

AI-Powered Mental Health Risk Detection in Clinical Environments

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Abstract- Mental disorders have emerged as one of the biggest challenges in the contemporary healthcare world, particularly amongst students and working professionals. Traditional mental health care programs usually suffer from several problems including unavailability of services, shortage of mental healthcare professionals, lack of timely assistance, and social stigma of visiting psychological clinics [1]. This study proposes an AI-based mental health risk detection and support system termed 'Doctorina' that has been designed and developed using the MERN stack framework and AI technologies in order to offer immediate mental health support and counseling assistance. The proposed system consists of a role-based system incorporating students, counselors, and administrators. The proposed platform provides AI-powered conversational support using Groq API and the Llama 3.3 70B models to offer real-time guidance for achieving mental well-being and emotional assistance. The platform also provides facilities for appointment booking, counselor management, authentication, and data management using JSON Web Tokens (JWT). The aim of this research is to design and develop a scalable and accessible mental health care platform which can help patients to deal with their emotional problems at early stages. In this paper, we mainly describe the system architecture, artificial intelligence integration, workflow, and implementation strategies for the development of the platform.

Keywords— Artificial Intelligence, Mental Health, MERN Stack, Clinical Support System, Conversational AI, Risk Detection, Chatbot, Healthcare Technology.

I. INTRODUCTION

1. Background of Mental Health Disorders

In recent times, mental disorders such as anxiety, depression, stress and emotional instability are becoming increasingly common [1]. There are many students and professionals who feel mentally strained due to competition, academic pressure, workload, social distance and imbalanced living styles. Despite the increase in awareness of mental health, some people still avoid seeking professional help due to social discrimination and the lack of mental health care facilities [2].

2. Importance of Artificial Intelligence in Mental Healthcare

Artificial Intelligence (AI) is considered an essential technology for healthcare purposes. AI applications are capable of understanding user interactions,

producing replies, and assisting users via automated systems [1].

Modern NLP and LLMs developments enable AI applications to engage in human-like conversations and offer emotional support in real-world settings [4]. AI-driven mental health platforms can increase mental healthcare accessibility and continuously support users irrespective of geographic barriers [2].

3. Problem Statement

Many people who suffer from mental strain and emotional distress fail to get timely assistance because of the non-availability of mental health experts, delays in the consultation process, and ignorance [3].

Current healthcare systems mostly emphasize chatbot communications or appointment scheduling

separately. It is required to develop a mental healthcare system that includes:

- AI-powered mental health care
- Conversational AI-based counseling
- Role-based user authentication
- Communication security
- Unified healthcare management system

4. Objectives of the Project

Main goals of the research include:

- Designing an AI-powered mental health support system
- Integrating AI conversational capabilities for emotional counseling and support
- Implementing role-based authentication and user management features
- Supporting appointment scheduling between students and mental health counselors
- Designing a scalable MERN stack architecture for mental healthcare systems
- Improving accessibility to mental healthcare services

5. Scope of the Research

The proposed system is focused on developing an AI-assisted mental wellness support system in educational and clinical settings. The system will facilitate:

- Student-AI chatbot interactions
- Appointment scheduling
- Counselor management
- Approval workflows for mental healthcare administration
- Healthcare communication security

The proposed application will be designed as a mental wellness assistant tool and not as a substitute for medical diagnosis.

II. LITERATURE REVIEW

1. Application of AI in Mental Healthcare

AI has proved to be quite effective in improving mental healthcare support systems. Various studies were carried out to evaluate the impact of AI chatbots, predictive

models, and therapy assistance tools for mental healthcare [1].

Based on the findings from E. E. Lee et al., AI technology plays a vital role in making mental healthcare more accessible through scalable and continuous support systems [1].

2. Conversational AI and Chatbots

Several AI chatbots like Woebot and Wysa are designed to guide people during stressful situations using Natural Language Processing techniques [2]. These chatbots provide emotional counseling and suggestions for mental wellness practices.

According to the findings published by G. Espejo and W. Reiner, there is a great potential for application of conversational AI in mental healthcare facilities [2].

3. Machine Learning and Behavior Monitoring Techniques

There are a variety of machine learning and behavior monitoring tools used for detecting emotions and behavior-related patterns [4]. These include sentiment analysis, speech analysis, and behavior monitoring for early prediction of risks associated with mental wellbeing.

