IJAREEIE

e-ISSN: 2278-8875
p-ISSN: 2320-3765

International Journal of Advanced Research

in Electrical, Electronics and Instrumentation Engineering

Volume 11, Issue 5, May 2022

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.18

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 8.18|

||Volume 11, Issue 5, May 2022||

|DOI:10.15662/IJAREEIE.2022.1105013 |

Monitoring the Performance Parameters of Solar Panel Using IOT

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ABSTRACT: Renewable energy sources have proven to be reliable and accepted as the best option to meet our growing energy needs. Solar photovoltaic energy is an emerging and attractive clean technology with zero carbon emissions in today's world. In order to utilize solar energy generation, serious attention must be paid to its maintenance as well as its use. Monitoring of solar energy projects is essential for optimal energy production. It helps in recovering efficient power output from power plants while monitoring faulty solar panels, connections, dust accumulated on output reducing panels and other issues affecting solar efficiency. So here we propose an automated IoT based solar energy monitoring system that allows for automatic solar energy monitoring from anywhere on the Internet. It is proposed to combine and analyze solar energy parameters to estimate the efficiency to ensure stable energy production by monitoring the efficiency parameters of solar panels using LOT. The main advantage of the system is to ensure optimal performance for good maintenance of solar PV (photovoltaic). The main goal of PV monitoring systems is to offer a cost-effective solution, which continuously displays remote energy generation and its efficiency on a computer or smart phone. The proposed system can measure voltage, current, voltage of solar module, also measure temperature and intensity of combat can be monitored. This monitoring system is developed by Smart Wi-Fi enabled ESP32 controller with the latest embedded Tensilica 32-bit RISC CPU Xtensa LX106 processor that communicates and uploads data to the cloud platform with ThingSpeak.Also wireless monitoring systems increase the operational reliability of the minimum system cost.

KEYWORDS: ESP32-NodeMCU controller,sensors ,powersupply ,Solar panel.

I. INTRODUCTION

The Internet of Things (IoT) is one of the most important technologies of everyday life, which helps people live . An IoT is a device, which is used to enable the connection between machine and the cloud. This technology helps to exchange the data between the connected devices on the available network. Through the internet, the user can acquire the data and control the devices from any place all over the world. It is an ecosystem which consists of web enabled gadgets that use processors, sensors and other communication hardware devices to fetch and send the data. By using IoT we can set up machine to machine connection or device to device connection without human interference. It also utilizes many facilities and software systems for data processing. The need for using IoT technology in this solar power monitoring system is as the range of sun's radiation is not fixed and may vary according to the location, time and climatic conditions, the solar panels which are exposed to the sun always need to be monitored. The solar panels can be monitored from any location remotely by using IoT .

In today's world, electricity is one of the most basic needs for everyone's. We require electricity for heating, lighting, refrigeration, transportation systems and all the home appliances for automatically controlling. Day by day the energy consumption is getting rapidly increased whereas the energy resources are decreasing in parallel. So, in order to balance the deficiency of electricity, various sources are used to generate electricity. There are two ways available for the generation of electricity one is by using renewable sources and the other one is by using non-renewable sources. Non-renewable sources are such as coal, natural gas, fossil fuels while the renewable sources can be utilized again and again such. as sun, wind energy, tidal energy.Therefore, solar energy is said to be an indestructible source of energy. Therefore, LOT based solar energy monitoring system has been proposed to overcome the problems related to power shortage. Solar energy has become very trendy as it is available in abundance and generation of solar energy is also cheaper in conversion technology. In this technology the light energy is converted into electrical energy which is known as photovoltaic effect and this is called solar energy. By using solar power, the pollution will be reduced and by monitoring it the energy forecasting, households and communities, the productivity can also be

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enlarged. By monitoring it , we can know the status of it and also shows when there is a problem which is so helpful for us.

Fig: Solar Panel

The proposed system describes a loT based solar energy monitoring system. In this system, sunlight is converted into electricity by the solar cells in the solar panel. We use ESP32. Current voltage parameters are measured using sensors. The valuesof current and voltage are shown on the LCD display. A loT device is also connected to sensors by which parameters are displayed on the display and can be monitored from anywhere using the available network.

How it works:

