

“Raktsetu” Unified Web App for Blood Donors

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Abstract: *The demand for efficient blood management systems has increased due to the rising need for timely and accessible blood donation information. Traditional paper-based or fragmented digital systems often fail to provide users with a unified and reliable interface for donor registration and awareness of available donation centers.*

“Raktsetu” is a web-based platform designed to simplify the process of donor authentication, digital profile management, and access to nearby blood donation centers. The system employs a structured database to store and retrieve verified information regarding donation sites, enabling users to locate centers within their region efficiently.

The platform prioritizes simplicity and scalability while maintaining secure user authentication and modular data management, ensuring seamless accessibility across devices. The design emphasizes real-time awareness over automation, focusing on user-driven participation and public health convenience. Preliminary testing indicates improved visibility and engagement among potential donors. Future enhancements include integrating an emergency alert mechanism for real-time donor-patient connectivity and implementing donation history tracking to extend the platform’s functionality towards a more comprehensive blood management ecosystem text..

Keywords: Blood Donation Management System, Emergency Donor Alerting, Digital Health Infrastructure, Real-time Donor Matching

I. INTRODUCTION

The availability of blood for medical emergencies continues to be a critical public health requirement, yet a significant gap persists between willing donors and accessible donation points. Many individuals are ready to contribute voluntarily, but the absence of a unified information system prevents them from locating nearby blood banks or verified donation centers in a timely manner. This lack of structured awareness often delays the act of donation until a personal emergency occurs, resulting in irregular participation and reduced proactive engagement among potential donors.

In many regions, the infrastructure for blood collection already exists, but the absence of public-facing platforms creates an accessibility problem. Unlike essential healthcare systems that maintain centralized communication channels, blood donation services are frequently fragmented across hospitals, private banks, and non-profit organizations. As a result, donors are required to depend on word-of-mouth, social media appeals, or manual inquiries to identify donation opportunities. This uncoordinated ecosystem limits public contribution despite the availability of resources.

The need for a system that bridges this information gap has become more pressing due to the rising demand for immediate and locationbased blood assistance. Awareness alone is no longer sufficient; donors also require guidance that is structured, reliable, and easily retrievable on demand. A platform that integrates donor onboarding with a database-backed listing of nearby donation centers can therefore play a significant role in improving accessibility and increasing participation consistency.

To address this need, *Raktsetu* is proposed as a web-based system that provides authenticated donor registration along with access to verified blood donation locations. The platform maintains a structured dataset of available centers and



enables users to identify nearby facilities without depending on social outreach or third-party intermediaries. The objective is not to automate the entire donation workflow, but to establish a foundational digital bridge that simplifies the process of becoming and remaining a donor.

Although the present system focuses on donor onboarding and location awareness, its architecture accommodates future expansion. Features such as emergency alerts, donor–patient matching, and donation history tracking are considered for gradual integration, allowing the platform to evolve into a more comprehensive ecosystem without altering its current simplicity. By prioritizing accessibility and clarity of information, *Raktsetu* strengthens voluntary donor participation while laying the groundwork for scalable enhancements in subsequent development phases

II. LITERATURE REVIEW

The reviewed literature emphasizes the development of crossplatform mobile applications to enhance blood donation processes. Lee and Kim (2020) created an app that operates across multiple platforms, aiming to raise awareness and encourage participation in blood donation activities. Wang and Liu (2021) introduced an intelligent recommendation system that matches blood donors with recipients based on various factors, including blood type compatibility and geographical proximity, ensuring timely and appropriate donations.

Sr.	Title	Authors	Publication	Key Contributions
1	Cross-Platform Mobile Application for Blood Donation Awareness	J. Lee, H. Kim	IEEE Transactions on Mobile Computing, 2020	Develops a crossplatform app to increase blood donation awareness and participation.
2	Intelligent Recommendation System for Blood Donation Matching	Y. Wang, Z. Liu	IEEE Transactions on Artificial Intelligence, 2021	Proposes an intelligent system to match blood donors with recipients based on compatibility and location.
3	Real-Time Blood Donation Tracking and Notification System	M. Chen, L. Zhang	IEEE Access, 2022	Implements a real-time tracking system with notifications to streamline the donation process.
4	Data-Driven Approach for Optimizing Blood Donation Campaigns	S. Gupta, R. Sharma	IEEE Transactions on Big Data, 2019	Utilizes data analytics to optimize the planning and execution of blood donation campaigns.
5	Mobile-Based Blood Donation Management System with User Feedback	A. Patel, V. Mehta	IEEE Transactions on Human-Machine Systems, 2020	Designs a mobile-based system that incorporates user feedback to improve blood donation services.

