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An Indoor Navigation System Using IOT

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Abstract: Big shopping malls usually provide a directory to their available shops, but these directories are most of the time static and do not provide any interactivity features to the visitors. In this work, we present a mobile shopping mall navigator. The main reason behind our conceptual idea of our proposed project is because we feel that when visitors often change their plan to go to other shops instead of the ones in their minds, it can be full of effort especially considering the crowded levels and location of the navigation material. The application developed is practical and feasible.Smart-Phones have become very popular these days, so we have combined the idea. Smart-Phone application helping you in an alienated mall. The idea revolves around our Smart-Phones & the
"Wi-Fi" provided by the mall. An application that needsreal-time, fast, & reliable data processing.
Technical Keywords-Indoor navigation, QR-Code scanner, Wi-Fi router

I. INTRODUCTION

Manual Shopping is the traditional way of shopping where the customers choose their desired productand carry the products along with them. Traditional shopping is a tedious and time consuming job. Intraditional shopping, the customer has to wait in long queues at the cash counter. This consumeslot of time and energy of both the customer as well as cashier. To overcome these flaws, the customerhimself can scan the QR-Code using his mobile while making purchase, retrieve essential details of allproducts from shops database and generate bill himself [11]. This bill can be sent to the customer's mobilethrough online banking service thus the user can make quick payment and leave the shop early.TheQR-Code of the product is scanned by the customer and move to the wish list if they are interested inchoice of item by using the proposed mobile application. In order to developan Android Applicationthat uses a QR-Code scanner for the purchasing and navigation[4] of items for store thatwill be self-checking and automatic payment transaction[1]. Here comes the term indoor navigation[5] andQR-Code scanning.Indoor positioning is still a challenging problem because satellite-based approach does not work properly inside buildings[1].

QR-Codes are ubiquitously used to identify products,goods or deliveries. Devices to read QR-Codesare allaround,in the form of pen type readers, laser scanners or LED scanners. Camera-based readers,as a new kind of QR-Code reader, have recently gained much attention. The interest in camera-basedQR-Code recognition is built on the fact that numerous mobile devices are already in use, which provide the capability to take images of a fair quality[11].This describes the hardware system architecturefor implementing the QR-Code reading system in mobile phones and its process. The camera device andapplication processors are necessary hardware components for the system. The application processorsare needed to implement the camera interface, LCD controllers, DSP for image processing, and application host in CPU for real-time computations. The application processor works for displaying themenu and preview of the display and computing of code recognition and decoding in real-time.Withthese systems, the user can control the position of the camera of Smart-Phone and decides the capturetiming of QR-Code[5].

II. RELATED WORK

A. Accurate and reliable real-time indoor positioning on commercial Smart-Phones

1) *Author:Gennady Berkovich*: This paper outlines the software navigation engine that was developed by SPIRIT Navigation for indoor positioning on commercial Smart-Phones[1]. A distinctive feature of our approach is concurrent use of Wi-Fi and BLE modules, together with the floor premises plan are used for hybrid indoor positioning in the navigation engine. Indoor navigation software uses such technologies as PDR and map matching. There is no need to enter initial position manually where it can be determined by GPS/GNSS (Global Navigation Satellite Systems) receiver. The automatic recovery of tracking in this case allows continuing tracking and increasing availability of indoor navigation. Positioning results given for different indoor environments in a shopping mall with accuracy of about 1-2 m.

B. Indoor positioning of wheeled devices for Ambient Assisted Living: A case study

2) *Author: Payam Nazemzadeh, Daniele Fontanelli, David Macii, Luigi Palopoli*

Indoor navigation is a well-known research topic whose relevance has been steadily growing in the last years thrust by considerable commercial interests as well as by the need for supporting and guiding users in large public environments, such as stations, airports or shopping malls. People with motion or cognitive impairments could perceive large crowded environments as intimidating. In such situations, a smart wheeled walker able to estimate its own position autonomously could be used to guide users safely towards a wanted destination. Two strong requirements for this kind of applications are: low deployment costs and the capability to work in large and crowded environments. The position tracking technique presented in this paper is based on an Extended Kalman Filter (EKF) and is analysed through simulations in view of minimizing the amount of sensors and devices in the environment.

