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Life Pulse – A Smart Blood Donor Locator

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Abstract

In emergency situations, hospitals often face serious difficulties in arranging blood on time for patients in need. The existing approach of searching blood banks, using outdated donor lists, or making repeated phone calls is time-consuming and inefficient, which can lead to critical delays and loss of lives. One of the major problems is the absence of a centralized system that can quickly identify nearby and available blood donors during emergencies. To solve this problem, this project develops Life Pulse – a Smart Blood Donor Locator System, a web-based application designed for use by a single hospital. The system enables the hospital to maintain a verified donor database and locate suitable donors within a 5-kilometer radius based on blood group and availability. Donor accounts are created by the hospital, ensuring authenticity and preventing fake registrations. Each donor is provided with a secure login to manage personal details, location, and availability status. The hospital can notify eligible donors through email or SMS, and donors can respond to requests by accepting or declining based on their availability. The system also ensures donor privacy by sharing only approximate location details and records donor consent and notification logs. This application aims to improve response time, accuracy, and reliability in emergency blood donor coordination.

Keywords: *Blood donor management; web application; Emergency medical systems*

1. Introduction

Blood is one of the most critical resources in emergency medical care, and the timely availability of compatible blood can determine the survival of a patient. Despite advancements in healthcare infrastructure, many hospitals still depend on traditional and manual methods such as contacting blood banks, referring to outdated donor lists, or making repeated phone calls to arrange blood during emergencies [1], [2]. These methods are often slow, unorganized, and unreliable, particularly when immediate response is required or when rare blood groups are needed. One of the key challenges faced by hospitals is the lack of a centralized and real-time system to identify nearby and available blood donors. Existing donor records are frequently outdated, and there is no reliable way to determine donor availability or proximity at the time of need. As a result, hospitals experience delays in communication, inefficient donor coordination, and increased pressure on medical staff during critical situations. To overcome these challenges, this project proposes Life Pulse – a Smart Blood Donor Locator System, a web-based application designed for use within a single hospital environment. The system provides a centralized donor database maintained by the hospital, ensuring data authenticity and preventing unauthorized or fake registrations. Donors are given secure login access to update their personal details, availability status, and location information using GPS or manual input. The application enables the hospital to quickly filter donors based on blood group, availability, and distance within a 5-kilometer radius, and to notify suitable donors through email or SMS during emergencies [3], [4]. Donor privacy is preserved by sharing only approximate location details, and explicit consent is recorded to ensure ethical data usage. By improving response time, accuracy, and coordination, the proposed system aims to support hospitals in saving lives through efficient emergency

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blood donor management.

1.1. Problem Identification

Hospitals often struggle to arrange blood during emergency situations due to the reliance on traditional and manual methods such as blood banks, outdated donor lists, and repeated phone calls. These methods are time-consuming and inefficient, especially when immediate blood transfusion is required [5], [6]. Donor information is usually unorganized or outdated, making it difficult to quickly identify suitable donors based on blood group and availability. Another major problem is the lack of a centralized, location-based system to identify nearby donors in real time. Hospitals have no reliable way to determine donor availability, proximity, or response status during emergencies. This results in delayed communication, uncertainty in donor confirmation, and increased risk to patient lives. The absence of proper consent handling and notification tracking further highlights the need for a secure and efficient donor management system [7], [8].

2. Literature Survey and Proposed Methodology

2.1. American Red Cross Blood Donor App

The American Red Cross Blood Donor App is designed to help donors locate nearby blood drives, schedule donation appointments, and receive reminders and alerts. It provides donor history tracking and rewards-based motivation to encourage repeat donations. However, the application primarily focuses on organized blood drives rather than real-time emergency donor identification. It does not provide hospital-specific control or immediate donor availability filtering during urgent situations.

2.2. e-RaktKosh

e-RaktKosh is a Government of India initiative that centralizes blood bank data and displays blood availability across registered blood banks. It improves transparency and accessibility of blood stock information nationwide. However, the system relies on blood bank inventory rather than direct donor participation. It does not support real-time donor availability, donor approval workflows, or hospital-level emergency donor notifications.

2.3. Blood Friends – Blood Donor App

Blood Friends provides a centralized platform for connecting blood donors and recipients based on location and blood group. It enables users to search nearby donors and access basic contact details. Despite its usefulness, the platform lacks verification mechanisms and hospital-controlled approval. The absence of donor availability validation and structured notification tracking limits its reliability in critical emergency scenarios.

