DEVELOPMENT OF AN EMERGENCY WEB-BASED BLOOD BANK DONOR SYSTEM

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ABSTRACT

Hospitals and blood banks provide blood, receive blood from willing donors, store the blood and make it available for use in the event of an emergency. The problems envisaged in this process include; accessing safe blood in an emergency situation and finding a donor who is in close proximity and willing to donate blood. The development of an Emergency Web-based Blood Bank Donor System is capable of synchronizing communication between blood donors, recipients, hospitals, and/or blood banks. The application provides registered users access to request for blood, search for nearby hospitals/blood banks, and also locate nearby donors. The methodology adopted in this work deploys the Incremental Model Development Lifecycle to achieve multiple stand alone modules. The platform for implementing this system uses HTML5, CSS and PHP for web development and PhpMyAdmin for the database. This work will provide a timely and more efficient approach to tackle the urgent need for blood donation in emergency situations.

Keywords: Blood bank, Blood Donor, synchronized Communication, interface system.

INTRODUCTION

Blood, a life saver for all living things is an important and unique fluid which can only be obtained through blood donation when the need for an external supply arises or there is an emergency need for it. Blood donation may be described as a process wherein blood is transferred from a healthy person to someone who is in need of it and occurs when a person voluntarily allows blood to be drawn and used for transfusions and other medical purposes. Blood donation is very important in health care as it ensures the availability of blood in blood banks and hospitals.

Blood donation and transfusion services are valuable components of health care system. The desired improvement in Nigeria's health care system can be achieved if provisions for sufficient blood supply and other interventions are made to strengthen the health system. Therefore, there is need to synchronize the communication between the blood donors, hospitals and the blood banks.

The Emergency Blood Bank Donor System is an option aimed at synchronizing blood donors, users and hospitals/blood banks. Registered users can view available donors and request for blood from donors with matching blood requirement using the application, thereby simplifying and automating the process of donating and requesting for blood. The system tracks the location

of the compatible donors and only donors within a boundary of a specified area from the requirement are notified. Hospitals are provided with windows to specify the blood requirement.

STATEMENT OF THE PROBLEM

Despite the availability of potential blood donors, not more than 5% of the total Nigerian population donates blood.

Each day, 145 women of childbearing age and 2,300 children under-five die in Nigeria, according to UNICEF. A greater percentage resulting from blood not being available at the time needed. Another reason for this high percent of death rate results from improper communication between the blood donors and the blood recipients, in which patients who need blood transfusion cannot locate people that are eligible and are willing to donate blood. These deaths can be prevented if there are active platforms that ensure proper communication between health services such as Hospitals, Blood banks, blood recipients, blood donors and quick access to clean safe blood.

In this paper, the design and development of an Emergency Web-based Blood Bank Donor System was achieved. The system is capable of simplifying and automating the process of donating and requesting for blood with few clicks.

LITERATURE SURVEY

Gaikwad, A., Mulla, N., Wagaj, T., Raviraj I., Gupta, B., & Kamal, R [1] proposed an application called Smart Blood Finder, where blood banks can timely update the blood stock availability, donors can register and users can find blood availability nearby. The study was aimed at developing a smart blood finder system to manage the records of people in need of blood to ensure they could find the needed blood in nearby donation center and also locate appropriate donors who could easily donate blood to them. The study presented significant results which include; Management of records of donors, blood banks, and recipients; Web-based registered blood bank; Voluntary blood donations and allocation of blood in various hospitals.

Jain, Nirmal, Sapre & Mone, [2] researched on Online Blood Bank Management System using Android. It was developed as a web-based mobile application using Representational State Transfer (REST) to enable users view information about nearby hospitals and blood bank centers.

The application selects nearby hospitals online using a GPS location service to track its location. It also provides direction to accidents/casualty scenes using the GPS function to enable emergency ambulance arrive at the accident scene without delay. The system has two main features:

The first includes a highly trained dataset i.e., data storage service and manipulation, which provides a great supporting model for the application. The second involves inventory management which handles and processes information very fast.

Pandit, Satish, & Shinde, [3] presented an examination between the existing framework & the enhanced framework. E-blood donation centers incorporate computerization frameworks. The fundamental motivation behind E-donation center is to interconnect every blood donation center in a region into a solitary mobile application system. The information obtained from

registered users can help the public to provide simple access to available status of blood in different donation centers.

