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AI Enabled Chatbot for regulating Mental Health

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Abstract: ***The most important healthcare questions affecting present-day human people are those related to mental health. Young adults and individuals of working age are more inclined to experience these troubles that have a detrimental effect on the person, his or her family, job, society, and economy. Conventional mental health care aids, while very successful, cannot be scaled until they meet the growing demand from affected individuals, as explained in the first two years of the COVID-19 epidemic. To begin with, it is supposed that there are 792 million families globally that have mental health issues and ailments. That equates to 1 in 10 people worldwide. Conversational assistants, or chatbots, are a recent science creativeness that has been efficiently adapted for mental health management to present first-level help for such individuals. Compared to face-to-face consultations, people are more forthcoming in online chats. Traditional methods for sentiment analysis and consoling may not be effective with adolescents because they are reluctant to express their negative emotions in personal interaction. As a result, this project places a firm attention on utilizing virtual programs to recognize depressing or anxious symptoms in individuals and control their stress.***

Keywords: Chatbot; conversational agent; machine learning; artificial intelligence; NLP; NLU; systematic review

I. INTRODUCTION

The World Health Organisation reports that India has the highest frequency of mental diseases. Every sixth Indian needs psychological health care, despite the fact that treatment inconsistency for various mental health issues ranges from 70% to 92%. Although mental health disorders are common, the number of people seeking treatment is small. Reasons noted for this discrepancy include structural boundaries in the way that a lack of availability, extreme cost and attitudinal barriers like perceived stigma. Mental disorders are mostly administered by psychotherapists.

However, there is a worldwide deficiency of human resources for giving specific mental health services. In grown nations, there are nine psychiatrists per 100,000 people available, while in underdeveloped countries there is a single psychologist per ten million people. According to the WHO, about 45% of families in grown nations and 15% of the public in developing countries have access to psychiatric aids.

This deficiency and expense issues have fashioned the Technology industry to take matters into its own hands. Advances in mathematical science along with increases in computer network approach and smartphone ownership could offer an opportunity to overcome few of these obstructions, causing relative obscurity and scalability at a lower cost. There is growing practical support for use of digital electronics in mental well-being, where web platforms or smartphone applications are used to give evidence-based interventions.

These digital interventions are effective, feasible and acceptable to consumers, even though they are associated with reduced engagement and poor adherence. Adherence rates and results appear more favorable when active human support or counseling is joined into the digital tool, but this limits scalability.

The growth of conversational assistants, or chatbots can offer an appealing solution. Chatbots take an informal approach, simulating human communication through written text. This ability to mimic human support could conceivably upgrade engagement while enabling scalability through automation. Building conversational systems and manifestos to form a humanlike AI has been one of the superior research fields to date.

Creating a virtual psychiatrist AI is a specific step nearer to a manlike AI dream. The chatbot simulates a realistic dialogue by bestowing the consumer appropriate answers in a style that he or she understands. As professional assistants like counseling are high-priced, nations are anticipating a more reliable and profitable answer to better mental health. With the increase in technology where machines can judge like persons, we've come to an answer that will repress these issues. Chatbots are a method that can converse accompanying persons utilizing natural languages that removes the need for communicating with a professional. This may be specifically appealing in low- and middle- income settings where there are large mental health treatment disparity and limited resources available.

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II. PROBLEM DESCRIPTION

Although there are numerous advantages to using AI in mental health chatbots, there are also several challenges to consider.

Technical limitations of mental health chatbots: Existing systems can't recall what was said in previous conversations, which could lead to inappropriate reactions [15]. To solve this problem, information about the user's mental state must be obtained and stored for use in subsequent conversations with the bot. A chatbot response may upset or dissatisfy a user due to a lack of understanding or emotional intelligence[15]. Existing virtual assistants for psychological health have generic skills that are frequently repetitious, and their interactions frequently resemble reading a self-help book [15], overall this may cause discomfort and reduce user adherence to such applications. Another critical consideration for the creation of ai-based chatbots is the fact that algorithms are typically trained on enormous data sets. Furthermore trained models can become biased towards specific population groups when the underlying training data is insufficiently sampled or data for some sub-groups is unavailable. Previous research does not investigate the technical limits of the created mental wellness chatbots comprehensively [16,17].

