**Requirement Analysis Phase**

**Data Flow Diagram**

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| --- | --- |
| Date | 28 June 2026 |
| Team ID | LTVIP2025TMID36180 |
| Project Name | Personalised learning with generative AI and Lms Integration |
| Maximum Marks | 4 Marks |

**Data Flow Diagrams:**

🔁 **Key Entities:**

**1. Citizen (External Entity)**

* **Role**: The primary users interacting with the platform for education and personalized learning.
* **Attributes**:
  + **Citizen ID** (unique identifier)
  + **Name**
  + **Email**
  + **Courses Enrolled**
  + **Quiz Results**
  + **Performance History**
* **Interactions**:
  + Logs in to the platform (via **Streamlit Frontend**)
  + Takes quizzes and diagnostic tests
  + Receives personalized feedback and recommendations
  + Provides data used for **ML Models** (for progress prediction, learning style, etc.)

**2. City Administrator (External Entity)**

* **Role**: The administrator who manages the platform for multiple citizens, ensuring smooth functioning.
* **Attributes**:
  + **Admin ID** (unique identifier)
  + **Admin Name**
  + **Assigned Regions** (areas under their management)
  + **Administered Policies** (set of policies impacting citizens)
* **Interactions**:
  + Logs in to the system (via **Streamlit Frontend**)
  + Reviews **Citizen Data** and performance reports
  + Monitors and adjusts **City-wide Learning Policies** and KPIs

**3. Streamlit Frontend**

* **Role**: The user-facing interface for both citizens and administrators.
* **Attributes**:
  + **UI Components** (dashboards, forms, feedback)
  + **User Authentication** (OAuth for login)
  + **Course Catalog** (available courses for citizens)
  + **Real-Time Feedback** (displays personalized feedback from **ML Models** and **Granite LLM**)
* **Interactions**:
  + Sends requests to **FastAPI Backend** for user data and analytics
  + Displays dynamic quizzes and performance metrics
  + Presents personalized learning paths based on **Granite LLM** insights

**4. FastAPI Backend**

* **Role**: The backend service that handles logic, data processing, and routing between frontend and other system components.
* **Attributes**:
  + **API Endpoints** (for data retrieval, quiz generation, etc.)
  + **User Session Management** (session storage for active users)
  + **Data Processing Logic** (handles user data, feedback generation, etc.)
  + **External Integrations** (connects to **Granite LLM**, **Pinecone**, **ML Models**)
* **Interactions**:
  + Handles requests from **Streamlit Frontend**
  + Queries **Granite LLM** for dynamic quiz generation and feedback
  + Retrieves **Citizen Data** from **Database** for performance tracking
  + Calls **ML Models** for forecasting and anomaly detection
  + Stores interaction results in the **Database**

**5. IBM Granite LLM**

* **Role**: The AI language model used for dynamic content generation, quiz creation, and personalized feedback.
* **Attributes**:
  + **Model ID** (unique identifier)
  + **Learning Style Prediction** (analysis of how citizens learn best)
  + **Topic-Specific Quiz Generation** (AI-generated quizzes on specific topics)
  + **Adaptive Difficulty Adjustment** (adjusts quiz difficulty based on student performance)
* **Interactions**:
  + Receives data from **FastAPI Backend** (e.g., citizen performance, quiz results)
  + Generates quizzes and personalized feedback
  + Sends feedback/results to **Streamlit Frontend** for display

**6. Pinecone Vector Store**

* **Role**: The vector database used for storing and searching embeddings to enable personalized learning paths and content recommendations.
* **Attributes**:
  + **Embedding Vectors** (semantic representations of content, quizzes, and citizens' learning profiles)
  + **Query Data** (search queries from **Streamlit Frontend** for personalized recommendations)
* **Interactions**:
  + Stores **Citizen Learning Embeddings** (from **ML Models**)
  + Receives queries from **FastAPI Backend** for personalized content recommendations
  + Returns relevant results based on similarity search (e.g., suggest content based on learning history)

**7. ML Models (Forecasting, Anomaly Detection)**

* **Role**: A suite of machine learning models used for predicting student performance and detecting anomalies (e.g., potential drop-offs or learning gaps).
* **Attributes**:
  + **Model Type** (forecasting, anomaly detection, clustering, etc.)
  + **Prediction Metrics** (e.g., likelihood of improvement, score predictions)
  + **Anomaly Flags** (alerts on underperforming citizens or trends)
* **Interactions**:
  + Receives **Citizen Data** from **FastAPI Backend**
  + Makes predictions and anomaly flags for performance issues
  + Sends results back to **FastAPI Backend** for integration into user reports
  + Provides data for **Pinecone Vector Store** for personalized recommendations

**8. Database (Feedback, KPI, Policy Docs)**

* **Role**: The central data store for various types of data, including user profiles, feedback, KPIs, and policy documents.
* **Attributes**:
  + **User Data** (citizens' profiles, courses, quiz scores)
  + **Feedback Records** (historical feedback data for citizens)
  + **KPI Metrics** (city-wide learning outcomes, progress tracking)
  + **Policy Documents** (documents governing learning policies, citizen engagement)
* **Interactions**:
  + Stores **Citizen Data** for historical tracking and analysis
  + Stores **Feedback** and **Performance Data** for educators and citizens
  + Serves **KPI Metrics** to **City Administrator** and other stakeholders
  + Provides **Policy Docs** to **City Administrator** for monitoring



