Using mobile applications to apply a blood registration bank system in Libya

Dr.[1]Aeman I .G. Masbah
College of Technical Science-Derna
Aimn_gramay@yahoo.com

[3]Omar S. Mosa Elsharif
Lebo.Land@yahoo.com

[2]Amier A. Frag Gebril
College of Engineering Technologies - Al-Gubba
amer.gebril@gmail.com

[4]Aymen Fathalla H. Alhasadi
High Polytechnic Institute Albayda
Aymenalhasadi1979@gmail.com

الملخص

يتم حاليًا استخدام العديد من التطبيقات القائمة على تكنولوجيا المعلومات في مؤسسات الرعاية الصحية، على الرغم من أنه لا يزال من الصعب جدًا العثور على معلومات حول مراكز التبرع بالدم بليبيا، والتي تعد من المتطلبات المهمة جدًا في حياة الإنسان. الطريقة المستخدمة في الوقت الحالي هي أن يذهب المتطوع جسديًا إلى مركز طبي أو مستشفى، وهو أمر مستهلك للوقت ومكلف. فعلية دعت الحاجة لتصميم تطبيق قائم على الهاتف المحمول باستخدام تقنيات JSP وMySQL التي من شأنها تبسيط العملية. باستخدام جهاز يدعم WAP، يمكن للمستخدم بسهولة التسجيل وطلب الدم من أقرب مركز طبي، وبالتالي يتم إنقاذ حياة الأفراد المحتاجين للدم. في هذه الدراسة، تم تطوير نظام تسجيل الدم بليبيا عن طريق الموبايل واختباره بالهلال الأحمر–القبة وتقيمه بنجاح وذلك من خلال عمل مقارنة بين النظام الحالي والنظام القائم.

الكلمات الرئيسية: بروتوكول التطبيقات اللاسلكية، الاختبار والتقييم، الجوال، الرعاية الصحية.

Abstract

Many IT-based applications are currently being used in healthcare organisations, although it is still very difficult to find information about blood donation centres in Libya, which are very important requirements in human life. The method used at the moment is for a volunteer to go, physically, to a medical centre or hospital, which

is time-consuming and expensive. There is a need to develop a mobile-based application using Java Sever Pages (JSP) and MySQL technologies that will simplify the process. Using a WAP-enabled device, a user can easily register and request blood from the nearest medical centre, hence saving the lives of those individuals in need. In this study, mobile applications to apply a blood registration bank system in Libya has been successfully developed and tested in the Libyan Red Crescent - Al-Gubba and usefulness using formative evaluation by made comparisons between the current system and the proposed system.
Keywords: WAP, T&E, mobile, healthcare

1.0 Introduction

Human beings are vulnerable and susceptible to many threats. When a person needs to undergo an operation, standby blood is usually needed due to severe bleeding during surgery and accidents that occur, mainly during holidays. There are many more diseases for which blood transfusion is the only cure, such as anaemia, dengue and malaria. So, to ensure everything goes to plan, hospitals need a lot of blood on call in the blood bank.

Since blood cannot be industrially produced, and there is still no proper and easy way of donating blood, there is a need to use mobile phones, which are owned by many people, to register online and/or request blood within a short time, anytime, anywhere. There are many willing blood donors who cannot afford a computer connected to the internet or the cost of travelling to medical centres for the process of registering or checking the availability of blood. There is no system for Libyan hospitals that uses mobile phones to access the internet for the purpose of donating or requesting blood from a hospital or the nearest healthcare facility. IT can help improve lives. Use of the WAP-based blood donation application will enable donors to register as blood donors anywhere and at any time (Goh, Kim, Lavanya, Kim, & Soh, 2006).

2.0 Related work

Wireless Application Protocol plays an important role in the field of communication as a technical solution for devices supported by

technology, such as personal digital assistant (PDAs) and mobile phones (Xia et al., 2008). Wireless technology, specifically through mobile phones, has been characterised as being fast, convenient, easy to access (any time, any location) as well as readily available. Mobile services have many benefits for their users, including mobility, availability, and the ability to personalise, as distinct from other non-WAP technologies (Pagani, 2004). The usability of mobile terminals means they are a viable alternative in enhancing m-learning, which will result in effective and meaningful learning by a targeted community. The development of WAP sites has been achieved using Wireless Markup Language (WML), whereby HTML pages are translated to WML for WAP users to be able to read contents designed for personal computers using mobile phone screens (Gwo-Jen et al., 2002).

