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HemoMatch: Emergency Blood Matching System

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Abstract: ***Finding a blood donor during a medical emergency is often a race against time. Despite the importance of blood donation, the process remains unorganized, relying on scattered phone calls or unverified social media posts. To solve this, we developed HemoMatch, a full-stack digital platform designed to centralize and simplify blood donation. The system connects donors, hospitals, and blood banks on a single platform. It features an Admin Dashboard for profile verification, automated WhatsApp/Email alerts for emergency requests, and an instant E-certificate system to reward donors. This paper discusses the system architecture, design methodology, and implementation of this life-saving application.***

Keywords: ***Blood Donation Platform, MERN Stack, Emergency Matching, Admin Verification, Automated Alerts, Digital Certificates.***

I. INTRODUCTION

In a world where almost, every service is available at the click of a button, the process of finding blood during a medical crisis is still surprisingly manual. Families often spend hours calling friends or visiting multiple blood banks. This communication gap causes severe delays that can be life-threatening. HemoMatch was created to address these hurdles by providing a unified digital presence for medical facilities and donors. Built using the MERN stack, it offers a fast and responsive way to locate donors based on blood group and location. By removing intermediaries and automating the connection process, HemoMatch aims to create a more reliable and transparent healthcare ecosystem. Beyond just a search directory, the platform introduces a layer of accountability through a centralized administrative dashboard that verifies every donor profile to ensure data integrity. To further encourage a culture of voluntary donation, the system integrates an automated recognition engine that instantly issues digital certificates to contributors upon verification.

II. PROBLEM STATEMENT

The primary issue in the current blood donation cycle is fragmented information. There is no central real-time database that shows donor availability across different hospitals and regions. Paper-based records and manual tracking lead to data loss and slow response times. Additionally, the lack of a verified system often results in people following up on outdated or fake leads during emergencies. There is a critical need for a computerized system that ensures data integrity and provides instant communication between donors and those in need. Without a centralized digital presence, medical facilities struggle to broadcast urgent requirements to a wider audience efficiently. HemoMatch addresses these systemic failures by eliminating manual bottlenecks and providing a verified, real-time lifeline that bridges the gap between those in need and those ready to help.

III.PROPOSED SYSTEM

Our proposed system, HemoMatch is an integrated platform that simplifies the entire blood donation lifecycle. Within this ecosystem, medical facilities can establish and manage their digital profiles, while individual donors can securely register their availability and blood group details. The system utilizes intelligent algorithms to ensure fast, accurate blood group matching and perform location-based searches to minimize response times during emergencies.

A unique and critical feature of the platform is the Admin Command Center, a dedicated module where all donor profiles are reviewed and officially approved or rejected by administrators to ensure data integrity and user trust. The system automates donor appreciation by instantly generating and issuing digital E-certificates to contributors immediately after a verified donation. By combining modern web technologies with strict administrative oversight, HemoMatch eliminates manual bottlenecks and provides a reliable, real-time connection between those in need and those ready to help.

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IV. FLOW CHART

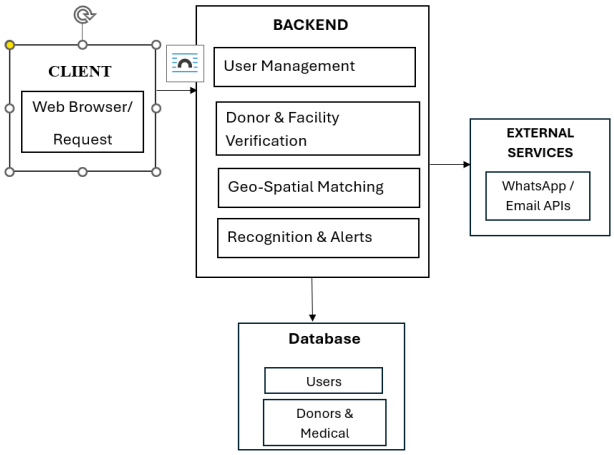
The HemoMatch flowchart is designed for maximum efficiency and ease of use, establishing a seamless journey from donor registration to emergency matching. The process begins when donors securely submit their personal and medical details into the database, where administrators utilize a dedicated Admin Command Centre to monitor, approve, or reject registrations to maintain high data integrity. When a recipient requires an urgent blood match, they can utilize advanced geo-spatial filtering to identify the nearest compatible donors based on real-time proximity and blood group. Once a match is confirmed, the system eliminates manual delays by triggering automated alerts via WhatsApp or Email APIs, instantly notifying eligible donors of the emergency. To close the cycle and promote sustainable voluntary participation, the backend automatically generates and dispatches digital E-certificates to donors immediately following an approved donation. This entire life-saving workflow is managed through a robust three-tier architecture consisting of a React frontend, a Node.js/Express backend, and a MongoDB database, ensuring a secure and scalable solution for modern healthcare needs.



