Development of an Online Blood Management System

Subrata Talapatra
Assistant Professor, Department of Industrial Engineering and Management
Khulna University of Engineering & Technology
Khulna-9203, Bangladesh
subrata@iem.kuet.ac.bd

Raihanul Kabir
Department of Industrial Engineering and Management
Khulna University of Engineering & Technology
Khulna-9203, Bangladesh
rafs719@gmail.com

Akash Shingha Bappy
Department of Electronics and Communication Engineering
Khulna University of Engineering & Technology
Khulna-9203, Bangladesh
akashshingha850@gmail.com

Abstract

The main aim of this study is to offers such a cross platform web interface which will let anybody to access the detail contact of potential blood donors around the required location. An algorithm has been developed to identify the potential blood donors. A website has also been created using this algorithm in the backend using HTML5, PHP and JAVA programming languages. XAMMP software was used in hosting local server. Several automated blood management system are available like the Facebook blood donation, but none of them offer any efficient algorithm considering the variables like frequency of blood donation, last date of donation, gender and age factor. To find the eligible donors we have considered all factors simultaneously, which makes the study unique. Practically this search engine will be helpful for the automated blood donation organizations and other blood bank for identifying the potential blood donors from their large database.

Keywords
Healthcare, Database management, Recruitment algorithm, Location based blood donor, Web Interface.

1. Introduction
Blood is a necessary element in human body. Without blood human body is incomplete. According to the scientist about 7 to 8 percent of human weight is comprised of blood (Sissons, 2018). In conventional way blood is donated via blood donation organizations or blood bank. Blood bank is observed as an area wherever blood is gathered as a results of the activity of blood donation by donors that is stored and preserved (maximum twenty eight days) for later transfusion. Most of the blood banks in Bangladesh don't support online blood donors database. In countries like Bangladesh blood a huge amount of units of blood is donated on average every year. According to statistical study in the year 2011 about five-lakh unit of blood was recorded as donated in Bangladesh the value of which increased to seven lakh in following five years (Molla, 2017). It is a clear sign that blood donors are on the rise along with the increase of population. Due to this huge amount of data of donors an automated and efficient way of data management is to be introduced for which online platform of blood donation can become a pavestone. Besides blood management problem occurs due to traditional techniques of data entry by manual operators where there is a risk of data to be outdated and data retrieval process is also hampered due to it. Owing to solve all the issues the study is done on an automated blood bank. Besides in present traditional ways the factors like gender, age, last date of blood donation, frequency of blood donation per year are not recorded which is given vital importance in this

study and used as recruitment factors in blood donation. So the prime objective of the study is to find a more efficient way in blood donor database management and to create a medium for people to get connected with potential blood donors around the locality. The blood donors are recruited using a recruitment algorithm which is also an aim of the study.

2. Literature Review

There are some researches on automation of blood donor database. Because for efficient blood donor recruitment different factors are to be considered and different researchers used different factors in the recruitment process. Al-Rashdi et al. (2018) assessed some factors that influence the levels of recruitment for blood donations in Saudi Arabia. Fincket al. (2016) did a study on the factors of motivation and deterrents of blood donation among high school blood donors. Ferguson (2015) used MOA approach in the case of recruitment of blood donor. Alfouzan (2014) did a research to measure the level of knowledge on blood donation, to identify positive and negative attitudes, find the obstacles, and suggest some motivational factors. Bani et al. (2014) accessed the reasons of gender gap sampling donors who stopped donation at least two years before the study and also analyzed frequency of donation. Arif et al. (2012) used last date of blood donation, BMI and last date of contact between donor and receivers in an asterisk technology based automated blood donation system as recruitment factors in their work. The outcomes of the researches are shown below in table 1. Though a good number of studies have been done in last couple of years but some limitations in the studies are observed. In recruitment of blood donors gender factor which is males can donate blood with a delay of 3 months but females can donate with 4 months delay, is not considered. Besides some frequency preferences of donors in each year has never been taken into concern in any of the past studies.

