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Helping Hands for Handicaps

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Abstract: ***We have more advanced wheelchairs in today's generation. it includes joystick wheelchair, head motion control wheelchair, gesture control wheelchair etc. But with the advance technology it is expensive too, which is not affordable for most of the middle-class families. In order to provide an advanced wheelchair in an affordable price, we have to use less components to reduce the cost so that a person can buy it with a price less than the today's basic bikes price. To achieve this, we used some basic electronic components such as Arduino MINI and NANO, gyro sensor, Node MCU, Motors etc. To get extra security we integrated some calling and GPS location features too. The person sitting in the wheelchair can control the wheelchair through hand gestures. Additionally, whenever the person sitting in the wheelchair faces any problem, such as if the wheelchair falls, the caretaker will receive a notification and through the GPS location, the caretaker will be able to reach their location.***
NOTE: GPS: Global Positioning System, Node MCU: Node Microcontroller Unit.
Keywords: Gesture controlled wheelchair, Arduino, GPS, Electronics,

I. INTRODUCTION

We titled our model as "Helping Hands for Handicaps". It is a hand gesture-controlled wheelchair that represents a groundbreaking endeavor at the intersection of assistive technology and human-computer interaction, seeking to revolutionize the mobility experience for individuals with physical disabilities. In a world where traditional wheelchair controls often present challenges for those with limited motor functions, this project endeavors to provide a more inclusive and intuitive solution. Leveraging advancements in hand gesture recognition technology, the system aims to decode and interpret a predefined set of gestures, allowing users to navigate their wheelchair with simple, natural hand movements. The underlying motivation for this innovation lies in the pursuit of enhancing the quality of life for individuals facing mobility impairments, promoting autonomy, and reducing reliance on complex control interfaces or assistance from caregivers. At its core, the project focuses on four key objectives. Firstly, it aims to develop a robust hand gesture recognition system capable of accurately and efficiently interpreting a range of gestures. The second objective is that requiring a seamless interface that allows for real-time and responsive control based on the recognized gestures. The third objective emphasizes the importance of user friendliness, as the system must cater to individuals with varying degrees of technological familiarity. The final objective involves rigorous testing and optimization, wherein the system's accuracy, responsiveness, and overall performance are assessed. User feedback and testing results inform iterative improvements, refining the technology to meet the specific needs of its intended users.

II. LITERATURE SURVEY

When an unfortunate event like leg problems affect the person, it is necessary to use devices like wheelchairs that offer a means of displacement for patients with problems. Tremendous modification has been made in the field of wheelchair technology. However, significant advances haven't been able to help quadriplegics navigate wheelchair unassisted. Some patients those who cannot operate the wheelchair with their arms due to a lack of force or psychomotor problems in the superior members, request electric wheelchairs, frequently manipulated with joysticks or gesture-controlled wheelchairs. In this paper, we demonstrate our project ideas. Our project involves using a gyro sensor, Arduino Nano, RF transmitter, RF receiver, L298N motor driver, motors, IR sensor, Node MCU (ESP8266), buzzer, and connecting wires.

1) Hand Gesture Controlled Wheelchair
Author: Reshma Anilkumar, Amal M R
Published in: IJCRT 2023
The persons with disabilities are always facing barriers in accessing the basic services, these barriers can be effectively addressed through advanced technologies.

To overcome that a wheelchair is developed that will be beneficial to mankind, here an accelerometer sensor is used, which gives the analog signal according to the tilt of the accelerometer in x and y direction and RF module is used to transmit the signal from the transmitter section to receiver section then the movement of the wheel is controlled.[1]

2) Head Motion Controlled Wheelchair

Author: Farah Binte Haque, Tahwid Hossain Shuvo, R khan

Published in: IEEE conference 2021

Head motion-controlled wheelchair is an intelligent wheelchair with facilities for navigating, recognizing obstacles, and moving automatically by managing detectors and motions. In this wheelchair performs head motion through a microcontroller and wheelchair performs head motion through a microcontroller. The controller filters the indication and allows the action of the wheelchair for its navigation. The ultrasound detector helps to resist impediments. DC motors will drive the wheelchair during the gesture of control mode. The motors will not work, and consequently, the wheelchair will not run when the head is neutral. [2]

