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Automated Smart Trolley with Smart Billing Using Arduino

Suganya.R[1], Swarnavalli. N[2], Vismitha. S[3], Mrs. G.M. Rajathi[4]
[1]Department of ECE, Sri Ramakrishna Engineering College, Coimbatore
[2]Associate professor, Department of ECE, Sri Ramakrishna Engineering College, Coimbatore

Abstract*—Shopping mall is a place where people get their daily necessities. There has been an emerging demand for quick and easy payment of bills in shopping malls. Quite often, when shopping in a supermarket shoppers are frustrated at locating the items on the shopping list and no assistance is available. To overcome these problems we have designed a smart trolley with a mobile application. This paper provides an app which helps the customers in finding the location of the product. It also provides a centralized and automated billing system using RFID. Each product of shopping mall, super markets will be provided with a RFID tag, to identify its type. Each shopping cart is implemented with a Product Identification Device (PID) that contains microcontroller, LCD, an RFID reader. Purchasing product information will be read through a RFID reader on shopping cart and it is displayed in LCD which is interfaced to the controller. At the billing counter, the total bill will be transferred to PC by Bluetooth module.

***Index Terms*—RFID Reader, RFID Tag, LCD, mobile APP**

I. INTRODUCTION

Now a day's interest in shopping malls is widely increasing among people. In the present shopping malls, customers find various difficulties. Those difficulties are mentioned below. One third of major shoppers buy groceries on a budget. Most of the times, it is only at the end of purchase shoppers come to know that the overall purchase total is greater than their budget. Then they spend much time in searching for their desired products and finally overall shopping process becomes more time consuming too. Due to this, several times shoppers couldn't buy all their desired products and miss out few items. Another major problem faced by users is that they have to wait in long queues for billing. Thus the proposed system overcomes all these drawbacks faced by shoppers in shopping malls.

In the first step of this project, a mobile application is developed to make shopping process easy. This application is designed in such a way that it holds information about all the products available in the shopping mall with price. As soon as the shopper opens the app, list of items with price gets displayed. The customer goes through the items and will select the desired items. After selecting, this application sorts the

Selected items and displays them rack wise i.e. rack1 items first, rack2 items second and so on.

Each item in Supermarket is tagged with a unique RFID label. Each shopping cart is designed or implemented with a Product Identification Device (PID) that contains microcontroller, LCD, an RFID reader .RFID Reader recognizes the products put in the cart. As soon as each item is placed, various information like item name, price of the product are displayed in the LCD display placed in the cart. Along with this total sum is also displayed. The total bill amount will reach the bill counter immediately through Bluetooth technology. Then the user has to pay just the total amount and can walk away. Thus Item-level deployment of RFID technology allows for quick checkout aisles that scan all products at once and generates total automatically, eliminating different sectional counters and long queues, which are consistently reported as one of the most negative aspects of supermarket shopping.

II. LITERATURE REVIEW

Galande Jayshree, Rutuja Gholap, Preeti Yadav in the year 2014 proposed RFID Based Automatic Billing Trolley. This paper proposed a system that will be placed in all the trolleys. It will consist of a RFID reader. All the products in the mall will be equipped with RFID tags. When a person puts any products in the trolley, its code will be detected and the price of those products will be stored in memory. As we put the products, the costs will get added to total bill. Thus the billing will be done in the trolley itself. Item name and its cost will be displayed on LCD. Also the products name and its cost can be announced using headset. At the billing counter the total bill data will be transferred to PC by wireless RF modules.

Several previous studies have also discussed the development of marketing applications, including the study entitled "Design of E-Marketing at PT. Rajawali Nusindo" [6] and "Design of Web-based Marketing Information Systems at BMT (Baitul Maal

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Wattamwil) Cita Sejahtera" [7]. The purpose of this system is a media campaign for the company. This system other than as a promotional media can also process ordering goods, ordering transaction processing, and display the status of the goods, as well as providing reports the purchase of a product level. However, there are still shortcomings in the system, especially in terms of marketing, which is a form of promotion that is carried out is limited to display only items available. There is no specific approach to attract potential buyers to purchase the product supplied. Limited mobility and lack of customer personalization

III. PROPOSED SYSTEM

Technological developments have opened up new opportunities for the company to conduct its business activities. According to the report published by techinasia, there are several smart phone technology bases that have been popular among people and it plays a big part of a day to day necessity. The development of mobile technology is very rapid and it enables a new approach to e-marketing. Today's consumers are surfing more, shopping more and socializing more on their mobile devices. In this paper, a mobile application is used. It displays the list of products present and its cost. The user is asked to select the products. Once the selection process is over, the products are sorted and displayed based on its location.

