

Finding the Blood Donor and Inventory Monitoring via Mobile Application

Reem D. Ismael ¹, Harith A. Hussein ², Mahmood M. Salih ³

Department of Computer Science, the College of Computer Science and Mathematics, University of Tikrit, Saladin, (Tikrit), 34001, Iraq

reem.dh.ismail@tu.edu.iq ¹, Harith_abd1981@tu.edu.iq ², mahmaher1989@gmail.com ³

ABSTRACT

Blood is a significant part of the human body because it is essential for life. Nowadays, should make use of modern technologies to use in all fields like medical areas, especially the blood banks, which is a big challenge in poor countries. Despite many applications being provided via the internet, they lack privacy, authenticity, and reliability, and some need to purchase. Since the Mobile technology is widely spread and many people have their own mobile devices. In addition, the managing of blood bags starting from the donation step requires careful planning and control. So, the aim study is to create a trusted, effective way to connect donors and patients directly in time. A Mobile-Based Blood Bank Management System has been offered as a mechanism for finding the nearest suitable donors and provides an easy way to manage information and monitor the blood inventory, which helps reduce the number of people who die due to expired blood. This Application was developed through Android Studio and delivered the result on a Real-time basis.

Keywords: Blood bank, Blood donors, Inventory, Android, Mobile.

Introduction

Blood donation is essential in saving lives. It is vital for many surgeries, medical disorders, and potentially life-threatening conditions necessitating blood transfusions as part of their critical management. Because blood cannot be manufactured artificially, so can only be achieved from human blood sources. Consequently, blood donation has become a basic procedure that every health care department should consider[1]. According to a World Health Organization (WHO) survey conducted in 2019, there is a significant blood shortage. Also, the quantitative correlation between the number of available blood banks and the number of required blood banks is not ideal[2]. Every day, at least 2,000 donors are needed but are insufficient. In an emergency, traffic accidents, hospitalization, childbirth, etc., still need external blood supplies[3, 4].

A blood bank is a facility where blood and its components are collected from blood donors are stored in one place[5]. Before donating the blood, it should be tested to ensure health. So, blood bags always needed to be observed inside the refrigerators for safety and sufficient[1]. Blood applications based on new technology would lower the boundary between individuals needing blood and keep the blood inventory. So, this paper introduces A Blood Finding donor framework developed to handle the lack of communication between donors and patients and monitor the blood inventory.

The remainder of this paper is organized as follows. Section (2) discusses the Literature Review related to blood bank applications. Then, Section (3) provides the Problem Definition. Next, Section (4) provides the Objective. Section (5) discusses the Research Methodology. Section (6) discusses the Implementation and data analysis. Section (7) provides the Challenges. Finally, the conclusions are discussed in Section (8).

Literature Review

Many studies have been conducted on the blood bank concept, some of which dealt with donor records management to ease the donation process, others with linking blood banks in one system and one database, and the rest using advanced technology such as electronic cards and barcode systems.

In [6] aims to create a Blood Donation System based on cutting-edge information technologies such as cloud computing and mobile computing. In addition, utilizing social media and smartphone applications worldwide is helping to make the blood donation process more suitable, offer further services, and develop blood donation centers. The researcher in [7] has introduced a system where hospitals can directly contact the registered persons who have blood types within their local area, or people can donate blood to the nearest blood bank. This blood type is updated along with the total quantity of different kinds of blood available in the various blood banks. The time requirement of the blood by the needed has been

improved effectively in the system. The blood bank has been introduced in this paper [1] as a computerized central blood bank management system developed to manage donor information, monitor blood screening, and provide secure medical reports. The system has been proposed to overcome the problems of the paperwork system. It has been designed and implemented as a web-based using My SQL database, PHP programming language, and a bar-code technique. The aim of the paper [8] is to implement an effective management approach of a blood transfusion network by combining reusable simulation techniques and deep neural networks with multiple recursive layers in the blood supply chain, in order to minimize the costs of blood waste, return, and shortage. In addition, the model has enabled better prediction of hospital demand, which helps significantly reduce blood unit returns, increase inventory availability, and reduce costs.

