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SCHOOL OF NATURAL SCIENCES

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BLOOD BANK MANAGEMENT INFORMATION SYSTEM

BY

NAZANA JUMA

10034196

This thesis is submitted in partial fulfillment of the requirements for the Bachelor of Computer Science

- Information Systems Management
- Information Resource Management.

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DECLARATION

, the undersigned hereby declare that the Blood Bank Information Management System is my own work, that it has not been submitted for any degree or examination in any other university to my knowledge, and that all sources I have used or quoted have been indicated and acknowledged by complete references.

Name: Nazana Juma.

Signature:.....

Supervisor

Name: Dr E Lampi.

.....

ACKNOWLEDGEMENT
Firstly I would like to thank God for helping me accomplish this humble study and for seeing me through to this level of academic achievement. Many thanks to my family for their love and support.

I would like to seize this opportunity to extend my gratitude to my supervisor Dr Lampi for kindly supervising this study, his priceless instructions and valuable directions have had a great role in the accomplishment of this work.

290158

Dedication

In memory of my brother Katongo Juma.

ABSTRACT

The importance of blood in the existence of mankind cannot be over emphasized. It supplies all nutrients and oxygen in the body; it has been medically proven that no human being can survive without blood. It is for this reason that blood banks were introduced; to help in the collecting, separating, and storing blood. A blood bank is a place for stocking blood donations from donors. To provide web based communication there are numbers of online web based blood bank management systems that exists for communicating between department of blood centers and hospitals, to satisfy blood necessity, to buy, sale and stock the blood, to give information about this blood.

Manual systems as compared to Computer Based Information Systems are time consuming, laborious, and costly.Automation systems and information technology can greatly help medical facilities to improve their working efficiency and optimize the whole workflow. The main objective of this project was to develop a blood management information system to assist in the management of blood donor records and ease/or control the distribution of blood in various parts of the country basing on the hospital demands. Without quick and timely access to donor records, creating market strategies for blood donation, lobbying and sensitization of blood donors becomes very difficult. The blood management information system offers functionalities to quick access to donor records collected from various parts of the country. It enables monitoring of the results and performance of the blood donation activity such that relevant and measurable objectives of the organization can be checked. It provides to management timely, confidential and secure medical reports that facilitates planning and decision making and hence improved medical service delivery. The reports generated by the system give answers to most of the challenges management faces as far as blood donor records are concerned.

The System was designed as a client/server and web-based system and implemented using open source solutions that include MySQL as the database and back-end storage engine, and PHP, HTML and JavaScript as the programming languages.

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CHAPTER ONE: INTRODUCTION

Project Background

The Blood Bank Management system is a web-based database application system that is to be used by the hospital blood bank or blood center as a means to store donor records and store blood products. In addition, the system also provides functions for the hospital administrators to manage the appointments made by the donors, the blood stock and donor. This system also has the ability to keep track of the donor's donation records and the blood stock in the blood bank.

This project intends to computerize the blood and donor management system in a hospital blood bank in order to improve the record management efficiency due to the grown size of records of data.

Blood banking is the process that takes place in the laboratory to ensure that donated blood, or blood products, are safe before they are used in blood transfusions and other medical procedures. Blood banking includes typing the blood for transfusion and testing for infectious diseases.The term "blood bank" typically refers to a division of a hospital where the storage of blood product occurs and where proper testing is performed (to reduce the risk of transfusion related adverse events). However, it sometimes refers to a collection center, and indeed some hospitals also perform collection.[1]

Today, blood banks collect blood and separate it into its various components so they can be used most effectively according to the needs of the patient. Red blood cells carry oxygen, platelets help the blood clot, and plasma has specific proteins that allow proper regulation of coagulation and healing. Although research has yielded drugs that help people's bone marrow produce new blood cells more rapidly, the body's response time can still take weeks, thus donated blood remains an important and more immediate life-saving resource[2].

Blood is the vital connection to having a healthy body, and according to the Zambian Red Cross, 130,000 units of blood are needed each year [3]. Thanks to years of research, much progress has been made towards making transfusions safer and more effective.

Blood bank systems must exert strict control over database changes. Where the blood bank system is part of a comprehensive pathology system, it is essential that changes to patient demographic details made in other disciplines do not overwrite the blood bank database. This will ensure that patient details provided to blood banks are not amended by other laboratory computer users.[4]

In Zambia, blood safety is among the priority medical interventions that are expected to significantly contribute to the achievement of the Millennium Development Goals (MDGs). The

blood bank management system relates especially to child and maternal health, fight against the HIV/AIDS epidemic, TB and malaria. Since 1998, Zambia has made significant achievements towards the establishment of a comprehensive, nationally coordinated blood safety system, based on the WHO guidelines on the organization and management of national blood safety programs. With the old paper based donor system all donors even the regular ones, had to fill out new registration forms, because the old forms were not stored in an accessible way. With the new donor tracking system retention of reliable blood donors, from low risk population groups will be easier.[5]

In Zambia, blood collection, safety and management is an activity that is carried out by Zambian Blood Transfusion Services (ZBTS).

1.2 Motivation and Importance of Thesis

Globally, approximately 80 million units of blood are donated each year.2 Of this total, 2 million units are donated in Sub-Saharan Africa, where the need for blood transfusions is great because of maternal morbidity, malnutrition, and a heavy burden of infectious diseases such as malaria. Several factors have led to the World Health Assembly resolutions WHA28.723 and WHA58.134 urging member states to develop national blood transfusion services based on voluntary nonremunerated blood donation:[6] the chronic shortage of safe blood and blood products particularly in low- and medium-income countries; the need to prevent transmission of HIV and other blood-borne pathogens through unsafe blood and blood-product transfusions by collecting blood only from donors at the lowest risk of carrying such infectious agents; and the recognition that voluntary, nonremunerated blood donation is the cornerstone of a safe and adequate national blood supply that meets the transfusion requirements of all patients. The collection of blood only from voluntary, nonremunerated blood donors is an important measure for ensuring the safety, quality, availability, and accessibility of blood transfusion. Innovative ways to recruit and retain voluntary donors in Sub-Saharan Africa include: celebration of the gift of blood donation; recognition of voluntary blood donors; increasing public awareness of voluntary nonremunerated blood donation; educating the public on the importance of regular, voluntary, nonremunerated blood donation; educating the public on the benefits of voluntary nonremunerated blood donation to recipients; promoting healthy living (nutrition, exercise, lifestyle); and provision of noncash incentives to encourage people to donate blood. Blood safety remains an issue of major concern in transfusion practice in most countries in Sub-Saharan Africa where national blood transfusion services and policies, appropriate infrastructure, trained personnel, and financial resources are inadequate to support the running of a voluntary, nonremunerated donor transfusion service.[7] This is further aggravated by the predominance of family replacement and commercially remunerated blood donors, rather than regular, benevolent, nonremunerated donors who give blood through altruism.

The author came up with the Blood Bank information system with the view of creating a fast and efficient records management system for any generic blood bank, by allowing members of staff go about with their daily operations but only this time assisted by the system to make

information and get information as and when it is available in a fast manner. The main motivation stemmed from the need to implement particular view points on issues concerning the management of blood donor records in various health centers around the country. The inspirations came from the Integrated blood donor tracking system which has been implemented by the Zambia Blood Transfusion service (ZBTS) since July of 2008.

1.3 Scope

The system is a generic blood bank developed for Living Hope Clinic. The Blood Bank management system encompasses donor record management, blood safety and blood distribution. It was designed in such a way that makes it possible to access it through any web browser program, which serves as the user interface. The web browser supported interface created is dynamic and as a result backed by a database system that enables users to have the ability to input, access and manipulate data from the database.

HTML (Hyper Text Markup Language) and CSS (Cascading Style Sheets) were used as the languages of preference for the design of user interfaces. Java script was used as the client side validation tool in the interfaces.

PHP was used as a scripting language for linking the interfaces to the SQL database(s). PHP is a server-side scripting language that enables one the ability to insert into a web interface instructions that web server software would execute before sending a response to the web browser [8].

SQL was used as the programming language for developing the database. SQL is the de facto standard language used to manipulate and retrieve data from these relational databases.

The proposed system is a simple web platform for Living Hope Clinic to enable clinic staff keeps track of their blood donor records, blood inventory and the records of the recipients. Thus, the system will be Web-based.

The scope of the project will cover the system functionalities, technologies used, the targeted users, system deployment and methodology.

1.4 Problem Statement

Every year our nation requires about 130,000 units of blood; in the year 2012 only 108,000 units of blood were collected leaving a gap of 22,000 units. Less than 1% of Zambians are active blood donors. [9] It is not that, people do not want to donate blood. Often they are unaware of the need and also they do not have a proper facility to enquire about it. As a result, needy people end up going through a lot of pain. Zambia has very few blood banks, all-functioning in a decentralized fashion under the control of the Zambia Blood Transfusion Service(ZBTS). In the current system, only government hospitals are included leaving out many privately owned

hospitals. We can never have enough blood banks or hospitals offering blood banking services since the country always falls short of the targeted number of units of blood needed every year. Hence the development of blood banks in as many hospitals around the country can help lessen the strain on the few hospitals that have blood banks thereby increasing the donation camps.

1.5 Aims and Objectives

To provide online information flow for the management of blood donors and Recipients and support the production, storage and issue of blood and blood products.

1.5.1 General Objective

To design and develop a Blood Bank management information management system for Living Hope clinic that would enable faster and more efficient storage, retrieval and updating of blood bank records.

