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An Efficient QR Methodology for Authentication of Reviews in Hospitality Sector

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Abstract: ***Consumer-created reviews of services are a critical driver of everyday decision-making. A service that has a higher average review or rating usually gets picked against a similar service with less favourable reviews. Customer feedbacks are useful for restaurants in order for them to recognize their strengths and weaknesses, and therefore generate ideas to enhance their services. Social media applications already provide us with an option of sharing our reviews which helps a new visitor to know the place in advance, but it is really hard to get a holistic view of the restaurant mainly due to the fact that almost anyone can submit a review regardless of whether they have actually visited the restaurant or not. Some mischievous people deliberately put-up misleading reviews about a particular restaurant due to which other people get a bad image of that restaurant, thus bringing down the business. This paper aims to address all these concerns specifically. The objective was to build an interface that would prevent malicious users uploading deceptive reviews about a restaurant. Two techniques namely Bill Number Concept and QR Code Concept were proposed to build the required interface. Sentiment Analysis was then used to convert these reviews into ratings. The interface created using the mentioned techniques enabled only verified users to submit their reviews thereby successfully preventing malicious users from submitting a review.***

Keywords: feedback, reviews, bill number, QR code, sentiment analysis

I. INTRODUCTION

Feedback from customers is extremely important to firms because it makes them aware of the areas where they need to improve, and therefore generate ideas to improve their services. The proliferation of a wide variety of communication media has provided customers the potential to write down and express their experiences about the products and services availed.

Due to modern lifestyle, youth find it easy to grab easily available foods rather than spending time on making one. The business of restaurants is flourishing due to the increasing demand. Day by day new outlets appear in the market and thus competitors keep on increasing. In the race of becoming the best everyone is making ways out to degrade the position of the competitor. Being aware of the fact that reviews about a particular venue are submitted without any valid proofs, people try to bring down the business of the competitor by publishing fake reviews about his work. Dependency on social media makes common man believe the deceptive reviews and creates a degraded image of the place in advance and thereby preventing one from visiting the restaurant in near future. This way of misleading people by using social media platform is harmful for the restaurant business and thus humiliates their reputation. The research work for this problem is related to limiting malicious user access and using different techniques to extract relevant features and information from text, while at the same time also making sure that false reviews are prevented.

II. LITERATURE SURVEY

The Location Based Social Networks (LBSNs) Application Programming Interfaces (API's) are used to get the location of a place from where a user is using LBSN such as, Foursquare. LBSN provides suggestions to users based on their check-in interest. But this disclosure of information has adverse effect on security of LBSN users. Malicious users over the LBSNs are detected using Machine Learning approaches such as supervised Machine Learning. The user accounts are verified based on their profiles and respective check-ins. Foursquare social network dataset of New York and Tokyo is used. [1]

Due to the importance of systems security, a model based on Host IDS is created that detects known attacks on smart devices by Artificial Neural Networks (ANNs). Moreover, Back Propagation (BP) learning algorithm is used to train the neural network in order to recognize the patterns of intrusions. ANNs is a soft computing approach to improve the capabilities of Intrusion Detection System (IDS). An intrusion detection system observes system activities, detects malicious actions, and generates reports for a system administrator. An intrusion detection system is an element in computer systems and smart devices security that detects malicious activities and responds to them. [2]

Lee and Vaithyanathan used a supervised machine learning approach for sentiment analysis. It is the first paper, that used this approach. Unigram and bigram used as features for classification, which classify movie reviews as negative or positive. Learning methods used are Naive Bayes, maximum entropy and support vector machines.

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Conclusion made was, machine learning techniques are quite good as comparison to the human baselines for opinion-based text classification and comparatively SVM preforms better. But supervised learning is sensitive to the quality and quantity of the training data and may fail when training data are not sufficient. [3]

Opinion spam, defined by Ott et. al. [4] as "inappropriate or fraudulent reviews", has been examined by numerous researchers. Most approaches used to descry deceptive opinion spam, or fake reviews, have analysed the language used in the review's text.

