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Location Based Blood Donor Finding System

Vaibhav Kamble[1], Ganesh Chaudhari[2], Prof. Pallavi Thakur[3]
Master of Computer Application, Department Sardar Patel Institute of Technology Mumbai, India

Abstract: ***This research paper delineates the creation and execution of an application based on serverless architecture, aimed at simplifying blood donation by enabling location-based donor searches. The system primarily uses cloud services such as API Gateway, Lambda Functions, and DynamoDB on popular cloud platforms. Google Maps API integration provides a dynamic mapping solution for a better user experience. This application allows a donor and blood bank to register their details including her GPS coordinates, thus providing users with an efficient and real-time way to find a donor nearby. Serverless architecture ensures cost efficiency, scalability, and seamless management of resources. API Gateway and Lambda functions are us ed to create RESTful APIs and facilitate communication between applications and databases. The DynamoDB database is used to store donor information, ensuring data persistence, reliability, and easy retrieval. Users can use the application to search for donors based on their current location and view the results on an interactive map. The system optimizes the blood donation process by calculating and displaying important information such as distance to the donor's location, direction, and estimated time of arrival.***

Keywords: Cloud, Serverless, Blood Donor, Google Maps, Global Positioning System, Amazon Web Services

I. INTRODUCTION

Blood donation is a critical aspect of healthcare, playing a pivotal role in saving lives during emergencies, surgeries, and various medical conditions. However, despite its importance, blood donation processes face challenges, particularly in the efficient identification and mobilization of donors. Traditional methods of donor identification often lack real-time precision, leading to delays and inefficiencies in emergency situations. To address these challenges, this research introduces a "Server- less Application on Cloud with Location-Based Blood Donor Finding System using Gmaps API."

Key features of the application include secure donor registration, efficient data storage, and location tracking. The serverless architecture enhances the system's responsiveness and scalability, ensuring optimal performance during peak us- age. The integration of Gmaps API enriches the user interface, providing an intuitive and interactive mapping solution.

The findings of this research contribute to the growing body of knowledge surrounding serverless architectures and their applicability in healthcare-related systems. The proposed ap- plication demonstrates the feasibility and benefits of leveraging cloud services for developing efficient and dynamic location- based blood donor finding systems, ultimately contributing to enhanced healthcare services and blood donation processes.

II. RELATED WORK

The electronic database of IEEE Xplore was queried using the search terms: "Google Maps," "Amazon Web Services," "Serverless Architecture," "Blood Donation," "Blood Donor Finding," and "Cloud Technologies." There are various study and research on topics on Application of Serverless Archi- tecture in use case project using Rest API and Google Maps. Following works were found useful or relevant to our proposed study.

1) Introducing an innovative solution to address the persis- tent blood supply shortage, a recent study proposes a cloud computing web application. This application aims to streamline the process of blood donation, storage, and distribution. Highlighting the crucial role of cloud computing, the study emphasizes its potential to improve blood availability for critical situations, ultimately con- tributing to saving lives, as researched by reference [1].

2) Investigating the Serverless First strategy in cloud appli- cation development, another study explores the growing popularity of serverless computing. Through a systematic literature review, the study evaluates the advantages of serverless computing by comparing various implementa- tion approaches, including AWS Lambda, AWS Lambda with Chalice framework, and the traditional Flask frame- work [2].

3) With a focus on enhancing medical services, a recent research initiative aims to develop a location-based ser- vice considering key variables such as travel distance and time [3]. Leveraging algorithms such as the Haversine algorithm and TOPSIS algorithm, the system identifies nearby medical services and determines optimal service options [3].

4) Additionally, a study proposes the delivery of backend services for frontend developers through REST APIs. This approach allows developers to optimize their time on frontend development by efficiently managing client user records with minimal API calls [4].

Apart from these, there have been various research on system related to blood donation management but on different technologies like android [5], web technology based [6] etc.

