

SISTEM KENDALI OTOMATIS PANEL SURYA MENGIKUTI PERGERAKAN MATAHARI BERBASIS ESP32

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ABSTRAK

penggunaan panel surya statis memiliki keterbatasan karena tidak dapat mengikuti pergerakan matahari, sehingga penyerapan energi cahaya menjadi kurang optimal. Penelitian ini bertujuan untuk merancang sistem kendali otomatis panel surya berbasis mikrokontroler ESP32 yang mampu mengikuti pergerakan matahari secara real-time. Sistem menggunakan sensor Light Dependent Resistor (LDR) untuk mendeteksi intensitas cahaya dari berbagai arah, serta motor servo sebagai aktuator penggerak panel pada dua sumbu, yaitu horizontal dan vertikal. Data dari sensor diproses oleh mikrokontroler untuk menentukan arah dengan intensitas cahaya tertinggi, kemudian mengarahkan posisi panel ke titik optimal. Selain itu, sistem dilengkapi dengan fitur monitoring berbasis Internet of Things (IoT) menggunakan aplikasi Blynk sehingga kondisi sistem dapat dipantau secara real-time melalui smartphone. Hasil perancangan menunjukkan bahwa sistem solar tracker berbasis ESP32 mampu bekerja secara otomatis dalam mengikuti pergerakan matahari, sehingga panel surya dapat menerima intensitas cahaya yang lebih optimal dibandingkan panel statis. Dengan demikian, sistem ini berpotensi meningkatkan efisiensi penyerapan energi dan daya listrik yang dihasilkan, serta menjadi solusi dalam pengembangan teknologi energi terbarukan yang lebih efektif dan efisien.

Kata kunci: Panel Surya, Solar Tracker, ESP32, Sensor LDR, Motor Servo, Internet of Things (IoT).

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ABSTRACT

The increasing demand for electrical energy has encouraged the utilization of alternative energy sources that are environmentally friendly and renewable. One of the most promising sources in Indonesia is solar energy. However, the use of static solar panels has limitations because they cannot follow the movement of the sun, resulting in less optimal absorption of solar energy. This study aims to design an automatic control system for solar panels based on the ESP32 microcontroller, which is capable of tracking the sun's movement in real-time. The system uses Light Dependent Resistor (LDR) sensors to detect light intensity from various directions, and servo motors as actuators to move the panel along two axes, namely horizontal and vertical. The sensor data is processed by the microcontroller to determine the direction of the highest light intensity, and then adjust the panel position to the optimal angle. In addition, the system is equipped with an Internet of Things (IoT)-based monitoring feature using the Blynk application, allowing real-time monitoring via a smartphone. The results show that the ESP32-based solar tracker system can operate automatically in following the sun's movement, enabling the solar panel to receive more optimal light intensity compared to a static system. Therefore, this system is expected to improve energy absorption efficiency and the electrical power generated, as well as provide an effective and efficient solution for renewable energy technology development.

Keywords: Solar Panel, Solar Tracker, ESP32, LDR Sensor, Servo Motor, Internet of Things (IoT).