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Virtual Assistant Using Supervised Learning

Asst.Prof. MD Mohsin Ali[1], S.Vamshi[2], S.Shiva[3], S.Bhanu Prakash[4]
[1, 2, 3, 4]*Dept. of ECE Vignana Bharathi Institute of Technology, Ghatkesar, Hyderabad, Telangana, India-501301*

Abstract: ***Todays modern world, everything got evoluted including technology from vacuum tubes to nanoelectronics.Now a days the total world is in single palm of human in the form of mobile.But these days we aren't using hands, instead we using voice commands to wake electronics devices like mobiles,it is not only in mobiles, also in every electronics.This type of usage is possible by embedding a virtual assistant into electronics. Virtual Assistants are software programs that help you ease your day to day tasks, such as showing weather report, creating reminders, making shopping lists etc. They can take commands via text (online chat bots) or by voice. This paper delivers steps to build a web based virtual assistant using supervised learning to achieve goals which cannot done by the VA's in market.And as this model uses supervised learning, so there will be limited commands and data to maintain it in our control.***

Keywords: Virtual assistant, natural language understanding, framework, tokens, featuring, intents,entities.

I. INTRODUCTION

Virtual assistants or virtualbots or virtual advisors are the software programs which will be used to interact with the user or an individual.These are commonly used in the business interactions, product marketing, personal assistance, sales etc.Virtual assistants are the digital beings build using many domains in the comuter science. Basically virtual assistants understand the natural language which will be an input feed by user in form of either the text or voice. A wakecall or wake command given by the user will initialize the assistant, the wake call can be customize according to developers need.

Virtual assistants developed using artificial intelligence, machine learning, deep learning, natural language processing, to extract data from the user conversational input(either text or voice).From the discovery of artificial intelligence there are many inventions and new technologies emerged,from those the virtual assistant is an milestone which enable the humans to talk and chat and interact with machines, also get works done without using physical efforts.

Conversational AI has revolutionized the way businesses interact with their customers. The use of advanced chatbots and virtual assistants has led to increased productivity and reduced costs for service teams. With the help of natural-language processing (NLP) and machine learning (ML), these intelligent virtual agents are able to process data and respond to a wide range of commands and requests from users. This technology simulates human-like conversation, allowing for personalized support and improved customer experiences. As advancements in AI technology continue, we can expect to see even more innovative solutions that drive efficiency and growth for businesses across all industries.

Machine learning plays a crucial role in developing bots or virtual assistance.The algorithms in machine learning will helps to achieve goals of bot.So basically what is machine learning? Machine learning is a branch of computer science & artificial intelligence which deals with to make machines to learn from the data from humans, classify the data using algorithms and mathematical calculations and imitate the humans and gradually improve accuracy. Now a days many MNC's are focused on machine learning and artificial intelligence to make their products and services smart and accurate.

A. Machine Learning

Machine learning are of 4 types 1)Supervised learning 2)Unsupervised learning 3)Semi supervised learnig 4)Reinforcement learning.

1) *Supervised learning:* One type of machine learning in which the training data will be labeled and classified.
2) *Unsupervised learning:* Type of machine learning where the input data is unlabeled data and no supervision in required while tesing.Here the learning model will itself label data using appropriate algorithms.
3) *Semi-supervised learning:* Combination of both supervised as well as unsupervised learning.It uses small amount of labeled data and larger amount of unlabeled data
4) *Reinforcement learning:* In this learning the model will learning from mistakes.Here the reward and penalty words are essential.Model will train based on the rewarding desired and/or punishing undesired once.

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B. Natural Language Processing

Natural language processing is a branch of artificial intelligence & machine learning and computer science. The natural language means general language which is utilized and understand by humans.It may be any language around world can be considered as natural language.The linguistics included in the computer science as a subject because to make machines to understand the human languages. NLP dealt with enabling the computers to listen and understand or ability to understand text and spoken words in much the same way human beings can.But how the machines understand the natural language.

NLP combines the technologies like machine learning,deep learning, artificial intelligence,computational linguistics,rule-based modeling of human language, statistics,probability etc.Together ,these technologies enable a model or a system or a device to understand human language also learn language ,speakback to humans.

NLP has two subsets :-

1) *NLU(natural language understanding):* NLU is a subset of NLP which enables machine to understand the natural language.It uses the syntax and semantics to understand language.Syntax means structure of word and sentence while semantics means specific meaning to that particular input.By using syntax and semantics machine will split the words and sentences. NLU also setup a relevant ontology i.e, a data structure which defines the relationships between words and phrases. While humans naturally do this in conversation, the combination of these analyses is required for a machine to understand the intended meaning of different texts.
2) *NLG(natural language generator):* This is a core element in NLP which is a reason to generate an relevant response to particular phrase or sentence given as input. NLG is a generator which is used to generate language which can be spoken and understand by humans.This language can be in form of text or speech.Text can be converted into voice using TTS(text-to-speech) converter.

