A Mental Health Chatbot Delivering Cognitive Behavior Therapy and Remote Health Monitoring Using NLP And AI

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***Abstract*— Saarthi is a mental health interaction portal that offers a virtual solution to patients suffering from anxiety and depression. The platform is designed to provide comprehensive information on these conditions and their treatments and to connect patients with trained professionals who can provide support and guidance. At the heart of Saarthi is a chatbot, which uses advanced AI algorithms to provide personalized and empathetic support to patients. The chatbot is trained in various therapeutic techniques, and can help patients manage their symptoms, improve their wellbeing, and access the resources they need to live a fulfilling life. The website also provides access to a community of peers and medical professionals, allowing patients to connect with others who understand their struggles and offer support. With Saarthi, patients can access quality mental health care from the comfort of their own homes, making it a convenient and accessible solution for anyone struggling with anxiety and depression.**

Keywords—Anxiety Assist, Mental Well, Empathy Bot, Chatbot, NLP, AI

I. INTRODUCTION

Mental health is a pressing global issue, and with the advancements in technology, there is an increasing interest in the use of chatbot to provide mental health support. This research paper introduces a novel chatbot system that employs natural language processing (NLP) and artificial intelligence (AI) to deliver Cognitive Behavioural Therapy (CBT) and remote health monitoring for individuals experiencing mental health issues. The chatbot aims to provide accessible, affordable, and convenient mental health care by delivering evidence-based treatment in real-time. This study investigates the effectiveness of the chatbot system in reducing symptoms of anxiety and depression, as well as its potential for long-term monitoring of mental health outcomes.

Poor lifestyle and bad habits of human life have led to the most significant problems such as stress, anxiety, depression which is creating havoc in human life and distinguishing it from a comfortable and peaceful brain state. As a result, according to the study there is a sudden decrease in the emotional strength of a person due to which symptoms like peritraumatic distress, bipolar disorder, hypertension, brain fog, brain fatigue has gained control over. To overcome these problems, cognitive behaviour therapy is the best option. Making it free and easily accessible is the goal of this study. Due to mental health diseases, human to human conversation has decreased and thus it is very important to monitor human brain health and provide mankind an instant solution for the same.

II. BACKGROUND

A psychotherapy strategy called Cognitive Behaviour Therapy (CBT) tries to change harmful thought and behaviour patterns that fuel mental health issues. A variety of mental health conditions, such as depression, anxiety, and post-traumatic stress disorder, have been successfully treated with it (PTSD). A mental health practitioner often conducts one-on-one sessions with patients to give CBT, an evidence-based treatment.

Despite its effectiveness, many people may find it difficult to get CBT. Those who live in isolated or rural locations, where access to mental health care may be constrained, are especially at risk in this regard. Individuals may also find it challenging to get CBT due to issues like financial limitations, stigma, and a lack of mental health experts. Using technology, such as chatbots, is one solution to this problem. Computer programmes known as chatbots simulate conversations with people by using natural language processing. They can be configured to offer assistance, psychoeducation, and even CBT therapies.

The usage of chatbots offers the potential to improve access to CBT and mental health services for individuals who need it. People can more easily ask for assistance from the comfort of their own home by using chatbots, which they can access via their smartphones or other devices, for instance. Moreover, chatbots can be trained to deliver CBT interventions in a systematic and predictable way. This can be very helpful for people who do not have access to normal therapy sessions.

Although chatbots cannot completely replace the advantages of in-person counselling with a mental health expert, they can be a useful tool for boosting access to mental health services, especially for individuals who might not otherwise be able to get help. The use of chatbots in a comprehensive mental health care plan is crucial, and those who are struggling with serious or complex mental health

concerns should still seek professional assistance from a qualified mental health professional

III. LITERATURE REVIEW

With practise, your mentality, behaviour, and general well-being will improve thanks to Cognitive Behaviour Therapy's method of recognizing, combating, and altering harmful thinking. Through CBT, your therapist will help you pinpoint the thought patterns that are contributing to your suffering. This is a crucial step in controlling strong emotions and destructive behaviour. [1] This technique converted Sat Methods A self-guided mental healthcare course and a chatbot system were established through digital content, and a comparison evaluation experiment without a chatbot was run as a control group [2]

According to the Survey of Mental Health and Well being in England 1 in 6 adults aged 16 and older reported experiencing symptoms of a common mental health disorder, such as sadness or anxiety . Common mental problems were more prevalent in women than in men., prevalence has increased since 1993. [3]. Chatbots can be integrated in the form of text, voice and virtual reality which can actual transform the interaction and more complex system as compared to ELIZA and rule based models such as advanced AI and NLP are used to enhance the level of counselling [18].

