REPORT

An IoT-based solar power monitoring system is described in the following section. Solar panels in this system contain solar cells, which in turn transform sunlight into energy.
Utilizing an Arduino, Sensors are used to measure the properties of current voltage.
On the LCD display, the current and voltage readings are displayed.
An IoT device is also connected to the sensors, allowing for remote network monitoring of the metrics that are presented on the display.

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1. Proposed System

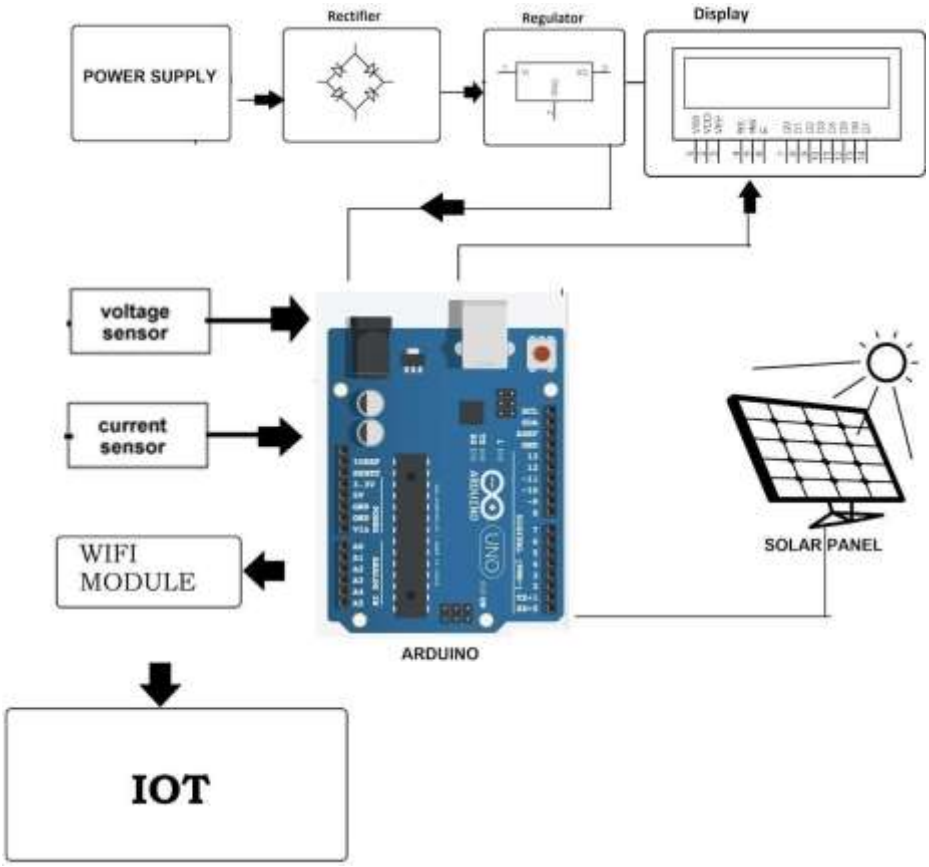


Figure 1. Block diagram of proposed System.

- The primary goal of this project is to maximize the solar panels' power production.
- Any issues with the solar panels' performance will be indicated, and IoT technology is used to monitor and display characteristics like voltage and current using sensors.
- Sunlight from the sun is caught by solar panels, which subsequently convert the sunlight into useful energy forms like heat and electricity. The electrical energy is then measured by sensors, such as voltage sensors, which use the voltage divider concept to measure the voltage produced by the solar panel and compute current using math.

The experimental arrangement of the introduced system consists of

1. Solar panels,
2. Regulator power supply,

3. Wi-Fi module-ESP8266,
4. Voltage sensor,
5. Current sensor,
6. LCD (Liquid Crystal Display)
7. Arduino Uno microcontroller.

- Programming codes are developed on Arduino IDE, Embedded C.

