Full Stack Project Documentation – Sustainable Smart City Assistant AI

1. Introduction

Project Title: Sustainable Smart City Assistant AI using IBM granite LLM

Team Members:

- Sai Prashanth (Frontend + Voice Interface)

- Abhilash (AI Model & Integration)

- Devendra (Backend & Database)

- Sai Madhan (Deployment & Testing)

2. Project Overview

Purpose:
To empower citizens and smart city administrators with a conversational AI that provides personalized sustainability recommendations, real-time alerts, service access, and predictive insights.

Features:

1.**CityUpdates:**

* User enters city name → AI returns local updates (e.g., events, temperature, news)

* Prompt includes local context and formatting expectations (JSON-style)

2.**ChatAssistant:**

* Free-form input from user → General AI response

* Can answer questions like "Where's the nearest water park in this city?"

3.**EcoTips:**

* No input needed → Returns a unique eco-friendly suggestion with emoji

* Example: "Use refillable water bottles instead of plastic!

4.**KPIForecast:**

* Input: A series of numerical KPI data

* Output: Forecasted next 3 values, structured in JSON

5.**GrammarCorrection:**

* Input: Paragraph or sentence

* Output: Corrected version, returned by model

6.**LiveWeatherReport:**

* Input: City name

* Output: AI-generated weather description + temperature (e.g., "Sunny, 30°C")

7.**PolicyCreator:**

* Input: Keyword + existing policy content

* Output: AI-summarized policy draft

8.**FeedbackSubmission:**

* Input: User name + message

* Output: Stores in SQLite and confirms submission

3. Architecture

Frontend:	Streamlit (styled with custom CSS, responsive cards)
Backend:	Python (FastAPI), SQLite (for feedback storage)
AI or `Model	IBM Granite-3.3-2b.assist
Deployment:	Streamlit Cloud frontend + FastAPI via ngrok
External APIs:	None used explicitly (weather and updates generated via LLM)

4. Setup Instructions

1. Clone the Repository

```
git clone https://github.com/praSHAnTH630490/Smart-City-assistant.git
cd Smart-City-assistant/backend
```

2. Create & Activate Virtual Environment

```
python -m venv venv
venv\Scripts\activate      # On Windows
# or
source venv/bin/activate
```

 # On Linux/Mac

📦 3. Install Dependencies

pip install -r requirements.txt

🚀 4. Run FastAPI Server

uvicorn main:app --reload

Access it via:

👉 http://localhost:8000/docs (Swagger UI)

5. Folder Structure

```
├── main.py # FastAPI backend
├── requirements.txt # Backend Python dependencies
├── .env # Optional environment variables
├── .gitignore # Ignore venv, pycache, etc.
└── README.md # Backend-specific documentation
```

```
├── app.py # Main Streamlit application
├── README.md # Frontend-specific documentation
├── render.yaml # Deployment config for Render (backend)
```

6. Running the Application

Run FastAPI Server & Streamlit server

uvicorn main:app --reload

streamlit run app.py

7. API Documentation

Endpoints:

/chat	AI chat assistant via IBM Granite
/text-correction	Fixes grammar & spelling
/climate-update	Real-time weather and air quality
/place-recommendation	City travel & tourism suggestions
/smartcity-data	Urban data: crime, oxygen, traffic, etc.
/policy-generator	Draft city policies with AI

Example Request:

```json
POST /api/chatbot
{ "query": "What is the air quality near me?" }
Response: { "response": "AQI in your zone is Moderate (AQI 72)" }
```

8. Authentication

JWT token-based auth
- Login, signup endpoints
- Access roles: citizen, admin
- Middleware: verifyToken, isAdmin

9. User Interface

- Home dashboard with metrics

- Chatbot panel (text + voice input)

