

Development of A Web Based Intelligent Blood Bank Matching and Management System

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ABSTRACT

Blood is a living tissue-fluid that is responsible for the replenishment of all nourishment consisting of nutrients and oxygen in the body. Blood transfusion safety remains an important public health. Blood banks carry an inventory of different blood types that is used by health care providers, such as hospitals and clinics. The conventional method of taking and managing the flow of blood donated and blood given out to patient is very slow, the current method is prone to errors which is very detrimental to patient requesting for blood, as it can cause the death of patient, improper handling of both the donors and recipient data, which might lead to mismatching of blood samples, time wastage in checking if a patient can donate blood to another patient. This paper present an intelligent blood bank matching and management system which is a new approach that will be able to match blood donors and recipient in a blood bank and also help to manage the records of donors and patients effectively. The methodology adopted to carry out this research is Waterfall which is a model under the Structured System Analysis and Design Methodology. The system was designed and implemented using the HTML (Hypertext mark-up language), CSS (Cascading style sheet), PHP (Hypertext pre-processor) and MYSQL database. At the end of the research work, the system developed was able to automatically match blood group to know who can donate and who cannot and also manage and keep records of blood donor and recipients in concise database.

Keywords: Blood bank, recipient, donor, web based, intelligent

INTRODUCTION

Blood is a living tissue-fluid that is responsible for the replenishment of all nourishment consisting of nutrients and oxygen in the body. Medical science has proven beyond any reasonable doubt that no human-being can survive without blood [2]. According to [3] the demand for blood or its products is largely driven by variety of factors that among these are hemorrhage during child birth, RTAs, Malnutrition, sickle cell anemia and HIV/AIDS among others. Advances in medical techniques have made it possible to treat many serious illness and wounds and this have resulted in a corresponding climb in the demand for blood transfusion in order to support patient's recovery and to maintain health [7].

Blood transfusion safety remains an important public health. The availability of blood of all blood types and the provision of its safety ensure public trust of its excellent healthcare system. However, lack of availability of these blood products and provision of unsafe blood products still impact morbidity and mortality in the Sultanate. Through the use of online blood bank management system, blood transfusion safety is expected to be enhanced or improved. Risks on improper blood donors' documentation and misplaced record scan be minimized or totally avoided. Also, processes involving blood bag collection, storage, and inventory will be systematized and organized, hence, improving the healthcare management [4].

For hospitals, a blood bank known as blood collection center also is an area in which collected blood bags are stored and preserved for future use in blood transfusion services. Blood transfusion is a medical operation where a patient requires blood or blood products as a lifesaving measure. In an article published in Times of Oman in 2014, it was reported by Ministry of Health that the total amount of blood donated annually in Muscat is approximately 25,084 units. Ministry of Health further reported that its Department of Blood Services is functioning at full capacity to meet the demands in the Sultanate. Most blood banks are still running manual system in its processes. As such, there is a lack of efficiency because it is still paper-based in collecting information about donors, inventories of blood bags, and blood transfusion services.

The lack of proper documentation may endanger patients' health due to the possibility of having contaminated blood bags. Contamination happened when there is an incomplete donors' medical history record and the blood bags' shelf life is not monitored properly. Hence, web based intelligent blood bank matching and management system might be needed to address these issues and problems encountered to ensure blood transfusion safety.

Blood bank storage and management involves keeping records of blood available as well as information regarding the donors of the blood and also hospitals and patients that are in need of the blood. Blood donation is a very delicate process and therefore, it should be managed and controlled with high caution. Managing this process has a very little margin for error, if it has any [3].

Blood is classified into four main types, each with its negative and positive variations. Other information relevant data like blood sugar content, antibodies, and so on are also necessary to while matching a donor to a recipient. Hence, there is an absolute need for these data and information to be stored and maintained with high security and integrity. Other relevant information includes the donors primary test results.

