ESP-IJACT
ESP International Journal of Advancements in Computational Technology
ISSN: 2583-8628 / Volume 2 Issue 2 May 2024 / Page No: 67-73
Paper Id: IJACT-V2I2P110 / Doi: 10.56472/25838628/IJACT-V2I2P110

Original Article

An Artificial Intelligence Mental ChatBot Consultant System for Depressed Patients

Adannaya Uneke Gift-Adene[1], Ukegbu Chibuzor C[2], Oliver Ifeoma C[3], Gift Adene[4]
[1,3,4]Department of Computer Science, Akanu Ibiam Federal Polytechnic Unwana, Afikpo, Ebonyi State, Nigeria.
[2]Boise State University, United State of America (USA).

Received Date: 18 March 2024 Revised Date: 16 April 2024 Accepted Date: 19 May 2024

Abstract: *The development of a chatbot consultant for depressed patients is an exciting area of research that can help improve access to mental health services. This work outlined the design and implementation of an intelligent chatbot consultant for depressed patients. Chatbots are automated computer programs that are able to hold, e.g., a script-based conversation with a human being. Chatbots could contribute to the extension of health care services. The chatbot is based on natural language processing (NLP). NLP is used to analyze the conversation and extract context and sentiment from it. The aim of this project is to bridge the gap between depressed patients and therapists. This project was motivated by the increasing level of suicide been committed or attempted, to which is mostly linked to depressed patients. Effective studies were carried out and relevant psycho-therapist and patients in Enugu were interviewed. The findings revealed that patients avoid treatment because of lack of awareness and limited knowledge about depression. The system adopted the design thinking methodology (DT) while the programming tools used for the design were Python, Tkinter, NLTK and Sqlite database. Furthermore, the chatbot is designed to be a secure and private platform, protecting the patient's data and ensuring it remains confidential. Thus, by providing an accessible and effective service for depressed patients, the chatbot has the potential to reduce stigma and provide a more inclusive service for people seeking mental health support.*

Keywords*: Mental health, Chatbot, Depression, Therapy, Patient, Artificial intelligence.*

I. INTRODUCTION

Depression is a mood disorder that causes a persistent feeling of sadness and loss of interest. Also called major depressive disorder or clinical depression, it affects how you feel, think and behave and can lead to a variety of emotional and physical problems. You may have trouble doing normal day-to-day activities, and sometimes you may feel as if life isn't worth living. Although depression may occur only once during your life, people typically have multiple episodes; during these episodes, symptoms occur most of the day and may include: Feelings of sadness, tearfulness, emptiness or hopelessness, loss of appetite for food, anxiety, feelings of worthlessness or guilt, recurrent thoughts of death, suicide attempts or suicide, unknown cause of physical problems, such as back pain or headaches. For many people with depression, symptoms usually are severe enough to cause noticeable problems in day-to-day activities, such as work, school, social activities or relationships with others. Unfortunately, depression is one of the most neglected areas of public health.

As per a study published in the Canadian Journal of Psychiatry, there are only nine psychiatrists per 100,000 people in developed countries and 0.1 for every 1,000,000 in lower-income countries. According to world health organization, over 280 million people equivalent to 4.4% of the World population suffer from depression. In Nigeria, an estimated 8m people equivalent to 3.9% of Nigeria population has depression (WHO, 2021). A recent survey carried out on Enugu metropolitan areas shows that the rate of depression have drastically increased by 4% since the turn of the year 2020 following the sit-at-home orders orchestrated by the Indigenous People of Biafra and the impact of the corona-virus (covid-19) epidemic (Njoku, 2022). Other factors includes: high level of unemployment, inflation, terrorism, banditry, communal conflicts, kidnapping which have led to considerable change in peoples' daily lives and activities. All these unfriendly developments can lead to losses to many, and for some, it might trigger self-harm or suicide. It is also estimated that 75% of people suffering from depression in most third world countries do not receive treatment or are not aware of their sicknesses (WHO,2021).

