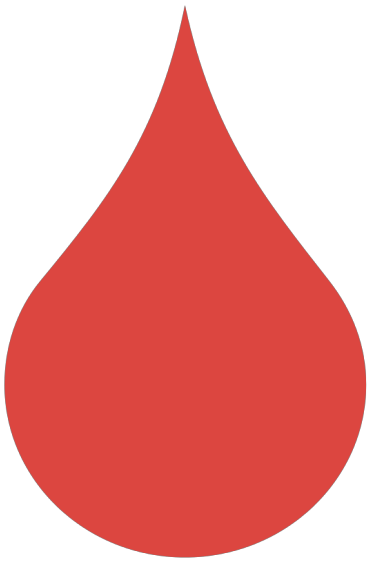


Blood Bank Management System

ISTM 6210
Dr. Subhasish Dasgupta
Fall 2019

Final Project Documentation

Group B
Group Members: Drithi Iyer, Jerome Doe, Linxiao Qu, Min Jae Park, Xinru Zhao

Table of Contents

1. Introduction

1) System Introduction

Our team will be creating and developing a blood bank donation system, specifically targeting the needs of rural areas. Blood transfusion is the process of transferring the blood of a person into the veins of another. This process saves lives and improves health. However, many patients who require a transfusion do not have timely access to safe blood. Our system will be designed to actively engage low-income countries to continue donating blood to help save lives. According to the World Health Organization (WHO) around 117.4 million units of blood are collected globally every year, and 42% of these units come from high-income countries. There is a huge disparity with blood donation between high-income and low-income countries. Every country also needs to ensure that their blood supplies are free from HIV, hepatitis viruses and other infections that can be transmitted through blood transfusion.

2) Project Charter

Key Personnel

The Blood Bank Management system currently consists of five members, as mentioned in the table below. Each team member is tasked with different responsibilities based on their skills, expertise and knowledge. The project sponsor is Dr. Subhasish Dasgupta, who will also oversee the progress of the project, while achieving our key milestones.

Key Personnel	Role	Email
Drithi Iyer	Project Manager	drithi@gwu.edu
Jerome Doe	Business Analyst	jdoe@gwu.edu
Linxiao Qu	Business Analyst	qulinxiao444@gwu.edu

Min Jae Park	System Analyst and Developer	minjae92@gwu.edu
Xinru Zhao	Donor Recruitment Coordinator	xzhao18@gwu.edu

Note: Team members were tasked with multiple different roles to achieve the goals of our project. The roles mentioned in the above table only represents major contribution from every individual.

Problem Statement

Currently, the huge disparity of blood donation in high-income and low-income countries is due to the awareness factor. Not many people in low-income families may be aware about active blood drives in order to donate blood. Additionally, the current system in rural areas may be a very manual system, with managing donors' records. Currently, information pertaining to blood donations, blood types and volunteer details are being recorded on paper, thereby resulting in human errors and more often, loss or misplace of information. Considering a centralized database to record all donors does not exist, it is tedious for people to grab information as required. Blood donation is a time-sensitive matter, so when people require information in a timely fashion, this system will prove to be a failure. Without an automated system, there are problems in keeping track of the actual amount of each and every blood type in the blood bank system. There are no alerts created when the blood quantity of a certain group falls below the required level or when the blood has supposedly expired.

Project Goals and Objectives

The goal of the project is to develop a Blood Bank Management System that eliminates the use of a manual paper-work system, creating efficiency in retrieval of data as well as matching donors and recipients quickly. This system will also help create engagement in certain areas to encourage more volunteers to take action and donate blood. This will be done by organizing blood drives and advertising the importance of blood donation.

Project Scope

The system could possibly extend to maintain records of organ donation and bone marrow donation in the future. While developing this system, there will be scope for further modification as required as well as any documentation required in this process.

Timeline of Key Milestones

Phase	Key Milestone	Deadline
I: Planing	Introduction and Business Presentation	Sep 23th
II: Analysis	System Requirements Specifications & Models	Oct 5th
II: Analysis	Analysis Presentation	Oct 7th
III: System Design	User Stories, Product Backlog & Detailed System Design	Oct 26th
III: System Design	Technical Presentation	Oct 28th
IV: Database DesignI	Behavioral Modeling, Database Design, Security & Project Management Documentation	Nov 16th
IV: Database Design	Database Design Presentation	Nov 18th
V: Testing & Implementation	User Test Plan & Scenarios, System Capacity and Performance	Nov 30th

V: Testing & Implementation	Implementation, Support & Training	Dec 1st
V: Testing & Implementation	Practice Presentation	Dec 2nd
VI: Final Documentation	Final Project Document & Final Presentation	Dec 9th

*Communication Pla*n

For this project, the following communication plan has been established to meet all the requirements. The plan aims to complete tasks in an effective manner and mitigate any communication issues that may arise during the project lifespan.

Communication	Tool	Frequency
Team Meetings	Skype for Business	Weekly on Mondays
Progress Updates and Regular conversations	Slack and Instant Messaging tools	Every other day to make sure the project is running smoothly
Delivery of Requirements	Email, Blackboard and Google Drive tools	As per milestone requirements and schedule
Prototype	Google Drive tools - Google Docs, Google Sheet	As per milestone requirements and schedule

Key Stakeholders

Following are the key stakeholders in the project

Key Stakeholders	Description
Administrators and Project Team members	Have the right to modify all the details to the systems, such as blood group availability, locations nearby and the quantity where they are
Blood Donors	Blood donors' information should be recorded in case of emergency when the blood is not available then asking directly to the donors
Organization	Blood banks, hospitals, clinics
Blood Recipients	Include patients, who needs blood
Volunteers	People who voluntarily sign up to donate blood in the future. All records including contact details and blood group information will be stored to reach out to them, when the need arises

2. Business Case

1) Organization Description

The goal of our organization is to make blood accessible in a timely manner in rural areas. Blood transfusion is a time sensitive process and we intent to solve this problem by creating a centralized system to access records of different volunteer donors when the need arises.

Business Goals

- To develop a system that provides convenience, efficiency and security to the system users and blood seekers.
- To provide a means to actively engage people in the blood donation system by organizing regular blood drives and advertising the importance of donation.
- To reduce pair matching time and support fast searching to find match blood bags for the right person.
- To improve the efficiency of blood stock management by creating system alerts for staff when the blood quantity is below the threshold and/or has expired.
- To provide a means to actively engage people in the blood donation system by organizing regular blood drives and advertising the importance of donation.

Competitive Position and Benchmark

The system we are proposing will have a strong competitive advantage over the existing platforms because it would combine a comprehensive list of key features aimed at improving both donor and recipient experience and ease of access to blood types. Our system would enhance the environment for both donors and those who are in need of blood. The SWOT analysis captures the competitive position of our system.

Strengths	Weaknesses
• Automated system • Upgraded communication method • Speed & Safety	• Requires skilled staff with professional knowledge • Lack of understanding and awareness • Struggle to recruit repeat donors
Opportunities	**Threats**
• Increasing demand for service • Digitization of service • Easy inventory management • Increase use of new media	• New technology • Budget cuts

Summary: Need for the System

People these days are not aware of how blood transfusion can save lives. It cannot be ignored that there is a huge disparity of blood donation between high-income countries and low-income countries. Therefore, an automated system that can bring efficiency to this process while making if safe and checked for quality is essential. Blood donation is a time-sensitive matter and without a proper centralized system, many people might suffer in times of emergency. In order to save lives in countries where people are not yet aware of active blood drives to donate blood and also where many people have challenges in finding their blood types, this Blood Bank Management System has to be put into practice so that both donors and recipients experience a better environment to donate and receive blood.

Further, if this system performs well, it could potentially expand to other areas like organ donation and bone marrow donation, saving more lives in an efficient and centralized manner.

2) System Description

This system, the Blood Bank Management System is a web-based database application system that will be used by blood banks as a means to advertise nationwide blood drives and events to the public. At the same time, the system will allow volunteers to add their names and details of their blood type, in case a need arises in the future.

The system will also keep track of the donor's past donation records and list any medical diseases or treatment the donor has undergone, following the HIPAA guidelines. The project intends to make record management more efficient in order to retrieve data as quickly as possible, when required.

Business Problem Addressed

There are many areas of concern surrounding the business aspects of a blood bank. These include blood collection & processing, blood testing & storage, supply, and revenue/cost structure. Taking a stab at blood collection and processing, an important piece of this is creating the public awareness as stated in the problem statement. Our proposed application will counter this problem by not only improving awareness through advertisement of blood donation drives, but will also improve the data collection process. Records management will be streamine to some extent by giving potential donors an opportunity to pre-register before attending a blood drive and also providing their blood type if known.

Predicting the number of donors attending a blood drive isn't an exact science, it's unpredictable. Our application will at a minimum give blood banks an idea of the number of people who plan to attend drives and have pre-registered using our application. This will in turn help staff to adequately prepare logistic to accommodate the minimum number of people expected. Records of blood storage will be automated, giving the measure of each blood type currently in inventory. Also alerting employees when there is a shortage. Blood supply to external or internal facilities will be improved especially for time sensitive situations as employees will have all the necessary information in a snapshot.

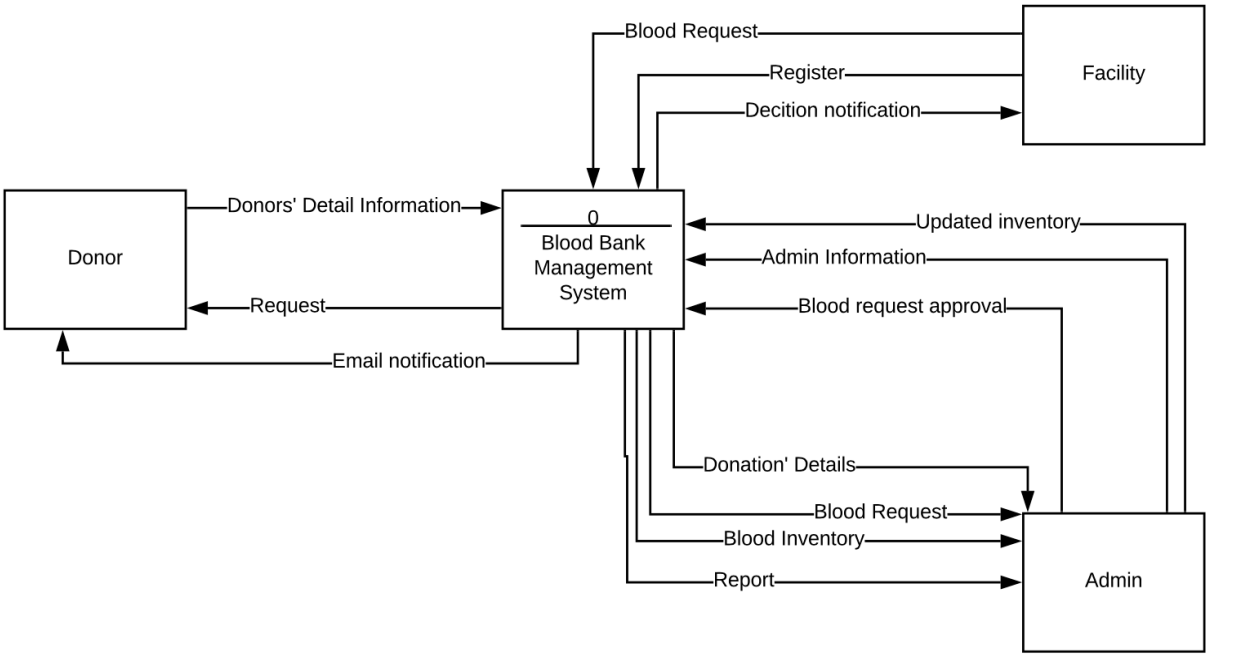
Two major questions from a broader management perspective of a blood bank are:

1. What quantity of blood should be collected during each drive?
2. Of the blood collected, how much should be componentized?

