

# Self Heal: AI-Enhanced Conversational Therapy Bot for Mental Wellbeing

Dr. Bhagyashri R Hanji<sup>1</sup>, Charanya S<sup>2</sup>, Divyanshi Gupta<sup>3</sup>, Eesha Krishna<sup>4</sup>, Harshita G Devadiga<sup>5</sup>,

<sup>1</sup>*Professor, Department of CSE, Dayananda Sagar Academy of Technology and Management, Bangalore, India*

<sup>2,3,4,5</sup>*Student, Department of CSE, Dayananda Sagar Academy of Technology and Management, Bangalore, India*

**Abstract**—Self-Heal stands as an innovative initiative dedicated to delivering accessible mental health support through a cutting-edge application. In response to the escalating challenges in mental health, the work centers around an AI-enhanced conversational therapy bot, uniquely empowered with voice-enabled capabilities. Leveraging advanced natural language processing and machine learning algorithms, this therapeutic companion engages users in empathetic and personalized conversations, transcending the boundaries of traditional text-based interactions. Self-Heal integrates cutting-edge Language Models (LLMs) to continuously enhance its conversational capabilities. These LLMs are trained on vast datasets of human interactions, enabling the therapy bot to understand nuanced language nuances and respond with even greater empathy and effectiveness. The integration of sentiment analysis further enriches the application by offering deep insights into users' emotional states. Complemented by a resourceful hub for education on mental health, Self-Heal envisions contributing significantly to the well-being of individuals by providing a stigma free, technologically advanced platform for those seeking emotional support and guidance.

**Keywords**— *Conversational bot, Machine Learning, Mental Health, NLP (Natural Language Processing), Sentimental Analysis.*

## I. INTRODUCTION

Student depression is an escalating concern affecting a considerable portion of college and university students, exacerbated by the intersection of academic pressures and personal challenges. Suicide is the third leading cause of death among 15-to-24-year-olds globally [1-2], intensifying pressure on strained healthcare services. The critical need to address mental health issues for their profound impact on academic success and overall well-being is

undeniable. Chatbots have emerged as valuable tools in mental health treatment, offering advice and communication lines for patients. Self-Heal responds to this challenge by introducing an affordable AI-driven conversational therapy bot, aspiring to cultivate a culture of mental health awareness. Beyond immediate support, the proposed work aims to empower students by fostering proactive well-being, facilitating open dialogues, and equipping individuals with tools to manage stress and anxiety. In doing so, Self-Heal strives to contribute to a supportive educational environment, promoting the holistic development of individuals. Importantly, it recognizes the significance of continuous learning, staying abreast of emerging therapeutic approaches, and leveraging technological advancements to refine mental health support strategies. It unfolds against a pressing societal need, seeking to provide an accessible and innovative solution to the burgeoning mental health challenges among students. As education becomes increasingly demanding, the mental wellbeing of students is a paramount concern. Self-Heal's AI-driven conversational therapy bot represents a leap forward in technological innovation and fostering a compassionate approach to mental health care. By creating a virtual space that transcends traditional communication barriers, the work envisions a future where students can seamlessly access mental health support, reduce stigma, and embark on self-discovery and healing. Through collaborative efforts with educational institutions and mental health professionals, Self-Heal aspires to be a catalyst for positive change in the landscape of student well-being, committed to cultivating enduring support and fostering a proactive approach to mental health challenges.

The rest of the paper is organized as follows. Section 2 details the literature survey. The proposed method is described in section 3. The conclusion and future scope are summarized in section 4.

## II. LITERATURE SURVEY

This extensive literature survey provides an in-depth exploration of diverse methodologies and cutting-edge technologies within the dynamic field of mental health solutions. The work by Atmaja and Sasou stands out, offering valuable insights into natural language processing and emotion recognition. Their use of sentiment analysis in speech, employing UniSpeech-SAT models on the CMUMOSEI dataset, showcases a nuanced understanding of affective speech tasks. Rathnayaka et al.'s introduction of "Bunji," a Mental Health Chatbot, is a noteworthy innovation. Powered by the Rasa framework with Behavioral Activation oriented NLP modules, "Bunji" goes beyond conventional solutions, providing ongoing support with a personalized touch. This distinctive approach signifies a leap forward in tailoring mental health interventions to individual needs. Martínez-Gárate et al. contribute significantly by shedding light on model-driven approaches for conversational agent development. Emphasizing transparency and user consent, their insights lay the groundwork for ethical considerations in the design and deployment of mental health chatbots.

