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Centralized Blood Bank Management System Using Integrated Cloud Services and Real-Time Analytics

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Abstract: ***it is a simple web-based website that helps connect and coordinate blood donors with hospitals and blood banks. When someone needs blood, the system suggests the doners and contact details who are eligible to help. Doners can sign up on the website and provide their blood type and personal information. Hospitals and blood banks can request blood whenever there is a need. The system then identifies suitable donors and immediately suggests the doner contact details and nearest blood banks. This process helps save valuable time during emergencies. The website stores information about all donors and blood banks in one centralized place, making it easy to locate blood quickly when required. It reduces waiting time, prevents blood wastage, and connects doners, hospitals, and blood banks efficiently. The user-friendly design encourages more people to donate blood and ultimately helps save lives.***

Keywords: Blood Bank, Blood Donation, Donors, Recipient, Emergency, Hospitals, appointment, blood request.

I. INTRODUCTION

Blood is essential in many life-saving medical situations. It is used in emergencies such as road accidents and trauma cases where patients lose a large amount of blood and need immediate transfusions. During major surgeries like heart operations, organ transplants, and childbirth complications, blood helps replace blood loss and stabilize patients. Cancer patients undergoing chemotherapy often require blood or platelet transfusions because their blood cell counts decrease. People with blood disorders such as sickle cell anomia and thalassemia need regular transfusions to survive. Burn victims and patients with severe infections may also require plasma or other blood components for recovery. Overall, donated blood plays a critical role in saving lives and supporting modern medical treatments.

Initially, when we researched this idea, we found a few websites. One of them was an official government website of Jharkhand state, which had features like donor registration, a carousel, and other basic functionalities. Then we searched for a similar website for Andhra Pradesh state but did not find one. So, we decided to build a centralized Blood Bank and Donor Management System with real-time analytics and integrated cloud support. That is why we included all the blood banks found in Andhra Pradesh. During registration, users are asked to select their district and town from Andhra Pradesh through a select menu. We have included personalized dashboards for different roles. Blood banks can approve appointments, update the number of units of blood donated by users (which is directly updated in the inventory), and accept requests from hospitals. Hospitals can find the nearest donors and blood banks, view the real-time inventory

II. LITERATURE REVIEW

Recent research highlights the growing importance of centralized and technology-driven blood bank management systems [1], particularly in regions where fragmented systems create delays in emergency response [1]. Existing state-level platforms such as the Government of Jharkhand Blood Donor Portal demonstrate how centralized digital systems can facilitate donor registration, blood bank listings, and emergency requests through an integrated interface [1]. However, other regional resources, such as local directory-based listings of blood banks [2], often function merely as static information portals without real-time coordination capabilities. Similarly, organizational websites such as the Andhra Pradesh Red Cross Society [3] provide essential humanitarian and blood donation information but lack unified, state-wide digital integration. These examples highlight the limitations of isolated or partially digitized systems and emphasize the need for comprehensive, interconnected infrastructure.

Several studies on digital health infrastructure in India emphasize the importance of state-level integration to ensure faster donor identification, efficient communication between hospitals and blood banks, and transparent inventory tracking [4][5]. Researchers point out that many existing platforms operate in isolation, limiting accessibility and real-time coordination [4]. This gap is especially critical in emergency situations where even minor delays in locating compatible blood donors can cost lives [5].

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These findings strongly support the development of a centralized system that connects all blood banks within a specific state and enables structured, location-based donor registration.

Further studies on automated blood bank systems demonstrate that integrating cloud-based platforms and real-time analytics significantly improves operational efficiency and data accuracy [5][6]. Research on automated donor management systems explains how digital dashboards for different stakeholders—such as blood banks, hospitals, and administrators—enhance accountability and streamline workflows [4]. Features such as online donor registration, appointment approval, automated inventory updates, and real-time availability tracking reduce manual errors and improve transparency [6]. Scholars also emphasize the importance of role-based access control, which ensures that each stakeholder can perform only authorized tasks while maintaining data security [4][6]. These technological advancements align closely with the concept of a centralized Blood Bank and Donor Management System with personalized dashboards and integrated cloud support.

