IoT-Based Air Quality Monitoring for Open Wood-Burning Cremation Facilities

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1. Product Description

This project presents a small-scale prototype of an open wood-burning cremation facility equipped with an IoT-based air quality monitoring system. The system uses three sensors—SDS011 (particulate matter), MQ135 (toxic gases), and BME680 (temperature, humidity, VOCs)—to measure emissions produced during the cremation process continuously. Data is transmitted to Firebase and displayed in real-time on a custom-built Flutter mobile application. The system allows users to monitor live data, analyze historical trends, and receive alerts when pollutant levels exceed safe thresholds. The project offers a sustainable way to lessen the environmental effect of traditional cremation procedures by combining affordable IoT technology with practical design.

2. Innovation Objectives

The main objective of this innovation is to design and implement a real-time IoT-based air quality monitoring system specifically for open wood-burning cremation facilities. The project focuses on integrating low-cost sensors with an ESP32 microcontroller to measure particulate matter, gases, temperature, and humidity, with the data transmitted to a cloud database for processing. A mobile application is developed to provide users with real-time monitoring, historical data, and alert notifications when pollutant levels exceed safe thresholds. The

project's system aims to encourage sustainable cremation practices by providing facility owners with effective, based on data information for pollution management and community protection. In conclusion, the project highlights how low-cost IoT solutions are affordable to address urgent environmental and public health issues.

3. Problem Statement

Air pollution is a critical global issue that threatens public health, with pollutants such as particulate matter (PM), carbon monoxide (CO), volatile organic compounds (VOCs), and other harmful gases linked to respiratory and cardiovascular diseases. Traditional open wood-burning cremation facilities are significant contributors to these emissions, yet they often lack effective systems to monitor and manage real-time air quality. This creates risks for both workers and surrounding communities, while making it difficult to take timely action to reduce pollution. To address this challenge, this project proposes an IoT-based air quality monitoring system using ESP32 with SDS011, MQ135, and BME680 sensors, which will provide accurate, real-time data accessible through mobile application. This solution offers a low-cost and practical approach to improving environmental safety in cremation practices while preserving cultural traditions.

4. Authenticity / Novelty
Creating a small-scale prototype of an open wood-burning cremation facility with an IoT-based air quality monitoring system offers a new approach to reducing pollution in traditional practices. The integration of sensors with a Flutter mobile app for real-time monitoring makes the project unique.

5. Implementation Level

a) Hardware setup with ESP32, SDS011, MQ135, and BME680 sensors.

b) Integration with Firebase for real-time data transmission.

c) Development of mobile application

6. Uses and Applications
The IoT-Based Air Quality Monitoring System for Open Wood-Burning Cremation Facilities can be applied directly within cremation sites to monitor pollutant levels during burning processes. The IoT-Based Air Quality Monitoring System for Open Wood-Burning Cremation Facilities can be applied directly within cremation sites to monitor pollutant levels during burning processes. The system delivers real-time data on particulate matter, gases, temperature, and humidity, allowing operators to make immediate adjustments to reduce smoke and increase combustion efficiency. The mobile application ensures that both facility managers and policymakers have accessible, actionable insights to guide operational decisions and environmental strategies. By offering accurate monitoring and historical records, the system can also be used in educational and research fields to study air quality impacts, making it versatile and beneficial for daily operations and academic research.

7. Innovation Product/Project Impact

- Enables Real-Time Air Quality Monitoring

The system uses IoT sensors to continuously measure particulate matter, gases, and environmental conditions, giving cremation facility operators a quick overview of pollution levels.

- Delivers affordable and accessible technology through IoT and mobile integration

By using low-cost sensors and a Flutter mobile app, the project ensures that environmental monitoring is practical and accessible without depending on expensive industrial systems.

- Contributes to environmental sustainability and community well-being Monitoring helps reduce harmful exposure for workers and nearby residents, while also aligning with global sustainability goals such as clean air and healthier communities.