II. LITERATURE

In the mid 20th century the British logician and computer pioneer Sir Alan turing substantially worked on AI and found the turing test model.He is also known as founding father of artificial intelligence.But in 1927 initially the term artificial intelligence is first coined by American computer scientist John McCarthy.After that this technology was hugely emerged and leads to development of chatbots, which can be converse with users in text-to-text manner.

Later the text-to-text conversation evoluted to speech-to-text and text-to-speech.The invention of chatbots easily gain huge popularity in market and used in business for customer satisfaction.The speech-to-text and vice-versa is converted as virtual assistant.

Now, means today in market everywhere we can observe the bots to help customers in many ways.Like In medical field ,for prescribing medicenes,for emotional attachment etc, In business to calculate stocks,suggest best ways to invest etc.And in many domains bots were using.

Every mobile in recent times are manufacturing with a preinstalled virtual assistant which can access operating system and controlled through voice commands as well as text format.

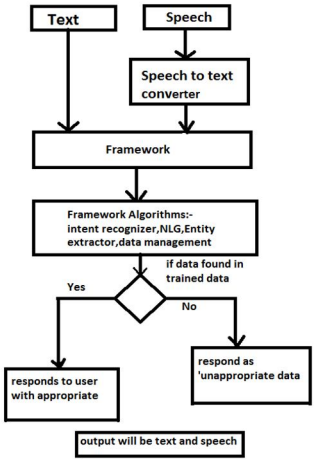


Fig 1:-Flow of Project

Every company giving its own virtual assistant installed in mobile which will work only in there specific OS.For example Google assistant from google, Siri from Apple, Alexa,Echo from Amazon, Cortona from Microsoft, and many more.

III. FRAMEWORKS FOR VIRTUAL ASSISTANT

Basically Framework is a structure which is act as support to build something useful.Same as in software side, to build anything useful then we can use some predeveloped frameworks to complete works smartly and in short duration.This will allow us to easily integrate the work with other domains as well as complete whole work in a easy way.

Some frameworks to develop virtual assistants are available in market.So by using this frameworks we can develop easily an virtual assistants or bots but understanding the framework will be bit complicated.

In this paper we used say about framework called as RASA.It is an comversational AI framework specially designed to build chatbots.Many companies outside using this framework to create their own bots and utilizing in their services.

The architecture of framework given below:-

The RASA architecture consists of mainly 2 units

1) *RASA NLU:-* It is a natural language understanding unit which will take the input from user either in text or in speech format.Then it send the extracted data to rasa core.In this NLU ,the structure of input data will be in semantic and syntactical format from which the NLU will divide it as intents,entities,slots etc.
2) *RASA Core:-* It acts as NLG(natural language generator), which will analyse and process the intents and entities extracted from the input data .The intents are configured with core, so according to input data the core will generate an appropriate response to user.

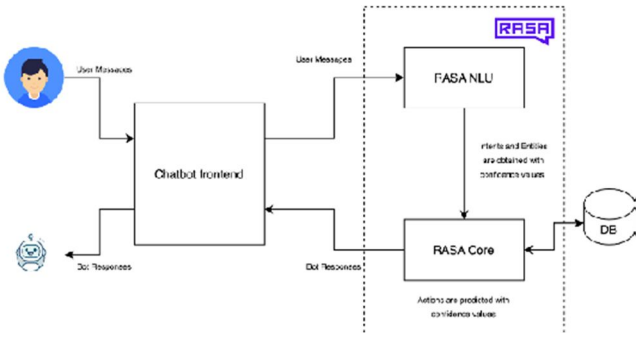


Fig 2:-NLU and Core blocks

IV. WORKING

Importantly , here we are using supervised learning means the data fed to model will be in labeled form.Each intended data will have particular label or specified label and data will be in form of either in morphological ,semantical and syntactical .

Supervised learning, so data will be labeled and predefinely trained by user before testing.So the data will be user friendly and the data will be decided by user itself.It may be huge data or limited data.Here using this framework we have to establish a story for specific task.

