International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 06 | June 2022 www.irjet.net p-ISSN: 2395-0072

# IoT-based Solar Energy Monitoring

**Preethi Sekar[1], Priya Sabde[2], Ganesh Patil[3]**

[1,2]*B-Tech Student & NIELIT*
[3]*Senior Project Engineer, NIELIT, Aurangabad (Maharashtra), INDIA.*

---

**Abstract -** *whilst the non-renewable power resources are dwindling, the usage of renewable resources for generating energy is developing. Nowadays sun power era is an outstanding option for utilizing natural belongings and we can also say that solar panel gathers sun power, and then converts that power into electric strength and stores it in a battery this power we will use on every occasion we wished. Proper here we're the usage of tracking, which offers easy facts about numerous solar parameters, fault detection, and related energy loss.*

*And we will tune all the crucial parameters of solar PV structures in real-time from our smartphones. The precept aim is to lay out sun power monitoring and share the information thru IoT. IoT is an era that permits clever gadgets to speak through the net.*

***Key Words***: IoT – Internet of things, PV – photovoltaic,iOS - iPhone Operating System, PCB - Printed Circuit Board.

## 1. INTRODUCTION

According to the International Energy Agency, Renewable energy will be the fastest-growing source of electricity in which the natural resource we get is solar power, it is the most available natural resource to generate electricity. In this project, we have made a simple solar monitoring system by using an ESP32 development board, where the solar panels are used for producing electricity, with the help of sunlight. The system is manually operated by human so, there is a need for an efficient approach that automatically control and monitor the current, voltage, and other parameters of the solar system and provides real-time statistics to users.

The aim is to design solar energy monitoring and share information through IoT. It consists of a charge controller with an ESP32 module, a voltage sensor, and a current sensor. When the ESP32 module is a controller integrated with Wi-Fi and Bluetooth support, where the sensor checks the conditions that are programmed and detects the output voltage and current.

### 1.1 Literature Survey

Jiju, k., et al: development of Android-based online tracking and manipulation of the device, for allotted Renewable power assets. On this, he defined how we can utilize the Bluetooth interface of Android pills or mobile telephones as a verbal exchange link. And additionally for replacing facts with the assistance of virtual hardware of the electricity Conditioning Unit.

Ersan KABALCI: Introduces tracking of a renewable power era machine this is constituted with solar panel arrays. And in which he explained the implementation of the tracking gadget, the tracking device platform is primarily based on modern and voltage measurements of each renewable supply, and the related values are measured with a sensing circuit, and the coded visible interface of monitoring software can manage the saved facts to research the values of each size.

### EXISTING SYSTEM

In existing devices each home tool isn't always interfaced with a records acquisition module this is an IoT object with a unique IP deal ensuing in a massive mesh wireless community of gadgets so it creates less privacy and security additionally in existing techniques the statistics acquisition machine on Chip (SoC) module isn't capable of collects power intake information from each tool of each smart domestic and transmits the information to a centralized server for further processing and analysis that's why this data from all residential areas isn't accumulated in the software's server as big facts so it becomes gives a less finest answer.

IoT-based smart power meter solves the problems of prepaid electricity metering by using minimizing the complexities and mitigates the non-technical losses with the aid of ensuring the credibility of facts. It also brings new essential features, which include real-time viewing of consumption statistics and far-flung control of home equipment. A single section static watt-hour meter is used to calculate the consumed energy and that information is extracted from the meter through a LED.

## 2. WORKING

PROCESS FLOW CHART

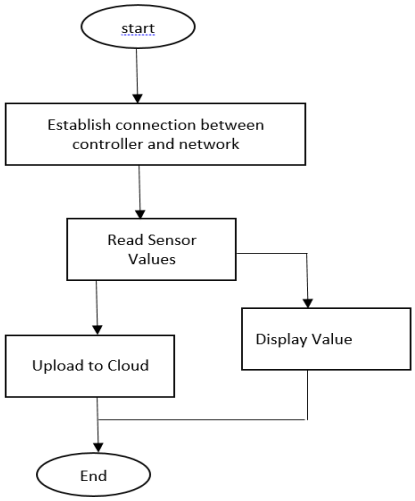


**Fig-2:** Flow Chart

The primary goal of this task is to layout solar monitoring devices and share the information through the IoT. In which the main object of work is the energy of the device can be monitored using the voltage, and the contemporary sensed using the ESP32, and the monitor of the solar power machine suggests power and energy usage.