C. Methods and Tools to Construct a Global Indoor Positioning System

1) Author: Suk-Hoon Jung, Gunwoo Lee, Dongsoo Han

A GIPS is a system that provides positioning services in most buildings in villages and cities globally[2]. An unsupervised learning-based method is adopted to construct radio maps using fingerprints collected via crowd sourcing and a probabilistic indoor positioning algorithm is developed. An experimental GIPS, named KAILOS was developed integrating the methods and tools. The more volunteers who participate in developing indoor positioning systems on KAILOS-like systems, the sooner GIPS will be realized.

D. Interactive android-based indoor parking lot vehicle locator using QR-code

1) Author: Siti Fatimah Abdul Razak, Choon Lin Liew, Chin Poo Lee, Kian Ming Lim

In this study, we report on an android based application development aimed to provide navigation services to locate parked vehicles in an indoor parking space of shopping malls. We utilize the motion sensor, bar code scanner function and camera function built in smart-phones. This application is able to show the route from user current location to his parked vehicle based on an indoor map of the parking area stored in a database.

E. Mitigating the antenna orientation effect on indoor Wi-Fi positioning of mobile phones

*1) Autho: Da Su, Zhenhui Situ, Ivan Wang-Hei Ho*In this paper, we implement a practical and convenient indoor positioning system based on the fingerprint method and Kalman filter on Android mobile devices[3]. This paper discusses the positioning algorithms and addresses various challenges in practical application, such as the effect of antenna orientation and signal fluctuation. Specifically, an improved mapping algorithm based on k-nearest neighbour (K-NN) is introduced to tackle the orientation effect, and an orientation-based fingerprint database is established through studying the received signal strength patterns in different directions to handle the large fluctuation caused by orientation change. Finally, their experimental result indicates that the proposed IPS can achieve up to 1.2 meters accuracy, is sufficient for various navigation services in indoor environments (e.g., shopping malls).

F. GROPING: Geomagnetism and Crowdsensing Powered Indoor Navigation

*1) Author: Chi Zhang, Kalyan P. Subbu, Jun Luo, Jianxin Wu*paper proposes GROPING as a self-contained indoor navigation system independent of any infrastructural support. It relies on geomagnetic fingerprints that are far more stable than Wi-Fi fingerprints, and it exploits crowd sensing to construct floor maps than expecting individual venues to supply digitized maps[12]. Based on their experiments with 20 participants in various floors of a big shopping mall, GROPING is able to deliver a sufficient accuracy for localization and thus provides smooth navigation experience.

III.EXISTING SYSTEM

In traditional shopping, people have to search exact product in the mall with wide range of available brands. Sometimes they will ask for help in searching product to assistant but may be they also don't know the exact position. On other hand, customers have to wait in the billing line to scan the products.

In foreign countries there are some malls which use indoor navigation. To use this system user should go to the particular LED/LCD screen and search for product location[2]. But on the weekends or holidays there is too much rush, so there can be number of people waiting in queue to search their product, which is little bit time consuming.

Fig.1. Billing Section

Fig.2. Navigation System

Also at the billing section user need to scaneach product and does the total. There is no technology to scanthe entire products at the same time so that user can do the shopping in minimum time as possible[11].

IV. PROPOSED METHODOLOGY

A. Methodologies to implement the system modules

1) *Point out product:* Now-a-day's malls are getting bigger and bigger. It is very difficult to find the expected product in mall. User search all over mall for needed product. Propose system provide the better way to search the desired product. User just needs to search product in mobile then it will point out the product where user will get the product.
1) *Scan QR-Code:* When user wants to add product in cart he/she scan the QR-Code of product and select the quantity. Then it will automatically add the products into the cart. After selecting required products user can pay the bill.
2) *Payment:* Traditionally, payment is done by debit card, credit card or cash. But in propose system user can pay the bill online. So customers don't need to carry any kind of card or cash.

