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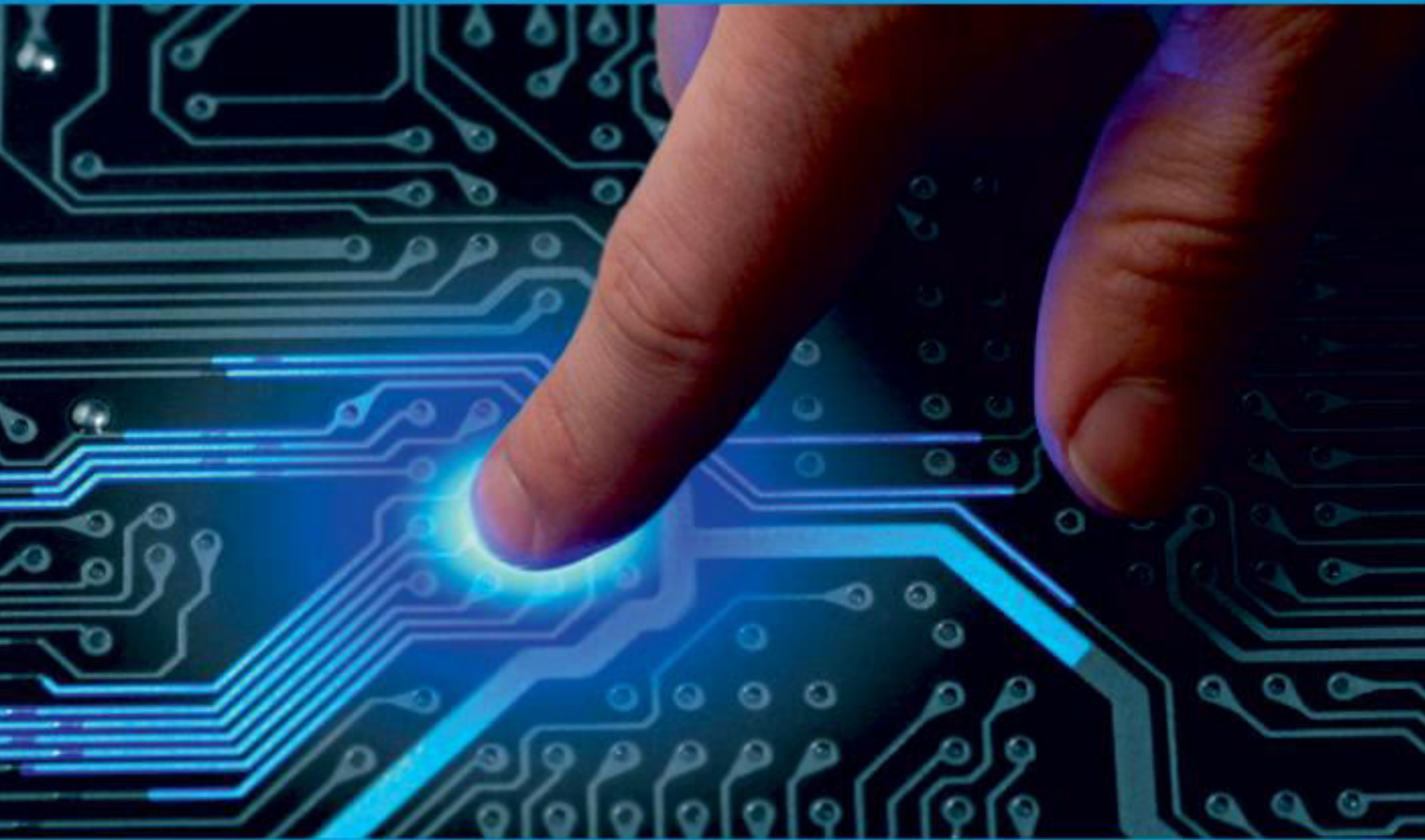

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Solar Power Monitoring System Using Iot

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ABSTRACT: Solar power plants need to be monitored for optimum power output. This helps retrieve efficient power output from power plants while monitoring for faulty solar panels, connections, dust accumulated on panels lowering output and other such issues affecting solar performance. Our system constantly monitors the solar panel and transmits the power output to IOT system over the internet. Here we use IOT Server to transmit solar power parameters over the internet to IOT server. It now displays these parameters to the user using an effective GUI and also alerts user when the output falls below specific limits. This makes remotely monitoring of solar plants very easy and ensure best power output.

