IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 1, July 2023

IoT Based Solar System Parameter Measurements

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Abstract: *Using the Internet of Things Technology for supervising solar power generation can greatly enhance the performance, monitoring and maintenance of the plant. With advancement of technologies the cost of renewable energy equipment is going down globally encouraging large scale solar plant installations. This massive scale of solar system deployment requires sophisticated systems for automation of the plant monitoring remotely using web based interfaces as majority of them are installed in inaccessible locations and thus unable to be monitored from a dedicated location. The Project is based on implementation of new cost effective methodology based on IOT to remotely monitoring a solar plant for performance evaluation. This will facilitate preventive maintenance, fault detection of the plant in addition to real time monitoring.*

Keywords: Arduino, a microcontroller, DHT 11 sensor, Wifi module, voltage divider, LDR are used for solar system parameter measurements

I. INTRODUCTION

Solar power plants need to be monitored for optimum power output. This helps retrieve efficient power output from power plants while monitoring for faulty solar panels, connections, and dust accumulated on panels lowering output and other such issues affecting solar performance. So here we propose an automated IOT based solar power monitoring system that allows for automated solar power monitoring from anywhere over the internet. We use ATmega controller based system to monitor solar panel parameters. Our system constantly monitors the solar panel and transmits the power output to IOT system over the internet. Here we use IOT Thing speak to transmit solar power parameters over the internet to IOT Thing speak server. It now displays these parameters to the user using an effective GUI and also alerts user when the output falls below specific limits. This makes remotely monitoring of solar plants very easy and ensures power output. The internet of things (IoT) defines everyday physical objects being able to communicate data with other internet-connected gadgets by identifying themselves to them.

This technology helps with system monitoring, upkeep, and performance improvement. Energy conservation is the main issue facing society. Even though there is a lot of research being done in solar energy, consumers still do not readily accept sun-based applications. This may be due to minimum knowledge of such applications. The proposed system aims to continuously supervise the monitoring and maintenance of the solar panels using IoT. The system should maximize its production and for that it being rotated as per sun's direction. The rotation of the panel will be in accordance with the real time position, intensity of the sun's radiation and climatic condition. In case the system is ineffectual to harness the required amount of energy for all when using home appliances at a set time, additional energy will be obtained from other sources. electricity. The project highlights in providing analysis of the system data along with user friendly interface to the people. Timely notifications will be provided to the user regarding dust accumulation to restore the efficiency of the system and minimizing its effects in energy production.

II. METHODOLOGY

2.1 Block diagram

Solar power plants need to be monitored for optimum power output. This helps retrieve efficient power output from power plants while monitoring for faulty solar panels, connections, and dust accumulated on panels lowering output and other such issues affecting solar performance. So here we propose an automated IOT based solar power monitoring system that allows for automated solar power monitoring from anywhere over the internet. We use ATmega controller based system to monitor solar panel parameters. Our system constantly monitors the solar panel and transmits the

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power output to IOT system over the internet. Here we use IOT Thingspeak to transmit solar power parameters over the internet to IOT Thingspeak server. It now displays these parameters to the user using an effective GUI and also alerts user when the output falls below specific limits. This makes remotely monitoring of solar plants very easy and ensures power output. The internet of things (IoT) defines everyday physical objects being able to communicate data with other internet-connected gadgets by identifying themselves to them.

