**PHASE 1- AIR QUALITY MANAGEMENT**

**Problem Statement:**

Air pollution is a growing concern worldwide, affecting public health and the environment. To effectively manage air quality, real-time monitoring, data analysis, and control mechanisms are essential. Traditional air quality monitoring systems are often expensive, lack scalability, and provide limited access to data.

Air Quality Monitoring is an exercise to measure ambient air pollution levels. The data received from ambient sensors indicates the status of the quality of the air we breathe, and this is why air quality monitoring using IoT is done which can be accessible to every human being to check the quality of the air they breathe.

Helps determine if an area is meeting the air quality standards devised by CPCB, WHO or OSHA.

Therefore, there is a need for an innovative solution that leverages IoT (Internet of Things) technology to monitor and manage air quality efficiently.

**Design Solution:**

Real-time Air Quality Monitoring:

* Develop a network of IoT sensors capable of monitoring various air pollutants in real-time.
* Ensure accurate measurement of key pollutants such as Particulate matter (PM2.5, PM10), CO, NO2, SO2, O3, Volatile Organic Compounds (VOCs), aerosols and temperature humidity.
* These pollutants cause inflammation, oxidative stress, immune-suppression, and mutagenicity in cells throughout our body, impacting the lungs, heart, brain among other organs and ultimately leading to disease.

To address the problem of air quality management using IoT, a comprehensive solution can be developed as follows:

**1.Sensor Network:**

Deploy a network of air quality sensors throughout the target area, such as cities or industrial zones. These sensors should measure the above-mentioned pollutants and should trigger an alarm when the air quality goes down beyond a certain level, which means when there are number of harmful gases present in the air. The system shows the air quality in PPM on the display or the web page or in the mobile application, so that it can be monitored very easily.

**2.Data Acquisition:**

Connect the sensors to a central data acquisition system using wireless communication protocols such as LoRaWAN, Zigbee, or Wi-Fi. This system collects real-time data from the sensors, including pollutant concentrations, temperature, humidity, and GPS location.

**3.Data Storage and Processing:**

Store the collected data in a cloud-based database for long-term storage and analysis.

**4.Data Analysis and Visualization:**

The data of all the gas sensors used for measuring gases in the air is fed to the microcontroller for analysis, and it results in the Pollution level in PPM (parts per million). Gas sensors give the output in the form of voltage levels, using Analog-to-Digital conversion the digital data is outputted.

Implement data analytics and visualization tools to process and present air quality data. This includes generating real-time air quality indices, historical trend analysis, and predictive modeling. Provide easy-to-understand visualizations and alerts to inform the public and relevant authorities about air quality conditions.