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Sakhi: AI-Generated Mental Health Companion

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***Abstract*—In modern human society, mental health issues have become one of the biggest healthcare challenges. Nowadays, every individual experiences these issues that cause harm to the person, family, career, community, and even the economy. Chatbots, also referred to as communicative agents, are a relatively new technical advancement effectively utilized in mental healthcare. They are a scalable platform that offers initial support to those having mental health issues. We conducted a mental health study and received feedback from about 800 users. The female users in the age group of 30 and above were the majority. We conducted statistical analysis and used various machine learning models to extract various insights. The results show age, struggle in coping-up, and change in work were some factors that resulted in feeling stressed among users. The accuracy of the Random forest classifier is 0.37 and that of the Gradient boosting classifier is 0.33. This demonstrates the necessary inclusion of AI in mental health support. In this study, we aim to provide individual mental health care with the help of an Artificial intelligence-driven mental health chatbot, Sakhi. It delivers insightful analysis that offers emotional support, individualized help, and remote mental health monitoring.**

***Index Terms*—Artificial Intelligence, Machine Learning, Study, Stress, Chatbot, Efficacy, Daily Monitoring, Therapy**

I. Introduction

Mental health issues represent a widespread global health concern, affecting almost 1 billion individuals worldwide, and encompass a variety of ailments such as sadness, anxiety, depression, and more serious diseases like psychosis and personality disorders. It has far-reaching effects that extend beyond personal suffering and initially show up in adolescence and early adulthood. They significantly lower the quality of life of those who suffer from them and make it more difficult for them to contribute to society and the economy. The yearly anticipated expense of mental health problems worldwide is staggering; by 2030, estimations indicate that the amount will have risen to USD 6 trillion. There are various traditional mental healthcare services, although incredibly successful, that are not scalable to satisfy the increasing demand from the affected persons.

Chatbots, also known as conversational agents, are a relatively new technology that has been effectively used in the mental health industry. They serve as a scalable platform to help individuals with mental health issues. They can interact with people who would otherwise be reluctant to ask for help since mental health is stigmatized as an illness or disorder. Studies have examined how well chatbots can support self-disclosure and expressive writing. They have provided a range of social and emotional support, especially to young people who are experiencing mental health issues. Consumers see chatbots as a potential solution for various mental health issues, displaying early indicators of improvements in both physical and mental well-being outcomes.

In this study, a mental health study was carried out to obtain insightful information on experiences related to mental health. We performed this study using machine learning algorithms (ML). We proposed Sakhi, a mental health chatbot, as a cutting-edge approach to enhance mental health assessment and support. This chatbot is based on Behavioral Activation (BA) therapy, which provides various therapies in the form of daily monitoring, professional therapy, and various other therapies.

This research examines the characteristics of chatbots for mental health, a study on mental health, the suggested approach for the chatbot algorithm, and the several treatments that are suggested on the recommended site.

II. Characteristics of Mental Health Chatbot

Chatbots have become useful technology in the field of mental health care. They have a wide range of features intended to cater to different needs. Our study discusses the four main characteristics of a mental health chatbot [4]. The four main characteristics of a chatbot for mental health are shown in Figure 1:

- **Technological Assistance**: Chatbots make technology more convenient by giving people a way to communicate quickly and easily. They provide 24/7 assistance, so users can interact whenever it's convenient for them.
- **Informative**: The chatbot gives users relevant data about their queries. They function as virtual assistants that are outfitted with knowledge bases and natural language processing skills to provide accurate and pertinent information.
- **Social Relationship**: Chatbots are designed in such a way that they form a social relationship with users to make them feel more bonded. Chatbots converse with users, playing the part of social buddies.
- **Psychological Support**: Chatbots help users with coping mechanisms by providing emotional and psychological support. They may use therapeutic approaches, mindfulness, and behavioral psychology concepts to offer emotional support, self-help advice, and encouragement.

