Software Development (SD)

Bir Hassan Technical Institute

Project: Blood bank website
Period: Feb 23, 2024 - May 7, 2024

Submitted by:
Elias Balqis
Mohammad Rajha

Under the Guidance of:
Mr. Tarek Eless
Ms. Fatima Al Khatib

Acknowledgement

The fulfilment accompanying the culmination of this project would be lacking without due acknowledgment of the individuals involved in its attainment. We shall cherish all those who, be it through direct or indirect involvement, lent their contributions to this project.

We extend our thankfulness to our instructor and project mentor, **Mr. Tarik Eless**. His guidance has propelled us closer to the attainment of our project's objectives.

We further wish to convey our profound gratitude to our communication instructor, **Ms. Fatima Al Khatib**, whose generous allocation of time and invaluable insights undoubtedly enriched our project report.

Ultimately, we would like to express our heartfelt gratitude to the almighty and our parents for their unwavering moral support.

- Elias Balqis

- Mohammad Rajha

Executive Summary

Our project, better known as bloodX, is an online platform designed to revolutionise the blood donation and reception processes by supplying users with a convenient and accessible way to schedule appointments, bringing the platform a step closer to achieving its aim of facilitating and enhancing the efficiency of blood donation.

Its user-friendly interface allows users to easily register, schedule appointments, and receive reminders, thereby encouraging blood donations regularly. Moreover, the implementation of the compatibility section allows users to check blood groups compatible with theirs without a hitch.

Staff members are authorised to oversee appointments, track user details, and guarantee a smooth operation of the website, all by the virtue of the administrative panel featured in our platform. This enables administrators to efficiently organise appointments and communicate with donors and recipients, enhancing the overall coordination and effectiveness.

By leveraging the power of technology, bloodX aims to bridge the gap between blood donors and recipients, in order to corroborate a steady supply of blood for those in need, all while providing a trouble-free and user-centric experience. We are confident that this platform will make noteworthy impact in the field of blood donation and healthcare.

LIST OF FIGURES

TABLE OF CONTENTS

1. Introduction

1.1 Definition & Background

Are you aware that every four minutes, an individual in Lebanon finds themselves in need of blood? Establishments of specialised nature, also known as blood banks, bear the responsibility of obtaining, refining, and maintaining blood for the purpose of transfusion. Their indispensable contribution to healthcare frameworks globally guarantees a consistent supply of secure and pleasant blood components, which are essential for countless medical interventions and emergent situations.

1.2 Purpose

This document's primary objective is to provide the reader with an overview of how our website works, along with its outcomes and possible add-ons in the future. The purpose and complete declaration for the development of the website, which includes but is not limited to the system design, modules & features, and interactions with the end-user shall be illustrated in this document.

1.3 Problem Statement

A blood bank's role is to supply individuals in need with the essential blood components. Woefully, due to their reliance on traditional methods, challenges such as limited accessibility to data, and difficulties in tracking donor information and blood compatibility records are oft faced by blood banks. bloodX, the website we developed for our blood bank facility, aims at tackling such obstacles by offering users an online appointment system to effortlessly donate and receive blood. By the same token, an admin panel was implemented for admin users to simplify the process of viewing and manage appointment and user details.

1.4 Goal & Vision

The motivation behind our project stemmed from the desire to streamline the processes of blood donation and reception, enhance donor engagement, and ensure a constant supply of blood for those in need within our community. bloodX aims to accomplish these goals by providing a user-friendly platform for users to register, schedule appointments, and easily donate or request blood.

2. Project Overview

2.1 Scope

Our website will assuage the storing and management process of user details and appointments by offering the features below:

- Registration & login
- Overview & management of the user's profile
- Overview of the user's appointment history
- Online appointment system for easier and faster appointments
- Admin panel for administrators
- General statistics about the number of donors & recipients
- Management of users, donors, and recipients
- Management of appointment requests
- Overview of appointments history
- Overview of appointment reports
- Queue system/waiting list

2.2 Benefits

Multifarious merits and outcomes, such as improved efficiency in blood collection, increased donor recruitment, and easier appointment tracking & management resulted from the implementation of this system.

2.3 Project team

individual	contributions	role
Elias balqis	- provided numerous ideas & suggestions that contributed to the development, deployment, and maintenance of the project - wrote, tested, and improved a reasonable amount of code in the project - wrote and managed most sections of the project report	team member
Mohammad Rajha	- provided numerous ideas & suggestions that contributed to the development, deployment, and maintenance of the project - wrote, tested, and improved most of the project's code	team member
Mr. Tarek Eless	- provided some suggestions that contributed to the development of the project	stakeholder/teacher
Ms. Fatima Al Khatib	- provided some suggestions that contributed to the project report	stakeholder/teacher

Figure 1: *project team table*

2.4 Methodology

The formation of this document resulted from exerting the **descriptive research** method. This method relies on gathering information about a particular group or phenomenon, providing a detailed and accurate picture of the characteristics and behaviours of a particular subject. By observing and collecting data on a given topic, descriptive research plays an important role in providing valuable insights and assisting researchers to gain a deeper understanding of a specific issue. For instance, sections such as technology stack, requirement specifications, constraints, and assumptions can be considered compelling examples for showcasing the usage of this research technique.

Additionally, platforms and tools such as **Discord, GitHub, Obsidian**, and **Visual Studio Code** were used to host meetings, collaborate, organise notes, and work on the project as a team.

