LLM Health Assistant

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Abstract

The LLM Health Assistant is a health consultation platform based on a large language model (LLM), leveraging generative AI and retrieval-augmented generation (RAG) technologies to provide users with personalized and intelligent health Q&A services. The system integrates multiple functional modules, including text interaction, voice interaction, PubMed paper retrieval, user information management, and conversation storage.

1 Technology Overview

This project prioritizes technologies that offer high response speed, stability, and costeffectiveness.

1.1 Backend Framework

The backend uses **FastAPI** with an **SQLite** database for user management and **Pinecone** for conversation storage. FastAPI ensures efficient asynchronous processing, strong type safety, and seamless **JWT-based authentication** via **RESTful APIs**.

1.2 Frontend Technology

The frontend is built with HTML, CSS, and JavaScript, integrating Fetch API for asynchronous data exchange. This approach enhances customization, UI flexibility, and user experience.

1.3 Large Language Model (LLM)

The system employs **GLM-4-Plus** for text-based processing and **GLM-4-Voice** for real-

time speech interaction. These models ensure high accuracy, long-context understanding, and adaptable responses.

1.4 Database Selection

SQLite stores user data, while Pinecone enables efficient semantic search for personalized responses. Data access is managed securely via FastAPI.

1.5 Security Authentication

The system implements **OAuth2.0** + **JWT** for user authentication and **bcrypt** encryption for password protection. Tokens have expiration control to mitigate security risks.

1.6 External Data Augmentation (PubMed API)

The **PubMed API** retrieves up-to-date medical literature, enhancing response accuracy with real-world scientific data.

2 System Architecture

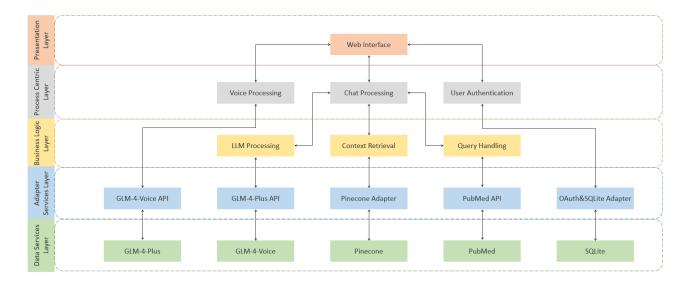


Figure 1: System Architecture

This system adopts a Layered Architecture design, which consists of five layers: Presentation Layer, Process Centric Layer, Business Logic Layer, Adapter Services Layer, and Data Services Layer. This architecture ensures modular decoupling, scalability, and efficiency.

2.1 Presentation Layer

Web Interface (User Interface):

- Serves as the interaction interface for users, supporting text input and voice interaction.
- Sends user requests to **Chat Processing** and **Voice Processing** and receives the final processed results.

2.2 Process Centric Layer

Voice Processing:

- Processes voice input and calls the GLM-4-Voice API for speech recognition and synthesis.
- Voice data is not stored and is only used for real-time interaction.

Chat Processing (Text Chat Processing):

- Handles user text input and interacts with the Business Logic Layer to obtain responses.
- Manages the conversation flow and works with Context Retrieval to provide more intelligent replies.

User Authentication:

• Ensures user authentication and API access security.

2.3 Business Logic Layer

LLM Processing:

• Calls the **GLM-4-Plus API** to generate appropriate text responses based on user input.

Context Retrieval:

- Queries user chat history to provide context-aware intelligent responses.
- Connects to the Pinecone Adapter for vectorized storage and retrieval of historical conversation data.

Query Handling:

• Parses user queries and calls the **PubMed API** for medical literature retrieval based on query type.

2.4 Adapter Services Layer

GLM-4-Voice API:

- Processes voice input and returns both text and speech output.
- Connects to **GLM-4-Voice** to ensure high-quality voice synthesis.

GLM-4-Plus API:

 Handles AI-powered text conversations by calling GLM-4-Plus for natural language understanding and response generation.

Pinecone Adapter (Vector Database Adapter):

• Connects to the **Pinecone** vector database for storing and retrieving user conversation history.

PubMed API:

• Retrieves medical literature and provides professional health consultation based on the **PubMed** database.

OAuth & SQLite Adapter (Authentication and Database Adapter):

• Manages user authentication using

OAuth.

• Interacts with the **SQLite** database to store and manage user information.

2.5 Data Services Layer

GLM-4-Voice:

 A cloud-based large model providing speech recognition and synthesis capabilities.

GLM-4-Plus:

• Mainly used for text processing, supporting intelligent Q&A and conversation generation.

Pinecone:

• Stores user chat history and provides efficient context retrieval functions.

PubMed:

 A medical literature database that provides health information based on the latest research.

SQLite:

• Stores user basic information and authentication data.

3 APIs Used

The LLM Health Assistant integrates several APIs to provide intelligent health consultations and voice interaction services. Below are the external APIs used in the system:

• GLM-4-Plus API: Processes user health queries and generates intelligent responses.

- **GLM-4-Voice API**: Supports voicebased interaction by converting speech to text and generating spoken responses.
- Pinecone: Stores and retrieves past conversation history for context-aware interactions.
- **PubMed API**: Retrieves up-to-date medical literature for evidence-based responses.