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IOT Based Smart Public Distribution System

Manaswi Kamarajugadda[1], Amit Marmat[2]
[1]*B.E Student,* [2]*Assistant Prof, School of Engineering and Technology, Vikram University, Ujjain, India*

Abstract: Taking care of poor families in developing countries such as India, it is an important aspect of meeting people's basic needs. The current public distribution system of grocery stores requires manual quantification and transaction records. In existing systems, we have - City guide card holders who have been authenticated, cardholders spend hours collecting rations, human resource management, black market marketing, unfair human intervention in transaction, update and maintenance entries in the complex ledger, and many other illegal activities.
Keywords: Public Distribution System, Smart Card, RFID Reader, Fingerprint Authentication, Android Application.

I. INTRODUCTION

The government provides food, oil and fuel to underprivileged people at subsidized prices and distributes theses goods to the consumers through grocery stores. The commodities in these grocery stores are purchased by farmers and then sold at subsidized prices. Most grocery store owners use unfair practices, and the amount of ration allocated to people is not distributed to authorized personnel. In order to resist these fraudulent activities, a system which includes functions mentioned has been developed, like fingerprint authentication system for identifying specific users to make the system secure, product and its quantity must be selected through the Android application and allocation automatic rationing mechanism. The country's social distribution system has undergone organic changes, from the rationing system introduced during World War II to a major social security program aimed at ensuring the country's food security. As part of the Public Distribution System (PDS), the central government purchases and delivers special necessities. Commodities with a fixed central sale price. Although various raw materials such as iodized salt, palm oil, candles, ghee, textiles, etc. were sold through PDS in the past, today food and commodities are sold at fair prices, as many as several grains and wheat, Rice, sugar and kerosene. Today, India has 4.78,000 grocery stores in many cities across the country, making it the largest distribution network in the world. The Ministry of Food and Supply issues ration cards to citizens based on their financial status. There are basically two types of maps- Maps below the poverty line (BPL) and Maps above the poverty line (APL). Many fraudulent activities that violate the Commodity Law are carried out in stores with unfair prices. Users have to queue for several hours to meet the demands for basic goods. Data of cardholders and their relatives are stored in notebooks. Transactions are carried out by the cardholder, and entries in the account books must be carried out manually. General ledger accounting is difficult and requires an efficient automated system to minimize misappropriation. The number of rations for these cards depends on the number of family members of the cardholder. The Ministry of Food and Supply oversees health and safety regulations under the Essential Commodities. Act of 1955, which regulates the trade of these basic products. Manage goods by closely monitoring inventory, access, quality and availability. The application includes collecting information and evidence of violations of relevant control regulations, as well as measures taken against them in accordance with the provisions of the Essential Commodities Law. The purpose of the system is to create an automatic and convenient system to protect the consumers interests by combating unfair behaviour. The main goal of the system is to implement a fingerprint matching algorithm for user authentication, thereby reducing the possibility of damage as a whole. Misuse of cards and time required for manual data entry are reduced. This system is used to protect goods purchased at fair prices on the black market.

II. LITERATURE SURVEY

The development of the social distribution of staple food in India began with the rationing system introduced by the United Kingdom during World War II. The system began in Mumbai in 1939 and gradually expanded to other cities. Cities are included in the rationing system. In 1946, approximately 771 cities or towns were included. Some rural areas with chronic power shortages have also been recorded. PDS follows the same pattern. There are several changes in the country from Public Distribution System. At first, the user is required to swipe the smart card. Raspberry Pi compares the unique ID of the tag with the database. If the tag ID matches, the user will be prompted to scan the finger. After confirming the user's identity, the product and quantity can be selected through voice commands. If the product and quantity are valid, the system issues a valid product. A message will be sent to the user with details of the transaction. However, if the authentication fails, the system will expect a valid authentication [1].

Sana et al. [2] proposed a transparent and highly scalable ration distribution system with biometric authentication. Plain paper cards are replaced by smart cards. The system is connected to the server via the Internet. log in. The user does not have to pay in cash because the corresponding balance is deducted from the user's bank account, so the grocery store owner is not directly involved in the transaction. The details of the transaction are sent to the user's mobile phone.

