

Web-based Development: Smart Blood Bank Management System

Smart Blood Bank Management System

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Abstract: *Smart Blood Bank Management System is a web-based system developed to help blood bank staff to manage the donor and recipient record. The current system used by the blood bank is a manual system in which the blood bank staff need to register donor and patient manually by filling their details in paper form. With the manual system, there are issues in managing the donor and patient records and there is no centralized database of the donors and recipients. This system allows staff to manage the donor and recipient information. It also accepts registration for people who intend to become a donor. The blood bank staff are able to search for the donor and request blood through this system for the recipient. The development of this system is the Waterfall model methodology which includes six phases namely requirement analysis, system design, implementation, testing, and maintenance. The software used are Visual Studio code and the database used is phpMyAdmin. This system consists of several modules which are login, donor management, blood donation, recipient management, handed over and user. This system is expected to help blood bank staff in managing donor and recipient information.*

Keywords: *web-based, donor, recipient*

1. Introduction

Blood is one of the most important components of human life. There are a variety of situations in which the need for blood arises in society. People should donate blood to those in need since it has the potential to save lives and can be used individually for patients with specific conditions [1]. Blood donation is typically performed at a hospital or blood bank center, which is a location where blood is collected and stored before it is needed for transfusion [2]. Blood is collected during blood donation, which involves blood donors. All details of every activity involving donating and receiving blood will be managed by blood bank staff. Currently, computerized blood bank management is not used by the blood bank center. Usually this is done manually where all the details of the donors and patients will be filled in the paper form. Plus, the blood bank staff will keep the form in a file for future use if they do not record the details in the system. This puts them at risk of losing the forms if misplaced. The main

problem is finding donated blood. Blood center staff have to search one by one which can take a long time. Additionally, paper records can be lost or misplaced. Therefore, the thing that should be done to solve these problems is the system for the blood bank management to make it easier for the blood bank staff to register the donor and recipient. Moreover, to ease the staff to manage donors and recipients records. Hence, the Smart Blood Bank Management System which is a web-based system is designed to manage donor and recipient information as the system provides blood bank staff with many conveniences for the management of the donors and recipient. The objective of this system is to design and develop Smart Blood Bank Management System using structured and web-based approach. Furthermore, to test the functionality of the system to ensure it fulfills user requirements. Target users for this system are blood bank staff and the administrator.

2. Related Work

2.1 Comparison with the Existing Systems

Table 1 shows These are existing systems such as Bharat blood bank, Blood donation management system and Lions blood bank and research foundation. These three systems have the similar part with the proposed system and it is worth making a comparison analysis.

Table 1: Comparison Between Existing System and Proposed System

System Feature	Bharat Bank	Blood Donation Management system	Lions Bank Research Foundation	Blood & Bank Management System
Login module	√	√	√	√
Donor management module	√	√	√	√
Blood donation module	√	√	√	√
Recipient module	X	√	X	√
Searching function	√	√	X	√
System type	Online	Online	Online	Online

3. Methodology

Waterfall Methodology is another approach used in the Software Development Life Cycle (SDLC). The Waterfall Approach is a linear application development model with fixed stages that begin when one phase ends. Steps are performed in order, and if the model is left unchanged, developers will be unable to return to prior steps (Eric Conrad, 2011). It was chosen for implementation in the Smart Blood Bank Management System because it is very easy to learn and operate. There will be no overlapping phases in a waterfall model since each phase must be completed before the next can begin. The phases consist of requirement analysis, system design, implementation, testing, and maintenance. The phases in the waterfall model are as shown in Figure 1 below.

