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Androz Chatbot for Alzheimer's Patients

Subhalakshmi Y[1], Shivani G S[2], Sri Shandhya Devi T[3], Sri Raksha Avanthiga S[4], Dr. Ahila R[5]
[1, 2, 3, 4]*UG Scholars,* [5]*Assistant Professor, Department of Computer Science and Engineering, Avinashilingam Institute for Home Science and Higher Education for Women, School of Engineering, Coimbatore-Tamil Nadu*

Abstract: ***Chatbots are computer programs that automatically respond to messages and can be configured to respond the same way every time, to respond differently to messages with specific keywords, and even to use machine learning to adapt their responses to the situation. Users can communicate with artificial intelligence using a text or voice interface using chatbots. Alzheimer's is a chronic neurological illness whose root cause is unclear. Since there is no recognized cure, patient care is mostly focused on creating a comfortable atmosphere for them and supporting the caretakers. In the proposed model, we have redesigned the chatbot's architecture to be able to follow the patient's movement with location and if the patient wanders or moves away from their house, voice notes-based guidance and navigation is used to help them. The system's main job is to carry out memory training operations using names and information of well-known people, locations, and events that may be dynamically***

Keywords: Chatbot, Healthcare Bot, Alzheimer, GPS, Neural Network, Speech Recognition

I. INTRODUCTION

Alzheimer's is the most common cause of dementia, a general term for memory loss and other cognitive abilities serious enough to interfere with daily life. The disease typically progresses slowly over several years, and in the early stages, symptoms may be mild and easily overlooked. As the disease advances, however, symptoms become more severe and may include, Memory loss, especially recent events and important information, Difficulty with language and communication, Impaired judgment and decision-making, Disorientation and confusion, Personality changes, such as irritability or anxiety, Loss of interest in previously enjoyed activities, Problems with daily tasks, such as dressing or grooming, Difficulty with spatial awareness and coordination. Overall, Alzheimer's disease is a complex and challenging condition that requires ongoing care and support for patients and their families. Early diagnosis and treatment, along with support from caregivers and healthcare professionals, can help to improve outcomes and quality of life for those affected by the disease. The exact cause of Alzheimer's disease is not fully understood, but it is believed to be caused by a combination of genetic, environmental, and lifestyle factors. Some of the known risk factors for Alzheimer's disease include age, genetics, family history, head injury, cardiovascular disease, and lifestyle factors such as diet, exercise, and smoking. Alzheimer's disease is typically diagnosed through a combination of medical history, physical and neurological exams, cognitive tests, and imaging tests such as magnetic resonance imaging (MRI) or computed tomography (CT). Early diagnosis is important for initiating treatment and improving outcomes for patients and their families. Alzheimer's disease is typically divided into three stages: early, middle, and late. In the early stage, symptoms are mild and may include memory loss and difficulty with language and communication. In the middle stage, symptoms become more pronounced and may include confusion, personality changes, and problems with daily tasks. In the late stage, patients may be unable to communicate or care for themselves and require round-the-clock care. There is no cure for Alzheimer's disease, but there are treatments available to manage symptoms and improve quality of life for patients and their caregivers. These treatments may include medications to improve memory and cognitive function, as well as behavioural and lifestyle interventions such as exercise, social engagement, and cognitive stimulation. Alzheimer's disease can be challenging for patients and their families, and caregiving can be both physically and emotionally demanding. Caregivers may need to provide assistance with daily tasks, monitor medications and treatments, and provide emotional support and companionship. Support groups and other resources are available to help caregivers manage the demands of caregiving and maintain their own health and well-being.

II. LITERATURE SURVEY

The purpose of Vaishnavi M et al., paper "Consort Chat-Bot for Alzheimer Patients" is to study and explain how software helps the Alzheimer patient to lead a regular existence simply like any different ordinary person. It focuses on monitoring the movement of the patient and supplying the notification to the caretaker.