Additionally, literature focusing on healthcare information systems underscores the value of real-time inventory visibility and geographic filtering for efficient resource allocation [5]. Studies reveal that enabling hospitals to view nearby blood banks, check live inventory levels, and send digital requests dramatically reduces response time during emergencies [4][5]. Similarly, donor-focused features such as viewing past donations, booking appointments, and receiving updates improve donor engagement and retention [6]. Research also highlights the importance of administrative control features, such as monitoring system-wide data and managing public awareness content like blood donation camp images through dynamic carousels [4]. Collectively, these studies validate the necessity of a comprehensive, state-level centralized platform—such as the proposed system for Andhra Pradesh—that integrates blood banks, hospitals, donors, and administrators into a single, efficient, and responsive digital ecosystem [1][4][5][6].

III. METHODOLOGY

The development of the Centralized Blood Bank Management System using integrated cloud services and real time analytics was carried out in several well-defined phases to ensure systematic progress and alignment with user requirements. The system was built as a web-based application using HTML, CSS, and React for front-end development and firebase, firebase database for backend, with a focus on personalized dashboards, real time tracking analytics, appointment, blood request.

A. System Design

We initially draw a rough design on note books then we designed a simple design for each dashboard and home screen using Figma tool which has all the design features like animations, different shapes dimensions and we want to use less dark colours which are less strain for eyes and latest Glassmorphic design which is inspired by apple.

B. Development

We decided to use react frame work because it is single page application (no need to load for each page or dashboard) with functions, hooks and states and it has components which helps in reusability of code. For the initial setup we used vite , vite is platform which is used for setting up all node modules and directories and essential files like readme, gitignore, src, components etc…

We used firebase as a backend for the project and for database we used firebase database.

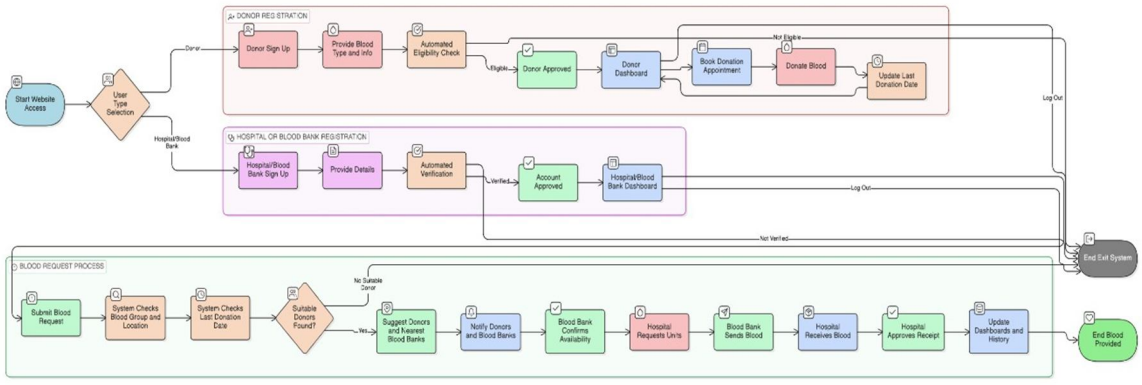


Fig.1.Flowchart for Blood Donation and Donor Management System.

C. Deployment

Once we check that all features are working properly pushed our code into git hub and we hosted the whole website in GitHub pages and for the database and backend we went with the
Firebase for demonstration and testing purpose it is beneficial while demonstration.

D. Documentation

To make sure user get to know everything we have created an elaborated user manual or documentation using Ms word with the results which helps the user to guide how to use this system in better way for better experience we explain every feature with real time screenshots for guidance.

E. Maintenance

We continuously improve the experience by fixing bugs through git hub and implement modern uerinterface for better user experience and we will try add new feature which are we wanted to add in future scope .

