BDonor: A Blood Donor Management System Using Mobile Crowdsourcing

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A thesis submitted in partial fulfillment of the requirements for the degree of Bachelor of Science in Computer Science and Engineering

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Declaration

We, hereby, declare that the work presented in this thesis is the outcome of the investigation performed by our group mate under the supervision Linta Islam, Lecturer, Department of Computer Science and engineering, East West University. we also declare that no part of this thesis has been submitted elsewhere for the award of any degree or diploma.

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Letter of Acceptance

This thesis entitled **"BDonor: A Blood Donor Management System Using Mobile Crowdsourcing"** Submitted by Rakib Ahmed (2015-2-60-004), Nurunnahar Smrity (2015-2-60-003) and Hridoy Deb Das (2015-2-60-090) to the Department of Computer Science and engineering, East West University, Dhaka, Bangladesh is accepted by the Department in partial fulfillment of the requirements for the degree of Bachelor of Science in Computer Science and Engineering on summer 2019.

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Abstract

The number of blood donation agencies are limited in developing and developed countries and it is difficult to find a blood donor of required blood groups. Patients suffer a lot and death is occurred in most of the times. Emergency situations such as accidents, ongoing treatments and elective operations create a critical and immediate need for a specific blood group. In this regard, the easier availability of blood from nearest locations has been given a little attention.

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. There are currently huge number of people using different smartphones of different operating systems. The prototype has been built on Android platforms, android Smartphone with built in GPS will be required to able to use the service. If and only if a registered user is willing to donate his/her blood system will send him notification of blood donation requests. This system will help users to find the nearest blood donor.

Smartphones collect the exact location information using GPS and send it to the user. Users have to provide their source and destination location for searching the nearest available donor using mobile crowdsourcing. The user can easily detect the donor without wasting any time. The entire system search donor within 5Km radius from the requester location.

In future, we will develop our system more congenial with more features. We will

implement the system for different platform to make the system more friendly.

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First of all, we would like to express my deepest gratitude to the almighty ALLAH for His blessings on us. we would not like to make eorts to nd best words to express my thankfulness other than simply listing those people who have contributed to this thesis itself in an essential way. This work was carried out in the Department of Computer Science and Engineering at East West University, Bangladesh.

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Chapter 1

Introduction

1.1 Overview

Crowdsourcing is a process where it is possible to request or distribute a task to a large number of people. Crowdsourcing system, which enrolls a large number of people to help, solves a wide variety of problems. It enrolls a crowd of clients to artifact that is definitely helpful to the whole community[1].Crowdsourcing can be related to a wide range of issues and present various enticing technological and social challenges.

In recent years, crowd sourcing has developed as a collaborative framework of problem-solving and business development[2]. In crowdsourcing, the crowd is "a group of people with varying knowledge, heterogeneity and numbers," who willingly undertake a task proposed by an organization[3]. Future research strategies will concentrate on analyzing active online community leadership, using crowdsourcing to evaluate large-scale data, and continuing emphasis on motivations and quality analysis[4]. Crowdsourcing will democratize problem-solving in science and health care and promote innovation.

Every year our nation needs about 5.1 Crore units of blood but only 2.5 Crore units of blood are available. Over 38,100 blood donations are required each day. A aggregate of 31 million blood elements are transfused every year. Each year above 1.1 million new people are diagnosed with cancer and they want blood, typically daily at the time of their therapy treatment. Blood Donation is a aristocratic act and one of the most symbolic contribution one person can make to save a human life. One unit of blood can be life-

saving to patients who are involved in a road accident or who will have major surgery or patient who need long term blood therapy or chemotherapy. Patients of anaemia and thalassemia need to go through regular blood transfusions. Most of the time when a patient needs blood the donor is the patient's friend or family member.In worst cases, there is a possibility that patient's blood group does not match with friends or family members and creates a mess and they need to search for a donor or blood in the blood bank. Blood bank stores blood from donors but donated blood has a short self-life approximately 42 days. It is clinically prohibited to use blood that has been donated 30 days prior to serious condition patient. This is the reason blood bank can not store a large number of units of blood and maintain a limited reserve. Searching for unknown volunteer live donors is a tedious process. These situations may create a chaos for the patient and their relatives.

The main source for blood is is the people who donate blood in health care center through voluntary system. Nowadays smart phone is a commonly used device and almost everyone has a smartphone. Through the smartphone, it is possible to find blood donor way more easily. In an emergency condition when the stocks are less than required target we can gather large number of donor in short time through the concept of Crowdsourcing.

1.2 Motivation

Smartphone and tablet development has influenced the rapid growth in m-health. Already, most people use devices like smart health trackers and fitness bands that capture or provide information and data on health. So there is no doubt that mobile applications will help a blood donor or a person who needs blood in an emergency to find out how, when and where blood can be donated, saving them a lot of time and struggle. There are few blood donation or search blood donor-based applications available in the different app stores. But there is a question about the usability of these applications. Ouhbl et

al [5], the author of Free Blood Donation Mobile Applications analyzed and assessed the characteristics of free apps for blood donation based on their features and functionality. In this paper, they found a total of 169 free blood donation applications, where 63% were found in Google Play, 17% in the Apple App store and rest from other app stores. The result they found was more fascinating. Few of the applications could not be installed or accessed. Of those that could be installed, half of the application does not require any kind of authentication. Moreover, a few of them are available in more than one language and half of them have a geographical restriction. Also around 60% of them do not notify the user of blood donation events and requests majority of them do not provide blood donation recommendations. Thus, before implementing this system, we surveyed among

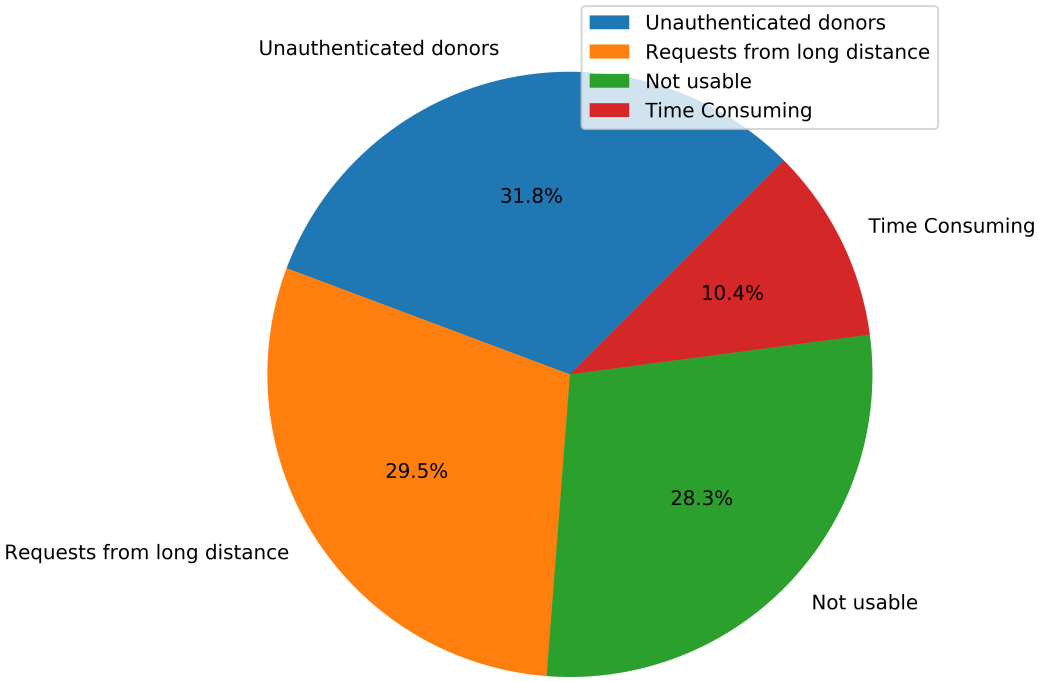

Figure 1.1: Reasons people get demotivated use Blood Donation App

250 students of East West University, Dhaka, Bangladesh. Among these 250 students, 174 students went through a situation when they had to look for a blood donor or had to donate blood. From this survey we got to know none of these student used any kind of blood donation mobile application. Figure 1.1 helps to visualise the reasons of unwillingness of people to use blood donation mobile applications to find a donor or to donate blood. 29.5% people consider that they get demotivated to donate blood when the need to travel a long distance to donate blood, 10.4% people thinks using an application to search blood donor is time consuming. 31.8% of people consider it is risky to receive blood from unauthenticated donors. 28.3% people consider mobile application for blood donation would not be useful.

