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CLOUD BASED BLOOD BANK AND DONOR INFORMATION SYSTEM IN NIGERIAN HOSPITALS

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Abstract

The blood is a connective tissue in the body and one of the most significant rudiments of human life. The scarcity of this life-saving fluid has become a persistent problem to deliver medical care in many countries, because in emergencies, relatives of patients run around to get specific blood type when unavailable at the hospital, without adequate information on the closest available source. While there are existing blood bank management systems that help locate available blood bank centers with the needed blood type, they do not provide information on the nearest center and donor. This research therefore developed a cloud based system that provides information for the discovery of blood bank centers and human donors with the highest proximity during emergencies. Web development technologies were used, and the Google Map API was used to track, calculate and display the

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location of each blood bank and donor. The system thus aid users in obtaining blood faster rather than going from one hospital to another in search for a specific blood type to reduce the number of deaths caused by lack of blood during emergencies.

INTRODUCTION

Blood bank in hospital has a very important role. Blood bank ensures that blood supply of every blood type available all the time in case it needed urgently. (Sulaiman, S., etal, 2015) explain the blood bank as the place where blood supply collected from blood donation event and stored properly. Generally, (Li & Dong, 2017) also explain that blood bank system consists of an independent blood centre which is in charge in collecting, storing and distributing human blood. Indirectly, this has become an important matter to update blood supply and distribute the blood supply for those who need it. On this ground, Nigeria has significant increase of population. This population surely has high life expectancy rate. On their daily activities, accident may happen, or surgery could have been performed. Because of that, ready or not, hospital must prepare for extra blood supply Desai, K., & Satapara, V. (2014). According to (American Association of Blood Banks (AABB), 2014), blood bank or transfusion unit should be developed, tested, and evaluated on emergency situations, policies, processes and procedure to prevent, reduce, prepare, and response quickly during recovery from disasters and emergency situations itself, due to technology. Statistic shows that every two seconds, there are people who need blood transfusion (Selvamani, K., & Kumar Rai, A., 2015).
Unfortunately, in reality, there are still many cases about lack of blood supply or even their unavailability in various hospitals in Nigeria. When the blood supply is low while condition is on the high demand, urgency of blood supply for patient is crucial. Delayed process could result in death of patient. A Location Based Service (LBS) is an information service, accessed through mobile devices using the mobile network and employing the geo-location ability of the mobile device. According to Schiller, J., Voisard (2014), they are services that integrate a mobile device's location or position with several other information so as to provide more information and meaningful value

to the user. They locate a mobile user geographically and deliver services required by the user based on his current location. They can be used in different settings, such as health, business and personal life. In a health-based system, it can be used to identify the location of people or objects, or finding the closest hospital or location of a business associate. Different techniques and tools are used to achieve this; one of such is the Google Maps which was used in this paper. Google Maps are mapping services developed by Google. It gives a clear view of satellite imagery, street maps, real-time traffic conditions (Google Traffic), enabling one to plan route for traveling by any means of transportation. The service's front end utilizes JavaScript, XML, and Ajax. It offers an Application Programming Interface (API) that allows maps to be integrated on third-party websites. It also makes it possible to embed a locator to be used by businesses and other organizations in different countries across the globe.

Currently, the use of cloud computing has been increasing in various companies and fields. Cloud computing can be used as a place to manage data and application using a computer that has authorized access. (Liu, S., et'al, 2018) It refers to IT services by combining hardware and software based on computer demand (request information) on an internet network with a self-service mode where any devices are used.

Problem Statement

As the day passes by, there is a prevalence of accidents, ranging from simple injuries to deaths. Quite many individuals require blood for survival during emergencies, but are handicapped by its unavailability. Even in cases where it is available, there is an issue of proximity and time to obtain the blood. The American Red Cross Association asserts that, just one car accident victim can need up to 100 pints of blood. Furthermore, the National Blood Transfusion Service (NBTS) postulates that, Lagos (a state in Nigeria) is projected to need at least 185,000 units of blood annually, but regrettably has only 80,000 units, as a result, in 2012, 4,260 people lost their lives to road accidents.

Nigeria as country encounters a major problem in blood donation and blood bank services. In 2012, a bomb blast occurred in Abuja wrecking the United

Nations (UN) building, leaving 21 dead and 73 injured. A significant number of these deaths can be traced to the unavailability of blood at the right time and place. Some of the injured lost their lives because they were unable to access blood due to shortages and accessibility issues. The United Nation's Children Fund (UNICEF) accounts that 145 pregnant women die every day in Nigeria and statistics have shown that 20% of maternal deaths occur as a result of the unavailability of blood.

