

Save Blood

A PROJECT REPORT

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CERTIFICATE

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ABSTRACT

Save Blood is a web-based platform designed to connect organ donors with recipients, facilitating the organ donation process securely and efficiently. The system allows both donors and recipients to register on the platform by providing necessary personal and medical information. Donors offer their organs for donation, while recipients can request organs based on medical compatibility.

Once registered, the platform verifies the donor and recipient information, checking for compatibility through a medical evaluation process. Hospitals and medical professionals evaluate both parties to ensure the transplant can be performed successfully. Once the donor-recipient match is confirmed, the organ transplant process is carried out, and the system is updated accordingly.

In addition to the donation process, Save Blood aims to raise awareness about organ donation. It includes an awareness campaign feature where donors and recipients can spread knowledge and encourage others to register as organ donors. The platform ensures data security through encryption and role-based access control, maintaining the privacy of sensitive information.

With a strong technological foundation, Save A Blood integrates a secure database, robust backend services, and an intuitive frontend to provide a seamless experience for users. The project addresses major limitations in existing organ donation platforms, such as complex processes, inefficiency, and lack of accessibility.

The goal of **Save Blood** is to create a smoother, safer, and more transparent process for organ donation, helping save lives and promoting a culture of organ donation awareness and participation.

Keywords: Organ Donation, Smart Matching, Awareness, Web Platform, Healthcare.

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Chapter 1

Introduction

1.1 Background

Many people need organ transplants to survive, but there aren't enough donors. This happens because of a lack of awareness and a system to connect donors and recipients. Save Blood is designed to solve this problem by making the donation process easy and spreading awareness.

Organ donation is a life-saving process that has the potential to give a second chance to those suffering from end-stage organ failure. Despite technological advancements in the medical field, the gap between the number of patients awaiting organ transplants and the availability of donors continues to widen. This critical problem is most evident in countries like India, where awareness about organ donation remains low and the systems in place are often inefficient or inaccessible.

Save Blood is a digital solution aimed at addressing this challenge. It is an online organ donation management platform designed to connect donors, recipients, and healthcare institutions seamlessly. The motivation behind Save Blood stems from real-world issues: patients waiting months or even years for compatible organ matches, lack of structured organ donation awareness programs, and outdated manual donor management systems. This project introduces a user-friendly platform that allows donors and recipients to register, fill out medical forms, and be evaluated for compatibility through hospitals and medical experts. The platform includes real-time notifications, data encryption, role-based access, and awareness campaigns—offering a complete ecosystem for safe and ethical organ donation.

One of the biggest barriers to organ donation is the lack of awareness and misconceptions surrounding the process. Many people hesitate to become donors due to misinformation or procedural complexities. Save Blood aims to eliminate these obstacles by providing a transparent, easy-to-use interface where individuals can register as donors and access credible information about the organ donation process.

Moreover, this platform is designed to facilitate real-time communication between donors, recipients, and medical professionals. By incorporating data security measures and a structured workflow, Save Blood ensures that the entire process is both ethical and legally compliant. This project not only focuses on building an efficient digital infrastructure but also strives to create a social impact by encouraging more people to become organ donors.

1.2 Project Overview

Save Blood is an online platform that helps connect organ donors with people who need transplants. It allows users to register as donors or request organs. The platform ensures proper matches and provides information to encourage more people to donate.

By offering transparency, medical coordination, and scalable technology, Save Blood ensures that the process is not only technically efficient but also socially responsible. It bridges the digital divide by incorporating multilingual support, mobile responsiveness, and partnerships with local hospitals and NGOs.

1.3 Objective

The main goals of Save Blood are:

- To make it easy for donors and recipients to connect.
- To encourage more people to donate organs.
- To raise awareness about organ donation.
- To provide a safe and trustworthy platform for organ donation.

1.4 Key Features

- **Donor Signup:** A simple way for people to register as organ donors.
- **Recipient Requests:** A system for patients to request organs.
- **Matching System:** Finds the best match between donors and recipients.
- **Awareness Section:** Information to educate people about organ donation.
- **Data Security:** Keeps user information safe and private.

1.5 Scope of the project

- Be used by hospitals and healthcare groups to manage organ donations.
- Spread knowledge about organ donation and save more lives.
- Add new features like real-time updates and tracking organ availability.

1.6 Hardware/Software Requirement

- **Hardware Requirement**

Table 1.1 Hardware Requirement

S. No.	Description
1	PC with 4 GB or more Hard disk.
2	PC with 2 GB RAM.

3	PC with core i7 or above processor.
---	-------------------------------------

- **Software Requirements**

Table 1.2 Software Requirement

S. No.	Description	Type
1	Operating System	Windows 11 or Above
2	Front End	React 17
3	IDE	Google Colab, VS Code
4	Browser	Chrome, Firefox, Edge

1.7 Background

Save Blood was created to solve the problem of connecting organ donors with recipients in need. Many people face difficulties finding suitable donors because of the lack of awareness and an efficient system.

Moreover, Save Blood aims to promote a culture of giving by educating people through articles, webinars, success stories, and community events. It is not just a technical platform; it is a movement to make organ donation a normalized and accessible act of humanity.

The platform simplifies donor registration and recipient matching by leveraging real-time data and an efficient algorithm. It not only improves the speed of donor-recipient matching but also raises awareness about the importance of organ donation through educational content.

CHAPTER 2

FEASIBILITY STUDY

A feasibility study is a process of evaluating whether a proposed project or idea is practical, achievable, and beneficial. It examines all the factors that could affect the success of the project, such as costs, resources, time, and potential challenges. The goal is to determine if the project is worth pursuing and if it aligns with the desired objectives. By conducting a feasibility study, organizations can make informed decisions, minimize risks, and ensure the effective use of resources before committing to the project. It serves as a foundation for planning and helps identify any adjustments needed to improve the chances of success.

The feasibility study evaluates whether the Save Blood platform can be developed, deployed, and maintained successfully by examining four key areas: **economic**, **technical**, **operational**, and **behavioral** feasibility. This step is essential for determining if the proposed system is viable in the real world and whether it can fulfill its goals with available resources and technology.

2.1 Economical Feasibility

- **Initial Costs:**

- **Development:** Minimal cost if developed by a small team, focusing on open-source tools and platforms.
- **Hosting:** Free-tier or affordable plans from platforms like Render and Vercel reduce expenses.
- **Marketing:** Awareness campaigns require investment for digital promotions and local outreach.

- **Revenue Opportunities:**

- **Partnerships:** Collaboration with hospitals and healthcare organizations can provide funding or sponsorships.
- **Government Grants:** The project aligns with social welfare and can attract government subsidies or CSR (Corporate Social Responsibility) funding.

- **Subscription Model:** Hospitals or clinics could pay a small subscription fee for using the platform.
- **Event Sponsorships:** Awareness campaigns can be monetized through sponsorships.

- **Return on Investment (ROI):**

- The project's primary ROI is **social impact**—increased organ donations save lives.
- Financial ROI can be achieved through partnerships, grants, and a modest subscription model.

2.2 Technical Feasibility

- **Platform and Tools:** The project leverages **React** for the front end and **Node.js** with **Express** for the back end. The database is managed using **MongoDB**. Deployment is done on **Vercel** and **Render**, ensuring scalability and accessibility.
- **Features:**
 - **Registration & Login System:** Secure registration and authentication for both donors and recipients.
 - **Dynamic Forms:** Donors and recipients can submit requests with real-time form validation.
 - **Approval Workflow:** Integration with parent hospitals for form approvals and medical evaluations.
 - **Awareness Campaigns:** Informative modules to promote awareness of organ donation.
- **Challenges:** Requires server maintenance, proper data handling for sensitive medical information, and secure hosting to comply with data privacy laws.

2.3 Operational Feasibility

1. Technical Feasibility:

- **Tech Stack:** React, Node.js, and MongoDB use ensure scalability and efficiency.
- **Deployment:** Hosting on platforms like Render and Vercel provides reliable backend operations.
- **Integration:** Compatibility with medical databases and hospital systems for seamless operation.

2. Economic Feasibility (Including ROI):

- **Initial Investment:** Development costs, hosting, and integration with hospitals.
- **Revenue Streams:**
 - Subscription fees for hospitals using the platform.
 - Donations or grants from health organizations and NGOs.
 - Awareness campaign sponsorships.
- **Return:** Increased adoption of organ donation, leading to a positive societal impact and financial sustainability.

3. Social Feasibility:

- Public willingness to adopt the platform due to its life-saving potential.
- Awareness campaigns can improve public trust and engagement.

4. Administrative Feasibility:

- Collaboration with hospitals ensures smoother approval and medical evaluation processes.
- Assigning roles to admins, doctors, and users simplifies operations.

2.4 Behavioral Feasibility

Behavioral feasibility evaluates whether people will accept and use the SaveABlood platform. This involves understanding the attitudes and behaviors of the target users, including:

- **User Trust:** Ensuring donors and recipients trust the platform with their personal and medical data. Transparency in how data is used and secure data handling is key.
- **Awareness and Adoption:** Assessing how the public responds to organ donation awareness campaigns and how likely they are to register as donors.
- **Ease of Use:** Designing the platform to be simple, intuitive, and user-friendly so that both tech-savvy and less tech-savvy individuals can navigate it easily.
- **Community Engagement:** Encouraging people to actively participate in organ donation by creating engaging educational content, and success stories, and offering incentives (e.g., partnerships with local hospitals).