III. METHODOLOGY

A. *Blood Donation - Understanding Need and Challenges*

Blood donation is essential for healthcare systems globally, yet numerous challenges persist in ensuring a steady and timely blood supply.

These challenges include:

1) *Geographical Disparities:* Uneven distribution of blood donors across geographical regions contributes to delays in accessing blood during emergencies.
2) *Lack of Real-Time Information:* Traditional blood dona- tion systems often rely on outdated databases, hindering real-time donor identification and mobilization.
3) *Emergency Response Delays:* In emergencies, the time taken to locate and reach a suitable donor can be a critical factor in saving lives.

B. *Application in Problem Resolution*

In order to overcome these obstacles, the suggested Server- less Application on Cloud with Location-Based Blood Donor Finding System integrates the Gmaps API and takes use of serverless architecture.

Users may locate donors and blood bank with available count in their area quickly and precisely thanks to the technology, which allows donors to record their real-time GPS locations.

Because of its serverless design, which guarantees affordable scalability, it is the perfect choice for healthcare applications with a range of demand. With rapid access to vital data including the donor's position, distance, direction, and projected arrival time, this application seeks to expedite the blood donation procedure.

Through the use of cloud-based technology, the system helps to overcome geographical differences, shorten response times, and improve the general effectiveness of blood donation campaigns. The subsequent segments of this study explore the technical as- pects, execution, and assessment of this inventive resolution, elucidating its possible influence on healthcare systems and emergency response mechanisms.

C. *Benefits of Serverless Architecture*

Serverless architecture offers a paradigm shift in appli- cation development, emphasizing event-driven functions and abstracting the underlying infrastructure management.

This architecture provides several advantages, including:

1) *Cost Efficiency:* Serverless applications operate on a pay- as-you-go model, eliminating the need for provi- sioning and maintaining dedicated servers. This results in cost savings by only charging for actual resource usage.
2) *Scalability:* Serverless platforms automatically scale based on demand, ensuring optimal performance during peak loads without manual intervention. This scalability is particularly crucial for applications with varying usage patterns, such as blood donation systems.
3) *Reduced Operational Overheads:* With serverless, devel- opers can focus on writing code rather than managing infrastructure. This reduces operational complexities, allowing organizations to allocate resources more effec- tively.
4) *High Availability:* Serverless platforms are designed for high availability by distributing functions across multiple data centers. This ensures robustness and reliability, critical for applications like blood donor finding systems where downtime can have severe consequences.

D. Proposed Application Architecture

Consider the Application Architecture Figure 1.

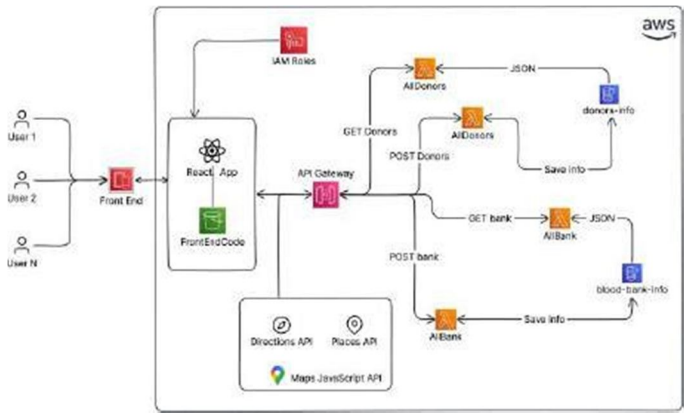

Fig. 1. Application Architecture.

1) Front End - React Code Hosted on AWS

The frontend of your application is built using React and hosted on Amazon S3. React code files, including HTML, CSS, and JavaScript, are stored in an S3 bucket, providing a scalable and reliable solution for hosting static assets.

2) API Gateway to Handle REST API Requests

AWS API Gateway serves as the entry point for handling REST API requests from the frontend to the backend. It allows you to define API endpoints, manage requests, and integrate them with backend services.

