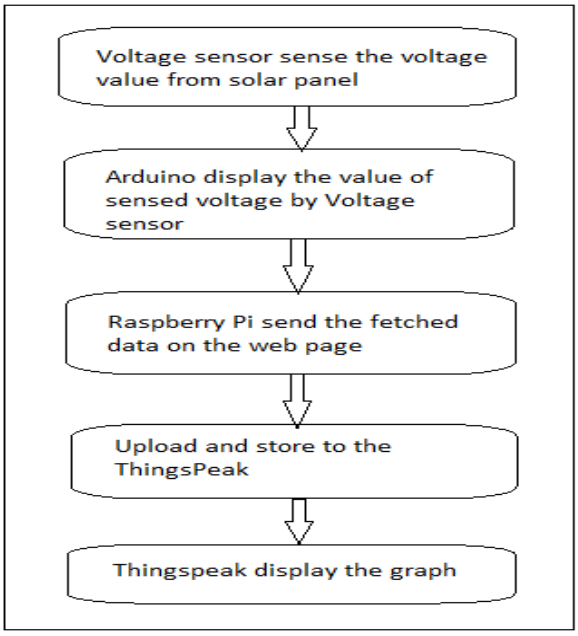

Fig.5. Work flow of the system

Step 1: Voltage sensor sense the voltage at the terminal of the solar panel.

Step 2: Arduino display the voltage value sensed by voltage sensor.

Step 3: Raspberry Pi fetch the arduino output data through serial port and display on the web page through WiFi.

Step 4: Raspberry sends the monitoring data on to the cloud i.e. Thingspeak platform.

Step 5: Thingspeak display the graph of voltage-time

Hardware setup:

The following fig.6 shows the hardware setup of the proposed system. Solar panel absorbs the solar energy and converts into electrical energy. The output terminal of the solar panel is connected to voltage sensor. Voltage sensor senses the output voltage of solar panel and sends the data to the arduino. Arduino displays the voltage value of voltage sensor. Raspberry pi fetch the arduino output data through serial port and display on the web page through WiFi. Raspberry sends the monitoring data on the thingspeak online platform and stores the data on cloud database. Thingspeak displays the voltage-time graph in real time basis and refresh the data on every 15 seconds.

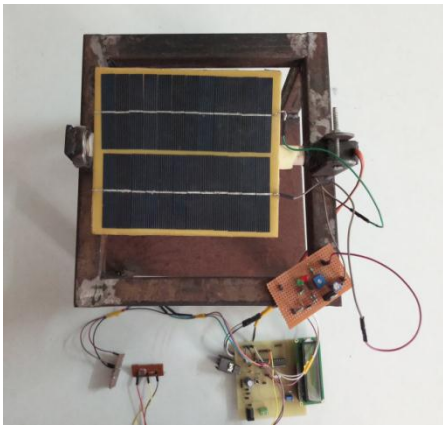

Fig.6. Hardware setup

Software coding setup:

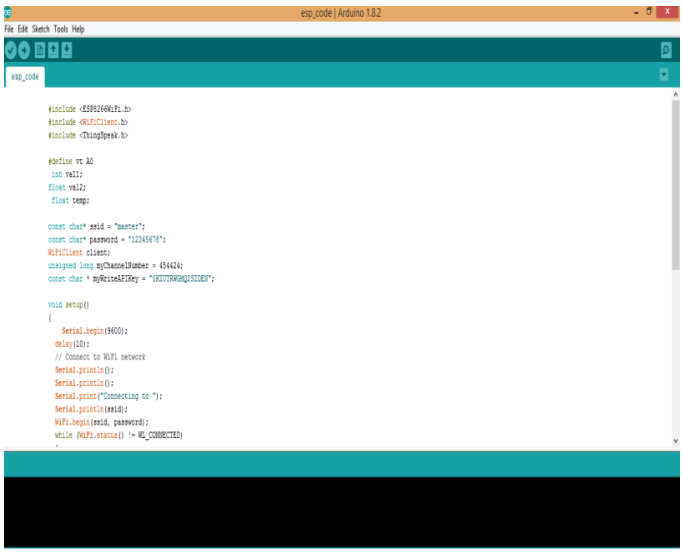

Fig.7.Software Setup

The microcontroller ESP8266 gets automatically connected to the WiFi which name is “master” and password is “12345678”. Create the new channel on thingspeak platform. Put the API key and channel number in the microcontroller program to access the channel. While connecting the microcontroller to the WiFi, the message displays as “connecting” and when WiFi connected, the message displays as “connected” and shows the IP address of WiFi. Connect the same WiFi to the server. The microcontroller sends the fetched data to the arduino through WiFi network, The arduino displays the voltage value and sends the data to the online platform. Thingspeak displays the graph of voltage-time and automatically refresh the data on every 15 seconds.

