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Student's Name	REG NO	COURSE	MODULE
ERNEST, YUSTO RAPHAEL	2021-04-01747	BIT	WEB
ENOSI, ROSE JOHN	2021-04-01727	BIT	MOBILE APP
WILSON, SAMWEL	2021-04-12578	CS	BACKEND

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Supervisor Name: Mr. Henry Mkama

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LIST OF ABBREVIATION

App	Application
CoICT	College of Information and Communication Technology
UDSM	University of Dar es salaam

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1.0 CHAPTER ONE

INTRODUCTION

1.1. General Introduction

Blood donation involves collecting blood from a donor so it can be used to treat someone else. Blood donations are an essential part of our healthcare system. If we did not have volunteers giving blood, many medical procedures we take for granted could not take place. Recently, worldwide efforts have been undertaken to utilize social media and smartphone applications to make the blood donation process more convenient, offer additional services, and create communities around blood donation centers. Underscores the imperative of addressing donor recruitment and retention. The revelation that donors often contribute only once highlights the need for further education, motivation, and information dissemination. Situating our efforts within this broader perspective, the module seeks to substantively contribute to the discourse on healthcare optimization, envisioning a future where diagnostics are not only more efficient but also intricately connected with the evolving needs of the healthcare landscape.

Historical context

The Blood Donation App originated as a response to persistent challenges in global healthcare systems, particularly the historical issue of blood shortages. Traditional methods for organizing blood drives and maintaining donor databases have often proven inadequate, leading to consequences for patient treatment and public health. In the context of this historical challenge, it is essential to recognize the remarkable evolution of blood donation practices over the centuries. The early history of blood transfusion, as detailed by (S, 2022) reveals a transition from crude and risky practices, such as bloodletting, to the groundbreaking work of individuals like British obstetrician James Blundell and Austrian physician Karl Landsteiner. Blundell's pioneering transfusions in the 19th century and Landsteiner's identification of blood groups in the 20th century laid the foundation for safer and more effective blood donation practices. The subsequent establishment of the first blood bank in the U.S. by Bernard Fantus in 1937, and the pivotal contributions of African American physician Charles Drew, further shaped the modern landscape

of blood banking. Today, the Blood Donation App project draws inspiration from this historical context, aiming to leverage technological advancements and smartphone ubiquity to create a dynamic platform that addresses the ongoing challenges in blood donation and ensures a steady supply for healthcare needs.

Current System in Tanzania

Overview of the Blood Donation Process in Tanzania

In the context of Tanzania, the blood donation process operates within the framework of a manual and decentralized system. This intricate system relies on traditional outreach methodologies, employing physical channels like personalized letters and announcements disseminated across diverse platforms to connect with potential donors. The multifaceted process unfolds through a sequence of meticulously coordinated steps, encompassing the identification of potential donors, solicitation of participation through formal communication channels, and the organization of blood donation events. These events serve as focal points for engaging donors and conducting the vital process of blood collection, all managed manually. In essence, the current blood donation system in Tanzania reflects a dynamic interplay of physical interactions and decentralized efforts, highlighting the need for a more streamlined and technologically advanced approach to address existing challenges and enhance the efficiency of the overall process.

Blood Donation Processes

Initiating the blood donation process involves a systematic approach to identifying potential donors and communicating the urgent need for blood.

Step 1: Identification of Potential Donors

At the outset, blood centers meticulously analyze the demand for blood and identify potential donor groups. This critical step lays the foundation for the subsequent outreach efforts.

Step 2: Outreach to Institutions

With potential donors identified, the next phase entails reaching out to various public institutions. Formal request letters are methodically distributed to schools, colleges, universities, churches,

and mosques. These letters seek permission to organize upcoming blood donation events, fostering collaboration between healthcare entities and community institutions.

Step 3: Broadcasting Announcements

Simultaneously, broadcasting channels become a vital conduit for disseminating announcements regarding the impending blood donation events. Through these channels, the public is informed about the urgent need for blood donations and encouraged to participate actively in supporting the community's healthcare needs.

Step 4: Donor Recruitment

Donors are informed about the procedure, highlighting its simplicity and the potential life-saving impact of their contributions. Additionally, they are apprised of the manifold benefits associated with blood donation, fostering a deeper understanding of how their altruistic actions can positively impact the well-being of their community. This informative approach aims to enhance awareness and encourage a sense of responsibility, ensuring that potential donors are wellinformed and motivated to participate in this vital and life-affirming act of giving.

Step 5: Collection of Donor Information

Following donor recruitment, the manual collection of basic information commences. This includes recording contact details and checking donor eligibility, creating a foundation for effective coordination throughout the blood donation process.

Step 7: Blood Collection Process

Trained medical professionals collect blood from donors during these events.

Forced Replacement

In case a patient gets blood and he or she has not donated before then relatives of patients who received blood are compelled to donate to replenish the supply.

Identifying Challenges

Challenges include a lack of a centralized platform, difficulty in reaching potential donors, and the reliance on forced replacements, which may not be sustainable.

1.2. Statement of the Problem

In Tanzania, the blood donation process faces significant challenges, marked by outdated outreach methods leading to limited donor engagement, ineffective awareness campaigns, forced replacement practices, inefficient manual data collection, and a lack of permanence in the donor pool. These obstacles underscore the pressing need for a transformative solution to modernize the system, improve donor participation, and establish a more efficient and sustainable blood donation framework in the country.

1.3. Objective

1.3.1. Main Objectives

To streamline the blood donation process in Tanzania through a digital application, enabling donors and blood donation centers to register, track the progress and history of donors, and recognize permanent donors.

1.3.2. Specific Objectives

1. Gathering and analyzing the requirements for the system
2. Design the user interface (UI)
3. Implement features that will be helpful to users with different purposes.
4. To establish smooth integration between user interface and API to ensure quick data flow.

1.4. Significance of the Project

The significance of this project lies in its potential to revolutionize blood testing and results management, contributing to more effective patient care. By addressing the identified challenges, we aim to enhance the overall efficiency of healthcare systems and improve health outcomes.

1.5. Project Scope

The scope of the Tanzania Blood Donors app project encompasses the development and implementation of a comprehensive digital platform designed to revolutionize the blood donation process in Tanzania. This initiative will involve creating user-friendly interfaces for both donors and healthcare organizations and automating the coordination of blood donation events

2.0 CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

The literature review delves into the examination of prevailing systems associated with blood donation, investigating their implementations, operational methods, utilized technologies, encountered challenges, and identified shortcomings. In this context, the chapter concentrates specifically on applications dedicated to blood donation systems.

2.2. Strengths of Existing website

Some blood donation website prioritizes a positive user experience by employing intuitive interfaces and straightforward navigation. This design approach makes it effortless for donors to access relevant information and schedule appointments. Additionally, many of these websites example (Donor, n.d.) Red Cross Blood donors website integrate real-time notifications, promptly alerting donors about urgent blood needs and encouraging immediate action.

2.3. Weaknesses of Existing website

Certain blood donation applications exhibit limitations in their functionality. For instance, some platforms lack essential features, such as donor history tracking, personalized recommendations, or confirmation of appointment scheduling. In terms of communication, inefficiencies in the channels between donors and blood centers are observed, resulting in missed opportunities and delays. Another critical concern is data security, where some applications may not implement robust measures to safeguard sensitive informationand also navigation is complex and bias for first time users.

2.4. Related Works

While numerous blood donation websites exist globally, some noteworthy examples include:

2.4.1 BloodLink

BloodLink is a notable blood donation website recognized for its impact in connecting donors with recipients globally. The purpose of blood links was to provide details about the accessibility of blood banks, hospitals when needed (CollossalHeallthPrivateLimited, n.d.)

Strengths and Contributions of BloodLink :

1. Global Donor Connectivity:

- BloodLink establishes a global network, connecting donors with recipients worldwide, ensuring a broader reach for blood donation assistance.
- The app facilitates communication and coordination in emergency situations, providing timely assistance.

2. Accessibility and User Engagement:

- BloodLink prioritizes user accessibility with an intuitive interface, making it easy for donors to navigate and contribute.
- Engaging features encourage regular participation, fostering a sense of community among users.

Gaps and Future Directions:

- While BloodLink excels globally, there is room for adapting the app to regional contexts.
- Creating Tanzania blood donor's app to suit the local needs and preferences could enhance effectiveness within the Tanzanian context.

2.4.2 Red Cross Blood Donor Website

The Red Cross Blood Donor Website is a widely recognized website used in various countries for blood donation scheduling and information. (Red Cross, n.d.)

Strengths and Contributions of Red Cross Blood Donor Website:

1. Established Reputation:

- The Red Cross website is backed by the reputation of the Red Cross organization, instilling trust and credibility among users.
- It serves as a reliable platform for blood donation information and appointment scheduling.

2. Global Reach:

- The website operates in multiple countries, ensuring a wide geographical reach for blood donation efforts.
- Its integration with the global Red Cross network enhances its impact on a larger scale.

Gaps and Future Directions:

- Customizing the website to meet the specific needs and preferences of users in Tanzania could further enhance its effectiveness.
- Addressing language and cultural considerations can improve the overall user experience in the Tanzanian context.

2.5. Project Gap

While existing blood donation websites offer various functionalities, they often fall short in addressing certain critical aspects of the blood donation process. This project aims to bridge these gaps and provide a more comprehensive and efficient solution through the development of the Blood Donation web application.

1. Limited Accessibility:

2. Inefficient Communication:

3. Limited Features and Personalization:

4. Data Security Concerns:

Bridging the Gap - The Blood Donation web application: The proposed Blood Donation web Application addresses these identified gaps by offering:

- Interactive map: A user-friendly map displaying nearby blood centres with detailed information, including operating hours, contact details, and available blood types.
- Real-time notifications: Instant alerts for urgent blood needs based on the donor's location and blood type.
- Comprehensive donor dashboard: A central hub for tracking blood donation history, accessing personalized recommendations for future donations, and managing appointments.
- Robust data security measures: Employing industry-standard encryption and data protection protocols to safeguard sensitive information.

By addressing these critical gaps and offering a user-friendly and feature-rich platform, the Blood Donation Mobile App aims to significantly enhance the blood donation experience for both donors and blood centers.

3.0 CHAPTER THREE

METHODOLOGY

3.1. Project Overview

Methodology is a standard process followed by an organizational to conduct all steps necessary to analyze, design, implement and maintain information system. These steps are done in ascending order so as to ensure proper work is done on the required task. In implementing the web and mobile application for Blood Donors App, the chosen methodology is Agile Methodology, which is a project management framework that break project down into several dynamic phase known as sprint. So, this method was chosen because was a project management approach that involves breaking the project into phases and emphasized continuous collaboration and improvement. So, it uses feedback loops and test-driven development to solve problem. Agile include the following steps which are requirement, design, develop, test, release and feedback.