Text mining is deployed to examine customer reviews and then automatically allocate a collective restaurant star rating based on five fixed aspects: ambiance, cost, food, hygiene, and service. The application offers a web and mobile crowd sourcing platform where users share dining experiences and get perceptions about the strengths and weaknesses of a restaurant through user contributed responses. Text reviews are tokenized into sentences. Noun-adjective pairs are mined from each sentence and are associated to features based on the container of associated words fed into the system. An inclusive restaurant star rating is computed based on the individual aspect rating. The more feedbacks are added the more reflective the sentiment score to the restaurants' performance. [5]

Soft computing undergoes with uncertainty, partial truth to gain robustness and low-cost solution. Intrusion detection system is a device or software application that monitors a network or system from unwanted activities. If the system detects any malware, it reports to the administrator using security information. To develop efficient security methods, many researchers used fuzzy logic, neural network, machine learning, support vector machines, evolutionary computation, and probabilistic reasoning techniques. [6]

In their paper, Prakash et. al. proposed three new features to classify real-world Amazon product reviews as fake such as average break between reviews on same category products, standard deviation of number of reviews written per day and deviation from average rating. Moreover, they also proposed new feature of preventing the fake reviews using device detection, bot detection, and sending review writing link to the registered email-id. [7]

III.CLASSIFICATION OF ALGORITHMS

A. *Text Mining*

It encompasses varied techniques to dissect and digest information from textual data including information retrieval, data mining, natural language processing and machine learning. Customer reviews served as corpus to understand the general perception of the customer towards the products and services. A study by Jack and Tsai relied on term frequency (ngram) to aggregate top attributes and issues related with devices like laptops and tablets expressed in customer reviews to make sure what the customers preferred about the products. [8]

B. *Sentiment Analysis*

Sentiment analysis, also known as opinion mining is a natural language processing technique used to determine whether data is positive, negative or neutral. Sentiment analysis is frequently performed on textual data to help businesses track brand and product sentiment in client feedback, and understand client requirements. Sentiment analysis models emphasize on polarity (positive, negative, neutral) but also on feelings and emotions (angry, happy, sad, etc.), urgency (critical, not critical) and even intentions (interested v. not interested).

1) *Fine-grained Sentiment Analysis:* If divergence precision is important to an organisation, they might consider expanding their categories to include:

a) Veritably Negative
b) Negative
c) Neutral
d) Positive
e) Veritably positive

This is generally appertained to as fine-grained sentiment analysis, and could be used to construe 5-star ratings in a review.

2) *Emotion Detection:* This type of sentiment analysis aims to distinguish emotions, like contentment, frustration, rage, dejection, and so on. Many such detection systems use lexicons (i.e., lists of words and the emotions they convey) or complex machine learning algorithms. One of the shortcomings of using lexicons is that people show emotions in varied ways. Some words that typically express anger, like kill (e.g., your customer support is killing me) might also express happiness (e.g., you are killing it).
3) *Aspect-based Sentiment Analysis:* When analyzing sentiments of texts, we want to know which particular feature or aspect people are stating in a positive, neutral, or negative way. That's where aspect-based sentiment analysis can aid.

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4) *Multilingual Sentiment Analysis:* Multilingual sentiment analysis can be tough as it involves a lot of pre-processing and resources. Many of these resources are accessible online (e.g., sentiment lexicons), while others need to be formed (e.g., noise detection algorithms or translated corpora).

IV. PROPOSED METHOD

The objective of the project is to build an interface that would detect malicious users uploading deceptive reviews about a restaurant. Fake reviews compel a visitor to have a bad image of the restaurant in advance. In this project we propose two techniques namely Bill Number Concept and QR Code Concept to build the required interface.

By comparing the bill number provided to the user with the valid bill numbers in the existing database, unauthorized users are prevented from giving fake reviews. The concept of QR Code being used is dynamic as it creates a unique session for the user and changes the QR code automatically by implementing the concept of Web socket and thus no person can give a review unless and until he has actually been to the restaurant. Thus, the interface prevents a malicious user from degrading the image of the restaurant as no unauthorized user will be able to give a review. The interface enables only verified users to submit his/her reviews. Ratings are purely based on authenticated analysis.

A. Software Specification

A software requirements specification is a portrayal of a software system to be developed. It may include a set of cases that describes user interactions that the software must provide. The main points regarding the software specification are as under: interested v. not interested).