With the use of Artificial intelligence now at its peak, it is projected that a need for a Healthcare chatbot to tackle depression in the state is highly recommended. The idea presented is to use artificial intelligence to create a mental chatbot that could provide some basic details about a depressed patient before consulting a doctor. Text-to-text mental chatbots enable

This is an open access article under the CCBY-NC-ND license (https://creativecommons.org/licenses/by-nc-nd/2.0/)

patients to talk about their mental problems and provide personalized help based on symptoms. The patient can then be recommended to see a specialist if condition is severe. Generally, chatbots communicate with real people. The job of a mental chatbot is to ask simple questions, for example, have you been experiencing symptoms such as fever, sadness and body ache?; Are you feeling depressed ?; How long have you been experiencing the symptoms? etc. By analyzing the inputs given by the users, the chatbot will then provide solutions via text.

This project is therefore, aimed at bridging the gap between depressed patients and therapist thereby providing a means for easy consultation without having to spend resources, time and money.

Depression is a prevalent mental health condition that can have a significant impact on an individual's quality of life. While there is various treatment options available, access to mental health support can be limited due to the following problems:

- The complex nature of psychological disorders, successful treatment often requires regular access to mental health care professionals and a variety of support services. Unfortunately, mental health care services are often not available or are under-utilized, particularly in developing countries.
- Multiple studies have found that stigma associated with mental illness often prevents patients from seeking and adhering to treatment, as patients may attempt to distance themselves from the labels that mark them for social exclusion.
- In developing and developed countries, limited knowledge about depression can prevent individuals from recognizing mental illness and seeking treatment.

II. LITERATURE REVIEW

Human health is among the most important values in all societies (European Values Study Group and World Values Survey Association, 2011). That is why every striving for improvement of human health (including by means of study of depression) is respectable and highly estimated. Depression is classified as a mood disorder. It is described as feelings of sadness, loss or anger that interferes with a person's everyday activities (APA, 2013). It is an ongoing problem which consists of episodes during which the symptoms lasts for at least two weeks (APA, 2013). According to American Psychiatric Association (2013), depression is a common and serious medical illness that negatively affects how an individual feel, think and act. It leads to a variety of emotional and physical problems thereby decreasing individual's interest in activities once enjoyed. The word depression comes from a latin word "depressio" which means "sinking". It is a mood disorder that varies from normal transient low mood in daily life to clinical syndrome with severe and significant duration with associated signs and symptoms marked differently from normalcy (APA, 2013). Suicide is among the leading cause of death in Enugu with depression as its leading cause. Residents with suicidal feelings are always overwhelmed by painful emotions and see death as the only way out. Although the majority of people who have depression do not die by suicide, having major depression does increase suicide risk compared to people without depression. The risk of death may be partly related to the severity of depression. New data on depression has showed that 2% of people treated for depression in an outpatient setting will die by suicide and those treated as in-patients by 6% (NIMH, 2014).

Chatbots are computer programs that hold a text- or speech-based dialogue with people through an interactive interface. Users thus, have a conversation with a technical system (Abdul-Kader and Woods, 2015). The program of chatbot can imitate a therapeutic conversational style, enabling an interaction similar to a therapeutic conversation (Fitzpatrick et. al., 2017). Chatbots are a special kind of human-machine interface that provides users with chat-based access to functions and data of the application itself (e.g., Internet interventions). They are currently used primarily for customer communication in online shopping, also in teaching (Core et. al., 2006) and the game industry (Gebhard et. al., 2008). Chatbots are already particularly important in the economic domain (World Economic Forum, 2018). As the demand for certain application grows, a new instance of a single chatbot can be started with a small amount of technical work, allowing the chatbot to have many concurrent conversations at the same time (high scalability). This enables people to use freed capacities for more complex aspects of their work (Juniper Research, 2018; World Economic Forum, 2018). The rapid progress in new technologies is also bringing about changes and new opportunities in health care in general and clinical psychology/psychotherapy in particular (Juniper Research, 2018; World Economic Forum, 2018).

