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Supply Chain Monitoring and Authentication Using Blockchain

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Abstract: ***The Frozen Food industry produces and supplies packaged food products that are to be delivered at a particular freezing-points, therefore it is important that they are supplied in such an environment where they do not get damaged. To achieve this, continuous tracking of the shipped product must be monitored in a freezing environment where temperature and also humidity are maintained called supply chain management. During transportation of the packaged food, there may be a chance of getting damaged food like fluctuations in the temperature maintenance might cause food to be rotten. And there is a chance of leakage of canned goods or bulge at the ends which indicates the unhealthy and unhygienic condition of the packaged food. Quick Response (QR) codes provide a robust technique to fight the practice of counterfeiting the food products. Counterfeit food products are detected using a QR code scanner, where a QR code of the packaged good is linked to a Blockchain. And this system may be used to store shipped product details and generated unique code of that product as blocks in the database. So, we aim at two important aspects, firstly on continuous monitoring of supply chain and then on fake product detection which is done using Blockchain.***

I. INTRODUCTION

Problem of supply chain of frozen food is that it doesn't monitor at every stage of food production. Now a days there's a huge demand for these frozen foods and semi cooked frozen foods. These are involved in both exports and imports in large scale. But in importing and exporting these frozen foods there is a chance of getting damaged. And when the time it reaches the customer, the food will be in an unhygienic or improper way which leads to the customer unsatisfaction. Also, in different sectors like industries and software employees use these semi-cooked or frozen food in order to save their time. Demand for frozen foods has been growing day by day which leads to increase the rate of marketing. Continuous monitoring frozen food have to be done in every part of the transportation of frozen food products. In the case of continuous monitoring, we can identify whether the food product is in good hygienic condition or not by checking temperature and humidity levels of the product. By this continuous monitoring of frozen food supply chain there is no chance of customer unsatisfaction. Not only in continuous monitoring but also by generating the unique QR code we can track the food order and get the information of the temperature and humidity levels of the food in the time of tracking. These problems made us to develop the process of supply chain management and counterfeit product detection to overcome these problems in the transportation of frozen foods.

To implement an IoT sensor-based technology which uses DHT 11 sensor for continuous monitoring of supply chain. Followed by QR generation for all the food products which helps the customer in getting the complete information of the packaged product. We follow a type of Distributed Ledger Technology (DLT) which is used to trace the supply network from procuring of packaged good till delivery. It creates an immutable list so that transparency is maintained at each level and quality guaranteed. In this project, we will implement IoT with Blockchain to track the packaged good. And to develop a platform that will simulate securing frozen food supply chain using blockchain as data entered in a public ledger can be verified by all and modified by none. And to establish an untampered supply chain management of frozen goods and how the supplier supplies the goods to the end user.

II. LITERATURE SURVEY

A. Supply Chain

Supply chain management is the management of the flow of goods and services and includes all processes that transform raw materials into final products. Supply chain data is not always visible, available or trusted. Blockchain helps supply chain partners share trusted data through permissioned blockchain solutions. The use of IoT and Blockchain to make the Supply chain management process more efficient and secure. IOT sensors and devices can be used to collect important data related to the products and the environment and Blockchain is used to ensure its integrity and availability.

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B. *Internet of Things (IoT)*

The Internet of things (IoT) is a system of interrelated computing devices, mechanical and digital machines provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

C. *Blockchain*

Blockchain technology is best known for its association with cryptocurrencies and many other potential applications. For example, it can be used to create secure supply chain management systems, track the ownership of digital assets, and even create decentralized social networks. Blockchain technology is also highly secure. Because of the cryptographic hashes used to link each block, it is almost impossible to tamper with the data in the blockchain without being detected. This technology provides security at a top priority. Each block in the blockchain contains a cryptographic hash of the previous block, along with a timestamp and transaction data.