Chatbots are capable of delivering traditional psychotherapy due to advanced AI and virtual engagement but they are limited to some extent which may not be able to deliver more physical and one to one interaction.[15]

Chatbots are capable of tracking person's mental health and are more capable of providing them the accurate result and better counselling by using smart algorithm which segments the level of suffering by analyzing the input from the user and referring it to more advanced psychotherapy in order to fasten and create more effective results.[19]

IV. PROBLEM STATEMENT

Today's era consists of multiple challenges not with physical but with mental health too. It is mandatory to maintain the body and mind equilibrium in order to live a healthy life. People are often creating stress in their mind as a result their emotional health is at the edge and quality of life has decreased .

The problems which are generally affecting the quality of life are multiple and the chatbot is capable of solving some major life problems such as -

- Personal loss
- Relationship issues
- Health issues
- Negative curiosity
- Educational Problems
- Finance problems
- Negative overthinking
- Mental Trauma

V. SYSTEM ARCHITECTURE

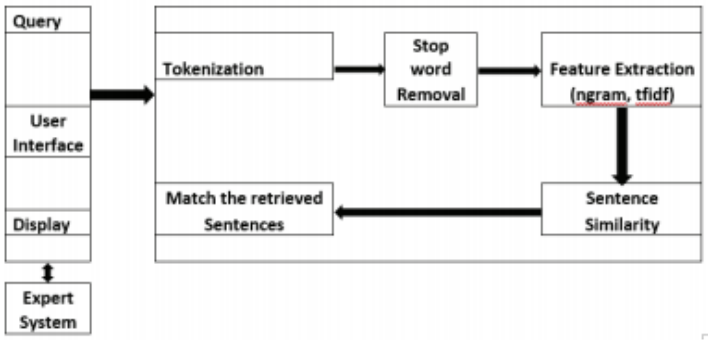

Fig.1. System Architecture

VI. METHODOLOGY

The Chatbot focuses on merely decreasing the stress levels inside the brain which creates mental health disorders such as Depression, Anxiety, Bipolar Disorder, Alzheimer's.

It uses techniques such as -

A. Natural Language Processing

Natural Language Processing, or NLP, is the process through which computers comprehend human language. It undergoes text generation, classification, summarization, translation, and more. NLP uses a variety of methods and ideas to represent text as mathematical formulas, patterns, paradigms, and equations Common NLP formulas include the following:

B. Term Frequency-Inverse Document (TF-IDF)

A formula called frequency assesses a word's significance in a document in relation to a group of documents. It is determined by dividing the inverse document frequency by the term frequency, or how frequently a word appears in a document (how rare a word is across all documents).

The weight of each term in the sentence is determined using term frequency and inverse document frequency.
Using the formula below, you may determine the term's frequency to see how frequently it appears in each sentence.

$$tf = tfi$$

The abbreviation tf stands for term frequency.

The weight of unusual terms across all reports in the document was calculated using IDF. The document's words that only sometimes appear have high IDF scores. It is provided by the underlying circumstance.

$$idf = Log\ N / df$$

IDF, or inverse document frequency, is to be noted.

The weight of the term or word in the document is created by combining the tf and idf. The weight is calculated by multiplying the tf and idf numbers.

$$Wi = tfi * logN/df$$

C. N-Gram

With variable length arrangements, N-gram aims to expand existing N-gram models. A grouping of words, a word class, a grammatical feature, or any other succession of items that the modeler believes to have important language structure data might be considered a sequence. N-grams are employed in this system to extract the pertinent keywords from the

database, compress the text, or decrease the amount of data in the document.

D. NLTK (Natural Language Toolkit)

A set of tools for doing natural language processing (NLP) activities are provided by the Python package known as NLTK (Natural Language Toolkit). For the tokenization, stemming, tagging, parsing, and categorization of text data, it contains several algorithms and modules. It can also be combined with statistical and mathematical methods to evaluate text data and produce insights.

