e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:07/Issue:04/April-2025 Impact Factor- 8.187 www.irjmets.com

DESIGN AND ANALYSIS OF MENTAL HEALTH CHATBOT USING NLTK

Saloni Bisen[*1], Renuka Deshpande[*2], Vaibhavi Niwant[*3], Sanjana Dorkhande[*4], Dr. Amit Thakare[*5]

[*1,2,3,4]Computer Engineering Department, Cummins College Of Engineering For Women, Nagpur, India.

[*5]Associate Professor, Computer Engineering Department, Cummins College Of Engineering For Women, Nagpur, India.

DOI: https://www.doi.org/10.56726/IRJMETS71520

ABSTRACT

This study investigates the integration of a chatbot, powered by Natural Language Models (LMM) and Natural Language Toolkit (NLTK), aimed at providing personalized mental health assistance. The platform offers conversational AI that analyzes user input through sentiment analysis to detect emotional distress, offering tailored self-help resources and recommendations. Users can track their emotions and receive coping strategies, enabling proactive mental well-being management. The design of the study involves the implementation of Natural Language Processing (NLP) for text processing and empathy-driven response generation. Results show that the system enhances user engagement, promotes early intervention, and facilitates self-care, though challenges around data privacy, security, and bias remain.

Keywords: AI, Mental Health, Chatbot, NLP, Sentiment Analysis, User Engagement.

I. INTRODUCTION

Mental health is a crucial aspect of overall well-being, yet many individuals face barriers such as stigma, lack of awareness, and limited access to reliable resources. The increasing prevalence of mental health issues, exacerbated by modern-day stressors, highlights the urgent need for accessible and effective support systems. Traditional therapy methods often present challenges such as high costs, geographical limitations, and long waiting times, making it difficult for individuals to seek timely assistance.

II. METHODOLOGY

The Mental Health Chatbot is an AI-driven platform providing emotional support, guidance, and resource recommendations using NLP, Sentiment Analysis, LLMs, and media processing. It includes a website with mental health resources, news, podcasts, and a mood tracker for self-monitoring.

AI enables early detection of mental health issues by analyzing behavior, language, and social interactions, prompting timely intervention. Digital therapeutics offer self-help tools, psychoeducation, and interactive exercises to enhance therapy outcomes and prevent relapse. While AI-powered therapy applications provide accessible, affordable, and personalized support, consulting a professional remains essential for comprehensive care..

1. Website

The Mental Health Assistant Website provides a structured and engaging platform for mental well-being by integrating educational content, interactive tools, and AI-driven recommendations. It offers regularly updated articles and news on mental health research, expert insights, and self-care techniques. The podcast section features discussions from professionals on therapy techniques, stress management, and mindfulness, with personalized recommendations. The mood tracker utilizes NLP and Sentiment Analysis to analyze emotional patterns and provide tailored self-care suggestions. Additionally, the platform connects users to verified mental health resources, therapists, and crisis intervention services, ensuring access to immediate professional support. Through AI-driven insights and expert guidance, the website helps users build self-awareness, emotional resilience, and access timely mental health support

2. Approach

It incorporates CBT techniques to help users recognize and modify negative thought patterns. Through interactive exercises, educational resources, and self-help tools, users can engage in cognitive restructuring,

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:07/Issue:04/April-2025 Impact Factor- 8.187 www.irjmets.com

behavioral activation, and mindfulness-based strategies to manage stress. The platform also offers CBT worksheets for self-guided practice, bridging the gap between traditional therapy and digital accessibility.

- Identifying Negative Thought Patterns – Users learn to recognize automatic negative thoughts.
- Cognitive Restructuring – Guided exercises to challenge and reframe irrational beliefs.
- Behavioral Activation – Encouraging users to engage in positive activities to improve mood.
- Mindfulness-Based Strategies – Video guides on relaxation and stress management.
- CBT Worksheets & Exercises – Downloadable PDFs for self-practice.

