

ABSTRAK

Akbar Mukti Sasono. 2026. Pengembangan Sistem Monitoring Daya Listrik Secara Real-Time Menggunakan ESP2. Skripsi. Program Studi Pendidikan Teknik Elektro, FKIP, Universitas PGRI Madiun. Pembimbing (I) Ihtiari Prastyaningrum, S.Si., M.Si. ,(II) Pramudya Ardi, S.Pd., M.Pd.

Peningkatan kebutuhan energi listrik dan tidak adanya sistem monitoring yang efisien sering menimbulkan pemborosan energi dan risiko keamanan akibat beban berlebih. Penelitian terdahulu umumnya masih terbatas pada monitoring pasif tanpa integrasi fitur perhitungan biaya real-time, proteksi otomatis, pengaturan durasi pemantauan, serta tampilan monitor yang informatif dalam satu platform. Penelitian ini bertujuan untuk mengembangkan sistem monitoring daya listrik secara *real-time* berbasis ESP32 yang terintegrasi dengan sensor PZEM-004T, layar TFT ILI9341, modul *relay 4 channel*, dan platform Blynk IoT. Metode yang digunakan adalah *Research and Development* dengan model ADDIE *Analysis, Design, Development, Implementation, Evaluation* yang meliputi analisis kebutuhan, perancangan sistem, pengembangan prototipe, implementasi uji coba, dan evaluasi kelayakan. Hasil pengembangan menunjukkan bahwa sistem mampu membaca parameter kelistrikan meliputi tegangan, arus, daya, energi, frekuensi, dan *power factor* secara *real-time*, menghitung biaya listrik otomatis dalam satuan Rupiah, menyediakan data riwayat harian, mingguan, dan bulanan, serta melakukan proteksi *cut-off* otomatis saat terjadi *overload* atau batas biaya terlampaui. Uji kalibrasi sensor menunjukkan akurasi tinggi dengan *error* rata-rata tegangan sebesar 0,27%. Hasil validasi ahli memperoleh nilai 92,8% dengan kriteria sangat layak, sedangkan uji respon masyarakat terhadap 15 responden di Desa Purworejo memperoleh nilai 93,6% dengan kriteria sangat sesuai. Kesimpulan dari penelitian ini adalah sistem monitoring daya listrik berbasis ESP32 telah berhasil dikembangkan dan dinilai sangat layak digunakan sebagai alat pemantauan serta proteksi konsumsi energi listrik bagi rumah tangga dan usaha kecil.

Kata Kunci : Monitoring daya listrik, ESP32, PZEM-004T, Internet of Things, ADDIE, Blynk, proteksi over-current.

ABSTRAK

Akbar Mukti Sasono, 2026. Development of a Real-Time Electrical Power Monitoring System Using ESP2. Thesis. Electrical Engineering Education Program, Faculty of Teacher Training and Education, PGRI University of Madiun. Advisors: (I) Ihtiari Prastyaningrum, S.Si., M.Si., (II) Pramudya Ardi, S.Pd., M.Pd.

Key Terms : Electricity monitoring, ESP32, PZEM-004T, Internet of Things,

ADDIE, Blynk, overcurrent protection The increasing demand for electrical energy and the lack of an efficient monitoring system often lead to energy waste and safety risks due to overloads. Previous research has generally been limited to passive monitoring without integrating real-time cost calculation, automatic protection, adjustable monitoring duration, and an informative display into a single platform. This study aims to develop a real-time electrical power monitoring system based on the ESP32, integrated with a PZEM-004T sensor, an ILI9341 TFT display, a 4-channel relay module, and the Blynk IoT platform. The method used is Research and Development following the ADDIE model (Analysis, Design, Development, Implementation, Evaluation), which includes requirements analysis, system design, prototype development, pilot testing, and feasibility evaluation. The results of the development show that the system is capable of reading electrical parameters—including voltage, current, power, energy, frequency, and power factor—in real time; automatically calculating electricity costs in Rupiah; providing daily, weekly, and monthly historical data; and performing automatic cut-off protection in the event of an overload or when cost limits are exceeded. Sensor calibration tests showed high accuracy with an average voltage error of 0.27%. Expert validation yielded a score of 92.8%, meeting the “highly suitable” criterion, while a community response survey of 15 respondents in Purworejo Village yielded a score of 93.6%, meeting the “highly appropriate” criterion. The conclusion of this study is that the ESP32-based electricity monitoring system has been successfully developed and is deemed highly suitable for use as a tool for monitoring and protecting electricity consumption in households and small businesses.