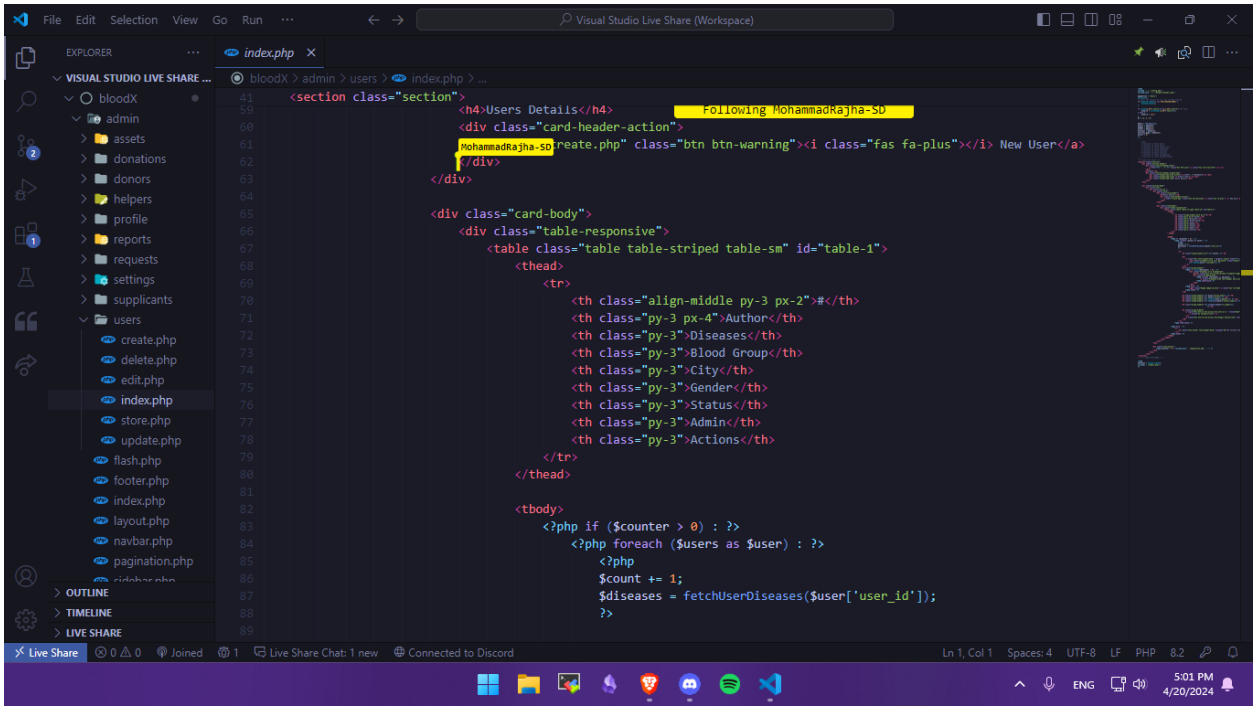


Figure 2: *snapshot of collaboration sessions*

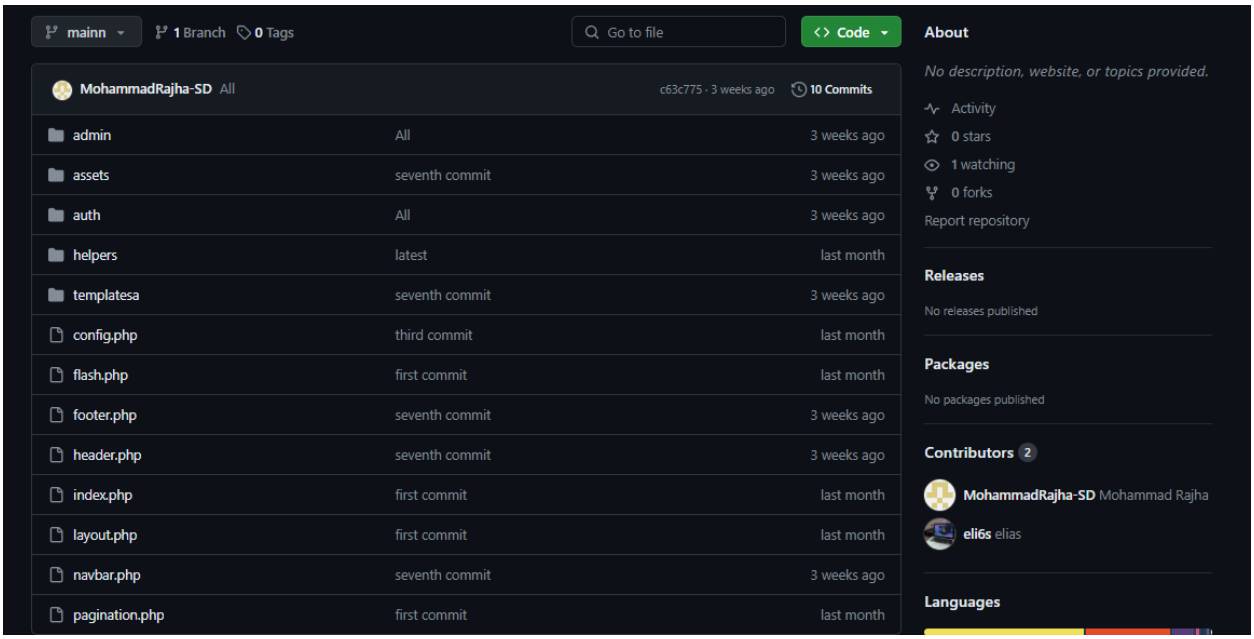


Figure 3: *snapshot of the repository*

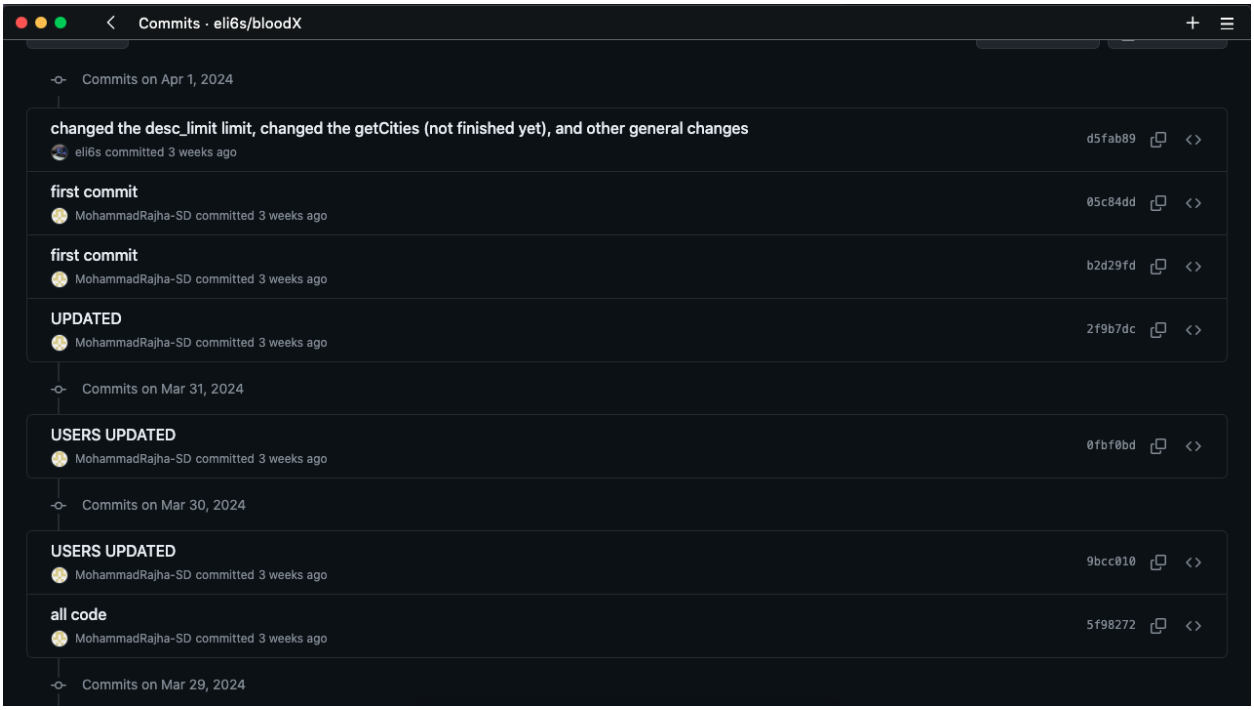


Figure 4: *snapshot of the repository commits*

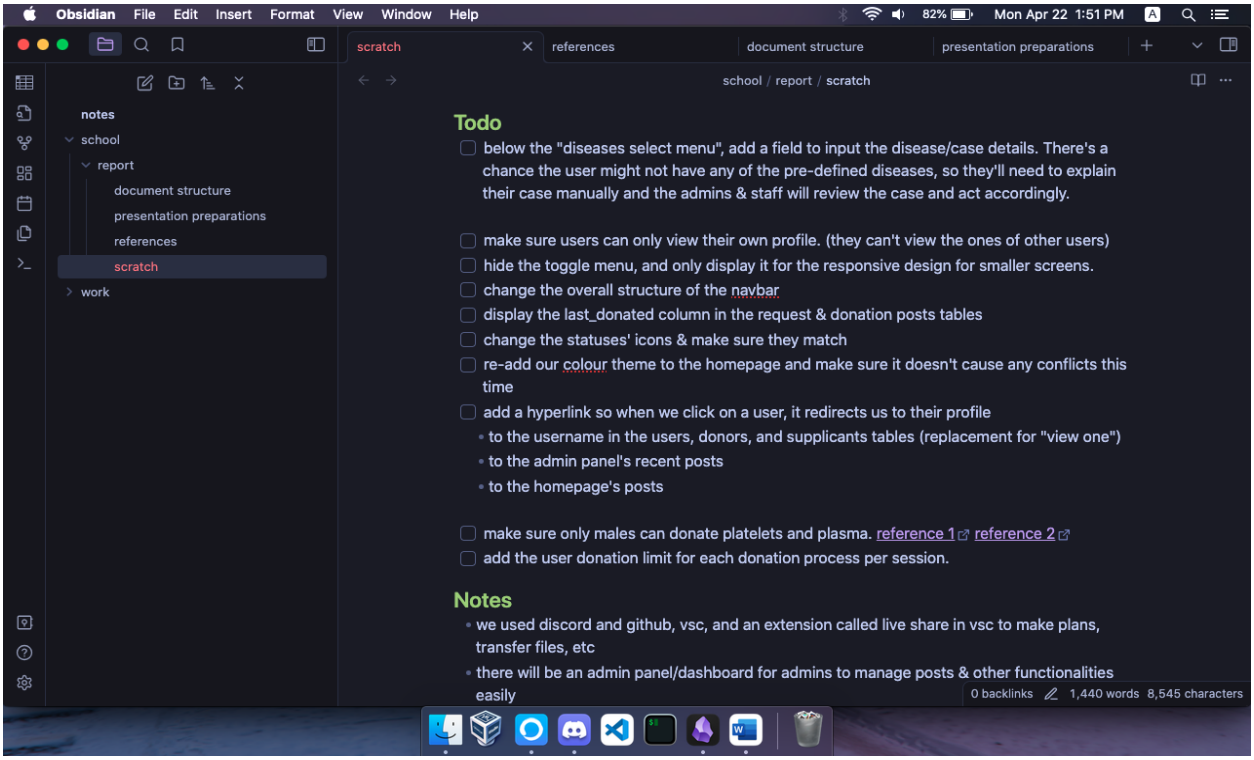


Figure 5: *snapshot of notes & preparations*

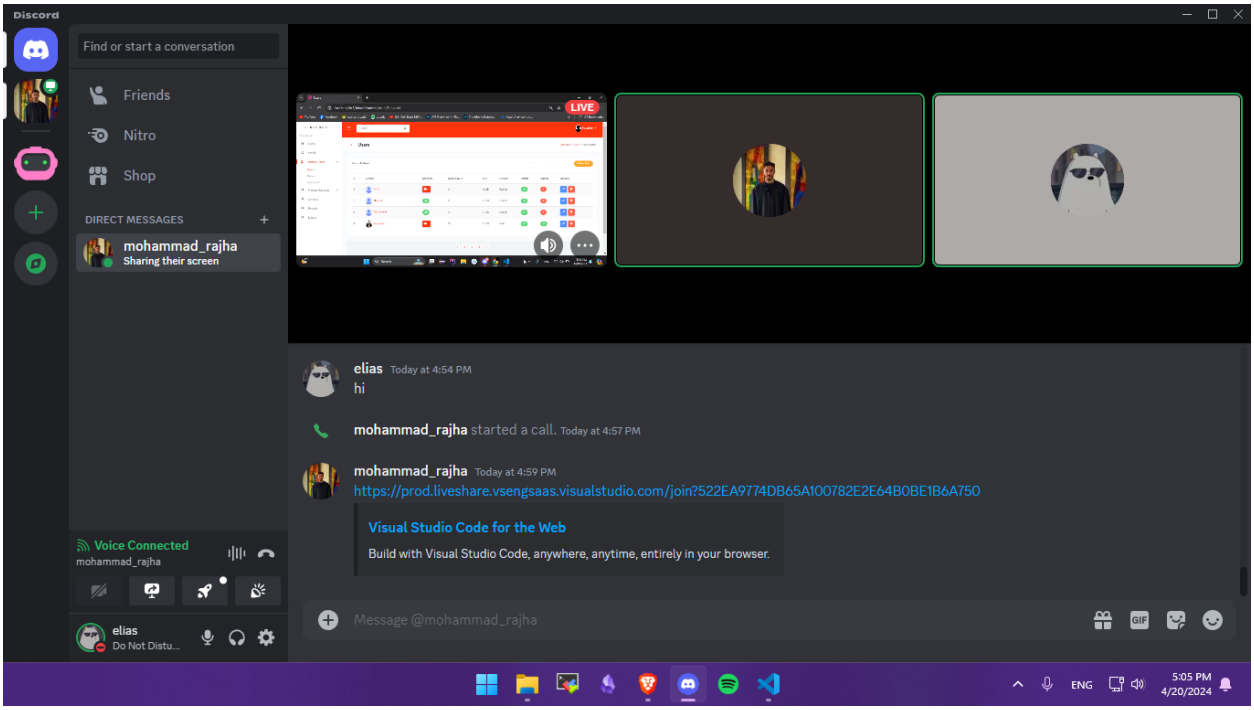


Figure 6: *snapshot of discord meetings*

3. Requirement specifications

3.1 User characteristics

Two types of users will interact with the software, which are:

3.1.1 End-users

These are the standard users, encompassing donors and recipients. As well as possessing the ability to register and login to the website, they have sufficient clearance to personalise and oversee their profiles, scrutinise their appointment history, and solicit appointments for the purpose of blood donation or reception.

3.1.2 Admins

Ordinarily, these users include the blood bank staff, healthcare professionals, and system administrators. They are granted the ability to monitor everything on the website, including overseeing users, appointments, and their corresponding details.

3.2 Software requirements

- ✓ Windows 10/11 operating system
- ✓ WampServer 3.3.x installed
- ✓ All versions of the Microsoft C++ Redistributable (2005 – present)

3.3 Hardware requirements

- ✓ At least an Intel Core i3 CPU
- ✓ At least 4 GB RAM
- ✓ At least 2 GB of Hard Disk space

4. Constraints

Currently, English is the only supported language in the software.

Guest users are not supported. In order to access the full functionality of the software, users must be authorised (registered and logged in).

Plasma donations are not supported. Our blood bank only handles whole blood, power red, and platelet donations.

In order to eliminate nearly all risk of TRALI (Transfusion-Related Acute Lung Injury), platelet donations are only taken from males.

All blood groups may perform “whole blood” donations. The amount per session must be between 450-500 ML.

Only A-, B-, and O blood groups may perform “power red” donations. The amount per session must be 500 ML.

Only A-, A+, and AB- blood groups may perform “platelet” donations. The amount per session must be between 300-650 ML.

5. Assumptions

Firstly, it’s assumed that the end users of this software are familiar with fundamental computer concepts i.e., pointing and clicking.

