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# IoT Enabled Solar Power Monitoring System

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**ABSTRACT:** Solar power plants need to be monitored for maximum power output. This helps regain economical power output from power plants whereas watching for faulty solar panels, connections, dirt on panels lowering output and different such problems moving solar performance. therefore here we've a bent to propose machine-driven an automatic IOT based solar power watching system that permits for automated solar power watching from anyplace over the online . we are using Arduino based mostly system to observe a 10 Watt solar array parameters. Our system perpetually monitors the solar battery and transmits the power output to the IOT system over the online . Here we've a bent to use IOT lizard to transmit solar power parameters over the online to the IOT lizard server. It currently displays these parameters to the user exploitation an honest graphical interface and conjointly alerts users once the output falls below specific limits. This makes remotely seeing of solar plants simple and guarantees the simplest power output.

**KEYWORDS:** Internet of Things (IoT), NODE MCU, Arduino, Solar panel, Things Speak.

## I. INTRODUCTION

Internet of things (IoT) is playing a serious and crucial role within the lifestyle of humans by enabling the connectivity of the many and most of the physical devices through internet to exchange the data for monitoring and controlling the devices from a remote location, where the devices become intelligent. This technology can connect a wide range and varieties of things such as animals, humans, smart transport, smart grids, virtual power grids, smart cities, vehicles, heart monitoring systems, environmental sensing, shopping systems, home automation, energy utilization, helping for disabled and elderly individuals, cochlear implants, tracking of things, equipment manufacturing, agriculture, emergency monitoring systems, electronics tool collections systems, vehicle control etc. according to the survey there is an increase of 30% i.e 9.2 billion internet connected devices from 2017-2018. In 2020, the connected device might be increased to 30 billion by 2020 and which makes the business market around 7.1 trillion dollars. By using the IoT we are capable of enabling the machine to machine communication M2M or device to device communication without human intervention. In the modern life electricity became the important and essential part of the life. For any work now, each day we require electricity like lighting, heating, refrigeration, cooling, transportation systems what not all the house appliance works on electricity. Nowadays the consumption of electricity is increasing at each instant. To compete with the demand of the public of electricity is to be generated and give to the end users. As the population increases the consumption also increases.



**II. LITERATURE OF THE EXISTING METHOD**

Many researchers had made many studies in this major problem and proved that 50% of the PV solar panels performance reduces by the dust accumulation on the cleaned panels.

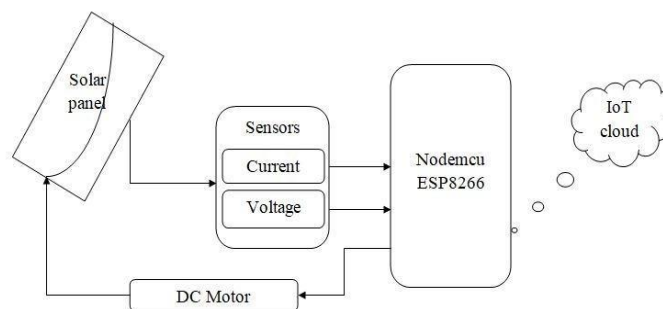


**Figure1: Solar module covered by heavy layer due to dust accumulation before cleaning.**

Due to accumulation of dust on the panels it is observed that useful energy is reduced by 30%. The common methods used for cleaning the dust is spraying water on the surface Of the panels with cleaning agent. Vibrating the panels with motors because the telephone vibrates in order that the dust pops from the panels. The dust jumps faraway from the panels by creating a charge . By employing a brush manual, we must clean the PV panels. Solar panel monitoring is important. It is very impotant that solar panels are monitored regularly. You need to form sure they're operating correctly, and therefore the system is generating the maximum amount as predicted. If you have solar panels installed at your or for any other place, you should at least check the generation meter once a week and must take a note of the reading . And should attend the place of the panels arranged and note the readings whenever . It is a manual checking procedure, always should attend the place of solar array system arrangement to notice down the readings. So, it's impossible to require readings all the time, whenever required should attend the place of system arrangement. And optimum power cannot be obtained due to no proper alignment of solar panel.

