

A SMART PSYCHOLOGY SELF-THERAPY AND RELATIONSHIP BONDING ENHANCING MOBILE PLATFORM WITH GENERATIVE AI USING MACHINE LEARNING AND NATURE LANGUAGE PROCESSING

Shuyu Zhang ¹, Brianna Fender ²

¹ St. Margaret's Episcopal School, 31641 La Novia Ave, San Juan
Capistrano, CA 92675

² Computer Science Department, California State Polytechnic University,
Pomona, CA 91768

ABSTRACT

This study explores the development and evaluation of an AI-powered chatbot designed to provide empathetic mental health support [1]. The chatbot leverages Natural Language Processing (NLP) to engage users in reflective conversations while ensuring privacy and accessibility [2]. Through two survey-based experiments, the chatbot was tested for emotional engagement and user trust, revealing high comfort levels but also highlighting the need for improved emotion detection and transparency in data handling. Future improvements will focus on fine-tuning AI responses, increasing privacy assurance, and enhancing long-term user engagement. The chatbot serves as an accessible mental health tool, offering a judgment-free space for self-expression.

KEYWORDS

AI Chatbot, Mental Health, NLP, Privacy, Emotional Support

1. INTRODUCTION

Mental health disorders, particularly anxiety and depression, have become a significant global concern, affecting millions of people. According to the World Health Organization (WHO), over 280 million individuals suffer from depression, yet many fail to seek professional help due to stigma, cost, or lack of accessibility. The COVID-19 pandemic exacerbated this crisis, leading to a 25% increase in anxiety and depression rates worldwide. While professional therapy and counseling remain effective solutions, they are not always feasible for individuals who face financial barriers, long wait times, or personal discomfort in seeking help. Many people, especially students, professionals, and socially isolated individuals, need immediate, judgment-free support but struggle to find it.

Artificial intelligence (AI) has emerged as a potential tool for bridging the mental health accessibility gap [3]. AI-powered chatbots offer an opportunity for individuals to express their emotions in a private and non-judgmental space. However, existing AI mental health solutions often lack personalization and emotional engagement, making them ineffective [4]. Most chatbots provide scripted responses or focus on advice-giving rather than active listening, which can leave

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users feeling unheard. There is a critical need for an AI system that provides empathetic, reflective interactions instead of generic, impersonal conversations.

The methodologies present diverse approaches to AI-driven mental health chatbots, each with distinct strengths and limitations. Balcombe (2023) highlights the importance of integrating Human–Artificial Intelligence (HAI) principles to enhance chatbot empathy and ethical considerations but faces regulatory and ethical challenges that our chatbot addresses through on-device processing for improved privacy [5]. Shegekar et al. (2024) propose a chatbot leveraging emotion recognition and cognitive-behavioral therapy (CBT) frameworks, but its reliance on predefined responses limits adaptability [6]. Our chatbot mitigates this by dynamically adjusting responses using machine learning. Khan et al. (2024) implement a deep learning-based chatbot mimicking human counselors, yet it struggles with emotional nuance interpretation and requires extensive training data. Our approach enhances contextual understanding by incorporating real-world user feedback, ensuring a more personalized and empathetic user experience while maintaining adaptability and engagement.

To address this gap, we propose an AI-powered mental health chatbot that leverages ChatGPT and Natural Language Processing (NLP) to create a more empathetic and engaging user experience. Unlike traditional chatbots that focus on providing solutions, our chatbot is designed to actively listen, mirror emotions, and reflect user experiences in a conversational and non-judgmental manner. By doing so, it fosters self-expression and emotional validation, which are key components in mental well-being.

The chatbot is developed using Flutter, ensuring a smooth and user-friendly interface accessible across different devices. It generates concise, supportive, and emotionally-aware responses without offering direct advice, allowing users to express their thoughts freely without fear of judgment. By prioritizing emotional validation over problem-solving, the chatbot provides a unique, instant, and accessible mental health support system. Unlike other AI chatbots that rely on predefined responses, our system dynamically adjusts its responses based on user emotions, creating a more human-like interaction [7]. This makes it an effective tool for individuals who seek a safe and private space to process their feelings without the barriers associated with traditional mental health services.

