



Artificial Intelligence-Based Chatbot for Student Mental Health Support

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How to cite this paper: Oghenekaro, L.U. and Okoro, C.O. (2024) Artificial Intelligence-Based Chatbot for Student Mental Health Support. *Open Access Library Journal*, 11: e111511.

<https://doi.org/10.4236/oalib.1111511>

Received: March 30, 2024

Accepted: May 18, 2024

Published: May 21, 2024

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Abstract

This research addresses the urgent concern of student mental health by innovatively implementing an efficacious chatbot intervention. The primary focus is on delivering accessible and personalized support, adopting a mixed-methods approach that combines quantitative insights from pre-intervention and post-intervention mental health assessments with qualitative perspectives gathered through user interviews. The dataset, sourced from Kaggle and GitHub, contains authentic conversations between healthcare providers and patients, grounding the project in real-world scenarios. Leveraging Visual Studio Code, ReactJS, Vite, SCSS, and Dido for chatbot training, keyframes are strategically applied to integrate these technological components seamlessly. Data preprocessing involves a meticulous curation process, emphasizing crucial attributes for addressing student mental well-being effectively. The resultant metrics encompass comprehensive user engagement data, pre- and post-intervention mental health scores, and valuable qualitative insights. This project stands out for its user-centric design, which makes use of cutting-edge technologies to produce a platform that is welcoming and stigma-free. The final objective is to significantly improve student mental health support, which will represent a breakthrough in this field.

Subject Areas

Computer Science, Data Science

Keywords

Chatbot, Stigma, Healthcare, Mental Health, Cognitive Behavioral Therapy

1. Introduction

In recent years, there has been growing interest in leveraging chatbot technology to support students' healthcare and well-being. A chatbot is a computer program

that copies human communication by using natural language processing to deliver information, carry out activities, and interact with users. According to [1], traditional counseling clinics don't do enough to improve students' mental health. Schools use cutting-edge techniques, including telehealth, group therapy, and peer counseling. By acting as "first responders", professors encourage the early detection of suffering. Chatbots, with their ability to provide personalized and accessible support, have the potential to revolutionize the way students access mental health resources and receive guidance on various health-related concerns.

One area of focus is student mental health support. College and university campuses often face challenges in providing timely and adequate mental health services to their students due to limited resources and high demand. Chatbots can fill this gap by offering immediate support, 24/7 availability, and a non-judgmental environment for students to express their concerns. These chatbots can provide information on mental health resources and coping strategies and even offer basic counseling techniques. Another aspect is the integration of chatbots into student healthcare systems. By incorporating chatbots into existing healthcare platforms, students can access medical information, schedule appointments, and receive reminders for medication or follow-up visits.

In [2], an AI pioneer created the ELIZA psychotherapist chatbot in the 1960s. He noticed that although it was praised as a success, people were interacting with it as though it was a real therapist, which raised questions about its actual therapeutic effectiveness.

Furthermore, the use of chatbots in student healthcare has the potential to enhance accessibility and support for students greatly. Through their availability, personalized interactions, and integration into existing systems, chatbots can play a significant role in promoting student well-being. Further research and development in this field will continue to refine and improve the effectiveness of chatbots in student healthcare.

The rising mental health crisis among students, with over 60% feeling overwhelmed and nearly 46% experiencing difficulty functioning due to depression, underscores the urgency for effective interventions [3]. Existing chatbots, while addressing the issue, often lack efficacy. Barriers like limited availability, cost, and stigma hinder students from seeking help, possibly made worse by a lack of awareness of available resources.

This important initiative improves human connections across sectors by addressing the growing need for AI-powered conversational structures. It focuses on mental health care in particular, breaking down barriers using a chatbot that is available around the clock, battling stigma, getting beyond time limits, and offering tailored help for a range of student requirements.

This research extends [4] work, by developing a user-friendly interface with ReactJs and Vite, integrating a Dido-trained chatbot for confidential mental health support. It aims to enhance accessibility and assess the chatbot's impact on student well-being through conversation analysis, user engagement data, and pre- and

post-intervention mental health evaluations.

[5] analyzes language and persona impact on chatbot outcomes, addressing efficacy, usability, and user confidence. Drawbacks include informal language in online therapy and user skepticism. [6] extracts keywords from sentences, scoring and comparing them for user queries. Technology's transformative role in healthcare, as highlighted in various sources (Peachyessay, Ivory Research, Wikipedia), emphasizes improved patient care, enhanced health literacy through chatbots, and the challenge of integrating new technologies into existing healthcare systems. [7] outlines obstacles, including cost reduction, privacy concerns, and training programs for efficient technology use by healthcare professionals.