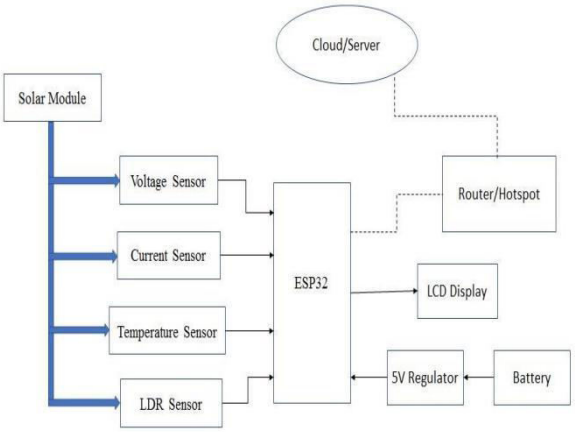

Fig:blockdiagram

The IoT based monitoring solar panel parameter is project is based on internet of things, which connected to cloud/server directly using an ESP32 controller. ESP32 controller have an in-built wi-fi chip which can give ability to publish the sensor on internet service, above fig. shows the is block diagram of our project.
When light rays are incident on solar panel , then various sensors start sensing the data i.e, The LM35 temperature sensor is used to measure the temperature, The Operating temperature range is -55°C to 150°C.ACS712 Current sensor is used to measure current, This sensor requires 5V for operation and outputs an analog voltage which varies linearly with the sensed current. It can measure a maximum of 30A of current. Voltage sensor is used to measure the voltage of solar panel .LDR sensor is used to measure the intensity of sunlight, i.e, the solar panel is in darkness or in light. Buzzer is used to The data from various sensors are given to ESP32 nodeMCU. After processing the data is send to the LCD display for local monitoring and also data is send to the Cloud for remote monitoring.

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Circuit Diagram:

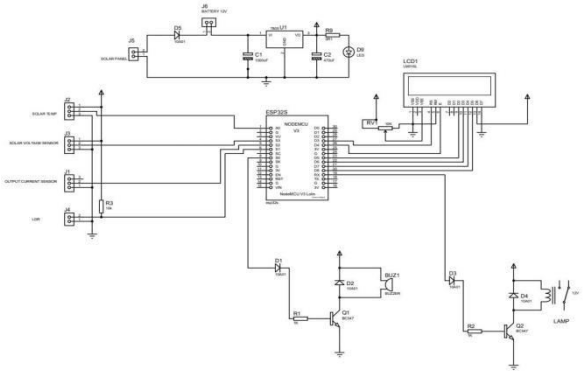

Fig. Circuit Diagram

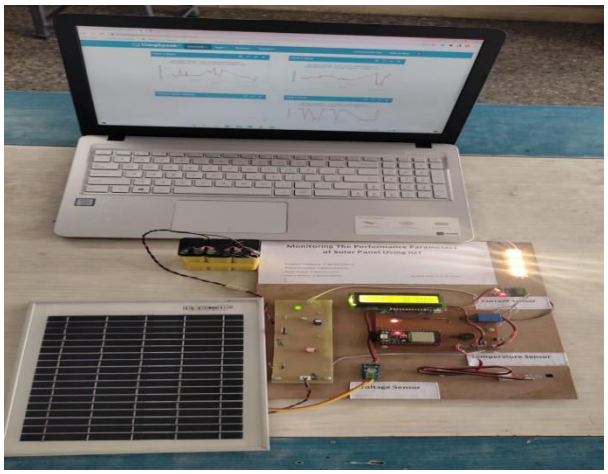

Fig: Hardware Setup

II. RESULT

Date/Time	Light intensity	Current	Voltage	Temperature
23/05/2022 12:28 PM	Low	70mA	1.62 V	33.70 °C
23/05/2022 12:30 PM	High	33mA	5.26 V	33.70 °C

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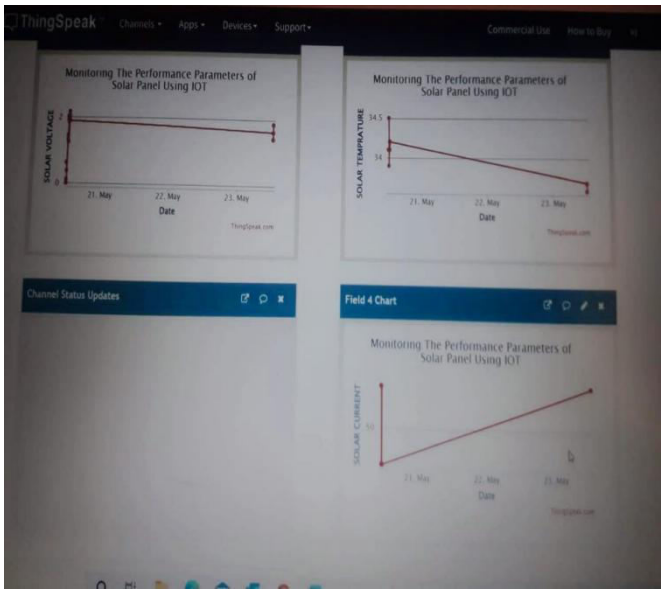

Fig : Thingspeak Output

Applications:

• View performance parameters in real time, get suggestions for improved settings, and eliminate power outages at remote areas.

• Facilitate remote troubleshooting of plants and firmware update and also program customization on site.

• This system Reduces costs associated with physical monitoring 24/7 while ensuring optimal performance.

• Analyze energy consumption and also power generation while continuously optimizing energy of solar use and reducing waste.

• Supervise the functioning of solar equipment components and determine whether they are in optimum condition or not.

• By installing the system, we can improve the power efficiency of (1) Solar water heating (2) Solar heating of buildings (3) Solar distillation (4) Solar pumping (5) Solar drying of agricultural and animal products (7) Solar cooking (8) Solar electricity generation**.**

Benefits:

- Gain highly interactive, real-time access to key performance indicators and accelerate alignment with business goals.
- View the energy information of all solar grids anytime, anywhere using the device of your choice.
- Transparent real-time visibility into key indicators of solar assets (such as performance degradation, downtime, health and warranty management).
- Get real-time updates on key events in solar power plants and gain operational, financial and environmental insights.
- Save money, time and energy.
- Easy to maintenance solar modules.

