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TITLE OF THE PROJECT

Bangladesh Blood Services Management System (BBSMS)

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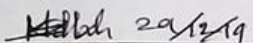
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APPROVAL

This Project titled “**Bangladesh Blood Services Management System (BBSMS)**”, Submitted by **ABDULLAH BIN KASEM BHUIYAN** ID No: **182-16-329** to the Department of Computing & Information Systems, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computing & Information Systems and approved as to its style and contents. The presentation has been held on 29-12-2019.

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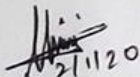
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Dedication

I like to dedicate this project to my parents and late uncle Saiful Islam Chowdhury. Without my parent's courage, support and inspiration I am nothing but incomplete. I want to dedicate to my uncle because, he was my guide and he encouraged me to study computer science.

Executive Summary

Bangladesh Blood Services Management System (BBSMS) is an academic project. This project is about safe blood transfusion under the centralized supervision and regulation of the government. By using this system blood seekers can made request for emergency blood and the system will find the nearest available blood donors of particular blood group and then send an email and message to them. Blood banks and their medical officers can check if the donor is eligible for donation based on donor's last donation date. Voluntary organizations can maintain their private donor database and respond to seekers private request. This system will ensure safety of blood donors and also increase revenue of the government.

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Chapter 1 - Introduction

1. 1 Introduction

In this era of computer science, the world is like a small village. The first priority of the technology is safety of the human. Blood transfusion is a very common matter in today's world. Though now a days there are many people who donate blood voluntarily and many non-profitable organizations works in blood donation, but according to world health organization almost 80% of the pregnant women died due to lack of blood at the time of delivery. On the other side, according to the health ministry of Bangladesh there are more than thousand blood transfusions occurs in the country. Since, there is no centralized monitoring system and record keeping system some people sell blood which is a criminal offence. And also, it is not possible to identify whether the donor is eligible to donate because there is no verification system. that's why the medica officers need to relay on the donors.

Since, now a days Bangladesh facing a massive technological change, especially in IT sector, by using the internet and growing infrastructure of the country it is very much possible to automate the entire blood donation and transfusion process.

There is need for a system that will save time and automate the entire process and ensure the record keeping. The system will minimize the cost for the hospitals and blood banks and also increase the revenue for the government by proper tax calculation. So **BBSM** or similar system will be the only way to implements the needs.

1. 2 Document Contents

This document will cover the following chapters to document the project work.

Chapter 1: Introduction

Introductory description about the proposed system and project.

Chapter 2: Initial Phase

This chapter contains the initial study details about the proposed system including the main aims and objectives, problem area, alternative solutions and background of the project.

Chapter 3: Literature Review

In this chapter the detailed discussion about the problem domain, solutions, evaluation of existing solution and finally recommendation.

Chapter 4: Methodology

Here the necessity of using methodology, different methodologies that can be used and the recommended methodology and its implementation will be discussed.

Chapter 5: Planning

This chapter is about the various project plans like, project plan, test plan, risk and change management etc.

Chapter 6: Feasibility

The detailed feasibility study report and cost-benefit analysis will be documented here.

Chapter 7: Foundation

Details about the problem area identification, overall requirement list, recommended technologies and justifications will be documented in this chapter.

Chapter 8: Exploration

It contains some old system and new system basic UML diagrams and requirement catalogue with the prototype.

Chapter 9: Engineering

The logical and behavioral modeling of the proposed system are in this chapter.

Chapter 10: Deployment

The coding samples and development problem break down with development priority are discussed here.

Chapter 11: Testing

Various test plans and results are attached in this chapter.

Chapter 12: Implementation

The implementation approach, training model and related things are discussed here.

Chapter 13: Critical Appraisal and Evaluation

The evaluation of the initial objectives that met and not met with details.

Chapter 14: Lessons Learned

Mainly pre-project-closing review contains the learnings and difficulties faced during the project.

Chapter 15: Conclusion

Summary of the project along with goal and success and experience will be documented here.

Chapter 2 – Initial Study

2.1 Project Proposal

Introduction

Bangladesh Blood Services Management System is aimed to develop a centralized Internet Based solution for blood donation across the country. It is very common scenario that many people die due to not getting blood in emergency time. This project is aimed to provide a safe and quick way to find or donate blood. This project is going to be developed into a system that will help the blood banks, voluntary organizations, blood donors & patients to easily collaborate and carry out hassle-free blood donation.

Background Study

Though there are many voluntary organizations working in our country to serve blood request. There are some online blood searching portals also which are mainly based on the basic search query on ABO blood grouping like <http://infoblood.org/> which enable the users to search the specific donor no location based searching, <https://badhan.org/> allows district wise donor searching, <http://www.bdracs.org/donate-blood> Red Crescent blood donation society has a small database with no search option and finally, <http://www.blooddonorsbd.com/> has the blood group wise and district wise donor searching. But there is no centralized blood donation management system in our country. Currently there is no way to justify whether a donor is fit enough to donate blood or if a donor is donating blood after minimum 120 days of previous donation. Also, there is no way to automatically notify the nearby available blood donors about an emergency blood donation request. Voluntary organizations and volunteers usually try to manage the required blood which may sometimes cause death for getting late. This system will make the whole process more easy, reliable and effective and also ensure the safety of donor's health issues. So, this sort of system has high demand in the market.

Description of the proposed system

Bangladesh Blood Services Management System (BBSMS) is a web-based application along with a mobile application that helps to locate the current location of the blood donor. Using this system, the people can search & request for blood donors, blood donors can view notification and blood requests and also see their donation history, blood banks can justify the donor's eligibility to donate blood, manage donor's serology reports and add the last donation details of the donor.

The system includes the voice search option for searching blood donor and whenever a blood request is posted the available blood donors around 5 square kilometers of the requested location are notified using email and text message.

On the other hand, individual blood fighter (volunteer) and voluntary organizations can manage their private volunteer, donor and working history. People can send request to the organizations for blood.

Feasibility Study

❖ Operational Feasibility

Since, operational feasibility concern about the usability, ease-of-use and required functionalities of the proposed system, the proposed **BBSMS** has proper validation and verification for user inputs, very easy and smooth navigation system, location-based searching option, easy request option which will make the system much easier and effortless to use. Admin, medical officer, blood donor and blood seeker can easily get access to their portal with valid credentials and perform their tasks very efficiently.

❖ Technical Feasibility

Some aspects of technical feasibility are:

Technical feasibility test reveals that the users of **BBSMS** can easily manage their activities rather than previous manual process. We are going to use apache web server, MySQL database server, Laravel 6 web framework, android 9, Microsoft office for development and documentation purpose. The system is designed and developed using latest and popular web and mobile technologies

that ensures that the system is compatible to run in any web browsers with low-level Internet connection. System has an access control hierarchy to maintain secure access to the system data. Web based application is platform independent and its chosen development platform and resources are affordable and cost effective so it will be technically feasible.

❖ **Economic Feasibility**

There are various alternatives to develop the proposed system including, web-based application, mobile application, desktop application etc.

🌐 **Web-based Application-** the entire application and data are hosted into a remote server and it can be accessed via Internet anytime from anywhere, no installation is needed.

Equipment	Cost per unit	Cost
Extranet network with VPN	₹2000 per month	₹2,000
Desktop pc (core i9, 3.6 GHz processor, 32 GB DDR4 RAM, 2 TB HDD)	₹1,00,000	₹1,00,000
Web, File and Email servers	₹10,000 per month	₹10,000
Total		₹1,12,000

Table 1: Cost Estimation of the Web-based solution

✚ **Mobile Application-** the app containing the system need to install on every device and there need to develop three different application for blood bank/hospital, blood donor and blood seeker. Which might a bit costly than other solutions?

Equipment	Cost per unit	Cost
Web, email, file servers.	₹5,000 per month	₹5,000
Desktop pc (core i9, 3.6 GHz processor, 16 GB DDR4 RAM, 1 TB HDD)	₹1,00,000	₹1,00,000
Total		₹1,05,000

Table 2: Cost Estimation of the Mobile Application

✚ **Desktop Application-** the app needs to install on every desktop computer which is not portable and also need a remote server to store data which is much costly than web-based solution.

Equipment	Cost per unit	Cost
Web, email, file servers.	₹5,000 per month	₹5,000
Desktop pc (core i9, 3.6 GHz processor, 16 GB DDR4 RAM, 1 TB HDD)	₹1,00,000	₹1,00,000
Total		₹1,05,000

Table 3: Cost Estimation for Desktop-based solution

To make the system live a domain name and hosting service are required. Since, to serve the location-based donor search the system need to track the location of the donor continuously, I will develop a mobile app to track donor's location and to send them emergency notifications. Rest of the system will be developed as web application.

❖ **Market Research Analysis Based on the Feasibility Factors**

This section includes the market and user demand. According to **WHO** (World Health Organization) only 40% of required blood is collected each year in Bangladesh and 80% women who die during pregnancy, die for blood (WHO, 2017). On the other hand, road accidents, fire, dangerous heart diseases are common in our country and all these cases require a huge amount of blood for the victim. Now a days, there is huge demand for an automated system for managing the safe blood donation. the system can automatically send message, email and notification to the relevant blood donors after a blood seeking request is generated, it will also bring the entire process into the supervision of a central authority. So, the **BBSMS** will be a new and effective platform for the people of the country.

Foundations

Aims, Objectives & Scope

Aims of the proposed project

Aims of the “**Bangladesh Blood Services Management System (BBSMS)**” project is:

- Centralized blood donation service.
- Location based blood donor search.
- Maintain blood transfusion history.

Objectives of the proposed project

- Managing the blood grouping and components info.
- Donor’s eligibility checking and serology history management.
- Searching nearby blood donors and sending notification to them.
- Manipulating voluntary organizations.
- Managing Blood Banks information
- Manipulating blood transfusion history

Main Goals

- Ensure the central monitoring over the blood transfusion process.
- Location-based emergency blood donor searching.
- Ensure safe blood transfusion by maintaining the serology reports and donation history.
- Report generation: donation history, serology history for individual donor and eligibility report of the donor for the medical officer.

High-level features/requirements for achieving the goals and objectives of the project

- Registration and login for the hospital, blood bank, voluntary organization, donor and seeker.
- Donor and hospital, blood bank approval process for the admin.
- Private donor database management system for voluntary organizations.
- Blood request management for the voluntary organization.
- Medical officer manipulation for the hospital or blood bank
- Blood request management for hospital and blood bank
- Serology reports manipulation for blood bank and hospital
- Transfusion history record for blood bank and hospital
- Location tracking and mobile phone login for the blood donor
- Notification of the blood request for the donor
- Various report showing for the donor (serology report, donation history etc.)
- Blood request submit for the blood seeker.
- Private request to the blood bank or voluntary organization for the seeker.

Key activities for achieving the goals

Activity	Description
Project Initiation	I have chosen this project to illuminate the increasing complexity in blood donation and to keep track and control the entire process centrally.
Feasibility Study	Operational, technical and economic feasibility of the project is measured to determine whether the project is feasible enough to continue.
System Analysis	Prioritized functional and requirements were selected from the requirement catalogue which.
System Architecture	Various technical architectures like DBMS, Web Server, interaction with other applications measured in this part.
System Design	Both structural and behavioral model of the proposed system designed in this part.
Implementation	In this part development methodology and required tools and programming languages are chosen and the development architecture will cutover to implantation.
Testing	System will be tested throughout the development.
Other Project Matters	Risk management, configuration management etc.
Documentation	The documentation of the project will be recorded in this section.

Table 4: Kea activities for achieving the goals

Prioritized Features according to MoSCoW

MoSCoW is a prioritization technique used in requirement analysis stage. It helps to understand the weight of the requirements.

According to MoSCoW technique prioritized requirements are:

SL	Requirement	Priority
01	Registration & Login for all users	Must have
02	Admin manipulation	Should Have
03	Manage blood bank, hospital donor and seeker	Must Have
04	Manage Medical officer	Must Have
05	Manage blood request	Must Have
06	Manage serology reports	Must Have
07	Manage transfusion history	Must Have
08	Manage blood seekers requests	Must Have
09	Manage private request to voluntary organizations.	Could Have
10	Private organization database management	Could have
11	Location tracking of the donors	Must Have
12	Sending email, message and notification to donor	Must Have
13	Reports	Must Have

Table 5: Prioritized Features

Exploration & Engineering

Based on the Prioritized Requirements List (PRL) the final requirements are:

- Blood donor manipulation system
- Blood seeker management facility
- Hospital and blood bank and medical officer manipulation
- Donors location tracking system
- Location-based donor searching facility
- Private request management for organizations
- Email, SMS and notification sending facility
- Serology test history system
- Blood transfusion history management
- Private organizations donor database

Iterative development – Timeboxing

Iterative development approach needs to divide the tasks into segments and a estimation of time for each segment. The project feasibility and foundation stage will take the 15-20% of the total time, actual development will take 50-60% time and documentation will take 10-15% of the project life time.

The project has to be completed within 3 months that means approximately within 280-320 hours. The entire project is divided into seven time-boxes of 20-40 hours.

Here I am going to use “T-Shirt” estimation technique estimating the time-boxes. Story points will be estimated by categorizing them t-shirt sizes like XS, S, M, L, XL. Both time and effort for the bigger size will more than smaller ones. (Berteig, 2015)

Timebox	Start Date	End Date	Duration	Tasks/Deliverables
TB1	21-09-2019	05-10-2019	9-10 days	Feasibility and foundations.
TB2	06-10-2019	12-10-2019	5-6 days	Requirements analysis and database design.
TB3	13-10-2019	25-10-2019	10-12 days	Developing the donor management, location tracking and notification sending system and admin manipulation.
TB4	26-10-2019	01-11-2019	6-7 days	Developing blood seeker and blood request management system.
TB5	02-11-2019	12-11-2019	10-11 days	Implementing hospital, blood bank and medical officer manipulation system.
TB6	13-11-2019	20-11-2019	11-12 days	Designing and developing location-based donor searching and private blood request management.

TB7	21-11-2019	24-11-2019	4 days	Implementing the private organization manipulation and their database manipulation.
TB8	25-11-2019	05-12-2019	10-11 days	Develop the safe transfusion and serology history management system.
TB9	11-12-2019	20-1-2019	10 days	Implementing the testing and deployment of the developed application.
TB 10	21-09-2019	20-12-2019	80-90 days	Documentation of the development.

Table 6: Time box estimation

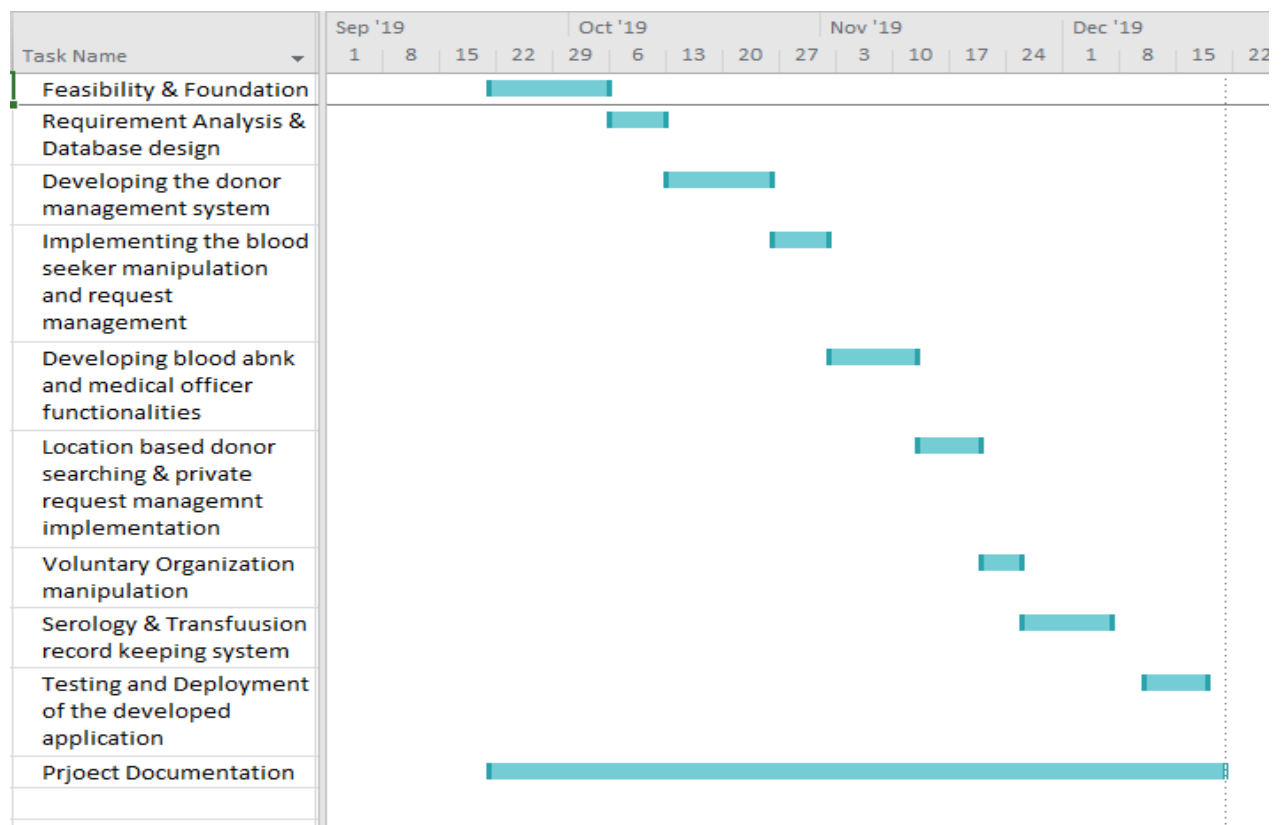


Figure 1: Gantt Chart of the Proposed Timebox Estimation

Deployment

In this phase the recommended solution will be implemented. I will design and develop the database, web application, android mobile application for the proposed system. I will develop the system iteratively using the DSDM Atern methodology. I am going to develop the web application using PHP/Laravel framework along with Bootstrap, jQuery for front end. I have chosen the MySQL for database implementation and android for mobile application development.

Conclusion

From the above discussion, we can say that **“Bangladesh Blood Services Management system”** will be very helpful for the people and it will ensure the safety concerns regarding to the blood transfusion. Realtime location-based blood donor searching helps people to easily manage the emergency blood requirements. Hopefully, this system will have a great impact on our country’s medical sector.

2. 2 Background of the project

Not only the Bangladesh but almost no developing countries don not have any centralized blood services. As a result, no regulation over the blood serology test and transfusion established in country’s health sector. Since last decade developed countries like Canada, USA and Japan deployed their national blood services under government regulation. In our country accidents like road accident, construction accident is common scenario and needs a handsome amount of blood for victims of these accidents. But finding blood donors at emergency is very tough so and some dishonest organizations make profit of it. On the other hand, each transfusion cost a minimum amount of money and government receive a 10% VAT from the private medical centers for these operations. There are some existing websites that allows to search for donors but none of these have accurate

information about donor like, last blood donation date, either donor is available or not and many other things. Besides this, the government is losing a huge amount of revenue just because of not having a central monitoring system. Info Blood Org, Bondhon, Sondhani, Badhon etc. are the most famous systems currently operating in blood sector.

That's why there is a huge demand for integrated and centralized blood services management system like this **Bangladesh Blood Services Management System** that offer individual blood donor and seeker operations, voluntary organization facility and blood bank or hospitals blood serology and transfusion tracking system. Because this type of applications reduces the time consumption and also provide easier way to accomplish the task.

2.3 Problem Areas

It is a serious problem that the lack of blood in emergency situations like operation and pregnancy problem. According to **World Health Organization (WHO)** only 31% of demanded blood comes from the voluntary donors and 69% required blood comes from the private sector specially from the professional donors and sellers. (WHO, 2018) A study shows that, almost all cases patients relatives or attendants are careless about the blood group and donor collection! In most cases they depend on blood brokers for managing emergency blood.

Study participants	Sample size Baseline assessment	Sample size end line assessment
KII with hospital director, professor cum managers	07	01
KII with associate professor and assistant professor	02	03
KII with healthcare providers, nurses and blood broker	04	03
KII with blood bank executive, technologists	01	04
IDI with patient relatives	20	20
Total	34	30
Grand total	64	

Figure 2: Patient Kills due to blood problems in Bangladesh

. (Sadika Akhter, 2016)

In 2008 processing cost for each bag of blood was BDT 200 to 400 in public blood bank and 500 to 1000 in private blood bank. In 2018 it costs 300-800 in public blood bank and 1500-4000 in private blood banks! And a total amount of blood screening in 2008 was approximately 351,188 times and in 2018 it increases to 750,526 times.

Screening Report of the Year 2008						
Donor Group	Total	(%)	HIV +ve		HBV +ve	
	Screening		No	%	No	%
Voluntary non- remunerated blood	96,572	27.50	5	0.0014	1,045	0.2976
Relative blood donor	250,117	71.22	7	0.0020	1,872	0.5330
Others	4,499	1.28	0	0.0000	20	0.0057
Total	351,188		12		2,937	

Figure 3: Blood Screening amount Report for 2008

(Islam, 2009)

Another problem is donor information because there is no donor database containing the donor's personal and contact info, blood grouping and tracking which makes the entire process very complex and time consuming.

2.4 Possible Solutions

It is really very complex process and the users faces lot of hassles. The solution must contain the option for monitoring the entire system by the regulator, central database for donors, seekers information should also store. Location wise and eligibility wise donor searching should contains in the solution and separate part for managing voluntary organizations should also include. Automatic donor filtering, eligibility checking, request validating should consist.

These all can be deployed via a web-based application, or server-based desktop application, mobile application or by combination of a web and mobile based system.

Chapter 3 – Literature Review

A sort of assessment article is called literature review. Literature review refers the term of a material UI collection on a specific topic not necessarily means the greater literary content of the world. The trusted information about any specific criteria refers the term literature review which is published any sort of renowned magazine doing a lot of research and analysis. (writingcenter, 2017) Literature review supplies the overall idea to understand a specific topic for the development purpose of the system. A literature review of the project helps to find out the problems area and solution of those problem area. This section helps to provide the potential discussion about the research and assists to make a compare within the same work area which paves the way for making a successful project.