E. Tokenization

Tokenization is a natural language processing technique that involves breaking down a text or speech into individual words, phrases, or symbols, called tokens. This process enables algorithms to analyse and process language more effectively, allowing for tasks such as language modelling, text classification, and machine translation. Tokenization is a critical step in many NLP applications.

F. Sentimental Analysis

The goal of sentiment analysis is to recognize and classify the views and sentiments represented in the text in order to extract subjective information from text data. It often entails examining text data for subjectivity, sentiment intensity, and polarity (positive, negative, or neutral). Rule-based methods, machine learning-based methods, and lexicon-based methods, which use mathematical formulas to assign scores or weights to words and phrases depending on their sentiment polarity, are common methodologies for sentiment analysis as shown in Fig. 2.

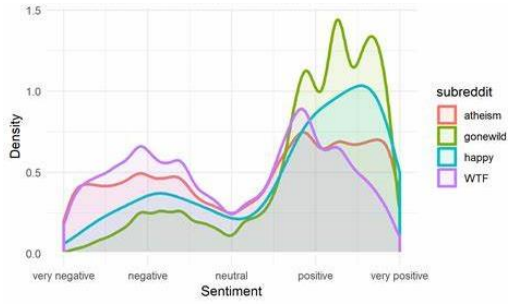

Fig. 2. Average Mood Profile

G. Rasa

An open-source framework called Rasa is used to create conversational AI chatbots and personal assistants. It enables the development of sophisticated dialogue systems that make use of machine learning and natural language processing. Rasa offers capabilities for processing user input, organizing dialogues, and interacting with outside systems.

H. Stop word expulsion

Stop word expulsion is a popular method in natural language processing for getting rid of words that are deemed unnecessary or unimportant in a certain context. Some words, like "a," "the," and "and," have little significance and can be safely eliminated from a writing or speech without changing its main point. Algorithms for text analysis and classification gain accuracy and efficiency from this process.

I. Flutter

Google developed the open-source Flutter framework for building mobile apps. With a single codebase, it lets developers to create high-performance, cross-platform programmes for both the Android and iOS platforms. Flutter offers a wide range of pre-built widgets and features that make it simple and quick to create apps with stunning, native-looking user interfaces.

VII. RESULTS

It was found on the comprehensive information about the 2021–2022 CLI (Clinical Load Index).This study carefully reviewed hundreds of centers via phone and email extensively and data from 685 member centers were received.

For accuracy we monitored the centers and due to inappropriate benchmarks, 59 centers in total were omitted. The CLI distribution for 2021–2022 is as follows.[10]

- N = 626
- Range = 21-291
- Mean = 106
- Median = 100
- Standard Deviation = 41
- Zones:
- – Low: 21 to 65
- – Mid: 66 to 147
- – High: 148 to 291

In many centers, the reasons for the CLI changes were mainly due to declines in counselling centre utilization (utilization), with decreases in staffing levels (clinical capacity) following the start of COVID-19.Therefore, it was a big concern of visiting clinics for mental health counselling due to fear of COVID- 19.

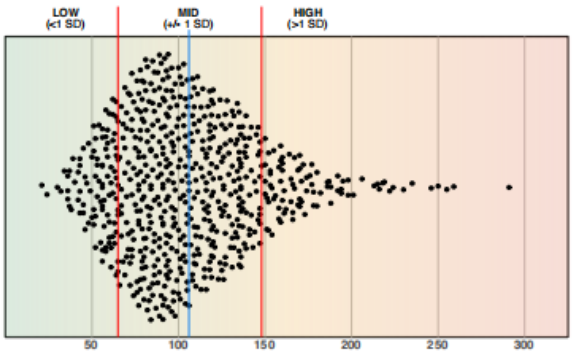

Fig. 3. CLI Distribution of CCMH 2021-22 study

To improve this CLI index, a platform is provided where each individual belonging to any class can avail the platform and the load on the physical clinics were reduced with a better efficiency in counselling procedures providing satisfactory counselling using NLP and AI as well as a tool to CBT(Cognitive Behaviour Therapy).

People can avail the facility at any remote place by just holding a mobile device making availability more easier.

