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PV SOALR PANEL GRID AND BATTERY VOLTAGE MONITORING OVER IOT

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Abstract: The internet of things is a new technology that has the potential to significantly improve our everyday lives. It lowers living expenses by automating manual operations. It utilises the internet to connect physical items and gadgets for coordinated communication. As the price of power is now over the roof, we need some sources that can generate electricity organically and for free. Here, solar power plants and panels are used to generate electricity from the sun's energy. These devices employ photovoltaic cells to turn solar energy into electricity. Most solar systems are set up in rural or agricultural regions where there are currently no reliable electrical sources. These systems are run manually by people. Hence, an effective method that automatically regulates and keeps track of the current, voltage, and other solar system characteristics while giving users access to real-time information is required. This research study suggests an Internet of Things (IOT)-based method for tracking solar power use and enabling mobile monitoring and management of solar plants. As solar power facilities are often constructed in remote areas that the general public cannot access on a regular basis, this method enables users to virtually operate their systems from a distance.

Keywords— **Solar System, Power Monitoring, ConsumptionMonitoring, Internet of Things, Cloud**

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I. INTRODUCTION

The Internet of Things (IOT) is a cutting-edge technology that allows a machine to be sensed or controlled remotely with the aid of a cloud server [1]. Nowadays, technology is employed in every aspect of life, automating routine tasks, facilitating data flow between humans and machines, and monitoring or manipulating physical objects remotely from a distance [2]. It affects a wider range of physical and digital items, machines, people, animals, etc. [3]. All of the functions of a person's machines, robots, or other IOT-based devices are accessible to them. IOT links a wide range of objects together, including automated homes, smart cities, smart automobiles, monitoring systems, smart road lighting, shopping systems, and more [4]. IOT makes it possible for machines to behave independently, meaning they won't need to rely on people to carry out their tasks any more [5]. Today, the world is run by electricity, and we are powerless without it. Every aspect of everyday life needs electricity, including home lights, refrigerators, heaters, coolers, transportation, etc. [6]. The generation of electricity should be raised as well as the demand for it as time goes on. Yet, power is not generated in sufficient quantities to fulfil demand in our nation or other emerging nations. The majority of individuals cannot afford the rising cost of power. We need a really effective technology that can generate power from natural resources in order to solve this issue. To address these problems, solar power plants

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have been built. Yet, appropriate energy generation and consumption is still a problem with solar power facilities. Effective methods for monitoring, managing, and controlling solar panels are also required. In places with no economically viable electric power, these solar plants serve as a source of light [7]. This energy source is among the finest since it does not hurt either people or other living things or the environment [8]. These solar power plants use photo voltaic cells, which transform sunlight directly into energy when it strikes them. These solar panels are linked to batteries, which store energy and subsequently deliver it to homes, industries and schools [9]. Some solar power plants have been constructed close by and are readily accessible, while others of these plants have been erected in places where people cannot regularly visit to monitor plant activity [10]. So, this research study aims to develop a highly effective IOT-based solar power consumption and monitoring technique that allows users to monitor the operations of these solar plants while seated at remote locations. Solar power facilities must be frequently inspected to see if they are operating effectively. In this study, a prototype is created to put the suggested approach into practise and confirm the findings from the system's real-time monitoring of solar plants. With a mobile application, the whole functioning, utilisation, energy, heat, etc. is shown. In order to upload these parameters to the cloud, Arduino is utilised as the system's primary board to govern charging and power use across the whole system [11]. For the purpose of storing and transmitting the real-time statistics, we employed Adafruit cloud services [12].

IOT warmly welcomes new, developing technology platforms [13]. The prototype alerted the user when the battery was full and could not store any more power [14], allowing the user to adjust the system as necessary.

The remainder of the essay is divided into four parts. The second section reviews the literature to highlight pertinent research and important solar system elements. System design is detailed in section three with the use of a block diagram and the system's operational flow. This section also provides an illustration of the experimental setup. Graphs are used in Section 4 to describe the experimental findings. The study is concluded in Section 5, which also outlines possible future possibilities.