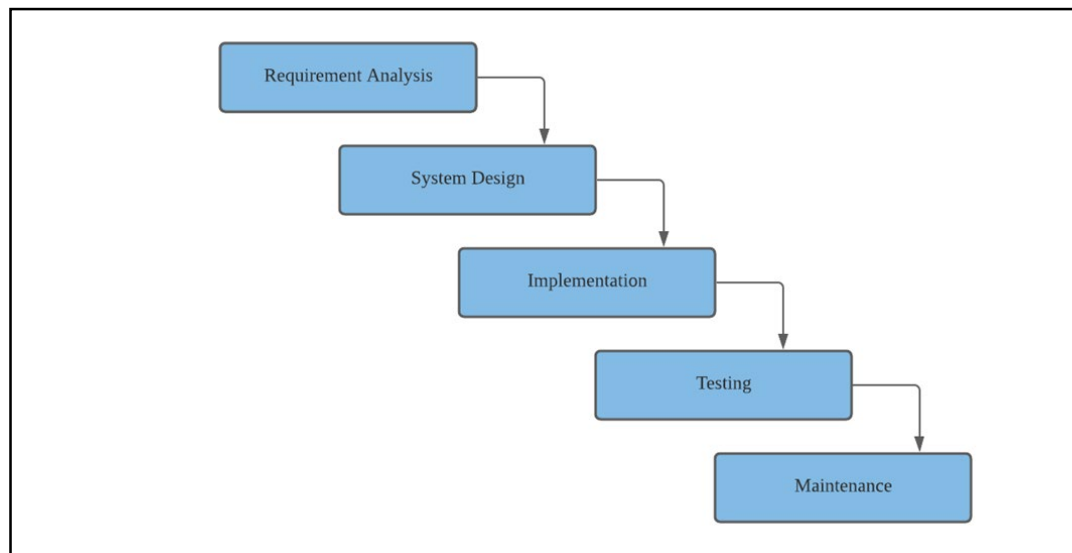


Figure 1: Waterfall Methodology

3.1 Requirement Analysis Phase

In this phase, the possible requirements for Smart Blood Bank Management System are recorded and analyzed. The problem statement, objectives, system scope, and literature review had all been stated. This first phase is also done by find the solution for the problem faced. Hence, this project, Smart Blood Bank Management System was proposed. A Gantt Chart is developed as a guide so that each task is completed on time. Information on hardware and software requirements has also been gathered.

3.2 System Design Phase

The design phase is focused on how the proposed system will be constructed. The requirements gathered from the first phase are studied and the system design for Smart Blood Bank Management System is prepared which meet the hardware and system requirements. This to ensure that the requirements are suitable with the system. This stage will assist in defining the overall system flow for Smart Blood Bank Management System. Designing the Context Diagram (CD), Data Flow Diagram (DFD), and Entity Relationship Diagram (ERD) are also being done here in order to translate the process flow of Smart Blood Bank Management System

3.3 Implementation Phase

After the design phase is the implementation phase. This is where programming or coding during a software development [3]. In the implementation phase, the source code is written following the requirements. The code is written to produce a functional system. Smart Blood Bank Management System is developed using Visual Studio Code and the database that will be used to store data of the proposed system is phpMyAdmin by XAMPP.

3.4 Testing Phase

Once the implementation is done, Smart Blood Bank Management System will be tested and evaluated to detect any problem that might occur on its performance. Error is fixed in this phase. This is also where the system will be determined whether it meets the requirements or not.

3.5 Maintenance Phase

After the testing phase, the next step is to provide support and maintenance for the system by making sure it works perfectly as it should. If user got any errors during the process, fixing them is the main purpose of this stage.

4. Analysis and Design

The software used in system development are and Visual Studio Code for code editing while the data will be stored in phpMyAdmin.

4.1 Functional and Non-Functional Requirements

a. Functional Requirements

- i. This system allows staff to register healthy person as a donor
- ii. This system allows staff to register people who need blood as a recipient.
- iii. The admin and staff should have access to all the details of donors and recipients
- iv. The system will use a database to facilitate data collection, store, and access data.

b. Non-Functional Requirements

- i. The system should be always available if internet connection is reliable
- ii. The system can be run in the device.
- iii. The system will have backup and recovery requirements such as stored data in database.
- iv. The system will allow administrator and staff to create, read, update and delete information.

Table 1: Example of presenting data using a table

Item	Parameter Name	Variable Value	Unit or Dimension
1	Data Point 1	0.001	Kilograms (kg)
2	Data Point 2	1.000	kgm/s ²
3	Data Point 3	1.0 x 10 ⁴	psi
4	Data Point 4	-1.0 x 10 ⁻⁴	Dimensionless

4.2 Context Diagram

The system context diagram shows a complete system with its inputs and outputs from external factors or to external factors such as administrators as well as users. The system context diagram represents all external entities that interact with the system (Alexander Kossiakoff, William N. Sweet, Samuel J.Seymour 2011). The main objective of the context diagram sketch made is to focus on the external factors that need to be emphasized in developing a system that is complete with requirements and free from problems. System context diagrams are used at the initial stage of the project to obtain agreement for the scope that has been studied.

