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RoboKid: A Voice-Guided Robo

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Abstract: ***A robot is an electro-mechanical machine that's guided by computer and electronic programming. numerous robots have been erected for manufacturing purpose and can be set up in manufactories around the world. This project is all about creating a voice-controlled robochild that can show simple emotions like crying, laughing, singing, and even dancing, just by listening to voice commands. The idea is to blend technology and human-like interaction in a fun and affordable way using components that are easy to find. At the heart of it is an Arduino Uno, which works together with a Bluetooth module (HC-05) to receive voice commands through a mobile app. To bring the robot's emotions to life, we used an ISD1820 voice recording module that plays recorded sounds like laughter, crying, or songs. LED lights are added to give visual cues for each emotion, and gear motors along with an L298N motor driver help the robot move and dance. Everything is controlled by the Arduino, which listens for specific commands and reacts accordingly in real time. The goal is to keep things budget-friendly while making the robot feel expressive and interactive—perfect for educational use or just to entertain kids. This robo child shows how voice-controlled robots can become more emotionally engaging, and it opens the door to building even smarter, more human-like machines in the future.***

Keywords**:** ***Voice-Controlled Robo, Arduino Uno, ISD1820, Human-Robot Interaction, Bluetooth Module (HC-05), gear Motor, L298N Motor Driver, Voice Commands, Educational Robotics, Child-Friendly Robot, Embedded Systems, Low-Cost Robotics, LED Indicators.***

I. INTRODUCTION

Latest technology is going strong, and it's making our machines and tools smarter. Here, this project is centered around developing a voice-responsive robot. You command it with words, and it responds and executes the action—giving orders to a human. The voice command is read by an Android phone, interpreted into basic instructions, and relayed to the robot to perform on. The aim is to achieve a more natural and human form of communication with machines. This type of technology can assist in various fields such as healthcare, education, and manufacturing, simplifying things and streamlining them.

Motivation & Problem

Kids with disabilities have a difficult time with conventional toys and technology because they're difficult to operate. Most assistive tools are too technical and don't provide the type of emotional connection or enjoyment that children require. Our robo, controlled through voice commands, is easy to operate, interactive, and empowering—making children more independent and part of the group.

The capacity of a machine to mimic human feelings and respond vocally creates new possibilities for our relationship with technology. This article presents a novel idea: a Voice-Controlled Robo Child that can execute expressive movements like crying, laughing, singing, and dancing upon voice commands. The setup is largely built around an Arduino Uno microcontroller, which serves as the brain of the robot, processing and carrying out commands. It has wireless communication with an Android smartphone using a Bluetooth module (HC-05) that can support a voice control app. This voice-controlled system greatly adds to the robot's interactivity and makes it even more engaging and friendly, especially for kids. To mimic emotions and body movements, the robot is also equipped with an ISD1820 voice record and play module for voice functions, LEDs for visual indication, and servo motors through an L298N motor driver for movement, e.g., dancing. A certain voice command is assigned to each emotion or action, and the system is programmed to respond suitably in real time. The main goal of this project is to explore how cheap and common hardware modules can be used to create an emotion-expressing child robot. This paper presents the design, modules, implementation, and possible future improvements of the system proposed.

II. PROBLEM STATEMENT

While robotics has experienced exponential growth, the majority of low-cost and DIY robot projects are not emotionally interactive and are only capable of performing simple movement-based tasks.

Current voice-controlled systems tend to be centered on utilitarian commands (such as switching devices on/off or moving through environments), voice controlled robotic vehical as opposed to expressive, child-oriented behaviors that mimic human emotions.
There seems to be a gap in the market for low-cost, voice-interacting robots that not only comprehend voice instructions but also respond emotionally with actions such as crying, laughing, singing, and dancing.

