

Flutter-Based Blood Donation Application

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DECLARATION

We, Md. Sakib Hasan(IT- 20010) and Fatin- Al- Mahir Molla(IT- 20011) hereby declare that The design entitled "**Flutter-Based Blood Donation Application**" which is submitted in partial fulfillment of the conditions for the award of the Bachelor of Science(Engg.) degree in the Department of Information and Communication Technology(ICT), at Mawlana Bhashani Science and Technology University(MBSTU), Santosh, Tangail- 1902, Dhaka, Bangladesh, is the result of group work. The work has not been submitted previously in part or full to any other institution or university for any degree or diploma. Again declare that all the work in this design is original and any sources of information, data, figures or software used in the design have been duly conceded and substantiated.

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ACKNOWLEDGEMENTS

The successful completion of any task is deficient and pointless without giving any due credit to the people who made it possible without which the project would not have been successful and would have been in proposition.

We enjoy a lot of thanks to our supervisor, Dr. Monir Morshed, Professor, Department of Information and Communication Technology(ICT), at Mawlana Bhashani Science and Technology University(MBSTU) for energy and constantly motivating us and guiding us in the idea of a creatively and astonishingly performed Major project in bearing this bid and challenge also for being there whenever we demanded his guidance or backing.

We'd also like to take this moment to show our thanks and thankfulness to one and all who laterally or directly have given us their hand in this grueling task. We feel happy and joyous in expressing our vote of thanks to all those who have helped us and guided us in presenting this project work.

Last, but noway least, we thank our well- provision and parents for always being with us, in every sense and constantly supporting us in every possible works

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ABSTRACT

Blood Donation Application presents an Android application developed using the Flutter Framework, aimed at bridging the gap between blood donors and recipients through a smart, real-time mobile platform. The app enables users to register as donors, request blood, and search for matching nearby donors based on blood type and location using integrated Geo location services.

The application incorporates a Firebase backend to handle user authentication, data storage, and real-time updates, ensuring a seamless and secure user experience. The cross-platform nature of Flutter allows for a consistent user experience and performance across both Android and IOS devices.

The key features of the app include donor/recipient profiles, request notifications, blood group information, and a communication module for coordination. The intuitive interface and efficient matchmaking system aim to streamline the blood donation process, especially during emergencies.

This Application highlights how modern mobile development tools like Flutter can be utilized to create scalable, responsive, and impactful healthcare applications, ultimately promoting social responsibility and saving lives.

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Chapter 1

Introduction

1.1 Introduction

In today's fast-paced world, the demand for blood in emergency situations—such as accidents, surgeries, or chronic illness management—often surpasses the available supply. While various organizations and blood banks strive to maintain a consistent inventory, one of the biggest challenges lies in bridging the communication gap between donors and recipients in real time. With the advancement of mobile technology, Android and iOS platforms offer an efficient solution to this problem.

This Application introduces a Blood Donation Android Application developed using the Flutter framework, a modern UI toolkit by Google that allows for fast development and cross-platform compatibility. The primary objective of this application is to connect blood donors with individuals or organizations in urgent need of blood, ensuring timely assistance and saving lives. The application is designed with an intuitive user interface, enabling users to register as donors, request blood based on blood group and location, and receive notifications when a match is found. Flutter was chosen due to its capability to build high-performance applications from a single codebase for both Android and iOS platforms, reducing development time and effort while maintaining a native-like experience.

This Application aims not only to demonstrate technical competence in mobile application development but also to make a positive social impact by promoting voluntary blood donation and enhancing communication among donors, hospitals, and patients.

1.2 Motivation of the Application

Here is a detailed motivation for a flutter-based blood donation application:

- **Addressing the Critical Need for Blood:** Blood is a vital component in medical treatments, especially in the cases of surgery, trauma, cancer therapy, childbirth complications, and chronic diseases. Despite advances in medical sciences, there is no substitute for human blood, making donations essential. Unfortunately, many regions around the world face shortages in blood supply due to lack of awareness, difficulty locating donors,

and inefficient communication between donors and recipients. This application aims to bridge this gap.

- **Increasing Accessibility and Reach Through Technology:** With the proliferation of smartphones and internet connectivity, mobile applications have become one of the most effective tools for social outreach. A Flutter-based mobile application ensures a cross-platform solution, reaching both Android and iOS users with a single codebase. This improves accessibility for a wider audience and encourages more people to participate in blood donation efforts.
- **Real-Time Communication and Emergency Support:** Emergencies often require immediate blood donations. Traditional methods, such as calling hospitals or blood banks, can be time-consuming and inefficient. This application provides real-time notifications and communication tools that help connect recipients with eligible donors quickly based on their location and type of blood. This feature is crucial in saving lives during critical situations.
- **Promoting Voluntary and Regular Donations:** Many individuals are willing to donate blood but are unaware of when and where to do so. The application can motivate users by sending reminders, showing nearby donation camps, and providing a user-friendly interface to register and track donations. It also allows users to maintain their donation history and set donation schedules in accordance with health guidelines.
- **Building a Community of Donors:** One of the long-term goals of the project is to create a strong community of regular blood donors. By offering features such as donor badges, contribution leaderboards, thank-you messages, and social sharing options, the app helps cultivate a culture of giving and social responsibility. It also allows users to invite friends and family, thus expanding the network of donors.
- **Encouraging Data-Driven Health Policy and Awareness:** The application can collect anonymized data on blood type distributions, donor availability, donation frequency, and geographical needs. This information can be used by healthcare providers and policy makers to plan better blood drives, allocate resources efficiently, and launch targeted awareness campaigns.
- **Utilizing Flutter for a Scalable and Efficient Solution:** Flutter's robust UI toolkit allows rapid development, consistent user experience across platforms and excellent performance. Its widget-based architecture makes it easy to implement a clean and intuitive user interface. Furthermore, the open-source nature of Flutter enables cost-effective development and easy integration with third-party services like maps and notifications.

1.3 Purpose and Objectives of the Application

1.3.1 Purpose

The primary purpose of developing a Flutter-based Blood Donation Application is to facilitate and streamline the process of blood donation and acquisition by leveraging mobile technology. The application serves multiple stakeholders, donors, recipients, hospitals, and blood

banks, and is designed to create a reliable, efficient, and accessible platform to manage blood donations:

- **To Connect Blood Donors with Recipients Efficiently:** One of the key goals of the application is to create a direct and real-time link between people in need of blood and potential donors. By using location-based services and blood type matching, the application allows recipients to quickly find suitable donors in emergency situations.
- **To Promote Voluntary Blood Donation:** The application encourages individuals to become regular donors by raising awareness, educating users about the benefits and safety of blood donation, and offering a simple way to register and schedule donations. It aims to build a habit of voluntary blood donation in society.
- **To Improve Access to Blood During Emergencies:** During accidents, surgeries, or other critical health scenarios, time is of the essence. The application is designed to reduce response time by enabling quick notifications, emergency alerts, and fast donor search based on the recipient's requirements.
- **To Simplify Blood Donation Management for Hospitals and Blood Banks:** Hospitals and certified blood banks can use the application to update their blood inventory, notify users of donation needs, organize blood drives, and manage donor records. This improves the overall management of blood supplies.
- **To Provide a Centralized and User-Friendly Platform:** The application offers a centralized platform where users can:
 1. Register as donors or request blood.
 2. Search for blood based on type and location.
 3. Receive alerts and notifications.
 4. Track their donation history and eligibility.
 5. Participate in community blood donation events.

1.3.2 Objectives

Here are the key objectives of a Flutter-based blood donation application:

Primary Objectives:

1. **Efficient Donor Registration:-** Collect and Manage donor details such as Name, Email, Mobile number, NID Number, Comments, Blood group, Last Blood Donation, Address, Password and Confirm password.
2. **Connect Donors and Recipients:-** Facilitate real-time matching between blood donors and recipients based on location, blood group, and availability.
3. **Simplify Blood Donation Process:-** Provide an intuitive, user-friendly interface to register, request, and donate blood.
4. **Raise Awareness:-** Educate users on the importance of regular blood donation and dispel myths through in-app information and notifications.

Functional Objectives:

- 1. User Registration and Authentication:-** Secure registration/login for donors, recipients, and administrators.
- 2. Blood Request and Donation Management:-** Allow users to post blood requests and donors to respond easily.
- 3. Geolocation Services:-** Enable location-based search to find nearby donors, recipients, or blood banks.
- 4. Notification System:-** Alert potential donors when a nearby blood request is posted.
- 5. Eligibility Tracking:-** Keep track of donor eligibility based on last donation date and health info.

Non- Functional Objectives:

- 1. Cross-Platform Compatibility:-** Ensure consistent performance and UI on both Android and iOS using Flutter.
- 2. Data Security and Privacy:-** Protect user data using encryption and secure notification protocols.
- 3. Scalability:-** Design the Application architecture to handle a growing number of users and requests efficiently.

1.4 Features

Here are the detailed features of a Flutter-Based Blood Donation Application, organized into functional categories for clarity:

User Features:**1. User Registration and Login:**

- Email Registration:- Password-Based Login.
- Role Selection:- Register as Donor or Recipient.
- Profile Setup:- Name, Email, Contact No, Blood Group, Last Donation Date, Address, NID Number and Comments Section.

2. User Dashboard Details:

- Profile Section.
- See Details.
- Request by Donor.
- Recent Contact List.
- Logout Button.

3. Blood Request System:

- Create Donation Request:- Request by me and Request from other.
- Live Request Feed:- List of active request by me and active request from other
- Request Tracking:- Real-time status of requests(Open, Accepted, Fulfilled).

4. Donor Matching and Notifications:

- Auto Matching:- Suggest suitable donors based on location and blood type.
- Push Notifications:- Alert donors of nearby blood request. Reminders for next eligible donation date. Notifications about blood donation events.

5. Geo location Integration:

- Map Integration(Google Maps/Map box):- Locate nearby Donors,Recipients and Blood Banks. Provide directions to hospitals and location sites.

Security and Technical Features:

1. Secure Authentication:

- Firebase Auth or OAuth 2.0
- Role-based access control.

2. Real-time Database:

- Firebase Firestore or other backend integration for live updates.

3. Data Encryption Privacy:

- User data securely stored with end-to-end encryption where necessary.
- GDPR-compliant (or local regulation-compliant) privacy policy and data handling.

4. Cross-Platform Support:

- Native-like performance on both Android and iOS using a single Flutter codebase.
- Responsive UI adaptable to various screen sizes and devices.

Chapter 2

Application Description

2.1 Application Perspective

Flutter-Based Blood Donation Application is a mobile-based platform developed using Flutter, aimed at connecting blood donors with recipients efficiently. The application will provide a seamless experience for users to register as donors, request blood, and locate nearby blood banks. The application will be designed as a cross-platform mobile application, ensuring compatibility with both Android and iOS devices. The Flutter framework will be used for UI/UX consistency, faster development, and a single codebase.

2.2 Why did I choose This Application?

I choose to developed a blood donation application using Flutter because it addresses a critical societal need facilitating timely and efficient blood donation and leverages modern cross-platform technology to maximize its reach and usability.

- **Social Impact:-** Blood donation can save lives, yet many people are unaware of nearby donation needs or struggle to find donors in emergencies. This application bridges that gap by connecting donors with recipients or hospitals in real time, contributing directly to public health.
- **Cross-Platform Development with Flutter:-** Flutter allows for building high-performance applications for both Android and iOS using a single codebase. This ensures the application is accessible to a wider audience without duplicating development effort, which is especially important for socially driven application where time and resources may be limited.
- **Modern UI/UX Capabilities:-** Flutter provides a rich set of pre-built widgets and responsive UI components, which help create a user-friendly, visually appealing interface. A smooth user experience is crucial to encourage more people to register, donate, or request blood without friction.
- **Faster Development and Maintenance:-** Flutter's hot reload and robust framework make development faster and easier to iterate. This efficiency is ideal for academic projects and real-world application that may require frequent updates and testing.

