

AI –Driven Blood Donation and Crisis Response Network using Geo Tracking

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Abstract—Blood availability during emergencies and natural disasters remains one of the major challenges faced by healthcare organizations. Existing blood donation systems often lack instant communication, intelligent forecasting, and efficient donor coordination. This research proposes a Smart Emergency Blood Supply Management System that combines artificial intelligence, geo-location services, and predictive analytics to improve blood availability during critical situations. The system enables hospitals and blood banks to send emergency alerts to nearby eligible donors using real-time GPS tracking. Machine learning algorithms analyze previous donation records, seasonal demand patterns, and emergency data to predict future blood shortages. The proposed framework also supports optimized donor matching, emergency response coordination, and secure data handling through cloud infrastructure. The developed system aims to reduce response time, improve blood inventory management, and enhance healthcare preparedness during disasters and medical emergencies.

Keywords— Smart Blood Management, Emergency, Healthcare System, Predictive Analytics, GIS Tracking, AI in Healthcare, Blood Bank Automation, Donor Alert System

I. INTRODUCTION

Blood donation plays a critical role in saving human lives during emergencies, disasters, accidents, and medical surgeries. However, traditional blood donation systems face major challenges such as delayed communication, inefficient donor management, lack of real-time tracking, and unavailability of blood during crisis situations. During natural disasters like floods, earthquakes, pandemics, and road accidents, the demand for blood suddenly increases, creating pressure on hospitals and blood banks.

To overcome these limitations, an AI-Driven Blood Donation and Crisis Response Network using Geo Tracking is proposed. The system integrates Artificial Intelligence (AI), Machine Learning (ML), Geographic Information System (GIS), and real-time geo-tracking technologies to create an intelligent blood donation ecosystem. The proposed network helps hospitals locate nearby donors instantly, predicts future blood shortages using AI algorithms, and provides emergency alerts through mobile applications and SMS notifications.

The main objective of this research is to develop a secure, intelligent, and scalable crisis-response blood donation network capable of reducing blood shortages, minimizing response time, and improving healthcare support during emergencies.

II. RELATIVE WORK

1) AI-Based Blood Donation Management System (2024): This research introduced an AI-powered blood donation platform that automates donor matching and blood inventory management. Machine learning algorithms were used to predict blood demand and optimize donor selection. However, the system lacked disaster-awareness and realtime geo-tracking support.

2) Blockchain-Based Blood Donation Network (2024): The study focused on secure blood donation management using blockchain technology. It improved transparency, traceability, and data security between hospitals and blood banks. Although secure, the system did not provide predictive shortage analysis or emergency crisis response mechanisms.

3) GIS-Based Emergency Blood Supply System (2023): This paper proposed a GIS-enabled blood distribution model that identified nearby blood donors using GPS technology. The work improved emergency response time but lacked AI driven predictive analytics and automated crisis management features.

4) IoT and Machine Learning for Healthcare Resource Allocation (2024): Researchers developed a smart healthcare monitoring framework using IoT sensors and machine learning models to allocate healthcare resources during disasters. The model efficiently handled emergency situations but did not specifically focus on blood donation systems.

5) Social Media-Based Blood Donation Mobilization (2024): This work analyzed the use of social media platforms to mobilize blood donors during emergencies and accidents. The approach increased donor participation but suffered from unreliable communication and absence of intelligent donor matching.

The existing systems mainly focus on either donor management, security, or emergency communication. Very few systems combine AI prediction, geo-tracking, disaster awareness, and crisis response into a single intelligent

platform. Therefore, the proposed work aims to bridge this gap.

III. PROPOSED WORK

The proposed system introduces an AI-driven disaster aware blood donation network that integrates geo-tracking, machine learning, and emergency response technologies.

The working process of the system is as follows:

1. Hospitals or emergency authorities raise blood requests during critical situations.
2. The AI engine analyzes blood availability, donor eligibility, and emergency priority.
3. Geo-tracking technology identifies nearby donors using GPS.
4. Real-time alerts are sent through mobile applications, SMS, and email notifications.
5. Machine learning models predict future blood shortages based on historical donation records and regional emergency trends.
6. Smart routing algorithms optimize blood transportation and donor-hospital communication.
7. Administrators monitor all operations through a centralized dashboard.

