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Study of Vehicle Fare Detection using Geocoding with QR Code

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Abstract: ***An auto rickshaw / taxi is one of the chief modes of transport in India. A large number of people use these vehicles for their daily commute and every time they pay some fare because there is no check on the reading of meter. Auto rickshaw meter tampering in India has become quite common because the current meter calculates fare on the basis of the rotations of the wheel and this system can be easily tampered. Hence, it is necessary that we should have something that can cross check the reading of the meter and guide us the right fares. The system is developed using the latest technology QR code. In this system, scanners are used to capture the QR code which is tagged in each vehicle which contains relevant details of the driver and the vehicle. The distance is calculated using the geocoding algorithm and the speed detection algorithm. The payment is done through a payment gateway. We have included many additional features like emergency SOS call button, SMS system which regularly updates the customer on each ride on the vehicle for security purposes. 24/7 support and road side assistance can be initiated within the application.***

Index Terms: Vehicle Fare Detection, QR code, Geocoding, Speed Detection Algorithm

I. INTRODUCTION

In this vehicle fare detection, we focused on detecting the fare according to a vehicle. The approach of detecting the fare helps to avoid invalid payments and provide safe, secure, effective strong system in real world transport system. Recent trends in the market have shown an increase in the use of QR codes than can be scanned and read by camera in a smartphone. QR codes are easily readable barcodes that when scanned with a QR decoder (usually available on smartphones) can translate the code into a URL, a telephone number, a bit of text, or other data even using it for payment and transfer of money.

In this Android based application, both the driver and the customer can register and login using personal information. The driver or the vehicle owner can login to the application and enter the details resulting the generating of unique QR code which is encrypted using the algorithm. The unique QR code generated for the vehicle / driver can be scanned by the customer for the relevant information about the vehicle and the driver. The application also finds the distance travelled using *geocoding algorithm and the speed detection algorithm*. Hence the application helps to cross check the reading of the meter and guide us the right fares. The application integrates a *payment gateway* which is approved by the government hence enables an ease of transaction.

II. LITERATURE REVIEW

In this paper [1], the implementation of the proposed system consists of 3 stages. The first stage consists of extraction of the signal, which is integrated with the wheel for the core purpose of only counting the rotations. The second stage consist of the display and controlling sections, which contains the processing unit, display unit, controlling switches, GSM device, RFID reader and the RFID module. The third stage consist of web section which contains the database management system which is linked with the second stage over GSM. It mainly consists of 4 core portions. Distance measurement in this project is calculated using the equation according to the one full rotation of the wheel is as follows:

$$D=2*\pi*R*N$$

Where the symbols resemble, D= total distance covered, R= radius of the wheel, N= number of rotations. The second portion is the fare calculation which is calculated at the server side. It`s calculated using the distance travelled and the waiting time which can be taken from the Arduino. Third portion is the control switches consist of 5 control switches for the operation of the system. Hire on switch, Hire off switch, Payment switch, Balance check switch, Driver ID update switch, Offline payment switch. The fourth portion is the transaction where RFID cards are used with unique ID with a website for hosting the data values. The languages used for developing the website are PHP script, MySQL, CSS and HTML5. The corresponding fare amount will be deducted from the customers ID and added to the driver's ID through the website developed for the transaction.

Gaussian mixture model and blob detection methods has been used in paper [2] for creation of a unique algorithm for vehicle detection and tracking. This method was able to acquire 91% result using the above two methods. The Gaussian mixture model in

general uses to differentiate the foreground from the background images using frames. A binary computation is used to identify the foreground images. Gaussian Mixture Model (GMM) is a function to measure parametric probability density represented as Gaussian component identities. A threshold values is calculated to define the similarities of the objective and the quality that has been learned by the GMM. Blob detection is a technique used to track the movements of an object in frame. A blob is a group pixel identifies as an object.

The mechanism finds the bobs position in every image frame. Each and every position has a subtle variation in real world scenario. One light or color is selected then blob might only be few pixels. The system finds new blobs in the new image and make meaningful connections between the seemingly different blobs present in each frame. Blob detection uses contrast in a binary image to compute a detected region, its centroid, and the area of the blob.