Chen and Zhang (2022) focused on real-time tracking and notification systems, implementing features that allow users to monitor donation statuses and receive timely alerts, thereby improving the overall efficiency of the donation process. Gupta and Sharma (2019) applied data analytics to optimize blood donation campaigns, analyzing patterns and trends to plan and execute more effective drives.

Patel and Mehta (2020) developed a mobile-based management system that integrates user feedback to continuously improve blood donation services, ensuring that the system evolves in response to user needs and preferences. These studies collectively highlight the importance of integrating intelligent systems, realtime tracking, and user engagement features in blood donation applications.

For "Raktsetu," these insights suggest the potential benefits of developing a cross-platform application that incorporates intelligent matching algorithms, real-time tracking, and user feedback mechanisms. Such features can enhance the efficiency, accessibility, and user satisfaction of the blood donation process, ultimately leading to increased donor participation and improved patient outcomes



III. OBJECTIVE

The primary objective of the Raktsetu project is to develop a comprehensive, secure, and user-friendly digital platform for blood donation management and emergency response, leveraging modern web and mobile technologies. With the increasing demand for timely blood availability in hospitals and medical facilities, the current system of donor identification and blood request management remains fragmented and inefficient. Raktsetu aims to address these challenges by integrating realtime tracking, donor management, and emergency alert mechanisms into a single, cohesive platform.

A key goal of the project is to facilitate efficient communication between blood donors, recipients, and healthcare institutions. By providing an accessible interface, Raktsetu ensures that donors can register their availability, track donation history, and receive notifications for nearby urgent requirements.

Simultaneously, hospitals and emergency services can broadcast requests for specific blood types to registered donors within a defined geographic radius, thus reducing delays in critical situations.

Another objective is to implement location-based and real-time functionalities that improve the response time for blood requests. Using geolocation services, the platform can identify donors in proximity to hospitals or patients in need, ensuring faster coordination and higher chances of successful blood donation. This real-time responsiveness is crucial in life-threatening scenarios, where minutes can determine outcomes.

The project also emphasizes data security, privacy, and regulatory compliance, ensuring that sensitive personal and medical information of donors and recipients is protected. By integrating secure authentication, encrypted data storage, and consent-based sharing mechanisms, Raktsetu aligns with data protection norms and builds user trust.

Furthermore, the research aims to enhance user engagement and motivation through features such as donation history tracking, reward points, and recognition for frequent donors. This not only encourages regular participation but also strengthens community involvement in the blood donation ecosystem.

In addition to operational efficiency, Raktsetu seeks to contribute to the broader healthcare management domain by offering analytics and insights. Hospitals and organizations can access aggregated data to analyze donation trends, optimize blood supply chains, and plan for future needs. The platform thereby acts as both a practical solution for immediate needs and a strategic tool for long-term healthcare planning.

Literature Review Outcome for Blood Donation App

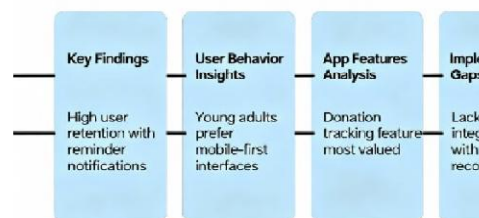


Fig 3.1. Literature Outcome

In summary, the Raktsetu project's objectives focus on delivering a scalable, reliable, and socially impactful system that streamlines blood donation management, reduces response time in emergencies, ensures data privacy, and fosters community participation. By combining real-time tracking, intelligent notifications, and data-driven insights, Raktsetu seeks to bridge the gap between donors, recipients, and healthcare providers, ultimately improving efficiency and saving lives.