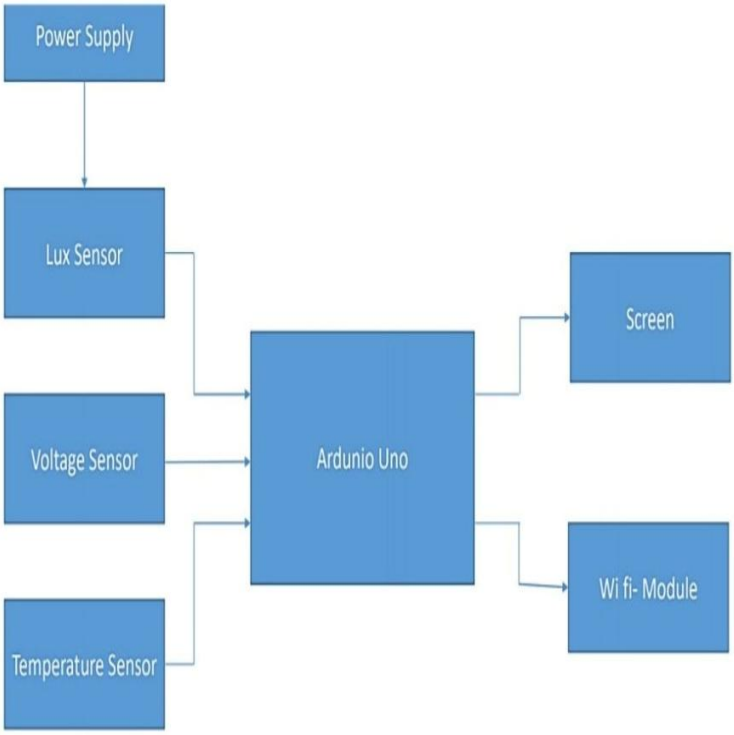

Fig: IOT based solar system parameter measurements

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The main intention of this proposed project is to get maximum power output from the solar panels. Additionally, if there is any improper functioning of the solar panels will be shown and also the parameters like voltage and current are monitored by using the sensors and displayed by using the IOT technology. This model is explained by using the solar radiation i.e., sunlight from the sun is trapped by the solar panels and then these solar panels capture sunlight and turn into useful energy forms of energy such as heat and electricity. Then the obtained electrical energy is sensed by the sensors such as voltage sensor sense the voltage generated by the solar panel with the help of voltage. divider principle and current is obtained by using mathematical formulation. The designed structure of the proposed monitoring system is shown in figure no. 3.2. The experimental arrangement of the introduced system consists of solar panels, Regulator power supply, Wi-Fi module-ESP8266, Voltage sensor, Current sensor, and Arduino Uno microcontroller. Programming codes are developed on Arduino IDE,embedded C.

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2.2 Flow chart of the system

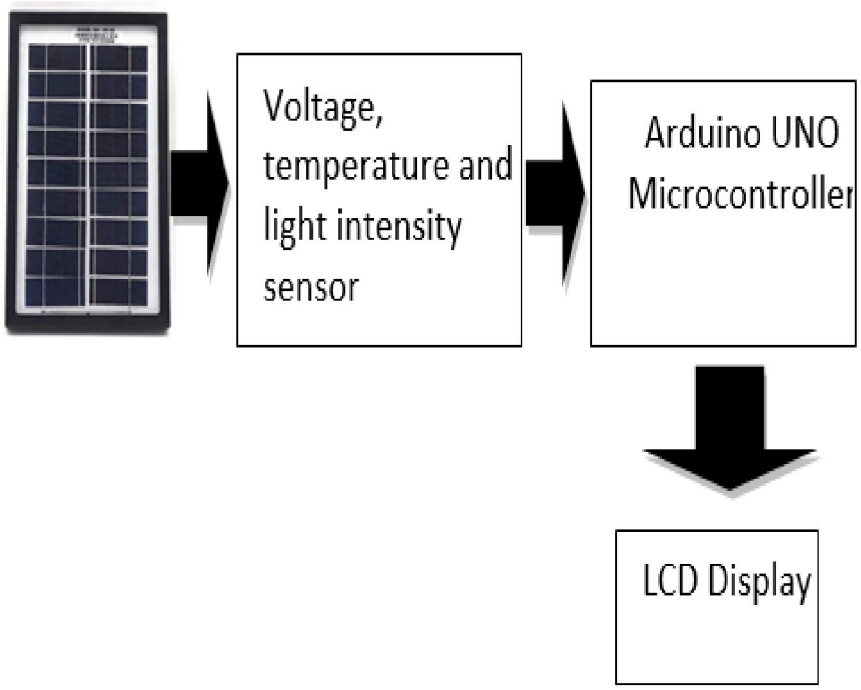

Fig: Solar parameter monitoring system

Special Issue Published in Int. Jnl. Of Advanced Networking & Applications (IJANA)