Aim and Objectives

This work is aimed to bridge this gap via information systems which are designed for collecting, organizing, storing and communicating information, making them readily available at the nick of time. A Cloud Based Blood Bank Information System (CBBIS) can therefore come in place to help tackle the problem of proximity by providing real-time information of where blood can be obtained to reduce the death cases in Nigerian hospitals.

The objectives of this work include:

1. To developed a web based system that provides information for the discovery of the blood bank centers and human donors with the highest proximity during emergencies
2. Use Google Map API to track, calculate and display the location of each blood bank and donor.
3. To make the system available on the cloud so that it aid users in obtaining blood faster rather than going from one hospital to another in search for a specific blood type to reduce the number of deaths caused by lack of blood during emergencies.

Review of Related Work

Several similar applications developed specifically to address the issue of locating available blood banks and donors readily in an emergency exist and they are discussed in this section.

In (Alkandari, A., 2016) journal, it was described that the proposed blood bank system was connecting between blood bank and personal donor by sending a message to regular/permanent donor who has been registered before. In the other case, (Ali et al, 2017) propose a blood bag system. It is a

web-based system which connects with the central database to control all data from the blood bank and blood donation campaign. Basically, this system identifies donors, tests and stores blood bags, and deliver them to patients. Blood bag system supports donor and blood bank to help patients in needs of blood donation by centralized control system which can arrange all transfusion process. Every process recorded in the database.

The LifeBank App is an instinctive blood donor database that moves committed Africans to give blood and save lives in their group (Suchitra, Sannitha, Ravikanth, Anusha & Abhilash, 2015). It is a venture commercial center for blood donation. The application searches for the available blood and blood items that patients require in its database. With an agile coordination framework set up, items are delivered to patients on time. An extension of this application, the Life-BankPlus is a smart blood system that connects hospitals and blood banks and helps individuals, find blood needed faster, safer, and cheaper. However, when a user orders for blood the system does not provide the nearest center to where the particular blood type can be obtained, it only provides several locations without sorting them on the basis of proximity.

The Location Based Online Blood Bank System (LOBB) uses a Global Positioning System and nearest neighbor algorithm for primary blood transfusion services (Jonathan, 2018). The main aim is to provide a fast and efficient way to gain attention of potential donors in the need of hour. It includes the use of SMS and Email services such that the donors can locate the patient when the request for blood is generated. The system helps in the process of blood donation. It consists of a web application which acts as an interface for the clients of the system and a database for storing the donor's data, blood bank details and hospital details. The system was built to locate only donors, and not blood bank centers.

The central blood bank database with anti GPS mobile system was primarily de-signed to have a focal database of blood donors and make a hospital administration to locate the present area of a donor in the event of crises or emergencies. It utilizes GPS with incredible exactness to discover the position of any of the nearest donors through a web gateway (Meshram, Bramhe & Jaronde, 2013). The users of the systems are administrators (this

could be a general body from the central blood bank agency) blood banks, hospitals and clinics. Lay individuals do not have access to the system.

The Optimal facility for tracking the location of blood bank and donor is a pro-posed system which is aimed at solving existing problems with other system using Global Positioning System (GPS) for tracking of nearest blood banks and donors. It requires an android device that supports a GPS. The application then has to be installed on the device. During the urgent need of blood, a user can instantly access people with a particular or related blood group and contact them through phone calls or text messages through the application (Pawar, Thigale, Walekar & Thakar, 2016). The Android blood donor lifesaving application on the other hand is a web application that interfaces all donors and patients. The system allows individuals to enlist as donors, and they can get an SMS from neighborhood customers who need blood to give in instances of need (Jenipha, 2014). The system however, does not supply the real time location of the donor, as his registered address might differ from his current location.

The review shows some existing blood bank management system implemented but a certain number of them are not present within the geographical location of Nigeria. The only present one is the LifeBank app which only offers location on where blood can be obtained, however, this system aims to provide a user with the nearest location of a blood bank or donor in cases of emergency.

Methodology

In this section, the authors collect data with a systematic literature review; also refer to previous studies, related to the current conditions in Nigeria. Several studies from hospitals performed, especially in operational activities in blood banks and blood donors. By matching those previous studies, the authors are trying to connect them to the case in Nigeria, by adding features to get better result. Since everything is collected, the authors draw a conclusion which refers to the proposed application that will be described in the subsequent sections.