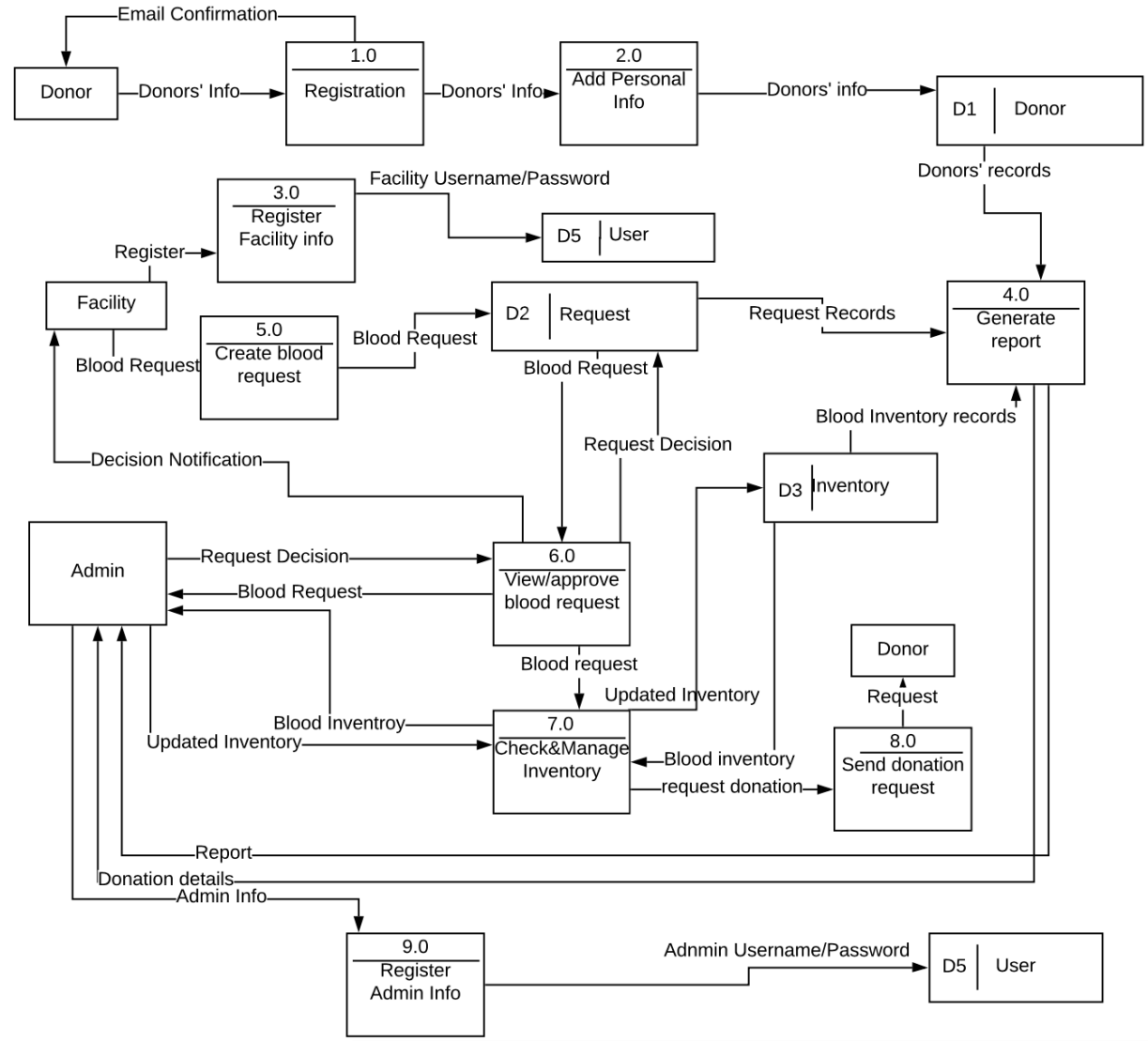
The above questions need to be answered by the blood bank manager before every drive. Our application will be of great assistance in his/her decision making process also increasing efficiency.

Data Flow Diagrams (DFD)

Context Diagram

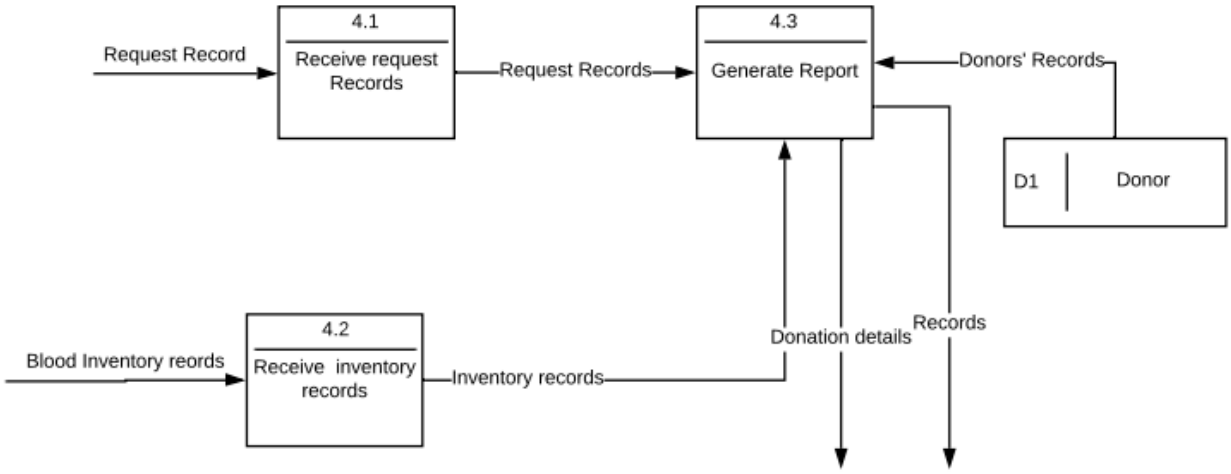


Level-0 Diagram

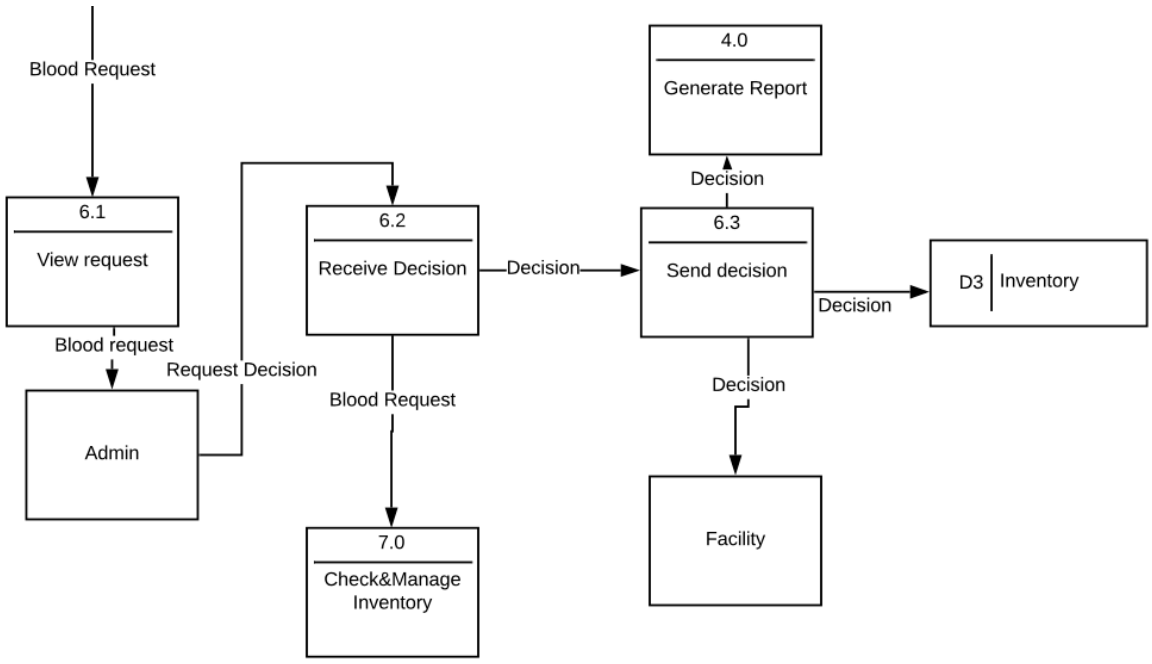


Level-1 Diagram

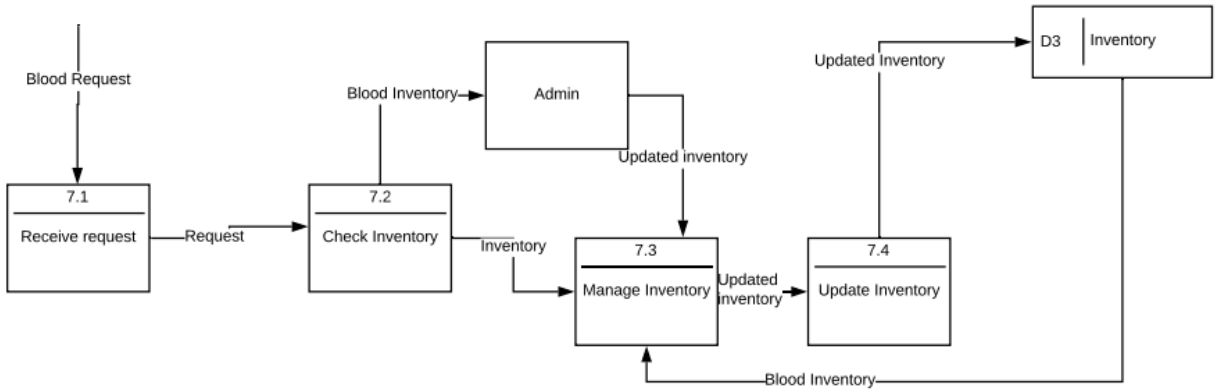
Level 1 for process 4.0



Level 1 for process 6.0



Level 1 for process 7.0



Business Assumptions and Risks

Following are the main assumptions of the Blood Bank Management System:

- This project is not profitable but can get financial support

  This is a charitable project providing efficient ways to make blood donation and receiving more efficient. Voluntary donors show their sympathy by donating blood and do not make any profit from doing so. However, system maintenance, employees hiring and traveling fee will still be a cost for this project. To cover this cost, we need to outsource reliable sponsors. According to our knowledge, organizations like WHO and UN are very willing to support this kind of projects. NGOs like Gates Foundation might also have a plan to sponsor medical programs.

- There are no barriers to communication

  Since this system would cover a relatively wide geographic area, it is important that users and administrators can communicate well between each other. Communication will take place via email, phone calls and any other method the organization may see fit.

- Every region's regulations are met in terms of quality and process

  Since different countries have different medical law and regulation, it is assumed that this system will meet all medical requirements. For example, if the system is being implemented in the United States, it is assumed to meet the HIPAA regulations.

Following are the main risks of the Blood Bank Management System:

- Costs might be too high for rural area hospitals and clinics in the initial years

  We assume that this system will get initial sponsorship. However, after the initial years of implementation, the project will return huge benefits like saving people's lives, which will outweigh the cost of the project.

- Blood security

  Blood is from different donors in different countries and hence transporting blood in the right temperature and controlling quality could be a problem. It is also important for blood drives to test the donor for any deficiencies or previous diseases before they make a blood donation. Implementing a quality control could potentially be a risk.

- Emergency Request handling

  It is important for hospitals to manage emergency requests with this system efficiently. At the same time, when there is any scarcity of a blood type, appropriate action must be taken as soon as possible, in order to have the right amount of blood when required.

Systems Cost Targets and ROI Estimates

Currently, our NPV of all benefits adds to $69,343.19 and our NPV of all costs is $66,983.04 for years 0 to 7. Based on this, our overall NPV is $2,360.16 with a ROI estimate of 0.04. According to our calculations, our projected breakeven will occur between the 5^{th} and 6^{th} year, with actual breakeven happening in 5.46 years. Detailed calculation of economic feasibility analysis can be found in Appendix A.