Almost 90% of 250 students said it would be really helpful if they could find an authenticated donor in their nearby locations. They would get more motivated to donate blood if the requester is near from their current location.

1.3 Objective

In our study, we tried to built a system which will be helpful for the donor also it will motivate people to donate blood as they do not need to travel a long distance for the donation. The requester and patient will also get benefited, as they will find blood donors in their nearby locations. In the time of emergency, when every second is a matter of life and death the whole process of searching donors and donating blood will save some time. Our designed system will create an enormous blood donation community that can receive and donate blood as soon as possible. We want that there will be no blood shortage in Bangladesh. Regardless of how rare a patient's blood is, his or her blood group will always matches with some donor and she will receive that blood in time.

1.4 Problem Description

"Blood" is one of our life's most essential needs. Emergencies, such as injuries, generate an urgent and vital need for a specific type of blood[6]. Timely availability of quality blood is a key requirement for healthcare services to be maintained. In the hospital, when blood is needed, it was not possible to provide on time causing unpleasant things in most cases. While there is a donor in the hospital, the patient is not aware of it, and so is a donor. To solve this, it is important to communicate between hospital, blood bank, donor, and receptor[7]. In our project, we are proposing a new and efficient way to overcome this outline using android. By using GPS, we can search for blood donor nearby at the emergency time of the blood required. Once the user of the app enters the blood group he / she needed, it will show the nearby donor automatically and send the donor an alert message. If the first donor is not available, the next donor present in the queue will be checked automatically. If the donor approves the request, the donor must obtain a one-time password (OTP) to confirm. Once the donor donates the blood, the donor information will be automatically removed for the next three months[8].The proposed system will be used in Blood Banks, Hospitals, Donors and Requester that signs for the service.

1.5 Outline

Rest of the chapter 2 is Background study of our research. This chapter contain Basic concept, terminology, mobile crowdsourcing, data collection, google map API, and so one. Chapter 3 is existing of our related work. We proposed our system framework in chapter 4. This chapter contain system model, Problem formulation and algorithms. Chapter 5 contains our Experimental result analysis. Here we describe our sample data set, output and performance analysis. And last chapter 6 contains conclusion and future work.

Chapter 2

Background Study

2.1 Basic Concept and Terminology

"More heads are better than one," is the concept of crowdsourcing. Through a large crowd of people, ideas, expertise, and engagement, the superior value of the material is achieved. One can only expect quality outcomes if many individuals give their best ideas, expertise, and support. It will be most detailed in terms of information. It is the most conceptualized in terms of design. It is the most detailed in terms of micro-tasks. Crowdsourcing helps you choose the best outcome from a broad range of skills instead of a single supplier. The results are also much faster than traditional or modern methods as a type of freelancing. Crowdsourcing is considered as the new revolution in Business[9], Health[10], Transport[11], Academia[12] and many more. Crowdsourcing requires a large group of people to solve their tasks online. Crowdsourcing is a powerful business marketing tool as it enables a company to take advantage of its audience's imagination and assets to support and grow the business without any cost. From planning marketing campaigns to researching new goods and to resolving difficult business roadblocks, it is possible to provide valuable feedback and reactions to a company. Besides, all the consumer wants some acknowledgment or even a basic reward in return for their perception and hard work.

Crowdsourcing increases a company's efficiency and reduces labor costs to the minimum. The Internet offers time-based input from an effective consumer base. Today,

consumers want to engage in businesses from which they purchase that making Crowdsourcing an incredibly useful instrument. There are numerous types of Crowdsourcing available that help organizations, at little or no cost, to get jobs or funds from a large group of people. Crowdsourcing has a huge potential that can be fully expanded to include mobile devices rich in sensing like Smartphone. [13]

Many kinds of jobs, including the creation and transcription of the website, can be crowded. Companies seeking to develop new goods frequently turn to the public for their views. Installations can reach millions of consumers via social media instead of relying on small focus groups, to ensure that businesses get feedback from a variety of cultural and socio-economic backgrounds. Some businesses also use Crowdsourcing to determine how many people sometimes split large jobs on the same task through Crowdsourcing. For example, if a company wants a new logo, it can collect samples at low cost from dozens of graphic designers. The agency can then choose a preference and pay for a logo set that is more accurate.

Modern mobile phones have developed and changed the way people communicate and connect with each other everyday. In fact, because of the universal availability of mobile devices, the transmission and sharing of information are almost automatic. The technology of modern smartphones is higher than previous ones. It creates new possibilities for different kind of crowdsourced tasks. The rise of the smartphone has created a new instance in the Crowdsourcing region [14]. Mixing smartphone-based mobile technology, Crowdsourcing provides enormous computing resources with the great development of smartphones with rich built-in sensors and ratio interfaces and refers to a new approach called Mobile Crowdsourcing.

2.2 Mobile crowdsourcing and data collection

The worldwide influence of mobile phones has been widely documented. Such instruments are now acting as vital fundamental resources for billions of economic livelihoods. In some of our most underserved societies, the most dramatic classification has been given to the transformative influence of what is now the fastest technological development in human history.[15] Mobile crowdsourcing makes easier to complete a complex task. Nowadays, mobile crowdsourcing is used in various types of fields, namely, eHealth, transportation, location-based service, etc. There are some additional advantage and benefit to use crowdsourcing for data collection[16] and data verification[17] such as:

- Get insight into local areas easily with near-real-time information, like cities and neighborhoods.
- Access to correct information for marketing programs, techniques and case studies.
- Verified data to support risk management and event confirmation.
- Getting the lead in the developed market on data collection.
- Minimize the time of traveling while still gathering personal data.

The data collection of crowdsourcing involves the creation of data sets with the support of a large population. There are a source and data providers that are willing to add appropriate, incomplete or new information to their data. Researchers may gather sufficient, useful and distribute information at a cost that typically less than conventional methods of data collection via crowdsourced data collection. [18]. Crowdsource allows gathering information from hundreds or even thousands of diversified sources.Based on a non-profit business model, Wikipedia is a free, web-based multi-lingual and co-operating encyclopedia that improves leadership quality through the use of so much useful information as is feasible.[1]. The project has over 100,000 active volunteers who add new

expertise to the program every day. In practice, "OpenStreetMap" is another big example of crowdsourcing. [19].

Then any member of the system can complete a task and be rewarded for their efforts. Although this method of a labor organization has been pioneered in the computing industry, companies have begun using crowdsourcing for a variety of tasks and they think that can be best performed by crowd members rather than their workers.[20] However, these advantage increases the use of crowdsourcing rapidly in all sector.

2.3 Use Cases of Crowdsourcing

Using the idea of crowdsourcing developers use various technologies and device sensors to gain the location and use them as crowd or storage. MCS sensing has recently emerged as an area of interest, as smartphones become the main communication devices in the daily lives of people. It creates new possibilities for different kind of crowdsourced tasks. The rise of the smartphone has created a new instance in the crowdsourcing region. Smartphone has different types of sensors which are used in different kinds of task. For these reasons, the connectivity increases between them which makes real-time data collection easier. The modern smartphone has many different kinds of sensors and functionalities, such as GPS, accelerometer, magnetic sensor, temperature sensor, etc. These sensors can be used to solve a different kind of task. To have these kinds of sensors in smartphones, developers are encouraged to use these devices for source and destination.

2.3.1 Transportation System

Intelligent Transportation platforms and their applications are attracting notable attention in the supply chain. Through sensing and communication technologies, the smart transport systems assist transportation authorities and vehicle drivers in making informative decisions. Data collection and more importantly the use of the collected data analysis

are crucial elements in intelligent transportation. In these platforms, vehicles and cars are equipped with proper sensing and communication capabilities such as drivers' mobile phones.

Among different Intelligent Transport platforms, Crowdsourced Transportation Platforms (Road) getting more growing significantly. Within the supply chain scope, a growing number of Uber-like platforms for commercial transportation are entering the market in the U.S. as well as in Europe. Last-mile logistics represents a good near-term opportunity for crowdsourcing transportation.Crowdsourcing provides a solution to complex systems management multi-dimensional problems. For internet connecting devices, there has been a significant increase in the range of issues that crowdsourcing can address. The major idea is to enable those ITS applications without on-road and in-vehicle special sensors or communication devices.[21] Crowdsource delivery platforms making inroads into the commercial transportation sector to match OTR capacity with shoppers demand. These solutions allow shippers to instantly book the loads they want to haul. This kind of on-demand offering, which sources transportation needs abroad, the online community of shippers and carriers through the use of Uber-like social collaboration techniques, is seen increasingly in the transportation market with strong backing from the private equity community.