Each class in the blob is marked as candidate blob (CB). The CB is checked for size and is removed from the algorithm to reduce false detection. When the vehicle passes through a current frame and these are compared using the k-means clustering. The moving vehicle is counted upon passing of the base line. GMMs are trained for 150 images, with typical frame rate. Pixel manipulation techniques are carried out to de-noise and filter the binary image. Blob analysis identifies potential objects and box around them. Count box is the specific region where tracking is carried out. The region is built so to reduce the redundancy in computation and higher performance. Tracking is done by searching for the centroids in the small rectangular region. If it's not found then it is added to new found track array. Automatic vehicle counting system counts less numbers of vehicle due to the real-life congestion and heavy traffic flow.

In paper [3] novel taxi ride sharing models for smart city have been discussed. Ride sharing taxies are in high demand and also, they are in tested in various cities that have shown interest in them. This paper discusses the real time operation of this ride sharing system. The request enabled ride sharing allows the request to be send from the smartphones and schedule proper taxi pickup. This allows constant gain for both rider and driver alike. Passenger will not have to pay more when compared with other counterparts as they can be cheated by the driver by charging them more. The cloud is used to first find the riders taxi quickly for a request using the algorithm. A ride request generator is developed in terms of the stochastic process modeling. The real time taxi sharing problems is defined using constants such as Data model, constraints. The data model consists of ride request which allows a full-grown set of data equations using ride request Q and time stamp Q.t. Q.o is of the orgin point and Q.d is the destination point. Q.pw is the time window that the time interval between rider pickup.

The next model is the taxi status where a set of constraints are being used which is represented by V. it is also an instantaneous state of the taxi. V.id is the unique identification of the taxi. V.t is the time stamp associated with the status. V.l is the geographical location, V.s is the current schedule of the V. from the equation it is clear that the status of the vehicle will be dynamic i.e it changes over time. In order to find an optimal solution to a multiple ride sharing request an objective function is been used. In this they have discussed based on the ride sharing request that should satisfy the condition that there should be minimum increase in the travel distance. The architecture of the system consists of different levels. The cloud is tasked with monitoring and running of multiple servers.

The taxi driver and the rider will be using the same smart phone application as it is easy to provide them with different interfaces. The taxi automatically reports its location to the cloud system via the mobile application. The taxi will establish connection. A rider will get on and off the taxi is all recorded to the cloud system by the mobile application. The rider submits a new ride request to the communication server. Here the first come first serve principle is being used hence the need for a queue also arises. For each request the server sends it to the indexing server to search for the candidate taxis. A candidate taxi will receive the request and accept it. The communication server then sends the ride request and the received candidate taxi will set the scheduling based on the scheduling algorithm. Each rider will be asked if willing to accept new riders. If they are willing to accept then a new price figure with the deducted amount will be shown to the rider. The system automatically saves the data's hence it will be able to predict if the customer will accept or reject the request in a particular route. This enable for a smooth riding for the passenger as he/she is not bothered with requests. The taxi searching is inducted by using the index of taxis already present in the cloud system. The road networks will be divided into grids and these grids will be able to identify the candidate taxis within that grid. This system effectively selects out the taxis that are far away from the point and that allows for faster travel time. The system is validated with the GPS system hence the location of each and every taxis in the grid was accurate. The system was able to calculate the fare for each rider without affecting the driver profit.

