ABSTRACT

Global warming caused by energy consumption has opened opportunities to develop clean and sustainable renewable energy sources. Solar energy is one of the most promising options; however, its utilization remains suboptimal because conventional solar panels are static and unable to track the sun's movement. As a tropical country, Indonesia receives high levels of sunlight throughout the year, making it a region with significant solar energy potential. This research designs a dual-axis solar tracker prototype based on the Internet of Things (IoT) to enhance the efficiency of solar energy conversion. The system uses Light Dependent Resistors (LDRs) to detect changes in light intensity from various directions and an ESP32 microcontroller to control servo motors, allowing the panel to follow the sun's position in real-time. Performance data is transmitted to the web-based Blynk platform. Testing was conducted over a 9-hour period, from 08:00 to 16:00, to compare the efficiency of the tracking system with that of a static panel. The results showed that the tracking system produced an average power output of 0.602 W, which is higher than the 0.387 W generated by the static panel. This study demonstrates an improvement in solar energy system efficiency and supports the advancement of IoT-based renewable energy technologies.

Keywords: *solar tracker, dual axis, Internet of Things (IoT), solar panel, energy efficiency, renewable energy, ESP32, LDR sensor.*