Prathamesh, Prachi, Yogesh, Sumeet, & Sanjay [4] presented a paper on Blood Bank Management system. The proposed system was designed to help Blood banks meet the growing demand for blood donation through sending and/or serving the request for blood as at when required. As a web application, it provides information on the availability status of a required blood type to registered hospitals and/or blood banks and allows sending of blood requests to nearby donors or blood bank with matching requirement. The application aimed at simplifying the process of blood donation and/or reception while ensuring that all functionalities obtained using the manual blood bank method is adopted. The system is made of four modules which include; Android application, Hospital web application, Blood bank web application and Database.

E- Blood Bank: This application helps a user to find and contact people donating blood in a specified area through phone number or email address. The user sees the location of other users in map and gets a notification in case the blood group matches the required blood type. Nearby hospitals can be traced and accessed. The features essentially finds donor with specific blood type including the respective states and cities. Sending notification to alert the user or other users with the same blood group within a specified area, Finding nearby hospitals in maps, and Providing help line numbers in case of emergency.

METHODOLOGY

The methodology adopted for developing the blood bank application is the Incremental model system development lifecycle. This model has been selected because project can be developed through cycle of phase. The development of the project is carried out in multiple standalone modules. Incremental model include five phases which are; requirement analysis, design, implementation and unit testing, system testing and operation. The development iteration follows these five stages and if there is a feature that needs to be updated; such update can be made right in the middle of the development process.

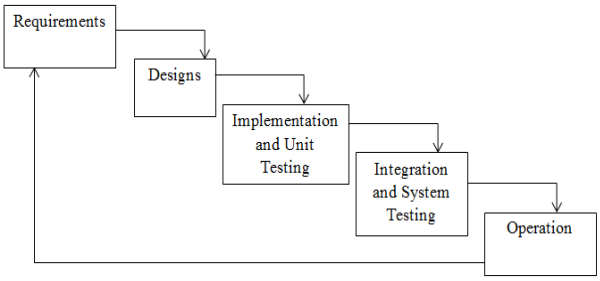

Fig. 1: Incremental Model System Development Lifecycle

REQUIREMENT GATHERING

Requirement gathering is the fundamental and first step of any software development project. All the requirements (functional, system, technical, etc.) are gathered together, analyzed and processed in this phase. This is required to determine the most suitable one that will be important and required in developing the project.

In this stage, analysis is carried out on the important features to be developed in the application. The process flow of the system is ideated and drawn. This will be a guide base for the next development stage after knowing the important features required through analysis of the system's process flow.

DESIGN
The design stage makes sure the flow of the development process is successful. After gathering all the important information as regards the project, a framework is developed to further explain the process flow of the application so that it is easily understood.

A flow chart diagram, use case diagrams and activity diagrams are used to explain in details, the flow of the software architecture and process specifically.

The design phase is divided into two development phases, Development I & II. Development I will focus on the interfaces such as designing and overall system functionalities and Development II will focus on Database.

The design of the user interaction and overall look and feel of the software with the aid of design and prototyping software is carried out at this stage.

There are lots of database software available in the market. However, there is need to choose a database program that will suit both user's and application's need. The database program chosen is the phpMyAdmin database. The programming languages used in developing the interface are HTML, CSS, PHP and JavaScript. Designing a simple interface that is user-friendly is very important because it makes the program understandable, easy to navigate through and enables a user to know the correct type of information to input into the database.

IMPLEMENTATION
After gathering the required information and the design giving features and specifications of the architecture and processes, the software is then developed using the specified requirements as gathered from the requirement gathering stage.

TESTING
In this stage, the application will be tested using different test unit cases. Errors encountered are debugged and solved at this stage and if there be a need to make changes, such change also has to be implemented back to design phase so that the flow of the system is not affected.

DEPLOYMENT
The deployment stage is the final stage in the software development lifecycle. After carrying out all unit and integration testing and all bugs or errors encountered has been solved, the application is then ready to be deployed to the market.

FUNCTIONAL SPECIFICATION
Admin: Manages user registration, requests made by donors/patients, updates blood bank information.

Blood bank: Blood bank information view/updates blood bank information, donor's information and manages patients request for blood donation.

Donor: View and manage profile, schedules and manages donation appointment and requests.
Patient: View and manages profile, search for blood banks, and request for blood

SYSTEM FEATURES
The developed application provides a wider range of accessibility for users since almost everyone has access to the internet. The application has the following features:

New Patient: This module allows the admin to register and add new patients into the database Donor Center (Hospital): This module displays a list of registered hospitals and/or blood bank centers where users can easily locate and contact in an emergency case.