The device is for designing the monitoring of solar energy, in which the solar strength enables the storage of the power in a battery. The Battery is the power which we can use as electrical home equipment.

On this mission, we're the use of the voltage sensor, represent-day or, ESP32, Battery, OLED show, charge Controller, buck Converter, and solar panel having 10W 12V. The sun panel voltage and cutting-edge are sensed by measuring voltage and cutting-edge sensor respectively. Similarly, the ambient temperature is sensed by means ofutilizing0 the Temperature sensor. The uncooked sensor facts from all of the sensors are processed with the aid of an ESP32 board and we have to calculate the electricity, electricity, temperature, voltage, and present day. The processed statistics then it's far sent to an OLED display for nearby monitoring and additionally to the cloud far-off. The faraway monitoring is executed through the Blynk app set up on a telephone which may be utilized by each android and iOS.

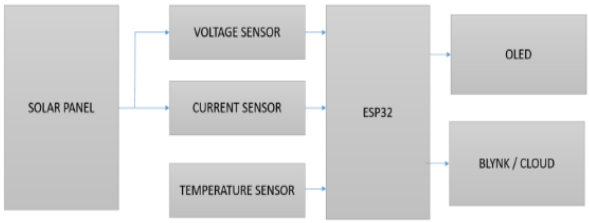


**Fig-1:** Block Diagram

MEASURING TEMPERATURE

We have used an external DS18B20 probe for measuring the ambient temperature. It uses a one-wire protocol to communicate with the microcontroller. One-wire devices need a pull-up resistor connected to their signal line to be properly read by our board. Here, we have used a 4.7k resistor as a pull-up resistor.

MEASURING VOLTAGE

ESP32's analog inputs can be used to measure DC voltage between 0 and 3.3V. The solar panel that we have considered can generate up to 12V. To read this voltage we have to step down the voltage which can be done by using a voltage divider network.

For a voltage divider circuit

Vout = R2/ (R1+R2) * Vin

Vin = (R1+R2)/R2 *Vout

The analog read () function reads the voltage and converts it to a number 0 to 4095. We are going to read the output value with one of the analog inputs of Arduino and its analog Read () function. That function outputs a value between 0 to 4095 which is 3.3/4095 for each increment.

MEASURING CURRENT

For the current sensor, we have used ACS712. The ACS712 current sensor reads the current value and converts it into a relevant voltage value, the value that links the two measurements is sensitivity. The output sensitivity can be obtained from the datasheet. As for the datasheet, the sensitivity is 200mV/A.

Current in amp = (ADCVoltage - Offset Voltage) / sensitivity.

INTERFACING OLED DISPLAY

To display the solar panel parameter locally, we have used an OLED to display. It uses a 12C bus to communicate with the ESP32. Two pins SCL (GPIO22), and SDA (GPIO21) in ESP32 are used for communication.

3.3V ---------->VCC

GND ---------->GND

GPIO21 -------->SDA

GPIO22 -------->SCL

( Here we are connected the VCC to 3.3V of DC voltage ESP32 of GND is connected to OLED of GND and the GPIO21 is connected to SDA and the GPIO22 is connected to SCL)

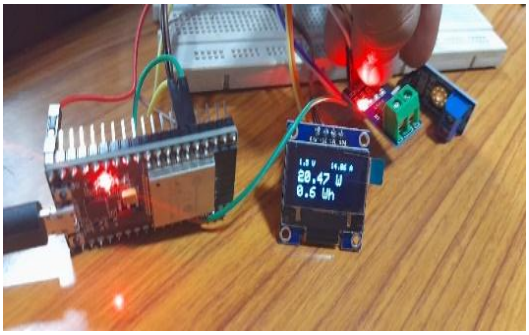

**Fig-3:** Hardware Output Display

In this project we are also using ESP32, where the GPIO34 is connected to the Analog pin of the voltage sensor, the GPIO35 pin is connected with the output of the Current Sensor, GPIO22 and GPIO21 pins are connected with the SCL and SDA of OLED display and the GPIO4 is connected with resister and data wire of temperature probe. Here we are using the charge controller, a solar charge controller used to keep the battery from overcharging by regulating the voltage and current coming from the solar panel to the battery. And the charge Controller is connected to the positive and negative terminal of the PV solar panel, the positive and negative terminal of a battery which is used in a project with the efficiency of 12V, another connection is with load and the buck converter is used to reduce the voltage. Which is connected with a charge controller, battery, and load .and the solar panel is connected with a charge controller with 10W and 12V.