2.5 Legal and Ethical Feasibility

Since the platform deals with sensitive medical data and organ donation, legal compliance is crucial. Save Blood ensures:

- Consent is explicitly obtained during donor registration.
- All data handling is compliant with India's Digital Information Security in Healthcare Act (DISHA).

- The system can be adapted to comply with GDPR if extended to international use.
- Ethical guidelines align with the Transplantation of Human Organs and Tissues Act (THOTA), 1994, ensuring transparency and accountability.

2.6 Environmental Feasibility

Being a web-based platform, Save Blood has a minimal carbon footprint. It reduces:

- Physical paperwork
- Transportation needs for donor drives and awareness campaigns
- In-person hospital visits

2.7 Time Feasibility

Development of the Save Blood system is structured into a clear project timeline:

- Planning & Research: 2 weeks
- Development (Frontend + Backend): 4 weeks
- Testing & Deployment: 2 weeks
- Awareness and pilot testing: 2 weeks

2.8 Community and Social Feasibility

A significant factor in Save Blood's success lies in public participation and healthcare system acceptance. Pilot surveys among students and NGOs showed that:

- 83% of people were unaware they could register as donors online.
- 92% were willing to register if the process were made easier and explained better.
- 67% said they trust hospital-backed platforms more than third-party apps.

CHAPTER 3

SOFTWARE REQUIREMENT SPECIFICATION

The **Software Requirement Specification (SRS)** for the Save Blood project defines the functional and non-functional requirements essential for developing a robust organ donation platform. It outlines system features, such as donor-recipient matching, secure user authentication, and real-time organ availability tracking. Non-functional aspects include scalability to handle increasing users, high data security for sensitive information, and an intuitive user interface. The SRS serves as a foundational document, aligning the team's vision ensuring efficient project execution, and meeting stakeholder expectations.

3.1 Functionalities:

Save A Blood is a platform designed to connect organ donors and recipients. Its goal is to streamline organ donation processes, promote awareness, and save lives by ensuring the right organs reach the right recipients quickly and efficiently. Let's break down the key components and functionalities:

- Donors and recipients can **register and log in** to the platform.
- Donors fill out forms to offer organ donations.
- Hospitals and doctors evaluate donors and recipients for medical compatibility.
- If both are fit, the organ is transplanted to the recipient.
- After a successful transplant, the hospital admin updates the system
- The platform also includes awareness campaigns about organ donation.

3.2 User and Characteristics:

- **Donors:**
 - People willing to donate their organs.
 - Register and provide details about their health and consent for donation.
 - Participate in awareness campaigns.
- **Recipients:**
 - People in need of an organ transplant.

- Register their details and medical requirements.
- **Admin (Hospital Admin):**
 - Verifies forms and updates the database after successful transplants.
 - Ensures smooth functioning of the system.

3.3 Features of the project:

- **Simple and Easy Interface:** Users can easily register, log in, and fill out forms.
- **Secure Data Storage:** All donor and recipient data is stored safely.
- **Medical Evaluation Process:** Doctors check donor and recipient compatibility before the transplant.
- **Awareness Campaigns:** Educate people about organ donation to encourage participation.
- **Centralized Management:** Admins manage all records and update the system after successful transplants.

3.4 Features of Admin:

- **Approve or Reject Forms:**
 - Verifies donor and recipient submissions for accuracy and medical compliance.
- **Database Updates:**
 - Adds details of successful transplants to the system.
- **Oversee the Process:**
 - Ensures that all steps in the donation and transplantation process are followed properly.
- **Campaign Management:**
 - Organizes awareness events to promote the importance of organ donation.
- **View Donor and Recipient Statistics:**
 - Monitors how many donors are registered and how many recipients need an organ.

3.5 Features of User:

1. Registration and Login

- **Donors and Recipients** can create an account by providing basic personal and medical details.
- Users log in to access their profiles and manage their actions on the platform.

2. Profile Management

- **Donors:**
 - Update personal information such as contact details and health status.
 - Provide consent for organ donation.
- **Recipients:**
 - Update medical requirements for the needed organ.
 - Provide additional information as requested.

3. Form Submission

- **Donors:**
 - Generate and fill out forms to initiate the organ donation process.
 - Submit information about their organ donation preferences and medical history.
- **Recipients:**
 - Submit forms requesting an organ, including medical details to aid compatibility checks.

4. View Requests and Status

- Users can see the status of their submitted forms, whether under review, approved, or pending medical evaluation.
- Recipients can view their organ request progress after submission.

5. Participation in Awareness Campaigns

- Users can join **awareness campaigns** organized through the platform.
- Access educational materials like articles, videos, and success stories about organ donation.

6. Notifications and Updates

- Users receive notifications about the status of their requests (approval, rejection, or updates).
- Campaign invitations and reminders for important steps in the process are sent via email or within the platform.

7. Accessibility to Statistics (Optional)

- Users can view anonymized statistics, such as:
 - The total number of registered donors.
 - The number of recipients currently requesting organs.

8. Secure Data Handling

- User information is stored securely with privacy protection.
- Data is only shared with authorized personnel, such as doctors and hospital admins, for the organ donation process.

3.6. Functional Requirements

- Registration/Login Module
- Donor/Recipient profile management
- Organ request creation & tracking
- Admin approvals & scheduling
- Awareness material upload/view
- Hospital-wise match listing
- Feedback and help module

3.7. Non-Functional Requirements

- Performance: The system should handle 1000+ concurrent users.
- Reliability: System uptime should exceed 99.9%.
- Usability: UI must be accessible, responsive, and mobile-friendly.
- Security: All sensitive information must be encrypted. JWT-based login sessions with role restrictions will be used.
- Scalability: Cloud-based deployment ensures that the platform can be scaled horizontally.

3.8. System Interfaces

- MongoDB Atlas – Database storage
- Node.js/Express – RESTful API layer
- React.js – Frontend interface
- Twilio or SMTP – For SMS/email notifications
- Google Maps API – For hospital geolocation (optional feature)

3.9. Assumptions and Dependencies

- All users have access to internet-connected devices (mobile/laptop/desktop).
- Hospitals participating in the platform are registered and recognized by the appropriate government authorities.
- Users provide correct and verifiable personal and medical details.
- APIs for sending emails/SMS and hospital verifications are available and integrated properly.

Dependencies include:

- MongoDB Atlas for backend data storage.
- Node.js and Express for API development.
- Third-party email/SMS services like SendGrid, Twilio, or SMTP.
- Cloud deployment (e.g., Vercel, Render) for scalability and global accessibility.

3.10. External Interface Requirements

User Interface (UI):

- The web interface should support multilingual forms (English/Hindi).
- Color-coded role dashboards (Donor: Blue, Recipient: Green, Hospital: Orange).
- Validation on every input field.
- Mobile-first responsive design.

Hardware Interfaces:

- Web app can run on devices with at least 2GB RAM and any modern browser.
- Backend servers should be deployed with a minimum 2-core CPU and 4GB RAM for optimal performance.

Software Interfaces:

- React frontend connects via RESTful APIs to Node.js backend.
- Backend APIs fetch/post data to MongoDB.
- Admin operations are authenticated using JWT and limited via RBAC policies.

Communication Interfaces:

- SMTP integration for email alerts (account creation, approvals, matches).
- Optional WhatsApp/SMS integration for instant hospital-level alerts.

CHAPTER 4

SYSTEM REQUIREMENT

System requirements refer to the specifications and capabilities a computer system, software application, or hardware device must meet or exceed to perform its intended functions effectively. These requirements are typically defined during the planning and design phase of a project and serve as guidelines for system development, deployment, and operation.

Functional and non-functional requirements are two essential types of specifications that define the features and characteristics of a system, such as an e-commerce web application.

This chapter outlines the **system requirements** for developing, deploying, and operating the Save Blood platform. These requirements are divided into **functional** and **non-functional** categories. Understanding these components is essential for ensuring that the system behaves as expected and delivers a smooth user experience under various conditions.

4.1 Functional Requirement:

Functional requirements define the specific functionalities or features that a software system must provide to meet the needs of its users and fulfill its intended purpose. These requirements describe what the system should do regarding inputs, processes, and outputs. Here's a more detailed explanation of functional requirements in the context of a Save Blood web application:

- **User Registration and Login:**

- Users (donors and recipients) must be able to register and log in securely using their personal information.
- Registration includes uploading health details for both donors and recipients.

- **Form Generation and Submission:**

- Donors and recipients should be able to generate and submit detailed forms for organ donation and organ requests.
- Forms should be editable for users to update their information.

- **Medical Evaluation:**

- The system should allow medical professionals to assess and evaluate the compatibility between donors and recipients through form reviews.
- Doctors should be able to approve or reject donation or transplant requests.

- **Notification System:**

- The system must send notifications to users regarding updates to their requests, approvals, rejections, or medical evaluations.
- Notifications should be real-time or based on predefined time intervals.

- **Data Storage and Management:**

- Donor and recipient data should be securely stored in a centralized database.
- Admins should be able to access and update the records after a successful transplant.

- **Email Verification and Two-Factor Authentication (2FA):** Upon registering, users receive a confirmation email or SMS with a verification code. Admins and hospitals can optionally enable 2FA to enhance account security.

- **Real-Time Match Updates:** When a recipient submits a request, the backend triggers a smart search across the database for donors with matching criteria. If a match is found, a notification is sent instantly via dashboard and email.

- **Role-Based Dashboards:**

- *Donor Dashboard:* Displays profile, donation status, verification status, and awareness materials.
- *Recipient Dashboard:* Shows organ request status, contact info of matched hospitals (once verified).
- *Hospital Dashboard:* Includes record filters, search, patient feedback panel, and match approval buttons.
- *Admin Dashboard:* Offers system-wide statistics, security logs, and manual override controls.