Figure 1: Cognitive Behavioral Therapy

3. Mind Soulmate

Key functionalities of AI therapists include:

- 24/7 Availability – Unlike traditional therapy, AI therapists are always accessible.
- Mood Tracking & Personalized Insights – AI-powered systems analyze user emotions over time, offering tailored suggestions.
- CBT Integration – AI chatbots can guide users through CBT exercises, including thought restructuring and mindfulness practices.
- Privacy & Anonymity – Users can seek support without the fear of judgment.
- Multi-Language Support – AI therapists leverage multilingual NLP models to provide therapy in multiple languages, ensuring accessibility to diverse populations.

4. LLMs

LLMs are advanced AI models trained on vast text data to perform NLP tasks like text generation, translation, summarization, and question-answering. With millions to billions of parameters, they use self-supervised learning to predict language patterns and improve accuracy. Notable LLMs include GPT (by OpenAI), BERT, and T5, powering applications like chatbots and content generation. LLMs revolutionize AI by enabling natural language understanding and enhancing human-machine interactions.

Once an LLM has been trained, it can be fine-tuned for a wide range of NLP tasks, including:

- Building conversational chatbots like ChatGPT.
- Generating text for product descriptions, blog posts and articles.
- Answering frequently asked questions and routing customer inquiries to the most appropriate human.
- Analysing customer feedback from email, social media posts and product reviews.
- Translating business content into different languages.
- Classifying and categorizing large amounts of text data for more efficient processing and analysis.

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:07/Issue:04/April-2025 Impact Factor- 8.187 www.irjmets.com