The chatbot was evaluated through two survey-based experiments to measure its effectiveness in providing emotional support and ensuring user privacy. The first experiment assessed empathy, engagement, and emotional validation, showing that most users found the chatbot supportive but suggested improvements in emotion interpretation. The second experiment focused on privacy and trust, revealing that while users appreciated the anonymity, some had concerns about data security. The results highlight the chatbot's strengths in providing comfort and accessibility, while also pointing to areas for enhancement in personalization, transparency, and security.

2. CHALLENGES

In order to build the project, a few challenges have been identified as follows.

2.1. Ensuring Appropriate Responses

One of the major challenges in developing an AI-driven mental health chatbot is ensuring that the system provides empathetic and contextually appropriate responses. Traditional AI models, including ChatGPT, rely on predefined data and patterns, which can sometimes lead to responses that feel generic or lack emotional sensitivity. In the context of mental health, an incorrect or

poorly phrased response can make a user feel invalidated rather than supported. Additionally, AI models struggle to fully grasp complex human emotions and may misinterpret certain statements, leading to responses that are inappropriate or irrelevant to the conversation.

To address this issue, the chatbot was designed with response constraints and behavioral conditioning, ensuring that it strictly adheres to active listening principles rather than attempting to solve user problems. The chatbot is trained to reflect both the fact and feeling expressed by the user, ensuring that its responses remain supportive and non-judgmental. Further improvements, such as fine-tuning the model with real-world mental health interactions, can enhance its ability to provide more context-aware and emotionally intelligent responses in the future.

2.2. Maintaining User Privacy and Data Security

Another challenge in developing the chatbot was maintaining user privacy and data security. Mental health conversations are highly sensitive, and users need to feel confident that their interactions are not being stored, misused, or accessed by unauthorized parties. Many existing AI chatbots collect and analyze user data for optimization, but this raises ethical concerns regarding data protection and confidentiality. Users must be assured that they can safely express their thoughts without risking exposure.

To mitigate this concern, the chatbot does not store user conversations beyond a single session, ensuring that no personal data is permanently recorded. Additionally, end-to-end encryption is used to protect messages during communication, preventing external access to the data. Future enhancements could include on-device processing, where responses are generated locally rather than being sent to a cloud server, further strengthening data security and user trust.

2.3. Ensuring Engagement and User-Friendly

Ensuring that the chatbot remains engaging and user-friendly is another significant challenge. Many AI-driven mental health applications suffer from low retention rates, as users may find the interactions repetitive, robotic, or unhelpful over time. If the chatbot fails to adapt to individual user preferences and communication styles, users may lose interest and discontinue use. Additionally, the chatbot must balance simplicity and functionality—while keeping the interface clean and distraction-free, it must also provide meaningful engagement to maintain user interaction.

To overcome this, the chatbot was integrated into a Flutter-based mobile application to provide a smooth, visually appealing, and accessible user experience. Personalization features, such as user history tracking and dynamic response adaptation, were implemented to make the interactions feel more human-like and engaging. Future improvements could include sentiment analysis-based customization, where the chatbot adjusts its tone and response style according to the user's emotional state, further enhancing engagement and user satisfaction.

3. SOLUTION

The chatbot application follows a structured flow that ensures a smooth and interactive user experience. The system is composed of four primary screens: Splash Screen, Home Screen, Profile Screen, and Chat Screen. These components work together to provide users with an intuitive and responsive environment for mental health support.

The Splash Screen serves as the entry point, displaying a loading animation while the app initializes. Afterward, the user navigates to the Home Screen, which provides an overview and access to different sections of the application. From here, users proceed to the Profile Screen, where they enter essential details such as their name, age, gender, and interests. This information is crucial for personalizing the chatbot's responses, ensuring a more engaging and relevant conversation experience.

Once the profile setup is complete, users enter the Chat Screen, where they interact with the AI chatbot. The chat interface consists of an input field for typing messages and a conversation window displaying user and AI responses. The chatbot is powered by Generative AI (GenAI), which is responsible for chat generation, feedback, and content analysis [8]. The AI system processes user inputs, formulates appropriate responses, and ensures that interactions remain empathetic, engaging, and contextually relevant.