[8] explores the use of Conversational Interfaces (CIs) in occupational health consultations, implementing a web-based information dashboard and a chatbot assistant for real-time recommendations. Two system designs, on-demand and proactive chatbot interactions were implemented. Limitations include a single round of tests with simulated medical cases and a small participant sample, making the impact on long-term consultations unclear.

In [9], an intelligent virtual assistant was designed to engage with patients in natural language, provide medical advice, manage medications, and track health metrics. The system allows users to create health profiles, describe symptoms, find doctors, and schedule appointments. Future enhancements aim to improve the Symptom Checker module by including details on disease rarity and offering automatic dietary and exercise recommendations based on the user's medical history.

1.1. Importance of Mental Health Support for Students

The integration of technology into the healthcare industry, as highlighted by [10] and [11], has significantly improved patient outcomes and saved lives. Access to medical information and data has increased, leading to better patient outcomes and higher revenue for profit-focused healthcare organizations. [11] notes that healthcare organizations utilize technology to monitor patient progress, store data, and enhance overall outcomes. However, this technological shift brings new responsibilities for medical practitioners, requiring proficiency in both clinical skills and technology, posing a challenge for some.

Several technologies have been employed in healthcare, including Nanohealth for targeted medication delivery, personalized healthcare based on genetic information, and diagnostic equipment such as X-rays and CT scans [10] [12]. Information technology, encompassing electronic health records and telemedicine, further enhances access to medical information [10].

Challenges in integrating disruptive technologies, which significantly advance previous versions, are acknowledged [13]. Overcoming these challenges requires addressing production costs, selling prices, privacy, and security issues, along with implementing effective training programs for healthcare professionals [13]. The

healthcare sector faces ongoing transformations, balancing the benefits of technology with the complexities of integration.

1.2. Examination of Chatbots in Student Mental Health Support

Chatbots, while not replacing real specialists, are crucial for student mental health, offering anonymity, privacy, and 24/7 availability. [14] explored their role in delivering CBT.

Cognitive Behavioral Therapy (CBT), a widely used psychological method, addresses disorders by altering thinking and behavior patterns. Traditionally delivered by professionals, chatbots are increasingly providing CBT-based support, ensuring students have 24/7 access to mental health assistance. Chatbots have emerged as valuable tools supporting Cognitive Behavioral Therapy (CBT) in mental health. Developed in collaboration with psychologists and therapists, these chatbots engage students in CBT sessions, addressing distorted thinking and promoting emotional expression. They operate 24/7, offering accessibility and privacy, allowing students to express emotions without judgment. While not replacing human therapists, chatbots serve as essential initial support, enhancing students' well-being. In a study by [15], a randomized controlled trial assessed a chatbot named Shim delivering positive psychology and CBT techniques to smartphones. Engaging actively with the chatbot positively impacted psychological well-being and reduced perceived stress, emphasizing its effectiveness. The study highlighted the chatbot's acceptability and accessibility, with approximately 79% of participants actively engaging during the 2-week intervention. Qualitative data revealed the chatbot's perceived relationship formation, human-like advice imitation, and role as a self-reflection moderator, showcasing its ability to provide personalized interactions. Despite challenges like low adherence, the study concludes that chatbots, offering scalable and cost-effective therapies, hold great promise for supporting students' mental health across diverse populations.

1.3. Existing Chatbot Applications in Student Healthcare and Their Impact

AI-driven chatbots play a vital role in student healthcare, offering accessibility and personalized support. Key examples include Woebot, Ellie, and Tess, each serving distinct mental health needs.

Woebot: [4] shared her experience with Woebot, an AI-powered chatbot providing Cognitive Behavioral Therapy (CBT). Woebot engages users in conversations addressing mental health issues, employing CBT principles to guide them through identifying problematic thought patterns. While praised for accessibility and instructional courses, limitations include occasional conversational restrictions.

Ellie: Developed by the Institute for Creative Technologies, Ellie assists University of Southern California students in managing mental health issues. Ellie

evaluates emotional states through facial, body, and speech recognition, and screening for disorders like PTSD and anxiety. AI-Therapy and SIMCOACH are two computer-assisted therapy systems that improve conventional therapy by providing specific treatment plans and screening tools for disorders. They support therapy and encourage consumers to get help [16].

Tess: Developed by X2 AI, Tess serves dual roles as a sexual health educator at the University of California, Berkeley, and a mental health support for caregivers [17]. Tess prioritizes accessibility, offering timely assistance to caregivers and acting as a supplementary mental health resource alongside traditional therapy.

These chatbots demonstrate the potential of AI in addressing mental health challenges among students, offering immediate support, personalized interactions, and accessibility. While they do not replace human therapists, they serve as valuable allies, providing users with tools for self-improvement and mental health support.