Result and Discussion

In Nigeria, the connection between hospitals and the personal donor has not been developed yet. Hospitals have their own blood bank facility to fulfill their operational needs. But when hospital is running out of the specific type of blood, there are three options to get it. First, hospital can ask it from the patient's family member. Second, they can request from Blood Bank in the hospital, and the third is from the personal donor. See the current system in figure 1. That's how requesting blood is performed based on the procedure in the hospital. And for personal donor, who wants to donate their blood, hospitals have different methods for that (as our finding during shows in some hospitals), some hospital use books for keeping records of the donors, e.t.c. The mechanism of blood supply now is depending on blood donation event by hospital. On this situation, hospital should always organize blood donation event to restock blood supply, so in case they face emergency situation, blood supply will be available. When specific blood type is needed, hospital should check blood supply first on their blood bank and then personal donors. This is inefficient because it takes more time when the patient is on critical condition and immediately need blood supply from blood bank, but they have low or empty supply. The purpose of the system proposed in this research is developing an application to integrate hospitals, blood banks, and personal donors in Nigeria. The application is using web-based and mobile application by using cloud computing technology. As you can see on figure 2 about general display of proposed application where hospitals system, Blood Bank, and personal donor devices are connected by cloud computing system by using application called Cloud Based Blood Bank and Donor Management Information System (CBBDMIS).

