A Project Synopsis on

"UTILIZING IOT FOR SOLAR PANEL MONITORING"

Submitted to

Visvesvaraya Technological University

Jnanasangama, Belagavi

In partial fulfilment for the award of the degree of

Bachelor of Engineering

In

Computer Science & Engineering

Submitted by

JAZIB HASSAN	**1GC20CS018**
MOHAMMAD FARMAN	**1GC20CS031**
SAMEER	**1GC20CS049**
SYED NABIL UR RAHMAN	**1GC20CS056**

Under the guidance of

Prof. MOHAMMED FAZALE ELAHI

Assistant Professor

GHOUSIA COLLEGE OF ENGINEERING

RAMANAGARAM 562159

2023-2024

GHOUSIA COLLEGE OF ENGINEERING, RAMANAGARAM

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

B.E PROJECT SYNOPSIS

Ref. No.: GCE/CSE/Project Work/23-24/B1

Sl. N0.	NAME and USN	Contact No. And Email ID	Internal Guide Details	External Guide Details (If any)	Domain	Accepted/ Rejected
1	Jazib Hassan 1GC20CS018		Mr. Mohammed Fazale Elahi		IoT	
2	Mohammad Farman 1GC20CS031					
3	Sameer 1GC20CS049					
4	Syed Nabil Ur Rahman 1GC20CS056					

"UTILIZING IOT FOR SOLAR PANEL MONITORING"

ABSTRACT

The rapid integration of renewable energy sources, such as solar panels, into our power generation system has led to an increased need for efficiently monitoring and maintenance strategies. This work presents an innovative approach to monitoring and fault detection of solar panels using Internet of Things [IoT] technology. By deploying a network of sensors and communication devices, real-time data on various parameters, including temperature, voltage, current, light intensity, and panel orientation, can be collected, and transmitted to a centralized data repository. The proposed IoT-based system offers several advantages over traditional monitoring methods. It enables remote and continuous monitoring of solar panel performance, eliminating the need for manual inspections and reducing maintenance costs. The data collected from the sensors can be processed and analysed using advanced algorithms to detect

anomalies, faults, and suboptimal conditions. Such timely detection allows for swift corrective actions, thereby optimizing energy generation and increasing the overall lifespan of the solar panel system.

EXISTING SYSTEM

While conventional non-renewable energy sources are diminishing, the utilization of renewable resources for energy generation is on the rise. Solar energy technology stands out as an excellent choice for harnessing natural assets. It involves the collection of solar energy through solar panels, its conversion into electrical power, and subsequent storage in batteries for on-demand usage. This monitoring system furnishes straightforward information regarding diverse solar parameters, facilitates fault detection, and addresses associated energy losses. Enhancing the efficiency of this work can be achieved through the incorporation of solar trackers which utilize maximum power point tracking mechanisms (MPPT). This system evaluates the sun's position and directs the movement of solar panels to optimize sun exposure on their surface. MPPT solar charge controllers, equipped with algorithms for maximum power point tracking, have been devised to substantially amplify the current supplied to batteries from photovoltaic modules. This work presents an innovative IoT-based solution designed for the detection and diagnosis of issues in solar PV panels. The primary objective of this approach is to enhance the performance and dependability of solar PV panels, which are susceptible to a range of problems like shading, soiling, degradation, and electrical malfunctions. The system incorporates wireless sensor nodes strategically placed on the panels to gather data concerning their electrical characteristics and environmental factors, including temperature, irradiance, and humidity. Compared to traditional manual inspection and maintenance practices, this system offers multiple advantages, such as reduced downtime, lower maintenance expenditures, and enhanced energy efficiency.

PROPOSED SYSTEM

The cutting-edge Solar Panel Monitoring System, employing Internet of Things (IoT) technology, is designed to optimize the efficiency, reliability, and sustainability of solar energy generation. This innovative system utilizes IoT to collect and analyze data from solar panels in real-time, offering remote-control capabilities and providing valuable insights. The system facilitates the continuous monitoring and collection of energy generation data, which is then transmitted to a cloud server, enabling monitoring from anywhere in the world.

Key Feature:

1. **Real-time Data Collection:** The system employs IoT sensors and devices installed on each solar panel to collect real-time data on various parameters, including energy production, temperature, humidity, and voltage.