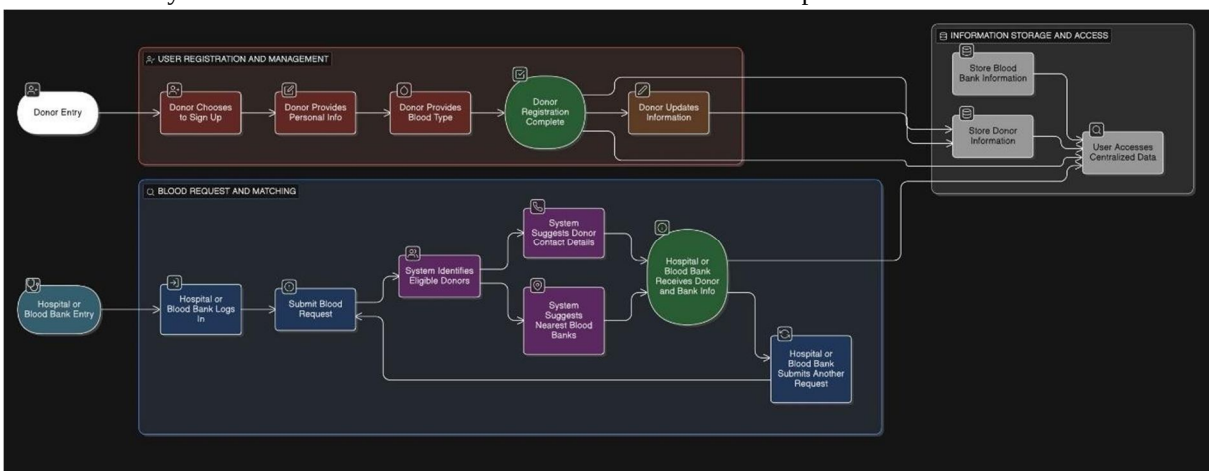


Fig.2.Use Case diagram

IV. SYSTEM WORKFLOW

A. Home Page Feature

The home page is the main entry point for our website the initial link will redirects to the home page homepage includes:

1) A carousel which displays multiple photos which can be controlled by admin he can add photos and description of the recently organized blood camps.

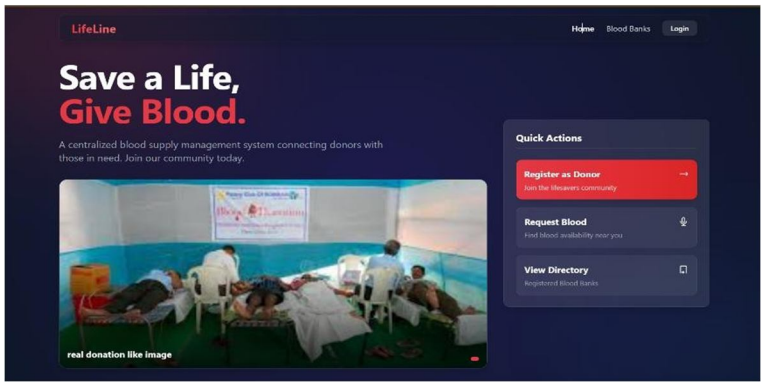


Fig.3.Home Page

2) Quick actions: It has three buttons Register as donor button redirects to donor registration, Request Blood takes to temporary registration form and view directory button helps to see all the blood banks available in Andra Pradesh.

3) Login button which redirects to login page for donor or hospital or blood bank.

B. Registration Pages

In this project there are mainly 3 registration forms which allows users to register according to roles it takes details based on roles.

1) Donor registration: Donor registration takes the details ki donor last donation date , location through select menu etc.

2) Blood Bank: In Blood bank registration it takes blood bank location , capacity , tests they offer etc.

