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RED DROP: Optimisation of Blood Donor Using Genetic Algorithm

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***Abstract*—** The number of online blood banks are available but none of them offer direct contact between donor and recipient. algorithm. The optimization of donor is also on the basis of most nearest location of requested person i.e. recipient. Based on the constraint satisfaction and most nearest location of donor the fittest donor is found out. Contact information of fittest donor is made available to recipient at any time even in urgent need of blood.

***Keywords*—** Genetic Algorithm; Constraints, Fitness Function, Donor, Blood Bank, Crossover, Mutation, Genetic Operators.

I. INTRODUCTION

If someone needs blood, first of all he searches it within his family members, then nearest hospitals and blood banks. If they cannot manage blood in these ways, it is really hard for them to contact other people to collect blood in a short time. That is the problem we want to solve through our application. Our system in which electronic information This is the major drawback particularly in case where there is an urgent need of blood. Our project aims to overcome this communication barrier by providing contact information of fittest donor to the requested recipients. The data of the user can be collected through registration process and maintained on server. The best donor selected on the basis of genetic algorithm where all the constraints checked strictly. The donor with high constraint satisfaction will be optimized using optimization about the donors and organizations related to donating the blood is created. Through this application, any person interested in donating blood can register himself as donor. Moreover if any general consumer wants to make request to have blood online, he can also take the help of this system. As soon as any update occurs in the blood database, the changes are reflected in all the interfaces used. So, the system provides a simple and quick interaction among various groups connected with the blood banks. It is designed to overcome the drawbacks of existing system. The recipient can get blood on emergency. But the system we present here provides a lot of information about donors on different level and also reflects the current work status. User friendliness of the developed system is provided in the application with various controls. The system makes the blood management much easier and flexible. It provides high level of security with different level of authentication. The Red drop System we present here is aiming for human welfare. This paper is focused on the system which is a web application with supporting mobile application aimed to serve as a communication tool between patients recipient and blood donor. To become members of the system, donors need to create their profiles by providing fundamental information like name, blood group, email address, password, and exact location. Visitors can search blood donors from the home page by blood group and the place where blood is needed. The system will show the available donors along with their phone number, email address and mailing address through arranging them by nearest place. Blood donors can also be searched from the mobile application, but this is only accessible for registered members. The goal of this paper is to reduce the complexity of the system to find blood donors in an emergency situation. Blood is most critical element of human life and truly referred as a 'river' of life. There are number of scenarios where urgent need of blood comes.

At these critical times, the optimisation of blood donor using genetic algorithm will be of great aid. We here intend to achieve this through the use of genetic algorithm which searches the fittest donor by analysing registered information. This kind of a system is more advantageous compared to traditional blood bank management systems as immediate contact information of donor is provided instantly every time. An immediate response and fulfillment of the blood donor requirement made possible through this system which saves number of human lives, as every two seconds someone needs a blood due to accidents, heart surgery, and Organ transplants, women with complications dung childbirth, new-borns and premature babies, cancer and other diseases.

Donor must satisfied the constraints mentioned below.
Donor should be:

A person who is between 18-60 years of age.
A person must be healthy and fit.
A person whose weight should not less than 45 kgs.
A person whose body temperature normal at time of donation.
A person should not suffering from transmittable disease.
A person who has not taken any medicine in last 48 hrs.
A person with Hb count is above 12.5g/dl.
A person not addicted to drugs.
A person should not consume alcohol in last 24 hrs.
A person not contacted jaundice in previous 3 months.
A person who has normal blood pressure at time of Donation.
Time period between successive donations should be more than 3 months.
In past 6 months should not undergone body Piercing or tattoo.
Past one month should not have immunization.
Women who is pregnant can't be donor.

II. LITERATURE SURVEY

[1] "A New Genetic Algorithm for Optimization "by Peirong Hu Xinyu Zhao Qing a pseudo-parallel chaotic genetic algorithm for optimization is presented. Three testing functions are used to verify the effectiveness of the proposed algorithm, simulation results show that PPCGA is superior to SGA in the aspects of avoiding premature and convergence, and superior to PPGA in the aspect of avoiding premature. The good performance of the proposed Algorithm indicates that pseudo-parallel chaotic genetic algorithm presented in this paper is a promising and feasible method.