V. ALGORITHM

Let $X = \{x_1,x_2,x_3,\ldots\ldots,x_n\}$ be the set of data points and $V = \{v_1,v_2,\ldots\ldots,v_c\}$ be the set of centres.
Randomly select 'c' cluster centres.
Calculate the distance between each data point and cluster centres.
Assign the data point to the cluster centre whose distance from the cluster centre is minimum of all the cluster centres.
Recalculate the new cluster centre using:

$$Vi = (1 / C\,i) \sum_{j=1}^{C\,i} xi$$

Where, 'c_i' represents the number of data points in i^{th} cluster.
Recalculate the distance between each data point and new obtained cluster centres.
If no data point was reassigned then stop, otherwise repeat from step 3).

A. K-means clustering algorithm

K-means simple and easy way to classify a given data set through a certain number of clusters (assume k clusters). The main idea is to define k centres, one for each cluster. These centres should be placed in a cunning way because of different location causes different result[8]. So, the better choice is to place them as much as possible far away from each other. The next step is to take each point belonging to a given data set and associate it to the nearest centre. When no point is pending, the first step is completed and an early group age is done. At this point we need to re-calculate k new centroids as barycentre of the clusters resulting from the

previous step. After we have these k new centroids, a new binding has to be done between the same data set points and the nearest new centre. A loop has been generated[8]. As a result of this loop we may notice that the k centres change their location step by step until no more changes are done or in other words centes do not move any more.