III. METHODOLOGY

A. *IoT Module*

This module reads the values of temperature and humidity of the food product when shipped to till the delivery. This can be done by using ESP32 developer board and DHT 11 sensor, where these are connected using some jumper wires. This module is executed by the installation of Arduino where the libraries related to ESP32, ThingSpeak and DHT 11 needed to be downloaded. ESP32 board allows WIFI access where the values of the sensor can be updated to the ThingSpeak cloud platform. The code is written for DHT 11 sensor in the Arduino IDE software and then compiled and uploaded using port, later the in the serial monitor the server gets connected using WIFI username and password when we press reset button on ESP32 board which connects to the client side which is ThingSpeak platform where the sensor values are updated and stored. Once the server connects to the WIFI and the channel gets established, the port is no longer used and disconnected. Instead, a power supply like power bank or battery is connected to the module which results in wireless communication. The API key and channel ID in the ThingSpeak is used to retrieve sensor values. The user can track the order by browsing the repl.it webpage in which the sensor values are exported from ThingSpeak, the values get updated each 15 seconds into the webpage. Through IFTTT in connection with ThingSpeak, applet is created to ensure that the admin gets alert VoIP calls and pop-up notifications when there is a drop or sudden rise in sensor values which may affect the quality of the product.

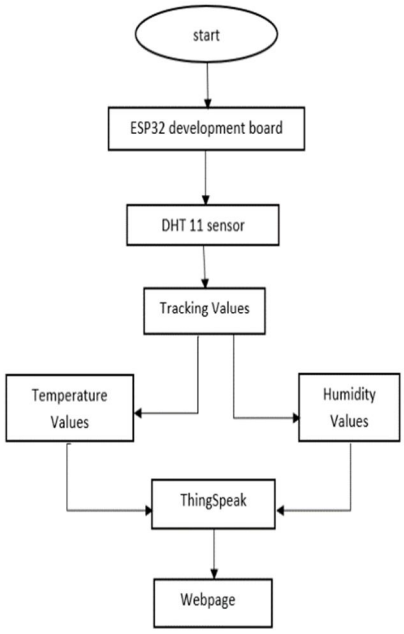


Fig 1: IoT module Flowchart

B. Blockchain and QR Code Generation

Blockchain technology is also used to secure transactions between peers. So, a crypto currency gateway is created for our website to safeguard transactions when the user pays for the order using Bitcoins. This module is implemented using a third-party platform named ecommerce Bitcoin wallet which is an Ethereum wallet, it is implemented by given the plugin of the wallet to the WordPress. To store the transactions details in the backend, an API is used by giving the API key or by using MetaMask. Each transaction detail gets stored here for viewing or to verify in future. This gateway is used for the customers who opt for the payment using Bitcoins. This wallet involves in price changing from price to Bitcoins. The customer needs to add the Bitcoin and give hash value to do the transaction. For this process we need to create a hash value to help user in paying easily. This module also involves in generation of QR code of the particular order that is placed after selection of payment mode. QR Code Generation is done using a pure Swift translation of the Project Nayuki QR code generator library. Also, NEM Blockchain is the technology used to import all the libraries and packages needed to generate an encrypted QR code. The QR plugin of NEM blockchain is plugged into the WordPress and hence the swift code of QR code generation is written and uploaded. This results in an efficient encoding and therefore a less-dense QR code. This module also helps in finding counterfeit products by authenticating using QR code. Authentication can be done by decrypting the encrypted QR code which can only be done by the delivery agent as they will have the decrypted scanner installed in their device.