3) Hospital: In this will take hospital location , HFR ID(this is id provided by national organisation for all health facilities), etc

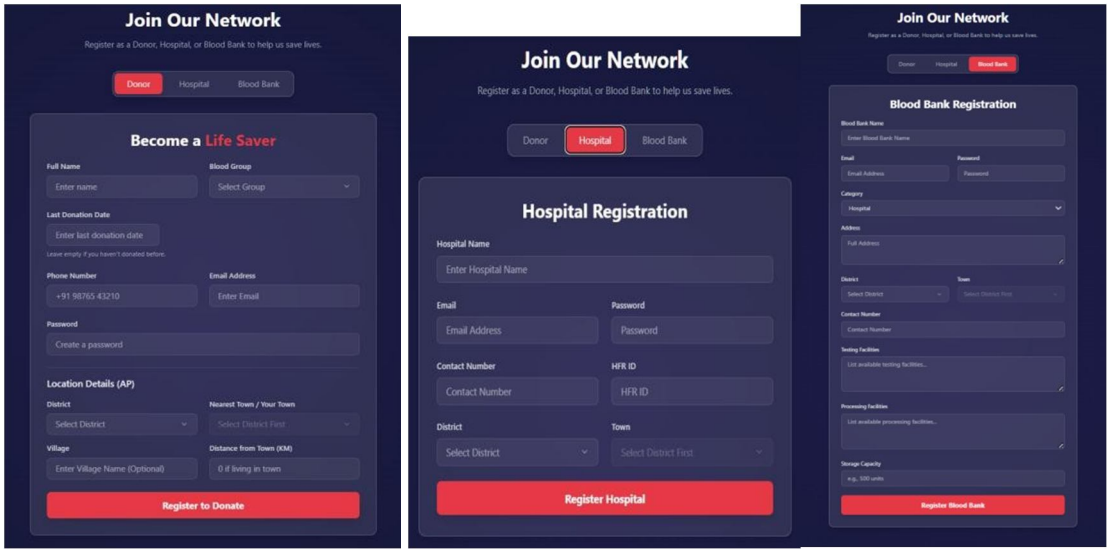


Fig 4,5,6. Donor, hospital, blood bank registration forms

a) Donor Dashboard:

Donor dashboard offers features like donation history, last donation, appointment booking.

- Appointment booking: If it's been 3 months that donor donated his last donation then he can book appointment by selecting date and all.
- Donation history: It show last donation done by the user with blood bank name and number of units donated by user.

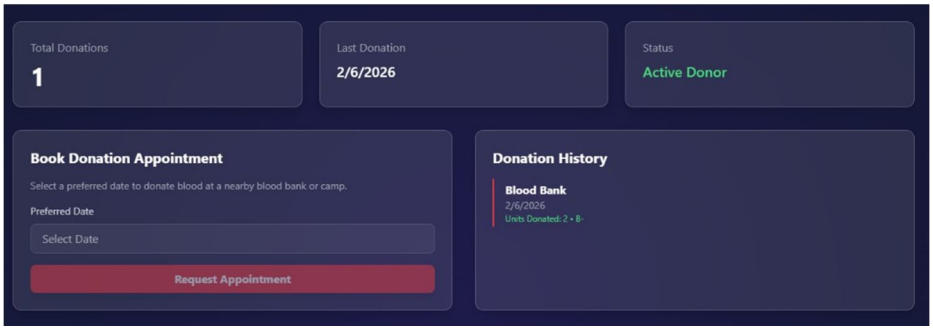


Fig.7.Donor Dashboard

b) Blood Bank Dashboard:

Blood bank has the features like donor appointment management, blood request management and show live inventory.

- Donor appointment: Blood bank show donor appointment then they can accept or decline the request with the date so it will be reflected to donor.
- Live inventory: live inventory update the blood level of different blood group so that nearest hospitals get to know levels.
- Blood request : Request by hospitals will be shown in this request panel and they can accept and send that particular blood group.