1. Hardware description

1.1. Arduino Uno

- It is a board for a microcontroller that uses an ATmega328P chip. Uno means One.
- With the use of a USB cable, the Arduino IDE (Integrated Development Environment) can handle the Arduino Uno's 6 analogue I/O pins in addition to its 14 digital input/output pins, which may be connected to a variety of different circuits.
- The Arduino Uno has a Power Jack, a 16MHz crystal oscillator, and a reset button.
- It requires 5 volts to work.
- All of the features necessary to support the microcontroller are present.

Figure 2. Arduino UNO.

Figure 3. Solar Panels

1.1. Solar Panels

- Solar panels, also known as PV (Photovoltaic) panels, are used to transform the light energy from the sun.
- Solar panels are composed of several separate solar cells that are created by layering components like silicon, phosphorus, and boron.
- These panels take in photons from the sun and work with the electrons already there to produce power that can be utilized for a variety of things.

1.2. Regulated Power Supply

- It is an embedded circuit and it comprises of a rectifier circuit that changes an AC supply into a DC supply.
- It gives a gadget that requires a fixed power source a constant voltage.
- Output might be alternating or unidirectional, the output obtained from the regulated power source is always close to DC (Linear power supply).
- This includes a step-down transformer, rectifier, DC filter, and regulator also.

Figure 4. Regulated Power Supply.

1.3. WI-FI Module

- This is a self-contained SoC microchip with a TCP/IP protocol stack that enables access to a Wi-Fi network for any microcontroller.
- It has sufficient storage and on-board processing to communicate with other sensors and devices.

- This module can't shift logic from 5V to 3V, hence an external logic level converter is needed.

Figure 5. Wi-Fi Module.

1.4. Voltage Sensor

- A voltage sensor is a tool that can detect different electrical signals.
- This sensor is used to both monitor and calculate the amount of voltage that is obtained in an object. Detecting and measuring AC or DC voltage levels are its main uses. This sensor receives voltage as an input, and its output options include switches, analogue voltage signals, current signals, etc.

Figure 6. Voltage Sensor.

1.5. LCD Display

An LCD (Liquid Crystal Display) is an electronic display module which is commonly used in various devices and circuits to display the data. The LCD display used in this system is shown in figure 7. Generally, an LCD works by blocking the light. We are using a 16x2 LCD display in this system. A 16x2 display consists of 16 characters and 2 lines. LCD is a formation of both solid and liquid. It uses liquid crystals to produce a visible image on the screen.

