UNIVERSITY OF DAR ES SALAAM

COLLEGE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

IS335 / CS498: Final Year Project Report – Mid of Semester One

Project Title: TANZANIA BLOOD DONORS APP

Supervisor's Name: Mr Henry Mukama

Group Members

Student's Name	Registration Number	Course
ROSE JOHN ENOSI	2021-04-01727	BIT
YUSTO ERNEST	2021-04-01747	BIT
SAMWEL P WILSON	2021-04-12578	CS

TABLE OF CONTENTS

4.0 CHAPTER FOUR: SYSTEM DESIGN

Introduction

4.1   System Architecture

4.2   Flowchart Diagram

4.3   Entity Relationship Diagram

4.4   Use Case Diagram

4.5   Sequence Diagram

LIST OF ABBREVIATION

UDSM	University Of Dar es salaam
COICT	College Of Information and Communication Technology
TBDA	Tanzania Blood Donors App

List of Tables and Figures   Page

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 (Nabil, 2020). (Joshua, 2014) 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

1.1.   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 well-informed 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.

Figure 1: Showing the current blood donation process in Tanzania
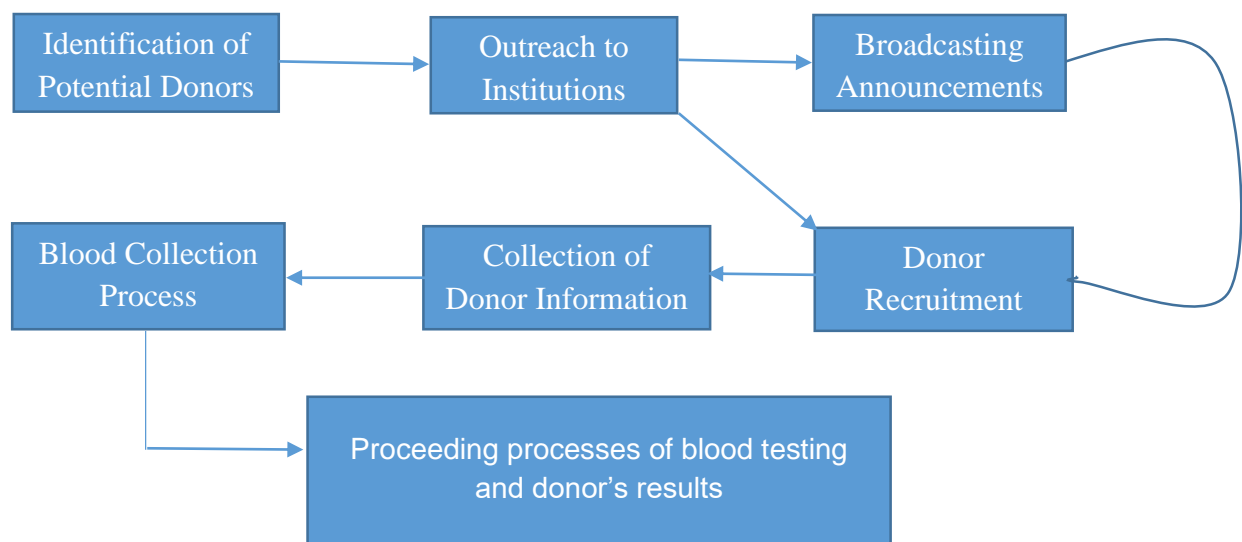
Forced Replacement
In case a patient gets blood and he or she has not donated before then relatives of patients who received blood are compelled to donate to replenish the supply.

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.   Objectives

1.3.0.   Main Objective

The main objective of the project is to streamline the blood donation process through an application in Tanzania. This includes enabling donors and blood donation centers to register, tracking the progress and history of donors, and recognizing permanent donors.

1.3.1.   Specific Objectives

      i. Design user friendly interface (UI)

      ii. Implement features and design elements that will be helpful to users with different levels of knowledge.

      iii. To optimize system performance to enable accurate and fast search for donors and blood centers

      iv. 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, facilitating efficient donor recruitment, and automating the coordination of blood donation events. The app aims to address the current challenges by providing real-time updates on blood supply levels, enhancing communication through push notifications, and establishing a centralized database for streamlined data management. The ultimate goal is to significantly improve the accessibility, efficiency, and sustainability of the blood donation system in Tanzania through the integration of modern technology and user-centric design.

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 Applications

Some blood donation applications prioritize 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 applications, like bloodlink integrate real-time notifications, promptly alerting donors about urgent blood needs and encouraging immediate action. Furthermore, several platforms feature interactive maps, providing detailed information about nearby blood centers to assist donors in locating convenient donation locations.

2.3. Weaknesses of Existing Applications

Certain blood donation applications exhibit limitations in their functionality. For instance, some platforms like Simply blood-Find blood donor application 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 information. This poses potential risks and raises apprehensions among users about the security of their data.

2.4   Related Works

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

1. BloodLinks

BloodLinks is a notable blood donation app recognized for its impact in connecting donors with recipients. People often encounter difficulty finding the right blood from the right blood. The purpose of blood links was to provide details about the accessibility of blood banks, hospitals when needed. (ColossalHealthPrivateLimited, 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.