- **Personal Motivation or Local Need :-** I was personally motivated to work on a blood donation platform due to a lack of organized donor systems in my community. By building this application, I aim to contribute a meaningful solution to a real-world problem.

2.3 System Planning

Flutter-Based Blood Donation Application aims to connect blood donors and recipients, facilitating quick and efficient blood donation services. Developed using Flutter, the application will provide real-time donor matching and blood bank location services.

1. System Objectives:

- Provide a user-friendly platform for blood donors and recipients.
- Enable real-time tracking of available blood donors.
- Integrate Google Maps for locating nearby donors and blood banks.

2. System Requirements:

A. Functional Requirements:-

- User Authentication:- Sign-up, login via email.
- Donor Registration:- Name, Email, Mobile Number, NID Number, Blood Group, Remarks, Last Blood Donation, Address, Password and Confirm Password.
- Blood Requests:- Request for me and Request from others.
- Real-Time Donor Finder:- Location-Based donor search using Google Maps API.

B. Non-Functional Requirements:-

- Performance:- Fast response time and smooth UI experience.
- Security:- Data encryption, secure API calls, Firebase authentication.
- Scalability:- Cloud-based backend to support growing users.
- Cross-Platform Support:- Compatible with Android iOS using Flutter.
- Reliability:- 99 percent Up time with Firebase and scalable cloud storage

3. System Architecture:

A. Frontend (Flutter- Dart):-

- User Interface (UI/UX):- Built with Flutter for a smooth, responsive design.
- Navigation State Management:- Provider, Riverpod, or Bloc for efficient state handling.

B. Backend (Node.js / Firebase):-

- Database:- Firestore (NoSQL) / MySQL for structured data storage.
- Authentication:- Firebase Authentication (Email).
- APIs:- Google Maps API (Location services).

4. Technology Stack:

Component	Technology Used
Frontend	(Flutter - Dart)
Backend	Node.js / Firebase
Database	Firebase Firestore (NoSQL) / MySQL for structured data storage.
Authentication	Firebase Authentication (Email).
APIs	Google Maps API (Location services).

Table 2.1: Technology Stack for Flutter-Based Blood Donation Application

2.4 System Analysis

Flutter-Based Blood Donation Application is a cross-platform mobile application developed in Flutter to connect blood donors and recipients efficiently. This system analysis is problem analysis and system modeling to ensure a smooth and scalable solution.

1. Problem Analysis:

Current Challenges in Blood Donation:

- Difficulty in finding donors in emergencies.
- No real-time tracking of available donors.

Proposed Solution:

- A mobile application to register donors and recipients efficiently.
- Real-time donor matching using google location.

2. System Modeling:

A. Context Diagram:

- User (Donor/Recipient) → Send Requests → Blood Donation Application → Check Requests → Donor Accept Requests.

B. Data Flow Diagram (DFD)

- User Registration → Store in Firebase.
- Blood Request Initiated → System searches for nearby donors.
- Donor Accepts Request → Communication for Call, Email and Maps.
- Donation Confirmed → Updates in Firebase.

2.5 Application Goals:

The primary goal of this Application is to design and develop a cross-platform mobile application using Flutter that facilitates efficient, accessible, and real-time blood donation services. The application aims to connect blood donors, recipients, hospitals, and blood banks in a centralized and user-friendly platform. The following are the key application Goals:-

- Develop a Cross-Platform Mobile Application.
- Connect Donors and Recipients in Real Time.
- Facilitate Easy and Quick Blood Donation.
- Ensure Data Security and Privacy.
- User Role Management.
- Real-Time Notifications.
- Secure User Authentication.
- Location Based Services.
- Track Donation History.
- Ensure Scalability and Performance.

Chapter 3

Methodology and Requirement Analysis

3.1 Introduction

The development of a Flutter-based Blood Donation Application requires a systematic approach that ensures both functionality and reliability across multiple platforms. This chapter outlines the methodology adopted for designing, developing, and testing the application, along with a detailed analysis of the tools and technologies used in the process.

The primary objective of this application is to create a user-friendly platform that seamlessly connects blood donors and recipients while ensuring data security, real-time communication, and location-based services. To achieve these goals, the development process followed a structured methodology combining agile principles, iterative development, and user-centered design practices.

The chapter begins with a description of the selected development methodology, justifying its suitability for this type of cross-platform mobile application. It further elaborates on the key tools and frameworks used, such as the Flutter SDK for frontend development, Firebase for backend services, and GitHub for version control and collaborative coding.

This analysis not only highlights the technical stack but also explains the rationale behind choosing these technologies. Factors like platform compatibility, ease of integration, development speed, community support, and scalability were carefully considered to optimize performance and user experience.

Ultimately, this chapter serves as a foundation for understanding the practical execution of the application and the technologies that enabled its successful implementation.

3.2 Methodology Designing

The design methodology of the Flutter-based Blood Donation Application focused on creating an intuitive, responsive, and user-centric interface that simplifies the process of blood donation and request. The design phase was broken down into several key steps to ensure both functional and aesthetic quality, while aligning with the application goals of accessibility, usability, and real-time interaction.

1. Requirement Gathering and Analysis

The first step in the design process involved collecting requirements from potential users, including blood donors, recipients, hospital staff, and NGOs. Surveys and informal interviews

were conducted to understand pain points, user expectations, and necessary features. The findings were documented and translated into technical and design requirements.

2. User Flow and Use Case Definition

Based on the gathered requirements, user person as were created and mapped with their respective use cases. User flow diagrams were developed to illustrate how different users interact with the system—from registering and logging in to requesting blood or donating during a camp. This step helped identify the key screens and decision points.

3. Wireframing and Prototyping

Low-fidelity wireframes were designed to visualize the layout of the application. Tools like Figma and Adobe XD were used to create initial mockups that showcased the navigation structure, content placement, and essential UI elements. These wireframes were then developed into interactive high-fidelity prototypes for testing and validation.

4. UI/UX Design Principles

During the UI/UX phase, principles such as minimalism, consistency, accessibility, and responsiveness were prioritized. The Flutter framework allowed for a uniform design across Android and iOS platforms. Key components included:

- **Color Scheme:** Red and white were chosen to symbolize health and urgency.
- **Typography:** Readable and scalable fonts were selected for easy navigation.
- **Icons and Buttons:** Clean and recognizable icons ensured a smooth user experience.

5. Responsive and Adaptive Layouts

The design was implemented using Flutter's 'Material' and 'Cupertino' widgets to maintain cross-platform consistency. Layouts were made responsive using media queries and dynamic sizing, ensuring optimal display on various screen sizes and resolutions.

6. Feedback and Iteration

The prototype was tested with a small group of users representing all roles (donor, recipient). Feedback was collected on usability, aesthetics, and navigation. Based on this feedback, design iterations were carried out to improve clarity, reduce complexity, and enhance user satisfaction.

7. Final Design Documentation

All approved UI components, interaction patterns, and navigation flows were documented for use by the development team. This ensured smooth hand-off and consistent implementation across all modules.

3.3 Methodology Developing

The development of the Flutter-based Blood Donation Application followed a structured and modular approach to ensure code reusability, scalability, and maintainability. The application was developed using the Flutter framework, supported by Firebase for backend services, and Git for version control. This section outlines the key stages involved in the development process.

1. Agile Development Approach

An Agile methodology was adopted for the development phase, enabling iterative and incremental progress with continuous user feedback. The work was divided into multiple sprints, with each sprint focusing on specific features such as user authentication, request management, and notification services.

2. Setting Up the Development Environment

The development environment was configured with the following key tools:

- **Flutter SDK** – for cross-platform application development.
- **Android Studio/VS Code** – as the primary IDEs.
- **Firebase Console** – for backend setup.
- **GitHub** – for source control and collaboration.

3. Backend Integration Using Firebase

Firebase was chosen as the backend due to its seamless integration with Flutter and real-time capabilities. The following Firebase modules were used:

- **Firebase Authentication** – to handle secure Login and Registration.
- **Cloud Firestore** – to store user data, Donation history, and Requests.
- **Firebase Cloud Messaging (FCM)** – to send real-time notifications.

4. Modular Code Architecture

The application was structured into logical modules to separate concerns and simplify development:

- **Authentication Module** – for login, sign up, and user verification.
- **Donor and Recipient Module** – for sending and accepting blood requests.
- **Notification Service** – for alerting users in real-time.
- **Location Service** – to fetch and utilize user GPS location.

5. API and Plugin Integration

Various Flutter packages and plugins were used to extend application functionalities:

- `google_maps_flutter` – for map-based donor search.
- `geolocator` – for real-time location detection.
- `firebase_auth`, `cloud_firestore`, `firebase_messaging` – for Firebase services.
- `provider` or `bloc` – for state management.

6. Testing and Debugging

Unit testing and manual UI testing were conducted throughout development. Debugging tools from Android Studio and Flutter Dev Tools were used to monitor performance and fix issues. Firebase Crash lytics was also integrated to capture and analyze runtime errors.

7. Deployment and Maintenance

Once all modules were completed and tested, the application was prepared for deployment to the Google Play Store and optionally for iOS using Xcode. Future updates and bug fixes were planned through versioning and issue tracking on GitHub.

3.4 Methodology Testing:

Testing is a critical phase in the software development life cycle, aimed at ensuring the reliability, functionality, and performance of the application. For the Flutter-based Blood Donation Application, a multi-level testing approach was adopted to identify and resolve bugs, improve user experience, and validate the system's readiness for deployment.

1. Types of Testing Conducted

To ensure the application met all functional and non-functional requirements, the following types of testing were performed:

- **Unit Testing:** Focused on testing individual components and functions, such as user input validation, API calls, and database transactions.
- **Widget Testing:** Verified the behavior and rendering of individual UI elements in isolation, including buttons, forms, and dialogues.
- **Integration Testing:** Ensured that different modules—like authentication, location services, and notifications—worked together as expected.
- **System Testing:** Tested the complete application as a whole to validate end-to-end functionality, user flows, and edge cases.
- **User Acceptance Testing (UAT):** Real users (donors and recipients) tested the app to ensure it met usability expectations and functional needs.

2. Testing Tools and Frameworks

The following tools and frameworks were used during the testing phase:

- `Flutter Test` – for unit and widget testing using Dart's built-in test package.
- `Integration_test` package – to simulate complete user workflows.
- `Firebase Crashlytics` – to monitor runtime errors and crashes in real-time.
- `Emulators and Physical Devices` – to test application performance on different screen sizes and operating systems (Android and iOS).

3. Test Case Design

Test cases were designed based on the application's requirements. Each test case included input data, execution steps, and expected results. Key functionalities tested included:

- User registration and login (valid and invalid credentials).
- sending and accepting blood requests.
- Real-time notifications.
- GPS location access and donor matching.
- Role-based access (donor, recipient).

4. Bug Tracking and Resolution

During the testing phase, identified bugs and performance issues were documented using a version control system and issue tracker (e.g., GitHub Issues). Each issue was prioritized based on severity and resolved iteratively in sprints.

5. Performance and Security Testing

- **Performance:** Application loading time, data syncing with Firebase, and real-time notification speed were tested under different network conditions.
- **Security:** Firebase Authentication and Firestore access rules were tested to ensure only authorized users could access sensitive data.

6. Feedback Loop

Send-testing, feedback from users and testers was gathered and analyzed. Suggestions for UI improvements, feature additions, or technical fixes were considered for future iterations and updates.

3.5 Requirement Analysis

1. Android Studio

Android Studio is the official integrated development environment (IDE) for Android application development, based on IntelliJ IDEA. It is developed by Google and provides a powerful code editor, real-time preview, emulator, and integrated tools for building, testing, and debugging Android and Flutter application.