2.3.2 Social Media

MOst of us are already dependent on strangers online to relieve stress. We write about our day, thoughts, dreams, and from friends and unknown people who visit the blog or forum or watch the video, we get peaceful words. A patient counseling blog was used by a hospital in North Carolina where patients share only first names and express feelings.[22] Developers have developed lots of social networks to share their emotions and opinion. Social media marketing strategy that enables us to communicate directly with our audience. And we come to know know who is interested in our company because

we choose to post our social media profile. They developed these social media by using the idea of crowdsourcing. Crowdsourcing is now illustrated by websites like Wikipedia, Facebook, YouTube and Digg, which create desired content that rivals the best published outlets without conventional value standards. Statistics of web traffic affirm this content's value. More than 17 percent of global Internet users, for instance, viewed YouTube alone in September 2008.[23] In U.S. more than 77 percent people use social media, for our business, it's a great opportunity to start using social media marketing to reach new members. We learn more about social media marketing and can ask about the pro's and cons of social media. There are lots of people who use social media platforms. Businesses have such a great chance to reach a wide pool of people involved in products or services.Posting free organic content from social media is a tremendous benefit to the client. It opens various doors for companies to link to valuable leads at no charge. It's one of the reasons that companies keep using these channels.

2.3.3 Industrial Website

Industries also attracted attention to crowdsourcing and found innovative ways to engage their valued customers in the processes of development and promotion. Crowdsourcing draws people around each other so that you don't need any regional restrictions to get into the way. It allows advertisers to achieve amazing talent that might not be on their private business. Crowdsourcing is usually achieved via social media, allowing companies to learn things about what people think about, what they are worried with, and where their abilities are. Crowdsourcing offers a common approach by automatically organizing devices and working people and providing answers to complex issues. Different types of challenges remain separate from the acceptance of crowdsourcing by the widespread industry. For example, the performance of workers in the crowd is important and depends on different aspects such as their expertise, experience, engagement, etc. Different types of problems remain separate from the embrace of crowdsourcing by the widespread indus-

try. For example, the performance of workers in the crowd is important and depends on different aspects such as their expertise, experience, engagement, etc. Using the concept of crowdsourcing, nowadays lots of websites have grown up, Like- freelancing websites, data transformation websites, cloud contacts websites, etc.

2.3.4 Gaming Industry

Though academics and industry have found it difficult to find ways of engaging customers, usersor participants, They voluntarily pay substantial amounts of money and time, playing games. This led to the birth of a "gamification" research area. The most common aspects of gamification are the introduction of game terminology, social games and a reputation system or the development of an active reward system. The gamification process in crowdsourcing by finding ways to give rewards. Gamification can be extended to many places where human labor is basically necessary. In attempting to promote ' joy ' as a target state, it distinguishes itself from other motivational studies. To date, gamification studies have established various incentive methods for applications or visual representation. Nevertheless, despite plummeting interest in the issue, most gamification study, particularly on rewards, are case studies that document the effects of implementing the gamification approach to particular conditions and therefore lack any practical effect in many other circumstances. Therefore, generalizable findings are needed for the theoretical discourse on the methodology. [24] Gamification work also lacks the concept of ' fun, ' even though the goal is to create a condition of pleasure. The term itself is broad and vague, but it is important to have a functional definition of pleasant in conjunction with each research context for further research discussions. While it is recognized that the frequency of anticipatory feelings influences the decision-making process in economics. Based on previous studies, the researchers hypothesized that enjoyable experiences will come from the tension created by the expectation of diversity about future results in the sense of a project and the incentive situation, But on the assumption that there is no

physical threat. This proposed structure is not used for 7 concepts linked to a pleasant experience in Hoonhout's identification.

2.4 Google Map Platform

The resources used in the wide range of applications in today's Google Map GPS. The Google Maps Platform is a collection of APIs and SDKs that enables developers to include or download Google Maps information in mobile apps and web pages. Google APIs are a range of Application Programming Interfaces (APIs) created by Google that allows Google Services to connect and integrate with other systems. APIs can be used by third-party developers to manipulate or extend existing services.

Google Maps attributes have been divided into various APIs such as the Dynamic Maps API, Street View image API,and Distance Matrix API. Google Maps allows Google Maps to be completed using a single JavaScript or Flash interface via externally accessible web pages with the help of the Google Maps API. It is structured for both mobile and classical desktop server apps. The API provides language translation for more than 50 languages. Using the Android Maps SDK to integrate maps into an Android system and then use the iOS Maps SDK to integrate maps into the iOS device. The JavaScript API Maps has been designed to cope with mobile devices and is designed to support desktop-focused software applications and also provide a full JavaScript web browser such as Apple iPhone execution. The static API Maps provide GIF, JPG and PNG images for applications which are not appropriate for using Maps JavaScript API, like markers or poly-line tools. Password instructions can be obtained for bus, drive, walk and cycling modes. Designers can also use road points to measure paths to other locations and to predict journey times.

Users can access a matrix of origin and destination points on journey distances and times using the Google Maps Distance Matrix API. In addition, developers can also

obtain distance data for various modes of travel, modify the devices where distance data is provided and calculate trace travel time depending on the proposed route between starting points and endpoints. The Google Maps Roads API allows users to identify the roads a car uses and offers more data, such as speed limits. With this API, developers can use their applications to integrate Maps Roads products.This API requires an API key when making requests.

The Maps SDK for Android can be applied to a Google Map-based app. The API automatically handles access to the Google Maps database, data download, map display, and map gesture response. API calls can be used to add markers, polygons, and overlays to a basic map and to change the view of a specific map area by the user.

The Google Maps Places API is a system that uses an HTTP request to retrieve information about a "place": an organization, a geographical location, or a prominent point of interest. Setting requests specifies locations as coordinates of latitude and longitude.Place search methods, details, photos, and autocomplete queries are available. After making URI requests and authenticating with the API Key, the Places API returns mapping data in JSON and XML formats.

There are location search methods, descriptions, photographs and auto-complete queries. The Areas API delivers mapping data in JSON and XML formats after creating URI queries and verifying them with the API Key. The GPS location API returns a position and specificity radius based on WiFi nodes and cell phone tower details that can be identified by the mobile user.

The Google Maps Time Zone API allows users to offset information to any Earth spot. Designers can request information on a certain time , longitude/ latitude , and the API will return the time zone name, the offset of UTCs and the compensation for daylight savings. Results will be delivered in English by default, but other languages are present.

2.5 Server System and Crowdsourcing

A server operating system designed specifically for servers, which are specialized computers which function within a client / server architecture to support user computers requests on the network. The widespread availability of mobile devices and personal computers, along with the development of new ICTs has provided new opportunities for more effective problem-solving or performing various types of tasks using the work and efforts of large groups or crowds of interested persons. In this field, the crowdsourcing paradigm is increasingly popular having various methods and business models both in the scientific and practical contexts. The standard architecture of a crowdsourcing system considers the performance of a task or the solving of a problem by an undetermined crowd of people, where the task could be divided into small parts. Often, there is a need or opportunity to solve several such tasks but by other crowds, which naturally leads to the formation of a network of crowds for solving independent problems. On the other hand, the software implementation of a unifying crowdsourcing project enables this type of network to be executed with more limited technical, programming and human resources.

For the organization of crowdsourcing systems, including such for mobile crowdsource, various types of architectures, systems, infrastructure and cloud services are being developed and studied. Most of the system has multiple task requester and multiple workers.

In this system, the crowd worker provides task and task requester request the task. Two types of mobile crowdsourcing architecture are centralized and decentralized[25]. In this model, all computing is performed on a central server and computer resources are located in the primary data center[26]. Only the clients or terminals send requests to the center and receive the results from their server / cloud services.

