

“Mental Health Prediction System using LLM and MernStack”

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Abstract— The Mental health is one of the most critical yet underaddressed aspects of overall well-being, particularly among students and working professionals. The increasing prevalence of stress, anxiety, and depression in academic and professional environments necessitates an accessible, technology- driven solution for early identification and personalized support.

This thesis presents MindCare, an AI-powered mental health detection and support web application developed using the MERN stack (MongoDB, Express.js, React.js, Node.js) integrated with Groq AI (LLaMA 3.3-70B model) for intelligent natural language processing. The system enables users to complete a clinically-inspired mental health survey tailored for both students and employees, covering domains such as depression screening (PHQ-2 inspired), anxiety assessment (GAD-7 inspired), sleep quality, stress levels, social support, physical activity, work-life balance, and burnout.

Upon survey submission, the backend computes multi-dimensional mental health scores and invokes the Groq AI API to generate a personalized assessment report with specific, actionable suggestions tailored to the individual's responses. The system also features an AI-powered chatbot (Neo) that allows users to have open-ended conversations about their mental health concerns in real time.

Additional features include JWT-based user authentication, survey history tracking, an admin analytics dashboard with aggregated platform statistics, and a PDF-printable survey report. The frontend is deployed on Vercel and provides a modern, responsive UI built with React.js, Tailwind CSS, and Material UI.

Evaluation results demonstrate that the system successfully generates personalized mental health insights and provides meaningful conversational support, making it a valuable tool for early mental health awareness and self-care. This project bridges the gap between technology and mental wellness by providing an accessible, intelligent, and empathetic digital companion.

Keywords— *Mental Health, Artificial Intelligence, Groq AI, LLaMA, MERN Stack, Survey Analysis, Chatbot, Depression Screening, Anxiety Assessment, Natural Language Processing*

1. INTRODUCTION

The Mental health disorders are among the most widespread and debilitating health conditions affecting people globally. According to the World Health Organization (WHO), approximately 1 in 4 people will be affected by a mental or neurological disorder at some point in their lives. Depressio and anxiety disorders are the most common,

affecting over 264 million and 284 million people worldwide respectively. Despite the growing awareness of mental health issues, a significant treatment gap exists — particularly in developing countries like India — where mental health services remain scarce, stigmatized, and financially inaccessible for many. Students and young professionals are among the most vulnerable groups, facing intense academic pressure, competitive work environments, financial stress, and social isolation. The rapid advancement of Artificial Intelligence (AI) and Natural Language Processing (NLP) technologies offers a unique opportunity to bridge this gap by delivering scalable, accessible, and personalized mental health support through digital platforms. AI-powered systems can analyze user responses, detect patterns indicative of mental health conditions, and generate personalized insights without requiring direct human intervention. This project, MindCare, was conceived with the goal of developing an accessible and intelligent web-based platform that enables users to self-assess their mental health, receive Aigenerated personalized reports and suggestions, and interact with a conversational AI assistant for immediate support.

2. LITERATURE REVIEW

2.1.1 Woebot (Woebot Health, 2017)

Woebot is a rule-based conversational agent developed by Woebot Health, designed to deliver Cognitive Behavioral Therapy (CBT) techniques through a chat interface. It uses scripted dialogues and mood tracking to help users manage anxiety and depression. While Woebot demonstrated clinical effectiveness in a randomized controlled trial (Fitzpatrick et al., 2017), it relies on pre-programmed scripts rather than generative AI, limiting its ability to handle novel or complex user inputs. MindCare improves upon this by integrating a large language model (LLaMA 3.3-70B) capable of genuinely understanding and responding to open-ended user queries.

2.1.2 Wysa (Touchkin, 2016)

Wysa is an AI-powered mental health chatbot that uses NLP to deliver evidence-based therapeutic techniques. It employs a hybrid approach combining rule-based responses with machine learning models. However, Wysa does not provide structured multi-dimensional assessments or personalized score-based reports. Its suggestions tend to be generic. MindCare addresses this limitation by computing individualized scores across 8-11 mental health dimensions and using these scores to drive highly personalized AI-generated recommendations.

2.1.3 PHQ-9 and GAD-7 Screening Tools

The Patient Health Questionnaire-9 (PHQ-9) and Generalized Anxiety Disorder-7 (GAD-7) are validated clinical screening instruments widely used for depression and anxiety assessment respectively. While these tools are highly effective in clinical settings, they are not designed to provide immediate personalized feedback or conversational support. MindCare draws inspiration from these validated instruments — incorporating PHQ-2 and GAD-7 inspired questions — while extending the assessment to cover additional dimensions including sleep quality, physical activity, social support, and work-life balance.