III. LITERATURE REVIEW

Voice-controlled robots have become an important area of interest in the field of assistive and interactive technologies, particularly for educational and targeted support operations. colorful studies have explored the integration of Arduino microcontrollers, Bluetooth communication, and voice recognition modules to enable stoner- robot commerce.
Kannan and Selvakumar (2015) presented an Arduino-based robot that could comprehend voice commands via the EasyVR module, transmitting control signals via ZigBee to perform initial motions like walking and turning.
Maheswari et al. (2021) also tested voice-controlled robotics through a demonstration of an Android operation and HC- 05 Bluetooth module to transfer stoner commands to a robot using Arduino. The study concentrated on ease of use, availability for impaired individualities, and the significance of wireless, app- based command transmission. It also bandied the advantages of Bluetooth over Wi- Fi for short- range, real- time control in robotic operations.
Pinjarkar et al. (2017) proposed a minimal voice-operated robot based on AT89S52 microcontroller and HC- 05 Bluetooth. The device repeated voice instructions to textbook using an Android application, which were also reused to control the movement of the robot. The research highlighted low-cost educational robotics feasibility and targeted availability via smartphones.
John et al.(2021) experimented with the design of a voice-aided mortal care robot using jeer Pi and advanced features like face and object identification, OCR, and textbook-to-speech transformation. Though still more advanced in capability, the model also authenticated the use of voice as an initial interface for certain robotic attendants. It demonstrated the use of voice not merely for navigation but for information provision and stoner commerce, especially for the physically disabled and the elderly.
These studies clearly demonstrate that while many sweats have been produced to create voice-controlled mobile robots, a void has existed in designing robots that perform emotional activities like weeping, laughing, singing, and dancing. maximum study so far has primarily dealt with control of stir or support duties, rather than emotional interactivity.
This system builds on the groundbreaking ideas found in these studies and offers a new concept — combining emotional expression with stir control on a child-friendly robot. Taking inspiration from components like Arduino Uno, ISD1820 voice IC, servo motors, L298N motor motorist, and LED pointers, this study seeks to fill the gap by building a robot that not only responds to voice commands but also expresses passions in an interacting, dynamic way.

IV. METHODOLOGY

A. Components Description

Components of the Voice Controlled robot are chosen to get an efficient output with a greater accuracy.

1) Arduino:

Arduino is a design, open- source tackle, and software platform that's used to produce and construct electronic bias.It produces and manufactures micro controller kits and single-board interfaces to construct electronics projects. It is a common micro controller platform that can be employed to create customized voice-operated robots. The users develop code in the Arduino IDE, which is an easier version of C++, employing a text-based editor. The code is transferred to the Arduino board via a USB connection. The microcontroller runs the code, driving outputs and reading inputs according to instructions. The board communicates with external devices, including sensors, actuators, and s displays, according to the programmed instructions. Users can observe and debug their projects via serial communication (e.g., Serial Monitor in the Arduino IDE)

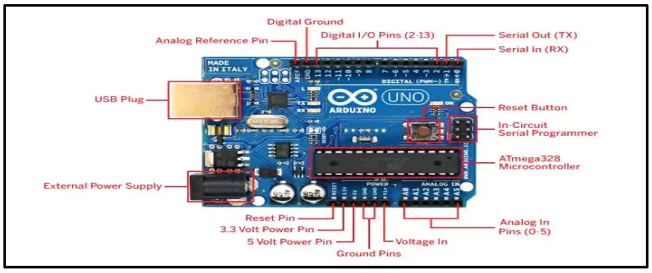


Fig: 1.1: Arduino UNO

2) ISD1820 IC voice recorder:

This is the ISD1820 Playback and Voice Recording Module. The non-volatile storage and playback time of this voice recorder module is 8 to 20 seconds. This one-chip voice recorder module uses the ISD1820 integrated circuit (IC) to record and play back a single message.

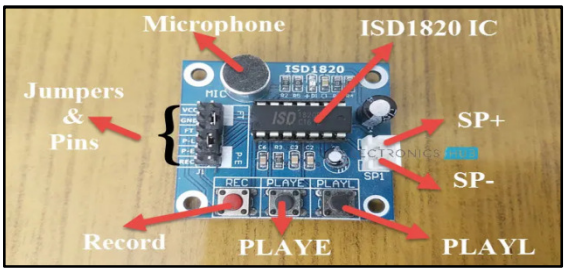


Fig.1.2: ISD1820 IC module

3) Bluetooth Module (HC-05):

The HC-05 Bluetooth module is a popular device for wireless serial communication. It supports both master and slave modes and communicates. It's widely used in robotics, homeautomation, and wireless data transferprojects

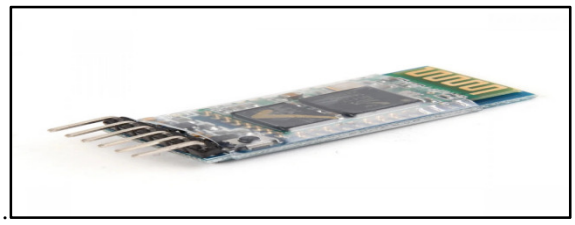


Fig 1.3: HC-05 module

4) Motor Driver:

The L298N module is a dual full-bridge motor driver capable of handling high current and high voltage and is used for the driving of DC motors and stepper motors. It facilitates control over both speed and direction of two DC motors. This module employs an L298 dual-channel H-Bridge motor driver integrated circuit (IC) and employs two methods for DC motor speed and direction control: Pulse Width Modulation (PWM) for speed control and H-Bridge for direction control. The module can handle two DC motors or a stepper motor at once. The L298N motor driver module is Arduino-friendly and is quite reasonable in cost. It is typically applied in robotics to control motors, allowing the connection of as many as four motors simultaneously; however, when the control of speed and direction is required, it supports the connection of two motors

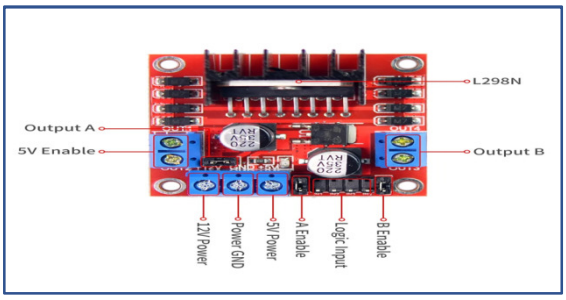


Fig 1.4: L298N module

5) Gear Motor:

A gear motor is an all-in-one combination of an electric motor and a gearbox. This makes it a simple, cost-effective solution for high-torque, low-speed applications because it combines a motor with a gear reducer system.

Fig 1.5: Gear Motor

6) Speaker:

A speaker is employed in a voice-controlled robot to give voice feedback, make sounds, or talk to people. It interacts with a microcontroller (such as an Arduino or Raspberry Pi), a voice recognition module, and occasionally text-to-speech (TTS) software.

Fig 1.6: Speaker

B. Software components

1) Arduino IDE

Arduino is an open-source electronics platform that uses software and hardware that are easy to use. Arduino boards can sense hundreds of various inputs, such light from a button push, a detector, or a tweet, and use that information to do things like turn on an LED, turn on a motor, or upload a textbook to the internet. To navigate their boards, addicts send a barrage of commands to the board's microcontroller using the Arduino Programming Language, which is based on Wiring, and the Arduino Integrated Development Environment (IDE), which is based on Processing.

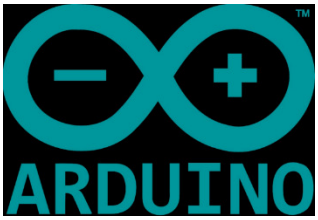


Fig :2.1: Arduino Ide

2) Arduino Bluetooth Control App:

These apps and resources provide a range of functionalities for controlling Arduino projects via Bluetooth, from voice commands to customizable controls, making them suitable for various applications in robotics and automation.Thisapplications allow you to control your Arduino, ESP32 or any other microcontroller via bluetooth connection. It can be used to control Robot, car, Led, Motor, fans, home applications.

Fig 2.2: Bluetooth control app

C. Proposed Work

Arduino using breadboard, bluetooth module and ISD1820 ic module performing cry, laugh, sing poem by giving a voice command through arduinobluetooth control app.

1) Module 1 Components

- Arduino
- Voice Recording IC ISD1820
- Bluetooth Module (HC-05)
- Speaker, Breadboard and Jumper Wires

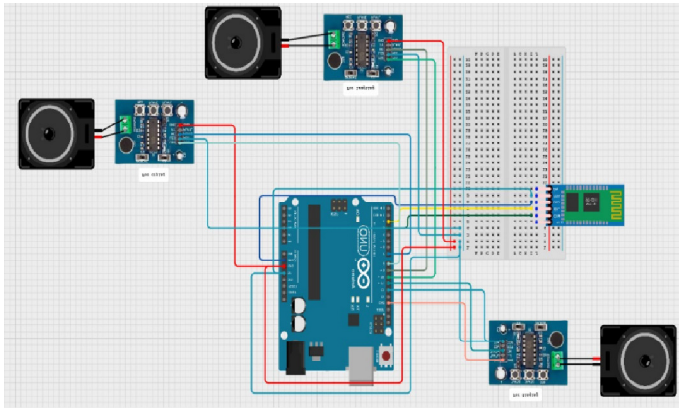


Fig 3.1: Circuit Diagram for Gestures

2) Module 2 Components

- L298N Motor Driver
- Arduino
- Gear Motor
- Bluetooth Module(HC-05)
- BreadBoard and Jumper Wires