As per the findings of N. K. Iyortsuun et al., machine learning and deep learning algorithms can be useful for developing effective mental health diagnosis tools [4].

4. Challenges with the Current Solutions

Some challenges with the current mental health care solutions include:

- Data Privacy Issues
- Non-Scaleable Solution
- Unavailability and Limited Accessibility
- Inadequate Personalization Options
- AI-Related Ethical Issues [5]

Several solutions fail to integrate an appointment management system and secure clinical workflows into their platforms.

5. Limitation with the Current Solutions

Currently available solutions are focused on the following areas:

- Chatbot Interactions
- Virtual Therapy Tools
- Monitoring Solutions

Not many platforms offer:

- Conversational Support with AI Tools
- Appointment Management System
- Clinical Workflows for Counselors
- Secure Role-Based Architecture On a single platform.

6. AI-Assisted Teletherapy and Virtual Counseling

AI-based teletherapy applications have increased accessibility to mental health care facilities through remote connections between patients and counselors [1]. Virtual counseling software that is augmented with artificial intelligence technology has the capability of analyzing user interactions and offering guidance on emotional matters in real-time. Virtual counseling is helpful for people who reside in rural settings where access to professional mental health facilities might be limited.

Some AI-integrated software, including BetterHelp and Talkspace, have shown great success in the application of virtual communication combined with AI-driven healthcare procedures [2]. AI can further aid therapists in scheduling appointments, tracking user interactions, and recommending suggestions during the therapeutic process.

7. Significance of Explainable AI in Mental Health System

Explainable Artificial Intelligence has been considered an essential field of study within healthcare systems due to its black-box nature [4]. In the case of mental health care systems, transparency is required for healthcare workers to be aware of how the output from AI is generated.

Techniques such as LIME (Local Interpretable Model-Agnostic Explanations) and SHAP (SHapley Additive exPlanations) help improve transparency by identifying which input features influence AI predictions. Explainable AI improves trust,

accountability, and reliability in AI-assisted mental healthcare systems [5].

III. METHODOLOGY

1. Research Approach

The proposed system follows an implementation-oriented research methodology focused on developing a scalable and secure AI-powered mental health support platform.

The methodology includes:

- Requirement Analysis
- System Design
- Frontend Development
- Backend API Development
- Database Integration

2. Frontend Development

The frontend of the application was developed using:

- React.js
- Vite
- Tailwind CSS
- React Router DOM
- Login interfaces
- Dashboard systems
- Chatbot interfaces
- Appointment management pages
- Admin control panels

3. Backend Development

The backend server was developed using:

- Node.js
- Express.js

REST APIs were created for:

- Authentication
- User management
- Appointment booking
- Counselor approval
- Chatbot communication

4. Database Design

MongoDB was used as the primary NoSQL database.

The database stores:

- User information
- Appointment records

- Counselor details
- Authentication data
- System activity records

Mongoose ODM was used for schema management and database communication.

5. AI Integration

The AI chatbot system was integrated with:

- Groq API
- Llama 3.3 70B language model

The chatbot takes user input and creates helpful responses focused on emotional wellness support.

6. Authentication and Security

The system uses secure authentication with:

- JSON Web Tokens (JWT)
- bcrypt password hashing
- Role-based access control

Different dashboards and permissions are assigned to:

- Students
- Counselors
- Administrators

IV. ARCHITECTURE EXPLANATION

1. System Architecture Overview

The proposed platform uses a client-server structure that connects with external AI services. The structure includes:

- Frontend Layer
- Backend Layer
- Database Layer
- AI Service Layer

2. Frontend Layer

The frontend layer handles:

- User interaction
- Dashboard rendering
- Form management
- API communication

The frontend connects to the backend using Axios API calls.

3. Backend Layer

The backend layer manages:

- Business logic
- Authentication
- API routing
- AI communication
- Database interaction

Middleware functions are used for role verification and token verification.

