

# Result on Disaster-Aware Blood Donation Network using Geo-Alerts and Predictive Shortage Modeling

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**Abstract**—Traditional blood donation networks often lack the real-time communication and predictive planning necessary to respond effectively during disasters. This project proposes a framework that integrates geo-location alerts with machine learning-driven predictive modeling to improve emergency response. By analysing historical donation and usage trends, the system forecasts potential shortages to allow for proactive inventory management. Real-time geo-tracking and smart routing minimize delays and ensure the availability of blood in crisis scenarios.

**Keywords**—Blood Donation Network, Geo-Alerts, Disaster Response, Predictive Shortage Modeling, Healthcare Informatics.

## I. INTRODUCTION

Sudden spikes in blood demand during natural disasters and accidents pose severe challenges to existing healthcare infrastructures. The Disaster-Aware Blood Donation Network addresses these gaps by using data-driven insights and intelligent forecasting. Geo-alert technology is employed to notify nearby registered donors instantly during emergency shortages. Furthermore, predictive algorithms analyse consumption patterns to identify potential deficits in specific regions before they occur. This approach aims to bridge the gap between donors and recipients through automation and improved preparedness.

## II. RELATIVE WORK

1) Multi-objective location-distribution optimization in blood supply chain: an application in Turkiye (2024) Focuses on locating and distributing blood donation centres (fixed mobile) in Turkey under dual objectives: cost and quality. The cost objective covers setup and transport, while quality covers timely delivery and correct quantities. Uses a multiobjective mathematical model to balance these tradeoffs. While not explicitly limited to “disaster” scenarios, the location/distribution optimisation is highly relevant when systems face sudden demand or supply shifts (as in disasters). The model likely assists network designers create resilient infrastructure (mobile centres, strategic placement) which is a key feature of a disaster-aware network. This paper offers actionable insights for blood network planning (especially in emerging or unstable contexts). It could serve as a basis to extend into disaster-specific modelling (e.g., facility damage, demand surges) for your “Disaster-Aware Blood Donation Network” survey.

2) A Blockchain-Based Blood Donation System:

Enhancing Transparency, Accountability, and Sustainability in Healthcare (2024) Proposes a blockchain based system for blood donation management with goals: transparency, account ability, privacy, and sustainability. Addresses typical challenges in blood-systems: traceability of donor/recipient, secure personal data, efficient resource management. Although not solely framed in disaster response, the features (traceability, rapid matching, decentralised ledger) are very relevant in disaster contexts (when supply chains are stressed). The paper hints that such systems can reduce wastage and optimise resources

— crucial during disasters when every unit counts. For your topic of “Disaster-Aware Blood Donation Network”, this offers a technology-layer perspective: how system design (blockchain) can increase resilience. It would complement supply-chain / network-optimization papers by adding an ICT/traceability dimension. Might also prompt you to examine how blockchain could help in disaster scenarios (facility failure, donor data integrity after disaster, rapid re-routing of supply).

3) The role of social media in promoting voluntary blood donation during disasters: a short communication of the Lagos State bus-train collision (2024) Examines a real-life mass casualty event (bus-train collision in Lagos) and how social media was used to mobilize voluntary blood donation. Only 0.58 % of Lagos’s population are donors; the event triggered sudden demand, and the study reports on efforts to meet it. Focuses on donor mobilisation (via Twitter, community outreach) and centre expansion to meet the surge. Though a “short improving scalability, ensuring that event records could be easily retrieved and analyzed for institutional insights communication”, it is directly disaster-aware: showing how a sudden event required rapid donor mobilisation and flexible infrastructure. Useful for your literature survey because it links the social mobilization / human-behaviour side of a disaster aware blood donation network. It raises issues of scalability, communication, donor responsiveness — all relevant when designing networks that must perform under stress. Could help you anchor your survey in not just network/optimization but also behavioural, mobilization and communication dimensions of disaster-aware systems.

## III. PROPOSED WORK

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relevant when designing networks that must perform under stress. Could help you anchor your survey in not just network/optimization but also behavioural, mobilization and communication dimensions of disaster-aware systems. The primary goal of this architecture is to identify urgent blood demands during disaster situations, locate nearby eligible donors, and facilitate immediate response and delivery through optimized routing and notification mechanisms. The system ensures seamless communication among hospitals, donors, and administrators through a cloud-based infrastructure.