[2] "A Genetic Algorithm of Test Paper Generation" by Song Yan, Yang Guoxing .the author has presented a genetic algorithm of test paper generation in this paper. Chromosome coding, fitness function, and genetic operator are the main contents we discussed. This algorithm has a good performance for a medium scale item bank. In practice, the values of some parameters such as weights of each factor in the fitness function, the cross probability Pc and the mutation probability Pm are very important. So we should take different parameter values in different item bank. The factors that influence the parameter values include the MoB1.4 scale of the item bank and the distribution of question type, difficult and knowledge point.

[3] "A Fast and Elitist Multiobjective Genetic Algorithm: NSGA-II "by Amrit Pratap, Sameer Agarwal, and T. Meyarivan In this paper, the author suggested a no dominated sorting-based Multiobjective EA (MOEA), called non dominated sorting genetic algorithm II (NSGA-II), which alleviates all the above three difficulties. Specifically, a fast non dominated sorting approach with (2) computational complexity is presented.

[4] "Optimizing the Assignment of Blood in a Blood Banking System: Some Initial Result "by Aderemi Adewumi, Nigel Budlender and Micheal Olusanya —This paper presents a mathematical model that facilitates good management and assignment of red blood cell units in order to minimize the quantity of imported units from outside the system. The model makes use of the Multiple Knapsack Algorithm, which is implemented using several optimization techniques, in order to determine the most optimal assignments

[5] "Solving Problems with a Mix of Hard and Soft Constraints Using Modified Infeasibility Driven Evolutionary Algorithm (IDEA-M)" by Hemant Kumar Singh, Md. Asafuddoula and Tapabrata Raying this paper, a modification to earlier reported Infeasibility Driven Evolutionary Algorithm (IDEA) is proposed to deal with optimization problems involving a mix of hard and soft constraints. The proposed algorithm (IDEA-M) aims to deliver a set of solutions which satisfy hard constraints, and achieve trade-offs with respect to the soft constraints.

[6] "Multidimensional data ranking using self-organizing Maps and genetic algorithms" Weber Martins"' Jos6 Carlos Meira e Silva'9374 Federal University of GoiBs. School of Electrical Engineering. PIRENEUS Research Group. This paper proposes a generic procedure for ranking, based on one-dimensional self-organizing maps (SOMs). Additionally, the similarity metric used by SOM is modified and automatically adjusted to the context by a genetic search. This process seeks for the best ranking that matches the desired probability distribution provided by the specialist expectation. Promising results were achieved on the ranking of data from blood banks inspection.

[7]"Solving NP hard Problems using Genetic Algorithm" Gaurang Panchal & Devyani Panchal U & P U Patel Department of Computer Engineering Chandubhai S. Patel Institute of Technology Changa, India Genetic Algorithm based learning has promisingly showed results to a vast variety of function and problems. Travelling Salesman Problem, Tabu Search, and Transportation Problem is such classical problems for computation. This paper represents how to find optimal solution using various method of genetic algorithm. Advantages and disadvantages of this algorithm are reported and discussed.

[8] "Blood Donation Management System M Akkas Ali Institute of Information Technology, Jahangirnagar University, Dhaka, Bangladesh Department of Computer Science and Engineering, Jahangirnagar University, Dhaka,

Bangladesh This paper is focused on Blood Donation Management System which is a web application with supporting mobile application aimed to serve as a communication tool between patients and blood donor. The goal of this paper is to reduce the complexity of the system to find blood donors in an emergency situation.

[9]"A Survey on Blood Bank Management System"Prof. Animesh Tayal,Harshad Department of Computer Science & Engineering S. B. Jain Institute of Technology, Management and Research, Nagpur In this website the author proposed a new and efficient way to overcome such scenarios with our project. These records contain the information like Donor Name, Blood Group, Email Address, etc. After that your contact details will appear in alphabetical order on the screen; The location-based app, operational on android platform, will help users easily find donors of matching blood groups in their location and access their mobile numbers for instant help.