Bhalekar et al. [3] This article proposed an online smart card system using RFID and biometric data. RFID tags contain information about family members. The RFID tags provided to specific customers must be displayed in the RFID reader. Whether the card is valid, if it is valid, the customer passes the biometric authentication; if the customer passes the identity verification, the family member will show the monthly fee; after the welding is completed, the record is stored in the online database.

Ashok Kumar et al. [4], a comparative study of EVM fingerprint matching algorithms. The three matching methods are direct matching, minutiae matching and based matching in order to live in seclusion. When evaluating FVC-2000, observe the records and results by selecting a matching method and finding the best matching method.

Sharath et al. [5], this article establishes the correspondence between two fingerprint images by quantifying the amount of information available in tiny features, thereby solving the problem of fingerprint personality.

III. PREVIOUS WORK

Fingerprint processing includes two steps: fingerprint registration and fingerprint matching. When registering, the user must provide two fingerprint samples. Using these two fingerprint image modes, the system creates a fingerprint in the template used to verify the user's identity. after that. Compare the created fingerprint template with the fingerprint library template. The system returns the corresponding result as successful or unsuccessful. This fingerprint comparison is performed in the controller using a fingerprint comparison algorithm [6]. Most of the methods used in previous research are based on biometric authentication, such as fingerprints. Fuzzy storage system is one of the most important security biometric authentication mechanisms based on fingerprint data, in which the key is generated by extracting straw points from the checkpoint pattern. Fingerprint matching using Gabor filters is another technique for fingerprint matching using Gabor filters 16 from templates, which led to the development of new methods. Use adaptive filtering technology to compare two image comb sample cards. There have been several methods to improve fingerprint images based on image normalization, Gabor filtering (Hong algorithm) and Bean method. The general fingerprint matching algorithm is based on direct matching, minute-based matching and ratio of relational distance matching. In this comparison process, the input image and the original image are read; the comparison is made by comparing the two-pixel images wise [7]. Minutia based matching is most popular and widely used in commercial applications due to its good performance and low computing time, especially for high-quality images. This method attempts to match the details of the input image (request template) and the saved template (link template). And find out the number of interesting facts that match. After alignment, if the special distance and direction difference between the two control points is less than the specified tolerance, then the two control points are considered in the comparison [8]. The correct orientation of the fingerprint is very important to maximize the number of matching minutiae. This requires calculation of displacement and rotation information and other geometric transformations, such as scaling and deformation. Each line segment contains the following information: the length of the line segment and the angle formed by the line segment and the direction of the small things. Fingerprint matching algorithms based on small details are useful in some data protection applications - The fingerprint image pre-processing and fingerprint image enhancement aims to make the image clearer and facilitate subsequent operations. The ink tank is very helpful to ensure higher accuracy of fingerprint recognition.

Histogram is a process of trying to distribute gray levels in an image so that they are evenly distributed over its area. Basically, it redistributes the brightness value of each pixel according to the histogram of the image. The purpose of flattening the histogram is to expand the distribution of pixel values in the image. Images to increase the perception of information. The binarization of the fingerprint image includes converting the 8-bit Gray scale image of the fingerprint into a 1-bit image, where the rib value is 0 and the groove value is 1. After the operation, the groove on the fingerprint will be highlighted in black, and the groove will be highlighted in white. The local adaptive binarization process is used to convert the fingerprint image into a binary form. The local adaptive binarization method comes from the mechanism of converting the pixel value to 1 if the value is greater than the average intensity value of the current block (16×16) to which the pixel belongs. The local adaptive threshold is applied to the directional filtered image to produce the final enhanced binary image. This involves using the training pixels to calculate the average of the gray levels in the image window, and if the average exceeds the threshold, the pixel value is set to a binary value equal to 1; otherwise, it is like zero. In finger print image segmentation to extract the region of interest (ROI), a two-step process is used. The first step of the method is to evaluate the direction of the block and check the diversity of directions, and the second step is to use some morphological methods.