Present day blood bank storage is file based. This means that data and information regarding blood, donors and recipients are kept in spreadsheets, papers and files arranged in alphabetical or numeric order. This makes data and information retrieval hard and time consuming. Donors test results are recorded on papers too. This makes the data susceptible to errors and human mistakes which in turn puts human lives in danger. Another problem with this system is the poor efficiency. The process of retrieving blood, donor or recipient information is a tedious process and takes a lot of time. Considering the hospitals' and recipients' needs and the urgency usually involved, this makes it hard for the hospitals and put the recipient's life in danger. Data Safety, security and backup is also poor as the papers and files can be easily stolen, lost or destroyed. This makes it an unreliable system. Computerized blood bank management system (BBMS) had been developed in previous years but is highly inadequate. The existing BBMS's are mere storage systems that are mostly unusable by the hospital workers. They focus more on storage rather than coordinating management and operational activities and therefore are still yet to be accepted by the establishments.

Blood banks carry an inventory of different blood types that is used by health care providers, such as hospitals and clinics. Carrying enough inventories to provide the required blood type to patients in critical life-threatening situations is an important issue that blood banks have to deal with. A big challenge in managing the inventory is that banks cannot "order" or "get shipments" of a particular blood type at any moment in time. Blood is donated by donors, and this process is performed voluntarily, thus it requires planning. The blood bank is considering implementing a warning system that informs the staff when the inventory falls under a pre-specified level. These warnings will initiate special drives to collect the particular type of blood the bank is short of.

The blood bank has data about the blood collected by donors as well as the patients that used blood from this bank.

Statement of the Problem

Despite advances in technology, nowadays, most blood bank systems are running in manual system. As such, there is a prevalent problem in the availability of needed blood types. For instance, when a person needs a certain type of blood and this type is not available in the hospital, family members send messages through social media to those who can donate to them and this process takes longer than the life of the patient to the most dangerous. In addition, it seems that there is lack of proper documentation about blood donors and its medical history. This may lead to blood bag contamination and may affect the blood transfusion safety. Generally, this study aims to determine how the use of online bank management system enhance blood transfusion safety.

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The growing need of blood due to accidents and various health problems has increased by the year, and the various blood banks and hospital has not been able to meet up to expectation due to improper handling of both the donors and recipient data and there is no intelligent blood bank matching system. The following are other problems of the conventional method of taking and managing the flow of blood donated and blood given out to patient:

1. The conventional method of taking and managing the flow of blood donated and blood given out to patient is very slow.
2. The current method is prone to errors which is very detrimental to patient requesting for blood, as it can cause the death of patient
3. Improper handling of both the donors and recipient data, which might lead to mismatching of blood samples.
4. Time wastage in checking if a patient can donate blood to another patient; this is usually done by collecting both blood samples for diagnosis which usually waste a lot of time.
5. There is no platform that educates rhesus factors Rh- mothers on the danger of their blood group and solution when they are pregnant.

Research Aim/Specific Objectives

The aim of this paper is to introduce a web based intelligent blood bank matching and management system that will be able to match blood donors and recipient in a blood bank and also help to manage the records of donors and patients at a blood bank. The objectives are to:

1. Create a module that match blood donor in other to know if a patient can donate blood to another patient without any diagnoses.
2. Develop a platform that will enable easy management of blood in the blood bank
3. Create a database that keep proper record of blood which include available blood and not available.
4. Provide the recording functions for every process of the blood in order to keep track of the blood stock accurately.
5. Create a platform that educates rhesus factors Rh- blood group mothers on the danger of their blood group and solution when they are pregnant.

Significance of the Study

The significance of paper is to develop an electronic platform to effectively manage records of blood donated by different donors with their different blood types and group and also the amount and type of blood given out to patients, this tends to save the time taken to access records of blood donated and given out, and also reduce the labor and man-power required to manage and take inventory of the blood donated and blood given out. This research will improve on the current method of donating blood in the sense that the right blood will be donated to the recipient. The research will be a useful tool in the hands of doctors and blood bank management, because there will be no need to take blood samples from both recipient and donor to know if they can donate blood to each other, rather the system will intelligently match the blood group and know if they are compactable or not.