1.5.2 Specific Objectives

- Effectively Recruit and Manage Blood Donors; the Donor feature allows the clinic staff to efficiently recruit donors and track their appointments for blood collection. In addition, the organization can maintain a current donor database to track blood donor information

- Track Inventory and Blood Utilization; Blood Bank supports comprehensive inventory management by tracking physical inventory, as well as inventory utilization, based on pre-transfusion data. All transfusable products are tracked from the time they are entered into inventory through final disposition.

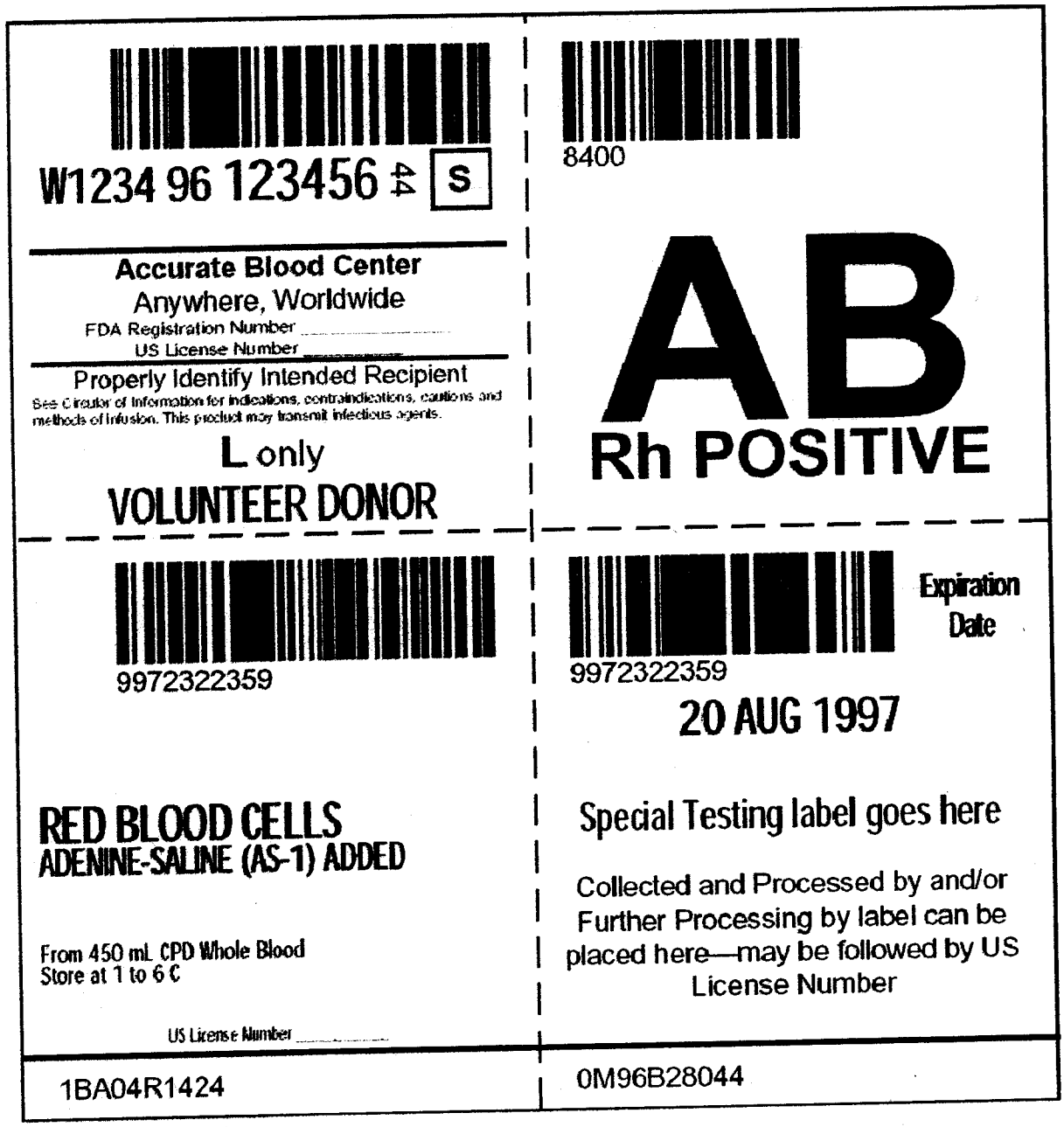
- Perform Electronic Crossmatching; Electronic crossmatching saves critical testing time by checking for incompatibilities between a patient's blood and a unit of blood or blood product prior to transfusion. The electronic crossmatching capabilities allow users to safeguard that:

- Patient specimen and blood type results are current
- Blood type results were confirmed by two determinations
- Patient and donor units are ABO compatible

1.5.3 Case Study

According to Li et al. (2005), the barcode technology had been widely applied in blood bank and other transfusion facilities. Barcode technology provides effective blood product administration and management. Whilst, with the wide use of computer and information technology in blood bank environment, it is essential to label blood and blood products for electronic data processing systems. The major functions of applying barcode technology in blood bank are:

1. Controllingworkflow
2. Managing blood and blood components
3. Tracking donationandtransfusion



1.6 Expected Benefits

There are various reasons behind which one can justify the need of the management information system. International economy, worldwide competition, increasing business complexity, social constraints. Information comes from the data. Management information system assists managers

in storing data. The concept of management information systems can lead to the development of many application specific soft wares which provide various solutions.

Benefits of the blood bank information system to donors

- It provides the unique identification number at the time of the first blood donation at a given camp which with future correspondence. This feature helps the administrator to collect the information of all the donors area wise and blood group wise.

Benefits of the blood bank information system to patients

- The patient can get the information of the desired blood group from the central inventory
- The patient can get the list of donors' area wise, blood group wise if the desired blood group is not available in the central inventory.
- The patient can get the information of the particular blood group available in the blood bank.
- The patient can get the information of that blood group which is not fit for blood transfusion.
- The patient can get the blood units according to his requirement from the blood bank.

Benefits of the blood bank information system to the blood bank

- Blood bank in charge is getting rid from manual procedure. Now they to do the entries in the information system.
- The probability of error should be minimal.
- Information retrieval should be precise and effective.
- Inventory control can be properly controlled and managed as researcher is using the FIFO (First In First Out) concept.
- Report can be generated of donors, seekers, total consumption of the blood units and overall report monthly, bi-monthly, quarterly, half yearly, annually.
- Blood bank in charge can get the information which blood is in demand but rarely available and which blood group is rarely in demand but plenty in stock.
- Blood bank in charge can get the information which is maximum cause for which the blood units are required like accidental cases, heart surgery, delivery cases.
- Blood bank in charge can get the information which doctor has recommended the blood units.
- Blood bank in charge can view the list of discarded blood units; they can also view the reason for which the blood units are discarded.

- Blood bank in charge can view the central inventory as it shows the total account of number of units of the particular blood group.

- Blood bank in charge can manually discard those units which become unhealthy due to some technical fault.
- Blood bank in charge can check by viewing the report whether the replacement donor has actually donated the blood or not.

1.7 Constraints

- The GUI is only in English.
- Login and password is used for the identification of users.
- Only registered donors registered personnel will be authorized to use the services.

CHAPTER TWO: LITERATURE REVIEW AND RELATED WORKS

2.1 Introduction

In order to understand the concepts associated with blood bank management systems and or computer based records management systems, it is imperative to examine and analyze published material from experts regarding the field. The purpose of this review is to analyze and examine and obtain experience as regards to the creation and archival processing of electronic blood bank records. The review is based on an exhaustive assessment of the literature on blood bank management and electronic records, and contains an overview of the main concepts associated with the creation of an electronic records management system from the perspective of published experts.

2.2 Literature Review

2.2.1 Background Theory

In 1964 the city of Alameda in California developed what's believed to be among the earliest Blood management systems. The James Famer report(1982) states that the system was an inventory control program. Since then a number of computerized systems have since been developed for Blood Banks and regional blood donor services.[10].

The Malaysian 3iCare Blood Bank Management System is an example of the current available systems. It is a comprehensive software for standalone and multi-site healthcare organizations.[11] It was designed to help and manage the full cycle of blood bank activities in hospital and standalone blood bank. The software safeguards the entire process of transfusion therapy and ensures full traceability of blood units and components.

The report by Dr. Sharad Maheshwari in the International Journal of Engineering Research and Applications (IJERA) stated that in India, the Blood Bank Management Information System is an integrated blood bank automation system. The web based mechanism interconnects all the Blood Banks of each State into a single network. The MIS of Blood Bank refers the acquisition, validation, storage and circulation of various live data and information electronically regarding blood donation and transfusion service. The system is able to assemble heterogeneous data into legible reports to support decision making from effective donor screening to optimal blood dissemination in the field. It provides the criteria of city wise and blood group wise search of the blood (a person who needs blood). After that when a search command is given then the MIS of Blood Bank will result the donor name from its database. A person or a hospital can request the blood from the blood bank when they need. For this the blood bank keeps the name of the patient, a blood group which is needed, city in which the blood needed, name of the hospital where the blood will be sent, address of the hospital, name of the doctor who demands for blood, date and time when the blood will required, contact name, contact email id, contact phone number, address, city, state of the person who needs the blood in their MIS.[12]

Bharat Blood Bank: - The MIS of Bharat Blood Bank which was launched in September 2005 is a web portal that brings blood donors and recipients throughout India under a common onlinePlatform. Blood recipients or those who are in need of blood visit the site and view the list of blood donors near their locality. BharatMatrimony Group(2006) stated that the system keeps the name of the donor, a unique id and password through which the donor can access his account, date of birth of the donor, gender status of the donor, blood group of the donor, weight of the donor, mobile no, email id, address, city, state, date of last blood donation, and information about Hepatitis B, C, AIDS, Cancer, Kidney disease, Heart disease(if a donor is suffered from these disease) when a new blood donor registered himself as a Blood Donor with Bharat Blood Bank. [13].