This paper has presented an architecture prototype of a Blood Management System to find the nearest suitable donors and monitor the blood store. The proposed system facilitates communication between donors, blood donation centers, and patients. It integrates the blood information dispersed among different medical centers and health institutions throughout the city. It provides an application and installs it on smartphones (with different operating systems) to help them enter the blood donation information with minimal effort and time.

Problem Definition

The lack of communication between blood banks, donors, donation centers, hospitals, and patients is causing blood waste in poor countries, which could significantly affect the country's healthcare system. As well as, compared to other countries the number of blood donors is decreasing. Moreover, finding blood donors is a challenging issue, also the lack of blood during a crisis is one of the most severe problems faced in hospitals and medical centers. Another important thing is that the urgent need to transfer blood needs careful management to determine which blood group is available. Even though many applications are available on the internet, they lack confidentiality, truthfulness, and dependability, and some require payment. Besides, it becomes complicated When donors' information, blood groups, and data tracing are maintained manually. All of this is led to human mistakes. If blood is not available in such cases, this type of proposed application may be helpful.

Objective

As mentioned the problems above, the study's objective is to produce a practical framework for the blood bank system that assists in collecting and providing real-time blood information that has been gathered from donors who use the application. As well as it helps to manage and control the data of blood and inventory inside the blood bank remotely.

Research Methodology

The research methodology has been created with study, problem definition, data collection, analysis, design, and finally, the conclusion.

I. Data Collection:

Based on the objective, the interviews have been made with staff from the blood bank to describe the blood donation process stages and collect related information to conduct the work.

II. Analysis:

First, it has been declared that the blood bank's main tasks are donor registration process, donor information and checking, blood donation process, blood screening, blood inventory control, and supply chain. These procedures are done manually, which has many problems and errors. Also, it has been tried to acquire some of the forms they use in collecting information about donors. The collected data was evaluated, analyzed, and then extracted the needed. There is no electronic or automated app to communicate directly to the donors to collect the blood needed in emergencies to avoid wait time or the lack of blood type.

III. Design:

The proposed app framework for the blood donor finding and inventory monitoring in the blood banks is a mobile app that would be installed by individuals or entities that want to be in the same database (donors, blood banks, medical centers, individuals, or patients). The main functions are performed by the app, are shown in figure (1).