II. LITERATURE REVIEW

There is a need for certain non-conventional resources that can be utilised forever since the traditional sources of power are running out. Solar power systems are one of the sources. By turning sunlight into energy, this system generates and supplies power. The batteries deliver previously stored electricity when there is no sunshine to convert solar energy into electrical power. These IOT-based PV systems are the newest technology that will enhance solar system monitoring [2]. [4] suggests another cheap IOT-based PV system. They employed a low-cost microcontroller that would receive all of the information from the PV system together with a GPRS module. IOT is frequently used in the electronics industry. This system monitors the PV system's current and temperature. A webpage is used to access the system's data. The solar power panel is one of the non-conventional energy resources, and now that the price of contemporary technology has dropped dramatically, these solar power systems are relatively affordable and widely available [12]. However in order for individuals to successfully track and regulate these systems, frequent monitoring is required. Monitoring techniques and data loggers are crucial to the efficient operation of solar systems. These techniques allow us to gather all system-related information prior to more serious harm. Another research [3] offered a raspberry pi-based IOT-based solar power system with component integration. Also, this system offers ongoing data online. The data logger logs information on voltage, current, humidity, and temperature. Another cloud-based solar system monitoring method that sends continuous records via cloud after a certain amount of time was suggested by Kishore et al. [15]. By watching the power plant continuously, it becomes simple to analyse the present state of the solar system. The advantage of analysis is that it aids in locating or identifying potential system flaws and keeps a close check on output from a great distance. Another environmentally beneficial solar system was presented by Rakesh et al. Electricity generation is continuously tracked and updated in the server [7]. Every nation is turning to the solar systems as a result of the global lack of renewable resources, and scientists are working hard to make them effective. In order to illustrate the solar system and keep up with the rapidly advancing technical landscape, Abilash et al. [16] examine the operation of photovoltaic cells in great detail. The performance of the solar panels in terms of energy usage is also impacted by dust on the panels. In this research, a system is proposed that provides a technique and solution for tracking dust buildup on solar panels [1]. This technology keeps track of the dust that builds up on solar panels and prevents radiation from reaching them. The LDR sensor and NodeMCU in this setup are used to check for dust. For the optimum performance, solar power facilities should be routinely inspected. The parameters of the proposed research system are controlled by an AT mega controller. This technology uploads parameters to the cloud while continually monitoring solar plant performance [17]. Another system is given by [10], and in this system many solar panel metrics, including intensity, current, voltage, temperature, and power, are monitored. To measure the light intensity, they utilised an Arduino UNO controller with LDR censors. She uses the ACS712 and LM35 to measure the load current. All of the parameters are then presented on an LCD after that.

III. SYSTEM DESIGN AND EXPERIMENTAL SETUP

The whole amount of energy generated by the solar panels is continually analysed in our suggested method. The system's sensors perceive the environment, and Arduino analyses the sensor data to determine various metrics. It includes a Wi-Fi module that facilitates attaching a mobile device [18]. All of these characteristics have been uploaded to the cloud, and the user may access them whenever they want [19].

Figure 1 shows a block diagram of the suggested method, which combines a microcontroller chip with all necessary sensors, parts, and statistical analysis software. The Arduino is equipped with 4 sensors that detect the many elements that affect the whole system. The battery is connected to these sensors, and the solar panel is connected to the battery. Using an LCD display, Arduino further connects to the ESP8266. The procedure of the whole system is shown in a flow diagram in figure 2 below. An internet connection is first established before Arduino is started. If the connection is successfully made, the system will continue; otherwise, it will provide an error message. After a successful internet connection, an IP address is established, the input from the solar panel is then accessed, and the sensors linked to the panel transfer the input to the Arduino microcontroller [20]. The first data is processed by Arduino and sent through the cloud. These metrics are shown on the LCD screen, uploaded to the cloud, and accessible to users through mobile applications.