Radio Frequency Identification (RFID) is becoming preferable technology as an alternative to barcode systems. RFID systems provide an automatic identification method, relying on storing remotely retrieving data using RFID tags or transponders. An RFID tag is an object that can be attached to or incorporated into a product, animal, or person for the purpose of identification using radio waves. Chip-based RFID tags contain silicon chips and antennae. In this paper, we have developed a smart shopping cart system that allows customers to manage their shopping list while shopping and only pay the bill at the checkout counter.

The shopping cart has the ability to calculate automatically and display the total prices of all the products inside it. This makes it easy for the customer to know how much he or she has to pay while shopping and not at the checkout counter. This way the customer can receive faster service at the checkout. The advantage for the shop owners is that they would need fewer cashiers, which would result in a large cut in their costs.

IV. BLOCK DIAGRAM

A. Trolley Unit

In this unit the Arduino microcontroller is attached to a RFID reader and barcode reader. As the user puts the items in the trolley the reader on the trolley reads the tag and sends a signal to the controller. The controller then stores it in the memory and compares it with the lookup table. If it matches then it shows the name of item on LCD and also the total amount of items purchased.

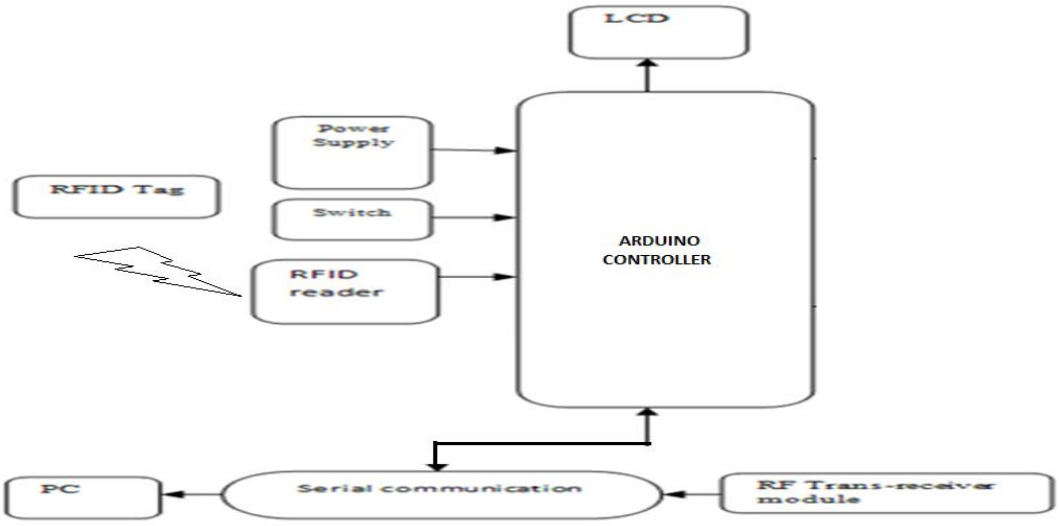

Figure 1: Block diagram of billing system

B. Billing Unit

As soon as the shopping is over the user comes near the billing section .The total bill will display on the billing computer.

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C. Power Supply

The AC supply is applied to 12V step down transformer. The transformer output is the 12V AC which is rectified using a diode bridge. The output of Diode Bridge of 12V DC is filtered by capacitors.

D. RFID Tags

Tags are of two types: passive tags which have no battery life and active tags which have battery life. RFID tags released for automatically identifying a person, a package or an items. These are transponders that transmit information. RFID tag contains two parts. One is integrated circuit for modulating, storing and processing information and demodulating radio frequency (RF) signal. The second is an antenna for receiving and transmitting signal.

E. RFID Reader

RFID reader consists of an RF module that acts as a transmitter and receiver of radio frequency signal. Transmitter consists of an oscillator to create the carrier frequency; a modulator to make impact on data commands upon this carrier signal & a receiver that contains demodulator to extract the data returned.

F. LCD Display

LCD has the ability to display numbers, characters and graphics. The display is interfaced to I/O port of microcontroller (P0.0-P0.7). The display is in multiplexed mode i.e. only one display remains on at a time. Within 1/10th of a second the next display switches on. In this way sequentially on and off display will result in continuous display of count due to persistence of Vision.