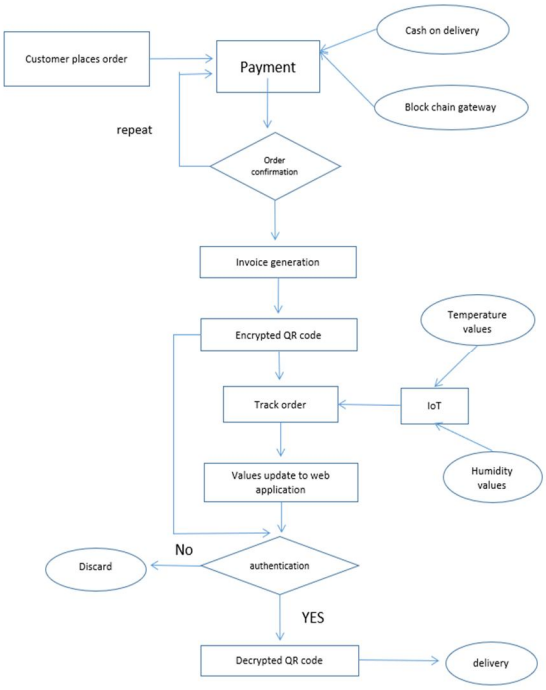


Fig 2 : Data Flowchart of Proposed System

C. Report Analysis

To create a user web interface, we used WordPress which is created by using “pro-free host” website in which a unique link was generated for our website by the help of domain where this link can be used by the user everywhere to meet their needs. Then Astra was the template used inside the WordPress to style our website. The domain name where our website is created is Unaux, in which we chosen our frozzy name as our respective domain. Website includes home page where the details of our process is mentioned clear and the user can view all the food products with some offers and discounts and can also contact us using contact page and there is a tracking page to track the order ordered by the user. To place an order firstly the user needs to create an account and can select the item which in further gets added to the cart. Checking out from cart forwards to the checkout page where the delivery details of the customer should to be given. The user can also select his availability date and time to pick his order. And then proceeds to the payment page where the user can select payment method like cash on delivery, crypto currency gateway and also Paytm gateway which leads to the placing of order.

Later the QR code is generated indicating the order is confirmed along with the order delivery time and date. The customer gets notified with a pop-up notification from the browser when there is a drop or sudden rise in sensor values to verify the quality of his product. The user can track the order by browsing the repl.it webpage in which the sensor values are exported from ThingSpeak, the values get updated each 15 seconds into the webpage. This module also includes report analysis of the customer logins, products, availability of stock, range of products sold in a range of scale i.e., in an hour, in a month, and also the highest sold product. All the report can be viewed in the admin side login and can be analyzed only by the admin.