Additionally, the data filled by the end-user in forms and text inputs is assumed to be meaningful and not just random characters/words.

Last but not least, the admin users are assumed to be vigilant when dealing with sensitive information, chiefly when it comes to deletion or alteration, whether knowingly or unknowingly, potentially leading to errors and misfunctions in the software (and or) inconsistency in the database.

6. Modules & features

The homepage and the admin panel are the two segments that make up this website. The functionalities found in the homepage are mainly used by the end-user, whereas the admin panel is wielded and accessible only by admins.

6.1 Homepage

6.1.1 Registering & logging in

Simple and straightforward registration and login systems. Users would fill in the required details for account creation, and upon logging in, they’ll gain full access to the functionalities of the website.

6.1.2 Viewing & managing one's profile

Logged in users are able to view their profile and modify details such as their email, phone number, blood group, etc. A user's profile is public, meaning it's visible to everyone.

6.1.3 Viewing one's appointment history

Logged in users have the ability to view their appointment history. This includes all their completed, cancelled, and rejected appointments. Logically, their appointment history is private and only visible to them.

6.1.4 Resetting or changing one's password

In case of a forgotten password, this functionality is rather handy. After logging out and navigating to the login page, users are required to click "forgot password" in order to reset their password. To acquire the password-reset link from inbox, they'll be asked to input their email. On the other hand, changing a password requires users to be logged in. It is as easy as going on their profile, clicking **edit**, and filling in their current and new password.

6.1.5 Making appointments

In order to donate or receive blood, logged in users must solicit an appointment through the online appointment system. The instant their request for an appointment gets approved, a notification containing details regarding the status and date of their appointment will pop up in their "recent appointments" section on the homepage.

6.1.6 Contacting us