[10] "Automated Online Blood Bank Database" by Muhammad, Arif Sreevas S, Nafseer K, Rahul R. In this paper, author suggested blood is a primary necessity of life. There are lots of scenarios where immediate availability of blood can save human lives. Our project makes one step in this direction. Online database aided with automatic call routing facility can is an apt choice for immediate fulfillment of blood requirements.

[11] "Blood Donor's safety using Data Mining" by Rohini Patil, Pooja Pawar, Madhu Poi, Tejashree Patil, Prof.Namrata Ghuse. In This Paper, The proposed system facilitates blood donor's safety against various reactions occurred during blood donation with the help of data mining techniques. The system categorizes the reaction into different clusters according to reaction type and symptoms. So far frequent donors pre-prevention technique against their reaction is applied in this system. The frequent blood donor will get suggestions from web based application which will improve safety. This application helps donors receive the notification on urgent blood donation call using email.

III. GENETIC ALGORITHM

A genetic algorithm is a search heuristic that is inspired by Charles Darwin's theory of natural evolution. This algorithm reflects the process of natural selection where the fittest individuals are selected for reproduction in order to produce offspring of the next generation. The process of natural selection starts with the selection of fittest individuals from a population. They produce offspring which inherit the characteristics of the parents and will be added to the next generation. If parents have better fitness, their offspring will be better than parents and have a better chance at surviving. This process keeps on iterating and at the end, a generation with the fittest individuals will be found.

Initialization

The process begins with a set of individuals which is called a Population. Each individual is a solution to the problem you want to solve. An individual is characterized by a set of parameters (variables) known as Genes. Genes are joined into a string to form a Chromosome (solution).In a genetic algorithm, the set of genes of an individual is represented using a string, in terms of an alphabet. Usually, binary values are used (string of 1s and 0s). We say that we encode the genes in a chromosome

[12] "Solving Problems with a Mix of Hard and Soft Constraints Using Modified Infeasibility Driven Evolutionary Algorithm (IDEA-M)" by Hemant Kumar Singh, Md. Asafuddoula and Tapabrata Raying this paper, a modification to earlier reported Infeasibility Driven Evolutionary Algorithm (IDEA) is proposed to deal with optimization problems involving a mix of hard and soft constraints. The proposed algorithm (IDEA-M) aims to deliver a set of solutions which satisfy hard constraints, and achieve trade-offs with respect to the soft constraints.

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[15] In "The Optimization of Blood Donor Information and Management System by Technopedia" by P. Priya and V. Saranya , they have proposed an efficient and reliable blood donor information and management system based on GIS integrated in android mobile application. The service provided by the proposed system is needed and valuable to health sector where a quality of the blood is considered for the safety of the patient through a systematic process by the blood management system.

Fitness Function
The fitness function determines how fit an individual is (the ability of an individual to compete with other individuals). It gives a fitness score to each individual. The probability that an individual will be selected for reproduction is based on its fitness score.

Selection
The idea of selection phase is to select the fittest individuals and let them pass their genes to the next generation. Two pairs of individuals (parents) are selected based on their fitness scores. Individuals with high fitness have more chance to be selected for reproduction

Crossover
Crossover is the most significant phase in a genetic algorithm. For each pair of parents to be mated, a crossover point is chosen at random from within the genes. Offspring are created by exchanging the genes of parents among themselves until the crossover point is reached. The new offspring are added to the population.

Mutation
In certain new offspring formed, some of their genes can be subjected to a mutation with a low random probability. This implies that some of the bits in the bit string can be flipped. Mutation occurs to maintain diversity within the population and prevent premature convergence.

Functionalities of fittest donor finding algorithm:
A key component of the system is algorithm used for determining a prospective donor in real time. The parameters taken into consideration are:
Blood Group
Last time of blood donation
Health parameters mentioned before closeness of location of requester.
Frequency of donation.
This algorithm consider three parameter for selection .The parameters with their priority given below:
Health parameters in section before location i.e. distance between donor and recipient.
Last donation date

Functioning of genetic algorithm:

1. Start
2. LOC=closest location from donor's list
3. Get list of donors in LOC=l1 (let list l1)
4. OLD_DONATION=oldest donation date from list l1
5. From list l1, get list of donors who donates old in OLD_DONATION (let list l2) 6. BMI=Maximum BMI from l2
7. From l2, select donor whose body mass index >=BMI. He/she is the fittest donor.
8. Check all hard constraints accordingly so on.
9. Stop

IV. WEB INTERFACE

Web interface helps recipients to view list of prospective donors and also allow new donor to register to the database and recipients to request for required blood donor using details such as name, blood group, doctor name, hospital name, address, contact information etc. Programming languages used for developing web interfaces are PHP, JavaScript, HTML, and CSS.XAMP and MYSQL for databases.