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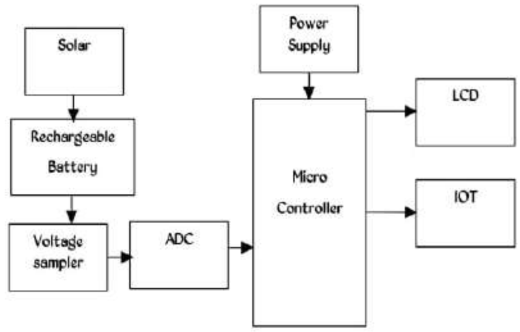


It is an advanced board for integrating different sensors and devices for automation [21]. It has a total 54 pins for the input/output in digital form, 16 analog inputs, a 16 MHz crystal oscillator, 4 UARTs, a USB connection, an ICSP header, a power jack, and a reset button. It has everything needed to support the microcontroller, just connect it to the computer with a USB cable or power it with an AC-to-DC adapter or a battery to get started.

SOLAR PANEL

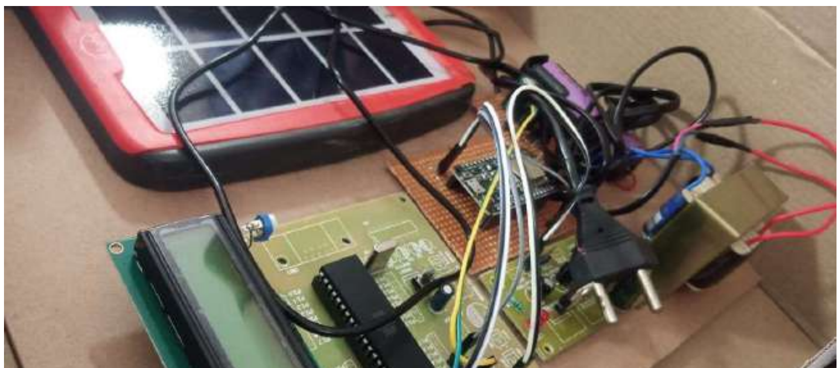
It is made up of solar cells. These PV cells transform solar radiation into electrical energy when sunlight or other solar radiation strikes them. These PV modules produce electricity by using photons from the sun's light. It is subsequently supplied to homes, workplaces, etc. and stored in batteries. We utilise certain sensors to account for the fluctuations in the sun's radiation [22]. Fig. 5. Batteries are used to store energy generated by solar panels, which is then used to power appliances.

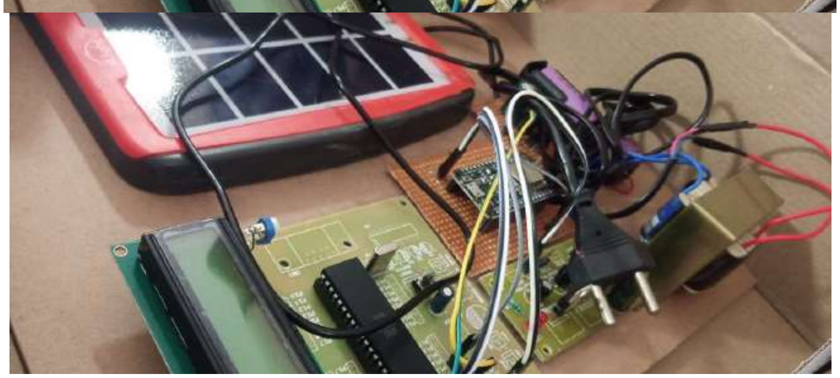
Microcontroller 8052: The 8052 has all the same characteristics as the 8051, plus an additional 128 bytes of Memory and a second timer. Moreover, the on-chip programme ROM includes 8K bytes rather than 4K bytes.

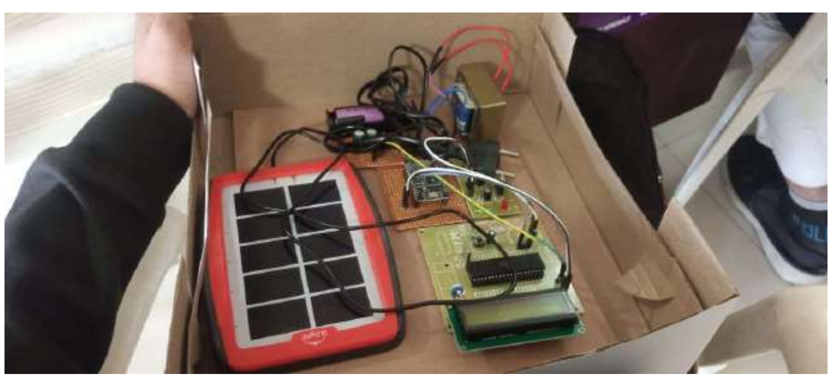
BATTERY

One or more electrochemical cells are present in the gadget. The cathode and anode connections on it are utilised to connect the battery to any device [23]. the electric power