3.2. Requirements Collection

Requirement gathering involve identifying the project's exact requirements from start to finish. This process occurs at initiation phase, but it will continue to manage the project requirement throughout the project timeline. The method will be used to gather information is interviews with a list of prepared questions which will be answered by blood donors and blood centers.

3.3. Requirement Analysis

In this stage, from the requirements gathered in the previous stage, functional and non-functional requirements will be identified. Functional requirement defines how the system must work and non-functional requirement detail how the system should perform, So it refine requirements in short sprints, allowing for continuous adaptation to user feedback and changing needs

Functional Requirements

1. The system must enable user registration.
2. The system should enable the user to log in

3. The system should enable users to search for donors and blood centers, also to retrieve relevant information.
4. Blood group identification; The system must identify the blood group of donors after blood testing.
5. Tracking of blood donors' history; The system should display a donor history
6. The system should record and maintain an up-to-date inventory of available blood.

Non Functional Requirements

1. Usability:

The application must have a user-friendly interface that is easy to navigate for blood center staffs.

2. Performance:

The system should respond to user actions within 2 seconds.

3. Reliability:

The system should have an uptime of 99.9%, ensuring it is available and operational at all times.

4. Scalability:

The application should be scalable to accommodate future increases in the number of users and data volume.

5. Security:

Implement strong authentication and authorization mechanisms to protect user data.

6. Compatibility:

The application should be compatible with major web browsers .

3.4. System Design

The Tanzania Blood Donors app represents a pioneering solution to transform and modernize the blood donation process in Tanzania. It delves into the comprehensive system design that underpins the functionality and architecture of the application. With the overarching goal of enhancing efficiency, accessibility, and sustainability, the design intricacies encompass the user interface, application logic, and backend infrastructure. This chapter unfolds the thought process and considerations that have informed the creation of an intuitive, user-centric design. Systems design is the process of defining the architecture, components, modules, interfaces, and data for a

system to satisfy specified requirements. Systems design could be seen as the application of systems theory to product development. There is some overlap with the disciplines of systems analysis, systems architecture and systems engineering. High level design identifying the system processes, functional components and their interfaces. Derived from system requirements, provides an overview of the project (Jawale, 2016).

3.5. System Implementation

System implementation uses the structure created during design and result of system analysis to develop the system that meet the stakeholder and system requirements. it involves coding so the mobile application will be implemented by React Native and for web is React.js, for backend will be Node.js, Express.js, MongoDB also for database MongoDB.

3.6. Project Management

Effective project management is the lifeblood of the Tanzania Blood Donors App's success. To orchestrate this vital process, we leverage GitHub, a dynamic platform for software development and version control. GitHub allows developers to store and manage their code, fostering a collaborative environment where developers can contribute, review, and refine the code collectively from anywhere.

GitHub's capabilities in collaboration and version control are crucial. It provides a real-time window into the progress, ensuring crystal-clear visibility of individual responsibilities and overall development status. The integration of pull requests, commits, and code issue tracking ensures that the status of development is transparent to all stakeholders.

By leveraging GitHub and maintaining open communication through regular meetings, we aim to create a cohesive and efficient development process, empowering our team to deliver a successful Tanzania Blood Donors App.

4.0 CHAPTER FOUR

SYSTEM DESIGN

4.1 Introduction

This chapter delves into the comprehensive system design that underpins the functionality and architecture of the application. With the overarching goal of enhancing efficiency, accessibility, and sustainability, the design intricacies encompass the user interface, application logic, and backend infrastructure. This chapter unfolds the thought process and considerations that have informed the creation of an intuitive, user-centric design. Systems design is the process of defining the architecture, components, modules, interfaces, and data for a system to satisfy specified requirements. Systems design could be seen as the application of systems theory to product development.

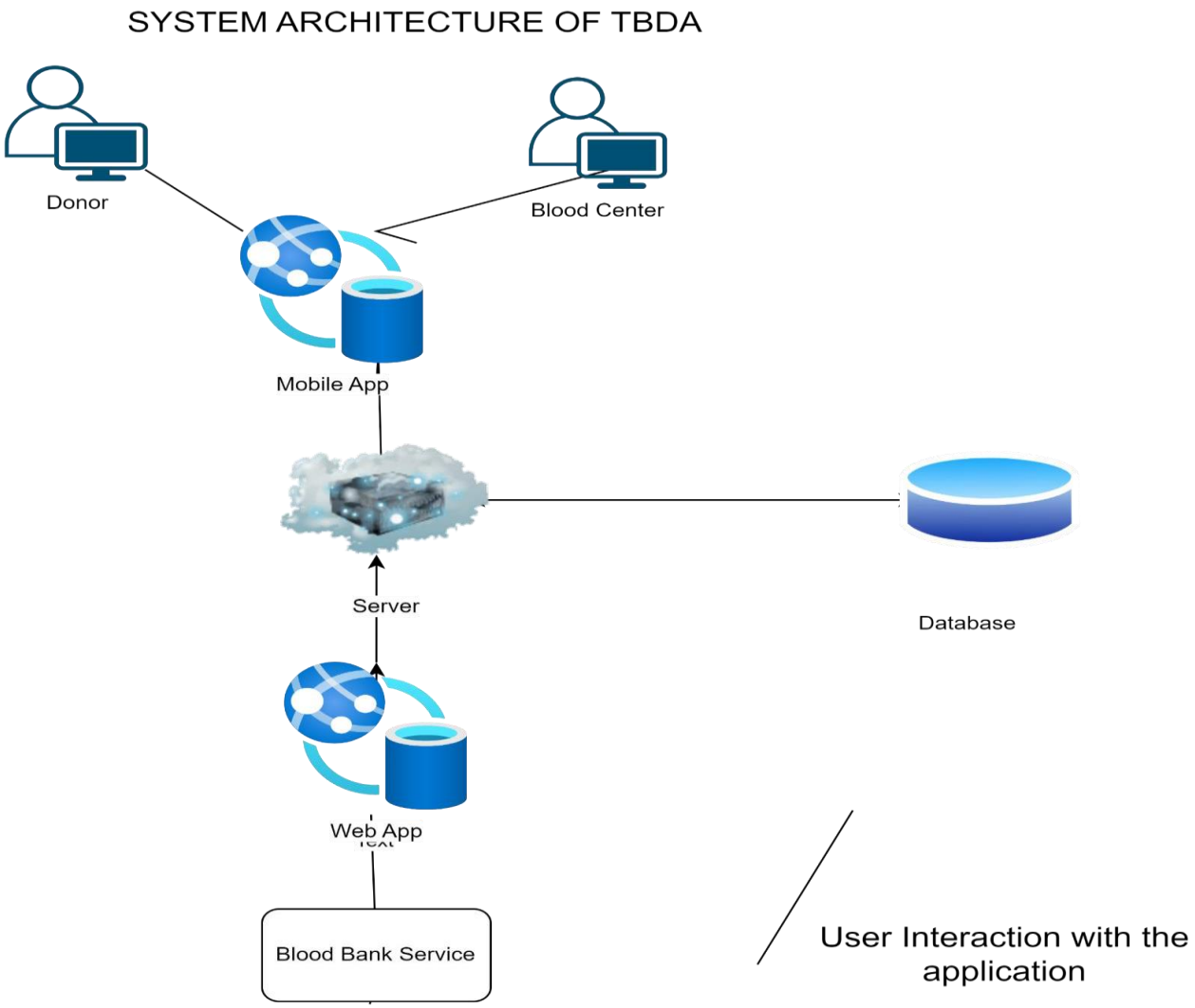
A formal exploration of user needs, system functionalities, and constraints, this section outlines the essential criteria that steer the design journey. Some functional requirements are;

- The system must enable user registration.
- The system should enable user to log in
- The system should enable users to search for donors and blood centers, also to retrieve relevant information.
- Tracking of blood donors' history; The system should display a donor history
- The system should send notifications to users for updates, reminders, or promotional content.
- The system should record and maintain an up-to-date inventory of available blood.

The Tanzania Blood Donors app must ensure timeliness in uploading testing results, efficient performance under varying loads, reliable storage and retrieval of donor history, utmost privacy and confidentiality in handling donor information, scalability to handle increasing user and data volumes, robust security measures to protect user data, uninterrupted availability to users, and an intuitive and user-friendly interface.

4.2 System Architecture

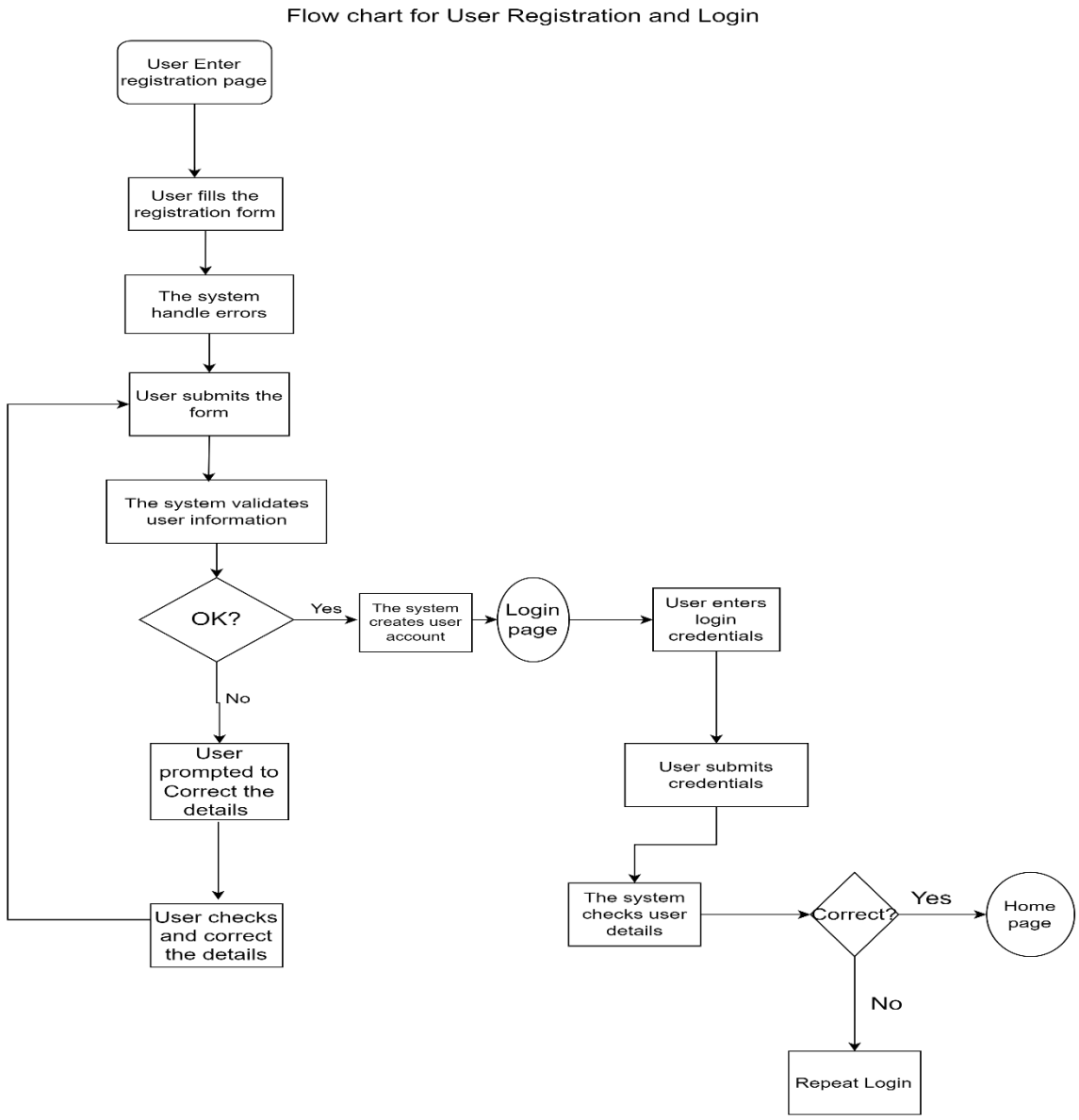
At the core of the Tanzania Blood Donors app lies a thoughtfully designed system architecture, meticulously crafted to facilitate seamless communication and collaboration among its essential components. Orchestrated by a robust server, the architecture ensures efficient interactions with the database, blood bank service, web app, and mobile app. The web and mobile interfaces serve as key channels, extending the app's reach to its primary users—donors and blood centers. Aligned with principles from the American Journal of Engineering Research, the architecture comprehensively defines the system's structure, behavior, and relationships, prioritizing reliability and privacy. Figure 1; Showing the system architecture for Tanzania blood donors app