In comparison, all computation and interaction is carried out locally in an appropriate manner in each peer in distributed platforms. Growing node of the network is equally responsible for contributing to the global outcome and could be situated at different

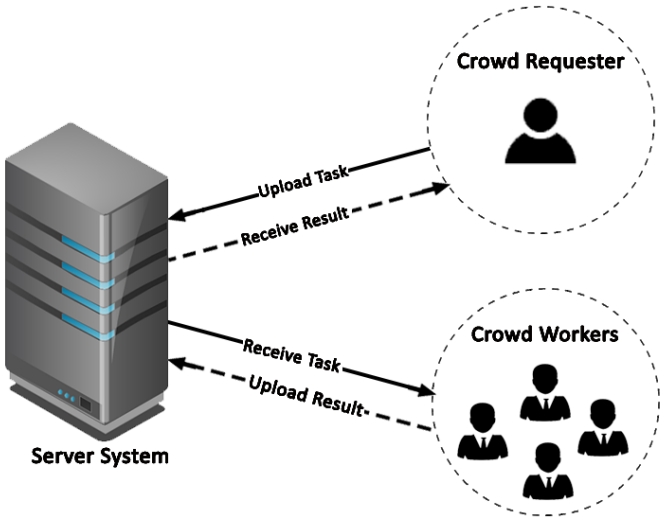

Figure 2.1: Crowdsource system architecture.

locations where the geographic location is important to the process itself. Therefore, through mechanisms based on their experiences with the world, each node can process and distribute its information without relying on any centralized authority. In digital crowdsourcing systems, they can generally be considered by a dynamic group of human participants and mobile devices as a decentralized problem-solving method. The systems propagate the request and task in distributed methods among many participants, particularly on mobile devices, where all computing and interaction is conducted locally.Instead, via communication channels, these tools are allowed to fully exploit and distribute the application to others.

Figure 2.1 shows that, in a crowdsourcing server system, a crowd requester or task requester uploads the task in the server. Then the crowd workers receive or read the task and make a solution. Then the crowd workers upload the solutions or result to the crowd and the crowd requester read the solutions and receive it.

2.6 Mobile Crowdsourcing Challenges

In mobile crowdsourcing usually requires a large number of participants with common aspects to sense the environment using the sensing devices. There are some challenges that we have to solve. The first challenge is ensuring privacy and security. For everybody, confidentiality is very necessary. No one wants to tell anyone his / her information. Within MCS transmissible correspondence, sensitive information about end-users and workers can be identified . Therefore, information or computational results must be secured from hackers or harmful parties .Moreover, most MCS systems remain limited in terms of processing and interaction capabilities.[27]. Additionally, open wireless networks and the decentralized nature of MSC enable the hackers to track easily. As an open system, some greedy or dishonest workers will eventually be included, who can carry out various attacks and destroy the normal function of the system.

To provide mobile device with security, we can use a different technique. In order to collect information from selected nodes, the network layer for data collection is used. This provides privacy mechanisms to the data user. Another challenge is how to offer useful opportunities that allow honest contributions to mobile crowdsourcing and computing and this is a new solution. There is a need for a new opportunity and price structures to attract, encourage and reward authentic and high-quality data sensing contributors, for a highly dynamic mobile computing and crowdsourcing process.In the case of mobile crowdsourcing, the data distribution in the temporary network is an additional challenge because of mobile crowdsourcing and computing features.

2.7 Mobile Crowdsourcing Algorithms

The principle of crowdsourcing is to use the expertise of a community for a single purpose. It is best used to innovatively address complex issues or streamline complex processes. Crowdsourcing is an important tool for companies in a variety of fields to leverage,

including data collection, creating operational efficiencies, and general problem-solving. It has helped many businesses to scale to the degree that it has revolutionized entire industries at an unprecedented rate. In a crowdsourcing system, there are a huge number of data, task requester, and task provider. When the task requester requests a task the coordinator had to find the suitable participant or data from the database in an efficient way. A different algorithm is used for finding the participant. The ranking algorithm ranked the participants from the large user pool.

Classification is based on the availability of participants and then selects top participants to assign the task. Suppose there are ten participants in the user pool, based on the participant availability in the user pool, the ranking is assigned. Out of these top-ranked participants will perform tasks they have the highest priority. For finding data from the server different algorithm may use. In our proposed framework we used the nearest transport finding algorithm. That we will discuss in the next chapter. Similarly, we studied the quadtree algorithm for selecting the nearest transport.

2.8 Crowdsourcing and Android Application

Crowdsourcing is a sourcing model in which individuals or organizations obtain goods and services, including ideas and finances, from a large, relatively open and often rapidly-evolving group of internet users; it divides work between participants to achieve a cumulative result.

In the last few years, a significant amount of hype and interest have been created over mobile information and communications technology (MIT). Conducted by substantial improvements in spectrum use, advances in network and application infrastructure and the increasing growth of mobile and wireless phones, the dream to provide' always on' communication and to provide consumer and business products and services, where and how they seemed to become a reality rapidly. There is ample evidence of the signif-

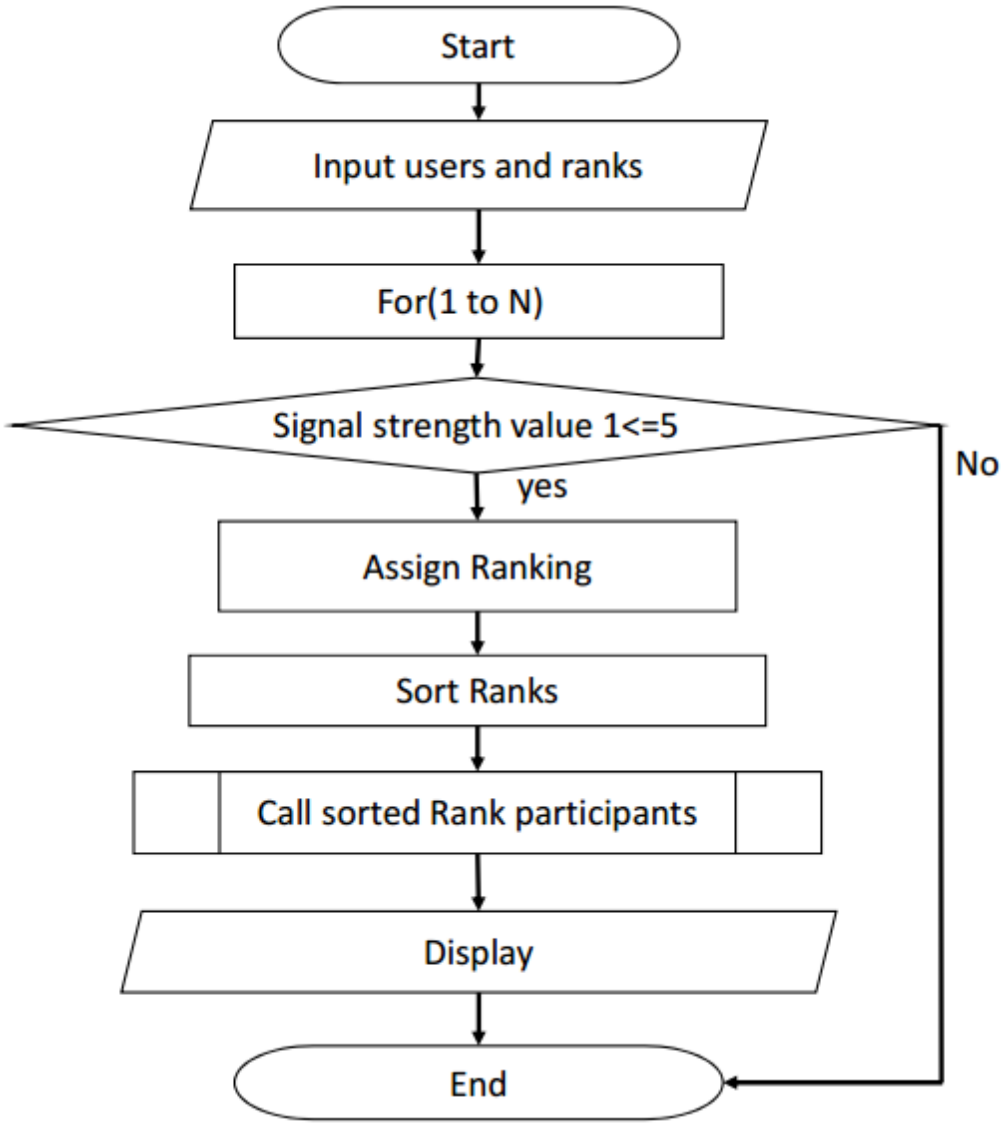

Figure 2.2: Ranking algorithm.

icant interest in mobility and the issues related to 'being mobile'. The explosive growth in mobile devices, the emergence and convergence of information and communication technologies (ICTs), and substantial investments in wireless infrastructures are some of the many indicators of a society becoming increasingly mobile. A rising interest in the issues surrounding mobility can also be found in the academic community, where the design of mobile information systems, value of mobile applications.[28]

As having a smartphone is very common, developers have tried to serve all kinds of facilities to the user through mobile phones. Android is a large-scale mobile open-source operating system that simplifies the process of mobile app development. Companies use Android to build custom mobile apps that solve consumer issues and improve business value. Android Application Development Company is also an open-source solution for mobile devices offering a complete software stack including operating systems, middleware, and key mobile applications. The demand for Android app development grew through its robust offerings with many new android devices. The major facilities from android devices are:

- Low Investment High ROI.
- Open Source.
- Easy to Integrate.
- Multiple Sales Channels.
- Easy Adoption

According to a survey recently, many Java programmers have found it easy to take up and integrate mobile app software in the Android OS. The conversion of the code script into a mobile application and the integration of Android application development services in the system is now very beneficial to Java technology developers.