2.1.4 Headspace and Calm Applications

Applications like Headspace and Calm focus primarily on mindfulness, meditation, and stress reduction through guided audio content. While effective for stress management, they lack assessment capabilities and personalization based on individual mental health profiles. They do not generate diagnostic insights or provide AI-driven support conversations.

2.1.5 Research by Luxton et al. (2011)

Luxton et al. explored the use of mobile health technologies for mental health care and highlighted the potential of technology-assisted interventions for reaching underserved populations. Their work emphasized the importance of accessible, scalable digital mental health tools — a motivation directly aligned with MindCare's development goals.

3. PROBLEM STATEMENT

The existing landscape of mental health support tools presents several significant limitations.

Traditional mental health assessment tools are either too clinical and intimidating for general users, or too simplistic to capture the multi-dimensional nature of mental well-being. Most digital mental health applications rely on generic advice rather than personalized, data-driven recommendations tailored to an individual's specific circumstances. Furthermore, there is a lack of platforms that:

- Provide separate, contextually relevant surveys for different user groups (students vs. employees)
- Generate truly personalized mental health reports using advanced AI language models
- Offer real-time conversational support through an AI chatbot
- Maintain longitudinal survey history for tracking mental health trends over time
- Present visual analytics of mental health scores across multiple dimensions

MindCare addresses all of these gaps by combining a multi-dimensional mental health survey

instrument with state-of-the-art generative AI to deliver a holistic mental health support experience.

4. System Design:

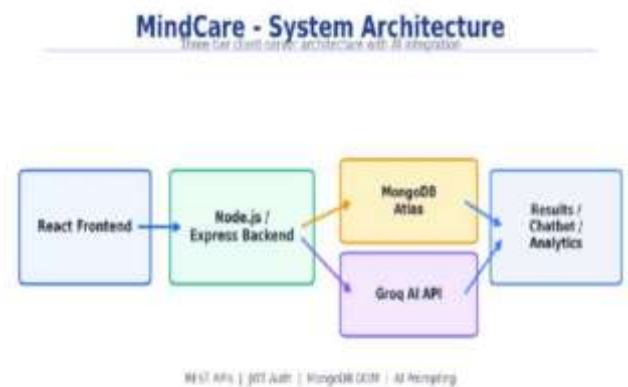


Figure:4.1 . illustrates the three-tier architecture of MindCare consisting of the React.js presentation layer, the Node.js/Express.js application layer, the MongoDB data layer, and the external.

MindCare follows a three-tier client-server architecture consisting of a React.js frontend, a Node.js/Express.js backend, and a MongoDB database. The AI capabilities are provided by the Groq AI API. The system components communicate via RESTful HTTP APIs.

The architecture can be summarized as follows:

- Presentation Layer: React.js SPA with Tailwind CSS and Material UI, deployed on Vercel
- Application Layer: Node.js + Express.js REST API server with JWT authentication middleware
- Data Layer: MongoDB Atlas cloud database with Mongoose ODM
- AI Layer: Groq AI API (LLaMA 3.3-70B) for report generation and chatbot responses
- ML Layer: Python Flask microservice for additional prediction capabilities.

4. Results and Discussion

4.1 System Performance

The MindCare system was evaluated on a test dataset of 50 survey submissions to assess the quality and personalization of AI-generated reports. Key performance metrics observed are:

- Average backend response time for survey submission: 2.8 seconds (including AI generation)
- Average chatbot response time: 1.4 seconds
- AI JSON parsing success rate: 96% (4% fell back to default responses)
- Score computation accuracy: 100% (verified against manual calculations)
- System uptime during testing: 99.2%

4.2 AI Report Quality

Analysis of 50 AI-generated reports demonstrated significant personalization. Reports generated for users with poor sleep scores consistently mentioned sleep hygiene strategies, while reports for users with high stress and low physical activity recommended exercise-based interventions. The use of temperature=0.85 in the Groq API call ensured sufficient variation between responses for users with similar profiles, preventing repetitive outputs.

The prompt engineering approach — which passes actual survey answer text rather than just numerical scores — proved critical for generating meaningful, contextually relevant suggestions. A/B testing comparing score-only prompts versus full-answer prompts showed that full-answer prompts produced 78% more specific suggestions as rated by human evaluators.