SIBAS, the acronym of "Sistema Integrado de BAncos de Sangue", is a blood bank information system running at Macau blood transfusion center (Li et al., in press). It has been specially optimized for blood donation service at Macau blood transfusion center, and equipped with many advanced technologies, for example, electronic donor cards (Li & Dong, 2006), the ISBT 128 barcode technology (Li, Chao, & Dong, 2006), and so on. As to computerized decision making support, two kinds of paradigms are adopted in SIBAS: rule-based expert systems and quantitative statistical analyses. Both kinds of decision making support modules are distributed in SIBAS so as to support the decentralized affairs in that blood center. Finally, the decision making support modules in SIBAS provide analytical results and operational suggestions only. Any decision should be validated and approved by the relevant blood bank staffs.

e-Blood Donors: - The MIS of e-Blood Donors keeps the name of the donor who is donating blood, a unique id through which the donor can view his account, password for accessing the account, date of birth of the donor, gender status of the donor, blood group of the donor, weight of the donor, photo, mobile no, email id, address, city, state, date of last blood donation when a

new blood donor registered himself as a Blood Donor. It provides the criteria of city wise and blood group wise and gender wise search of the blood (a person who needs blood). It does not provide any mechanism that a patient can request for blood online.[14]

The system developed by Teh Geok Tuan for the faculty of information and communication technology for the Kolej University in Malaysia is an online blood donation Reservation and Management system. It is a web database application that enables the public to make online session reservation, to view nationwide blood donation events online and at the same time provides centralized donor and blood stock database. The application was developed by using JSPI Servlet technology from J2EE with the MySQL 5.0 as the database management system. The methodology used to develop the system as a whole was Object Oriented Analysis and Design; whilst, the database for OBDRMS was developed by following the steps in Database Life Cycle. The targeted users for the application were the public who are eligible to donate blood, 'system moderator, administrator from National Blood Center and the staffs who are working in the blood banks of the participating hospitals. The main objective of the development of this application was to overcome the problems that exist in the current system, which are the lack of facilities for online session reservation and online advertising on the nationwide blood donation events, and also decentralized donor and blood stock database. Besides, extra features in the system such as security protection by using password, generating reports, reminders of blood stock shortage and workflow tracking can even enhance the efficiency of the management in the blood banks.[15]

The Indian Institute of Information Technology and Management-Kerala developed a web-based portal to facilitate the co-ordination between supply and demand of blood. Their earlier system hard all the blood banks attached to a hospital. Each hospital had its own systems and limitations and the coordination between blood banks from other hospitals was practically impossible. They later proposed a system were blood banks from other hospitals were able to communicate.[16]

The introduction of computerized Blood banks has also brought about some challenges in most developing countries an example been Uganda. The Ugandan Red Cross Society(URCS) report touched on how blood donation service involve a series of interdependent operations such as donor registration, donor screening/evaluation, evaluation, blood collection, blood screening, inventory management and blood dissemination. Most of the popular existing blood information systems in the western world today are mainly online systems. The systems interfaces do not meet fully the blood safe policy described in this study and as such not suitable for illiterate population. Most blood donors in Uganda are rural based where online systems may not be the best. The level of computer literate among the blood donors in Uganda is growing because the majority of them are school students. The main challenge remains customizing interfaces that are suitable for capturing basic donor information. Some of the attributes on the interfaces used in the western world such as state and province are not applicable in Uganda. Tripura blood donor information system is a good example of the blood donor system that is not suitable for Uganda. Also some key attributes such as age and sessions in Uganda are lacking on most the interfaces

viewed. The interfaces also are not user-friendly as there are many links within the system that can easily confuse the system users and hence leading to data entry errors and boredom.[17]

The Indian case study of Prathma Blood Center, Gupta (2004), promises insights into the integration of IS/IT in management of blood records. The Prathma Blood Center is a quest for modernizing blood banking. The entire function from blood donation to its testing and separation, storage, issue and usage have been integrated through a custom designed enterprise resource planning (ERP) software that minimizes human intervention and making it less error prone. The implementation of ERP in blood bank in India has registered many successes in medical data such as security, confidentiality, secrecy and quick retrieval of historical records all of which were challenges at URCS blood center. However, full automation of all blood donation activities like the case cannot be done in Uganda due to limited resources. It requires transition, as it is resource constraining in terms of IT, other equipment and human resources.

In Malawi prior to the formation of the Malawi Blood Transfusion Service each hospital blood bank was responsible for the collection, testing and distribution of whole blood for patients on request from the clinicians. Occasional blood collection drives were organized by expatriate volunteer groups at two of the four central hospitals in Malawi. Blood donor education and recruitment was, at best, rudimentary, and was always uncoordinated and fragmented. Blood collection was inadequate and procedures did not meet minimal standards for donor and staff care and protection. A large number of groups were formed throughout the country to try and meet the requirements of blood in hospitals. Those who were encouraged to donate blood on a voluntary basis often found that, on a future occasion, when they, or their relatives, required blood there was none available. On some occasions blood could be provided for a 'fee' from a willing 'impromptu' relative. This fee was provided to the procurers of the blood. Invariably time was insufficient for a full screening profile prior to the urgent need for transfusion. Often there was no blood available. This led to the implementation of the blood donor program in many of Malawi's general hospitals [18]

The Zambia National Blood Transfusion Service (ZNBTS) with help from the International Institute for Communication and Development (IICD) has developed a computerized system that has digitalized registration of donors and sends SMS messages to blood donors reminding them that they can donate blood again (2009). Not only does the software send SMS messages, it also makes it easier to reach blood donors. First-time donors are often high school students living in rural areas. ZNBTS staff used to register them on paper. The problem was that if they moved to another location, even if this was only to another village or city and wanted to donate blood again they would then have to redo the entire registration process. With the computerized system, potential donors can just stop by, have their blood taken and all their data will be saved in an online database that is accessible from every office of the ZNBTS.[19]

CHAPTER THREE: ANALYSIS AND METHODOLOGY

3.1 Introduction

A software development methodology or system development methodology in software engineering is a framework that is used to structure, plan, and control the process of developing an information system. Common methodologies include waterfall, prototyping, iterative and incremental development, spiral development, rapid application development, and extreme programming. A methodology can also include aspects of the development environment (i.e. IDEs), model-based development, computer aided software development, and the utilization of particular frameworks (i.e. programming libraries or other tools).[20]

Extreme programming was used as the methodology of choice in developing the management system.Extreme programming is a software development methodology which is intended to improve software quality and responsiveness to changing customer requirements. As a type of agile software development, it advocates frequent "releases" in short development cycles. This is intended to improve productivity and introduce checkpoints where new customer requirements can be adopted. The main goal of XP is to lower the cost of change in software requirements.

A Business functional model for the BBIS was developed together with the laboratory group. The scope and functions of Blood Bank were with the help of a group of hematologists and medical lab technologists with experience in blood banking and clinicians involved in using the blood bank services.

The experts analyzed the business functions by mapping the relationship between functions, work processes, and work flows. The operational policies and system functionalities to support the workflows were then developed.

3.1 .1 System Development Life Cycle

The overall system was developed using the following steps.

1. **Planning**

Project planning was done to provide the basis for acquiring the resources needed to achieve a solution. This phase ensured that the problem solved was the one that needed to be solved and that the initial description was complete and consistent.

Under the planning phase of the project, a project timeline and work plan was developed. (Please refer to appendices). Under this phase;

- The project team was formed which consisted of one person
- The system flowcharts were prepared
- The characteristics of the proposed system were defined and identified

2. **Analysis**

At this point, the system in place was analyzed to determine where the problem was in an attempt to fix the system. This step involved breaking down the system in different pieces to analyze the situation, analyzing project goals, breaking down what needed to be created and attempting to engage users so that definite requirements could be defined.

Under analysis, Requirement gathering is the most crucial aspect as many communication gaps arise in this phase and this leads to validation errors and bugs in the software program.

Therefore, the following techniques were used to gather information

- **Semi-structured interviews:** Semi-structured interviews are conducted with a fairly open framework which allow for focused, conversational, two-way communication. They can be used both to give and receive information. In the process of developing the system, the development team consulted a group of hematologists and medical lab technologists from various blood banks around Lusaka and Kitwe in order to identify the processes, obtain specific quantitative and qualitative information from the interviewees, obtain general information relevant to blood banking, and to gain a range of insights on the process of records management.

This tool was used as a data collection methodology of choice because it is; less intrusive to those being interviewed as the semi-structured interview encourages two-way communication.

- **Direct (Reactive) Observation:** Direct Observation is a method in which a researcher observes and records behaviour / events / activities / tasks / duties while something is happening. This was used in correspondence to interviewing in order to gain a more holistic view of the other blood banks in the area.

Observations give additional, more accurate information on behaviour of people than interviews or questionnaires. They can also check on the information collected through interviews especially on sensitive topics.

- **Using available information:** This is a data collection method that involves the process of examining and evaluating already existent literature material to obtain facts and data regarding a specific subject. Locating these sources and retrieving the information can help in data collection.