3.1 Discussion on the Problem Domain

Blood Services Management System (BBSMS) focused on the Transaction Processing System (TPS) and Management Information System (MIS). After the government of Bangladesh re-formed the Bangladesh Council of Blood Transfusion in 2009, some organizations developed websites. Like INFOBLOOD, Blood Donors Club Bangladesh, Blood Cell, BADHON, Bangladesh Red Crescent Society. But still now there is no complete solution for the blood screening and transfusion in the country. Each of the above organization develop their system just considering their organizational activities. But the main problem is there is no collaboration among these organizations and their activities, due to lack of analysis and in-depth assessment. The main problems associated with the transfusion system of the country are-

- No monitoring system over the private blood transfusion sector.
- Not centralized
- Don't have donor information, blood grouping and tracking system.
- Not having the donor verification and eligibility checking system.
- Donor transfusion and serology/screening history storage.
- Unconsciousness of the victim and their relatives.
- Not having proper law and policy.
- No real-time donor location tracking and notification system.

(Islam, 2009)

These are the main problems in the safe and timely blood transfusion in Bangladeshi medicals and blood banks.

3.2 Discussion on the Problem Solution:

The BBSM project is about the centralized and safe blood transfusion which is under health and medical domain. In this era of technology and globalization automation is in everywhere from the bed to the office. Medical sector is not out of here. Technology make changes every day in this sector. Everything is getting computer based and data driven. The solution should consider about the issues stated bellow:

- **Security**

Since the system have to store confidential data including personal data, so data security should be the number 1 consideration for the solution. The system should implement high security features and implement role based restricted access to the data.

- **Trust**

The problem most faced by this type of systems is the trustworthiness. The entire system should be transparent to its users. To earn trust from the users the government policy should incorporate.

- **Privacy**

Privacy of the blood donor, seeker, voluntary organization, and blood banks need to ensure. To ensure the privacy the system should use encrypted data transfer and also use encrypted VPN tunnel for client server response.

- **Remote Access**

As the Bangladesh Blood Services Management System hosted on the Internet and different users access it through the Internet the access should be verified and protected. Network Address Server, External Firewall and VPN should be used to ensure safe remote access.

- **Users Identity Verification**

People provide fake information on the Internet due to less trustworthiness. To ensure the Identity of the blood donor, voluntary organization, blood bank and medical officer they should provide an identification material like NID for

donors, registration number for the voluntary organization, Bangladesh Medical Association provided approval number for the medical officer. As the system admin can verify the identity by querying to relevant authority.

- **Server Down or 24/7 Availability**

The availability of the application all the time from all over the country should be considered. Since, there is no alternative so the application must available 24/7. Server down, low bandwidth, mass traffic needs to handle.

- **Backup**

The system works with a huge amount of information so it needs to ensure regular backup of these data. A proxy server and data storage should always keep ready for backing up the system.

3.3 Comparison among the leading solutions

Surrounding is changing over the time and the time brings new technologies to get updated and make the life easier to live. Now a days the world is really too small like a village just because of the Internet. There are thousands of solutions for solving the same problem in different ways. Though BBSM is unique solution but there are some existing systems operating in the same domain.

Here in this section I am going compare the well renowned and popular current websites and list out their best features, strengths and weaknesses. These are-

- ❖ <http://infoblood.org/> (Bangladesh)
- ❖ <https://blood.ca/en> (Canada)
- ❖ <https://badhan.org/> (Bangladesh)

Info Blood

Infoblood.org is the largest blood searching portal in Bangladesh. The site allows its users to search as blood donors, or to become a donor. It also facilitates the various organizations to get registered and use this website for their activities.

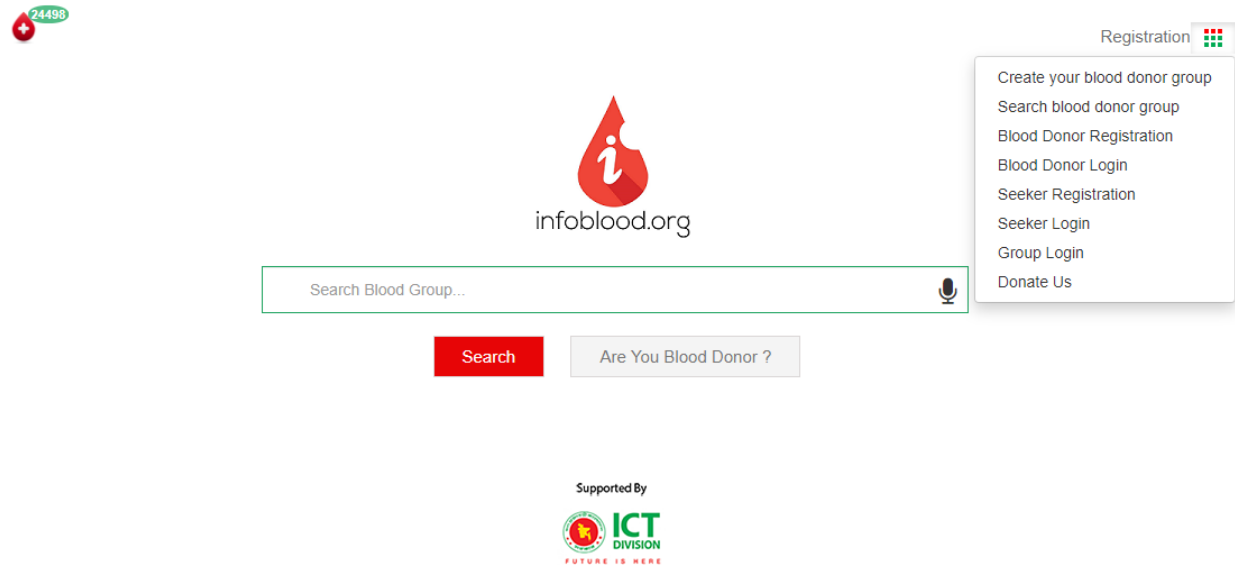


Figure 4: the overview of the Info blood

Best Features

- ✓ Blood group and static location wise blood donor search.
- ✓ Donor group
- ✓ Maintaining the user's personal profile.
- ✓ Send person to person request

Limitations

- o Lack of data privacy and security
- o No identity verification for users
- o No real-time request processing or notification system.

Canadian Blood Services

The largest blood services management system in the Canada as well as in the world. The system is funded by the territorial and central government of Canada. It facilitates all the medical and health services like, hospital, ambulance, blood, research and so on. It keeps track of its users and ensure the real-time request processing of emergency requests.

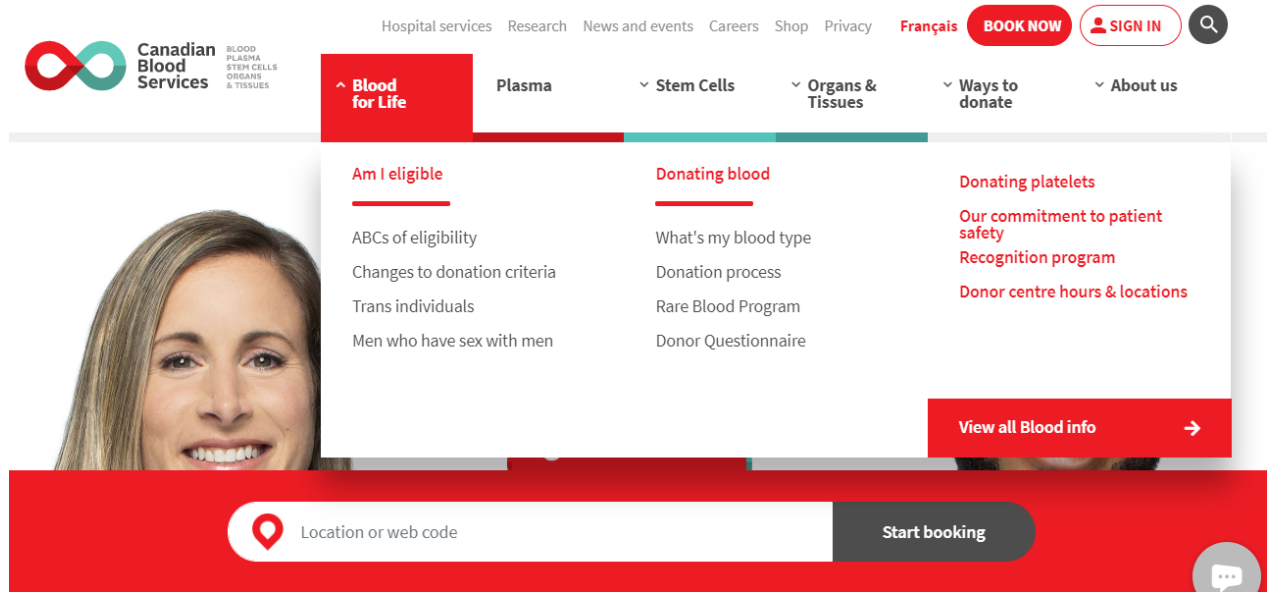


Figure 5: Overview of the Canadian Blood Service

Best Features

- ✓ Well organized and wonderful design.
- ✓ Donation time booking system.
- ✓ Individual donor can set his own donation criteria!
- ✓ Facilitates other medical supports also.
- ✓ Have a recognition program for the donors.

Limitations:

- Not only for blood services
- Pre-request donation system may.
- Don't manage the interaction among the hospital and donors.
- No private request options.

Blood Donors Club Bangladesh

One of the most popular blood donors searching website in the Bangladesh. This site facilitates to search blood donors by blood group district, and making request query.

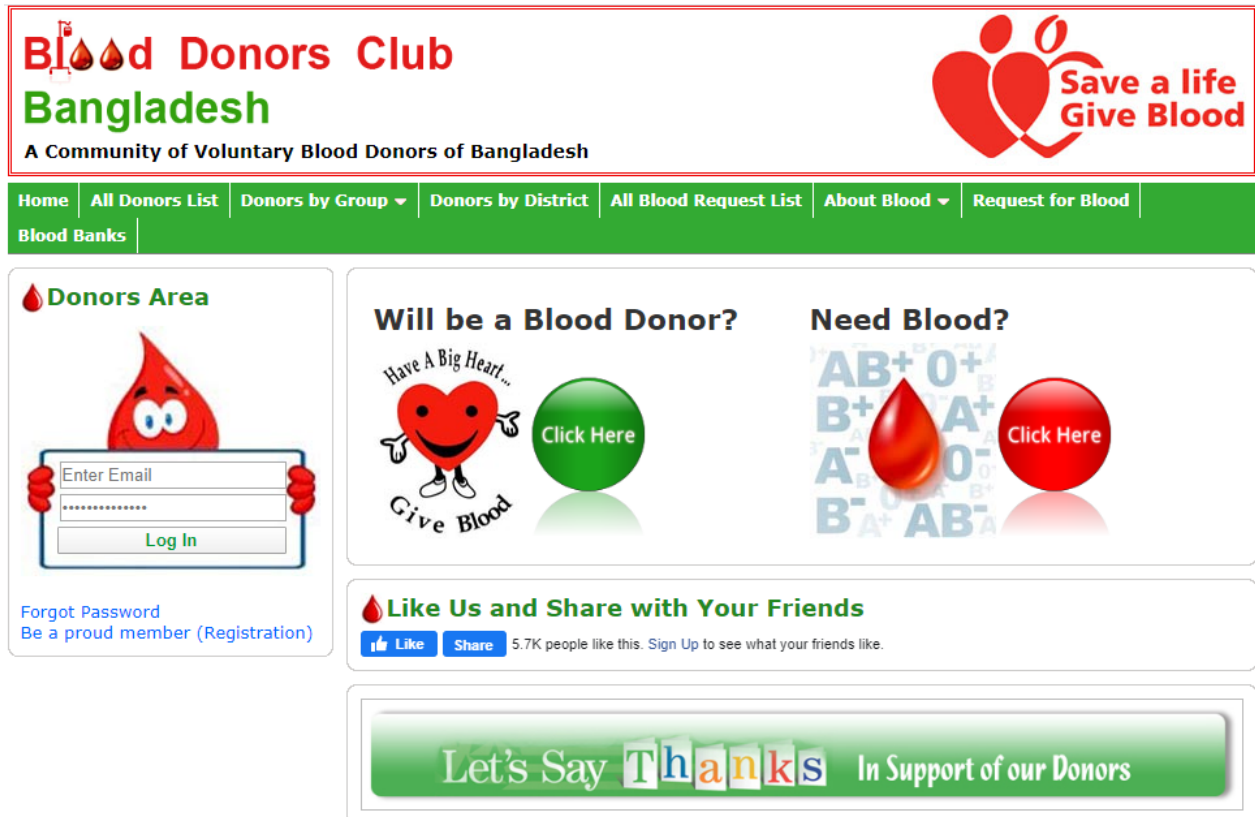


Figure 6: Overview of the Blood donors Club Bangladesh

Best Features

- ✓ Thanks giving to donor by the requester.
- ✓ Static location wise donor search.
- ✓ Blood group-wise searching.

Limitations

- Unattractive design and outlook.
- Donors privacy sacrifice.
- No real-time searching options.
- No option for donor's location tracking and request filtering.

3.4 Recommended Approach

From the above discussion it is clear that the existing websites don't have the required features. It also clears the functionalities and considerations need to take into account for the new system. The new system should provide the aspects listed here-

- User friendly and attractive outlook design of the system.
- Restricted access to the donor's information.
- Automated notification system.
- Private request to the voluntary organization.
- A central regulatory authority should be incorporated.
- Identity verification and approval process.
- Recognition program for the blood donors and voluntary organizations.

Chapter 4 – Methodology

For the successful project and management of the project in an efficient way software development methodology is chosen by the software team that works for the best of the project. All the methodologies have their own strengths and weakness and they exist for their own specific reason. Most often success rate of the development depends on the methodology which is selected for the development purposes. (alliancesoftware, 2017) This chapter will elaborately discuss the selected methodology and the appropriate reason for selecting the methodology with proper research and information.

4.1 What to Use

Software development methodologies actually play a vital role for the development process of the software. There are many software development methodologies like waterfall model, prototype model, agile software development, rapid application development, dynamic systems development model, spiral model, joint application development etc. (synopsys, 2018). Here I will describe 3 methodologies with their advantages and disadvantages.

Dynamic System Development Method (DSDM)

Dynamic system development method is actually a methodology based on the rapid application development methodology. Simultaneous user involvement through the whole iterative and incremental approach is the main priority of this methodology. (tatvasoft, 2014) For building a quality project with always customer feedback, DSDM always follows a proper approach.

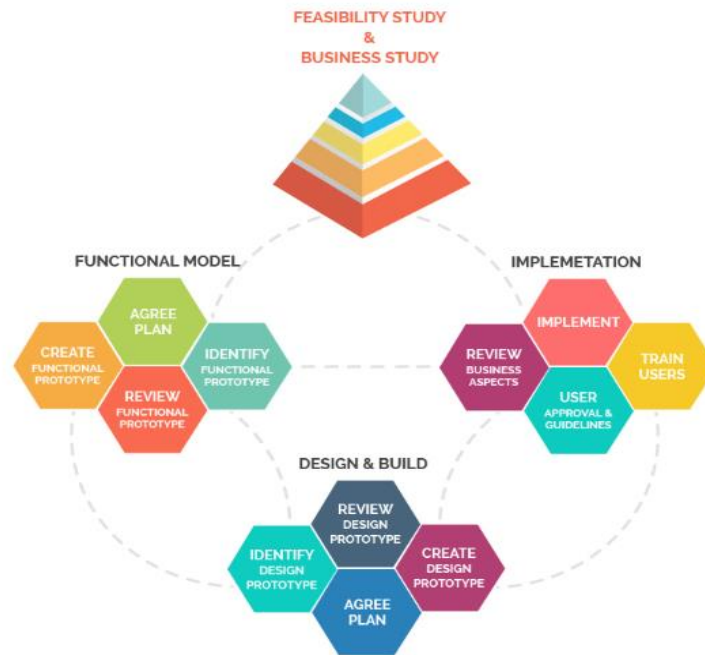


Figure 7: DSDM Methodology

Benefits of DSDM

- As users are highly involved in this methodology so they have the chance to get the grip through the development process.
- In this process the core functionality is developed quickly and the rest of the functionality is developed in an interval period.
- It delivers the project approach on time and within the budget. (tatvasoft., 2017)
- Allow changes and response quickly.

Drawbacks of DSDM

- Time limitation and cost is high.
- During the decision-making process senior programmer only plays a role.
- The project can be easily spoiled if the client is heisted and not clear about the final outcome of the project.

Structured System Analysis and Design Method (SSADM) or Waterfall Model

Most common model for software development among the software development methodologies. Often the approach of this methodology is considered with the classic style of the software development. (acodez, acodez.in, 2018) This model approach actually

follow the linear sequence that refers the term only any phase will start the workflow when earlier phase will be completed. This development process doesn't allow to go earlier phase if any changes are required to fill up the requirement.

SSADM Structure

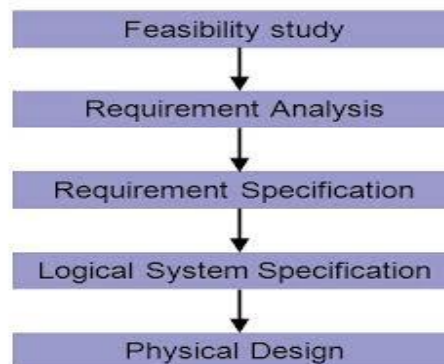


Figure 8: SSADM methodology

Benefits of SSADM

- Easy to understand and simple to implement.
- Because of solidness of the model it is flexible to manage the model. Because specific deliverables are done in every phase.
- Time saving and easier task tracking.
- For the smaller project this method is appropriate where the requirement is clearly notable.
- The testing part is easier following this method by using the references of the scenario mentioned in the before stage.

Drawbacks of SSADM

- Not ideal for maintenance type project.
- Don't allow to going back to previous stage means changes are not accepted.
- This model is most suitable for smaller kind of project but not suited for bigger and ongoing project.

Rapid Application Development

Rapid application development is an effective methodology that actually supplies the quicker development and quality work comparing with the other software development methodologies. Basically, it is decorated in such a way that it credits the maximum advantages of the software development in an easy way.

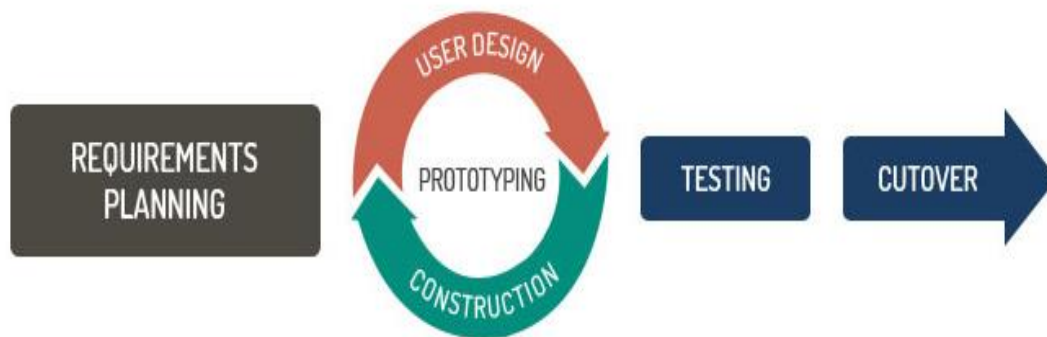


Figure 9: RAD Methodology

The main vision of this methodology is to increase the acceleration of the whole software development. Because of the involvement of the active user in the development process the vision of this methodology is easily achievable. (acodez, acodez.in, 2018)

Benefits of RAD

- Decrease the risk to minimum and required action to the software development industry.
- Good for small project.
- Feedback is received at the beginning of the development process.
- This method encourages the customer about the feedback message that helps to improve

Drawbacks of RAD

- Dependent of the experts for handling.
- Very much costly because of requiring expert persons.
- The overall progress depends on the individual's members performance.

Choosing Methodology

For considering the above criteria I have decided to apply the DSDM methodology for the Bangladesh Blood Services Management System project. DSDM will be the best choice and suitable option for the Bangladesh Blood Services Management System project because DSDM methodology always ensure the product and project quality within the time frame and it is quite flexible for using in any company or organization. Client or customers can change their requirement if they think any change is required for his project during development process.

4.2 Why to Use

The system needs to follow a methodology to successfully met the requirements on the given time frame and budget. A methodology helps to achieve the main goals of the project by following its proven predefined steps. Though it is really tough to choose a perfect methodology for an academic project like this but it will help a lot to complete the project and deliver output.

4.3 Sections of Methodology

The DSDM methodology have some fixed sections which the development team needs to follow. These are-

Pre-project Phase

In this section the initial project idea is generated along with time duration, budget and initial requirements.

Feasibility Study Phase

The economic, technological and operational feasibility for the proposed project measured in this section.

Requirement Gathering Phase

In this section both functional and non-functional requirements of the project are identified by using various techniques.

Requirement Analysis and Prioritization Phase

In this phase gathered requirements are examined and prioritized using a prioritization technique like MoSCoW.

Exploration and Engineering Phase

The main iterative section of the methodology used to explore the requirements and developed the solution iteratively.

Review Phase

In this section the developed deliverables are tested with the users and send back to previous phase if changes needed.

4.4 Implementation Plans

The last stage of the project work, where the developed application is released for use. To make the new system available for use if there is any problem associated with this identified and resolved. The release criteria, configurations and plan are decided in this section. After this if everything is okay then the new system is launched.

Chapter 5 – Planning

5.1 Project Plan

In this portion, showing the planning way of project completion. Basically, the project is divided into some specific parts and follow the planning all works will be completed in a fixed period of time that things are decided in this phase.