Figure 3.1: Android Studio

In this application, Android Studio was used as the primary development platform to create a Flutter-based blood donation application. Its integration with Flutter SDK allowed for cross-platform development targeting both Android and iOS devices.

2. Flutter for Android and iOS platform

Flutter is an open-source UI toolkit developed by Google that enables developers to build natively compiled applications for both Android and iOS from a single codebase.



Figure 3.2: Flutter

Using the Dart programming language, Flutter renders widgets directly to the screen, offering consistent performance and appearance across platforms.

3. Dart Language

Dart is a modern, Object-oriented programming language developed by Google. It is optimized for UI development and is the primary language used in Flutter for building cross-platform mobile, web, and desktop applications.



Figure 3.3: Dart Language

Dart is a fast, modern, and efficient programming language that makes Flutter development powerful and flexible. Its features like hot reload, null safety, `async/await`, and native compilation make it ideal for building cross-platform application.

4. Android SDK (Software Development Kit)

The Android SDK (Software Development Kit) is a collection of tools, libraries, and documentation required for developing Android applications. It provides everything developers need to build, test, and debug Android application.



Figure 3.4: Android SDK

The Android SDK is an essential toolkit for building, testing, and deploying Android application. It is fully compatible with Flutter, making it a key component for cross-platform mobile development.

5. Firebase

Firebase is a Backend-as-a-Service (BaaS) platform by Google that provides various services like authentication, database, cloud storage, notifications, and analytics. It allows Flutter developers to build scalable and real-time applications without managing their own backend infrastructure.



Figure 3.5: Firebase

Firebase simplifies backend management for Flutter apps by providing authentication, database, storage, notifications, and analytics. It is widely used for real-time applications like chat application, social media, and e-commerce platforms.

3.6 Block Diagram

Here is a Block diagram description showing how these components like Android Studio, Flutter, Dart, Firebase, and Android SDK work together in an Flutter-based Android application (such as blood donation application). Below is:

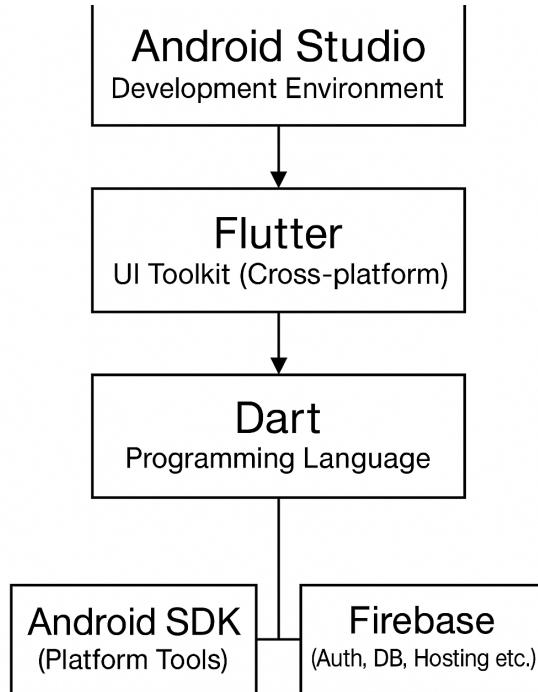


Figure 3.6: Block Diagram for this components

3.7 Summary

This chapter presented a comprehensive overview of the methodology and requirements analysis essential for developing the Flutter-based blood donation application. It outlined the step-by-step approach followed throughout the software development life cycle, including design, development, and testing phases. The chapter also emphasized the selection of tools such as Flutter, Dart, Android Studio, Firebase, and Android SDK that collectively support efficient, cross-platform mobile development.

Chapter 4

Implementation

4.1 Introduction

Implementing a Flutter-Based Blood Donation Application requires creating several features Such as Sign Up, Login, Home Page, Profile, Dashboard, See Details, Request by me, Request from other, Contact, Logout and Data collection in Firebase.

4.2 Application Design

Application Design is most of the two parts Such as Flow-Chart of Flutter-Based Blood Donation Application and Class Diagram of Flutter-Based Blood Donation Application. These below shows:

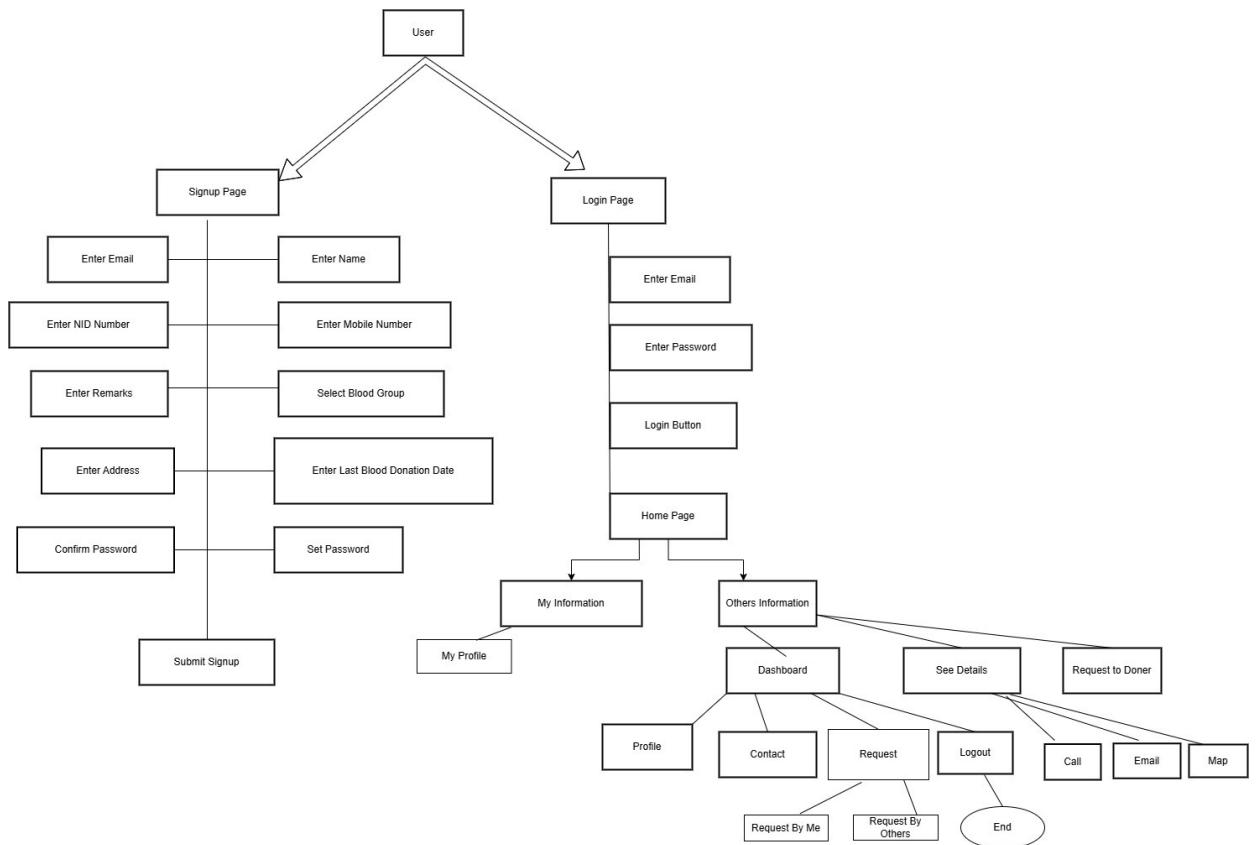


Figure 4.1: Flow-Chart of Flutter-Based Blood Donation Application

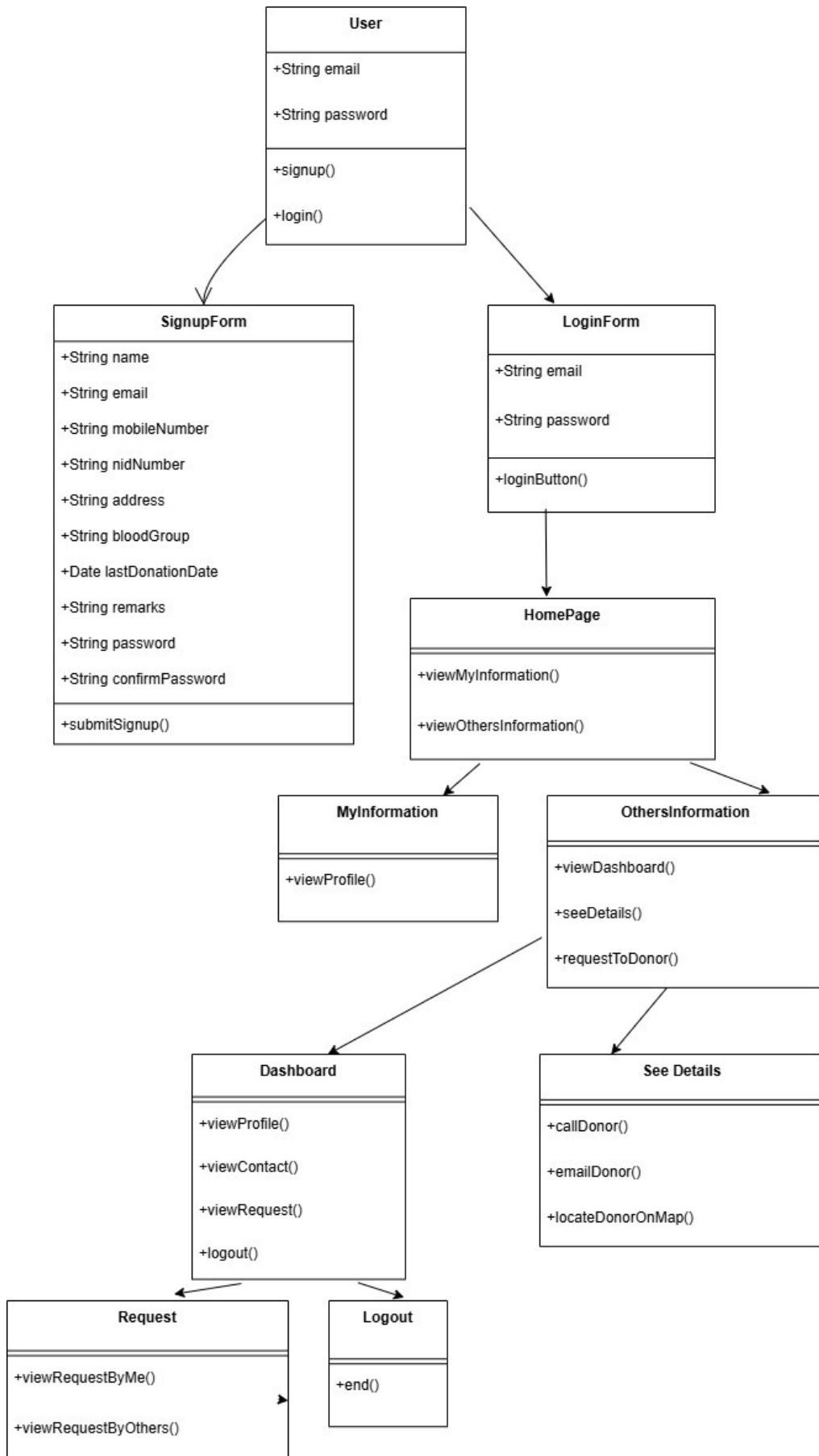


Figure 4.2: Class Diagram of Flutter-Based Blood Donation Application

4.3 Application Process

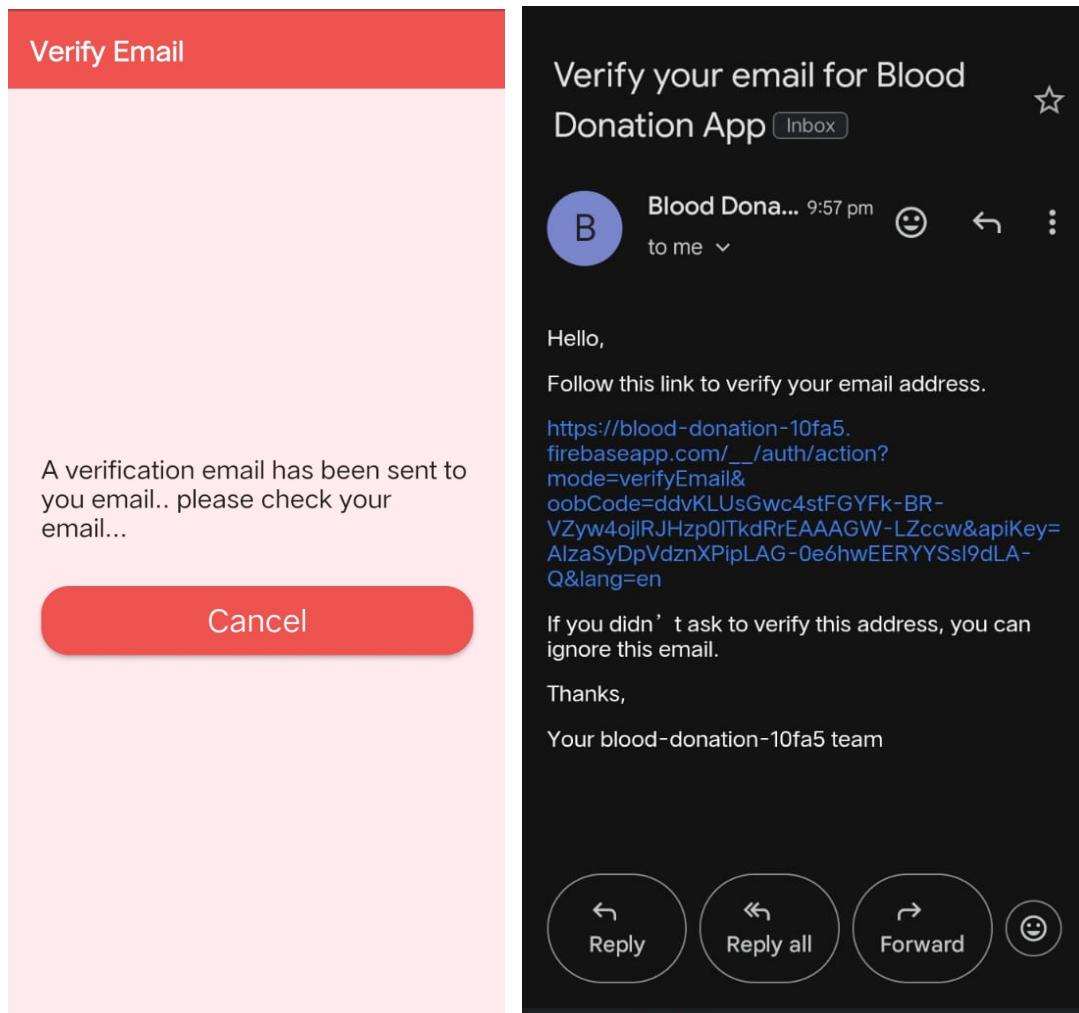
The application process describes the workflow and interaction between users (donors and recipients) and the system. The Flutter-based blood donation application is designed to streamline the blood donation and request process through intuitive and responsive application interfaces. Below is the showing process:

1. Sign Up Page

Flutter-Based Blood Donation Applications sign-up page allows new users to create an account by providing details like Name, Email, Contact number, NID number, Blood group, Remarks, Last blood donation, Address, Password, and Confirm password. After form validation, the application registers the user using Firebase Authentication or a backend service.

Figure 4.3: Sign-Up Page

Once the account is created, a verification email has been sent to the user's email address. The user must open the email address and click the verification link to verify email address. Then email address has been verified activated the account. Now, sign in with new account. This ensures that the email is valid and helps prevent fake registrations. Until verified, the application may restrict full access or display a reminder to verify the email.



Your email has been verified

You can now sign in with your new account

Figure 4.4: Sign-Up Verification via Email Address

2. Login Page

The login page allows registered users to securely access the flutter-based blood donation application using their email and password.

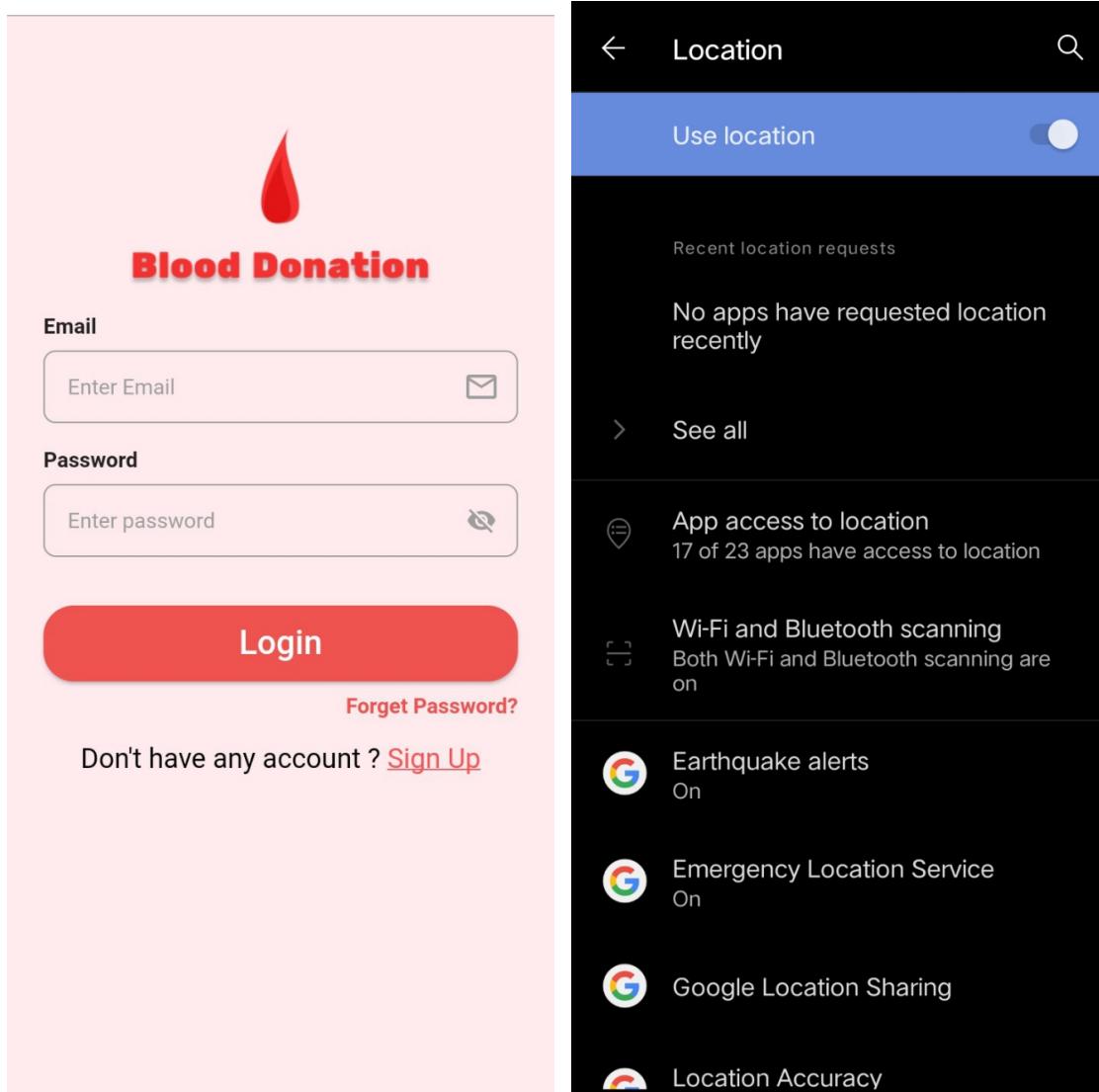


Figure 4.5: Login page and Access Location

Upon successful login, the application may request permission to access the user's current location using Flutter's location services. This location data helps the system identify nearby users, enabling faster donor-recipient matching and more relevant notifications. By updating the user's location at login, the application ensures real-time accuracy for emergency blood requests and location-based services.

3. Forget Password Page

Flutter-Based Blood Donation Application Password allows users to reset their password if they forget it. On the Login screen, the user taps the "Forgot Password" link and enters their registered email address. The application then sends a password reset email using Firebase Authentication. The email contains a secure link that the user can click to the link.

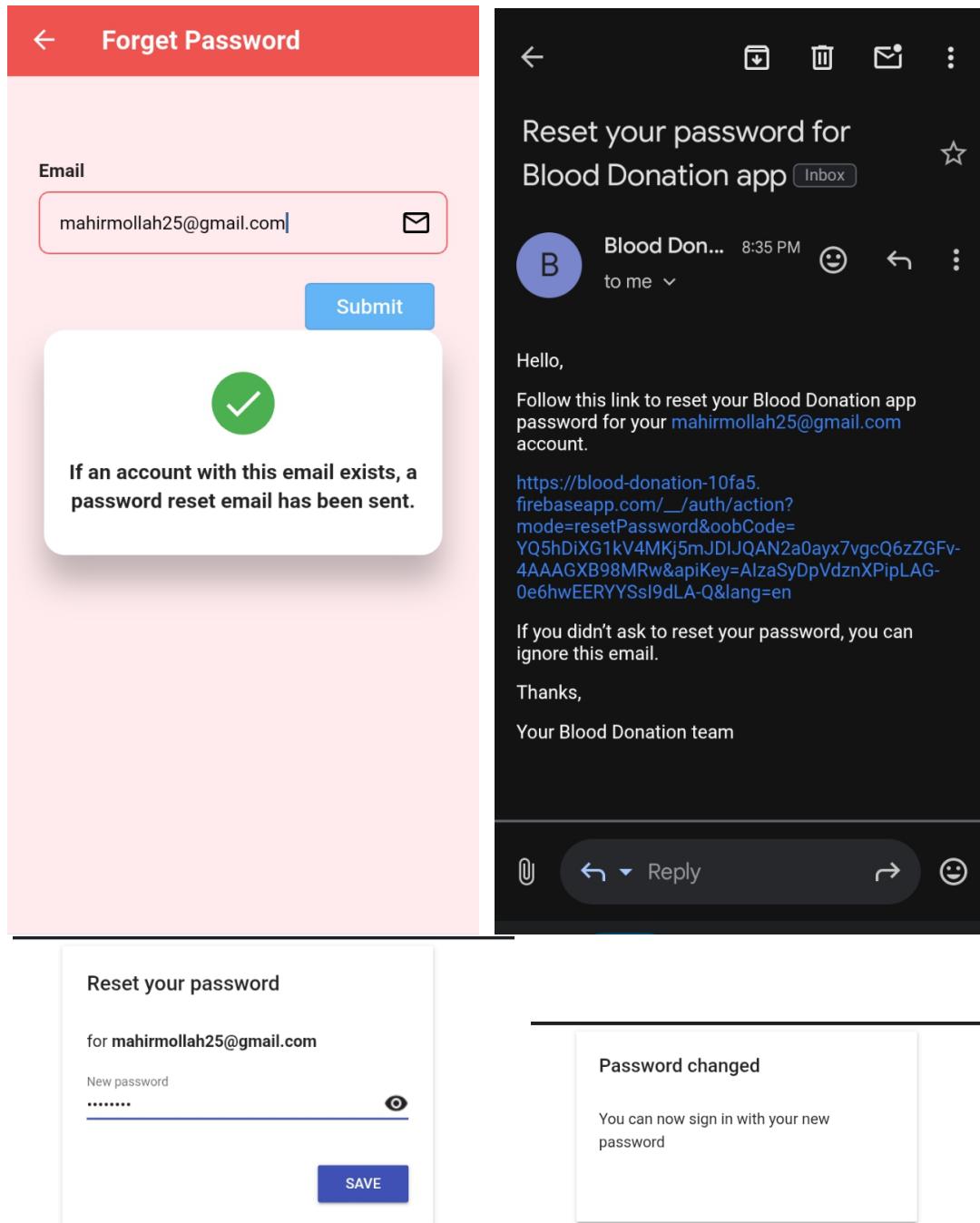


Figure 4.6: Forget Password Page

Then set a new password and click the save button. Now, can sign in with new password. This ensures account recovery without compromising security and helps the maintain smooth access to the application without the need for manual support.

