iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** V **Month of publication:** May 2021

DOI: https://doi.org/10.22214/ijraset.2021.34657

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue V May 2021- Available at www.ijraset.com

IOT based Advance Shopping Mall System

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Abstract: ***Nowadays, buying and searching at huge malls is turning into a daily activity in subway cities. We can see large rush at malls on holidays and weekends. The rush is even a lot of once there are special offers and discount. People purchase totally different things and place them in trolley. After total purchase one needs to go to cashier for payments. The cashier prepares the bill using bar code reader which is a time overwhelming method and leads to long queues at charge counters. This paper targeted to minimize the Queue at a billing counter in a shopping complex. Our project does the same by displaying the total price of the product kept inside the cart. In this way the customer can directly pay the amount and leave with the commodities he/she has bought. The hardware is based on NFC Tags and Stickers. It eliminates the traditional scanning of products at the counter and in turn speeds up the entire process of shopping, also with this system the customer will know the total amount to be paid and hence can accordingly plan his shopping only buying the essential commodities resulting in enhanced savings. Since the entire process of billing is automated it reduces the possibility of human error substantially. Also, the system has a feature to delete the scanned products by customer to further optimize the shopping experience***

I. INTRODUCTION

In the early times when people wanted to possess any item, they had to barter i.e. exchange any item which they owned or possessed with the item they wanted to purchase. With barter, an entity having any surplus of value, such as a measure of food or a number of livestock could directly trade that for something perceived to have comparable or greater worth or usefulness, such as a clay pot or a tool. The ability to carry out barter dealings is restricted in that it depends on a coincidence of wants. The seller of food grain has to find the buyer who wants to buy. There is no agreed standard measure into which both seller and buyer could exchange merchandise according totheir relative value of all the various goods and services offeredby other possible barter partners. As a result, this system of purchasing became obsolete and was replaced by monetary transactions in which the goods were bought or sold for a specified or mutually agreed upon amount of money and the money thus used in the transaction can be used elsewhere to buy anything else. But in the modern times where everyone is in a hurry, when people go to markets, they look out for ease and convenience of shopping. When they step out of their homes for purchasing desired items, they expect a good shopping experience and can get easily turned off on seeing large crowds. As a result, looking for convenience and ease ofshopping, people turn to online shopping. As a result, e- commerce giants like Amazon™ and eBay™ are experiencing very huge annual growth in the number of users shopping online. This booming e-commerce market has also resulted inthe adoption of e-payment options like using debit/credit cards,net banking and using third party e-wallets like PayPal™,Paytm™ etc by the people globally. These e-payment optionshave eased the payment methods adopted for online shopping.But still people prefer to go to brick and mortar stores formaking daily purchases like groceries, food items, fruits andvegetables etc. Today, majority of the people have a verydecent standard of living as compared to about 100 years ago.So, they prefer shopping in supermarkets. But they arebecoming very crowded now-a-days due to a slow checkoutprocess which involves using barcodes, which is a 50 year oldtechnology still very much in use till date. Continuousenhancement is required in the long-established shoppingmethods and billing scheme to enhance the quality of shopping experience for the customers. Also sometimes customers face trouble regarding the partial information about the merchandiseon sale and waste needless time at the billing counters. Thisresults in large lines at the checkout counters of the supermarkets which makes the shopping experience of thecustomers very chaotic and frustrating To rise above theseproblems stated above and to enhance the existing system, weaim to develop a smart shopping system for best customerexperience, where a customer just enter to the supermarket and grabs a smart cart and carry on for shopping. The customer will browse the items traditionally and just drop them in the smartcart, the items will be automatically billed, and once thecustomer is done with the shopping an automatic debit from hisaccount will be conducted. The customer will just checkout without any frustration of payment queues and delays. Toachieve this goal, first, we aim to design a smart shopping cartusing NFC technology. This can be done by attaching NFCtags to the merchandise and a NFC reader on the shopping cart,and also by pairing the customer's smart phone with the cart.With this system in place, customer will have the informationabout price of everu item that is scanned in total price of theitem and also brief about the product at his fingertips.