4.3 Flowchart Diagram

A flowchart is a picture of the separate steps of a process in sequential order. It is a visual representation of the sequential steps within the Tanzania Blood Donors app, illustrating the systematic process involved in facilitating efficient blood donation. This versatile tool, one of the seven basic quality tools, is adapted to describe the various components of the application's functionality.

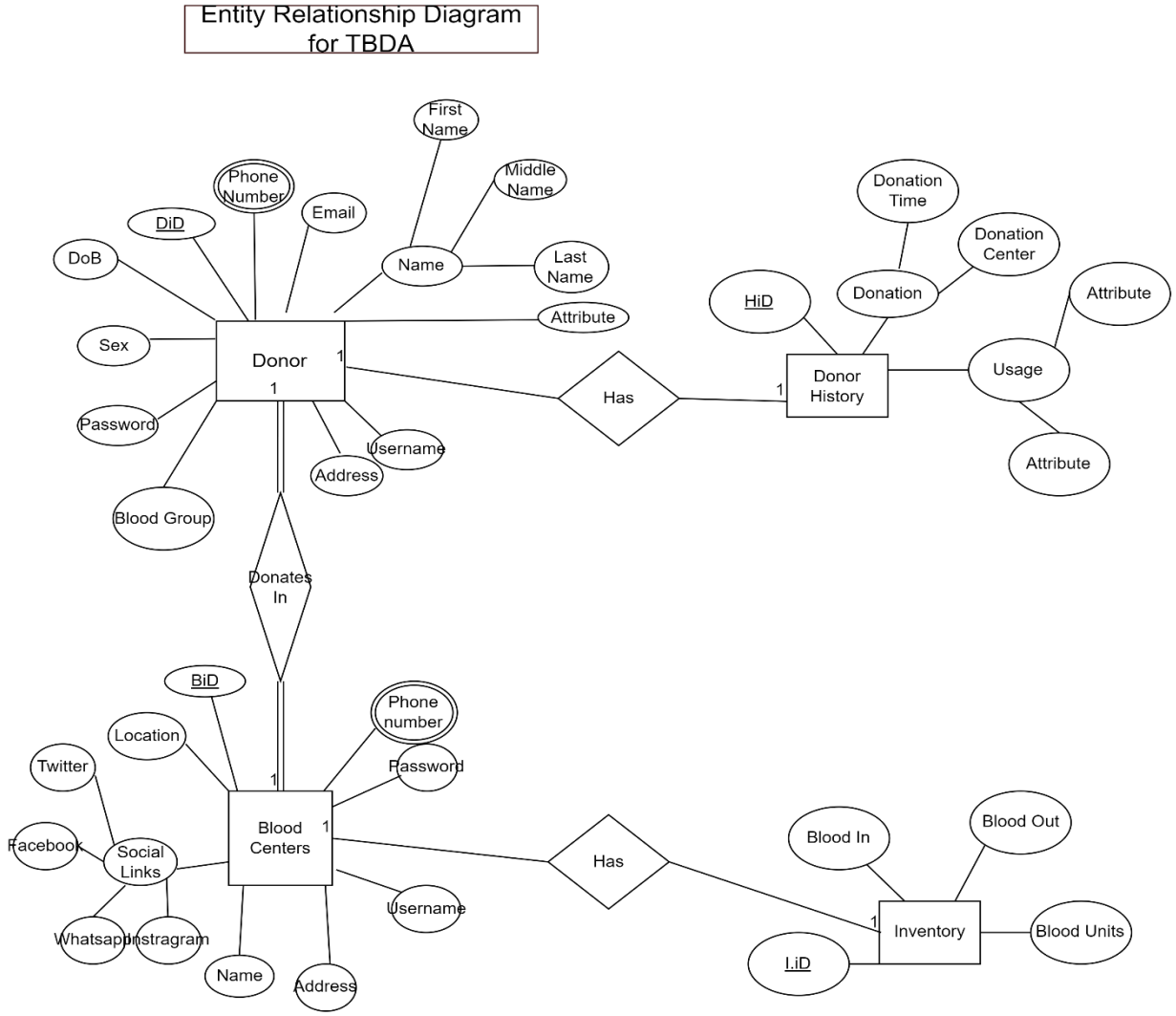
Figure 2: The Flow chart for User registration and Login



4.4 Entity Relationship Diagram

An Entity Relationship (ER) Diagram is a specialized form of a flowchart designed to visually articulate the relationships and connections between entities within the Tanzania Blood Donors app. In this context, entities encompass crucial elements such as donors, blood donation events, and user interactions, shedding light on how these components interrelate within the system..

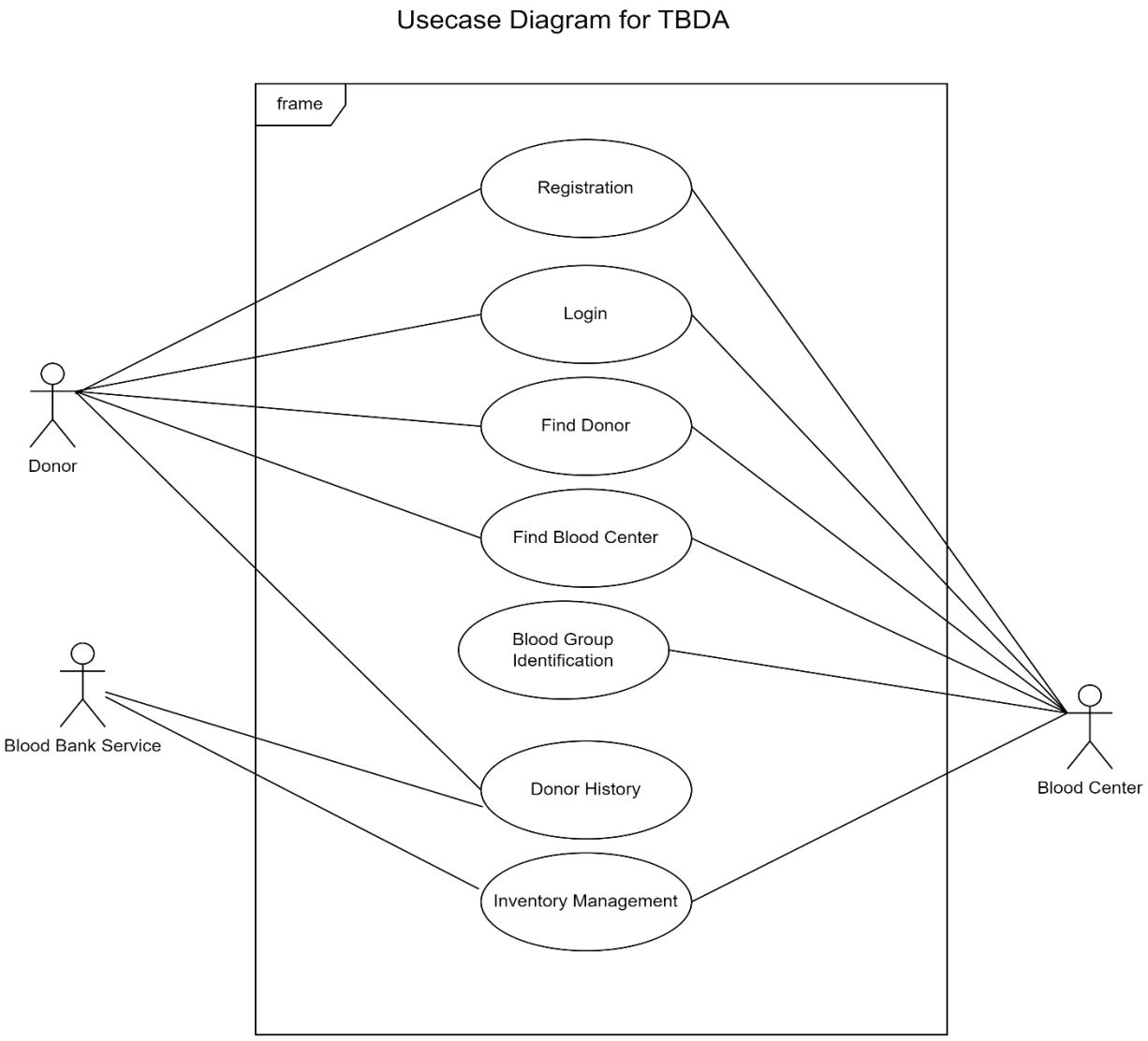
Figure 3 Below: The entity relationship diagram for Tanzania blood donors app



4.5 Use Case Diagram

Use Case Diagram becomes a pivotal visual representation for the Tanzania Blood Donors app, encapsulating the intricate interactions between users (actors) and the system. Employing specialized symbols and connectors, this diagram unfolds scenarios wherein the application seamlessly engages with donors, healthcare professionals, and administrators. The diagram aims to outline the diverse goals achieved by the app, from facilitating blood donations to providing essential information. Aided by the diagram for use cases for the Tanzania blood donors app.

