A Project Report on

Airlytics: Air Pollution Tracker

Submitted in partial fulfillment of the requirements for the award of the degree of

Third Year Engineering

in

Information Technology

by

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CERTIFICATE

This to certify that the Mini Project-2A report on **"APSIT DevOps Club: A Web Platform for interacting Students through Collaboration and Innovative Activities"** has been submitted by **"Vinay Narendra Suryarao" (24204003)**, **"Rumiza Sayyeda" (24204005)**, **"Deep Sadanand Varkute" (24204010)**, and **"Avisha Abhay Varkute" (23104175)** who are bonafide students of A. P. Shah Institute of Technology, Thane as a partial fulfillment of the requirement for the degree in **Information Technology** during the first half of academic year **2025-26**, in the satisfactory manner as per the curriculum laid down by University of Mumbai.

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External Examiner	Internal Examiner
1.	1.

Place:A.P.Shah Institute of Technology, Thane

Date:

Acknowledgement

This project would not have come to fruition without the invaluable help of our guide **Mr. Sachin Kasare**. Expressing gratitude towards our HoD, **Dr. Kiran Deshpande**, and the Department of Information Technology for providing us with the opportunity as well as the support required to pursue this project. We would also like to thank our project coordinators **Ms. Sonal Jain** and **Ms. Shafaque Fatma Syed** who gave their valuable suggestions and ideas when we were in need of them. We would also like to thank our peers for their helpful suggestions.

Contents

Abstract

Air pollution has become one of the most pressing challenges in Indian cities, driven by rapid industrialization, traffic emissions, and construction dust. These pollutants, especially PM2.5, CO2, and NO2, directly impact human health, causing respiratory and cardiovascular diseases while reducing life expectancy. Despite its severity, real-time air quality data is either fragmented, delayed, or presented in a highly technical format, making it inaccessible for ordinary citizens. This knowledge gap prevents timely precautions and weakens collective efforts toward environmental safety.

This project introduces "Airlytics," a full-stack web platform designed to track and visualize air pollution in a simple and interactive manner. The system integrates real-time AQI data with dashboards, maps, and alert mechanisms, ensuring users can easily interpret complex environmental information. Features such as city-level dashboards, color-coded AQI categories, PDF report generation, and health-based recommendations enhance awareness while promoting informed decision-making. A clean user interface with dark mode support ensures accessibility for diverse audiences, ranging from citizens to policymakers and researchers.

By consolidating real-time monitoring, trend analysis, and alert notifications into one platform, Airlytics contributes directly to sustainable development goals related to health and urban resilience. It demonstrates the potential of modern technologies such as Node.js, Express, PostgreSQL, Leaflet, and Chart.js in building scalable and user-friendly solutions. In the long term, this system can be expanded with IoT sensor integration, mobile applications, and AI-based forecasting, making it a powerful tool for combating air pollution and fostering healthier, smarter cities.

Chapter 1

Introduction

In today's fast-growing urban environments, air pollution has become one of the most critical challenges affecting human health and overall quality of life. Rapid industrialization, increasing vehicle emissions, and construction activities have significantly contributed to deteriorating air quality, especially in Indian cities. Pollutants such as PM2.5, CO2, and NO2 are directly linked to respiratory illnesses, cardiovascular diseases, and reduced life expectancy. Despite the severity of this problem, reliable and real-time data on air pollution is often either unavailable, scattered across multiple sources, or presented in highly technical formats that ordinary citizens cannot easily interpret.

While government agencies and news outlets provide some information, the absence of a unified, user-friendly, and accessible digital platform prevents individuals from making timely and informed decisions to protect their health. Citizens frequently remain unaware of when pollution levels cross safe thresholds, leaving them exposed to harmful air conditions without guidance. Moreover, policymakers and researchers face challenges in analyzing historical pollution trends and identifying hotspots due to limited and fragmented access to data.

This gap in accessible, actionable information is what motivated the creation of our project, Airlytics: Air Pollution Tracker. The platform is designed to act as a bridge between complex environmental data and the everyday needs of citizens, researchers, and decision-makers. By providing real-time monitoring, visual dashboards, and interactive maps, the system translates technical data into a format that is simple, meaningful, and practical for non-technical users.

Current Challenges: The Inefficiencies of Fragmented Pollution Data: Despite the availability of environmental monitoring agencies, the ecosystem for air quality information remains fragmented. Different platforms often provide inconsistent or delayed data, which is confusing for citizens who rely on accurate and timely information. Health advisories are often absent, leaving people uninformed about precautions they should take during hazardous conditions. Additionally, pollution data is rarely personalized, meaning users cannot filter or compare information based on their city or locality.

Furthermore, most platforms lack features such as historical analysis, customizable reports, or alert systems. Without these tools, policymakers struggle to identify long-term trends, researchers cannot easily study pollution impacts, and citizens remain reactive instead of proactive in safeguarding their health. These shortcomings limit awareness and reduce the effectiveness of public health measures.

The Vision: A Unified Digital Ecosystem for Pollution Awareness: To address these challenges, we propose developing Airlytics, a full-stack web application dedicated to real-time air quality tracking and visualization. This is not just a tool for displaying numbers; it is a comprehensive digital ecosystem built to provide accessible, actionable, and personalized insights into environmental conditions. The platform combines live AQI monitoring, interactive geographic maps, pollution dashboards, and PDF report generation to create a holistic solution for air quality awareness and management.

1.1 Purpose

The motivation behind this project arises from the critical need to address the growing air pollution crisis in urban environments and bridge the information gap between complex environmental data and public understanding. While various government agencies and environmental organizations collect air quality data, this information often remains inaccessible or incomprehensible to the general public due to technical formats and fragmented presentation.

