**Project Design Phase-II**

**Technology Stack (Architecture & Stack)**

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| Date | 26 june 3035 |
| Team ID | LTVIP2025TMID32104 |
| Project Name | sustainable smart city assistant using ibm granite llm |
| Maximum Marks | 4 Marks |

**Table-1: Components & Technologies**

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| S.No | Component | Description | Technology |
| 1 | User Interface | Web-based user dashboard with forms, search, and chat | Streamlit |
| 2 | Application Logic-1 | Feedback handling, chat, policy summarization, eco tips | Python + FastAPI |
| 3 | Application Logic-2 | AI summarization, chat response, report generation | IBM Watsonx Granite LLM |
| 4 | Application Logic-3 | Semantic document search (vector-based) | Pinecone Vector Database |
| 5 | Database | Storing feedback, responses, KPI data | JSON / Local CSV storage |
| 6 | Cloud Database | (Optional) cloud-based vector storage | Pinecone Cloud Service |
| 7 | File Storage | Upload and store CSV, TXT files locally | Local Filesystem |
| 8 | External API-1 | Embedding text for vector similarity search | Sentence Transformers (MiniLM) |
| 9 | External API-2 | Optional external policy sources or city data (future) | Open Government APIs (future expansion) |
| 10 | Machine Learning Model | KPI forecasting and anomaly detection | Scikit-learn (Linear Regression), StatsModel |
| 11 | Infrastructure | Backend + Frontend hosted on local or cloud | FastAPI (Backend), Streamlit (Frontend), IBM Cloud / Local |

**Table-2: Application Characteristics**

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| --- | --- | --- | --- |
| S.No | Characteristics | Description | Technology |
| 1 | Open-Source Frameworks | Used for development, visualization, and data processing | FastAPI, Streamlit, Scikit-learn, Pandas |
| 2 | Security Implementations | Environment variable protection, API key handling | .env, python-dotenv |
| 3 | Scalable Architecture | Modular folder structure, separate API routes and services | Microservices-style modular Python code |
| 4 | Availability | Real-time interaction via Streamlit + FastAPI, option for cloud hosting | Pinecone Cloud, IBM Watsonx, Localhost |
| 5 | Performance | Fast response through modular routing, caching options | FastAPI, lightweight models, stateless UI |