Blood Donor: This module displays a list of registered donors and their contact information. Request Blood: This module allows the admin to accept or reject any request for blood made from the user on the application.

Application Summary: This module gives a chart report that presents the general and overall statistics, data, and information about the application in a diagrammatic representation.

SYSTEM FLOW CHART

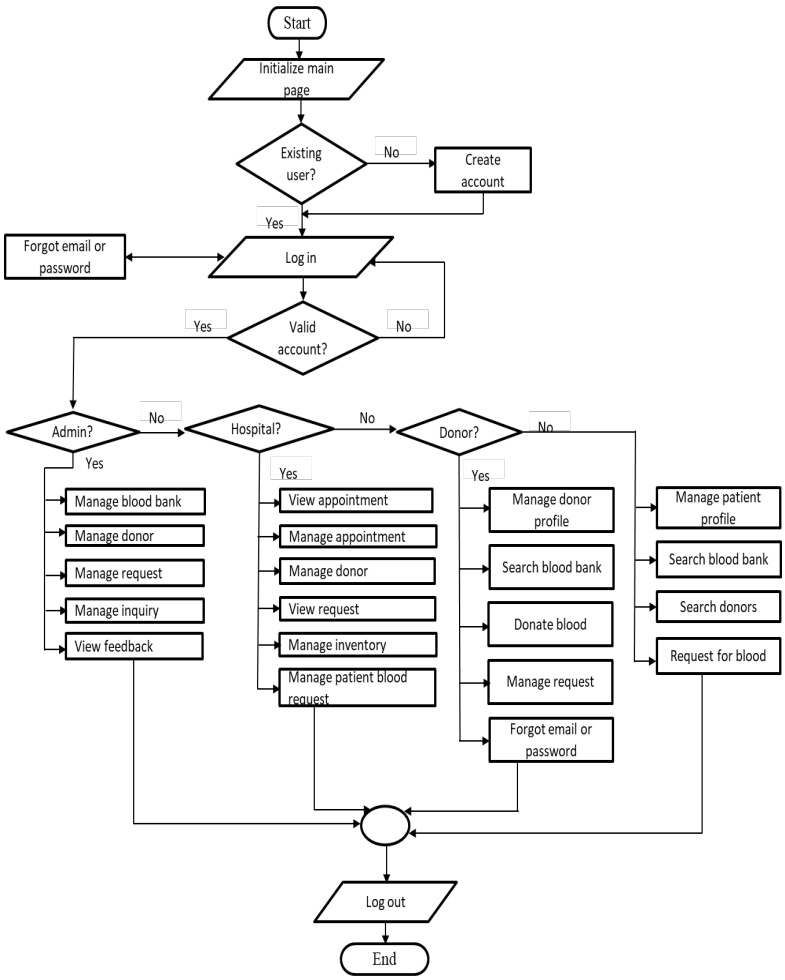

Figure 1: Flowchart of the Blood Bank Donor System

UML DIAGRAM

Unified Modeling Language (UML), is a new method of modeling and software documentation. It is diagram-based and is used to visually represent a given system including the main actors, the roles and actions played by the actors; to give a better understanding, maintain and/or make changes, and then document information about the system.

USE CASE DIAGRAM

It is used to summarize the details of the system's users, their interactions and dynamic behaviour with the system. It is a way to capture the system's functionality and requirements in UML diagrams.