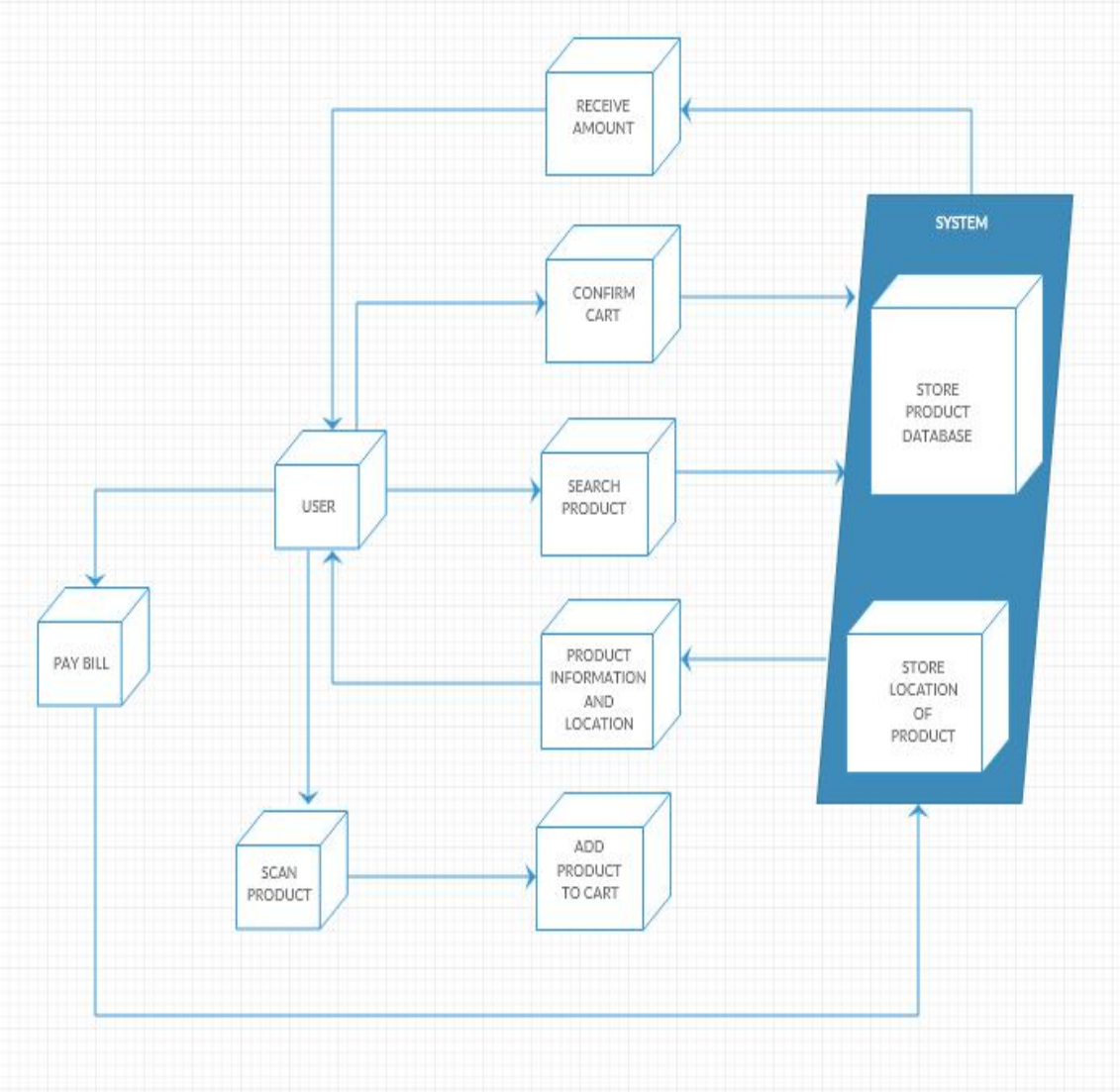

Fig.3. Flow Chart

VI. MODULES

A. User

User login into application. Search the required product location. Then scan the QR-Code to add the product into cart. Then user will pay the bill.

B. QR-Code scanner

QR-Code holds the all information about product like name, amount, etc. Users scan the product QR-Code to add it into cart. Product will add to cart by scanning QR-Code.

C. Payment

As per the product cost, bill will be generate by system. User can pay the bill by credit/debit card or online payment. If user pay the bill by credit/debit card then system will ask card details like card no, expiry date, bank name, etc. if user pay the bill online then system will ask bank details.

D. Component Design

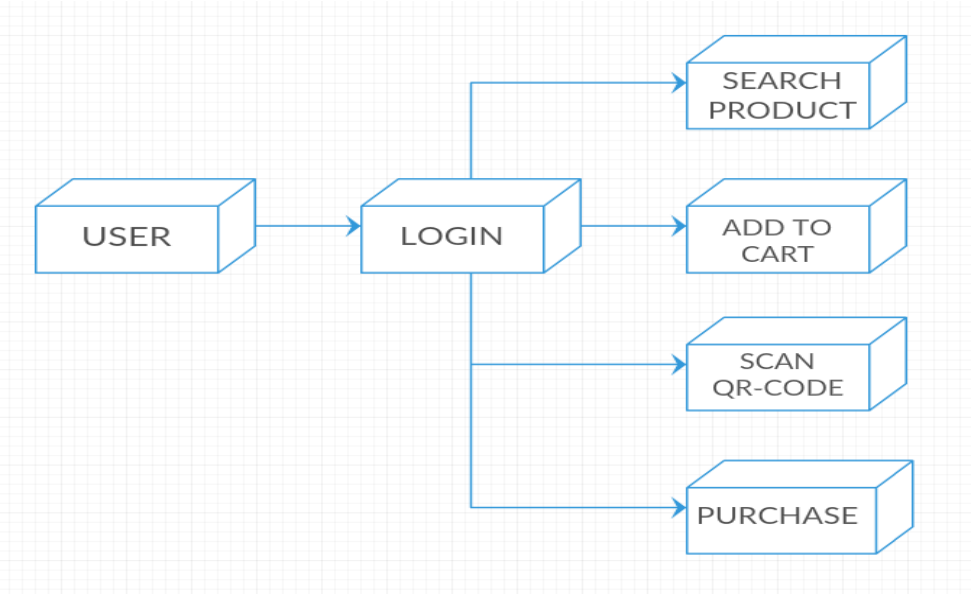

Fig.4. component design

E. Performance Requirement

Performance of the functions and every module must be well.
The overall performance of the software will enable the users to work efficiently.