1.4. Analysis of Therapeutic Strategies Applicable to Chatbot Design

In the realm of mental health support, the integration of Cognitive-Behavioral Therapy (CBT) principles and empathetic communication into chatbot design emerges as a pivotal strategy. CBT, a well-established approach for addressing mental health concerns, involves recognizing and altering harmful thought patterns. The study by [18] underscores the significance of incorporating CBT principles into chatbot design, emphasizing the role of questioning distorted views and promoting self-reflection. This integration not only advances cognitive restructuring but also fosters a therapeutic dialogue, enhancing users' cognitive and emotional well-being. Therapeutic Interactive Conversational Agents (TICAs), highlighted in Psychiatric Times, showcase the potential of chatbots in psychiatric education by providing CBT-based therapeutic interactions. TICAs offer a flexible tool for mental health care, allowing customization for teaching various CBT techniques.

Empathetic communication, a cornerstone of therapeutic interaction, is explored in [19], stressing the importance of morally and empathetically designed chatbots for mental health assistance. The Journal of Medical Internet Research reinforces the value of empathetic communication in virtual healthcare interactions, underscoring its positive impact on patient outcomes and satisfaction.

In essence, combining CBT principles and empathetic communication in chatbot design is essential for elevating their therapeutic efficacy in mental health support applications, offering personalized and empathetic interactions to users seeking assistance.

2. Materials and Methods

This creative approach to student mental health uses a chatbot trained with the best responses from datasets via Diddo training. The chatbot incorporates in-

formation and specific support for mental health issues. Most importantly, user-friendly interaction is guaranteed by the ReactJs and Vite front end of the system.

With an easy-to-use interface that offers secure login and customization choices, students can simply get mental health support, improving their overall experience. Potential hazards include privacy worries and technological difficulties, but the system's advantages—a private platform, round-the-clock support, and enhanced accessibility—have a big impact on students' well-being.

A smooth frontend interface, high-quality datasets, and chatbot training are essential materials for the system's ability to help students with their mental health.

As for the method, the proposed system adheres to a thorough design that describes the backend operations and user interface, as shown in **Figure 1**. The ReactJS and Vite-based user interface offer safe login, registration, personalization, and a homepage with chat capability.

Through the use of Diddo integration, the Language Understanding-Analysis Center processes user requests and gathers contextual data and intent. At the same time, information retrieved by the Data Sources component from GitHub and Kaggle is analyzed and assessed for appropriate responses.

The conversation management center filters and processes user requests alongside relevant data, ensuring a streamlined generation of user-desired responses. The system emphasizes user-friendly features, including secure access, personalization options, and an intuitive chat interface. Diddo facilitates chatbot creation and training using Kaggle and GitHub data, specifically therapist-patient conversations. The system workflow encompasses user registration, login authentication, and homepage features, prioritizing ease of use and accessibility. The data flow within the Conversation Management Center ensures the chatbot is trained effectively using real therapy dialogue data, enhancing the system's ability to provide valuable advice and suitable responses. This architecture represents a holistic

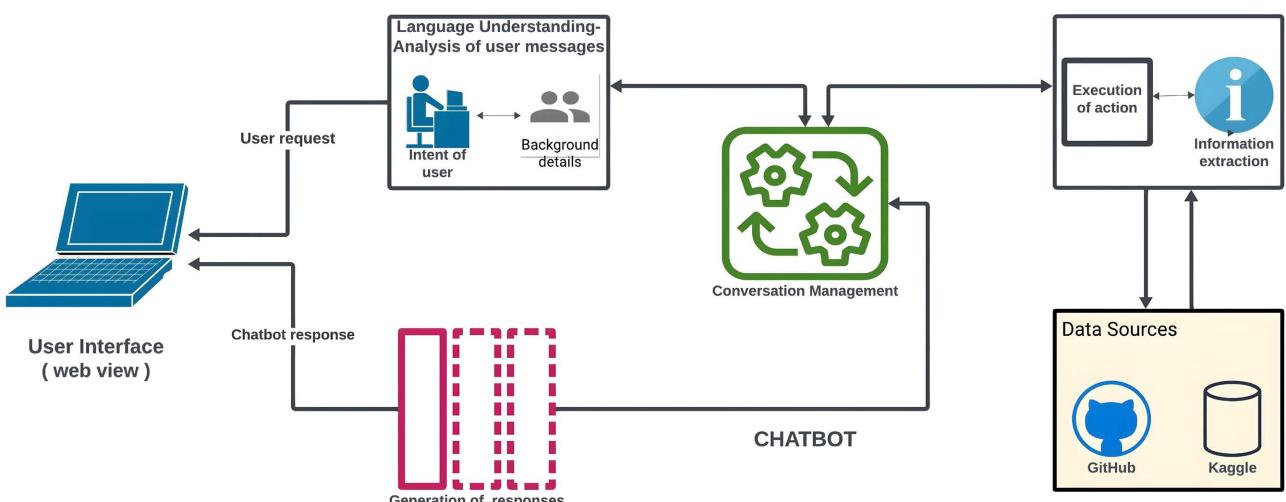


Figure 1. Architecture of the proposed system.

approach, focusing on user experience, security, and the integration of real-world therapy data for effective mental health support.