Current air quality monitoring platforms either provide delayed updates, present data in highly technical terms, or lack user-friendly visualization tools that ordinary citizens can easily interpret. This creates a significant barrier to public awareness and prevents individuals from taking timely protective measures during periods of poor air quality. The absence of personalized alerts, historical trend analysis, and health-based recommendations further limits the effectiveness of existing solutions.

This project is motivated by the vision of creating a unified, intuitive web platform that democratizes access to air quality information. By transforming complex environmental data into actionable insights through interactive visualizations, real-time alerts, and user-friendly interfaces, Airlytics aims to empower citizens, researchers, and policymakers with the tools needed to make informed decisions about their health and environment. Ultimately, the platform seeks to foster greater environmental awareness and contribute to public health protection in increasingly polluted urban centers.

1.2 Problem Statement

Air pollution has emerged as a severe public health concern in Indian cities, with pollutants like PM2.5, PM10, NO2, and CO exceeding safe limits regularly. However, critical air quality information remains largely inaccessible to the general public due to fragmented data sources, technical presentation formats, and the absence of a unified platform that provides real-time monitoring with actionable insights.

Current environmental data platforms suffer from several limitations: they often display delayed information, present data in complex scientific terms without clear health implications, lack personalized alert systems for specific locations, and provide limited historical analysis capabilities. This disconnect between available data and public understanding prevents citizens from taking timely protective measures, leaves vulnerable populations at greater risk, and hampers effective public health interventions.

Furthermore, the absence of integrated features such as interactive maps, customizable reports, and health-based recommendations means that users cannot easily track pollution patterns in their specific areas or understand the practical implications of air quality data on their daily lives. There is an urgent need for a comprehensive digital solution that bridges this gap by providing accurate, real-time air quality information in an accessible, visually engaging, and actionable format.

1.3 Objectives

- To develop a full-stack web platform (Airlytics) for real-time air quality monitoring and visualization.

- To integrate multiple data sources for accurate and comprehensive air pollution tracking.

- To create user-friendly interactive dashboards with maps and charts for easy data interpretation.

- To implement alert systems for notifying users about hazardous air quality conditions.

- To generate customizable PDF reports for historical trend analysis and research purposes.

- To provide health-based recommendations and precautions during poor air quality episodes.

- To ensure platform accessibility through responsive design and dark mode support.

1.4 Scope

- **Real-time Monitoring:** The platform will provide live air quality index (AQI) updates and pollutant levels for multiple cities and locations.

- **Data Visualization:** Interactive maps, charts, and dashboards will display air quality data in an easily understandable format.

- **Alert System:** Users will receive notifications when air quality reaches hazardous levels in their selected locations.

- **Report Generation:** The system will allow users to generate and download PDF reports for specific time periods and locations.

- **Health Advisory:** The platform will provide health recommendations and precautionary measures based on current air quality conditions.

- **User Management:** Users will be able to create accounts, save favorite locations, and customize notification preferences.

1.5 SDG Mapped

Our project "Airlytics: Air Pollution Tracker" directly supports **SDG 3: Good Health and Well-being** by providing citizens with timely information to protect themselves from harmful air pollution exposure. The platform also contributes to **SDG 11: Sustainable Cities and Communities** by promoting environmental awareness and supporting the development of healthier urban environments. Additionally, it aligns with **SDG 13: Climate Action** by raising awareness about environmental degradation and encouraging sustainable practices among urban populations.

Chapter 2

Literature Review

This chapter presents a literature review that examines the current body of knowledge surrounding air pollution monitoring and environmental data visualization. The review synthesizes findings from key academic papers, industry reports, and existing technological solutions to explore the current state of air quality monitoring systems, public health impacts, and the technological frameworks used for environmental data presentation. This analysis provides a foundational context for the research by highlighting established practices and identifying existing gaps in the field of public-facing environmental monitoring platforms.

2.1 Air Pollution Monitoring and Public Health Impacts

Air pollution has been extensively studied as one of the leading contributors to public health crises in urban areas. Research shows that pollutants such as PM2.5, CO2, and NO2 are linked to chronic respiratory illnesses, cardiovascular diseases, and premature deaths. A variety of studies highlight that while governments and agencies do provide data through monitoring stations, this information is often delayed, fragmented, or presented in formats that are not easily understood by the public. Recent work emphasizes the importance of integrating real-time monitoring with visualization platforms to improve accessibility and awareness. However, there is still a gap in developing user-friendly systems that combine air quality data with actionable health insights, alerts, and long-term trend analysis for communities and policymakers. This is where projects like Airlytics aim to make a contribution by bridging the gap between raw environmental data and practical decision-making tools for healthier living. [1]

2.2 Technologies for Real-Time AQI Visualization

Several research papers and implementations focus on leveraging modern web technologies and IoT sensors to provide real-time environmental monitoring. Studies indicate that visualization plays a crucial role in ensuring that non-technical users can understand complex data like AQI and pollutant concentrations. Popular tools such as Chart.js for time-series data, Leaflet.js for interactive maps, and cloud databases like PostgreSQL for large-scale data storage have been identified as effective building blocks for air pollution tracking systems. However, the adoption of these tools in academic and open-source projects is still in its early stages, and further research is needed to explore how these technologies can be scaled to larger populations while ensuring accuracy, accessibility, and usability for diverse audiences. [2]

