LLM-Powered Mental Health Chatbot with Mobile App Interface

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***Abstract*—Mental health issues are a growing concern worldwide, and AI-driven solutions can play a crucial role in providing accessible and scalable support. This project presents a mental health chatbot powered by large language models (LLMs), integrated with a mobile application developed using Flutter. The chatbot is designed to offer empathetic and informative responses to users while analyzing user interactions to enhance engagement.**

To ensure scalability and deployment efficiency, the application is containerized using Docker and can be hosted on cloud platforms. AI-driven personalization enhances the user experience by tailoring responses based on past interactions. This project showcases the intersection of AI, mobile app development, and cloud-based virtualization, contributing to the advancement of digital mental health solutions.

Terms-Large Language Models (LLMs), Mental Health Chatbot, Flutter App Development, AI Integration, Cloud-Based Virtualization, Docker Containerization, Scalable AI Solutions.

I. Introduction

A. Problem Statement

Mental health is a critical aspect of well-being, yet many individuals struggle to access professional support due to social stigma, financial barriers, and limited availability of mental health professionals. Many people hesitate to seek help, which can lead to untreated mental health issues.

With the rise of **Artificial Intelligence (AI)**, **Large Language Models (LLMs)** provide a potential solution by offering virtual mental health assistance. AI-powered chatbots can act as accessible, non-judgmental, and immediate support systems, helping users express their concerns, find relevant resources, and get guidance based on expert-curated responses.

B. Objective

This project aims to develop an **AI-powered Mental Health Chatbot**, integrated into a **Flutter-based mobile application**, to assist users in addressing mental health concerns. The chatbot is trained on an **enhanced dataset**, including the *Mental Health FAQ dataset from Kaggle*, with additional curated content for better response accuracy and topic coverage. The system is deployed using **Docker for cloud-based virtualization**, ensuring scalability and efficiency.

C. Scope

The chatbot is designed for:

- **Students** facing academic stress and anxiety.
- **Working professionals** dealing with burnout or workplace stress.
- **Individuals seeking self-help** before reaching out to a therapist.
- **Anyone in need of emotional support and well-being resources**.

While the chatbot does not replace professional mental health services, it serves as an **initial support system** to help users navigate their thoughts and emotions.

D. Challenges

Developing an AI-powered mental health chatbot presents several challenges:

- **Response Accuracy** – Ensuring the chatbot provides relevant, non-harmful, and empathetic responses.
- **User Privacy & Data Security** – Protecting sensitive user conversations from leaks or misuse.
- **Real-Time Performance** – Enabling quick and natural interactions without delays.
- **Context Understanding** – Making the chatbot more context-aware rather than providing generic responses.
- **Scalability** – Deploying the chatbot efficiently using Docker and cloud-based solutions for broader access.

E. Dataset Description

The chatbot is trained using the **Mental Health FAQ dataset from Kaggle**, which contains frequently asked questions related to mental health. To enhance response accuracy, we have extended the dataset with additional curated responses covering various mental health concerns such as anxiety, depression, stress management, and self-care strategies.

The dataset consists of:

- **Questions:** Commonly asked mental health-related queries.
- **Responses:** Expert-curated answers providing guidance and support.
- **Categories:** Topics like anxiety, depression, therapy, self-care, and mindfulness.

This enriched dataset ensures a more contextually relevant and empathetic chatbot experience.

II. Literature Review

A. Existing Mental Health Chatbots

Several AI-driven mental health chatbots have been developed to assist users with psychological well-being. Some well-known examples include:

- **Woebot**: Uses Cognitive Behavioral Therapy (CBT) techniques to provide emotional support.
- **Wysa**: Employs AI-based interactions for stress management and mindfulness.

While these chatbots are effective, they often rely on predefined scripts and do not fully utilize **Large Language Models (LLMs)** for dynamic, personalized responses.

B. LLMs in Chatbot Development

This project integrates **LLMs**, such as **Mistral-7B**, to generate human-like responses. The benefits of using LLMs include:

- **Context-aware conversations** tailored to user inputs.
- **Better understanding of natural language** for mental health support.
- **Adaptability**: Unlike rule-based bots, LLMs generate varied responses instead of following strict scripts.

Our chatbot utilizes API calls (e.g., `Hugging face API`) or a locally fine-tuned model in Google Colab for response generation.

C. Dataset Used in This Project

Unlike existing mental health chatbots that rely on predefined rule-based responses, this chatbot leverages LLM-based responses combined with a custom dataset.

- **Dataset Source**: The chatbot is trained on an enhanced version of the **Mental Health FAQ dataset from Kaggle**, with additional curated content for improved response accuracy.
- **Preprocessing Steps**: Data cleaning, tokenization, and handling stopwords are applied in the Google Colab environment.
- **Fine-tuning (if applicable)**: Additional mental health-related Q/A pairs are integrated for improved response generation.

D. Cloud-Based AI Applications and Containerization

Since this chatbot is developed in **Google Colab**, a cloud-based Jupyter notebook environment, it benefits from:

- **Efficient GPU/TPU usage** for LLM inference.
- **Seamless integration** with APIs (e.g., OpenAI, Hugging Face).
- **Pre-installed libraries** (e.g., `transformers`, `Flask`, `FastAPI`) to accelerate development.

To deploy the chatbot, **Docker** ensures portability and scalable hosting.

