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Design and Implementation of Interactive Robot for Navigation Assistance in the Campus

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Abstract: ***Maximum number of people faces difficulty in navigating to the correct desired location of their choice in an unidentified area such as malls, universities, hospitals, industries, museums etc. In order to direct such person in dilemma situation proposed system works effectively in user friendly manner. The paper guides the new visitor by properly instructing them to the destination location either providing audio play back or by displaying the route map. This is developed to behave as intelligent robot by using Artificial Intelligence (AI). The Interactive Robot is developed by considering the College (SJB Institute of Technology) point of view, where new visitor can find Individual Departments, Administration Block, Library and Hostel very easily. Human-Robot interaction is developed by first Robot approaching towards new visitor in enquiry section by Ultrasound detection method then the assistances for visitor can be done using two methods. In the foremost method is done by an audio player which uses Voice Reorganization Module and Audio Player Recorder, where both utilize the trained voice data for their operation. The next method is display the route path image of the collage, Route map display is achieved by interfacing the Interactive Robot to MATLAB software tool with the aid of wireless equipment (ZIGBEE). For the security purpose the face of the person is detected and stored in the database. This Paper is needful for people to understand new surroundings for the first glance. The development is done using ARM- LPC2148 and programming is done using Kiel Software.***

Keywords: ***ARM-LPC2148, Voice Reorganization Module, APR, Ultrasonic Sensor, Stepper motor, MATLAB, Kiel Software, DC Motor.***

I. INTRODUCTION

India is one of the developing countries. Technology is one of the important factors that contribute for the nation to be developed. In this concern many new building, universities, complex government offices etc., are built with the complex infrastructure and it difficult for the individual to find a particular location in the building and move to that location of choice easily for the first glance. To sort out this problem the paper provides the help/guide to the new visitor to move from one location to another location with the help of Robot Assist.

Technologies like GPS, NFC, Bluetooth Beacons, and Accelerometer etc. helps to provide positioning and navigation. The more appropriate among the above mentioned technology is GPS as it provides more accurate latitude and longitudinal position. GPS enabled mobile application provide routing in outdoor navigation but its application becomes limited indoor navigation like find the particular branch in the campus (ECE Block, Mechanical Block), Xerox, library, hostel, canteen.

The application of the Robot is growing in the field is care-giving agencies, home, hospitals. Artificial intelligence improves the quality of the Robot by providing them intelligence. For the safety reason before Robot make any decision it should study the environment including human detection, motion detection etc. A human-Robot interaction is one of the important factors of the Robot and provides most of the solution for the existing problem in today's life.

Autonomous or self-directed are more useful compare to the Robot placed in the place. The problem with the placed Robot is they are passively waited for the person to approach them, activate them and start the conversation, in this case the person may not know what the Robot can do or how it can help hence the system fails. But as of Mobile Robot they can move to the person initiate the conversation and help them if they need.

II. RELATED WORK

This paper [1] deals with the development of algorithm that helps Robot to approach the pedestrian and to initiate the conversation. The Robot identifies the person in social zone by anticipating their behaviour and position it also identifies is the person busy or not and approach form frontal direction. After approaching the person it react to them by adjusting its body orientation. This is helpful in proactively serving the person who is needy.

Geographical topology of the building and the route arrangements are accomplished in the smart phone. Indoor cell positioning is

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provided by Bluetooth beacons [2]. Walking cycle detection, heading estimation, floor level discovery is described using pedestrian dead reckoning using cell's GPS, Wi-Fi, and Bluetooth. The person is directed to the desired location of his choice by the command spoken.

Autonomous Robot are most useful with the sensor equipped with them like kinect V2 [3] sensor. It consists of RGB-D sensor which can sense colour and depth information. With this kind of sensor with the motion planning the robot movement is achieved. Robot is used as shopping guides [4], which help the person to shop home used item. It is equipped with touch screen which help the person to select items after selection the robot provides location moving along the person. Robot can also be used as e-Receptionist [5] which identifies the person with help of camera and guiding them orally with the respective of their query.

