Web-based Blood Donation and Reservation System for the Blood Bank

K. R. M. Shihab

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Web-based Blood Donation and Reservation System for the Blood Bank

A dissertation submitted for the Degree of Master of Information Technology

K.R.M. Shihab

University of Colombo School of Computing

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Declaration

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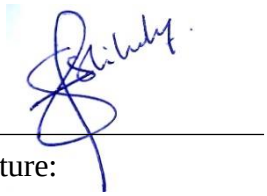
To the best of my knowledge, it does not contain any material published or written by anotherperson, except as acknowledged in the text.

Student Name: Kaleelur Rahuman Mohamed Shihab

Registration Number: 2018/MIT/074

Index Number: 18550743



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Abstract

Blood donation plays a significant role in saving human lives. A blood bank is the main center that gathers blood from different donors and is preserved for later use for blood transfusion. Although the Blood bank has a website for its general-purpose, a proper communication system among donors and recipients is necessary to fulfill emergency needs. Also, the current system does not have a process to request blood, and there is no system to request blood donations. At present, there is no such communication system to support one another needs. In an emergency, when the recipients need a specific blood group, there can be situations where that is unavailable in hospitals.

In such instances, they will have to wait until the relevant hospital goes through their standard process of fulfilling the need. The hospital checks the availability of the blood in the blood bank or a nearby general hospital. Even though the blood is available, the blood bank faces issues transporting the blood on time based on the requirements. Delays might happen due to such problems, and this is a significant concern when blood is required for an emergency.

Blood bank needs an automated communication system to provide blood on emergency needs. The primary purpose of this study is to help blood banks to connect all stakeholders to manage and store blood. The proposed system is a Web-based blood donation and reservation system to instantly assist communication among the blood bank, the donor, and the recipient. Anyone can use the proposed system to request blood at any time and donate blood. A blood recipient can check the status of the requested blood on the system. When a user requests blood and blood is not available at the blood bank, the system will automatically send notification SMS and Email to the registered donors to donate blood, thereby saving lives in an emergency. The system notifies and reminds the donors to donate blood at the right time.

The proposed Web-based system was implemented using PHP in Apache NetBeans 12.4. HTML, CSS(Cascading Style Sheets), and JavaScript were used for GUI design, while XAMPP Server is used to execute MySQL server for Database and Apache server to deliver web content.

User feedback was derived to evaluate the implemented system. Overall, the user feedback was positive, and they claimed that the system is easy to use and helpful for an emergency needs to save lives. Hence, we argue that the project was successful completed to meet the user expectations.

Acknowledgements

I am using this opportunity to express my thanks to everyone who supported me to complete this project. Specially I must thank the supervisor to Dr. L.N.C De Silva at UCSC, for her support and guidance on this project.

At the same time, I must thank Blood bank staff for helping me and shared truthful information. Also, they have shared their experience of the difficulty of the current system to users.

Specially I must thank my parents who supported and help me in many ways to complete this project. And my sister who is an undergraduate student at Faculty of Medicine, University of Kelaniya, helped me a lot to get the understanding of bloods and the process. With her help only I got all the blood bank contact and other details. I would like to thank my friends who supported in many ways to make this project a success.

Table of Contents

Table of Figures

List of Tables

List of Acronyms

DB – Database

MVC - Model-View-Controller

UI – User Interface

IT – Information Technology

NBTS – National Blood Transfusion Services

CSS - Cascading Style Sheets

HTML - HyperText Markup Language

UML - Unified Modeling Language

Chapter 1 - Introduction

1.1 Project Overview

A blood bank is a center where blood is collected from blood donors island-wide, stored, and preserved for later use for blood transfusion. Blood donation can be considered as a national responsibility of the Sri Lankans in saving human lives. In Sri Lanka, many individuals and organizations conduct blood donation campaigns to encourage this valuable activity.

There are lots of interested donors willing to donate blood in an emergency. Island-wide some recipients need blood urgently and for some to undergo operations. In the current context, this has become a very timely need due to the pandemic.

Though the blood bank has a website for its general purpose, a proper communication system among donors and recipients is a timely need to fulfill emergency needs. At present, there is no such communication system to support one another needs. In an emergency, when the recipients need a specific blood group, there can be situations where that is unavailable in remote hospitals. In such instances, they will have to wait until the relevant hospital goes through their standard process of fulfilling the need.

The relevant hospital checks the availability of the blood in the blood bank or a nearby general hospital. There are instances where the hospitals fulfill this requirement by creating awareness via word of mouth among relatives and friends of the recipient to get the required blood group. There are situations where the blood bank also finds it challenging to meet the demand, especially in pandemic situations like we undergo these days. The blood collection process is time-consuming as there are several conditions to be tested before donating the blood. Blood collection centers and the blood bank follow a manual process to find donor contacts to a donation to fulfill the need. It is essential to reduce this time to expedite the entire process to minimize the impact on human life.

Hence, the proposed web-based blood donation and reservation platform will link all stakeholders within this process. This will connect the blood bank, collecting centers, donors, and recipients for better communication between these parties while maintaining the donors' and recipients' information. Any interested individual can use this platform to donate, request blood, or organize blood donation campaigns. Moreover, this will also address the issues in the transportation of blood island-wide in an organized manner to receive blood instantly.

The proposed web-based system can check blood delivery status through managing and tracing blood transportation. The system will increase transparency, and selected stakeholders can view the blood inventory managed by the blood bank. Donors will be able to donate blood at their convenience at any blood collection center island wide.

The main aim of this system is to make the blood donation process more convenient and thereby increase the number of donors. Rectifying the issue in the process and motivating donors to donate blood may ultimately save many lives.

1.2 Motivation

In Sri Lanka, the blood bank has a system (NBTS, 2016) to request a pre-blood donation and update the donors' details such as the blood group, contact details, address, etc. However, there is no given facility or a system to connect the donor, recipient, and the blood bank via one point of contact. Connecting these three parties via one platform would provide an efficient service in minimal time. Also, the current system in the blood bank is not advanced to create awareness by sending a request via SMS and an email. In the modern era, social media is compelling to create awareness among people. However, directly creating awareness on blood donations and campaigns organized on the targeted parties can increase efficiency in blood donations.

The existing system does not have the tracking facility of blood requests creating difficulties in an emergency to track the need. This feature is more convenient for the recipients to save time and to act accordingly. At present, the interested parties need to search to identify and locate the nearest blood bank locations. The current issues faced by the donors and recipients in handling and tracking blood motivated to design and develop the proposed web-based blood donation and reservation system. The proposed system will also motivate more donors to donate blood without a hassle and save the lives of people.

1.3 Objectives

The main objective of the proposed system is to create a web-based system for the blood bank to efficiently handle the daily operations while connecting to the donors and recipients competently. This main objective will be achieved via the sub-objectives mentioned below.

- Create a platform to link donors, recipients, and the blood bank instantly.
- Collect blood efficiently while linking with all blood collection centers island-wide to ensure there is no shortage of blood (blood groups) when required urgently.
- Generate a SMS and an email to create awareness among interested donors and support the recipients instantly.
- Track and direct the donors to the nearest blood bank to donate blood.
- Generate reports for blood bank audits.
- Track the transportation of blood to the recipient and blood bank.

1.4 Scope of the Study

The Proposed web-based system consists of,

1. Blood donor management
2. Blood recipient management
3. Blood bank management
4. Blood collection center management
5. Blood transportation management

1.4.1 Blood Donor Management

Access to the blood donor management interface requires the users' authentication. The registered users can log in using their credentials and can request a blood donation. Once they register as a new user, an email verification process will happen before they log in. Once the email verification is confirmed, they can login to donate blood. In addition, users can check and get details regarding their nearest blood collection centers. The blood donors can also request blood campaigns. On this view, user can edit their profile and they can check the status of their Donations. Below are the sub views of blood donor management:

a) Donate blood: -

Users can register to donate blood and check the nearest blood bank. Once they conform to the date, the user will get a confirmation status on the user view on the system. On this view, user can check the status of their donation request and their donated history. Donors need to fill a form with a doctor's guild line on the arrival to donate blood. Also, they will have to go for a body checkup before they donate blood at the blood bank.

b) Campaign request: -

Users can request blood campaigns through this functionality. The blood bank will authorize and assign corresponding authorities based on the availability to conduct the campaign.

c) Guest Donation: -

User can easily request to donate blood without register to the system. Also, this option will give more convent for the people who is willing to give blood.

d) History view: -

The donor can check their blood donations history and blood campaign history on this view.

e) Nearest blood bank: -

The donors can check the nearest blood bank by providing their district on donation request.

f) Profile editing: -

Blood donation users have the option to edit their profile form edit profile option in the proposed system.

1.4.2 Blood recipient management

The blood recipients should register in this web-based system to request blood in an emergency. If they have already registered/ already registered to donate blood users also can use the login credentials to login to the system. Once they register as a new user, an email verification process will happen before they login. Once the email verification is confirmed, they can request blood for themself, or they can request blood on behalf of a patient.

Also, they can check the status of their requested blood. The recipient can check the status of their requested blood from the notification option. In addition to that, the recipient can check their nearest blood bank. On this view, users can also edit their profile and can check the history report on their blood request. The subcategories of the blood recipient management module are listed below:

a) Personal blood request/ Blood request on behalf of a patient: -

Users can request blood by sending a personal blood request or request on behalf of a patient. On the request, the availability of the requested blood group will be validated, and it will show on the system whether the blood is available or not. If it is available, the system will send an approval/ reject request to the blood bank. The user will get the approval/ reject request status on the notification. If it's approved, the system will notify the user whether the blood is picked up by transportation, delivered to the nearest blood collection center, or ready to collect on the notification bar. Once it's ready user can request to a particular hospital to get the reserved blood from the blood bank with user details.

If the blood is not available, user will get a system notification that blood is not available at the blood bank and the system will notify once a donor donates that particular blood. Meanwhile, the system will check with the database, and it will send an email and SMS instantly to donors who have already donated blood to request to donate again. If anyone interest, they can click the link on their email and SMS notification to register/schedule to donate blood. Once blood is the available system will notify the requested recipient via system notification. Also requested user can check their blood request status.

b) History view: -

The Recipient can check their blood request and blood request for a patient history on this view.

c) Nearest blood bank: -

The Recipient can check the nearest blood bank by providing their district on blood request.

d) Profile editing: -

Blood request users have the option to edit their profile form edit profile option in the proposed system and they cannot change their blood type once they add to the system on registration process.

1.4.3 Blood bank management

Admin will create login for Blood bank view. Blood bank view can view the blood donation, blood campaign request, and blood request for approval and manage the process. All the blood requests and blood donations going through blood bank management. This view can add old blood donors' data to the system. This process will help to increase blood donor's database to request blood when it needs.

After approving blood requests, the blood bank management system can request transportation or can directly hand it over to the collection center if it's in the same place. At the same time system will notify the user, transportation, and collection center of the process. On this view, users can also edit their profiles. Blood banks must manage blood inventory through this system by coordinating with other blood banks. Blood bank management system can generate an individual report and summary report from the system. Below are the subviews of blood bank inventory management:

a) Personal donation and donation campaign: -

On this view, Blood bank need to approve/ reject blood donation/campaign request by user. Blood bank management can easily check the history on approved and rejected donation/ campaign request from the blood personal donation and donation campaign.

b) Guest Donation: -

On this view, Blood bank can see the guest donation request with user details and requested blood bank. After donate blood, Blood bank will add the user blood count to the system through add donor option in the system.

c) Blood Reservation: -

In this view, the Blood bank will get personal blood requests and blood requests on behalf of a patient for approval. The blood bank will approve/ reject their request by investigating from their nearest blood bank whether the request is true because each hospital initially checks with blood bank for blood. They have that record.

The manual process will not happen properly on time, that is the main purpose for the proposed Web-based system to process blood requests to get the blood instantly from the main blood store. After Accept the request, it will go for the waiting reservation option to check the status of blood availability and blood pickup to delivery. If the blood is not available also will notify as no quantity until they get the blood
to blood inventory.

d) Report generating; -

Several reports will be generated through this view. User Report will include all blood donation/ reservation with blood banks individually. With this report management have the visibility of seeing, how many blood donation/ blood reservation happened in each blood bank. Blood stock report will give the visibility of how much blood is available in each blood bank. Summary report will give total system summary records in one view for management to view easily and reports were generated on a daily, monthly, or yearly basis.

e) Add old donor details: -

Adding old donors data to the system. This process will help to increase blood donor's database to request blood when it need automatically.

f) Public Awareness:-

With this view blood bank can easily send SMS and email to the registered donors and blood bank can share blood donation request through social media.

a) Profile editing: -

Blood bank users have the option to edit their profile form edit profile option in the Web-based system.

1.4.4 Blood collection center management

Admin will create login for Blood collection center since this is a part of the blood bank. The system will automatically notify, once they get the blood to the blood collection center from transportation/Direct from the blood bank. Once all the details are correct, the Blood collection center will request through the system to blood recipient that blood is ready to collect. Now recipient will get the notification automatically, then they need to inform their hospital, that the blood is reserved with his/her name at the blood bank – Blood collection center. The hospital

only can collect blood from the blood collection center with a reserved person name/ID number. Blood collection center users have the option to edit their profile from the edit profile option in the Web-based system. Also, collection center can generate summary reports of the collection center daily, weekly, monthly, and yearly.

1.4.5 Blood transportation management

Admin will create login for Blood transportation management since this is a part of the blood bank. The system will automatically notify once they have a blood delivery. Transportation will notify about blood collection and delivery to the Web-based system. The blood recipient and blood bank also will get the notification of transportation status. Blood transportation center users have the option to edit their profile from the edit profile option in the Web-based system. Also transportation center can generate summary report of transportation center with daily, weekly, monthly, and yearly.

1.5 Outline of the Dissertation

The outline of this dissertation is as follows:

Chapter1. Introduction:
Introduction of Web-based blood donation and reservation system with objectives. Project scope with background study, used technology, and methods are contained in this chapter.

Chapter 2. Background:
Gathering relevant requirements identified the issue on the current system with the solution to the proposed system. Elaborate on functional and non-functional requirements. Finally, discussed the feasibility study of the proposed system in this chapter.

Chapter 3. Design Architecture:
Design of the proposed system, methodology and system architecture with design diagram used in the system and justification are deeply discussed in this chapter.

Chapter 4. Implementation:
Major code with tools and techniques, and management report for proposed system are discussed in this chapter and how the system got implemented using methods also discussed.

Chapter 5. Testing and Evaluation:
Test the system with apply actual information to the system and discussed various type of testing output in this chapter. In evaluation, discussed on user feedback with their outputs.

Chapter 6. Conclusion:
This chapter includes the proper output of the system with data analysis and the future improvement on the system

References: List of references cited in my thesis with Harvard references format

Appendices: Additional materials used in Web-based blood donation and reservation project

1.6 Summary of design tools and technology

Web-based blood donation and reservation systems use PHP as a server scripting language to develop the system with Apache NetBeans 12.4. HTML, CSS(Cascading Style Sheets), and JavaScript used for GUI design to view the webpage in the proposed system. Using XAMPP Server to use MySQL server for Database and Apache server to delivery of web content.

The proposed system will be a Web-based system. The software development methodology that will be used in developing the proposed Web-based system is a waterfall methodology. Using MVC architecture as design architecture for the proposed system. Also, the system uses system architecture as a clint server architecture in the proposed system.

Chapter 2 - Background

2.1 Introduction

This chapter contains the requirement analysis with functional and non-functional requirements. Also include a review of the similar systems with the comparison, related technology, and discussed related design strategies. Finally include a feasibility study for the proposed Web-based system.

2.2 Requirement Analysis

Requirement analysis was conducted to identify both the functional requirements and nonfunctional requirements.

2.2.1 Functional Requirements

Below are the system module functionalities to describe the functional requirements.

1. Blood donor management module:

Functionalities

- Donate blood: Can register user to donate blood and check the status of donation request.
- Blood Campaign request: Campaign request to blood bank and can check the status.
- Guest donation: User can request to donate without register to the system
- Report view: Can check the donation history.
- Check nearest blood bank: Can check the closest blood bank location by giving their district on the process.
- Profile editing: User can edit profile

2. Blood recipient management module:

Functionalities

- Request blood: Can register user and request blood through the system. If blood is not available, donors will get the request via SMS and Email. Also, can check the status of requested blood.
- Report view: Can check their blood request history.
- Check nearest blood bank: Can check the closest blood bank location by giving district on blood request process.
- Profile editing: User can edit profile.

3. Blood bank management module:

Functionalities

- Blood bank login: Separate login credential is allocated to this function.
- Blood donation: update the availability of blood, accept/reject request, can check the pending donor details and can check the status of donation blood.
- Blood Request: Can check the pending request by user. accept/reject request. If the blood is available blood bank will request to delivery to nearest blood collection center or collection center.
- Guest Blood Donation: Can check guest blood request from this view.
- Inventory update: Update blood inventory with blood availability.
- Report generation: Can generate several reports through this function. User report will generate how many people donated/ receive blood through each blood bank. Blood stock report will give a stock update on each blood bank. Blood request report, Campaign report. and summary statistic report can get daily, monthly, yearly.
- Add or remove donor details: Adding old donor's data through this function.
- Profile editing: User can edit profile

4. Blood collection center inventory management module:

Functionalities

- Blood collection center login: Separate login credential is allocated to this function.
- Blood collection: Can check the blood collection details and can put update on handed over blood details. Also, can see the pending blood collection details and can request to recipient to collect the blood.
- Report generation: Blood collection report can be generated through this function.
- Profile editing: User can edit profile

5. Blood transportation management module:

Functionalities

- Blood transportation login: Separate login credential is allocated to this function.
- Blood transportation: Can update the collected and delivery status to the system.
- Profile editing: User can edit profile

6. Administrator module:

Functionalities

- Admin Login: Special privilege to login to the system.
- User profile modification: Can create/edit user profile through this function.
- System maintains: Can fix all system issues, bugs and system maintenance.

Below, Figure 2.1 illustrates the use case diagram of the Web-based blood donation and reservation system. Accordingly, the proposed system will include six (6) main system users, namely, the

I. Blood Bank
II. Donor
III. Blood Recipient
IV. Blood Collection Center
V. Blood Transport Center
VI. System Administrator

Use Case Diagram: -

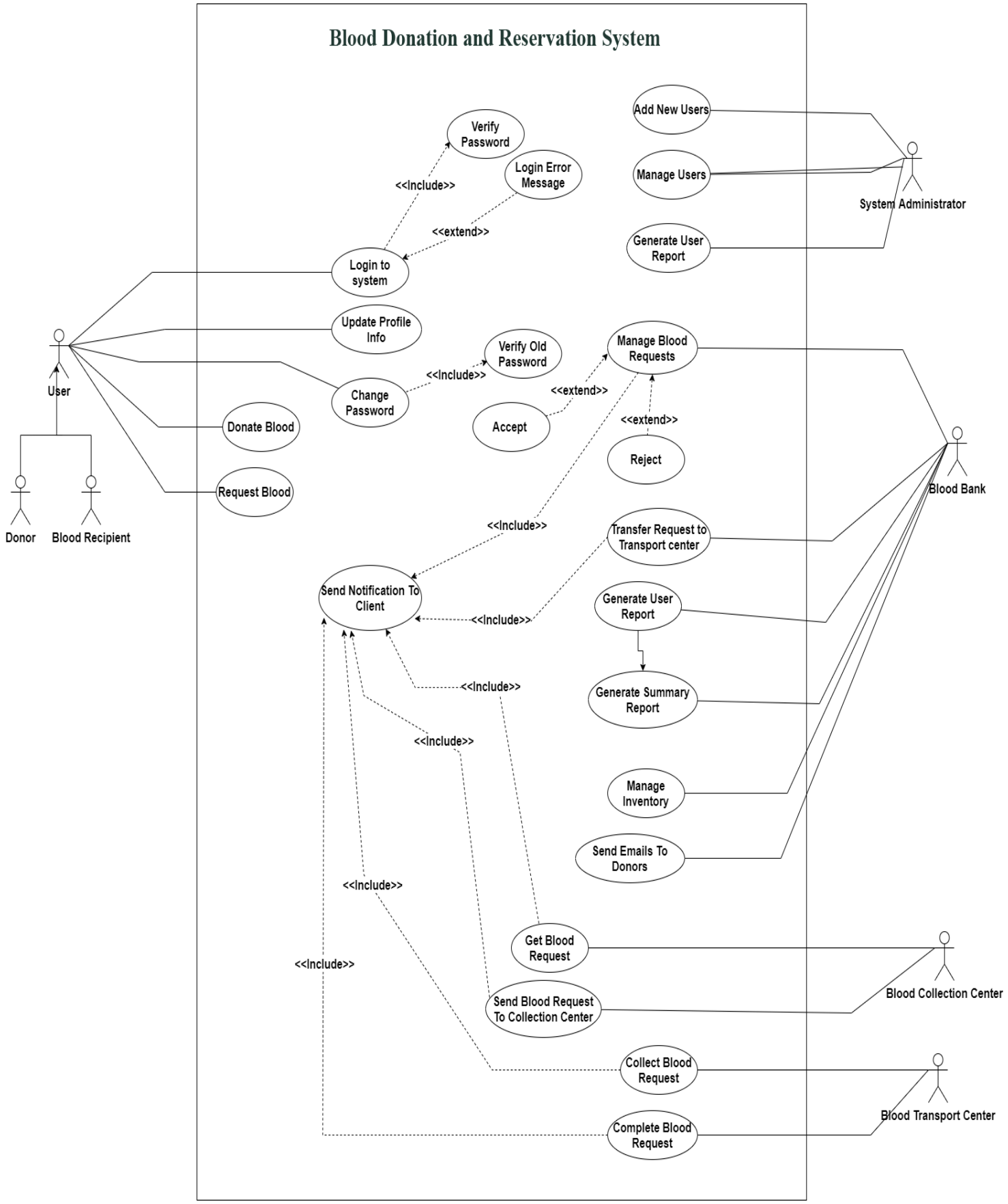


Figure 2.1: Use Case Diagram

The functional requirements for each use case identified above for the Web-based blood donation system are described in more detail.

Detail Use Cases Narratives:

Use case narrative for accept and reject blood donation illustrated in Table 2.1

Table 2.1: Use case 1 - Accept or Reject Blood Donation

Use Case 1:	Accept or Reject Blood Donation
Primary Actor:	Blood Bank
Pre-Condition:	System must be connected to the network
Main Scenario:	▪ They will verify the Blood group and personal information ▪ Center will see the availability and venue ▪ Then they will decide to accept /reject

Use case narrative for accept and reject blood campaign illustrated in Table 2.2

Table 2.2: Use case 2 - Accept or Reject Blood Campaigns

Use Case 2:	Accept or Reject Blood Campaigns
Primary Actor:	Blood Bank
Pre-Condition:	System must be connected to the network
Main Scenario:	• They will verify the Campaign details • Center will see the availability and venue • Then they will decide to accept /reject • They will inform with relevant contact details

Use case narrative for request to blood transportation illustrated in Table 2.3

Table 2.3: Use case 3 - Request to transportation

Use Case 3:	Request to Donate transportation
Primary Actor:	Blood Bank
Pre-Condition:	System must be connected to the network
Main Scenario:	▪ In an emergency they will call for a donation from their database through web portal. ▪ Create an request event ▪ Set date and time

Use case narrative for enter old blood donor illustrated in Table 2.4

Table 2.4: Use case 4 - Enter old blood donors

Use Case 4:	Enter old blood donors
Primary Actor:	Blood Bank
Pre-Condition:	System must be connected to the network
Main Scenario:	▪ They will enter the old donor database details to the system

Use case narrative for request to blood collection center illustrated in Table 2.5

Table 2.5: Use case 5 – request to collection center

Use Case 5:	Request to blood collection center
Primary Actor:	Blood Bank
Pre-Condition:	System must be connected to the network
Main Scenario:	▪ System will send the request to blood collection center

Use case narrative for report generate illustrated in Table 2.6

Table 2.6: Use case 6 – report generate

Use Case 6:	Report generates
Primary Actor:	Blood Bank
Pre-Condition:	System must be connected to the network
Main Scenario:	▪ Can get daily/weekly/monthly/yearly report to see the progress ▪ Can download the report at any time. ▪ If there is an inquiry on blood donation/ Blood request person, this function will work to get full details of that incident.

Use case narrative for donor registration illustrated in Table 2.7

Table 2.7: Use case 7 - Donor Registration/Deregistration as individuals

Use Case 7:	Donor Registration/Deregistration as individuals
Primary Actor:	Donor
Pre-Condition:	System must be connected to the network
Main Scenario:	▪ Individuals who is willing to give blood, they can register them self with this function

Use case narrative for request blood donation illustrated in Table 2.8

Table 2.8: Use case 8 - Request blood donation

Use Case 8:	Request blood donation
Primary Actor:	Donor
Pre-Condition:	System must be connected to the network
Main Scenario:	▪ After register with Blood bank, they can request to donate blood with nearest blood bank. ▪ Can check the nearest blood bank by adding

Other Use Cases Narratives are attached in Appendix A

2.2.2 Non-Functional Requirements

2.2.2.1 Performance Requirements

If a lot of users/donors access the web portal to register or access, server bandwidth will go high. Initial need a fiber connection for this system, in future, this might happen and at that time we can go for a leased line with fiber to give high performance to web site users. This website is supported for all browsers but needs an internet connection. Because of that website, users will not get any performance issues from the front end. In the future, we can expand the memory if the need for server performance.

2.2.2.2 Safety Requirements

Users must log in to correct web site - Web-based blood donation and reservation system. There will be other third-party websites, we need to be aware on that. This is user safety with their information.

2.2.2.3 Security Requirements

This is a Web-based system, all users must have virus guard on their laptop / desktop when their accessing internet. Web based blood donation system also an internet access website, therefor we need to be careful, and who doesn't have virus guard on their computers.

2.2.2.4 Software Quality Attributes

Availability: - 24x7 hours on 365 days to give the best service to save lives except for the hours when maintenance takes place.

Maintainability: - we used to take backup every day. Therefore, their want be an issue on maintain a server/computer or a system. If a need come to change interface or bug fixes can do it on off peak hours and then we can patch to live time. Also, if a system crashes, we can restore with the backup.

Reliability: - This is from Sri Lanka authorized web site, because of that we can give guarantee on your data.

Capacity: - concurrently can use.

Usability: - Usability is very import in Web-based system. User can get a user manual of the system through the system. User manual will guide the user how to use the system with full function. Anyone any one can to easily understand the system and use it without any problem. Very user friendly

Flexibility: - Can use through web site from any country with the link. No restriction to use and system is very user friendly

Accessibility: - Can access this web site at any time. Users can access this site with simple computer/ phone with internet access.

Restrictions: - Need internet connection and a device.

2.3 Review of Similar Systems

Web-based blood donation and reservation system for blood bank is the key communicating system of the blood banks, donors and the recipients instantly to save lives. Sri Lanka, India, and many other countries using the same system with different methods. If these systems get implemented to communicate relevant parties will be an added advantage to country people for their emergency needs.

In Sri Lanka, The National blood transfusion service (NBTS, 2016) is a similar system that have pre blood donor request only. On this current system, there are no emergency request systems for emergency blood purposes and there are no services to combined three parties (Donors, recipient and blood bank) in one to get the better output for an emergency need. This system doesn't have blood availability checking system with blood bank. Also, this system doesn't have online report generation option to take the history on current donated blood details. The Web-based blood donation and reservation system will give better service to people to save their lives when an emergency need comes. Also United Kingdom and India having a Web-based blood donation system with all tracking systems.

Indian Web-based systems having Online Donation Request, Blood availability, online blood request, Schedule to donate blood and can check the nearby blood bank details. Process of above system is that blood recipient must register and give their details with relevant blood group details.

Once they request, system will check the availability with blood bank database and then registered donors will get request via e-mail or SMS. Also, above system has a live blood availability check for the recipient who needs blood urgently. Above Indian system has a new feature on the web-based application to show the live statistic of blood donation and blood camps. (NHM India, 2018) (TSBTC CHENNAI, 2016)

UK web-based system has Blood donor registration, Appointment for blood donation, and Blood donation Campaigns. From the initial view of web-based system of NHS blood and Transplant – UK will appear with details of blood donors, the donation process and where to donate. (NHSBT, 2015).

If an individual is already a donor, he/she can use their credentials to donate again, and new donor has to register and then can put an appointment to donate blood. Also, they can schedule a blood campaign with the user credentials.

UK web-based system has several sub links to donate Organ Donation, Platelet Donation, Tissue Donation, Cord blood bank and Blood transfusion. This will be very useful to my project to get some good idea on different technics to give best service to people through the proposed web-based blood donation and reservation system. (NHSBT, 2015)

Below are the similar systems with their technologies to improve my project.

1. The National blood transfusion service – Sri Lanka. (NBTS, 2016)
2. eRaktKosh - Blood Cell, National Health Mission, Ministry of Health & Family Welfare, New Delhi . (NHM India, 2018)
3. Tamilnadu State Aids Control Society & Tamilnadu State Blood Transfusion Council, Chennai. (TSBTC CHENNAI, 2016)
4. NHS Blood and Transplant – UK. (NHSBT, 2015)

2.3.1 The National Blood Transfusion Service Website – Sri Lanka.

The National blood transfusion service (NBTS, 2016) is a similar system that allows pre-blood donor requests through the website. However, at present, emergency requests are handled manually, and there are no proper techniques for managing emergency blood requests. Also, there is no appropriate way in handling the different parties, including Donors, recipients, and blood collection centers, to get the better output during an emergency.

Figure 2.2 shows the National blood transfusion service (NBTS) website's home page. As illustrated, it includes services related to handling blood donation requests and other information required by the donors. In addition, blood campaign handlers can also obtain details regarding the available centers and the blood bank branch details. Overall, this webpage includes several tabs for user convenience.

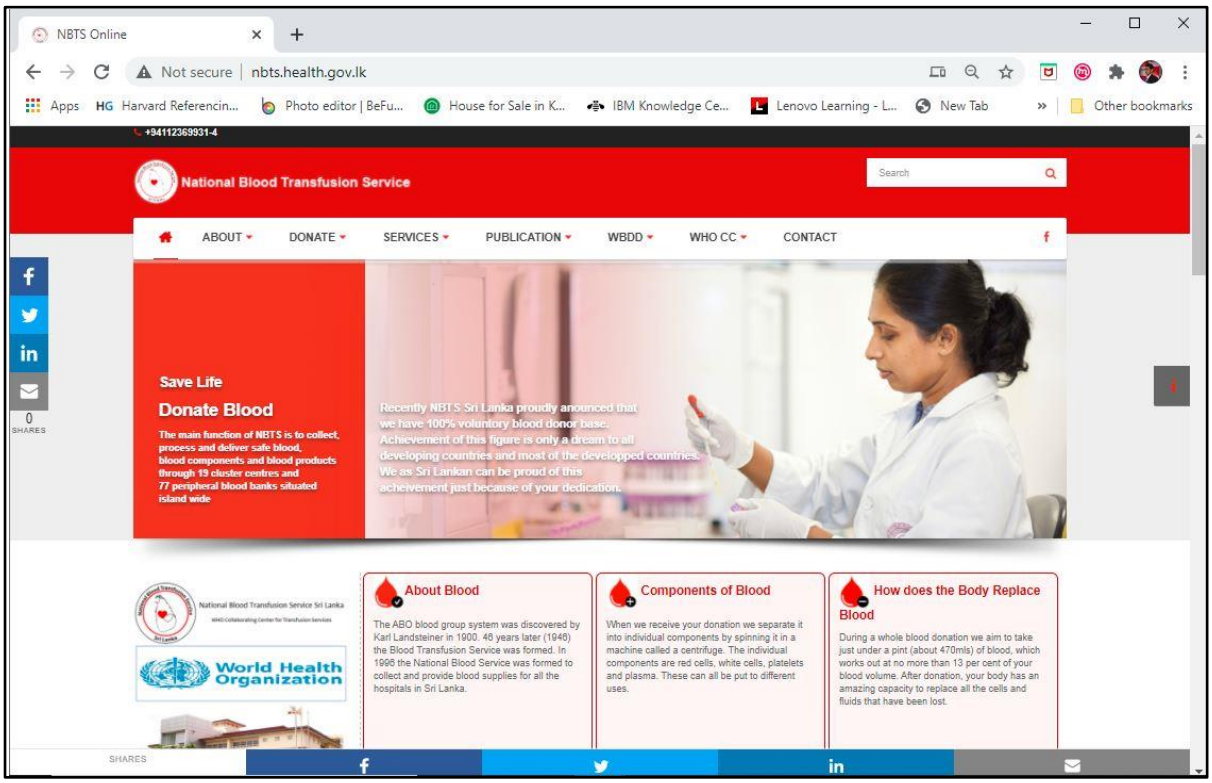


Figure 2.2: NBTS-Web interface

Also Figure 2.3 shows the Donate tab, which a donor can check the eligibility and information on blood donation.

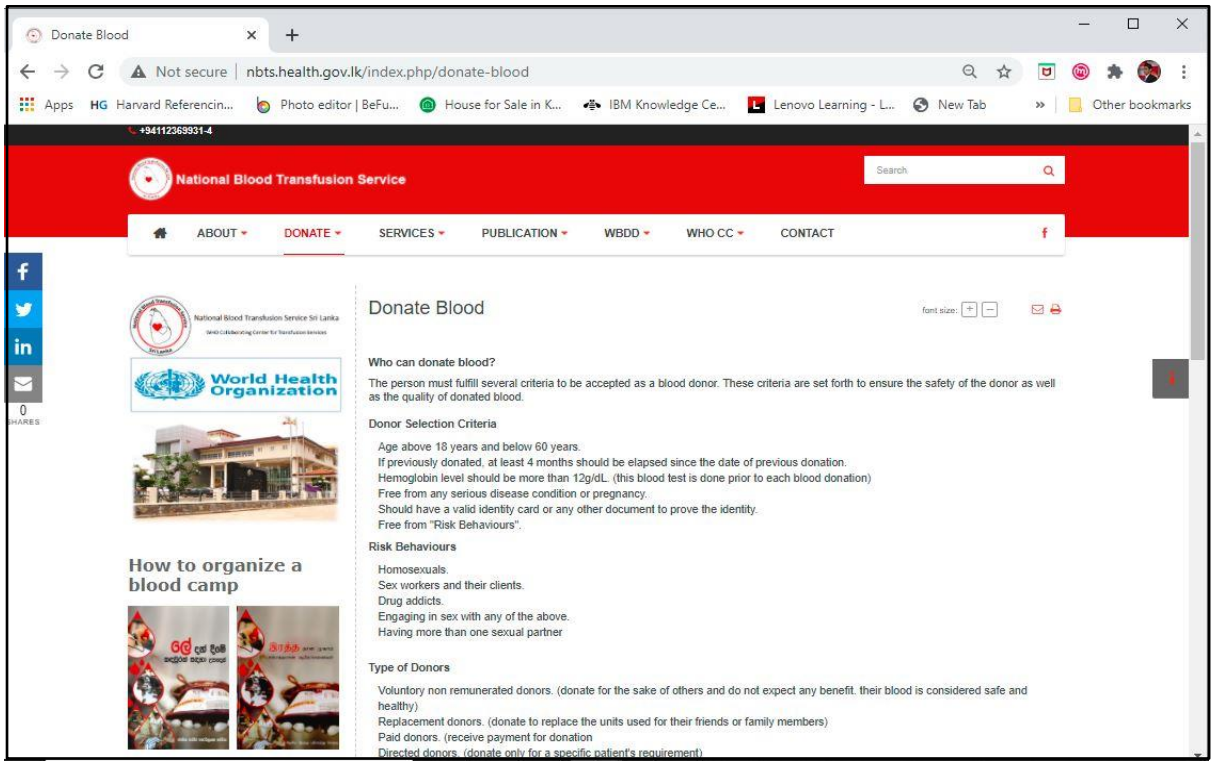


Figure 2.3: NBTS-Web Donations

Figure 2.4 Shows the Publication of the National blood transfusion service to show case their annual reports and magazines.

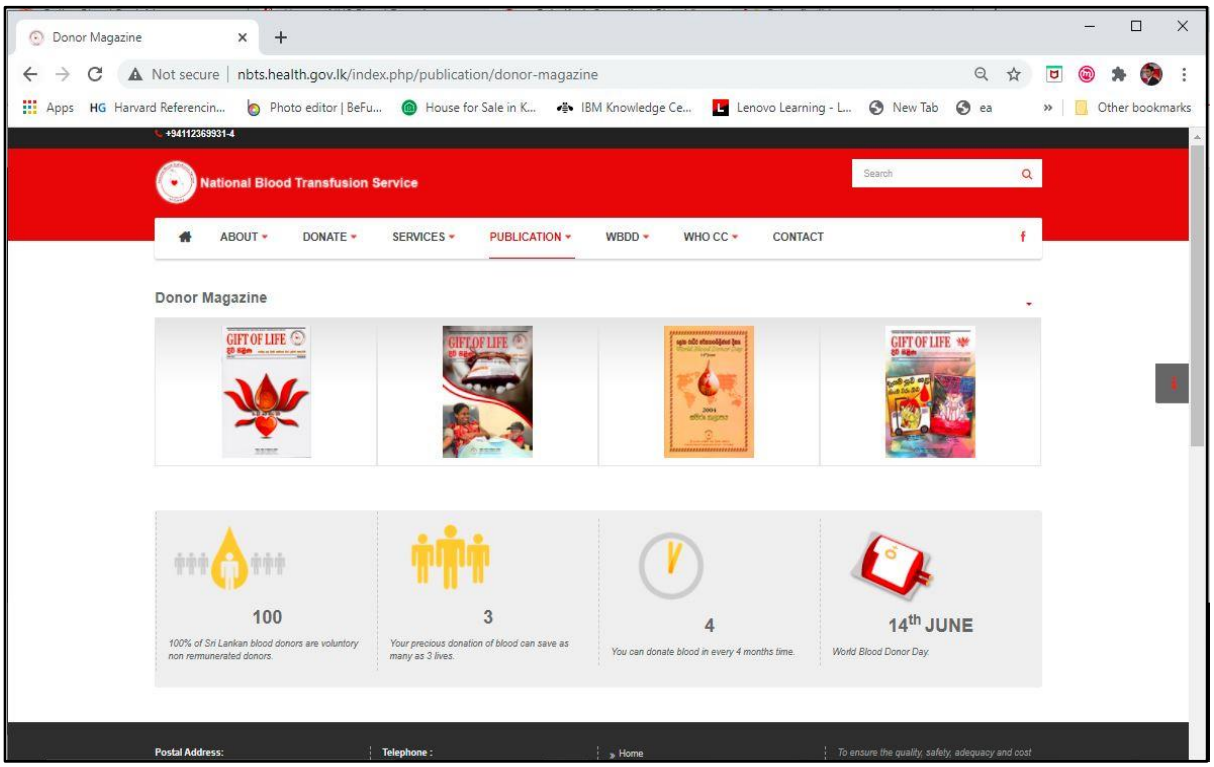


Figure 2.4: NBTS-Web Publications

2.3.2 eRaktKosh - Centralized Blood Bank Management System.

This is one of a popular blood donation and reservation system in New Delhi, India. eRaktKosh blood donation and reservation system (NHM India, 2018) has many features, which will connect Blood bank, Donors and recipient at one point. That is a very good thing in this Web-based system. Below Figure 2.5 shows the general system content with live location to search blood bank, View registered blood bank, my donation history, Login option and live donation e-pass to donate blood and live chat for help. These are amazing features on one view of login.

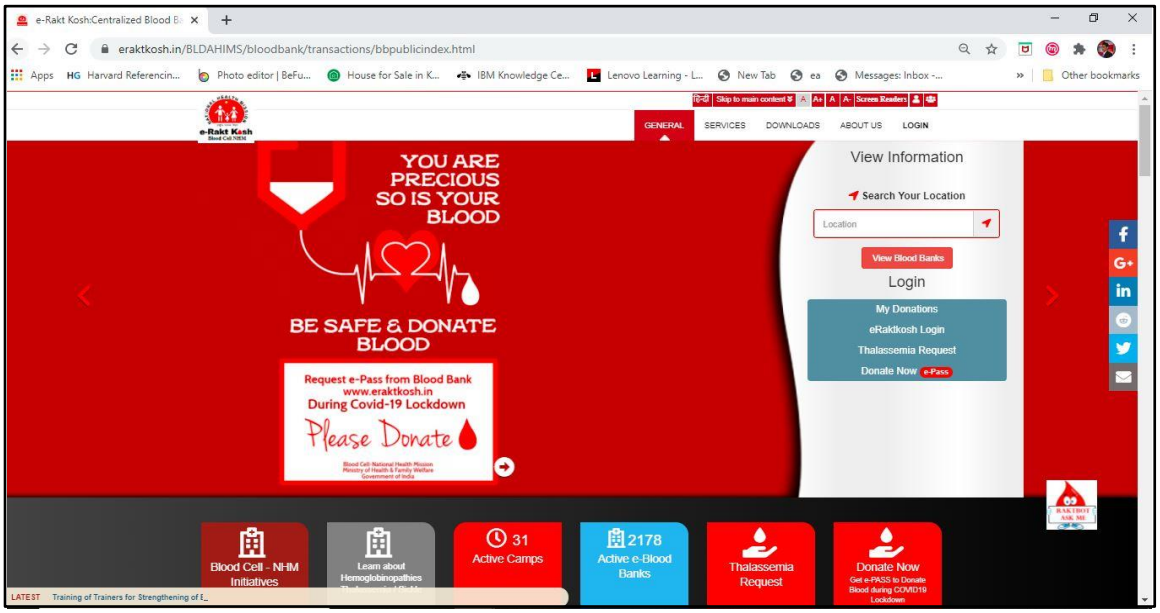


Figure 2.5: eRaktKosh-Web interface

Figure 2.6 shows the services of this web-based system. It includes services related to an online donation request, blood availability, camp Schedules, nearby blood bank details, and user logging.

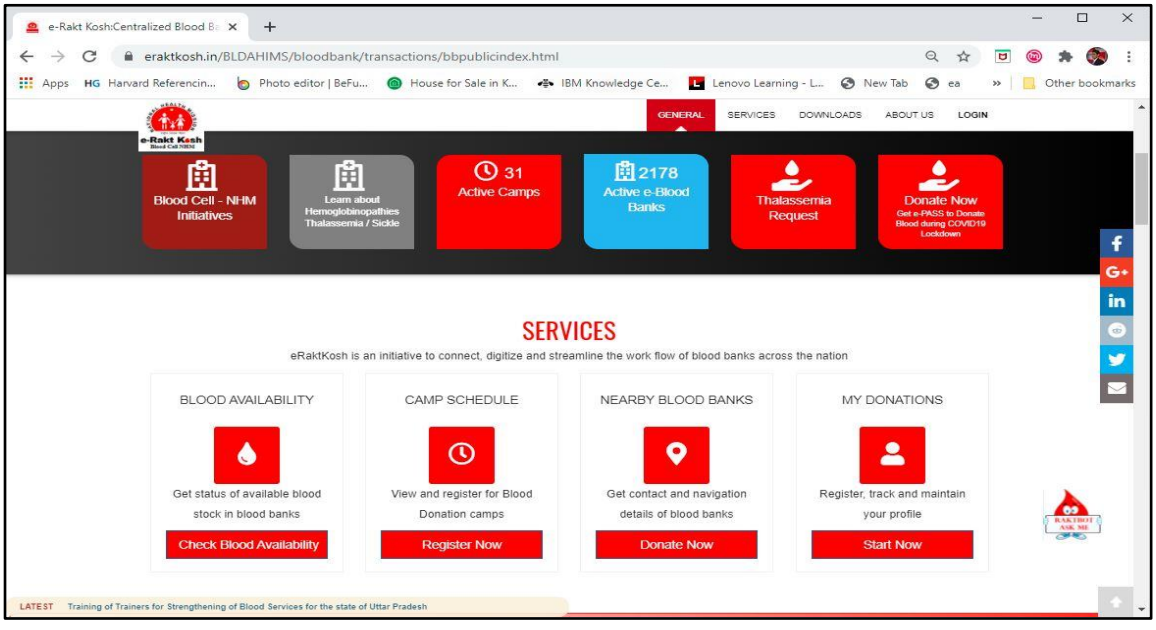


Figure 2.6: eRaktKosh-Web services

Figure 2.7 shows the downloadable features available on this website. This is downloadable as a mobile application. In addition to that, additional software can also be downloaded from this interface.

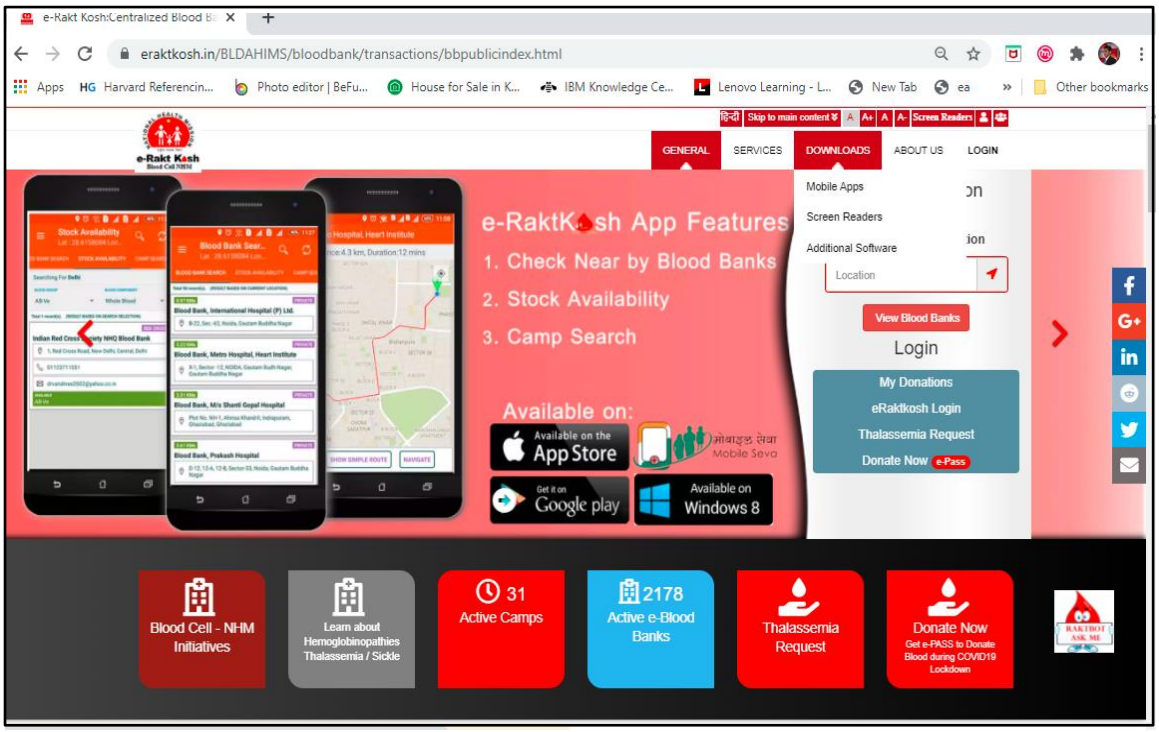


Figure 2.7: Downloadable features

Figure 2.8 shows the statistics related to blood donations and blood camps on this Web-based application.

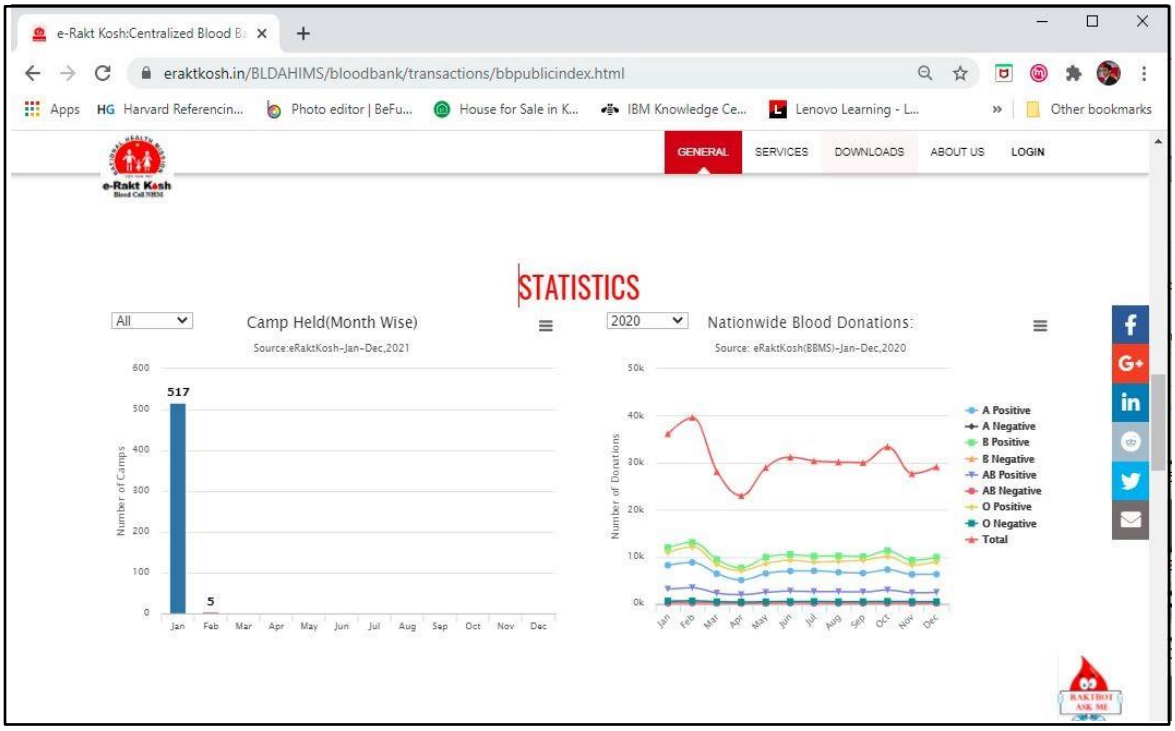


Figure 2.8: eRaktKosh-Web Statistics

2.3.3 ONLINE BLOOD BANK MANAGEMENT SYSTEM - Chennai.

This is also an Indian blood donation and reservation system only for Tamilnadu, Chennai (TSBTC CHENNAI, 2016). This System also includes blood donation registration, blood bank details and blood camps with areas. Figure 2.9 shows the Web-based system initial interface with general quarries.

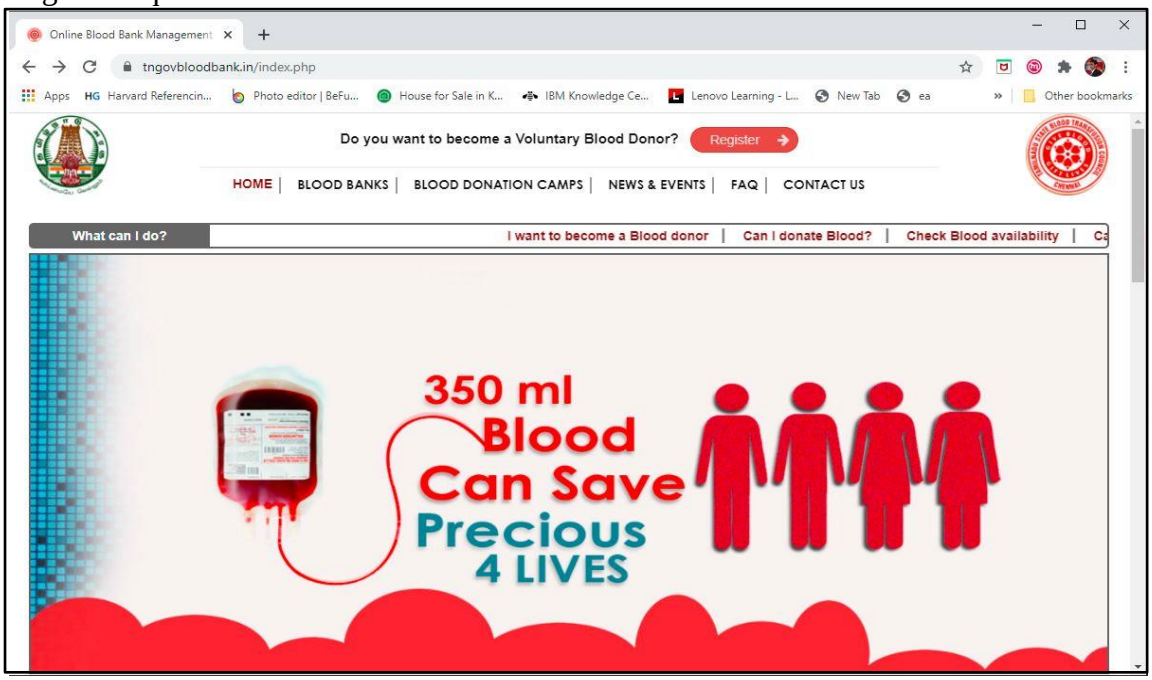


Figure 2.9: TSBTC- Web interface

Figure 2.10 shows the user login with registration, available blood details and view blood stock report from second view. This information also will help to improve the proposed system.

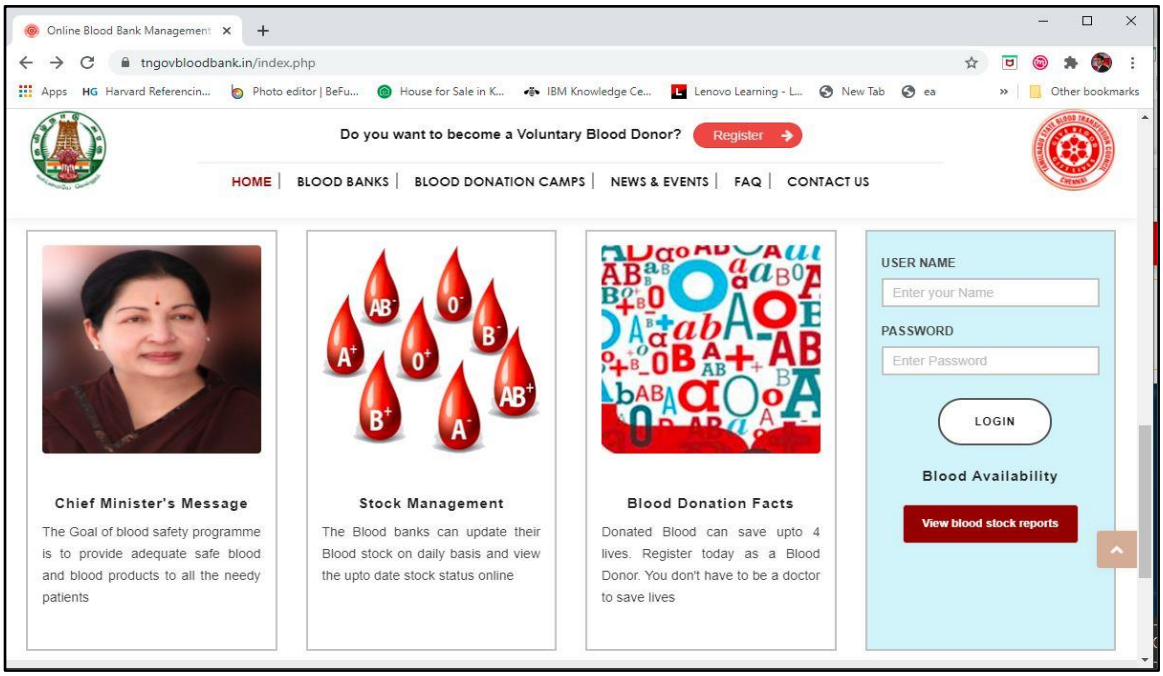


Figure 2.10: TSBTC- Web Details view

2.3.4 NHS Blood and Transplant – UK.

UK based system has Blood donor registration, Appointment for blood donation, and Blood donation Campaigns. Also it has many sub links connected with Organ Donation, Platelet Donation, Tissue Donation, Cord blood bank and Blood transfusion. Figure 2.11 shows the initial view of web-based system of NHS blood and Transplant – UK. This will appear with details of blood donors, the donation process and where to donate.

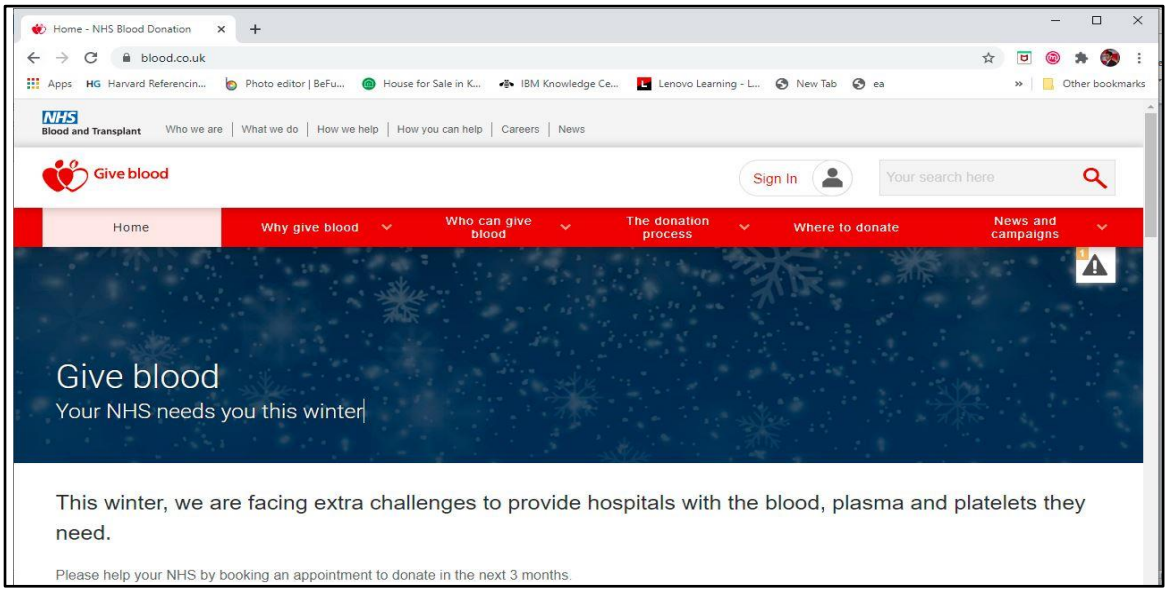


Figure 2.11: NHS-Web Interface

Figure 2.12 shows the logging view. If an individual is already a donor, he/she can use their credentials to donate again and new donor has to register and then can put an appointment to donate blood. Also this has several sub links to donate Organ Donation, Platelet Donation, Tissue Donation, Cord blood bank and Blood transfusion. This will be very useful to my project to get some good idea on different technics to give best service to people.

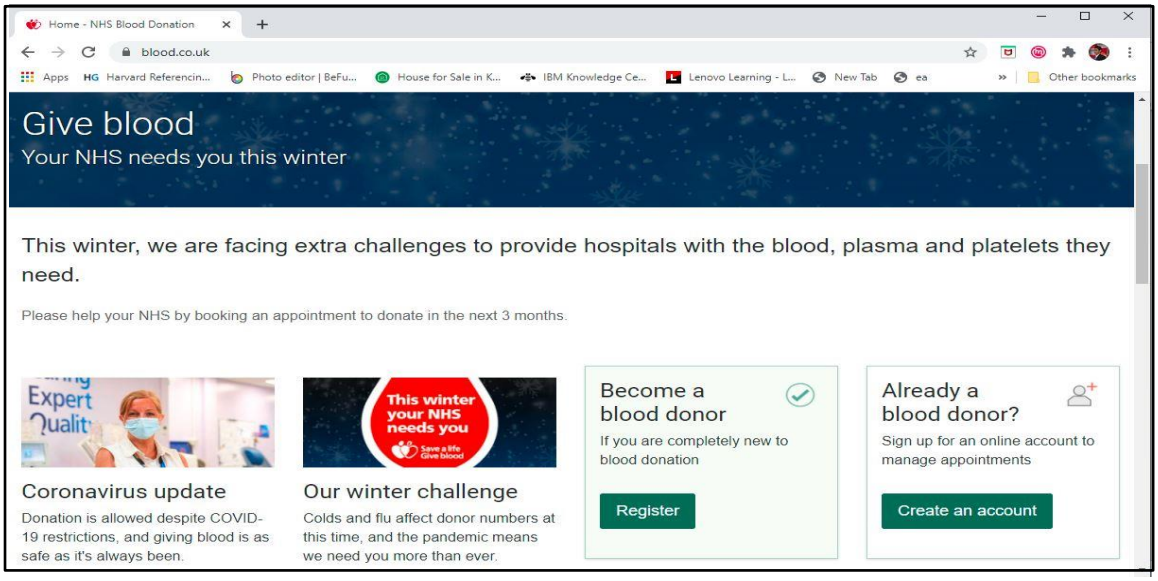


Figure 2.12: Logging view

2.4 Comparison of Similar System

Blow Table 2.9 shows the comparison with Proposed Web-based blood donation and other similar systems.

Table 2.9: Comparison with Proposed Web-based system and similar systems

Description of the function	**NBTS – Sri Lanka**	**eRaktKosh – New Delhi**	**TSBTC - Chennai**	**NHS - UK**	**Proposed System**
Pre-Request donation	Yes	Yes	yes	yes	Yes
Donation request real time	No	Yes	yes	yes	Yes
Request blood for emergency – Instant request	No	No	No	No	Yes
Check status of requested blood	No	No	No	No	Yes
Request Blood campaign	No	Yes	yes	Yes	Yes
Check nearest blood bank	Yes – Can see all the places	Yes	Yes	No	Yes- Only can see near blood bank
Report view/generation	No – only can see the pre-request details	Yes	Yes	No	Yes

2.5 Related Technologies

The proposed web-based blood donation and reservation system will include services specially to handle and manage online donation requests and blood requests. In addition to that, the system will provide details related to blood availability on request and Blood Campaign requests. The system will also generate emails and SMS alerts on emergency blood requests to registered donors.