SOFTWARE USED

-Arduino IDE

-Blynk App

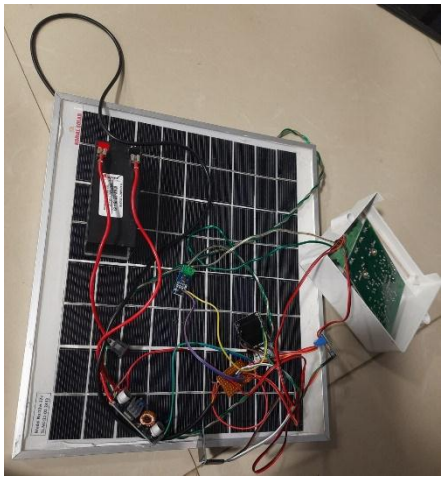

**Fig-4:** Hardware Setup.

## RESULT

The most performance of this assignment may be progressed via incorporating solar Trackers based totally on most energy point monitoring mechanisms (MPPT). The machine checks the location of the sun and controls the movement of a solar panel so that radiation of the sun comes commonly to the surface of the solar panel and MPPT sun fee controllers are created and inscribed with maximum strength factor monitoring algorithm to considerably boom the amount of present-day supplied to the batteries from the photovoltaic modules.

Any other effective way to screen the setup sun device in an actual-time situation is by way of including the statistics logging feature in this project. Because the middle of all strength tracking structures massive or small, the records logger is important to acquiring the vital records by the use of a collection of communications protocols that the related sensors might also rent. The information logger is a storage device keeping many files with the uncooked facts generated by the IoT primarily based solar electricity tracking device. The statistics (date, time, voltage, etc.) are recorded on an SD card and can be analyzed with a spreadsheet or energy BI software records equipment.

Cloud computing offers services in diverse structures along with sources, software, and statistics to the computer systems over the internet. Cloud computing offers sources and infrastructure as a supply with minimal fee rather than spending a whole lot cost of resources. The idea of Cloud computing is carried out on this undertaking through the usage of cloud software which includes Google cloud or Amazon AWS services.

## 3. CONCLUSIONS

In the end, the solar monitoring gadget using IoT has been established efficaciously on this mission with the monitoring gadget for the power produced through the sun strength assets. With the implementation of IoT, it has eased the monitoring technique from every other location by using the Blynk utility, suitable for both Android and IOS users. This solar PV monitoring device sooner or later will assist the customers to evaluate and predict the overall performance of the solar panel. The users can determine what predictive maintenance needs to be finished to ensure the solar PV gadget function smoothly and can supply non-stop power to the load. There are numerous tips of works that can be proposed for a higher result in the future: so that you can enhance the specific percentage of present-day analysis, it's miles recommended to degree the cutting-edge use of the clamp meter at some stage in the actual implementation of the solar PV machine in the fertigation machine. The monitoring gadget ought to be examined in the actual setting of the farming so that that analyzing of the parameters wanted can be acquired effectively. It is better to construct or put into effect more accurate sensors so the fee may be displayed successfully. The accuracy may be set by way of calibrating the offset value of the sensors.

For a better circuit method, it's far encouraged to design the circuit PCB to ease the relationship between the sensors with the microcontroller. Furthermore, with the PCB circuit, any blunders regarding the twine disconnection can be prevented.

## REFERENCES

[1] Kabalci, Ersan, Alper Gorgun, and Yasin Kabalci. "Layout and implementation of a renewable energy tracking device." power Engineering, energy and electric Drives (POWERING), 2013 Fourth worldwide conference on. IEEE, 2013.

[2] Jiju, k., et al. "development of Android-based totally on line monitoring and manipulate gadget for Renewable power resources." laptop, Communications, and control era (I4CT), 2014 international conference on. IEEE, 2014.

[3] Stankovic, John A. "studies guidelines for the internet of things." IEEE net of factors magazine 1.1 (2014): three-nine.