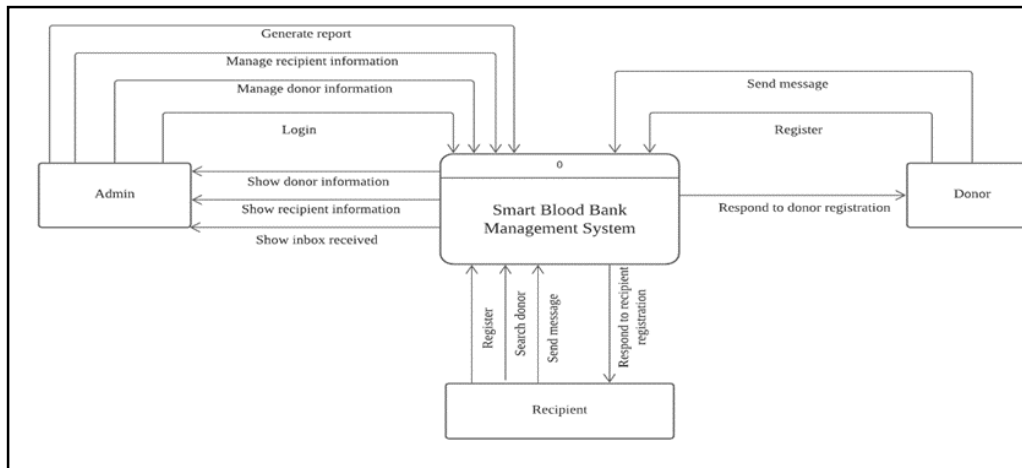


Figure 2: Context Diagram

Figure 4.1 shows a context diagram for Smart Blood Bank Management System. There are two entities involved in this namely administrator and staff.

4.3 Data Flow Diagram level 1

Level one data flow diagram or "DFD Level 1" is used to show how the system is divided into several sub-systems which are the processes involved in the system. In a level one data flow diagram, the processes involved in a zero-level data flow diagram will be further broken down and described in more detail. Each of the processes will relate to one or more of the flow data from external factors or to external factors where both are required to produce a complete system.