F. Safety Requirement

The application is designed in modules where errors can be detected and fixed easily.
This makes it easier to install and update new functionality if required.

G. Security Requirement:

To access the system, person have to register him/herself in database. Only authorized users can make payment online.

VII. TECHNIQUE USED

Data Migration.
Interfaces with other systems.
Set up and maintenance of security rights and access permissions.

A. Scope

Propose system effectively used in mall to notify the expected product. It also reduces efforts of customer and shopper at the time of bill payment. Propose system can be used in shops for billing purpose. Propose system can be used in canteen for selecting food and bill payment.

VIII. FEATURES OF THE PROJECT

A. Navigation

Registration/Login: Customer register himself using his credentials and sets username & Password to use the application for the first time. Then user will LOGIN in our android app using his username & password. Then user will input the product name and location automatically taken by Latitude & Longitude values of receiver. After that system will show the path towards the product.

B. Billing System

By using navigation system user reach to the destination. Then customer has to scan QR-Code of the product and add it to cart. Customer has to repeat this process till he ends the shopping[11]. After that application will create the QR-Code of the total product with the MRP and details. So, that at the billing time, employee will scan the QR-Code and does fast billing process.

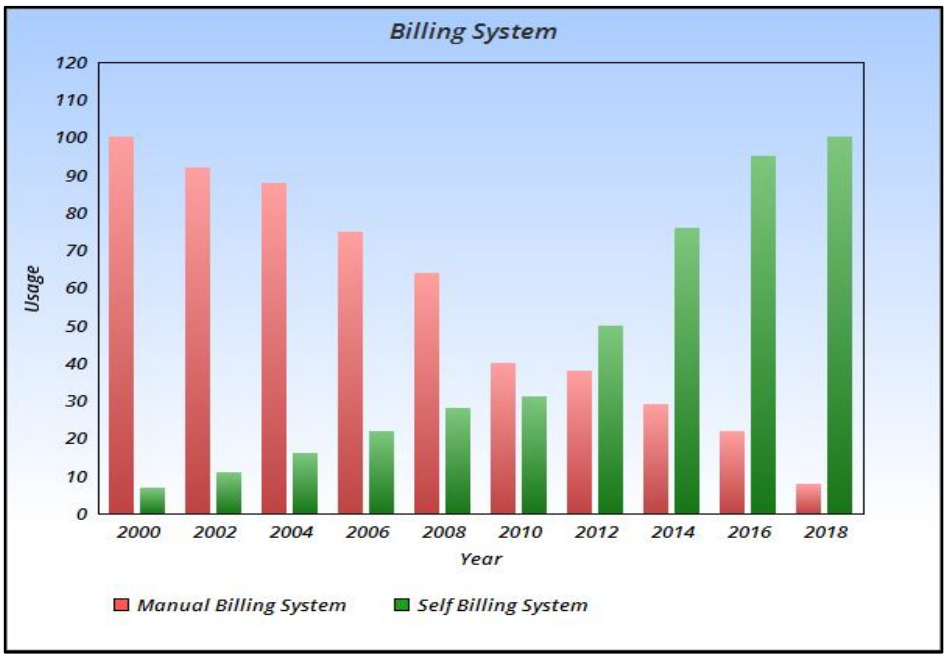

Fig.5. Manual billing system v/s self billing system

IX. CONCLUSIONS

In a step aimed for promoting shopping methods and make people life easier, we are going to build this mobile application that willplay an important role in Indian society. The usage of Pocket PC mall navigator as a shopping mall navigator, in addition to helping the users to find shops efficiently and effectively, were able to create awareness in using smart mobile devices for flexibility in almost every task among the shopping mall.