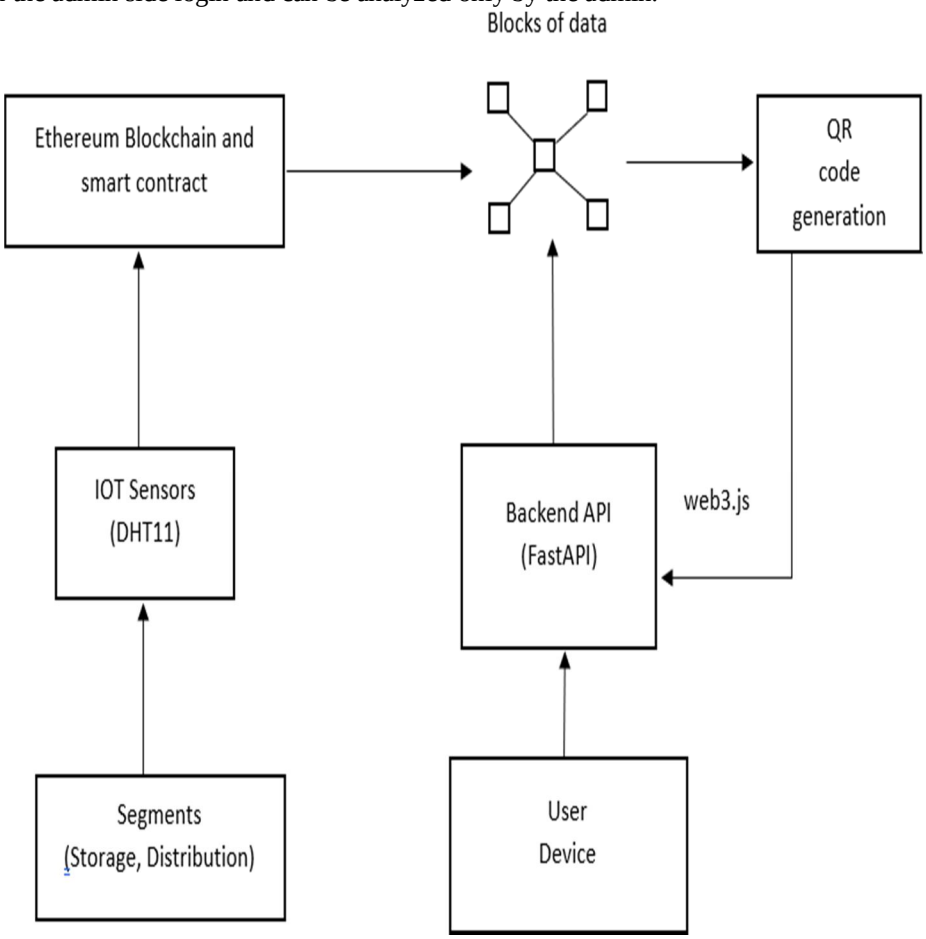


Fig3 : Architecture of Proposed System

IV. IMPLEMENTATION DETAILS

A. *WordPress*

The WordPress is used to create user's own website by providing different templates of user choice. The user can use plugins for the activation of the website and hence can activate or deactivate the plugins whenever needed. The user also has the ability to store the data in APIs rather than storing in the system database in WordPress.

B. *ThingSpeak*

ThingSpeak platform is a MathWorks cloud platform of IoT, which stores and views the values generated by the sensor continuously in cloud, within the user specified time either each 15 seconds or one minute. It represents the values in a graphical representation, gauge, numeric display and in many other widgets. This platform also shows the channel location of the sensor.

C. *IFTTT*

IFTTT platform helps to create applets to undergo the HTTP requests when a particular event occurred then request to that event takes place. Like in our project, when the threshold value crosses then an alert VoIP call and pop-up notification is received by the admin by conveying that the sensor value has crossed the threshold value that is marked in ThingSpeak platform.

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V. RESULT

A. Report Analysis Outputs

The below graphs represents the total analysis of the website from when it was created till date in different aspects.

