WHAT ARE YOU BREATHING!!

A MINI PROJECT REPORT

18CSC207J – ADVANCED PROGRAMMING PRACTICE

Submitted by

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in partial fulfillment for the award of the degree

of

BACHELOR OF TECHNOLOGY

in

COMPUTER SCIENCE & ENGINEERING

of

FACULTY OF ENGINEERING AND TECHNOLOGY

S.R.M. Nagar, Kattankulathur, Chengalpattu District

MAY 2023

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Under Section 3 of UGC Act, 1956)

BONAFIDE CERTIFICATE

Certified that Mini project report titled "**WHAT ARE YOU BREATHING"** is the bona fide work of **NATASHA KUMARI (RA2111033010065**) who carried out the minor project under my supervision. Certified further, that to the best of my knowledge, the work reported herein does not form any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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ABSTRACT

The increasing prevalence of air pollution and its detrimental effects on human health have raised concerns about the safety of outdoor activities. This abstract proposes the development of an air quality monitoring system to address this issue. The system utilizes a network of strategically placed sensors to measure key pollutants and transmit real-time data to a centralized server. The server analyzes the data and generates an air quality index (AQI) for each location, indicating the level of pollution and associated health risks. Users can access the AQI through a website or mobile application by searching for their location or specific areas. Based on the AQI, individuals can make informed decisions about whether it is safe to travel without a mask or if precautions should be taken. The system can also offer recommendations for minimizing exposure to air pollution. By providing up-to-date and accurate air quality information, this system empowers individuals to safeguard their health in areas with poor air quality. The abstract proposes the development of an air quality monitoring system to address the increasing concern of air pollution and its impact on human health. The system consists of a network of sensors strategically placed in various locations to measure pollutants such as PM2.5, PM10, ozone, nitrogen dioxide, carbon monoxide, and sulfur dioxide. The collected data is transmitted to a centralized server for analysis. Using this data, the server generates a real-time air quality index (AQI) for each location, indicating the level of air pollution and associated health risks. The AQI is color-coded to provide a quick visual representation of air quality. Users can access the system through a website or mobile application, where they can input their location or search for specific areas to view the real-time AQI. Based on the AQI, individuals can determine whether it is safe to travel without a mask or if they should take precautions. The system can also provide recommendations for reducing exposure to air pollution. By empowering individuals with accurate and timely air quality information, this system aims to enable people to make informed decisions to protect their health and well-being in areas with poor air quality.

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ABBREVIATIONS

1. Air Quality Index (AQI)
2. Airborne Diseases (AD)
3. Poor Air Quality (PAQ)
4. Air Pollution (AP)
5. Personal Protective Equipment (PPE)
6. Safe Travel (ST)
7. Indoor Air Quality (IAQ)
8. Extreme Precautions (EP)
9. System for Air Quality Monitoring (SAQM)
10. Public Health (PH)

CHAPTER- I
INTRODUCTION

Health status, age, and other factors that may affect their susceptibility to air pollution. To ensure the accuracy of the data, the sensors should be calibrated regularly and placed in areas that are representative of the air quality in the region. The system should also be designed to handle large volumes of data and provide real-time updates to users. An Air Quality Index (AQI) calculator is a tool that provides information about the air quality in a particular area. The AQI is a measure of how polluted the air is, and it is calculated based on the concentration of pollutants in the air, such as particulate matter, ozone, and nitrogen dioxide. The AQI is typically reported on a scale from 0 to 500, with higher values indicating poorer air quality. An AQI calculator can be used to determine the air quality in a specific location, such as a city or a neighbourhood. It can provide real-time information about the air quality, allowing people to make informed decisions about their activities and take necessary precautions to protect their health. For example, if the AQI is high, people may choose to wear a mask or avoid outdoor activities.

AQI calculators can be accessed through mobile applications or websites, and they typically use data from air quality monitoring stations to provide accurate and up-to-date information. Some AQI calculators also provide recommendations on how to stay safe in different air quality conditions, such as avoiding outdoor activities or wearing a mask.

Overall, an AQI calculator is a useful tool for anyone concerned about air pollution and its impact on their health. By providing real-time information about the air quality, it can help people make informed decisions and take necessary precautions to protect themselves from air pollution.