1) *Eclipse:* Eclipse is an integrated development environment (IDE) for evolving applications using the Java programming language. Using this IDE and the concept of java servlets, we are able to implement the bill number authentication method and thus develop an interface that will prevent malicious users from giving reviews about a particular restaurant. We have used the feature of dynamic web project in eclipse to implement our methodology.
2) *Servlet API (Application Program Interface):* The javax.servlet and javax.servlet.http packages signify interfaces and classes for Servlet API. The javax.servlet package encompasses many interfaces and classes that are used by the servlet or web container and are not specific to any protocol. The javax.servlet.http package comprises of interfaces and classes that are accountable for http requests only.
3) *HttpServlet Class:* The HttpServlet class covers the GenericServlet class and implements Serializable interface. It delivers http specific approaches such as doGet, doPostetc. There are numerous approaches in HttpServlet class. Some of them are as follows:

a) Protected void doGet(HttpServletRequest req, HttpServletResponse res)
b) Protected void doPost(HttpServletRequest req, HttpServletResponse res)

4) *Apache Tomcat:* It is an open-source web server and servlet container, created by the Apache Software Foundation. Tomcat employs many Java EE specifications including Java Server Pages (JSP), Java Servlet, Java EL, and WebSocket, and provides a “pure Java” HTTP web server environment for Java code to run in. Tomcat’s architecture comprises of a sequence of functional components that can be combined according to precise rules. The construction of each server installation (via these functional mechanisms) is described in the file server.xml, which is positioned in the /conf subdirectory of Tomcat’s installation folder.
5) *Web.Xml:* Web.xml outlines mapping among servlets and URL paths that handle requests with those paths. XML i.e., Extensible Markup Language defines set of rules for encoding document in a format that is readable by both as human and machine. The web.xml file provides configuration and deployment data for the Web components that include a Web application. The web.xml descriptor files signify the core of the java application. The web.xml file is situated in WEB-INF directory of web application.
6) *Oracle Database Express Edition (XE):* Oracle Database (commonly stated to as Oracle RDBMS or simply as Oracle) is a proprietary multi-model database management system marketed and produced by Oracle Corporation. It is a group of data treated as a unit. The purpose of a database is to store and retrieve related data/information. Oracle Database XE is a free-to-use entry-level version of Oracle Database accessible for Windows and Linux platforms. We are using Oracle Database 10g XE which is a free version of the world's most capable relational database.
7) *Web Socket:* Web Sockets are an alternative to HTTP communication in Web Application. They provide a long lived, bidirectional communication channel between server and client. Once established, the channel is kept open, providing a very fast connection with low latency and overhead. HTTP is a request/response protocol, the server returns some data when the client requests for it.

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With Web Sockets

a) The client and the server can communicate with each other simultaneously.
b) Minimal data overhead needs to be exchanged to send messages, which makes it a low latency communication.
c) The server can direct a message to the client without the client explicitly requesting something.
d) Web sockets are good for real-time and prolonged communication.

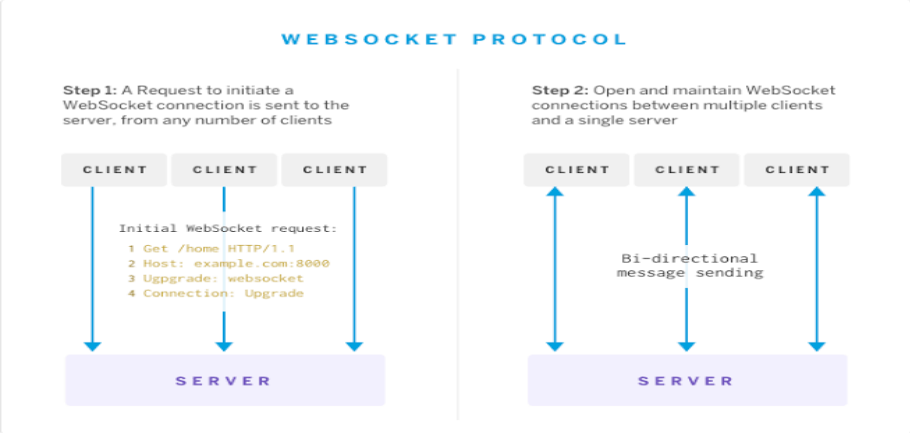

Fig 1. Web Socket Protocol

8) *QR (Quick Response) Code:* A QR Code works in the similar way as a barcode at the supermarket. It is machine scannable image that can promptly be read using a Smartphone camera. Every QR code comprises of a various black squares and dots which characterize certain fragments of information. When a Smartphone scans this code, it decodes that information into something that can be easily understood by humans. Simply put, a QR code is an encoded segment of data. The QR code can have data in many forms like binary, numeric, alphanumeric or Kanji (Kanji is a form of Chinese characters that are used in the modern Japanese writing system).

Fig 2. QR Code

QR code scanning is one touch away for millions of people around the world that use a Smartphone every day. This makes QR code an enormously simple way to access stored data in an instant which makes them a faultless solution to conversion hungry marketers.

