Addis Ababa Science and Technology University

College of Mechanical and Electrical Engineering

Department of Software Engineering

Final Project Document

Blood Bank Information Management System (BBIMS)

For National Blood Bank Service of Ethiopia

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Glossary

HTML - Standard markup language for creating web pages and web Applications.

CSS - Language used to make interactive and awesome designs.

JavaScript - A programming language commonly used to create interactive effects.

Angular - Frontend JavaScript Framework.

MongoDB - Non - relational database management system.

Angular JS - Frontend JavaScript Framework,

Loopback - Backend Node JavaScript Framework,

JQuery - JavaScript Library,

Bootstrap - Frontend user interface template library.

Webpack - a module bundler tool.

Eslint - JavaScript linting utility.

Prettier - opinionated code formatter with support for: JavaScript, including Angular.

Postman - a powerful HTTP client for testing web services.

Abbreviations and Acronyms

NBBS - National Blood Bank Service of Ethiopia.

BBIMS- Blood Bank Information Management System.

HTML - Hypertext Markup Language.

CSS - Cascading Sheet Style.

MVC - Model View Controller.

AASTU - Addis Ababa Science and Technology University.

HTTP – Hypertext Transfer Protocol

UML – Unified Modelling Language

Abstract

The title of our project is Blood Bank Information Management System. The purpose of the project is to facilitate the Blood Bank Information Management Process of the NBBS of Ethiopia and to make it synchronized by having a central database in which all branches and their processing units can access. Previously, there was no centralized system throughout Ethiopia, which means no previous history of a donor was kept in a database; there was no computerized interconnection between all the branches, hospitals, blood collection centers and all other participatory organs such as donators. Our system has aimed to solve these problems by making a web based system in which all branches, hospitals, blood collection centers and staff workers inside branches communicate using it and access a centralized database for all the management processes. This system is used to provide fair distribution of blood throughout the country. Our system is going to be accessed via the internet so that users can access it using their desktop computers, smart phones.

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1. Chapter 1 – Introduction

1.1 Introduction

A blood donation is a process whereby a person voluntarily has blood drawn to be used for future transfusions when in need at hospitals for treatment procedures.

There are different reasons for blood donation for example:

- ✓ to maintain sufficient blood supplies for medical treatment ,
- ✓ to support local communities and hospitals ,
- ✓ to feel good about ourselves,
- ✓ to help people in the emergency .

Blood Bank - A place where blood is collected from donors, typed, separated into components, stored, and prepared for transfusion to recipients. Blood banks often participate in the process of collecting blood and other procedures such as managing stocks, approving blood requests and updating donation information.

The National Blood Bank Service of Ethiopia's (NBBS) was established in 1969 by Ethiopian Red Cross society but since 2004 has been transferred to the Federal Ministry of Health Ethiopia.

The mission of NBBS is to ensure the availability of safe and adequate supply of blood and blood products to all Transfusing Health facilities in Ethiopia.

1.2 Statement of the Problem

The following problems arise from the existing system of the National Blood Bank Service of Ethiopia.

Problem 1

The current system available in National Blood Bank Service of Ethiopia is semi-automated. Within this system, there is problem in managing the donors' records. There is no centralized database used to keep the donors' records. Due to this reason, the following problems happen:

- ✓ the records of the donor might not be kept safely ,
- ✓ there might be missing of donor's records due to human errors or disasters,
- ✓ staff keeps more than one record for the same donor,
- ✓ if a donor donates blood in a hospital, no donation of history of the donator is found in another hospital. Unless the donor brings a donation certificate.

Problem 2

The National Blood Bank Service of Ethiopia is required to maintain the amount of blood and blood types in the inventory including their branches. However, according to current working style, it is difficult to investigate the amount of remaining blood with its type in the stock of different branches of NBBS.

Problem 3

Currently there is time-consuming process in order to figure out different information related to blood bank statistical data and the amount of stored and remaining blood on the system.

1.3 Project Objectives

1.3.1. General Objective

The general objective of this project is to develop a web-based application for the National Blood Bank Service of Ethiopia and its branches to manage blood, donation and user information.

1.3.2. Project Specific Objectives

The specific objectives of this web-based application can be defined as follows:

- ✓ To provide a means for the NBBS to publicize and advertise blood donation programs.
- ✓ To provide immediate storage and retrieval of data and information.
- ✓ To provide synchronized and centralized donor information and blood stock database.
- ✓ To improve the efficiency of blood stock management by alerting the blood bank staffs when the blood quantity is below it per level or when the bloodstock has expired.
- ✓ To provide an efficient donor and blood stock management functions to the blood bank by recording the donor and blood details.
- ✓ To inform donors about their blood result after donation.
- ✓ To support searching, matching and requesting for blood convenient for administrators.
- ✓ To make balanced and fair distribution of blood with its type in different branches of blood bank.

1.4 Scope

The system is used for maintaining the main processes and activities of the NBBS.

1.4.1. Functionalities

The system functions and features of our system will include the following:

Registration

This function allows administrators and other stakeholders to register as a user to interact with the system. The system requires registration and login before viewing and editing any kind of information.

Login

The system requires user to be logged in before viewing and editing any information. It is important to restrict information to be addressed for users according to their access level.

View and Edit Information Online

Actors of the system are allowed to view their activities online by using their account. They can also edit different information according to their role in the system.

Record Data

The donor's information and donation records can be added from NBBS workers. The administrator is responsible for managing administrative issues of the total data stored in the system.

Manage Blood Inventory

The System administrator takes role in order to manage and control over the blood transaction in the system.

Summary Report Generation

The system generates a report to summarize all records including blood donation reports, blood request forms and blood stock reports for the administrator.

1.4.2 Stakeholders of the System

1**) System Owner** - National Blood Bank Service of Ethiopia.

2**) System Users -**

- ✓ **Super Administrator-** has full privilege on the overall system's functionality
- ✓ **Branch Administrator**- has full privilege on the system's functionality of assigned branch.
- ✓ **Hospital Administrator**- has full privilege on the system's functionality of assigned hospital.
- ✓ **Staffs -** has privilege on the system's functionality according to their role.
- ✓ **Donor -** can participate in blood donation events and they will donate blood.

1.5 Significance of the Project

The purpose of the Blood Bank Information Management System is to simplify and automate the process of searching for blood in case of emergency and maintain the records of blood donors, recipients, blood donation programs and bloodstocks in the bank.

This project is intended to computerize the blood and donor management system in National Blood Bank Service of Ethiopia in order to improve the record management efficiency due to the grown size of records of data.

The inspiration of this project is to improve National Blood Bank Service of Ethiopia and to develop a blood bank information system, which focuses on making an online system that is accessible for all the stakeholders.

The system is also developed for the administrators, who have the highest authority in the system. An administrator can add, modify, delete, and query to BBIMS when necessary. The administrator is also responsible for responding blood requests and checking stocks in the NBBS inventory.

1.6 Methodologies and Technologies

1.6.1. Data Collection

The requirement elicitation process was conducted through interview and observation. We conducted interview with the workers and administrators of the NBBS head office at Addis Ababa Stadium in Red Cross Organization enclosure. We had also observed all the processes conducted during blood donation process in our university AASTU.

Another technique that we used for data collection is sampling. We take different working guideline samples and formats of NBBS.

1.6.2. System Analysis and Design Tools

Microsoft office applications are used to collect and prepare system requirement specification (SRS) document.
Enterprise Architecture , Edraw Max , Lucid Chart are chosen as a UML designing tool for system analysis and design phase since these tool has fully object oriented features that help for the preparation of system design document (SDD).

Gantt Project is selected to prepare project schedules with in their correspondence timetable.

1.6.3. Development Tools

We plan to use different tools for the accomplishment of the project. The following is list of tools planned to be used.
For front end and backend development, we will use the following programming languages:

- ✓ Hyper Text Markup Language(HTML) ,
- ✓ Cascade Sheet Styles (CSS) ,
- ✓ JavaScript ,
- ✓ Mongo DB (non-relational Database)

Frame Works and 3rd Party libraries

- ✓ Angular JS - For front end JavaScript Framework,
- ✓ Loopback - For Backend Node JavaScript Framework,
- ✓ JQuery - JavaScript Library,
- ✓ Bootstrap - front end user interface template library.

It is also planned to use

- ✓ Bracket and Visual Studio code Editor, which provide easy and supportive text editors.

Other helper tools like

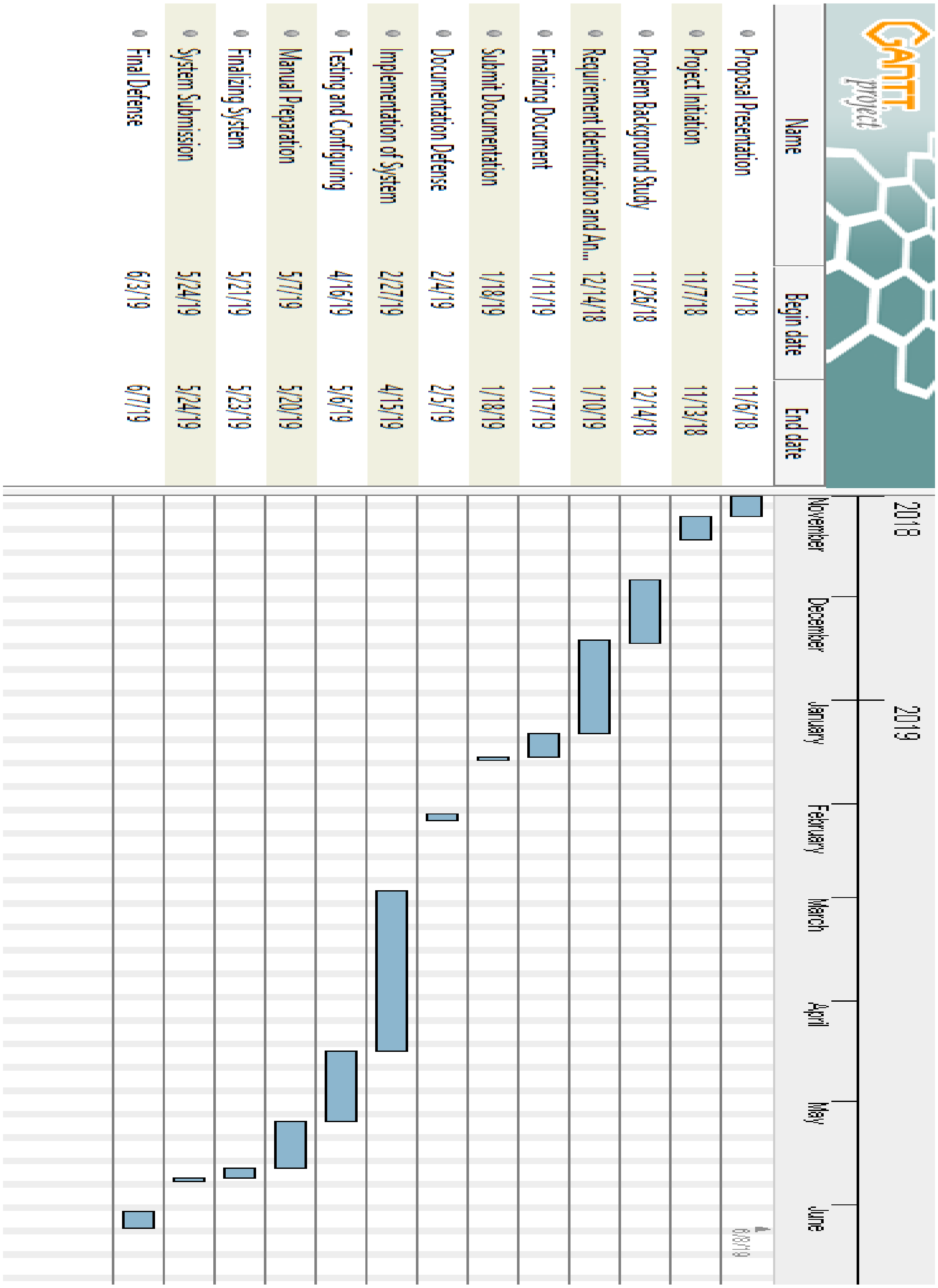
- ✓ Webpack - Bundling tool,
- ✓ Eslint - JavaScript validator,
- ✓ Prettier - to beautify the code structure,
- ✓ Chrome Browser - rendering,
- ✓ Windows Operating System will be used in project,
- ✓ Postman - API Lifecycle (design, testing and full production) supporter.

Testing Tools

- ✓ Jasmine and Karma.

1.7 Project Schedule

Our project takes 7-month duration to be completed and to be accessible for users. Here is the Schedule of our project:



Name	Begin date	End date
Proposal Presentation	11/1/18	11/6/18
Project Initiation	11/7/18	11/13/18
Problem Background Study	11/26/18	12/14/18
Requirement Identification and An...	12/4/18	1/10/19
Finalizing Document	1/11/19	1/17/19
Submit Documentation	1/18/19	1/18/19
Documentation Defense	2/4/19	2/5/19
Implementation of System	2/27/19	4/15/19
Testing and Configuring	4/16/19	5/6/19
Manual Preparation	5/7/19	5/20/19
Finalizing System	5/21/19	5/23/19
System Submission	5/24/19	5/24/19
Final Defense	6/3/19	6/7/19

Figure 1: Project Schedule Gantt Chart Diagram

2. Chapter 2 - System Requirement Specification

2.1 Background

Blood Bank Information Management System is a web-based application dedicated to facilitate the management and monitoring process of the NBBS.

The blood transaction process throughout our country is now being done manually and in a semi-automated system in some branches like Addis Ababa. The system will enable users: Super Administrator, Branch Administrator, Hospital Administrator Blood Collector, Laboratory Technicians and donors register to be registered and interact with the functionalities the system provides respective to their roles in the system.

2.2 Functional Requirement

Registration

RG00 – New users will be registered into the system.

RG01 – Register Branch Administrator

- ✓ Super Administrator has authority to register Branch Administrators.
- ✓ They will have basic information: First Name, Father Name, Grand Father Name, Sex, Branch, Tel (office), Phone (mobile), and Email.

RG02 – Register Hospital Administrator

- ✓ Branch Administrator has authority to register Hospital Administrators.
- ✓ They will have basic information: First Name, Father Name, Grand Father Name, Sex, Branch, Tel (office), Phone (mobile), and Email.

RG03 - Register Blood Collector

- ✓ Branch Administrator has authority to register Blood Collectors.
- ✓ They will have basic information: First Name, Father Name, Grand Father Name, Sex, Branch, Telephone, Phone Number, and Email.

RG04 - Register Laboratory Technician

- ✓ Branch Administrators has the authority to register and assign Laboratory Technicians.
- ✓ They will have basic information: First Name, Father Name, Grand Father Name, Sex, Branch, Telephone, Cell Phone, and Email.

RG05 – Register Donor

- ✓ Blood Collectors has the authority to register new blood donors.
- ✓ Basic information: First Name, Father Name, Grand Father Name, Title, Date of Birth, Sex, Occupation, City, Sub-city, Zone, Wereda, Kebele, Telephone Number, Email, P.O.Box are necessary in order to register as Donor.

Login

LG00 – Login to the system by using Email and password if the user is registered.

LG01 – Login as Super Administrator

- ✓ He/she will have the highest authority on the system.

LG02 – Login as Branch Administrator

- ✓ Based on their credential they can control all activities within their branches.
- ✓ Add, update and remove information about staffs of NBBS with in their branch.
- ✓ View any data and transactions with in their branch.

LG03 – Login as Laboratory Technicians

- ✓ Based on their credential they can test the amount of blood collected by blood collectors.
- ✓ They will test the amount of blood collected.
- ✓ Notify the amount of blood becomes ready to use and the amount of blood to be removed.
- ✓ Add blood to bloodstocks with in its type and Rh factor.

LG04 – Login as Blood Collectors

- ✓ They can register, update and access donor’s information.
- ✓ They will collect and submit the amount of collected blood to NBBS.

LG05 – Login as Hospital Administrator

- ✓ Based on their credential they can manage blood related issues with in their hospital.
- ✓ If there is no enough amount of blood with in hospital, they will request needed amount of blood from their NBBS branch.

Add Information

AD00 –Add Information

AD01 –Add New Branch

- ✓ New Branches will be added to the system by Super admin of the system.
- ✓ Branch will have the following information: Name, City, Region, Zone, Woreda, Telephone, P.O.Box.

AD02 – Add New Hospital

- ✓ New hospitals will be added by the Branch Administrators.

AD03 – Add New Donation Center

- ✓ Donation centers that are need.

AD02 - Add Blood Information

- ✓ This component used to store relevant information about the amount of blood collected within its type and branch.
- ✓ Information related to blood will be inserted by Laboratory Technicians.

Update Information

UP00 – Update Information

UP01 – Update Branch Administrators' Personal Information

- ✓ Super Administrator has responsibility to update information about Branch Administrators.

UP02 – Update Staff Personal Information

- ✓ Branch Administrators take task of updating information related to their staffs.

UP03 – Update Donor's Personal Information

- ✓ Donor's information will be updated by Blood Collectors.

UP04 – Update Information related to amount of blood with in the Stock.

- ✓ The amount of blood could be inserted and updated by Laboratory technicians.

UP05 – Update Hospital Information

- ✓ Information with in specific hospital will be updated.

UP06 – Update Donation Center Information

- ✓ Information related to targeted donation center of NBBS will be modified.

Delete Information

DE00 – Delete Information

- ✓ Information which is no more helpful can be deleted.

DE01 - Delete Branch Administrator Information

- ✓ Delete branch administrator if he/she left the institution.

DE02 – Delete Staff Information

- ✓ Delete staff member information if it is not necessary.

DE03 – Delete Branch

- ✓ Delete branch of NBBS if it is closed or out of use.

View Information

VI00 - View Information

VI01 – View Donor's Information

- ✓ View donor basic information, donation records and histories about specific donor.

VI02 – View Staff Information

- ✓ Manipulate information related to staffs of NBBS. The staffs will be Administrators, Laboratory Technicians or Blood Collectors

VIO3 – View Information about Branches

- ✓ Visualize the status of the branches.

VIO4 – View Information about Hospitals

- ✓ Visualize information related to registered hospitals with in the branch.

VIO5 – View Information about Donation Centers

- ✓ It is used to view donation centers that are used to collect blood from donors.

VI06 – View Available Amount of Blood

- ✓ View the amount of blood with in all branches of NBBS.
- ✓ It will helps to analyze and request blood during shortage.

VI07 – View Used Amount of Blood

- ✓ View the amount of blood already used with in all branches of NBBS.

VI08 – View History about Blood Transaction

- ✓ Can visualize summarized and analyzed contents about past blood transactions with in branches of NBBS.

VI09 – View Generated Statistical Reports

- ✓ Visualize daily or monthly statistical reports.

VI10 – View Alert Notification

- ✓ Viewing alerts or notifications.

Manipulate Information

SE00 – Search Information within the system.

- ✓ It is important to visualize the system easily.
- ✓ This feature makes us to search any data by using key words.

ST00 - Sort Information within the system.

- ✓ We can sort data by using different measurements like data and alphabetical orders.

Blood Transaction

DB00 – Donate Blood

- ✓ Take blood from donor and register donor history.

GB00 - Get Blood from System.

- ✓ If we have role of branch admin we could utilize blood stored in the stock.

SR00 – Send Blood Request

- ✓ Ask needed amount of blood. The request will be sent from registered members with in branch or it will be form another branch that gets lack of blood.
- ✓ Ask some amount of blood from another branch which have adequate amount of blood per need type.

RR00 - Reply for Request

- ✓ Provide the requested amount of blood.

Generate Report

GR00 – Generate Report

GR01 – Generate Report about Donors

GR02 – Generate Report about bloodstock

GR03 – Generate Overall and Summarized transaction reports.

Alert Notification

AN00 – Alert Notifications.

AN01 – Alert when there is low amount of Blood in the Stock.

AN02 – Alert when there is Blood Request and approval of the Request.

Modifying Account

CP00 - Change Password.

RP00 - Reset Password.

Logout from System

LG00 – Logout from System.

2.3 Non-Functional Requirements

The following are the nonfunctional requirements of the system to be developed.

Interoperability

This web based application is viewable and fit with any standard web browsers, various operating systems such as Windows , Linux , Macintosh and on devices like personal computers, PDAs, mobile phones and tablets.

Availability

BBIMS web based application is accessible 24/7, anywhere and via PC, PDAs (Personal Digital Assistances), mobiles devices and tables with an internet connection.

Usability

The system will have a user friendly user interface which requires little to no time of training. It includes many icons and common symbols that can be easily identified by users.

Speed

Its backend will be built by using Loopback (Node JavaScript Framework) that gives less access time and high speed to our platform.

Manageable and Reusable

It is very easy to update the look and feel of the application or for customization and it is expandable, general and self-descriptive.

Maintainable and Testable

The website will be simple, consistent and developed with Angular JavaScript Framework, which encourages modularity and separation of patterns.

Secure Access

Actions within the system are secured and data access is managed through token-based authentication it makes the system secured.

To explain token based authentication in a very simple terms, it is a solution to provide authentication in an applications where it is either difficult to maintain state or the preferred architecture is stateless. It as simple as you holding a physical token for vetting your identity. Like we buy platform tickets to enter railway platforms, we buy different tickets to travel, each of these are issued by an authority and you hold them with you to get access to certain things. Tokens have expiry times associated with them; they can have different use case and can contain Meta data to retrieve extra information. Most importantly, they are associated with your identity and can grant you the access required to do your job.

So this makes the system more secures.

Resource Usage

Angular framework by nature it is single page application. Therefore, it will reduce the resource consumption.

Scalability

The system will be designed to accommodate increased volumes, workloads and users.

2.4 Feasibility Study

The feasibility study attempts to assess the viability of the system. It seeks to identify potential problems and to determine whether the system can work efficiently or not. The information gathered helps in identifying the requirements and determine the extent to which a project can be performed successfully.

The study assesses the following feasibility studies on NBBS:

2.4.1 Technical Feasibility

In this technical feasibility we tried to assess the current resources (such as hardware and software) and technology, which are required to accomplish user requirements in the system within the allocated time and budget. The system is technically feasible because the current technical capability of our team is sufficient to support the projects requirements.

The technological equipment's that are used to support this project are available. To deploy and implement this system database server and application server are found in NBBS besides that there are different sized desktop and laptop computers available at NBBS. Each stakeholders could use their smartphone or tablet in order to use the system. The above evidences approve our system is technically feasible.

2.4.2 Operational Feasibility

In operational feasibility, we tried to investigate the capability of the existing environment to support the proposed system. The following points shows the system is operational feasible:

- ✓ **Portable** – the system can be operative in range of devices. It will be used in large screen desktop computers and in small screen hand held devices.
- ✓ **Interoperable** – there are diverse types of operating systems like Mac, Linux, Windows, Android. The system will be operative in all of the above operating systems. As it is web-based application, it is platform independent.
- ✓ **Scalable** – when the number of users and the amount of data increases, the system can keep its performance.

2.4.3 Economic Feasibility

The system is economically feasible, as the fruit of system after deployment will exceed the cost required to develop and use the system. The system is cost efficient because the development of system is free from any type of fee.

Each branch of NBBS have their own personal computers that are needed to use this system. Besides, of this data is stored in central server so there will not be need of server in each branch. This makes the system more economically feasible.

2.4.4 Schedule Feasibility

We proposed to use latest technologies in order to implement the system. This makes us to get relevant and current information to speed up the development of the project. Therefore, the system will be developed in given time of period.

2.4.5 Behavioral Feasibility

The system will have eye catching and user-friendly interactive user interface design. Therefore, users could not get difficulty in order to operate the system.

After the system is developed, there will be manual that shows how to use the system. It helps any user to manipulate the system without getting great difficulties.

3. Chapter 3 - System Analysis and Design

3.1 Overview

In this chapter, different types of requirement modeling techniques will be used to better describe the system's functionality. We will analyze requirements of the system in depth in order to identify its key components to create a system that will achieve its goals in an efficient way. The models planned to be used are Scenario Based Modeling, Behavioral/Dynamic Modeling and Class-Based Modeling. In the scenario-based modeling use case modeling and activity diagram will be used. In the dynamic modeling, sequence diagram and state diagram will be used. In the class-based modeling, class diagram will be used.

3.2 Scenario Based Modelling

Scenario based modelling with UML is the technique begins with the creation of different scenarios in order to understand the problem to be solved.

3.2.1 Use Case Identification

Use case identification is essential for simplifying the system and better understand it in simple terms as a result it will help us during the development of the system.

- ✓ Register
- ✓ Login
- ✓ Authenticate
- ✓ Add Information
- ✓ Update Information
- ✓ Delete Information
- ✓ View Information
- ✓ Search
- ✓ Sort
- ✓ Donate Blood
- ✓ Get Blood
- ✓ Send Request
- ✓ Reply Request

- ✓ Alert Notification
- ✓ Change Password
- ✓ Reset Password
- ✓ Logout

3.2.2 Actor Identification and Description

The following actors have their own role in our system.

1. Super Administrator

- ✓ Has the responsibility to over control all activities within the system.
- ✓ Can view blood transactions in all branches of NBBS.
- ✓ Approve blood requests from different branches.
- ✓ Create, edit and delete Branch Administrators.
- ✓ Create, edit and delete Branches of NBBS.
- ✓ See information about donors and staff members of the NBBS in the country.
- ✓ Print generated reports.

2. Branch Administrators

- ✓ Create, edit, update and delete Hospital Administrators, Laboratory technicians and Blood Collectors with in their branch.
- ✓ Create edit and delete hospitals with in branch.
- ✓ Create edit and delete donation centers with in branch.
- ✓ Request blood from other branches when there is blood shortage.
- ✓ Approve blood request comes from registered hospitals and other branches of NBBS then they will transfer the amount of blood needed by that hospital or branch.

