**Sustainable Smart City Assistant Using IBM Granite LLM**

*A Project Report*

*submitted in partial fulfillment of the requirements*

of

Generative AI with IBM Cloud

Internship

**with  
 SMARTBRIDGE** in collaboration **with APSCHE**

by

**Padala Suguna**

**Team ID:** LTVIP2025TMID34559

[sugunapadala739@gmail.com](mailto:sugunapadala739@gmail.com)

**Institution:** DMSSVH College of Engineering

# **Contents**

1. [Introduction](#Xe3d0fc0bea9a42ce7605565d0964033d7f6ee47)  
   1.1 [Project Overview](#X3cfb67467c1dfe6e44f6390a4fcc69befb3282a)  
   1.2 [Purpose](#X703d73d1cd65e1562d98bcff591c1f67aec4444)
2. [Ideation Phase](#X4d8f901898a9ece0888e9b56b9f7b1ee961192c)  
   2.1 [Problem Statement](#X84e712a5f7ee5733a84054c1894a4cc46528cb6)  
   2.2 [Empathy Map Canvas](#X8ba89014ac8c0ba4076a9863fc5ff164315b445)  
   2.3 [Brainstorming](#X2965ee415ce3f95d4f437e2585a8d17aa4cf796)
3. [Requirement Analysis](#Xc83afb61f0e24e1f29b24c6d32c3d10a9f7bc5e)  
   3.1 [Customer Journey Map](#X81ff29dac938b0799c6391a9cd5e5a9a7b9d75f)  
   3.2 [Solution Requirement](#Xd622ec8a87a271ea8551107f1df91362c9a2d8e)  
   3.3 [Technology Stack](#Xae94554faf646ca8fda2e6d5c33967ee82a72c7)
4. [Project Design](#X876ef147d845fce17a0bedb112d23d57949bb6d)  
   4.1 [Problem Solution Fit](#X0d491bd540ec0d90fcac257052ad02142c612c2)  
   4.2 [Proposed Solution](#Xc9054c83c1b6992026a6384a90f1402f07081de)  
   4.3 [Solution Architecture](#Xd9abdcd017a28a122b29684d3a318041b5f9bef)
5. [Project Planning & Scheduling](#X1642b8df58bc1288ad912eddea99cfe5edbeabe)
6. [Functional and Performance Testing](#X84d142e9180504d2cc653b17da76c9ec5a3c9a5)
7. [Results](#X7f71dd75448129b74f2fc659b5486981c0282bb)
8. [Advantages & Disadvantages](#Xb32c5915fe71ccfadc997c70c7500bfc681ce25)
9. [Conclusion](#Xf084a3aad2ba019113a3f84a3b857d0628c92ce)
10. [Future Scope](#Xe68ffc7e5ee7e6ad94fe7f4573eeb6753b5db87)
11. [Appendix](#X1979d828485a8f9447718c0429d15cb667d9095)

## 1. Introduction

### 1.1 Project Overview

The Sustainable Smart City Assistant is an innovative web application designed to empower urban planners, environmental scientists, and local government officials with advanced, data-driven tools for sustainable city management. It leverages cutting-edge AI via IBM Granite LLM, combining KPI analysis, time-series forecasting, anomaly detection, and AI chat assistance through a seamless Streamlit-FastAPI framework.

### 1.2 Purpose

To streamline sustainability efforts by enabling real-time KPI analysis, prediction, and eco-guided decision-making, enhancing efficiency and resilience in urban planning.

## 2. Ideation Phase

### 2.1 Problem Statement

Urban sustainability is challenged by fragmented systems, poor data usability, and lack of AI integration. This tool bridges the gap between data analytics and decision-making.

### 2.2 Empathy Map Canvas

**Stakeholders:** Urban Planners, Scientists, Officials  
**Say:** “We need fast, insightful analysis.”  
**Think:** “Smart tools should simplify decision-making.”  
**Do:** Upload data, use chat assistant, generate reports.  
**Feel:** Confused by complex data, desire clarity.