Based on the above estimates, following are some of the benefits analyzed

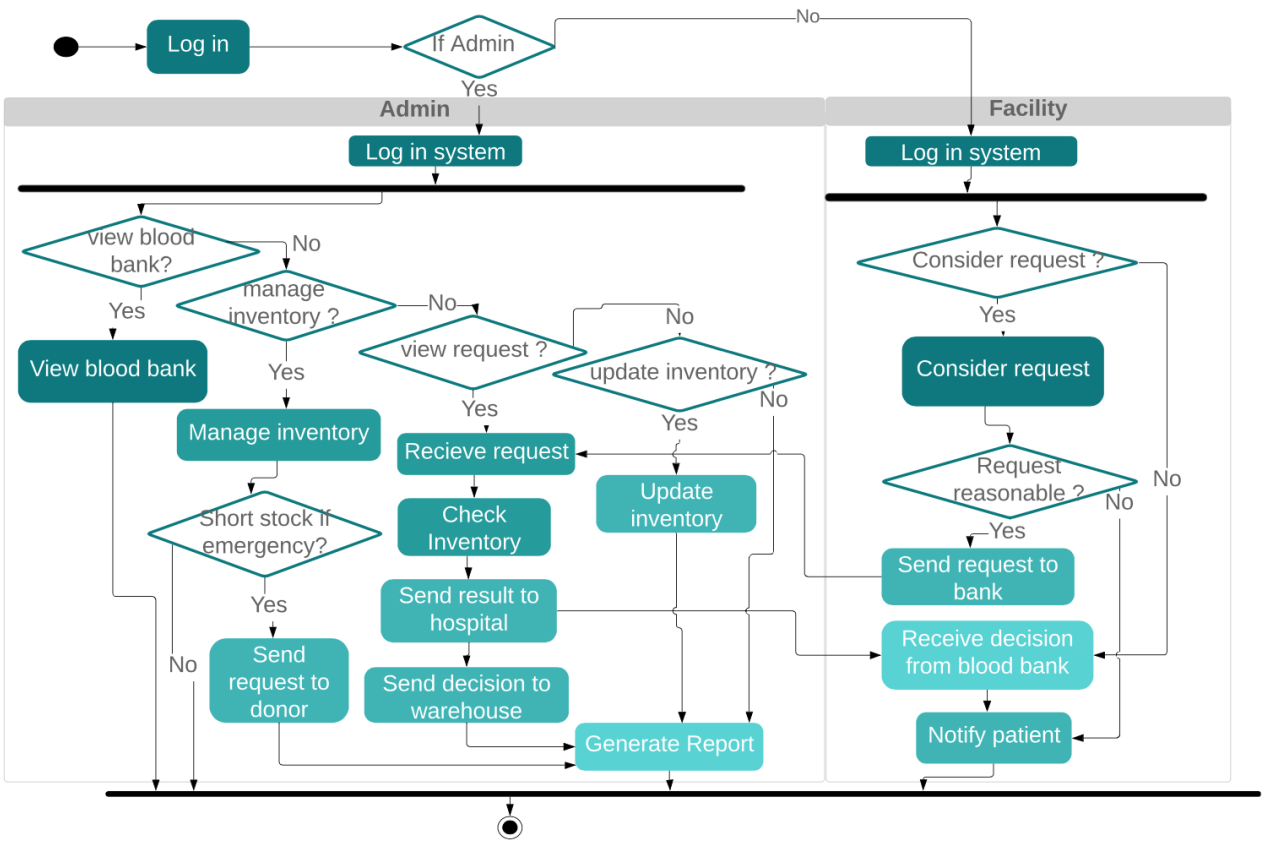
- Reports and information are kept in electronic form making it easier to maintain by hospital staff.

- Donors and recipients can access their records at any time by logging into the front-end of the system.

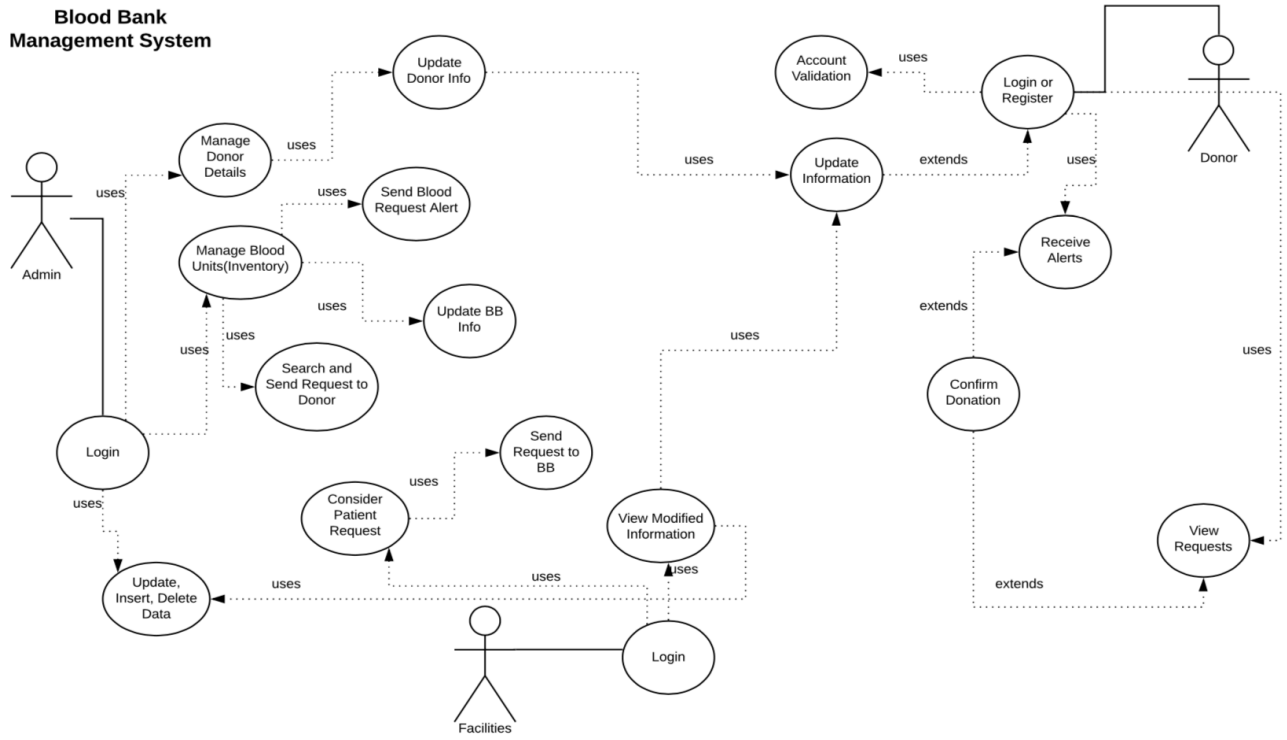
- Administrators can easily target specific blood groups that are below the threshold and order more by involving engagement for blood drives or contacting volunteers to donate more blood.

3. Requirement Specifications and Models

1) Activity Diagram (process flow)



2) Use Case Diagram



3) Interfaces

- Credential and Two Factor Authentication – when an individual or a hospital entity logs into our system, we will be using the appropriate authentication tokens to make sure the system verifies the user logged in. At the same time, we will use a two factor authentication to process for security purposes.

- Background, Physical and Blood Checks – the system will be connected to a new recently developed technology called Steripath Initial Speciment Diversion Device (ISDD) developed by Magnolia Medical Technologies that checks blood samples to make sure all specifications are met and it is acceptable. If the blood is not of acceptable standards, a blood rework will be done in order to meet the standards.

- Tableau and R – Our system will also provide analytics solutions to our customers to see value in our service. We will be using Tableau and R to provide prediction analysis as well as data visualizations of past performance using the system.

- Facebook – Our system will also connect with Facebook to help find users to donate blood in their area and be notified when a nearby blood donation center is in need of a particular blood group.

4. User Stories

Hospital Doctor

As a hospital doctor, I want to request for blood necessary for my patient according to their blood type and current situation. I can do this by logging into the system to make a request, confirm details of blood volume and type, and declare any specific requirements.

Hospital Manager

As a hospital manager, I want to make sure that every blood request from my hospital is reasonable in terms of health standards (free from diseases etc.), regulations and quantity. I can do this by logging into the system to verify every request made by the doctors at the hospital.

Blood Donor Volunteer

As a volunteer, I want to make sure that my blood type is needed in the area as well as free from any diseases. Based on my current situation, I want to make decisions on whether I should sign up as a volunteer in order to be contacted to donate blood as required from nearby hospitals. I can do this by registering in the system as a volunteer and then checking to see if any requests have been made by a hospital, based on my blood type.

System Administrator

As a system administrator, I want to make sure the blood bank is in good condition and well managed and continuously monitor inventory when blood requests are made. I can do this by logging into the system to view the current blood bank donation as well as check the quantities available in the blood warehouse. Based on this information, I can make requests to fund extra blood drives in the locality as needed.

Blood Bank Nurse

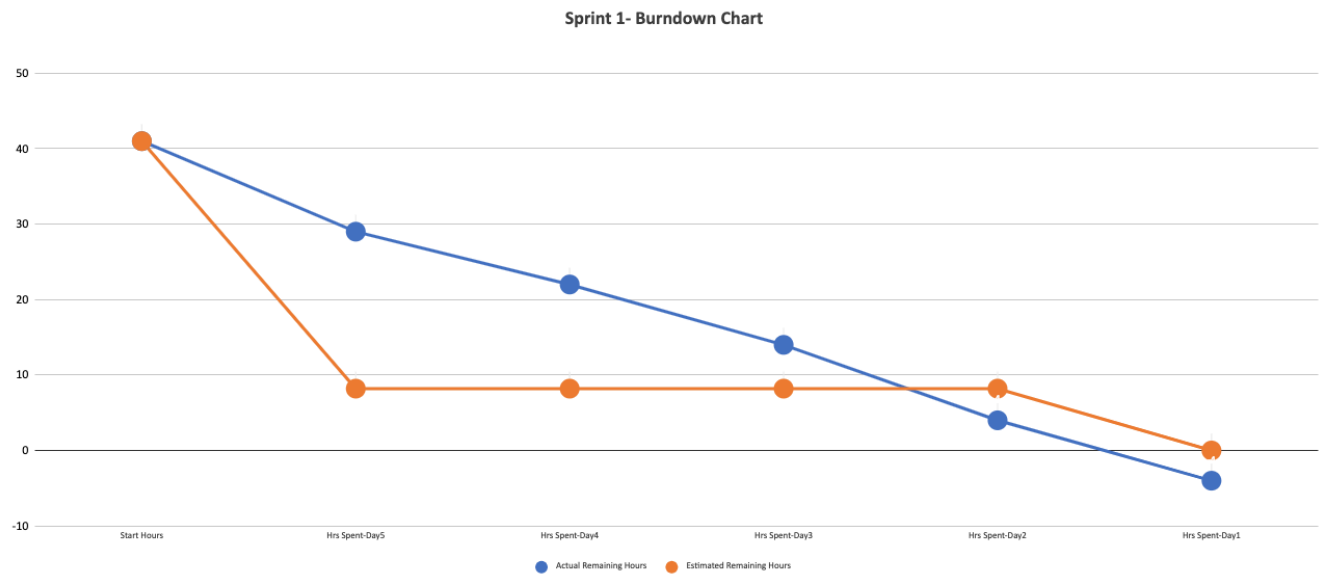
As a nurse work in blood bank, I want to make sure that all volunteer donors can get qualified treatment and medical service. So that I can log in system to check the condition and information of donors.

5. Burndown Chart and Sprint I

- Hours spent on each task of Sprint 1

Task	Start Hours	Hrs Spent-Day5	Hrs Spent-Day4	Hrs Spent-Day3	Hrs Spent-Day2	Hrs Spent-Day1	Total Hours
Task 1 (User stories)	8	2	0	2	2	2	8
Task 2 (Product Backlog)	7	2	1	2	0	2	7
Task 3 (Detailed Software/Systems Design)	10	2	2	2	4	2	12
Task 4 (Reports)	8	2	2	0	2	2	8
Task 5 (Business Rules for Screens/Fields)	8	2	2	2	2	0	8
Actual Remaining Hours	41	29	22	14	4	-4	
Estimated Remaining Hours	41	8.2	8.2	8.2	8.2	0	