G. RF Module

RF module consists of RF transmitter and RF receiver. It is a small electronic circuit used to transmit and receive radio signal. It selects one out of a number of carrier frequencies. Types of RF module are:

1) Transmitter module
2) Receiver module
3) Tran receiver module

In this project we have used Tran receiver type RF module. It is a small PCB sub assembly and is capable of transmitting and modulating a radio wave that carries data. Transmitter modules are implemented alongside a micro controller which will provide data that can be transmitted to the module.

V. FLOWCHART

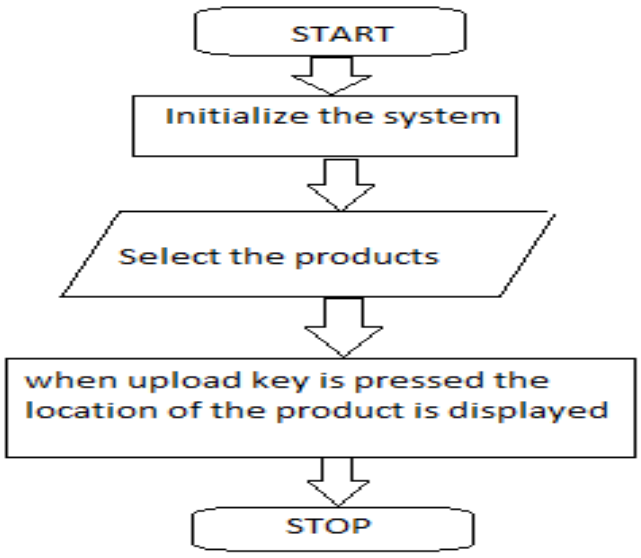

Figure 2: Control flow diagram for Mobile APP

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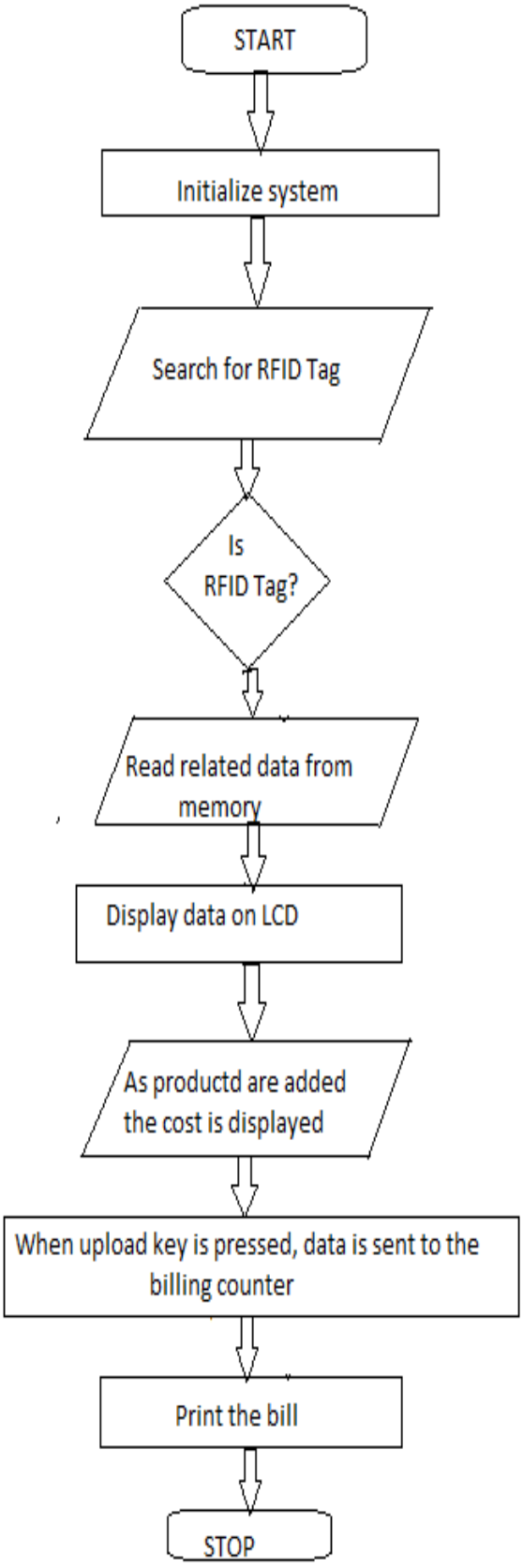

Figure 3: Control flow diagram for billing

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VI. EXPERIMENTAL RESULTS

The Automatic smart trolley consists of two modules namely product selection module and billing module. Production selection is done using a mobile app. It displays the list of the products that are available in the supermarket.The user is now allowed to choose their desired product. Once selection is done, the app displays the sorted location for each product.