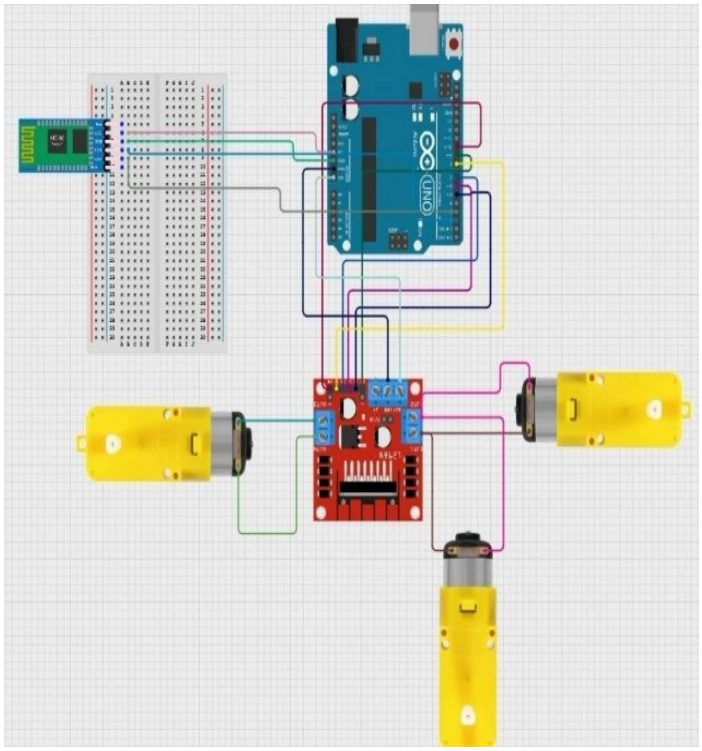
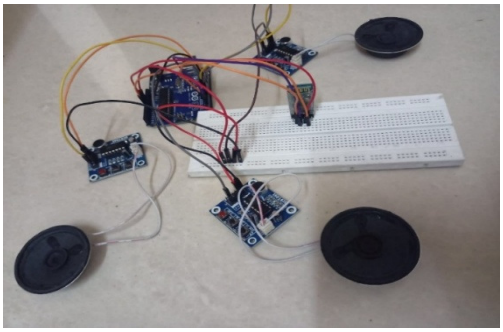


Fig 3.2: Circuit Diagram for Dance(Shoulders and Head Movement)

V. ACTUAL IMPLEMENTATION AND WORKING

A. *Module1:*



1) *Overview of Components*

- Arduino Uno (central unit) – This acts as the main controller that processes voice commands and sends activation signals to the ISD1820 modules.
- HC-05 Bluetooth Module (mounted on the breadboard) – This module is responsible for receiving voice commands from an Android application via Bluetooth.
- ISD1820 Voice Playback Modules (three units) – Each module is linked to a small speaker and is preloaded with unique sounds: Crying, Laughing, Singing.
- Speakers (three in total) – These are connected to the ISD1820 modules to produce sound.
- Jumper wires and breadboard.

2) *Operational Procedure (Step-by-Step)*

- Voice Command Input:

A mobile application, such as the Arduino Bluetooth Control App, is employed to send commands like "cry", "laugh", or "sing". The application transmits the command to the HC-05 Bluetooth module.

- Command Reception & Processing:

The HC-05 module relays the received command to the Arduino Uno via the serial interface.

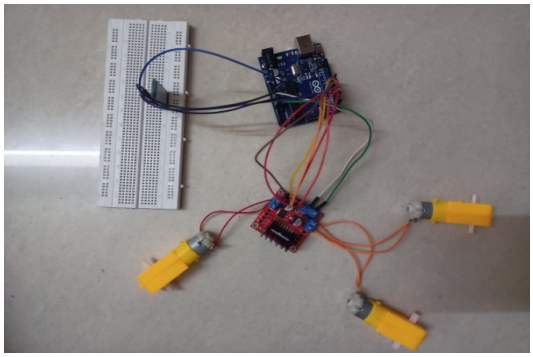
- Activating the Corresponding ISD1820 Module:

The Arduino is programmed to recognize the voice command and activate the appropriate ISD1820 module.
For "cry" → Cry module pin goes HIGH
For "laugh" → Laugh module pin goes HIGH
For "sing" → Sing module pin goes HIGH
This is done using digitalWrite(pin, HIGH) for a short delay, then LOW again.

- Audio Playback:

Once activated, each ISD1820 plays its assigned audio clip through the connected speaker. Only one module is activated at a time to avoid audio overlap.

