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College of Information Technology
Department of Computer Science
ITSE305
Online Blood Bank Management System

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1.0 Introduction

This project is aimed to develop and implement an online blood bank management system. Blood transfusion safety and availability is an important concern in the kingdom of Bahrain, which aims to establish an excellent healthcare system for the citizens. To achieve that, a proper efficient blood bank system is required.

Blood transfusion is a medical operation where a patient requires blood or blood products as a life saving measure. Most blood banks are still running manual system for its processes because of which there is a lack of efficiency, high risk of loss of donor's records, unavailability of blood products, contamination of blood bags which happens due to loss of data such as shelf life of blood bags. Blood products unavailability or unsafe blood products put the lives of the citizens at high risk, in most cases death and thus, increase mortality rate in the kingdom.

By establishing an efficient online blood bank system, we can minimize the probability of such adverse situations, and reduce related risks such as shortage. Support fast searching to find the right matching blood bag. Increase proper blood donor's records documentation and their blood donation activities, blood bag collection and information such as collection and expiry dates and provides all-time availability of blood products inventory records which is crucial for hospitals.

The system also aims to promote the act of blood donation by providing the citizen with various facilities such as online donation appointments, and home collection of blood donation.

The manager and team members along with CEO discussed about the project in detail for better understanding and figuring out the budget. The manager drafted a business case, shared sample templates and divided the project into different phases with the help of team members.

2.0 Pre-Initiation and Initiation

The initiation stage is the initial part of a project, as it will give us a realistic overview into the future in which the project will progress by specifying the scope, time, and cost, and will help us identify whether we should progress with the project.

Continuing with the project and if it is feasible or not were the major concerns. After solving that, we wanted to figure out the outcomes and limitations of this project. We also worked on time to avoid any amount of delay in the work.

2.1 Business Objective

To draft the business objective, Shaffa and her team sat together and discussed important issues regarding the project about critical assumptions, constraints, preliminary requirements, problem statement, budget and financial analysis, schedule estimate and success criteria and the following table was drafted by Afnan along with the team and manager as shown in the table 2.1.

Table 2.1: business case

Project Name: Online Blood Bank Management System
1.0 Introduction/ Background
<p>The project aims at developing a blood bank system that digitalizes the current work of blood management. The system will be accessible to donors, administrators and licensed hospitals, clinics and blood bank organizations. Our project aims to manage inventory in the blood bank for storage and issuing of the blood and to help the hospitals in case of emergency by providing them the right blood on time.</p> <p>Our system's central aim is to build an efficient online blood bank system for the people of the kingdom of Bahrain. The project contains a main bank containing various blood deposits available along with their details (blood type /age/patient history/name etc.). It also allows to check whether required blood of a certain group is available in the blood bank. The system has added features such as patient history / blood booking / posting blood requests to find donors in emergency situations.</p>

Recently, we are not able to find blood donors as all are afraid to go to hospitals or blood banks for donation. Keeping this in mind, we aim to develop such a system that gives an opportunity to those who are interested to donate the blood from home by just taking an appointment. The staff taking all the precautions will come at the donor's place to collect the blood after COVID test and several other checkups.

2.0 Business Objective

The objective behind the creation of this system is to save more lives of the citizens of Bahrain by providing an efficient way of blood collection and supply to the hospitals. The system aims to ensure that there is mobility of blood bags across the country i.e., make it easier to check for hospitals that have needed blood types, this can avoid shortage of blood bags of blood type in emergencies. Promote and ease the process of blood donation by providing facilities for the donor. the system will include blood donors' registration and health details, thus, ensuring that blood transfusion services will be safe and secured. The blood bank system is of great help for doctors, nurses, medical practitioners, patients and others in ensuring a better health care system and avoid / reducing the possibility of unfavorable situations due to lack of blood.

This web-based application allows hospitals to make inventories of their blood bags online, thus, allowing each hospital to check the availability of blood bags anytime. Likewise, proper accounting of blood donors ensures that the expected blood transfusion services will be safe and secured.

3.0 Current Situation and Problem/Opportunity Statement

In the current situation of covid-19 no one wants to go outside to donate the blood and most patients came to the hospitals in an emergency and they needed blood quickly, sometimes the hospitals did not have that required blood in their blood bank or the blood did not match with the patients' blood then only their families or friends came to the hospital to give them the blood. Some patients need red blood cells, stem cells or plasma. So, for these patients, hospitals normally do not have these cells stored then they take someone's blood and separate these cells from the blood, and it takes time. Also, many patients have a disease like leukemia, thalassemia, and anemia these patients need blood weekly or monthly. It is also one of the major problems that these types of patients die due to the

shortage of blood in the hospitals or they do not find anyone to donate them the blood because of not having a system of large blood storage.

So, we are developing a system that will be available on the website. The website will be used for keeping records of the hospitals, clinics and health centers to whom the bank delivers the blood, and collecting the information related to the donor and giving opportunity to donors for taking an appointment to donate a blood either by going to the blood bank or by donating it from home.

4.0 Critical Assumption and Constraints

1. This project will need to have high quality hardware.
2. The system must be accessed through multiple operators like that can run on Windows, Linux, and Android.
3. The software should be accessed by the Hospitals and clinics and controlled by the Blood Bank Administrator and operator.
4. All team members must need to have all required skills to complete this project.
5. The project will be completed within budget and time, any delay in the project will be required to increase the work hours for the team members.

5.0 Analysis of Options and Recommendation

Options:

1. The system administration must implement the IT policies and standards as per required by the organization.
2. Use of Modular design and UML:
 - Modular design helps us to continuously refine our solutions and contributes to production efficiency by reuse.
 - UML allows one to organize programs into traditionally reusable pieces of code (blueprints).
3. In-house design and development of the latest intranet capabilities, often utilizing existing hardware and software.

4. Data Backup: Recovery is necessary in case of loss, corruption or deletion of original data. Creating backup helps in duplicating the original data.

Recommendations: Based on discussion with stakeholders, option 2,3,4 is best recommended for an Online Blood Banking system.

6.0 Preliminary Project Requirements

- Ease of use /useability: The system will be simple and easy to use for users of all backgrounds. The layout of the website will aim at easy navigation and access to all available features through a menu. The website will also be considerate of users with disabilities and will provide suitable options such as voice assistance, color adjustments and size of the page. The system will support multiple languages such as Arabic, Urdu, Hindi, Filipino apart from the default site language English. Medical terms that will be used shall have a definition or description in easy words for better understanding by the users not related to medical fields.
- Privacy and confidentiality: medical records are extremely sensitive information. The system ensures that all user data will be private and highly protected by taking proper measures. The data displayed or accessed will be limited. The results from a search will depend on the type of user logged in.
- Records such as inventory of all blood types, donors and receivers, hospitals stock of all blood types, and blood bag information will be stored and will be accessible by the registered authorities such as hospital administration
- Availability: The site must be available 24 hours a day, 7 days a week.
- The site will be accessible on browsers such as chrome, Mozilla, Firefox, Opera, safari, Internet explorer
- Hospitals' Blood receptionists can check for availability of specific blood types and place a request through the system.
- Booking blood test appointments: Donors can book appointments for blood test either from home or by going to the blood bank. Due to the given circumstances, a COVID-19 test will also be performed. Based on their test reports, the eligible donor then can choose the blood donation date as per their ease. The system

<p>provides facilities for the eligible donor to choose blood donation date, time and method.</p> <ul style="list-style-type: none"> • View eligibility test reports: The results can be viewed by the donor. The result of blood test reports will decide the eligibility of the donor to donate blood. • Receive Notifications: The system should notify the admin whenever a donor books an appointment and when a hospital requests blood. The hospitals will get confirmation notifications. Donors will receive notifications regarding the eligibility test reports. • Request blood: The hospital can request for specific blood group blood bags by placing a request through the system.
<p>7.0 Budget Estimate and Financial Analysis</p> <p>The entire budget the company can loan is BD 75,000/-. To a full extent, the budget is totally under the detailed budget estimate of BD 71,600/-</p> <p>The company is expected to gain a profit of BD15,000/- and BD3400/- is being kept aside for any unexpected consequences.</p> <p>Hardware, deployment, download and all other related system activities are expected to cost a sum of total BD 30,000/-.</p> <p>All the internal staff are expected to work a total of 40 hours a week for a period of 3 months. The manager will be paid BD9/- per hour and the total is BD4320/-. The Systems analyst and designer will both be paid BD7/- per hour which amounts to Bd6720/-. The programmer and tester will be paid BD6/- per hour which equals BD5760/-.</p> <p>The external consultant, Dr Jones, will be paid BD600/- for 60 hours of presence in 3 months, any extra hour will be paid by BD10/-</p> <p>The company will take care of initial storage setting and blood collection which is expected to cost a sum of 10,000/- but later the storage, collection, transport, delivery, system maintenance and everything will be overseen and managed by the MOH.</p>
<p>8.0 Schedule Estimate</p> <p>The sponsor might want to see the project finished inside a half year, yet there is some adaptability in the timetable. We likewise accept that the</p>

new framework will have a valuable existence in any event in five years if updated and maintained accurately.

9.0 Potential Risks

There are many risks associated with the system,
In a business context, it is to get the money put in developing the system back within a certain number of years. In everyday cases, the risks are that the system contains highly confidential data of donors and patients and maintaining confidentiality will forever be a risky and difficult task. Since it is a blood bank, there can be misuse of others' blood for illegal activities and any wrong information given by patients or hospitals can cause large problems. This system serves as an often lifesaving one and any unexpected problem can cause lives. Wrong classification and storage of blood within and outside of the system will be a very high risk. Low level of user acceptance to the system.

2.2 Stakeholder Register for Online Blood Bank System

Table 2.2 was drafted by Aaisha and Maria which shows who the sponsor is and what the role of each member in this project, it will facilitate them to communicate with each other. Also, there are positions for each member in this project it will be easy for them to divide the work in between them in future.

Table 2.2: Stakeholder Register

Name	Position	Internal/External	Role	Contact Information
Ministry of Health	CEO	External	Sponsor	moh.gov.bh
Shaffa Abdul Sattar	Manager	Internal	Team Member	20170305@stu.uob.edu.bh

Faiza Faisal	Software Analyst	Internal	Team Member	20170523@stu.uob.edu.bh
Afnan Javed	Software Designer	Internal	Team Member	20173794@stu.uob.edu.bh
Aaisha Nazeer	Software Programmer	Internal	Team Member	20177427@stu.uob.edu.bh
Maria Rashid Mehmood	Software Tester	Internal	Team Member	20177820@stu.uob.edu.bh
Dr. Jones	Consultant	External	Team Member	Dr.jones@gmail.com
Eva Rose Smith	Risk Manager	Internal	Team Member	evasmith@gmail.com

2.3 Stakeholder Management Strategy

After analyzing the stakeholders registered, team members decided to draft a table that includes the most prominent stakeholders, and their level of interest in the project and strategies to gain their interest to make the most of their potentials. Aaisha and Maria made the table as shown in table 2.3 along with the help of team and manager.

Table 2.3: Stakeholder Management Strategy

Name	Level of interest	Level of influence	Potential management strategies
Dr Jones	Medium	High	Dr Jones is the representative from the medical side and plays a key role in informing us how the blood bank system

			works. He is a calm man, but it is better to not get on his nerves so that he should not purposely affect the creation of the system
Shaffa	High	High	Shaffa is the manager of the project and is deeply interested in the outcome of the project. She is very keen on managing time efficiently. She should be kept updated about all things related to the project
MOH	High	Low	They are the main stakeholders and sponsors, keeping them satisfied should be our main goal.

2.4 Project Charter

Project charter is a short document which describes the project and plays an important role in planning out the project. Shaffa and Faiza along with the help of team members discussed the content and drafted it successfully as shown in table 2.4.

Table 2.4: project charter

Project Title: <i>Online Blood Bank Management System</i>	
Project Start Date: 10/1/2020	Projected Finish Date: 12/31/2020
Budget Information: The firm/organization has allocated 75,000 BD for this project. The initial estimate is based on all the internal staff working approximately for 40 hours a week for three months.	
Project Manager: Shaffa Abdul Sattar, (+973) 39019085, 20170305@stu.uob.edu.bh	
Project Objectives: This web-based application goal is to help the hospitals, clinics, and patients to get the blood supply by 24/7 whenever in a case of emergency or need. It also allows a donor to donate blood from home after several test. Without this, it would be difficult for the hospitals and clinics to arrange blood during emergency cases. Also, due to recent pandemic people hesitate to go to hospitals to donate blood. The registered users can view the available blood and can request for blood donation appointment. The hospital, clinic and blood bank administrator can maintain, and	

update information related to blood donors, available blood, and blood inventory management.			
Success Criteria: The main success criteria are to complete the project with in given time and budget.			
Approach: <ul style="list-style-type: none"> • The project proposal is to get official approval from the government. • develop a survey to get feedback from the hospitals, clinics. • review project templates and documentations • research software to provide security • Create and construct an estimated authorized budget from all relevant stakeholders for the development of the application. • Design and generate an Iterative approach due to its easier identification of risk and is more flexible which means less costly to change scope and requirements. 			
Roles and Responsibilities			
<i>Name</i>	<i>Role</i>	<i>Position</i>	<i>Contact Information</i>
Ministry of Health	CEO	Sponsor	moh.gov.bh
Shaffa Abdul Sattar	Project Manager	Team Member	20170305@stu.uob.edu.bh
Faiza Faisal Murtaza	Software Analyst	Team Member	20170523@stu.uob.edu.bh
Afnan Javed	Software Designer	Team Member	20173794@stu.uob.edu.bh
Aaisha Nazeer	Software Programmer	Team Member	20177427@stu.uob.edu.bh
Dr. Jones	Consultant	Team Member	Dr.jones@gmail.com
Eva Rose Smith	Risk Manager	Team Member	evasmith@gmail.com
Maria Rashid	Software Tester	Team Member	20177820@stu.uob.edu.bh
Sign-off: Shaffa Faiza Afnan Aaisha Maria Jones Eva			

2.5 Kick-Off Meeting

Our very first meeting with the whole project team and the sponsor for the online blood bank management system project is shown in the table 2.5 and was drafted by Shaffa.

Table 2.5: kick-off meeting

<p align="center">2.5 Kick-Off Meeting</p> <p align="center">Date: 29-09-2020</p> <p>Project Name: Online Blood Bank Management System</p> <p>Meeting Objective: Get the project off to an effective start by introducing key stakeholders, reviewing project goals, and discussing plans and meetings.</p> <p>Agenda:</p> <ul style="list-style-type: none"> • Introductions of attendees • Review of project background • Review of project-related documents (i.e., business case, project charter) • Discussion of project organizational structure • Discussion of project scope, time, and cost goals • Discussion of other important topics • List of action items from meeting 		
Action Item	Assigned To	Due Date
-Introduction/ background for business objective -Schedule Estimate	Faiza Faizal Murtaza	1/10/2020
-Introduction -Analysis of Option and Recommendations	Shaffa Abdul Sattar	1/10/2020
-Business objectives -Preliminary project requirements	Syeda Afnan Javed	1/10/2020
-Budget Estimate and Financial Analysis -Potential Risks	Aaisha Nazeer	1/10/2020
-Critical Assumption and Constraints -Current situation and Problem/Opportunity Statement	Maria Rashid Mehmood	1/10/2020
<p>Date and time of next meeting: On 01-10-2020 at 3:00 P.M</p>		

3.0 Planning

The planning process is creating and maintaining a practical framework to ensure that the project is in accordance with the organization's requirements and creating precise boundaries.

This phase of the project includes management plans related to the scope, schedule, cost and procurement. All these plans define the knowledge area related to the project. This also includes project summary and deliverables, product characteristics/features and their requirements, project success criteria, and the WBS along with its dictionary which specifies the tasks to be done during the project. This will help the members to keep a track of tasks done and need to be done and stay on schedule.

3.1 Team Contract

The team contract is helpful for the team as well as the project. It states the ground rules and is to be used as a guide throughout the project. It should be respected and abide by all team members.

The project manager took into consideration various situations such as personal life issues (emergencies), internet issues as all meetings will be held virtually and allowed flexibility and adjustments to some extent to make sure that all members feel encouraged and respected.

The team contract was made through discussion with the team members. Each statement in the contract was noted down with full consent of the members. Table 3.1 was drafted and reviewed by project manager Shaffa.

Table 3.1: team contract

Team Contract Date:14-10-2020	
Project Name: Online Blood Bank Management System	
Project Team Members' Names and Sign-off:	
Name	Date

Shaffa Abdul Sattar	14-10-2020
Faiza Faisal	14-10-2020
Syeda Afnan Javed	14-10-2020
Aaisha Nazeer Ahmed	14-10-2020
Maria Rashid Mehmood	14-10-2020
Dr. Jones	14-10-2020
Eva Rose Smith	14-10-2020
<p>Code of Conduct: As a project team:</p> <ul style="list-style-type: none"> • Team members will work proactively, effectively, and smoothly. • Team members will use the project budget appropriately and keep sponsors updated about all the purchases. • Team members will follow a transparent decision-making process. • Team members must be working toward the progress of the project, anticipating their potential differences, and working to prevent them. • Team members will provide constructive, encouraging feedback and ensure honest and direct interaction. • Team members must be honest and act with integrity to ourselves, each other and external stakeholders, staff and users. • See the project through to completion. 	
<p>Participation: We will:</p> <ul style="list-style-type: none"> • Be honest and be open with each other during all project activities. • Encourage the diversity and different ideas in teamwork. • Provide an opportunity to all the team members for equal participation. • Let the project manager know well about the team member's attendance at the meetings in advance. • Ensure that the consent of all the team members is taken before taking any decision. 	
<p>Communication: We will:</p> <ul style="list-style-type: none"> • Use relevant technologies like, MS Teams, e-mail, and WhatsApp as the means of communication due to the current situations. • The Project manager will assign each team member with specific tasks and explain it with a deadline to submit it. • Keep all work in schedules and abide by it. • Always keep in touch with all the members of the team and be updated. 	
<p>Problem Solving: We will:</p> <ul style="list-style-type: none"> • Motivate the team members to actively take part in solving problems. 	

- Use constructive criticism to solve problems, issues and respectfully challenge the idea, not blame the person.
- Motivate the team members to share new ideas and draw on the ideas of one another.

Meeting Guidelines: We will:

- Meet through Microsoft teams on Tuesdays and Thursdays at 2:00 pm.
- Respect the scheduled timing and will be prepared for the meeting.
- Arrange new meetings if needed and timings can be modified or adjusted if required.
- Inform the agenda of the meeting in advance.
- Oversee documenting the meeting agenda, meeting minutes and will be maintained by one member from the team.

3.2 Requirement Elicitation and Analysis

The system analyst is responsible for generating a list of requirements from the stakeholders which will become the basis of the project's specifications.

The methods used for requirements elicitation include brainstorming, benchmarking and observation.

3.2.1 Functional requirements

A functional requirement defines a system; the things and functions that the user demands to be in the system. A function is inputs, outputs, calculation, business process, user interaction, services, tasks or any other functionality which defines "What should the software system do?". Basically, they help to capture the intended behavior of the system. Other way round, if the functional requirements are not met, the system will not work as it is intended to.

Description: The online blood bank system makes it easier for hospitals to check the available needed blood types. Likewise, there will be blood donors' registration, thus, ensuring that blood transfusion services will be safe and secured. The system will be of great help to all users; donors, hospital staff, administration in ensuring a better healthcare system. The system allows the blood bank to make inventories of their blood bags online, thus, allowing each hospital to check the availability of blood bags anytime.

Likewise, proper management of blood donors ensures that the expected blood transfusion services will be safe and secured.