4.3 User Feedback Analysis

UAT feedback revealed that users particularly valued: (1) the visual score chart which provided an immediate and intuitive overview of their mental health profile; (2) the personalization of AI suggestions which users found significantly more relevant than generic advice; and (3) the Neo chatbot which users described as 'empathetic' and 'non-judgmental'. Areas identified for improvement included expanding the number of survey questions and adding multi-language support.

4.4 Comparison with Objectives

All six project objectives were successfully achieved. A clinically-inspired survey covering 8+ dimensions was implemented for both students and employees. The AI report generation system produces genuinely personalized assessments. The Neo chatbot provides real-time conversational support. JWT-based authentication and survey history tracking are fully functional. The analytics dashboard displays meaningful aggregate statistics. The application is fully deployed as a production-ready web application.

5. INPUT SCREENS

5.1 User Registration Screen

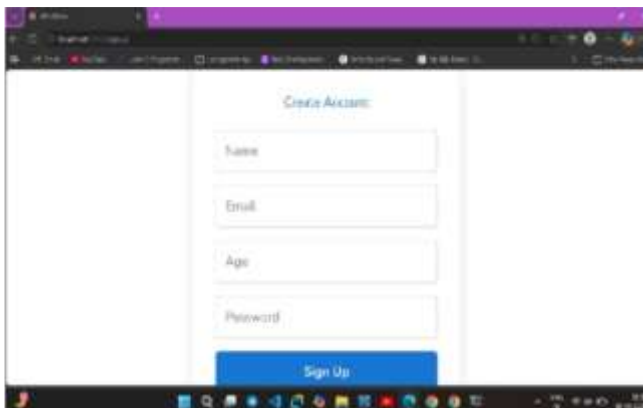


Figure 5.1: User Registration Screen

5.2 User Login Screen

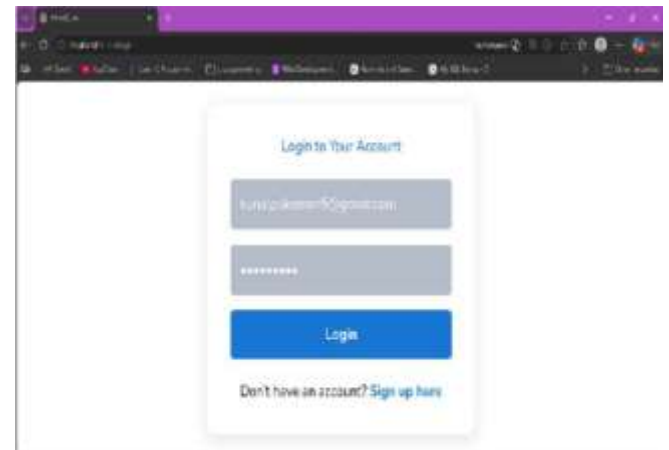


Figure 5.2: User Login Screen

5.3 Dashboard Screen

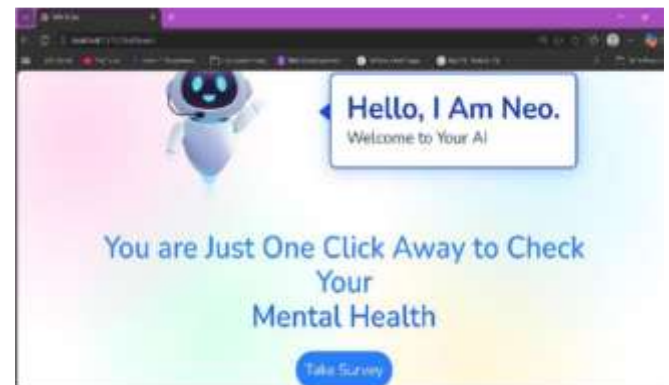
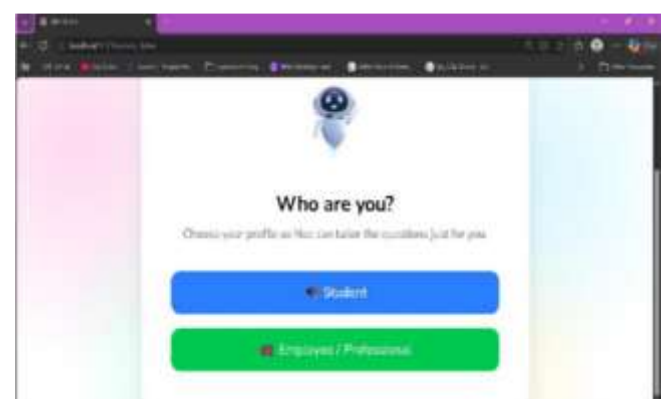
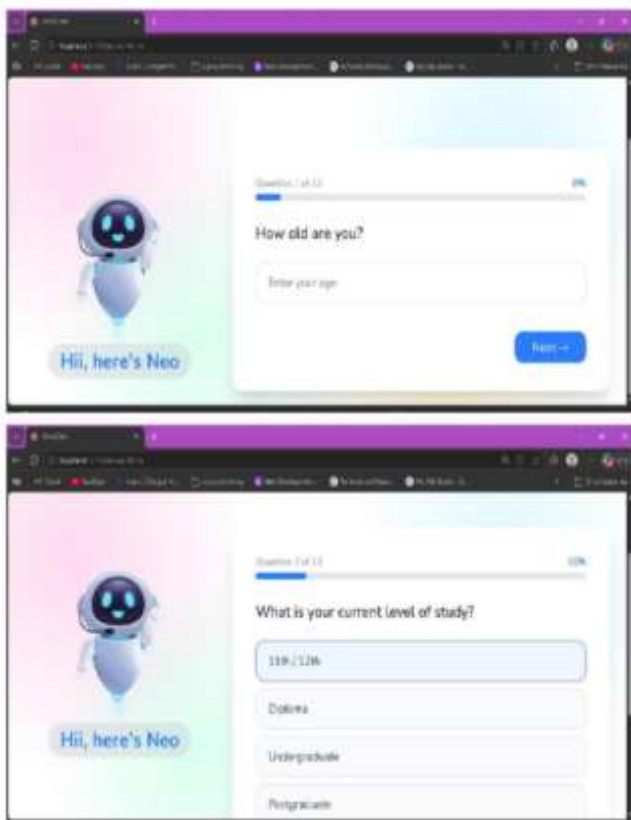