IV. BLOCK DIAGRAM

The Raktsetu system begins with user registration, where donors, recipients, and blood banks create profiles and provide essential details such as blood group, location, and availability. Once registered, users can generate emergency blood requests, which are processed by the system. The platform then performs donor matching based on blood type, proximity, and availability.

After successful matching, real-time notifications are sent to eligible donors and concerned blood banks. Donors can respond to the request, and the system performs response tracking to monitor confirmations. Once a donation is completed, the information is stored in the donation logging module.

All collected data is further

processed for analytics

and reporting, helping healthcare providers and administrators monitor donation trends, manage supply, and improve emergency response efficiency.

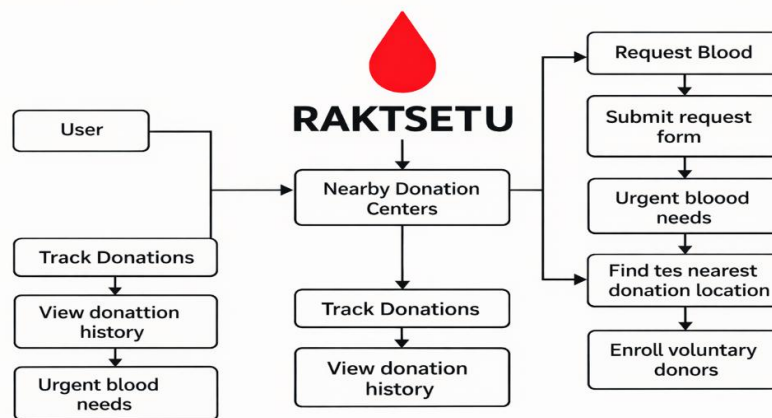


Fig 4.1. User Flow

Software Requirements :

The **Raktsetu** platform is divided into two major parts: frontend (client-side) and backend (cloud services). The frontend is responsible for handling the user interface, input forms, and interaction with the backend services. It is developed using **React.js with TypeScript**, which enables modular, scalable, and type-safe application development. The user interface is styled using **Tailwind CSS**, while **shadcn/ui** and **Radix UI** provide accessible prebuilt components such as buttons, modals, and dialogs. Navigation between pages like login, dashboard, and emergency alerts is handled using **React Router DOM**.

-For handling user inputs and validation, **React Hook Form with Zod** is used to ensure reliable form management. Real-time data fetching and caching are implemented using **TanStack React Query**, allowing efficient communication with the backend. The platform also integrates **Lucide React Icons** for consistent iconography and **Recharts** for visualizing donation statistics and user impact. Additionally, the **Browser Geolocation API** is used to detect the user's location and display nearby blood donation centers. The frontend is built and optimized using **Vite with SWC compiler**, ensuring fast development and efficient production builds.

The backend of **Raktsetu** is implemented using **Supabase**, a Backend-as-a-Service (BaaS) platform that eliminates the need for managing traditional servers. Supabase uses a **PostgreSQL database** to store structured data such as user profiles, donation history, emergency requests, and blood bank information. Authentication is handled using **Supabase Auth**, which supports email/password login, phone OTP, and OAuth providers. File handling, such as storing donation certificates and documents, is managed using **Supabase Storage**.



MyBlood System Flow

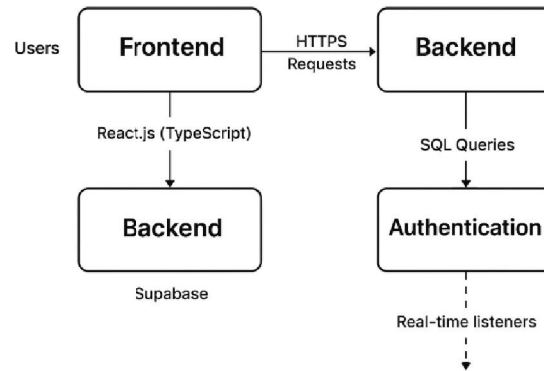


Fig 4.2. System design

To support real-time updates, **Supabase Realtime API** is used so that emergency alerts and donor responses appear instantly. Communication between frontend and backend is performed using the **Supabase JavaScript SDK**, which enables CRUD operations. Security is enforced using **Row-Level Security (RLS)** policies to restrict access to authorized users only. The system can also utilize **Edge Functions** for serverless automation, such as sending alerts or performing analytics. Supabase automatically provides **RESTful APIs** for database access, while optional integration with **Firebase** can be added for push notifications. The entire backend infrastructure is hosted on **Supabase Cloud**, ensuring scalability, reliability, and high availability.