- Chart representing the hours spent on each task of Sprint 1



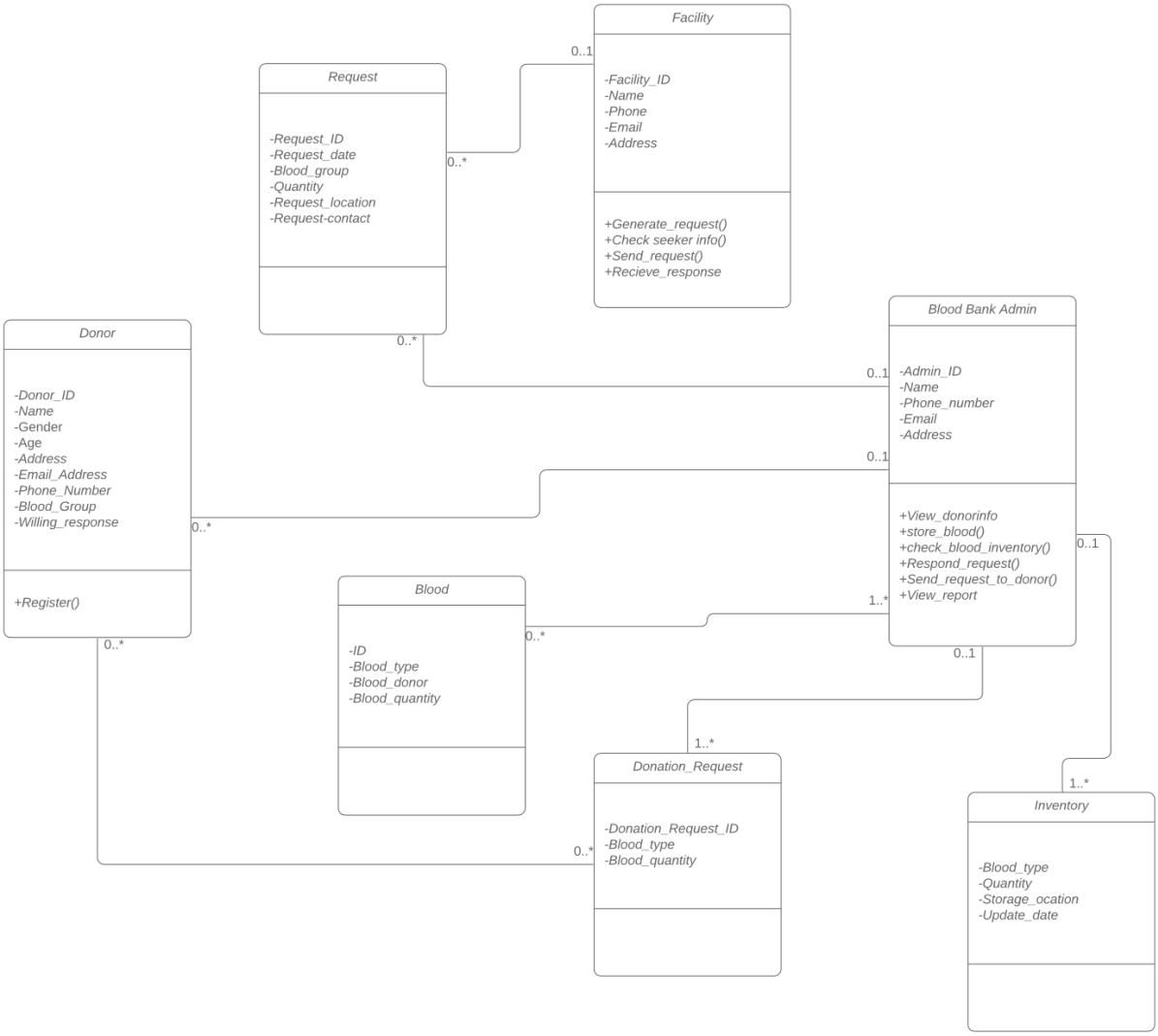
6. Detailed Software and Systems Design

1) Classes and Methods

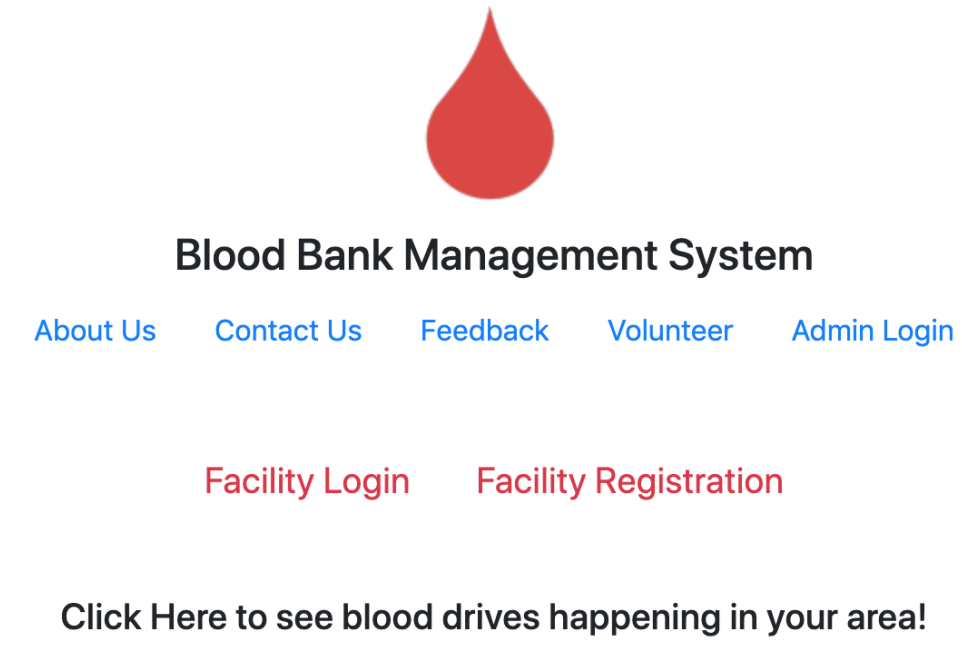
The class diagram below provides context for various system components in order to reduce ambiguity between the users and the software. The class diagram includes classes, attributes, methods and associations within the system. The blood bank donation system has classes which are Donor, Hospital, Request, Receptionist, Blood Bank Nurse, Blood, Donation Request and Seeker. The methods within the system represent the type of actions that a class might perform. Methods are public and different from each class.

- Donor
    - +Register()
- Facility
    - +Generate_request()
    - +Check seeker info()
    - +Send_request()
    - +Recieve_response
- Blood Bank Admin
    - +View_donorinfo
    - +store_blood()
    - +check_blood_inventory()
    - +Respond_request()
    - +Send_request_to_donor()
    - +View_report

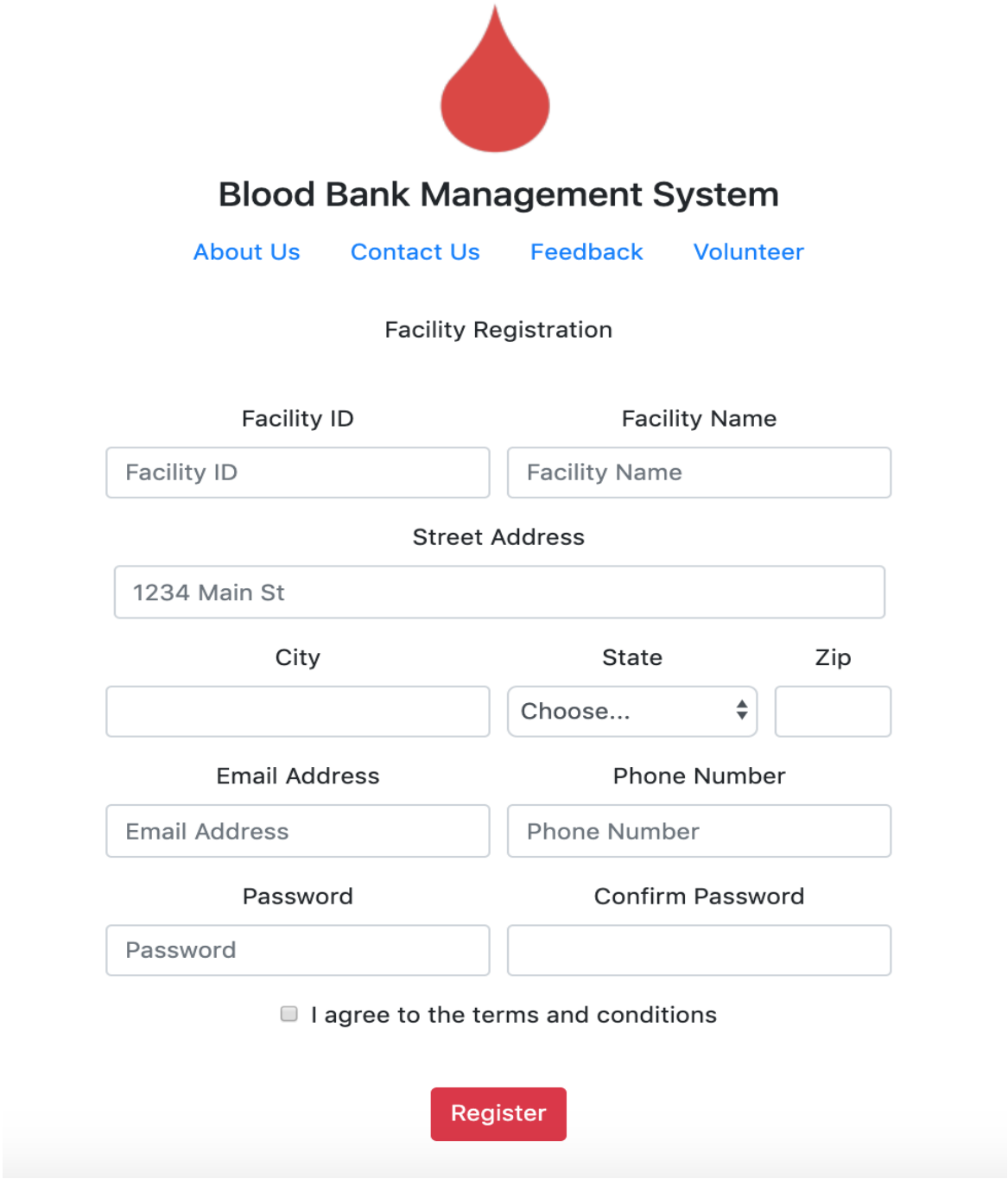
2) Class Diagram



3) Screens and Screen Flow



1.0 Screen showing the landing page of the system for a facility to either register or login or an admin to login



2.0 Screen showing the facility registration page, for a facility to register and be a part of the Blood Management System. The system requires facility details such as an email, facility ID and street address. Once a facility registers, the system administrators will review their details following which they will be added to the database. Once a facility is added to the system database, they will be able to login using the credentials used to register.

Blood Bank Management System

About Us Contact Us Feedback Volunteer Admin Login

Facility Login

McLean Hospital

•••••

Login

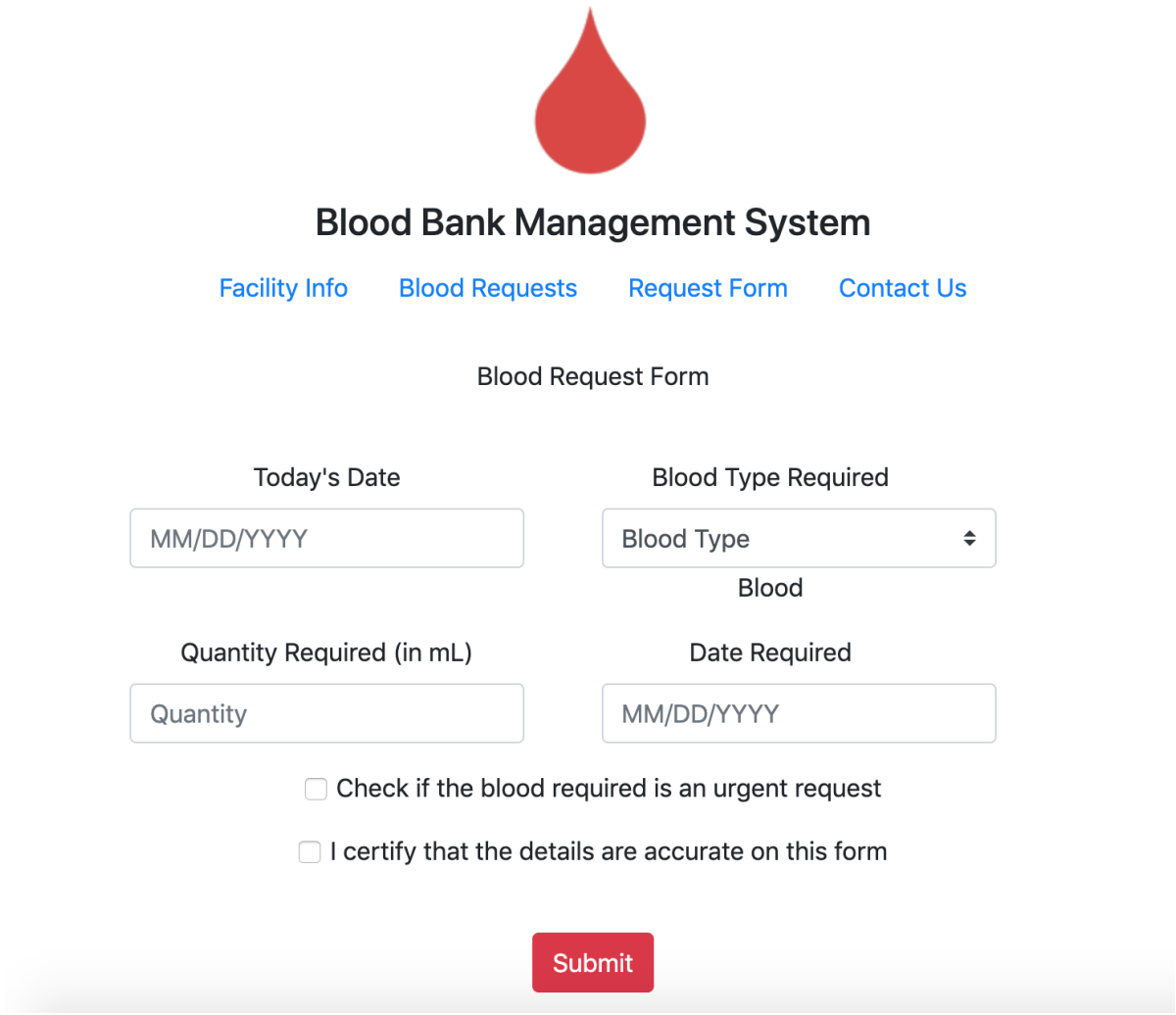
3.0 Screen showing the login page for a facility. When the facility is added to the system database, they will see the facility name in the list of dropdowns to choose from. Once they login a session is created for the facility user.

Blood Bank Management System

Facility Info Blood Requests Request Form Contact Us

Welcome McLean Hospital

4.0 Screen showing the landing page when a facility logs into the system. The facility can now put in a blood request or view all past blood requests to see the status of their order.