V. METHODOLOGY

The methodology adopted for the HemoMatch platform is designed to provide a secure, efficient, and user-friendly environment where medical facilities and donors can interact without intermediaries. The system has been modularized into different components to ensure scalability, maintainability, and smooth integration of features. By utilizing a modern technology stack, the project follows an iterative approach to bridge the critical communication gap in blood donation services.

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A. *User and Facility Management*

The user and facility management module establishes the foundation of the platform by handling registration, authentication, and secure account maintenance. New users can create accounts by entering essential personal and medical details such as name, blood group, contact number, and geographical location. To ensure maximum system security and patient privacy, all passwords and sensitive data are strictly encrypted during registration. Authentication protocols verify user identities and maintain secure session states, while the platform supports Role-Based Access Control (RBAC) to distinguish between voluntary donors, medical facilities (hospitals and blood banks), and administrators. Each role is assigned specific privileges, ensuring that only authorized personnel can manage facility data and verified donor records. While users can update their profiles and donation availability at any time, administrators are granted extended control via the Admin Dashboard to verify registrations and maintain the integrity of the life-saving network.

B. *Donor and Facility Management*

Donor and facility management focuses on enabling medical institutions and voluntary contributors to create and maintain detailed digital profiles. Each facility listing includes essential information such as the hospital or blood bank name, category, precise geographical location, and active contact helplines. Medical officers can update their profiles to reflect current blood stock availability, upcoming donation camps, or specialized facility features. Strict validation checks are implemented during the registration process to ensure that all donor and facility details remain accurate and consistent across the platform. The system also highlights specific donor features such as blood group, eligibility status, and the date of the last donation. This structured representation of critical resources helps recipients and healthcare providers make informed, life-saving decisions and establish immediate contact during emergencies.

C. *Search and Filter Module*

A central feature of HemoMatch is its advanced search and filtering capability, specifically engineered to save time during medical emergencies. Users can search for blood donors and medical facilities based on multiple critical parameters, including blood group, state, district, and city. To enhance usability and precision, the system provides advanced filters that allow recipients to distinguish between individual voluntary donors, organized blood banks, and multi-specialty hospitals.

Location-based searches are powered by geo-spatial intelligence, utilizing MongoDB's $near operator to calculate the real-time proximity between the requester and available donors. This allows users to explore life-saving resources around specific landmarks or medical hubs, ensuring the fastest possible response. Additionally, the system enables users to trigger instant emergency alerts via WhatsApp or Email once a compatible match is identified. Results are presented in an intuitive, tabular layout, accompanied by verified contact details and eligibility status to improve the overall user experience and reliability.

D. *Communication and Alert Module*

The communication module ensures smooth and instantaneous interaction between recipients and voluntary donors during critical medical emergencies. A built-in alerting system enables direct outreach within the platform, maintaining a verified record of all

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donation requests for future reference. To keep users informed during high-pressure situations, WhatsApp API and Node mailer are integrated to trigger instant emergency notifications for new blood requests, donation camp updates, or verification status. Privacy and data protection are prioritized by securing donor contact information through administrative filters, while registered facilities can promptly respond to recipient inquiries regarding blood group availability, compatibility, or facility locations. This automated approach eliminates the traditional "communication gap," ensuring that life-saving information reaches the right person at the right time.

E. Donor Recognition and Motivation Features

Recognizing the critical need for a sustainable and motivated donor base, HemoMatch incorporates a specialized recognition-oriented module. This system allows administrators to issue verified E-certificates to voluntary donors immediately following a successful and approved donation. By narrowing the focus to donor appreciation, the platform ensures that contributors feel valued and are encouraged to return for future life-saving opportunities. This automated recognition cycle serves as a digital incentive, fostering a consistent community of volunteers without compromising the medical integrity or transparency of the donation process.

F. Security and Data Handling

The platform leverages secure authentication mechanisms, role-based token management, and advanced encryption techniques to safeguard sensitive user and medical data. Personal identification details and donor records are stored using secure database protocols, ensuring data persistence and high availability while minimizing server load during peak emergency periods. Strict Admin Command Centre protocols ensure that public users cannot alter critical facility or donor data, maintaining absolute data integrity. Furthermore, token expiration and secure refresh protocols are implemented to enhance the overall security posture and protect the privacy of the life-saving network.