The user's (donors/hospital staff) should register in the system by providing all the required information, then they can login (refer Table 3.1.1.1). The donors will take appointments to donate blood (refer Table 3.2.1.2) and can select a time and preferred method (refer Table 3.3.1.6) to first check if they are eligible or not. (refer Table 3.2.1.7). Admin can view all the records of the blood bags (refer Table 3.2.1.3), they can manage all records by updating, deleting or editing them, the admins can search for any donors based on their blood group (refer Table 3.2.1.4). The admin will upload blood reports in the system and the donor can view them (refer Table 3.2.1.7). The hospitals will place requests for blood through the system (refer Table 3.2.1.5). The system should notify whenever an appointment for donating blood is made or blood is requested by the hospital (refer Table 3.2.1.8).

The following tables show functional requirements required for this project and was drafted by Aisha and Maria along with the team.

Table 3.2.1.1: functional requirement-registration

Requirement ID	FUN.REQ.01
Title	Registration/ login
Priority	High Priority
Description	The users are categorized into 3 types i.e. The admin, the hospital/clinic staff, and the donors. All users must register in the system as per their type to access the facilities provided by the system. The users can then login with the unique id and password assigned during registration.
Version	V1.0

Table 3.2.1.2: functional requirement-booking blood test appointments

Requirement ID	FUN.REQ.02
Title	Booking blood test appointments
Priority	High Priority
Description	Donors can book appointments for blood test either from home or by going to the blood bank. Due to the given circumstances, a COVID-19 test will also be performed. Based on their test reports, the eligible donor then can choose the blood donation date as per their ease.
Version	V1.0

Table 3.2.1.3: functional requirement-view blood information

Requirement ID	FUN.REQ.03
Title	View Blood Information
Priority	High Priority
Description	Admin can view the blood stock as well as the blood bag information like blood group, blood donation date, expiry date.
Version	V1.0

Table 3.2.1.4: functional requirement-manage records

Requirement ID	FUN.REQ.04
Title	Manage records
Priority	High Priority
Description	The admin can search, sort, add, update or delete any records related to donors and hospitals and blood inventory as well as blood bags.
Version	V1.0

Table 3.2.1.5: functional requirement-request blood

Requirement ID	FUN.REQ.05
Title	Request blood
Priority	High Priority
Description	The hospital can request for specific blood group blood bags by placing a request through the system.
Version	V1.0

Table 3.2.1.6: functional requirement-booking blood donation appointment

Requirement ID	FUN.REQ.06
Title	Booking blood donation appointment
Priority	High Priority
Description	The system provides facilities for the eligible donor to choose blood donation date, time and method.
Version	V1.0

Table 3.2.1.7: functional requirement-view eligibility test reports

Requirement ID	FUN.REQ.07
Title	View eligibility test reports
Priority	High Priority

Description	The results can be viewed by the donor. The result of blood test reports will decide the eligibility of the donor to donate blood.
Version	V1.0

Table 3.2.1.8: functional requirement- receive notifications

Requirement ID	FUN.REQ.08
Title	Receive Notifications
Priority	High Priority
Description	The system should notify the admin whenever a donor books an appointment and when a hospital requests blood. The hospitals will get confirmation notifications. Donors will receive notifications regarding the eligibility test reports.
Version	V1.0

3.2.2 Quality Attributes

Quality attributes defines the systems behavior, features and the general characteristics that affects the user experience. It defines the quality of the system.

Different attributes are defined in this system such as robustness of the system against any failure, availability, security, maintainability, performance, portability of the system and usability. These attributes explain how the system run under certain circumstances and how the system respond to specific user.

The following tables shows quality attributes required for this project and was drafted by Aisha, Shaffa, Maria along with the team.

Table 3.2.2.1: quality attributes-robustness

Requirement ID	QA.01
Title	Robustness
Priority	High Priority
Description	The system should automatically store all the information in the system such that no data will be lost in case any failure.
Version	V1.0

Table 3.2.2.2: quality attributes -availability

Requirement ID	QA.02
Title	Availability

Priority	High Priority
Description	The system should be available 24/7.
Version	V1.0

Table 3.2.2.3: quality attributes -security

Requirement ID	QA.03
Title	Security
Priority	High Priority
Description	The system should validate the username and password to login. The system prevents unauthorized users from accessing the system.
Version	V1.0

Table 3.2.2.4: quality attributes -modifiability

Requirement ID	QA.04
Title	Modifiability
Priority	High Priority
Description	The system should be flexible for adding or modifying different functions without any errors
	V1.0

Table 3.2.2.5: quality attributes-performance

Requirement ID	QA.05
Title	Performance
Priority	High Priority
Description	The system should have response time of not more than 3 seconds.
Version	V1.0

Table 3.2.2.6: quality attributes -portability

Requirement ID	QA.06
Title	Portability
Priority	High Priority
Description	The system should be able to run on different browsers such as google chrome, Microsoft edge.
Version	V1.0

Table 3.2.2.7: quality attributes -usability

Requirement ID	QA.07
Title	Usability

Priority	High Priority
Description	The system should be simple and easy to use for users of all backgrounds. The layout of the website will aim at easy navigation and access to all the available features through a menu.
	V1.0

3.2.3 Requirement traceability matrix

A requirement traceability matrix is a document that demonstrates the relationship between requirements and other artifacts. It captures all requirement processed by client and RTM in a single document delivered at the end of software development life cycle. The RTM is prepared by software tester, Maria with the help of software analyst, Faiza along with team and is shown in table 3.2.3.

Table 3.2.3: requirement traceability matrix

Requirement No.	Name	Category	Source	Status
FUN.REQ.1	Registration/ login	Functional Requirement	Software analyst	Complete
FUN.REQ.2	Booking blood test appointments	Functional Requirement	Software analyst	Complete
FUN.REQ.3	view blood information	Functional Requirement	Consultant	Complete
FUN.REQ.4	manage records	Functional Requirement	Software analyst	Complete
FUN.REQ.5	request blood	Functional Requirement	Consultant	Complete
FUN.REQ.6	Booking donation appointment	Functional Requirement	Consultant	Complete
FUN.REQ.7	view eligibility test reports	Functional Requirement	Software tester	Complete

FUN.REQ.8	receive notifications	Functional Requirement	Software designer	Complete
Quality Attributes				
NON-FUN.REQ.1	Robustness	Quality Attribute	manager	Complete
NON-FUN.REQ.2	Availability	Quality Attribute	Software tester	Complete
NON-FUN.REQ.3	Security	Quality Attribute	Software designer	Complete
NON-FUN.REQ.4	Modifiability	Quality Attribute	Software Programmer	Complete
NON-FUN.REQ.5	Performance	Quality Attribute	Software Programmer	Complete
NON-FUN.REQ.6	Portability	Quality Attribute	Software Programmer	Complete
NON-FUN.REQ.7	Usability	Quality Attribute	Software designer	Complete

3.3 Project Scope Management

Project Scope is the description of all the work that needs to be done to create deliverables and achieve the project objective. Project scope management includes defining and developing scope statement, scope baseline, work breakdown structure, WBS dictionary validate and control scope.

3.3.1 Scope Statement

Scope statement includes the project summary, justifications, characteristics, requirements, project deliverables, project management, project related activities and the project success criteria.

It outlines the entire project including any deliverables and their characteristics as well as a list of stakeholders who will be affected. It also includes any major project objectives, deliverables and targets to help determine success.

The scope statement was drafted by Shaffa with the help of team members as shown in table 3.3.1.

Table 3.3.1: scope statement

Scope Statement	
Project Title: Online Blood Bank Management System Date: 15-10-2020 Prepared by: Shaffa Abdul Sattar, Project Manager, 20170305@stu.uob.edu.bh	
Project Justification: <p>The Ministry of Health in the Kingdom of Bahrain has requested this project to facilitate the hospitals by providing them the required amount of blood anytime and provide an ease to the donor to donate the blood either by home or hospital after some tests. The budget for this project will be 75,000 BD.</p>	
Product Characteristics and Requirements: <ol style="list-style-type: none"> 1. Security: The main feature of this software is to maintain a very high level of security because it consists of people's identity and information. A part of this system should be accessed by licensed hospitals and clinics and ministry of health, on the other hand, other share would be for the users. 2. Register and login: All the users must register and then login to the system. Also, the system will log out automatically after several minutes of inactivity. 3. Update information: Admin can update and provide accurate information about donor and available blood. 4. The website is designed to be very simple and efficient. It is also designed in such a way to help the disabled people to use it. 5. The system will be accessible and available 24/7 as there could be a case of emergency during any time. 6. Requesting appointment: Requesting an appointment and viewing the available blood is the only option visible to the public so they could get the required blood at the right time and they can serve or help other people in getting blood by donating at the right time. The request of appointments will be responded less within an hour. 7. The application will be tested monthly to avoid any inconvenience. 8. Search feature: The system allows the admin to search for donors through their blood group. 9. Reliability: The system must be flexible in such a way that it should not harm or loss data whenever system failure occurs. 	

Summary of Project Deliverables

Project management-related deliverables: business case, charter, team contract, scope statement, WBS, schedule, cost baseline, status reports, final project presentation, final project report, lessons-learned report, and any other documents required to manage the project.

Product-related deliverables: research reports, design documents, software code, hardware, etc.

1. Survey: survey issued from ministry of health for the hospitals and clinics to get more ideas and features required to develop the system.
2. Files for templates: during the first implementation phase, the system will include templates for at least 20 documents.
3. Examples of completed templates: templates used in this project are from the textbook.
4. Instruction for using project management tools: MS project is the project management tool which will be used for this project for work breakdown structures, Gantt charts, network diagrams, cost estimates, earned value management.
5. Example applications of tools: MS project is an example for the tool being used for the project.
6. Database: the system includes and access a database to the licensed hospitals, clinics and ministry of health.
7. Request appointment: the website allows the users to request for appointments at hospitals or at home.
8. Intranet site design: the web application will be simple, straightforward and user-friendly which makes all the users easy to understand.
9. Intranet site content: the intranet site will include different section for users like register, login, view available blood along with medical history, request appointment to donate blood and for the hospitals and clinics to accept appointments and for the admin to manage records (of donors, hospitals and blood).
10. Test plan: testing will be done by testing and quality assurance team first and then ministry of health. Once its approved, it would be available for all the hospitals, clinics and to the people of Bahrain.
11. Promotion: promoting the websites will be done through social media, advertisements and banners.
12. Project benefit measurement plan: benefit plan will measure the financial values and how the system has benefitted the hospitals and people.

Product Success Criteria:

Our goal is to finish this project within three months and within the given budget.

3.3.2 Scope baseline

A project's scope is made up of the functionalities or specifications outlined in the requirements. Baseline is the starting point of your project plan. The scope baseline consists of the approved version of the scope statement, work breakdown structure and WBS dictionary.

Scope baseline is established by the team members with stakeholder's requirements taken into consideration. Once the scope baseline is established, it can be changed only through formal control procedures if necessary and is used to measure progress and performance.

3.3.3 Work Break Down Structure

Work breakdown structure (or WBS) is a hierarchical tree structure that outlines your project and breaks it down into smaller, more manageable portions. The goal of a WBS is to make a large project more manageable. Breaking it down into smaller tasks ensures that the work can be done simultaneously by different team members, leading to better team productivity and easier project management overall.

WBS consist of five task levels, which further have multiple tasks that need to be completed within the duration as allotted by the project schedule.

The task levels are as follows:

- pre-initiation and initiation
- planning
- execution
- monitoring and controlling
- closing

WBS was drafted by Faiza along with the manager and team members.

1. Pre-Initiation and Initiation

- 1.1 Appoint project manager and team
- 1.2 Define Project Goals
- 1.3 Kick-off meeting
- 1.4 Business Case
- 1.5 Develop Project Charter
- 1.6 Project Stakeholder Management
 - 1.6.1 Develop Stakeholder Register
 - 1.6.2 Develop Stakeholder Management Strategy

2. Planning

- 2.1 Team meeting
- 2.2 Develop project approach
- 2.3 Develop Team Contract
- 2.4 Requirement Management
 - 2.4.1 Functional requirement
 - 2.4.2 User characteristics
 - 2.4.3 Concern and constraints

- 2.5 Requirement Traceability Matrix
- 2.6 Project Scope Management
 - 2.6.1 Scope Statement
 - 2.6.2 Scope Baseline
 - 2.6.3 Create WBS and WBS dictionary
 - 2.6.4 Statement of Work
 - 2.6.5 Verifying Scope of project Deliverables
- 2.7 Project Time Management
 - 2.7.1 Schedule baseline
 - 2.7.1.1 Gantt chart
 - 2.7.1.2 Network diagram
 - 2.7.1.3 Critical path analysis
- 2.8 Establish Communication Management
- 2.9 Risk prioritization
 - 2.9.1 Risk Management Plan
 - 2.9.2 Risk Register
- 2.10 Establish Project Work Plan
 - 2.10.1 Setting goals and objectives
 - 2.10.2 Establishing team responsibilities

3. Execution

- 3.1 Review/update requirements
- 3.2 Design architecture
- 3.3 Develop Use case Diagram
- 3.4 Develop Class Diagram
- 3.5 Develop Sequence Diagram
- 3.6 Design Graphical User Interface
- 3.7 Map UML Class Diagram to Create Database
- 3.8 Implementation/Coding according to Class Diagram
- 3.9 Milestone Report
- 3.10 Perform Testing
 - 3.10.1 Alpha Test
 - 3.10.2 Beta Test
- 3.11 Performance report
- 3.12 Documentation
- 3.13 Launch web Application

4. Monitoring and Controlling

- 4.1 Update status meeting
- 4.2 Update Milestone report
- 4.3 Change request form
- 4.4 Performance report
- 4.5 Issue log

5. Closure

- 5.1 Contract Closure Notice
- 5.2 Customer acceptance form
- 5.3 Lesson-learned report

3.3.3.1 WBS dictionary

The object of the dictionary is to describe the task information. This will help prevent the excessive work of project team members that is out of the reach of the project. In sense that holds the representatives inside a limit that cannot be exceeded, the boundary, in this case, is the scope. WBS dictionary is shown in table and was made by Faiza along with the team.

Table 3.3.3.1: WBS dictionary

Reference	Title	Description
1.0	Pre-Initiation and Initiation	
1.3	Kick off meeting	A first formal meeting should be scheduled and held by the project manager with the sponsors and team members of the project team. The purpose of this meeting is to present an opportunity for members to chat about their thoughts and offer their input into the project team.
1.4	Business case	Project manager with the help of software analyst document business objective and information related to project specifications, assumptions and scope statements.
1.5	Project charter	A formal, typically short document that outlines the entire project objectives, goals, determining project approach, defining project scope, identifying stakeholders and listing their responsibilities Since it is used in the project life cycle, it is a key ingredient in preparing the project.
1.6	Stakeholder management	Process of identifying of stakeholders, organizing and analyzing their needs and expectations; and planning

		and implementing various tasks to engage with them. It also involves drafting formal stakeholder management register and strategy.
2.0	Planning	
2.3	Team Contract	A contract that is used between the project manager and members of the team. The deal covers the terms and the regulations to be enforced during the working period. It also involves the number of working hours and how much each hour will be paid for.
2.5	Requirement Traceability Matrix	It is a good way to help ensure the project's scope, requirements and deliverables maintain the same information throughout the project. It helps track the status of any requirement during the project.
2.6	Scope Management	Process of defining what work is required and then making sure all that work is done. Scope management should include the scope baseline, scope statement, create WBS and WBS dictionary, statement of work and verifying scope deliverables.
2.6.2	Scope Baseline	The approved version of a scope statement, work breakdown structure (WBS), and its associated WBS dictionary. It consists of the scope statement and the defined work breakdown structure of that project, subject the approval of the relevant stakeholders.
2.8	Communication Management	The method of interaction used by team participants and stakeholders.
2.9	Risk prioritization	It involves risk manager and PM to draft formal risk management register by identifying potential risks, ranking the risk forms highest to lowest impact, create mitigation plan and monitor and control risks.

		The risk manager should review the identified project risks and understand each one well to avoid unpleasant surprises and barriers that can arise.
3.0	Execution	
3.2	Design Architecture	Identify a set of components that will perform a function required by the system. Identify a set of connectors that helps in coordination, communication, and cooperation between the components.
3.7	Map UML Class Diagram to Create Database	UML object models (Class Diagram) can be converted to create relational databases.
3.8	Coding according to class diagram	Start writing efficient code referring class diagram.
4.0	Monitoring & Controlling	
4.2	Update Milestone Report	It documents the progress of projects relative to the specific requirements of each milestone. It helps validate that the milestone has been achieved and project is on track. When a milestone is achieved, it is updated in milestone report.
4.3	Change Request form	A formal document for requesting change in any category like scope, cost, schedule, technology or other. It contains information related events that made this change necessary, justification for change and its impact on scope, cost etc.
4.4	Performance Report	A formal progress report for tracking progress of project include information related about how much work is completed in this reporting period and how much is due, how well is project going.
4.5	Issues log	A document that contains a list of ongoing or closed issues of project. It is used to manage issues and track error.

5.0	Closure	
5.3	Lesson Learned Report	A report written by the team members that includes the lessons learned during the period that they worked in the project.

3.3.4 Statement of work

The statement of work is the document that captures and defines all aspects of a project, such as the activities, deliverables, and the time schedule for the project. It is a very detailed document as it will set the foundation for the project plan.

It includes a description of the business need for the project, a summary of requirements, all deliverables and their due dates, the individual tasks and steps that lead to the completion of the deliverable, and who these tasks are assigned to and as well as the resources needed for the project including facilities, equipment, and quality assurance procedures.

3.3.4.1 Scope of work

Task I: Pre-Initiation and initiation

- 1. Business management:** The project manager will prepare a business case to define the purpose, objective, scope and the problem for which the system is needed. Also, they will provide the preliminary requirements, constraints and assumptions as well as financial analysis and budget estimation.
- 2. Pre-project initiation:** After determining the business needs and objectives of the project in brief, the project team sets basic project goals, then the manager drafts the project charter which will give an overview of the project. The stakeholders will be presented with the charter to get feedback and make changes if required.
- 3. Stakeholder management:** All stakeholders including internal or external will be identified and their opinions and requests will be

documented. Analyze and prioritize the stakeholder's requirement and communicate regularly. Ensuring good management of stakeholder will promote steady progress and eventually improve the quality of the product. For proper engagement of stakeholder, stakeholder registry and management strategy will be created.

Task II: Planning

- 1. Communication plan:** The manager will plan all the meetings and record meeting minutes. They will decide which platform they will use for meetings. All team members can contact each other through chosen platforms. All the work will be distributed during meetings based on each member's area of interest.
- 2. Requirement management:** During the meeting with stakeholders, it is the responsibility of the software analyst to gather all functional and non-functional requirements required for this project and will make a traceability matrix table and include the sources of all requirements needed for this project.
- 3. Scope management:** The project scope and boundaries will be described by the Analyst along with the project manager. They will write the scope statement, scope baseline and create a WBS and WBS dictionary in which all the projects will be divided into different tasks in the WBS and the purpose of all tasks will be described in WBS dictionary. All the procedures will be documented in the statement of work. Also, all the project deliverable scopes will be verified.
- 4. Time management:** To meet the official project end date, the project manager needs to develop a time management plan in accordance with the WBS. It is the management of time spent and the progress made on project's tasks and activities. The project manager along with the team develops schedule baseline for assigning resources, duration to the tasks which helps in developing Gantt chart and network diagram.
- 5. Risk management:** Risk manager and project manager will work together to identify the risks that might be encountered in the project

lifecycle. Once the risk has been identified, it needs to be analyzed. Ranking the risks is based on their severity of the risk. The risk manager will develop mitigation plan to eliminate that risk. Not all the risks can be eliminated, some risk are always monitored and controlled by the risk manager and project manager, if not risks can be painful in terms of budget and time resources and hinder the success.

- 6. Project work plan:** To ensure the success of the project, the project manager will set smart goals and objectives to finish this project on time and assign responsibilities and tasks to the team members according to their respective roles.

