INITIAL REPORT

ON

ORGAN BANK

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ABOUT THE PROJECT

The Organ Bank is a comprehensive digital solution developed as a mobile application to automate and streamline the process of organ donation, matching, and transplantation. This project eliminates the inefficiencies of traditional manual systems by providing an integrated, real-time platform that ensures reliability, transparency, and efficiency in managing organ donations and transplants.

The existing system for organ donation and transplantation often involves manual processes, leading to delays, inefficiencies, and missed opportunities for life-saving procedures. While some organizations maintain static websites for registration or informational purposes, these systems fail to provide dynamic solutions for managing donor and recipient data, organ matching, and hospital coordination. Such limitations result in underutilized resources, lack of transparency, and delayed decision-making, which can cost lives.

The Organ Bank addresses these shortcomings by introducing a dynamic and real-time platform designed to meet the needs of all stakeholders, including administrators, donors, recipients, and hospitals. Key features include automated organ matching based on medical criteria, real-time notifications for compatibility testing schedules, transplant dates, and a feedback mechanism to ensure continuous improvement and accountability.

The system uses Flutter for developing a responsive and intuitive user interface across both mobile and web platforms, ensuring seamless user experiences. Node.js powers the backend, efficiently handling server-side logic, organ matching algorithms, and business processes, while MongoDB serves as the database for secure, scalable, and real-time data storage and management. The development environment integrates Visual Studio Code for the mobile app.

By utilizing these modern technologies, the Organ Bank provides a robust and efficient solution that automates processes, reduces manual errors, and accelerates decision-making. Its real-time features and enhanced communication build trust among stakeholders while significantly improving the success rate of organ transplants.

This innovative solution not only addresses critical challenges in organ donation and transplantation but also contributes significantly to the noble cause of saving lives, making it a vital tool for modern healthcare management.

ACTORS AND THEIR ROLES

The Organ Bank involves multiple actors, each playing a significant role in ensuring the efficient and transparent functioning of the system. These actors include Admin, Donor, Recipient, and Hospital.

1. Admin

- Manages donor, recipient, and hospital registrations.
- Monitors the system for new registrations and approves/rejects them.
- Oversees the automated organ matching system and reviews potential matches.
- Approves organ matches and adds them to the matched organs table.
- Notifies donors, recipients, and hospitals about approved matches.
- Tracks organ availability and generates detailed reports.
- Manages system data and ensures proper functionality.
- Monitors transplantation results and oversees feedback submissions.

2. Donor

- Registers with the system, providing consent for organ donation.
- Updates personal details and organ donation preferences.
- Receives notifications from the admin and hospital regarding matches, compatibility tests, and transplantation schedules.
- Provides feedback about the system and hospital services.

3. Receipient

- Registers with the system, requesting organ transplants.
- Updates personal details and organ requirements.
- Receives notifications about organ matches, compatibility tests, and transplantation schedules.
- Tracks organ match statuses and compatibility test results.
- Provides feedback about the system and hospital services.

4. Hospital

- Registers with the system and manages hospital-related data.
- Conducts compatibility tests for matched donors and recipients.
- Schedules and carries out transplantation procedures.
- Notifies donors and recipients about test and transplantation schedules.
- Updates the system with test results and transplantation outcomes.
- Provides feedback on the organ bank system.

DESCRIPTION OF MODULES

1. **User Management**

   - Donors, Recipients, and Hospitals can register themselves by providing necessary details such as personal information, contact details, and medical records (for donors and recipients).
   - Hospitals provide their registration details, including location and address.
   - Admin reviews the registration details.
   - Approves or rejects registrations based on validity and authenticity of the provided information.
   - Sends approval/rejection notifications to the respective users via mail.
   - Donors and Recipients can update their profiles after approval.
   - Hospitals can edit their details, such as contact information and services provided.

2. **Donation Module**

   - Donors can register and select the organ they wish to donate.
   - Donors can update the availability status at any time before the match is approved by admin.
   - Donors can view the status of the organ donated.

3. **Request Module**

   - Receipients can register and select the organ they wish to request.
   - Receipients can view the status of the organ requested.

4. **Organ Matching Module**

   - Automatically matches registered donors and recipients based on compatibility factors such as blood group and organ type when a donation or request is submitted.
   - Successful matches wait for admin approval.
   - Admin approves the matches, and notifications are sent to the respective hospital.

5. **Compatibility Testing Module**

   - Hospitals schedule onsite compatibility tests for approved matches.
   - Updates the system with test results (success /failure).
   - Notifications are sent to the donor and receipient.

6. **Transplantation Management Module**

   - Hospitals conduct transplantation procedures after successful compatibility tests.
   - Updates the system with transplantation outcomes (success or failure).
   - Notifications are sent to Admin, Donors, and Recipients about the procedure status.

7. **Feedback and Complaint Management Module**

   - Donors, Receipients, and Hospitals can submit feedback on their experiences, system usability, and hospital services.
   - Feedback is visible to the Admin for system improvement.
   - Donors and Receipients can raise complaints about hospital services, compatibility testing, or delays in processes.
   - Hospitals can report any issues related to the system or donor/receipient cooperation.

8. **Report Management Module**

   Admin generates reports on transplantation outcomes and success rates.

BUSINESS RULES

- Registrations for Donors, Recipients, and Hospitals must be reviewed and approved by the Admin before granting access to the system.
- Donors must provide explicit consent for organ donation during registration.
- Consent can be revoked at any time before a match is approved by the Admin.
- Receipients must provide valid medical records during registration to justify their request for an organ.
- Priority will be given based on medical urgency, compatibility, and waiting time.
- Matches must be reviewed and approved by the Admin before proceeding to compatibility tests.
- Only verified hospitals can perform compatibility tests and transplantation procedures.
- Admin must review all registrations (Donors, Receipients, Hospitals) within 24–48 hours of submission.
- Complaints must be addressed by the Admin .

TECHNOLOGY/FRAMEWORK

Frontend Development

- Flutter: Used for creating the user interface for both the mobile app and the web-based system. Ensures cross-platform compatibility, providing a consistent and seamless experience across Android, and web devices. Offers interactive and user-friendly interfaces for donors, recipients, hospitals, and the admin. Built using the Dart programming language for high performance and a smooth user experience.

Backend Development

- Node.js:Powers the backend by providing a fast, scalable, and event-driven environment. Manages server-side logic, including user authentication, organ matching, notifications, and admin approval workflows. Ensures efficient communication between the frontend and database via RESTful APIs.

Database Management

- MongoDB: A NoSQL database used for storing all system data in a flexible, JSON-like format.Manages critical data, and ensures data consistency and supports complex relationships within the system.

PROJECT FEASIBILITY

A project feasibility study is essential to evaluate the technical, economic, and operational viability of the proposed Organ Bank. The study ensures that the project can succeed within the defined scope, resources, and timeline while identifying potential challenges.

1. Technical Feasibility

The Organ Bank is technically feasible due to its use of robust and widely adopted technologies:

- **Frontend**:
    - Built using **Flutter**, a cross-platform framework delivering a seamless experience across Android, iOS, and web platforms.
    - **Dart**, the programming language used in Flutter, ensures smooth animations, responsive UI, and efficient application performance.

- **Backend**:
    - Developed using **Node.js**, a fast, scalable, and event-driven environment ideal for handling server-side logic, organ matching algorithms, and notifications.
    - RESTful APIs ensure efficient communication between the frontend and database.
- **Database**:
    - **MongoDB**, a NoSQL database, manages unstructured and semi-structured data like donor and recipient profiles, organ availability, and transaction logs.
    - MongoDB's flexible schema supports scalability, fast data retrieval, and ensures data consistency.

This technology stack provides a modern, reliable, and efficient solution that is widely supported. It ensures compatibility with various devices, making the system accessible to all users, including donors, recipients, hospitals, and administrators.

2. Economic Feasibility

The Organ Bank is cost-effective due to the following:

- **Open-source Technologies**: The use of **Flutter**, **Node.js**, and **MongoDB** eliminates licensing fees, significantly reducing development costs.
- **Availability of Skilled Developers**: These technologies are widely adopted, making it easy to find skilled professionals at reasonable rates.

- **Automation Benefits**: The organ-matching system, notification module, and reporting features reduce manual administrative costs and time investment.

While initial development, deployment, and maintenance will require investment,the system's ability to reduce operational costs, optimize resource utilization, and improve decision-making provides strong economic justification.

3. Operational Feasibility

The Organ Bank streamlines operations and builds trust through:

- **Frontend**:
    - **Flutter** delivers an intuitive and responsive user interface for all stakeholders.
    - The cross-platform nature ensures a consistent experience across mobile and web platforms.

- **Backend**:
    - **Node.js** efficiently handles backend processes, including user authentication, organ matching, and notifications.
    - The **MongoDB** database ensures fast and reliable data storage and retrieval, supporting complex queries and maintaining data integrity.
- **Automation**:
    - Automates organ matching, notifications, compatibility testing management, and data logging, significantly reducing manual effort and minimizing errors.
- **Trust and Transparency**:
    - The notification and feedback systems enhance transparency and communication, building trust among donors, recipients, hospitals, and administrators.

By automating critical processes and reducing manual interventions, the system optimizes workflows and enhances operational efficiency. Regular updates, skilled developers, and strong security measures will ensure long-term success and scalability.