Scope of the Study

This research work focuses on intelligent blood bank matching and management system which is an intensive part in the hospital to manage the records of blood donated to the blood bank and it entails the quantity of blood given to the patient, total blood donated and blood remaining in the bank. This research covers automatic matching of blood to know who can donate or not.

Review of Related Literature

“A survey on Blood Bank Management System” by [1]. This work proposes a new and efficient way to overcome the problems associated with population reluctant to donate blood. The system lists all the blood donors with a certain city or town and the application is aimed at addressing cases of emergency [6]. In this work it is assumed that everyone has a smartphone all the time which ensures tracking and communication.

“Blood Bank Management System” by [8]. The research project was to produce a system that bridges the gap between the blood donors and the people that are in need of blood and blood products [10]. The android based application synchronizes the blood banks and the hospitals with the assistance of the internet.

“A study on the Blood Bank management system” by [17], the product assists to manage the records of the donors and the recipients of Blood at a Blood Bank [20]. It allows the authorized blood bank staff user to login using a private password key and the mange the records of the blood donors and the recipients in need of blood or its products.

“Android Blood Bank” by [11], the system they produced was an android application which timely updates the information of the donors were the administrator accesses the whole information about the blood bank [18].

“Benefits of management Information System in Blood Bank” by [14] the project focused mainly on the benefits of the management information system in blood banks. It discusses more on the benefits of the blood bank management system

[16]. At present, many people are informed about blood donation camps or events through mainline media such as radio shows, notice boards, and television advertisements. There was no information on blood donation on any portal. There was need to create an online Blood Bank Management System which registers potential blood donors, and is able to generate sms in dire situations to potential blood donors.

A number of researches have written on the concept of blood bank management systems with the majority of them praising computerization as a mechanism of achieving efficiency and effectiveness in this area thus not looking at some problems the system may face due to limited or misuse of functionalities.

[8] proposed a development of a management information system to manage blood bank based on information of donor, recipient and blood. Their system has three modules: the donor module, patient module and blood module. However some crucial issues are left aside in this approach, for instance who is responsible for administration of the system.

According to [9] proposes a development of blood bank data management system as a solution to prevent near miss events and improve record retrieval. Their argument is that with computerization fast retrieval of records will improve efficiency of blood banks operations.

[12] suggests a management information system application that covers some of the blood bank management issues related to a particular region. An interesting approach by [15] is that of supply chain management for blood and blood products terming the process as irregular and the demand for blood stochastic. This is of great implications if the management of blood banks were to become effective.

Finally, [17] developed a Blood Bank Management system to gather all the blood donors into one place automatically and inform them constantly about the opportunities to donate blood via a SMS to the donor's mobile phone.

Analysis of the Existing System

The existing method of managing information in a blood bank is such that information of blood donors at the blood bank is recorded in a book log (paper format). The information of the blood donor ranges from the personal information of the donor, test carried out in the blood of the donor, number of blood donated (in bags). The bloods donated are kept in a particular location in the bank and the locations of each blood are also recorded in the book log alongside the information of the donors. Patients requiring transfusion of blood are tested for their blood type, genotype and for other possible diseases. If their blood type matches that of any of the donated blood recorded and it's has not been used up, the patient is given the blood and his/her information is also recorded. The blood given out would be recorded as used up.

Blood banks store freshly donated blood for up to six weeks before it is considered outdated and thrown away. But some recent studies suggest that people who receive transfusions of blood older than two or three weeks may suffer adverse effects.

