SYNOPSIS

ON

"AIRSONA: An AI Driven AQI Solution"

Submitted in

Partial Fulfilment of requirements for the Award of Degree *of*

Bachelor of Technology

In

Computer Science and Engineering

(Data Science)

By

(Project Id: 25_ CS_DS_03)

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1. Introduction

Air pollution has emerged as one of the most pressing challenges in urban environments today, severely impacting public health, the ecosystem, and economic growth. As cities expand and industrial activity intensifies, maintaining a healthy **Air Quality Index (AQI)** becomes increasingly complex.

Traditional approaches, such as sporadic tree planting initiatives, often fall short due to inadequate planning, unsuitable species selection, and the lack of real-time data necessary for forecasting and prevention. Moreover, conventional strategies seldom offer tangible incentives that motivate businesses or private landowners to participate actively in environmental protection.

Recognizing these shortcomings, our project titled **"AirSona: An AI-Driven AQI Solution"** aims to introduce a transformative, technology-powered approach to air quality management. By leveraging advancements in Artificial Intelligence, and Machine Learning, this solution provides a comprehensive **software-as-a-service (SaaS) platform** that optimizes tree plantation strategies, delivers precise AQI monitoring, and supports policy implementation through actionable insights.

Through smart algorithms, AirSona identifies optimal locations for tree planting, selects the most effective species based on local climate and pollution absorption capacity, and ensures minimal disruption to economic activities.

A key innovation of AirSona is its integrated predictive analysis engine, which uses real-time and historical AQI data to forecast high pollution days and issue early warnings. The system's anomaly detection tools also monitor sudden spikes in pollution from causes such as traffic congestion or industrial emissions, enabling rapid intervention and control.

By fostering a culture of sustainability through data-driven incentives and seamless coordination among stakeholders, the project seeks to overcome traditional barriers and translate environmental policies into effective action.

In summary, AirSona is designed to revolutionize air quality management by delivering scalable, AI-powered tools that foster long-term improvement and active collaboration. By combining technological innovation with practical environmental solutions, our project presents a forward-thinking model for cleaner, healthier cities in an era of rapid urbanization.

2. Project Objective

- **Valid Tree Recommendation:**

  Develop an AI-driven system that recommends at least four effective tree species for plantation, customized according to the local climate, soil conditions, and pollution absorption rates. Ensure tree planting strategies maximize AQI reduction while minimizing impact on existing businesses and land use.

- **Anomaly Detection of Pollution Spikes:**

  Implement advanced anomaly detection algorithms to identify and alert authorities about sudden spikes in pollution. Detect causes such as increased traffic, industrial emissions, or unexpected environmental incidents, enabling quick intervention.

- **Real-Time Analysis for AQI Stations:**

  Enable real-time monitoring and analysis of AQI data from multiple stations across different regions. Use machine learning models for predictive analysis, early warnings, and dynamic reporting to help authorities take preventive and corrective measures.

- **Carbon Credits and Incentives:**

  Integrate mechanisms for calculating and tracking carbon credits earned through tree plantation and reduced emissions. Provide incentives and transparent reporting, motivating individuals, businesses, and communities to participate in eco-friendly initiatives and maximize green impact.

3. Feasibility Study

1. Technical Feasibility:

- **Objective**: Assess whether the required technology and resources are available to develop, implement, and maintain the AirSona system.

- **Considerations**:
    - AI and Machine Learning Implementation: Evaluate the availability and effectiveness of AI techniques for tree recommendation, anomaly detection of pollution spikes, real-time AQI analysis, and carbon credit calculations.
    - Scalability & Maintenance: Examine the platform's ability to process large data volumes efficiently and its maintainability over time.

2. Operational Feasibility:

- **Objective**: To determine if AirSona can be integrated and operated efficiently within current urban and community environments.
- **Considerations**:
    - Evaluate how effectively AirSona will coordinate plantation drives, pollution alerts, and carbon credit incentives among city management and citizen groups.
    - Verify the ease of ongoing maintenance, technical support (bug fixes, updates), and capacity for implementing future features and improvements.

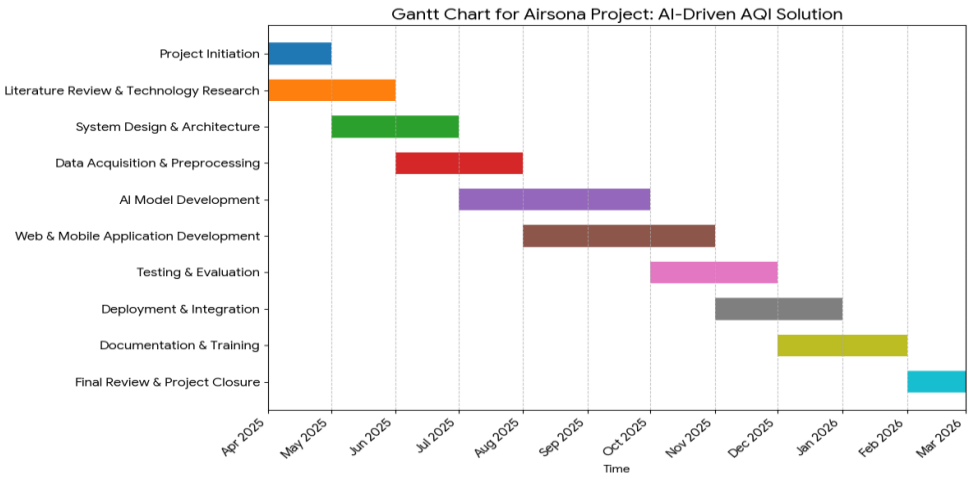
3. Schedule Feasibility:

- **Objective**: To determine if the AirSona system can be developed and deployed within the desired time frame.
- **Considerations**:
    - Assess time needed for integrating with existing AQI stations, testing prediction accuracy, and refining recommendation logic with field data.
    - Review realistic durations required for developing core modules—tree recommendation engine, anomaly detection algorithms, AQI analysis dashboard, and carbon credit system.

4. Legal Feasibility:

- **Objective**: To ensure AirSona's implementation complies with all relevant laws and regulations.

- **Considerations**:
    - Confirm that data collection, storage, and processing comply with city, state, and national guidelines for environmental monitoring and data privacy.
    - Validate that carbon credit tracking and reporting align with international standards and local carbon markets.
    - Ensure all algorithms, data sources, and system components respect third-party IP and licensing requirements.



4. Methodology/ Planning of work

Here's the **methodology and planning of work** for your AirSona project, specifically tailored for a software-only approach. Here's a step-by-step plan for organizing the work effectively:

- **Requirements Analysis:**
    - Precisely define project objectives, focusing on effective tree recommendation, anomaly detection of pollution spikes, real-time AQI data analysis, and carbon credit calculation.
    - Gather stakeholder requirements and identify software tools and datasets necessary for web/mobile application development.
- **System Design and Architecture:**
    - Design a modular software architecture for the AirSona web and mobile platforms.

    - Plan seamless integration of external AQI data sources available online or through public APIs (instead of IoT stations).
- **Data Acquisition and Preprocessing:**
    - Source AQI, environmental, and tree species data from open databases and web APIs.
    - Clean and preprocess the collected data for use in machine learning algorithms and statistical models.
- **AI model Development:**

  Develop software-based AI models for:
    - Tree species recommendations based on environmental conditions.
    - Anomaly detection for pollution spikes (using historical and real-time online AQI data).
    - Real-time AQI analysis and carbon credit computation, relying solely on software-side logic.
- **Web Application Development:**
    - Build the complete AirSona application stack, focusing on intuitive user interfaces and responsive dashboards.
    - Integrate AI models directly into the software backend—no physical sensor or hardware dependencies.
    - Implement modules for user login, reporting, recommendation, and live analytics.
- **Validation and Testing:**
    - Conduct comprehensive testing (unit, system, integration) using simulated and live online data sources.
    - Collect feedback from potential users and iterate on application features and UI/UX.
- **Evaluation:** Evaluate the model's performance using appropriate metrics like accuracy, precision, recall, F1-score, etc.
- **Deployment and Roll Out:** If the model's performance is satisfactory, deploy the model for AirSona.
- **Monitoring and Updating:** Continuously monitor the model's performance in the real-world setting. Collect feedback and use it to update and improve the model

5. Tools/Technology Used:

5.1 Minimum Hardware Requirements

1. **CPU:** Intel Core i5 Inspiron 3000
2. **RAM (Memory):** 8GB of RAM
3. **GPU (Graphics Processing Unit):** Integrated Graphics
4. **HDD (Hard Disk Drive) or SSD (Solid State Drive):** 256GB SSD

5.2 Minimum Software Requirements:

1. **Operating System (OS):** Windows 11

   1.Development Tools:

   - Here are some essential development tools and software for creating an AirSona:
     - **Python:** A programming language commonly used for AI, machine learning, and model development.
     - **Development IDE:** Python include Visual Studio Code.
     - **Version Control:** Use Git for version control to manage code changes and collaborate with your team effectively.
     - **Web Framework (if applicable):** HTML, CSS or JAVASCRIPT, React, Tailwind CSS, NodeJS, ExpressJS, Prisma ORM,
2. **Other Tools Used for Development:**
   - Specify any other tools or software that are specific to your development requirements. For example:
   - **Python Library:** Geocoder.
   - **Machine Learning Frameworks:** Pandas, NumPy, Scikit-Learn, Seaborn, Matplotlib, TensorFlow.
   - **Database Management:** Prediction requires database integration, specify the database system (e.g., MySQL, PostgreSQL) and any related tools.

6. References: [IEEE format]:

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  Details the use of machine learning models for accurate AQI forecasting and pollution intervention planning.

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