III. METHODOLOGY

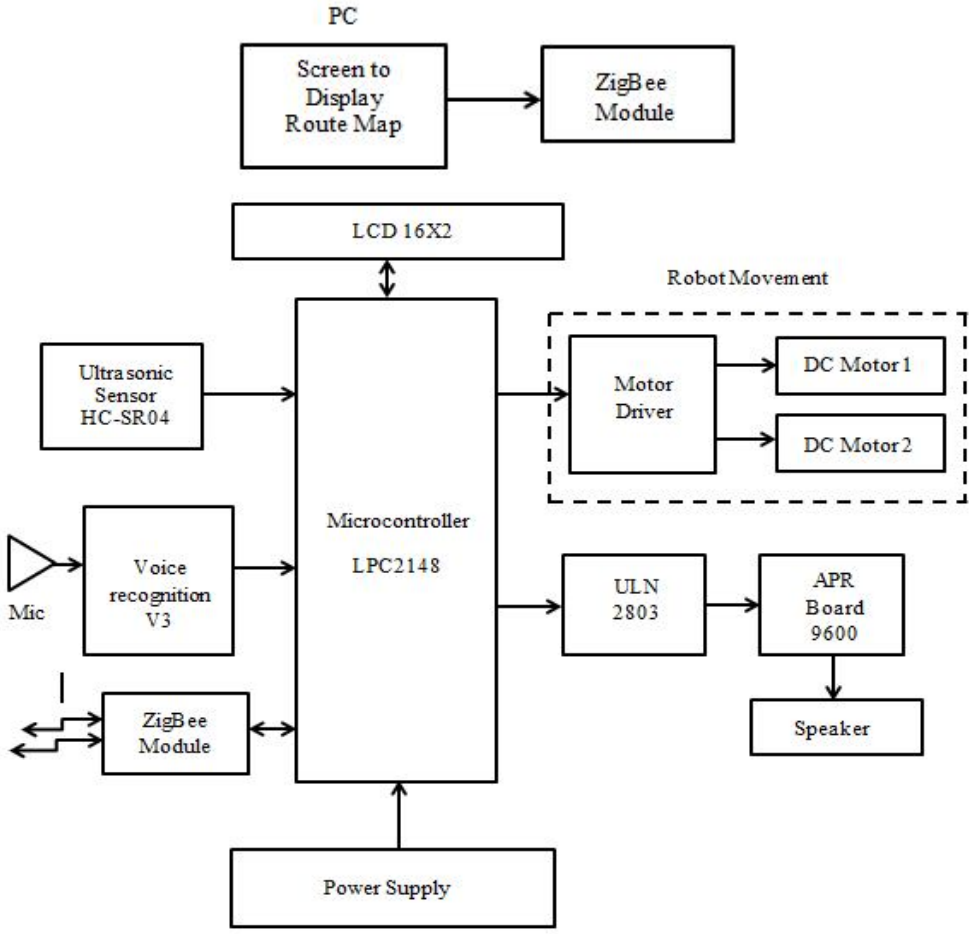

Fig. 1 Block Diagram of proposed System.

Microcontroller is one of the most important components of Embedded System which is responsible to control all the peripherals attached to it. The proposed block diagram uses LPC2148 of 32bit controller with 64 pins. Ultrasonic sensor is mounted on the stepper motor of 7.2˚ and senses the new visitor in 180˚ angle. The stepper motor is derived by ULN2803 driver. The voice recognition kit works in 2 modes train and recognition mode.80 voices (maximum of 7 commands can work at a time) can be trained to it each of 30-40 seconds. APR board has 8 channels 8 voices of can be trained and played back through audio speaker. ZigBee is used for wireless transmission. Route map is developed using MATLAB software which is equipped with UI panel or components.

When visitor need to enquire about the desired or destination location visitor has to enter into the enquiry section or zone. The section has 3 imaginary boundaries. The first boundary is about 30m it is maximum range where the robot can sense the new visitor. The last section of about 3m (robot section) is a section up to which the visitor can come. The middle range of 27m is the maximum range of

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the robot can move and start interaction with the visitor. The sensing process is done using Ultrasonic sensor which is mounted on stepper motor and sense the person up to 180˚ angle.

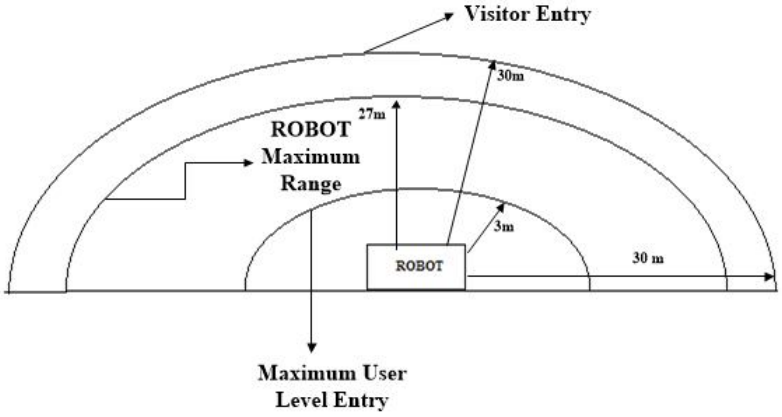

Fig. 2 Shows the Enquiry and Robot Zone.

