WEBAI AQI - THE AIR QUALITY MONITORING PLATFORM

Team: FusionX

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PROBLEM STATEMENT

AIR QUALITY MONITORING AND PREDICTION

Implement an AI system that continuously monitors air quality across the city at real time, predicts pollution levels, and suggests actionable measures to mitigate the effects of poor air quality on residents' health.

- Air pollution in urban areas poses serious *health risks* while also hindering *sustainable development*.

- Accurate *monitoring* and timely intervention are crucial for minimizing environmental impact and ensuring cities remain livable and productive.

- Thus, the project caters to these issues by utilizing AI techniques to predict pollution levels by *calculating AQI* and provide *real-time alerts* to users.

- Serving as both an *information hub* and an interactive platform, the project leverages data-driven *models* and user-friendly interfaces to keep citizens informed, enabling timely actions and fostering *discussions* among users. Ultimately, the project contributes to better environmental and public health outcomes through collaboration and awareness

SOCIAL, ECOLOGICAL AND ECONOMIC IMPACT

The project fosters community action through *real-time AQI updates*, Reducing AQI *suggestions,* and anonymous *discussion* forums.

The *chatbot* and *visualizations* make information accessible, promoting environmental awareness

Socially, it raises awareness, helping citizens make informed decisions to protect their health.

Ecologically, it promotes pollution reduction and a cleaner environment by targeting key pollutants.

Economically, it can lower healthcare costs by reducing pollution-related illnesses and encourage sustainable practices that boost productivity.

PROMOTING SUSTAINABILITY

- For every AQI level, offering tailored suggestions to reduce emissions at different AQI levels.

- Enabling anonymous collaboration in forums, driving collective action.

- Providing real-time updates and notifications to promote immediate response.

- Visualizing data to increase awareness and drive long-term behavioral change

- Educating users on pollutants and their sources to reduce future emissions.

ESTIMATED IMPACT AND SCALE

- 20% reduction in peak AQI levels through collective action and awareness.

- 10% decrease in healthcare costs related to air pollution

- Improved air quality and ecosystem recovery, leading to more sustainable urban environments.

SOLUTION DESCRIPTION

- Developed an *Air Quality Index (AQI)* Predictor and *Health Advisor* application utilizing *Random Forest Regression* to forecast PM2.5 and PM10 levels based on environmental factors such as CO, SO2, NH3, and more.

- The application integrates *real-time* data processing to deliver actionable insights on air quality.

PROBLEM-SOLVING APPROACH AND CORE INNOVATION

Real-Time Insights

- Provides immediate feedback on air quality, empowering users to make informed decisions regarding their health and environment.

- Includes a *severity classification system* that ranks air quality on a scale of 1 to 5, guiding users on necessary precautions.

AI-DRIVEN AQI PREDICTOR AND HEALTH ADVISOR
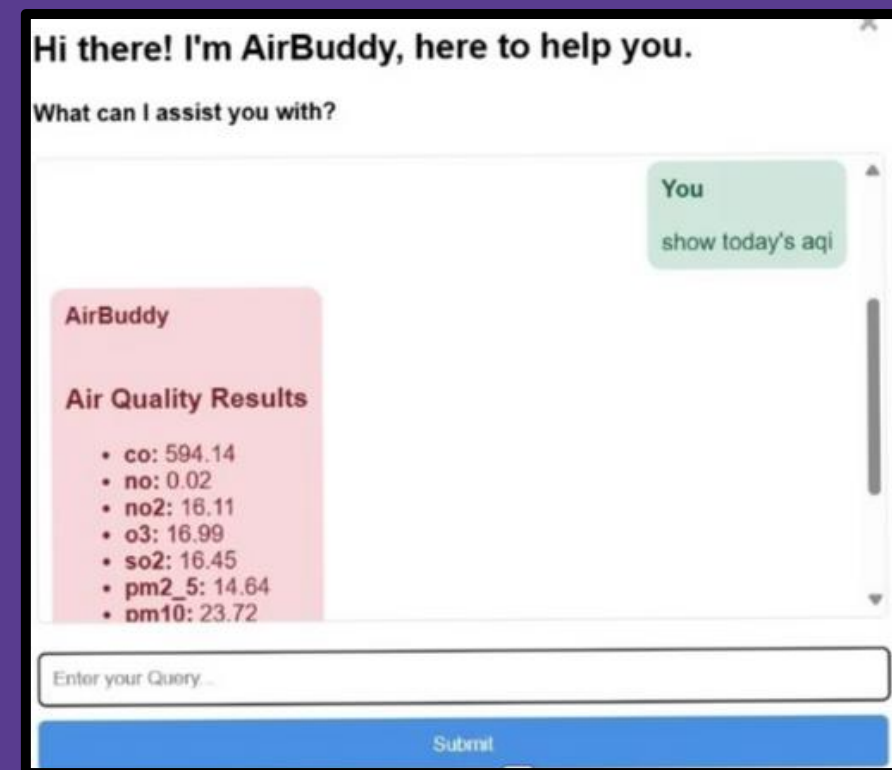
User Engagement

