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Prediction of Bus Arrival Time Using Global Positioning System (GPS)

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Abstract: Buses are the most economical form of public transport available. Bus services are ubiquitous in cities and have proved themselves to be an excellent means of transport; however, the only problem associated with buses is that no one knows the exact arrival time of the bus at a particular stop. Instead of waiting for buses, passengers would prefer knowing the arrival time of bus at their desired bus stop so that they can plan their journey accordingly. Thus, for the convenience of commuters, this application is proposed, which continuously tracks the locations of the bus using GPS, and then calculates the approximate time required by the bus to reach the stop including the traffic analysis and various other parameters.

I. INTRODUCTION

Among all public transportation services available, bus service is the major transportation used by public. However, bus transportation service has very poor transportation information system nowadays. Bus user do not know the exactly arrival time for a bus, but only know the scheduled arrival time. Compare to train or flight transportation system, bus transportation service does not have a proper system to track all buses position and the actual arrival time in every bus stops. These problems occur because current bus service system did not apply real time tracking technology to track on each bus on the road and also lack of a platform to update latest bus traffic information to bus users. In order to solve these problems and enhance current bus service system, real time bus tracking system has to develop and implement. With real time bus tracking system, bus position data is connected real time and transmitted to a central server for processing and extracting transit information. The developed bus tracking system will able to provide bus users a real-time platform to check on updated bus traffic information, for examples bus arrival or departure time. Besides, this system will also able to reduce workload for bus management team and provide an immediate platform to update latest and accurate bus traffic information to bus users.

II. LITERATURE SURVEY

In this system, there are three major components which are Sharing user, Querying user and Backend user. The querying user queries the bus arrival time by sending the request to the backend server. The querying user indicates the interest bus route and bus stop to receive the predicted bus arrival time. While the sharing user is used to collect the information through the mobile phone sensing and send it to the server via cellular network. Also, the sequencing algorithm is used for getting a particular location of a bus. The backend server is used for maintaining the database of the uploaded information and addressing the queries of the query user. The detection methods proposed in this for sequence generation are Audio Detection and Accelerometer Detection. In this system, there are various drawbacks like the public participation, overlapped routes, etc[1].

This paper describes the design, analysis, implementation, and operational deployment of a real-time trip information system that provides passengers with the expected fare and trip duration of the taxi ride they are planning to take. This system was built in cooperation with a taxi operator that operates more than 15,000 taxis in Singapore. It has first described the overall system design and then explain the efficient algorithms used to achieve our predictions based on up to 21 months of historical data consisting of approximately 250 million paid taxi trips. Then it describes various optimizations and accuracy analysis which are performed to increase both the runtime performance and prediction accuracy. Also, its large-scale evaluation demonstrates that our system is (a) accurate --- with the mean fare error under 1 Singapore dollar (~ 0.76 US$) and the mean duration error under three minutes, and (b) capable of real-time performance, processing thousands to millions of queries per second. Finally, it described the lessons learned during the process of deploying this system into a production environment [2]

III. SYSTEM OVERVIEW

The main idea for this project is to predict the expected arrival time of the bus to the bus stop. The user logins or registers into an application and then enters the source i.e. present location and destination into the application. Let's say, if user is unaware about the nearest bus stop if he/she is new to a particular location so the application will help the user to navigate to the nearest bus stop and

from there the user will get the details of the bus that will help him/her to reach the destination. Also, the user will be given the estimated time of arrival of the upcoming bus.
The aim behind this application is to digitize the present service offered by the bus transportation service and to overcome all the drawbacks faced in the existing bus transportation system and generate a digital platform for the existing system.