Currently, handheld devices are being developed with web browsers, which are a powerful platform for playing different digital media contents for the purpose of improving the present circumstances, where service providers are required to prepare their own players (Vu et al., 2007).

2.1 WAP architecture

WAP is an **industry-wise** requirement for building up applications that normally function over wireless communication networks (Kristian, 2002). This concept is also supported by the WAP forum, which calls it "an open, global specification that empowers mobile users with wireless devices to easily access and interact with information and services instantly". It provides a way of making the information from the internet accessible by users with WAP enabled mobile phones by transforming it (the information) into the format of WAP pages. WAP intended of different types of handheld devices, such as PDAs, mobile phones and pagers. WAP Gateway is the software found in the mobile networks used to connect to the internet and is meant for the purpose of sending content and applications to the WAP-enabled mobile phone, as shown in Figure 1 below:

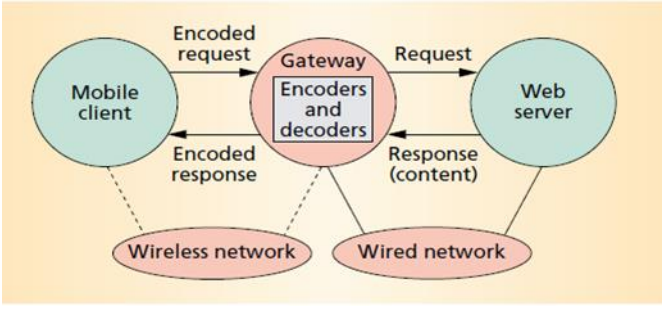


Figure 1. Proposed system architecture

2.2 Mobile Technology and Health Management Information Systems (HMIS)

Fredrick (2009) reveals that HMIS is an information system designed to assist in the management and planning of health programs, as opposed to the delivery of care. Mobile technology refers to handheld devices such as personal digital assistants (PDAs), mobile phones and so on. Advanced development in mobile technology has mediated the latest changes in mobile technologies, transforming them from being just an electronic address device to powerful tools that support wireless network connectivity. The DoH (2005) has concluded that mobile technologies are electronic tools capable of surfing the internet, sending and receiving email/text messages and functioning as information repositories, which is also useful in the healthcare industry. The source further states that mobile technology offers immediate and ubiquitous access to patients' integrated electronic health records. Such records can be further enhanced if the device is also able to display graphical information related to clinical examination records.

A good Health Management Information System (HMIS) is necessary to manage a health organization effectively and efficiently (Jayawardena, 2014). HMIS is the key factor for an effective decision making process. A Hospital Information System (HIS) is a comprehensive, integrated information system designed to manage the administrative, financial and clinical aspects of a hospital. This includes paper-based information processing as well as data processing by using machines (Wani & Sankaranarayanan,

2014). Hospital information systems may contribute in different ways to quality assurance activities such as assessing the quality of primary care, monitoring quality indicators, supporting clinical care evaluation studies, and auditing concurrently the ongoing process of care using reminders or decision support techniques (Wani & Sankaranarayanan, 2014).

In the case of the URCS blood donor system, where counsellors used to take blood donors' results using sheets of paper that were subject to damage by rainfall and rodents, and easily accessed by unauthorised parties, mobile technology can provide a better alternative. This is because it provides the security, secrecy, confidentiality and consistency expected of medical records**.**

Over a million blood units are collected from donors every year; nevertheless, many more millions still need to be collected to meet the global demand and ensure sufficient and timely provision of blood (Damesyn, 2003). This shows that blood donation is a highly relevant issue worldwide that calls for government commitment to it, as well as research in this field.

2.3 WAP-based Online Blood Donation and Application Issues and Challenges

Previous researchers have revealed that one of the major problems associated with blood banking is having some kind of satisfactory control of all the stocks of bloods at various hospitals that operate the blood bank (Peterson, 1969; Li & Dong, 2006). Authors have stressed further that the 21-day limitation on the usability of blood calls for booking in advance for the quantities and types of blood that are going to be needed by hospitals. All these pose a serious problem to the member hospitals. Therefore, there is need for a mobile-based blood donation application system that can give an up-to-date record of blood availability without any processing time required.