Table 1: Reference Details

Sl. No.	Authors (Year)	Details of Work	Factors considered for Study	Outcomes
1	Al-Rashdi et al. (2018)	Assessing the factors of blood donors which influence the recruitment for blood donation in Saudi Arabia.	Motivation in the donation of blood.	Few people intend to give voluntary blood transfer and most of the past donors had to donate in unavoidable situations.
2	Finck et al. (2016)	Factors of motivation and deterrents of blood donation within high school blood donors.	Motivating factors like pro-social, empathetic, altruistic thoughts and beliefs. Deterrents were phlebotomy. Incentives were chosen as movie tickets and snacks.	Motivating factors like empathetic and altruistic thoughts were higher rated and phlebotomy was potential deterrent.
3	Ferguson (2015)	Mechanism of altruism approach is used to recruit blood donors.	Mechanism of altruism	MOA suggested financial incentives in forms of gifts and movie tickets are efficient in blood donation.
4	Alfouzan, N. (2014)	Measure the level of knowledge on blood donation, to identify positive and negative attitudes, find the obstacles, and suggest some motivational factors	It is a statistical study to find the positive and negative attitudes for blood donation.	Majority of educated population of about 31 to 50 years age are more likely to donate and thus suggested some education program arrangement to increase awareness of the range of people.
5	Bani et al. (2014)	Accessed the reasons of gender gap sampling donors who stopped donation at least two years before the study and	Gender and frequency of blood donation.	Time is identified as a key factors in decision to stop blood donation. Despite motivational aspects the differences in donor

Sl. No.	Authors (Year)	Details of Work	Factors considered for Study	Outcomes
		also analyzed frequency of donation		management was observed.
6	Arif et al. (2012)	Use of asterisk technology in automation of blood donor database	Last date of blood donation of individual, BMI and last date of contact between donor and receivers.	Automated Database of blood donors and asterisk based blood donor recruitment platform.

3. Factors to be considered to be blood donor
These are some of the factors which are considered worldwide or in most of the countries of the world as parameters for recruitment of blood donor

3.1 Age Limit
Age limit is a vital factor in blood donation. The safe age limit is 18 to 65. RBC is produced from bone marrow of long bones like femur and humerus. Below 18 the stage is of bone marrow maturation and besides body itself needs hemoglobin in puberty stage. For this reason below 18 is not safe for donation of blood. On the contrary, 65 years aged people go through osteoporosis for which results in bone marrow destruction and reduction of RBC. For this reason above 65 is marked as unsafe for blood donation.

3.2 Hemoglobin Count
Hemoglobin counts minimum of 125 g/L for females and 130 g/L for males (Canadian Blood Services, 2018). Below this limit anybody will suffer from deficiency of blood if donated.

3.3 Blood Pressure
For blood donation blood pressure must be 90 to 180 for systolic and 50 to 100 for diastolic (The American National Red Cross, 2018). The reason is if the blood pressure is below normal then blood will not come out by syringe whereas if the blood pressure is above normal then the flow of blood pressure cannot be controlled.

3.4 Diseases
If the donor is affected by any kind of disease there is a possibility of transmission of the disease to other host bodies. In case of fatal diseases like AIDS it may dangerous. For this reason donor must be free from any kind of diseases (Arif, 2012). Besides patient of hepatitis B is not allowed to donate blood because it may even be the reason of death of blood receiver.

3.5 Drug Addiction
Drug addicts are prone to fatal diseases. For this reason drug addicts are not allowed to donate blood. Because, their blood may transmit diseases.

3.6 Last Date of Blood Donation
The duration of last blood donation must be 12 weeks for males and 16 weeks for females (Give Blood, 2018). The reason is RBC needs 4 months to regenerate. In case of females the duration is more due to menstruation.