3) Joystick Controlled Wheelchair

Author: Trinayan Saharia, Jyotika Bauri, Mrs Chayanika Bhagabati

Published in: IRJET 2017

A joystick control wheelchair is very important for the physically challenged people. They cannot move anywhere like a normal person. For this reason, they always depend on the other people. But the joystick control wheelchair can remove this problem and help them to move anywhere. The movement of wheelchair can be control manually by the joystick. The command is implemented by using joystick and then the command is sent to the Arduino board where the controller ATMega328p will process the command. After processing the controller send the command in the form of digital signal to the motor driving IC and the motor driving IC control the movement of wheelchair. [3]

4) Mind Controlled Wheelchair

Author: Utkarsh Sinha, M Kanthi

Published in: IOSR-JEEE 2016

The study focuses on building an electric wheelchair out of a standard wheelchair and creating a Brain-Computer Interface (BCI) system that connects the electric wheelchair to the human brain. The ARM microcontroller FRDM KL-25Z, a Freescale board, processes the signal from the EEG sensor. Based on floor detection and obstacle avoidance sensors installed on the wheelchair's footplate, the microcontroller decides which way to move the wheelchair. On a color LCD that is interfaced to the MCU, real-time information is shown. [4]

5) Accelerometer Based Hand Gesture Controlled Wheelchair

Author: Abirami, Anupriya, Nagaraju

Published in: IJTRA 2016

People who are unable to walk owing to physical or physiological illnesses, injuries, or disabilities use wheelchairs. Recent advancements indicate that there is much room for progress in smart wheelchairs. This article describes a gesture-based wheelchair that is operated by hand gestures. The wheelchair control and the memory sensor are the two primary components of the system. The Mems sensor, which is connected to hand, is a 3-axis accelerometer with digital output (I2C) that provides hand gesture detection, converts it into the 6-bit digital values and gives it to the PIC controller. The wheelchair control unit is a wireless unit that is developed using another controller. [5]

6) Hand Gesture Wheel Chair Using Raspberry Pi And Open CV

Author: Konduru Sujana, N Gunasekhar Reddy

Published in: INSETR 2016

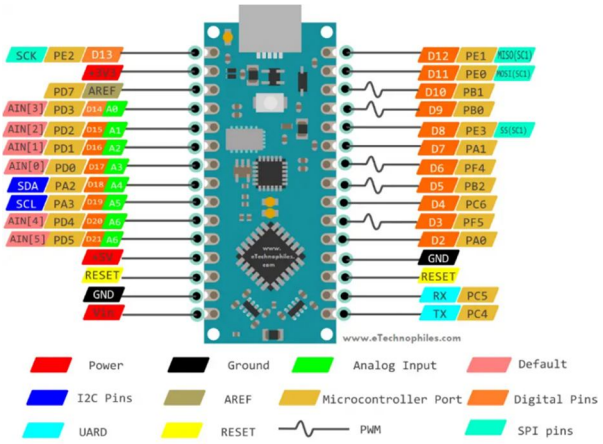
It's possible to capture gestures from any body movement or state but common way is to capture from face or hand. In the proposed system they mainly concentrate on Hand gesture recognition. This Novel system completely depends on the Python OpenCV software and Arm11 controller. By using USB Web Camera and DC motor they control the movement of the wheelchair.

This Proposed system not only captures hand movement, but also control the wheelchair depending on the hand movement i.e. wheelchair will move according to the number of fingers. By recognizing the number of fingers wheelchair will move in all four directions. [6]

III. METHODOLOGY

A. *Hardware Specification and Requirements*

1) *Arduino:* Arduino is an open-source electronics platform that is widely used for creating interactive projects. It consists of both hardware and software components, making it accessible and versatile for users. Arduino boards are equipped with microcontrollers, which are small computers on a single integrated circuit, and they can be programmed to perform various tasks.