IV. RESULT







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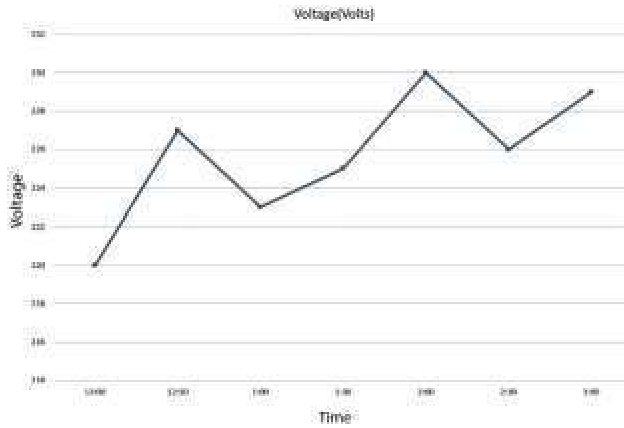

Fig. . Voltage Profile

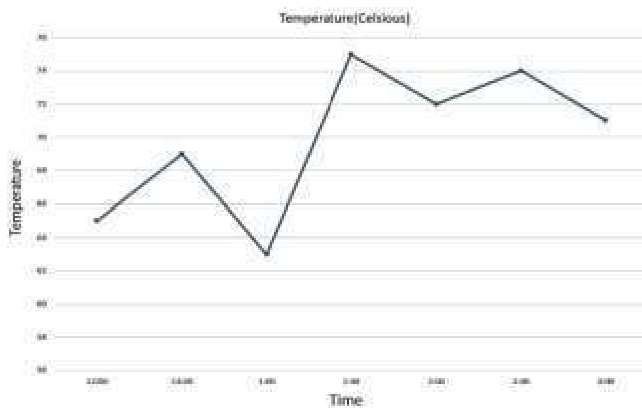

Fig. . Temperature Profile

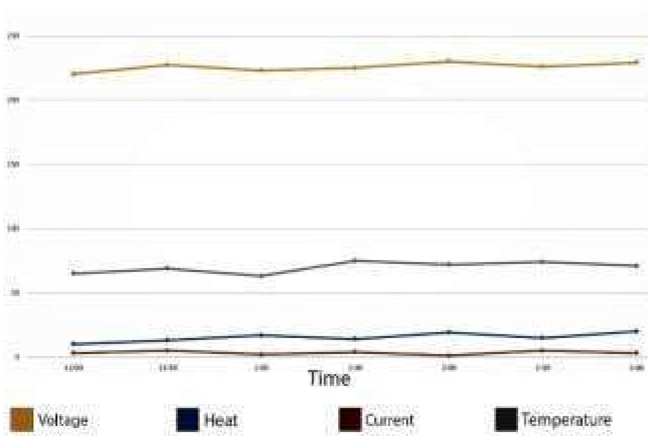

Fig. . Comparative profile of Current, Voltage andTemperature

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In this figure 16 the mobile display of all parameters is shown which were uploaded to the cloud and the user can have accessof it anywhere.

V. CONCLUSION

The need for power is increasing daily, but conventional energy sources cannot keep up with this trend. This exponential demand has an impact on both the price of power and human life. Every aspect of human existence is being revolutionised by the internet of things. Solar panels are not a typical source of power that can meet all of your energy needs. An IOT-based method for tracking solar power use is provided in this research, and a prototype is created to mimic the outcomes. The basic method uses sensors to record the solar panel's perimeters, including current, voltage, and temperature, and then uses Arduino to transmit the data via the cloud. Results are shown on both the onboard screen and a mobile app. To optimise the amount of energy, users will be able to digitally track, monitor, and manage their panel. To forecast solar panel consumption and power output in the future, we will use a reinforcement learning system.

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