### 2.3 Brainstorming

* KPI uploads in CSV
* Time-series forecasts
* Chat assistant for queries
* AI news summarization (SerpAPI)
* PDF report generation with eco-friendly tips

## 3. Requirement Analysis

### 3.1 Customer Journey Map

**Awareness:** Discovered via GitHub/events  
**Engagement:** Uploads data, interacts with UI  
**Decision:** Uses reports to guide policy  
**Retention:** Regular insights, updates

### 3.2 Solution Requirement

**Functional:**  
- CSV upload, chatbot, forecasting, anomaly detection  
- PDF export, AI summaries

**Non-Functional:**  
- FastAPI backend, <2s responses, Streamlit UI

**Constraints:**  
- No authentication, CSV file storage

### 3.3 Technology Stack

**Frontend:** Streamlit, matplotlib, seaborn  
**Backend:** FastAPI, Python 3.11, statsmodels, SerpAPI, IBM Granite LLM  
**Storage:** CSV, optional SQLite/MongoDB  
**APIs:** Watsonx, SerpAPI, optional Pinecone, Google Maps

## 4. Project Design

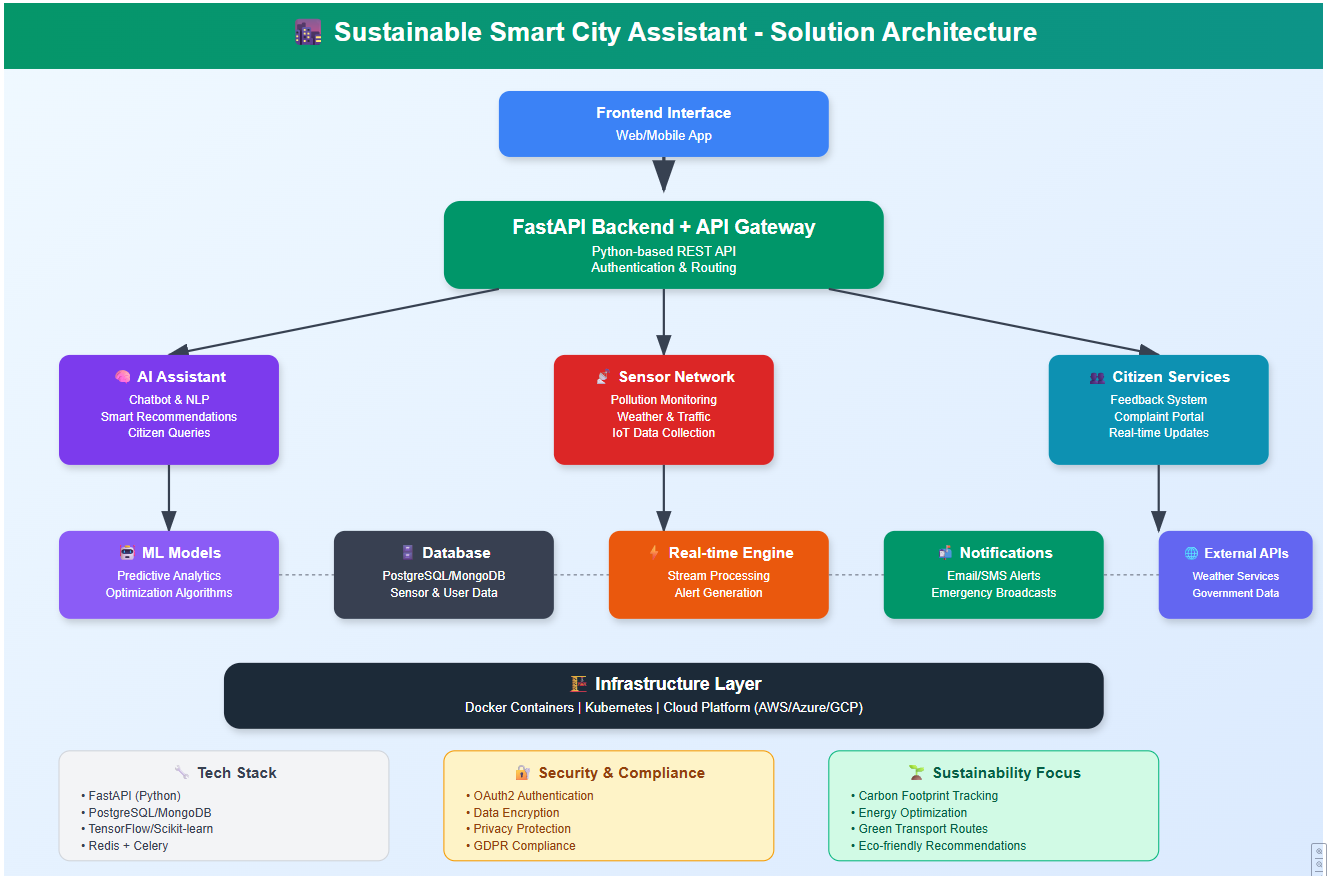
