

INTISARI

Penelitian ini berjudul “Sistem Monitoring Kualitas Udara Wilayah Klaten Berbasis IoT (Studi Kasus: Wilayah Industri Kecamatan Ceper)”. Penelitian bertujuan merancang dan membangun sistem monitoring kualitas udara berbasis *Internet of Things (IoT)* yang menyajikan data secara berkala, mengimplementasikan sistem peringatan otomatis apabila konsentrasi asap/gas polutan melampaui ambang batas, serta mengetahui kinerja sistem pada tiga titik pemantauan di kawasan industri Kecamatan Ceper, Klaten. Variabel penelitian dibatasi pada konsentrasi asap/gas (sensor MQ-2) serta suhu dan kelembaban udara (sensor DHT22), dengan ESP32 sebagai pengendali dan *platform* Blynk sebagai media penyajian data. Penelitian menggunakan Prototype Model, dengan analisis data mencakup konsistensi pembacaan sensor, kinerja notifikasi otomatis, keberhasilan transmisi data, dan fungsionalitas sistem. Hasil pengujian menunjukkan prototipe berhasil menyajikan data konsentrasi asap/gas, suhu, dan kelembaban secara berkala melalui dashboard Blynk. Pengujian Black-box menunjukkan seluruh lima fitur utama berfungsi baik, dengan seluruh data berhasil ditransmisikan tanpa kehilangan data di tiga titik pemantauan. Sistem peringatan otomatis tervalidasi berhasil pada seluruh lima kali pengujian *trigger* tersendiri dengan rata-rata waktu respons 3,4 detik, mengingat konsentrasi asap/gas rill di lapangan selama tujuh hari pemantauan tidak pernah melampaui ambang batas. Selama tujuh hari pemantauan, konsentrasi asap/gas tertinggi berada di Titik 2 Ngawonggo (113,81 ppm), diikuti Titik 1 Tegalduwur (89,52 ppm), dan terendah di Titik 3 Krawingan (53,7 ppm), sejalan dengan kepadatan industri di sekitarnya, serta menurun pada hari libur dibanding hari kerja. Dapat disimpulkan bahwa sistem monitoring kualitas udara berbasis IoT menggunakan ESP32, sensor MQ-2, dan DHT22 yang terintegrasi dengan platform Blynk berhasil dibangun, berfungsi dengan baik, andal dalam transmisi data, serta mampu mendeteksi variasi kualitas udara secara spasial maupun temporal. Sistem ini berpotensi menjadi alat bantu pemantauan kualitas udara di kawasan industri serta masukan bagi masyarakat dan pemerintah daerah.

Kata kunci: monitoring kualitas udara, *Internet of Things*, ESP32, sensor MQ-2, sensor DHT22

ABSTRACT

This research is titled "IoT-Based Air Quality Monitoring System for the Klaten Region (Case Study: Industrial Area of Ceper District)." The study aims to design and build an Internet of Things (IoT)-based air quality monitoring system that provides periodic data, implements an automatic warning system triggered when smoke or pollutant gas concentrations exceed a threshold, and evaluates system performance at three monitoring points within the industrial area of Ceper District, Klaten. Research variables were limited to smoke/gas concentration (measured by the MQ-2 sensor) and air temperature and humidity (measured by the DHT22 sensor), utilizing the ESP32 as the controller and the Blynk platform for data presentation. The study employed the Prototype Model, with data analysis covering sensor reading consistency, automatic notification performance, data transmission success, and overall system functionality. Test results indicate that the prototype successfully presented periodic data on smoke/gas concentration, temperature, and humidity via the Blynk dashboard. Black-box testing demonstrated that all five key features functioned correctly, achieving successful data transmission across all point without data loss across the three monitoring points. The automatic warning system was validated successfully across all five separate trigger test with an average response time of 3.4 seconds; notably, actual smoke/gas concentrations in the field never exceeded the threshold during the seven-day monitoring period. Throughout the seven days of monitoring, the highest smoke/gas concentration was recorded at Point 2 (Ngawonggo: 113.81 ppm), followed by Point 1 (Tegalduwur: 89.52 ppm), and the lowest at Point 3 (Krawingan: 53.7 ppm) a pattern consistent with the surrounding industrial density with levels decreasing on holidays compared to workdays. It can be concluded that the IoT-based air quality monitoring system utilizing the ESP32, MQ-2 sensor, and DHT22 sensor integrated with the Blynk platform was successfully developed; it functions effectively, ensures reliable data transmission, and is capable of detecting air quality variations across both spatial and temporal dimensions. This system holds potential as a tool for monitoring air quality in industrial areas and as a source of information for the public and local government.

Keywords: air quality monitoring, Internet of Things, ESP32, MQ-2 sensor, DHT22 sensor