KEYWORDS: IOT , GUI ,Solar Panels

I.INTRODUCTION

Energy Resources:

Energy is the capacity to do work and is required for life processes. An energy resource is something that can produce heat, power life, move objects, or produce electricity. Human energy consumption has grown steadily throughout human history. Early humans had modest energy requirements, mostly food and fuel for fires to cook and keep warm. In today's society, humans consume as much as 110 times as much energy per person as early humans. Most of the energy we use today come from fossil fuels (stored solar energy). But fossil fuels have a disadvantage in that they are nonrenewable on a human time scale, and cause other potentially harmful effects on the environment. In any event, the exploitation of all energy sources ultimately relies on materials on planet Earth. Since fossil fuels are non-renewable sources of energy, we need to ask how much longer society can rely on this source. This enervation of nonrenewable energy resources is the harbinger of renewable energy resources.

Renewable Resources – Solar Energy:

Renewable resources are resources that are replenished by the environment over relatively short periods of time. This type of resource is much more desirable to use because often a resource renews so fast that it will have regenerated by the time you've used it up. Solar power is one of the most well-known renewable energy sources among geothermal, hydropower, wave power, wind power, biomass and biofuel power.

Solar energy is one such resource because the sun shines all the time. Imagine trying to harness all of the sun's energy before it ran out. Solar energy has come into use where other power supplies are absent, such as in places far off from the national electrical grid and in space. Solar energy is currently used in a number of applications like solar cooking, electricity generation, desalination of seawater i.e. taking the salt out so it can be used for drinking or grow crops

Solar Panel Functioning:

Solar energy is simply the light and heat that come from the sun. Sun's energy is harnessed by Photovoltaic cells, which convert sunlight into electricity. A solar panel converts the light energy into electrical energy whose output is connected to the DC battery, and then the battery is continuously charged. The inverter transmutes the DC voltage into AC supply which is connected to the appliances used in our everyday life in the dearth of power supply. So, this entire system requires monitoring of basic parameters like voltage, current, power etc., from a remote location.

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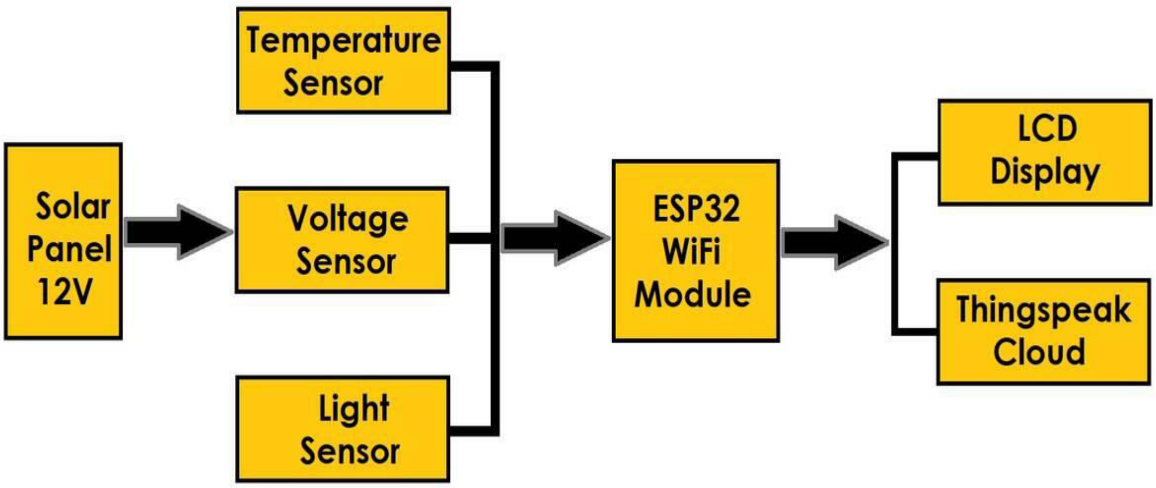
II.LITERATURE SURVEY

[1] Solar tracking system with two axis and four sensors: The defined paper is to enhance simple design and cheap implementation of the solar monitoring system. This consists of two axes to incorporate the system with Azimuth angle and with Altitude angle. Also provide the occurrence of the sunlight by using LDR sensor (Light Dependent Sensor) with real dimension of the system .The process consists of solar panel along with two motors as satellite dish and with ball-joint which are recognized the processing of solar panel that emergence of high range of sensor.