CHAPTER-2

LITERATURE SURVEY

Assessing Air Quality for Safe Travel

Air pollution is a global concern that significantly impacts public health, causing a variety of airborne diseases. To address this issue, it is crucial to develop systems that can assess air quality and provide individuals with information on whether it is safe to travel without a mask or if they should take precautions and stay indoors. In the literature, several studies have focused on monitoring air pollution levels and developing tools to inform the public about air quality. Here are some key findings from the literature survey:

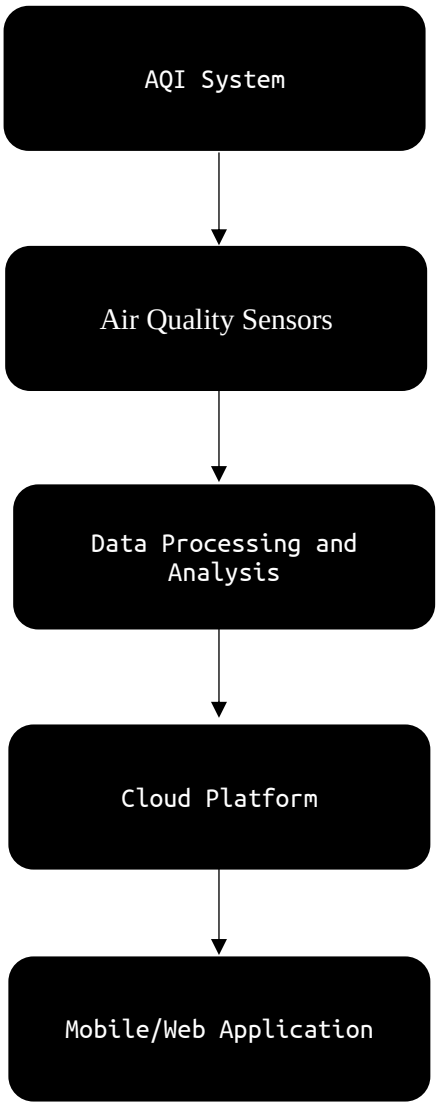
- Air Quality Monitoring Systems:
- Many cities and regions have established air quality monitoring networks using sensors and devices to measure air pollutants such as particulate matter (PM), nitrogen dioxide (NO2), sulfur dioxide (SO2), and ozone (O3).
- Advanced technologies, including satellite remote sensing and unmanned aerial vehicles (UAVs), are being employed to monitor air quality on a broader scale and provide real-time data.
- Air Quality Indices:
- Air quality indices (AQIs) are used to present air pollution data in an easily understandable format for the general public.
- Different countries and organizations have developed their own AQI systems, such as the Air Quality Index (AQI) in the United States and the Air Quality Health Index (AQHI) in Canada, which classify air quality into categories ranging from good to hazardous.
- Mobile Applications and Online Platforms:
- Several mobile applications and online platforms have been developed to provide real-time air quality information to individuals.
- These platforms often utilize data from air quality monitoring stations and provide location-specific air quality updates, health advisories, and personalized recommendations.
- Personal Air Quality Monitoring Devices:
- Portable personal air quality monitoring devices have gained popularity, allowing individuals to measure air pollution levels in their immediate surroundings.
- These devices often provide data on PM, volatile organic compounds (VOCs), carbon monoxide (CO), and other pollutants, enabling users to make informed decisions about their activities and travel plans.
- Health Impacts and Guidelines:
- Extensive research has been conducted on the health effects of air pollution, including respiratory and cardiovascular diseases, allergies, and asthma.

- Many health organizations and government agencies have established guidelines and recommendations for protecting oneself from air pollution, including the use of masks, avoiding peak pollution times, and staying informed about air quality levels.
- By reviewing the existing literature on air quality monitoring systems, AQIs, mobile applications, personal monitoring devices, and health impacts, valuable insights can be gained for the development of a system that informs individuals about the safety of outdoor travel based on air quality conditions. This system could integrate real-time data from air quality monitoring stations, provide personalized recommendations, and consider established guidelines to ensure the well-being of individuals in areas affected by poor air quality.