Rahman et al.'s meticulous systematic review delves into the intricate landscape of machine learning applications for mental health detection on Online Social Networks (OSNs), offering a nuanced exploration of data sources, diverse machine learning methodologies, and advanced feature extraction techniques. Despite acknowledging potential sample bias, the study underscores the remarkable adaptability of deep learning techniques within this domain, showcasing their potential for robust and sensitive mental health assessments. This literature survey not only contributes a wealth of insights into current tools and methodologies but also positions itself as an indispensable resource, guiding researchers, practitioners, and developers as they navigate the ever-evolving terrain of mental health technology. As technological advancements continue to shape the intersection of mental health and machine learning, Rahman et al.'s review serves as a foundation for future innovations and interventions in this critical domain.

The work in [3] is dedicated to advancing techniques for extracting emotional and sentiment-related information from speech data, making noteworthy contributions to both natural language processing (NLP) and emotion recognition fields. By analyzing spoken language nuances, the study aims to refine and develop methodologies capable of identifying and interpreting emotional cues embedded within verbal expressions. In the realm of NLP, the focus extends beyond traditional syntactic and semantic structures, delving into the subtleties that convey sentiments, attitudes, and underlying emotional states. Large-scale pre-trained speech embeddings (UniSpeech-SAT Large) demonstrated consistently superior performance across affective speech tasks compared to other variants. Paper [4] addresses the significant challenge of mental health issues in society, particularly among working age individuals, this paper introduces a novel chatbot. Rooted in Behavioral Activation (BA) therapy and powered by Artificial Intelligence (AI), the chatbot goes beyond conventional solutions by providing ongoing support with a personalized touch. The creation of the BA-based AI chatbot, named "Bunji," and its favorable participatory evaluation validate its efficacy in offering support to individuals dealing with mental health issues. Demerit: Notably, the text highlights a primary limitation—the absence of long-term evaluation data concerning the functionality and impact of regular usage of the chatbot across diverse sociodemographic groups. The work[5] aims to provide state of the art through a Systematic Mapping Study regarding Model Driven Development approaches to automate or semi automate the development of Chatbots. Chatbots can expand their knowledge base by extracting valuable information from various sources, allowing them to answer a wider range of user questions beyond predefined intents.

Authors in [6] provide a comprehensive evaluative examination of the detection of mental health indicators on Online Social Networks (OSNs), considering data sources, machine learning methodologies, and feature extraction approaches. The study may suffer from sample bias, as it primarily focuses on data from OSNs. This could lead to an underrepresentation of certain demographic groups or individuals who do not use OSNs, potentially biasing the findings. A large number of datasets are available and studies can be further carried. The authors in [7] developed "Web Mind," an experimental platform leveraging Support Vector Machine (SVM) modeling to predict users' mental health

status based on web browsing behavior. The integrated recommender system generates personalized suggestions for mental health adjustments. Ethical considerations, transparency, and user consent are prioritized in handling data. Paper [8] shows the results of the review conducted to analyze the present scientific literature concerning the deployment of conversational agents or chatbots in the field of psychiatry, specifically examining their functionalities in the processes of screening, diagnosing, and treating mental illnesses. The efficiency of chatbots in individuals diagnosed with major depressive disorder implies the practicability of their application within clinical populations. A potential risk lies in the apprehension that certain individuals might develop an overly strong attachment, potentially stemming from a distorted or parasocial relationship, possibly influenced by the patient's psychiatric condition.

