



AIR QUALITY MONITORING AND PREDICTION

Prepared by Michael .V. D



Air Quality Index

Air Quality Index on Cities of India



Problem Statement:

Analyse air quality data from different locations to identify pollution trends and predict future Air Quality Index (AQI) levels.

Overview

1

Introduction

2

Data Collection

3

Data Analysis

4

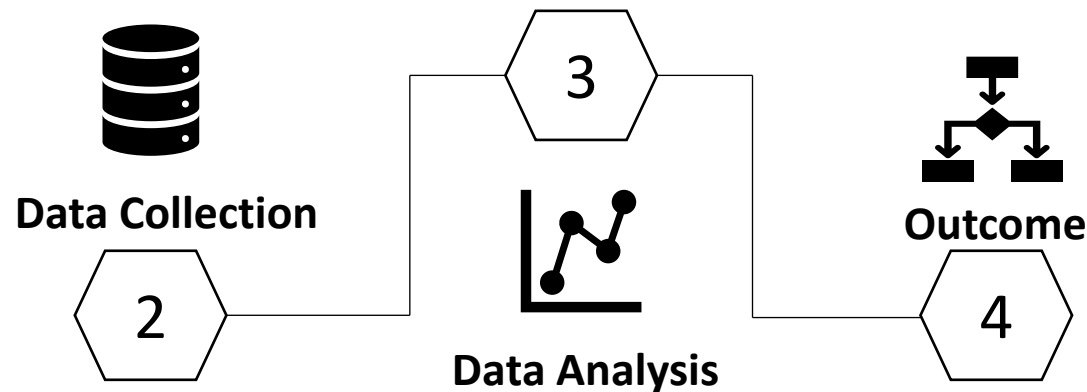
Outcome

Introduction

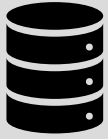
As the topic is Air Quality Monitoring and Prediction. I have collected data of 80 cities that are Most polluted, Moderate polluted and Least polluted throughout India.

Air quality is a critical environmental factor impacting human health, ecosystems, and the economy. With rising urbanization and industrialization, air pollution has become a global challenge. This presentation explores the techniques, tools used for monitoring and predicting air quality.

Process

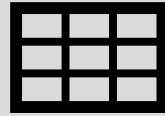


Project Process



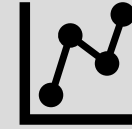
Database

The data is been collected from different sources and is been stored into SQL Database
Database : aqi



Data Merging and Cleaning

The data is been Merged and Cleaned in MS Excel
Filename : aqi_excel.xlsx



Data Visualization

The data is been visualized and analyzed in PowerBI
Filename : aqi.pbix

Key Insights

After Analyzing the data, I have sub-divided the data into three blocks

1. Top 10 Most polluted Cities
2. Top 10 Least Polluted Cities
3. Top 8 Metropolitan Cities

The Major Pollutants in every Cities are

PM 2.5 : PM2.5 stands for **Particulate Matter that is 2.5 micrometers or smaller in diameter**. It is a critical component of the Air Quality Index (AQI) and is used to measure air pollution levels.

Sources: Natural: Wildfires, dust storms, and sea spray.

- Human-made: Vehicle emissions, industrial processes, construction activities, and burning of fossil fuels or biomass.

Health Impacts: Can cause respiratory issues like asthma, bronchitis, and other lung diseases.

- Long-term exposure is linked to heart disease, stroke, and reduced lung function.

PM2.5 levels are a major factor in determining the Air Quality Index (AQI), which ranges from Good (0-50) to Hazardous (301-500).

SO₂ : SO₂ (Sulfur Dioxide) is one of the key pollutants measured in the Air Quality Index (AQI)

Sources: Human-made: Power plants burning coal or oil, Industrial processes like metal smelting, Vehicle emissions (especially diesel engines).

Natural: Volcanic eruptions, Decay of organic matter.

Health Impacts: Short-term exposure can cause: Respiratory issues such as coughing, throat irritation, and shortness of breath, Aggravation of asthma and bronchitis.