On road vehicle detection aims at developing driver assistance systems such as smart alerts and possible collision with another vehicle. In paper [4] robust and reliable vehicle detection is a critical step. This system presents a camera mounted on a vehicle rather than at some traffic stops in order to better detect the vehicle and its environment. The most common approach is active

sensor based, radar based, laser based and acoustic based. These approaches are for detecting vehicle. An active based is called because they try to detect the object by measuring the distance the signal travelled until reflecting. These active sensors when moving in one direction can cause inference and low spatial resolution allows for the active passers to be updated or used for only smaller groups. Passive sensors are the optical ones such as the camera. One of the advantages of passive sensors are the inexpensive cost. Where we can place multiple cameras at the vehicle and can enable 360-degree vision. There are two types of vehicle detection techniques discussed and they are HG where the location of the vehicle hypothesized. HV where tests are performed in order confirm the presence of vehicle in the image. The objective of HG is to find the candidate vehicle in the image as quickly as possible for this we employ techniques such as Knowledge based, stereo based and motion based. Inverse Perspective Mapping is been used in the stereo based. In knowledge-based method a prior method is been employed. Optical flow detection in motion-based method. Symmetry, color, shadow and corners are some of the objectives the method in knowledge based try to implement. The term Inverse Perspective Mapping doesn't correlate to any actual inversion of perspective mapping. It denotes an additional constraint that all inversely mapped points lie on the horizontal plane. The polar histogram was calculated by scanning different image and the number over the threshold is counted. HV methods uses the input from the HG to perform various tests like template based and appearance based. In template-based method a predefined patterns and points are calculated between the image and the template. Appearance method is calculated as two class classification method. Features of neural networks and extraction features are used in the appearance-based method. Detecting vehicles in different regions needs different methods hence all of these methods should be integrated in order to find the vehicle in the road. Vision based vehicle detection should be modular and reconfigurable. According to different range of operation different methods can be incorporated. The enhancement of sensor capabilities and performance. There needs to be several improvements but the system itself is needed to have a great amount of detection through the different vision and sensor configuration fitted into the vehicle.

III. SOFTWARE REQUIREMENTS

For this project we have used the following software for the development of the application that is available to the user.

A. Android Studio
B. Google Chrome
C. Microsoft Word
D. Notepad

We have made use of the following languages for the development of this application.