Our smooth and straightforward contact system permits users to get in touch with us by navigating to the "contact us" section, where they may compose an email ventilating their questions and complaints.

6.2 Admin panel

6.2.1 Viewing & managing one's profile

Similarly to standard users, logged in admin users are able to view their profile and modify details such as their email, phone number, blood group, etc. An admin user's profile is also public, meaning it's visible to everyone.

6.2.2 Resetting or changing one's password

Equivalently to end-users, this feature may also be used by admins. Succeeding the navigation to the "settings" section in the sidebar, admins will be presented with possibilities to reset or change their password. Upon clicking "reset password", they'll be asked to input their email in order to acquire the password-reset link in their inbox. On the other hand, clicking "change password" would present them with text inputs corresponding to their original and new passwords.

6.2.3 Viewing & managing users, donors, and recipients

The "manage users" section allows admins to view and manage the data of users, donors, and recipients. They're able to search for, modify, or completely delete entries.

6.2.4 Viewing & managing appointment requests

When a user attempts to donate or receive blood, a request to book an appointment is forwarded to the admin panel. Details regarding these appointment requests are presented in the form of a table in the "manage requests" section. Admin have the authority to observe, approve, and deny these requests. An appointment is marked as a request only when its condition is **pending**.

6.2.5 Viewing the appointments history

Appointments with the status **completed**, **cancelled**, and **rejected** are displayed in the "appointments" section. For security reasons, we settled at not granting admins clearance to alter or erase displayed entries, making the data view-only.

6.2.6 Viewing the reports history

This section was introduced to be of service by supplying the admins with reports regarding appointments. They may filter out appointments created in the last 1, 7, 30, 60, or 90 days. Only appointments with the status **completed**, **approved**, **cancelled**, and **rejected** will be presented. For security reasons, we settled at not granting admins clearance to alter or erase displayed, making the data view-only.