[2] Processing with Hybrid PV cells: The processing of solar power system for the reliable supply of solar power as of electric power through photovoltaic cell (PV).The system contains two major components, One is that which absorbs solar energy radiation and converted it to solar power by using solar panels .The next major component is “solar inverter”-which defines the process of alternation of direct current into alternating current. For the processing of mounting, connecting, cabling and switching some more minor sensing components are used.

[3] Using Micro grids-Dependable control : The recognized system incorporates such module like photovoltaic boards (PV) which is defined for gathering radiation that is flow over from the sun. And it moves the system with two degrees of angle flexibility in order to control the azimuth value and board height to enhance the control over the process. By involving the mechanism of inherent or either by remote controller the movement of the system is controlled. The main communication is enhanced by gateway that controls signals from Modbus serial processing to Modbus TCP protocol.

[4] Indigenous solar tracking systems : The system is defines with prediction of the sun’s position in undesirable condition like cloudy days, rainy days, dust etc., that all are processed using segmentation algorithm and also with filters to enable a accurate and enhancing self-monitoring in the point of focus.ANN algorithm is used for self estimation that defines difference between the actual data stored and the target data .The captured image is converted into desirable RGB to some HIS model that including a sun image.



SOLAR POWER MONITORING SYSTEM

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III.PROPOSED METHODOLOGY

Materials and resources for implementing the Monitoring System of Solar Panel Using IoT encompass a variety of components essential for its successful deployment. IoT sensors, including solar irradiance, temperature, humidity, and voltage/current sensors, are foundational materials that capture real-time data from the solar panels and surrounding environment. These sensors can be sourced from reputable manufacturers specializing in IoT and renewable energy technologies. Communication infrastructure materials, such as microcontrollers, communication modules, and networking components, facilitate the seamless transmission of data from the sensors to the central monitoring system. Commonly used microcontrollers include Arduino or Raspberry Pi, and communication modules may include GSM, Wi-Fi, or Zigbee modules.

For the central hub, a reliable cloud platform is a critical resource, with providers like AWS, Azure, or Google Cloud offering scalable and secure storage solutions. Edge computing devices, comprising edge servers or gateways, enhance the system's real-time processing capabilities, and their selection may depend on specific processing requirements and compatibility with the chosen IoT architecture. User interface materials involve software development tools, frameworks, and platforms to create intuitive dashboards and interfaces. Programming languages such as Python or JavaScript and frameworks like React or Angular may be employed.

Security materials include encryption algorithms, authentication protocols, and authorization mechanisms to protect the system from cyber threats. Integration modules, including hardware interfaces and communication protocols, facilitate connectivity with smart grids and other external systems. Maintenance and diagnostics modules may involve predictive maintenance software or algorithms, while user training resources consist of documentation, online tutorials, an training materials for educating users on system operation and troubleshooting.

Environmental sensors, measuring air quality and other environmental factors, can be sourced from environmental monitoring equipment providers. Lastly, data analytics tools, such as software for statistical analysis and machine learning libraries, are crucial resources for deriving meaningful insights from the vast amount of collected data. Open-source platforms like TensorFlow or commercial solutions like Tableau may be utilized for data analysis. Overall, the successful implementation of the Monitoring System of Solar Panel Using IoT requires a combination of reliable hardware, software tools, and data resources to ensure its effectiveness and sustainability.

IMPLEMENTATION

Implementing the Monitoring System of Solar Panel Using IoT involves several straightforward steps. Firstly, acquire IoT sensors, including solar irradiance, temperature, humidity, and voltage/current sensors, from reputable manufacturers. Connect these sensors to microcontrollers like Arduino or Raspberry Pi, and use communication modules such as GSM, Wi-Fi, or Zigbee for data transmission. Set up a central hub with a reliable cloud platform like AWS or Azure for secure storage and accessibility. Employ edge computing devices for real-time data processing, utilizing edge servers or gateways based on specific processing needs.

Develop a user interface using programming languages like Python or JavaScript, along with frameworks like React or Angular, to create intuitive dashboards. Implement security measures, including encryption algorithms and authentication protocols, to safeguard the system from cyber threats. Integrate external systems, such as smart grids, using appropriate hardware interfaces and communication protocols. Include a maintenance and diagnostics module, potentially using predictive maintenance software, to monitor the health of solar panels.