1) PHP
2) Java
3) Android

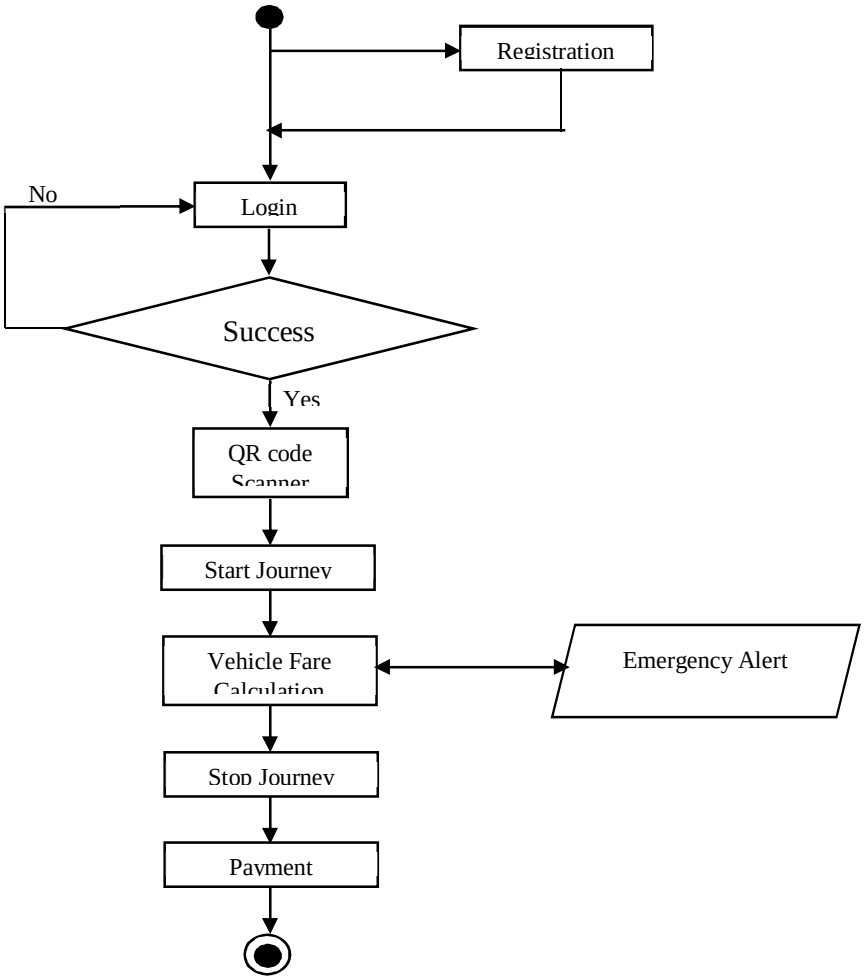
IV. PROPOSED SYSTEM

An idea based on the development of an Android based vehicle fare detection system which can accurately measure the distance and also can give solution to the fare payment difficulties using a payment gateway, all accumulated in a single system has been proposed in this paper. Our main goal is to digitize the current system in such a way which would be of convenience both for the driver and the passenger.

A. Advantages

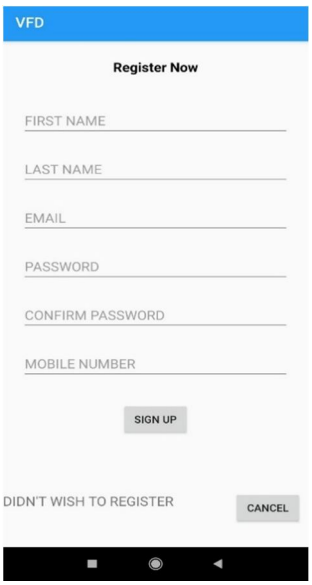
1) *No Meter Tampering:* Here this application will ensure that no one can tamper the meters. In conventional methods the analogue meters can be easily tampered.
2) *Fare Transparency:* This system will ensure that the user will pay the right fares after taking their rides, the drivers can't vary the fare on peak time.
3) *Security:* Our proposed system has the utility of sending of emergency messages/calls with the driver details during an adverse situations the system guarantee's high degree of security.
4) *Online Payment Gateway:* The customer can pay via online after taking their rides, this is integrated with RAZORPAY which ensures safe and seamless payment.payment