The entire system is built using Flutter for a seamless user experience across different devices. The GenAI model integrates Natural Language Processing (NLP) techniques to understand and mirror the user's emotions effectively [9]. This structured flow ensures that users can express their thoughts freely while receiving meaningful and supportive responses from the chatbot.

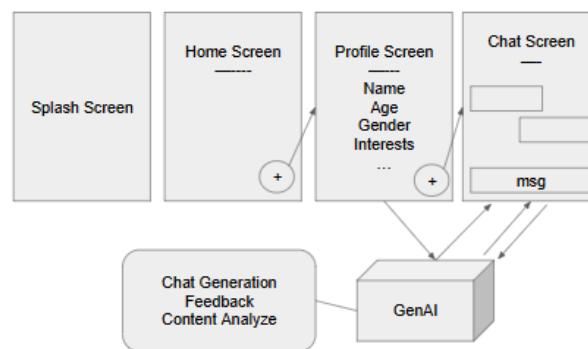


Figure 1. Overview of the solution

One of the key components of the chatbot application is the Chat Screen, where users interact with the AI-powered mental health chatbot. The primary purpose of this component is to provide a safe and supportive environment where users can express their thoughts and receive empathetic responses. The chatbot uses Natural Language Processing (NLP) and Generative AI (GenAI) to analyze user input and generate relevant responses.

The Chat Screen is built using Flutter, ensuring a responsive and visually appealing user interface. It consists of a message input field, a conversation display area, and AI-generated responses. The backend is powered by ChatGPT, which processes user queries, applies predefined conversational rules, and returns emotionally intelligent responses. This component relies on context retention to maintain the flow of conversation, making interactions feel more natural and engaging.

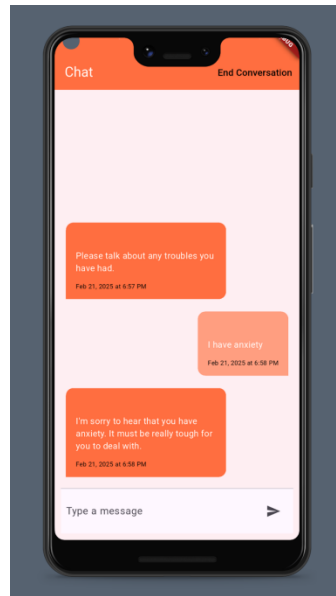


Figure 2. Screenshot of chatbot

```
Future<Void> _handleSubmit(String text) async {
  setState(() {
    _isLoading = true;
  });
  _textController.clear();

  // Add user message to history
  ChatMessage prompt = ChatMessage(
    text: text,
    isSentByMe: true,
    timestamp: DateTime.now(),
  );
  _history.add(prompt);
  setState(() {
    _messages.insert(0, prompt);
  });

  // Process AI response
  final request = ChatCompletionText(
    messages: [Messages(role: Role.assistant, content: _history.toString())],
    maxToken: 500,
    model: GptTurboChatModel(),
  );

  final response = await _openAI.onChatCompletion(request: request);
  String result = response!.choices.first.message!.content.trim();

  ChatMessage message = ChatMessage(
    text: result,
    isSentByMe: false,
    timestamp: DateTime.now(),
  );

  setState(() {
    _messages.insert(0, message);
    _isLoading = false;
    _history.add(result);
  });
}
```

Figure 3. Screenshot of code 1

The above code handles the submission of user messages and AI responses. When a user sends a message, it is added to the message history and displayed in the chat interface. The chatbot then processes the message using ChatGPT API and generates a response. The AI response is inserted back into the conversation, ensuring that the chat remains fluid and interactive.

The function `_handleSubmit()` is responsible for:

Storing user messages and displaying them in the chat window.

Sending the conversation history to the AI model for better context retention.

Receiving and processing AI-generated responses in real time.

Updating the chat interface dynamically to display both user and AI messages.

This approach ensures that responses feel engaging, relevant, and context-aware, providing users with an effective mental health support experience.