2.9 Summary

Though crowdsourcing provides the easiest solution but implementation of crowdsourcing is a difficult task. It has a data collection issue. The collected data also had to preprocess so that there is no unnecessary data on the server. In this system, the server had to cooperate with a huge amount of data along with task requestor and task provider. However, for mobile crowdsourcing provide strong privacy and security and also use less amount of resource is very important. The system needs to run a good and efficient algorithm to find data or task provider so that it becomes time and cost-efficient. Moreover, using the crowdsourcing idea on android applications is also very challenging. Developers need to think about users' security issues, large database management issues, mapping and location issues and most importantly fixing the bugs of the developed system. Therefore, developing an android application, developers have to find out the compilation of the previous applications. They have to think about future development issue of those need to be developed consequently. To conclude, developing an android application is quite difficult, but if it is possible to develop an android application, it can make our life easier.

Chapter 3

Existing Work

3.1 Similar Research

3.1.1 Blood Donation And Life Saver-Blood Donation App

In this paper, they proposed a method to create an android application in which the blood donor is always available in time. At the time of searching blood, all the registered donors are shown in this application. The GIS(Geographic Information system) tracks the nearby donor locations. This application [8] is intended to donate blood in the event of an emergency. The application also contains various information about blood donation and can enroll through this application who are willing to donate blood. They proposed some functionalities for their system:

1. The system updates the information on blood donation.

2. The system allows approved functionality to allow only authorized users to access private and confidential information.

3. To keep track of blood supply, the system will keep records of each donor.

The system has enhanced the connectivity between different devices, allowing people to communicate from anywhere via phone at any time. The aim of this system to set up blood donation services/camps and to maintain records of blood donors that are easy to distribute around the country.

Even if every blood consists of the same key elements, not every blood type is similar. In fact, the presence or absence of certain antibodies determines eight different common

forms of blood, given that some antibodies can trigger a patient's immune system to attack the transfused blood. Until blood transfusion, the blood type of the donor must be determined.

- Group O is the common donor for supplying red blood cells to anyone.
- Group A is able to donate A's and AB's red blood cells.
- Group B is able to donate B's and AB's red blood cells.
- Group AB may donate only AB's but can receive blood from all others.

The proposed architecture for their system is First, the admin gives a unique id and password to each donor. The administrator of the system maintains the details of the donor and he can also update and can change the password of the donor. The admin checks the expiry date of the blood regularly and updates it.

In an emergency case, the requester can request blood and can also provide information about the patient's condition. There are some features given to the donor such as finding blood group, log out and details of the service. If any user already registered, then the admin provides the already stored database information to the user. In this system, a one-time password is generated when the donor accepts the blood request. This one-time password is set for security. This system provides blood to anybody and anywhere.

In this paper, they proposed a secure GIS and OTP(One-time password) information system in android mobile applications. This system's main concept is important for health care. The current problem such as misuse of data and information given to third parties will be replaced with this information.

3.1.2 Smart Blood Query: A Novel Mobile Phone Based Privacy-aware Blood Donor Recruitment and Management System for Developing Regions

In this paper,[29] they proposed a framework that was developed with Rapid SMS which is an SMS-based open-source tool. There are several explanations for selecting this technology:

1. RapidSMS allows the collection and messaging of mobile data on a mass scale.

2. It is easy and efficient to collect both qualitative and quantitative data.

3. Multiple users around the world can simultaneously access the network using the web interface of RapidSMS (with appropriate login credentials) to view receiving information when it arrives.

4. RapidSMS is "open-source" software that can be downloaded, used, modified and operated freely even on low power or old computers.

The network part of this system consists of two device types:

1. Any mobile phone with the ability to communicate.

2. A server to run the database (usually a PC).

Blood donors register their blood groups and other data in a specific format for this system, through SMS. These are saved in the main database. Donors can also edit their profile and review information including location or availability changes.

When a blood search is received by the server, the request is made fast and a bulk SMS is transferred to the top 5 donor search results. Donors can approve the request by answering "YES" or reject it by saying "NO." If a donor agrees to the request, a short questionnaire is sent to the donor to check that the donor meets the blood donation requirements. If all is well, the donor will then contact the recipient. When a donor updates the date of the final donation via SMS his name is deactivated 89 days after a donation from the list of donors. Likewise, if the donor is not well, his profile may be edited and labeled as "Unavailable". In their system, Some of the major concerns about

blood donation have been identified through careful surveys and discussion with blood donors, recipients, and voluntary blood donation organizations. They are the following:

1. Where to go, to whom to call: most people don't know where to go in emergencies such as accident or injury, to whom to contact to get the right blood group.

2. Lack of motivation of the donor: donors are usually not self-motivated because they are not conscious of blood urgency. When donors are aware of the recipient's emergency or critical condition, they may understand the scenario and are encouraged to willingly donate blood.

3. Many inappropriate human characteristics, like superstitions that people of the same culture donate or receive blood.

4. Security issues such as donor information privacy is a major challenge in the management system for blood donors.

One of the main features of their system is to ensure a user-friendly and responsiveness system. A blood receiver may check the location and type of emergency for a specific blood group. The system compares the blood type of registered donors and sends it to the top five matched donor those are near the recipient. If no response (YES / NO) is received by donors in 5 minutes, a new search for blood banks near the recipient will be initiated, and an SMS will be sent to the client with the information. It ensures 24/7 service and anyone can make a blood request anytime and anywhere with just a mobile phone. One can access hundreds of blood donor organizations, centers, and hospitals statewide with only one SMS. One can update his location or status as 'Available' or 'Unavailable'. They plan to provide donors to regular health tips, free medical advice and alerts, and a timely reminder of the blood donation via their program. This system has highlighted the importance of confirming, notifying and counseling post-donation as it is an important aspect of blood safety.

3.1.3 Android Blood Donor Life Saving Application in Cloud Computing

T.Hilda Jenipha and R.Backiyalakshmi [6], made a cloud based blood donation app and we get to know about this from their paper "Android Blood Donor Life Saving Application in Cloud Computing". They designed a model, wherein the case of emergency and urgent requirement of blood one can find a blood donor and contract him/her through Call or SMS. This application provides contract details of donors available in the requester's local area. They have designed a cloud-based model, where information of donors is stored in the cloud. The information about donor location also gets stored in the cloud. A user of this application can receive donor information and location when they require a blood donor very easily. Since almost everyone carries a smartphone, immediate access to donor information through this application can be very helpful in the time of emergency. There is a major flaw in their model which is, they did not provide any mechanism for continuous and automatic updates of the donor location.

3.2 Comparing Our Proposed System with Existing Technologies

In our application, we used real-time database of Google's firesebase and a user can log in to the system using a valid and verified email and Gmail. Users will input their details (Blood group, age, name, medical profile, phone number, email id) and these values will be stored in the database under a unique id for every user. Their location will be automatically taken and updated in the database when the registration is being done. We used Google maps and place API to get the location from the user. Users' locations will be automatically taken to the system using the built-in GPS of users' smartphones. The location will be updated in real-time whenever the app is running in the background if the user moves to a different location. To get the address of places or users' location

we have used Geo fire.

Our system is different than others because no other online blood donor searching model has been implemented using the concept of crowdsourcing. We have implemented a system where a user can place a blood request referencing a blood group and a static location point. Our system will create a default 5Km radius zone from that static location point and available donors of the same blood group will automatically receive a notification of that request. Any donor entering the zone will also receive the notification. Users can also search nearby available donors of any blood group and then send a request to the contract. Our proposed system utilizes the concepts of crowdsourcing and location-based model more efficiently.