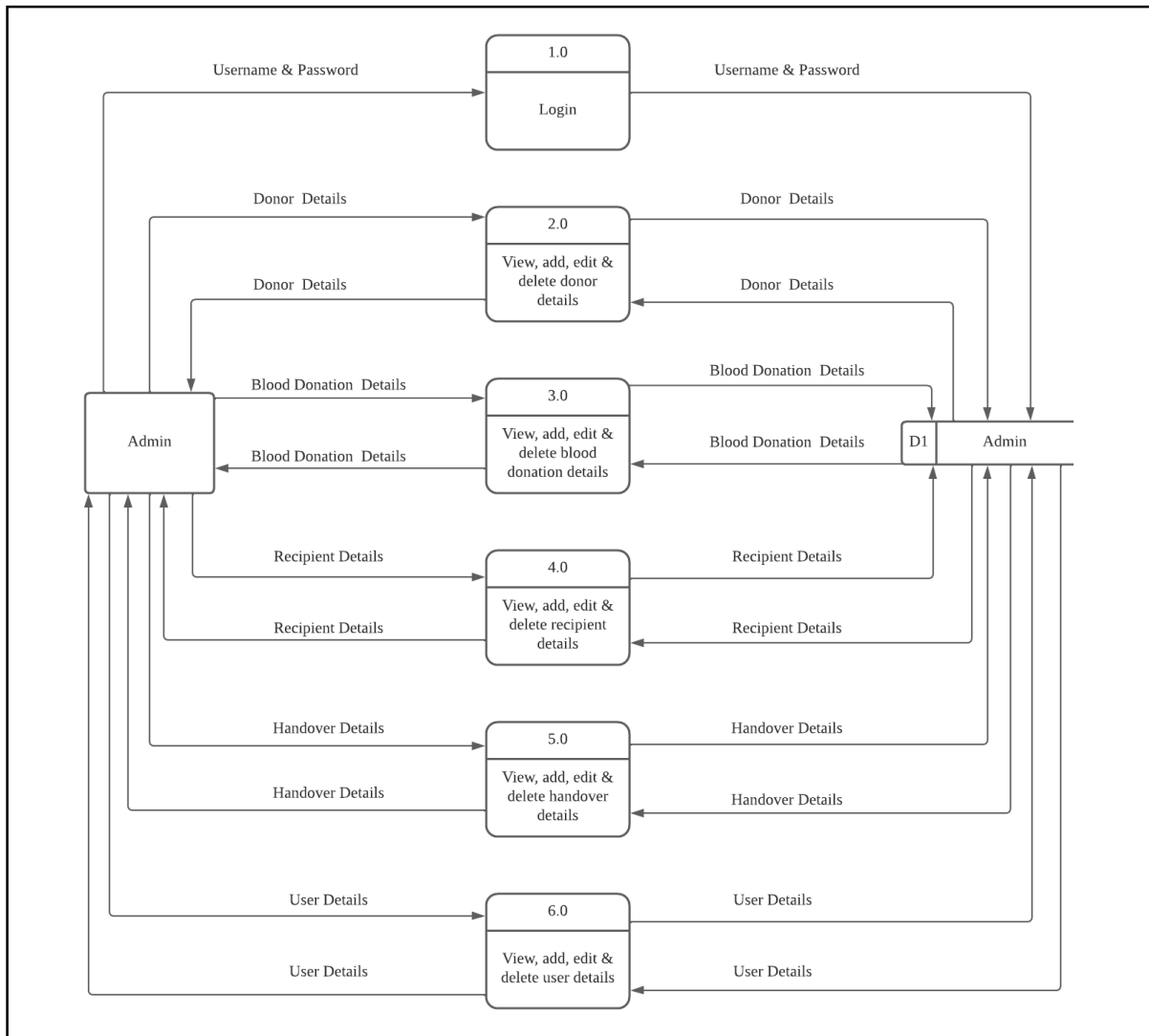


Figure 3(a): Data Flow Diagram Level 1

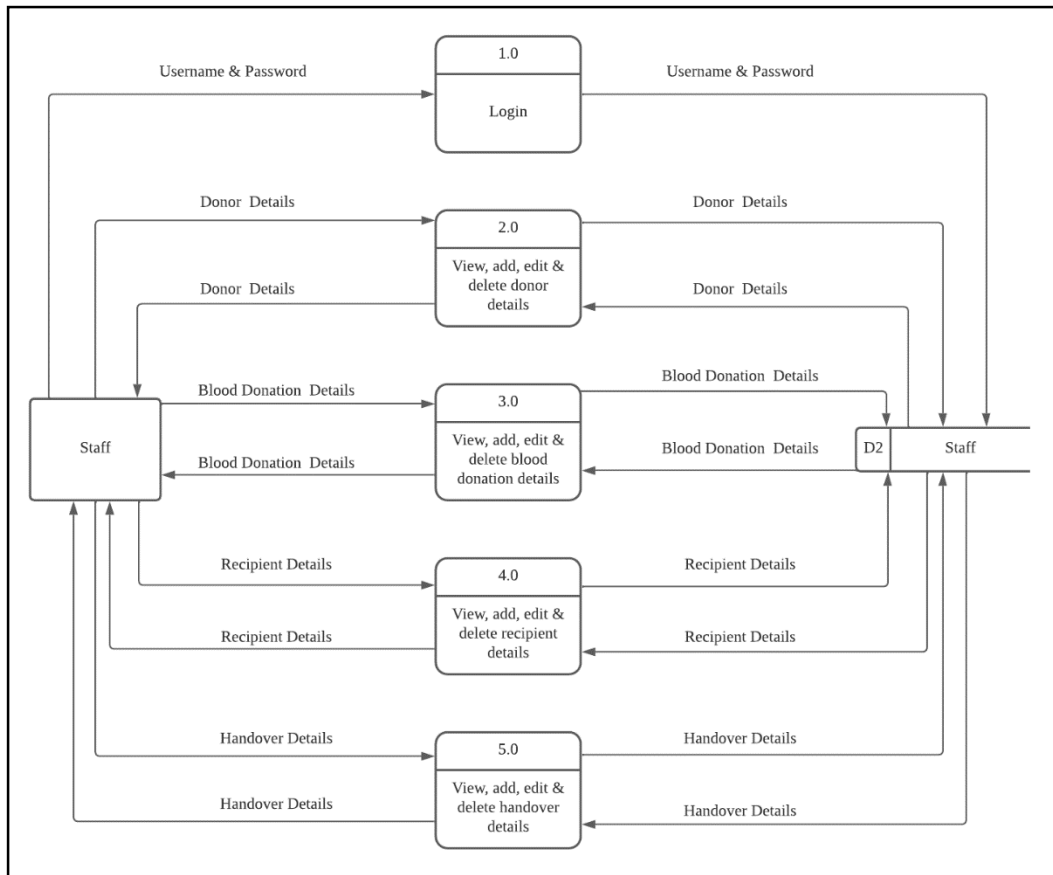


Figure 3(b): Data Flow Diagram Level 1

Figure 3(a) and Figure 3(b) shows level one flow diagrams for login administrator and staff.

4.4 Entity Relationship Diagram

Entity relationship diagram is a data model that is a graphical notation in conceptual data modelling that describes the relationship between entities. The entity relationship diagram contains entities, attributes, cardinalities, relationships and primary keys or better known as "primary keys".