Ethical challenges: Furthermore, there is limited evidence on the therapeutic effect of mental health chatbots.A systematic review concluded that it is difficult to draw definitive conclusions about the effect of chatbots on various mental health outcomes due to a high risk of bias in the included studies, low quality of evidence, a lack of investigation assessing each outcome, a small sample size in the involved investigations, and conflicts in the findings of some studies that were reviewed. Such constraints may endanger users through improper suggestions or unidentified dangers.

Website design and functionality: A poorly designed website can negatively impact the user experience and lead to lower sales. Ensuring that the website is intuitive, easy to navigate, and provides adequate information.

Accountability implications: Because of the presence of regulations that protect patients from any neglect, mental healthcare providers are held liable for providing inefficient care and not looking after patients' anonymity. This sort of accountability is not presented in the case of chatbots. In other words, there is an insufficiency of rules and measures safeguarding the privacy and confidentiality of chatbot users. [18]

III. LITERATURE REVIEW

1) K. Denecke, S. Vaaheesan and A. Arulnathan, "A Mental Health Chatbot for Regulating Emotions (SERMO) - Concept and Usability Test,". In this research paper the author talks about the use of conversational agents, such as SERMO, that implement methods from cognitive behavior therapy that can help support mentally ill people in regulating their emotions and dealing with their thoughts and feelings. The study conducted on SERMO's user experience shows that the app was efficient, perspicuous, and attractive to use. Although the fun of use was rated neutral, the overall findings suggest that SERMO is a promising tool to help support the mental health of people worldwide.

2) Chatbot-Delivered Cognitive Behavioral Therapy in Adolescents With Depression and Anxiety During the COVID-19 Pandemic: Feasibility and Acceptability Study. : The study examines the feasibility and acceptability of using a chatbot to deliver cognitive-behavioral therapy (CBT) to adolescents with depression and anxiety during the COVID-19 pandemic. The results indicate that the chatbot intervention was feasible and acceptable to participants, with high engagement and satisfaction rates. The study suggests that chatbot-delivered CBT may be a promising approach to addressing mental health needs during times of crisis, such as the COVID-19 pandemic.

3) Developing a Mental Health Virtual Assistance(Chatbot) for Healthcare Workers and their Families by Ali Zamani. : The text discusses the development of a mental health chatbot called MIRA, which uses a transformer-based architecture for detecting intent and extracting features. The chatbot offers resources for healthcare workers and their families with mental health issues. The chatbot evaluation showed that 61% of the users did not start a conversation with the chatbot, which may indicate that some web crawlers are using the chatbot. The text suggests that emotional intelligence could be incorporated into dialogue generation to improve the chatbot's responses. The text also provides suggestions for using the chatbot for other use cases.

4) Generate Reflections and Paraphrases out of Distress Stories in Mental Health Forums Zheng Wang Supervisor: Kalpani Anuradha Welivita, Dr. Pearl Pu Faltings Human Computer Interaction Group, IC, EPFL. : This text discusses the importance of therapeutic conversational agents or chatbots in providing counseling services to people suffering from mental health issues and emotional distress. The paper focuses on the technique of "reflection and paraphrasing" and how chatbots can be trained to generate these responses. The authors extracted reflections and paraphrases from existing dialogue datasets and created a large-scale dataset for this purpose. They fine-tuned a GPT-2 model to generate reflections and paraphrases and discussed the limitations of this process and how it can be improved in the future.

