

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

Project name : Air Quality Monitoring

Team name : MNSN_TEAM

Team members :

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Problem Statement

Air quality is a critical concern in many urban areas, impacting the health and well-being of residents. Monitoring air quality is crucial for identifying pollution sources and implementing effective measures to improve it. This project aims to develop an IoT-based system for real-time air quality monitoring. The system will collect data from various sensors and provide a user-friendly platform for users to access and visualize this data.

Objectives:

1.Real-time Air Quality Monitoring: Develop an IoT system that can continuously measure key air quality parameters, including particulate matter (PM2.5 and PM10), carbon monoxide (CO), nitrogen dioxide (NO2), and ozone (O3).

2.Data Collection and Transmission: Set up IoT devices equipped with appropriate sReal-time Air Quality Monitoring: Develop an IoT system that can continuously measure key air quality parameters, including particulate matter (PM2.5 and PM10), carbon monoxide (CO), nitrogen dioxide (NO2), and ozone (O3).

3.Data Collection and Transmission: Set up IoT devices equipped with appropriate sensors to collect air quality data and transmit it to a central platform.

4.Data Visualization: Create a user-friendly data-sharing platform where users can access real-time air quality information and historical data through an intuitive user interface.

5.Alerting and Reporting: Implement an alerting system that notifies users when air quality parameters exceed predefined thresholds. Additionally, generate reports for historical data analysis.ensors to collect air quality data and transmit it to a central platform.

6.Data Visualization: Create a user-friendly data-sharing platform where users can access real-time air quality information and historical data through an intuitive user interface.

7.Alerting and Reporting: Implement an alerting system that notifies users when air quality parameters exceed predefined thresholds. Additionally, generate reports for historical data analysis.

IoT Device Setup:

- For the IoT device setup, we will use the following components and sensors:
- **Microcontroller:** Raspberry Pi or Arduino for data processing and communication.
- **Air Quality Sensors:** Sensors capable of measuring PM2.5, PM10, CO, NO2, and O3 levels.
- **Data Transmission:** Wi-Fi or GSM module to send data to the central platform.
- **Power Supply:** Battery or an external power source depending on the deployment location

Platform Development:

- Database Setup: Create a database to store the incoming air quality data.
- Web Application: Develop a web-based application that allows users to access and visualize the data. The platform should have user registration, login, and data representation features.
- Threshold Configuration: Implement a feature that enables users to set alert thresholds for each air quality parameter.
- Real-time Updates: Ensure that the platform receives and updates data in real-time.

Code

```
import random
```

```
# Function to generate random sensor data
```

```
def generate_sensor_data():  
    pm25 = random.uniform(0, 100)  
    co = random.uniform(0, 5)  
    no2 = random.uniform(0, 1)  
    o3 = random.uniform(0, 0.1)  
    return pm25, co, no2, o3
```

```
# Function to calculate the Air Quality Index (AQI)
```

```
def calculate_aqi(pm25, co, no2, o3):  
    # Replace with your AQI calculation logic  
    # This is a simplified example; use an appropriate formula for AQI calculation  
    aqi = (pm25 + co + no2 + o3) / 4  
    return aqi
```

```
# Function to classify air quality based on AQI
```

```
def classify_air_quality(aqi):  
    if aqi <= 50:  
        return "Good"  
    elif aqi <= 100:  
        return "Moderate"  
    elif aqi <= 150:  
        return "Unhealthy for Sensitive Groups"  
    elif aqi <= 200:  
        return "Unhealthy"  
    else:  
        return "Very Unhealthy"
```

```
# Generate sensor data
```

```
pm25, co, no2, o3 = generate_sensor_data()
```

```
# Calculate AQI
```

```
aqi = calculate_aqi(pm25, co, no2, o3)
```