This research employed an Agile methodology to assess the efficacy of a chatbot-based mental health intervention, integrating both quantitative and qualitative data collection approaches. Quantitative methods encompass pre-intervention and post-intervention metrics, measuring user engagement and mental health assessments. Meanwhile, qualitative techniques involve semi-structured interviews and NLP analysis of chatbot interactions, unveiling user perspectives and interaction patterns. Thematic analysis is applied to qualitative data, while statistical methods gauge changes in mental health scores and user engagement quantitatively. This combined approach ensures a comprehensive evaluation. Ethical considerations prioritize confidentiality, participant consent, and the right to withdraw. By adopting Agile, the study aligns with evolving mental health research needs, providing valuable insights into the effectiveness of chatbot-based therapy dynamically and responsively.

2.1. Use Case Diagram of the Proposed System

The user is associated with the use cases Greet User, Assess Mental Health, Provide Personalized Support, Monitor Progress, and End Conversation (see **Figure 2**). Chatbot is associated with the use cases Greet User, Assess Mental Health, Provide Personalized Support, Monitor Progress, and End the conversation. The proposed system prioritizes a user-friendly experience through customized input and output designs. For input, users can share their concerns via text or voice,

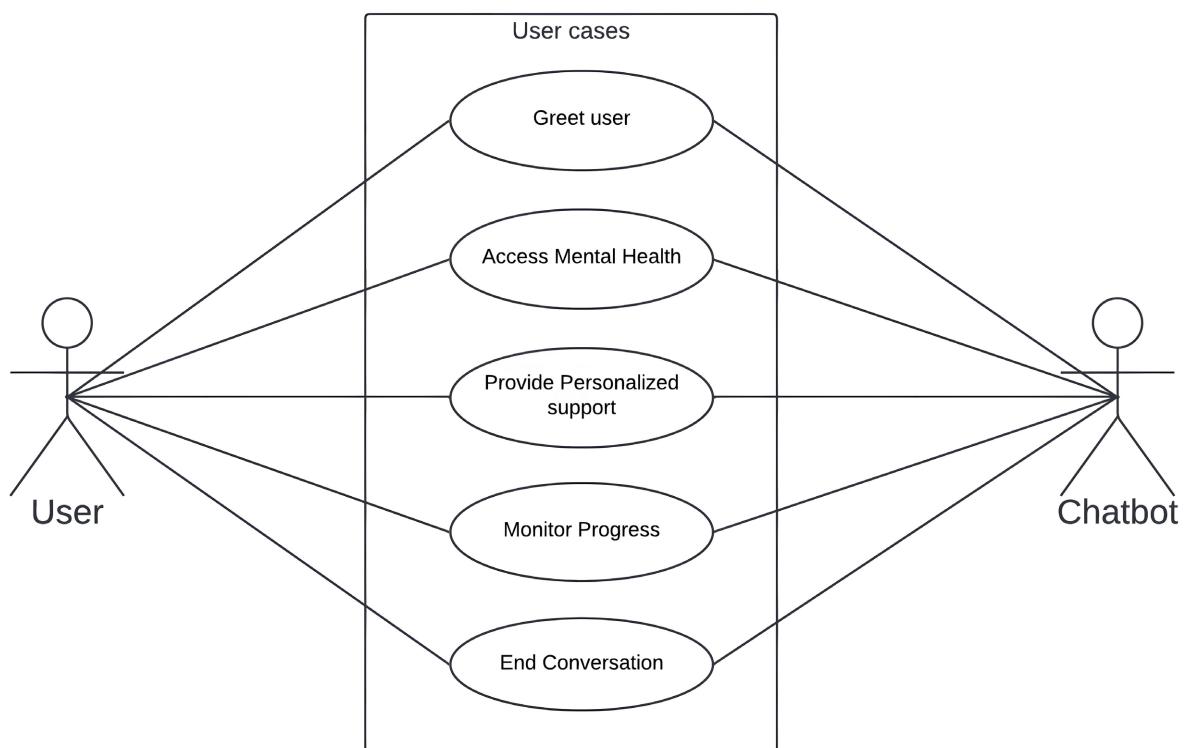


Figure 2. Use case diagram of the proposed system.

aided by clear menu options and dropdown lists for topic selection or preferences. Voice recognition adds flexibility for users who prefer speaking. Output design focuses on conversationally presenting chatbot responses, utilizing visual feedback like icons or emojis for emotional expression. Information is organized in a structured format for easy access, including mental health resources and advice. Personalized feedback and recommendations enhance user engagement.