IV. ALGORITHM AND FLOW CHART

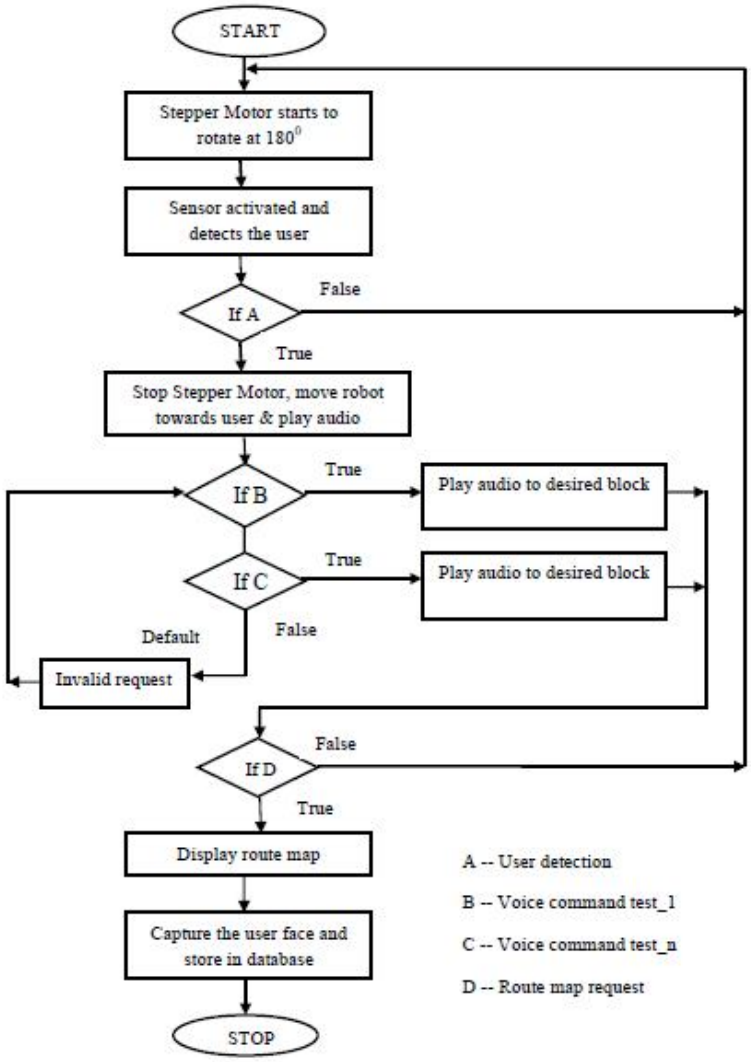

Fig. 3 Flow Chart

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A. With the control of microcontroller primarily stepper motor rotates in both clock and anti-clock wise direction and covers 180˚ angle with the help of ULN2803 driver.

B. The sensor continuously monitors the specified region or zone. It transmits the ultrasonic signal if it is received back then signal at sensed output changes and that is detected but microcontroller.

C. Once it senses the person the robot move towards the person with help of wheel connect to Dc motor with a driver L293D driving it. The driver can drive 2 DC motors and rotation direction is changed by changing the input (A and B pins) values to driver.

D. The stored voice from APR9600 request the visitor to specify the location, the new visitor request input (voice form) is recognized by voice recognition kit V3. The microcontroller verifies received signal with stored signal data and play back the corresponding output. Ultimately visitor desired location is guided through APR board.

E. If user need to see the route map it can be seen by pressing the switch provided. Route map development is done through MATLAB software.

F. LCD is used to indicate the process happen ZigBee is used for wireless transmission.

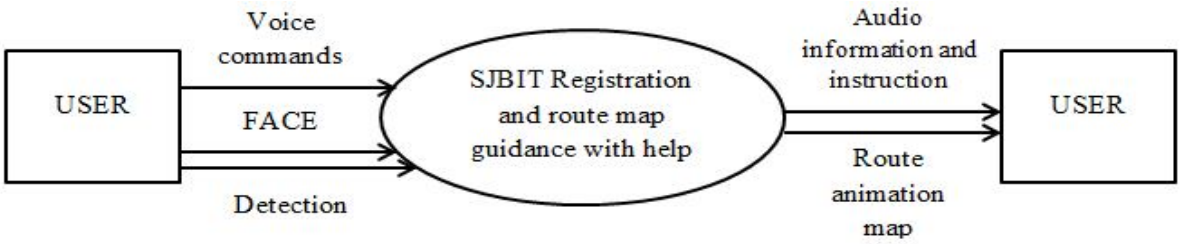

Fig. 4 Dataflow diagram of the system.