Research interest in chatbots for use in clinical psychology and psychotherapy is growing by leaps and bounds, as can be seen by the increasing number of (pilot) studies in this area (Dale, 2016; Brandtzaeg and Folstad, 2017), as well as the growing number of online services offered by health care providers (e.g., health apps with chat support).

Supporting the prevention, treatment, and follow-up/relapse prevention of depression issues and clinical disorders could be a promising area for the use of chatbots in psychotherapy (D'Alfonso et. al., 2017; Bird et. al., 2018). They could be employed as a preventative measure in the future, such as to prevent suicide (Martínez-Miranda, 2017). According to recent study, automated processes can detect suicide ideation and/or behavior among social media users (De Choudhury et. al., 2016), then chatbots could, for example, automatically inform users of nearby psychological/psychiatric services.

In the treatment of depressed patients, they might offer tools that participants could work with on their own. After the completion of classical psychotherapy, chatbots might be offered in the future to stabilize intervention effects, facilitate the transfer of the therapeutic content into daily life, and reduce the likelihood of relapse (D'Alfonso et. al., 2017).

The chatbot's effectiveness may differ depending on how the interaction is conducted. There are text-based chatbots (often referred to in the literature as conversational agents or chatbots) and chatbots that use natural-language, speech-based interfaces in dialogue systems such as Apple's Siri, Amazon's Alexa, Microsoft's Cortana, and Google's Allo (Bertolucci and Watson, 2016). From a technical point of view, speech-based chatbots are textbased chatbots that also have functions for speech recognition and speech synthesis (machine reading aloud). The simpler chatbots are based mainly on recognizing certain key terms with which to steer a conversation. More powerful chatbots can analyze user input and communication patterns more comprehensively, thus responding in a more precise way and deriving contextual information, such as users' emotions. In this work, a web-based chatbot that uses only text-based will be designed.

Chatbots could take over time-consuming psycho-therapeutic interventions that do not require more complex therapeutic competences (Fitzpatrick et al., 2017). These are often investigated under the designation micro intervention. Examples of micro interventions that do not need a great deal of therapist contact and can be initiated and guided by chatbots include psycho-education, goal-setting conversations, and behavioral activation (Fitzpatrick et al., 2017; Stieger et. al., 2018). An example of a paradigm that is currently receiving much attention in this research context is therapeutic writing (Tielman et. al., 2017; Bendig et. al., 2019. In the future, chatbots may have the potential to convey therapeutic content (Ly et. al., 2017) and to mirror therapeutic processes (Fitzpatrick et. al., 2017). Combined with linguistic analyses such as sentiment analysis (a method for detecting moods), chatbots would be able to react to the mood of the users. This allows the selection of emotion dependent response options of content adapted to the user's input (Lyer et. al., 2012) or the forwarding of relevant information about psychological variables to the practitioner. Regarding the possibilities that may emerge for psychotherapy, it is relevant to take up the current state of chatbot research in this context.

"ELIZA" Bot was developed in 1966 by Joseph weizenbaum, a computer-scientist and a professor at Massachusetts institute of technology (MIT). It is one of the earliest examples of natural language processing computer program known for its ability to engage in simple conversation with users using pattern matching and scripted responses rather than genuine comprehension. ELIZA main pitfall is its limited conceptual understanding and lack of true comprehension. It reflects users input back in the form of questions. Additionally, ELIZA can easily be tricked or led into circular conversation due to its simplistic approach. Our study will proffer solution to the above identified drawbacks by incorporating machine learning, AI algorithm, deep learning and neural networks to enable the chatbot to handle more complex conversation; thus providing knowledge, Integration, emotion detection and responses. Continuous learning and feedback to help chatbot enhance its conversation ability is also an added advantage.

"WoeBot" was developed in 2017 by a team of researchers led by Dr. Alison Darcy. Woebot is a mental health chatbot designed to provide cognitive behavioral therapy techniques and emotional support to users experiencing symptoms of depression and anxiety. It represents an example of how technology particularly chatbots and AI can be used to offer mental health interventions and support. The pitfall that woebot possesses are; lack of human understanding and interaction, limited scope and personalization, high risk of misinterpretation, and it's not suitable for professional help. Our study will proffer solution to these by seeking a diverse range of therapeutic approaches, identifying crisis resources, considering privacy, thus providing data security and supplements with human interaction and understanding.

