Phase 1: Problem Definition and Design Thinking

Problem Definition:

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. This project aims to design an IOT-based air quality monitoring system using the internet from anywhere using a computer or mobile to monitor the air quality of the surroundings and environment. There are various methods and instruments available for the measurement and monitoring quality of air. The IoT-based air quality monitoring system would not only help us to monitor the air quality but also be able to send alert signals whenever the air quality deteriorates and goes down beyond a certain level

Design Thinking:

1. **Project Objective:**
   Implement a real-time monitoring system to continuously collect data on key air quality parameters. Enables quick detection of changes in air quality, allowing for prompt response to emerging issues. Measure and analyse critical air quality parameters such as particulate matter (PM2.5, PM10), carbon dioxide (CO_2), ozone (O_3), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), temperature, and humidity. Provides a comprehensive understanding of the air quality profile, helping to identify sources of pollution and potential health risks. These objectives collectively contribute to the development and implementation of a comprehensive IOT-based air quality management system that addresses environmental concerns, protects public health, and supports sustainable development.
2. **IOT Sensor Design:**
   Designing IOT sensors for air quality monitoring involves careful consideration of the specific parameters you want to measure, the environmental conditions, power consumption constraints, and communication requirements. Below are key aspects to consider in the design of IOT sensors for air quality monitoring Choose sensors based on the air quality parameters of interest (e.g., PM2.5, CO_2, NO_2).
   Consider sensor accuracy, sensitivity, and response time.
   Evaluate the suitability of sensors for outdoor or indoor deployment. Decide on the power source, considering factors such as battery life and maintenance requirements.

Explore energy-efficient options, and assess the feasibility of renewable energy sources (solar, wind) where applicable.

3. **Real-Time Transit information platform:**
   Select communication protocols based on the application and network infrastructure (e.g., MQTT, CoAP, LoRa, NB-IoT).Consider the range and data throughput requirements. Determine whether data processing will be done locally (edge computing) or in the cloud. Consider the storage capacity and the ability to handle real-time Ensure compatibility with the selected IOT platforms for seamless integration. Implement standard data formats and communication protocols for interoperability. analytics Implement a calibration mechanism to ensure sensor accuracy over time. Include self-diagnostic features to identify and compensate for sensor drift.
4. **Integration Approach:**
   Determine whether data processing will be done at the edge (on the sensor or gateway) or in the cloud. Consider the advantages of edge computing for real-time processing and cloud computing for in-depth analytics. If using edge computing, deploy IOT gateways to collect and pre-process data from sensors.
   Ensure gateways are compatible with both the sensors and the communication infrastructure. Choose a cloud platform for data storage, analysis, and visualization (e.g., AWS, Azure, Google Cloud).Integrate IOT devices with cloud services using platform-specific APIs or protocols.