IV. PROPOSED SYSTEM

The basic idea for this project is to guide the bus travelers with the routes, all the possible stops that come on their way to the destination and moreover, display maps and track their locations and show the estimate remaining time required to reach. The aim is to overcome all the drawbacks faced in all the previous applications and generate fast and accurate results. The proposed system has been divided into two modules as follows. Module 1 gives information about all the routes from the source to the destination and give maps for the same. Module 2 give information about all the buses along with the bus numbers that go through the selected stops, track the location of the selected bus and send this information to the passenger giving him/her the estimate time required for the bus to reach. This is done using the Client-Server technology.
Module 1 (Routes and Maps) The first module depicts the process of selection of routes from source to destination and presents the respective map for the same. Every direct and indirect route would have a map for itself.
Module 2 (Stops and Location Tracker): The second module depicts the process of selection of the stops till where the passenger wants to travel. Passengers wanting to select stops can do so, irrespective of the routes. The Location Tracker is will detect the current location of the bus and send the location back to the passenger's device. The Client-Server technology is used in this kind of system.
The system provides the following functionalities:

A. Route Information, Bus Information, Stop Information, Map Generation, Location Tracking are the core functional parameters.

B. Database

The databases created in this application are created in SQLite. User passes a query to access the database. All the rows in the database that match this query are passed as a type of pointer(cursor) and then displayed to the user. The application maintains an Adapter class that handles calls that are made to the database. The databases play an integral part of the system as all the bus information, stop information as well as routes are all stored in these databases.

C. Location Based Services (LBS)

The LBS is a mobile application which depends on the location of a mobile phone. It is used as an IP service that uses geographic information in order to track the location of the bus. The bus is tracked and sent to the server and the server then forwards this tracked bus information to the client device which makes the user keep track of the bus location and get an estimate remaining time for the bus to reach his bus stop. It is a widely-used application in mobile data services which has led to the rapid development in wireless communication strategies as well as location positioning technologies. The travelers having the location-aware mobile phones can find out about the respective bus stops at any place.

D. Module Description

1) *Registration:* This module is provided for the user to register themselves with details such as name, password, confirm password, email id, mobile number and use the application for tracking the college bus. The registered users can login with their credentials once they have registered. The details of the registered users are maintained in the database.
2) *Bus Tracking Module:* In this module when the bus route is selected the appropriate bus is found using the IP address of that particular bus. Then the location of the bus is tracked using its latitude and longitude. Corresponding to the bus movement the change in latitude and longitude are updated in the database for every minute.
3) *Route Finding Module:* In this module, the updated latitude and longitude value in the database is used to find the exact location of the bus using maps and the bus source and destination, user, bus are displayed in the Google map with different colors to distinctly identify them. The distance between the user and bus along with the expected time is calculated and displayed.

