

ABSTRACT

Increasing urban air pollution has become a critical environmental issue, posing serious health consequences for its residents. To address this, an effective environmental monitoring system is needed to provide accurate, real-time air quality data. This research develops such a solution using the prototyping development model. The system is built based on the Internet of Things (IoT), with an ESP32 microcontroller serving as the central data processing unit. This device integrates a comprehensive set of sensors, including those for CO₂, NH₃, temperature, humidity, atmospheric pressure, and wind direction. All collected data is then transmitted wirelessly to the Thingspeak cloud platform for continuous analysis and visualization. The results of a 48-hour field test in Bandung demonstrated the system's stable and reliable performance. Specific data readings included CO₂ levels between 2300-2500 ppm, temperatures of 28-28.1°C, and atmospheric pressure of 932-935 hPa. The resulting Air Pollution Standard Index (ISPU) value was 85, indicating "moderate" air quality during the testing period. Data was successfully transmitted without packet loss and displayed on a custom AQMS web dashboard. Thus, this system proves to be a cost-effective and scalable solution, providing access to accurate data for the public and environmental authorities to support pollution mitigation efforts.

Keywords— Air Quality, Environmental Monitoring, ESP32, Internet of Things (IoT), Thingspeak