2. **Data Transmission:** Data collected from the solar panels is transmitted securely to a centralized cloud-based platform. This ensures that the information is accessible from anywhere and can be monitored by relevant stakeholders.

3. **Analytics and Monitoring:** Advanced analytics and machine learning algorithms are used to process the data, enabling the system to detect issues such as panel malfunctions, shading, or dirt buildup. System operators can monitor the performance of individual panels and the entire array in real-time.

4. **Energy Efficiency:** By continuously monitoring panel performance and making real-time adjustments, the system maximizes energy output, contributing to increased efficiency and return on investment for solar installations.

5. **User-Friendly Interface:** The user interface is designed to be intuitive, allowing users to access comprehensive data and control functionalities easily. It can be accessed via web or mobile applications.

OBJECTIVE OF THE PROJECT

- A solar monitoring system utilizing IoT collects real-time data on solar production, enabling remote monitoring from any location through the internet.
- Examine data for power generation, evaluating its efficiency, output, and trends to optimize and enhance overall energy production processes.
- Display data both offline and online by utilizing a cloud server, ensuring accessibility and synchronization for efficient information management.
- Aiding in pinpointing faults, it facilitates the identification of issues within solar panels, contributing to efficient troubleshooting and maintenance.
- It offers a user-friendly interface, ensuring ease of interaction for users to navigate and engage with the system seamlessly.

PROBLEM STATEMENT

The widespread adoption of solar energy as a clean and sustainable power source has led to the deployment of solar panel arrays across diverse geographical locations. However, the efficient operation and maintenance of these solar panels present challenges, including the need for real-time monitoring, fault detection, and performance optimization. Traditional monitoring methods often lack the granularity and immediacy required to address issues promptly, leading to decreased energy output, increased maintenance costs, and potential environmental impact. To address these challenges, there is a need for a comprehensive and intelligent solar panel monitoring system that leverages the capabilities of the Internet of Things (IoT). The current lack of a standardized and scalable IoT solution tailored for solar panel monitoring poses a significant obstacle to maximizing the potential of solar energy. This project aims to develop an integrated IoT-based monitoring system to enable real-time data collection, analysis, and management of solar panel performance, addressing key issues such as:

I. **Fault Detection and Diagnostics:** Existing solar panel monitoring systems often struggle to promptly detect faults or anomalies, leading to reduced energy output and increased downtime. An IoT-based solution should provide real-time fault detection and diagnostics, allowing for swift identification and resolution of issues.

II. **Performance Optimization:** Solar panel efficiency can be impacted by various factors, including shading, dirt accumulation, and environmental conditions. The IoT monitoring system should facilitate continuous performance optimization by collecting and analysing data related to solar irradiance, temperature, and other relevant parameters.

III. **Remote Monitoring and Management:** Solar panel installations are often distributed over large areas, making manual monitoring and management challenging. The proposed IoT solution should enable remote monitoring and management capabilities, allowing operators to access real-time data, configure settings, and perform updates without the need for physical presence at the site.

IV. **Energy Yield Prediction:** Predicting energy yields accurately is crucial for optimizing the overall efficiency of solar panel installations. The IoT-based monitoring system should incorporate predictive analytics to estimate future energy yields based on historical data and environmental conditions.

V. **Security and Data Privacy:** As IoT devices collect sensitive data related to energy production and consumption, ensuring the security and privacy of this data is paramount.

METHODOLOGY

At the core of this model is the foundational role played by the ESP32 Wi-Fi Module. The project's operational framework is elucidated through a comprehensive block diagram and graphical representation, detailing the integration of various sensors and the crucial ESP32 Wi-Fi Module. This intricate system comprises a solar panel, temperature sensor, voltage sensor, light sensor, ESP32 Wi-Fi module, LCD display, and cloud server, collectively shaping the study's architecture. The solar panel, a key element, generates electricity, initiating a meticulously orchestrated sequence. The generated power flows to the voltage sensor, which performs a crucial measurement task. The ESP32 Wi-Fi Module not only analyzes the data but also facilitates its display on the LCD, providing a tangible representation of the system's dynamics. The journey of information doesn't conclude there; rather, the ESP32 Wi-Fi Module acts as a conduit for transmitting the processed data to the Cloud. This strategic integration with the Cloud expands the project's reach, enabling users to access information remotely from any location. In essence, the project symbolizes a symbiotic relationship between innovative technology and purposeful design, with the ESP32 Wi-Fi Module orchestrating the harmonious interplay of sensors. The solar panel, temperature sensor, voltage sensor, light sensor, LCD display, and cloud server, each contributing its unique function, collectively exemplify the potential of sensor-based systems and interconnected technologies in a dynamic and accessible framework.