Our AI-Enhanced Conversational Therapy Bot for Mental Well-being stands apart from existing solutions detailed in the literature survey. Unlike the models discussed, such as "Bunji" and "Web Mind," our bot employs a sophisticated integration of LLM (Large Language Model) technology, particularly GPT (Generative Pre-trained Transformer), to optimize natural language understanding and generation capabilities. This allows our bot to comprehensively analyze user inputs and generate empathetic, tailored responses, showcasing a profound understanding of individual mental health needs. Additionally, our bot prioritizes ongoing support with a personalized touch, incorporating advanced natural language processing techniques to discern contextual cues and provide precise

interventions. Unlike other models that may focus on specific methodologies or data sources, our bot aims to provide a holistic approach to mental well-being, leveraging cutting-edge neural network architectures and deep learning methodologies to refine linguistic proficiency and cognitive abilities. Our bot's strategic utilization of LLM technology underscores its commitment to achieving optimal efficacy and user engagement, positioning it as a technologically sophisticated yet empathetic ally in the realm of mental health support.

### III. PROPOSED WORK

The "Self-Heal" AI-enhanced conversational Therapy Bot for Mental Wellbeing offers a unique approach to mental health support, focusing on the following key features. **Conversational Interface:** Leverages NLP for natural and engaging spoken dialogues, creating a more immersive and genuine user experience. **Crisis Response:** Incorporates a Crisis Button for immediate support, resource access, and facilitation of professional help in critical situations. **Personalized Insights:** Utilizes sentimental analysis to provide users with insights into their mood and progress over time through data-based reports. **Therapy Booking System:** Enables users to schedule personalized one-on-one therapy sessions with therapists, integrating availability checks. **Comprehensive Self-Help Strategies:** Provides practical self help techniques and diverse resources, including podcasts, music therapy, and yoga sessions, enhancing stress and anxiety management.

