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# Implementation of Automatic Parking Module using IoT for Congestion Control System

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***Abstract:*** ***The increasing number of vehicles on the road along with the mismanagement of available parking space leads to the parking related problems as well as increased traffic congestion in urban areas. Thus it is highly required to develop an automated smart parking management system that would help the driver to find out some suitable parking space for his/her vehicle very quickly. Although ample amount of research works on the development of smart parking system exist in literature, but most of them have not addressed the problem of real-time detection of improper parking and automatic collection of parking charges***
***Keywords:*** ***Traffic Management, IoT, Automatic Parking System (APS), Mobile Application, Analytics.***

## I. INTRODUCTION

Smart city uses the information, communication and technologies to improve the operational efficiency for the public, helps in accelerating towards the improvement quality of life for citizens. Internet of Things (IOT), Automation, and Machine Learning are the emerging trends which drive towards smart city adoption. With the latest proliferation of the vehicle availability finding the parking place availability is more difficult. Car parking is a main problem because of increasing in the vehicle number. Searching of a parking place around the cities is the routine work. In the smart parking system the parking space information is available at the real time. It consists of real time data collection, low cost sensors and mobile phone enabled systems. The proposed smart parking system is implemented using mobile application and the system helps the user to know the parking space availability. The user can able to interact with the system by installing car parking application on their mobile phones. A significant amount of research works exist in the area of design and development of smart parking system. Various features of smart parking system are listed below.

*1)* Inquiry on availability of parking space and reservation of parking lot
*2)* Real-time parking navigation and route guidance
*3)* Vehicle occupancy detection and management of parking lots

## II. LITERATURE REVIEW

There are many technologies are used in Automatic parking system. There are listed below with some short description of each technique.

### *A. Smart Parking Systems Based on RFID Technology*

The main mechanism of RFID technology depends on an electromagnetic field to identify and track tags attached to objects automatically used RFID technology in automation. Their system uses a software program for controlling and reporting changes in the status of the parking space, and for the operation of tasks such as choosing the closest vacant parking space, and it then sends the report to the driver. Meanwhile, a system containing Gate-PC Controller and Embedded Gate Hardware, an RFID System, and a Modular Parking Management Platform: “Most systems in the Modular RFID Parking Management System are modulated and can be substituted for any other similar system or hardware”.

### *B. Wireless Sensor Networks-Based Systems*

The most popular technique in the last decade with researchers, as wireless sensor networks have various advantages, such as flexibility, intelligence, reasonable cost, rapid deployment, and sensing, as it usually consists of sensor nodes. The following papers discuss WSN-based parking systems, this type of system, which utilizes sensors to monitor environmental conditions, is widely used, especially in academia, due to the ease of installation and configuration, and the reasonable price. Developed a system using crossbow products, which have a low unit cost. This system enables a car to detect entry to the car park, and it efficiently guides the driver to an empty parking space through signs displayed to the driver presented a new smart parking system using an ultrasonic detector.

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*C. Smart Parking Systems Based on Global Positioning Systems GPS*

Global Positioning Systems (GPS) technology is used to determine and track a vehicle's precise location. In this domain, it is used to offer information about the location and availability of parking spaces at the destination. This technique proposed for presented a location-based system called NAPA.

The server in the system associates buildings on the campus with parking lots in the order of distances to the building. After locating the nearest available parking lot, the user sends the NAPA server a message that he/she has parked. Then the server updates the information about the lot accordingly.

When the user leaves the parking lot, the NAPA server can automatically charge the appropriate parking fee if necessary. proposed a new smart parking system using SMS services. This system is capable of finding parking spaces in specific car park areas. A parking reservation system is developed in such a way that users can book their parking spots over short message services (SMS) using the GPS.

*D. Smart Parking Systems Based On Vehicular To Infrastructure Communication (V2I)*

Other studies proposed using the term (CVT) to refer to Connected Vehicle Technology which depends on wireless data transmission between vehicle and infrastructure (V2I).

This promising technology emerged recently.[2] It proposes a new smart parking technique that depends on developing a new VANET-based smart parking to be used for smart steering and smart parking. It refers to Vehicular Communication Systems, in which vehicles and roadside units are the communicating nodes, that is, they communicate and exchange information with each other, such as safety warnings or supplying the traffic congestion information and even for finding vacant parking spaces. Basically, vehicular networks are considered to contain two types of nodes: vehicles and roadside stations.