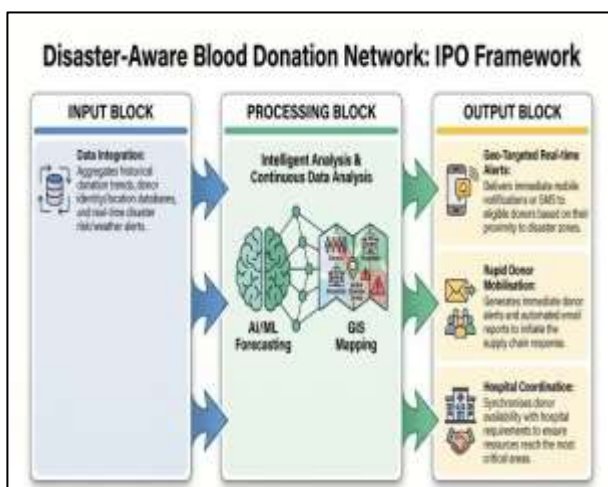


Fig.1 Architecture

IV. LITERATURE REVIEW

Recent advancements in Artificial Intelligence (AI), Machine Learning (ML), Geographic Information Systems (GIS), and cloud technologies have significantly improved healthcare and emergency response systems. Several researchers have proposed smart blood donation frameworks to enhance blood availability and donor management during critical situations.

Bhattacharya et al. (2024) developed an AI-powered blood donation management system that uses machine learning algorithms to automate donor matching and predict blood demand during emergencies. Their work improved the efficiency of blood distribution and reduced manual coordination efforts.

Similarly, Patel and Rao (2024) proposed a disaster-aware blood supply chain optimization system using IoT and machine learning technologies. Their research focused on improving blood inventory management and transportation during disaster situations.

Gupta et al. (2023) introduced a blockchain-enabled blood donation network to ensure transparency, security, and traceability in blood donation processes. The study highlighted the importance of secure healthcare data management during emergencies. Kumar and Kaur (2024) designed a smart blood bank management system using cloud computing and GPS technologies to track donor locations and improve real-time communication between hospitals and donors.

Furthermore, Zhang et al. (2023) applied deep learning techniques to predict blood demand during disasters and healthcare emergencies. Their predictive model helped authorities forecast future shortages and prepare blood inventories in advance.

Verma and Joshi (2024) integrated GIS and AI technologies to develop a real-time disaster-aware blood distribution system that improved donor identification and route optimization during emergency conditions.

Although these studies contribute significantly to healthcare and blood management systems, most existing solutions focus on individual technologies such as AI, blockchain, IoT, or GIS separately. Very few systems provide a combined approach integrating AI-based prediction, geotracking, real-time donor communication, and crisis response management. Therefore, the proposed AI-Driven Blood Donation and Crisis Response Network aims to bridge this gap by developing a unified intelligent platform for efficient blood donation management during disasters and emergencies.

V. PROBLEM STATEMENT

During emergencies and disaster situations, hospitals face sudden shortages of blood due to poor coordination, delayed donor communication, and inefficient blood management systems. Existing blood donation networks lack real-time geo-tracking, predictive analytics, and intelligent crisis response mechanisms.

Objective:

The main objective of the proposed AI-Driven Blood Donation and Crisis Response Network using Geo Tracking is to develop an intelligent and efficient blood donation management system that can provide quick support during emergencies and disaster situations. The system aims to use Artificial Intelligence, Machine Learning, and Geo-Tracking technologies to identify nearby eligible blood donors, predict future blood shortages, and improve communication between hospitals, blood banks, and donors in real time. The proposed framework focuses on reducing response time during critical situations by sending geo-based alerts and notifications to nearby donors through mobile applications and SMS services. It also aims to optimize blood supply management using predictive analytics and real-time

monitoring techniques. Additionally, the system is designed to improve coordination among healthcare authorities, ensure better blood availability, minimize wastage, and support fast decision-making during disasters and medical emergencies.