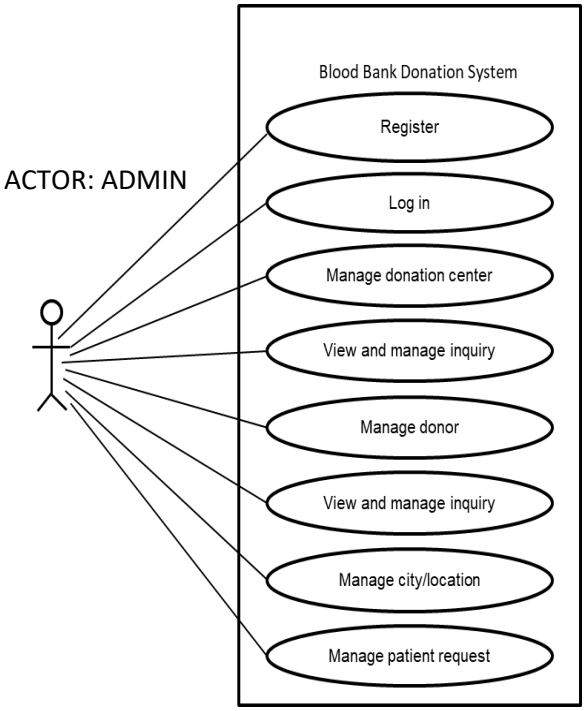

Figure 2: Use case diagram for Admin

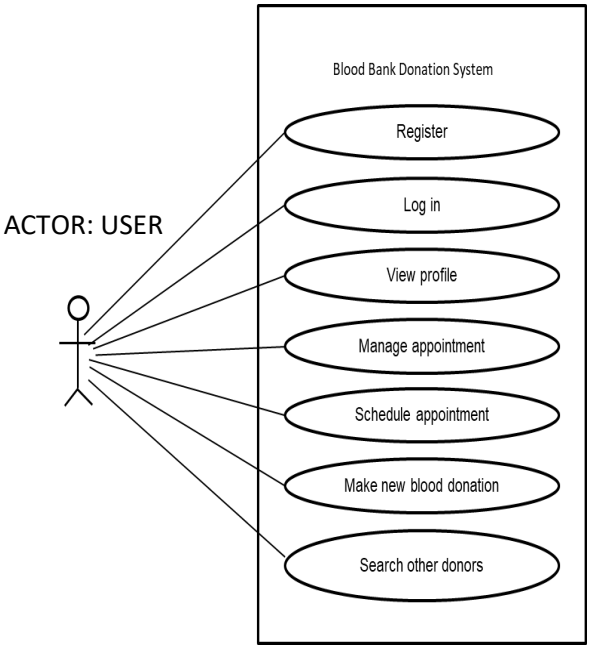

Figure 3: Use case diagram for User

ACTIVITY DIAGRAM

This is another important behavioral diagram in UML diagram. It describes dynamic features of the software. Activity diagram is an advanced version of flow chart that models the activity flow from one activity to another. The flow can either be linear, branched, or concurrent

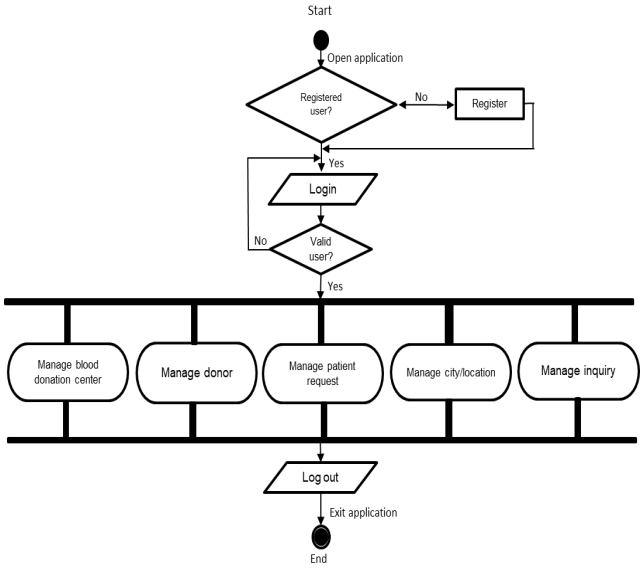

Figure 4: Activity diagram for Admin

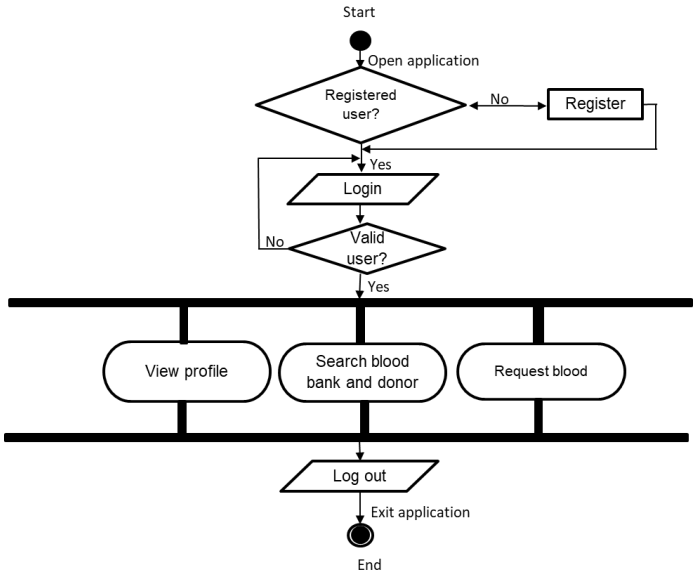

Figure 5: Activity diagram for User

RESULTS AND DISCUSSION

SIGN-IN SCREEN: This screen allows registered users sign into the application and search for available blood donors, hospitals, and/or blood banks. The user can request or donate blood. The user is required to input certain fields such as user name/email address and a password to enable the application validate the user before access is granted to make use of the application. The user can also request for a password change in the event the user cannot remember the password that was used while registering.