5.1.1 Work Breakdown Structure

This phase means that the project is to break into small task and through this, project can be completed within the fixed time period and in an easier and efficient way. This structure gives us an assumption about time and task. Without this structure, project could be more complex to complete. So, in the WBC, the proposed system has been formed into category and sub category by a chart in below:

	Task Name	Duration	Start	Finish
1	Introduction	5 days	Tue 9/24/19	Sat 9/28/19
2	Initial Study	5 days	Sun 9/29/19	Thu 10/3/19
3	Literature Review	4 days	Fri 10/4/19	Wed 10/9/19
4	Methodology	5 days	Wed 10/9/19	Tue 10/15/19
5	Plannig	5 days	Wed 10/16/19	Tue 10/22/19
6	Feasibility Study	4 days	Wed 10/23/19	Sat 10/26/19
7	Foundation	3 days	Sun 10/27/19	Tue 10/29/19
8	Exploration & Engineerin	16 days	Wed 10/30/19	Wed 11/20/19
9	Deployment	12 days	Wed 11/20/19	Thu 12/5/19
10	Testing	3 days	Fri 12/6/19	Tue 12/10/19
11	Implementation	2 days	Wed 12/11/19	Thu 12/12/19
12	Critical Appriasal & Evaluation	1 day	Fri 12/13/19	Fri 12/13/19
13	Lessons Learned	1 day	Sat 12/14/19	Sat 12/14/19
14	Conclusion	1 day	Sun 12/15/19	Sun 12/15/19
15	Totals	68 days		

Figure 10: Work Breakdown Structure of the BBSMS

5.1.2 Resource Allocation

All the assets and resources are allocated and managed to ensure the completion of the proposed project in an organized way. Resource allocation is one of the most important part of the project planning. Since it an academic project so I will perform in different roles on different times because there is no team. To meet the pre-scheduled task delivery deadline the resource allocation for the BBSM project is as follows-

SL	Task	Duration	Resource
1	Introduction	5	Analyst, User
2	Initial Study	5	Analyst
3	Literature Review	4	Analyst
4	Methodology	5	Analyst, User
5	Planning	5	Analyst, Team Leader
6	Feasibility	4	Analyst, User
7	Foundation	3	Analyst, Designer, Developer
8	Exploration & Engineering	16	Analyst, Designer, Developer
9	Deployment	12	Designer, Developer
10	Testing	3	Developer, Tester, User
11	Implementation	2	Analyst, Developer, User
12	Critical Appraisal & Evaluation	1	Analyst
13	Lessons Learned	1	Analyst, Designer, Developer, Tester
14	Conclusion	1	Analyst

Table 7: Resource allocation list

5.1.3 Time Boxing

DSDM divide the tasks into some time boxes to meet the goals before the deadline it is another very important part of the DSDM project planning. In this part all tasks divided into some timeboxes with a time duration. The iterative approach needs to complete these tasks withing the give period.

Timebox	Task	Resource
TB1	Introduction	Analyst, User
	Initial Study	Analyst
	Literature Review	Analyst
TB2	Methodology	Analyst, User
	Planning	Analyst, Team Leader
	Feasibility	Analyst, User
TB3	Foundation	Analyst, Designer, Developer
TB4	Exploration & Engineering	Analyst, Designer, Developer
TB5	Deployment	Designer, Developer
	Testing	Developer, Tester, User
TB6	Implementation	Analyst, Developer, User
TB7	Critical Appraisal & Evaluation	Analyst
	Lessons Learned	Analyst, Designer, Developer, Tester
14	Conclusion	Analyst

Table 8: List of the Time Boxes

5.1.4 Gantt Chart

Gantt Chart is the graphical representation of the project activity schedule. It shows the duration in a progress bar from start to end date rather than in days. The Gantt chart for the Bangladesh Blood Services Management System attached below:

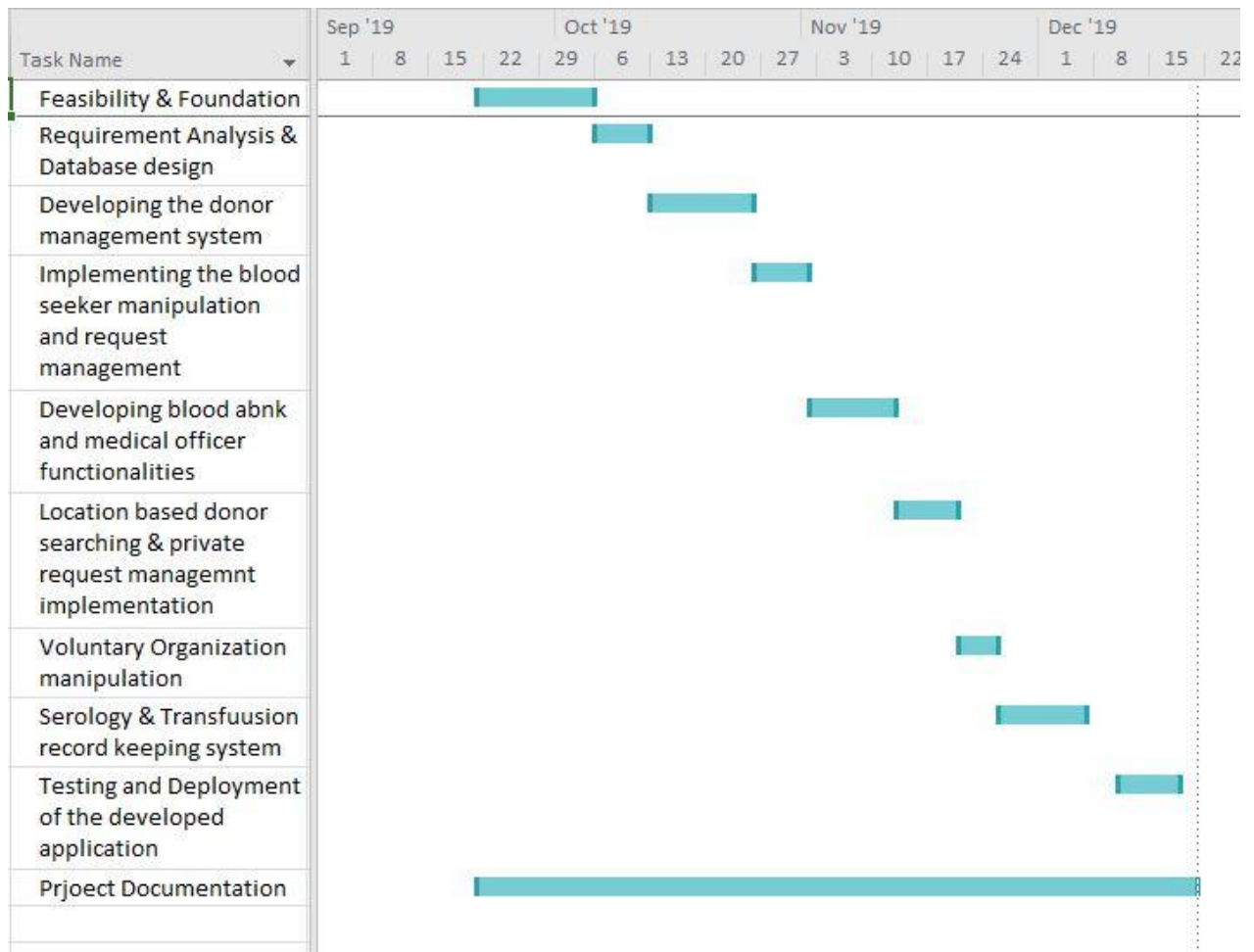


Figure 11: Project File cycle Gantt Chart

5.2 Test Plan

Test plan has been done based on differences between given input and expected output of particular system. During the software development the testing has been done including verification and validation process (codeProject.com, 2012)

5.2.1 Testing Against the Time Boxes

Time box process has been done by estimating a fixed and a maximum unit of time for a particular segment. Testing against time boxes-

User name	Example	Role	Example
Time box ID			
Time box content			

Test type	Test steps	Expected result	Actual results	Comment
Unit test				
Integration test				
System test				
Acceptance test				
Security test				
Usability test				
Reliability test				

Figure 12: Sample of Testing Against the Timebox

5.2.2 Required Test

There are several testing modules exists but functional and non-functional testing is the major two types of a system:

Functional Testing:

- Unit Testing: It works only on small parts of software design. In this area we separate units and check them making as individual or group of units. It is completed by the involved developer by using simple input and observing expected output. (GreekForceGreeks)
- Integration Testing: It works by taking unit tested components and making a program infrastructure that has been demonstrated by design. In this segment Group of components are combined together to produce expected output based on the given input by the programmer. Here included black box and white box testing. (GreekForceGreeks)
- System Testing: It works for several operating system included windows, Linux etc. It performs only with black box testing technique. By taking required input and demonstrate expected output with internal working (GreekForceGreeks)

Acceptance Testing: Users are directly interacted with this testing. After completion of above testing it has been done. It works based on user

expectation and satisfaction as well as fulfill the business requirements.
(GreekForceGreeks)

Non-Functional Testing:

- Security Testing: Security testing is completed by external and security testing of an application included web application. It validates unauthorized user or access as well as protecting external and internal attack included SQL injections.
- Usability Testing: It ensures the system make them as user friendly and how users can interact and acquire services too much easily. These types of checking and validation has been occurred in this usability testing.
- Reliability Testing: Users can interact directly with this testing. It ensures the reliability of the system's operation. It checks and ensures diverse types of failures of a system

5.2.3 Test Case

Test case included test case no, test type, test description and test steps.

Test Case No			
Test Type			
Test Description			
Test Steps	Expected Result	Actual Result	Comment

Table 9: Sample Test case

5.2.4 User Acceptance Test Plan

User acceptance is the final step of testing segment. It refers and check testing performance by the involved user.

Test Case No			
Test Type			
Test Description			
Precondition of testing			
User's name			
Act as			
Test Steps	Expected Result	Actual Result	comment

Table 10: User Acceptance Test Plan

5.3 Risk Management

Risk management is the method of identifying, analyzing and according to any risk that may be occurred on the ongoing project over the project development life cycle which help to track the remain project and meet its goal and expected outcome. A risk of a project may be included project's timeline, budget as well as on performance of the project. There are several types of risk management included

- Risk identification
- Risk assessment
- Risk precaution / action plan
- Steps taken for possible risks

5.3.1 Risk Identification

Risk identification is one of the most crucial segment and process of risk management planning. The first step of the risk identification is to ensure and identify risks which may be occurred and effected on the project as well as

identify and originate documents characteristics with its features. According to this project some risk identification criteria will be justified which are given below:

- Possible risk identification and track the risk with documented
- Identified risk elaboration included actual causes
- Future consequence and effect with impact of the risk

Elaboration of possible risk identification and track the risk of this project which are given below:

Type of Risks	Causes	Impact and Consequence
Scheduling	There are diverse types of reasons to occur scheduling risks included- ➤ Unintentionally delay cause of Natural disaster ➤ Specific segments failure included data loses of donors, admins as well as patients	➤ Project late submission
Database Error and Destroy	In this project several types of user included like donor, patient, admin etc. If a patient could not be found on the time of needed blood for the reason of lacking	➤ Patient could not find their expected blood

	system materials failure included ➤ Donner could not get access to the system because of database error	
Unauthorized Access	IF a person who is try to access to this system without a permission. This may cause and create a difficulty with risk included ➤ Data may be changed of donner, patient by this unauthorized user	➤ Confidential data may be hacked as well as changed
Technical Problem ➤ Hardware	➤ Lacking of required speed ➤ Lacking of required performance ➤ Lacking of required configuration	➤ Scheduling may failure
Project Backup	➤ Lacking of project backup on github or Similar to this	➤ Effects on costs ➤ Loses whole project

Network Failure	➤ Lacking of required internet connection access for some integrated api and email management	➤ Email cannot be sent to the donor, patient.
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Table 11: Risk Identification Table

5.3.2 Risk Assessment

Risk assessment involves with quantitative or qualitative value of risks included threats of a project

Types of risks	Likelihood	impact	Restore time
Scheduling	4	6	8
Database Error and Destroy	5	5	5
Unauthorized Access	6	6	6
Technical Problem ➤ Hardware	3	4	4
Project Backup	5	6	4
Network Failure	4	4	8

Table 12: Risk Assessment

5.3.3 Risk Precaution / Action Plan

Risk action plan has been done after completion of risk identification and risk assessment. There are diverse types of steps to plan action for risk included

- To prevent occurred and possible risks
- To reduce occurred and possible risks
- To solve those occurred and possible risks

Types of risks	Action	Action Taken By	Action Required
Scheduling	To make accurate time estimation by using Gantt chart etc. Technology Use: Forecast, Hive etc.	Involved developer	Before starting project development
Database Error	➤ To make required normalization ➤ To make perfect required relation on table	Involved developer	On the time of Data add, update and delete
Unauthorized Access	➤ To perform code with maintaining code smelling. ➤ To make multi-authentication system on this project	Involved Developer	On time of setting of authentication segments
Technical Problem ➤ Hardware			

Project Backup	Project backup on any cloud server like git hub	Involved developer	Update frequently
Network Failure	To build strong communication with network service expertise	Involved Developer	On time of project development

Table 13: Risk Precaution

5.3.4 Steps Taken for Possible Risks

After identifying and evaluating the possible risks the required steps are taken by the responsible person. This are-

Types of risks	Description	Likelihood	Impact	Steps Taken
Scheduling	One of the most possible risk is possibility to miss the project schedule and deadline.	Rare	High	The project time boxing and the Gantt chart and work breakdown structure created.
Database Error	May be possibility of duplicate entry, invalid relationships.	Likely	High	3 rd normal form normalization and entity relationship diagram used and data dictionary developed.
Unauthorized Access	Unauthorized access to the system.	Unlikely	High	The proper authentication system and access authorization implemented.

Technical Problem ➤ Hardware	Hardware may crash or may become unresponsive.	Frequent	Medium	Ensured backup and regular maintenance and monitoring.
Network Failure	Internet failure or connection problem.	Frequent	Low	The proxy server has arranged and high-speed bandwidth allocated.

Table 14: Risk dealing steps

5.4 Change Management

5.4.1 Factors that Might Cause Change

There are several types of changes needed for this system which are included:

- Changes in the scheduling segments
- Changes in the functional requirements
- Changes on different module of user interface
- Changes in the rating and review segments of the patient and donor segments
- Changes in the security handling segments

5.4.2 DSDM Welcome Change

The project development life cycle should be changed sometimes based on the project requirements. Because of these causes we should follow some methodology which accept diverse types of challenges based on needed the system. So here 'DSDM' is one of the applicable, reliable, proper executable methodology. In this system we follow this methodology to maintain and performing changes the time of development.

It works in several approach

- It develops a system to track for updating of any module of the system
- It takes review from the several users on time of segment changes

Like donner details, patient details, email automation changes

- It performs after completion of changes.
- It ensures the security purposes
- It ensures the reliability as well as scalability

5.4.3 Considering Business Priority

5.1 Changes has been considered as to fulfill expected goal and vision with business purpose. Because of this reason we need to prioritize on changes functionalities as well as requirements which will be the cause of strong benefit expected by involved users.

Priorities included-

Area of Topic	Priority Level
Scheduling segments	5
Functional requirements	7
User interface	5
Rating and review segments	4
Security handling segments	7

5.4.4 Change Workshop

By knowing profile of team members as well as user's communication will be built up in strongly. According to required changes and addition involved developers can make a workshop with creating questionnaire what will be needed to change and addition on this system.

By knowing profile of diverse types of users include patient, donner from experience typical discussion can be made as well as implementations has been done based on user experience and review which will be maintained by this change workshop.

Change workshop require for-

- To define the change and involved team
- To create strong profile of team members including users.

5.4.5 Changes That are Allowed

Changes has been needed to accept based on the change's priority level.

Changes has been needed to accept based on the several resource, cost, schedule, quality and risk. The time of development on a particular segment of this system we need to allow priority wise changes.

5.4.6 Key Decision Taker of Change

Key Decision taker of changes will take by the several expertise of their area.

In this project here included separated decision taker to changes included

- Requirements Analyst
- Developer
- Tester

Analyst can change the functional requirement if needed and developer take decision to change the relevant code if required.

5.5 Quality Management

Quality management is the maintaining the standard that user agreed to accept during the project initiation. Quality management depends on several characteristics included-

- To track donners, patients
- Communication among team members and users
- Continuous changes on requirements

5.5.1 Rules Applied to Maintain Quality

Rules are applied to maintain quality varies on system to system and users to users.

At the time of maintaining quality some rules are needed follow included quality control and quality assurance.

Quality Control:

By evaluating of donner, patients service quality control has been maintained included-

- By taking donner and patient review

Quality Assurance:

By evaluating the right and wrong approach justification quality assurance has been maintained included-

- To ensure quality by user request handling
- To ensure quality by sending perfection of email automation to the donor.

5.5.2 DSDM Standard Quality Measures

Solution quality: Solution quality has been ensured based on expected business needs and user's expectation by tracking user's requirements. To complete these process two types of prioritization has been used.

- Time Boxing
- MoScow

These two approaches have been completed with maintaining the scheduling.

Process quality: Process quality has been ensured based on targeted organization. To complete these process quality two types of approach has been defined and used.

- CMMI
- DSDM

5.5.3 Quality Plan and Measuring Meter

There several types of quality plan have been maintained in this stage included

- Scheduling and resource allocation have been done properly
- Testing has been done in every segment after completion of modules
- When all the changes have been done then need to track and documented all the changes properly for further proceed execution

Chapter 6 – Feasibility

6.1 All Possible Types of Feasibility

Operational Feasibility:

Since, operational feasibility concern about the usability, ease-of-use and required functionalities of the proposed system, the proposed BBSMS has proper validation and verification for user inputs, very easy and smooth navigation system, location-based searching option, easy request option which will make the system much easier and effortless to use. Admin, medical officer, blood donor and blood seeker can easily get access to their portal with valid credentials and perform their tasks very efficiently.

Technical Feasibility:

Some aspects of technical feasibility are:

Technical feasibility test reveals that the users of BBSMS can easily manage their activities rather than previous manual process. The system is designed and developed using latest and popular web and mobile technologies that ensures that the system is compatible to run in any web browsers with low-level Internet connection. System has an access control hierarchy to maintain secure access to the system data. Web based application is platform independent and its chosen development platform and resources are affordable and cost effective so it will be technically feasible.

So, clearly in this project perspectives the technical aspects are given below:

Hardware:

- HP laptop (Configuration)
- Wi-fi Router

Software:

- Xampp
- Microsoft office
- Google chrome browser
- Windows 10(operating system)
- PHP storm

Database:

- MySQL

Technology:

Client Side:

- Html
- CSS
- Java Script
- Bootstrap
- JQuery
- Ajax
- Android9 (for mobile user)

Server Side:

- PHP
- Laravel 6.3

Economic Feasibility:

There are various alternatives to develop the proposed system including, web-based application, mobile application, desktop application etc.

- Web based application cost:

the entire application and data are hosted into a remote server and it can be accessed via Internet anytime from anywhere, no installation is needed.

Equipment	Cost per unit	Cost
Extranet network with VPN	₹2000 per month	₹2,000
Desktop pc (core i9, 3.6 GHz processor, 32 GB DDR4 RAM, 2 TB HDD)	₹1,00,000	₹1,00,000
Web, File and Email servers	₹10,000 per month	₹10,000
Total		₹1,12,000

▪ Mobile Application cost:

the app containing the system need to install on every device and there need to develop three different application for blood bank/hospital, blood donor and blood seeker. Which might be a bit costly than others solution.

Equipment	Cost per unit	Cost
Web, email, file servers.	₹5,000 per month	₹5,000
Desktop pc (core i9, 3.6 GHz processor, 16 GB DDR4 RAM, 1 TB HDD)	₹1,00,000	₹1,00,000
Total		₹1,05,000

▪ Desktop Application cost:

Equipment	Cost per unit	Cost
Web, email, file servers.	₳5,000 per month	₳5,000
Desktop pc (core i9, 3.6 GHz processor, 16 GB DDR4 RAM, 1 TB HDD)	₳1,00,000	₳1,00,000
Total		₳1,05,000

To make the system live a domain name and hosting service are required. Since, to serve the location-based donor search the system need to track the location of the donor continuously, I will develop a mobile app to rack donor's location and to send them emergency notifications. Rest of the system will be developed as web application.

Market Research Analysis Based on the Feasibility Factors:

This section includes the market and user demand. According to WHO (World Health Organization) only 40% of required blood is collected each year in Bangladesh and 80% women who die during pregnancy, die for blood (WHO, 2017). On the other hand, road accidents, fire, dangerous heart diseases are common in our country and all these cases require a huge amount of blood for the victim. Now a days, there is huge demand for an automated system for managing the safe blood donation. the system can automatically send message, email and notification to the relevant blood donors after a blood seeking request is generated, it will also bring the entire process into the supervision of a central authority. So, the BBSMS will be a new and effective platform for the people of the country.