VI. RESULT

Dashboard

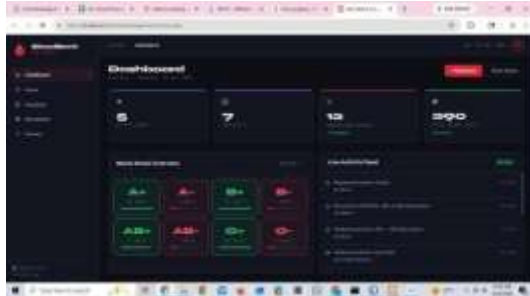


Fig 2 .Admin Dashboard

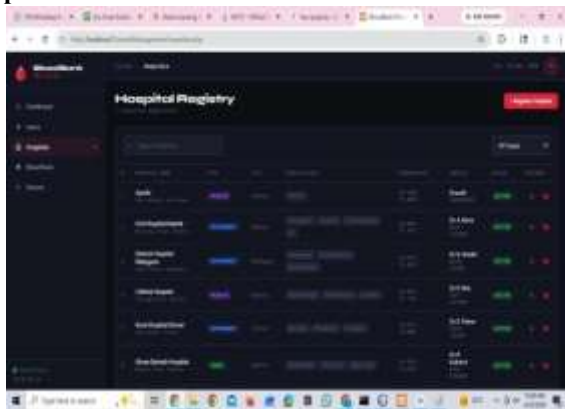


Fig 3.All Hospitals

Displays all registered hospitals in the system Shows type, city, specialties, coordinates, contact, status

Blood Stocks

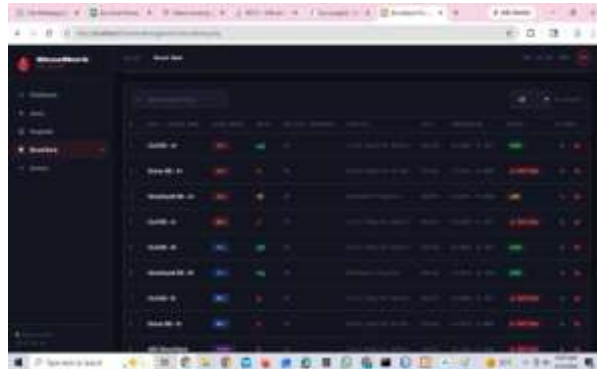


Fig 4.Blood Stocks

Displays all blood stock records with units available Shows status like Good, Low, Critical based on threshold

Blood Donor Login

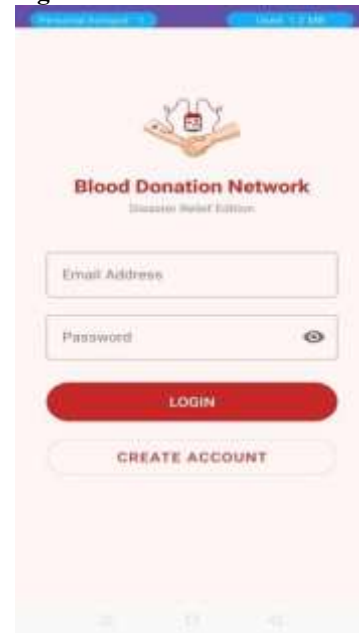


Fig 5.User Login

The login page allows users to enter their email address and password to access the application. It also provides a Create Account option for new users who want register

Donor Home



Fig 6.Donor Homepage

The dashboard is the main screen after login. It displays donor statistics like total donors, lives saved, and blood banks available. It also provides quick options such as:

- Add Donor Information
- Find Near Blood Banks
- Locate Near Hospitals
- Logout

Near Hospitals



Fig 7. Near Hospitals

This screen helps users find nearby hospitals using Google Maps. It shows hospital names, ratings, distance, address, and availability status such as Open 24 Hours.

VII .CONCLUSION

The AI-Driven Blood Donation and Crisis Response Network using Geo Tracking provides an intelligent and efficient solution for emergency blood management. The integration of Artificial Intelligence, Machine Learning, GIS, and real-time geo-tracking technologies enhances donor identification, blood shortage prediction, and emergency communication. The system enables rapid response during disasters by connecting hospitals, blood banks, and donors through a centralized smart platform.

The proposed framework improves healthcare resilience, reduces delays in blood delivery, minimizes shortages, and supports life-saving decisions during critical situations. Future enhancements may include blockchain-based security, IoT-enabled health monitoring, and advanced deep learning models for more accurate prediction and disaster management.

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