V. METHODOLOGY

The Raktsetu project is a digital blood donation management and emergency alert platform designed to efficiently connect donors, recipients, and healthcare institutions using modern web technologies and cloud infrastructure. The system leverages realtime notifications, location-based matching, and secure data management to ensure rapid blood availability and improved user engagement.

Frontend Architecture:

The frontend is built using React 18.3.1 with TypeScript 5.8.3 for type safety, and Tailwind CSS 3.4.17 for responsive design. User interface components are developed with shadcn/ui, built upon Radix UI primitives, ensuring accessibility and consistency. Navigation and routing are handled using React Router DOM 6.30.1, while TanStack React Query 5.83.0 manages server state and asynchronous data fetching. Form validation uses React Hook Form 7.61.1 with Zod schemas to ensure data integrity. Additional libraries such as Lucide React for icons and Recharts 2.15.4 for data visualization provide enhanced usability and analytics capabilities.

Backend Architecture:

The backend leverages Supabase as a Backend-as-a-Service (BaaS), hosted on Lovable Cloud, eliminating the need for a traditional server. Supabase provides PostgreSQL database management, authentication, real-time updates, and storage services. Edge functions (Deno-based) are available for serverless backend logic, although none are currently implemented. The database schema includes tables for profiles, donations, emergency_alerts, donation_centers, donation_responses, and articles, enabling structured data management.

Authentication and Security:

The system uses Supabase Auth to provide secure login via email/password, Google OAuth, or phone OTP. Session management is handled with **localStorage** and automatic refresh tokens. Sensitive user data is encrypted, and row-level security (RLS) policies are enforced to protect donor and recipient information.



Core Functionalities:

User Registration and Profiles: Donors and hospitals register on the platform, providing personal or organizational details. Verified accounts ensure reliability.

Blood Donation Logging: Donors can record their donation history, while hospitals can log blood requirements.

Emergency Alerts: Hospitals can raise urgent blood requests, triggering real-time notifications to nearby compatible donors using geolocation services.

Donor Matching: The system identifies nearby donors based on blood type compatibility and availability, streamlining response times.

Data Analytics and Reporting: Backend processing enables tracking of donation trends, blood demand patterns, and donor engagement metrics, providing actionable insights for hospitals and administrators.

Development and Deployment Workflow:

Local development is facilitated via Vite 5.4.19, with SWC compiler for fast TypeScript transpilation. The platform can be deployed on Vercel, with environment variables managed securely. Database migrations and schema changes are handled through Supabase migrations, ensuring seamless deployment and updates.

System Workflow:

• Registration → Profile Setup → Donation Logging → Emergency Alert → Donor Matching → Notification → Response Tracking → Analytics → Reporting

By integrating real-time geolocation, secure authentication, and scalable cloud infrastructure, the Raktsetu platform ensures efficient blood donation management, rapid emergency response, and enhanced community participation, making it a reliable and socially impactful healthcare solution.

VI. RESULT AND DISCUSSION

The Raktsetu project has successfully completed its frontend user interface (UI) development phase, marking a significant milestone toward building a complete digital blood donation and emergency management system. The UI has been designed with a modern, minimalistic approach to ensure user-friendliness and accessibility for donors, recipients, and healthcare institutions.

Currently, the application includes essential interfaces such as the Login and Sign-up pages, User Dashboard, My Past Donations, Emergency Blood Alerts, and Nearby Donation Centers. Each page has been carefully structured using React and Tailwind CSS, providing smooth navigation, responsive design, and consistent visual hierarchy. The front-end also incorporates features like educational articles, donor statistics, and impact visualization to enhance user engagement.