According to Khan and Kureshi (2009), an automated blood donation system is considered useful to patients, doctors and researchers. It means that research in this area will have a significant impact on the health sector of any society. This justifies the need for this study, since the system will save medical practitioners the stress of manual donor reservation and

application, and will also suit the donor's application and eradicate any kind of delay.

Blood donation services are associated with a set of interdependent operations, including donor registration, donation evaluation, blood collection, blood screening, component production, inventory management and blood dissemination (Li & Dong, 2006). According to the source, the success of all these operations depends on how frequently donors come for blood donation applications. Inconvenience can hinder donors from applying for blood donation and, practically speaking, if no donors apply, there is no blood donation. This shows the need for an effective blood donation application system.

It is revealed that information and communication technology and mobile technology are associated with the recorded popularity in blood banking and blood application for efficiency and service quality (Li, Dong & Chao, 2006). This means that traditional blood banking has been lacking in this regard. The proposed mobile-based blood donation application is going to be an added advantage in this regard.

3.0 Research approach

A systematic investigative process was employed to increase or revise current knowledge of automatic marking. This section discusses the research approach, which consists of two sub-phases: (A) designing an improved Mobile Blood Registration bank system and (B) testing and evaluating the developed system.

3.1 Building a Prototype System

Using the JSP and MySQL database management system, a prototype was developed. All concepts of frameworks and the suitable design were used in the process of converting the requirements into the working prototype.

The proposed system consists of two main phases, the administrator side and the user side, as shown in Figure 2.

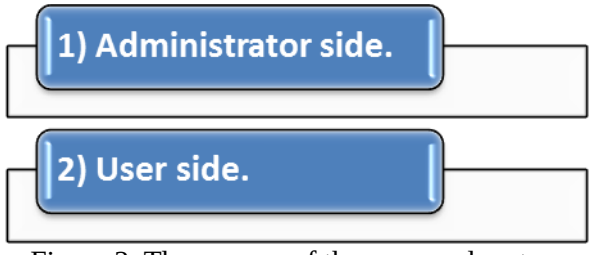


Figure 2. The process of the proposed system

3.1.1 Interface for implemented system

The system is implemented using Java programming language and MySQL as its database management system.

The user interface (UI) were designed for two actors: (I) the administrator, and (II) the user.

(I) Administrator Side

UI enables the administrator to log into the system (as shown in Figure 3). After the administrator logged into the system by ID number, the system will appear on the main page to the administrator (as shown in Figure 4).

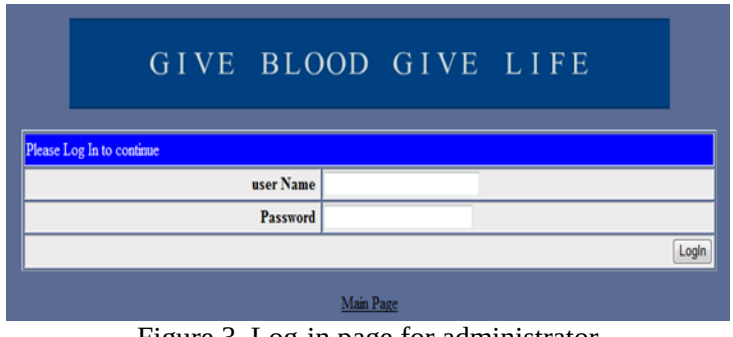


Figure 3. Log-in page for administrator

Figure 4. The main page for the administrator

This page allows the administrator to:

- Manage a request:

  When the administrator clicks on this button, another page will appear, then the administrator can add a new request, update a request, delete a request and view a request.

- Manage the user:

  With this page, the administrator can add new users, update users, delete users and view information users.

- Logout.

(II) User Side

Users go through the following steps:

- Log into the system using users' own credentials (as shown in Figure 5).
- The system shows the options page (as shown in Figure 6).
- The users have the ability to perform such tasks as making a request, updating their profile, deleting their profile and viewing information.
- Logout.