5.0 Screen showing a blood request form for McLean Hospital. Once the form is submitted, the request gets added to the database. The admin can then change the status of the order based on inventory.

Blood Bank Management System

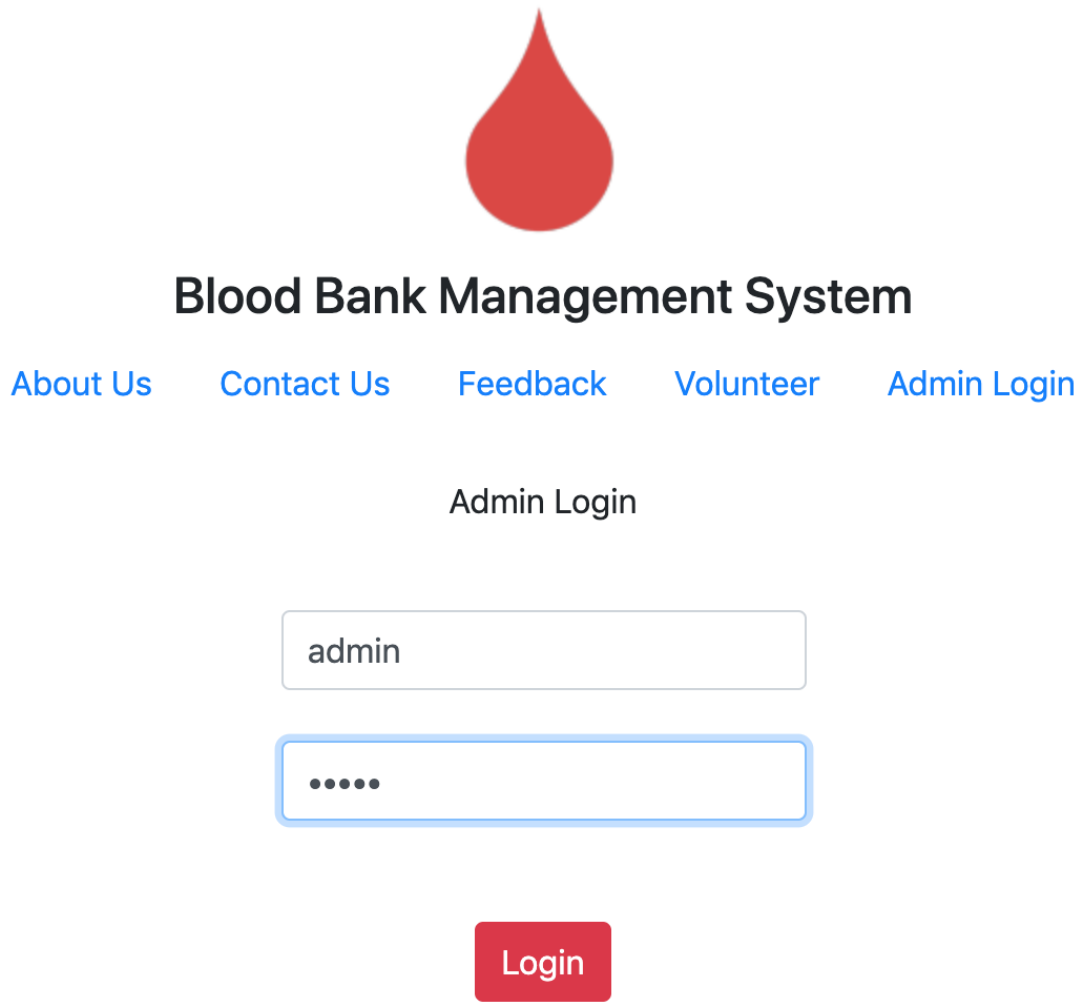
Facility Info Blood Requests Request Form Contact Us

Welcome McLean Hospital

Blood Requests

#	Date Requested	Blood Type	Quantity	Status
10	12/09/2019	A-	223	Fulfilled
11	12/17/2019	B+	738	Received

6.0 Screen showing all blood requests made my McLean Hospital. As you can see, the first request has been fulfilled. The second request has been received and will have new change updates based on the admin.



7.0 Screen showing the login page for an admin

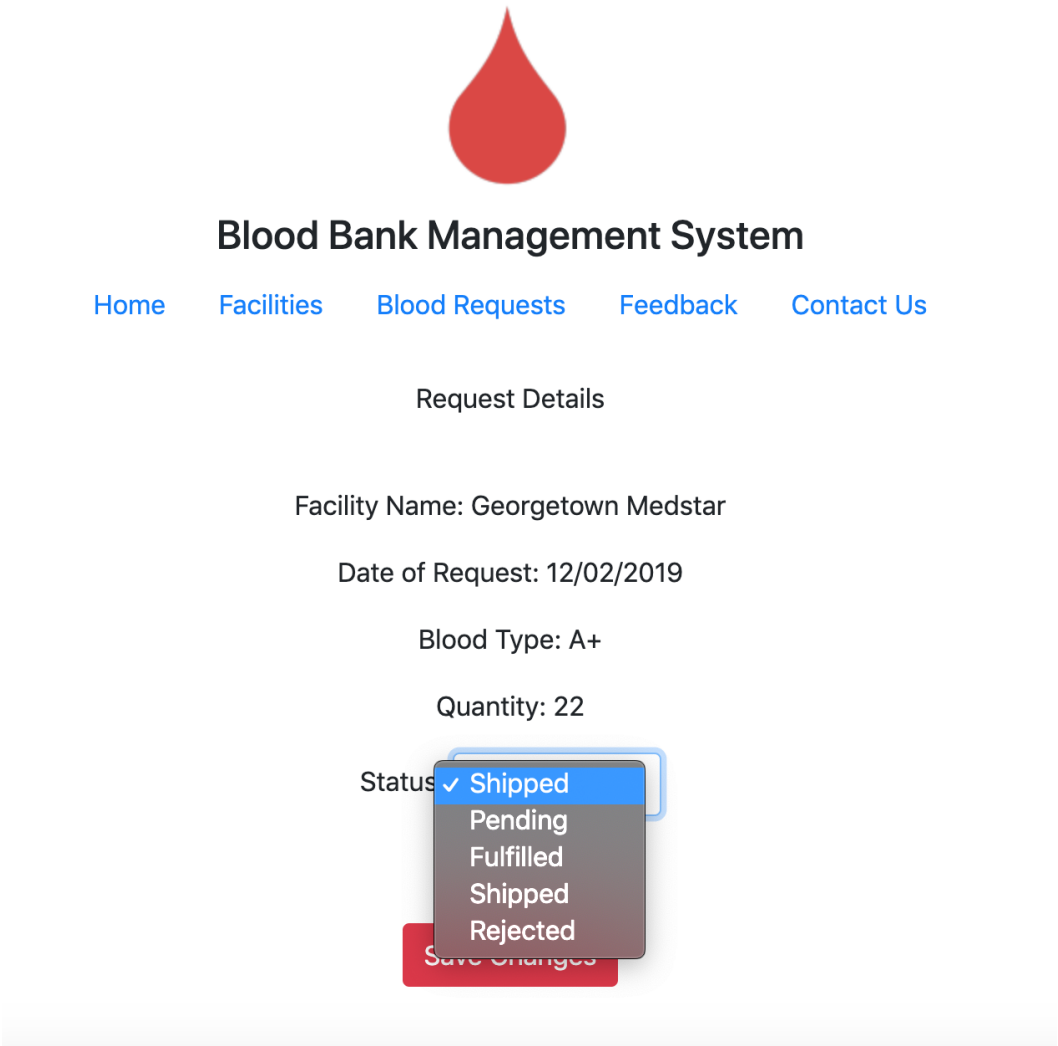
Blood Bank Management System

Home Facilities Blood Requests Feedback Contact Us

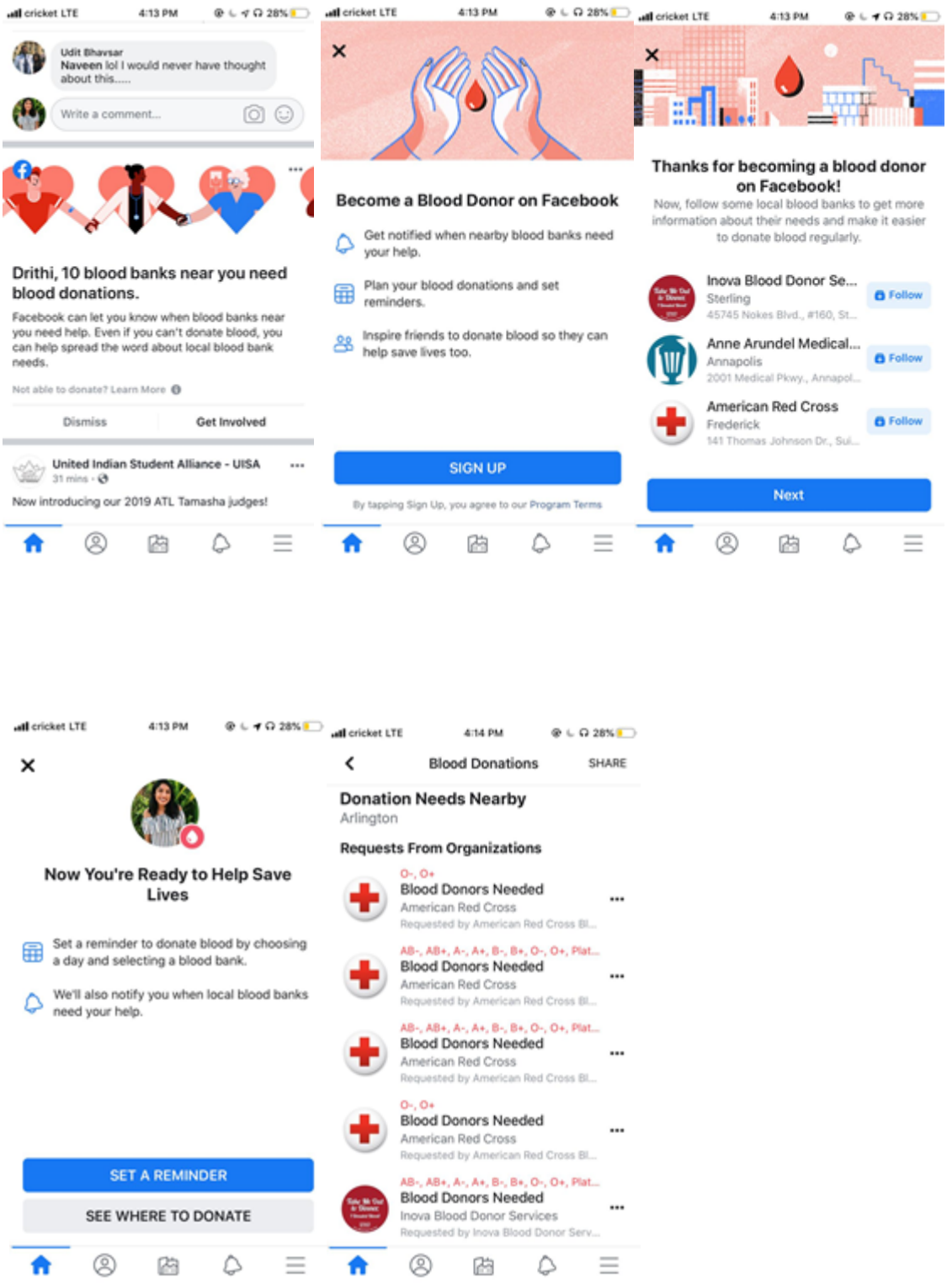
Blood Requests

#	Facility Name	Date of Order	Blood Type	Quantity	Date Required	Status
2	Taylor Center	12/02/2019	B+	123	12/17/2019	Received
3	Georgetown Medstar	12/02/2019	A+	22	12/09/2019	Shipped
4	Georgetown Medstar	12/24/2019	A+	12	12/17/2019	Fulfilled
5	Georgetown Medstar	12/24/2019	A+	12	12/17/2019	Fulfilled
6	GW Clinic	12/02/2019	A-	33	12/17/2019	Shipped
7	GW Clinic	12/02/2019	B+	12	12/05/2019	Received
8	DuPont Clinic	12/02/2019	A+	12	12/11/2019	Received

8.0 Screen showing all blood requests received from all facilities for the admin. On this screen, the admin can click on a status and change accordingly.



9.0 Screen showing the status of blood requests. The admin can change the status based on inventory and needs of the facility. The four statuses available are: Pending, Fulfilled, Shipped and Rejected. When a facility submits a blood request, the status automatically changes to the "Received".



10.0 Facebook Integration Screenshots

4) Reports

Already part of our DBMS platform, we will have built in reports via our SQL database. The Blood Banks will find some of these very helpful when managing their sites. Some of these built in reports are:

- Measure of current blood Inventory
- Componentized blood inventory
- Numbers of donors currently registered with facility

In addition to our built-in reports, we will also have ad hoc reports. The ad-hoc reports will be based on individual blood banks which will vary in terms of location and other attributes.