In the development of the blood bank management system, this research methodology was mainly used in the analysis and design phases of the system development process. This is because it permitted the researcher to analyze changes in trends.

3. **Design**

In systems design the design functions and operations was described in detail, including screen layouts, business rules, process diagrams and other documentation. The output of this stage

described the new system as a collection of modules or subsystems. The design stage took as its initial input the requirements identified in the approved requirements document. For each requirement, a set of one or more design elements was produced as a result of interviews, workshops, and/or prototype efforts.

Design elements described the desired system features in detail, and generally included functional hierarchy diagrams, screen layout diagrams, tables of business rules, business process diagrams, pseudo code, and a complete entity-relationship diagram with a full data dictionary.

4. **Implementation Phase**

Here all the iterations were brought together and integrated to make one working system. Modular and subsystem programming code was accomplished during this stage. Unit testing and module testing was done in this stage.

3.2 System Requirements

The system is client-server architecture were a server is necessary to host the application and the database .The users will access the server to retrieve information from their desktops through their web-based interfaces.

3.2.1 Functional Requirements

Functional requirements capture the intended behavior of the system. This behavior may be expressed as services, tasks or functions the system is required to perform.

- Ability of the system to trace all recipients of a particular donor.
- Ability for the system to maintain the National Donor Registry.
- The system should include details of shelf life of all units (i.e. time to expiry)
- Every donor should have a unique ID(donor number)
- It should be possible to enter coded and text free comments against patients' results.
- Ability of the system to trace all donors to a particular recipient.
- Ability to capture and store the following information for Blood grouping:-
  - Sample No.
  - Date donation was performed.

3.2.2 Non-Functional Requirements

These are constraints on the services or functions offered by the system.

- Users must login in order to access the system resources.

3.2.3 Hardware Specifications

- Processor Pentium II, Pentium III, Pentium IV or higher
- RAM 20 Mb or Higher

- Disk Space130 Mb or higher
- LAN Ethernet 10/100Mbps card/bus.

3.2.4 Software specifications

- Operating System: Win-XP, Windows Vista, Windows 7 or Higher
- Web Browser: Any, but preferably Mozila Firefox
- Database: MySQL version 5.0.1 or higher
- Webserver: Apache 2.0 as web server

3.3.3 System Design

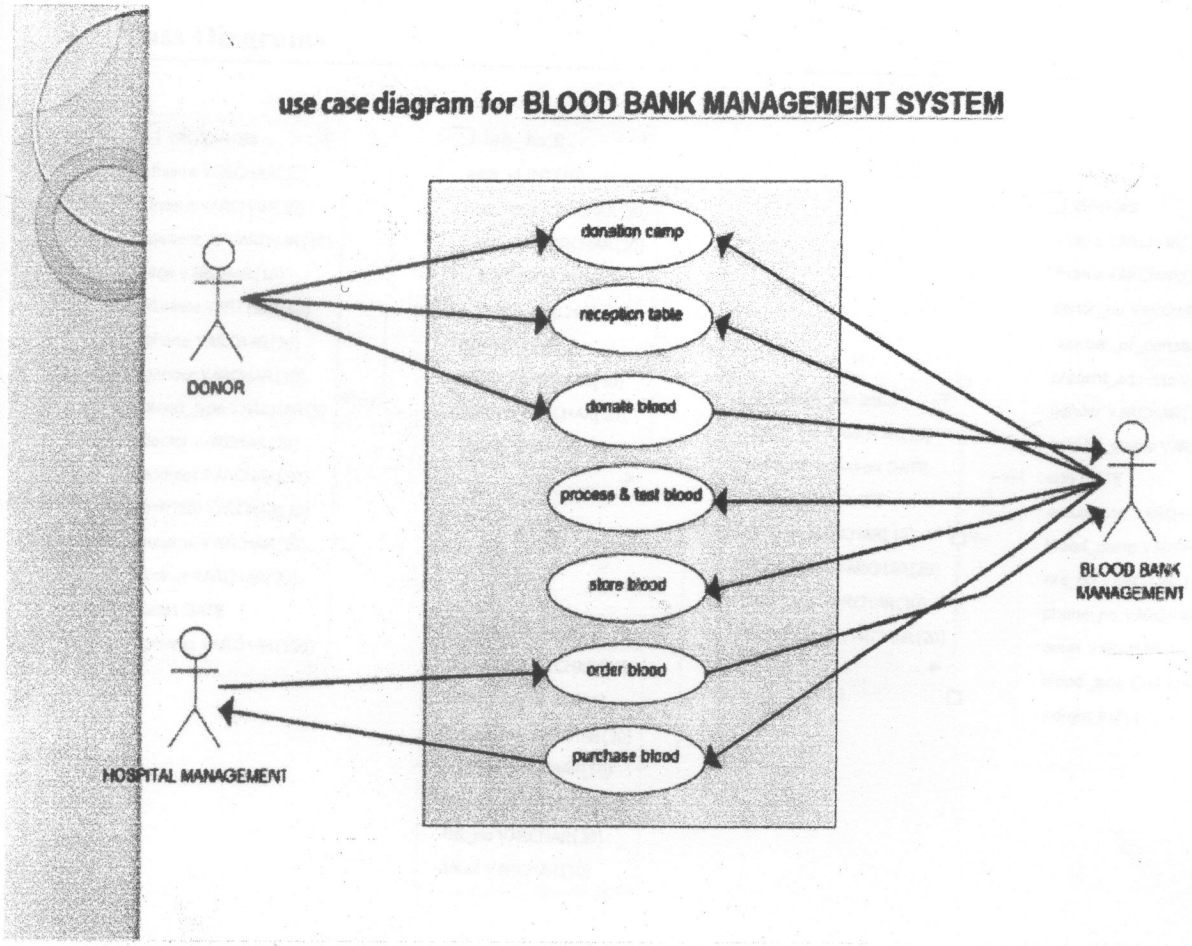
Using the Model View Controller Architecture

According to Bennett et al. (2002), Model-View-Controller (MVC) is a system architecture that separates application into three main components, namely the model, view and controller, each playing different roles. Model is the main functionality or the domain-specific representation of the information, views are the user interfaces and the controllers are the ones who respond to user actions and invoke appropriate changes on the model and view. The purpose of separating the application is to make sure that the modification to one component will cause the least impact to the others (inhttp://en,wikipedia.org/wiki/Model-view-controller) and thus promoting system maintainability. This architecture is especially useful in a system where there exist many types of users with many different levels of authorization. Different styles of display or data are required to facilitate different types of users. No duplicate user interface needed to be created as the model and controller will detect and react according to user role. This is because MVC architecture supports multiple presentations of data and separate styles of interaction with each presentation (Sumrnerville, 2001).

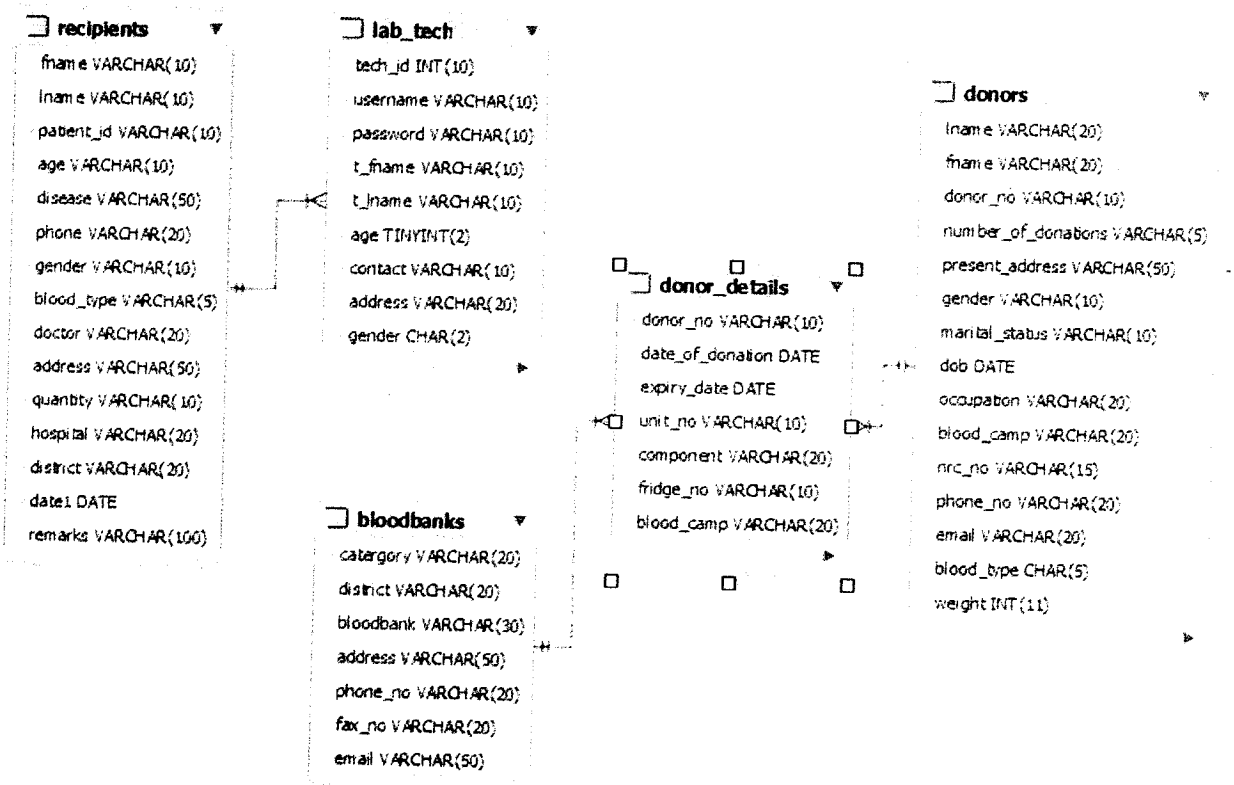
The Records Management system has a backend engine that consists of a MYSQL database, PHP as the programming language and Apache as the webserver and the user interface modules. (Diagram)