Task III: Execution

- 1. Review requirements:** The software analyst validates the requirements and should meet the requirements of the stakeholders. In case of varying requirements, the software analyst must update the scope according to the requirements and other related deliverable documents. The software analyst must write the nonfunctional requirements as quality attribute. He should also establish user characteristics, concerns and constraints of the system.
- 2. System design and architecture:** Based on the results from the above requirement reviewing, the software designer will propose and develop the software architecture design model. The software designer proposes the manager to use ADD design to create software design using architecturally important requirements and develop a detailed architecture to achieve relevant diagrams like class diagram, sequence diagram etc. The architect will be available later to update the architecture designs as new requirements and ideas are likely to appear.
- 3. Implementation:** The manager will overlook all implementation processes and allocate responsibilities among team members for various tasks like designing user interface, mapping Class Diagram to create database etc. and making sure they are going according to the designed architecture. The software programmer will do a regular review of coding to ensure the success of the system.

- 4. Testing and documentation:** The software tester will overlook all testing and documentation process and progress. Relevant stakeholders' opinion will be taken regarding the testing outputs. Any problems or changes needed will be clearly dealt by relevant team members. Before launching the software, the software must be tested through alpha and beta test.
- 5. Launch:** The official release of the software will include completely defined task list, templates, deliverables and a trained team. The manager should prepare the training tools needed. The manager should make sure that the tools can easily be understood by the trainers and beginners.

Task IV: Monitoring and controlling

- 1. Update and monitor progress:** The manager will always be active and promote regular status update meetings where current situations and problems are discussed, and when milestones are successfully completed, they will be registered without fail. The performance of the team will also be noted into performance report. Any issue surfacing will be drafted in issue log.
- 2. Configure and manage deviations:** The project manager will organize and update any changes occurring in the requirements, scope baseline, schedule baseline, cost baseline etc. and will ensure the changes made are properly documented and managed. Change request forms must be submitted to the manager which will then be discussed by the relevant team members to discuss its feasibility which will then be taken to the architecture and development team to make necessary amendments.

Task V: Closure:

- 1. Closure reports:** The company will create a proper closure notice to notify MOH. A customary lesson learned report will be generated by the project members to close off the project. The report should provide overall goal of the project, methods used, results, results and adherence to time and budget.

3.3.4.2 Location of work

Due to the current conditions, all the work is scheduled to be at homes and if there will be any need for people to meet, the organization will take necessary precautionary steps for the safety of its employees. Current periodic meetings will be held through MS Teams and daily problems will be solved through either MS Teams, email or WhatsApp.

3.3.4.3 Period of performance

The project starts on 1 October 2020 and ends by 31 December 2020.

3.3.4.4 Deliverables schedule

Deliverables schedule helps in tracking the delivery of the project and is shown in table 3.3.4.4.

Table 3.3.4.4: deliverables schedule

Week	Project activity
1-2	Pre-initiation and initiation
2-5	Planning
5-8	Execution/Implementation
8	Monitoring and controlling
9	Closure

3.3.4.5 Acceptance criteria

Acceptance criteria are a set of conditions that is required to be met before deliverables are accepted. All the deliverables that are to be presented to MOH should meet their specified requirements. After a complete review of

the project deliverables, all the adjustments will be made if needed. Formal acceptance will be requested once the project is approved by MOH.

3.4 Project Time Management

Time management is one of the major functions of project management.

A project, by definition, has an official end date. To meet this date, every project needs a schedule. Project managers need to manage their own time and the team's time to ensure that the schedule is met. Time management is the management of the time spent, and progress made, on project's tasks and activities. For a better project time management, the team should focus on the planning, scheduling, monitoring, and controlling of all project activities. The aim is to provide a guidance on how project schedule will be managed throughout the project life cycle.

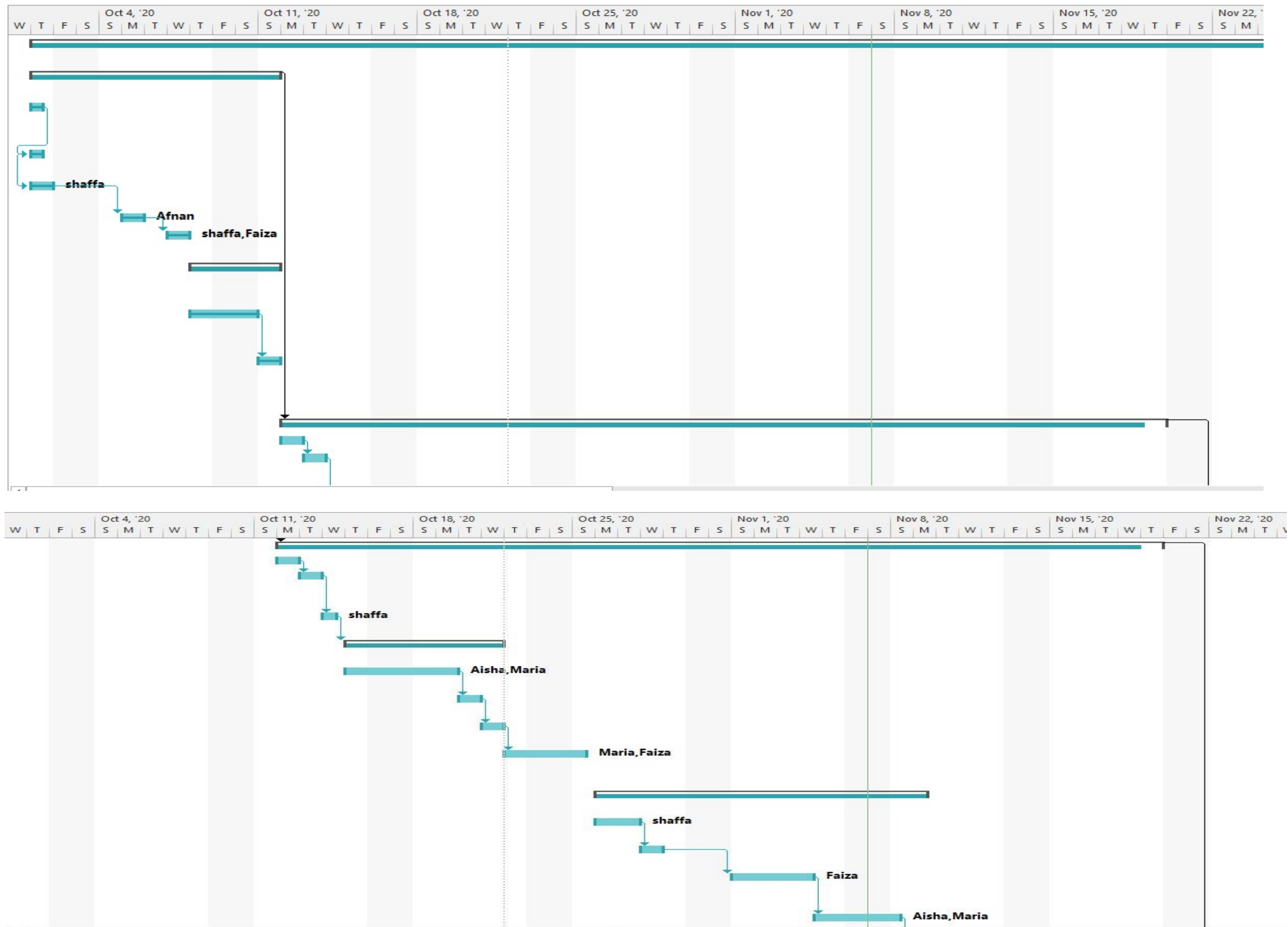
This includes defining and sequencing activities, estimating resources and durations, developing and controlling the schedule.

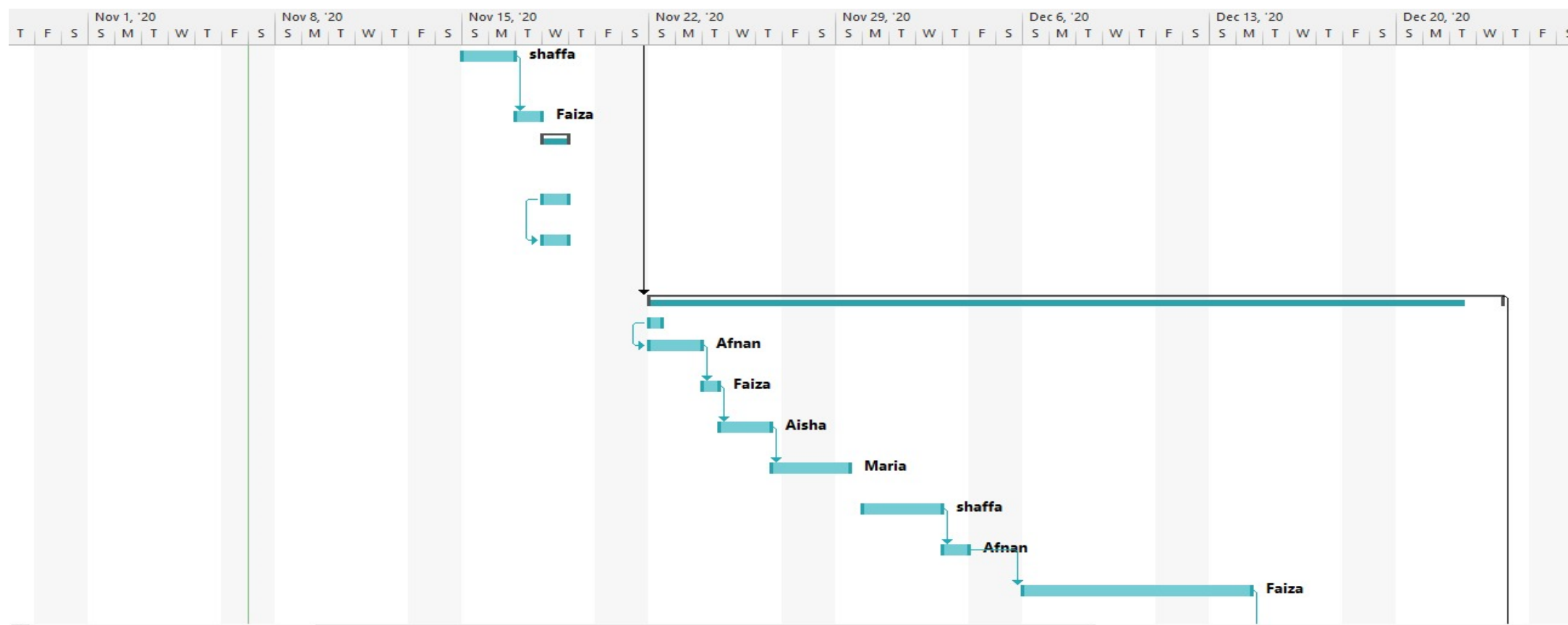
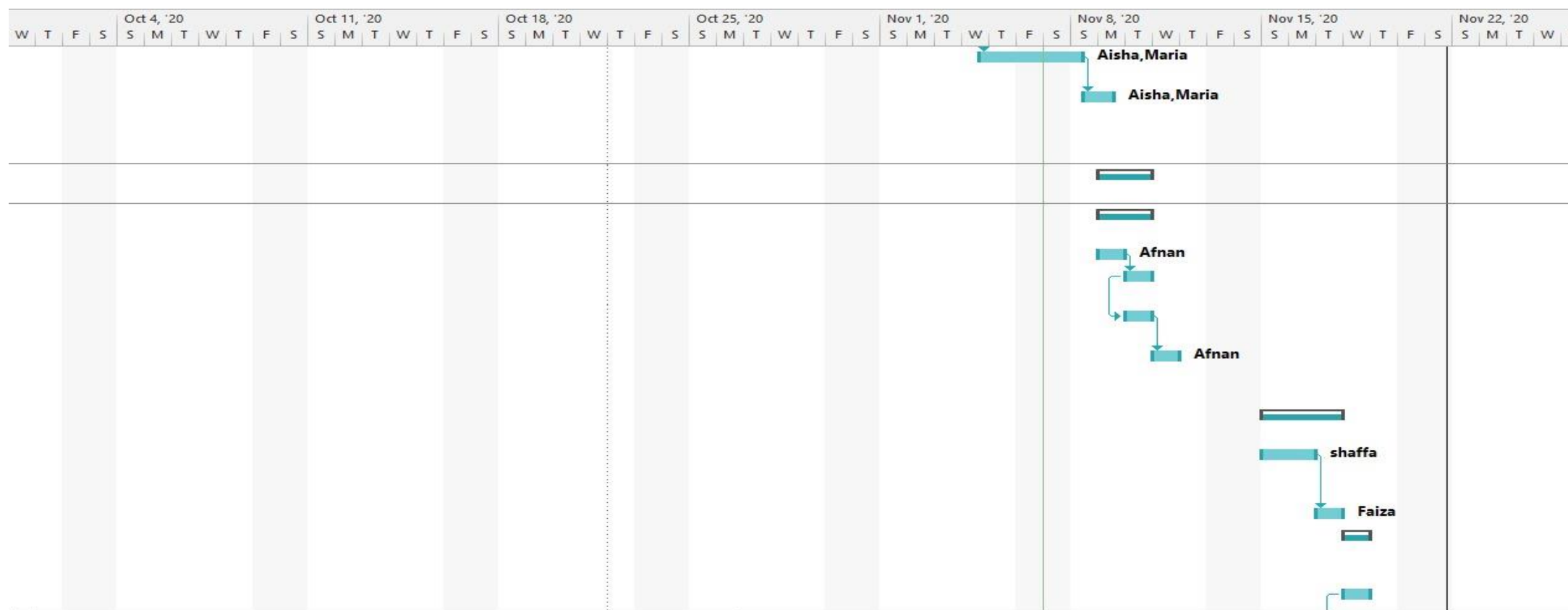
A Meeting was scheduled and conducted among the team members on MS - teams. All the members discussed and defined the activities of the project. After listing all the activities, they were ordered in a sequenced fashion and then finally after a careful review by the project leader, the project time management plan was approved and was put into effect.

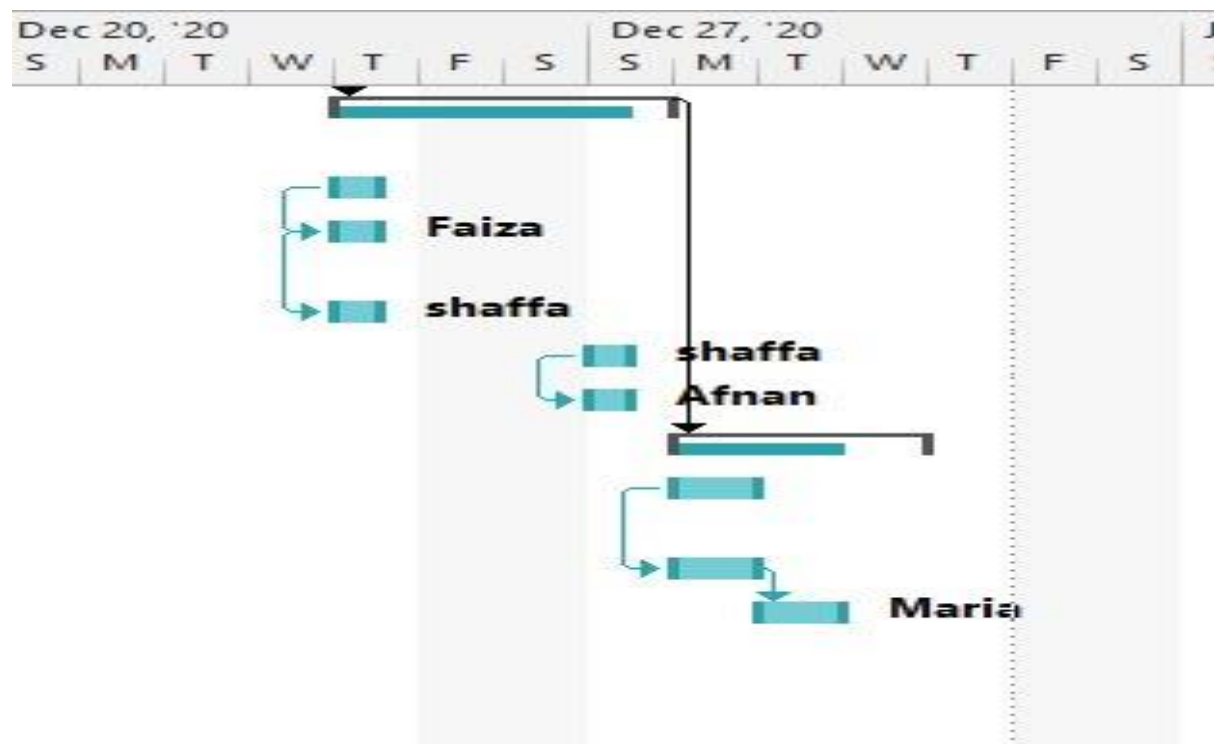
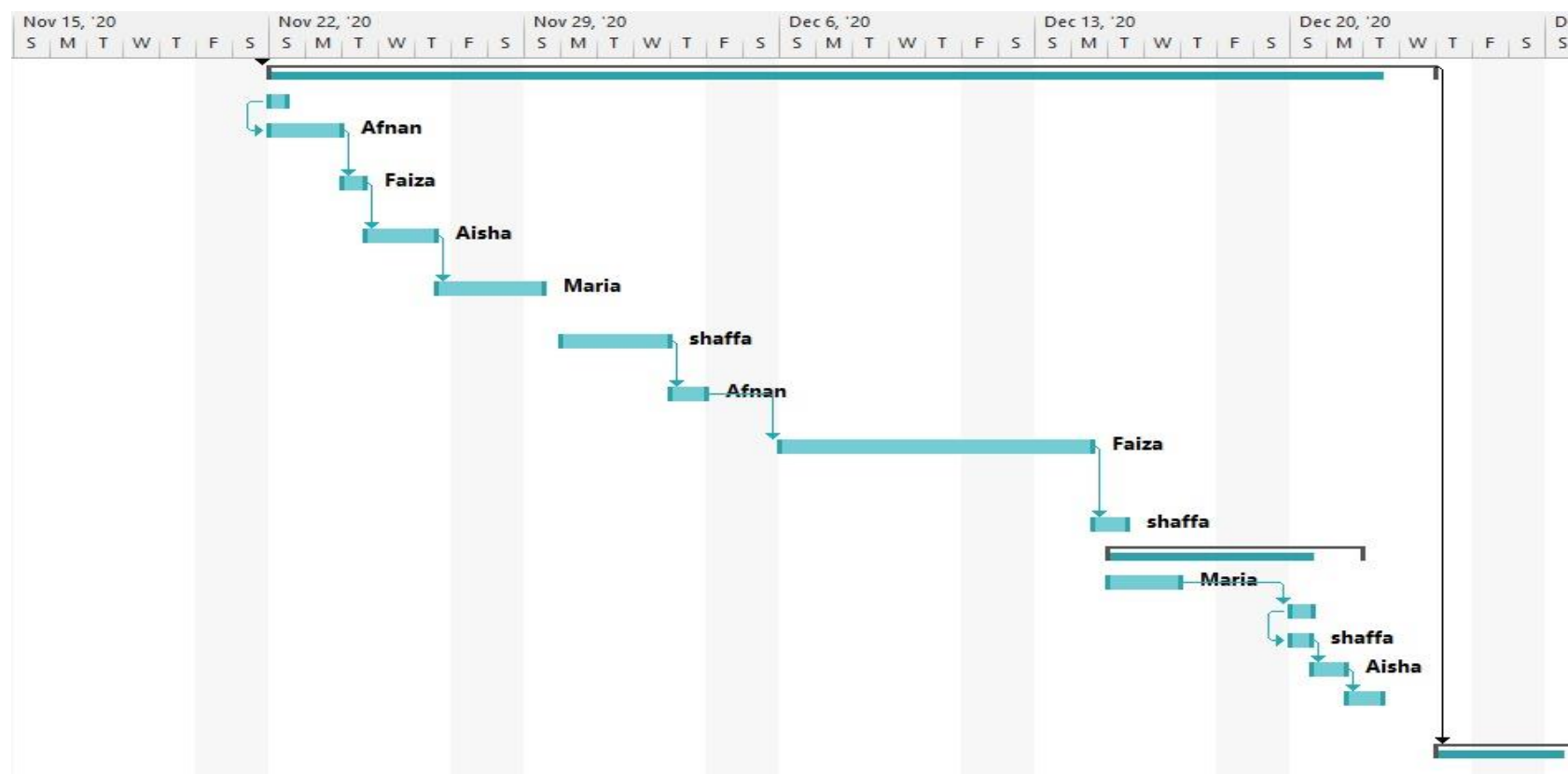
3.4.1 Gantt chart

Gantt chart shows project schedule, a calendar of tasks, dependency relationship between activities and schedule which helps to successfully manage time. Afnan made Gantt chart for our project along with the manager and other team members to organize the tasks and is shown in figure 3.4.1. All the tasks, duration, resources and dependencies were entered in the task sheet after discussion among the team.