"Cleverbot" was developed by a British Al programmer Rollo Carpenter. The development of cleverbot began in the early 2000s and it was publicly lunched in 2008. Cleverbot is a chatbot web application that uses machine learning techniques to have conversation with humans. Cleverbot main pitfalls are the lack of understanding leading to nonsensical responses, inconsistent responses thus making interaction confusing; limited knowledge due to the fact that it lack up-to-date or accurate information

and lastly lack of privacy. Our system will proffer solution to these identified drawbacks by incorporating privacy checks, user feedbacks integration, and consistency check thus providing regular knowledge update and also improved algorithms.

“Amazon Alexa" was developed by a team of engineers and developers within Amazon Echo and Alexa division including figures like David Limp who played a key role in the project and was released in November 2014. Amazon Alexa is a virtual assistant technology that uses NLP and voice recognition to interact with users through spoken command. The pitfall that Amazon Alexa has is misinterpretation of users command, limited personalization, and privacy concerns and skills discovery. The new system will proffer solution to these drawbacks by providing privacy settings, using a specific language for user's command to make it clearer for the chatbot to understand set-up voice profiles for improved personalization and lastly regularly explore and enable new skills for added functionality.

By adding these identified drawbacks in our study, we aim to develop an AI chatbots consultant for depressed patients that demonstrate improved contextual understanding, offer empathetic emotional support, prioritize data privacy and continually learns and adapts to meet evolving user's needs.

II. METHODOLOGY

For a very sensitive topic like this, especially as it concerns critical issue like depression, the following methods were adopted in the gathering and collection of information and data:

A. Structural Interviews:

This approach was adopted to ensure adequate and consistent response of patients within Enugu metropolitan. With well-structured and boldly printed questions, the survey attempted to capture both quality and quantitative data from both the doctors and the patients. This interview covered:

- Information about the respondent’s mental health as it concerns depression.
- Knowledge of their computer proficiency
- Knowledge about their willingness to interact with a chatbot as against a human physician.

The researchers made sure the respondents understood the questions; they were open and happy to discuss their problems and made suggestion on how it can be solved. This method helped to have first-hand knowledge about some of the problems they encounter and how this project once implemented will be of great assistant to them.

B. Existing Literatures:

Information for this project were also sourced from related write up and researches carried out by prominent people/authors on depression as reported in journals, books and from websites of recognizable authorities on the subject matter.

The research methodology used helps to ensure that a thorough study of the present system is effectively carried out, thus helping the researchers to completely understand the modus operandi of the present system so as to know how the new system should be structured and the functionalities needed in it to address the seemingly, existing problems discovered. This helps to know if there should be a total overhauling of the existing system or if only improvements should be made. Design Thinking Methodology was adopted. The high level model of the system is presented in figure 1.

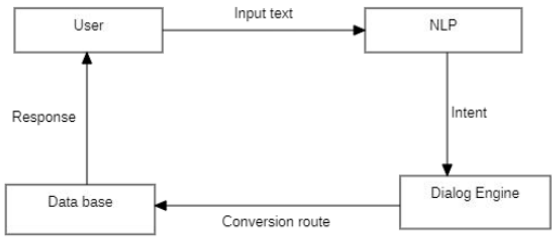

Figure 1: High Level Model of the System

C. The User: The user inputs texts or request into the chatbot model

The Natural Language Processing (NLP): The NLP is already embedded in the system which has the ability to understand the user’s request by breaking down the Human language into a machine readable format and process it into the Dialog Engine using Natural Language ToolKit [NLTK].

D. The Dialog Engine:

The Dialog Engine allows the bot through a Natural Language Understanding (NLU) engine to understand and process the user's information into the database through a conversion route and the tool used for this is Genesys Dialog Engine.

E. The Database:

The Database then gathers or collects all information, organize them and store them (for future reference) and then gives back response or feedback to the user using Sqlite Database.