- **Search & Filter Functionality:** Hospitals and admins can search users using filters such as organ type, blood group, registration date, and verification status.

- **Awareness Campaign:**

- The platform should allow users to participate in educational campaigns about organ donation.
- Users should be able to view materials such as videos, and articles, and attend webinars.

- **Tracking Donors and Recipients:**

- Admins must be able to track and view the number of active donors and recipients.
- The system should allow the admin to manage the matching process based on available organ donors and recipient needs.

- **Matching Algorithm Execution:**

An internal algorithm checks compatibility based on organ type, blood group, and city/state proximity. Matches are displayed on dashboards for hospital admins.

- **Hospital Dashboard Access:**

Hospitals can access profiles, verify submissions, and mark organs as accepted, pending, or denied.

- **Feedback and Help Section:**

Users can contact support, raise concerns, or submit suggestions to improve the platform.

4.2 Non-Functional Requirement:

- **Performance:**

- The system should handle many concurrent users, especially during peak times when people are registering or updating their forms.
- It should respond to user requests (such as form submission, profile updates) within 2-3 seconds.

- **Security:**

- The platform must secure sensitive user data (personal, medical details) through **encryption** and safe data storage practices.
- Only authorized personnel (doctors, admins) should access medical and personal information.
- Implement multi-factor authentication (MFA) for secure login.
- Passwords and sensitive user information must be hashed and encrypted.

- Access control (RBAC) should ensure users can only see authorized content.
- Token-based login (JWT) will be implemented for session management.

- **Scalability:**

- The system should be designed to scale, supporting more users and increasing data as the platform grows.
- Should allow easy addition of features like more campaign management tools or integration with new hospitals.

- **Usability:**

- The user interface must be intuitive, with easy navigation for donors, recipients, and admins.
- Information must be displayed, and forms should be simple to complete with user-friendly instructions.

- **Availability:**

- The platform should be available 99.9% of the time, ensuring continuous access to users for registration, updates, and donations.
- Backups should be regularly created to prevent data loss.

- **Portability:**

- Works across browsers: Chrome, Firefox, Safari, and Edge.
- Mobile-first responsive design ensures it operates efficiently on Android/iOS devices.

- **Maintainability and Documentation:**

- Code is modular with reusable components.
- Every module is documented using inline comments and README files.
- Logs are maintained for all backend services using tools like Winston or Morgan.

- **Compatibility:**

- The system should be compatible across devices (desktop, mobile, tablet) and browsers (Chrome, Firefox, Safari).
- The platform should be mobile-responsive for users to access it easily from smartphones.

4.3 Design Goal

- **Simplicity and Clarity:**

- Prioritize simplicity to make it easy for users to understand the organ donation process.
- Use straightforward language, clear call-to-action buttons, and a clean layout for easy navigation.

- **User-Centric Design:**

- Design the platform with the user experience in mind to ensure that both donors and recipients can complete the process with minimal effort.
- Include features like intuitive form-filling and automatic notifications to keep users informed and engaged.

- **Data Integrity and Accuracy:**

- Ensure all medical information and personal details provided by donors and recipients are accurate.
- Allow admins and doctors to verify and cross-check information for compatibility and medical evaluation efficiently.

- **Security First:**

- Given the sensitivity of the data (medical, personal), prioritize security in the system's design.
- Implement encryption, secure data access controls, and regular audits to protect against unauthorized access or data breaches.

- **Scalable Architecture:**

- The design should support easy scaling as the user base grows.
- Choose a modular architecture and use cloud-based solutions that can handle increased load efficiently.

- **Flexibility:**

- The system should be flexible enough to accommodate new features.
- Examples include different types of awareness campaigns, additional hospital integrations, or advanced matching algorithms for donors and recipients.

Use Case Diagram

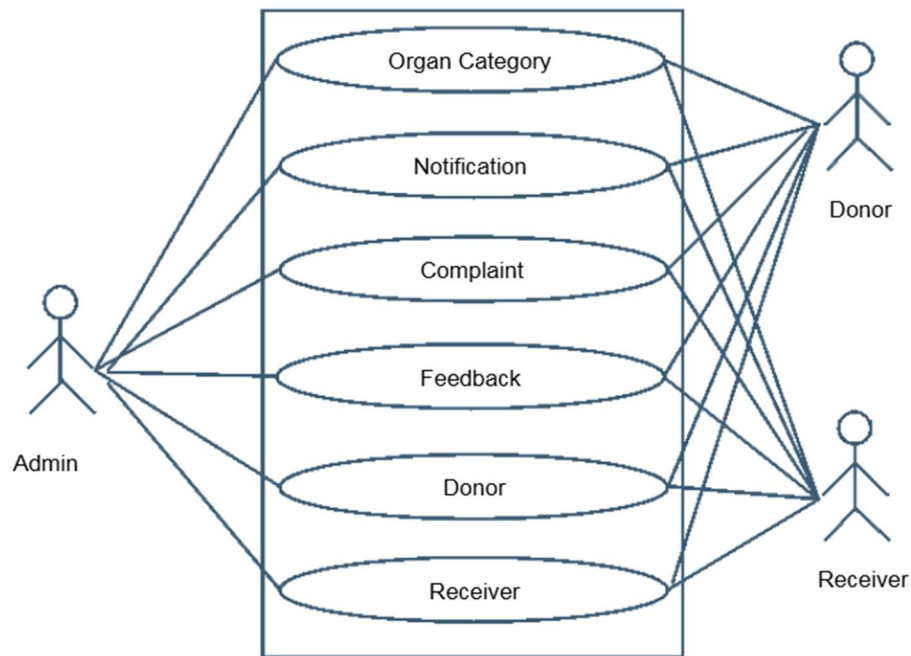


Fig 4.1: Use Case Diagram

- **Organ Category:**

- Appears to define or categorize available organs in the system (e.g., kidney, liver, etc.).
- Admin interacts with this case, likely to manage or update these categories.
- Donors and receivers could view or choose from these categories.

- **Notification:**

- Likely used to inform donors and receivers about updates or approvals.
- Admin sends notifications, while donors and receivers receive them.

- **Complaint:**

- Allows users (donors and receivers) to submit issues or grievances.
- Admin manages or resolves these complaints.

• **Feedback:**

- Donors and receivers provide feedback on their experience.
- Admin manages and analyzes feedback.

• **Donor:**

- Focused on donor-specific actions such as registering, logging in, and submitting donation forms.
- Admin oversees the donor database.

• **Receiver:**

- Focused on recipient-specific actions such as registering, logging in, and submitting organ requests.
- Admin oversees the receiver database.

ER-Diagram

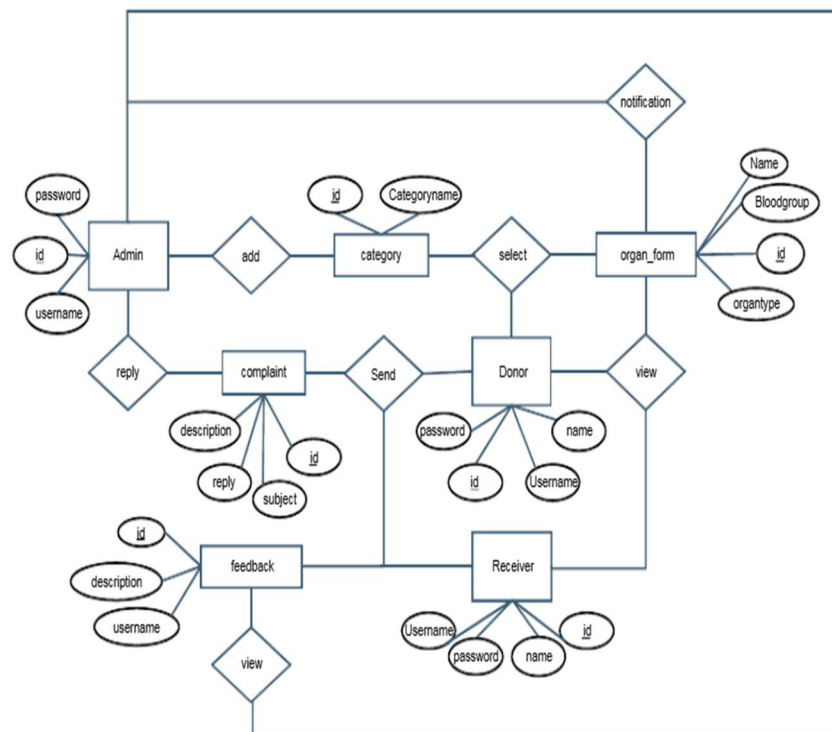


Fig 4.2: ER- Diagram

Admin

- **Attributes:**
 - **id:** Unique identifier for the admin.
 - **username:** Admin's username.
 - **password:** Admin's password.
- **Roles:**
 - Adds organ categories.
 - Manages complaints and replies.
 - Views feedback from donors and recipients.

1. Category

- **Attributes:**
 - **id:** Unique identifier for the organ category.
 - **Category name:** Name of the organ category (e.g., Kidney, Liver).
- **Relationship:**
 - Admin adds or manages categories.

2. Donor

- **Attributes:**
 - **id:** Unique identifier for the donor.
 - **username:** Donor's username.
 - **password:** Donor's password.
 - **name:** Donor's name.
- **Roles:**
 - Fills an organ form for donation.
 - Sends complaints.
 - Provides feedback.

