

Blood Donor: Web Application Based Voluntary Blood Donation

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Abstract: *The demand for blood has become a significant concern in the present context all over the world. In critical or emergency situations where accidents occur or during further treatment and surgery, etc., there is an urgent need for a specific blood group. It is difficult to arrange blood quickly whenever needed. It takes a lot of time to make blood available, and it is inconvenient during an emergency. Some rare blood groups are time-consuming and difficult to arrange. There are many online blood bank databases available, but none of them offers the capability for direct contact between the donor and recipient. In this project, we have proposed an effective way to overcome the problems in the existing system. This system will help the blood requester to find the donors of the requested blood groups in his/her nearby location quickly and protect from any disappointment. The user has to register as a donor on the system. The donor will be prompted to enter an individual's details like name, phone number, blood type, etc. During the urgency of blood, you can quickly check for all the possible contacts matching a particular or related blood group and reach out to them via Phone Call/Message. This proposed solution provides a reliable and efficient method of locating blood donors, especially in distant rural areas where few blood banks are available. For this, we are developing a Web application which is low in cost, convenient, and requires less time to find blood banks and donors.*

Keywords: Blood donation, Blood Donor, Blood Recipient, Web application, Blood Donation Awareness, Smart Blood Management, Blood Request, WhatsApp Alert Message.

I. INTRODUCTION

Blood is a liquid substance that circulates the necessary nutrients and oxygen to every cell in the body. Blood donation is a noble act but during emergency times people rarely find blood donors. Every year, many people die because of the shortage of safe blood. This problem becomes severe during an emergency and after major operations. Again, blood is required for some other diseases like cancer, dengue, leukemia, thalassemia, etc. There are time periods in which blood must be processed or preserved. Otherwise, collected or stored blood can't be used. So, an efficient flow of blood is required in blood banks or blood donation camps to meet the regular demands of recipients. Recently, concern has grown about blood donation for COVID-19 during the pandemic situation [1].

People all over the world donate blood for this purpose. According to the World Health Organization (WHO), around 118.5 million blood donations are collected globally, 40% of which are collected from high-income countries. One unit of blood can be life-saving for patients who are involved in a road accident, or who will have major surgery, or who need long-term blood therapy or chemotherapy. Patients with anemia and thalassemia need to go through regular blood transfusions [2][5]. A donor should be:

- A person between the ages of 18 and 60.
- A person with a hemoglobin counts greater than 12.5 g/dl.
- A person weighing no less than 45 kg.
- A person whose body temperature is normal at the time of donation.
- An individual with normal blood pressure at the time of donation.
- Someone who is free of all diseases.
- A person who has not taken any medicine in the last 48 hours.

- Someone who hasn't had jaundice in the last three years.
- Someone who is not addicted to drugs.

II. LITERATURE SURVEY

The necessity of blood has become a significant concern in the present context all over the world. Due to a shortage of blood, people couldn't save themselves or their friends and family members. A bag of blood can save a precious life. Statistics show that a tremendous amount of blood is needed yearly because of major operations, road accidents, blood disorders, including anemia, hemophilia, and acute viral infections like dengue, etc. For them, plasma is needed to recover from their illness. Our purpose is to build a platform with clustering algorithms that will help to provide the closest blood or plasma donors of the same group in a particular area that can be explored within less time and more efficiently [1]. In this paper, we present an architecture for and prototype of a blood donation system using crowdsourcing for smartphones, whereby anyone at the nearest location can search for their desired blood group. Requesters can search for donors from their current or destination location. And, by requesting more than one blood group, you will save time and avoid disappointment [2]. It uses an internal management analytic that always takes care of the availability of blood and uses predetermined logic that can pre-populate a blood bank based on the highest frequency of the need for a certain blood type in an area. This system has an integration of user interaction also, where users and even hospitals can make requests for blood through the app (including app verification) [3]. This system aims to promote and popularize blood donation, respectively, by supporting an effective and permanently extant communication channel between the project's two target audiences. One of the target audiences includes people who are willing to donate blood. For them, the system provides a mobile application for logging and scheduling their donations, for receiving notifications, and for accessing useful information related to the blood donation process [4].

2.1 Background Study and Motivation

The blood is the body fluid that all humans and other animals' life is based on and accounts for 7% of the human body weight. It is mainly composed of about 55% of blood fluid called plasma that has 60% liquid part (water) and 40% solid part. And the main thing is that, Blood is needed at some regular intervals and at all times as it has only finite time of storage. Red blood cells are about 45% of whole blood that can be stored for about 42 days [7].

Every year, our nation needs about 5.1 million units of blood, but only 2.5 million units of blood are available. Over 38,100 blood donations are required each day. An aggregate of 31 million blood elements are transfused every year. Each year, more than 1.1 million new people are diagnosed with cancer. They need blood, typically daily at the time of their therapy treatment.