4. Methodology
In order to seek for blood donor in the system the receiver needs to register him in the database by filling up the registration form in figure 1. After submitting the form the website verifies the information and redirects to login page. Then the user needs to login to his new account. In order to search blood the blood group and address is to be entered in the search engine. The backend algorithm of search engine then searches the database, sorts them and shows them in a table shown in table 2. The result is sorted on the basis of most eligibility according to the recruitment algorithm.
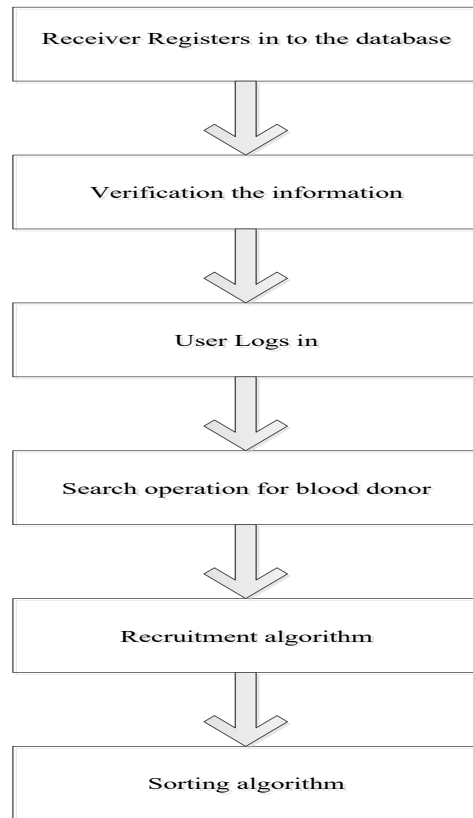
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┌─────────────────────────────────────────┐
│   Receiver Registers in to the database   │
└─────────────────────────────────────────┘
                    ↓
┌─────────────────────────────────────────┐
│        Verification the information        │
└─────────────────────────────────────────┘
                    ↓
┌─────────────────────────────────────────┐
│               User Logs in                 │
└─────────────────────────────────────────┘
                    ↓
┌─────────────────────────────────────────┐
│      Search operation for blood donor      │
└─────────────────────────────────────────┘
                    ↓
┌─────────────────────────────────────────┐
│           Recruitment algorithm            │
└─────────────────────────────────────────┘
                    ↓
┌─────────────────────────────────────────┐
│              Sorting algorithm             │
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Figure 1. Functional Block Diagram

5. Development of Algorithm
5.1 Receiver Registration in Database
If anyone wants to search a blood donor in this system he needs to enlist himself as a donor in the database at first. For this reason he needs to fill the registration form shown in figure 9. The algorithm for initializing the procedure is shown in Figure 2.
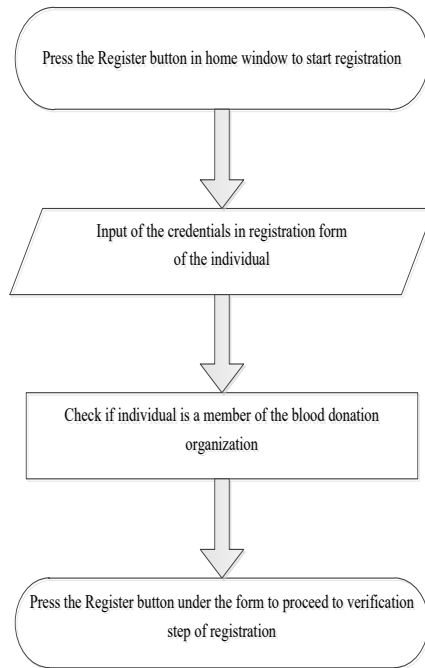
Figure 2: Algorithm Flow chart of Receiver registration in Database