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The various stages of dementia are discovered with the acknowledged reminiscence exercising remedy the use of the consort chatbot interface through making use of the reminiscence education and scoring operations. In future the chatbot can be developed, with a fitness difficulty feature, which collects the small print of signs and symptoms from the patient, to operate the preliminary prognosis process. [1]

In their study, “An Overview of Artificial Intelligence Based Chatbots and An Example Chatbot Application” Naz Albayrak et al., introduces a new and novel discipline of the core working theory and concepts of artificial intelligence-based conversations and conceptual frameworks, as well as their applications in telecommunications, finance, healthcare, client contact centers, and e-commerce. Furthermore, the observations of an example Chatbot for contribution services constructed for a telecom service provider are addressed utilizing the proposed architecture. [2]

"CureBot - An Artificially Intelligent Interactive Bot for Medical Diagnostics" by Kanksha et al. considers a multilingual conversational application using Natural language processing that will be developed by this CureBot in an effort to close the gap between the demand and present healthcare services and the needs of the impoverished and rural people. This unique, tailored healthcare bot offers general healthcare information as well as information on common disorders and is attentive to the requirements and comprehension of the Indian rural people. The chatbot's suggested paradigm functions as a client-server web application. The bot will learn to reply on the server while using the web application as both the front end and back end. The user inputs will be collected by our system, and the resulting output will be shown. The user will be required to supply basic contact information. The information would include the name, phone number, and email address. If more communication is necessary, the submitted information will be utilized. [3]

“A Chatbot Designed for Alzheimer Patients with Medical Assistant," by R. Kabilesh et al. discusses the system of creating chatbots that can quickly match patients with the appropriate contacts via connection between patient portals and EMRs. Fixing an appointment, making changes, and updating preferences can all be beneficial. It aids patients in filling medications, making payments, and acting upon signs. Through the Zapier app, a reminder is established for Alzheimer patients to eat at the proper time and perform their daily tasks. Any conversation or communication that has already taken place between a bot and a humanwill be preserved and cannot be removed. [4]

In “Model of Multi-turn Dialogue in Emotional Chatbot”, Chien-Hao Kao et al., the study, we merged a release interaction framework with an emotion recognition model to create a chatbot designed for conversational talks rather than computational tasks. As a result, anytime a customer connects with the chatroom, the robot responds with comments about how it feels. It may suggest a vast range of emotional responses to the material, guess it depends on the content of the user's conversation The dataset is skewed due to its roots in a television show, as actors may face tremendous psychological issues in order to portray the plot tension in the show. To circumvent this impediment, we have to include sentiment-based tags into our system. Offer a higher rating than usual for prolonged pleasurable or bad feelings that linger for an extended period of time to determine the emotional transition seems gradual rather than abrupt. The majority of the sample, the question–answer interactions that make up today's bots' learning algorithm, are tiresome and impossible to distinguish from actual speech. This is because the generative model for each job is unique. [5]

Mubashra Akhtar et al., in the paper, “The Potential of Chatbots: Analysis of Chatbot Conversations” look into a chatbot deployed by a telecommunications business to see how successfully it may have been utilized to measure:

1) user problems and

2) user contentment.

Text mining algorithms analyze user inputs to represent chat messages as a chain of actions. Users' public conversational contributions can offer useful information about their desires and well-being, according to the study's findings. If the chatbot does not respond quickly, the bulk of people will abandon the conversation. As a result, the discourse's subjects frequently overlap. As such looking into the study, organizations that use chatbots should carefully review the data they acquire in order to truly comprehend their clients' desires. According to the findings, they could increase customer loyalty by offering personalized service and incorporating real-time reviews. [6]

The research paper, “Intelligent Chat bot for Easy Web Analytics Insights”, author Ramya Ravi et al., suggests a chatbot driven by Ai Research Learning Algorithms and fed by raw aggregated data, allowing bot users to obtain market insights by just putting in a question. In this post, I suggest a chatroom that permits bot users to input a digital analytics question and receive an instant response. This is to avoid having to spend time learning how to utilize a web analytics tool, which may be time-consuming. The raw statistics data generated with AIML is used in the proposed chatbots data set. Investigations were performed out in order to have a better understanding of the tool's performance. The tool was put through its paces in terms of response accuracy, and it performed excellently. Because the chatbot is constructed with AIML, the user should read a script in order to fill in the inquiry. [7]