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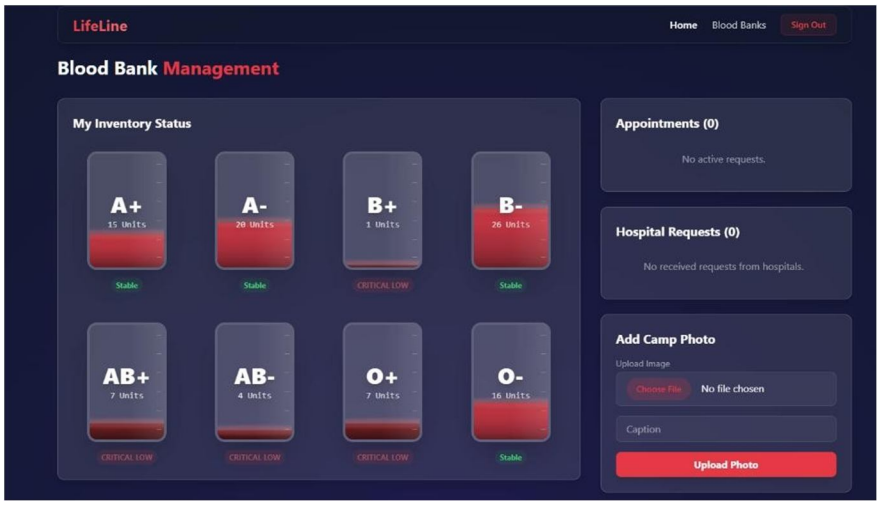


Fig.8. Blood bank Dashboard

C. Hospital Dashboard

Hospital dashboard has features like: live inventory, blood request, history.

- Blood request: Hospital can request a particular blood group then the system will suggest nearest donor with that same blood group and nearest blood bank.
- Live inventory: It will show the blood level from the nearest blood bank.
- History: shows all the request from blood bank with number units.

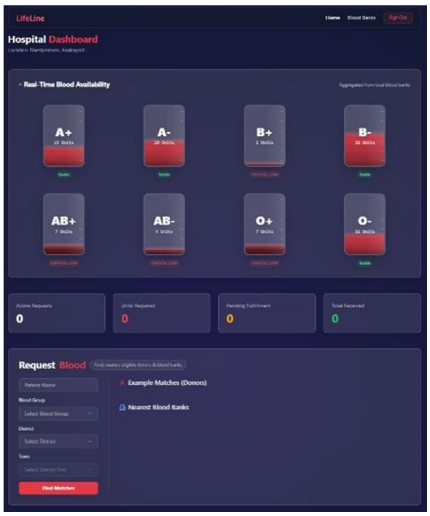


Fig.9 Hospital Dashboard.

V. FUTURE SCOPE

1) AI-based Demand Prediction: Artificial Intelligence can be integrated into the system to analyse past donation records and hospital blood requests to predict future blood demand. This will help blood banks maintain sufficient stock of specific blood groups and organize donation drives in advance to prevent shortages during emergencies.

2) Mobile App Integration for Donors: A mobile application can be developed to allow donors to easily register, receive emergency notifications, schedule donation appointments, and track their donation history. This will improve accessibility and encourage more people to participate in blood donation.

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3) Inclusion of Telugu Language in the Website: Adding Telugu language support will make the platform more accessible to users in Andhra Pradesh. It will help local donors, hospital staff, and blood bank personnel use the system comfortably and increase participation from rural and regional communities.

4) Integration with National Health Systems: The system can be integrated with national healthcare platforms and government blood bank networks to share blood availability data across different regions. This will enable hospitals to locate required blood units quickly during critical situations and improve nationwide coordination.