**III. PROPOSED METHOD**

The main objective of this project is to get an optimum power output from the solar panels during dust is accumulated on it. Also, if 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. The system detects and alerts the user or the administrator when is fall belowthe pre-define conditions, and display on the cloud. A solar array is employed that keeps monitoring the daylight In this technology, we get more power from solar energy and we uploading to the IOT cloud using Esp8266 In this method, we used Things speak cloud to see the output in graph manner The sensor also used to measure the power value of the solar plant.



**Figure 2: Block diagram of proposed method.**

#### IV. HARDWARE IMPLEMENTATION OF THE PROPOSED METHOD

The most conspicuous a part of a residential solar energy system is that the solar panels. Thin-film semiconductor or crystalline silicon is used make the P V solar cell for many of the residential applications. These photovoltaic (PV) devices contain semiconductors that generate electricity directly from sunlight. The electrical devices are powered, or it's send to the grid when electrons are made free by solar power in these materials. One of the foremost important aspects of getting your solar panels to supply electricity at optimum efficiency is keeping them fully and direct sunlight. DC voltage current is generated when the Photovoltaic solar panels are exposed directly to the sunlight. Solar panels generate the DC were the home appliance works on the AC power, so the output of the panels is given as input to the inverter. All the appliance works through the inverter. The inverter consists of a battery. The battery gets charges when the appliance isn't in used and gets discharged when requires the availability . Solar monitoring systems will track the quantity of electricity your solar panels have generated and contributed to the facility grid. For the sensing the light we have used a light dependent resistor is component varies the resistance with the light intensity that fall on it and can different a night and eachday There are many potential ways of monitoring solar panels. There are high tech solutions which upload data continuously to an internet portal which allows you to watch your systems performance from anywhere within the world. In this proposed system we have an open source cloud platform application things speak is used. Which retrieves and stores the info from the sensor or the items connected to the systems through internet that uses hypertext transfer protocol (HTTP) from the local network to the cloud. It updates all the info logs received from the sensors, tracking location applications, and therefore the status application giving to the users and brought from the users. To use this the user has create an account which contains different channels for monitoring of different parameters in the system or in the monitoring the parameters in a remote device. This cloud enables the administrator or the user to visualize the data in graphical representation. With internet-based monitoring, energy output data is transferred to a router, making it available through a web interface. The main advantage of systems like these is that your solararray output information is quickly available anywhere you'll get an online connection The node MCU acts as a key processing element for the proposed system as shown in figure 4 and figure 5 which is developed by ESP8266 open source community of micro-controller on single board that can be programmed using the Arduino IDE having a RAM size of 128Kbytes and program storage capacity of 4 Mega Bytes. It can be powered by a USB cable, having a operating voltage of 3.3 to 5 volts and an in built Wi-Fi SoC Architecture.

##### 1.Arduino

The digital and analog input/output pins equipped in this board can be interfaced to various expansion boards and other circuits. The Serial communication interface is a feature in this board, including USB which will be used to load the programs from computer.



Figure 3: Arduino.

##### 2.ESP8266 WiFi Module

ESP8266 Wifi module is generally used to establish the wireless communication between the devices. But this module is not capable of 5-3v logic shifting and will require an external logic converter.



Figure4: ESP8266 WiFi Module/ Node MCU.

### 3.Solar Panel

The electricity generated by capturing the sun light is called as solar energy which is used for business and home purpose. The natural nuclear reactor is sun which releases the energy with tiny packets called photons. The atoms lose the electrons when the photons hit the solar cells. A solar panel is made of multiple panels that wired together, more electricity is generated by the more panels we deploy. Silicon like semiconductors are used to make the PV photovoltaic solar panels. Direct Current is generated by the solar panels. Most of the electrical appliance works on AC supply can be less expensive for transmit to long distances.