6.2 Cost Benefit Analysis

Cost benefit analysis mainly focus on getting the assumption of earning and expenditure. To get the benefit total expenditure and earning are compared. Cost benefit analysis are given below for this project:

Total cost:

SL no.	Equipment	Year 1	Year 2	Year 3	Year 4	Year 5	Total
1	Web based application cost	₹1,12,000	-	-	-	-	₹1,12,000
2	Mobile Application cost	₹1,05,000	-	-	-	-	₹1,05,000
3	Desktop Application cost	₹1,05,000	-	-	-	-	₹1,05,000
4	Domain and hosting Cost	₹20,000	₹20,000	₹20,000	₹20,000	₹20,000	₹1,00,000
5	Employee Expenses	₹40,000	₹40,000	₹40,000	₹40,000	₹40,000	₹2,00,000
6	Other Cost	₹20,000	₹20,000	₹20,000	₹20,000	₹20,000	₹1,00,000
	Total Cost	₹4,02,000	₹80,000	₹80,000	₹80,000	₹80,000	₹7,22,000

Table 15: Total Cost Estimation for the project

Total Earn:

SL no.	Earn Sector	Year 1	Year 2	Year 3	Year 4	Year 5	Total
1	Govt. Tax 1	₹1,50,000	₹1,80,000	₹2,10,000	₹2,40,000	₹2,70,000	₹1,050,000
2	Govt. Tax 2	₹2,00,000	₹2,10,000	₹2,40,000	₹2,60,000	₹3,00,000	₹1,210,000
	Total	₹3,50,000	₹3,90,000	₹4,50,000	₹5,00,000	₹5,70,000	₹2,260,000

Table 16: Earning estimation for the project

Total Revenue:

SL no.	Sectors	Year 1	Year 2	Year 3	Year 4	Year 5	Total
1	Total Earning	₹3,50,000	₹3,90,000	₹4,50,000	₹5,00,000	₹5,70,000	₹2,260,000
2	Total Equipment Cost	₹4,02,000	₹80,000	₹80,000	₹80,000	₹80,000	₹7,22,000
	Total Revenue	-₹52,000	₹3,10,000	₹3,70,000	₹4,20,000	₹4,90,000	₹1,538,000

Table 17: Estimated Revenue on a Five-year scale

So, it is clear that, promoting this system, the govt. will earn revenue per yearly a big amount of taka from collecting VAT and Taxes from various blood banks and hospitals. The revenue will be increased per year. So, this project will be benefitable for government and also humanly for human.

6.3 Is DSDM Good or Bad for this Project

This is an academic project and need to complete within a limited amount of time with all basic functionalities. The project may need accept changes during the development so it should develop iteratively. DSDM ensure the iterative development process and impose strict rule and restrictions. It ensures the quality of the work within the time limit. It also ensures user involvement throughout the project life time. So, it is clear that DSDDM is the best methodology to follow for Bangladesh Blood Services Management System.

Chapter 7 – Foundation

7.1 The Problem Area Identification

Finding out the problem is a best improvement for any project. And that part can be done by the user because mainly they will be used the system. So, there are some portion seems problem which collect from the user are given below:

7.1.1 Interview

Want to gather information or know the actual problem or know the actual goal, for this interview is the best option. By finding problem can be percept the actual solution. So, for the proposed system, from user some questions are set to take the interview which are given below:

1. For Donor:

- At the time of blood donation what kind of problem faces
- Can get the notification and is it real time
- Previous tracking history is important or not

2. For Seeker:

- At the time of emergency blood search what kind of problem faces

- Is currently search process perfectly work or need to more smooth or user friendly
- Proper help from voluntary organization to manage private request

3. For Medical Officer:

- Faced any problem of getting update of donor for checking the eligibility
- Faced any of managing serology reports

7.1.2 Observations

Observations are also very helpful for collect user's requirements and know the actual problem. Mainly observations techniques use to go to the work place and finds out solution to accept the users. So, main points of observations are:

- For Donor, check blood donation system in the existing system
- For Donor, Check notification system in the existing system
- Know the actual purpose of previous history tracking in the existing system
- For Seeker, checking emergency blood search portion in the existing system
- Reviewing the voluntary organization help in the existing organization
- For Medical Officer, reviewing donor eligibility report in the existing system

7.1.3 Questionnaires

Questionnaires are effectively best techniques to collect information and asking question to the users and other actors. Some questions are set for the user and it might be MCQ or short questions. So, questions are given below:

Questions for Problem Identification			
Name		Age	
General User	Blood donor	Gender	
Question-1	How frequently you donate blood?		
Ans			
Question-2	How do you want to get notified if you are prepared for donate again?		
Ans			
Question-3	How do you feel to share your location?		
Ans			
Question-4	Tell us your thought about donation management system.		
Ans			

Questions for Problem Identification			
Name		Age	
General User	Blood seeker	Gender	
Question-1	How do you manage donor on emergency?		
Ans			
Question-2	What should be the emergency blood processing system?		
Ans			
Question-3	How do you contact with the voluntary Organizations?		
Ans			

Questions for Problem Identification			
Name		Age	
General User	Medical Office	Gender	
Question-1	Will it easy for you to handle things if a central system is developed?		
Ans			
Question-2	How do you validate that a donor is really eligible?		
Ans			
Question-3	Is it important to kept serology history of the donor?		
Ans			

7.2 Rich Picture

Rich picture is the birds eye view or top view of the activities of a system's users. It also visualizes the conflicting issues, communication, and business processes. The rich picture of the BBSM is as follows-

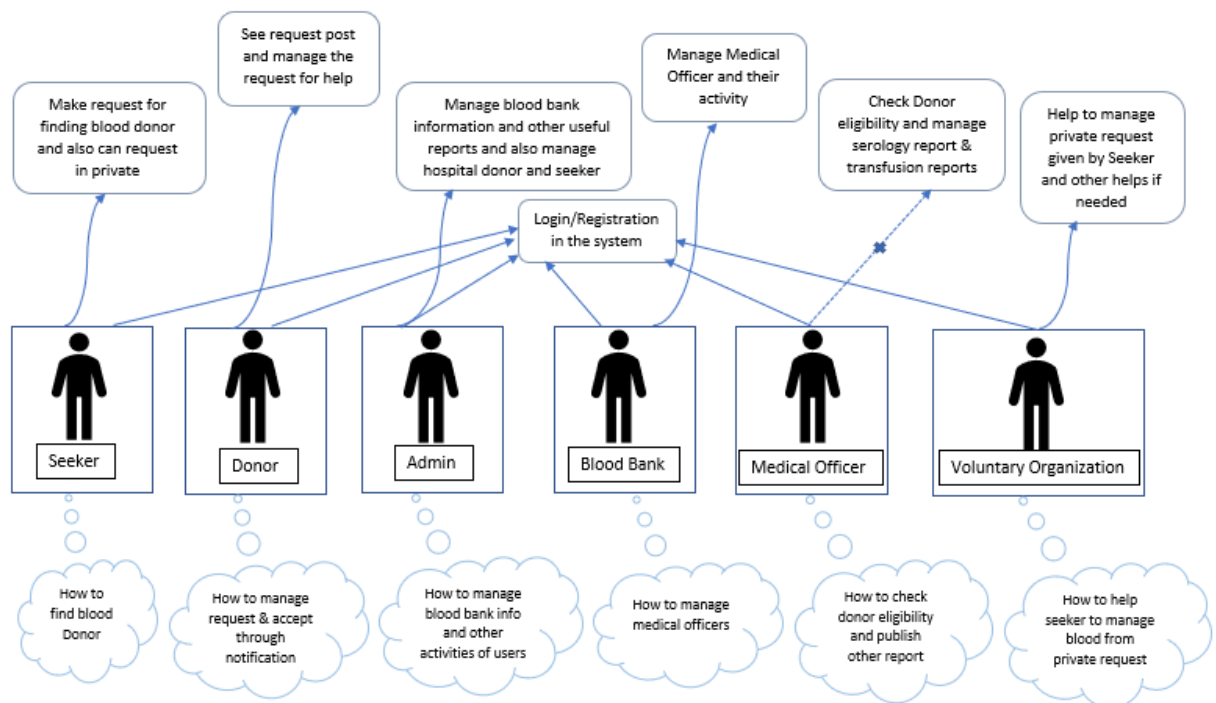


Figure 13: Rich Picture of the BBSMS

The legends of rich picture

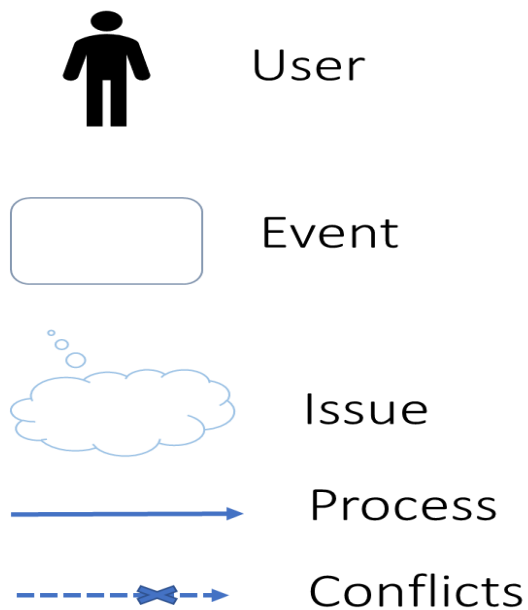


Figure 14: Legends of the rich picture

Key actors

There are six types of actors in the BBSMS system

- Admin
- Blood Donor
- Blood Seeker
- Blood Bank
- Medical Officer
- Voluntary Organization

Short description of rich picture:

The picture shows that admin can monitor and manage every processes and manage conflicts. It shows the conflict between the donor and medical officer, seeker and medical officer, medical officer and admin. It also shows that many issues may arise.

7.3 Specific Problem Area Identification

By using the information gathering techniques a number of problems are identified in the problem area identification section. And rich picture illustrates the entire system processes of the BBSMS. By analyzing these I have identified some specific problems which are-

- No centralized blood service management system in the country.
- No real-time emergency blood need processing.
- No real-time location tracking and location-based donor filtering.
- Insecure donor information and donor's privacy violation.
- To record keeping system for transfusion and serology.
- Almost impossible to track the donor's eligibility and last donation date.
- There is no way to identify and verify the users.

7.4 Possible Solutions

The proposed solutions against the identified problems are-

- A new centralized system can be developed means BBSMS.
- Real-time donor location tracking and notification system should develop.
- Increase trustworthiness by imposing government policy and legal rules.
- Security and privacy concerns should resolve.

7.5 Overall Requirement List

The final overall requirement list is given below-

Functional Requirement

- Blood donor manipulation system
- Blood seeker management facility
- Hospital and blood bank and medical officer manipulation
- Donors location tracking system
- Location-based donor searching facility
- Private request management for organizations
- Email, SMS and notification sending facility
- Serology test history system
- Blood transfusion history management
- Private organizations donor database

Non-functional Requirements

- Proper data security and privacy
- Ensure the data and resources backup.
- User friendly interface design.
- Implement the authentication and authorization to restrict the access.
- Implement the accessibility issues as defined in law.
- Validation and verification

7.6 Technology to be Implemented

There are various implementation technology options for implementing the proposed system. Choosing the right technology is very important to become successful. The alternatives are-

Client-Server Application Technology

This technology is a desktop-based technology, where the application needs to install on the client's device and the data stored on the remote server. The client application requests to the remote server for required data and the server responded. (toastyttech.com, 2019)

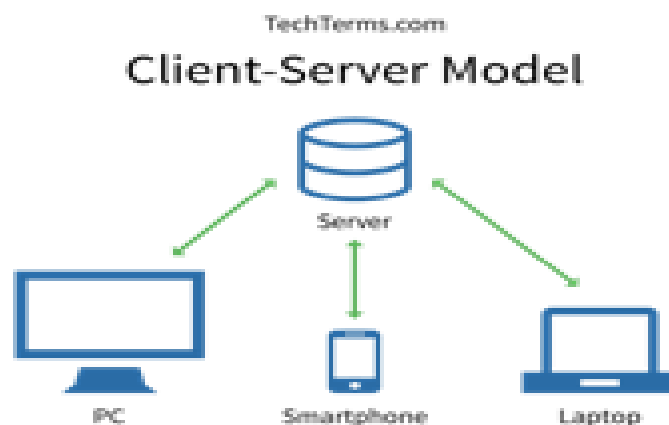


Figure 15: Client Server Application Model

(TechTerms, 2016)

Basic features of client-server application are listed as follows-

- Application need to physically install

- Need to maintain server and client application
- Costly as users need to purchase the application.
- Not portable and always accessible.

Web Application

Web applications are hosted on the remote server and there is no need to install anything on client device. The application is accessed over the internet and a web browser. This required two types of scripting. These are client side and server-side scripting. (Kohan, 2019) main features of a web-based application are-

- No installation needed.
- Accessed via internet and web browser on the cloud.
- Relatively low cost.
- Accessible from anywhere at any time.

7.7 Recommendation and Justification

The proposed Bangladesh Blood Services Management System need to accessible from all over the country all the time. Even the system should be accessible from any internet enabled device like smartphone, laptop, desktop and tablets. It also should accommodate a huge number of users at the same time. Which is not possible by using client-server application technology, so the web application is the recommendation for the proposed system.

Chapter 8 – Exploration

8.1 Old System Use Case

Use Case diagram illustrates the flow of the business functionalities of a system. Here I am going to give the Infoblood.org's use case as old system use case.

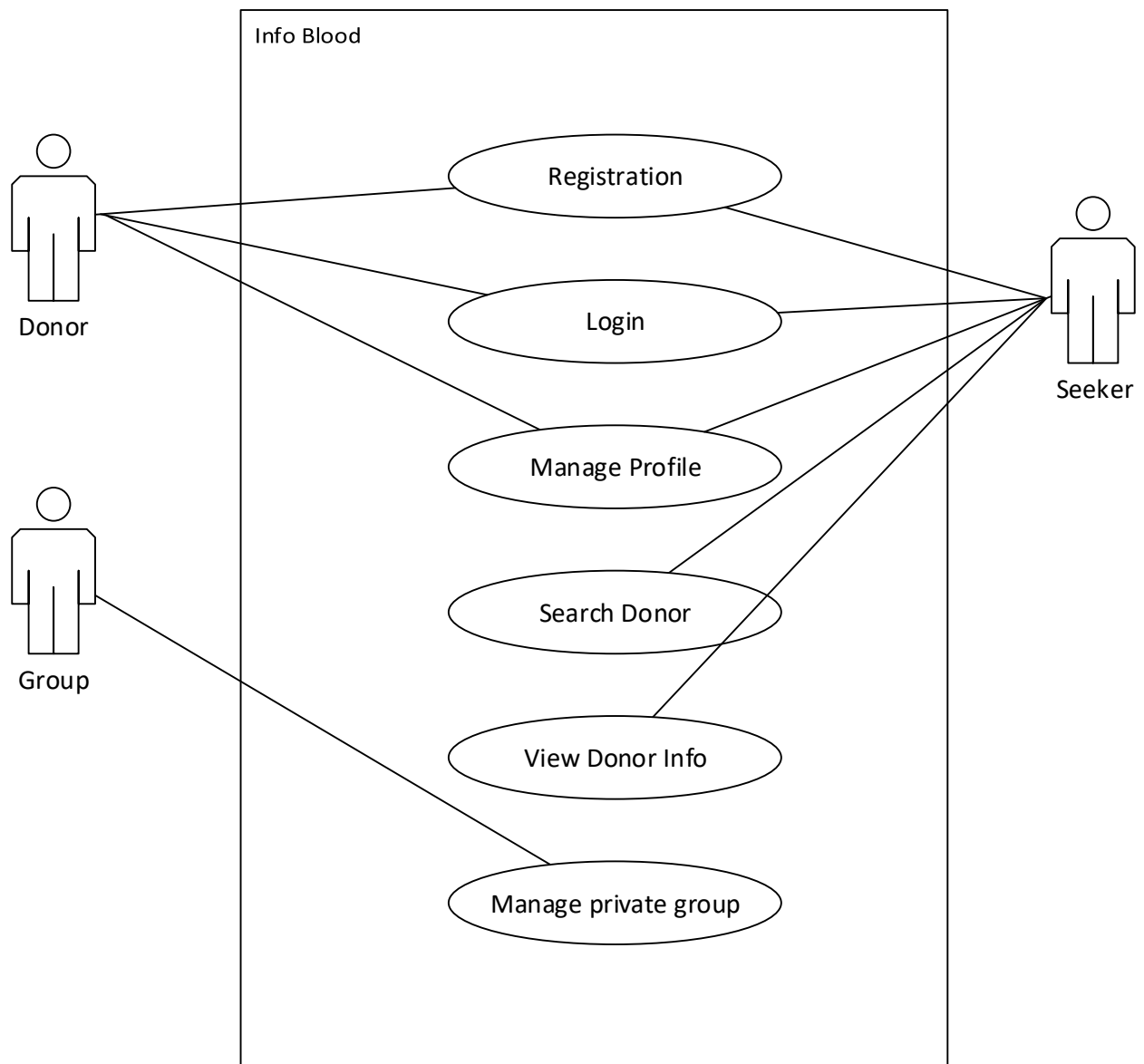


Figure 16: Use Case Diagram of Info Blood

8.2 Activity Diagram

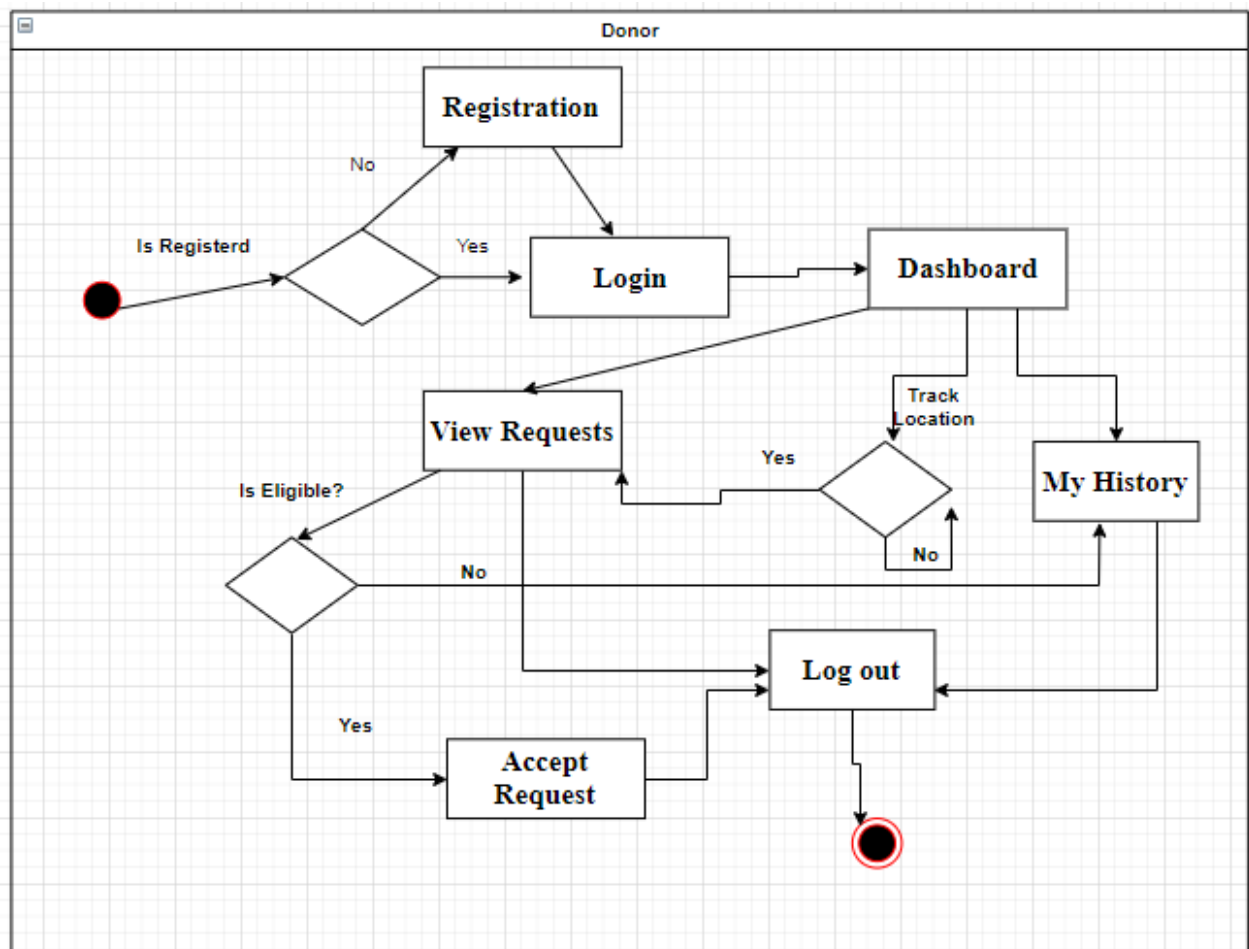


Figure 17: Donor Activity Diagram of BBSMS

8.3 Full System Use Case

Use Case diagram for the proposed BBSMS is given below-

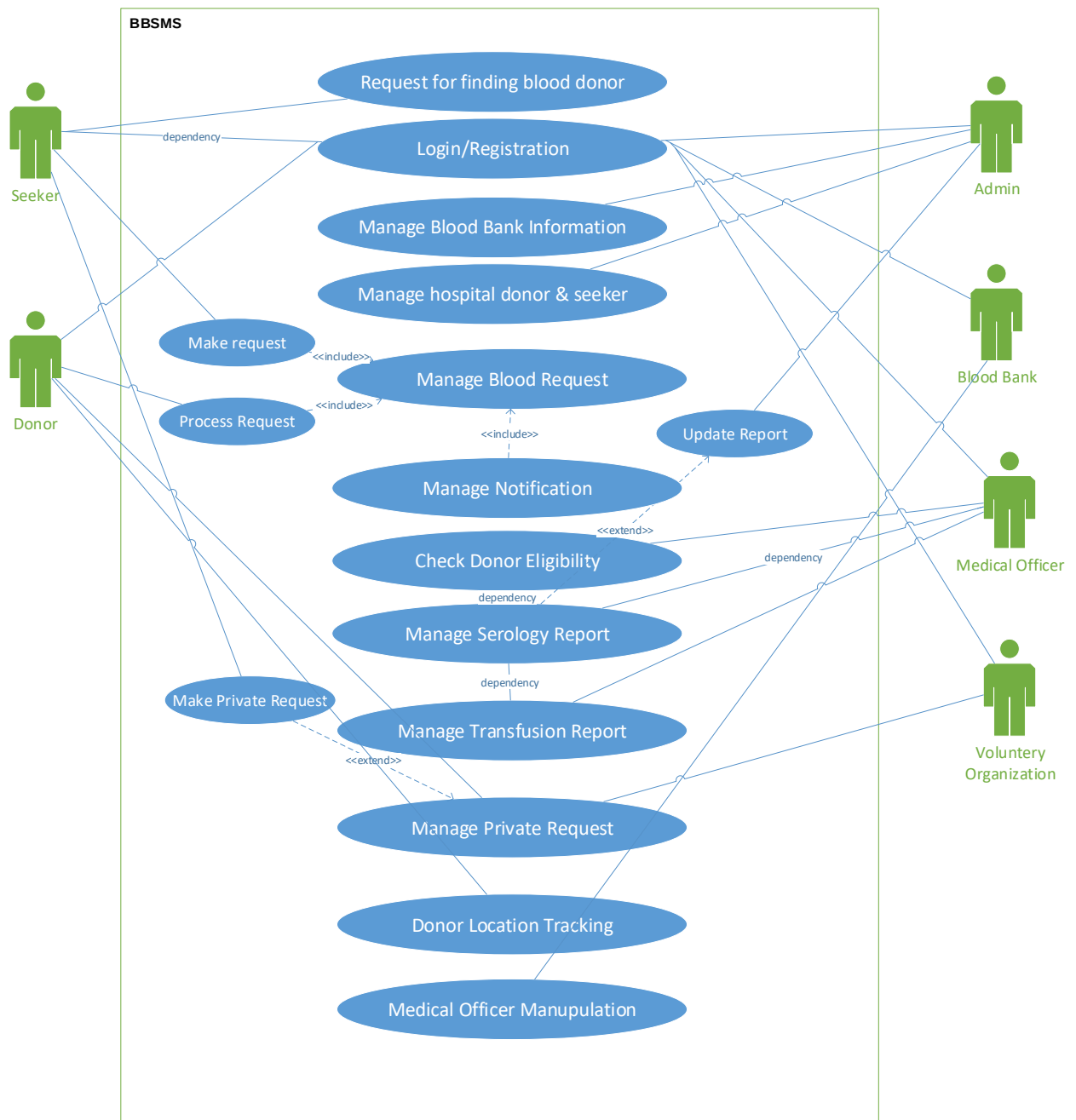


Figure 18: Use Case of the Propose BBSMS System

8.4 Full System Activity Diagram

The proposed BBSMS system have various types of users with different workflow. The activity diagrams for these work flows are given below-