Long-term exposure can lead to: Decreased lung function, Increased risk of respiratory infections.

The AQI categorizes SO₂ levels as: Good (0–50), Unhealthy (101–500).

CO : CO in the Air Quality Index (AQI) refers to **Carbon Monoxide**, a colorless, odorless, and tasteless gas that is harmful when inhaled in high concentrations.

Source: Natural: Volcanic activity, wildfires, and natural decomposition.

Human-made: Incomplete combustion of fossil fuels (e.g., from vehicles, industrial processes, and heating systems).

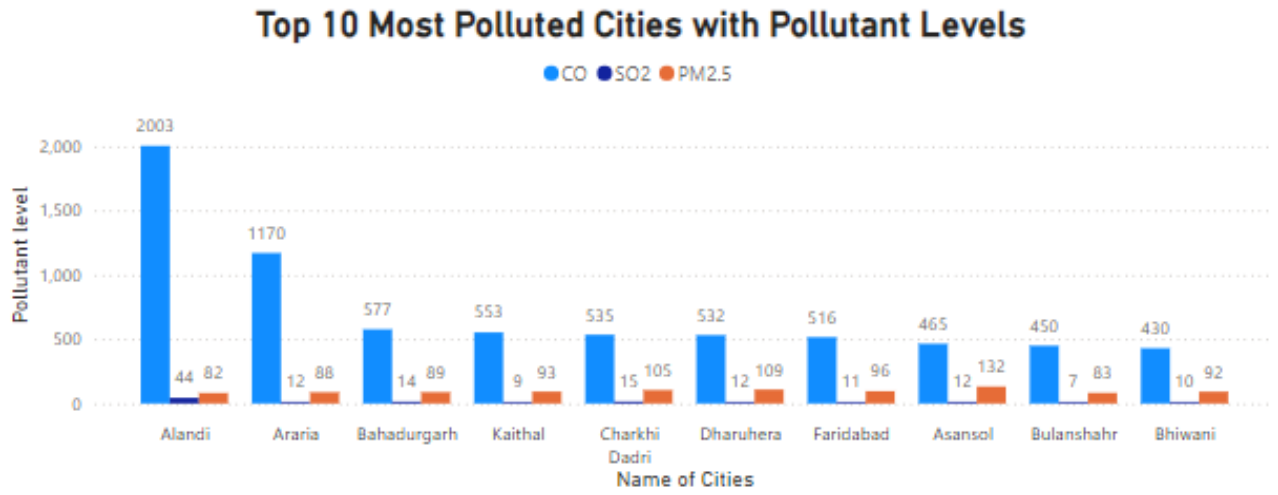
Health Impacts: Binds with hemoglobin in the blood to form carboxyhemoglobin, reducing oxygen delivery to organs and tissues.

Symptoms of exposure include headaches, dizziness, nausea, confusion, and, at high levels, it can be fatal.

AQI Ranges for CO: Good (0-50), Unhealthy (301–500)