### 4.1 Problem Solution Fit

It provides a one-stop, AI-enabled interface to guide eco-conscious city development through accurate data insights.

### 4.2 Proposed Solution

* Upload city KPI data
* Forecast trends and detect anomalies
* Chatbot interaction with IBM Granite
* Generate PDF reports with sustainability recommendations

### 4.3 Solution Architecture

See the architecture diagram 

## 5. Project Planning & Scheduling

### 5.1 Project Planning

**Phase 1:** Chat assistant integration   
**Phase 2:** CSV upload   
**Phase 3:** Forecasting & anomaly logic   
**Phase 4:** Frontend UI with Streamlit   
**Phase 5:** Pinecone integration   
**Phase 6:** Voice & report modules

## 6. Functional and Performance Testing

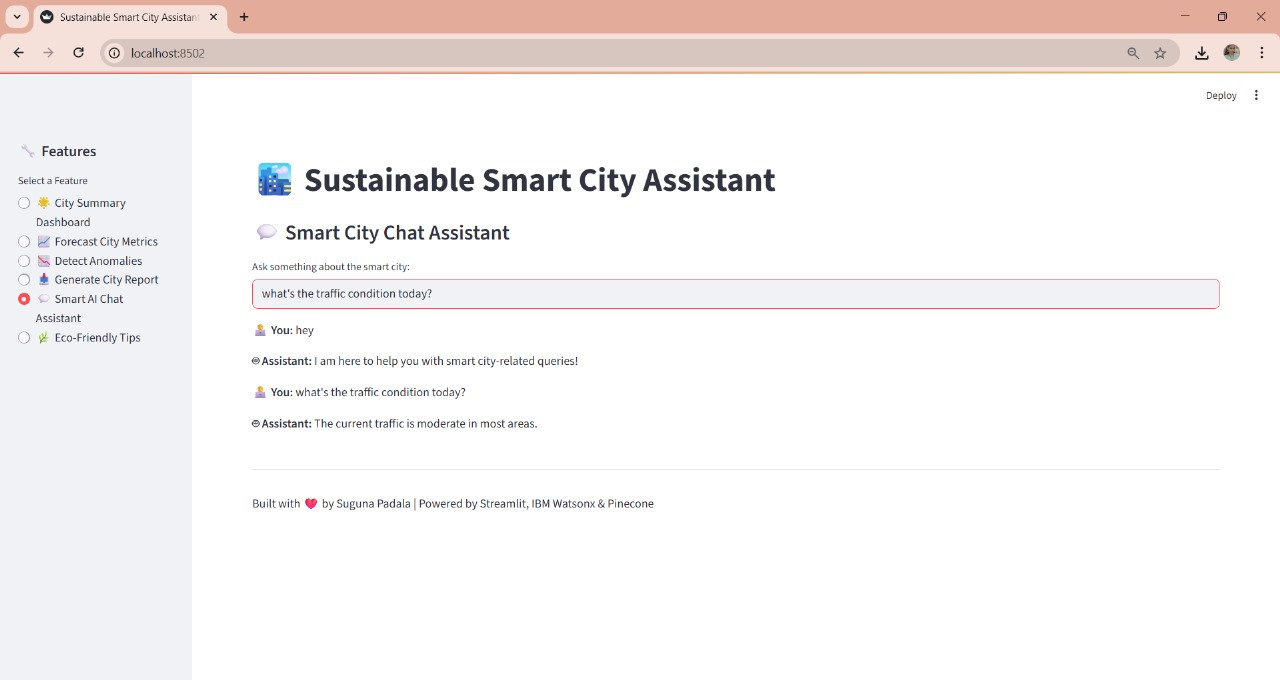
* Forecasting & anomaly detection validated with sample data
* Chatbot tested for urban queries
* File uploads and dashboards responsive  
  **Performance Benchmarks:**
* Chat API: <500ms
* Forecast: <2s
* News Summary: <3s