4. Home Page

The Home Page serves as the central navigation hub of the flutter-based blood donation application. It provides users with two primary options: "My Information" and "Other Information". These options are presented as clearly labeled, clickable buttons in the middle of the screen. When a user taps on "My Information", the application navigates to a screen that displays personal data such as the Users Name, Email, Mobile, Blood Group and Last Blood Donation Date. This section is personalized and only accessible to the logged-in user.

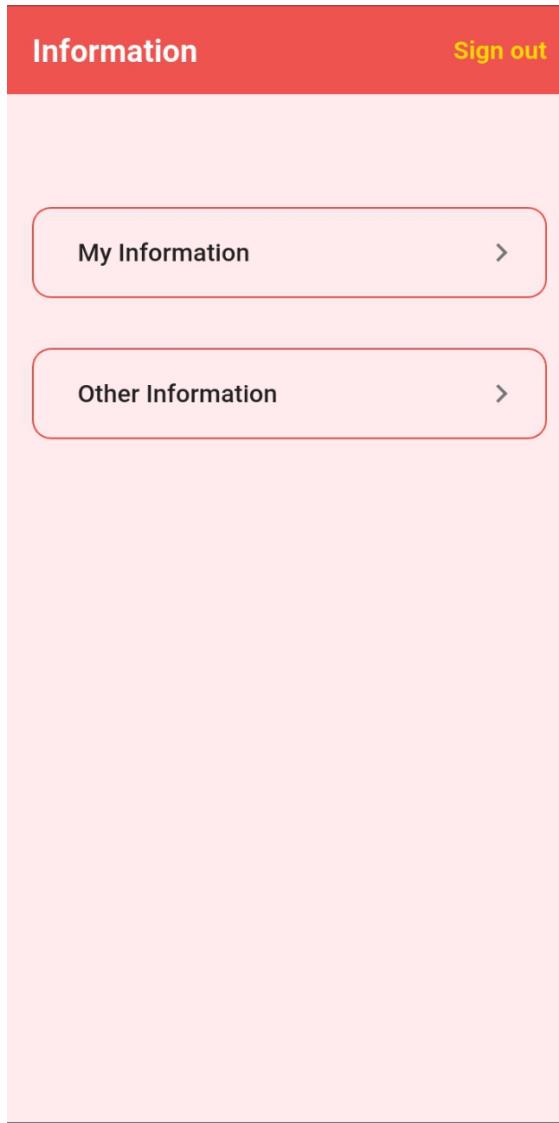


Figure 4.7: Home Page

On the other hand, tapping "Other Information" redirects the user to another screen that displays general or externally related information. This see that Dashboard, See details and Request them.

Both buttons are styled with a red outline and contain a right-pointing arrow to indicate they lead to more content. The design promotes ease of use and clear direction for users, ensuring a smooth and intuitive navigation experience.

5. Dashboard Page

The Dashboard page of a Flutter-based Blood Donation application is thoughtfully designed to provide users with a clear, engaging overview of their profile and relevant blood donation activities. At the top of the page, the Profile Section is prominently displayed, showcasing the user's name, profile picture, blood group, and donor status (active/inactive). It also includes the date of the last donation.

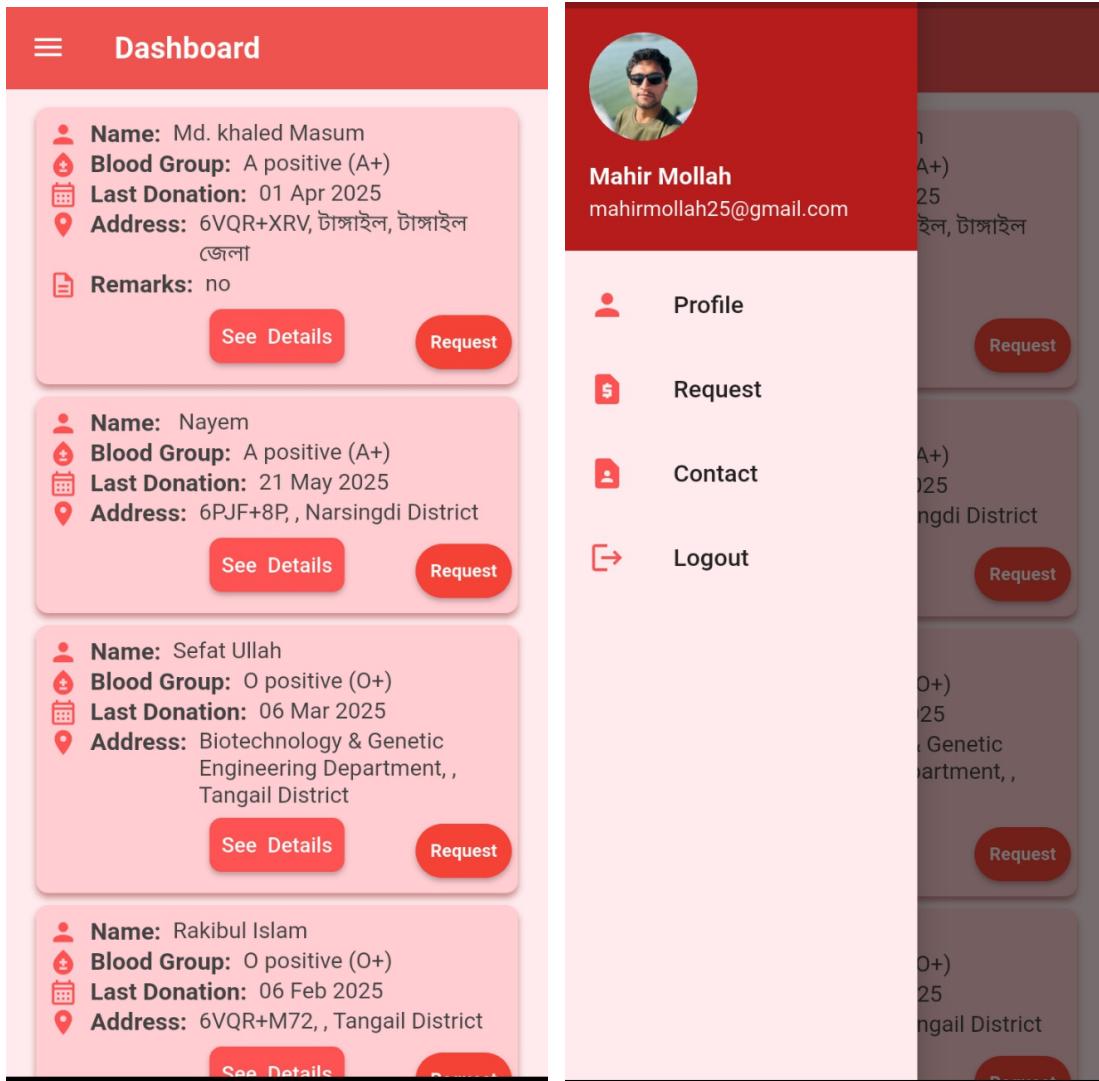


Figure 4.8: Dashboard Page

Below the others info section, the dashboard presents a Donation Summary with key stats like total donations, lives saved, and milestones, displayed using attractive cards or icons. The Nearby Blood Requests section follows, listing urgent local requests with details such as blood group, patient name, hospital, distance. Additional sections include Upcoming Events showing nearby donation camps, a Notification Panel for alerts and reminders, and a Health Tips area offering rotating donor safety advice.

6. My Profile Page

The My Profile Page serves as the personal dashboard where users can view and manage their account details and customize their profile. One key feature of this page is the ability to upload or update a profile picture, which helps personalize the user experience and improve identification during donation drives or hospital visits. Users can choose their profile image either from their device's gallery or by taking a new photo directly using the device's camera. This functionality is implemented using Flutter plugins such as which allows seamless access to both the camera and the gallery

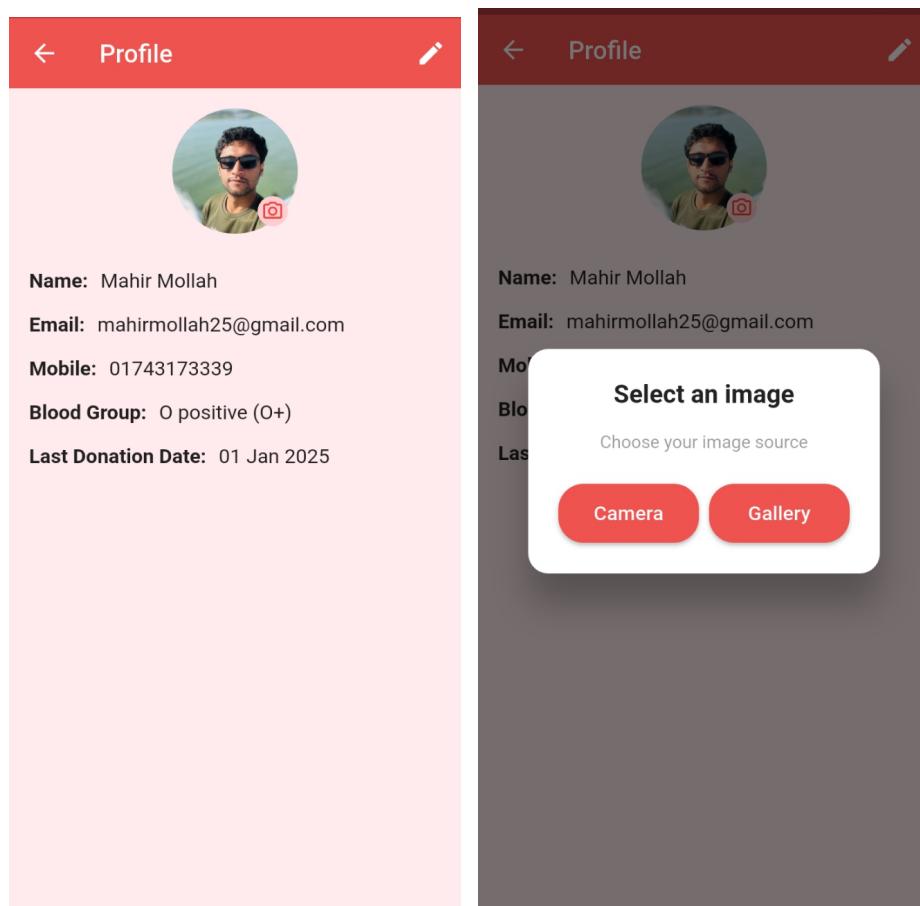


Figure 4.9: My Profile Page

Upon selecting or capturing a photo, the image is previewed on the profile page before being uploaded to Firebase Storage, where it is securely stored and linked to the user's profile data in Fire store. The profile type section also displays relevant user information such as their role (donor, recipient), blood group, last donation date, and contact details. By combining real-time data updates with easy image management, the My Profile Page enhances user engagement, trust, and interaction within the application community.