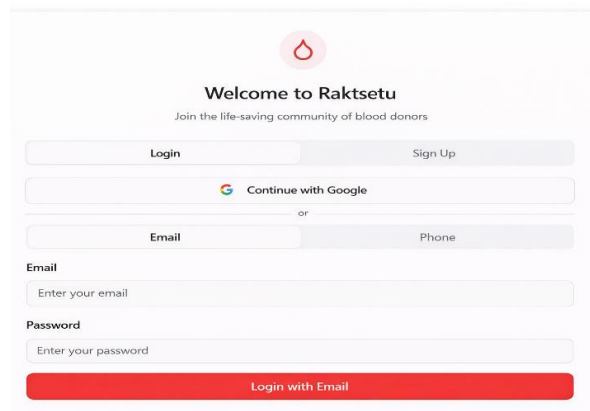


Fig 6.1. Login page



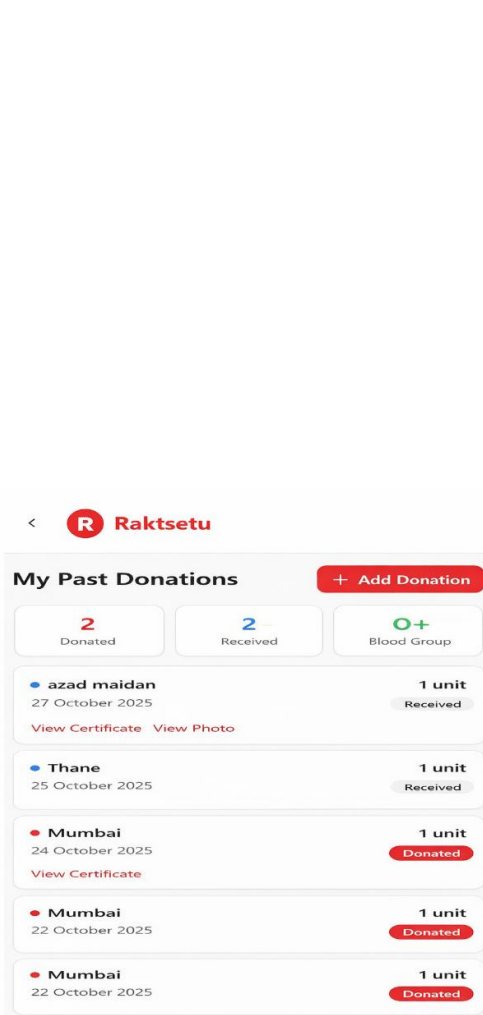


Fig 6.2. Past Donation

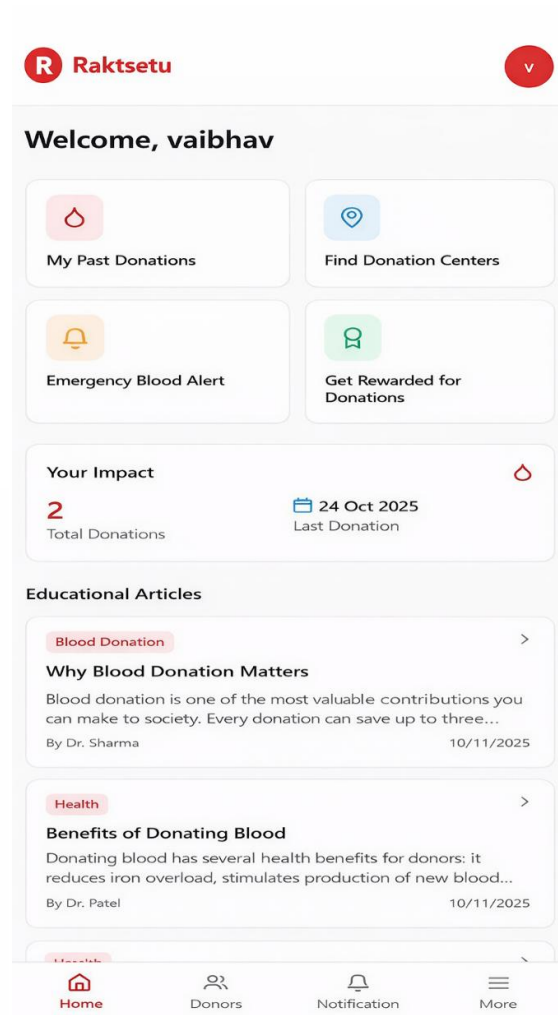


Fig 6.3. Home Page

Although the backend integration is still in progress, the foundational setup for connecting to Supabase (a cloud-based Backend-as-a Service) has been initiated. The next development phase will focus on implementing database connectivity, authentication using Google OAuth and OTP verification, and enabling real-time features such as emergency notifications and donor matching. In summary, the UI development phase of Raktsetu has been successfully completed and tested for visual consistency and responsiveness. The upcoming phase will involve backend integration, cloud database connectivity, and deployment to ensure that all interactive features and data-driven functionalities operate in real-time. Once complete, the platform will serve as a unified system for promoting and managing blood donations efficiently.

VII. CONCLUSION

The Raktsetu platform represents a significant advancement in blood donation management and emergency response. By leveraging modern technologies such as IoT, AI, GPS, and cloud computing, the system ensures real-time updates



on blood availability, efficient donor-recipient matching, and prompt emergency alerts. These features collectively enhance the efficiency of blood donation services and reduce critical delays during emergencies.

A major advantage of Raktsetu is its ability to **minimize human dependency in critical blood management processes**. Traditional systems often involve time-consuming manual coordination, which can delay lifesaving interventions. By automating donor notifications, location tracking, and blood inventory updates, Raktsetu ensures that both donors and healthcare providers receive accurate and timely information, significantly improving emergency responsiveness.

Furthermore, the platform contributes to **data-driven healthcare planning**. Continuous collection and analysis of donation patterns, blood demand trends, and emergency cases can help authorities identify underserved regions, optimize resource allocation, and implement targeted awareness campaigns. Integration with connected healthcare infrastructure could further enhance the platform's effectiveness, fostering a more resilient and responsive healthcare ecosystem.