- Admin panel with usage and feedback stats

- city updates

-KPI forecast

-live weather

-eco tips

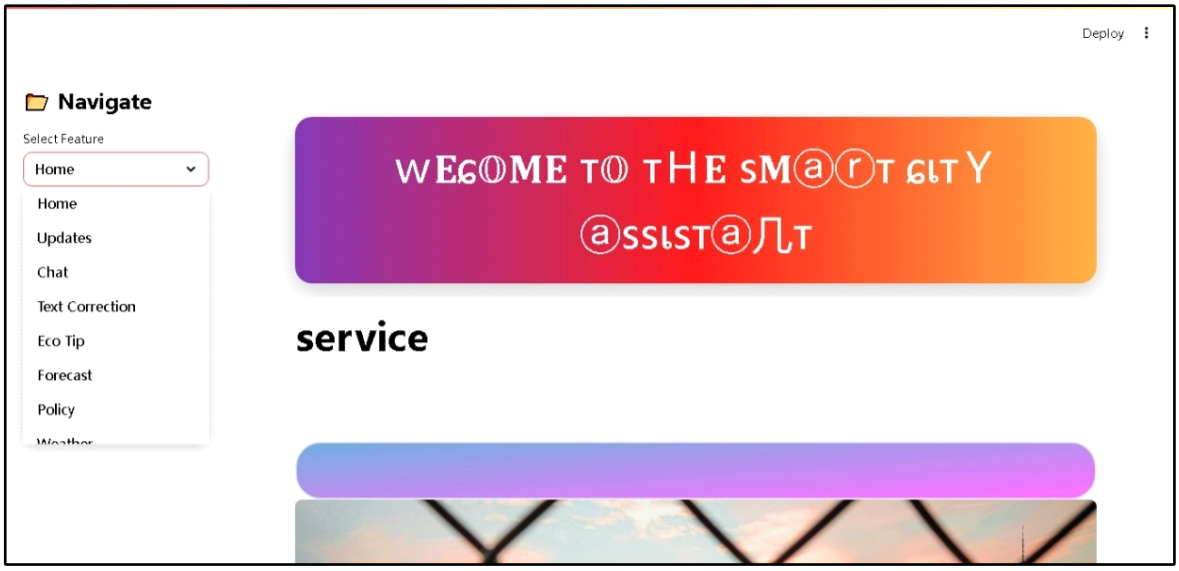
-

10. Testing

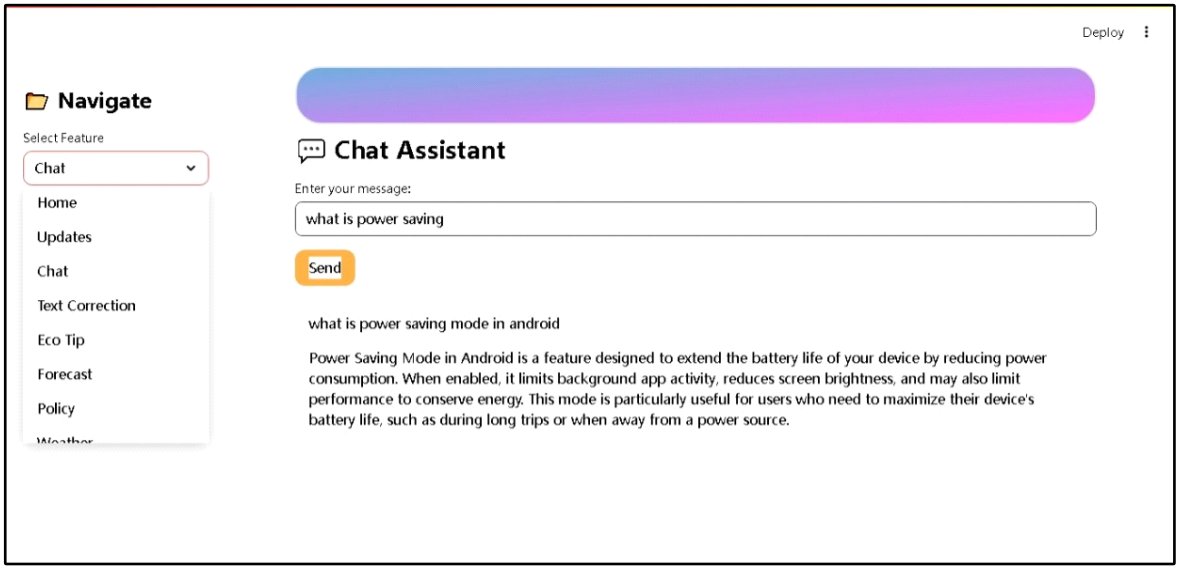
- Unit Testing: Jest (FastAPI), Rest Testing Library
- Integration: Postman for API tests
- Load Testing: Apache JMeter
- Manual UI/UX walkthroughs