5) Business Rules

1. Facility/hospitals and individual donors must create an account to access system features. Each facility can have designated users to perform certain administrative functionalities, while the others would just be users of the system to add and delete data entries.

2. The system will not show blood types of an individual that are rejected by the hospital if not confirmed to standards.

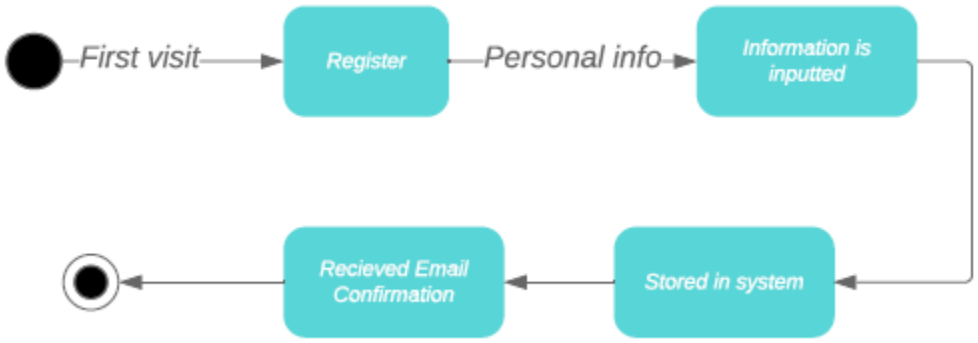
3. The system will now show blood types that are expired or low in quantity, based on the current date.

4. The system will not confirm individual registrants by the hospital until paperwork has been uploaded to the website and checked.

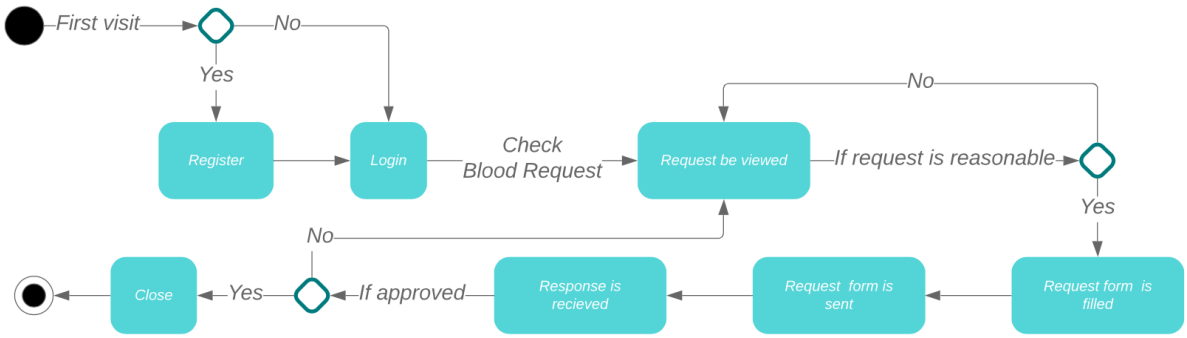
7. Behavioral Modeling

1) State Diagram

For donor registering:

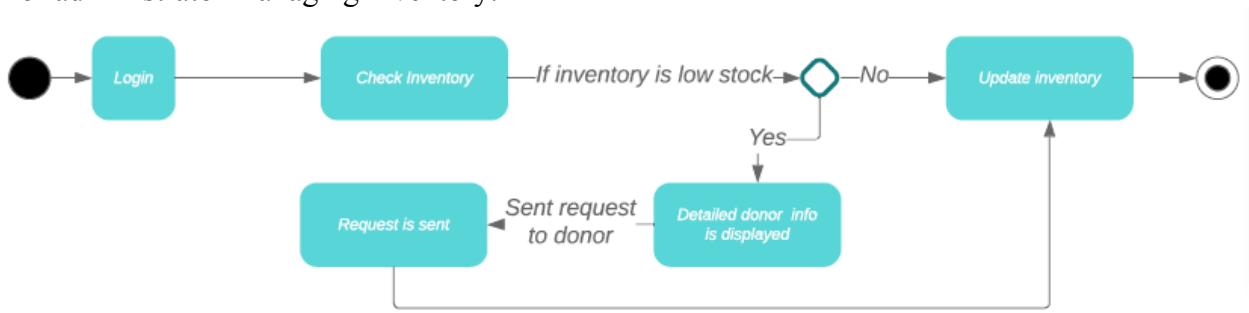


For hospitals sending requests:

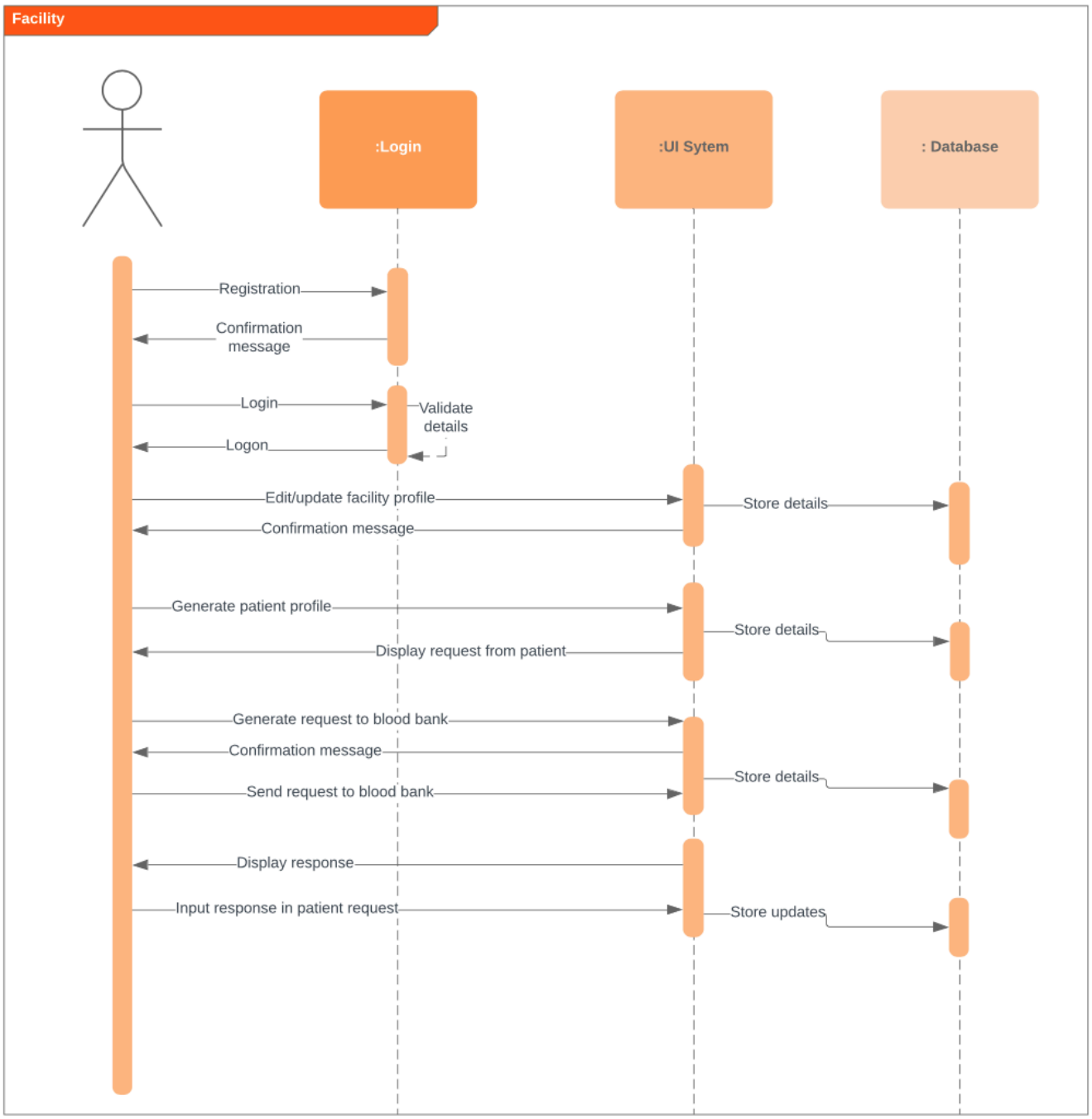


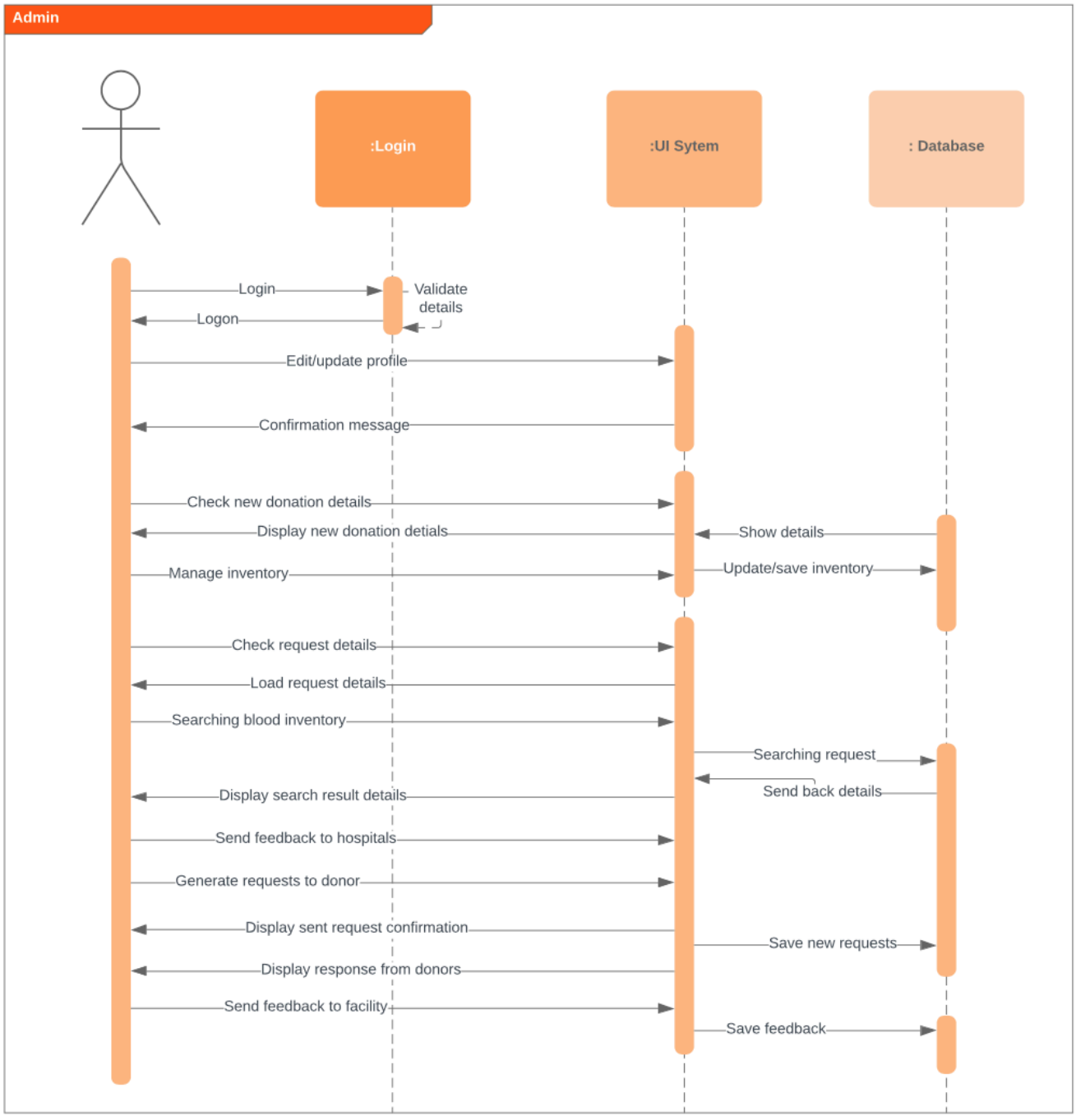
For administrator receiving requests and making responses:

For administrator managing inventory:



2) Sequence Diagram

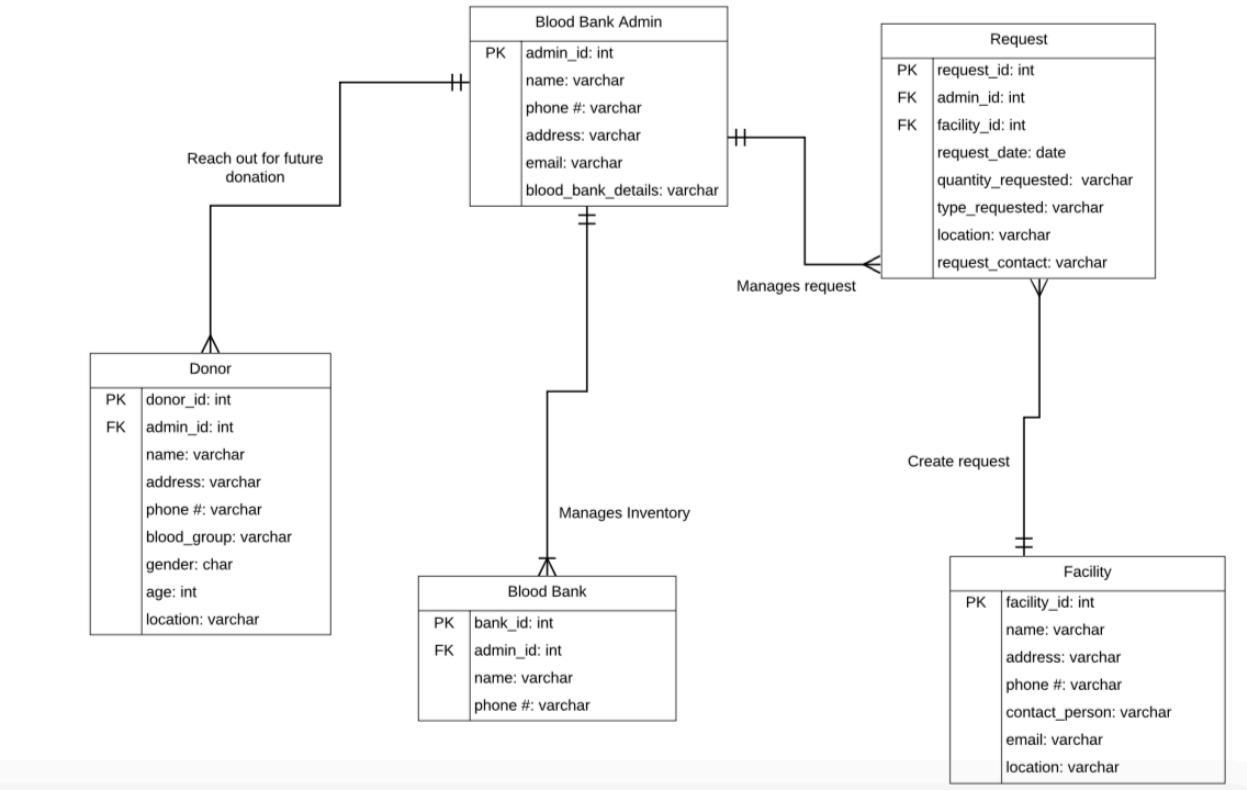



Admin
:Login
:UI Sytem
: Database
Login
Validate details
Logon
Edit/update profile
Confirmation message
Check new donation details
Display new donation detials
Show details
Manage inventory
Update/save inventory
Check request details
Load request details
Searching blood inventory
Searching request
Send back details
Display search result details
Send feedback to hospitals
Generate requests to donor
Display sent request confirmation
Save new requests
Display response from donors
Send feedback to facility
Save feedback

8. Database Design

Our Blood Bank Management System entity relationship diagram comprises of six entities with a focus on our web-based system/Blood Bank. The Donor entity stores relevant information for volunteers. Attributes include some personally identifiable information along with other relevant information used for registration and in the event a blood bank needs to make contact with a donor. The Feedback entity is useful for the blood bank to gauge their performance in the eyes of donors and healthcare facilities. The Blood Bank Administrator entity stores attributes for the person in the employ of the Blood Bank who is responsible for running reports, also making sure the site is running effectively/efficiently as possible. The Healthcare Facility entity has attributes for the hospital or clinic that will be making blood request. The Request entity contains attributes that specify the quantity, type, and other items for a blood request(s) made by a healthcare facility. The Blood Bank entity captures relevant information for a site such as the site identification number, address, and phone number. The relationship between entities in the databases is illustrated in the entity relationship diagram below.

1) Physical Database Schema and Entity Relationship Diagram



2) Data Dictionary

Attribute Name	Required	Type	Field Length	Default Values	Notes
Bank Facility ID	Yes	int	10	N/A	Generated Automatically
Bank Name	Yes	varchar	255	N/A	
Bank Phone	Yes	varchar	15	N/A	
Bank Address	Yes	varchar	255	N/A	
Bank Email	Yes	varchar	255	N/A	
Bank Details	No	varchar	255	No Information	
Request ID	Yes	int	10	N/A	Generated Automatically
Request Date	Yes	date	10	00-00-0000	
Request Quantity	Yes	varchar	5	N/A	
Request Type	Yes	varchar	5	N/A	
Location	Yes	varchar	255	N/A	
Request Contact	Yes	varchar	255	N/A	
Donor ID	Yes	int	10	N/A	Generated Automatically

Donor Name	Yes	varchar	255	N/A	
Donor Address	Yes	varchar	255	N/A	
Donor Phone	Yes	varchar	15	N/A	
Donor Blood Type	Yes	varchar	5	N/A	
Donor Gender	Yes	char	1	N/A	
Donor Age	Yes	int	5	N/A	
Donor Location	Yes	varchar	255	N/A	
Administrator ID	Yes	int	10	N/A	Generated Automatically
Administrator Name	Yes	varchar	255	N/A	
Administrator Phone	Yes	varchar	15	N/A	
Healthcare Facility ID	Yes	int	10	N/A	Generated Automatically
Healthcare Name	Yes	varchar	255	N/A	
Healthcare Address	Yes	varchar	255	N/A	
Healthcare Phone	Yes	varchar	15	N/A	

Healthcare Contact	No	varchar	255	No Information	
Healthcare Email	No	varchar	255	No Information	
Healthcare Location	Yes	varchar	255	N/A	
Feedback Number	Yes	int	10	N/A	Generated Automatically
Name	No	varchar	255	Anonymous	
Date	Yes	date	10	00-00-0000	

3) Test and Demonstration Data

Blood Bank Test Data

ID	Name	Phone	Address	Email	Details
14256	BloodBank_Region1	397102976	32 Race St, Dry Ridge, KY 41035	region1@gmail.com	
34296	BloodBank_Region2	390772198	2277 State Rd 46, Nashville, IN 47448	region2@gmail.com	State Core Blood Bank
78623	BloodBank_Region3	240901642	130 S Russell Ave, Douglas, WY 82633	region3@gmail.com	

Request Test Data

ID	Date	Quantity	Type	Location	Contact
42325534	12/5/2014	200cc	O	Kansas	Jack 4972762626
40937832	10/6/2017	500cc	AB	Idaho	Linda 8345235677
94997412	4/23/2018	700cc	A	New Mexico	Bob 8987372223

Donor Test Data

ID	Name	Address	Phone	Blood Type	Gender	Age
986937	Jane	1873 Mass Ave	3906732727	B	F	34
349320	Mary	892 Washington Drive	9873635222	O	F	25
826962	Thomas	876 Loyola Road	6362521828	AB	M	45

Blood Bank Administrator Test Data

ID	Name	Phone
987	Henry	2838471029

234	William	3902478387
543	Jerry	2098332092

Facility Test Data

ID	Name	Address	Phone	Contact	Email
3903	HP Health	3092 Connecticut Ave	2429837623	Allen	Allen.hsu@gmail.com
4729	YY Heathcare	212 Hdson Ave	3902774732	Bill	Bill.wq@hotmail.com
8261	GHG	209 dsodfh Drive	2348092809	Cindy	Cindy.dnu@ghg.com

Feedback Test Data

ID	Name	Date
339	None	4/29/2016
489	Lily	8/19/2019
213	Zoe	7/10/2018

9. Security

Data and system security will be ensured in the following ways –

- Data Encryption -
  Our system will ensure that the data being transmitted is encrypted to safeguard sensitive data of its hospital patients. Data interaction between end users and the website will be encrypted through the usage of Secure Socket Layer. Data residing in the database will be encrypted through the inherent encryption algorithms adopted by MySQL.

- Employee Training -
  To minimize the risk of security breach from social engineering and misconduct of employees, there will be mandatory training sessions to educate the users of the system.

- Amazon Web Services and the Cloud -
  To minimize the risk of data being lost on our servers and any natural disasters that could potentially disrupt existing data, all data will be stored on the AWS Cloud.

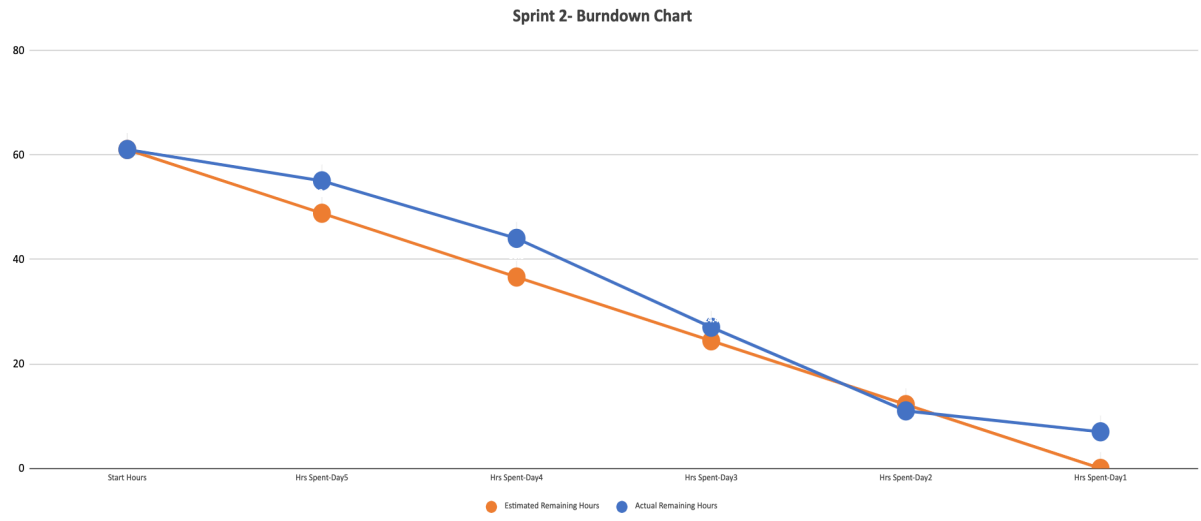
- Access Control -
  Access control will be in place within the system. Individuals in various departments will have limited access to data based on the departmental purposes for business objectives. The data will retain its confidentiality, integrity and availability. Any changes made by respective individuals will be logged to trace responsibility for the future.

10. Burndown Chart and Sprint II

- Hours spent on each task of Sprint 2

Task	Start Hours	Hrs Spent-Day5	Hrs Spent-Day4	Hrs Spent-Day3	Hrs Spent-Day2	Hrs Spent-Day1	Total Hours
Task 1 (State Chart)	8	0	1	1	1	1	4
Task 2 (Sequence Diagram)	8	0	1	1	2	0	4
Task 3 (Physical Database Schema & Description)	12	4	4	3	1	0	12
Task 4 (Data Dictionary)	5	0	3	3	0	1	7
Task 5 (Test and Demonstration Data)	8	0	0	3	3	2	8
Task 6 (Security – all aspects)	5	0	0	2	2	0	4
Task 7 (Sprint and Product Backlogs	8	0	2	3	3	0	8
Task 8 (Burndown Chart)	7	2	0	1	4	0	7
Actual Remaining Hours	61	55	44	27	11	7	
Estimated Remaining Hours	61	48.8	36.6	24.4	12.2	0	

- Chart representing the hours spent on each task of Sprint 2



11. User Test & Plan Scenarios

The aim of the testing process is to identify all the defects in the website and database. Testing will provide a practical way of reducing defects in the system and increasing users' confidence in a development system. Failure of testing indicates conditions which should behave as expected should be noted and modified in the future since the testing contains subjects of system that should behave as expected. Unit testing will consist of the entire individual functions and modules which will be tested independently. The following cases will be used to test functionality of system:

1) Testing register and login module for users
   From donors' prospection, the registration form should be displayed and available to be input information. The information gathered from donors' registration should be stored in donors' database which can be investigated in our backstage PHP database. Users as admin and hospitals should be able to log in using credentials which are users' emails and passwords. Upon registration, login credentials will be saved to in order to easier move forward after login.

2) Testing submit blood request forms for hospitals
   After registering and logging in the system, as a hospital, test users will be able to find the blood request form, fill single and multiple forms and submit them. The requests history should be displayed as well as the requests status to users.

3) Testing receive and respond blood request for admin
   Registered as an admin, test user should be able to check requests list. Based on the details that described in each form, test users can make response as declined, pending, shipped, and approved that will display on each request and send them back to request senders.

4) Testing manage inventory for admin
   Registered as an admin, test users should be able to check the inventory such as blood type, quality and storage location after receiving requests, as well as update inventory when new donations come.

