Sun Track: A Compact IoT System for PV Parameter Monitoring with NodeMCU

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Abstract: *This project presents Sun Track, a compact and cost-effective IoT-based system designed to monitor key electrical parameters of a photovoltaic (PV) module using the NodeMCU ESP8266 microcontroller. The system utilizes voltage and current sensors to measure real-time output from a PV module, capturing essential data such as voltage, current, and power. A voltage divider and ACS712 current sensor are interfaced with the NodeMCU's analog input to gather sensor readings, which are then processed and displayed via serial output or transmitted over Wi-Fi for remote monitoring. The project aims to provide a scalable and accessible solution for educational, experimental, and small-scale solar power setups, offering insights into PV performance under varying environmental conditions. With its low power consumption and wireless capabilities, Sun Track demonstrates the potential of IoT in advancing renewable energy monitoring. The use of the internet of things (IoT) in solar photovoltaic (PV) systems is a critical feature for remote monitoring, supervising, and performance evaluation. Furthermore, it improves the long-term viability, consistency, efficiency, and system maintenance of energy production. However, previous researchers' proposed PV monitoring systems are relatively complex and expensive. Furthermore, the existing systems do not have any backup data, which means that the acquired data could be lost if the network connection fails. This paper presents a simple and low-cost IoT-based PV parameter monitoring system, with additional backup data stored on a micro SD card. A NodeMCU ESP8266 development board is chosen as the main controller because it is a system-on-chip (SOC) microcontroller with integrated Wi-Fi and low-power support, all in one chip to reduce the cost of the proposed system.*

Keywords: NodeMCU's.