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MENTAL HEALTH SUPPORT CHATBOT USING NATURAL LANGUAGE PROCESSING ALGORITHM

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Abstract : Mental health problems are one of the measure concern of the 21th century in the field of health care. A study on depression among Indian universities found that 37.7%, 13.1%, and 2.4% of the students were suffering from moderate, severe, and extremely severe depressions, respectively. This study stresses the need for mental health support services to these students immediately. And we are going to provide mental health services for all these students and people who suffered from all of those issues via our Chatbot. Individuals can confidently share their feelings, emotions, and life challenges. In response, our Chatbot analyzes their questions and provides insightful solutions, empowering them to overcome their struggles.

A Chatbot is a computer program that response as a smart entity when converse the text and understand one or more human languages (Marathi, Hindi, English) using NLP(naturallanguage processing), But we are going to provide you a English Chatbot. Chatbot could be used progressively and become more relevant as the next generation of psychological interventions , Chatbot can be a great assistive tool for people undergoing therapy. Timelyinterventions by Chatbot with patients can help to manage mental health conditions.Natural language processing (NLP) is the ability of a computer program to understand human language as it is spoken and written, For example, NLP makes it possible for computers to read text, hear speech, interpret it, measure sentiment and determine which parts are important. Basically, it allows developers and businesses to create a software that understands human language. Due to the complicated nature of human language. NLP algorithms use a variety of techniques, such as sentiment analysis, keyword extraction, knowledge graphs, word clouds, and text summarization. It is a component of artificial intelligence (AI).

Index Terms **- Chatbot, Depression, Insightful solution, Mental health.**

I. INTRODUCTION

According to the World Health Organization (WHO), health encompasses complete physical, mental, and social well-being, not merely the absence of disease or infirmity (WHO, 2018). Life is full of ups and downs, and not everyone can handle stress effectively when problems arise. In such situations, seeking help for mental illness is recommended. Unfortunately, not everyone has access to mental healthcare services. In developing countries, community-based mental health care is scarce; around 52% offer such programs compared to about 97% in high-income countries (Saxena et al., 2007). Financial constraints are not the only barrier; the limited availability of medications and mental health professionals further exacerbates the problem.

The goal of developing this Chatbot is to provide free mental healthcare services. Users only need an internet-connected device to access these services anytime and anywhere, offering a more convenient option to alleviate stress and anxiety. Chatbots have the potential to revolutionize how people interact with data and services. However, there are no empirical studies on why people use Chatbots. This study aims to enhance our understanding of the factors that motivate the use of conversational interfaces. Its findings could guide future research and inform the design and development of Chatbots. Mental health affects our emotional, psychological, and social well-being, influencing how we think, feel, and act. It also impacts how we handle stress, relate to others, and make decisions. Individuals with mental health issues often isolate themselves and avoid discussing their problems. During difficult times, being alone can increase the risk of depression. Continuous attention to mental health is crucial to prevent this. Our project's objective is to create a conversational system accessible to anyone at no cost.

Problem Statement

1. Lack of Voice-Based Communication in Mental Healthcare Chatbots: Most existing mental healthcare Chatbots, such as Woebot and Wysa, rely on text-based communication. Users must type or select predefined options, and implementing voice interaction requires technical knowledge. Our proposed Chatbot will include built-in voice communication, allowing users to choose between voice and text input easily. This feature aims to assist individuals with hearing or vision impairments by offering multiple communication methods, thereby enhancing the service's accessibility and effectiveness.

2. Lack of Diverse Responses in Mental Healthcare Chatbots: Many Chatbots suffer from a lack of generality and variation in their responses (Woudenberg, A.V., 2014). For instance, Chatbots built using APIs like Facebook Messenger Bot often provide repetitive responses if the same question is asked multiple times. Moreover, they struggle to understand unfamiliar inputs. This limitation makes them less suitable for providing counseling services. To address this, our proposed Chatbot will utilize deep learning to improve its understanding of words and deliver more accurate and varied responses. This approach ensures that users receive relevant and diverse answers, enhancing the Chatbot's effectiveness in mental healthcare.

By incorporating voice communication and deep learning, our Chatbot aims to offer free, accessible, and effective mental healthcare services to a wide range of users.