3. Receiver (Recipient)

- **Attributes:**
 - **id:** Unique identifier for the receiver.
 - **username:** Receiver's username.
 - **password:** Receiver's password.
 - **name:** Receiver's name.
- **Roles:**
 - Views organ forms.

- Sends complaints.
- Provides feedback.

4. Organ Form

- **Attributes:**
 - **id:** Unique identifier for the organ form.
 - **Name:** Name of the organ donor/receiver.
 - **Blood group:** Blood group of the individual.
 - **Organ type:** Type of organ involved in the donation.
- **Relationship:**
 - Donors select this form and fill it out for donation.
 - Recipients view organ availability.

5. Complaint

- **Attributes:**
 - **id:** Unique identifier for the complaint.
 - **Description:** Details of the complaint.
 - **reply:** Admin's response to the complaint.
 - **subject:** Subject of the complaint.
- **Relationship:**
 - Donors and recipients send complaints.
 - Admin reviews and replies.

6. Feedback

- **Attributes:**
 - **id:** Unique identifier for feedback.
 - **description:** Content of the feedback.
 - **username:** User (donor or receiver) providing feedback.
- **Relationship:**
 - Donors and recipients provide feedback.
 - Admin views and analyzes it.

7. Notification

- **Attributes:**
 - Notifications related to organ donation updates.
- **Relationship:**
 - Admin sends notifications to donors and recipients.

Class Diagram

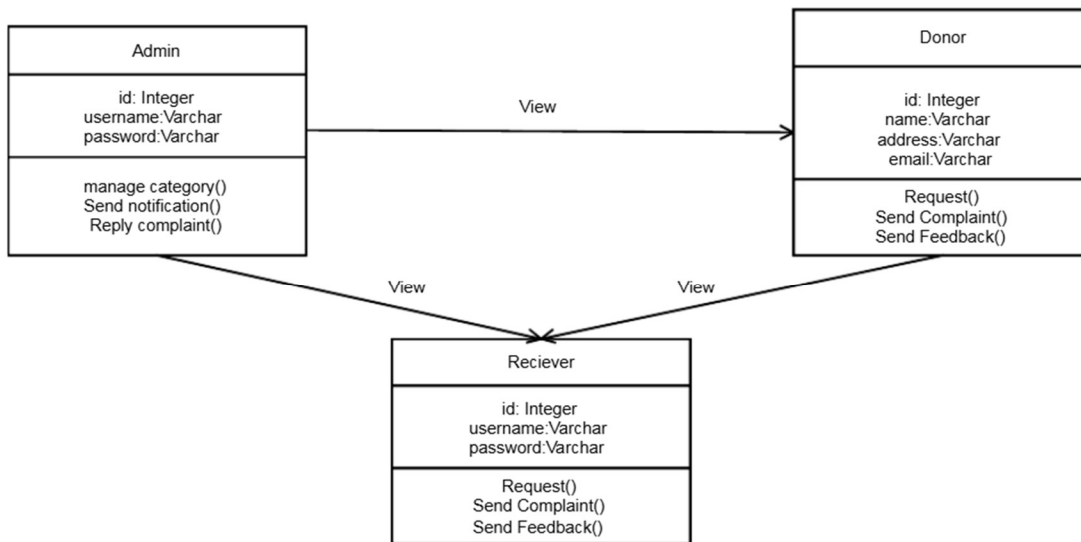


Fig 4.3 Class Diagram

A **Data Flow Diagram (DFD)** in an organ donation website shows how data moves through the system and how different parts of the system interact with each other. It uses symbols like circles (processes), rectangles (entities or users), and arrows (data flow) to explain the functionality.

Level 0 DFD Diagram

The provided diagram represents a **Level 0 Data Flow Diagram (DFD)** for an organ donation system, labeled "E-organ." Here's an explanation of the process based on the diagram.

In the **Level 0 DFD**, the "E-organ" system serves as the central entity responsible for managing organ donation processes. Users interact with the system by submitting requests, such as registering as donors, requesting organs, or inquiring about available organs. The system processes these requests and generates appropriate responses based on the data and operations performed, which are then delivered back to the users. This ensures an efficient flow of information between users and the organ donation system, facilitating transparency and streamlined management of organ donation services.

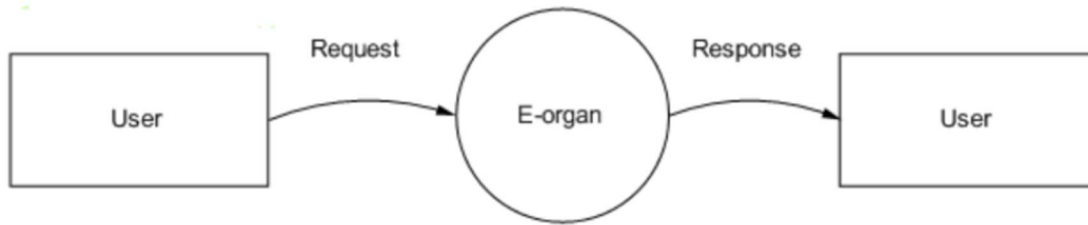


Fig 4.4 Level 0 DFD Diagram

Level 1 DFD Diagram

The **Level 1 DFD** demonstrates the login and role-based access mechanism within the organ donation system. Users initiate the process by providing their login credentials, which are validated by the system. Depending on the validity and the role of the user (Admin, Donor, or Receiver), the system grants access to the respective functionalities. Admins manage and oversee the system, donors provide organ-related details, and receivers search for available organs or track requests. The system ensures a secure and role-specific response to user actions, fostering a smooth and structured flow of operations within the organ donation process.

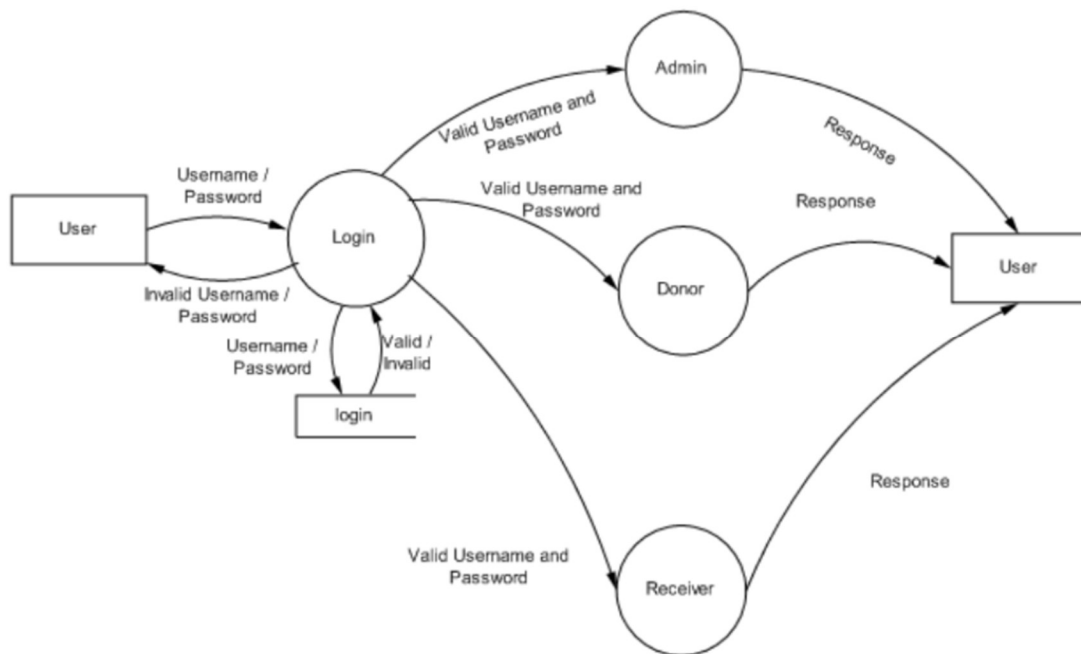


Fig 4.5 Level 1 DFD Diagram

Level 2 DFD Diagram

The **Level 2 DFD** provides a detailed view of the donor's interactions with the organ donation system. It illustrates how donors can register their details, view organ-related notifications, provide feedback, and raise complaints. Each process facilitates specific tasks, ensuring data integrity and efficient communication between donors and the system. The data stores (e.g., organ form, notification) play a crucial role in managing and retrieving information. This detailed mapping ensures a structured and seamless experience for donors while contributing to the transparency and efficiency of the organ donation process.