Figure 5. LOG IN

Figure 6. Option page

3.2 Testing and Evaluation

Test and Evaluation (T&E) is the process by which a system or its components are compared against the requirements and specifications through testing. The results are evaluated to assess the progress of design, performance, supportability and more. Developmental Testing and Evaluation (DT&E) is an engineering tool used to reduce risk throughout the acquisition cycle. Operational Test and Evaluation (OT&E) is the actual or simulated employment by typical users of a system under realistic operational conditions.

In this phase, we took time to perform the debug code and usability testing of our prototype for the purpose of examining it performance and usefulness.

4.0 Discussion and Results

According to many of the studies, many online applications are used in others countries. However, there is no proper online application available in Libya. The Blood Bank application is an efficient system and the fundamental objective of the Blood Bank application is to assemble all the blood benefactors into one spot

automatically and educate them continually about the chances of donating blood via the database linked to the proposed system. Ultimately, the system provides proper communication between the blood benefactors and the individuals who need blood. Table 1 shows who needs to make blood bank application as follow:

TABLE 1. Shows who needs to make blood bank application

Who needs the blood bank application	
Givers:	Individual who needs to give blood intentionally. The system keeps the information about blood benefactors.
Searchers:	Individual who needs the blood from the blood donation centre for various reasons.
Blood donation centre:	Staff individuals which are working in the blood donation centre.

Before testing the application, several questions were asked of the Libyan Red Crescent Al-Gubba, as shown in table 2.

TABLE 2. Questions asked of the Libyan Red Crescent - Al-Gubba

Question	Answer
How can the required blood type be provided if it is not available in the blood bank?	It can be requested from the patient's family members and, if it is not available from family members, the blood bank contacts the nearest other blood bank or announces it on social media.
How long does the blood bank take to provide the appropriate blood type?	The blood bank cannot determine the appropriate time. If the family members do not have it, it will take a long time to obtain it. Even if the appropriate blood type is obtained, there are routine procedures before obtaining blood from the donor, which is a medical examination for the donor, and these procedures take time, ranging from a minimum of 20 to 45 minutes, in addition to the time during the donation process, which ranges from 10 to 15 minutes
Is the appropriate blood type provided for critical cases in a timely manner?	If the blood type is not rare, it can be obtained by personal endeavour, direct contact with relatives and advertising on social media, although this procedure takes longer than the appropriate time.

Five donors were selected by the Libyan Red Crescent Al-Gubba and their data were included in the proposed blood bank

application. Table 3 and Figure 7 shows the data listed for one of the donors.

TABLE 3. The Data Listed for one of the Donor.

Name of the donor	**Ali**
Phone Number	**00218945164770**
Bool Group	**A+**
Address	**Libya-Elgubba**

According to the report submitted by the Libyan Red Crescent Al-Gubba, the link for the proposed application was published on social media, and within a period of time ranging from 2 to 7 hours, 5 donors of different blood groups were registered (A+ , AB- , O+ ,A- , B-).

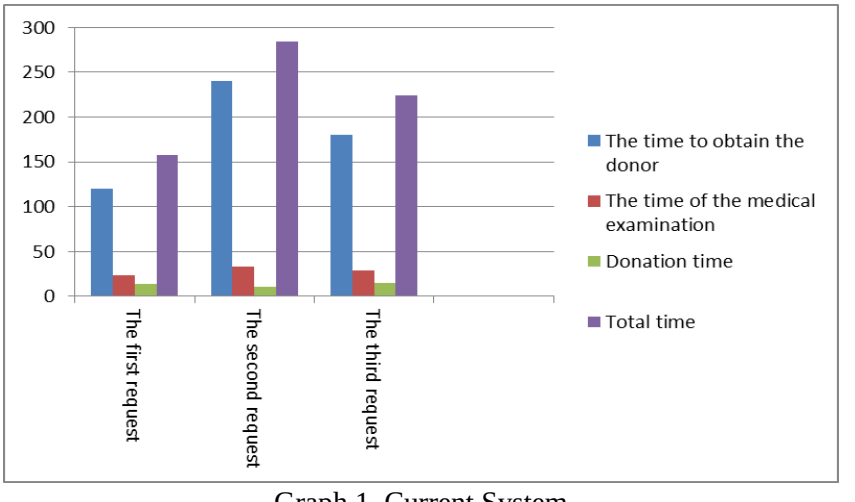
Figure 7. Page displaying the result.