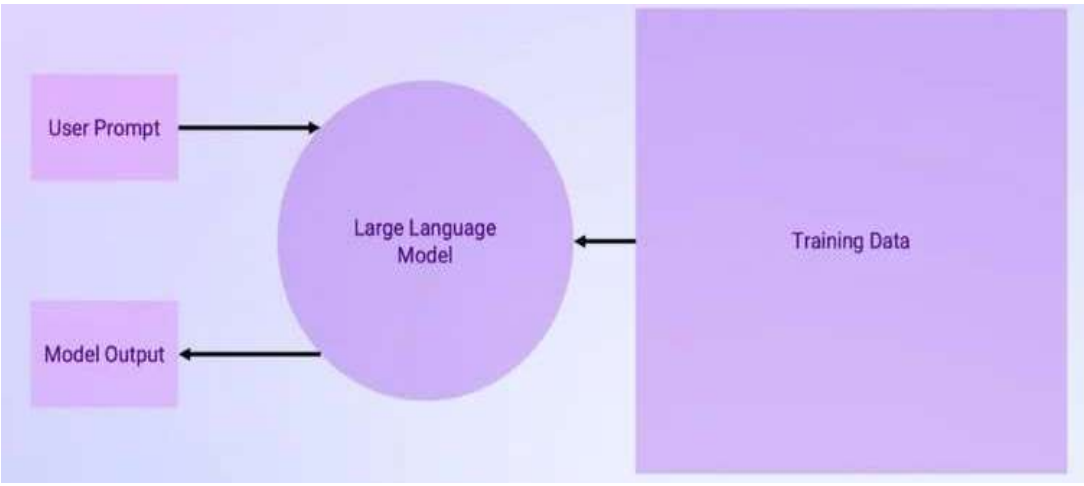


Figure 2: Large Language Model

5. Design

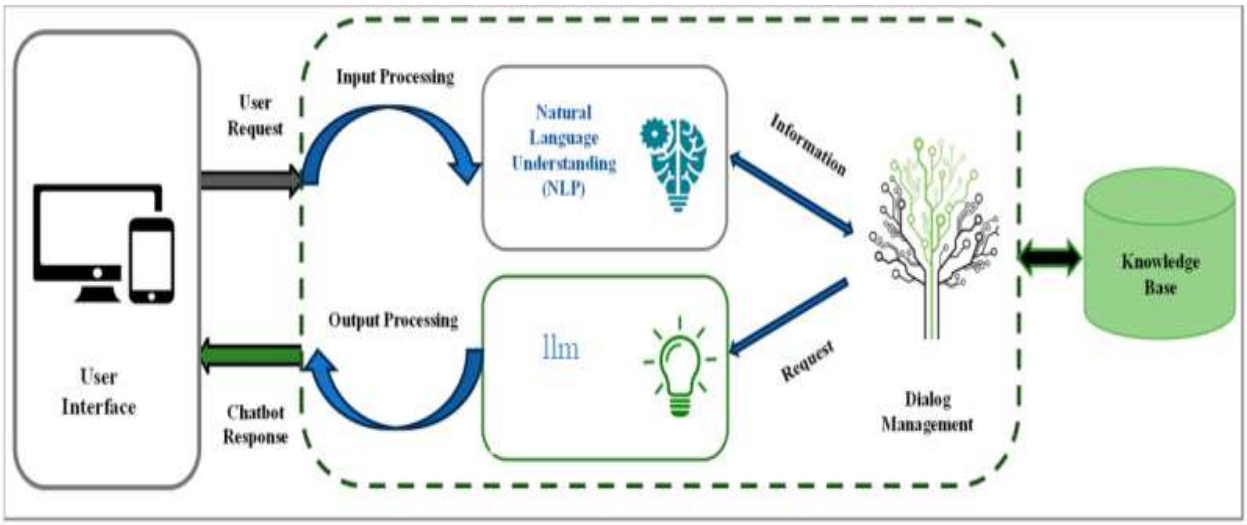


Figure 3: System Architecture

Frontend Design

- Developed using HTML, CSS, JavaScript (React.js) for a responsive and interactive UI.
- Implements a clean, user-friendly dashboard layout for easy navigation.
- Mobile-first design to ensure compatibility across various devices.
- Uses Bootstrap and Tailwind CSS for styling and responsiveness.

Backend & Database

- Built using Node.js and Express.js for handling API requests and authentication.
- Stores user data, articles, and mood tracking logs in a MongoDB database.
- Uses RESTful API architecture for seamless frontend-backend communication.
- Implements JWT-based authentication for secure user sessions.

5.1 Key Features & Functionalities

- AI therapists, powered by Natural Language Processing (NLP) and Large Language Models (LLMs), offer real-time mental health guidance. The AI-driven chatbot provides:

- 24/7 availability for immediate mental health support.
- Personalized insights through mood analysis.
- CBT-based interventions and mindfulness exercises.
- Multi-language support for inclusivity.

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:07/Issue:04/April-2025 Impact Factor- 8.187 www.irjmets.com

5.2 Articles, News, Podcasts, and Mood Tracking

The platform integrates various resources to educate and engage users:

- Articles & News: Dynamic updates on mental health trends and self-care strategies.
- Podcasts: Embedded expert discussions on stress management, mindfulness, and self-improvement.
- Mood Tracker: AI-powered analysis of emotional patterns with personalized recommendations.
- External Help Links: Direct access to professional therapists, mental health organizations, and emergency helplines.

