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Solar Tracking And Fault Detection Of Solar Panels Using IoT

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Abstract - This project presents an open hardware or software test bench for solar tracker and fault detection .The suggested prototype runs a dual axis sun tracker and fault detection on an Arduino Uno, an open source prototyping platform with user-friendly hardware and software. It is built on a solar tracker, which rotates automatically to follow the sun using four LDR sensors and two servo motors. Solar power facilities need to be watched over for optimum power output and to find the problem's origin .This helps to assess the solar plant's efficiency in terms of power output while keeping a look out for dust accumulation and loose solar panel connections that lower the panels' power output. We suggested
a technique to locate panel imperfections and tracking.

Index Terms: IoT And Blynk Cloud, solar tracking, fault detection.

I. INTRODUCTION

Since solar energy is widely accessible worldwide, it can help reduce reliance on imported energy. The earth receives enough sunshine in 90 minutes to provide all of the planet's energy needs for a year. During operation, solar photovoltaic systems produce no greenhouse gases and no other pollutants either. According to the International Energy Agency, renewable energy sources are anticipated to expand as a power source at the quickest rate due to their technological advancement and financial sustainability. (IEA). However, the need for energy continues to grow globally.. Physical objects are able to be controlled remotely using Internet connections, allowing for constant monitoring of solar panels to meet the rising need for electricity. Compared to nuclear power plants, solar panels produce 300 times more hazardous waste per unit of energy. For remote PV structures, an IoT-based cloud fault detection solution based on the Arduino and node MCU is suggested and built. A microcontroller and the Blynk app are used to monitor the fault and tracker operation intelligently to ensure efficiency development. This article describes an Internet of Things-based intelligent defect detection and tracking system for solar power. The main objective of this proposed project is to maximise solar panel power generation through monitoring and tracking in order to obtain maximum power throughout the day. Also, the condition of the solar panels will be revealed, and attributes like voltage and current are tracked and shown using IoT technology. Solar radiation is used to illustrate this paradigm. In solar radiation, sunlight from the sun is captured by solar panels, which then capture sunlight and transform it into usable energy sources like heat and electricity. After that, sensors like voltage sensors, which employ the voltage divider, are used to keep an eye on the electrical energy generated.This system makes use of technologies such as the Cloud and the Internet of Things (IOT) to accomplish its goals. Every device should be connected to the internet and any other necessary technology, according to the "internet of things" movement's core element. The data produced by Internet of Things devices can easily be transferred to the cloud and then provided to end users over the internet.

II. LITERATURE SURVEY

There are two methods for producing electricity: one makes use of renewable resources, the other does not. Coal, natural gas, and other fossil fuels are examples of non-renewable sources, while the sun, wind, and tidal energy are examples of renewable sources that can all be recycled. Hence, solar energy is thought of as an unbreakable power source. An Internet of Things-based solar fault detection and tracker system is being developed to address the problems caused by a lack of electricity and to increase efficiency . Due to its accessibility and lowered cost in terms of conversion technology, solar energy has grown in popularity. This process, known as the photovoltaic effect, converts light energy into electrical energy and is referred to as solar energy. Solar energy will increase production and reduce pollution.

III. HARDWARE

This section provides a description of the model's intended layout and design. The next section provides an in-depth look at the model and all of its constituent parts.