*E. Other Hybrid Algorithm Based, M2M, IoT Systems*

An integrated IoT retractable bollard management system to allow vehicular access to restricted city areas based on standard infrastructure and software components; the authors have invented an intelligent parallel technique which involves using RFID technology with fuzzy logic controllers and two ultrasound range sensors. This system contains a Gate-PC Controller and Embedded Gate Hardware, an RFID System, and a Modular Parking Management Platform. As mentioned previously, most systems in a Modular RFID Parking Management System are modulated and can be substituted for any other similar system or hardware. Finally, check-ins and checkouts of the parking lots are under the control of RFID, reader, labels, and barriers modeled a parking lot as a continuous-time Markov chain.

*F. M2M System Technology*

The parking area is modeled as a grid, and schemes for information aggregation and dissemination over the grid are proposed. Moreover, in, M2M system technology has recently emerged as a promising enabler for the development of new solutions in a plethora of IoT application domains including transportation, health care, smart energy, smart utility metering, supply and provisioning, city automation, manufacturing, and others. M2M enables highly scalable direct communications among wireless enabled heterogeneous terminals, called M2M devices.

Basically, the principal of M2M applications that realize M2M communication involves four stages:

1) Data collection.
2) Transmission of specific data over a communication network.
3) Assessment of the data.
4) Response to the available information.

All these specifications make the involvement of the M2M desirable in smart parking systems.

## III. PROPOSED SYSTEM

The proposed system user can book the parking from the phone. The parking spaces can be monitored using the raspberry pi which will detect the occupied and empty parking slot and assign to the user. The solution use can navigate the user to the particular parking slot assign to the user to assure the user parking the vehicle at right place.

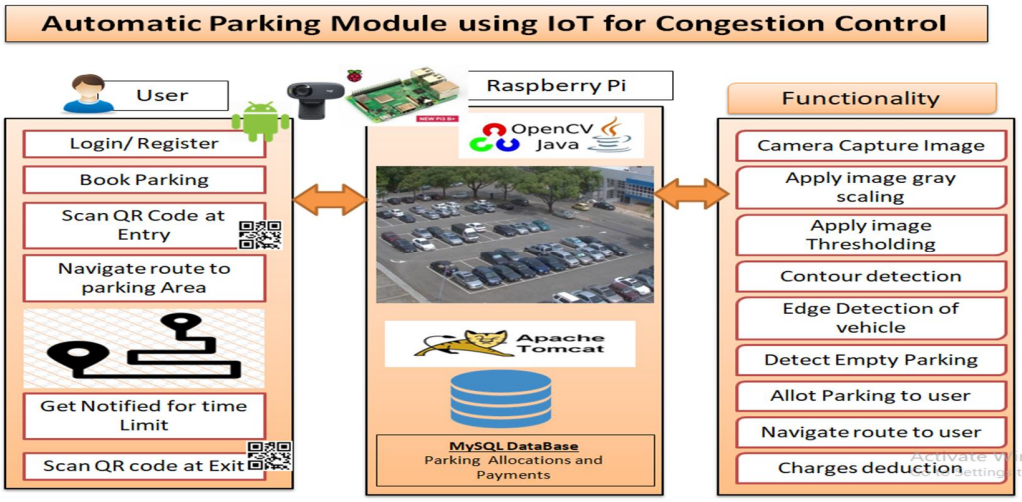


Figure: - System Architecture.