The Fig 4.1, 4.2, 4.3, 4.3.1 shows the working of the application to reduce the Clinical Load and better counselling facility at convenience.

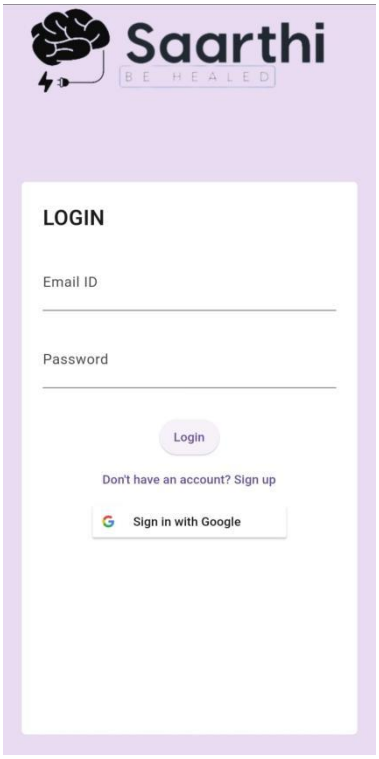

Fig. 4.1. Login page

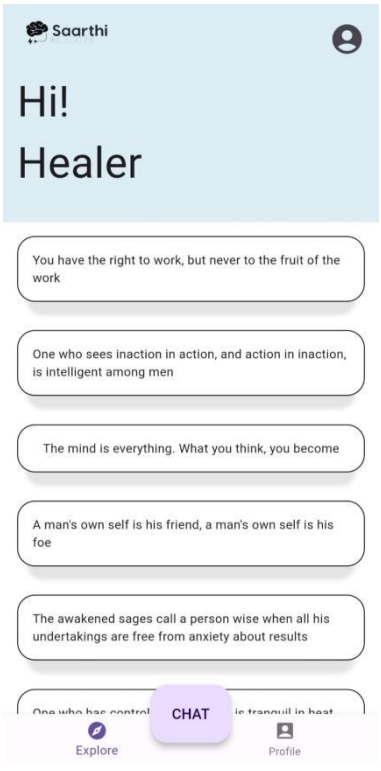

Fig. 4.2. Home Screen

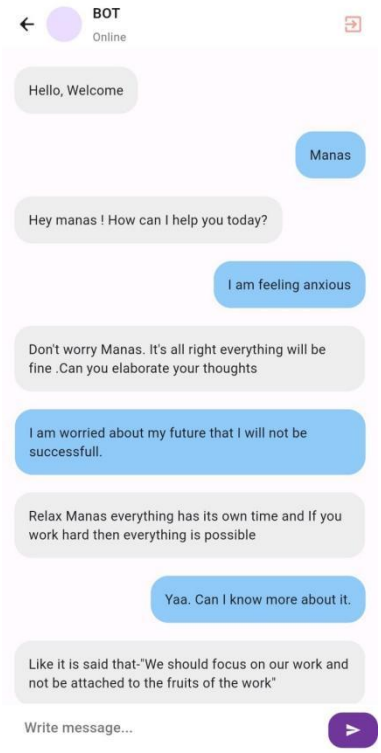

Fig.4.3. Chatbot Screen

Fig.4.3.1 Chatbot Screen

VIII. FUTURE SCOPE

Saarthi can give free mental health counselling online in a very efficient manner, assisting a class of people who cannot afford the high costs of in-person physical and mental counselling. Chatbots are more usable for humans because they can be easily accessed and helpful with just a mobile device and an internet connection. Mental health Chatbots can

offer people a flexible and convenient approach to obtain mental health support. Because Chatbots are available around-the-clock, they can offer support whenever it is convenient for the users. Saarthi's mental health Chatbot will advance, allowing for more individualized support that is tailored to each person's requirements and preferences.

This can entail customizing the chatbot's responses to each user's personality, tastes, and mental health background. Also, the bot can be used in conjunction with various exercises and a positive wall to motivate and inspire users to recover themselves and be prepared to use the bot immediately rather than waiting for a physician appointment. The purpose of mental health chatbots is to help people create the right feelings within themselves that will help them heal using an efficient and more tailored solution more similar to human cognitive behaviour therapy. These chatbots are programmed to understand the human brain condition using the feelings and to judge and provide a more stable and effective counselling using feeling-centric solutions.

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