Overall, the design aims to facilitate efficient communication, ensuring a smooth and supportive interaction between users and the mental health chatbot.

2.2. Activity Diagram of the Proposed System

The proposed mental health support system prioritizes user-friendliness through thoughtful input and output designs, creating an accessible and engaging experience. For user input, individuals can express their concerns through text or voice, providing flexibility and accommodating various user preferences. Clear menu options and dropdown lists guide users through selecting specific topics or preferences, enhancing the ease of navigation.

Voice recognition further enriches the input capabilities, catering to users who find speaking more convenient. The output design emphasizes a conversational presentation of chatbot responses, employing visual elements such as icons or emojis to convey emotional nuances effectively. Information is thoughtfully organized in a structured format, ensuring easy access to mental health resources, tips, and advice.

A key feature of the output design is the provision of personalized feedback and recommendations, tailoring the user experience based on their interactions with the chatbot. This personalization enhances user engagement and fosters a supportive environment. The overall design aims to facilitate efficient communication, creating a seamless and empathetic interaction between users and the mental health chatbot. By combining user-friendly input mechanisms with informative and personalized output features, the system strives to enhance mental health support accessibility and effectiveness for users from diverse backgrounds and with varying preferences (see **Figure 3**).

3. System Implementation

The development of the proposed mental health support system utilized Visual Studio Code as the primary Integrated Development Environment (IDE). Frontend development was powered by ReactJS, ensuring an interactive user interface, while Vite expedited the process and optimized bundling for enhanced performance. SCSS (Sassy CSS) was employed for structured styling, enhancing visual aesthetics. Dido played a central role in chatbot training and integration, accessing datasets efficiently. CSS keyframes facilitated seamless integration of the chatbot into the front end, ensuring smooth and visually appealing interactions. This integrated toolset within Visual Studio Code aimed to streamline development, prioritize user-centric design, and deliver a robust system for students' mental health needs.