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5) Dosovitsky G, Pineda BS, Jacobson NC, Chang C, Escoredo M, Bunge EL. Artificial Intelligence Chatbot for Depression: Descriptive Study of Usage. : This text discusses a study on chatbots and mental health, which found that user engagement was affected by the length, complexity, content, and style of questions within the modules and routing between modules. The author suggests that developers should focus on usability and engagement by developing short, simple, and consistent modules and testing them with small iterative studies before expanding the content. Additionally, the author emphasizes the importance of addressing high attrition rates and the potential for scalable interventions and personalized interventions in the future.

6) Monnier, D. Woebot: A continuation of and an end to psychotherapy? Psychotherapies. : The article examines Woebot, an online psychotherapy service that uses artificial intelligence and is based on CBT. The authors suggest that the service aims to help patients feel liberated by talking and overcome guilt, and tends to lead patients to establish a special link with the machine, turning the session into a kind of confession. The authors also suggest that the real target of the service is psychotherapists who come across as out-of-reach moralizing inquisitors.

7) Abd-alrazaq AA, Safi Z, Alajlani M, Warren J, Househ M, Denecke K (2020) Technical metrics used to evaluate healthcare chatbots: Scoping review Journal of Medical Internet Research. : This study examined previous research on health care chatbots and identified 27 technical metrics used to evaluate their performance. The metrics were grouped into categories such as usability, response generation, response understanding, and esthetics. The lack of standardization and objective measures in these metrics could inhibit the advancement of the field, and the authors suggest the development of a framework of technical metrics with recommendations for specific circumstances for their inclusion in chatbot studies.

8) Abd-alrazaq AA, Alajlani M, Ali N, Denecke N, Bewickd BM, Househ M (2020) Patients' attitudes toward using chatbots for mental health: Scoping review. Journal of Medical Internet Research. : The text is about a scoping review of studies conducted to assess the perceptions and opinions of patients about chatbots for mental health. The study was carried out using the PRISMA guidelines, and 37 unique studies were included in the review. The review generated 10 themes from the findings of the studies, including usefulness, ease of use, responsiveness, and content. The overall conclusion was that patients have positive perceptions and opinions about chatbots for mental health, but there is a need to address issues such as the linguistic capabilities of the chatbots and personalization of chatbot conversations for clinical practice.

9) Laranjo L, Dunn AG, Tong HL, Kocaballi AB, Chen J, Bashir R, Surian D, Gallego B, Magrabi F, Lau AYS, Coiera E (2018) Conversational agents in healthcare: a systematic review. Journal of the American Medical Informatics Association. : This article reviews the current applications and evaluation measures of conversational agents with unconstrained natural language input capabilities for health-related purposes. A total of 17 articles met the inclusion criteria, and dialogue management strategies were mostly finite-state and frame-based. Half of the conversational agents supported consumers with health tasks such as self-care. The only randomized controlled trial found a significant effect in reducing depression symptoms. The study concludes that more robust experimental designs and standardized reporting are needed in this emerging field of research.

10) Denecke, Kerstin & Abd-alrazaq, Alaa & Househ, Mowafa. (2021). Artificial Intelligence for Chatbots in Mental Health: Opportunities and Challenges. : This text is discussing the use of chatbot systems in mental health, which use artificial intelligence to understand natural language and communicate with users in a human-like manner. The potential benefits of chatbots have been shown with respect to psychoeducation and adherence, but there are also limitations and ethical issues to be considered.

IV. REVIEW ON MAJORLY USED CHATBOT APPLICATIONS

To have a look upon how chatbots measure up to in person therapy here are some surveys on the different chatbot therapists developed by different institutions and labs.

A. Woebot

It's a fully automated therapist chatbot that is developed by the Woebot labs in San Francisco. It is a user-friendly device and it does a short survey to see what areas a person might want to focus on. It takes care of confidentiality and also reminds the user that it's not for replacing human support. A Woebot gives instructions on what to do if there is an emergency situation. It also has a sense of humor. Woebot uses cognitive behavioral therapy in which it identifies the mood of users with the support of emoji, identifies three thoughts related to that mood and makes users realize that these thoughts are distortions that can be replaced with helpful thoughts. Over time it charts the emoji responses to make users visualize their responses. This makes the user understand why they should bother to check-in on a daily basis. The chat exchange is for 10 minutes, though you can stop chatting any time you wish.

