Application of the Internet of Things to Measure Smoke and Dust Particles as Air Quality Parameters

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ABSTRACT

Poor air quality caused by fine particulate matter (PM2.5) can be harmful to health. Nogosari Village is an area at risk of air pollution due to agricultural activities and waste burning. However, to date, there has been no real-time air quality monitoring system available. This research aims to design and implement an Internet of Things (IoT)-based air quality monitoring system using a NodeMCU ESP8266, a GP2Y1010AU0F dust sensor, and a 16x2 I2C LCD. Data is sent via the MQTT protocol to the Node-RED dashboard and displayed as graphs and location maps. The system also sends automatic notifications via Telegram if PM2.5 values fall into the Alert (55.5–150.4 µg/m³) and Hazard (>150.5 µg/m³) categories. Test results show that all system components achieved a 100% success rate, including sensor readings, data transmission to the dashboard, and warning notifications. Although no professional benchmarking tools are used, the system still accurately illustrates air quality trends in real time.

Keywords: Air quality, PM2.5, Internet of Things, NodeMCU, Node-RED