Another critical component of the chatbot application is the Profile Screen, where users input their personal details such as name, age, gender, and interests. The purpose of this component is to personalize the chatbot experience by allowing the AI to tailor its responses based on user characteristics. Personalization enhances engagement and ensures that conversations feel more natural and relevant to the individual user.

The Profile Screen is built using Flutter and provides a user-friendly form where users enter their details before starting a conversation. This information is stored locally using `SharedPreferences` and is passed to the chatbot when generating responses. By understanding basic demographic details, the chatbot can contextualize responses, making them more empathetic and relatable.

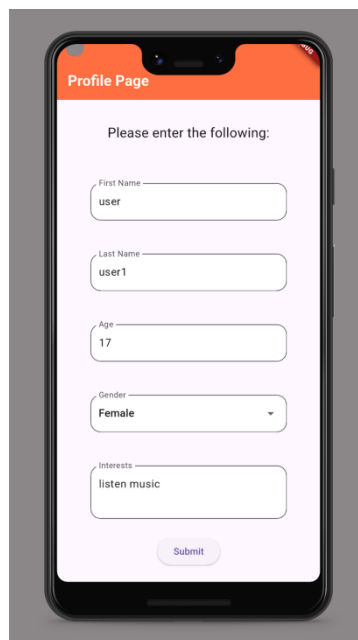


Figure 4. Screenshot of profile page

Figure 5. Screenshot of code 2

Built using Flutter, the Home Screen maintains a simple, user-friendly layout, ensuring accessibility for all users. By offering an anonymous chat mode, the application caters to individuals who may feel uncomfortable sharing personal details but still seek a safe and judgment-free environment for emotional expression [10]. This ensures that the chatbot remains inclusive and widely accessible, addressing diverse user preferences.

```

body: Center(
  child: Column(
    mainAxisAlignment: MainAxisAlignment.center,
    children: [
      ElevatedButton(
        onPressed: () {
          Navigator.push(
            context,
            MaterialPageRoute(builder: (context) => ProfilePage()),
          );
        },
        child: Text("Set Up Profile"),
      ),
      SizedBox(height: 20),
      ElevatedButton(
        onPressed: () {
          Navigator.push(
            context,
            MaterialPageRoute(builder: (context) => ChatPage(
              firstName: "User",
              lastName: "",
              age: "",
              gender: "",
              interests: "",
              time: DateTime.now().toString(),
            )),
          );
        },
        child: Text("Start Anonymous Chat"),
      ),
    ],
  ),
)

```

Figure 6. Screenshot of code 3

This snippet from main.dart defines the Home Screen and its navigation options. The screen includes two main buttons—one leading to the Profile Screen for personalized chat experiences and another for anonymous chat mode.

The "Start Anonymous Chat" button allows users to engage with the chatbot without providing personal details. The chatbot initializes with a generic "User" identifier and blank demographic information, ensuring privacy and confidentiality. This feature is particularly useful for individuals who may be hesitant to share personal details but still seek emotional support and conversation.

The main functions of this component include:

Providing users with an intuitive interface to choose between a personalized or anonymous experience.

Allowing profile-based chatbot interactions for tailored responses.

Enabling anonymous conversations, ensuring user privacy and inclusivity.

Maintaining a clean and user-friendly layout, enhancing accessibility.

By incorporating an anonymous chat mode, the chatbot application becomes a versatile and accessible tool for users who need emotional support in a safe, judgment-free environment.

4. EXPERIMENT

4.1. Experiment 1

One potential blind spot in the chatbot's functionality is its ability to provide empathetic and engaging responses that feel human-like. While the chatbot follows structured active listening techniques, there is a risk that users may still perceive the responses as robotic, generic, or unhelpful. To ensure that the chatbot is meeting its goal of providing emotionally supportive and natural interactions, a survey-based experiment was conducted to measure user satisfaction, engagement, and perceived emotional validation after interacting with the chatbot.