3. Laboratory Technicians

- ✓ Examine the blood collected by blood collectors of NBBS.
- ✓ Classify the blood whether it is usable or not.
- ✓ Add the amount of blood with in its type and Rh factor after examination.
- ✓ Add, update and delete Private Donor information like Blood Type, RH-factor.

4. Blood Collectors

- ✓ Register new donors on the system.
- ✓ Add the amount of unidentified blood collected from their workstation.
- ✓ Add, edit and update basic donor information.

5. Hospital Administrator

- ✓ When there is need of blood with in hospital, hospital administrator will request the required amount of blood from their branch.

6. Donors

- ✓ Donate Blood.

3.2.3 Use Case Diagram

A use case is a collection of interactions between external actors and a system. We used the following use cases in order to represent functionality of BBIMS for NBBS.

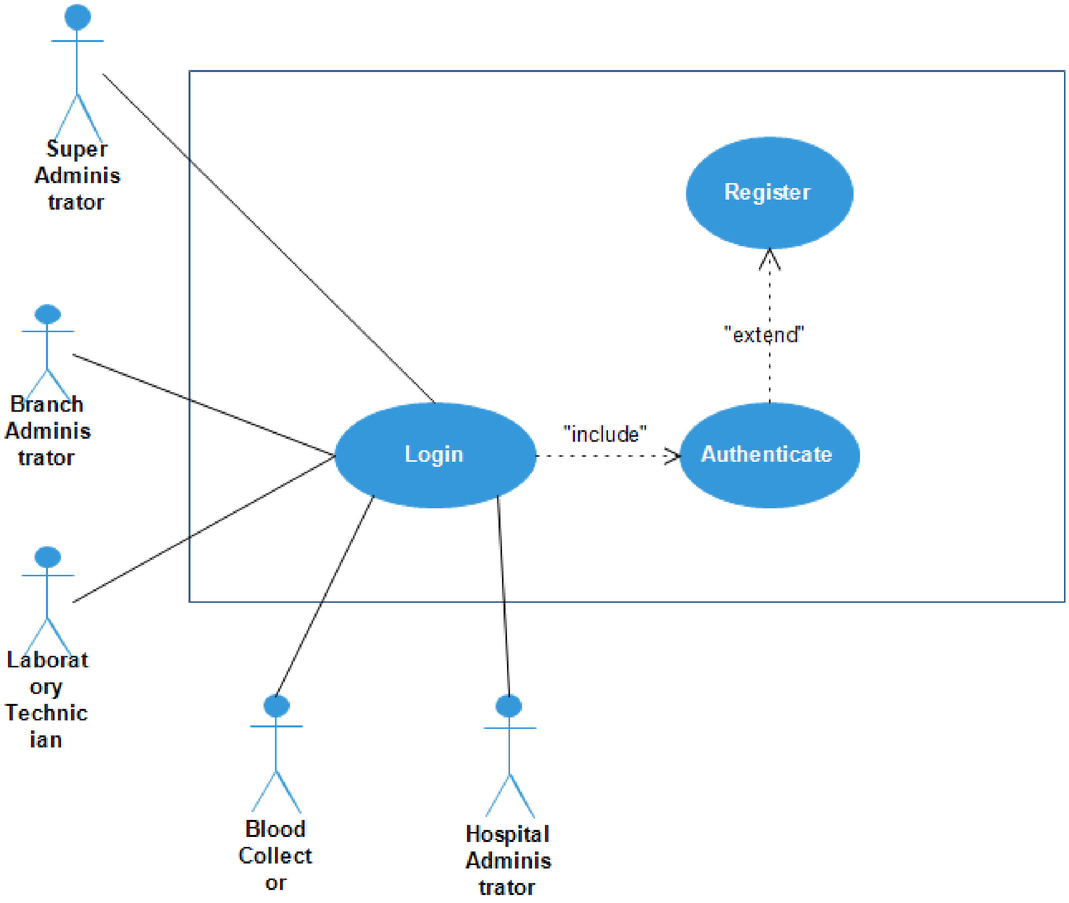


Figure 2 : Use Case Diagram for Authentication

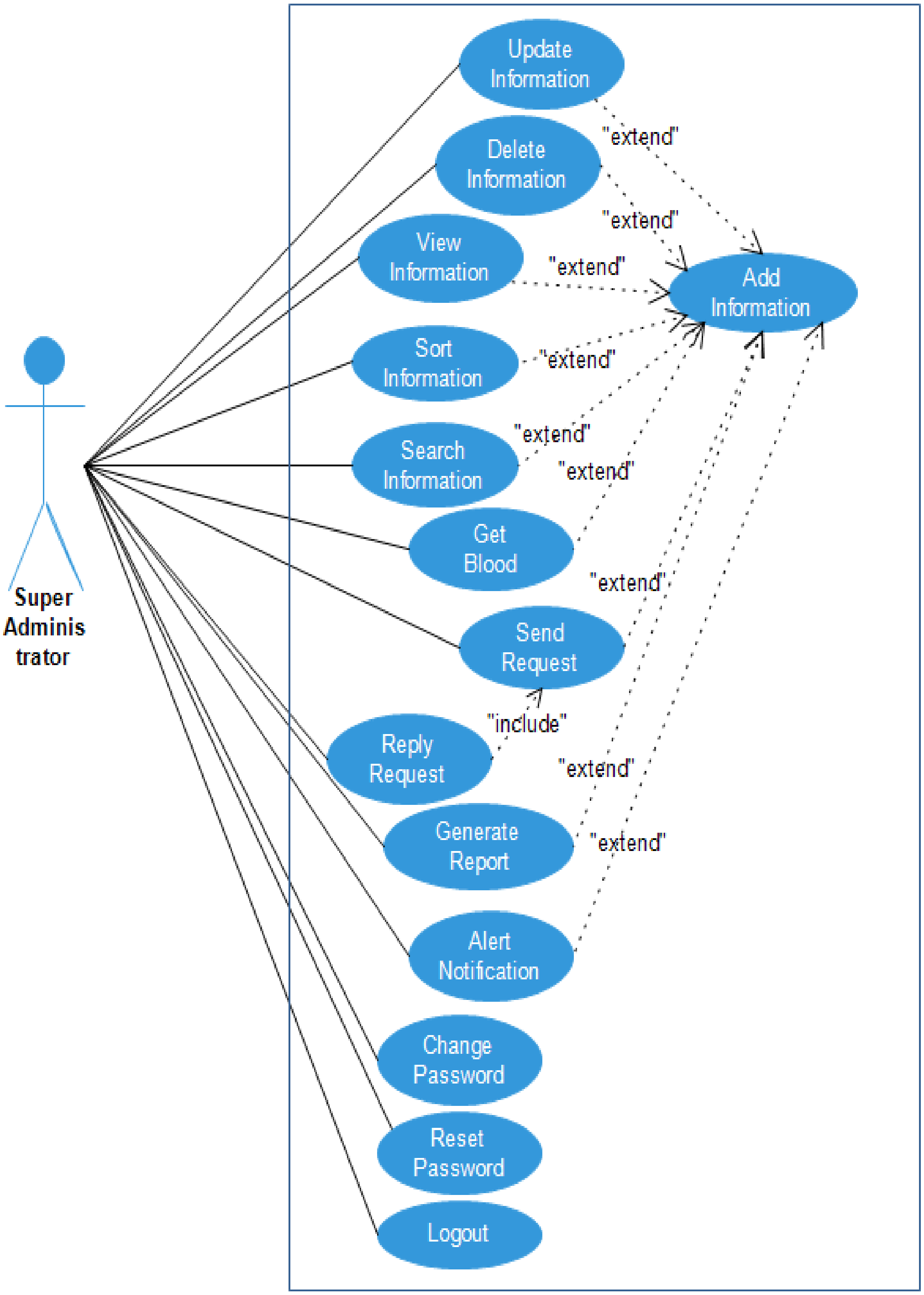


Figure 3 : Use case diagram for Super Administrator of the System

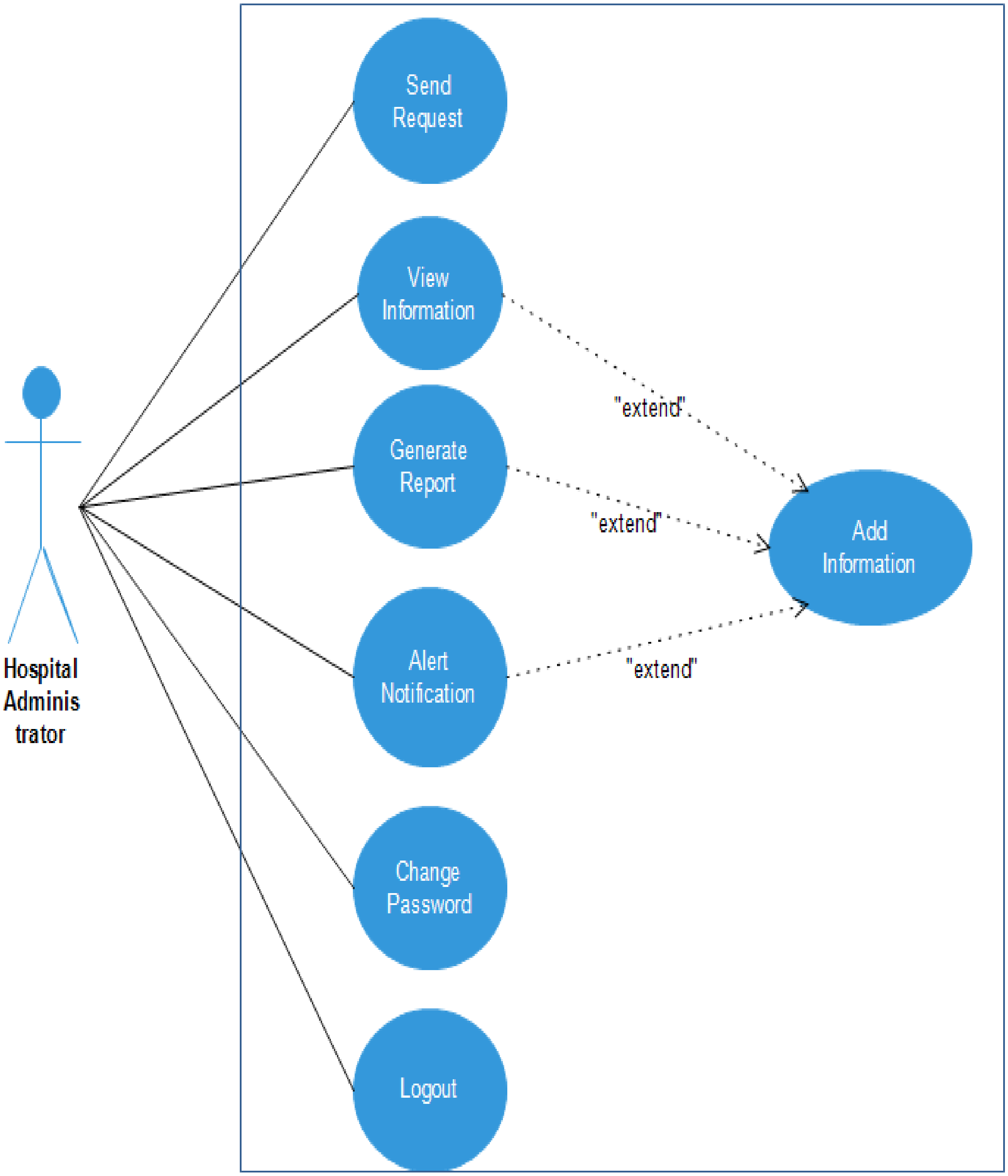


Figure 4 : Use Case Diagram for Hospital Administrator

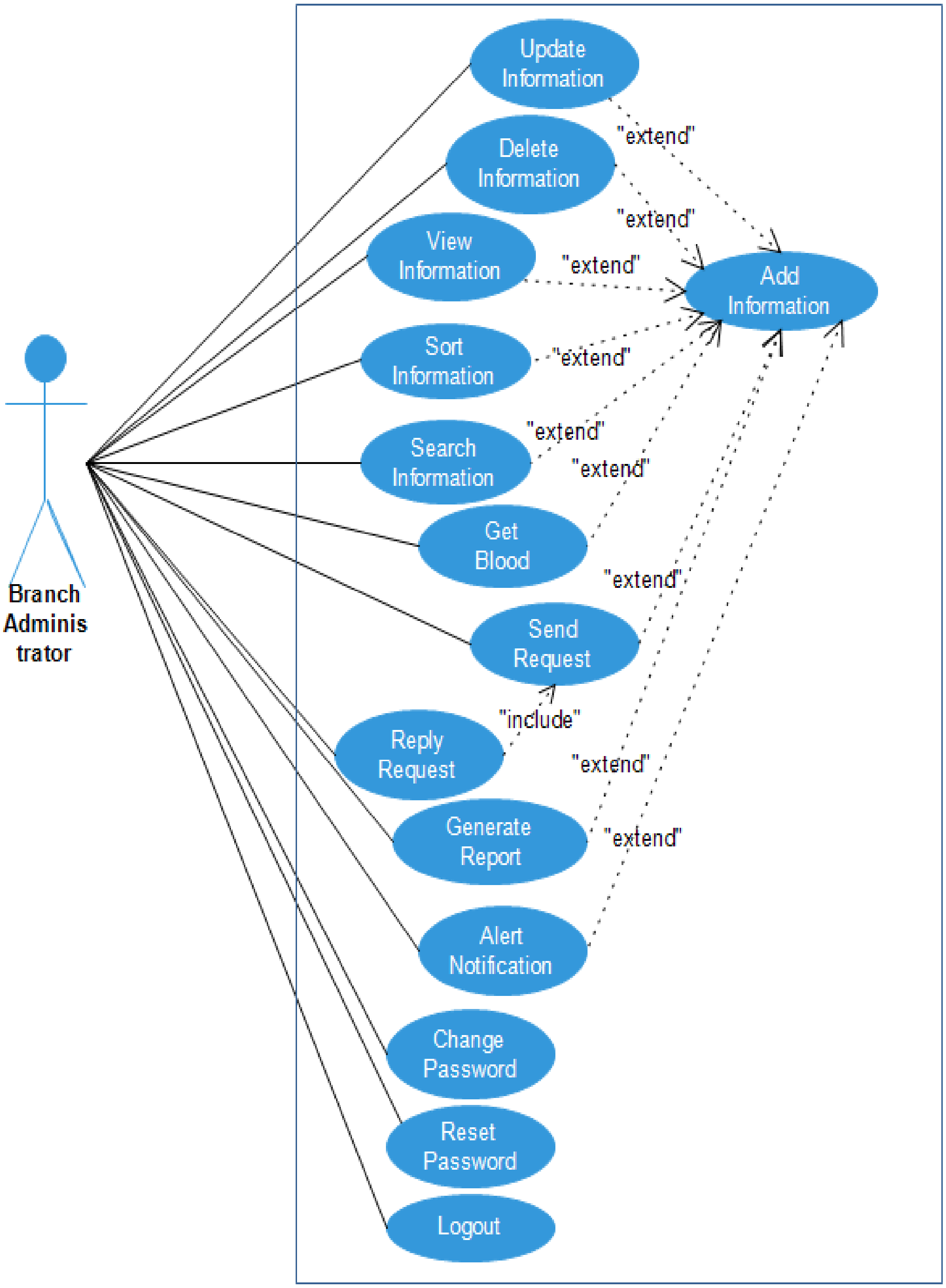


Figure 5: Use Case Diagram for Branch Administrator

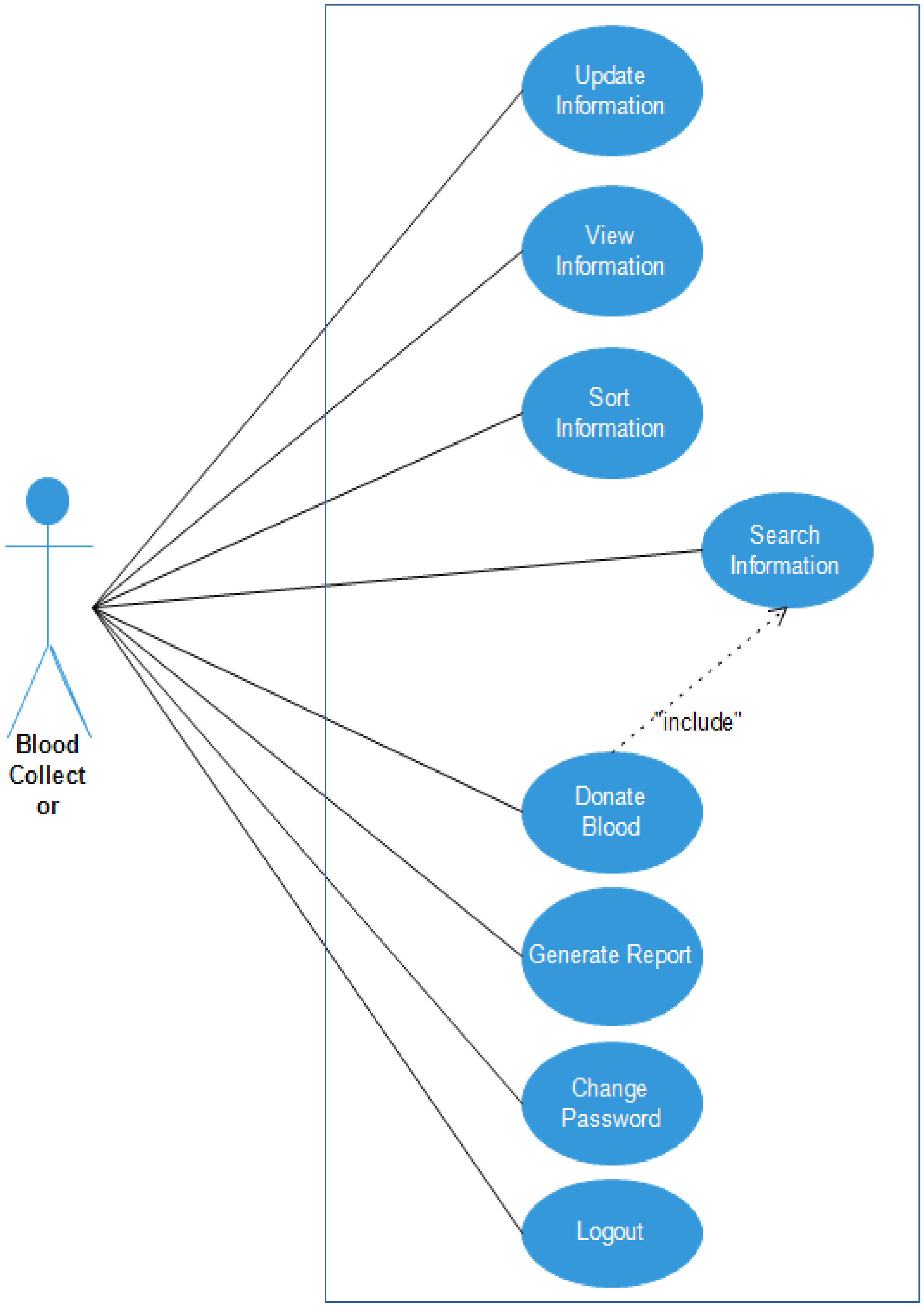


Figure 6 : Use Case Diagram for Blood Collector

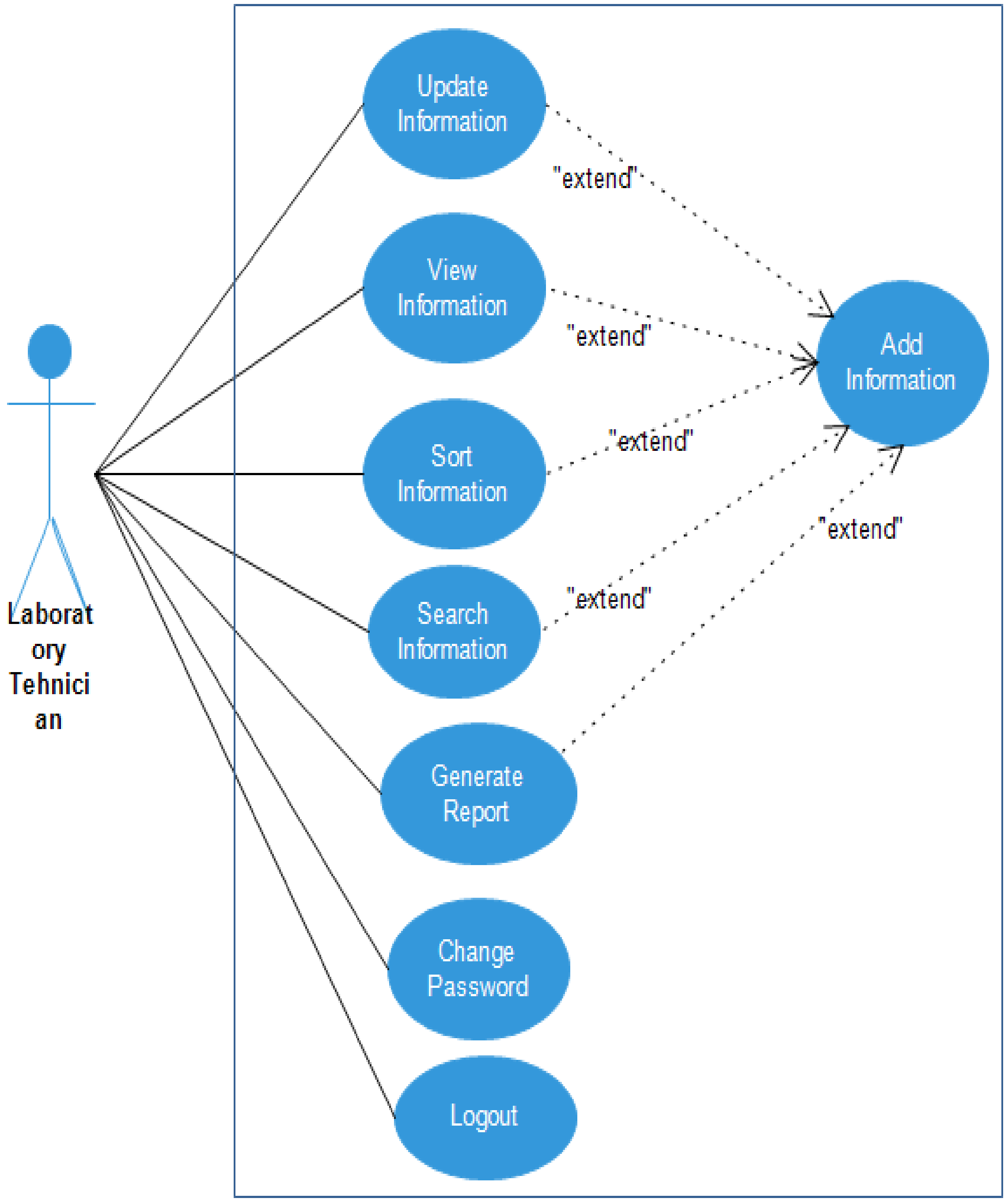


Figure 7 : Use Case Diagram for Laboratory Technicians

3.2.4 Use Case Description

Use-case Name	Register	
Brief Description	After opening the website and going in to the registration page, the actor requests the system to be registered	
Actor	Super Administrator , Branch Administrators, Laboratory Technicians , Blood collectors, Hospital Administrator, Donors	
Used use case		
Pre-condition	1. Super Administrator must exist in the system, 2. Branches should be created by super Administrator, 3. Branch administrators should be assigned by Super Administrator, 4. Blood Collectors and Laboratory Technicians should be staff members of the branch	
Post-condition	1. Password and other identification number will be generated that are used to access the system. 2. Actor will have access to the system based on their role after verification.	
ACTOR		SYSTEM
Flow of events	1. Actor opens the website 2. Actor inputs email and password.	1. Actor will verify entry. 2. System will display user's home page.
	I. Register Branch Administrator 3. Super administrator clicks on staff menu. 4. Super administrator fills	3. System will open staff data table and display form to be filled. 4. System will verify and register branch administrator to

Scenario	the form to be filled and click register button to save his work.	database.
Scenario	II. Register Staff 3. Branch Administrator clicks on staff menu. 4. Branch administrator fills information of specific staff (may be Laboratory Technician or Blood Collector) and clicks register button.	3. System will display staff data table and form to be filled. 4. System will register specific staff to the database.
Scenario	III. Register Hospital Administrator 3. Branch Administrator will click on hospital menu. 4. Branch Administrator fills important data about hospital and hospital administrator click register button.	3. System will open hospital's information data table and display form to be filled. 4. System will add hospital with collected data to database.
	IV. Register Donor 3. Blood Collectors clicks on donor's menu. 4. Blood Collectors fills important data about donor and click register	3. System will open donor's information data table and display form to be filled. 4. System will send collected data to database.

Scenario	button.	
Exception	1. if the actor enters invalid information, ✓ registration will be denied, ✓ the actor will be notified about the situation, ✓ the actor will be asked to retry 2. if the actor is already registered, ✓ the actor will be notified about the situation ✓ redirected to the login page.	

Table 1: Use Case Description for Register

Use-case Name	Authenticate
Brief Description	The actor requests the system to login after opening the website and going in to the login page.
Used use-case	Include: Register
Actors	Super Administrator , Branch Administrator ,Hospital Administrator, Laboratory Technicians , Blood collectors
Pre-condition	Actor must have been registered on the system. Actor must have his/her own role, Email and generated password.
Post-condition	Actor will be authorized to use the system based on his/her role.
ACTOR	SYSTEM

Flow of Events	1. Actor opens the website 2. Actor inputs email and Password.	1. System will load the login page. 2. System verifies Email and password then actor will be redirected to actor's homepage depending on their access level.
Exception	1 The actor enters invalid email or password ✓ The actor will be notified about the situation. ✓ The actor will be prompted to enter email and password. ✓ The actor will be prompted if he/she has forgotten their password.	