1) *User Login/Registration:* The user will fill all the information and the information will be stores on the database. After the registration is successful then the e-wallet for the user will be created.
2) *Book Parking:* User will enter the vehicle number and entry time and tentative time period of parking.
3) *Capture Image:* CCTV camera consciously captures the image of the parking area using a top camera. Camera images are then transmitted to central machine for processing.
4) Apply Pre-Processing on input Mat Image (OpenCV image)
5) *Threshold Control:* This is the process of removing of extra noise from images; noise is removed by averaging colors. Thresholding is the simplest method of image segmentation. From a grayscale image, thresholding can be used to create binary images.
6) *Grayscale Image:* In this then the converted to binary image and used for further processing.
7) *Edge Detection:* Car boundaries are detected using canny edge detector, Edge detector detects the edges after the image is threshold. It works by detecting discontinuities in brightness. Edge detection is used for image segmentation and data extraction in areas such as image processing, computer vision, and machine vision. Common edge detection algorithms include Canny, sober methods.
8) Finding Contours. Contours are nothing but shadow areas of hand. Contours can be explained simply as a curve joining all the continuous points (along the boundary), having same color or intensity. The contours are a useful tool for shape analysis and object detection and recognition. We remove all contours of small size having area < 10 and replace them with black color
9) *Draw Parking Boundaries:* The Bounding box of the parking area will be defined.
10) *Pixel Counting Using Modified Flood Fill Algorithm:* The flood-fill algorithm takes three parameters: a start node, a target color, and a replacement color. The algorithm looks for all nodes in the array that are connected to the start node by a path of the target color and changes them to the replacement color. There are many ways in which the flood-fill algorithm can be structured, but they all make use of a queue or stack data structure, explicitly or implicitly. We are using flood fill algorithm to count number of pixels within a specific parking outline.
11) *Detect Occupied Parking:* Based on output of pixel counting algorithm, we detect the occupied and empty parking's. And assign the empty parking to the user
12) *Scan QR Code:* When user reaches to parking location he needs to scan QR code for authentication and if authenticated the he can enter into parking.
13) *Route User to Parking Location:* When the user granted to enter in the parking then the on his phone the map will navigate him to the parking location.
14) *Alert to the User:* User will be notified at the time the entered time period of parking is near to exceed.
15) *Charges Deduction:* At the time of the leaving parking the user need to scan QR code and the charges of the parking will be deducted from the e-wallet of the user.

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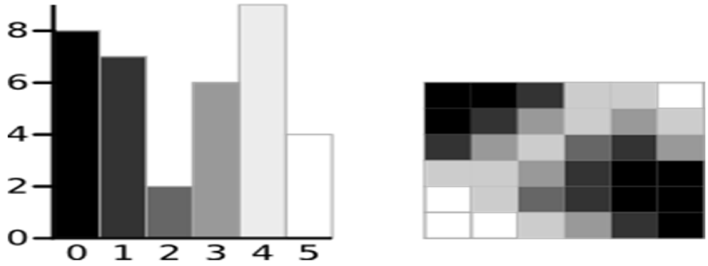
## IV. ALGORITHMS USED

### *A. Otsu's Thresholding*

Thresholding involves iterating through all the possible threshold values and calculating a measure of spread for the pixel levels each side of the threshold, i.e. the pixels that either falls in foreground or background. The aim is to find the threshold value where the sum of foreground and background spreads is at its minimum.




The calculations for finding the foreground and background variances (the measure of spread) for a single threshold are used.

$$\text{Within Class Variance} \quad \sigma_W^2 = W_b\,\sigma_b^2 + W_f\,\sigma_f^2 \quad \text{(as seen above)}$$

$$\begin{aligned}\text{Between Class Variance} \quad \sigma_B^2 &= \sigma^2 - \sigma_W^2 \\ &= W_b(\mu_b - \mu)^2 + W_f(\mu_f - \mu)^2 \quad (\text{where } \mu = W_b\,\mu_b + W_f\,\mu_f) \\ &= W_b\,W_f\,(\mu_b - \mu_f)^2\end{aligned}$$

Where,
Wb=Weight background
Wf=Weight foreground
Uf= mean foreground
Ub=mean background
σb=variance background

### *B. Contour Detection*

Edges are computed as points that are extreme of the image gradient in the direction of the gradient. If it helps, you can think of them as the min and max points in a 1D function. The point is, edge pixels are a local notion: they just point out a significant difference between neighboring pixels.
Contours are often obtained from edges, but they are aimed at being object contours. Thus, they need to be closed curves. When they are obtained from edges, you need to connect the edges in order to obtain a closed contour.

### *C. Flood Fill Algorithm*

The flood-fill algorithm takes three parameters: a start node, a target color, and a replacement color. The algorithm looks for all nodes in the array that are connected to the start node by a path of the target color and changes them to the replacement color. There are many ways in which the flood-fill algorithm can be structured, but they all make use of a queue or stack data structure, explicitly or implicitly.
Flood-fill (node, target-color, replacement-color):
*1)* If target-color is equal to replacement-color, return.
*2)* If the color of node is not equal to target-color, return.
*3)* Set the color of node to replacement-color.
*4)* Perform Flood-fill (one step to the south of node, target-color, replacement-color).
Perform Flood-fill (one step to the north of node, target-color, replacement-color).
Perform Flood-fill (one step to the west of node, target-color, replacement-color).
Perform Flood-fill (one step to the east of node, target-color, replacement-color).