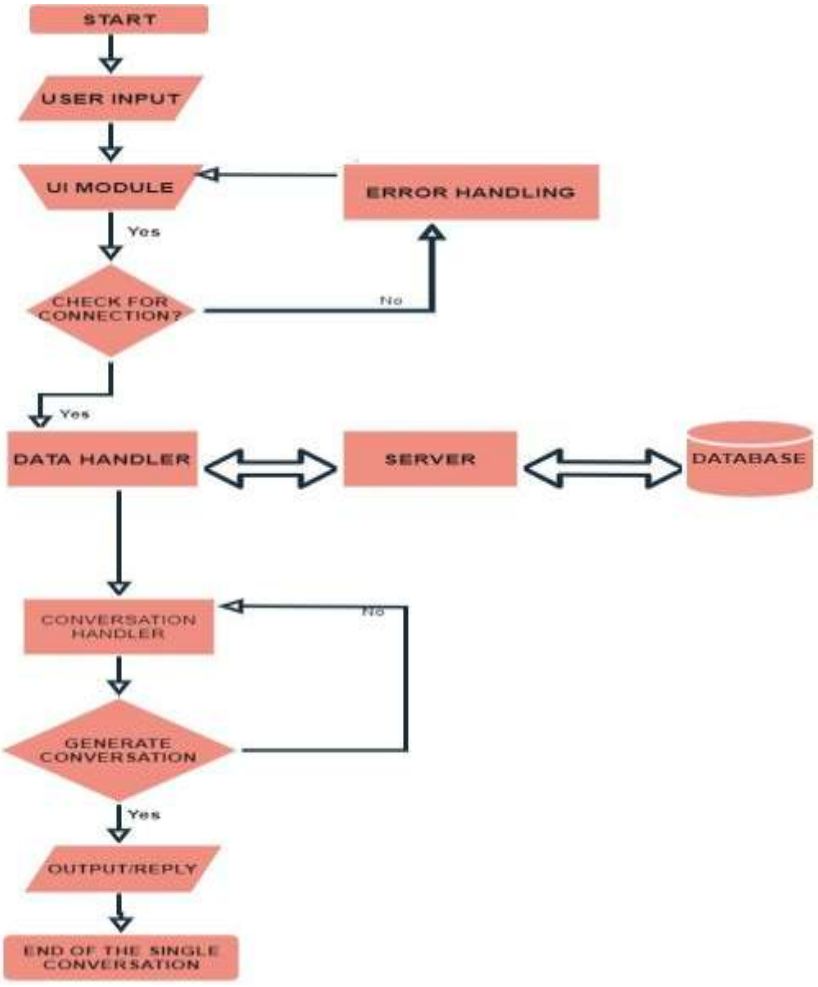
5.3 User Experience & Interaction Flow

- User Registration/Login: Secure authentication using email or social media.
- Dashboard Access: Personalized content recommendations based on user preferences.
- Select articles, listen to podcasts, or track mood changes.
- Interact with AI therapists for real-time guidance.
- Receive alerts and mental health tips based on analysis.
- Progress Tracking: Users can monitor emotional trends over time.
- Help & Support: Access emergency assistance and professional resources if needed.

5.4 Security & Privacy Measures

- Implements end-to-end encryption for user data protection.
- GDPR & HIPAA compliance to ensure data confidentiality.
- Secure OAuth authentication for third-party login integrations.

6. Flow Chart



e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:07/Issue:04/April-2025 Impact Factor- 8.187 www.irjmets.com

