PROJECT NAME : AIR QUALITY MONITORING

Phase 1: Problem Definition and Design Thinking

Problem Definition:

Developing an effective Air Quality Monitoring system that can accurately measure and analyse air pollution could be difficult. Air quality remains a significant environmental health challenge in India and large sections of the population remains in areas with higher population. Efforts are necessary to improve measurement coverage and quality including the use of Air Quality Index Meter to measure the particulate matter present in the air.

- *Accuracy:* The developing model should be accurate as it has various air pollutants to take into account, such as Particulate Matter (PM2.5 and PM10), Nitrogen Dioxide (NO2), Sulphur Dioxide (SO2), Carbon Monoxide (CO) and Ozone(O3) as they are the major particles for measuring air pollutants.

- *Data Accessibility:* To make the model successful, data which has been measured has to accessible to the public for research and awareness of the surroundings.

- *Real Time Monitoring:* The AQM system should monitor continuous and real-time data to allow immediate responses on deteriorating air quality. It has to measure PM for two size ranges,

i)PM2.5: PM2.5 consists of “fine particles” with aerodynamic diameters less than or equal to 2.5 microns.

ii)PM10: PM10 includes both “fine particles” and “coarse particles” with aerodynamic diameters greater than 2.5 microns and less than or equal to 10 microns.

- *Scalability*: A system should be designed so that it can be scaled up to cover larger geographical areas.

- *Environmental Factors*: The system should measure environmental factors like weather conditions, temperature and humidity which can influence air quality.

Design Thinking:

The AQM system includes setting up IoT devices to measure air quality parameters like pollution levels and particulate matter. This data can be made publicly available to raise awareness about air quality and its impact on public health.

The monitoring system is developed for transmission and reception of information received from various data-sources with micro-controllers. The wireless sensing real-time data are transmitted into desired form across network through internet connection.

Front end application can be developed and hosted on the cloud platform. Additionally, an App can be developed on Android platform to visualize real-time data, which are

uploaded in the designed web server, displayed data on the smart phone.

The system can also alert the users if the air quality reaches a dangerous level, allowing them to take precautions to protect themselves.

I. Components of IoT Monitoring System:

1)*Sensors*:

Sensors are the primary components of IoT-based air pollution monitoring systems. They measure various air quality parameters such as particulate matter, carbon monoxide, sulphur dioxide, and nitrogen oxides. The sensors can be classified into two categories: physical and chemical sensors. Physical sensors measure parameters such as temperature, humidity, and pressure, while chemical sensors measure air pollutants. Eg: VOC Sensors

2)*Microcontrollers*:

The microcontroller is the brain of IoT-based air pollution monitoring systems. It receives data from the sensors, processes it, and sends it to the cloud server. The microcontroller is usually a microprocessor such as Arduino, Raspberry Pi, or similar devices.

3)*Communication Module:*

The communication module is responsible for transmitting data from the microcontroller to the cloud server. Communication modules can use various wireless technologies such as Wi-Fi, Bluetooth, or cellular networks.

4)*Cloud Server:*

The cloud server is a centralized platform for storing, analysing, and sharing air quality data. It collects data from the communication module and stores it in a database. The cloud server also provides web and mobile applications for users to access the data. Eg: esp8266 module can be connected to upload this data to cloud.

5)*Power Supply:*

IoT-based air pollution monitoring systems require a power supply to operate. In case of permanent installations external power supply is provided and batteries are provided for portable devices.

6)*Enclosure:*

The enclosure is the outer covering that protects the components from environmental factors such as dust, water, and temperature.

II. Blog Creation:

IoT can be used to create blogs for better understanding of the data received. A blog can be used to raise awareness about the use of IoT in Air Quality Monitoring and its benefits. It can be used to enhance research and innovation in the field of air quality and environmental science.

Creation of blog on AQM includes the steps such as

- Choose a specific topic or theme of the blog, such as the effects of air pollution on health, the challenges and opportunities of IoT for air quality monitoring.
- Conduct research on the topic using reliable sources, such as scientific journals, reports, websites, etc.
- Write an outline the blog post, including a catchy title, an introduction that summarizes the main idea and purpose of your post.
- The blog post using clear and concise language, avoiding jargon and technical terms that might confuse your readers.
- Use headings, subheadings, bullet points, tables, charts, images, etc., to organize your content and make it more visually appealing.

Visualizing the data of air quality monitoring is a useful way to understand and communicate the levels and trends of air pollutants in the atmosphere. There are different methods and tools that can help to create interactive and informative graphs and charts to display air quality data.

- *Heatmaps:* Heatmaps are plots that use colours to represent the values of a variable across a grid. For example, you can use heatmaps to compare the PM2.5 levels in different cities during a certain period of time, as shown in this blog post. Heatmaps can help you see the patterns and variations of air quality across space and time.
- *Line charts:* Line charts are plots that use lines to connect the values of a variable over time. For example, you can use line charts to show the changes of air quality over time in a single location. Line charts can help see the trends and fluctuations of air quality over time.
- *Pie charts:* Pie charts are plots that use sectors of a circle to represent the proportions of different categories of a variable. For example, you can use pie charts to show the composition of air pollutants in a certain location. Pie charts can help see the relative contributions of different sources or types of air pollutants.
- *Scatter plots:* Scatter plots are plots that use points to represent the values of two variables on a coordinate plane. For example, you can use scatter plots to show the relationship between two air quality parameters, such as temperature and humidity . Scatter plots can help you see the correlation and distribution of air quality data.

To create these kinds of graphs and charts, various tools and software can be used such as Python, R, Excel, Tableau, Power BI, etc.