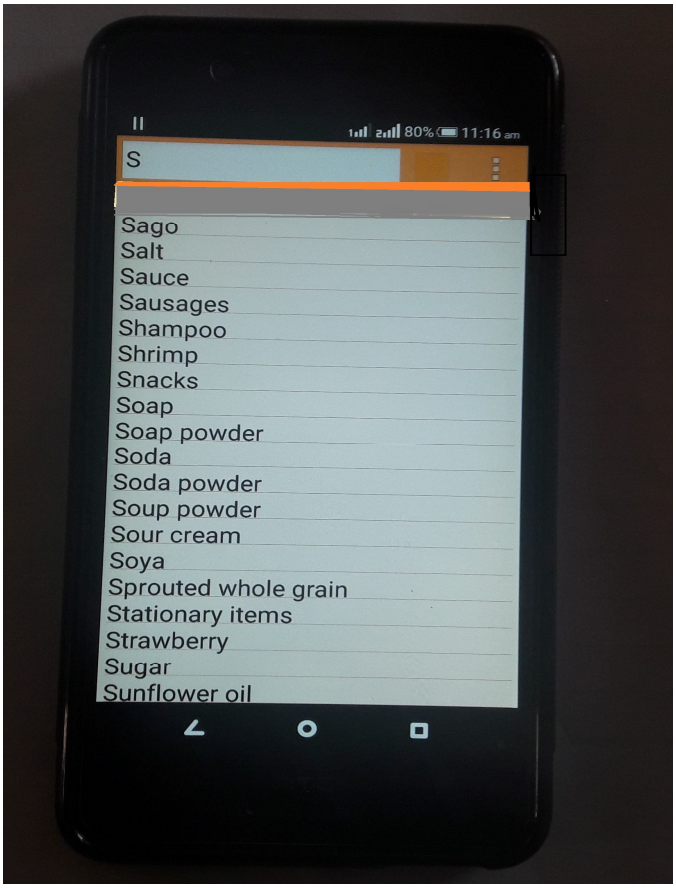

Figure 4: Mobile app displaying the product list

Each shopping cart is designed or implemented with a Product Identification Device (PID) that contains microcontroller, LCD and RFID reader. Purchasing product information will be read through a RFID reader on shopping cart and it is displayed in LCD which is interfaced to the controller. At the billing counter, the total bill will be transferred to PC by Bluetooth module**.** When a customer purchase a product, he/she first scans the RFID tag of each product to the RFID reader and then places it into the trolley.

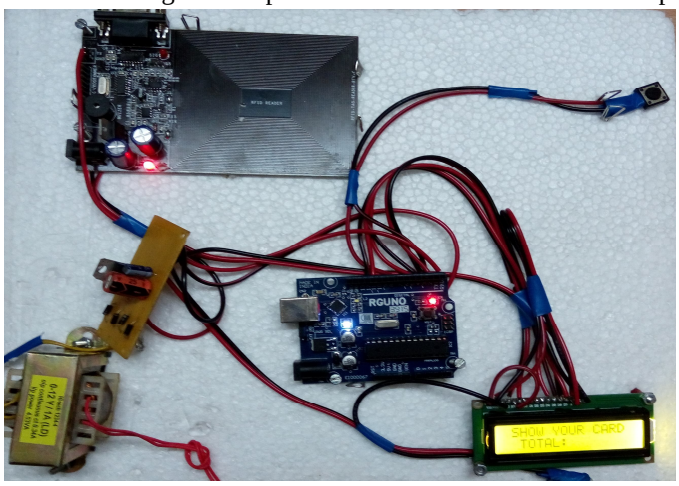

Figure 5: Smart Billing System

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After scanning the tag, the price and name of the product is displayed in LCD.As the products are added continuously, the cost is also generated accordingly. When upload key is pressed the total number of items and its cost is displayed in the LCD.
The complete shopping information is send to the server PC with the help of a Bluetooth module.Finally the bill is generated at the counter. If any product has to be replaced or removed it can be done at the counter.