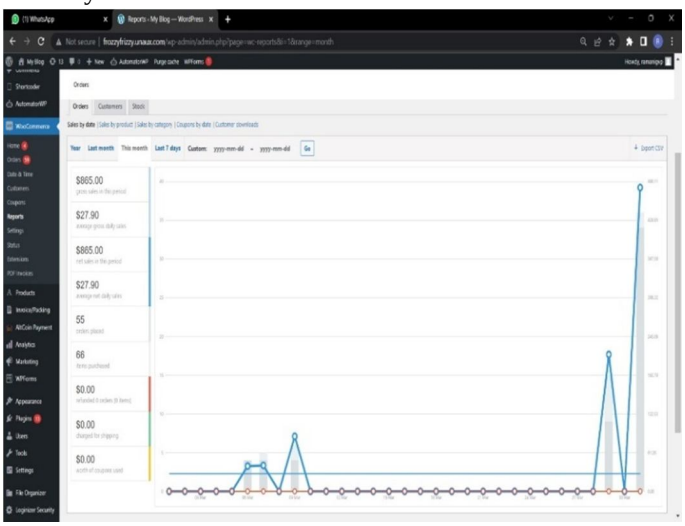


Fig 4 : March Month Report

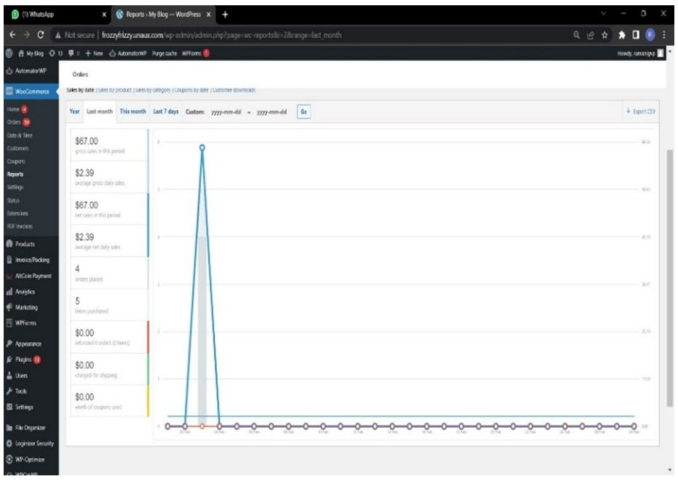


Fig 5 : February Month Report

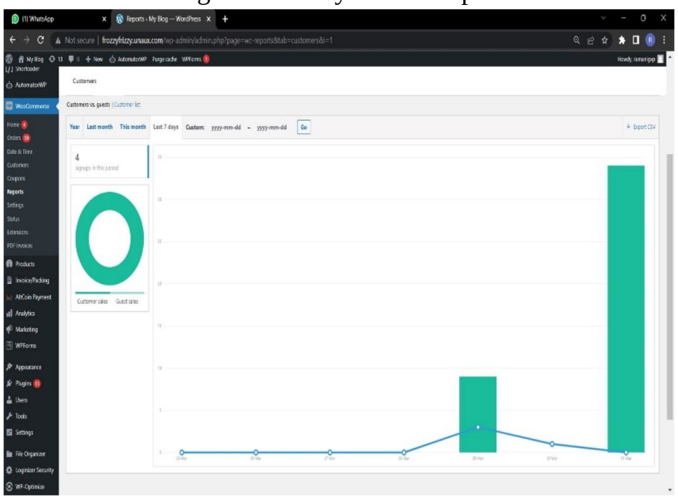


Fig 6 : Customer Sign-Up Report

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VI. EXECUTION

Website link - http://frozzyfrizzy.unaux.com

The above link is given as input for the user and the below Fig 7 is the output produced while authenticating the QR code generated when order is placed.

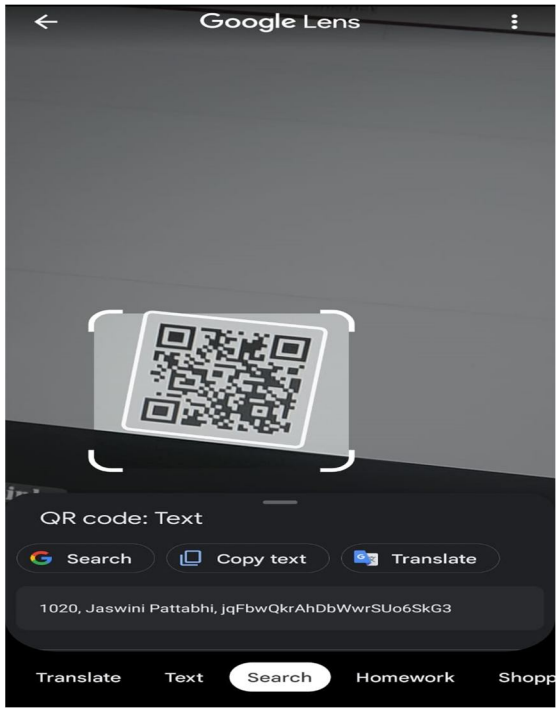


Fig 7 : Output – QR Code Authentication

VII. CONCLUSION

This system helps the industries in maintaining the QOS (Quality of Service) i.e., continuous monitoring of frozen foods gives the information of the condition of food at different levels which in order tells about the best services that provided by the industries which helps to the growth of industries. It uses sensors to get humidity and temperature levels information of the frozen food products and also blockchain Ethereum wallet to do online payments. The project came in comfortable which a worthy elucidation for maintaining the frozen food products in industries. The proposed system is an attempt to improve current damage avoidance in industrial areas.

