**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:**

Solution architecture defines the structural blueprint that bridges the gap between complex urban sustainability challenges and intelligent technology solutions. Its key objectives are to:

* Identify the best technology stack to address sustainability, governance, and citizen engagement challenges
* Describe the structure, behavior, and key components of the system to project stakeholders
* Define core features, development phases, and technical requirements
* Provide specifications that guide the design, development, management, and delivery of the AI-powered assistant

**Sustainable Smart City Assistant Architecture Overview:**

The proposed Sustainable Smart City Assistant follows a modular, scalable architecture designed to support real-time data processing, citizen interaction, and AI-driven decision support for city administrators. It enables efficient information access, resource forecasting, anomaly detection, and citizen engagement using cutting-edge AI technologies.

**Key Components:**

* **Front-end:** Streamlit-based interactive dashboard for policy search, KPI viewing, eco-tip generation, feedback submission, and AI chat interaction
* **Backend:** FastAPI-powered server handling business logic, API routing, and integration with AI services
* **AI Service Layer:** IBM Watsonx Granite LLM (Granite-13b-instruct-v2) for document summarization, eco-tips, chat responses, and sustainability report generation
* **Document Processor:** PyMuPDF (fitz) for extracting and processing text from uploaded policy documents and reports
* **Vector Search Layer:** Pinecone Vector Database for semantic search and efficient retrieval of policy document content
* **Data Storage:** Streamlit session state for temporary user interactions; optional local file storage for static data
* **Security Layer:** .env configuration and secure API key handling for Watsonx and Pinecone services

**Development Phases:**

* **Phase 1:** Streamlit user interface setup with modular navigation for different assistant features
* **Phase 2:** Integration of policy summarization, eco-tip generation, and citizen feedback form
* **Phase 3:** Implementation of KPI forecasting, anomaly detection, and vector search for policy documents
* **Phase 4:** Development of AI-powered chat assistant for real-time citizen and administrator queries
* **Phase 5:** Performance optimization, multi-user support, and deployment on IBM Cloud or local infrastructure

This architecture ensures flexibility, modularity, and real-time interaction, empowering city administrators and citizens with AI-driven insights to promote sustainable, efficient, and citizen-friendly urban governance.