3.3.1 System Analysis and Design

- **Use Case Diagram for the System**

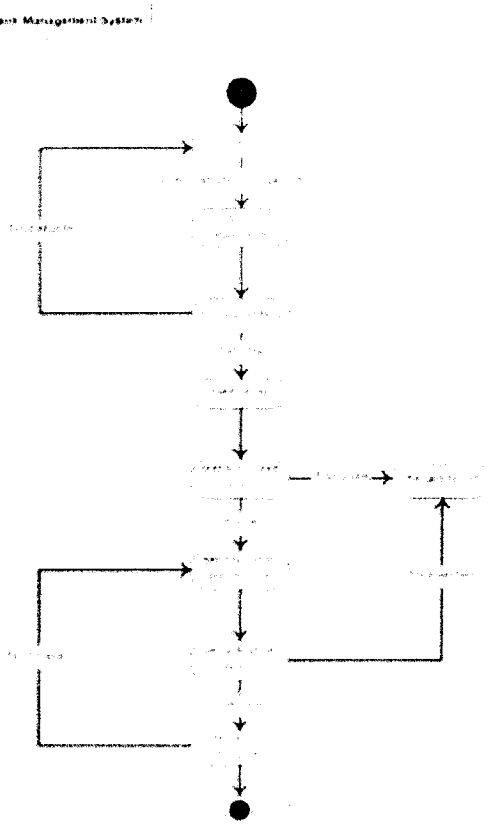


- **Class Diagrams**

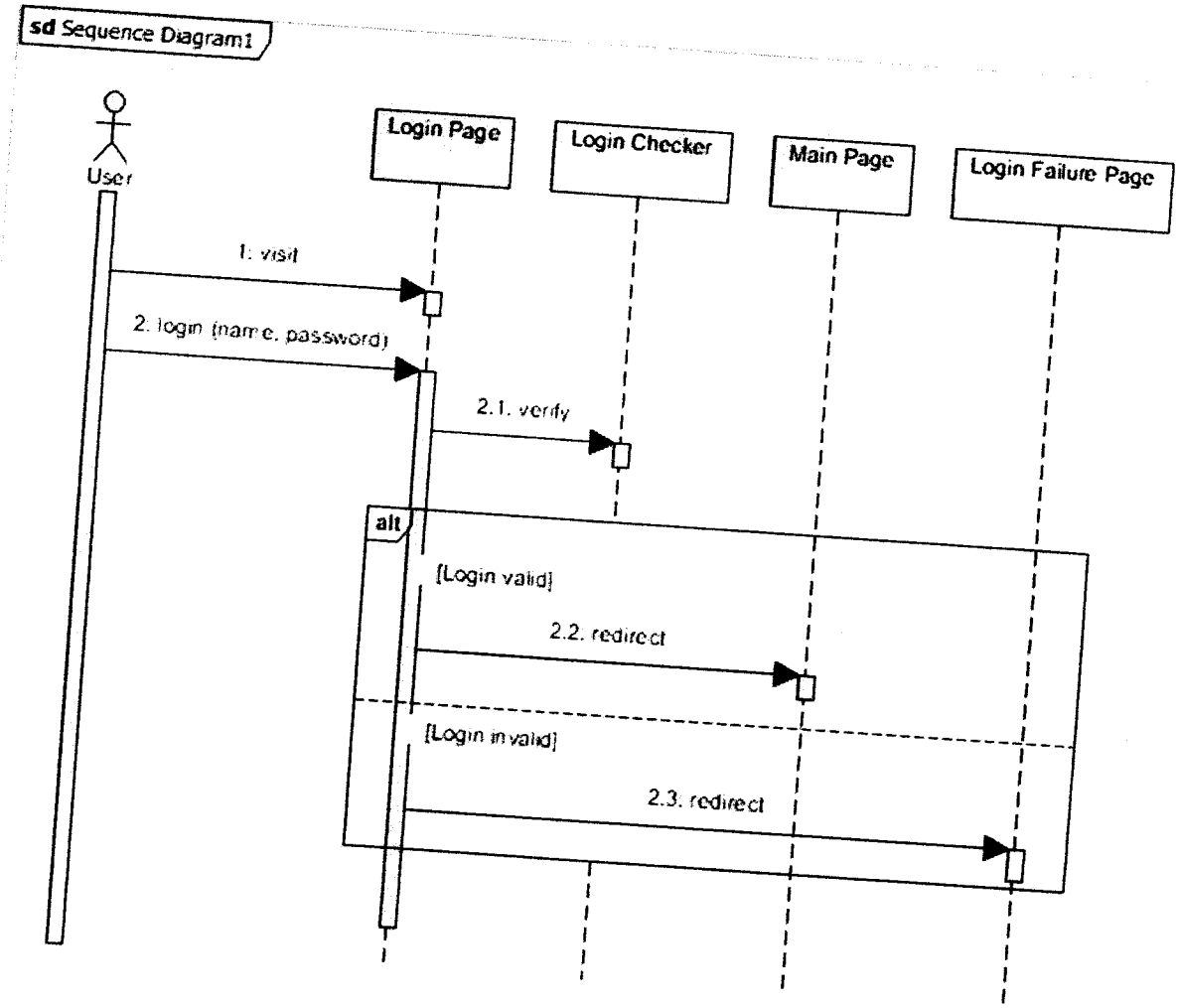


- **State Chart**

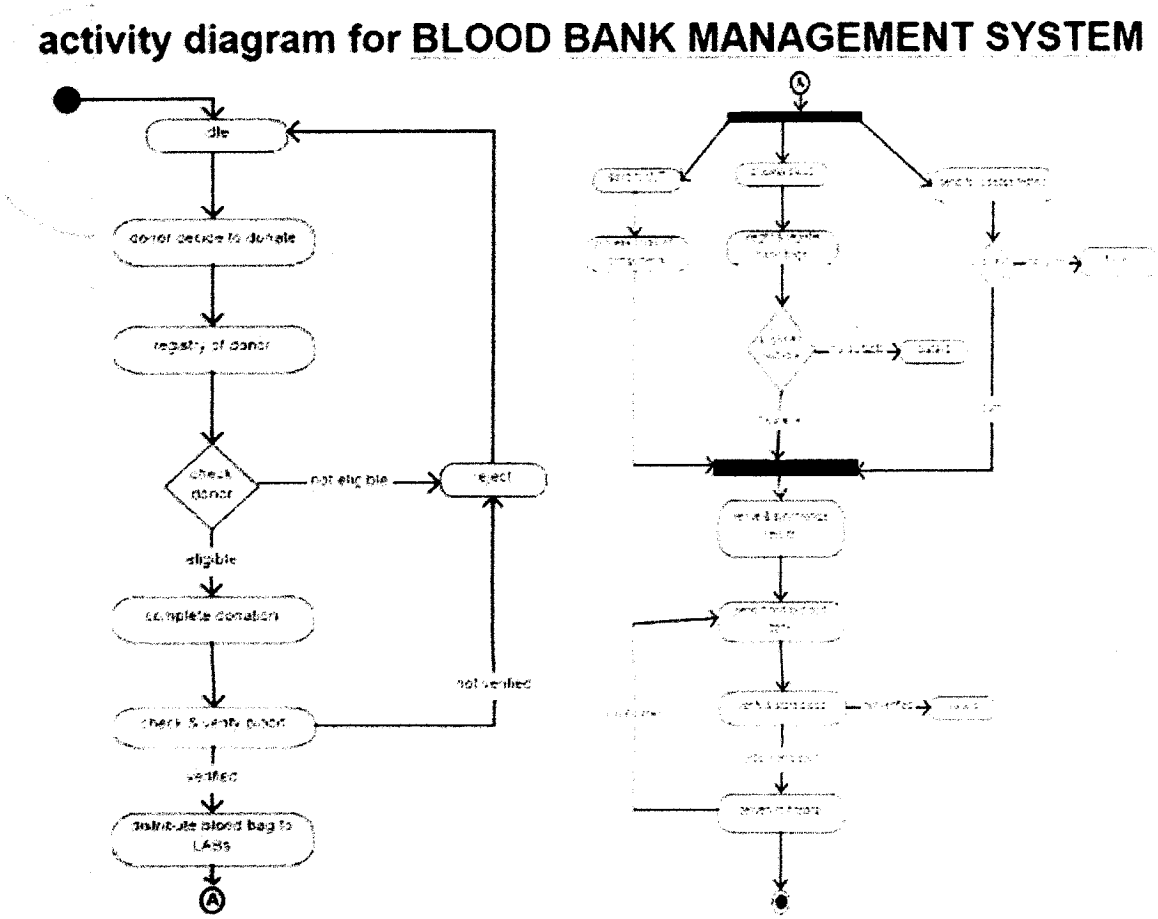
state diagram for BLOOD BANK MANAGEMENT SYSTEM



- **Sequence Diagram Login functionality**



- **Activity Diagram**



- **User Login Activity:**User is made to enter the username and password then entered values are verified. If it is a valid username and password, then the user is logged in, or else they are asked to re enter the correct values.