Figure 6: Initialization of system

Figure 7: Displays the total cost when upload key is pressed

V. CONCLUSION

The desired objectives were successfully achieved in the prototype model developed. The developed product is easy to use and economical. Though the project showcases the proof of concept, there are a few aspects that can be included to make the smart shopping cart more robust. To begin with, in this project the latency time of the wireless communication with the server may need to be considered. Secondly, the communication is not very secure.It is impossible to stick RFID tag to some products. In such cases, conventional scanning of barcode is more sophisticated. Further, a more sophisticated micro-controller and larger display system can be used to provide better consumer experience.

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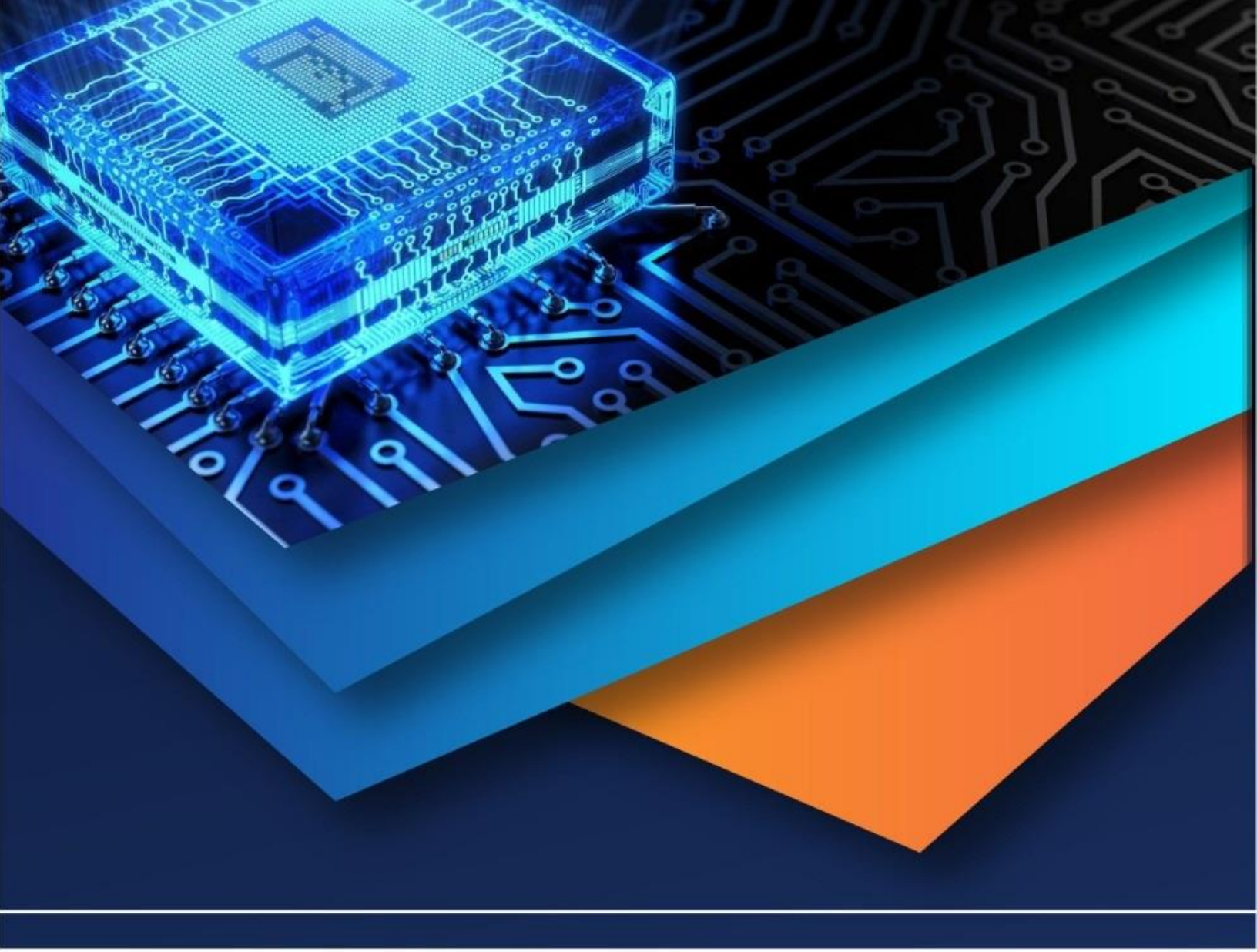

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