



Plasma Connect

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Abstract: Timely access to plasma donors is critical in medical emergencies, yet traditional coordination methods often rely on phone calls, social media posts, and manual records, which can cause delays. Plasma Connect is a full-stack web platform designed to simplify and improve the plasma donation process by connecting donors, recipients, hospitals, blood banks, and administrators within a single system. The platform allows users to search for plasma donors based on blood group and location, submit donation requests, and track request status in real time.

The system is developed using modern web technologies, including React for the frontend, Node.js and Express for backend services, and MySQL for database management. Secure authentication is implemented using JSON Web Tokens and bcrypt encryption. Real-time notifications are provided through Socket.IO, while location-based services are supported using Leaflet maps integrated with OpenStreetMap.

The proposed platform improves coordination between donors and recipients, reduces response time in emergency situations, and provides a scalable digital solution for plasma donation management. The results demonstrate that Plasma Connect enhances accessibility, communication, and efficiency in plasma donor coordination.

Keywords: Plasma Donation System, Healthcare Web Platform, Donor Matching System, Blood and Plasma Donation Management, React, Node.js, Real-Time Notifications, Location-Based Services, Web Application Development.

I. INTRODUCTION

Plasma plays an essential role in modern medical treatments, particularly for patients suffering from severe infections, immune disorders, and emergency health conditions. However, the process of finding suitable plasma donors is often difficult and time-consuming. In many cases, patients and hospitals rely on manual methods such as phone calls, personal networks, and social media posts to locate donors. These traditional approaches are inefficient and may cause delays during critical medical situations.

With the rapid advancement of digital technology, web-based healthcare platforms have emerged as effective solutions for improving communication and resource management in medical services. Digital systems can simplify the process of donor registration, request management, and communication between donors and recipients.

Plasma Connect is proposed as a full-stack web platform designed to streamline plasma donation coordination by connecting donors, recipients, hospitals, blood banks, and administrators within a single digital system. The platform allows users to search for plasma donors based on blood group and location, send donation requests, and track request status efficiently.

The system is developed using modern web technologies such as React for the frontend interface, Node.js and Express for backend processing, and MySQL for database management. Real-time communication is enabled through Socket.IO, and location-based services are provided using Leaflet maps integrated with OpenStreetMap.

By integrating these technologies, Plasma Connect aims to improve the efficiency of plasma donor coordination, reduce response time during emergencies, and provide a reliable digital platform for plasma donation management.

II. LITERATURE REVIEW AND PROBLEM IDENTIFICATION

Several studies have explored the development of digital healthcare systems to improve the management of medical services and donor coordination. Research on healthcare applications highlights the importance of secure data management, efficient communication, and user-friendly interfaces to support medical processes.



Previous studies on blood and plasma donation platforms have introduced mobile and web applications that allow donor registration, appointment scheduling, and communication between donors and recipients. These systems help increase donor awareness and simplify the donation process. However, many existing platforms provide limited functionality and often lack real-time request management and efficient donor discovery features.

Research on location-based services has also demonstrated their importance in healthcare applications. Integrating mapping technologies and GPS services enables users to locate nearby medical resources quickly, which is especially useful during emergency situations.

Despite these developments, many current systems do not provide a centralized platform that integrates donor discovery, request tracking, real-time notifications, and location-based navigation within a single system. This limitation can delay plasma donation coordination and reduce the effectiveness of emergency response.

Therefore, there is a need for a comprehensive digital platform that connects donors, recipients, hospitals, and administrators while supporting real-time communication and location-based donor discovery. Plasma Connect is proposed to address these challenges by providing an integrated web-based solution for efficient plasma donation management.

III. SYSTEM DESIGN AND METHODOLOGY

The Plasma Connect platform is designed as a full-stack web application that enables efficient coordination between plasma donors, recipients, hospitals, blood banks, and administrators. The system follows a client-server architecture where the frontend interface interacts with backend services through RESTful APIs to manage plasma donation requests and donor discovery.

The platform focuses on providing a secure, scalable, and user-friendly environment for managing plasma donations. The system integrates modern web technologies, real-time communication mechanisms, and location-based services to improve donor coordination and emergency response time.

A. System Architecture

The overall system architecture consists of three main layers: the presentation layer, the application layer, and the data layer.

The presentation layer is developed using React 18 with Tailwind CSS for responsive user interface design. This layer provides role-based dashboards for administrators, donors, and recipients. Users can register, log in, search for donors, send plasma requests, and track request status through an intuitive web interface.

The application layer is implemented using Node.js and Express. This backend layer processes user requests, manages authentication using JSON Web Tokens (JWT), and handles communication between system components. Passwords are securely stored using bcrypt hashing to ensure user data protection.

The data layer uses MySQL as the primary relational database to store donor profiles, user details, plasma requests, and system activity logs. Sequelize ORM is used for database interaction and data management.