V. SYSTEM ARCHITECHTURE

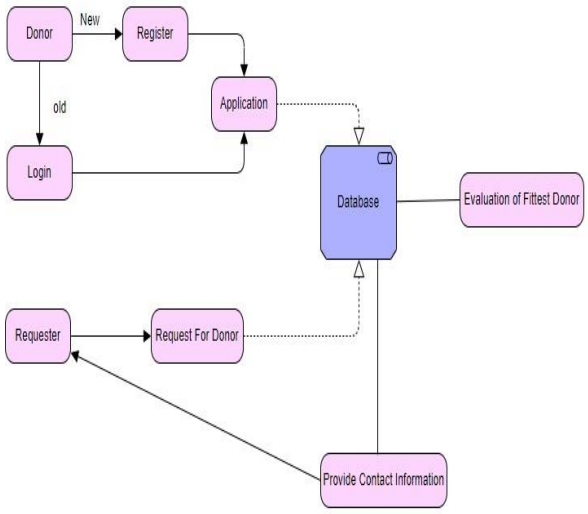


Fig 1.1: System Architecture

Initially there is a bulk of donor available who wants to donate blood .They can directly register as a donor. If user is new to the system then he will register by filling registration form otherwise login to system using login details. Now, recipients who wants blood will request for required blood by providing self-contact details, address and medical details. The data is stored in database on cloud .The list of suitable donors made available to recipients by evaluating each and every donor on the basis of constraints provided by them and location of donor nearest to requestor. The fittest and best donor selected using genetic algorithm due to evaluation of fitness function. The donor is fittest if fitness function is high. Finally, the contact information of fittest donor made available to recipients.

BLOCK DIAGRAM

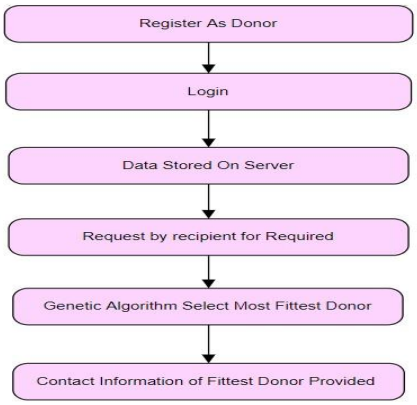


Fig 1.2: Block Diagram

Processing Steps are as follows:
Registration made by donor on server.
Interested donor can be login using login credentials.
Recipient made request for required donor by filling some details.
Now, genetic algorithm comes into play getting list of all eligible or fittest donors.
List of fittest donors can be viewed by recipient with contact information of required donor.
In case the fittest donor is not available, automatically it provides second fittest donor and so on based on requestor's nearest location otherwise provides universal donor's information.