Web-based blood donation and reservation system architectures consist of application components, middleware systems, and databases. Web-based blood donation and reservation systems use PHP as a server scripting language to develop the system with Apache NetBeans 12.4. HTML, CSS(Cascading Style Sheets), and JavaScript are used for UI design to view the webpage in the proposed system. Using XAMPP Server to use MySQL server for Database and Apache server to delivery of web content (Anon., 2021). Also, this Server has the database administration tool phpMyAdmin, to control the Database of Web-based blood donation and reservation system.

2.6 Related Design Strategies

The proposed system will be a Web-based system. The software development methodology that will be used in developing the proposed Web-based system is a waterfall methodology. This is referred to Linear-sequential life cycle model. It is very simple and easy to understand. There is no overlapping in Waterfall model since each phase must be complete before the next phase can start.

Using MVC architecture to propose Web-based system as design architecture and The Model-View-Controller (MVC) is an architectural pattern that separates an application into three main logical components: the model, the view, and the controller. Each of these components is built to handle specific development aspects of an application. MVC is one of the most frequently used industry-standard web development frameworks to create scalable and extensible projects.

The proposed system uses system architecture as a client-server architecture. This architecture uses a centralized computer/server to host the Web-based system from the backend. For the front-end user will get a user-friendly web page through the internet to access the proposed system and the back-end web host will happen accordingly with proper coding with the database.

2.7 Feasibility Study

The main objective of the feasibility study is to test the Technical, Operational, and Economic feasibility of the proposed system. Therefore, in the preliminary investigation below mentioned feasibility studies were conducted to identify the feasibility of the proposed Web-based solution.

- Technical Feasibility
- Operation Feasibility
- Economical Feasibility

2.7.1 Technical Feasibility

A technical feasibility study was carried out to answer the following:

- Does the necessary technology exist to do what is suggested?
- Does the proposed system have the technical capacity to hold the data required to use the new system?
- Will the proposed system provide an adequate response to inquiries, regardless of the number or location of users?
- Can the system be upgraded if developed?
- Are there technical guarantees of accuracy, reliability, ease of access and data security?

Earlier no system existed to cater to the needs of 'Web-based blood donation and reservation system' with connecting the blood bank to efficiently handle the daily operations while connecting to the donors and recipients in a competently. The proposed system is technically feasible. It is a web-based blood donation system to create a platform to link donors, recipients, and the blood bank instantly with tracking of the nearest blood bank.

The database's purpose is to create, establish and maintain a workflow among various entities to facilitate all concerned users in their various capacities or roles. Permission to the users would be granted based on the roles specified. Therefore, it provides the technical guarantee of accuracy, reliability and security in the Web-based Blood donation and reservation system. Need an entry level server/a computer to run from the backend service for proposed Web-based system. MySQL and Apache with XAMPP server and Apache NetBeans IDE for implement the coding, that are open source is used for implementing the MVC components for software requirements.

The project is done with the available equipment, tools, and existing software technology. Addition to that need a necessary bandwidth to run the Web-based system without any interruption.

2.7.2 Operational Feasibility

The Proposed web-based blood donation and reservation system project is operationally feasible as this can connect the blood bank, collection centers, donors, and blood recipients efficiently through the system. All donors and recipients will use this web-based system to fulfill their needs. The current manual process consumes more time and faces issues due to a lack of donor support. Compared to the manual system, the proposed system will handle all the operations efficiently, reducing the time in managing the process.

Hence, the management will also derive full benefits with time and reduce the operational cost in managing and handling the blood collection. The proposed system will be operational for 24x7 hours on 365 days to give the best service to save lives except for the hours when maintenance takes place.

All managerial issues and user requirements were handled carefully to provide a better service. User feedbacks were carried out to investigate all possible scenarios. The user resistance will be minimal due to the potential benefits of this application. The design is well planned to fulfill the user needs, and it will ensure the optimal utilization of computer resources, improving the overall performance. Accordingly, the operational feasibility of the proposed system is well justified.

2.7.3 Economic Feasibility

The development cost in creating the system is evaluated against the ultimate benefit derived from the new proposed system in the economic feasibility. The Web-based Blood donation system is economically feasible due to the reasons mentioned below. The development cost is minimal due to the less cost associated with hardware and software.

It requires minimum hardware, and it can be in-house with an administrator. All the front-end and back-end software used in the development are free and open-source. Minimum hardware or software is required in developing the web-based blood donation system. There is nominal expenditure and economic feasibility for certain.

Chapter 3 - Design Architecture

3.1 Introduction

Design Architectural is a concept that focuses on components or elements of a structure. Design architecture is also the main part of a Web-based system to implement. System quality will depend on the architect's design. This chapter includes the system architecture of the proposed system, Methodology approach, UML diagram, and quality of the solution.

3.2 System Architecture

The architecture diagram of the Web-based blood donation and reservation system presents the system overview as illustrated in figure 3.1. The system includes three main components, central database, Users (donors, recipients, blood bank, admin, and blood collection center) and Web server.

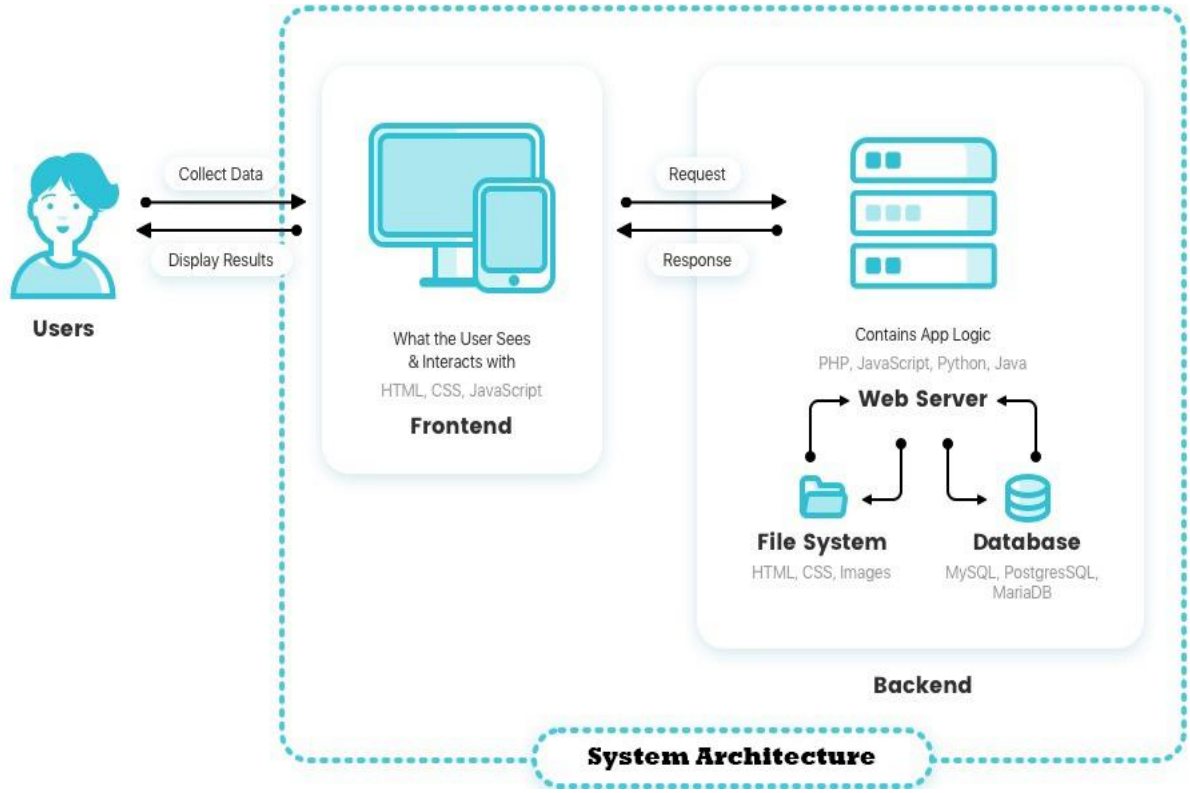


Figure 3.1: System Architecture

In figure 3.1 shows there are two main parts for system architecture, one is front end and back end. From front end user can view the Web-based system interface using a browser and they will not get the access for back end. Once they log in from frontend, they will get a verification process through the web server, and they will get the access to use the system by their user privileges

Every single request will manage by backend. Backend side of Web-based system contain the operation functions of the system. From backend of the system uses PHP as a server scripting language. HTML, CSS(Cascading Style Sheets) and JavaScript used for UI design to view the frontend webpage. Using XAMPP Server to use MySQL server for Database and Apache server from backend system to delivery of web content. Developing, Bug fixing and maintaining will also happened from backend. To use the system frontend, need an internet connection to access the centralized server. This is called Client server architecture.

The interaction between different entities helps acquire information on blood bank, recipient, and donors' current situations, predict the future needs, and take proactive actions. Integration with blood bank helps donors and recipients to get their needs done in a good way. Also, blood bank will keep a track and history of donors in their main database. Also, can obtain statistical information through this system from database.

Integration with donors will help to get blood on time for emergency need. If the donor willing to donate blood, they can register themselves to donate blood through frontend view. If a donor is already register with the system, will invite appropriate donors to be ready in the right place and right time via SMS or Email for an emergency need.

Also below figure 3.2 shows the MVC architecture of proposed Web-based blood donation and reservation system. The Model-View-Controller (MVC) is an architectural pattern that separates an application into three main logical components: the model, the view, and the controll. Each of these components is built to handle specific development aspects of an application. MVC is one of the most frequently used industry-standard web development frameworks to create scalable and extensible projects.

All the views of the system which can be seen to the end user are stored in the view layer. All the programing scripts are stored in the control layer. It is worth to maintain the connectivity among these three layers to work the system effectively and efficiency. Following figure 3.2 shows the directory structure of the system. (Anon., 2021)

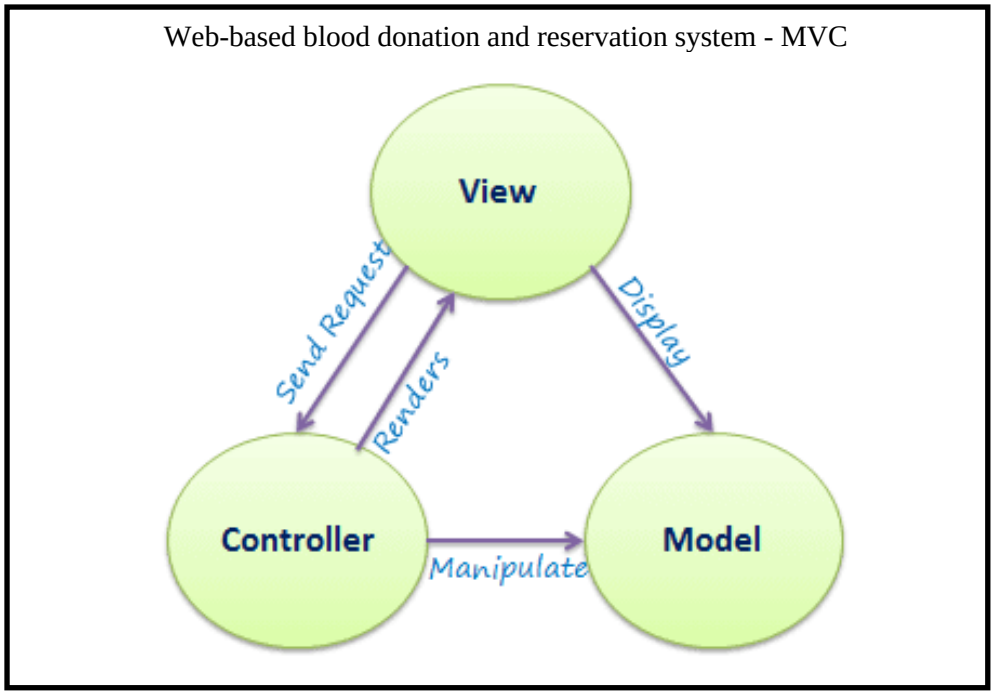


Figure 3.2: MVC

3.3 Methodological Approach

Web-based blood donation reservation system will be more important system to people's life since this process will expedite the blood request and blood needs. That is the main reason to develop this system. Target audience identification is the main key success of this project. This system will benefit who need blood to save a life and who have internet connection can access. Among them who need immediate blood will get the full benefit from the system. The main process of this project is connect donor, recipient and blood bank instantly. The users will be getting the full use from the system to save a lives.

3.3.1 Waterfall Module

Web-based blood donation and reservation system was carried out under waterfall module and before starting the project all the specifications of the system were identified and documented. The entire process was carried out by one person under the waterfall module which including requirement analysis and feasibility analysis in the initially following by designing database and system, developing the system, system testing and implementation.

The necessity of this system is well understood and defined in the early stages of this system lifecycle. Further, the third-party plugins are also complicated for the target users who are with special needs. As they will feel exhausted on handling complex systems by facing many meetings and discussions. Hence, all user requirements were concluded before start designing and developing the system.

In this module, the developers must follow the order of the steps and one step should be fully completed to follow the next step. Retracing is not possible in this system. Figure 3.3 shows the steps of waterfall modules.

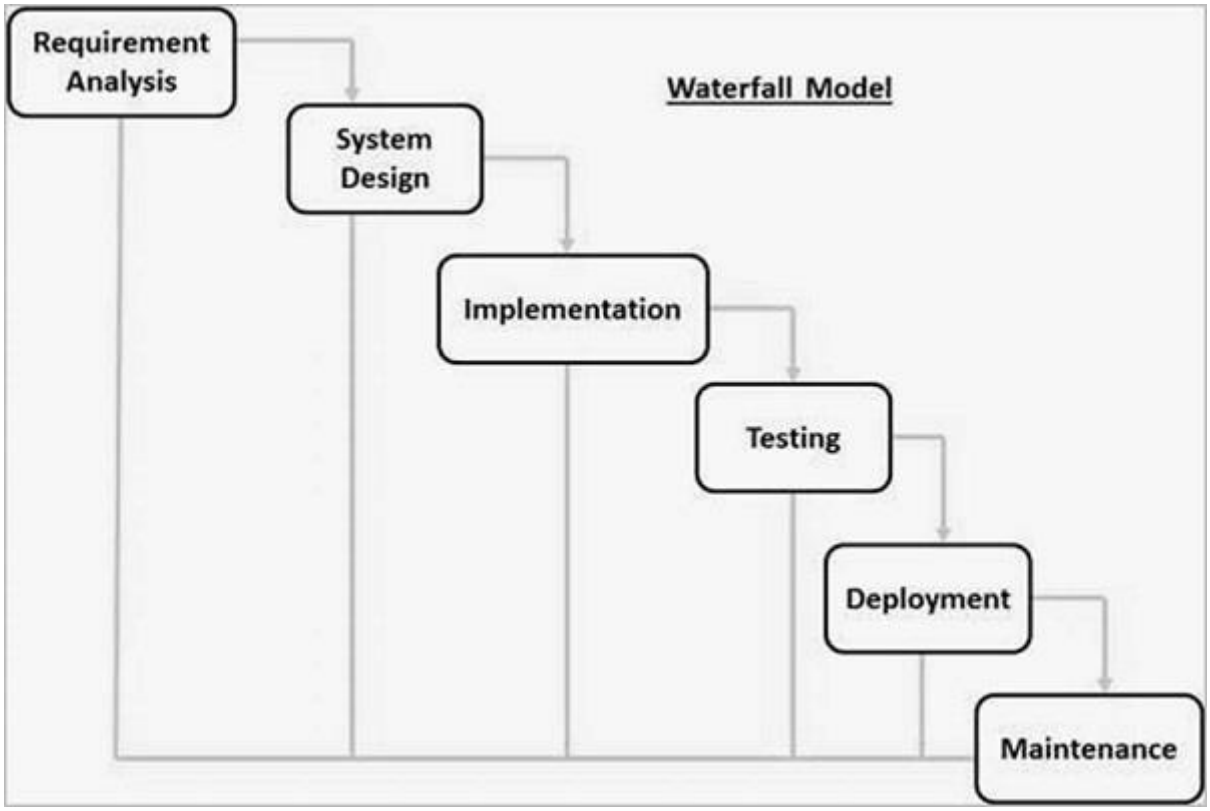


Figure 3.3: Waterfall Modules

3.4 UML diagrams

The Unified Modeling Language (UML) is a standard language for specifying, visualizing, constructing, and documenting the artifacts of software systems, as well as for business modeling and other non-software systems.

The UML diagrams below will analyze the web-based blood donation and reservation system in detail.

1. Use case diagram
2. Class diagram
3. Sequence Diagram
4. Activity Diagram

Sequence diagram and activity diagrams are attached in Appendix B

3.4.1 Use Case Diagram

The system actors include users and other systems that directly connect with the system to exchange information. The proposed web-based blood donation and reservation system includes six (6) main system actors as mentioned in Chapter 2. Figure 2.1 shows the use case with use case diagram in chapter 2.2.1.

3.4.2 Class Diagram

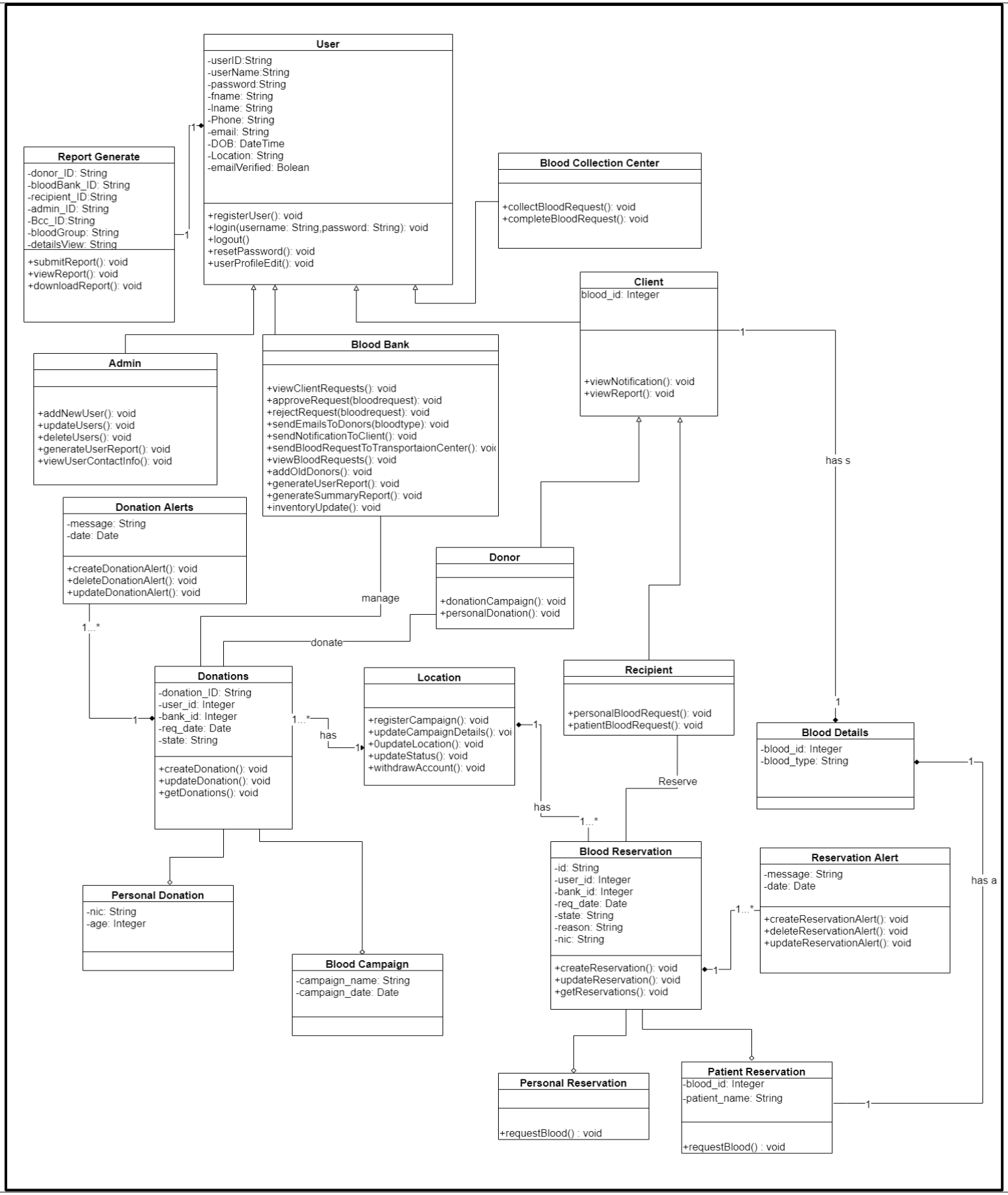


Figure 3.4: Class Diagram

3.5 Hardware and Software Requirement specifications:

Web-based system need to run database server, web server, web application, and the user interface or client browser through a hardware with software. The system was developed in a computer or entry level server with the following software installations listed in Table 3.1 below. Also, the hardware specification mentioned in Table 3.2 to run the Web-based system.

Software Requirements:

Table 3.1: Software Requirements

Name of component	**Specification**
Operating System	Windows 8, Windows 8.1 or Windows 10
Language	PHP Runtime Environment
Open-source software	XAMPP Server
Database	XAMPP Server – MySQL Database server
Scripting Language Enable	PHP, HTML, CSS, JavaScript

Hardware Requirements:

Table 3.2: Hardware Requirements

Name of component	**Specification**
Hardware device	Server / Computer
Processor	Intel(R) Core(TM) i5-4300M CPU @ 2.60GHz 2.59 GHz
RAM	12 GB
Hard Disk – storage	500GB/1TB
Network Card	10GB/1GB Nic Adapter
Monitor	14” LED Monitor

3.6 Quality of the solution

Web-based blood donation and reservation system for blood bank is the key communicating system of the blood banks, donors, and the recipients instantly to save lives. Sri Lanka, India, and many other countries using the same system with different methods. If these systems get implemented to communicate relevant parties will be an added advantage to country people for their emergency needs.

Proposed Web-based blood donation and reservation system will give better service to people for save their lives when an emergency need comes. Through this proposed system will combined three parties (Donors, recipient, and blood bank) in one to get the better output for an emergency need. Donor can easily register to donate blood. Also, proposed system proves that on an emergency need, recipient can request blood through web-based system and if its available system will notify that the blood is available. Blood bank will pass the request through the system to blood transportation/blood collection center for the next step. If the blood is not there. System will notify the user and system will inform registered donors to donate blood.

Donors will get the request through the system to donate blood. Also, this system will have an option to request blood campaign. Web-based system can check blood delivery status through system notification. Blood transportation management and blood collection center options available in this system to help to handover deliver the system on time and those process status can easily see from blood recipient and blood bank. Also, this system will manage the inventory of the blood to give the best service to save lives.

The system will manage the details of the available stocks of collected blood and pending blood to provide the status or the details to the blood recipient and the blood bank. Can check the nearest blood bank when user request blood. Above features will be the best thing in Web-based blood donation and reservation system project.

Chapter 4 - Implementation

4.1 Introduction

In this chapter, will discuss the implementation technologies and tools, and software to implement the Web-based blood donation and reservation system. Also, this chapter includes screen shots of the system and management reports. This system was implemented and developed by an individual. We-based system was on the proposed direction and overall concept of the project was completed as per the project plan.

4.2 Implementation Technologies and tools

4.2.1 PHP

PHP server scripting language were used to develop the Web-based blood donation and reservation system. PHP is a server scripting language and a powerful tool for making dynamic and interactive web pages. PHP server-side scripting language is designed especially for web development and no licenses required/ software need for PHP, this is open source and totally free. PHP works with Apache server and MySQL database server to develop a Web-based system.

PHP is a more convenient language to understand and develop a web base system and also this is a very easy to read and modify. Other programing languages required long scripts and difficult to understand and PHP is widely available in internet. PHP scripts can have API and Tags to input HTML tags and other free API to improve the system. Between Tags, function and code needs to manage in PHP to develop a system and need to make sure the codes are in the correct place to get the correct output.

4.2.2 MySQL

MySQL used to manage system database for Web-based blood donation and reservation system. It is an open-source relational database management system which is freely available, and it will support in all platforms. MySQL is an important part of every Web-based system. Cost effective system to implement and delivery with good performance and reliable. It is a very ideal database for entry level and large systems, and it works extremely well for Web-based system. Deploy and understanding is also very easier than other database systems.

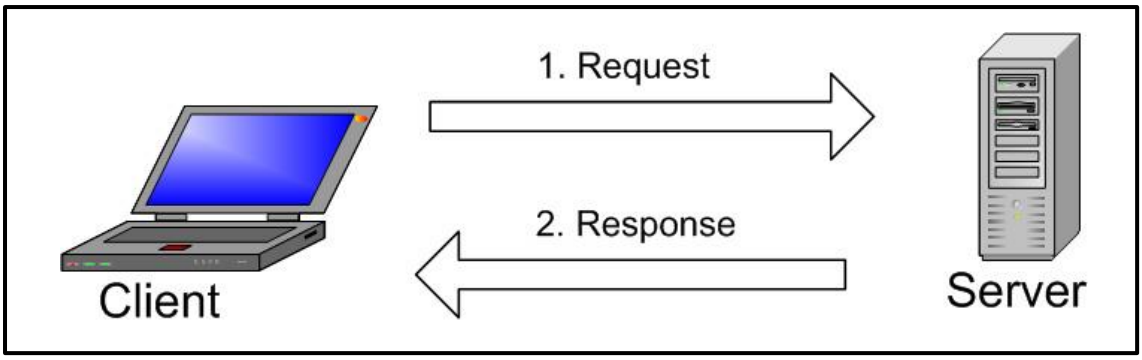


Figure 4.1Client server structure

Above Figure 4.1 shows the client server structure for MySQL. MySQL will create a database for data and it will define the relationship of each table. When client request to access/view data, the server application will respond with the requested information and it will appear to the client. This is the way MySQL works for Client server system and one or more devices can access MySQL at a time. Proposed system used XAMPP server to get the MySQL database server to run.

4.2.3 HTML5

HTML5 is the latest version of HTML and it's a markup language. Proposed Web-based system also used in HTML5. It's used for present and structure the content on the World Wide Web.

4.2.4 CSS/CSS3

Cascading Style Sheet used to add style to the web page Proposed system also used with CSS to add attraction style to get the user view. CSS3 is the latest version of Cascading style sheet.

4.2.5 Bootstrap

Bootstrap is a free open-source CSS framework. This will be a front-end web development using CSS and JavaScript based templates for typography, forms, buttons, navigation, and other interface components. Proposed system used bootstrap templates to get the web view in a perfect way.

4.3 Hardware and Software

4.3.1 Software

A) XAMPP:

Proposed Web-based system used XAMPP server to develop the website with Apache and MySQL servers. XAMPP is a free and open-source cross-platform web server solution stack package. This will include mainly of the Apache HTTP Server, MySQL database, and interpreters for scripts written in the PHP and Perl programming languages. XAMPP server makes transitioning from a local test server to a live server possible. It supports for windows 7,8,8.1,9 and 10.

4.3.2 Hardware

As already discussed on Chapter 3.4, System needs a minimum hardware for backend ith 12GB RAM and 500GB/1TB hard disk with latest version of windows O/S to run the XAMPP server software.

4.4 Sample screen shots of the system

In this section sample screen shots of the proposed system will be shown. Include only the important pages to display in this section.

I. Home Page: -

Below UI Figure 4.2 Shows the home top page and Figure 4.3 shows the bottom page of the Web-based Blood donation and reservation system.

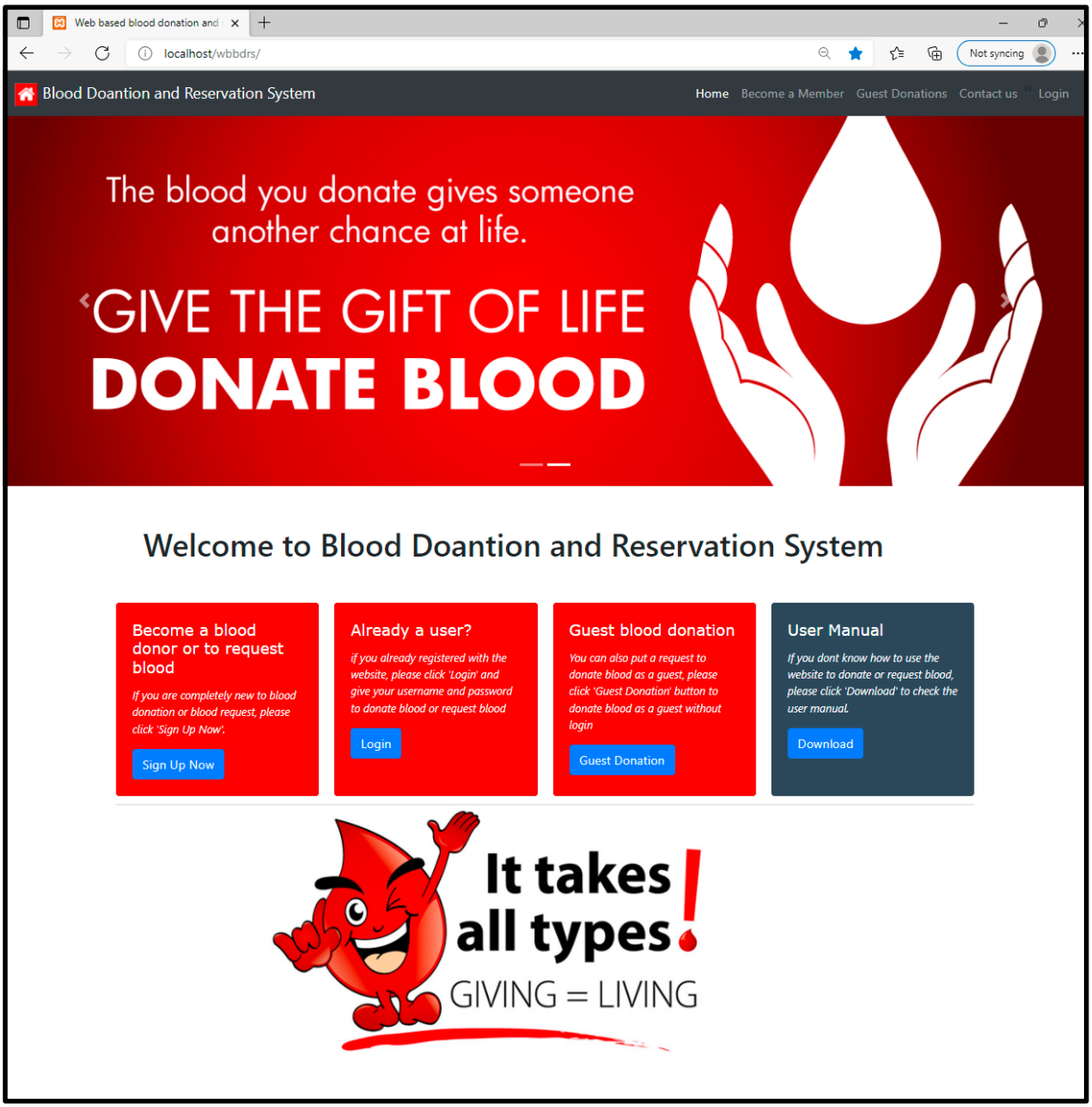


Figure 4.2: Home Top Page

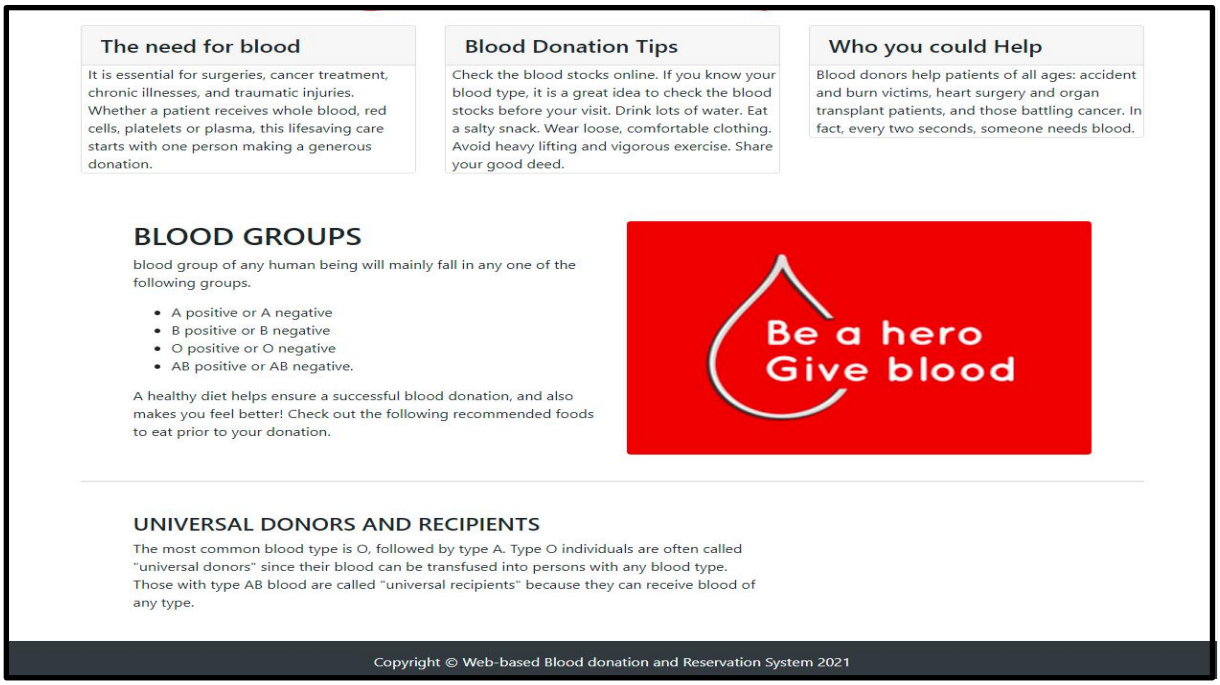


Figure 4.3: Home bottom page

II. Sign Up page: -

Blow UI Figure 4.4 shows the Sign up part for the system.

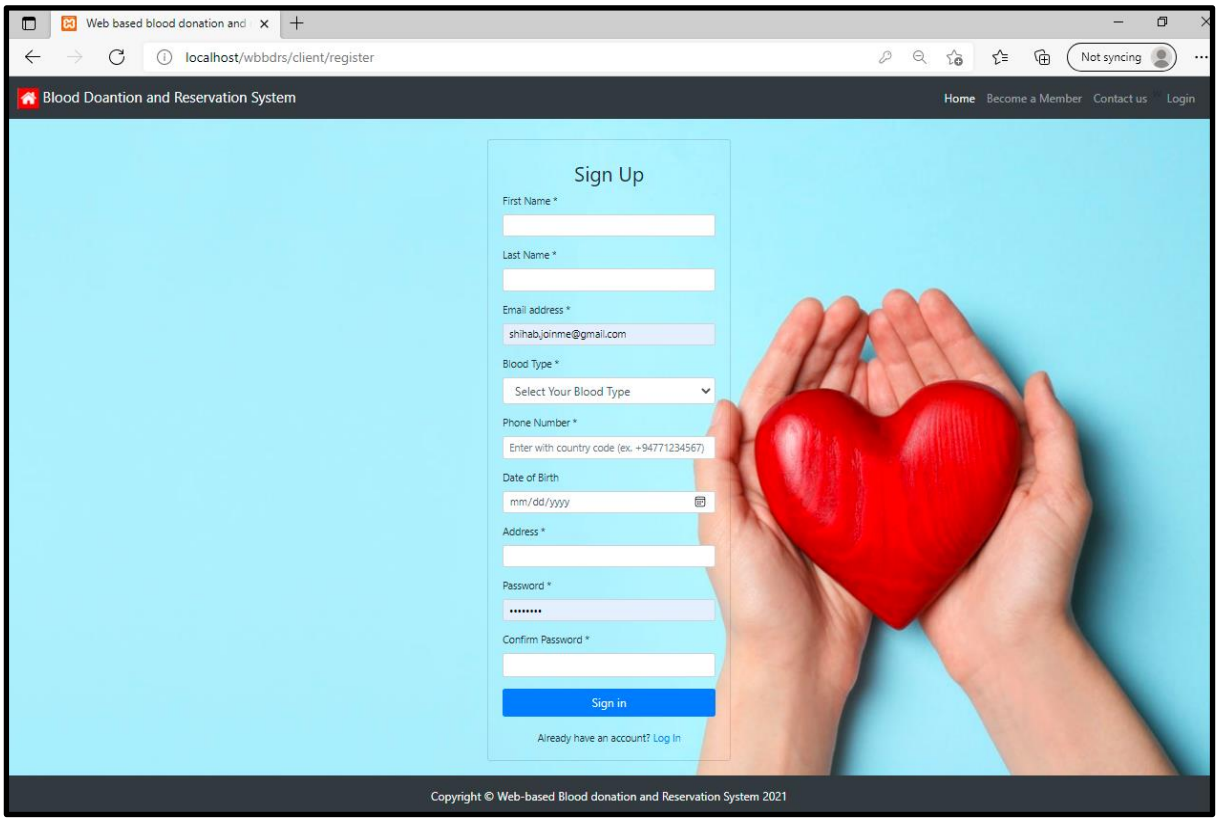


Figure 4.4: Sign up page

III. Log In Page

Blow Figure 4.5 shows the log in page on the system.

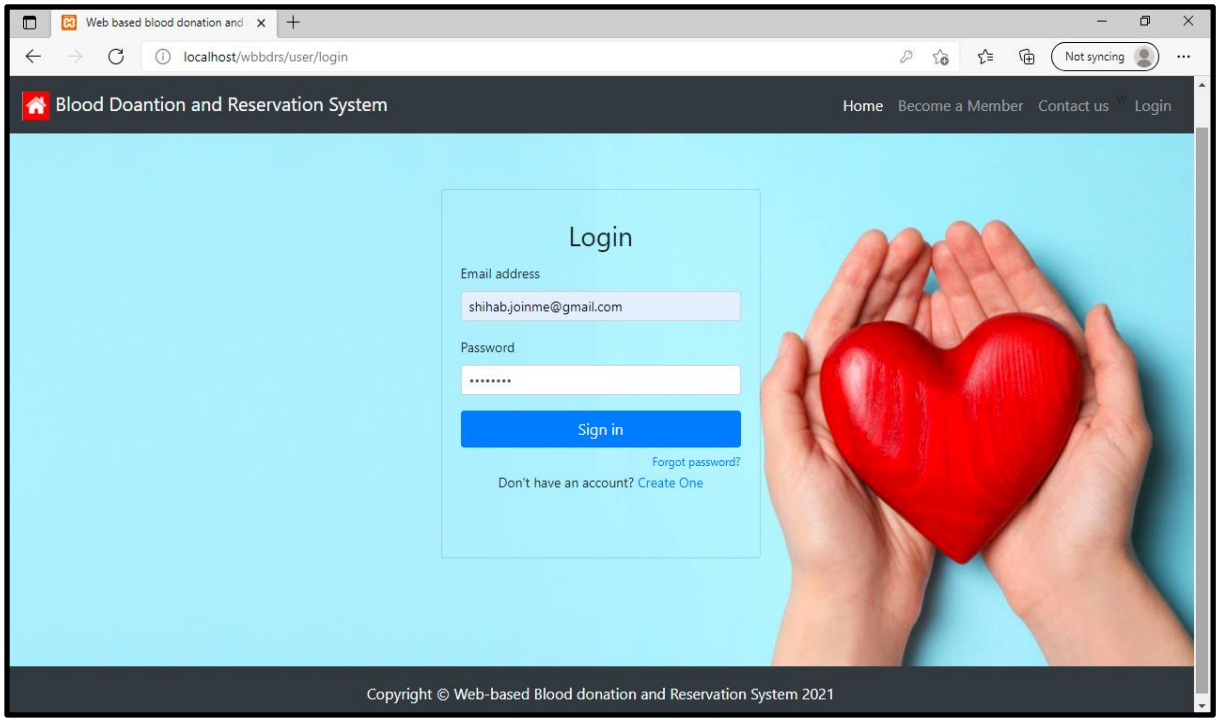


Figure 4.5: Log In Page

IV. Dashboard page for user: -

Below Figure 4.6 shows the Dashboard page to donate/request blood.

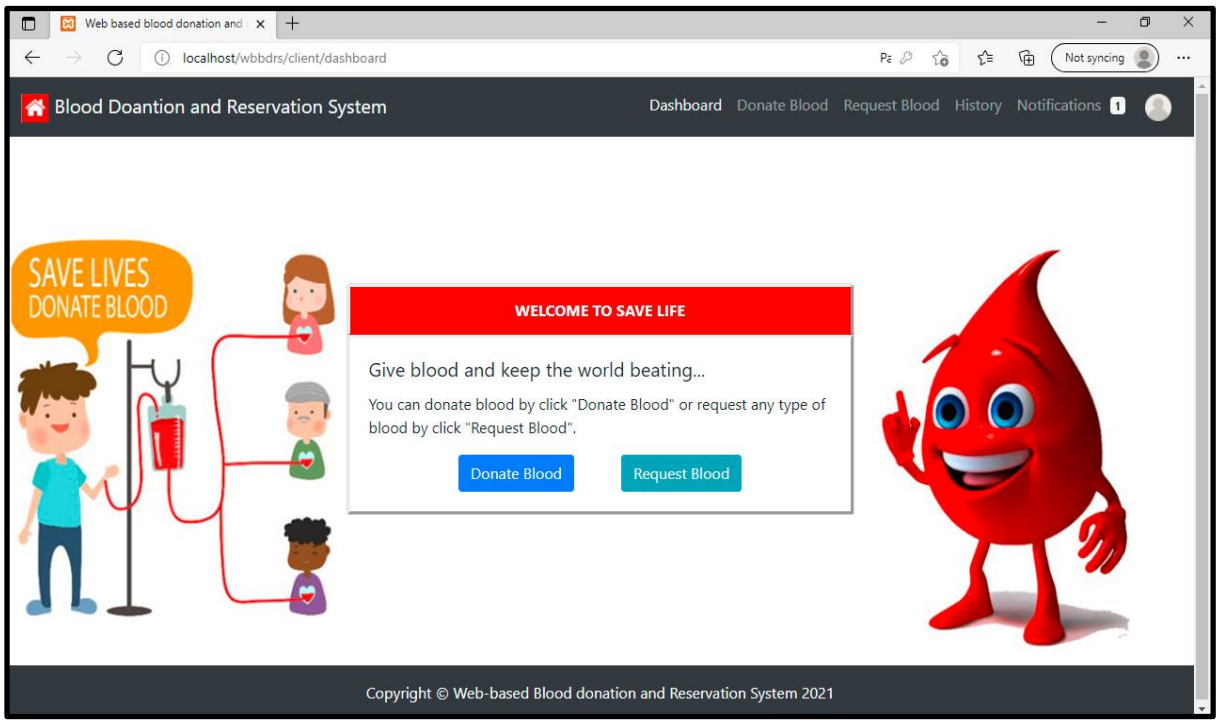


Figure 4.6: Dashboard page for user

V. Blood Donation Page: -

Blow Figure 4.7 shows the personal blood donation page to donate blood.

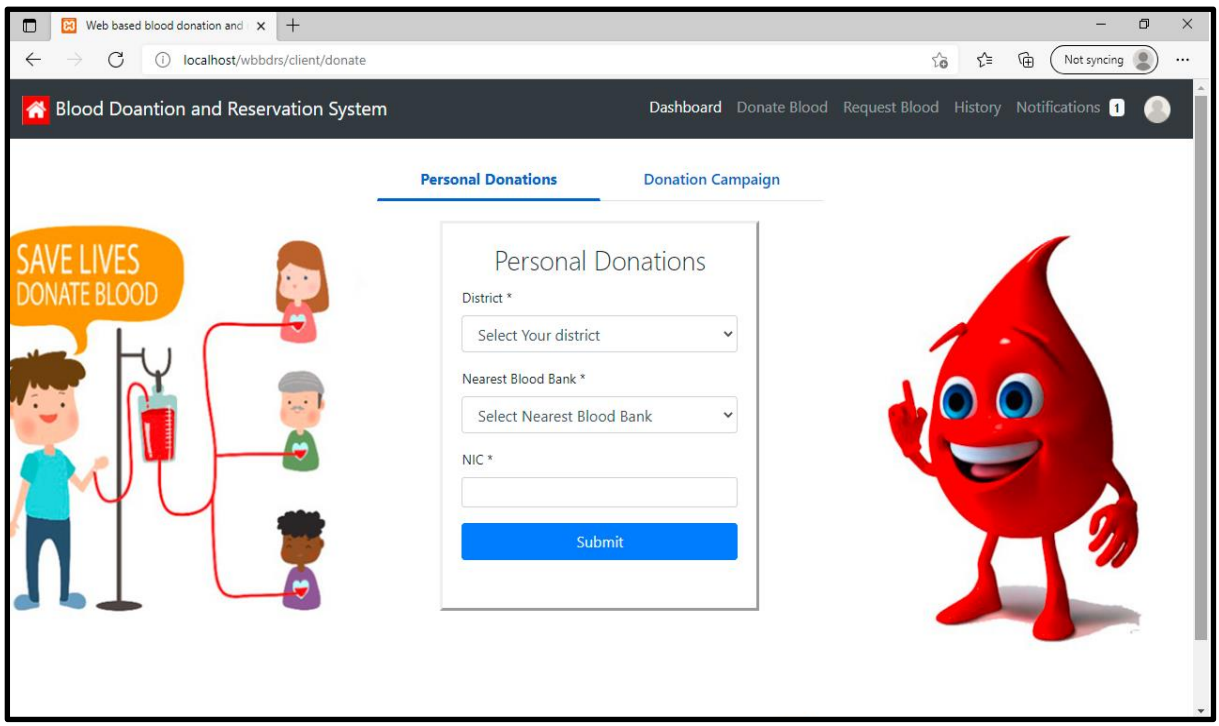


Figure 4.7: Personal blood donation Page

Blow Figure 4.8 shows the blood donation camping request page.

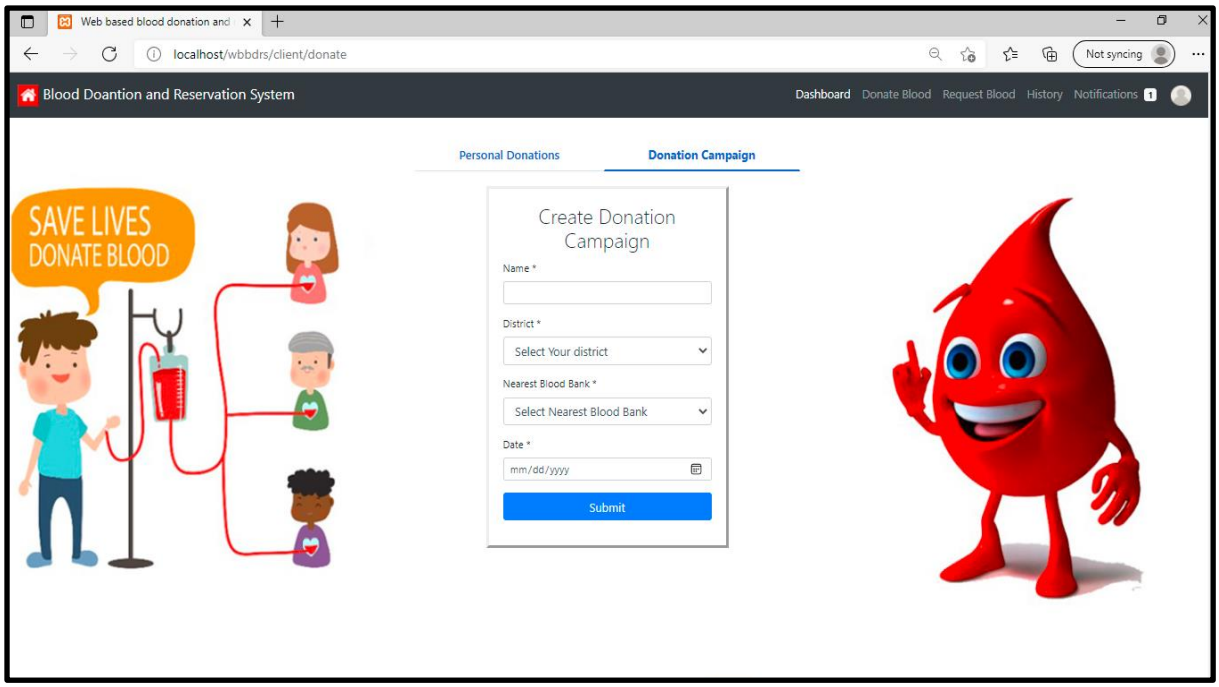


Figure 4.8: Blood donation camping request page

VI. Blood Request Page: -

Below Figure 4.9 shows the personal blood request page to request blood for them self.

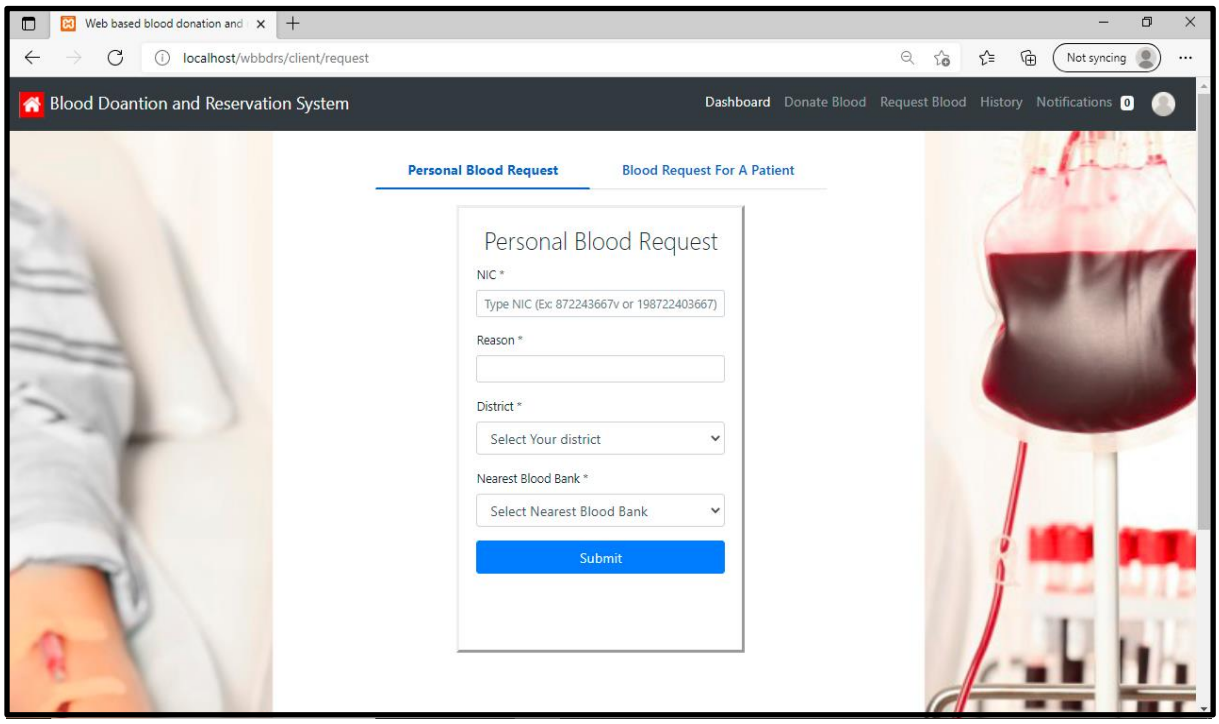


Figure 4.9; Personal blood request page

Below Figure 4.10 shows the blood request for a patient, from this view user can request blood on behalf of others.

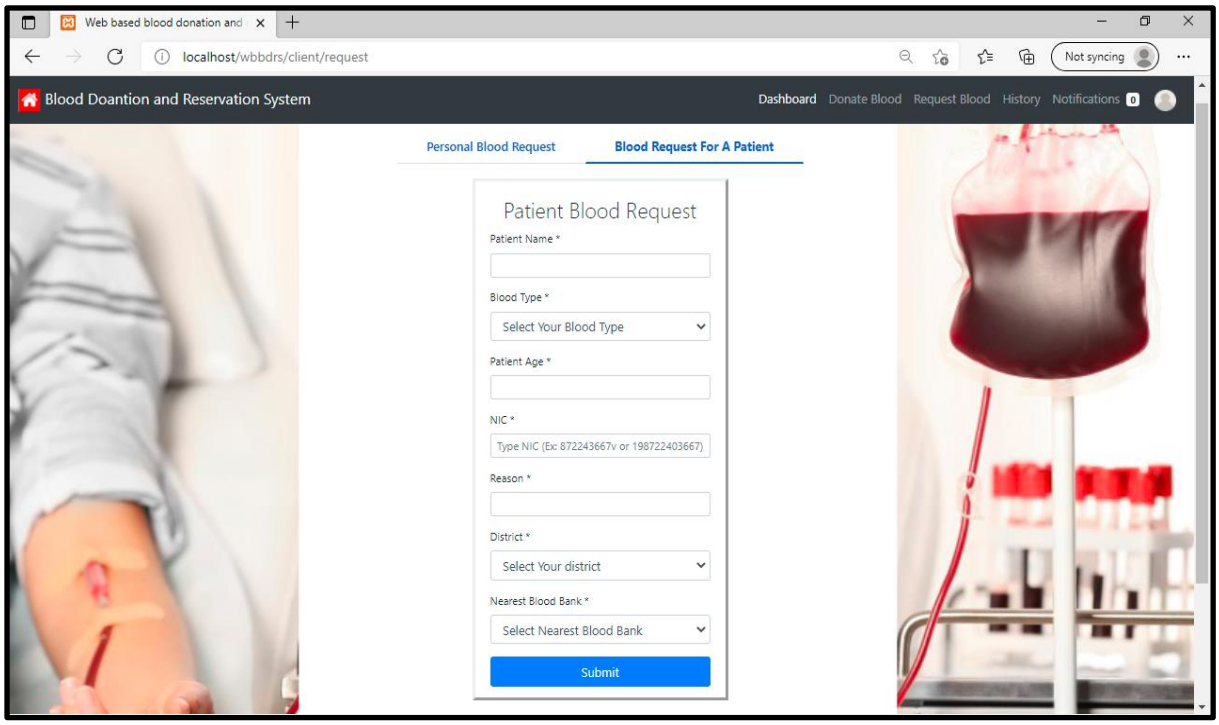


Figure 4.10: Blood request for a patient

VII. User Profile Editing page: -

Below Figure 4.11 shows the user profile editing page which user can modify their profile.