Table 2: Use Case Description for Authenticate

Use-case Name	Add Information	
Brief Description	The actor logins in to the system and commands the system to add new information.	
Used use-case	Include: authenticate, extend: register	
Actors	Super Administrator, Branch Administrator, Laboratory Technician	
Pre-condition	All actors must have their own accounts.	
Post-condition	New information inserted in to the system.	
ACTOR		SYSTEM
Flow of Events	1. Actor opens website. 2. Actor inputs email and password.	1. System exposes login page. 2. System will load home page.
	I. Add Information related to amount of blood with	3. System will display Add blood sub-menu.

Scenario	in the Stock. 3. Laboratory technicians click on Blood Menu. 4. Laboratory technicians will click on Add Blood sub menu. 5. Laboratory Technician will fill needed data then he will press save button.	4. System will display blood data table and form to be filled. 5. Database becomes synchronized and update the amount and type of blood.
Scenario	II. Add Personal blood information. 3. Laboratory technicians click on Donor Menu. 4. Laboratory technicians will click on Update button. 5. Laboratory Technicians will fill required data then he/she presses the Save button.	3. System will display Donor data table. 4. System will open personal form to be filled. 5. Database becomes synchronized and updates personal record of the Donor.
Scenario	III. Add Branch Super administrator clicks on branches. Super administrator fills forms and presses register.	5. System will open branches information data table and provides forms to be filled. 6. System will insert new branch to database.
Scenario	IV. Add Hospital 1. Branch administrator clicks on Hospitals. 2. Branch administrator fill	1. System will open hospitals information data table and presents forms to be filled. 2. System will insert new

	forms and press register.	hospital to database.
Scenario	V. Add Donation Center 1. Branch administrator clicks on donation centers. 2. Branch administrator fill forms and press register.	1. System will open donation centers information with in branch and presents forms to be filled. 2. System will insert new donation centers to database.
Exception	1. The actor enters incorrect input ✓ The actor will be notified about the situation 2. While adding new donor information, if the user is already registered, the actor will be notified about the situation and will be told to insert under that account.	

Table 3: Use Case Description for Add Information

Use-case Name	Update Information	
Brief Description	Updating updatable information based on access levels.	
Used use-case	Include: Authenticate ,extend: Register, Add Information	
Actors	Super Administrator , Branch Administrator ,Laboratory Technician , Blood Collectors	
Pre-condition	All actors should have their own accounts. Data should be available.	
Post-condition	Information will be modified and up-to-date.	
ACTOR		SYSTEM

Flow of Events	1. Actor opens website. 2. Actor inputs email and password.	1. System exposes login page. 2. System will load home page.
Scenario	I. Update Branch Administrator Information 1. Super administrator clicks on staff menu. 3. Super administrator clicks update button of specific branch administrator. 4. Super administrator edit information and click save button.	3. System will open staff data table. 4. System will display detail information about branch administrator. 5. Update personal information of branch administrator in database.
Scenario	II. Update Staff Information 3. Branch Administrator clicks on staff menu. 4. Branch administrator clicks update button of specific staff (may be Laboratory Technician or Blood Collector). 5. Branch administrators edit user information and click save button.	3. System will display staff data table. 4. System will pop up personal information about staff member. 5. Update personal information of staff member in database.
	III. Update Donor’s Information 3. Blood Collectors clicks on donors menu.	3. System will open donor’s information data table. 4. System will present detail information about specific

Scenario	4. Blood Collectors clicks update button of specific donor. 5. Blood Collectors edit information and click save button.	donor. 5. Update personal information of donor in database.
Scenario	IV. Update information related to amount of blood with in the Stock. 3. Laboratory technician click on Blood Menu. 4. Laboratory technicians will click on Add Blood sub menu. 5. Laboratory Technician will modifies needed data then he will press save button.	3. System will displays Add blood sub-menu. 4. System will display blood data table. 5. Database becomes synchronized and updates amount and type of blood.
Scenario	V. Updating Branch Information 3. Super administrator clicks on branches. 4. Super administrator clicks update button of specific branch. 5. Super administrator edit information and click save button.	3. System will open branches information data table. 4. System will present detail information about specific branch. 5. Update branch's information' in database.
	VI. Updating Hospital Information 3. Branch administrator	3. System will open hospitals information data table. 4. System will present detail

Scenario	clicks on hospitals. 4. Branch administrator clicks update button of specific branch. 5. Branch administrators edit information and click save button.	information about specific branch. 5. Update hospital's information in database.
Scenario	VII. Updating Donation Center Information 3. Branch administrator clicks on donation centers menu. 4. Branch administrator clicks update button of specific donation center. 5. Branch administrator edit information and click save button.	3. System will display donation centers information data table. 4. System will display detail information about specific donation center. 5. System will modify donation center's information in database.
Exception	1. The actor enters incorrect input ✓ The actor will be notified about the situation ✓ The actor will be prompted to try again	

Table 4: Use Case Description for Update Information

Use-case Name	Delete Information
Brief Description	Removing removable information based on access levels.
Used use-case	Include : Authenticate, extend: Register, Add Information

Actors	Super Administrator , Branch Administrator	
Pre-condition	All actors should have their own accounts. Data should be inserted.	
Post-condition	Unnecessary information will be removed.	
ACTOR		SYSTEM
Flow of Events	1. Actor opens website. 2. Actor inputs email and password.	1. System exposes login page. 2. System will load home page.
Scenario	I. Delete Branch Administrator Information 3. Super administrator clicks on staff menu. 4. Super administrator clicks delete button of specific branch administrator. 5. Super administrator will click yes button.	3. System will open staff data table and it will display detail information about branch administrator. 4. System will display ask verification question. 5. System will delete personal information of branch administrator in database.
	II. Delete Staff Information 3. Branch Administrator clicks on staff menu. 4. Branch administrator clicks delete button of specific staff member (may be Laboratory Technician or Blood	3. System will display staff data table and personal information about staff member. 4. System will display verification and require response from actor. 5. System will remove

Scenario	Collector). 5. Branch administrator clicks YES button.	personal information of staff member from database.
Scenario	III. Delete Branch 3. Super administrator clicks on branches. 4. Super administrator clicks delete button of specific branch. 5. Super administrator will press YES button.	3. System will open branches information data table. 4. System will present verification. 5. Branch will be removed from database.
Exception	1. The actor enters incorrect input ✓ The actor will be notified about the situation ✓ The actor will be prompted to try again	

Table 5: Use Case Description for Delete Information

Use-case Name	View Information
Brief description	Seeing the viewable information based on access levels.
Used use-case	Include: Authenticate, extend: Add Information
Actors	Super Administrator , Branch Administrator ,Laboratory Technician , Blood Collectors , Hospital Administrator
Pre-condition	All actors should have their own accounts.
Post-condition	Necessary information will be present.
ACTOR	SYSTEM

Flow of Events	1. Actor opens website. 2. Actor inputs email and password.	1. System exposes login page. 2. System will load home page.
Scenario	I. View Donor's Information Actor clicks on Donor Menu.	System will display donor's data table.
Scenario	II. View Staff Information Actor clicks on staff menu.	3. System will present staff's data table with full information.
Scenario	III. View Branch Information 3. Branch Administrator will click Hospitals menu.	3. System will return table, which contains information about NBBS Branches.
Scenario	IV. View Hospital Information Branch Administrator will click Branches menu.	3. System will present table, which contains detail information about Hospitals.
	V. View information of Donation Centers Branch Administrator will click Donation centers menu.	3. System will get and retrieve information about temporary donation centers with in branch.
	VI. View available amount of blood 3. Actor will press Blood	3. System will displays list of sub-menus. 4. System will present amount of available blood

Scenario	Stock menu. 4. Actor will select Available submenu.	with in its type and amount.
Scenario	VII. View used amount of blood 3. Actor will press Blood Stock menu. 4. Actor will select used sub-menu.	3. System will displays sub-menus. 4. System will present amount of used blood with in its type and amount.
Scenario	VIII. View History about blood 3. Actor will click on Blood Stock menu. 4. Actor will select History sub-menu.	3. System will present sub-menus. 4. System will display necessary history information to be viewed by an actor.
Scenario	IX. View Generated Reports 3. Actor will click on Printable menu.	3. System will display generated reports according to role of an actor.
Scenario	X. View Alert Notifications 3. Actor will click on the notification Icon.	3. System will pop up the relevant notification.

Table 6: Use Case Description for View Information

Use-case Name	Search	
Brief description	Actors search information from the system by inserting key	
Used use-case	Include: Authenticate , extend: Add Information	
Actors	Super Administrator , Branch Administrator , Laboratory Technician, Blood Collector	
Pre-condition	- There should be relevant data to be searched.	
Post-condition	Filtered and searched data will be found and presented for use.	
ACTOR		SYSTEM
Flow of events	1. Actor opens website. 2. Actor inputs email and password. 3. Actor will type on search form.	1. System will detects trigger and presents login page. 2. After validation system will display home page. 3. System will find and return data from database.
Exception	✓ Information that matches with the search key might not be available. ✓ The search key might be invalid.	

Table 7: Use Case Description for Search

Use-case Name	Sort
Brief description	Actors can sort information in ascending or descending order
Used use-case	Include: Authenticate , extend: Add Information

Actors	Super Administrator , Branch Administrator , Laboratory Technician, Blood Collector	
Pre-condition	There should be relevant data sorted.	
Post-condition	By using different constraints data will become sorted and ordered.	
ACTOR		SYSTEM
Flow of events	1. Actor opens website. 2. Actor inputs email and password. 3. Actor will select and press data table to be sorted and selects constraint.	1. System will detects trigger and presents login page. 2. After validation system will display home page. 3. System present sorted data.

Table 8: Use Case Description for Sort

Use-case Name	Donate Blood	
Brief description	Blood collectors insert new donated blood to the system.	
Used use-case	Include: Authenticate , extend: Search , register	
Actors	Blood Collector, Donor	
Pre-condition	There should be created Donor’s account.	
Post-condition	Blood will be donated and added to system.	
ACTOR		SYSTEM

Flow of events	1. Actor opens website. 2. Actor inputs email and password. 3. Actor will press Blood menu. 4. Actor will select Donate Blood sub menu. 5. Actor will search Donor record. 6. Actor add new history to donor record.	1. System will verify entry. 2. After validation system will load Blood Collector’s home page. 3. System will presents list of sub-menu. 4. System display donation page. 5. System will return necessary information. 6. System will update status of Donor.

Table 9: Use Case Description for Donate Blood

Use-case Name	Get Blood	
Brief description	Actors can get blood by requesting for it.	
Used use-case	Include: Authenticate	
Actors	Super Administrator, Branch Administrator	
Pre-condition	There should be enough amount of blood in the store.	
Post-condition	Blood will be taken from system.	
ACTOR		SYSTEM
Flow of events	1. Actor opens website. 2. Actor inputs email and password.	1. System will verify entry. 2. After validation system will load Blood Collector’s home page.

	3. Actor will press Blood menu. 4. Actor will select Get Blood sub menu. 5. Actor will fill form and press Get Blood button.	3. System will presents list of sub-menu. 4. System display form to be filled. 5. System will decrease the amount of blood from system.
Exception	1. Actor inserts inputs while responding ✓ The actor will be notified about the situation ✓ The actor will be prompted to try again	

Table 10: Use Case Description for Get Blood

Use-case Name	Send Request	
Brief description	Actors request for blood.	
Used use-case	Include: Authenticate	
Actors	Super Administrator , Branch Administrator, Hospital Administrator	
Pre-condition	-logged in as Super administrator or Branch Administrator -Shortage of blood amount with in branch. -identify branch with sufficient amount of blood	
Post-condition	Sent requested amount of blood to another branch	
ACTOR		SYSTEM

Flow of events	1. Actor opens website. 2. Actor inputs email and password. 3. Actor clicks Blood Menu. 4. Actor clicks Get Blood sub -menu. 5. Actor choose branch to be requested. 6. Actor fills the amount of blood needed per its type and RH factor. 7. Actor click request button.	1. System verifies entry. 2. System will load actor's home page. 3. System will display sub menu. 4. System will display needed forms to be filled. 5. System getting branch to be requested. 6. It tries to validate the type of data inserted. 7. System will transfer request to the right branch.
Exception	1. Actor inserts inputs while responding ✓ The actor will be notified about the situation ✓ The actor will be prompted to try again	

Table 11 : Use Case Description for Send Request

Use-case Name	Reply Request
Brief description	Actors reply to requests from other actors.
Used use-case	Include: Authenticate , Send Request
Actors	Super Administrator , Branch Administrator
Pre-condition	-logged in as Super Administrator -request from Super administrator or Branch Administrator
Post-condition	Reply and provide amount of blood requested by another branch

ACTOR		SYSTEM
Flow of events	1. Actor opens website.	1. System verifies entry.
	2. Actor inputs email and password.	2. System will load actor’s home page.
	3. Actor get notification.	3.System will provide notification
	4. Actor clicks Blood Menu.	4. System will display sub menu.
	5. Actor clicks Transfer Blood sub - menu.	5. System will display needed forms to be filled.
	6. Actor choose branch to be transferred.	6. System getting branch to be transferred.
	7. Actor fills the amount of blood to be transferred per its type and RH factor.	7. It tries to validate the type of data inserted.
	8. Actor click Send button.	8. System will transfer amount of blood to the requested branch.
Exception	1. Actor inserts inputs while responding ✓ The actor will be notified about the situation ✓ The actor will be prompted to try again	

Table 12: Use Case Description for Reply Request

Use-case Name	Generate Report
Brief description	Actors can generate and remove report
Used use-case	Include: Authenticate , extend: Add Information
Actors	Super Administrator , Branch Administrator , Laboratory Technician, Blood Collector , Hospital Administrator

Pre-condition	There should be relevant data to be generated.	
Post-condition	Summarized and analyzed data will be presented.	
ACTOR		SYSTEM
Flow of events	1. Actor opens website. 2. Actor inputs email and password. 3. Actor will click on Pintables menu. 4. Actor will choose the relevant generated report.	1. System will presents login page. 2. After validation system will display actor's home page. 3. System will present different generated reports based on actor's role.

Table 13: Use Case Description for Generate Report

Use-case Name	Alert Notification	
Brief description	Actors get new notifications about different situations	
Used use-case	Include: authenticate, Send Request extend: register, Add Information	
Actors	Super Administrator , Branch Administrator , Hospital Administrator	
Pre-condition	There should be some changes to be notified.	
Post-condition	Notifications will be addressed for the right actor.	
ACTOR		SYSTEM
Flow of events	1. Actor opens website. 2. Actor inputs email and password.	1. System will presents login page. 2. After validation system will

	3. Actor will click on Notification Icon.	display actor’s home page. 3. System will load the notifications from database and it will make notification as viewed in database.

Table 14: Use Case Description for Alert Notifications

Use-case Name	Change Password	
Brief description	Actors can change their own password.	
Used use-case	Include: Authenticate	
Actors	Super Administrator , Branch Administrator , Laboratory Technicians , Blood Collectors , Hospital Administrator	
Pre-condition	There should be account.	
Post-condition	Actor’s password become modified.	
ACTOR		SYSTEM
Flow of events	1. Actor opens website. 2. Actor inputs email and password. 3. Actor will click on Setting menu. 4. Actor will set new password and press Change Password button.	1. System will presents login page. 2. After validation system will display actor’s home page. 3. System will display form to be filled. 4. System will override the

Exception	1. The actor enters incorrect input ✓ The actor will be notified about the situation ✓ The actor will be prompted to try again

Table 15: Use Case Description for Change Password

Use-case Name	Reset Password	
Brief description	Actors can reset their own password if they forget or lost.	
Used use-case	Include: Authenticate	
Actors	Super Administrator, Branch Administrator	
Pre-condition	Passwords will become forgotten.	
Post-condition	Password of another actor will be changed.	
	ACTOR	SYSTEM
Flow of events	1. Actor opens website. 2. Actor inputs email and password. 3. Actor will click on Setting menu.	1. System will presents login page. 2. After validation system will display actor's home page. 3. System will open page which contains forms.
Scenario	I. Branch Administrator Super Administrator will select actors name and fill new form then he/she will Reset Password.	System will be reset the password of the selected actor.
	II. Laboratory Technician ,	System will be reset the password

Scenario	Blood Collector’s and Hospital Administrators Branch Administrator will select actors name and fill new form then he/she will Reset Password.	of the selected actor.
Exception	1. The actor enters incorrect input ✓ The actor will be notified about the situation ✓ The actor will be prompted to try again	

Table 16: Use Case Description for Forgot Password

Use-case Name	Logout
Brief description	Actors can log out of the system.
Used use-case	Authenticate

Actors	Super admin , Branch Administrator , Laboratory Technicians , Blood Collectors, Hospital Administrator	
Pre-condition	Account should be logged in.	
Post-condition	Leave the system and close the session.	
ACTOR		SYSTEM
Flow of events	1. Actor opens website. 2. Actor inputs email and password. 3. Actor will click on Logout Icon.	1. System will presents login page. 2. After validation system will display actor's home page. 3. System will delete all logged in actor session data.

Table 17: Use Case Description for Reset Password

3.2.5 Activity Diagram

Activity diagrams are the object-oriented equivalent of flow charts and data-flow diagrams from structured development. Activity diagrams describe the workflow behavior of a system.

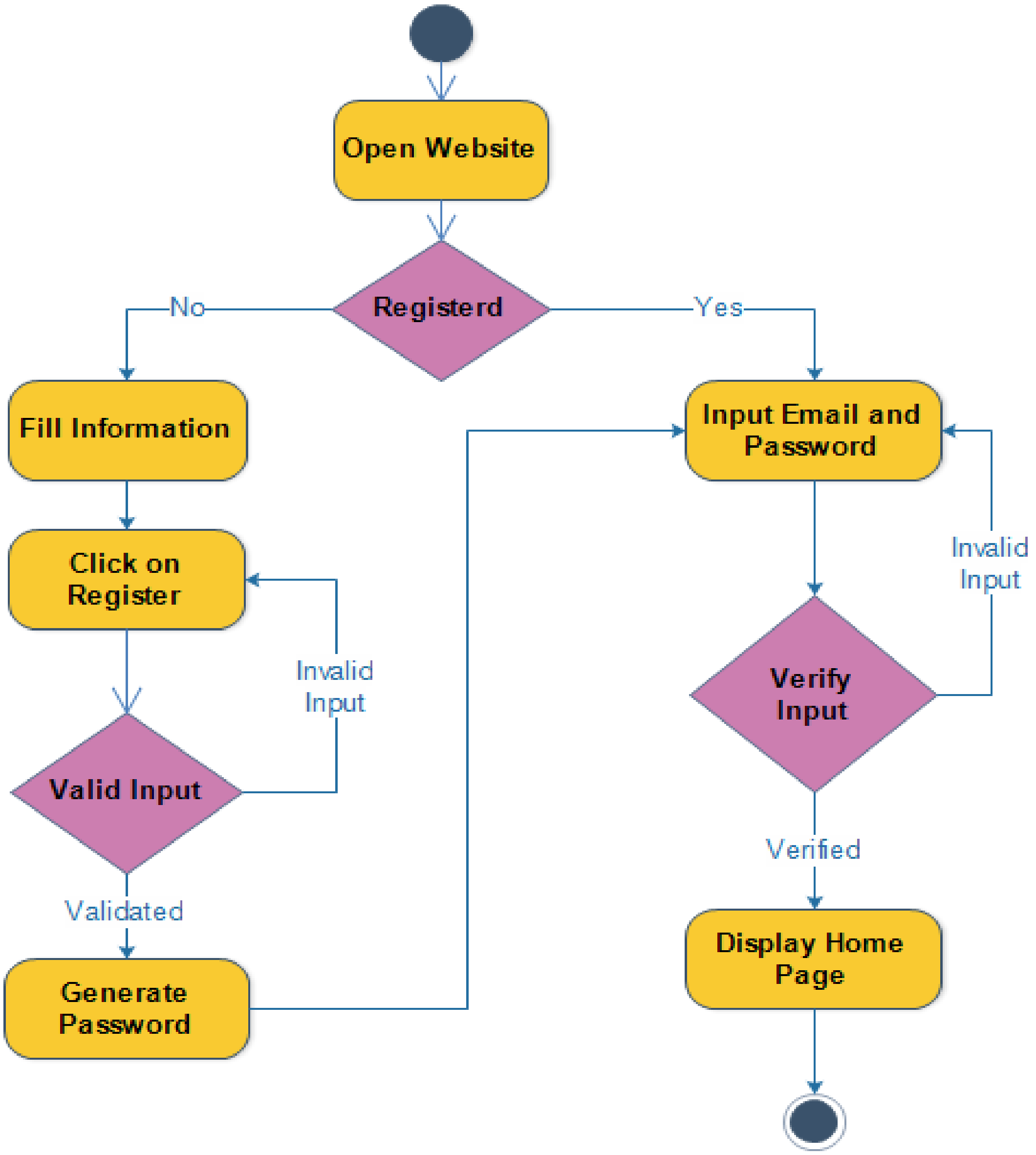


Figure 8 : Activity Diagram for Login Authentication

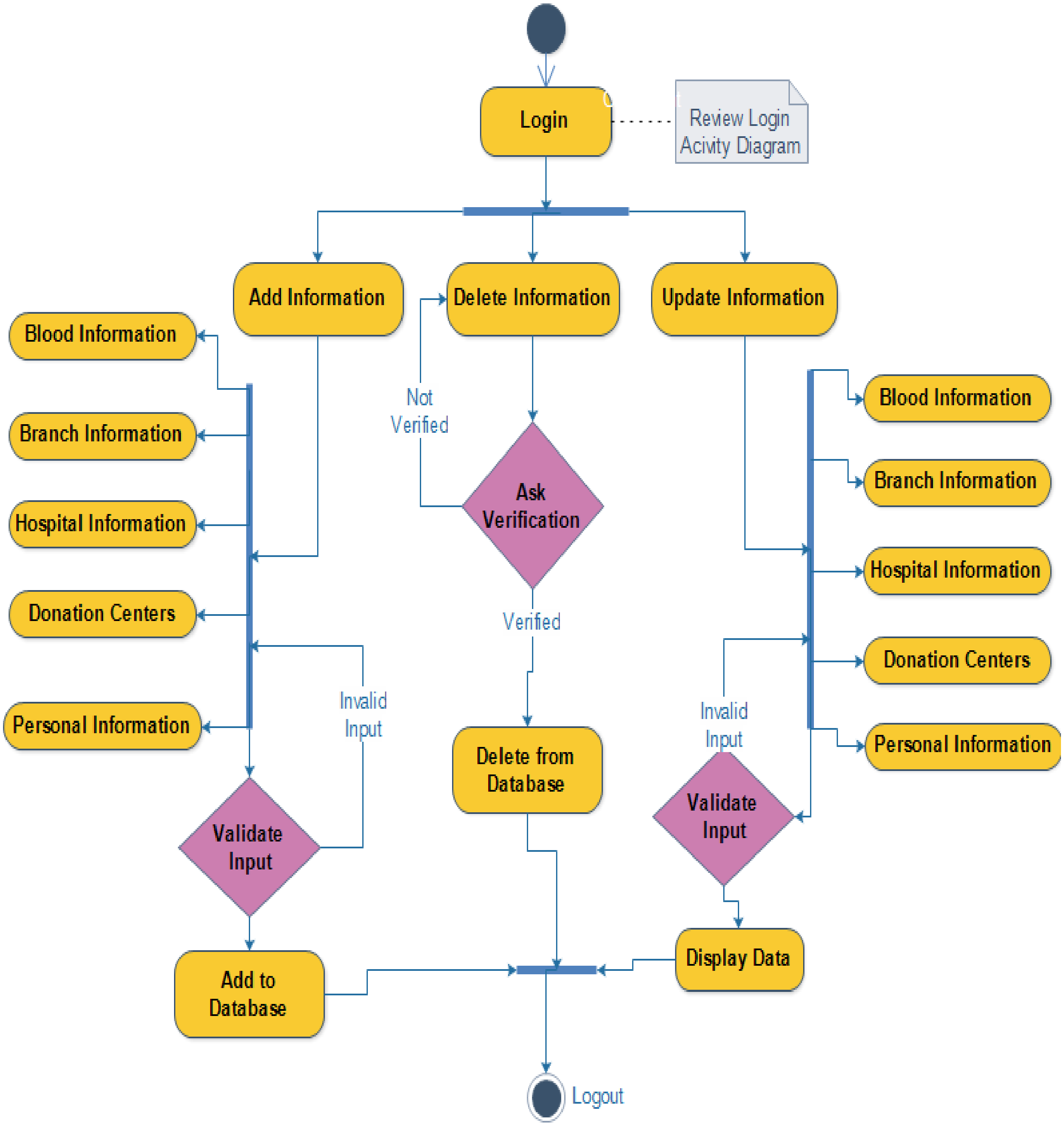


Figure 9: Activity Diagram for Add, Update and Delete Information.