B. System Architecture

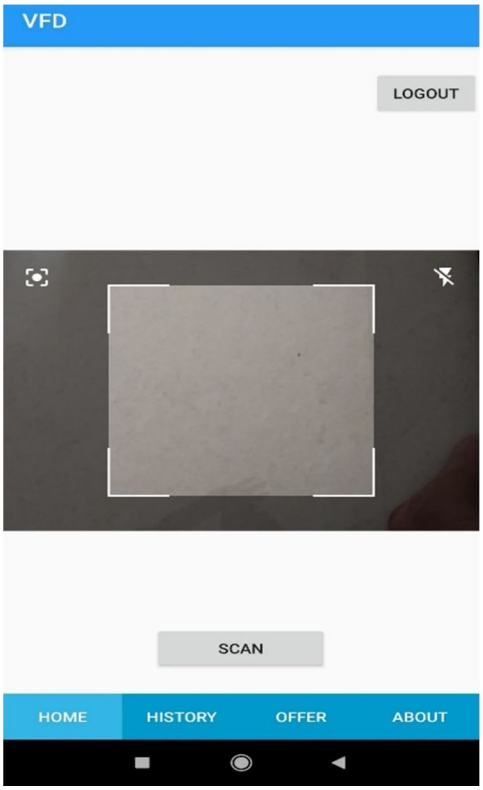


C. Design Phase Customer

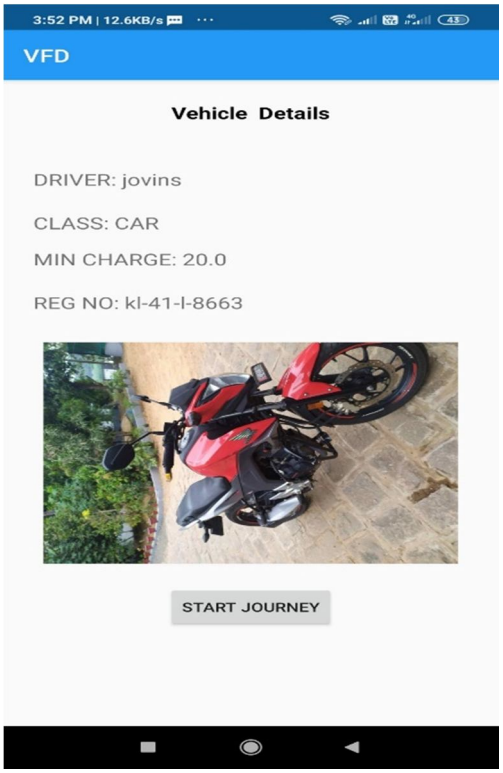
1) Customer Registration: The new customer needs to register here in order to be a login as a valid end user, after registering successfully customer can login.



2) *Customer Homepage:* A valid user after a successful login comes to this homepage. The homepage consists of a QR code scanner which can be enabled by clicking the SCAN button underneath.



After scanning a valid QR code the homepage redirect to this page where the relevant details about the driver is shown. The vehicle fare detection can be checked by starting the ride by clicking the SRART JOUNEY button.



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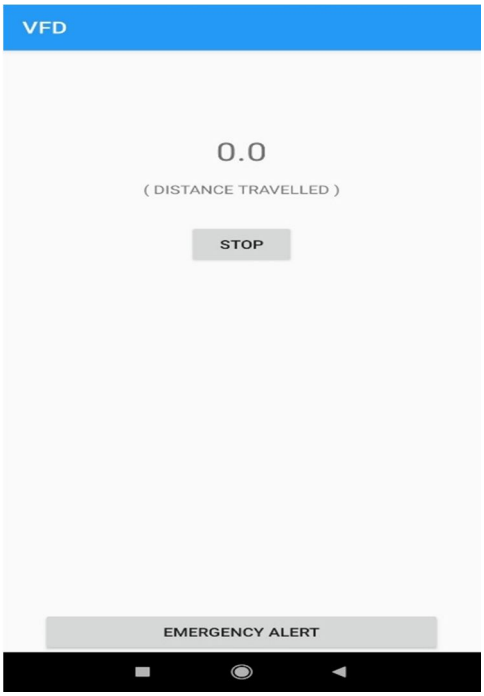
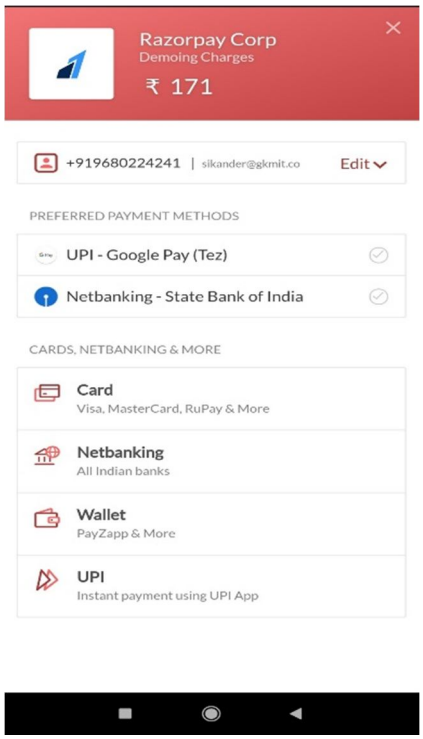
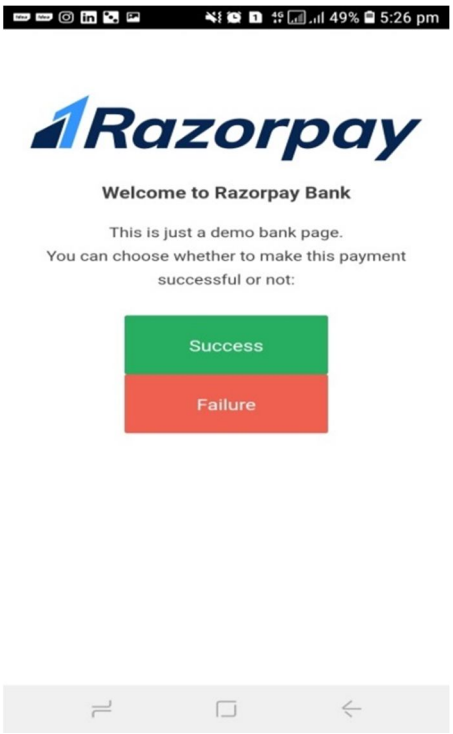
3) *Fare Calculation Page:* Here the calculation according to the speed detection algorithm and geocoding algorithms is performed.



