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Solar Power Plant Monitoring and Maintenance System using IoT

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Abstract-Monitoring of the solar power plant is needed to obtain the optimum output power. This efficient output power plants while monitoring for connections, the accumulation of dust or any other faults in solar panels affects the solar performance by lowering by the output IoT based the solar power monitoring system allows the solar monitoring and check whether there is the problem in the solar panel connection by lowering the output to find the problem occurs in the solar panel. The AT Mega controller used to monitors the parameters in the solar panel. They monitor the solar panel and transmit the output to the IoT Thingspeak transmits the solar power parameters in the Thingspeak server. The parameters are displayed by using GUI and when the output falls below the specific limit it alerts the user, there is the problem in solar panel connections or any dust particles on the solar panel. This makes the monitoring of the solar panel easier and ensure the best power. Blynk is a platform with an android app to control arduino. It's a digital dashboard where by simply dragging and dropping widgets one can build a graphic interface for work.

Keywords:-Solar energy, photovoltaic panel, arduino microcontroller, internet of things, power measurement and electricity.

I. INTRODUCTION

Current situation the energy deficiency problem faced by the world countries are urging researches to find alternative energy source that would complement the conventional fossil fuel. Solar energy is taken from sun in that form of heat light.

This energy is essential for life on earth. It is a renewable resource that is pure, economical, and less pollution compared to other resources and energy. Solar energy is the energy generated by harnessing the power of the solar radiation. Solar energy is energy produced by sun (solar energy has a fixed orientation to the sky) solar power plants need to be monitored for optimum power output.

The power output of solar panels are unable to extract the maximum when it's oriented perpendicular to the direction of the sun rays as both the area of illumination of sunlight on solar panel and intensity of sun rays is maximum in this case.

This retrieve efficient power output from power plants, while monitoring faulty of PV cells connections and dust accumulated on cells lowering output and other such issues affecting solar performance.

Solar we propose an automated IoT based solar power monitoring from anywhere over this internet. We can use Arduino parameter because Arduino boards are relatively inexpensive compared to other microcontroller.

The Arduino is based Atmel's ATMEGA8 and ATMEGA168 microcontrollers. Our system constantly monitors the PV cells transmits the power output to IoT system over the internet. Then we use IoT to transmit solar power parameters over internet.

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II. METERIALS AND METHODS

On this phase, we gift the device layout of the solar power the monitoring gadget herbal of the solar monitoring protection gadget.

Microcontroller based the layout the technique of the automatic solar tracker is developing the overall gadget, the hardware, and software quantities of the venture. The PV mobile tracker alter the path that the PV panel is dealing with consistent with the position of the sun inside the sky.

By using maintain the panel perpendicular to the solar, extra daylight moves the sun panel, the much less mild is reflected and more energy is absorbed. That power may be transformed in to the energy.

III. SYSTEM DESIGN

The proposed the device is for monitoring solar electricity using IoT the solar panel facilitates to shop the electricity within the battery. The battery has the energy which is beneficial for electrical appliances. Is four sensors voltage, contemporary, dirt, and the depth sensor that's linked with Arduino in addition to the bread board Arduino microcontroller can be used to read the sensor values.

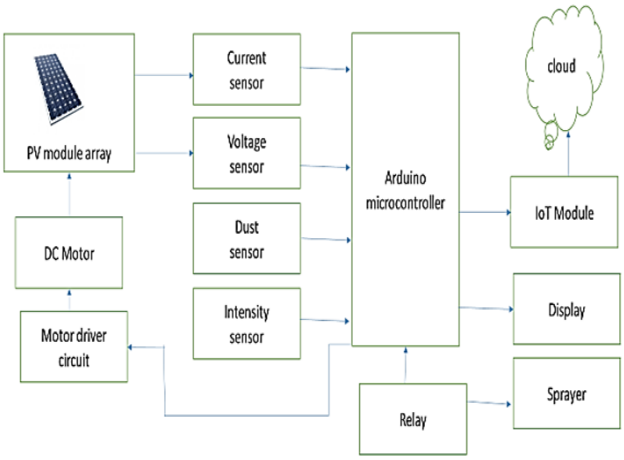

Fig 1. Block diagram.

1. Arduino:
Arduino has been used which abates the programming complexity. Arduino initiatives may be stand by myself, or they can communicate with the software going for walks for your laptop (e.g. the flash, processing Max MSP). Open supply physical computing platform primarily based on a easy microcontroller board.

