e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:04/Issue:06/June-2022 Impact Factor- 6.752 www.irjmets.com

IoT BASED SOLAR POWER MONITORING SYSTEM

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ABSTRACT

Solar power plants need to be monitored for optimum power supply. This helps retrieve efficient power output from power plants while monitoring for faulty solar panels, connections, 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 arduino based system to monitor a 10W solar panel parameters. Therefore, internet of things technology using sensors to monitor the parameters of the solar photovoltaic systems remotely from anywhere using smartphones and computers using web server. In order to achieve it here we propose a sun tracking technology to control the solar panel and rotate it so it absorbs maximum sunlight every instant. The system is based on a using a IoT monitors and controls the solar photovoltaic system remotely from anywhere around the world. The purpose of the project is to implement a system to continuously track the sun rays with the help of the solar panel and grasping the maximum power from the sun by checking the solar panel according to the sun rays direction with respect voltage sensor and current sensor.

Keywords: Ardunio, Solar power, IoT, Solar Panel, ThingSpeak.

I. INTRODUCTION

In today's world, electricity is one of the most basic needs in everyone's life. We need electricity for heating, lighting, refrigeration, transportation systems and all the home appliances. Day by day the energy consumption is getting rapidly increased whereas the energy resources are decreasing in parallel. Solar power has become very trendy as it is available in abundance and solar power generation is also cheaper in the 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 monitoring this system, we can know the status of it and also shows when there is a problem which is so helpful. The proposed system describes an IoT based solar power monitoring system. In this system the sunlight is converted into electricity by solar cells which are present in solar panels. Current voltage parameters are measured by using sensors and the values of current and voltage are shown on the LCD display.

II. METHODOLOGY

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 1. The experimental arrangement of the introduced system consists of solar panels, Regulator power supply, Wi-Fi module-ESP8266,

Voltage sensor, Current sensor, LCD (Liquid Crystal Display) and Arduino Nano microcontroller. Programming codes are developed on Arduino IDE, Embedded C.

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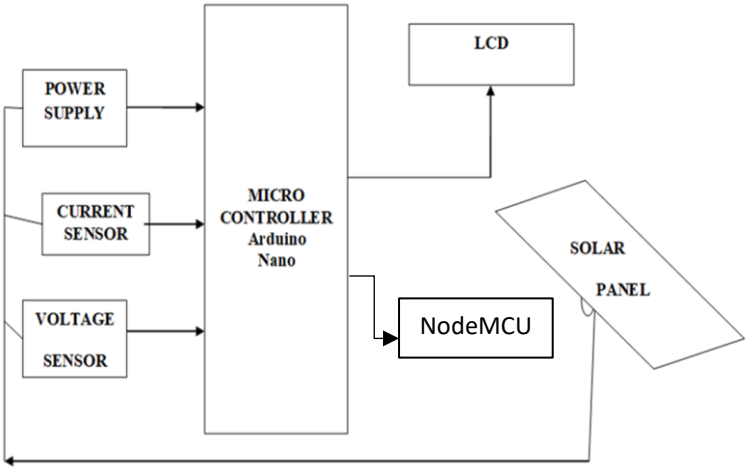

Figure 1: Block Diagram for Solar Power Monitoring System

Hardware Components Used:

1. Arduino Nano - Easy-to-use as hardware,software and able to read inputs.
2. LCD Display - To display Current and Voltage Values.
3. Voltage Sensor - Used to calculate and monitor the amount of voltage from Solar Panel.
4. Current Sensor – It is a device that detects and converts current to an easily measurable output voltage.
5. Solar Panel – Used to absorb the sun's rays and convert them into electricity or heat.
6. Battery - An Electric Battery that supplies a nominal voltage.
7. NodeMCU - Connect objects and data transfer using the Wi-Fi protocol.

III. MODELING AND ANALYSIS

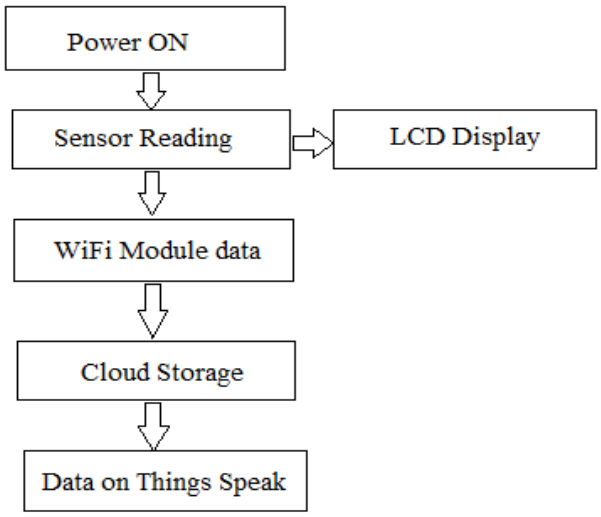

Figure 2: Flow Chart Process

The Method used in solar monitoring using IoT have several steps as described in the following flowchart fig 2 to caluculate solar position and move solar panel to position of sun. It reads the sensor value such as current and voltage. The value gets displayed on LED.

Power supply: Used the 9 volts transformer for continuous power supply. A.C transformer is giving the input to Bridge Rectifier. Bridge Rectifier converts A.C to D.C. After that we are using one filter capacitor 1000uf/25v electrolytic capacitor.

Sensor Reading: It Reads Voltage and Current Sensor values through Solar panel where Current sensor detects electric current in a wire and generates a signal proportional to that current and Voltage sensor can determine both the Ac or Dc voltage level.

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Wi-Fi Module Data: It is capable of hosting an IoT applications or offloaded all Wi-Fi networking functions from another application processor and it is wireless transceiver enables internet connectivity to embedded applications. It follow some functions like Networking, Data Processing, P2P Connectivity and Web Server.

