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

| | |
|---|---|
| Date | 28 June 2025 |
| Team ID | LTVIP2025TMID35907 |
| Project Name | Sustainable Smart City Assistant using IBM Granite LLM |
| Maximum Marks | 4 Marks |

## Solution Architecture:

The solution architecture for the Sustainable Smart City Assistant using IBM Granite LLM includes a user-friendly interface (Streamlit/Gradio), a FastAPI backend connected to Granite for chat and summarization, real-time IoT data integration, a vector database for semantic search, and secure cloud deployment with monitoring tools. It's modular, scalable, and designed for responsive, AI-driven urban services.

1. User Interface Layer
    - Built with **Streamlit** or **Gradio** for web/mobile access
    - Supports multilingual chat, dashboards, and feedback forms
2. Application Layer
    - **FastAPI** handles routing, authentication, and API orchestration
    - Connects to IBM Granite LLM for chat, summarization, and eco-tip generation
    - Integrates forecasting and anomaly detection modules (e.g., LSTM, Isolation Forest)
3. AI & NLP Layer
    - **IBM Granite LLM** for natural language understanding and generation
    - **Prompt templates** for summarization, eco-advice, and citizen query handling
    - **Vector database** (Pinecone or FAISS) for semantic search and memory
4. Data Layer
    - **IoT data ingestion** from sensors (pollution, traffic, energy) via APIs
    - **Cloud storage** (AWS S3, GCP) for structured/unstructured data
    - **Relational DB** (PostgreSQL) for user and feedback data
5. Security & Governance Layer
    - TLS encryption, RBAC, audit logging
    - Compliance with GDPR and India's Data Protection Bill
6. Deployment Layer
    - Containerized with **Docker**, orchestrated via **Kubernetes**
    - Hosted on **cloud platforms** (AWS, Azure, or GCP)
    - Monitored using **Prometheus** and **Grafana**

**Solution Architecture Diagram:**