SYSTEM ENVIRONMENT

Hardware Environment

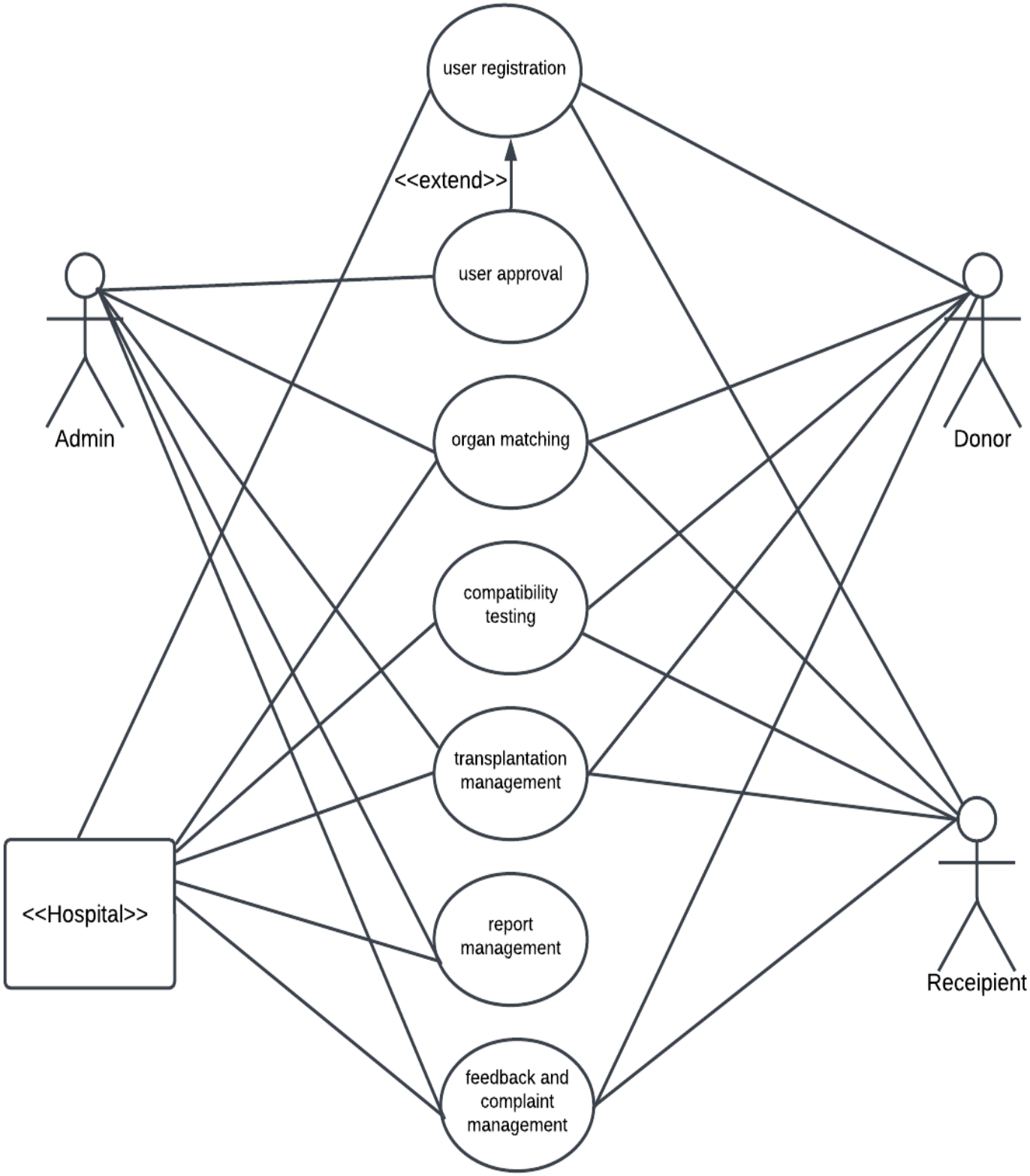
1. Client Devices:
    a. Smartphones and PCs for donors, recipients, and hospital staff.
    b. Minimum: Dual-core processor, 4GB RAM, 500MB storage.
2. Server Requirements:
    a. High-performance server with the following:
        i. Quad-core processor or higher.
        ii. 16GB RAM minimum.
        iii. 1TB storage with SSD for fast data access.
        iv. Reliable internet connectivity for seamless operations.
3. Networking:
    a. Secure, high-speed network for communication between client devices and the server.

Software Environment

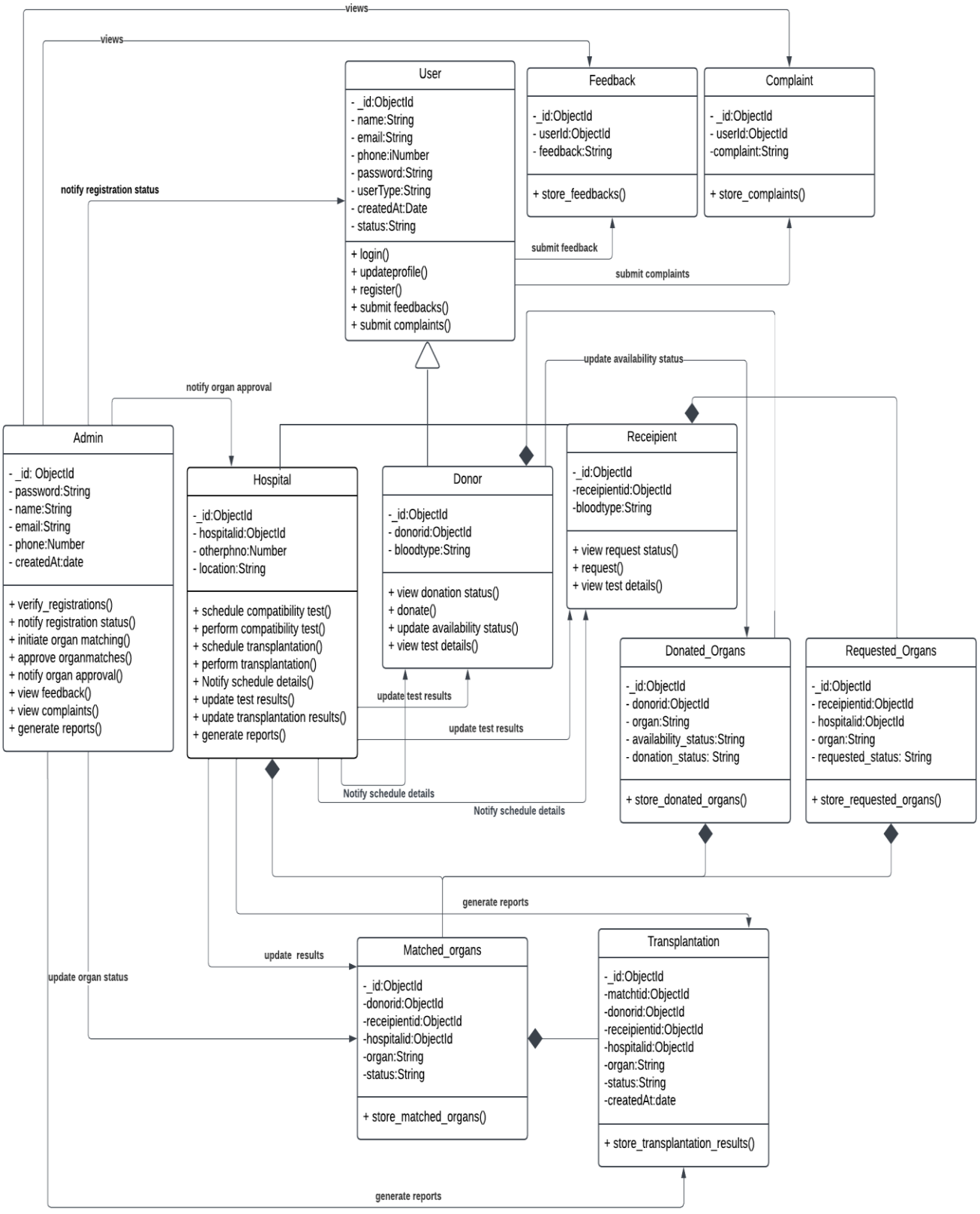
1. Frontend: Flutter (Dart Language) for cross-platform mobile and web application development.
2. Backend: Node.js for efficient server-side logic and API handling.
3. Database: MongoDB for scalable, NoSQL-based data management.
4. Server OS: Linux (Ubuntu) for high performance, reliability, and cost-effectiveness.
5. Development Tools:
    - Android Studio for Flutter development.
    - VS Code for backend development.
    - Postman for API testing.
6. APIs & Frameworks: RESTful APIs for frontend-backend communication.

