Smart Medical Video AI Assistant

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Project Goal:
To develop an intelligent assistant that can analyze YouTube videos (mainly medical content), transcribe their audio, store the extracted text in a vector database, and answer user questions related to the video through an interactive interface using OpenAI models.

Main Components of the Project:

1. Library Installation

Purpose: Install all required dependencies:

- yt-dlp for downloading YouTube videos.
- openai-whisper for speech-to-text.
- youtube-transcript-api for subtitles.
- langchain, chromadb, sentence-transformers for vector storage and retrieval.
- gradio for building the UI.
- langsmith for debugging and tracing.

2. Environment Setup & Library Imports

Purpose: Import necessary Python libraries such as:

- os, tempfile, pydub.
- Configure OpenAI API keys and environment variables for LangChain and LangSmith.

3. YouTube Video Processing

Component: YouTubeProcessor
Function:

- Extracts the video ID from a YouTube link.
- Downloads the audio as .mp3 using yt-dlp.
- If audio is unavailable, tries to fetch subtitles using the YouTubeTranscriptApi.

4. Speech-to-Text with Whisper

Component: TranscriptionProcessor

Function:

- Loads OpenAI's Whisper model ("base").
- Transcribes audio files to text.
- Saves the output into .txt files.

5. Vector Database Construction

Component: VectorDatabaseManager

Function:

- Splits the transcript into smaller chunks using RecursiveCharacterTextSplitter.
- Converts text chunks into embeddings using:
  - OpenAI Embeddings (if API key is provided), or
  - Local all-MiniLM-L6-v2 model.
- Stores text vectors and metadata in ChromaDB for fast retrieval.

6. Retriever Setup

Purpose:

- Enables semantic search by retrieving text chunks relevant to the user's question.
- Powered by the previously created vector database.

7. Question Answering System with LangChain

Tool Used: RetrievalQA from LangChain

How it works:

- A prompt template is used to format questions and context.
- When a user asks a question:
  - The retriever finds the most relevant chunks from the transcript.
  - The model (ChatGPT) generates an answer based on those chunks.

8. User Interface with Gradio

Features:

- Input field for YouTube link.
- Button to analyze the video.
- Input field for user questions.
- Area for displaying AI-generated answers.

Workflow:

- User inputs a video link → Audio is downloaded and transcribed → Text is embedded and stored → User can ask questions → Answers are generated from the video content.

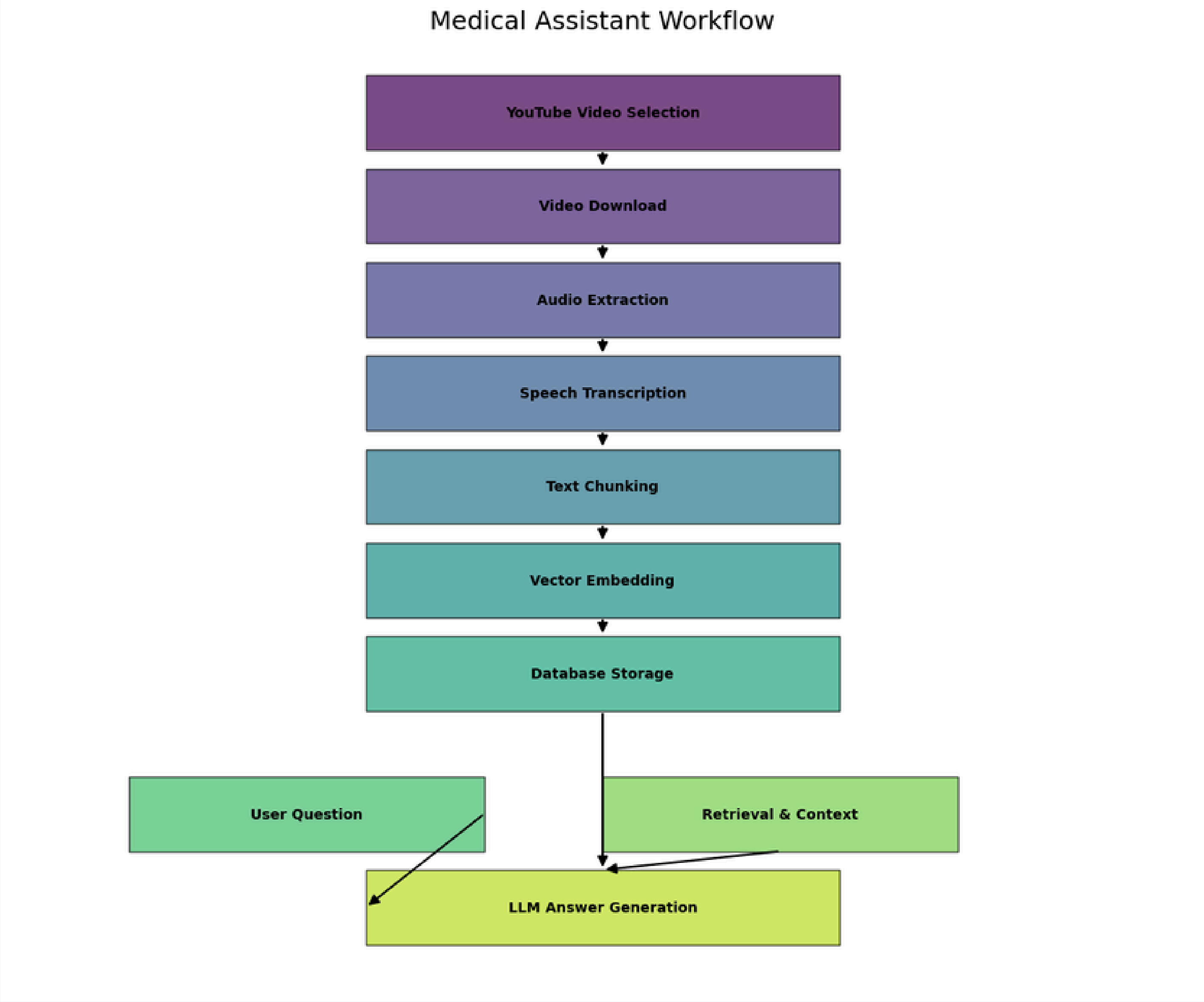
9. Tools and Technologies Used

Category	Tool/Library	Purpose
Speech Processing	OpenAI Whisper	Transcribe audio to text
Language Model	OpenAI ChatGPT	Generate answers
Vector Database	ChromaDB	Store and retrieve vectorized text
Embedding Models	OpenAI / Sentence-Transformers	Convert text to embeddings
YouTube Handling	yt-dlp	Download audio from YouTube
Subtitle Extraction	YouTube Transcript API	Get subtitles as text
Interface	Gradio	Build interactive UI
Monitoring	LangSmith	Track and debug flows

10. Final Output

An interactive AI assistant that:

- Takes a YouTube medical video link.
- Converts the video content into searchable text.
- Lets users ask questions related to the video.
- Answers intelligently using retrieved context and a powerful LLM.


Medical Assistant Workflow
YouTube Video Selection
Video Download
Audio Extraction
Speech Transcription
Text Chunking
Vector Embedding
Database Storage
User Question
Retrieval & Context
LLM Answer Generation