Real-time communication between donors and recipients is enabled through Socket.IO. This allows users to receive instant notifications when a plasma request is created, accepted, or updated. Location-based services are integrated using Leaflet maps and OpenStreetMap to help users locate nearby donors and navigate to donation locations.

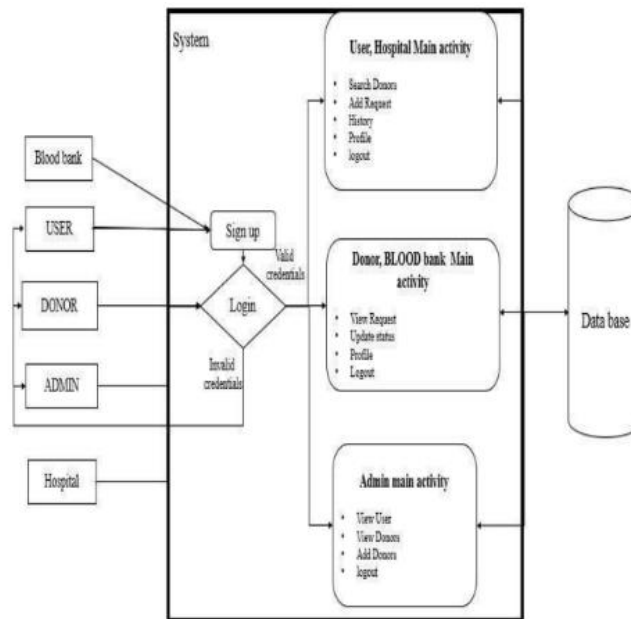


Figure 1: System Architecture of Plasma Connect

B. System Workflow

The system workflow begins when a user registers and logs into the platform. Once authenticated, the user can search for plasma donors based on blood group and location filters. If a suitable donor is found, the user can submit a donation request.

The request is stored in the database and notifications are sent to relevant donors. Donors can view incoming requests and choose to accept or reject them based on availability. When a donor accepts the request, the system updates the request status and provides location information to facilitate the donation process.

Administrators monitor system activity, manage donor records, and ensure that valid information is maintained in the database. This structured workflow improves coordination between donors and recipients and ensures faster response during emergency situations.

IV. PEER REVIEW AND VALIDATION

The Plasma Connect system was evaluated through systematic testing and validation procedures to ensure its reliability, performance, and usability. The evaluation process focused on verifying system functionality, response time, and user interaction across different modules. Functional testing was conducted to validate core features such as user registration, login authentication, donor search, request submission, and request tracking. The system successfully handled valid and invalid inputs, ensuring accurate processing of user actions and proper error handling.

Integration testing was performed to verify the interaction between frontend and backend components. The results confirmed that data flow between React-based user interfaces and the Node.js backend operated correctly, with consistent communication through REST APIs. System testing was carried out to evaluate the overall performance of the application. The platform demonstrated stable behavior under multiple user interactions, maintaining efficient response times and accurate request processing.

User validation was also conducted to assess the usability and effectiveness of the platform. Users reported that the interface was easy to navigate, and the donor search and request features were intuitive and efficient. The real-time notification system improved communication between donors and recipients, reducing delays in response.

Overall, the validation results indicate that the Plasma Connect system is reliable, user-friendly, and capable of efficiently supporting plasma donation coordination. The system meets its intended objectives of improving accessibility, communication, and response time in plasma donation processes.

V. RESULTS AND DISCUSSION

The implementation of the Plasma Connect platform demonstrates the effective use of modern web technologies for improving plasma donation coordination. The system was evaluated based on usability, functionality, and response efficiency across different modules.

The application begins with a user-friendly interface that allows users to access the system through a main activity screen. This screen provides navigation options for registration, login, and system access.