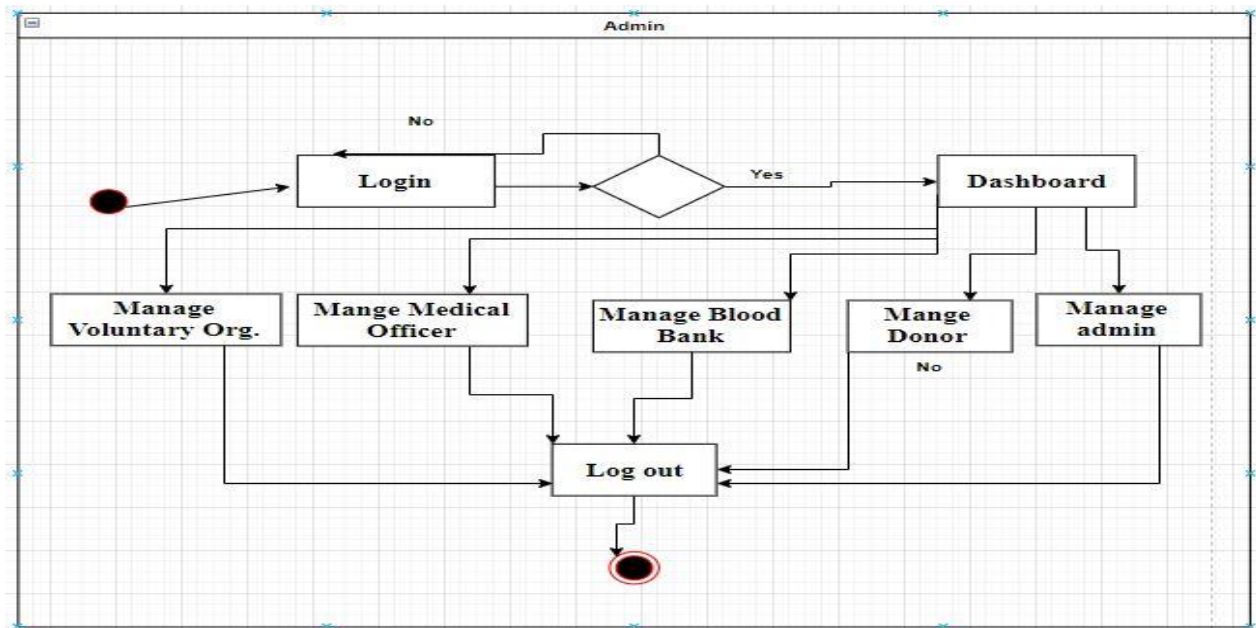


Figure 19: Admin Activity Diagram

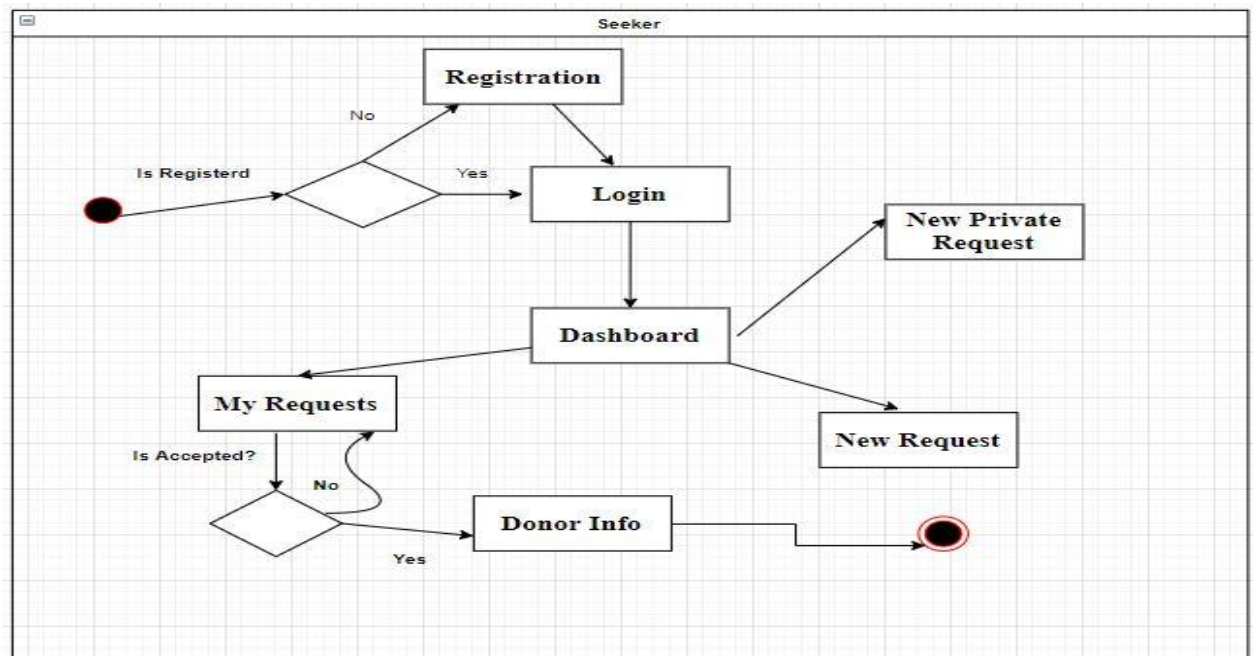


Figure 20: Blood Seeker Activity Diagram

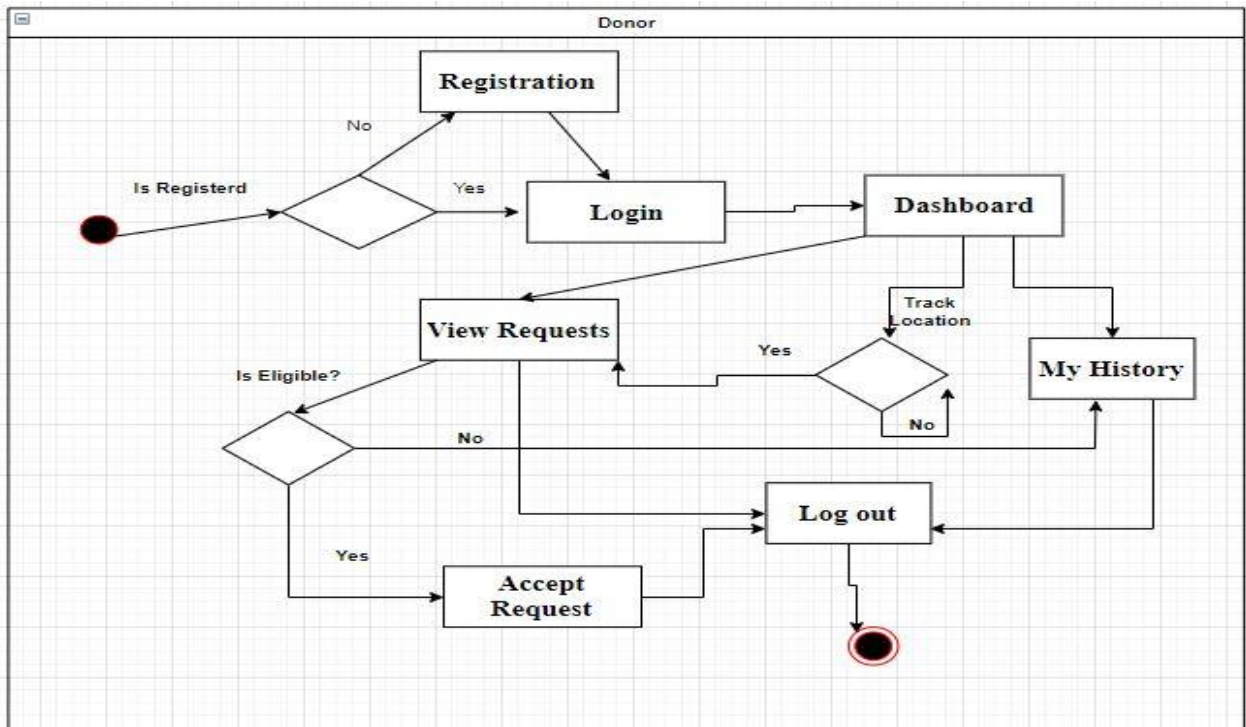


Figure 21: Blood Donor Activity Diagram

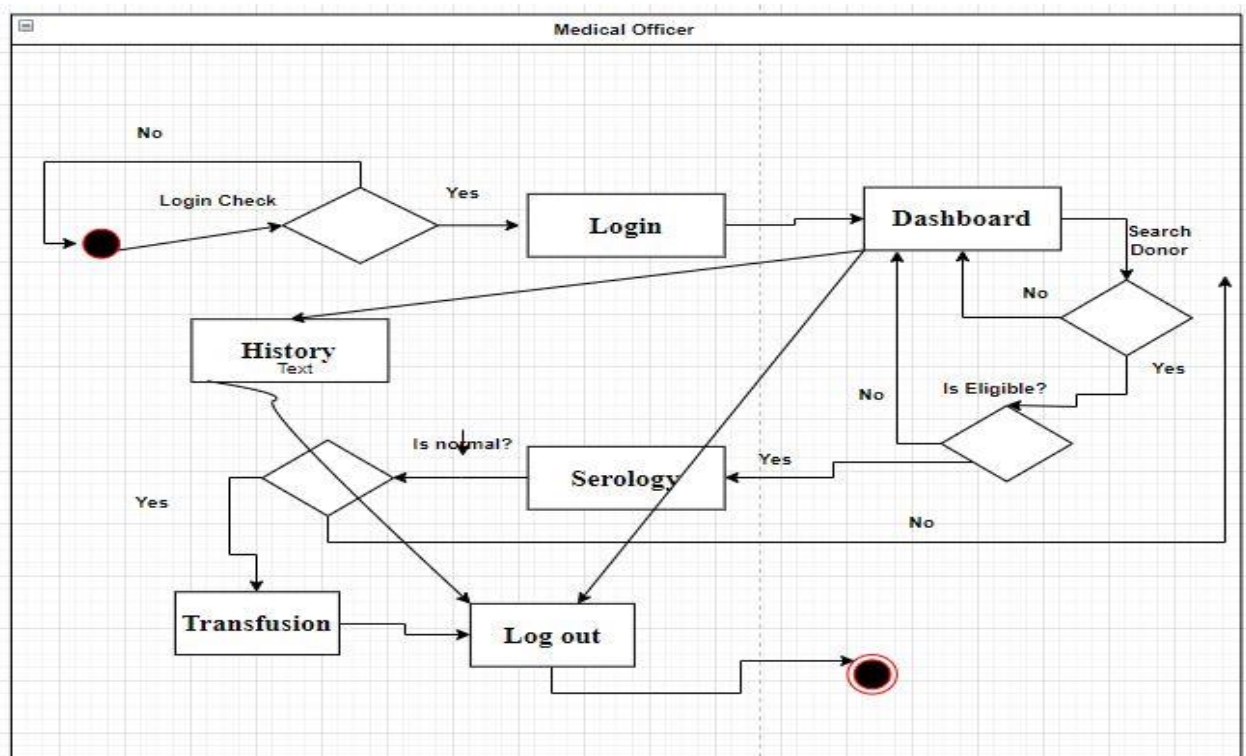


Figure 22: Medical Officer Activity Diagram

8.5 Requirements Catalogue

Requirement catalogue is a list containing all the identified requirements of a project. Here I am going to add the identified requirements to requirement catalogue following standard format.

Registration and login requirement catalogue

Source:	Sing off:	Priority	Requirement ID:
Admin	All users	Must	M-001
Functional Requirement			
Registration and Login for users			
All types of the system users need to get registered and then login into the system. No one can perform an action without proper authentication.			
Non-functional requirement			
Description	Target Value	Acceptance Value	Comment
Login/Registration per day	10000 per day.	8500	

Table 18: Requirement Catalogue for Registration & Login

Blood Request requirement catalogue

Source:	Sing off:	Priority	Requirement ID:
Seeker	Blood seeker	Must	M-002
Functional Requirement			
New blood request for the seeker.			
The seekers can post new blood request and also manage their history.			
Non-functional requirement			
Description	Target Value	Acceptance Value	Comment
Blood request per day	3000	2000	

Table 19: Blood Request Requirement Catalogue

Donor's location tracking and notification system

Source:	Sing off:	Priority	Requirement ID:
Donor	Blood Donor	Must	M-003
Functional Requirement			
Location tracking and real-time notification sending			
Location of the donor need track and eligible donors need send emergency notification whenever a blood request is posted.			
Non-functional requirement			
Description	Target Value	Acceptance Value	Comment
Location Tracking and notification sending	20000	17500	

Table 20: Location Tracking and notification requirement catalogue

Private request management requirement catalogue

Source:	Sing off:	Priority	Requirement ID:
Seeker	Blood Seeker	Could	C-001
Functional Requirement			
Private blood request			
Seekers could send the private blood request to the voluntary organization.			
Non-functional requirement			
Description	Target Value	Acceptance Value	Comment
Private blood request per day	1000	300	

Table 21: Requirement Catalogue for private blood request

Eligibility and serology history management requirement catalogue

Source:	Sing off:	Priority	Requirement ID:
Medical Officer	Medical Officer	Must	M-004
Functional Requirement			
Donor eligibility checking and serology & transfusion			
Medical officer must be able to check the eligibility of the donor and also able to add serology and transfusion info.			
Non-functional requirement			
Description	Target Value	Acceptance Value	Comment
Serology & transfusion history per day	5000	2700	

Table 22: Eligibility and serology requirement catalogue

8.6 Prioritized Requirements List (PRL)

I have used MoSCoW prioritization technique to make priority list of identified requirements. The prioritized requirement list of the Bangladesh Blood Services Management System is given below-

Must have requirements-

SL	Requirement	Priority
01	Registration and login for all users	Must
02	Manage blood bank, donor, seeker and organizations	Must
03	Manage Medical Officer	Must
04	Manage normal and private blood request	Must
05	Manage serology and transfusion history	Must
06	Location tracking and notification system	Must

Should have Requirements-

SL	Requirement	Priority
01	Admin manipulation	Should
02	Seeker request history management	Should

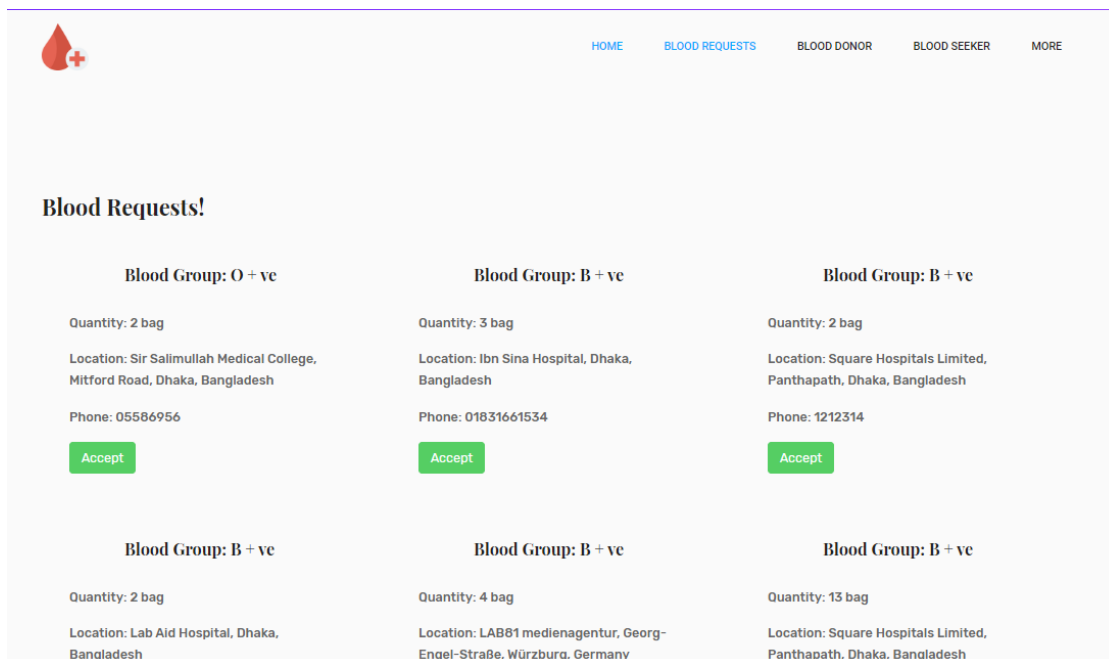
Could have Requirements

SL	Requirement	Priority
01	Mange private requests	Could
02	Private organization donor database management	Could

8.7 Prototype of the new system

Some Prototypes of the Bangladesh Blood Services Management System are given here.

Blood Request Page Prototype



The prototype shows a web interface for blood requests. It features a navigation bar with a red blood drop icon and links for HOME, BLOOD REQUESTS, BLOOD DONOR, BLOOD SEEKER, and MORE. The main content area is titled "Blood Requests!" and displays six request cards in a 2x3 grid. Each card includes the blood group, quantity, location, phone number, and an "Accept" button.

Blood Group	Quantity	Location	Phone
O + ve	2 bag	Sir Salimullah Medical College, Mitford Road, Dhaka, Bangladesh	05586956
B + ve	3 bag	Ibn Sina Hospital, Dhaka, Bangladesh	01831661534
B + ve	2 bag	Square Hospitals Limited, Panthapath, Dhaka, Bangladesh	1212314
B + ve	2 bag	Lab Aid Hospital, Dhaka, Bangladesh	
B + ve	4 bag	LAB81 medienagentur, Georg-Engel-Straße, Würzburg, Germany	
B + ve	13 bag	Square Hospitals Limited, Panthapath, Dhaka, Bangladesh	

Figure 23: Blood request page prototype

Seeker Registration page prototype

BBSMS Seeker Panel[Home](#)[New Request](#)[New Private Request](#)[My R](#)

Seeker Registration

Name

Select Blood Group ▼

Address

Phone

Email

Password

Image

No file chosen

Figure 24: Seeker registration page prototype

Admin Home Prototype



Figure 25: Admin Home prototype

Donor's Request Accept History Page Prototype

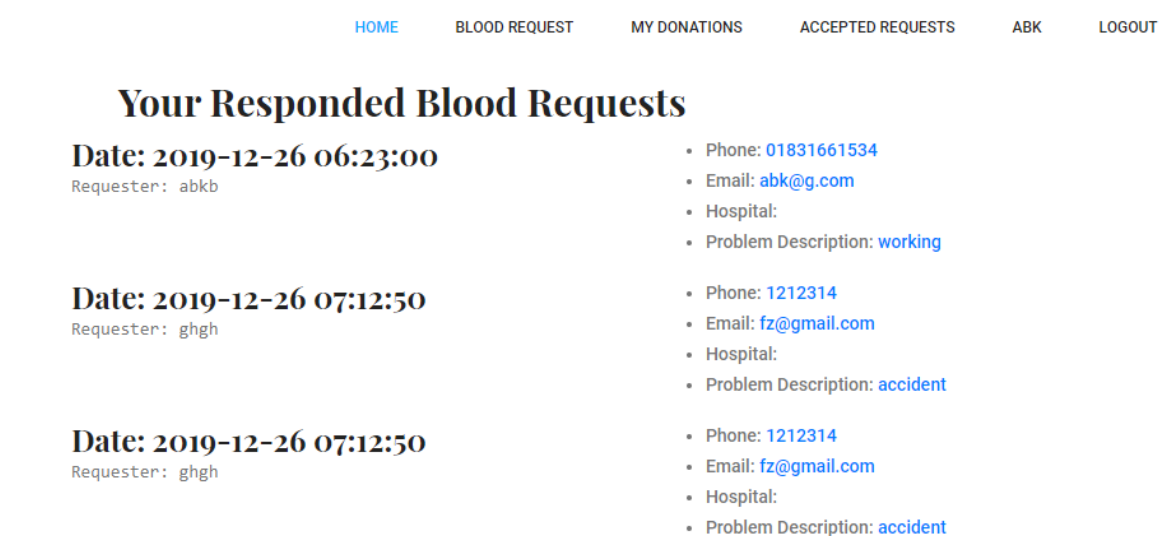


Figure 26: Request accept history page prototype

Medical Officer's Donor Search Page Prototype


BBSMS

☰


 ggf

ggf

[Dashboard](#)

[Donors](#)

[My History](#)

Find a donor details

[+ Register a new donor](#)

SEARCH

Name	Phone	NID	BLood Group	Last Donation	Status	Action
 ABK	01755552	0155555785	B + ve		pending	↻Check Eligibility
 as	222	333	A + ve	2019-12-25	active	↻Check Eligibility

Figure 27: Donor search Page prototype

Chapter 9 – Engineering

9.1 New System Modules

There are numerous modules in the BBSMS new system. But some of the core modules are listed below with the working process.