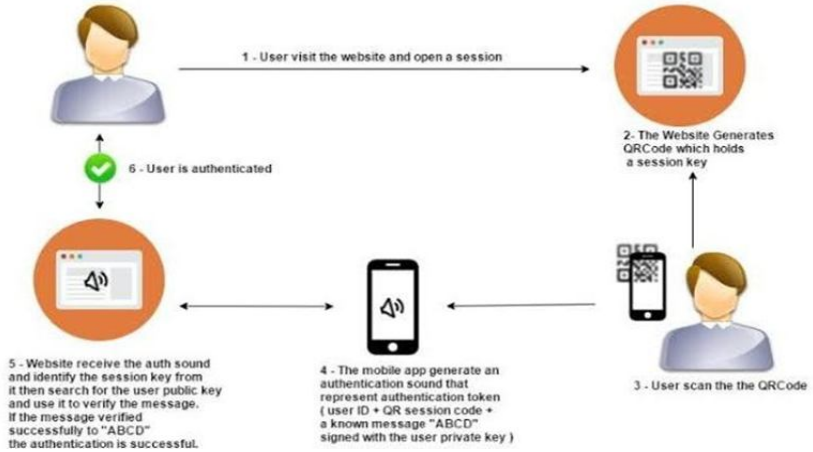

Fig 3. Normal Login Scenario

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9) *Sentiment Module:* It is a Node.js module which performs Sentiment Analysis on arbitrary blocks of input text using the AFINN-165-word list and Emoji Sentiment Ranking. AFINN is a series of words rated for valence with an integer between minus five (negative) and plus five (positive). Sentiment analysis is achieved by cross checking the string tokens (words, emojis) with the AFINN list and attaining their respective scores. Here the comparative score is determined as following:

$$comparative\ score = \frac{sum\ of\ tokens}{total\ number\ of\ tokens} \quad (1)$$

B. Working Model

1) *Bill Number Authentication Method:* To develop an authentication system for giving reviews about different restaurants, Bill number is used as an authenticator. The bill number which a customer is provided with as he visits some restaurant is a unique number and this number acts as a proof that a user has visited the place. An interface is created that will ask a user to provide a bill number as he enters the review. Currently a manual database has been created which contains some set of bill numbers. The bill number is compared with the existing stored valid bill numbers. If the bill number entered by the user is matched in the database already provided by the particular restaurant, only then the review is submitted. The review will not be submitted if the user fails to provide the valid bill number that already exists in the database. Hence his review will not get submitted and this prevents malicious activity of sharing reviews. Also, a user cannot submit a review more than once using the same bill number. Thus repetition of using the same bill number again and again will not result in submission of any review. Thus, the goal of giving deceptive reviews by a malicious user is avoided. The concept of using the bill number to create an authentication system is shown in Fig 4:

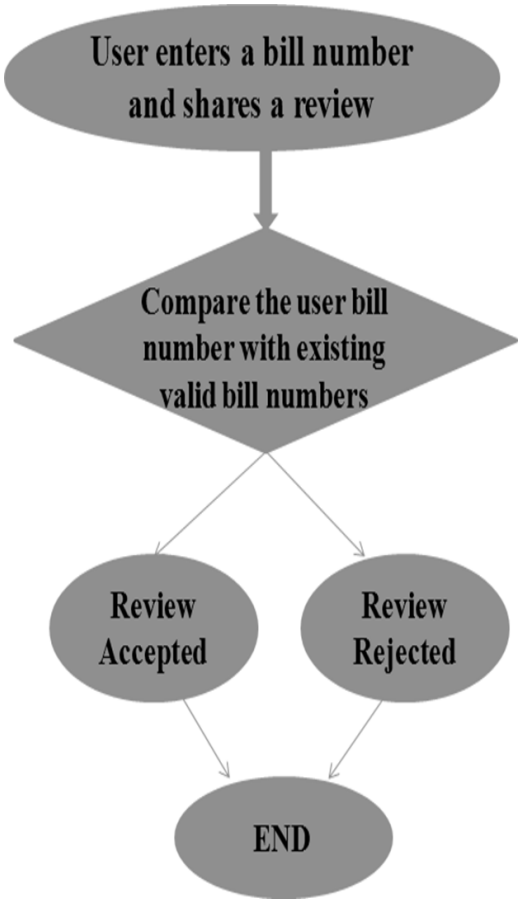

Fig 4. Concept of Bill Number Authentication Method

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2) *QR Code Authentication Method:* Web socket is used to carry out this implementation. It is a bidirectional communication channel between the client and the server. Both the client and server listen on a single port. Any change in the server is reflected in all the clients. The QR code concept is an advanced concept and helps in achieving better view about the project. Reviews are converted into star ratings using Sentiment Analysis. Each word of the review submitted by the user is compared with the already existing words in AFINN-165 Word List. These words are assigned the integer values from -5 to 5 according to the used word list.