2.4. Blood Bank (Android App)

The Blood Bank Android application allows donors and recipients to connect through blood group and location-based filtering. It supports direct communication between users, making it useful for individual requests. However, the system operates in a decentralized manner without hospital supervision or donor authentication. This can lead to outdated donor data, privacy concerns, and unreliable response during emergencies.

2.5. Friends2Support.org – Web & Mobile Application

Friends2Support.org maintains a large voluntary donor database and supports location-based donor searches. The platform has strong community participation and wide geographic coverage. However, donor availability is not updated in real time, and hospital-specific control is not supported. The lack of automated emergency alerts and approval-based access reduces its effectiveness in time-critical hospital environments (Table 1 and Figure 1).

Table 1 Existing Blood Donor Platforms Vs Proposed Hospital-Based System

Existing System	Proposed System
American Red Cross Blood Donor App focuses on planned blood drives.	Life Pulse supports real-time emergency donor notification by hospitals.
e-RaktKosh shows blood bank stock data only.	Life Pulse connects hospitals directly with nearby donors.
Blood Friends lacks donor verification and control.	Life Pulse uses hospital-approved donor access.
Blood Bank works without hospital supervision.	Life Pulse is fully hospital-controlled.
Friends2Support.org does not provide real-time alerts.	Life Pulse sends instant emergency notifications.

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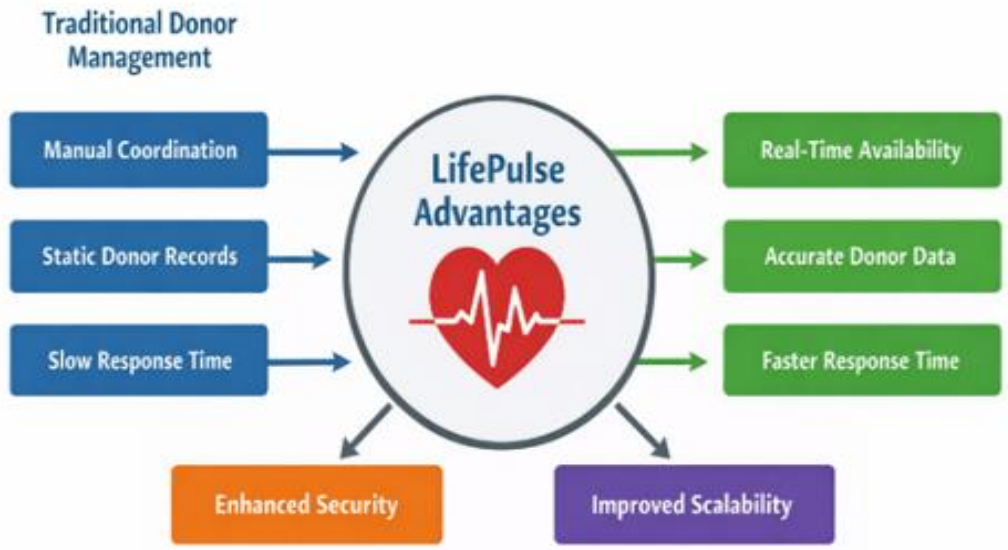

Figure 1 Life Pulse Advantages

Table 2 Core System Parameters

Module	Description
Hospital Management	Manages donor records and emergency requests.
Donor Dashboard	Allows donors to update details and availability
Location Filtering	Finds nearby donors within 5 km radius.
Consent & Logs	Stores donor consent and activity records.

3. Proposed Methodology

3.1. Hospital Management Module

This module allows the hospital administrator to manage the entire system (Table 2). The hospital can add and maintain donor records, view the complete donor list, filter donors based on blood group and availability, and initiate emergency blood requests. It serves as the central control unit of the application. In addition, this module enables the hospital to monitor donor responses in real time, helping staff quickly identify willing donors during emergencies [9]-[12]. The hospital can also manage notification history, ensuring that alerts are sent efficiently without duplication. By centralizing all donor-related operations, this module reduces manual effort and improves overall coordination during critical situations.

3.2. Donor Dashboard Module

The donor dashboard provides donors with secure access to update their personal information, location details, and availability status. Donors can view emergency blood requests sent by the hospital and respond by accepting or declining based on their current availability. This module empowers donors to actively participate in the system by keeping their information up to date, which improves the accuracy of hospital searches. It also ensures that donors have full control over their availability, reducing unnecessary notifications when they are unable to donate. Secure access prevents unauthorized modification of donor data.