- CreatingTanzania blood donors app to suit the local needs and preferences could enhance effectiveness within the Tanzanian context.

2. Red Cross Blood Donor App

The Red Cross Blood Donor App is a widely recognized application used in various countries for blood donation scheduling and information. Find local blood drives and donation centers quickly and easily right from the palm of your hand. The app makes scheduling and rescheduling appointments easy and convenient (AmericanRedCross, n.d.)

Strengths and Contributions:

1. Established Reputation:

   - The Red Cross app 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 app 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 app 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.

3. **Blood Donor (NHS)**

Blood Donor, developed by the National Health Service (NHS) in the United Kingdom, is recognized for its impact in local blood donation efforts.

Blood Donor Mobile enables blood banks to connect with donors anywhere in the world.

(BloodDonorMobile, n.d.) Strengths and Contributions:

1. Localized Support:

- Blood Donor caters specifically to the United Kingdom, providing a localized platform for blood donation efforts within the country.

- The app is aligned with the local health service, enhancing its credibility and trust

among users.

2. Appointment Management:

- Users in the UK can efficiently find local blood donation sessions, book appointments, and receive notifications, streamlining the entire donation process.

Gaps and Future Directions:

- For potential use in Tanzania, considerations should be made for localizing the app to align with Tanzanian health regulations and cultural expectations.

● Collaboration with Tanzanian health authorities and organizations can contribute to the app's successful integration into the local healthcare landscape.

4. **Oneblood**

OneBlood, a non-profit blood bank operating in several US states, has established itself as a leader in blood donation and transfusion services. This review examines OneBlood's innovative approaches and their impact on blood donation practices and patient care.

Strengths and Contributions of OneBlood:

● Enhanced Donor Experience: OneBlood utilizes user-friendly online platforms for scheduling appointments, accessing donor information, and providing educational resources. This convenience and accessibility significantly enhance the donor experience.

As evidenced from their website by writing the words, "Check out your OneBlood

Journey, a program that will notify you when your donation is on its way to a hospital." (oneblood, n.d.)

● Efficient Resource Management: OneBlood leverages technology and data analysis to optimize blood collection, processing, and distribution. This ensures efficient resource allocation and minimizes waste.

Gaps and Future Directions:

● OneBlood's services are primarily focused on specific US states, limiting its reach and impact on a wider world level. Exploring partnerships or expansion strategies could address this gap.

5. **Give Blood App**

Knowing your blood group is important. You can see your blood type on your donor card, or simply ask next time you give blood. (ScottishNationalBloodTransfusionService, 2024)

Strengths and Contributions of Give Blood App:

1. User-Friendly Platforms:

   • Give Blood App provides a seamless and user-friendly online platform for donors. The app allows users to easily schedule appointments, access donor information, and provides educational resources.

2. Donor Journey Program:

   • The app enhances the donor experience through innovative features like the "Donor Journey" program. This program notifies donors when their blood donation is on its way to a hospital, creating a sense of connection and impact.

3. Efficient Resource Management:

   • Similar to OneBlood, Give Blood App leverages technology and data analysis to optimize blood collection, processing, and distribution. This ensures efficient resource allocation, minimizing waste and enhancing overall operational effectiveness.

Gaps and Future Directions:

1. Limited Geographic Reach:

One of the significant limitations of the Give Blood App is its focus on a specific geographic area. The app's services are currently limited to certain regions, which may restrict its impact on a broader scale.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

Methodology is a standard process followed by an organizational to conduct all steps necessary to analyze, design, implement and maintain information system**Invalid source specified.**. These steps are done in ascending order so as to ensure proper work is done on the required task.

3.2 Methodology Applied

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 **Invalid source specified.**. 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 **Invalid source specified.**. Each iteration includes these components and once the release occurred that iteration is complete, and the next one is ready to begin.

3.3 Requirement Gathering

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 **Invalid source specified.**. 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.

3.4 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 **Invalid source specified.**, So it refine requirements in short sprints, allowing for continuous adaptation to user feedback and changing needs also prioritizing requirement based on their value and impact ensuring the most essential features are developed first and other requirement can be continuously refined and updated based on new information and feedback.

3.5   System Design

In this stage, It emphasize prototyping and designing system that can respond to changing requirement and user needs **Invalid source specified.**, This allow for quick feedback loops and adjustments to ensure the system design is efficient and user-friendly. So this will make collaboration between developers, designers and other stakeholder throughout the designing process leading to better understanding of user needs. Therefore it emphasize principles such as individuals and interactions over processes, tools and working software over comprehensive documentation that guiding system design towards collaboration and working solution**Invalid source specified.**.

3.6   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 **Invalid source specified.**, it involve 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.