Figure 3.4.1: Gantt chart







The task sheets which was required to achieve a gantt chart and network diagram is shown in figure 3.4.1.1

Figure 3.4.1.1: task sheets

		Task	Task Name	Duration	Start	Finish	Predecessors	Resource	Ac
1			◀ <online blood bank system >	67.5 days	Thu 10/1/20	Thu 12/31/20			
2			◀ pre initiation and initiation	7.13 days	Thu 10/1/20	Sun 10/11/20			
3			appoint project manager and team	0.5 days	Thu 10/1/20	Thu 10/1/20			
4			define project goals	0.5 days	Thu 10/1/20	Thu 10/1/20	3		
5			kick off meeting	0.88 days	Thu 10/1/20	Thu 10/1/20	4SS	shaffa	
6			business case	1 day	Mon 10/5/20	Tue 10/6/20	5	Afnan	
7			Develop project charter	0.88 days	Wed 10/7/20	Wed 10/7/20	6	shaffa,Faiza	
8			◀ project stake holder management	2 days	Thu 10/8/20	Sun 10/11/20		Aisha,Maria	
9			develop stake holder register	1 day	Thu 10/8/20	Sun 10/11/20			
10			develop stake holder management strategy	1 day	Sun 10/11/20	Sun 10/11/20	9		
11			◀ planning	29.5 days	Mon 10/12/20	Thu 11/19/20	2		
12			team meeting	0.88 days	Mon 10/12/20	Mon 10/12/20			
13			develop project approach	1 day	Tue 10/13/20	Tue 10/13/20	12		
14			develop team contract	0.88 days	Wed 10/14/20	Wed 10/14/20	13	shaffa	
15			◀ Requirement management	5 days	Thu 10/15/20	Wed 10/21/20	14		
16			Functional Requirements	3 days	Thu 10/15/20	Mon 10/19/20		Aisha,Maria	
17			user characteristics	1 day	Tue 10/20/20	Tue 10/20/20	16		
18			concern and constraints	1 day	Wed 10/21/20	Wed 10/21/20	17		
19			Requirement Traceability matrix	2 days	Thu 10/22/20	Sun 10/25/20	18	Maria,Faiza	
20			◀ Project Scope management	11 days	Mon 10/26/20	Mon 11/9/20			

	i	Task	Task Name	Duration	Start	Finish	Predecessors	Resource
20		★	▸ Project Scope management	11 days	Mon 10/26/20	Mon 11/9/20		
21		★	Scope Statement	2 days	Mon 10/26/20	Wed 10/28/20		shaffa
22		★	scope baseline	1 day	Wed 10/28/20	Thu 10/29/20	21	
23		★	create WBS and WBS dictionary	3.88 days	Sun 11/1/20	Wed 11/4/20	22	Faiza
24		★	statement of work	1.5 days	Wed 11/4/20	Sun 11/8/20	23	Aisha,Maria
25		★	verifying scope of project d	1.5 days	Sun 11/8/20	Mon 11/9/20	24	Aisha,Maria
26		★	▸ project time management	2 days	Mon 11/9/20	Wed 11/11/20		
27		★	▸ schedule baseline	2 days	Mon 11/9/20	Wed 11/11/20		
28		★	ganttt chart	1 day	Mon 11/9/20	Tue 11/10/20		Afnan
29		★	network diagram	1 day	Tue 11/10/20	Wed 11/11/20	28	
30		★	criticial path analysis	1 day	Tue 11/10/20	Wed 11/11/20	29SS	
31		★	establish communication management	0.88 days	Wed 11/11/20	Wed 11/11/20	30	Afnan
32		★	▸ risk prioritization	3 days	Sun 11/15/20	Tue 11/17/20		
33		★	risk management plan	2 days	Sun 11/15/20	Mon 11/16/20		shaffa
34		★	risk register	1 day	Tue 11/17/20	Tue 11/17/20	33	Faiza
35		★	▸ establish project work plan	1 day	Wed 11/18/20	Thu 11/19/20		Afnan,shaffa
36		★	setting goals and objectives	1 day	Wed 11/18/20	Thu 11/19/20		
37		★	establishing team responsibilites	1 day	Wed 11/18/20	Thu 11/19/20	36SS	

	i	Task Mode	Task Name	Duration	Start	Finish	Pre	Resource Name
38		★	▸ execution	24.5 days	Sun 11/22/20	Wed 12/23/20	11	
39		★	review / update requirements	0.5 days	Sun 11/22/20	Sun 11/22/20		
40		★	design architecture	2 days	Sun 11/22/20	Mon 11/23/20	39SS	Afnan
41		★	develop UseCase diagram	0.88 days	Tue 11/24/20	Tue 11/24/20	40	Faiza
42		★	develop class diagram	1.88 days	Tue 11/24/20	Thu 11/26/20	41	Aisha
43		★	develop sequence diagram	1 day	Thu 11/26/20	Sun 11/29/20	42	Maria
44		★	design graphical user interface	3 days	Mon 11/30/20	Thu 12/3/20		shaffa
45		★	map UML class diagram to create Database	0.88 days	Thu 12/3/20	Thu 12/3/20	44	Afnan
46		★	implementation/coding according to class diagram	7 days	Sun 12/6/20	Mon 12/14/20	45	Faiza
47		★	milestone report	0.88 days	Mon 12/14/20	Tue 12/15/20	46	shaffa
48		★	▸ perform testing	5 days	Tue 12/15/20	Mon 12/21/20		

TASK SHEET

TASK SHEET	48	✦	▶ perform testing	5 days	Tue 12/15/20	Mon 12/21/20		
	49	✦	alpha test	1.88 days	Tue 12/15/20	Wed 12/16/20		Maria
	50	✦	beta test	1 day	Sun 12/20/20	Sun 12/20/20	49	
	51	✦	performance report	0.88 days	Sun 12/20/20	Sun 12/20/20	50SS	shaffa
	52	✦	documentation	0.88 days	Sun 12/20/20	Mon 12/21/20	51	Aisha
	53	✦	launch web application	1 day	Mon 12/21/20	Tue 12/22/20	52	
	54	✦	▶ monitoring and controlling	2 days	Thu 12/24/20	Sun 12/27/20	38	
	55	✦	update status meeting	0.5 days	Thu 12/24/20	Thu 12/24/20		
	56	✦	update milestone report	0.5 days	Thu 12/24/20	Thu 12/24/20	55SS	Faiza
	57	✦	change request form	0.5 days	Thu 12/24/20	Thu 12/24/20	56SS	shaffa
	58	✦	performance report	0.5 days	Sun 12/27/20	Sun 12/27/20		shaffa
	59	✦	issue log	0.5 days	Sun 12/27/20	Sun 12/27/20	58SS	Afnan
	60	✦	▶ closure	2.88 days	Mon 12/28/20	Wed 12/30/20	54	
	61	✦	customer acceptance form	1 day	Mon 12/28/20	Tue 12/29/20		
	62	✦	contract closure notice	1 day	Mon 12/28/20	Tue 12/29/20	61SS	
	63	✦	lesson learned report	1 day	Tue 12/29/20	Wed 12/30/20	62	Maria

3.4.2 Network diagram

A network diagram is a graphical representation of all the tasks, responsibilities, and workflow for a project. It is used to map out the schedule and work sequence for the project, as well as track its progress through each stage, up to and including completion. Since it encompasses every single action and outcome associated with the project, a network diagram also illustrates the scope of the project and the critical path.

A team meeting was held to discuss the network diagram. Afnan, with help of the team members created the network diagram which was then reviewed by the project manager and is shown in figure 3.4.2. The critical task is also shown in figure 3.4.2.1.

Figure 3.4.2: network diagram

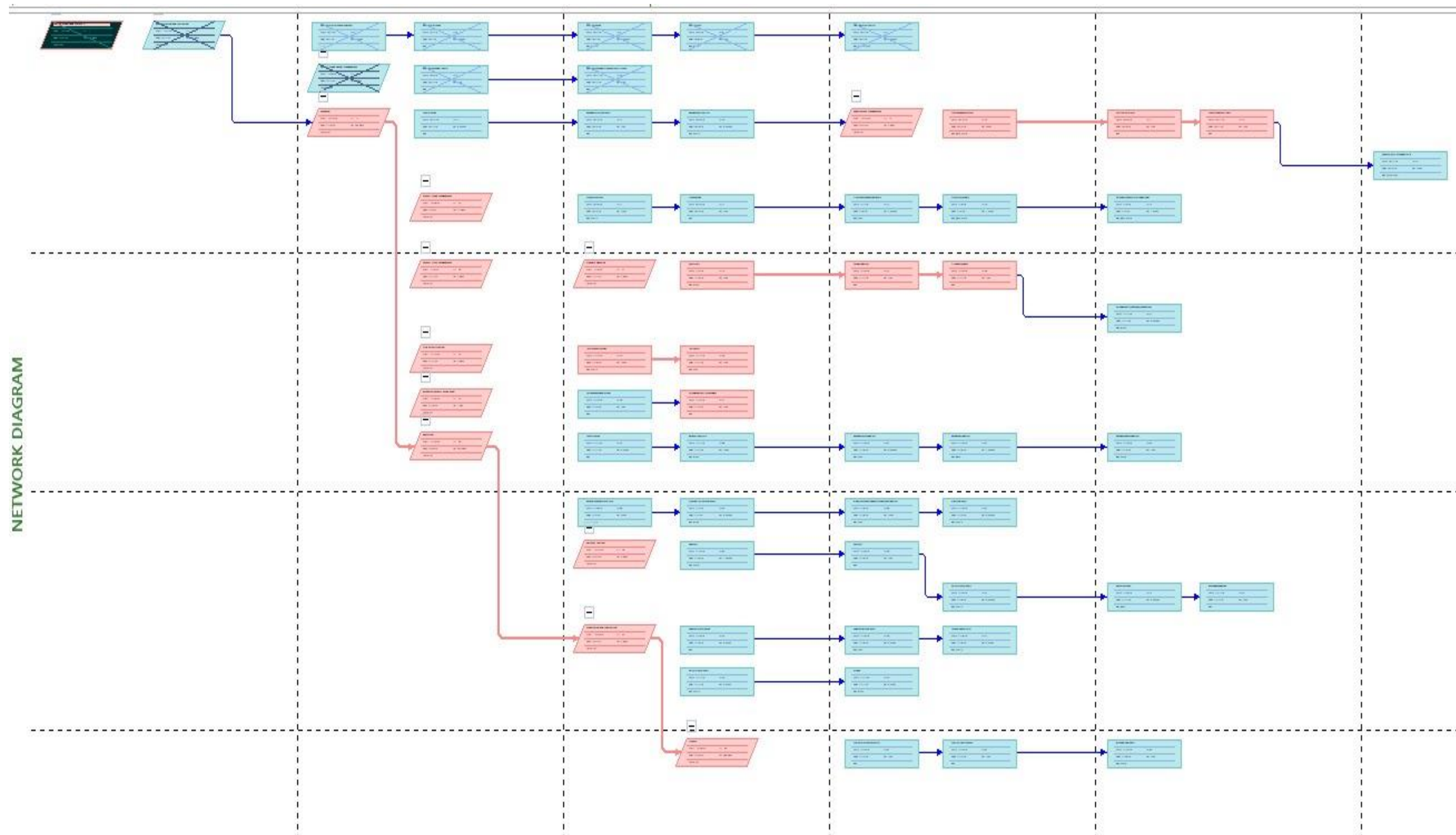


Figure 3.4.2.1: critical task

CRITICAL TASKS

CRITICAL TASKS



■ Status: Complete ■ Status: Late
■ Status: Future Task

A task is critical if there is no room in the schedule for it to slip.

[Learn more about managing your project's critical path.](#)

Name	Start	Finish	% Complete	Remaining Work	Resource Names
Functional Requirements	Thu 10/15/20	Mon 10/19/20	0%	48 hrs	Aisha,Maria
user characteristics	Tue 10/20/20	Tue 10/20/20	0%	0 hrs	
concern and constraints	Wed 10/21/20	Wed 10/21/20	0%	0 hrs	
gantt chart	Mon 11/9/20	Tue 11/10/20	0%	8 hrs	Afnan
network diagram	Tue 11/10/20	Wed 11/11/20	0%	0 hrs	
critcial path analysis	Tue 11/10/20	Wed 11/11/20	0%	0 hrs	
risk management plan	Sun 11/15/20	Mon 11/16/20	0%	16 hrs	shaffa
risk register	Tue 11/17/20	Tue 11/17/20	0%	8 hrs	Faiza
establishing team responsibilites	Wed 11/18/20	Thu 11/19/20	0%	0 hrs	

3.5 Project Communication Management

Excellent communication is a critical part of a project success. Most projects fail due to poor communications hence establishing and managing the communication between all the stake holders is significant.

Project managers spend most of their time communicating with team members and project stakeholders, whether they are internal or external to the organization. Effective communication creates a bridge between diverse stakeholders who may have different cultural and organizational backgrounds, levels of expertise, perspectives, and interests, which impact or have an influence upon the project execution or outcome.

Due to the ongoing COVID-19 pandemic, and as per the instructions issued by the Ministry of Health, the team decided that means of communication for the project will be virtual. MS-Teams will be used to conduct virtual meetings, work division and reviews. Emails and WhatsApp will be used for exchanging messages, notifications and one to one communication.

Table 3.5 was drafted by Afnan along with the team and was approved by project manager.

All meeting minutes are noted and documented and can be found in the appendix.

Table 3.5: table communication strategy

Recipient	Frequency	Mode	Responsibility
Ministry of health	Monthly	Email MS-Teams	Sponsor
Project Manager	Weekly	Email MS-Teams WhatsApp	Project Team Member
Software Analyst	Weekly	Email MS-Teams WhatsApp	Project Team Member
Software designer	Weekly	Email MS-Teams WhatsApp	Project Team Member

Software Programmer	Bi-weekly	Email MS-Teams WhatsApp	Project Team Member
Software Tester	Weekly	Email MS-Teams WhatsApp	Project Team Member
Consultant	Weekly	Email MS-Teams WhatsApp	Project Team Member
Risk Manager	Weekly	Email MS-Teams WhatsApp	Project Team Member

3.6 Risk Management Plan

Risk management plan is the process of identifying and analyzing the risk in the project. Project teams hold several meetings to identify, analyze, manage and control risks along with the risk manager. It is important to clarify roles and responsibilities, prepare budgets and schedule estimates for risk related work and carefully review the risks along with the team members. Ignoring any unclear task or any unclear analysis could increase the chances of risk. Identifying risk earlier is very important. Shaffa held a team meeting to identify the potential risks. Table no 3.6 was drafted by risk manager and approved by project manager and it shows how the risk management plan is carried out.

Table 3.6: risk management plan

Risk Management Plan Date: 24-10-2020	
Project Name: Online blood bank management system	
1. Methodology Many tools and techniques like brainstorming, SWOT analysis, risk register are available for identifying the risks.	
2. Roles and Responsibilities	
Roles	Responsibilities

Risk manager	<ul style="list-style-type: none"> ➤ Plan and draft all the risk. ➤ Identify the root cause, consequences of each risk. ➤ Assess the probability occurrence and impact for each risk in a project. ➤ Develop mitigation plan and preventive measures. ➤ Facilitate risk review meetings.
Project manager	<ul style="list-style-type: none"> ➤ Participate actively in risk management plan. ➤ Update the team about the risk. ➤ Analyze, review and manage the risk. ➤ Provide suggestions and solutions.
Project team	<ul style="list-style-type: none"> ➤ Participate actively in risk management plan. ➤ Inform the manager about new risks. ➤ Discuss about risk mitigation.

3. Budget and Schedule

The estimated cost and schedules for performing risk related activities depend on their priority level and depends on the time taken to solve the problem.

4. Risk Categories

- Cost
- Schedule
- Quality
- Environment
- Client
- Technical
- Quality
- People

5. Risk Probability and Impact

The risk manager and the entire project team including manager will discuss the issues of the project and once done, the risk manager would list them into potential risks based on risk category. The risk manager can plan the probability and impact on a chart which lists the relative probability and relative impact of the risk occurring. This would help the team to identify those risks that need maximum attention. For this, the risk manager would note down the risks that they think are likely to occur and label them as high, medium or low probability and impact.

6. Risk Documentation

Whenever the risk is identified by anyone in the team, it should be discussed to the risk manager and the team and form a document explaining briefly about the risk and mentioning the risk probability and risk impact.

7. Risk Tracking

Risk tracking is the procedure of examining and monitoring the risks regularly and documenting them whenever any modifications were made. The project manager tracks and controls the risk throughout the project by communicating with the related stakeholders and

develop a potential solution to eliminate or reduce its impact. It is the responsibility of the risk manager to alert the team whenever risk mitigation plans are applied and update the risk register.

3.6.1 Risk Register

The risk register is a tool used to record possible risk events and associated information to classify specific or unknown events that could arise to decide how these risks are handled and resolved. With the support of the team members, the project manager is responsible for writing certain activities.

Table 3.6.1: risk register

ID No	Rank	Risk	Description	Category	Root Cause	Triggers	Potential Responses	Risk Owner	Probability of Occurrence	Impact	Status
R1	1	Schedule Risk	The probability for a task to take longer than scheduled.	Time management	Lack of Intent, Sluggish, Not following Schedule	Loss of product delivery on Time Accumulation of costs and wasting resources	One potential solution would be to do overtime or depending on project budget and resources extend the deadline or in case of reserves overflow introduce more resources.	Team member, Project Manager	High	High	The PM must call meeting to check progress of tasks and review all work monthly to ensure smooth project workflow.
R2	2	Poor Financial Record	Inadequate Record	Financial Management	Inability to keep track of fund.	Poor Audit Report Financial Irregularities	Financial Regulations must be in sited and reviewed monthly by Finance manager and approved by all sponsors.	Team Member for managing financial record	Medium	High	The PM must prepare a meeting to verify and review financial records.
R3	3	Inadequate Reserves	Lack of funds to meet unexpected expenditure	Financial Management	Poor forward planning Poor management	Loss of stakeholder confidence Poor Audit Report Loss of product delivery	Selecting the sensible budgeting plan presented by risk manager.	Project Manager	Medium	High	The PM must prepare a meeting to discuss and develop a mitigation plan.
R4	4	Mishandling of Reserves	Loss of sponsor Reserves	Financial Management	Theft / Fraud / Sabotage	Additional Costs and Wasting resources	Sufficient Funds to cover repair or replacement of assets	Project Manager	Low	High	The PM must call a meeting to discuss the issue and review all reserves monthly.
R5	5	Failure to meet varying Requirements of stakeholder	Unable to recognize the changing needs and expectations of the committee	Strategical Issues	Poor decision making No forward planning	Loss of community/ stakeholder confidence.	Follow continuous monitoring of stakeholder engagement Strategy	Project Manager	Medium	Hight	The PM should set up a meeting with stakeholders to discuss.
R6	6	System Incompatibly	Component Inconsistency (Unable to perform together)	Operational Issues	Lack of regular Integration testing	Loss of product Delivery Delays testing	The project manager should monitor, review and perform unit and integration testing.	Programmer, Project Manager	Low	High	The PM should set up a meeting to discuss.