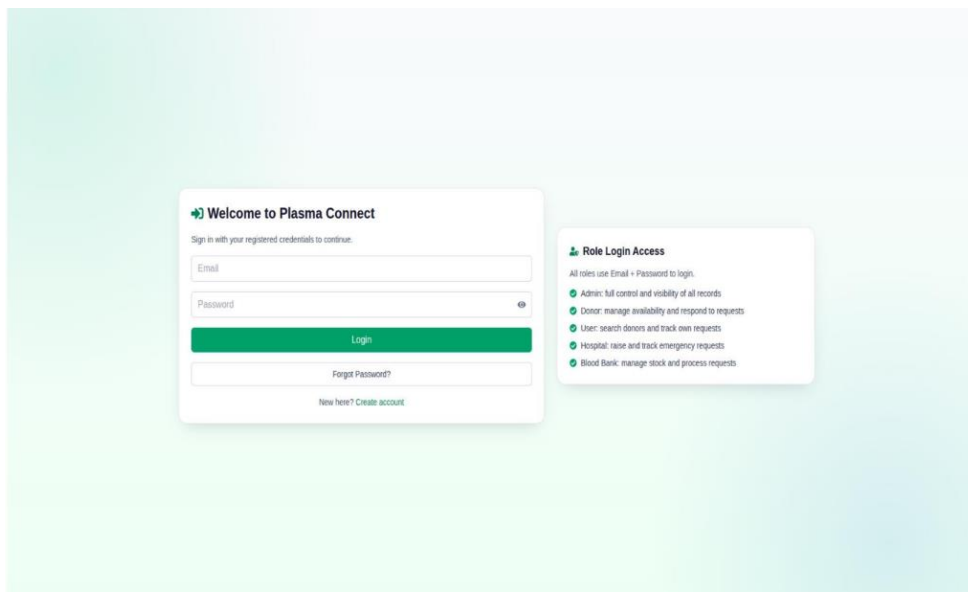


Figure 1: Main Activity Page

The system supports secure user registration and login functionality. Users can create accounts and authenticate their credentials to access the platform features.

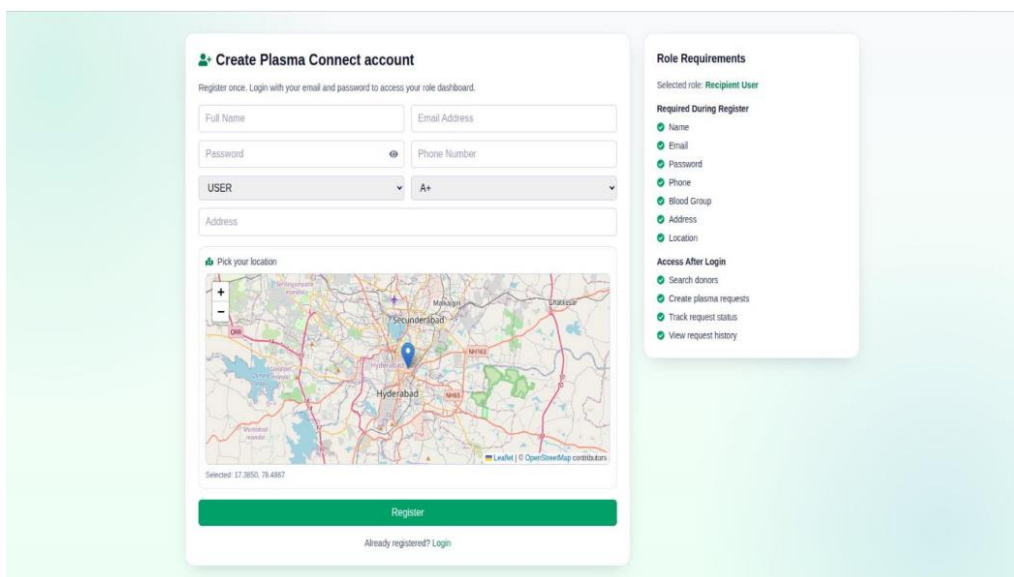


Figure 2: User Registration Page

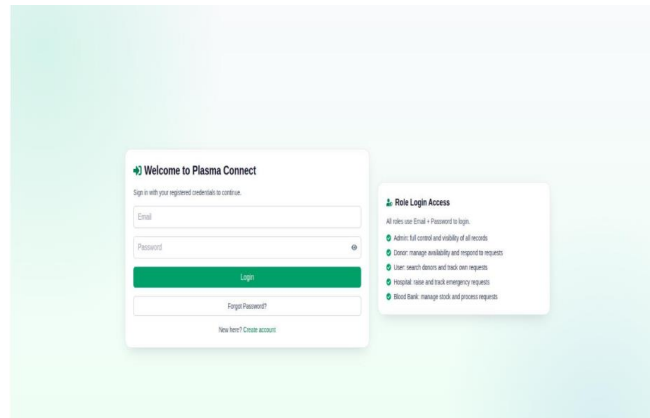


Figure 3: User Login Page

Once authenticated, administrators can access a dashboard that provides control over donor data and system activities. The admin dashboard allows monitoring of users, managing donor records, and ensuring system reliability.

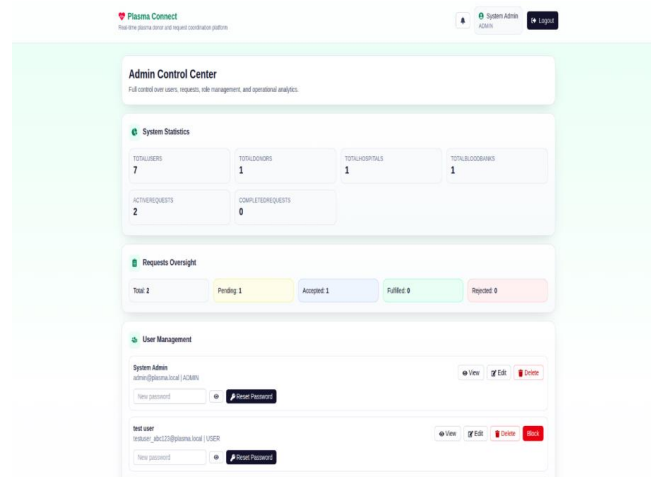


Figure 4: Admin Dashboard

The system also provides detailed donor profiles, which include information such as blood group, availability, and location. This helps users identify suitable donors quickly.

