

Solution Architecture – Sustainable Smart City Assistant Using IBM Granite LLM

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Project Name: Sustainable Smart City Assistant Using IBM Granite LLM

Solution Architecture:

The solution architecture defines the technical structure and flow that powers the Sustainable Smart City Assistant. It showcases how AI services, user inputs, and backend logic work in unison to address urban governance, sustainability, and citizen interaction through intelligent automation.

Its goals are to:

- Design an AI-first platform to simplify city-level decision-making and public communication.
- Define core modules for civic functionality like summarization, forecasting, and feedback.
- Bridge gaps between citizens, city officials, and data using a conversational, intuitive interface.
- Ensure a scalable, modular, and secure design ready for cloud deployment. .

Sustainable Smart City Architecture Overview

Smart City follows a modular architecture using Streamlit as the frontend, integrating IBM Watsonx as the backend AI engine to handle prompt-based classification, generation, and summarization.

Key components include:

- **Frontend:**
Built with Streamlit — includes sidebar navigation, text input/output boxes, file uploader (PDF/CSV), dynamic response panels, and chatbot interface.
- **AI Engine:**
IBM Watsonx Granite LLM (e.g., granite-3b or granite-13b) used for text summarization, chat responses, eco-tip generation, and anomaly analysis.

- **Document Parsing:**
PyMuPDF (fitz) is used for extracting content from uploaded city policy PDFs.
- **KPI Processing:**
pandas for CSV handling; Scikit-learn (Linear Regression) for forecasting and anomaly identification.
- **State Management:**
Streamlit session_state to maintain user data across modules and preserve chat history.
- **Optional Expansion:**
Pinecone for semantic document search (future scope)
LangChain for chat memory and retrieval-augmented generation (RAG)
- **Development Phases**
 - Phase 1: Set up project structure, credentials (.env), and integrate Watsonx LLM API
 - Phase 2: Build Policy Summarizer, Feedback Form, KPI Forecasting module
 - Phase 3: Add Anomaly Detection, Eco Tips Generator, and Chat Assistant
 - Phase 4: Enhance UI/UX — loader animations, theme styling, iconography
 - Phase 5: Testing, bug fixes, and local deployment with future readiness for IBM Cloud/Streamlit Cloud hosting