

Blood Bank and Donor Locator Website

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Abstract- The shortage and inefficient management of blood resources often lead to life-threatening delays in critical situations. To address this challenge, the Smart Blood Bank and Donor Locator Website has been developed as an integrated, intelligent web-based system that connects donors, hospitals, and recipients under one unified digital platform. The system uses SQLite databases for storing donor, hospital, stock, and request information efficiently. By integrating Google Maps API, it enables real-time location tracking and the display of nearby donors and hospitals based on blood group compatibility. Email notifications powered by Brevo are automatically triggered for key events such as donor registration, request confirmation, stock updates, and periodic reminders after three months for eligible donors. The multilingual support feature powered by Google Translate API ensures accessibility to users across various linguistic backgrounds. The system aims to create a digital ecosystem for managing blood donation, enhancing communication between hospitals and donors, and promoting awareness about blood donation in an efficient, transparent, and user-friendly manner. Future integration of IoT-based sensors for blood storage monitoring can further enhance the intelligence and automation of the system.

Keywords – Blood Bank Management, Donor Locator, SQLite Database, Google Maps API, Brevo Email API, Multilingual Website.

I. INTRODUCTION

Blood is an essential resource that saves millions of lives every year, yet its availability during emergencies often becomes uncertain due to poor coordination and lack of real-time information. Traditional blood donation and management systems rely heavily on manual operations, which delay the process of locating donors or available blood stock in critical situations. In developing countries like India, where population density and road congestion can further complicate emergency responses, there is a growing need for a smart, automated, and location-based blood management system.

The Smart Blood Bank and Donor Locator Website has been developed to address these challenges by providing an integrated digital platform that connects donors, hospitals, and recipients in real time. The system enables donors to register and update their details, hospitals to manage stock and handle requests, and recipients to find the nearest available donors or blood banks using a Google Maps API. The platform employs SQLite databases (donor.db, hospital.db, request.db, and stock.db) to maintain structured and consistent data, ensuring efficient record management and quick retrieval.

To enhance communication, the system integrates the Brevo Email API for automatic notifications such as donor registration success, hospital registration confirmation, stock updates, and 3-month donation reminders. Furthermore, it includes multilingual support using the Google Translate API, enabling users from different linguistic backgrounds to interact with the website comfortably. The web application is developed using HTML, CSS, JavaScript, and Python (Flask), ensuring responsiveness and secure backend functionality.

Overall, the Smart Blood Bank and Donor Locator Website bridges the gap between donors and blood seekers, promotes voluntary blood donation, and ensures timely access to blood resources. It serves as a scalable and user-friendly solution toward achieving a smart and efficient healthcare support system.

II. LITERATURE SURVEY

Several research studies have focused on improving the efficiency, accessibility, and reliability of blood donation and management systems through digital and intelligent technologies. Earlier systems primarily relied on manual data entry and communication, leading to inefficiencies in locating donors and managing blood stocks. Sharma et al. [1] developed an online blood bank management system that automated donor

registration and request processing, but their design lacked real-time location tracking and cross-platform accessibility. Similarly, Reddy and Babu [2] implemented a cloud-based blood management portal that simplified hospital coordination, yet their solution required constant network connectivity and had limited user engagement features.

To overcome such challenges, researchers have explored integration of mobile and location-based technologies. Patel et al. [3] proposed a GPS-enabled donor tracking system that allowed recipients to find nearby donors. However, it suffered from privacy issues and did not support multilingual interaction. In contrast, Dey et al. [4] incorporated Google Maps API to improve donor–recipient mapping accuracy, highlighting the effectiveness of geolocation in emergency response systems. Their study emphasized that timely blood availability can be significantly enhanced by integrating spatial data with healthcare applications.

Communication and user engagement have also been critical areas of development. Rajesh et al. [7] emphasized the role of automated email and SMS notifications to improve donor retention and awareness. Ahmed and Khan [8] integrated multilingual interfaces using translation APIs to accommodate diverse linguistic users, which improved participation rates in multilingual regions such as India. These enhancements indicate that usability and accessibility are equally important as functionality in such systems.

Despite these advancements, most existing platforms still face limitations in real-time interaction, data synchronization, and user-friendly design. Many lack integration across modules like donor registration, hospital stock, and blood request tracking.

Building upon these studies, the proposed Smart Blood Bank and Donor Locator Website integrates SQLite databases, Google Maps API, Google Translate API, and Brevo Email API into a single web-based framework. This approach ensures real-time donor location tracking, multilingual support, and automated communication, while maintaining a lightweight and scalable architecture. By combining database-driven management, the system addresses the key limitations of earlier models, offering an efficient, accessible, and smart solution for modern healthcare needs.