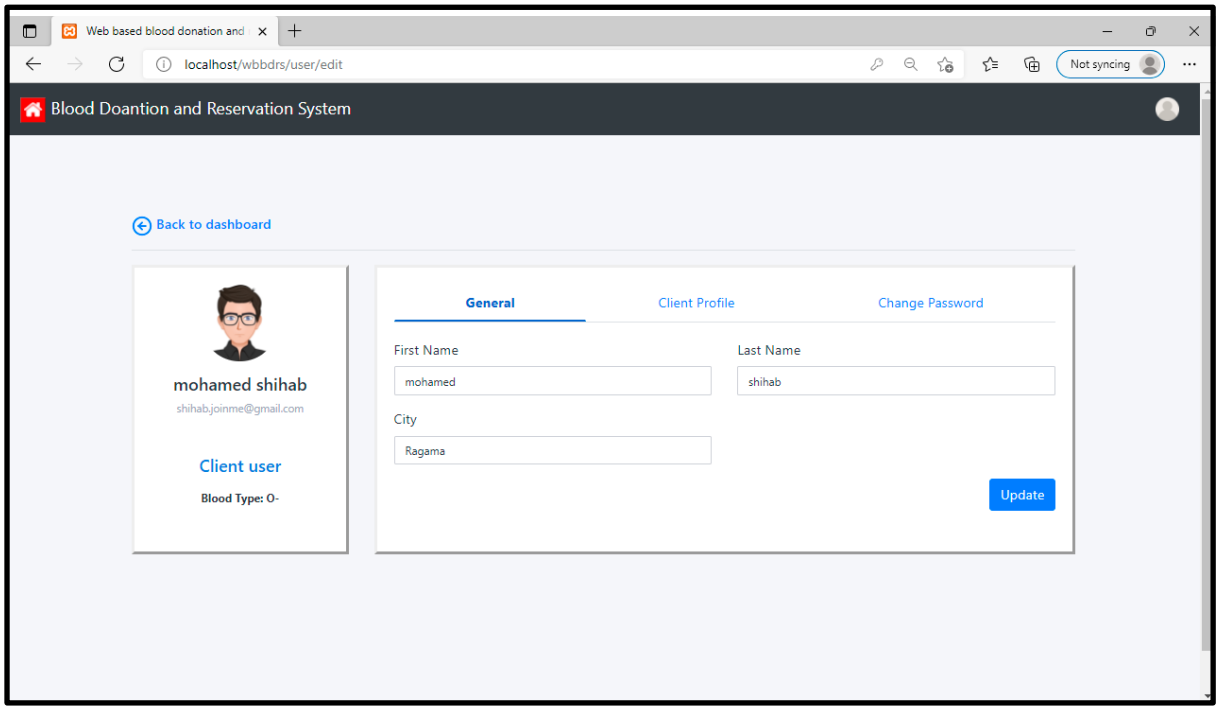
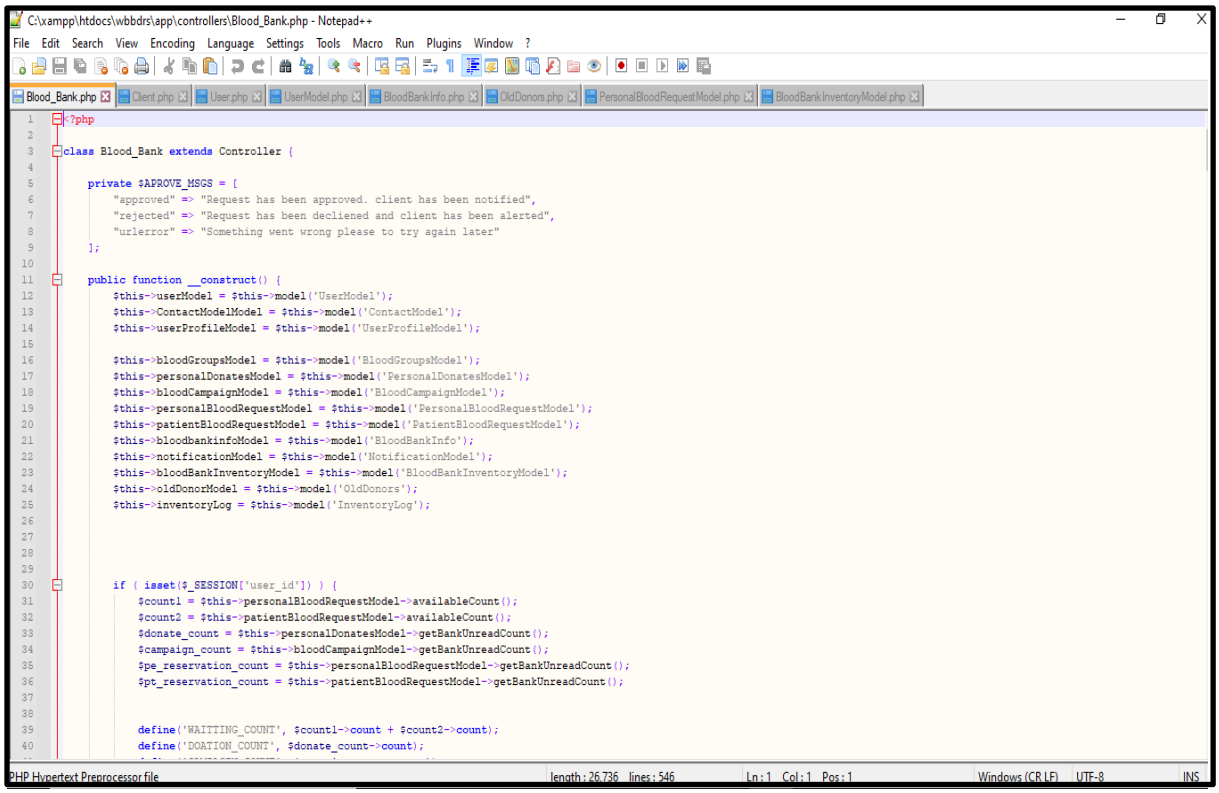


Figure 4.11: User profile editing page

4.5 Major codes

A. Controllers

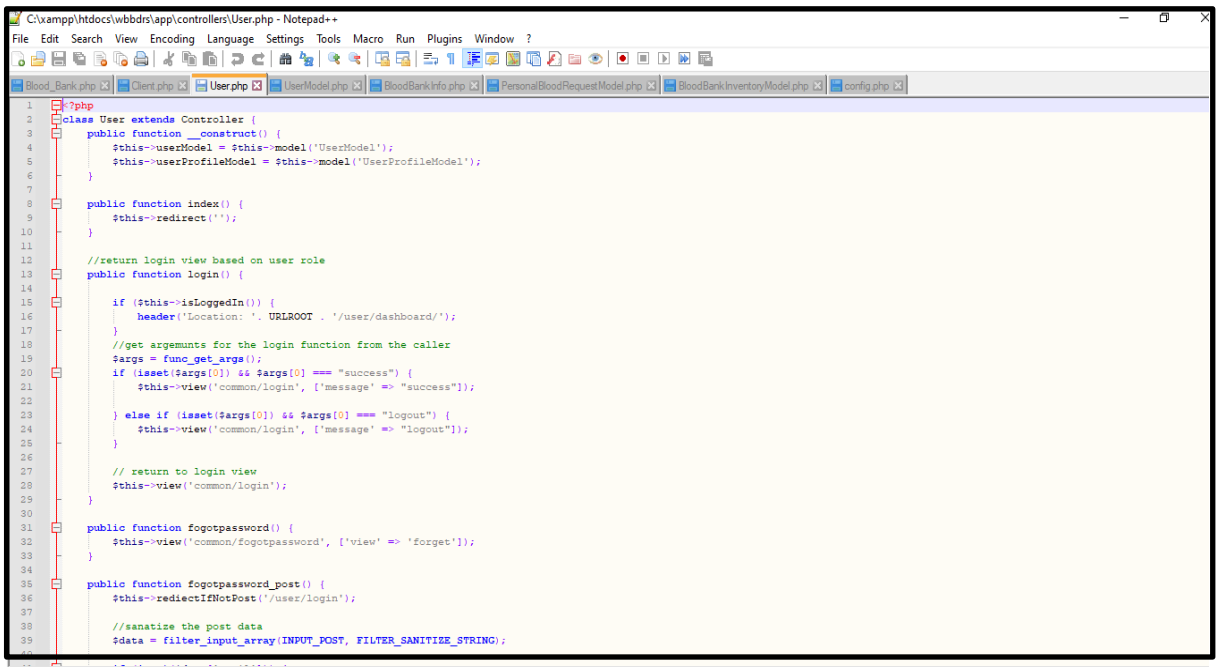
Blow Figure 4.12 shows Blood_bank.php controller for Blood bank.



```
<?php

class Blood_Bank extends Controller {

    private $APROVE_MSGS = [
        "approved" => "Request has been approved. client has been notified",
        "rejected" => "Request has been decliened and client has been alerted",
        "urlerror" => "Something went wrong please to try again later"
    ];

    public function __construct() {
        $this->userModel = $this->model('UserModel');
        $this->ContactModelModel = $this->model('ContactModel');
        $this->userProfileModel = $this->model('UserProfileModel');

        $this->bloodGroupsModel = $this->model('BloodGroupsModel');
        $this->personalDonatesModel = $this->model('PersonalDonatesModel');
        $this->bloodCampaignModel = $this->model('BloodCampaignModel');
        $this->personalBloodRequestModel = $this->model('PersonalBloodRequestModel');
        $this->patientBloodRequestModel = $this->model('PatientBloodRequestModel');
        $this->bloodbankinfoModel = $this->model('BloodBankInfo');
        $this->notificationModel = $this->model('NotificationModel');
        $this->bloodBankInventoryModel = $this->model('BloodBankInventoryModel');
        $this->oldDonorModel = $this->model('OldDonors');
        $this->inventoryLog = $this->model('InventoryLog');




        if ( isset($_SESSION['user_id']) ) {
            $count1 = $this->personalBloodRequestModel->availableCount();
            $count2 = $this->patientBloodRequestModel->availableCount();
            $donate_count = $this->personalDonatesModel->getBankUnreadCount();
            $campaign_count = $this->bloodCampaignModel->getBankUnreadCount();
            $pe_reservation_count = $this->personalBloodRequestModel->getBankUnreadCount();
            $pt_reservation_count = $this->patientBloodRequestModel->getBankUnreadCount();


            define('WAITTING_COUNT', $count1->count + $count2->count);
            define('DOATION_COUNT', $donate_count->count);
```

Figure 4.12: Blood Bank Controller codes

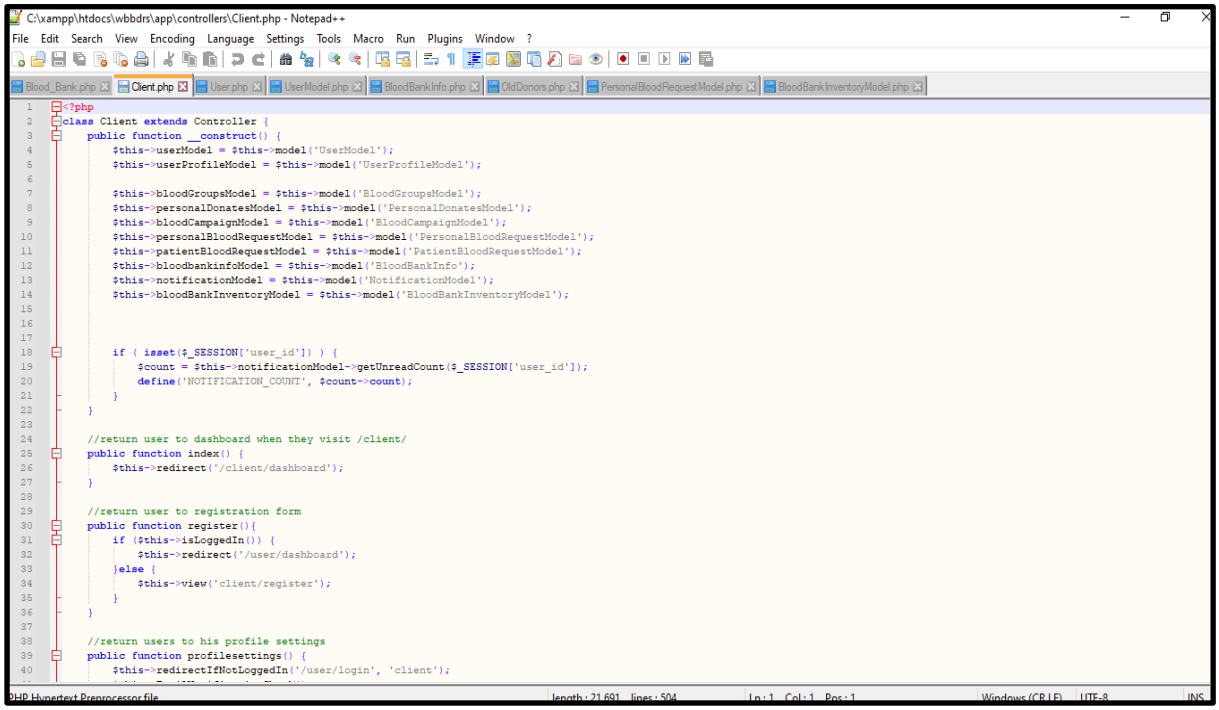
Below Figure 4.13 shows User.php controller for users.



```
<?php
class User extends Controller {
    public function __construct() {
        $this->userModel = $this->model('UserModel');
        $this->userProfileModel = $this->model('UserProfileModel');
    }

    public function index() {
        $this->redirect('');
    }

    //return login view based on user role
    public function login() {

        if ($this->isLoggedIn()) {
            header('Location: '. URLROOT . '/user/dashboard/');
        }
        //get argemunts for the login function from the caller
        $args = func_get_args();
        if (isset($args[0]) && $args[0] === "success") {
            $this->view('common/login', ['message' => "success"]);

        } else if (isset($args[0]) && $args[0] === "logout") {
            $this->view('common/login', ['message' => "logout"]);
        }

        // return to login view
        $this->view('common/login');
    }

    public function fogotpassword() {
        $this->view('common/fogotpassword', ['view' => 'forget']);
    }

    public function fogotpassword_post() {
        $this->rediectIfNotPost('/user/login');

        //sanatize the post data
        $data = filter_input_array(INPUT_POST, FILTER_SANITIZE_STRING);
```

Figure 4.13: User Controller codes

Below Figure 4.14 Shows Client.php controller for client.

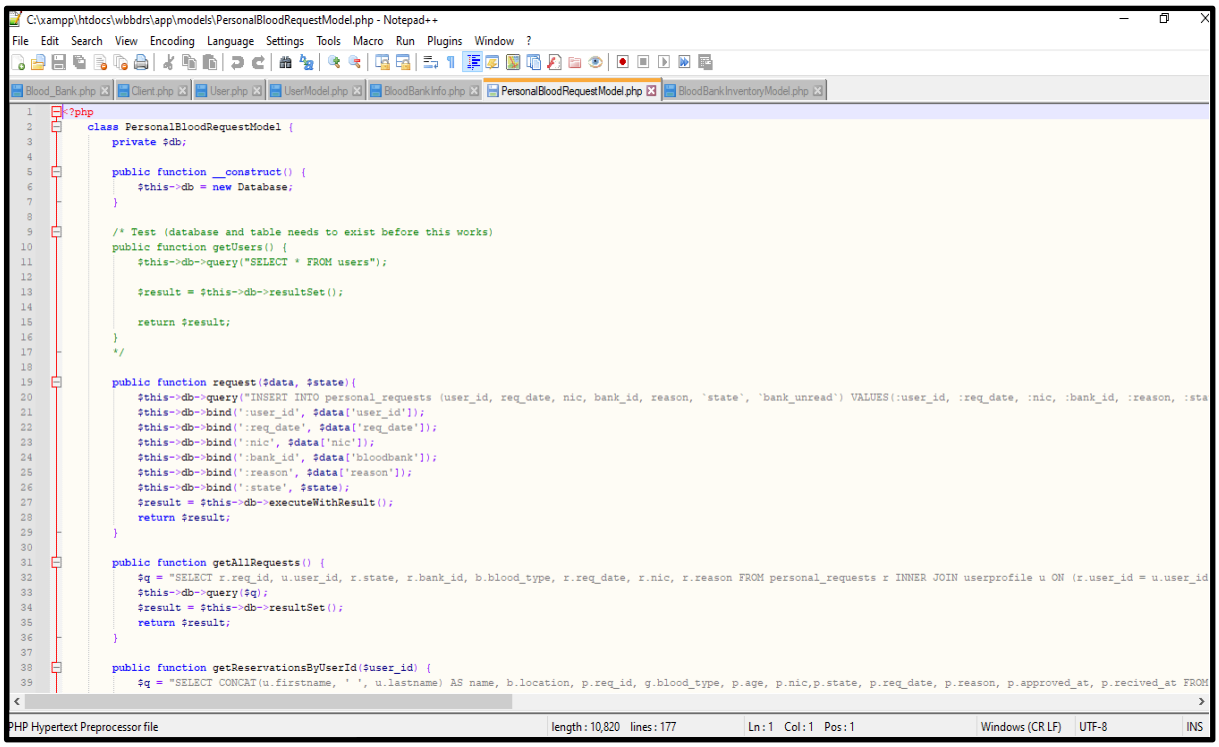


```
<?php
class Client extends Controller {
    public function __construct() {
        $this->userModel = $this->model('UserModel');
        $this->userProfileModel = $this->model('UserProfileModel');

        $this->bloodGroupsModel = $this->model('BloodGroupsModel');
        $this->personalDonatesModel = $this->model('PersonalDonatesModel');
        $this->bloodCampaignModel = $this->model('BloodCampaignModel');
        $this->personalBloodRequestModel = $this->model('PersonalBloodRequestModel');
        $this->patientBloodRequestModel = $this->model('PatientBloodRequestModel');
        $this->bloodbankinfoModel = $this->model('BloodBankInfo');
        $this->notificationModel = $this->model('NotificationModel');
        $this->bloodBankInventoryModel = $this->model('BloodBankInventoryModel');



        if ( isset($_SESSION['user_id']) ) {
            $count = $this->notificationModel->getUnreadCount($_SESSION['user_id']);
            define('NOTIFICATION_COUNT', $count->count);
        }
    }

    //return user to dashboard when they visit /client/
    public function index() {
        $this->redirect('/client/dashboard');
    }

    //return user to registration form
    public function register(){
        if ($this->isLoggedIn()) {
            $this->redirect('/user/dashboard');
        }else {
            $this->view('client/register');
        }
    }

    //return users to his profile settings
    public function profilesettings() {
        $this->redirectIfNotLoggedIn('/user/login', 'client');
```

Figure 4.14: Client Controller Code

B. Models

Below Figure 4.15 shows PersonalBloodRequestModel.php for personal blood request.



```
<?php
    class PersonalBloodRequestModel {
        private $db;

        public function __construct() {
            $this->db = new Database;
        }

        /* Test (database and table needs to exist before this works)
        public function getUsers() {
            $this->db->query("SELECT * FROM users");

            $result = $this->db->resultSet();

            return $result;
        }
        */

        public function request($data, $state){
            $this->db->query("INSERT INTO personal_requests (user_id, req_date, nic, bank_id, reason, `state`, `bank_unread`) VALUES(:user_id, :req_date, :nic, :bank_id, :reason, :sta
            $this->db->bind(':user_id', $data['user_id']);
            $this->db->bind(':req_date', $data['req_date']);
            $this->db->bind(':nic', $data['nic']);
            $this->db->bind(':bank_id', $data['bloodbank']);
            $this->db->bind(':reason', $data['reason']);
            $this->db->bind(':state', $state);
            $result = $this->db->executeWithResult();
            return $result;
        }

        public function getAllRequests() {
            $q = "SELECT r.req_id, u.user_id, r.state, r.bank_id, b.blood_type, r.req_date, r.nic, r.reason FROM personal_requests r INNER JOIN userprofile u ON (r.user_id = u.user_id
            $this->db->query($q);
            $result = $this->db->resultSet();
            return $result;
        }

        public function getReservationsByUserId($user_id) {
            $q = "SELECT CONCAT(u.firstname, ' ', u.lastname) AS name, b.location, p.req_id, g.blood_type, p.age, p.nic,p.state, p.req_date, p.reason, p.approved_at, p.recived_at FROM
```

Figure 4.15: Personal blood request model's code

Blow Figure 4.16 shows UserModel.php for users.

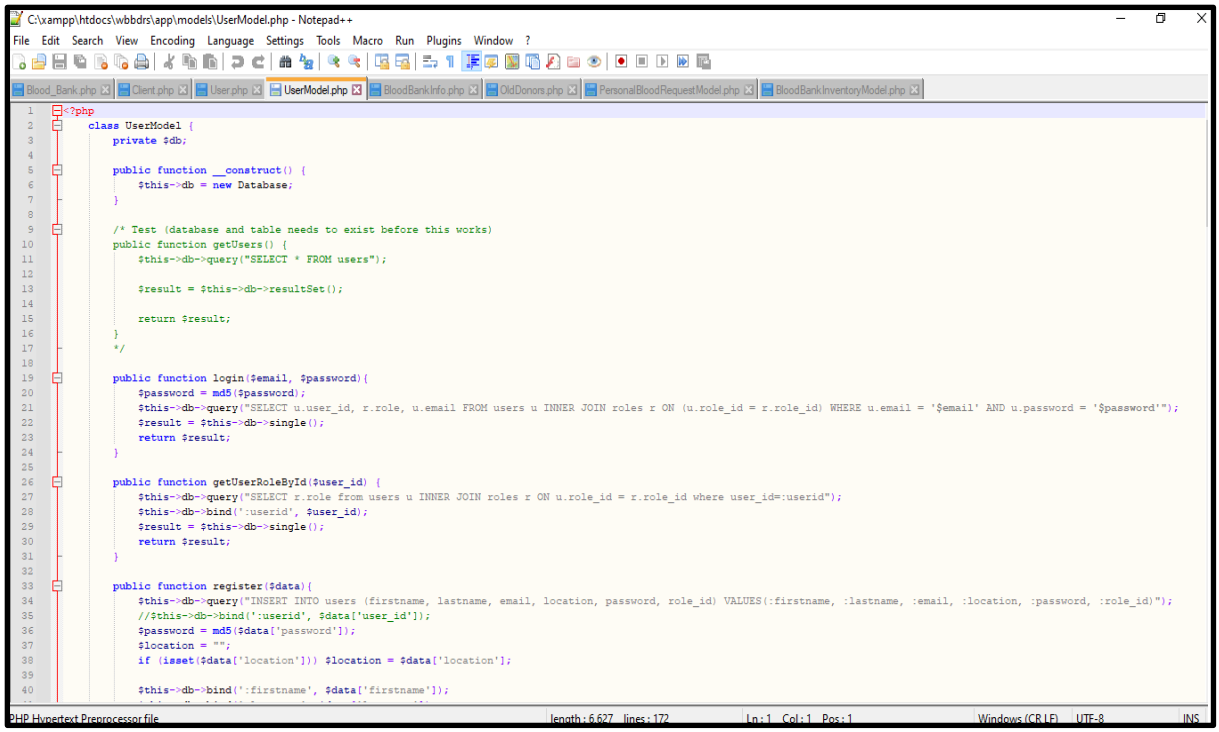


Figure 4.16: User model codes

Below Figure 4.17 shows BloodBankInventoryModel.php for Blood Bank.

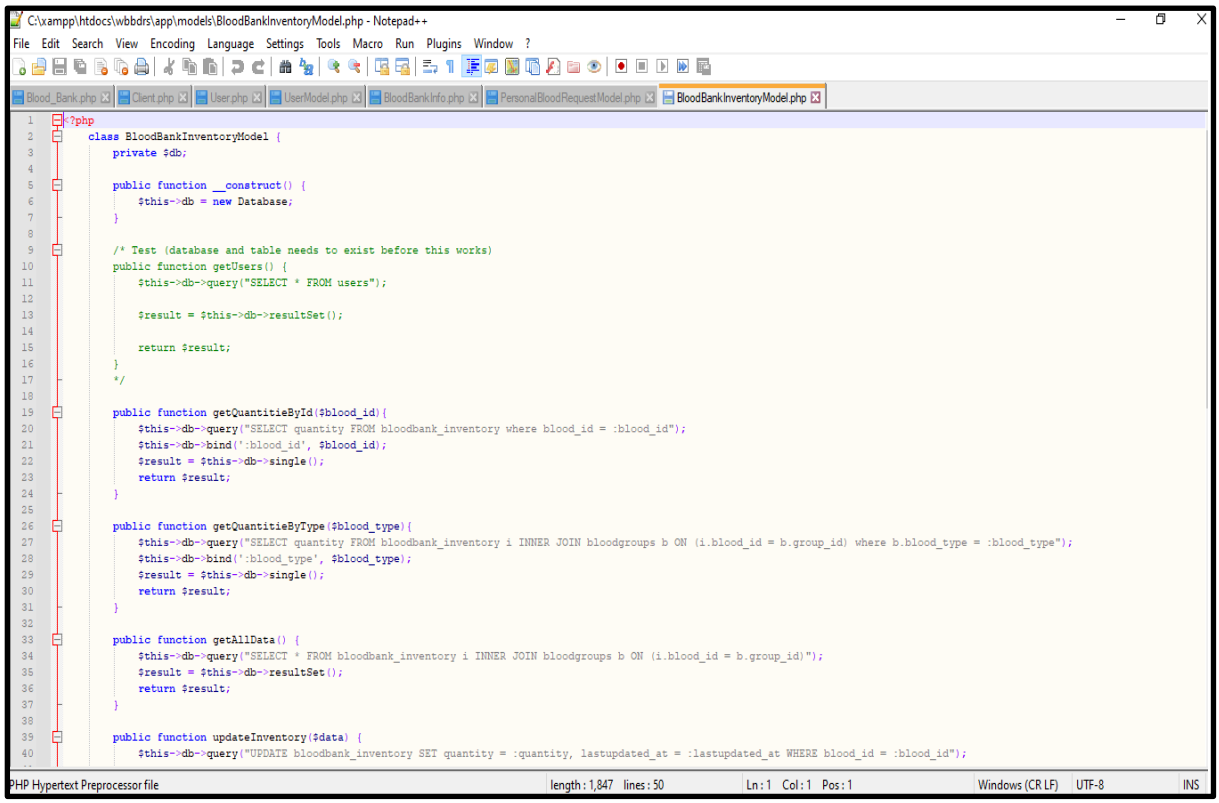


Figure 4.17: Blood bank Inventory model code

Below Figure 4.18 shows Config.php Configuration file.

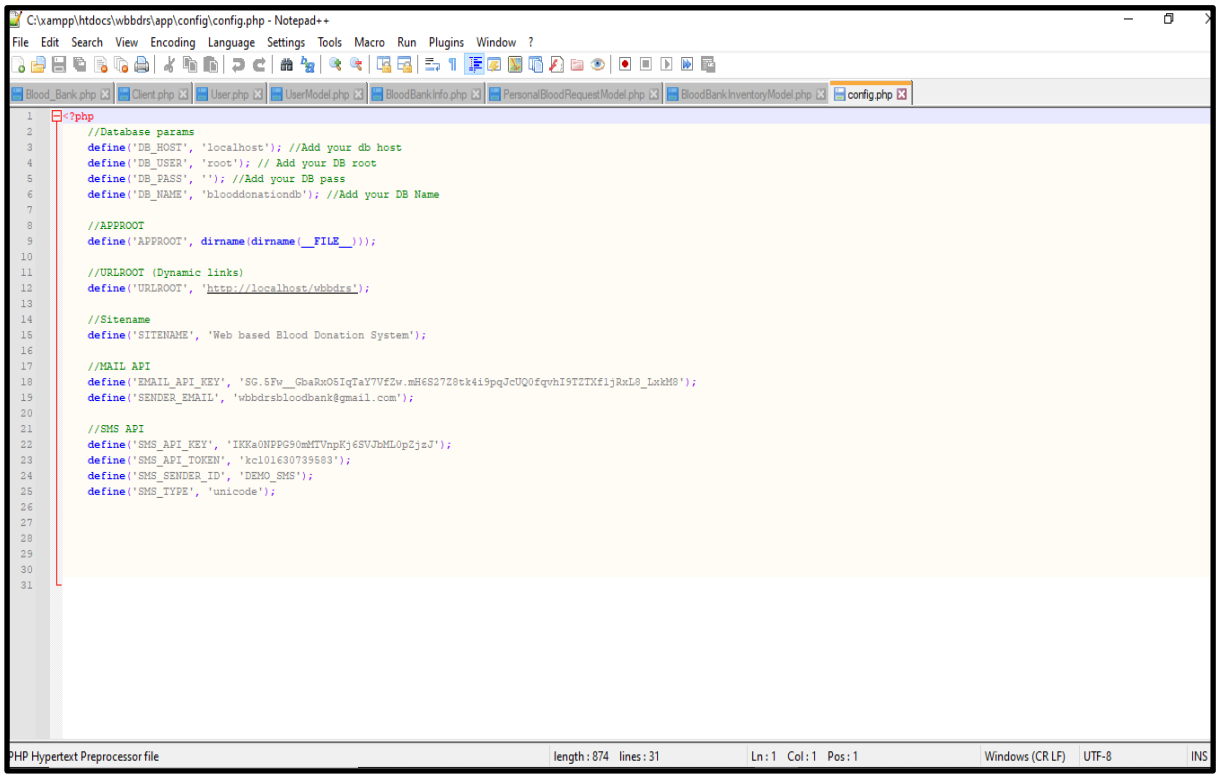


Figure 4.18: Config Code

4.6 Management Reports

4.6.1 Summary report

Summary report is showed in Appendix C. It is built for blood bank management module since blood bank is paying the major role in the system. Initially report shows the blood donation/blood campaign summary details with selected dates and the amount of donation/campaign happened, how many pending donations/campaigns are there, how many donation/campaigns got approve and how many donations got reject by blood bank on the selected dates with the graph. Secondly it shows the personal/patient blood reservation summary. It shows the total reservation with given dates, total pending, total approval and total rejected by blood bank, and total completed reservation with graphs on the selected date. Total completed will count only the recipient got the requested blood to handover stage.

Thirdly it shows the transportation and collection center summary with total request, total pending and total compete with selected dates. And finally on the summary report it will shows the blood inventory with total blood received, total blood donates and total blood available in hand on selected dates. Total blood available will shows as at today's count. Management can take easy decision with the summary report on the process. This report will help blood bank management to increase donation or can identify the donation rates to keep blood in store. Also, they can see the rejection amount and they can take a solution for those rejections. User report also will help to get deep information to management part by part on summary reports.

4.6.2 User Report

User Report is showed in Appendix C. This report will give a visibility of how many blood donated/ revered to each blood bank filtered with district. With this report management can get how many blood donated/reserved blood in each district and also can get blood bank level to increase blood donation. Also, with this report management can get an idea on the demand of blood with district/ blood bank level.

4.6.3 Blood Stock Report

Blood Stock Report is showed in Appendix C. This report will give a good visibility to management on blood stock availability with district level and blood bank level. With this management can take a decision to request blood donation or not. Also this will help to increase blood stock availability to save lives.

4.6.4 Status report

User report is showed in Appendix C. It also built with blood bank management module integrated with other modules. With the status report, Blood bank management can get full details for accept/reject, complete or pending in user level on selected dates. This will help to make decision along with summary report. Summary report only gives the total summary of the process with selected dates. Status report will give each models full user details with status on selected dates. With that management can investigate with the user on the rejection part and they can improve to reduce the rejection by blood bank. This will improve the blood bank process and blood needers can get blood immediately.

Chapter 5 – Test and Evaluation

5.1 Related Testing Types

The proposed web-based blood donation and reservation platform will link all stakeholders within this process. This will connect the blood bank, collecting centers, donors, and recipients for better communication between these parties while maintaining the donors' and recipients' information. Any interested individual can use this platform to donate, request blood, or organize blood donation campaigns. Moreover, this will also address the issues in the transportation of blood island-wide in an organized manner to receive blood instantly.

The proposed web-based system can check blood delivery status through blood transportation. The system will increase transparency, and selected stakeholders can view the blood inventory managed by the blood bank. Donors will be able to donate blood at their convenience at any blood collection center island wide.

Web-based blood donation and reservation system used below methods to test the system.

5.1.1 Unit testing

Unit testing is a type of testing where individual units or components are tested. The purpose is to validate that each unit of the software code performs as expected. Unit Testing is done during the development (coding phase) of an application by the developers. Unit testing ensures that all code meets quality standards before it's deployed. This ensures a reliable engineering environment where quality is paramount. Over the course of the product development life cycle, unit testing saves time and money, and helps developers write better code, more efficiently. In Web-based blood donation and reservation system has developed as module by module and it used individual module which got tested each module as unit testing in the implementation part.

5.1.2 Integration Testing

Integration testing is the phase in software testing in which individual modules are combined and tested as a group. Integration testing is conducted to evaluate the compliance of a system or component with specified functional requirements. In proposed system, each unit tested using unit testing strategies was integrated to form the corresponding modules. Individual units were tested with units pash happened in integration testing.

5.1.3 System Testing

System Testing is a type of testing performed on a complete integrated system to evaluate the system's compliance with the corresponding requirements. For Web-based system different modules were integrated and checked for errors. Both functional and non-functional testing strategies were used to test the system. Proposed system tested all modules with integrated modules without an error.

5.1.4 Black box Testing

As a part of this system, used black box and white box testing as application testing method. Used test and run process to reduce the debug mode. Part of block box testing, used to check inputs and outputs of the data. Positive and negative test scenarios were executed in this testing phase. Since, if the use enters wrong username or password, they will get an error saying user name and password incorrect. If not, user never know its incorrect this can confuse user.

5.1.5 User Interface Testing

System was tested user interface are up to user expectation and find out any UI issues on user testing. System should work as expected because users are directly interacting with the UI of the system. With that, proposed system got tested and verified under UI testing.

5.1.6 Usability testing

In this testing, system got tested how easy and compatible to use the system by user. Also user can use the system with minimum training. With usability only user will decide to go ahead and use the system or not. Because if the system is not user-friendly to use, user will never user the system again. With this testing, system was identified as user-friendly system to use.

5.1.7 Functional testing

Functional testing is referred to activities that verify a particular function code or action. All the functions which users are going to use from the system got tested through functional testing. Registration of user, requesting blood and donate blood request etc.

5.1.8 User Testing

At the user testing level, the proposed we-based system was given to several users for their feedback and it works. User feedbacks are positive, and it works without any issue with all functions. Users are happier on the UI and usability. This is a success of User testing.

5.2 Test Cases and Result of testing

Below Table 5.1 shows the test cases for Web-based blood donation and reservation system and result of testing

Table 5.1: Test cases and result of testing

Test ID	Test Cases	Result of testing (Status)
001	Donor/ Recipient registration.	Registered successfully or Invalid input error.
002	Donor/ Recipient logging request.	Logged in with registered user or Error with invalid username and password.
003	Donor/ Recipient email verification.	Successfully verified.
004	Donor/ Recipient user profile editing.	Edited completed successfully.
005	Blood donation request.	Successfully requested to Blood bank.
006	Blood donation campaign request.	Successfully requested to Blood bank.
007	Blood request for user.	Successfully requested to Blood bank.
008	Blood request for a patient.	Successfully requested to Blood bank.
009	View donor/ recipient history.	Viewed history of blood donation and blood request by user.
010	View notification.	Successfully showed the notification of requested blood and blood donation status.
011	User registration for blood bank, blood transportation and blood collection center by admin.	Successfully created user for blood bank, blood transportation and blood collection center.
012	blood bank, blood transportation and blood collection center logging request.	Logged in with blood transportation and blood collection center user.
013	User profile editing by Admin.	Edited completed successfully.

014	Report generation with user creation/ modification history by admin.	Successfully download requested report.
015	Accept / reject user donation/ campaign request by Blood bank.	Successfully Accept/ reject user donation/ campaign request.
016	Accept / reject blood request by Blood bank.	Successfully Accept/ reject user blood request.
017	Request for blood transportation by blood bank.	Successfully request sent to transportation management.
018	Update blood available inventory.	Successfully updated blood available quantity.
019	Add old donor to system.	Successfully added to database.
020	Summary report/ individual details report generation for blood donation, blood request, blood campaign and blood inventory by blood bank.	Successfully download requested report.
021	Accept transportation request by blood bank to transportation management.	Accepted the request.
022	Blood delivered request to blood collection center by transportation management.	Delivered to collection center.
023	Transportation details report generation with blood transport by transportation management.	Successfully download requested report.
024	Accept the blood by transportation management to collection center.	Accepted the blood from transportation.
025	Accept the blood-by-blood bank to collection center.	Accepted the blood from blood bank.
026	Notify the requested user to collect blood by blood collection center.	Successfully Notified the user-to-user notification in user login.
027	Report generation with blood collection and handover details by blood collection center.	Successfully download requested report.
028	Send donation request for old donors via Mail and SMS through system.	Successfully sent email and SMS to old donors.
029	Forgot username and password.	Successfully send email to rest password.

Results of outputs

1. Donor/ Recipient registration

Figure 5.1 shows the output of Test ID 001 account successfully created.

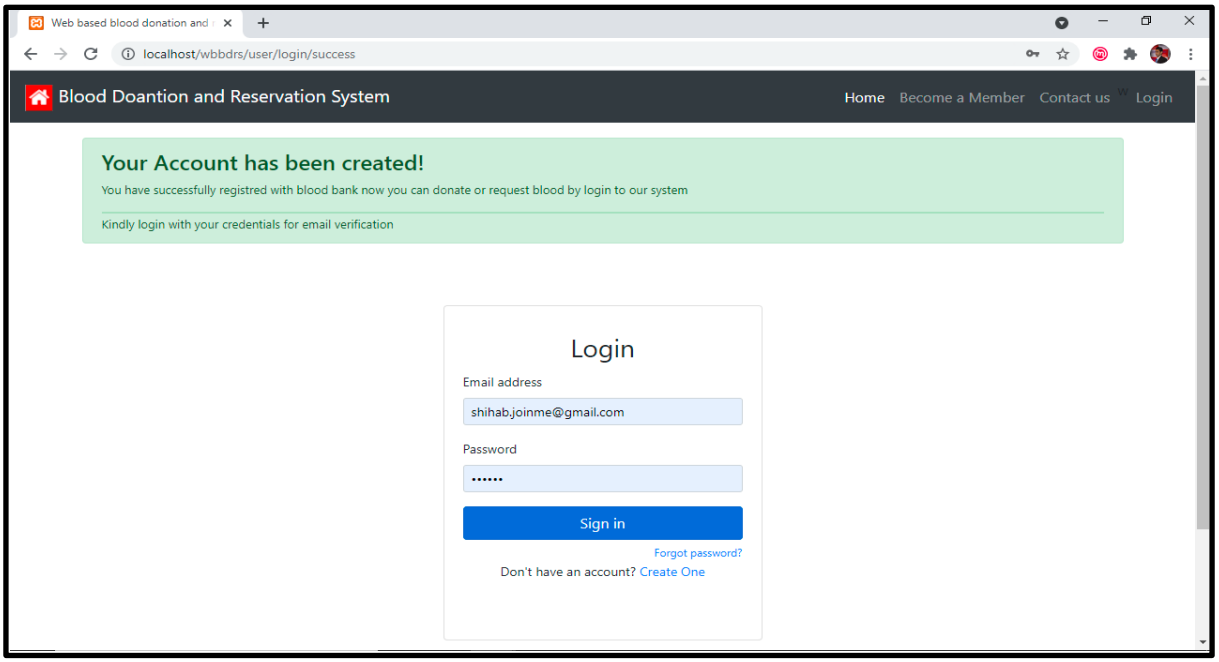


Figure 5.1: Donor/ Recipient registration

2. Invalid input error on sign up.

Below Figure 5.2 shows the output of Test ID 001, invalid input error on sign up process

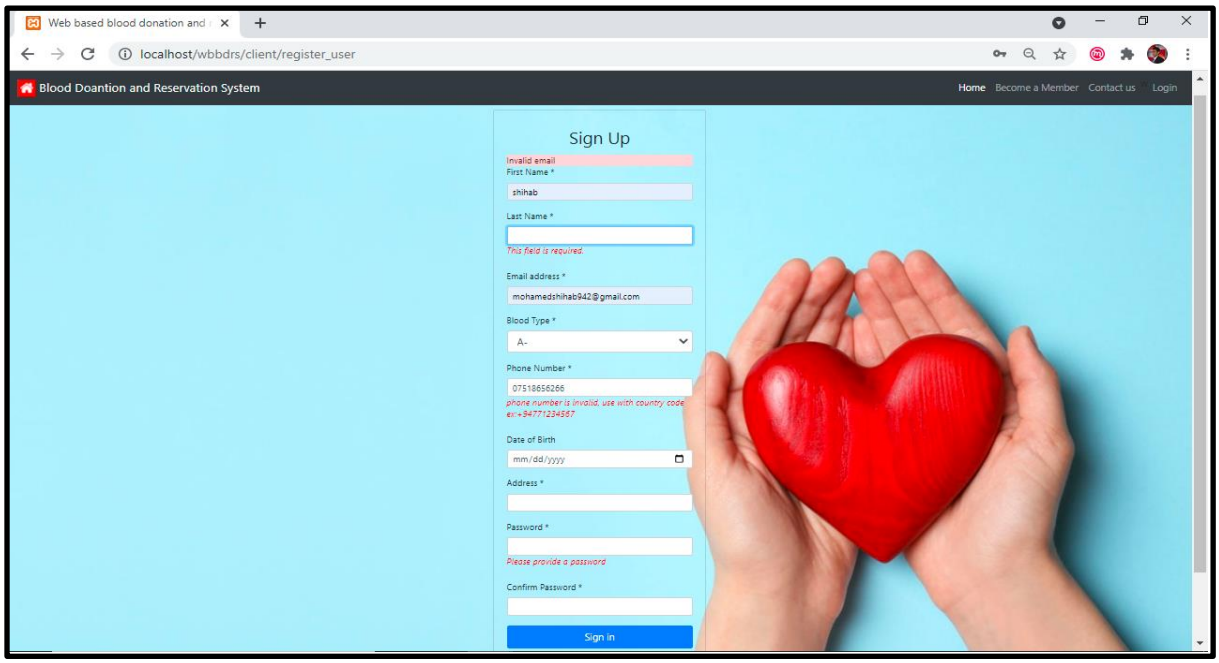


Figure 5.2: Invalid input error on sign up

3. User login with different username/password

Figure 5.3 shows the output of Test ID 002, User login failed with wrong username and password

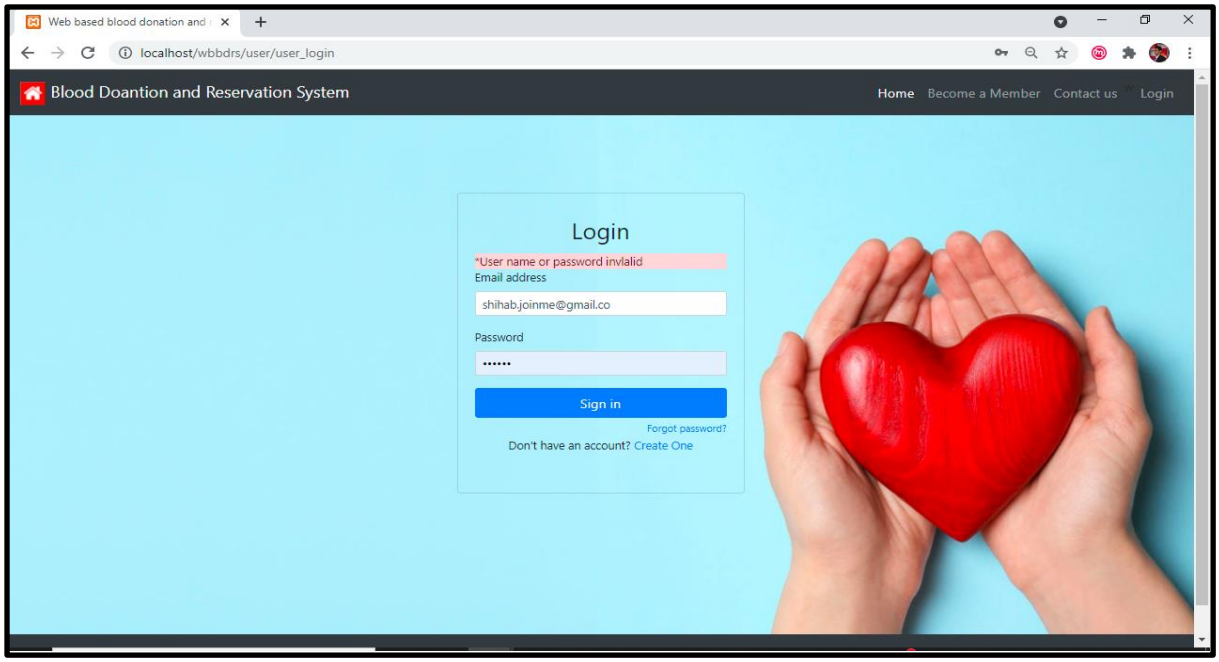


Figure 5.3: User login with different username/password

4. User email verified to donate/ request blood

Figure 5.4 shows the output of Test ID 003, email verified successfully

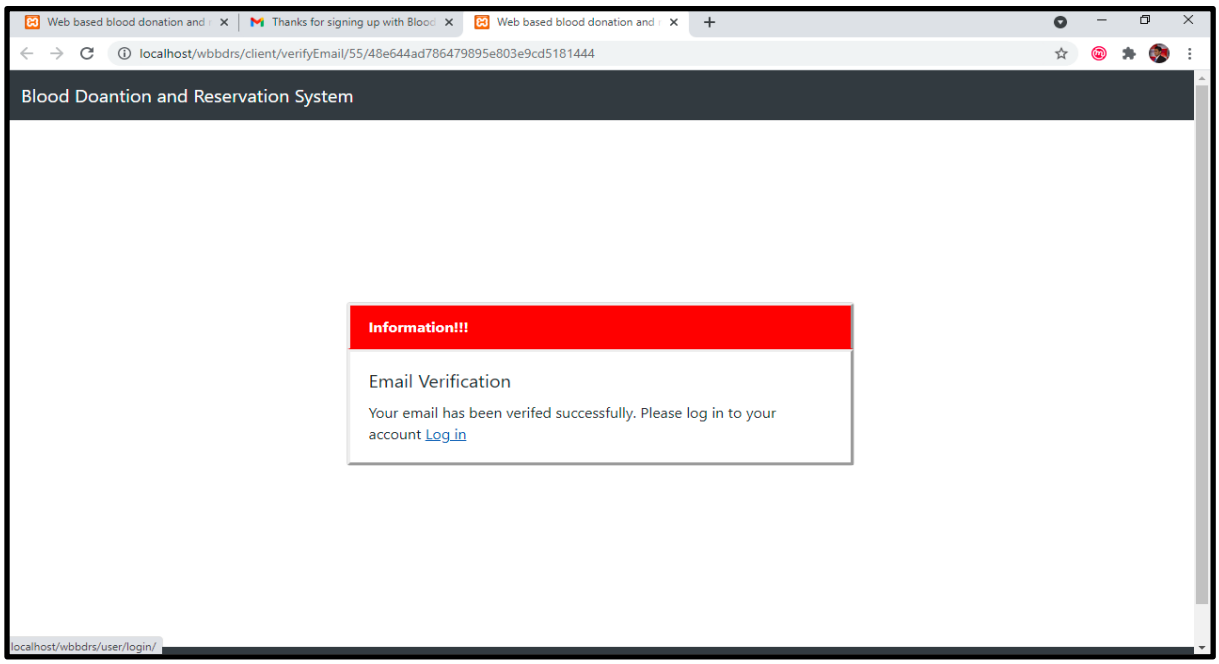


Figure 5.4: User verified to donate/ request blood

5. Blood donation request and it successfully went to blood bank approval

Figure 5.5 shows the output of Test ID 005, Donation request successfully send to blood bank for approval.

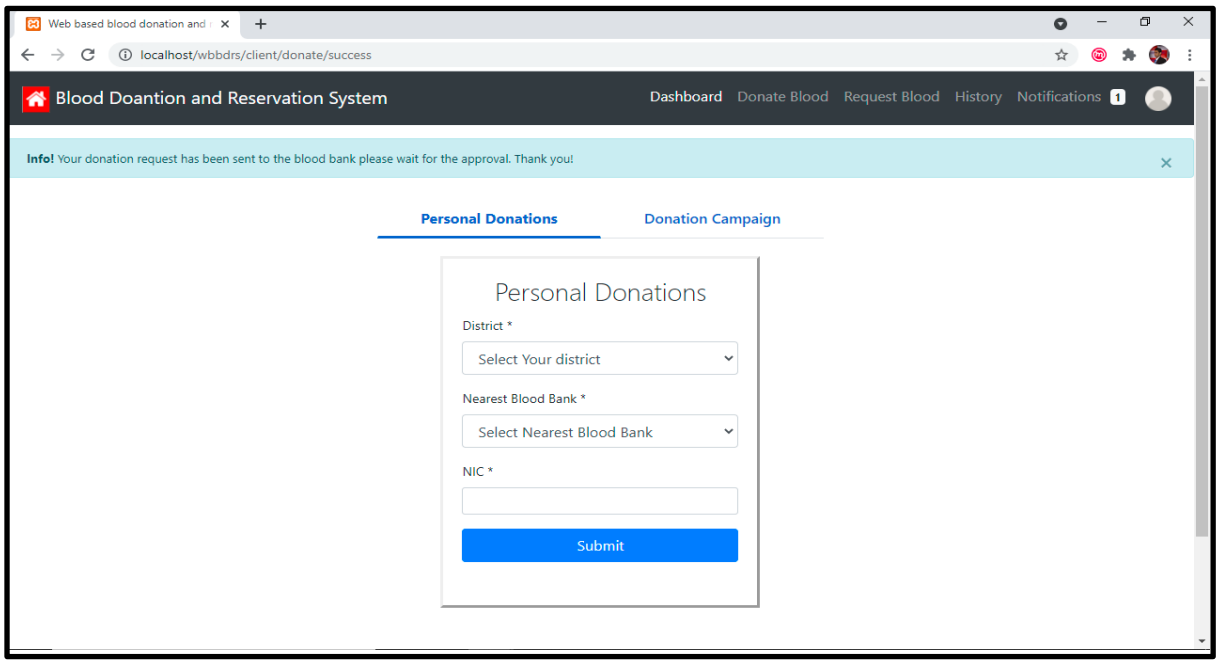


Figure 5.5: Blood donation request

6. After accepting by blood bank, donor will get the confirmation notification

Figure 5.6 shows the output of Test ID 010, successfully get the approval notification.

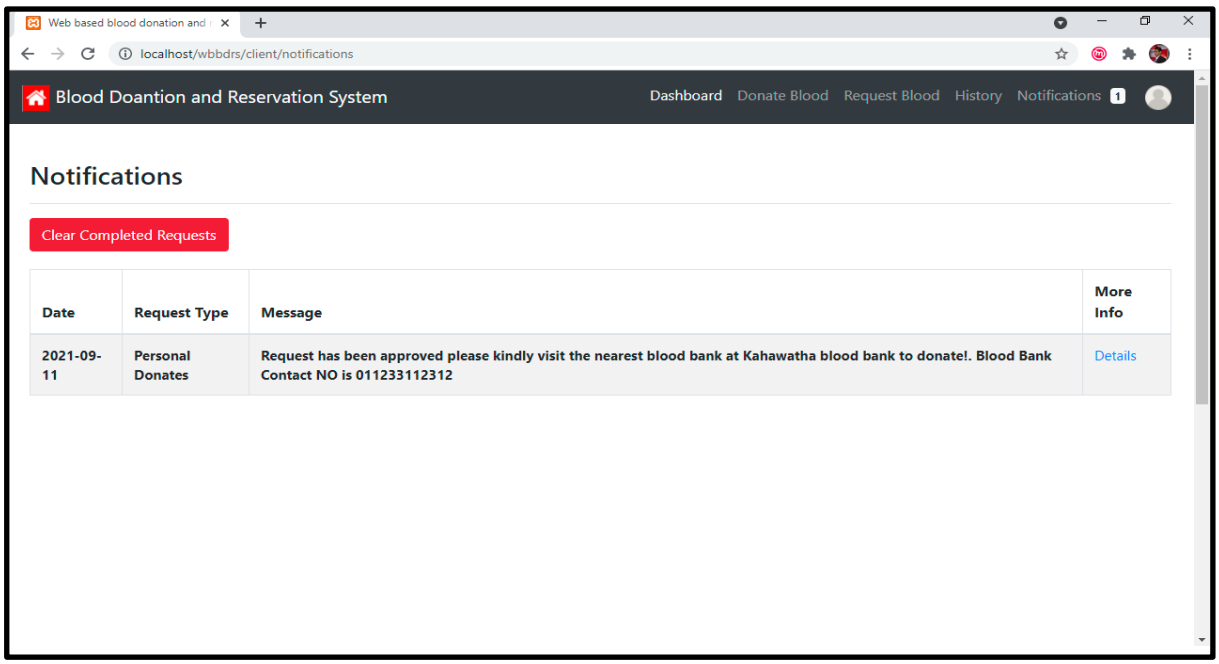


Figure 5.6: Confirmation notification to donors

7. If blood is available with blood bank. System will successfully notify that blood is available with blood bank. And it will go to blood bank for approval

Figure 5.7 shows the output of Test ID 006, show the availability of blood and successfully send to blood bank approval.

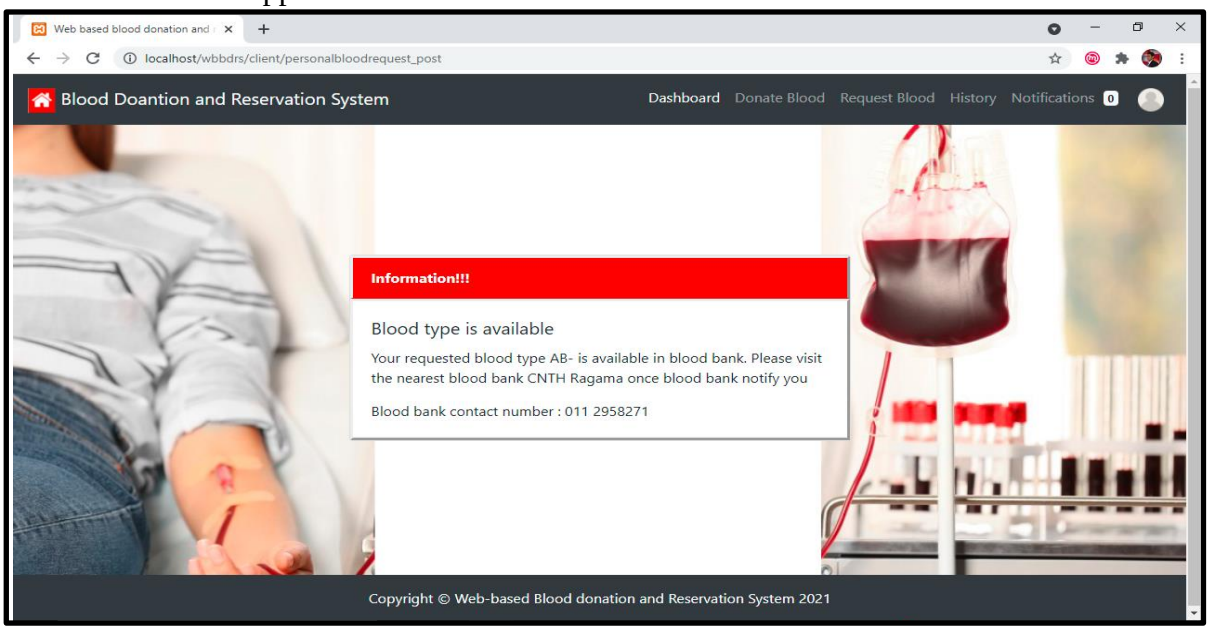


Figure 5.7: blood available notification

8. Blood type is not available, System sends notification request after blood bank accept the blood request.

Below Figure 5.8 shows the Test ID 28 all the relevant donor successfully notify via SMS and Email.

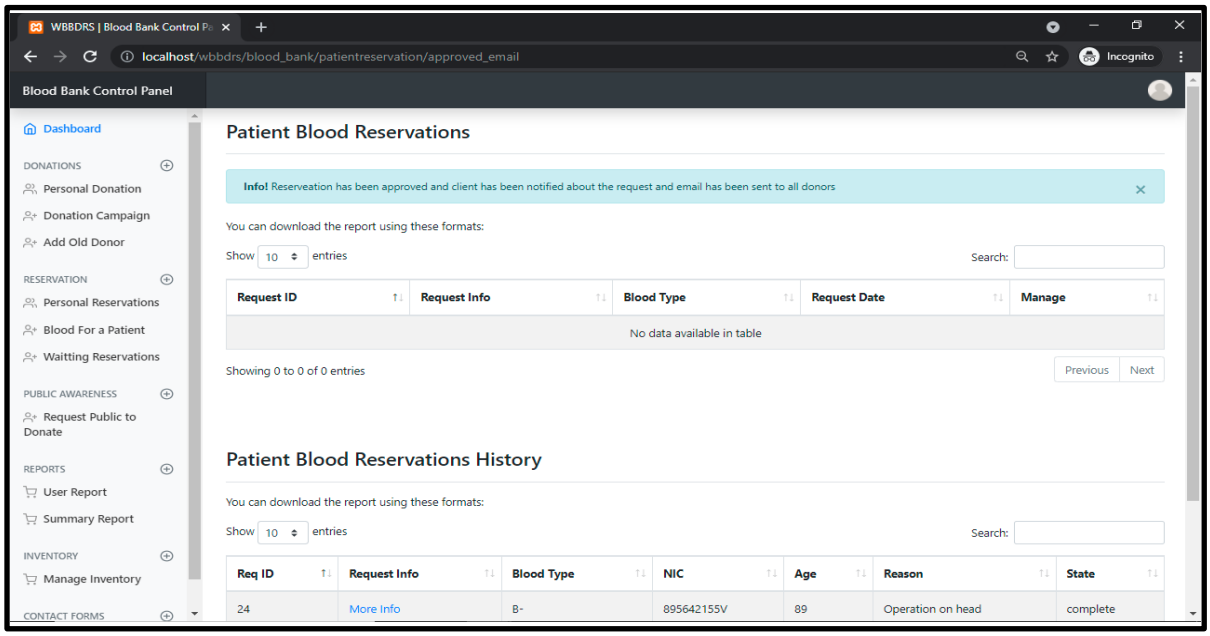


Figure 5.8: Blood type is not available and send notification

Other results of outputs are attached in Appendix D.

5.3 User Evaluation

User's feedback would be a huge help to improve the design/development of the proposed system. As mentioned, user evaluation form is very important part right after completing a system. There for user evaluation questionaries carried out a survey and published for user feedbacks. This project is going live to users, and they will give their feedbacks on below questions with real output of the system. With that we can justify how strong this the system is to publish with general public on the usability basis.

1. What is your age?
2. How visually appealing is our website?
3. Will the system be user friendly to use?
4. Is this system is useful for general public?
5. Will this web-based system satisfy with your need of visit to the site?
6. Did you experience any of the following issues on our web-based system?
7. Rate us on the web-based system

Screenshots of user evaluation questionaries' forms is attached to Appendix F

5.3.1 Output of user evaluation form

User evaluation form is attached in Appendix F. For the user evaluation form, we have got 30 feedbacks form different users for web-based blood donation reservation system. Below are the outputs of the evaluations.

1. What is your age?

Table 5.2: Output of user evaluation question 1

Age Limit	Total Replies from users	Used % out of 30
0-20	2	6.7%
21-40	11	36.6%
41-60	15	50%
60-80	2	6.7%
81 and above	0	0

With the result of the above Table 5.2 and Figure 5.9 shows that, 50% of the users are age limit of 40-60, 36.6% of the users are age limit of 21-40 and 6.7% of users are age limit of 0-20 and 60-80. With this output we can justify that the system is mostly used by 40-60 age limit people who need the use of this the web-based system.

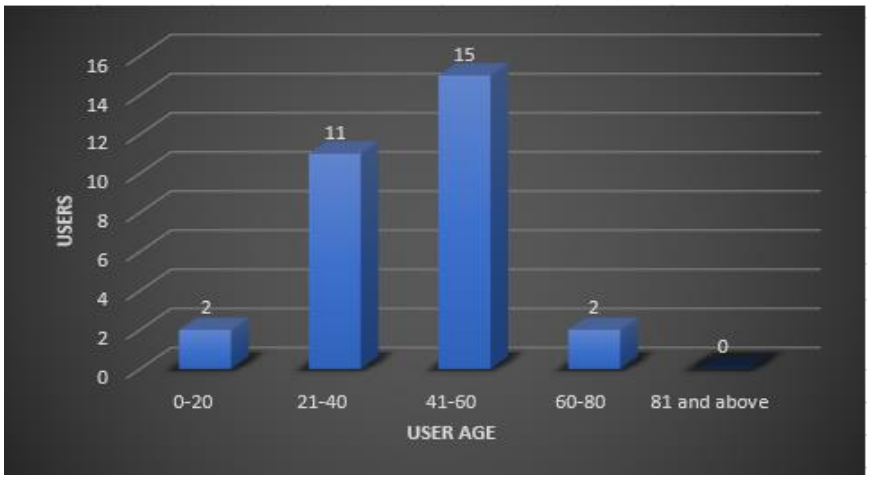


Figure 5.9: Output of user evaluation question 1

2. How visually appealing is our website?

Table 5.3: Output of user evaluation question 2

	Total Replies from users	Replied % out of 30
Very good	10	33.3%
Good	19	63.4%
Not bad	1	3.3%
Bad	0	0%
Not at all appealing	0	0%

With the result of the above Table 5.3 and below Figure 5.10 shows that the visually appealing is good since 33% got very good and 63.4% got the good visual appealing. With that we can justify that the web-based system is visually good to use.

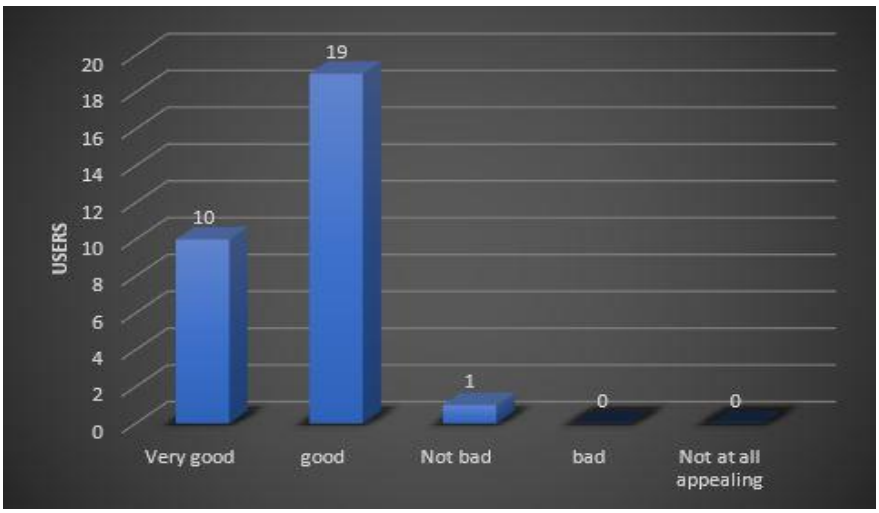


Figure 5.10: Output of user evaluation question 2

3. Will the system be user friendly to use?

Table 5.4: Output of user evaluation question 3

	Total Replies from users	Replied % out of 30
Yes	30	100%
No	0	0%

With the result of the above Table 5.4 and below Figure 5.11 shows the user friendly of the system. Its 100% for user friendliness to use the proposed web-based system.

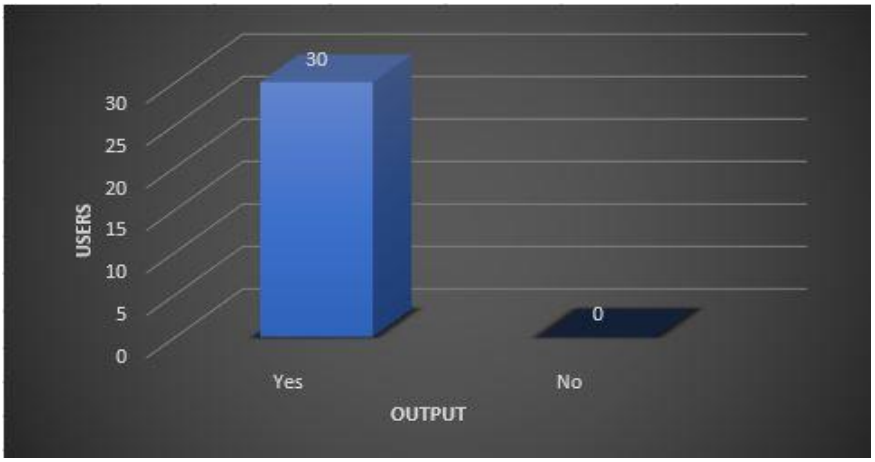


Figure 5.11: Output of user evaluation question 3

4. Is this system being useful for general public?

Table 5.5: Output of user evaluation question 4

	Total Replies from users	Replied % out of 30
Yes, very useful	22	73.3%
No, not that much	8	26.7%

With the result of the above Table 5.5 and below Figure 5.12 shows the usefulness of the system to general public. 73.3% of people vote for the usefulness and with that we can justify that the system is very useful to general public.

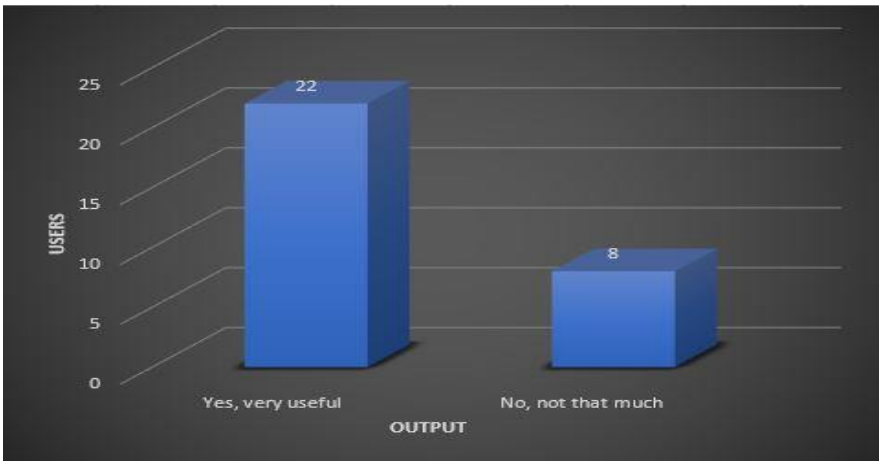


Figure 5.12: Output of user evaluation question 4

5. Will this web-based system satisfy with your need of visit to the site?

Table 5.6: Output of user evaluation question 5

	Total Replies from users	Replied % out of 30
Yes, satisfied	30	100%
No, Not use	0	0%

With the result of the above Table 5.6 and below Figure 5.13 shows the satisfaction of need of visit of the system. Its 100% for satisfied with the purpose of visit to the site.

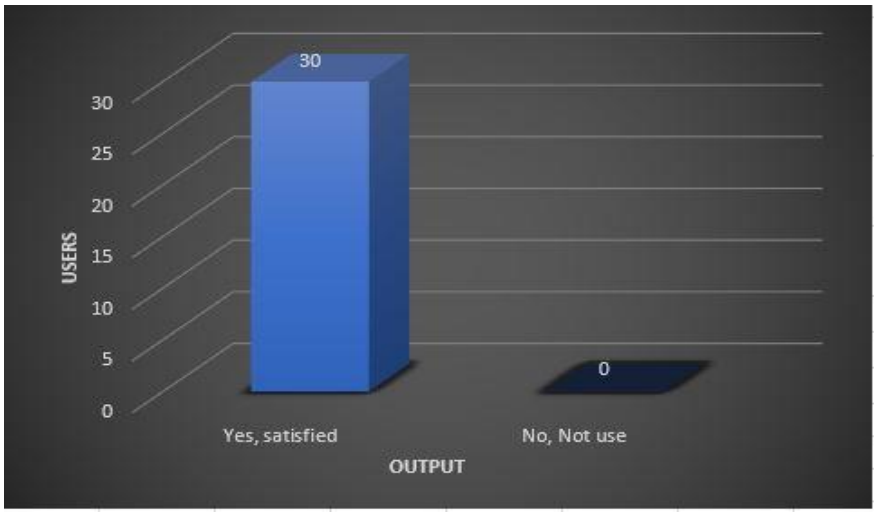


Figure 5.13: Output of user evaluation question 5

6. Did you experience any of the following issues on our web-based system?

Table 5.7: Output of user evaluation question 6

	Total Replies from users	Replied % out of 30
Website did not display properly on desktop	0	0%
Too many pop-ups	0	0%
Ads were too intrusive	0	0%
Pages loaded too slowly	5	16.7%
Site navigation confusing	1	3.3%
No Issues	24	80%

With the result of the above Table 5.7 and below Figure 5.14 shows the issues user faces with the system. 80% users mention that the system doesn't have an issue on use. And 16.7% users mentioned about the page loaded too slow. It can be issue from user end since they have to use their network. With that we can justified that the system doesn't have page issues.