6.2.7 Viewing & managing the waiting list/queue

Once an appointment request gets approved by an admin, it will be appended to the waiting list. In this section, admins have sufficient clearance to mark an appointment as **completed** or **cancelled**, depending on peculiar circumstances which correspond to the appointment.

7. Technology stack

We brought our website to life using a combination of HTML, CSS, and JavaScript for the frontend section, and PHP for the backend. For storing necessary information, MySQL was the most fitting database. Due to this particular stack being mandated by the institute, it was an obligation upon us to utilise it in our project. Had it been otherwise, we would've doubtlessly taken a different route to develop this project.

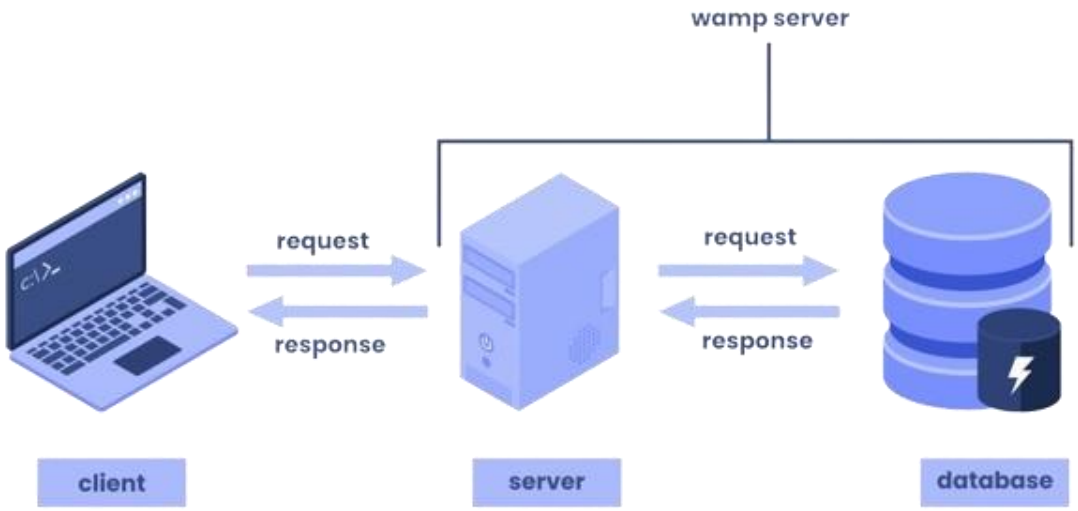


Figure 7: client-server demo.

7.1 HTML

Hypertext Markup Language, HTML for short, is the standard markup language for documents designed to be displayed in a web browser. It defines the structure of a website, making it basically the skeletal system of every website, including ours.

7.2 CSS

Cascading Style Sheets, also known as CSS is used for styling and beautifying the content and design of a website. Although some vanilla CSS was utilised in our website, most of the styling was dependent on the **bootstrap framework**.

7.3 Bootstrap

The number one free and open-source CSS framework whose main purpose is to facilitate the development of responsive websites by offering countless templates for forms, buttons, navigation, and many other interface components. For our website's homepage, **bootstrap 5.0** was implemented, whereas for the admin page, we chose to use **bootstrap 4.1**.

7.4 JS

JavaScript, often abbreviated as JS, is a programming language and core technology of the web, alongside HTML and CSS. 99% of websites use JavaScript on the client side for website behaviour. In spite of the **jQuery library** being put to use throughout the development phase of our website, vanilla JavaScript was still used to some extent.

7.5 jQuery

jQuery is a JavaScript library designed to simplify HTML DOM tree traversal and manipulation, as well as event handling, CSS animations, and AJAX. **jQuery 3.6** was used for this project. AJAX was implemented for database-related operations, in addition to supplementary jQuery functionalities being used for other features such as the initialisation of the **Virtual Select** library.

7.6 PHP

PHP is a server-side programming language geared towards web development. It can be used to create websites, applications, and much more. **PHP 8.0** was utilised for the backend development of our website.

7.7 MySQL

MySQL is an open-source relational database management system. Since it's included with WampServer, it was the most fitting option for the storage of our website's data. For this project, **MySQL 8.0** was used.

7.8 Geonames API

To fetch all the cities found in Lebanon, the Geonames API was used in order to perform a one-time API call. An array inside the **getCities** function, which can be found in helpers/helpers.php, was populated with the returned result from the API.

8. Database

8.1 Design philosophy

Normalisation is the process of organising the data in the database. It is used to minimise the redundancy from a relation or set of relations. Furthermore, normalisation is known for dividing the larger table into smaller ones and linking them using relationships. The 3NF technique was applied on our database tables. A relation is said to be in 3NF if it's in 2NF and no transition dependency exists.

8.2 Data Dictionary (DD)

8.2.1 Users table

Field	Data type	Size	Constraint
user_id	INT	11	P.K
username	TEXT	50	N/A
name	TEXT	50	N/A
email	TEXT	100	N/A
passwrd	TEXT	100	N/A
phone_number	TEXT	20	N/A
gender	TEXT	10	N/A
blood_group_id	INT	11	F.K
birthday	TIMESTAMP	N/A	N/A
city	TEXT	60	N/A
profile_pic	TEXT	50	N/A
status_id	INT	11	F.K
is_admin	BOOLEAN	N/A	N/A
donated_at	TIMESTAMP	N/A	N/A
created_at	TIMESTAMP	N/A	N/A
updated_at	TIMESTAMP	N/A	N/A
reset_token	TEXT	255	N/A
expiry	TIMESTAMP	N/A	N/A

8.2.2 Appointments table

Field	Data type	Size	Constraint
appointment_id	INT	11	P.K
user_id	INT	11	F.K
status_id	INT	11	N/A
blood_process_id	INT	11	N/A
type	TEXT	25	N/A
blood_unit	INT	11	N/A
created_at	TIMESTAMP	N/A	N/A
updated_at	TIMESTAMP	N/A	N/A
approved_at	TIMESTAMP	N/A	N/A
appointment_at	TIMESTAMP	N/A	N/A
case_details	TEXT	150	N/A

8.2.3 Blood groups table

Field	Data type	Size	Constraint
group_id	INT	11	P.K
group_name	TEXT	3	N/A

8.2.4 Blood processes table

Field	Data type	Size	Constraint
process_id	INT	11	P.K
process_name	TEXT	30	N/A
interval_days	INT	11	N/A
min_	INT	11	N/A
max_	INT	11	N/A