In case of any emergency there is a dedicated feature used that directly redirect the phone app just by clicking the EMERGENCY ALERT button at the button.

4) *Payment Gateway Page:* While clicking the PAY NOW button in the previous page the app redirects to the payment gateway page called RAZORPAY. The payment can be done via different option as well as manually. If the payment is a success then the amount will be credited to the driver.





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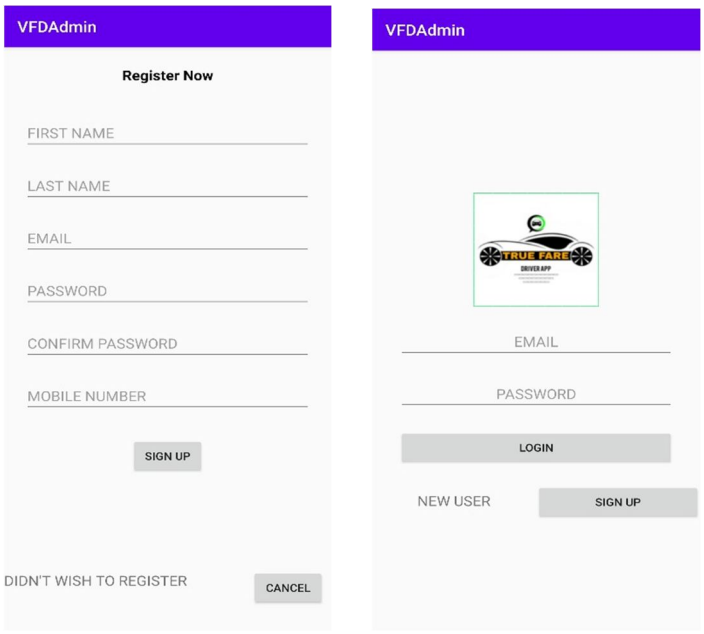
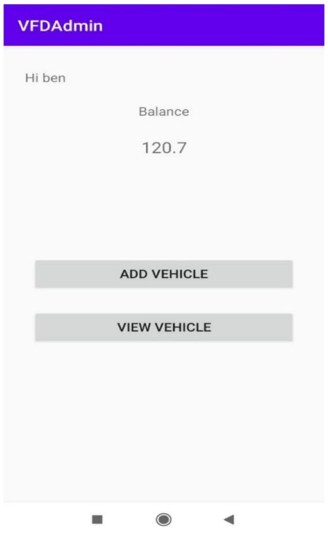
D. Driver App

1) *Driver Registration and Login:* There is a dedicated application for the driver. After a valid registration the driver can login to the application.



2) *Driver Homepage:* After a valid login process the driver comes to the homepage where he/she can ADD or VIEW a vehicle. The amount that is credited to the driver will be shown in the top as the balance amount. Whenever a customer pays the amount it will be added to this balance.



V. CONCLUSION

The modern technology influence in today's world has increased and the study we have conducted shows that meter tampering is common in conventional methods and the customers faces numerous difficulties, so we developed an Android based vehicle fare detection system which can accurately measure the distance and also can give solution to the fare payment difficulties using. We have integrated a payment gateway into our application. Geocoding helps to keep tracks of the customer's journey along with current latitudes and longitudes. The application was able to over come the problems of the existing system such as meter tampering and manipulation. Giving importance to the security of the passengers was one of our main criteria while designing the application hence, a faster dialer of emergency alerts was built into the application. The application is a new idea which is developed from the problems of the existing system. The study implemented shows a user-friendly application that is suitable for both driver and passenger alike.