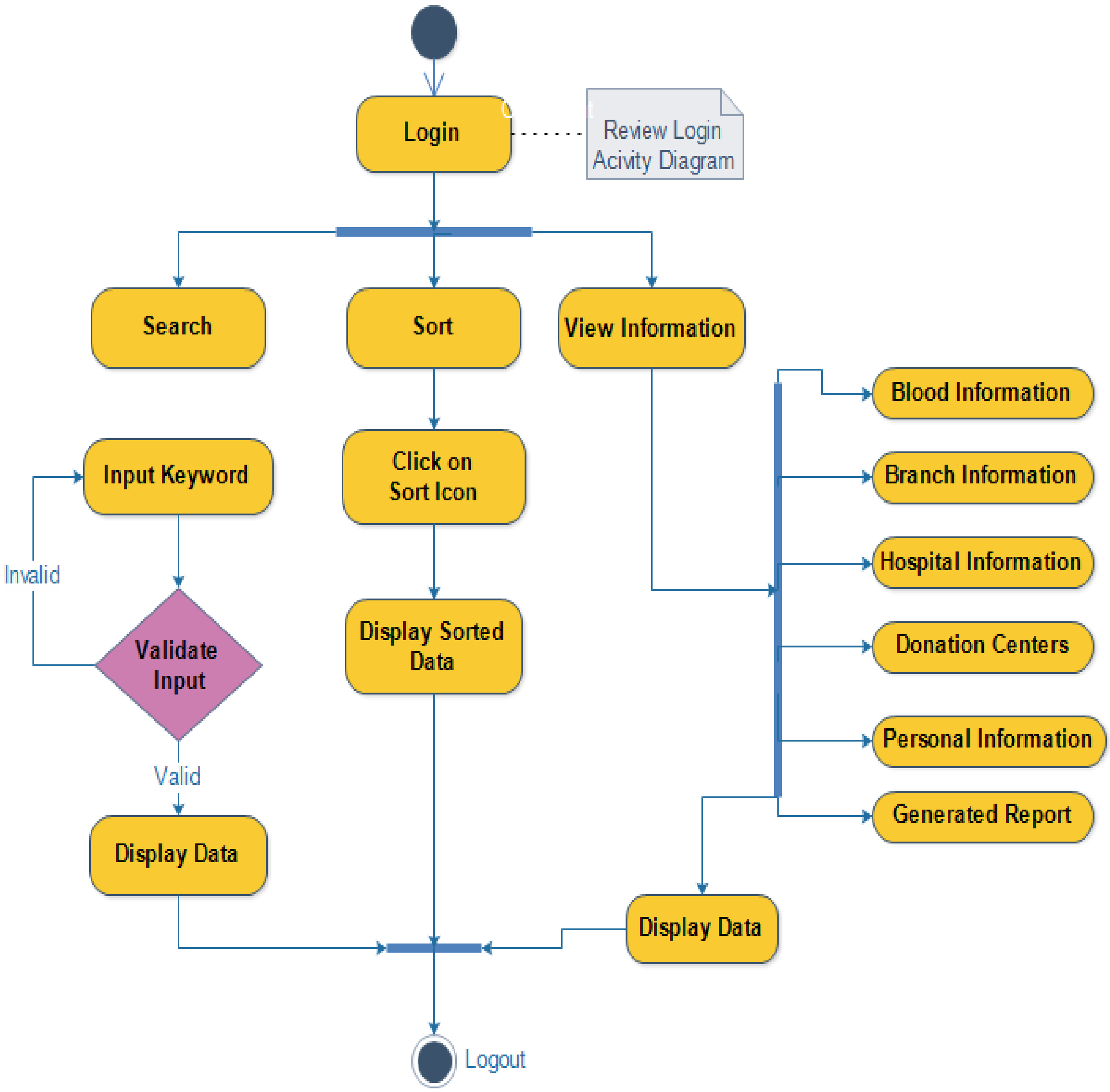


Figure 10 : Activity Diagram for Search, Sort and View Information.

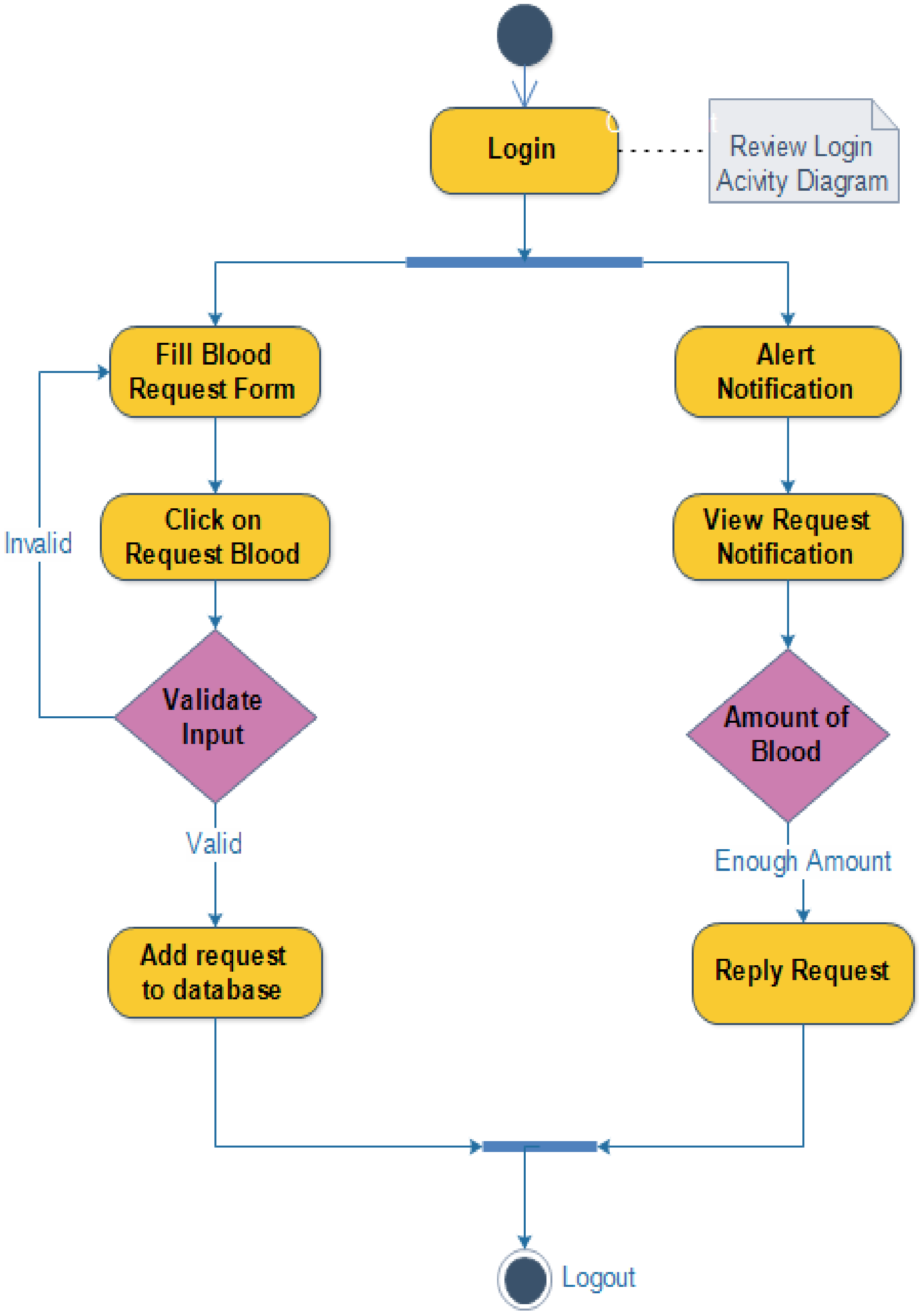


Figure 11 : Activity Diagram for Send blood Request and Reply Blood Request.

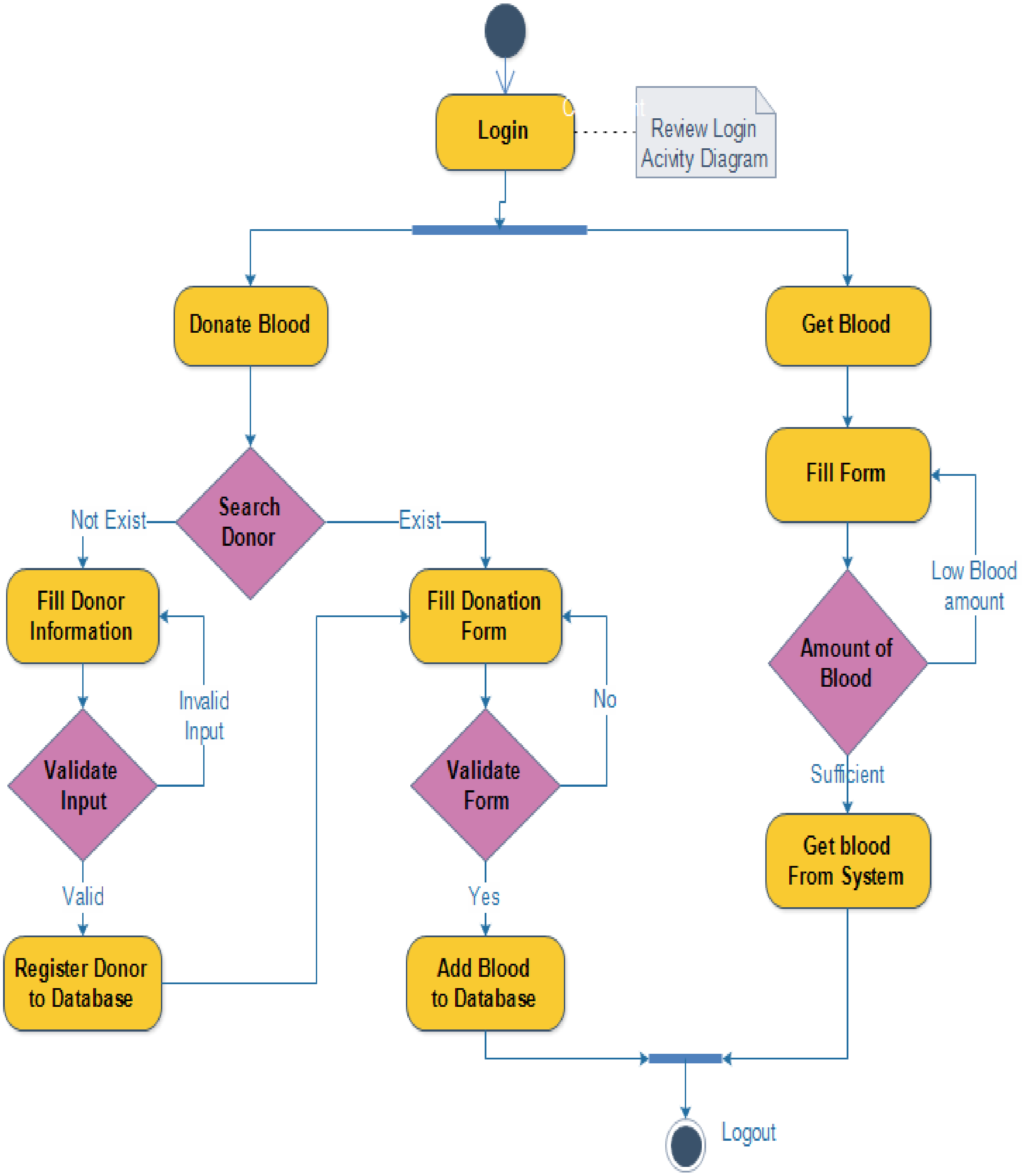


Figure 12: Activity Diagram for Donate Blood and Getting Blood from System.

3.3 Dynamic Modelling

Dynamic Modeling also used to represents the interaction, workflow, and different states of the static constituents in a software.

3.3.1 Sequence Diagram

A sequence diagram is an interactive diagram that shows how objects operate with one another and in what order. It shows object interactions arranged in time sequence.

The following sequence diagrams represents the sequence of each functionality of BBIMS of NBBS.

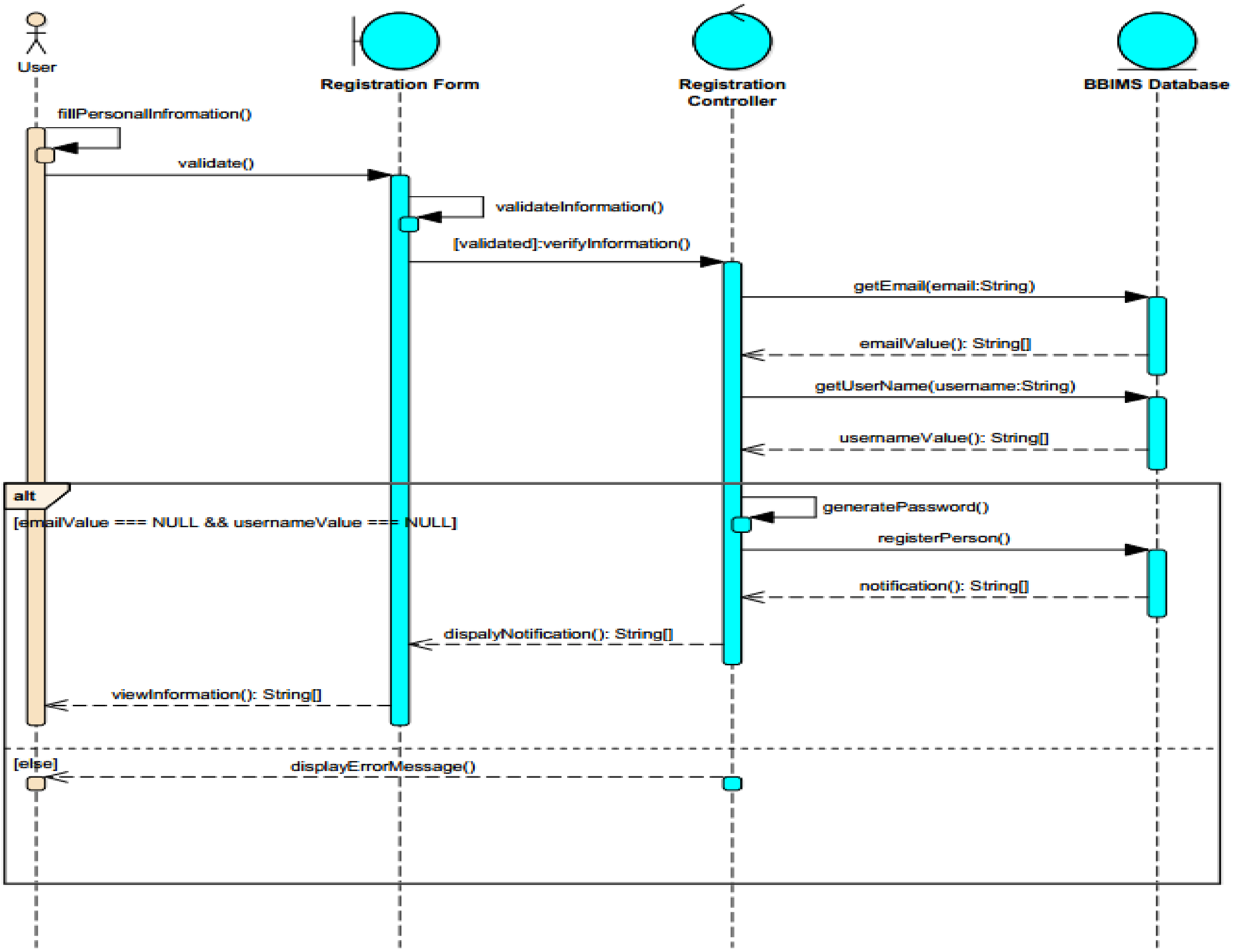


Figure 13 : Sequence Diagram for Registration of User

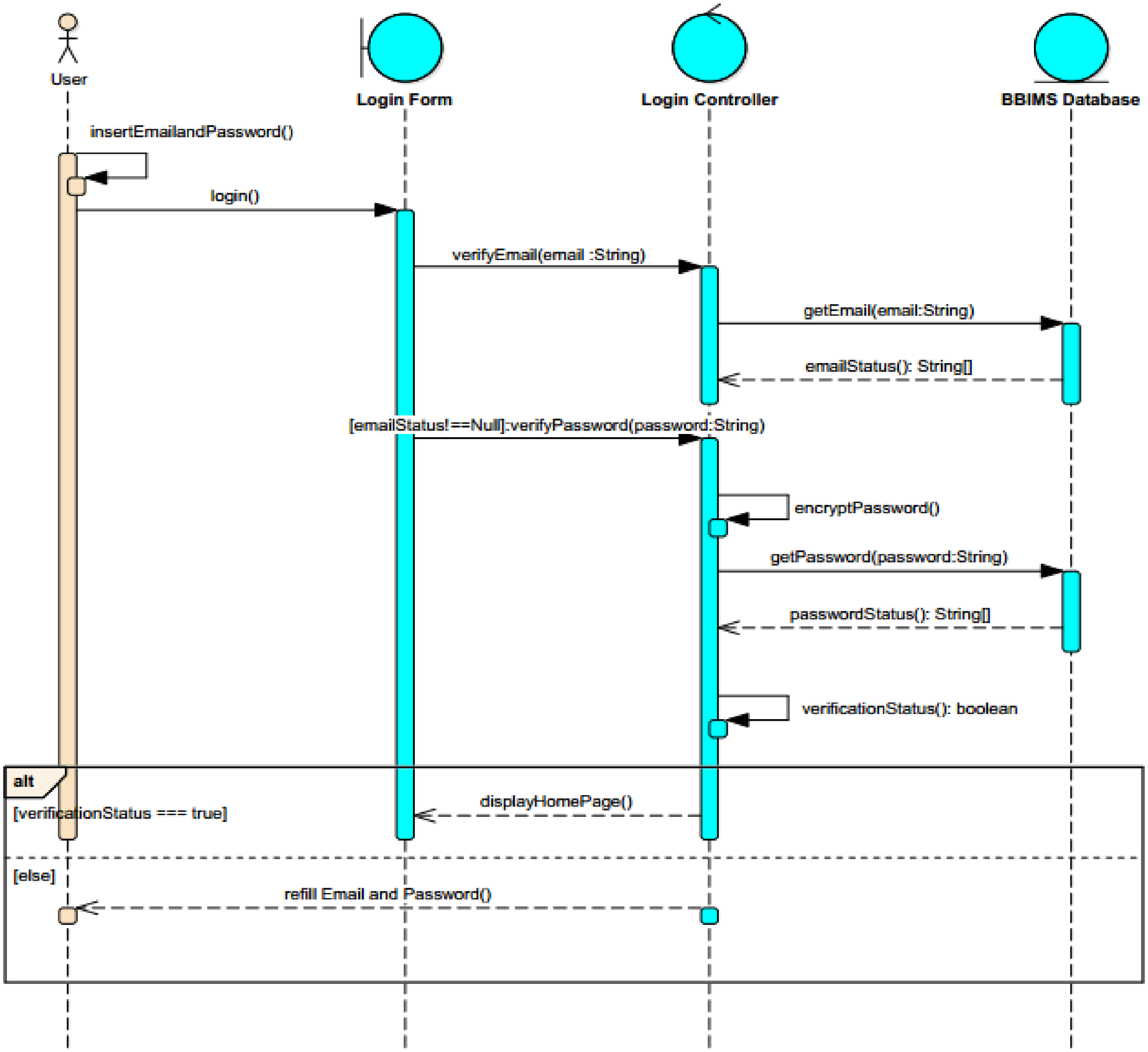

User
Login Form
Login Controller
BBIMS Database
insertEmailandPassword()
login()
verifyEmail(email :String)
getEmail(email:String)
emailStatus(): String[]
[emailStatus!==Null]:verifyPassword(password:String)
encryptPassword()
getPassword(password:String)
passwordStatus(): String[]
verificationStatus(): boolean
alt
[verificationStatus === true]
displayHomePage()
[else]
refill Email and Password()

Figure 14 : Sequence Diagram for Authentication

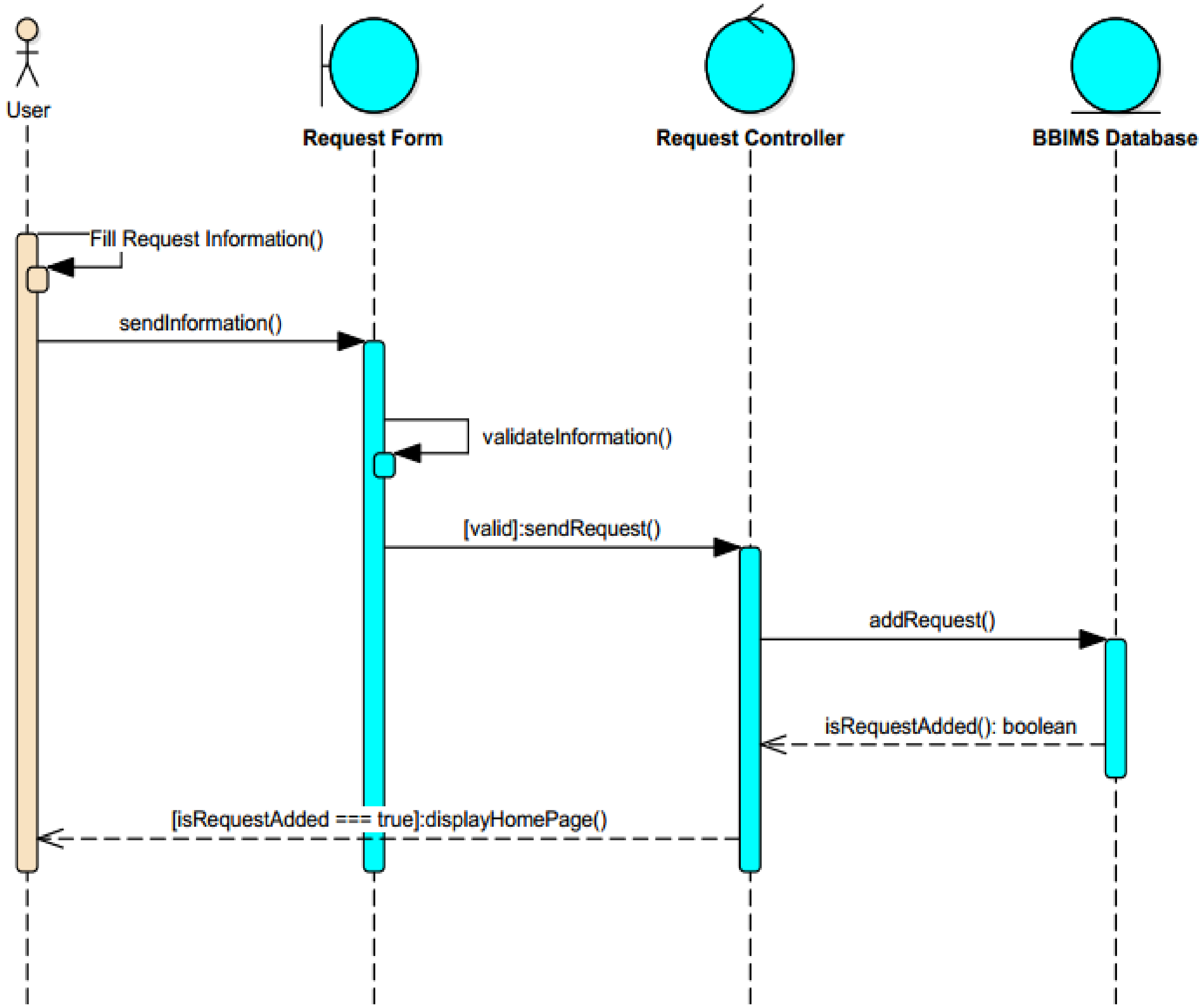


Figure 15 : Sequence Diagram for Send Blood Request

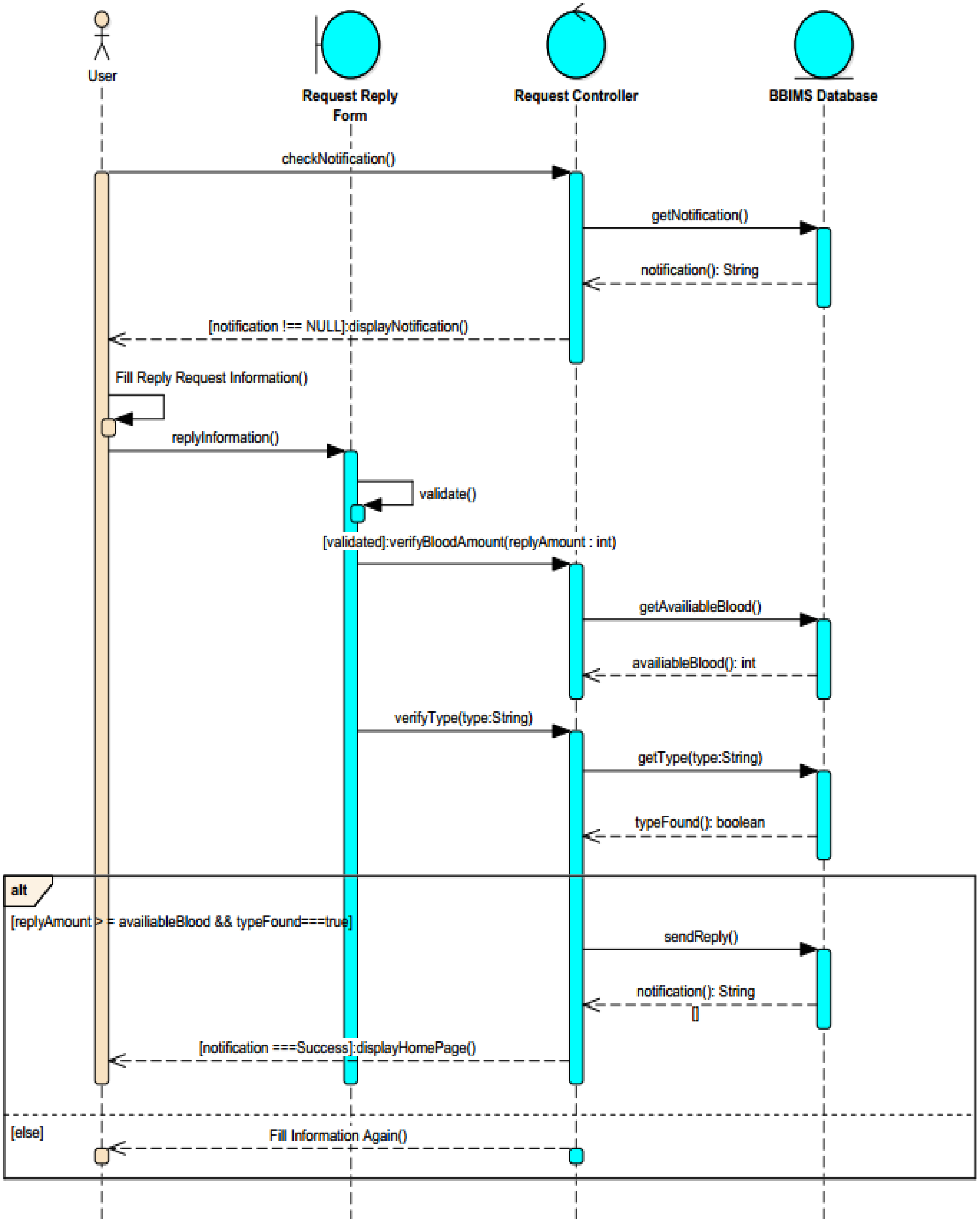

User
Request Reply Form
Request Controller
BBIMS Database
checkNotification()
getNotification()
notification(): String
[notification !== NULL]:displayNotification()
Fill Reply Request Information()
replyInformation()
validate()
[validated]:verifyBloodAmount(replyAmount : int)
getAvailiableBlood()
availiableBlood(): int
verifyType(type:String)
getType(type:String)
typeFound(): boolean
alt
[replyAmount > = availiableBlood && typeFound===true]
sendReply()
notification(): String
[]
[notification ===Success]:displayHomePage()
[else]
Fill Information Again()