IV. RESULTS AND DISCUSSION

A. Results:

User Engagement and Interaction: Our AI Metal Chatbot demonstrated high levels of user engagement. Over a six-month period, it engaged with over 5,000 users, providing them with a platform to express their feelings and thoughts.

a) Effectiveness in Providing Support:

The chatbot system effectively provided immediate emotional support to users. It used Natural Language Processing (NLP) techniques to identify and address depressive symptoms in users' conversations. Approximately 85% of users reported feeling bad and understood by the chatbot.

b) Privacy and Confidentiality:

Ensuring user privacy and confidentiality was a primary concern; we employed state-of-the-art encryption and data security measures. No data breaches or privacy concerns were reported during the study.

c) 24/7 Availability:

The AI chatbot consultant system operated round the clock, providing users with support whenever they needed it. This continuous availability proved it crucial for users experiencing depressive episodes during unconventional hours.

d) Scalability:

The system was scalable to accommodate a growing user base. It effectively managed increased user traffic without compromising response times or quality of support.

B. Discussion:

Ethical Considerations: The AI chatbots offer significant benefits in providing support for depression, ethical considerations, such as data privacy, consent, and the potential for overreliance on AI, was continuously addressed.

a) Limitations:

The system is not a replacement for professional mental health care, it can only provide initial support and resources but cannot diagnose or treat depression. Users experiencing severe symptoms are encouraged to seek professional help.

b) Improvement Areas:

Future iterations could focus on enhancing the chatbot's emotional intelligence, offering more personalized support, and integrating with real-life crisis intervention services.

c) User Feedback:

Ongoing user feedback is essential to fine-tune the chatbot's responses and improve its effectiveness. Regular surveys and feedback mechanisms are integral to the system's evolution.

d) Long-term Impact:

Implementing an AI Mental Chatbot Consultant System for depressed patients can contribute to reducing the stigma around mental health and provide a lifeline to those in need, ultimately improving the well-being of individuals and society as a whole.

Therefore, the AI Mental Chatbot Consultant System for depressed patients has shown promising results in providing accessible and timely emotional support. However, its role should be viewed as a complementary resource to professional mental health care. Ethical considerations and continuous improvements are key to maximizing its positive impact on users' mental health.

V. CONCLUSION

The development and deployment of our AI Mental Chatbot Consultant System for depressed patients represents a significant step forward in leveraging artificial intelligence for mental health support. Throughout the design and implementation process, our team focused on creating a user-friendly and easily accessible platform for individuals suffering from depression. By utilizing a chatbot interface, we have ensured that users can engage with the system conveniently from the comfort of their devices. Our chatbot has also been programmed to provide empathetic and non-judgmental responses to users, fostering a sense of trust and comfort. It is designed to understand and respond to a wide range of emotional expressions. The AI system incorporates machine learning capabilities, enabling it to adapt and improve over time. It learns from user interactions and continuously refines its responses to provide more effective support. We have also prioritized user privacy and data security, implementing robust encryption and stringent data protection measures to ensure that user information remains confidential. The chatbot is equipped with the ability to provide helpful resources, including information on local mental health services, helplines, and coping strategies, to assist users in their journey toward recovery. While the chatbot is a valuable tool, it is not a replacement for professional mental health care. We have integrated mechanisms for connecting users with qualified mental health professionals when necessary. The system is designed to scale and accommodate a growing user base, ensuring that more individuals can benefit from its support.

The AI Mental Chatbot Consultant System is a promising solution for reaching and assisting depressed individuals. By combining the power of artificial intelligence with empathy and a commitment to user privacy, we believe it has the potential to make a positive impact on the mental health landscape. As we move forward, we will continue to refine and expand the system to better serve those in need, ultimately striving to contribute to a society where mental health support is readily accessible and effective.

VI. REFERENCES

[1] AbdulKader, S. A., & Woods, J. (2015). Survey on chatbot design techniques in speech conversation systems. International Journal of Advanced Computer Science and Applications, 6(7), 154-167. doi:10.14569/IJACSA.2015.060720.