5.2 Verification of Information

When the registration form is submitted the entered data needs to be verified. It is initiated by checking wheather the email previously listed in the database. After ensuring the individual is totally new in the system the email is checked for validity of member of orgamization this may be done manually or by using token system. The process of verification of email is shown in figure 3 as algorithm flowchart.
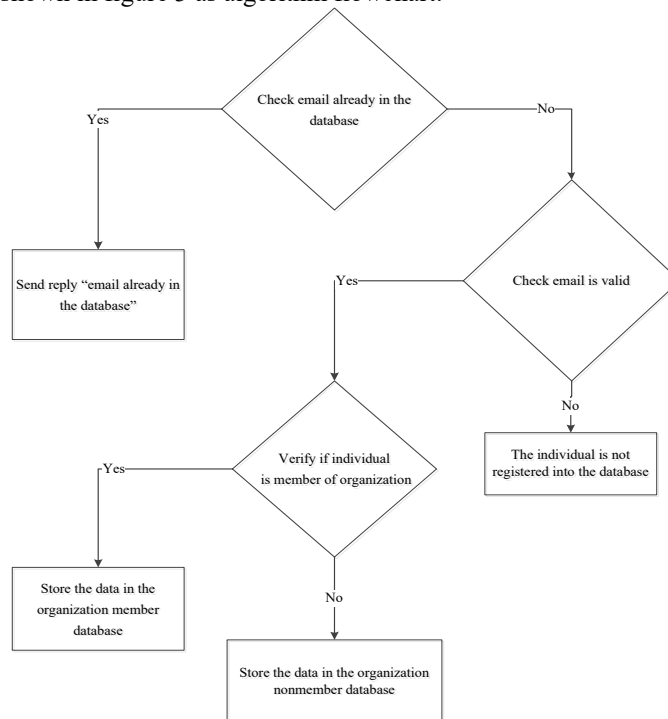
Figure 3: Algorithm Flow chart of Verification of information of receiver

5.2.1 User Log in

After the verifying all information of the user the data is finally saved in the database. Then the user is redirected to login interface shown in figure 8. In order to login as registered member the user needs to input email and password in required field. The process of verification algorithm is shown in figure 4.
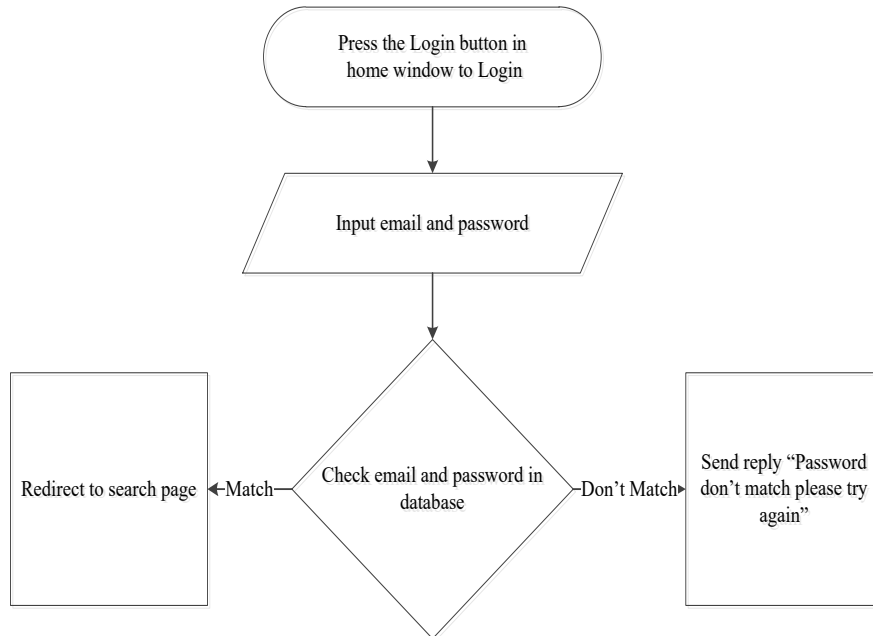
Figure 4: Algorithm Flow chart of Login of user