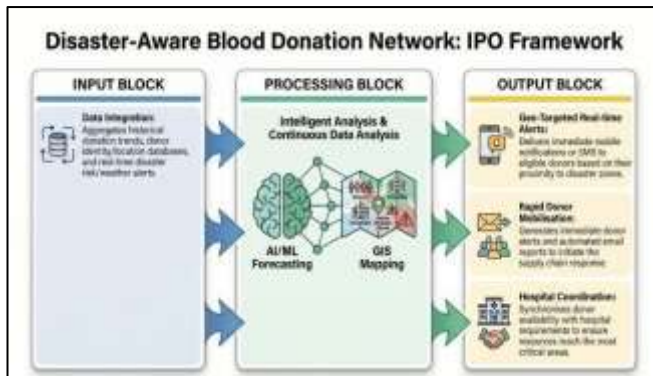


**Fig.1 Architecture User Authentication:**

The system shall allow users to log in using their username and password.

The system shall validate user credentials before granting access.

#### **Data Management:**

The system shall store and retrieve user data efficiently.

The system shall allow users to update their profile information.

#### **Search Functionality:**

The system shall provide a search feature to find specific products or information.

The system shall return relevant search results based on user queries.

#### **Notification System:**

The system shall send notifications to users for important events or updates.

The system shall allow users to customize their notification preferences.

#### **IV. LITERATURE REVIEW**

Recent research has explored various technologies to optimize blood supply chains, including multi-objective optimization models for centre placement and distribution. Blockchain-based systems have been proposed to enhance transparency, accountability, and donor privacy. Additionally, real-world case studies, such as the response to the Lagos bus-train collision, have demonstrated the effectiveness of social media in mobilizing voluntary donors during mass casualty events. While individual technologies like AI, GIS, and predictive analytics have been developed, there is a lack of a unified framework that combines all these elements into a single intelligent platform.

#### **V. PROBLEM STATEMENT**

During disasters, accidents, and medical emergencies, hospitals and blood banks often face sudden shortages of blood due to poor coordination, delayed communication, and lack of predictive planning. Traditional blood donation systems are unable to respond effectively because they do not provide real-time donor tracking, intelligent shortage prediction, or rapid communication mechanisms.

Additionally, the absence of geo-location-based donor identification and automated emergency alerts increases response time and affects the availability of blood during critical situations. Therefore, there is a need for an intelligent disaster-aware blood donation system that can predict future blood shortages, identify nearby eligible donors using geo-tracking, and provide real-time emergency alerts for efficient blood supply management.

#### **Objective:**

The primary objective of the proposed Disaster-Aware Blood Donation Network using Geo-Alerts and Predictive Shortage Modeling is to develop an intelligent and responsive blood donation management system for handling emergencies and disaster situations efficiently.

The system aims to integrate Artificial Intelligence, Machine Learning, Geo-Tracking, and Predictive Analytics technologies to identify nearby blood donors, forecast blood shortages, and improve communication between hospitals, blood banks, and donors in real time. The proposed framework also focuses on reducing response time through geo-based notifications, improving blood inventory management, optimizing donor-recipient matching, and enhancing emergency healthcare coordination. Additionally, the system is designed to support proactive disaster preparedness, minimize blood wastage, and ensure timely blood availability during critical situations using data-driven decision-making and automated alert mechanisms.

#### **VI. RESULT**

The implementation features dedicated interfaces for all stakeholders to ensure seamless coordination:

- **Admin Dashboard:** Provides a real-time overview of active users, hospitals, and total blood units [16 image, 22, 40 image, 46].
- **Inventory Management:** Displays blood stock levels with status indicators such as Good, Low, or Critical based on predefined thresholds [16 image, 22, 40 image, 46].
- **Donor Application:** Allows users to find nearby blood banks and hospitals using live mapping and GPS services
- **Performance Metrics:** The predictive model achieved an accuracy of 89.60% and a precision of 87.30% using a Random Forest Classifier
- In the Nashik region, the system predicts disaster probabilities based on historical datasets

## VII.CONCLUSION

The Disaster-Aware Blood Donation Network provides an intelligent solution for emergency blood management by centralising communication and using predictive analytics. The framework minimizes delivery delays and enhances healthcare resilience during crises. Future enhancements may include IoT-enabled monitoring, cloud scalability, and blockchain security to further protect data and improve response management.

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