Blood Management System

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Abstract — The Blood Management System is a web and mobile-based digital platform developed to simplify and automate blood donation, request processing, and inventory control. The system establishes a direct connection between donors, receivers, and blood banks to ensure faster communication and improved accessibility. Major functionalities include secure user authentication, real-time blood stock monitoring, donor and receiver management, request approval workflows, notification services, and analytical reporting. By digitizing the entire blood management process, the system minimizes manual errors, enhances transparency, and ensures accurate tracking of blood units. This secure and user-friendly solution significantly improves the availability and efficient utilization of blood resources, especially during emergency situations.

Keywords: Blood Management System, Blood Donation, Blood Bank, Inventory Control, Donor, Receive

I. Introduction

Blood plays a vital role in healthcare services and is essential for surgeries, trauma cases, maternity care, cancer treatments, and various critical medical procedures. Despite its importance, many blood banks continue to rely on traditional manual or partially automated systems. These outdated methods often result in inefficient record management, delayed communication, poor tracking of blood stock, and increased wastage due to missed expiry dates. During emergencies, the absence of real-time information makes it difficult to locate the required blood group promptly.

The Blood Management System is designed as a modern digital solution to overcome these challenges. It provides a centralized platform that connects donors, receivers, blood banks, hospitals, and administrators, enabling seamless coordination and real-time data sharing. The system automates key operations such as donor registration, blood requests, stock monitoring, and notification alerts. With support for both web and mobile platforms, users can access the system anytime and from anywhere. Features such as live blood availability, emergency notifications, and role-based dashboards ensure efficient interaction among all stakeholders. The ultimate goal of this system is to build a reliable, transparent, and responsive blood management network that contributes to saving lives.

II. Problem Statement

Many blood banks still operate using manual or semi-automated methods to manage blood collection, storage, and distribution. This results in inaccurate data records, delays in identifying available blood units, weak coordination between donors and receivers, and increased wastage due to poor expiry tracking. In emergency situations, patients and hospitals struggle to locate suitable blood groups because there is no centralized system that displays real-time availability.

Additionally, blood banks face difficulties in contacting eligible donors quickly and managing requests efficiently, which leads to slower response times. Existing systems often lack essential features such as real-time notifications, role-based access control, and administrative monitoring tools. These limitations reduce the overall efficiency, transparency, and reliability of blood management services. Therefore, there is a strong need for an integrated, mobile-based Blood Management System that connects all stakeholders on a single platform to ensure timely blood availability, reduce errors, and improve operational efficiency.

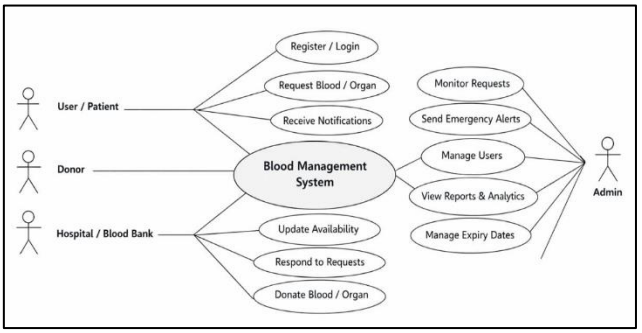
III. System Design

The Blood Management System follows a client–server architecture that integrates donors, receivers, blood banks, and administrators through both web and mobile applications. The system architecture consists of three main layers:

- Frontend Layer: Provides a user-friendly mobile and web interface
- Backend Layer: Handles business logic, authentication, and request processing
- Database Layer: Stores user information, blood inventory details, and transaction records

Role-based access control is implemented to ensure secure operations. Donors can manage their availability and donation history, receivers can submit and track blood requests, blood banks can manage inventory and approve requests, and administrators can monitor the entire system. Core modules include authentication, donor management, request handling, inventory monitoring, notification services, and administrative controls. This design ensures data security, real-time updates, and efficient coordination during critical situations.

IV. Use Case Diagram



V. TECHNOLOGIES USED

1) Flutter & Dart: Used to develop a cross-platform mobile application with a responsive and intuitive user interface.
2) PHP: Used for backend development and API services to handle application logic.
3) XAMPP: Acts as a local server environment for backend testing and database integration.
4) Supabase: Provides authentication, real-time database services, and cloud storage.
5) MySQL: Used as the relational database to store donor details, blood stock, and request records.
6) Google Maps API: Enables location-based search for nearby donors, blood banks, and hospitals.
7) Firebase / Push Notifications: Used to send instant alerts and emergency notifications to users.