5.2.2 Search Operation for blood donor

To search blood donorthere are two fields. In field one the individual has to enter the blood group which he is looking for. In another field he has to enter the address of requirement of blood. The search interface is shown in figure 10. The process is shown in following figure 5.
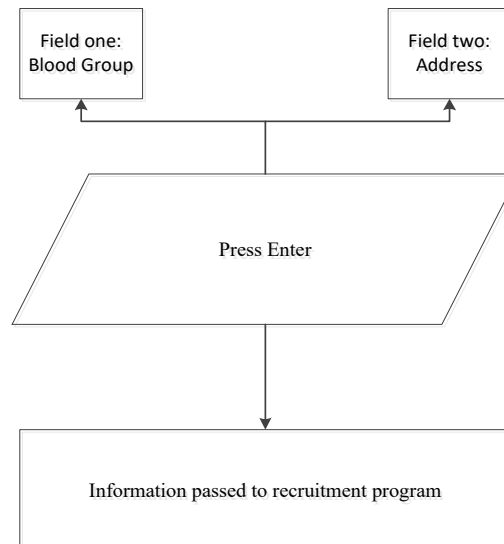
Figure 5: Algorithm Flow chart of Search operation for blood donor

5.3 Recruitment Algorithm

The recruitment algorithm is initiated after inputting the location and type of blood group needed. The parameters used in the algorithm are address, last Date of blood donation, blood group, age, frequency of donation of blood each year, gender. The parameters are so taken as to determine eligibility with high precision. Each of the entities (blood donors) is once checked though the recruitment procedure in the backend. At first the entities are recruited according to address and blood group parameter. Then the recruited list is checked for the age parameter. In this stage the entities having age outside the safe age of blood donation is dropped and the remaining entities go through the gender check. The remaining entities are then passed for sorting. The process algorithm is in figure 6.
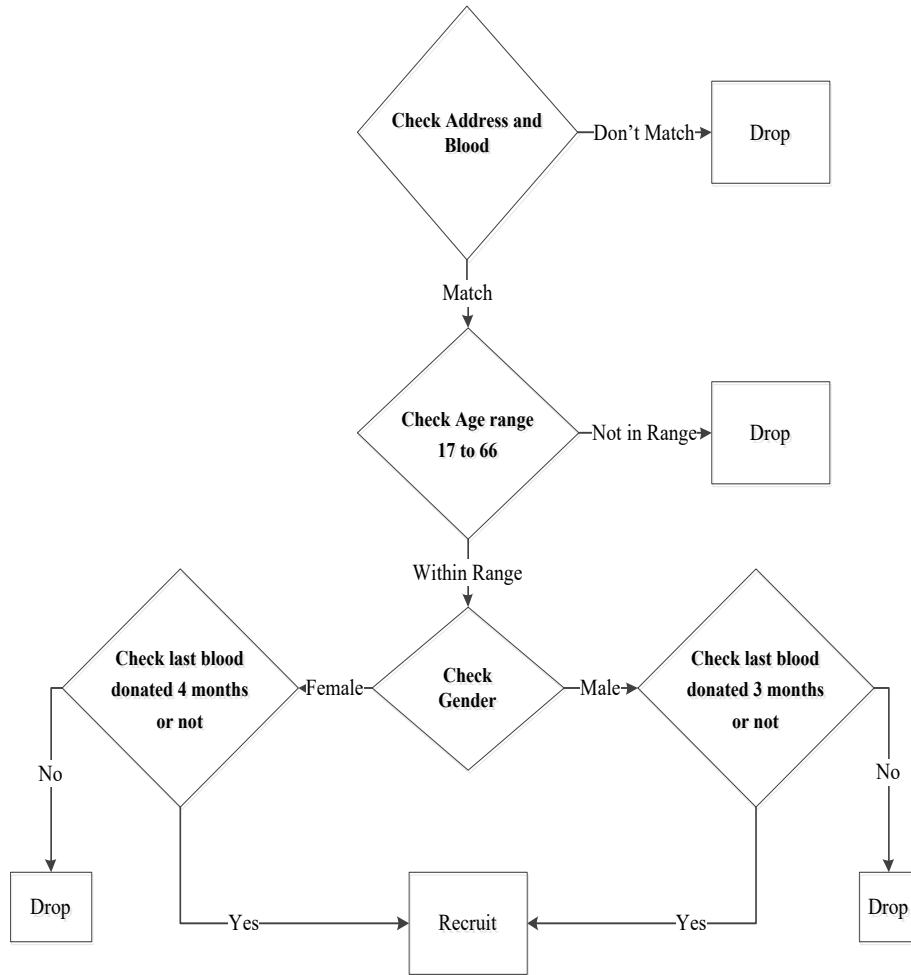
Figure 6. Algorithm Flow Chart of Recruitment Program