2.3 Model Implementation

Simulation

Fig.2 shows the schematic of our proposed IOT based solar system parameter measurements

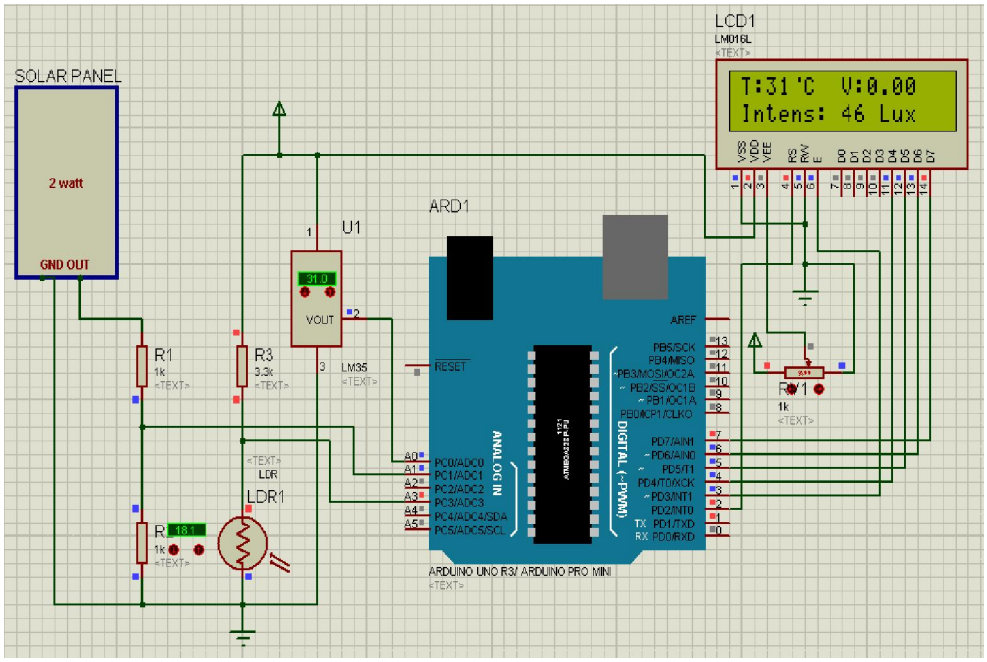

Fig 2.Model implementation of IOT based solar system parameter measurements.

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Here designed project measures different solar cell parameters like voltage, lux, humidity and temperature by using multiple sensor data acquisition. The project uses a solar panel to monitor sunlight and Arduino board which has ATmega family microcontroller attached to it. The project requires an a voltage divider to measure voltage and a temperature sensor to measure the temperature. These measurements are then displayed by the microcontroller to a screen. Thus this system allows user to effectively monitor solar parameters using this system.