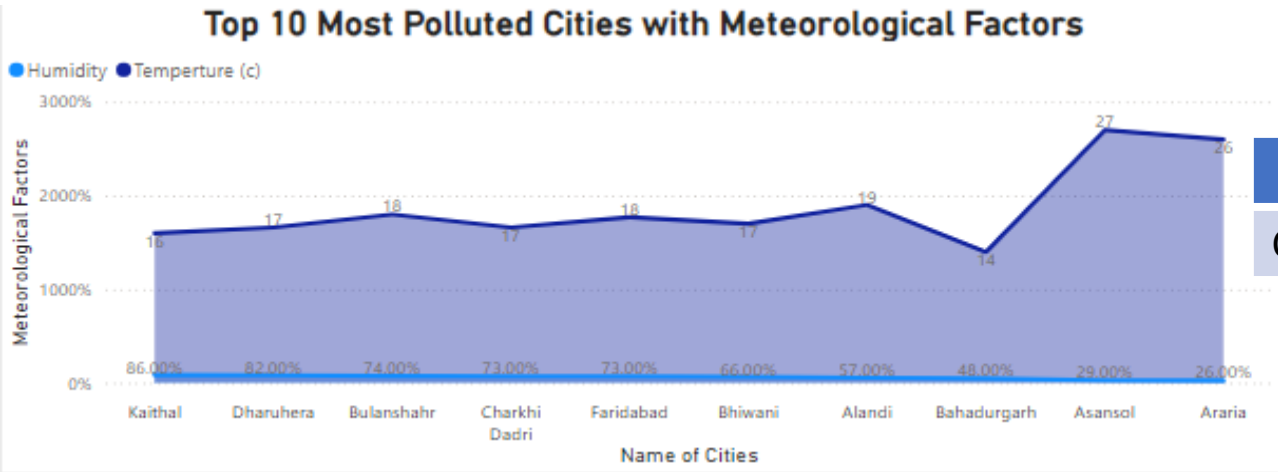
Top 10 Most Polluted Cities

The below graphs represent the Pollutant level and Meteorological Factors of a day



Most pollutants by cities

Pollutants	PM2.5	SO2	CO
Cities	Asanol	Alandi	Alandi

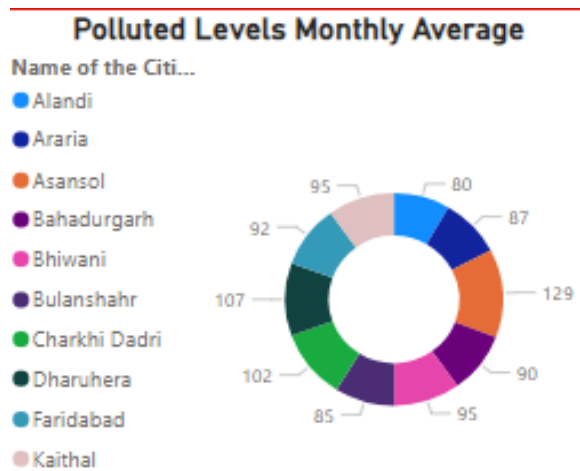


Most Meteorological Factors by cities

	Temperature	Humidity
Cities	Asanol	Kaithal

Top 10 Most Polluted Cities

The below graphs represent Monthly Average City wise



Most pollutant by city

Pollutant	PM 2.5
Cities	Asanol

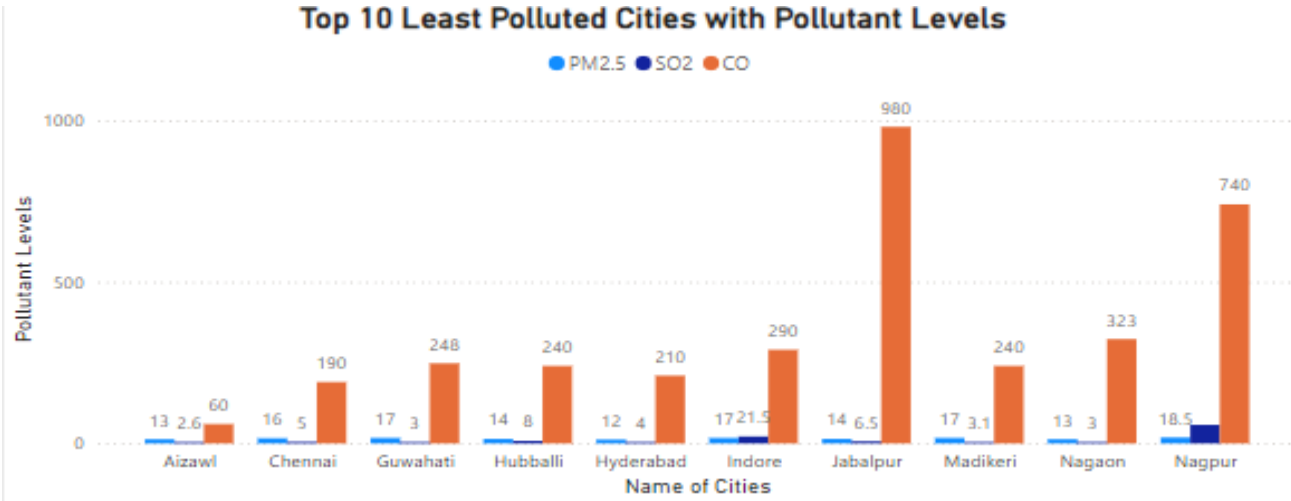
Asansol, a city in West Bengal, India, is among the most polluted cities in the country due to several environmental and industrial factors. Here are the primary reasons for Asansol's high pollution levels:

- **Coal Mining:** Asansol is part of the **Raniganj coal belt**, which is one of the largest coal mining regions in India. The mining operations release particulate matter (PM2.5 and PM10) and other pollutants into the air.
- **Thermal Power Plants:** Nearby thermal power plants burn coal to generate electricity, releasing significant amounts of sulfur dioxide (SO₂),
- **Steel and Iron Industries:** The presence of heavy industries, including steel plants, contributes to air and water pollution due to the release of toxic gases and industrial waste.

Increased vehicular traffic in Asansol leads to high emissions of carbon monoxide (CO)

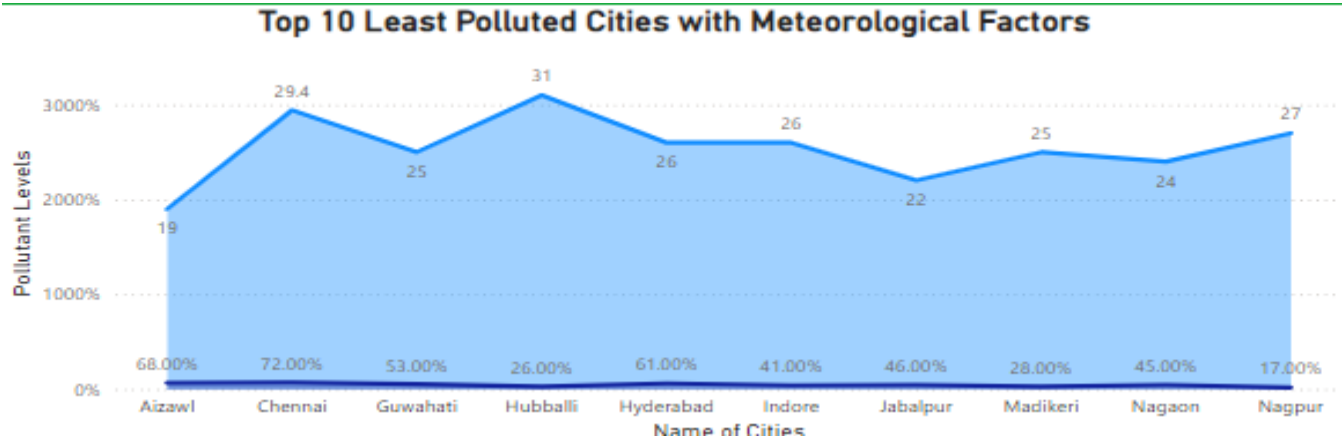
Top 10 Least Polluted Cities

The below graphs represent the Pollutant level and Meteorological Factors of a day