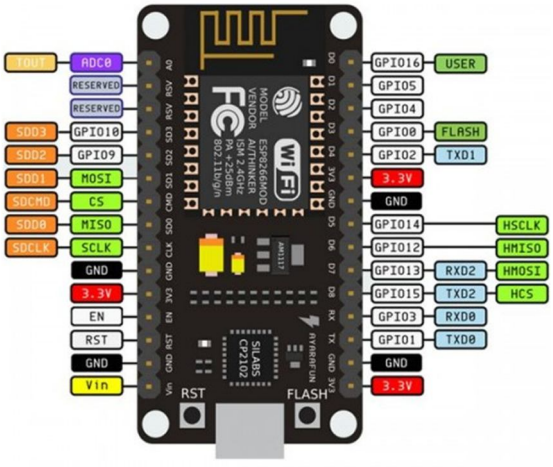


3.1 Arduino Board Pin Specification

Arduino is widely used in the maker community, educational settings, and prototyping environments due to its affordability, ease of use, and versatility. It empowers individuals to bring their electronic and programming ideas to life, whether they are beginners or experienced engineers. The open-source nature of Arduino encourages collaboration and the sharing of projects, contributing to a dynamic and creative ecosystem

2) *ESP8266 Node MCU:* This development board, which is constructed from an ESP 12e module, has an ESP8266 chip with a 32-bit LX106 RISC microprocessor built of silica.The microprocessor maintains RTOS and operates on 80MHz to 160MHz variable clock frequency. Node MCU includes 128KB RAM and 4MB of non-volatile storage to store data and programs.

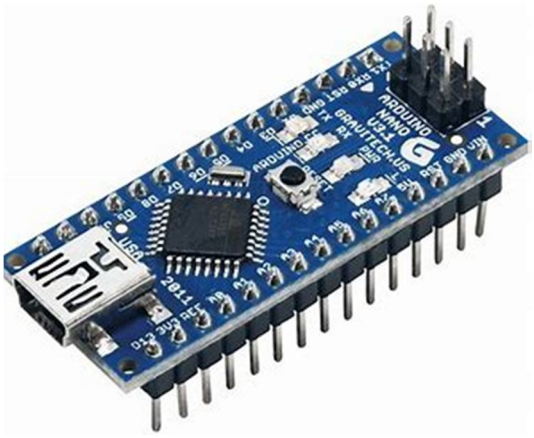
Its high transforming power with congenital Wi-Fi or Bluetooth and deep sleep operating features referee for IoT projects. Node MCU board can easily be programmed with Arduino IDE Since it's easy to use. We've used Arduino IDE software to regulate the robotic manipulator using Node MCU. Arduino IDE is software which is often ready to write the program in C/C++.



3.2 Node MCU Pin Secifications

3) *Arduino Nano:* The Arduino Nano is a compact and versatile microcontroller board based on the ATmega328P chip. Designed for ease of use in electronics projects, it offers a wide range of features despite its small size. The Nano is equipped with 14 digital input/output pins, 8 analog inputs, and a 16 MHz clock speed, providing flexibility for various applications.

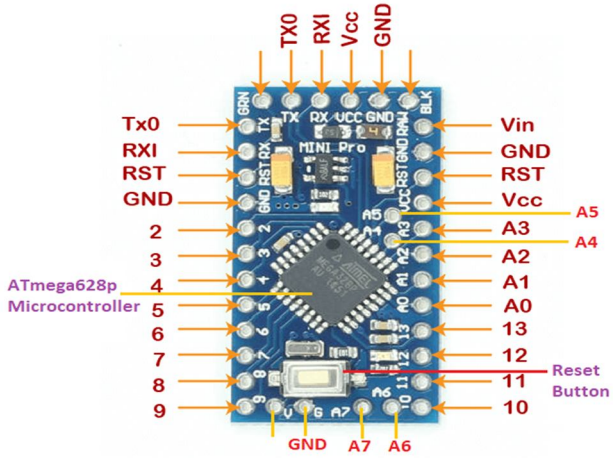
Its USB interface simplifies programming and power supply, making it accessible to beginners and experienced enthusiasts alike. With a compact form factor, the Nano is suitable for projects with space constraints. It supports a diverse range of sensors, actuators, and communication modules, fostering creativity in project development. Arduino Nano's compatibility with the Arduino Integrated Development Environment (IDE) enhances its accessibility, enabling users to write, compile, and upload code seamlessly.