8.2.5 Diseases table

Field	Data type	Size	Constraint
disease_id	INT	11	P.K
disease_name	TEXT	50	N/A

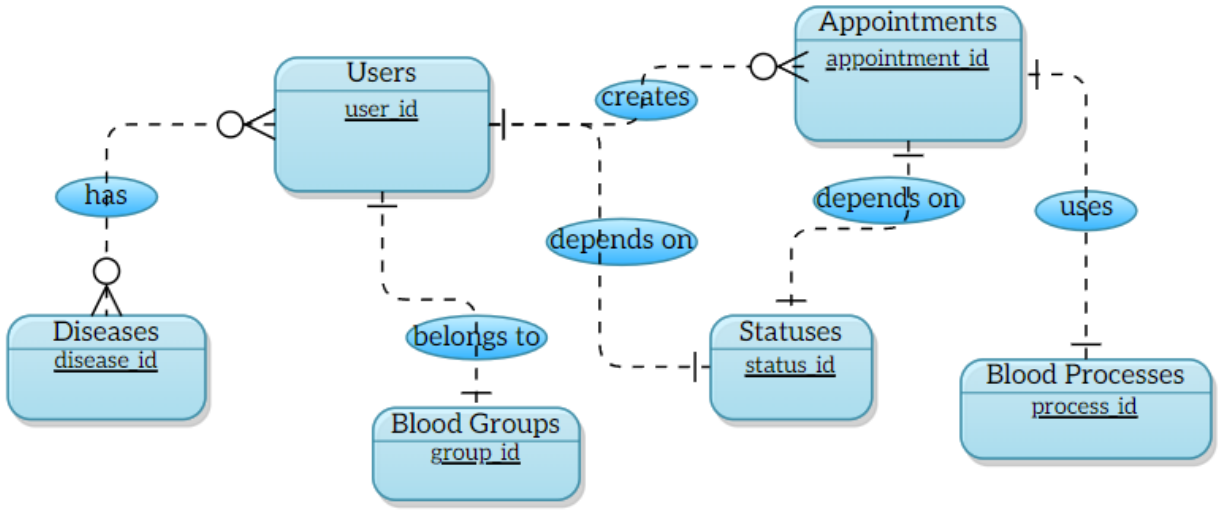
8.2.6 User diseases table

Field	Data type	Size	Constraint
user_id	INT	11	F.K
disease_id	INT	11	F.K

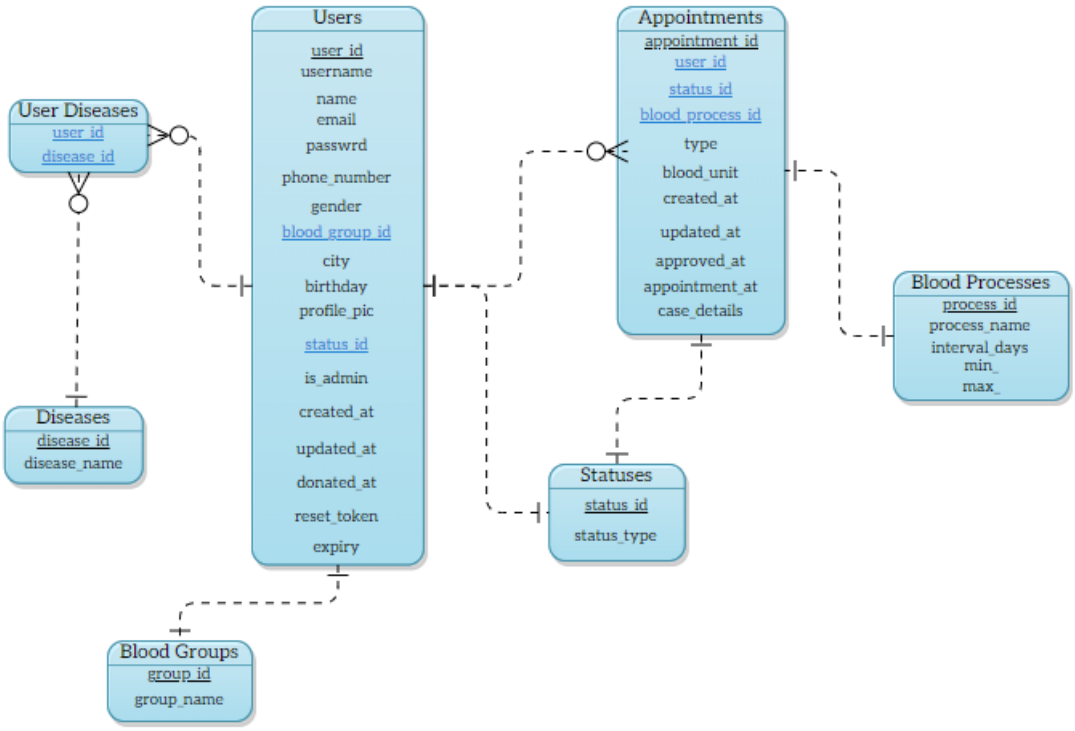
8.2.7 Statuses table

Field	Data type	Size	Constraint
status_id	INT	11	P.K
status_type	TEXT	20	N/A

8.3 Conceptual Data Model (CDM)



8.4 Logical Data Model (LDM)



9. Incidents & resolutions

In this section, we shall dive into the errors and trials we faced throughout the development phase, along with their corresponding solutions. They are in descending order, meaning the major ones will be explored first. Kindly bare in mind that extremely minor incidents will not be discussed, as the size of this section would become relatively unfathomable.

9.1 Idea swapping mid-development

The idea swapping mid-development was infuriating to some extent. Originally, the idea was about listing posts for blood donations and requests. Users would create posts to donate or request blood, and other users from the same country would view these posts and get in touch with the post owner in order to donate or receive blood from them. Despite this idea sounding inventive and futuristic, it lacked efficiency since blood donations and receivals can be easily done by paying a local

blood bank a visit. The idea of representing a specific blood bank was agreed on for being the most fitting replacement. As a result, the post listing had its place taken by an online appointment system, in order to accelerate and facilitate the blood donation and reception processes.