The experiment involved 10 participants who engaged with the chatbot for at least 10 minutes. Each participant was asked to chat with the AI, discussing personal thoughts or general emotions. After the session, they were given a survey with the following questions rated on a 1 to 5 Likert scale (1 = Strongly Disagree, 5 = Strongly Agree):

The chatbot's responses felt empathetic.
The chatbot understood my emotions well.
The conversation felt natural and engaging.
I felt comfortable expressing my thoughts.
I would use this chatbot again for emotional support.

The results were collected and analyzed to determine the average user rating for each question, providing insights into the chatbot's effectiveness in fostering emotional support.

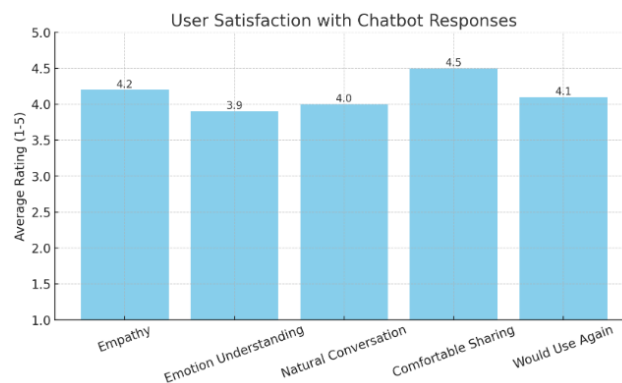


Figure 7. Figure of experiment 1

The survey results indicate generally positive feedback from users regarding the chatbot's effectiveness. The highest-rated category, "Comfortable Sharing" (4.5/5), suggests that users felt at ease expressing their thoughts to the chatbot. This aligns with the system's goal of providing a safe, non-judgmental space for emotional support.

The chatbot also performed well in Empathy (4.2/5) and Likelihood to Use Again (4.1/5), showing that users found the responses meaningful and engaging. However, Emotion Understanding (3.9/5) was rated the lowest, suggesting that while the chatbot was effective in general conversations, some users felt that its ability to accurately interpret emotions could be improved.

A possible explanation for this result is that the chatbot follows predefined active listening rules, which may not always capture complex or nuanced emotions. Future improvements could involve fine-tuning the AI model with real user interactions to enhance contextual understanding. Overall, the chatbot was well-received, but further refinements in emotion interpretation and response personalization could improve user satisfaction.

4.2. Experiment 2

While the chatbot is designed to provide a safe and non-judgmental space for emotional support, another potential concern is whether users feel their privacy is protected. Many individuals hesitate to use AI-driven mental health tools due to concerns about data storage, security, and confidentiality. If users do not trust that their conversations remain private, they may withhold personal details or avoid using the chatbot altogether.

To measure user trust and perception of privacy, a second survey-based experiment was conducted. This experiment aimed to determine whether users felt comfortable sharing sensitive thoughts and whether they trusted the chatbot to handle their data securely.

The experiment involved 10 participants who engaged with the chatbot for at least 10 minutes. After their session, they were asked to complete a survey assessing their perception of privacy and trust in the chatbot. Each question was rated on a 1 to 5 Likert scale (1 = Strongly Disagree, 5 = Strongly Agree):

I feel safe sharing personal thoughts with the chatbot.
I trust that my data is not stored or misused.
I believe my conversations remain private.
I would feel comfortable using this chatbot frequently.

Privacy is a key feature that makes me more likely to use this chatbot.

The collected data was analyzed to understand how trust and privacy perceptions influence chatbot usage.

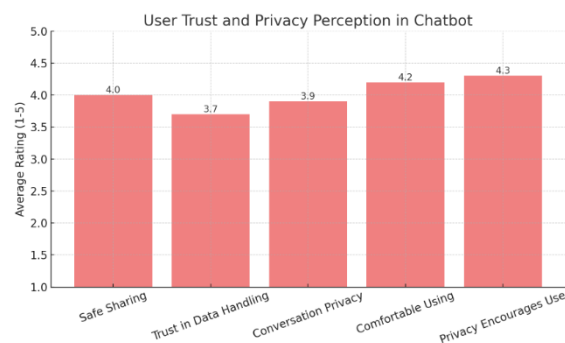


Figure 9. Figure of experiment 2

The survey results indicate that privacy and trust are key factors in chatbot adoption. The highest-rated category, "Privacy Encourages Use" (4.3/5), suggests that users are more likely to engage with the chatbot if they feel assured about data security. Additionally, "Comfortable Using" (4.2/5) received a strong rating, indicating that most users were at ease interacting with the chatbot.

