

## **Solar Energy Monitoring System using by IOT**

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### **ABSTRACT**

The Internet of Things has a vision in which the internet extends into the real world, which incorporates everyday objects. The IoT allows objects to be sensed or controlled remotely over existing network infrastructure, creating opportunities for pure integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. This technology has many applications like Solar cities, Smart villages, Micro grids and Solar Street lights and so on. As Renewable energy grew at a rate faster than any other time in history during this period. The proposed system refers to the online display of the power usage of solar energy as a renewable energy. This monitoring is done through raspberry pi using flask framework. Smart Monitoring displays daily usage of renewable energy. This helps the user to analysis of energy usage. Analysis impacts on the renewable energy usage and electricity issues.

**Keywords:** Renewable energy, IoT, Solar panels, Cloud, Remote monitoring.

### **INTRODUCTION**

The Internet of Things (IoT) is a system of related computing devices, digital and mechanical machines, objects, people with unique identifiers and potential transfer of data over a network without human-to-human or human-to-computer interaction. Physical objects those are no longer disconnected from the virtual world, but can be controlled remotely through Internet services. In this modern world, Electricity is also added to the most basic needs in everyone's life. The graph of energy consumption is getting increased day by day whereas the energy resources are diminishing parallel. In order to balance the scarcity for electricity, various sources are used to generate electricity. For the generation of electricity, there are two ways: one is by conventional method and other one is nonconventional method. Some of the energy carriers like fossil fuels and nuclear fuels are also used,

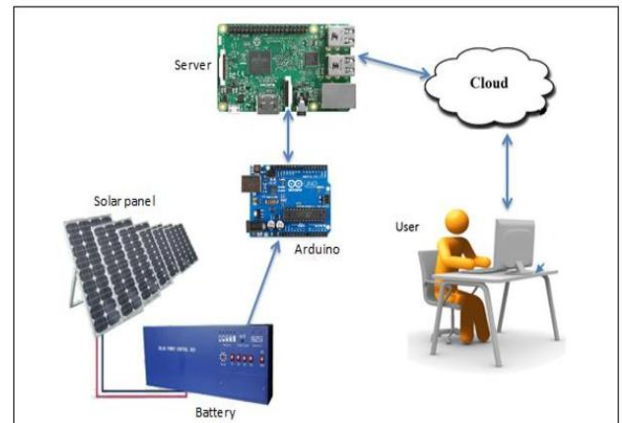
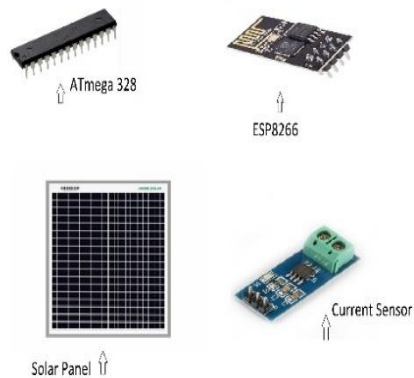
but they are not renewable resources (i.e., they are not ‘refilled’ by nature) and it is said to be non-conventional. In its broadest sense, sustainable power source can be achieved by using the solar power as source. The wide availability of solar energy has throughout the world. Even The sun has produced energy for billions of years. The sun’s rays may cat as an important source for the generation of electricity by converting it into a electric power. Such application is called as solar thermal energy, which is conventional. Even though various sustainable sources are available such as wind, rain, tides and geothermal, natural based bio fuels and conventional biomass, solar power have huge benefits.

Nowadays in India, frequent power cut is very common. For that it is primary to use the renewable energy and monitoring it secondarily. The rapid growth in renewable energy applications have been empowered by a critical drop in cost over the earlier decades and specialized change in their productivity, unwavering quality and lifetime. And by means that of monitoring the energy prediction, households and communities, the productivity gets increased.

In case of India’s development and economic growth, electricity plays a vital role. In energy consumption, India is the fourth biggest country after China, USA and Russia. The electrification rate in India is 64.5%, while 35.5% of the population still lives without access to electricity. Internet of things means that merely the network of Physical objects. This provides the connection of each and every object in the world by means of wireless sensor network. Some devices, buildings, vehicles and other objects embedded with software, network connectivity and sensors can enable these objects to collect and exchange data. This IoT (Internet of Things) is achieved by wireless sensor networks, sensor networks, 2G/3G/4G, GSM, GPRS, RFID, WI-FI, GPS, microcontroller, microprocessor, etc. Empowering advancements for the Internet of Things are considered and gathered into 3 classifications. They are,

- Advance that empower “things” to accept contextual information or Data.
- To process the relevant data, and
- Innovation to enhance security and protection.