Figure 4: Use case diagram for Tanzania blood donors app



4.6 Sequence Diagram

Sequence diagrams serve as crucial tools in unraveling the intricacies of cooperative objects within the Tanzania Blood Donors app's use case scenarios. These diagrams, depicted below, illuminate the dynamic interactions between actors and the sequential flow of events within each module of the application. By illustrating how messages are exchanged among various objects, sequence diagrams become instrumental in understanding the orchestration of actions, depicting the order and arrangement of events

Figure 5: the sequence diagram for User Login for Tanzania blood donors app

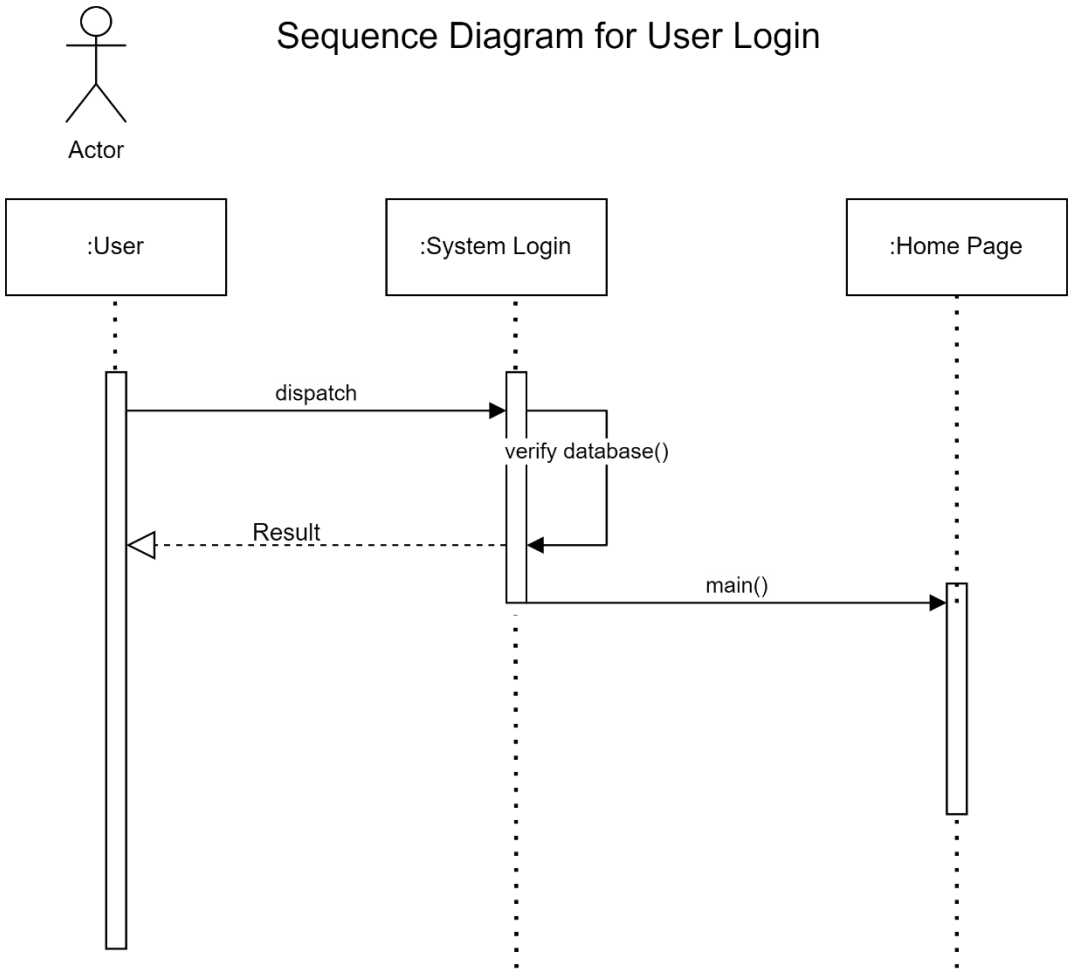
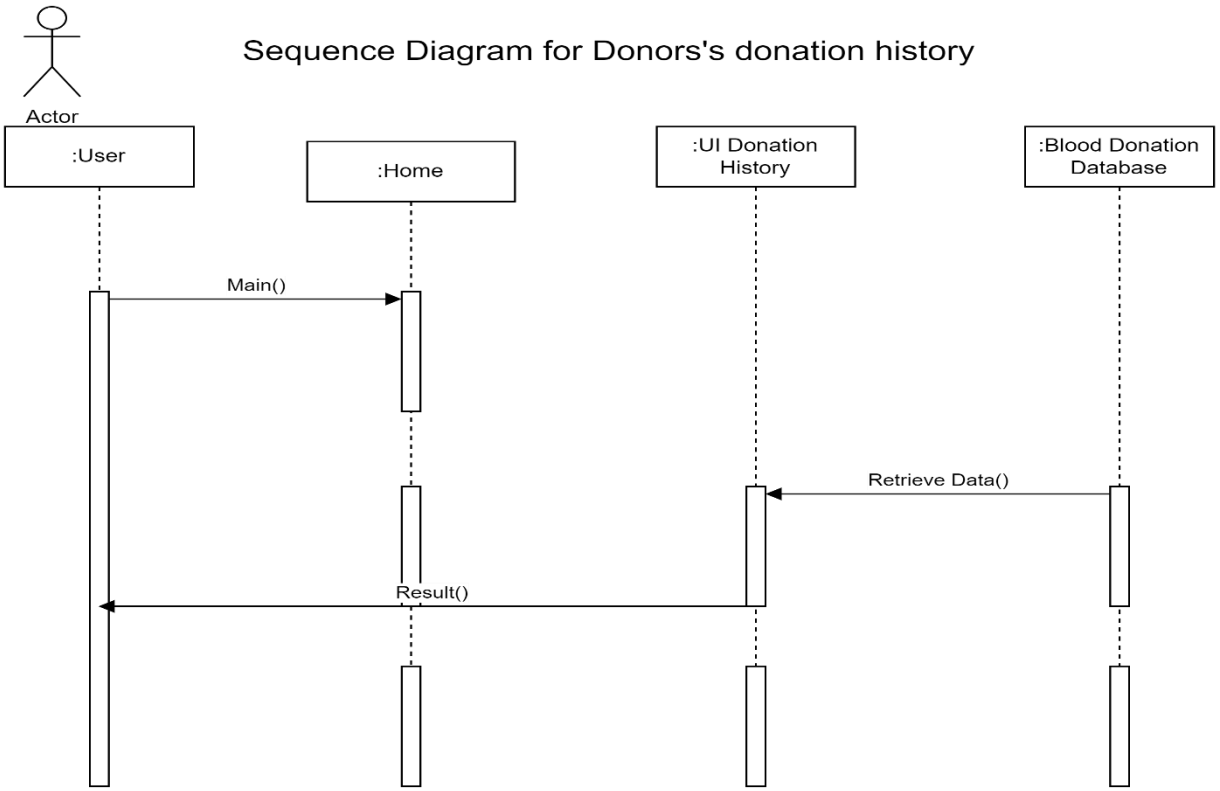


Figure 6: the sequence diagram for Donors' donation history



5.0 CHAPTER FIVE
STSYTEM IMPLEMENTATION

5.1 Introduction

This chapter describes the implementation and evaluation process for the mobile application of Tanzania blood donors app. So, all the processes that were conducted towards implementing the mobile application are fully described here, including the development environment and database used.

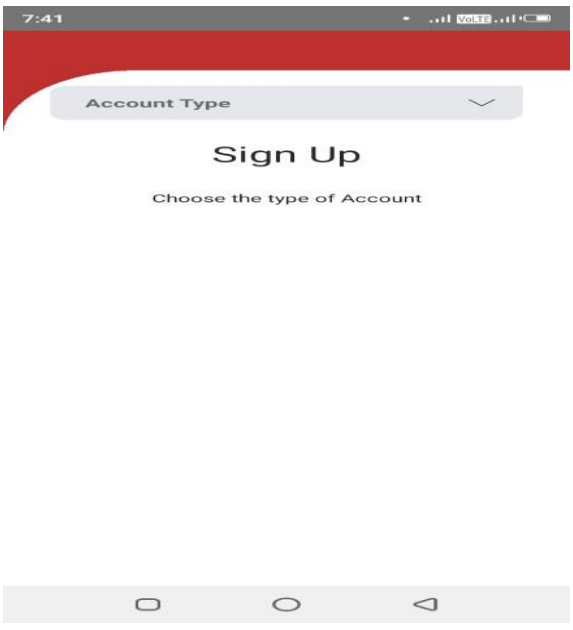
5.2 Mobile Application Interfaces

This refers to all the screens which the user (customer) will interact with when using this application. It is designed to ensure that all activities that the user wants to achieve in the application are met without fail.

5.2.1 Registration Page

In this page it contains list of fields that the blood center and donor will input data into and submit to the system. User fills fields like First name, age, last name, surname, etc.