3.3. Location Filtering Module

This module identifies suitable donors within a predefined radius of 5 kilometers using GPS or manually entered location data. It helps the

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hospital quickly shortlist nearby donors while displaying only approximate location details to maintain donor privacy.

3.4. Donor Dashboard Module

This module manages donor consent and maintains detailed system activity logs. It records donor permission for sharing contact and approximate location details, along with logs of emergency notifications sent and donor responses, ensuring ethical data handling and system transparency [13]. Donors are provided with clear control over their availability status and consent preferences through their dashboard. The inclusion of consent tracking builds trust between donors and the hospital by ensuring responsible and authorized use of personal information. Activity logs provide accountability by recording actions such as donor approval, notification delivery, and response status [14]. These logs allow hospital administrators to review past interactions, monitor donor participation, and analyze system usage patterns. Overall, this module supports compliance with ethical standards, improves transparency, and enhances reliability during emergency blood coordination (Figure 2).

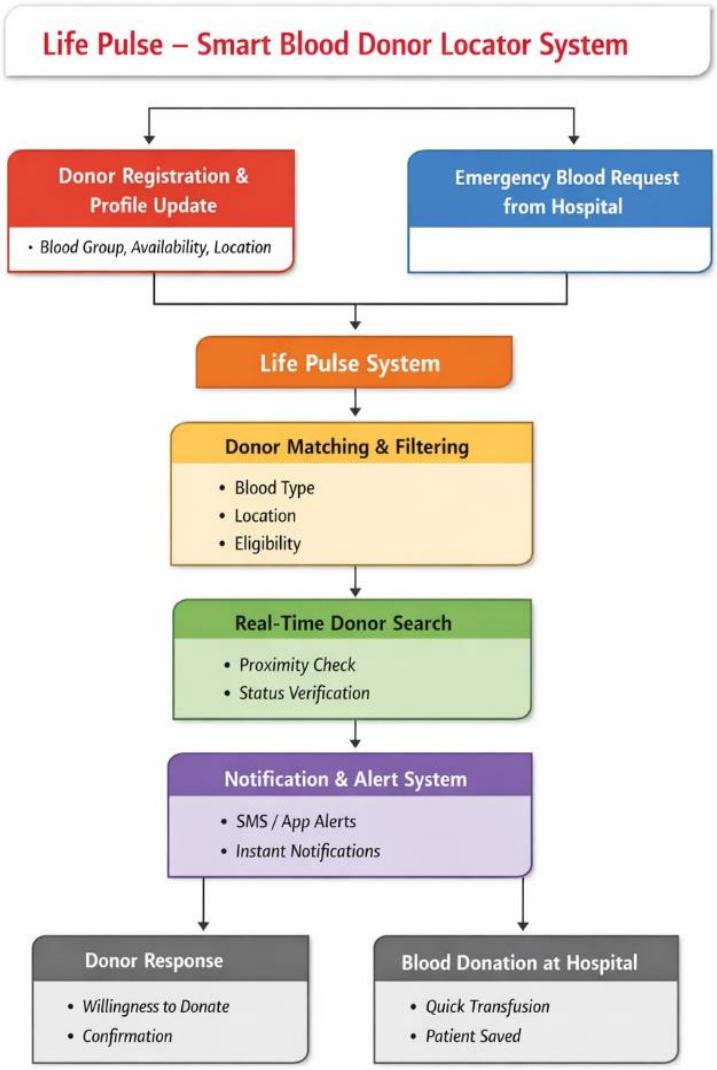

Figure 2 Workflow of Donor Registration and Hospital Booking Process

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4. Results and Discussion

Blood donor web application successfully addresses the limitations identified in existing blood donation platforms. The system provides a centralized, hospital-controlled donor database, ensuring that all donor records are verified and reliable. Unlike public donor platforms where data accuracy is uncertain, the hospital-managed approach resulted in cleaner data, reduced redundancy, and improved trust in donor information, as shown in Figure 3, which illustrates the hospital dashboard and system summary. The availability management feature proved effective in improving donor coordination. Since donors can manually update their availability status through their dashboard, the hospital is able to avoid contacting unavailable donors. The inclusion of availability indicators and last-updated timestamps further enhances decision-making by allowing hospital staff to prioritize donors with recent status updates, as shown in Figure 4, which presents the verified donor records along with availability details [15]. Location-based filtering within a 5 km radius significantly improved donor shortlisting efficiency. Compared to existing systems that rely on city-level or manual searches, this approach ensures that contacted donors are geographically closer and more likely to reach the hospital in time. At the same time, donor privacy is preserved by displaying only approximate distance values rather than exact location coordinates, as shown in Figure 4. The notification and response mechanism improved communication reliability between hospitals and donors. Emergency alerts sent via email or SMS enabled faster donor engagement, and the accept/decline response feature provided clear confirmation to the hospital. This eliminated uncertainty regarding donor willingness, which is a major drawback in many existing web applications. The notification history and donor responses are clearly recorded, as shown in Figure 5, which displays the emergency notification logs and backend records. The hospital-controlled donor creation, approval process, and secure data storage further enhanced system reliability and authenticity. Backend database records store donor credentials, approval status, availability flags, and timestamps, ensuring traceability and accountability of all actions, as reflected in Figure 5. Overall, the results demonstrate that the proposed system offers a structured, secure, and practical solution for emergency blood donor coordination. The integration of hospital supervision, real-time availability tracking, location-based filtering, and notification logging makes the system suitable for real-world hospital environments (Figure 6).