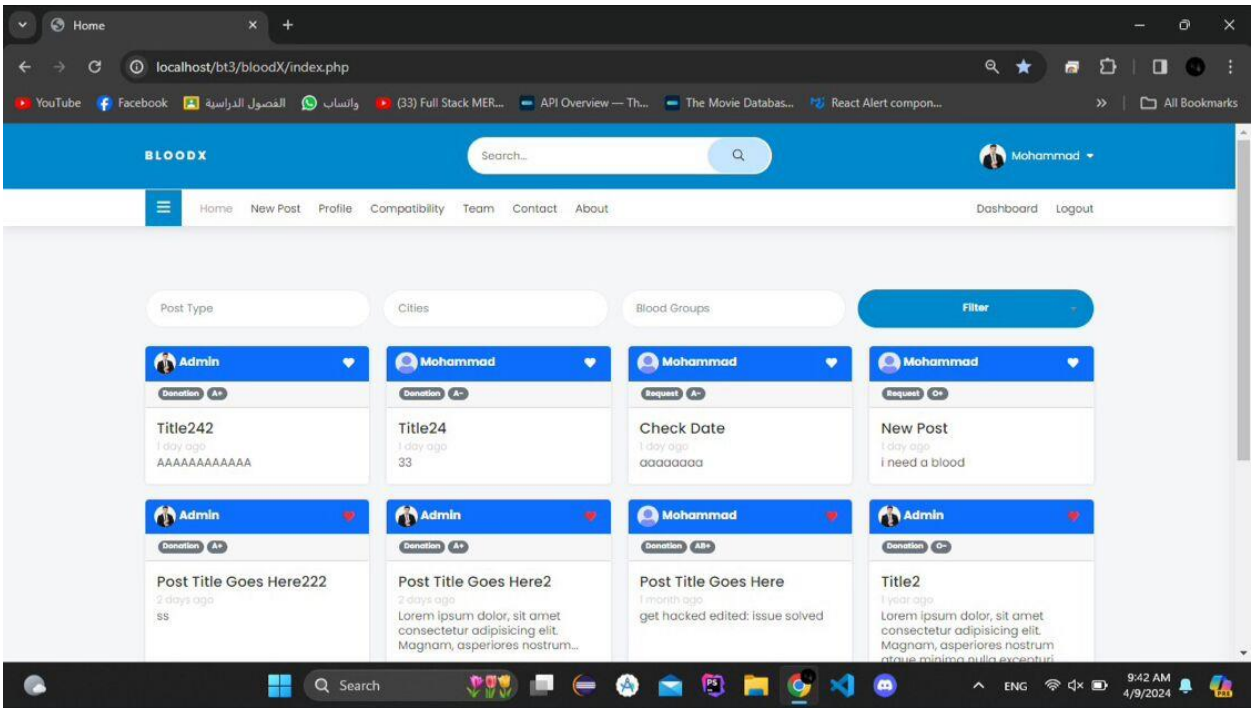


Figure 8: *snapshot of the original project idea*

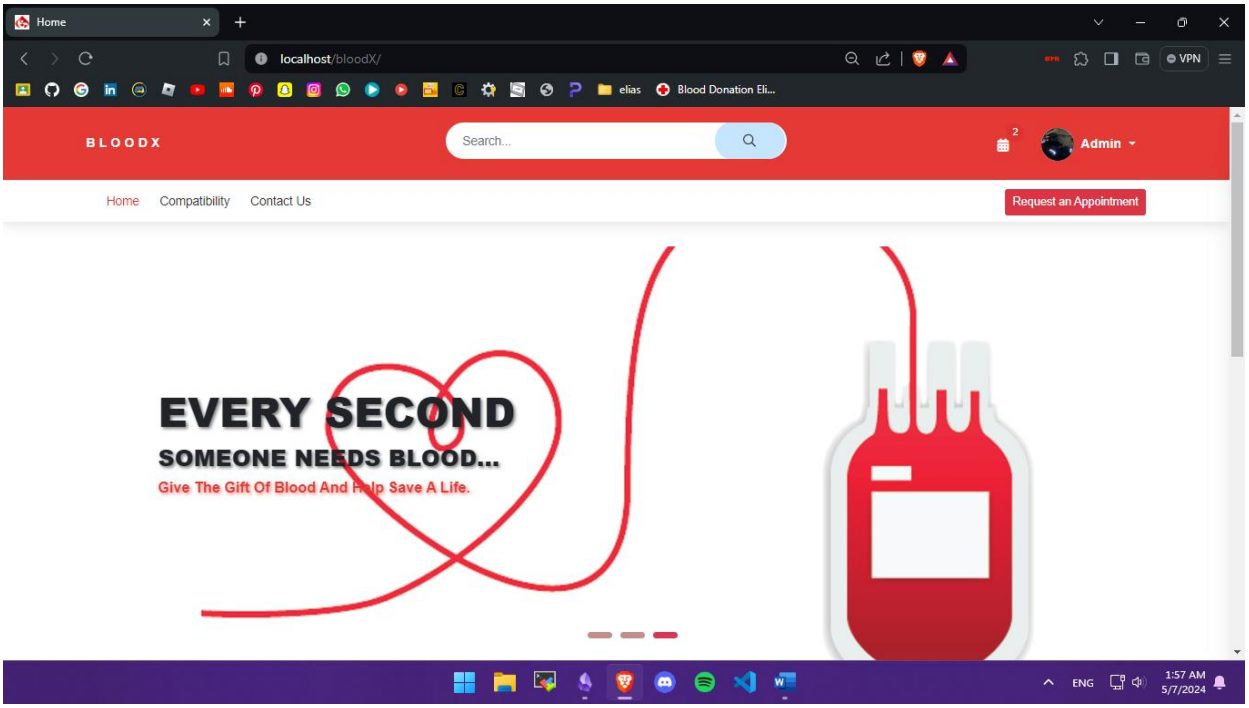


Figure 9: *snapshot of the new project idea*

9.2 ON DELETE CASCADE

When defining foreign keys in database tables, one tends to rely on the ON DELETE CASCADE to prevent any complications from arising in the child table, in case of the erasure of the primary key in the parent table. Although it was being defined correctly, the ON DELETE CASCADE didn't seem to work at first, which left us quite perplexed. Upon further investigation, the issue was identified and resolved by switching the tables types from MYSIAM to InnoDB.

9.3 Admin users potentially deleting their own data

Our SELECT queries, which are substantially used to populate tables with information, were displaying the data of the logged in admin user, opening up the possibility for them to erase their own data if they wished to. Since this could lead to errors and inconsistency in the software, a fix had to be initiated as swiftly as possible. As a result, the queries were modified and the line "**users.user_id <> $user_id**" was added, allowing the seal to be set on this matter.