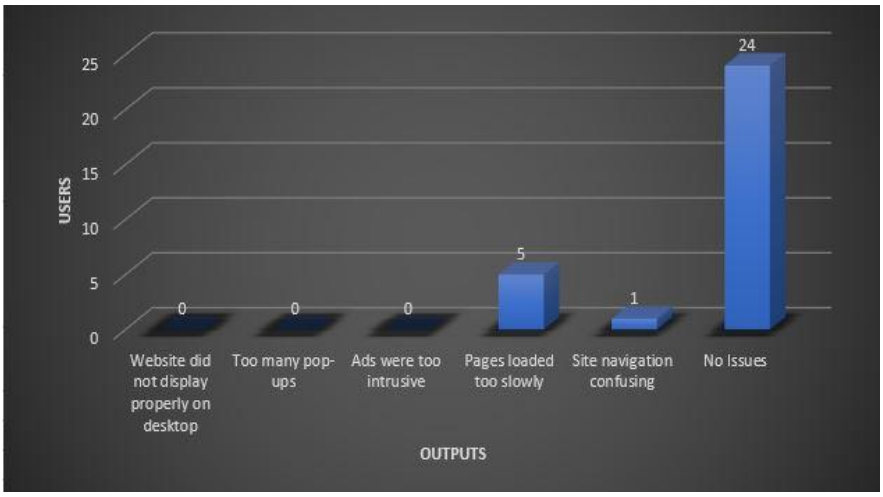


Figure 5.14: Output of user evaluation question 6

7. Rate us on the web-based system

Table 5.8: Output of user evaluation question 7

	Total Replies from users	Replied % out of 30
Very poor	0	0
Poor	0	0
average	2	6.7%
Good	22	73.3%
Excellent	6	20%

With the result of the above Table 5.8 and below Figure 5.15 shows the rate for the system. 73.3% users mention that the system is good to use, 20% users mention that the system is excellent, and 6.7% users mention average to the system. With the output of the rates, we can justify that the system is very good to use.

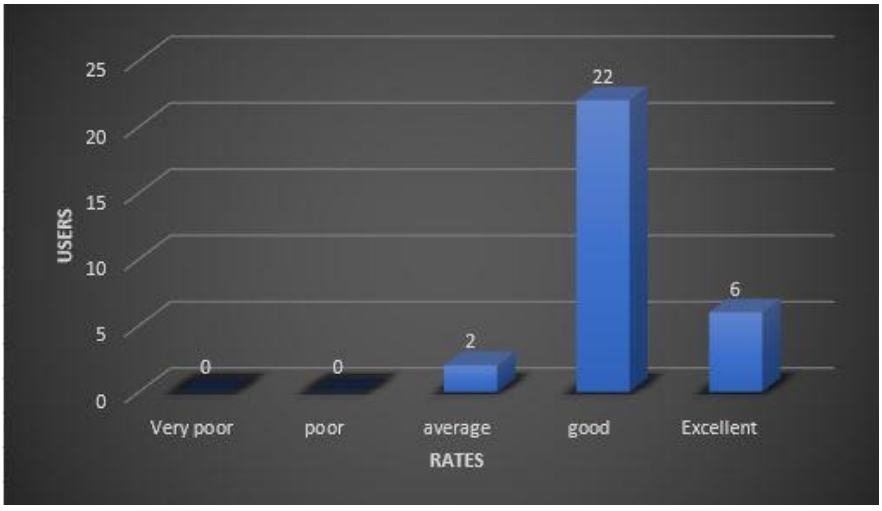


Figure 5.15: Output of user evaluation question 7

User feedbacks are more positive. With that we can justified that, overall system is visually good to use, very user friendly, high user satisfaction, very useful for general public with less system error and finally user rates are high on the feedbacks. Therefor we can conclude that the system is in a standard to use.

Chapter 6 – Conclusion and Future works

6.1 Conclusion

Blood donation can be considered as a national responsibility of the Sri Lankans in saving human lives. In Sri Lanka, many individuals and organizations conduct blood donation campaigns to encourage this valuable activity. There are lots of interested donors willing to donate blood in an emergency. Island-wide some recipients need blood urgently and for some to undergo operations. In the current context, this has become a very timely need due to the pandemic.

However, in an emergency, there were situations where people had to spend more time searching for blood and finding donors with rare blood groups. To donate, they must visit the blood bank physically to request or need to put a pre donation request through current system. The blood bank has a website for its general purpose, the current system does not have a process to request blood. At present, there is no such communication system to support one another needs. Transportation and tracking is another issue faced by the relevant personnel in an emergency. There are also time delays and inefficiencies reported in the existing system. There are instances where the hospitals fulfill this requirement by creating awareness via word of mouth among relatives and friends of the recipient to get the required blood group. There are situations where the blood bank also finds it challenging to meet the demand, especially in pandemic situations like we undergo these days.

The proposed Web-based blood donation and reservation system for blood banks will fulfill the needs while creating an efficient communication mechanism. This will connect the blood bank, collecting centers, donors, and recipients for better communication between these parties while maintaining the donors' and recipients' information. Furthermore, any interested individual can use this platform to donate, request blood, or organize blood donation campaigns. As a result, blood donations can be handled efficiently while linking all blood collection centers island-wide to ensure no shortage of blood (blood groups) when required urgently. In case of a shortage, notifications will be generated, and donation requests will be sent to existing donors requesting blood donations. The system will also alert donors at an emergency, and hence this would be a significant advantage to save lives in a short period. Moreover, this will also address the issues in the transportation of blood island-wide in an organized manner to receive blood instantly.

The evaluation results derived from a user questionnaire showed that the proposed system can connect the blood bank, donor, and recipient in an efficient manner. The evaluation was also carried out to identify the usability and how valuable the features are to fulfill users' needs.

User feedback was derived to evaluate the implemented system. Overall, the user feedback was positive, and they claimed that the system is easy to use and helpful for an emergency needs to save lives.

Hence, we argue that the project was successful completed to meet the user expectations and also the proposed system can cater to the needs more conveniently while satisfying the system's stakeholders. Moreover, the system will be helpful in an emergency and for those willing to donate blood at their convenience

6.2 Problems uncounted & Lessons Learned

Due to the current pandemic situation, obtaining user requirements was done with difficulty. The final evaluation was also got affected, and hence it was done with difficulty through online surveys and meetings. Time constraints due to the job workload and working from home mode have heavily affected the milestones but met difficulty to achieve the project goals successfully.

However, managing challenges and balancing the workload to get this project done was a good lesson learned through this journey. It was a new experience to work with different stakeholders; interviewing them and especially working with the blood bank staff to derive requirements add a lot of unique experience in requirements gathering. In addition, the author got exposure to a lot of technical knowledge by working hard to achieve the target, though, in the beginning, the author had less knowledge on programming languages and the web development process. Also, this led the author of this thesis to think out of the box and cater to the users' needs while completing the project successfully.

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6.3 Future works

The proposed system was developed successfully while achieving the objectives identified at the initial stage. Apart from the met features and functionalities, below are a few further enhancements that can be done to the system to make it more user-friendly and efficient.

1. A mobile application could be developed for user convenience and to access difficulties.
2. The proposed website can be further enhanced by adding more features and functionalities supporting all blood bank operations.
3. The proposed website can be further enhanced by adding all hospitals (Private and Government) to manage blood collection and circulation to make it more efficient.

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Appendices

Appendix A – Use Case Narratives

Use case narrative for request blood illustrated in Table A.1

Table A.1: Use case 9 - Donation Request

Use Case 9:	Donation Request
Primary Actor:	Donor
Pre-Condition:	System must be connected to the network
Main Scenario:	▪ After register with Blood bank, in an emergency they will request donor for a donation from this function ▪ Donor can see the request form web based portal ▪ Also they will get email and a phone notification on this from this function.

Use case narrative for view on donation history, illustrated in Table A.2

Table A.2: Use case 10 – view on donation history

Use Case 10:	View on donation history.
Primary Actor:	Donor
Pre-Condition:	System must be connected to the network
Main Scenario:	▪ Can get daily/weekly/monthly/yearly blood donated report to see the progress ▪ Can view the history at any time.

Use case narrative for blood recipient registration/deregistration as individuals illustrated in Table A.3

Table A.3: Use case 11 - Blood recipient Registration/Deregistration as individuals

Use Case 11:	Blood recipient Registration/Deregistration as individuals
Primary Actor:	Blood Recipient
Pre-Condition:	System must be connected to the network
Main Scenario:	▪ Individuals who is willing to request they can register them self with this function ▪ Also they can add/ modify the user profile

Use case narrative for request to donate blood illustrated in Table A.4

Table A.4: Use case 12 - Request to Donate blood

Use Case 12:	Request to Donate blood
Primary Actor:	Blood Recipient
Pre-Condition:	System must be connected to the network
Main Scenario:	▪ After register with Blood bank, they can request for blood with the system ▪ Blood Request will go to donors who have already registered with the system via SMS and Email.

Use case narrative for view on blood request history illustrated in Table A.5

Table A.5: Use case 13 – view on blood request history

Use Case 14:	View on blood request history.
Primary Actor:	Blood Recipient
Pre-Condition:	System must be connected to the network
Main Scenario:	▪ Can get daily/weekly/monthly/yearly blood requested report to see the progress ▪ Can view the history at any time.

Use case narrative for accept blood illustrated in Table A.6

Table A.6: Use case 14 – Accept blood

Use Case 15:	Accept blood
Primary Actor:	Blood collection center
Pre-Condition:	System must be connected to the network
Main Scenario:	▪ Accept the blood request from transportation / blood bank.

Use case narrative for ready to collect illustrated in Table A.7

Table A.7: Use case 15 – ready to collect

Use Case 16:	Ready to collect
Primary Actor:	Blood collection center
Pre-Condition:	System must be connected to the network
Main Scenario:	▪ Once blood is ready, collection center can notify recipient to collect the blood.

Use case narrative for add/ modify profile illustrated in Table A.8

Table A.8: Use case 16 - Add/ Modify profile

Use Case 17:	Add/ Modify profile
Primary Actor:	Blood collection center
Pre-Condition:	System must be connected to the network
Main Scenario:	▪ Blood collection center employees only can add/modify their user details and passwords.

Use case narrative for Inquiry and report for collection of blood/ pending collections illustrated in Table A.9

Table A.9: Use case 17 - Inquiry and report for collection of blood/ pending collections

Use Case 18:	Inquiry and report for collection of blood/ pending collections
Primary Actor:	Blood collection center
Pre-Condition:	System must be connected to the network
Main Scenario:	▪ Can get daily/weekly/monthly/yearly blood collection report ▪ Can download the report at any time.

Use case narrative for accept blood collection illustrated in Table A.10

Table A.10: Use case 18 – accept blood collection

Use Case 19:	Accept Blood collection
Primary Actor:	Blood Transport center
Pre-Condition:	System must be connected to the network
Main Scenario:	▪ Accept the blood collection request by blood bank

Use case narrative for hand over blood illustrated in Table A.11

Table A.11: Use case 19 – hand over blood

Use Case 20:	Hand over blood
Primary Actor:	Blood Transport center
Pre-Condition:	System must be connected to the network
Main Scenario:	▪ Hand over blood to collection center and notify the system.

Use case narrative for add/ modify user profile illustrated in Table A.12

Table A.12: Use case 20 - Add/ Modify user profile.

Use Case 21:	Add/ Modify user profile
Primary Actor:	Blood Transport center
Pre-Condition:	System must be connected to the network
Main Scenario:	▪ Blood transport center employees only can add/modify their user details and passwords.

Use case narrative for Inquiry and report for hand over and delivery of blood illustrated in Table A.13

Table A.13: Use case 21 - Inquiry and report for hand over and delivery of blood

Use Case 22:	Inquiry and report for hand over and delivery of blood
Primary Actor:	Blood Transport center
Pre-Condition:	System must be connected to the network
Main Scenario:	▪ Can get daily/weekly/monthly/yearly blood delivered report ▪ Can download the report at any time.

Use case narrative for Add/ Modify User profiles illustrated in Table A.14

Table A.14: Use Case 22 – Add / Modify user profiles

Use Case 24:	Add/ Modify User profiles
Primary Actor:	System administrator
Pre-Condition:	System must be connected to the network
Main Scenario:	▪ Admin will give different privileges to users to get their interface. ▪ Add/ Modify user privileges to the system

Use case narrative for Login to the system illustrated in Table A.15

Table A.15: Use Case 23 - Login to the system

Use Case 25:	Login to the system
Primary Actor:	Blood Bank, Blood Collection center, Blood Transport center, Donor, Recipient and Administrator
Pre-Condition:	System must be connected to the network
Main Scenario:	▪ Need a separate login to log to the system, Username with password

Appendix B – UML Diagram

1) Sequence Diagram

I. Sequence Diagram for Admin

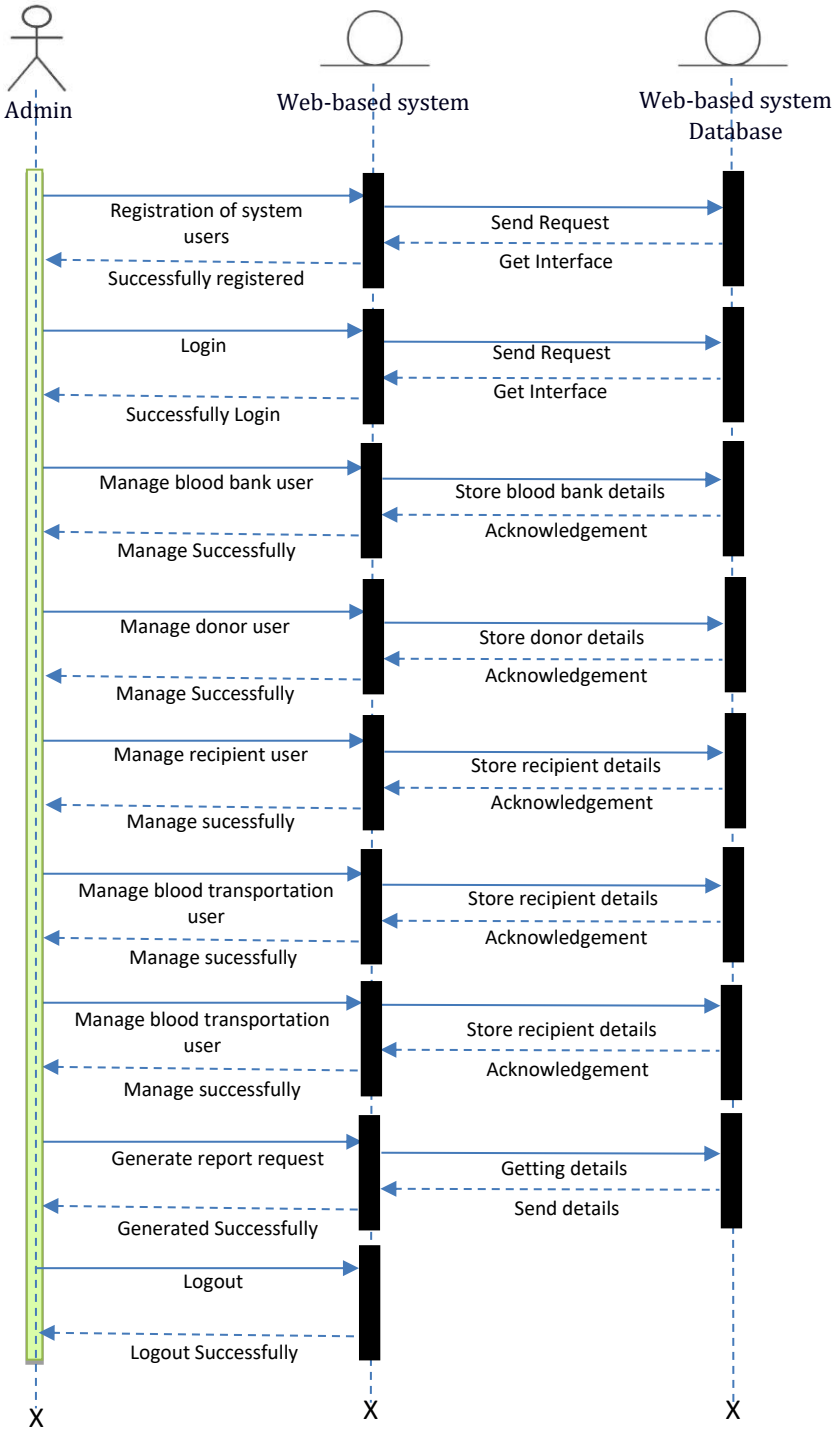


Figure B.1: Sequence Diagram for Admin

II. Sequence Diagram for Blood Bank

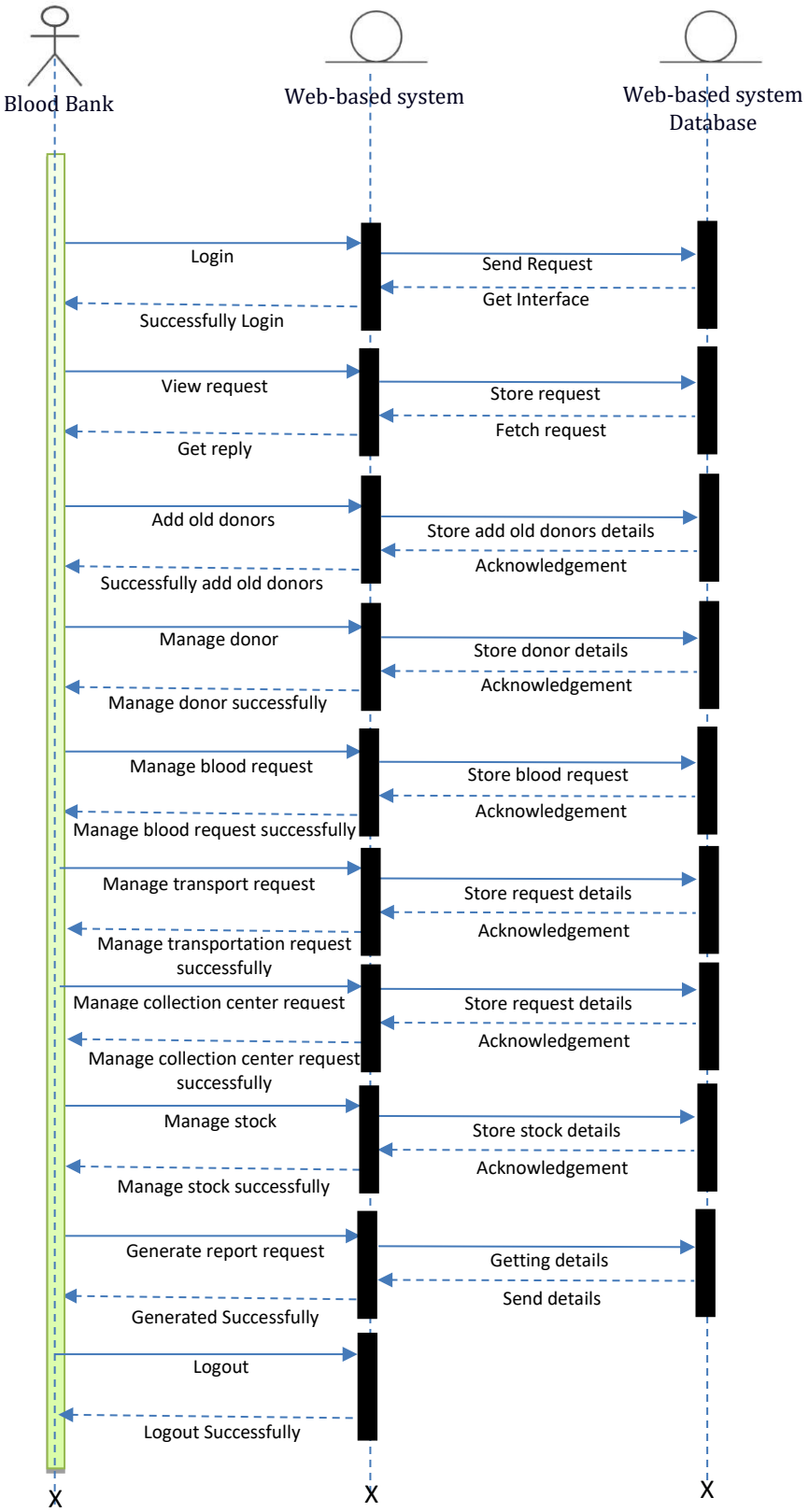


Figure B.2: Sequence Diagram for Blood Bank

III. Sequence Diagram for Donor

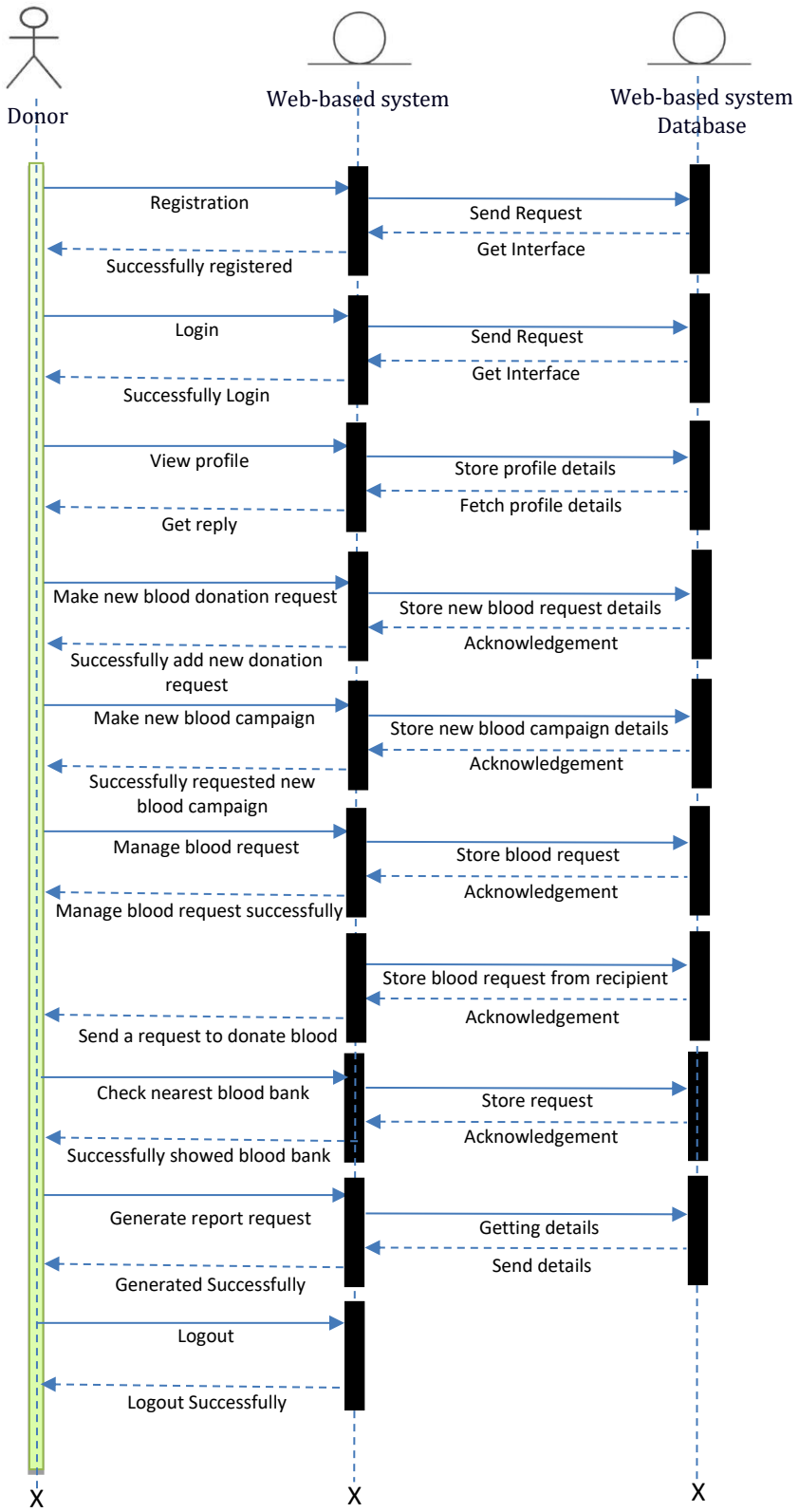


Figure B.3: Sequence Diagram for Donor

IV. Sequence Diagram for Recipient

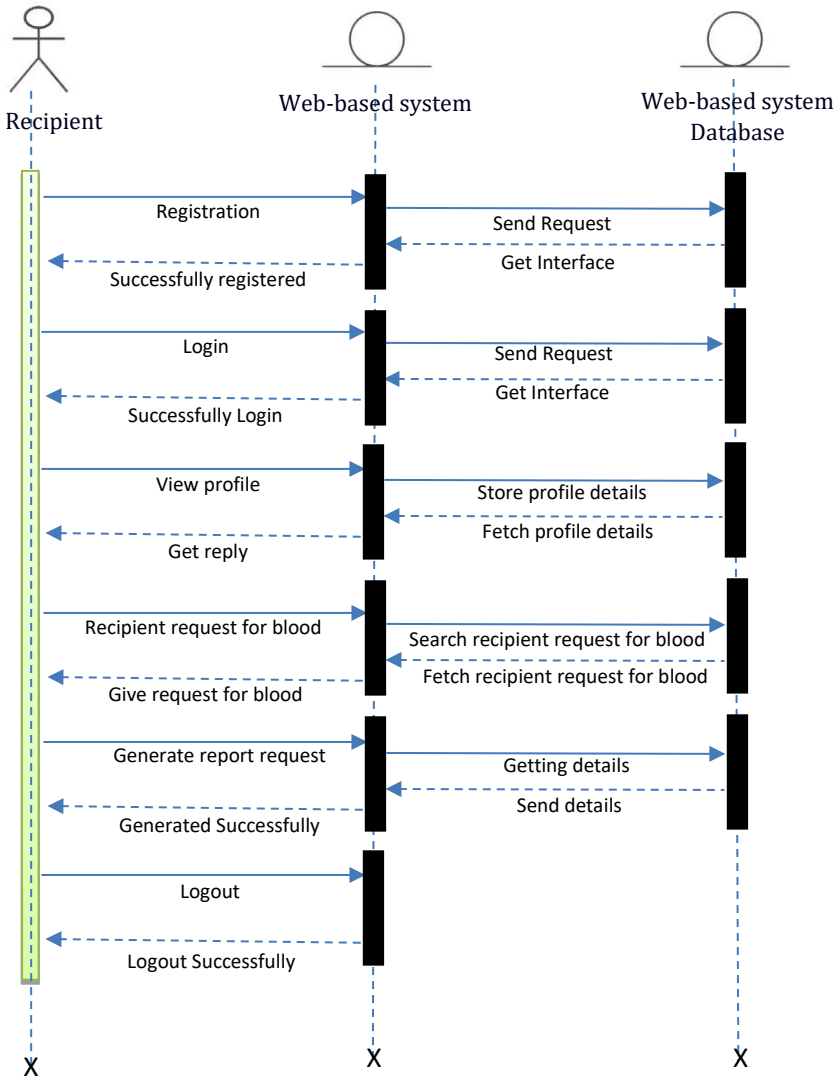


Figure B.4: Sequence Diagram for Recipient

V. Sequence Diagram for Blood Collection Center

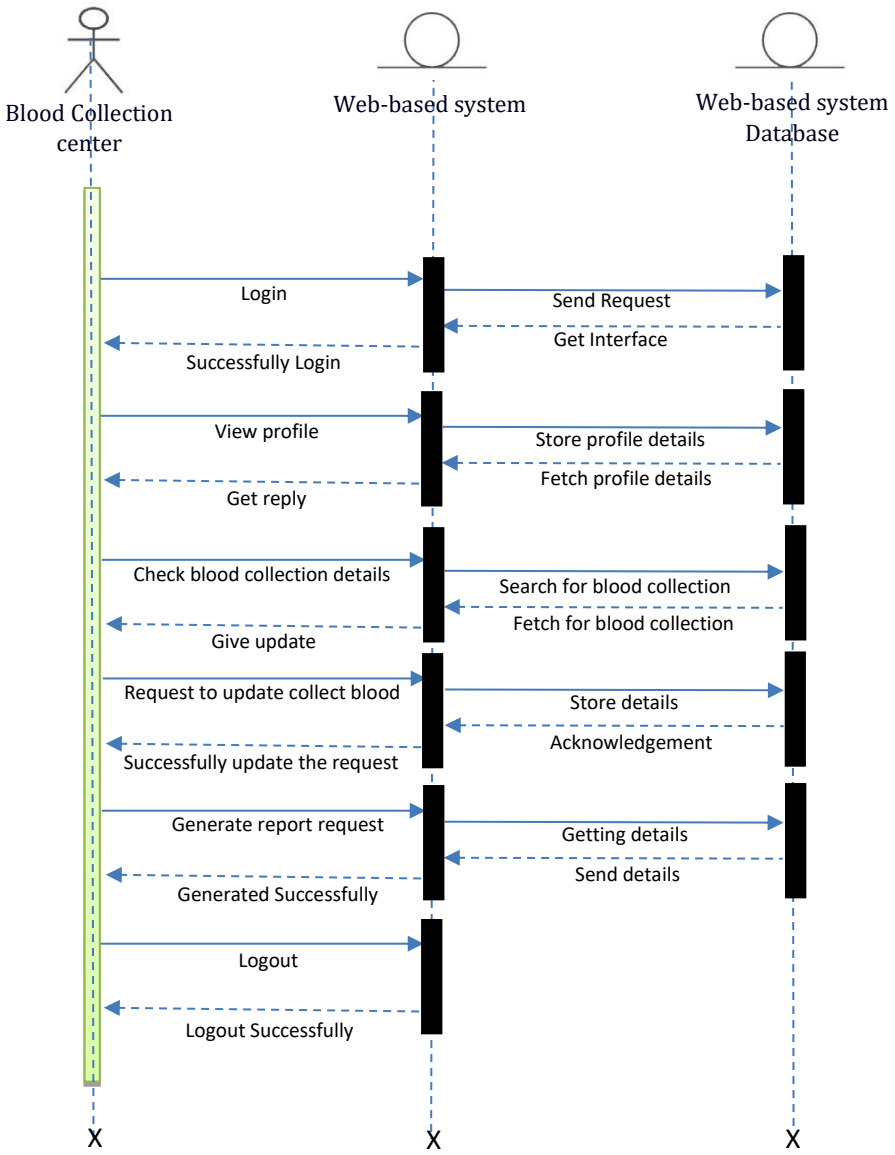


Figure B.5: Sequence Diagram for Blood Collection Center

VI. Sequence Diagram for Blood Transportation

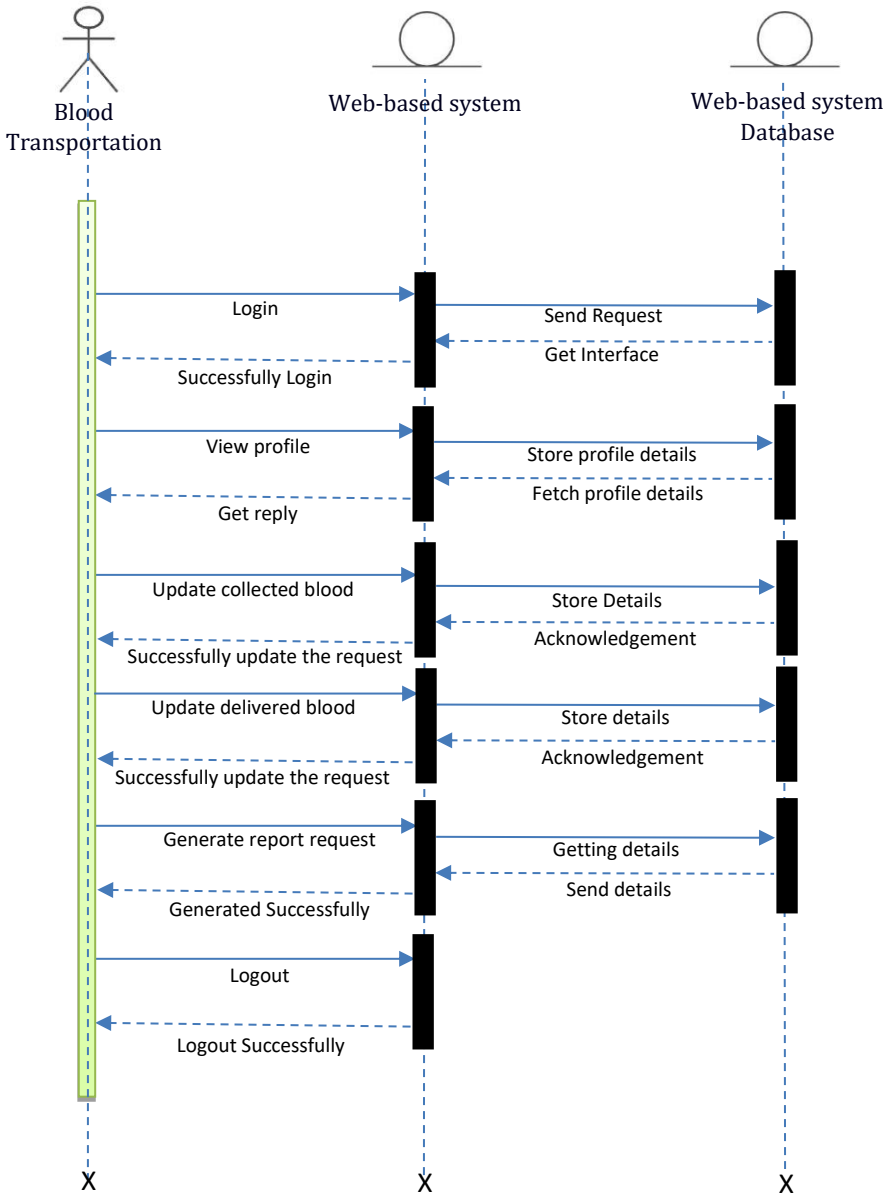


Figure B.6: Sequence Diagram for Blood Transportation

2) Activity Diagram

I. Activity Diagram for Admin

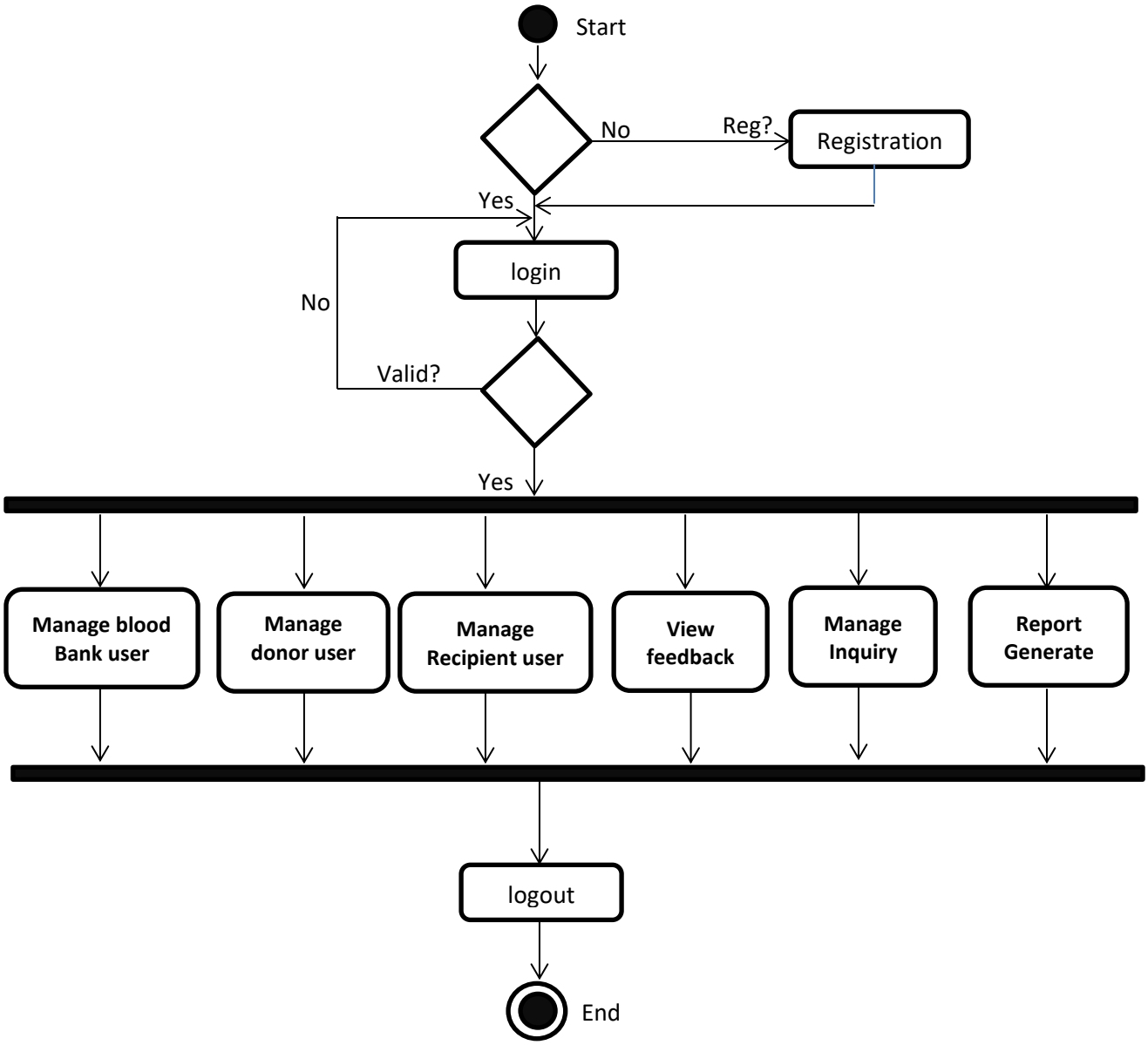


Figure B.7: Activity Diagram for Admin

II. Activity Diagram for blood bank

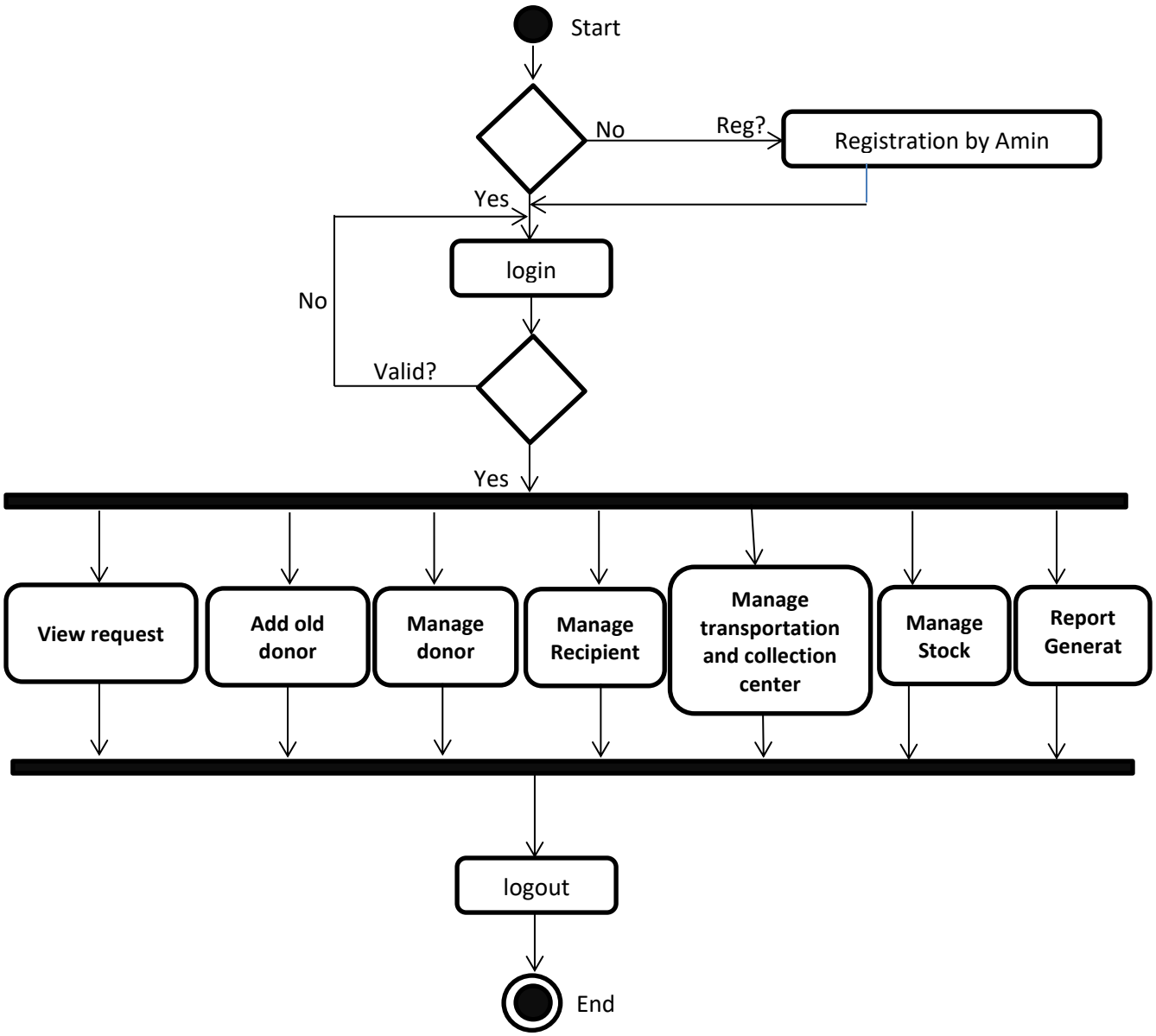


Figure B.8: Activity Diagram for blood bank

III. Activity Diagram for Donor

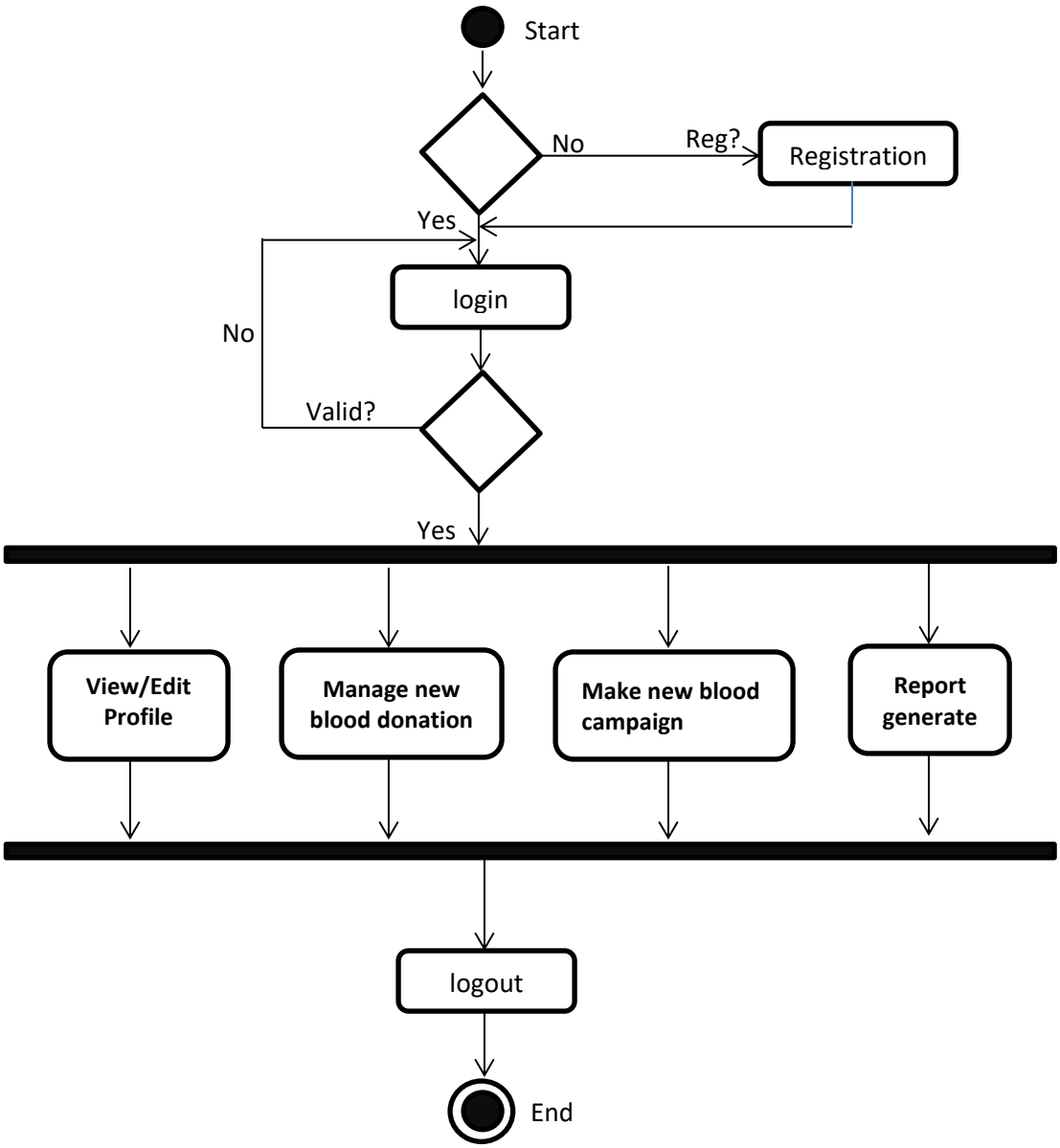


Figure B.9: Activity Diagram for Donor

IV. Activity Diagram for Recipient

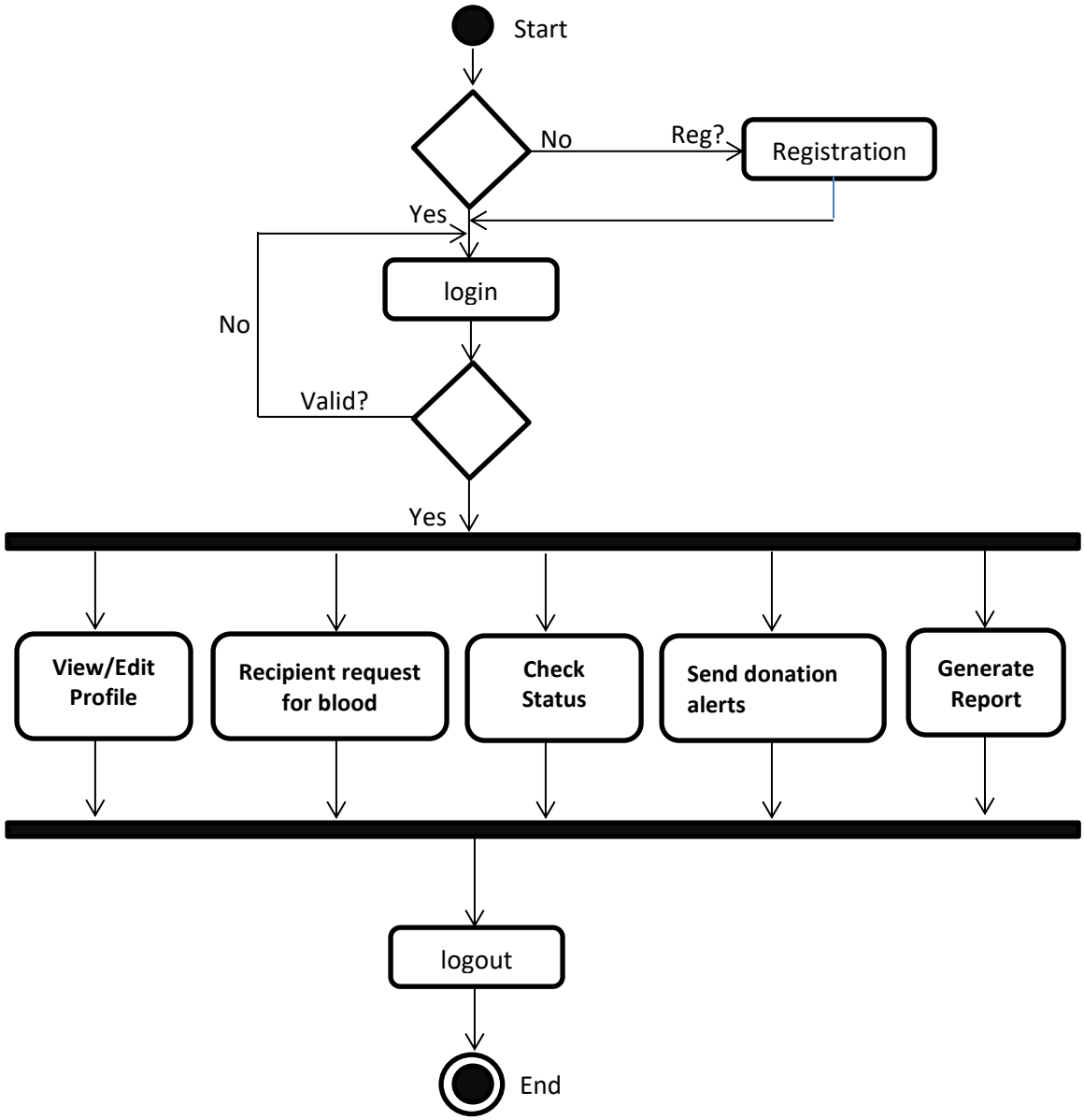


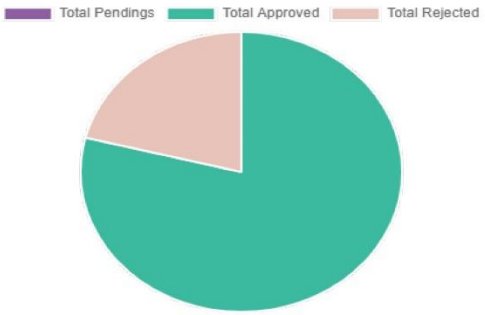
Figure B.10: Activity Diagram for Recipient

Appendix C – Management Report

1. Summary report

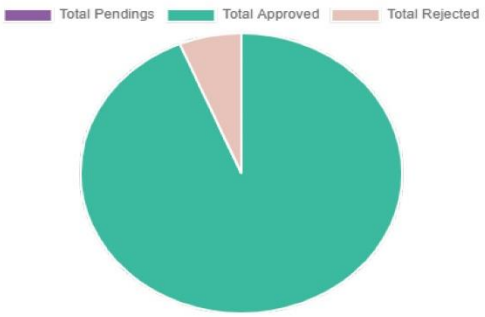
Donation Report From 2021-09-01 To 2021-09-14

Total Donations	Total Pendings	Total Approvals	Total Rejected
19	0	15	4



Campaign Report From 2021-09-01 To 2021-09-14

Total Campaigns	Total Pendings	Total Approvals	Total Rejected
16	0	15	1

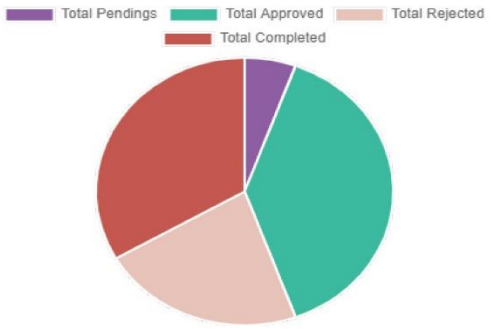


Personal Reservation Report From 2021-09-01 To 2021-09-14

Total Reservations	Total Pendings	Total Approvals	Total Rejected	Total Completed
21	1	16	5	15

Patient Reservation Report From 2021-09-01 To 2021-09-14

Total Reservations	Total Pendings	Total Approvals	Total Rejected	Total Completed
22	2	14	8	12



Transport Center Report From 2021-09-01 To 2021-09-14

Request Type	Total Requests	Total Pendings	Total Complete
Patient Request	16	1	15
Personal Request	13	0	13

Collection Center Report From 2021-09-01 To 2021-09-14

Request Type	Total Requests	Total Pendings	Total Complete
Patient Request	15	0	15
Personal Request	13	1	12

Transport Center Report From 2021-09-01 To 2021-09-14

Blood Type	Total Donated	Total Recived	Total Available
A+	2	4	2
A-	2	4	2
B+	0	0	1
B-	0	0	3
O+	2	2	1
O-	1	1	1
AB+	0	2	4
AB-	2	1	0