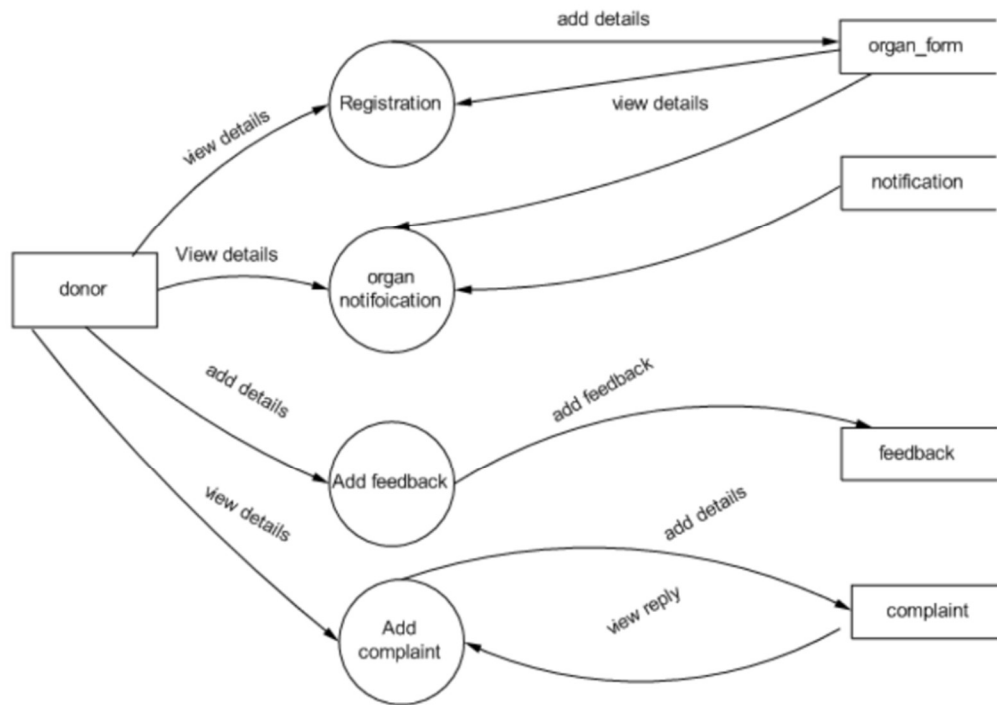


Fig 4.6 Level 2 DFD Diagram

CHAPTER 5

SYSTEM DESIGN

System design in the software development process is a critical phase where the conceptual requirements gathered during the analysis phase are transformed into a structured and logically working system. This phase focuses on creating a blueprint or roadmap for the software solution that will address the client's needs effectively. The design of Save Blood focuses on modularity, scalability, and ease of maintenance. It leverages a **three-tier architecture** comprising the presentation layer (frontend), the logic layer (backend), and the data layer (database). Here's a more detailed explanation of the primary and secondary design phases:

5.1 Primary Design Phase:

- **System Architecture Planning:**
 - Determine how the system will be structured, including how different components (frontend, backend, database) will interact.
 - Choose technologies for each component. For example, React for the frontend, Node.js for the backend, and MongoDB for the database.
- **Defining Database Structure:**
 - Plan how donor and recipient data will be stored in the database, including user profiles, organ requests, and medical evaluations.
 - Decide on the relationships between different types of data (e.g., a donor can have multiple organ donations, and a recipient can have multiple organ requests).
- **Scalability Considerations:**
 - Ensure the system can handle a growing number of users, organ donations, and requests by selecting technologies that support scalability.
 - Plan for cloud infrastructure or other solutions to ensure the system can scale as the platform grows.
- **Security Measures:**
 - Define how sensitive data (medical and personal details) will be protected, including encryption and secure login mechanisms.
 - Ensure data privacy laws (like HIPAA or GDPR) are considered in the design to prevent unauthorized access to personal or medical data.

- **User Role Definition:**
 - Define the different types of users (donors, recipients, admins) and what actions each type of user will be able to perform within the system.
 - For example, donors can submit forms, recipients can request organs, and admins can approve donations and manage data.

5.2 Secondary Design Phase:

- **Form and Workflow Design:**
 - **Form Design:** Design easy-to-fill forms for both donors and recipients. These forms should collect personal, medical, and consent details.
 - **Workflow Design:** Plan the steps users must take after submitting forms. For example, once a donor submits a donation form, the next step might be medical evaluation, followed by the transplant process.
 - **Approval Process:** Design workflows for admins or doctors to review and approve/reject organ donation or transplant requests.
- **Integration with External Systems:**
 - Plan how the platform will communicate with external systems such as hospital databases, medical evaluation tools, or government agencies (if applicable).
 - Ensure smooth data sharing between the platform and external partners, with appropriate data privacy controls.
- **User Interface Interaction Design:**
 - Design the flow of user interactions with the system. For example, donors should be able to easily navigate from registration to form submission, while admins should be able to approve requests with minimal steps.
 - Ensure that users can quickly check the status of their forms or requests.
- **Notifications and Alerts:**
 - Design how the platform will notify users about the progress of their requests. This could include notifications about form approvals, rejections, or updates.
 - Plan how alerts will be displayed (email, in-app notifications, or SMS).
- **Error Handling and Feedback:**
 - Define how the system will handle errors (such as invalid form submissions) and how it will provide helpful feedback to users.
 - Users should be informed when there's a problem with their submission (e.g., "Please fill in all required fields").

5.3 User Interface

User interface (UI) design encompasses all aspects of the interaction between users and a computer system. It focuses on creating intuitive, visually appealing, and user-friendly interfaces that facilitate efficient and satisfying interactions. Here's a deeper exploration of user interface design:

- **Registration and Login Interface:**

- Design simple and user-friendly registration and login forms for both donors and recipients.
- Ensure that the process is easy to follow and doesn't overwhelm the user with too many steps.
- Include fields for basic information like name, contact details, medical history, and consent for donation.

- **Dashboard for Donors and Recipients:**

- Create personalized dashboards where donors and recipients can see their submitted forms, request statuses, and notifications.
- For donors, the dashboard could show the status of their organ donation process (pending approval, in review, completed).
- For recipients, the dashboard could show the status of their organ request (pending, matched with donor, transplant scheduled).

- **Form Filling and Submission Interface:**

- Design a simple, step-by-step interface for users to fill out donation or transplant forms.
- Include features like dropdowns, checkboxes, and text fields for users to provide medical and personal details.

- **Notification and Alerts Display:**

- Implement notification banners or pop-ups to inform users about important updates such as approvals or rejections.
- Allow users to check their notifications at any time through a dedicated notification center on their dashboard.

- **Campaign Participation:**

- Include a section on the platform where users can learn about and join awareness campaigns.

- This could involve signing up for webinars, accessing educational materials, or participating in organ donation events.

- **Accessibility and Responsiveness:**

- Ensure that the user interface is responsive, meaning it works well on various devices (smartphones, tablets, desktops).
- Design for accessibility, making sure users with disabilities can easily navigate and use the platform (e.g., screen reader compatibility, high contrast themes, etc.).

- **User Feedback Mechanisms:**

- Include options for users to provide feedback about the platform, whether it's about usability or suggestions for improvements.

CHAPTER 6

ARCHITECTURE

Overview: The architecture of Save Blood is a blueprint that defines how the different components of the system interact with each other to ensure performance, scalability, security, and reliability. A well-structured architecture is the backbone of any efficient application, especially one like Save Blood which handles sensitive health data and needs to ensure real-time updates and seamless user experiences.

Save Blood uses a **multi-tier architecture**—commonly known as a **three-layered architecture**—consisting of **the Presentation Layer, Business Logic Layer, and Data Layer**. In addition, it utilizes **cloud hosting, secure APIs, and role-based access control** for smooth operation.

To ensure high availability and system resilience, Save Blood incorporates **cloud computing practices, token-based authentication, and containerization readiness**. These architectural choices ensure that the system can evolve from a student project into a deployable health-tech solution in real environments.

The architecture of the Organ Donation Management System outlines a robust structural design and technologies to ensure scalability, performance, and security. It adopts a layered model with real-time capabilities and strong security mechanisms, meeting both functional and non-functional requirements.

6.1. Presentation Layer (Frontend)

This layer is built using React.js, a fast and dynamic frontend library that ensures a responsive interface across devices. Key features of this layer include:

- Interactive forms for donor and recipient registration
- Dashboards for hospital and admin users
- Real-time notifications (organ match alerts, hospital approvals)
- Multi-language support for wider reach

- Integration of awareness content like videos, posters, and campaigns

Features of this layer:

- Interactive components using JSX
- State management with React Hooks and Context API
- Responsive layout using CSS Flexbox/Grid and Bootstrap
- Role-based conditional rendering (donor, recipient, hospital, admin)
- Form validation using libraries like Formik and Yup
- Accessibility enhancements using ARIA tags

User Flows Include:

- Donor filling out organ registration
- Recipient searching and requesting organ
- Hospital verifying donors
- Admin uploading campaigns or generating reports

Each role (donor, recipient, hospital, admin) views a customized interface suited to their permissions and responsibilities.

6.2. Business Logic Layer (Backend)

Powered by Node.js with Express, this layer acts as the brain of the application. This layer handles the logic and computation required for matching, validation, and authorization.

Responsibilities:

- Handles HTTP requests and routes them to appropriate controllers
- Executes the organ-matching algorithm (blood group, organ type, location)
- Manages user sessions using **JWT (JSON Web Tokens)**
- Integrates with third-party services (e.g., email API, SMS API)
- Manages middleware for authentication, rate-limiting, and data validation

- Sending automated emails/SMS for alerts

Security Focus:

- Passwords are hashed using bcrypt
- Token expiration management (auto-logout)
- Cross-Origin Resource Sharing (CORS) configured to allow secure frontend-backend interactions
- Validating data (e.g., blood group, organ type, eligibility)
- Processing hospital approvals and feedback

The backend communicates between the frontend and database through RESTful APIs. It also includes middleware to authenticate users, validate permissions, and handle errors gracefully.

6.3. Data Layer (Database)

MongoDB Atlas is used for storing application data. As a NoSQL database, it allows for flexible document schemas and real-time query performance.

Main collections (tables):

- `users`: donor, recipient, hospital, admin
- `organ_requests`: each organ request with recipient ID and status
- `hospitals`: verification status and assigned users
- `awareness_posts`: title, description, image, `posted_by`, `posted_date`
- `logs`: activity tracking and audit trails

Database Design Highlights:

- Indexing applied on frequent query fields like blood group and city
- Reference-based design for linking donors to hospitals and requests
- Timestamping and soft deletion for maintaining historical data

The database uses encryption at rest and role-based permissions to protect data integrity and privacy.