Figure 16 : Sequence Diagram for Reply Blood Request

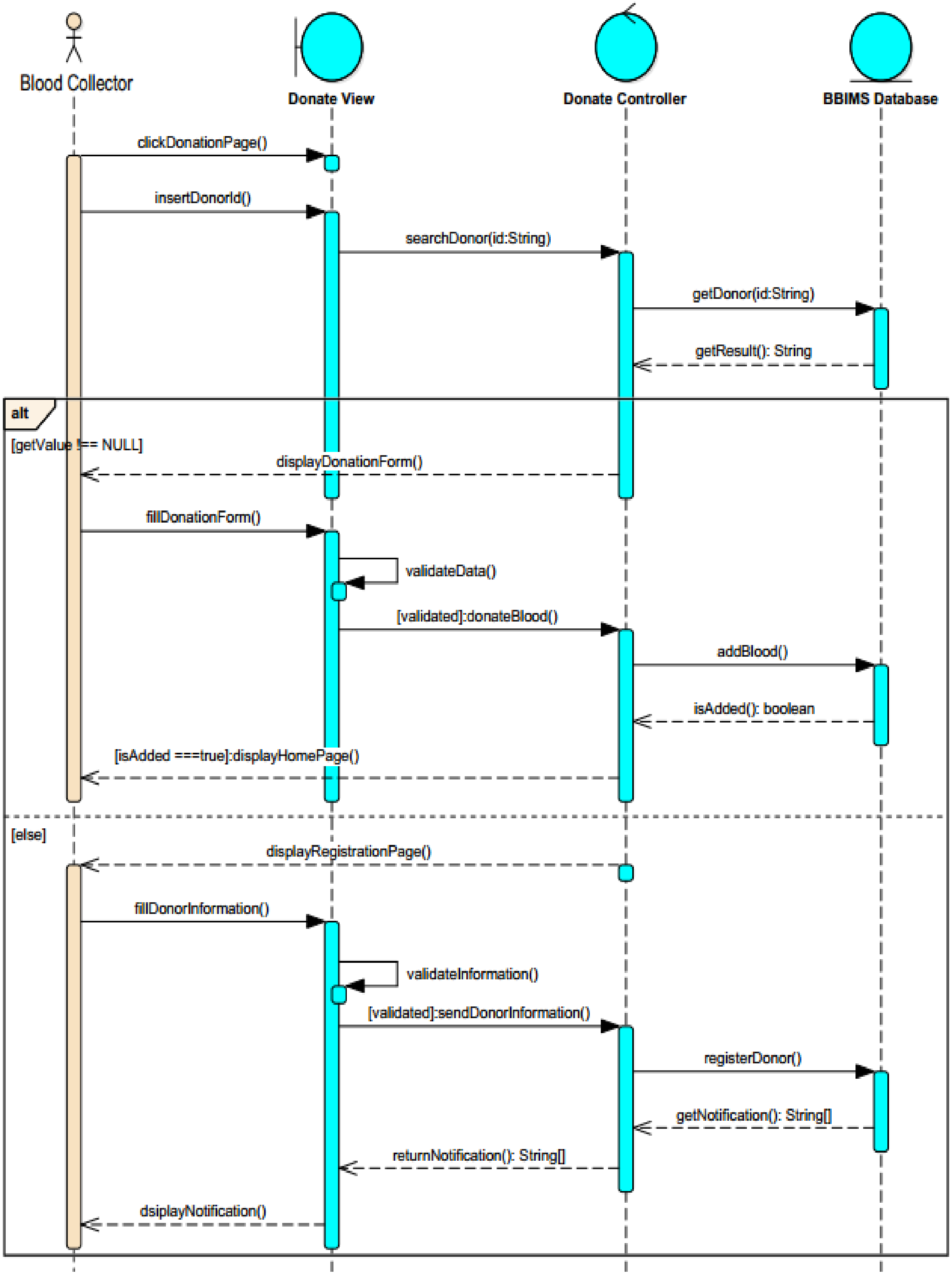


Figure 17 : Sequence Diagram for Donate Blood

3.3.2 State Diagram

A state diagram is type of diagram that describes the behavior of the system. It is essential to understand the instant condition or "run state" of a model when it executes.

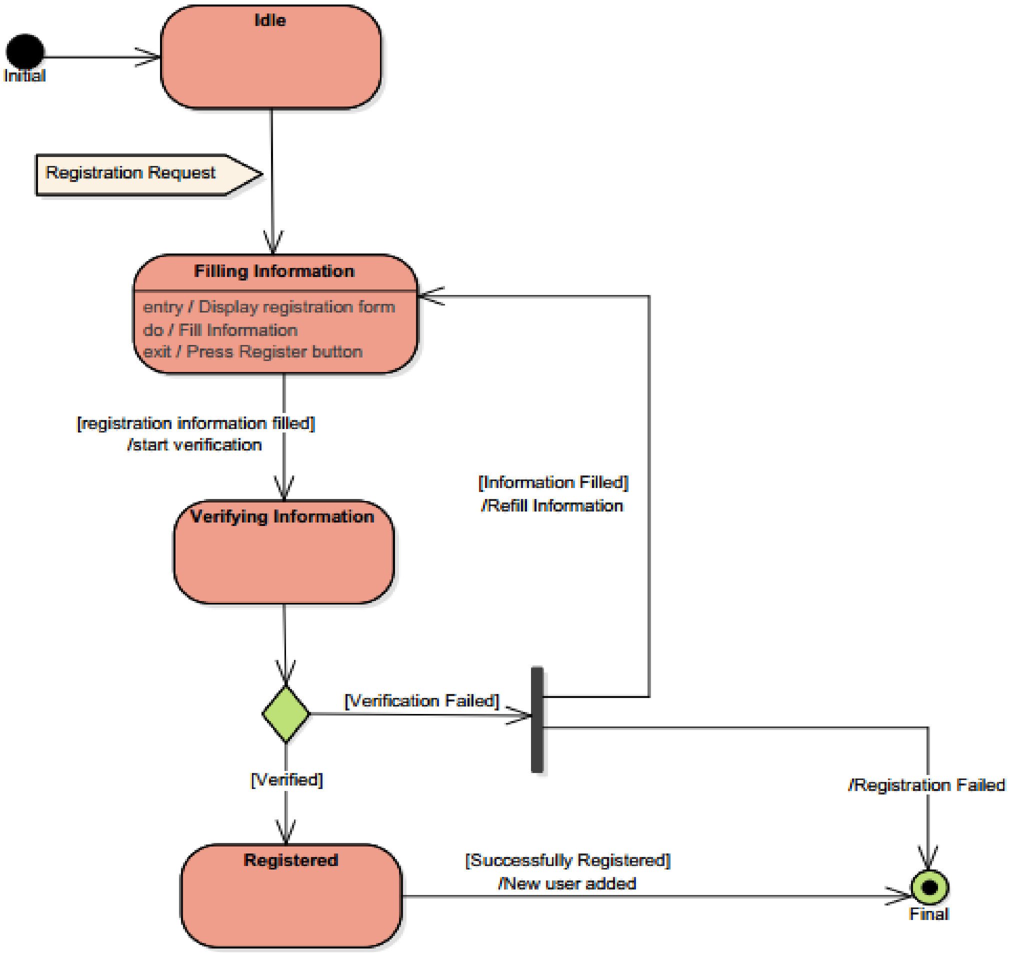


Figure 18 : State Diagram for User Registration

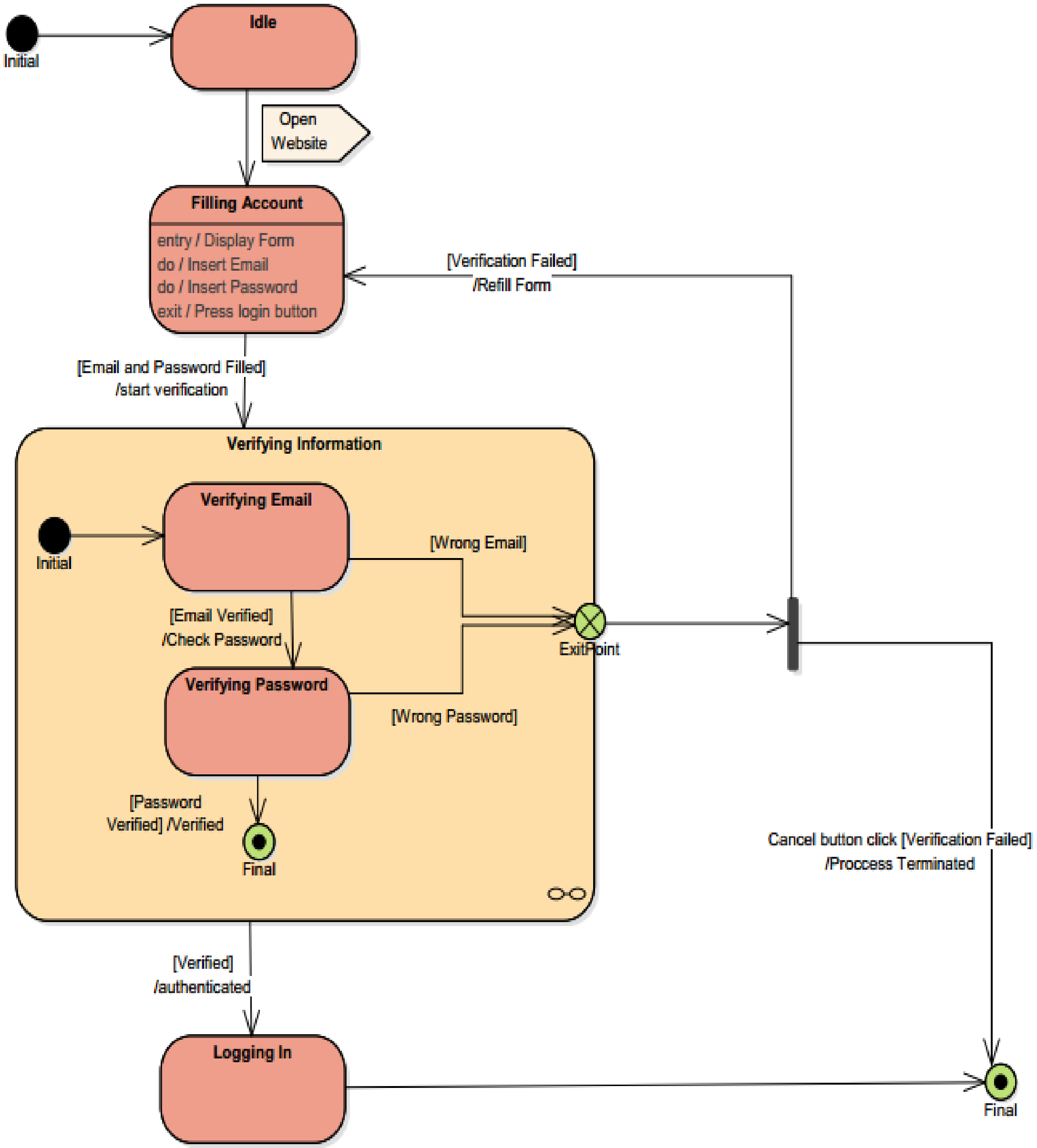

Initial
Idle
Open Website
Filling Account
entry / Display Form
do / Insert Email
do / Insert Password
exit / Press login button
[Verification Failed] /Refill Form
[Email and Password Filled] /start verification
Verifying Information
Verifying Email
Initial
[Wrong Email]
[Email Verified] /Check Password
ExitPoint
Verifying Password
[Wrong Password]
[Password Verified] /Verified
Final
Cancel button click [Verification Failed] /Proccess Terminated
[Verified] /authenticated
Logging In
Final

Figure 19 : State Diagram for Login Authentication

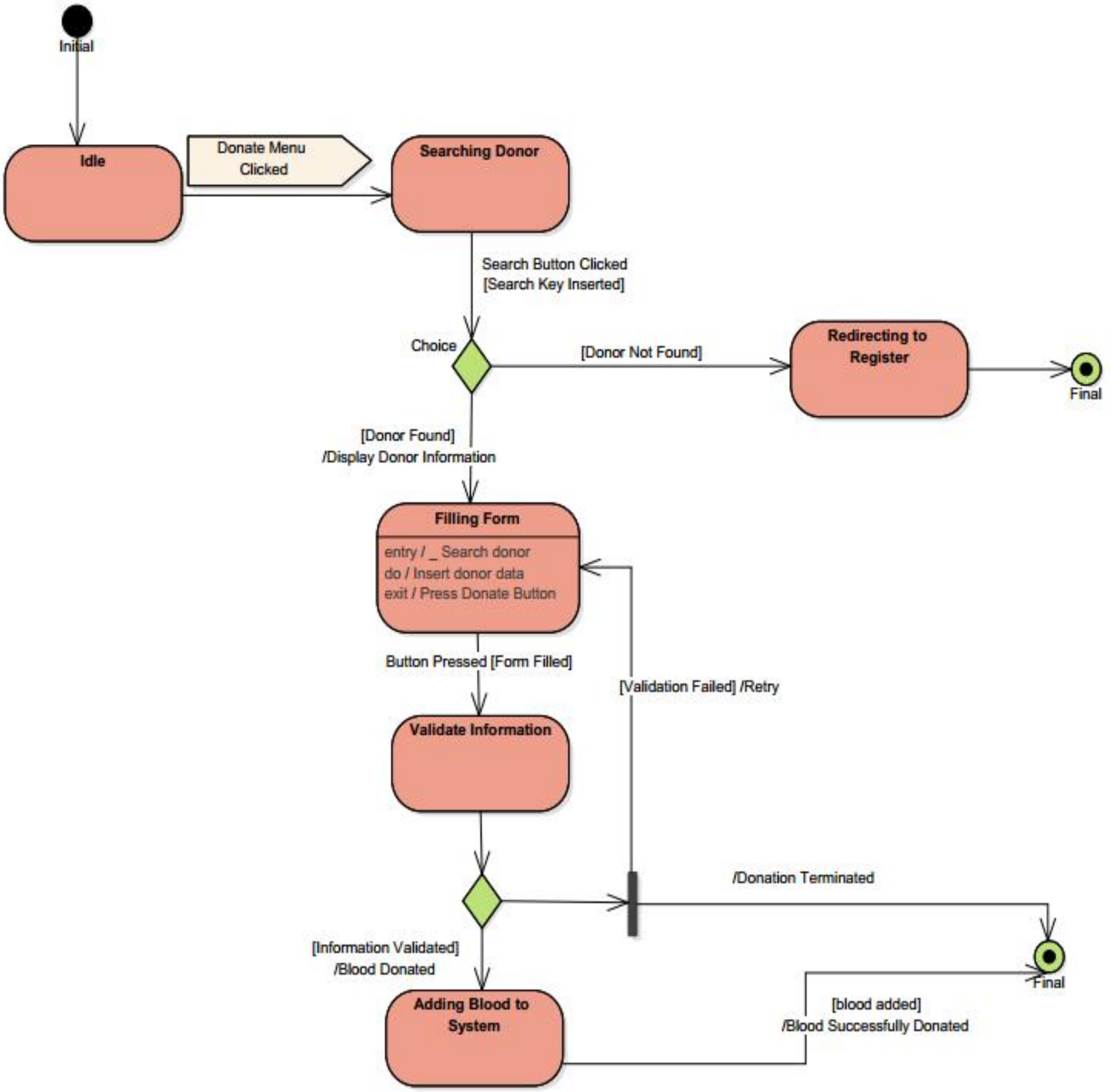

Initial
Idle
Donate Menu Clicked
Searching Donor
Search Button Clicked [Search Key Inserted]
Choice
[Donor Not Found]
Redirecting to Register
Final
[Donor Found] /Display Donor Information
Filling Form
entry / _ Search donor
do / Insert donor data
exit / Press Donate Button
Button Pressed [Form Filled]
[Validation Failed] /Retry
Validate Information
/Donation Terminated
[Information Validated] /Blood Donated
Final
Adding Blood to System
[blood added] /Blood Successfully Donated

Figure 20 : State Diagram for Donate Blood

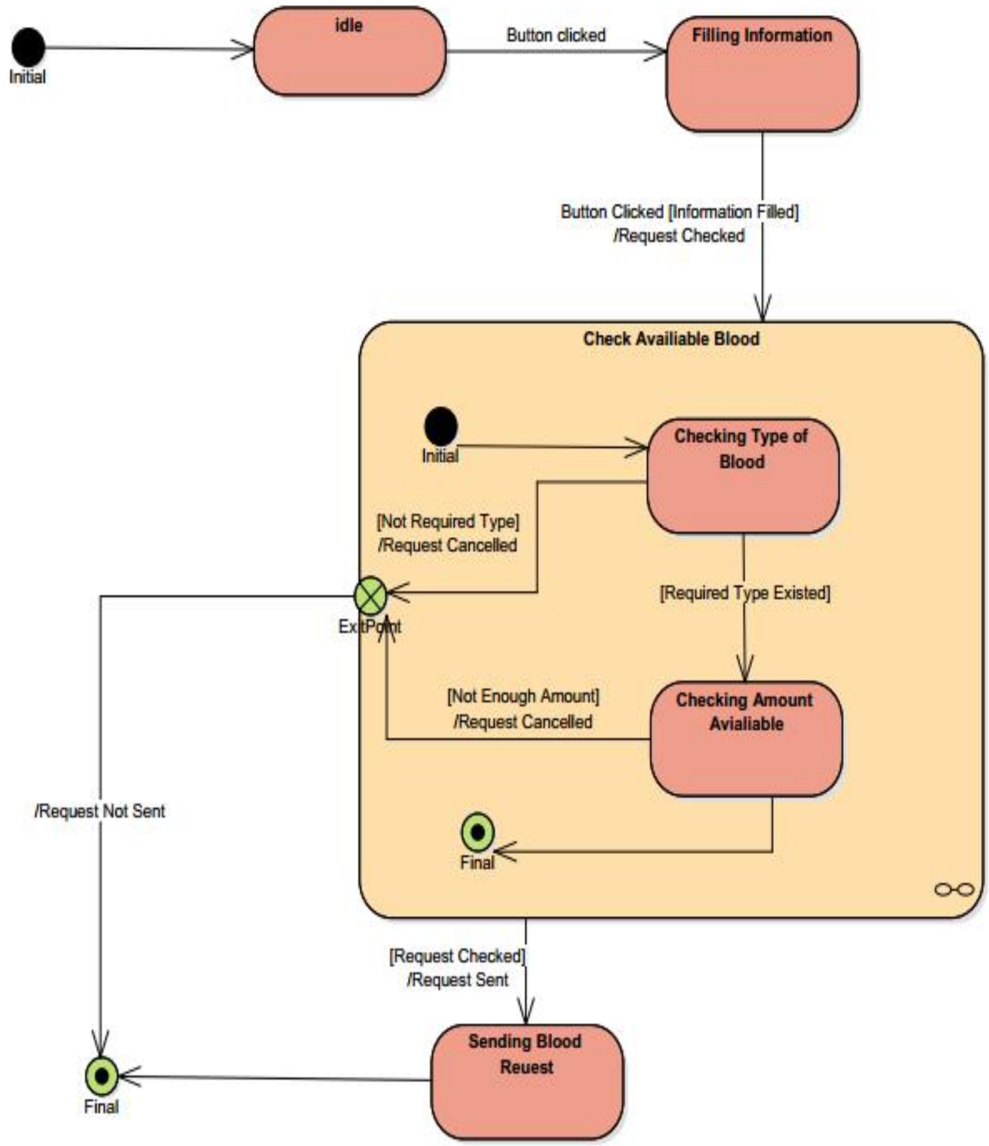


Figure 21 : State Diagram for Sending Request

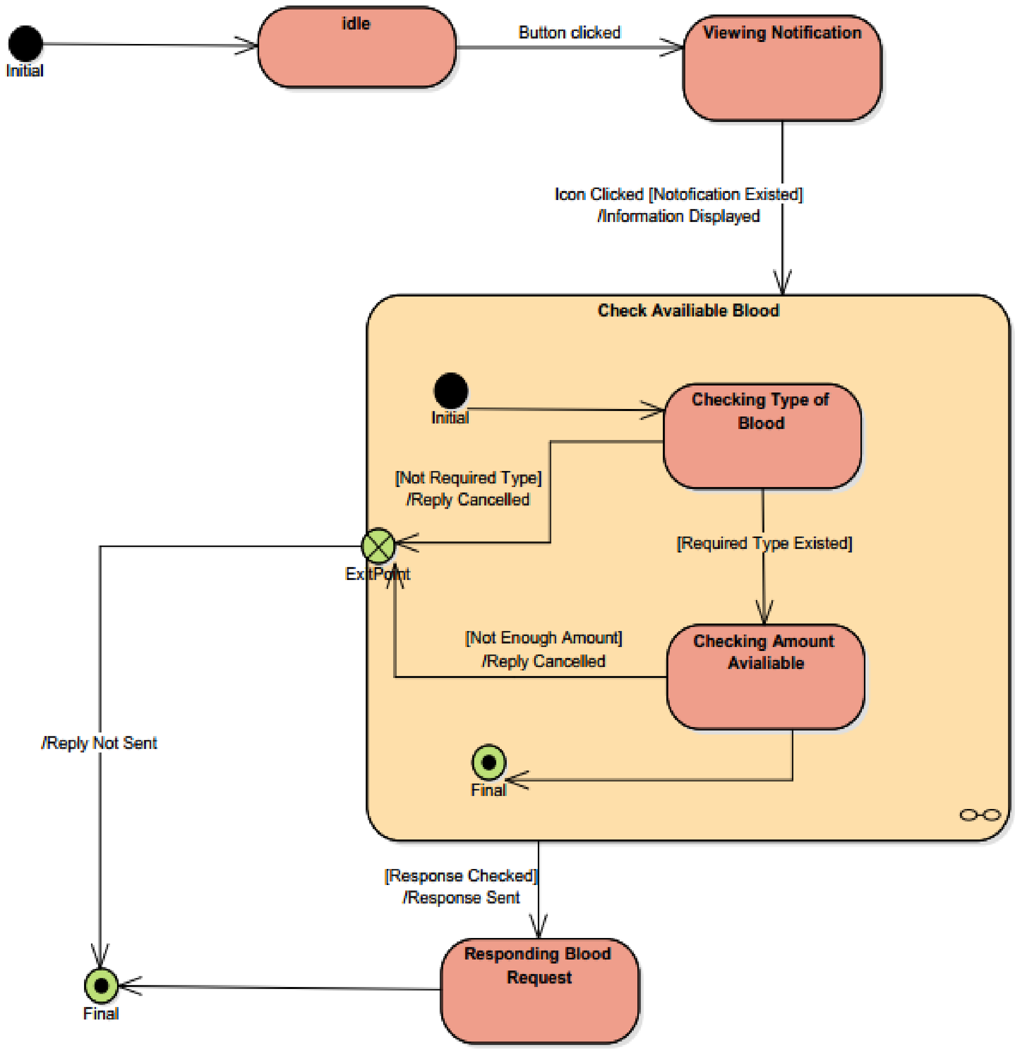


Figure 22 : State Diagram for Reply Blood Request

3.4 Class Based Modelling

Class based modeling represents the objects that the system will manipulate, the operations (also called methods or services) that will be applied to the objects to effect the manipulation and their relationships.

3.4.1 Class Identification

For BBIMS we have identified the following classes:

- ✓ Person
- ✓ Super Administrator
- ✓ Branch Administrator
- ✓ Blood Collector
- ✓ Laboratory Technician
- ✓ Hospital Administrator
- ✓ Donor
- ✓ Address
- ✓ Hospital
- ✓ Branch
- ✓ Blood Stock
- ✓ Donation Center
- ✓ Report History
- ✓ Donor History

3.4.2 Class Diagram

Class diagrams capture the static structure of Object-Oriented systems, or how they are structured rather than how they behave. They identify what type of classes there are, how they interrelate and interact each other.

