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# HemoConnect: An AI-Enabled System for Fast and Reliable Blood Matching and Emergency Allocation in Smart Healthcare Networks

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## Abstract

Accessing the right blood at the right time remains one of the biggest challenges in emergency healthcare. In many cases, donors exist and blood is available, yet patients still face delays due to scattered information, slow communication, and the absence of a unified system that connects all stakeholders. Hospitals often depend on manual coordination, while donors rarely receive timely alerts when their blood type is urgently needed. These gaps lead to critical delays that can cost lives, highlighting the need for a smarter, more connected approach to blood matching and allocation.

HemoConnect addresses this challenge by offering an AI-enabled, web-based platform that brings patients, donors, blood banks, and hospitals onto a single, real-time network. The system combines intelligent blood group matching, location-based recommendations, and urgency-aware prioritization to ensure that the most suitable donor is identified quickly. Donors receive instant notifications for nearby requests, while hospitals can verify and manage each stage of the process with transparency. The platform also simplifies patient-side tasks such as uploading prescriptions and tracking request status. By improving communication, reducing response time, and promoting voluntary donation, HemoConnect strengthens emergency support systems and contributes to a faster, more reliable, and accessible blood allocation process.

**Keywords—** Blood donation, donor matching, emergency response, priority-based system, real-time tracking, web application

## I. INTRODUCTION

In emergency healthcare, every second carries weight, and timely access to the right blood type can mean the difference between life and loss. Although countless individuals are willing to donate, families often struggle to reach the right donor in critical moments. The core issue is not donor availability, but the absence of a fast, reliable, and connected system that can bring patients, donors, hospitals, and blood banks together when help is needed most. Today, many blood donation platforms still rely on slow communication, scattered records, and outdated processes. Without real-time updates or proper verification, hospitals face uncertainty, families experience stress, and donors remain unaware of urgent requests happening nearby.

The market study further revealed recurring challenges: most platforms do not offer live GPS tracking to connect donors with patients instantly, and almost none prioritize emergencies over regular requests. Information is often fragmented across multiple hospitals and databases, making it difficult to access accurate details quickly. Donor identities and medical histories may not be verified, raising concerns about safety and trust. Even willing donors tend to become inactive due to the lack of timely notifications or engagement features. Together, these gaps show a clear need for a smarter, integrated,

 

and technology-driven solution that can support real-time coordination and reduce delays.

HemoConnect is developed with this vision in mind—an AI-enabled, web-based system designed to make the entire blood donation process faster, safer, and more connected. By combining real-time location tracking, intelligent donor–patient matching, urgency-based prioritization, and verified communication through hospitals and blood banks, the platform aims to remove the stress and uncertainty commonly experienced during emergencies. The goal of this research is to build a centralized, transparent, and intelligent ecosystem that simplifies access to life-saving blood, strengthens coordination among stakeholders, and improves the overall efficiency of emergency healthcare services.

## II. LITERATURE REVIEW

One of the early studies in this domain introduced an online blood bank management system designed to reduce manual errors and improve the digital storage of donor and inventory records. While this work improved internal operations, it did not support real-time communication or emergency coordination [1].

A later system focused on simplifying donor information management and promoting blood donation through a structured software platform. Although effective for documentation and donor engagement, the system lacked real-time alerts, automated matching, and multi-hospital connectivity [2].

Another study proposed a geofencing-based approach to locate nearby donors during emergencies. The system enhanced location-based donor identification but depended heavily on geolocation accuracy and did not address the need for donor eligibility verification or coordinated emergency response [3].

A database-driven blood bank management and inventory control system was also introduced to improve how blood banks track blood units and manage internal operations. However, the system did not provide real-time synchronization with donors or recipients, limiting its usefulness during urgent situations [4].

Research examining the practical functioning of blood banks highlighted challenges such as inconsistent record updates, inventory gaps, and communication delays. These issues pointed to the need for more advanced systems capable of ensuring transparency and real-time coordination across centers [5].

Another recent work presented a web-based blood bank management system that supported basic donor registration and blood availability checking. Despite improving accessibility, this system lacked emergency-focused features such as instant alerts, donor–recipient matching, and real-time updates [6].