3.7   Project Management
For the Tanzania Blood Donors App App to truly thrive, effective project management is the lifeblood. To orchestrate this vital process, we leverage Trello, a dynamic task tracking platform. Its intuitive interface provide a real time window in progress ensuring crystal-clear visibility of individual responsibilities and overall development status. A platform and cloud-based service for software development and version control, allowing developers to store and manage their code is GitHub**Invalid source specified.** where, Collaboration and version control are equally crucial seamlessly handled by GitHub. Its a code hosting platform for version control and collaboration, it lets team to work together on projects from anywhere. This foster open communication and a collaborative environment, empowering developers to contribute, review

and collectively refine the code. Developers and product managers rejoice because Trello now integrate with github, this means that tracking pull requests just got a lot smoother, and status of commits and code issue is now clear to everyone that needs to stay informed **Invalid source specified.**. While Trello and GitHub are powerful tools challenge remain bottleneck and potential discrepancies in task understanding emerged as areas for improvement. To address this, regular team meetings are scheduled to discuss project objectives, clarify doubts, and ensure everyone is aligned with the overall vision**.**

CHAPTER FOUR

SYSTEM DESIGN

The Tanzania Blood Donors app represents a pioneering solution to transform and modernize the blood donation process in Tanzania. 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. 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).

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.

❖ Blood group identification; The system must identify the blood group of donors after blood testing.

❖ 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, high accuracy in blood type establishment and infection testing, 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.

Below is the architecture diagram that visually represents the comprehensive design and interplay of components for the Tanzania Blood Donors app, showcasing the systematic structure and behavioral intricacies essential for its transformative role in revolutionizing blood donation practices

4.1 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. Notably, the system caters to emergency scenarios by providing direct access to crucial donor information, exemplifying its commitment to prompt and effective blood donation services in Tanzania and facilitates services like direct access to the site to get donor's information if there is an emergency. (K M Akkas Ali, 2015)

