

**METHODOLOGY**

**Team No:** 12

**Project Title:** IOT Based Solar Power Monitoring System

**Problem Illustration:**

In the realm of solar power monitoring, traditional systems often fall short in providing real-time insights and proactive management. This deficiency hinders the optimization of solar panel performance and compromises energy efficiency. The absence of an interconnected and intelligent infrastructure results in delayed detection of issues such as panel malfunctions, suboptimal energy production, or environmental factors impacting system efficiency. To address this, an IoT-based solar power monitoring system becomes imperative. By deploying a network of sensors on solar panels, capable of relaying data to a central server, this proposed solution seeks to revolutionize the monitoring paradigm. This interconnected system not only facilitates immediate issue identification but also empowers users with real-time, comprehensive data analysis, ultimately enhancing solar energy production, system efficiency, and overall sustainability.

**Proposed Method:**

The envisioned approach centers around the deployment of Internet of Things (IoT) devices integrated with an array of sensors meticulously positioned to capture and monitor essential parameters associated with solar power generation. These parameters encompass voltage, current, temperature, and sunlight intensity. The data collected in real-time by these sensors is then transmitted wirelessly to a designated central server.

**Proposed method Illustration:**

**1. Sensor Deployment:** Strategically place sensors on solar panels to capture and measure critical parameters including voltage, current, temperature, and sunlight intensity.

**2. IOT Devices:** Connect these sensors to IoT devices, such as microcontrollers, capable of processing and transmitting the collected data.

**3. Data Transmission:** Utilize wireless communication protocols such as MQTT or HTTP to establish a seamless flow of data from IoT devices to a central server.

**4. Central Server:** Establish a dedicated server to receive, store, and process the incoming data. This server serves as the central hub for monitoring and managing the solar power system.

**5. Data Analysis:** Implement sophisticated algorithms to analyze the collected data, extracting insights into energy production, system efficiency, and environmental conditions.

**6. User Interface:** Develop a user-friendly interface, either in the form of a web application or mobile app, enabling users to monitor the solar power system in real-time. This interface should also facilitate historical data analysis and provide timely notifications.

**Parameter Formulas:**

**1. Energy Production:** E = P \* t

where P is the power generated and t is the time.

**2. Efficiency (η):** η= (Actual Power Output / Maximum Possible Power Output) \*100 %.

**3. Temperature Correction Factor (TCF):** TCF = 1 + 0.005 \* (T - 25)

where T is the temperature in degrees Celsius.

**4. Performance Ratio (PR):** PR = (Actual Output Energy / Expected Output Energy) \* 100 %.

These formulas provide a foundational framework for calculating and evaluating key parameters within the IoT-based solar power monitoring system. Modifications may be necessary based on specific sensor types and system requirements to ensure optimal accuracy and functionality

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| **Signature of the Supervisor** |
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