4. Database Layer

MongoDB stores all the information related to the app including:

- User records
- Counselor data
- Appointment details
- Authentication tokens

5. AI Service Layer

The AI service layer uses:

- Groq API
 - Llama 3.3 70B model
- The chatbot provides:
- Emotional support
 - General wellness guidance
 - Conversational interaction

Limitations and Challenges

AI limitations

The AI model can be of assistance by giving advice and suggestions to people who are in emotionally difficult situations, but it is not as capable as professionals such as psychologists, psychiatrists and certified therapists. This is because the model is based on language models and conversational patterns and does not involve any clinical or medical assessment. Therefore, this platform use should be considered as an assistance tool and not as a medical diagnostic device.

Sometimes, AI-generated responses may not detect some emotions or sarcasms in the user's questions or messages. Sometimes human intervention may be required as the user is facing some very sensitive situation or severe psychological problems. Additionally, the model may also generate inaccuracies or generalizations depending on users' inputs.

Issues Related to Data Privacy

The systems for mental health services have to deal with very confidential information such as conversations about feelings, appointments and personal data of users. This data protection against any kind of leakage is a major issue which needs to be considered while discussing health information technology systems [5].

The proposed platform employs data authentication and secure access technologies, but still the complete security against attacks is an issue in practical implementations. This may involve issues like leakage of data, access to data by unauthorized parties, and server security.

Reliance on External APIs

Reliance on external APIs such as Groq API and Llama language model integration influences the operation of the chatbot. Therefore, the operation and efficiency of the chatbot rely on external services, their availability, the latency of their API responses, and the availability of internet connections.

In cases where the third-party AI provider has issues with its services such as downtime, restrictions on access, or problems with internet connectivity, the chatbot will be unavailable. Also, costs and requests for

API usage will influence the efficiency of the system at peak hours.

Finally, reliance on a third-party provider for the services required by the system makes its maintenance difficult and uncertain in the future.

Ethical Issues

The use of AI-based systems in mental healthcare requires adherence to certain ethical rules to ensure the absence of any adverse consequences from the interaction with the platform [1]. The AI-generated responses to user inquiries must be non-malevolent, unbiased, and supportive.

Bias represents one of the key ethical issues related to conversational AI models. When using AI in the

mental healthcare field, there is a risk that the language model will be biased due to the use of unfair or discriminatory data during its training process.

Overreliance on the system to provide adequate therapy and counseling services also constitutes an ethical problem. Some users may opt to seek help from the chatbot alone rather than contacting mental healthcare professionals whenever such help is needed.

Ethical transparency also represents a crucial issue since the users need to know whether they are interacting with an AI-based program or a real therapist.

Technical and Scalability Issues

There are some technical issues that have to be overcome during the development of the scalable AI-enabled health care application. The increase in users should not affect the work efficiency of the server, database, and AI communication parts.

Efficient API communication and speed are crucial for real-time chatbot communication. Inefficiencies in the speed and effectiveness of the system's response may adversely impact the user experience. Server and database optimization are also needed for smooth work flow management.

Integration of different technologies such as React.js, Node.js, MongoDB, authentication, and AI-related APIs makes the application more complex. It is hard to ensure the compatibility of all the parts when implementing new software updates and deployments.

Some other scalability issues are as follows:

- Increased burden on the server
- Greater requirement for database storage space
- API call restrictions
- Latency
- Costs of cloud deployment

In order to overcome the above challenges, appropriate infrastructure and optimization practices need to be used.

Lacking Real-time Clinical Validation

The proposed solution is an academic implementation project that lacks wide-scale medical validation with actual healthcare institutions and psychiatric practitioners. As a result, the efficiency of the chatbot replies and support systems remains untested in the clinical environment.

The current solution is more focused on communication and workflow assistance as opposed to scientifically backed up psychological diagnoses. Future development may involve clinical data use, therapist input, and cooperation with healthcare institutions which would lead to increased reliability and efficiency of the application.

Since clinical validation by professionals is lacking, AI-based suggestions for psychological issues must be regarded as purely informative and not as any kind of decision made by professionals.

Future Directions

Advanced Risk Detection

Future systems may integrate:

- Sentiment analysis
- Facial expression recognition
- Voice analysis
- Behavioral monitoring

for improved early risk indication [4].

Mobile Application Integration

The platform can be expanded into Android and iOS mobile applications to improve accessibility and portability. Mobile integration would allow users to access mental health support services anytime and anywhere through smartphones and tablets.

