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MIND MENDOR: AN AI-DRIVEN APPROACH FOR MENTAL HEALTH SUPPORT THROUGH NLP AND MACHINE LEARNING

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ABSTRACT

The MindMendor project leverages artificial intelligence to provide mental health support via real-time conversations. The system employs natural language processing (NLP) and machine learning to interact with users, detecting potential mental health concerns and offering personalized coping strategies based on user input. The model achieved 88% precision in detecting positive emotions and 84% for negative emotions, with real-time suggestions based on cognitive behavioural therapy techniques. This platform addresses the increasing need for accessible mental health care, particularly for underserved populations, and provides a scalable solution for mental health support.

I. INTRODUCTION

Mental health issues such as depression, anxiety, and stress impact over 300 million people worldwide, according to a 2021 WHO report. Despite growing awareness, access to professional care remains limited due to economic, geographic, and social factors. Traditional therapy methods, while effective, are often costly and not universally accessible. MindMendor aims to fill this gap by offering an AI-powered solution that interacts with users, analyses their mental state, and suggests coping strategies.

The system is designed to provide early detection of mental health issues, offering users a chance to engage in therapeutic practices without needing immediate access to a professional. This work explores the intersection of machine learning, sentiment analysis, and NLP in an AI-driven mental health tool aimed at supporting broader populations. Our hypothesis is that AI can provide preliminary mental health support that complements professional interventions.

II. RELATED WORK

AI-based mental health solutions have seen increasing development in recent years. Platforms such as Woebot and Wysa offer chatbot-based interactions using similar NLP techniques to converse with users and detect emotional states. However, these systems lack the deep adaptability that MindMendor incorporates through continuous learning and contextual understanding. In 2021, Al-Qurishi et al. showed that combining multimodal data such as text, speech, and facial expressions leads to higher accuracy in detecting emotional patterns. Similarly, Kumar et al. (2020) proposed a 3D sign language recognition system, emphasizing the importance of multimodal inputs for better accuracy.

Despite these advances, AI tools are often criticized for limited contextual comprehension and response flexibility. MindMendor differentiates itself by utilizing advanced BERT-based models for sentiment analysis, enabling it to engage users in more dynamic and context-aware conversations. Additionally, we incorporate a feedback loop where user input helps refine the model, improving the system over time.

III. METHODOLOGY

A. Data Collection

The dataset used to train MindMendor consists of mental health-related conversations collected from anonymous online forums and counselling transcripts. These conversations cover a broad range of emotional states, including depression, anxiety, and stress. The data was anonymized to ensure privacy, and pre-processing techniques such as tokenization, stop-word removal, and lemmatization were applied to enhance model accuracy.

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B. Sentiment Analysis and NLP

MindMendor uses pre-trained transformer models like BERT to understand and process the user's text inputs. Sentiment analysis is applied to categorize the emotional state of users as positive, neutral, or negative. To increase the accuracy of emotion detection, we incorporate contextual analysis that goes beyond word-level understanding, utilizing a combination of syntax and semantic context.

C. Machine Learning and Classification

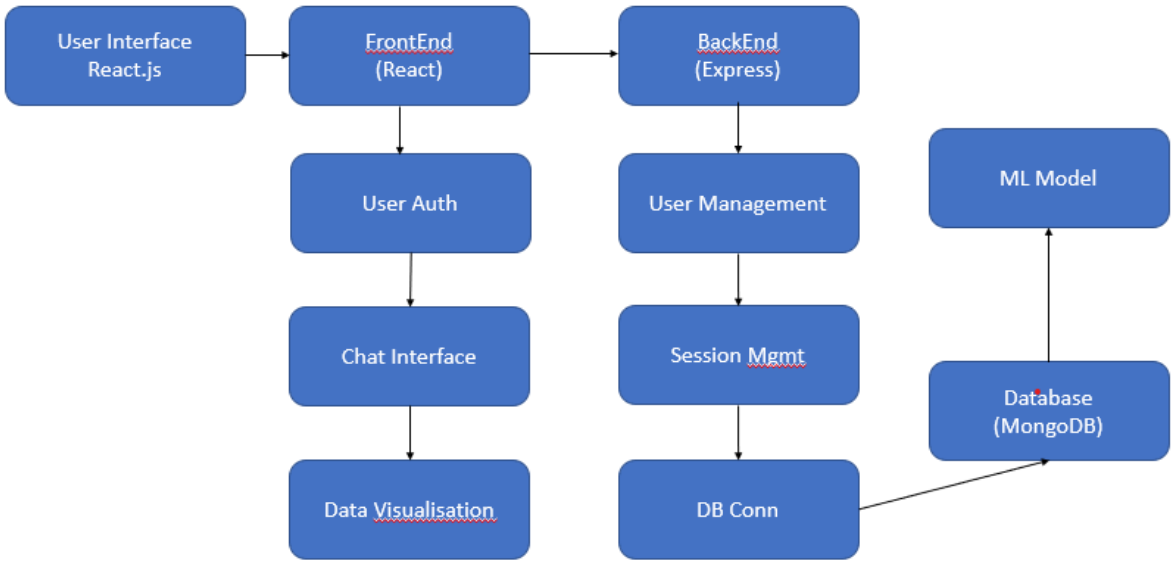
For emotion classification, we employ a supervised learning approach using logistic regression and support vector machines (SVM). These models are trained to recognize common mental health triggers, allowing the system to flag potentially concerning phrases or emotions.