Accepting the information and processing the relevant data can provide an understanding which is needed to build the “intelligence” into “things”. This is the highlighted feature that differentiates IoT from standard internet. The need for using IoT concept in this solar tracing system is to overcome the major disadvantages of electricity generation from the solar energy. The range of sun’s radiation that reaches the ground surface is not in a fixed value. Because the range may vary according to location, time and climatic conditions. For that the solar panel can be completely exposed to the sun’s radiation always. And hence the solar panel can be monitored by using Internet of Things. Among all techniques which have been studied for the solar panel tracking system by using IoT.



**Figure 1:** Methodology and Design of the System

## METHODOLOGY AND DESIGN CONSTRAINS

**System Design:** *Figure 1 is 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 Controller. micro controller which is used to read the sensor values. Current sensor and voltage divider are connecting to the micro controller.

### Controller:

#### ATmega 328

1. 131 powerful instructions – Most Single Clock Cycle Execution.
2. 32 x 8 general purpose working registers
3. Fully static operation.
4. Up to 20MIPS throughput at 20MHz.
5. On-chip 2-cycle multiplier.
6. Write/erase cycles: 10,000 flash/100,000 EEPROM.
7. Optional boot code section with independent lock bits.
8. In system programming by on-chip boot program.
9. True read while write operation.
10. Programming lock for software security
11. Two 8-bit timer/counters with separate preclear and compare mode.
12. One 16-bit timer/counter with separate preclear, compare mode, and capture mode.

13. Real-time counter with separate oscillator.

### **Solar panel**

Solar panel is of 12V. Solar panels are those devices which are used to absorb the sun rays and convert them into electricity. A solar panel is actually a collection of solar radiations, which can be used to generate electricity through photovoltaic effect.

### **ESP8266 module**

ESP32 module is a series of low-cost, low power system on a chip microcontroller with integrated Wi-Fi and dual-mode. It is an all-rounded chip for the development of IOT projects and embedded systems in general. it's very reliable.

### **Voltage regulator**

To step down the voltage of solar panel from 12V to 5V as all the components works on 3V-5V. It also helps for over current and voltage protection.

### **Voltage divider**

Normally voltage of 5V is measured by

Arduino channel so, to measure the voltage more than 5V Voltage Divider is used.

### **Current sensor**

ACS 712 current Sensor of range 20A is used to measure the current.

### **LCD screen**

It is used to display the monitored values of Voltage, current and power in Watt.

### **Cloud setup**

Cloud computing is the delivery of computing services—including servers, storage, databases, networking, software, analytics, and intelligence—over the Internet to offer faster innovation, flexible resources, and economies of scale.

### **Voltage sensors**

A voltage sensor is a sensor is used to calculate and monitor the amount of voltage in an object.

Voltage sensors can determine both the AC voltage or DC voltage level.

### **Main switch and load switch**

To ON/OFF the system and load respectively.

### **Load**

Incandescent bulb of 12V, 400mA is used as a load.

## LITERATURE SURVEY

Sr. No	Paper Name	Author	Advantages	Disadvantages
1	Implementation of Arduino Uno Based multi-agent for rural Indian Microgrids 2013	Purusthaman SRRD, Etal	1) Simple structure 2) Compactable	Storage Capacity
2	Design and Implementation of Renewable Energy Monitoring System 2013	Kabalci, Ersan, Alper Gorgun and Yasin Kabalci	1) Low cost maintenance 2) Saves Money	Limited Storage
3	Development of Arduino Based Online Monitoring Control System for Renewable energy Sources 2014	Jiju, K, Etal	Easy to exchange data	More complex control Methodology
4	An IoT Based Smart Solar Photovoltaic Remote Monitoring System 2019	Nilesh Chamat, Etal	1) Improved Specify 2) High Noise	1) Measures all of performance 2) Large size
5	Solar Power Monitoring System Using IOT 2021	Nehali datar, Etal	Advance and easy to use	More Objective