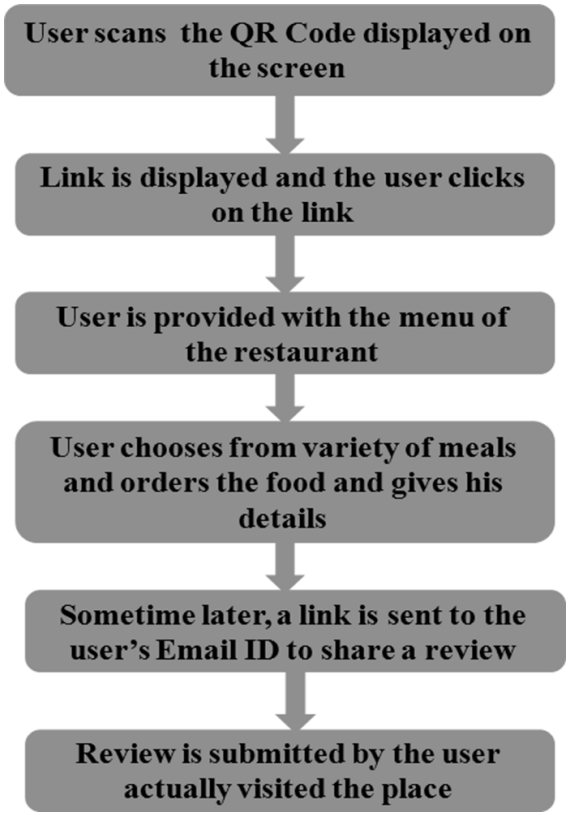

Figure 5. Concept of QR code Authentication Method

V. EXPERIMENTAL RESULTS AND COMPARISON

Since the ongoing restaurant business is flourishing at a high scale, people are spending a lot of money in enjoying the delicacies from these fancy restaurants. To save the time in selecting a good restaurant, many previously built applications help the visitor to know about the restaurant's food in advance based on the reviews provided by the people who have already visited the venue. Because of the competition in business, hundreds and thousands of restaurants are available in a particular city and competitors are always snooping to bring down the image of other restaurants. These previously built applications allow anyone to share a review even if the person has not visited the restaurant, thus allowing them to publish fake reviews and misguide people. This further degrades the reputation of restaurants. We have used the interface developed using the concept of bill number comparison as discussed above which overcomes the existing shortcomings. This interface enables a valid user to share a review and thereby prevents a malicious user. Thus, the interface developed is reliable than the already existing interfaces. Now, to prevent malicious activity in a more advanced way, i.e., without using the bill number as primary proof for validation of the user giving a review, we have developed an interface using the concept of QR code. The interface developed (as already discussed) will automatically be the proof of a user visiting the place. Also, a same QR code can't be re-scanned again and again, thus making the system more secure from malicious activity. Also, implementation of the concept of QR code will further reduce the need of human resources in restaurants. Moreover, in restaurants having self-service, a customer will not have to wait in the long queues to order food rather he can order the food by scanning the QR code available himself.

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Table I. Comparison between Methods

Existing Methods	Bill Number Authentication Method	QR Code Authentication Method
Review submitted by anyone	Review submitted by valid users	Review submitted by valid users
No proof required to submit a review	Bill number of the user acts as a proof to submit a review	Review submitted by the user who has scanned the QR code
Not reliable	Reliable	Reliable and Dynamic
No reduction of human resources in restaurants	No reduction of human resources in restaurants	Reduction of human resources in restaurants
Common method	Modified method	Advanced and modern method

VI. CONCLUSION AND FUTURE SCOPE

A. Conclusion

We have developed an interface that helps in preventing malicious users from giving fake review about restaurants. The reviews being displayed are uploaded by a valid user who has actually been to the restaurant. This gives other people the surety that the reviews are authenticated and uploaded by a valid user.

Also, QR code implementation being advanced than the Bill number implementation, is more reliable. The concept of QR code introduced is completely new for restaurants and very helpful as it reduces workload for the restaurants. Also, in restaurants having self-service and people being in constant long lines, QR code is very efficient since the user can directly scan it and select his favorite food and order it. This also helps in saving a human resource and saves time.