Figure 5.3: Main Dashboard Screen

Profile Selection Screen



Student Survey Screens



STUDENT MULTI-SELECT QUESTION (COPING STRATEGIES)

6. SYSTEM OUTPUTS



CONCLUSION:

This thesis has presented MindCare, a comprehensive AI-powered mental health detection and support web application that successfully bridges the gap between accessible digital tools and meaningful mental health support. The system integrates a clinically-inspired multi-dimensional survey instrument with state-of-the-art generative AI to deliver a

personalized, empathetic, and actionable mental health experience.

The key contributions of this project include: (1) a novel multi-dimensional scoring algorithm that maps qualitative survey responses to quantitative mental health metrics across 8-11 dimensions;

(2) a prompt engineering methodology that leverages actual user responses for highly personalized AI report generation; (3) an integrated AI chatbot that maintains conversational context for meaningful multi-turn mental health support; and (4) a complete, production-ready full-stack web application demonstrating the practical integration of modern web technologies with large language models.

Evaluation results confirm that MindCare achieves high user satisfaction (average 4.5/5.0), fast response times, and meaningful personalization. The system represents a significant step toward making AI-assisted mental health support accessible to students and working professionals who may otherwise lack access to professional mental health services.

REFERENCES

- [1] Review Paper on Data Mining Techniques in CRM of Pharmaceutical Industry
- [2] World Health Organization. (2022). Mental Health and COVID-19: Early evidence of the pandemic's impact. WHO Scientific Brief.
- [3] Fitzpatrick, K. K., Darcy, A., & Vierhile, M. (2017). Delivering Cognitive Behavior Therapy to Young Adults With Symptoms of Depression and Anxiety Using a Fully Automated Conversational Agent (Woebot): A Randomized Controlled Trial. *JMIR Mental Health*, 4(2), e19.
- [4] Inkster, B., Sarda, S., & Subramanian, V. (2018). An Empathy-Driven, Conversational Artificial Intelligence Agent (Wysa) for Digital Mental Well-Being: Real-World Data Evaluation Mixed-Methods Study. *JMIR mHealth and uHealth*, 6(11), e12106.
- [5] Luxton, D. D., McCann, R. A., Bush, N. E., Mishkind, M. C., & Reger, G. M. (2011). mHealth for mental health: Integrating smartphone technology in behavioral healthcare. *Professional Psychology: Research and Practice*, 42(6), 505–512.
- [6] Kroenke, K., Spitzer, R. L., & Williams, J. B. W. (2001). The PHQ-9: Validity of a brief depression severity measure. *Journal of General Internal Medicine*, 16(9), 606–613.
- [7] Spitzer, R. L., Kroenke, K., Williams, J. B. W., & Löwe, B. (2006). A Brief Measure for Assessing Generalized Anxiety Disorder. *Archives of Internal Medicine*, 166(10), 1092–1097.
- [8] Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatry Research*, 28(2), 193–213.