Figure 2: Showing the system architecture for Tanzania blood donors app
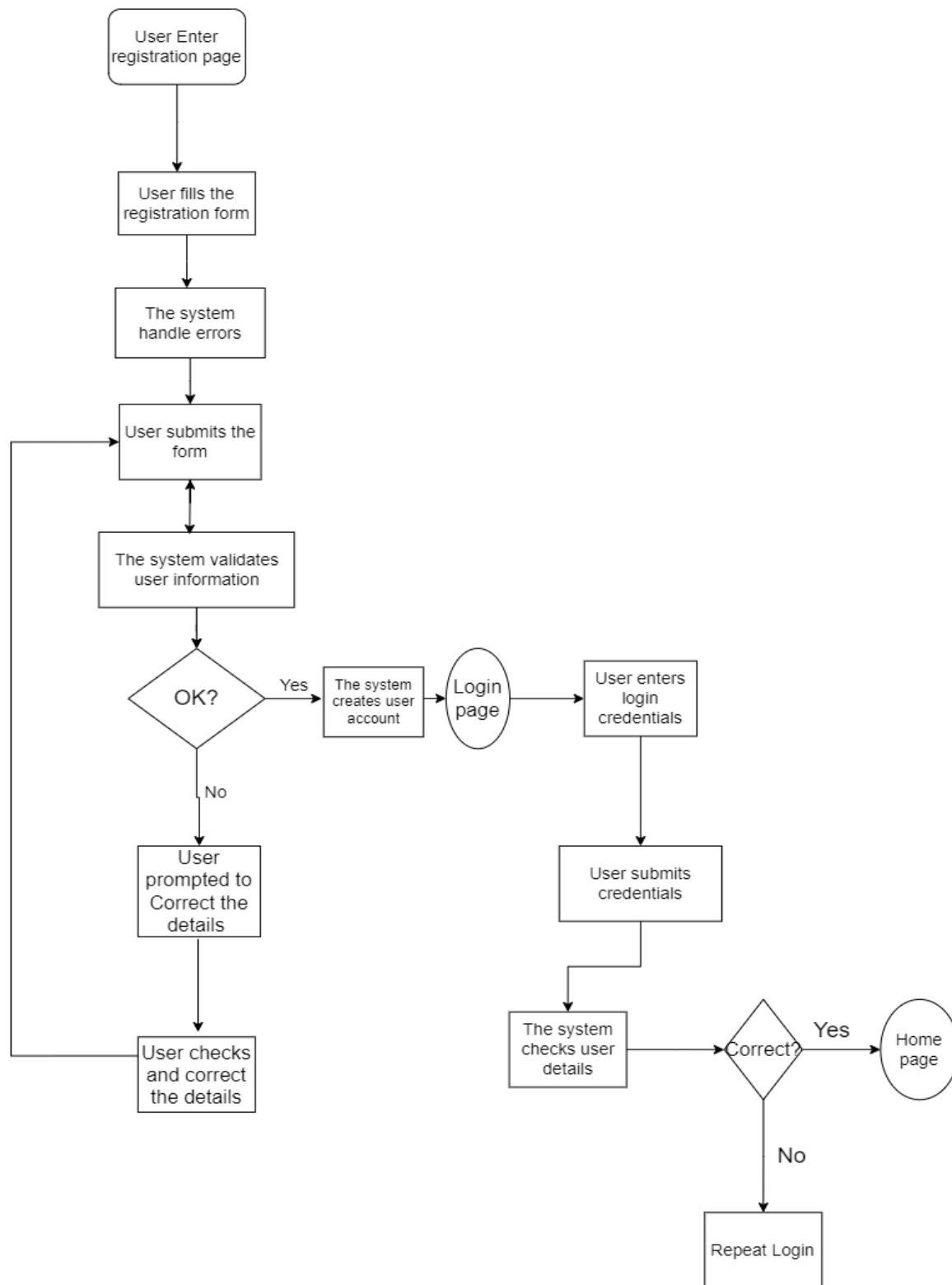
SYSTEM ARCHITECTURE OF TBDA
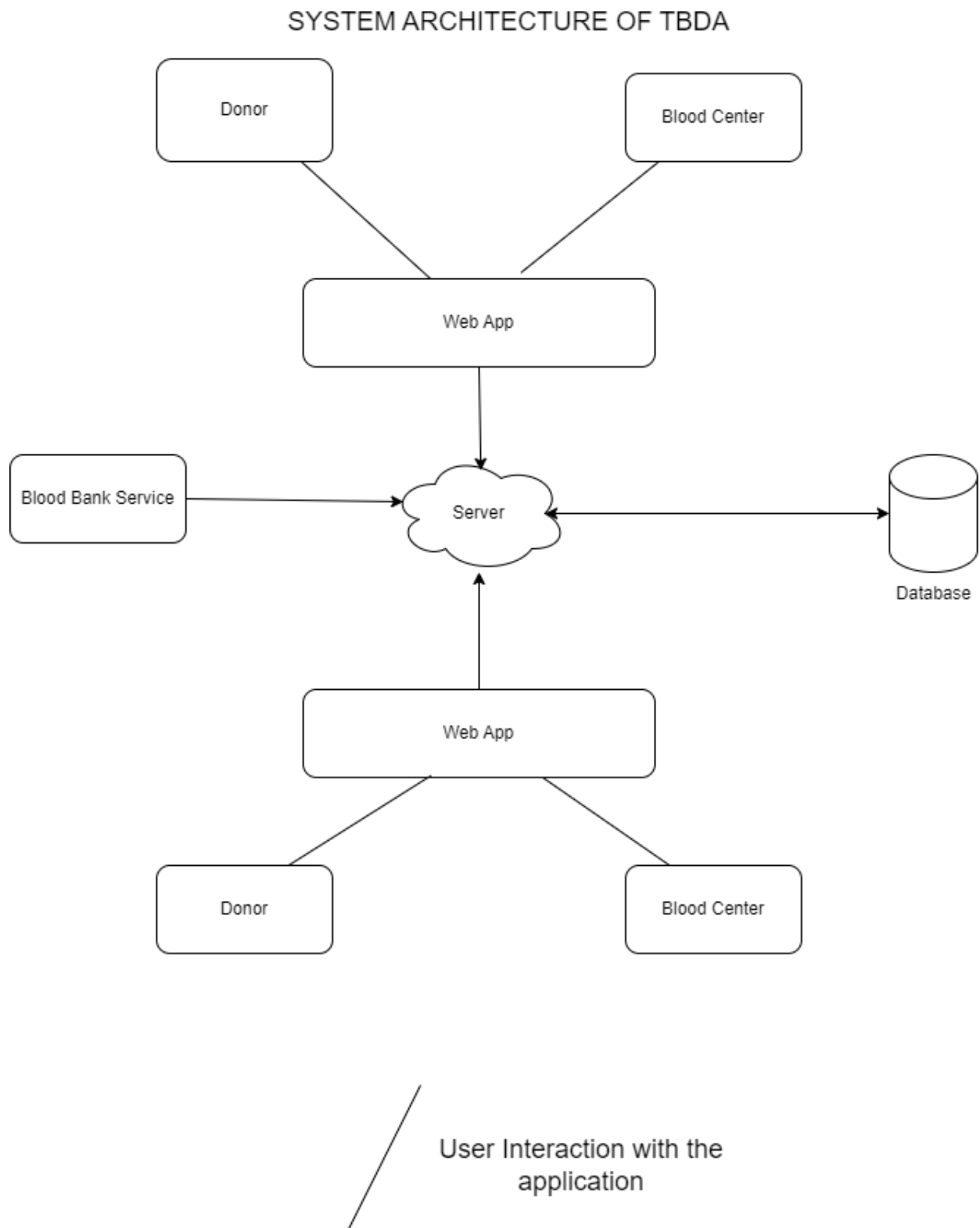
4.2 Flowchart Diagram

A flowchart is a picture of the separate steps of a process in sequential order (AmericanSocietyforQuality, 2024). 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 3: Showing the Flow chart for User registration and Login

Flow chart for User Registration and Login

4.3 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. Much like a roadmap for the app's data structure, the ERD serves as a powerful tool for database design, elucidating key relationships and ensuring the integrity of the data model. (smartdraw, 2024)

Figure 4: Showing The entity relationship diagram for tanzania blood donors app

4.4 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. (Lucidchart, 2024). Aided by the diagram for use cases for the Tanzania blood donors app