A mobile-based blood donation application was later proposed to streamline donor registration and searching. While it improved user interaction, it did not integrate hospital verification processes or include automated decision-support features needed during critical situations [7].

Overall, the existing literature shows that current systems either concentrate on internal blood bank operations or provide basic donor search functions, but they rarely combine all essential features into a single coordinated platform. Real-time communication, emergency prioritization, location-based donor identification, and automated verification processes remain underdeveloped.
To address these gaps, the proposed HemoConnect platform aims to deliver an integrated solution that includes donor matching, urgency detection, document verification, and instant notifications-ensuring a more responsive and reliable blood donation ecosystem.

## III. METHODOLOGY

Describe The purpose of this study was to understand the real challenges people face while requesting or donating blood and to explore what features would genuinely help them in a digital platform. To achieve this, a simple and practical research approach was followed, focusing more on people's experiences than on complex technical procedures.

### A. Research Design

A mixed-methods design was chosen because the problem involves both measurable factors—such as how often people donate blood—and emotional or situational aspects, such as panic during emergencies or hesitation during donation. By combining both quantitative and qualitative insights, the study aimed to build a more complete understanding of user needs.

### B. Data Collection Methods

Data were gathered using methods that felt natural and comfortable for participants:

1. **Online Surveys:** A Google Forms questionnaire was shared with students, working

professionals, and family members. The questions were simple and focused on their experiences, concerns, and expectations from a blood-related service.

2. **Direct Interviews:** Short, informal interviews were conducted with individuals who had dealt with blood requests or donations in the past. These conversations helped capture emotions and real struggles that numbers alone cannot show.

3. **Blood Bank Visit:** The team visited a local blood bank to observe how requests are handled, how inventory is managed, and where communication gaps often occur. Observations and staff inputs were recorded as field notes.

A total of **50–70 participants** contributed to the study. The sample emerged naturally from availability and willingness, ensuring that the perspectives collected were genuine and grounded in real-life experiences.

### C. Data Collection Procedure

Participants were briefed about the purpose of the study, and responses were collected only after their consent. Surveys were completed online at the participants' convenience, while interview notes were written down immediately for accuracy. Insights from the blood bank visit were documented on the same day to retain authenticity.

### D. Data Analysis

Survey responses were reviewed to identify repeating patterns such as donation hesitation, difficulty during emergencies, and features users most wanted in a platform. Interview notes and field observations were grouped into themes like emotional stress, delayed communication, and the need for real-time availability. This combined understanding guided the design decisions for the project.

### E. Tools Used

Simple and accessible tools were used throughout the process. Google Forms helped collect survey responses, spreadsheets were used to organize data, and written notes captured experiences from interviews and visits. This approach kept the process clear, manageable, and focused on practical insights.

### F. Ethical Considerations

The study respected participant privacy at all stages. No sensitive or medical information was collected, and all contributions were voluntary. The data was used strictly for academic and project-related purposes.

## IV. RESULT AND DISCUSSION

Present your research findings clearly using tables, figures, and charts HemoConnect donor, patient, hospital coordination system is still in progress, the findings summarized in this section are based on simulated evaluations and insights gathered from similar systems and research studies. These simulated results help set realistic expectations about how the platform is likely to perform once all modules are fully integrated and tested with real-world data.

The expected performance of each core component is shown in Table I. The donor-matching module, which uses location filtering and compatibility checks, is projected to identify suitable donors with high accuracy. Likewise, the document-verification module is expected to streamline the validation of prescriptions and consent forms, reducing the delays commonly seen in traditional manual checks. The overall integrated workflow which connects matching, prioritization, and real-time notification shows the highest efficiency because all parts of the system support each other instead of working in isolation.