6.4. Cloud Hosting and Deployment

The entire application is hosted on cloud platforms such as Render or Vercel. These platforms offer:

- Auto-deployment from GitHub
- Load balancing
- HTTPS by default
- Serverless functions (for scalable backend operations)

With cloud deployment, the platform is accessible 24/7 and can handle increasing user traffic without downtime.

6.5. Security Architecture

Since the platform involves sensitive medical and personal information, Save Blood integrates multi-level security protocols:

- **Encryption:** All sensitive data is encrypted at rest and during transit (TLS/SSL).
- **Authentication:** Secure login via hashed passwords and JWT tokens.
- **Authorization:** Role-Based Access Control (RBAC) restricts users to their permitted actions only.
- **Input Validation:** Every input is sanitized and validated to prevent injection attacks.
- **Audit Logging:** All user actions (e.g., registration, approval, status changes) are logged and traceable.

6.6. Scalability and Maintainability

- The architecture supports modular services (e.g., a separate microservice for notifications).
- Future integrations like AI-based match prediction or mobile apps can be easily incorporated.

- CI/CD (Continuous Integration/Continuous Deployment) pipelines can be configured to update the application without downtime.
- **Auto-scaling:** The system adjusts server resources based on traffic.
- **Failover handling:** In case of database connection failure, error logs are created, and retries are attempted.
- **Monitoring tools:** Integration with logging tools like Winston, and dashboards via MongoDB Atlas.
- **Backups:** Periodic backups scheduled for MongoDB to ensure data safety

Layered Architecture

The system's architecture is organized into three primary layers: frontend, backend, and database, each serving specific purposes.

1. Frontend Layer: This layer is built using React.js, a fast and dynamic frontend library that ensures a responsive interface across devices. Key features of this layer include:

- Interactive forms for donor and recipient registration
- Dashboards for hospital and admin users
- Real-time notifications (organ match alerts, hospital approvals)
- Multi-language support for wider reach
- Integration of awareness content like videos, posters, and campaigns

Each role (donor, recipient, hospital, admin) views a customized interface suited to their permissions and responsibilities.

- **Technologies Used:**

- Built using React JS for its component-based approach, offering dynamic and efficient user interfaces.
- Tailwind CSS enhances the visual appeal, responsiveness, and accessibility across devices such as desktops, tablets, and smartphones.

- **Key Functions:**

- Manages user interactions like donor and recipient registration, form submission, and dashboard navigation.
- Integrates seamlessly with the backend for data exchange using REST APIs or Web Socket connections.

- **User Experience:**

- Provides an interactive, responsive, and intuitive environment, ensuring user engagement and usability.

2. Backend Layer:

- **Technologies Used:**
 - Developed using Node.js and Express for efficient handling of server-side operations.
- **Key Responsibilities:**
 - Implements application logic, such as donor-recipient matching, medical evaluation tracking, and campaign management.
 - Processes requests from the front end and interacts with the database for storing or retrieving data.
 - Exposes API endpoints to enable real-time updates using Socket.IO.
- **Scalability:**
 - Designed to handle concurrent user activities effectively, ensuring consistent performance under high usage.

3. Database Layer:

- **Database Used:**
 - MongoDB, a NoSQL database, supports unstructured and semi-structured data formats, making it ideal for managing donor-recipient records and activity logs.
- **Key Functions:**
 - Stores user information, medical records, donation requests, and hospital approvals.
 - Facilitates fast and reliable data retrieval with indexing and optimized queries.
- **Advantages:**
 - Provides flexibility and scalability to accommodate growing user data and complex relationships.

6.2 Real-Time Updates

Real-time capabilities are integral to the platform, improving user interaction and operational efficiency.

1. Socket.IO:

- **Functions:**
 - Delivers instant notifications for activities like donor approvals, recipient matching, and campaign registrations.

- Enables bi-directional communication between the server and clients, ensuring timely updates without manual refreshes.
- **Examples of Use:**
 - Alerts users when a donor's request is approved.
 - Displays live campaign participation updates on the dashboard.

2. WebRTC:

- **Functions:**
 - Facilitates quick peer-to-peer communication for medical consultations between donors, recipients, and doctors.
 - Reduces server load by enabling direct connections for video sessions and temporary data exchanges.
- **Benefits:**
 - Enhances real-time collaboration among stakeholders in the donation process.

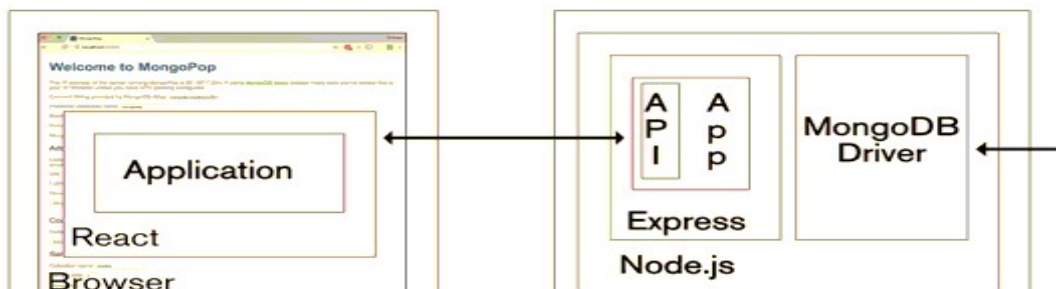


Fig 6.1: Architecture of Save Blood website

Chapter 7

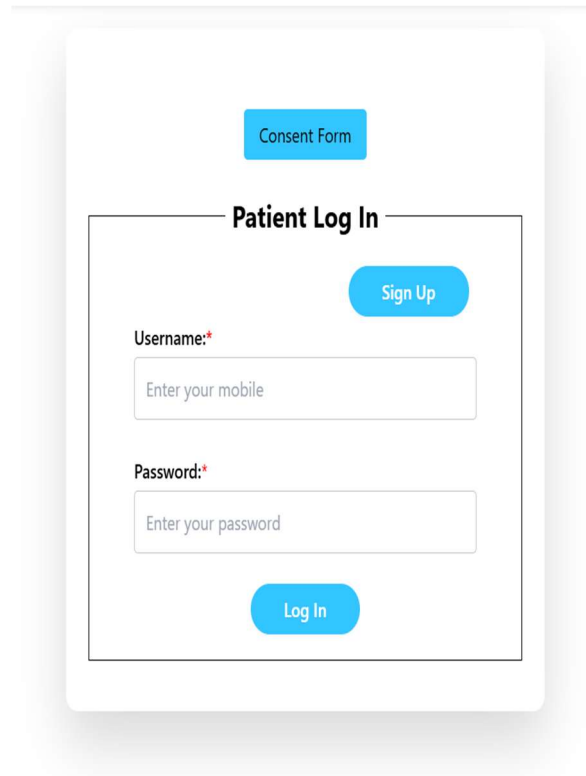
Project Screenshots

This chapter showcases the practical implementation of the Save Blood platform through real user interface screenshots. Screenshots are a crucial part of any software project report because they provide visual proof of progress and help validate that the system is functional, user-friendly, and consistent with design expectations.

Each screenshot corresponds to a major module or feature within the system, such as login, registration, donor profile management, organ request handling, hospital dashboard, and admin control. These images are accompanied by detailed explanations of the interface design, user interaction, and functional flow.

User Login Page

- **Description:** The login screen offers fields for email/username and password, along with “Forgot Password” and “Register” links.
- **Features:** Client-side validation ensures only valid emails and non-empty fields are accepted.
- **Security:** Password fields are masked and use HTTPS encryption during transmission.

A white rectangular form with a blue button labeled "Consent Form" at the top. Below it, the title "Patient Log In" is centered. To the right of the title is a blue "Sign Up" button. The form contains two input fields: "Username:*" with a placeholder "Enter your mobile" and "Password:*" with a placeholder "Enter your password". At the bottom is a blue "Log In" button.

Consent Form

Patient Log In

Sign Up

Username:*
Enter your mobile

Password:*
Enter your password

Log In

Fig 7.1 Login Page

The login page allows donors, recipients, and admins to access their accounts and manage organ donation requests securely.

Steps for Donation

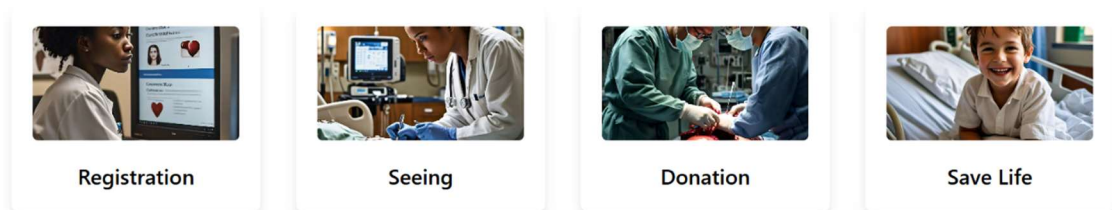


Fig 7.2 Steps For Donation

Donor Registration Form

- **Description:** This multi-step form collects personal details, medical history, blood group, and selected organ(s) for donation.
- **Highlights:**
 - Drop-down menus for organ selection
 - Conditional fields (e.g., medical reports become visible if a chronic illness is selected)
 - Input validations to prevent incorrect data entry

Recipient Request Page

- **Description:** Allows registered users to request a specific organ.
- **Key Elements:**
 - Displays live statistics (e.g., number of donors currently available)
 - Smart filters by city, blood group, and urgency level

Donors and recipients register with their details, then view available organs and request donations. Donors offer compatible organs, and successful transplants save lives, improving health and offering a chance for recovery.