3.3 Arduino Nano Board

Whether used in robotics, home automation, or educational settings, the Arduino Nano empowers individuals to bring their electronic ideas to life. Its popularity stems from its affordability, functionality, and a supportive community that shares resources and projects, fostering a vibrant ecosystem around this microcontroller board.

4) *Arduino Mini:* The Arduino Mini is a compact Whether used in robotics, home automation, or educational settings, the Arduino Nano empowers individuals to bring their electronic ideas to life. Its popularity stems from its affordability, functionality, and a supportive community that shares resources and projects, fostering a vibrant ecosystem around this microcontroller board.



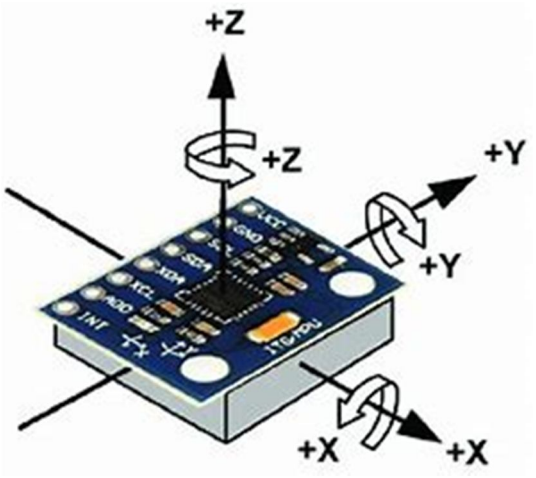
3.4 Arduino Mini Board

The Arduino Mini is programmed using the Arduino Software (IDE), our Integrated Development Environment is common to all of our boards and running both online and offline.

5) *DC Motor:* An electromechanical device that transforms electrical energy into mechanical motion is a DC (direct current) motor. It operates on the principle of the Lorentz force law, where a current-carrying conductor placed in a magnetic field experiences a force. In our Arduino project, we are integrating a DC (Direct Current) motor to achieve specific functionalities. DC motors are widely used in Arduino projects for their simplicity and ease of control, making them suitable for applications like robotics, automation, and various electronic devices.
6) *Driver Module:* DC and stepper motors can be driven by this high-power L298N motor driver module. An L298 motor driver integrated circuit and a 78M05 5V regulator make up this module. The L298N Module may control two DC motors with directional and speed control, or up to four DC motors.

3.5 L298N Driver Module

7) *RF Transmitter & Receiver:* RF (radio frequency) transmitter and receiver modules are integral components in wireless communication systems, allowing the transmission and reception of data or signals over radio frequencies. These modules are commonly used in various applications, including remote controls, wireless sensors, telemetry systems, and communication between electronic devices.
8) *MPU6050 Gyro Module:* The MPU6050 Gyro Module is a compact sensor integrating a 3-axis gyroscope and a 3-axis accelerometer in a single chip, communicating with microcontrollers through the I2C interface. Known for its wide measurement range and low power consumption, it excels in applications such as inertial measurement units (IMUs), gyro-stabilization for drones and cameras, gesture recognition, virtual reality (VR), gaming, and robotics. With libraries available for popular platforms like Arduino, the MPU6050 facilitates seamless integration, providing precise real-time data on acceleration and angular velocity for diverse motion tracking and control purposes.