II. LITERATURE SURVEY

ARTIFICIALLY INTELLIGENT CHATBOTS IN DIGITAL MENTAL HEALTH Fulmer et al. (2023) point out that as smart phones and internet access continue to grow, digital mental health care solutions are becoming essential for addressing the accessibility issues found in traditional in-person care. Digital mental health interventions (DMHIs) can reach large and underserved populations. In response to the mental health impacts of the pandemic and concerns about access to mental health services, the U.S. Food and Drug Administration (FDA) issued temporary guidance in April 2020. This allowed for the distribution of digital therapeutics for certain psychiatric conditions, like major depressive disorder and generalized anxiety disorder, without the usual regulatory clearance. Some digital interventions include various types of support, such as therapist guidance, peer support, or administrative assistance provided by non-clinicians like nurses, research coordinators, or lay people.
Input/Data set used: Input Library Data Set.
APPROACH/ALGORITHM/TECHNIQUE: Logistic Regression, KNN Classifier, Decision Tree, Random Forest.
DRAWBACKS: Requires a large dataset.

MENTAL ILLNESS PREDICTION Satvik Gujrkar et al. (2022) highlight that the World Health Organization (WHO) has warned about the cautious use of generative AI in healthcare. AI algorithms depend heavily on the data they are trained with, and biases in this data can lead to biased results. The use of AI in mental health care brings up significant risks and ethical concerns, including issues related to security, bias, and privacy, especially concerning sensitive medical and personal data. More broadly, there are high-risk applications of AI and automated decision-making that could cause harm, such as the creation of deep fakes and algorithmic bias. There are also concerns that AI could perpetuate or amplify biases and narrow viewpoints, and potentially replace humans in some roles. However, AI can also help counter disinformation and improve the accuracy and reliability of information. Defining "unsafe" AI is challenging, and Australian science experts have called for strict safety measures, robust regulations, and standards to mitigate these risks without hindering AI progress.
INPUT/DATASET USED: Provided the questions.
APPROACH/ALGORITHM/TECHNIQUE: SVM (Support Vector Machine), Random Forest, Naive Bayes.
DRAWBACKS: Low accuracy level of the algorithms.

MENTAL HEALTH PREDICTION Chetna Patil et al. (2022) conducted a review paper where they first planned, followed by searching and analyzing relevant documents, which were then summarized and discussed. Their conclusions were presented at the end of the review. Several research questions or objectives were investigated in this review. They aimed to summarize the latest research on machine learning approaches for predicting mental health problems, providing useful information for clinical practice. The review also identified widely used machine learning algorithms in this field, examined the limitations of applying machine learning to mental health, and explored future research opportunities to maximize the potential of these approaches.
INPUT/DATASET USED: Enter the questions.
APPROACH/ALGORITHM/TECHNIQUE: Logistic Regression, SUM, Random Naive Bayes, Random Forest, K-Neighbors.
DRAWBACKS: Requires large datasets for different categories such as anxiety, depression, and insomnia.

MENTAL HEALTH CHATBOT Madhura Adadande et al. (2021) refer to the WHO definition of mental health as a state where an individual realizes their abilities, copes with normal life stresses, works productively, and contributes to their community. Mental disorders affect approximately 29% of people during their lifetime and are one of the leading causes of disability globally. In 2010, mental, neurological, and substance use disorders accounted for 28.5% of global Years Lived with Disability (YLDs), making them the top cause. These disorders also caused about 10% of global Disability-Adjusted Life Years (DALYs), with absolute DALYs increasing from 182 million to 258 million (41%) between 1990 and 2010. The global economy is projected to lose $16 trillion from 2011 to 2030 due to lost labor and capital output from mental disorders. There is a global shortage of mental health workers, with high demand exceeding service provision. Developed countries have about 9 psychiatrists per 100,000 people, while low-income countries have as few as 0.1 per 1,000,000 people. This shortage makes traditional one-on-one mental health interventions difficult. The WHO estimates that mental health services do not reach about 55% of people in developed countries and 85% in developing countries, potentially leading to increased suicidal behavior and mortality.
INPUT/DATASET USED: Please enter the questions.
Approach/Algorithm/Technique: Logistic Regression, KNN Classifier, Decision Tree, Random Forest.
DRAWBACKS: Requires a large dataset.