Login Module

SL	User Action	SL	System Action
1	Admin click on the login link	1	User will be shown a login form.
2	Admin will provide login credentials	2	The system validates the given data.
3	Admin click on login button	3	The system authenticates the admin. And if authenticated then redirected to admin dashboard otherwise send back to login page with error message.

Table 23: Login module

Donor's Request Accept Module

SL	Donor Action	SL	System Action
1	Admin click on the requests link	1	Current emergency request page will be shown.
2	Donor chose a request and click on the accept button.	2	The system check if donor is eligible to donate and confirm request acceptance.

Table 24: Donor Request Accept Module

Donor location module

SL	Donor Action	SL	System Action
1	Donor login and go to home	1	The system asks for location permission.
2	Donor click on the accept button	2	The system will find and update the donor's current location.
3	Donor refresh the home	3	System will display the blood requests nearest to the donor.

Table 25: Donor Location Module

Medical Officer's transfusion module

SL	Medical Officer's Action	SL	System Action
1	The MO click on the search button	1	A donor search page will appear.
2	The MO will provide search criteria	2	System will find the donor based on the given data
3	MO click on the check eligibility button	3	System will display the donor's info including last donation date. If eligible then serology and transfusion button are appeared.
4	MO center serology test reports	4	System check if reports are normal and provide the transfusion button.
5	Mo enter the transfusion details.	5	The system will store the transfusion details and redirected to the home page.