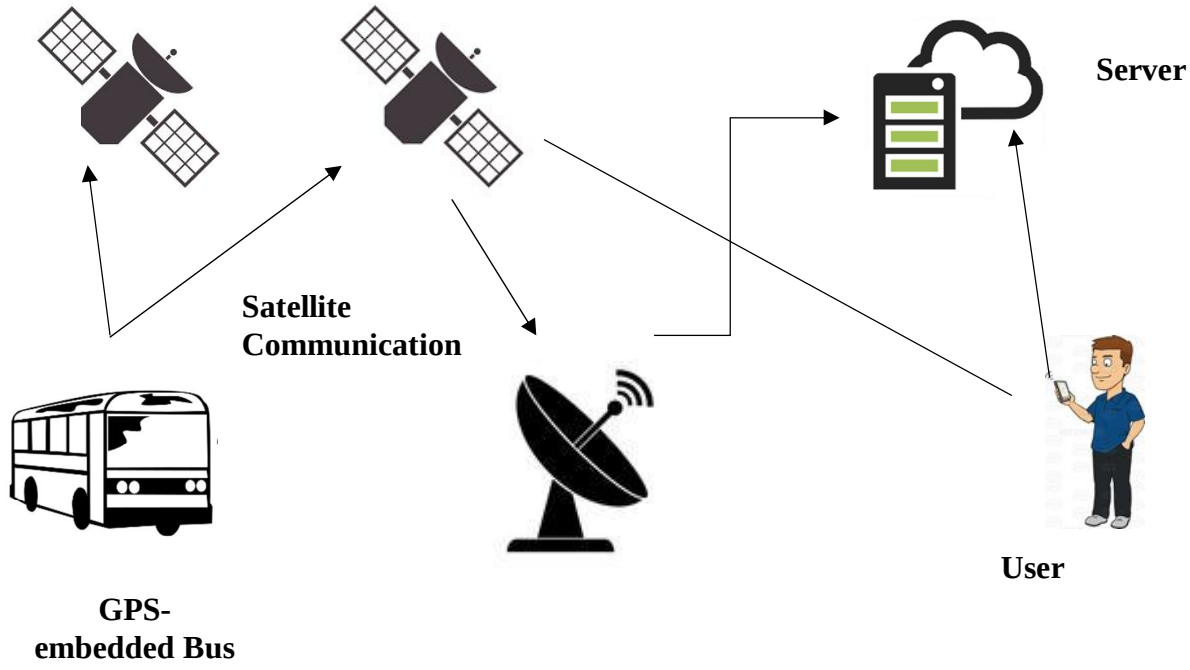

Fig.1: Architecture of Proposed model

V. METHODOLOGY

The GPS tracker is installed in buses where the bus driver enters bus number and tracking begins. Since buses are changed frequently, we identify a bus by its unique code or number assigned to it. This system can be implemented through an application which requires devices with GPS sensors embedded in them, where we can embed a fully functional map interface. The map view contains a flattened representation of user's surroundings. When a Coordinates of user are sent to the server where they are translated into known locations. Based on user's location, estimated time of bus arrival is predicted using GPS and presented to the user on the application screen.

This system has three main modules Transmitting Unit, Monitoring Unit and Server. Transmitting side performs tracking functionality. It tracks the vehicle through GPS and transmits its current location to the server. The main function of monitoring side is to provide login interface to user and to show the map with vehicle locations. Server woks as a central connector for transmitting unit and monitoring unit. As both transmitting side and monitoring side communicate with each other through Server only. As shown in mobile application communicates with server and access the remote database. Where at transmitting side Tracker application obtained its current location through GPS technology and update it to server.

VI. IMPLEMENTATION DETAILS

We have made a website which acts as a control interface for our system. New buses/bus stops can be added and routes can be edited. On the other hand, we have a mobile application on which users or drivers can login. Driver login initiates bus tracking by continuously updating latitudes and longitudes, whereas user login allows users to search for nearby bus stops and view expected arrival time of bus on a particular bus stop. Following are screenshots of the implemented website.