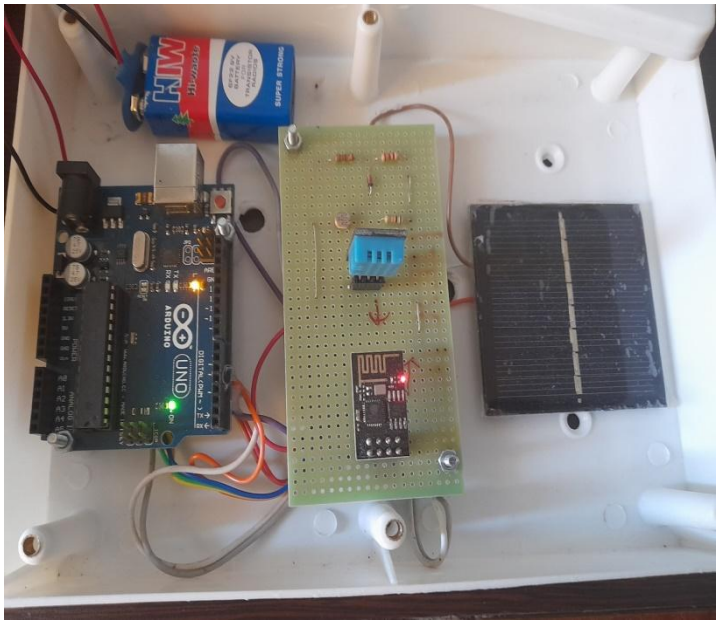

Fig 3.Real implementation of IOT based solar system parameter measurements

III. LITERATURE REVIEW

We had the opportunity to study a number of projects, journals, articles, and books relating to the topic of our project as it was being developed. We think that all of the reviewed resources have contributed positively to the overall development and design of the project we have selected. Several of the relevant projects we looked at are described in this section.

3.1.Development of Android based on-line monitoring and control system for Renewable Energy sources based on android platform:

This paper describes the development of an online monitoring and control system for distributed Renewable Energy Sources (RES) based on Android platform. This method utilizes the Bluetooth interface of Android Tablet/ Mobile phone as a communication link for data exchange with digital hardware of Power Conditioning Unit (PCU). The Low Cost Android tablet can replace the graphical LCD displays and Internet modem of RES Power Conditioning Unit (PCU) with enhanced graphical visualization and touch screen interface.

Published in:2014 International Conference on Computer, Communications, and Control Technology (I4CT).

Author: K. Jiju; P. Ramesh; P. Brijesh; B. Sreekumari.

3.2.Controllogger: A remote monitoring system for decentralized renewable energy sources

The development of a remote monitoring and control system for decentralized renewable energy plants is described in the present paper. The system has a microcontroller-based unit for local storing and data transmission to internet by a GSM modem and a database server to store the data. The proposed architecture is easily extended for controlling a decentralized renewable energy plant by a remote operator. Correlations and performance tests are used to compare the data collected by the system prototype with data collected by a commercial data acquisition system. The results indicate that the Root Mean Square Error (RMSE) is 0.103 m/s for the wind speed measurement and the correlation factor is

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greater than 0.9996. Overall, the low errors rates indicate that the data have been stored in a similar form to what would be expected with the use of a commercial data logger.
Published in: April 2012.
Author: Fábio Brito,Sandro Juca**.**

3.3. Development of a data acquisition system for remote monitoring of RES.
The widespread application of Renewable Energy Sources (RES) requires the use of data acquisition units both for monitoring system operation and control of its operation. In this paper, the development of a data acquisition system for remote monitoring and control of RES plants is presented. It is based on the Client/Server architecture and it does not require the physical connection of the monitored systems to the data collection server. This feature is essential in RES plants since they are usually installed in inaccessible areas. The measured parameters are available on-line over the Internet to any user.
Published in: September 2003.
Author: Eftichios Koutroulis, Vassilios Vlachos

IV. RESULT

The working model of the proposed system is shown in figure below. In this project an IOT based Solar power monitoring system is designed to obtain the maximum output power from the solar panels. After the conversion of light energy into electricity through solar panels, the current, temperature, humidity and voltage parameters are recorded using sensors. The amount of voltage and current received are shown on the display with the help of IOT technology. As there is a Wi-Fi module connected to the sensors, we can view the readings in our mobile device by connecting to the Wi-Fi network. Whenever the readings or data changes it automatically updated in our mobile. By using IOT technology we can monitor the working of solar panels and there may be a chance to detect the problem when anything goes wrong.

V. CONCLUSION

The proposed system stores the voltage, temperature, humidity, date and time and current parameters and keeps updating the new values. By tracking the solar photovoltaic system continuously, the daily or monthly analysis also becomes simple and easy. It is also possible to detect any errors occurring in the system if there is any uncertainty in the generated data by tracking the solar panels that are operated at the maximum capability. These method has continues tracking of solar energy weekly, monthly and daily basis The analysis became more simple and convenient and economically aditional .Non conventional energy which can be endlessly relished by process .The solar array voltage generation is one of the most higher solutions for clean energy production by observation and controlling the voltage generated by our planned system we have tendency to might overcome the drawback of earlier proposed system .This technique contain a low operating cost and find its application in remote areas and additionally reduces man power.

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