B. *Module 2:*



1) Components Overview

- Arduino Uno – This is basically the brain of the robot. It interprets voice commands such as "dance" and makes the motors send commands to get the robot to move accordingly.
- L298N Motor Driver Module – This driver module serves as a go-between for the Arduino and the motors. It directs the speed and direction of spinning of the motors, depending on what the Arduino instructs it to do.
- DC Gear Motors – These little yellow motors are actually what propel the robot forward. They're probably used to mimic arm and head movements—particularly when the robot is dancing.
- Jumper Wires and Breadboard – These are used to connect everything together. They make it possible for signals and power to travel between all the pieces easily.

2) Operational Procedure (Step-by-Step)

- Voice Command Activation

The process begins once the user initiates a voice command such as "dance" using an Android application. This command is wirelessly sent by Bluetooth to Arduino Uno.The Arduino receives and identifies the command, and as a result, it comes to life by invoking the motor control sequence.

- Controlling the Motors

The Arduino sends signals to the motor driver on digital pins 5, 6, 7, and 8, which are connected to IN1 through IN4 on the L298N module. These signals indicate whether each motor should rotate forward or backward.To control the motors' speed or power, Enable pins (ENA on pin 9 and ENB on pin 10) are utilized. These can either be controlled through PWM (Pulse Width Modulation) or be left with a fixed configuration, depending on the requirements of the project.

- Motor Use in the Robot

In this configuration, two motors are assigned to robot arm movement, while one motor is responsible for head movement.
When paired with the emotional displays integrated into Module 1—such as crying, laughing, or singing—this dance function provides a more realistic, interactive feel to the robot child.

VI. ADVANTAGES

1) Enhanced Operational Efficiency

- Automates processes and minimizes manual involvement
- Quickly adapts to new directives

2) Improved User Accessibility

- Provides a user-friendly and intuitive interface
- Decreases the necessity for specialized expertise
- Promotes wider adoption across various sectors

3) Increased Productivity and Cost Saving

- Optimizes resource utilization
- Lowers operational expenses

4) Superior Human-Robot Collaboration

- Enables dynamic, real-time communication

5) Fosters Innovation and Technological Progress

- Propels advancements in multiple industries
- Establishes new benchmarks for efficiency and interaction

VII. LIMITATIONS

1) Accuracy and Recognition Challenges

- Faces difficulties in noisy settings
- Struggles with understanding various accents and speech patterns

2) *Absence of Context Awareness*
- Lacks the ability to comprehend or interpret the context of commands

3) *Privacy and Security Issues*
- Ongoing listening may result in unauthorized data collection
- Potential for misuse or breaches of sensitive voice information

4) *Limitations in Task Complexity*
- Built for straightforward, single-step commands
- Restricted in performing intricate tasks or grasping environmental context.

VIII. FUTURE SCOPE

1) *Enhanced Emotional Intelligence*
- Incorporate machine learning algorithms to detect and react to the tone or sentiment in a user's voice, facilitating more organic interactions.
- Utilize sensors (such as audio and visual devices) to respond according to the surrounding context, for instance, laughing only when another individual nearby is laughing.

2) *Natural Language Processing (NLP)*
- Transition from static voice command systems to NLP-driven voice assistants (for example, Google Assistant API, Amazon Alexa SDK).
- Allow for unrestricted communication instead of relying on limited, predefined commands.

3) *Application and Connectivity Features*
- Develop a specialized Android/iOS application that offers personalized controls and real-time feedback from the robot (such as battery level and sound options).

4) *Practical Applications*
- Educational Companion: Utilize it as an engaging resource to assist children in learning poems, numbers, or even various languages through gestures and emotional expressions.
- Therapeutic Robotics: Modify it for use with children facing autism or emotional development issues to aid them in recognizing and responding to emotions.

5) *Energy Efficiency*
- Introduce sleep modes and sensor-activated wake-up features to prolong battery longevity.

6) *Security and Personalization*
- Implement voice recognition authentication to guarantee that only the designated user can operate the robot.