UML Diagrams

1. UseCase Diagram

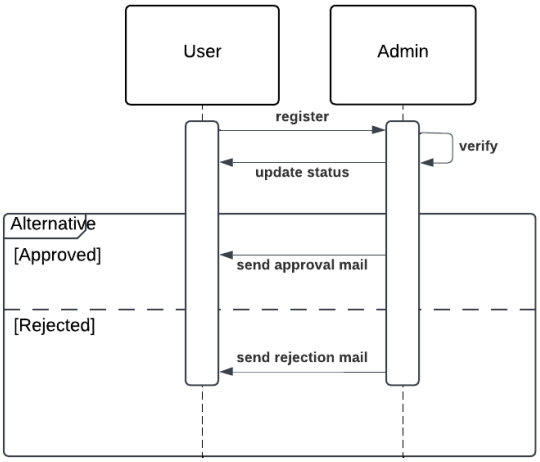


2. Class Diagram

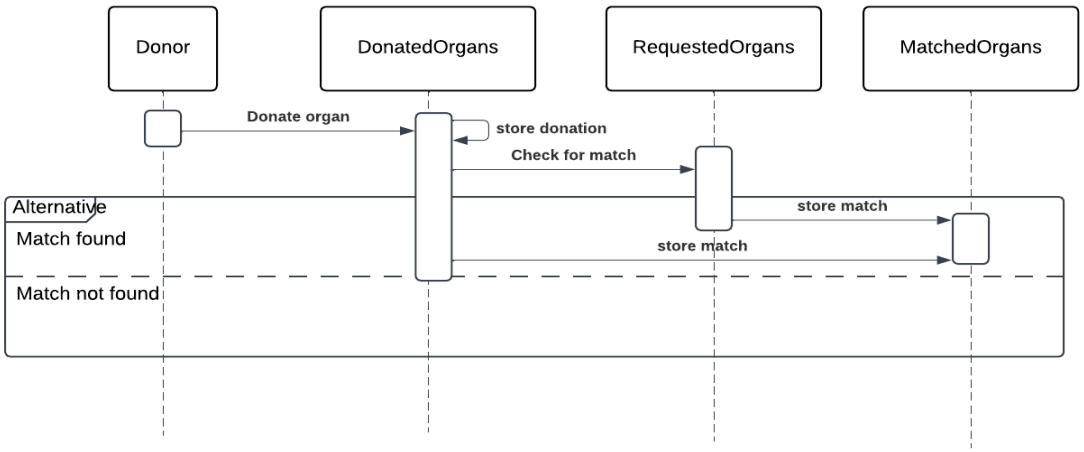


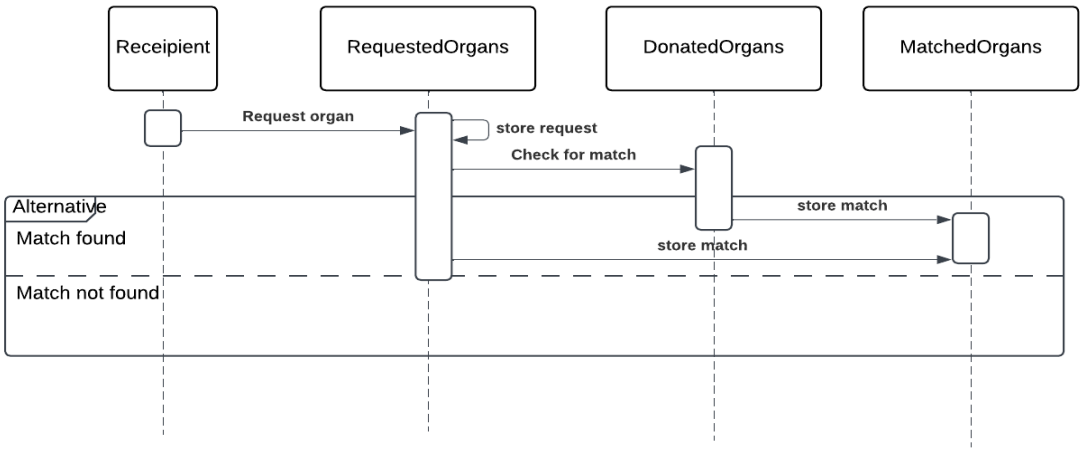
3. Sequence Diagram

3.1 User Registration

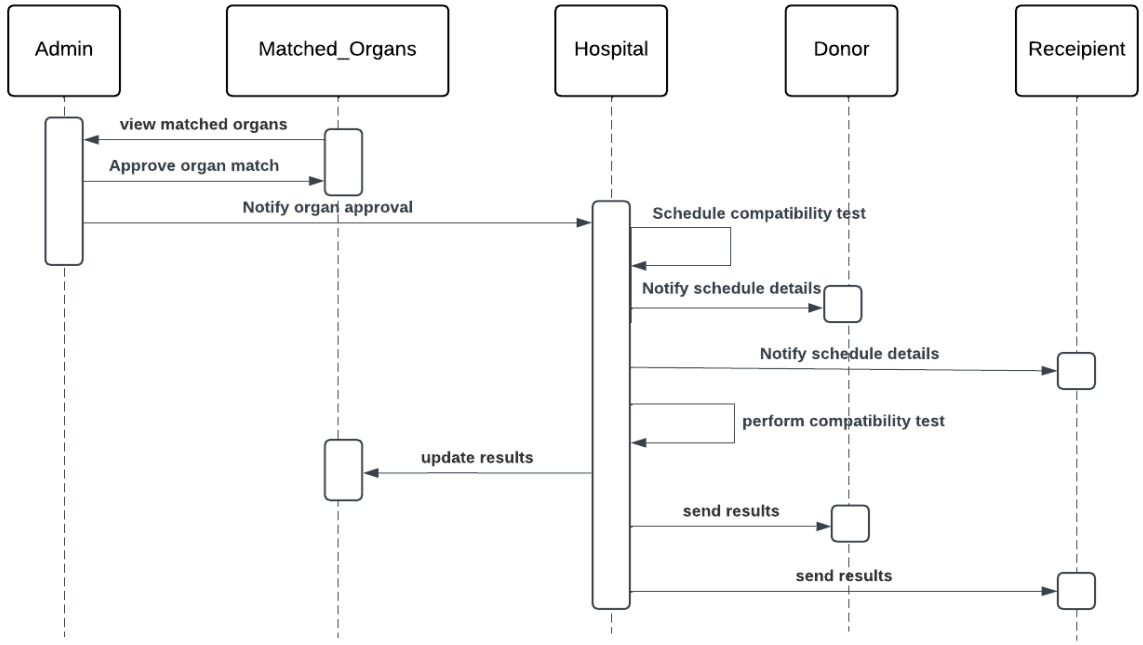


3.2 Organ Matching

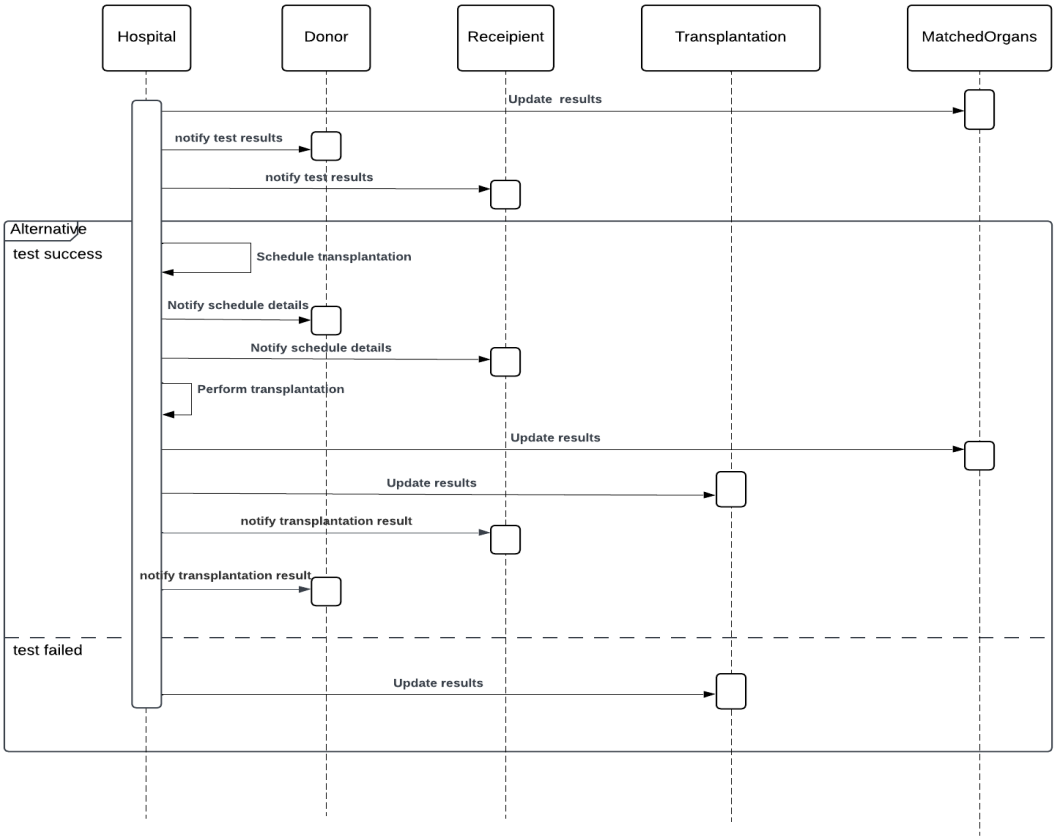




3.3 Compatibility Test

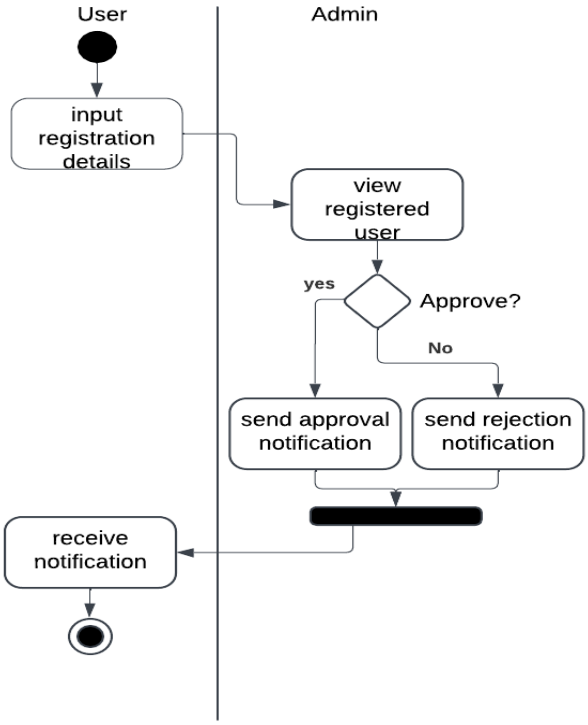


3.4 Transplantation Module

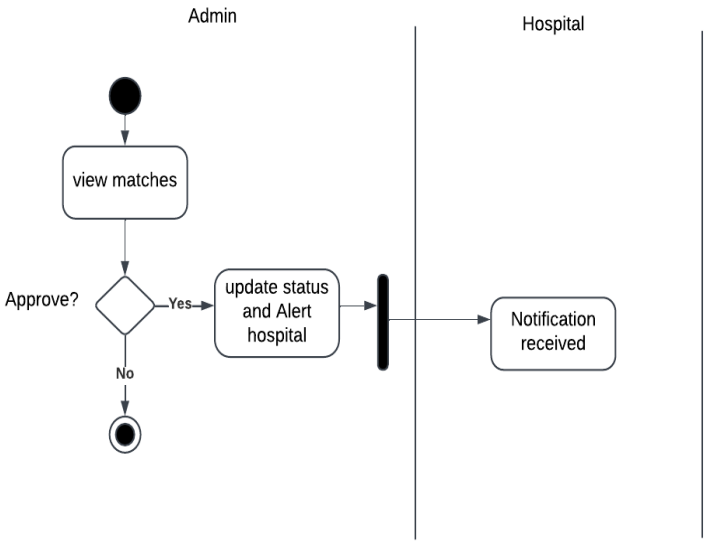


4. Activity Diagram

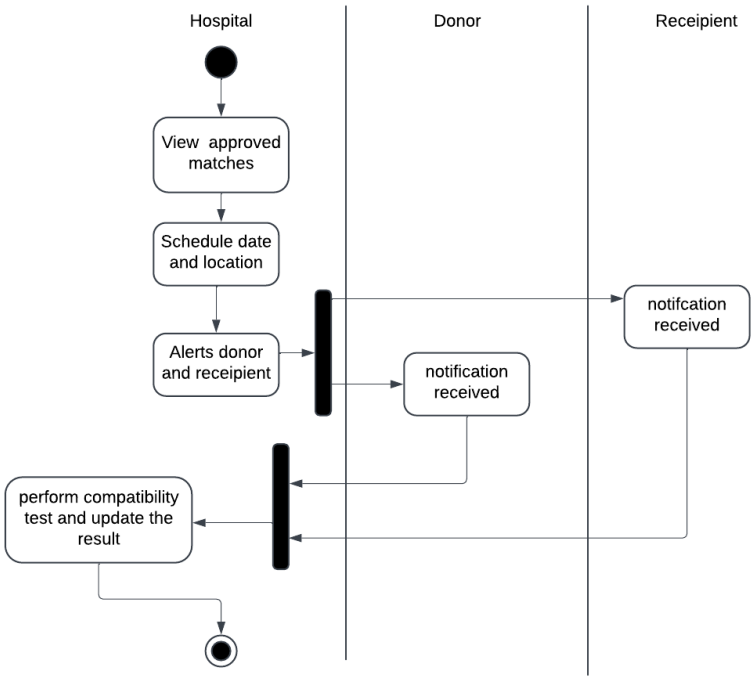
4.1 User Registration



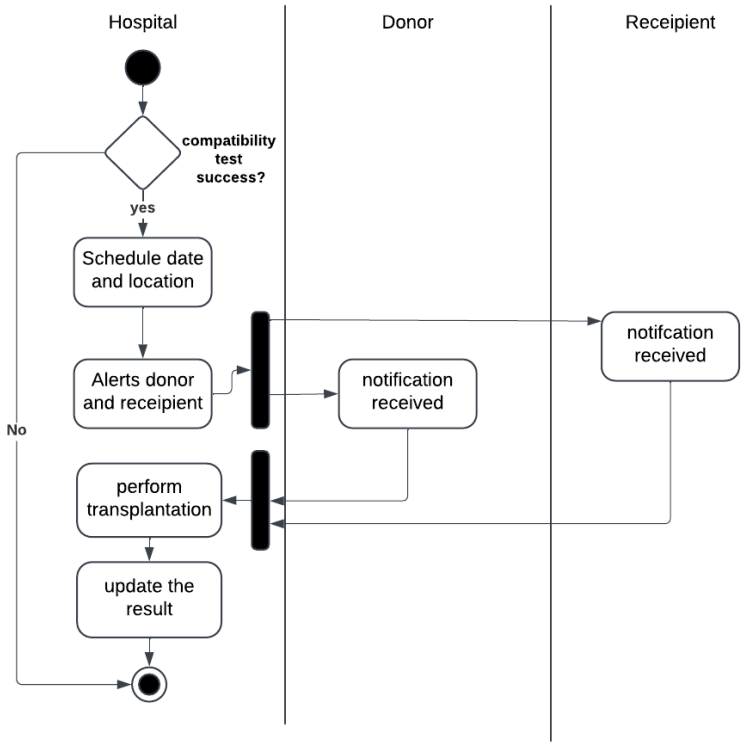
4.2 Match Approval Module



4.3 Compatibility Test Scheduling Module



4.4 Transplantation Scheduling Module



SUPPORTING LITERATURE

1. Literature Review

Paper 1: Hawashin, D., Jayaraman, R., Salah, K., Yaqoob, I., Simsekler, M. C. E., & Ellahham, S. (2022). Blockchain-Based management for organ donation and transplantation. *IEEE Access*, *10*, 59013–59025. https://doi.org/10.1109/access.2022.3180008

The paper "Blockchain-Based Management for Organ Donation and Transplantation" by Diana Hawashin et al. explores technological advancements to enhance organ donation and transplantation processes. Traditional organ donation systems face challenges such as inefficiencies, lack of transparency, and security risks due to manual processing and centralized data storage. The study proposes automated donor-recipient matching, real-time organ tracking, and system-generated notifications to streamline the organ donation workflow and reduce administrative delays.

The study introduces six key algorithms that automate various phases of organ transplantation, including donor registration, organ removal, transportation, and recipient matching. The system implements ranked matching based on blood type, BMI, and age compatibility, ensuring fair and efficient organ allocation. Additionally, it emphasizes real-time scheduling and updates, ensuring that all stakeholders, including hospitals, doctors, and patients, receive timely notifications regarding compatibility tests, transplant schedules, and result updates.

The findings of this study align with the Organ Bank project, as both focus on optimizing organ donation through technology. The project, built using Flutter, Node.js, and MongoDB, aims to automate donor-recipient matching, ensure real-time data synchronization, and improve communication among hospitals and recipients. By integrating features such as automated scheduling, system-generated notifications, and optimized organ allocation algorithms, the Organ Bank project ensures efficient organ tracking, minimal delays, and enhanced coordination. This research provides a strong foundation for enhancing transparency, efficiency, and scalability in organ donation management.

Paper 2: Dajim, L. A., Al-Farras, S. A., Al-Shahrani, B. S., Al-Zuraib, A. A., & Mathew, R. M. (2019). Organ Donation decentralized application using blockchain technology. *Organ Donation Decentralized Application Using Blockchain Technology*, 1–4. https://doi.org/10.1109/cais.2019.8769459

The paper "Organ Donation Decentralized Application Using Blockchain Technology" by Lama Abdulwahab Dajim et al. presents a technology-driven approach to improving organ donation and transplantation systems. Traditional organ donation processes face challenges such as long waiting times, lack of transparency, and inefficiencies in centralized systems. The proposed web-based system ensures that donor and recipient information, including medical ID, blood type, and organ type, is securely recorded and managed. The system operates on a first-in, first-out basis, prioritizing critical cases when necessary, thus enhancing fairness and efficiency in organ allocation.

The study highlights the advantages of automated organ matching, real-time data updates, and secure donor-recipient management. The system ensures data integrity, secure handling of organ availability records, and automated recipient matching based on blood type, medical urgency, and organ compatibility. Additionally, it introduces real-time scheduling for compatibility tests, transplant procedures, and notification updates to keep all stakeholders informed. The comparative analysis with traditional organ transplant management systems shows that automated donor-recipient matching and real-time communication improve efficiency and reduce delays in organ allocation.

This research is relevant to the Organ Bank project, as both systems aim to enhance organ donation management through technology. The project, built using Flutter, Node.js, and MongoDB, focuses on automating donor-recipient matching, ensuring real-time data synchronization, and improving coordination among hospitals and recipients. By implementing automated scheduling, instant notifications, and optimized allocation processes, the Organ Bank project ensures efficient organ tracking, minimal delays, and enhanced coordination. This research supports the adoption of automated processes to streamline organ donation, improve stakeholder communication, and enhance the overall efficiency of the transplantation workflow.