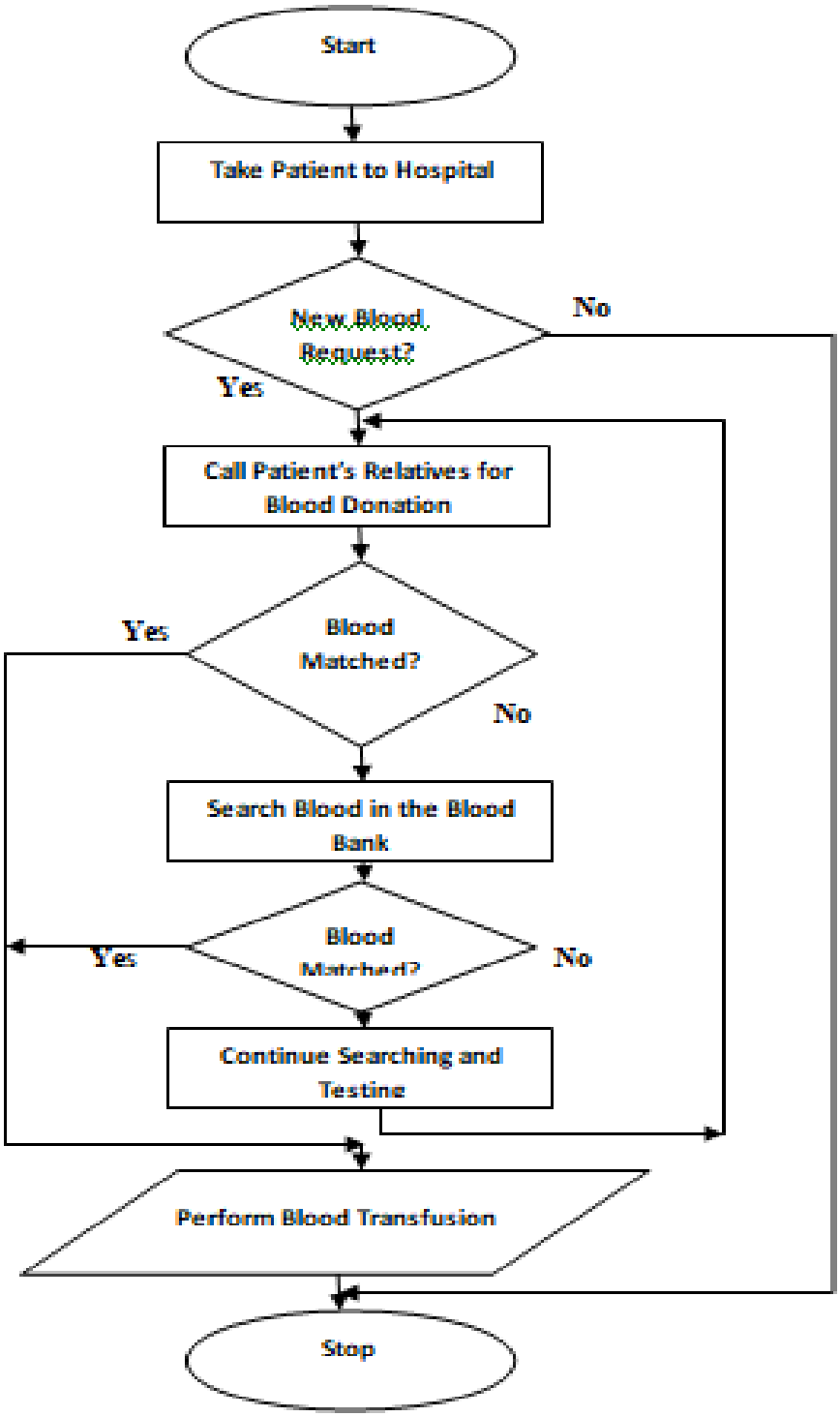


Figure 1: Existing System operations

As shown in the above flowchart, existing system has no means of keeping record of blood bank using I.T infrastructure. If there is any request for

blood, patient's relatives are summon for test and if match is found then donation takes place or otherwise doesn't take place.

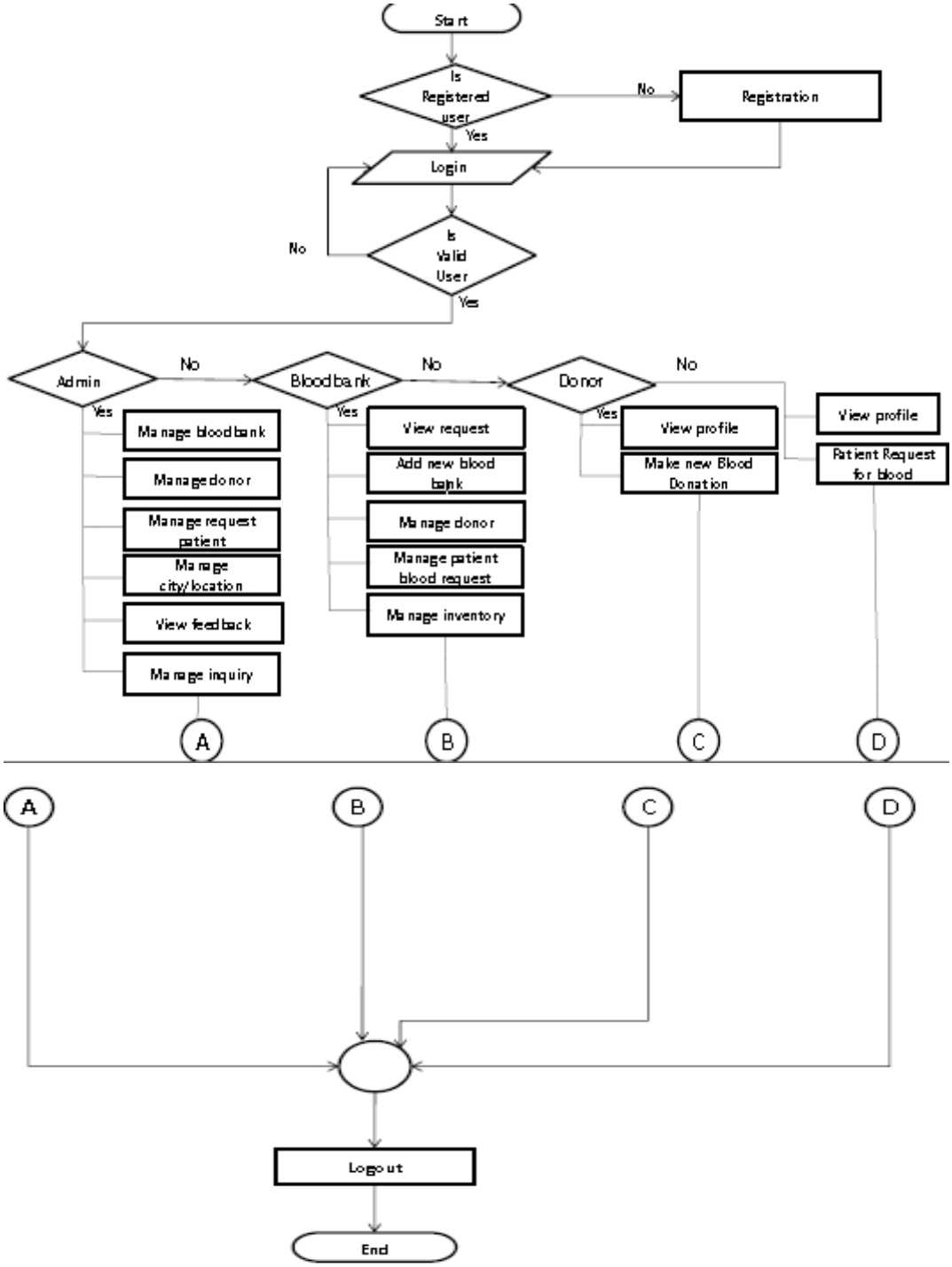


Figure 2: Proposed Cloud Based Blood Bank and Donor Information System flow chart