Top level data flow diagram of entire system. The system initiates with user voice commands, observed user movements and captured user face these data are processed at the robot system and properly guides the user by Audio instruction and Route map display.

V. EXPERIMENTAL RESULTS

When the 'Navigation Assist Robot' System turn on it greets the new visitor by displaying Welcome to SJBIT then the visitor should provide the voice command by mentioning destination location. The System waits and then back the audio output directing the route direction to reach the desired location. For example if the visitor give the voice input as admin block then robot guide by play back audio as go straight for 30m and take immediate left and also LCD display show the totol distance to travel with the block name.

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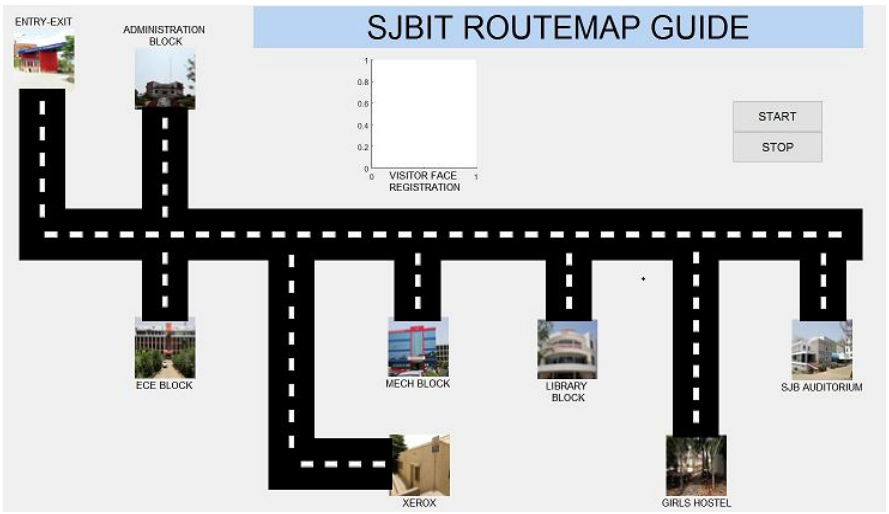
Fig. 5 Display messages on LCD Display.

The System also provides the route map which provide complete route direction with the image of the respective block of the college



When new visitor specifies the destination block the route map show the route by indicating in green color.

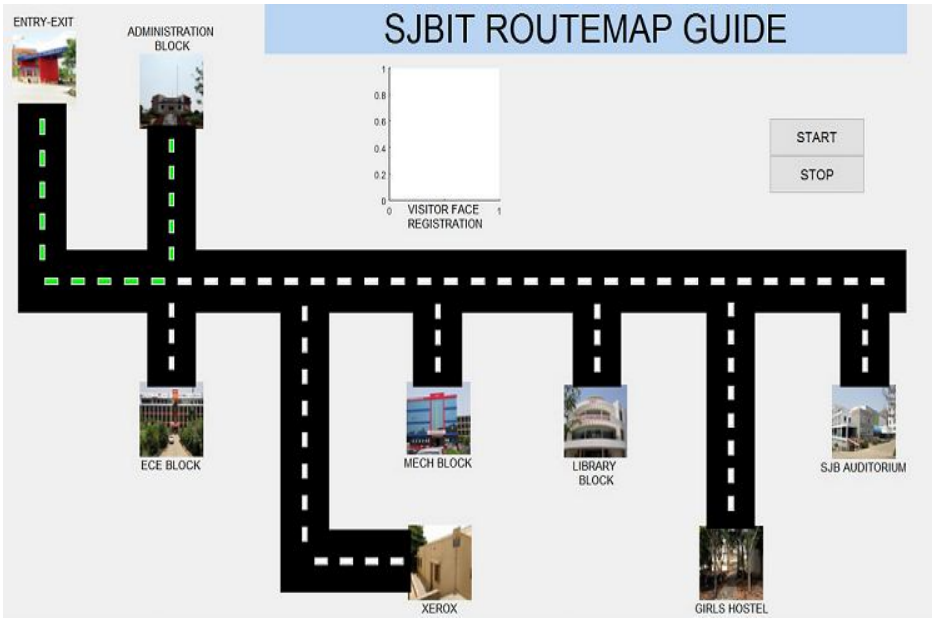


Fig. 6 Route map displaying the route direction.