Paper 3: Somasundar, A., Chilakarao, M., Raju, B. R. K., Behera, S. K., Ramana, C. V., & Sethy, P. K. (2024). MongoDB integration with Python and Node.js, Express.js. *MongoDB Integration With Python and Node.js, Express.js*, 1–5. https://doi.org/10.1109/icaect60202.2024.10469546

The paper "MongoDB Integration with Python and Node.js, Express.js" by Santi Kumari Behera et al. presents a detailed study on the integration of MongoDB, a popular NoSQL database, with Python and Node.js for efficient data management. MongoDB's scalability, flexibility, and document-based architecture make it well-suited for handling semi-structured and unstructured data in modern web applications. The authors analyze key drivers and APIs, particularly PyMongo for Python and Mongoose for Node.js, highlighting their role in facilitating seamless database interactions. Additionally, the study discusses MongoDB's integration with the MEAN stack (MongoDB, Express.js, Angular, and Node.js), demonstrating its effectiveness in building robust web applications.

A significant focus of the study is query optimization and indexing, where B-trees and hash tables are utilized to enhance data retrieval performance. The authors emphasize the benefits of aggregation pipelines and MapReduce, which contribute to efficient data processing and real-time analytics. Security concerns such as unauthorized access and injection attacks are also addressed, with recommendations for implementing authentication, encryption, and role-based access control to strengthen database security and integrity.

The findings of this study are highly relevant to the Organ Bank project, as MongoDB's scalability and efficiency align with the system's need to handle large volumes of donor-recipient data, real-time organ matching, and hospital coordination. The use of Mongoose for Node.js and PyMongo for Python can enhance database operations, improve query execution speed, and ensure secure data management. By incorporating automated organ matching, real-time scheduling, and optimized security measures, the Organ Bank project can enhance performance, maintain data accuracy, and streamline organ transplantation workflows

2. Literature Summary

The paper "Blockchain-Based Management for Organ Donation and Transplantation" by Diana Hawashin et al. presents a solution to enhance the efficiency and security of organ donation systems. Traditional systems suffer from manual processes, data manipulation risks, and lack of real-time tracking. The study proposes a structured approach to donor-recipient matching, organ removal, transportation, and transplantation, aiming to ensure secure and transparent organ allocation. The authors highlight the importance of automating key steps in the organ donation process to minimize delays and improve trust between stakeholders.

Similarly, the study "Organ Donation Decentralized Application Using Blockchain Technology" by Lama Abdulwahab Dajim et al. supports the use of a digitized, automated platform for organ donation management. This research emphasizes the importance of data integrity, privacy, and transparency in organ transplantation. The proposed system ensures that patient records, organ availability, and recipient priority lists are managed efficiently and fairly. The study highlights that standardized organ allocation criteria and real-time communication between hospitals and medical teams play a crucial role in improving the organ donation process. Both studies advocate for automated donor-recipient matching systems to eliminate inefficiencies and enhance decision-making.

Efficient data management is crucial in organ donation systems, where large volumes of donor-recipient information require real-time access and updates. The paper "MongoDB Integration with Python and Node.js, Express.js" by Santi Kumari Behera et al. explores the advantages of using MongoDB, a widely adopted NoSQL database, for handling semi-structured and unstructured data in modern web applications. MongoDB's scalability, flexibility, and document-oriented structure make it an ideal choice for organ donation platforms, where dynamic data storage and rapid retrieval are essential.

The study examines PyMongo for Python and Mongoose for Node.js, both of which facilitate seamless integration of MongoDB with web applications. The research also explores indexing mechanisms like B-trees and hash tables, which enhance query performance by reducing retrieval time. Security vulnerabilities such as injection attacks, unauthorized access, and data leakage are also analyzed, with recommended best practices including encryption, authentication, and role-based access control. These findings are highly relevant to organ donation systems, which require secure, efficient, and scalable data management solutions.