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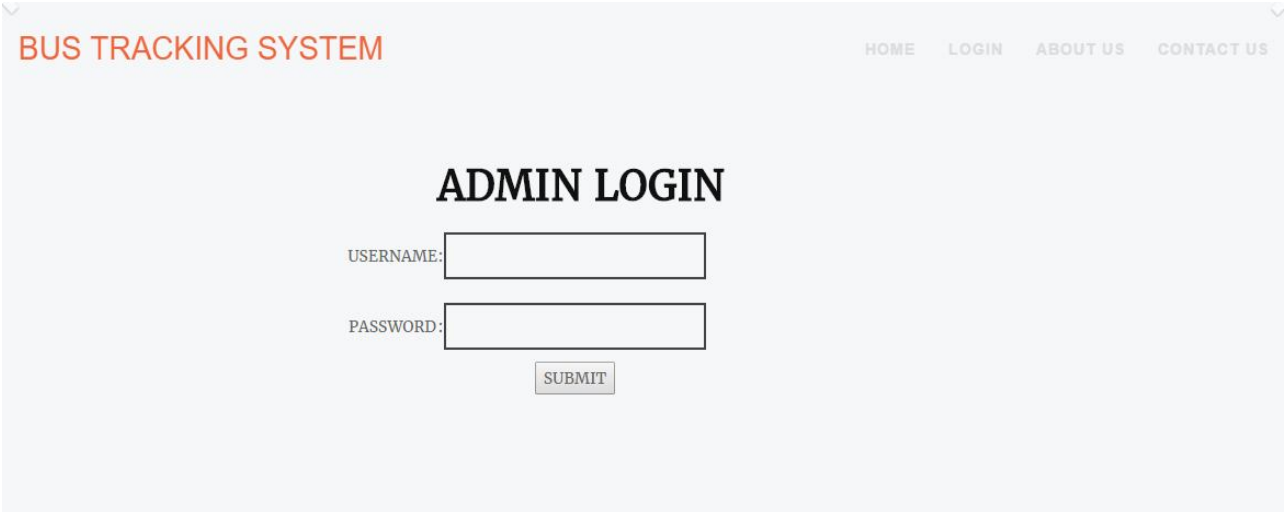
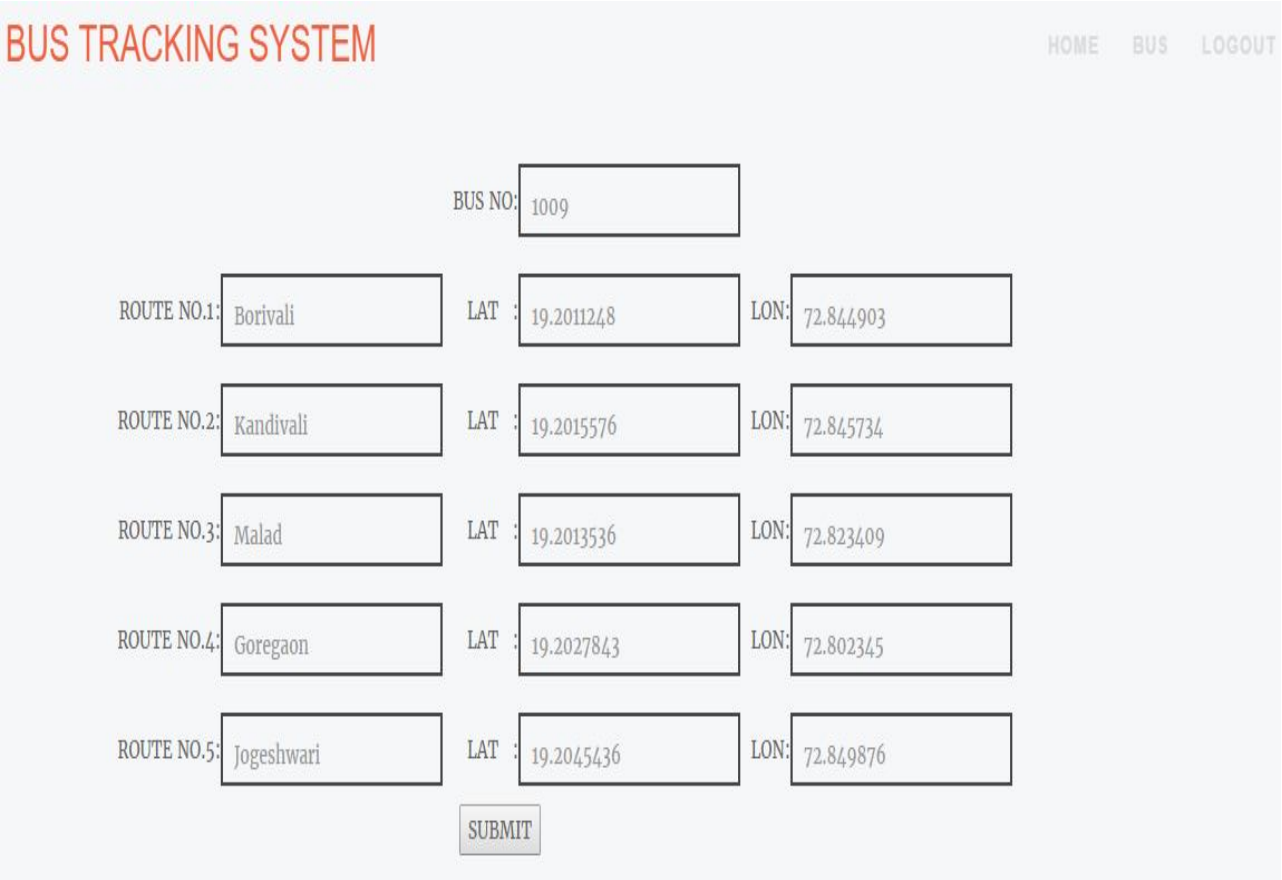