## 7. Results

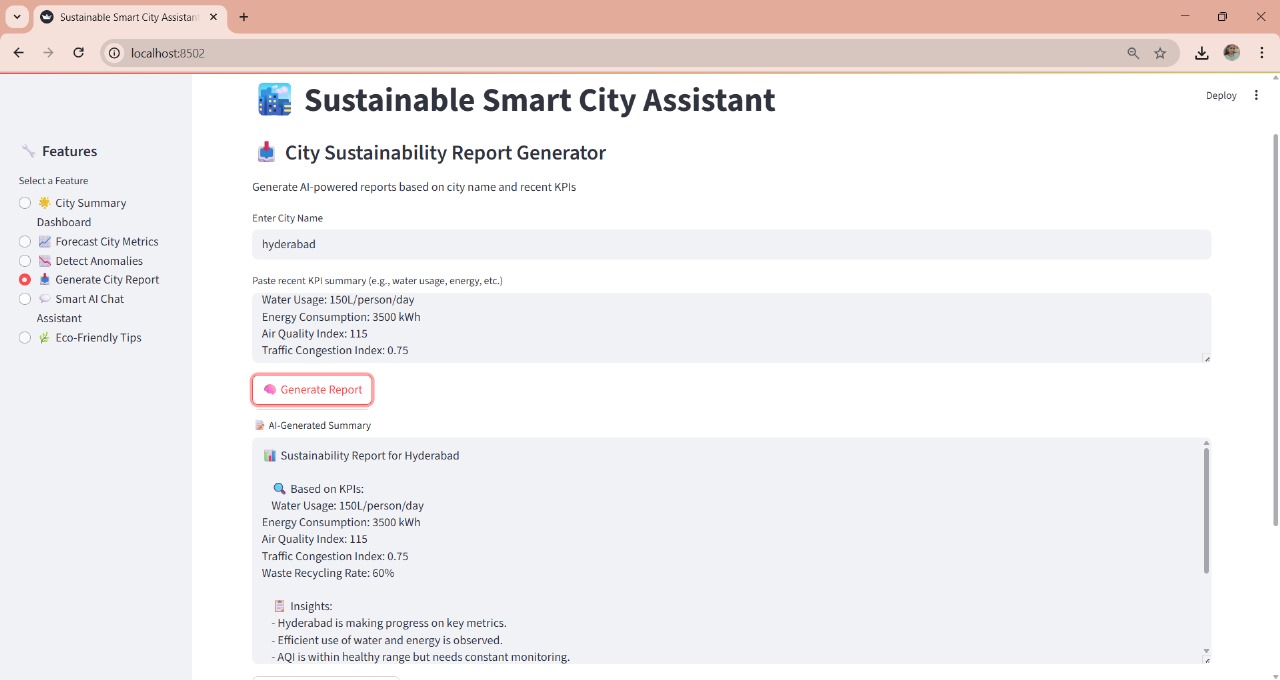
### 

### 7.1 Output Screenshots

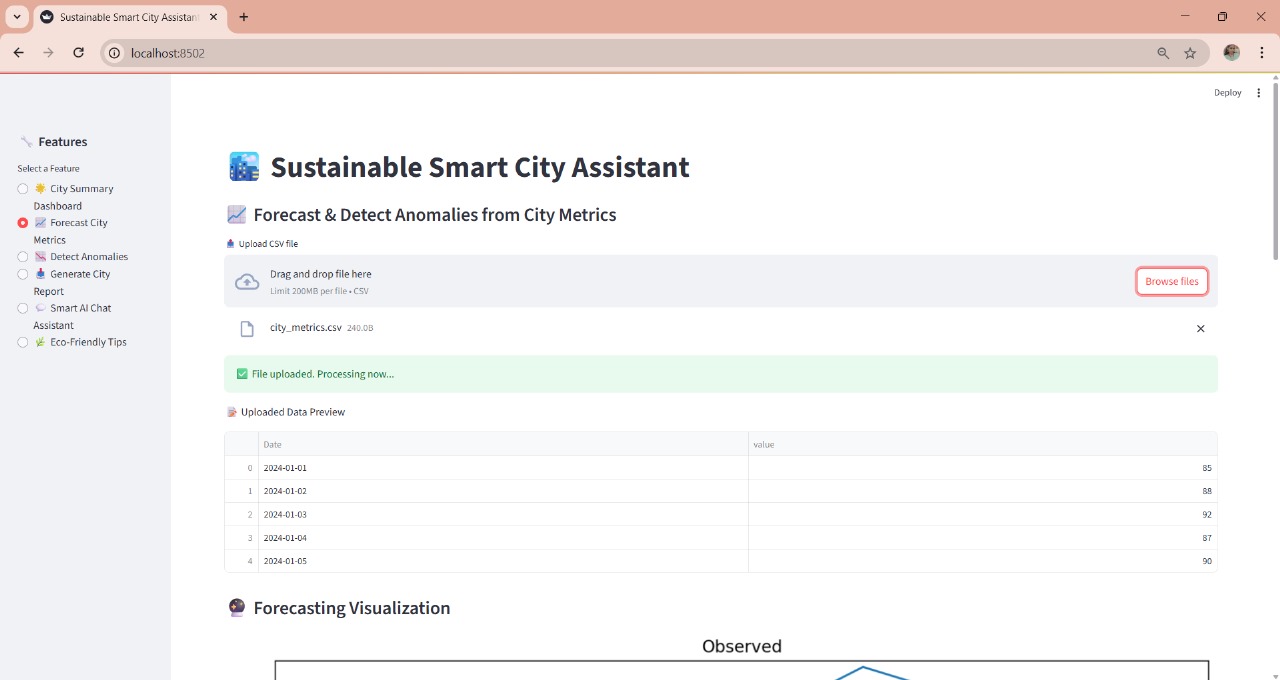
**Figure 1:** Chat Assistant



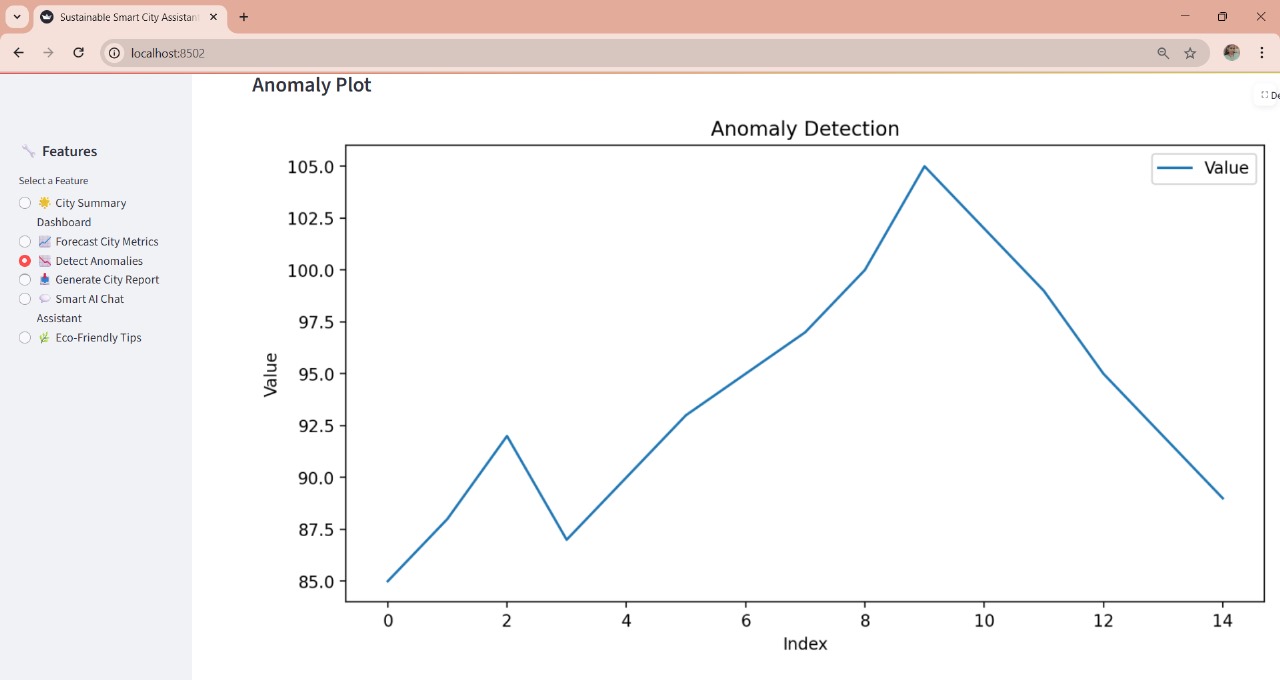
**Figure 2:** Report Generation



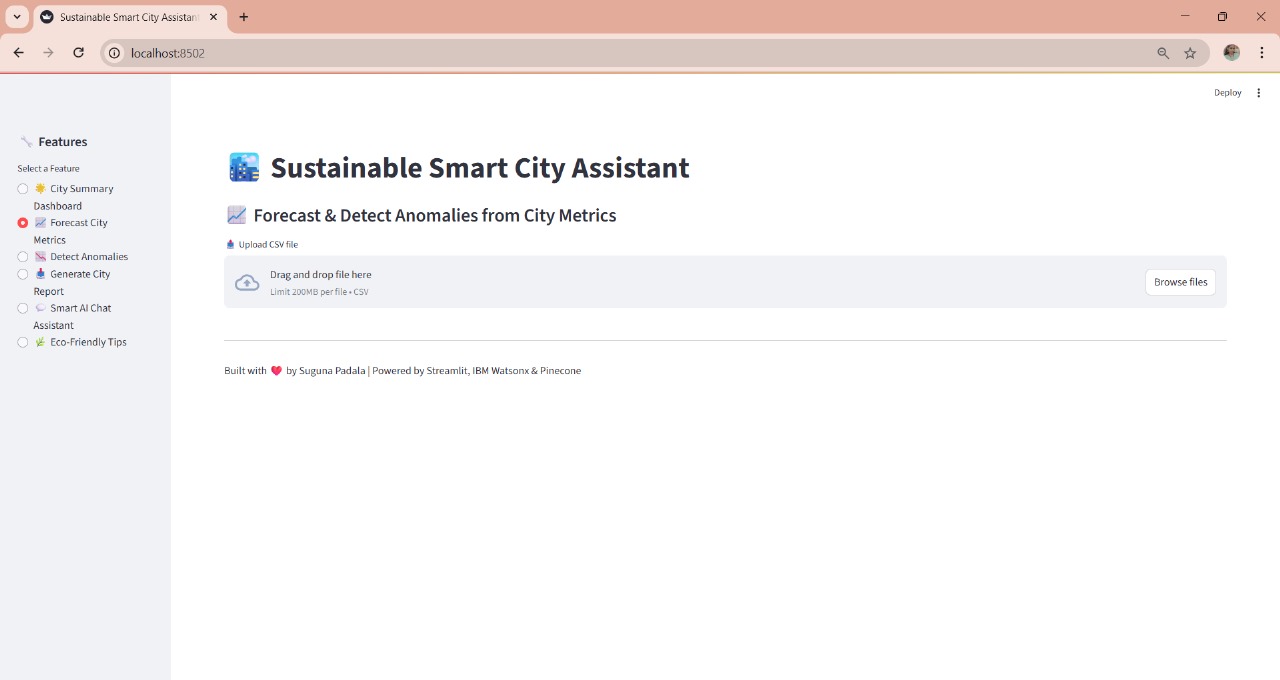
**Figure 3:** CSV Upload & Forecast



**Figure 4:** Anomaly Detection Graph

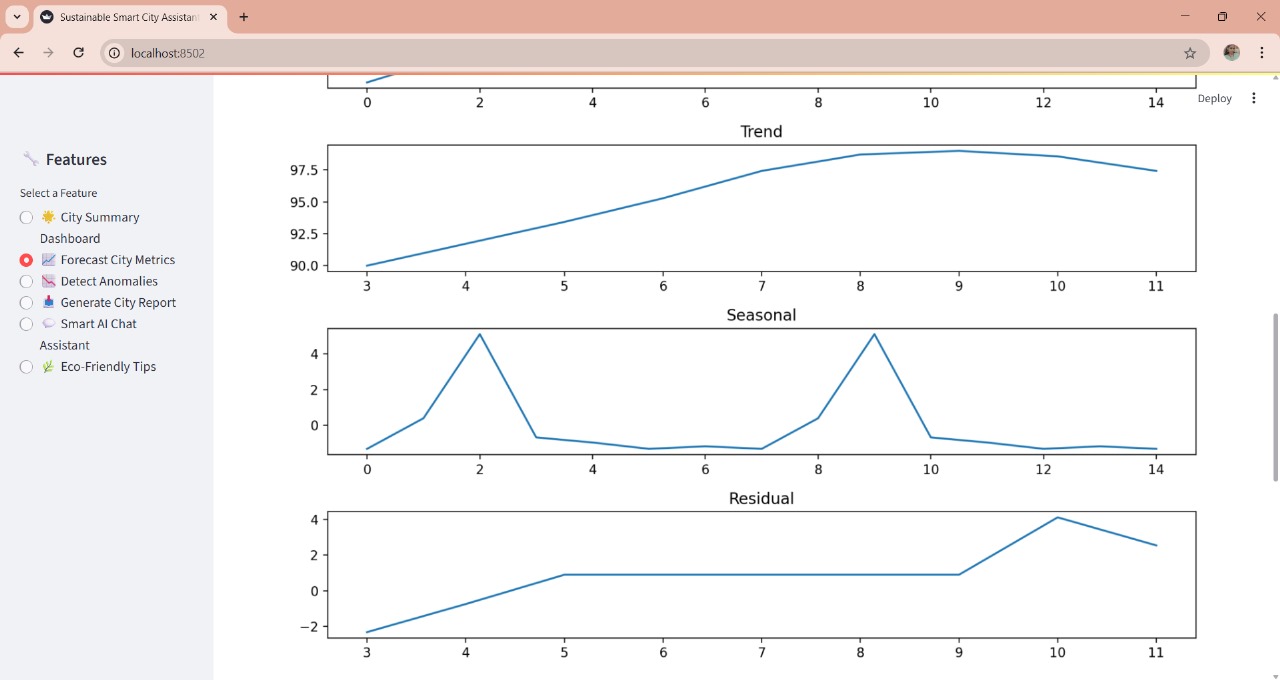


**Figure 5:** KPI Dashboard



### 

### 7.2 Sample Outputs

**Sample Forecast:**  


## 8. Advantages & Disadvantages

### 8.1 Advantages

* User-friendly Streamlit UI
* Modular FastAPI backend
* Real-time assistance with IBM LLM
* Extensible with future integrations

### 8.2 Disadvantages

* Relies on CSV, no DB by default
* No user auth or multi-role setup
* Voice/semantic features not fully implemented

## 9. Conclusion

The Smart City Assistant demonstrates a viable approach to sustainable city analytics using LLMs, forecasting models, and real-time tools. It meets current planning needs while offering a roadmap for scalable innovation.

## 

## 10. Future Scope

* Role-based authentication (OAuth2/JWT)
* DB storage (SQLite/MongoDB)
* Real-time IoT integration
* Map route planning APIs (Google/TomTom)
* Multilingual support & voice assistant
* Domain-specific AI news curation

## 11. Appendix

11.1 GitHub & Project Demo Link

[Project Demo Video URL](https://vimeo.com/1096858547?share=copy)

[My Github Repo](https://github.com/Sugunapadala/Sustainable-Smart-City-Assistant)