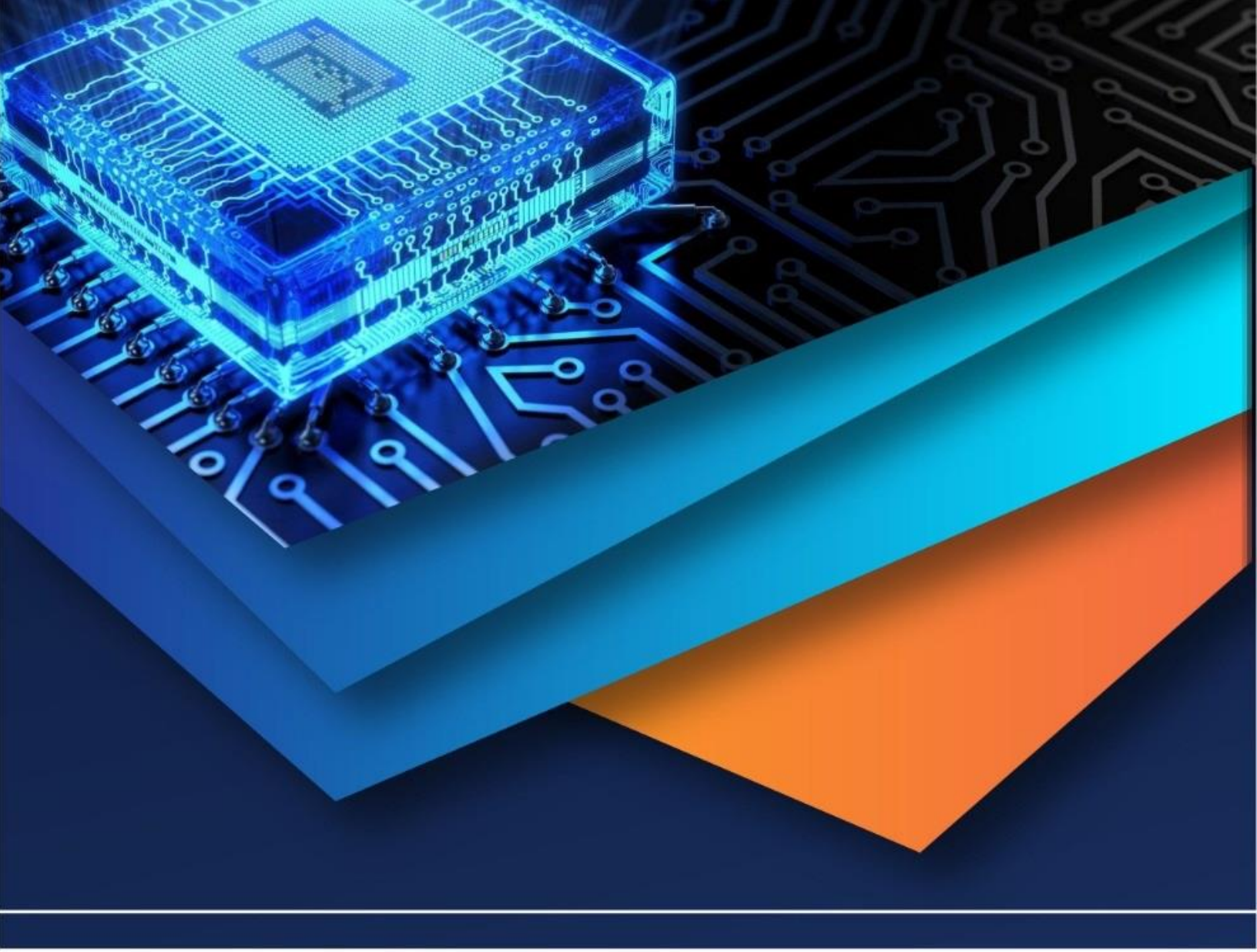
VI. CONCLUSION

The Centralized Blood Bank Management System using Integrated Cloud Services and Real-Time Analytics provides an efficient digital solution to improve coordination between blood donors, hospitals, and blood banks. By integrating all stakeholders into a single web-based platform, the system simplifies donor registration, blood request management, and real-time inventory tracking. The use of modern technologies such as React for the frontend and Firebase for backend services enables fast data access, real-time updates, and a scalable cloud-based infrastructure. Personalized dashboards for different users, including donors, hospitals, and blood banks, help streamline operations and improve transparency. The system also allows hospitals to quickly locate eligible donors and nearby blood banks during emergencies, which significantly reduces response time and improves the chances of saving lives. Overall, this project demonstrates how technology can enhance healthcare resource management, reduce blood wastage, encourage voluntary blood donation, and create a more organized and responsive blood supply network across Andhra Pradesh.

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