Two morphological operations are accepted: OPEN and CLOSE. The OPEN operation can expand the image and remove peaks caused by background noise. The CLOSE process can shrink the image and remove small gaps. Ridge Thinning involves using an iterative parallel extraction algorithm to remove extra pixels from the ridges until the ridges are only one pixel wide. Each time the entire fingerprint image is scanned, the algorithm marks a small sine window of the word pixel image (3×3). It will eventually delete all marked pixels after multiple scans. Minute Marking is relatively easy. Generally, for each window (3×3), if the centre pixel is 1 and there are exactly 3 adjacent values, then the centre pixel is a ridge branch. If the centre pixel is 1 and it has only 1 neighbour, then the centre pixel is called the end of the edge. At present, it is not possible to completely rule out incorrect ridge breaks due to insufficient glazing and ridge transverse seams due to excessive colouring. In addition, some of the above methods introduce some false details in the image. The smallest details must be deleted. First calculate the distance D between the projections, that is, the average distance between two adjacent projections. To do this, we scan each line to calculate the distance between the ridges. We all use the morphological operation MATLAB BWLABEL [8] to mark all the refined ribs in the fingerprint image with a unique identifier for subsequent operations. If there are two matching fingerprint images, select any part from each image and calculate the similarity of the two ribs associated with the two designated control points. When the similarity exceeds the threshold, you turn a lot of small things into a new coordination system. The origin is at the anchor point, and the x-axis coincides with the direction of this point.

After the two sets of transformed control points are obtained, assuming that the two control points are with almost the same position and same direction, they are used in the elastic fitting algorithm to calculate the matched control point pairs. If the control points to be matched are within the placed rectangular frame and the direction deviation between them is small, then the two control points are considered to be a pair of matched control points. Each control point in the template image has no matching control point or only one matching control part. Ratio of relational distance matching method is to obtain a set of common control points (control points that exist in both the base image and the input image). The main goal of this step is to find the number of common breakpoints available in a pair of fingerprint images. This step generates common control points available in both images. If the two are the same, the reference image and the input image are the same.

IV. SYSTEM OVERVIEW

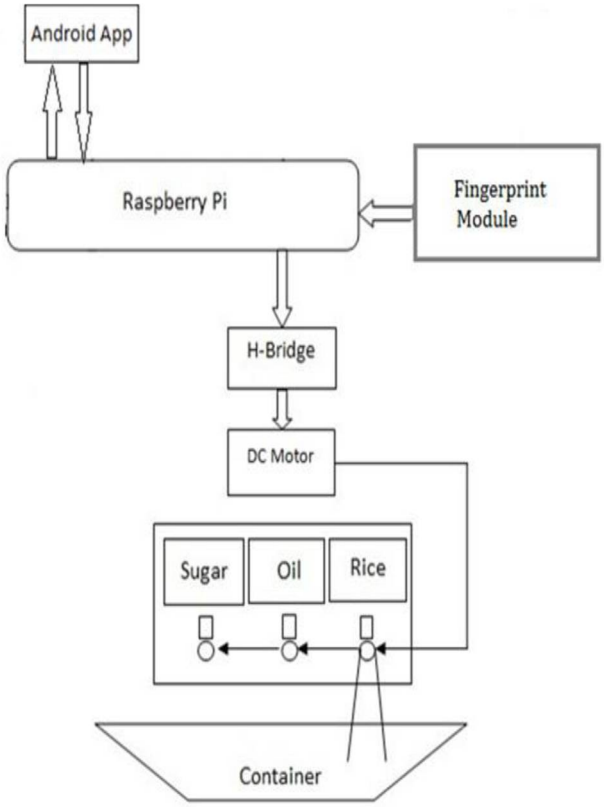

Fig. 1 Block diagram of IOT based smart public distribution system.

V. HARDWARE TOOLS

The following Hardware components are used to implement the required functions. It consists of two parts: fingerprint registration and fingerprint matching. When registering, the user needs one finger twice. Process the results and save the template.