Figure C.1: Summary report

2. User Report

A. Personal Donation

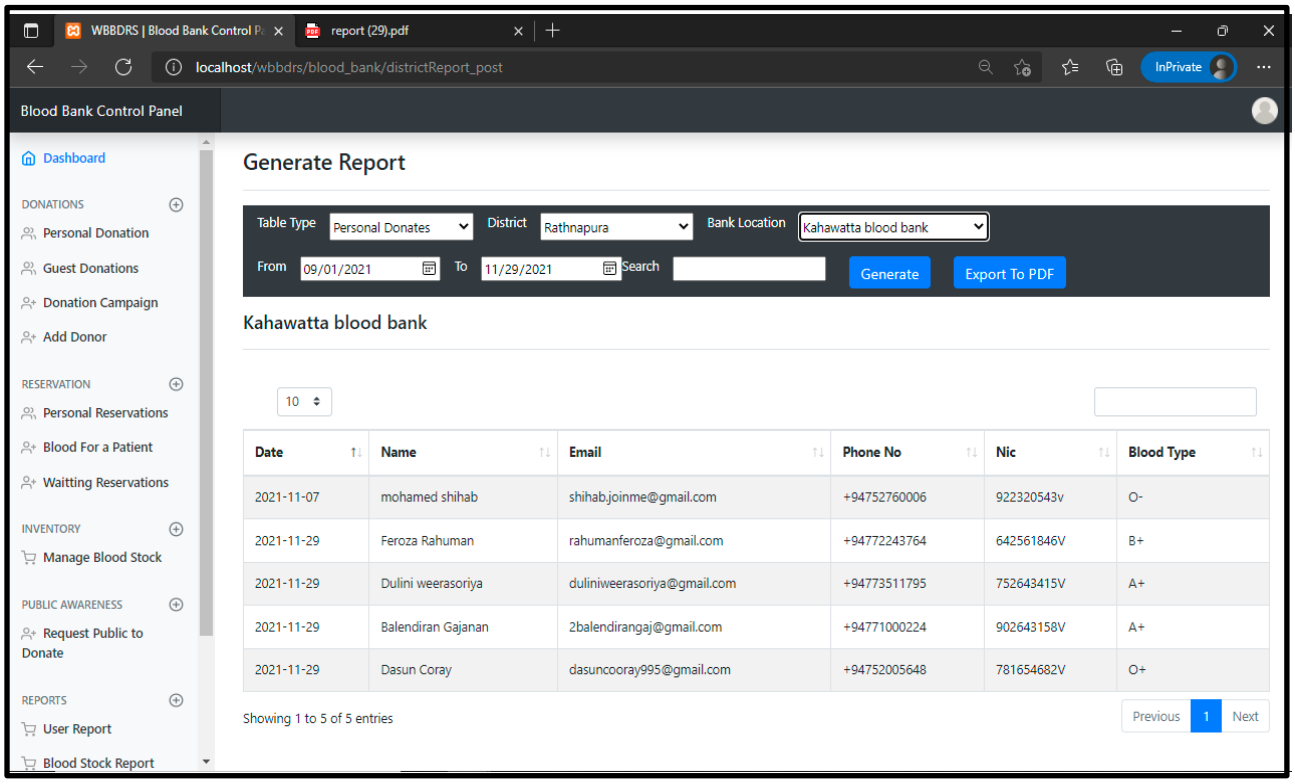


Figure C.2: Personal Donation

B. User - Donation Campaign

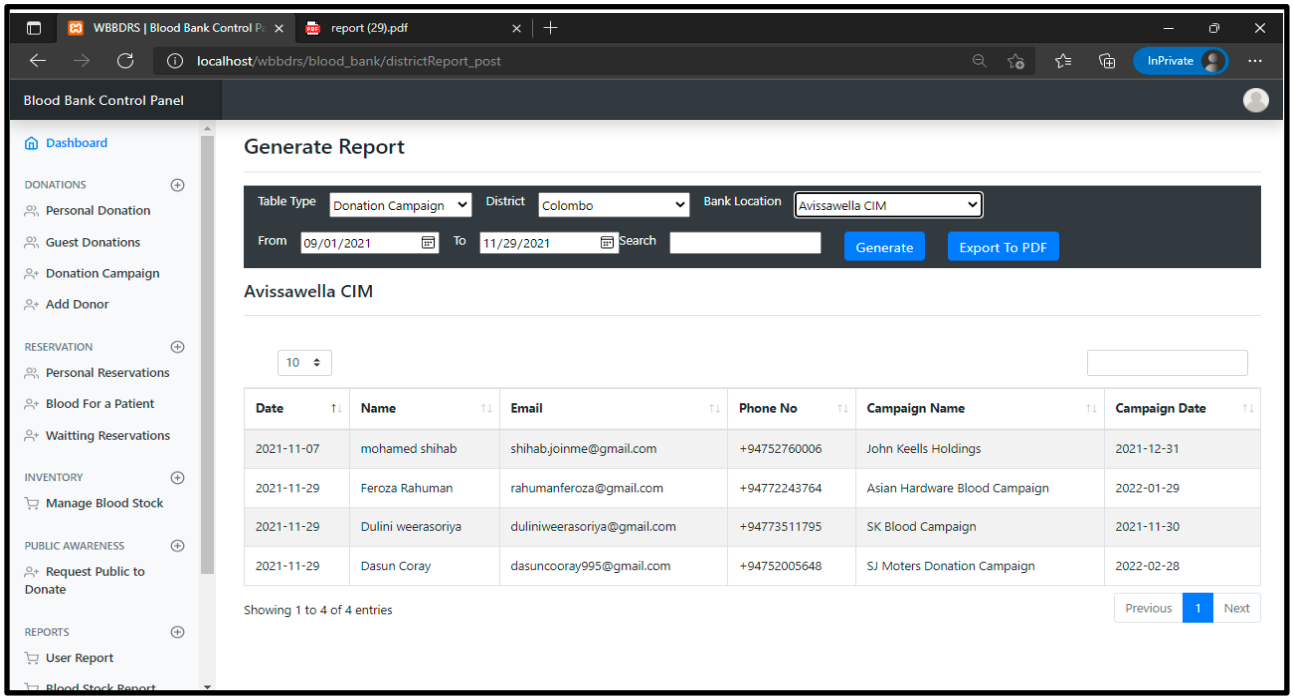


Figure C.3: Donation Campaign

C. User - Personal blood reservation

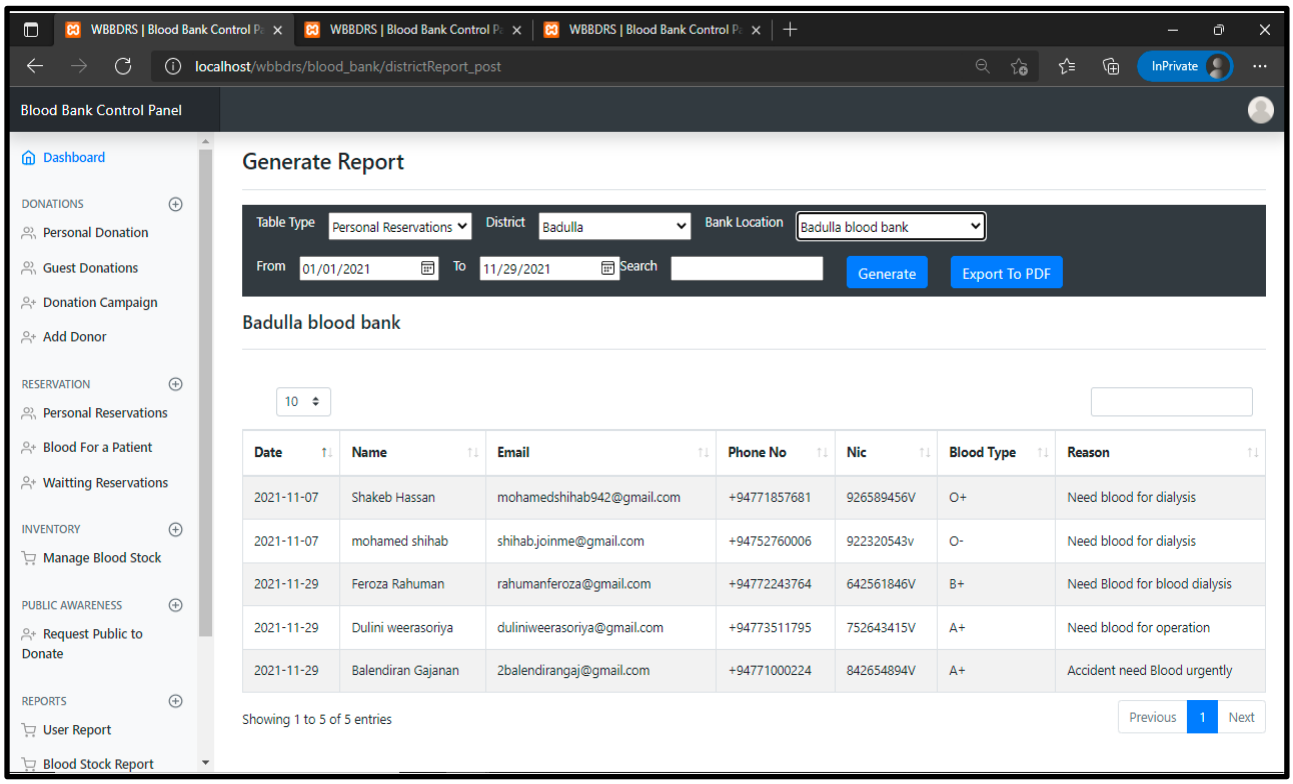


Figure C.4: Personal blood reservation

D. User - Reservation for patient

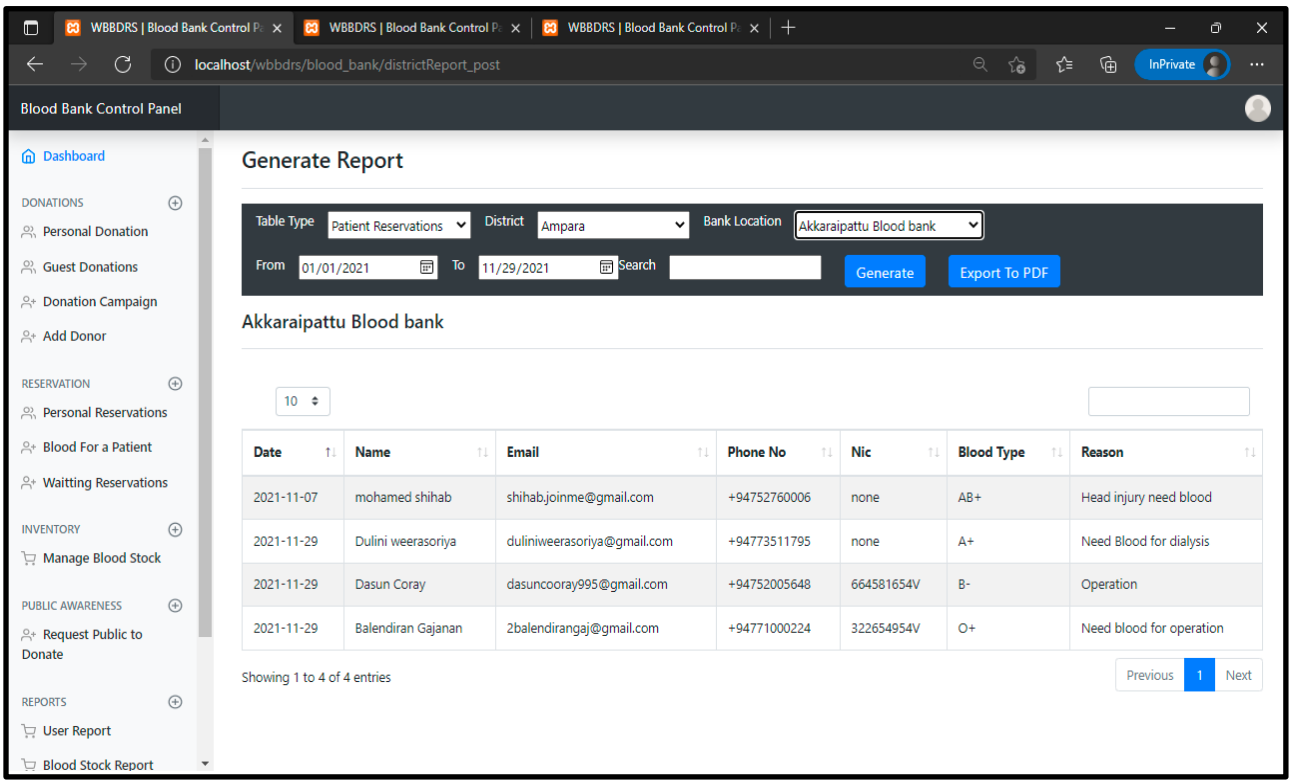


Figure C.5: Reservation for patient

3. Blood Stock Report

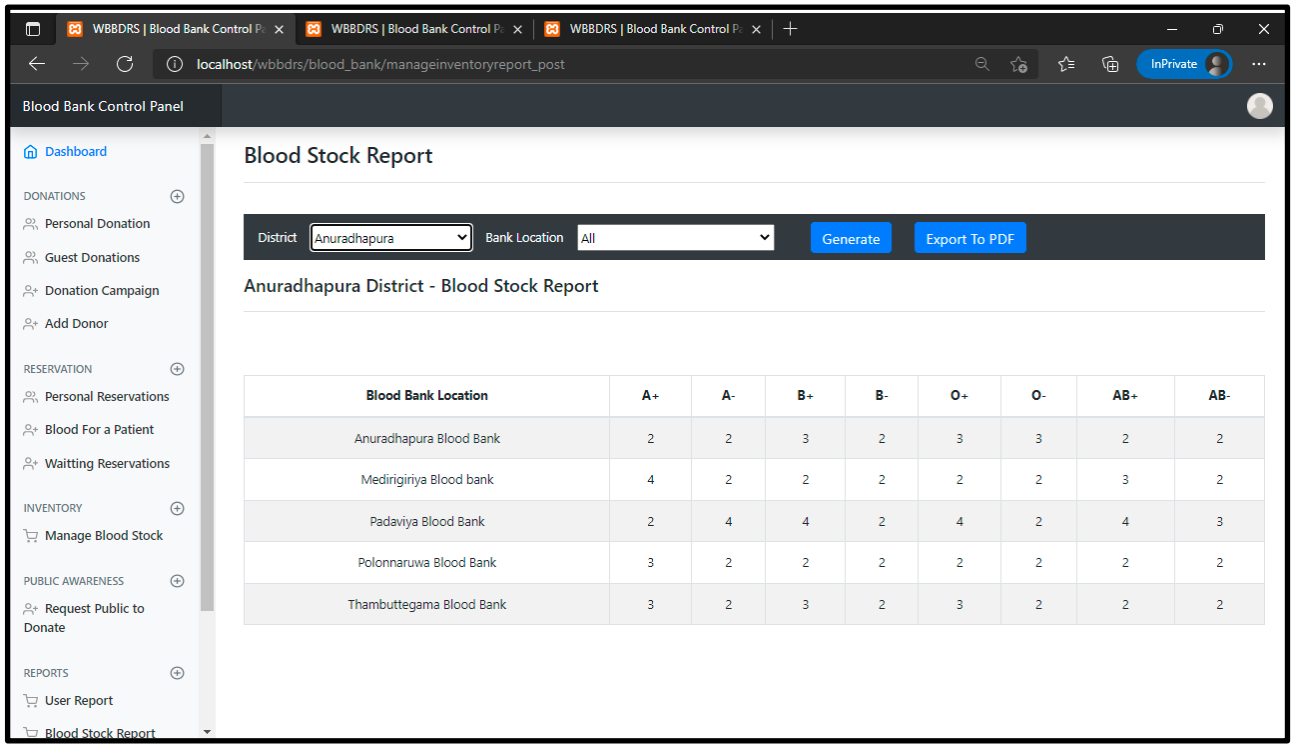


Figure C.6: Blood Stock Report

4. Status Report

A. Personal Donation

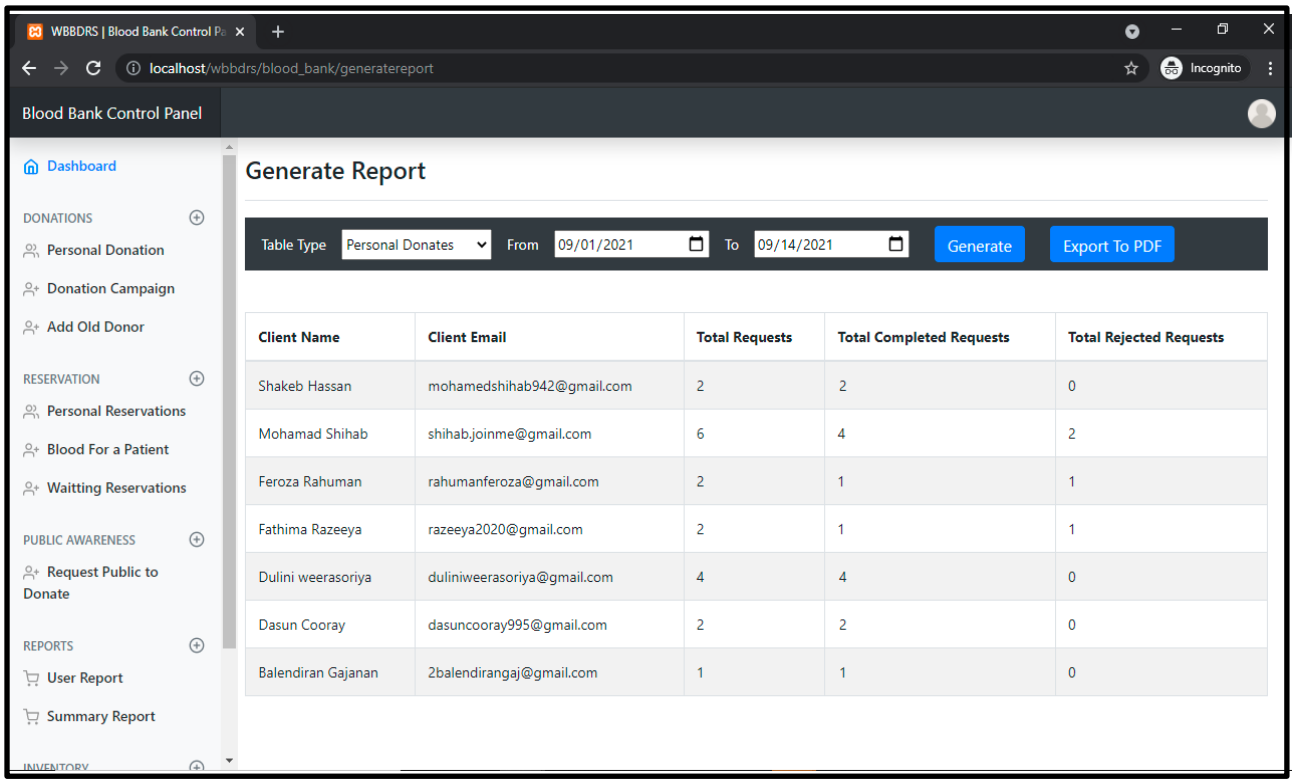


Figure C.7: Personal Donation

B. Donation Campaign

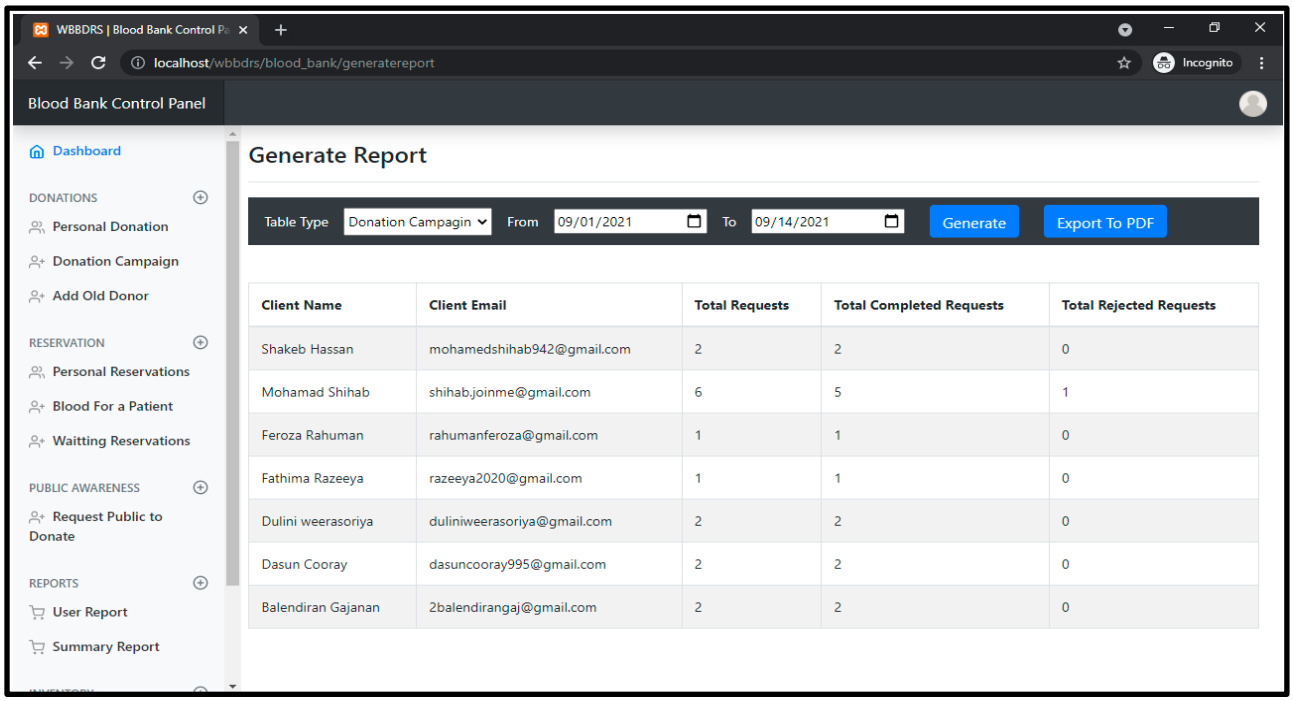


Figure C.8: Donation Campaign

C. Personal blood reservation

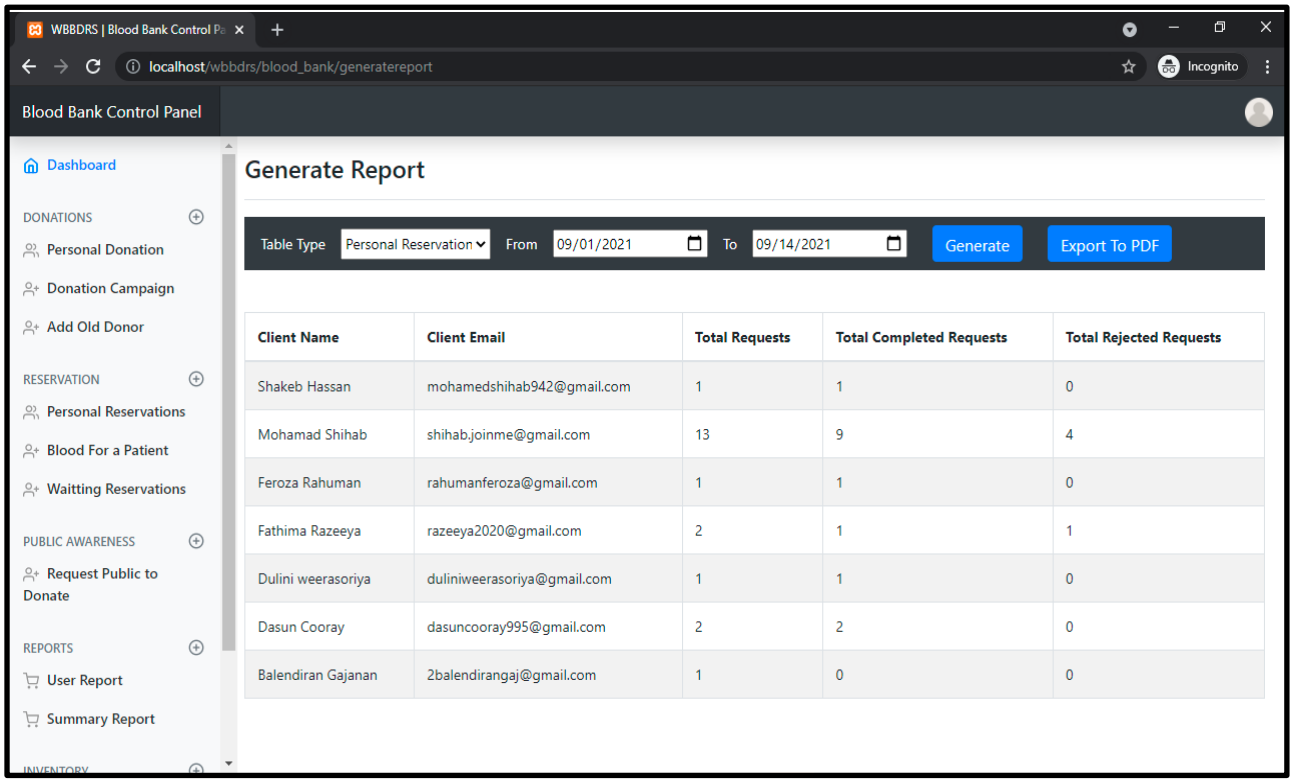


Figure C.9: Personal blood reservation

D. Reservation for patient

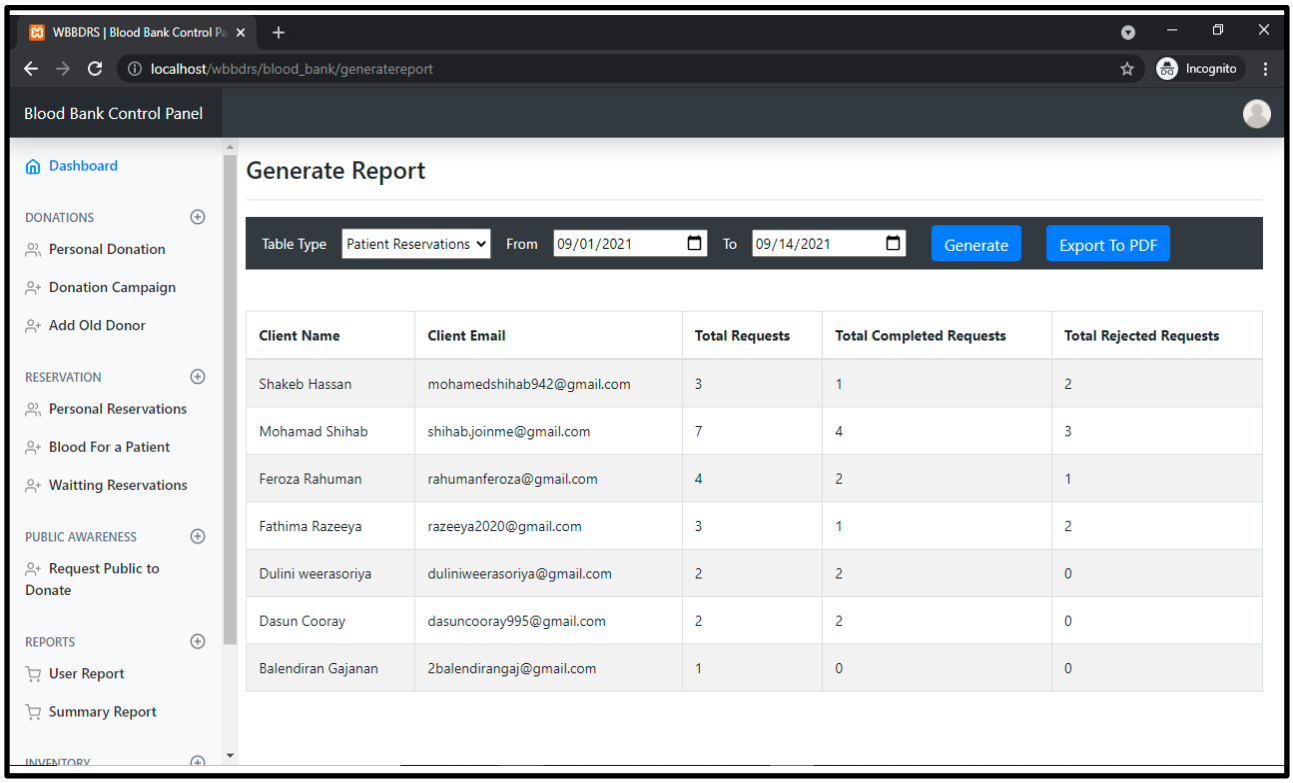


Figure C.10: Reservation for patient

E. User - Transportation center inventory report

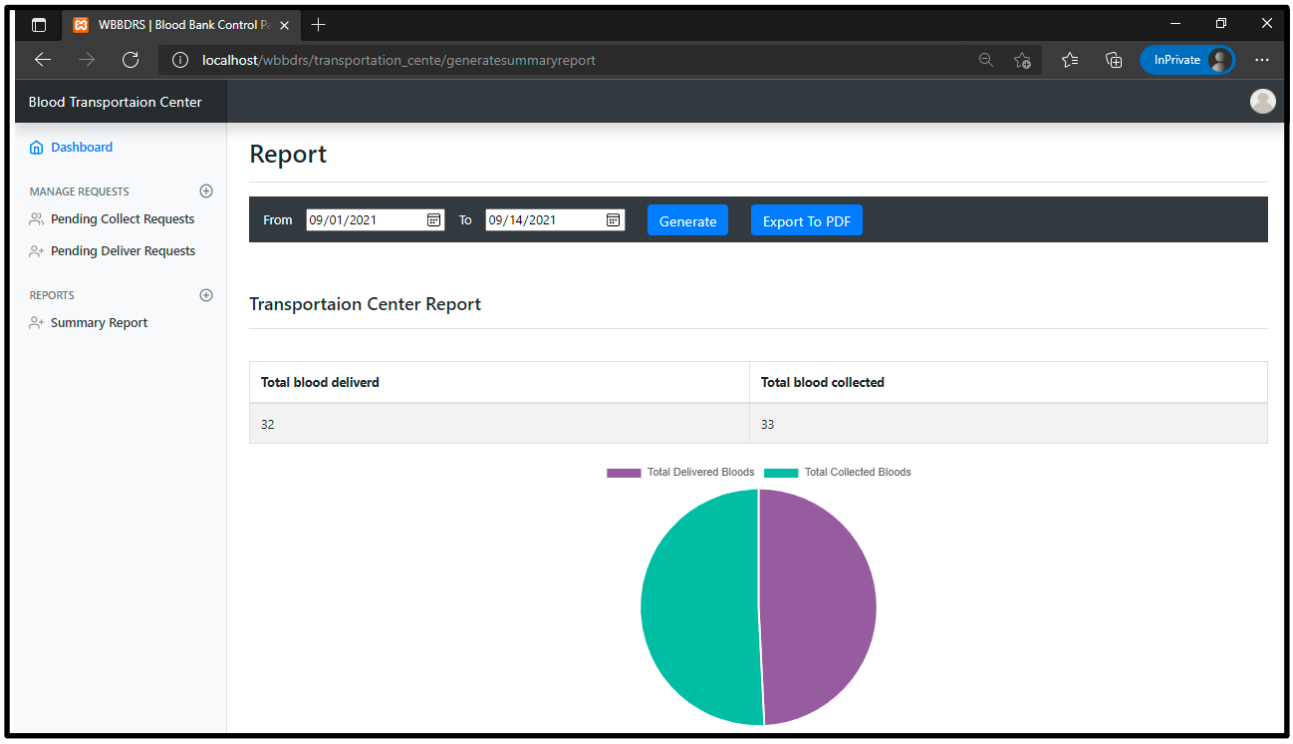


Figure C.11: Transportation center inventory report

F. Collection center inventory report

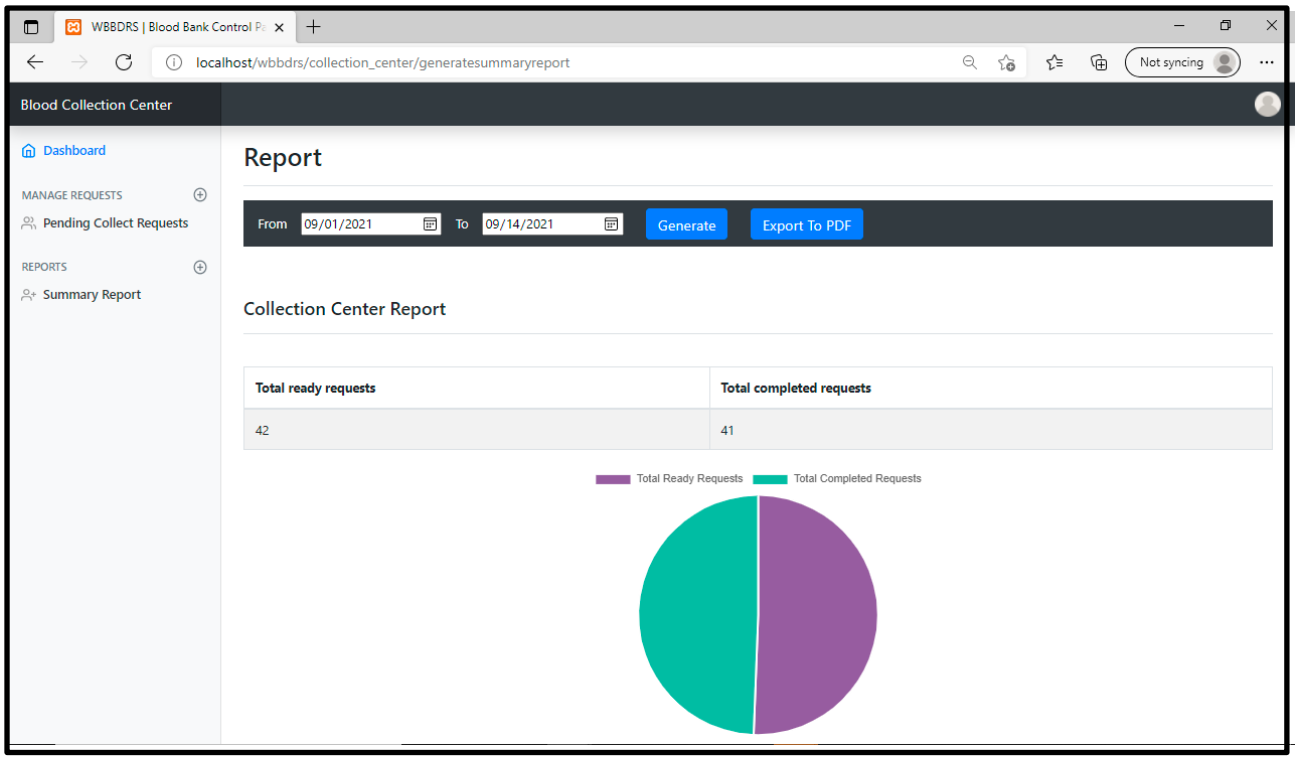


Figure C.12: Collection center inventory report

G. Administrator inventory report

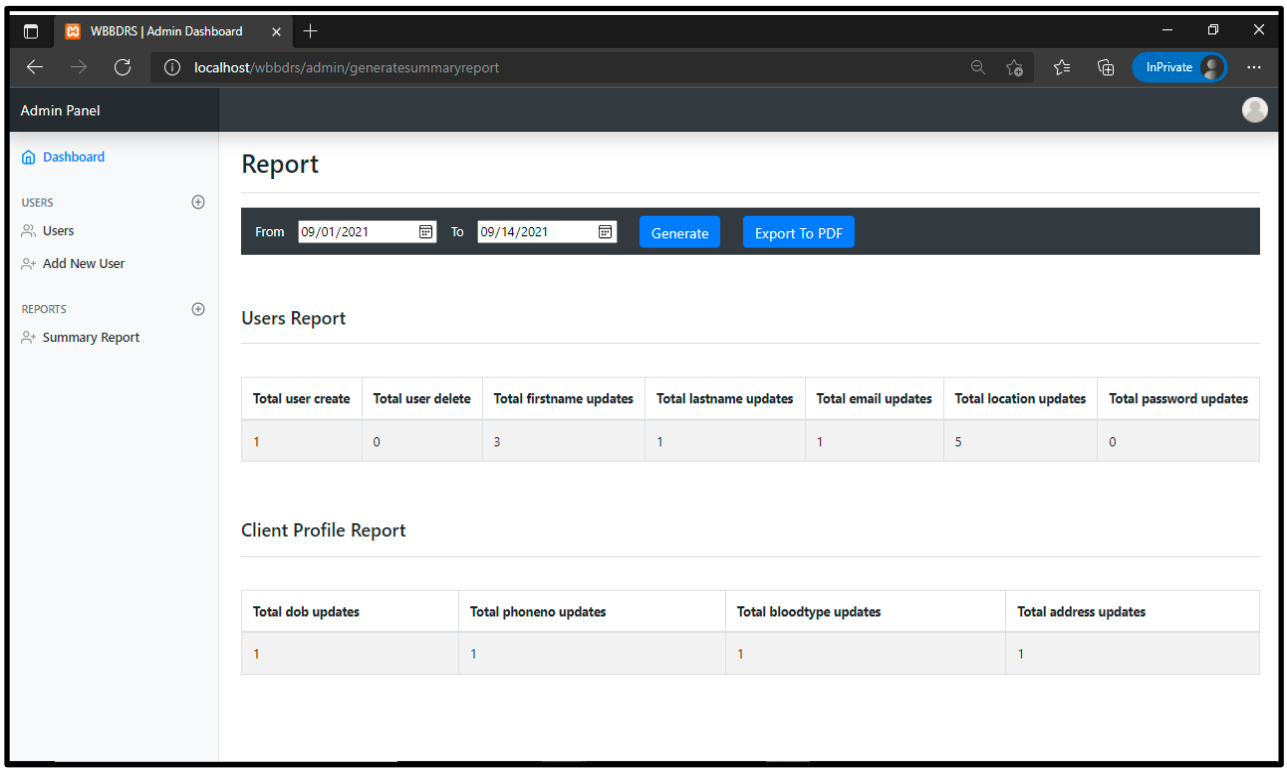


Figure C.13: Administrator inventory report

D. Appendix D – Result of outputs

1. Email verification request for Donor/ Recipient

Figure D.1 shows the output of Test ID 003, show the email verification request and it succeed.

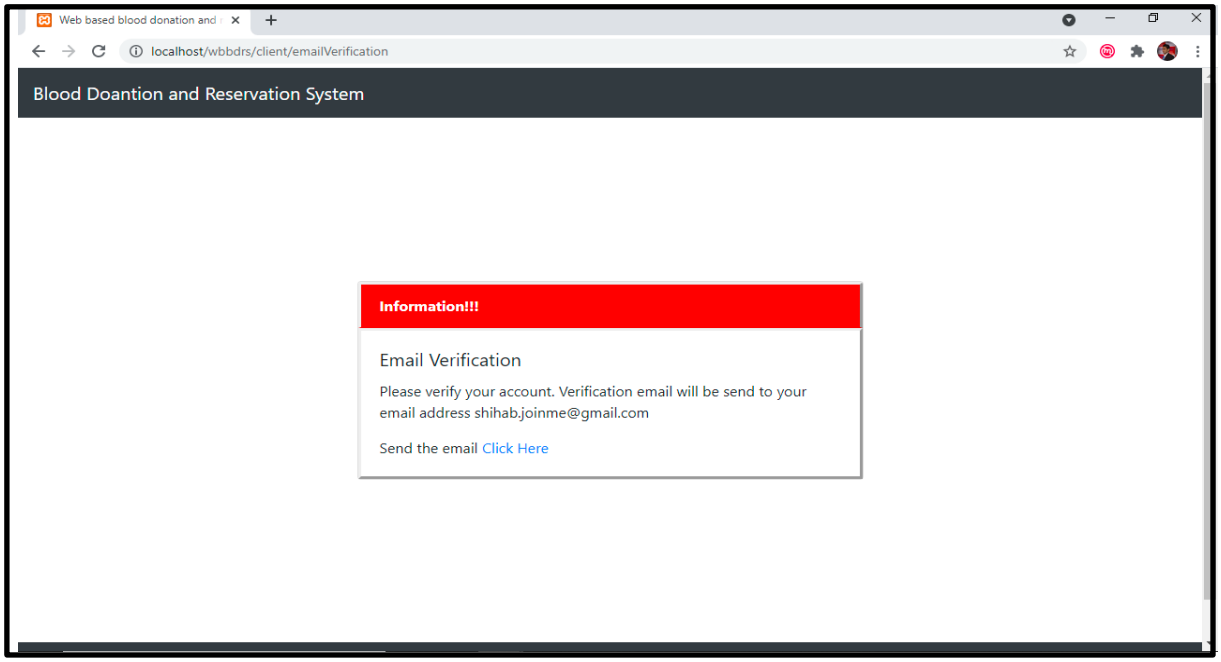


Figure D.1: Email verification request for Donor/ Recipient

2. Email request sent to donor/ recipient

Figure D.2 shows the output of Test ID 003, show the email verification request sent to user successfully.

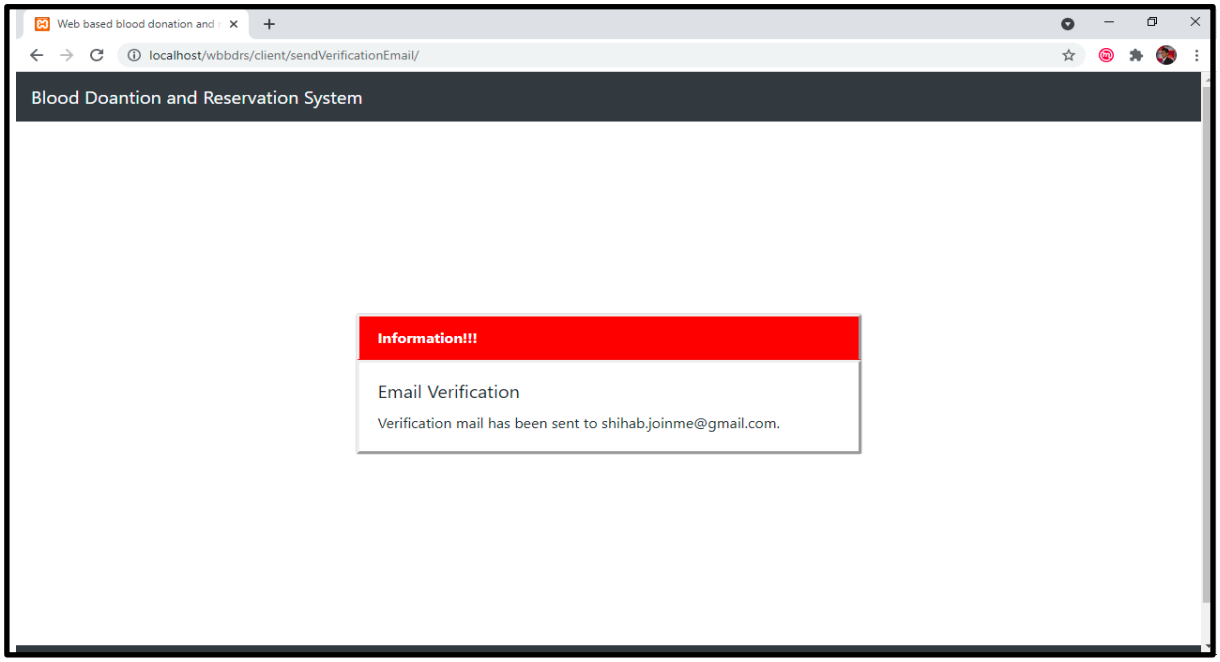


Figure D.2: Email request sent to donor/ recipient

3. Verification mail to donor/ recipient.

Figure D.3 shows the output of Test ID 003, show the verification email came successfully.

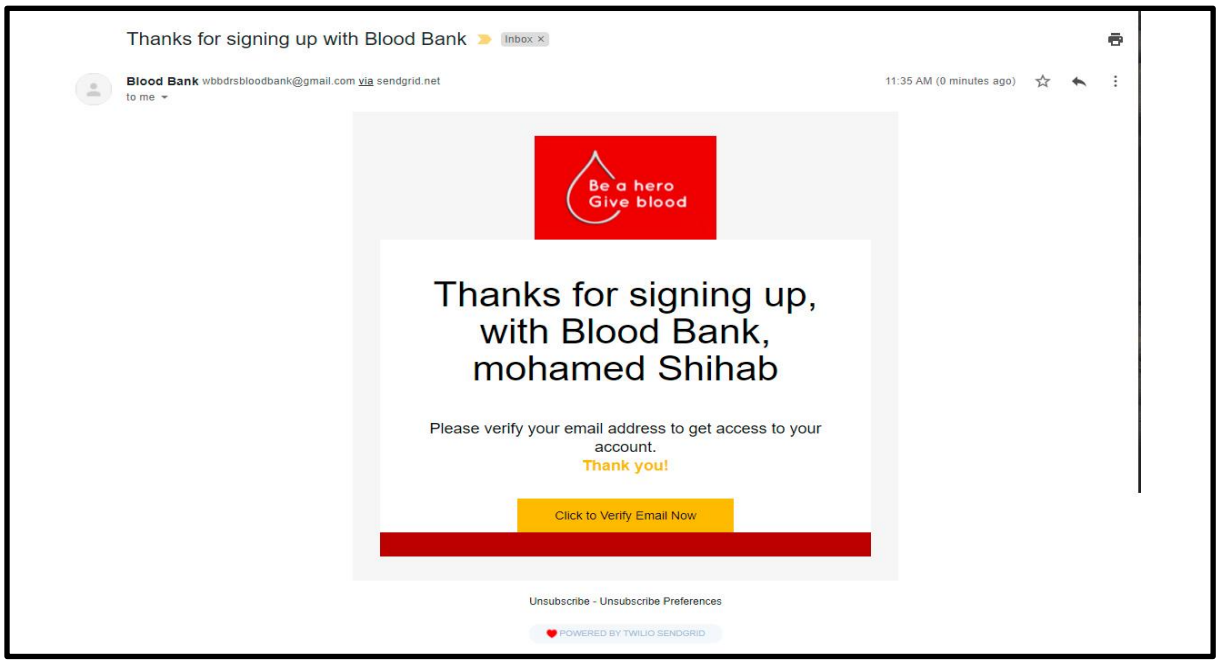


Figure D.3: Verification mail to donor/ recipient.

4. User verified to donate/ request blood

Figure D.4 shows the output of Test ID 003, show user verified successfully.

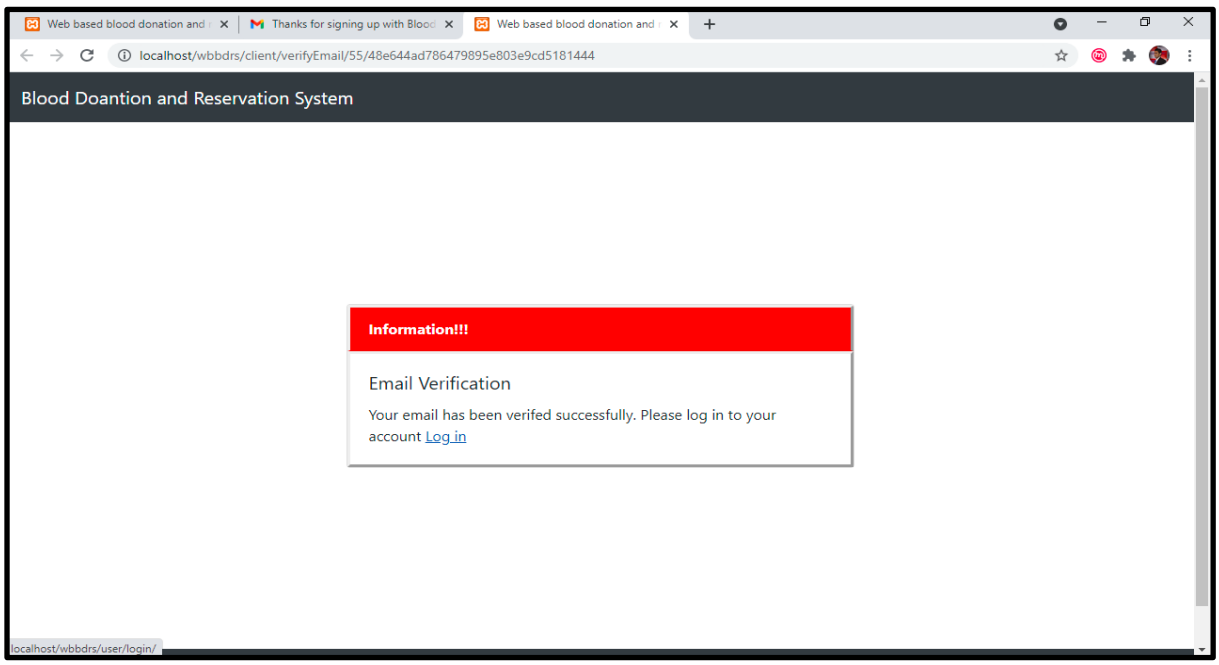


Figure D.4: User verified to donate/ request blood

5. Donor/ Recipient user profile editing

Figure D.5 shows the output of Test ID 004, show the user profile edited successfully.

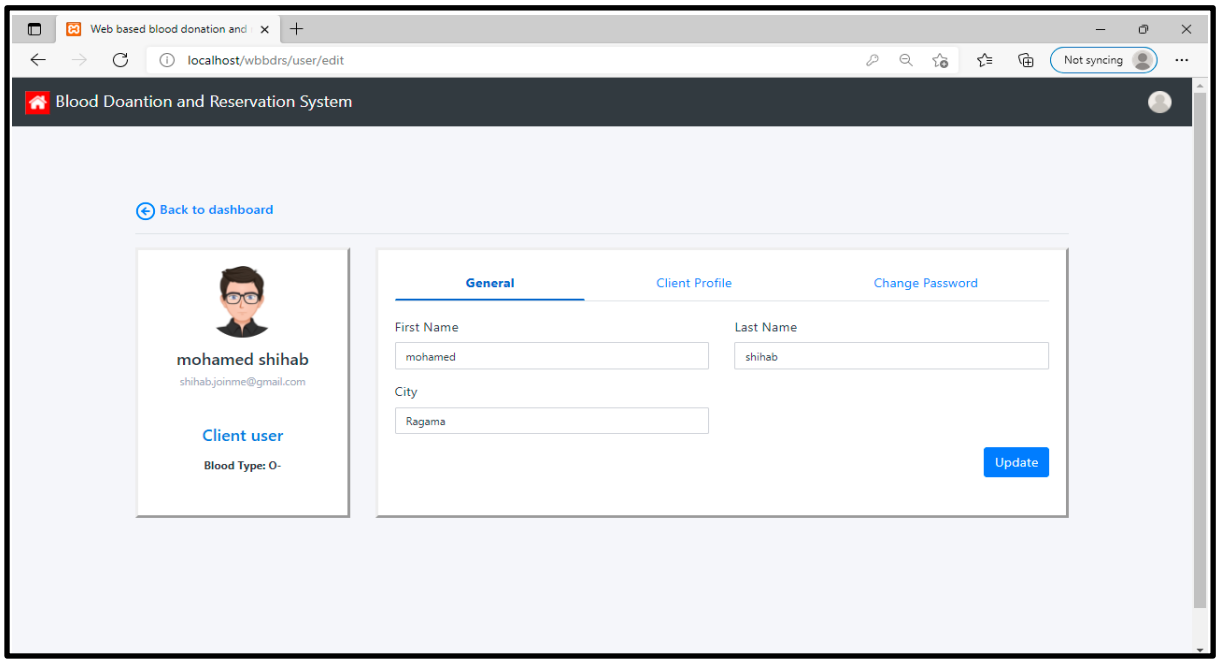


Figure D.5: Donor/ Recipient user profile editing

6. User successfully registered for blood bank, blood transportation and blood collection center by admin.

Figure D.6 shows the output of Test ID 013, User created successfully by admin.

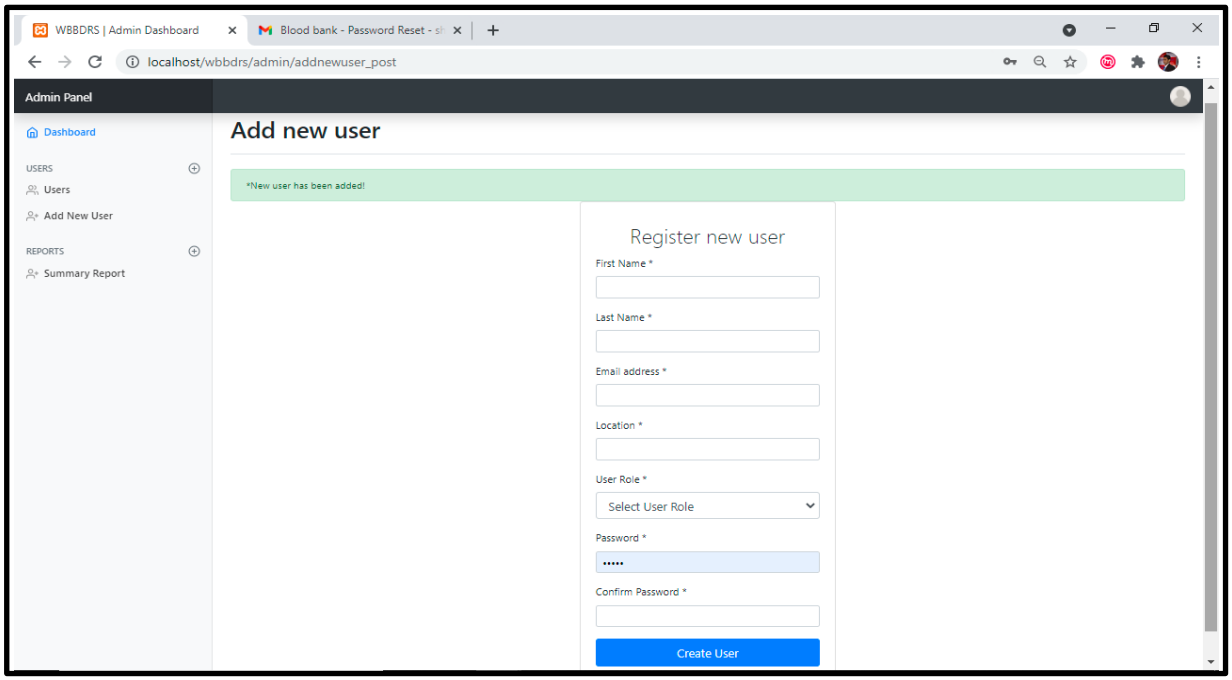


Figure D.6: User registration for blood bank, blood transportation and blood collection center by admin

7. User profile edit/delete by admin control and its successfully updated

Figure D.7 shows the output of Test ID 013, profile edited successfully.

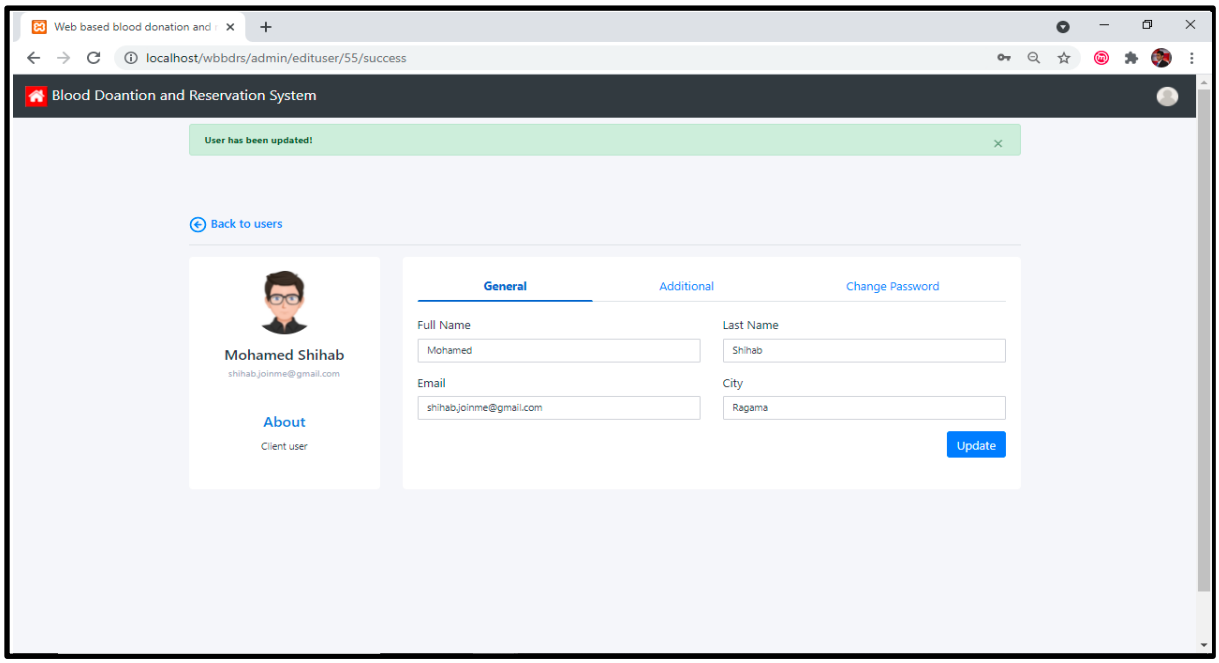


Figure D.7: User profile edit/delete by admin control and its successfully updated

8. Once request went to blood bank, pending notification will accrue in donor profile until blood bank accept/reject the request.

Figure D.8 shows the output of Test ID 010, successfully showed the notification

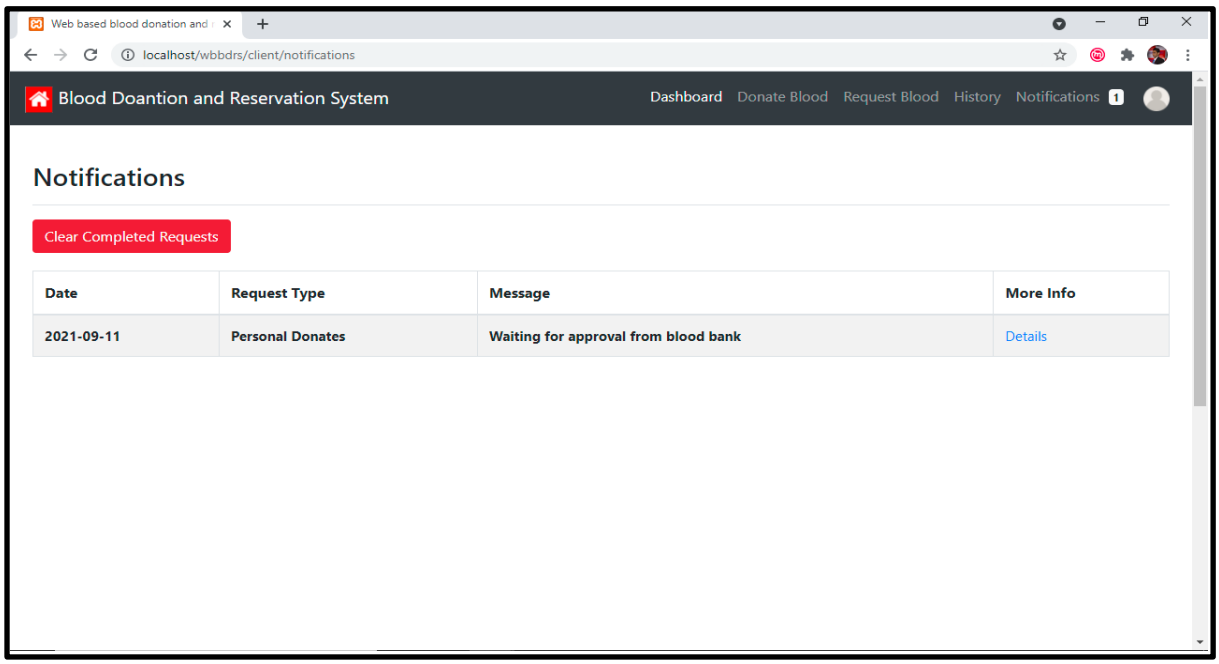


Figure D.8: Pending notification

9. Accept / reject blood donation by Blood bank. Below D.9 Figure Shows Successfully got the request from donor and it is notified in the personal donation tab. Bank will check with nearest location on availability and they successfully approve or decline the request. Once it approves or decline, request will go to donation request history.

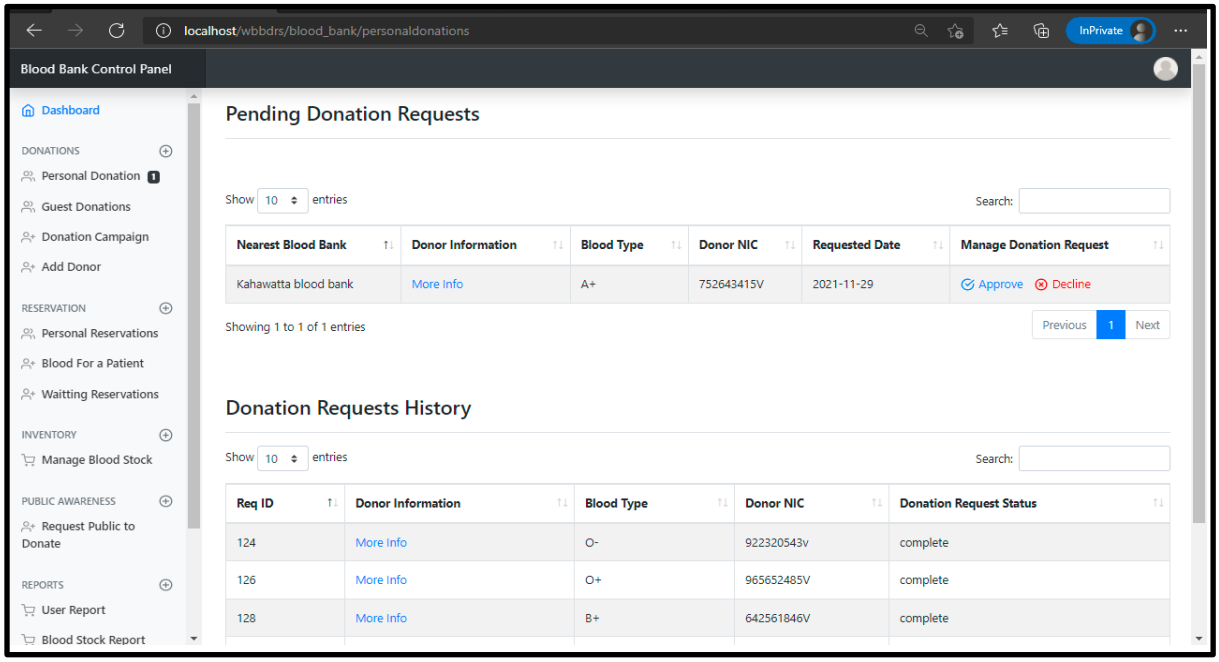


Figure D.9: Accept / reject blood donation by Blood bank

10. After accept by blood bank, donor will get the confirmation notification

Figure D.10 shows the output of Test ID 010, successfully showed the notification

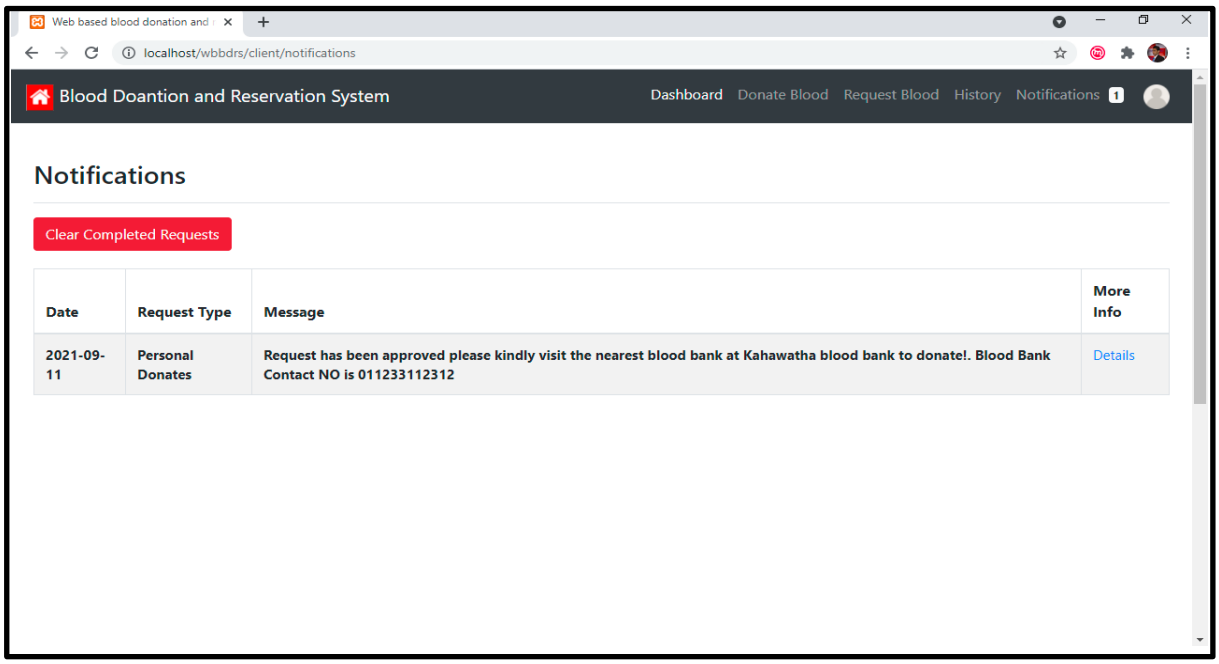


Figure D.10: Confirmation notification to donors

11. Below Figure D.11 shows, blood bank will notify the system after successfully get the blood from donor. After the donate button pressed, system will add blood to inventory.

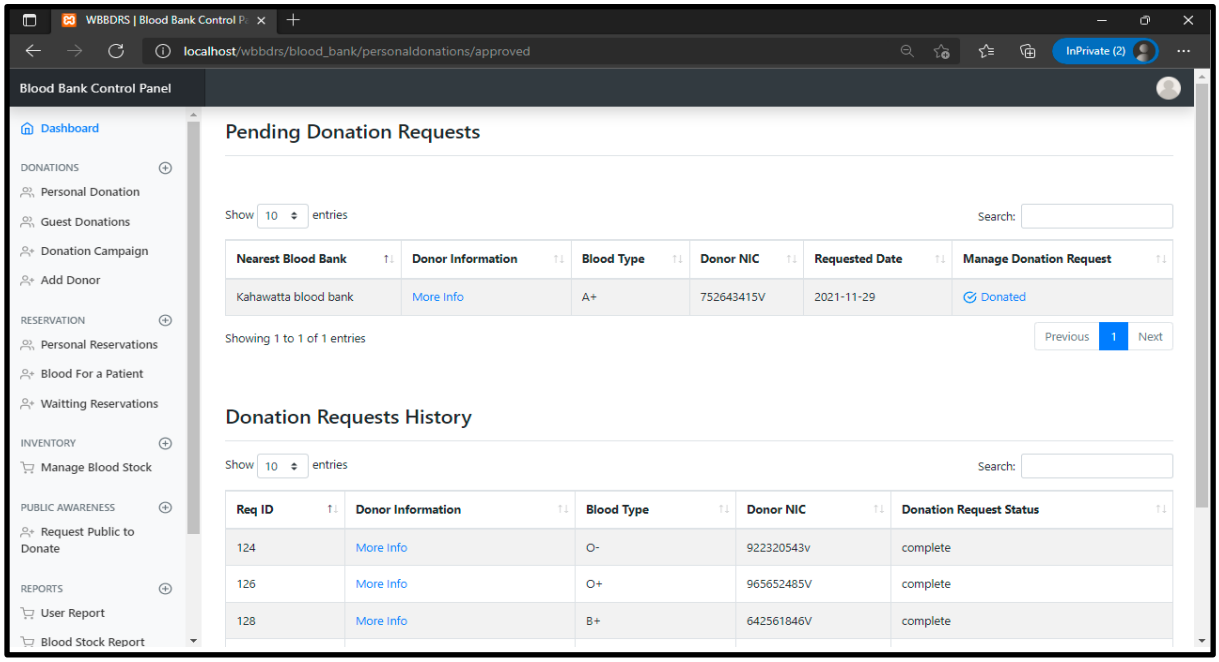


Figure D.11: After Donor donated blood

12. Below Figure D.12 shows, Blood donation campaign request and it successfully went to blood bank approval

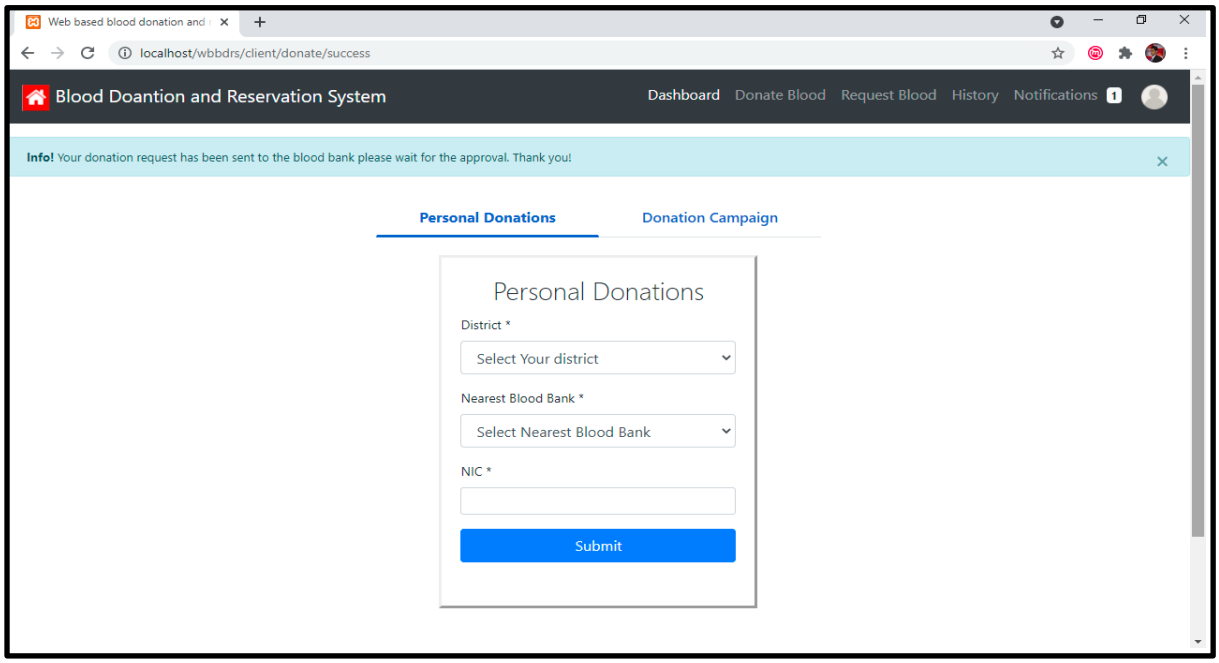


Figure D.12: Blood donation campaign request

13. Once request went to blood bank, pending notification will accrue in donor profile until blood bank accept/reject the campaign request.