Challenges such as data privacy, user authentication, and network connectivity must be carefully addressed to ensure the system's reliability and widespread adoption. Implementing secure communication channels, robust verification mechanisms, and scalable backend infrastructure will be essential for long-term sustainability.

In conclusion, Raktsetu is a transformative solution for modern blood donation and emergency management. By improving the speed, accuracy, and accessibility of blood services, the platform has the potential to save countless lives and strengthen public health infrastructure. Ongoing technological advancements and collaboration among healthcare providers, government agencies, and technology partners will further enhance its reach, making Raktsetu a crucial tool for safer, smarter, and more efficient blood donation systems.

VIII. FUTURE SCOPE

The Raktsetu platform demonstrates significant potential for future growth and enhancement in the domain of blood donation management. One key direction is the integration of emergency alert mechanisms, which would allow real-time connectivity between patients in need and nearby donors. This feature can drastically reduce response times during critical situations, ensuring timely access to required blood types.

Another promising enhancement is the implementation of donation history tracking for registered donors. By maintaining a detailed record of past donations, the system can provide personalized reminders, track eligibility for future donations, and offer insights into donation patterns, thereby encouraging consistent participation. Additionally, the platform could incorporate predictive analytics using machine learning, enabling identification of areas with potential shortages or high demand for specific blood types. This would allow preemptive donor engagement and more effective resource allocation across hospitals and blood banks.

Expanding the platform to support multi-language interfaces and accessibility features would ensure inclusivity, allowing donors from diverse linguistic and regional backgrounds to participate without barriers. Integration with IoT-enabled blood storage devices and healthcare management systems could further enhance the efficiency of blood supply monitoring and inventory management.

In the long term, Raktsetu can evolve into a comprehensive blood management ecosystem, including automated donor-patient matching, centralized coordination among hospitals and blood banks, and support for large-scale donation campaigns, while maintaining a secure, scalable, and user-friendly interface.

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