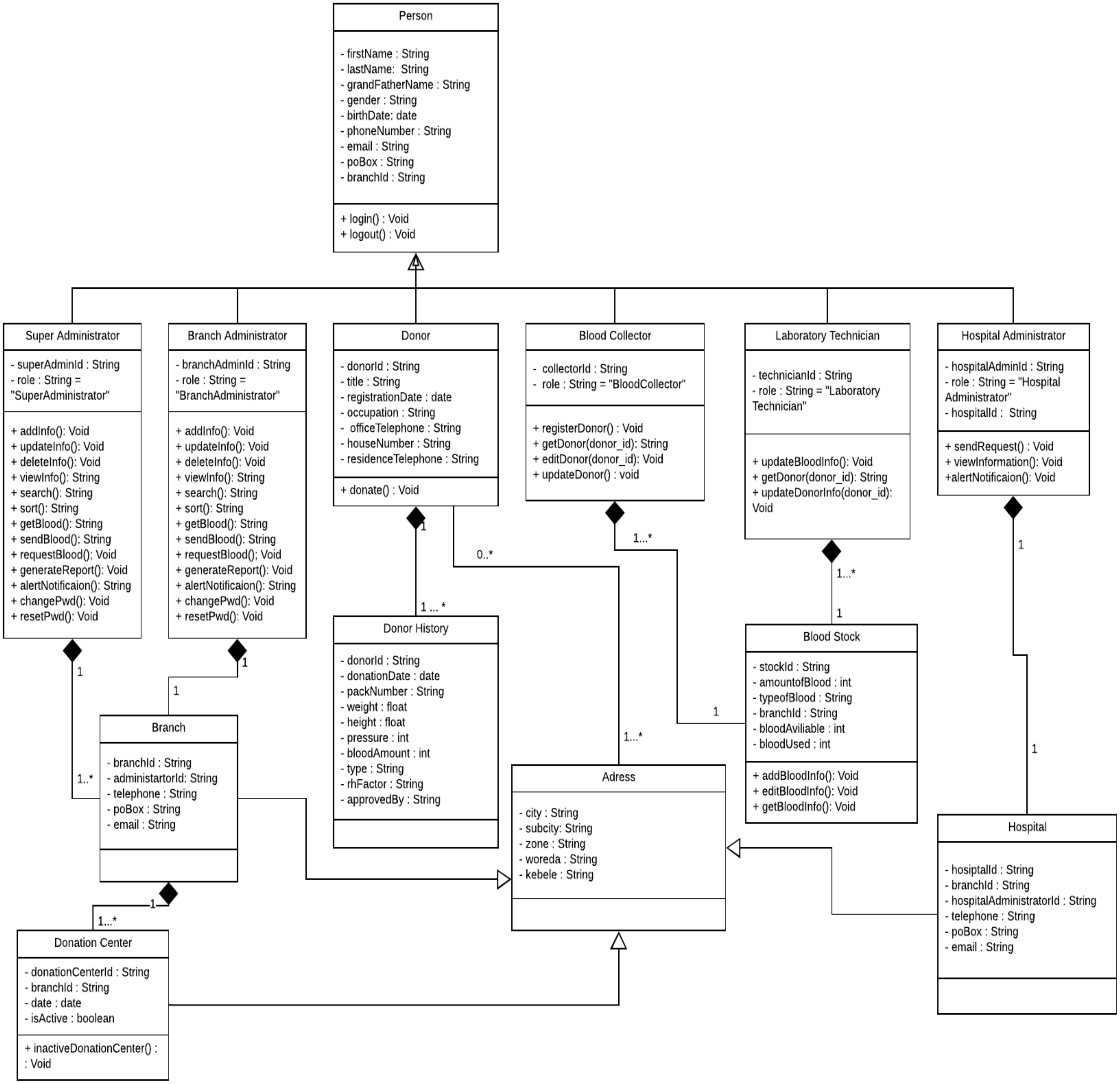


Figure 23 : Class Diagram for BBIMS

4. Chapter 4 - System Design

4.1 Overview

After analyzing the requirements, the next phase is designing the system. System Design is defining the architecture, modules, interfaces, and data for a system to satisfy specified requirements. Systems design could be seen as the application of system theory to product development. In this phase, sufficient detailed data and information about the system and its system elements to enable the implementation consistent with architectural entities as defined in models and views of the system architecture are provided.

4.2 Design Goal

Design goals and strategies can be used as an easy way to control the implementation tool achieve best result based on your particular design tools. They will contain predetermined sets of processes properties that have been planned to achieve particular design goals.

The following are among the design goals that we have planned to achieve when completed.

Correctness

Correctness refers to satisfying the requirements. When we implement BBIMS for NBBS we will try to satisfy the requirements we have collected during software requirement specification.

Correctness will be expressed in the following three approaches:

- ✓ Testing – falsify correctness claim by finding counter example to check BBIMS system functionalities.
- ✓ Formal Verification – takes mathematical approach.
- ✓ Code Inspection – manually walk-through code to increase correctness.

Robustness

System will tolerate misuse without catastrophic failure. The misuse will be bad data, bad use or bad programming.

Robustness achieved in the following ways:

- ✓ By using data abstraction and encapsulation
- ✓ By initializing variables
- ✓ Qualifying all inputs
- ✓ Qualify all formal parameters to a method and
- ✓ Qualify post conditions.

Flexibility

The requirements may change during or after the project implementation. Flexibility will be achieved in the following ways:

- ✓ Encapsulation (hiding the representation),
- ✓ Different types of the same base category by means of abstract classes,
- ✓ Extend functionality by new class methods or with an abstract class and several derived classes.

Reusability

Systems aim is to cut cost of code production over 1 or more projects. The followings are the ways of reusability:

- ✓ Reuse object code,
- ✓ Reuse source code,
- ✓ Reuse assemblies of related classes,
- ✓ Reuse patterns of designs.

Efficiency

BBIMS System aim to make greatest use of the processing, memory size and network speed. Efficiency will be achieved by:

- ✓ Writing clever algorithms and data structures.

4.3 System Component Design

4.3.1 System Decomposition

We tried to decompose the system into the following components that are easier to conceive, understand, program, and maintain.

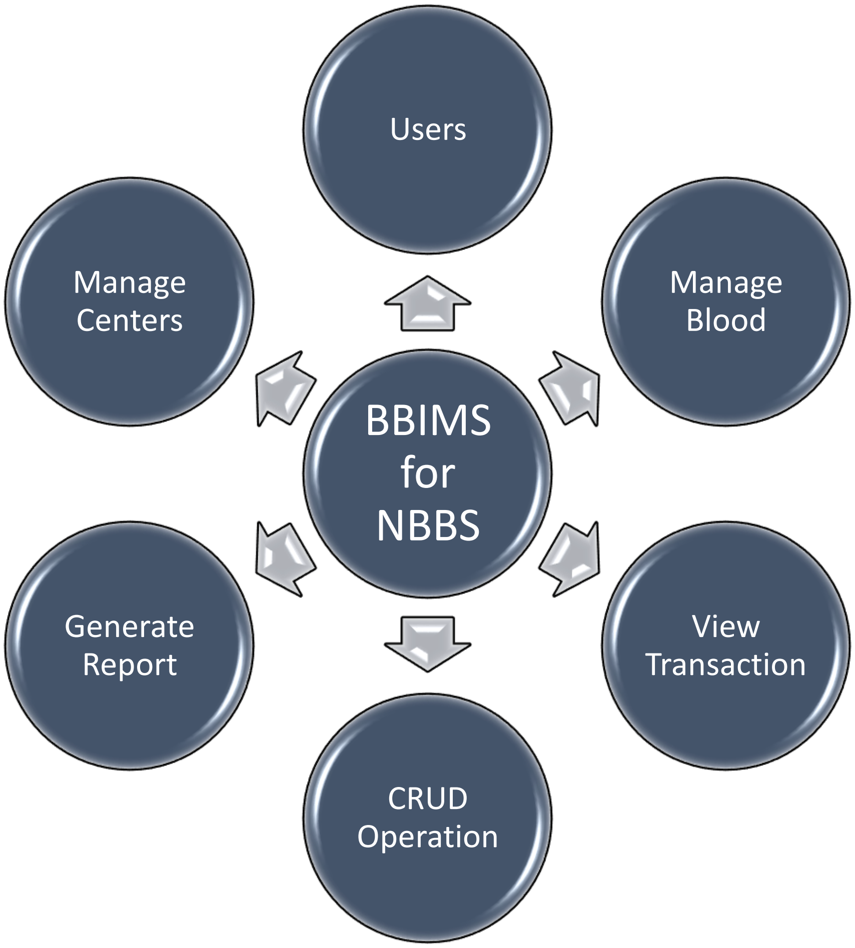


Figure 24 : System Decomposition of BBIMS

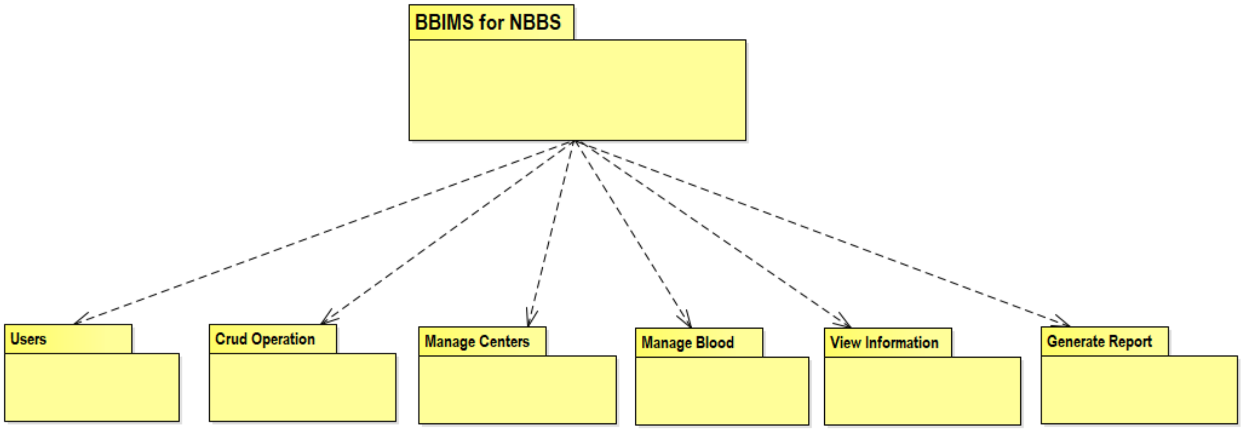


Figure 25 : Package Diagram for System Decomposition

4.3.2 Module Description

1. Users

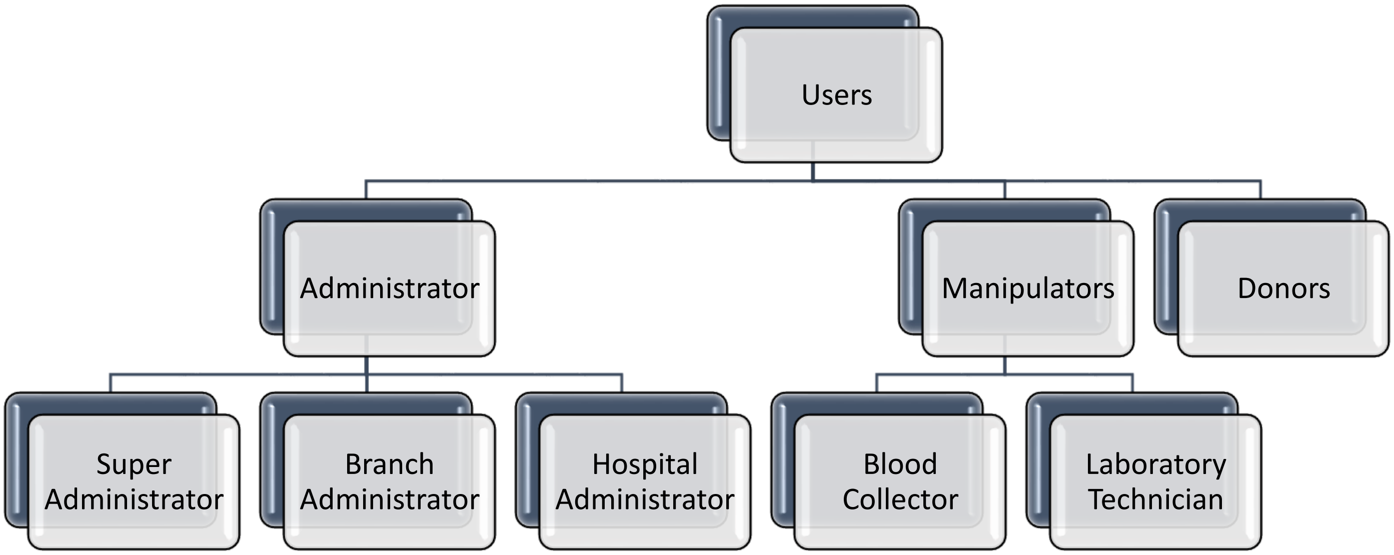


Figure 26 : User’s Diagram of BBIMS

- ✓ New users can be registered to the system. These users will interact with the system based on the access level provided to them at the time of account creation.
- ✓ Administrators can delete an account when deemed necessary

Provided Interface - Registration Form

Required Interface - Website’s Dashboard

Processing:

1. **Creating Account**

- ✓ Fill in Basic information
- ✓ Verify information
- ✓ Login Page will be displayed to the user

Super and Branch Administrators	**Blood Collectors and Lab Technicians**	**Hospitals (Hospital Administrators)**	**Donors**
✓ ID ✓ First Name ✓ Last Name ✓ Grand Father Name ✓ Gender ✓ Birth Date ✓ Phone Number ✓ Office Telephone ✓ Email ✓ PO.Box ✓ Role	✓ ID ✓ First Name ✓ Last Name ✓ Grand Father Name ✓ Gender ✓ Birth Date ✓ Phone Number ✓ Office Telephone ✓ Email ✓ PO.Box ✓ Role	✓ ID ✓ Hospital Name ✓ Hospital Administrator’s (First Name, Last Name, Grandfather Name) ✓ Office Telephone ✓ Email ✓ PO.Box	✓ ID ✓ First Name ✓ Last Name ✓ Grand Father Name ✓ Gender ✓ Birth Date ✓ Phone Number ✓ Role

	✓ Branch	✓ Role	

Table 18 : Table of Account

Access Information

In order to login and use the system the following access information is required:

- ✓ Email,
- ✓ Password.

Level of Access 1

Hospital Administrators have access level of 1. They can view information of their own hospital, update their password, Send blood requests and get reply notification.

Level of Access 2

Blood collectors are users of system with access level of 2. They have authority of managing donor’s information, adding collected amount of blood to system, getting report related to their level of access and modifying their password.

Level of Access 3

Laboratory Technicians have access level of 3. They have the authority to view amount of blood within the system, add and modify blood with in their branch, modify donor’s information such as blood type and change their access password.

Level of Access 4

Branch Administrators have access level of 4. They manage hospitals and donation centers, manage blood stock and transaction within their branch, view amount of blood available and used, view and generate reports and control staff member’s information.

Level of Access 5

Super Administrators have higher level of authorization on the system. They can reset Branch Administrators' passwords, review all transactions, view amount of blood all over the country, view analyzed and generated reports.

Level of access	Users
1	Hospital Administrator
2	Blood Collector
3	Laboratory Technicians
4	Branch Administrator
5	Super Administrator

Table 19: Level of Access

2. Delete Account

When branch administrators' account is needed to be deleted,

- ✓ Super administrators will perform the action.

When blood collectors' and lab technicians' account is needed to be deleted,

- ✓ Branch administrators will perform actions.

After verification, system will generate password for user.

Users are able to modify their access information like password.

2. CRUD Operations

This module provides a way to perform

- ✓ Create
- ✓ Read
- ✓ Update and
- ✓ Delete

Operations on basic information based on access level of users.

Create operation – operations used to add or write new information into the system.

Read operation – operations used to read or view already existing information in the system.

Update operation – operations used to modify status of existing information in the system.

-These operations are essential when

- ✓ Users insert erroneous information may be because of typing error.
- ✓ Existing information has become obsolete

Delete operation – operations used to remove information from the system. These operations are necessary when the existing information is no longer needed or should be removed.

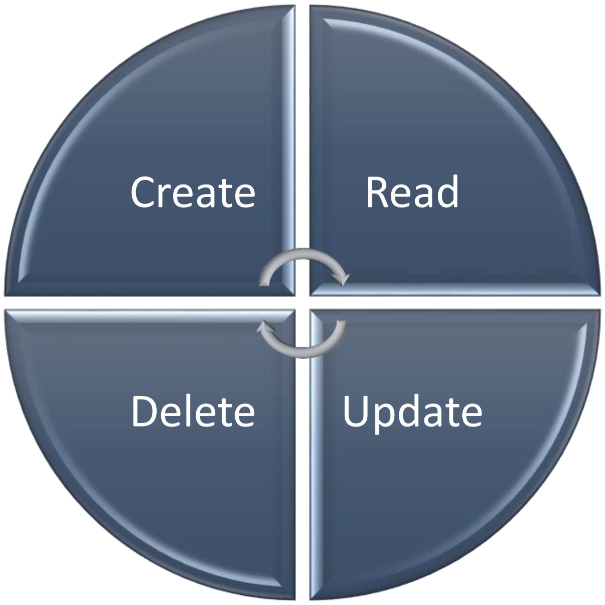


Figure 27: Create, Read, Update and Delete Operations of BBIMS

3. Manage Centers

One of the implications of the system is, to provide simple way to manage NBBS's different centers centrally. Mainly there are three classifications of centers of NBBS. These are:

Branch

- ✓ Branches have the responsibility of Checking the result and type of collected blood. After different analysis, they will distribute usable blood for their member hospitals and corresponding branches.
- ✓ Mainly controlled by Branch administrators and it will have many Staffs like Blood Collectors and Laboratory Technicians. Besides, Hospital Administrators also should be member of NBBS branch.
- ✓ Currently NBBS has over 35 branches throughout the country. The main branch of NBBS is in Addis Ababa. Other branches are located in regional states of Ethiopia.

Hospitals

- ✓ Hospitals are institutions, which use the collected blood through branches of NBBS.
- ✓ People who need blood will get it via member hospitals of NBBS.
- ✓ Hospital Administrators are responsible for carrying out blood transaction between their hospital and residing hospital.

Donation Centers

- ✓ Donation centers are locations where Blood Collectors collect blood from voluntary donors.
- ✓ Donation centers will be permanent or temporary according to their role and primary goal.

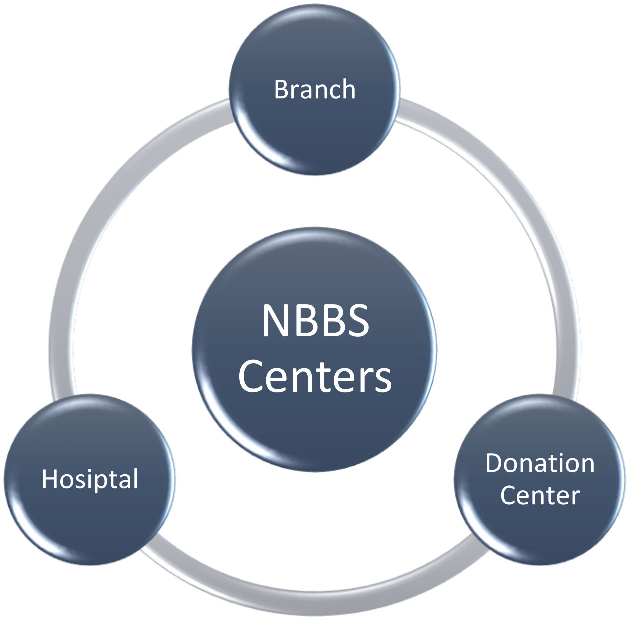


Figure 28 : Centers of NBBS

4. Manage Blood Information

The main reason why we develop this system is to provide a better solution and to manage collected blood under NBBS.

Blood information can be managed in different ways, such as:

Add Blood

After blood is collected, the Blood Collectors will be added the amount in to the system. Then it will become tested and analyzed, finally it will be categorized with in its type and Rh factor and it will become ready for use.

Get Blood

Branches could get and use blood stored with in their stock.

Send Blood Request

Hospitals should send blood request to their branch in order to get blood. Sometimes branches will also send blood request to another branch, which has sufficient blood.

Reply Blood Request

Branch administrators will review the notifications that came from different member hospitals and branches. If the request is legal and if there is enough amount of blood they will provide the requested blood.

Check amount of Blood

Hospital Administrators, Branch Administrators and Super Administrators will review and check used and available amount of blood before any blood transaction.

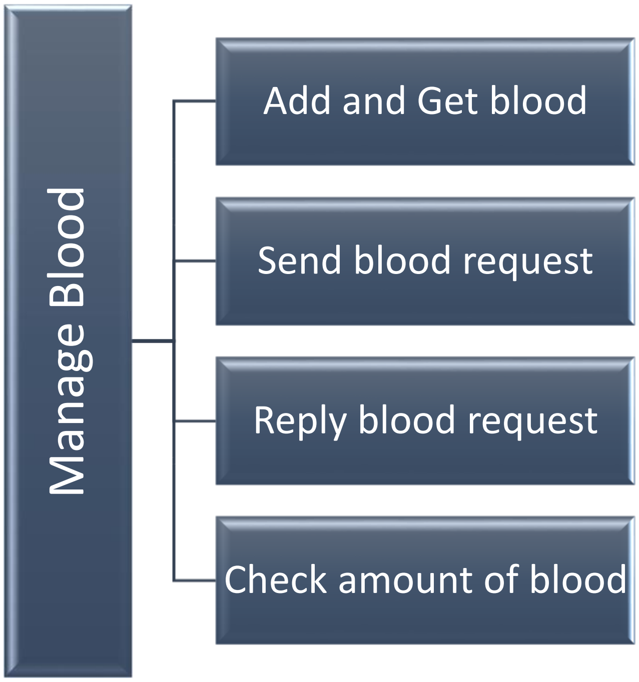


Figure 29 : Management of Blood in BBIMS

5. View Information

Different users of the system will view the system based on their role. Information to be viewed can be categorize:

1. View Personal Information
    - I. Users can see personal information
        - i. Donation history
        - ii. Donor's status…
2. View Blood Information
    - I. Administrators can see the amount of blood under transaction with its status based on access level.
    - II. Lab technicians can see blood with its status.
3. View Center Information
    - I. Super Administrator can see all Branches, Hospitals and Donation centers under NBBS.
    - II. Branch Administrators can see total number of Hospitals and Donation centers inside their own branch.

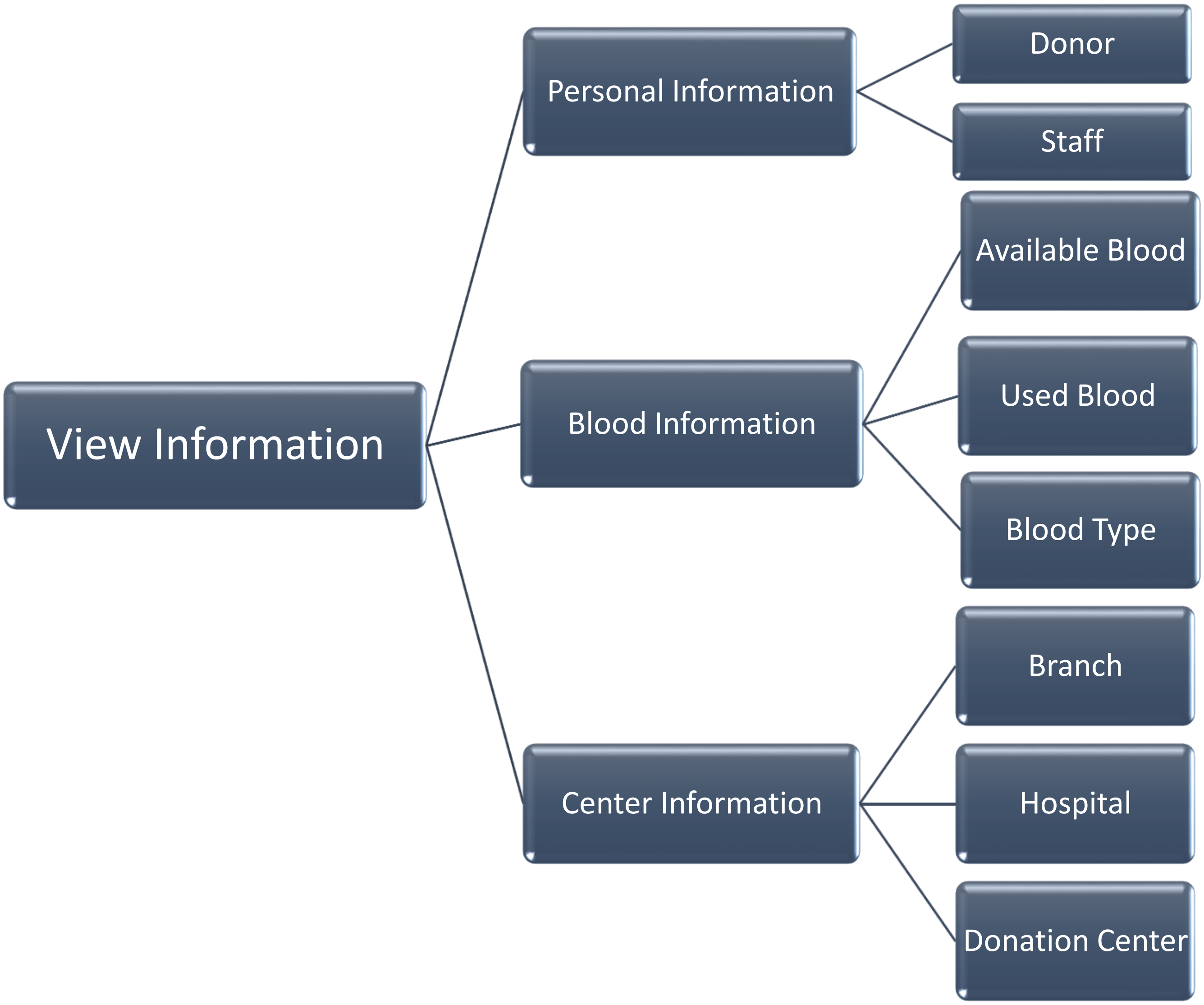


Figure 30 : View Information of BBIMS

6. Generate Report

BBIMS will generate and present different reports for users of system according to their credentials.