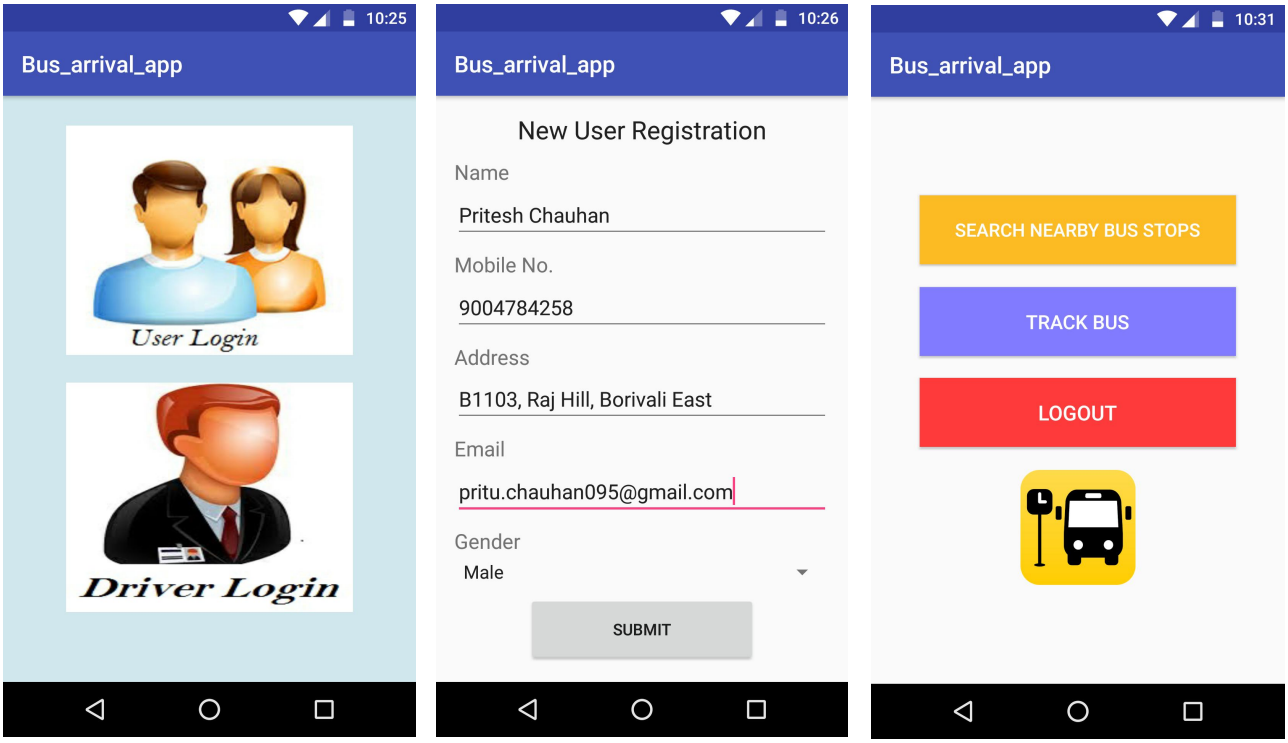
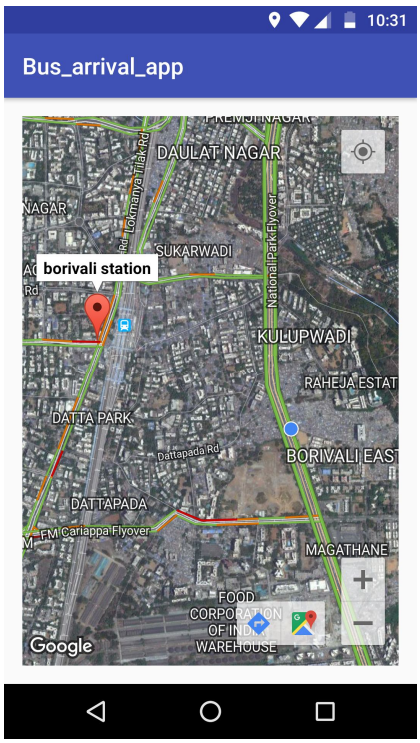
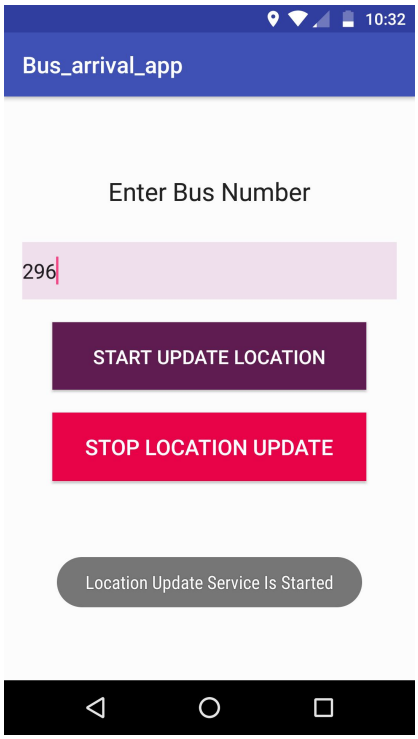


