IoT-Based Multi-Sensor Disaster Prevention System With Real-Time Local and Remote Alerts via SMS and Web Dashboard

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In 2023, U.S. fire departments responded to 1.39 million fires, resulting in 3,670 civilian deaths, 13,350 injuries, and $23 billion in damages (Hall, 2024). This investigation developed a groundbreaking, low-cost IoT device that provides immediate local and remote alarms based on the hazardous conditions being presented. This Wi-Fi- and battery-powered device features visual, auditory, and remote alerts via text (SMS) messages to prompt action. The software required more than 800 lines of original C++ code, ensuring sensor functionality, the transmission of the SMS alerts, and real-time monitoring via a remote web dashboard. With the ESP32 microcontroller at its core, the system incorporates five different sensors, Wi-Fi, and a web dashboard, enabling global accessibility from desktop and mobile platforms. The device was tested in five simulated scenarios: fires, floods, gas leaks, and extreme temperatures and humidity levels. Measurements were taken from when the condition was presented until the text message was received. A total of 265 reaction time measurements were recorded across various mobile devices, wireless providers, and times of day for each condition. This innovative IoT device helps prevent disasters by delivering rapid alerts that can save lives and protect property. Its low cost and ease of use make it accessible globally. The device achieved outstanding performance, demonstrating 100% reliability on all trials, an average response time of less than 4 seconds (3.90126316), with the slowest measurement at 7.75 seconds and the fastest at 1.16 seconds, validating the hypothesis and further demonstrating the impact the device can have on society.

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