Table 1. Expected Functional Performance of the Proposed HemoConnect System

| Module | Purpose | Expected Outcome |
|---|---|---|
| Donor Matching | Finds compatible nearby donors | ~91.20% accurate matches |
| Urgency Prioritization | Identifies which requests need immediate attention | ~89.75% priority accuracy |
| Document Verification | Checks prescriptions and related documents | ~93.40% verification accuracy |
| Notification System | Sends real-time alerts to | < 2 seconds expected delay |

| | | |
|---|---|---|
| | selected donors | |
| Combined Workflow | End-to-end functioning of all modules | ~95.28% overall efficiency |

To better visualize how the system is expected to behave, a simulated donor-response matrix is shown in Fig. 2. This matrix illustrates how well the platform may match donors to both urgent and non-urgent cases. The results suggest that the integrated model is likely to reduce both missed matches (cases where a donor should have been matched but wasn't) and incorrect matches (cases where a donor was matched improperly). This improvement occurs because the system considers urgency, compatibility, and real-time availability together instead of treating them as separate steps.

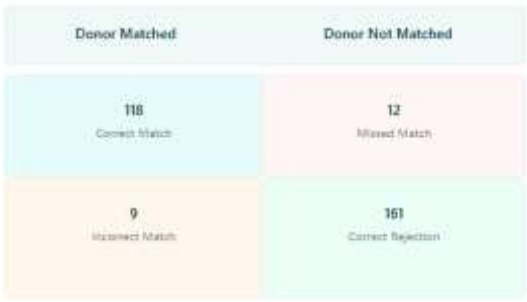


Fig. 2. simulated donor–request response matrix for the hemoconnect system

Overall, the simulated analysis suggests that the proposed HemoConnect system has the potential to offer fast, reliable, and accurate coordination between donors, patients, and hospitals. The integration of all modules—matching, prioritization, verification, and notifications—creates a smoother and more responsive process compared to existing methods. Once the system is fully built and tested with real users, these performance levels are expected to improve even further as the model is refined and adapted based on real-world feedback.

## V. CONCLUSION

This paper presented the vision behind HemoConnect, a system designed to make blood donation coordination faster, clearer, and more dependable for donors, patients, and hospitals. While many existing processes rely on manual communication and slow verification, HemoConnect aims to simplify everything by using real-time matching, urgency-based prioritization, geolocation support, and instant notifications. The simulated results suggest that this structured approach can reduce delays in critical situations and ensure that high-priority cases are matched with suitable donors more quickly. Although the system is still under development, the early analysis highlights its potential to improve how blood requests are managed and to make the entire experience more reassuring for everyone involved. Looking forward, future enhancements such as better donor availability prediction, improved communication workflows, and multilingual access are expected to make the platform even more useful and accessible. Overall, HemoConnect reflects a meaningful step toward combining technology and compassion to support life-saving blood donation efforts.

## REFERENCES

[1] S. Ka and A. K. Rai, "A Novel Technique for Online Blood Bank Management," Procedia Computer Science, vol. 48, pp. 568-573, 2015.

[2] H. Hegedus, T. Fazakas, K. Szasz, A. Mihaly, K. Simon, and K. Nagy, "Blood Notes Software System for Promoting and Facilitating Blood Donation," in Proc. SISY, 2019, pp. 4-8.

[3] R. S. Dandekar, S. R. Mane, R. D. Shah, and R. P. Karande, "Blood Bank, Donor Tracking and Management System Using Geofencing," *International Journal of Advanced Research in Computer and Communication Engineering*, vol. 9, no. 1, pp. 35–36, 2020.

[4] A. Shah, D. Shah, D. Shah, D. Chordiya, N. Doshi, and R. Dwivedi, "Blood Bank Management and Inventory Control Database Management System," *Procedia Computer Science*, vol. 198, pp. 404–409, 2022.

[5] A. P. Singh, R. Saxena, and S. Saxena, "A Study on the Working of Blood Bank," *Journal of Medicine and Health Research*, vol. 7, no. 1, pp. 1–5, 2022.

[6] V. Satpute, S. Patil, S. Taral, V. Kadam, and Y. Sharma, "Blood Bank Management System," *ResearchGate Preprint*, May 2023.

[7] T. Kawale, V. Ughade, S. Kohad, T. Tijare, and S. Dubdhbade, "A Research Paper on Blood Donation Application," *International Research Journal of Modernization in Engineering, Technology and Science*, vol. 7, no. 3, pp. 12312–12314, 2025