

ABSTRAK

SISTEM MONITORING KUALITAS TANAH PERTANIAN BERBASIS FUZZY LOGIC

(2026 : xiv + 104 Halaman + 31 Gambar + 36 Tabel + 10 Lampiran)

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Penelitian ini membahas perancangan sistem monitoring kualitas tanah pertanian berbasis Internet of Things (IoT) dan Fuzzy Logic untuk memantau kondisi lahan secara *real-time* dan mengklasifikasikan kualitas tanah menjadi kategori Buruk, Sedang, dan Baik. Sistem menggunakan mikrokontroler ESP32 yang terhubung dengan sensor tanah NPK, modul RS485, LCD 20x4 I2C, serta jaringan Wi-Fi untuk pengiriman data dan notifikasi melalui bot Telegram. Parameter yang dipantau meliputi kelembapan tanah, Nitrogen (N), Fosfor (P), dan Kalium (K), yang diolah menggunakan metode Fuzzy Inference System (FIS) Mamdani dengan defuzzifikasi centroid. Pengujian dilakukan di dua lokasi lahan pertanian di Kota Palembang dan menunjukkan bahwa sistem mampu membaca parameter tanah dengan stabil, mengirim notifikasi dengan baik, serta mengklasifikasikan kualitas tanah sesuai kondisi lapangan. Sistem ini diharapkan dapat membantu pengambilan keputusan pemupukan dan pengelolaan lahan secara lebih tepat, efisien, dan berbasis data.

Kata kunci: kualitas tanah, IoT, ESP32, sensor NPK, Fuzzy Logic Mamdani, Telegram bot, monitoring *real-time*.

ABSTRACT

SOIL QUALITY MONITORING SYSTEM FOR AGRICULTURAL LAND BASED ON FUZZY LOGIC

(2026: xiv + 104 pages + 31 figures + 36 tables + 10 appendices)

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This study discusses the design of an agricultural soil quality monitoring system based on the Internet of Things (IoT) and Fuzzy Logic to monitor field conditions in real time and classify soil quality into Poor, Moderate, and Good categories. The system uses an ESP32 microcontroller connected to an NPK soil sensor, an RS485 module, a 20x4 I2C LCD, and a Wi-Fi network for data transmission and notifications through a Telegram bot. The monitored parameters include soil moisture, Nitrogen (N), Phosphorus (P), and Potassium (K), which are processed using the Mamdani Fuzzy Inference System (FIS) with centroid defuzzification. Testing was carried out at two agricultural sites in Palembang and showed that the system could read soil parameters stably, send notifications properly, and classify soil quality according to field conditions. This system is expected to support fertilization and land management decisions more accurately, efficiently, and data-driven.

Keywords: soil quality, IoT, ESP32, NPK sensor, Mamdani Fuzzy Logic, Telegram bot, real-time monitoring.