7. Edit Profile Page

The Edit Profile Page allows users to update and manage their personal information to keep their profile accurate and up to date. The key editable fields include the user's full name, which helps maintain identification; phone number, used for communication and verification; blood group, which is crucial for matching with potential recipients; and address, to update the user's current or permanent location.

The screenshot shows the 'Edit Profile' page with the following fields:

- Name:** Mahir Mollah (with a person icon)
- Mobile number:** +880 01743173339 (with a flag icon and dropdown arrow)
- Blood group:** O positive (O+)
- Last Donation Date:** 01 Jan 2025
- Live Address:** 6VQR+XRV, টাঙ্গাইল, টাঙ্গাইল জেলা (with a location pin icon)

A large red 'Update' button is located at the bottom center of the form.

Figure 4.10: Edit Profile Page

One of the most important fields is the last donation date, which helps the system automatically calculate eligibility for the next donation based on standard medical guidelines (usually 90 days). This information is essential for maintaining a healthy donor cycle. All changes made on this page are securely updated in Firebase Fire store and reflected throughout the application in real time. The edit profile feature enhances user control, improves data accuracy, and ensures that the donor-recipient matching system functions efficiently.

8. Donor Details Page

The Donor Details Page provides essential information about each registered donor to help recipients make informed decisions during urgent needs. This page typically displays the donor's full name, email address, contact number, and last donation date, which helps determine eligibility for the next donation. The donor's permanent or current address is shown to assess proximity, along with their NID number (National ID) for identity verification and credibility.

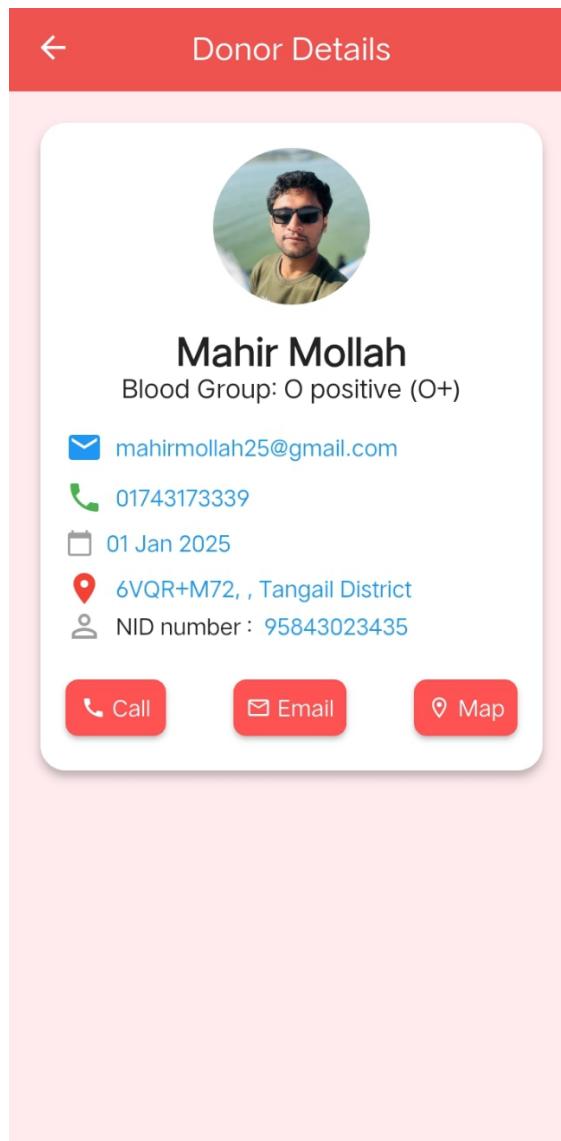


Figure 4.11: Donor Details Page

Additionally, a remarks section allows admins or the donors themselves to include relevant notes such as health conditions, donation preferences, or availability. All this data is securely stored and retrieved from Firebase Fire store, ensuring that only authorized users (e.g., verified recipients or admins) can view sensitive details. The layout of this page is designed to be clean and readable, making it easy to access critical donor information quickly in emergency situations.

9. Request by me and Notification Page

The "Request By Me" page allows users (typically recipients) to view and manage all the blood donation requests they have submitted. Each request contains key details such as the required blood group, quantity, urgency level, and the date/time of the request. Once a request is submitted, it is stored in Firebase Fire store and becomes visible to compatible nearby donors.

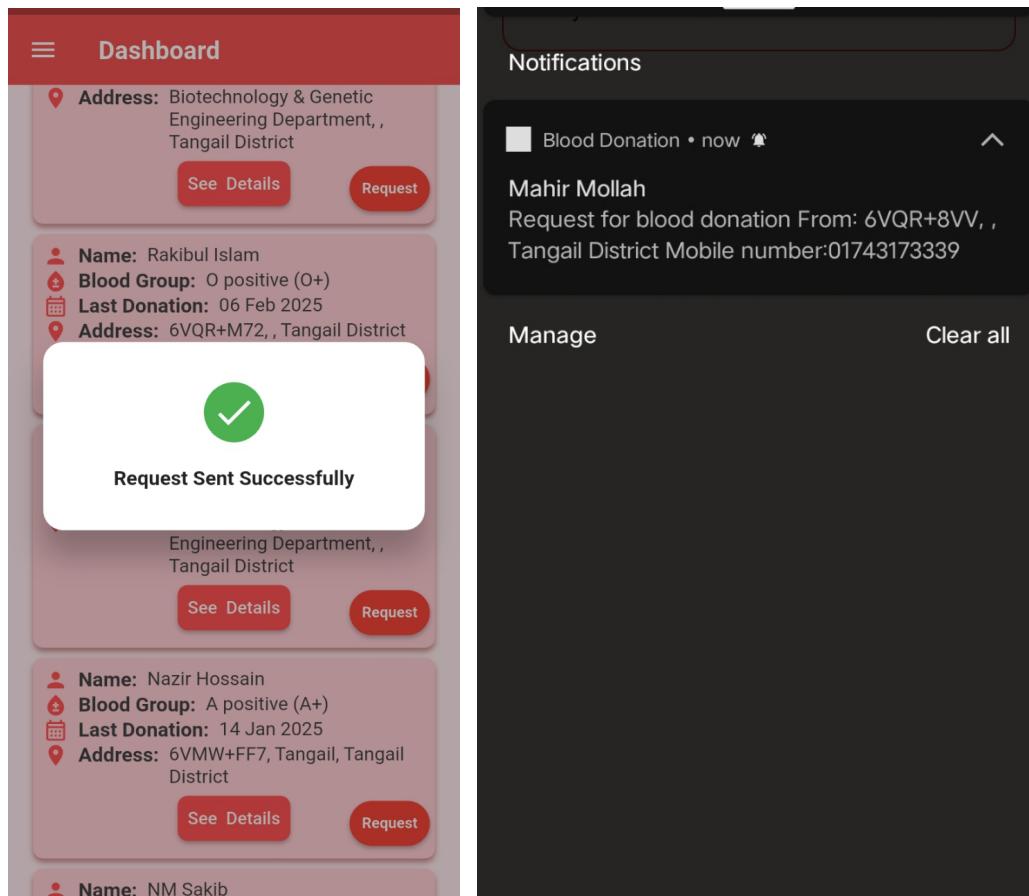


Figure 4.12: Request by me and Notification Page

The "Notification" page works alongside this by displaying real-time alerts about the status of those requests—such as when a donor accepts the request, when the request is fulfilled, or if it expires. Notifications are delivered using Firebase Cloud Messaging (FCM) and appear instantly within the application or as push notifications on the user's device. This system ensures recipients are promptly informed about changes to their requests and can respond quickly, which is especially critical in emergencies. The combined functionality of these pages streamlines blood request tracking and enhances user engagement by maintaining real-time, transparent communication.

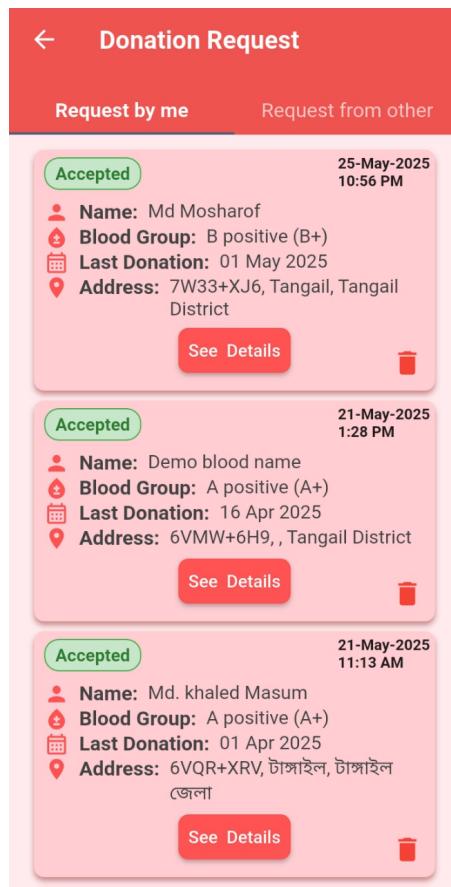


Figure 4.13: Request by me and Notification Page

This shows a section of a blood donation application under the "Request by me" tab, where the user can see the blood donation requests they have made. Each request card displays the donor's name, blood group, last donation date, and address. All requests shown are marked as "Accepted" and include the date and time they were accepted. There are also buttons to view more details or delete the request. The interface is designed to help users easily manage their blood donation requests.

10. Request from other and Notification Page

The “Request from Other Notification” page displays blood requests sent by other users (recipients) who are nearby and match the donor’s blood group. When a request is made, the application uses real-time location and blood type matching to notify suitable donors via Firebase Cloud Messaging.

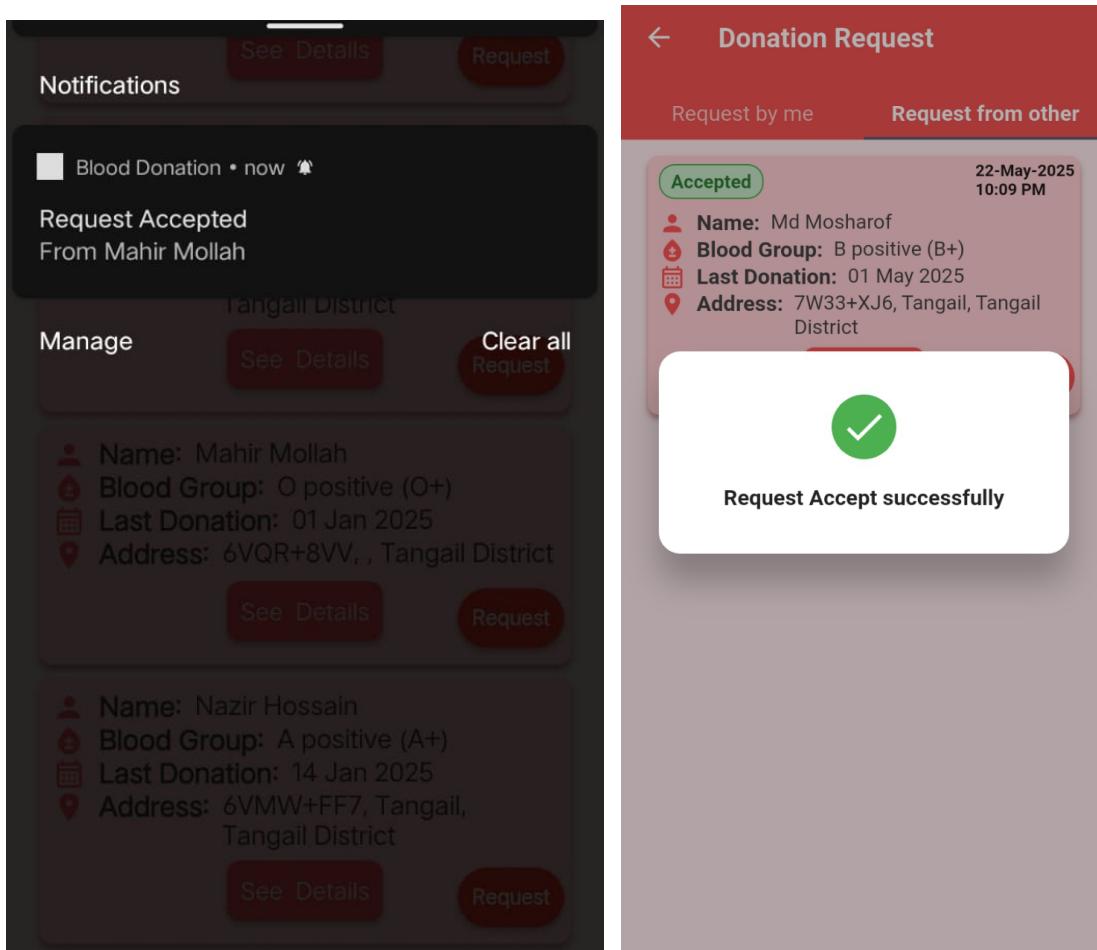


Figure 4.14: Request from other and Notification Page

These donors can view details like the requester blood type, location, and urgency on this page. They can choose to accept or ignore the request, and accepted responses are updated instantly in Firebase. This feature ensures quick visibility and efficient handling of urgent blood donation needs.

