A

SYNOPSIS

of

MINOR PROJECT

on

Edge-Based Enviromental Monitoring For Pollution Control

Submitted by

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22EGICS145

Project Guide
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Problem Statement:

Traditional environmental monitoring systems are often centralized, expensive, and can experience delays in detecting and responding to pollution events. This limits their effectiveness in timely pollution control and management.

Brief Description:

The project aims to develop a decentralized environmental monitoring system using edge computing technology. This system will employ distributed edge devices equipped with sensors to detect pollutants in real-time at various locations. By processing data locally on these devices, the system aims to overcome the limitations of traditional centralized systems and provide more immediate and accurate information for pollution control efforts.

Objective and Scope:

- **Objective**: Develop a cost-effective and real-time environmental monitoring solution.
- **Scope**: Focus on designing edge devices with integrated pollution sensors, developing algorithms for real-time data processing and analysis, and creating a network for centralized monitoring and control.

Methodology:

- **Hardware Development**: Design and deploy edge devices (such as Raspberry Pi) equipped with sensors for pollutants like PM, NO2, SO2, and O3.

- **Software Development**: Develop algorithms using languages like Python and C/C++ for real-time data processing on edge devices. This includes data aggregation, analysis, and visualization.

- **Integration**: Establish a network of edge devices connected through IoT protocols (e.g., MQTT) to enable seamless data transmission to a centralized monitoring platform.

- **Testing and Validation**: Conduct rigorous testing to ensure the accuracy, reliability, and scalability of the system under various environmental conditions. This includes unit testing for individual components, integration testing for data flow, and field testing to validate performance in real-world scenarios.

Hardware and Software Requirements:

- **Hardware**: Edge devices (e.g., Raspberry Pi), pollution sensors (PM, NO2, SO2, O3), communication modules (Wi-Fi, GSM).

- **Software**: Embedded programming languages (Python, C/C++), data analytics libraries (Pandas, NumPy), web development technologies for visualization (HTML, CSS, JavaScript).

Technologies:

- **Edge Computing**: Processing data locally on edge devices to reduce latency and bandwidth usage, enhancing real-time responsiveness.
- **IoT**: Connecting sensors and edge devices to facilitate continuous data collection and transmission.
- **Data Analytics**: Employing machine learning algorithms for analyzing pollution data and detecting patterns or anomalies.
- **Cloud Integration**: Optionally integrating with cloud platforms for data storage, further analysis, and remote monitoring.

Testing Techniques:

- **Unit Testing**: Ensuring individual components (sensors, edge devices) function correctly.
- **Integration Testing**: Verifying seamless communication and data flow between edge devices and the centralized monitoring platform.

- **Field Testing**: Evaluating the system's performance and reliability in actual environmental conditions to validate its effectiveness and accuracy.

Project Contribution:

The project aims to advance environmental monitoring capabilities by providing a decentralized, cost-effective, and real-time solution for detecting and managing pollution. By enabling faster response times and more informed decision-making, the system supports proactive pollution control measures and contributes to sustainable development efforts.

This detailed explanation should provide a thorough understanding of each component and aspect involved in developing an edge-based environmental monitoring system for pollution control. Adjustments can be made based on specific project goals, resources, and environmental considerations.