Sustainable Smart City Assistant Using IBM Granite LLM

🔍 \*\*1. Additional Functional Modules

Add these modules to increase scope and utility:

✅ \*\*a. Smart Waste Management

\* Predict waste levels based on city data

\* Suggest optimal pickup routes

\* Alert system for overflow zones

✅ \*\*b. Green Energy Assistant

\* Track solar panel usage

\* Recommend energy-efficient alternatives

\* Generate carbon footprint reports

✅ \*\*c. Traffic Management Insights

\* Recommend alternate traffic routes

\* Use past data to predict congestion

\* Suggest timing adjustments for traffic lights

---

🧠 \*\*2. AI Enhancements Using IBM Granite

Use LLM not just for Q\&A, but also for:

\*Text summarization\*\* (e.g., city council reports)

\*Multi-language support\*\* for local users

\*Sentiment analysis\*\* of citizen feedback

\*Conversational memory\*\* for ongoing dialogues

---

📲 \*\*3. Frontend Integration Ideas

Make the interface more powerful with:

\* 🌍 \*\*Map integration\*\* (using Leaflet.js or Google Maps)

\* 🎙️ \*\*Voice Input/Output\*\* with Web Speech API

\* 📊 \*\*Live Dashboards\*\* (plot waste, pollution, traffic metrics)

---

🛠️ \*\*4. Advanced Architecture Diagram

Include:

\* Data flow between user, app, and IBM LLM

\* Microservice breakdown

\* Real-time API sources (traffic, pollution)

---

🌐 \*\*5. Real APIs for Data (Optional)

Integrate APIs to make it semi-realistic:

\* [OpenWeather API](https://openweathermap.org/)

\* \[City Traffic APIs]\(e.g., TomTom or Google Maps)

\* Pollution Data ([https://aqicn.org/api/](https://aqicn.org/api/))

---

🧪 \*\*6. Test Cases and Results

Add unit tests using `pytest`:

```python

def test\_assist():

response = client.post("/assist", json={"query": "Reduce water usage?"})

assert response.status\_code == 200

assert "response" in response.json

```