3) Lambda Function to Process API Requests

AWS Lambda functions act as the backend logic to process API requests from API Gateway. For ”GET donors,” a Lambda function retrieves donor information from DynamoDB. For ”POST donors,” another Lambda function processes and validates the incoming donor in- formation, saving it to DynamoDB. Similarly for Blood Banks, 2 APIs for to fectch Blood Bank details and save into DynamoDB

4) Donor Info Stored on DynamoDB

DynamoDB is a fully managed NoSQL database by AWS, used to store donor information. It provides fast and scalable storage for donor records, allowing for efficient retrieval and storage of data.

5) Google Maps - Places API

Google Maps Places API is utilized to point places on an interactive map. It enables the application to search for and display places related to blood donation centers, hospitals, or other relevant locations.

6) Google Maps - Directions API

Google Maps Directions API is used to calculate the distance and time between two points on the map. It helps users estimate the travel time to reach a blood donation center or the donor’s location.

7) Google Maps JavaScript API

Google Maps JavaScript API is integrated into the frontend to display an interactive map. It allows users to interact with the map, view locations, and receive dynamic updates based on the information retrieved from the backend.

8) IAM Role for DynamoDB Access

An AWS Identity and Access Management (IAM) role is created and associated with the Lambda functions. This IAM role grants the necessary permissions for Lambda functions to read and write data to DynamoDB securely.

E. User Consent on Location Sharing

In the context of our application, prioritizing user privacy is paramount, particularly when collecting location data. To address the privacy issues in Location Based Services (LBS) raised in [7], we have implemented a transparent approach to inform users about the purpose of location data collection. During onboarding, users are presented with an explicit checkbox, seeking their consent for location sharing. This opt- in mechanism provides users with control over their location preference. Through these efforts, our application seeks to balance functionality with respect for user privacy, fostering a secure and trustworthy user experience.

IV. IMPLEMENTATION

A. Solution Stack

Table I outlines the solution stack used for implementing the proposed application.

TABLE I SOLUTION STACK

Frontend	
React JS	To create webpage with interactive maps and forms to collect donor information
AWS Managed Services	
S3 Bucket	To store React Code Files
API Gateway	To call lambda function upon GET and POST requests
Lambda Function	Contains Python code for logic implementa- tion
DynamoDB	NoSQL Database to store donor information
IAM Roles	To allow lambda functions to interact with DynamoDB

B. Workflow of System

1) The React frontend hosted on S3 makes REST API requests to API Gateway.
2) API Gateway forwards these requests to the appropriate Lambda function.
3) Lambda functions process the requests, interact with DynamoDB for data retrieval or storing, and return re- sponses.
4) Google Maps APIs (Places, Directions) are used to en- hance the map functionalities and provide location-based information.

a) Figure 2 shows the code files stored in S3 bucket, which also acts as static website hosting.

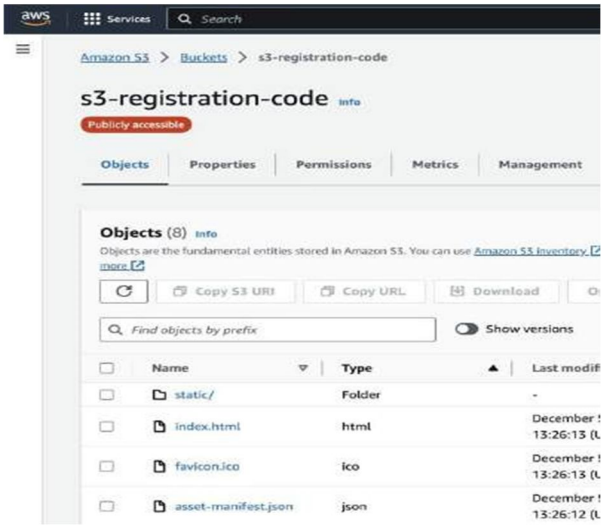

Fig. 2. Code files in S3 Bucket

b) Figure 3 displays the registration page of donor, we will register an user for demonstration, the page also gets the gps coordinates of the user automatically.
c) Figure 4 displays the registration page blood banks, they register along with their blood availability count.
d) We can see the newly created user in DynamoDB along with other previously created users and blood bank in Figure 5 and Figure 6 respectively.
e) Figure 7 displays the dashboard where the users can search for donors filtered by blood group. It will also show nearby blood banks.