9.4 Issues with profile pictures

It caught our attention that upon the removal of a user from the database, the deletion of their profile picture, which is stored in a local folder, was unsuccessful. To resolve this matter, the **“**deleteImage**”** function was implemented.

Unluckily, an issue concerning the standard profile picture crossed our path. In the event that a user had not provided a custom profile picture, the default one would act as a placeholder and be automatically assigned. The dilemma here is that, should the user be deleted, the default profile picture would also be subject to deletion. To address this, the "deleteImage" function was modified to incorporate a safeguard, whereby deletion would be skipped if the image is explicitly "default.png."

```
function deleteImage($dir, $path) {
    // Check if the file exists before attempting to delete it
   // If the file is NOT “default.png”, we proceed with the deletion
    if (file_exists($dir . $path) && $path !=
$_SESSION['DEFAULT_IMAGE_PATH']) {
        // Attempt to delete the file
        unlink($dir . $path);
    }
}
```

Figure 10: *deleteImage function code snippet*

10. Testing

10.1 Technique

Manual testing is the technique of manually testing software for defects. A tester would play the role of an end user, where most of the application's features are put into action to ensure unerring behaviour. It’s a time-consuming process, as it’s done by humans rather than automation scripts. Characteristics of this technique include flexibility, examining complex situations, and testing user interfaces (UI). The familiarity with the product, stability, and the increased fixation of defects are the primary reasons behind the essentialness of this technique.

10.2 Tested features

Throughout the testing phase, we went over most features and modules of the website to ensure their stability and the end-user experience.

The User Interface (UI) was undoubtedly of great importance. We made sure it's user-friendly, easy to navigate through, and most importantly, responsive on mobile and other devices.

Afterwards, we tested the login and signup systems. While putting ourselves in the end-user's shoes, all the checks and limits were taken into consideration and thoroughly examined throughout the process.

Moving on, the "forget password" section was examined to guarantee its functionality and stability. We verified that password reset tokens are one-time use, and that they cease to exist 1 hour subsequent to their generation.

Next on the list was testing the "contact us" section. Simply, we ensured the email-sending procedure was successful and free of any issues and errors.

Furthermore, it was essential to conduct a thorough inspection of the "appointments" section to guarantee its functionality and stability. This involved verifying the functionality of all components including the dispatching of emails to users, the validation of dates to ensure appointments cannot be scheduled in the past, and the enforcement of constraints within text fields.

Lastly, we tested and verified the stability and functionality of all the sections within the admin panel. The defers identified were quite insignificant, yet they demanded attention and could not be disregarded. The outcome was a website that is both reasonably responsive and functional.

11. Installation & setup instructions

Although bloodX is a web application, one still has the ability to run it locally using the following prerequisites: **WampServer**, and the **C++ Redistributable.** Features such as **forget password** and **contact us** require an internet connection due to the utilisation of the **emailJS** library. As a result, having an internet connection is exhorted to ensure their functionality**.** Anyways, without further ado, the installation and setup instructions are as follows:

a) Clone one of the repositories if you don't have the source code already:
$ git clone https://github.com/MohammadRajha-SD/bloodX.git
$ git clone https://github.com/eli6s/bloodX.git

b) Download and install WampServer 3.3.x on your machine:
https://www.wampserver.com/en/download-wampserver-64bits/

c) Download and install all versions of the C++ Redistributable:
https://learn.microsoft.com/en-us/cpp/windows/latest-supported-vc-redist?view=msvc-170

d) Open up your web browser and navigate to phpMyAdmin:
http://localhost/phpmyadmin/

e) Create a database called **blood_bank**:
CREATE DATABASE IF NOT EXISTS blood_bank;

f) After downloading the **blood_bank.sql** file:

- **Navigate to the "import" tab in phpMyAdmin**
- **Click on it and choose the SQL file**
- **Click import**

g) You're all set! Start using bloodX:
http://localhost/bloodX

h) To login as an admin:
username: **admin**
password: **admin12**

12. Future enhancements

In the course of time, a handful of upgrades and improvements shall be carried out in order to enhance and enrich our project.

- the ability to conduct name specific donations, meaning the blood you donate will only be given to that particular individual.
- a more sophisticated and specific system for roles and permissions (moderator, staff, manager, etc.).
- an inventory/stock management system.
- predictive analytics for inventory management

Support for **name-specific donations** would be tremendously convenient, especially if these donations are aimed at a family member or friend.

The current system for **roles and permissions** is fairly unsophisticated. Developing a more state-of-the-art one would increase the flexibility in managing the role hierarchy and permissions.

Developing a system to manage and track the **stock and inventory** of our blood bank facility would significantly lessen accidents and errors. The navigation and handling of UI based systems is known to be as easy as pie, making such systems more advantageous and favoured over traditional ones.

Implementing **predictive analytics** using machine learning will play a major role in the anticipation of demand and prevention of shortages. Models can be trained over time to respond to new data or values, delivering results that fit our needs.

Technology advancements have also been taken into consideration. As time passes, we could end up utilising Next/React.js to re-write the frontend portion of the project. For the backend section, we could bring into play technologies such as Flask, Django, or Laravel. Finally, PostgreSQL or SQLite would take the place of MySQL.

13. Conclusion

In a nutshell, the future of blood bank management will be contingent on systems such as bloodX, due to the utilisation of innovative techniques, rather than old-school ones. Such systems aim to replace traditional methods with more pioneering ones, in order to ease the procedure of requesting appointments for users, and the tracking of donor information and blood compatibility records for staff. This expedites the process of blood reception and donation, resulting in a more refined experience for both end users and administrators, leading to their satisfaction.

References

1) Wikipedia
2) https://www.citewrite.qut.edu.au/write/writing-well/report.html
3) https://www.enago.com/academy/descriptive-research-design/
4) https://www.javatpoint.com/dbms-normalization
5) https://www.moph.gov.lb/userfiles/files/Quality%26Safety/BloodTransfusion/BrochureGeneral_en.pdf
6) https://www.slideshare.net/AKSHAYPRATAP0/completeminiprojectreport
7) https://www.slideshare.net/CrGaurav/a-project-report-on-chat-application
8) https://www.slideshare.net/ManojKumar1530/attendance-management-system-project-report