Cloud Based Blood Bank and Donor Information System

A web based application can be developed as now days almost everything behind developing this application is to reduce time, cost required for finding blood in critical situation and donating blood. The system provides facilities for finding and donating blood in less time as compared to traditional system. We have developed web application for end users which provides facilities such as registration, find blood (by registered, current, provided location), donate blood, post request, view stock details etc. Blood locator system also provides functionality for calling user by just one click on contact number which is displayed on screen. In blood locator system, web application is for blood banks used for maintaining stock details like quantity of blood, blood type etc.

User can register themselves by providing their details like name, address, contact, DOB, blood group, email address etc. After registration, user get username and password by using it they can login to our system. Once the user logins, our proposed Online Blood Bank and Donors application provides facility to find blood, donate blood, check stock details, post request to users, view other's posted request and post request to blood bank, view donation history**.**

User can find blood banks or donors by current location and registered location. Now when the user selects find donors then select the blood group you need and click on locate. Now the user has to select search from donors current location or donor's registered location (it means the address which was provided during registration).

Implementation

The user interface was developed using Hyper-Text Markup Language (HTML), Cas-cading Style Sheets (CSS), and JavaScript. They were used for designing and imple-menting some functionalities in web application. PHP, an HTML-embedded scripting language was used to design the backend of the system while jQuery, a cross-platform JavaScript library simplified the client-side scripting. They were used because they are free and open-source. The MySQL relational database management system (RDBMS), was used to implement the database for storing required information. In addition, the Google Map API (Application Programming Interface) was used to

implement the location tracking and map generation functionality. In all, the Model–View–Controller (MVC) software architectural pattern was used in order to separate internal representations of information from the ways it is presented to and captured from the user.