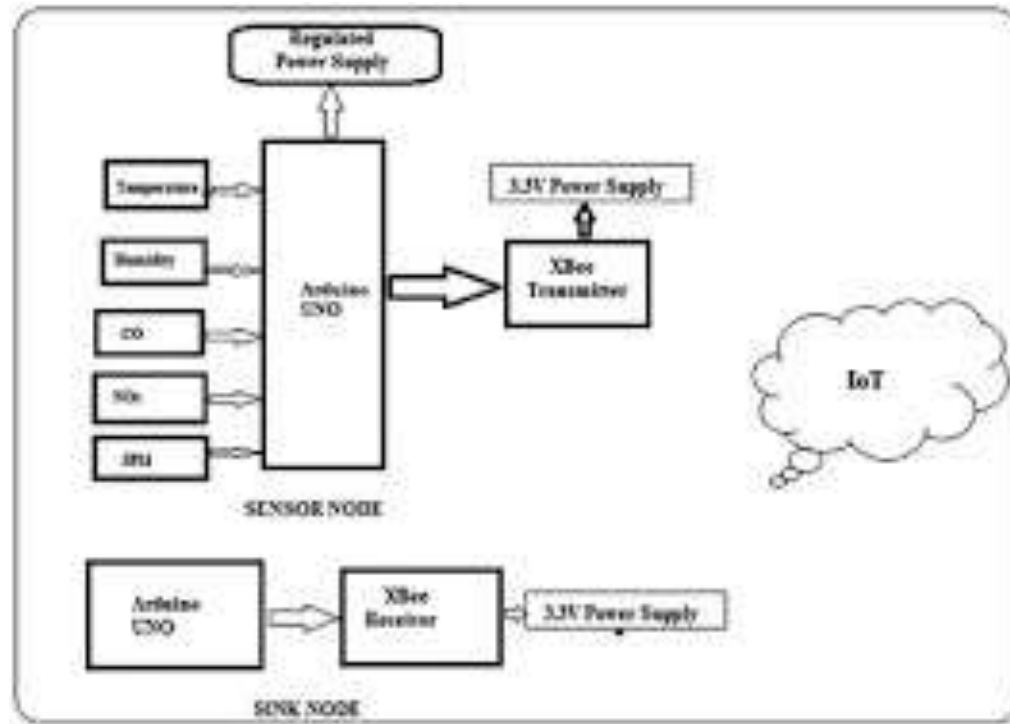
```
# Classify air quality
```

```
air_quality = classify_air_quality(aqi)
```