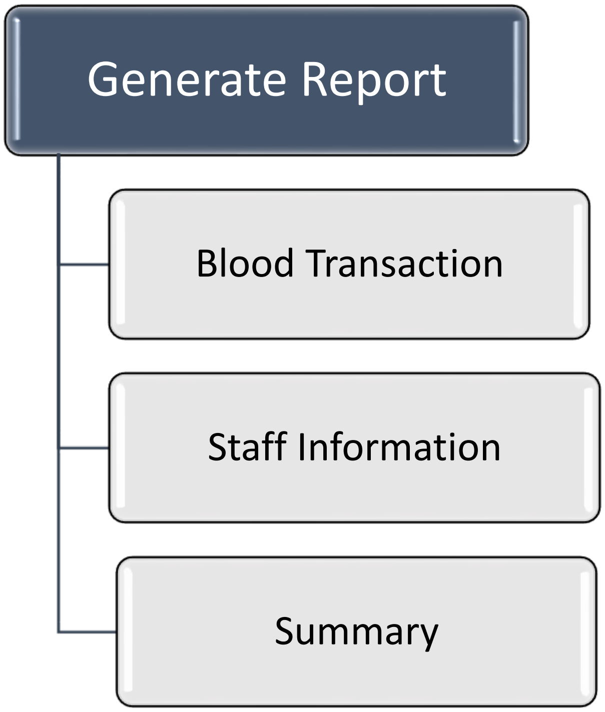


Figure 31 : Generate Report Diagram

Processing

1. Users order the system to generate reports
2. This process is based on the access levels of users
    - ✓ Super administrator - can generate reports throughout the country
    - ✓ Branch administrators - can generate reports inside their branch.
    - ✓ Hospital administrators - can generate reports inside their hospital

Blood Transaction Report

Either super administrator, branch administrators or hospital administrators can generate this report.

- ✓ Super Administrator - All blood transactions inside NBBS.
- ✓ Branch Administrators - All blood transactions inside their branch.
- ✓ Hospital Administrators - All blood transactions inside their hospital.

Staff Information Report

Either super administrator or branch administrators can generate this report.

- ✓ Super Administrator - All branch staffs inside NBBS.
- ✓ Branch Administrators - All staffs inside their branch.

Summary Report

All other reports in one place. Either super administrator or branch administrators can generate this report.

4.4 Architecture of the System

4.4.1 Architectural Style and Pattern

Architectural Style

- ✓ Language Based – Object-Oriented

It is a design paradigm based on the division of responsibilities for an application or system into individual reusable and self-sufficient objects.

- ✓ Layered – Client Server

It is a distributed application structure that partitions tasks or workloads between the providers of a resource or service, called servers, and service requesters, called clients.

- ✓ Data-Flow – Batch-Sequential

It is a classical data processing model in which, separate programs are executed in order and the data is passed as an aggregate from one program to the next.

Architectural Pattern

Model-View-Controller (MVC)

MVC is an architectural pattern that separates an application into three main logical components:

Model

The model component corresponds to all the data-related logic that the user works with.

View

The view component is used for all the UI logic of the application.

Controller

Controllers act as an interface between model and view components to process all the business logic and incoming requests, manipulate data using the model component and interact with the views to render the final output.

MVC is one of the most frequently used industry-standard web development framework to create scalable and extensible projects. Nowadays, MVC is the most popular pattern to better organize and also it is user friendly to do things better.

The big idea behind MVC is that each section of our code has a purpose, and those purposes are different. Some of our code holds the data of our app, some of our code makes our app look nice, and some of our code controls how our app functions.

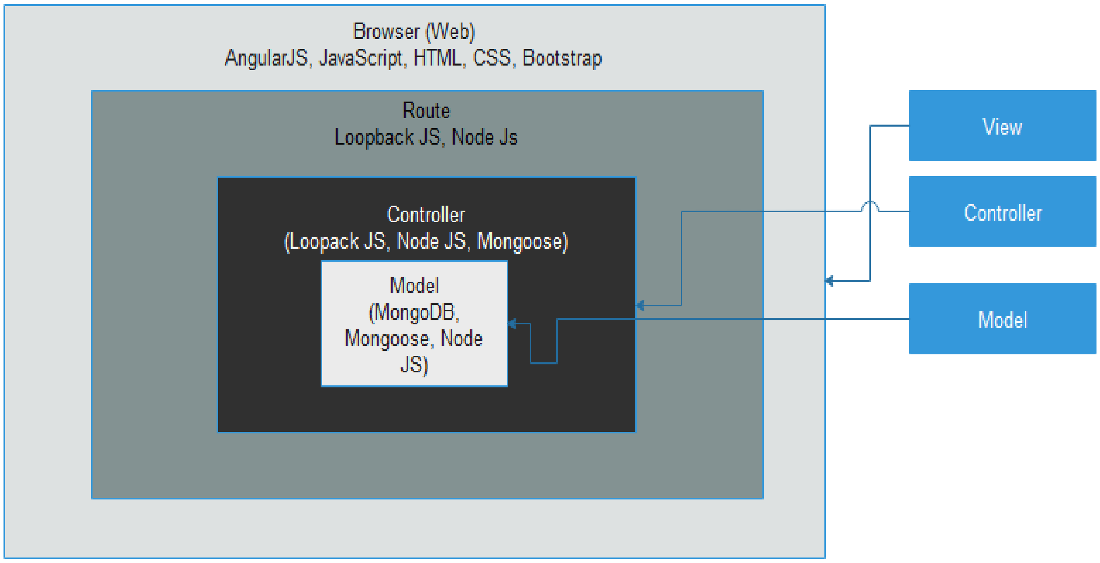


Figure 32 : Model View Controller Diagram

4.4.2 Component Diagram

Component diagrams are used in modeling the physical aspects of object-oriented systems that are used for visualizing, specifying, and documenting component-based systems and for constructing executable systems through forward and reverse engineering.

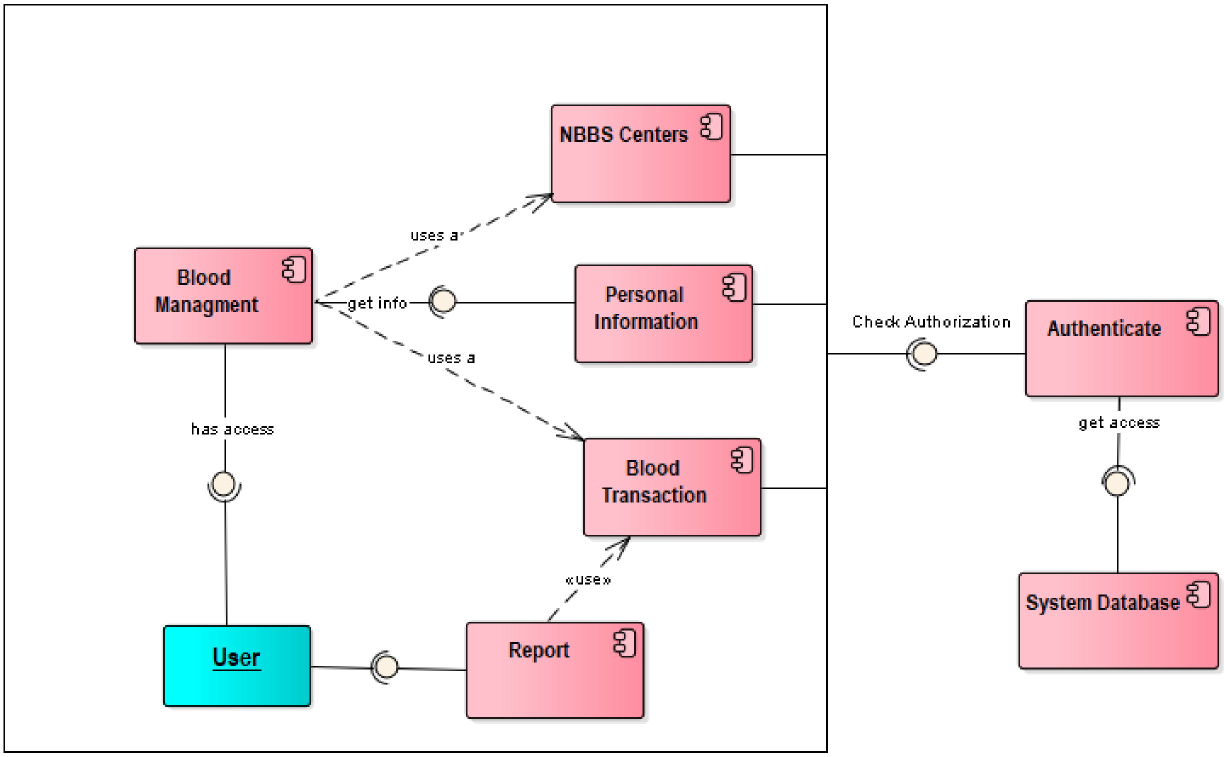


Figure 33 : Component Diagram of BBIMS

Component Description

Blood Management – this component is responsible for management of blood information under the system also for displaying available blood inside bloodstocks with its type, Rh factor and other essential information.

NBBS Centers – this component is the one, which controls information under the NBBS stocks in each branch.

Personal Information – In this component, all information related to people, who have relation with the BBIMS, is stored, processed and displayed when necessary based on the access level of each users.

Blood Transaction – Blood is moved from one branch to another branch, to hospitals and so on. Consequently, this component controls these transactions.

Report – The system generates different types of reports based on the information processed under the NBBS based on the access level of users.

Authenticate – this component is the guard of the system.

- ✓ It identifies who is who,
- ✓ Who can perform actions and who cannot,
- ✓ Who has done things (identifies who is responsible for actions)

System Database – this is the ultimate source and bank of data, which is necessary for the existence of the system. Data should be inserted and information should be fetched to do any kind of meaning full activity.

4.4.3 Deployment Diagram

Deployment diagrams is diagrams that show the configuration of run time processing nodes and the components that live on them. They a kind of structure diagrams used in modeling the physical aspects of an object-oriented system.

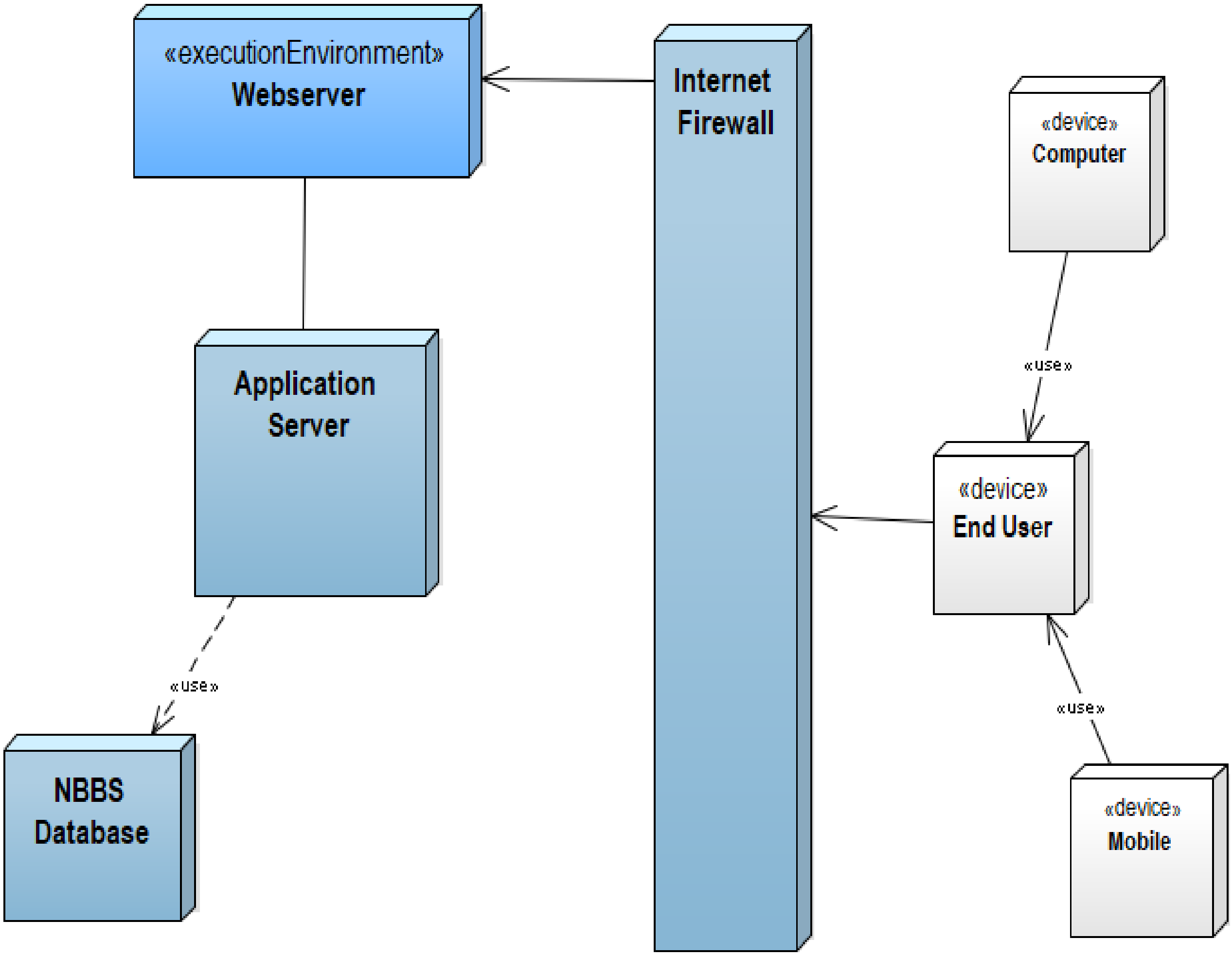


Figure 34 : Deployment Diagram for BBIMS

4.5 Access Control

Access control is a security technique that regulates who or what can view or use resources in a computing environment. In other terms, access control is a process by which users are granted access and certain privileges to systems, resources or information.

Actor	User Manag-ement	Blood Information Management	View Transaction	CRUD Operations	Report Generation	Center Management
Super Administrator	YES	YES	YES	YES	YES	NO
Branch Administrator	YES	YES	YES	YES	YES	YES
Hospital Administrator	NO	YES	YES	YES	NO	NO
Blood Collector	YES	YES	NO	YES	NO	NO
Lab Technician	NO	YES	NO	YES	NO	YES
Donor	NO	NO	NO	NO	NO	NO

Table 20 : Table of Access Control

4.6 Database Design

Database is a collection of information that is organized so that it can be easily accessed managed and updated.

Database design is the organization of data according to a database model. It involves classifying data and identifying inter relationships. It is the activity of representing classes, attributes and relationships in a database.

Entity Relationship (ER) diagram also known as an entity relationship model , is a graphical representation of an information system that depicts the relationship among people objects places concepts or events with in that system. It is a data modelling technique that can help define business processes.

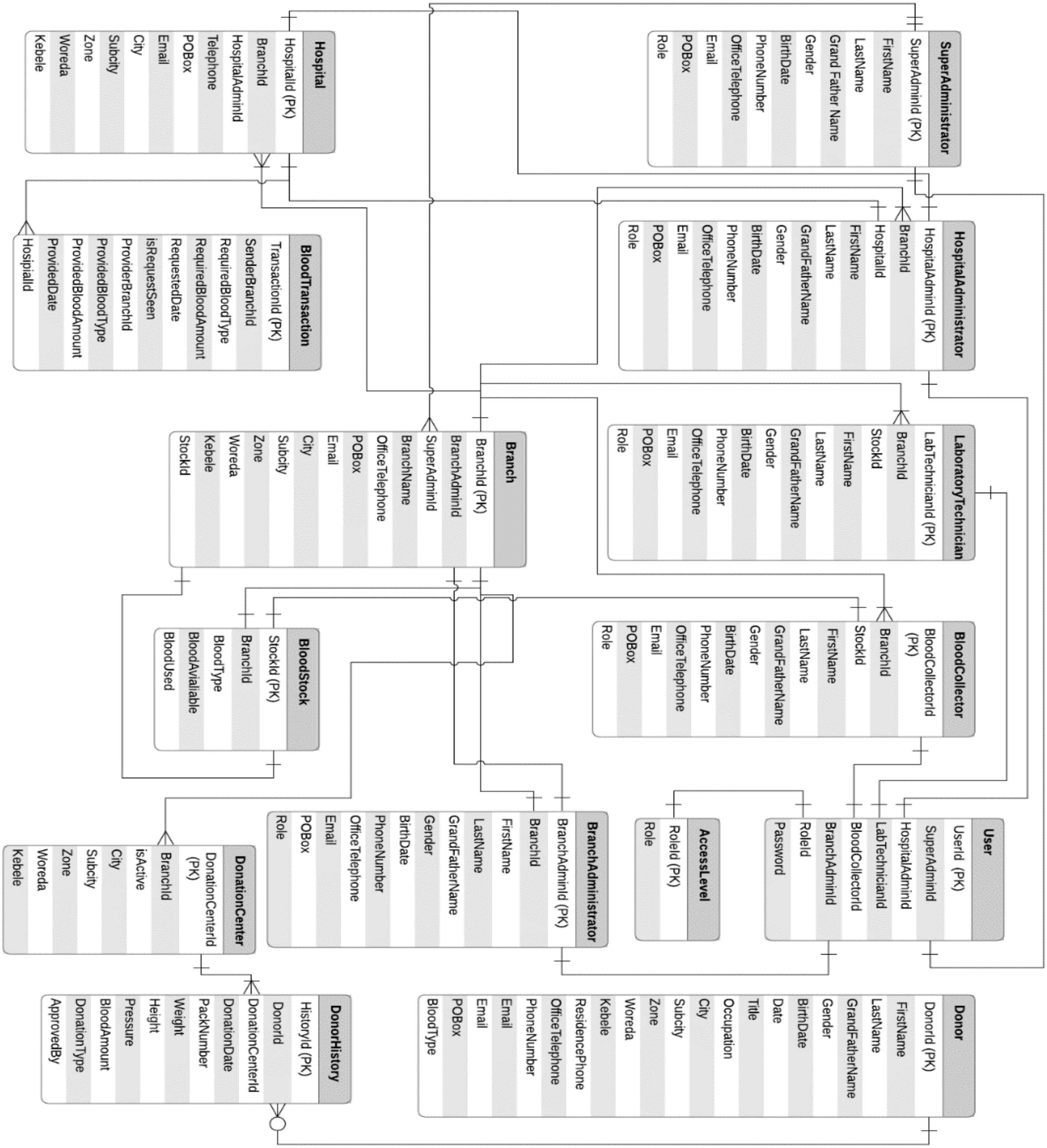
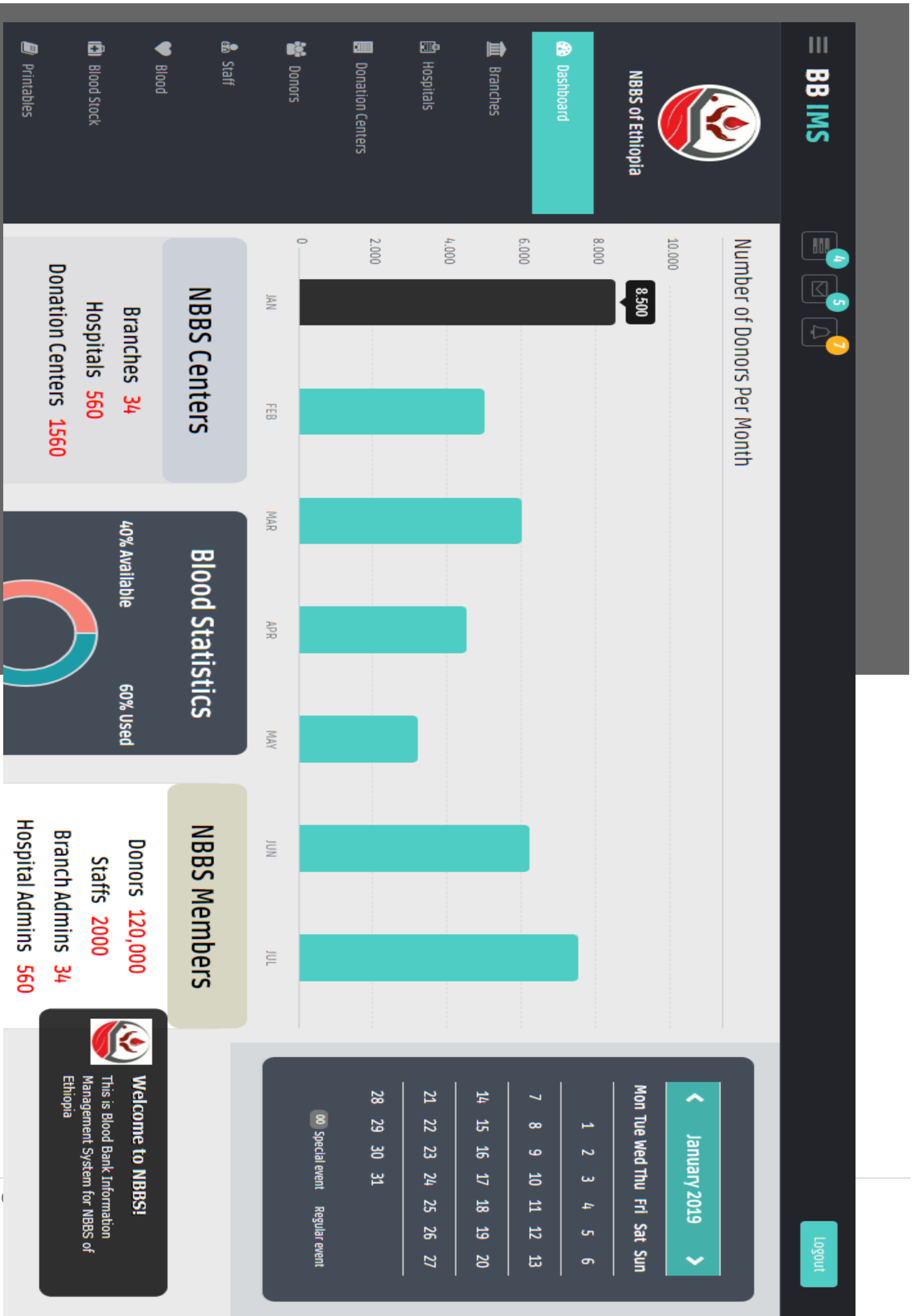


Figure 35 : Entity Relationship Database Design Diagram of BBIMS

5. Chapter 5 – User Interface Design



NBBS Centers

Branches 34
Hospitals 560
Donation Centers 1560

Blood Statistics

NBBS Members

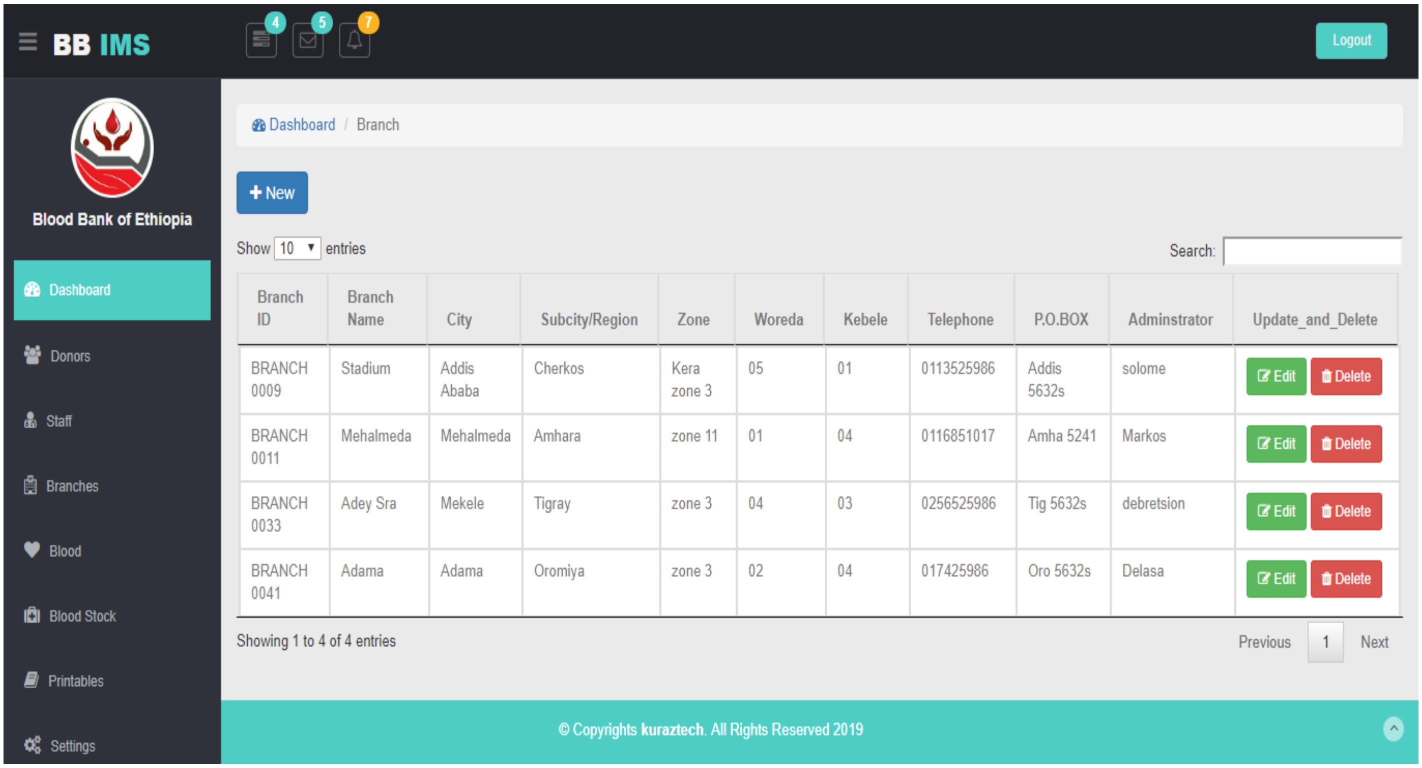
Donors 120,000
Staffs 2000
Branch Admins 34
Hospital Admins 560

Welcome to NBBS!