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## V. RESULT AND DISCUSSION

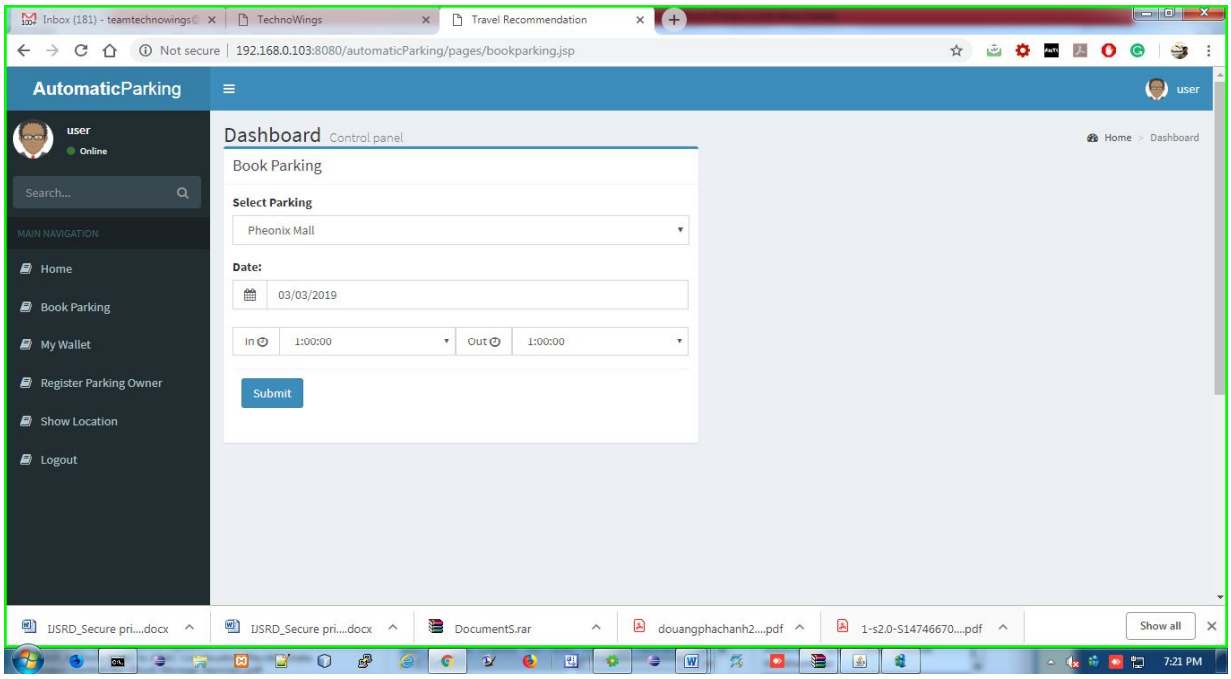


Figure: - Book Parking

Above screen shoot is of booking the parking slot in advance. By filling the details like the date, time of in and out and so on. The following screen shoot is of payment transaction history.