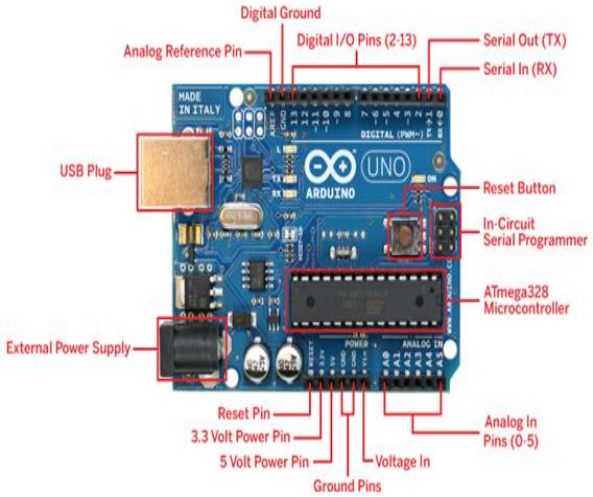

Fig 2. Arduino.

2. Voltage and Current Sensors:
This sensor is used to calculate and decide the AC or DC voltage stage. The input of this switches analog voltage sign, a present day sign an audible signal and so forth. The estimation of these sensors can depend on the voltage separator.

A contemporary is a tool that find out electrical modern-day in a twice and produces a signal proportional to it. it can be then applied to display the measured present day in an ammeter or can be saved similarly analysis in a statistics acquisition system or sensed can be utilized for control cause.

The sensed present day and output sign can be

- AC current input
- DC current input

3.Intensity Sensor:
The mild devices is a non-resistant tool that converts this "light power "whether visible or in the infra-crimson components of the spectrum into an electrical sign output. Light sensors are more commonly called "photoelectric devices "or "image sensor "because the convert the mild energy into power.

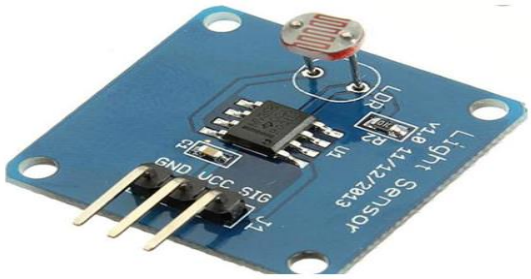

Fig 3.Intensity sensor.

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4. Dust Sensor:

Fig 4. Dust Sensor.

Dust sensor is small in size and can detect dust and smoke particles in the environment. It consumes very little power while it's running, making it ideal for an always-on monitoring system. The sensor has a tiny six-pin connection interface, it comes with a connector when you usually buy it.

5. IoT Module:

IoT is a community of physical gadgets with embedded electronics that gather and proportion records". The assessment of modern-day and voltage are checked and sent to the IoT module, at that point the IoT module stores the modern also ,voltage analyze with records and time.

IoT gadgets proportion the sensor data they accumulate through connecting to an IoT gateways or other side device. Those devices communicate with different related gadgets and behave at the data they acquire from each other. It is a growing time powerful than current techniques for far flug checking shape for photoelectric solar cellular.

The work consists of faraway checking structure supposed to photoelectric sun cell. This module is utilized for far flung checking the photoelectric solar mobile. The current and voltage evaluation of PV are estimated with the assistance of present day and voltage sensor. These yields are in easy facts compose, so it changed over into automatic form using analog to superior converter. The estimated information are given to the MCU.

The microcontroller sends the planned records to the IoT. The internet of things is the gadget of physical equipment which empowers these modules to partner and exchange information. The fundamental reason for this assignment is to display the PV and setting away the statistics in the container. Along this traces from, this venture, we can productively display screen the photo voltage forums remotely and put away the deliberate records. The microcontroller unit reviews are shared to the IoT.

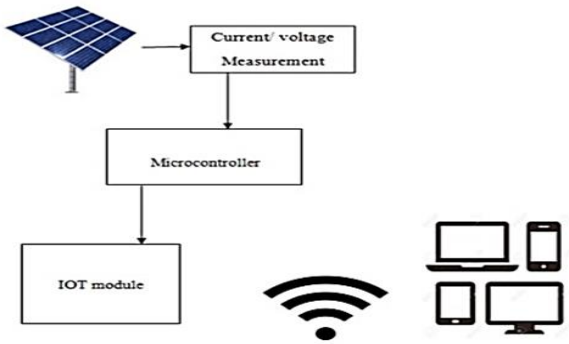

Fig 5. Structure of panel monitoring using IoT module.

The connectivity networking and communication eagerly depend on the specific IoT application deployed.

