Research Paper

CBBR Centralized Blood Bank Repository

Implementation with Java/JSP and Integrated with mobile app using phonegap (Case Study on Developing countries)

Ibrahim Fawze Akar

BSc Business Information System

FTMS College Malaysia

iakar89@gmail.com

Tukur Anas Mohammad

BSc Software Engineering

FTMS College Malaysia

dgreat91@gmail.com

Mohamed Ismail Z

Program Leader cum Senior Lecturer

School of Engineering and Computing Sciences (SOECS)

FTMS College Malaysia

ismail@ftms.edu.my

Abstract

A blood bank is a central repository in which blood is stored and managed as a result of blood gathered by collection and donation which are preserved for future use in blood transfusion. There are numbers of online web based blood bank management system existing for storage of data for blood centers and hospitals to maintain information of donors, blood available, as well as transaction information. Recent research on this topic shows that manual systems as compared to computer based information system are time consuming, laborious and costly. Thus it also evince praising computerization as a mechanism of achieving efficiency and

effectiveness in this field and pointing out some crucial issues which are left aside such as proper responsibility for administration of the system. In this paper, we introduce to you a new solution blood bank management which is called the Centralized Blood Bank Repository (CBBR). With this system, donors and other recipients such as patients and hospitals can register into the system. Donors will be able to access information about the various blood banks registered to the system as well as blood donation campaigns organized by blood banks. The blood banks are added into the system by the administrator. Recipients (Patients, hospitals, clinics, etc.) will also have access to important information like type of blood available and at which blood center. Also, continuous track of all transactions in the blood banks will be done by the system to keep efficient log of data and enhance proper report and decision making. With the new CBBR, 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.

Keywords: *Donor, Recipient, Cloud Computing, Transfusion, Repository, Cloud Server.*

1.0. Introduction

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.

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 include 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 are 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.

As you go into this paper, you will be introduced to a new solution that we offer after a careful study of relevant researches and documents.

1.1. Aims and Objectives

The aim of this research is to find a possible solution to the problems that are currently faced by blood banks and blood donation centers.

The objectives of this research is to:

- Develop a feasible solution to handle management activities in blood banks
- Create an effective means of communication between donors, hospitals, donors and recipients.
- Device means of coordinating the activities of blood banks and blood donation centers.

2.0 Literature review

The purpose of this research is to find a way to implement a system that will provide a solution not only to blood centers but also to the numerous patients and willing blood

donors. To do that, a lot of effort has been put to study a number of researches in this field and to gather enough information that will help achieve that goal.

In order to appreciate the facts within this research, there is a necessity to analyze the current state and the overall nature of the blood bank system as well as the effort being put in order to appreciate the centralized blood bank repository.

2.1 Existing System

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.

Pah Essah and Said Ab Rahman (2011) 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 Mailtrey D Gaijjart (2002) 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.

Akshay V Jain Khanter (2009) suggests a management information system application that covers some of the blood bank management issues related to a particular region.

An interesting approach by Jeroen Benien and Hein Force (2012) 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, E. M. S. S. Ekanayaka and C. Wimaladharma (2015) 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.

Below is a proposed system that will eliminate all the problems that the blood bank management system are facing currently.

2.2 Proposed System

So from the above literature, we make it the aim of our research to pay a very close attention to blood transfusion centers, blood banks and the various processes and stakeholders that are involved in those establishments in order to develop a system that will coordinate and improve the quality of the various activities and processes that are carried out.

The system we are proposing will be centralized. This means that it will be a single system that will accommodate different types of users all accessing the same information and a number varying functionalities.

The proposed system will be Web-based. It will be developed in HTML 5/CSS and JSP on the WWW platform and will be accessed through the HTTP protocol. HTML 5/CSS will be used to develop the user interface for the application while JSP will be used to implement the backend functionalities.

The proposed system will store a large amount of information and therefore will be connected to a database. For this project, we will use H2 database. H2 database is a pretty new, open source database implementation built for java. It can be embedded in the system as a Java library thereby leaving very small footsteps. As a result, it is really fast, secured and quite easy to use.

A number of important yet lacking functionalities have been identified while reviewing the existing systems. These functionalities represent the processes that tends to keep the blood centers lagging technologically.

On the blood bank side, they will have access to the donor information, recipient data and requests, respond to the various requests, make donation appointments with donors and organize blood donation campaigns to create awareness and attract more donors. They will also be able to have a real time update on their blood repository. The system will also help them eliminate errors from donor's tests.