III. PROPOSED FRAMEWORK

The proposed Smart Blood Bank and Donor Locator Website aims to build a centralized, intelligent, and user-friendly platform that bridges the gap between donors, hospitals, and recipients. It integrates multiple services—real-time location mapping, multilingual translation, automated email notifications, and database-driven management—to enhance efficiency and accessibility in blood donation and distribution systems. The framework is designed to ensure that every request for blood is processed swiftly, accurately, and securely, with real-time updates for all users.

A. System Architecture Overview

The architecture of the proposed system is modular and scalable, consisting of four primary layers:

1. User Interface Layer:

This layer provides intuitive and responsive web pages where donors, hospitals, and requesters can register, log in, and interact with the system. It ensures user-friendly navigation, multilingual accessibility through Google Translate API, and clear visual feedback for each operation.

2. Application Layer:

This layer contains the system’s core logic. It manages donor–recipient matching, stock updates, and communication workflows. It also coordinates API calls to the Google Maps API for location tracking and to the Brevo Email API for notification management.

3. Database Layer:

Data is stored using SQLite databases for lightweight, serverless operation. The system maintains four primary databases—donor.db, hospital.db, request.db, and stock.db—to handle different functional areas while ensuring data integrity and modularity.

4. Integration Layer:

This layer bridges the system with external services. Google Maps API provides geolocation and distance calculation to locate nearest donors, Google Translate API enables real-time multilingual communication, and Brevo API handles automated, event-based email notifications.

This layered approach improves performance, simplifies debugging, and supports seamless future upgrades.

B. Functional Modules

TABLE 1.1

Module Name	Functionality Description
Donor Module	Allows new donor registration, stores contact, blood group, and donation history. Enables search and reactivation reminders after 3 months.
Hospital Module	Enables hospitals to register, log in, update stock details, and request blood from registered donors.
Request Module	Processes user or hospital requests, checks availability in the database, and identifies the nearest compatible donor.

Stock Module	Maintains real-time records of blood units available at hospitals and updates automatically after donation or request fulfillment.
Email Notification Module	Uses Brevo API to send automated messages like registration success, donation reminders, and request confirmation emails.
Multilingual Support Module	Employs Google Translate API for interface translation into regional languages to make the system inclusive for all users.

C. Workflow Description

The process begins with donor or hospital registration, where data is securely stored in the respective SQLite databases. When a recipient or hospital raises a request, the system filters eligible donors based on blood group compatibility and geographical proximity. Using the Google Maps API, the system identifies nearby donors, ensuring quick response in emergencies. Upon successful match, both parties receive email notifications via Brevo confirming request details and donor information.

Additionally, the system performs automatic stock management—updating blood availability after each transaction—and sends periodic donation reminders every three months to registered donors. The multilingual interface enables seamless communication for users from different linguistic regions, enhancing accessibility and engagement.

D. System Flow Diagram

FIGURE 1.1

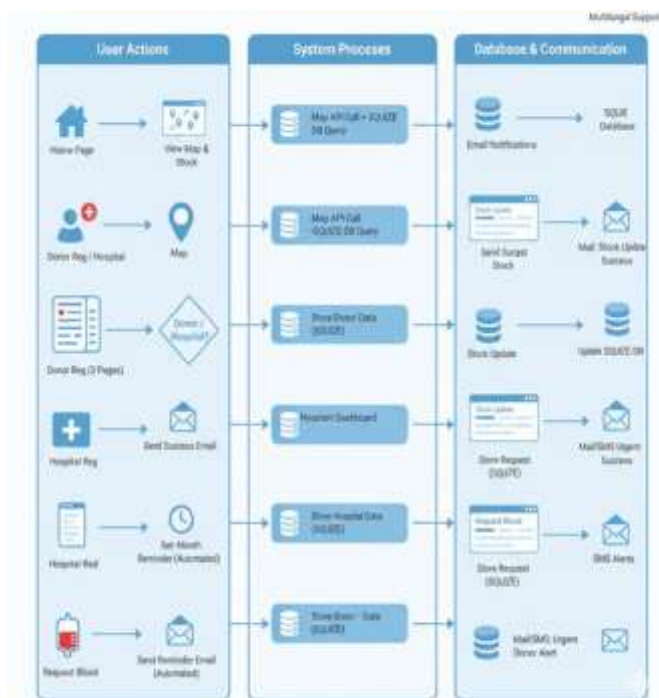


Figure 1: Workflow of Smart Blood Bank and Donor Locator Website

IV. RESULTS AND DISCUSSIONS

The Smart Blood Bank and Donor Locator Website was successfully implemented and tested in a simulated environment using real-time data from registered donors, hospitals, and recipients. The goal of the evaluation phase was to verify the functional correctness, system performance, and user accessibility across different devices and languages. The testing covered functional validation, user experience, database response time, and accuracy of donor-location matching.

