Component Interaction data flow and userstories

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Team ID	LTVIP2025TMID38464
Project Name	Sustainable Smartcity Assistant Using IBM Granite LLM
Maximum Marks	

- **User Input**: Users interact through Streamlit dashboard

1. **API Gateway**: FastAPI routes requests to appropriate services
2. **AI Processing**: IBM HuggingFace processes natural language queries
3. **Vector Search**: Pinecone handles semantic document retrieval
4. **Data Analysis**: ML models process KPI data for insights
5. **Response**: Results rendered in user-friendly interface

- **User Interaction Layer**

Tool: Streamlit Dashboard

Purpose: Acts as the front-end interface where users interact with the assistant.

Function: Users input queries, upload data files (e.g., CSV, PDF), and view results like KPIs, forecasts, anomalies, and AI-generated reports.

API Gateway Layer

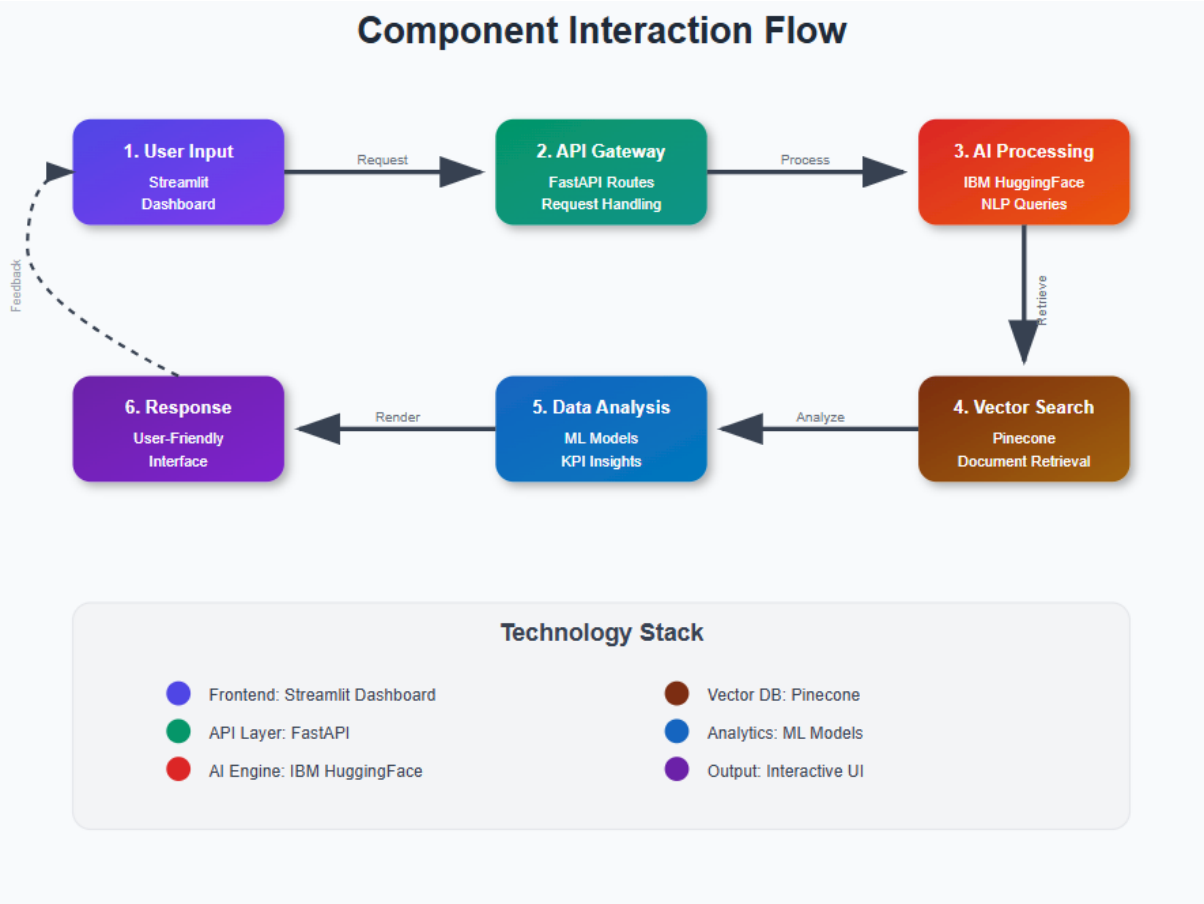
Tool: FastAPI

Purpose: Manages backend routing of all requests from frontend.

Function:

- Receives user input from Streamlit**.**

- **Directs it to relevant backend services like AI assistant, forecaster, anomaly detector, or document search.**



AI Model Layer

- **Tool:** IBM Watsonx Granite LLM (ibm/granite-3-8b-instruct via HuggingFace
- **Purpose:** Processes natural language input from users.
- **Function:**
    - Handles chat interactions.
    - Generates smart reports and explanations based on uploaded documents.

Vector Search Layer

- **Tool:** Pinecone + MiniLM Embeddings
- **Purpose:** Retrieves semantically relevant information from stored documents.
- **Function:**
    - Converts uploaded documents into vector embeddings.
    - Performs similarity search to retrieve relevant context for AI model.

Data Analysis & Prediction Layer

- **Tool:** Custom ML models (NumPy, Pandas, Scikit-learn)
- **Purpose:** Performs KPI forecasting and anomaly detection.
- **Function:**
    - Forecasts water/energy consumption using Linear Regression.
    - Detects abnormal spikes in utility data.

Response Rendering Layer

- **Tool:** Streamlit + PDF Generator (fpdf) I use
- **Purpose:** Displays output in user-friendly format.
- **Function:**
    - Renders interactive visualizations.
    - Generates downloadable PDF reports.
    - Logs user feedback and eco tips.