This proof for the practicability and effectiveness of online one-on-one psychological state therapies that use text-based synchronous chat is discussed by According to Saurav Kumar Mishra et al article, ”Dr. Vdoc: A Medical Chatbot that Acts as a Virtual Doctor”, describes the chatbot that would operate as a virtual doctor and will allow patients to interact with the virtual doctor. Natural language processing and a pattern matching algorithm were used to construct this chatbot. The Python programming language is used to create it. According to the results of the poll, the chatbot provides 80 percent correct answers and 20 percent wrong or unclear responses. According to the results of a chatbot poll and research, this software can be used for training and as a virtual doctor for awareness and primary care. [8]

Divya Madhuet et al., developed an approach in “A Self Diagnosis Medical Chatbot Using Artificial Intelligence”, where an AI can identify diseases based on symptoms and provide a list of therapy options. If a person's body is examined on a regular basis, it is possible to foresee any potential problems before they begin to harm the body. For the successful application of customized medicine, several challenges include research and implementation expenses, as well as government laws, which are not covered in the report. [9]

Hameedullah Kaziet et al. in “MedChatBot: An UMLS based Chatbot for Medical Students” describes the creation of an open source AIML-based Chatter bean-based chatbot for medical students.Natural language queries are converted into relevant SQL queries by the AIML-based chatbot. A total of 97 question samples were gathered, and the questions were then classified into categories based on their type. The resultant categories were ordered based on the number of questions in each category. The questions were based on enquiries, with posed questions accounting for 47 percent of the total. [10]

III. METHODOLOGY

Implementation modules for developing the chatbot are to be illustrated in this chapter along with the detailed explanation about the interactive computing for the assistive technologies. The input design for a chatbot designed for Alzheimer's patients is an important consideration, as it can impact the user experience and the effectiveness of the chatbot. Here are some key considerations for input design:

1) *User-Friendly Interface:* The chatbot interface should be designed to be user-friendly, with large buttons or simple voice commands to make it easy for Alzheimer's patients to navigate. The design should be intuitive and straightforward, with clear instructions and prompts
2) *Visual And Auditory Cues:* The chatbot should provide both visual and auditory cues to ensure that the user understands what is being asked of them. This can include text prompts, images, and sound effects to reinforce the message.
3) *Simple language:* The chatbot should use simple, clear language that is easy to understand. Avoid using complex or technical jargon, and use plain language to communicate information and instructions.
4) *Repeat and clarify:* Alzheimer's patients may have difficulty with short-term memory, so the chatbot should be designed to repeat and clarify instructions as needed. This can help to ensure that the user understands what is being asked of them and can complete tasks effectively.
5) *Personalization:* The chatbot should be designed to personalize the user experience, based on the user's preferences and interests. This can help to build engagement and make the chatbot more effective in assisting with daily tasks and cognitive stimulation.
6) *Accessibility:* The chatbot should be designed to be accessible to users with a range of abilities and disabilities. This can include features such as text-to-speech functionality, adjustable font sizes, and the ability to use simple voice commands.

IV. SYSTEM MODEL

Chatbots designed for Alzheimer's patients can offer several advantages, including:

1) *Reminders and assistance:* Chatbots can provide reminders for important tasks, such as taking medication or attending appointments. They can also offer assistance with daily tasks, such as making phone calls or sending messages.
2) *Cognitive stimulation:* Chatbots can offer cognitive stimulation and engagement for Alzheimer's patients, which may help to slow the progression of the disease and improve quality of life. For example, they may offer games, puzzles, or trivia questions to challenge the user's memory and cognition.
3) *Emotional support:* Chatbots can provide emotional support and companionship for Alzheimer's patients, who may experience feelings of loneliness or isolation. They can offer conversation prompts, jokes, or positive affirmations to help boost mood and provide a sense of connection.