B. Wysa

It's an AI and NLP based playful penguin that was launched in late October 2016, designed to track emotions and create awareness and make its client motivated. It operates on android and iPhone platforms. The chats are private and encrypted. If a user responds by saying that he has stress issues then based on his responses, Wysa would build a toolkit that contains a variety of exercises for better focus. These exercises are based on mindful meditation, which is an evidence-based approach to managing a variety of psychological issues, especially stress and anxiety. It creates a weekly report of the performance of the individual over a week so that the person has a track of how he has been doing the entire week. Wysa can restructure thoughts as well as has CBT skills and it is user-friendly, attractive and easy to use. Also, if there is a suicidal thought then the bot would suggest having a talk with a psychiatrist.

C. Joyable

Joyable was developed by the powerhouse team of experts and scientists in the field of therapy. It is an online platform that supports users with a dedicated real-life coach and a two-month course in CBT. It has a seven-day free trial and then it would cost you $99 per month. It performs a structured assessment of the eight-week program that helps users understand what to work on. The program contains mood tracking, 10 minutes of activities and one-on-one coaching. Each week a new themed course is unlocked, allowing a chance to tackle a new set of BT challenges. In addition to treating, the Joyable also provides a lot of information about why a person feels depressed or what happens to the brain when people get better (psychoeducation).

D. Talkspace

Provides online therapy with a licensed health practitioner at a significantly reduced rate. Once your case has been handed over, you are matched with a therapist in the form of photos and bios- a bit like a dating app, but for the therapist. It is similar to Joyable, it uses a variety of activity-based tools to improve a variety of areas like happiness, balance, compassion, productivity, and self-awareness. Users can also contact by leaving a text, video or audio message anytime. The tool is perfect for the people who are not comfortable speaking to a professional face to face. It is also convenient because you don't have to worry about making appointments with your therapist

V. METHODOLOGY

There are various research papers available related to conversational agents that are developed to help people manage and identify their mental state. After reading many of them we came to know that many people have worked in this field and their work is also good but there is always something which can be improved. The methodology we used for conducting our research was to read and analyze the existing research work on this. There are also some web applications running on the internet which deliver psychological assistance to people in need. We visited those websites and analyzed their working. We found that there are many chances for improvement in the existing works. There are several technologies which can be incorporated in our web application.
Enough improvement can be done in the existing systems to get a highly dynamic and resilient system. There are many technologies in the market which are evolving day-by-day. These technologies are playing an important role in the field of AI and healthcare.

VI. PROPOSED SYSTEM

The goal of our work is to raise awareness about tools that can help people manage their overall mental wellness and to provide a straightforward and readily available platform where individuals can quickly reach out for support if they are distressed or need to talk about their intrusive and negative thoughts. The platform will have many features which will engage the user to know about various mental disorders as well as users will also get the tips and advice from the chatbot and blogs. Our platform is dedicated to helping people identify their depressive or anxious symptoms, manage their stress, and prevent the onset of mental illness. So on this platform users can chat with our AI agent and read up on various articles designed to help them navigate their emotional and psychological state. It is developed from scratch with the intention of helping people in regulating their moods and eliminating distorted and negative thinking. We will also provide a facility to book an appointment to the nearest psychologist so they can get professional help.

VII. HARDWARE AND SOFTWARE REQUIREMENTS

The computer hardware required for this platform must have minimum 2GB RAM. The Windows 10 or greater versions of Windows OS are required to run this web application. The software requirements include visual studio code, HTML, CSS, JavaScript, Python, LSTM, SkLearn, keras, tensorflow, numpy, pandas.