1) *Fingerprint Module:* The fingerprint module is assigned to the Raspberry Pi. The fingerprint received by the module is processed using a sophisticated algorithm.
2) *Raspberry Pi:* The information of each user in the family is recorded in the database. The Raspberry Pi obtains the serial number of the card reader and accesses the corresponding entry in the database based on fingerprint identification.
3) *Motor and Relay Circuit:* The motor is used to control the valve device (that is, to open and close the valve). These motors are controlled by a relay circuit (timer). When the grain falls from the hopper, the relay circuit is used to measure the weight, and when the required quantity is reached, the valve is automatically closed [9].
4) *Hydraulic Valve:* The purpose of low-speed control in any hydraulic system is to adjust the speed. The valve controls the speed of the actuator by adjusting the flow rate. The valve is controlled by the current flowing through the DC motor. Hydraulic valve for supplying oil to the cardholder. The details of each family card holder are entered into the database. The Raspberry Pi obtains the serial number of the card reader and accesses the corresponding entry in the database based on fingerprint identification. Raspberry Pi is a credit card-sized single-board computer developed in the UK by the Raspberry Pi Foundation to promote computer science teaching in schools.

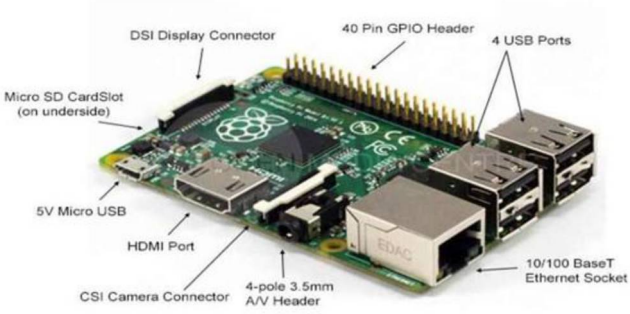

Fig. 2 Raspberry pi embedded board.

5) *Processor:* The core of the Raspberry Pi is the processor. The chip is a 700 MHz 32-bit system-on-chip based on the ARM11 architecture. ARM chips have different architectures, with different cores configured for different functions.
6) *Secure Digital (SD) Card Slot:* Pi does not have a hard drive. Everything is saved on the SD card. The SD card used to store operating systems, programs, software, and databases must have a minimum requirement of 8 GB.
7) *USB Ports:* Type B has two USB 2.0 ports, but type A has only one. Some early Raspberry Pi boards were limited in the amount of current they can provide. Some USB devices can consume 500 mA.
8) *Ethernet Port:* Type B has a standard RJ45 Ethernet port. Model A does not have this, but it can be connected to a wired network via a USB Ethernet adapter (Model B port is actually a built-in USB to Ethernet adapter). Another possibility is to connect via a USB dongle.
9) *HDMI Interface:* HDMI interface provides digital video and audio output. Supports 14 different video resolutions, and can convert HDMI signals to DVI (used by many monitors), composite (usually send analogue video through a yellow RCA connector) or SCART (European standard for AV equipment) through an external connection.
10) *Analog Audio Output Adapter:* This is standard 3.5 mm Analog mini audio jack for connecting high impedance loads (such as active speakers). Passive headphones or speakers don't sound very good.
11) *Power Input:* This micro-USB is connected or used for power supply (this is an additional USB port, only for this).

The fingerprint module is used for registration and authentication. You need to get the thumbnail. Optical scanning is used to scan images. The core of the optical scanner is a charge-coupled device (CCD). CCD is just a group of photodiodes called light spots, which generate electrical signals in response to photons. Each photo site records a pixel, a small dot that represents the light that hits that point. The bright and dark pixels together form an image of the scanned scene (such as a finger).

Typically, the analogue-to-digital converter in the scanning system processes the analogue electrical signal to produce a digital representation of the image. The glass plate and CCD camera take pictures. The scanner has its own light source, usually a series of LEDs, used to illuminate finger protrusions.