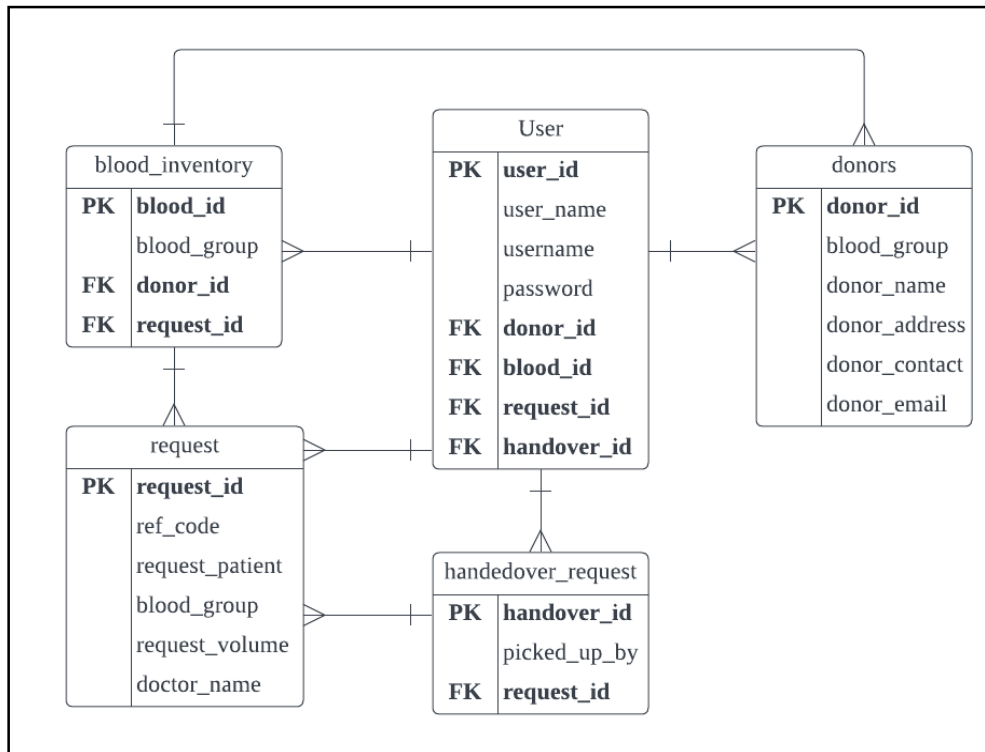


Figure 4: Entity Relationship Diagram

Figure 4 shows an entity relationship diagram for Smart Blood Bank Management System. There are five entities includes user, blood inventory, request, donors and handover request.

5. Implementation

The planning that has been set at the initial of this project is referred as a reference point in the implementation process of the Smart Blood Bank Management System. In this phase, the actual system is developed. Implementation phase takes the longest time among the other phase in the development of the system due to the complexity of the coding. The production of the programming of the previously mentioned modules and the installation of the software are the process involved in this implementation. The programming language used in the development of this project is PHP along with MySQL database

5.1 Login Module

The first module to be discussed is login module. The login module allowed the user to login to Smart Blood Bank Management System by using username and password. The user required to enter the correct combination of username and password in order to access the system. There will be an alert message display on the screen if the user inserts the wrong username and password.