This is Blood Bank Information Management System for NBBS of Ethiopia

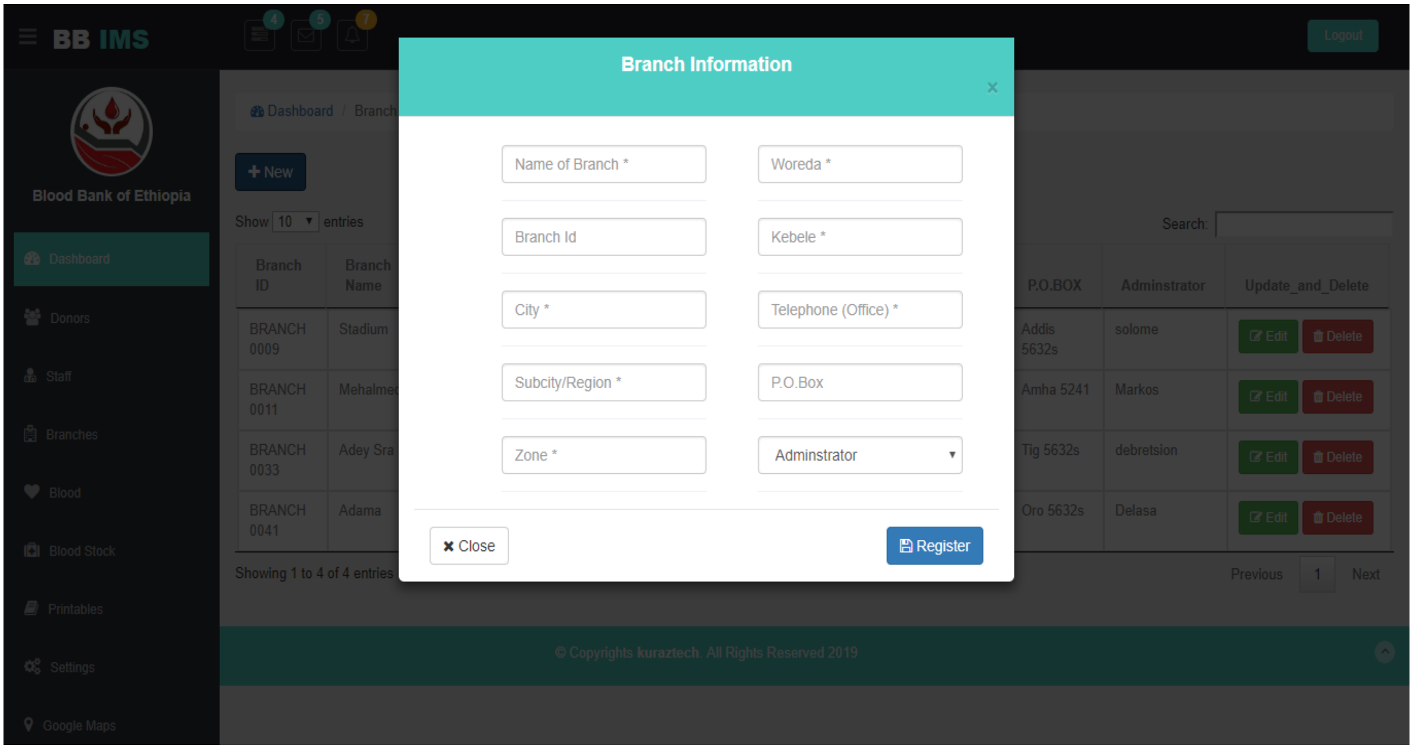
Figure 36 : Login Page of BBIMS

Figure 37 : Home Page of BBIMS



Branch ID	Branch Name	City	Subcity/Region	Zone	Woreda	Kebele	Telephone	P.O.BOX	Adminstrator	Update_and_Delete
BRANCH 0009	Stadium	Addis Ababa	Cherkos	Kera zone 3	05	01	0113525986	Addis 5632s	solome	Edit Delete
BRANCH 0011	Mehalmeda	Mehalmeda	Amhara	zone 11	01	04	0116851017	Amha 5241	Markos	Edit Delete
BRANCH 0033	Adey Sra	Mekele	Tigray	zone 3	04	03	0256525986	Tig 5632s	debretsion	Edit Delete
BRANCH 0041	Adama	Adama	Oromiya	zone 3	02	04	017425986	Oro 5632s	Delasa	Edit Delete

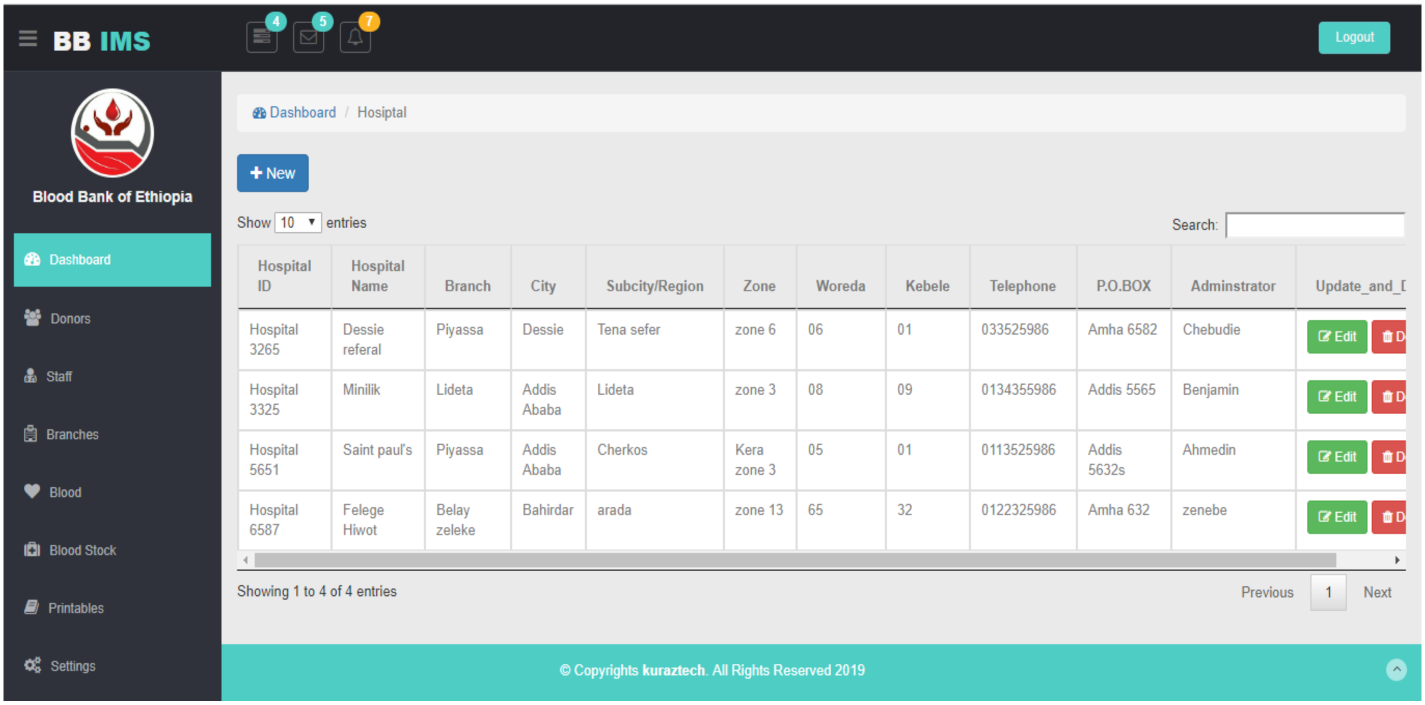
Showing 1 to 4 of 4 entries



Name of Branch *	Woreda *
Branch Id	Kebele *
City *	Telephone (Office) *
Subcity/Region *	P.O.Box
Zone *	Adminstrator ▾

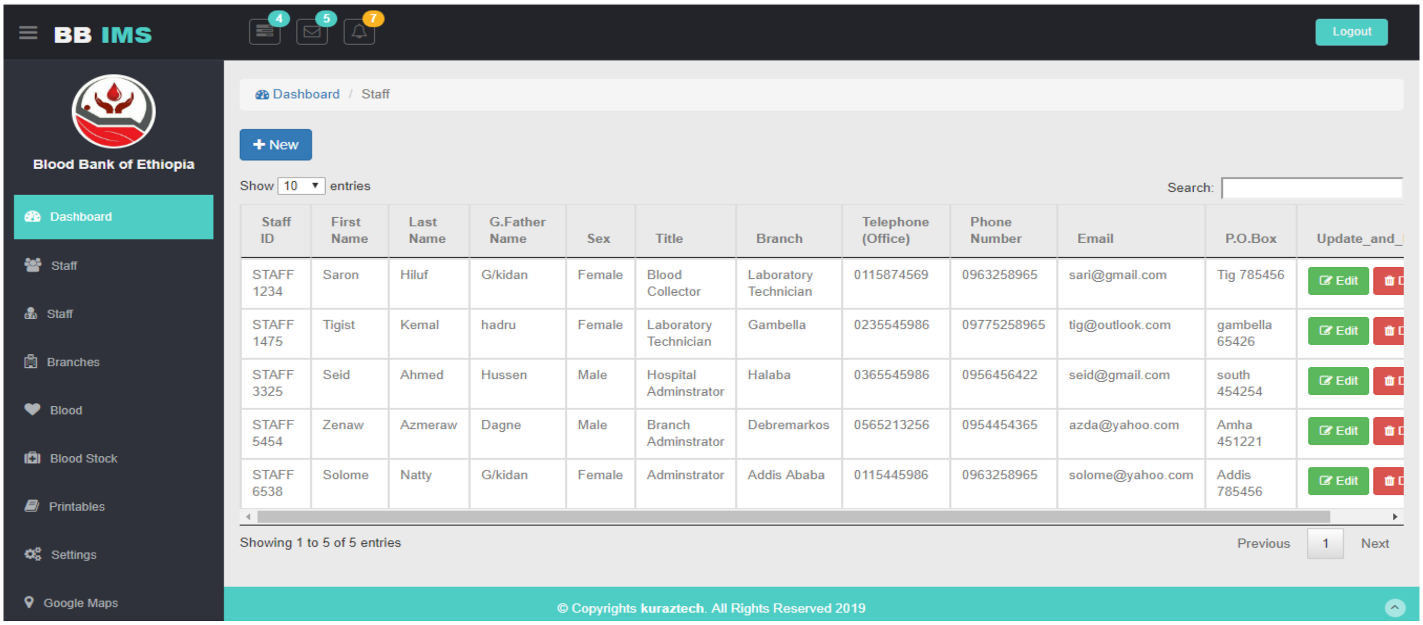
Figure 38 : Branch Page of BBIMS

Figure 39 : Registration Form of Branches



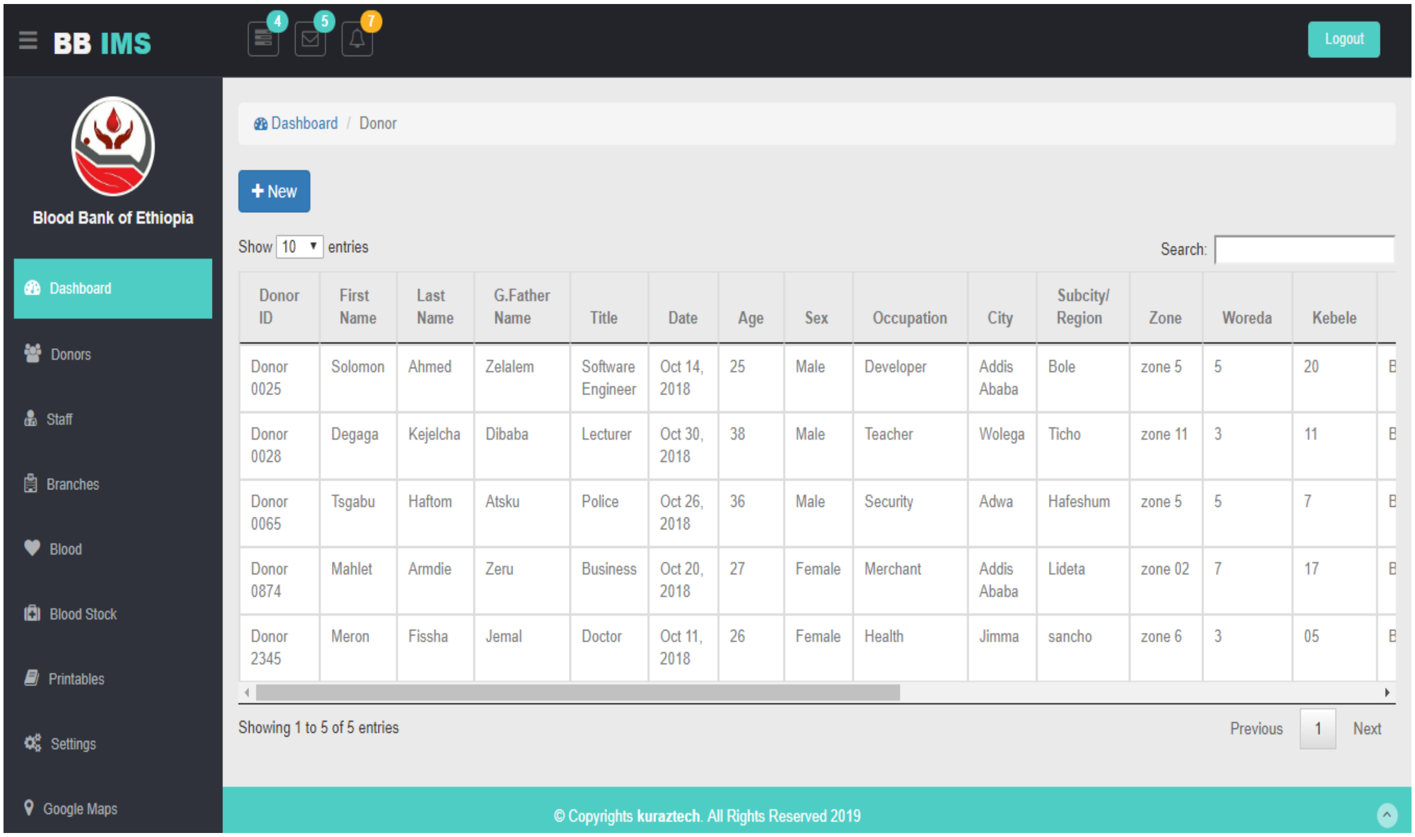
Hospital ID	Hospital Name	Branch	City	Subcity/Region	Zone	Woreda	Kebele	Telephone	P.O.BOX	Adminstrator	Update_and_[
Hospital 3265	Dessie referal	Piyassa	Dessie	Tena sefer	zone 6	06	01	033525986	Amha 6582	Chebudie	Edit D
Hospital 3325	Minilik	Lideta	Addis Ababa	Lideta	zone 3	08	09	0134355986	Addis 5565	Benjamin	Edit D
Hospital 5651	Saint paul's	Piyassa	Addis Ababa	Cherkos	Kera zone 3	05	01	0113525986	Addis 5632s	Ahmedin	Edit D
Hospital 6587	Felege Hiwot	Belay zeleke	Bahirdar	arada	zone 13	65	32	0122325986	Amha 632	zenebe	Edit D

Figure 40 : Hospital Page of BBIMS



Staff ID	First Name	Last Name	G.Father Name	Sex	Title	Branch	Telephone (Office)	Phone Number	Email	P.O.Box	Update_and_
STAFF 1234	Saron	Hiluf	G/kidan	Female	Blood Collector	Laboratory Technician	0115874569	0963258965	sari@gmail.com	Tig 785456	Edit
STAFF 1475	Tigist	Kemal	hadru	Female	Laboratory Technician	Gambella	0235545986	09775258965	tig@outlook.com	gambella 65426	Edit
STAFF 3325	Seid	Ahmed	Hussen	Male	Hospital Adminstrator	Halaba	0365545986	0956456422	seid@gmail.com	south 454254	Edit
STAFF 5454	Zenaw	Azmeraw	Dagne	Male	Branch Adminstrator	Debremarkos	0565213256	0954454365	azda@yahoo.com	Amha 451221	Edit
STAFF 6538	Solome	Natty	G/kidan	Female	Adminstrator	Addis Ababa	0115445986	0963258965	solome@yahoo.com	Addis 785456	Edit

Figure 41 : Staff Page of BBIMS



Donor ID	First Name	Last Name	G.Father Name	Title	Date	Age	Sex	Occupation	City	Subcity/ Region	Zone	Woreda	Kebele	
Donor 0025	Solomon	Ahmed	Zelalem	Software Engineer	Oct 14, 2018	25	Male	Developer	Addis Ababa	Bole	zone 5	5	20	B
Donor 0028	Degaga	Kejelcha	Dibaba	Lecturer	Oct 30, 2018	38	Male	Teacher	Wolega	Ticho	zone 11	3	11	B
Donor 0065	Tsgabu	Haftom	Atsku	Police	Oct 26, 2018	36	Male	Security	Adwa	Hafeshum	zone 5	5	7	B
Donor 0874	Mahlet	Armdie	Zeru	Business	Oct 20, 2018	27	Female	Merchant	Addis Ababa	Lideta	zone 02	7	17	B
Donor 2345	Meron	Fissha	Jemal	Doctor	Oct 11, 2018	26	Female	Health	Jimma	sancho	zone 6	3	05	B

Showing 1 to 5 of 5 entries

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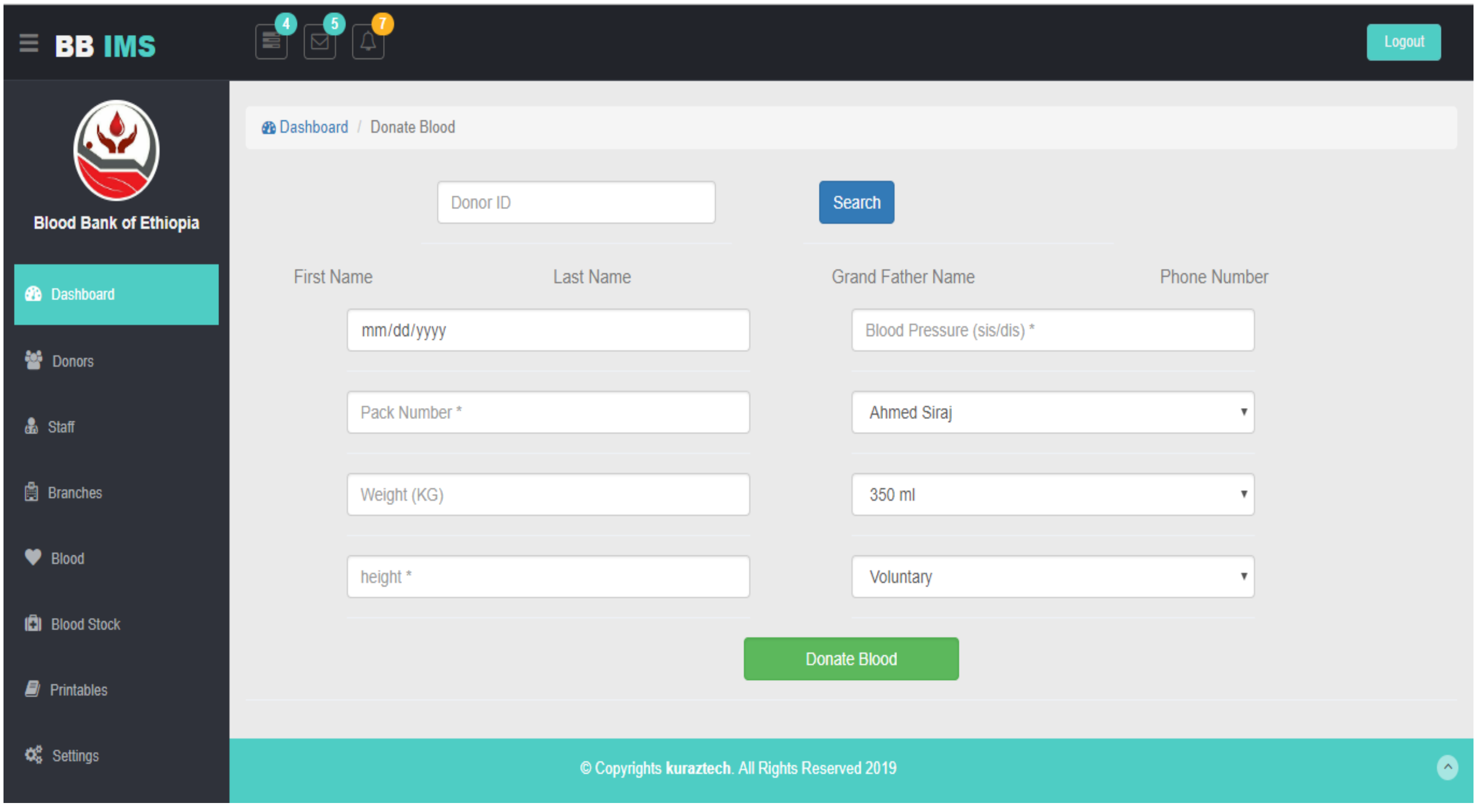
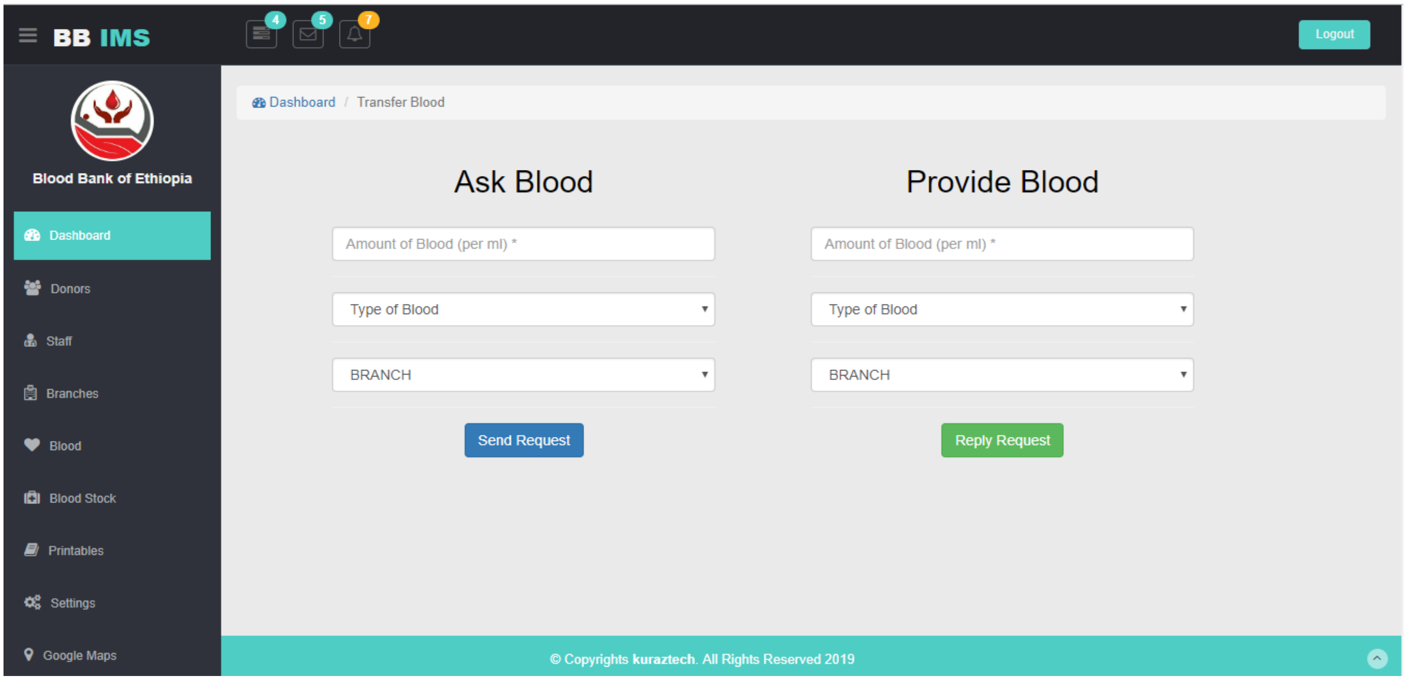
Figure 42 : Donor Page of BBIMS



First Name
Last Name
Grand Father Name
Phone Number

mm/dd/yyyy
Blood Pressure (sis/dis) *
Pack Number *
Ahmed Siraj ▾
Weight (KG)
350 ml ▾
height *
Voluntary ▾

Figure 43 : Donate Blood of BBIMS



Ask Blood

Amount of Blood (per ml) *

Type of Blood

BRANCH

Send Request

Provide Blood

Amount of Blood (per ml) *

Type of Blood

BRANCH

Reply Request

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Figure 44: Blood Transfer Page of BBIMS

References

[1].Blood Bank Management System.pdf -----By Ashrarfi , Sadia and Rahman.

[2].Roger S. Pressman, Ph.D., Software Engineering a Practitioner Approach, Fifth Edition 2001.

[3].Sparax systems, “systems”, retrieved from www.sparaxsystems.com/forums, Last accessed on January 10, 2019.

[4].MOH, “Ministry of Health of Ethiopia”, retrieved from httpx://www.moh.gov.et/da/web/guest/national-blood-bank-services-office,Last accessed on November 05, 2018.

[5].Wikipedia, “Wikipedia Organization”, retrieved from https://en.wikipedia.org/wiki/Blood_donation , Last accessed on December 06, 2018

[6].Jembi, “Jembi Systems”, retrieved from https://www.jembi.org/bssp-implementaitons/bssp-ethiopia-national-blood-bank-service/, last accessed on November 27, 2018.

[7].Tutorials point, “Tutorials point”, January 2019, retrieved from https://www.tutorialspoint.com, Last accessed on January 17, 2019.

[8]. Unknown Writer, “prutt05_lec7.pdf”, retrieved from http://www.nada.kth.s , Last accessed on January 7, 2019.