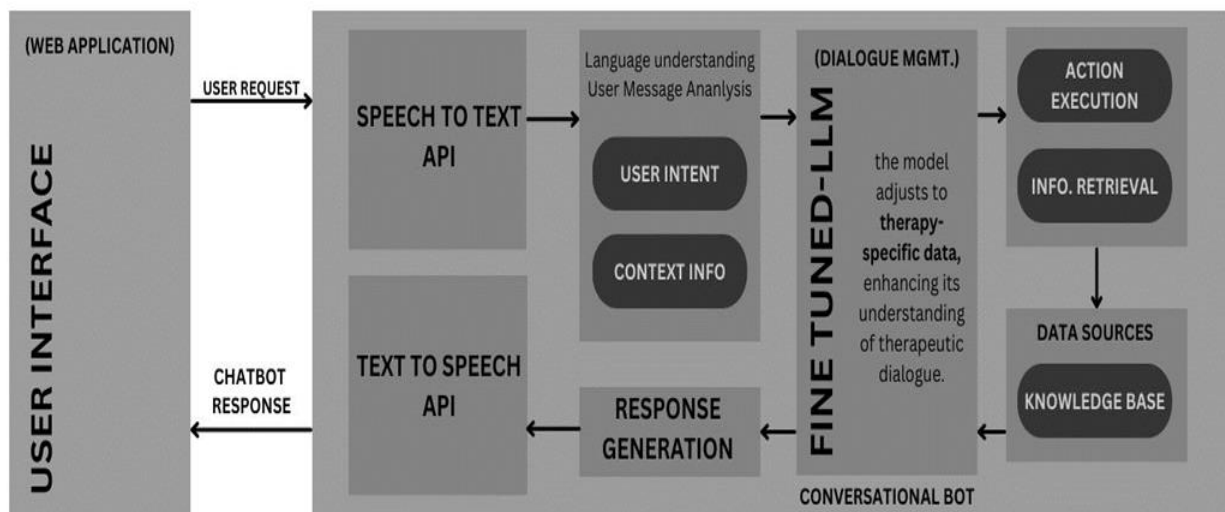


Figure 1 Architecture of proposed work

Unlike many counterparts, Self-Heal introduces a distinctive conversational interface, breaking away from the limitations of text-based interactions. This dynamic communication style not only provides a more natural and immersive experience but also fosters a genuine connection between the user and the bot. Going beyond the typical wellness tips, Self-Heal assumes the role of a virtual therapist, delivering empathetic responses and personalized insights tailored to individual needs. Another notable aspect of its uniqueness is its adaptability, allowing the chatbot to effectively cater to a diverse range of users. This adaptability ensures a personalized and supportive virtual environment, enriching the user experience and therapeutic effectiveness. In addition, the work is a trailblazer in improving accessibility and user engagement in the field of mental health support because it incorporates spoken dialogue in a novel way. The architectural workflow of the proposed work is as briefed in figure 1 which begins with the user's verbal input, which is initially processed through a Speech-to-Text API, converting spoken words into text format. Subsequently, a robust analysis is applied to the text, elucidating the user's intent through advanced natural language processing techniques. Concurrently, pertinent data is retrieved from the knowledge base, optimizing the potential for generating a contextually relevant response. This information retrieval triggers the execution of predefined actions, and the dialogue management component orchestrates the construction of a coherent response. The finalized response, in textual form, undergoes conversion through a Text-to-Speech API, resulting in the generation of an

articulate audio response. This meticulous process ensures a seamless conversational experience.

The four central entities encapsulated are as shown in Figure 2, "Customer" "Therapist", "Knowledge Base" and "Model." The relationship between the "Customer" and "Therapist" classes is characterized by a one-to-many association, denoting that a single customer may interact with multiple therapists. Meanwhile, the "Model" class forms a one-to-one relationship with the "Customer" class, emphasizing personalized and tailored interaction model for each user. This signifies that a specific customer is associated information to enhance the user experience. This comprehensive class diagram establishes the foundational structure for the mental health application, facilitating both one-on-one interactions with therapists and personalized engagements through an intelligent model, enriched by insights from the knowledge base.

The flow of the mental health chatbot application is detailed in Figure 3 which begins with user registration, where users interact with the registration UI, and the system validates and Chatroom Controller for real-time messaging. The application supports a seamless user experience, emphasizing modularity and independence between features. Users can effortlessly switch between the chatbot, chatroom, and informational components, creating a comprehensive mental health support system. The flow ensures secure user authentication, personalized interactions, and access to informative resources, contributing to a user-centric and efficient mental health chatbot application.