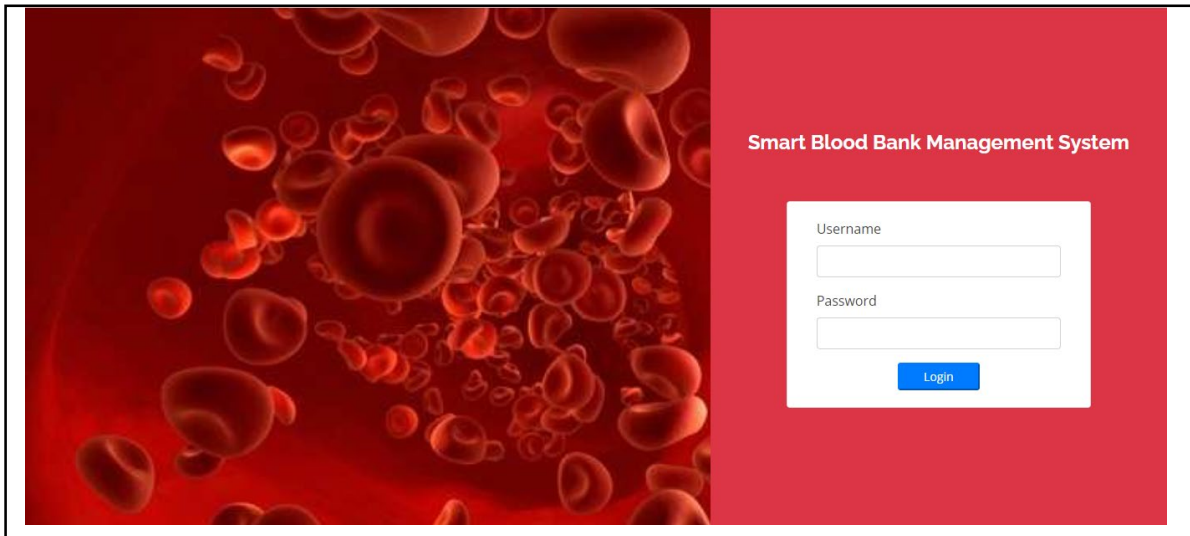


Figure 5: Login Page

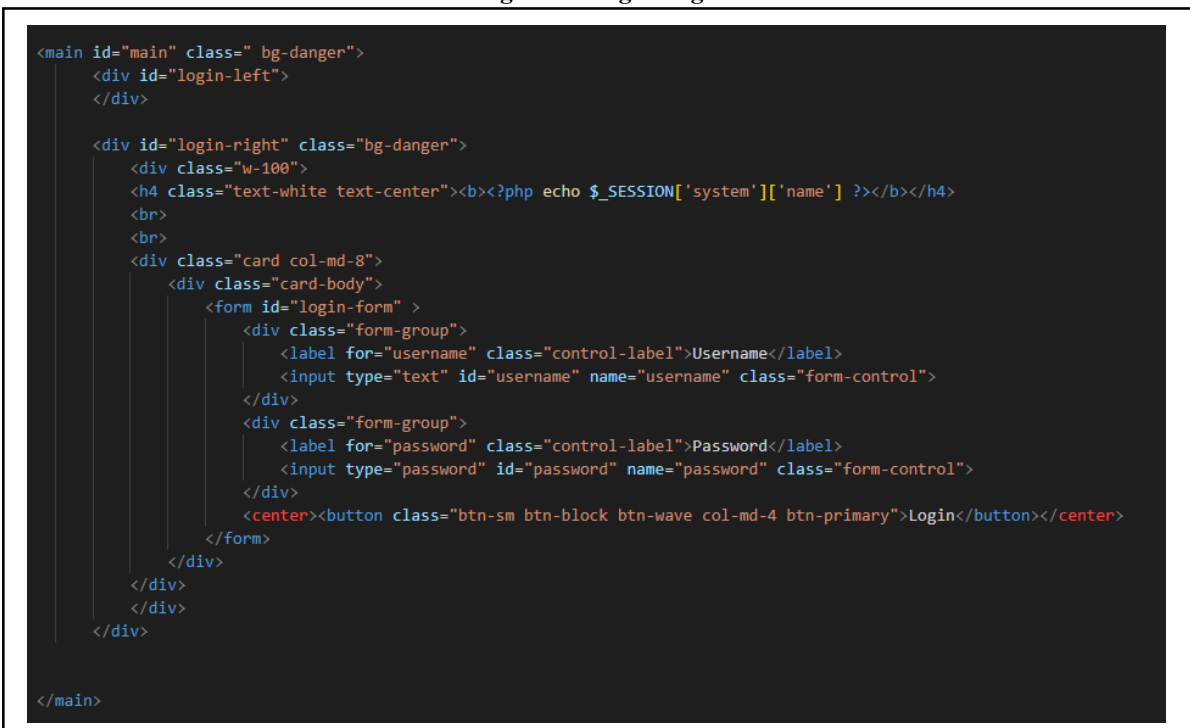


Figure 6: Code segment of login page

Figure 5 and Figure 6 shows the login page and the code segment of login page.

5.2 Donor Management Module

The second module is donor management module. The donor management module allowed the user to manage the information of the donor which they can view the list of donors, add new donor, edit and delete donor details. In order to add new donor, user required to enter donor full name, address, email, contact and blood group. User also able to search any details of the donor in search area to find the information of donors.