5.3 Sorting Algorithm

The potential donors are recruited but they are not sorted according to most potentiality of blood donation. At first the results are sorted according to increasing order of age and stored in temporary memory. Then the sorted results are again sorted according to nested sorting on the basis of last date of blood donation. In this case the order is decreasing. By this step the donors who donated with maximum duration of previous donation are sorted at first in the list. Again nested sorting is done by frequency of blood donation as for example males can maximum donate 4 times a year but some donors may prefer twice a year. According to this preference most frequent donors are sorted in the above of the list. After all these nested sorting the final result is displayed in a table. The algorithm flow chart is in figure 7. The result table of an example search is in the table 2.
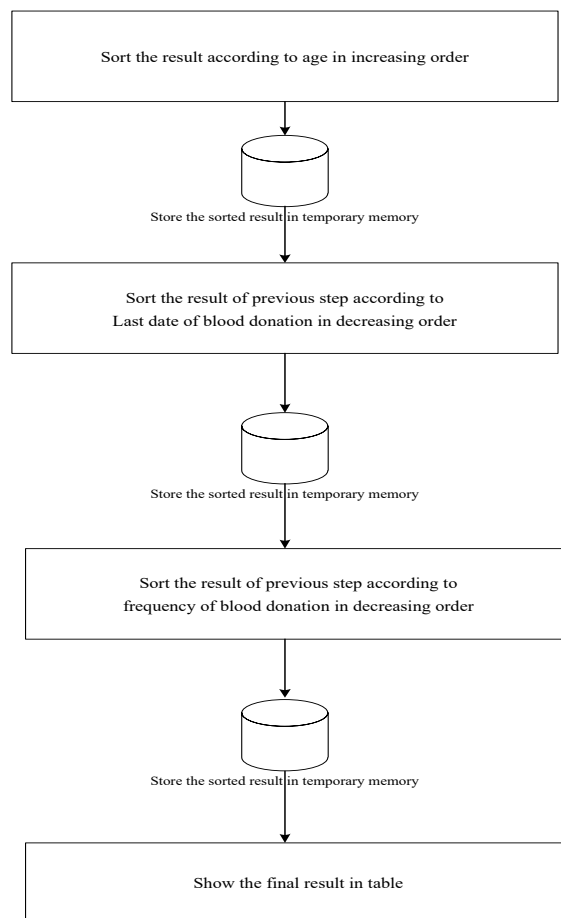
Figure 7: Algorithm Flow Chart of Sorting Program