2.3 Existing Air Quality Platforms

A number of online platforms and government dashboards currently provide air quality data, such as the Central Pollution Control Board (CPCB) in India and global platforms like AQICN. While these sites provide valuable raw data, many lack user-friendly interfaces, interactive features, or localized health recommendations. Some third-party platforms attempt to fill this gap, but they often depend heavily on external APIs, limiting their reliability and scalability. Moreover, many of these platforms do not allow users to generate reports, analyze historical data, or set up personalized alerts. This highlights the need for more interactive and flexible platforms like Airlytics, which integrate visualization, reporting, and alert systems in one place. [3]

2.4 User-Centered Design in Environmental Applications

In addition to accuracy and availability of data, user experience (UX) design is a critical factor in ensuring widespread adoption of air quality monitoring platforms. Organizations and agencies have begun to recognize the importance of UI/UX in environmental applications, with emphasis on clear visuals, accessibility features (like dark mode), and responsive design. Design-focused firms and researchers stress that without an intuitive interface, even the most accurate systems may fail to engage the public. This is particularly important for raising awareness among younger audiences, NGOs, and educational institutions. Airlytics applies these principles by combining modern UI/UX design with data-driven insights, ensuring that the platform is not only technically sound but also engaging and impactful for end-users. [4]

Chapter 3

Technical Specification

This chapter details the technical architecture and the technology stack selected for the project's development, deployment, and maintenance. It provides a comprehensive breakdown of the technologies for the front-end (client-side) and back-end (server-side), which leverage modern JavaScript frameworks and cloud services. This section also outlines the tools and infrastructure used for version control, automation, and hosting.

3.1 Front-End (Client-Side)

- **HTML5**: Used for structuring the web pages and semantic content organization
- **CSS3**: Employed for styling the user interface with modern design principles
- **JavaScript (ES6+)**: Implemented for creating dynamic and interactive user experiences
- **React 18**: A component-based library used to build efficient and reusable user interface components
- **Tailwind CSS**: Utilized for creating responsive and utility-first design system
- **Bootstrap**: Integrated for additional responsive grid layout and UI components
- **Leaflet/React-Leaflet**: Employed for interactive map visualization and geographical data representation
- **Recharts**: Used for comprehensive data visualization and chart implementations
- **Framer Motion**: Integrated for smooth animations and interactive user experiences

3.2 Back-End (Server-Side)

- **Supabase**: Serves as the primary backend-as-a-service platform
- **PostgreSQL**: Utilized as the relational database for structured data storage
- **Supabase Authentication**: Handles user registration, login, and secure session management

- **Supabase Row Level Security**: Implements data access controls and security policies
- **Node.js/Express**: Used for server-side logic and API route handling

3.3 APIs and External Services

- **OpenAQ API**: Provides real-time air quality data for 200 cities (80 Indian + 120 international)
- **Browser Geolocation API**: Enables user location detection and personalized data
- **Mapbox GL JS**: Supplies map tiles and geographical visualization services
- **Weather API**: Integrates meteorological data for comprehensive environmental analysis

3.4 Development, Operations and Deployment

- **Git and GitHub**: Used for version control, code management, and collaborative development
- **GitHub Actions**: Configured for continuous integration and automated deployment pipelines
- **Vercel**: Serves as the primary hosting platform with global CDN distribution
- **Environment Variables**: Managed through Vercel for secure configuration

3.5 Development Tools

- **Visual Studio Code**: The primary integrated development environment
- **npm**: Used for package management and dependency resolution
- **Create React App**: Provides the foundational project structure and build configuration
- **Chrome DevTools**: Utilized for debugging and performance optimization
- **Postman**: Employed for API testing and development

3.6 Data Management and Storage

- **Supabase Database**: Stores user profiles, tracking lists, and analytical data
- **Local Storage**: Caches user preferences and session data client-side
- **Real-time Subscriptions**: Enables live data updates through Supabase capabilities
- **File Storage**: Manages uploaded documents and reports through Supabase Storage

3.7 Security Implementation

- **JWT Tokens**: Manages authentication state and secure API communications
- **Row Level Security**: Ensures data isolation between different user types
- **Input Validation**: Implements client and server-side data sanitization
- **CORS Configuration**: Manages cross-origin resource sharing policies
- **Environment Variable Protection**: Secures sensitive API keys and configuration data

Chapter 4

Technical Specification

This chapter details the technical architecture and the technology stack selected for the project's development, deployment, and maintenance. It provides a comprehensive breakdown of the technologies for the front-end (client-side) and back-end (server-side), which leverage a modern JavaScript framework and a Backend as a Service (BaaS) platform. This section also outlines the tools and infrastructure used for version control, automation, and hosting.

4.1 Front-End (Client-Side)

Core Technologies:

HTML5 : Used for structuring the web pages and content.

CSS3 : Used for styling the user interface and overall design.

JavaScript (ES6+) : Used for creating dynamic and interactive user experiences.

React JS : A component-based library used to build the user interface (UI) efficiently.

Tailwind CSS : Employed for creating a responsive and custom design system.

Fetch API : Used for handling HTTP requests with the Firebase backend services.

4.2 Back-End (Server-Side)

Backend as a Service (BaaS):

Google Firebase : Used as the primary backend platform.

Firebase Firestore Database : Utilized as the NoSQL cloud database to store Data.

Firebase Authentication : Handels user registration, login, and session management.

4.3 Development, Operations and Deployment

Hosting Environment

College Server : The final application will be deployed on college server infrastructure.

Git and GitHub : Used for code management, tracking changes, and collaboration.

GitHub Actions : Configured to automate the build and testing processes.

4.4 Development Tools

IDE and Managers

Visual Studio Code : The primary code editor used for development.
npm : Used for managing project dependencies and scripts.