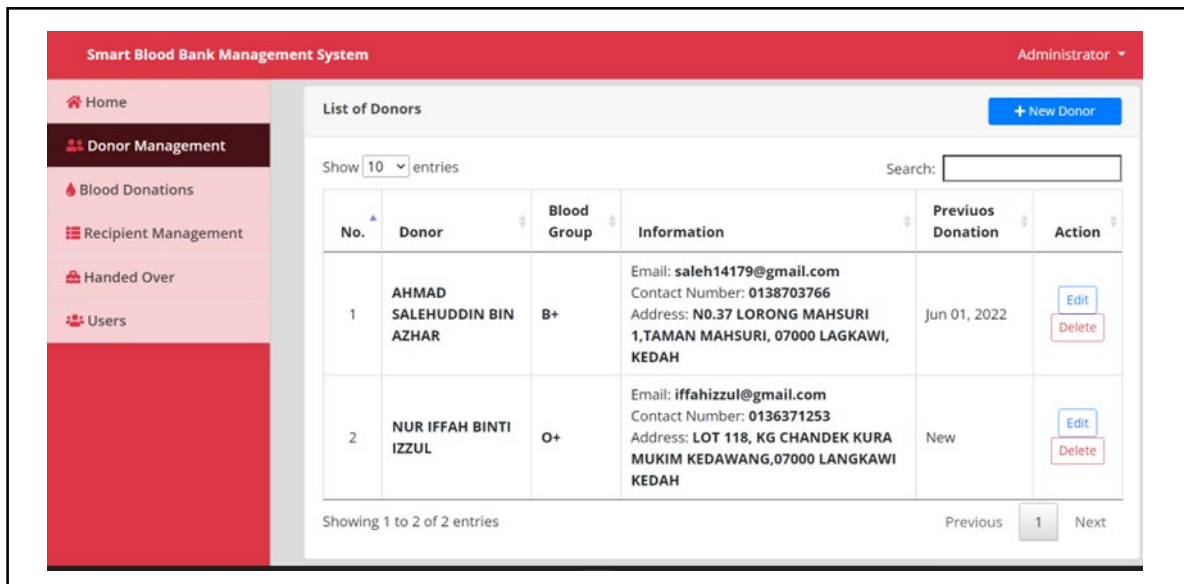


Figure 7: Donor Management Page



Figure 8: Code segment of donor management page

Figure 7 and Figure 8 shows the donor management page and the code segment of donor management page.

5.3 Recipient Management Module

The recipient management module allowed user to view the list of recipients, add new request, edit and delete the details of the recipient. to add the new request, the user required to enter the recipient's full name, blood group, volume of blood needed and doctor name. To update the request, user can update it in edit section. User also able to search any details of the recipient in search area to find the information of the recipient.

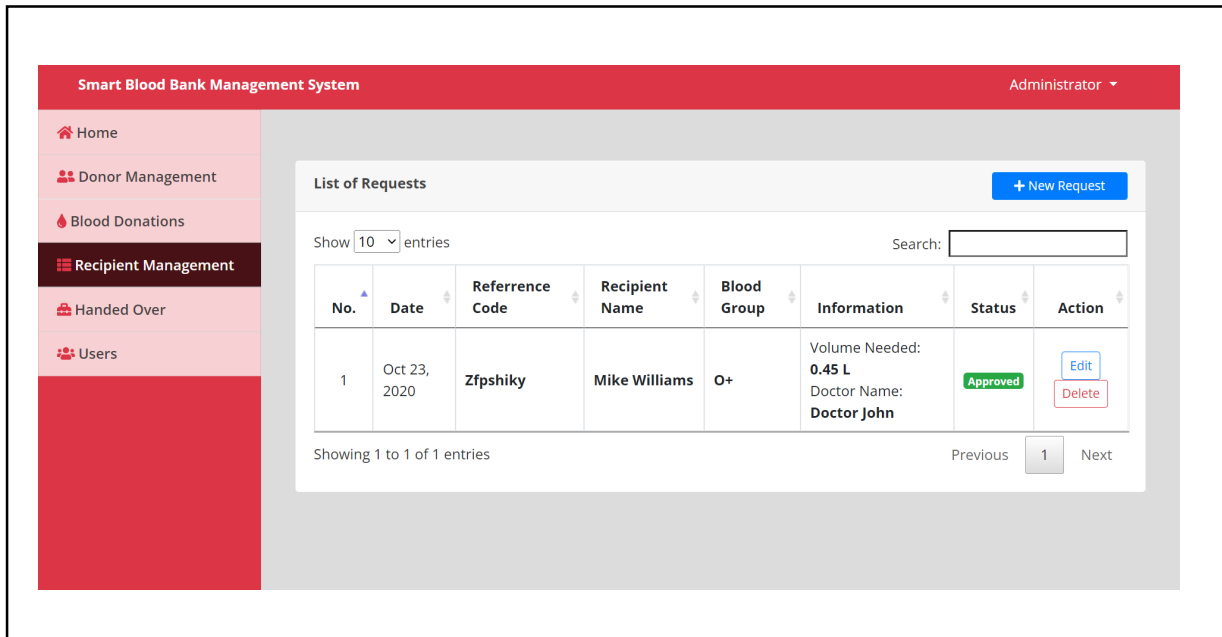


Figure 9: Recipient management page



Figure 10: Code segment of Recipient management page

Figure 9 and Figure 10 shows the recipient management page and the code segment of recipient management page.