3.7 Establishing project work plan

The table below shows distribution of work among the team members according to their respective roles.

Table3.7: distribution of work

Role	Responsibilities
Project Sponsor	<ul style="list-style-type: none">· Provide business context, expertise and responsible for the overall success of the project.· Acts as an escalation point for decisions and issues that are beyond the authority of the project manager.· Ensure the authenticity of the business case and the possibility of the business proposition.· Ensure ongoing alignment to business objectives.· Define project success criteria that align with the business objectives.
Project Manager	<ul style="list-style-type: none">· Software project manager defines the requirements of the project, builds the project team, lays out a blueprint for the whole project.· Initiation Phase· Planning and defining scope· Activity planning and sequencing· Project Status Meeting· Project time management· Communication Plan· Statement of Work· Creating the WBS· Conduct Project Management· Monitoring and reporting progress· Launch the website
Software Analyst	<ul style="list-style-type: none">· Systems analysts collect and analyze the requirements for the system, perform complex analysis, designing and programming to meet business requirements.· Requirements Management· Requirements Elicitation and Analysis· Interact with end-users and software consultants· Requirements Traceability Matrix· Develop the design architecture models

Software Designer	<ul style="list-style-type: none"> · Develop the design Architecture Models · Start Prototyping · Develop Interface Design · Deploying software tools, processes and metrics · Searching, designing, implementing and managing software programs · Develop design specifications in accordance with business requirements and issues.
Software Programmer	<ul style="list-style-type: none"> · Determine the framework required for the web application (Laravel - php framework) · Create the Database · Writing and implementing efficient code · Managing database systems · Maintaining operating systems · Identifying areas for modification in existing programs and subsequently developing these modifications · Determining operational practicality · Developing quality assurance procedures
Software tester	<ul style="list-style-type: none"> · Detect and track software defects and inconsistencies · Perform testing · Conduct the testing, analyze the results and submit observations to the development team
Risk manager	<ul style="list-style-type: none"> · Identify risks and analyze · Develop risk management plan · Conduct risk review meetings · Develop mitigation plan and preventive measures. · Develop risk register
Consultant	<ul style="list-style-type: none"> · Provide feedback and suggestions related to medical issues · Share experience (medical insights related to the system)

4.0 Execution

The project execution phase is the third phase of the project lifecycle. This phase is usually the longest phase in the project life cycle and it typically consumes the most resources.

The main objectives of this phase are creation of project deliverables, monitoring and controlling and reviewing. In execution phase, we implement tasks stated in the planning phase, monitor and control them by implementing the plans developed in the planning phase to manage time, cost, quality, change, and risks. Reviewing each completed task and deliverables is required to ensure that it is in accordance with the customer requirements. The deliverables produced are then presented to the customer for acceptance.

4.1 User Characteristics

Admin: Admins can search for donors, hospital staff and blood types as well as blood bags. Admins can view all the information in the database of the system as well as edit, make necessary updates, add or delete information such as blood inventory, blood bag information, all booked appointments for blood tests, and blood donations, as well as blood tests results for all donors and the blood requests sent by the hospitals. Admins upload the results of blood tests for donors, and sets eligibility based on the test results. Admin receives notifications regarding booking of appointments (blood tests and donation), blood test results and blood bag request from hospital staff.

Donors: Donors are one of the users of the system. They can view their information which they entered during registration and edit it if required. They can book blood tests appointments and choose type of collection method they prefer. They can view their blood test reports once the results are uploaded by the admin. Eligible donors can book blood donation appointments and are given the facility to choose the time and date that is suitable for them. They can also view their all their blood test results and blood donations records in their record history. Donors receive notifications regarding their appointment confirmation and blood tests results.

Hospital staff: Hospital staff can search for a specific blood type and view available blood bags for it. They can place a request for blood bags through the system and receive confirmation notification about the request. Hospital staff can view their information entered during registration and their request records.

4.2 Use Case Scenarios

Use Case 1: Registration/Login

Primary Actors: User

Pre-Condition: There must be internet connection for accessing the website

Post-Condition: User will be able to register and login

Main Scenario:

1. User will access the website.
2. User will select login or register.
3. User will select register.
4. System will ask the user to enter information.
5. User will enter the required information like first name, last name, CPR, phone number, username, password
6. User will click on “Register”.
7. System will show confirmation message.
8. User will click on “Sign in”.
9. System will ask the user to enter username and password.
10. User will input the username and password.
11. User will click on “Login”.
12. System will direct the user to the main page.

Alternate Scenario:

10(a): User entered wrong username or password.

10(a)1: System will ask the user to enter the username and password again.

Quality Requirements:

1. Security
2. Performance
3. Availability
4. Usability
5. Portability

Priority Level: High priority (Core requirements)

Use Case 2: Booking Blood Test Appointments

Primary Actors: Donor

Pre-Condition: User is logged in.

Post-Condition: Blood test appointment is booked.

Main Scenario:

1. Donor will click on the blood test appointment for safe blood transfusion (COVID-19 test and other medical check-ups).
2. System will ask the user to enter the method they prefer for blood check-up (at home, clinic or hospital).
3. If donor selects check-up at home, the system will ask the user to enter required information like address, date, time, CPR.
4. System will save the record.

Alternate Scenario:

3(a): Time and date slot selected is not available.

3(a)1: System asks the user to select new slot.

Quality Requirements:

1. Usability
2. Availability
3. Performance

Priority Level: High priority (Core requirements)

Use Case 3: View Blood Information

Primary Actors: Admin

Pre-Condition: Admin is logged in.

Post-Condition: Admin should be able to view blood information.

Main Scenario:

1. Admin clicks on “view blood information”.
2. System displays blood information like the blood group, blood donation date and its expiry date.

Alternate Scenario:

2(a): Internet connection fails.

2(a)1: the system asks the user to reconnect for viewing the information.

Quality Requirements:

1. Availability
2. Usability
3. Performance

Priority Level: High priority (Core requirements)

Use Case 4: Manage Records

Primary Actors: Admin

Pre-Condition: Logged into the system

Post-Condition: the admin can search, add, update, delete records related to donor, hospital and blood inventory records.

Main Scenario:

1. The admin clicks on “manage records”.
2. The system displays option of selecting donor record, hospital record, blood inventory.
3. Admin clicks on records of blood inventory.
4. System displays available options:
 - Add
 - Delete
 - Update
 - Search
5. Admin selects update blood inventory record.
6. System asks the user to enter information to update.
7. Admin enters the blood group, donation time and expiry date of the blood donated.
8. Admin clicks on save.

Alternate Scenario:

8(a): Unsuccessful update

8(a)1: The system allows admin to try again

Quality Requirements:

1. Robustness
2. Security
3. Availability
4. Usability
5. Maintainability

Priority Level: High priority (Core requirements)

Use Case 5: Request Blood

Primary Actors: *Hospital or clinic staff*

Pre-Condition: *Logged into the system*

Post-Condition: *the hospital/ clinic will be able to request the blood*

Main Scenario:

1. Hospital staff clicks on “Request blood”.
2. System asks the user to enter the blood group.
3. System displays the number of blood bags in the requested blood group.
4. System will ask the user to enter the number of blood bags required, date and time.
5. Hospital staff will enter the number of bags required, delivery date and time and clicks on submit.
6. System will save the information.
7. The staff will receive confirmatory notification **via use case Receive Notifications.**

Alternate Scenario:

3(a): The requested blood group is not available

3(a)1: System will display selected blood group bags are “not available”.

5(a): User enters the number of blood bags greater than the number of available bags.

5(a)1: System will notify the available number of blood bags

Quality Requirements:

1. Availability
2. Performance
3. Usability

Priority Level: High priority (Core requirements)

Use Case 6: View Eligibility Test Report

Primary Actors: Donor

Pre-Condition: Donor is logged in and have given blood samples for the test

Post-Condition: The donor can see the eligibility of the donor for blood donation.

Main Scenario:

1. The system will send the notification to the donor regarding the blood test report.
2. Donor will view the report.
3. If he is eligible, then he will proceed for donating blood [Extension point: XPbook].

Alternate Scenario:

3(a). Donor is not eligible.

Quality Requirements:

1. Availability
2. Usability

Priority Level: High priority (Core requirements)

Use Case 7: Booking Donation Appointments

Primary Actors: Donor

Pre-Condition: Donor is eligible to donate blood

Post-Condition: Donor will be able to book appointment.

Main Scenario:

[at extension point: XPbook]

1. Donor will click on “Booking” for booking donation appointment.
2. System will ask the user to choose blood donation date, time and method.
3. Donor will enter the blood donation date, time and method.
4. User will click on “submit”.
5. System will store the information.
6. System will notify the admin about donors request for appointment.

Alternate Scenario:

3(a): Time and date slot selected is not available.

3(a)1: System asks the user to select new slot.

Quality Requirements:

1. Usability
2. Availability
3. Performance

Priority Level: High priority (Core requirements)

Use Case 8: Receive Notifications

Primary Actors: *Users (Admin, Hospital staff, Donor)*

Pre-Condition: *Donor books an appointment or Hospital requests blood.*

Post-Condition: *Receive notification*

Main Scenario:

1. Donor books an appointment for blood test.
2. System sends the notification to the admin regarding the donor's appointment.

Alternate Scenario:

- 2(a): Internet connection fails.
 - 2(a)1: the system asks the user to reconnect for viewing the information.

Quality Requirements:

1. Availability
2. Usability

Priority Level: High priority (Core requirements)

4.2.1 Use case description

It provides the description of all the use cases as mentioned in the below table 4.2.1 and was drafted by Maria.

Table 4.2.1: use case description

Use Case ID	Use Cases	Description
UC-1	Registration/Login	The user (admin, Donor, Hospital/clinic staff) can register and login into the system
UC-2	Booking Blood Test Appointments	The donor can book an appointment for the blood test.
UC-3	View Blood Information	Admin can view the information related to the blood (and their groups).
UC-4	Manage Record	Admin can make changes in any record related to the donor, hospital, and blood inventory.
UC-5	Request Blood	The hospital can request for the blood from the blood bank.
UC-6	View Eligibility Test Report	The donor can view his/her eligibility by the result of his/her blood test report.
UC-7	Booking Donation Appointment	Only the eligible donor can take the blood donation appointment.
UC-8	Receive Notification	The admin should be notified by the system whenever a donor books an appointment and the hospital requests a blood. Donors will receive notifications regarding blood test reports. Hospitals will get blood test confirmation notifications.

4.2.2 Quality attributes

It provides the description of all the quality attributes as mentioned in the table 4.2.2 and was drafted by Shaffa.

Table 4.2.2: quality attributes

Id	Quality attribute	Description	Related Use case
QA-1	Robustness	The system should automatically store all the information in the system such that no data will be lost in case any failure.	UC-4
QA-2	Availability	The system should be available 24/7.	All
QA-3	Security	The system should validate the username and password to login. The system prevents unauthorized users from accessing the system.	UC-1, UC-4
QA-4	Modifiability	The system should be flexible for adding or modifying different functions without any errors.	UC-4
QA-5	Performance	The system should have response time of not more than 3 seconds.	UC-1, UC-2, UC-3, UC-5, UC-7
QA-6	Portability	The system should be able to run on different browsers such as Google Chrome, Microsoft edge.	UC-1
QA-7	Usability	The system should be simple and easy to use for users of all backgrounds. The layout of the website will aim at	All

		easy navigation and access to all the available features. through a menu.	
--	--	--	--

4.2.3 Concerns

Applying cultural views to model the design based on stakeholder concerns and table 4.2.3 was drafted by Faiza which shows main concerns of our system.

Table 4.2.3: concerns

ID	Concerns
CRN-1	Establishing an overall initial system structure.
CRN-2	The team members are knowledgeable about php framework.
CRN-3	Allocate work to members of the development team.
CRN-4	The system must be able to maintain and update.
CRN-5	The system must support logging, authentication, authorization and configuration.

4.2.4 Constraints

Constraints are some conditions that are likely to happen or wish them to happen while designing. Table 4.2.4 was drafted by Aisha and it shows some of the constraints that our system will have.

Table 4.2.4: constraints

ID	Constraints
CON-1	Minimum of 500 users must be supported simultaneously.
CON-2	The system must be completed within 3 months.
CON-3	The system should be accessible by Android and IOS users.
CON-4	Web application requires an active internet connection.
CON-5	A database must be used to store all information about blood bank, hospitals and users.
CON-6	Network connection to all the user's workstations must have high bandwidth.

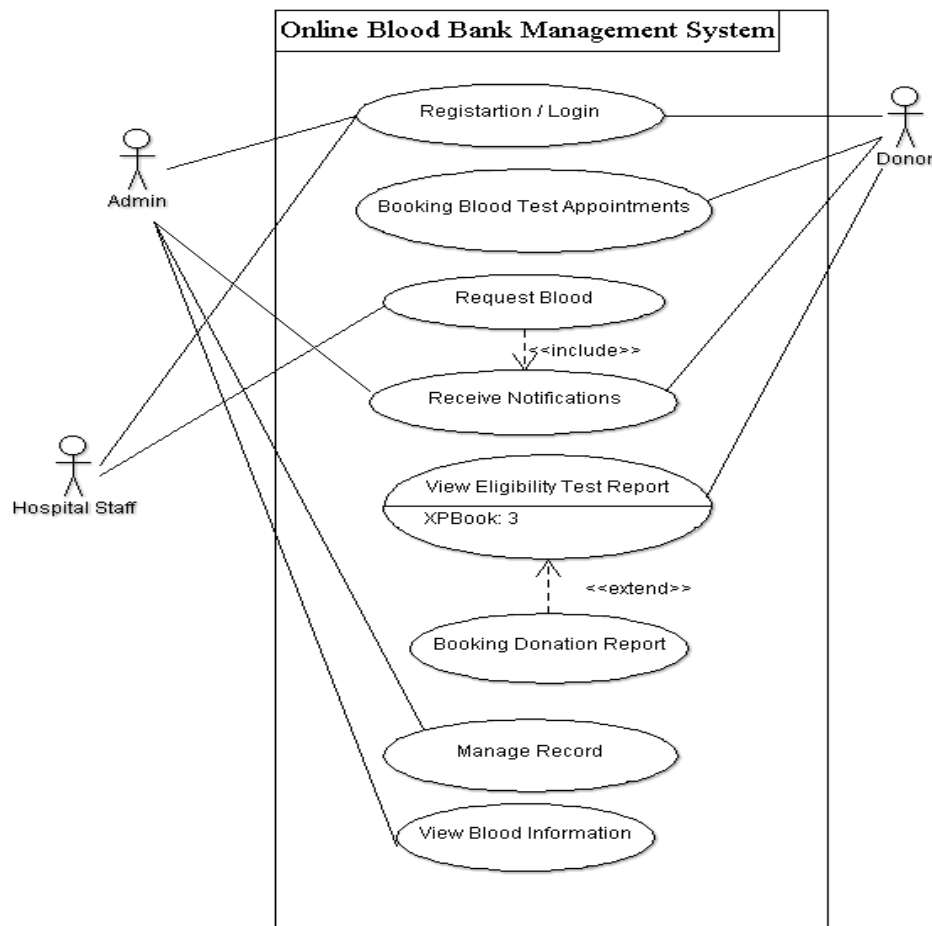
4.2.5 Use case diagram

In 1986, Ivar Jacobson first formulated textual and visual modeling techniques for specifying use cases. A UML use case diagram is the primary form of system requirements for a new software program. The diagram is used to model the system of an application. A single use case diagram captures a particular functionality of a system. Use cases specify the expected behavior (what), and not the exact method of making it happen.

A key concept of use case modeling is that it helps us design a system from the end user's perspective. It is an effective technique for communicating system behavior

in the user's terms by specifying all externally visible system behavior. Use case diagrams are used to Specify the context of a system, capture the requirements of a system, drive implementation and generate test cases. It is an effective technique for communicating system behavior in the user's terms by specifying all externally visible system behavior. The following figure 4.2.5 was sketched by Faiza and Shaffa.

Figure 4.2.5: use case diagram

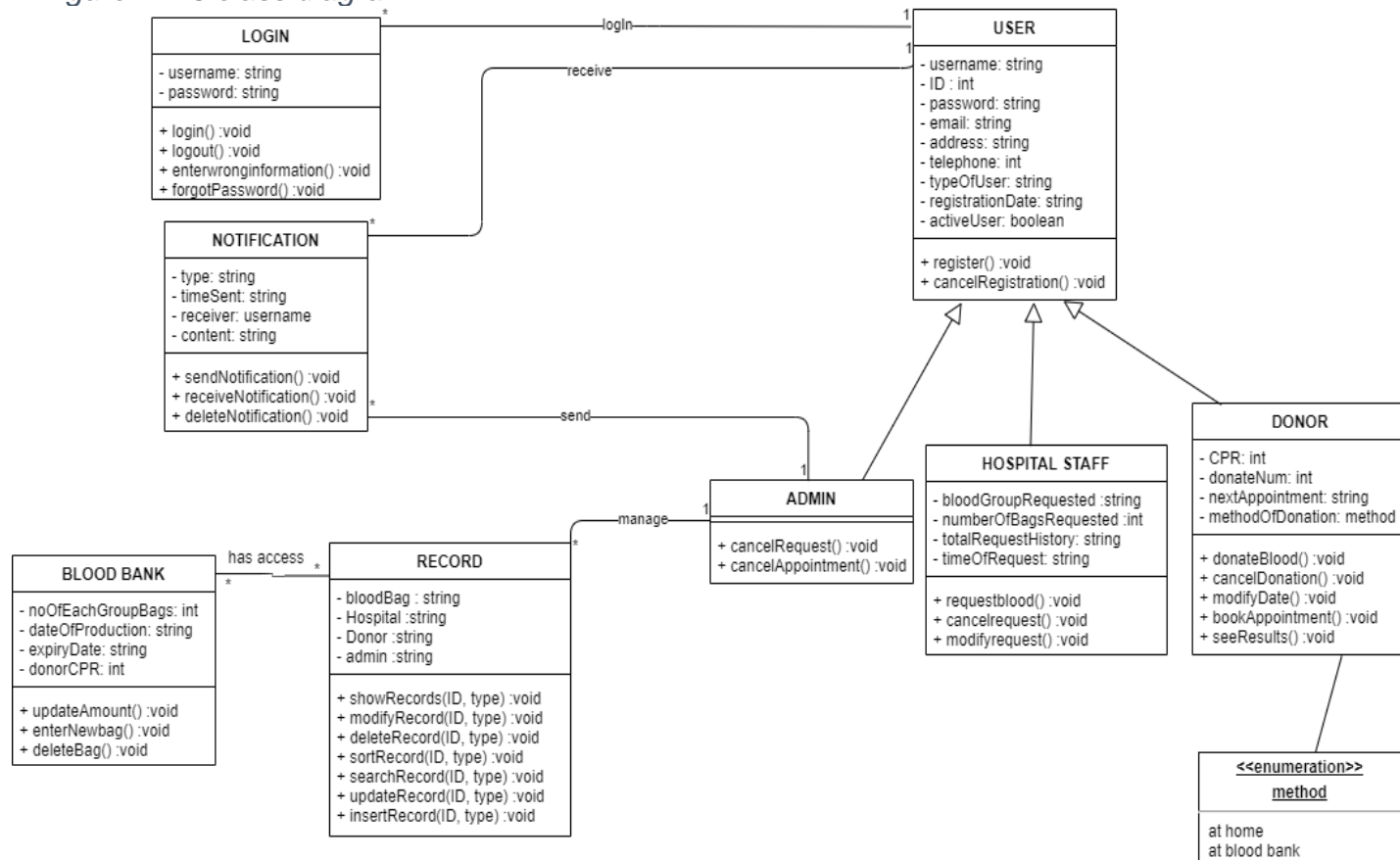


4.2.6 Class diagram

A class is a description of a group of objects all with similar roles in the system, which consist of structural (attributes) and behavioral (operations) features. In the Unified modelling language (UML), the class diagram is a type of static structure diagram that describes the structure of the system. it shows the system's classes, attributes and methods for each class and the relationships between them.