3.6 MPU6050 Gyro Module

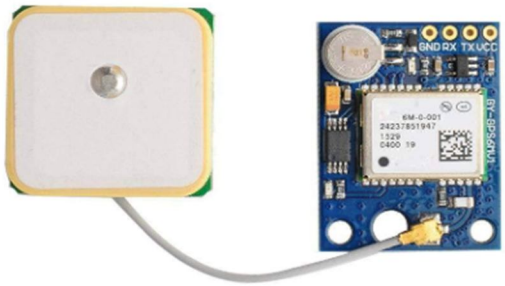
9) *IR Sensor:* An IR (Infrared) sensor is a device that detects infrared radiation in its surrounding environment. It works by emitting an infrared beam and then measuring the intensity of the reflected or emitted infrared radiation. IR sensors are commonly used in various applications such as proximity sensing, object detection, motion detection, and temperature measurement. [8]

3.7 IR Sensor

10) *Buzzer:* A buzzer is a small electronic device that produces sound when an electrical current is passed through it. It typically consists of a coil of wire wound around a magnet, and when the current flows through the coil, it creates a magnetic field that interacts with the magnet to produce vibrations. These vibrations generate sound waves, creating the audible noise that we hear.

3.8 Buzzer

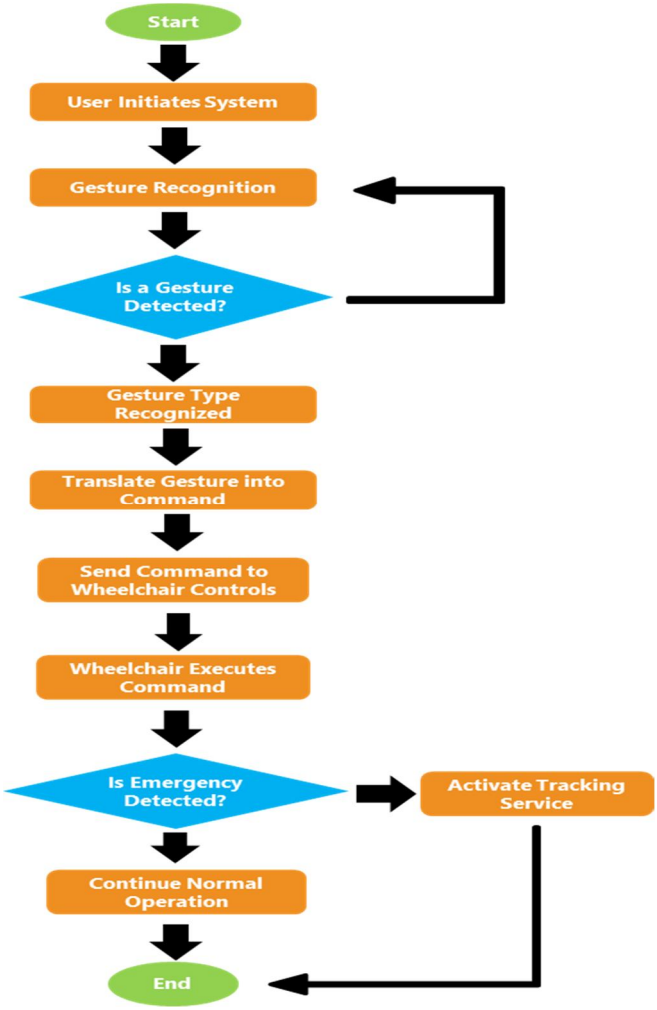
11) *IFTTT:* IFTTT is a website where you can create automated connections between different apps and devices using triggers and actions. It allows you to automate tasks and streamline workflows across various platforms. [7]
12) *GPS Module:* It is a device that receives signals from satellites to determine its precise location on Earth. It typically consists of a receiver that picks up signals from multiple satellites, a processor to calculate the device's position, and sometimes additional components like antennas or memory storage. The module uses the timing and positioning information from the satellites to triangulate its exact latitude, longitude, altitude, and sometimes speed. This information can be used in various applications such as navigation, tracking, and timing synchronization.



