

RANCANGAN *PROTOTYPE* IoT UNTUK MENDETEKSI GAS AMONIA DAN METANA PADA LINGKUNGAN TERNAK AYAM MENGGUNAKAN SENSOR MQ-135 DAN MQ-4

ABSTRAK

Peningkatan populasi ayam pada sektor peternakan menyebabkan bertambahnya akumulasi kotoran yang dapat menghasilkan gas amonia (NH_3) dan metana (CH_4). Konsentrasi gas yang tinggi dapat menurunkan kualitas udara kandang, mengganggu kesehatan ternak, serta berdampak terhadap lingkungan. Penelitian ini bertujuan merancang dan membangun prototype berbasis Internet of Things (IoT) untuk mendeteksi serta memantau kadar gas amonia dan metana secara real-time menggunakan sensor MQ-135 dan MQ-4. Metode penelitian yang digunakan adalah pendekatan kualitatif dengan teknik pengumpulan data melalui observasi, wawancara, dan studi pustaka. Pengembangan sistem menggunakan model Waterfall yang meliputi analisis kebutuhan, perancangan, implementasi, dan pengujian. Prototype menggunakan NodeMCU ESP32 sebagai mikrokontroler, sensor MQ-135 dan MQ-4 sebagai pendeteksi gas, LCD 16×2 dan buzzer sebagai indikator lokal, serta website dan Telegram sebagai media monitoring dan notifikasi. Data hasil pembacaan sensor dikirim melalui jaringan internet ke server dan ditampilkan secara real-time. Berdasarkan hasil pengujian, sistem mampu mendeteksi perubahan konsentrasi gas, menampilkan data pada LCD dan website secara sinkron, serta memberikan notifikasi ketika kadar gas melebihi ambang batas 25 ppm. Pada kondisi berbahaya, sistem secara otomatis mengaktifkan buzzer dan kipas untuk membantu mengurangi konsentrasi gas. Pengujian usability terhadap website memperoleh nilai rata-rata 89,83% dengan kategori sangat baik, sedangkan pengujian blackbox menunjukkan fungsi utama sistem berjalan sesuai kebutuhan. Dengan demikian, prototype yang dirancang dapat membantu peternak melakukan pemantauan kualitas udara kandang secara efektif dan mendukung tindakan peringatan dini untuk menjaga kesehatan serta produktivitas ayam. Sistem juga memungkinkan pemantauan jarak jauh sehingga peternak dapat mengetahui kondisi kandang tanpa harus melakukan pemeriksaan secara langsung dan terus-menerus di lokasi kandang.

Kata kunci : *Internet of Things (IoT), MQ-135, MQ-4, monitoring gas, peternakan ayam.*

***IoT PROTOTYPE DESIGN TO DETECT AMMONIA AND
METHANE GASES IN A CHICKEN FARM ENVIRONMENT
USING MQ-135 AND MQ-4 SENSORS***

ABSTRACT

The increasing population of chickens in the livestock sector leads to the accumulation of manure, which can produce ammonia (NH₃) and methane (CH₄) gases. High concentrations of these gases can reduce air quality inside poultry houses, affect livestock health, and have environmental impacts. This study aims to design and develop an Internet of Things (IoT)-based prototype for detecting and monitoring ammonia and methane gas levels in real time using MQ-135 and MQ-4 sensors. The research employed a qualitative approach, with data collected through observation, interviews, and literature review. The system was developed using the Waterfall model, which consists of requirements analysis, system design, implementation, and testing. The prototype uses a NodeMCU ESP32 as the microcontroller, MQ-135 and MQ-4 sensors for gas detection, an LCD 16×2 and buzzer as local indicators, and a website and Telegram as monitoring and notification media. Sensor readings are transmitted through an internet connection to the server and displayed in real time. Based on the testing results, the system was able to detect changes in gas concentrations, display data synchronously on the LCD and website, and provide notifications when gas levels exceeded the threshold of 25 ppm. Under hazardous conditions, the system automatically activates the buzzer and fan to help reduce gas concentrations. Usability testing of the website resulted in an average score of 89.83%, categorized as very good, while black-box testing showed that the main system functions operated according to requirements. Therefore, the developed prototype can effectively assist farmers in monitoring poultry house air quality and support early warning measures to maintain chicken health and productivity. The system also enables remote monitoring, allowing farmers to monitor poultry house conditions without continuous direct inspection.

Keywords : *Internet of Things (IoT), MQ-135, MQ-4, gas monitoring, poultry farming.*