

**Project Design Phase**  
**Solution Architecture**

Date	28 June 2025
Team ID	LTVIP2025TMID60548
Project Name	<b>Sustainable Smart City Assistant Using IBM Granite LLM</b>
Maximum Marks	4 Marks

**Solution Architecture:**

**1. Frontend Layer (User Interface)**

- Built using **Streamlit** for an intuitive dashboard experience.
- Components include:
  - smart\_dashboard.py for centralized UI
  - feedback\_form.py, eco\_tips.py, chat\_assistant.py for module-based interaction
- Features include dynamic KPI cards, toast notifications, sidebar navigation, and eco-themed design.

**2. API Layer (Backend Services)**

- Powered by **FastAPI**, serving modular endpoints such as:
  - /chat → powered by Watsonx Granite LLM
  - /feedback → logs and categorizes citizen reports
  - /summarize and /search → document summarization and semantic search via Pinecone
  - /forecast-kpi and /detect-anomaly → for KPI-based analytics

**3. AI & ML Services**

- **IBM Watsonx Granite LLM:** Handles chat, policy summarization, eco tips, and report generation.
- **ML Models** (Scikit-learn): Linear Regression for KPI forecasting; statistical techniques for anomaly detection.
- **Vector Embedding:** Sentence-transformers convert documents into vectors for semantic search via Pinecone.

**4. Data Layer**

- **Pinecone Vector Database:** Stores vectorized policy documents for similarity-based retrieval.
- **File Ingestion:** CSV/JSON/Text for KPI data and document uploads.

- **Environment Config:** Managed via .env and pydantic, protecting API credentials.

## 5. Process Flow

1. **User Input** via Streamlit: prompts, file uploads, and feedback forms.
2. **API Request** routed via FastAPI endpoints.
3. **LLM or ML Model Execution:** Watsonx generates responses; ML forecasts or detects anomalies.
4. **Storage or Retrieval:** Pinecone and file loaders fetch or store data as needed.
5. **Response Rendering:** AI-generated results displayed back in the Streamlit interface.

### Example - Solution Architecture Diagram:

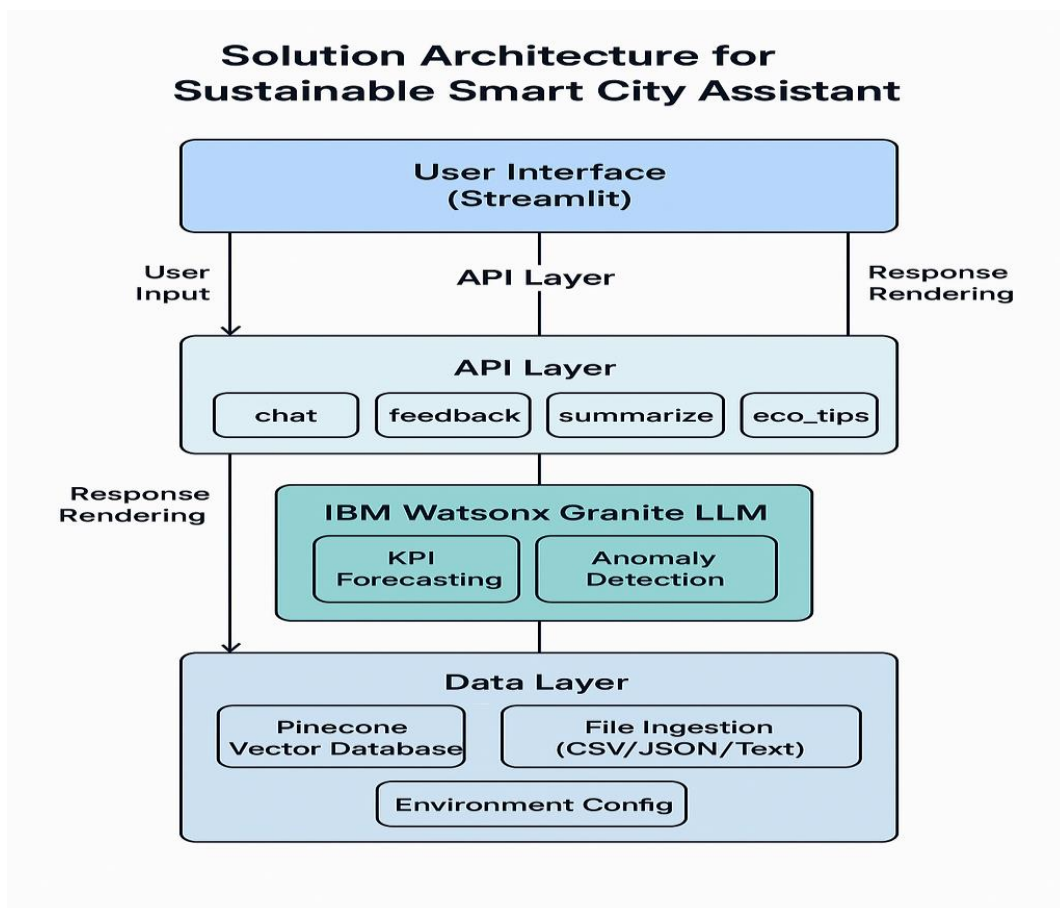


Figure 1: Architecture for Sustainable Smart City Assistant using IBM Granite LLM