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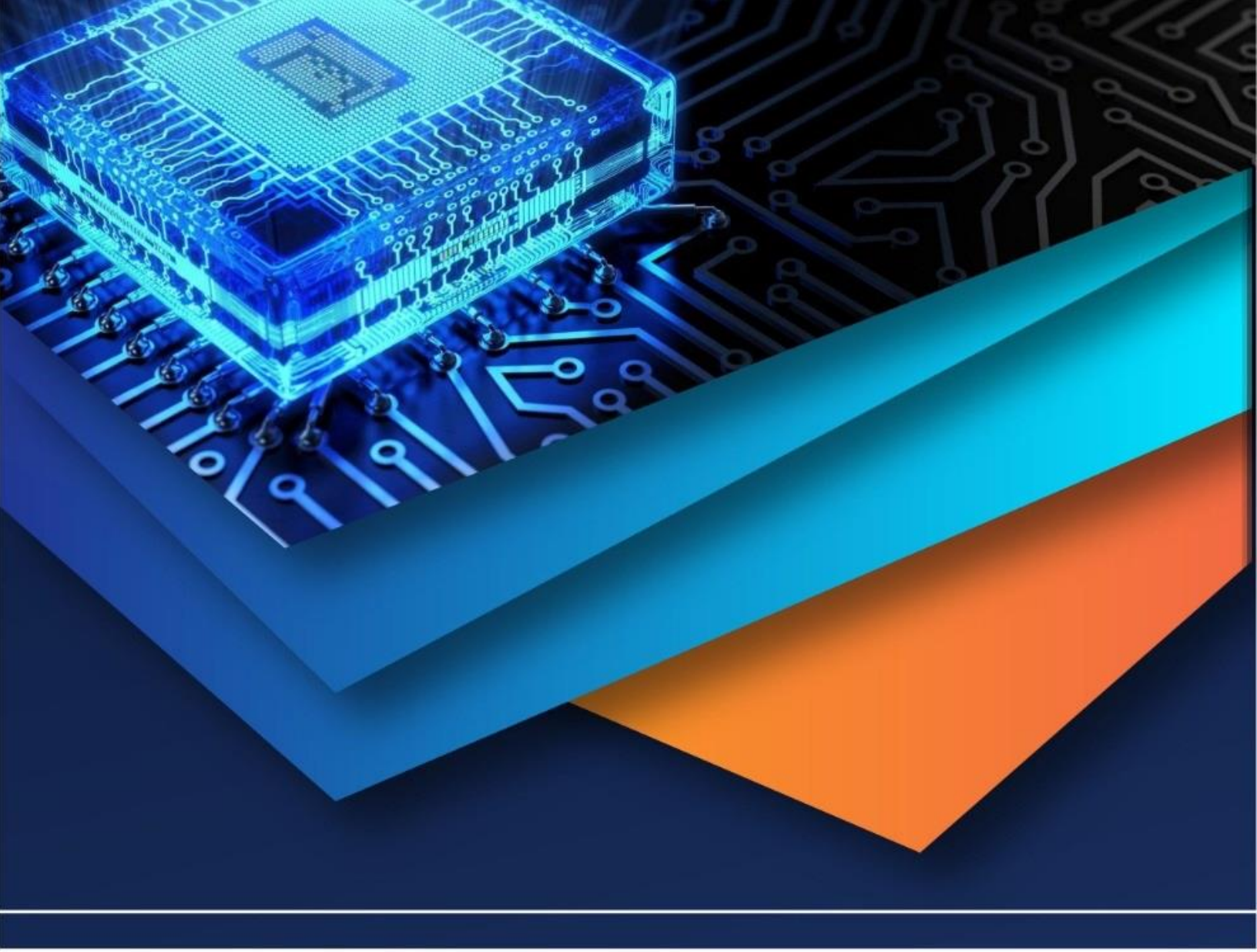

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