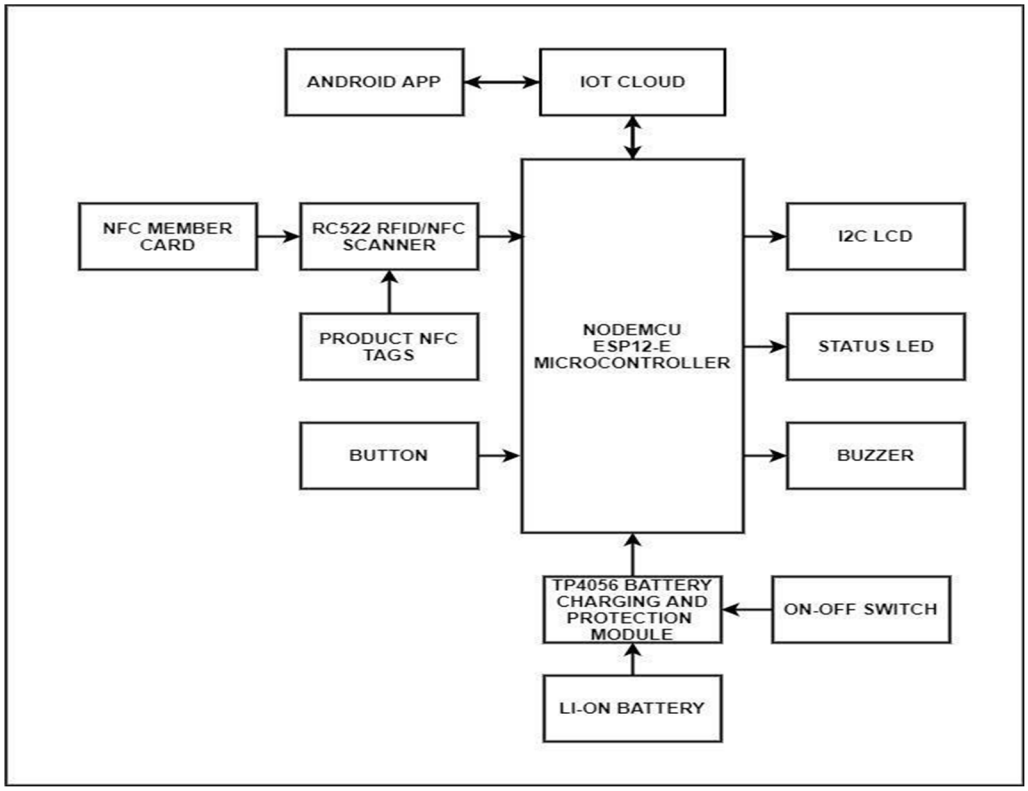
Thissystem will save time of customers and manpower required insupermarkets and also the running expenses incurred. The project aims at removing inadequacy of both traditional and online shopping. The customer can scan the NFC Stickers on the products while purchasing and generate bill by themselves. The waiting in long queue at the cash counter will also be avoided as the customer can make payment using NFC Membership Card. Hence the user can make quick payment and leave the shop early. The owner or the sales executive can verify the payment by looking at the indicators connected to the cart. Hence the process is made easy for both customer as well as shop owners and staff.31

II. CONCEPT USED

While a user collects an item for consumption from theshopping mall and puts it into the cart, the code written within the frequency Identification antenna (RFID) tagstrike to the merchandise is while not human intervention browse by the RFID reader put in within the cart. The RFID code is then checkered with the catalog system for the equivalent product. Then the merchandise is further to the bill for the customer. With every dive of the merchandise into the tram the reader reads the RFID code from the merchandise to the bill for the customer. One time the RFID report the code, the liquid visual {display unit computer screen video display} permanent on thetram display the value and amount of each product.The client has the choice of keeping back the merchandise and therefore the system would deduct the merchandise from the bill. After getting, the client will provide a final enter command to the asking system, the ultimate bill together with the value is written.The client will use his revolving credit to buy the merchandise by swiping it through the revolving credit reader put in inside the asking system.