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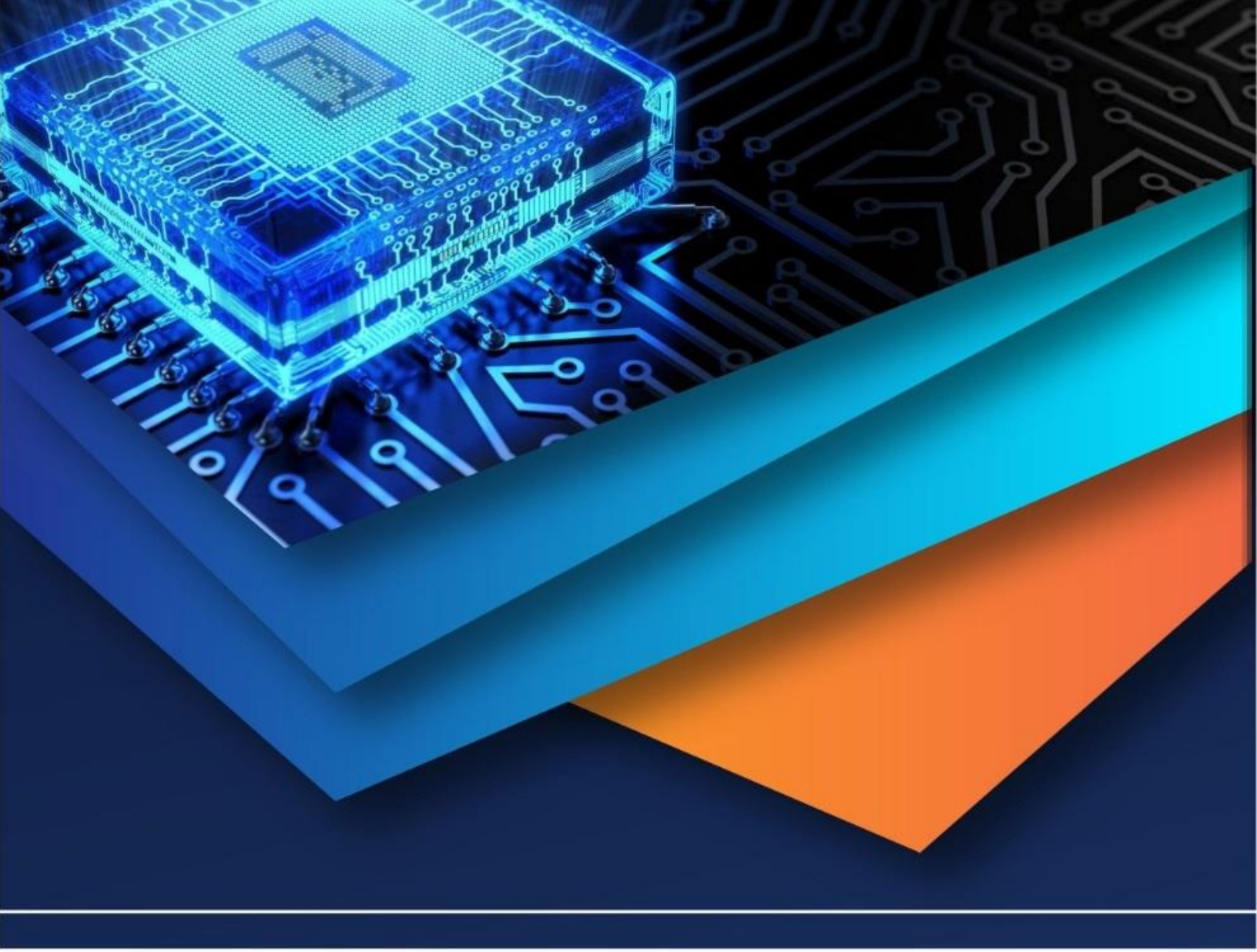

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