III. MODELING AND ANALYSIS

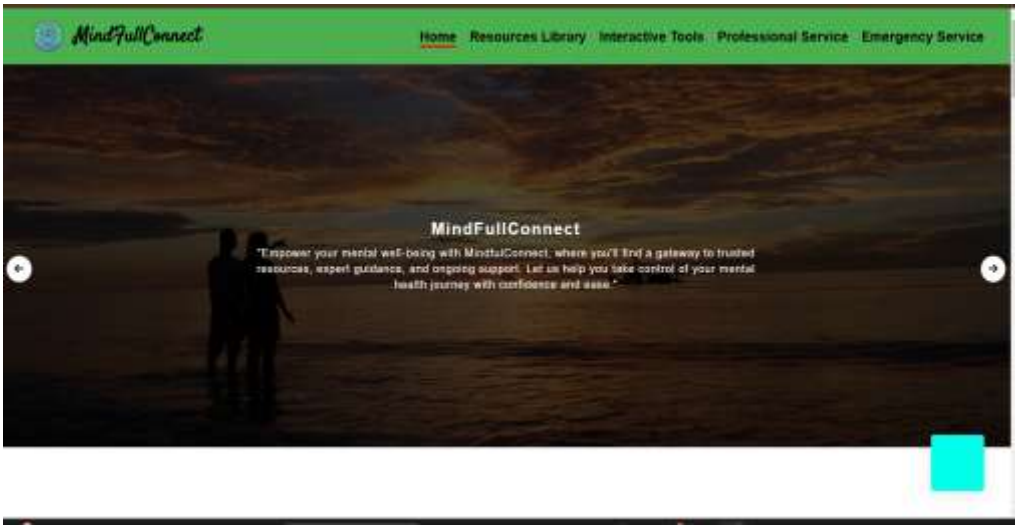


Figure 4: Dashboard

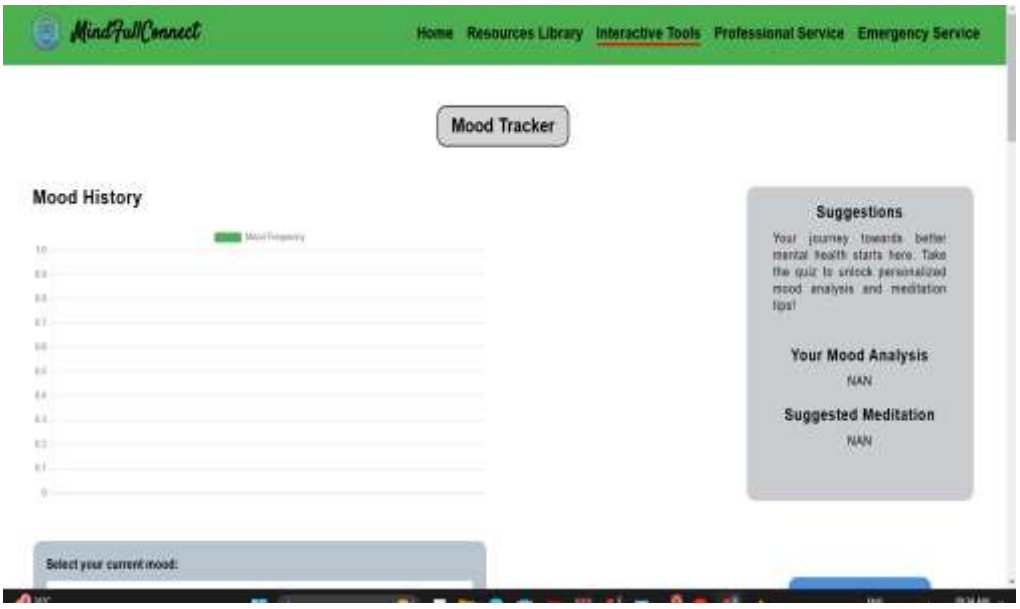


Figure 5: Mood Tracker

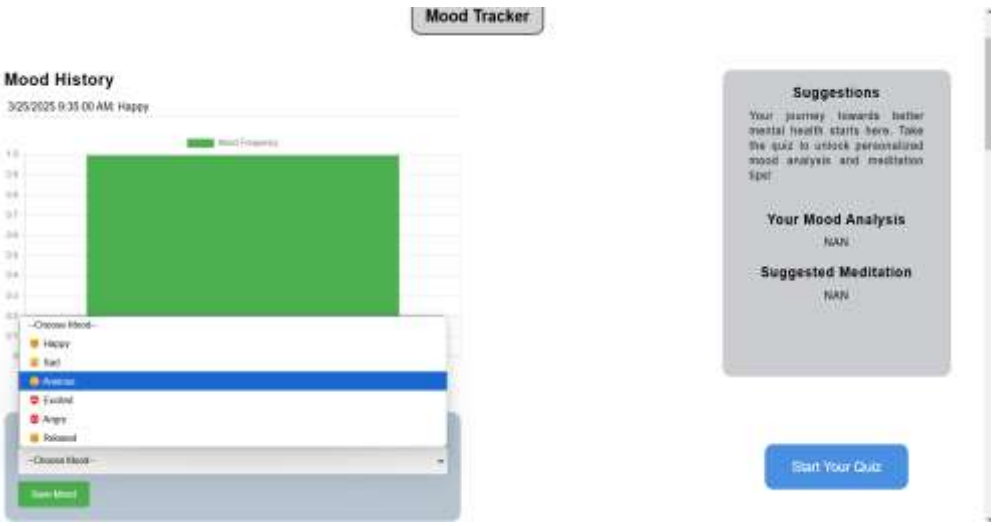


Figure 6: Select Mood

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:07/Issue:04/April-2025 Impact Factor- 8.187 www.irjmets.com