V. DEMONSTRATION & RESULT

We will demonstrate to find the nearby blood donor of blood group 'B+'. Figure 8 shows the donor and blood bank location on the map. Both have different markers.
Upon clicking any of the donor places, we can see the contact and name of the donor along with the time duration and direction between the user and donor location as shown in Figure 9. We can see that the donor Ganesh is 12 min away and we can see the Vaibhav's contact number, and direction between the locations.
Figure 10 shows how blood bank information will be displayed. Additional detail of count of availability will be presented along with direction and time to reach. This will also help to identify blood banks where multiple blood types can be procured.

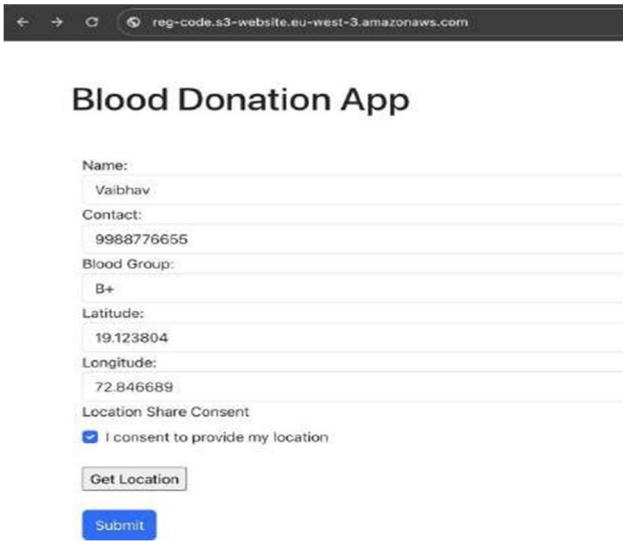

Fig. 3. Registration Page - Donor

VI. FUTURE SCOPE

The proposed application has several potential future scopes and areas for expansion. Here are some possibilities:

1) *Integration with More APIs:* Explore integrating addi- tional APIs that can enhance the functionality of the application. For example, you might consider integrating health-related APIs to provide more context about blood types, medical conditions, or donor eligibility criteria.
2) *Enhanced User Profiles:* Improve user profiles by allow- ing donors to provide more detailed information, such as blood type, past donation history, and any relevant medical information. This can help recipients make more informed decisions when selecting donors.
3) *Real-Time Notifications:* Implement a notification sys- tem to alert donors when there is an urgent need for their blood type in their vicinity. This could be achieved through push notifications or SMS alerts, ensuring a faster response in critical situations.
4) *Advanced Matching Algorithms:* Enhance the matching algorithms to consider additional factors such as travel time, traffic conditions, and the availability of specific blood types in the donor's location. This could optimize the matching process and improve the efficiency of blood donation coordination.
5) *Global Expansion:* Extend the application's coverage to a global scale, allowing users to find donors and recipients not only within their local area but also in different regions or countries. This could involve collab- oration with international blood donation organizations and adherence to relevant regulations.