3.3.2 Logical Database Design

During this phase, the database conceptual, logical and physical designs are performed. The conceptual design requires the end-user views, outputs, and transaction-processing requirements to be determined. Then, the entities, attributes and relationships are defined by using Entity Relationship Diagram (ERD) followed by the process of normalizing the tables in the database till third normal form (3NF).

The database design phase is then continued by performing the logical design where the conceptual model is translated into definitions of tables, indexes and views. Only certain tables such as blood details and system users need to have view as not all of the records are made visible to all users.

CHAPTER 4 : SYSTEM IMPLEMENTATION

Implementation is the stage in the software engineering process at which an executable software system is developed.

The System keeps track of all donor details and patient details.The main functionalities available in this system are:

- maintaining blood donor records
- Finding compatible blood types for patients
- Checking the blood inventory for available blood and when it will likely expire

Accessing the System

Login; the system provides security features through password security where only authorized user can access to the system with different authorization level.

The login process is done through the default administrative account. A user gains access to the system resources after a username password combination has been verified as accurate after which they are redirected to the homepage. The system homepage serves as the gateway to the entire records management system. Therefore, once a user is logged into the system they can access all system resources available to them. Once logged into the system the user can register donors, search for donor and patient details and check the inventory for blood products.

The system only has one user privilege which is the administrative level so all laboratory technicians and heamatologists fall under this level.

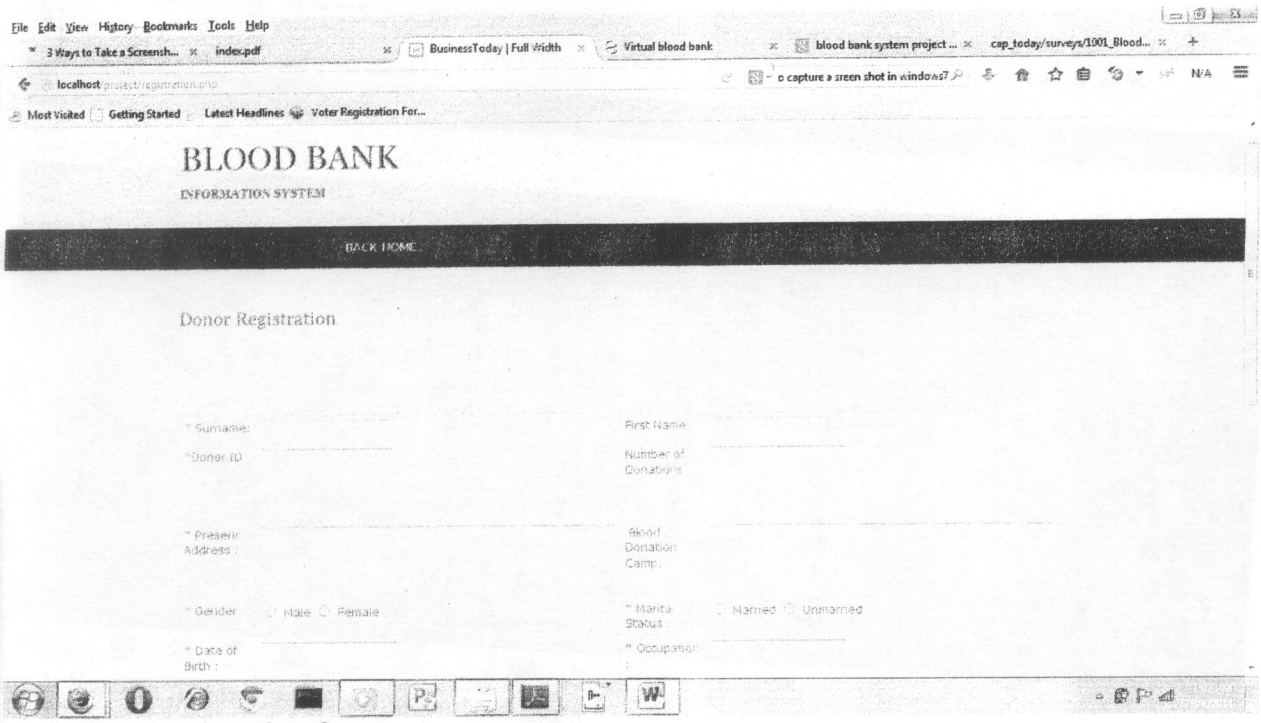


fig 1; donor registration form

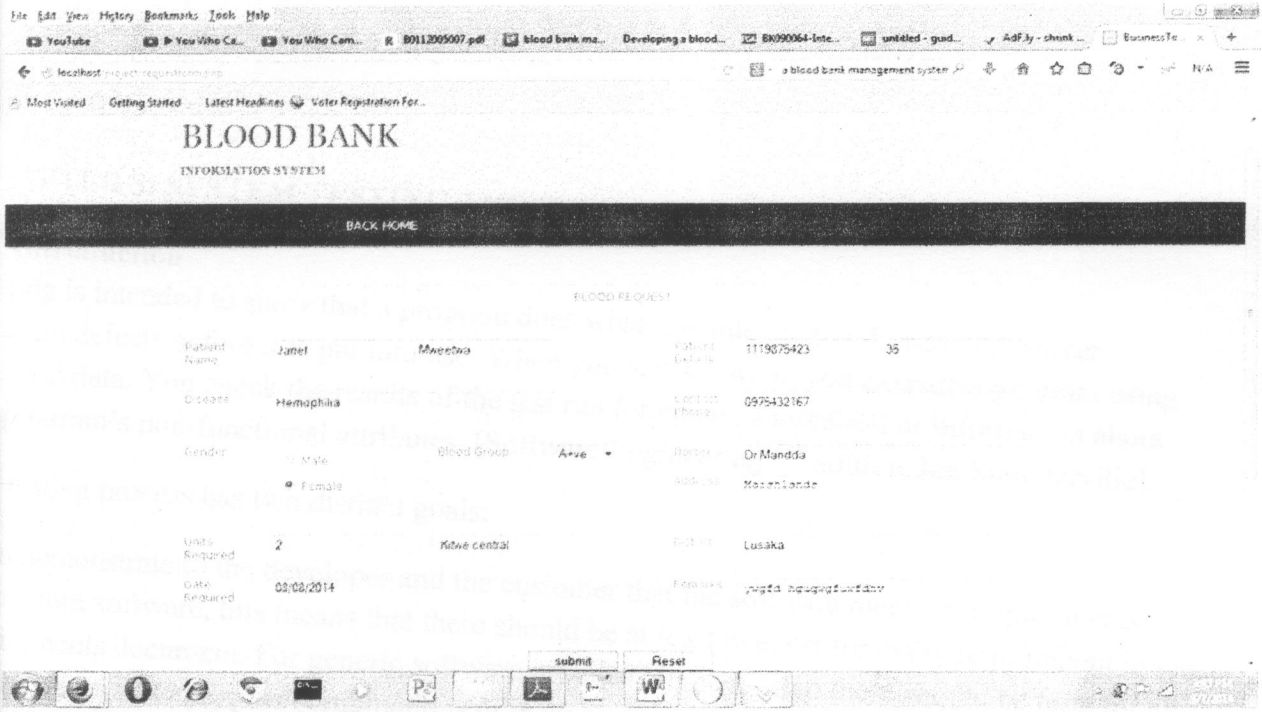


Fig 1; Enter recipient details

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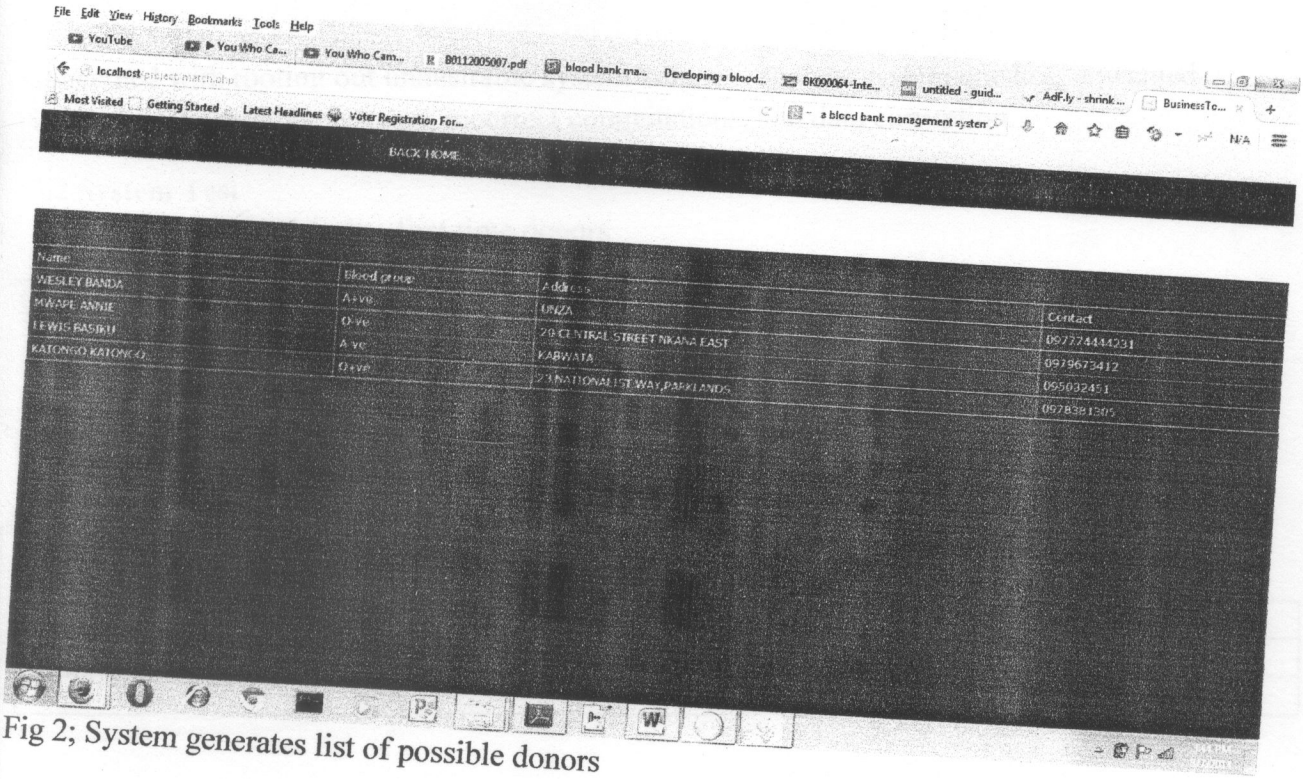