The Organ Bank project aligns with these studies by leveraging automation, real-time data synchronization, and secure database management to streamline donor-recipient matching and improve transparency in the organ transplantation process. By incorporating efficient scheduling, system-generated notifications, and optimized data retrieval, the system ensures accuracy, efficiency, and reliability in organ donation management.

3 . Findings and Proposals

The reviewed studies highlight the need for real-time updates and automated processes in organ donation management. A key proposal for the Organ Bank project is the implementation of real-time notifications for scheduling compatibility tests, transplant procedures, and result updates. This ensures that hospitals, donors, and recipients receive timely alerts, reducing delays in organ transplantation

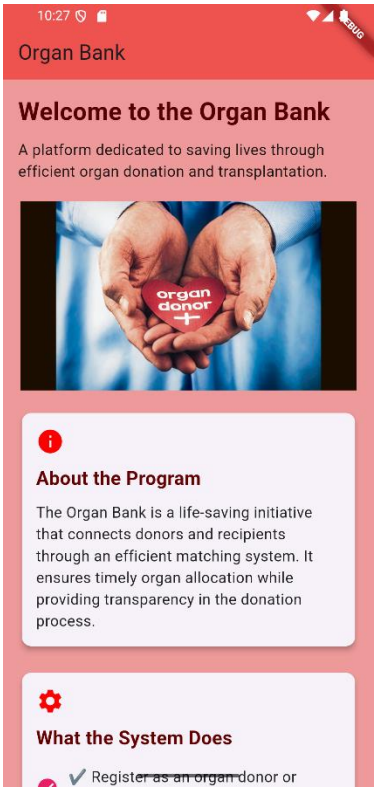
Another crucial recommendation is automated donor-recipient matching based on blood type and organ compatibility. Every time a donation or request is submitted, the system should instantly analyze the available donor-recipient data and provide the best possible matches. The use of MongoDB indexing and querying mechanisms will allow for fast and efficient retrieval of donor-recipient pairs, ensuring a seamless and automated matching process.

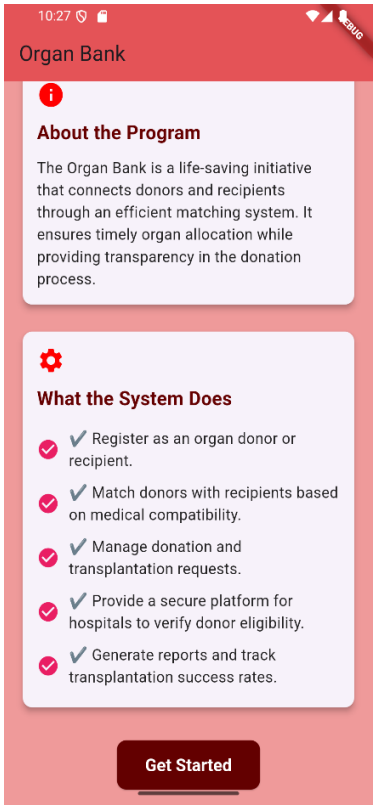
Furthermore, email communication should be integrated into the system to facilitate coordination among stakeholders. Whenever an organ match is found, the system should automatically send email notifications to the recipient, donor, and medical personnel involved, ensuring efficient communication and scheduling. These proposals align with modern digital automation trends and will significantly enhance the efficiency, security, and transparency of the Organ Bank system.

In conclusion, automated donor-recipient matching ensures efficient and fair organ allocation, while MongoDB integration provides scalability, high-speed data access, and security. These technologies can significantly improve data integrity, transparency, and real-time decision-making in organ donation management. By incorporating these advanced solutions, the Organ Bank project can establish a robust, automated, and life-saving platform for efficient organ donation and transplantation.