Table 26: Blood Transfusion Module

9.2 Use Case Diagram of the BBSMS

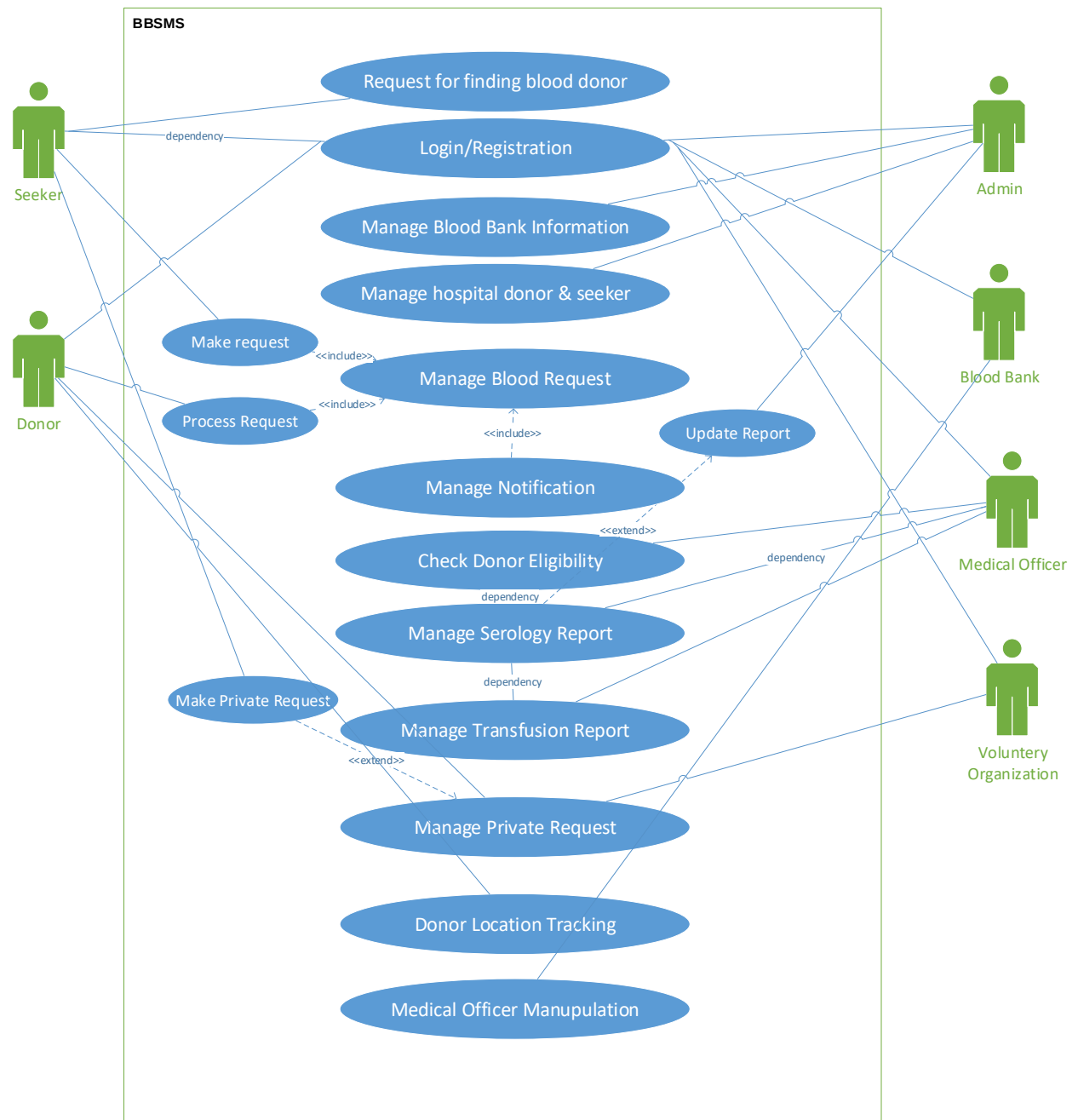


Figure 28: BBSMS Use Case

9.3 Class Diagram of the BBSMS

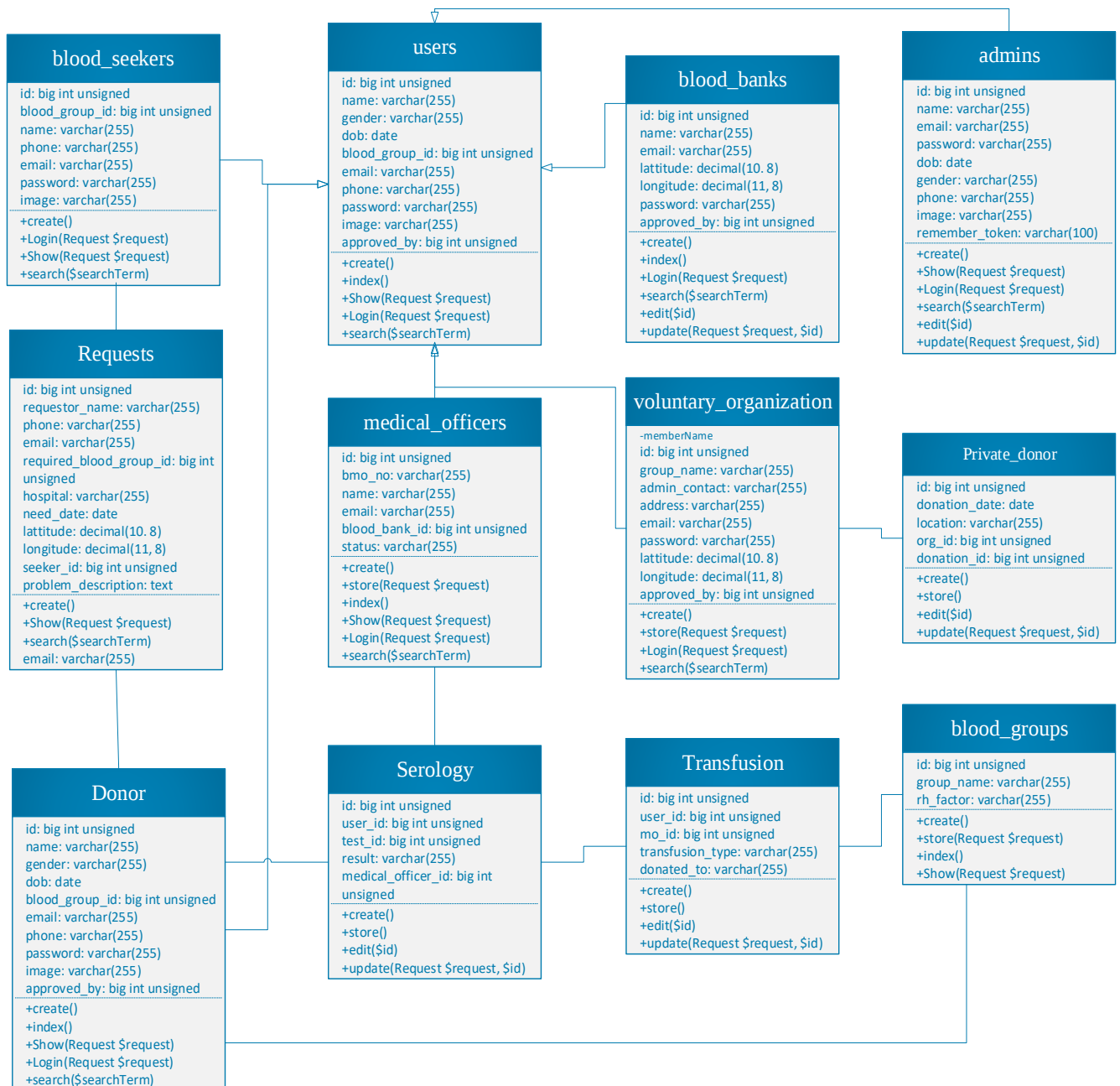


Figure 29: BBSMS Class Diagram

9.4 Entity Relationship Diagram



Figure 30: BBSMS ER Diagram

9.5 Sequence Diagram

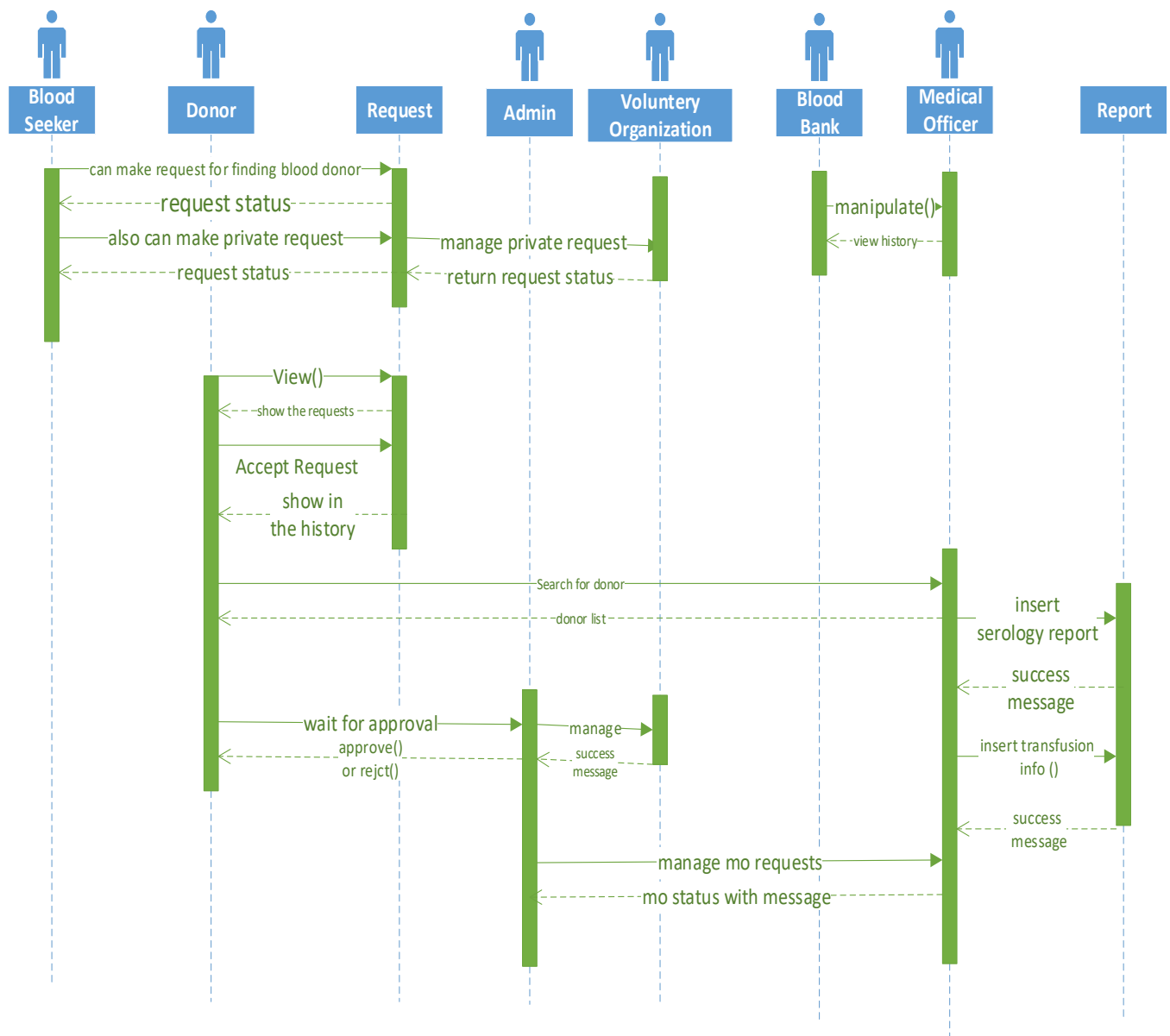


Figure 31: BBSMS Sequence Diagram

9.6 Component Diagram of the BBSMS

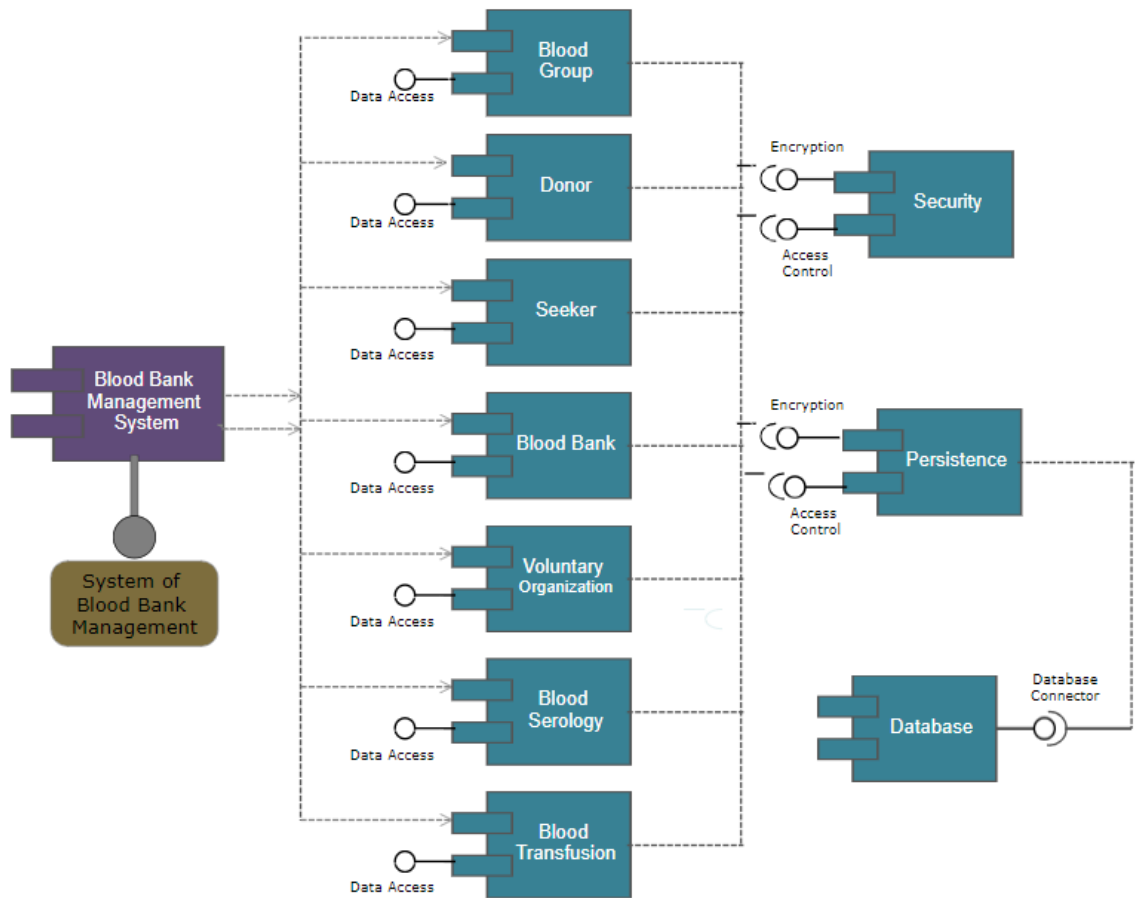


Figure 32: BBSMS Component Diagram

9.7 Deployment Diagram

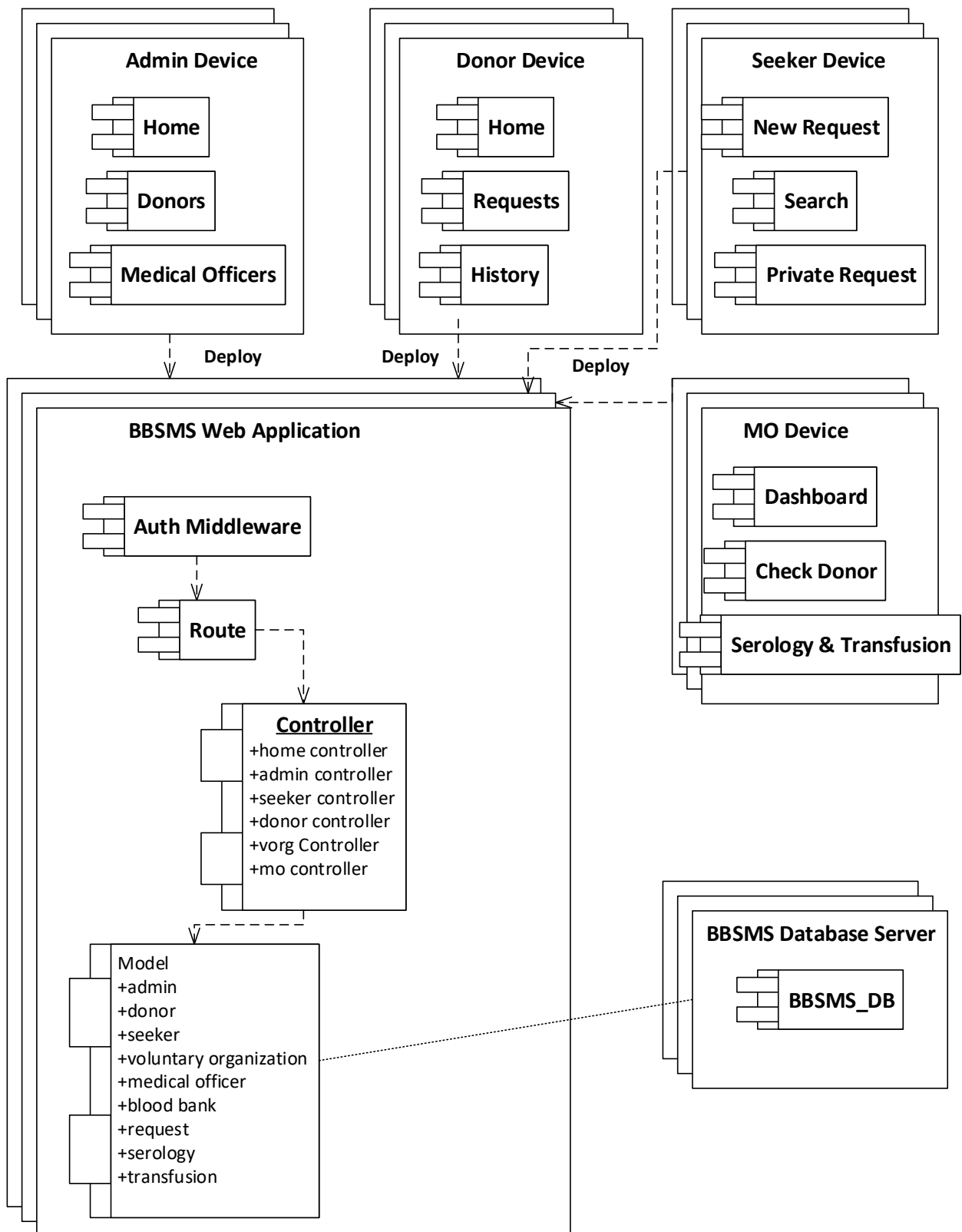


Figure 33: BBSMS Deployment Diagram

9.8 System Interface Design

Home page Interface Design

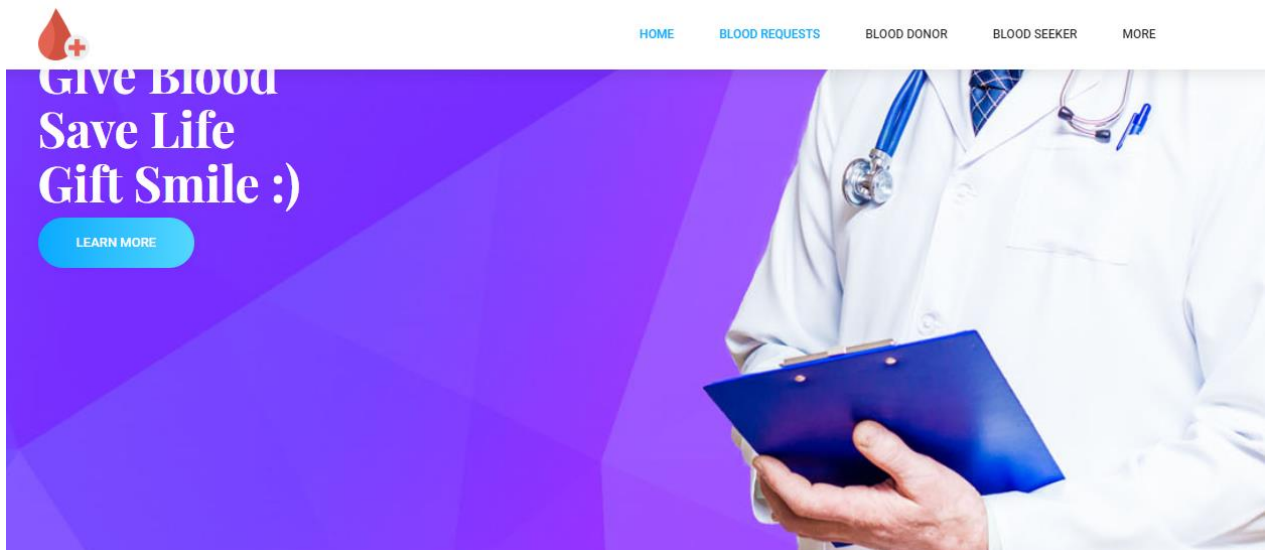


Figure 34: Interface design home page

Blood request Page interface

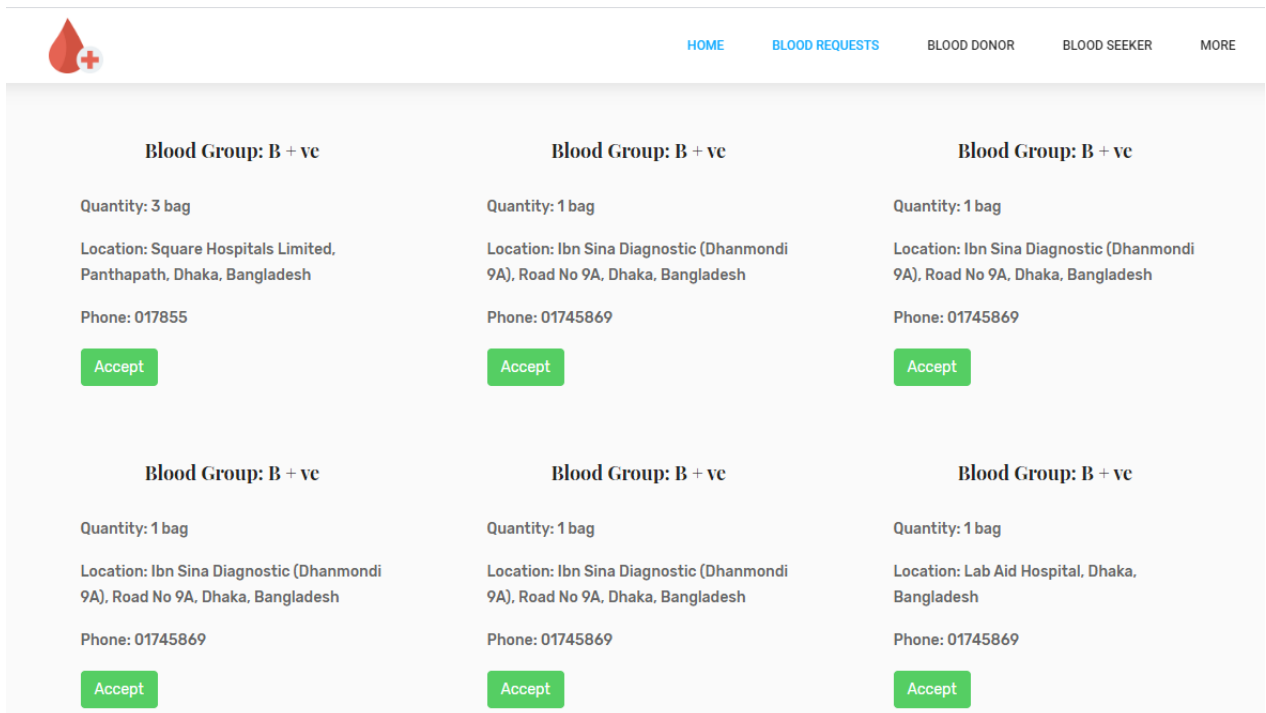


Figure 35: Blood request page interface

Blood donors request page

BBSMS ABK Bhuiyan

Admin Panel

- Dashboard
- Departments
- Admins
- Blood Banks
- Blood Donors
- Voluntary Orgs
- Medical officer

Current Blood Donor Requests + Add Blood Donor

Donor Name Email Phone SEARCH

Donor Name	NID No	Phone	Email	Approve	Reject
R Donor 1	012365489	0145	abc@d.com	Approve	Reject
R sfsfsf	222	43434	shakil@gmail.com	Approve	Reject
R ABK	0155555785	01755552	abk@gmail.com	Approve	Reject

Figure 36: Pending blood donor page

Blood Bank add page for admin

BBSMS ABK Bhuiyan

Admin Panel

- Dashboard
- Departments
- Admins
- Blood Banks
- Blood Donors
- Voluntary Orgs
- Medical officer

Add New Blood Bank

Full Name* Registration Number*

Email * Password*

Confirm Password* Latitude

Longitude

Address*

SAVE BLOOD BANK

Figure 37: New blood bank page

Blood donor profile interface

[HOME](#)
[BLOOD REQUEST](#)
[MY DONATIONS](#)
[ACCEPTED REQUESTS](#)
[ABK](#)
[LOGOUT](#)

ABK's Profile



[My Settings](#)

Name: ABK

NID No: 0155555785

Phone : 01755552

Phone : B+ ve

Small Biography :

Phone : abk@gmail.com
Date OF Birth : 1996-12-26
Gender : male

Registered Address :

66/2 west raza bazar

Figure 38: donor profile

New blood request form

BBSMS Seeker Panel
Home
New Request
New Private Request
My Requests
Logout

Send Blood Request

Your Name *

Phone *

Email

Blood Group *

Quantity *

Hospital Location *

Need Date *

Problem Description *

Figure 39: New Blood request form

Blood seeker's request history

BBSMS Seeker Panel						Home	New Request	New Private Request	My Requests	Logout
Blood Banks										
Request Date	Blood Group	Hospital	Need Date	Quantity	Info					
R	O + ve	Sir Salimullah Medical College, Mitford Road, Dhaka, Bangladesh	2019-12-26	2	i See Details					
R	B + ve	Ibn Sina Hospital, Dhaka, Bangladesh	2019-12-25	3	i See Details					
R	B + ve	Square Hospitals Limited, Panthapath, Dhaka, Bangladesh	2019-12-27	2	i See Details					
R	B + ve	Square Hospitals Limited, Panthapath, Dhaka, Bangladesh	2019-12-27	2	i See Details					
R	B + ve	Lab Aid Hospital, Dhaka, Bangladesh	2019-12-20	2	i See Details					
R	B + ve	LAB81 medienagentur, Georg-Engel-Straße, Würzburg, Germany	2019-12-25	4	i See Details					
R	B + ve	Square Hospitals Limited, Panthapath, Dhaka, Bangladesh	2019-12-25	13	i See Details					
R	B + ve	Square Hospitals Limited, Panthapath, Dhaka, Bangladesh	2019-12-26	3	i See Details					

Figure 40: seeker request history

Donor's eligibility checking page interface

BBSMS

Mr. X

Mr. X

[Dashboard](#)

[Donors](#)

[My History](#)

as's Profile

as

Not Eligible

Never Donated

[Serology](#)
[Transfusion](#)

Last Donation Date:

2019-12-25

Last Donated:

Never Donated

Blood Group:

A + ve

Phone:

222

Email:

a@a.com

Birthday:

2019-12-17

Address:

\$donor->address

Gender:

\$donor->gender

Figure 41: Donor eligibility check page

Chapter 10 – Deployment

10.1 Core Module Coding Sample

I have used the HTML5, CSS, Bootstrap, JavaScript, and jQuery for front-end development of the BBSMS. And used the MySQL as a database management system, PHP Laravel 6.3 for back-end development. The major important part coding samples are provided here-

Registration sample for the users-

```
<div class="col-sm-6">
  <div class="form-group">
    <label>Organization Type</label>
    <select name="group_type" class="select form-control">
      <option @if(old('group_type')== 'Publicly Available'){{ 'selected' }}@endif value="Publicly Available" >Publ
      <option @if(old('group_type')== 'Private'){{ 'selected' }}@endif value="Private">Private</option>
    </select>
    @error('group_type')
    <div class="text-danger">{{ $message }}</div>
    @enderror
  </div>
</div>

<div class="col-sm-6">
  <div class="form-group">
    <label>Organization Name </label>
    <input name="group_name" value="{{ old('name') }}" class="form-control" type="text">
    @error('group_name')
    <div class="text-danger">{{ $message }}</div>
    @enderror
  </div>
</div>

<div class="col-sm-6">
  <div class="form-group">
    <label>Phone </label>
    <input name="group_contact" value="{{ old('group_contact') }}" class="form-control" type="text">
    @error('group_contact')
```

```

public function update(Request $request, BloodBank $bloodBank)
{
    $request->validate([
        'name' => 'required',
        'address' => 'required',
        'latitude' => 'max:90|min:-90',
        'longitude' => 'max:180|min:-180'
    ]);
    if($request->has( key: 'password')){...}
    if($request->has( key: 'approved_by')){...}
    if($request->has( key: 'status')){...}
    if($request->has( key: 'address')){...}
    if($request->has( key: 'longitude')){...}
    if($request->has( key: 'latitude')){...}
    if($request->has( key: 'name')){
        $bloodBank->name = $request->name;
    }
    $bloodBank->save();
    return redirect()->route( route: 'bloodBank.index');
}

```

Figure 42: Code sample for registration process

Donor Location Tracking code

```

<script>
$(function () {...});
function getLocation() {
    if (navigator.geolocation) {
        navigator.geolocation.getCurrentPosition(upload);
    } else {
        alert("Geolocation is not supported by this browser.");
    }
}
function upload(position) {
    let url = '{{route('donor.location')}}';
    let user = '{{ auth()->user()->id }}';
    console.log(user);
    let latitude = position.coords.latitude;
    let longitude = position.coords.longitude;
    console.log('latitude'+latitude);
    console.log('longitude'+longitude);

    $.ajax({
        url:url,
        data:{lattitude: latitude...},
        type: 'get',
        dataType: "json",
        success: function (response) {
        }
    });
}
</script>

```

```

public function updateLocation(Request $request){
    $dl = DonorLocation::where('user_id',$request->user_id)->first();
    $dl->latitude = $request->latitude;
    $dl->longitude = $request->longitude;
    $dl->save();
    return json_encode(['message'=>'Location Updated']);
}

```

Figure 43: Code for location tracking

Distance Wise Donor Filtering

```

@extends('layouts.seeker.master')
@section('title','Blood Request')
@section('content')
    <div class="hero-wrap js-fullheight" style="..." data-stellar-background-ratio="0.5">
        <div class="overlay"></div>
    </div>
    {{--Show direction--}}
    <script type="text/javascript" src="http://maps.googleapis.com/maps/api/js?v=3&key=AIzaSyD20fa8okNg5tseZ2om1G0aaf7qzVmOvGQ&1">
    <script type="text/javascript">
        var directionsService = new google.maps.DirectionsService();
        google.maps.event.addListener(window, 'load', function () {
            new google.maps.places.SearchBox(document.getElementById('hospital'));
            // new google.maps.places.SearchBox(document.getElementById('txtDestination'));
            directionsDisplay = new google.maps.DirectionsRenderer({ 'draggable': true });
        });
    </script>

    <div class="ftco-section bg-light">
        <div class="container">
            <div class="row">
                <div class="col-md-12 col-lg-10 mb-5">
                    <h2 style="...">Send Blood Request</h2>
                    @include("layouts.bloodDonor._message")

                    <form action="{{route('seeker.sendBloodRequest')}}" class="p-5 bg-white" method="post" role="form" enctype="multipart/form-data">
                        @csrf
                        <div class="row form-group">
                            <div class="col-md-12 mb-3 mb-md-0">

```

```

//geocode generator
public function getCoordinate($address){
    $apiKey = 'AIzaSyD20fa8okNgStseZ2om1G0aaf7qzVm0vGQ&libraries';
    // Change address format
    $formattedAddrFrom = str_replace( search: ' ', replace: '+', $address);
    // Geocoding API request with hospital address
    $geocodeFrom = file_get_contents( filename: 'https://maps.googleapis.com/maps/api/geocode/json?address='.$formattedAddrFrom);
    $outputFrom = json_decode($geocodeFrom);
    if(!empty($outputFrom->error_message)){
    }
    $latitudeFrom = $outputFrom->results[0]->geometry->location->lat;
    $longitudeFrom = $outputFrom->results[0]->geometry->location->lng;
    $credntial['latitude']= $latitudeFrom;
    $credntial['longitude']= $longitudeFrom;
    return $credntial;
}

//distance calculator
public function getDistance($latitudeFrom, $longitudeFrom, $latitudeTo,$longitudeTo){
    // Calculate distance between Latitude and Longitude
    // dd($latitudeFrom, $longitudeFrom, $latitudeTo,$longitudeTo);
    $theta = $longitudeFrom - $longitudeTo;
    $dist = sin(deg2rad($latitudeFrom)) * sin(deg2rad($latitudeTo)) + cos(deg2rad($latitudeFrom)) * cos(deg2rad($latitudeTo)) * cos($theta);
    $dist = acos($dist);
    $dist = rad2deg($dist);
    $miles = $dist * 60 * 1.1515;
    return round( $miles * 1.609344, precision: 2);
}

```

Figure 44: Distance Wise donor filtering codes

Live Donor Search & Eligibility Checking

```

<div class="card-box profile-header">
    <div class="row">
        <div class="col-md-12">
            <div class="profile-view">
                <div class="profile-img-wrap">
                    <div class="profile-img">...</div>
                </div>
                <div class="profile-basic">
                    <div class="row">
                        <div class="col-md-5">...</div>
                        <div class="col-md-7">
                            <ul class="personal-info">
                                <li>...</li>
                                <li>
                                    <span class="title">Last Donated:</span>
                                    <span class="text">@if($donationCount<=0){{'Never Donated'}}@else{ $lastDonation.' Days' }</span>
                                </li>
                                <li>...</li>
                                <li>...</li>
                                <li>...</li>
                                <li>...</li>
                                <li>...</li>
                            </ul>
                        </div>
                    </div>
                </div>
            </div>
        </div>
    </div>

```

```

public function searchByReg(Request $request){
    $bloodDonors= User::where('phone','like','%'.$request->name.'%')->orderBy('id','DESC')->paginate(10);
    $output='';
    if ($bloodDonors->count()>0){...}

    $data['result'] = $output;
    return json_encode($data);
}

public function checkEligibility($id){
    $data['donor'] = User::findOrFail($id);
    $q = "select * from `blood_transfusion_histories` where `user_id`=" . $id;
    $dh = DB::select($q);
    $data['donationCount'] = count($dh);
    $data['bloodGroup'] = BloodGroup::findOrFail($data['donor']->blood_group_id);
    $lastdonation = 0;

    if($data['donor']->last_donation_date != null){
        $qry = 'SELECT DATEDIFF(NOW(),''.$data['donor']->last_donation_date.''' as days';
        $diff = DB::select($qry);
        $lastdonation = $diff[0]->days;
    }

    $data['lastDonation'] = $lastdonation;
    return view('view:medicalOfficers.checkDonor',$data);
}

```

Figure 45: Live searching and eligibility checking

10.2 Possible Problem Breakdown

To make the system development easier and more efficient the entire project needs broken into small tasks. The possible breakdowns for the proposed project are as follows-

- Analysis and database design
- Admin panel management development
- Blood seeker panel management
- Blood donor panel development
- Blood bank & medical Officer panel development
- Voluntary organization panel development

Analysis and Database Design

- Identify and finalize the requirements
- Gather information to deal with
- Normalize the gathered information

- Produce ERD and data dictionary
- Create the schema following the data dictionary.

Admin panel development

- design the required pages.
- Develop admin manipulation system
- Develop blood bank manipulation system
- Develop the seeker, donor and medical officer approval option.

Blood seeker panel development

- Front-end design
- Registration and login system
- Blood request manipulation
- Private blood request management

Blood donor panel development

- Front-end design, registration and login system.
- Location based request filtering and notification system development
- Request management

Medical Officer Panel development

- Front-end & authentication system development
- Donor searching and eligibility checking system
- Serology and transfusion management system

Voluntary organization panel development

- Front-end and the registration and login system
- Private request management
- Private donor database manipulation

10.3 Prioritization while Developing the Solution

We have already prioritized the requirements list to identify the functionality of the system. Now it is time for prioritizing the tasks during the development phase, because it is very important because random development may miss some core functionalities to develop. The prioritized tasks list for the development as follows-

- Analysis & database design
- Database development
- Registration and login system implementation for the required users.
- Donor panel implementation
- Donor location tracking implementation
- Seeker panel implementation.
- Medical Officer panel implantation
- Voluntary organization panel implementation and
- Finally, the admin panel development.

Chapter 11 – Testing

11.1 Test Plan Acceptance

To produce a successful software testing plays in important role. Testing plan should be developed during the analysis phase. These plan needs to be accepted by the user and the developer. The test plan for the is project will ensure the relevant testing requirements and acceptance criterions of the user. There are two types of testing

- **Functional Testing**

Functional testing divided into three types these are-

- ✚ **Unit Testing**

- Form field validation for the input fields
- Blood donor approval filtering
- Blood bank filtering from the list
- Approved, pending and rejected medical officer list filtering form the MO list.

- ✚ **Module Testing**

- Submitting the registration and login form without data
- Registration with the invalid data.
- Submitting a from with proper data.

- ✚ **Integration Testing**

- Login system with the valid credentials
- Successful Blood request placement
- Successful serology and transfusion add.

- **Non-functional Testing**

In this project I am going to implement four types of non-functional testing which are-

- ✚ **Acceptance Testing**

- Request response show after accepting a request
- Personal information updating.

- ✚ **Security Testing**

- Role wise dashboard and page access

- Login attempt with the invalid credential

Accessibility Testing

- User friendliness testing
- Color and contrast testing by color blind user.

Usability Testing

- Admin panel testing
- Testing with the blood donor

11.2 Test Case

Test cases need to be prepared after finalizing the test acceptance plan. The test cases for the BBSMS system are-

Unit test – test case:

Test Case Name	Unit Test		
Test Class			
Test Description			
Data Source	Test Steps	Expected Result	Actual Result

Module Test – test case:

Test Case Name	Module Test		
Test Class			
Test Description			
Data Source	Test Steps	Expected Result	Actual Result

Integration Testing – test case:

Test Case Name	Integration Test		
Test Class			
Test Description			
Data Source	Test Steps	Expected Result	Actual Result

11.3 Unit Testing**Unit Test 1**

Test Case

Test Case Name	Unit Test		
Test Class	Donor Register Controller		
Test Description	Donor name validation for donor registration		
Data Source	Test Steps	Expected Result	Actual Result
User Entry	1. Filling all required fields except the donor name field. 2. Submit the form	An error message should return that donor name must not be empty.	A message is showing that donor name is required for getting registered.

Figure 46: unit test 1 test case

Donor name validation

Donor Registration

Donor Name

The name field is required.

Gender

Male ▼

NID No.

Date Of Birth

Blood Group

A+ ve ▼

Address

*Figure 47: Unit test one result***Unit Test 2**

Test Case

Test Case Name	Unit Test		
Test Class	Admin\Donor Controller		
Test Description	Pending donors list validation		
Data Source	Test Steps	Expected Result	Actual Result
System	1. login as admin 2. check the current donor request page.	Pending donor requests should displayed.	The result is as expected and showing pending blood donor requests.

Pending blood donors list filtering

BBSMS ABK Bhuiyan

Admin Panel

- Dashboard
- Departments
- Admins
- Blood Banks
- Blood Donors
 - Donors List
 - Add Donor
 - Donor Requests
 - Rejected Blood Donors
- Voluntary Orgs
- Medical officer

Current Blood Donor Requests + Add Blood Donor

Donor Name Email Phone SEARCH

Donor Name	NID No	Phone	Email	Approve	Reject
R Aminul islam	1234567895	01831661534	aminul@gmail.com	Approve	Reject
R Md Emon	012365489	01954253652	emon@gmail.com	Approve	Reject
R Ashik ELahi	1997256354586	0155869865	ashik@gmail.com	Approve	Reject
R Saif Islam	1995404521543645	01785695326	saif@gmail.com	Approve	Reject

Figure 48: Unit Test 2

Unit Test 3

Test Case

Test Case Name	Unit Test		
Test Class	Medical Officer\Donor Controller		
Test Description	Donor Searching list		
Data Source	Test Steps	Expected Result	Actual Result
Medical Offcier	1. login as medical officer 2. click on the search donor.	Whenever press a key the list should be updated	The result is as expected. The search result is updated.

Donor search for the medical Officer

Mr. X

Find a donor details [+ Register a new donor](#)

Search By Name Search By Phone [SEARCH](#)

Name	Phone	NID	Blood Group	Last Donation	Status	Action
ABK	01755552	0155555785	B + ve		active	Check Eligibility
Saif Islam	01785695326	1995404521543645	B - ve		pending	Check Eligibility
Ashik ELahi	0155869865	1997256354586	A + ve	2019-12-25	Pending	Check Eligibility
Aminul islam	01831661534	1234567895	B + ve	2019-06-10	pending	Check Eligibility

Figure 49: Unit Test 3

11.4 Module Testing

Module Test 1

Test Case

Test Case Name	Module Test		
Test Class	Admin\Donor Controller		
Test Description	Donor registration attempt without input.		
Data Source	Test Steps	Expected Result	Actual Result
Admin	1. login as admin 2. click on add new donor 3. press on save button without giving any value to the form.	Error message should be displayed for all required fields.	The actual result displaying that the donor name, email, and phone must not be empty.