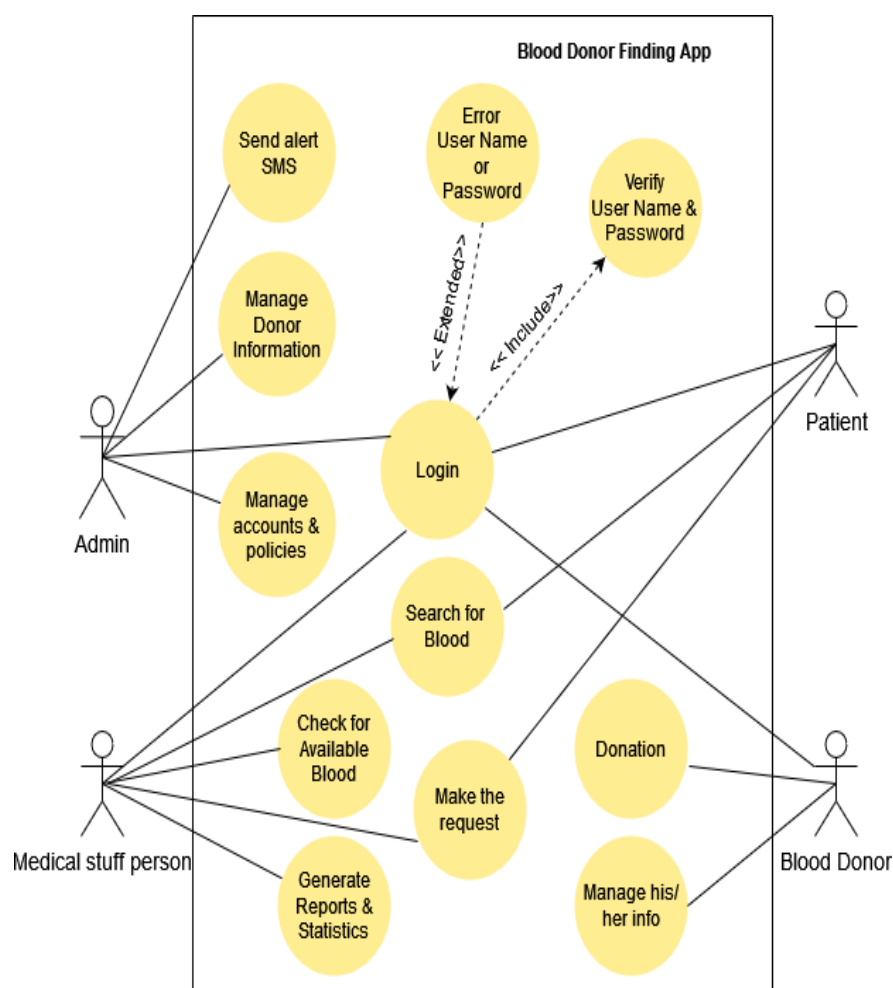


Figure 1: Use Case Diagram for Donor Finding App.

Create an application for Android Smartphones that will be useful to all Android users. It would be improved in Java and Kotlin using the Android Studio as the Integrated Development Environment (IDE). The Android Software Development Kit (ASDK) contains a set of designer tools that guide the development of smartphone applications on the Android platform, and the Android Emulator and Android Development Tools (ADT) will function as plugins. Adobe XD is used to create the user interface. And GPS technics, cloud to store data.

After installing the app, and creating an account with activation, the donor can provide his/ her info, the patients can search for blood type and direct contact with the donor. Also, the app admin can manage all information (donors, patients, user accounts', medical centers, etc.). These functions can be cleared as several steps. The registration adds the information related to donating (donors info, info contact, blood type, region, date, etc.). Also, the information of the blood inventory is added to the app, and all who have the authenticity to log in can see the information needed and ask for it. The three entities (donors, patients, and medical centres) can communicate with each other directly.

The app is easy, effective, fast, and secure in providing blood, which has been divided in five main functions, as shown in Figure (2). Registration, Screening & Matching, Storing, Controlling the blood and its products, and Supplying and Transfusion.

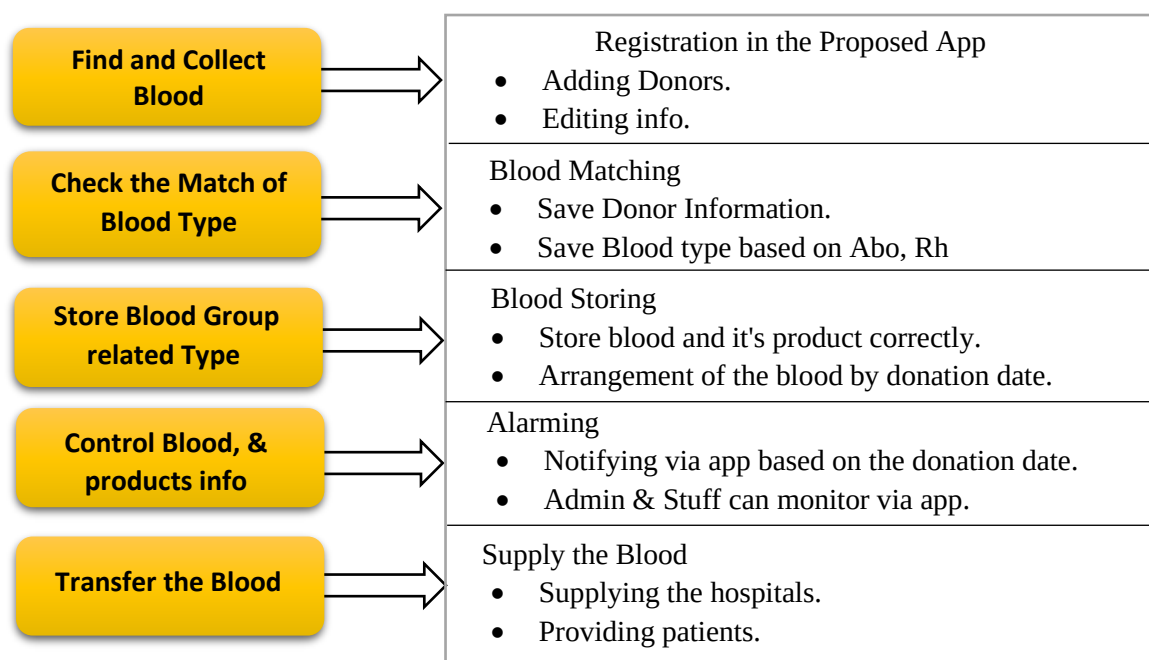


Figure 2: The proposed framework Functions

The proposed application framework to apply a set of functions are:

A. Registration

The application begins with the registration of the different users: (donors, blood banks, medical centers, individuals, or patients). Also, it could be edit and updated information. Donors can be new or returning donors who enter the system commonly or for the first time. This step provides: (Donor details, Donation history, Blood group type details, Donor Statistics Report).