Chapter 4

Proposed Framework

4.1 Problem Formulation

Every year thousands of people die for the lack of blood. In Bangladesh, 600,000 units of blood can be collected, where there is a need for 800,000 units of blood. There are 319 blood donation centers in the country providing blood transfusion services covering both the public and private sectors. But blood donation centers are not enough efficient in number to collect a sufficient amount of blood. In worldwide, the efficiency of collecting blood in percentage remains the same. The availability of blood in blood banks is a critical and important aspect of a healthcare system. Blood banks are totally dependent of healthy blood donors. Beside blood banks can not preserve blood for more than 42 days. After 42 days preserved blood gets contaminated and patients health will get to a worst condition if transfused in patients body. The ability to identify regular blood donors will enable blood banks and voluntary organizations to plan systematically for organizing blood donation camps in an effective manner[30] . Many researchers and developers think about this noble act and come to a solution. To cover up the inefficiency number of application developers have worked to develop blood donation applications. To develop these kinds of applications a few of them work with a machine learning algorithm, some of them work with cloud, some of them develop distance algorithms and some of them design their application based on different features.

4.2 System Model

In this paper, we propose a system through which a user can request a blood donor also searches for donors of any blood group in his nearby location. Here, we proposed an android system blood donation service using the idea of Crowdsourcing. In the emergency situation, this system will help the user to find a blood donor which will save their time and relief them from the tension of finding blood donors. items and some of them design their applications based on different features.

In this system, a user USER is a tuple of uid, status, USERS , where uid is the unique user ID, status is a boolean type attribute, that can only contain the value of Interested or Not Interested and USERS is the finite set of the user. All the users having the status attribute as "Interested" are considered as Donors. However, the status of the users is not important to search for donors or request for blood. Thus if any user wants to search a donor or request for a blood donor will be considered as a requester. Figure 4.1 illustrates our system precisely. Our system will work with two processes side by side. The search donor option will let him find available donor near his location where place a request for blood will let him place a blood request referencing the location of the hospital and date where and when he needs the blood. All the available donors also the donors, who will come to that location will receive notification of that request.

In emergence, requesters will able to search for donors in his nearby location. Our proposed algorithm, search for all the donors with the same blood group within an area. For every searching, this area is calculated as a circle by taking a 5km radius. For the search donor option, the system finds out five donors of the requested blood group within this area. Whenever donors accept the request donor and requester can contact each other. This process is part of the search donor domain. Figure 4.1 we can see a requester is searching for donors and he receives a list of the available donors in his nearby location.

For the request blood option, the requester will be able to place a request referencing

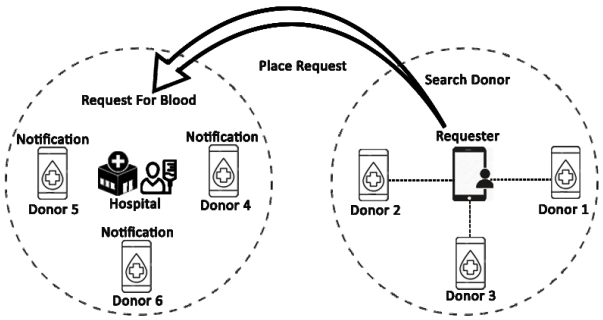

Figure 4.1: Blood Donation Service Framework

a static location point-like location of a hospital or blood camp. In this system a request for blood REQUEST is a tuple of rid, requestBloodGroup, requesterID, donorID, REQUESTS , where rid is the unique id for each request, requesterID contains the uid of the user requested for blood, donorID is the uid of the user accepted the request, requestBloodGroup is the type of blood requester need and REQUESTS is the finite set of requests. If any user of the requested blood group with available status enters within the area, they will receive notification of that request. Then donors can check notification and contact with the requester. This process is part of the request for the blood domain. Figure 4.1 we can see a requester place a request referring to the location of a hospital, all the available donors within 5Km range of that hospital will receive notification of that request.

4.3 Proposed Model

To use our system, a user must go through with some consequence steps. As blood donation is a sensitive job, a donor must need to be authentic. For using the first time, a

user must need to authorized himself or herself through a registration process. In our registration process, a user must provide their authorized email address and contact no. For the registration process, the users have to fill up a registration form by providing his or her information such as full name, email, password, mobile number, blood group, status, etc and the system will asking for allowing to trace users' location. In our registration process, a user must provide their authorized email address and contact no. After providing an email address, our system automatically sends a verification code to the users' mail to the user email automatically. When the user verifies the email then he will be able to log in to the system. The consumer has to provide the email and password for login. When an user log in to the system, the current location of the user gets automatically stored in the database. our system generates the current location of any user after every 10 seconds. As a result, our system can trace the live location of both blood requesters and donors.

In our proposed model any user can request for blood also donate blood, which indicates that any user can perform both the role of requester and donor. To request blood our proposed model work in two model systems. One is a blood requester can request blood to any specific location. Initially, we input 30 hospitals location, where a requester can create a blood request notification. The notification will provide in 5 km all the user who updates their profile with 'Interested' status and having the same blood group of request. And the second one is a blood requester can search donors from his or her current location. Similarly, the donor who updates their profile with 'Interested' status will get the request alert. Moreover, in both cases, the user with 'Not Interested' status will not get any notification or search alert from the system.

Moreover, according to our system model, a user can request blood and can donate blood also. Also, a blood requester can request for multiple grouped blood at a time. As a result, the time consuming and efficiency of finding multiple blood donors become decrease.

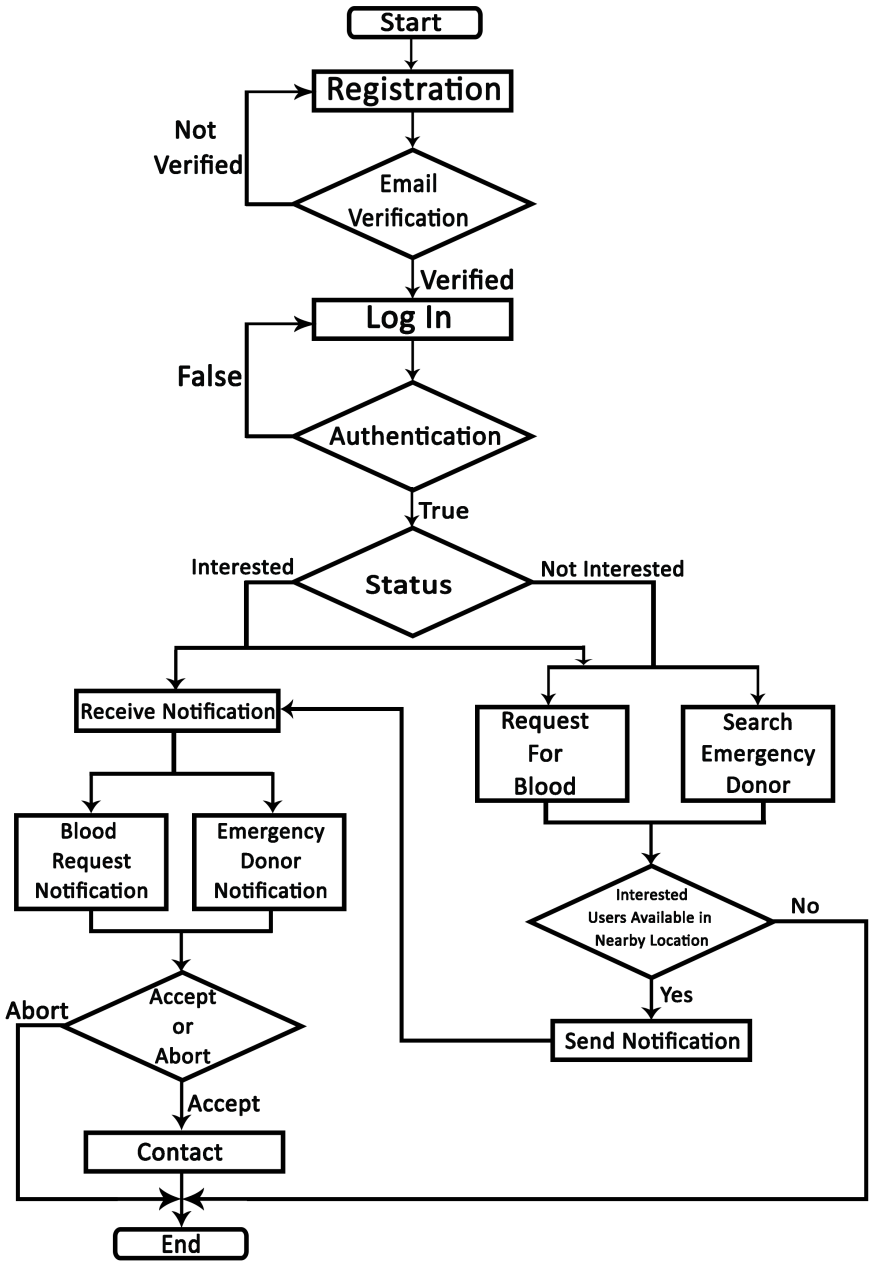

Figure 4.2: Work Flow Diagram

We can explain our model based on two sections. In the first section, we will discuss the model based on the requester's perspective. In the second section, we will discuss the model based on the donor's perspective.