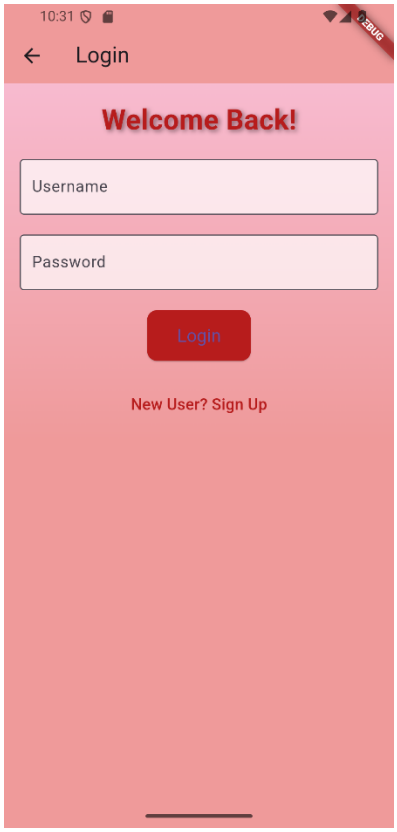
UI DESIGN

1. Home Page

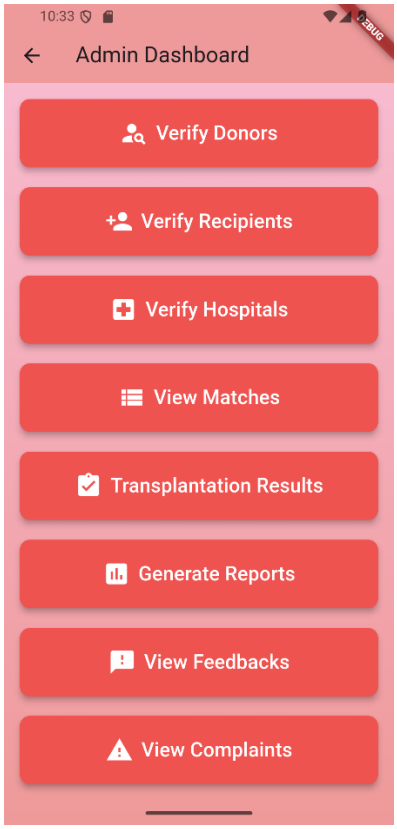




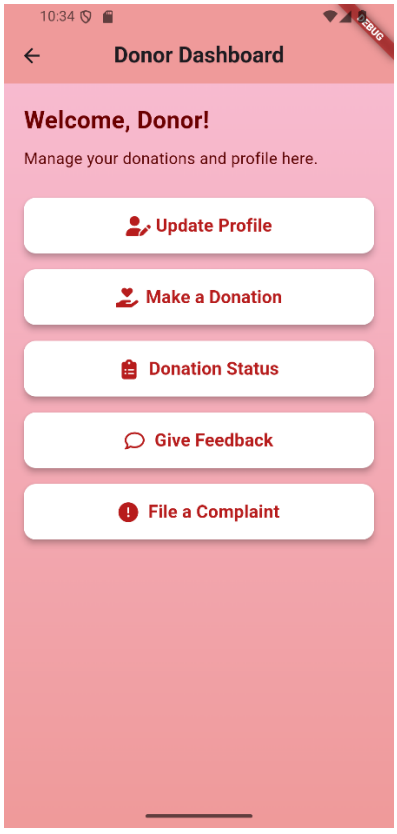
2. Login Page



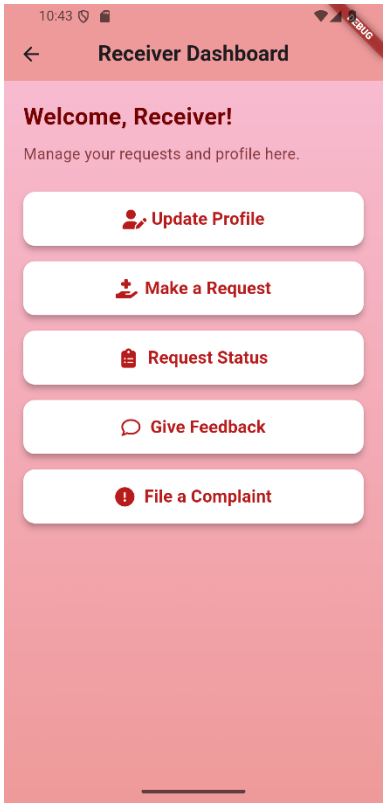
3. Admin Dashboard



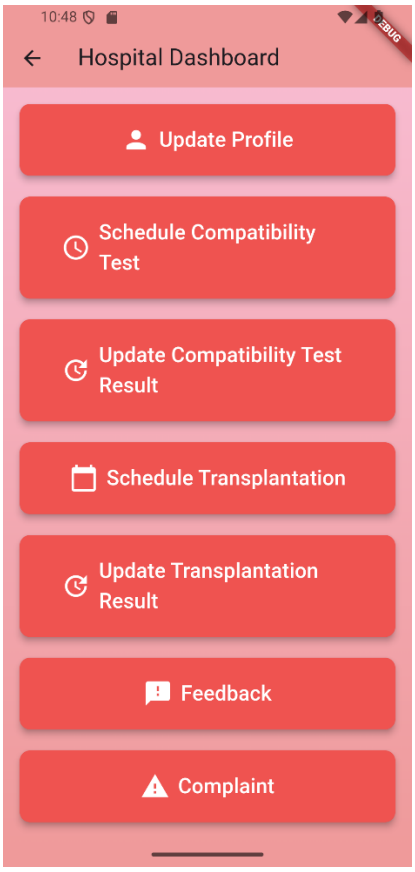
4. Donor Dashboard



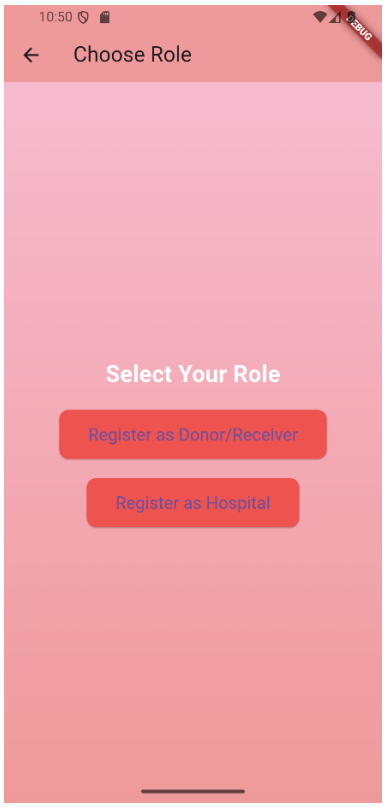
5. Receipient Dashboard

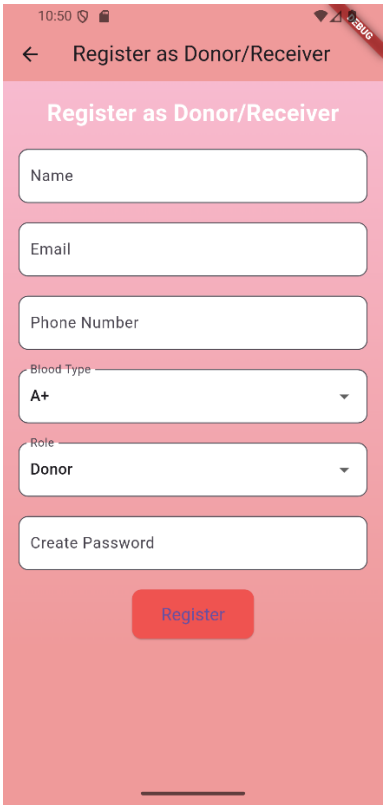


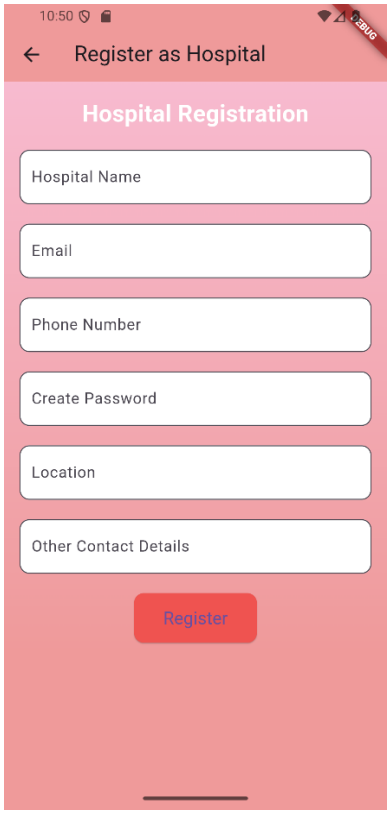
6. Hospital Dashboard



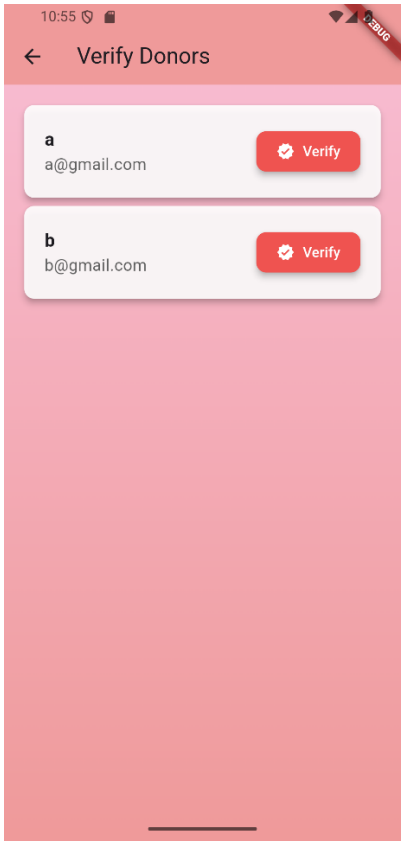
7. Registration Pages

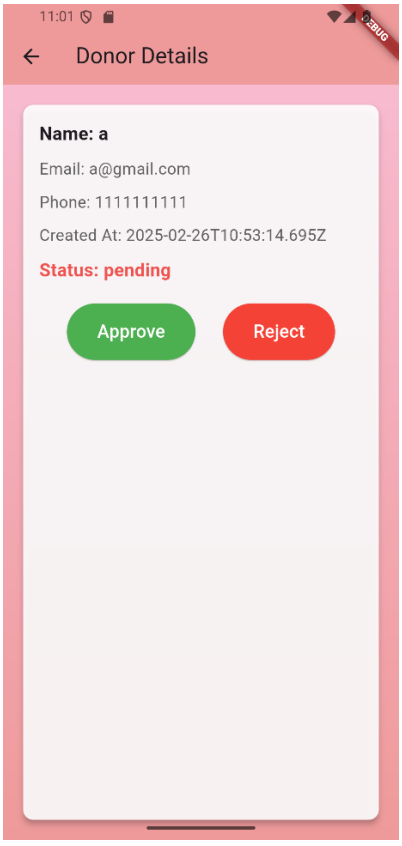


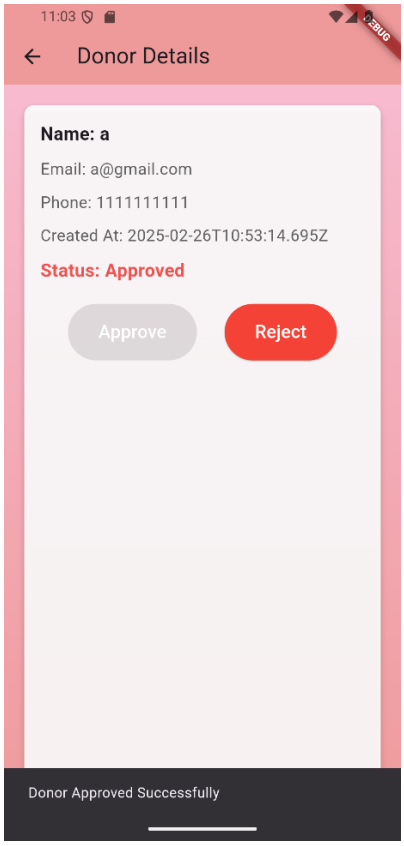




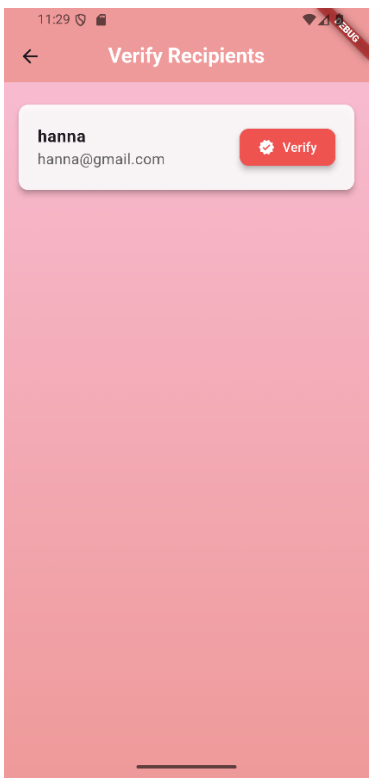
8. Verify Donor

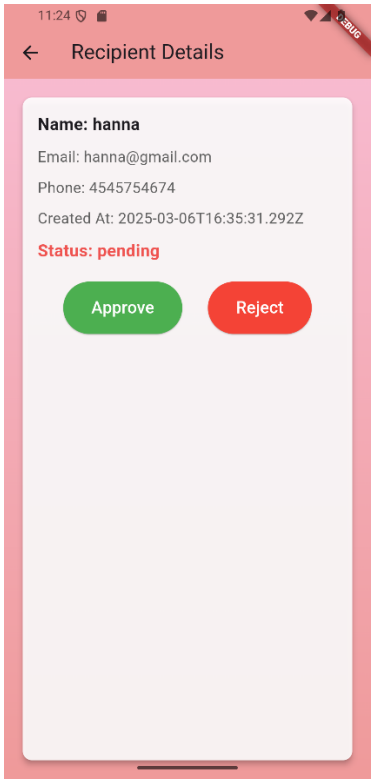


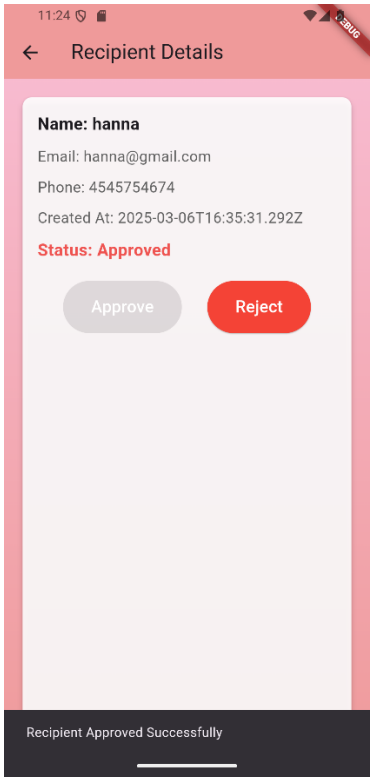




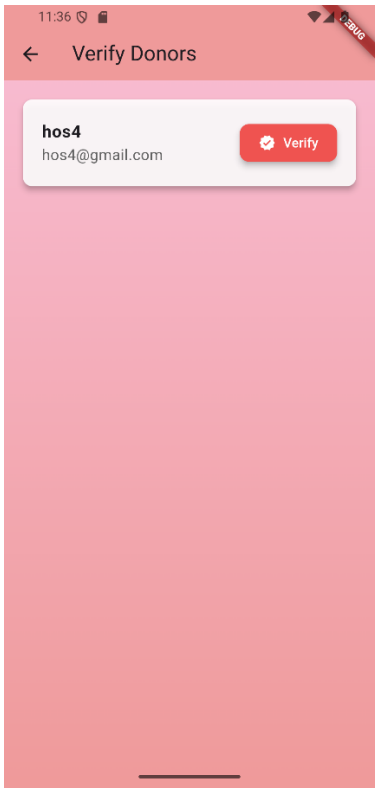
9.Verify Receipient

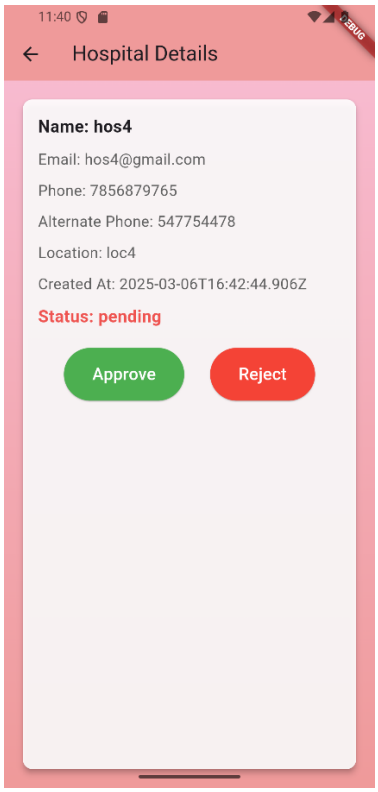


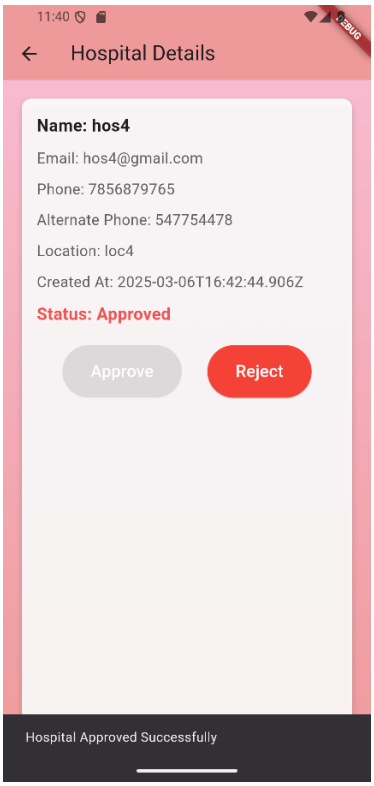




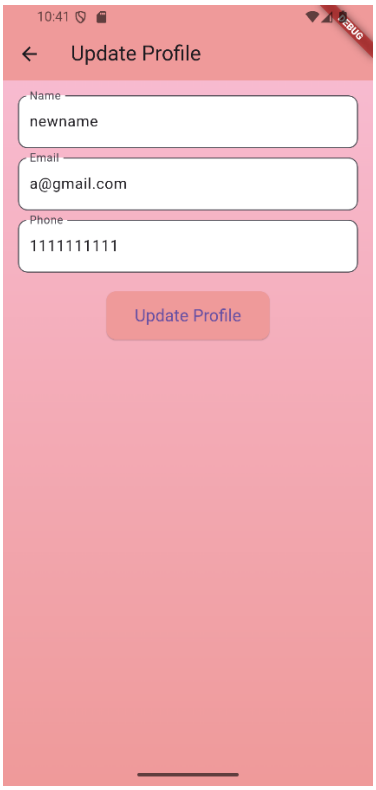
10. Verify Hospital

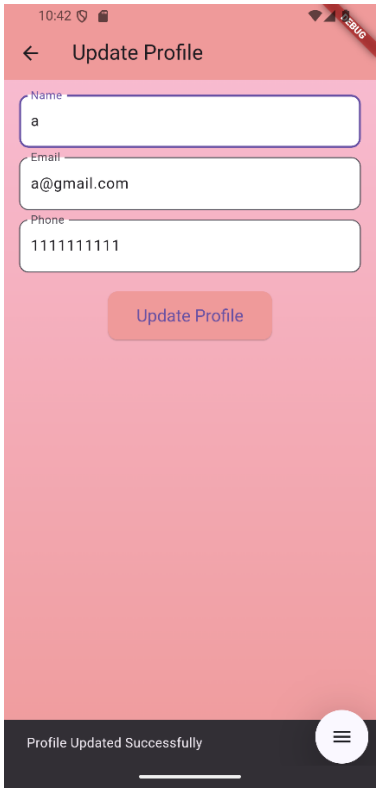




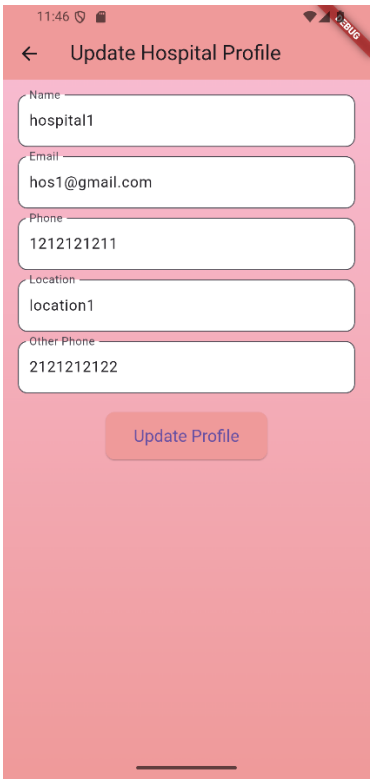


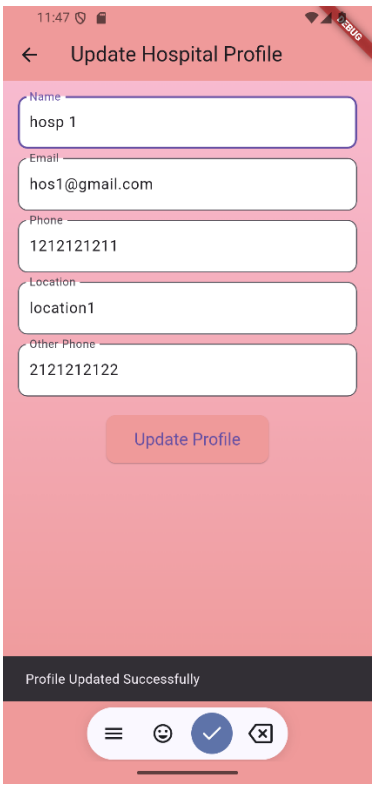
11. Update Donor/Receipient Profile



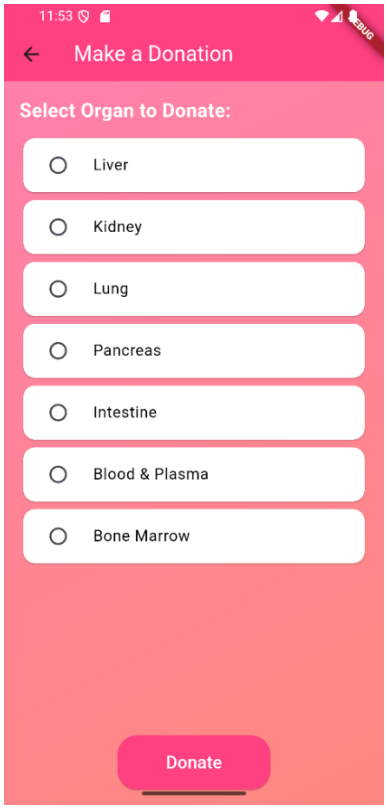


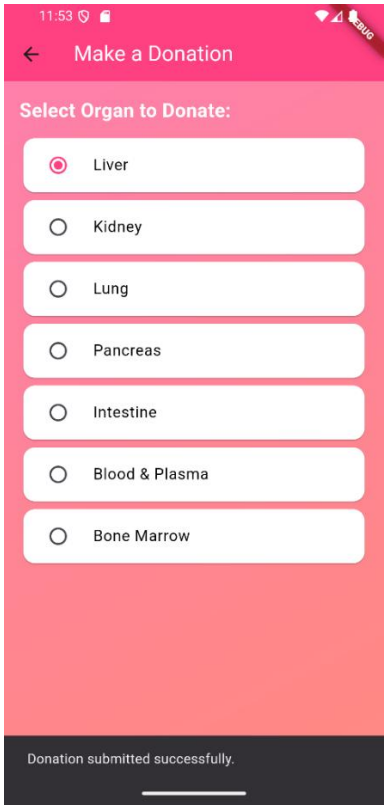
12. Update Hospital Profile



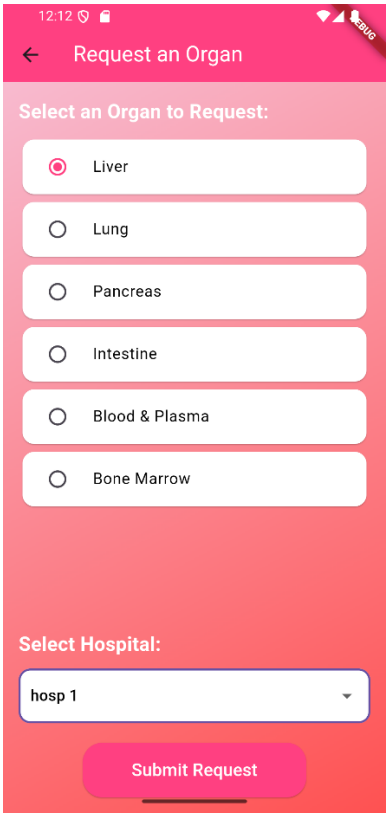


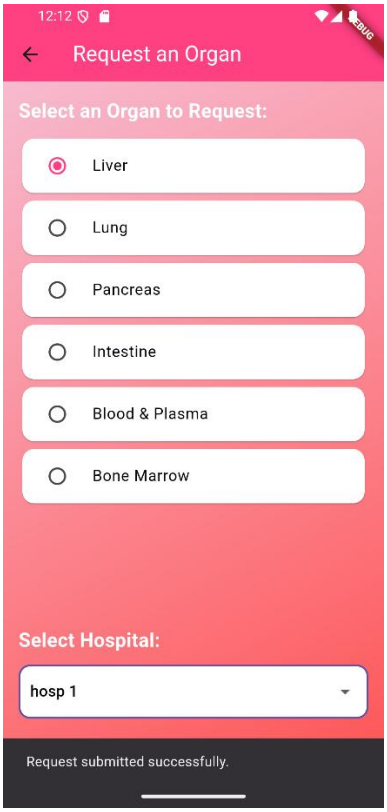
13. Make Donations



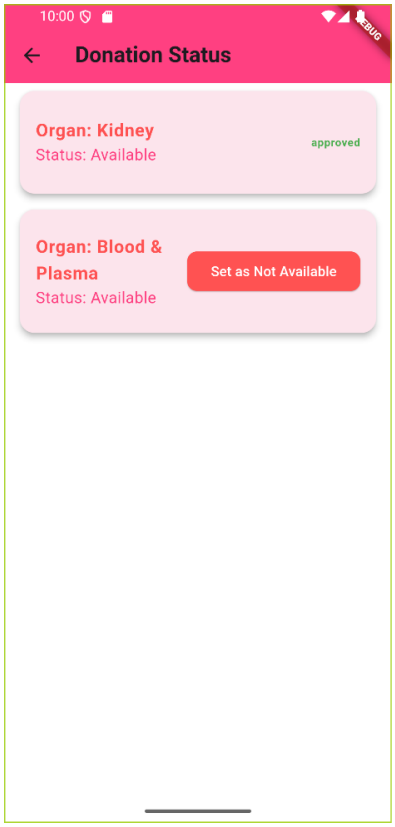


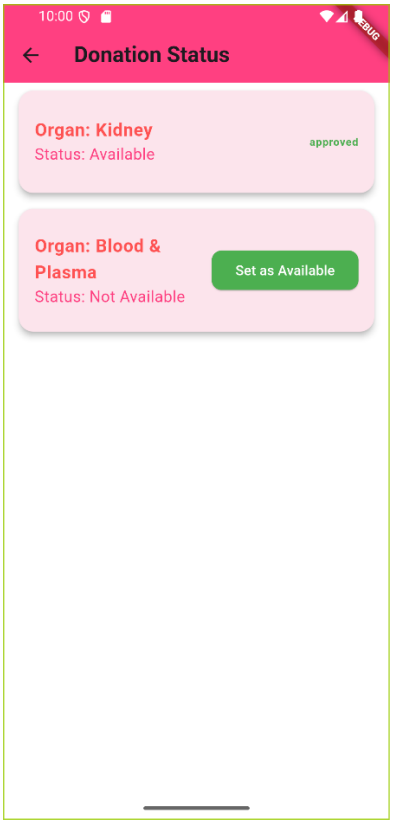
14. Make Requests



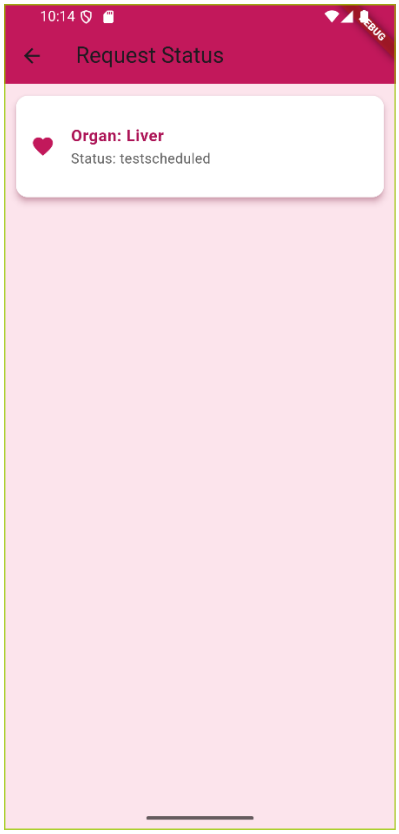


15. View Donation Status

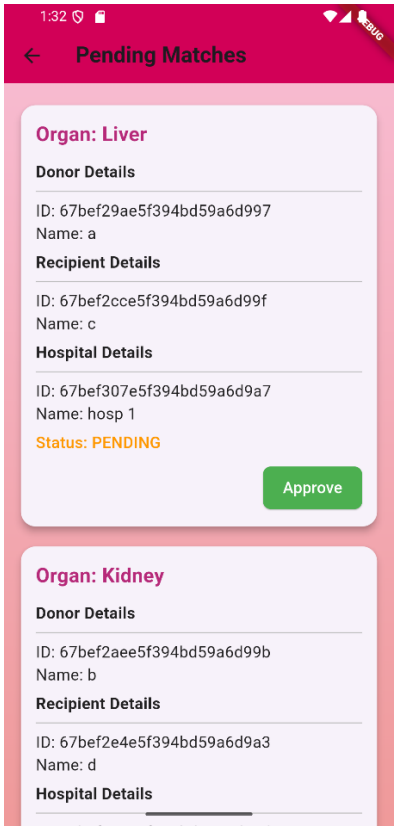