Fig 2; System generates list of possible donors

CHAPTER 5: SYSTEM TESTING AND RESULTS

5.1 Introduction

Testing is intended to show that a program does what it is intended to do and to discover program defects before it is put into use. When you test software, you execute a program using artificial data. You check the results of the test run for errors, anomalies, or information about the program's non-functional attributes. [Software Engineering 9th edition, Ian Sommerville].

The testing process has two distinct goals:

To demonstrate to the developer and the customer that the software meets its requirements. For custom software, this means that there should be at least one test for every requirement in the requirements document. For generic software products, it means that there should be tests for all the system features, plus combinations of these features, that will be incorporated in the product release.

To discover situations in which the behavior of the software is incorrect, undesirable, or does not conform to its specification. These are a consequence of software defects. Defect testing is

concerned with rooting out undesirable system behavior such as system crashes, unwanted interactions with other systems, incorrect computations, and data corruption.

5.2 System Test

Experiment one; registering first time donors

Aim; to check if the donor registration script is working according to the requirement and if the performance is acceptable.

OBJECTIVES:

- Check if the scripts are working – able to add new donors to the system
- Assess the performance of the scripts with different workloads

Use Case	Server request
Registering Donor	http://project/registration.php

Test	Result	Implication
Searching for compatible blood types	successful	The system generates a list of possible donors
Check inventory for blood products using barcode	successful	The system displays the expiry date of the specified blood
Search for donor by blood type	successful	System displays a list of donor with the specified blood type
Add patient to recipient list	successful	System displays list according to the level of priority

5.2.1 Database Testing and Evaluation

After the data have been loaded into the database, the database is tested for its performance, integrity, concurrent access, and security constraints. Normally, the testing and evaluation phase occurs in parallel with application programming. The testing covers the database connectivity with the application program and the successfulness of executing the Structured Query Language (SQL) statements embedded in the application program.

CHAPTER 5; CONCLUSION

5.1 Results

The system was able to attain some of the goals that were set the beginning of development. Below are a few of those goals that were reached;

- Cross matching: The system is able to generate a list of possible donors once a recipient has been added to the database.
- Screening Tests: Testing donated blood for diseases. Since the emergence of AIDS around 1985, anti-HIV testing is a must. Subsequently, additional tests such as Anti-HTLV-1, Anti-HBC, ALT, Anti-HCV and HBsAg are being added. Preservation and Storage of blood and its components:
  - Separation of blood components before recording them in the inventory. From the whole blood donation Whole blood, Packed red cells, Fresh Frozen Plasma (FFP), Platelet, Cryoprecipitate, Cryosupernatant..

  - From aphaeresis donation " Fresh Frozen Plasma (FFP), Platelet, Cryoprecipitate, Cryosupernatant. Each different blood product is stored at different temperatures. Unscreened Fresh Frozen Plasma (FFP), cryoprecipitate and cryosupernatant are stored at -70 to -75oC while screened FFP, cryoprecipitate and cryosupernatant arestored at -20 to -22oC. Screened whole blood and red cells are stored at 2-6oC.
  - The system can adequately keep donor records for future reference.
  - The system can generate a list of nearby blood banks with their contact details
  - The system is able to generate a report on particular blood components given the barcode number on the blood bag.
  - All the process of submission of registration form is quite simple.
  - Department can collect information regarding various blood groups.

5.1.2 Problems and Limitations

- The failure of the system could have serious ramifications for the entire blood bank in that this could lead to loss of donor records and inventory details.

5.1.3 Conclusion

The ultimate goal and aim of the project was to create a Blood Bank management information system that provides quick and instant access to patient's records and donor records. The researcher can confidently say that this has been met; additionally the objectives of this project were met.

Furthermore the resources listed in this report suffice for this project to be implemented, as well as the qualitative results performed have shown that the application can withstand a great deal of load.

The application meets all the user requirements and is usable in a local environment such as blood donation centers c to provide a quick access to the donor records as well as management.

5.4 Future Works, Challenges Faced and Recommendations

The greatest challenge the researcher faced understood the requirements which kept on changing. Furthermore, load testing software was difficult to find, the ones that came through are not reliable, those are reliable are expensive. Additionally, the researcher had a problem with logistical funds, as the sponsor did not come through.

The researcher recommends that, the powers that maybe should put in place measures to have logistical money be credited to the next team to work on the project. Additionally, certain load testing software should be provided by the powers that maybe.

APPENDICES

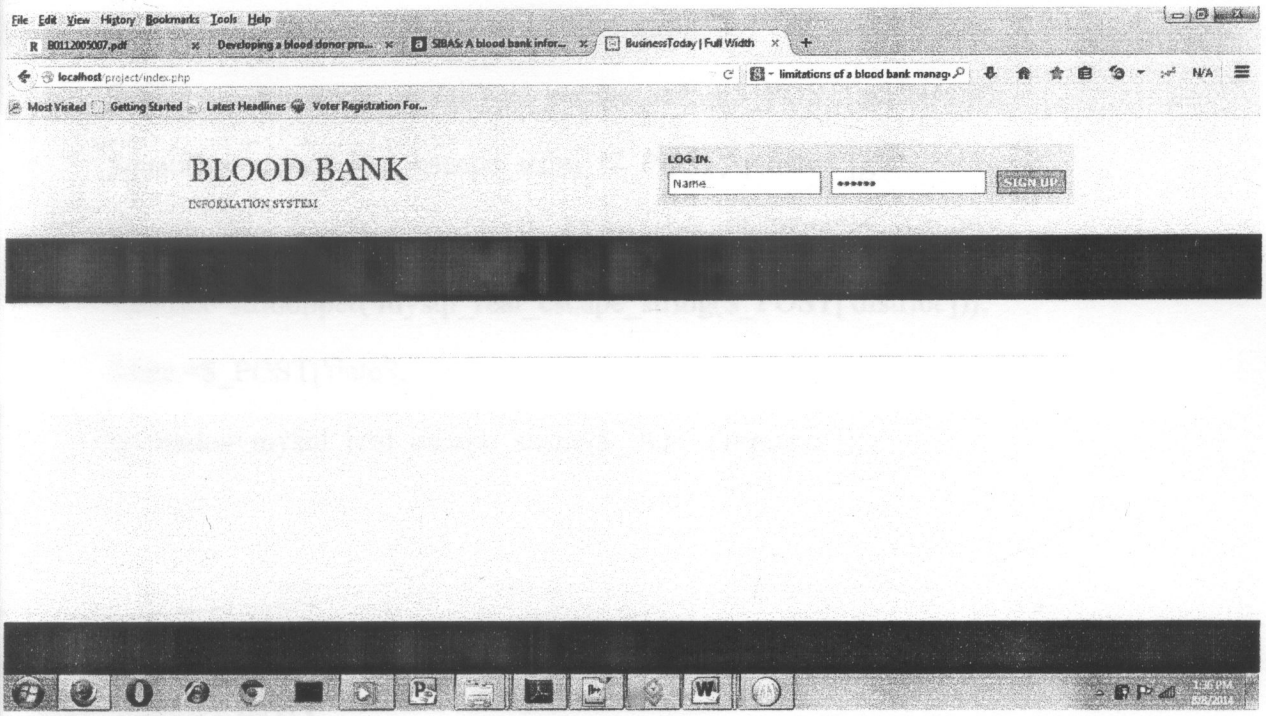
User Login Function and verification

Source code

```
<?php
session_start();

$host="localhost"; // Host name
$username="root"; // Mysql username
$password=""; // Mysql password
$db_name="blood_bank"; // Database name
$tbl_name="lab_tech"; // Table name

// Connect to server and select databse.
mysql_connect("$host", "$username", "$password")or die("cannot connect");
mysql_select_db("$db_name")or die("cannot select DB");

// username and password sent from form
$myusername=$_POST['name'];
$mypassword=$_POST['password'];
$count=0;

// To protect MySQL injection (more detail about MySQL injection)
$myusername = stripslashes($myusername);
$mypassword = stripslashes($mypassword);
```

```
$myusername = mysql_real_escape_string($myusername);

$mypassword = mysql_real_escape_string($mypassword);


$sql="SELECT * FROM $tbl_name WHERE username='$myusername' and
password='$mypassword'";

$result=mysql_query($sql);


// Mysql_num_row is counting table row


$count= mysql_num_rows($result);


// If result matched $myusername and $mypassword, table row must be 1 row


if($count==1){


// Register $myusername, $mypassword and redirect to file "login_success.php"

$_SESSION[username] = ("name");

$_SESSION[password]=("password");

header('location:../project/admin.php');

}

else {

 $_SESSION['errors'] = ("Your username or password was incorrect.");

 header("location:index.php");

                exit();

}
```