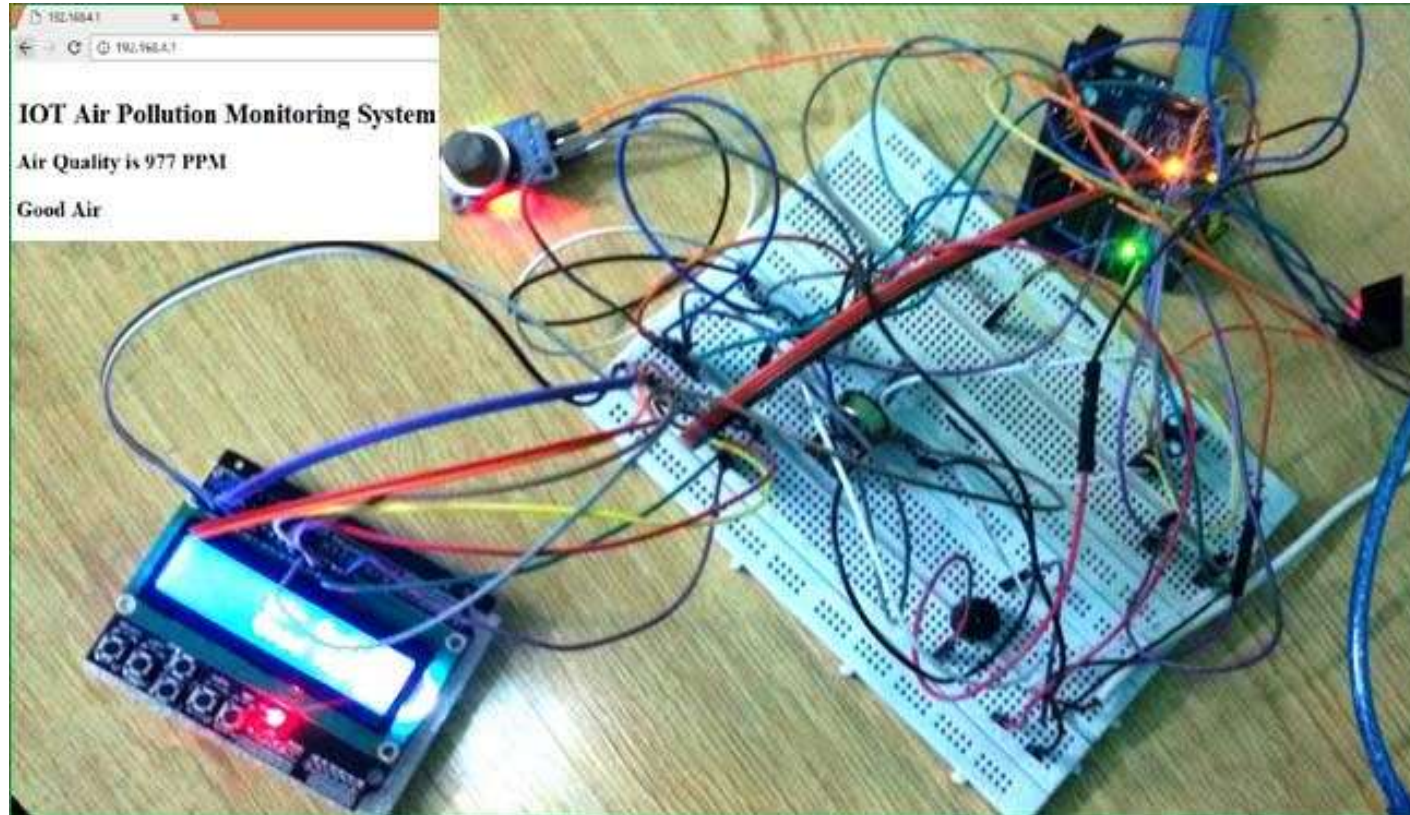
```
# Output the results
```

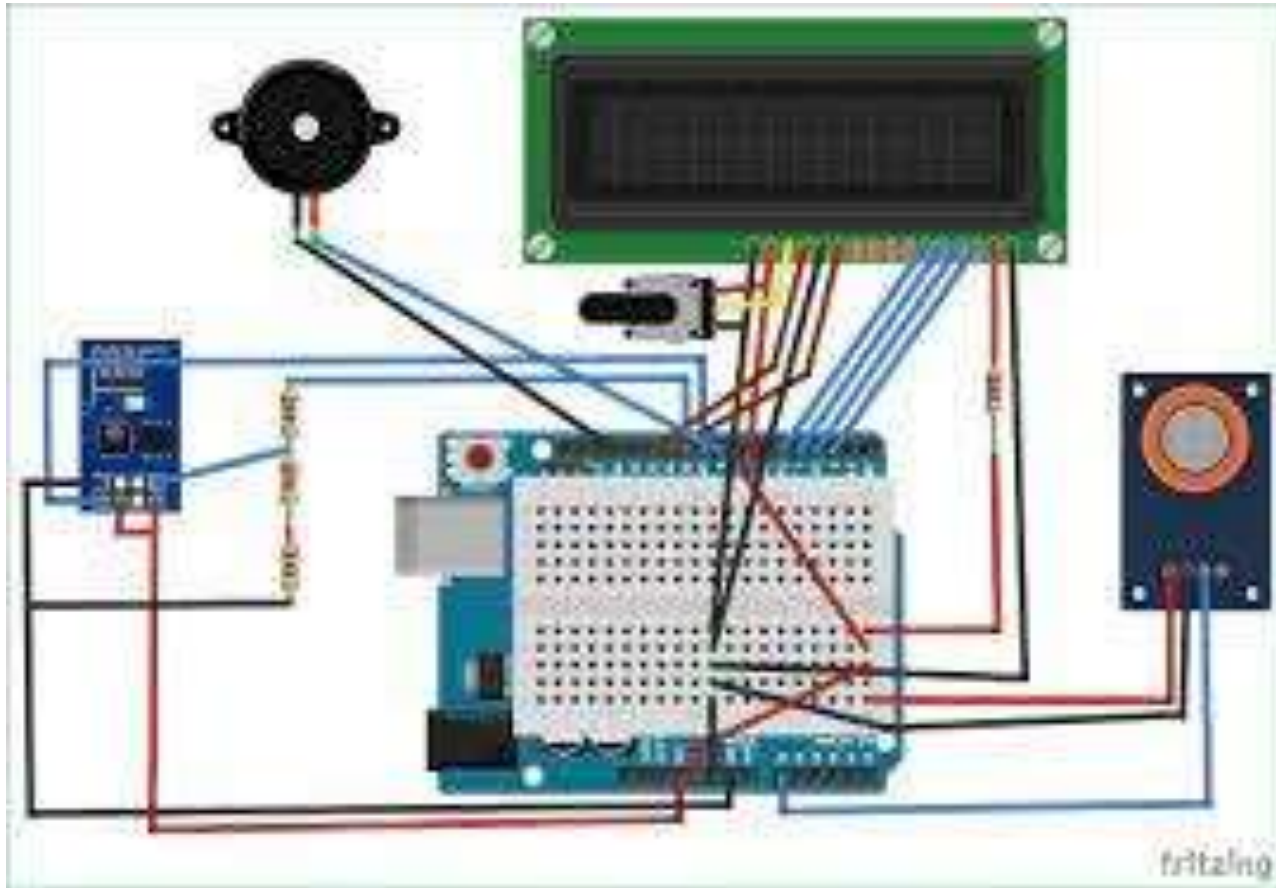
```
print(f"PM2.5: {pm25} µg/m³")  
print(f"CO: {co} ppm")  
print(f"NO2: {no2} ppm")  
print(f"O3: {o3} ppm")  
print(f"AQI: {aqi}")  
print(f"Air Quality: {air_quality}")
```