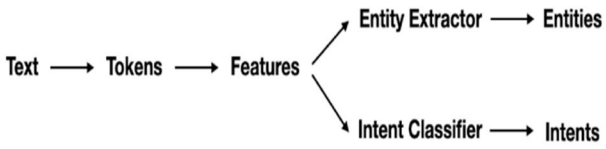


Fig 3 Text extraction

The RASA nlu consists of 4 stages

Tokenizer → featurizer → Entity extracter → intent classifier

Tokenization: The first step is to break or split an utterance(means unit of speech) into smaller parts(technically chunks) of text, known as tokens. This must happen before text is featurized for machine learning.

Tokenizers are different for different languages. For example,.WhitespacesTokenizer for English, SpaCy for non English europian languages , Jieba for Chinese and many more.

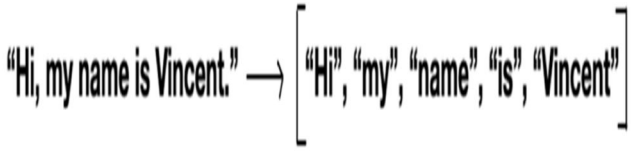


Fig 4:-Tokenization

Featurizer: Featurizers generate a number to specify the token with a unique feature.This numbers are numeric features for machine learning models. The diagram below showshow the word "Hi" might be encoded.

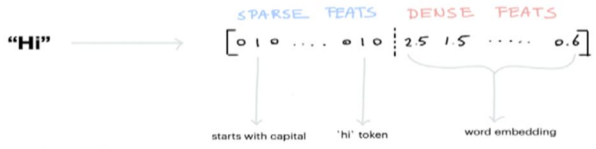


Fig 5:-Featurization

Intent classifier:- Once we've generated features for all of the tokens and for the entire sentence, we can pass it to an intent classification model.

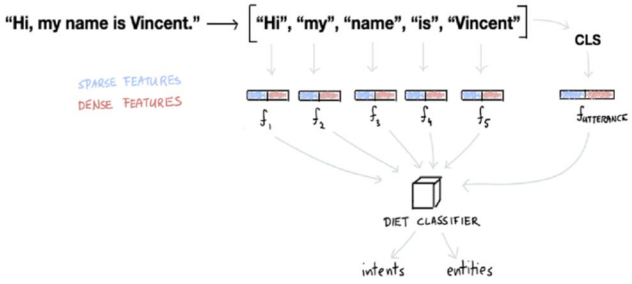


Fig 6:-Intent classifier

The appropriate responses for inputs are generated by performing response actions.This actions are given to model according to user needs.
The below figure shows the format of responses.

```
responses:

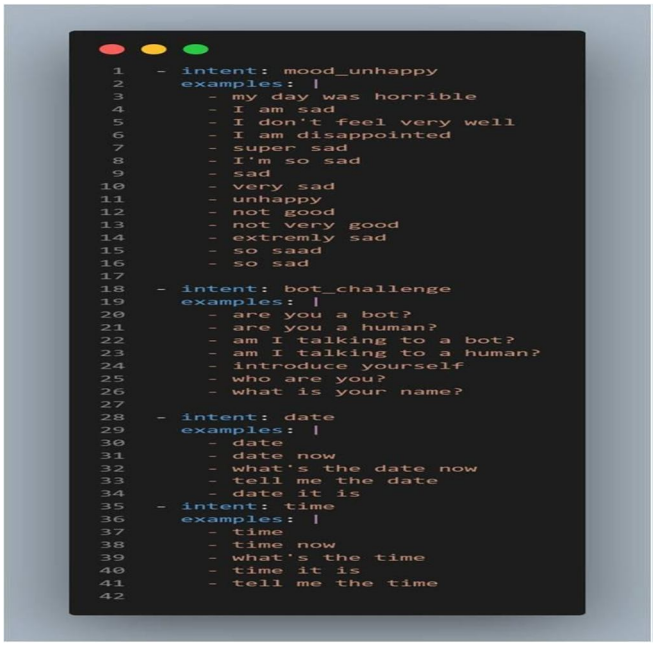
utter_ask_for_contact_info:
- text: Hello! Could you please provide your contact information?

utter_acknowledge_provided_info:
- text: Thanks for provided your info!
```

Fig 7:-Responses format

Responses will be provided by user while training the model.The workflow and the formats are discussed above.
Next this model should integrate with an user interface. To integrate created a web-based user interface with the help of HTML, CSS and Javascript.The web page will show the input of user on page by converting speech to text.
The above given figures of tokenization , featurization, responses, etc are all examples to explain working of NLU.This nlu is the main component for inputs and core is for responses.The training data of the model are given below in the form of picture.