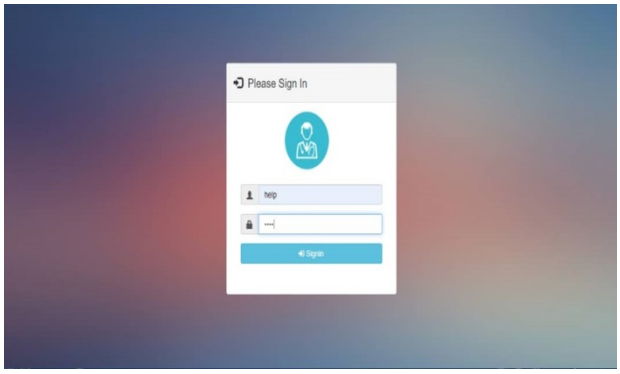

Fig. 2: Sign-in Screen of Blood Donor Application

REGISTRATION SCREEN: It allows the admin to register patients, hospitals and/or blood banks into the database. The registration process is divided into two: the pre-registration and full registration. The pre-registration allows the admin to quickly register a user on the database with the necessary details while the full registration is carried out later in the application.

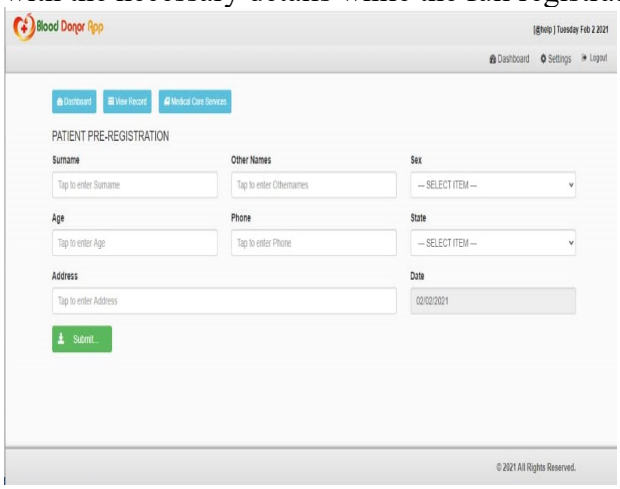

Fig. 3: Patient pre-registration screen

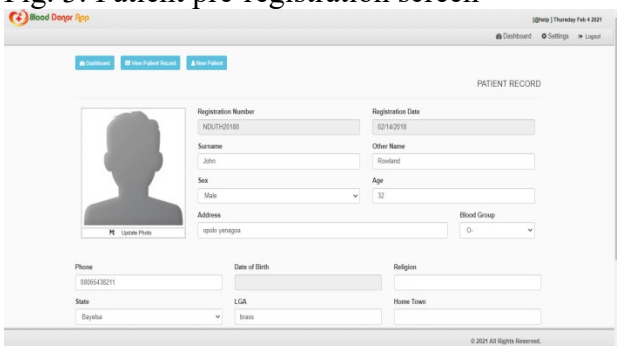

Fig. 4: Patient full registration

REQUEST BLOOD: the request blood button displays the request screen. Here, one can request blood for himself or on behalf of another. The user fills an online request form which has several fields that may require a user to select from a drop down option or manually input the required field.

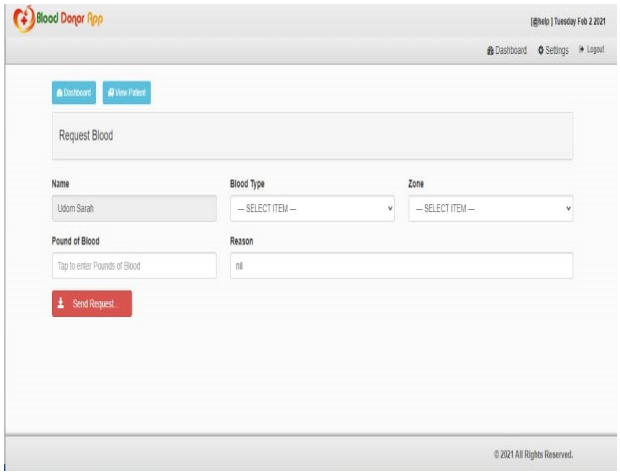

Fig. 5: Request blood screen

SEARCH BLOOD DONOR: By clicking on the "Search blood donor" button, the application queries the database and displays a list of available and eligible registered donors within the same locality/zone of the user. I.e. if a user of the application clicks the Find Donor, the application displays blood donors around him. The available blood donors vary with the search radius being set in the function. The further the radius, the more the number of blood donors being shown.