B. Screening and Matching

After the blood collection process, the blood is transported to a lab for testing before storing or supplying. To ensure the blood or its products are free from blood diseases. This process is done in the blood bank or blood donation centers. Then check and match the blood type based on ABO, and Rh system to ensure the right store for the blood.

C. Storing

Then, blood is separated into components, to store and transfer as needed. As well as, it is important to select the blood type (ABO, Rh) and match it before storing or supplying it. Blood is typically collected at body temperature or +37 °C. To keep the vital properties of products, they must be cooled to below +10 °C before transport and stored at +4 °C until use.

D. Controlling and Notifying

Blood refers to whole blood, red cells, blood components, and blood products. Blood components are separable elements from whole blood obtained through centrifugation, such as red cells, platelet concentrates, or fresh frozen plasma. Blood products are derived from plasma using pharmaceutical operations. All they stoat at different temperatures. The app can notify the admin if the blood type or one of its components is expired related to the donation date. That help to monitor the blood inventory.

E. Supplying and Transfusion

If the patient has anemia, a bleeding disorder, sickle cell disease, such as hemophilia, or cancer, a blood transfusion is required. Blood banks or centralized blood repositories are in charge of supplying blood to those who need it, with

the blood being transfused within 30 minutes. The refrigerator's temperature must be between $+2^{\circ}\text{C}$ and $+6^{\circ}\text{C}$, and it must be equipped with an acceptable temperature alert system.

The flow chart diagram of the app framework is shown in figure (3) below:

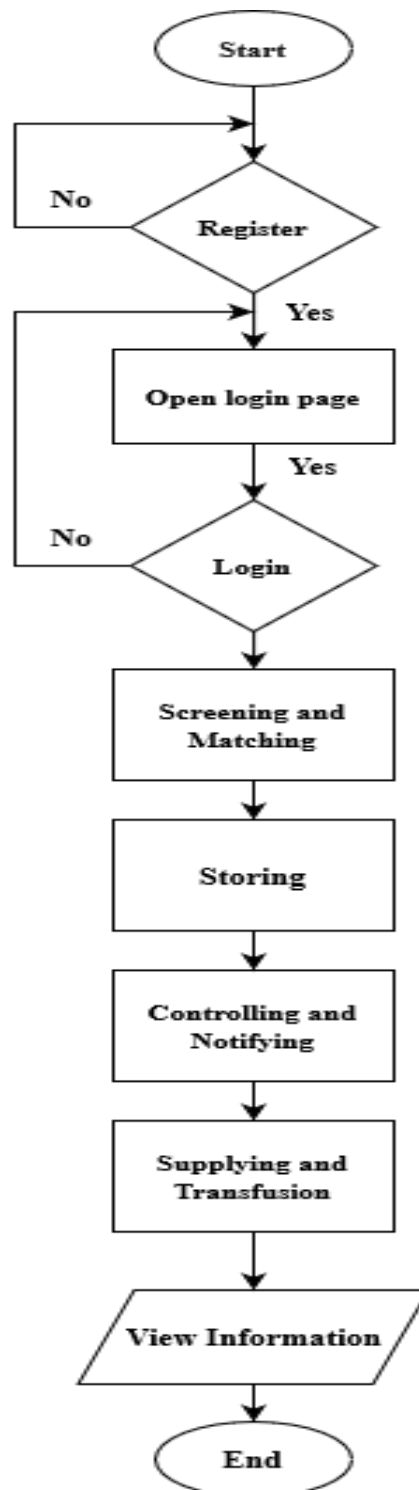


Figure 3: The flow chart of the proposed app

Implementation And Data Analysis

This step includes the registration and main processes for Donors, Patients, and Blood banks, which are explained as below:

Donor Registration: The proposed application uses a mobile-based Android module to collect donor information such as name, address, phone, blood group type, and GPS location coordinates.