VI. RESULTS

A. Our website name is HemoMatch

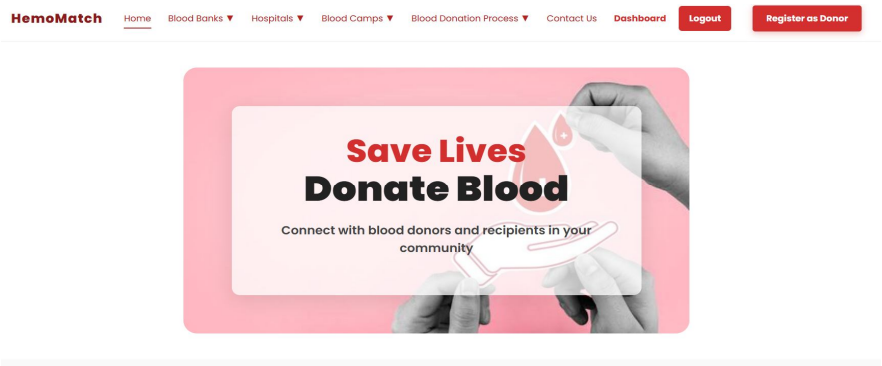


Fig. 1.1 Home Page

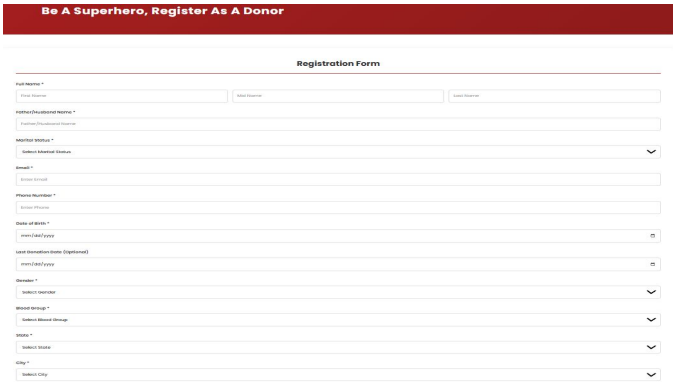


Fig. 1.2 Donor Registration Form

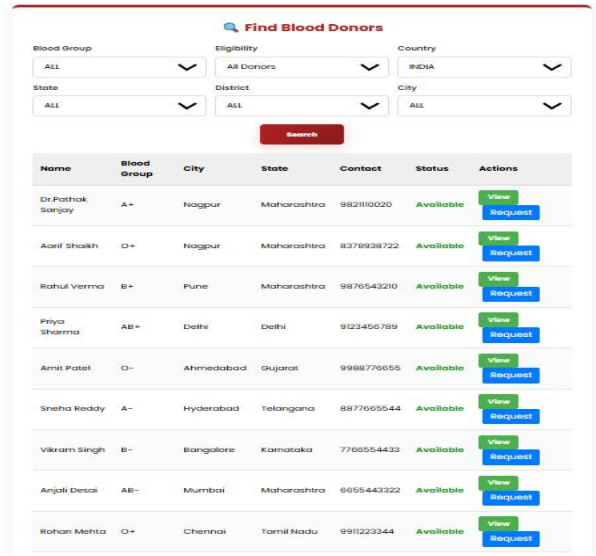


Fig. 1.3 Donors List

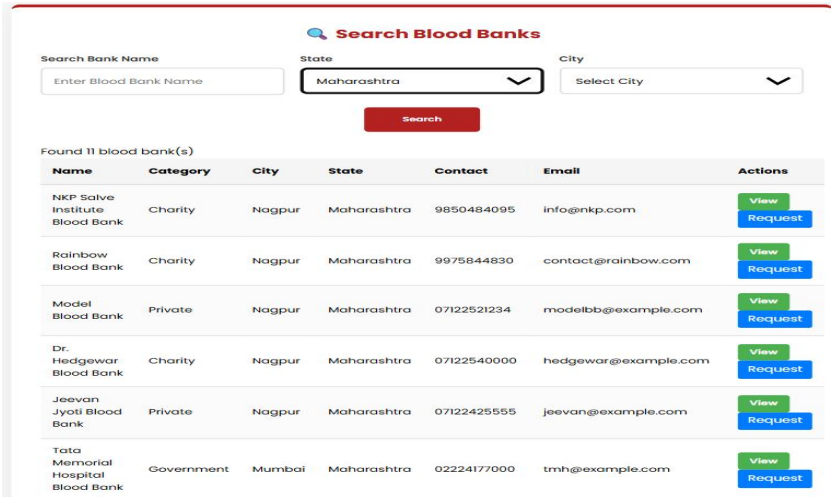


Fig. 1.4 Search and filter For Blood Banks

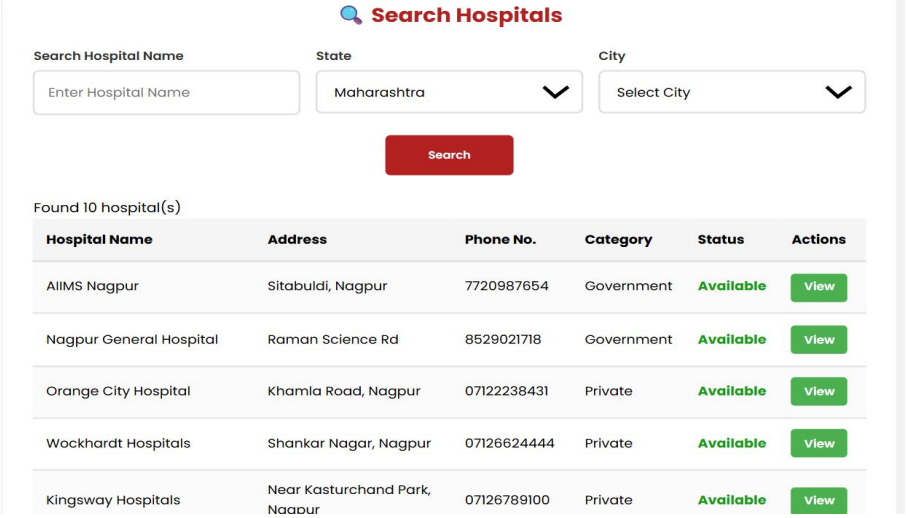


Fig.1.5 Search and filter For Hospitals

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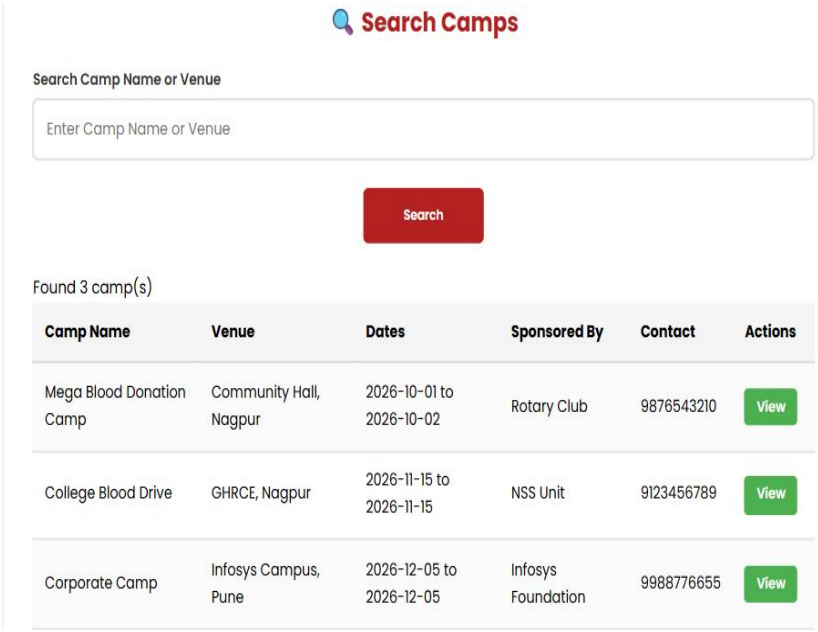


Fig.1.6 Search For Blood Camps

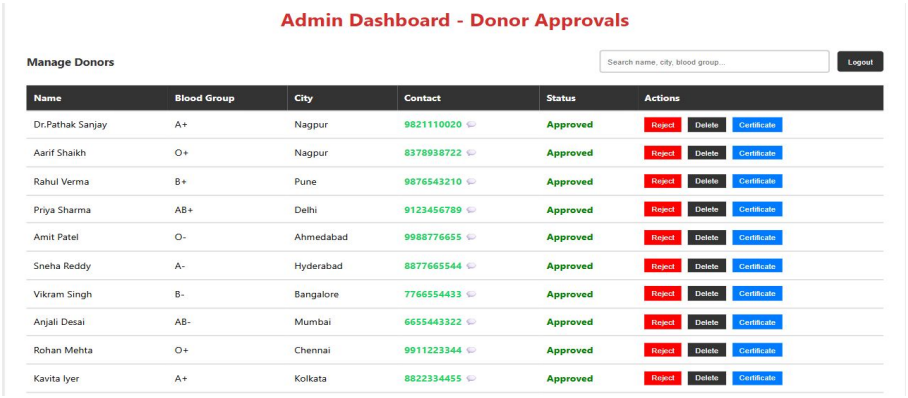


Fig. 1.7 Dashboard for Admin



Fig. 1.8. E-Certificates For Donors

VII. CONCLUSION

HemoMatch provides a modern solution to a long-standing problem in healthcare. By digitizing the blood donation process and adding layers of verification and automation, we have created a system that is both fast and trustworthy. The integration of real-time alerts and donor recognition features sets this platform apart from traditional directories. In the future, this can be expanded with mobile applications and AI-driven matching to further enhance its life-saving potential.

