

ABSTRACT

An Early Warning System (EWS) is a system that integrates hazard monitoring, information dissemination, and preparedness in addressing various types of disasters. This system is designed to provide early alerts, enabling anticipatory actions to minimize risks and impacts. One of the disasters that frequently occurs in Indonesia is forest fires. Data from 2023 show that forest fires have caused damage to more than 1.6 million hectares of ecosystems. The implementation of EWS for forest fires is crucial to ensure continuous environmental monitoring and real-time information delivery to support prevention and mitigation efforts.

This study developed a forest fire EWS based on a mobile application and web landing page integrated with a fiber optic network. The system utilizes temperature, smoke, and humidity sensors connected to a microcontroller to monitor environmental conditions. Testing was conducted by comparing sensor distances (30–70 cm) and variations in wind speed (1.0–2.0 m/s) to evaluate their effect on detection performance.

Based on the test results, temperature, humidity, and smoke concentration showed variations influenced by distance and wind speed. Temperature was higher at closer distances and decreased at farther distances, such as from 32.12°C to 29.84°C at 2.0 m/s, indicating heat dispersion by wind. Humidity increased with distance, for example from 68.72% to 69.98% at 1.0 m/s, as areas farther away were not directly exposed to heat. Smoke concentration also decreased, from 19.58 ppm to 17.54 ppm at 2.0 m/s, due to smoke particles dispersing more quickly with wind. Response time analysis showed that higher wind speeds accelerated detection, while greater distances delayed it by an average of 5 seconds per wind speed level. The system operated optimally with a web landing page receiving real-time data (≤ 1 second) and a mobile application displaying sensor data, live CCTV via IP, and automatic notifications when hazardous conditions were detected.

Keywords: forest fire, early warning system, mobile app, fiber optics.