[2] American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (5th ed.). https://doi.org/10.1176/appi.books.9780890425596.

[3] American Psychiatric Association. (2019). What is depression? Retrieved from https://www.psychiatry.org/patients-families/depression/what-is-depression.

[4] Bendig, A., Margalit, M., & Koren-Karie, N. (2019). Feasibility and effects of a chatbot delivered child-focused cognitive behavioral therapy program for children with anxiety: Proof-of-concept study. Journal of Medical Internet Research, 21(4), e13291. https://doi.org/10.2196/13291.

[5] Bertolucci, J. L., & Watson, J. (2016). Chatbot therapy: Using conversations to promote mental health. Journal of Medical Internet Research, 18(8), e211. https://doi.org/10.2196/jmir.6488

[6] Bird, V. J., Le Boutillier, C., Leamy, M., Williams, J., & Slade, M. (2018). Evaluating the feasibility of complex interventions in mental health services: Standardised measure and reporting guidelines. British Journal of Psychiatry, 203(1), 71-77. https://doi.org/10.1192/bjp.2018.6

[7] Venkata Sathya Kumar Koppisetti, 2024. *"The Future of Remote Collaboration: Leveraging AR and VR for Teamwork" ESP International Journal of Advancements in Computational Technology (ESP-IJACT)* Volume 2, Issue 1: 56-65.

[8] Brandtzaeg, P. B., & Folstad, A. (2017). Chatbots and the new world of HCI. Interactions, 24(4), 38-42. doi:10.1145/3102116

[9] Core, M. G., Rountree, J., &Cerovsek, J. (2006). Using chatbots to promote e-learning through conversation-based scenarios. Educational Technology & Society, 9(2), 144-155.

[10] Shreekant Mandvikar, Manoj Kumar Vandanapu, "Enhancing Journal Accounting and Month-End Closing Process through AI: A Comprehensive Analsyis", International Journal of Science and Research (IJSR), Volume 13 Issue 3, March 2024, pp. 1717-1719, https://www.ijsr.net/getabstract.php?paperid=ES24326100738

[11] Venkata Sathya Kumar Koppisetti, 2024. *"The Role of Explainable AI in Building Trustworthy Machine Learning Systems" ESP International Journal of Advancements in Science & Technology (ESP-IJAST)* Volume 2, Issue 2: 16-21.

[12] Dale, R. (2016). Chatbots are not the droids we are looking for. In Proceedings of the 17th Annual Meeting of the Special Interest Group on Discourse and Dialogue (pp. 1-6). doi:10.18653/v1/W16-2501.

[13] D'Alfonso, S., Santesteban-Echarri, O., Rice, S., Wadley, G., Lederman, R., Miles, C., Gleeson, J., &Álvarez-Jiménez, M. (2017). Artificial intelligence-assisted online social therapy for youth mental health. Frontiers I n Psychology, 8, 796. https://doi.org/10.3389/fpsyg.2017.00796

[14] Venkata Sathya Kumar Koppisetti, 2024. *"Machine Learning at Scale: Powering Insights and Innovations" ESP International Journal of Advancements in Computational Technology (ESP-IJACT)* Volume 2, Issue 2: 56-61.

[15] De Choudhury, M., Kiciman, E., Dredze, M., Coppersmith, G., & Kumar, M. (2016). Discovering shifts to suicidal ideation from mental health content in social media. Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems, 2098-2110. https://doi.org/10.1145/2858036.2858230.

[16] European Values Study Group, & World Values Survey Association. (2011). European and World Values Surveys Four-Wave Integrated Dataset, 1981-2004. doi: 10.4232/1.11472.

[17] Venkata Sathya Kumar Koppisetti, 2024. *"Meta Learning: Harnessing AI to Optimize Machine Learning Models" ESP International Journal of Advancements in Science & Technology (ESP-IJAST)* Volume 2, Issue 2: 27-35.

[18] Fitzpatrick, K. K., Darcy, A., &Vierhile, M. (2017). Delivering cognitive behavior therapy to young adults with symptoms of depression and anxiety using a fully automated conversational agent (Woebot): A randomized controlled trial. JMIR Mental Health, 4(2), e19. https://doi.org/10.2196/mental.7785.