The purpose of the class diagram is to show static structure of classes in a system as well provide a basic notation for other structure diagrams .class diagrams are helpful for developers and business analysts who can use the class diagram to model systems from a business perspective. The project manager along with the team discussed and created the class diagram.

Figure 4.2.6 class diagram



4.3 The Design Process

In this section, software designer Afnan with the help of project manager Shaffa starts the iteration process in the designing of the system or the translating system requirements into design decision.

Step 1: Review Input

In the following step, reviewing the inputs and identifying requirements will be considered as drivers and the input are summarized in the table. This table was drafted by Faiza.

Category	Details		
Design purpose	This is greenfield system from a mature domain. The purpose is to produce a sufficiently detailed design to support the construction of the system.		
Primary functional requirements	From the use cases presented, the primary ones were determined to be: UC-2: Because it directly supports the core business. (Book Blood Test Appointment) UC-5: Because it directly supports the core business. (Request Blood) UC-6: Because it directly supports the core business. (View Eligibility Test Report) UC-7: Because of the technical issues associated with it. (Book Donation Appointment) UC-4: Because of the technical issues associated with it. (Manage Records)		
Quality attribute scenarios	The scenarios described have now been prioritized as follows:		
	Scenario ID	Important to the customer	Difficulty of implementation According to Architect
	QA-1 (Robustness)	High	High
	QA-2 (Availability)	High	High
	QA-3 (Security)	High	Medium
	QA-4 (Modifiability)	High	High
	QA-5 (Performance)	High	High
	QA-6 (Portability)	High	High
	QA-7	High	Low

	(Usability)		
	From this list, only QA-2, QA-3, QA-4, QA-5 and QA-7 are selected as drivers		
Constraints	All the constraints discussed in Section 1.2.3. are included as drivers.		
Architectural concerns	All the architectural concerns discussed in Section 1.2.4. are included as drivers.		

Iteration 1: Establishing an Overall System Structure

This section presents the results of the activities that are performed in each of the steps of ADD in the first iteration of the design process.

Step 2: Establish Iteration Goal by Selecting Drivers

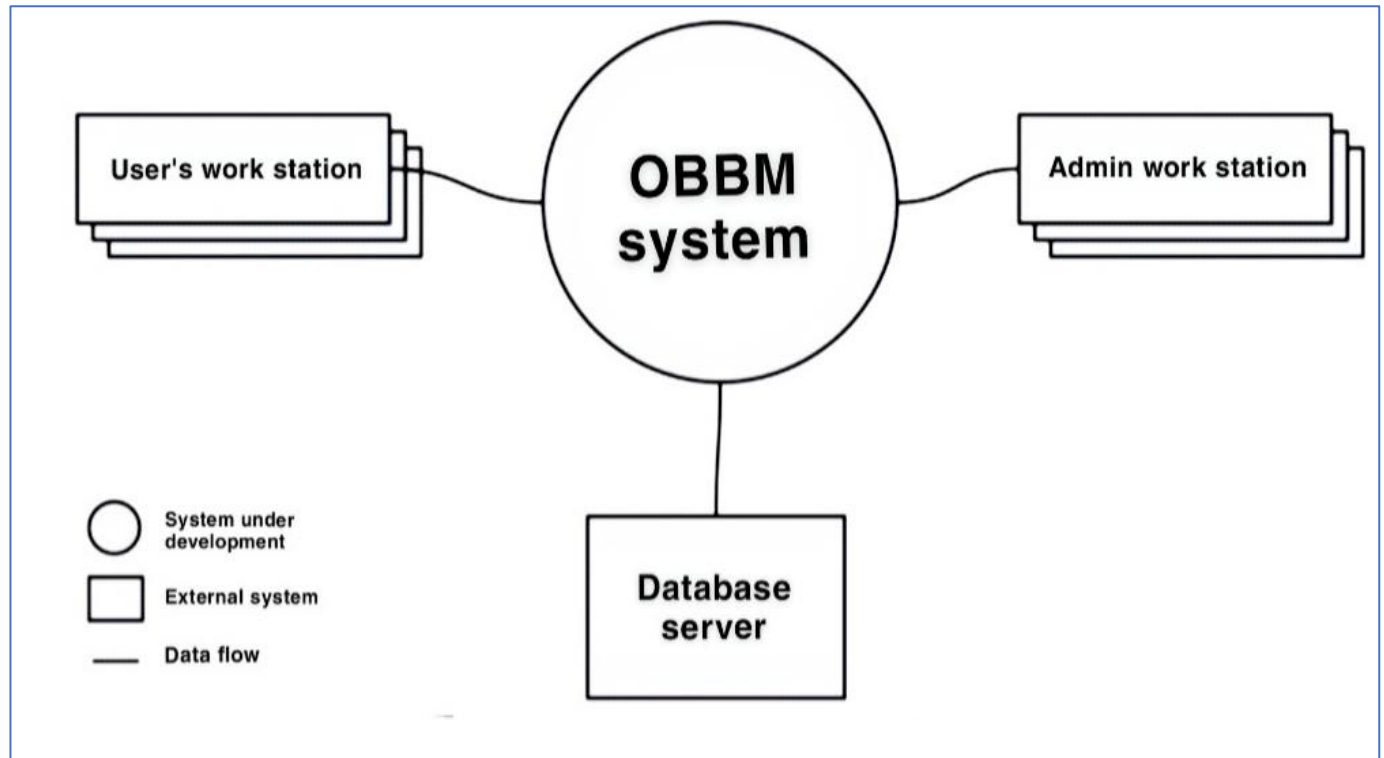
This is the first iteration in the design of Greenfield system, in which the iteration goal is to achieve the architectural concerns.

Although this iteration is driven by a general architectural concern, the architect must keep in mind all the drivers that may influence the general structure of the system. In particular, the architect must be mindful of the following:

- **QA-2:** Availability
- **QA-3:** Security
- **QA-4:** Modifiability
- **QA-5:** Performance
- **QA-7:** Usability
- **CON-3:** The system must be accessed through different desktop browsers (chrome, internet explorer, Firefox) and through different mobile browsers (safari for IOS users, and internet for android users).
- **CON-5:** All the operations must be stored in the system database.
- **CON-6:** Network connection to user workstation must have high bandwidth.
- **CRN-1:** Establishing an overall system structure.
- **CRN-2:** The team members are knowledgeable about php framework.
- **CRN-3:** Allocate work to team members.
- **CRN-4:** The system must be able to maintain and update.

- **CRN-5:** The system must support logging, authentication, authorization, and configuration.

Figure 4.3.1: context diagram



Step 3: Choose One or More Elements of the System to Refine

The entire OBBM system's elements is refined and this refinement is performed through decomposition, as followed in Greenfield develop.

Step 4: Choose One or More Design Concepts That Satisfy the Selected Drivers

The selection of design decisions is summarized below and was drafted by Shaffa:

Design Decisions and Location	Rationale	
The client part of the system is logically structured using Web Application .	This application is preferred as it supports all the mentioned use cases as it is implemented also keeping in mind that application needs to be accessible over internet, require portability of the user interface and to limit(minimize) the use of client-side resources. It also supports CON-3. Discarded alternatives:	
	<i>Alternate</i>	<i>Reason for discarding</i>
	Rich Internet Application (RIA)	The client is not required to perform any sort of processing on his\her side.
	Rich Client Application	The Rich Client Application (RCA) reference architecture doesn't support or run in a web browser. It rather needs deployment of application on the user's PC's and support intermittent or network connectivity.
	Mobile Applications	This reference architecture is oriented toward the development of applications that are deployed in handheld devices. This alternative was discarded because this type of device was not considered for accessing the system.
The server part of the system is logically using the Web Application .	The components in the server side of the application structure supports all the concerns of this system drivers. No other alternatives were considered and discarded as this architecture is fully adequate to meet the requirements.	
Three-tier deployment pattern is used to physically structure the application	The accessibility of the system is done through a web browser (CON-3) which is available in the web-tier in the three-tier deployment. This tier also consists a database tier that can be used for the secure storage of information (QA-4 QA-3, CON-5).	
	<i>Alternate</i>	<i>Reason for discarding</i>
	Four- tier deployment	This business logic tier in this the deployment pattern is not necessary for this system.
	Two-tier deployment	This is a server-client deployment pattern that doesn't provide security and multiple user functionality.
Build the user interface of the client application using MVC framework	It is the standard web development framework (CON-3) to create scalable, extensible projects and it is what developers are familiar with (CRN-2) Discarded alternatives include Swing Java framework because it supports Java Rich Clients that is not necessary for our system.	

Deploy the application using Laravel with Xampp.	XAMPP comes with pre-configured Apache web server along with PHP (CON-3) and MySQL cloud ensures security (CON-5, CON-6) that facilitates developer's ease of access. Moreover, Laravel framework comes with ORM (Object-Relational Mapping) and offers built-in authentication mechanisms and caching mechanism. Discarded alternatives include Java because it requires to have an SDK and it cannot run on a web browser.
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Step 5: Instantiate Architectural Elements, Allocate Responsibilities, and Define Interfaces

The instantiation design decisions considered and made are summarized in the following table and was drafted by Aisha:

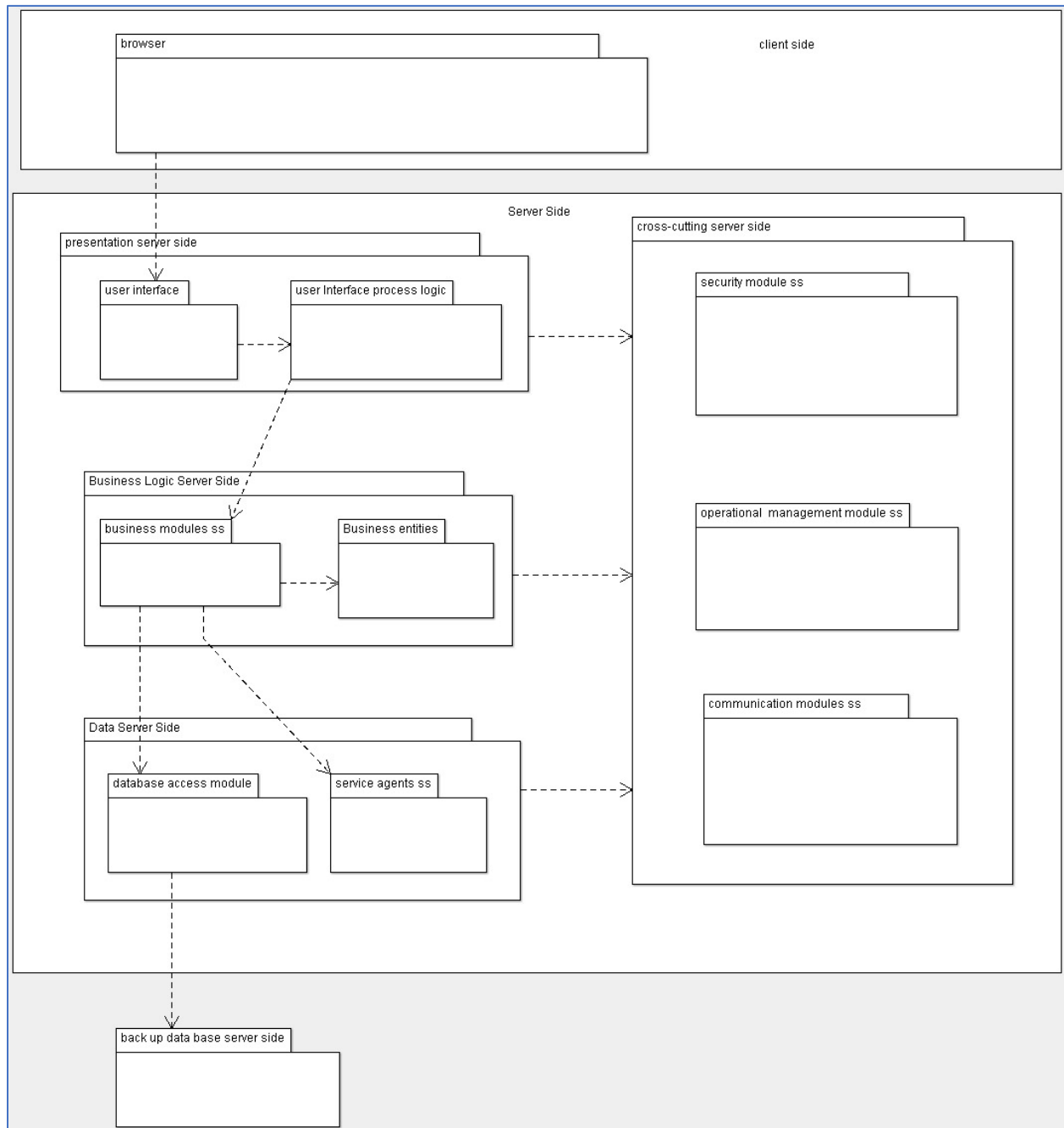
Design Decision and Location	Rationale
Remove helpers and utilities from the web application.	The system does not require an additionally functionality that is not specific to others.
Create backup database in the server side of the web application.	The backup stores crucial information that can be retrieved later in case of virtual attack.

The results of this instantiation decisions are recorded in the next step. In this initial iteration, it is typically too early to precisely define functionality and interfaces. In the next iteration, which is dedicated to defining functionality in more detail, interfaces will begin to be defined.

Step 6: Sketch Views and Record Design Decisions

Diagram 4.3.2 describes the sketch of a module view of the reference architectures that were selected for the client and server applications that is now adapted to the design decisions that we have made.

Figure 4.3.2: Modules obtained from the selected reference architectures



The diagram was sketched using Argo UML tool by Afnan. Through this tool, selected elements with a short description of their responsibilities and noted. The description merely contains the functional responsibilities without any detail.

Element	Responsibility
Browser (CS)	A web browser runs on the client side (CON-3).
Presentation (SS)	Responsible for managing user interaction (represents both IU components and UI process logic components).
User Interface (UI)	This component is responsible for enabling user interaction and presenting information to the users and controls the flow of all use cases.
UI process logic	These components are responsible for managing the control flow of the applications use cases
Business logic SS	These components are responsible for retrieving and processing application data and applying business rules on the data.
Business Modules SS	These modules either implement business operations that can be performed locally or expose business functionality.
Business entities	These components represent the entities from the business domain and their associated logic.
Cross cutting SS	The functionalities that go across different layers such as security, logging, and I/O are carried out in this layer which supports (QA-3) and (UC-4).
Security module SS	Authorization, authentication and other security aspects (QA-3, QA-4) are handled in the security component in the cross-cutting module.
Operational Management. Module SS	Exception management, logging, instrumentation and validation that is efficient for all the use cases are all incorporated in cross cutting module.
Communication Module SS	These components include cross-cutting functionality that handles communication mechanisms across layers and physical tiers.
Data SS	This layer contains modules that is responsible for the data persistence.
DB access modulus	This module is responsible for persistence of business entities (objects) into the relational database. It performs object oriented to relational mapping and shields the rest of the application from the persistence details.
Service Agents SS	This component abstracts communication mechanisms used to transfer data to external services.
Backup DB SS	This is used to duplicate the information stored in the original database to enhance security.

Figure 4.3.3: initial deployment diagram

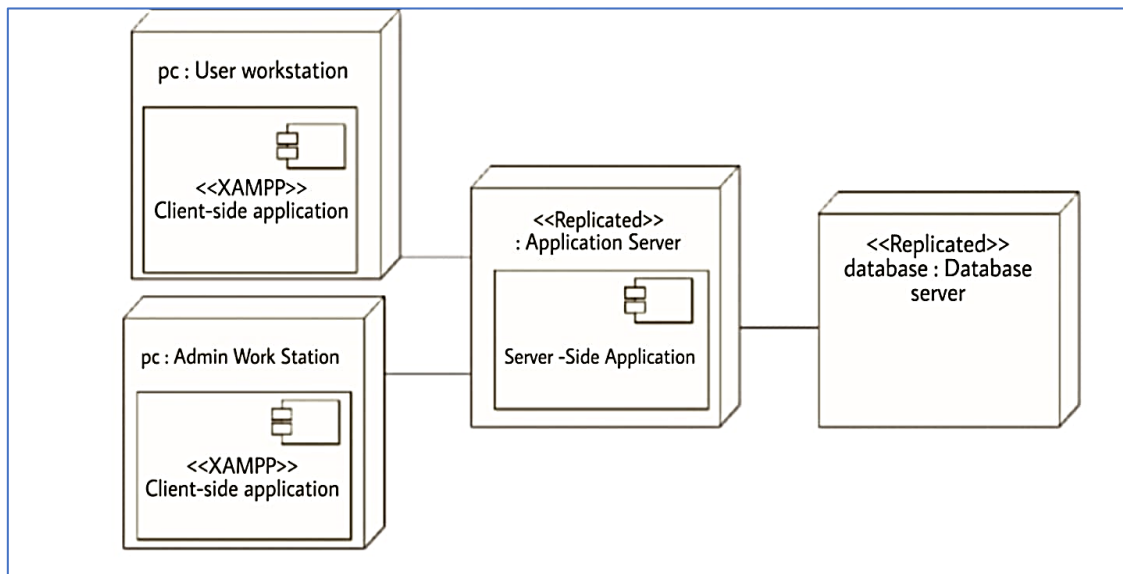


Diagram 4.3.3 is the deployment diagram sketched by Maria that sketches an allocation view that demonstrates where the components associated with the modules in the previous diagram will be deployed.

The responsibilities of the elements are summarized here:

Element	Responsibility
User Workstation	The customer's PC which hosts all the client-side logic application.
Admin's Workstation	The employee's PC's which hosts all the client-side logic application.
Application Server	The server that hosts server-side logic of the application also serves the web pages.
Database Server	The server that hosts the legacy relational database.

Also, information about relationships between some elements in the diagram that is worth recording is summarized in the following table drafted by Shaffa:

Relationships	Description
Between web/app server and the database server	Communication with the database is done using MySQL and PHP.

Step7: Perform Analysis of Current Design and Review Iteration Goal and Achievement of Design Purpose

The following summarizes the design progress using the Kanban Board technique discussed and was drafted by Faiza.

Not Addressed	Partially Addressed	Completely Addressed	Design decision made during the iterations.
	UC-2		Selected reference architecture establishes the modules that will support this functionality.
	UC-4		The login will be carried out through cross cutting server-side layer.
	UC-5		Selected reference architecture establishes the modules that will support this functionality.
	UC-6		Selected reference architecture establishes the modules that will support this functionality.
	UC-7		Selected reference architecture establishes the modules that will support this functionality.
QA-7			No relevant decision made.
	QA-3		It will be carried out through cross cutting server-side layer and security module server side.
	QA-4		It will be carried out through cross cutting server-side layer and security module server side.
QA-2			No relevant decision made as it is necessary to identify the elements that participate in use case associated with the scenario
	QA-5		It will be carried out through cross cutting server-side layer and security module server side.
		CON-5	The database server permits the storage of information with an additional backup database.

	CON-3	Supports execution through different browsers.
CON-6		No relevant decision made.
	CRN-1	Selection of reference architectures and deployment pattern.
	CRN-2	All the team members are professional with using PHP language.
CRN-3		The work was distributed equally between members. Each member is knowledgeable of the work assigned.
CRN-4		No relevant decision made.
	CRN-5	The operations will be incorporated in cross cutting server side.

Iteration 2: Identifying Structure to Support Primary Functionality

In this section present the result of the activities that are performed in each of the steps of ADD, in the second iteration of the design process for the OBBM. Here we go in more detailed decision that will drive implementation. Our goal for the first iteration was to establish an overall system structure. Now that this goal has been met, our new goal for this second iteration is to reason about the units of implementation.