Analysis of the Proposed System

This new system is geared remedying the existing method which involves using paper format in taking records of information of the blood donated and blood given out to patient. This system being a computerized one has the computational ability to take records of all the information of the flow of blood in the blood bank and information of the blood donated, and those requiring blood. The system has a level of secured integrity, where the system user would be required to login into the system with a username and password. Once the system validates the login information presented by the system user, the system pops up the main page which provides links to other pages where information of blood donors, recipient and also information of blood donated and blood transfused. On the home page the user can also view the total number of blood available, those that matches the type of blood of a particular patient, and also the amount of blood used up. Donated Blood stays in the shelf for up to six weeks before it is considered outdated and thrown away. But some recent studies suggest that people who receive transfusions of blood older than two or three weeks may suffer adverse effects. Finally educates rhesus factors Rh- mothers on the danger of their blood group and solution when they are pregnant.

Block Diagram of the Proposed System

The block diagram of the system proposed system is given below, which gives a description on the work.

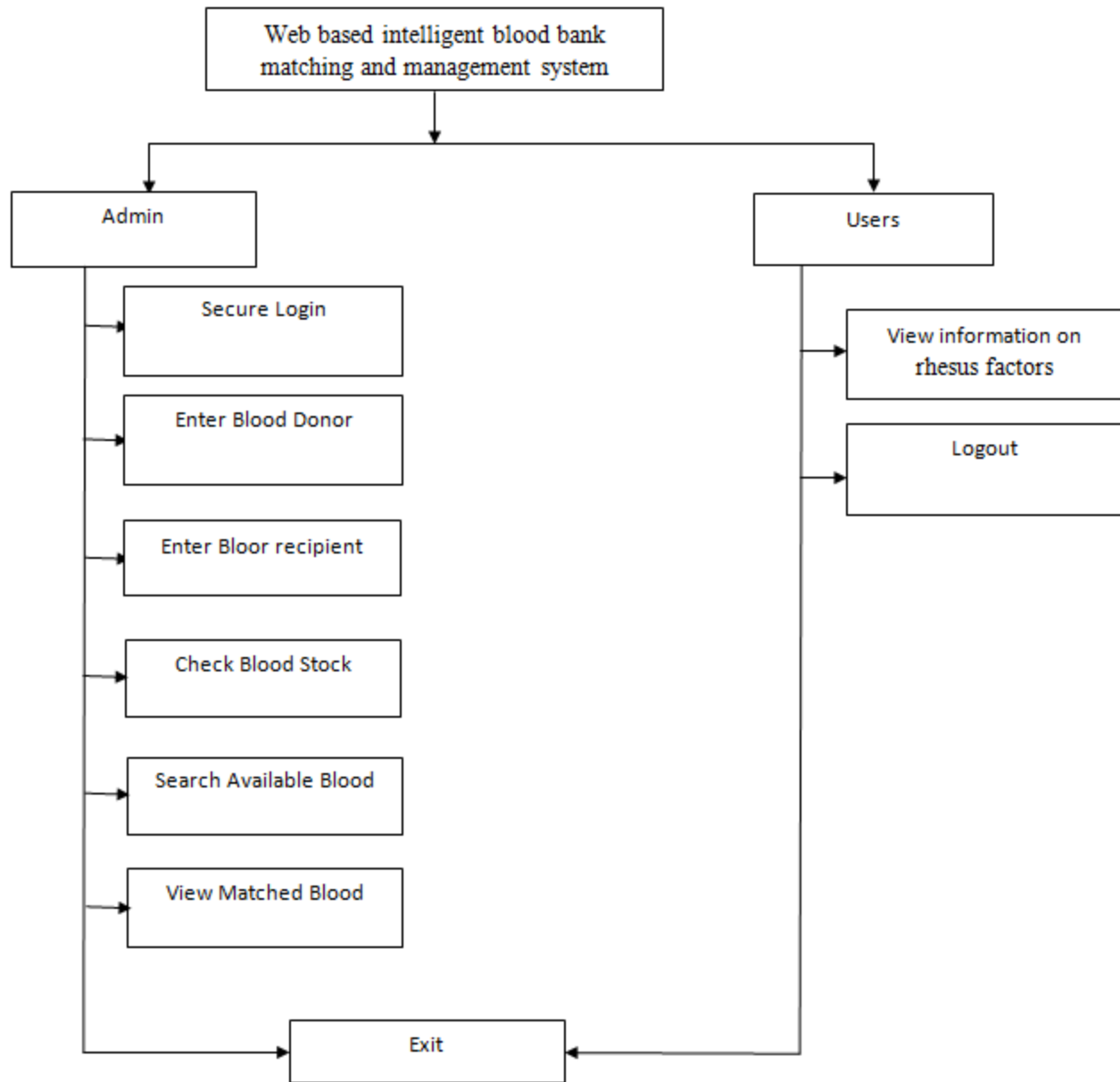


Figure 1: Block Diagram of the Proposed System

The block diagram in figure 1 explains the functionalities of various users in the system.

Design Methodology