For the donors, which can be paid or volunteer donors, they will have access to important information on blood donation process and requirements as well as the location of blood centers and blood donation campaigns. They can also be able to register as a regular donator. This provides a vital link that is lacking in the existing systems. With the new system, a donor is just clicks away from any information he needs on a blood center or campaign event. The proposed system will also help eliminate redundancy of performing group and genotype tests every time a donor is donating.

The proposed system will also support transactions on both acceptors and donor's side. An acceptor can pay for a transfusion center's services and a donor can also be paid for his services.

On the receptors side, the proposed system will provide them with important information about the availability of their required blood type, the blood center in which it is available and transaction information. Receptors can also communicate real time with donors and blood centers. In case of an unavailable type, the system will give the receptors the chance to post a general request that can be seen by anybody willing to be a donor.

The proposed system will also accommodate a super admin that will manage the existing, new and changing information on blood bank and centers and to confirm (Accept or Deny) campaigns and event requests before they are posted to the system.

The proposed system will also be integrated with SMS functionality to inform receptors on matching bloods or donor availability.

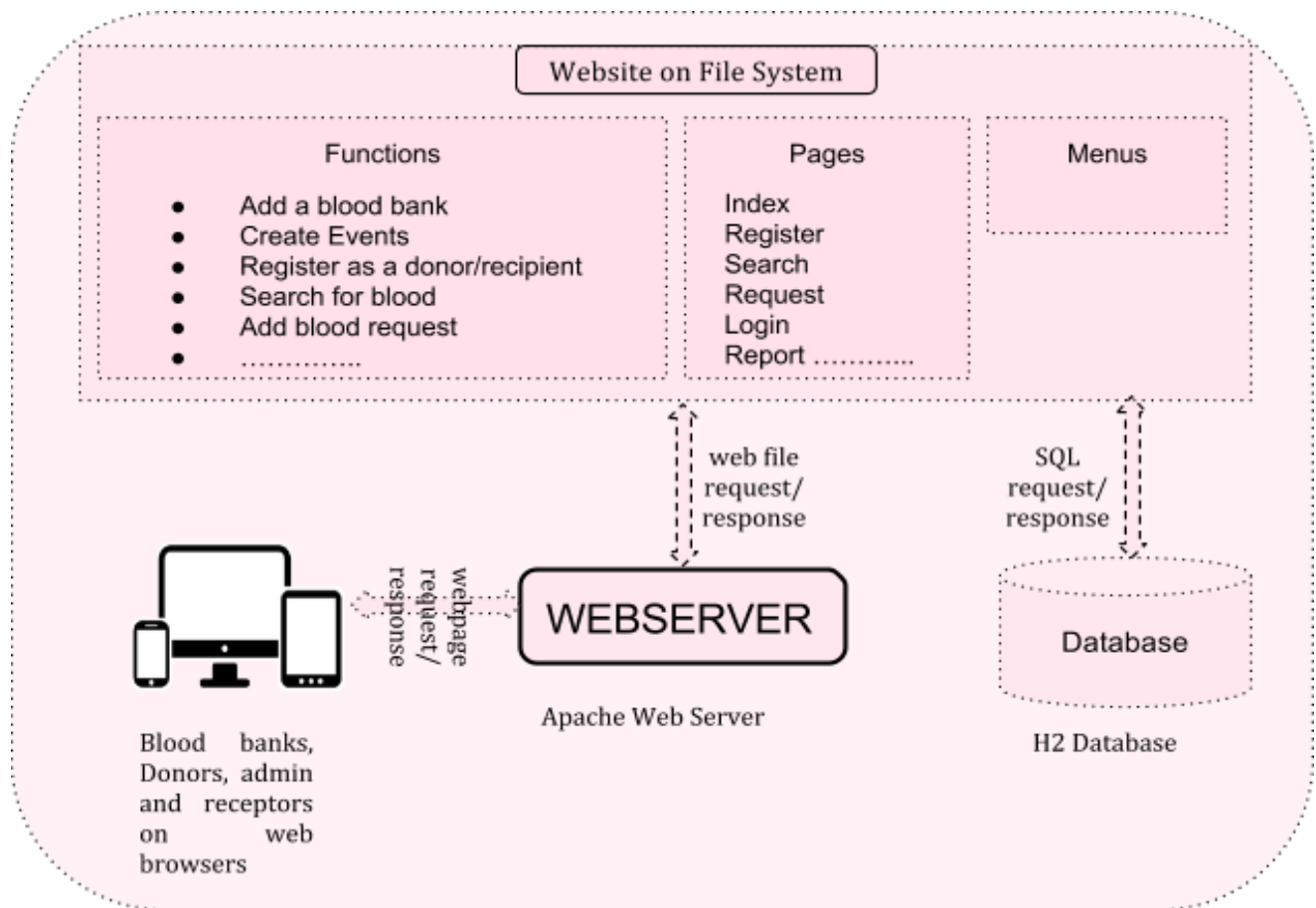The proposed system can be accessed by anybody with internet connection and a web browser.

