

## ABSTRAK

**MUH. HAJIR** Pengembangan Sistem Otomatisasi Panel Surya Pintar Dengan Mekanisme Auto-Park Dan Perlindungan Surya Berbasis Nodemcu-Iot. Skripsi ini dibimbing oleh **ADRIANI** dan **RIDWANG**.

Energi Sepanjang beberapa dekade yang lalu, pemanfaatan energi terbarukan, khususnya energi surya. Energi surya kini menjadi alternatif strategis dalam upaya untuk menekan ketergantungan pada energi fosil yang persediaanya kian menipis. Tujuan penelitian ini untuk merancang sistem otomatis *auto-park* dan *solar shield* pada panel surya berbasis *IoT* menggunakan NodeMCU. Metode penelitian yang diterapkan adalah metode eksperimen dengan disertai observasi langsung terhadap kinerja perangkat prototipe yang telah dirancang. Penelitian ini menguji sistem otomatisasi panel surya pintar berbasis NodeMCU-IoT yang dilengkapi sensor LDR, sensor hujan, dan servo motor. Hasil pengujian menunjukkan bahwa sensor LDR mampu mendeteksi intensitas cahaya dengan nilai 125 pada siang hari, 30 pada sore hari, dan 0 pada malam hari, sehingga panel bergerak otomatis mengikuti posisi matahari atau kembali ke posisi awal saat gelap. Sensor hujan juga terbukti efektif, ditunjukkan dengan status 1 saat kondisi kering, serta berubah menjadi 0 pada saat gerimis ( $<0,5$  mm/jam) maupun hujan, yang memicu mekanisme *auto-park* untuk melindungi panel. Dari sisi perangkat lunak, integrasi Arduino Mega, NodeMCU, dan aplikasi Telegram memungkinkan monitoring real-time, di mana sistem berhasil menampilkan status pencahayaan, deteksi hujan, serta parameter kelistrikan tanpa keterlambatan notifikasi. Secara keseluruhan, sistem ini terbukti efektif, responsif, dan andal dalam mengoptimalkan kinerja serta memberikan perlindungan panel surya terhadap kondisi lingkungan.

**Kata Kunci:** Sistem Otomatisasi, *Internet of Things*, *Auto-Park*, *Solar Shield*

## ***ABSTRACT***

**MUH. HAJIR** Development of a Smart Solar Panel Automation System with Auto-Park Mechanism and Solar Protection Based on NodeMCU-IoT. This thesis was supervised by **ADRIANI** and **RIDWANG**.

Energy is one of the essential elements required in various aspects of human life around the world, including in Indonesia. The utilization of solar panels as a solar power generation system (PLTS) has become an environmentally friendly solution to address the energy crisis and climate change. However, in its implementation, the performance of solar panels is greatly influenced by environmental conditions, such as sunlight intensity, temperature, and the presence of particles or rainwater that may interfere with energy absorption. The aim of this study is to design a smart solar panel based on IoT with Auto-Park and Solar Shield features using NodeMCU. The research method applied is an experimental method combined with direct observation of the performance of the designed prototype device. The smart solar panel system developed in this study has been proven to function according to its objectives, namely performing sun tracking, automatic protection during rain, and IoT-based energy monitoring. The integration of hardware components such as sensors and servos worked properly, supporting improved power absorption efficiency. The test results also demonstrated the ease of energy monitoring through real-time IoT connections. Nevertheless, several limitations were identified, such as potential servo wear due to long-term use, the need to improve the accuracy of the rain sensor, and limitations in inverter efficiency. Overall, this system is considered effective, safe, and practical, with significant potential for further development through component quality enhancement, the addition of precision features, and long-term testing to ensure its reliability and durability.

**Keywords:** Automation System, Internet of Things, Auto-Park, Solar Shield