IX. CONCLUSION

The creation of the Voice-Controlled Robot Child marks a notable progress in integrating technology with designs specifically aimed at children, especially those facing disabilities or learning difficulties. This project exemplifies the collaboration of integrated systems, voice recognition, and robotics to develop an interactive and emotionally responsive companion that offers entertainment, supports learning, improves communication, and encourages emotional growth. By allowing the robot to react to voice commands through behaviors such as crying, laughing, singing, and dancing, we strive to provide children with a delightful and flexible avenue for self-expression, exploration, and social interaction. The robot is more than just a toy; it functions as an essential educational tool that fosters independence, builds confidence, and promotes social engagement within a safe and nurturing environment. This initiative tackles important issues related to accessibility, affordability, and customization, making it an ideal choice for educational and supportive uses. Additionally, it establishes a strong groundwork for future developments in emotional artificial intelligence, intelligent learning systems, and inclusive robotics.

In summary, the Voice-Controlled RoboChild is not just a technological milestone; it represents a vision of how technology can aid children, bridge communication gaps, and contribute to a more inclusive future.

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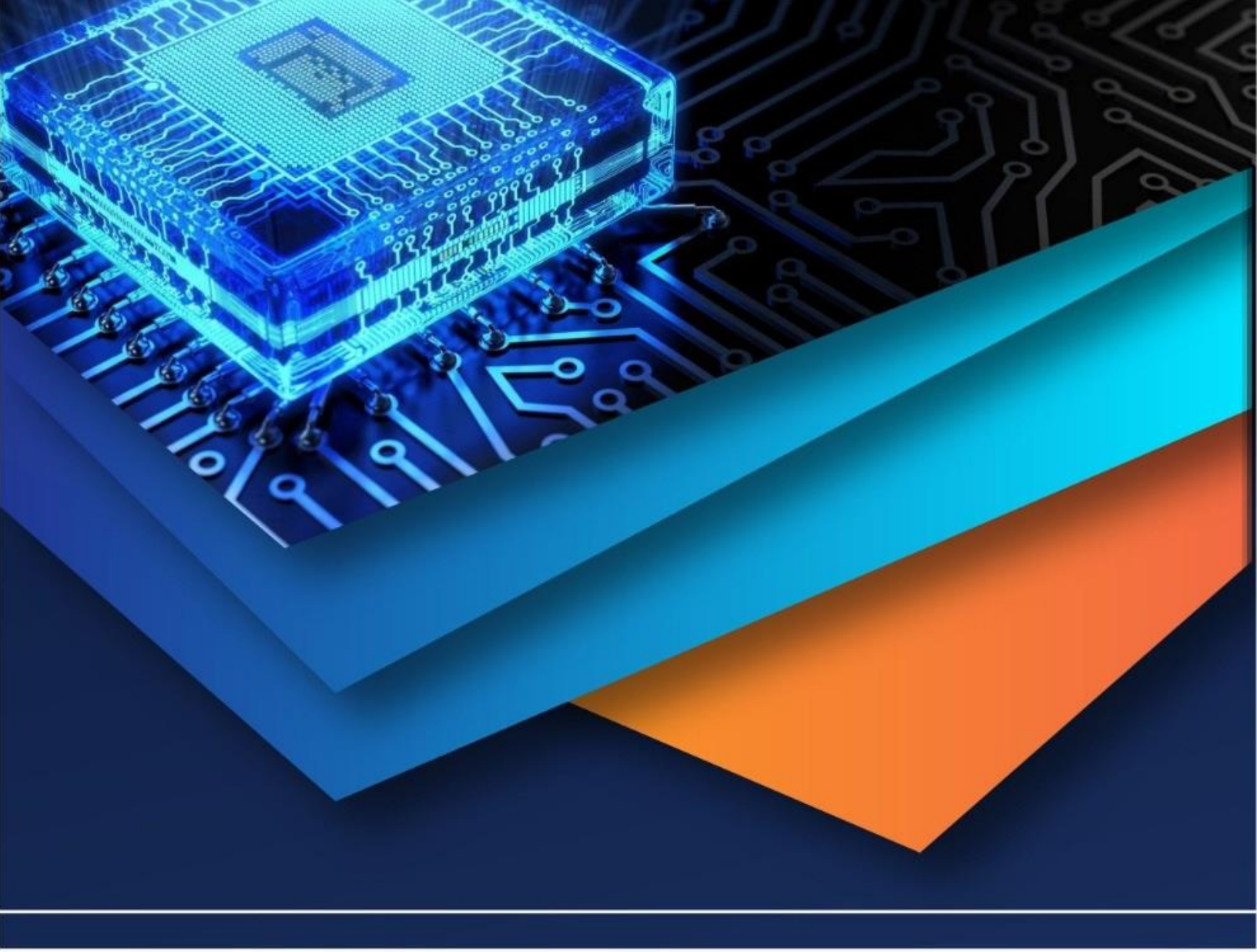

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