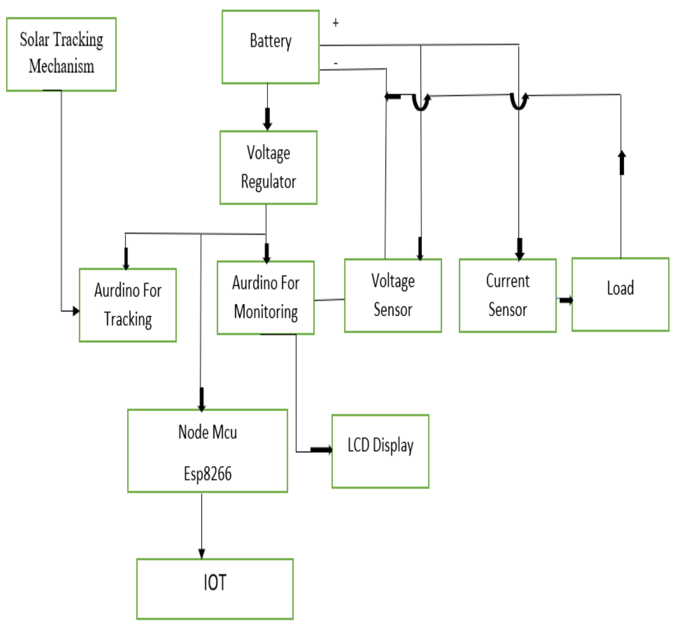


Fig.1. Block Diagram solar tracking and fault detection

A. Arduino UNO-328

The microcontroller that is built into the Arduino Uno board was developed by an organization known as Arduino. This open-source and freely available microcontroller platform for electrical projects is mostly based on the AVR Atmega328. Six analogue input pins and 14 digital I/O ports are included on the most contemporary Arduino Uno board, which also has a USB connector. Users can connect the board to a variety of different electrical circuits using these ports. Six of the I/O ports, out of a total of 14, may provide PWM output. It enables the designers to control and see any electrical equipment that is deployed in an outside area in real time.

B. LDR'S

An LDR is known by several various names, including photo resistor, photocell, and photoconductor. It is a specific form of resistor, and the amount of light that strikes its surface affects how much resistance it has. Light striking the

resistor causes the resistance to change. These resistors are widely employed in circuits where detecting the presence of light is necessary. These resistors have a wide range of applications and resistance.
The LDR, for instance, can be used to turn on a light in the dark or turn it off in the day. Typically, a light-dependent resistor will have a resistance of 1 Mega Ohm in complete darkness and a resistance of a few kilo Ohms in complete brightness.

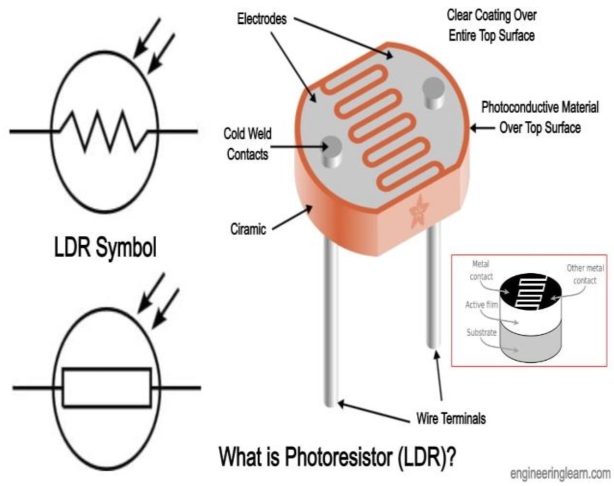


Fig 2. LDR sensor

C. Node MCU

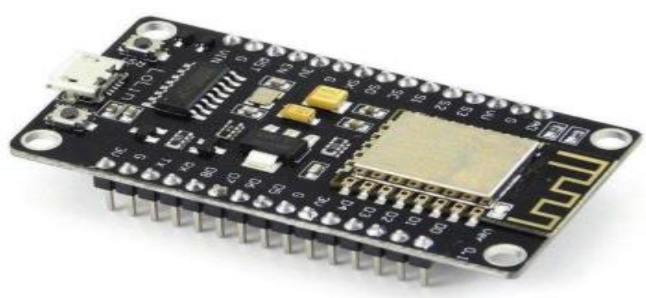


Fig.3 Node MCU

The Node MCU Wi Fi microcontroller unit comprises an embedded Wi Fi module. The board is built around an ESP8266 Wi Fi Module and an Arduino microcontroller. The ESP8266 Wi Fi Module is a self-contained system-on-a-chip (SoC) that can connect to your Wi Fi network and features an integrated TCP/IP protocol stack (or acting as an access point itself). Support for over-the-air (OTA) programming is one of the Uno Wi Fi board's most crucial features. This might be used to transmit Wi Fi firmware or Arduino sketches.

D. Solar panels

The figure represents ways PV (Photovoltaic) solar panels are used to transform solar light energy. Several individual solar cells that are formed by combining layers of silicon, phosphorus, and boron make up solar panels.

Fig.4. SOLAR PANELS

These panels gather photons from sunshine and mix them with the panel's electrons to produce energy that may then be used for a variety of purposes.