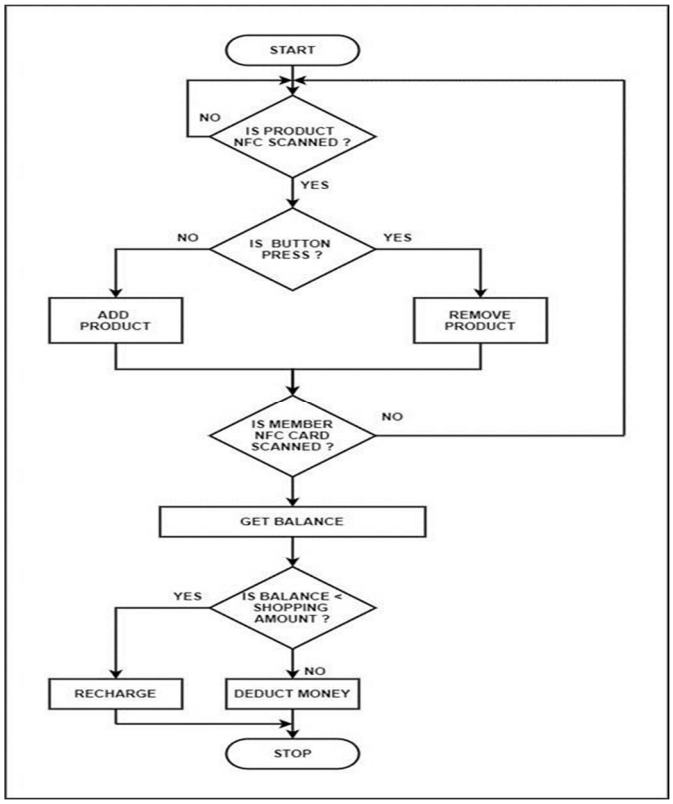
III. BLOCK DIAGRAM

1) Node MCU ESP12-E is used as the Microcontroller in this project.
2) RC522 RFID/NFC Scanner is used with the Node MCU toread product data using NFC Tags attached to the products and add to the shopping cart or remove from the shopping cart. It isalso used for scanning NFC Cards for making payments.
3) Product details such as price and weight of the product will be displayed on the LCD screen.
4) Total weight and total price will be also displayed on the screen when the user requests it before billing.
5) User can then tap the NFC Membership Card through which payment would be deducted.
6) LED and Buzzer are used for indication purpose such as whether the payment is complete or not. If it is complete then green led will be activated and for incomplete payment red led and buzzer will be activated.



7) User can scan the NFC Tag on the product directly toBlock Diagramadd it into the cart. For removing a product one has to press the push button and then scan the NFC Tag on the product.
8) An IOT cloud is used to store information such as payments and recharges/withdrawals.
9) Android App is used for First Recharge Purpose and Recharges. It will also display billing details for current transaction.
10) To make the device wireless it is made battery powered using TP4056 Module and Li-Ion Batteries.
11) Executives in the mall will only allow a user to leave if the payment is completed for the purchase made. Payment status indication is done using a LED. If the Red LED is on the user hasn't completed the payment while if the Green Led is on it indicates that the user has completed the payment.

Flow Chart



A. *Softwares Used*
1) Arduino IDE
2) Fritzing
3) Thingspeak
4) MIT App Inventor

B. *Hardware Used*
1) *NodeMCU ESP12-E Microcontroller:* NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP- 12 module. The term "NodeMCU" by default refers to the firmware rather than the development kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open-source projects, such as lua- cjson and SPIFFS.
2) *RC-522 RFID/NFC Scanner:* The MF RC522 is a highly integrated transmission module for contact-less communication at 13.56 MHz. RC522 supports ISO 14443A/MIFARE mode. RC522 - NFC/RFID Reader features an outstanding modulation and demodulation algorithm to serve effortless RF communication at 13.56 MHz. The S50 NFC/RFID Cards will ease up the process helping you to learn and add the 13.56 MHz RF transition to your project. The module uses SPI to communicate with microcontrollers. The open- hardware community already has a lot of projects exploiting the RC522 – NFC/RFID Communication, using Arduino.

3) RC522 - NFC/RFID Reader / Writer Features

a) Integrated MF RC522
b) 13.56MHz contactless communication card chip.
c) Low-voltage, low-cost, small size of the non- contact card chip to read and write.
d) Suitable for Smart meters and portable handhelddevices.
e) Advanced modulation and demodulation concept completely integrated in all types of 13.56MHz passive contactless communication methods and protocols.
f) 14443A compatible transponder signals.
g) ISO14443A frames and error detection.
h) Supports rapid CRYPTO1 encryption algorithm, terminology validation MIFARE products.
i) MFRC522 support MIFARE series of high-speed non-contact communication, two-way datatransmission rate up to 424kbit/s.
j) Low cost, and ideal for user equipment development.
k) The reader and RF card terminal design meet advancedapplications development and production needs.
l) Can be directly loaded into the various reader molds, veryconvenient**.**

IV. NFC CARD

NFC – or Near Field Communication – cards have become commonplace over the last few years. NFC technology is widely in use on public transport networks and also now integrated into credit and debit cards to enable small purchases to be made with just a tap. NFC is an evolution of radio frequency identification (RFID) technology – the technology used in everything from anti-theft tags in shops to the chips that track our pets.NFC chips can store data – such as how much funds are left on your travel card – which is then read by an NFC reader using electromagnetic radio fields.These fields allow communication over a short range, generally no more than a few centimetres. The NFC chips now common in transport or travel cards can be activated by an NFC reader, such as those you see at retail checkouts or in the entrances to public transport networks.To make sure data is secure, NFC connections are established over a secure channel that encrypts the data as it passes from card to reader.