MENTAL ILLNESS PREDICTION USING MACHINE LEARNING ALGORITHMS Madhura Adadande et al. (2020) emphasize that healthcare is a critical issue worldwide. Effective, well-organized, and robust health systems are essential for improving and maintaining quality of life. Anxiety, depression, stress, irritation, and disappointment have become so common that people now consider them part of personal and professional life. The WHO estimates that 3.8% of the global population experiences depression, including 5% of adults (4% among men and 6% among women), and 5.7% of adults over 60 years old.

Approximately 280 million people globally suffer from depression. Differentiating between anxiety and depression is challenging for machines, necessitating suitable machine learning algorithms for accurate recognition.
INPUT/DATASET USED: Enter any questions.
APPROACH/ALGORITHM/TECHNIQUE: SVM (Support Vector Machine), Random Forest, Naive Bayes.
DRAWBACKS: Low accuracy level of the algorithms.

III. PROPOSED WORK

Early Chatbot designs required programmers to specify a set of possible user inputs and corresponding replies. This process involved reviewing relevant literature to ensure the Chatbot utilized evidence-based medical knowledge. Languages like Artificial Intelligence Markup Language (AIML) and Rive script were employed to encapsulate this knowledge into the Chatbot's "brain" . Recently, AI has been leveraged to make Chatbot interactions more human-like. With AI, the ability of humans to understand and respond to each other is programmed into Chatbot systems. Frameworks such as OSCOVA, IBM Watson, and RASA stack support the development of AI-based Chatbots.

AI introduces two crucial elements for generating appropriate responses in Chatbots: machine learning and natural language processing (NLP). NLP helps Chatbots understand and interpret user input, recognize patterns, identify entities, detect co-occurrences, and determine relationships in user-generated data. Tasks in NLP include domain classification to ascertain user intent and slot filling. Analyzing user input is essential for crafting suitable responses, as NLP aims to understand intents, emotions, and other semantic elements within user statements. NLP is also used to summarize user utterances, identify significant changes, perform sentiment or emotion analysis, and recognize entities.

Benefits of Chatbots in Mental Health

Due to the global shortage of mental health professionals, Chatbots can significantly increase access to mental health support, potentially enhancing the availability and quality of mental healthcare at lower costs. Chatbots are particularly beneficial for individuals reluctant to discuss their mental health issues with healthcare providers due to stigma. Research by Lucas and colleagues found that veterans disclosed more symptoms of posttraumatic stress disorder to a Chatbot than to anonymized or non-anonym zed self-administered questionnaires.

Challenges

Despite the numerous benefits of AI in mental health Chatbots, several challenges must be addressed. These include technical, ethical, practical implementation, and accountability challenges.

Technical Limitations of Mental Health Chatbots

Even though AI can help create Chatbots capable of passing the Turing test, technical limitations persist. Current systems struggle to remember previous conversations, leading to potentially inappropriate responses. To address this, information about the user and their mental state needs to be collected and stored for future interactions with the Chatbot.

Ethical Challenges

Many mental health Chatbots available in app stores are not evidence-based or lack a solid research foundation. For Chatbots to be reliable and effective, they should be based on clinical evidence, incorporating approaches proven effective in clinical practice. Furthermore, there is limited evidence on the therapeutic effects of mental health Chatbots. A systematic review highlighted difficulties in drawing definitive conclusions about the impact of Chatbots on various mental health outcomes due to a high risk of bias, low quality of evidence, a lack of studies on each outcome, small sample sizes, and contradictory results in some studies. These limitations could potentially harm users through inappropriate recommendations or unrecognized risks.

IV. SYSTEM DESCRIPTION

Start: The chatbot initiates the conversation with a welcome message and prompts theuser to begin.
User Input: The chatbot asks an open-ended question to prompt the user to share theirreason for seeking support, such as "How are you feeling today?" or "What brings youhere?"
User Response Analysis: If the user expresses a specific mental health concern (e.g.,anxiety, depression, stress), the chatbot proceeds to provide relevant support and resources tailored to that concern.
If the user's response is vague or unclear, the chatbot may ask additional probing questions to better understand the user's situation.