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4) *Ease of use:* Chatbots can be designed to be user-friendly and easy to navigate, even for individuals with limited technical skills. They can offer simple voice commands or large buttons to make it easier for Alzheimer's patients to use.
5) *24/7 accessibility:* Chatbots can be available 24/7, which can be particularly helpful for Alzheimer's patients who may require assistance outside of traditional care hours.

The proposed system primarily designed to assist the dementia patients by providing the training process which will increase their memory performance. The system also performs the analysis and review process based on the training provided to the patient and the corresponding response received from the patient. The memory exercise includes the training regarding the names and details of loved ones, recent events and recently visited locations in text as well as in visual representations. Based on the analysis, the chatbot system generates the report which illustrates the memory level of the patient periodically.

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The output design for a chatbot designed for Alzheimer's patients is an important consideration, as it can impact the user experience and the effectiveness of the chatbot. Here are some key considerations for output design.The chatbot should provide both visual and auditory feedback to reinforce the user's actions and help them to understand what is happening. This can include images, sound effects, and spoken messages to reinforce the chatbot's responses. The chatbot should use simple, clear language that is easy to understand. Avoid using complex or technical jargon, and use plain language to communicate information and instructions. The chatbot should be designed to repeat and clarify information as needed, to ensure that the user understands what is happening. This can help to reduce confusion and frustration. The chatbot should be designed to personalize the user experience, based on the user's preferences and interests. This can help to build engagement and make the chatbot more effective in assisting with daily tasks and cognitive stimulation. The chatbot should provide positive reinforcement to the user, to help them feel motivated and encouraged. This can include praise for completing tasks, positive affirmations, and personalized messages.