With the help of arduino program monitoring data is upload to the cloud. ThingSpeak cloud is used in this project. It is an open source Internet of Things (IoT) application and API to store and retrieve data. In this cloud storage we create the social network of things with status updates.

VII.RESULT AND DISCUSSION

The proposed work specify the results for the Solar Energy Monitoring System. Snapshot of Solar Energy Monitoring System Setup

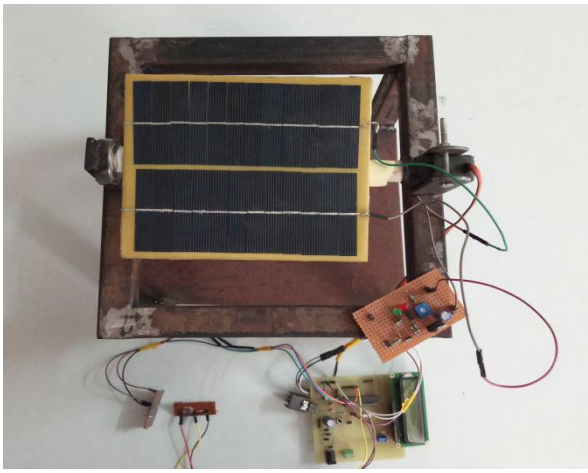

Fig.8. Solar Energy Monitoring System Setup

Graph

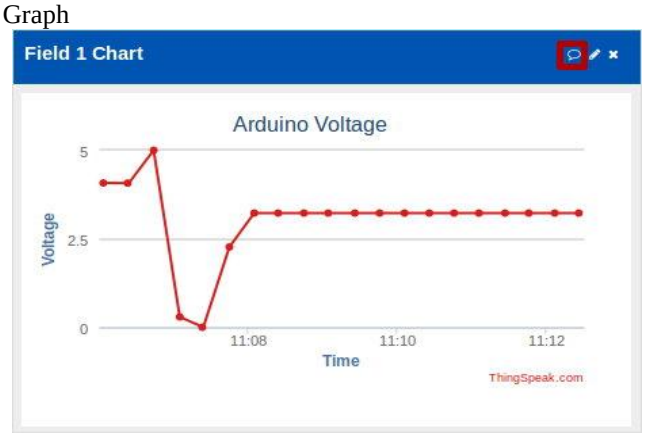

Fig.9.Graph of Voltage-Time

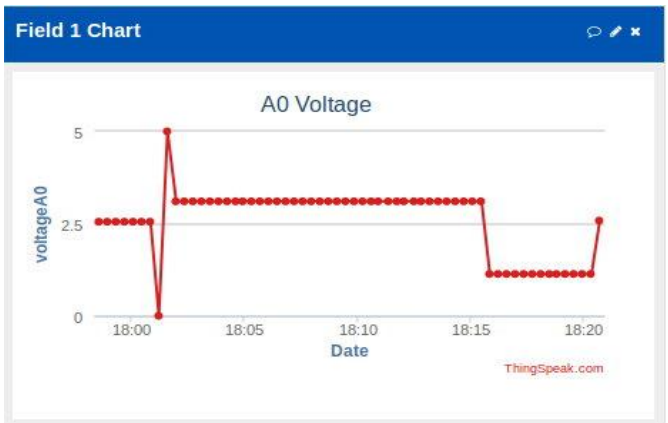

Fig.10.Voltage-Time Characterestics

Graphs emphasize the main point, make the data more convincing and provide a compact way of presenting information to the users. Graphs are plot for voltage value with respect to date. These graphs are access through internet from anywhere.

VIII. CONCLUSION AND FUTURE WORK

Implementing Renewable Energy technologies is one recommended way of reducing the environmental impact. Because of frequent power cut it is important to use renewable energy and monitoring it.

This project can be further enhanced, by using the results of this current project, i.e. the monitoring values obtained are helpful in predicting the future values of the parameters considered. The data stored in cloud can also be analyzed using the MatLab. The web application can be developed for interaction with the end user; the user can also predict values of the future events. In the same way we can go for android application also. During the prediction two or more models can be used for same dataset, to find the accuracy of each model.

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