5) Testing send request for donation from admin
   Assuming emergency happens, admin should be able to review donors' information list and send donation requests based on their contact information.

12. System Capacity and Performance

1) Numbers and types of users

Blood bank system will have two primary users. One primary user will be admin who will manage blood banks and could collect and provide blood for hospitals. Based on the NPR (2019), in rural clinics, the blood supply is even more limited than in urban hospital settings. Even though there is no estimated numbers that how much blood banks needs in rural areas; poor communication system is necessary, and the assumed users will over thousands.

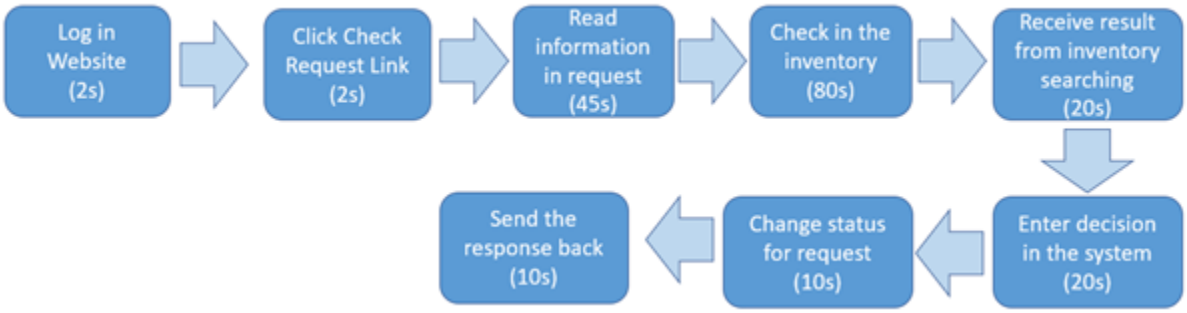
The other type of users is hospitals and clinics who have blood needs. Based on the population-based model, for a country with a population of 10 million, the hospitals need 200,000 units of blood per year approximately (WHO). According to the American Association of Blood Banks of 2013, about 36,000 units of blood are needed every day (John Hopkins Medicine). It is hard to establish the needs from all rural areas, but we assume that there might be over thousands of hospitals face depict blood supply and request more from blood bank.

2) Transactions

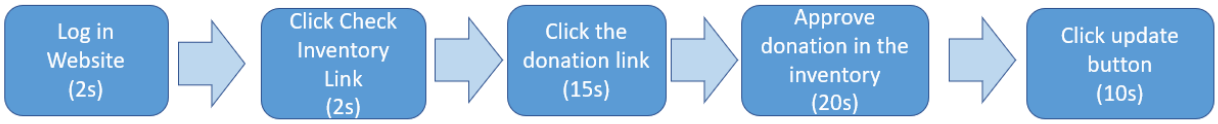
- Account signup (Users)

- Submit blood request

- Respond to blood request



- Manage the inventory



13. Implementation Stages and Conversion

1) Implementation Strategy

For blood bank, we will implement a detailed strategy to implement the system. And this sub-project is prioritized, since other users and functions are based on the successful implementation for blood bank.

We would provide customized implementation strategy for each healthcare facility, to help them get familiar with the system, get enough training, and make sure that all functions run well and stably.

2) Conversion

If other blood banks or healthcare facilities are planning to convert traditional system into our digital system, we will be happy to support the conversion process.

Firstly we would provide introduction and training to those core employees in related facilities. Conversion involves multiple new working processes and software, so we need to make sure that every can operate the system in a fluent way.

Conversion can be time-consuming and budget consuming, because every facility should be equipped with the necessary hardware. New computer systems must be introduced to those hospitals in rural areas. And since it is about healthcare, it is strictly regulated. So we must pay more attention to testing process.

3) Ongoing Support

Once a system is fully implemented, the client is introduced to our full-time support staff. Client support is dedicated to resolving client questions in a production state.

14. Support and Training

1) User Training Plan

For the new users, our Blood Bank Management System will provide training guide on how to navigate through the website for their desired services. A downloadable and printable document that provides step-by-step instructions on how to complete a specific activity or transaction in the Blood Bank Management System will be provided to users. These training guide documents would include graphic screen captures and detailed instructions including which buttons to click and sample data values to enter in the system to complete the transaction.
Below is a list of a few activities that our training guide would provide:

- Registration - Register and input requested information. All data fields must be filled in for successful account creation.
- Log-in - Enter username and password.
- Submit blood request form - Input requested information for successful blood request.

2) Help Functions

Our platform would allow users to be able to contact our Blood Bank Management System for help regarding technical issues, service feedback, and other general inquiries via email. Users can also either log in and submit assistance requests or contact us directly. The system will promptly respond to users' needs.

3) Installation and Turn-on strategy

The platform is developed at the beginning of the implementation stage and user testing was conducted to make necessary adjustments including unit testing to ensure the basic functioning of each code module. At this point of time, beta-test would be conducted by the user group. We will select a group of users to test the platform and provide feedback. This group would represent our larger target market and act as a virtual focus group. These users would go through each functionality on a real-time basis to see if our system has successfully implemented the required features. The purpose of this strategy is to face and become familiar with any flaws with the system's performance and receive suggestions for functional improvements. Any feedback that is considered relevant and critical to our system would be included in the final sprint backlog, which will be addressed before the official launch of the platform. In addition, taking into consideration that our platform has cloud-based infrastructure, another strategy would be to install appropriate web server, AWS and test and configure the proper operation of the server in order to ensure live and functional website.

15. On-Going Maintenance and Support

Quality assurance will be the critical factor in continuing operation of our system. Our Blood Bank Management system will ensure quality assurance for the users and guarantee on-going maintenance in order to assure the best quality and user experience. Our system would observe and adhere to customer needs and concerns and put efforts to address those issues in the process of on-going maintenance and support. The following list would be the requirement and intent for successful on-going maintenance and support:

- Frequent operational and technical updates to provide optimal levels of service quality for users.
- On-going maintenance to address issues and resolve bug fixes in order to ensure confidentiality, integrity, and availability.
- Promptly responding to user feedback and inquiries.
- Continue monitoring both front-end and back-end operation and analyze user preference to depict any inefficiencies and efficiently make improvements.
- Strengthen security levels to have safeguards in place for protecting user information.

16. Product Backlog

Blood Bank Administrator/Manager, Hospital Administrator, and Donor

ID	As a/an…	I want to be able to…	So that…	Priority	Status	Sprint
1	Administrator	See a snapshot of blood inventory	I can prioritize appropriate blood group(s) at donations	High	In progress	3
2	Administrator	See pending blood request(s)	I can reply appropriately (accept/reject)	High	Done	2
3	Administrator	Run various reports	I can better manage the blood bank	High	In progress	2
4	Administrator	See all donors in my area	I can better organize blood drive and reach out appropriately	High	Done	1
5	Administrator	Contact registered donors as need	I can address emergency or other urgent situations	High	In progress	2
6	Donor	Create an account	I can register as a donor	High	Done	1
7	Donor	Manage my email preferences	I'm not overwhelmed by emails	Medium	Done	1
8	Hospital Admin	Create an account	I can register as a requestor	High	Done	2
9	Hospital Admin	Request blood from the blood bank	I can take care of patients' needs	High	Done	2
10	Hospital Admin	Check requests sent to blood banks	I am aware of the status	High	Done	3

Database Management System

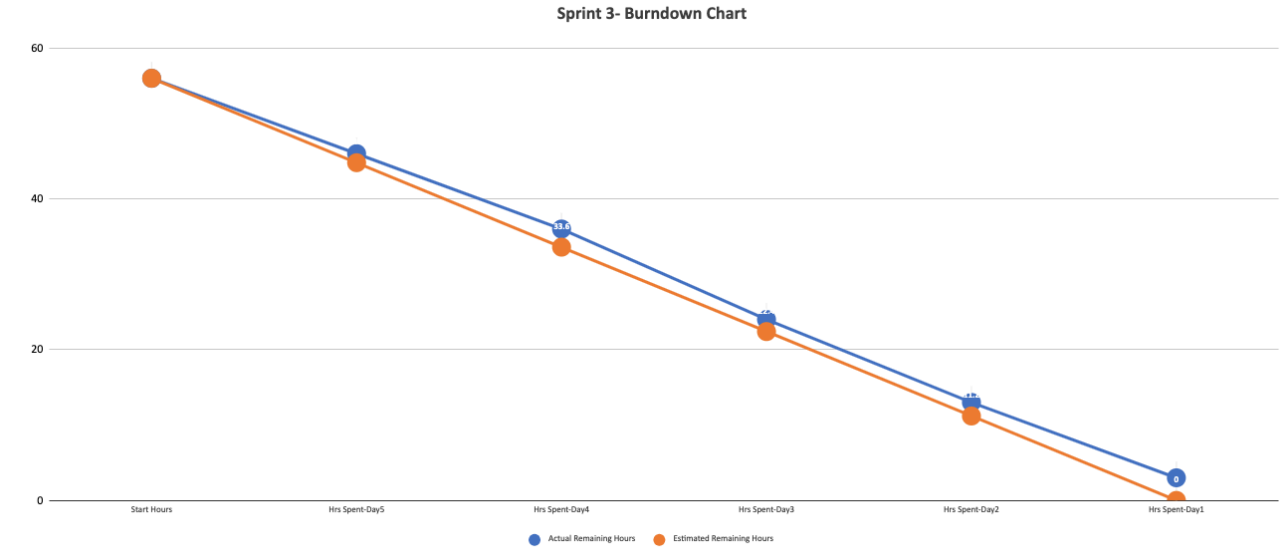
ID	As a/an…	Objective	So that…	Priority	Status	Sprint
11	Database	Effectively/Efficiently store data	Data is organized and easily retrieved	High	Done	3
12	Database	Secure data	Assets(s) are protected	High	In progress	2

17. Burndown Chart and Sprint III

- Hours spent on each task of Sprint 3

Task	Start Hours	Hrs Spent-Day5	Hrs Spent-Day4	Hrs Spent-Day3	Hrs Spent-Day2	Hrs Spent-Day1	Total Hours
Task 1 (User Test Plan and Scenarios)	8	2	2	2	2	0	8
Task 2 (Numbers and types of users)	8	3	0	2	2	2	9
Task 3 (User training plan)	8	2	2	2	0	2	9
Task 4 (Help Functions)	5	1	1	1	0	1	4
Task 5 (Installation and Turn-on strategy)	8	0	2	2	3	2	8
Task 6 (On-going maintenance and support)	8	2	0	2	2	2	9
Task 7 (Sprint and Product Backlogs	6	0	2	1	2	0	5
Task 8 (Burndown Chart)	5	0	1	0	1	1	3
Actual Remaining Hours	56	46	36	24	13	3	
Estimated Remaining Hours	56	48.8	36.6	24.4	11.2	0	

- Chart representing the hours spent on each task of Sprint 3



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Appendix A – Economic Feasibility Analysis

Blood Bank Management System									
Economic Feasibility Analysis									
	8%				**YEAR OF THE PROJECT**				
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**TOTALS**
BENEFITS									
Net Economic Benefit	-	15,000.00	15,000.00	15,000.00	15,000.00	15,000.00	15,000.00		
Discount rate (8%)	1.0000	0.9259	0.8573	0.7938	0.7350	0.6806	0.6302		
PV of benefits	-	13,888.89	12,860.08	11,907.48	11,025.45	10,208.75	9,452.54	-	
NPV of all benefits (cumulative)	-	13,888.89	26,748.97	38,656.45	49,681.90	59,890.65	69,343.19		69,343.19
COSTS									
One-time costs	(30,000.00)								
Recurring costs	0	(8,000.00)	(8,000.00)	(8,000.00)	(8,000.00)	(8,000.00)	(8,000.00)		
Discount rate (8%)	1.0000	0.9259	0.8573	0.7938	0.7350	0.6806	0.6302		
PV of all Costs	$ -	$ (7,407.41)	$ (6,858.71)	$ (6,350.66)	$ (5,880.24)	$ (5,444.67)	$ (5,041.36)	$ -	
NPV of all COSTS (Cumulative)	(30,000.00)	(37,407.41)	(44,266.12)	(50,616.78)	(56,497.01)	(61,941.68)	(66,983.04)		(66,983.04)
Overall NPV									2,360.16
Overall ROI									0.04
ROI=Overall NPV / NPV of all costs									
BREAK EVEN ANALYSIS									
Yearly NPV Cash Flow	(30,000.00)	6,481.48	6,001.37	5,556.83	5,145.21	4,764.08	4,411.19	-	
Overall NPV Cash Flow	(30,000.00)	(23,518.52)	(17,517.15)	(11,960.32)	(6,815.11)	(2,051.03)	2,360.16	2,360.16	
Project breakeven occurs between the 5th and the 6th year.									
Calculation of breakeven point = (4411.19-2360.16)/5446.28						0.46			
actual breakeven occurs in 5.46 years									