**AIR POLLUTION MONITORING**

**PHASE 1: PROBLEM DEFINITION AND DESIGN THINKING**

**AIR POLLUTION MONITORING IOT PROJECT UNDERSTANDING AND APPROACH**

**INTRODUCTION**

Air is getting polluted because of the release of toxic gases by industries, vehicle emissions and increased concentration of harmful gases and particulate matter in the atmosphere. The level of pollution is increasing rapidly due to factors like industries, urbanization, increase in population, vehicle use which can affect human health. Particulate matter is one of the most important parameters having a significant contribution to the increase in air pollution. This creates a need for measurement and analysis of real-time air quality monitoring so that appropriate decisions can be taken in a timely period.

**UNDERSTANDING THE PROBLEM**

**1. AIR POLLUTION**

Air pollution is one of the biggest threats to the present-day environment. Everyone is being affected by air pollution day by day including humans, animals, crops, cities, forests and aquatic ecosystems. Besides that, it should be controlled at a certain level to prevent the increasing rate of global warming

**2. SOLUTION OVERVIEW**

The project involves setting up IoT devices to measure air quality parameters and make the data publicly available for raising awareness about air quality and its impact on public health. The objective is to create a platform that provides real-time air quality information to the public. This project includes defining objectives, designing the IoT monitoring system, developing the data-sharing platform, and integrating them using IoT technology and Python.

**APPROACH TO SOLVING THE PROBLEM**

**1. DEFINE PROJECT SCOPE**

The first step is to clearly define the scope of the project. This includes determining the size of the area to be covered, the number of spaces to be monitored, and the level of detail required in reporting.

**2. SENSOR DEPLOYMENT**

**a. Sensor Selection**

Choose sensors based on the pollutants of interest and their measurement accuracy, sensitivity, and precision .Consider the type of sensor technology (e.g., optical, electrochemical, gravimetric) suitable for your monitoring objectives..

**b. Sensor Placement:**

Determine the optimal locations for sensor deployment to capture representative air quality data .Place sensors in areas with high pollution levels, near pollution sources, and in areas with high human exposure (e.g., near schools, hospitals.)

**3. DATA COLLECTION AND PROCESSING**

**a. Sensor Deployment:**

Deploy air quality sensors strategically in the target area. Ensure sensors are properly calibrated and maintained.Set the sampling rate for sensors based on the pollutants being measured and monitoring objectives. Continuous or periodic sampling may be used.

**b. Sensor Networks:**

Establish a network of sensors if monitoring a large area. Ensure sensors are interconnected for data transmission.

**c. Remote Sensing:**

In addition to ground-based sensors, consider using remote sensing technologies like satellite imagery for broader-scale monitoring.

**d. Data Storage and Management:**

Establish a data storage system to securely store and organize collected data. Consider using cloud-based solutions for scalability and accessibility.

**e. Alert Systems:**

Develop real-time or threshold-based alert systems to notify authorities and the public when air quality exceeds safety limits .Use color-coded scales or air quality indices (e.g., AQI - Air Quality Index) to communicate the level of pollution to the public.

**4. USER INTERFACE DEVELOPMENT**

**a. Real-time Data Display:**

Display real-time air quality data, including pollutant concentrations, air quality indices, and weather conditions. Provide current readings and historical trends for various pollutants, both at the city or region level and at specific monitoring sites.

**b. Alerts and Notifications:**

Implement an alert system to notify users when air quality exceeds predefined thresholds or when there are health advisories.

**5. DATA VISUALIZATION AND ANALYTICS**

Data visualization and analytics play a vital role in making sense of the vast amount of air pollution data collected from monitoring sensors. These tools help stakeholders, including scientists, policymakers, and the public, understand trends, identify pollution sources, and make informed decisions

**6. USER ADOPTION AND EDUCATION**

User adoption and education are critical aspects of successful air pollution monitoring initiatives. To ensure that the public, stakeholders, and decision-makers can effectively use and benefit from air quality data.

**7. MAINTENANCE AND MONITORING**

Maintenance and ongoing monitoring are crucial components of any air pollution monitoring system to ensure its reliability, accuracy, and longevity.

**8. SCALABILITY**

Design the system with scalability in mind, allowing for easy expansion to cover additional areas as needed.

**9. DATA SECURITY AND PRIVACY**

Implement robust security measures to protect sensor data and user information. Comply with relevant data privacy regulations.

**10. CONTINUOUS IMPROVEMENT**

Regularly evaluate the system's performance and gather feedback from users to identify areas for improvement and optimization.

**CONCULSION**

The results obtained from the experiments are verified through Google data. Moreover, the led indicators help us to detect the air quality level around the setup. However, the project experiences a drawback that is it cannot measure the ppm values of the pollutant components separately. Therefore, it is possible to conclude that the designed prototype can be utilized for air quality, humidity and temperature of the surrounding atmosphere successfully.