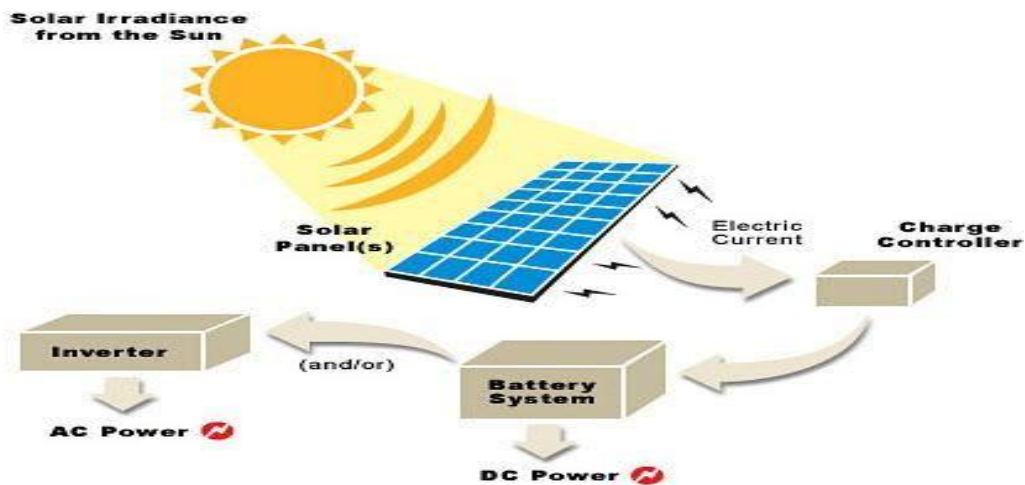


Figure 5:Solar Energy Conversion.

## V. THINGS SPEAK CLOUD SETUP IOT PLATFORM

An open source cloud platform application things speak is employed which retrieves and stores the data from the sensor or the items connected to the systems through internet that uses hypertext transfer protocol (HTTP) from the local network to the cloud. It updates all the info logs received from the sensors, tracking location applications, and therefore the status application giving to the users and brought from the users. To use this the user has create an account which contains different channels for monitoring of various parameters within the system or within the monitoring the parameters during a remote device. This cloud enables the administrator or the user to see the info in graphical representation. With internet-based monitoring, energy output data is transferred to a router, making it available through a web interface. the most advantage of systems like these is that your solar array output information is quickly available anywhere you'll get an online connection.The data from the various solar panels are collected by Internet of Things and it shares the knowledge to the address specific needs. The IOT platform like Thingspeak, and cloud platform can take the useful information and ignore other information. By using this information can detect the faults, and reduce the matter before they occur. Information by the connected sensors like voltage sensor and current sensor wont to decide perfect decisions supported real time information which reduces the cash and time. Solar monitoring



systems works through our system inverters. Many companies offer solar inverters with properties for monitoring with software setup. To convert DC current into AC current solar inverter is employed in home appliances, information about power level and production is gathered and send to cloud-based monitoring systems and their related apps. LCD is employed to display the worth of voltage and current obtained within the solar array. The knowledge are often accessed in several ways by the user through mobile apps and paired smart home devices.

## VI. RESULTS

In this project IoT based system is meant to urge an optimum power output from the solar panels during dust is accumulated thereon. And, a monitoring system is meant for there's any malfunctioning of the solar panels are going to be displayed on and that we also can get information about whether the solar or battery connected for the loads. It now displays the parameters using cloud to the user using things speak and alerts user when the output falls below specific limits. A solar array is employed that keeps monitoring the daylight. Here different parameters like voltage, current and temperature are displayed cloud by using IOT technology.

## VII. CONCLUSION AND FUTURE SCOPE

In this paper, we proposed a system which can smartly monitor and control the solar power station functionality with the help of Arduino Uno controller. In this paper, the sensed data will fed to the cloud server of IoT platform; the data will analyze and display on dashboard of the IoT platform. It has several advantages the gather data on cloud can be used to find the better solution in terms of optimizing the power generation; it would also prevent the system from damage using email or sms alert. The data can be accessed with authentication and security at any time any place. This system has a disadvantage that it cannot provide the reliable connectivity; ESP8266 WiFi module provides us limited range and bandwidth. In future scope we can use better communication protocol which will provide reliable internet connection, so that we can get the data time to time, it also helps to monitor the multiple solar power station remotely.

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