SISTEM *MONITORING* KADAR NH_3 DAN CH_4 PADA KANDANG AYAM TERTUTUP BERBASIS MIKROKONTROLER DAN TERINTEGRASI *INTERNET OF THINGS*

SKRIPSI

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ABSTRAK

Manajemen lingkungan yang kurang optimal pada peternakan kandang ayam tertutup memicu akumulasi gas amonia (NH_3) dan metana (CH_4) yang berisiko terhadap kesehatan ternak. Penelitian ini bertujuan untuk merancang dan mengimplementasikan sistem *monitoring* kualitas udara berbasis *Internet of Things* (IoT) untuk mengukur kadar NH_3, CH_4, dan temperatur secara *real-time*. Sistem dikembangkan menggunakan mikrokontroler NodeMCU ESP8266 dengan sensor MQ-137, MQ-4, dan DHT22 yang terintegrasi dengan platform Blynk. Pengujian dilakukan melalui karakterisasi sensor terhadap alat standar dan uji coba lapangan di peternakan ayam Universitas Andalas. Hasil penelitian menunjukkan bahwa sensor MQ-137 memiliki rata-rata error sebesar 5,36% dibandingkan alat *impinger* dengan koefisien determinasi (R^2) sebesar 0,9728. Sensor DHT22 menunjukkan rata-rata *error* suhu 1,94% dan kelembaban 3,31%. Sensor MQ-4 menunjukkan linearitas kuat (R^2) sebesar 0,9809, meskipun memiliki variasi *error* antara 4,76% hingga 66,10%. Data uji lapangan menunjukkan kadar gas amonia berkisar hingga ≥15 ppm, yang dalam praktik lapangan telah memicu tindakan pengelolaan kandang oleh peternak. Sistem ini dilengkapi fitur notifikasi peringatan dini pada layar LCD dan aplikasi Blynk yang aktif ketika kadar amonia mencapai 15 ppm sebagai dasar pengambilan keputusan pembalikan sekam. Sistem berhasil menyediakan informasi kuantitatif kualitas udara secara *real-time*, sehingga memungkinkan tindakan preventif yang lebih cepat dan berbasis data.

Kata kunci: Amonia, *Monitoring*, *Internet of Things*, Kandang Ayam Tertutup, Metana

SYSTEM MONITORING OF NH_3 AND CH_4 IN CLOSED HOUSE BASED ON MICROCONTROLLER AND INTEGRATED INTERNET OF THINGS

ABSTRACT

Suboptimal environmental management in closed-house poultry farming can lead to the accumulation of ammonia (NH_3) and methane (CH_4) gases, which pose risks to broiler health and productivity. This study aims to design and implement an Internet of Things (IoT)-based air quality monitoring system for real-time measurement of NH_3, CH_4, and temperature in a closed-house broiler farm. The system was developed using a NodeMCU ESP8266 microcontroller integrated with MQ-137, MQ-4, and DHT22 sensors, and connected to the Blynk platform for data visualization and remote monitoring. Sensor performance was evaluated through characterization tests against standard reference instruments, followed by field testing at the broiler farm of Universitas Andalas. The results show that the MQ-137 sensor achieved an average error of 5.36% compared to the impinger method, with a coefficient of determination (R^2) of 0.9728. The DHT22 sensor recorded average errors of 1.94% for temperature and 3.31% for humidity. The MQ-4 sensor exhibited strong linearity (R^2) of 0.9809, although the measurement error ranged from 4.76% to 66.10%. Field test results indicate that ammonia concentrations reached values of approximately 15 ppm, which in practical farm management has triggered immediate corrective actions by farmers. Therefore, the system was equipped with an early warning notification feature that activates when ammonia levels reach 15 ppm, displayed on both the LCD and the Blynk application as an indicator for litter turning. Overall, the developed system successfully provides quantitative, real-time air quality information, enabling faster and data-driven preventive actions in closed-house poultry farming.

Keywords: Ammonia, Monitoring, Internet of Things, Closed house, Methane