Features an *email notification system* to alert registered users about current air quality conditions, enhancing community awareness.

LEVERAGING AI IN THE PROJECT

Interactive Chatbot

An AI-powered chatbot responds to general queries about air quality and health, providing users with personalized support and information.

Community Forum with Summarization:

Facilitates a platform for users to discuss air quality issues, with the capability to summarize discussions, allowing for efficient information dissemination and user engagement.

TECHNICAL ARCHITECTURE

General Python Libraries

- *API Interaction*:
  - fetch API: Makes HTTP requests to fetch data (e.g., AQI data).
  - requests: Sends HTTP requests to web APIs for real-time AQI data.
  - json: Parses JSON data for handling API responses.

- *Database & Email*:
  - sqlite3: Interacts with SQLite databases for storing AQI and user data.
  - smtplib: Sends emails via SMTP for AQI updates.
  - email.mime: Formats and sends multipart emails (plain text and HTML).

- *Data Handling*:
  - os: Interacts with the operating system (files, paths).
  - re: Utilizes regular expressions for basic NLP tasks.
  - collections.Counter: Counts hashable objects, useful for tallying pollutants or interactions.

Machine Learning Libraries

- *Data Manipulation*:
  - **numpy**: Performs numerical computations and matrix operations.
  - **pandas**: Manages datasets (e.g., AQI data), cleaning, and organizing for analysis.

- *Modeling & Evaluation*:
  - **scikit-learn**:
    - **train_test_split**: Splits datasets into training/testing sets.
    - **StandardScaler**: Scales data for machine learning models.
    - **mean_squared_error, r2_score**: Metrics for evaluating regression models.

- *Regression Models*:
  - **Linear Regression**: Basic linear regression model.
  - **Decision Tree Regressor**: Tree-based regression model.
  - **Random Forest Regressor**: Ensemble model using multiple decision trees.
  - **Gradient Boosting Regressor**: Boosts decision trees for regression.
  - **SVR**: Predicts AQI levels using support vector machines.
  - **MLP Regressor**: Neural network-based regressor for complex relationships.

- *Model Persistence*:
  - **joblib**: Saves and loads trained machine learning models.

TECHNICAL ARCHITECTURE

NLP & Transformers

- *Transformers Library*:
  - Provides powerful NLP models for text generation and summarization.