Blood Bank or medical institute Registration: The proposed application uses a mobile-based Android module to collect donor information such as name, address, and phone along with GPS location coordinates.

Blood Inventory: The proposed framework uses an android-based mobile application and cloud technology to maintain a database of hospitals' and blood bank inventory, which keeps track of total capacity and vacancies by blood group. It would be initially managed by The hospital or blood bank of the blood unit count regularly. When a blood unit is transferred or received via the app, the count is locked, and the locked count is later updated in the database after the transfer is successful.

Donate Blood/ Request for Blood: The proposed work is implemented in the Azure cloud for high reliability, availability, and reduced latency.

Blood banks attempt to enhance their facilities, storage capabilities, and donor experience to encourage repeat contributions and decrease shortages. The risk of shortages is always present, so blood banks must manage their existing supply as closely as possible to avoid wastage.

The mobile-based GPS search module will locate the nearest location where can shift the blood units based on storage capacity and the shortest possible distance.

Challenges of Proposed Work Implementation

Visit and collect the information from hospitals, blood banks, donation centers, specialist doctors, and available facilities.

Conclusion

Patients suffering from anemia, hemophilia, or cancer may require a blood transfusion. A cancer patient typically requires at least 100 units of blood. Many poor countries heavily rely on blood transfusions because of the higher of blood-borne diseases. A blood bank is a storage unit where blood is gathered, stored, and used as needed or requested. But many blood banks in such countries don't provide an effective linkage between donors, patients, and hospitals or blood donation centers. As well as, they are suffered from traditional ways of work, especially monitoring the blood store. These problems may put the patient's life at risk, waste time searching for a proper donor, and the stock blood expiration without getting a warning. Patients can look for donors near their existing or desired location, find more than one donor simultaneously, and ask for more than one blood group. Using GPS, finding donors and arriving at the destination will be simple and quick. The proposed app includes registration and inventory monitoring features, allowing donors to register themselves and hospitals and blood banks to register through an in-app panel. Real-time blood inventory stock data can be gathered using the proposed cloud-hosted app and made available to hospitals and blood banks. These data structures involve stock information about blood units and GPS location. Patients can input information about the blood type and its current GPS location to find the closest donor. As future work, the next step is to implement it for android Smartphones and design a web-based application that will be integrated as a whole system that could apply to a variety of intelligent devices.

References:

- [1] M. Y. Esmail and Y. S. H. Osman, "Computerized Central Blood Bank Management System (CCBBMS)," in 2018 International Conference on Computer, Control, Electrical, and Electronics Engineering (ICCCEEE), 2018, pp. 1-5.
- [2] WHO, " National Guidelines On Screening Donated Blood For Ttis. Publications Of The World Health Organization. Version 1, (2013)," (2013).

- [3] S. Periyamayagi, A. Manikandan, M. Muthukrishnan, and M. Ramakrishnan, "BDoor App-Blood Donation Application using Android Studio," in Journal of Physics: Conference Series, 2021, p. 012018.
- [4] W. H. Orgnization, "Health and well-being profile of the Eastern Mediterranean Region," 2022.
- [5] S. Sulaiman, A. A. K. A. Hamid, and N. A. N. Yusri, "Development of a blood bank management system," Procedia-Social and Behavioral Sciences, vol. 195, pp. 2008-2013, 2015.
- [6] A. M. Mostafa, A. E. Youssef, and G. Alshorbagy, "A framework for a smart social blood donation system based on mobile cloud computing," arXiv preprint arXiv:1412.7276, 2014.
- [7] R. D. M. Angeline R, Lingaraj Gopalakrishnan, Saravanan B, "An GPS Based Online Blood Bank Management using Database Management System," International Journal of Innovative Technology and Exploring Engineering (IJITEE), vol. Volume-9, 2019.
- [8] F. Shaikh and V. Karwande, "BLOOD BANK AND BLOOD WASTAGE MANAGEMENT USING INTERNET OF THINGS AND STREAM ANALYTICS," INTERNATIONAL JOURNAL, vol. 6, 2021.