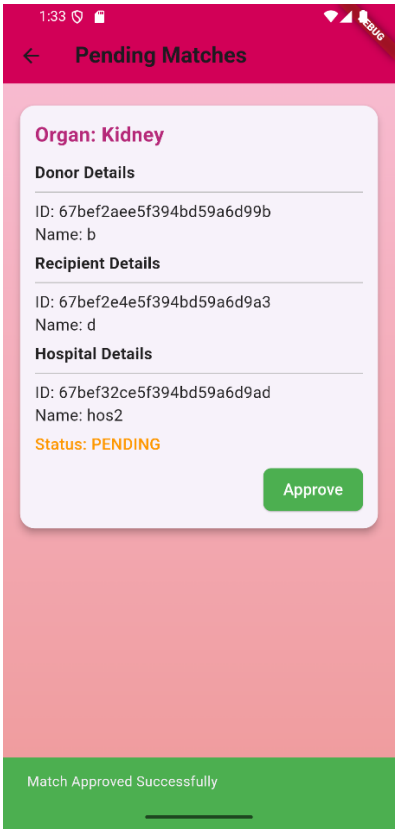


16. View Request Status

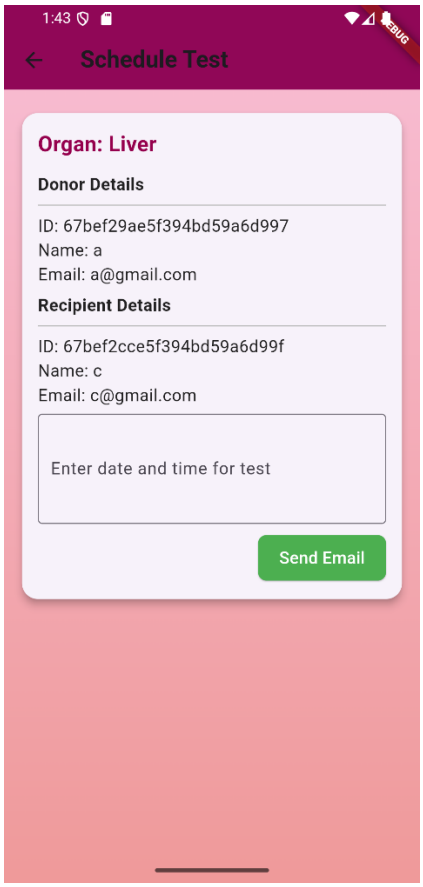


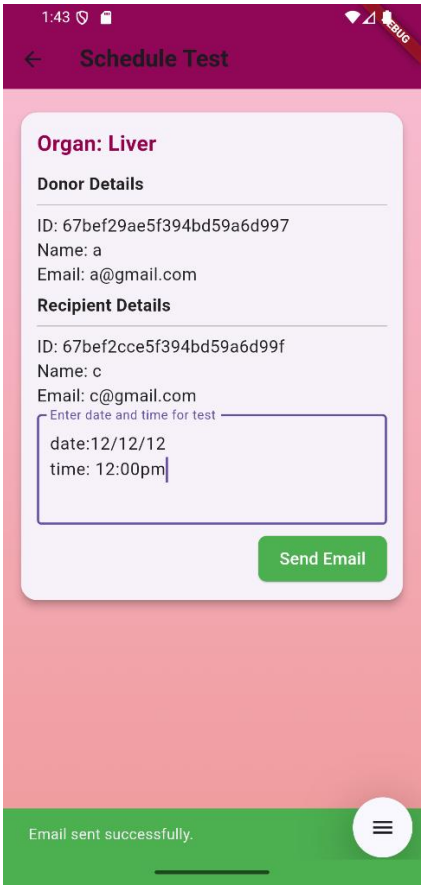
17.View Matches





18. Schedule Compatibility Test





DATABASE DESIGN

1. User

Attributes	Datatype	Constraints	Description
_id	Objectid	Unique	Autogenerated id
name	String		Name of user
email	String	Unique	Email of user
phone	Number	Unique	Phone number
password	String		Password for login
userType	String		Role of user
createdAt	Date		Registered date
status	String		Status of registration

2. Donor

Attributes	Datatype	Constraints	Description
_id	Objectid	Unique	Autogenerated id
donorid	Objectid	Ref(User:_id)	Donor's id
bloodtype	String		Blood group of donor

3. Receipient

Attributes	Datatype	Constraints	Description
_id	Objectid	Unique	Autogenerated id
receipientid	Objectid	Ref (User:_id)	Receipient's id
bloodtype	String		Blood group of receipient

4.Admin

Attributes	Datatype	Constraints	Description
_id	Objectid	Unique	Autogenerated id
name	String		Name of admin
email	String		Email of admin
phone	Number		Phone number
password	String		Password for login
createdAt	Date		Created date

5. Hospital

Attributes	Datatype	Constraints	Description
_id	Objectid	Unique	Autogenerated id
hospitaltid	Objectid	ref(User:_id)	Hospital's id
otherphno	Number		Other phone number
location	String		Location of hospital

6.Donated_Organs

Attributes	Datatype	Constraints	Description
_id	Objectid	Unique	Autogenerated id
donorid	Objectid	Ref (User:_id)	donor's id
organ	String		Donated organ