Figure 5: Showing Use case diagram for Tanzania blood donors app

Usecase Diagram for TBDA
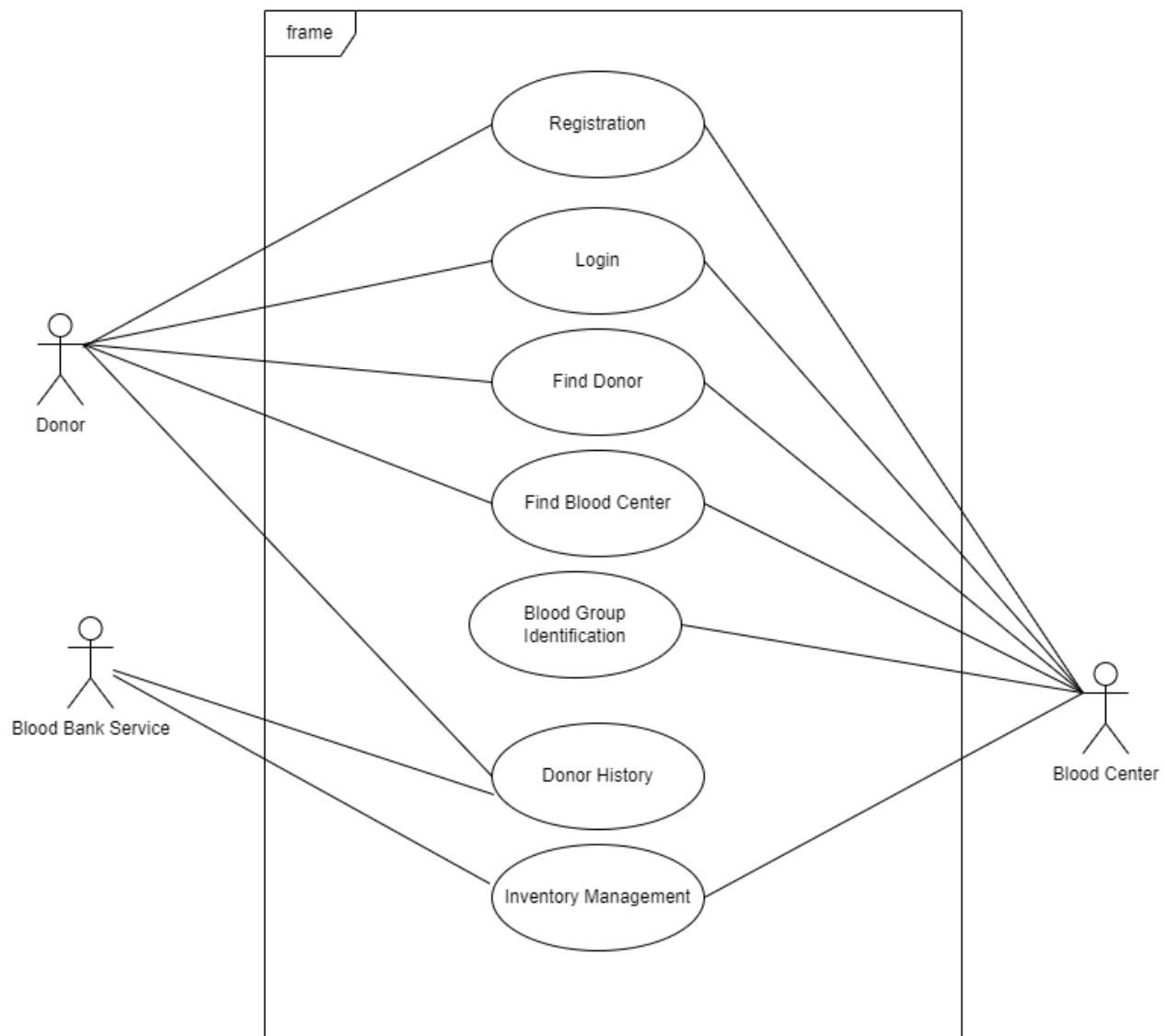
4.5 Sequence Diagram

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. In the context of the Tanzania Blood Donors app, these sequence diagrams offer a visual narrative that enhances comprehension, facilitates development, and ensures a streamlined coordination of activities, ultimately contributing to the seamless operation of the blood donation process. (AITCS, 2021)

