

ABSTRACT

Restaurants are often areas with high levels of cigarette smoke exposure, even though smoke-free zones (SFZs) have been implemented. Verbal prohibitions are more effective than written prohibitions. This study aims to design an Internet of Things (IoT)-based air quality monitoring and cigarette smoke detection system equipped with automatic voice alerts to support the implementation of SFZs in restaurants. The system uses an ESP32 as the microcontroller and three types of sensors: DHT22 for temperature and humidity, PM2.5 for fine dust particles, and MQ2 for detecting carbon monoxide (CO) levels from cigarette smoke. Sensor data is transmitted to the Node-RED dashboard in real time via the MQTT protocol. The system can display temperature, humidity, environmental comfort status, PM2.5 and CO concentrations in ppm and $\mu\text{g}/\text{m}^3$ units, as well as air quality indices based on ISPU standards. When CO levels exceed the threshold of $>9\text{ppm}$, the system activates the DFPlayer Mini as an audio warning prohibiting smoking. Testing shows the system can detect cigarette smoke up to 3 meters away. Measurement results indicate temperature and humidity values can indicate comfort index, while PM2.5 and CO levels are used to determine the ISPU index. The system also demonstrates good network performance with a delay of 60.95 milliseconds, jitter of 59.13 milliseconds, and 0% packet loss. This system can be used for remote air quality monitoring and provides automatic voice alerts, thereby supporting a healthier and smoke-free dining environment.

Keywords: Air Quality Monitoring, Cigarette Smoke Detection, IoT, Smokefree Areas, Voice Alerts