Fig. 1. Characteristics of a Mental Health Chatbot

III. Literature Review

The pandemic has drawn attention to the alarming rise in mental illness as well as the difficulties that many individuals have in obtaining and using various healthcare services. Mental health issues are classified into 20 primary categories, where anxiety and depression stand out as the most common mental health issues, particularly impacting the working-age population [15], [18]. While every individual aims to be mentally and physically fit, various technologies like apps and websites that support individuals with mental health issues have shown to be beneficial in addressing a variety of requirements in both adults and children, such as resolving housing and employment-related concerns by providing integrated therapies [2], [13], [21].

Artificial intelligence (AI) integration into chatbots has become a viable way in the field of mental health care, and that has led to brisk research and development in the field [1]. One of the studies compared chatbot therapy with bibliotherapy, and the results showed that chatbot therapy was more successful in reducing anxiety and depressive symptoms. Numerous research works have assessed how well mental health chatbots can assist people with a range of mental health issues. Furthermore, the study revealed that individuals who utilized the chatbot experienced an increased sense of connectedness to the therapy. Thus, the study raises the possibility that chatbots could be a helpful tool for individuals of any age group looking for assistance in controlling their depression, and any other mental health issues [10], [17]. It has also been observed that the Internet of Things (IoT) technology could be helpful in mental health issues with remote monitoring and emergencies like privacy and surety matters [20].

There are various chatbots available for mental health, each with its unique features and characteristics. A few well-known chatbots for mental health issues are Youper, Wysa, Replika, and Woebot [3], [7]. Even with the availability of these chatbots, research on chatbots for mental health is still lacking for many reasons, such as efficacy, as many chatbots are still new, and thorough scientific research is required for their effective use. It is also necessary to understand how to personalize interventions that depend on each person's demands and preferences. Also, handling the user's data with security is necessary. Thus, mental health chatbots present a viable option for scalable and easily available mental health support [9], [12]. Also, machine learning's importance in the evaluation of sustainable products showcases opportunities to apply ML to various fields of technology [14].

The user experience and engagement of AI mental health chatbots are commentating to their success, highlighting the significance of a user-centered design strategy that takes semantics, connection, and magnanimousness into account. Facilitating communication and understanding improves prolonged involvement and productive results. A recent study explores the use of chatbots to improve mental health, with a focus on Behavioral Activation (BA) therapy. Based on BA principles, researchers created an AI chatbot that offers remote mental health monitoring, targeted help, and ongoing emotional support. A pilot research demonstrates the efficacy of the chatbot and highlights its potential to assist people with mental health concerns. This study highlights the potential of AI-driven chatbots to provide scalable, individualized mental health services [6], [11], [19].

IV. Study on Mental Health

A. Feature Selection

The study was performed with the help of a questionnaire prepared based on basic details about the users and also the changes that they experienced. It includes various questions about their age, gender, profession, number of days indoors, change in weight, change in habits, mood swings, struggles to cope, change in work, and social weaknesses. Finally, they were asked about any mental history and if they were feeling stressed or depressed [5], [16].

This questionnaire was based on how chatbots usually interact with users to get to know them and recommend daily monitoring and various other therapies accordingly. These questions were then converted to form various attributes for our study which resulted in 12 attributes on which we performed various methods and machine learning models to analyze them.

B. User Interactions

The study was performed with the help of a Form that included the questionnaire and was given out through WhatsApp and emails. There were a total of 800 individuals, from almost all students to the working-age population, who gave feedback to our Form. There were around 434 females and 366 males. Figure 2 and Figure 3 represent a graphical representation of all attributes that were included and the feedback received from various users.

C. Methods

1) ***Statistical Analysis****:* To analyze the dataset and derive various insights from it, the Chi-squared test was performed on it. The chi-squared test is a statistical test that is used to analyze the association between categorical variables [8]. In the context of our dataset, Hypothesis testing was performed. The chi-squared test can be used to create hypotheses about the relationships between particular variables and evaluate the evidence supporting or against these hypotheses. The alpha (α)