Figure 6: Showing the sequence diagram for User Login for Tanzania blood donors app
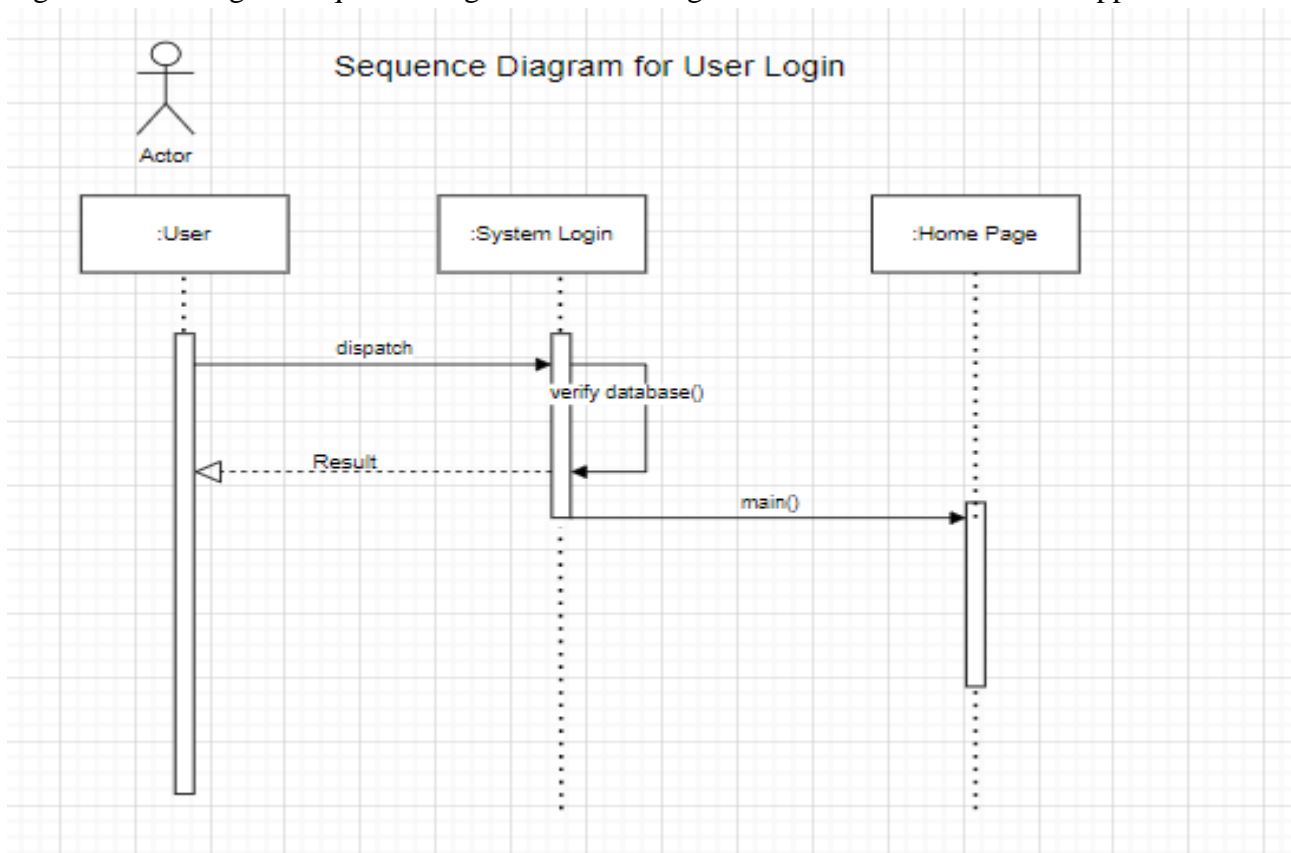
Figure 7: Showing the sequence diagram for Donors's donation history