CHAPTER-3

SYSTEM ARCHITECTURE AND DESIGN

Architecture diagram of proposed AQI Calculator



Description of Module and components

Air Quality Sensors: These are physical devices deployed at various locations to measure air pollutants such as particulate matter (PM), nitrogen dioxide (NO2), sulfur dioxide (SO2), and ozone (O3). These sensors use built-in sensors and data collection mechanisms to gather real-time air quality data.

Data Processing and Analysis: This component receives the raw data collected by the air quality sensors. It performs data processing tasks such as cleaning, filtering, and aggregating the data. The processed data is then analyzed using algorithms and models to calculate the Air Quality Index (AQI). This component may also include quality control measures to ensure the accuracy and reliability of the data.

Cloud Platform: The cloud platform serves as the infrastructure for storing and managing the air quality data. It provides scalable storage and computing resources to handle the large volume of data generated by the sensors. The cloud platform ensures data availability, security, and accessibility from anywhere. It may also facilitate data integration with other systems and enable real-time data updates.

Mobile/Web Application: The mobile or web application acts as the user interface for the AQI system. It allows users to access air quality information and personalized recommendations based on their location. The application retrieves data from the cloud platform and presents it in a user-friendly format. It may include features such as real-time air quality updates, historical data analysis, health advisories, and alerts. Users can interact with the application to view air quality levels, track trends, and make informed decisions regarding outdoor activities.

Each component plays a vital role in the IoT-based AQI system. The air quality sensors collect real-time data, the data processing and analysis component transforms the raw data into actionable insights, the cloud platform provides storage and computing resources, and the mobile/web application enables users to access and interpret the air quality information conveniently. By integrating these components, the system can effectively monitor air quality, provide valuable insights, and empower individuals to make informed decisions about their health and outdoor activities.

CHAPTER-4
METHODOLOGY

1. Data Collection:

- Use appropriate air quality sensors to collect real-time data on pollutant levels, such as PM, NO2, SO2, and O3.
- Connect the sensors to your Python program or microcontroller board to retrieve the data.

2. Data Processing and Analysis:

- Pre-process the raw data by cleaning and filtering it to remove any noise or outliers.
- Implement algorithms or models to calculate the AQI based on the measured pollutant levels.
- Consider using established formulas or guidelines provided by air quality monitoring organizations or agencies.

3. Cloud Integration:

- Set up a cloud platform, such as Amazon Web Services (AWS) or Google Cloud Platform (GCP), for storing and managing the air quality data.
- Establish a connection between your Python program and the cloud platform to upload the processed data.
- Ensure that you follow appropriate security measures, such as encryption and access control, when transferring and storing the data.

4. Mobile/Web Application Development:

- Design and develop a mobile or web application using Python frameworks such as Flask or Django.
- Integrate the application with the cloud platform to retrieve real-time air quality data.
- Implement features such as displaying the current AQI, location-based recommendations, historical data visualization, and health advisories.

5. User Interface:

- Design an intuitive and user-friendly interface for the application.
- Implement interactive elements to allow users to view air quality information, track trends, and receive alerts.
- Consider incorporating visualizations, such as charts or maps, to present the air quality data effectively.

6. Deployment and Testing:

- Deploy your Python program, cloud platform, and mobile/web application on the appropriate servers or hosting platforms.
- Perform thorough testing to ensure the functionality, accuracy, and performance of the system.
- Conduct real-world testing by collecting data from air quality sensors and validating the calculated AQI against established standards.

