Blood Bank Management Information System A Case Study of the Kenya National Blood Transfusion Services

Makau Nzoka and Fanon Ananda

Abstract— As the cost of creation, processing and distribution of information continues to decrease, there has been increased penetration of technology based applications in the various sectors of the economy and the health sector has not been left behind. Computer based applications in the Kenyan health sector range from simple records management to the provision of electronic health and mobile based health services commonly referred to as e-health and m-health respectively.

This paper focuses on the relevance of web based technologies in managing blood bank information with an aim to improve efficiency in this crucial process which has proven challenging in the past since the inception of Kenya National Blood Transfusion Services over a decade ago. Taking the republic of Kenya as a case study the research findings indicated that the blood bank sector lacked coordination since each blood bank kept independent records, which were not coordinated with other banks. The paper discusses development and deployment of a system that achieves coordination of activities between the blood banks, health centers and donors having them interact with a central database.

Keywords— Blood bank management, e-health, health informatics, and management information systems.

I. INTRODUCTION

Management of blood and blood transfusion services in Kenya is carried out by the Kenya National Transfusion Center at the Kenyatta National Hospital, KNH, which processes blood and then distributes it to blood banks located all over the republic. These blood banks then avail the blood for use by hospitals and health centers. Although each blood bank maintains its own records, there does not exist a central location from which records from the various banks can be accessed.

A situation is frequently encountered where some banks have more demand than they can satisfy while in other banks the blood overstays and is eventually declared unfit for transmission resulting in wastage of the valued commodity. The blood donor's records are also not efficiently managed given that someone is given donors card which has no national level management of the records i.e. it's just a serial number which is not assigned meaning in the context of blood donation process. There are no synchronized records of blood

availability in Kenya at any given point in time and the procedure of undergoing blood transfusion in Kenya is not an easy one since most patients have to source for blood in the event the hospitals lack blood of their type. Most patients have been forced to source for blood from family replacer donors a condition that according to the US Department of Health, (2005) is unadvisable due to high number of infection cases.

There is always the undeniable possibility of having a blood bank lack sufficient volume of some blood groups leaving patients stranded and some lives have been lost this way. The short shelf life of blood and blood related products necessitates up to date synchronized records that can be accessed from a national level. The effects of these challenges manifest themselves in the pronounced shortage.

II. LITERATURE SURVEY

A number of scholars 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. Mailtrey D Gaijjart (2002) et al proposes 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. According to Choudhury(2009) blood transfusion service is a multibillion dollar profession given the expenses and revenue involved in the blood transfusion process in India. Therefore, a process that has so much financial implications management of its data and information is called for. Catassi and Peterson (1967) in their joint paper on Inventory management of blood banks describe a computerized solution for controlling blood distribution between the blood bank and its client hospitals. It is Do-Sung Kim and Yoo S.K who recommend a computerized approach to facilitate monitoring and management by introducing Radio Frequency Identification and Ubiquitous sensor network.
Pah Essah and Said Ab Rahman (2011) propose 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. Akshay V Jain Khanter (2009) suggests a management information system application that

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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.

III. SYSTEMS REVIEW

A number of web based applications for blood bank management have been developed in developed countries. Two major representative applications are reviewed below.

A. Blood Bank India

The Management Information System (MIS) of Blood Bank India keeps the name of the donor who is donating blood, a unique ID through which the donor can view his account , a for accessing the account , date of birth of the donor because his age must be in the range of 18-60 years, gender status of the donor, blood group of the donor, weight of the donor, mobile no, email id, address, city, state and the 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 search of the blood. After that when a search command is given then the MIS will return 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.

B. E-blooddonors

The MIS of electronic based blood donors (e-blooddonors) 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. In the system a user clicks on the link "Post your requirement "on the homepage and provides personal details like patient's name, age, gender, hospital name, reason for requirement, required before date , IP no, hospital area, mobile number , country name, city name and the blood group name. Once done via the "Post your requirement" link, the user can send their request which will be saved in the system and an SMS is automatically sent to the donors registered with Ebloddonors.org in that locality. Registered donors will call those in need of blood.

The system does not provide statistics on blood availability within blood banks, registered donors per area and does not link between hospitals and blood banks.