DATAFLOW DIAGRAM

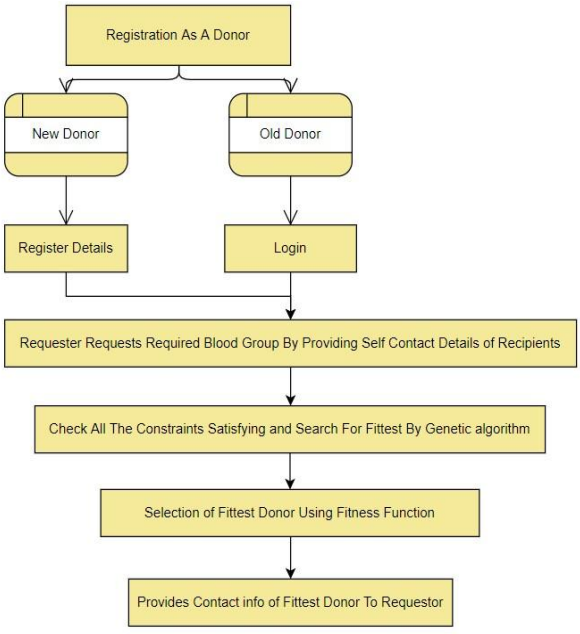


Fig 1.3: Dataflow Diagram

Initially there is a bulk of donor available who wants to donate blood .They can directly register as a donor. If user is new to the system then he will register by filling registration form otherwise login to system using login details. Now, recipients who wants blood will request for required blood by providing self-contact details, address and medical details. The data is stored in database on cloud .The list of suitable donors made available to recipients by evaluating each and every donor on the basis of constraints provided by them and location of donor nearest to requestor. The fittest and best donor selected using genetic algorithm due to evaluation of fitness function. The donor is fittest if fitness function is high. Finally, the contact information of fittest donor made available to recipients.

VI. KEY ISSUES

Tackling with fake donors:
Since a dynamic algorithm for choosing the most eligible donor is followed, which takes into account the willingness factor of each donor, fake donors will automatically be relegated to the bottom of the donor list.
Handling large user traffic:
To handle large user traffic parallel programming is employed. When a higher demand for blood is needed, by pressing a key on the phone, automatic redirection to the next most eligible donor is made possible. A limit of 5 donors is kept for each caller. For people with constant demand for blood, like people with blood cancer, a separate registry of their phone numbers is kept.
Follow-up communication with donors:
Once the initial communication between the donor and recipient is completed, a SMS containing the recipient's number is given to the donor for follow up communication.
Updating databases:
For every blood transfusion made, it is essential that the database is updated about this transfer. It is essential factor that should be considered for selecting the most eligible donor the next time, as a minimum of 56 days should be passed between successive whole blood donations. This updating is done based on the confirmation from both the donor and the blood bank/hospital where the donation was done.

VII. ADVANTAGES OVER OTHER SIMILAR SYSTEMS

Significant advantage is that location details of prospective donors is taken into account by the algorithm. This ensures that automatically nearest donor contacted and immediate fulfillment of blood requirement is done. In other systems, there is no such provision which again adds on to delay in getting donor.
Unfortunately blood banks still using traditional way i.e. they are maintaining data manually we overcome such time

wastage using genetic algorithm and storing data on cloud. It is handy as launched as an application in play store.

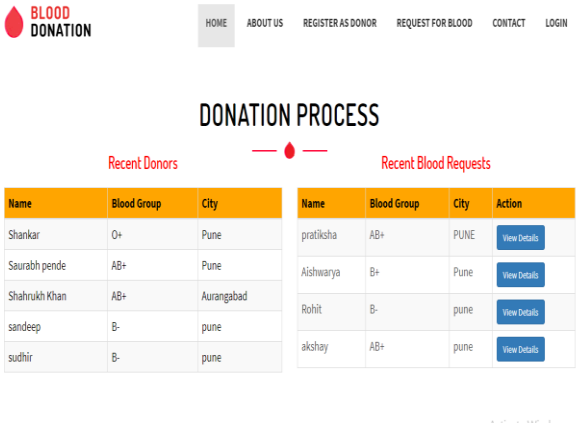
VIII. BENEFICIARIES OF OUR SYSTEM

Donors Recipient
Person who wants to donate blood they just have to register online instead of searching blood banks and visiting hospitals.
Person who need blood in emergencies can instantly search and contact to required donor only thing they have do is submit requestor's contact and blood details. Anyone can take advantage of system and can donate or receive blood anytime and anywhere in few minutes. No need to spend time in searching blood banks or hospitals.

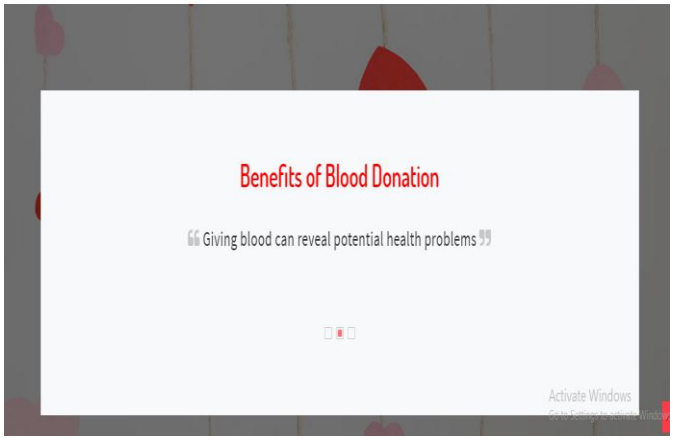
IX. RESULTS

Result of the project is provided with screenshots as below:
First screenshot shows the homepage of our project where we can register and login as a donor and can search for blood donor by providing address details.