Figure 1: Architecture of CBBR

2.3. Proposed Architecture

Our new system will be a website hosted on an apache web server. The overall architecture is centralized. In this sense, the system is deployed in a central server while being accessed and collecting data from browsers on different devices in distributed areas.

Unlike the existing blood bank management systems, the new system is designed to be used by different blood bank centers while maintaining data security and privacy of individual blood banks but at the same time having the same level of access to other data and information like donors' and recipients' information.

The new system is designed to be "deployed once and use anywhere" as opposed to some researches that suggest management activities to be implemented on standalone systems that will be deployed on individual computers in the blood bank centers. All System functionalities will be accessible over the internet depending on the type of user accessing the system.

3.0 Research Methodology

3.1. Design:

First, we will use qualitative research methodology, specifically an interview session with a number of people at a blood donation campaign. This will help us understand the processes involved, activities carried out and the amount of data and information collected during those processes.

We will then use the quantitative approach, in this case, document reviews and observation in order to back up the information that we gathered during the interviews. This is necessary as some of the information collected during the interview seems vague and some of the interviewees are likely to give information that varies from the way the real process is undertaken.

3.1.1 Approach:

We approach this research in two ways. In the beginning, we selected a number of research papers on this field. These papers are all peer reviewed. We then proceeded to extract all the important data pertaining our research. This part is done following the method proposed by Prof. Kitchenham which provides a set of guidelines for software engineering researchers for producing a literature survey that is a fair evaluation of a research topic by using a trustworthy, rigorous, and auditable methodology.

We then visit two blood donation campaign; one in FTMS College and another in Celebrity Gym in Endah Parade. Here, we tried to interview different people ranging from campaign organizers, donors and the nurses. In the two places, we manage to interview a total of seven people; two were donors, two campaign organizers and three nurses from Malaysian Blood Transfusion Society. We also tried to acquire some of the forms they use in collecting information of donors.

Interview Questions:

1. What are the steps i need to follow to donate blood?
2. How much time do you spend in processing each donor?
3. How do you reach people to let them know about your campaigns and attract them to your sites?
4. What are the things that will make the process faster in your opinion?

5. Do you Have errors in the processes? At what rate?

6. How do you get Information on blood donation campaigns?

3.2 Findings and Discussions

Age and gender of blood donors

Data about the gender profile of blood donors show that globally 30% of blood donations are given by women, although this ranges widely. In 20 of the 111 reporting countries, less than 10% donations are given by female donors.

The age profile of blood donors shows that more young people donate blood in low- and middle-income countries, proportionally than in high-income countries (see Figure 1). Demographic information of blood donors is important for formulating and monitoring recruitment strategies. (Who.int, 2014)
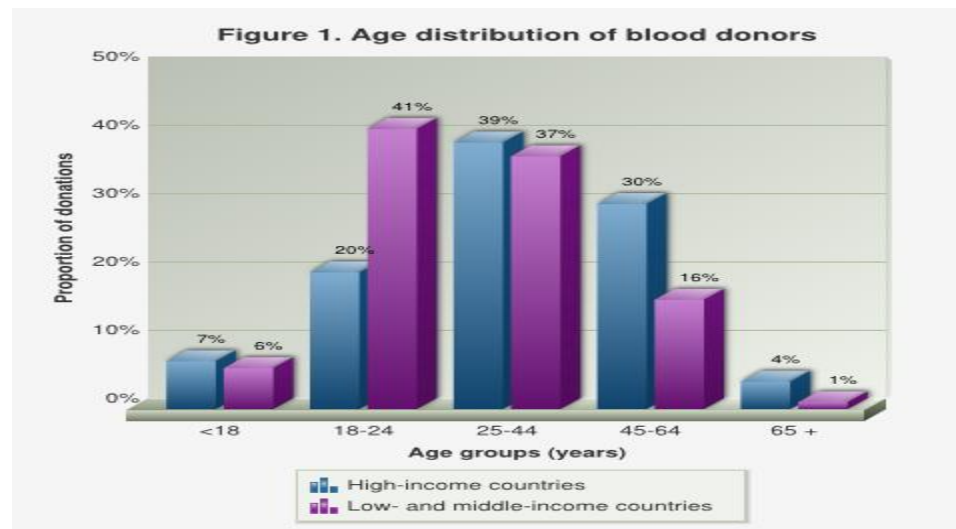

