

ABSTRAK

OPTIMALISASI DAYA PANEL SURYA DAN BATERAI MENGGUNAKAN SISTEM KONTROL LOGIKA FUZZY

([2025 : 71 Halaman] + [28 Gambar] + [9 Tabel] + [25 Daftar Pustaka] + [Lampiran])

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Energi matahari sebagai sumber terbarukan memiliki potensi signifikan dalam mendukung sistem *smart home* berbasis Internet of Things (IoT). Tantangan utama panel surya statis adalah ketidakmampuan mengikuti pergerakan matahari, mengurangi efisiensi penyerapan energi. Penelitian ini mengembangkan sistem optimalisasi daya panel surya dan baterai menggunakan kontrol logika *fuzzy* yang terintegrasi IoT. Sistem memanfaatkan dua sensor BH1750 untuk mendeteksi intensitas cahaya, dengan data diproses ESP32 menggunakan metode *fuzzy Mamdani*. Output sistem menggerakkan motor DC untuk mengarahkan panel surya secara otomatis dari timur ke barat, memaksimalkan penyerapan cahaya matahari sepanjang hari.

Pemantauan real-time dilakukan melalui aplikasi berbasis MIT App Inventor, memungkinkan pengguna mengawasi tegangan, arus, daya, dan status baterai dari jarak jauh. Pengujian menggunakan panel surya 20Wp dan baterai 12V menunjukkan rata-rata daya harian sebesar 16,75 watt (hari ke-1), 17,62 watt (hari ke-2), dan 15,77 watt (hari ke-3), dengan error berturut-turut 16,25%, 11,90%, dan 21,15% terhadap daya teoritis maksimum (20W). Fluktuasi ini dipengaruhi faktor eksternal seperti variasi intensitas cahaya dan kondisi cuaca.

KATA KUNCI: *Smart home, Internet Of Things, solar panels*

ABSTRACT

OPTIMIZATION OF SOLAR PANEL AND BATTERY POWER USING FUZZY LOGIC CONTROL SYSTEM

([2025 : 64 Pages] + [26 Pictures] + [8 Tables] + [References] + [attachment])

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Solar energy, as a renewable resource, has significant potential to support Internet of Things (IoT)-based smart home systems. The main challenge with static solar panels is their inability to follow the sun's movement, reducing energy absorption efficiency. This research develops a solar panel and battery power optimization system using IoT-integrated fuzzy logic control. The system utilizes two BH1750 sensors to detect light intensity, with the data processed by an ESP32 using the Mamdani fuzzy method. The system's output drives a DC motor to automatically orient the solar panels from east to west, maximizing sunlight absorption throughout the day.

Real-time monitoring is performed through an MIT App Inventor-based application, allowing users to remotely monitor voltage, current, power, and battery status. Testing using a 20Wp solar panel and a 12V battery showed an average daily power of 16.75 watts (day 1), 17.62 watts (day 2), and 15.77 watts (day 3), with errors of 16.25%, 11.90%, and 21.15%, respectively, against the maximum theoretical power (20W). These fluctuations are influenced by external factors such as variations in light intensity and weather conditions.

Keyword: Smart home, Internet Of Things, solar panels