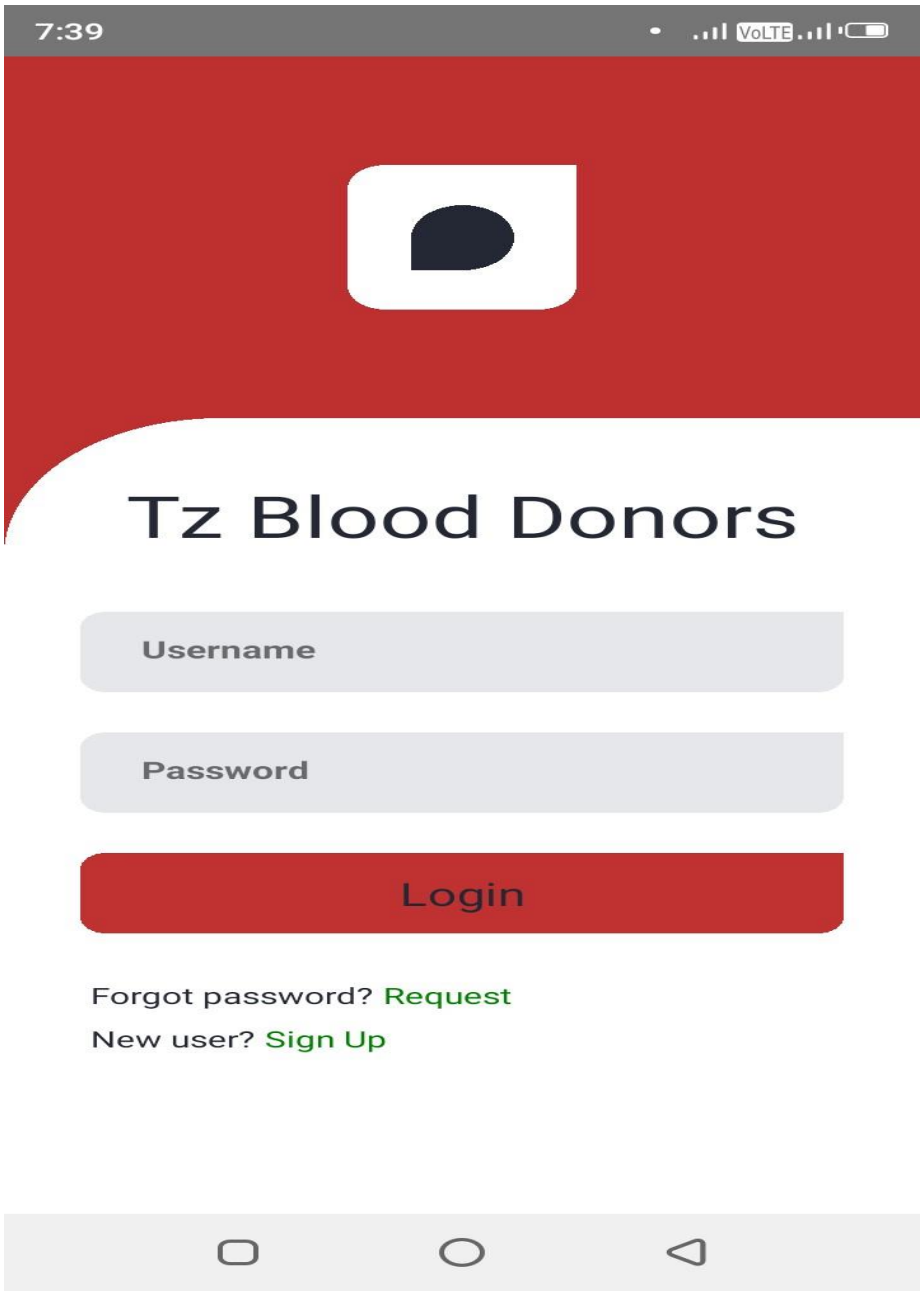
Figure 7; The Registration Page



5.2.2 Login Page

The first screen that the blood center and donors come across with after interacting with our app is the login page in which he or she is supposed to enter login credentials so as to be able to see the functionalities provided by our app.

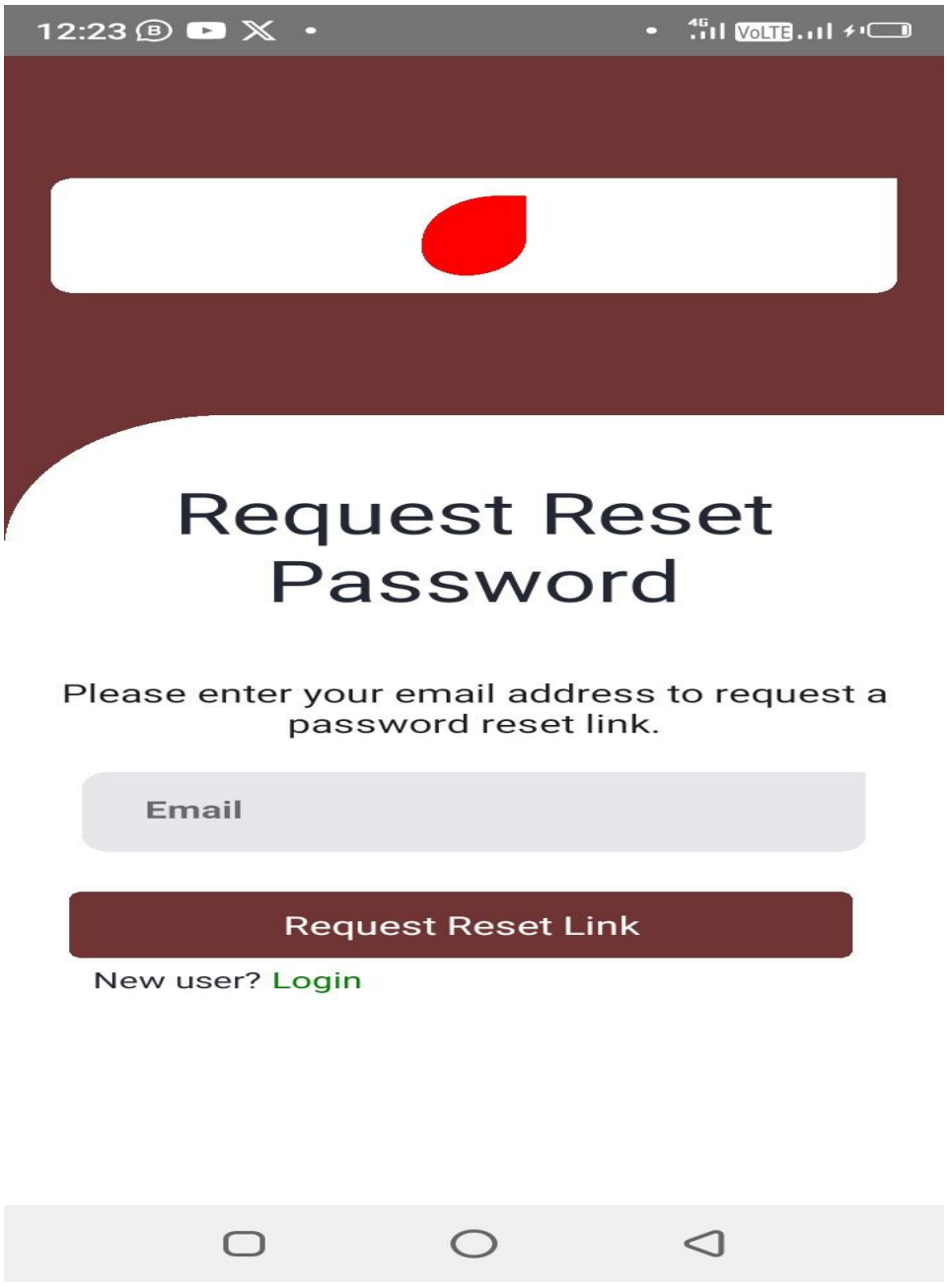
Figure 8; The Login Page



5.2.3 Request reset password

This page allows blood center who have forgotten their passwords to initiate a password reset process. Upon selecting this option, users typically receive an email or SMS containing a unique link or temporary password, enabling them to reset their password securely.

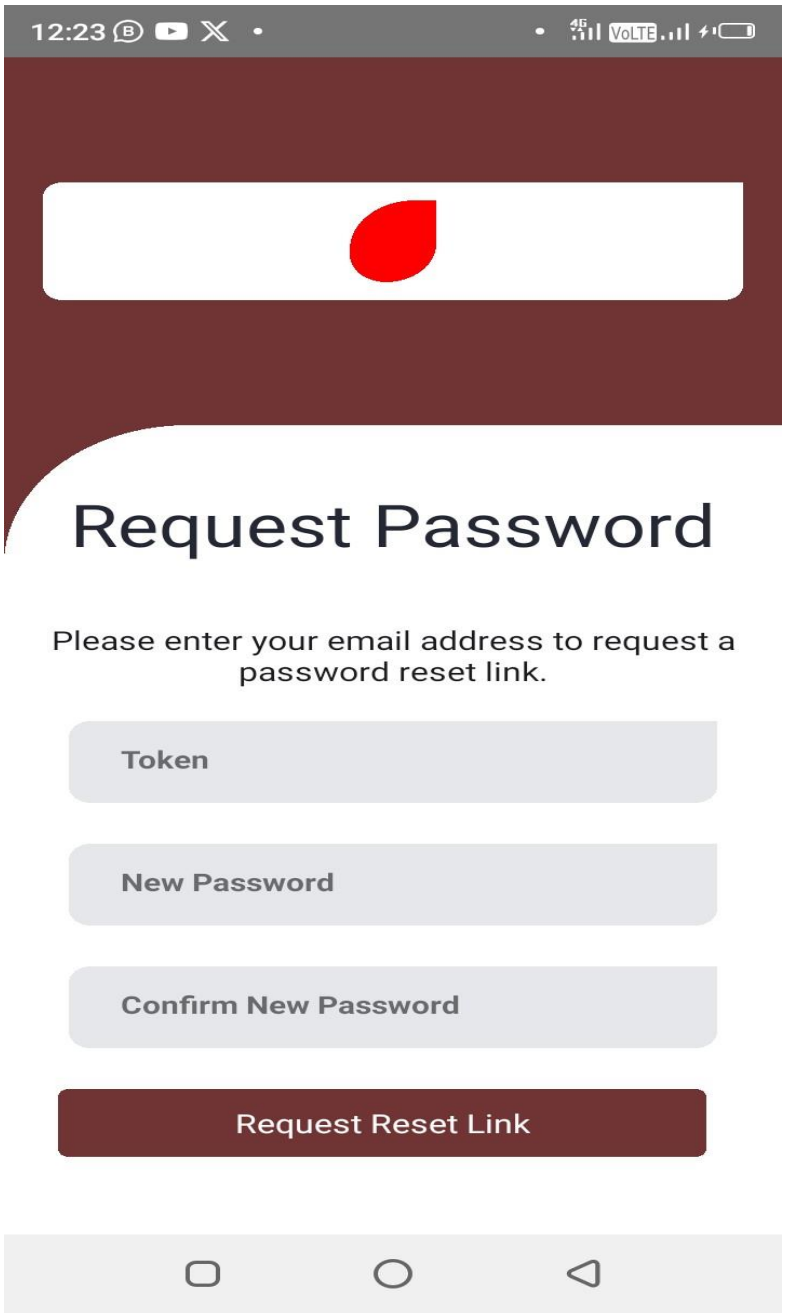
Figure 9; The Request reset password page



5.2.4 Reset password page

the password reset page provides your blood center with a way to change their passwords if they cannot log in. It allows users to regain access to their accounts if they have forgotten their passwords.