The methodology design employed here is the waterfall development which is a structured system design methodology approach, structured systems analysis and design methodology (SSADM) is a set of standards for systems analysis and application design. It uses a formal methodical approach to the analysis and design of information systems. The SSADM is an open methodology based on the waterfall model. SSADM follows the waterfall life cycle model starting from the feasibility study to the physical design stage of development. One of the main features of SSADM is the intensive user involvement in the requirements analysis stage. The users are made to sign off each stage as they are completed assuring that requirements are met. The users are provided with clear, easily understandable documentation consisting of various diagrammatic representations of the system. SSADM breaks up a development project into stages, modules, steps and tasks. For the purpose of this study structured system analysis and design will be used because of its numerous values such as: modularization, easy debugging and program modules can act as a building block for developing other programs.

Implementation Phase

The user interface implementation is the first interface that displays when a user launch the application, this is the interface where users interact with. It is on the interface that the user navigates to other menus of the application. The interface implementation is shown figure 2:

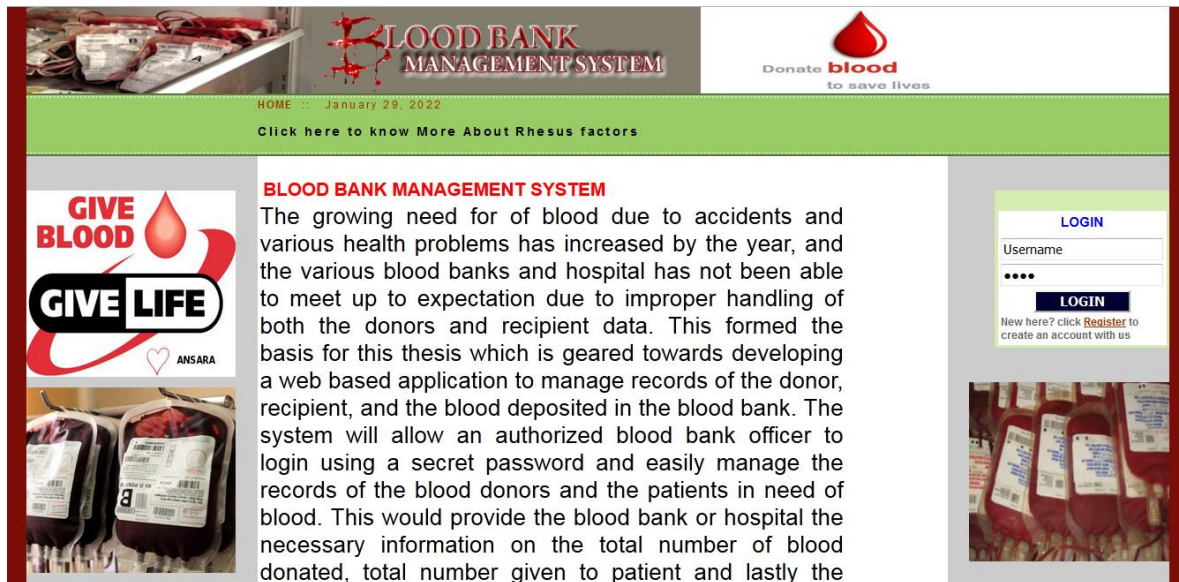


Figure 2: User Interface Implementation

Figure 2 is the user interface implementation, this is the first interface of the application, and this is the interface that allows users to navigate from one menu to another.