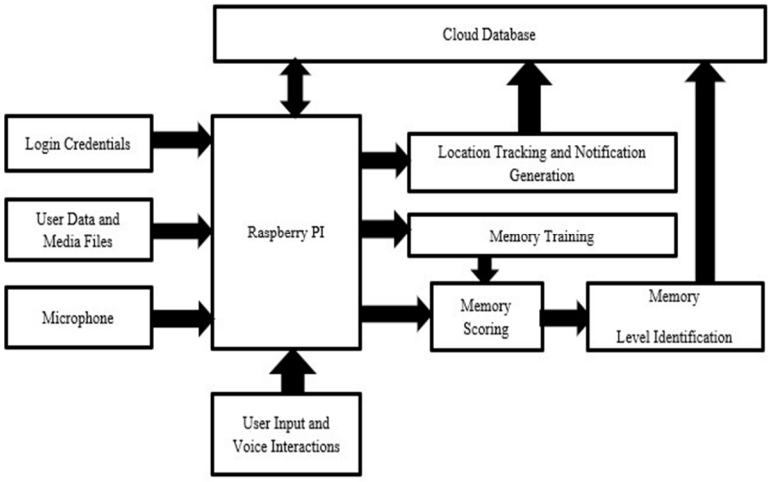

Figure 4.1 Block Diagram

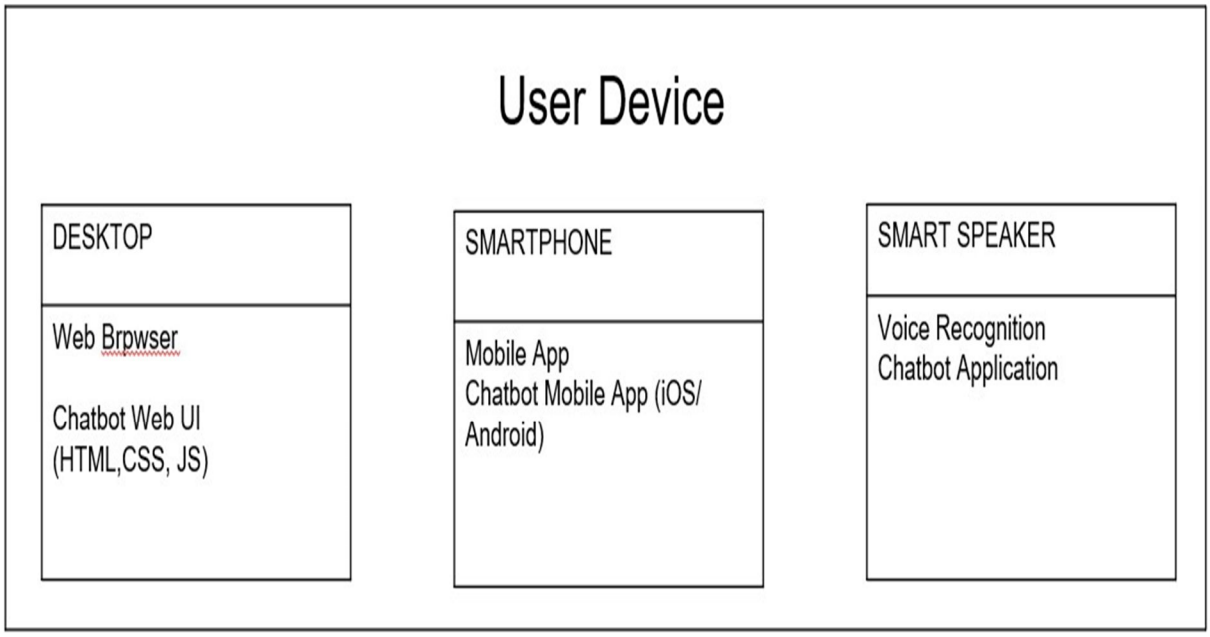

Figure 4.2 Flow Diagram (1)

This diagram shows the different user devices on which the chatbot can run, including desktops, smartphones, and smart speakers. Each device has a different interface for interacting with the chatbot - the desktop uses a web browser to access the chatbot's web UI, the smartphone uses a mobile app to access the chatbot's mobile UI, and the smart speaker uses voice recognition to interact with the chatbot directly.

The chatbot application itself can be hosted on a cloud server or on-premises server, and can be designed to run on various operating systems and programming languages. The chatbot application communicates with the user device through various communication protocols, such as HTTP for web browsers, or WebSocket for real-time communication.

a) Welcome message: The chatbot should begin with a welcome message that introduces the chatbot and provides some basic information about how to use it.

b) User input: The chatbot should prompt the user for input, either through voice commands or buttons on a screen. The input could be a request for assistance with a task, a question, or a prompt for cognitive stimulation.

c) Processing input: Once the user input is received, the chatbot should process the input and determine the appropriate response.

d) Response: The chatbot should provide a response to the user, which could include information, instructions, or prompts for further interaction.

e) Feedback: The chatbot should provide feedback to the user, either through visual or auditory cues, to reinforce the user's actions and help them to understand what is happening.

f) Personalization: The chatbot should be designed to personalize the user experience, based on the user's preferences and interests. This can include providing personalized prompts and activities, or adapting the chatbot's responses to the user's level of cognitive ability.

g) Goodbye message: The chatbot should end with a goodbye message, which could include a positive affirmation or encouragement to use the chatbot again in the future.

The proposed system has the following implementation modules:

- Creating the cloud web server and the database server in firebase.
- The cloud storage, data is stored on multiple third party servers.
- Before initiating the data access, user registration is performed to provide authorization.
- During registration process an unique ID is generated from the system to every registered individual.
- Finally, user entry is created in cloud data base to establish an authorized access to data.

A. Establishing communication between mobile device and cloud as Device Integration

Jsch connection is an established IP address, Device Id and corresponding credentials using the Wi-Fi/GSM interconnection model.The Firebase Database is a cloud-hosted SQL database that lets store and sync data between users in mobile environment.Firebase data is written to a FIRDatabase reference and retrieved by attaching an asynchronous listener to the reference. The listener is triggered once for the initial state of the data and again anytime the data changes.