4.3.1 Requester's Perspective

In our system, any user can place a request for blood. To place the blood request user need to provide the patient name, contact number, blood group, and hospital name. When the user selects the hospital, the system automatically stores the location of the hospital as the blood donation location point of the request. Any user willing to donate blood will receive this blood request notification if his or her current location is within the radius of 5km from the blood donation location point.

For the emergency need for blood, the user will be able to search for donors or users willing to donate blood. Users can search donors of any blood group but only get the donors whose current location is less than 5km away from the location of the requester.

Algorithm 1 Find Nearby Donor

Input: $RequesterID$, $ReqBloodType$, $RequesterLat$, $RequesterLon$, $USERS$

Output: $DonorID$

```
1 foreach Authenticated user ∈ USER do
2     if (ReqBloodType == user.BloodGroup) AND (user.Status ==" Interested") then
3         distance ←getDistance(ReqLat, ReqLon, user.Lat, user.Lon)
4         if (distance ≤ 5) then
5             DonorID ← user.ID,
6         end
7     end
8 end
9 return (DonorID)
```

In algorithm 1, For each authentic user the system will check whether the requester blood type is equal to user blood type and also check whether the user is interested or

not to donate blood . If both condition satisfied , then the getdistance function proposed in algorithm 2 will calculate the distance of the user location from requester's location. After calculating distance , it checks whether the distance is less than or equal to 5 or not . If the distance is between 5km radius from the requester location , then it will return the donorid otherwise it ends the process.

Algorithm 2 getDistance

Input: $ReqLat$, $ReqLon$, $userLat$, $userLon$

Output: $Distance$

$R \leftarrow 6371$

$Pi \leftarrow 3.1416$

$\Delta Lat \leftarrow (userLat - ReqLat)$

$\Delta Lon \leftarrow (userLon - ReqLon)$

$dLat \leftarrow \Delta Lat * (Pi/180)$

$dLon \leftarrow \Delta Lon * (Pi/180)$

$\mathrm{a} \leftarrow (\sin(dLat/2))^2((\cos(ReqLat) * \cos(userLat)) * (\sin(dLon/2))^2)$

$\mathrm{c} \leftarrow 2 * \arctan(\sqrt{a}, \sqrt{1-a})$

$Distance \leftarrow R * c$

return $(Distance)$

The requester will not get a contact number or email unless or until the requested donor accepts the request. When donor accept the request both requester and donor will be able to contact each other.

4.3.2 Donor's Perspective

In our proposed model any valid user with Interested status is considered as a donor. A donor will receive all the blood requests and emergency Donor requests which matches his blood group. A donor will only receive notification of a blood request if the blood donation location point is near to the current location of the donor. After donating blood, the status of the donor will be automatically updated to NotInterested for three

months. Moreover, within these three months, this donor can search donor or request for blood as usual.

Chapter 5

Experiment & Result Analysis

5.1 Experiment Setup

For the experimental purpose, we implemented our proposed algorithm in Python language. To check the performance of this algorithm, we took a data set of 300 data and then, we ran our algorithm on a computer having a core i5 3.4GHz processor with 8GB RAM. We collected 300 valid latitudes and longitudes, these latitudes and longitudes represent the current location of each User willing to donate blood and having the same Blood Group. Using this data set, we analyzed the performance and complexity of our proposed algorithm.

After analyzing the behavior of the algorithm we implemented this algorithm on our application and then implemented the whole application on a smartphone having a 4 core 1.3GHz processor with 2GB RAM. Then we analyzed the behavior of the whole application.

5.2 Prototype Implementation an Experiment

We implemented our proposed system in java Android environment. Here to use this system, users must register to the application using a valid email id only then the user can log in to the system and use this application.

The user must input Email id, password, full name, phone number, gender, blood group and his interest in donating blood for registration. After registration system will

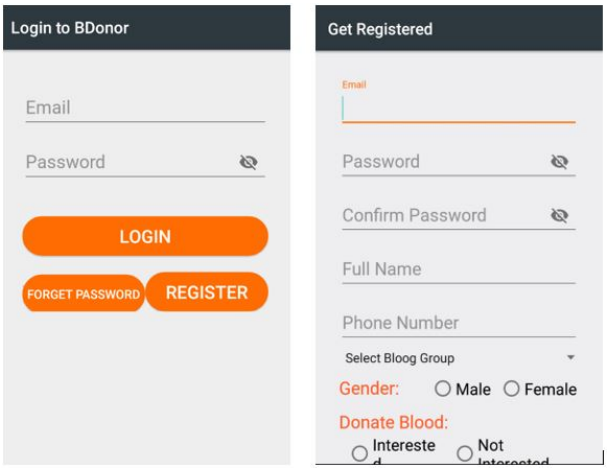

Figure 5.1: User Login and Registration

send a verification code to the email address provided by the user. After verifying the email, the address of the user will be able to log into the system.

When a user gets to log into the system he/she will get a page where he/she can see his/her current location in the google map. In this page users also gets the option to update his/her profile, can find the notification, option to move to the request page and the logout option. In this activity users, current location gets stored in the database.

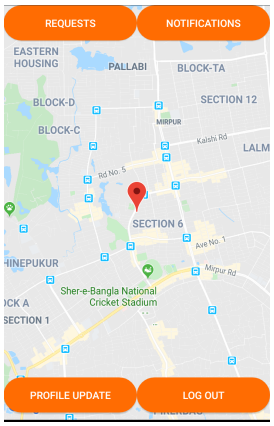

Figure 5.2: User's Current Location

Users cal also update their information by the profile update option.

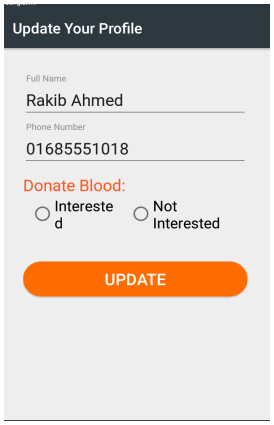

Figure 5.3: User's Current Location

A user can only change the name, phone number, and preference for donating blood. When for some reason if a user does not want to get notified for blood requests or donations, the user can change his blood donation preference to not interested. If a donor sets his blood donation preference to not interested, the system will not send any blood donation request or search donor notification to the user through the user still would be able to place a request for blood can also search nearby blood donors.

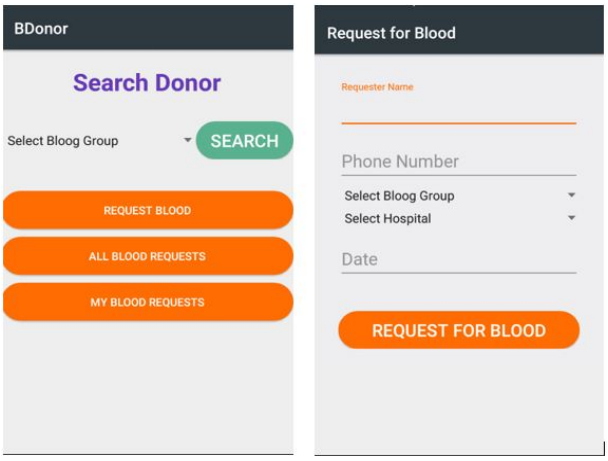

Figure 5.4: Search Donor and Place a Request for Blood

Users can search nearby donors of any blood group. Request blood option allows a user to place a request for blood. For placing a request user must input the patient name, phone number, blood group of the patient and select the hospital where the donor will donate blood and donation date. All the available donor of the required blood group and whose current location is in the nearby area of the selected hospital will receive notification of the request. As our system is a location-based system any new donor entering the area of the selected hospital will also receive a notification.