Input Interface Implementation Phase

The word input entails the various data supplied to the system which are processed to give out an output. One of the input interface implementation is displayed below:

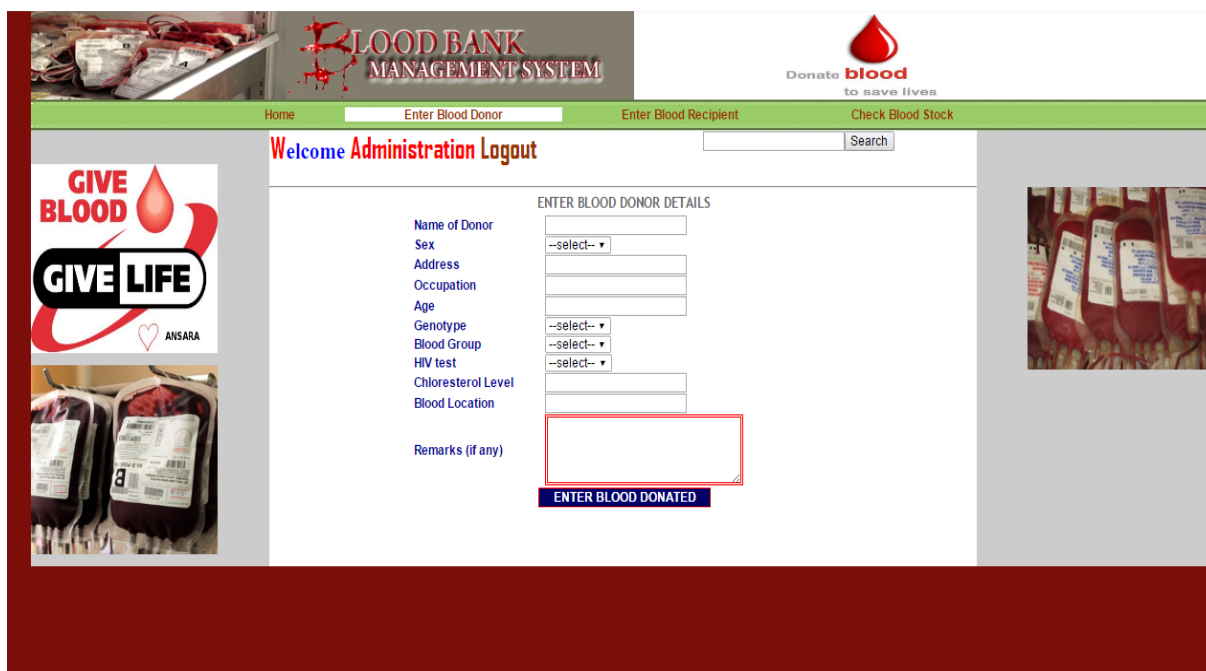
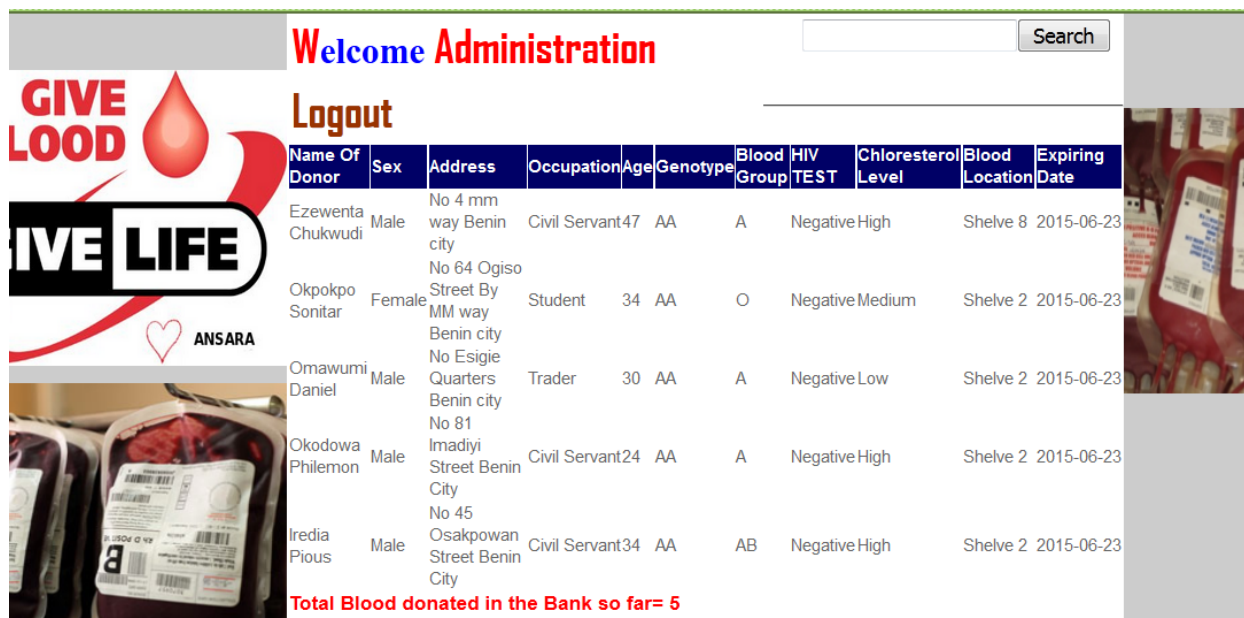