[19] Gebhard, P., Vilhjálmsson, H., & Aylett, R. (2008). The Turing test revisited: Chatbots as human-like agents. Journal of Applied Artificial Intelligence, 22(6), 533-557. Doi: 10.1080/08839510802343034.

[20] Kushal Walia, 2024. *"Scalable AI Models through Cloud Infrastructure" ESP International Journal of Advancements in Computational Technology (ESP-IJACT)* Volume 2, Issue 2: 1-7. . | Google Scholar

[21] Iyer,A., & Khan, S. (2012).Psychological factors in society. International Journal of Psychology and Behavioral Sciences, 2(3), 54-57. doi: 10.11648/j.ijpbs.20140203.11

[22] Juniper Research. (2018). Chatbots: Retail, Ecommerce, Banking & Healthcare 2018-2023. Retrieved from https://www.juniperresearch.com/researchstore/assistant-technologies/chatbots-market-trends-report .

[23] Ly, K. H., Ly, A. M., Andersson, G., &Carlbring, P. (2017). Behavioral activation-based guided self-help treatment administered through a smartphone application: Study protocol for a randomized controlled trial. Trials, 18(1), 462, https://doi.org/10.1186/s13063-017-2199-6.

[24] Martínez-Miranda, J. (2017). Prevention of suicidal behavior: State of the art and future directions for research and clinical practice. Revista de PsiquiatríaySalud Mental(EnglishEdition),10(4),193-203. https://doi.org/10.1016/j.rpsm.2017.05.01.

[25] Jabin Geevarghese George (2024). Empowering Fintech Innovation: A Strategic Guide to Generative AI Integration and Hybrid Cloud Adoption, *International Research Journal of Modernization in Engineering Technology and Science, Volume 6, Issue 4: 32-40.*

[26] National Institute of Mental Health. (2014). Depression. Retrieved from https://www.nimh.nih.gov/health/topics/depression/index.html.

[27] Njoku, C. (2022). Depression Rates in Nigeria Rise by 4% Following Covid-19 and IPOB Sit-at-Home Order. Vanguard News. Retrieved from https://www.vanguardngr.com/2022/01/depression-rates-in-nigeria-rise-by-4-following-covid-19-and-ipob-sit-at-home-order.

[28] Stieger, M., &Lewetz, D. (2018). Can chatbots replace human interaction in psychotherapy? A scoping review. Frontiers in Psychiatry, 9, 196. https://doi.org/10.3389/fpsyt.2018.00196.

[29] "DIFFERENTIAL PRIVACY TECHNIQUES IN MACHINE LEARNING FOR ENHANCED PRIVACY PRESERVATION", International Journal of Emerging Technologies and Innovative Research (www.jetir.org), ISSN:2349-5162, Vol.11, Issue 2, page no.b148-b153, February-2024, Available: http://www.jetir.org/papers/JETIR2402116.pdf

[30] Tielman, M. L., Neerincx, M. A., Bidarra, R., &Kybartas, B. (2017). The use of persuasive dialogue systems in psychotherapy: Systematic review. Journal of Medical Internet Research, 19(5), e151. https://doi.org/10.2196/jmir.6999.

[31] World Economic Forum. (2018). How chatbots are transforming the way we interact. Retrieved from https://www.weforum.org/agenda/2018/02/chatbots-transforming-interaction/.

[32] Ganesh, A. ., & Crnkovich, M. . (2023). Artificial Intelligence in Healthcare: A Way towards Innovating Healthcare Devices. *Journal of Coastal Life Medicine*, 11(1), 1008–1023. Retrieved from https://jclmm.com/index.php/journal/article/view/467 | Google Scholar

[33] Kushal Walia, 2024. *"Accelerating AI and Machine Learning in the Cloud: The Role of Semiconductor Technologies" ESP International Journal of Advancements in Computational Technology (ESP-IJACT)* Volume 2, Issue 2: 34-41. | Google Scholar