Login Screen



Add Recipient to database

Source code

```
<?php
        session_start();
        require_once('Connections/dbconn.php');


  $pfname= strtoupper(mysql_real_escape_string($_POST['pfname']));
        $plname= strtoupper(mysql_real_escape_string($_POST['plname']));
        $patient_id= mysql_real_escape_string($_POST['patient_id']);
        $age= mysql_real_escape_string($_POST['age']);
        $disease= strtoupper(mysql_real_escape_string($_POST['disease']));
        $phone= mysql_real_escape_string($_POST['phone']);
        $gender = $_POST['gender'];
```

```
$blood_type=$_POST['blood_type'];
$doctor= strtoupper(mysql_real_escape_string($_POST['doctor']));
$address= strtoupper(mysql_real_escape_string($_POST['address']));
$quantity= mysql_real_escape_string ($_POST['quantity']);
$hospital=strtoupper( mysql_real_escape_string($_POST['hospital']));
$district=strtoupper( mysql_real_escape_string($_POST['district']));
$date =$_POST['date'];
$remarks= mysql_real_escape_string($_POST['remarks']);
```

```
$sql="INSERT INTO
recipients(fname,lname,patient_id,age,disease,phone,gender,blood_type,doctor,address,quantity,
hospital,district,date1,remarks)VALUES('$pfname','$plname','$patient_id','$age','$disease','$pho
ne','$gender','$blood_type','$doctor','$address','$quantity','$hospital','$district','$date','$remarks')"
;

$result = mysql_query($sql);

if($result){
  echo "Successful<br/>";

$_SESSION['blood_type']=$blood_type;
header("location: match.php");
        }
        else{
        echo "ERROR";
```

```
        }
        mysql_close();

?>
```

Find suitable donor

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml" xml:lang="EN" lang="EN" dir="ltr">
<head profile="http://gmpg.org/xfn/11">
<title>BusinessToday | Full Width</title>
<meta http-equiv="Content-Type" content="text/html; charset=iso-8859-1" />
<meta http-equiv="imagetoolbar" content="no" />
<link rel="stylesheet" href="styles/layout.css" type="text/css" />
<link rel="stylesheet" href="styles/forms.css" type="text/css" />
<link rel="stylesheet" href="styles/tables.css" type="text/css" />
<link rel="stylesheet" href="styles/navi.css" type="text/css" />
</head>
<body>
<div class="wrapper col2">
<div id="topbar">
<div id="topnav">
<ul>
<li><a href="#"></a></li>
<li><a href="#"></a></li>
<li><a href="#"></a></li>
```

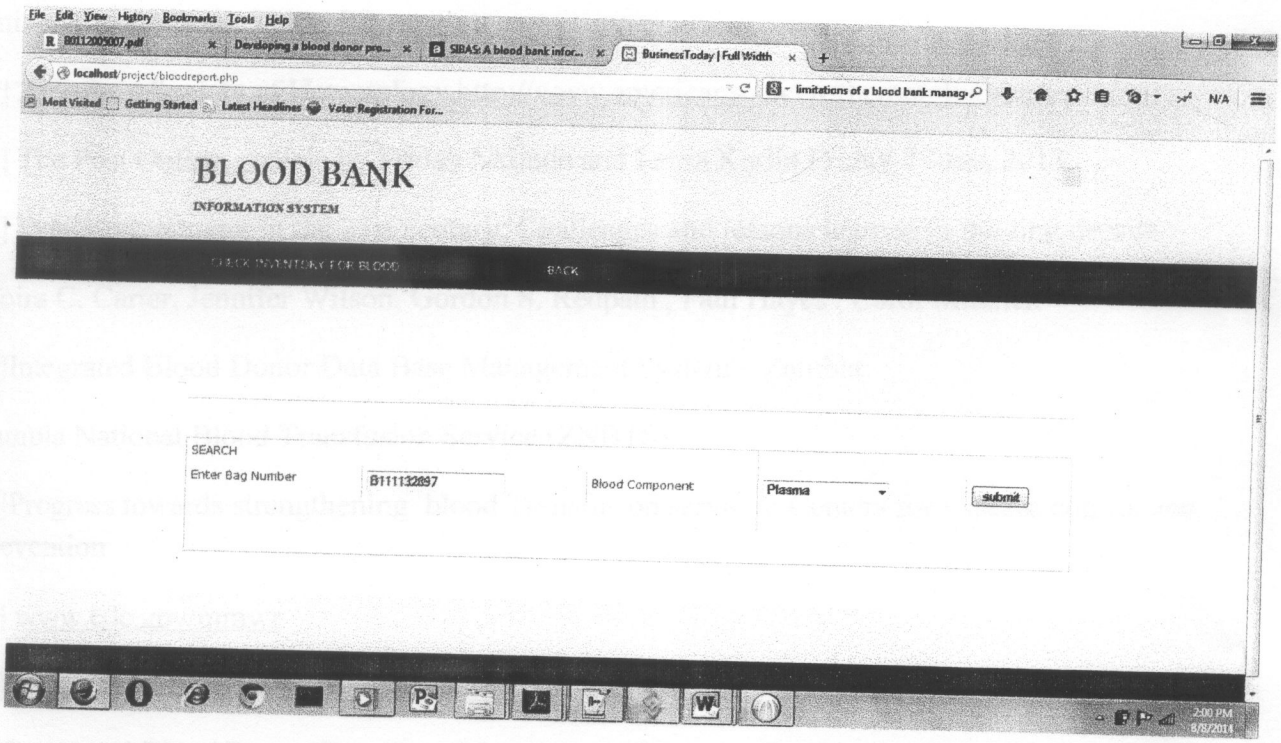
```
<li><a href="#"></a></li>
<li class="last"><a href="admin.php">BACK HOME</a></li>
</ul>
</div>

<br class="clear" />
</div>
</div>
<div class="wrapper col6">
<div id="footer">
<div id="login">

<p></p>

<p></p>
</div>



<br class="clear" />
</div>
</div>
<div class="wrapper col7">
<div id="copyright">
```

```
br class="clear" />
/div>
/div>
/body>
/html>
?php
        error_reporting(E_ALL);
        //if (!isset($_POST['submit'])) {
        // form not submitted
        //echo"Welcome to the search page";
        //}else
        //{

 Server Variables
host = "localhost";
user = "root";
pass = "";
db = "blood_bank";
tbl="donors";



query = "";
ession_start();
blood_type = $_SESSION['blood_type'];
```

```
if ($blood_type=="O+ve")

{

        $query = "SELECT CONCAT(fname,' ',lname) AS name,gender, present_address,
phone_no , blood_type , dob FROM donors WHERE blood_type IN ('O+ve','O-ve')";

}

elseif($blood_type== "O-ve")//Any blood type but specified distric

{

   $query = "SELECT CONCAT(fname,' ',lname) AS name,gender, present_address, phone_no ,
blood_type , dob FROM donors WHERE blood_type='O-ve'";

}

elseif($blood_type== "A-ve")

{

  $query = "SELECT CONCAT(fname,' ',lname) AS name,gender, present_address, phone_no ,
blood_type , dob FROM donors WHERE blood_type IN ('A-ve','O-ve')";

 }

elseif($blood_type=="A+ve")

{

 $query = "SELECT CONCAT(fname,' ',lname) AS name,gender, present_address, phone_no ,
blood_type , dob FROM donors WHERE blood_type IN ('A+ve','A-ve','O+ve','O-ve')";

}

elseif($blood_type=="B+ve")

{

 $query = "SELECT CONCAT(fname,' ',lname) AS name,gender, present_address, phone_no ,
blood_type , dob FROM donors WHERE blood_type IN ('A+ve','A-ve','O+ve','O-ve')";

}

elseif($blood_type=="B-ve")
```

```
{
 $query = "SELECT CONCAT(fname,' ',lname) AS name,gender, present_address, phone_no ,
blood_type , dob FROM donors WHERE blood_type IN ('B-ve','O-ve')";
}
elseif($blood_type=="AB+ve")
{
 $query = "SELECT CONCAT(fname,' ',lname) AS name,gender, present_address, phone_no ,
blood_type , dob FROM donors ";
}
elseif($blood_type=="AB-ve")
{
 $query = "SELECT CONCAT(fname,' ',lname) AS name,gender, present_address, phone_no ,
blood_type , dob FROM donors WHERE blood_type IN ('AB-ve','A-ve','B-ve','O-ve')";
}

// Open Connection

$connect = mysql_connect($host, $user, $pass) or die ("Unable to connect to host");

//Select Database

mysql_select_db($db) or die ("Unable to connect to database");

//Create query

$result = mysql_query($query) or die (mysql_error());
```

```
echo "<table border='1' ><tr><td>Name</td><td>Blood
group</td><td>Address</td><td>Contact</td></tr>";


while( $row = mysql_fetch_array( $result ) )

{


        echo"<tr><td>".$row['name']."</td><td>".$row['blood_type']."</td><td>".$row['present
_address']."</td><td>".$row['phone_no']."</td></tr>";

}

        echo "</table>";


mysql_close($connect);




//}

?>
```



Search the blood inventory to check for the expiry date of the specified blood component

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