Figure D.13 shows the output of Test ID 010, successfully showed the notification

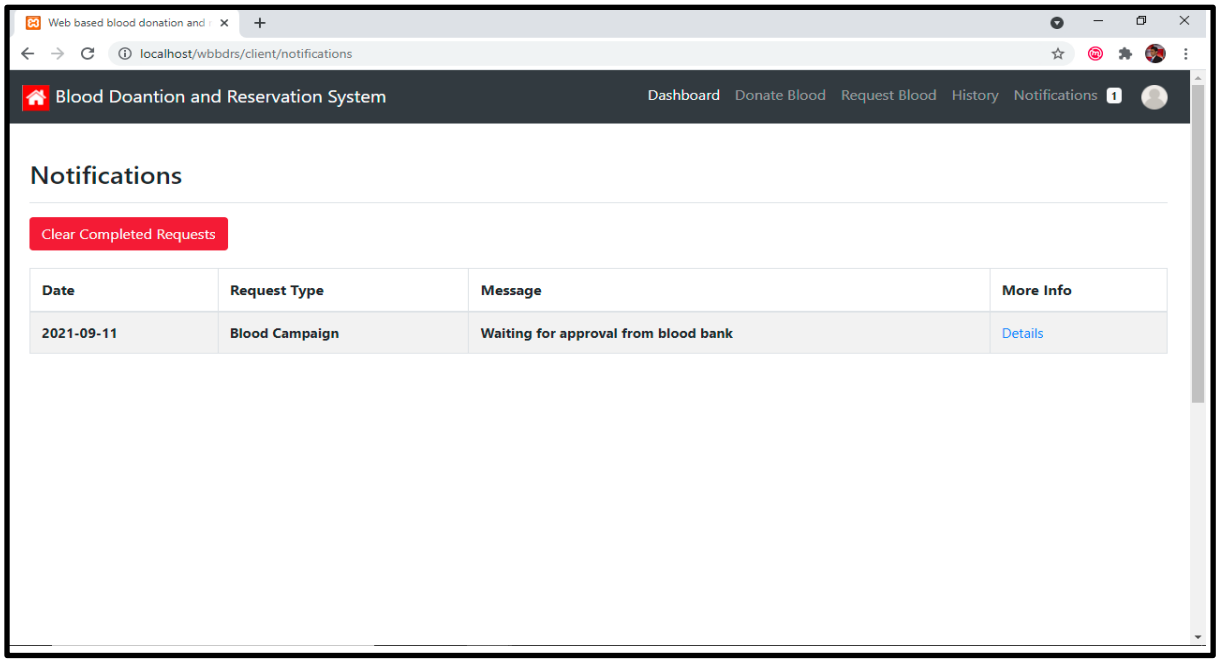


Figure D.13: Pending notification to donors

14. Accept / reject blood donation campaign by Blood bank. Below Figure D.14 Successfully got the request from donor and it is notified in the donation campaign tab. Bank will check with nearest location on availability and they successfully approve or decline the request. Once it approves or decline, request will go to campaign request history.

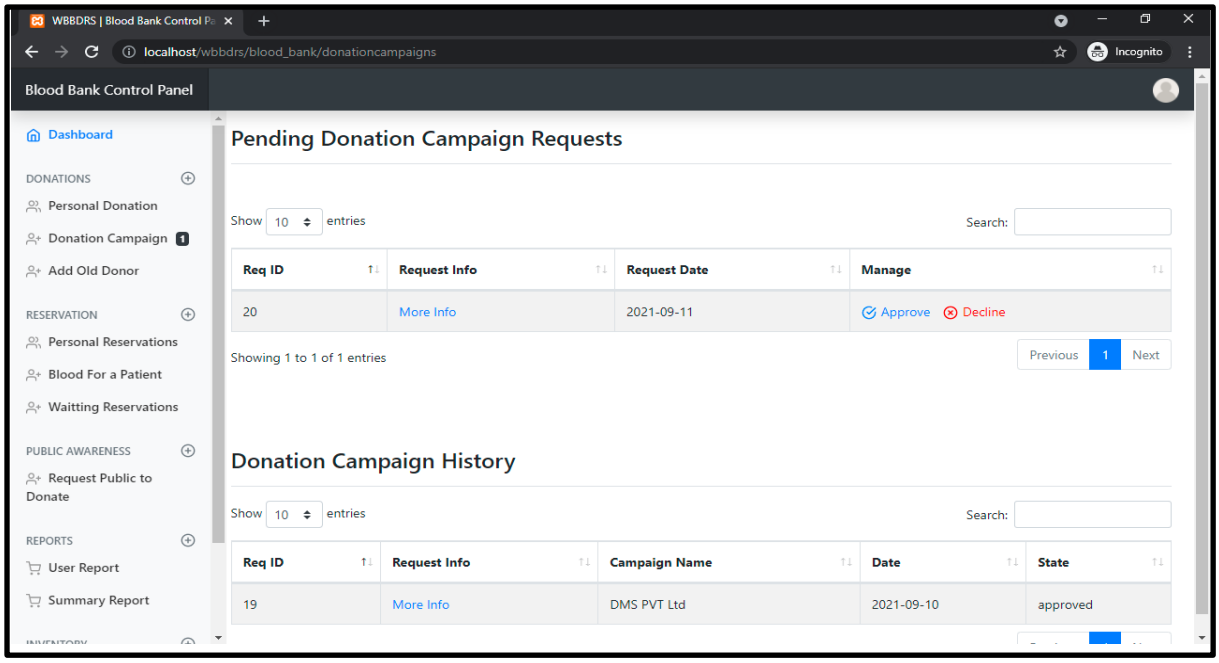


Figure D.14: Accept / reject blood donation campaign by Blood bank

15. After accepting by blood bank, donor will get the campaign confirmation notification

Figure D.15 shows the output of Test ID 010, successfully showed the notification

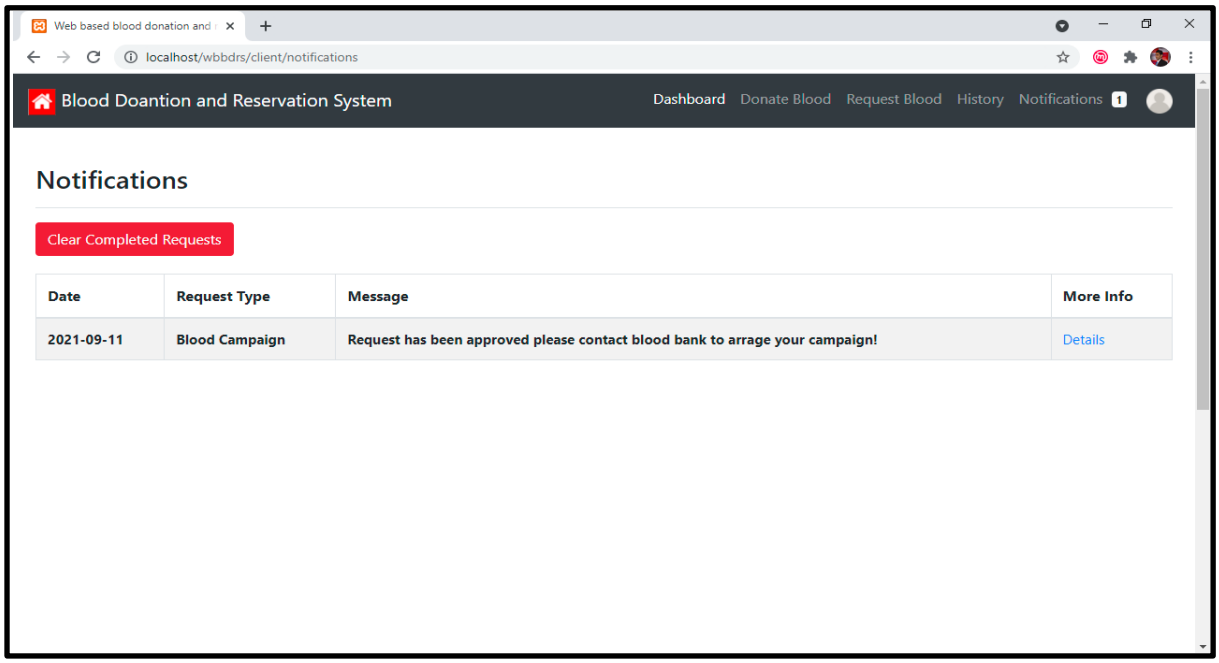


Figure D.15: Campaign confirmation notification

16. Below Figure D.16 Shows Personal blood request successfully went to blood bank for approval

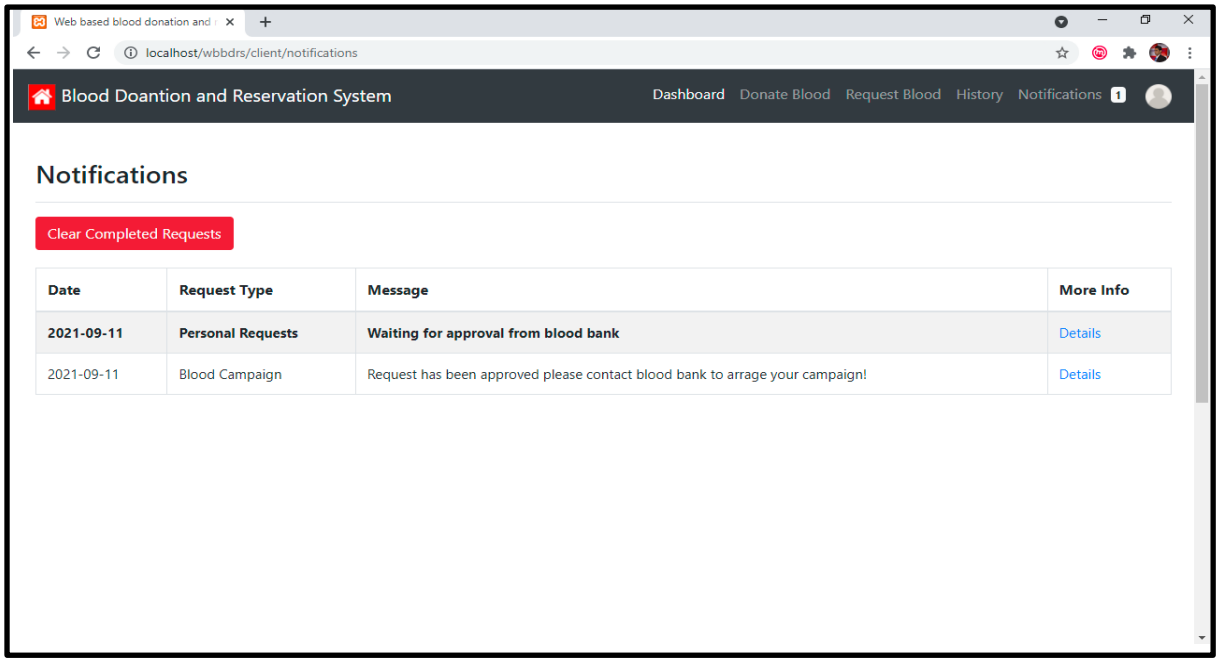


Figure D.16: Blood bank for approval

17. Below Figure D.17 shows if blood is available with blood bank. System will successfully notify that blood is available with blood bank. And it will go to blood bank for approval

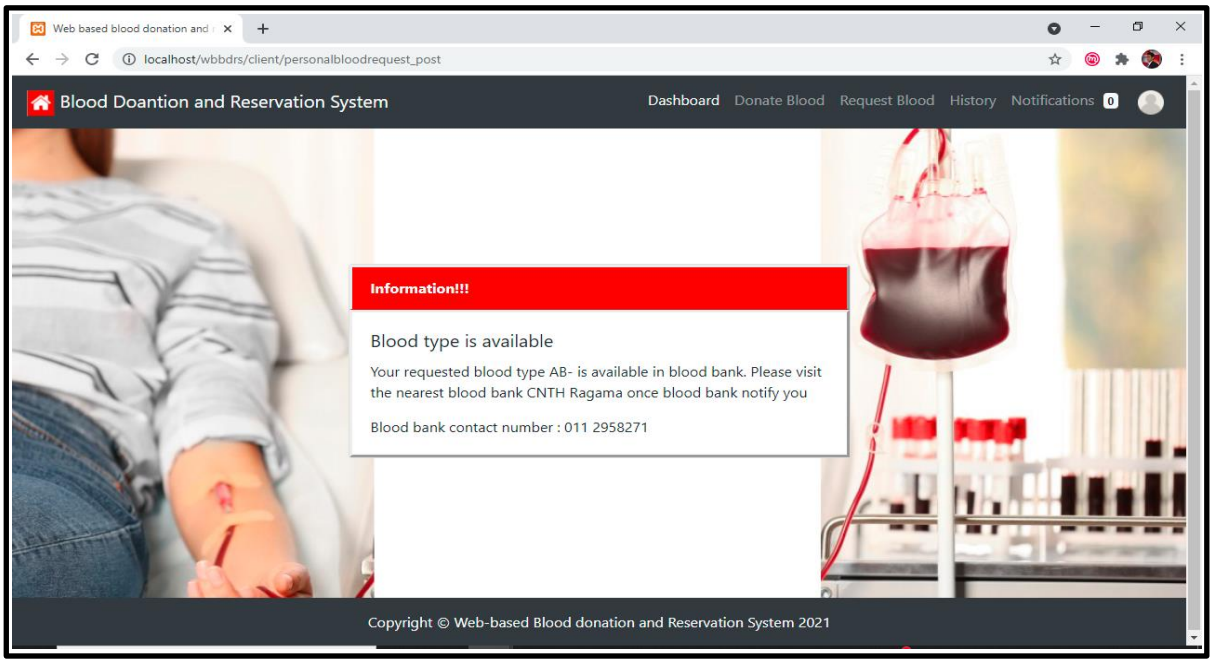


Figure D.17: blood available notification

18. Recipient will get a notification after successfully request a blood

Figure D.18 shows the output of Test ID 010, successfully showed the notification

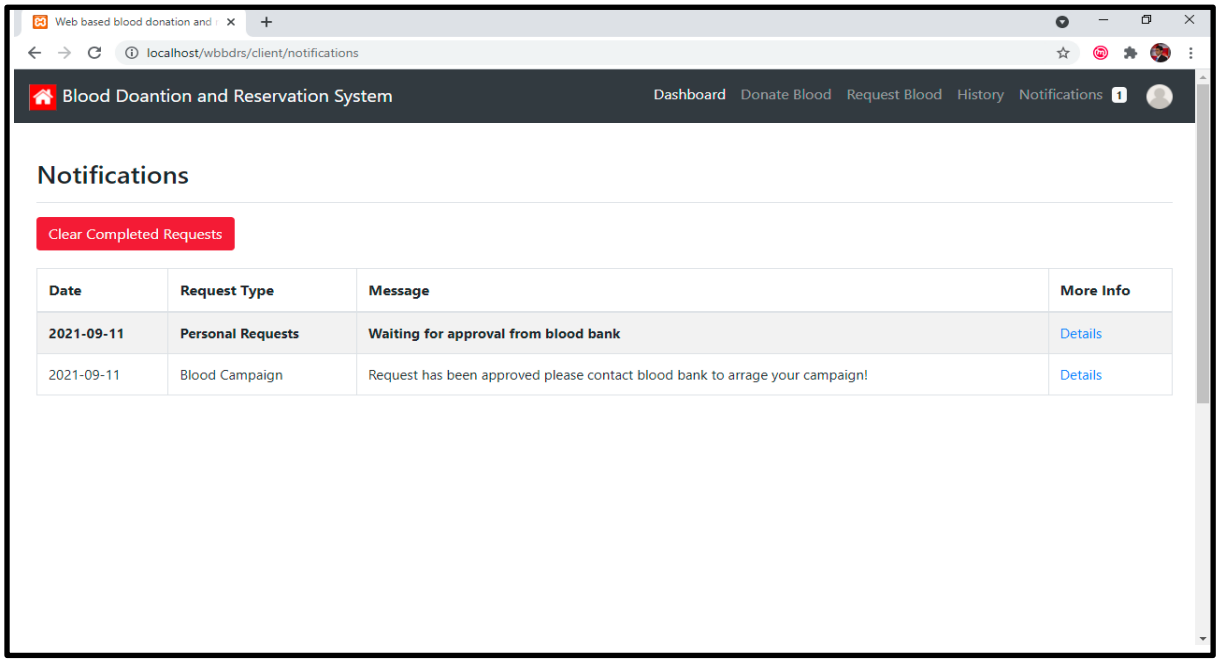


Figure D.18: Recipient notification

19. Below Figure D.19 Shows Accept / reject personal blood request or blood request for a patent by Blood bank. Successfully got the request from blood recipient and it is notified in the personal reservation tab. Bank will check with the user via mobile and they successfully approve or decline the request. Once it approve or decline, request will go to personal blood reservation history.

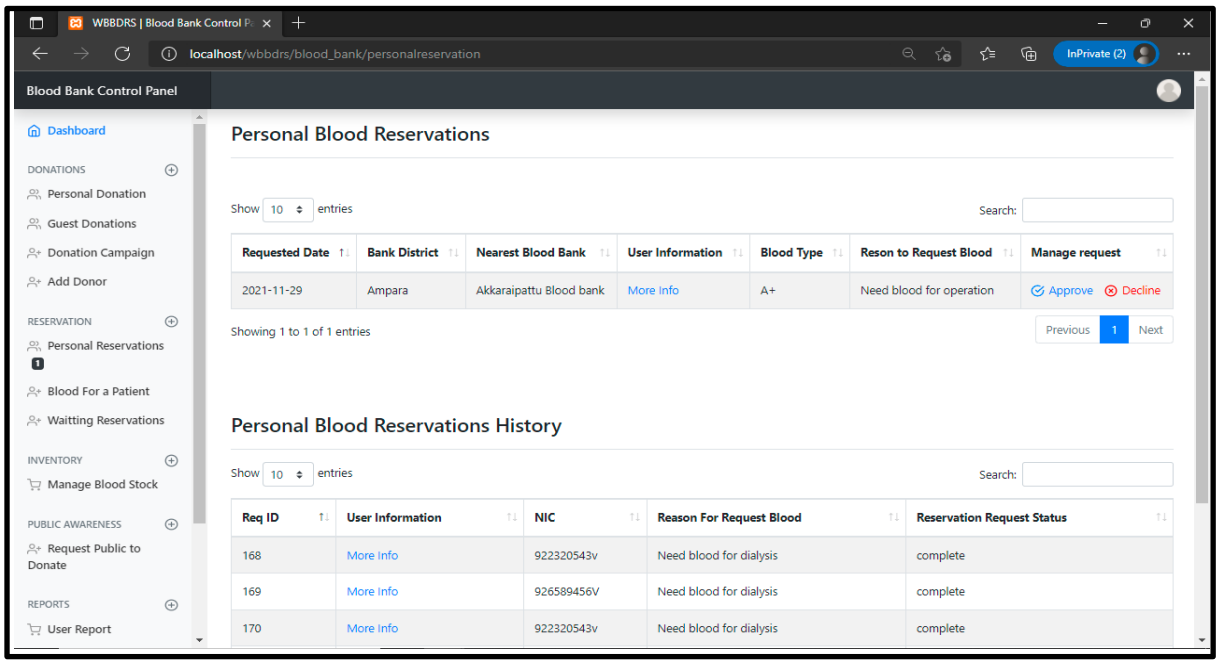


Figure D.19: Accept / reject personal blood request or blood request for a patent by Blood bank

20. Below Figure D.20 shows after accepting the request, blood bank will start the request to transportation if the location far. If the location is with the same blood bank, they will send the request to collection center to hand over the requested blood to recipient.

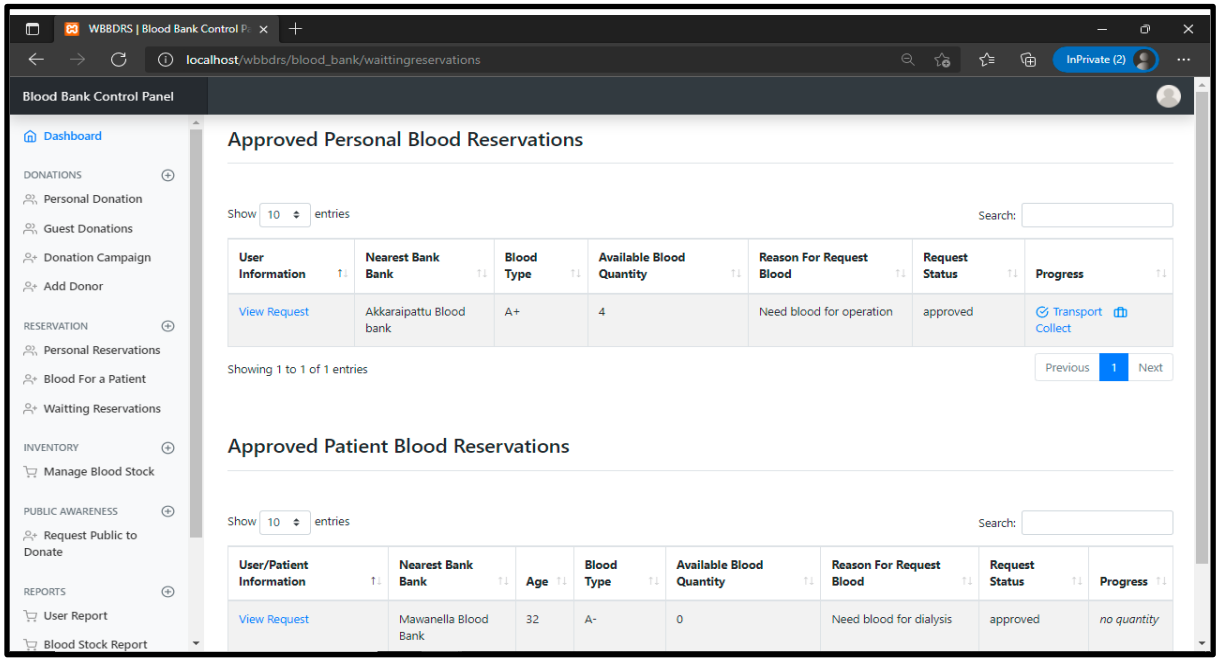


Figure D.20: Collection center request by blood bank

21. Below Figure D.21 shows if its inn the same location, blood bank will successfully send the collection request to blood collection center.

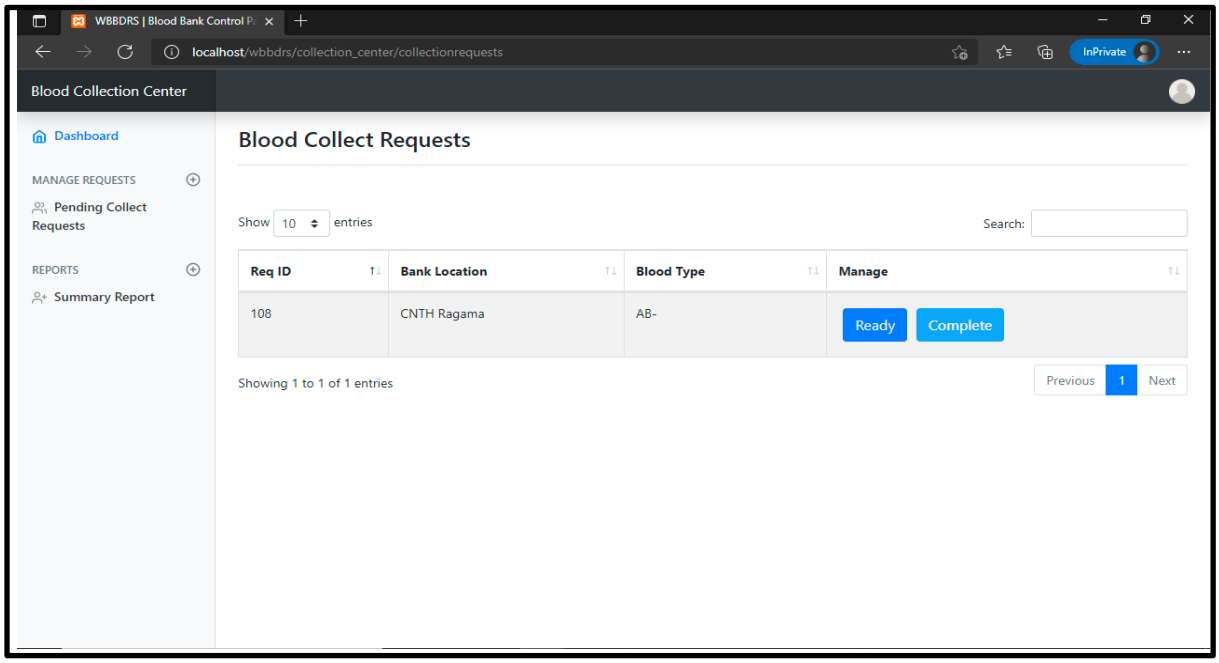


Figure D.21: Collection request to transportation by blood bank

22. Below Figure D.22 Shows that once collection center gets the notification, they will inform recipient to collect blood. Once they collect blood, they will notify to blood bank by clicking complete button.

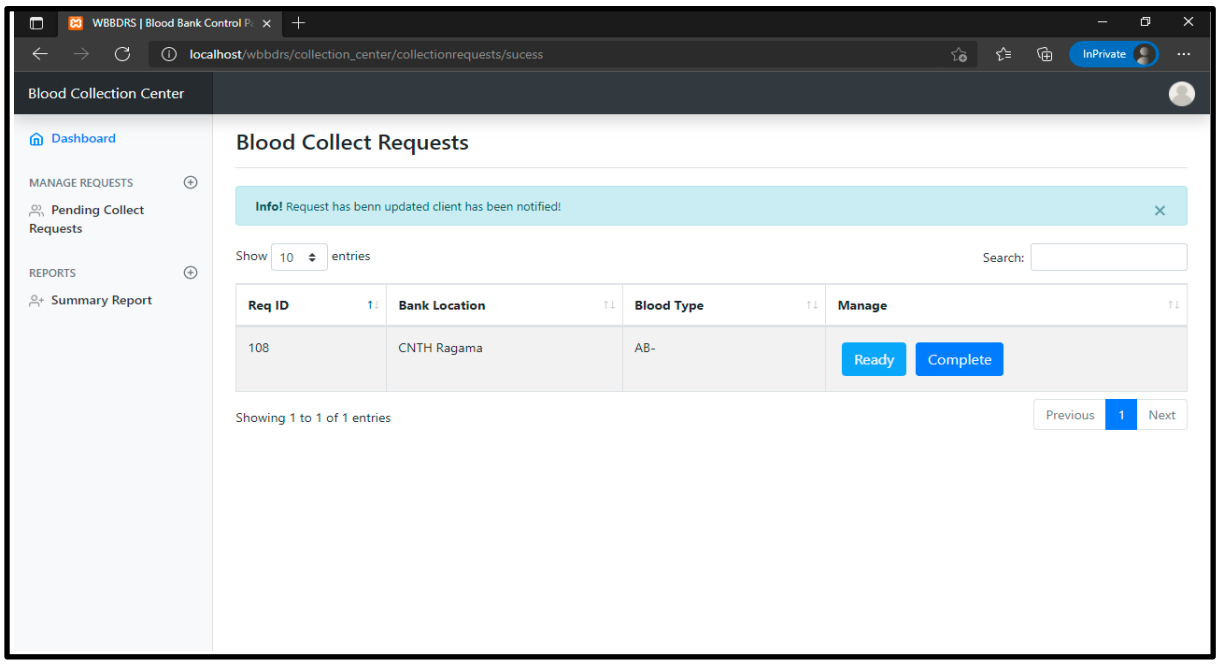


Figure D.22: Notifaction request to recipient

23. Recipient will get the conformation by collection center to collect blood.

Figure D.23 shows the output of Test ID 026, successfully showed the notification

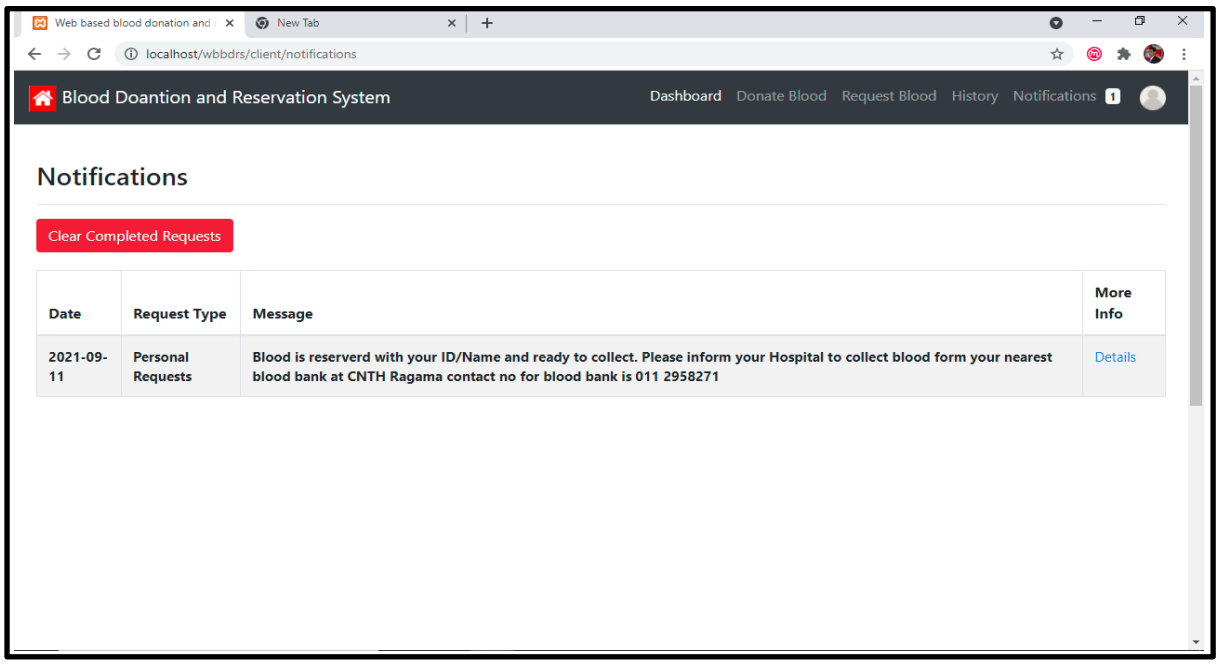


Figure D.23: Conformation request by system to recipient

Same process will happen to blood request for a patient if blood available in blood bank.

24. If the blood is not available, request will go to blood bank and blood bank will accept/ reject request. Once they accept, existing donors will get an email for a donation request. Below Figure D.24 shows the request sent to donors.

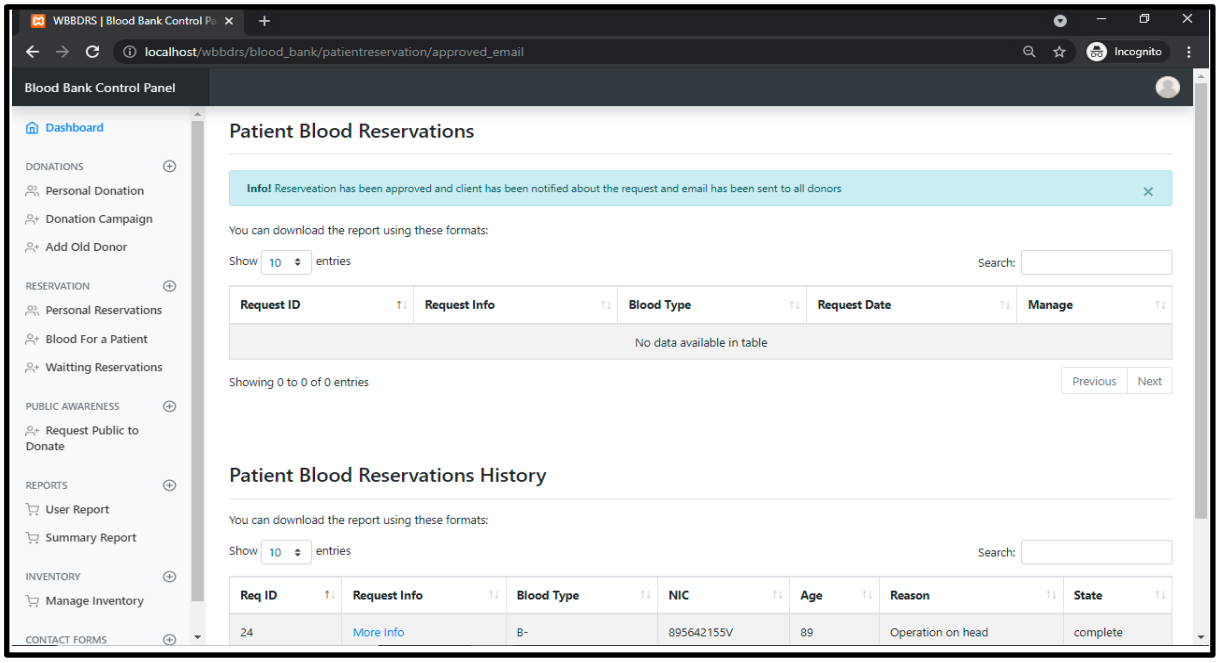


Figure D.24: Transportation request by blood bank

25. Below Figure D.25 shows existing donor got a donation request by email successfully

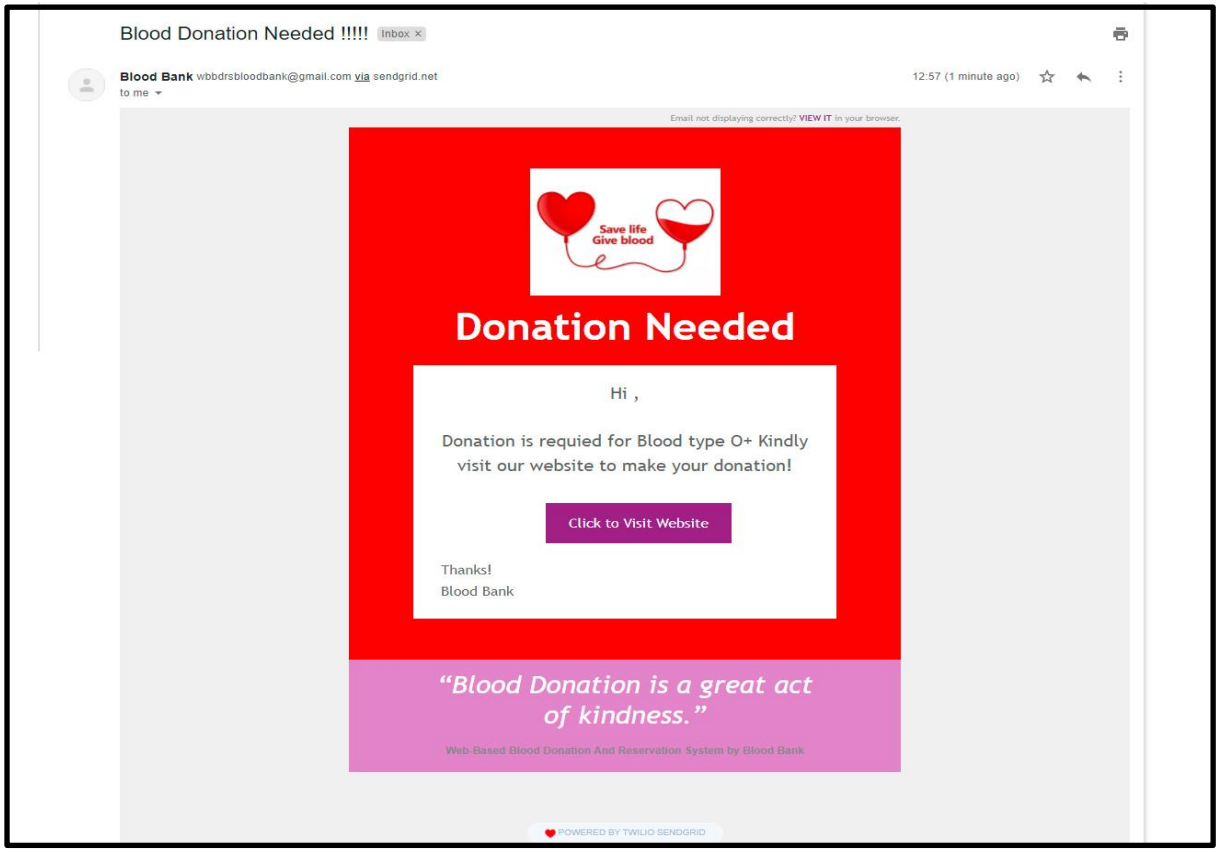


Figure D.25: Email request to donate blood

26. Below Figure D.26 shows the SMS which successfully sent to existing donors.

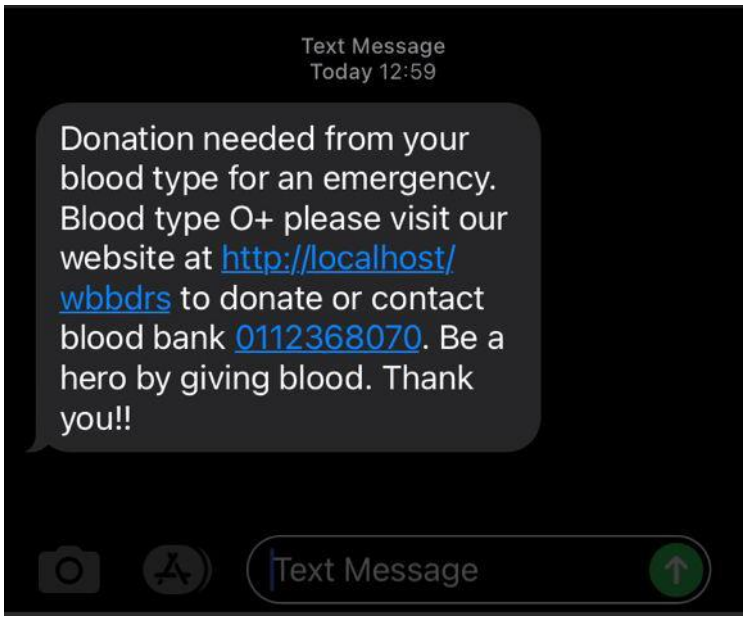


Figure D.26: SMS Request to donate blood

27. Blow Figure D.27 show that until donor donate blood, request will notify in waiting reservation with no quantity update.

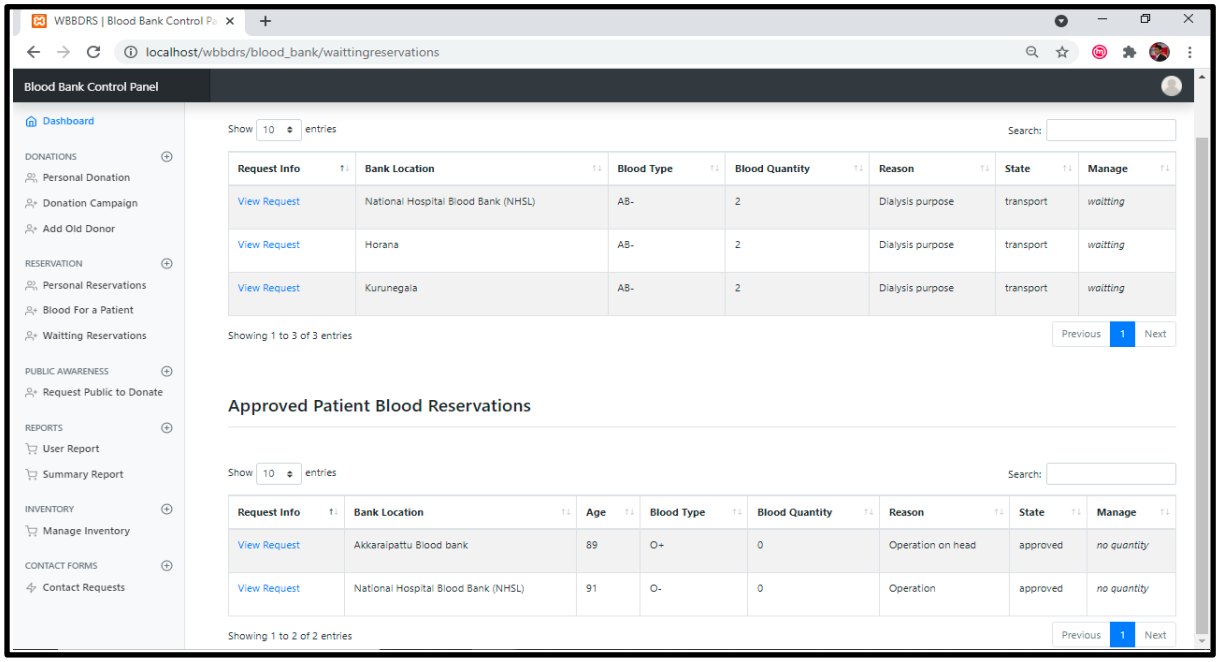


Figure D.27: Waiting reservation with no quantity update

28. User will notify on waiting for donors

Figure D.28 shows the output of Test ID 010, successfully showed the notification

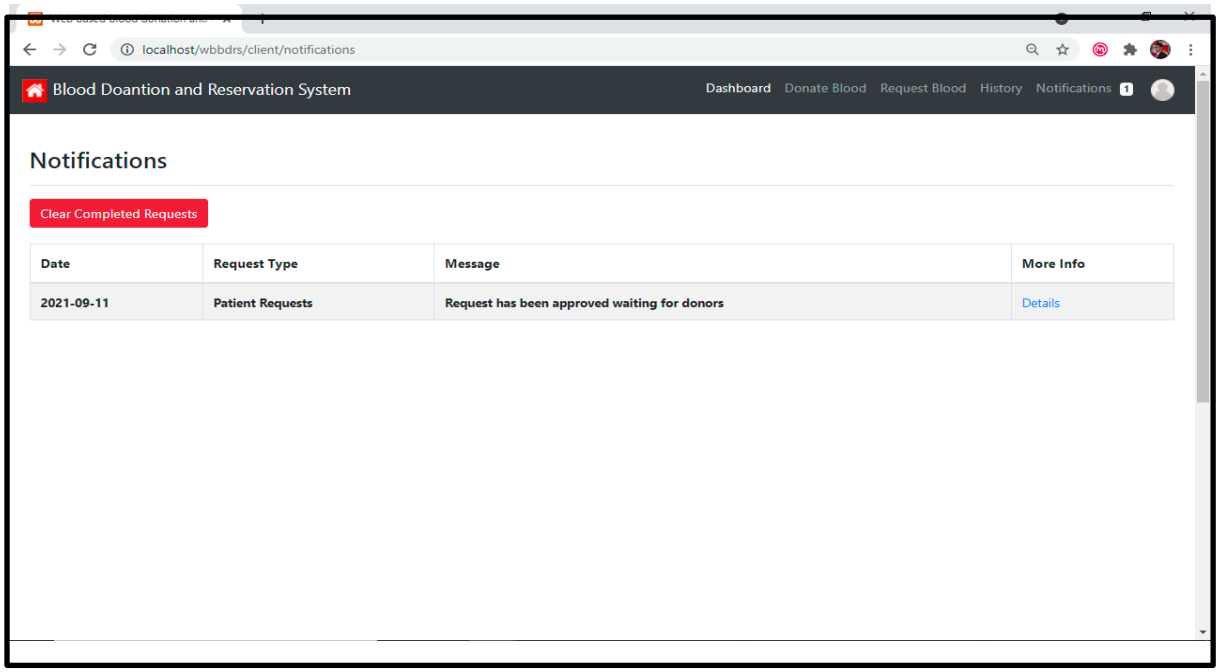


Figure D.28: User notification

29. Once a particular donor donated the blood and if the blood inventory updates the quantity of the blood will notify the availability.

Figure D.29 shows the output of Test ID 017, successfully shows the availability

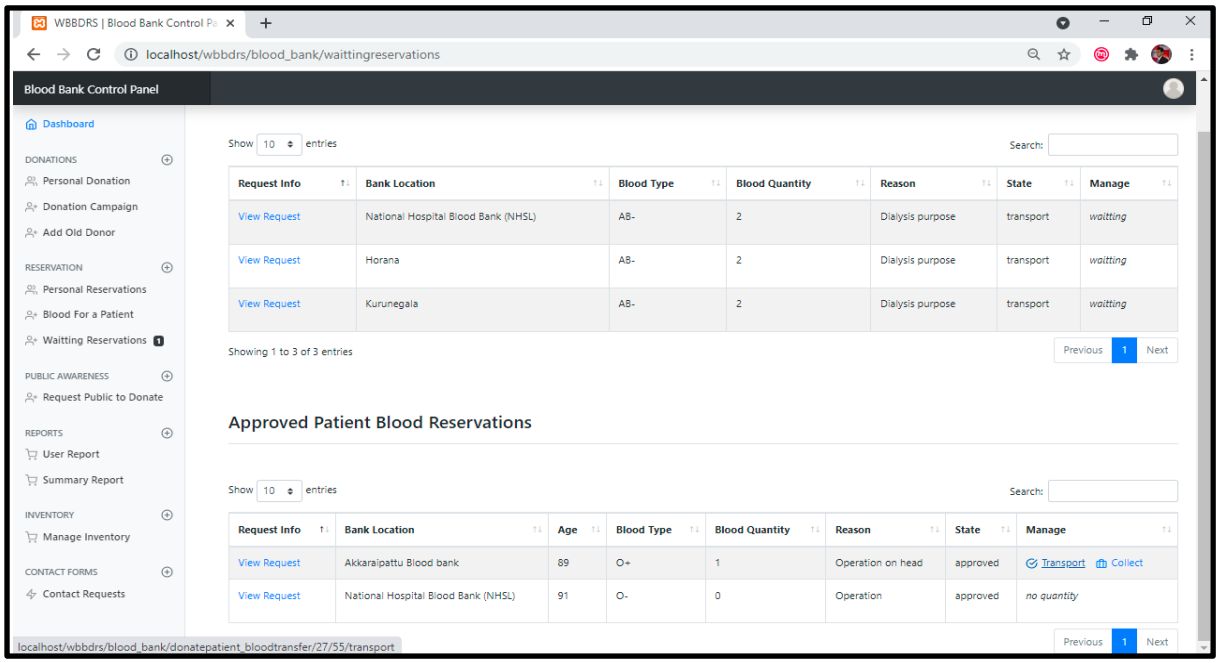


Figure D.29: Blood availability notification

30. Once its available blood bank can request for transportation if the location is far. If not blood bank can request to collection center to handover the blood to recipient.

Figure D.30 shows the output of Test ID 017, successfully request for transportation /collection center.

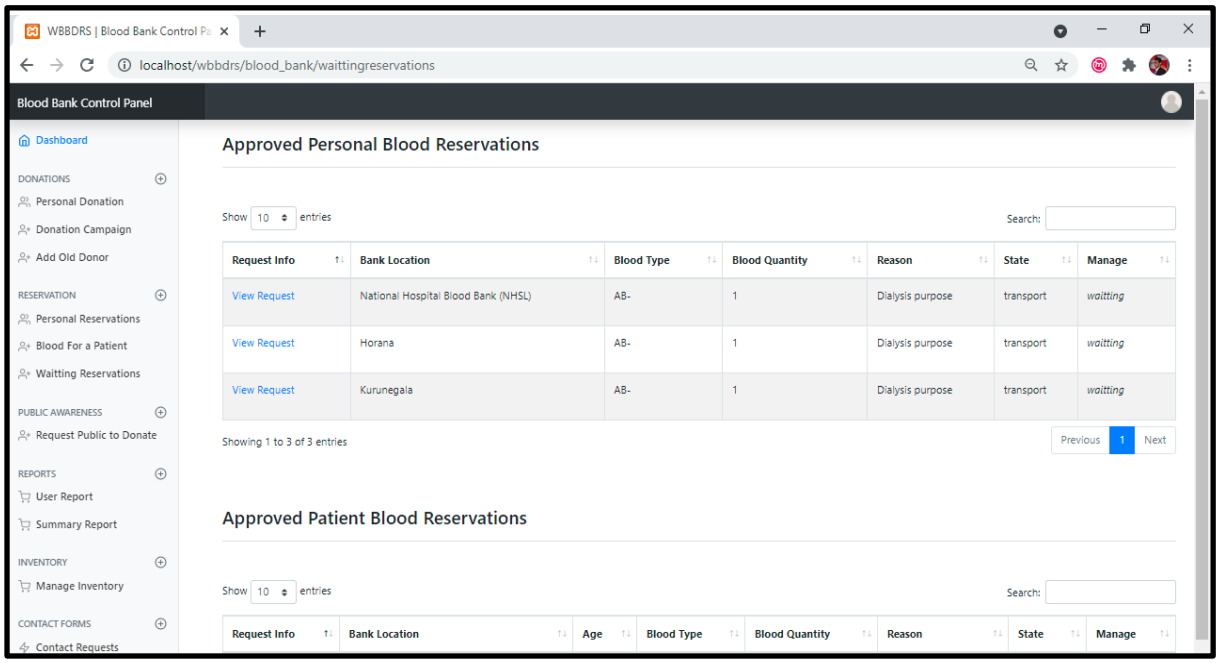


Figure D.30: Transportation request by blood bank

31. User will get the notification, waiting for transportation.

Figure D.31 shows the output of Test ID 010, successfully showed the notification

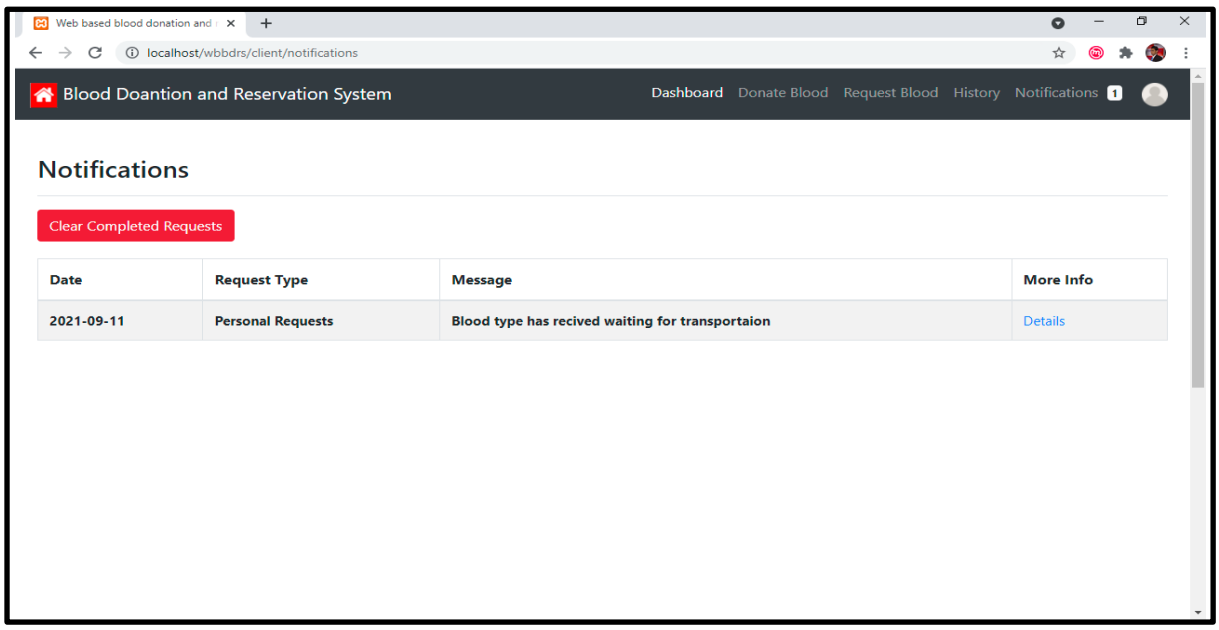


Figure D.31: User Notification

32. Once blood bank request for transportation, transportation will get the request.

Figure D.32 shows the output of Test ID 021, collected blood successfully by transportation

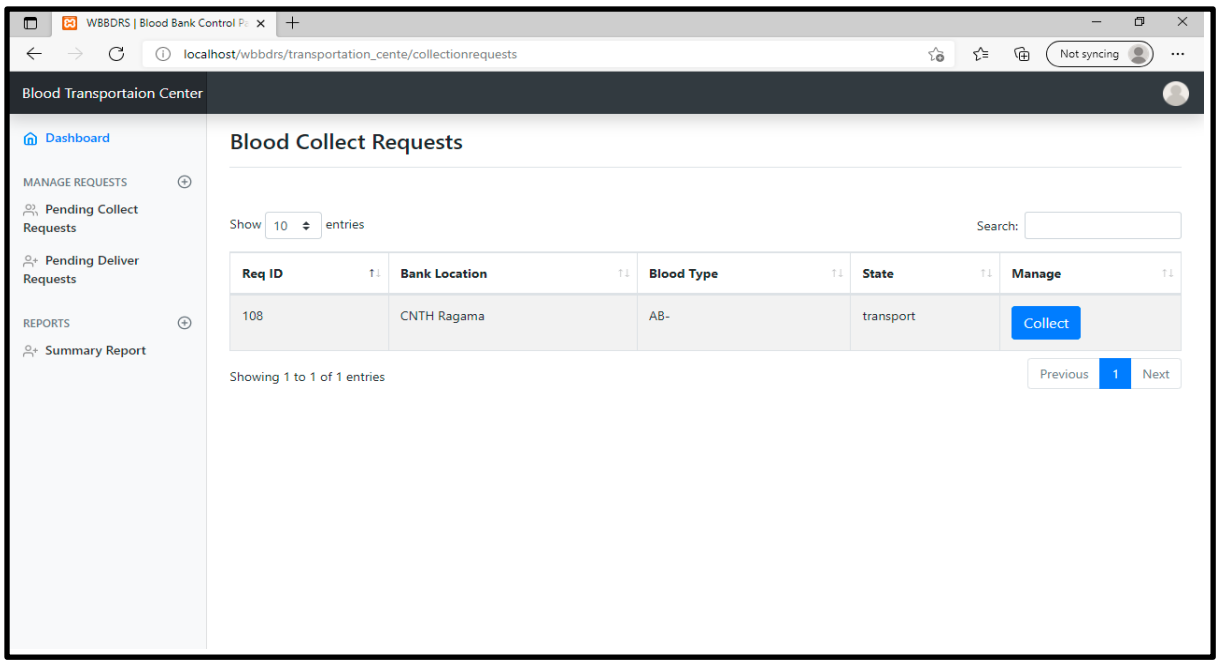


Figure D.32: Transportation view

33. Once they get the request recipient will get the notification with collected by transportation

Figure D.33 shows the output of Test ID 010, successfully showed the notification

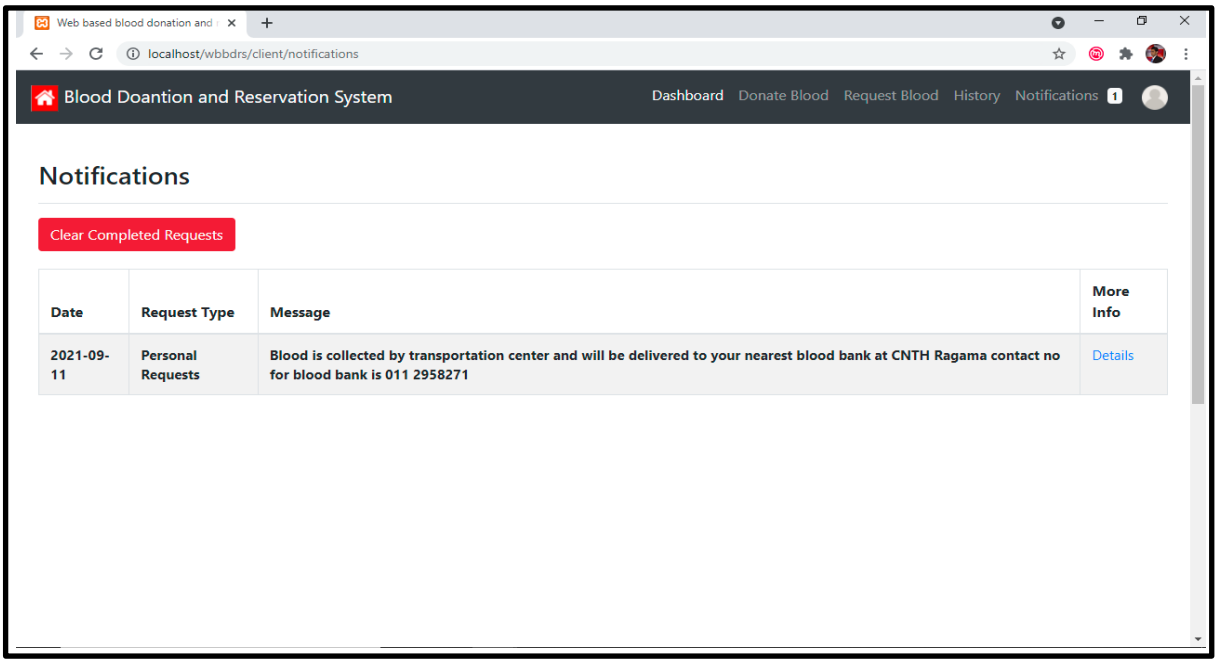


Figure D.33: Recipient noitification

34. Once the transportation hand over the blood to collection center. System will notify the delivery.

Figure D.34 shows the output of Test ID 022, successfully sent delivery request

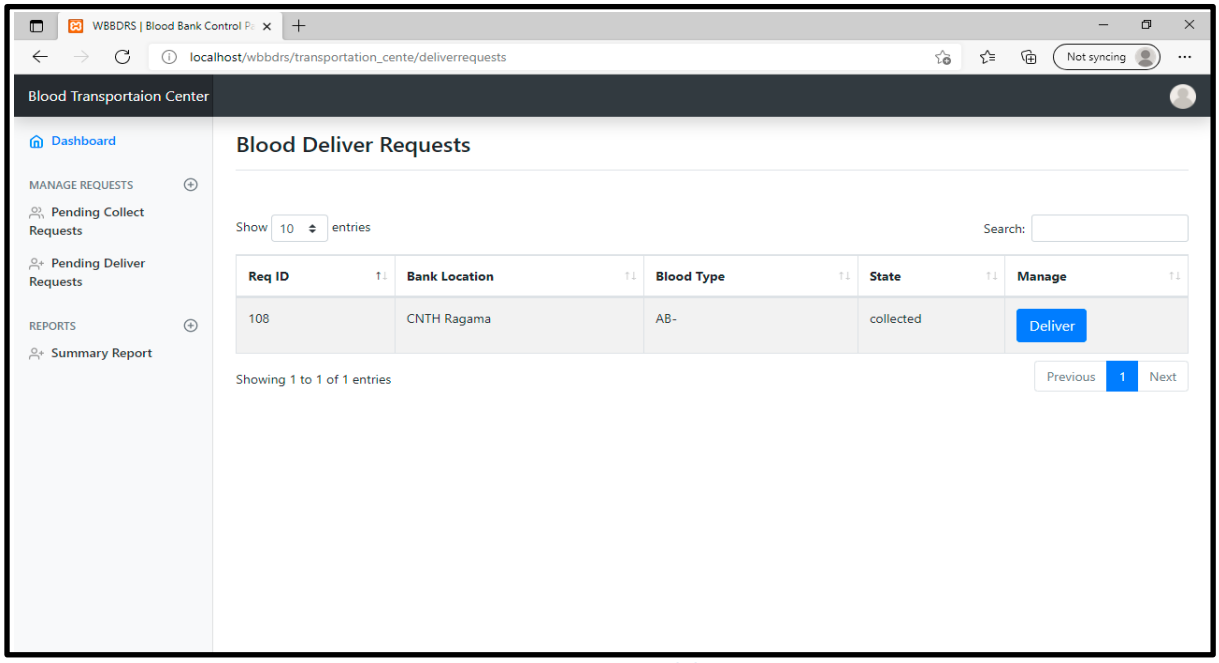


Figure D.34: Transportation delivery request

35. Once the blood got handed over to nearest blood bank will also get notify to recipient.

Figure D.35 shows the output of Test ID 010, successfully showed the notification

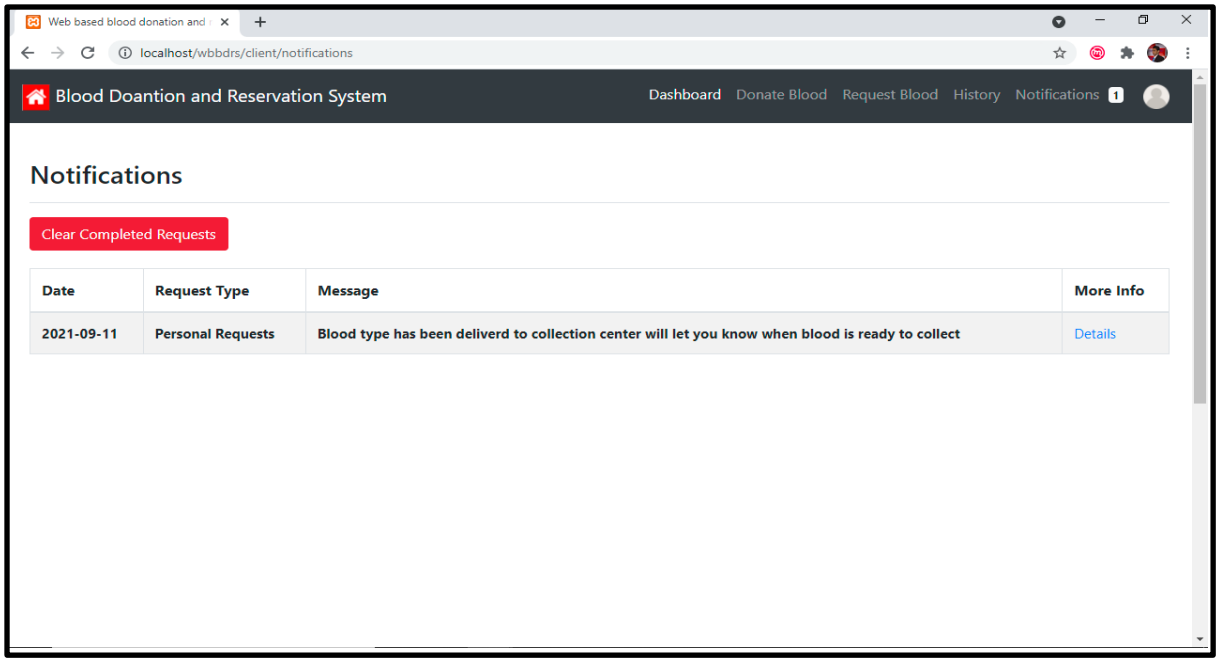


Figure D.35: Blood hand over notification to recipient

36. Collection center will notify the recipient by adding ready to collect note to the system.

Figure D.36 shows the output of Test ID 026, successfully request to collect blood.