- *Text Generation Models*:
  - **Falconsai/text_summarization**: Summarizes comments or reports.
  - **google/flan-t5-large:** Used for summarization and generating chatbot responses.
  - **gpt2**: Generates real-time textual outputs.
  - **intel/distilgpt2-wikitext2**: Efficient text generation.
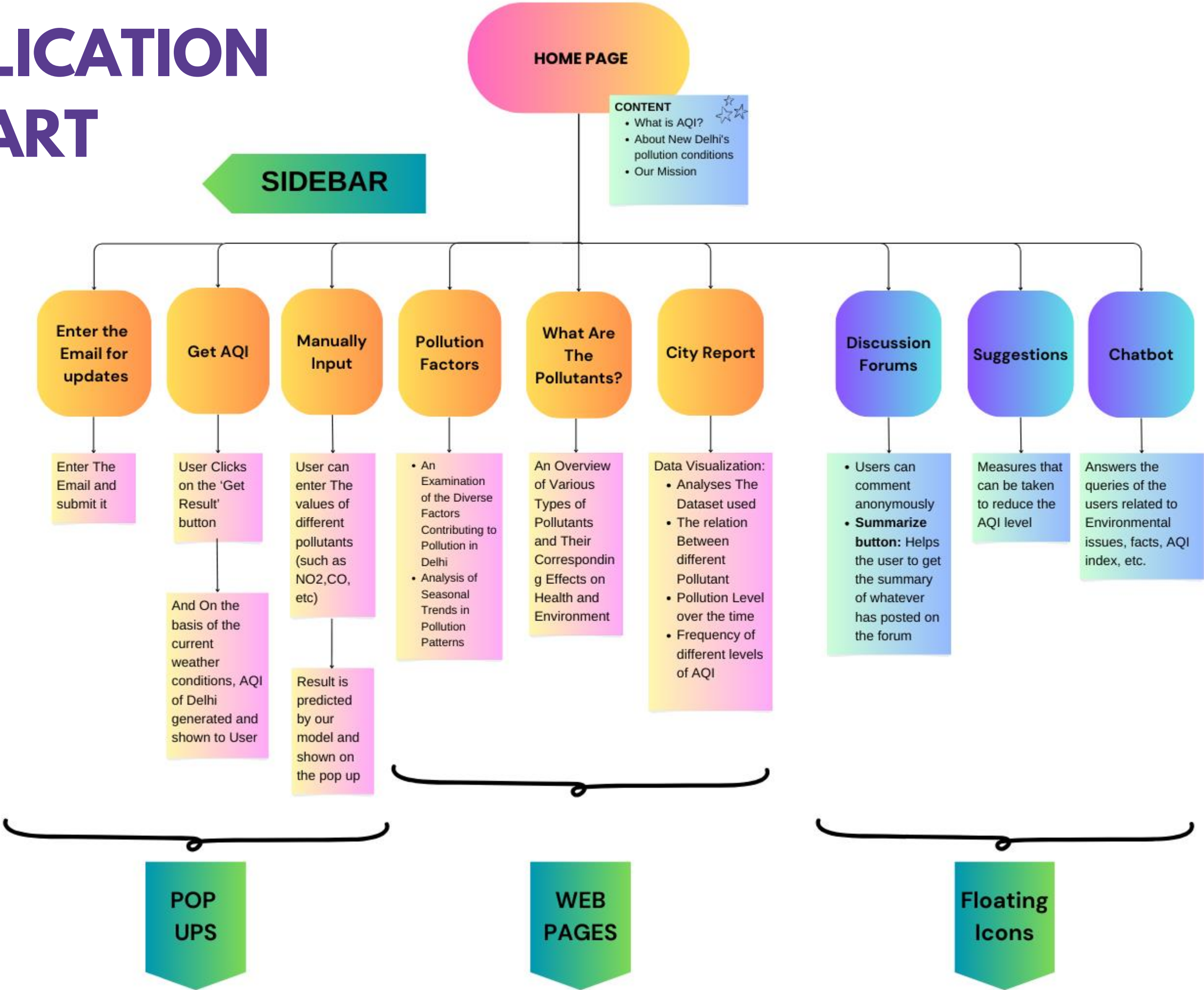 - **Intel/neural-chat-7b-v3-3**: Conversational model for chatbot interactions.

External APIs

- *OpenWeatherMap API*: Fetches real-time AQI and weather data.
- *llma3 API*: Used for NLP tasks like summarization and conversational AI.

OUR APPLICATION FLOWCHART

HOME PAGE

CONTENT
- What is AQI?
- About New Delhi's pollution conditions
- Our Mission

SIDEBAR

Enter the Email for updates

Enter The Email and submit it

Get AQI

User Clicks on the 'Get Result' button

And On the basis of the current weather conditions, AQI of Delhi generated and shown to User

Manually Input

User can enter The values of different pollutants (such as NO2,CO, etc)

Result is predicted by our model and shown on the pop up

Pollution Factors

- An Examination of the Diverse Factors Contributing to Pollution in Delhi
- Analysis of Seasonal Trends in Pollution Patterns

What Are The Pollutants?

An Overview of Various Types of Pollutants and Their Corresponding Effects on Health and Environment

City Report

Data Visualization:
- Analyses The Dataset used
- The relation Between different Pollutant
- Pollution Level over the time
- Frequency of different levels of AQI

Discussion Forums

- Users can comment anonymously
- **Summarize button:** Helps the user to get the summary of whatever has posted on the forum

Suggestions

Measures that can be taken to reduce the AQI level

Chatbot

Answers the queries of the users related to Environmental issues, facts, AQI index, etc.

POP UPS

WEB PAGES

Floating Icons

FUTURE POTENTIAL AND SCALABILITY

- **Market Opportunity:** Rising demand for air quality monitoring solutions in urban areas due to increasing environmental regulations.

- **Geographic Expansion:** Can easily scale beyond Delhi by integrating local datasets and APIs, adaptable for global deployment.