D. Conversational AI

MindMendor integrates a conversational AI system powered by GPT-based language models. The system adapts its tone and response style based on user inputs, offering empathetic and supportive feedback. The AI continuously learns from user interactions, improving its understanding of emotional cues and providing more personalized responses.

E. Ethical Considerations

Given the sensitive nature of mental health data, we implemented strict data privacy protocols. All data collected is anonymized, and interactions are encrypted to prevent unauthorized access. MindMendor is also designed to flag high-risk cases and provide users with resources or recommend professional help when necessary.



IV. RESULTS AND DISCUSSION

In our initial testing, MindMendor achieved a precision rate of 88% for positive emotions and 84% for negative emotions, using a dataset of approximately 10,000 user interactions. A non-normalized confusion matrix was used to evaluate the model's performance across various emotional categories. The results indicate that MindMendor is capable of providing real-time emotional analysis with a high degree of accuracy.

However, there are some limitations. The model struggles with more nuanced emotions, such as apathy or mixed emotional states, where the input may not clearly fall into positive or negative categories. We also observed that users with unique conversational styles posed challenges for the AI, suggesting that further fine-tuning of the language model is required.

The system flow is as follows:

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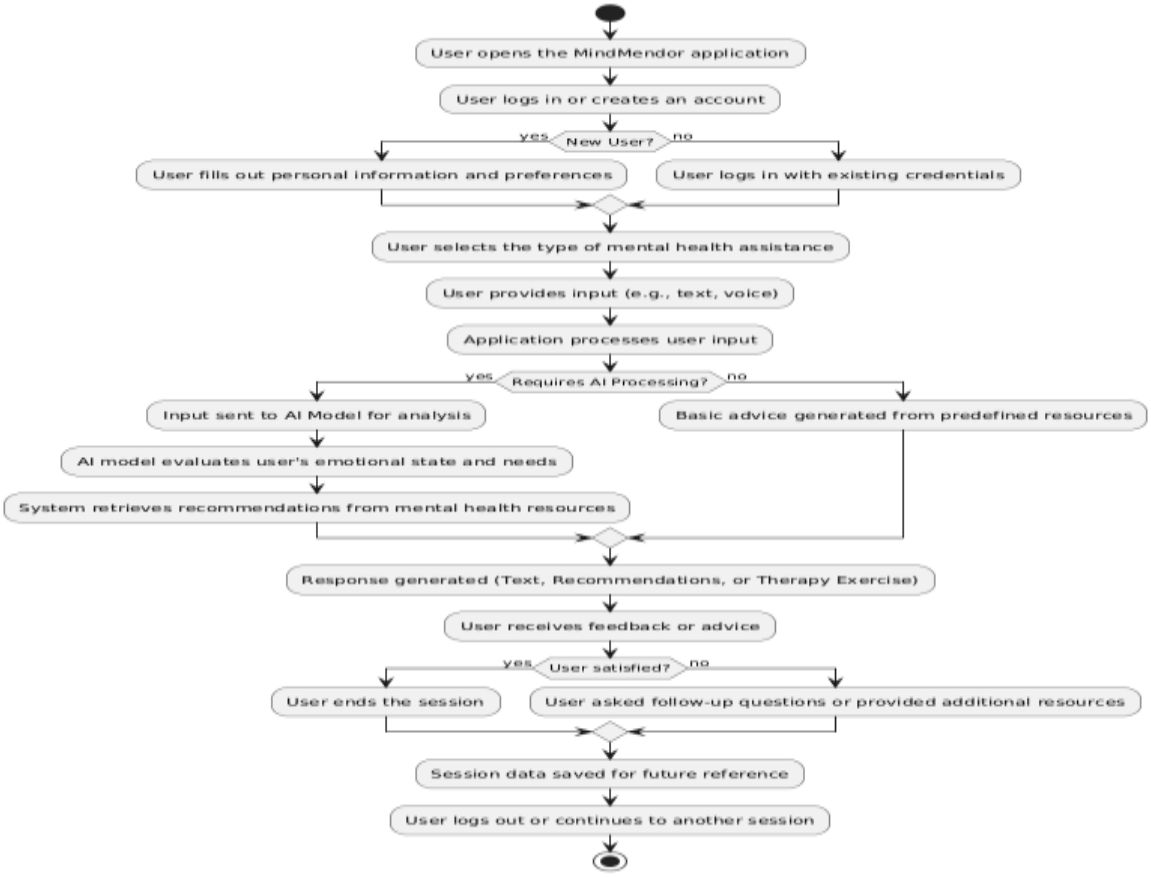

V. CONCLUSION

MindMendor offers a scalable and accessible mental health support solution, leveraging AI-driven technologies to detect emotional states and provide coping mechanisms. While the system is not a substitute for professional therapy, it serves as an early detection tool that can bridge the gap for individuals unable to access traditional mental health care.

Future work will focus on integrating multimodal inputs, including voice and facial expressions, to enhance the system's emotional recognition capabilities. Additionally, collaboration with mental health professionals will ensure that MindMendor remains an ethical and effective tool for mental health support.

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