Access to safe blood throughout the years has been a persistent problem in India. Voluntary donations decreased significantly during the pandemic and lockdowns due to travel restrictions as well as fear of going to hospitals and getting infected. The rate of blood donations in the country amounts to only 1% of the population, and the pandemic only compounded the issue [2][6].

Our proposed blood donation web-application aim's to make this process easier by allowing the people who are in need of blood to broadcast their need and also locate and contact the donors who are capable and interested in donating the blood.

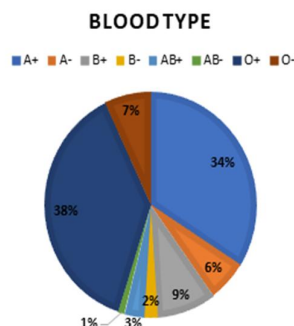


Figure 1: Blood Group Type Percentages

III. PROPOSED MODEL

In our proposed model any user can request for blood and also donate blood, which indicates that any user can perform both role of requester and donor. This Web application is for recipients and blood donors who are registered in our system. Donors can register themselves by providing their details like name, address, contact, DOB, blood group, email address etc. After registering, users get a username and password. By using it, they can login to our system. Once the user logs in, our proposed web application provides the facility to find a blood bank. And recipients can use this system to search for blood donors or banks within a specific location, post requests to other users, and users can contact a donor or blood bank by just tapping on that contact number. It is for the user's convenience to direct communication with the donor or blood bank.

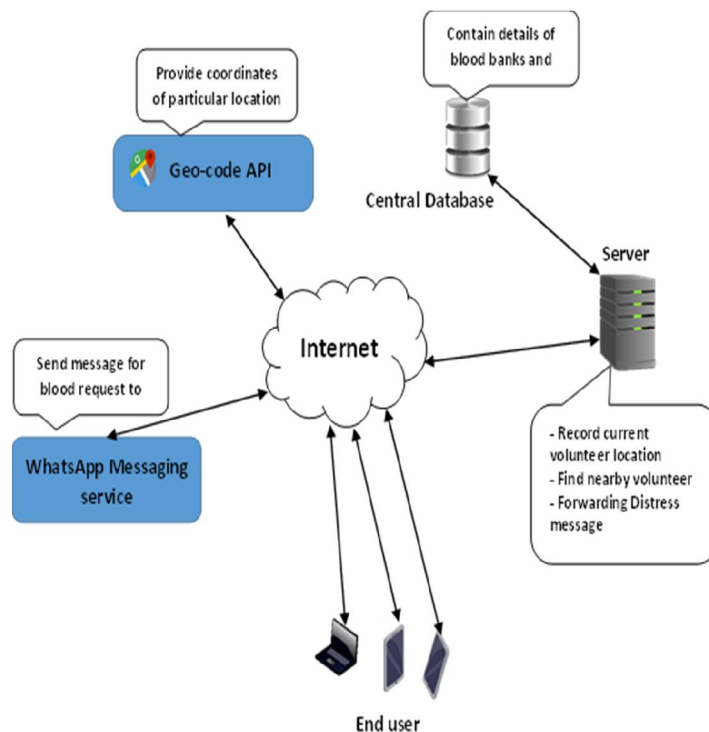


Figure 2: System Architecture

3.1 Recipient's Perspective

In our system, any user can place a request for blood. To place the blood request, the user needs to provide the patient's name, contract number, blood group, etc. When the recipient enters the location, the system stores the location of the user as the blood donation location point for the request. Any user willing to donate blood will receive this blood request notification if the recipient sends a request to the donor at his/her current location. For the emergency need for blood, the user can be able to search for donors or users who are willing to donate their blood. Users can search for donors of any blood group.

3.2 Donor's Perspective

In our proposed model, any valid registered user with an "open/interest" status is considered as a donor. A donor will receive all the blood requests and emergency blood requests that match his blood group. A donor can receive notification of a location update and a blood request if the blood donation location point is near to the current location of the donor. Donors can also search for a blood bank if they are willing to donate blood.