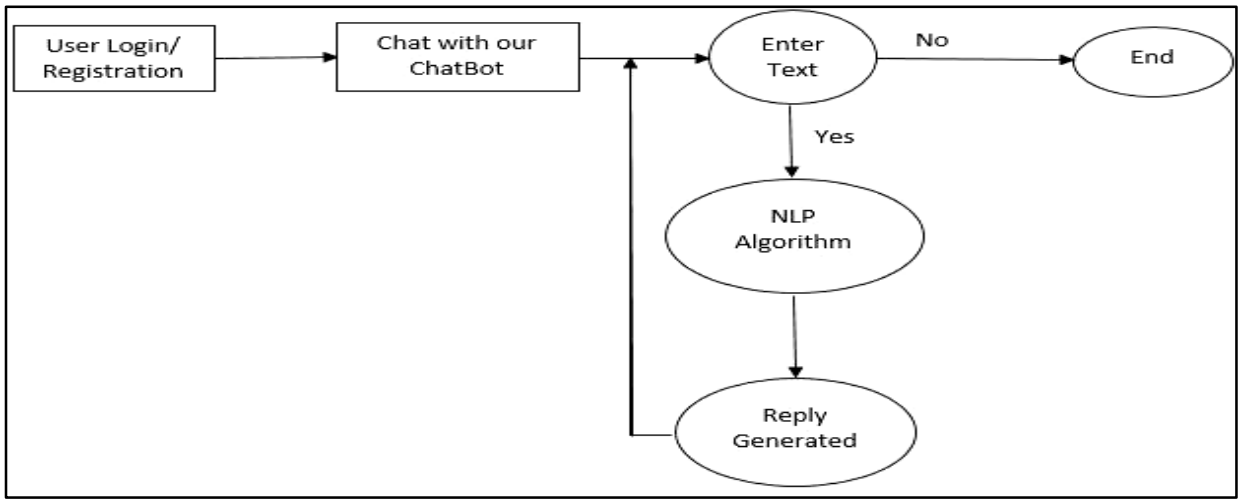

Fig: Flow Chart Diagram

Symptom Assessment: The chatbot asks the user a series of questions to assess theirsymptoms, such as their frequency, severity, and duration.
Based on the user's responses, the chatbot may provide psychoeducation about commonmental health symptoms and recommend self-help strategies or coping techniques.

Risk Assessment: If the user's responses indicate potential risk factors (e.g., thoughts ofself-harm or suicide), the chatbot responds with empathy and urgency, providing crisis support resources and encouraging the user to seek professional help immediately.
Intervention Options: The chatbot offers a range of intervention options based on theuser's needs and preferences, including self-help resources, guided exercises (e.g., relaxation techniques, mindfulness), and suggestions for seeking professional support (e.g., therapy, counseling).
Feedback and Follow-up: After providing support or resources, the chatbot asks forfeedback on the interaction and encourages the user to follow up if they have further questions or concerns.
The chatbot may also offer reminders for self-care activities or follow-up prompts tocheck in on the user's well-being at a later time.
End: The conversation concludes with a closing message, expressing support and encouragement for the user's well-being, and inviting them to reach out again if needed.

V. RESULT AND DISCUSSION

User Interface

Designing the user interface (UI) for a mental healthcare chatbot requires careful consideration to ensure its intuitive, supportive, and conducive to promoting mental well-being. Here's a suggested layout for such a chatbot:
Step1:-The user would first need to login or register for an account.
Step2:-Once logged in, you can chat with our Chatbot.
Step3:-The user would then enter some text or voice, such as a sentence or paragraph.
Step4:-The system would then use a natural language processing (NLP) algorithm togenerate new text based on the input text.
Step5:-The generated text would then be displayed to the user.

Main Page of User Interface

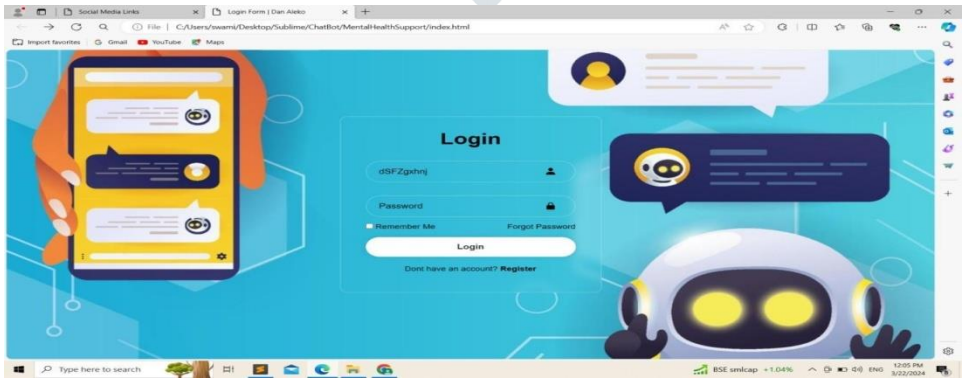

Fig. Main Page of Mental Health Support Chatbot

The main page of the User Interface (UI) of our Mental Health Support Web Chatbot. Here you can login or register through your email address and password and then proceed.