IV. LOGICAL DESIGN

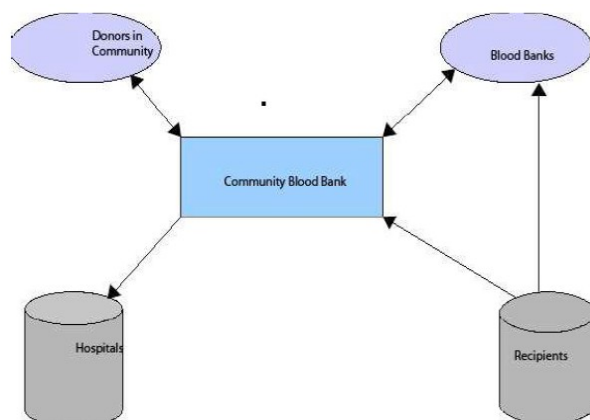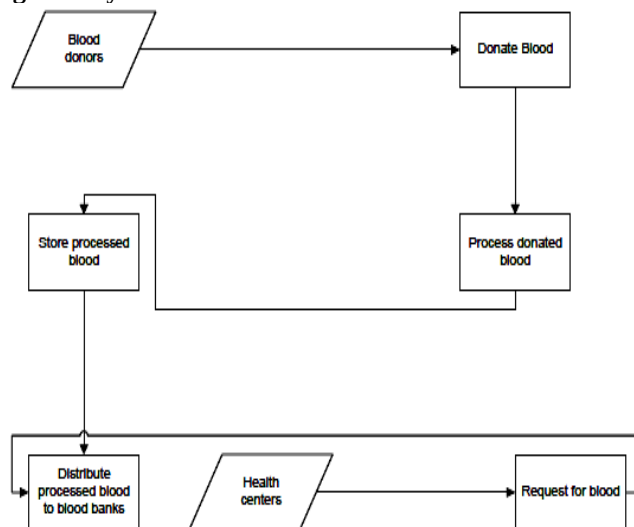**Figure 1 System Architecture**

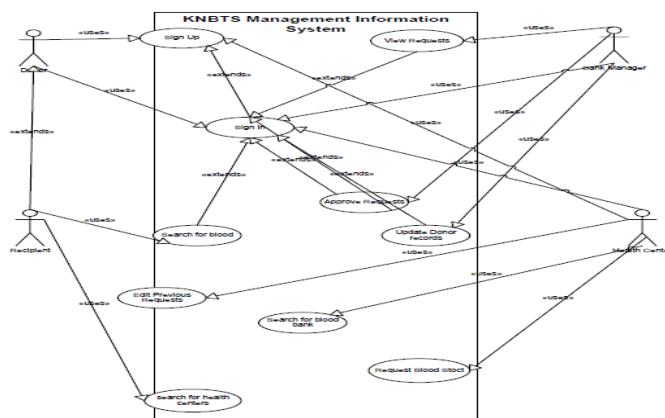**Figure 2 Business Model of the MIS**

Figure 3 Use Case Diagram

V. 5. PHYSICAL DESIGN

The system was implemented in MySQL database server This section illustrates the database schema and the crud matrix table.

TABLE I

CRUD MATRIX FOR THE BLOOD BANK MIS

	User action	Create	Read	update	delete
1	Sign Up	Reg_users	-	-	-
2	Log in	-	Reg_users	-	-
3	Add Blood Bank	Blood_banks	-	-	-
4	Delete Blood Bank	-	-	-	Blood_bank
5	Update Blood Bank	-	-	Blood_bank	
6	Record Donations	Blood_donation	-	-	-
7	Request Blood	Blood_request	-	--	-
8	Approve Blood Request	-	-	Blood_request	

3 A screenshot of the database schema for the MIS

VI. SYSTEM REQUIREMENTS

The system has been developed to target computing environment with the following specifications.

Software
  i. Operating System Red Hat Linux 8.0
  ii. Web Server Apache 1.3.34
  iii. PHP Version 4.4.1
  iv. MySQL Version 4.0.27
  v. Mail Sever: Zimbra
  vi. SMS Gateway Frontline

Hardware
  i. 80 GB of hard disk space
  ii. Windows compatible mouse
  iii. 256 MB RAM
  iv. SVGA card with mono or colour monitor
  v. CD-ROM Drive for installation
  vi. CPU Dual 2.4 GHz Xeon™
  vii. Primary Hard Drive 73 GB SCSI
  viii. Backup Hard Drive 120 GB EIDE

Design and Implementation Constraints
The system was designed and tested in the following computing environment:

    2 GB RAM
    1.66 GHz
    PHP VS 5.3
    Windows 7 Professional

VII. RECOMMENDATIONS AND AREAS FOR FURTHER RESEARCH

  i. Mobile optimization

 Many people are buying mobile phones and handheld devices that are capable of accessing the internet. This means that systems need to support Wireless Mark Up Language (WML) standard to facilitate access via these wireless devices.

  ii. Geographical Information Systems

There is always the need for developing location aware devices. Web Geographical Information Systems are finding significant use in the present day internet community. Future improvements along this line involve providing location awareness and geographical information in the system

  iii. Social Network Optimization

Another area for improvement is social network optimization in order to appeal to the millions of Kenyan residents who are on the social network as Facebook twitter and Digg.

iv. Data mining

Another area for future research is to utilize data mining techniques to build system intelligence.

VIII. CONCLUSION

The internet provides an effective avenue for communication which can be exploited to improve service delivery in the blood bank sector in Kenya.

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