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This project focuses on the development of a low-cost embedded wildfire monitoring system for environmental sensing and early hazard detection. The system is built around an ESP32 microcontroller and integrates an SHT31-D sensor for temperature and humidity, a PMS5000-series particulate matter sensor for smoke-related particle detection, a Wind Sensor Rev. P for airflow measurement, and a FLIR Lepton 3.5 thermal imaging module for surface temperature observation. Together, these components provide a compact and modular platform for monitoring multiple conditions associated with wildfire risk and fire behavior.

The goal of this work is to create an affordable system capable of collecting real-time environmental data in outdoor and fire-prone environments. Wildfire development is influenced by several interacting factors, including atmospheric dryness, temperature, wind conditions, airborne particulates, and thermal changes in the surrounding area. By combining these measurements into a single embedded platform, this project aims to improve situational awareness and support earlier identification of hazardous conditions.

A major emphasis of the project is accessibility and expandability. Many commercial wildfire monitoring systems are costly and difficult to adapt, so this design prioritizes low-cost hardware, modular sensor integration, and practical deployment. The platform is intended to serve as a stationary monitoring unit with future potential for adaptation to mobile or distributed sensing systems. This work contributes to fire science research by demonstrating a scalable and practical sensing approach for wildfire monitoring, environmental data collection, and future intelligent detection applications