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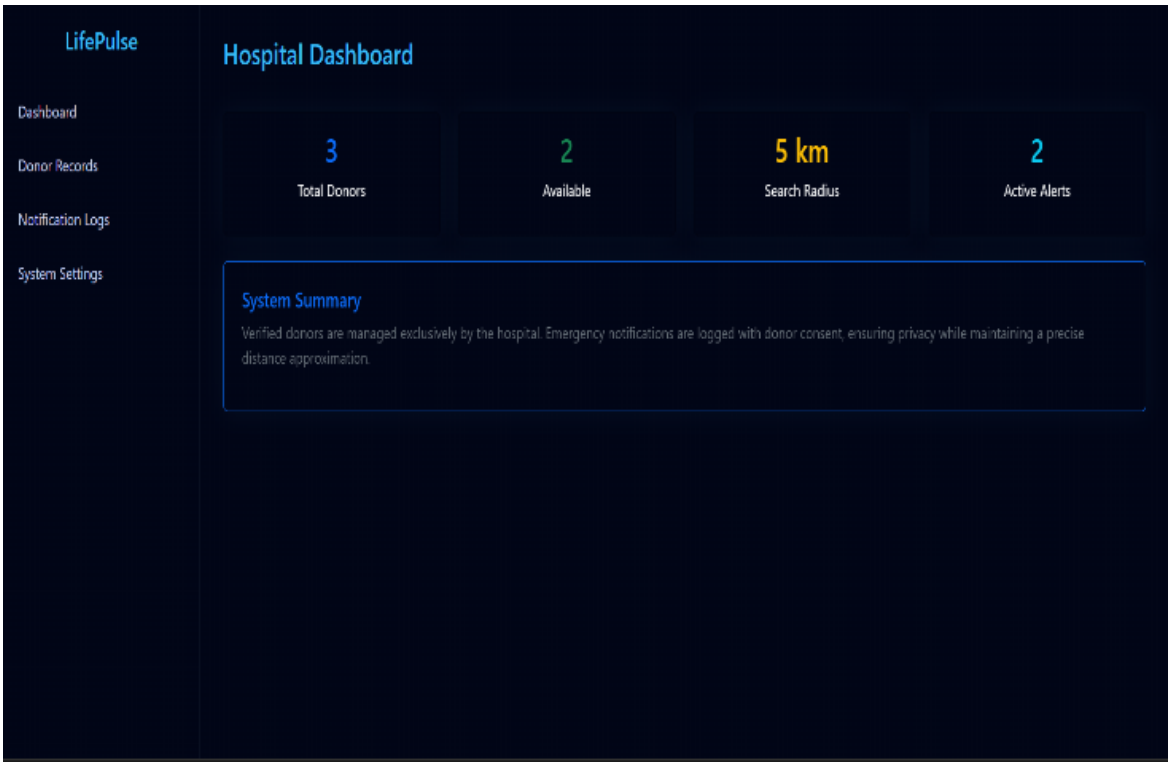