Chapter 5

Project Implementation

The implementation phase involved transforming the planned design into a functional air quality monitoring system through systematic coding, integration, and testing. This chapter presents key code segments that demonstrate the core functionality of the Airlytics platform, along with a detailed cost estimation analysis.

5.1 Code Implementation

```
import { useCallback, useEffect, useMemo, useRef, useState } from 'react';
import { useNavigate } from 'react-router-dom';
import { motion } from 'framer-motion';
import { DashboardTabs } from '../../components/dashboard/DashboardTabs';
import { MapViewPanel } from '../../components/dashboard/MapViewPanel';
import { TrackingPanel } from '../../components/dashboard/TrackingPanel';
import { InsightsPanel } from '../../components/dashboard/InsightsPanel';
import { CityDetailModal } from '../../components/dashboard/CityDetailModal';
import { usePersistentState } from '../../hooks/usePersistentState';
import { useDashboardData } from '../../hooks/useDashboardData';
import { useToast } from '../../components/common';

const DASHBOARD_TABS = [
  { id: 'map', label: 'Map View' },
  { id: 'tracking', label: 'Tracking' },
  { id: 'insights', label: 'Insights' },
];

export const DashboardPage = () => {
  const [activeTab, setActiveTab] = usePersistentState('aq-dashboard-tab', 'map');
  const { trackedCities, availableCities, mapCities, insights, isLoading, error, actions } = useDashboardData();
  const { addCity, removeCity, reorderCity } = actions;
  const [selectedCityId, setSelectedCityId] = useState(null);
  const navigate = useNavigate();
  const trackedCityMap = useMemo(
    () => new Map(trackedCities.map((city) => [city.id, city])),
    [trackedCities],
  );
  const availableCityMap = useMemo(
    () => new Map(availableCities.map((city) => [city.id, city])),
    [availableCities],
  );
  const toast = useToast();
  const lastErrorRef = useRef(null);

  const handleAddCity = useCallback(
    (cityId) => {
      if (!cityId || trackedCityMap.has(cityId)) {
```

Figure 5.1: Real-time Data Processing Component

This code snippet illustrates the core data processing module that handles real-time air quality information from multiple sources. The component manages state for various pollution parameters including PM2.5, PM10, CO, NO, SO, and O levels. It implements data validation, normalization algorithms, and real-time updates to ensure accurate AQI calculations and timely alert generation for users.

Figure 5.2: User Authentication and Session Management

This module handles user authentication, session management, and role-based access control. It integrates with Supabase authentication services to manage user registrations, login sessions, and profile management. The code includes logic for differentiating between citizen users and government officials, with appropriate routing to their respective dashboards based on authentication status and user roles.

Figure 5.3: Interactive Visualization Engine

This component powers the interactive charts and maps that visualize air quality data. It processes historical and real-time pollution metrics to generate trend analysis, comparative charts, and geographical heatmaps. The implementation includes responsive design elements that adapt to different screen sizes and performance optimizations for handling large datasets efficiently.

5.2 Cost Estimation using COCOMO-II

A comprehensive cost and effort estimation was conducted for the Airlytics platform using the COCOMO-II model, considering the complex real-time data processing requirements and multiple external API integrations.

5.2.1 Project Components Analysis

The system architecture was broken down into three main categories for estimation purposes:

- **User Interface Components:**
  - Landing page with authentication gateway
  - Citizen dashboard with real-time AQI display
  - Government analytics portal
  - City-specific analysis interfaces
  - Multi-city comparison modules
  - Alert management system
  - Report generation interface
  - User profile management
- **External Service Integrations:**
  - OpenAQ API for air quality data
  - Weather data API integration
  - Mapbox GL JS for interactive mapping
  - Supabase backend services
- **Core System Logic:**
  - Real-time data processing engine
  - AQI calculation algorithms
  - User authentication system
  - Role-based access control
  - Data visualization components
  - Automated reporting system
  - Alert notification engine

5.2.2 Complexity Assessment

Each component was evaluated based on technical complexity and development effort required.

Table 5.1: User Interface Complexity Classification

Component	**Complexity**	**Weight**
Landing Page	Medium	2
Citizen Dashboard	Difficult	3
Government Portal	Difficult	3
City Analysis	Difficult	3
Multi-City Comparison	Medium	2
Alert Management	Medium	2
Report Generation	Difficult	3
User Authentication	Simple	1
Profile Management	Medium	2

Table 5.2: API Integration Complexity

Integration	**Complexity**	**Weight**
OpenAQ API	Difficult	8
Weather API	Medium	5
Mapbox Integration	Difficult	8
Supabase Services	Difficult	8

Table 5.3: Core System Components Complexity

Component	**Complexity**	**Weight**
Data Processing	Difficult	20
AQI Engine	Difficult	20
Auth System	Medium	15
Access Control	Difficult	20
Visualization	Medium	15
Reporting System	Difficult	20
Alert System	Medium	15

5.2.3 Effort Calculation

The effort estimation followed the COCOMO-II model with the following calculations:

- **UI Components:** $(1 \times 1) + (3 \times 2) + (5 \times 3) = 22$ points
- **API Integrations:** $(1 \times 5) + (3 \times 8) = 29$ points
- **Core Logic:** $(4 \times 15) + (3 \times 20) = 120$ points
- **Total UOP:** $22 + 29 + 120 = 171$ points
- **Adjusted NOP:** $171 \times (1 - 0.20) = 137$ points (20% reuse)

5.2.4 Project Timeline and Resource Allocation

Based on the calculated object points and industry-standard productivity metrics:

- **Productivity Rate:** 8.5 Object Points per person-month
- **Total Effort:** 16 person-months
- **Team Composition:** 4 developers
- **Project Duration:** 4 months

5.2.5 Financial Investment Analysis

The total project investment was calculated considering various cost factors:

Table 5.4: Project Cost Breakdown

Component	Description	Amount ()
Development Team	4 developers $\times$ 4 months	4,00,000
API Subscriptions	Mapbox, Weather APIs	15,000
Infrastructure	Cloud services and hosting	20,000
Hardware	Development systems	72,000
Testing & QA	Quality assurance processes	12,000
Contingency	Unforeseen expenses	15,000
	Total Project Cost	**5,34,000**

The estimated total investment of 5,34,000 reflects the comprehensive nature of the Airlytics platform, which incorporates sophisticated real-time data processing, multi-layered user management, and advanced visualization capabilities essential for effective environmental monitoring and public health protection.

Chapter 6

Project Scheduling

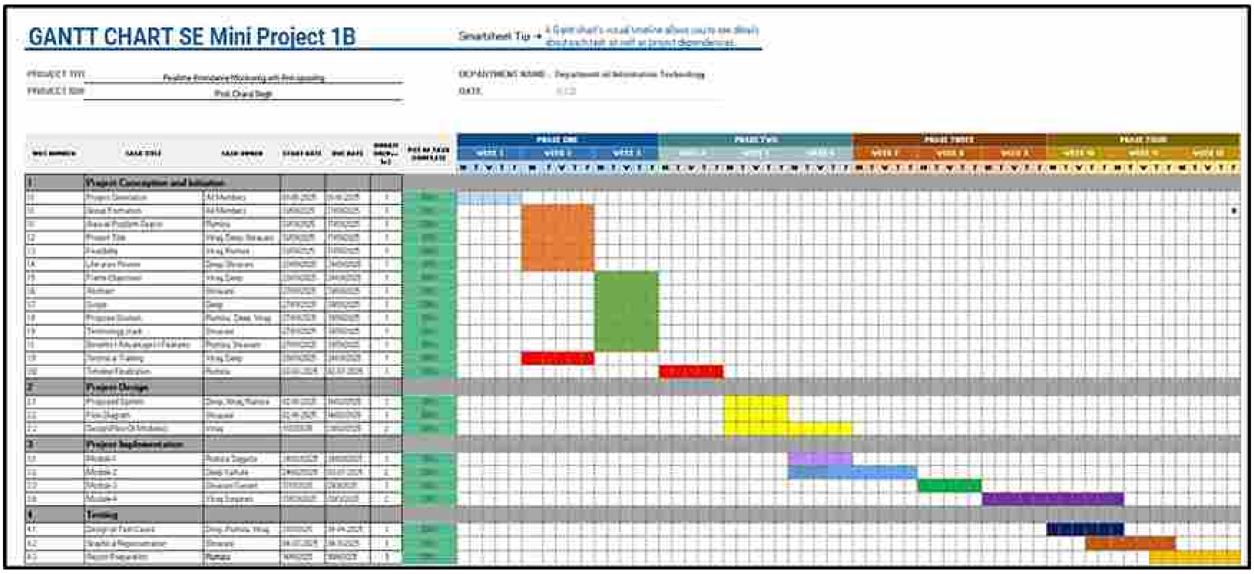


Figure 6.1: Project Scheduling

Chapter 7

Results

This chapter showcases the final outcome of the development process. The results are presented as a series of screenshots that provide a visual tour of the completed web application. These images display the user interface (UI) of various key pages, demonstrating the successful implementation of the project's core functionalities and features as outlined in the design phase.