6. Cloud Setup:

Cloud can offer the opportunity of storing records about the each day energy intake. Thing speak is an open source IoT software and API to store and retrieve data from things the usage of neighborhood place network or net. Aspect communicate allows the advent of sensor logging programs, area tracking programs and a social internet of factors with station updates. The cloud has constructed in functions in it which constitute the values in form of graphs. Multiple submit operations are accomplished on records over cloud and cell utility also access the records from cloud.

IV. IMPLEMENTATION

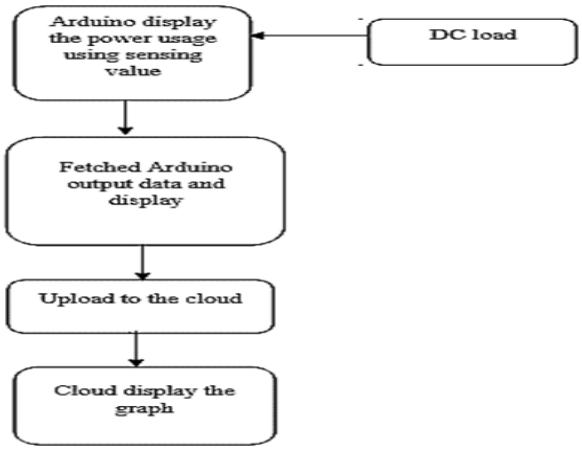

Fig 6. Flow chart.

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V. WORK FLOW

Figure.5. represents the process of proposed system from load to the monitoring system. The work flow of the solar energy monitoring system is presented in the form of step below.

- **Step 1:** Arduino show the capacity usage using sensed Values through current sensor and voltage divider.
- **Step 2:** Fetch the Arduino output data through serial port and display.
- **Step 3:** Arduino sends the monitoring data on to the Cloud.
- **Step 4:**Cloud display the data in the form of graph, which is visible to the entire user.

VI. HARDWARE SETUP

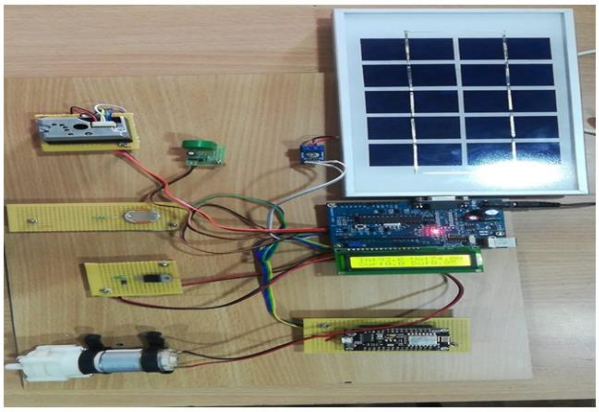

Fig 7. Hardware kit output.

Figure.6 indicates the hardware framework our challenge device. The solar electricity stored in battery by way of PV is DC modern.

One terminal of the bulb is hooked up to the battery for power supply. Different terminal is connecting to the cutting-edge sensor for present day reading. Breadboard is used for the complex circuit to construct. It additionally allows to construct voltage divider.

VII. RESULTS AND DISCUSSIONS

The result of the system is displayed on in the form of current. In Amber, voltage in volts, power in watts and energy in watt-hours with respect to data and time. The monitoring data send to the cloud are store in a separate fields. Each field displays the individual graph as shown figure no 7.

Fig 8. Blynk app output - Monitoring page in intranet.

Fig 9. Current, voltage and power energy graphs.

VIII. CONCLUSION

The necessity of energy is rising every day. And traditional sources of energy are not producing enough to meet this graph. This exponential need also effects on electricity cost and human lives. Internet of things revolutionizing human lives in every field of life.

Photovoltaic board is not established source of energy that may fulfill the need with energy. In this paper, an IoT based approach for monitoring the solar power consumption is presented and a prototype is developed to simulate the results.

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IX. FUTURE WORK

Fabrication of Microcontroller using ASIC concepts: The number of wires can be significantly decreased by rightly if a customized PCB is built upon which all the resistors can be directly soldered. This also removes the use of a Breadboard which was utilized to make all the external connections.

Design Improvements: With the current design, it can be view that the controller orbit goes round along with the board. This was over to eliminate tangling of wires. An inch, better design may be realized in which only the panel rotates and all other parts are stationery mounting of the Panels: In our design the panels are mounted on a horizontal shaft supported strongly at both ends.

We can mount the panels directly onto a motor placed at the center of the Panel-Base in order to provide East-West movement. This reduces the weight and effective cost of the project.

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