B. Training system for speech recognition and memory exercise

Application interface is created to capture the voice which is converted into text content using the Hidden Markov Model algorithm.It initially performs the noise removal process and denoised signal is given as an input to the speech recognition API.The API, performs the pattern matching process by considering the speech syllable, pitch, voice frequency, speech rate as features of the comparison.The HMM formulated the trained sequence of the words based on the various acoustics features and it significantly compares with the input voice track and identifies the words spoken.The entire process of the speech recognition is performed as the subtask of the memory exercise.In the process of the memory exercise, the collective and collaborative details of the patients are given as an input.The details including the sensitive information such as name, age, location, name and relationship of the known one, recent events and recently visited location.This information is stored in the memory exercise database for each individual patient.In the database, the information is stored in the form of text contents and visual files such as images

C. Memory Training and Level Prediction

The cognitive training and testing facility is integrated in the mobile environment to perform the memory exercise.The previously stored questions and the corresponding answers are retrieved from cloud server.The app interface randomly selects questions from the stored list and displays it to the patient.The interface also uses the TTS (TextToSpeech) methodology to depict the question to the patients in audio format.At the end of depiction, the speech recognition API is activated to get the relevant answers from the patients.As explained earlier, it uses the HMM to identify the words pronounced by the patients and formulates the answers.The provided answers are compared to the stored answers and the cognitive score is calculated using the EWMA estimation.It is stored in the database with the patient ID to determine the level of Alzheimer.The Alzheimer level is categorized into preclinical, mild_cognitive_impairment, mild_dementia, moderate_dementia and severe_dementia based on the obtained score of the patient.The memory training can assist the patient to improve their cognitive ability

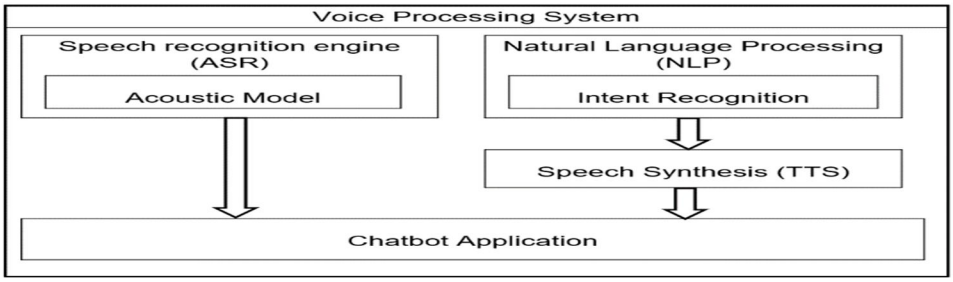

Figure 4.3 Flow Diagram (2)

This diagram shows the main components of a voice processing system for an Alzheimer's chatbot, including:

1) *Speech Recognition Engine:* This component listens to the user's spoken input and converts it into text using an Acoustic Model.
2) *Natural Language Processing (NLP):* This component analyses the text input to understand the user's intent and extract relevant information.
3) *Intent Recognition:* This component identifies the user's intent and maps it to a specific action or response
4) *Speech Synthesis (TTS):* This component converts the chatbot's response into speech.
5) *Chatbot Application:* This is the core application that runs the chatbot's logic and manages the interaction with the user.
6) The voice processing system receives audio input from the user, which is processed by the Speech Recognition Engine. The resulting text is then sent to the NLP component, which analyses the input and extracts relevant information. The Intent Recognition component then maps the user's intent to a specific action or response, which is sent to the Chatbot Application. The Chatbot Application generates a response, which is converted into speech by the Speech Synthesis component and sent back to the user.

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V. CONCLUSION

Alzheimer is the chronic disease caused by genetic disorder which does not have any perfect cure but with the help of memory training, it can be treated. Chatbot is used to perform the memory training process for the patients. It performs the conversation flow with the patients. Once the conversation flow has been designed, the user interface (UI) can be developed. With the conversation flow and UI design in place, the chatbot can be developed. This involves coding the chatbot using the chosen platform and technology, and integrating it with any necessary systems or APIs. The training data should be carefully selected to ensure that it reflects the language and topics that the chatbot will encounter in real-world interactions. Finally, the performance of the chatbot should be regularly analysed and refined based on user feedback and analytics. This involves measuring key performance metrics such as user engagement, retention, and satisfaction, and using this data to refine the conversation flow, UI, or functionality of the chatbot.

