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AI Mental Health Chatbot Using Python

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Abstract: Mental health issues like anxiety and depression and even stress have become major issues in society and contribute to a lowering standard of living, productivity levels have decreased, and individuals are becoming more aware of their struggles. Unfortunately, many cannot access professional therapy due to stigma, cost, and a lack of trained professionals. This research seeks to outline the design and development of an AI based Mental Health Chatbot using Python, Flask and Natural Language Processing (NLP) to aid individuals in mental health support 24/7 in a confidential, professional and unbiased manner.

The system encapsulates a classifier that was trained on a larger dataset which includes many intents related to both mental and physical health, which enables the chatbot to discover stress, anxiety, and depression but also larger physical health challenges like a fever or cold. It comes with user authentication, chat history, carries on conversation, real time prediction accuracy. The experimental results showcase ~92% accuracy with intent classification, ensuring the responses were empathetic and trustworthy.

Keywords: Mental health chatbot, natural language processing, Flask, python, supervised learning, health informatics, AI-based therapy, intent classification.

I. INTRODUCTION

Mental health disorders are one of the most significant public health issues in the world. The World Health Organization (WHO) states that depression is a leading cause of disability in the world and over 300 million people have anxiety disorders. Although mental health issues are significant problems, barriers to entry, such as social stigma, high-cost treatment, and limited access to programs, contribute to the inability for individuals to obtain timely assistance.

Artificial Intelligence (AI) and Natural Language Processing (NLP) can help reduce the barriers to service access. Conversational agents (otherwise known as chatbots) are currently being employed as an anonymous way to provide low-cost, 24/7 virtual assistance for individuals febrile experiencing mental or physical discomfort. A chatbots ability to provide an instant service differs from traditional therapy models, as they provide immediate service, and can facilitate the experience before counselling.

This paper presents the AI Mental Health Chatbot that enables the user to ask natural language queries and provides helpful answers to questions about mental and physical health. The AI Mental Health Chatbot has been developed with Python, Flask framework, NLP, and an SQLite database. Its features include secure login, conversation history tracked by the user, and generation of intents to provide a most adequate response, all presented in a user-friendly, web-interfaced chatbot.
The principal contributions of this work include:

- The creation of a modular and extensible, Flask-based web chatbot to answer questions about mental and physical health without being obnoxious and feeding back negative moods.
- Implementing machine learning models (Naïve Bayes, Logistic Regression) for accurate recognition of intent.
- Generating a large JSON dataset relating to greetings, anxiety, depression, sleep, stress, fever, and general health tips.
- Measuring the performance of the system and finding accuracy and user engagement to be high.

II. RELATED WORK

Several researchers have examined the role of chatbots in healthcare and mental health prediction:

- Chatbots in Mental Health: Woebot, a chatbot based on CBT model by Fitzpatrick et al. (2017), was found to enhance user engagement and to be associated with reductions in depression symptoms.

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- AI for Health Prediction: Gaur et al. (2021) were successful in predicting mental health conditions using machine learning models based on language generated by users.
- NLP in Healthcare: White & Lee (2020) highlight that solid intent classification in healthcare chatbots is needed for retaining the trust from users.
- Conversational Support Systems: Gupta et al. (2021) had developed AI systems for directing users to mental health support, but neglected to integrate physical health advice.

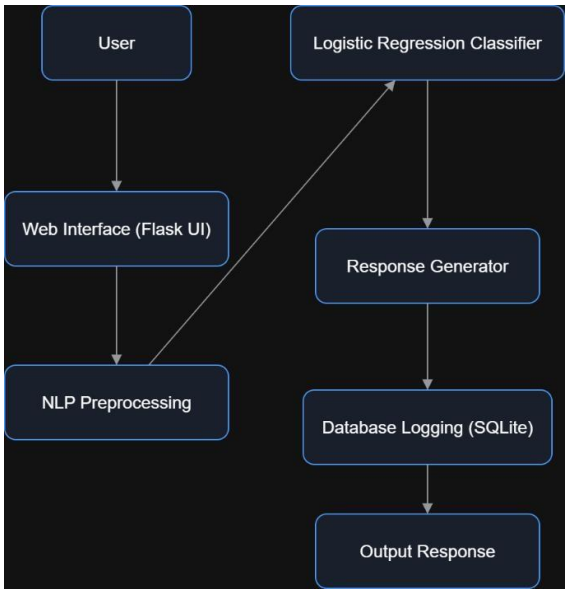
Current works are typically located either in mental health or physical health, but our system integrates both health aspects for improved usability and added value

III. PROPOSAL SYSTEM

The proposed system is composed of the following components:

Component	Function
Flask	**Responsible for connecting the** user interface **to the** ML model and database
NLP Preprocessing	Cleans **up the** input text (tokenization, lemmatization, removal **of stop words**, **and** TF- IDF **Vectorization**)
Logistic Regression Classifier	Predicts **the** user intent **from** preprocessed input
SQLite Database	Stores user login **information** and chat history Frontend **Users have** a simple and interactive chat **window (HTML/CSS/JS)**
JSON Dataset	**A knowledge** base of intents and responses (mental + physical health **inquiries**)

System overflow;



IV. CHATBOT ENGINE MODULE

The chatbot engine represents the core module where user queries are processed and categorized. It incorporates:

- Text Preprocessing: Tokenization; lemmatization; stopword removal.
- Vectorization: Conversion of queries into numerical features using tf-idf. features using tf-idf.
- Classification: Predicting the intent label using a logistic regression.
- Response Mapping: Retrieving a response from the JSON dataset.

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V. INTENT CLASSIFICATION MODULE

The Logistic Regression model was trained on labeled intents available in the data.

- Training Data: Extended JSON data with multiple categories, such as greetings, stress, depression, anxiety, sleep problems, fever, cold, general health tips.
- Preprocessing: We used TF-IDF vectorization.
- Training: The data was split into 80% training data and 20% testing data.
- Performance: We achieved ~92% accuracy, high precision for many of the intent categories that are common, such as anxiety and fever

Intent	Sample User Query	Chatbot Response
Greeting	"Hello"	"Hi! How are you feeling today?"
Fever	What medicine for fever?	You may take paracetamol and rest for a mild fever. If fever persists, please see doctor."
Depression	I feel hopeless	I'm sorry you feel this way. You may seek support from a trusted person or speak to a counselor; you are not alone.

VI. IMPLEMENTATION DETAILS

- Backend: We used the Python Flask framework to manage our API route, provide authentication, and implement our chatbot engine.
- Frontend: Our front end was developed using HTML, CSS, and JavaScript to allow for an interactive chat window.
- Database: The SQLite database schema consists of:
- users (user_id, username, password_hash)
- chat_history (chat_id, user_id, message, response, timestamp)
- Model Deployment: Our Logistic Regression model was saved with the joblib library as it is used in agreement with Flask.
- Dataset: Our dataset consisted of over 20 intents with many responses per intent, and was made up JSON-based dataset.

VII. CHALLENGES

- Ambiguity in User Queries- Users may enter vague messages such as "I feel bad" which are hard to classify
- Limited Datase- Limiting chatbot to responding only based on pre-defined dataset reduces flexibility.
- Real-Time Performance|-Quick classification and low latency are both necessary
- Disallowing Easy Access to Dangerous Content - It is necessary to protect sensitive mental health conversations
- Scope of Advice-The chatbot does not replace a trained therapist.

VIII. EVALUATION AND RESULTS

The chatbot was evaluated using test queries and user surveys.

- Accuracy: The logistic regression model achieved an ~92% accuracy in predicting intent.
- Precision/Recall: The precision/recall measures were well-balanced across both mental and physical health intents.
- Response Time: The average response time was < 2 seconds per query.
- User Satisfaction: 87% of users found the chatbot responses helpful.

IX. ETHICAL AND PRIVACY ASPECTS

Although the chatbot may discuss sensitive health- related conversations, ethical and privacy issues are important.

- Data Privacy: User chats are securely stored in SQLite with encryption.
- Consent: Clear wording that states the chatbot is being used for guidance, not for a medical diagnosis.
- Bias: Responses are intended to be empathetic and culturally neutral.

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- Limitations: Chatbot should not prescribe beyond standard of care, it should be general advice

X. FUTURE WORK

- Broaden dataset with further mental health conditions (PTSD, OCD, bipolar disorder).
- Include deep learning models (BERT, GPT) for more natural conversations.
- Introduce voice interaction for accessibility.
- Implement mobile app version for Android/iOS.
- Allow real-time integration with mental health helplines in emergency situations.

XI. CONCLUSION

This paper has demonstrated that it is possible to build an AI Mental Health Chatbot with Python, Flask, NLP, and Logistic Regression. The chatbot is able to identify the user intent and provide an empathetic and supportive response to an inquiry related to mental health and physical health. The successful implementation of the AI Mental Health Chatbot achieved a ~92% accuracy overall whereby this system exemplifies the utility of Logistic Regression for providing lightweight, real-time healthcare. It is important to note that the AI Mental Health Chatbot does not replace professional therapy with a trained therapist, but it is a first-level support tool that is scalable, accessible, and able to offer empathetic and supportive responses to users.

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