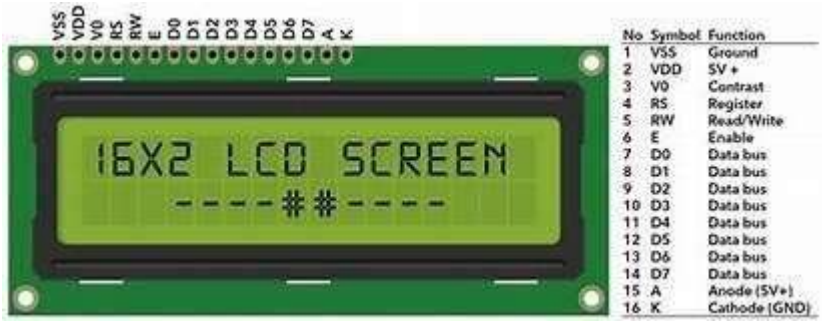


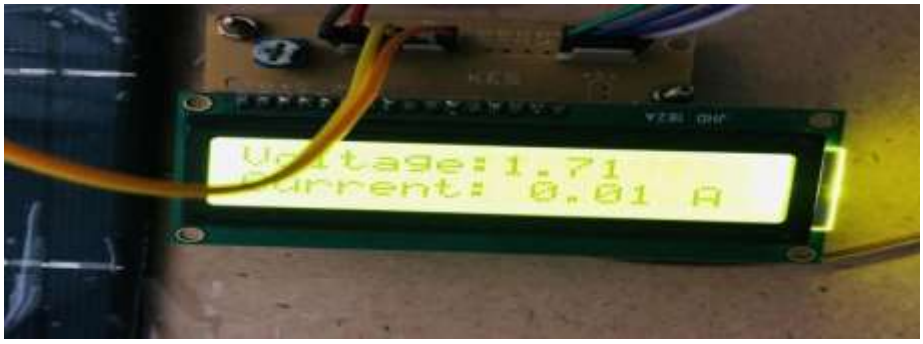
Figure 7. LCD Display.

2. Result

- Figure 8 displays the proposed system's operational model.
- To get the most output power from the solar panels, an IoT-based solar power monitoring system is created in this project.
- Sensors are used to capture the current and voltage parameters when solar panels convert light

energy into electricity.

- With the aid of IoT technology, the received voltage and current are displayed on the LCD screen.
- We may examine the readings on our mobile device by connecting to the Wi-Fi network because the sensors are connected to a Wi-Fi module.
- The readings or data are immediately updated on our mobile whenever they change.
- We can monitor the performance of solar panels using IoT technology, and there may be a possibility to identify the issue when anything goes wrong.



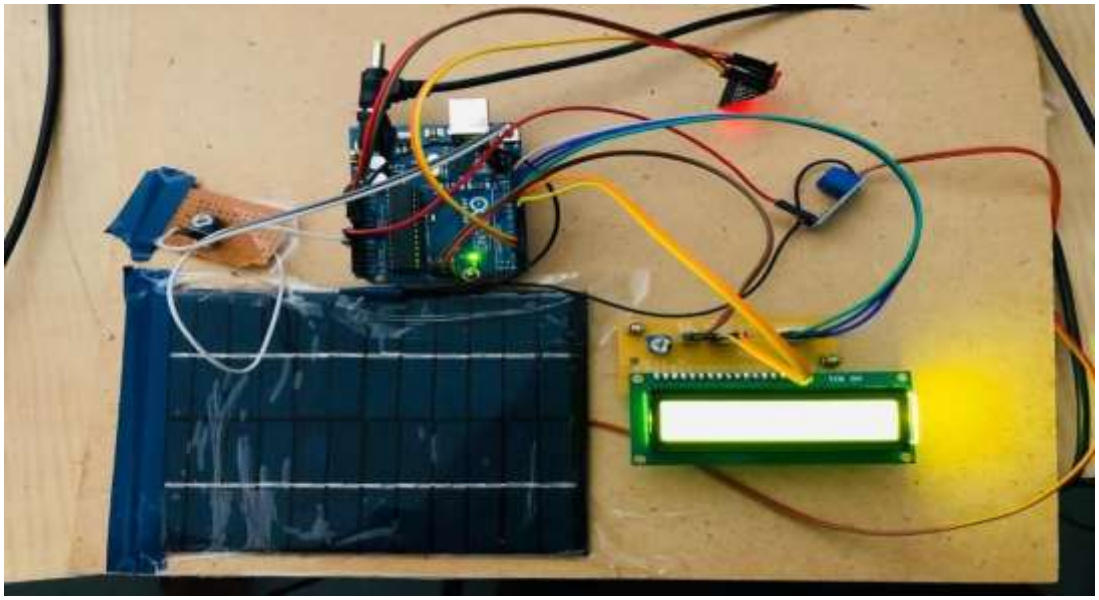


Figure 8. Demonstration of the proposed System.

3. Conclusion

The suggested approach continuously updates the voltage and current parameters by storing the most recent data.

Continuously monitoring the solar photovoltaic system makes it simple and straightforward to perform a daily or monthly analysis.

If the generated data is ambiguous, it is also feasible to find any flaws in the system by keeping an eye on the solar panels that are working to their full potential.