Figure 3: Input Interface Implementation

Output Implementation Phase

The output interface implementation is the form that will be displayed when a user tries to check blood stock in the bank. The output form is displayed below:



Welcome Administration

Logout

GIVE BLOOD

IVE LIFE

ANSARA

Name Of Donor	Sex	Address	Occupation	Age	Genotype	Blood Group	HIV TEST	Chlorestero Level	Blood Location	Expiring Date
Ezewenta Chukwudi	Male	No 4 mm way Benin city	Civil Servant	47	AA	A	Negative	High	Shelve 8	2015-06-23
Okpokpo Sonitar	Female	No 64 Ogiso Street By MM way Benin city	Student	34	AA	O	Negative	Medium	Shelve 2	2015-06-23
Omawumi Daniel	Male	No Esigie Quarters Benin city	Trader	30	AA	A	Negative	Low	Shelve 2	2015-06-23
Okodowa Philemon	Male	No 81 Imadiyi Street Benin City	Civil Servant	24	AA	A	Negative	High	Shelve 2	2015-06-23
Iredia Pious	Male	No 45 Osakpowan Street Benin City	Civil Servant	34	AA	AB	Negative	High	Shelve 2	2015-06-23

Total Blood donated in the Bank so far= 5

Figure 4: Output Implementation

System Requirement

System requirement specifies the type of hardware and software that will enable the system to run effectively. The requirements are listed below:

- Operating System: Windows 7, 8, 10 and 11
- Browsers: Google chrome, firwfox, and opera
- Internal memory (RAM): 16/32GB, 2GB RAM
- Total virtual Memory: 64MB

CONCLUSION

After proper analyses of these problems, a solution was then developed in order to meet up the needs of a more advanced system. This system is known as the intelligent blood bank matching and management system which helped in eliminating all the problems that the previous systems were facing. With this system, Blood banks Centers, Hospitals, Patients and Blood donors will be brought together to enjoy a large number of functionalities and access a vast amount of information, thereby making blood donation and reception a lot easier and faster.

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