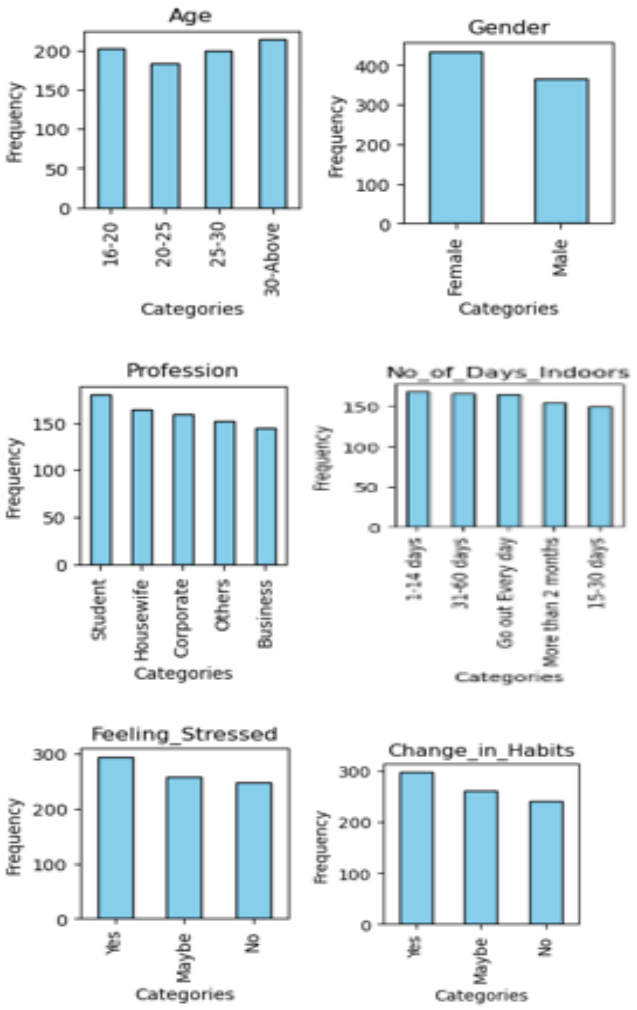

Fig. 2. Graphical Representation of Attributes

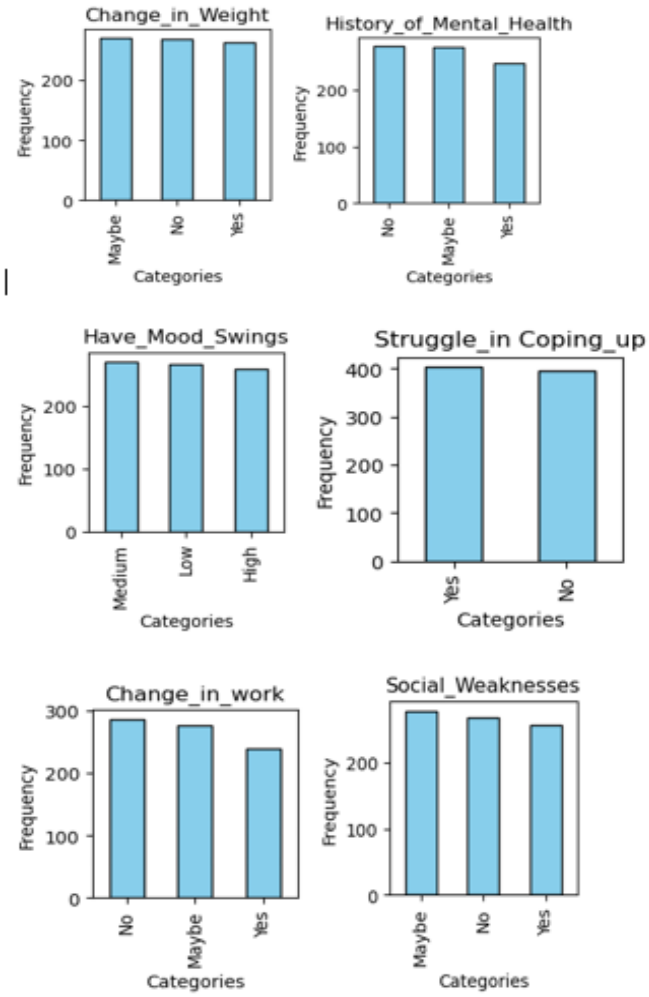

Fig. 3. Graphical Representation of Attributes

used for the testing is taken as α>=0.05. The null hypothesis (H0) and alternative hypothesis (H1) are as follows:

H0: There is no relationship between variables.