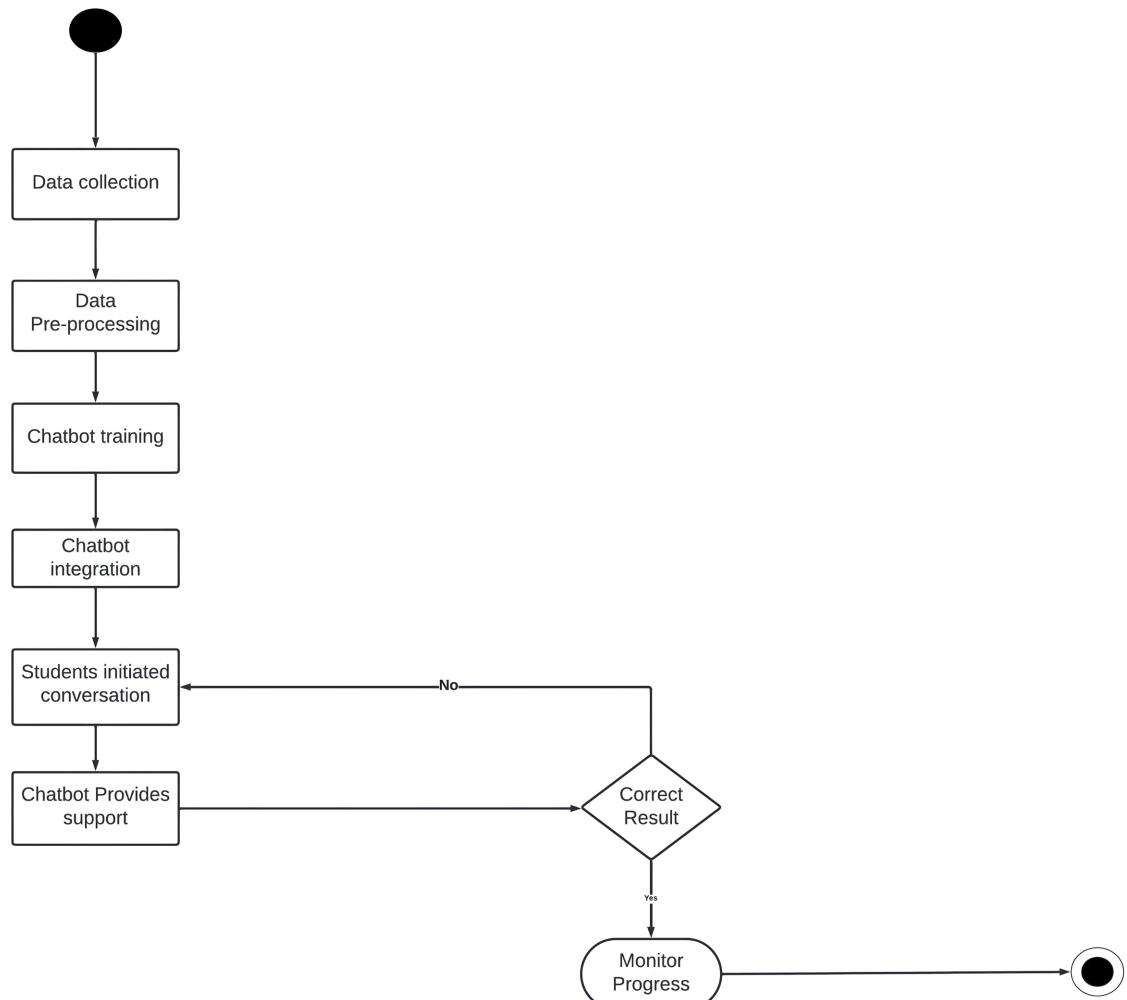


Figure 3. Activity diagram of the proposed system.

3.1. Data Collection and Processing

The dataset employed for training and testing the chatbot was sourced from Kaggle and GitHub, focusing on conversations between healthcare providers and patients, providing diverse interactions for mental health training. Using feature selection as a preprocessing step, essential conversational elements were prioritized (see [Figure 4](#)).

The dataset was carefully curated to focus on student mental health concerns. By extracting discussions relevant to student well-being, the chatbot's learning process was optimized. This means it can provide contextually appropriate responses to mental health issues students may face. The dataset was streamlined to prioritize crucial aspects of mental health in student interactions.

3.2. System Requirements

The system's optimal performance and user experience rely on specific hardware and software components. For hardware, a standard computer or mobile device with a good processor and at least 4GB of RAM is recommended for the smooth