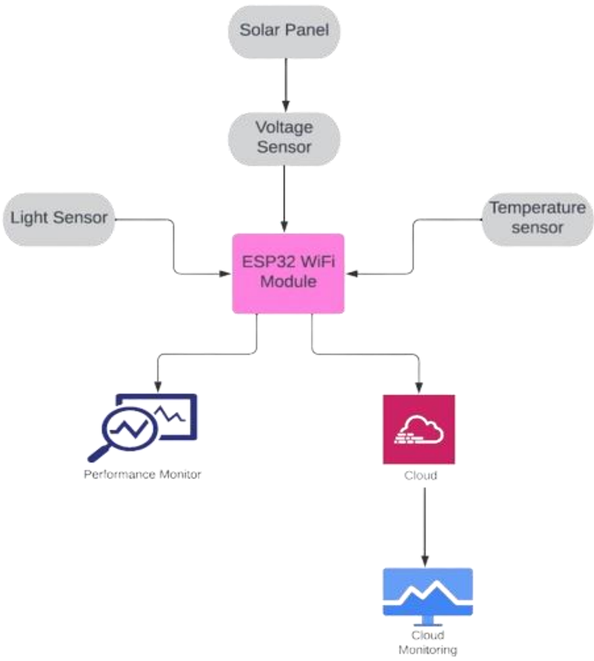

Fig. 1. Block Diagram of the System

EXPECTED OUTCOME

The system presents the solar voltage generated by the solar panel on the LCD screen, derived from data measured by the voltage sensor. Simultaneously, it generates a graphical output on the cloud server, accessible worldwide. Users can access this information from any location, offering a comprehensive and remote overview of the solar voltage data through the LCD screen and the cloud-based interface.

REFERENCES

[1] Vishal Singh 1st, 2Dr. Devesh Katiyar 2nd, 3MR. GAURAV GOEL 3rd, 4rth Yogesh Dev Singh 4th 2021 “IOT BASED SOLAR POWER MONITORING SYSTEM” JETIR September 2021, Volume 8, Issue 9.

[2] Balakrishnan D 1, Raja J 2, Manikandan Rajagopal3, Sudhakar K4 and Janani K 5 “IOT-BASED SYSTEM FOR FAULT DETECTION AND DIAGNOSIS IN SOLAR PV PANELS” Kalasalingam Academy of Research and Education, Anand Nagar, Krishnankoil-626126, Tamilnadu, India.

[3] T.Asha Rakshana 1st, R.Palselvam 2nd, S.Priya 3rd, K Genda Devi 4rth “IOT Based Solar Panel Fault Monitoring and Control By Using Wi-Fi Modem” SSRG_IJEEE)Volume 7 Issue 1 - January 2020.

[4] Preethi Sekar 1st, Priya Sabde 2nd, Ganesh Patil 3rd “IoT-based Solar Energy Monitoring “ (IRJET) Volume: 09 Issue: 06 | June 2022.

[5] P.Sampurna Lakshmi 1st, Dr.S. Sivagama Sundari 2nd, Dr. R. Manjula sri 3rd ” Solar Panel Fault Detection System using IoT” Eur. Chem. Bull. 2023, 12(Special Issue 7), 3199-3206.

[6] Kabalci, Ersan, Alper Gorgun, and Yasin Kabalci. "Layout and implementation of a renewable energy tracking device." power Engineering, energy and electric Drives (POWERING), 2013 Fourth worldwide conference on. IEEE, 2013.

Signature of Guide	Signature of Project Coordinator	Signature of HOD (CS&E)
Prof. MOHAMMED FAZALE ELAHI	**Prof. MOHAMMED FAZALE ELAHI**	**Dr. DILSHAD BEGUM**