Least pollutants by cities

Pollutants	PM2.5	SO2	CO
Cities	Aizawl	Hyderbad	Aizwal

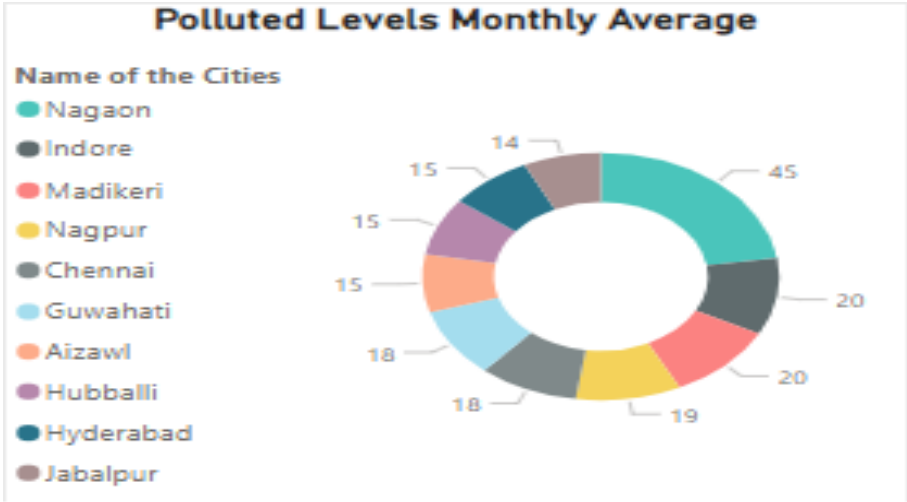


Least Meteorological Factors by cities

	Temperature	Humidity
Cities	Aizawl	Nagpur

Top 10 Least Polluted Cities

The below graphs represent Monthly Average City wise



Most pollutant by city

Pollutants	PM2.5
Cities	Nagaon

Nagaon, a city in Assam, India, is known for its relatively cleaner air compared to many other urban areas in the country. The reasons for its lower pollution levels can be attributed to several natural and human-made factors:

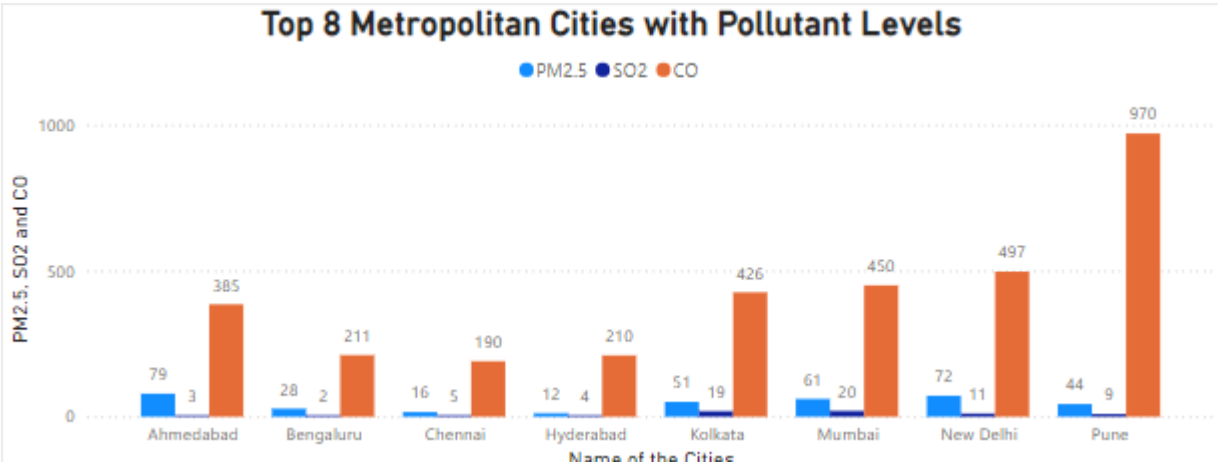
Nagaon does not have the heavy industrial base seen in cities like Delhi, Mumbai, or Asansol. The absence of large-scale industries such as coal mining, steel plants, or thermal power plants reduces the emission of harmful pollutants like particulate matter (PM2.5 and PM10), sulfur dioxide (SO₂),

Compared to larger cities, Nagaon has lower vehicular density. This reduces emissions of carbon monoxide, nitrogen oxides, and hydrocarbons from vehicles.

The city's smaller population means fewer private vehicles and less congestion on the roads.