E. Arduino IDE

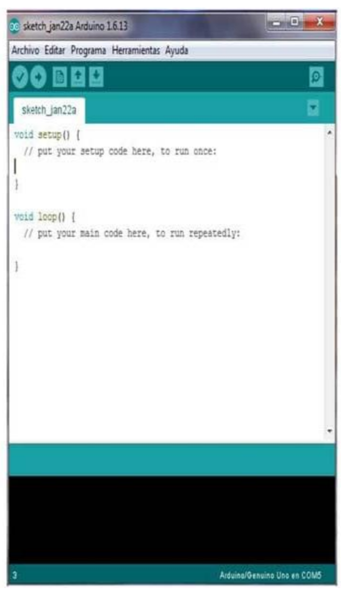


Fig.5. ARDUINO SOFTWARE

The Arduino Integrated Development Environment (IDE), sometimes known as the Arduino Software (IDE), has a code editor, a message area, a text terminal, a toolbar with basic action buttons, and a menu system. It connects with the Arduino hardware and uploads programs to it.

F .Voltage Sensor

The voltage supply is tracked, calculated, and determined using this sensor. Whether the voltage is AC or DC can be determined using this sensor. Voltage signals may be used as the sensor's input, and switches, analogue voltage signals, current signals, audio signals, etc. may be used as the sensor's output. While some sensors just output sine or pulse waveforms, others can generate AM (amplitude modulation), PWM, or FM (Frequency Modulation). The voltage divider could have an impact on the readings made by these sensors.

G. Current Sensor

Every system can readily measure voltage at any point without influencing the system's functionality, making it a "passive" activity. However, present measuring is "intrusive" because it necessitates the insertion of a sensor, which raises the possibility of having an impact on system performance.

In many power and instrumentation systems, current measurement is crucial. In the past, circuit protection and control were the main purposes of current sensing. Yet as technology has developed, current sensing has become a way to keep an eye on and improve performance. There are several applications where knowing how much current is being provided to the load might be helpful.

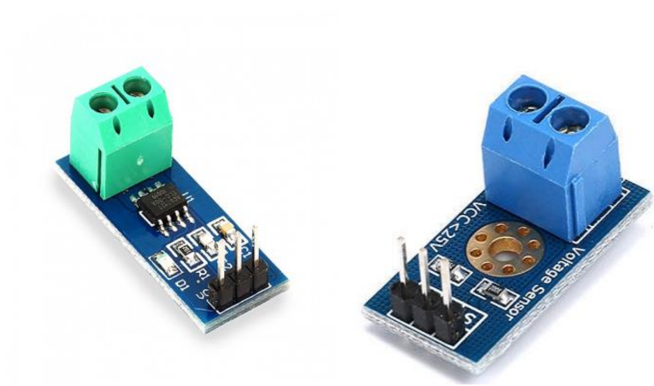


Fig.6&7. CURRENT & VOLTAGE SENSORS

H .Voltage Regulator

A system created to automatically maintain a constant voltage is known as a voltage regulator. Negative feedback or a straightforward feed-forward architecture can be used in a voltage regulator. It might make use of electronic parts or an electromechanical mechanism. It may be used to control one or more AC or DC voltages depending on the design.

Electronic voltage regulators are used to stabilise the DC voltages used by the processor and other components in devices like computer power supply.

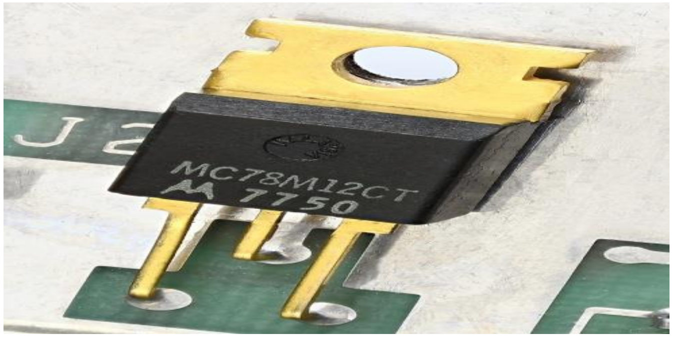
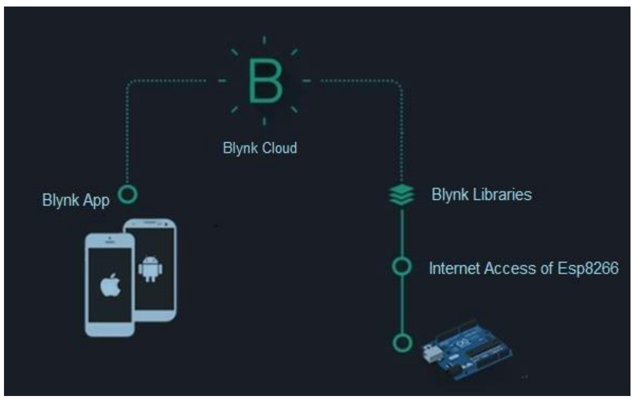