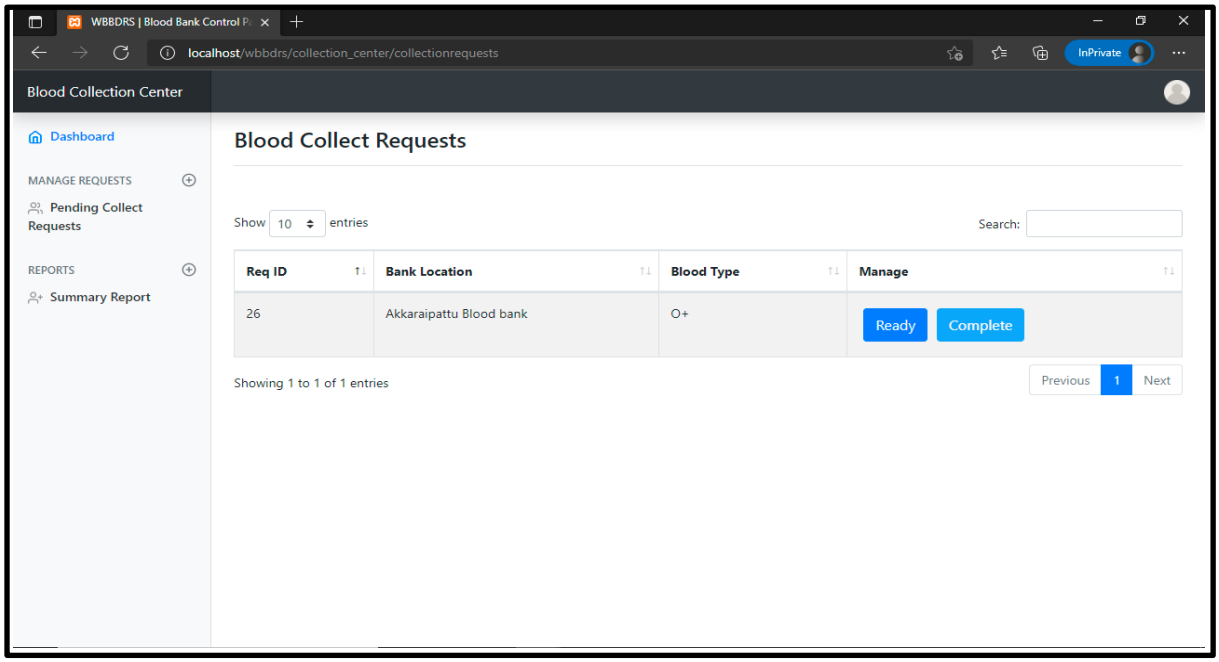


Figure D.36: Collection center view

37. Recipient will get the notification successfully.

Figure D.37 shows the output of Test ID 010, successfully showed the notification

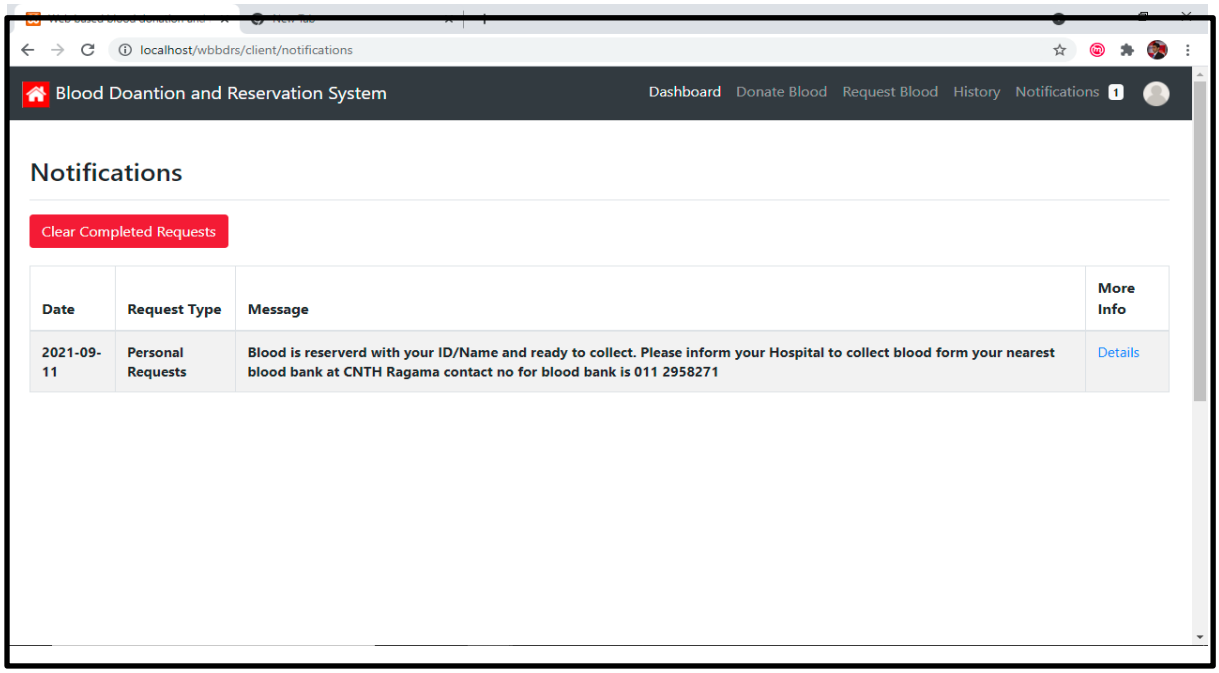


Figure D.37: Ready to collect notification to recipient

38. Also, Blood bank will also see the process until it hands over to recipient.

Figure D.38 shows the output of Test ID 016, successfully showed the status of the request

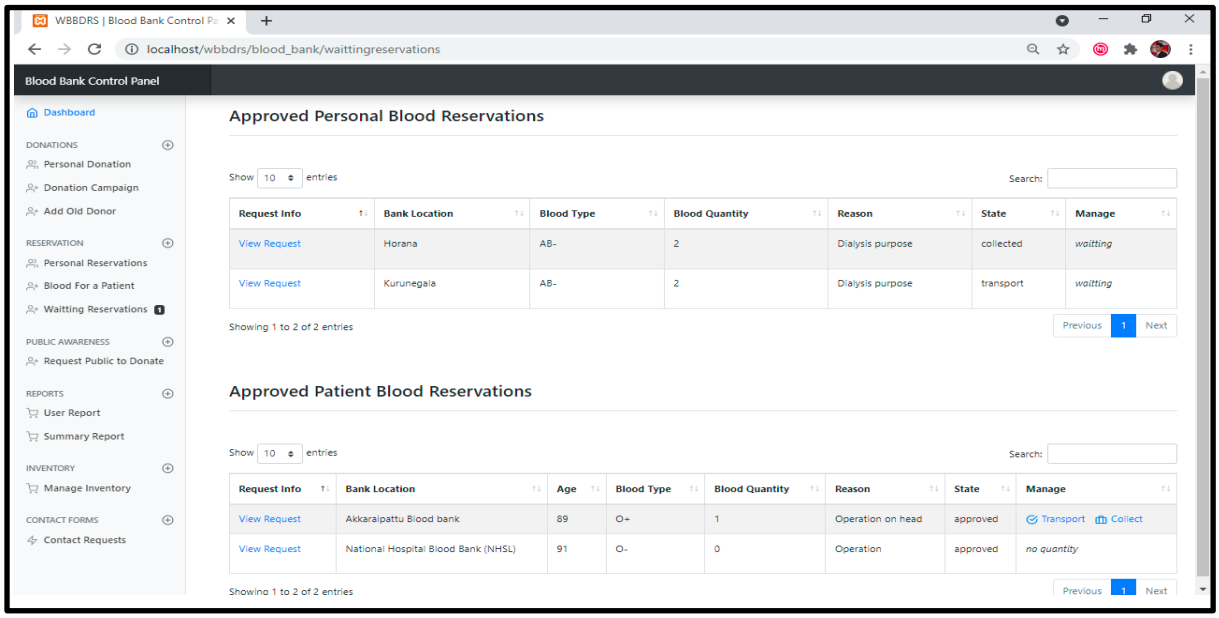


Figure D.38: Status on blood bank view

Same process will happen to blood request for a patient when they successfully request blood through the system.

39. Manage Blood stock will get update automatically/ manually also, when a donor donated blood, it will add automatically when blood bank clicks on donated button. When blood bank request to collection center / transportation for a blood reservation will get deduct automatically from blood stock through this system.

Figure D.39 shows the output of Test ID 018, successfully updated inventory.

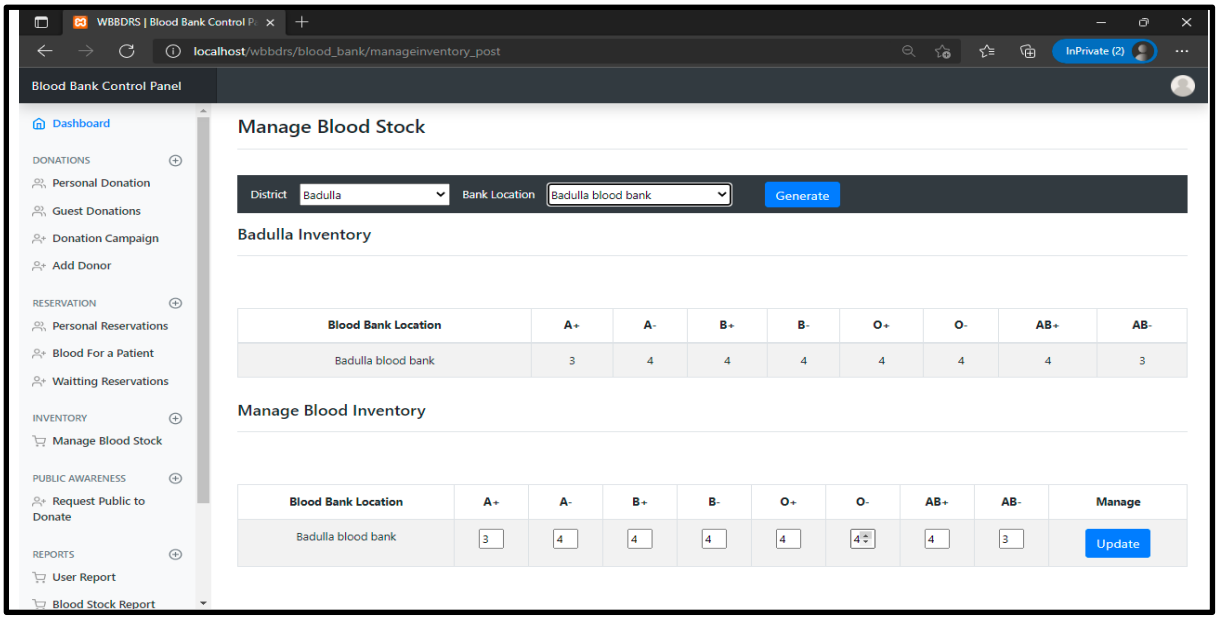


Figure D.39: Update blood available inventory

40. Successfully add old donor to the database

Figure D.40 shows the output of Test ID 019, successfully added old donors

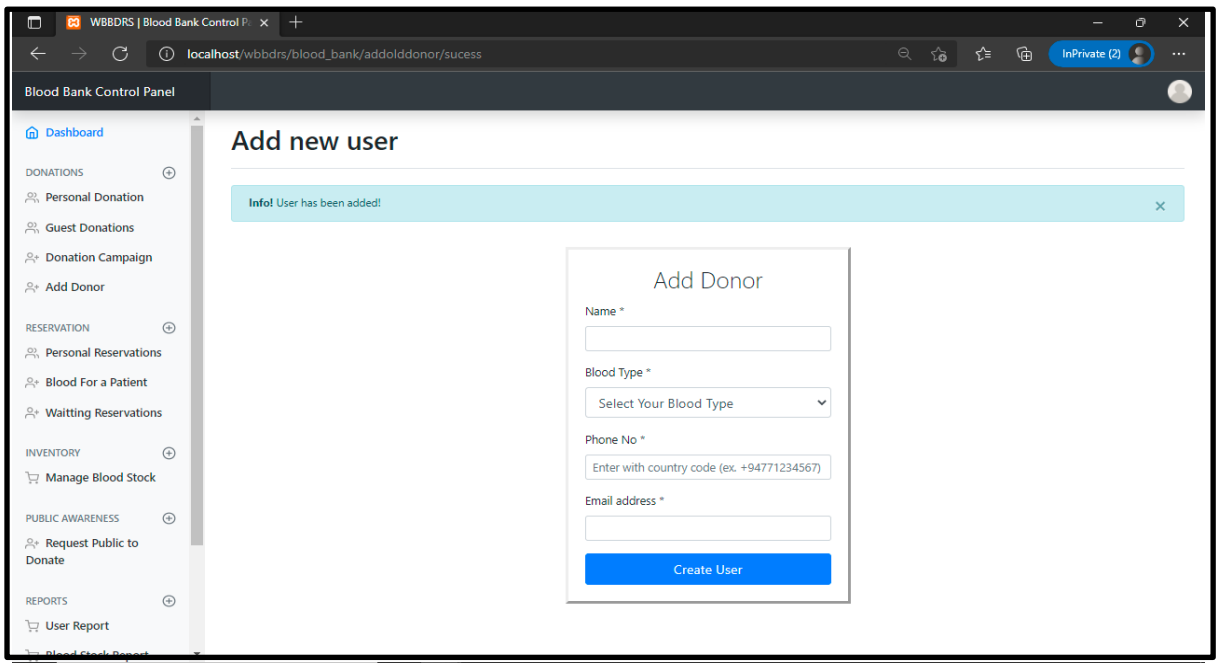


Figure D.40: Add Old blood donor details

41. Forgot password

Below Figure D.41 shows that Test ID 029 forgot password link work successfully worked.

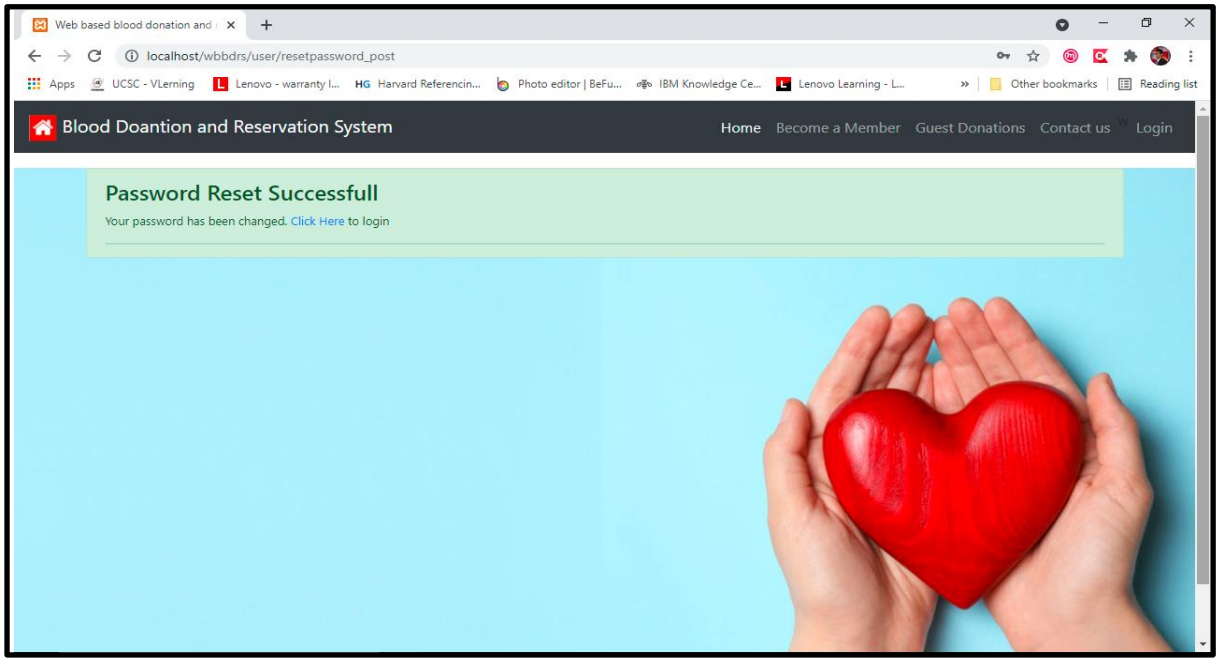


Figure D.41: Forgot password

E. Appendix E – User manual

User Manual
for
Web-based Blood Donation and Reservation System

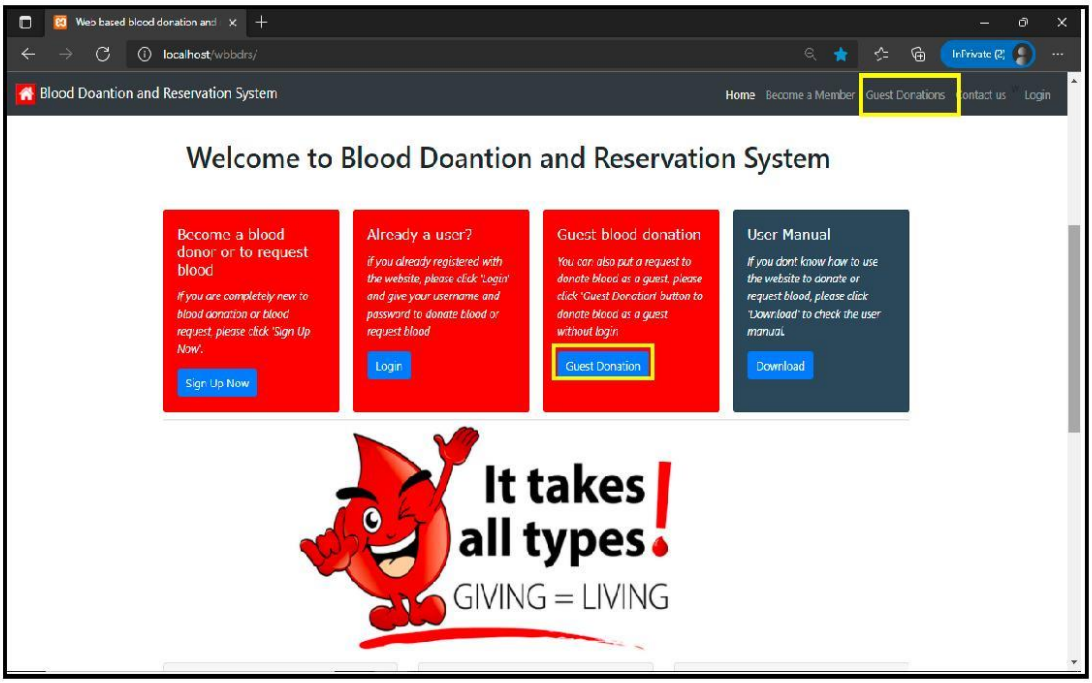
Well come to Blood bank

Thank you for your support to save lives by donate blood and you can request blood through this Web-based system for your emergency need.

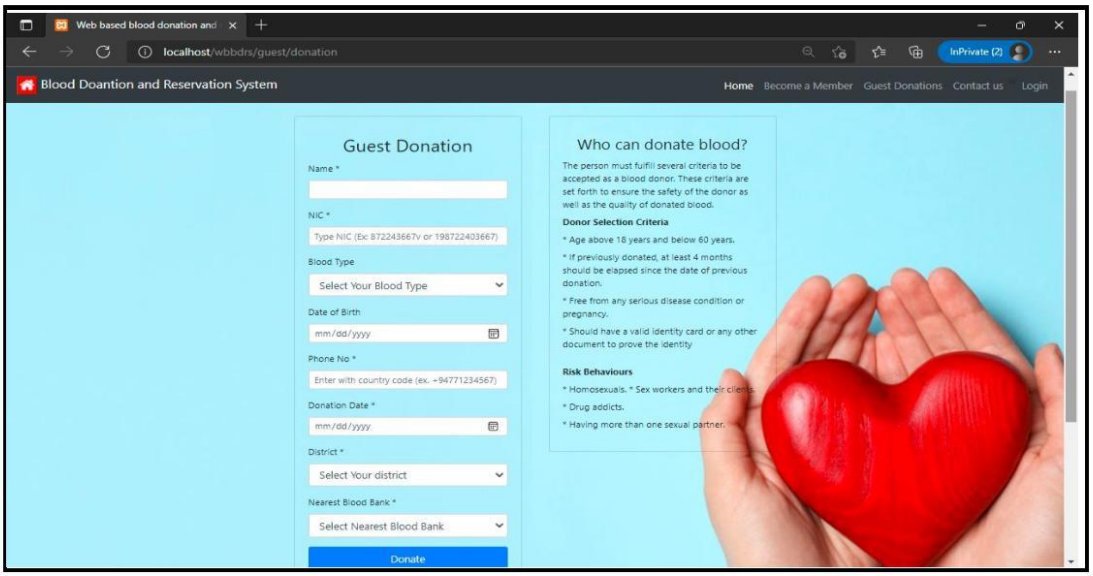
1. How you can donate / request blood

1.1 Guest login

i. Go to http://localhost/wbbdrs/ and click on Guest login button / Guest Donations tab on the header of the web site to donate as a guest. Note that you will be get Realtime notification and you can request blood for you / on behalf of a patient when you register and login to the system. 1.2 shows how to register and login to system.

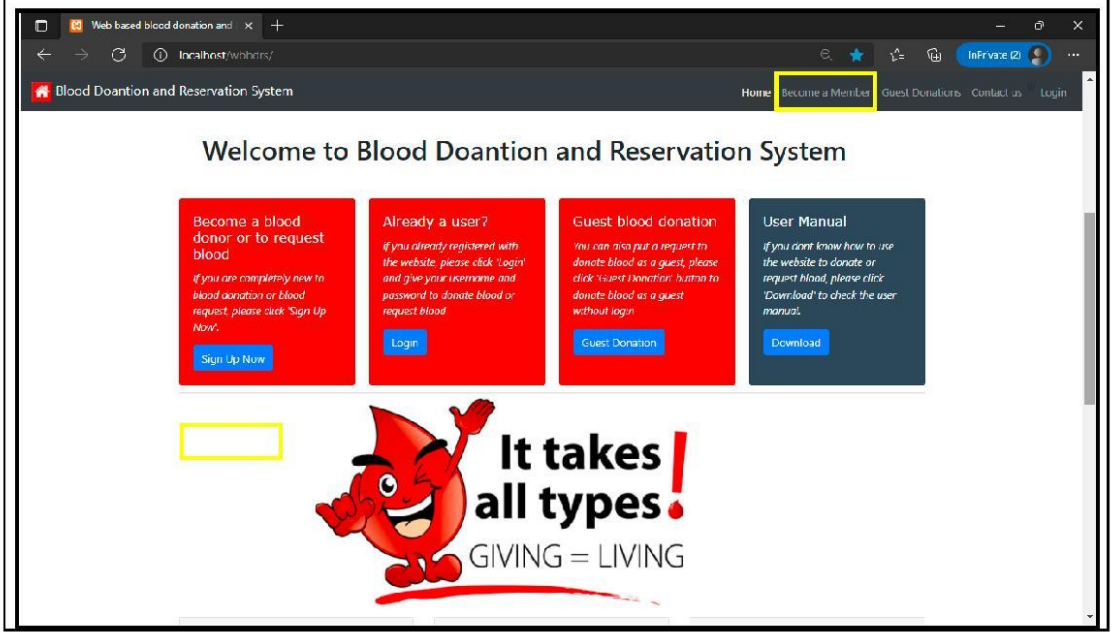


ii. Enter your personal details with nearest blood bank to donate blood. Once you request, you can go to your nearest blood bank and donate.

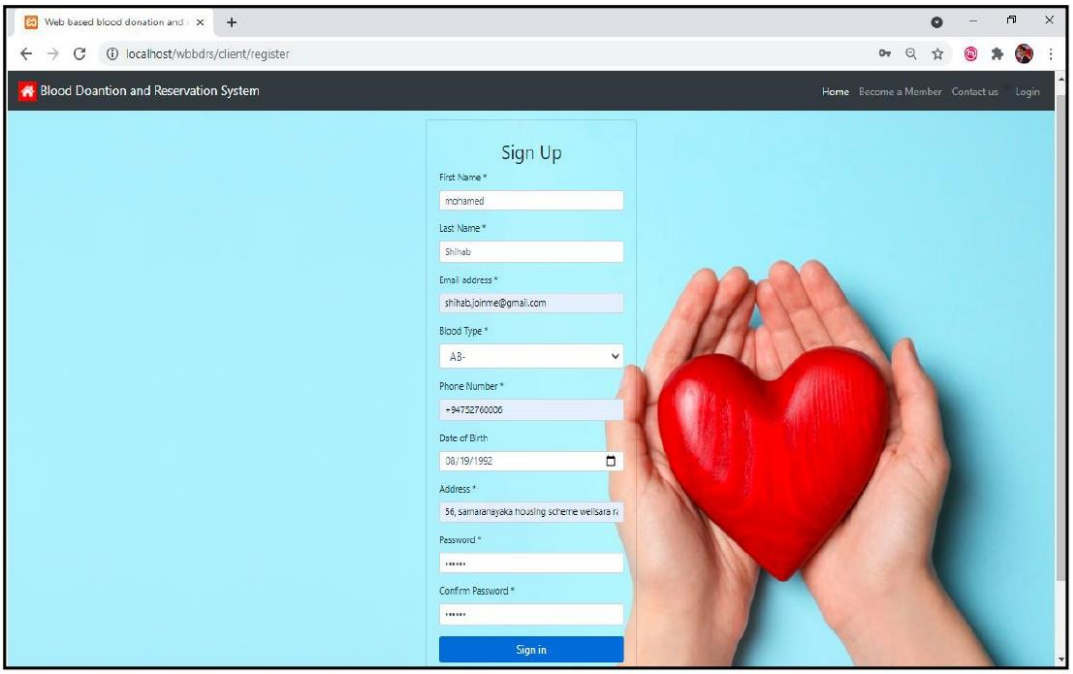


1.2 Register yourself to donate/ request blood

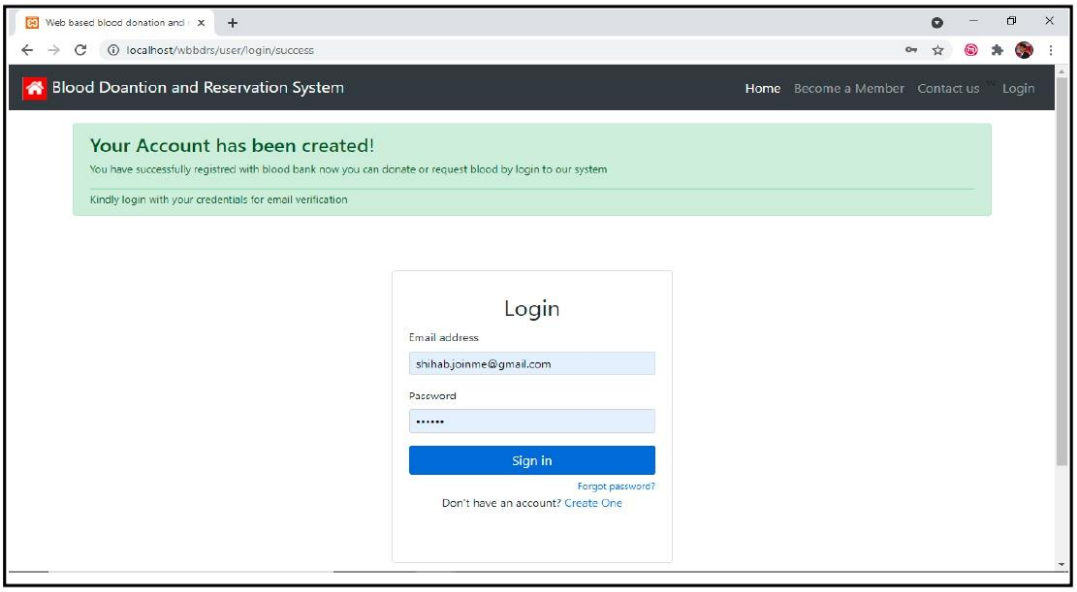
i. Go to http://localhost/wbbdrs/ and click on Sign Up button / Become a member tab on the header of the web site.



ii. Once you click on the Become a member you will get below registration form. Kindly fill the form with your correct details. Also put a password to your account. Example details in below figure shows for your reference.

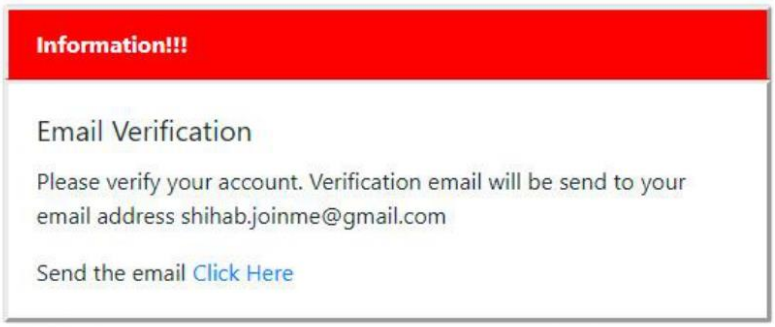


iii. Once you register successfully. You will get a notification like figure

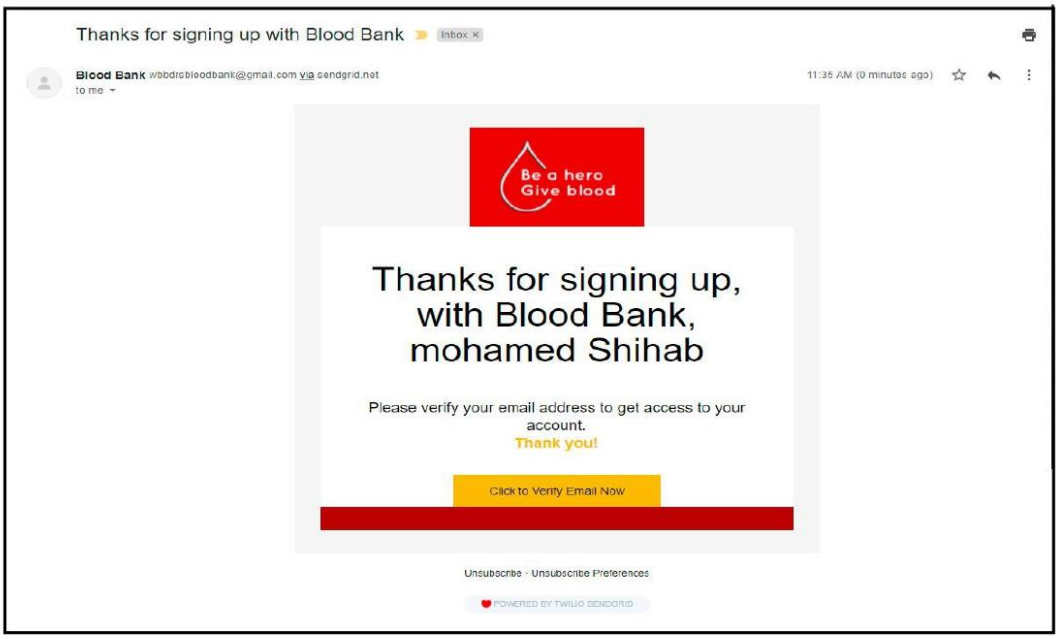


iv. Now you can login with your email and password which you gave in registration part.

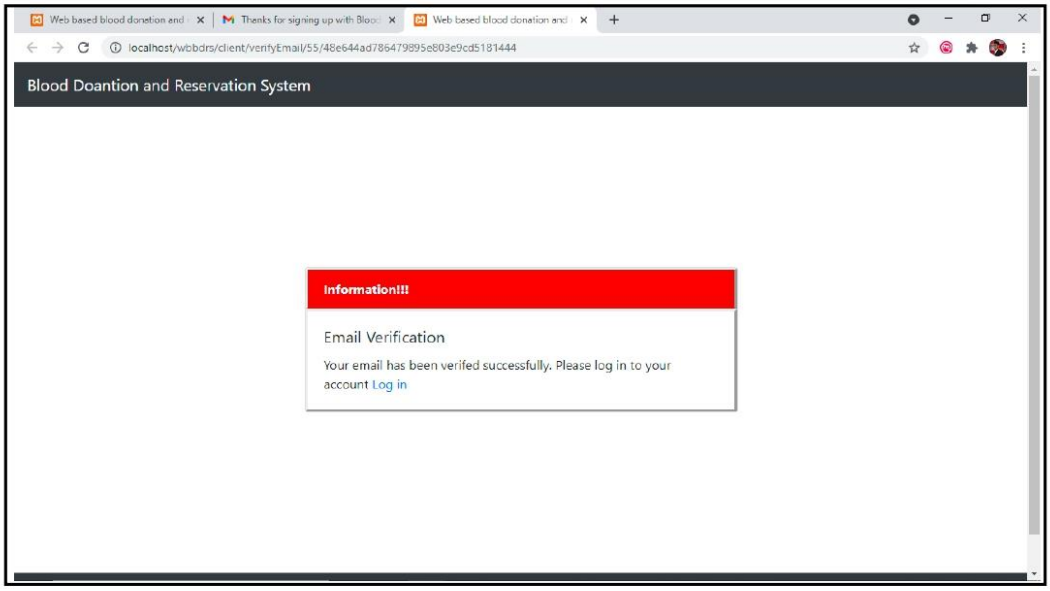
v. After you login, you have to verify you email. To verify your email, kindly click the click here notification in blue colour.



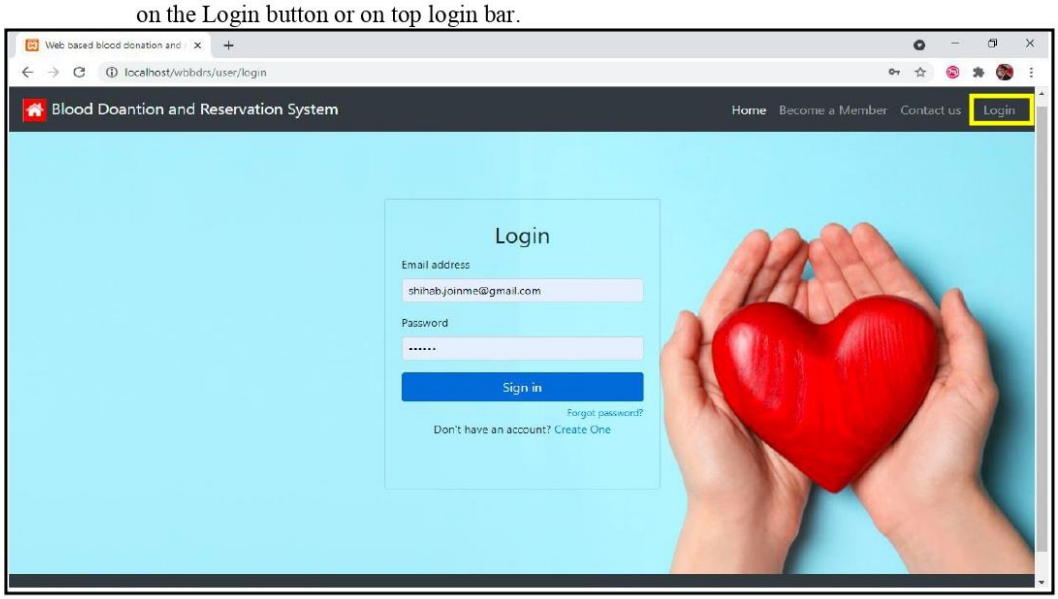
vi. Once you click that, you will get a conformation email to verify your mail. After that kindly click Verify email now button to validate your email.



vii. Once you validate you will get a conformation with the Web-based system

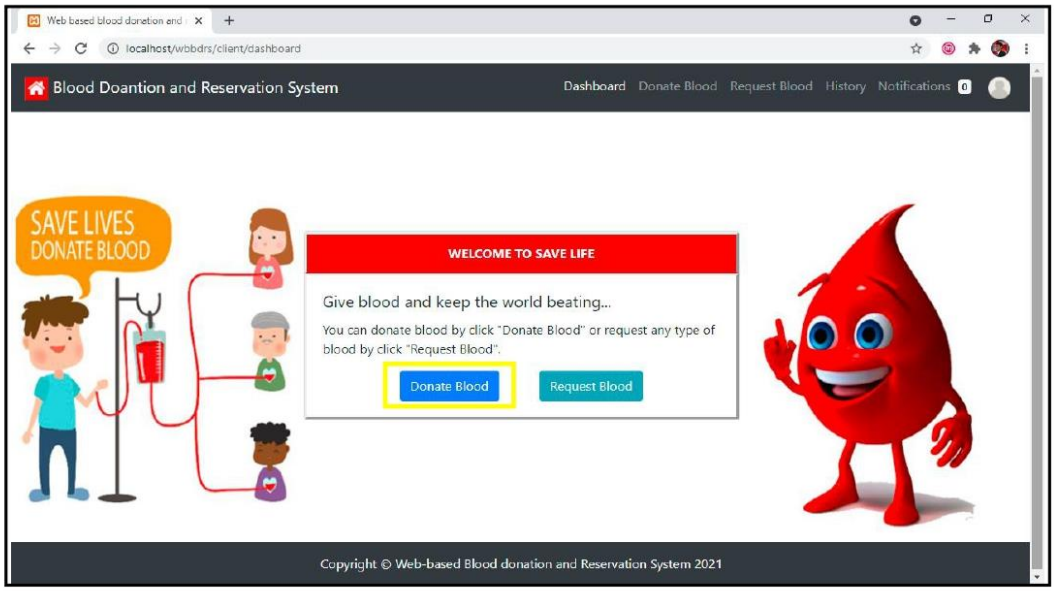


viii. Now you can use your email and password to login to donate/ request blood by click on the Login button or on top login bar.

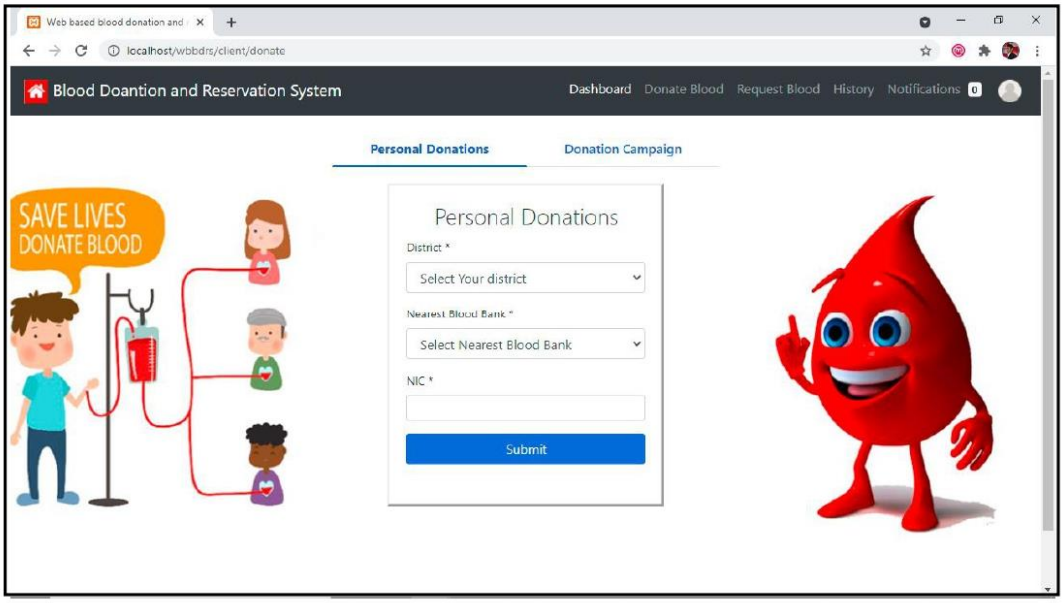


1.2 Donate blood request

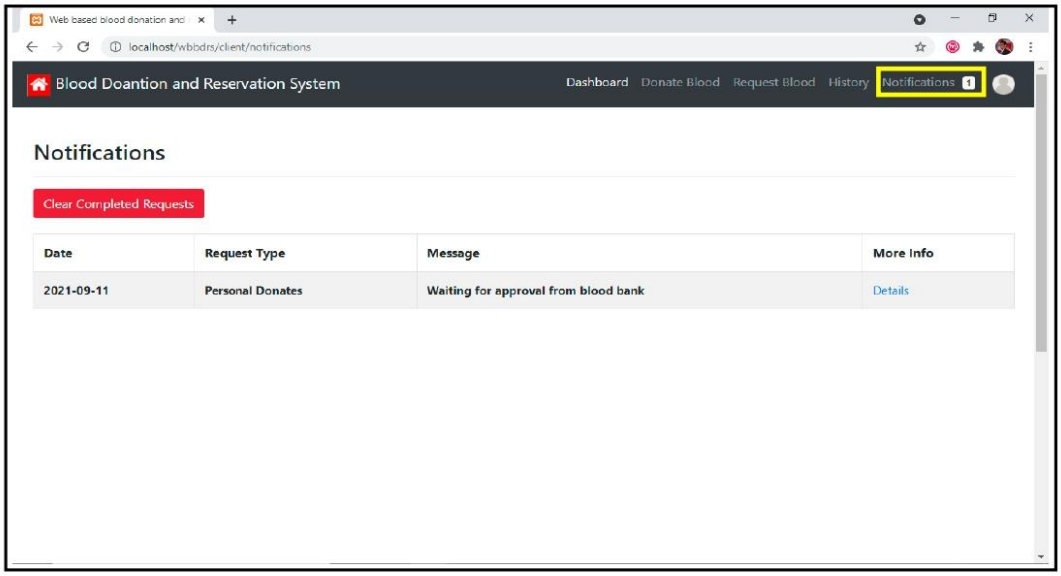
i. Click on donate blood option in the system after login.



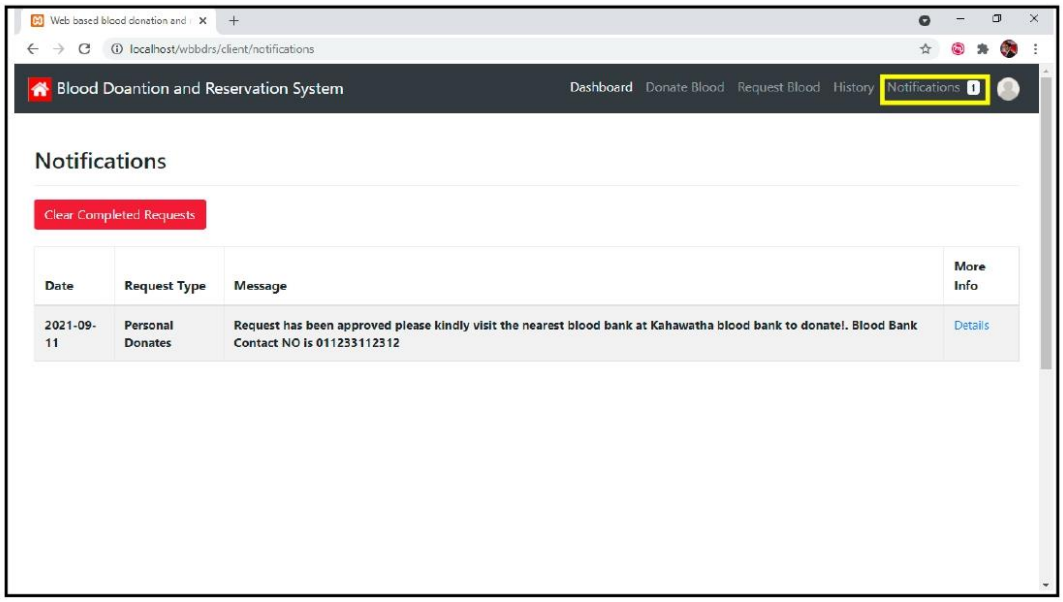
ii. If you are going to donate for yourself kindly fill the form with relevant details and submit



iii. You will get a notification about your request

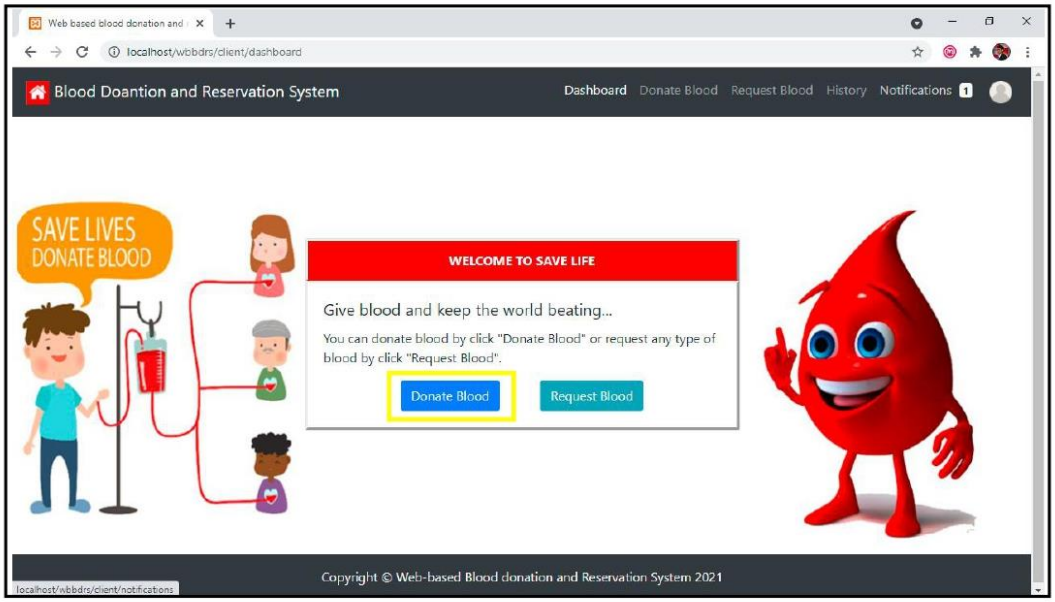


iv. Once blood bank approves your request again you will notify with the nearest blood bank details to donate blood

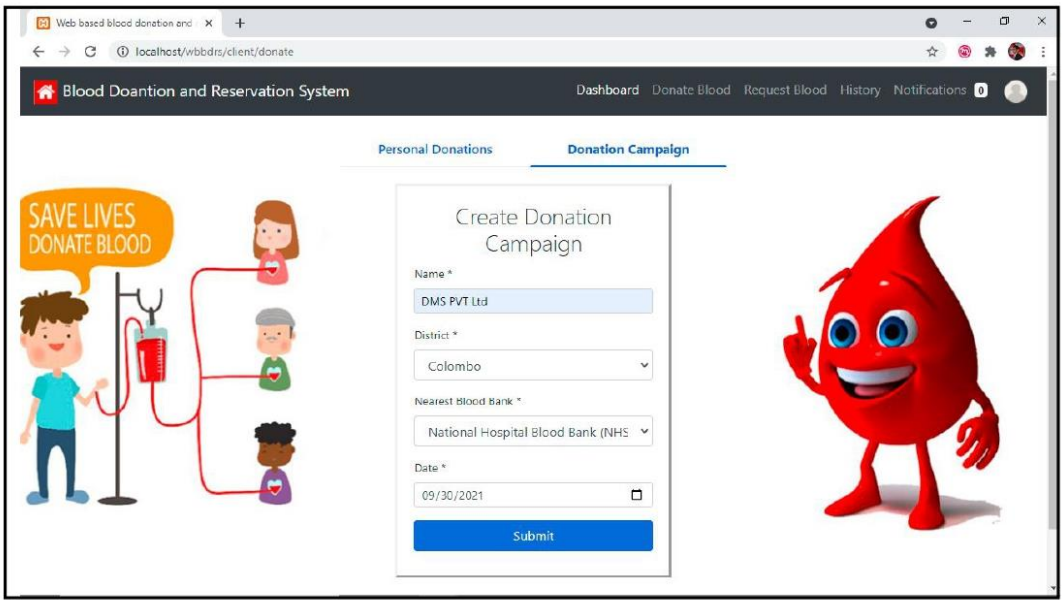


1.3 Blood Campaign request

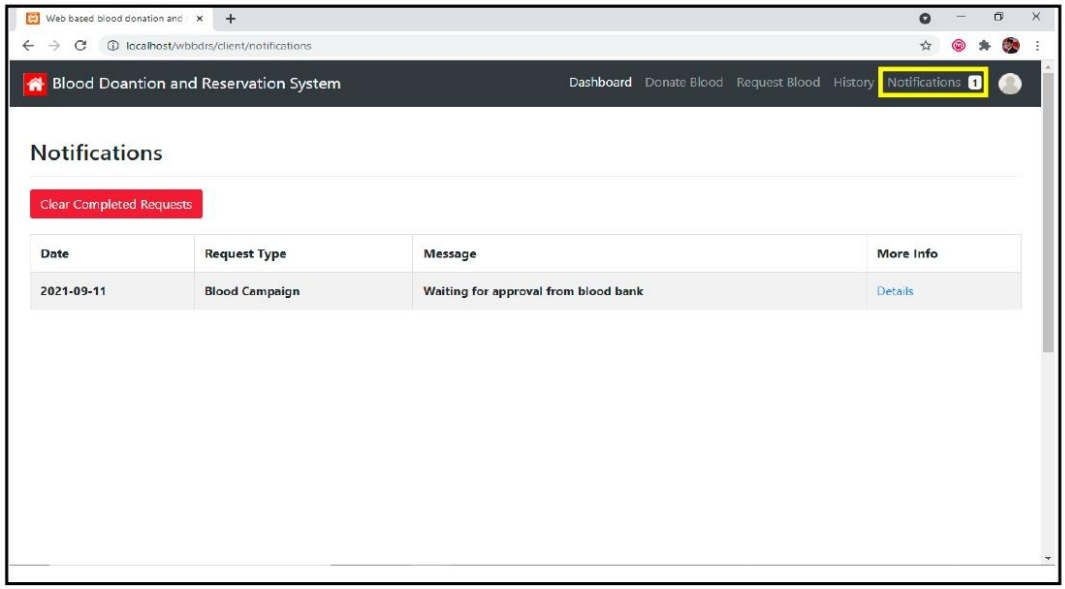
i. Click on donation blood option in the system



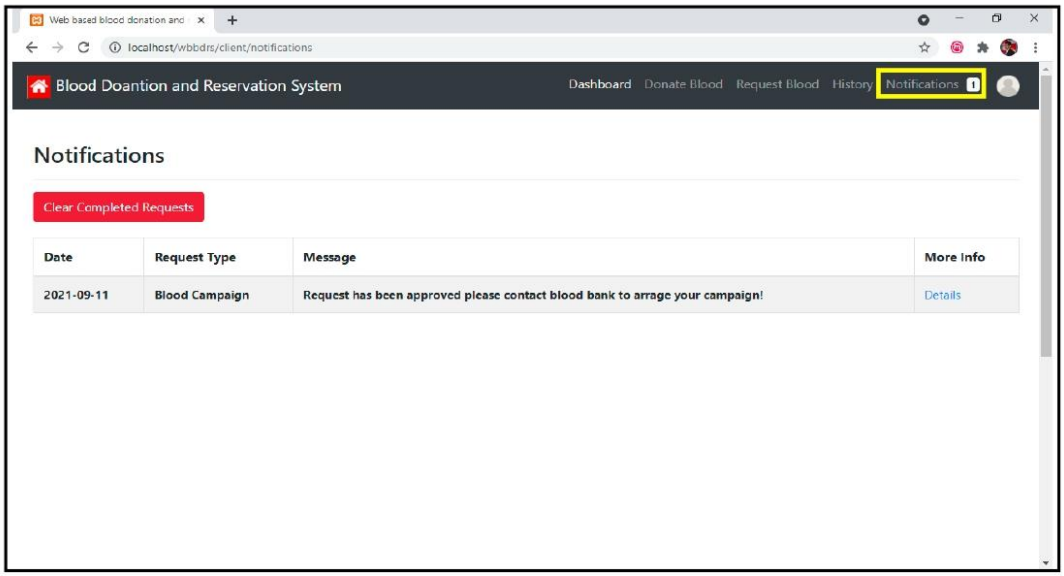
ii. Click on Donation Campaign tab and kindly fill the form with relevant details and submit for approval by blood bank



iii. You will notify once request submit to blood bank for approval

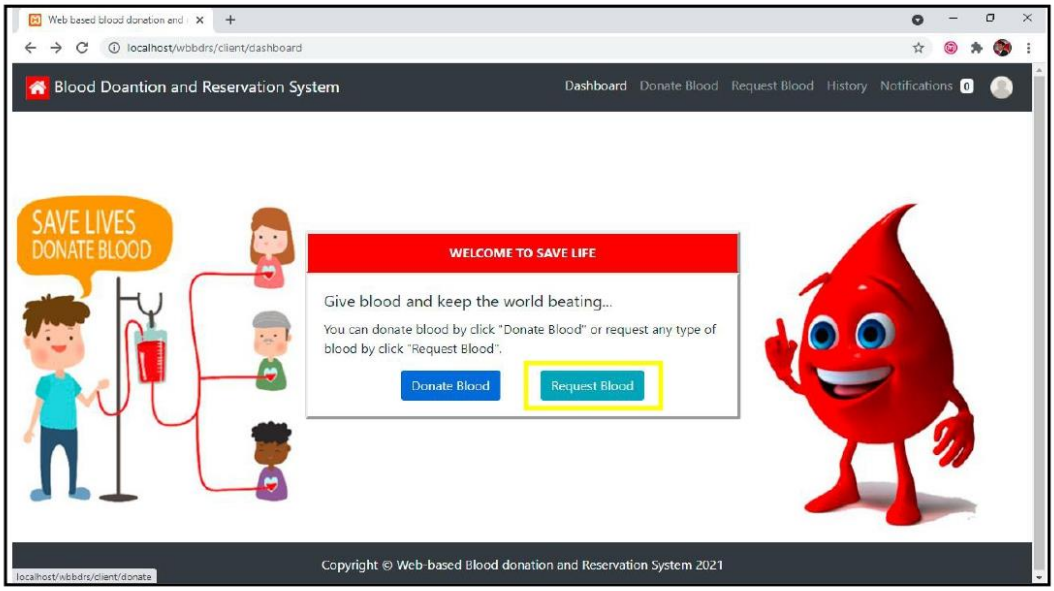


iv. Once blood bank approve your request you will get a notification with the blood bank details to contact and organize the campaign

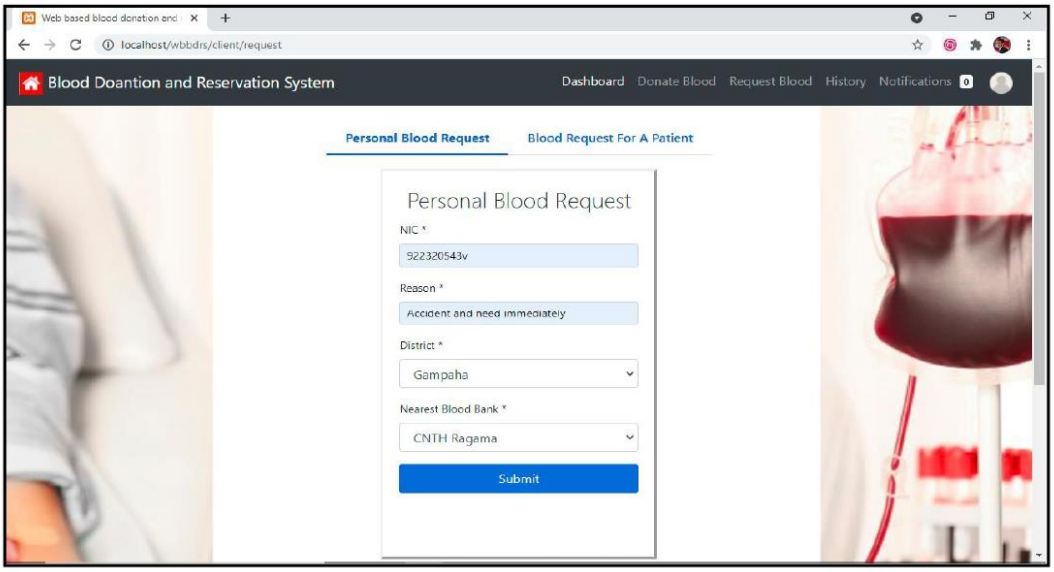


1.4 personal blood request

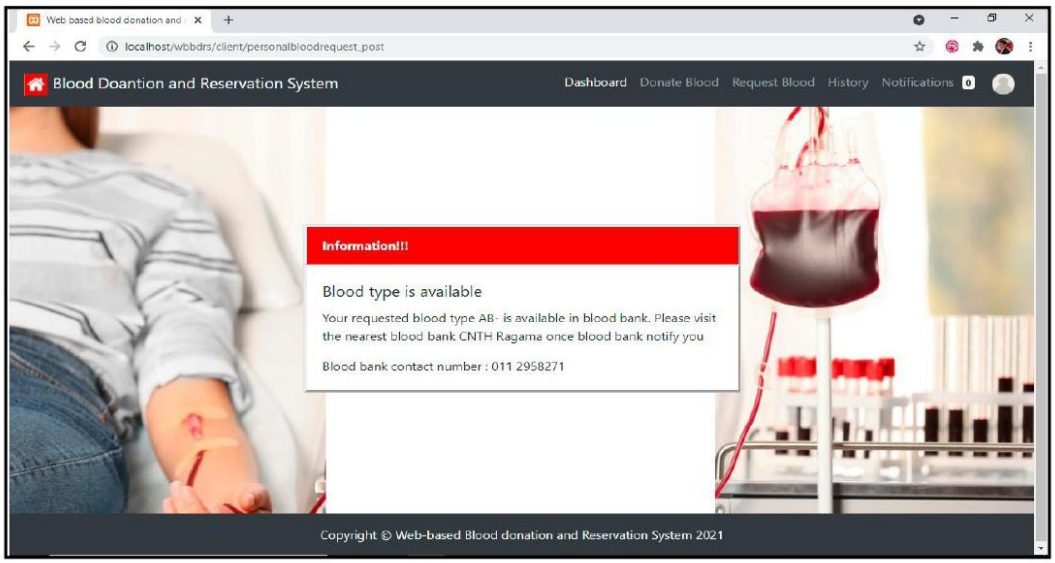
i. Click on request blood option in the system



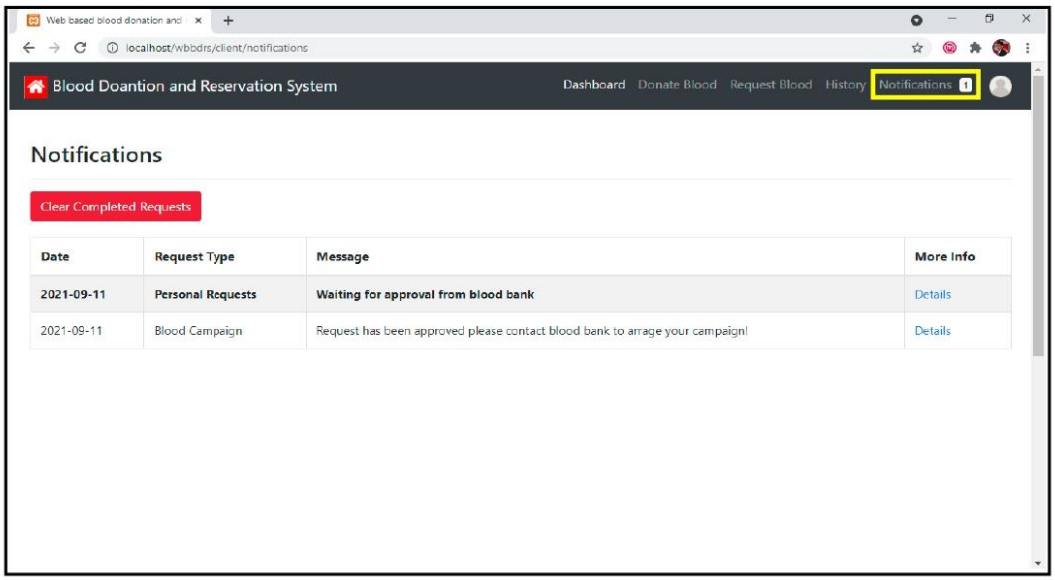
ii. Click on Personal blood request tab and kindly fill required details and submit