V. NFC TAGS (STICKERS)

NFC Stickers are a great way to add NFC technology to a wide array of items. They offer the same functionality as a smart card using a similar chip and antenna to that found in a card but with the convenience of a small form factor with an adhesive backing for easy application. NFC stickers are used in many sectors including events, hospitality, transport and security. They also offer a great opportunity for use in advertising, where they can be added to any object and encoded for use with NFC enabled devices

A. TP4056 Battery Charging and Protection Module

This module is made for charging rechargeable lithium batteries using the constant-current/constant-voltage (CC/CV) charging method. In addition to safely charging a lithium battery the module also provides necessary protection required by lithium batteries. See below concerning the protection features this module provides.

B. Protection Features

This module uses the TP4056 / TC4056 Li-Ion charge controller IC and a separate protection IC. There are other types of modules on the market that use the TP4056 / TC4056 but lack any protection circuits or ICs to provide the necessary protection needed with lithium batteries. This module uses both the TP4056 / TC4056 and the DW01A Li-Ion battery protection IC, which together in combination provide the following protection features:

Manage the constant current to constant voltage charging of a connected lithium battery.

Over-discharge protection - keeps your battery from being discharged below 2.4V, a healthy minimum voltage level for your battery.

If a connected battery has been discharged below 2.4V the module will cut output power from the battery until the battery voltage has been re-charged above 3.0V (the over-discharge release voltage), which at that time the module willagain allow discharge of power from the battery to a connected load. Although the module cuts output power from the battery during an over-discharge situation, it still allowscharging of the battery to occur through the parasitic diode ofthe discharge control MOSFET (FS8205A Dual MOSFET). Overcharge protection - the module will safely charge yourbattery to 4.2V.

Overcurrent and short-circuit protection - the module will cut the output from the battery if the discharge rate exceeds 3A orif a short-circuit condition occurs. Soft-start protection limits inrush current.

Trickle charge (battery reconditioning) - if the voltage level ofthe connected battery is less than 2.9V, the module will use a trickle charge current of 130mA until the battery voltage reaches 2.9V, at which point the charge current will be linearly increased to the configured charge current.

VI. LITERATURE SURVEY

In [1], The authors "Galande Jayshree, Rutuja Gholap, Preeti Yada" proposed RFID based automatic billing trolley, with this model the system consists RFID reader and the products in the malls equipped with RFID tags. When a person puts any product in the trolley its code will be detected by RFID reader and the price of the product will be stored in the memory. At the billing counter the total bill data will be transferred to the pc by wireless RF modules.

In [2], The authors "S.Sainath, K.Surender, V.Vikram Arvind" proposed a model Automated Shopping Trolley for supermarket Billing system in which the automated shopping trolley is a smart trolley which integrates a raspberry pie embedded chip with two barcode scanners and a battery kit to allow users to self-checkout at supermarket.

In [3], the authors "Mr. Yathisha L, Abhishek A, Harshit R, Darshan Koundinaya" proposed a model automation of shopping cart to ease queue in mall by using RFID module and Zigbee module. In this system we are using RFID tags instead of bar codes, whenever a customer puts a product into a trolley, it will get scan by RFID reader and product price and it will be displayed on the LCD. We are using Zigbee transmitter which is used to transfer the data to the main pc.

In [4], the authors "Jadhav Rahul, Pradeep, Nandkumar, Tarali ShivkumarJ" proposed a model of RFID based automated billing trolley. In this technology, the communication is in between RFID tag

In [5], the authors "Udita Gangwal, Sanchita Roy, Jyotsna Bapat" proposed a system of smart shopping cart for automated billing purpose using wireless sensor networks. In this paper authors describing the implementation of a reliable, fair and cost effi cient shopping card using wireless sensor networks.

In [6], the authors "Kalyani Dawkar, Shraddha Dhomae, Samruddhi Mahabaleshwarkar" proposed a model of electronicshopping cart for effective shopping based on RFID in which asystem consist of smart trolley will have RFID reader, lcd display. When the person puts a product in trolley it will scan and the cost, name and expiry date of the product will be displayed.

In [7], the authors "Ynajun Zuo" describe the importance of RFID for automatic item identification and data capture. He developed a secured tag reader authentication protocol to ensure the authenticity of RFID readers.

A. Features Advantages

1) Reduces long queues.
2) Reduces human intervention.
3) Safe and secure NFC Based Payments.
4) Increases ease of use.
5) Reduces human errors.

B. Disadvanatages

1) Requires an active internet connection.
2) Needs to be charged after intervals as it is powered bybattery.