The CCD system actually creates an inverted fingerprint, where dark represents more deflected light, and brighter areas represent less reflected light (valleys between the ribs). Checks average pixels in the small sample are dark or total. If the entire image is too dark or too bright, then abandon the scan. If the image is deviated, the scanner will adjust the exposure time to let more or less light fall, and then try to scan again. Three DC motor systems are used to open and close valves for the automatic distribution of rice, sugar and oil. The original position of the valve is to prevent grain and oil from dripping. Three DC motors, each with a voltage of 12V. For this, a nominal output of 60 rpm and 0.37 A is used.

The purpose of adjusting the flow in the hydraulic system is to control the speed. This valve controls the speed of the drive by adjusting the flow rate. The valve is controlled by current through a DC motor. This is used to supply fuel to the cardholder. The switch must be pressed by a motorized mechanism. CC is used to collect liquid. Its task is to close, release, dispense, dispense or mix liquids.

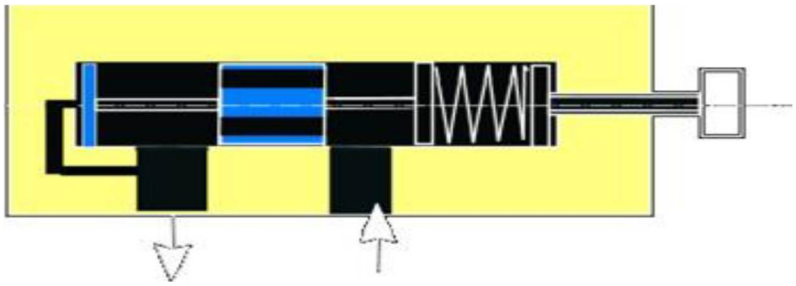

Fig. 3 Cross sectional view of Hydraulic valve.

VI. SYSTEM SOFTWARE

System software is an interface between hardware and user application. It is computer program used to execute computer hardware and application programs.

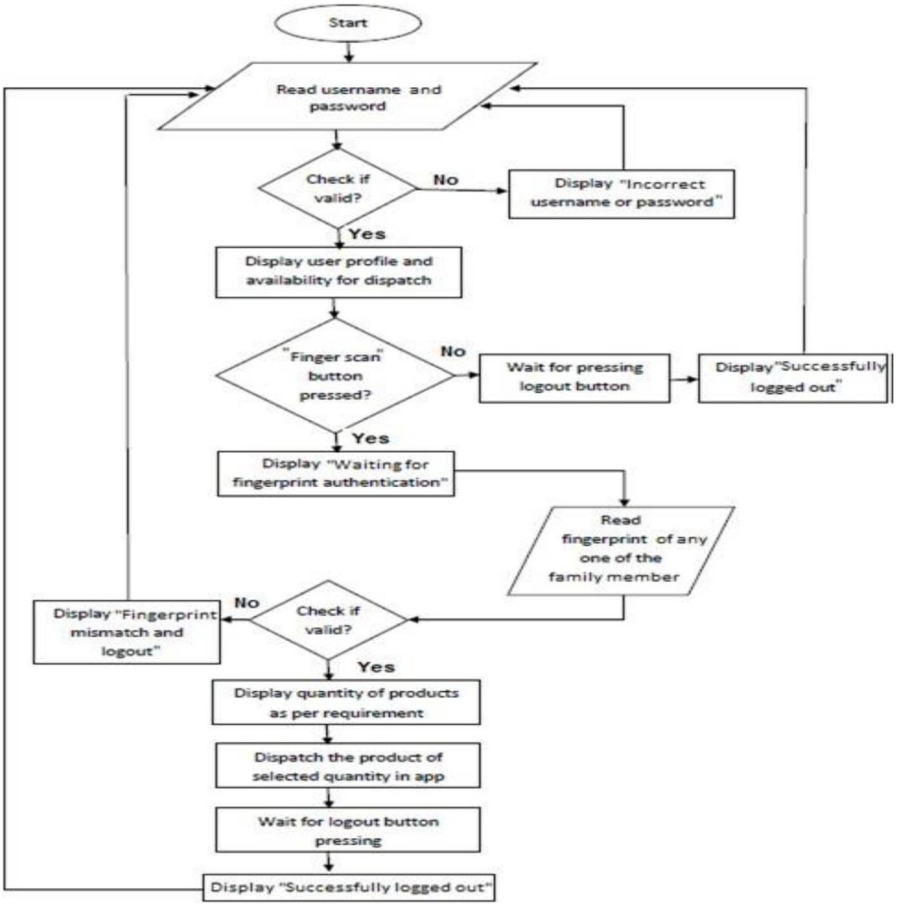

Fig. 4 Flowchart of IOT based smart public distribution system.

