

ABSTRAK
LAPORAN AKHIR
PERANCANGAN *PROTOTYPE AUTOMATIC RAINFALL PORTABLE*
BERBASIS PANEL SURYA

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Penelitian ini bertujuan untuk merancang dan menguji alat penakar curah hujan otomatis berbasis panel surya dengan sistem pengiriman data real-time menggunakan ESP32 dan Telegram. Pengujian dilakukan terhadap kinerja panel surya, kekuatan konstruksi alat, akurasi pengukuran curah hujan, serta kemampuan sistem dalam mengirimkan data hasil pengamatan.

Hasil pengujian menunjukkan bahwa sistem panel surya mampu memenuhi kebutuhan energi alat secara mandiri, terutama pada rentang waktu pukul 08.00–14.00 WIB, sehingga baterai dapat terisi sesuai kebutuhan operasional. Pengujian kekuatan konstruksi membuktikan bahwa seluruh komponen mekanik, seperti rangka, tipping bucket, panel surya, dan dudukan alat, berfungsi dengan baik dan mampu menopang beban kerja selama pengujian lapangan. Hasil kalibrasi bersama BMKG menunjukkan bahwa nilai curah hujan yang diperoleh memiliki tingkat ketelitian yang cukup baik dan mendekati nilai parameter acuan. Sistem pengiriman data menggunakan ESP32 dan Telegram juga berhasil menampilkan data curah hujan secara real-time. Namun, pada pengujian otomatis masih ditemukan selisih pengukuran yang cukup besar akibat keterbatasan sensitivitas sensor reed switch yang digunakan.

Secara keseluruhan, alat yang dirancang telah mampu menjalankan fungsi utama sebagai alat pengukur curah hujan otomatis berbasis energi surya dan layak digunakan untuk kebutuhan penelitian, pembelajaran, serta pengembangan teknologi instrumentasi cuaca. Meskipun demikian, alat ini masih memerlukan penyempurnaan pada sistem sensor dan akurasi pengukuran sebelum dapat dioperasikan secara penuh untuk pengamatan cuaca harian dalam jangka panjang.

Kata kunci: curah hujan, panel surya, ESP32, Telegram, tipping bucket, instrumentasi cuaca.

ABSTRACT

Design and Development of a Solar Panel-Based Portable Automatic Rainfall Prototype

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This study aims to design and evaluate an automatic rainfall measurement system powered by a solar panel and equipped with a real-time data transmission system using ESP32 and Telegram. The testing process focused on the performance of the solar power system, structural durability, rainfall measurement accuracy, and the capability of the system to transmit observation data.

The results showed that the solar panel system was able to independently meet the energy requirements of the device, particularly between 08:00 and 14:00 WIB, allowing the battery to be charged according to operational needs. Structural testing demonstrated that all mechanical components, including the frame, tipping bucket, solar panel, and supporting structure, functioned properly and were capable of withstanding operational loads during field testing. Calibration conducted in collaboration with BMKG indicated that the rainfall measurements obtained from the system had a satisfactory level of accuracy and closely matched the reference values. Furthermore, the ESP32 and Telegram-based data transmission system successfully displayed rainfall data in real time. However, automatic testing revealed a relatively large measurement discrepancy compared to the reference values due to the limited sensitivity of the reed switch sensor used in the system.

Overall, the developed device successfully performed its primary function as a solar-powered automatic rainfall measuring instrument and is suitable for research, educational purposes, and the development of weather instrumentation technology. Nevertheless, improvements in sensor performance and measurement accuracy are still required before the system can be fully implemented for long-term daily weather monitoring.

Keywords: rainfall measurement, solar panel, ESP32, Telegram, tipping bucket, weather instrumentation.