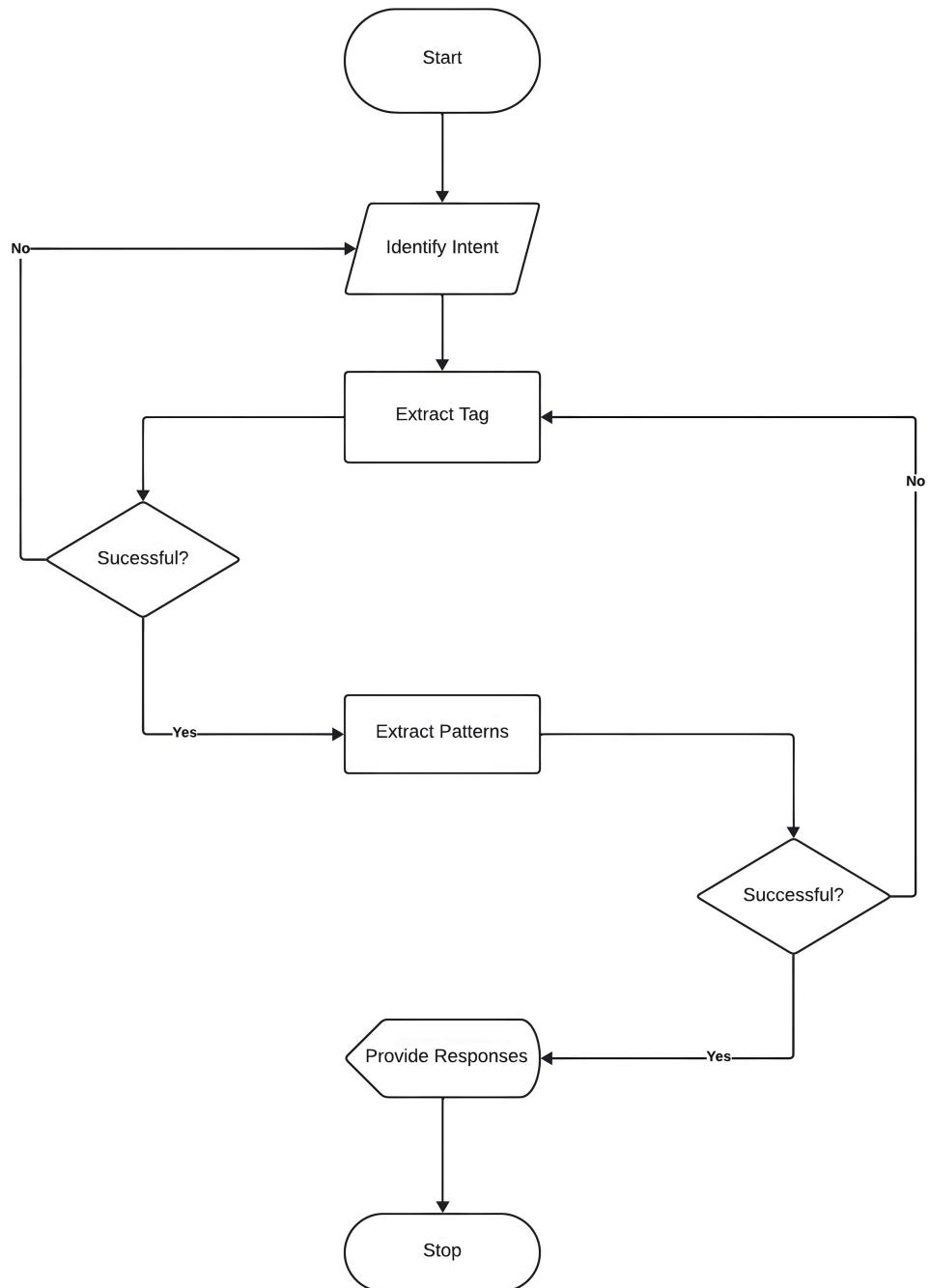


Figure 4. Image of the program's flowchart.

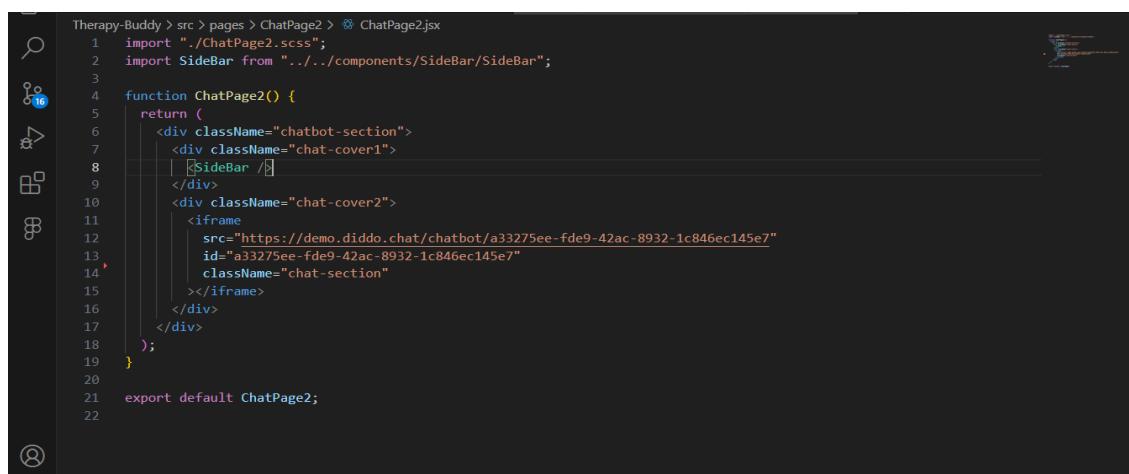
operation of the ReactJS-based frontend. A reliable internet connection is crucial for seamless interactions with the Dido-hosted chatbot and the front end. On the software side, a modern web browser such as Google Chrome or Mozilla Firefox is required to access the frontend interface, ensuring a user-friendly and smooth browsing experience. Additionally, Node.js, a JavaScript runtime, is necessary for managing dependencies within the ReactJS framework. These hardware and software components collaboratively contribute to the efficient functioning of the mental health support system.

3.3. System Integration

Keyframes are crucial for seamlessly integrating the Dido chatbot with the front end, acting as choreography signals that synchronize elements for cohesive interactions. They guide when and how different components come together, ensuring harmonious and rhythmic coordination between the front end and Dido. This enhances the user experience, contributing to a smooth and efficient interaction (see **Figure 5**).

4. User Interfaces

The user interface is a crucial part of the experience. It includes a personalized avatar page, login and register pages, and a dynamic chat interface. These elements work together to create a seamless and engaging user experience. The register page is designed to be user-friendly, making it easy for individuals to get started and access the mental health support they need. The login page as seen in **Figure 6** is designed with the user's privacy and data protection in mind. It ensures secure access for returning users, giving you peace of mind when accessing your account. The avatar page as shown in **Figure 7** allows users to personalize



```

Therapy-Buddy > src > pages > ChatPage2 > ChatPage2.jsx
1 import "./ChatPage2.scss";
2 import SideBar from "../../components/SideBar/SideBar";
3
4 function ChatPage2() {
5   return (
6     <div className="chatbot-section">
7       <div className="chat-cover1">
8         <SideBar />
9       </div>
10      <div className="chat-cover2">
11        <iframe
12          src="https://demo.diddo.chat/chatbot/a33275ee-fde9-42ac-8932-1c846ec145e7"
13          id="a33275ee-fde9-42ac-8932-1c846ec145e7"
14          className="chat-section"
15        ></iframe>
16      </div>
17    </div>
18  );
19}
20
21 export default ChatPage2;
22

```

Figure 5. System integration using keyframes.