First, the user is asked to enter the ID and password provided to him in the application. Raspberry Pi compares the unique ID with the database. If the IDs match, the user can see the configuration file containing the transaction details. The user is prompted to scan the finger. After the user is authenticated, these buttons can be used to select products and quantities. If the product and quantity are valid, the system issues a valid product. However, if the authentication fails, the system will wait for a valid authentication. Fig. 4 is a block diagram of an intelligent public distribution system based on the Internet of Things.

Android Studio is the official integrated development environment (IDE) for developing the Android platform. This was announced at the Google I/O conference on May 16, 2013. Android Studio is freely available under the Apache 2 license. Google provides an IDE called Android Studio for developing Android applications. The application logic is mainly written in Java language. Android development tools convert these files into Android applications. These tools allow you to compile, package, deploy, and run the applications you develop. The Android Software Development Kit (Android SDK) and Gradle tools contain the necessary tools. The Android SDK includes the Android Debug Bridge (ADB). ADB is a tool that allows you to connect to a virtual or real Android device. In this way, you can control the device or debug the application. Most Android configuration files are based on XML. Android tools provide a special dedicated editor for Android specific files. You can usually use these editors to switch between the XML representation of the file and the structured user interface.

VII. RASPBIAN

Raspbian based on Linux Debian was used as the operating system for the proposed project, which has reliable documentation. Raspbian comes pre-installed with many software for education, programming, and general use. It has Python, Scratch, Sonic Pi, Java, Math and so on. The PIXEL Raspbian image included in the Achieve ZIP exceeds 4 GB, which means that these files use features that are not supported by older decompression tools on some platforms. The fingerprint matching algorithm based on trivia is shown in Fig. 5. The three main steps are explained in the flowchart, which also includes the following processes:

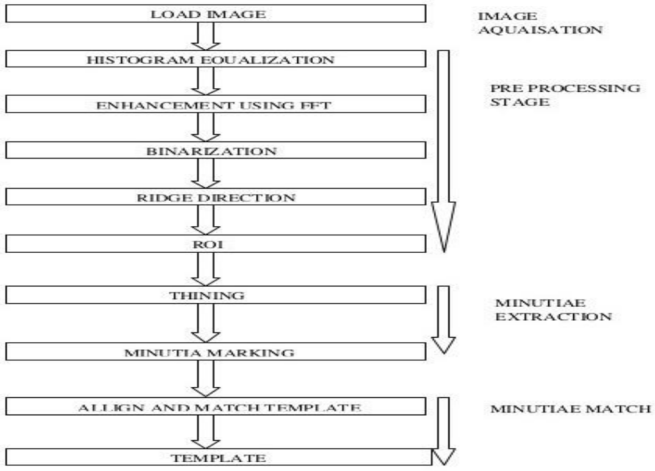

Fig. 5 Steps involved in fingerprint recognition.

Before purchasing, the user must provide fingerprints to verify the product. The saved template is used as a reference. When a user tries to purchase a product, the entered fingerprint will be compared with the stored database to identify the user. After that, if the fingerprints match, the user can purchase the product.

VIII. CONCLUSION

The intelligent public power distribution system based on the Internet of Things is an automated system that is competitive at the current fair price. Fingerprint authentication uses an algorithm based on extracting small details to make the system more secure and accurate. Ordinary people who guarantee national food security. Through their activities, corruption can be reduced. Product selection and quantity selection through Android APP make the system more intelligent and reliable. This will help the country's economy reach new heights. Automated PDS is easy to implement and requires much less work than any other system. With this system, fraud can be avoided because there is no manual operation and all information is also stored in the database. It's really useful for people. In the future, the project can be expanded by paying for products purchased online. This makes the system more automated. The communication distance between the server and the client on the Internet can be increased.