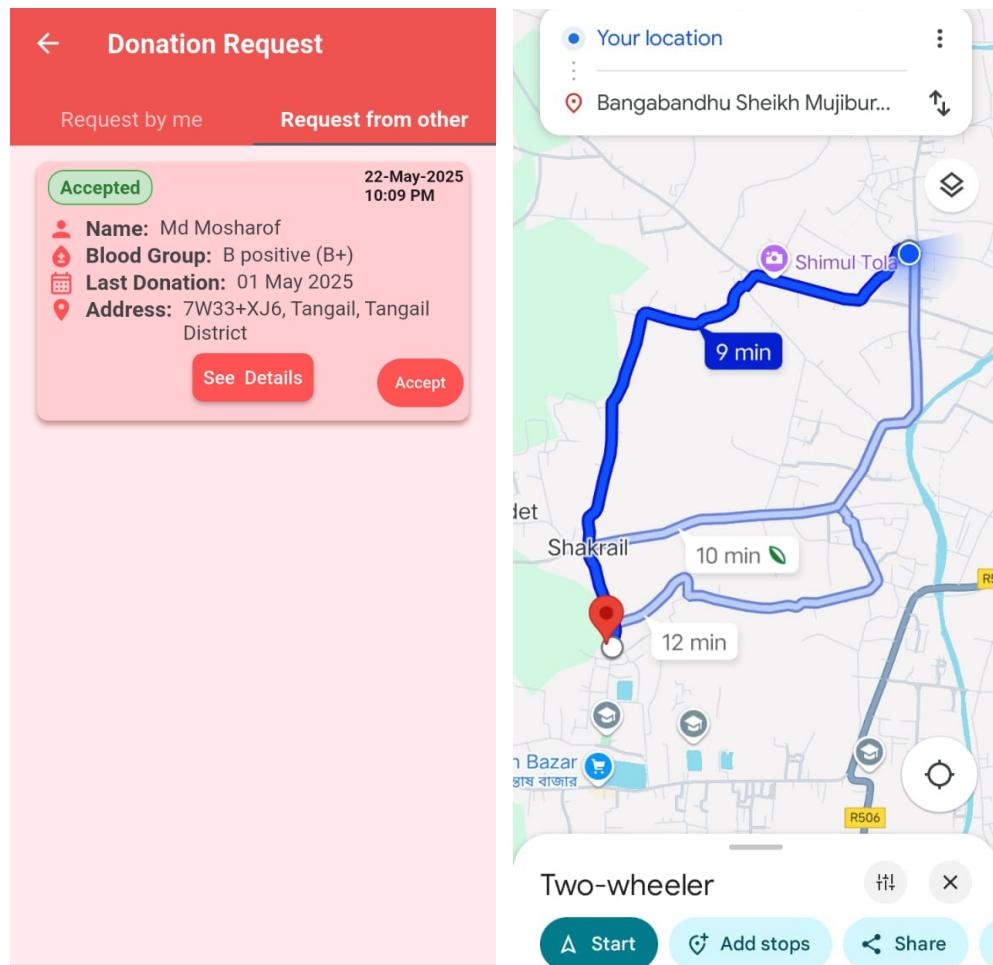
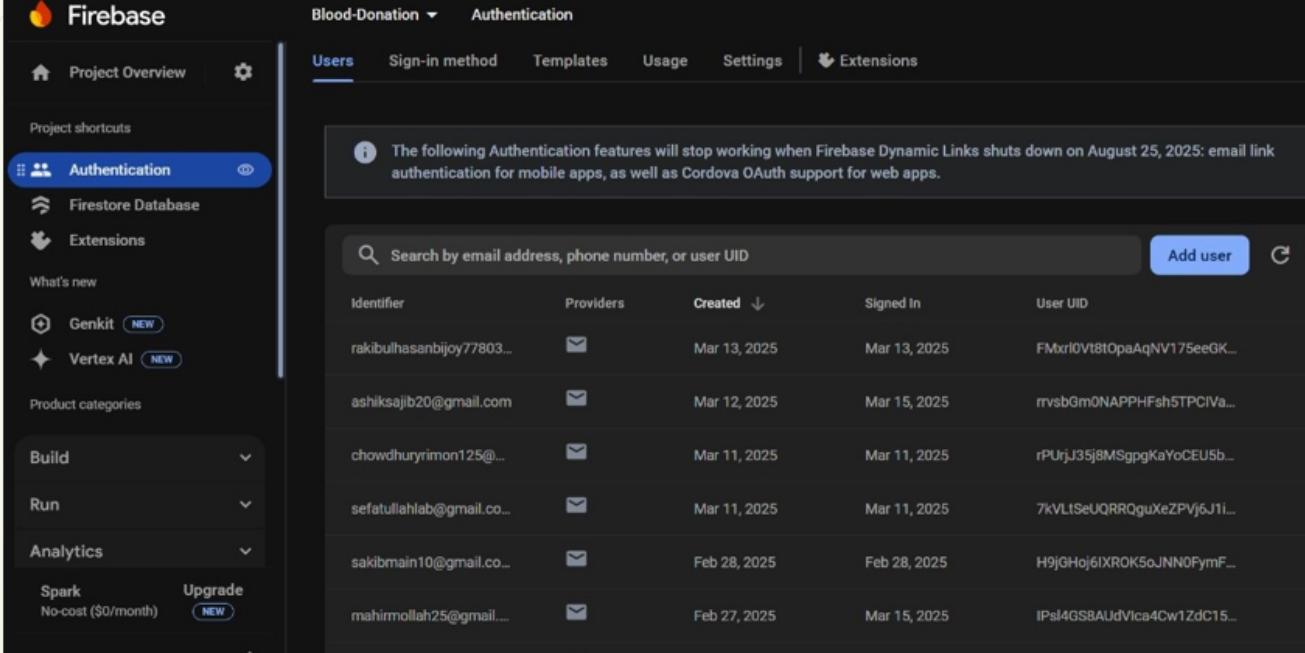


Figure 4.15: Request from other and Notification Page

The Updated instantly in Firebase then the automatically donor details such as Call,Email and Geo location map services.Then the track of my donors staying position until the blood is needed.The blood is needed when the contact by Call and Email. After finish the blood donate,The donate history is ever day recorded in the firebase data collection.

11. Data Collection in Firebase Page

In the Flutter-based blood donation application, Firebase plays a central role in managing and storing all user and application data securely and efficiently. Upon user registration or login, Firebase Authentication verifies credentials and creates a unique user ID. This ID is used to store user-specific information in Cloud Fire store, a scalable No SQL database. The application collects and stores data such as user profiles (Name, Email, Blood group, Contact, NID numbers and Remarks), Blood donation requests, Donor responses, and Donation history.



The screenshot shows the Firebase console interface for the 'Blood-Donation' project. The left sidebar has 'Authentication' selected. The main header says 'Blood-Donation ▾ Authentication'. Below it are tabs for 'Users', 'Sign-in method', 'Templates', 'Usage', 'Settings', and 'Extensions'. A note in a box states: 'The following Authentication features will stop working when Firebase Dynamic Links shuts down on August 25, 2025: email link authentication for mobile apps, as well as Cordova OAuth support for web apps.' A search bar at the top right says 'Search by email address, phone number, or user UID' and has a 'Add user' button. The 'Users' table lists the following data:

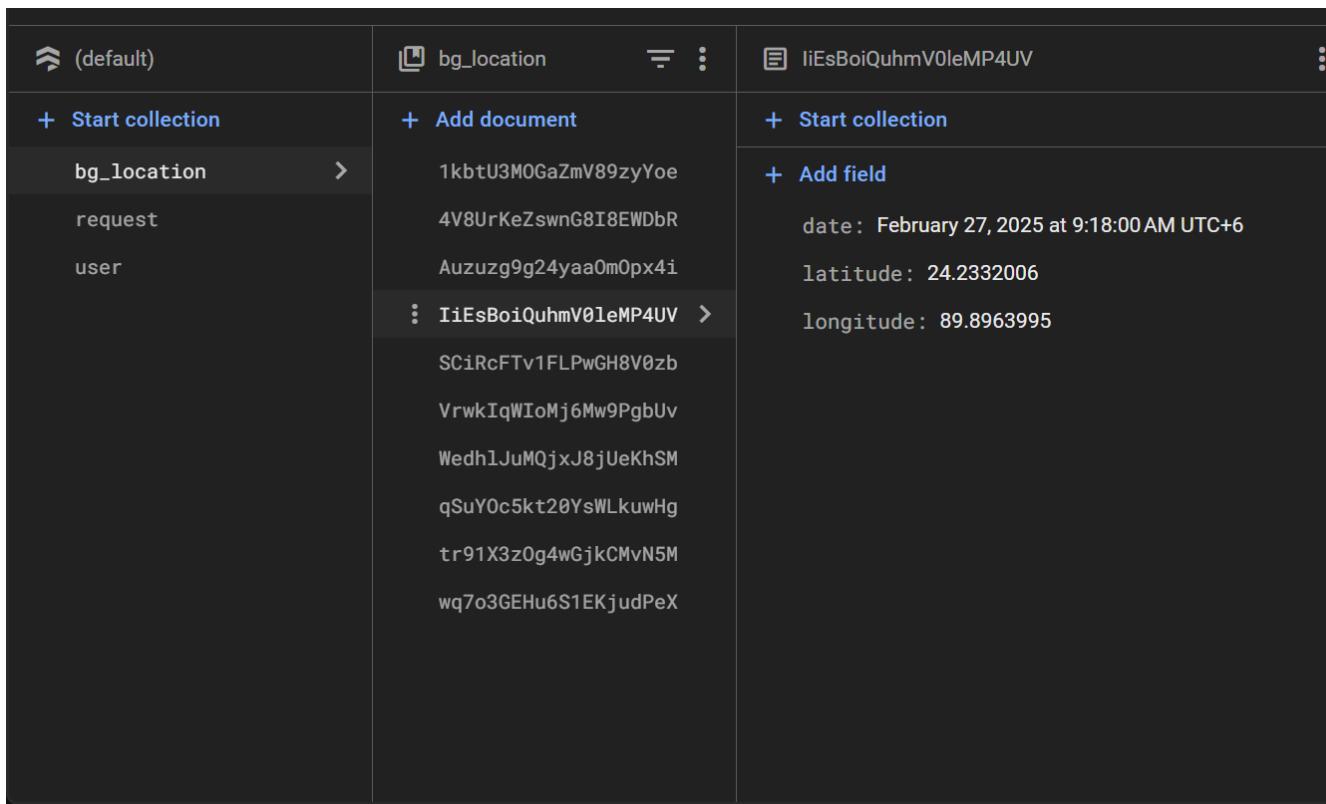
Identifier	Providers	Created	Signed In	User UID
rakibulhasanbijoy77803...	✉️	Mar 13, 2025	Mar 13, 2025	FMxrl0Vt8tOpaAqNV175eeGK...
ashiksajib20@gmail.com	✉️	Mar 12, 2025	Mar 15, 2025	rvsbGm0NAPPHFsh5TPCIVa...
chowdhuryrimon125@...	✉️	Mar 11, 2025	Mar 11, 2025	rPUrJ35j8MSgpgKaYoCEU5b...
sefatullahlab@gmail.co...	✉️	Mar 11, 2025	Mar 11, 2025	7kVLtSeUQRROguXeZPVj6J1i...
sakibmain10@gmail.co...	✉️	Feb 28, 2025	Feb 28, 2025	H9jGHoj6IXROK5oJNN0FymF...
mahirmollah25@gmail....	✉️	Feb 27, 2025	Mar 15, 2025	IPsl4GS8AUdVica4Cw1ZdC15...

