

Smart City Air Quality Network Project Design and Innovation

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1. Introduction:

These objectives collectively aim to create healthier, more livable cities by reducing pollution, safeguarding public health, and fostering sustainable urban environments through data-driven insights and informed decision-making.

2. Problem Statement:

To address these critical challenges, there is an urgent need for the development and implementation of a Smart City Air Quality Network (SCAN). SCAN should encompass an integrated system of advanced sensors, real-time monitoring, data analytics, and public awareness initiatives. This network aims to comprehensively monitor air quality, provide timely information to residents and policymakers, and foster data-driven decision-making to reduce pollution levels, protect public health, and promote sustainable urban development.

3. Design and Innovation Strategies:

3.1. Micro Controller Selection:

Consider microcontrollers like Raspberry Pi or Arduino with Wi-Fi/LoRa capabilities for data collection and processing. Opt for models with sufficient processing power, GPIO pins, and support for sensor interfaces (e.g., I2C) to connect various air quality sensors. Evaluate the scalability and community support for seamless integration into the network.

3.2. Sensors Selection:

Choose sensors like the SDS011 for PM2.5, the MQ-7 for CO, and the BME680 for multiple parameters (temperature, humidity, VOCs). Ensure high accuracy, durability, and compatibility with your microcontroller's interface (e.g., I2C). Consider power efficiency and calibration capabilities for long-term, reliable air quality monitoring.

3.3. Connectivity:

Utilize a combination of wired (Ethernet) and wireless (Wi-Fi, LoRa, or cellular) connectivity options for data transmission. Implement redundant networks for reliability and low latency, ensuring data can be sent to a centralized server or cloud platform securely. Consider mesh networking for scalability and coverage in urban environments while adhering to IoT communication protocols (MQTT, CoAP) for efficient data exchange.

3.4. Cloud Platform:

Select a robust cloud platform like AWS, Azure, or Google Cloud for data storage, processing, and analysis. Ensure it offers scalability, security, and real-time data processing capabilities to handle the volume of air quality data generated by sensors. Implement cloud-based dashboards and APIs for easy access and integration with city management systems.

3.5. Protocol:

MQTT's lightweight and efficient publish-subscribe model makes it well-suited for real-time data transmission from air quality sensors to a central server or cloud platform. It minimizes bandwidth usage and ensures reliable communication in the network.

3.6. Public platform:

"The Things Network" (TTN) as a public platform for your smart city air quality network. TTN provides a global LoRa WAN network infrastructure, making it a convenient choice for connecting and managing IoT devices, including air quality sensors. Its open-source nature and community support can facilitate network deployment and data management in a smart city context.

4. Conclusion:

The Smart City Air Quality Network (SCAN) represents a visionary and essential initiative for our urbanized world. With the relentless growth of cities and the ever-increasing impact of pollution on public health and the environment, SCAN emerges as a beacon of hope and innovation. By leveraging advanced sensor technology, real-time monitoring, and data-driven insights, SCAN empowers cities to understand, address, and improve air quality comprehensively. This network's significance extends far beyond simply measuring pollutants; it embodies a commitment to public health, environmental preservation, and sustainable urban development.