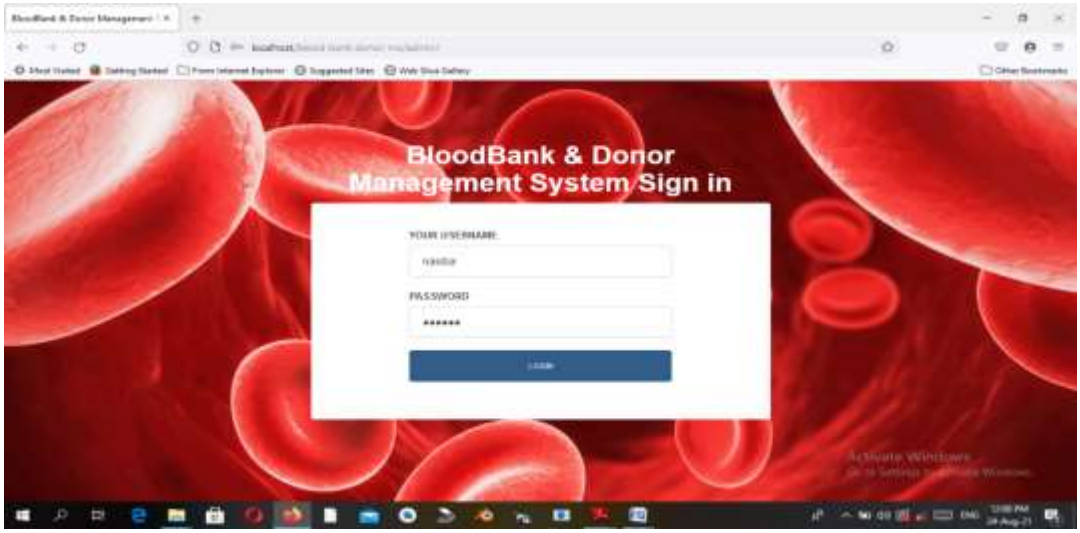
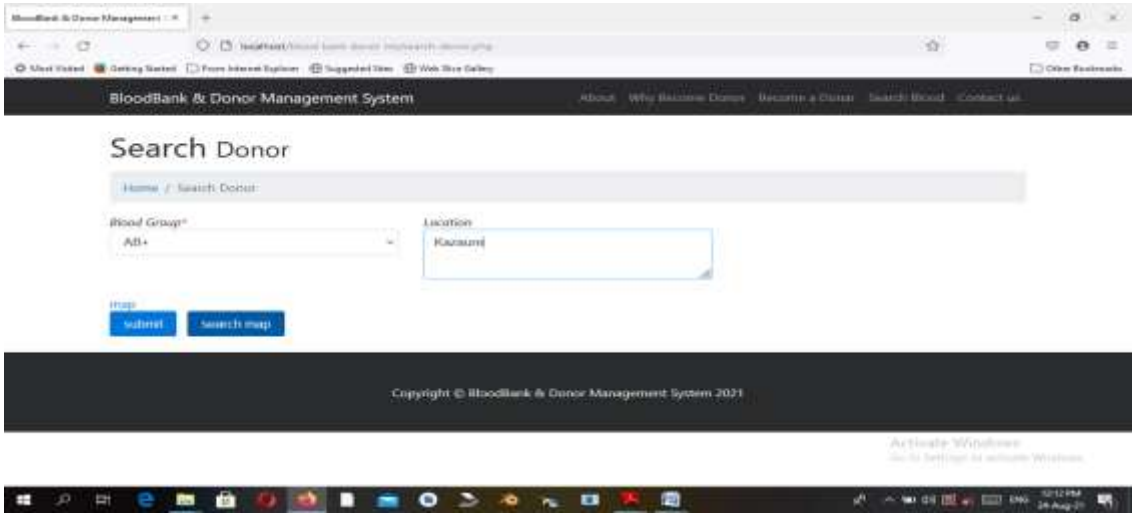
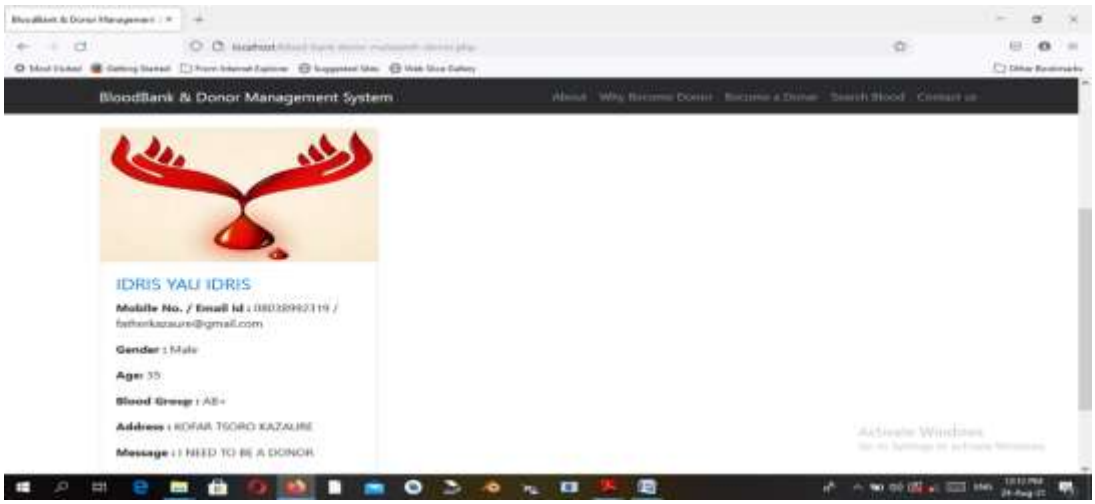
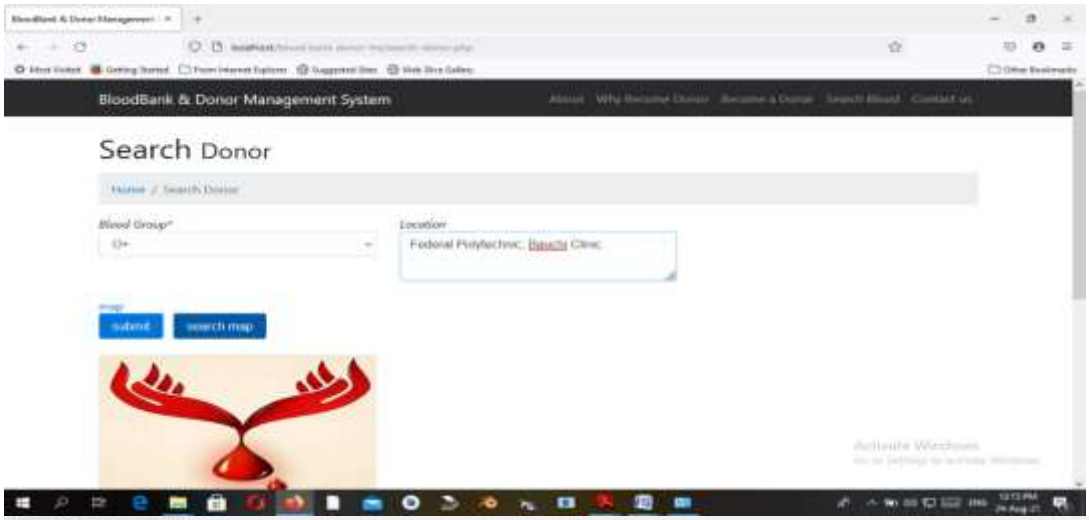