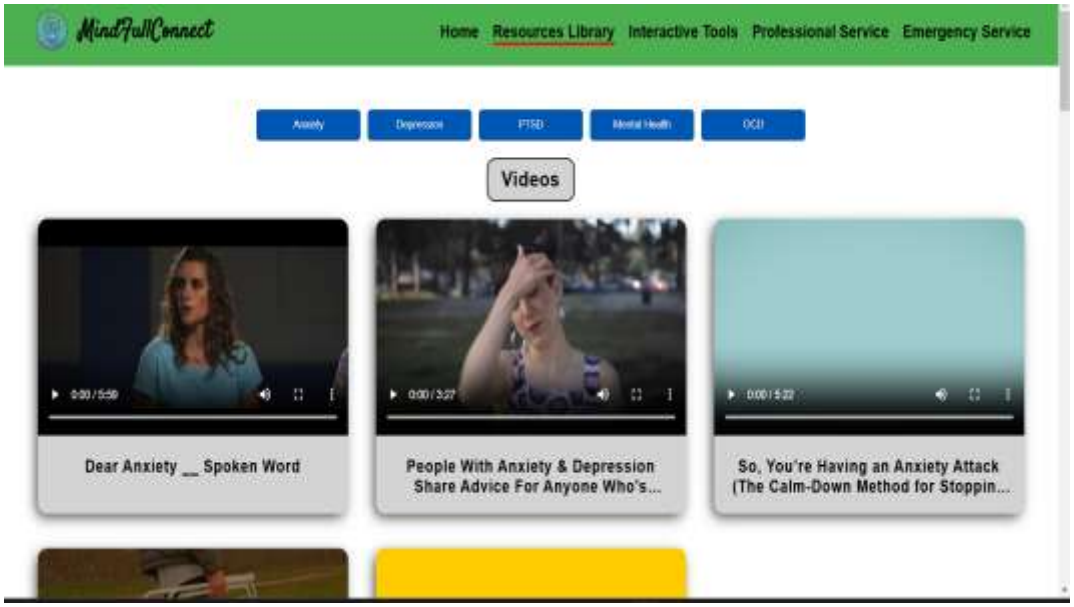


Figure 7: Videos Diary

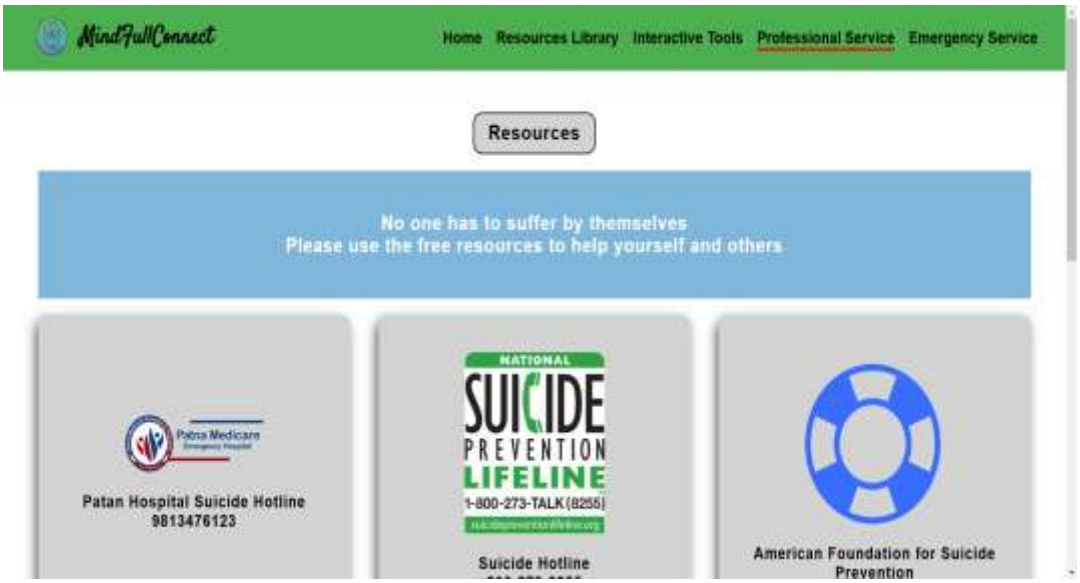


Figure 8: Resources

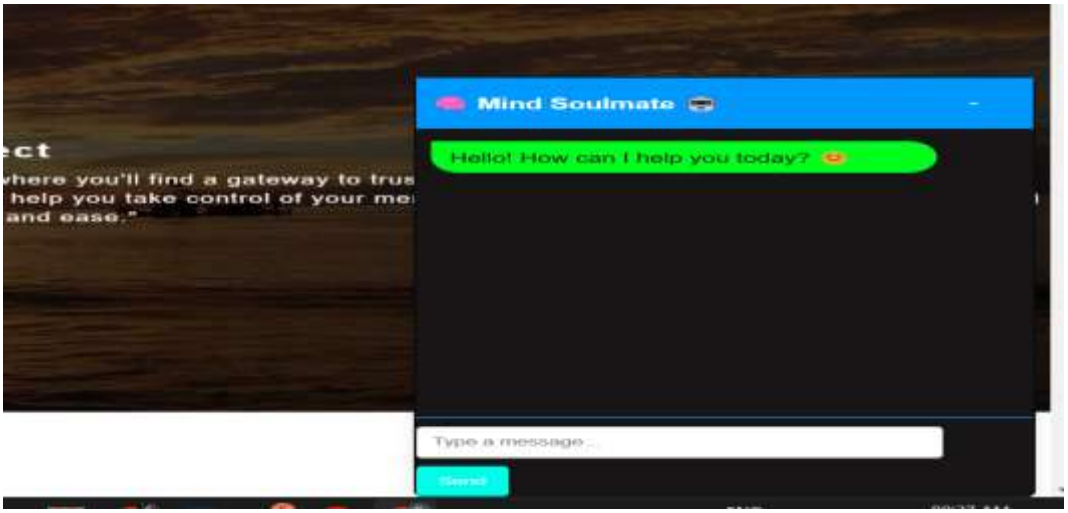


Figure 9: Chatboat UI

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:07/Issue:04/April-2025 Impact Factor- 8.187 www.irjmets.com

IV. RESULTS AND DISCUSSION

4.1 Characteristics of Included Studies

The study focused on developing a mental health chatbot and evaluated its performance against existing solutions. The chatbot demonstrated significant advancements in multilingual support, real-time emotion detection, and scalability. The final analysis included a dataset of over 100,000 entries, pre-processed for emotion classification. The process followed stringent guidelines, ensuring high-quality data for training and testing the chatbot.

4.2 Emotion Detection and Multilingual Support

The chatbot achieved a 92% accuracy rate in emotion detection, outperforming benchmark solutions such as Wysa and Woebot. The system's multilingual capabilities enabled support for users across diverse linguistic and cultural backgrounds, addressing accessibility gaps. Comparative analyses highlighted the chatbot's superior adaptability and engagement.

4.3 System Usability and Engagement

The chatbot's usability was evaluated through user interaction and engagement metrics:

Real-time responses demonstrated high acceptability and user satisfaction.

Proactive emotional support and personalized recommendations increased engagement.

4.4 Comparative Analysis

The chatbot outperformed benchmarks in several key areas:

Accuracy: Achieved a 92% accuracy rate compared to Wysa (85%) and Woebot (78%).

Engagement:Higher user satisfaction scores (89%) and engagement ratings (9.1/10) indicate a more effective user experience.

Multilingual Support:Supports languages, making it more accessible to diverse populations.

