

ABSTRACT

This research aims to design and develop an air quality monitoring system based on oxygen (O₂) and carbon dioxide (CO₂) sensors, integrated with the Tsukamoto Fuzzy Logic method and the Internet of Things (IoT). The system utilizes the Gravity: I2C Oxygen sensor to measure O₂ levels and the MG-811 sensor to detect CO₂ levels, with an ESP32 microcontroller serving as the central unit. Data acquisition, fuzzy classification, and real-time transmission to Firebase are handled by the ESP32, while data visualization and classification results are displayed through a mobile application built on Kodular. Sensor calibration was performed using the Boleen gas detector as a reference, and the results showed that sensor readings remained within acceptable tolerance limits. The Tsukamoto Fuzzy Logic method successfully classified air conditions into three categories: Normal, Not Normal, and Hazardous, with classification outcomes consistent with manual calculations. Overall, the system functioned accurately, reliably, and in real-time, demonstrating its effectiveness for ambient air quality monitoring in various environments.

Keywords: *Tsukamoto Fuzzy Logic, MG-811, Gravity: I2C Oxygen Sensor, IoT, Air Quality Monitoring*