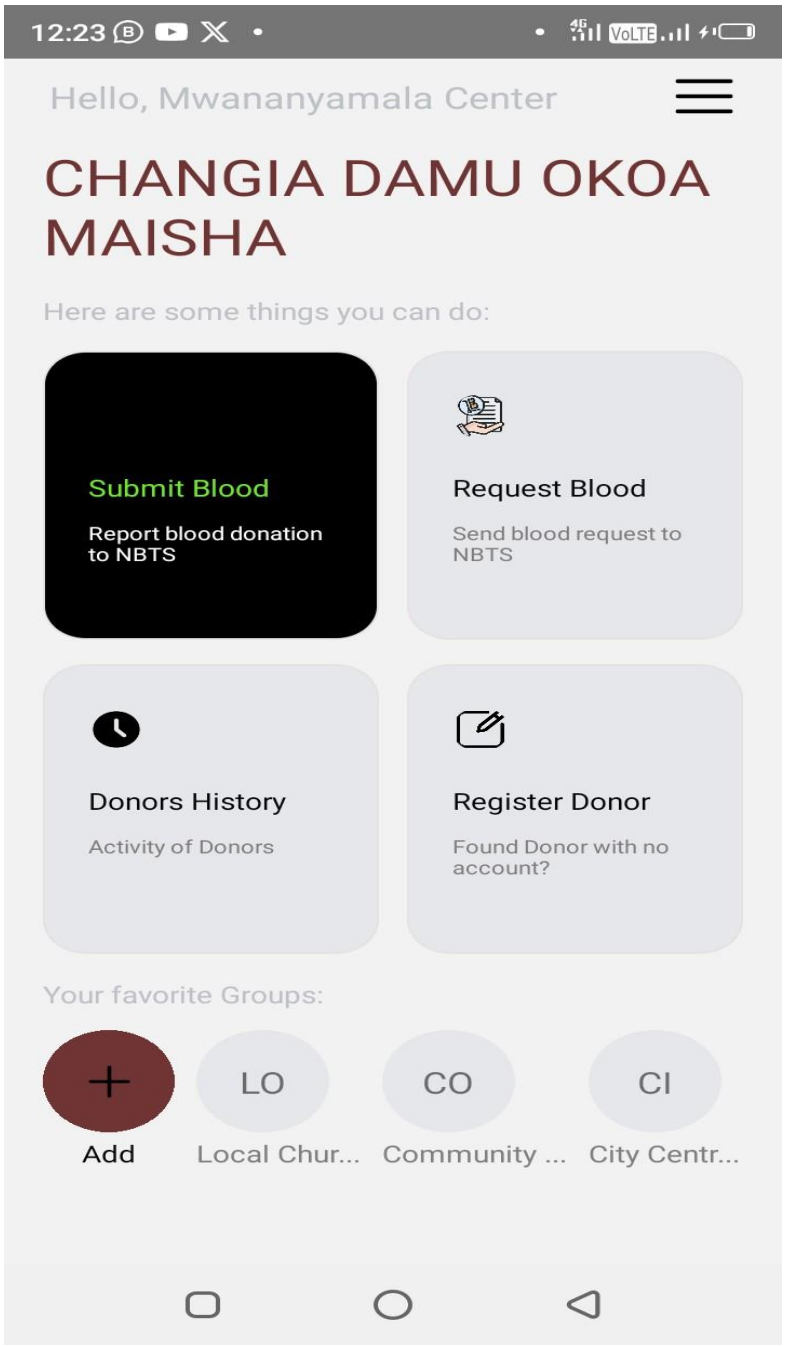
Figure 10; The Reset password page



5.2.5 Home Page

After the blood center completes login, comes across the App dashboard which displays components that the app provides information. In this page is where users can access essential features and information.

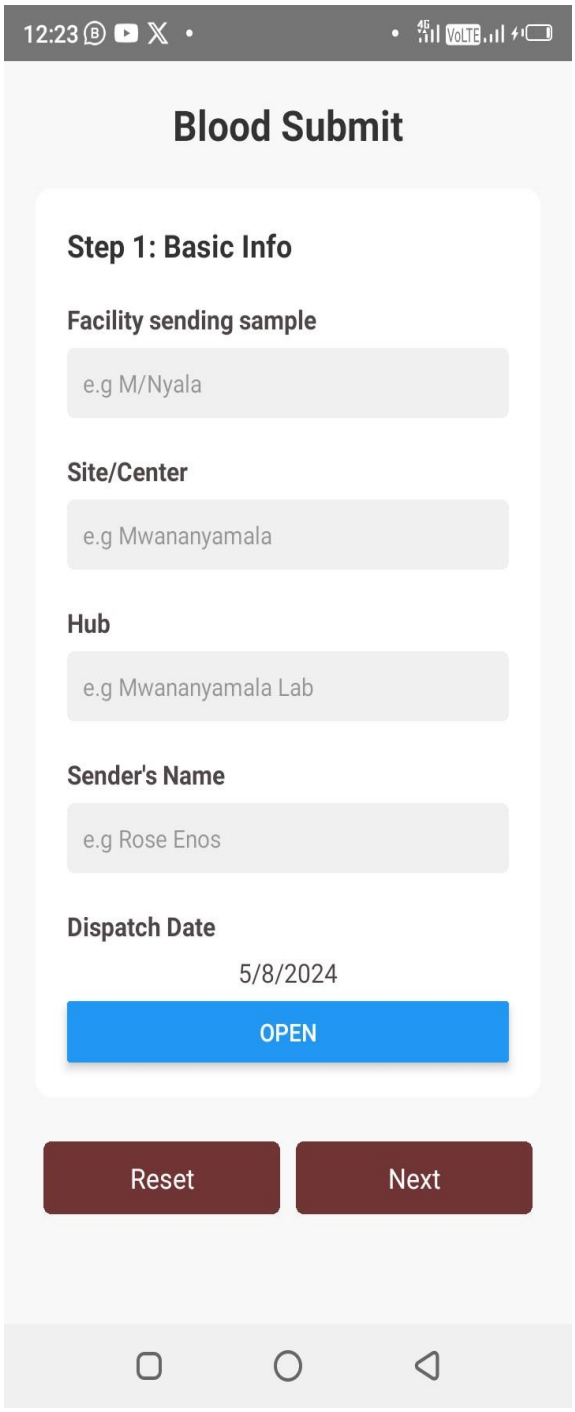
Figure 11; The Home Page



5.2.6 Submit blood page

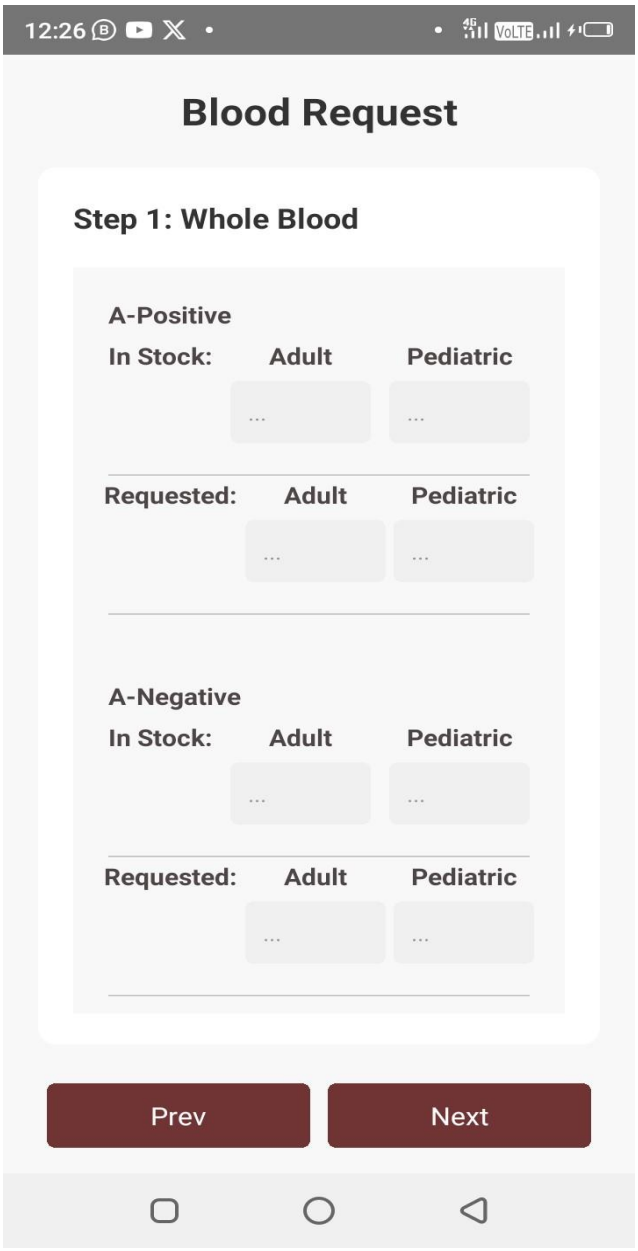
When a blood center submits their information on the blood, the system verifies the data, confirms the submission.

Figure 12; The Submit blood page



5.2.7 Request blood page

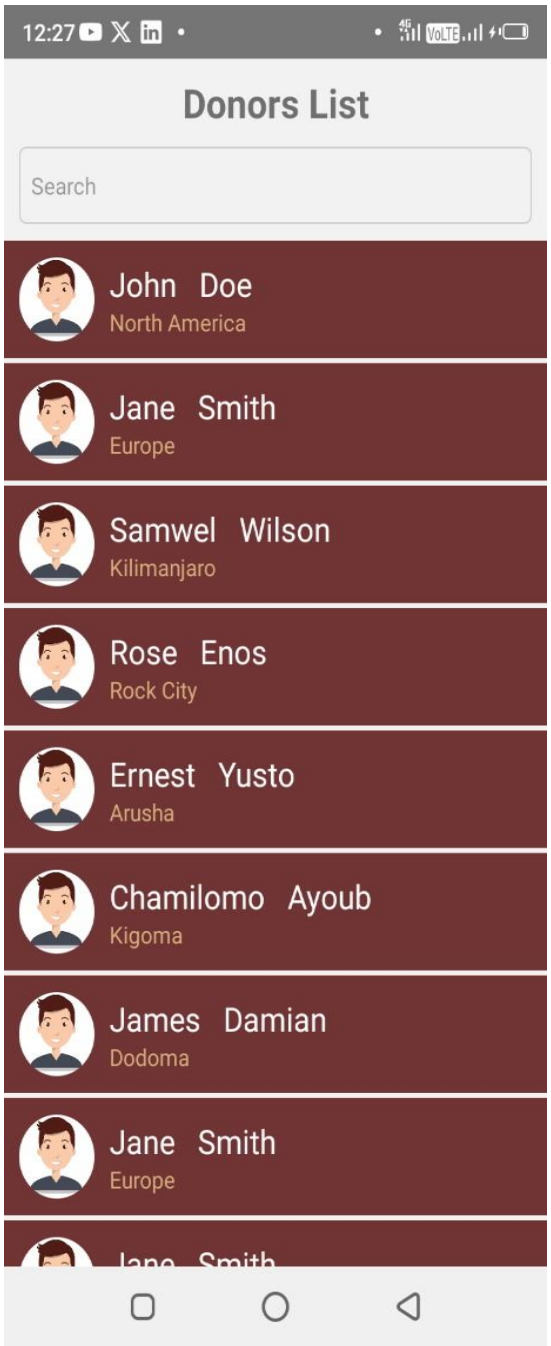
This page enables blood center to request blood units for recipients in need, Users provide recipient details, blood type requirements, quantity needed, and urgency of the request. Figure 13; The Request blood page



5.2.8 Donor history page

In this page it provides a comprehensive record of a donor's past donations and relevant medical history.