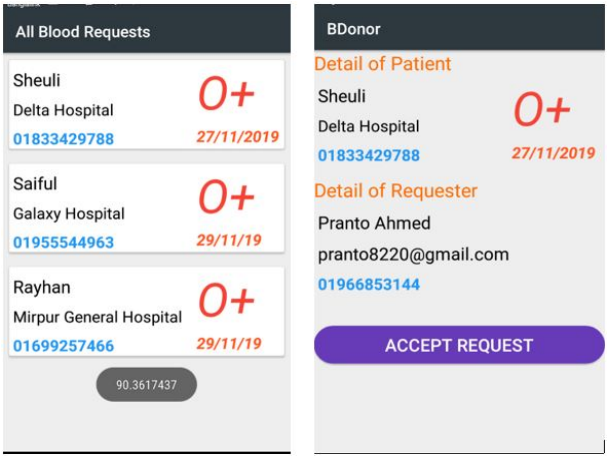

Figure 5.5: User getting notification

Any user with blood donation preference "Interested" (Donor) can see all the blood requests came from the different requester and different hospital. But all the hospitals are located in nearby locations of the user's current location. Selecting a notification will display detail of the patient and detail of the user who posted this request. If the user accepts the request the requester will get the contact information of the donor.

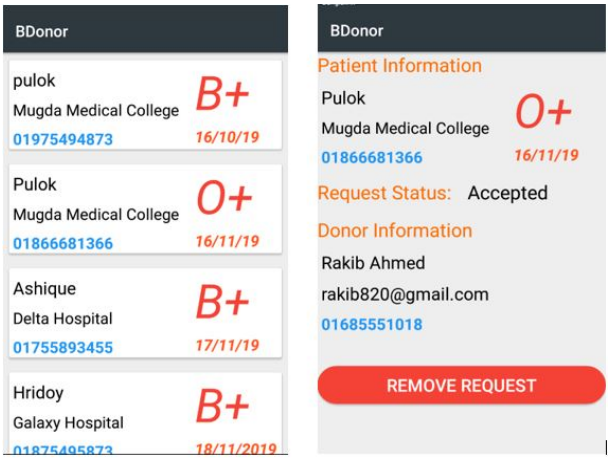

Figure 5.6: User's Requests Status

In an emergency, the user can post multiple requests. Users can check the status of all the requests posted by him. If any donor accepts any particular request of a requester, the request status changes to "Accepted" and contact information of the donor gets assigned. The requester will get contact information after any donor accepts his request.

When any donor accepts a particular request, the same request will be shown to any other donor. When the donation is complete requester can remove the request.

5.3 Result Analysis

Our data set consists of 300 Users' location. We need to measure the distance from the target location to the user's location and check whether the user's location is in the range of 5 kilometers from the target location. For measuring the performance and complexity, we made 6 test cases from our collected data set. The first test case contains 50 Users' location. The second, third, fourth, fifth and sixth test case contains 100, 150, 200, 250 and 300 Users' location respectively and so on. For each test case, we measured the time required to calculate the distance of all user's locations from the target location and check whether the user is in the range of target location. We ran each test case for 100 times and took the average CPU time required to execute the algorithm. Figure

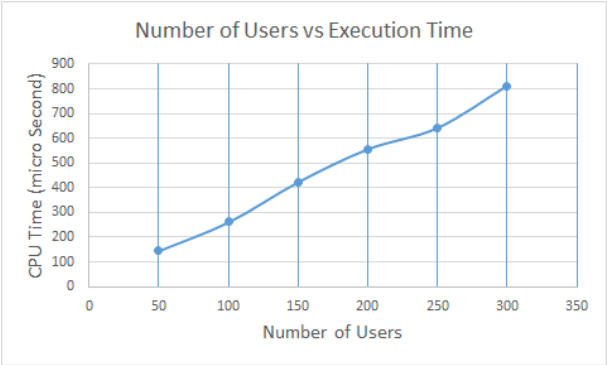

Figure 5.7: Performance Evaluation of Proposed Algorithm

5.7 represents the CPU time taken to execute each of the test cases for our proposed algorithm. We plotted the number of Users in each test in the horizontal axis and the CPU execution time of the algorithm in the vertical axis. The graph shows that the CPU time required for the first test case is 145 microsecond and for the second test case it is 261 microsecond. Figure 5.7 exhibits that the response time is linear with the number of users.

Table 5.1: Sample Output of Proposed Algorithm

Test Case	**Number of User**	**Number of Nearby Users**
Test Case 1	50	24
Test Case 2	100	34
Test Case 3	150	54
Test Case 4	200	60
Test Case 5	250	65
Test Case 6	300	79

Table 5.1 demonstrates the sample output of our proposed algorithm. For the first test case, we selected fifty pairs of valid latitude and longitude. Each pair of latitude and longitude represent an individual user's location point. Then our algorithm calculated the distance between each user's location from a specific target location and checked whether the distance is in the range of 0 to 5 kilometer. For test case 1, out of 50 users, 24 users were in the range. From the second, third, fourth, fifth and sixth test cases, we get 34, 54, 60, 65, 79 users respectively were in the range of 0 to 5 kilometer. To check the performance and behavior of our algorithm in the extreme situation, we used test cases with 200, 250 and 300 user's locations. We achieved a satisfying output and witnessed a linear relationship of CPU response time with the number of users in each test case.

All these test cases were tested to evaluate the performance of the algorithm in

extreme conditions. In real-life situations, our system will not find 79 donors, rather our system will stop searching whenever it will get five nearby available donors. The accuracy of the algorithm is very good as it has a linear relationship of CPU response time with the number of users. We did not consider the time spent in the Wide area network, time spent in the Application Server, Time spent in the Local area network and database time spent processing the user request the response time will vary.

5.3.1 Goal archived

1. User Authentication with firebase. Here email and Google login in enabled.
2. Users can input their details (Blood group, name, phone number, email) and their information gets updated in the database.
3. Automatic and real-time update of user location is achieved.
4. Users can search for a blood donor in his nearby location and then send a request for blood donation. If the donor accepts the request requester and donor can contract with each other.
5. The requester can make a blood request post referring to a hospital's location where the patient needs blood. To place a blood request donors don not need to be present at the hospital location. All the donors of the requested blood group available at the nearby location get the notification of the request. Any donor entering the location will also get the notification.
6. If one donor accepts the request, the same request will not be shown to any other donor's smartphone device.
7. All the user's location will be updated consistently in real-time to detect the user's correct location.

Chapter 6

Conclusion and Future Work

In this paper, blood donation is considered as a non- monetary act, where a donor can willingly donate blood. The major contribution is a distance calculation algorithm and few parallels generate features which help to find donors within 5km in a short time. Our distance calculation algorithm divided into two parts. One for finding the nearest donors within 5km and others for calculating the distance between donor and destination. The parallel feature helps the users to find out the donors in a short time. As blood donation is a profitless work, most of the people incurious to use blood donation applications, for the lacking and barrier of the applications. So we studied the barrier of other applications already exist. We develop our model with the idea of crowdsourcing and tried to make the easiest usage methods, that encourage the user to use this application. In every module where GPS work, our algorithm can be implemented. The proposed system makes this system easier for both donor and requester which will be implemented as a mobile application. In the future, we will develop our algorithm more congenial with more features

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Appendix A

List of Acronyms

GPS	Global Positioning System
QR code	Quick Response code
GPRS	General Packet Radio Service
API	Application Programming Interface
SDK	Software Development Kite
ISO	International Organization for Standardization
GIF	Graphic Interchange Format
JPG	Joint Photographic Experts Group
PNG	Portable Network Graphics
JSON	JavaScript Object Notation
XML	Extensible Markup Language
URL	Uniform Resource Locator
ICTS	Information Communication Technology Services
MCS	Mobile Connectivity Server
SMS	Short Message Service
AWS	Amazon Web Service
HTTP	Hyper Text Transfer Protocol
IMEI	International Mobile Equipment Identity
PHP	Hypertext Preprocessor
UTC	coordinated universal time

Appendix B

List of Publications

International Conference Papers

1. Submitted in Fifth International Conference on Research in Computational Intelligence and Communication Networks (ICRCICN - 2020) Kolkata, India, IEEE.