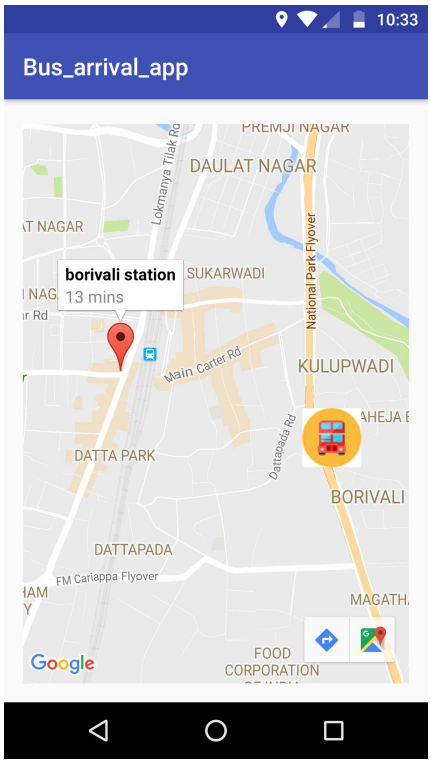


The mobile application is built in Android and map interface in implemented using google maps API.The home screen consists of driver login and user login.









VII. CONCLUSION

In this proposed system, we present an effective way of predicting bus arrival time based on user's location using GPS technology. Primarily relying on inexpensive and widely GPS sensors, the proposed system provides cost-efficient solutions to the problem. We have demonstrated how high-value data such as routes, stops, and transit schedules, can be computed automatically from simple

GPS traces. Our system produces high-fidelity route maps, extracts transit stops locations, and constructs transit schedules which are better and more accurate than the ones provided by the bus operators themselves.