11. Screenshots / Demo

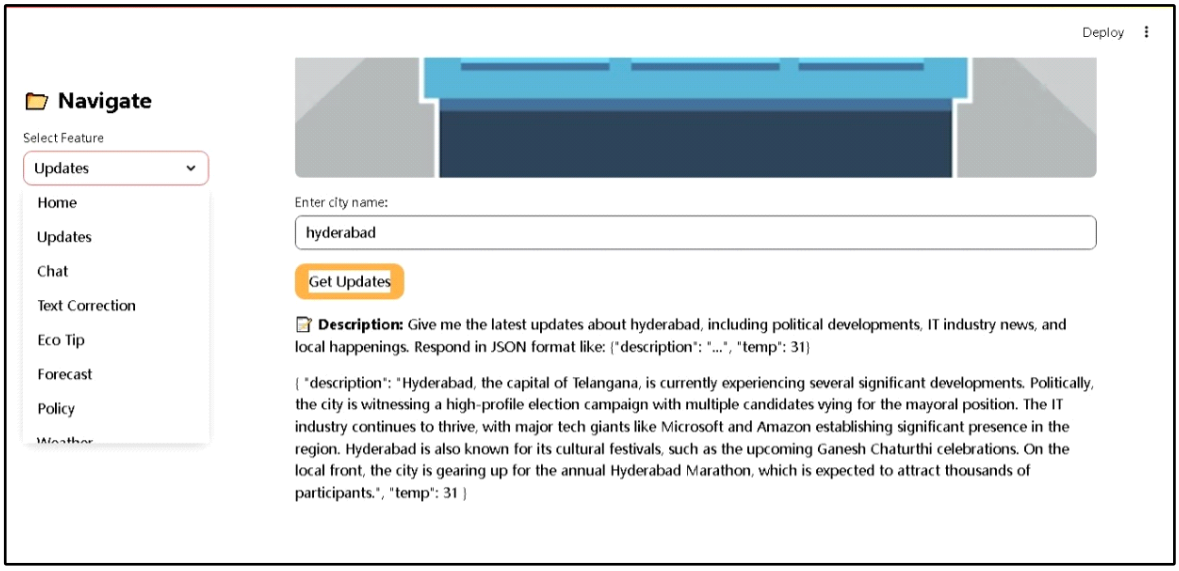
Dashboard UI



Chatbot Panel

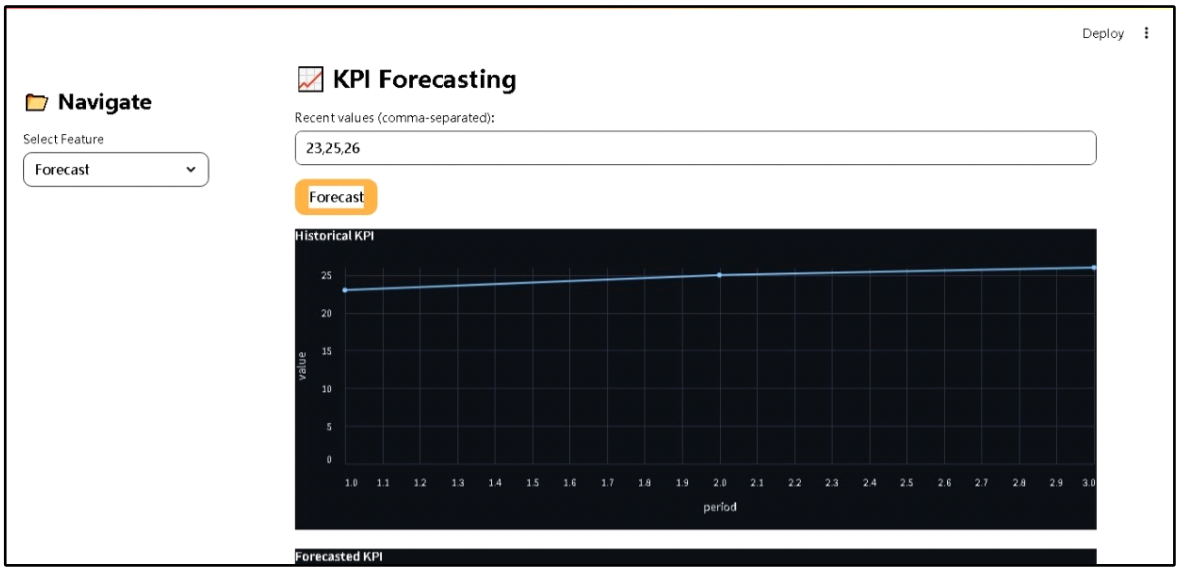


city updates

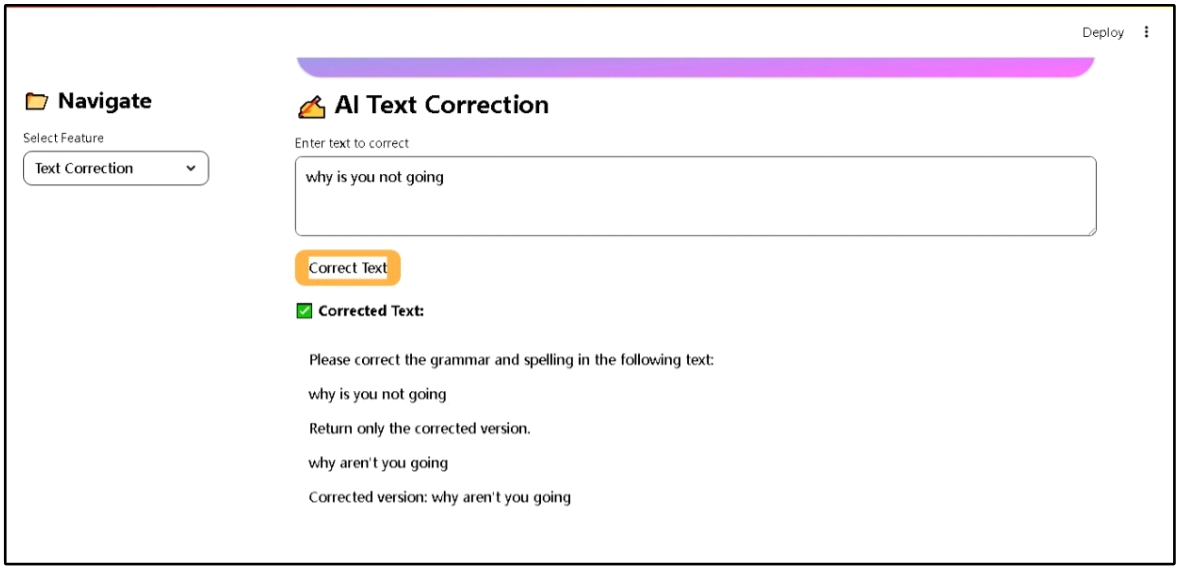


eco tips

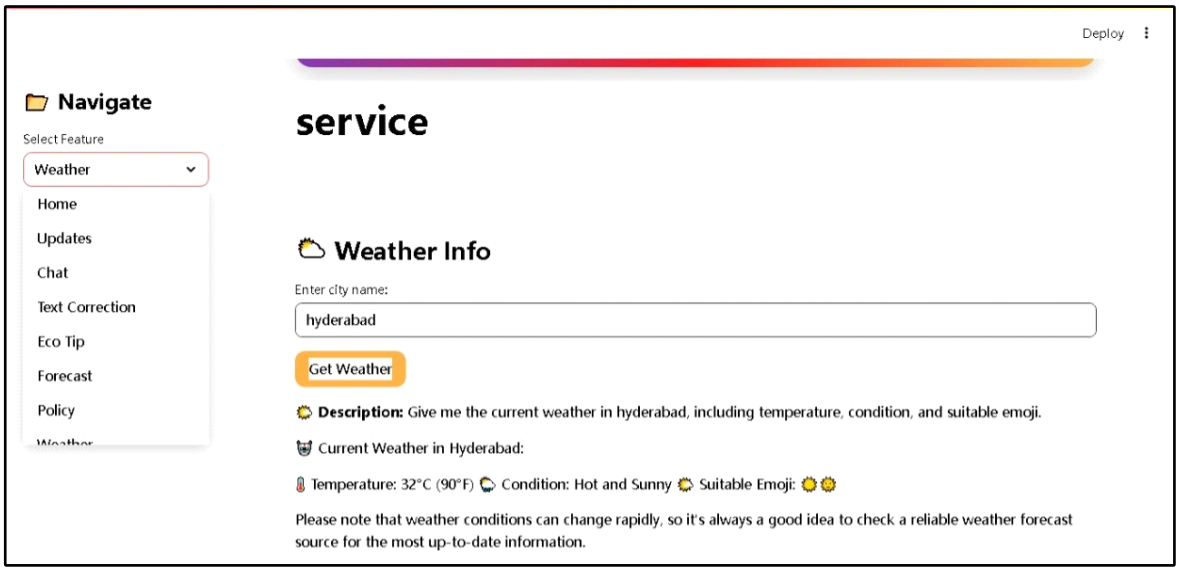
KPI forcast