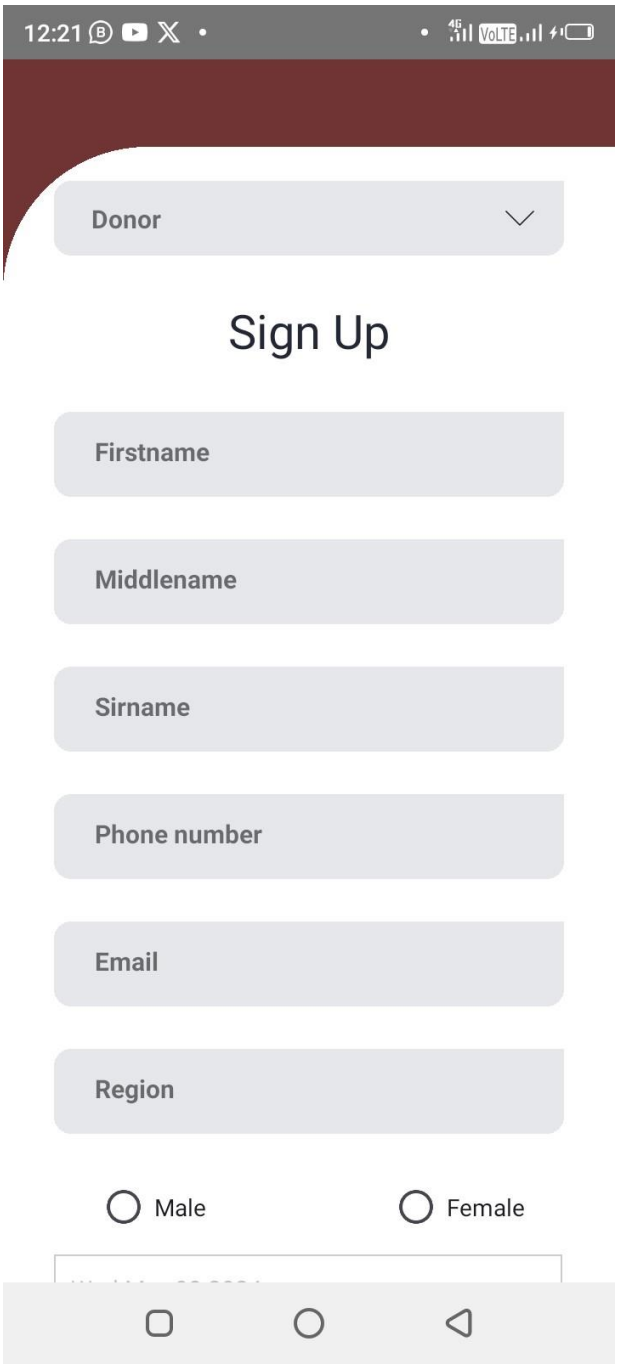
Figure 14; The Donor history page



5.2.9 Register donor page

In this page it serves as the initial step for individuals who want to become blood donors, hence they fill a form containing fields about the particular individual.

Figure 15; The Register donor page



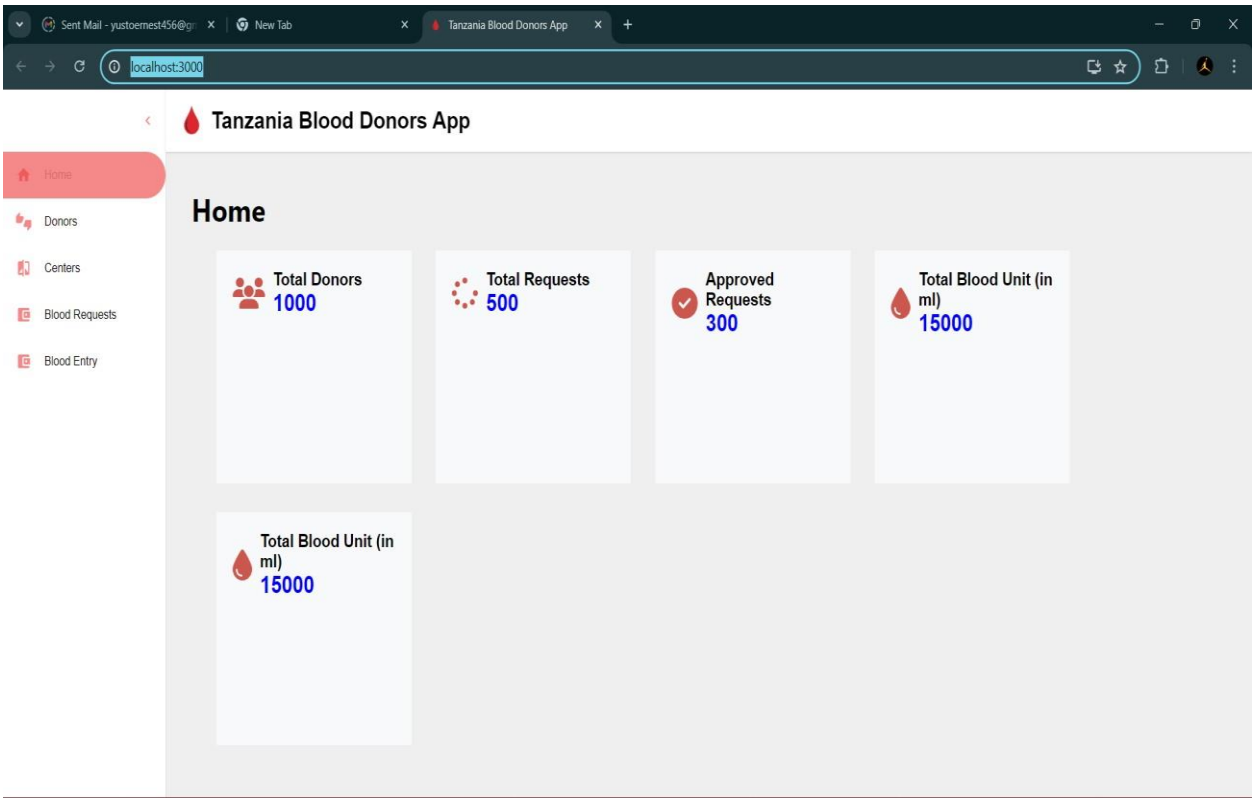
5.3 Web admin Interfaces

This refers to all the screens which the administrators will interact with when using this website. It provides a centralized platform for administrators to manage various aspects of a blood donation system efficiently.

5.3.1 Dashboard

The admin dashboard serves as a centralized part within a blood donor system, offering administrators an overview of key activities, and functionalities.

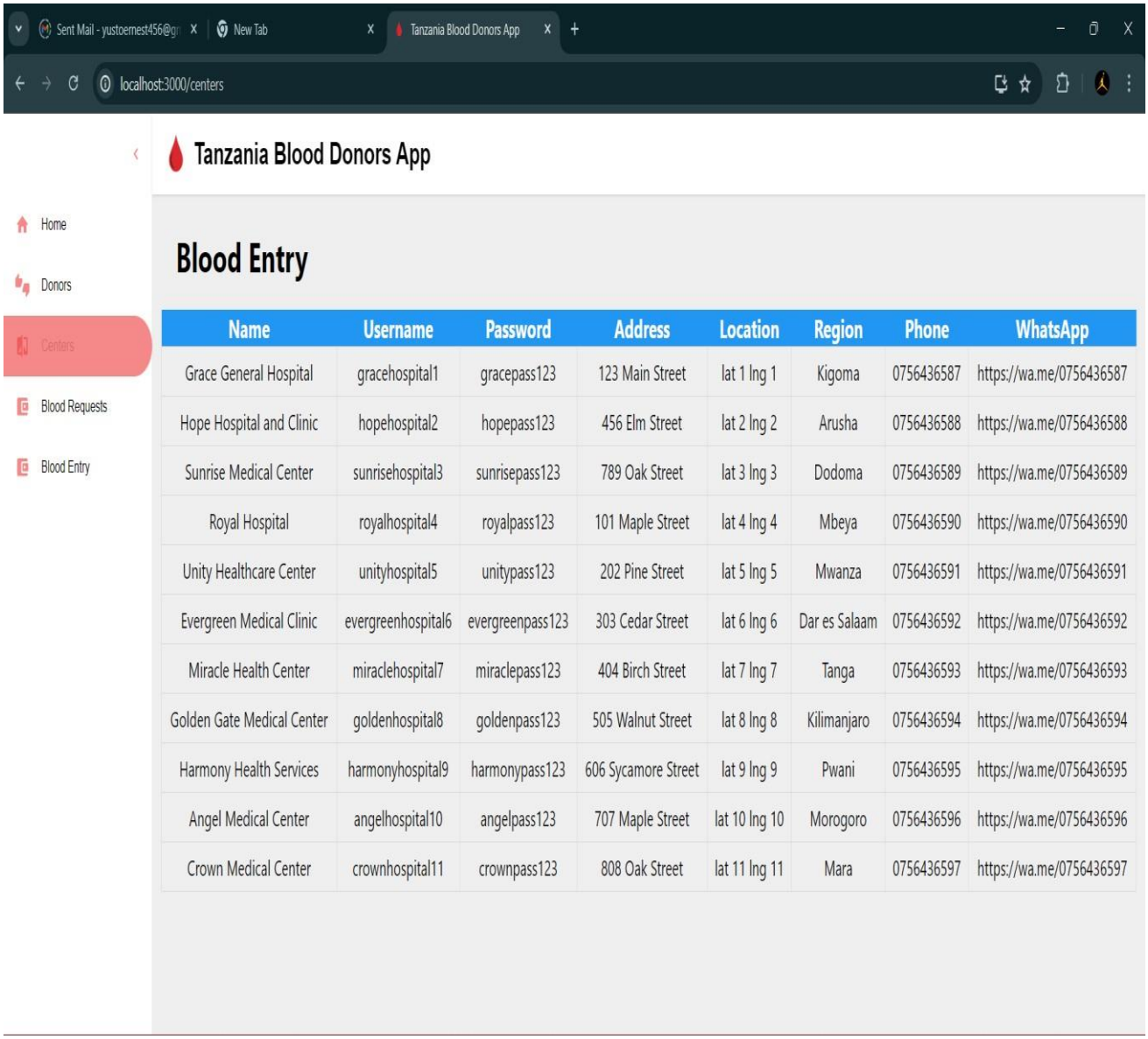
Figure 16; The Website Dashboard page



5.3.2 Blood entries

Blood entries for admin is a section within the blood system's administrative interface, providing administrators with a comprehensive view and management tools for blood-related data such as donor information, blood type, quantity donated, and donation date.