3.9 UBlox NEO-6M GPS Module

The UBlox NEO-6M is a GPS module commonly used for positioning and navigation applications. It's compact and efficient, providing accurate location data using signals from GPS satellites. The "6M" refers to its advanced version, offering improved performance and reliability. It's widely used in drones, IoT devices, and other gadgets requiring precise location tracking.

B. Flow Chart



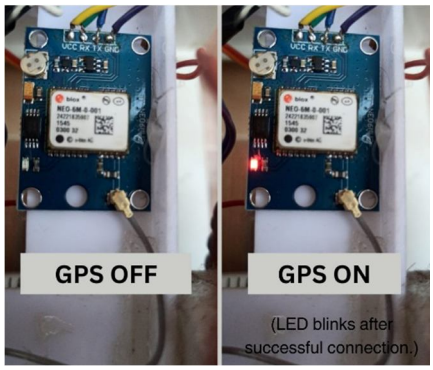
IV. RESULT

The successful implementation of the hand gesture-controlled wheelchair and IoT alarm system showcases a robust and functional solution for individuals with limited mobility. By the integration of GPS module, the location of the person can be traced remotely. Ensuring more safety to the user. The project not only meets its primary objectives but also lays the foundation for future advancements in assistive technology, making it a promising and adaptable solution.

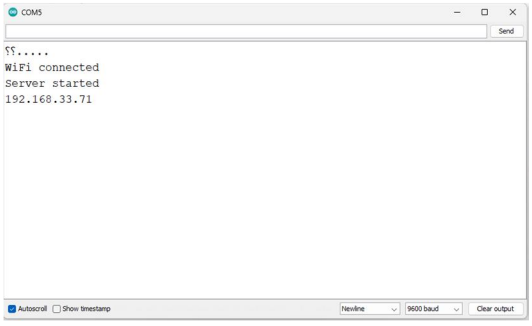
4.1 Picture of the project model

4.2 Movement to control the wheelchair

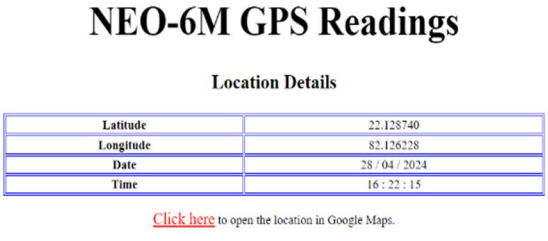
GPS work flow:



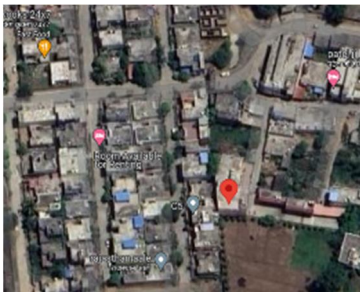
4.3 GPS Module



4.4 IP Address sent to PC by NodeMCU



4.5 Location Co-ordinates



4.6 Location of the wheelchair

Working model video: https://youtu.be/SgxzPYAPWwM

V. CONCLUSION

The integration of gyro sensors, RF transmission, Arduino controllers, motor drivers, IR sensors, Node MCU, GPS module and IOT technologies leads to an innovative assistive system. The hand gesture-controlled wheelchair provides a user-friendly interface for precise navigation which showcases the practical application of advanced sensor technology. Additionally, the alarm system enhances safety by measuring fall distances and activating alarms based on conditions. This project is an example of the transformative potential of innovative solutions, promoting freedom and well-being for individuals with mobility challenges.

After establishing the location system, the final conclusion is that this system not only aids in navigation but also provides an additional layer of safety for the user. It represents a significant step towards improving the lives of individuals with mobility challenges through advanced technology and innovation.

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VII. AUTHORS PROFILE

Prof. Deepika Bairagi pursuing her Ph.D. in Signal Processing from Chhattisgarh Swami Vivekanand Technical University (CSVTU). Had done M. Tech in Electronics and Instrumentation from NIT Rourkela and B. Tech in Electronics and Telecommunication degree from NIT Raipur. She is in teaching profession for more than 8 years. Presently she is working as Professor in the Department of Electronics and Telecommunication Engineering, Government Engineering College Bilaspur, Chhattisgarh, India. She has also published research paper for Optoelectronics Laser research papers in national conferences and Journals.