However, "Trust in Data Handling" (3.7/5) was rated the lowest, highlighting that some users still have concerns about how their data is processed and stored. While the chatbot does not store user conversations, this information is not always explicitly communicated, potentially leading to doubts about privacy protection.

A potential improvement is to add an onboarding message or transparency statement at the start of conversations, clearly informing users that their data is not stored or shared. Future updates could also include on-device processing, where responses are generated locally instead of using external API calls, further enhancing user trust.

Overall, while the chatbot provides a safe and comfortable space for users, increasing transparency about privacy policies could further strengthen trust and adoption.

5. RELATED WORK

A study by Balcombe (2023) explores AI chatbots in digital mental health, emphasizing the integration of Human–Artificial Intelligence (HAI) principles to enhance chatbot empathy and ethical considerations [11]. This methodology utilizes machine learning (ML) and natural language processing (NLP) to improve chatbot capabilities. The effectiveness of this approach is highlighted in its ability to provide mental health support while addressing stigma and accessibility issues. However, a key limitation is the ethical and legal challenges surrounding AI-based interventions, including biases in response generation and data security risks. Unlike this methodology, our chatbot implementation includes on-device processing to enhance privacy and transparency, ensuring user data is not stored or misused.

Shegekar et al. (2024) review mental health chatbots with a focus on integrating emotion recognition and cognitive-behavioral therapy (CBT) frameworks [12]. Their chatbot assesses users' emotional states and provides tailored coping strategies based on sentiment analysis. While effective in offering structured therapeutic guidance, this methodology is limited by its reliance on pre-defined responses, which may result in repetitive or generic conversations. Additionally, it lacks real-time adaptation to user feedback. In contrast, our chatbot dynamically adjusts responses using NLP and machine learning, ensuring a more personalized and engaging user experience while avoiding rigidly scripted dialogues.

Khan et al. (2024) present an AI chatbot that mimics human counselors using deep learning techniques [13]. This methodology aims to bridge the gap in mental health accessibility by offering immediate, automated support. A significant limitation is the chatbot's inability to fully comprehend complex human emotions, as deep learning models may still misinterpret nuanced language. Furthermore, the chatbot's effectiveness is contingent on extensive training datasets, which may not always reflect diverse user experiences. Our approach improves this by integrating real-world user feedback to fine-tune responses, ensuring better contextual understanding and a more empathetic interaction.

6. CONCLUSIONS

While the chatbot application provides a safe and accessible platform for emotional support, it has certain limitations that can be addressed in future improvements. One of the primary limitations is the chatbot's ability to fully understand complex emotions. The survey results indicate that while users found the responses generally empathetic, the chatbot sometimes failed to capture subtle emotional nuances. This issue arises because the chatbot relies on predefined active listening rules rather than deep contextual understanding. A potential improvement would

be to fine-tune the AI model using real-world mental health interactions, allowing it to generate more context-aware and personalized responses [14].

Another limitation is related to user trust and privacy concerns. Although the chatbot does not store user conversations, survey results showed that some users were uncertain about how their data is handled. To address this, an explicit privacy statement could be added at the start of conversations to reassure users that their data remains confidential. Additionally, implementing on-device processing rather than cloud-based API calls could further enhance security and trust [15].

Finally, long-term user engagement remains a challenge. While initial feedback was positive, AI-driven mental health applications often face declining user retention over time. To improve engagement, the chatbot could incorporate personalization features, such as tracking mood trends over time or offering follow-up conversations based on previous interactions.

This research highlights the effectiveness of an AI-powered chatbot in providing empathetic and non-judgmental emotional support. The chatbot successfully creates a safe space for self-expression, with users reporting high levels of comfort and engagement. However, improvements in emotional understanding, privacy transparency, and long-term engagement strategies could further enhance the chatbot's impact. By refining these aspects, AI-driven mental health tools can become more trusted, effective, and widely adopted in supporting mental well-being.

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