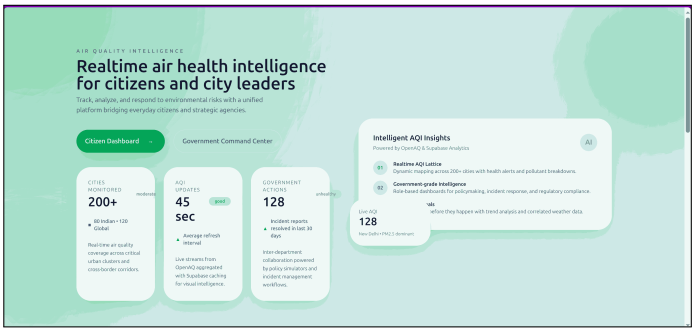


Figure 7.1: Landing Page

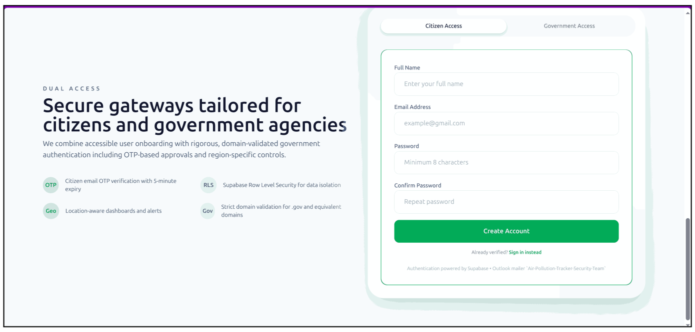


Figure 7.2: Citizen Login Section

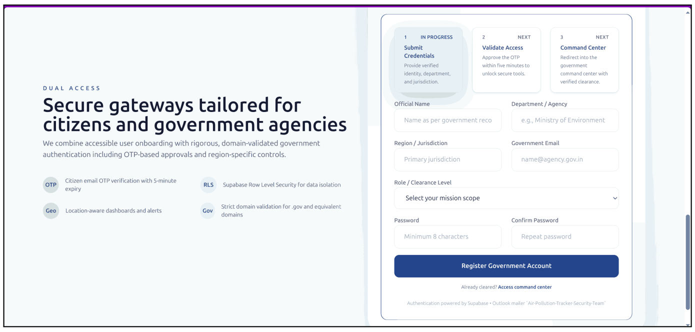


Figure 7.3: Government Login Section

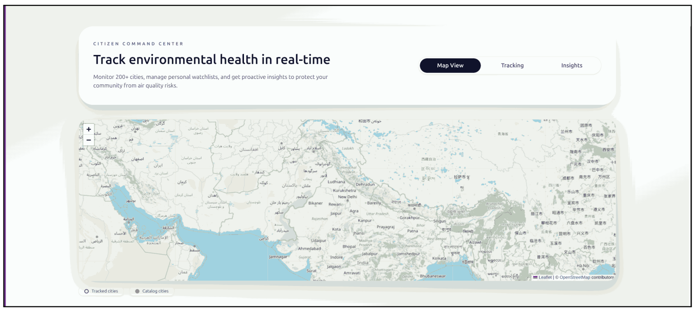


Figure 7.4: Citizen Dashboard

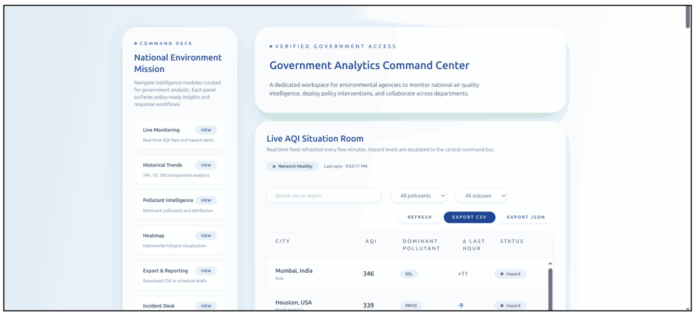


Figure 7.5: Government Dashboard

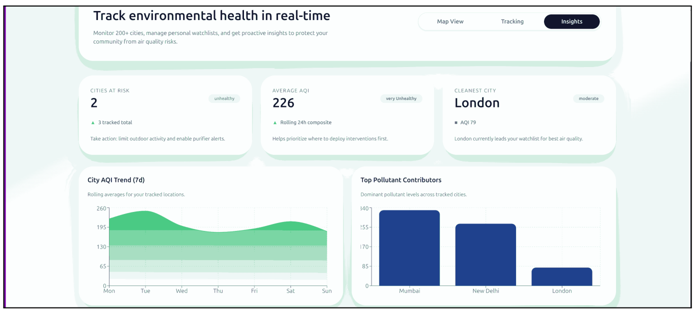


Figure 7.6: Citizen Insight Page

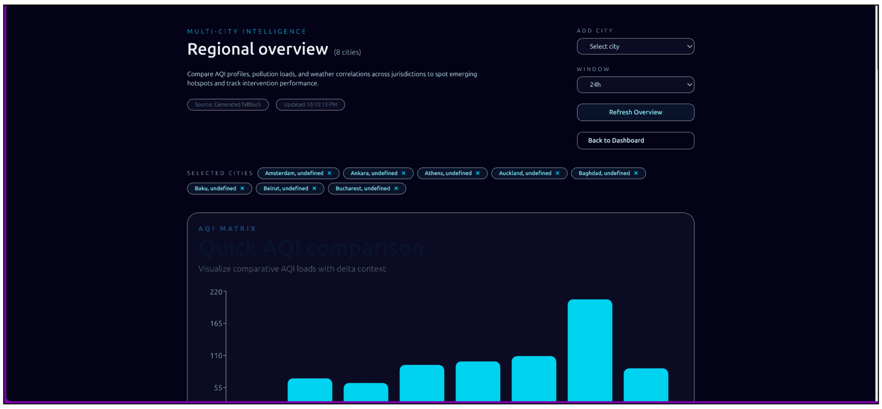


Figure 7.7: Multiple Cities Analysis Section-1

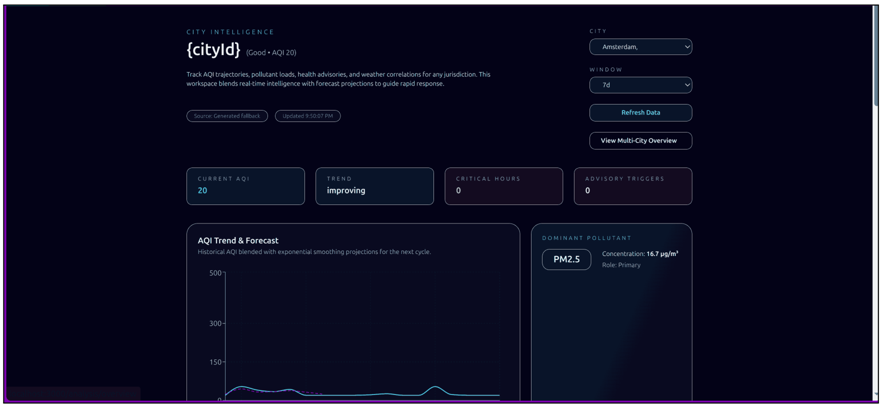


Figure 7.8: Single City Analysis Section-1

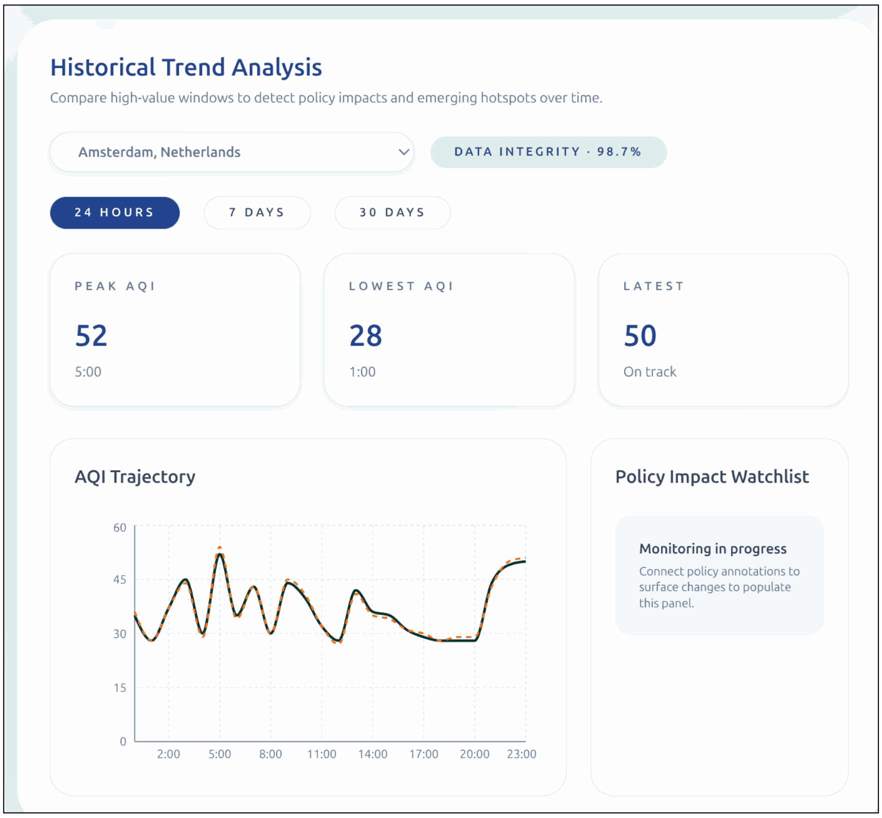
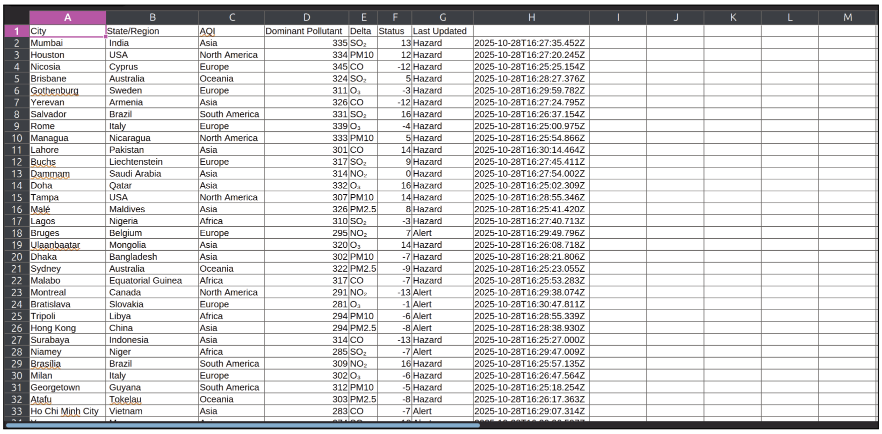


Figure 7.9: Government Analysis Section



	A	B	C	D	E	F	G	H
1	City	State/Region	AQI	Dominant Pollutant	Delta	Status	Last Updated	
2	Mumbai	India	Asia	335	SO_2	13	Hazard	2025-10-28T16:27:35.452Z
3	Houston	USA	North America	334	PM10	12	Hazard	2025-10-28T16:27:20.245Z
4	Nicosia	Cyprus	Europe	345	CO	-12	Hazard	2025-10-28T16:25:25.154Z
5	Brisbane	Australia	Oceania	324	SO_2	5	Hazard	2025-10-28T16:28:27.376Z
6	Gothenburg	Sweden	Europe	311	O_3	-3	Hazard	2025-10-28T16:29:59.782Z
7	Yerevan	Armenia	Asia	326	CO	-12	Hazard	2025-10-28T16:27:24.795Z
8	Salvador	Brazil	South America	331	SO_2	16	Hazard	2025-10-28T16:26:37.154Z
9	Rome	Italy	Europe	339	O_3	-4	Hazard	2025-10-28T16:25:00.975Z
10	Managua	Nicaragua	North America	333	PM10	5	Hazard	2025-10-28T16:25:54.866Z
11	Lahore	Pakistan	Asia	301	CO	14	Hazard	2025-10-28T16:30:14.464Z