Figure 4.16: Data Collection in Firebase Page

When a user makes a blood request or accepts one, the application updates the Fire store database in real-time, ensuring that all users see the most current data. Firebase's real time data sync allows instant updates across devices, which is critical in emergency situations. Additionally, Firebase Cloud Messaging (FCM) is used to send push notifications about request statuses. All data transfers between the application and Firebase are encrypted, and Firebase's rules-based access control ensures that only authorized users can read or write specific data, maintaining privacy and integrity across the system.

12. Cloud Fire store Page

The Cloud Fire store page in a Flutter-based application acts as the central hub for managing real-time data storage, retrieval, and synchronization across the application. Cloud Fire store, a No SQL database offered by Firebase, allows developers to structure data in collections and documents, enabling efficient and scalable data handling. In the context of a blood donation application, Fire store stores key data such as user profiles, blood requests, donation history, events, and notifications. Each user profile might be saved as a document within a users collection, containing fields like name, blood group, location, availability status, and last donation date. Similarly, real-time blood requests are stored in a requests collection, making them instantly accessible and Update able to all users when needed.



The screenshot shows the Cloud Fire store interface. On the left, there's a sidebar with a 'bg' icon and '(default)' text. Below it are three items: '+ Start collection', 'bg_location' (which is expanded), and 'request'. Under 'bg_location', there are three sub-items: 'request', 'user', and a document named 'IiEsBoiQuhmV0leMP4UV'. This document has several fields: 'date' (February 27, 2025 at 9:18:00 AM UTC+6), 'latitude' (24.2332006), and 'longitude' (89.8963995). The 'request' item also has a '+ Add document' button. The 'user' item is collapsed.

Figure 4.17: Cloud Fire store Page

The Fire store page also supports queries, such as filtering blood requests based on blood group or nearby location using geo hashing techniques. Data is automatically synced across devices, ensuring that users see the most up-to-date information without needing to manually refresh. In addition, Fire store's integration with Firebase Authentication allows secure access control, so users can only read and write data they're authorized to access. With Fire store's support for offline persistence, users can still view and interact with data even without an internet connection, making it reliable in critical situations. Overall, the Cloud Fire store page ensures the application remains dynamic, responsive, and capable of delivering real-time life-saving information efficiently.

4.4 Summary

This chapter presents the step-by-step implementation of the core components of the blood donation application using Flutter, Firebase, and Dart. The features include such Sign up page ,Login page,Home page,Forget password page,Dashboard page,Donor details page,My profile page>Edit profile page,Request by me and Notification page,Request from other and Notification page and Data collection in firebase page.

This chapter demonstrates the practical implementation of a fully functional, location-aware, real-time blood donation application. Each page is purpose-built to enhance usability, ensure data security, and support emergency services effectively using modern Flutter and Firebase tools.

Chapter 5

Application

5.1 Real Life Application

Here's a point-by-point detailed explanation of the real-life Flutter-Based Blood Donation Application:

Real-Life Flutter-Based Blood Donation Application

1. Emergency Blood Request Fulfillment

Use Case: In road accidents, Surgeries, or Childbirth Complications, Patients often require urgent blood transfusions.

How the Application Helps:

- A recipient can request an emergency blood.
- The application immediately notified nearby compatible donors.
- Donors can accept the request and respond quickly.
- The Location and Contact info are shared securely.

Real Impact: Reduces life-threatening delays in emergency situations by connecting donors instantly.

2. Organized Blood Donation Drives

Use Case: NGO's, Colleges, or Hospitals often conduct blood donation camps.

How the Application Helps:

- Admins can use the application to broadcast upcoming donation drives.
- Interested users get notifications and can RSVP to participate.
- The application can track turnout, manage pre-registration, and verify eligibility.

Real Impact: Reduces paperwork and improves planning for organized and successful donation events.

3. Regular Voluntary Donor Management

Use Case: Some people are regular donors but need reminders or tracking tools.

How the Application Helps:

- Tracks the last donation date and alerts users when they are eligible again.
- Maintains a donation history record.
- Sends motivational messages to encourage continued participation.

Real Impact: Increases donor retention and builds a loyal donor base.

4. Location-Based Donor Matching

Use Case: A recipient in a rural area needs blood urgently but is unsure where to find a donor.

How the Application Helps:

- Uses GPS location to match the recipient with the nearest compatible donor.
- Provides contact info such as call, email and map.
- Can prioritize matches by distance and blood group urgency.

Real Impact: Saves valuable time and effort in reaching the right donor nearby.

5. Blood Bank Inventory Monitoring (Future Integration)

Use Case: Hospitals and clinics often have difficulty tracking and sharing blood inventory data.

How the Application Can Help:

- Future versions can integrate with hospital databases to update blood availability in real time.
- Users can see which nearby blood bank has their required blood type.

Real Impact: Reduces unnecessary travel and directs users to the right facility.

6. Awareness and Education

Use Case: Many people don't donate blood because of misinformation or fear.

How the Application Helps:

- Includes an educational section with FAQs, eligibility criteria, benefits of blood donation, and myth-busting.
- Encourages users through testimonials and facts.

Real Impact: Improves public awareness and increases new donor registrations.

7. Secure Authentication and Verified Users

Use Case: Fake donors or prank requests are a serious issue in public health appslication.

How the Application Helps:

- Uses Firebase Authentication to verify user identity via phone or email.
- Future versions can use government ID integration or biometric login.

Real Impact: Ensures safe and trustworthy interactions between users.

8. Support for Rare Blood Type Requests

Use Case: Rare blood types like AB- are hard to find during emergencies.

How the Application Helps:

- Users with rare blood types can opt-in for urgent call alerts.
- Admins can flag critical requests and push them to a targeted group.

Real Impact: Improves access to rare blood types and boosts survival chances in critical cases.

9. NGO and Hospital Partnerships

Use Case: Social organizations want to automate and digitize their blood donation campaigns.

How the Application Helps:

- The application provides role-based access for NGOs and hospital staff.
- Enables custom reporting, user statistics, and automated follow-up for donors.

Real Impact: Digitally transforms manual health outreach programs into efficient, scalable operations.

10. Disaster or Pandemic Support

Use Case: In large-scale disasters (e.g., floods, earthquakes, pandemics), there is a sudden surge in blood demand.

How the Application Helps:

- Admins can send emergency broadcasts to all users in a region.
- Users can opt-in to donate during crisis response periods.

Real Impact: Provides a rapid-response channel for mobilizing blood donations during public emergencies.

Chapter 6

Future Scope and Advancements

6.1 Future scope

The development of the Flutter-based Blood Donation Application provides a solid foundation for connecting blood donors and recipients through mobile technology. While the current version of the application includes essential features such as donor registration, blood request handling, real-time notifications, and location-based services, there is significant potential to expand and improve the system further. The following are key areas for future development:-

- AI Machine Learning Integration.
- Blockchain for Transparency Security.
- IOT (Internet of Things) Integration.
- Emergency Disaster Response.
- Integration with Healthcare Systems.
- Donation Analytics Dashboard.
- Enhanced Security and Compliance.

6.2 Advancements

The proposed application leverages modern technologies and development frameworks to advance the way blood donation services are delivered. Below are the key areas in which the application provides significant technological and operational advancements:-

1. Cross-Platform Development with Flutter:

- Flutter, developed by Google, allows the creation of natively compiled applications for both Android and iOS using a single codebase.
- This drastically reduces development time, cost, and effort, while ensuring feature parity across platforms.
- Unlike native development (Java/Kotlin for Android or Swift for iOS), Flutter enables faster prototyping and deployment.

2. Real-Time Connectivity Using Firebase:

- Firebase provides real-time database updates, allowing instantaneous communication between donors and recipients.
- Features such as live request feeds, real-time chat, and instant blood request notifications make the system more dynamic and responsive.

3. Location-Based Services:

- View nearby donors or requests.
- Connect to Geo location Services.

4. Secure and Scalable Backend Integration:

- The application uses Firebase Authentication to ensure secure login and user management, supporting:
 - Email/Password login.
 - Google Sign-Up.
 - Email Verification.
- Cloud Firestore scales automatically to support growing user bases.

5. Role-Based Access Control:

- The application supports different user roles such as:
 - Donor.
 - Recipient.
- This improves the structure and security of user data handling, allowing role-specific access and operations.

6. Push Notification System:

- Real-time push notifications ensure:
 - Donors are alerted when a nearby requested.
 - Recipients are notified when a match is found.
- This minimized delay in communication, especially during emergencies.

Chapter 7

Limitation and Conclusion

7.1 Limitation of the Applications

Here are detailed limitations of a Flutter-based Blood Donation Application:

- Platform Dependency on Third-Party Services.
- Limited Background Functionality.
- Battery and Resource Usage.
- Data Accuracy and User Verification.
- No Integration with Official Blood Banks.
- Privacy and Data Protection Challenges.
- Internet Dependency.
- No Offline Functionality.
- Limited Support for Rare Blood Types.
- Scalability Constraints.

7.2 Conclusion of the Applications

Here's a detailed and well-structured conclusion for group Flutter-Based Blood Donation Application:-

The development of a Flutter-based Blood Donation Application represents a significant step toward leveraging modern mobile technology to address the persistent challenge of timely and efficient blood donation and transfusion services. This application aimed to bridge the gap between blood donors and recipients through a real-time, cross-platform mobile solution that is easy to use, scalable, and secure.

By using Flutter, the application benefits from a single codebase for both Android and iOS, reducing development time and maintenance complexity. The integration of Firebase as a backend ensures reliable data storage, user authentication, and real-time database updates, which are essential for time-sensitive tasks such as blood requests and donor notifications.

One of the key strengths of the application is its ability to connect nearby donors and recipients quickly, using location-based services and push notifications. Additionally, features like donation history tracking, user role management, and secure login systems enhance both usability and accountability within the system.

However, During the development and analysis of this application, several limitations were identified. These include:- Platform Dependency on Third-Party Services, Limited Background Functionality, Battery and Resource Usage, Data Accuracy and User Verification, No Integration with Official Blood Banks, Privacy and Data Protection Challenges, Internet Dependency, No Offline Functionality, Limited Support for Rare Blood Types, Scalability Constraints.

In conclusion, this application successfully demonstrates the potential of cross-platform mobile technologies in the healthcare domain. The Flutter-based blood donation application not only simplifies the donation process but also encourages more individuals to become regular donors by offering a convenient and transparent platform. With further enhancements and wider adoption, this application can play a pivotal role in saving lives and modernizing blood donation practices.

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