Fig.8. VOLTAGE REGULATOR

I.Blynk cloud



With the help of the Internet of Things platform Blynk, users with iOS or Android smartphones may control gadgets like the Arduino, Raspberry Pi, and Node MCU from a distance .To create a graphical interface or human-machine interface, you can build and deliver the correct address on the various widgets using this programme. (HMI).

IV. PROPOSED SYSTEM

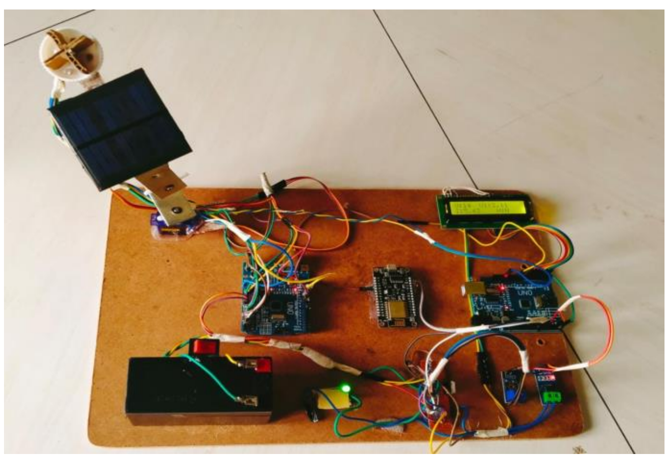


Fig.9. Proposed flow diagram

V. WORKING

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The solar tracking mechanism communicates with Arduino to determine the light intensity using sensors such light dependent resistors. The tracking mechanism then automatically points towards the sun based on the light intensity. We achieve maximum power output throughout the day by directing the panels in the direction of the sun using vertical and horizontal servo motors that respond to LDR signals.

.In this case, we employed four LDRs, two of which were used as the top left and right and two of which were used as the bottom left and right .Current and voltage sensors continuously monitor the generated voltage and current. Voltage regulator provides the power source for the kit's sensors and devices. The load is connected to the current sensor.

The load is in series connection with the current sensor .The voltage rating of solar plates, which is 2V, is an example of a pre-setting value that is dumped with code in Arduino. When a generated voltage value falls below a predetermined value, the LCD display indicates the health of the panels with a "F." (fault) further show the voltage and current of the fault as shown in below.

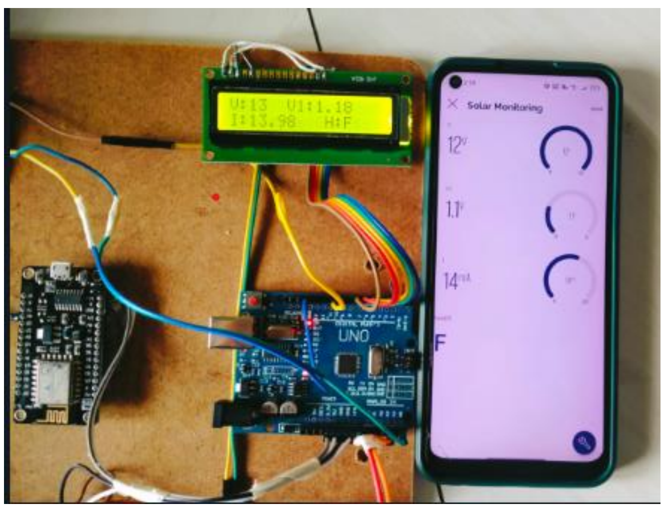

Fig.10 Circuit diagram at fault condition

The state of the panels is represented as "N" (no fault) on both the LCD display and Android mobile app displays, as illustrated in the diagram below. If the generated voltage is above the pre-setting value, then there is no concern.