Push notification systems can also be integrated for:

- Appointment reminders
- Wellness recommendations
- Emergency support notifications
- Daily mental wellness check-ins

A mobile-based platform would significantly improve user engagement and accessibility, especially for students and working professionals who frequently use mobile devices.

Wearable Device Integration

Future versions of the platform may integrate wearable healthcare devices for real-time monitoring of physiological and behavioral indicators [5]. Devices such as smartwatches and fitness bands can provide valuable data related to:

- Heart rate variability
- Sleep quality
- Physical activity
- Stress levels
- Breathing patterns

These parameters can be monitored continuously by AI algorithms and abnormal changes in behavior or physiology can be detected that could be indicative of mental health risks. This integration can enhance early detection and offer more personalized mental wellness suggestions.

Multi-language Support

Currently, most of the AI conversational systems are primarily designed for English communication. Future versions of the platform may feature multi-language conversation support, to increase accessibility for users from different linguistic and cultural backgrounds.

The user's comfort and emotional expression during the interaction with the chatbot can be improved by supporting regional languages. AI models trained for multilingual communication may help extend mental healthcare accessibility to rural and underserved populations.

Integration with Telemedicine Systems

Future versions of the system may include telemedicine and video consultation features that allow direct communication between users and professional counsellors. Systems that use video consultation could offer more personalized support for mental healthcare while also providing remote accessibility.

Telemedicine can make this happen:

- Real-time video counseling
- Online therapist consultation
- Remote patient monitoring
- Digital prescription management

- Virtual therapy sessions

This enhancement would make the platform more suitable for real-world healthcare and clinical environments.

Cloud Deployment and Scalability Enhancements

Future development may include deployment of the platform on cloud infrastructure, which would lead to improved scalability and availability. Deploying to the cloud can improve:

- System performance
- Real-time accessibility
- Data backup and recovery
- Load balancing
- Multi-user support

V. RESULTS

1. System Implementation Results

The developed system has been successfully integrated:

- AI conversational support
- Appointment management
- Role-based dashboards
- Secure authentication mechanisms

2. Chatbot Performance

Context-aware supportive responses were generated by the chatbot based on the Llama 3.3 70B language model, with Groq API integration.

3. System Workflow Validation

Testing confirmed:

- Proper role-based routing
- Secure API communication
- Successful appointment scheduling
- Efficient frontend-backend interaction

VI. CONCLUSION

The researchers demonstrated how to create a health support system named Doctorina. The system is intended to make it easier for people to get health help.

The system uses intelligence and modern web tools to provide a simple way for people to get mental health help.

Doctorina platform has combined technologies like conversational AI, secure login systems, booking of appointments and administrative tools.

In Doctorina, the chatbot uses the Groq API and the Llama 3.3 70B language model to understand and respond to users in a specific way.

The chatbot can provide users with support and guidance.

Role-based workflow management is a key feature of Doctorina.

This means students, counselors and administrators have dashboards to communicate and manage tasks.

The study emphasized the increasing importance of AI in healthcare.

AI powered chat systems can provide support to make mental healthcare more accessible.

These systems can be particularly useful for students and those who are reluctant to seek traditional counseling due to stigma or lack of access.

The implementation process has shown that it is possible to integrate technologies like Doctorina into a system.

The researchers discovered that such a system can improve communication efficiency and provide support services in education and clinical settings.

The Doctorina system and AI-powered mental health tools can help fill healthcare needs.

The implementation process showed the practical feasibility of combining several technologies such as:

- React.js
- Node.js
- Express.js

- MongoDB
- JWT Authentication
- AI APIs
- Conversational Language Models

The modular system architecture also provides for maintainability and scalability for future growth.

The platform offers supportive mental wellness assistance, but the research acknowledges that AI systems cannot replace qualified psychologists or certified medical professionals. In mental healthcare settings, human oversight, ethical application and professional healthcare assistance still have an important role to play. The chatbot is designed to provide supportive guidance and improve accessibility, but not to conduct clinical diagnosis or psychiatric treatment.

The study also identified several important challenges relating to:

- Data privacy
- Ethical AI usage
- Model transparency
- Scalability
- External API dependency
- Real-time clinical validation

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