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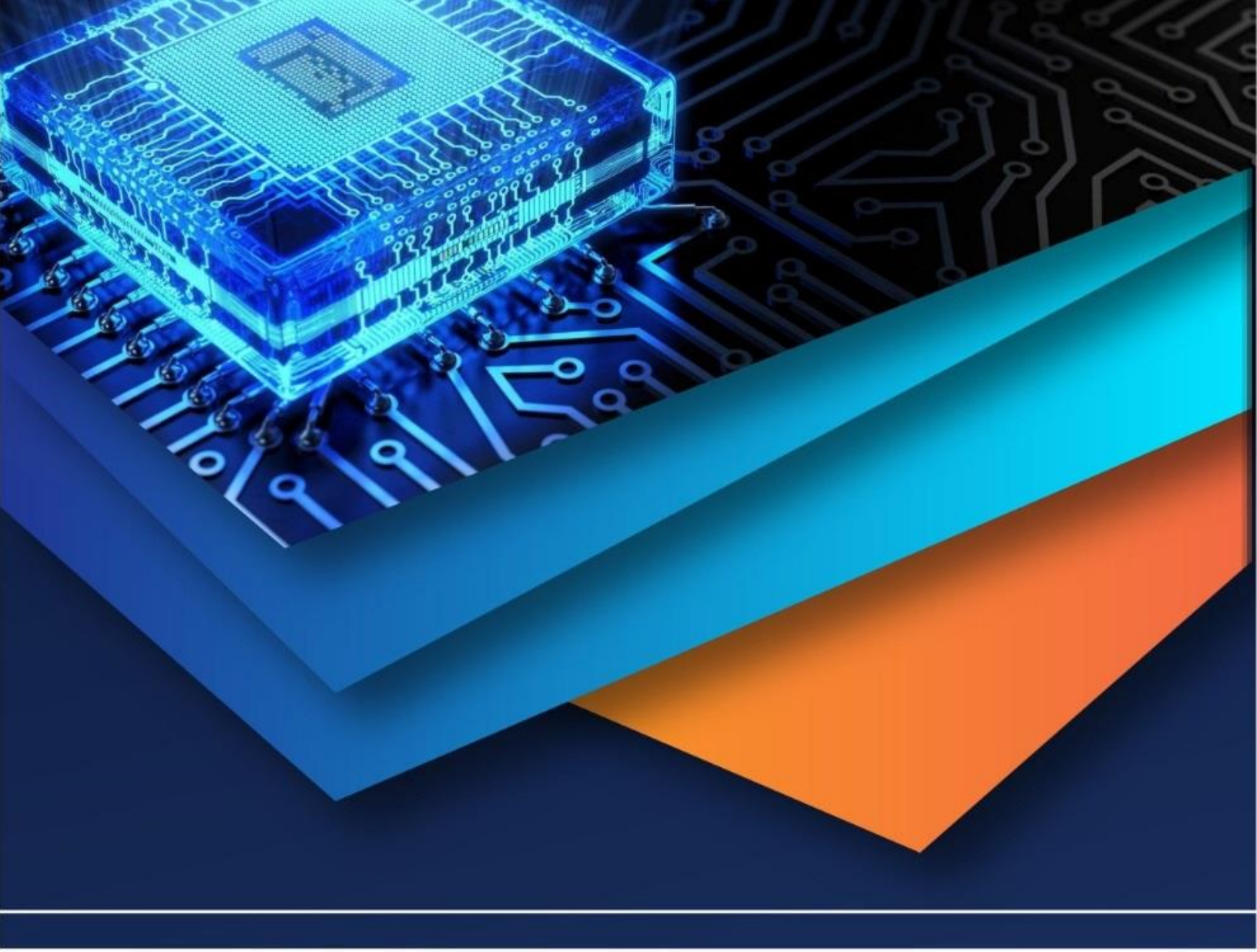

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