Blood donor registration form checking for the admin.

The screenshot shows the BBSMS Admin Panel interface. On the left is a sidebar with navigation links: Dashboard, Departments, Admins, Blood Banks, Blood Donors, Voluntary Orgs, and Medical officer. The main content area is titled 'Add New Blood Donor'. It contains a form with the following fields:

- Full Name***: A text input field with a red error message below it: "The name field is required."
- Email***: A text input field with a red error message below it: "The email field is required."
- Gender***: A radio button group with options "Male" and "Female".
- Blood group***: A dropdown menu showing "O + ve".
- Phone***: A text input field with a red error message below it: "The phone field is required."

A blue "SAVE" button is located at the bottom right of the form.

Figure 50: Module Test 1

Module Test 2

Test Case

Test Case Name	Module Test		
Test Class	Medical Officer\Donor Controller		
Test Description	Donor registration test by the medical officer with invalid data format.		
Data Source	Test Steps	Expected Result	Actual Result
Medical Offcier	1. login 2. click on add new donor 3. give an invalid email address. 4. click on save	A message should display that the input field contains invalid data.	It shows that email address is invalid.

Donor Registration with wrong input

The screenshot shows the BBSMS (Blood Bank System Management System) interface. The header is blue with the BBSMS logo and a user profile 'Mr. X'. The left sidebar contains navigation links: Dashboard, Donors, and My History. The main content area is titled 'Add New Blood Donor'. It contains several input fields: 'Full Name*' (Abdullah Bin Kasem), 'Email*' (abdullah), 'Gender*' (Male selected), 'Phone*' (01831661534), and a blood type dropdown (O + ve). A validation error message is displayed above the email field: 'Please include an '@' in the email address. 'abdullah' is missing an '@'.' A blue 'SAVE' button is at the bottom.

Figure 51:Module Test 2

11.5 Integration Testing

Integration Test1

Test Case

Test Case Name	Integration Test		
Test Class	1. Auth\Login Controller 2. Redirect If Authenticated Middleware		
Test Description	Successful login attempt and dashboard redirect.		
Data Source	Test Steps	Expected Result	Actual Result
Donor	1. go to login page 2. provide valid credentials 3. press on login	The Donor should be authenticated and login should be successful and redirected to the donor home.	It shows that email address is invalid.

Login system integration test

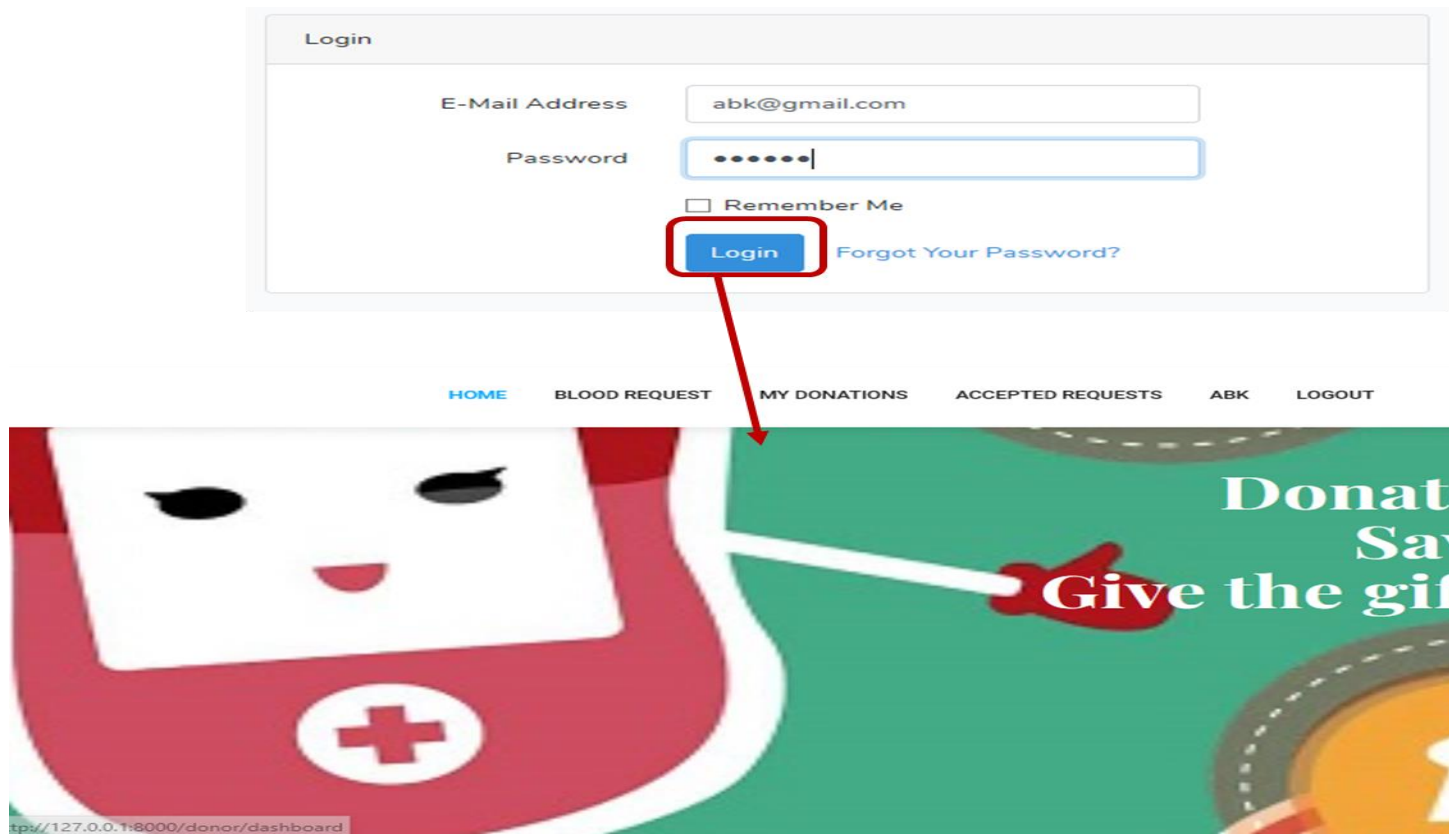


Figure 52: Integration Test 1

Integration Test2

Test Case

Test Case Name	Integration Test		
Test Class	Medical Officer\Serology Test Controller		
Test Description	Serology test add integration test.		
Data Source	Test Steps	Expected Result	Actual Result
Medical Officer	1. login as medical officer 2. check donor eligibility 3. provide donor serology test result.	Success message should show.	The system shows that seroly test successfully added.

Serology test result input integration testing

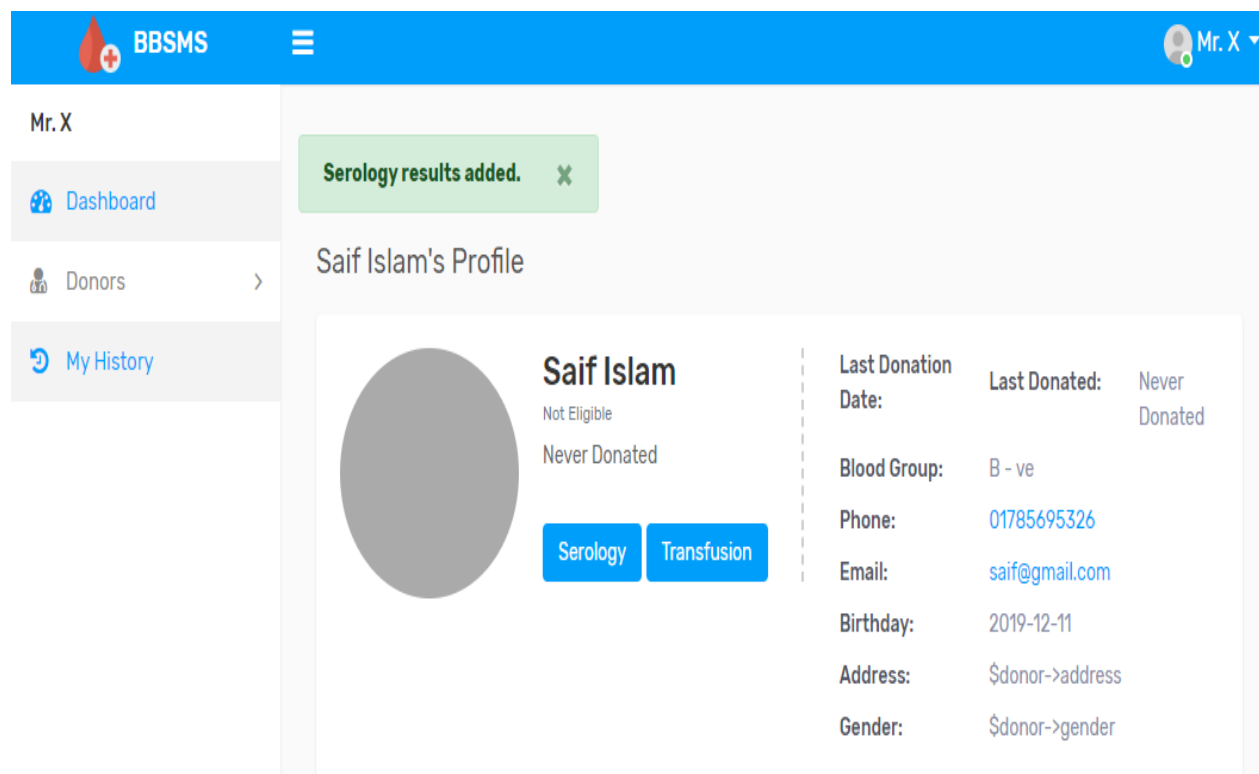


Figure 53: Integration Test 2

11.6 Acceptance Testing

Acceptance Test 1

Test Case

Test Case Name	Acceptance Test		
Test Class	Donor\Request Controller Seeker\Seeker Controller		
Test Description	Serology test add integration test.		
Data Source	Test Steps	Expected Result	Actual Result
Blood Seeker, Donor	1. login as donor 2. accept a request 3. check in seeker profile if the details is showing. .	Request accept history should updated and show to the seeker.	The result is as expected.

Request accept acceptance testing

BBSMS Seeker Panel
[Home](#)
[New Request](#)
[New Private Request](#)
[My Requests](#)
[Logout](#)

Request Details for request id #BBSMS-Request-24

Requested For: abkb
Quantity: 3 Bag

Close Request

- Phone: [01831661534](tel:01831661534)
- Email: abk@g.com
- Hospital: Ibn Sina Hospital, Dhaka, Bangladesh
- Date of Transfusion: 2019-12-25

Request History

AcceptedBy: ABK

- Phone: [01755552](tel:01755552)
- Email: abk@gmail.com

AcceptedBy: Saif Islam

- Phone: [01785695326](tel:01785695326)
- Email: saif@gmail.com

Figure 54: Acceptance Test

11.7 Security Testing

Security Test 1

Test Case

Test Case Name	Security Test		
Test Class	Auth\Login Controller		
Test Description	Invalid login attempt security testing.		
Data Source	Test Steps	Expected Result	Actual Result
Blood Seeker	1. go to the login page 2. provide invalid credential and try to login.	Should not logged in and a message should show.	The result is as expected.

Seeker login security testing.

Seeker Login

E-Mail Address 

These credentials do not match our records.

Password

☐ Remember Me

[Login](#) [Forgot Your Password?](#)

Figure 55: Security Testing

11.8 Accessibility Testing

Accessibility Test 1

Test Case

Test Case Name	Accessibility Test		
Test Class	Seeker Controller		
Test Description	Color & Contrast test by color blind seeker		
Data Source	Test Steps	Expected Result	Actual Result
Blood Seeker	A color-blind seeker used the system.	No problem occurs during the use.	The seeker does not face any difficulties.

Table 27: Accessibility testing

Accessibility Test 2

Test Case

Test Case Name	Accessibility Test		
Test Class	Admin Controller		
Test Description	User friendliness testing		
Data Source	Test Steps	Expected Result	Actual Result
Admin	Giving an admin to use the system.	The system is user-friendly.	The result is expected.

Table 28: Accessibility Testing2

Chapter 12 – Implementation

12.1 Training

Training is necessary to make the users acquainted with the developed system. Once its fully functional, the team must ensure that the users or operators are adequate enough to handle operations through the system. A chart that describes the training procedures is given below.

SL	User	Training Scope	Time Period	Comment
1	Users or donators	Registering as a donator, updating donation history, ensuring proper donation of blood to the patient	2 Hours	The users are grasping the procedures accordingly.
2	Admin	Add a database for the people need of blood, acquiring donators for specific locations, confirming their actions properly.	1 Hour	Admin easily understands the operations.

Table 29: User training

12.2 Implementation Scheme

Big Bang

Big bang works by turning off the existing system and enabling the new system immediately. This scheme is much faster than any other and utilizes the new system directly after the test has been completed. The exchange of data from the old system may damage and can also be unstable because data may be lost and the new system may crash. It is incorporated on a single site considering the human resources of a single site.

12.3 Scaling

No plans were devised to take the application scaling into consideration as it happens to be an academic project.

12.4 Load Balancing

Load balancing means the system is optimized against the users' influence. Users hit indicate how many users are using the system simultaneously and how much the system has sustained. This is known as load balance and load equalizer. It breaks down the load among different servers, so the system can continue working fast. Since there are six types of users and the number of hit per day is huge, so a perfect load balancing strategy should develop.

Chapter 13 – Critical Appraisal and Evaluation

13.1 Objective Could be Met

The objectives which are initially declared that are listed below.

- Registration system for users
- Donor and seeker management
- Screening and transfusion record management
- Donor location tracking and eligibility checking.

Objective-1

Achievement rate and others

The registration and login system are implemented successfully for all the user types. The donor, seeker, blood bank, voluntary organizations can process registration and after that they can login into the system. after login the user is directed to his/her intended dashboard and can only access pages they are allowed to ace. I have used the Laravel official authentication system for authenticating and authorizing the users to the system. the success rate is 100 percent.

Objective-2

Achievement rate and others:

The blood donor and seeker management system are fully implemented and successfully working. Seekers can search for the donor by requesting to the system and system notify the nearest available users. They can manipulate their history.

Donors can manage their profile and notified by email when a nearby blood request is generated. He/she can accept the request.

Objective-3

Achievement rate and others:

The blood transfusion and serology management are successfully completed. A donor's serology and transfusion record can be modified if the donor last donation day count is more than 120 days. Otherwise the medical officer could not get any option to add the serology and transfusion info.

Objective-4

Achievement rate and others:

The current location of the donors is tracked with the GPS Navigator. The system asks for allowing to location access and if donor allows then the new location is updated. This system is working with 100 % success rate.

A few highlights are not connecting a direct result of brief time of conveyance the venture. As it is a scholastic task so center usefulness is grown principally.

13.2 Objective that totally don't meet of touched

Practically the entirety of the articles is contacted for the activities. Be that as it may, just a single target which is thoroughly don't contacted that the mobile application for tracking the location.

The reasons why it could not be touch

The primary reasons of not getting contacted of the goal is brief time to finish the activities. Because of brief time it would very troublesome and another reason is its need to have constant facilitating server that is likewise very hard for the task. Since without live server the application cannot work so it could not develop.

What could have been done

To contact the highlights its need to reschedules the time box which need to additional opportunity to finish the component. It likewise needs to learn the hybrid application development.

Chapter 14 Lessons Learned

14.1 Pre-Project-Review-closing

To build up the Bangladesh Blood Services Management System mainly a web-based application with android location tracking, from the start I need to follow a predefined structure like project proposal submitting, project title defense, development and documentation. The system mainly concerned about the safe and timely emergency blood arrangement and centralization over the entire process.

14.2 What I have Learnt

I have adapted such a large number of significant things of building up a structure. I have figure out how to deal with a structure in various segments like structure, arrangement and database areas. I additionally improved my undertaking arranging aptitudes and testing abilities (black and white box, unit and acceptance, usability and accessibility) that will help me in my future profession. It additionally improves my programing aptitudes, for example, Application Programmable Interface (API) building with proper authentication and security measures. Haversine distance calculation algorithm, multi-level authentication and authorization. I have learnt Ajax request management with the Laravel framework of the PHP. The undertaking causes me to accumulate numerous basic information which is really need to proficient improvement life.

14.3 The problems I have faced

I have faced a lot of problems and challenges during the project lifecycle. As I have followed the Agile DSDM methodology which ensure iterative development, so I have to face and overcome problems iteratively. Means problems occurs in a timebox that solved another one occurred in another timebox and tasks. One of the main problems was extracting the geographical coordinates and calculating distance between two coordinates. Another problem was to implement live search without refreshing the page. I have also faced difficulties to build multi-level authentication and API development in Laravel. Finally, the most suffering problem was maintaining the timeboxes.

14.4 What Solution Occurred

Whenever a problem came to me, I have tried to figure out the solution for it. To solve the coordinate extraction problem, I have used the google geocode API which need to send and receive request in json format. To calculate distance among two coordinates I have used the haversine formula. To implement the multi-auth I have used custom authentication system including controller and middleware. I have used the Laravel passport driver to allow access over the AP. To maintain the time box, I have worked very hard and follows the deadline strictly.

Chapter 15 – Conclusion

15.1 Summary of the Project

Bangladesh Blood Services Management System is an online platform to ensure the safe and timely transfusion of blood in emergency situation. All the aspects of the seekers, donors, voluntary organizations, blood banks and related medical officers are fulfilled via the developed system. The system enables the medical officers to ensure about the donor's eligibility to donate blood. Automation of the emergency blood requirement notification to the available donors are now possible. Reports and other details are generated via system to utilize the key information and selecting appropriate blood donors. The system is developed with PHP Laravel framework along with the assistance of HTML, CSS, JavaScript, jQuery. All the related diagrams and charts are provided within the documents.

15.2 Goal of the project

The target of the project was to avail a convenient centralized system for secure, safe and on time blood transfusion. the main goals of the project are-

- Central monitoring over the entire system.
- Blood donor and seeker management including donor's location tracking and automated notification system.
- Private blood request management along with voluntary organization management.
- Donor's donation eligibility and serology reports checking by the medical officer.
- Ensure safe transfusion and maintain the transfusion history.

15.3 Success of the Project

The purpose of project development is successful because the goals against the target are met. The users can send request for emergency blood and system figure out the nearest availed donors and notify them. The medical officer of the blood bank can check the donation history and the eligibility of the donor. The program meets all the initial criteria and is thus a successful project.

15.4 What I have done in the documentation

I have complied with all of the tasks needed by the documentation from the start of the documentation. I conducted time boxing, numerous illustrations, analyzing, etc. The paper also includes different goals and addresses them properly. All the information necessary to complete a project are included in this report.

15.5 Value of the Project

Technology will always prevail over manual labors and manual procedures. This blood service system will enhance the experience of gather proper blood donors in due time without the need of any extra effort or transportation. This project has a unique value on the market place depending on how it's going to be utilized. The experience gathered from developing this project in this time period will give me advantage in the professional jobs.

15.6 My Experience

I have acquired a lot of experience throughout this project. I had several issues and I tackled those problems which brought me lots of experience. I learnt how to manage an entire project and how to fulfill all the criteria of the project in short time which really gave me great experience.

Appendix A

Unit Test 1

Test Case

Test Case Name		Unit Test	
Test Class		Donor Register Controller	
Test Description		Donor name validation for donor registration	
Data Source	Test Steps	Expected Result	Actual Result
User Entry	1. Filling all required fields except the donor name field. 2. Submit the form	An error message should return that donor name must not be empty.	A message is showing that donor name is required for getting registered.

Figure 56: unit test 1 test case

Donor name validation

Donor Registration

Donor Name

The name field is required.

Gender

NID No.

Date Of Birth

Blood Group

Address

Figure 57: Unit test one result

Unit Test 2

Test Case

Test Case Name	Unit Test		
Test Class	Admin\Donor Controller		
Test Description	Pending donors list validation		
Data Source	Test Steps	Expected Result	Actual Result
System	1. login as admin 2. check the current donor request page.	Pending donor requests should displayed.	The result is as expected and showing pending blood donor requests.

Pending blood donors list filtering

BBSMS ABK Bhuiyan

Admin Panel

- Dashboard
- Departments
- Admins >
- Blood Banks >
- Blood Donors
 - Donors List
 - Add Donor
 - Donor Requests
 - Rejected Blood Donors
- Voluntary Orgs >
- Medical officer >

Current Blood Donor Requests + Add Blood Donor

Donor Name Email Phone SEARCH

	Donor Name	NID No	Phone	Email	Approve	Reject
R	Aminul islam	1234567895	01831661534	aminul@gmail.com	✓ Approve	✗ Reject
R	Md Emon	012365489	01954253652	emon@gmail.com	✓ Approve	✗ Reject
R	Ashik ELahi	1997256354586	0155869865	ashik@gmail.com	✓ Approve	✗ Reject
R	Saif Islam	1995404521543645	01785695326	saif@gmail.com	✓ Approve	✗ Reject

Figure 58: Unit Test 2

Unit Test 3

Test Case

Test Case Name	Unit Test		
Test Class	Medical Officer\Donor Controller		
Test Description	Donor Searching list		
Data Source	Test Steps	Expected Result	Actual Result
Medical Offcier	1. login as medical officer 2. click on the search donor.	Whenever press a key the list should be updated	The result is as expected. The search result is updated.

Donor search for the medical Officer


BBSMS

☰


 Mr. X

Mr. X
[Dashboard](#)
 Donors
 Search Donors
 Add Donor
[My History](#)

Find a donor details

Name	Phone	NID	Blood Group	Last Donation	Status	Action
 ABK	01755552	0155555785	B + ve		active	Check Eligibility
 Saif Islam	01785695326	1995404521543645	B - ve		pending	Check Eligibility
 Ashik ELahi	0155869865	1997256354586	A + ve	2019-12-25	Pending	Check Eligibility
 Aminul islam	01831661534	1234567895	B + ve	2019-06-10	pending	Check Eligibility

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