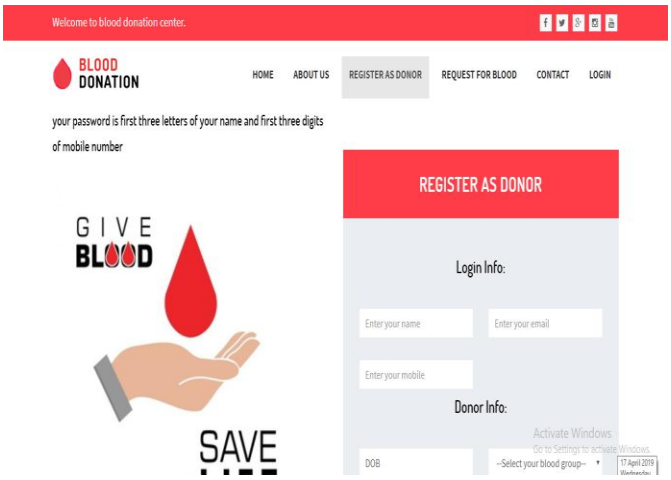
User can search for required blood according to pin code and city entered in search box so that he able to see list of available blood and donor's list whenever it is needed.



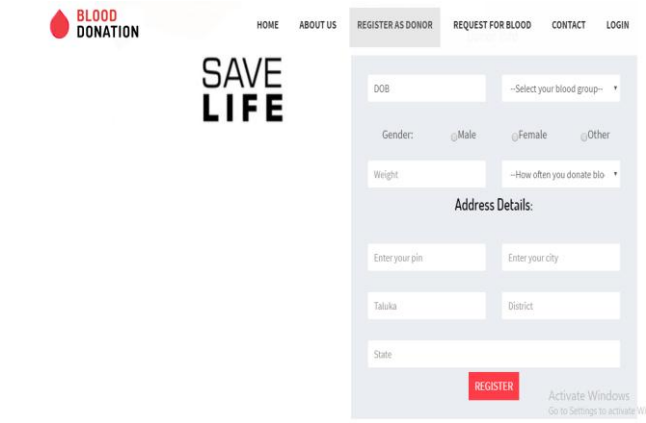
We are maintaining record of recent registered donors and blood requests so that donor is unable to donate blood immediately after previous donation just before 3 months. Eventually, Receiver will get appropriate donor as he can check recent donor's list.



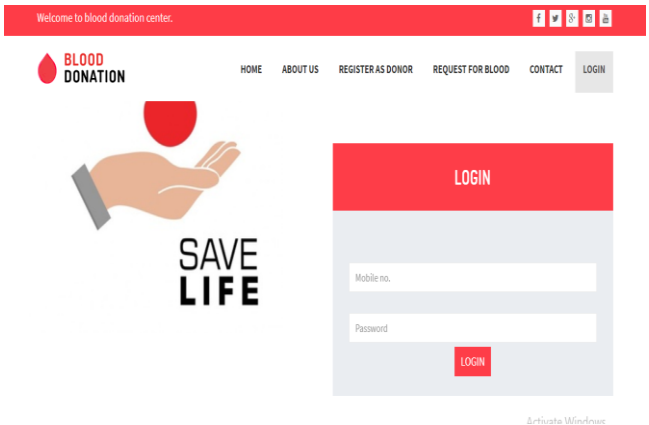
We are encouraging donors and receivers to participate in blood donation process by providing such user friendly interface.