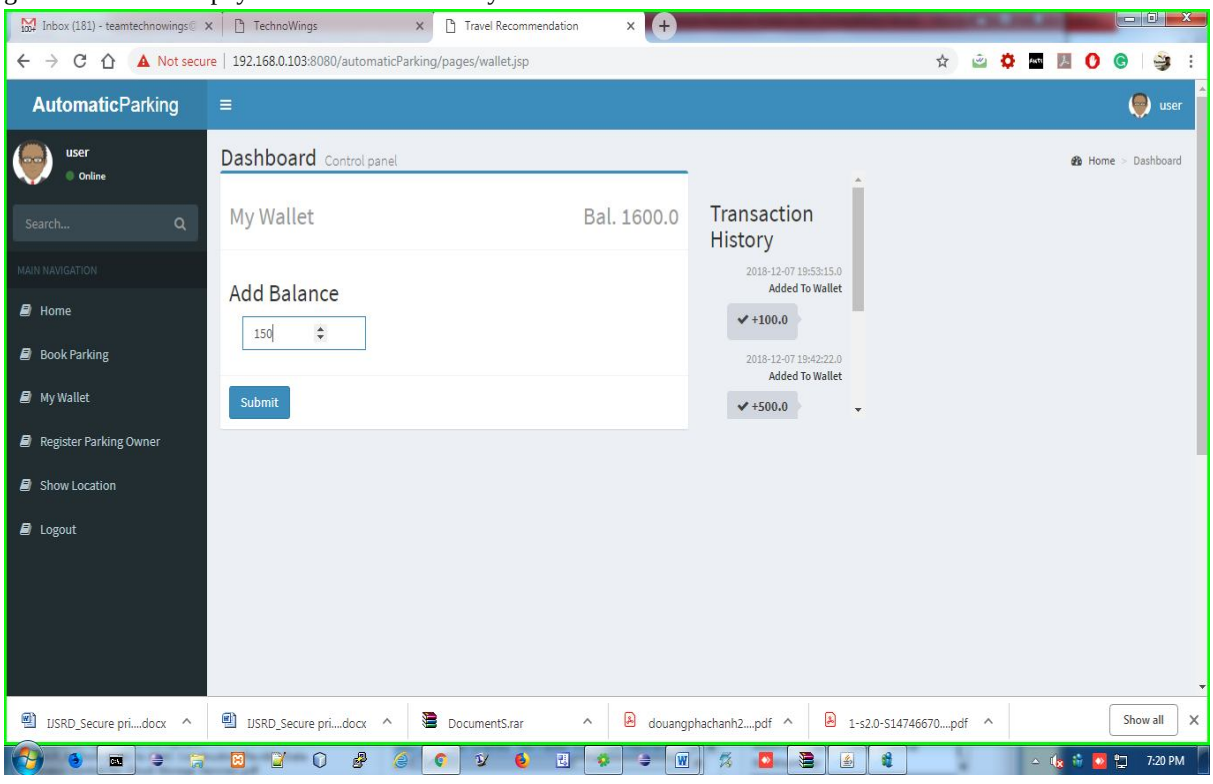


Figure: - Transaction History

Following is the Screen shoot of the new member registration. Here the new user has to register by filling the required credentials.

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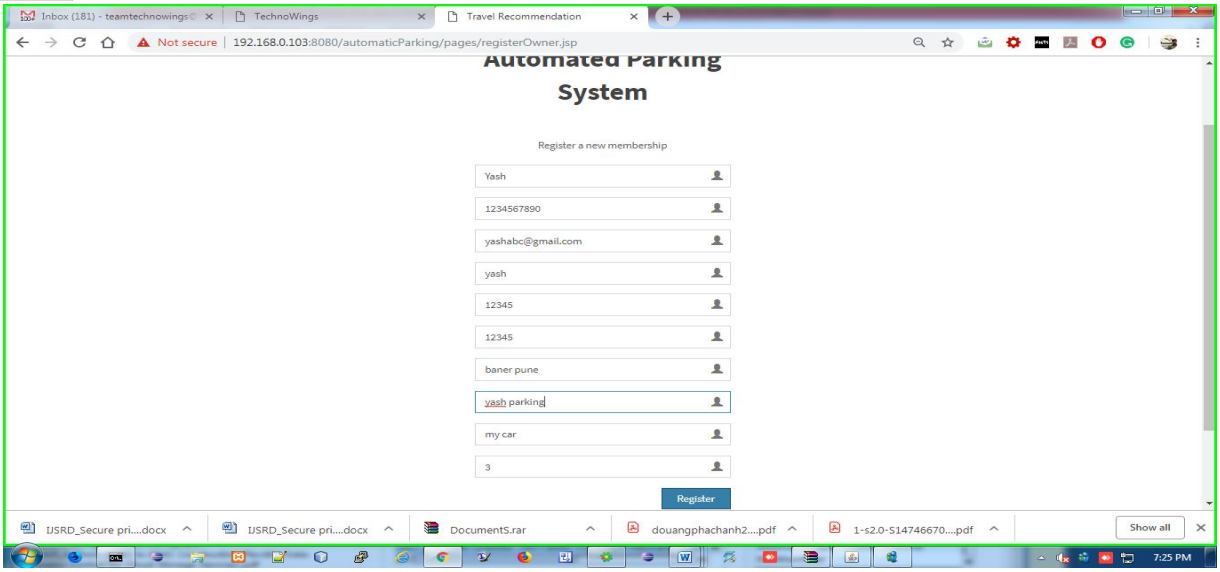


Figure: - New Member Registration

## VI. ADVANTAGES

*A.* To solve traffic congestion problem in a large parking facility.
*B.* To reduce waiting time at parking area.