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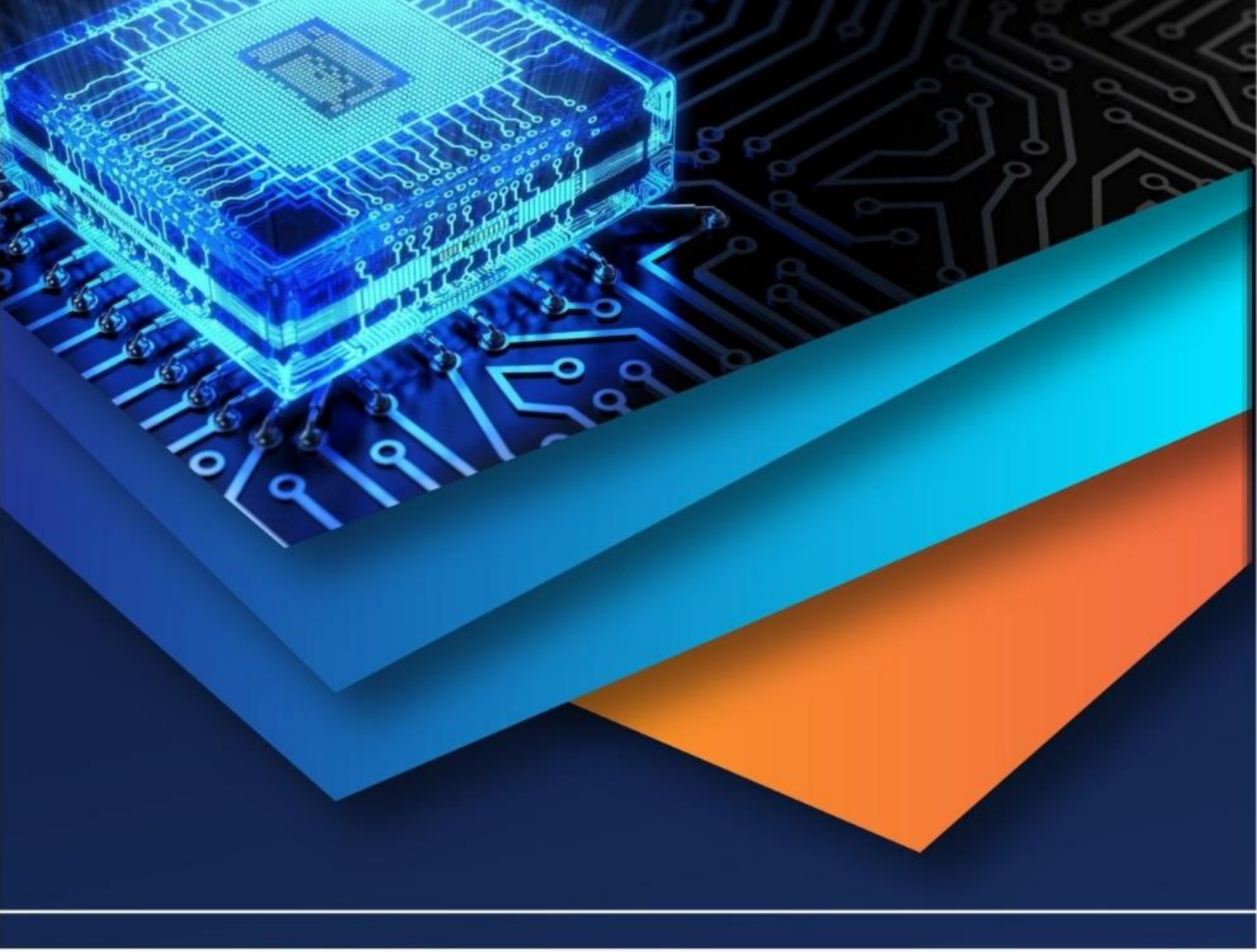

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