Upon receiving 6 requests for disease cases requiring different blood groups, 3 of the required blood groups were provided through the proposed application, and the other blood groups were provided with manual procedures in the current system. Table 4

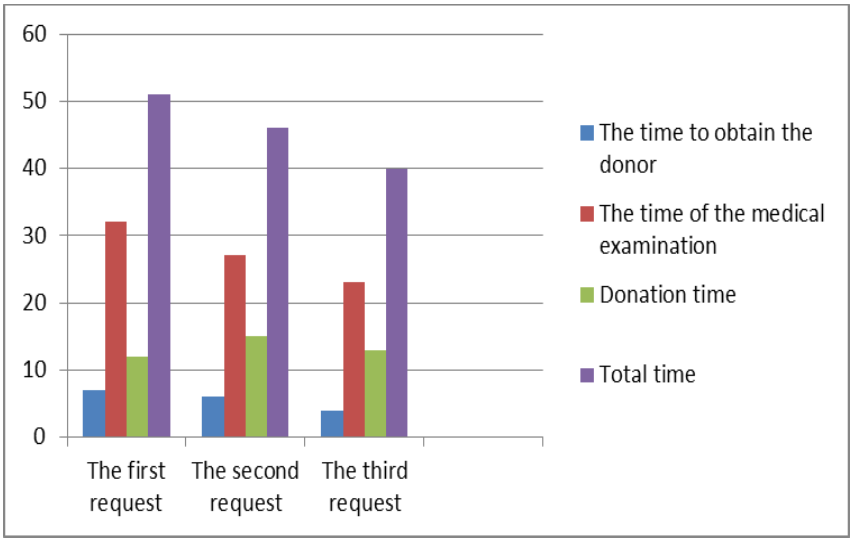
shows feature comparisons between the current system and the proposed system as follow:

TABLE 4. shows feature comparisons between the current system and the proposed system.

Current system				
Order number	**Time taken to obtain donor**	**Time of the medical examination**	**Donation time**	**Total time**
The first request	**120 minutes**	**24 minutes**	**14 minutes**	**158 minutes**
The second request	**240 minutes**	**33 minutes**	**11 minutes**	**284 minutes**
The third request	**180 minutes**	**29 minutes**	**15 minutes**	**224 minutes**
Proposed system				
Order number	**Time taken to obtain donor**	**Time of the medical examination**	**Donation time**	**Total time**
The first request	**7 minutes**	**32 minutes**	**12 minutes**	**51 minutes**
The second request	**6 minutes**	**27 minutes**	**15 minutes**	**46 minutes**
The third request	**4 minutes**	**23 minutes**	**13 minutes**	**40 minutes**



Graph 1. Current System

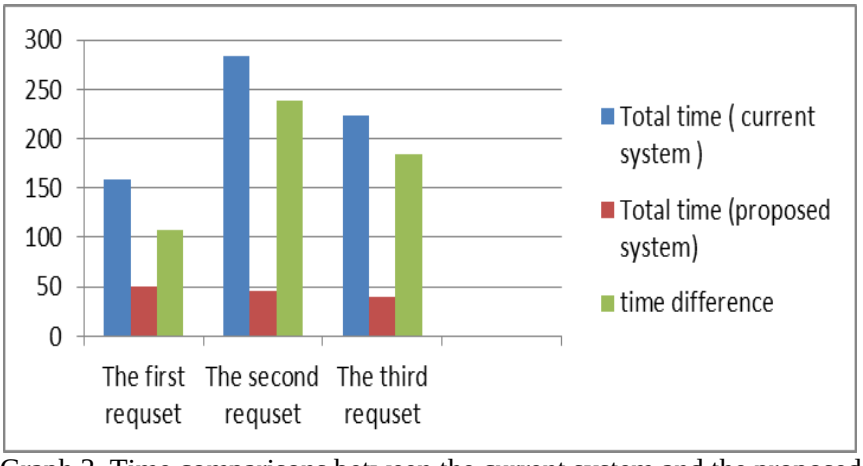


Graph 2. Proposed System

As reported, the application was tested and showed positive results: the blood bank can get rid of manual procedures that require time and effort, and the possibility of errors is minimal. There is also greater accuracy in retrieving information. Through the application, the inventory can be monitored and managed correctly and effectively. A responsible blood bank can create a monthly or annual report about donors and researchers, as well as the total consumption of blood stocks. It is possible to determine what blood type is rare and in demand, but available in large quantities, the responsible blood bank can obtain the information of blood units recommended by the doctor. At the same time, the results showed that there are other advantages to the blood bank application for searchers. A searcher can get the data of the ideal blood bunch. Moreover, the searcher can get the data of the specific blood bunch accessible in the blood donation centre. Also, the searcher can get the blood units as per their needs from the blood donation centre. Table 5 and graph 3 show time comparisons between the current system and the proposed system as follow:

TABLE 5. Time comparisons between the current system and the proposed system

Time comparisons between the current system and the proposed system			
Order Number	Total time (current system)	Total time (proposed system)	Time difference
The first request	158 minutes	51 minutes	158 – 51 = 107 minutes
The second request	284 minutes	46 minutes	284 – 46 =238 minutes
The third request	224 minutes	40 minutes	224 – 40 =184 minutes



Graph 3. Time comparisons between the current system and the proposed system

As shown in the table 5, there is a very large time difference between the current system and the proposed system, especially for the time taken obtaining the appropriate donor. The time difference between the first request in the current system and the first request in the proposed system is 107 minutes, the time difference between the second request in the current system and the second request in the proposed system is 238 minutes, and the time difference between the third request in the current system and the third request in the proposed system is 184 minutes.

Accordingly, the proposed system has proven to be effective, especially if the issue is related to time, which may be a major

factor in saving people's lives. The results proved that the proposed blood bank application has many advantages, the most important of which are the fastest way to reach the appropriate donor, and direct contact between the donor and people searching for blood.

5.0 Conclusion

The Blood Registration bank system was developed to help Libyan people looking for blood as well as those who need to donate. The prototype's usability was evaluated and the results prove that it is useful for users and it is capable of helping them make their transactions easy, direct and successful, regardless of location and time. It is hoped that the findings of this project will encourage hospitals and clinics to incorporate the Blood Registration bank system into the existing medical services in order to improve and enhance the medical services and so that it is available to users at any place and any time.

References

Damesyn, M.A., G. S. (2003). Bethel, J., Fridey, J., McMullen, Q., Garratty, G., Busch, M.P. Behavioural and infectious disease risks in young blood donors: implications for recruitment.

Department of Health (2005). NHS Connecting for Health, Records Management: NHS Code of Practice DoH London available online at *http://www.dh.gov.uk/Consultations/LiveConsultations/LiveConsultationsArticle/fs/en?CONTENT_ID=4114092&chk=l6ggnN*

Fredrick, K. (2009). A Web-based blood donor management information system for the Red Cross Society, Uganda (WBBDMI).

Goh, K. W., Kim, E., Lavanya, J., Kim, Y. & Soh, C. B. (2006, August 28). Issues in Implementing a Knowledge-based ECG Analyzer for Personal Mobile Health Monitoring. Paper presented at the Engineering in Medicine and Biology Society, New York City.

Gwo-Jen, H., Judy, C.R.T. & Yu-san, H. (2002). "I-WAP: an intelligent WAP site management system." IEEE transactions on mobile computing, April-June 2002 (Vol. 1, No 2), pp. 8295.

Jayawardena, A. S. (2014, January). The Electronic Hospital Information System Implemented at the District General Hospital Trincomalee-An Experience of Business Process Reengineering. *Community Medicine & Health Education*, p. 8.

Kristian, K. (2002). "Evaluating WAP usability; "what usability"" IEEE international workshop on Wireless mobile technologies in education (WMTE '02), p. 169.

Pagani, M. (2004). "Determinants of adoption of third generation mobile multimedia services," *Journal of Interactive Marketing*, vol. 18, no. 3, pp.46-59.

Vu, H. K., Kibong, K, & Keung H.L. (2007). "MiniWAP: Navigating WAP with Minimo," 31st annual international computer software and applications conference, vol.2-(COMPSAC 2007), pp.63-68.

Wani, S. M., & Sankaranarayanan, S. (2014). *Intelligent Mobile Hospital Appointment Scheduling and Medicine Collection.* International Journal of Computer and Communication System Engineering (IJCCSE). Volume 1 No. 02,ISSN: 2312-7694.