## VII. CONCLUSION

This project focuses on implementation of car parking place detection using Internet of Things technology. By using IR sensor the parking place vacancy is detected and it is updated to the user using the mobile application. The parking spaces can be monitored using the raspberry pi which will detect the occupied and empty parking slot and assign to the user. The solution use can navigate the user to the particular parking slot assign to the user to assure the user parking the vehicle at right place.
Developed best systems that are more efficient and more satisfied the user like:

*A.* Assigning nearest parking lot.
*B.* Reducing the traffic / conjunction at a time of Entry and exit of car parking.
*C.* Balance load to each entrance equally for reduce the conjunction at same entrance.

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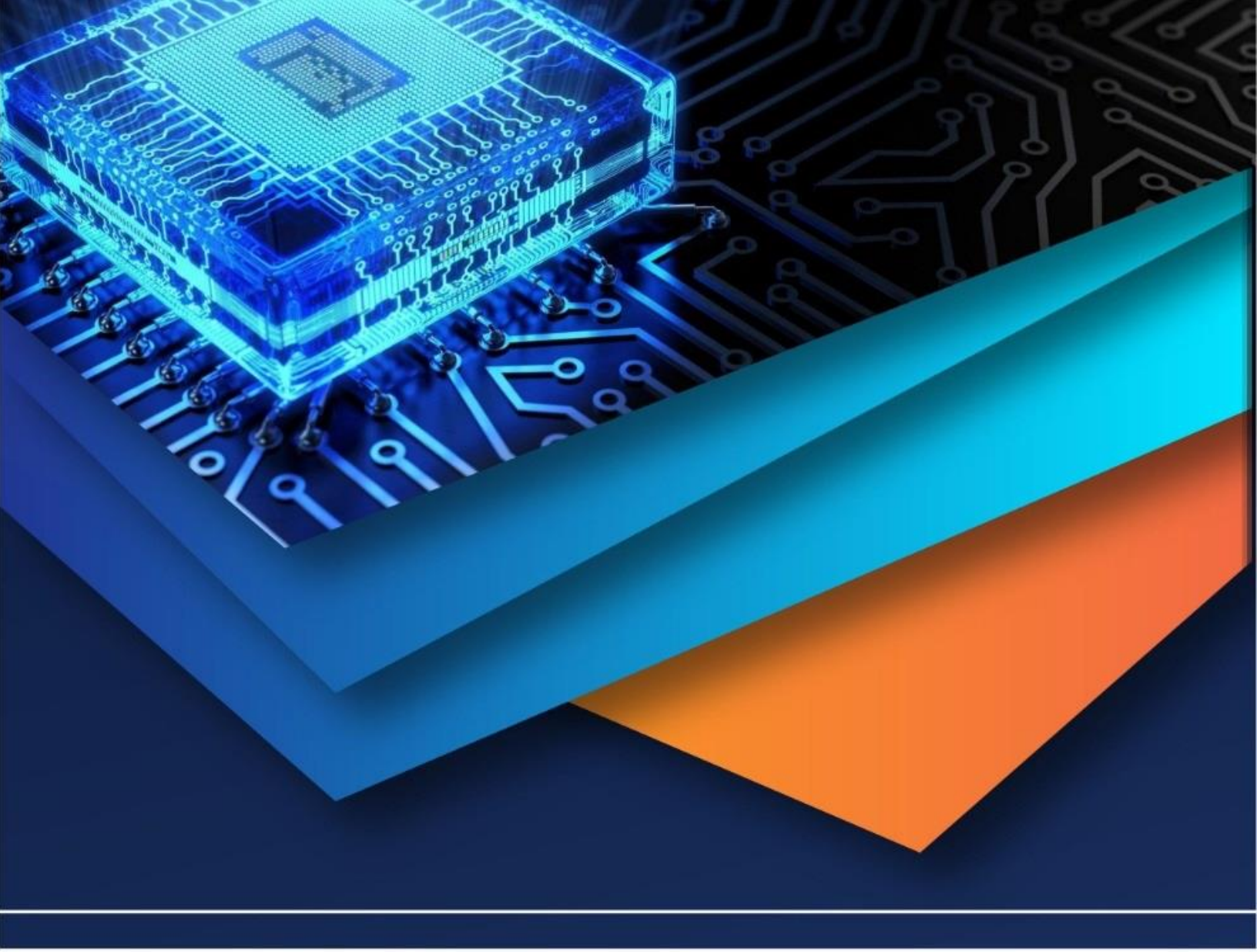

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