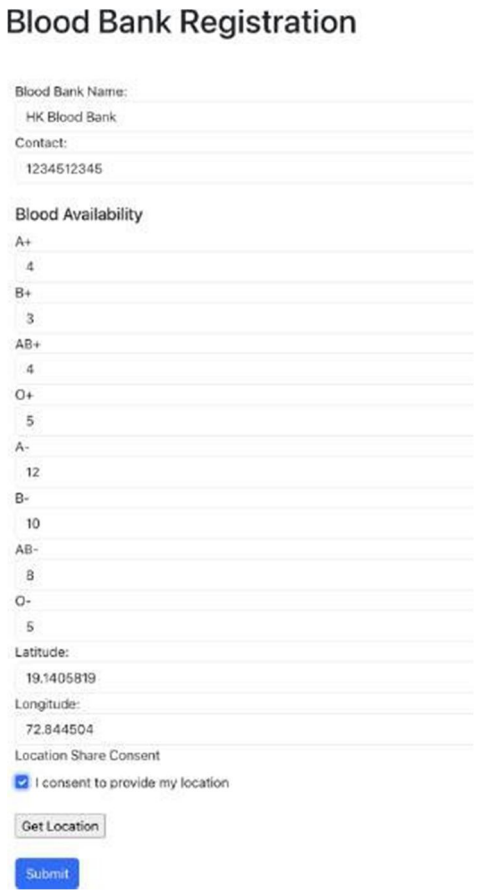

Fig. 4. Registration Page - Blood Bank

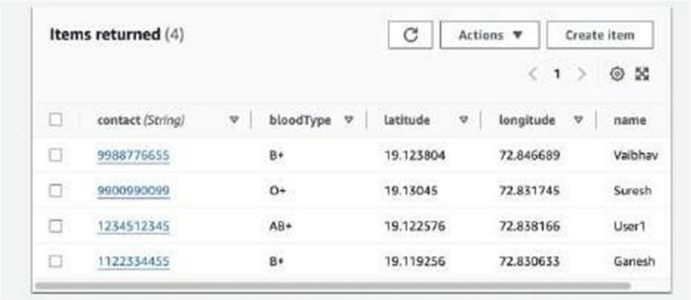

Fig. 5. DynamoDB Table - User

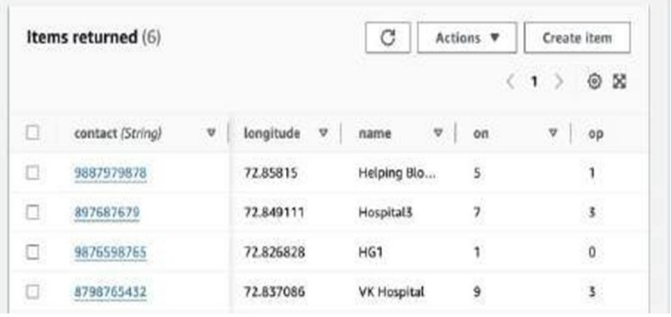

Fig. 6. DynamoDB Table - Blood Bank

Fig. 7. Dashboard

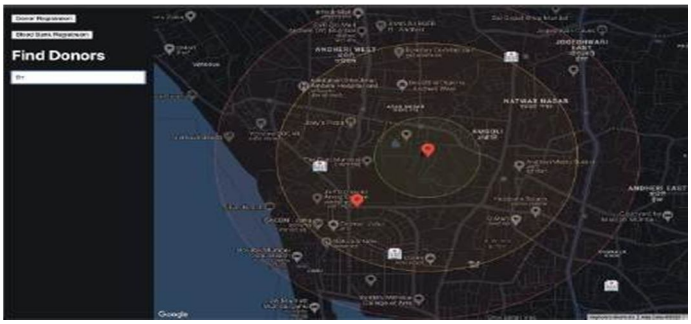

Fig. 8. Nearby Donors & Blood Banks

Fig. 9. Selected Donor Information

6) Provide dashboard for blood banks to monitor and maintain their real time blood availability count.