For environmental monitoring, source sensors from environmental equipment providers to measure air quality and other relevant factors. Finally, leverage data analytics tools, whether open-source platforms like TensorFlow or commercial solutions like Tableau, to analyze and derive insights from the collected data. Provide user training resources, including documentation and online tutorials, to ensure effective utilization. By following these steps and utilizing these resources, the Monitoring System of Solar Panel Using IoT can be successfully implemented, contributing to efficient and sustainable solar energy utilization.

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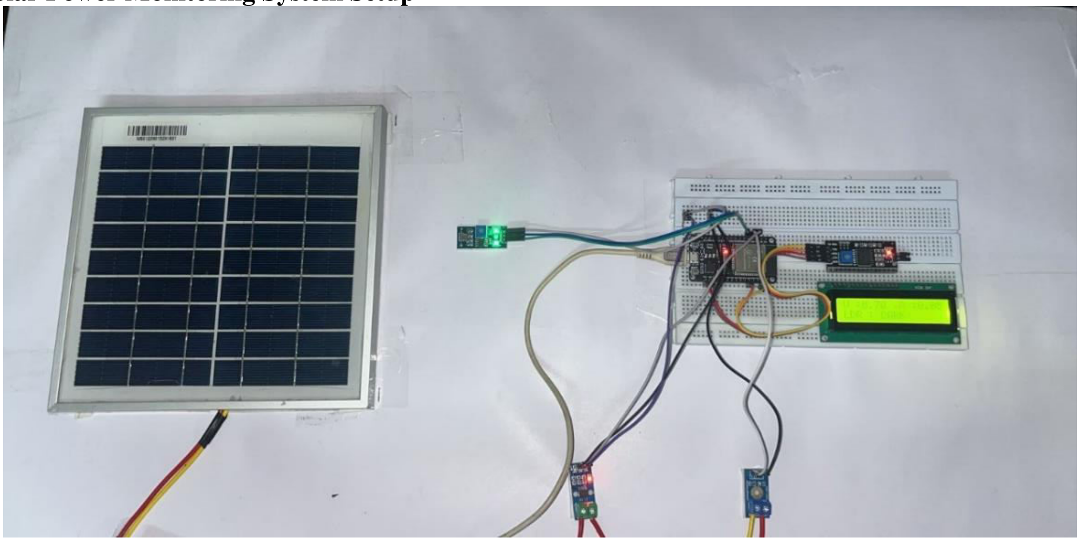
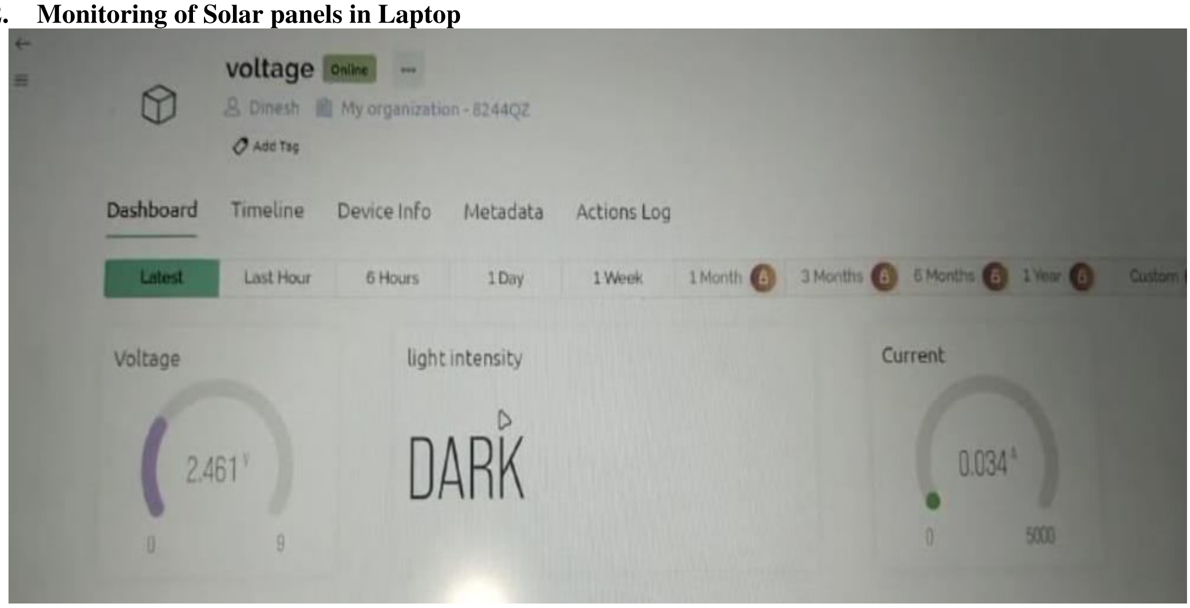
IV.RESULTS AND DECLARATION

