INTISARI

PERANCANGAN DAN IMPLEMENTASI ALAT MONITORING KUALITAS DAYA BERBASIS IoT UNTUK ANALISIS PENGARUH JENIS BEBAN TERHADAP FAKTOR DAYA

Gustiar Fikri Humami
21/480503/SV/19649

Kualitas daya listrik yang buruk akibat faktor daya rendah dari beban induktif menyebabkan ketidakefektifan energi dan kerusakan peralatan. Mengatasi keterbatasan sistem monitoring komersial yang kurang fleksibel, penelitian ini merancang dan mengimplementasikan sistem monitoring kualitas daya berbasis platform IoT *open-source* untuk menganalisis pengaruh jenis beban terhadap faktor daya dan mendeteksi penyimpangan sesaat.

Sistem ini menggunakan mikrokontroler ESP32, sensor PZEM-004T, dan *backend* berbasis Docker, InfluxDB, serta Grafana. Pengujian dilakukan pada beban resistif, induktif, dan kombinasi keduanya, dengan akurasi sistem tervalidasi di bawah 5% *error* terhadap alat ukur standar.

Hasil menunjukkan bahwa beban induktif secara signifikan menurunkan PF dari 0,98 menjadi 0,67. Kombinasi kedua beban terbukti efektif memperbaiki PF hingga 0,96, sesuai dengan perhitungan teoretis (0,948). Sistem juga berhasil mendeteksi dan merekam penyimpangan seperti penurunan tegangan sesaat yang berkorelasi tepat dengan momen aktivasi beban induktif, membuktikan fungsinya sebagai alat diagnostik yang akurat.

Kata kunci : Kualitas Daya, Faktor Daya, *Internet of Things* (IoT), Sistem Monitoring

ABSTRACT

DESIGN AND IMPLEMENTATION OF IoT-BASED POWER QUALITY MONITORING TOOL FOR ANALYZING THE EFFECT OF LOAD TYPES ON POWER FACTOR

Gustiar Fikri Humami
21/480503/SV/19649

Poor power quality, resulting from a low power factor (PF) caused by inductive loads, leads to energy inefficiency and equipment damage. To overcome the limitations of inflexible commercial monitoring systems, this research designs and implements an *open-source*, IoT-based power quality monitoring system to analyze the influence of load types on the power factor and detect transient deviation.

The system uses an ESP32 microcontroller, a PZEM-004T sensor, and a backend based on Docker, InfluxDB, and Grafana. Tests were conducted on resistive, inductive, and combined loads, with the system's accuracy validated to be under a 5% error margin when compared to standard measuring instruments.

The results demonstrate that inductive loads significantly reduce the PF from 0.98 to 0.67. The combination of both loads proved effective in improving the PF to 0.96, consistent with the theoretical calculation of 0.948. The system also successfully detected and recorded deviation, such as momentary voltage drops that correlated precisely with the activation of the inductive load, proving its function as an accurate diagnostic tool.

Keyword *: Power Quality, Power Factor, Internet of Things (IoT), Monitoring System*