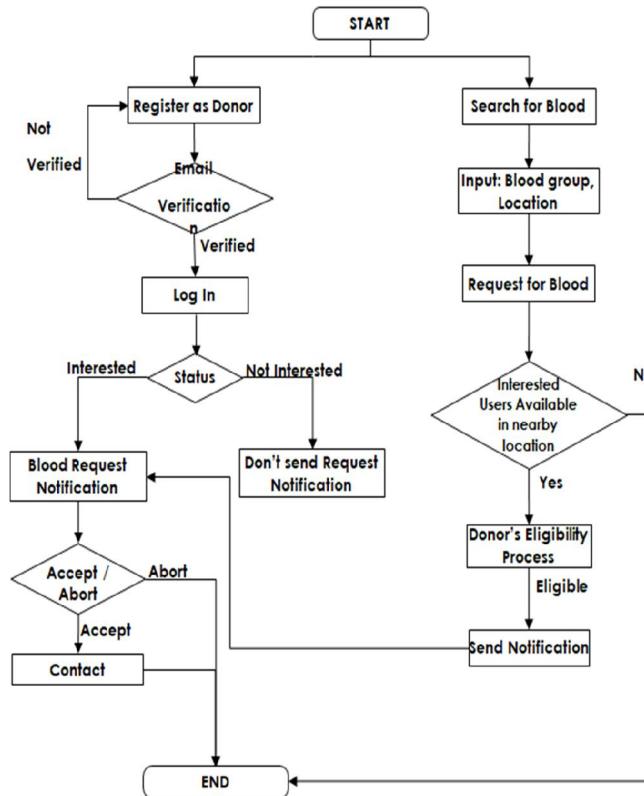


Figure 3: Flow Diagram

IV. SYSTEM COMPONENTS

4.1 Web Interface

Web interface helps recipients to view a list of prospective donors and also provide the facility of accepting or rejecting the request for donors. Allows new donors to register in the application [8]. The web application provides a user interface for data manipulation and for broadcasting notifications to the clients. It has a component-based architecture implemented in React.js [4]. The server will consist of a database where data such as stock of the blood bank, donor's details, and locations are stored in this database. Programming languages used for developing the web interface along with server are React and Spring Boot (Java).

4.2 Messaging Service

The system will keep donors connected with the community by notifying them of relevant updates regularly through the messaging service. In our project we are using WhatsApp as our messaging service. This will help donors to stay in touch with us so that they can take the necessary actions quickly when required.

4.3 Geo-code API:

ArcGIS Geo-code API service is used in this project for getting Geo-coordinates of a user which will then be used for ranking the donors according to their distance from recipient location. This service helps to set a donor's preference order for the recipient, which will help the requester to decide, communicate easily. And it can increase the percentage of blood donation.

V. WORKING OF PROPOSED SYSTEM

5.1 Users Registration

The system will provide a registration provision for donors who are willing to save lives by donating blood. This will generate a record for all the data about donors which is required and helpful in determining the eligible person who can donate blood. Any person can make a request for blood by specifying the blood group required by them and the place where the donation is required or where the patient is available without login or registration.

5.2 Eligible Donor Finding Algorithm

A key component of the system is the algorithm used to search a potential donor in real time. The parameters that are taken into consideration are:

- User's blood group.
- Donor's last donation date.
- Closest location from where the request is created.
- Health parameters.
- Requisition Form from the Doctor.

The system will suggest a list of registered donors to the recipient in need primarily based totally on their location. Donors available within the specified city or pin code will be suggested first at the top of the list.

- Inputs: blood group, location
- Outputs: The list of higher priority donors for that blood group within that location.

Table 1: Blood Group Type Match

Recipient Blood Type	Matching Donor Blood Type
A+	A+, A-, O+, O-
A-	A-, O-
B+	B+, B-, O+, O-
B-	B-, O-
AB+	Compatible with all blood types
AB-	AB-, A-, B-, O-
O+	O+, O-
O-	O-

5.3 Location Update

Based on the data given by the donor, the system will keep updating the donor's location from time to time in order to assure proper working of the functionality with accurate data.

5.4 Haversine Formula

In this project, we used Haversine formula to find the nearest blood donor. The system will find geo-coordinates of requesters and each donor with the help of ArcGIS geocode API. The distance between the user and each blood donor will be calculated by Haversine. The Haversine formula calculates the distance on spherical earth using latitude, longitude and radius of earth [9].

$$\text{lat} = \text{lat2} - \text{lat1}$$

$$\text{long} = \text{long2} - \text{long1}$$

$$d = 2R \cdot \arcsin(\sin^2(\text{lat}/2) + \cos(\text{lat1}) \cdot \cos(\text{lat2}) \cdot \sin^2(\text{long}/2))$$

d = distance between the requester and blood donor.
 R = radius of earth.

The above is the haversine formula with the help of which we can calculate the straight-line distance, using longitude and latitude coordinates [10]. These longitude and latitude coordinate points are retrieved from ArcGIS Geo-code API. Firstly, the difference between the latitude of blood donor and requester is calculated. Then, calculate the difference between the longitude of the blood donor and requester. Finally, the straight-line distance is calculated [9].

VI. CONCLUSION

We all know that blood is a primary necessity of life. There are lots of scenarios where the immediate availability of blood can save human lives. Our project is one step in this direction. The system allows citizens to communicate with blood donors about blood requirements in times of medical emergency in a better, faster, and more effective manner. The major contribution of our system is that we provide the ability to search for multiple blood donors in a short time within his or her location or in other specific locations. And a few parallels generate features in our proposed system. The parallel feature helps in raising awareness of blood donation by providing facilities to track the nearest blood bank to donate blood. Based on the algorithm developed for finding the most eligible donor, the donor's list will be displayed on the web interface. People living in places where blood banks are not available can use this system in medical emergency situations. It is even helpful in different types of geographical terrains to provide aid in saving lives.

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