1. Solar Power Monitoring System Setup



2. Monitoring of Solar panels in Laptop



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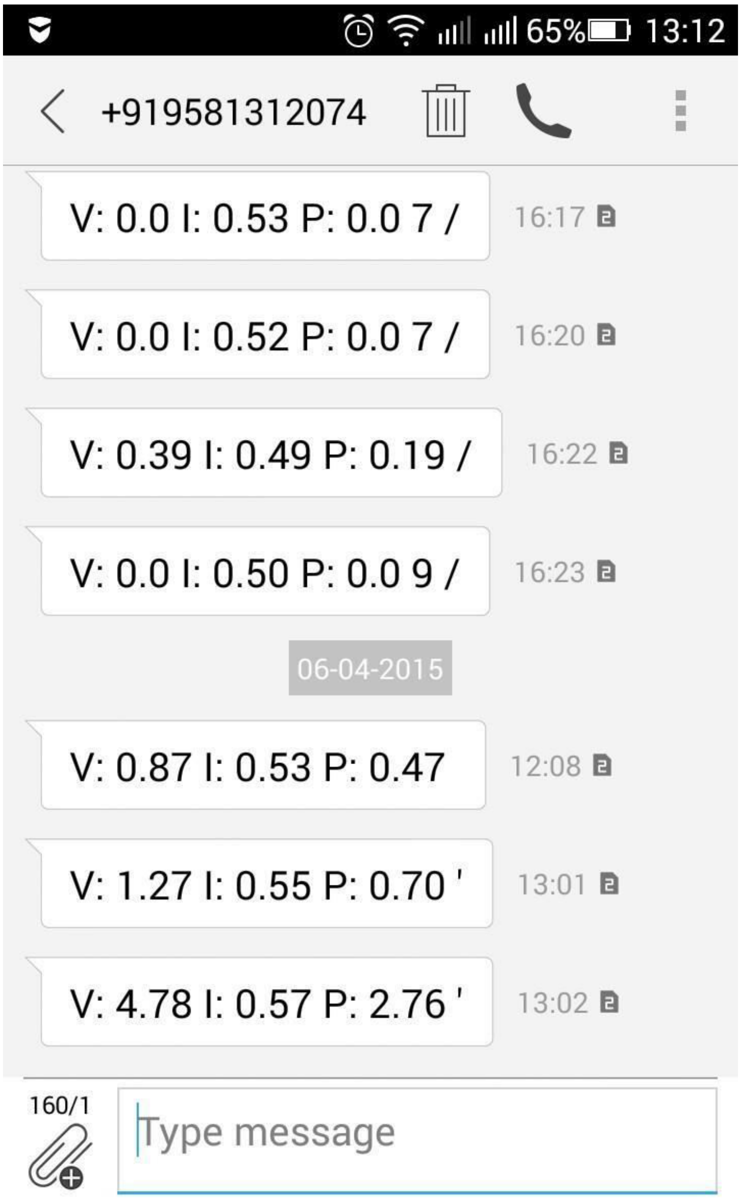
3.Monitoring of Solar panels through mobile phone



V.CONCLUSION

In conclusion, the implementation of a Monitoring System of Solar Panel Using IoT offers a transformative approach to optimizing solar energy generation, providing real-time insights, and enhancing the overall efficiency of solar panel systems. The system's advantages, including real-time performance monitoring, data-driven decision-making, and early fault detection, contribute to a more sustainable and reliable utilization of solar energy. However, it is crucial to acknowledge the potential disadvantages, such as initial costs, maintenance challenges, and security concerns. Despite these challenges, the benefits of improved efficiency, reduced downtime, and informed decision-making underscore the importance of careful planning, training, and mitigation strategies in maximizing the system's effectiveness. As technology advances and integration processes evolve, the Monitoring System of Solar Panel Using IoT stands as a promising solution for realizing the full potential of solar energy, paving the way for a more resilient and sustainable energy future.

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