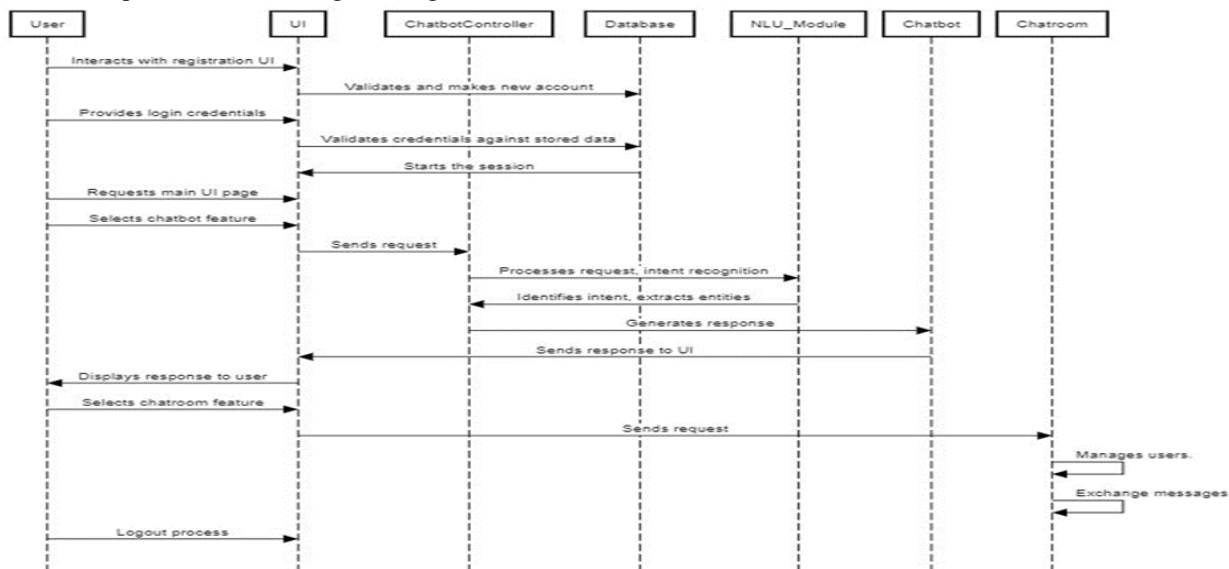


Figure 2 Class Diagram

The User Module prioritizes a user-centric experience, ensuring seamless account management, secure logins, and straightforward profile control. Users engage in audio conversations with the therapy bot, with the added functionality of reviewing generated reports. Incorporating sentiment analysis into a conversational AI platform enables the generation of insights and reports that track users' progress and emotional well-

being over time. This can be seamlessly integrated into the Rasa framework, enhancing the chatbot's ability to understand and respond to user emotions. Rasa's flexible architecture allows for the integration of sentiment analysis components into its natural language understanding (NLU) pipeline, enabling the chatbot to analyze sentiment alongside intent and entity extraction.