H1: There is a significant relationship between variables.

*2) **Machine learning models**:* Datasets related to mental health entail complex relationships. To determine this relationship, we performed on Jupyter lab using the Python programming language, where classification was performed using two machine learning algorithms, the Random Forest Classifier, and the Gradient Boosting Classifier algorithm.

- **Random Forest Classifier**: It is used to determine which of the variables has a greater influence on the target variable.
- **Gradient Boosting Classifier**: It is flexible for a variety of applications, such as regression or classification, because it optimizes a particular loss function. It modifies the model to reduce errors that are relevant to predictions about mental health.

D. Results

*1) **Statistical Analysis**:* The Chi-squared test was performed in such a way that if the p-value is less than α then the alternative hypothesis is significant else the null hypothesis is significant. The result is shown in tabular form through Table 1.

*2) **Machine learning models**:*

- **Random Forest Classifier**: The accuracy that the model gave is 0.36875.
- **Gradient Boost Classifier**: The accuracy given by the model is 0.33125.

The Random forest classification graph and the Gradient boost classifcation graph are shown in the form of a graphical representation. Figure 4 and Figure 5 represent the following:

V. Proposed Methodology

The study on mental health indicates that people from young age to the working-age population suffer from mental health issues. This could be due to their change in work and their

TABLE I
CHI-SQUARED TEST RESULTS

Variables				
Variable 1	**Variable 2**	***Chi-square value***	***P-value***	***Statistical Significance [Yes/No]***
Gender	FS	4.25	0.12	No
Profession	FS	1.54	0.99	No
Age	FS	6.45	0.37	Yes
Number of Days Indoors	FS	10.60	0.22	No
Change in Habits	FS	10.21	0.04	Yes
History of Mental Health	FS	2.59	0.63	No
Change in Weight	FS	1.03	0.90	No
Have Mood Swings	FS	5.60	0.23	No
SiC	FS	0.14	0.93	Yes
Change in Work	FS	5.90	0.21	No
Social Weak-nesses	FS	0.72	0.95	No
Gender	SiC	2.59	0.11	Yes

Abbreviations: Feeling Stressed - FS
Abbreviations: Struggle in Coping-up - SiC

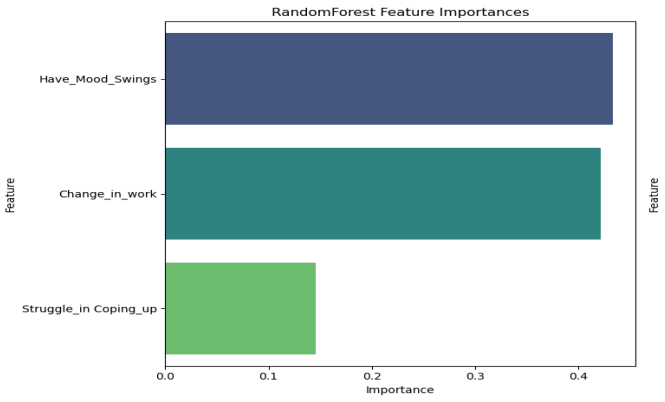

Fig. 4. Random Forest Classification Graph

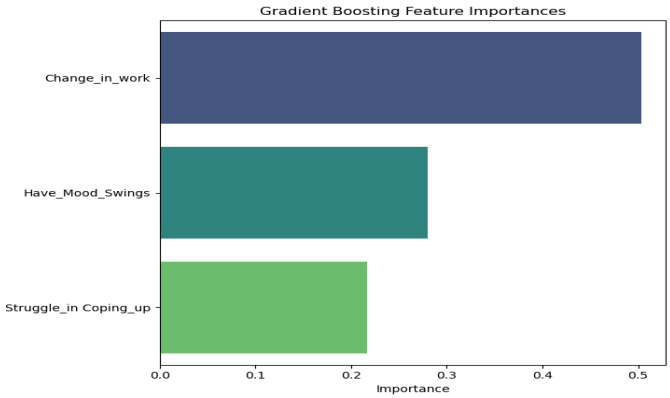

Fig. 5. Gradient Boost Classification Graph

struggle to cope with it. It became clear that the dynamic and nuanced features of people's mental health are difficult to capture by typical study methodologies.