Sequence Diagram for Donors's donation history
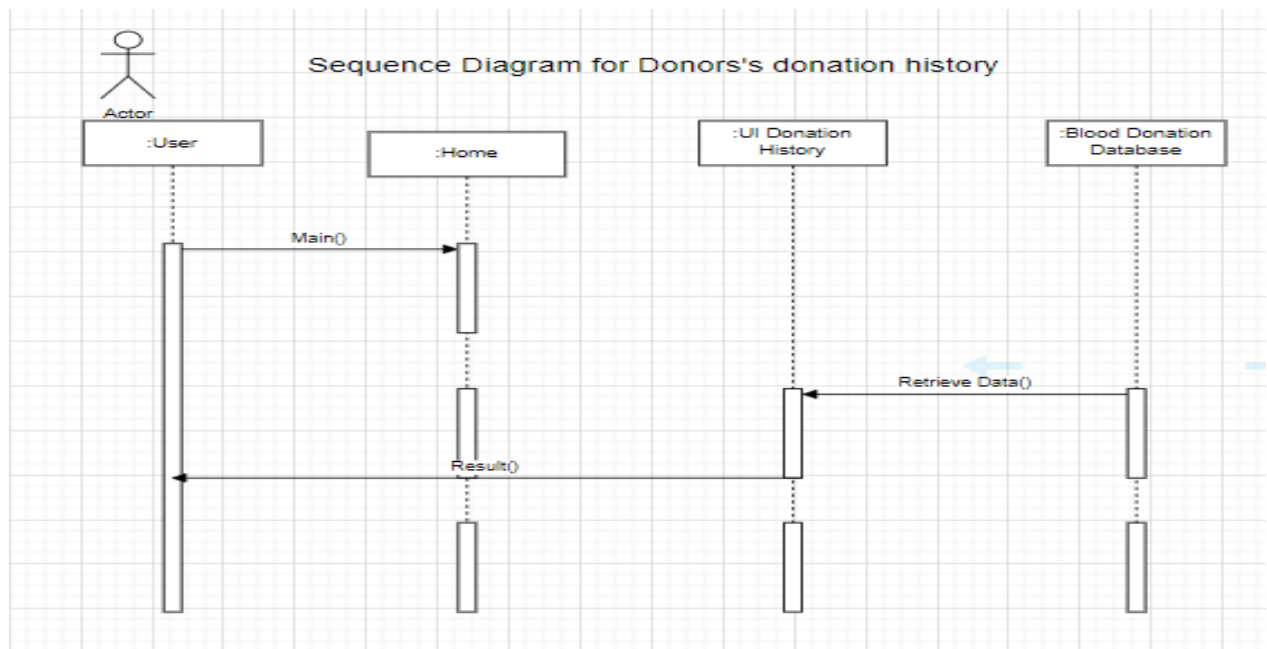
Figure 8: Showing the sequence diagram for User find
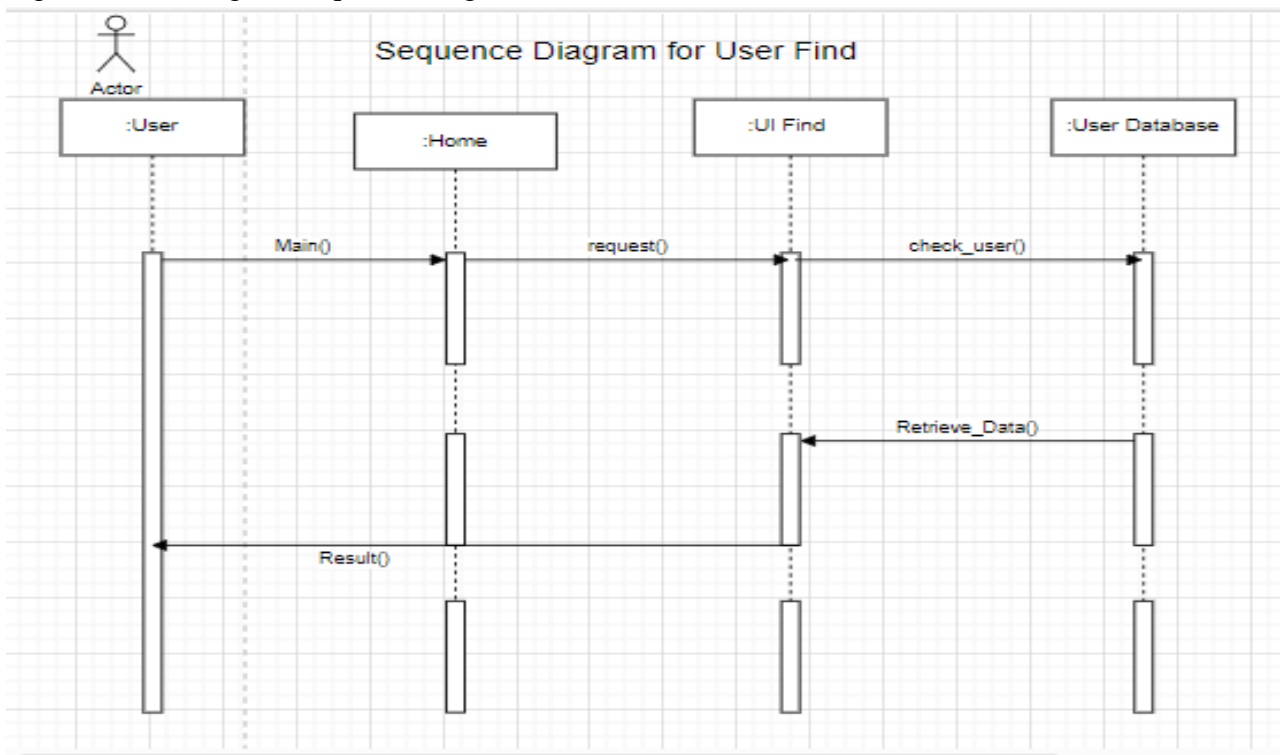
Figure 9: Showing the sequence diagram for posting Donation Updates