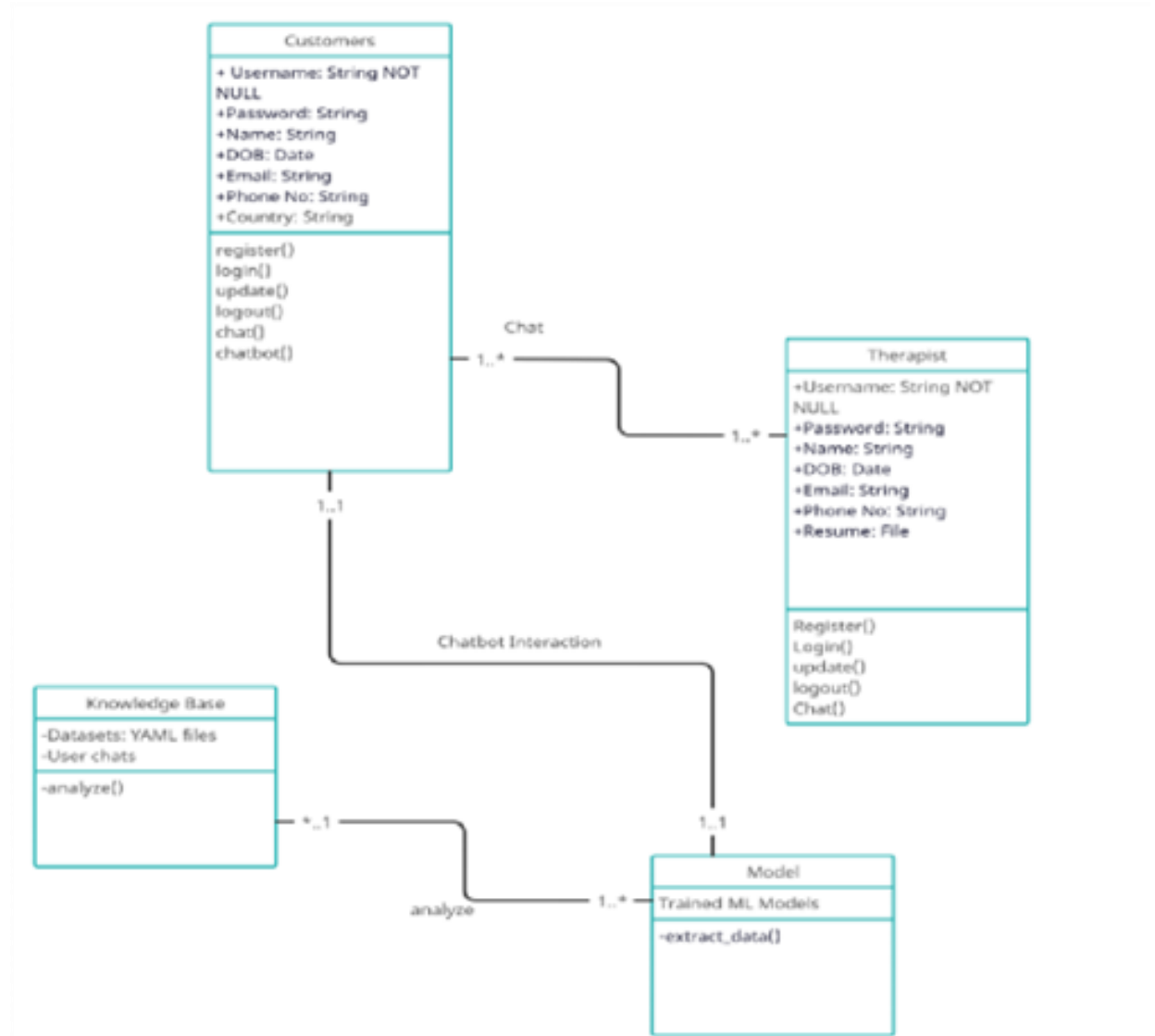


Figure 3 Sequence Diagram

Upholding user privacy is paramount, creating a comprehensive, supportive space for mental health awareness and empowerment. The conversational Bot Module deploys an AI-driven bot facilitating human-like conversations. It utilizes NLP for understanding user input and preparing predefined responses for

common queries. The implementation involves Python, leveraging NLP libraries such as spaCy or frameworks like Rasa. Chat Interface Module implements a text-based chat interface for instant communication between users and therapists. To ensure a safe and respectful environment, the user interface employs a combination

of React.js for the front end and Socket.io for real-time communication. Other Feature Modules Music Therapy Integration and Curated Playlists Access specially curated playlists for relaxation, stress reduction, and mood enhancement. Yoga Sessions: Engage in guided yoga sessions with varying durations and difficulty levels.

Python serves as the core backend language, forming the versatile foundation for conversational AI implementation in Self-Heal. Rasa, an open-source Python library, takes the lead in managing conversational AI, enabling natural language understanding (NLU) and dynamic dialogue management. With its flexible framework, Rasa allows developers to build sophisticated chatbot applications that can understand user intents, extract entities, and orchestrate complex conversational flows. Leveraging the capabilities of Large Language Models (LLMs), Rasa-powered chatbots can engage users in more natural and contextually relevant conversations, enhancing the overall user experience and effectiveness of the AI system. By integrating LLMs with Rasa's powerful features, developers can create chatbots that exhibit advanced language understanding and generate human-like responses, further improving their ability to provide personalized and empathetic interactions. With Rasa and LLMs, organizations can develop cutting-edge conversational AI solutions that meet the evolving needs of their users while delivering seamless and impactful experiences. MongoDB, as the backend database, efficiently stores user profiles, preferences, and session and conversation history, offering real-time data analysis capabilities. The integration of Speech-to-Text and Text-to-Speech APIs enhances the conversational experience. Speech-to-text precisely transcribes user voice inputs, while Text-to-Speech converts textual responses into natural sounding speech, ensuring a seamless voice-text interface.

In the formulation of a dataset for an empathetic therapeutic chatbot using the Rasa framework, it is imperative to encompass a diverse array of intents, entities, and responses to cultivate a nuanced and compassionate interaction. Intents, representative of user motivations, span a continuum from articulating emotions to soliciting advice on specific challenges. For instance, the "express emotion" intent encapsulates a spectrum of user inputs, including expressions such as "feeling overwhelmed," "experiencing anxiety," or "navigating emotional distress." This nuanced

categorization serves as the foundational bedrock for the chatbot's understanding of user requisites, allowing it to discern the subtle intricacies inherent in therapeutic conversations.

Entities, occupying a pivotal role within this context, are instrumental in distilling key information from user inputs. In the realm of therapeutic discourse, entities encompass specific emotions, such as "sadness" or "anxiety," and relevant contextual situations, such as "work-related stress" or "relationship challenges." Through meticulous annotation within the dataset, these entities become integral in facilitating the chatbot's nuanced recognition and processing of the multifaceted aspects inherent in user expressions, thereby contributing to more personalized and productive responses.