Table 2: Result table of A+ blood in Khulna

Name	Batch	Sex	Contact	Address	District	Blood	Age	Last Donated
Zakir	2k16	Male	01994518000	Fulbarigate	Khulna	A+	20	20/02/2017
Olid	2k16	Male	01521434523	Fulbarigate	Khulna	A+	22	19/02/2017
Mahmud	2k16	Male	01521401908	Fulbarigate	Khulna	A+	21	18/02/2017
Towhid	2k16	Male	01612331653	Fulbarigate	Khulna	A+	20	17/02/2017
Yeasin	2k16	Male	01521413414	Fulbarigate	Khulna	A+	20	16/02/2017
Raihanul	2k14	Male	01771236234	Fulbarigate	Khulna	A+	21	01/01/2017
Labib	2k16	Male	01768628045	Fulbarigate	Khulna	A+	21	26/02/2017
Mamun	2k16	Male	01536145707	Fulbarigate	Khulna	A+	20	25/02/2017
Shifat	2k16	Male	01910525325	Fulbarigate	Khulna	A+	20	24/02/2017
Somrat	2k16	Male	01781613349	Fulbarigate	Khulna	A+	22	23/02/2017
Emrose	2k16	Male	01754976017	Fulbarigate	Khulna	A+	21	22/02/2017
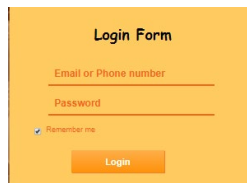
Figure 8. Login Interface
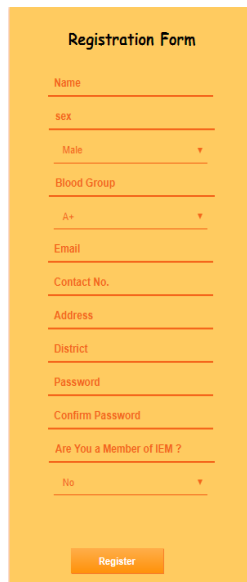
Figure 9. Registration Interface
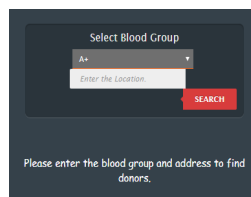
Figure 10. Blood Donor Search Interface

6. Conclusion

This study has developed an online platform which has made the blood receivers to connect with donors at the place of requirement. Due to use of gender of donors as recruitment parameters the male and female donors can maintain their respective duration of successive blood donation. Age parameter lets receivers get more potential donors within the range of blood donation criteria. Due to use of sorting program the more potential donors are listed in top rows of the result table which aids in selection of blood donors by receivers.

6.1 Practical Implementation

Practically this search engine will be helpful for the automated blood donation organizations and other blood bank for identifying the potential blood donors from their large database.

6.2 Limitation

Some of the information of the donors frequently change. For example address of the donor and last date of blood donation need always to be updated manually by the account holder. This two information are a major limitation of our study.

6.3 Future Research Scopes

The address of donors can be made updated automatically from the external device. GPS technology can be used in this purpose.

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Biographies

Subrata Talapatra is presently serving as an Assistant Professor in the department of Industrial Engineering and Management in Khulna University of Engineering & Technology. He obtained his B.Sc. in Mechanical Engineering from Rajshahi University of Engineering & Technology and M.Sc. in Industrial Engineering and Management from Khulna University of Engineering & Technology. His areas of research are Statistical Quality Control, Ergonomics, Operation Research, and 3d-Drawing. He is also a member of Institution of Engineers (Bangladesh) and IEOM. Email: sub_kay@yahoo.com.

Raihanul Kabir is a final year student of B.Sc. in Industrial Engineering and Management from Khulna University of Engineering & Technology**.** He is a member of the Student Chapter of the IEOM Society at Khulna University of Engineering & Technology. He was a former Publication Secretary of IEM Association of Khulna University of Engineering & Technology. He was also a former IT Secretary of IEM Debate Club of KUET. He is expert in excels coding, algorithm and designing activities. His areas of research interest are Management Information Systems, Database Management, and Automation.

Akash Shingha Bappy is a final year student of B.Sc. in Electronics and Communication Engineering from Khulna University of Engineering & Technology**.** His areas of research interest are Automation, Artificial Intelligence, Web designing, Management Information System.