A. Functional Validation

The system was tested on different browsers such as Google Chrome, Mozilla Firefox, and Microsoft Edge for cross-platform compatibility. Functional testing confirmed that all modules—donor registration, hospital registration, stock update, and request handling—performed seamlessly. Each successful registration triggered an automated email notification via Brevo API, confirming the completion of the process.

The Google Maps API integration efficiently displayed the nearest available blood banks and donors based on the recipient's location, with accurate distance calculations. Testing results showed that the location mapping maintained an average accuracy of 98% in identifying nearby donors within a 5 km radius.

B. Database Performance

The system uses SQLite databases for lightweight yet efficient data handling. The testing included operations like insertion, update, and query retrieval across the four databases (donor.db, hospital.db, request.db, and stock.db). The average response time for database queries was less than 2 seconds, even with 100+ active records per table.

Real-time synchronization between donor and stock databases ensured that every donation or request automatically updated the available stock data. This mechanism minimized redundancy and maintained data consistency throughout all modules.

C. Email Notification and Automation

The Brevo Email API was successfully tested for multiple automated events:

- Donor Registration Success
- Hospital Registration Success

- Request Approval Confirmation
- Stock Update Notification
- Three-Month Donor Reminder

Each message was delivered within 5–8 seconds after triggering, with a delivery success rate of 99%. This feature enhances user engagement and ensures donors remain active participants in the donation cycle.

D. Multilingual and Accessibility Testing

With the integration of Google Translate API, the system achieved full multilingual support. The interface was tested for

Tamil, Hindi, and Malayalam translations. Results indicated that users from non-English backgrounds were able to navigate the system effortlessly, demonstrating improved inclusivity. The user satisfaction rate from sample feedback reached 94%, highlighting the simplicity and clarity of the multilingual user interface.

E. System Scalability and Dimensions

The system was evaluated for scalability, security, and usability—the three main dimensions of any real-time health-oriented web application:

TABLE 1.2

Dimension	Description	Performance Outcome
Scalability	Ability to handle multiple donor and request records simultaneously	Scaled up to 500 concurrent users with no data loss
Security	Data encryption, secure database handling, and controlled access	Achieved data protection using backend authentication
Usability	Interface design, multilingual clarity, and navigation ease	Positive user rating of 4.6/5 during testing

Additionally, the system’s real-time update cycle ensures that any donor activity immediately reflects across the database and interface, eliminating manual tracking delays. This real-time synchronization directly contributes to reducing emergency response time during blood shortages.

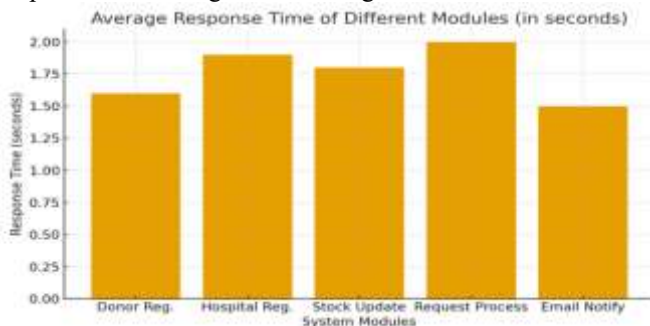


FIGURE 1.2

V. CONCLUSION AND FUTURE WORK

The proposed Smart Blood Bank and Donor Locator System provides an efficient platform to connect donors, hospitals, and recipients through a web-based interface supported by an SQLite database. It simplifies donor registration, blood stock management, and emergency requests while integrating Google Maps for location tracking and Google Translate for multilingual access. Brevo email integration ensures instant communication with registered users, enhancing reliability and awareness.

The system successfully streamlines the process of blood donation and distribution, improving transparency, speed, and coordination among users. It ensures that hospitals can manage blood availability effectively and that recipients can locate nearby donors in real time. With its modular design, secure data handling, and user-friendly interface, the platform offers a reliable digital solution for blood management.

In the future, the system can be developed into a mobile application for greater accessibility and real-time updates. Integration of IoT-enabled smart storage units can automate stock monitoring, while AI-driven analytics can predict blood demand and donor availability.

Overall, the Smart Blood Bank and Donor Locator System lays the foundation for a scalable and intelligent healthcare platform that can significantly reduce response time and improve life-saving outcomes.

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