The dataset's third and equally crucial facet is the set of responses. Responses, constituting the chatbot's reactions to user inputs, necessitate careful crafting infused with empathy and understanding. For instance, in response to the "express emotion" intent, the chatbot might convey, "I'm here for you. It's entirely acceptable to feel that way. How may I offer support today?" This nuanced and supportive language not only reflects the ethos of therapeutic conversations but also positions the chatbot as a compassionate and understanding conversational partner. This meticulously curated dataset is a robust foundation for training the therapeutic chatbot. By capturing the nuances of emotional expression, contextual details, and compassionate responses, it empowers the chatbot to engage in emotionally intelligent and nuanced dialogues, providing users with tailored and supportive interactions aligned with their individual mental health needs.

The proposed work involves augmenting our Rasa dataset with Hugging Face's Large Language Models (LLMs) to improve our conversational AI system's natural language understanding (NLU) capabilities. By integrating pre-trained LLMs from Hugging Face with our domain-specific Rasa dataset, we aim to improve the chatbot's ability to comprehend user intents and context, thereby enhancing the overall effectiveness and responsiveness of our chatbot application. Hugging Face and Rasa can be integrated to leverage the strengths of both platforms in chatbot development. Developers can use pre-trained models from Hugging Face, such as BERT or GPT, for natural language understanding tasks within the Rasa NLU pipeline. This involves fine-tuning the pre-trained models on domain-specific datasets relevant to the chatbot's application and integrating them

into the Rasa framework to improve the chatbot's understanding of user messages. Additionally, developers can utilize Hugging Face's models for text generation tasks within the Rasa dialogue management and response generation modules, enhancing the chatbot's ability to generate contextually relevant and engaging responses to user inquiries. By combining the capabilities of Hugging Face and Rasa, developers can create powerful and intelligent chatbots that deliver seamless and personalized conversational experiences.

Llama 2 operates by leveraging large-scale language models to comprehend and generate text relevant to mental health conversations. This involves training the model on a diverse range of therapy-related text data, encompassing various topics such as emotional support, coping mechanisms, therapeutic techniques, and common mental health issues. The model learns to understand the nuances of language used in therapy sessions, including expressions of emotions, concerns, and needs. Requirements for Llama 2 in this specialized domain include access to substantial computational resources for training and fine-tuning the model, as well as a large and diverse dataset specific to therapy conversations to ensure its proficiency. Fine-tuning Llama 2 on such a dataset involves adapting the pre-trained model to better understand and respond to therapy-related queries and prompts, requiring expertise in natural language processing, machine learning techniques, and domain knowledge in mental health and therapy practices

Conversations in therapy often involve complex contextual dependencies and the need for a coherent flow of dialogue over multiple turns. Personalization is crucial in therapy interactions, as users seek tailored advice and support for their unique emotional states and challenges.

Moreover, therapy conversations often involve discussions of sensitive or triggering topics. Rasa's conversational policies can be designed to handle such subjects with care, ensuring that the chatbot responds in a supportive and appropriate manner. Additionally, Rasa supports an iterative development process, enabling continuous model improvement based on user feedback and evolving language patterns. This iterative approach ensures that the therapy chatbot evolves dynamically, maintaining its effectiveness and relevance over time. In essence, the Rasa framework provides a comprehensive toolkit to address the multifaceted challenges inherent in developing a therapy chatbot, fostering a more

supportive and responsive conversational experience in the realm of mental health.

#### IV. CONCLUSION AND FUTURE SCOPE

The AI-Enhanced Conversational Therapy Bot for Mental Well-being represents a pioneering initiative in destigmatizing mental health issues. Employing advanced AI algorithms, the work introduces a transformative approach to addressing the initial stages of depression, anxiety, and exhaustion. Seamlessly integrating professional intervention when required, the bot serves as a crucial guide, particularly in potential self-harm scenarios. Providing a spectrum of self-healing techniques, it fosters a serene mindset. The utilization of sophisticated AI algorithms enhances responsiveness and ensures a nuanced understanding of user needs. This fusion of empathetic conversational interfaces and advanced technology not only diminishes mental health stigma but also emphasizes the harmonious synergy between AI innovation and compassionate mental well-being support.