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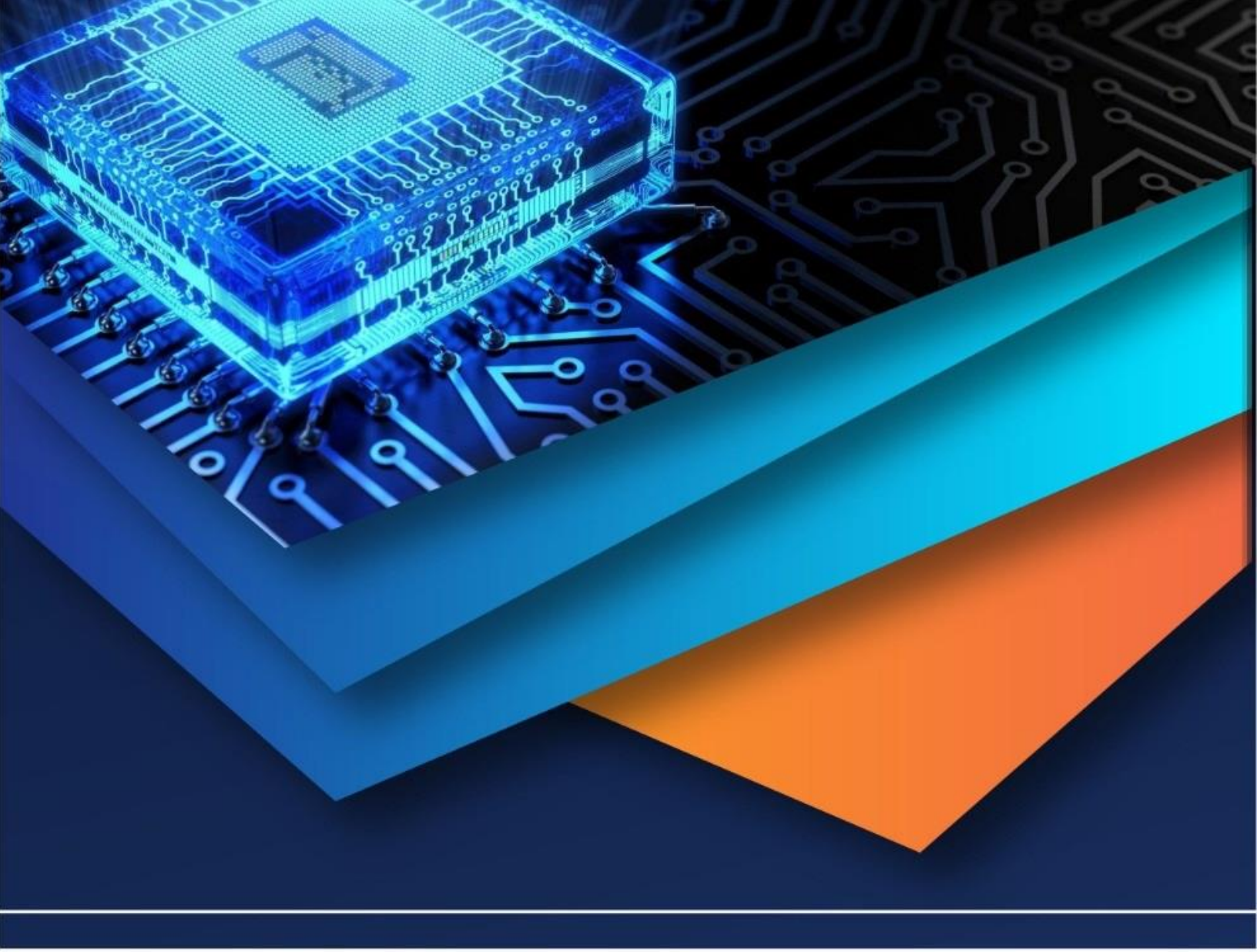
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