BLOCK DIAGRAM

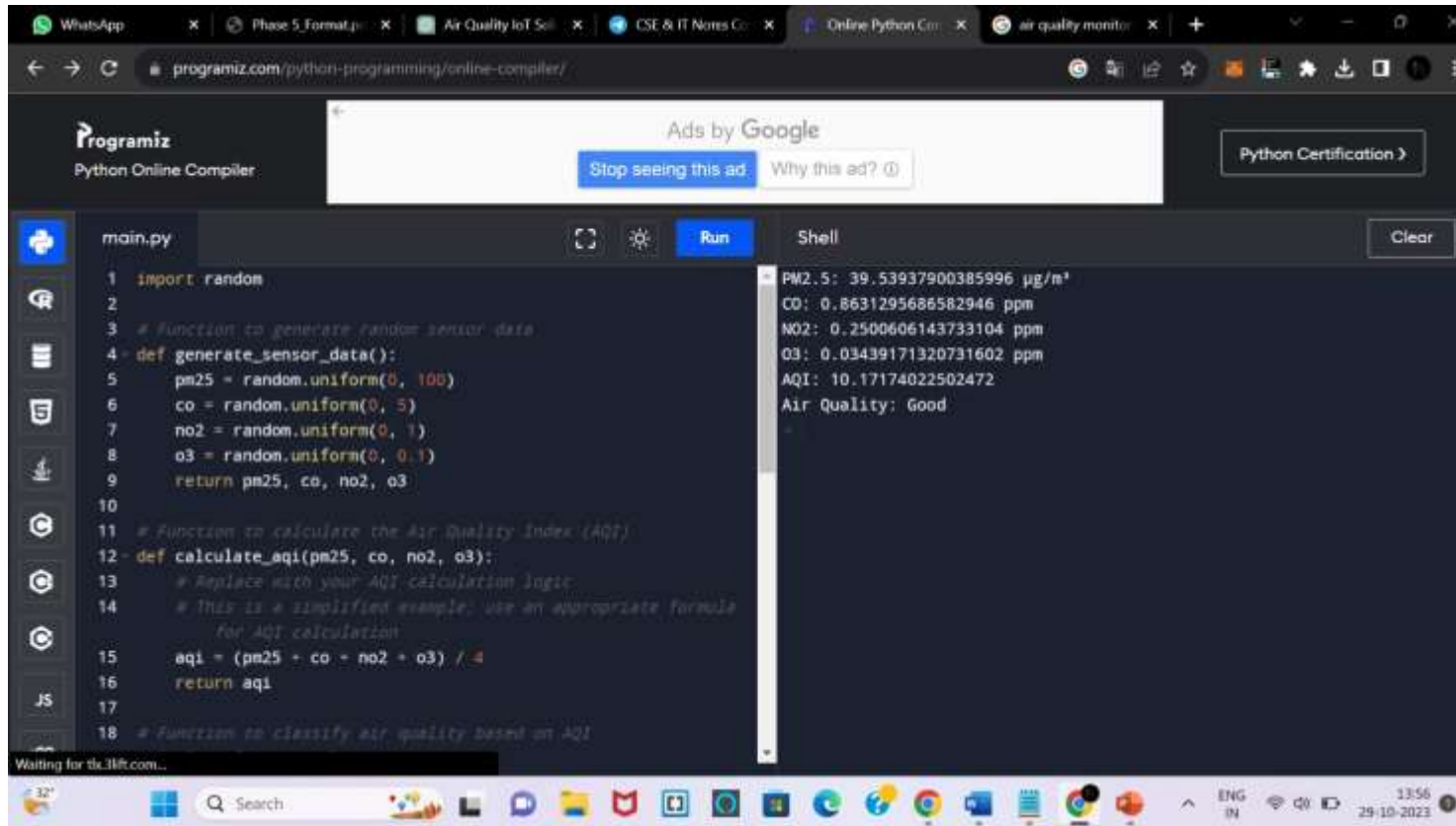


screenshots of the IoT devices





SCREENSHOT OF PYTHON CODE OUTPUT:



The screenshot shows a web browser window with multiple tabs. The active tab is 'air quality monitor' at the URL 'programiz.com/python-programming/online-compiler/'. The page features the Programiz logo and a Google Ad. The main area displays a Python code editor with a file named 'main.py'. The code defines two functions: 'generate_sensor_data()' which generates random values for PM2.5, CO, NO2, and O3, and 'calculate_aqi()' which calculates the Air Quality Index (AQI) based on these values. The code is executed, and the output is shown in the 'Shell' pane. The output displays the generated sensor data and the calculated AQI, which is 10, indicating 'Good' air quality.

```
1 import random
2
3 # Function to generate random sensor data
4 def generate_sensor_data():
5     pm25 = random.uniform(0, 100)
6     co = random.uniform(0, 5)
7     no2 = random.uniform(0, 1)
8     o3 = random.uniform(0, 0.1)
9     return pm25, co, no2, o3
10
11 # Function to calculate the Air Quality Index (AQI)
12 def calculate_aqi(pm25, co, no2, o3):
13     # Replace with your AQI calculation logic
14     # This is a simplified example; use an appropriate formula
15     # for AQI calculation
16     aqi = (pm25 + co + no2 + o3) / 4
17     return aqi
18
19 # Function to classify air quality based on AQI
```

PM2.5: 39.53937900385996 µg/m³
CO: 0.8631295686582946 ppm
NO2: 0.2500606143733104 ppm
O3: 0.03439171320731602 ppm
AQI: 10.17174022502472
Air Quality: Good

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main.py

Run

Shell

Clear

```
12 def calculate_aqi(pm25, co, no2, o3):
13     # Replace with your AQI calculation logic
14     # This is a simplified example; use an appropriate formula
15     # for AQI calculation
16     aqi = (pm25 + co + no2 + o3) / 4
17     return aqi
18
19 # Function to classify air quality based on AQI
20 def classify_air_quality(aqi):
21     if aqi <= 50:
22         return "Good"
23     elif aqi <= 100:
24         return "Moderate"
25     elif aqi <= 150:
26         return "Unhealthy for Sensitive Groups"
27     elif aqi <= 200:
28         return "Unhealthy"
29     else:
30         return "Very Unhealthy"
```

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main.py Run Shell Clear

```
28:     else:
29:         return "Very Unhealthy"
30:
31: # Generate sensor data
32: pm25, co, no2, o3 = generate_sensor_data()
33:
34: # Calculate AQI
35: aqi = calculate_aqi(pm25, co, no2, o3)
36:
37: # Classify air quality
38: air_quality = classify_air_quality(aqi)
39:
40: # Output the results
41: print(f"PM2.5: {pm25} µg/m³")
42: print(f"CO: {co} ppm")
43: print(f"NO2: {no2} ppm")
44: print(f"O3: {o3} ppm")
45: print(f"AQI: {aqi}")
46: print(f"Air Quality: {air_quality}")
47:
```

PM2.5: 39.53937900385996 µg/m³
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IoT Device Code:

- Initialize and configure sensors.
- Set up data transmission protocols (e.g., MQTT or HTTP).
- Implement error handling and retry mechanisms for data transmission.
- Continuously collect and send data to the central platform.

Data Sharing Platform UI:

- The platform's user interface should include the following components:
- **User Registration and Login:** Secure user authentication for data access.
- **Dashboard:** A user-friendly dashboard displaying real-time air quality data.
- **Historical Data Visualization:** Charts and graphs for historical data analysis.
- **Alert Configuration:** A settings page to set and manage alert thresholds.
- **Notifications:** Real-time alerts and notifications when air quality parameters exceed thresholds.

EXPLANATION

Air quality monitoring is essential for safeguarding public health and the environment, especially in urban areas facing air pollution challenges. This project presents an IoT-based Air Quality Monitoring System designed to continuously collect data from IoT devices equipped with sensors measuring key air quality parameters, including PM2.5, CO, NO2, and O3. The project's primary objectives are to send this data to a central platform, calculate an Air Quality Index (AQI), and classify air quality conditions. Users can access this information via a user-friendly platform, set alert thresholds, and receive notifications when air quality deteriorates. This system contributes to real-time environmental awareness and empowers individuals and communities to make informed decisions regarding their well-being and environmental impact.

CONCLUSION

The development of an IoT air quality monitoring system is crucial for public health and environmental monitoring. By integrating air quality sensors with web technologies, this project aims to provide a user-friendly platform for individuals and authorities to access real-time air quality data. The platform will enhance awareness of air quality issues and assist in making informed decisions for environmental management. It is expected that the successful completion of this project will contribute to improved air quality monitoring and management in various locations.

THANK YOU