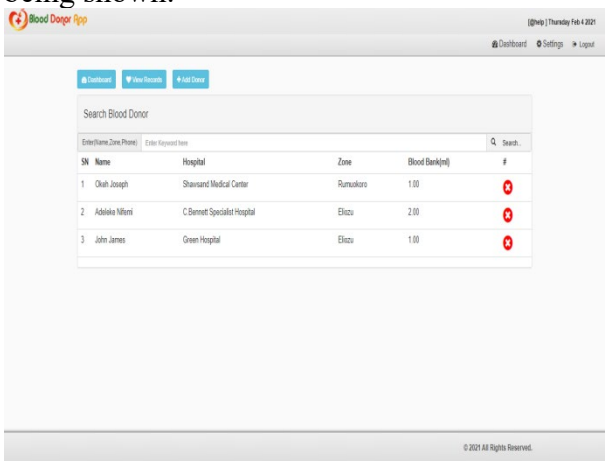

Fig. 6: Search blood donor screen

SEARCH HOSPITAL: This screen allows registered users to search for nearby hospitals or blood banks from different location zones. The application outputs a set of result based on the search criteria used. The user can then contact the selected hospital from the information provided in the result.

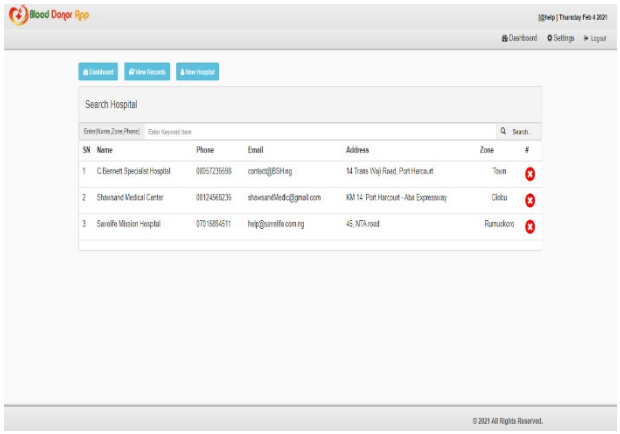

Fig. 7: Search hospital screen

PATIENT REPORT: This screen provides information about registered patients from the database. The admin can make blood requests and also receive donation requests from this page.

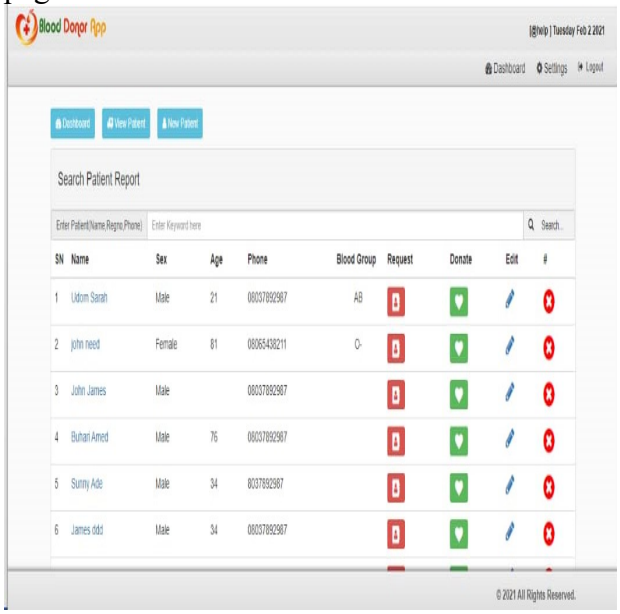

Fig. 8: Patient report

CONCLUSION

The development of an Emergency Web-based Blood Bank Donor System was achieved with the aim to synchronize the communication between blood banks and/or hospitals, blood donors, and patients with few clicks.

The design presented in this work provides a more efficient and faster way to tackle the urgent need for donating blood in an emergency scenario as the application makes the process of locating available blood banks and donors less time consuming.

The database is an important part of the system. More sensitization programmes to the public should be considered a viable option to boost the blood volume stock at the hospitals and decrease the mortality rate due to blood related issues.

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