## BLOCK DIAGRAM:

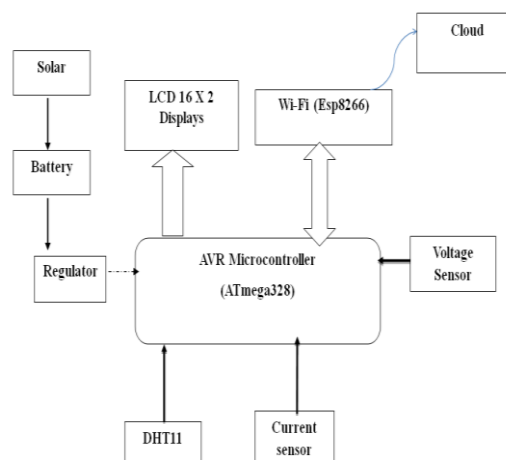


Figure 2: Block Diagram of the working System

## PROJECT OBJECTIVE

The objective of this proposed work is to Power of the system can be monitor using the current and voltage value sensed by the Controller. The monitor of the solar energy system shows the power and energy usage. This system helps to implementation of IOT for monitoring efficient solar energy.

## PROBLEM DEFINATION

The goal of this project is to design, simulate, develop the prototype for Solar Monitoring.

## SOFTWARE SPECIFICATION

- 1) Arduino IDE (Programming)
- 2) PCB Express (CKT design)

## HARDWARE SPECIFICATION

Controller ATmega328

Battery 12v

Regulator

Power Supply

LCD Display

Voltage Sensor

Wifi Module

Solar Panel

## IMPLEMENTATION

### Hardware Setup

Solar energy generated by solar panel we are connected to 12V battery. Voltage and current values sensed by Arduino through analog pins.

With these values, Arduino programing calculates Power, Energy, Temperature and Humidity.

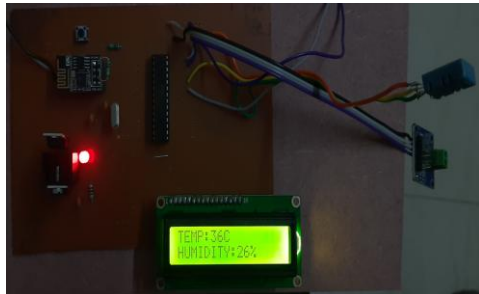
Further output is sent ESP8266 module through USB cable and Arduino is considered as the server.

The monitor displays the web page and could data.

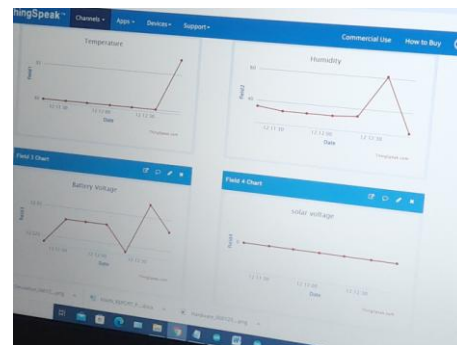
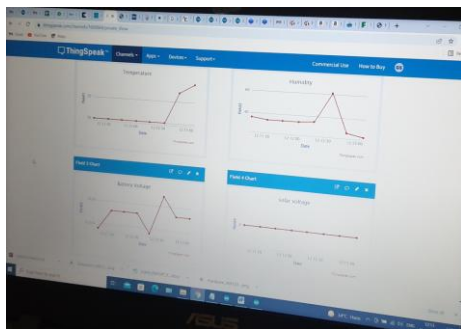
### Software Setup

The open-source Arduino Software is used in the system for upload the code on to board. The sensor and circuit are connected to the module for communicate with to sense voltage and current. We write the code in "C" for the sensing and calculating power and energy. We used web page of monitoring Data.

## RESULTS:



**Figure 3:** We observe the actual outputs of the sensor like Voltage, Temperature and Humidity



**Figure 4:** We observe the actual outputs of the sensor like. Battery Voltage also Observed.

Figure 3 and 4 are We observe the actual outputs of the sensor like Voltage, Temperature and Humidity of the sensor like. Battery Voltage also Observed

With help of C program monitoring data is uploaded to the cloud. ThingSpeak could is used in this project. It is an open source IoT application and API to store retrieve data in this cloud. We creation the social network of things with status update.

The result of the system is displayed on the web page in the form of Current in ampere, voltage in volts, Power in watts.

## CONCLUSION

Renewable energy sources are the non-conventional type of energy which can be continuously relished by natural process. The solar panel voltage generation is one among the

better solution for clean energy production by monitoring and controlling the voltage generated by our proposed system we could overcome the drawbacks of earlier proposed system. This topology allows us to power the load from solar panel with the available sun energy. This system has a low operating cost and finds its application in remote areas and also this method reduces the man power required.

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