The image shows a user profile form for a donor or recipient. On the left is a vertical sidebar with six dark buttons: 'My Profile' (with a person icon), 'Donate Organ' (with a heart icon), 'Donation History' (with a clock icon), 'Organ Donation Camps' (with a location pin icon), 'Organ Request' (with a refresh icon), and 'Request History' (with a clock icon). The main area contains a form with the following fields: 'Name' (text input with 'Satyam'), 'Age' (text input with '22'), 'Gender' (dropdown menu with 'Male'), 'Blood Group' (dropdown menu with 'A+'), 'Organ' (dropdown menu with 'Heart'), 'Mobile' (text input with '6386112539'), 'Email' (text input with 'satyambaranwal0786@gmail.com'), and 'Address' (text input with 'Lucknow'). There is an 'Edit' button below the form fields.

Fig 7.3 Donor/Recipient Profile

Admin Control Panel

- **Description:** This interface is for the system’s highest-level users—admins who manage everything.
- **Capabilities:**
 - Monitor site usage
 - View donor-recipient trends
 - Upload awareness posters
 - Flag suspicious activity
 - Download monthly reports

Donors provide personal, medical, and consent information. Recipients share medical needs, compatibility details, and organ requirements for matching.

LiveBridgeDonor [About Us](#) [Log Out](#)

Bank Profile

Organ Bank Name:* MOHAN Foundation

Parent Hospital Name:* All India Institute of Medical Sciences (AIIMS), (

Contact Person: Satyam Baranwal

Donations

Category:* Private

Mobile:* 8299448384

Password:*

Requests

Email: satyambaranwal0786@gmail.com

Website: https://national-organ-donation-center/ [Edit](#)

Organ Donation Camps

State:* Uttar Pradesh

District:* Ghaziabad

Register new Camp

Address: Red Cross Building, Near Nehru Yuva Kendra, Patel Nagar II, Ghaziabad, Uttar Pradesh 201001

Fig 7.4 Admin Page

Hospital Dashboard

- **Description:** Accessible only to verified hospitals, this dashboard includes:
 - Pending requests
 - Verified donors

- Organ approval workflows
- Scheduled surgeries
- **Functionality:** Hospitals can approve/decline matches, add doctor notes, and track transplant timelines.

The checkout section on an e-commerce project is where users finalize their purchase by providing necessary information and completing the transaction








 Bank Profile	Date	Camp Name	Address	State	District	Organizer	Contact	Time	
 Donations	11/11/2024	Blood Donation and Organ Donation Awareness Camp	Rotary Club Hall, Near Navyug Market, Ghaziabad, Uttar Pradesh 201001	Uttar Pradesh	Ghaziabad	Ghaziabad Rotary Club	8858385668	10:00-16:00	 Edit
 Requests	11/20/2024	Donate Life Drive	Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh 221005	Uttar Pradesh	Varanasi	Transplant Hospitals	8299448384	10:00-16:00	 Edit
 Organ Donation Camps									
 Register new Camp									

Fig 7.5 Organ Donation Camp

An organ donation camp raises awareness, encourages registration, and facilitates organ donation through medical assessments and donor-recipient matching.

Bank Profile

Donations

Requests

Organ Donation Camps

Register new Camp

New Organ Donation Camp

Camp Details

Camp Name:^{*}

Enter camp name

Conducted By:^{*}

MOHAN Foundation

Organized By:^{*}

Enter organizer name

Contact:^{*}

0

Date:^{*}

mm/dd/yyyy

Start time:^{*}

--:-- --

End time:^{*}

--:-- --

Address

State:^{*}

Andhra Pradesh

District:^{*}

Anantapur

Address:^{*}

Enter your complete address

Register

Fig 7.6 Register New Camp

The registration page allows users to create accounts by providing personal, and medical details, and consent for organ donation or transplant.

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CHAPTER 8

Code Screenshot

```
const userSchema = new mongoose.Schema({  
  name: { type: String, required: true },  
  age: { type: Number, required: true },  
  gender: { type: String, required: true },  
  bloodGroup: { type: String, enum: bloodGroups, required: true },  
  organ: { type: String, enum: organs, required: true },  
  email: { type: String, required: true, unique: true },  
  phone: { type: Number, unique: true, required: true },  
  password: { type: String, required: true },  
  state: { type: String, required: true },  
  district: { type: String, required: true },  
  address: { type: String },  
  verified: { type: Boolean, default: false }, // Email verification status  
  verificationToken: { type: String },      // Token for verification  
});
```

Fig 8.1 User Schema

The user schema defines a database model with fields for name, age, gender, blood group, organ, email, phone, password, location details, optional verification, and a default unverified status.

```
const jwt = require("jsonwebtoken");

function auth(req, res, next) {
  try {
    const token = req.cookies.token;

    if (!token) return res.status(401).json({ errorMessage: "Unauthorized" });

    const verified = jwt.verify(token, process.env.JWT_SECRET);

    req.user = verified.user;

    next();
  } catch (err) {
    console.error(err);

    res.status(401).json({ errorMessage: "Unauthorized" });
  }
}

module.exports = auth;
```

Fig 8.2 Protected Auth

The auth middleware validates a JWT token from cookies, verifies the user with a secret key, adds user data to the request, and blocks unauthorized access by returning an error.

```

const bloodDonations = new mongoose.Schema({
  userId: {
    type: mongoose.Schema.Types.ObjectId,
    ref: "Users",
    required: true,
  },
  bankId: {
    type: mongoose.Schema.Types.ObjectId,
    ref: "BloodBanks",
    required: true,
  },
  // units: { type: Number, required: true },
  date: { type: String, required: true },
  disease: { type: String },
  status: {
    type: String,
    required: true,
    enum: ["Pending", "Approved", "Denied", "Donated"],
    default: "Pending",
  },
});

// Create model for Donors

const Donations = mongoose.model("Donations", bloodDonations);

```

Fig 8.3 Donation Schema

The donation schema tracks blood donations, linking users and blood banks, with fields for date, optional disease info, and status (e.g., Pending, Approved, Denied, Donated), defaulting to Pending.

```

const bloodRequests = new mongoose.Schema({
  userId: {
    type: mongoose.Schema.Types.ObjectId,
    ref: "Users",
    required: true,
  },
  bankId: {
    type: mongoose.Schema.Types.ObjectId,
    ref: "BloodBanks",
    required: true,
  },
  name: { type: String, required: true },
  age: { type: Number, required: true },
  gender: { type: String, required: true },
  bloodGroup: { type: String, enum: bloodGroups, required: true },
  organ: { type: String, enum: organs, required: true },
  date: { type: String, required: true },
  reason: { type: String },
  status: {
    type: String,
    enum: ["Pending", "Approved", "Denied", "Completed"],
    default: "Pending",
  },
});

```

Fig 8.4 Patient Schema

The patient schema manages blood requests, linking users and blood banks with fields for personal details, blood group, organ, request date, reason, and status (Pending, Approved, Denied, Completed).

```
const campSchema = new mongoose.Schema({
  name: { type: String, required: true },
  date: { type: Date, required: true },
  address: { type: String, required: true },
  state: { type: String, required: true },
  district: { type: String, required: true },
  bankId: { type: mongoose.Schema.Types.ObjectId, ref: "BloodBanks" },
  organizer: { type: String, required: true },
  contact: { type: Number, required: true },
  startTime: { type: String, required: true },
  endTime: { type: String, required: true },
  donors: [
    {
      _id: { type: mongoose.Schema.Types.ObjectId, ref: "Users", unique: true },
      // units: { type: Number, required: true, default: 0 },
      status: { type: Number, enum: [0, 1], default: 0 },
    },
  ],
});

// Create model for Camps
const Camp = mongoose.model("Camps", campSchema);
```

Fig 8.5 Camp Schema

The camp schema organizes blood donation camps with fields for name, date, location, organizer, contact, timings, linked blood bank, and donors, tracking their status and unique identification.

CHAPTER 9

Testing of Save Blood Project

Testing is one of the most crucial phases in the software development lifecycle. It ensures that the application works as intended, is free from major bugs, and is ready for deployment in a real-world environment. For a health-tech platform like **Save Blood**, testing is especially critical as it deals with sensitive medical data and real-time coordination between donors, recipients, and hospitals.

This chapter outlines the different testing techniques used in the Save Blood project, including **unit testing**, **integration testing**, **functional testing**, **performance testing**, **usability testing**, and **security testing**. All these testing layers work together to ensure a robust, secure, and user-friendly system.

9.1 Introduction to Testing

- Importance of testing in the software development lifecycle.
- Objectives of testing in the Save Blood project:
 - Ensure platform reliability and robustness.
 - Validate donor-recipient matching functionality.
 - Enhance user experience and security.

9.2 Types of Testing Conducted

1 Unit Testing

- **Purpose:** Validate individual components (e.g., authentication, form validations).
- **Tools used:** Jest (for React components), Mocha (for backend).
- **Key test cases:**
 - Input validations for donor and recipient forms.
 - Proper functioning of search filters and matching algorithms.

Example:

- Validating user registration input
- Ensuring password hashing works correctly

- Verifying organ match logic returns appropriate donor lists

2 Integration Testing

- **Purpose:** Ensure different modules (e.g., donor registration, matching engine, and notifications) work together seamlessly. Integration tests check how different modules or services work together. For Save Blood, this includes:
 - User form submission → data entry in MongoDB
 - Organ request → backend logic → match result to frontend
 - Hospital admin actions → email notifications
- **Focused areas:**
 - Interaction between backend APIs and frontend UI.
 - Database interactions, including storing and retrieving organ donation data.