Every input should be in the form of intentions.From this intentions the intents and entities will be extracted.Using this extacted data the responses will be generated.



```
- intent: mood_unhappy
  examples: |
    - my day was horrible
    - I am sad
    - I don't feel very well
    - I am disappointed
    - super sad
    - I'm so sad
    - sad
    - very sad
    - unhappy
    - not good
    - not very good
    - extremly sad
    - so saad
    - so sad

- intent: bot_challenge
  examples: |
    - are you a bot?
    - are you a human?
    - am I talking to a bot?
    - am I talking to a human?
    - introduce yourself
    - who are you?
    - what is your name?

- intent: date
  examples: |
    - date
    - date now
    - what's the date now
    - tell me the date
    - date it is
- intent: time
  examples: |
    - time
    - time now
    - what's the time
    - time it is
    - tell me the time
```

Fig 8:-Training data

V. USER INTERFACE AND OUTPUT

A. User Interface

This is created by using HTML(hyper-text markup language), CSS, Javascript.By using these we created a web page appearing with a button and text(i.e, name of VA).Javascript will enable us to click the button and perform tasks.This web page will be configured to the framework and voice model, when we click on button and speak anything the web page will display user input on screen and at backend the input will be processed ,ends up with generating appropriate output.

The designed web page is shown in below figure:-

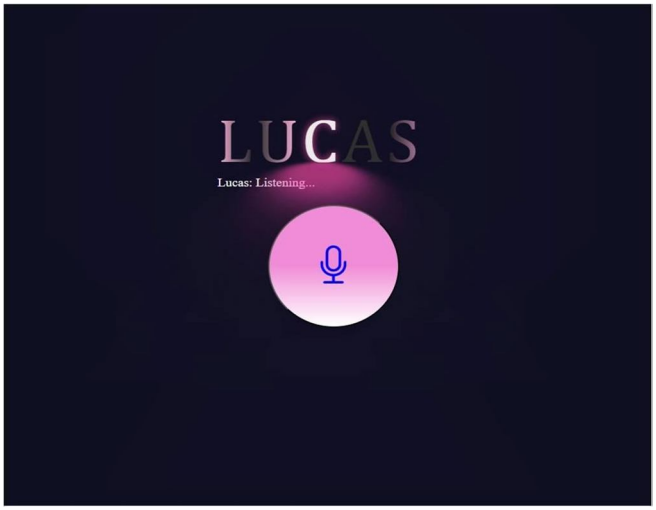


Fig 9:-User interface

This page could be run on local host or on server host.It will listen the speech using system microphone ,converts it to text and display on the screen also we can print input and output responses on console.The output in console are shown in given figure 10.

This virtual assistant is based on defined and trained data, so if it encounter an untrained input then it responds as ‘I didn’t understand’.

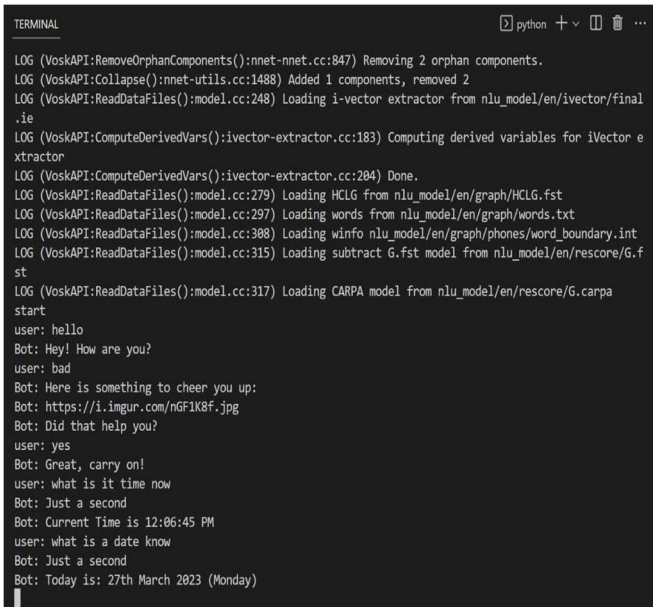


Fig 10:-Output in console

VI. FUTURE SCOPE

Every domain will be integrates with the artificial intelligence and machine learning in the outside market.Even now a days everything in our surroundings we are seeing technologies with machine learning and AI.

In coming days it will be more effectively emerge and become more intelligent.

Some of the application that virtual assistants evolve are:-

1) Enhanced personalization: AIML will be able to understand and interpret user behavior and preferences more accurately, enabling virtual assistants to provide highly personalized experiences.

2) Improved natural language processing: Virtual assistants will become better at understanding and responding to natural language queries and conversations, making interactions more intuitive and human-like.

3) Integration with IoT (Internet of Things): Virtual assistants will be able to connect and control various IoT devices, providing users with more control and convenience.