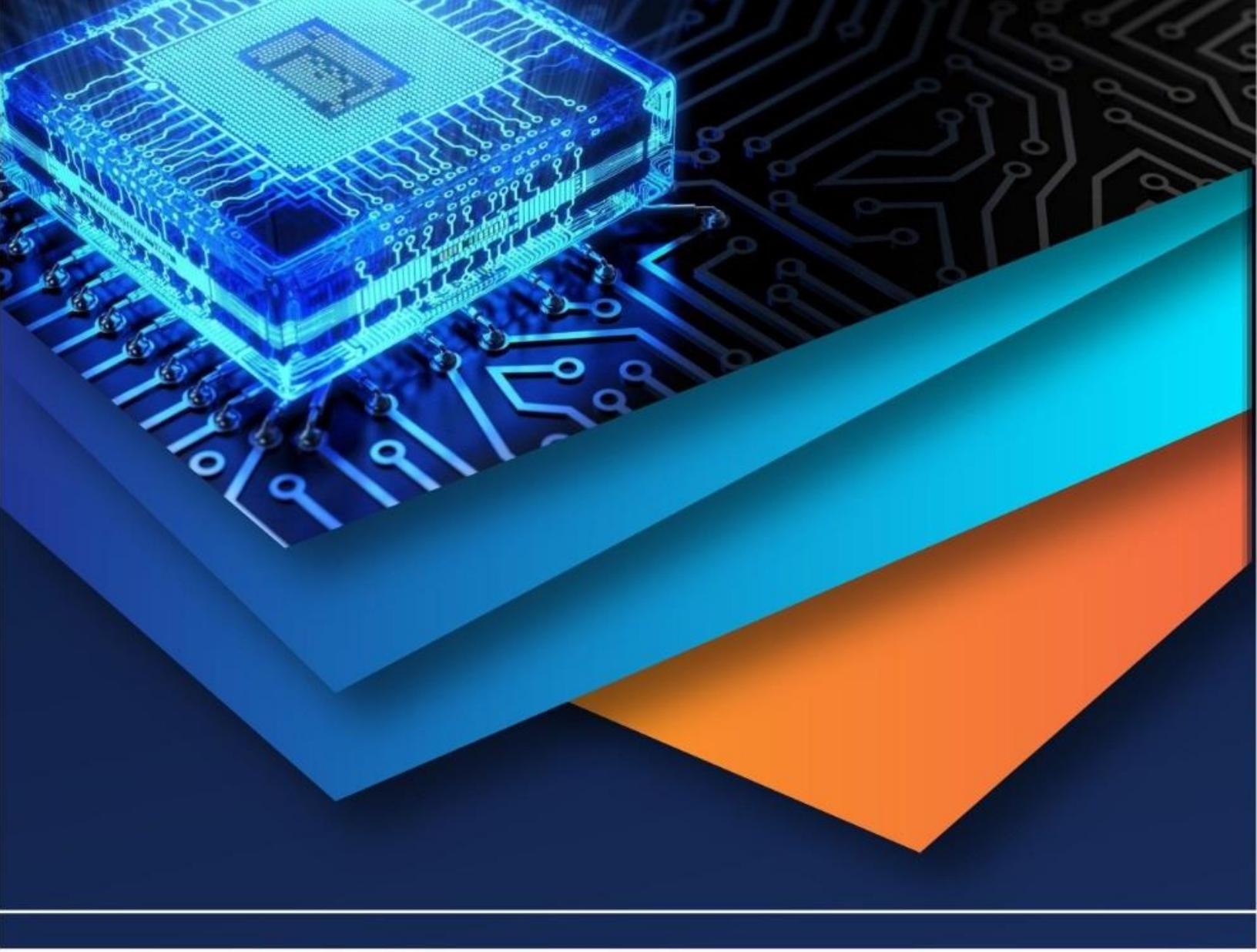
VIII. ACKNOWLEDGMENT

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