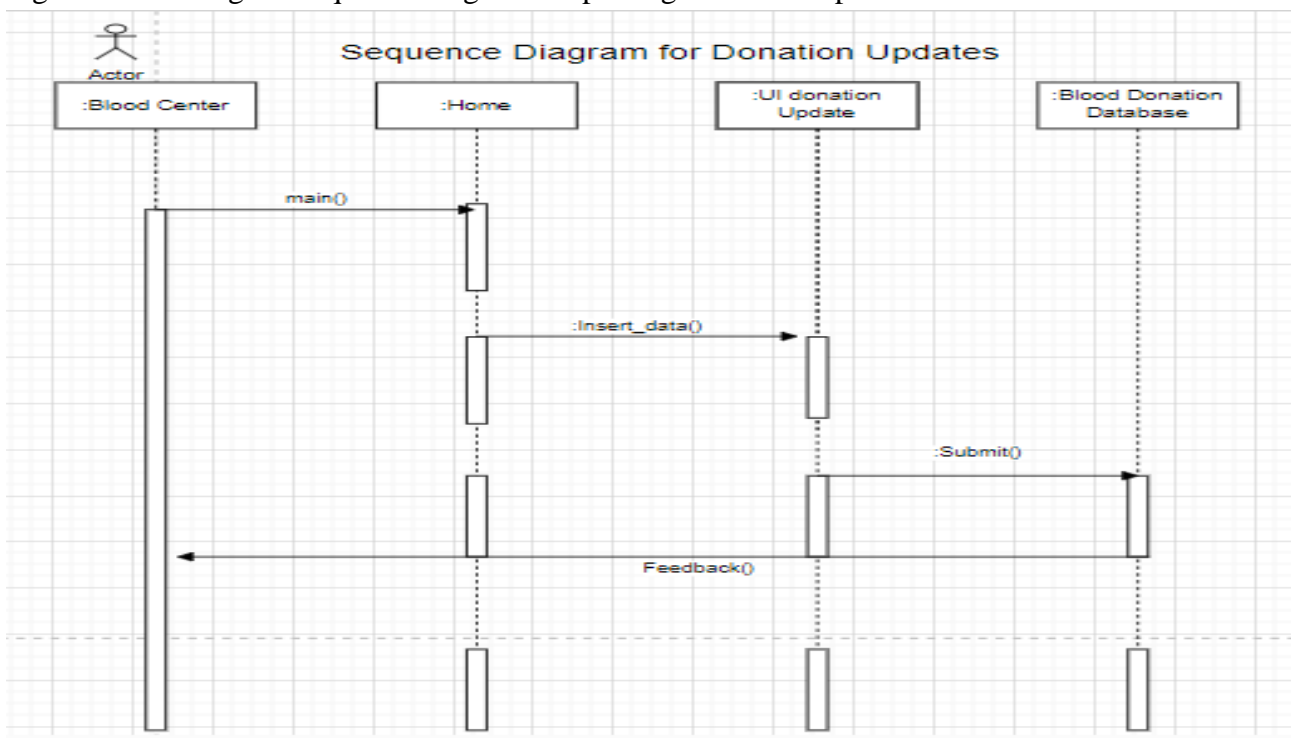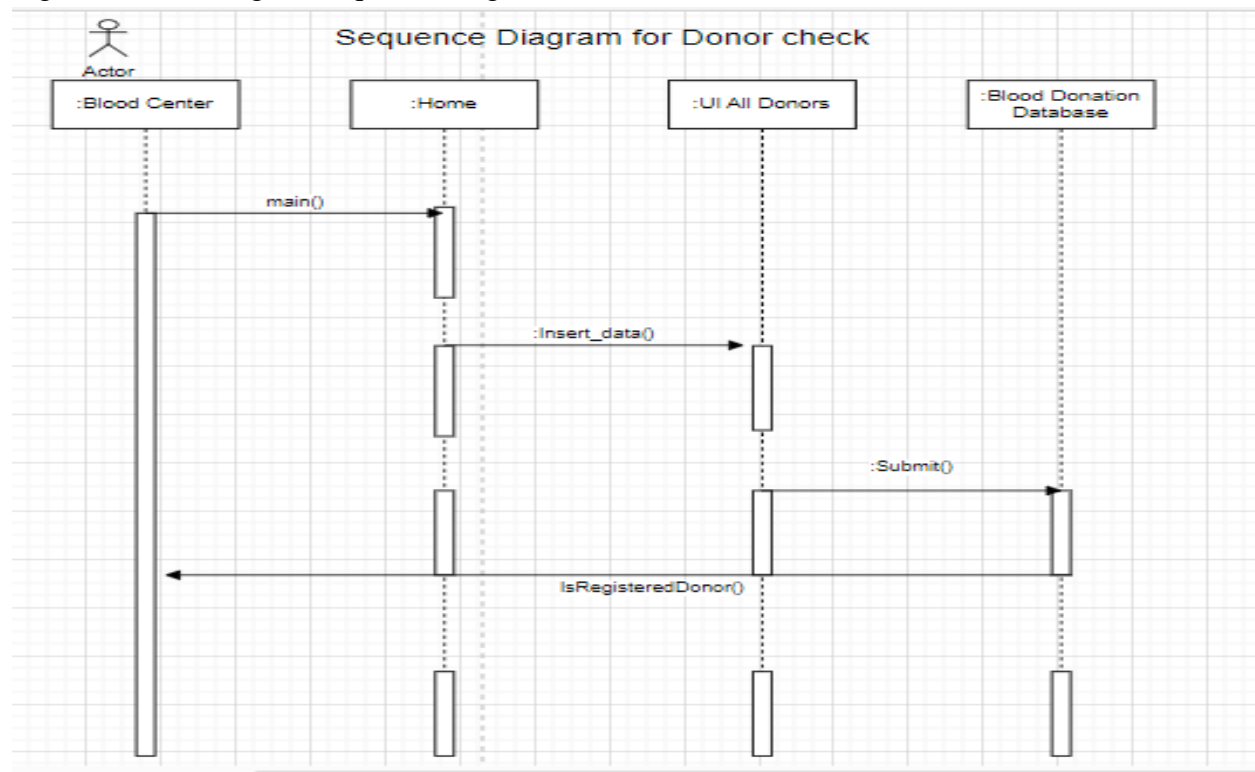
Figure 10: Showing the sequence diagram for Donor check

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.

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