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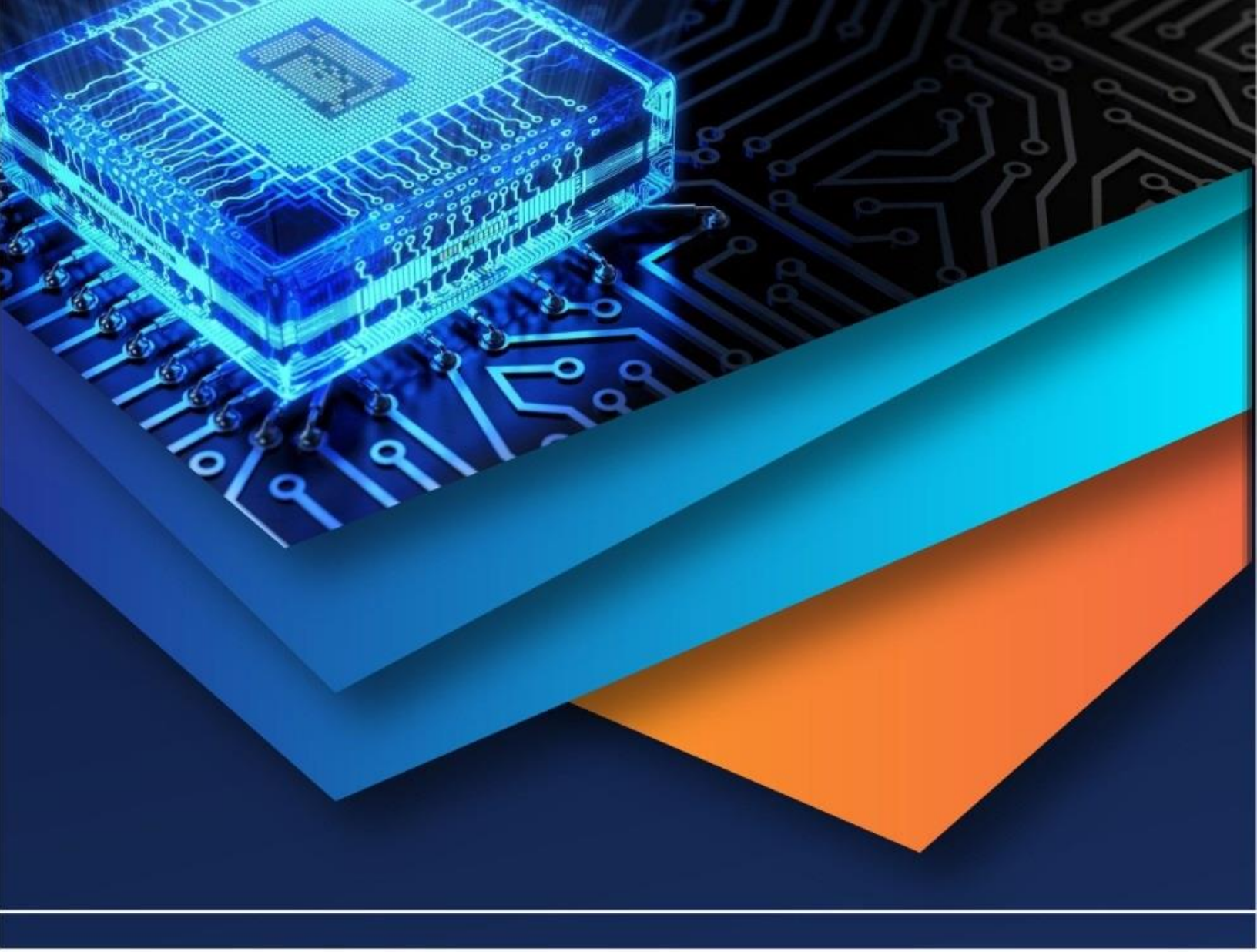

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