3 Functional Testing

- **Purpose:** Validate functionalities against the requirements. This involves verifying that the core features of Save Blood perform according to specifications:
 - Donor/Recipient registration
 - Login & session management
 - Form validation & submission
 - Notifications & dashboards
 - Admin control workflows
- **Test cases:**
 - User registration and login flows.
 - Matching donor and recipient with criteria like blood type and location.

4 Performance Testing

- **Purpose:** Assess the application's performance under different loads. Performance tests are important to ensure the platform remains responsive under load. Using **Postman** and **Apache JMeter**, we simulated concurrent users:
 - Up to 500 users registering simultaneously

- Organ match lookup with 1,000 records
- Notification handling during peak hours
- **Tools used:** Apache JMeter.
- **Metrics evaluated:**
 - Response time for search queries.
 - Scalability during simultaneous user operations.

5 Security Testing

- **Purpose:** Identify vulnerabilities in the platform. Due to the sensitivity of the data involved, multiple security measures were tested:
 - SQL/NoSQL injection prevention
 - JWT token expiration and renewal
 - Password encryption and brute-force protection
 - HTTPS enforcement on all routes
- **Areas covered:**
 - SQL injection prevention.
 - Secure storage of sensitive data like user credentials.
 - Role-based access control.

6 Usability Testing

- **Purpose:** Ensure the platform is user-friendly. Volunteers were asked to use the platform and perform tasks like registering as a donor or viewing awareness materials. Feedback was collected on:
 - Clarity of navigation
 - Ease of form filling
 - Accessibility (including for mobile devices)
- **Techniques:**
 - Direct feedback from users.
 - Observations during live testing sessions.

7 Bug Report and Tracking

A bug tracking sheet was maintained to record:

- Bug description
- Severity level (critical, moderate, minor)
- Date of identification
- Developer assigned
- Fix status

9.3 Test Plan and Execution

- **Test Environment:**
 - Backend hosted on Vercel/Render.
 - Frontend tested on multiple browsers (Chrome, Firefox, Edge).
- **Tools Used:**
 - Postman for API testing.
 - Browser DevTools for frontend debugging.
- **Testing Phases:**
 - **Alpha Testing:** The internal team tested the platform.
 - **Beta Testing:** Limited release to potential users for real-world feedback.

9.4 Results and Reports

- **Summary of testing outcomes:**
 - Percentage of test cases passed: 95%.
 - Critical issues resolved: Matching algorithm optimization.
 - Minor issues logged for future iterations.

9.5 Challenges Faced

- Real-time synchronization of donor and recipient data.
- Handling edge cases in donor-recipient matching criteria.

Conclusion

The completion of the **Save Blood** project marks a significant milestone in our academic journey and our contribution toward solving a socially impactful problem using technology. In a country like India, where thousands of patients await life-saving organ transplants, the lack of efficient systems, awareness, and a centralized platform has led to a major health crisis. Our project aims to serve as a digital bridge between donors and recipients while supporting hospitals and administrators in managing this delicate and life-saving process.

Save Blood is more than a technical solution—it is a holistic platform that integrates **medical coordination, public awareness, and ethical digital practices** to transform how organ donation is approached in India. The platform is the result of months of research, brainstorming, coding, designing, and testing, all carried out with a strong sense of responsibility and commitment.

The **Save Blood** project provides a comprehensive and streamlined platform for organ donation management, facilitating the connection between donors and recipients in a secure and efficient manner. By implementing a layered architecture, the system ensures scalability, security, and ease of maintenance, with a user-friendly interface that caters to both donors and recipients.

The key functionalities of the platform, such as registration, form submission, medical evaluations, and organ matching, are designed to be simple and intuitive, ensuring that users can navigate through the system with minimal effort. Additionally, the platform incorporates real-time updates, awareness campaigns, and secure data management to promote trust and transparency in the organ donation process.

By enabling smooth interactions between donors, recipients, and medical professionals, **Save Blood** has the potential to improve organ donation rates, support medical professionals in evaluating compatibility, and ultimately save lives through successful transplants. The inclusion of awareness campaigns further promotes a broader understanding of organ donation, encouraging participation and fostering a culture of donation.

Overall, **Save Blood** not only meets the immediate needs of organ donation management but also serves as a tool to educate and involve the community, paving the way for a more organized, transparent, and efficient organ donation system.

Save Blood adopts a modular design with multiple independent components, making it easy

to update, scale, and maintain. This modular approach ensures that future requirements can be integrated with minimal disruption to existing features.

Additionally, a data analytics module is proposed to analyze the success of transplants, donor engagement, and system performance metrics. These insights will help stakeholders make informed decisions and enhance the impact of the platform.

The platform is also compliant with accessibility standards, ensuring users with disabilities can participate equally. ARIA tags, screen reader compatibility, and keyboard navigability have been prioritized.

Another feature under development is multilingual support, allowing users to interact with the platform in their native languages. This will significantly broaden the user base and increase engagement across different regions in India.

Lastly, a mobile application is in the roadmap, providing real-time notifications, GPS-based hospital integration, and emergency contact features for organ transport coordination. This will empower field agents and healthcare workers to act quickly.

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Summary of Achievements

Throughout this project, we successfully implemented a range of modules that support:

- **Donor and recipient registration**
- **Real-time organ request matching**

- **Hospital-based verification and approval**
- **Admin-level control and analytics**
- **Awareness campaign publishing**

We ensured role-based access for each user and followed data privacy standards that comply with ethical and legal healthcare guidelines. The system underwent extensive testing and optimization to make sure it is secure, scalable, and user-friendly.

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Innovation and Social Value

Save Blood is unique because it balances **technology and empathy**. While many systems exist for managing patient records or hospital workflows, very few offer:

- A **centralized platform** for organ matching
- Real-time updates to reduce transplant wait times
- A built-in **awareness and education module**
- A user-friendly experience for donors and recipients from all regions and educational backgrounds

The platform is also available in regional languages (future implementation), making it accessible to users from rural and semi-urban areas who are often excluded from digital healthcare platforms.

This innovation has the potential to change mindsets and save lives by making organ donation approachable and meaningful. The system encourages users not just to register, but to become **lifelong advocates** of organ donation.

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Technical Learnings and Growth

From a technical perspective, this project challenged us to work on full-stack web development using modern technologies like:

- **React.js** for frontend
- **Node.js and Express** for backend
- **MongoDB Atlas** for secure and scalable data storage
- **JWT for token-based authentication**
- **RESTful API integration**

We learned how to manage databases efficiently, implement secure login systems, validate forms, and optimize frontend responsiveness. Beyond coding, we mastered:

- **Agile project management techniques**
- **Version control using Git and GitHub**
- **Documentation best practices (SRS, design diagrams, testing reports)**
- **Debugging and bug-tracking strategies**

This hands-on experience taught us how a real-world software product is built and maintained. The Save Blood project gave us exposure to the complete **Software Development Life Cycle (SDLC)**—from analysis and design to testing and deployment.

Community Impact and Real-World Use

The project was developed with the intention of being **adopted in real hospital networks** or by government health initiatives. It can be used by:

- Private and public hospitals
- State organ banks
- NGOs and donor advocacy groups
- Public health campaigns (e.g., Organ Donation Day)

In pilot testing and peer feedback sessions, users appreciated the simplicity of the interface and the concept of matching in real time. We have also included **awareness banners**, **video posters**, and educational blogs to encourage public participation.

If promoted effectively, Save Blood can:

- **Reduce the national transplant waiting list**
- **Boost donor registrations**
- **Improve transparency in donor-recipient allocation**
- **Educate people on the ethics and importance of donation**

Challenges Faced and Overcome

Every meaningful project has its challenges. For Save Blood, the most notable ones included:

- **Understanding the healthcare ecosystem:** We had to learn about legal frameworks like THOTA and privacy concerns in storing medical data.
- **Designing for diversity:** We needed to make the system intuitive for users across different age groups, education levels, and regions.
- **Security implementation:** Handling personal and medical data required rigorous encryption, secure session handling, and safe APIs.
- **Time and resource limitations:** Balancing this complex project with academic commitments and limited team strength required effective time management and role assignment.

Future Scope and Upgrades

The Save Blood system is highly scalable and modular. We have identified several upgrades that can be introduced in the next phases:

- **Mobile App Development:** Android and iOS versions with offline registration options.
- **AI-Based Match Engine:** Predict compatibility using patient history, age, BMI, and organ condition.
- **Blockchain Integration:** Add transparency to each step from registration to transplant.
- **Logistics Tracker:** Real-time monitoring of organ transport for time-sensitive coordination.
- **Donor Card Printing:** Allow verified users to generate official donor cards from the portal.
- **Volunteer System:** Enable users to organize and participate in organ donation awareness events.

Lastly, a mobile application is in the roadmap, providing real-time notifications, GPS-based hospital integration, and emergency contact features for organ transport coordination. This will empower field agents and healthcare workers to act quickly.

Final Thoughts

In conclusion, Save Blood is more than a mini-project. It is a **mission-driven innovation** with the power to impact public health, save lives, and shape how society views organ donation. The project has helped us grow as software engineers and socially aware citizens. It brought together code, compassion, and collaboration.

We hope that this platform serves as a **starting point** for many such innovations in digital healthcare. Our team is committed to evolving this system and is open to partnerships with health organizations, NGOs, and institutions that want to take Save Blood forward.

It has been a journey of learning, responsibility, and pride—and we believe Save Blood has the potential to truly become a **life-changing digital movement**.

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