5.4 Testing

Testing phase is one of the most significant phases in a Software Development Life Cycle before the software system is going through deployment. The purpose of testing phase is to ensure all the requirements of the software system are met (PerformanceLab, 2021). The complete testing phase of

Smart Blood Bank Management System is done. The test cases and results have been generated in this phase.

5.5 Overall Test Result

A total of 17 test cases were performed to test the functionality of the system. the system had passed 17 out of 17 of the test cases or 100% of all the test cases. The overall result is shown in Table 2.

Table 2: Overall Test Result for Smart Blood Bank Management System

ID	Total Test Cases	Total Passes	Total Fails
TEST_100	1	1	-
TEST_200	3	3	-
TEST_300	3	3	-
TEST_400	3	3	-
TEST_500	3	3	-
TEST_600	3	3	-
TEST_700	1	1	-
Total	17	17	-

6. Conclusion

The Smart Blood Bank Management System was developed with the main focus of improving the blood bank center's efficiency in managing and storing data. The system proved to be successful in all phases of development and achieved the purpose of its development. This project is claimed successfully as the countermeasure for the problem statement is achieved which eases the administrator's burden in managing donor and recipient information for both references and safe-keeping purposes. In its initial edition of development, many improvements and identified.

6.1 Advantages of Smart Blood Bank Management System

The Smart Blood Bank Management System is able to show few advantages for the Blood Bank center to gain. The advantages are listed as the follows:

- i. The system minimized the time wasting where blood bank staff can easily find donor's and recipient's record in the system without taking a long time
- ii. The system reduced the risk of losing the information since all the details are recorded in the system.
- iii. The system is a time saving as the admin or staff just need to enter the details of the donor and recipient in the system instead of filling in the paper form.
- iv. The system eased the admin or staff to search suitable donor in case of emergency. They do not have to find it manually as there are centralized database of the donors and the can find it through this system.
- v. The system allowed admin or staff to manage donor, blood donation, recipient, handover, and user by adding, editing and deleting the details.

6.2 Disadvantages of Smart Blood Bank Management System

There are few disadvantages of the Smart Blood Bank Management System after the system is fully developed. The disadvantages are list as the following:

- i. The interface of the system is not suitable for the use of smartphone screens.
- ii. Donor and recipient only can register as donor and recipient through administrator or staff. They cannot register by their self.

- iii. This Smart Blood Bank Management System is depending on the connectivity of the internet. The network problem will disrupt the smooth of the system.

6.3 Disadvantages of Smart Blood Bank Management System

As discussed above, there are some limitations found from the system. therefore, some recommendation of improvement can be made in the future in order to make the system better. The recommendations for the improvements of the system are:

- i. Create a user interface for the donor and recipient in order to allow the donor and recipient to register as donor and recipient by their self.
- ii. Allowed the recipient to search available donor or blood that they needed in case of emergency.
- iii. Create a user-friendly interface that is suitable to use in smartphone and desktop.

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References

- [1] Blood products: Blood donation. (2021, June 7). WHO | World Health Organization. <https://www.who.int/news-room/q-a-detail/blood-products-why-should-i-donate-blood>
- [2] University of Rochester Medical Center Rochester (2021). Blood donations and blood banking. Blood Donations and Blood Banking - Health Encyclopedia - University of Rochester Medical Center. Retrieved December 21, 2021, from <https://www.urmc.rochester.edu/encyclopedia/content.aspx?ContentTypeID=85&ContentID=P00084>
- [3] Zerkani, Y. (2017, May 10). Implementation Phase during Software Development Life Cycle. Retrieved December 6, 2021, from Helsinki Metropolia University of Applied Sciences: https://www.theseus.fi/bitstream/handle/10024/129622/Youssef_Zerkani.pdf?sequence=1
- [4] Kossiakoff, A. (2011). Systems engineering principles and practice (Vol. 266). Wiley.
- [5] University of Cape Town. (2011, January). Level 1 Data Flow Diagram. Level 1 data-flow diagrams. Retrieved December 20, 2021, from https://www.cs.uct.ac.za/mit_notes/software/htmls/ch06s07.html
- [6] Solutions, D. (2021). Entity relationship diagram (ERD). Datanamic. Retrieved December 21, 2021, from <https://www.datanamic.com/dezign/erdiagramtool.html>