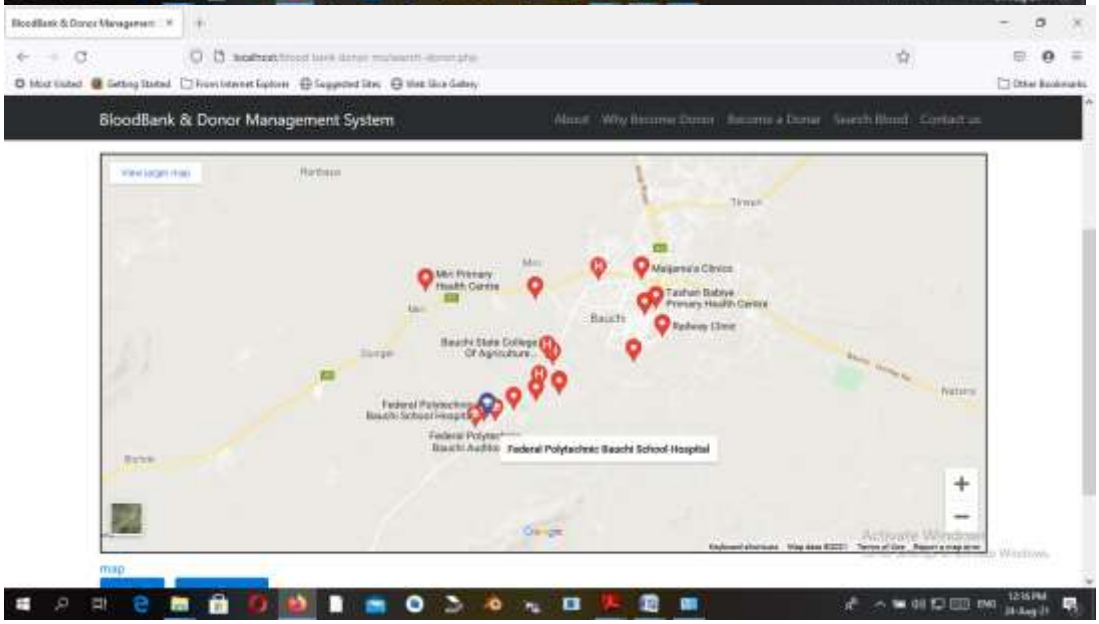
Fig. 4.1 The Login Page of the Blood Discovery system

The screen shots for the developed system are presented in Fig. 4.1, Fig. 4.2 and Fig.4.3. Fig. 4.4 shows the login page for a registered user while Fig.5 shows what the search interface looks like. Fig. 6, shows the output screen displaying the map and the distance of the user to locations with the required blood type.




BloodBank & Donor Management System
IDRIS YAU IDRIS
Mobile No. / Email Id : 08038962319 / fatherkazaure@gmail.com
Gender : Male
Age: 35
Blood Group : AB+
Address : KOFAR TSORO KAZAURE
Message : I NEED TO BE A DONOR


BloodBank & Donor Management System
Search Donor
Blood Group*
O+
Location
Federal Polytechnic, Bauchi Clinic
submit
search map


BloodBank & Donor Management System
Federal Polytechnic Bauchi School Hospital
map