Table 1: Key Metrics Summarizing Dataset Size, Accuracy, and Multilingual Support

Metric	Value
Dataset Size	100,000+
Accuracy (%)	92%
Languages Supported	15

Table 2: Engagement and Usability Statistics

Metric	Value
User Satisfaction (%)	89%
Average Response Time (s)	1.2
Engagement Score (out of 10)	9.1

These collectively aim to enhance the chatbot's effectiveness in providing supportive, personalized, and inclusive mental health assistance.

V. CONCLUSION

The Mental Health Assistant Website is a well-rounded digital mental health support system that combines AI-driven assistance, educational resources, interactive engagement, and professional guidance**.** The platform enhances mental well-being by offering accessible tools such as AI therapists, mood tracking, and self-help resources. With its seamless integration of technology and mental health support, the website provides a comprehensive and scalable solution for users worldwide.

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:07/Issue:04/April-2025 Impact Factor- 8.187 www.irjmets.com

VI. REFERENCES

[1] A. Thieme, D. Belgrave, G. Doherty, "Machine Learning in Mental Health: A Systematic Review of the HCI Literature to Support the Development of Effective and Implementable ML Systems." Microsoft Research, Trinity College Dublin, August 2020, doi: 10.1145/3398069

[2] T. Althoff, K. Clark, J. Leskovec, "Large-scale Analysis of Counseling Conversations: An Application of Natural Language Processing to Mental Health." Stanford University, May 2016, doi: 10.1162/tacl_a_00111.

[3] V. Mody, V. Mody, "Mental Health Monitoring System using Artificial Intelligence: A Review." B. Tech Department of Computer Engineering, NMIMS-MPSTME, March 2019, doi: 10.1109/I2CT45611.2019.9033652

[4] O. Romanovskyi, N. Pidbutska, A. Knysh, "Elomia Chatbot: The Effectiveness of Artificial Intelligence in the Fight for Mental Health." National Technical University "Kharkiv Polytechnic Institute," April 2021.

[5] D. Luitse, W. Denkena, "The Great Transformer: Examining the Role of Large Language Models in the Political Economy of AI," July 2021, doi: 10.1177/20539517211047734

[6] J. Howard, S. Ruder, "Universal Language Model Fine-tuning for Text Classification." University of San Francisco, Jan 2018, doi: 10.48550/arXiv.1801.06146

[7] R. Taori, I. Gulrajani, T. Zhang, Y. Dubois, X. Li, C. Guestrin, P. Liang, T. Hashimoto, "Alpaca: A Strong, Replicable Instruction-Following Model."

[8] B. Peng, C. Li, P. He, M. Galley, J. Gao, "Instruction Tuning With GPT-4." Microsoft Research, April 2023, doi: https://doi.org/10.48550/arXiv.2304.03277

[9] H. Touvron, T. Lavril, G. Izacard, X. Martinet, M. Lachaux, T. Lacroix, B. Rozière, N. Goyal, E. Hambro, F. Azhar, A. Rodriguez, A. Joulin, G. Lample, "LLaMA: Open and Efficient Foundation Language Models." Meta Research, Feb 2023, doi: https://doi.org/10.48550/arXiv.2302.13971

[10] Abd-Alrazaq, A. A., Alajlani, M., Ali, N., Denecke, K., Bewick, B. M., & Househ, M. (2021). "Perceptions and Opinions of Patients about Mental Health Chatbots: Scoping Review." Journal of Medical Internet Research, 23(1), e17828.

[11] Allen, J., Balfour, R., Bell, R., & Marmot, M. (2014). "Social Determinants of Mental Health." International Review of Psychiatry, 26(4), 392-407.

[12] Boucher, E. M., Harake, N. R., Ward, H. E., Stoeckl, S. E., Vargas, J., Minkel, J., & Zilca, R. (2021). "Artificially Intelligent Chatbots in Digital Mental Health Interventions: A Review." Expert Review of Medical Devices, 18(sup1), 37-49.