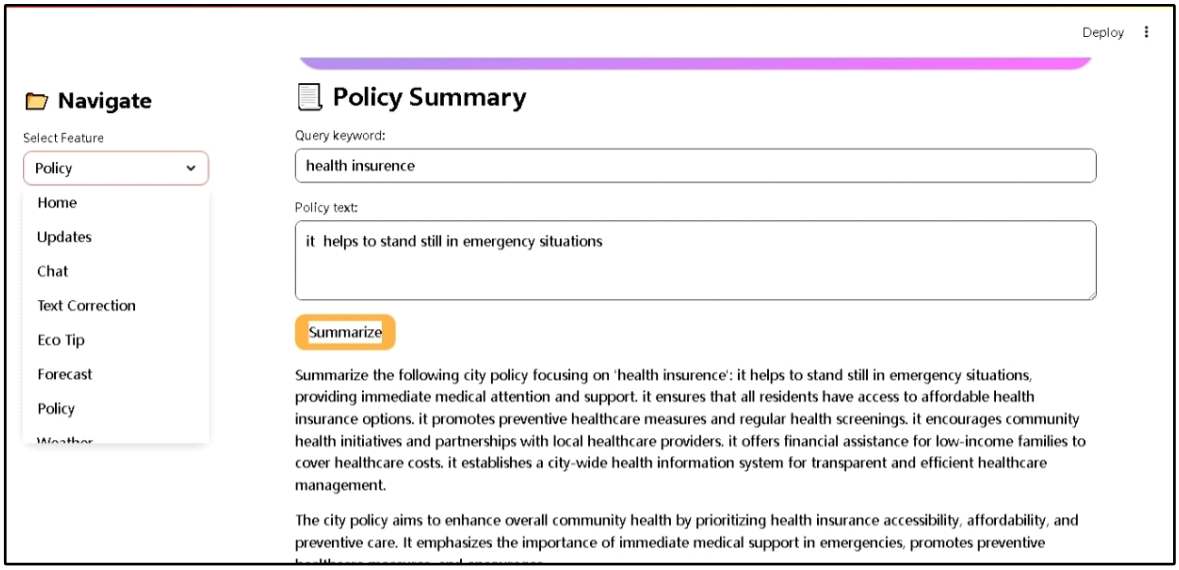
grammer correction



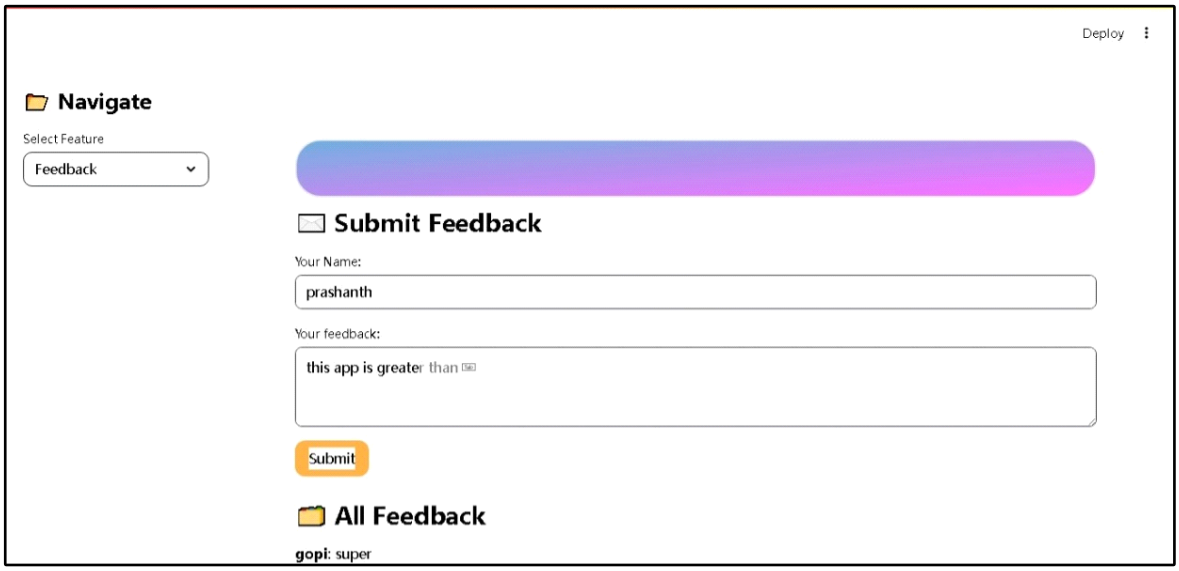
live weather



policy summery



Feedback Submission



[WebApp Link] https://smart-city-assistant-1.onrender.com
[GitHub Repo] https://github.com/praSHAnTH630490/Smart-City-assistant

12. Known Issues

- Some NLP queries misinterpret regional phrasing
- Hugging face API fails occasionally in low-bandwidth zones
- UI under testing for performance

13. Future Enhancements

- Smart Home IoT integration
- Voice alert system for seniors
- Predictive outage alerts