In addressing initial levels of depression, anxiety, and stress, the AI-enhanced conversational Therapy Bot serves as a supportive companion, aiding in stigma reduction and providing basic mental health support. It is essential to recognize the following limitations. The work primarily addresses 1<sup>st</sup> level issues and may not suffice for prolonged healing or handling concerns beyond its designated scope. Direct consultation with professionals is imperative for comprehensive assistance. Emphasizing the importance of seeking professional help, the bot is positioned as a complement, not a substitute, for the expertise provided by mental health professionals. The bot's continuous learning capability may encounter challenges in accurately interpreting evolving user language, potentially resulting in outdated responses.

Empowered by emerging AI technology, the AI-enhanced Conversational Therapy Bot for Mental Well-being signifies a promising trajectory. The integration of AI holds substantial potential to efficiently scale mental health support, providing personalized assistance and insights. This technological synergy is poised to revolutionize accessibility and effectiveness in mental health care.

The future scope envisions significant contributions to mental health care through potential developments and opportunities. Future iterations could prioritize

expanding language capabilities and enhancing cultural sensitivity to cater to diverse user needs. The bot's evolution may encompass a broader spectrum of mental health challenges, addressing specific disorders and conditions. Continuous updates, informed by the latest research and psychological insights, could enhance its capacity to assist users dealing with diverse mental health issue.

#### REFERENCE

- [1] <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2709750>
- [2] <https://www.snhu.edu/about-us/newsroom/education/why-is-mental-health-important>
- [3] B. T. Atmaja and A. Sasou, "Sentiment Analysis and Emotion Recognition from Speech Using Universal Speech Representations," *Sensors*, vol. 22, no. 17, pp. 6369, Aug. 2022.
- [4] P. Rathnayaka, N. Mills, D. Burnett, D. De Silva, D. Alahakoon, and R. Gray, "A Mental Health Chatbot with Cognitive Skills for Personalized Behavioral Activation and Remote Health Monitoring," *Sensors*, vol. 22, no. 10, p. 3653, 2022, doi: 10.3390/s22103653.
- [5] Á. A. Martínez-Gárate, J. A. Aguilar-Calderón, C. TrippBarba, and A. Zaldivar-Colado, "Model-Driven Approaches for Conversational Agents Development: A Systematic Mapping Study," in *IEEE Access*, vol. 11, pp. 73088-73103, 2023, doi: 10.1109/ACCESS.2023.3293849.
- [6] R. A. Rahman, K. Omar, S. A. M. Noah, M. S. N. M. Danuri, and M. A. Al-Garadi, "Application of Machine Learning Methods in Mental Health Detection: A Systematic Review.
- [7] D. Nie, Y. Ning, and T. Zhu, "Predicting Mental Health Status in the Context of Web Browsing", Institute of Psychology, University of Chinese Academy of Sciences, CAS, Beijing, 100190, China.
- [8] Vaidyam, A. N., Wisniewski, H., Halamka, J. D., Kashavan, M. S., and Torous, J. B., "Chatbots and Conversational Agents in Mental Health: A Review of the Psychiatric Landscape," *The Canadian Journal of Psychiatry*, vol. 64, no. 7, pp. 456-464, 2019.
- [9] R. Qasem, B. Tantour, and M. Maree, "Towards the Exploitation of LLM-based Chatbot for Providing Legal Support to Palestinian Cooperatives," 2023.
- [10] K. J. Kyu, M. Chua, M. Rickard, and A. Lorenzo, "ChatGPT and large language model (LLM) chatbots: The current state of acceptability and a

proposal for guidelines on utilization in academic medicine," *Journal of Pediatric Urology*, vol. 19, May 2023, Art. no. 10.1016/j.jpuro.2023.05.018.

- [11] T. Medeiros, M. Medeiros, M. Azevedo, M. Silva, I. Silva, and D.G. Costa, "Analysis of Language-Model-Powered Chatbots for Query Resolution in PDF-Based Automotive Manuals," *Vehicles*, vol. 5, pp. 1384-1399, 2023.