III. FUTURE WORK

This project can be further enhanced, by using the results of this current project, i.e., the monitored values obtained are helpful in predicting the future values of the parameters considered. Prediction of the solar energy will stored in the battery. Information stored in the cloud can also be analyzed using MATLAB software. The CSV file in the cloud is taken for analysis in R. Web applications can be developed to interact with the end user; The user can also predict future objective values. In the same way you can go for Android application. Two or more models can be used for the same dataset to find out the accuracy of each model during estimation.

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IV. CONCLUSION

In this project use IoT based system which is designed to get an optimum power output from the solar panels during dust is accumulated on it. and a monitoring system is designed for there is any malfunctioning of the solar panels will be displayed on and we can also get information about whether the solar or battery connected for the loads.

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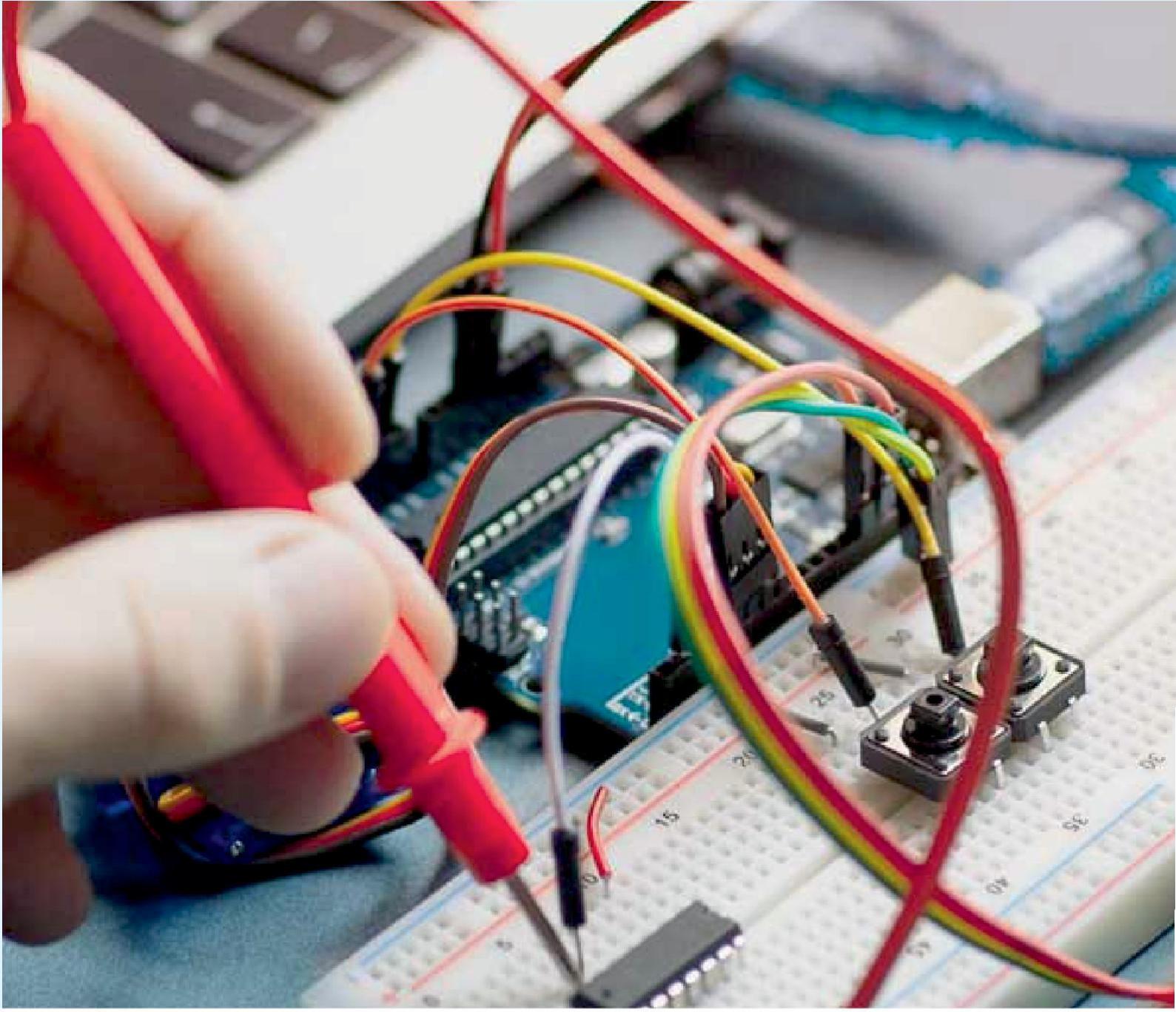

INNO SPACE
SJIF Scientific Journal Impact Factor

doi cross ref

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in Electrical, Electronics and Instrumentation Engineering

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