ABSTRAK

RANCANG BANGUN SOLAR TRACKER *SINGLE-AXIS* BERBASIS SENSOR UV DENGAN ALGORITMA *HYBRID* MODE ASTRONOMIS-SENSOR UNTUK PENINGKATAN EFISIENSI PANEL SURYA

(2026: 63 Halaman + 24 Gambar + 23 Tabel + Daftar Pustaka + Lampiran)

KADEK ENDRI SAPUTRA

062240342231

JURUSAN TEKNIK ELEKTRO

PROGRAM STUDI D-IV TEKNIK ELEKTRO

POLITEKNIK NEGERI SRIWIJAYA

Penelitian ini merancang dan membangun sistem *solar tracker single-axis* berbasis sensor *ultraviolet* (UV) GUVA-S12SD dengan algoritma *HYBRID MODE ASTRONOMIS-SENSOR* sebagai sumber energi listrik terbarukan untuk operasional sistem pakan ikan otomatis berbasis *IoT*. Algoritma *hybrid* yang dikembangkan menggabungkan dua lapisan strategi kendali secara sinergis, yaitu lapisan *open-loop* berbasis *Solar Position Algorithm* (SPA) dengan data waktu dari RTC DS3231, dan lapisan *closed-loop* berbasis koreksi *real-time* sensor UV. Mekanisme *dead-zone* (ε = 0,05 V) diimplementasikan untuk mencegah osilasi aktuator yang menjadi kelemahan metode kendali *on-off* konvensional. Sistem dibangun menggunakan mikrokontroler ESP32, sensor MPU6050 sebagai umpan balik sudut panel, motor driver BTS7960, aktuator linear DC 12V, dan modul PZEM-017 untuk monitoring daya. Hasil pengujian menunjukkan bahwa sistem mampu melakukan transisi mode secara otomatis dengan akurasi *tracking* RMSE rata-rata di bawah 0,57° pada seluruh kondisi cuaca yang diuji (cerah, berawan, dan mendung). Sistem *solar tracker* berhasil meningkatkan produksi energi rata-rata sebesar 28,8% dibandingkan panel surya statis, dengan total energi rata-rata 663,83 Wh per hari. Pengujian integrasi membuktikan bahwa energi yang dihasilkan mampu menyuplai seluruh kebutuhan operasional sistem pakan ikan IoT sebesar 196,02 Wh per hari dengan surplus energi 467,81 Wh, dan tegangan baterai LiFePO4 yang stabil sepanjang 24 jam.

Kata Kunci: Solar Tracker, Single-Axis, Sensor UV, Algoritma Hybrid, Astronomis-Sensor, Iot, Tambak Ikan, Efisiensi Energi, ESP32

ABSTRACT

VISUAL DETECTION OF CHICKEN GROWTH USING DEEP LEARNING IN AN AUTOMATIC CHICKEN COOP

(2026: 63 Pages + 24 Figures + 23 Tables + References + Appendices)

KADEK ENDRI SAPUTRA

062240342231

DEPARTMENT OF ELECTRICAL ENGINEERING

D-IV ELECTRICAL ENGINEERING STUDY PROGRAM

POLITEKNIK NEGERI SRIWIJAYA

This research designs and develops a single-axis solar tracker system based on GUVA-S12SD ultraviolet (UV) sensors with an astronomical-sensor hybrid algorithm as a renewable energy source for IoT-based automatic fish feeding system operations. The developed hybrid algorithm synergistically combines two control strategy layers: an open-loop layer based on the Solar Position Algorithm (SPA) with time data from RTC DS3231, and a closed-loop layer based on real-time UV sensor correction. A dead-zone mechanism (ε = 0.05 V) is implemented to prevent actuator oscillation, which is the primary weakness of conventional on-off control methods. The system is built using an ESP32 microcontroller, MPU6050 sensor as panel angle feedback, BTS7960 motor driver, 12V DC linear actuator, and PZEM-017 module for power monitoring. Test results demonstrate that the system successfully performs automatic mode transitions with an average tracking accuracy RMSE below 0.57° across all tested weather conditions (sunny, partly cloudy, and overcast). The solar tracker system achieves an average energy production increase of 28.8% compared to static solar panels, with a total average energy of 663.83 Wh per day. Integration testing proves that the generated energy is sufficient to supply all operational requirements of the IoT fish feeding system of 196.02 Wh per day, with an energy surplus of 467.81 Wh, and stable LiFePO4 battery voltage throughout 24 hours.

Keywords: Solar Tracker, Single-Axis, UV Sensor, Hybrid Algorithm, Astronomical-Sensor, Iot, Fish Pond, Energy Efficiency, ESP32