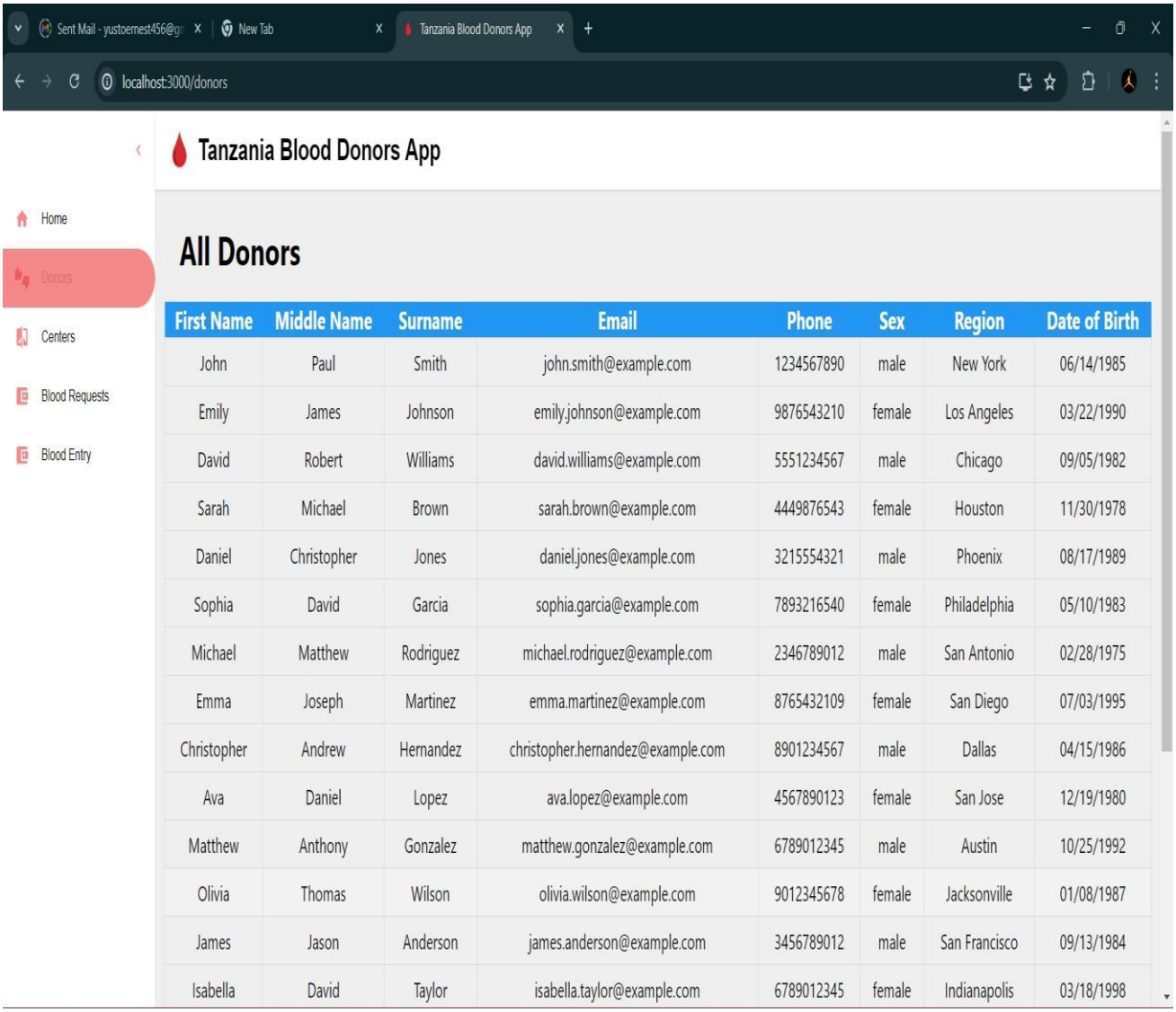
Figure 17; The Blood entries page



5.3.3 Blood donors

Administrators can access and review detailed donor profiles containing personal information, medical histories, and donation records. They can efficiently add new donors and update existing profiles.

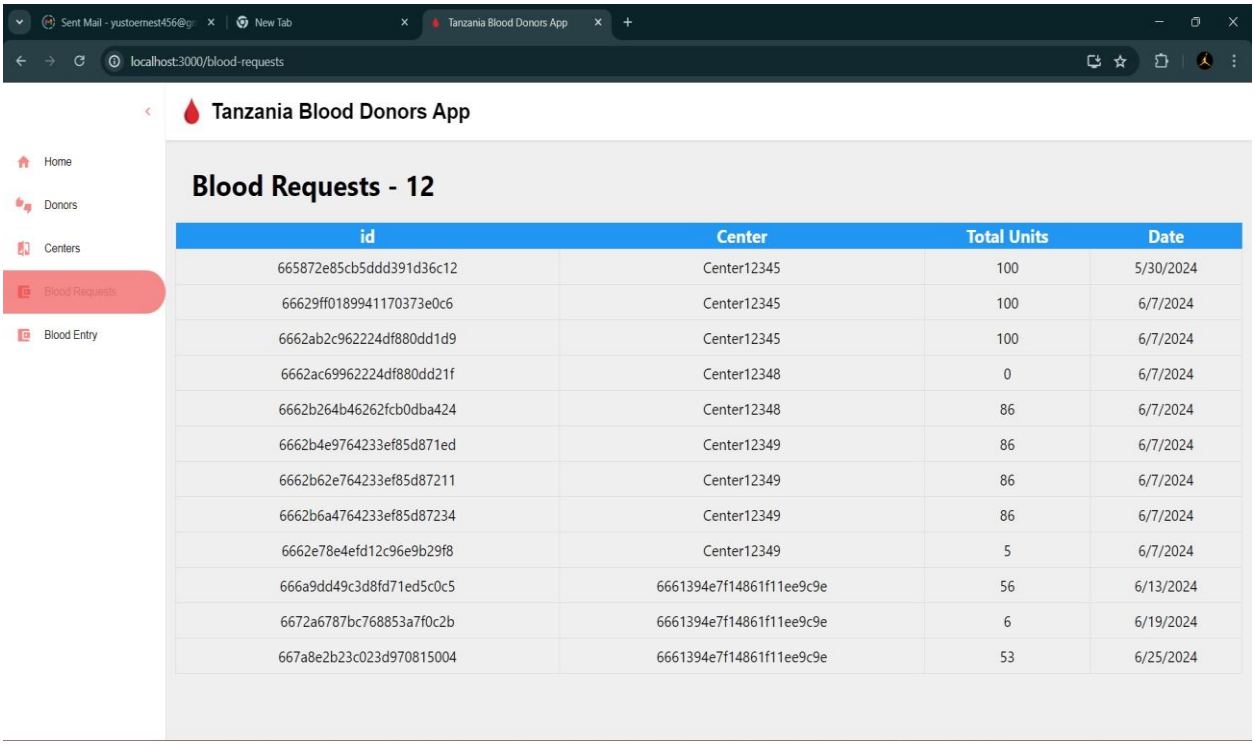
Figure 18; The Blood donors page



5.3.4 Blood Requests

Blood request system is responsible for managing blood requests, maintaining contact with blood centers and hospitals about requested blood and approve to be transported to the respective center or hospital requested the blood.

Figure 19; The Blood Requests page



5.4 Backend

The Tanzania Blood Donors App API is built using Node.js and Express.js framework, providing a robust foundation for creating RESTful APIs. MongoDB is chosen as the database, leveraging Mongoose for seamless interaction with the database through object modeling. This choice allows for flexibility in schema design and efficient data storage and retrieval. Express.js middleware such as Morgan and Body-parser are utilized for logging requests and parsing request bodies, respectively, enhancing the overall functionality and ease of development.

In terms of security, the API employs various measures to protect sensitive data and ensure secure communication. JSON Web Tokens (JWT) are utilized for authentication, providing a stateless mechanism for user identification. Endpoints requiring authentication are safeguarded by middleware that verifies the validity of JWT tokens included in request headers. Additionally, bcryptjs is used for hashing passwords, enhancing security by protecting user credentials stored

in the database. CORS headers are properly configured to restrict cross-origin requests, mitigating potential security risks associated with unauthorized access.

Figure 20; The Blood center routes

javascript Copy code

```javascript
const express = require('express');
const router = express.Router();
const { authenticateCenter } = require('../middleware/authenticate');
const BloodCenterController = require('../controllers/BloodCenterController');

// Get all blood centers (Requires authentication)
router.get('/', authenticateCenter, BloodCenterController.getAllBloodCenters);

// Register a new blood center
router.post('/register', BloodCenterController.registerBloodCenter);

module.exports = router;
```

CONCLUSION

In conclusion, the Tanzania Blood Donors App project represents a significant step towards modernizing and improving the blood donation process in Tanzania. The endeavor addresses the challenges inherent in the current manual and decentralized system by leveraging technology to streamline donor recruitment, enhance awareness campaigns, and establish a centralized platform for efficient data management. The comprehensive literature review highlighted both the strengths and weaknesses of existing blood donation applications globally, providing valuable insights for the design and development of the Tanzania Blood Donors App. The methodology employed, particularly the Agile methodology, facilitated a dynamic and iterative approach, allowing for continuous adaptation to user feedback and changing needs. The system design, including the architecture, flowchart, entity relationship diagram, use case diagram, and sequence diagram, offers a thorough understanding of the application's functionality and interactions. The project's significance lies in its potential to revolutionize blood donation practices, improve healthcare outcomes, and create a user-friendly platform that encourages donor participation. The comprehensive scope of the project encompasses user registration, donor history tracking, real-time updates on blood supply levels, and efficient communication through push notifications. Moving forward, effective project management tools such as Trello and GitHub ensure collaborative development and transparent progress tracking. The successful implementation of the Tanzania Blood Donors App holds the promise of significantly improving the accessibility, efficiency, and sustainability of the blood donation system in Tanzania, contributing to the advancement of healthcare services in the region.

Appendix

Sample Interview Questions

Questions for Blood Centers:

1. How does the current blood donation process operate in Tanzania?
2. Is there any existing digital platform for managing blood donations?
3. How long do donors typically wait for their results?
4. What are the main challenges you face in managing blood donations?
5. How do you track donor information and donation history?
6. What methods do you use to recruit new donors?
7. How is the inventory of blood supplies managed?
8. What safety measures are in place for blood collection and storage?
9. How do you communicate with donors and inform them about donation events?
10. What improvements would you like to see in the blood donation process?

Questions for Blood Donors:

1. How did you first hear about blood donation opportunities?
2. What motivates you to donate blood?
3. How often do you donate blood?
4. What is your experience with the current blood donation process?
5. Have you ever faced any issues or challenges when donating blood?
6. How do you receive your test results after donating blood?
7. How long do you usually wait for your test results?

Summary

Common Issues Identified:

1. Long waiting times for results.
2. Poor communication from blood centers.
3. Loss of donation cards, leading to disqualification.
4. Lack of online appointment scheduling.
5. Inconvenient donation timings.
6. Inefficient donation process.
7. Difficulty in finding donation locations.
8. Need for better follow-up on results.

Commonly Suggested Improvements:

1. Digital solution for tracking donations and donor information.
2. Faster result processing.
3. Better communication and follow-up from blood centers.
4. Online appointment scheduling.
5. Flexible donation timings.
6. Streamlined donation process.
7. Improved location information for donation centers.

These results highlight the need for a digital platform to manage blood donations, track donor information, and improve communication between donors and blood centers.

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