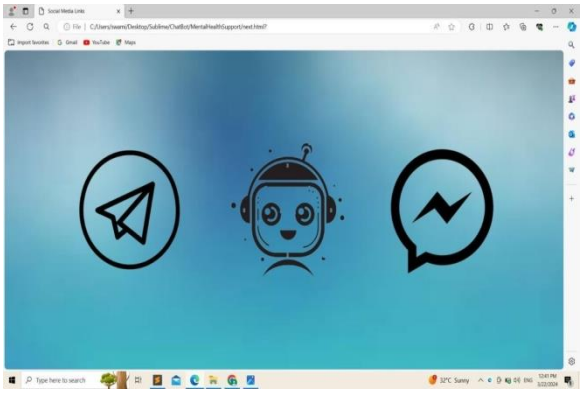

Fig. Platform Selection Paged to the next page.

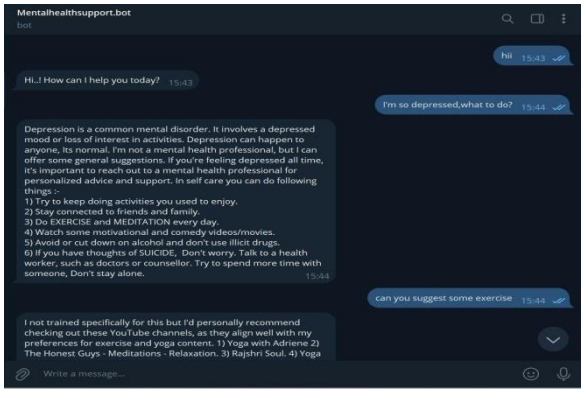

Fig. Telegram Bot

You can trust us with your mental health struggles. Share your concerns, and let's navigat through them together.You just have to tell your disease name to our chatbot then it will generate reply according to your disease.

VI. CONCLUSION AND FUTURE SCOPE

The main aim of the proposed chatbot is to assist people by offering both text-based and voice-based counseling services. Many individuals struggle to access mental healthcare services easily. This chatbot provides continuous support 24/7 without any cost. Despite its development, the chatbot still has limitations, particularly in providing varied responses consistently. Enhancing the accuracy of the model's predictions requires training with larger datasets.

Designing a smooth conversation flow for the chatbot is challenging. The lack of psychological expertise and experience contributes to this difficulty, as it is not guaranteed that users will follow the given instructions. While the chatbot can provide relevant responses even if the conversation strays from the intended path, this limits its ability to perform all functions effectively, reducing the overall quality of the mental healthcare service. To copy human typing behavior, a typing indicator was added. Cool colors like blue or green were chosen for the chatbot's UI to evoke a sense of calmness and trust, as colors can indicate basic moods, tones, concepts, and connotations.

In summary, the current version of the proposed chatbot cannot be considered perfect or capable of delivering 100% quality mental healthcare services. There is still significant space for improvement in the future.

Future Scope

The proposed chatbot can be enhanced by expanding its training data. Continually collecting user feedback or collaborating with human counselors to improve the chatbot's content is recommended. This would enable the chatbot to provide more professional counseling services.

Additionally, the chatbot could be made more advanced by incorporating facial emotion recognition. Similar to voice emotion recognition, facial recognition would enable the chatbot to respond to users' facial expressions appropriately. By integrating both recognition modules, the chatbot could more accurately assess users' situations and offer better support. The future of mental health support chatbots is promising, given the growing acceptance of digital mental health interventions. Potential future directions and advancements include:

Personalization and Adaptability: Future chatbots can enhance their ability to personalize interactions based on users' unique needs, preferences, and emotional states. By utilizing advanced machine learning algorithms and natural language processing (NLP) techniques, these chatbots can tailor responses and interventions more effectively.

Emotional Intelligence and Empathy: Improvements in AI and NLP could enable chatbots to better recognize and respond to users' emotional cues, showing greater empathy and understanding. This could involve analyzing text, voice, or even facial expressions to accurately gauge users' emotional states and provide appropriate support.

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