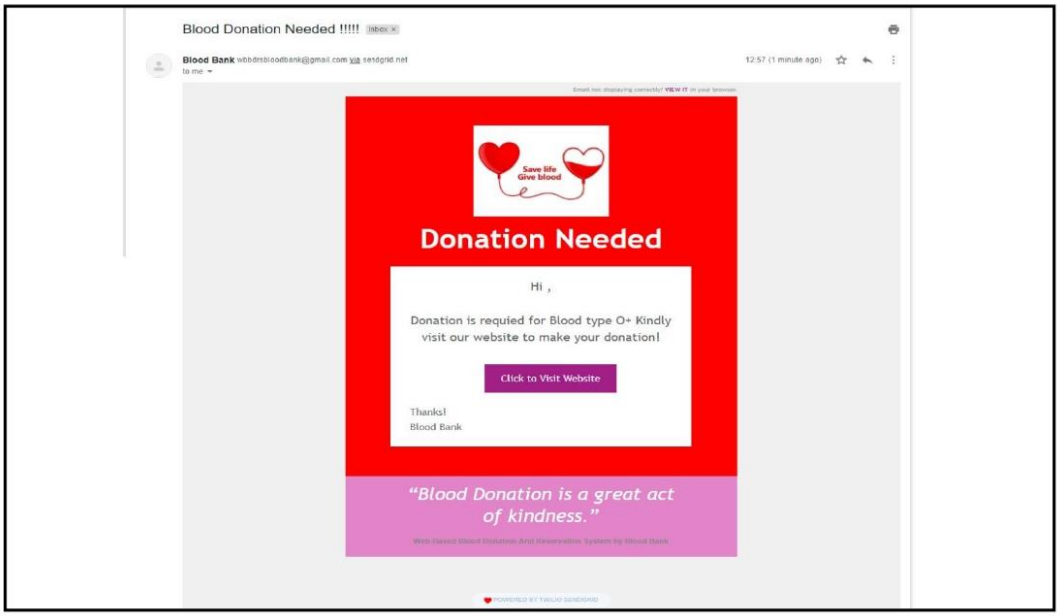
iii. If the blood is available, system will notify you with the details



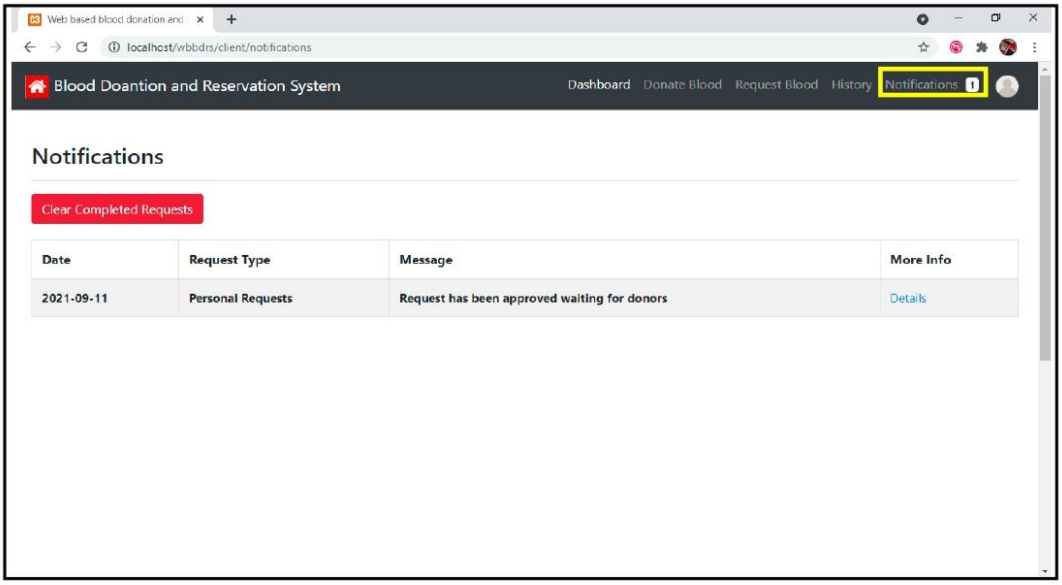
iv. After that you can see the notification bar to get update on the blood. Blood approval notification will accrue once you submit the request



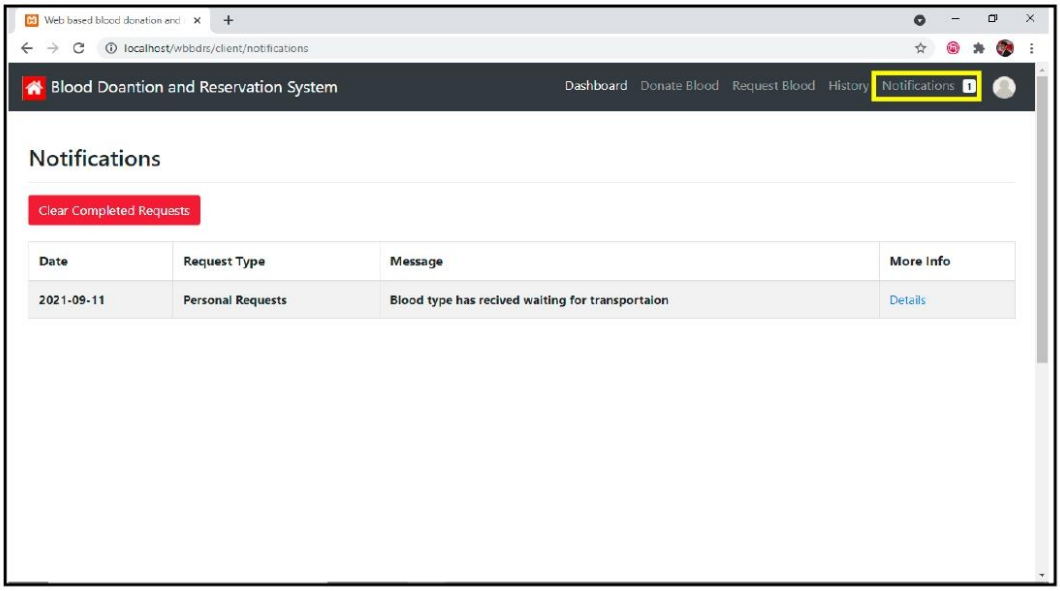
v. If the blood is not available system will notify you and system will send request email to existing donors to donate blood



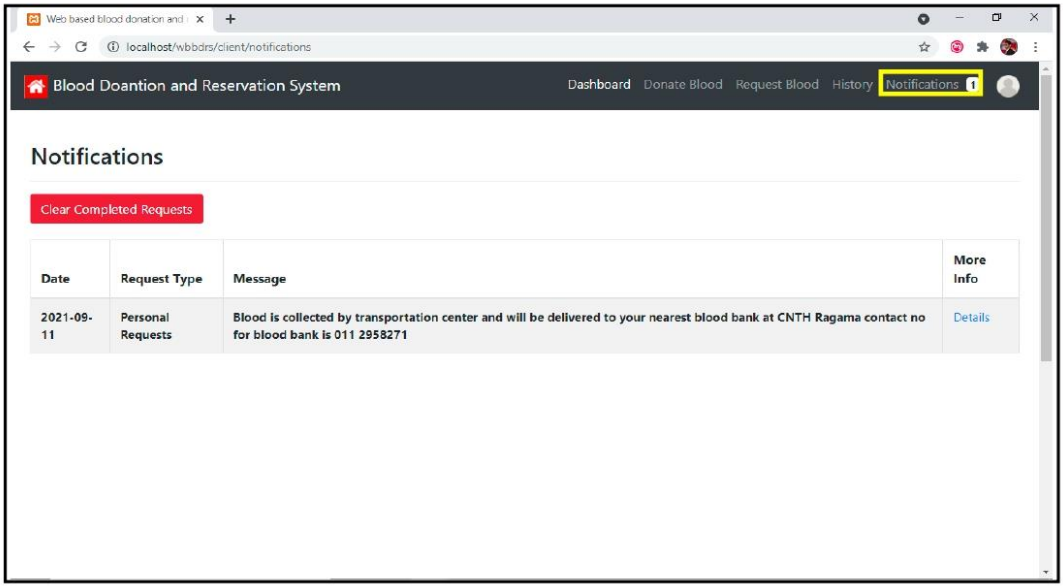
vi. Waiting for donors notification to user



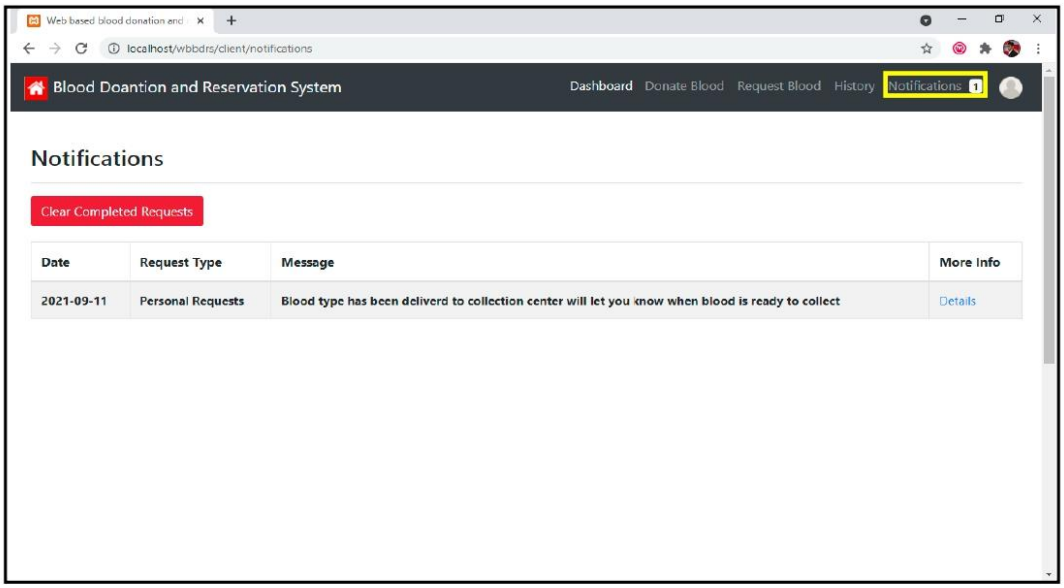
vii. Blood collection request send to transport and user will notify



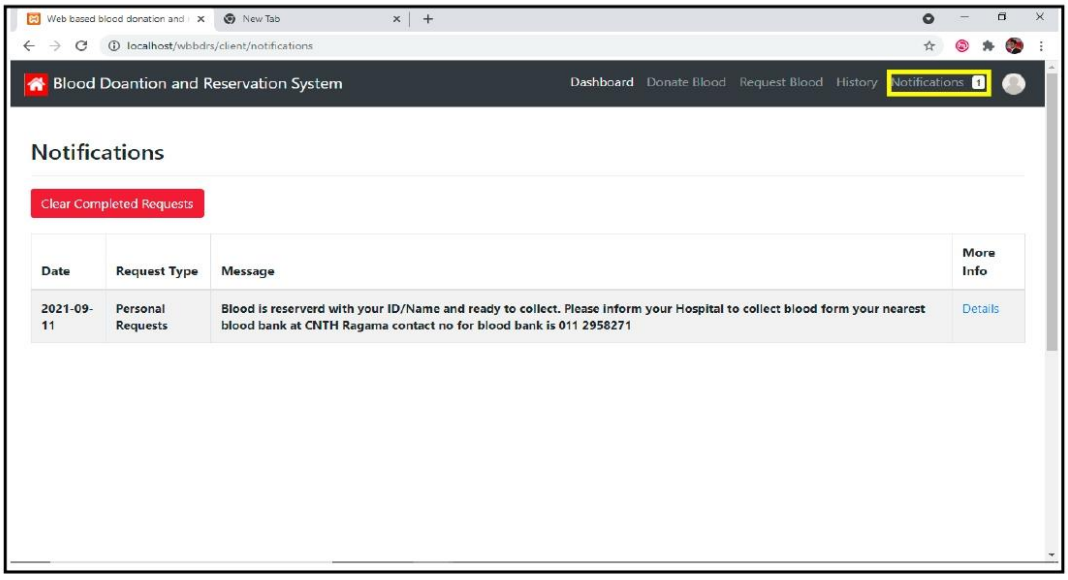
viii. Blood collected by transportation notification to user



ix. Blood delivered to collection center notification to user

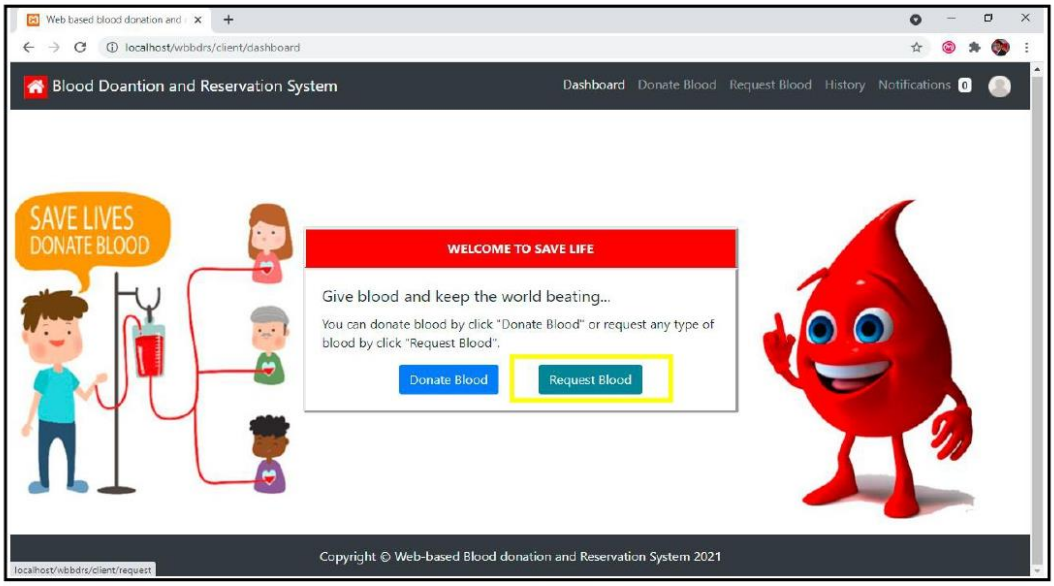


x. Finally, if the blood is ready to collect system will notify you to go and submit hospital evidence to collect blood from blood collection center to hospital

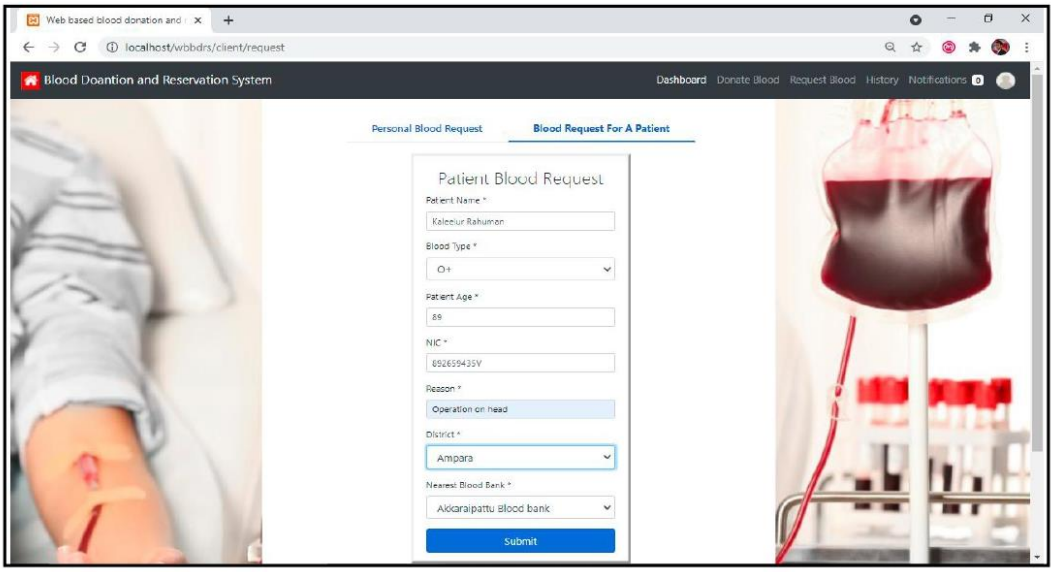


1.5 Blood request for a patient

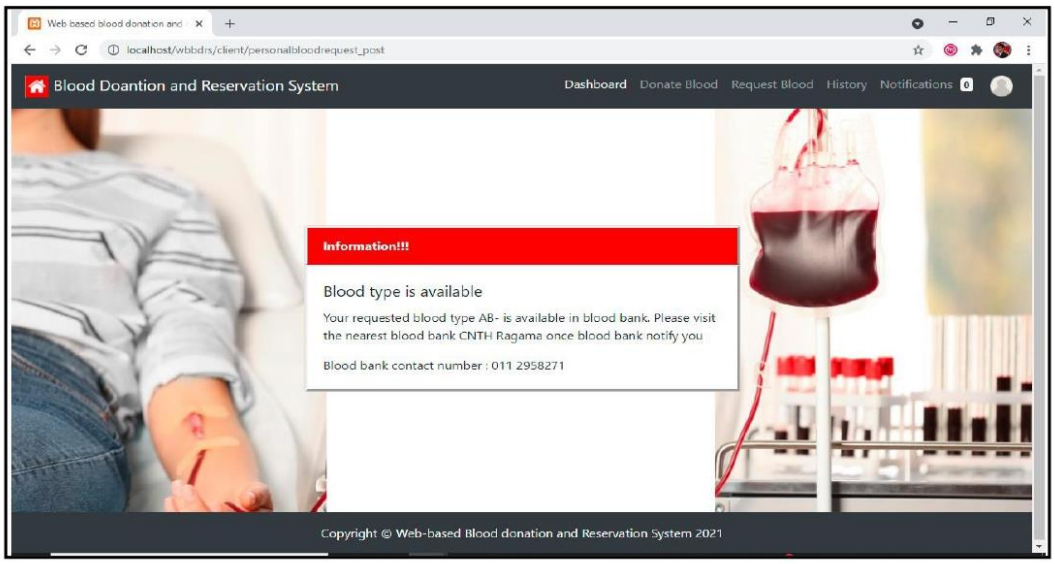
i. Click on request blood option in the system



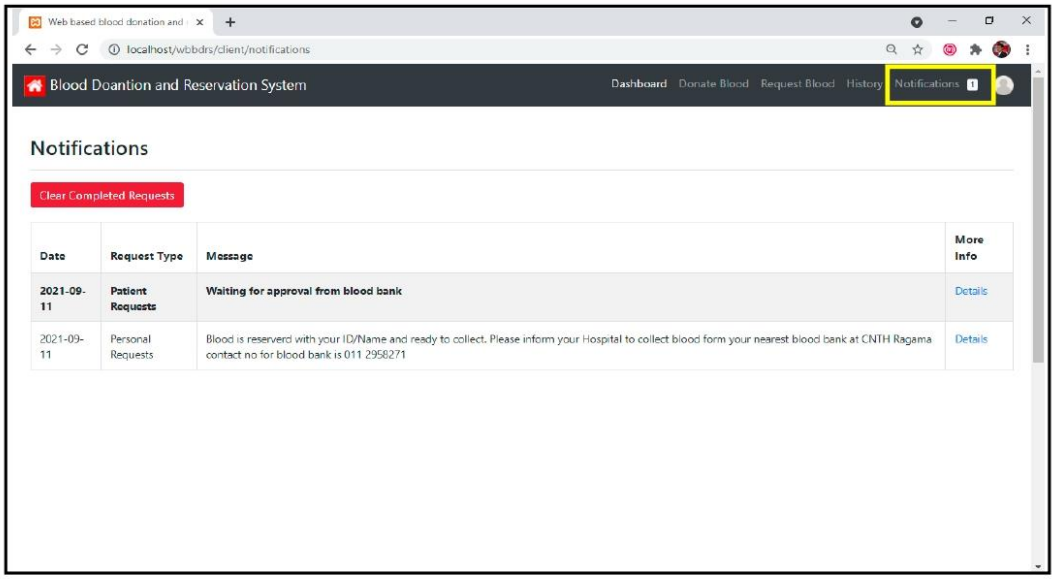
ii. Click on blood request for a patient tab and kindly fill required details and submit



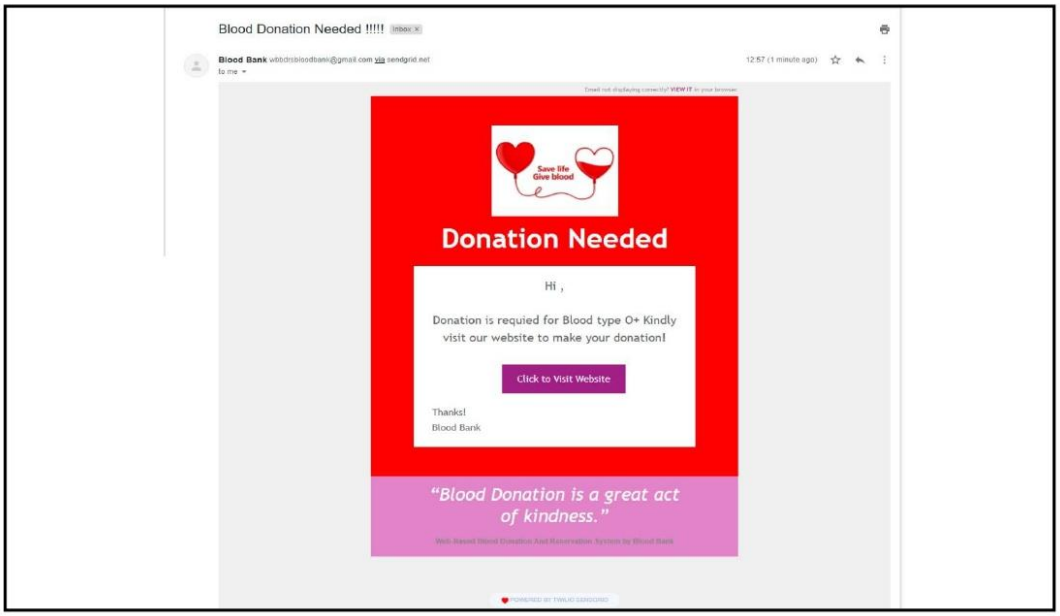
iii. If the blood is available, system will notify you with the details



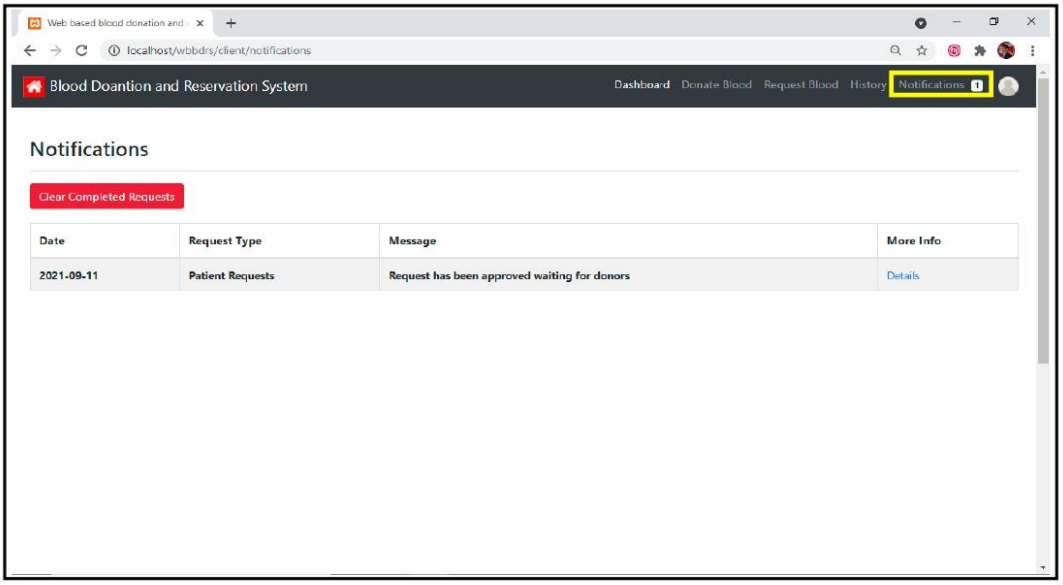
iv. After that you can see the notification bar to get update on the blood. Blood approval notification will accrue once you submit the request.



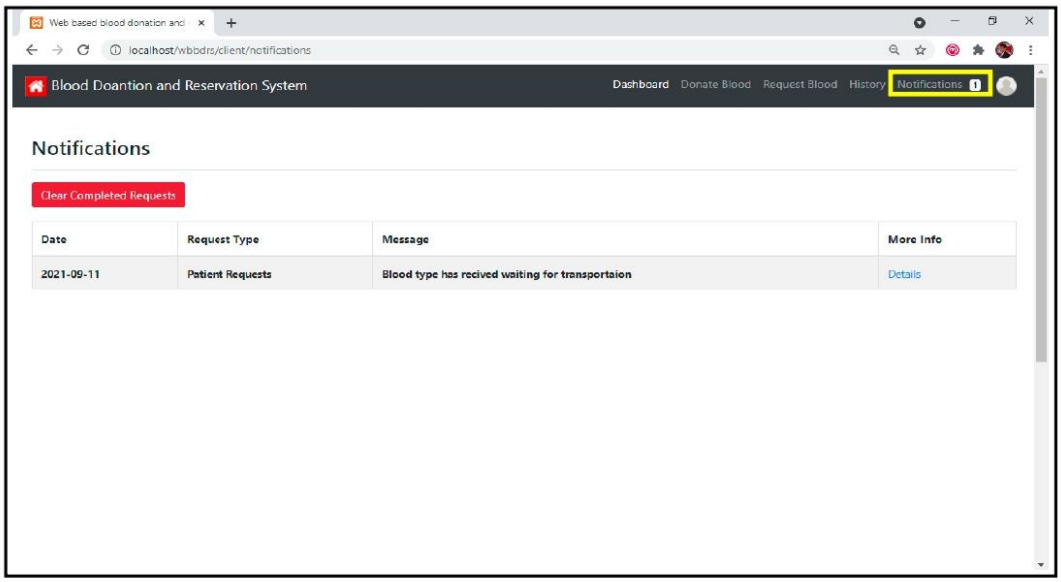
v. If the blood is not available system will notify you and system will send request email to existing donors to donate blood



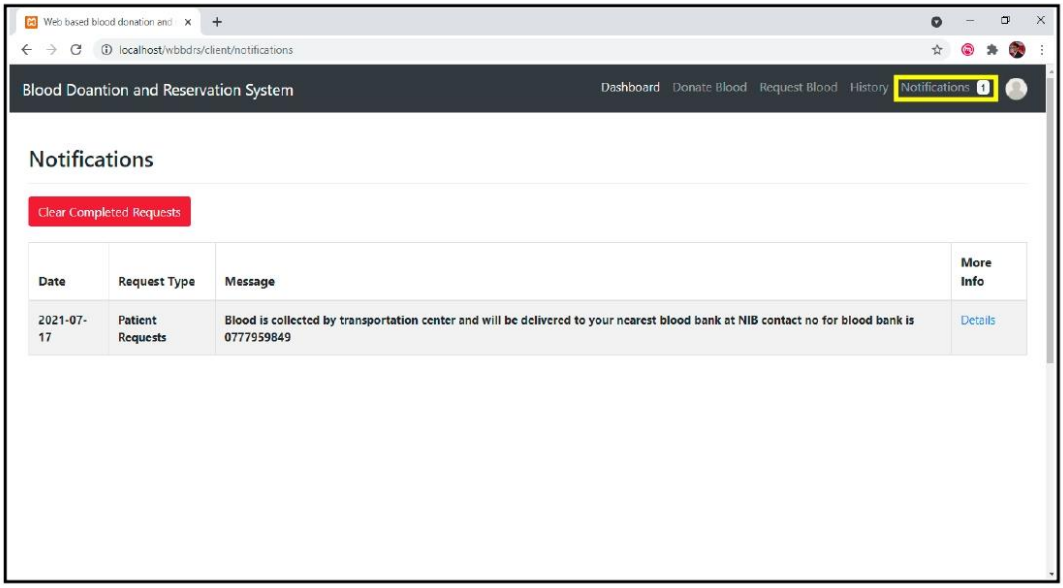
vi. Waiting for donors notification to user in notification



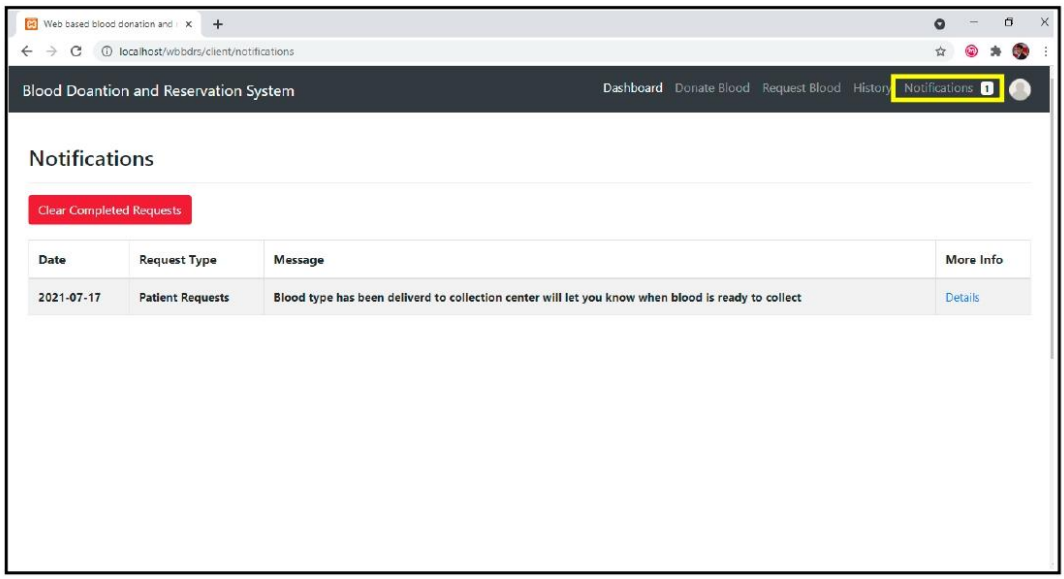
vii. Blood collection request send to transport and user will notify



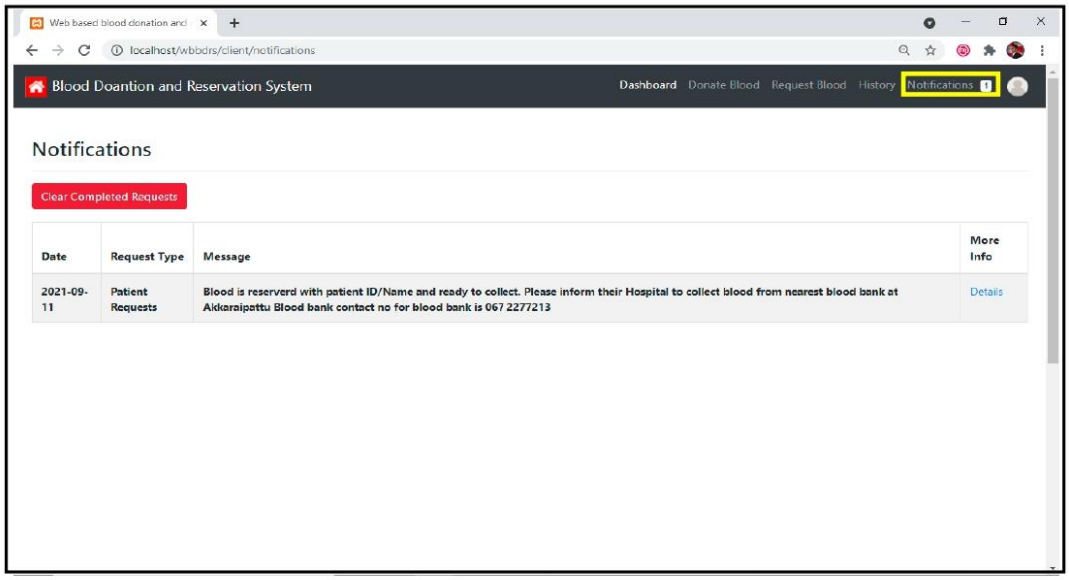
viii. Blood collected by transportation notification to user



ix. Blood delivered to collection center notification to user



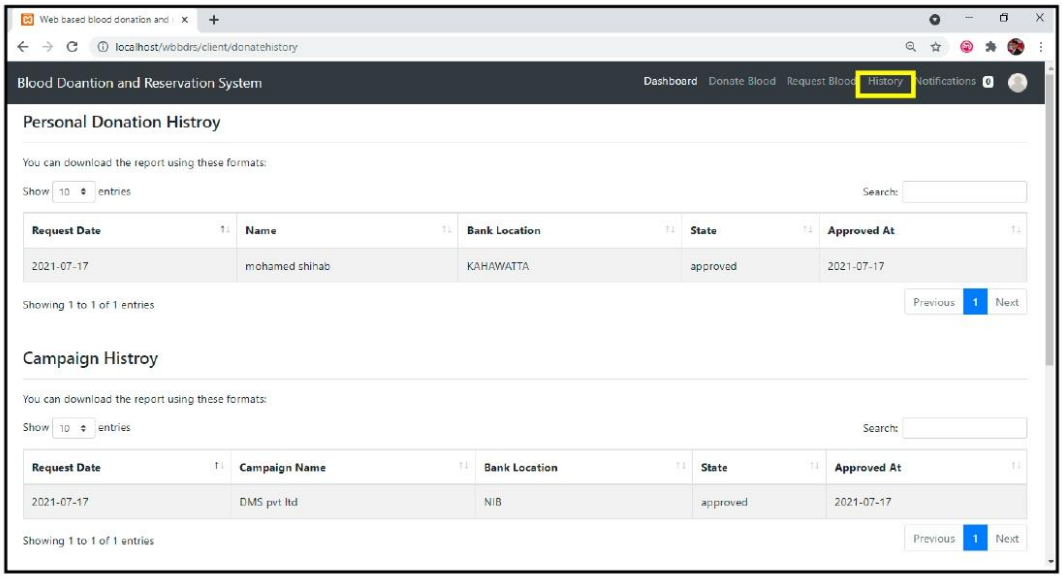
x. Finally, if the blood is ready to collect system will notify you to go and submit hospital evidence to collect blood from blood collection center to hospital



2. How you can see the history of your donation/blood requests

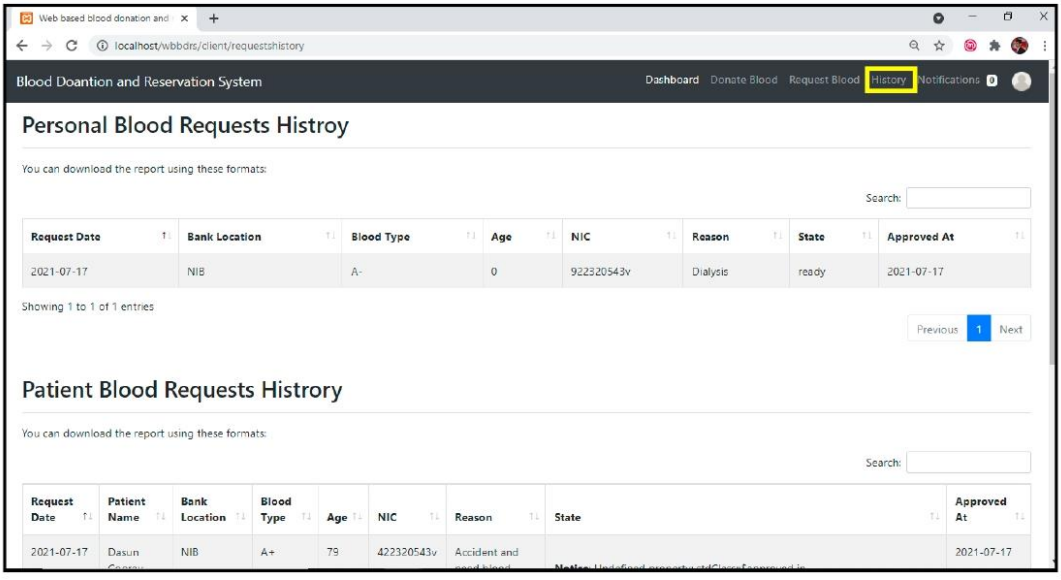
2.1 Donation history

i. User can see their Personal donation history and campaign history on the history tab



2.2 Blood request history

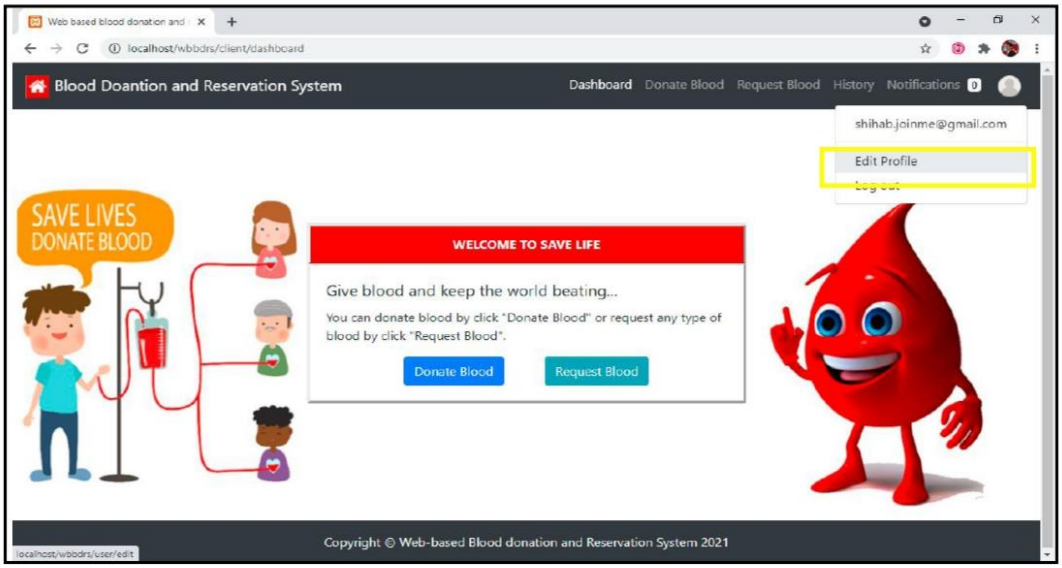
i. User can see their personal blood request history and blood request for a patient history on the history tab



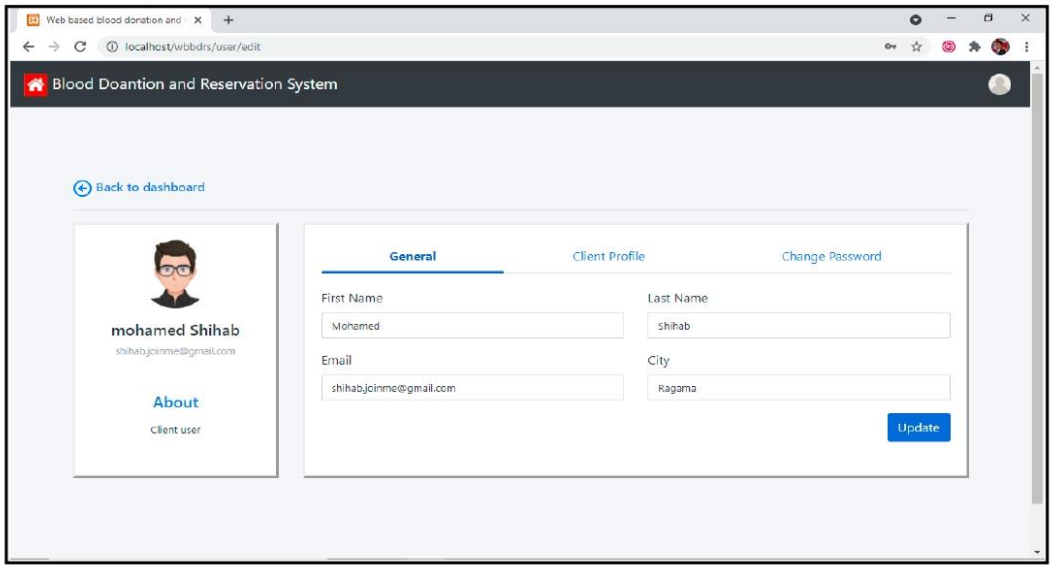
3. How you can edit your profile

3.1 User modification

i. User can easily edit their profile with the edit option in the top right corner option.

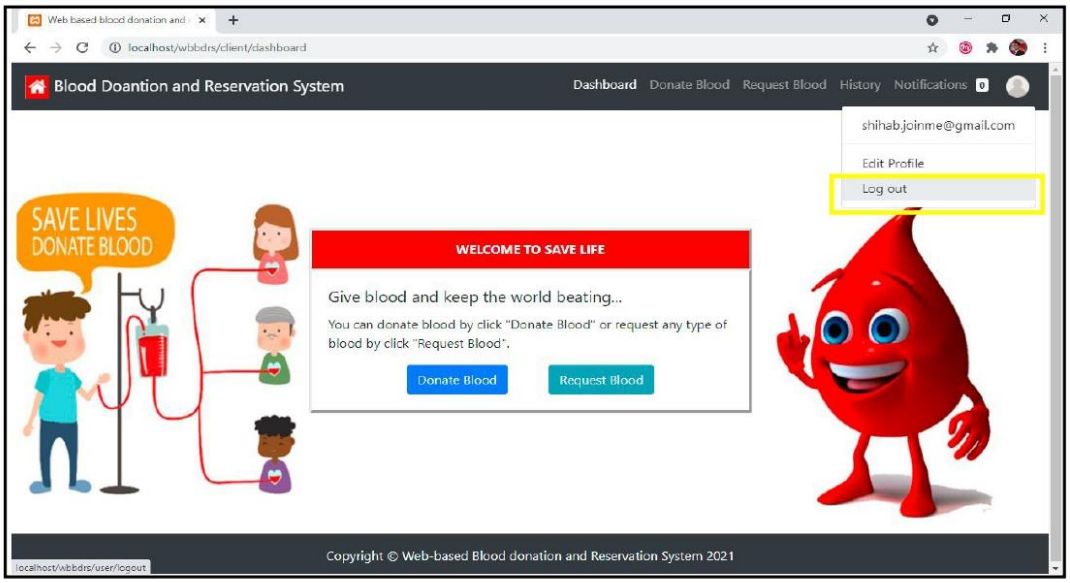


ii. Edit your profile and click update button to change in General, client profile and password.



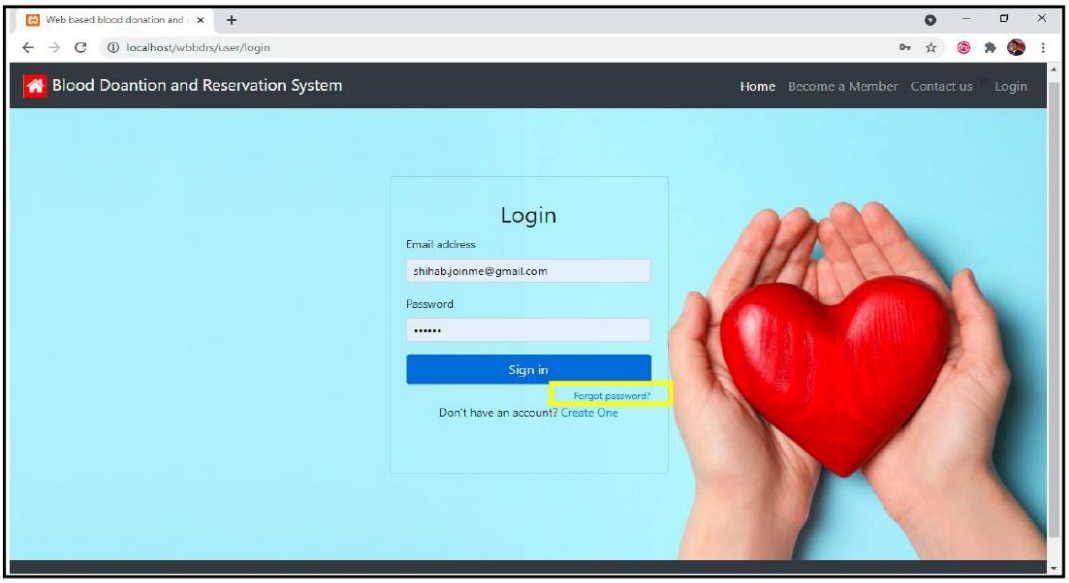
4. How you logout your profile

1. Finally, user can logout using logout option in top right corner from the Web-based donation and reservation system.

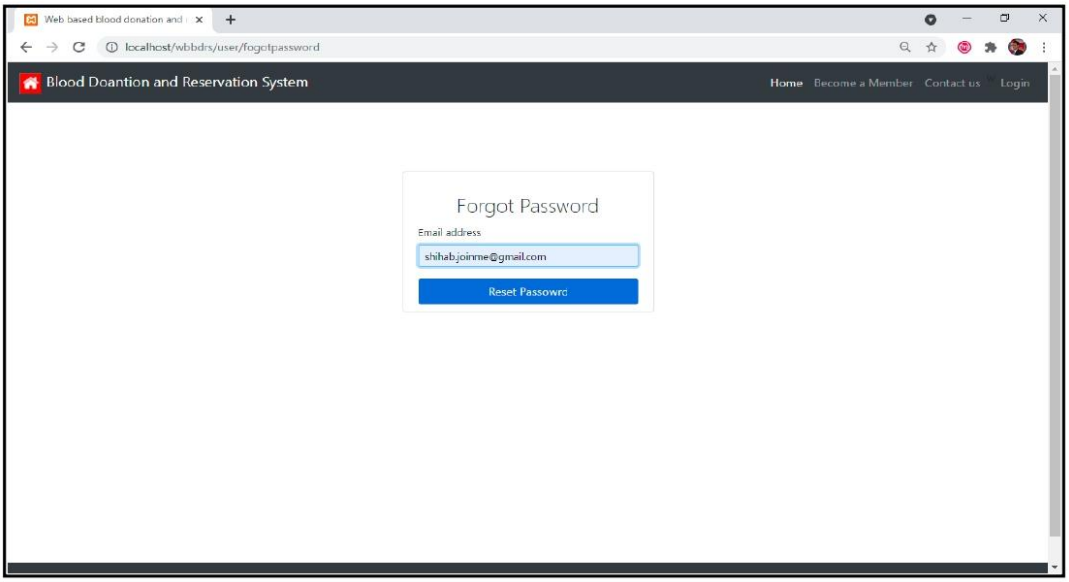


5. How to reset your password

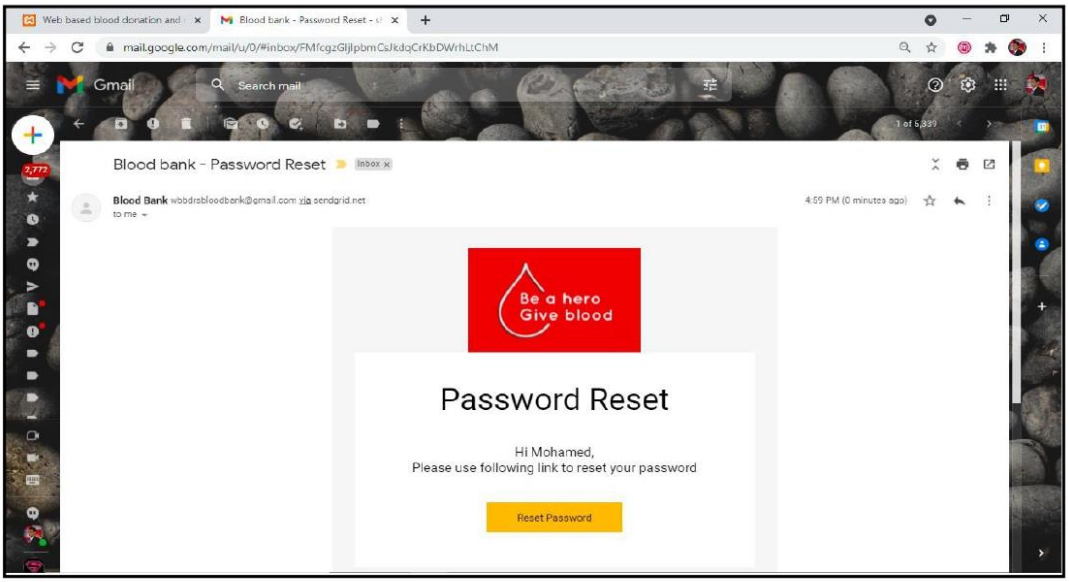
1. Click on forget password button on login page



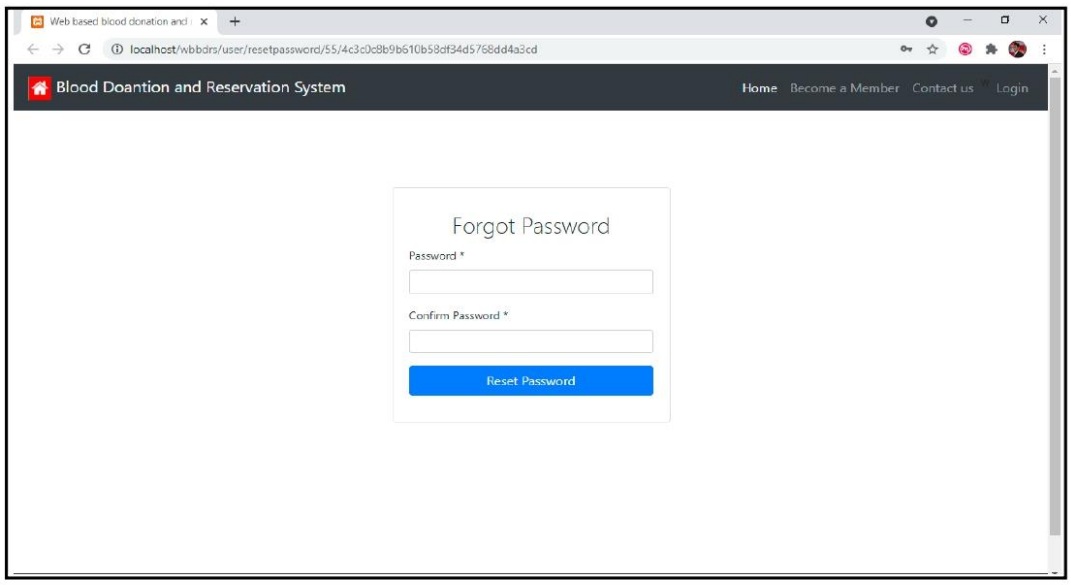
2. Enter your email address



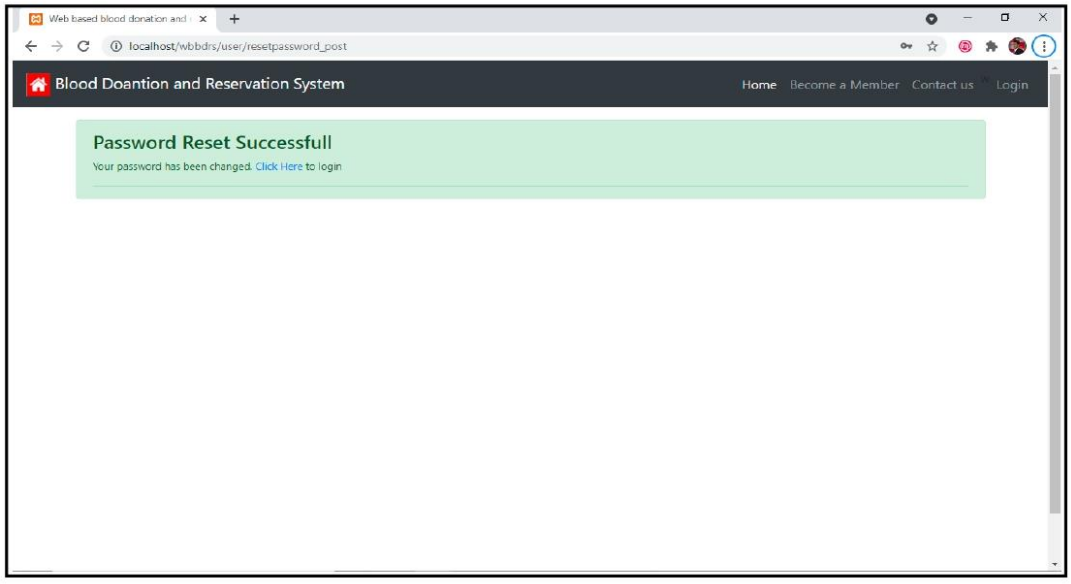
3. You will get a reset link to your email. Kindly click that



4. After that you will get a page to rest password. Enter new password.



5. Once you enter a new password. You can Login to system to save lives.



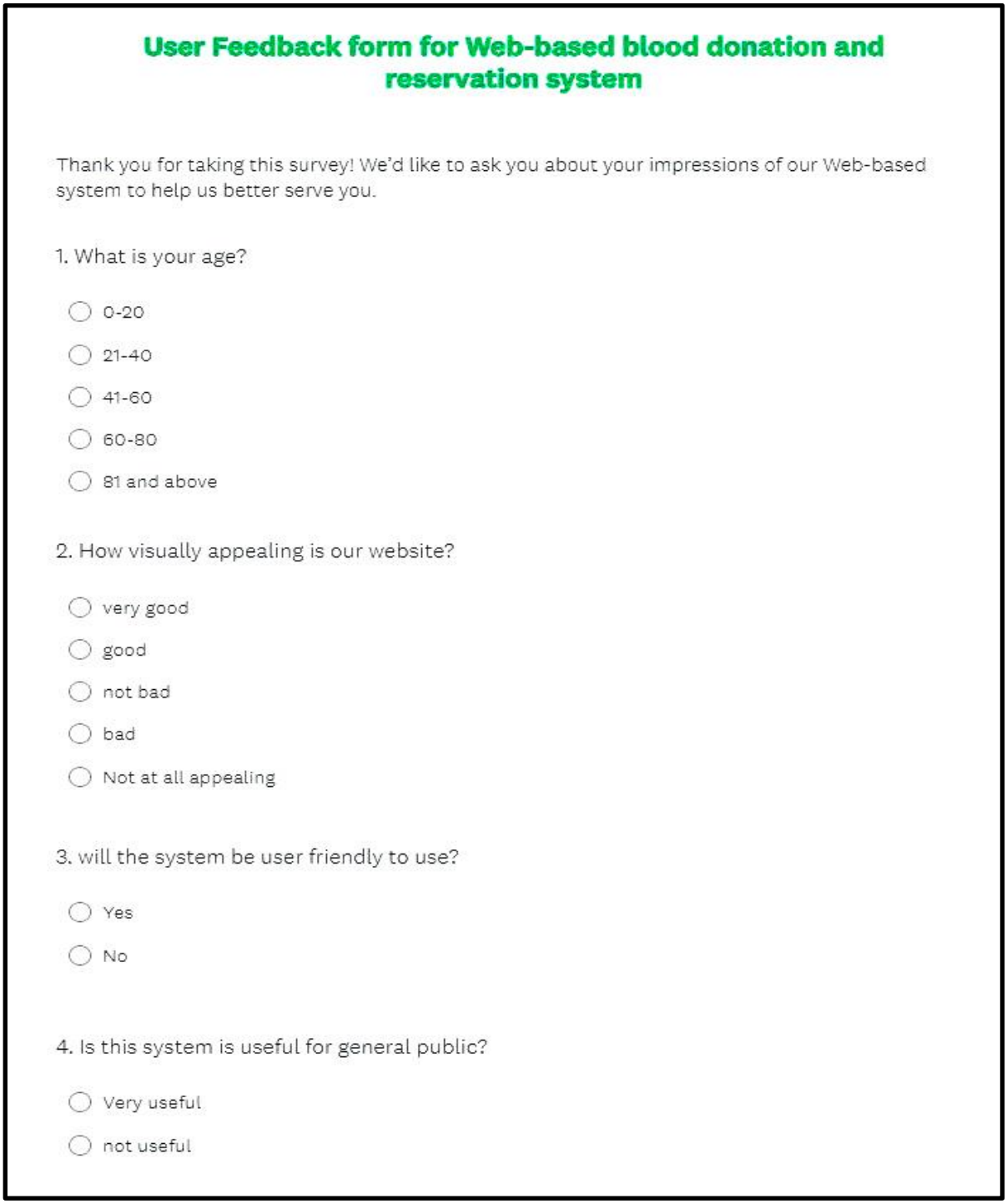
Your blood will save a life.

Thank You

Figure E.1: User Manual

F. Appendix F – User Evaluation

Below Figure 5.55 shows the user feedback form to get the user evaluation.



User Feedback form for Web-based blood donation and reservation system

Thank you for taking this survey! We'd like to ask you about your impressions of our Web-based system to help us better serve you.

1. What is your age?

- ◯ 0-20
- ◯ 21-40
- ◯ 41-60
- ◯ 60-80
- ◯ 81 and above

2. How visually appealing is our website?

- ◯ very good
- ◯ good
- ◯ not bad
- ◯ bad
- ◯ Not at all appealing

3. will the system be user friendly to use?

- ◯ Yes
- ◯ No

4. Is this system is useful for general public?

- ◯ Very useful
- ◯ not useful

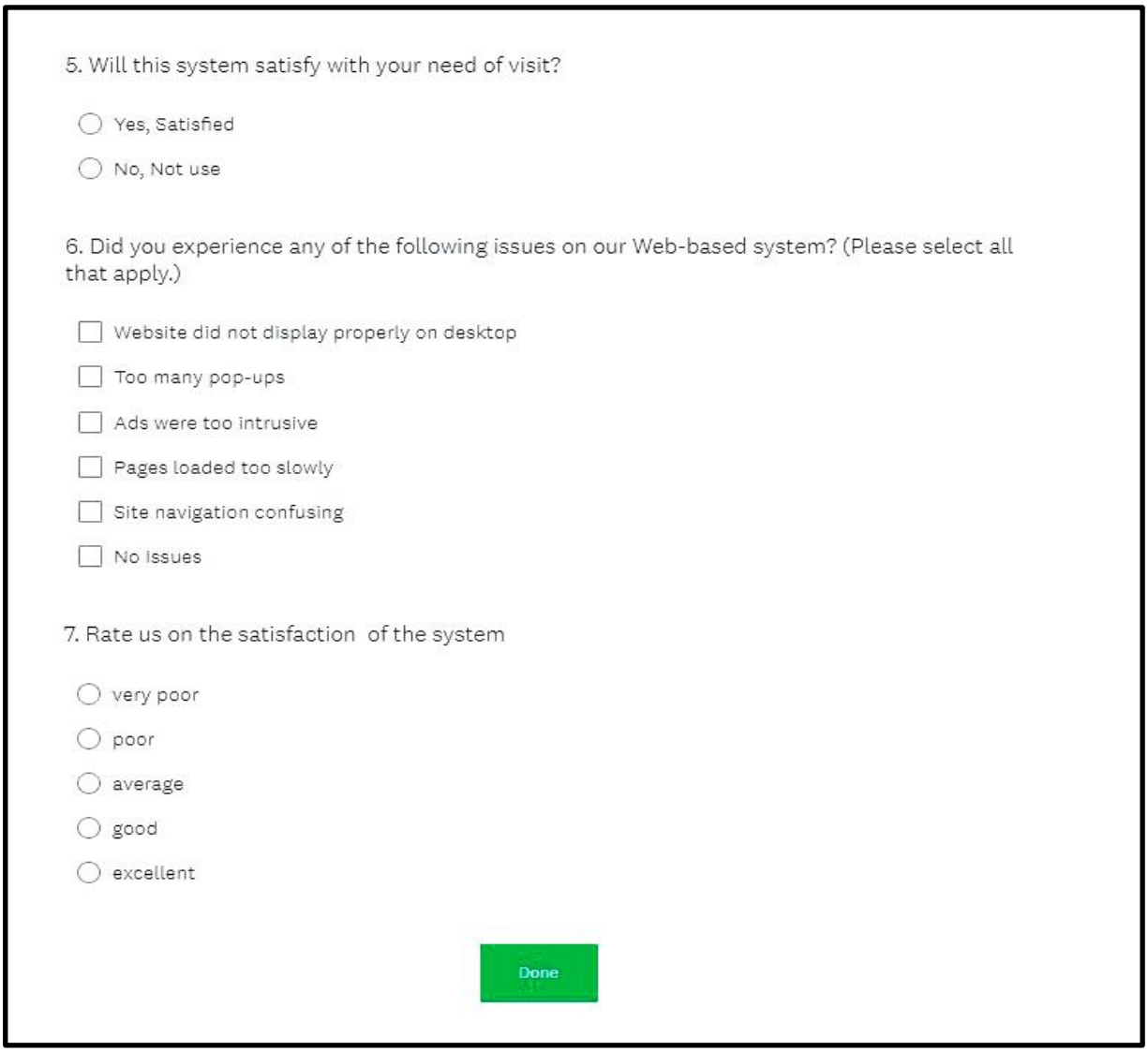


Figure F.1: User Evaluation Form