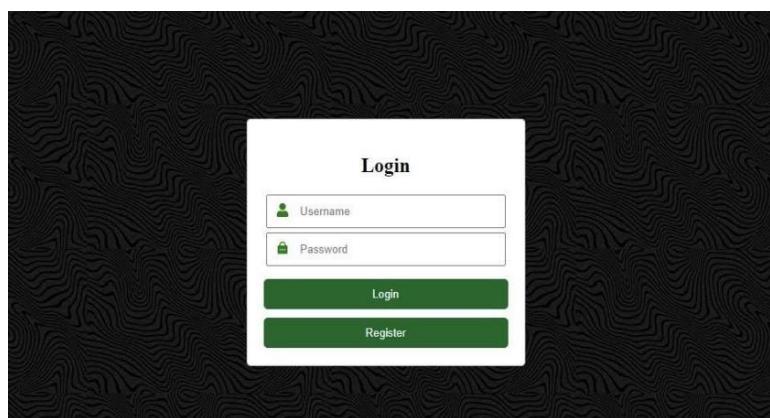


Figure 6. Login page.



Figure 7. Avatar page.

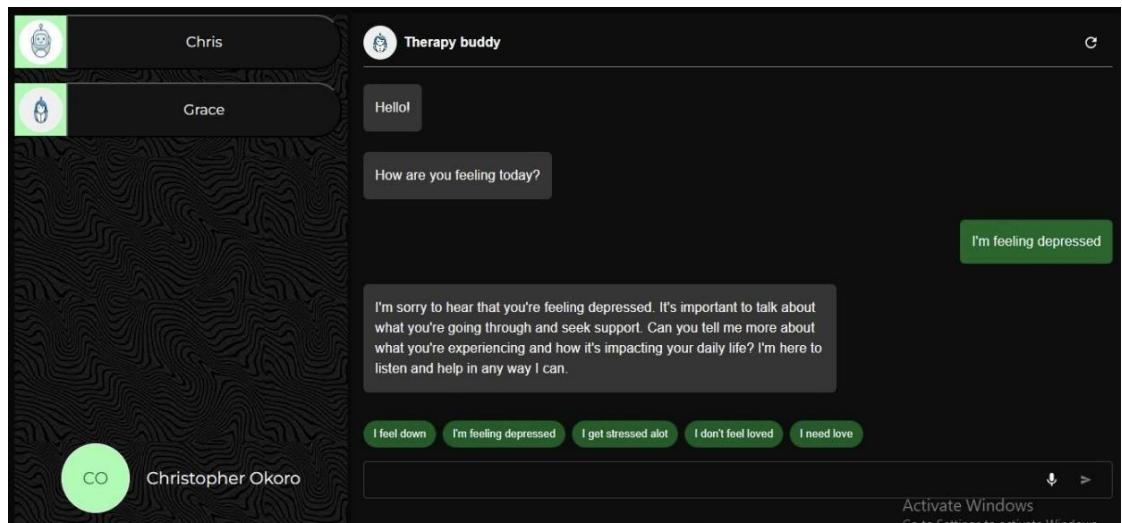


Figure 8. Chat section.

their chatbot by choosing its gender. This helps create a customized and relatable interaction that is tailored to individual preferences and comfort levels.

4.1. Chat Section

The chat page is designed to make user-bot interactions smooth and engaging. It displays the logged-in user's profile, making the experience more personalized. The convenient sidebar allows for seamless avatar switching, enhancing the user experience and promoting dynamic engagements with the chatbot. Additionally, it supports voice interactions, adding versatility to user engagement (see **Figure 8**).

4.2. Result Discussion

Two matrices guide assessing the chatbot's impact on users: User engagement metrics and Pre/Post-intervention mental health scores. User engagement data includes chat frequency, session length, and resource usage, informing chatbot improvements. The engagement rate is calculated as $(\text{Number of engaged users} / \text{Total number of users}) * 100$. Pre/Post-intervention mental health scores

measure users' initial and post-chat states using PHQ-9 and GAD-7 scales. PHQ-9 categorizes depression severity, while GAD-7 scores range from 0 to 27, and range from 0 to 21, classifying anxiety severity. These metrics collectively gauge the chatbot's effectiveness in fostering mental well-being and guiding its development.

5. Conclusions

The student-centric chatbot addresses mental health needs with personalized assistance. Integrated into a user-friendly front end, it enhances accessibility and individualization, aiming to reduce mental health stigma. Ongoing support and maintenance ensure continual improvement. The groundbreaking project introduces a tailored chatbot for diverse student mental health needs. The user-centric interface promotes openness and individualized support. Rigorous testing ensures effectiveness, while ongoing maintenance sustains the system's impact, contributing significantly to student well-being.

Recommendations for the project include institutional integration for widespread student access, regular knowledge base updates to ensure relevance, collaboration with mental health professionals for continuous improvement, and active monitoring of user feedback to enhance adaptive capabilities, maintaining the chatbot as a valuable student resource.

Conflicts of Interest

The authors declare no conflicts of interest.

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