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VI. CONCLUSION

The proposed system is implemented in the college campus which plays the important role in guiding the new visitor or person to the desired location of their interest by providing the audio play back and route map of the college. It helps the person to reach the destination place with easy and comfortable manner. The time factor of the new visitor is reduced in searching the new location. The system can be implemented in malls, railway station, complex offices building, hospitals which can help the needy person and to understand the infrastructure easily. The Proposed system is tested and implemented in SJB institute of Technology collage for the effective working.

Future Enhancement:

The system can be implemented with IOT (Internet of Things) technology, for advance application namely accessing the stored image data (new visitor face uploaded through robot) from cloud remotely as an when required. The existing system is added with Bluetooth model so that the system can send the stored video information to visitor's Bluetooth paired mobile.

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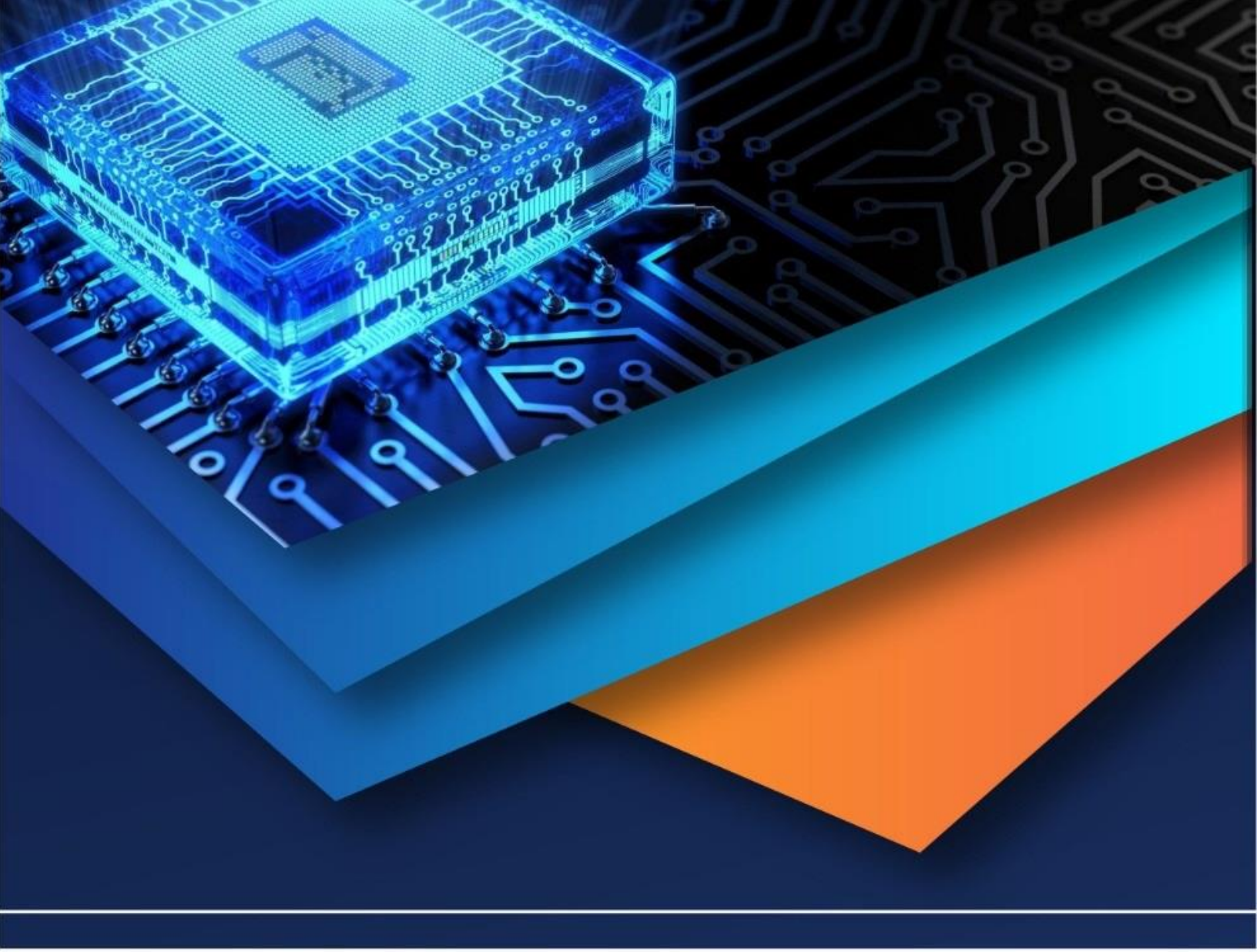

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