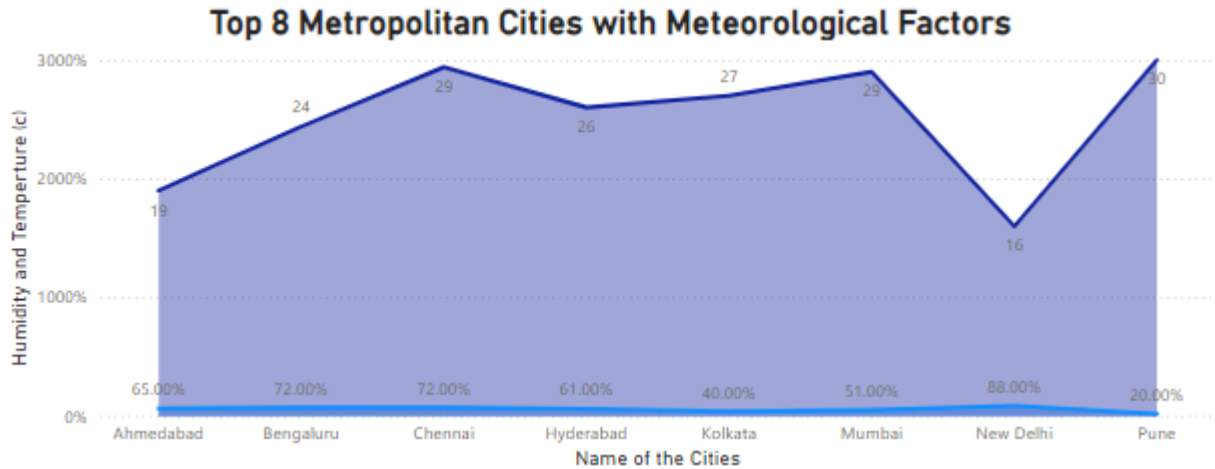
Top 8 Metropolitan Cities

The below graphs represent the Pollutant level and Meteorological Factors of a day



Most pollutants by cities

Pollutants	PM2.5	SO2	CO
Cities	Ahmedabad	Mumbai	Pune

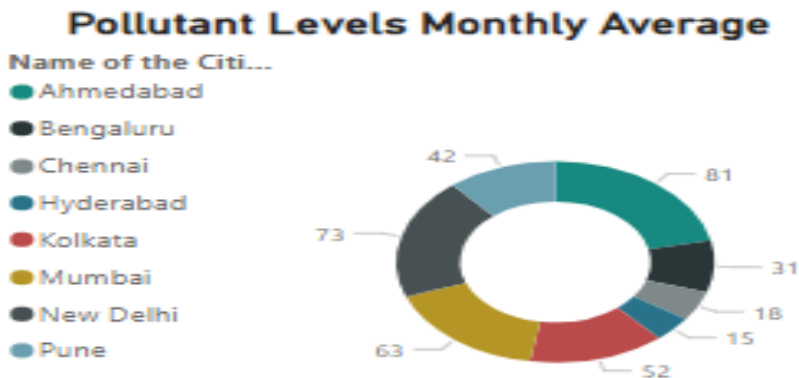


Most Meteorological Factors by cities

	Temperature	Humidity
Cities	Pune	New Dehli

Top 8 Metropolitan Cities

The below graphs represent Monthly Average City wise



Most pollutant by city

	PM 2.5
Cities	New Delhi

New Delhi, the capital of India, consistently ranks as one of the most polluted cities in the world. Its high pollution levels are the result of a combination of human activities, geographic factors, and seasonal variations. Here are the main reasons why New Delhi experiences severe air pollution:

- **High Vehicle Density:** Delhi has one of the highest numbers of vehicles in the country, contributing significantly to carbon monoxide (CO), nitrogen oxides (NO_x), and particulate matter (PM2.5 and PM10).
- **Diesel Engines:** A large number of vehicles use diesel, which emits more harmful pollutants compared to petrol engines.
- **Traffic Congestion:** Prolonged idling during traffic jams increases emissions.
- **Deforestation:** Urban expansion has led to the reduction of green spaces, which could have helped absorb pollutants.
- **Insufficient Tree Planting:** Despite efforts to plant trees, the rate of urbanization often outpaces these initiatives.