Cloud Storage: It can store the data on internet through cloud Applications access cloud storage through traditional storage protocols or directly cloud storage vendors manage capacity, security and durability to make data accessible to your applications all around the world and need to access shared files and require a file system.

LCD Display: By using LCD the solar panel parameters,the voltage current and the power is displayed in real time.

IV. RESULTS AND DISCUSSION

The result of the project is the LCD can display the solar panel parameters of voltage and current in real time. The solar panel parameters are also displayed and stored in an application or web page using the think speak IoT platform. So that the solar panel can be monitored remotely. The result in the webpage is displayed in the form of a table containing the parameters with their unit with date and time. Each parameter is displayed in a graph with reference to time and date in the web server to analyse the data.

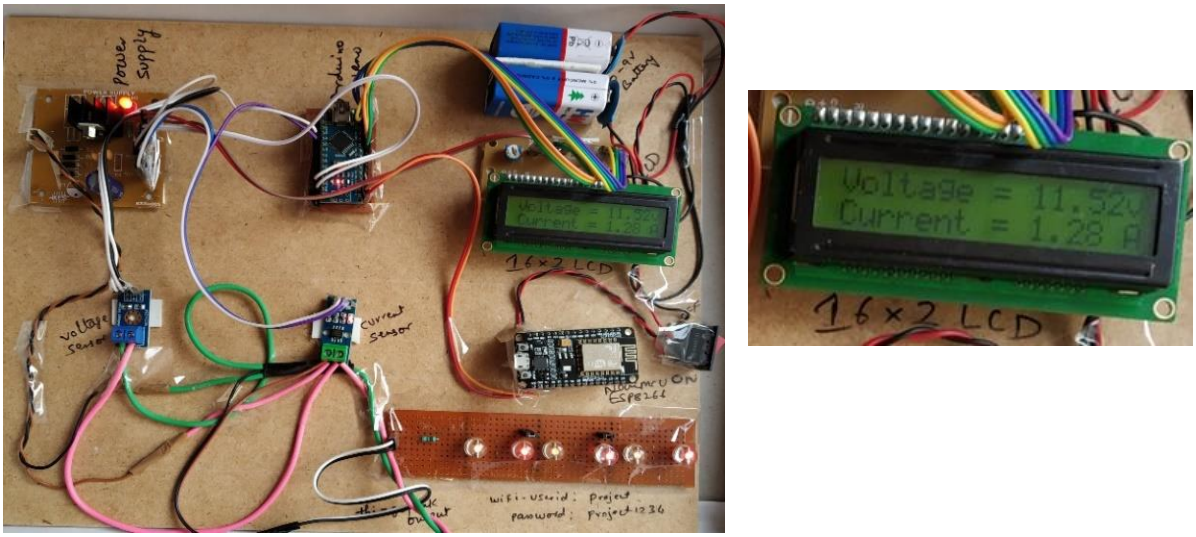

Figure 3: Result of IoT Based solar Power Monitoring System

Advantages:

- Solar Monitoring System withstand with Climatic conditions.
- Poor Power Quality with stability.
- Customization in Software and Hardware.
- Value to Money.

Disadvantages:

- Solar panels can be expensive.
- Solar power is used to charge batteries because the solar powered devices can be used at night time.

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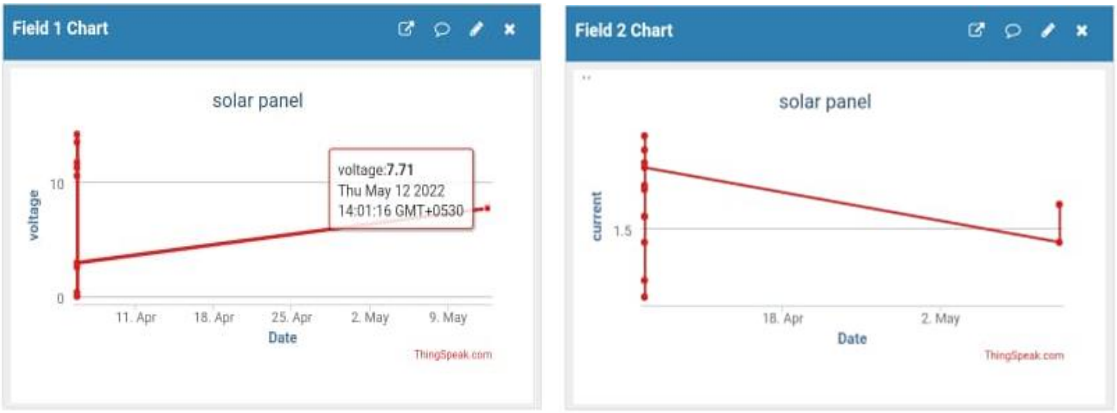

Figure 4: ThingSpeak Output

V. CONCLUSION

In this project we implemented a system which we can grasp the maximum power from the sun by continuous tracking and can use this energy for future purposes which is cost effective and easy maintainable and by using this analysis it is possible to detect any fault occurring in the system as there would be inconsistency in the data generated through system and by solar tracking the solar panel is operated at its maximum efficiency all day.

ACKNOWLEDGEMENTS

We are grateful to our guides Prof. B. GIRI RAJU and Assistant Prof. Mr. S. RAJENDRA KUMAR for their continuous support and guidance. Through their guidance, we were able to successfully complete our project. Sincere thanks go to Dr. P. SATISH KUMAR, Head of the department of Electronic and Communication Engineering at ACE Engineering College, for his support and time. We are very grateful to my family and friends for their constant support and encouragement during the project period.

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