4) Multimodal interactions: Virtual assistants will enable users to interact with them using various modes, such as voice, text, and gesture, making interactions more natural and seamless.

5) Emotional intelligence: Virtual assistants will become more emotionally intelligent, enabling them to recognize and respond to users' emotions, making interactions more human-like.

VII. CONCLUSION

This VA which is discussed in this paper is for personal usage as well as integrate with the applications like telegram.It is customizable so every thing we can add or remove from the previous data.As it is based on supervised learning the assistant will be listen to whatever the user says and nothing can do without user interference.It will learn from training data and from user inputs.So there will be no risk and it is a trustable model.

We can add any kind of data which can be in the breakable form.If the data is not in required format it will be bit complicated task to understand the data by the model.

If the model successfully understand and processed data then easily respond to user without complexiety.

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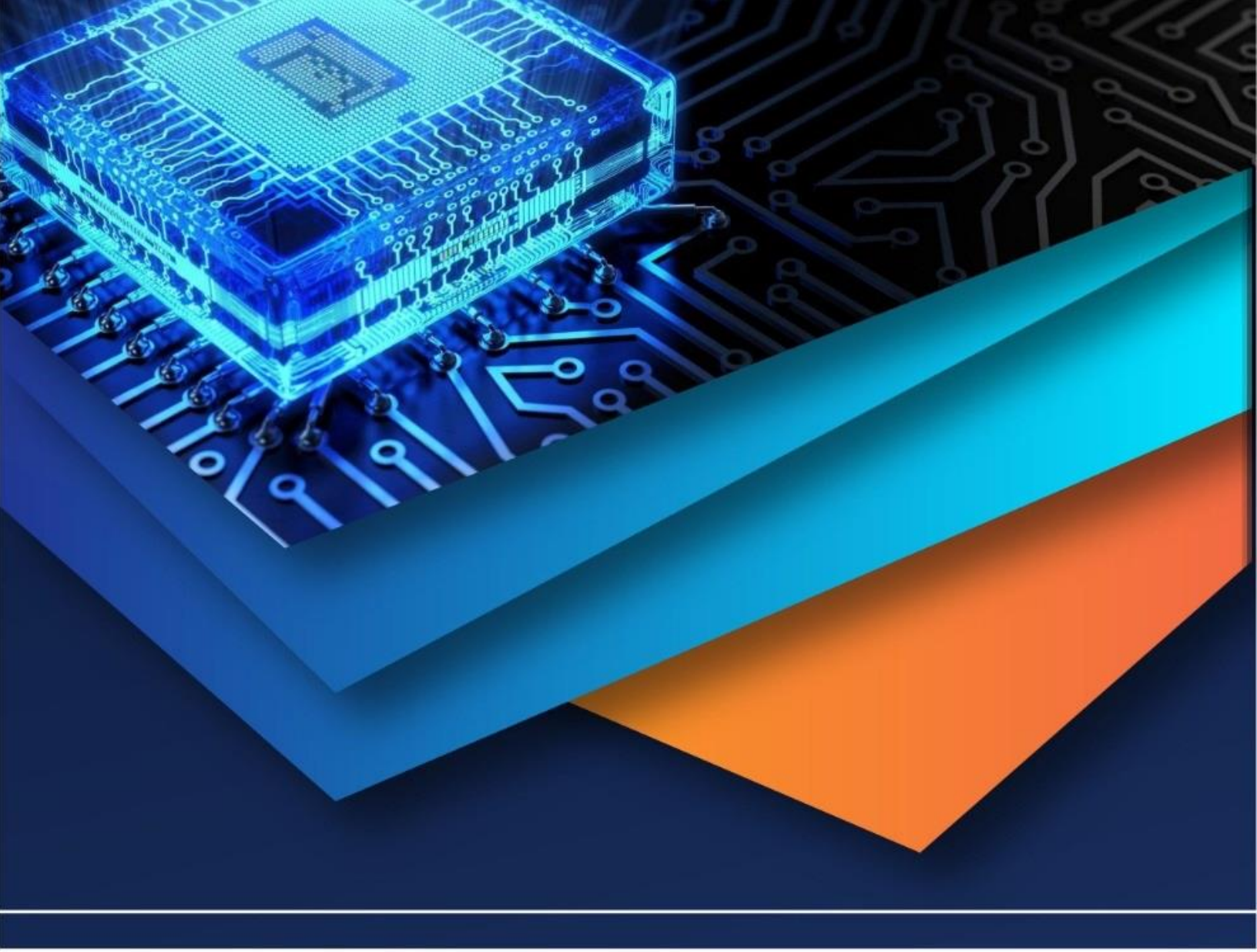
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