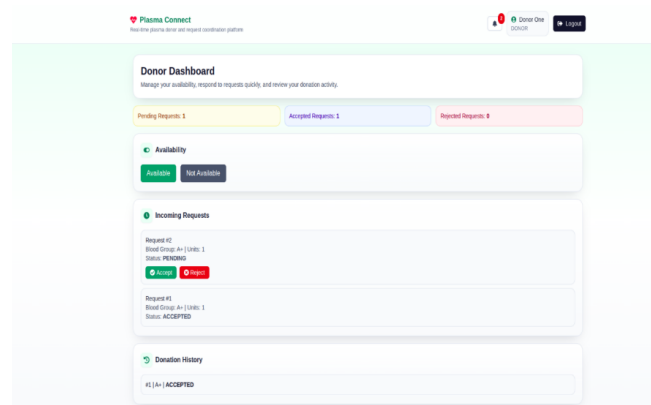


Figure 5: Donor Profile Page

Users can view donor details and initiate plasma donation requests. The platform enables efficient communication and request handling between donors and recipients.

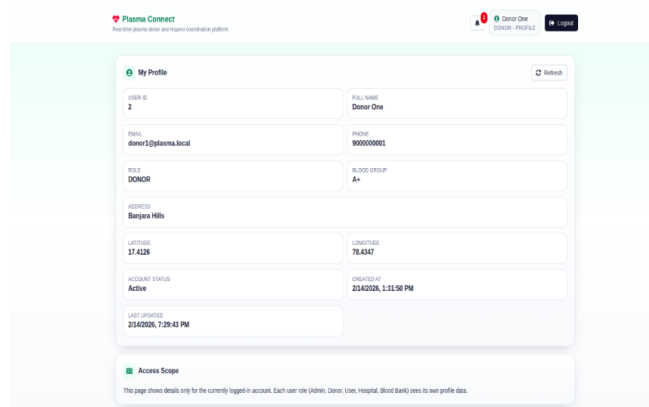


Figure 6: Donor Details Page

The results show that the system successfully supports donor search, request management, and real-time communication. The integration of role-based access and location-based filtering improves the efficiency of identifying suitable donors. The platform provides fast response times and ensures smooth interaction between system components. The real-time notification feature enhances communication, reducing delays in plasma donation coordination.

Overall, the results demonstrate that Plasma Connect is an effective and user-friendly platform that improves accessibility, reduces response time, and enhances coordination between donors and recipients.

VI. CONCLUSION

This paper presented Plasma Connect, a full-stack web platform designed to improve the efficiency of plasma donation coordination. The system integrates donors, recipients, hospitals, and administrators into a unified platform that enables real-time communication, donor discovery, and request management.

By utilizing modern web technologies such as React, Node.js, Express, and MySQL, the platform provides a scalable and secure environment for managing plasma donation processes. The integration of real-time notifications through Socket.IO and location-based services using Leaflet maps enhances communication and reduces response time during emergency situations.

The results demonstrate that the system effectively supports donor search, request tracking, and user interaction through an intuitive interface. The platform reduces delays associated with traditional manual methods and improves coordination between stakeholders involved in plasma donation.

Overall, Plasma Connect offers a reliable and user-friendly digital solution that enhances accessibility, improves response efficiency, and supports timely plasma donation in critical healthcare scenarios.

FUTURE ENHANCEMENTS

Although the Plasma Connect platform effectively improves plasma donation coordination, several enhancements can further expand its capabilities and real-world impact.

One potential improvement is the development of a dedicated mobile application for Android and iOS devices, which would provide better accessibility and faster interaction compared to a web-based system. Additionally, integrating push notification services can enhance real-time communication and ensure that users receive instant updates on donation requests.

The system can also be extended by incorporating advanced analytics to monitor donation trends, user activity, and system performance. This would help administrators make data-driven decisions and improve resource management.

Another enhancement is the integration of hospital and blood bank databases, enabling automatic verification of donor information and improving the reliability of the platform. Adding emergency prioritization features can further ensure that critical requests are handled with higher urgency.



Furthermore, implementing AI-based donor recommendation systems can help match donors and recipients more efficiently based on factors such as location, availability, and previous donation history. These enhancements would make Plasma Connect a more intelligent, scalable, and comprehensive healthcare solution for plasma donation management.

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