7) SMS Notification Feature - Upon initiating a search, users will receive SMS notifications containing relevant donor information, ensuring quick access to potential donors in their vicinity. This feature enhances user engagement and facilitates prompt communication be- tween donors and recipients

Fig. 10. Selected Blood Bank Information

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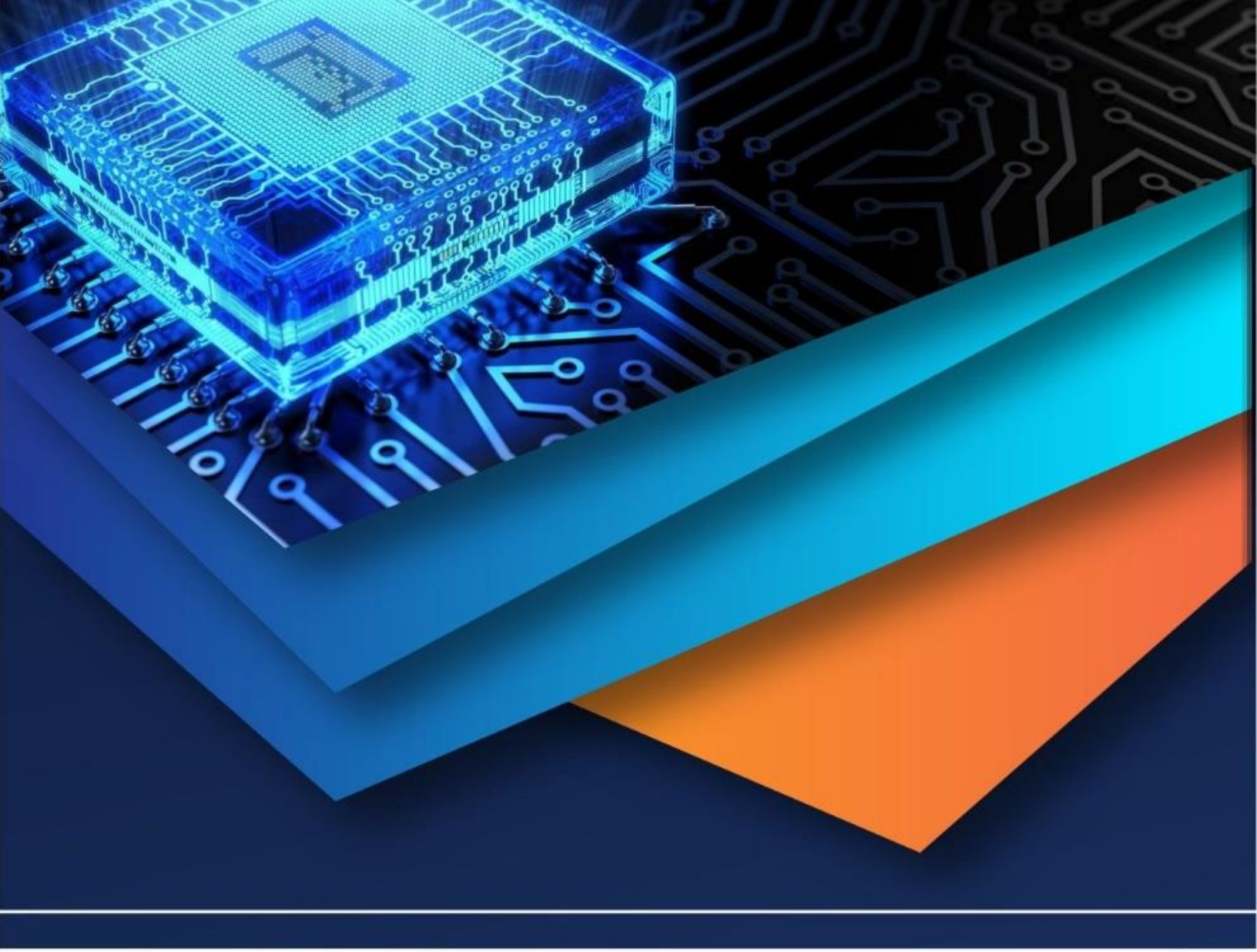

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