Figure 3 Hospital Dashboard

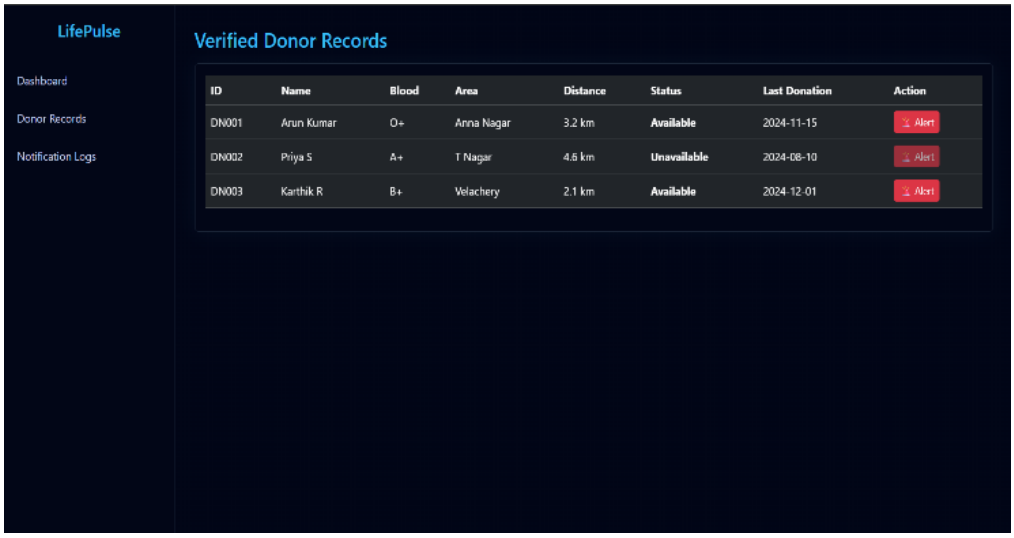

Figure 4 Verified Donor Records

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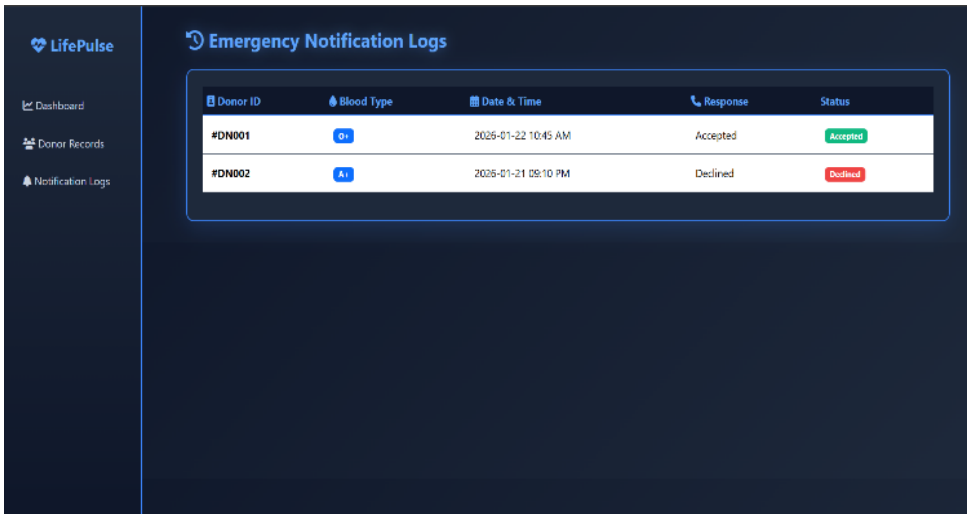

Figure 5 Notification Logs

donor_id		full_name	email	phone	blood_group	is_available	is_approved	created_at
1	1	Sharath R	9942074889	O	$2b$10$nFUR37MwblKniWGQVjGjGopuQCHl...		1	2020-01-21 20:20:45
2	2	Sharathvignayan	9942074889	O	$2b$10$ttnJlZODKC1ld61Awpgkrn10YTZMoJD3		0	2020-01-21 11:30:57
3	3	Sharath@gmail.com	9942074889	O	$2b$10$tphPSuA9clsyOPHyCMJhtLM58...		0	2020-01-21 08:13:41
10	10	Sharath R	9942074889	O	$2b$10$cZdZGojcp3.OWKUvueOZMVeon...		1	2020-01-21 20:20:58
10	10	Zac9888@kanarjag edu.in	9942074889	O	$2b$10$cZdZGojcp3.OWKUvueOZMVeon...		1	2020-01-21 20:20:58

Figure 6 Donor Database Table

Conclusion

This paper presented Life Pulse, a smart blood donor locator system designed to improve emergency blood donation workflows. By leveraging a three-tier web architecture and modern web technologies, the system addresses critical challenges associated with traditional donor management systems. Life Pulse enhances donor availability tracking, reduces response time, and improves data reliability. The proposed solution is scalable, maintainable, and suitable for deployment in real-world hospital environments. Future enhancements may include notification services and advanced analytics to further improve system effectiveness.

Acknowledgements

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connect donors and requestors with filtering and direct contact features.

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