We proposed a pioneering solution, a mental health chatbot to address these challenges. Our proposed methodology describes how a user could interact with the chatbot and how the chatbot recommends various therapies. This is represented with the help of Figure 6. The methods are as follows:

- **User**: The user will communicate with our chatbot via text messages. The user will be questioned in general about their everyday activities. Their feelings during the last few days and additional details on any health problems.
- **Chatbot**: The chatbot is developed using the DialogFlow framework. Dialogflow, powered by Google Cloud, is a platform that facilitates conversation flow and natural language understanding. It also integrates NLP capabilities to enhance the chatbot's ability to acknowledge the user's input. It utilizes the data acquired throughout the discussion to tailor the user's answers. Following an analysis of users' data, which includes their preferences, conversation history, and detected mental health concerns, the chatbot recommends tailored therapy solutions proactively. By seamlessly integrating with the specialized mental health website, the chatbot offers consumers a single location to access resources and support. The website's chatbot, which has an intuitive layout, makes it simple for users to navigate and talk, allowing them to discuss suggested therapies with ease.
- **Therapy Site**: The therapy site includes various therapy options that the chatbot recommends to the user. This site was developed using HTML, CSS, and JavaScript for frontend development and server-side languages, i.e., Node.js and Python, with Django used for backend development. The therapies recommended are shown in Figure 7.

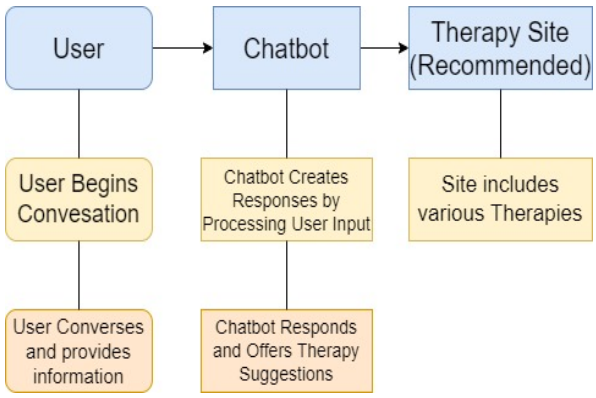

Fig. 6. Workflow Diagram

VI. ALGORITHM FOR MENTAL HEALTH CHATBOT

The algorithm of the chatbot for mental health issues is shown in Figure 8. The algorithm for mental health chatbot

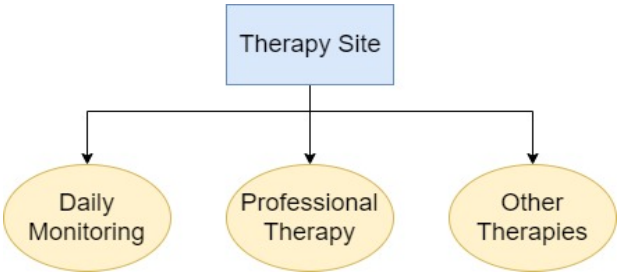

Fig. 7. Therapies Recommended by Site

includes the following steps:

1) The algorithm is initiated by a user interacting with the chatbot through text or speech input.
2) The chatbot sends the user's message to the Natural Language Understanding (NLU) module, where the user's intent is identified and various relevant entities are extracted from it, such as the user's emotions or symptoms. The chatbot then requests any data or action from its knowledge base.
3) The dialog management system of the chatbot chooses the proper response action based on the entities and intent that have been discovered. To deliver accurate and pertinent answers, the chatbot could ask for further details from a knowledge base.
4) The response action obtained from dialog management and the knowledge base is then used to generate a response message for the user.
5) The Natural Language Generation (NLG) module is used to generate a human-like response based on response action.
6) The produced response is shown to the user in a conversational style that keeps the tone light and encouraging.