III. Methodology

A. System Architecture

The chatbot follows a structured pipeline involving:

- **Frontend (Flutter App)**: Users interact with the chatbot through a mobile interface.
- **Backend (FastAPI/Flask)**: The app sends user queries to the backend for processing.
- **AI Model (LLM-based Response Generation)**: The chatbot processes input using a GPT-based LLM or a fine-tuned model.
- **Model Variant (mistralai/Mistral-7B-Instruct-v0.1)**: A powerful open-weight LLM used for generating context-aware and efficient responses, optionally replacing or enhancing the base model.
- **Response Handling**: The chatbot generates responses based on mental health FAQs and LLM predictions.

B. Data Flow & Processing

The chatbot follows this step-by-step data processing pipeline:

1) **User input (question)** $\rightarrow$ Sent to LLM API.
2) **Preprocessing** $\rightarrow$ Text is cleaned, tokenized, and vectorized (if needed).
3) **AI Model Response** $\rightarrow$ LLM generates context-based replies.
4) **Postprocessing** $\rightarrow$ Response is formatted for chatbot UI.
5) **User sees final response on the Flutter app.**

If custom LLM training is used, additional fine-tuning steps involve:

- **Data Preprocessing**: Cleaning and removing biases from the dataset.
- **Training on an enhanced dataset**: Merging Kaggle FAQ data with additional curated content.
- **Evaluating response quality**: Conducting human feedback assessments.

C. Deployment Strategy

- **Backend API Hosting**: Flask/FastAPI server deployed on AWS/GCP/Azure.
- **Containerization**: Dockerized deployment ensures environment consistency.
- **Scalability**: Cloud-based infrastructure to handle increasing user queries.

IV. Implementation Details

A. Frontend (Flutter App)

- Uses Flutter for a smooth, cross-platform chatbot UI.
- Chat interface mimics real-life mental health support conversations.

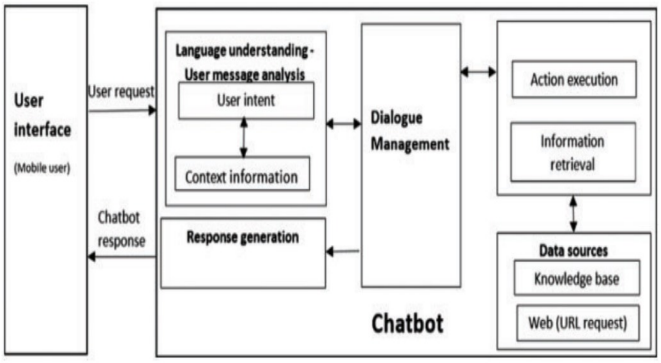
B. Backend (API Development)

- FastAPI/Flask-based API handles request processing.
- Integrates with LLM API (e.g., OpenAI, Hugging Face models).

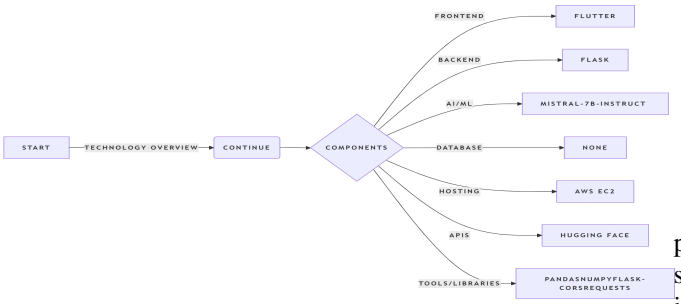
C. AI Model

- Uses a GPT-based LLM for response generation.
- Additional dataset added to improve chatbot accuracy and context awareness.

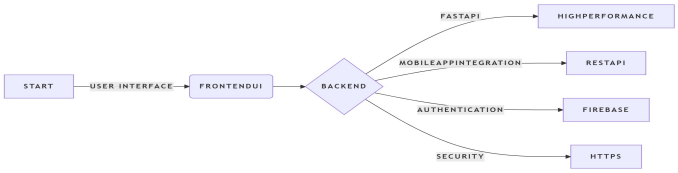
V. Result & Discussion



Overall chatbot artchitecture



Implementation Details



Technology Stack

VI. Conclusion and Future Work

This project has been a valuable learning experience, integrating cutting-edge AI technologies with mobile application development to create a meaningful impact in the field of mental health. By leveraging large language models (LLMs), app development, AI integration, and cloud-based virtualization, I have gained hands-on experience in building scalable and efficient AI-powered systems.

The successful implementation of this chatbot highlights the potential of AI in providing accessible and supportive mental health solutions. It demonstrates how AI can bridge the gap between individuals and mental health support by offering immediate, non-judgmental assistance.

A. Future Work

While this chatbot provides an initial framework for AI-driven mental health assistance, several enhancements can improve its effectiveness:

- **Real-time Sentiment Analysis:** Integrating sentiment analysis to assess users' emotions and adjust responses accordingly for better engagement and support.
- **Multilingual Support:** Expanding the chatbot's capabilities to support multiple languages, making it accessible to a wider audience.
- **Personalized Recommendations:** Implementing a recommendation system based on user interactions to provide tailored mental health resources.
- **Improved Context Awareness:** Enhancing the chatbot's memory and context retention to enable more meaningful and coherent conversations.
- **Privacy and Security Enhancements:** Strengthening encryption and anonymization techniques to protect sensitive user data.
- **Integration with Professional Support Services:** Providing a seamless transition for users who need to connect with mental health professionals.

This work has deepened my understanding of AI-driven applications while refining my problem-solving and development skills. It serves as a strong foundation for future advancements in AI and its applications in mental healthcare.

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VII. Github link

https://github.com/Vansh-1007/Cloud-Computing-Project