

ABSTRACT

Freon leakage in an Air Conditioner (AC) system can reduce cooling performance, increase energy consumption, and have a negative impact on the environment; therefore, an effective early detection system is required. This study aims to obtain an early detection system for AC freon leakage based on an ESP32 microcontroller integrated with the Internet of Things using an MQ-135 sensor, local alarms (LED and buzzer), an LCD display, as well as remote monitoring and control through the Ubidots platform. The research methods include hardware and software design, sensor calibration, and system testing by comparing the measurement results with the SNDWAY SW-743A standard instrument. Calibration was performed using a third-order polynomial regression method to improve data conformity. The results showed that the system was able to detect variations in freon leakage levels based on the degree of service valve loosening. Under conditions of 1/4 turn, 1/2 turn, 3/4 turn, and 1 full turn loosening, the average concentration values obtained were 229.048 ppm, 319.208 ppm, 476.144 ppm, and 1000 ppm, respectively. All of these values were above the threshold of 95.6 ppm, causing the system to classify the condition as a leak and automatically activate the warning alarm. In addition, IoT integration enables real-time data monitoring and data storage for further analysis.

Keywords: *Freon leakage, ESP32, MQ-135 Sensor, IoT, Gas detection*