availability_status	String		Available or not
donation_status	String		Status of donation

7. Requested_Organs

Attributes	Datatype	Constraints	Description
_id	Objectid	Unique	Autogenerated id
receipientid	Objectid	Ref (User:_id)	receipient's id
hospitalid	Objectid	Ref (User:_id)	id of the hospital ,receipient selected during request submission
organ	String		Requested organ
requested_status	String		Status of request

8. Matched_Organs

Attributes	Datatype	Contraints	Description
_id	Objectid	Unique	Autogenerated id
donorid	Objectid	Ref (Donated_Organs: donorid)	donor's id
receipientid	Objectid	Ref (Requested_Organs: receipientid)	receipient's id
hospitalid	Objectid	Ref (Requested_Organs: hospitalid)	hospital's id
organ	String		Matched organ
status	String		Status of matched organ

9. Transplantation

Attributes	Datatype	Constraints	Description
_id	Objectid	Unique	Autogenerated id
matchid	Objectid	Ref (Matched_Organs:_id)	Match's id
donorid	Objectid	Ref (Matched_Organs: donorid)	donor's id
receipientid	Objectid	Ref (Matched_Organs: receipientid)	receipient's id
hospitalid	Objectid	Ref (Matched_Organs: hospitalid)	hospital's id
organ	String		Organ transplanted
status	String		Status of transplantation
createdAt	Date		Transplanted date

10. Feedback

Attributes	Datatype	Constraints	Description
_id	Objectid	Unique	Autogenerated id
userId	Objectid	Ref (User:_id)	User's id
feedback	String		Feedback

11. Complaint

Attributes	Datatype	Constraints	Description
_id	Objectid	Unique	Autogenerated id
userId	Objectid	Ref (User:_id)	User's id
complaint	String		Complaint