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VIII. SYSTEM ARCHITECTURE

The flow diagram shown below in fig.1 gives an entire view of the working of the chatbot engine. By seeing the block-diagram the tasks performed by every component on this platform are very clear. The user interacts with the website and enters a message to the chatbot. The user's message is sent as a request to the web server. The chatbot engine receives the request and processes the user's message using Natural Language Processing (NLP). The chatbot engine accesses the database to retrieve relevant information or previously stored conversation history. The chatbot engine generates a response to the user's message using the NLP and context management. The user interacts with the website which contains an About page, a blog page, aa Contact page, and an AI chatbot. The about page contains information about our website and what is the mission of our team. The blog page contains the blogs of various people on their journey of fighting not talking about mental health openly in this society. This page is updated by our team by the stories shared by the people in their personal life encouraging people to overcome their depression. The website provides an AI chatbot that will answer to what they are curious about their mental health. we ensure our user's privacy. They can contact our team for a personal consultation with our brilliant doctor teams. They can subscribe to our blogs and we will let them know when our new blog will post.

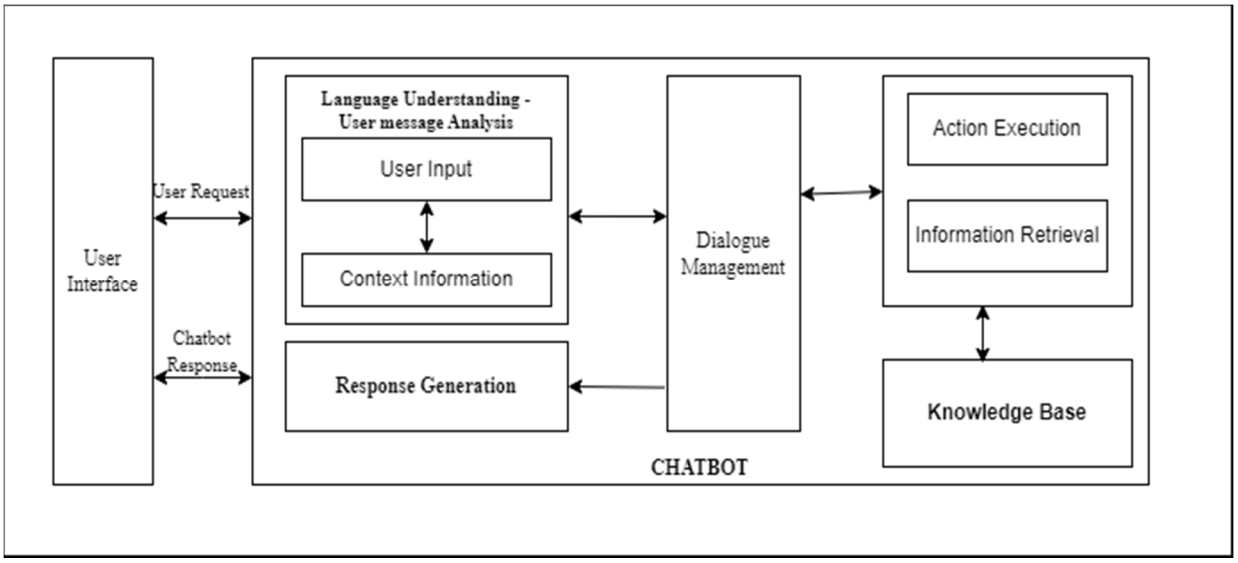


Fig 1. Chatbot Architecture Diagram

IX. TECHNOLOGY

A. HTML

HTML stands for Hypertext Markup Language, and it is the standard markup language used for creating web pages and applications. HTML is a markup language because it uses a series of tags to describe the structure and content of a document.