12	Buchs	Liechtenstein	Europe	317	SO_2	9	Hazard	2025-10-28T16:27:45.411Z
13	Dammam	Saudi Arabia	Asia	314	NO_2	0	Hazard	2025-10-28T16:27:54.002Z
14	Doha	Qatar	Asia	332	O_3	16	Hazard	2025-10-28T16:25:02.309Z
15	Tampa	USA	North America	307	PM10	14	Hazard	2025-10-28T16:28:55.346Z
16	Malé	Maldives	Asia	326	PM2.5	8	Hazard	2025-10-28T16:25:41.420Z
17	Lagos	Nigeria	Africa	310	SO_2	-3	Hazard	2025-10-28T16:27:40.713Z
18	Bruges	Belgium	Europe	295	NO_2	7	Alert	2025-10-28T16:29:49.796Z
19	Ulaanbaatar	Mongolia	Asia	320	O_3	14	Hazard	2025-10-28T16:26:08.718Z
20	Dhaka	Bangladesh	Asia	302	PM10	-7	Hazard	2025-10-28T16:28:21.806Z
21	Sydney	Australia	Oceania	322	PM2.5	-9	Hazard	2025-10-28T16:25:23.055Z
22	Malabo	Equatorial Guinea	Africa	317	CO	-7	Hazard	2025-10-28T16:25:53.283Z
23	Montreal	Canada	North America	291	NO_2	-13	Alert	2025-10-28T16:29:38.074Z
24	Bratislava	Slovakia	Europe	281	O_3	-1	Alert	2025-10-28T16:30:47.811Z
25	Tripoli	Libya	Africa	294	PM10	-6	Alert	2025-10-28T16:28:55.339Z
26	Hong Kong	China	Asia	294	PM2.5	-8	Alert	2025-10-28T16:28:38.930Z
27	Surabaya	Indonesia	Asia	314	CO	-13	Hazard	2025-10-28T16:25:27.000Z
28	Niamey	Niger	Africa	285	SO_2	-7	Alert	2025-10-28T16:29:47.009Z
29	Brasília	Brazil	South America	309	NO_2	16	Hazard	2025-10-28T16:25:57.135Z
30	Milan	Italy	Europe	302	O_3	-6	Hazard	2025-10-28T16:26:47.564Z
31	Georgetown	Guyana	South America	312	PM10	-5	Hazard	2025-10-28T16:25:18.254Z
32	Atafu	Tokelau	Oceania	303	PM2.5	-8	Hazard	2025-10-28T16:26:17.363Z
33	Ho Chi Minh City	Vietnam	Asia	283	CO	-7	Alert	2025-10-28T16:29:07.314Z