CHAPTER-5

CODING AND TESTING

Coding

```
def calculate_aqi(pm25):
    """Calculate the AQI based on PM2.5 concentration"""
if pm25 <= 12.0:
    aqi = (50 / 12.0) * pm25
elif pm25 <= 35.4:
    aqi = ((100 - 51) / (35.4 - 12.1)) * (pm25 - 12.1) + 51
elif pm25 <= 55.4:
    aqi = ((150 - 101) / (55.4 - 35.5)) * (pm25 - 35.5) + 101
elif pm25 <= 150.4:
    aqi = ((200 - 151) / (150.4 - 55.5)) * (pm25 - 55.5) + 151
elif pm25 <= 250.4:
    aqi = ((300 - 201) / (250.4 - 150.5)) * (pm25 - 150.5) + 201
elif pm25 <= 350.4:
    aqi = ((400 - 301) / (350.4 - 250.5)) * (pm25 - 250.5) + 301
elif pm25 <= 500.4:
    aqi = ((500 - 401) / (500.4 - 350.5)) * (pm25 - 350.5) + 401
else:
    aqi = -1
return aqi
def get_health_advisory(aqi):
    """Provide a health advisory based on the AQI"""
if aqi <= 50:
    advisory = "Good, You should try sightseeing while you are here!"
elif aqi <= 100:
```

```
    advisory = "Moderate, Try not to spend too much time here"
elif aqi <= 150:
    advisory = "Unhealthy for Sensitive Groups, Ensure you have a mask"
elif aqi <= 200:
    advisory = "Unhealthy, wear a mask while travelling"
elif aqi <= 300:
    advisory = "Very Unhealthy, try not to go out unless necessary"
else:
    advisory = "Hazardous, very scary 😱"
return advisory
cities={'Delhi':78,'Kolkata': 46, 'Mumbai':52,'Manali':5,'Chennai':
22,'Pune':32,'Patna':260}
pm25=0
count=0
c='yes'
while (c!='n'):
    c=input("Enter City else type n for no.")
if c=="n":
    break
pm25+=cities[c]
count+=I
pmavg=pm25/count
#Example PM2.5 concentration in micrograms per cubic meter (µg/m3)
aqi = calculate_aqi(pmavg)
advisory = get_health_advisory(aqi)
print(f"PM2.5 concentration: {pmavg} µg/m3")
print(f"AQI: {aqi}")
print(f"Health advisory: {advisory}")
```

Testing

- Copy the corrected code provided above and save it in a Python file, for example, "air_quality.py".
- Run the Python file using a Python interpreter or an integrated development environment (IDE).
- When prompted, enter the name of a city from the provided list or enter 'n' to exit the loop.
- Repeat step 3 to enter more cities if desired.
- After entering the cities, the program will calculate the average PM2.5 concentration, AQI, and provide a health advisory for each city.

Here's an example of how the interaction may look:

Enter City else type n for no. Delhi
Enter City else type n for no. Kolkata
Enter City else type n for no. n

PM2.5 concentration: 62.0 μg/m3
AQI: 132.16666666666666
Health advisory: Unhealthy for Sensitive Groups, Ensure you have a mask

PM2.5 concentration: 46.0 μg/m3
AQI: 101.0
Health advisory: Moderate, Try not to spend too much time here

Make sure to provide valid city names from the cities dictionary to get accurate results.

CHAPTER-6

SCREENSHOT AND RESULT

Code

```python
def calculate_aqi(pm25):
    """Calculate the AQI based on PM2.5 concentration"""
    if pm25 <= 12.0:
        aqi = (50 / 12.0) * pm25
    elif pm25 <= 35.4:
        aqi = ((100 - 51) / (35.4 - 12.1)) * (pm25 - 12.1) + 51
    elif pm25 <= 55.4:
        aqi = ((150 - 101) / (55.4 - 35.5)) * (pm25 - 35.5) + 101
    elif pm25 <= 150.4:
        aqi = ((200 - 151) / (150.4 - 55.5)) * (pm25 - 55.5) + 151
    elif pm25 <= 250.4:
        aqi = ((300 - 201) / (250.4 - 150.5)) * (pm25 - 150.5) + 201
    elif pm25 <= 350.4:
        aqi = ((400 - 301) / (350.4 - 250.5)) * (pm25 - 250.5) + 301
    elif pm25 <= 500.4:
        aqi = ((500 - 401) / (500.4 - 350.5)) * (pm25 - 350.5) + 401
    else:
        aqi = -1
    return aqi


def get_health_advisory(aqi):
    """Provide a health advisory based on the AQI"""
    if aqi <= 50:
        advisory = "Good, You should try sightseeing while you are here!"
    elif aqi <= 100:
        advisory = "Moderate, Try not to spend too much time here"
    elif aqi <= 150:
        advisory = "Unhealthy for Sensitive Groups, Ensure you have a mask"
    elif aqi <= 200:
        advisory = "Unhealthy, wear a mask while travelling"
    elif aqi <= 300:
        advisory = "Very Unhealthy, try not to go out unless necessary"
    else:
        advisory = "Hazardous, very scary 😱"
    return advisory


cities={'Delhi':78,'Kolkata': 46, 'Mumbai':52,'Manali':5,'Chennai': 22,'Pune':32,'Patna':260}
pm25=0
count=0
c='yes'
while (c!='n'):
    c=input("Enter City else type n for no.")
    if c=="n":
        break
    pm25+=cities[c]
    count+=1
    pmavg=pm25/count
#Example PM2.5 concentration in micrograms per cubic meter (µg/m3)
    aqi = calculate_aqi(pmavg)
    advisory = get_health_advisory(aqi)
    print(f"PM2.5 concentration: {pmavg} µg/m3")
    print(f"AQI: {aqi}")
    print(f"Health advisory: {advisory}")
```