Figure 5.1 Hardware Setup

Figure 5.2 Output Screen Showing Alzheimer level

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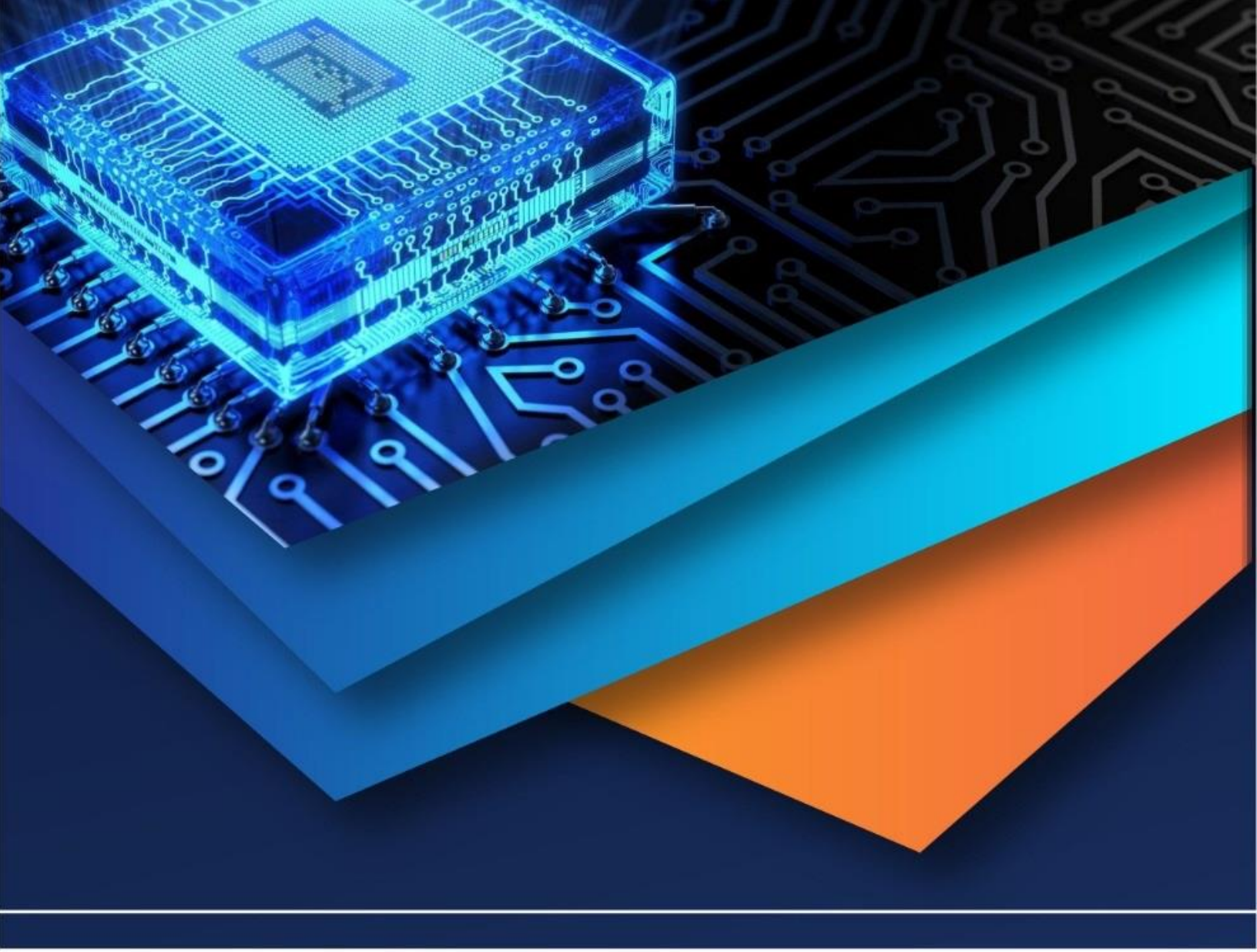

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