B. CSS

CSS stands for "Cascading Style Sheets." It is a coding language used in web development to define the look and formatting of HTML elements on a web page. CSS allows developers to separate the design and layout of a website from its content, which makes it easier to maintain and update the website. With CSS, developers can create rules that define how different HTML elements, such as text, images, and buttons, should be displayed, including things like font size, color, and spacing. CSS is a fundamental technology in modern web design and is widely used in conjunction with HTML and JavaScript to create interactive and visually appealing websites.

C. JAVASCRIPT

JavaScript is a high-level, interpreted programming language that is used to create dynamic and interactive websites. It is a client-side scripting language, which means that it runs on the user's computer rather than on the server. JavaScript is widely used in web development for creating interactive user interfaces, animating elements on a web page, and validating user input.

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D. MongoDB

MongoDB is a popular NoSQL document-oriented database management system. It is designed to handle large amounts of data, especially unstructured data, and to be highly scalable and flexible.

In MongoDB, data is stored in JSON-like documents, which allows for more flexible and dynamic data modeling than traditional relational databases. MongoDB uses a query language called the MongoDB Query Language (MQL), which is similar to SQL but is designed specifically for querying JSON documents.

E. NLP

Natural Language Processing(NLP) is a field of AI that gives machines the ability to read, understand and derive meaning from the human language. If you think about it like this, every line in a book or every tweet you read has information that can be extracted. It's easy to derive meaning from a sentence when there is only one of them. But imagine having to look at millions of tweets or text messages, it is just not manageable. This is unstructured data (Data generated from conversations, declarations or even tweets).

When building algorithms we usually have some traditional rows and column structure of relational databases. All in all, "neat" data. However with unstructured data, it is messy and very difficult to manipulate.

With NLP it is not just about interpreting a text or speech based on its keywords but actually understanding the meaning behind those works. Using NLP we can perform sentiment analysis and can also detect figures of speech like exaggeration.

X. CONCLUSION

In this discourse we have attempted to build a method which will allow the users to talk about their issues without thinking about the societal taboo and from the comfort of their home. It will be very useful for the people who need urgent care and do not have a trustworthy person around them.This will provide a one step platform where users can find relevant information to help them in their journey.The users will also get the information related to stress management tips and other useful exercises. The user can also look for doctors nearby their homes. The user can talk to our chatbot anytime , anywhere from the application. The chatbot is designed to talk like a human would so that users can talk comfortably and reflect on their thought.

XI. FUTURE SCOPE

The future potential of online chatbot helpers is highly promising as more and more people become aware of the serious consequences of ignoring ones mental health

The use of AI-based chatbots for providing mental healthcare has a number of advantages, some of which have been partially shown by previous studies. To develop trustworthy mental health chatbots and integrate them into traditional services, a number of open research topics will need to be addressed in the future. The linguistic abilities of chatbots for mental health are still something that need to be improved, among other things [41]. They need to be better able to comprehend user input and respond to it correctly. The ability to accurately identify emergency situations and formulate a suitable response after one has been identified is a major difficulty.

To ensure usage and usefulness, mental health chatbots have to be evaluated. What are the relevant aspects for evaluating technical issues of healthcare chatbots? Which Criteria and metrics should be considered? If the evaluation of chatbots were to align with practice of Evidence-Based Medicine (EBM) then the ideal is 'Level 1' evidenceas produced by randomized controlled trials (RCTs). These trials are realised as summative evaluations that give electronic intervention credibility from an EBMperspective for selected health outcome measures. However, given the complex nature of a health chatbot and its potential interaction with users, we recommend the use of a spectrum of quality measurements from across multiple dimensions that cover technical aspects, but also data security and efficiency to help ensure the feasibility and face-validity of the chatbot as the basis of a health intervention prior to attempting an RCT.