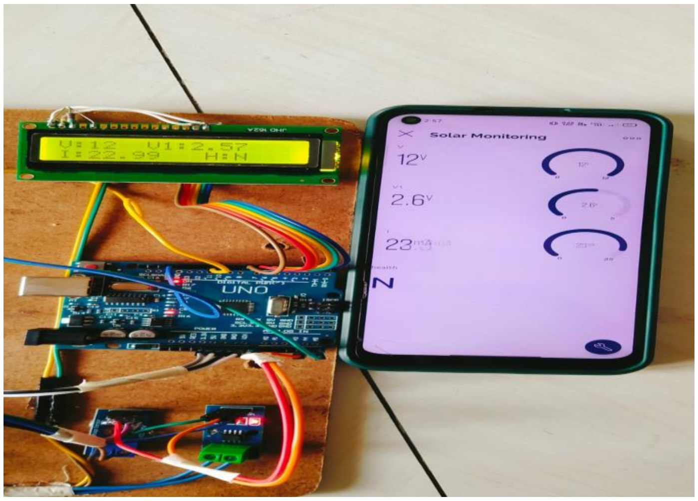

Fig.11 Circuit diagram at healthy condition

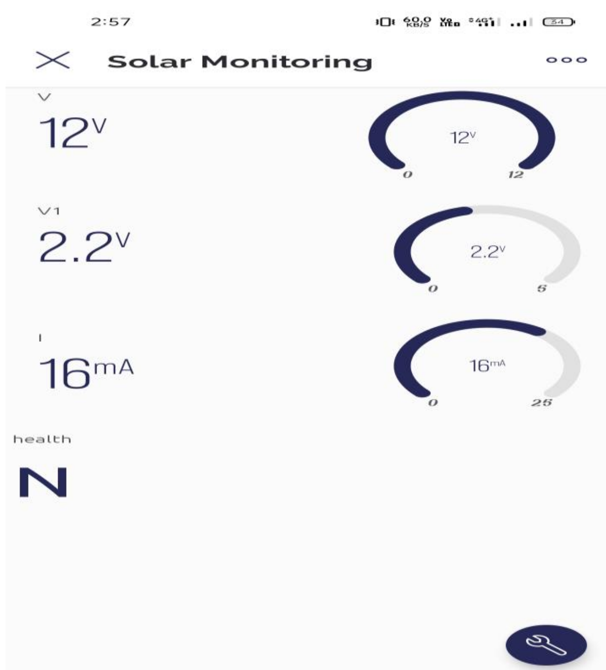

Fig.12. Figure showing the Monitoring data sent to server

VI. ADVANTAGES

- A moving solar panel can produce 40% more electricity.
- More adaptability, which enables a higher energy output on bright days.

- A higher level of directional pointing accuracy.
- Identify solar system issues as they arise by sending you a notification when performance is declining.
- Keep track of your electricity consumption.
- Calculate and estimate your electricity savings.
- Increased performance, regular maintenance, time savings, and increased effectiveness.

APPLICATIONS

- Solar tracking.
- Solar power generation plants.

VII. CONCLUSION

The solar panels are placed at an angle towards the sun by a solar tracker. It is a sophisticated sun-monitoring device that has the ability to rotate the panels to follow the sun's path across the sky. It makes it easier for the panel system to capture the most sunlight and maximise energy output. The use of a solar energy tracker has numerous benefits.

A solar energy monitoring and fault detection solution is crucial when it comes to solar power systems if you want to keep your system producing effective results. You get access to useful data insights when you monitor the functioning of your solar system and look for faults. The appropriate solar monitoring system for your solar array must be installed. It is quite dependable and aids in reducing energy consumption in general.

VIII. REFERENCES

[1] Naga Venkatarao K, Vijay Kumar K. An IoT Based Smart Solar Photovoltaic Remote Monitoring and Control Unit. International Journal and Magazine of Engineering, Technology, Management and Research. 2015;5:457-65.
[2] Basuvaiyan S, Rathinasabapathy V. IoT based Solar Photo Voltaic Monitoring System. National Convention of Electrical Engineers 2017, 24-25 November 2017. National Institute of Technology Trichy, Trichy: 2017:
[3] Adhya D, Saha D, Das A, Jana J, Saha H. An IoT Based Smart Solar Photovoltaic Remote Monitoring and Control unit. International Conference on Control, Instrumentation, Energy & Communication. 28-30 Jan. 2016 Kolkata, India: 2016.
[4] Solar tracking system by International journal of sustainable engineering.January 2016.
[5] Naga Venkatarao K, Vijay Kumar K. An IoT Based Smart Solar Photovoltaic Remote Monitoring and Control Unit. International Journal and Magazine of Engineering, Technology, Management and Research. 2015;5:457-65.