Policies for Air Pollution Mitigation

To address air pollution effectively, governments and organizations can adopt the following strategies:

1. Industrial Pollution Control

- **Enforce Emission Standards:** Mandate the use of scrubbers, filters, and catalytic converters in industries.
- **Cleaner Energy Transition:** Encourage industries to switch from coal to cleaner energy sources like natural gas or renewables.
- **Monitoring and Fines:** Regularly monitor industrial emissions and impose penalties for non-compliance.

2. Vehicular Emission Reduction

- **Promote Public Transport:** Expand and improve public transportation systems to reduce reliance on private vehicles.
- **Electric Vehicles (EVs):** Provide subsidies and infrastructure for EV adoption, including charging stations.
- **Fuel Quality Standards:** Transition to cleaner fuels like BS-VI (Bharat Stage VI) standards for vehicles.

3. Crop Burning Alternatives

- **Subsidize Equipment:** Provide farmers with subsidized alternatives like Happy Seeders to avoid stubble burning.
- **Incentivize Crop Residue Management:** Encourage farmers to recycle crop residues as organic fertilizers or for bioenergy production.

4. Waste Management

- **Ban Open Burning:** Strictly enforce bans on burning garbage and agricultural waste.
- **Waste Segregation and Recycling:** Promote segregation of biodegradable and non-biodegradable waste at the source.

5. Construction and Dust Control

- Dust Suppression: Mandate water sprinkling and use of dust suppressants at construction sites.
- Cover Materials: Ensure construction materials like sand and cement are properly covered during transport and storage.

6. Green Infrastructure

- Urban Greening: Increase tree plantations in urban areas to act as natural air purifiers.
- Green Belts: Establish green belts around industrial zones and highways.

7. Public Awareness and Education

- Community Engagement: Educate citizens on how individual actions (e.g., reducing car usage) can improve air quality.
- Air Quality Apps: Develop user-friendly apps to provide real-time AQI updates and recommendations.

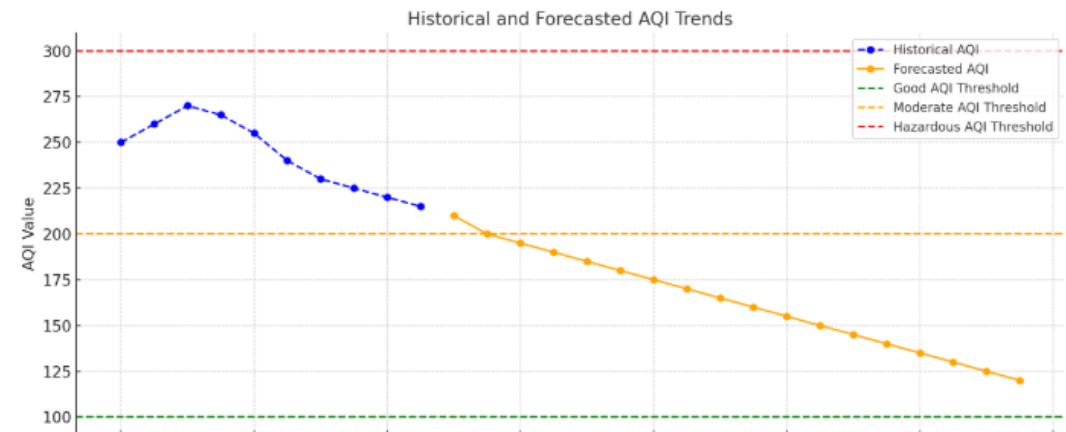
8. Policy Enforcement and Collaboration

- Regional Cooperation: Work with neighboring states to address cross-border pollution issues like stubble burning.
- Integrated Policies: Combine urban planning, energy, and environmental policies for sustainable development.

Data References :

<https://www.igair.com/in-en/> : igair.com

<https://cpcb.nic.in/about-namp/> : cpcb.nic.in





THANK YOU

Prepared by **Michael .V. D**