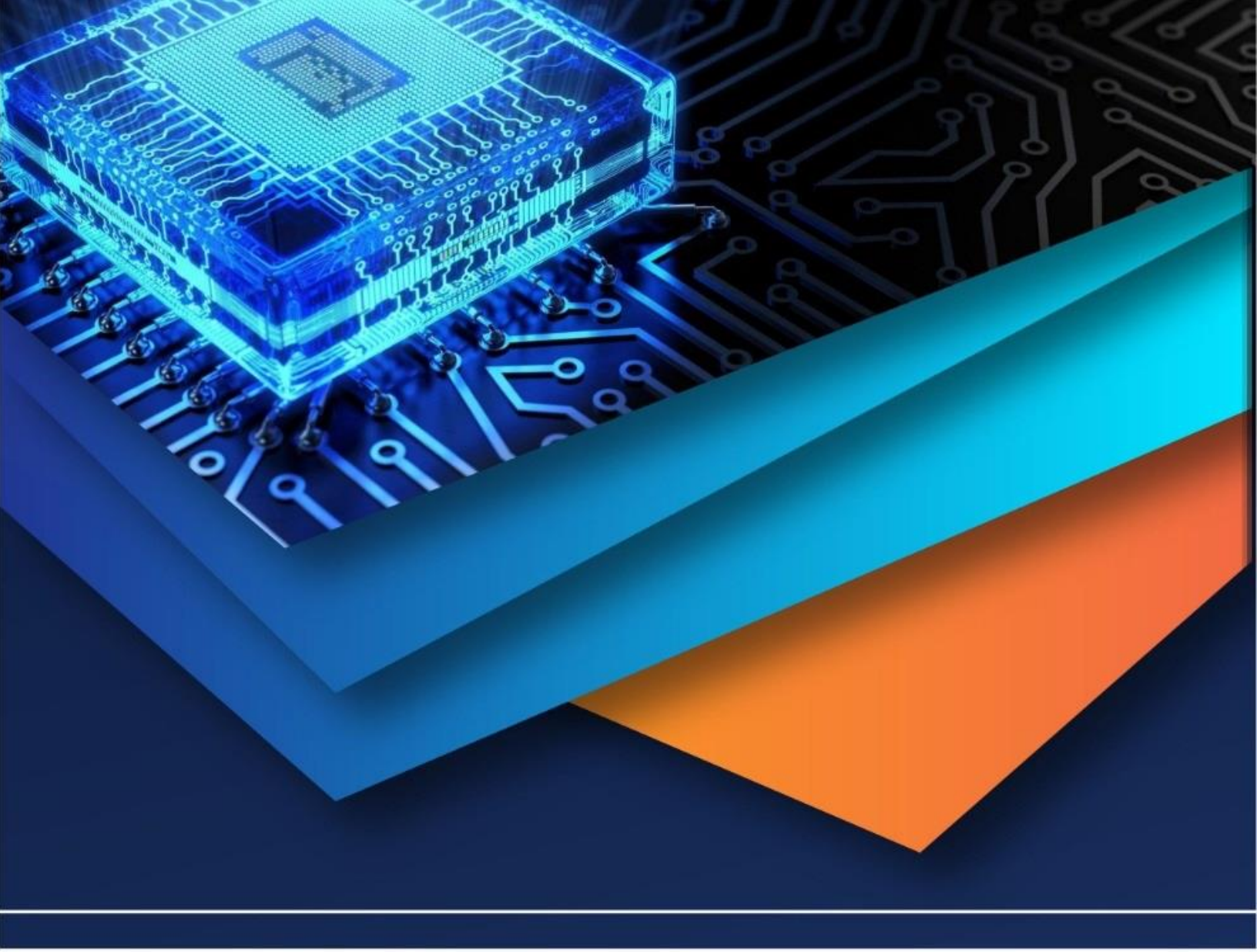
In conclusion, AI health chatbots are promising tools that could accompany regulartreatment in the future. Before this can happen, many open issues and challenges stillhave to be addressed and more experiences and lessons learned, in particular regardingnegative aspects, have to be gained.

XII. ACKNOWLEDGEMENT

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