Chart 1: Age Distribution of Blood Donors

Types of blood donors

There are 3 types of blood donors:

*   voluntary unpaid

*   family/replacement

*   Paid.

An adequate and reliable supply of safe blood can be assured by a stable base of regular, voluntary, unpaid blood donors. These donors are also the safest group of donors as the prevalence of blood borne infections is lowest among this group. World Health Assembly

resolution (WHA63.12) urges all Member States to develop national blood systems based on voluntary unpaid donation and work towards the goal of self-sufficiency.

Data reported to WHO shows significant increases of voluntary unpaid blood donations in low- and middle-income countries:

- An increase of 8.6 million blood donations from voluntary unpaid donors from 2004 to 2012 has been reported by 162 countries. The highest increase of voluntary unpaid blood donations is in the South-East Asia (78%) and African (51%) Regions. The maximum increase in absolute numbers was reported in the Western Pacific Region.

- 73 countries collect more than 90% of their blood supply from voluntary unpaid blood donations (38 high-income countries, 26 middle-income countries and 9 low-income countries). This includes 60 countries with 100% (or more than 99%) of their blood supply from voluntary unpaid blood donors.

- In 72 countries, more than 50% of the blood supply is still dependent on family/replacement and paid blood donors (8 high-income countries, 48 middle-income countries and 16 low-income countries).

- 25 countries still report collecting paid donations in 2012, around 1 500 000 donations in total.(Who.int 2014)

3.2.1 Challenges Facing Blood Transfusion in Developing Countries

In developing countries like Nigeria, blood transfusion process is plagued with many errors and challenges that leads to loss of human lives. According to Dr Neelam Dhingra; Coordinator Blood Transfusion Safety World Health Organization Headquarter, the challenges facing blood donation and transfusion include Blood shortages, inequitable access, increasing needs, Increasingly stringent donor selection criteria reducing the pool of eligible donors, poor blood stock management, Inadequate data and documentation as well as the limited interaction between hospitals and blood centers, donors and recipients. In the research, which involved 73 Countries, more than 50% of the blood supply still dependent on family/replacement and paid blood donors. This is due to the inadequate knowledge on the side of possible donors and poor outreach on the side of blood donors. Among these countries:

- 8 are high-income countries, 45 are middle-income countries and 20 are low-income countries.
- 22 countries still report collecting paid donations, around 800,000 donations in total.