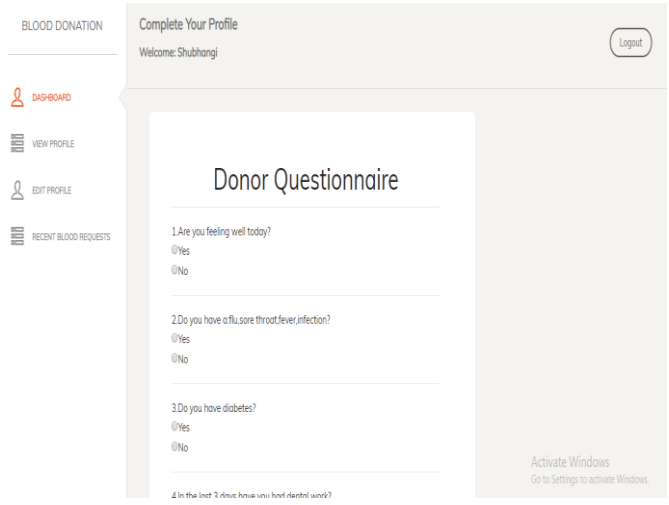
Donor can register to process just by providing some personal information and address details for the sake of optimization of the best donor from the list.



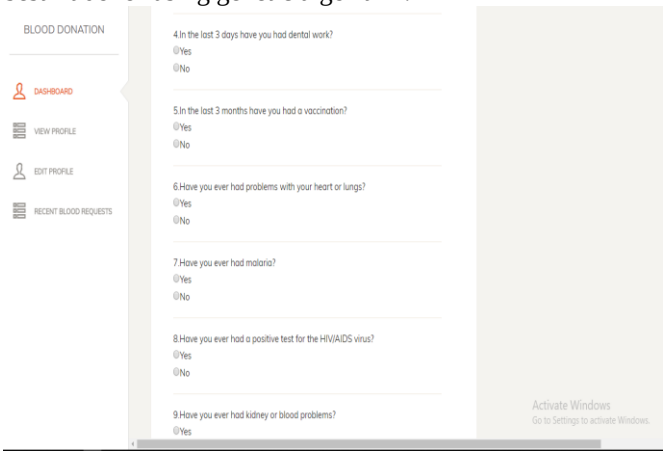
Once he registered name and blood group of donor will display on the homepage recent donor's list.

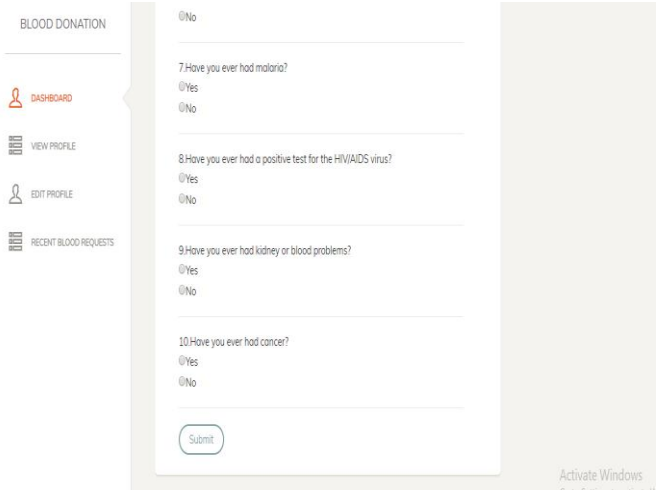


Already registered user can directly login by entering mobile number and password (password should be first three letters of your registered name and first three digits of mobile number).



Once login completed now user in on his own dashboard. Some Donor Questionnaire is provided in order to optimize best fit donor using genetic algorithm.





We are asking some questions to donor regarding their health and diseases so it's easy to rank donors on the basis of information they have provided. Now, donor can logout from the dashboard and return to homepage again.

X. CONCLUSION

We all know blood is primary necessity of life. There are lots of scenarios where immediate availability of blood can save human lives. Our project makes one step in this direction. This project concludes that we can get appropriate blood donor from anywhere. Fittest donors get searched for particular recipient.

XI. ACKNOWLEDGEMENT

We pay our thanks to **Mr. Sudhir Atkire** for providing a great support to us. He guided our project team efficiently.

We would like to express our gratitude to him for giving such great opportunity to work on Red-Drop project with his team .We are very thankful him for supporting and helping us in queries while working on project. We successfully accomplished our work only due to his guidance.

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