C. Applications

1) Supermarkets
2) Malls
3) Shops

VII. CONCLUSION

This IoT based Shopping Mall System creates an automated billing system for supermarkets and malls. Customer can easilyadd or remove products into the shopping cart by scanning NFC tags on the products using the scanner attached to the trolley. Using this, the customer does not require to stand in front of cash counters in long queues for billing their payment. Since the purchased products total cost and number of items data will be executed on LCD display itself and NFC payments are enabled it makes the complete shopping experience seamless and easier.

Also, usage of paper for billing is avoided, as it will be displayed in the customized app itself. The customer is only allowed to leave the mall when the Shopping Cart indicates payment completed message. Hence using this system not only saves time and benefits the customer but it also acts as a more convenient method for the seller

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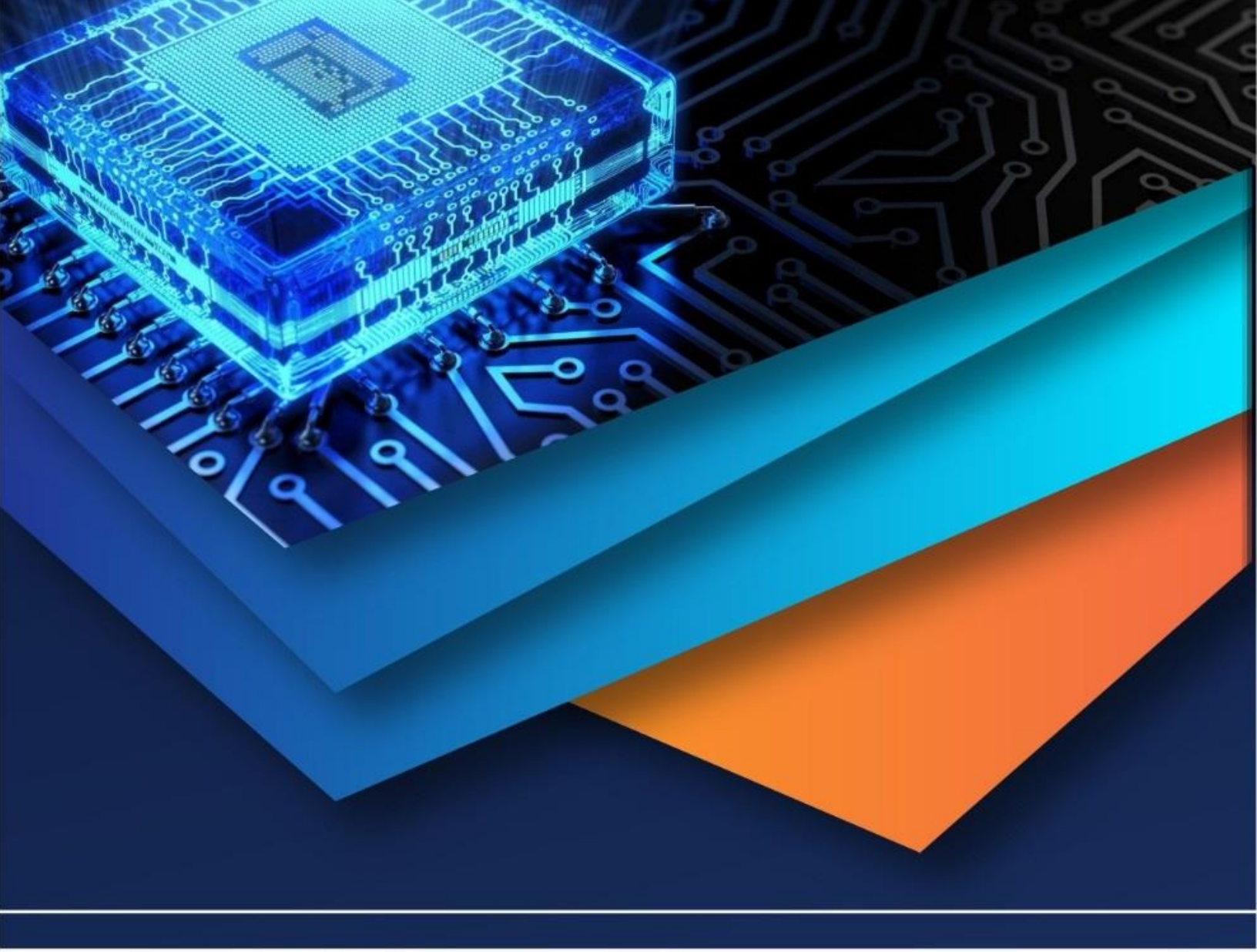

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