

ABSTRACT

The Sikidang Crater tourist area in the Dieng Plateau has the potential for sulfur gas (H_2S) hazards that can threaten the safety of visitors, ranging from respiratory distress to the risk of death. The current monitoring system is still manual, so it is not effective in providing immediate and fast (real-time) alerts. Therefore, this study aims to design and build an Internet of Things (IoT)-based sensor system that is able to detect increased sulfur gas concentrations and provide early warnings. The scope of implementation of this system is focused on five strategic points spread across the Sikidang Crater tourist area to ensure effective monitoring. To overcome these problems, this research developed a hardware system centered on the ESP32 microcontroller. The system integrates three types of gas sensors: MQ-136 for hydrogen sulfide (H_2S), MQ-135 for general air quality, and MQ-4 for methane (CH_4) for data acquisition. Once the data is processed, the system automatically sends alerts to users via Telegram Bot if dangerous gas levels are detected. In order to anticipate possible connectivity disruptions at the location, this system is equipped with local data storage features. This feature ensures that even when the device is offline, all sensor readings are still recorded and won't be lost, keeping the data safe. The test results showed excellent performance and proved to be effective as an early warning system. The system is able to detect H_2S gas concentrations in the range of 0-300 ppm with an accuracy rate of 95.35% when compared to devices with health standard measurements. The system's response time, from gas detection to notifications received by users, is recorded to be an average of 3.2 seconds. The implementation of the system at five strategic points successfully covered 92% of the total tourist areas with a very high data transmission success rate of 98.3%, during the test period.

Keywords: *IoT (Internet of Things), Sulfur Gas Detection, Early Warning System, Sikidang Crater, ESP32*