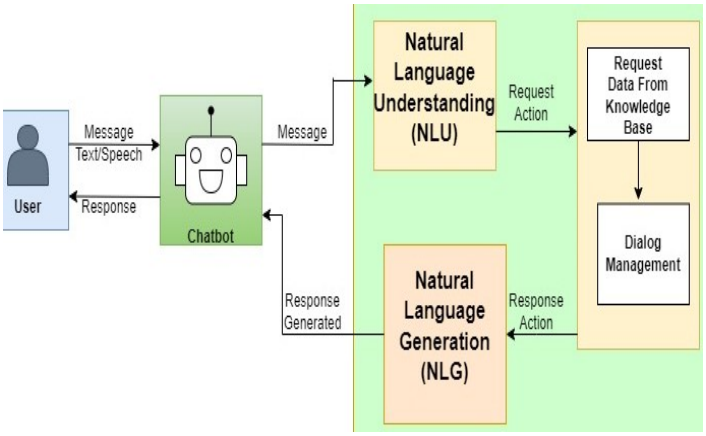

Fig. 8. Algorithm for Mental Health Chatbot

VII. Result

The study on mental health performed included a majority of users as females from the age group 30 and above. The statistical analysis determined that individuals feeling stressed depend upon various factors such as age, change in habits, and struggle in coping-up where their chi-squared values were 6.45, 10.21, and 0.14 respectively. The accuracy of the various machine learning models used is as follows, 0.37 for the Random forest classifier and 0.33 for the Gradient boosting classifier.

This demonstrates a thorough inclusion in the field of mental health support via the use of an artificial intelligence (AI) chatbot. Key findings, user feedback, and the merging of user-centric design and technical improvements demonstrate how well the mental health chatbot addresses the problems brought on by mental health concerns. The mental health chatbot not only gives users a way to communicate and comprehend their feelings, but it also broadens its impact by incorporating other therapeutic options.

The Sakhi chatbot is integrated with its website. The interaction of Sakhi with the user is shown in Fig 9. The therapeutic options from Sakhi are shown in Figure 10 as follows:

- **Daily Monitoring**: Together, the chatbot and users create customized self-care regimens that include daily routines, goal-setting, and sleep hygiene.
- **Professional Therapy**: The chatbot includes an option for consulting a professional doctor for serious mental health concerns.
- **Other Therapies**: This includes Yoga therapy, Audio therapy, Spiritual Therapy, and more, as shown in Figure 10.

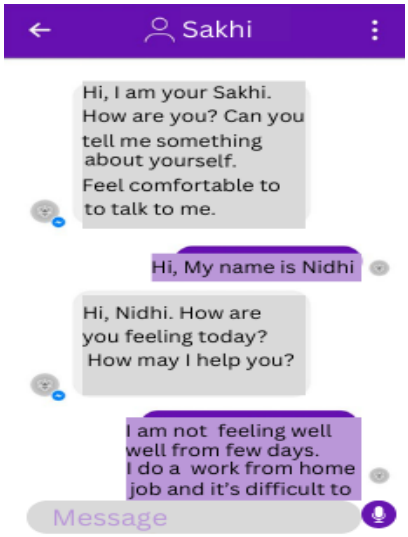

Fig. 9. User's Chat with Sakhi

VIII. Conclusion and Future Scope

Mental health issues are on the rise among children and the working-age population. AI-generated chatbots for mental health therapy could transform the field by offering individual, cost-effective, and easily accessible care.

The study performed, showcases the pressing need for services in mental healthcare. The paper highlights advances in

Fig. 10. Therapy Options

NLU and NLG, providing a range of therapeutic possibilities. Our proposed mental health site, Sakhi, contributes to fulfilling these requirements. It offers various therapy options to address mental health concerns. Also, it provides professional therapy and daily monitoring through its integration with the chatbot.

The following are some considerations for enhancing user experiences, attending to a range of mental health requirements, and contributing to the larger mental health care environment:

- Enhancing the personalization aspect could be one of the considerations for a mental health chatbot.
- Biometric information, like heart rate variability or facial expressions, might be included to get a further understanding of a user's emotional state.
- Incorporating IoT technology into mental healthcare could help with remote monitoring and in emergencies for better privacy and surety.

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