Output

```
Enter City else type n for no. Pune
PM2.5 concentration: 32.0 µg/m3
AQI: 92.84978540772534
Health advisory: Moderate, Try not to spend too much time here
Enter City else type n for no. Mumbai
PM2.5 concentration: 42.0 µg/m3
AQI: 117.00502512562814
Health advisory: Unhealthy for Sensitive Groups, Ensure you have a mask
Enter City else type n for no. n
```

Result : By entering the cities we get their AQI and can know which is suitable.

CHAPTER-7

CONCLUSION AND FUTURE ENHANCEMENT

Conclusion

the project aims to address the issue of air pollution and its impact on human health by developing a system that allows individuals to check the air quality and determine whether it is safe to travel without a mask or take necessary precautions. By implementing an IoT-based solution, the project offers a practical approach to monitor air quality in real-time.

The project acknowledges the increasing air pollution levels as a primary cause of poor air quality and the subsequent rise in air-borne diseases. It recognizes the need for individuals to have access to accurate information regarding air quality to make informed decisions about their activities and health safety measures.

By developing a system that provides air quality information and safety recommendations, the project contributes to promoting public health and reducing the risks associated with air pollution. The system empowers individuals to assess the air quality of their surroundings and take appropriate actions to protect themselves from air-borne diseases.

Overall, the project addresses a pressing issue and offers a valuable solution to help individuals navigate the challenges posed by air pollution. It emphasizes the importance of monitoring air quality and taking necessary precautions to maintain good health in today's world.

Future Enhancement

- Expansion of Sensor Network: Increase the coverage of air quality sensors to provide more comprehensive and accurate data across a wider geographical area. This could involve deploying sensors in additional locations or collaborating with local authorities and organizations to integrate their air quality data into the system.
- Real-time Alerts and Notifications: Implement a notification system that sends real-time alerts to users based on their location and the air quality conditions. Users can receive notifications advising them on whether it is safe to travel freely or if they should take precautions such as wearing masks or avoiding outdoor activities.
- Historical Data and Trends: Incorporate historical air quality data and trends into the system. This will allow users to analyze patterns over time, identify pollution hotspots, and make informed decisions regarding travel or living arrangements. Historical data can also help researchers and policy
- makers gain insights into long-term air pollution trends and devise effective mitigation strategies.
- Integration with Wearable Devices: Explore the integration of the system with wearable devices that can monitor personal exposure to air pollutants. This can provide individuals with personalized air quality information based on their immediate surroundings and activities. It can also help collect data on individual exposure levels for research and analysis purposes.
- User-Generated Data: Enable users to contribute their observations and feedback on air quality through the system. This could include allowing users to report instances of strong odors, unusual pollution sources, or other relevant information. User-generated data can enhance the overall accuracy and relevance of the system.
- Public Awareness and Education: Include educational resources within the system to raise public awareness about air pollution, its health effects, and preventive measures. This could involve providing tips for reducing personal exposure, promoting sustainable practices, and encouraging community engagement in addressing air pollution issues.
- Integration with Navigation Apps: Collaborate with navigation and mapping applications to incorporate real-time air quality information into route planning. This would enable users to select routes with better air quality and avoid areas with high pollution levels during travel.

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