- **Real-Time Data Integration**: Incorporates IoT-based air quality sensors for hyper-local AQI updates and insights.
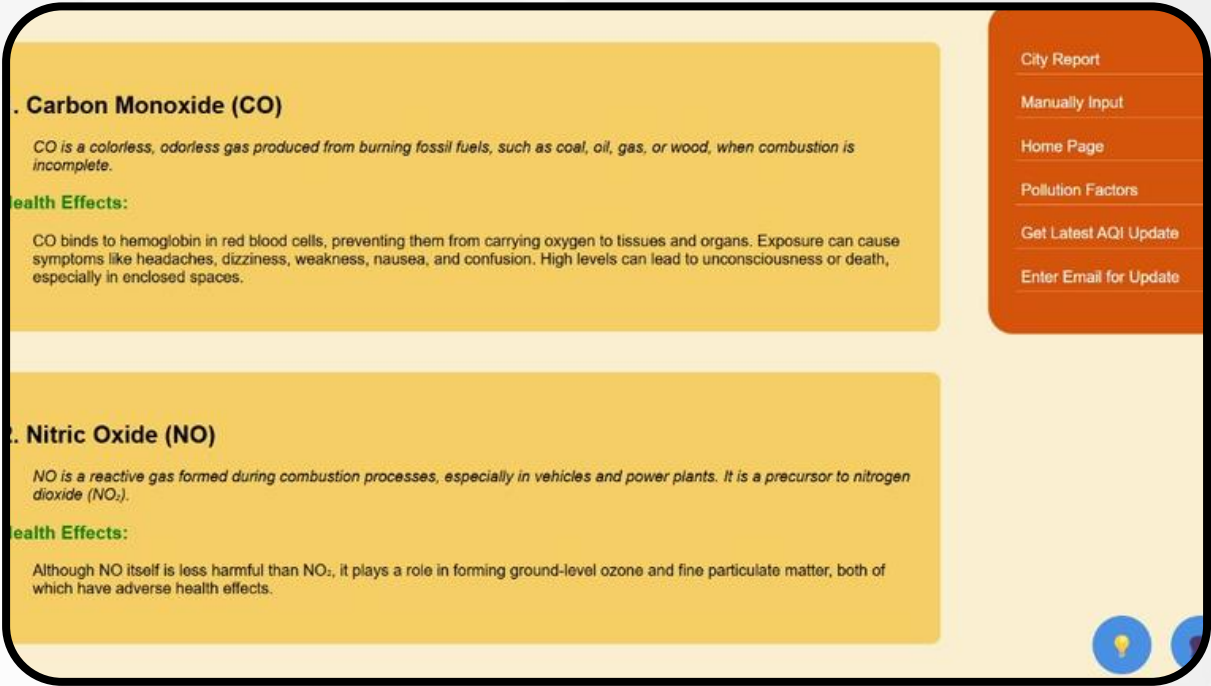
POTENTIAL FOR REAL-WORLD DEPLOY

- The system's architecture can be designed for flexibility, allowing it to integrate with existing **air quality sensors**, APIs, and **government portals**. It can also be adapted for **mobile applications**, further increasing its accessibility and user base.

- **Public Health** Initiatives: Easily integrates with healthcare systems to issue alerts for at-risk populations (e.g., children, elderly, and those with respiratory conditions) during high AQI levels.

- **Public Transportation** Systems: Integrates with local transportation to offer pollution-reducing tips, like suggesting public transport usage on high AQI days.

Intel® Tiber Cloud
- Purpose: Scalable AI infrastructure optimized for deep learning and NLP workloads, ideal for high-demand tasks.
- Usage: Powers large models for AQI prediction, text summarization, and real-time data processing.

Intel® neural-chat-7b-v3-3
- Purpose: Advanced conversational model for generating human-like responses.
- Usage: Enhances the chatbot (AirBuddy) for AQI-related queries, creating engaging, contextually relevant conversations.

Intel® distilgpt2-wikitext2
- Purpose: Efficient, lightweight version of GPT-2 for fast text generation.
- Usage: Generates AQI updates and pollution reduction suggestions in real time.

Intel® fid_flan_t5_base_nq
- Purpose: T5 model fine-tuned for answering open-ended questions and summarization.
- Usage: Provides accurate responses and summaries in the chatbot and forums.

Intel® distilgpt2
- Purpose: Optimized GPT-2 for faster, efficient text generation.
- Usage: Improves chatbot speed and ensures real-time AQI updates.

BuzzOnEarth India Hackathon
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THANK YOU