Project Design Phase
Solution Architecture

Date	15 February 2025
Team ID	LTVIP2025TMID31710
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 is designed to effectively bridge the gap between urban sustainability challenges and AI-driven technological solutions. It ensures scalability, interoperability, security, and real-time intelligence while leveraging the power of IBM Granite LLM.

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1. Objective: Finding the Best Tech Solution for the Problem

The architecture leverages IBM Granite LLM, a state-of-the-art large language model, integrated with smart city data systems to provide intelligent conversational support. It is designed to operate across multiple channels (web, mobile, kiosks) and provide tailored, actionable insights based on real-time data from urban systems such as:

- Traffic and transport APIs
- Energy grid sensors
- Waste management platforms
- Citizen service portals
- Environmental monitoring systems (e.g., air/water quality)

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2. Structure and Key Components

The system is organized into the following high-level components:

- User Interface Layer:
  Accessible via mobile app, chatbot, web portal, and public kiosks with multilingual support.
- AI/LLM Engine:
  IBM Granite LLM acts as the natural language processor, responsible for understanding queries and generating intelligent responses.
- Integration Layer (API Gateway):
  Bridges LLM with city services, IoT platforms, and third-party databases.

- Data Aggregation Layer:
  Collects, preprocesses, and stores data from various sensors and city departments (e.g., traffic, utilities, emergency services).
- Analytics & Insights Engine:
  Provides real-time dashboards and predictive analytics using historical and live data.
- Security & Governance Layer:
  Ensures data privacy, role-based access control, audit logging, and compliance with local data protection regulations.

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3. Development Phases & Features

Phase 1: MVP Development

- Basic chatbot functionality using IBM Granite LLM
- Integration with select city services (e.g., public transport schedules, waste pickup)

Phase 2: Full-Scale Rollout

- Add advanced AI capabilities: sustainability recommendations, congestion prediction
- Expand multi-language and voice support
- Mobile and kiosk deployment

Phase 3: Predictive and Prescriptive Intelligence

- Implement energy optimization recommendations
- Emergency alerts and resource planning based on forecast models
- Citizen feedback loop integration

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4. Specifications and Delivery

- Cloud-native deployment on IBM Cloud for scalability and flexibility
- Containerized services using Kubernetes for modular rollout
- Open standards-based APIs to ensure seamless integration with diverse city systems
- CI/CD pipelines for frequent, secure updates
- Performance monitoring dashboards for operational visibility

Solution Architecture Diagram:

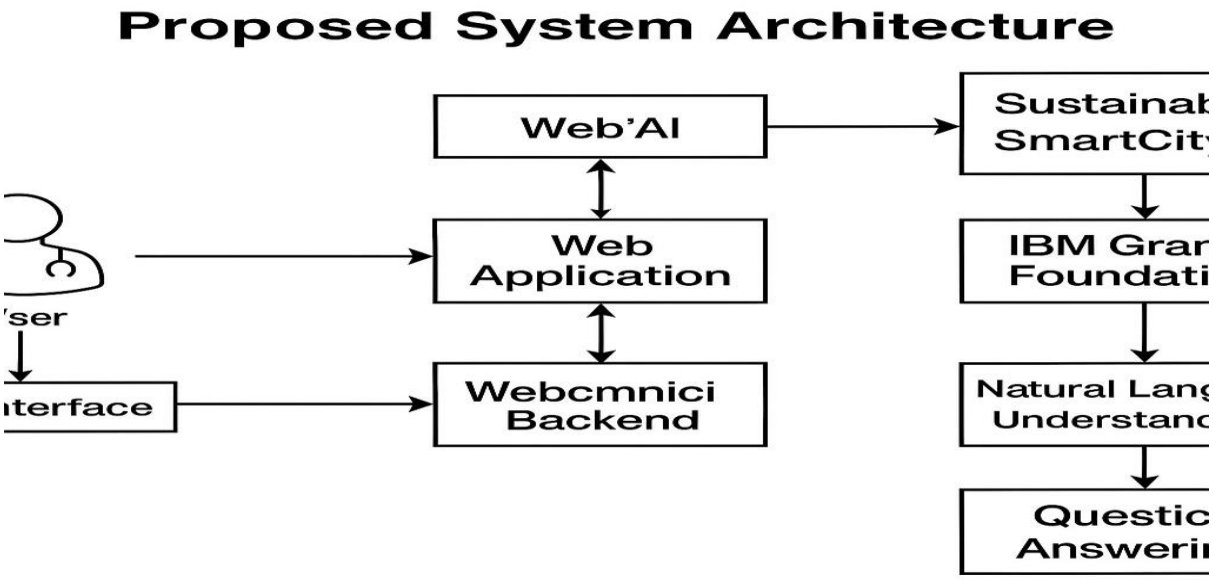

Figure 1: Architecture and data flow of the sustainable smart city assistant