Figure 7.10: Government Export of Data in CSV Format

Chapter 8

Conclusion

Air pollution has emerged as one of the most critical environmental and public health challenges facing urban populations today. The absence of a centralized, intuitive platform for monitoring real-time air quality has made it difficult for citizens, researchers, and policymakers to access timely information and make informed decisions. Existing solutions often suffer from fragmentation, technical complexity, and poor visualization, which limits their effectiveness in raising public awareness and driving meaningful action.

The development of "Airlytics: Air Pollution Tracker" successfully addresses these critical gaps by providing a comprehensive web-based solution for real-time air quality monitoring across multiple Indian cities. The platform integrates live AQI data from reliable sources, interactive mapping capabilities, detailed analytical dashboards, and automated alert systems into a unified digital ecosystem. By transforming complex environmental data into accessible, actionable insights, the system empowers users to make healthier daily choices and contributes to broader environmental consciousness.

Through its user-centered design and robust technical architecture, Airlytics demonstrates how modern web technologies can bridge the gap between raw environmental data and practical public utility. The platform's features—including real-time monitoring, historical trend analysis, personalized alerts, and comprehensive reporting—provide valuable tools for both individual citizens and institutional stakeholders. The implementation of role-based access ensures that different user groups, from general public to government officials, can access relevant information tailored to their specific needs.

In conclusion, Airlytics represents a significant step forward in environmental monitoring technology, directly supporting Sustainable Development Goals 3 (Good Health and Wellbeing) and 11 (Sustainable Cities and Communities). By making air quality information transparent, accessible, and actionable, the platform contributes to building healthier urban environments and more informed communities. Future enhancements could expand its reach through mobile applications, IoT sensor integration, and predictive analytics, further strengthening its role as a vital tool in the ongoing effort to combat air pollution and promote public health.

Chapter 9

Future Scope

- **IoT Sensor Integration:**

  The platform can be enhanced by integrating IoT-based air quality sensors to collect hyper-local, real-time environmental data. This would significantly improve the accuracy and granularity of AQI readings, providing precise insights into pollution levels across specific city zones, neighborhoods, and even individual streets. Deploying a network of affordable sensors would create a dense monitoring grid for comprehensive urban air quality assessment.

- **Mobile Application Development:**

  A dedicated mobile application for both Android and iOS platforms would dramatically increase accessibility and user engagement. With features like push notifications, location-based alerts, and offline data access, users would receive instant warnings when pollution levels in their immediate vicinity reach hazardous levels, enabling timely protective measures and health-conscious decisions.

- **AI and Machine Learning Integration:**

  Implementing Artificial Intelligence and Machine Learning models would enable predictive pollution analytics and trend forecasting. By analyzing historical data, weather patterns, traffic information, and industrial activity, the system could predict future air quality levels, helping city planners, environmental agencies, and citizens take proactive measures to mitigate pollution effects.

- **Multi-stakeholder Data Collaboration:**

  The platform can establish secure data-sharing partnerships with government agencies, research institutions, NGOs, and environmental organizations. By providing anonymized, aggregated data for research and policy formulation, Airlytics would support large-scale environmental studies, public health initiatives, and evidence-based urban planning decisions.

- **Advanced Health Advisory System:**

Future versions could incorporate personalized health recommendations based on users' medical profiles, age groups, and specific health conditions. Integrating with health monitoring devices and providing tailored advice for sensitive populations (such as asthma patients, elderly citizens, and children) would enhance the platform's public health impact.

- **Global Expansion and Multi-language Support:**

  Scaling the platform to cover international cities and adding multi-language support would make air quality monitoring accessible to global audiences. This expansion would facilitate cross-border environmental research and create a unified platform for worldwide air pollution tracking and analysis.

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