Cloud computing infrastructure

Cloud computing is a model for enabling portable and convenient on-demand network access to a shared pool of configurable computing resources, such as network, server, storage, application, and services (Boukerche, A., & De Grande, R. E., 2018). Cloud computing has various type of model. It can be Software as a Service (SaaS), Platform as a Service (PaaS) or Infrastructure as a Service (IaaS). Model used on this research is IaaS. Developer of CBBDIS rent a computer as database storage and CBBDIS can make custom requirements such as upgrading or adding storage capacity, Random Access Memory (RAM) or even processor to increase response speed of the cloud computing. The benefit of using IaaS is the security of data on cloud computing, and then saving cost because no need to buy server or perform maintenance system. Cloud computing also is accommodating data storage with large capacity, the system allocating resource can be managed easily and data or information can be provided easily to access on real time. IaaS also can be hosted for data storage. A virtual data stored can be found in the CBBDIS that can be accessed through a virtual machine and various integrated applications that can be accessed by both providers and users. Each hospital, Blood Bank, and personal user connected through internet service to the cloud server. This would help and increase effectiveness and efficiency of hospital or patient when blood donation is needed. They can directly check into CBBDIS and will get the information about blood supply they need and the nearest location they can get for the blood. The use of CBBDIS already answers the problem of blood supply availability on hospital blood bank.

Conclusion

This research addressed the challenge of finding blood during emergencies by creating a system that helps users find the nearest blood banks and donors which is a very important aspect of life. Undoubtedly, this approach is faster than utilizing the manual method of going from one hospital to another in search for a particular blood type, thereby reducing the number of deaths caused by lack of blood during emergencies. The field of blood discovery still has a lot of issues that are not completely resolved. Although, this topic seeks to address issues with blood bank and donor access in Nigeria, it is not designed to deliver the blood to the user.

The proposed system utilizes cloud computing by using Infrastructure model as a Service (IaaS). IaaS is cloud computing which provides IT infrastructure such as data centre facility, storage, server, the grid for

virtualized server, and networking component on the cloud system managed by third-party. It can also be upgraded such as improvement of storage capacity, amount of RAM, the processor or even the existing network.

Reference:

Sulaiman, S., Abdul Hamid, A. A. K., & Najihah Yusri, N. A. (2015). Development of a Blood Bank Management System. *Procedia - Social and Behavioral Sciences, 195*, 2008-2013.

Li, B. N., Chao, S., & Dong, M. C. (2007). SIBAS: A blood bank information system and its 5-year implementation at Macau. *Computers in Biology and Medicine, 37*(5), 588-597.

Desai, K., & Satapara, V. (2014). A study on knowledge, attitude, and practice on blood donation among health professional students in Anand: Gujarat. *Journal of Applied Hematology, 5*(2), 51-53.

American Association of Blood Banks (AABB), Standards for Blood Banks and Transfusion Services, 29th ed., American Association of Blood Banks, Bethesda, MD, 2014. Available:http://www.aabb.org/sa/standards/Documents/sigchngstds29.pdf

Selvamani, K., & Kumar Rai, A. (2015). A Novel Technique for Online Blood Bank Management. *Procedia Computer Science, 48*, 568-573

Schiller, J., Voisard, A.: Location-Based Services. , Berlin, Germany (2018).

Liu, S., Chan, F. T. S., Yang, J., & Niu, B. (2018). Understanding the effect of cloud computing on organizational agility: An empirical examination. *International Journal of Information Management, 43*, 98-111.

Alkandari, A. (2016). *Blood Bank Smart Phone Application For Managing And Organizing The Blood Donation* (Vol. 6).

Ali, R. S., Hafez, T. F., Ali, A. B., & Abd-Alsabour, N. (2017, 22-24 March 2017). *Blood bag: A web application to manage all blood donation and transfusion processes.* Paper presented at the 2017 International Conference on Wireless Communications, Signal Processing and Networking (WiSPNET).

Suchitra, R., Sannitha, M.L., Ravikanth, J., Anusha, G., Abhilash, B.: Location Based 10 Online Blood Bank System. BEST Int. J. Manag. Inf. Technol. Eng. (BEST IJMITE). 3, 1–4 (2015).

Jonathan, O., Azeta, A., Misra, S. Development of prepaid electricity payment system for a university community using the LUHN algorithm. Lecture Notes of the Institute of Computer Sciences, Social-Informatics and Telecommuni-cations (2018), 204, 107-114

Meshram, A., Bramhe, P., Jaronde, S., Ambatker, P.: Central Blood Bank Database With Anti GPS Mobile System. 3, 970–972 (2013).

Pawar, R., Thigale, S., Walekar, P., Thakar, G., Joshi, P.D.: Optimal Facility for Location Tracking of Blood Bank and Donor. Int. Res. J. Eng. Technol. 3, 1325–1330 (2016).

Jenipha, T.H., Backiyalakshmi, R.: Open Access Android Blood Donor Life Saving Application in Cloud Computing. 105–108 (2014).

Boukerche, A., & De Grande, R. E. (2018). Vehicular cloud computing: Architectures, applications, and mobility. *Computer Networks, 135*, 171-189.