Step 2: Establish Iteration Goal by Selecting Drivers

The goal of this iteration is to address the general architectural concern of identifying structure to support primary functionality. Identifying these elements is useful not only for understanding how functionality is supported, but also for addressing CRN-5, that is the system must support logging, authentication, authorization, and configuration and CRN-4, that is the system must be able to maintain and update. In this second iteration, besides CRN-5, CRN-3 and CRN-4, the architect considers the system's primary use cases:

- UC-2: Book Blood Test Appointment
- UC-4: Request Blood Test
- UC-5: View Eligibility Test Report
- UC-6: Blood Donation Appointment
- UC-7: Manage Records

Step 3: Choose One or More Elements of the System to Refine

The elements in the modules that are situated in different layers defined by the chosen reference architectures from the previous iteration in general are refined in this iteration. The support of functionality in this system, in general, includes the collaboration of modules-related elements that are in various layers.

Step 4: Choose One or More Design Concepts That Satisfy the Selected Drivers

The selection of design decisions is summarized below and was drafted by Afnan:

Design Decisions and Location	Rationale and Assumptions
Create a Domain Model for the application.	Before beginning a functional decomposition, it is important to establish the initial domain model for the system, to define the major entities in the domain along with their relationship. No better alternatives to this method have been identified. A domain model must finally be developed to avoid achieving an unmaintainable and nonsensical ad hoc architecture.
Identify Domain Objects that map to functional requirements.	Each functional element of the application needs to be encapsulated in a domain object Alternative: decompose layers into modules, but this increases the risk of not considering a requirement.
Decompose Domain Objects into general and specialized Components.	Domain objects represent complete sets of functionalities, but this functionality is supported by elements located within the layers. The components are what we have referred to as modules. Specialization of modules is associated with the layers where they are located (e.g., UI modules) There are no alternatives to decomposing the layers into modules to support functionality.
Use MVC framework.	Model – View – Controller (usually known as MVC) is a software design pattern widely used to build user GUI for web applications typically based on programming languages such as JavaScript, Python, Ruby and PHP straight out of the box for web application design. Other alternative frameworks are not considered because MVC framework is well suited for the project and the programmers are well familiar with it.

Step 5: Instantiate Architectural Element, Allocate Responsibilities, and Define Interface

The instantiation design decision made in this iteration are summarized in the following table and was drafted by Aisha:

Design Decision and Location	Rationale
Create only an initial domain model	Entities must be identified and modeled and these entities should participate in the primary use cases but an initial domain model is created to accelerate this phase of design.
Map the system use cases to domain objects	By analyzing the systems uses cases, an initial identification of the domain objects is made. Domain objects are identified for all the use cases.
Decompose the domain object across the layers to identify the layer-specific modulus with an explicit interface.	The support of all the functionalities is identified through this technique. Just for the primary use cases the architect will perform the task which provides the identification of the rest of the modules by the team member for the allocation of the work among them.
Connect component associated with modules MVC framework.	This framework provides structure and guidance when developing web applications which serves the main purpose of the system.
Associate frameworks with a module in the data layer.	This framework provides the baseline and can capture all the system drivers. It also provides the manipulation of both server and client-side aspects through the various provided coding languages.

In this step, the structures and interfaces are identified and in the next (step 6), they are structured.

Step 6: Sketch Views and Record Design Decisions

Figure 4.3.4: class diagram

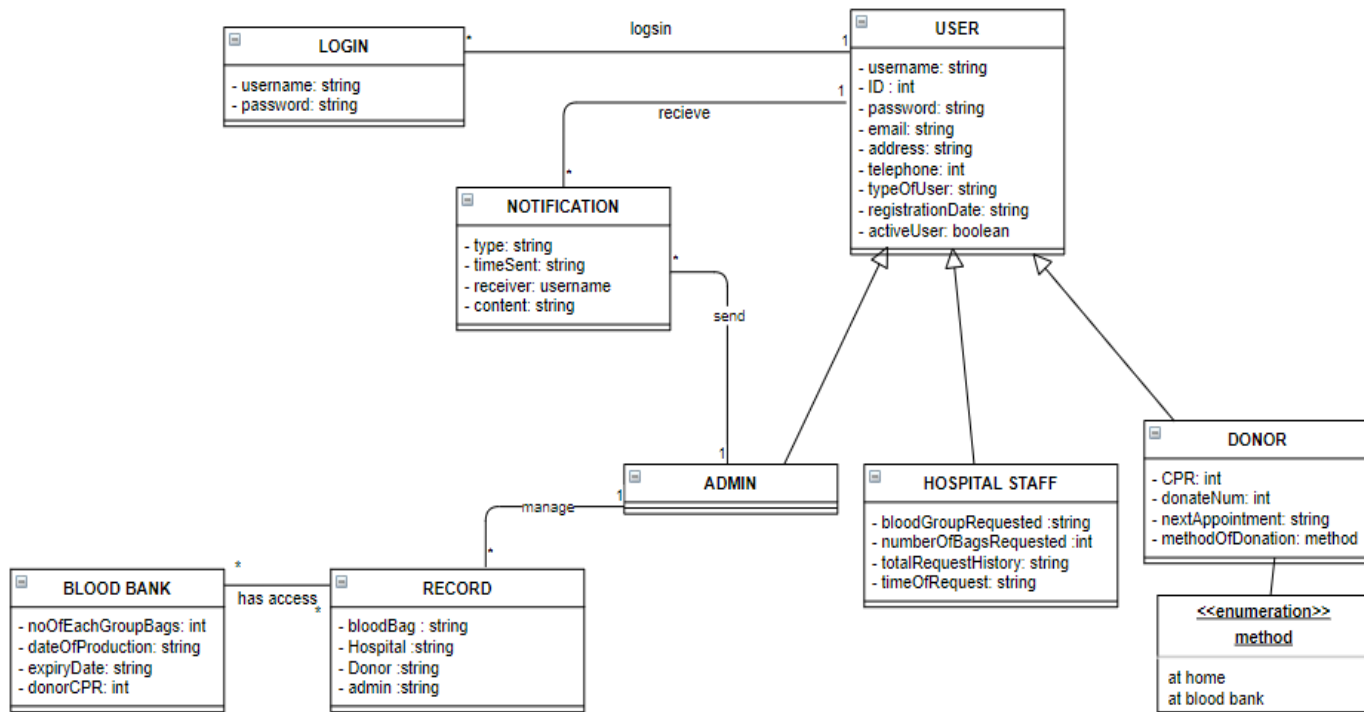


Figure 4.3.5: Domain objects associated with the use case model

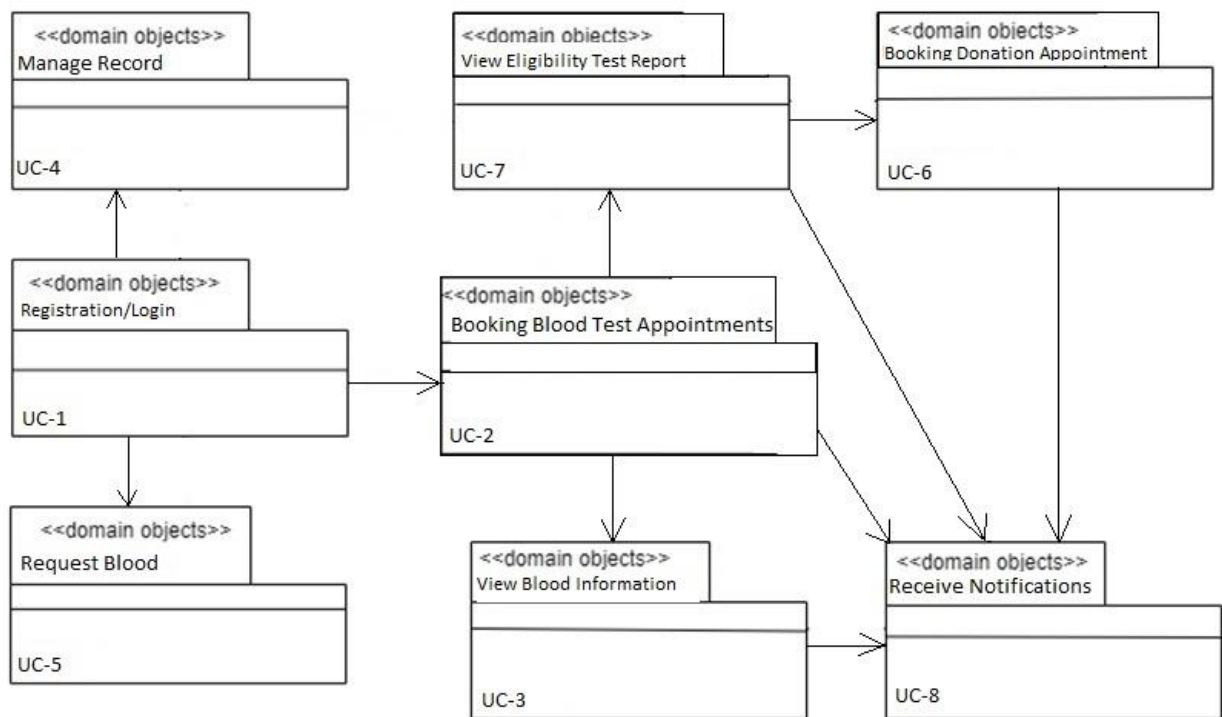
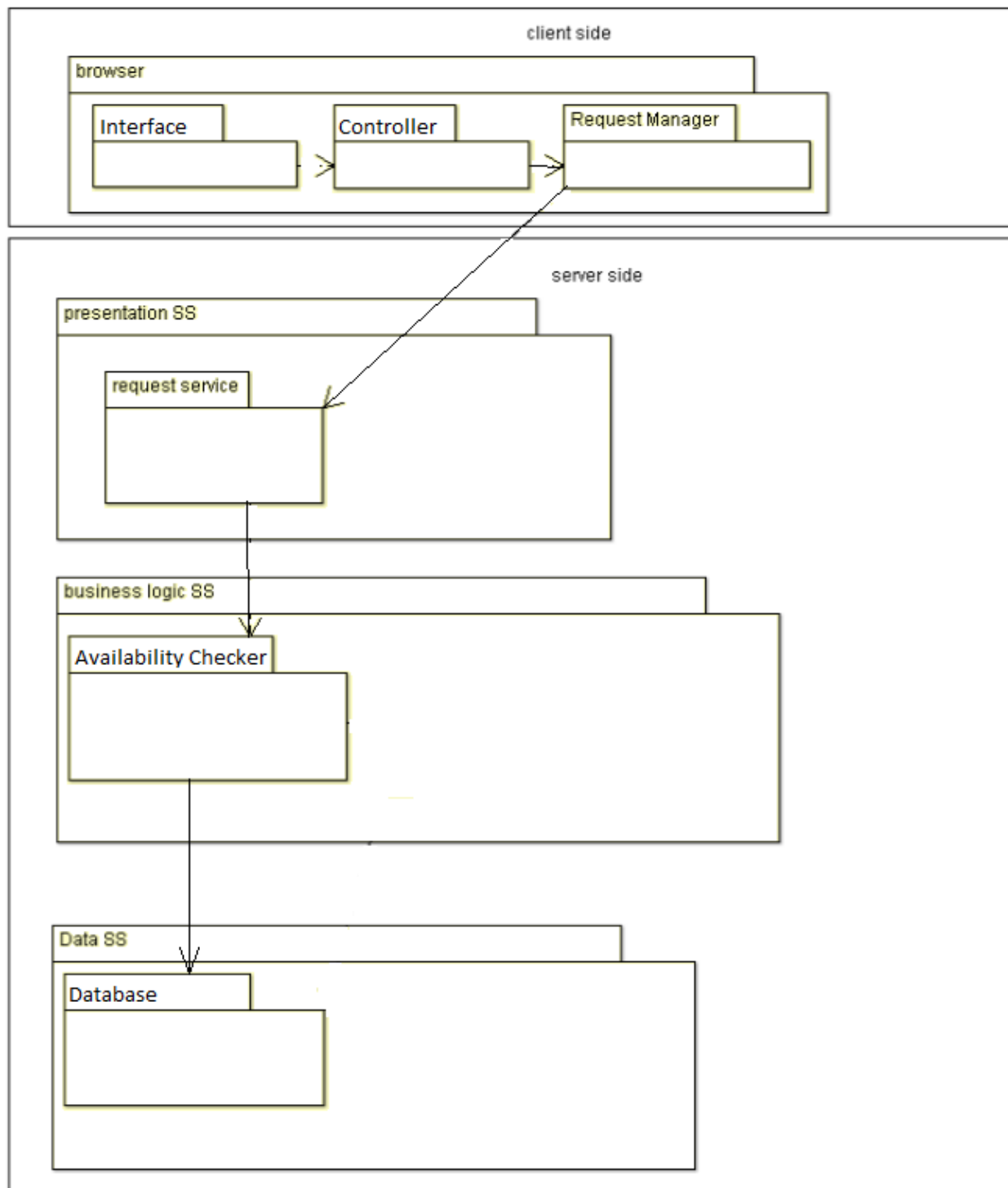


Figure 4.3.6: Modules that support primary use cases



The following table summarizes the information that is captured and was drafted by Faiza:

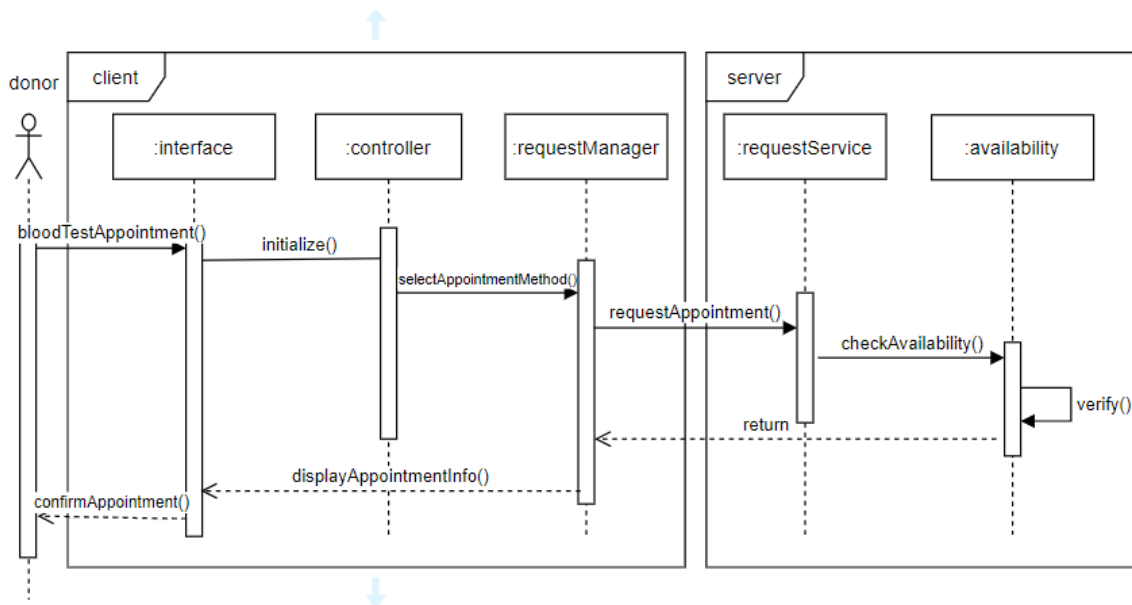
Element	Responsibilities
Interface	Displays the view of the system to the user of the system. There they can select from the choices provided to them.
Controller	Responsible for providing the necessary information to the presentation layer for displaying the system interface.
Request Manager	Responsible for communication with the server-side logic.
Request Service	It provides the front view that receives requests from the client-side.
Availability Checker	It checks if the requested service is available or not.
Database	This will access the database to check the availability and saves the data on the server-side.

SEQUENCE DIAGRAM

Sequence Diagrams are interaction diagrams that show how operations are carried out in detail. They describe interactions among classes in terms of an exchange of messages over time. They are also called event diagrams. A sequence diagram is a good way to visualize and validate various runtime scenarios. These can help to predict how a system will behave and to discover responsibilities a class may need to have in the process of modeling a new system.

They capture the interaction between objects in the context of a collaboration that is based on a use case. Sequence Diagrams are time focus and they show the order of the interaction visually by using the vertical axis of the diagram to represent time and the horizontal axis shows the elements that are involved in the interaction; what messages are sent and when. The Purpose of Sequence Diagram is to show and model the high-level interaction between active objects in a system.

Figure 4.3.7: UC2- book blood test appointment

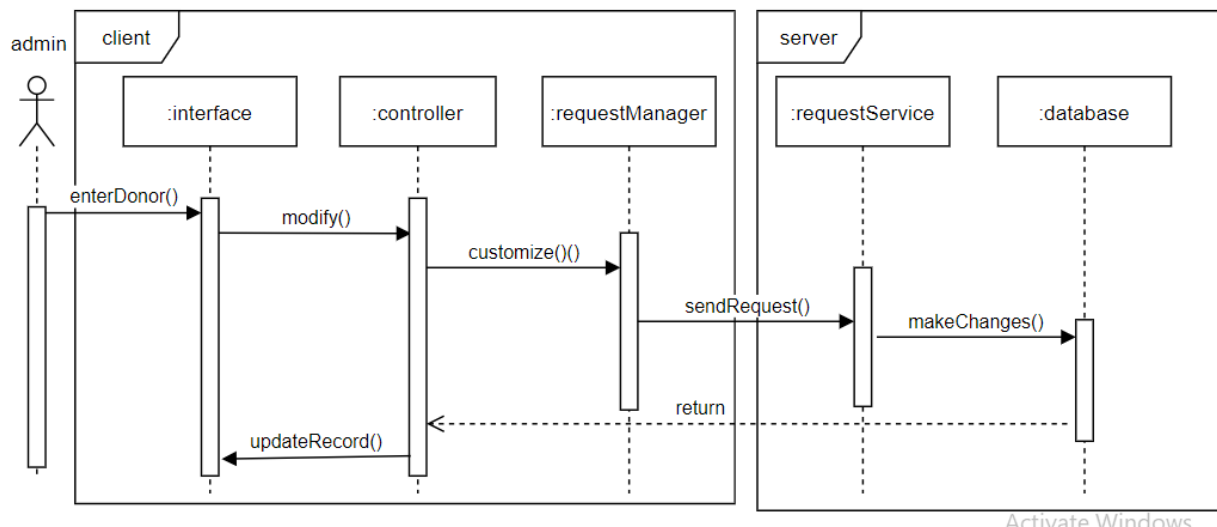


The following table summarizes the information that is captured and was drafted by Shaffa:

Method Name	Description
Element: Interface	
bloodTestAppointment()	This allows the donor to book blood test appointment.
Element: Controller	
initialize()	The system will take all the attributes given to the system and put them in to the system.
Element: RequestManager	
selectAppointmentMethod()	This allows the donor to select method depending on their wish to choose home or bloodbank.
Element: RequestService	
requestAppointment()	Request the appointment detail from the server side

Element: Availability	
checkAvailability()	This allows the system to check if the requested appointment is available or not.
verify()	The system will verify if the request is valid or not and sends true or false message to the system.