B. Future Scope

Implementing the concepts of Bill number and QR code, restaurants can get a tremendous boost in their business. Reviews would be reliable and more people would visit the restaurant depending upon the reviews given. In the near future it can be used for home delivery of food by simply scanning the QR code from the site, thereby saving time and making the process less hectic. Also, using a more diverse wordlist for performing Sentiment Analysis on the reviews will increase the overall efficiency and accuracy of the system. Furthermore, the current model is only optimized to work for restaurants, but it can also be modified and scaled up to work in other sectors.

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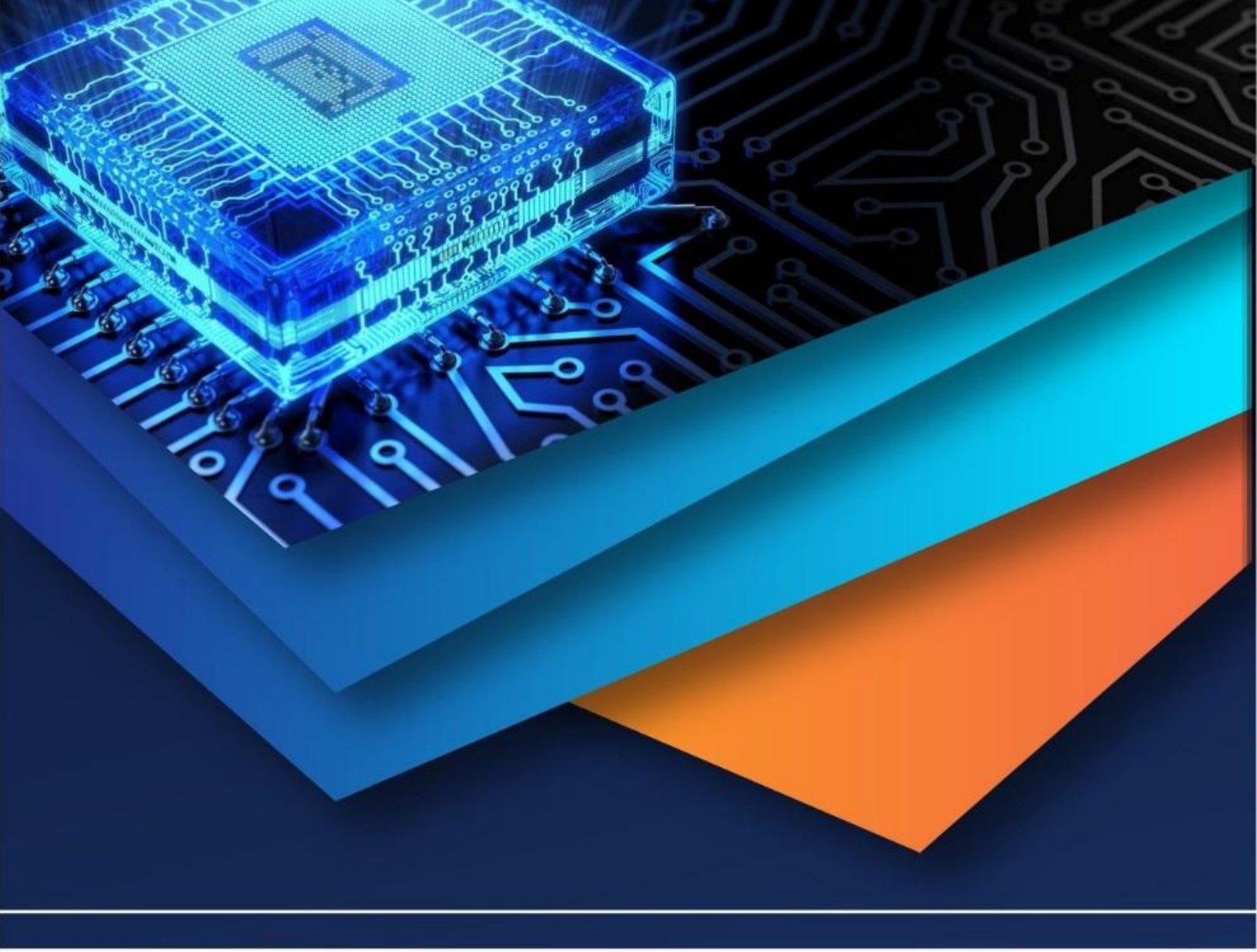

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