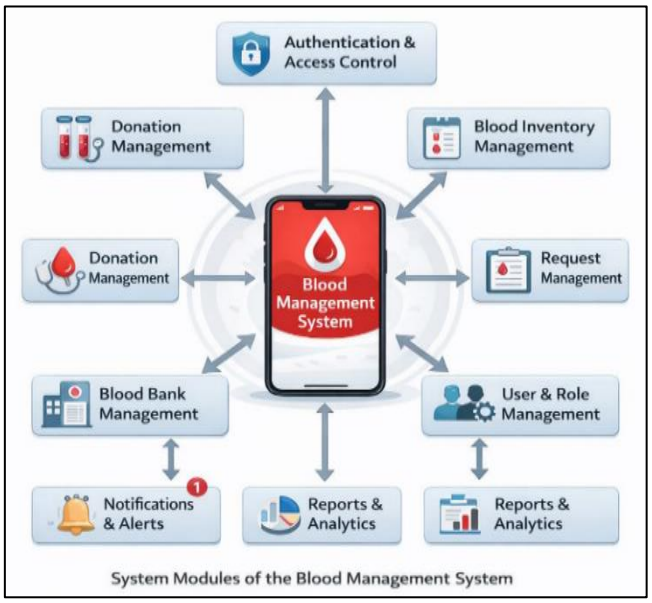
VI. PROPOSED SYSTEM

The proposed solution is a mobile-based Blood Management System that digitally integrates donors, receivers, blood banks, and administrators into a single platform. The system provides secure login with role-based access to ensure controlled functionality for each user. Donors can update their availability and respond to donation requests, while receivers can search for required blood groups, locate nearby blood banks, and monitor request status. Blood banks can efficiently manage inventory, track blood units by group and expiry date, and approve or reject requests. The system also generates notifications for urgent requirements and expiring blood units. An administrative module enables overall monitoring of users, requests, and system performance. This approach significantly improves coordination, accuracy, and emergency response efficiency.

VII. LITERATURE REVIEW

1) Several studies have explored blood bank management challenges and digital solutions. Smith et al. (2010) highlighted issues related to donor recruitment, screening, and safe storage of blood. Kumar and Sharma (2015) proposed an automated web-based system that reduced manual errors and improved efficiency.
2) Ahmed et al. (2019) focused on donor and inventory management software solutions, while Li et al. (2018) introduced a real-time blood stock monitoring platform to enhance emergency response.
3) Zhang et al. (2021) discussed the use of cloud computing, mobile applications, and artificial intelligence to optimize blood inventory management. However, most existing systems lack a fully integrated, real-time, mobile-based platform connecting all stakeholders. The proposed system aims to address this limitation.

VIII. METHODOLOGY



System Modules of the Blood Management System

– Step 1: User Registration: Donors, receivers, and hospitals register by providing personal and location details.
– Step 2: Profile and Availability Management: Donors and blood banks update availability and stock information.
– Step 3: Request Submission: Receivers submit blood requests through the application.
– Step 4: Location-Based Matching: Google Maps API identifies nearby donors or blood banks.
– Step 5: Emergency Notifications: Urgent requests trigger instant alerts via SMS or push notifications.
– Step 6: Donor Response: Donors accept or reject requests, and status updates occur in real time.
– Step 7: Record Update: Donation and transaction details are stored for future reference.
– Step 8: Administrative Monitoring: Admin oversees system activities, users, and reports.

IX. CONCLUSION

The Blood Management System offers a centralized and mobile-enabled solution to enhance the effectiveness of blood donation and distribution processes. By integrating donors, receivers, blood banks, and administrators on a single digital platform, the system improves transparency, coordination, and real-time communication. It reduces manual errors, enhances inventory monitoring, and minimizes blood wastage by tracking expiry dates accurately. Features such as location-based search, instant alerts, and role-based access ensure faster emergency response. Overall, the system demonstrates how digital transformation can modernize blood bank operations and contribute to improved healthcare outcomes and patient safety.

X. FUTURE SCOPE

1) AI-Based Donor Matching: Artificial intelligence can be used to identify the most suitable donors based on blood group, location, and availability, reducing response time during emergencies.

2) Voice Assistant Integration: Voice-enabled features can allow users to search for blood or request assistance hands-free during critical situations.

REFERENCES

[1] Agarwal, R., Singh, S., Atal, C., & Kingsley, D. (2020). Blood Bank System Using Database Security.
[2] Srivastava, D. K., Tanwar, U., Rao, M. G. K., Manohar, P., & Singh, B. A Research Paper on Blood Donation Management System. Lovely Professional University, India.
[3] Teena, A. C., Sankar, K., & Kannan, S. A Study on Blood Bank Management System. Bharath University, Chennai, India.