3.4. Global Population and Blood Supply

In a study carried out by Dr. Neelam Dhingra; Coordinator Blood Transfusion Safety World Health Organization in 2013, a look at the global population and the amount of blood supply shows that a total of 107 million blood collections from a total of 177 countries. Of these countries, medium-income countries which make 98 of the countries have the highest supply of blood from both paid and voluntary donations at 72%. 48 high-income countries recorded 49% while the 37 low-income countries recorded only 12% of the total blood collection.
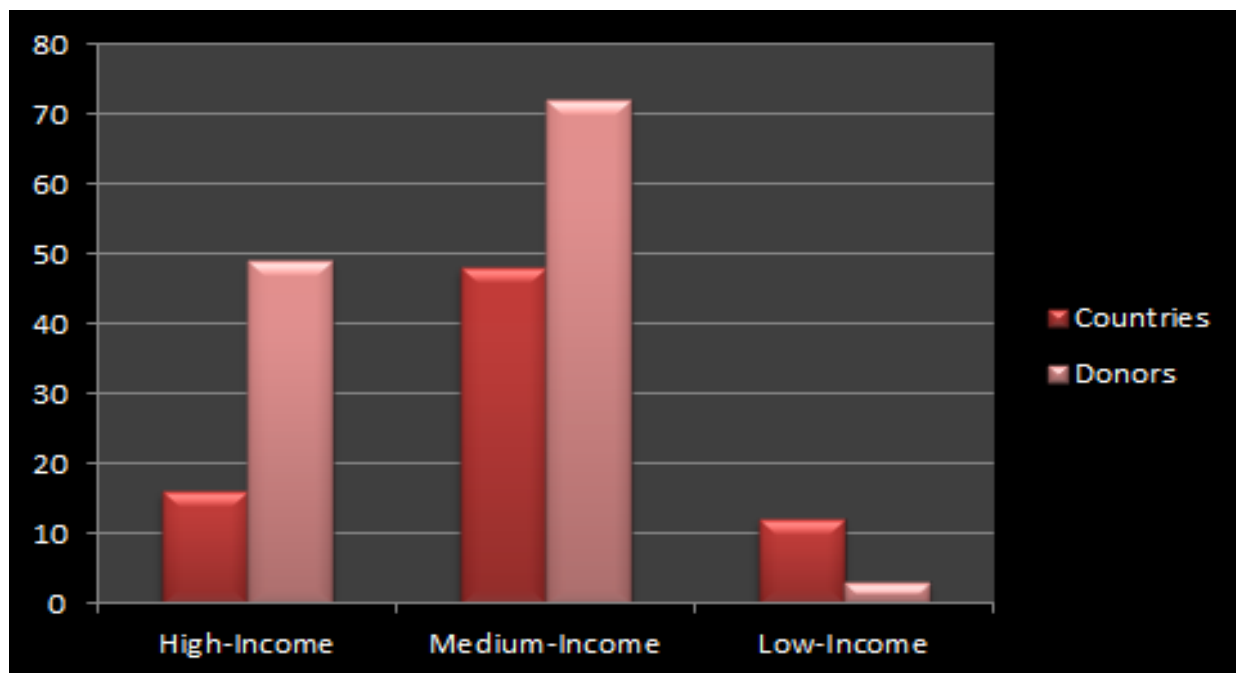

Chart 2: Blood supply among global population

4.0 Conclusion

Prior to this paper, a general study of blood bank management system was conducted from recent researches of various authors and facts were gathered in which helped to uncover the misfits that the system was facing. After proper analysation 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 centralized blood bank repository 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.

4.1. Future Work

In light with the current development in computing where everything is moving to cloud technology, our CBBR system is developed with the future in mind and it is therefore scalable and can easily be transformed into a cloud server that various blood banks can tap into and get required data and utilize various functionalities.

On a short-term basis however, we are looking into SMS integration, where alerts and notifications will be sent to users mobile phones.

References

Catassi, C. A., and E. L. Peterson. "The Blood Inventory Control System—Helping Blood Bank Management through Computerized Inventory Control*." *Transfusion* 7.1 (1967): 60-69.

Ekanayaka, E. M. S. S., & Wimaladharma, C. (2015). Blood bank management system. *Technical Session-Computer Science and Technology & Industrial Information Technology*, 7.

Esah, P., & Ab Rahman, S. (2011). Blood Bank Management System. [Accessed 22 Feb. 2015].

Nzoka, M. and Ananda, F. (2014). Blood Bank Management Information System A Case Study of the Kenya National Blood Transfusion Services. *Proceedings of Sustainable Research and Innovation Conference*, [online] pp.146-149. Available at:http://www.jkuat-sri.com/ojs/index.php/proceedings/article/view/110 [Accessed 20 Feb. 2015].

Who.int, (2015). *WHO | Blood safety and availability*. [online] Available at: http://www.who.int/mediacentre/factsheets/fs279/en/ [Accessed 24 Feb. 2015].

Library.med.utah.edu, (2015). *Blood Bank*. [online] Available at: http://library.med.utah.edu/WebPath/TUTORIAL/BLDBANK/BLDBANK.html [Accessed 25 Feb. 2015].

Anon, (2015). [online] Available at:

http://www.who.int/worldblooddonorday/campaignkit/WBDD_GlobalNeed_Englis h.pdf [Accessed 26 Feb. 2015].

Wake, D. J., & Cutting, W. A. M. (1998). Blood transfusion in developing countries: problems, priorities and practicalities. *Tropical doctor*, *28*(1), 4-8.

Dzik, W. H., Corwin, H., Goodnough, L. T., Higgins, M., Kaplan, H., Murphy, M., & Yomtovian, R. (2003). Patient safety and blood transfusion: new solutions. *Transfusion Medicine Reviews*, *17*(3), 169-180.

Dzik, W. H. (2003). Emily Cooley Lecture 2002: transfusion safety in the hospital. *Transfusion*, *43*(9), 1190-1199.