Figure 4.3.8: UC4-manage record

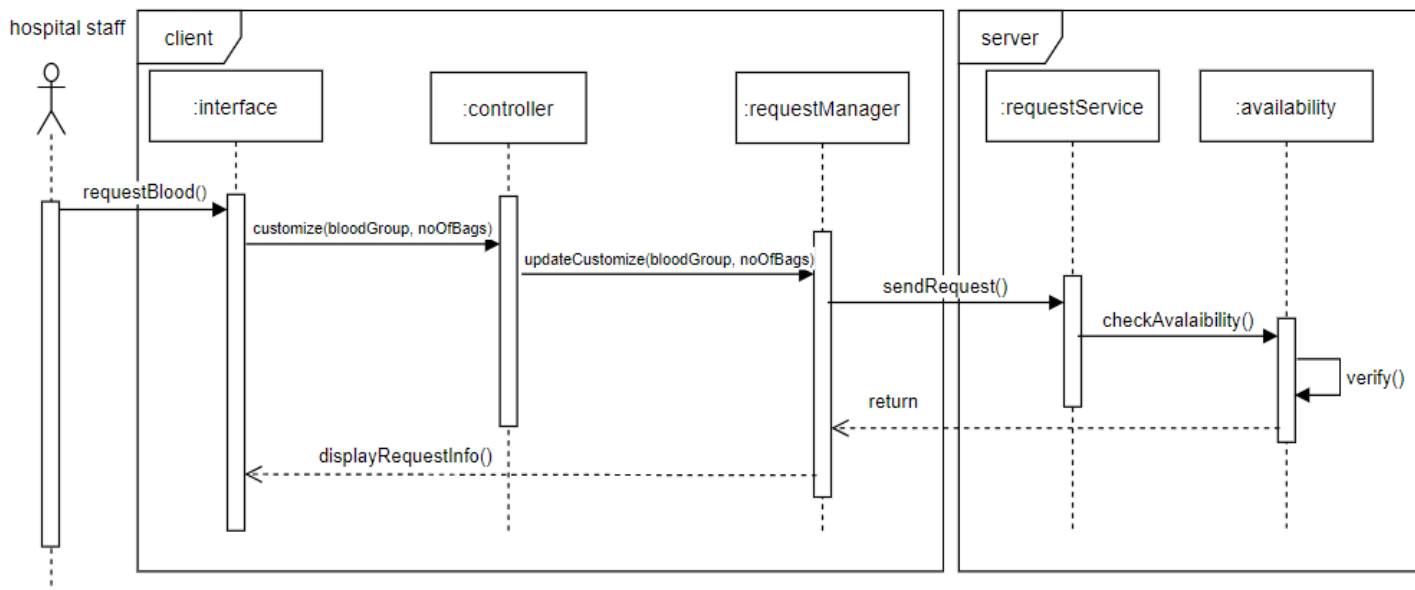


The following table summarizes the information that is captured and was drafted by Aisha:

Method Name	Description
Element: Interface	
enterDonor()	This allows the admin to enter any donor.
updateRecord()	After all the modification, new or modified record is updated.
Element: Controller	
modify()	The system will take all the attributes given to the system.

Element: RequestManager	
customize()	The system will then put them into the system.
Element: RequestService	
sendRequest()	Request the new details from the server side
Element: Database	
makeChanges()	Makes all the new changes and saves into the database.

Figure 4.3.9: UC5-request blood

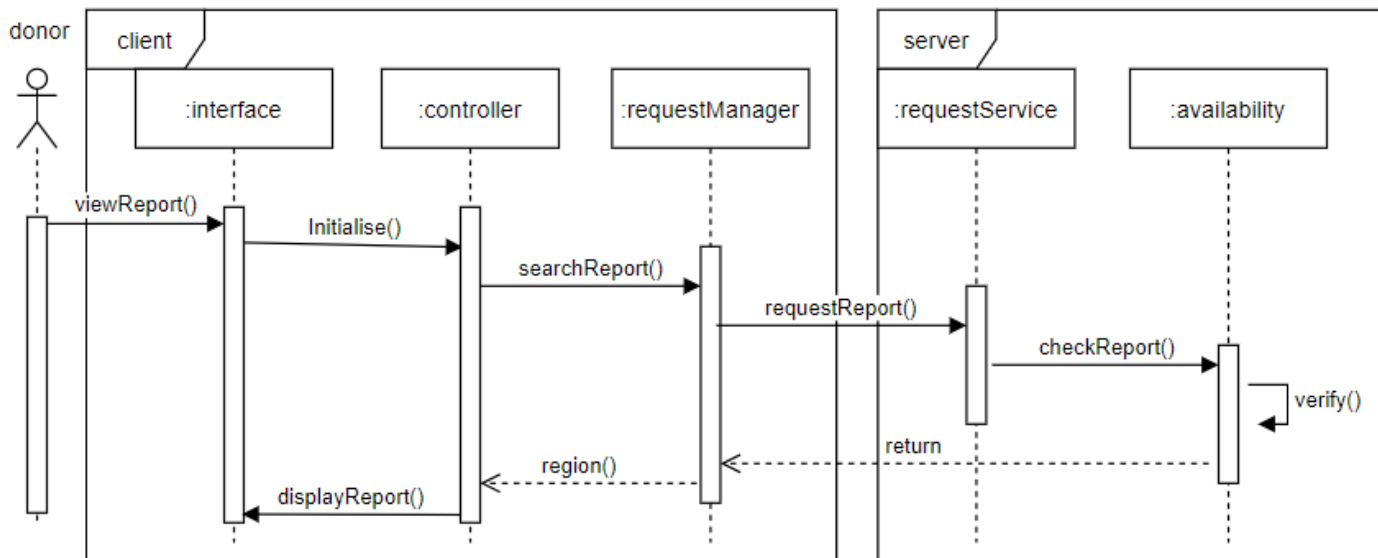


The following table summarizes the information that is captured and was drafted by Faiza:

Method Name	Description
Element: Interface	

requestBlood()	This allows the hospital staff to request for blood groups.
Element: Controller	
customize(bloodGroup, noOfBags)	The system will let the staff to select blood group and number of bags.
Element: RequestManager	
updateCustomize(bloodGroup, noOfBags)	This allows the staff to choose blood group, number of bags depending on how much they require.
Element: RequestService	
sendRequest()	Request the details about the blood to the server side.
Element: Availability	
checkAvailability()	This allows the system to check if the requested blood group and blood bags are available or not.
verify()	The system will verify if the request is valid or not and sends true or false message to the system.

Figure 4.3.10: UC6-view eligibility test report

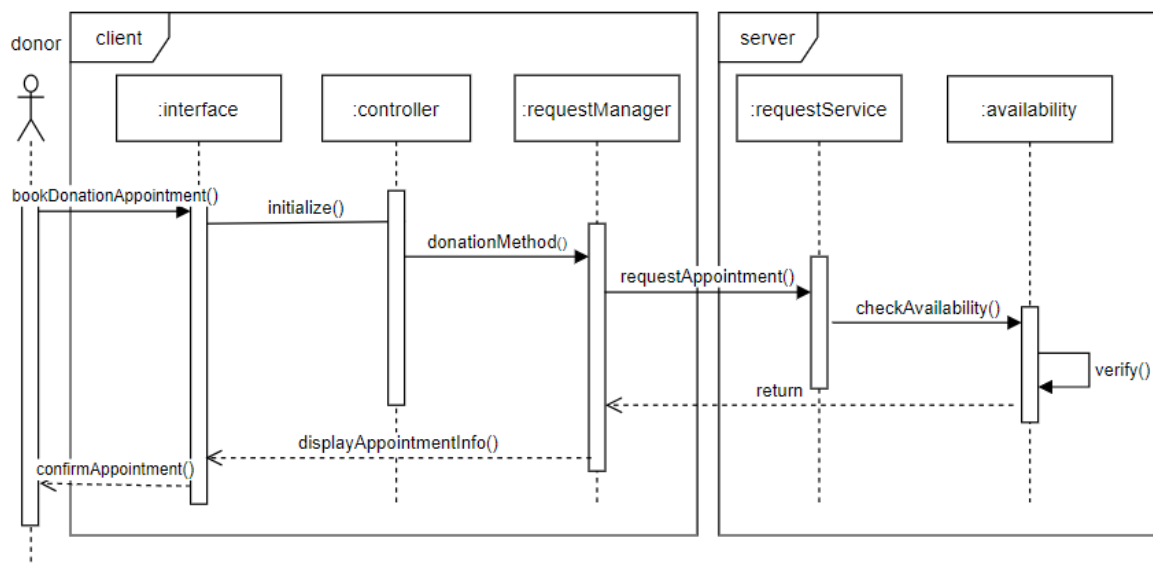


The following table summarizes the information that is captured and was drafted by Afnan:

Method Name	Description
Element: Interface	
viewReport()	This allows the donor to view their test reports.
displayReport()	The test report is displayed to the donor whether eligible or not.
Element: Controller	
initialize()	The system will take all the required information to get access to their report.
Element: RequestManager	
searchReport()	This allows the donor to search their test reports
Element: RequestService	

requestReport()	Request the test report to the server side.
Element: Availability	
checkReport()	This allows the system to check if the test report is available or not.
verify()	The system will verify if the request is valid or not and sends true or false message to the system.

Figure 4.3.11: UC7- book donation appointment



The following table summarizes the information that is captured and was drafted by Maria:

Method Name	Description
Element: Interface	
bloodDonationAppointment()	This allows the donor to book blood donation appointment.
Element: Controller	

initialize()	The system will take all the attributes given to the system and put them in to the system.
Element: RequestManager	
selectDonationMethod()	This allows the donor to select method depending on their wish to choose home or bloodbank.
Element: RequestService	
requestAppointment()	Request the appointment detail from the server side
Element: Availability	
checkAvailability()	This allows the system to check if the requested blood donation appointed is available or not.
verify()	The system will verify if the request is valid or not and sends true or false message to the system.

Step7: Perform Analysis of Current Design and Review Iteration Goal and Achievement of Design Purpose

The following summarizes the design progress and was drafted by Faiza:

Not Addressed	Partially Addressed	Completely Addressed	Design decision made during the iterations.
		UC-2	Modules across the layer and preliminary interfaces to support this use case have been identified.
		UC-4	Modules across the layer and preliminary interfaces to support this use case have been identified.

	UC-5	Modules across the layer and preliminary interfaces to support this use case have been identified.
	UC-6	Modules across the layer and preliminary interfaces to support this use case have been identified.
	UC-7	Modules across the layer and preliminary interfaces to support this use case have been identified.
QA-2		No relevant decision made.
	QA-3	The element that supports the associated use case (UC-4) has been identified.
QA-7		No relevant decision made.
	QA-4	The element that supports the associated use case (UC-4) have been identified.
	QA-5	The element that supports the associated use case (UC-5, UC-7) have been identified.
	CON-6	Modules responsible for collecting data have been identified.
CRN-4		No relevant decision made.
CRN-5		No relevant decision made.
	CRN-3	Modules associated with use case have been identified.

Iteration 3: Addressing quality attributes scenarios driver

This section presents the results of the activities that are performed in each of the steps of ADD in the third iteration of the design process. Building on the fundamental structural decisions made in iterations 1 and 2, we can now start to reason about the fulfillment of some of the more important quality attributes.

Step 2: Establish Iteration Goal by Selecting Drivers

For this iteration, the architect focuses on the QA-2 quality attribute scenario:

- a) Availability (QA-2): The system should be available 24/7.

- b) Usability (QA-7): The system should be simple and easy to use for users of all backgrounds. The layout of the website will aim at easy navigation and access to all the available features.
- c) Performance (QA-5): The system should have response time of not more than 3 seconds.

Step 3: Choose One or More Elements of the System to Refine

For availability scenario and Usability Scenario, the elements that will be refined are the physical nodes that were identified during the first iteration:

- Application Server
- Database Server

For Security Scenario, the elements that will be refined are the physical nodes that were identified during the first iteration:

- Application Server
- Database Server
- User's Workstation

Step 4: Choose One or More Design Concepts That Satisfy the Selected Drivers

The design concepts used in this iteration are the following and was drafted by Afnan:

Design Decisions and location	Rationale and Assumptions
Introduce State resynchronization tactic by replicating the application server.	Through the replication of the critical element, the system can withstand the failure of one of the replicated elements without affecting functionality.
Introduce limit access tactic by introducing an element firewall.	A firewall is a software that is enforced for the limiting the private networks and unauthorized internet users from accessing it. (QA-5, QA-3)

Step 5: Instantiate Architectural Elements, Allocate Responsibilities, and Define Interface

The instantiation design decisions are summarized in the following table and was drafted by Shaffa:

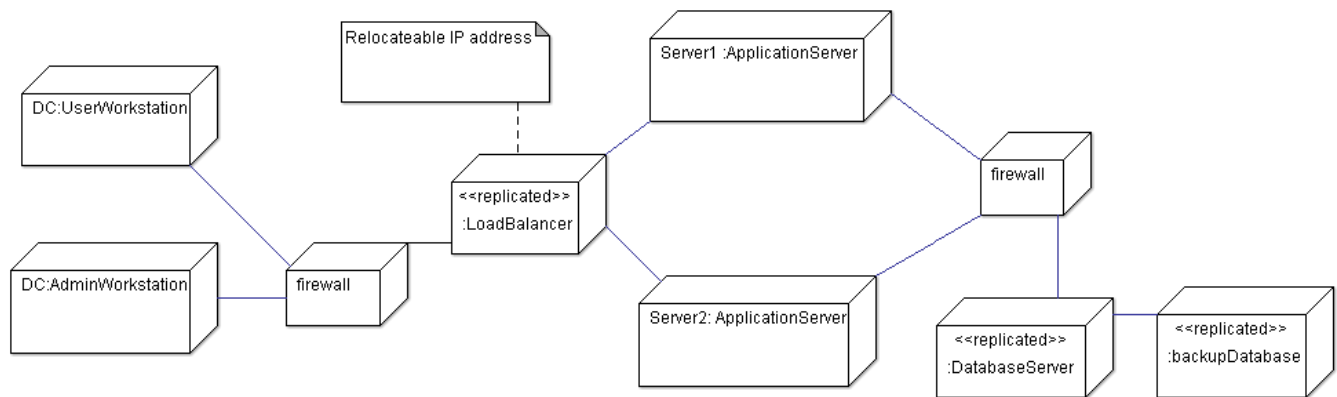
Design Decisions and Location	Rationale
Use state resynchronization and load balancer in the application server	Due to the use of two duplicate application server that are passively active there exist a necessity to balance the load between the servers.
Implement load balance and redundancy using technology support.	The implementation of load balancing and redundancy can be achieved without the need for external technology.
Introducing element firewall.	Firewall is introduced to barrier between secured internal networks and outside untrusted network

The results of these instantiation decisions are recorded in the next step.

Step 6: Sketch Views and Record Design Decisions

The deployment diagram is refined through introducing redundancy and firewalls and was drafted by Maria.

Figure 4.3.11: refined deployment diagram



The following table describes responsibilities for elements that have not been listed previously and was drafted by Faiza:

Element	Responsibilities
Load Balancer	Balances the load of requests coming from the users to the application servers. It also presents a unique IP address.
Firewall	It monitors all the incoming and outgoing network, requests and data and decides whether to allow or block specific traffic based on a defined set of security rules.

The UML sequence diagram shows how the firewall was introduced in this iteration and was sketched by Shaffa and Aisha:

Figure 4.3.13: Sequence diagram illustrating the messages exchanged between the physical nodes to support QA-3(security)

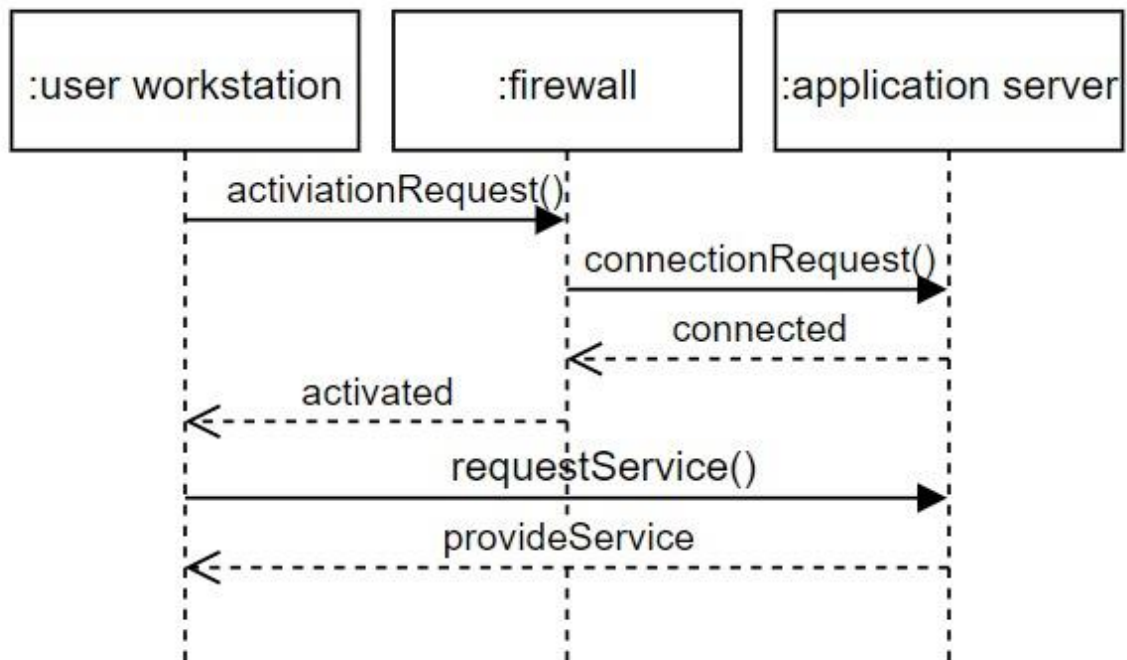
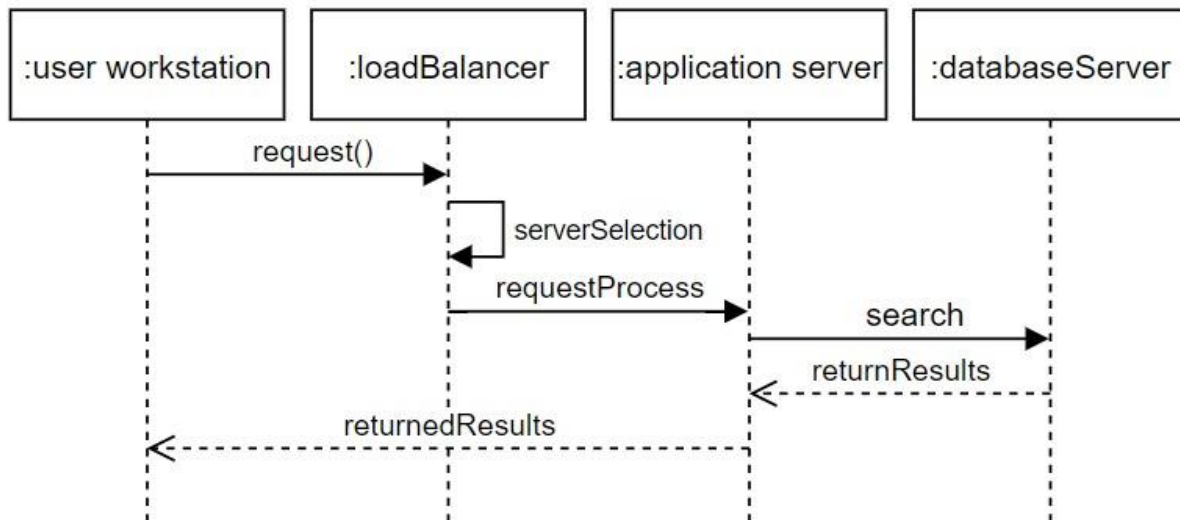


Figure 4.2.14: Sequence diagram illustrating the messages exchanged between the physical nodes to support QA-5(performance)



Step 7: Perform Analysis of Current Design and Review Iteration Goal and Achievement of Design Purpose

The following table summarizes the status of the different drivers and the decisions that were made during the iteration. Drivers that were completely addressed in the previous iteration have been removed from the table. In this iteration, important design decisions have been made to address QA-2, QA-7, QA-5 and was drafted by Afnan.

Not Addressed	Partially Addressed	Completely Addressed	Design decision made during the iterations.
QA-7		QA-2	No relevant decision made. By making the application server redundant, we reduce the portability of failure of the system. Furthermore, if the load balancer fails, a passive replica is activated, so in case the server fails the alternate the functions.
		QA-5	The element that supports this quality attribute, a firewall was defined and demonstrated.
CRN-4			No relevant decisions made.
CRN-5			No relevant decisions made.

