A Research Paper on Blood Donation Management System

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Abstract: Blood donation and transfusion has been an ever-serious issue and the shortage of blood throughout the world has caused many people to lose their life. The lack of a centralized system for blood donation is majorly responsible for those losses. Now in the era of online and digital processes, the conventional methods of collecting blood are absolute. An automated system is required to manage the centers and to showcase the information to the interested parties. We have developed a website that singlehandedly solves all these issues related to blood donation and reception. We have designed a SQLite database as an integral part of the integrated framework to store historical blood donation data in a centralized database for analytical processing. The proposed system would enable people to register as a donor to make themselves available whenever in need of their blood type. We have introduced a search tab to search available people ready to donate. In our proposed system in the donor registration, health-related details would be updated in the blood management system database for all to see.

Index Terms -**Blood Donation, transfusion, centralized system, conventional methods, automated system, analytical processing**

I. INTRODUCTION

Our country needs a very well-organized online healthcare system. An integrated technique for Blood Adoption is required for isolation of transmitted infections and also for safe and adequate blood transfusion services to the citizens. The main component of the strategy will be the collection of blood from voluntary blood donors, with screening for all transmitted infections and reduction of transfusion. The Blood Donation strategy in the country is highly complex and does not have many necessary resources like adequate infrastructure and finance. The main problem, which corrupts the blood banking system, is distributed management. The standards vary in every state, every city even in centers within the same city. Numerous large hospitals do not have their blood banks and this has led to a multiplication of private blood banks. There is a great need for trained health care professionals in this area of transfusion medicine.

For diligence, assurance, and viability of blood and blood tests, and blood products, centers with required apparatuses and well-prepared work force are a basic need. For the best clinical handling of blood, it is most important to train medical staff. To acquire the highest protection the requirements of good manufacturing practices and implementation of quality systems moving towards total quality management, have posed a challenge to the organization and management of blood transfusion service.

A human blood transfusion is a procedure of supplying a human body with adequate blood when needed as in cases of illness, accidents, diseases, surgery, etcetera. In the process, the blood obtained from the bodies of other voluntary healthy individuals is used to be supplied to the people who need it. The process generally takes around 60-180 minutes, varying on the amount of blood needed.

In most of the countries of the world, the demand for blood is much more than the supply they are able to get. For India in 2016, the Ministry of Health and Family Welfare reported a donation of 10.9 million units against the requirement of 12 million units [1]. Much of this shortfall is due to the lack of an active Voluntary, Non-Renumerated Blood Donation system in the country as well as an inefficient blood collection system. The lockdowns related to COVID-19 resulted in increasing blood shortages across the country. Various other reasons for such deficit were identified such as lack of social awareness, and public misconception related to blood donations.

It is very important for us to keep in mind that the shortage of blood in India is mighty and growing. Therefore, little moves won't do, what is needed and required is a holistic approach towards tackling the problem. The Central and State governments could continuously create social awareness about voluntary blood donations and apheresis donations and may organize giant scientific rallies and workshops letting people know about the benefits of blood donations. Similarly, more blood camps can be organized in places near to public localities so as to ensure high levels of public motivation as well as ease for donating blood. The Government can also work for coordination among different blood banks, hospitals, and NGOs that work in isolation. One blood bank has no update on the inventory of nearby blood banks.

WHO recommends that all exercises involving blood collection, testing, handling, storage, and dispersion be facilitated at the national level through compelling organizations and coordinated blood supply chains. The national blood framework ought to be administered by national blood policy, and administrative system to spread the uniform execution of benchmarks and consistency in the quality and security of blood and blood items.

WHO recommends the following integrated strategy for blood safety and availability for stakeholders, decision-makers, and partners:[2]

• Establishment of a national blood system with well-organized and coordinated blood transfusion services, effective evidence-based and ethical national blood policies, and legislation and regulation, that can provide sufficient and timely supplies of safe blood and blood products to meet the transfusion needs of all patients.[2]

• A collection of blood, plasma, and other blood components from low-risk, regular, voluntary unpaid donors through the strengthening of donation systems, and effective donor management, including care and counseling.[2]

• Quality-assured screening of all donated blood for transfusion-transmissible infections, including HIV, hepatitis B, hepatitis C and syphilis, confirmatory testing of the results of all donor screen-reactive for infection markers, blood grouping, and compatibility testing, and systems for processing blood into blood products (blood components for transfusion and plasma derived- medicinal products), as appropriate, to meet health care needs [2].

We have tried to focus our project on the above knowledge so as to develop an integrated website that solves most of the basic issues that are faced related to blood donation and reception. Our website focuses on all these statements to the highest levels that we could work on. We have concentrated our efforts on the timely supplies of blood, collection from regular unpaid voluntary donors, made efforts in finding out the quality of blood and also the medical conditions of the donor.

II. LITERATURE REVIEW

The current blood bank storage system is focused on files. This ensures that data and knowledge about blood, donors, and recipients are stored in documents and archives. Data and information processing becomes difficult and time-consuming as a result of this. All tests of blood donation and transfusion are recorded on physical papers as well. This makes information helpless to blunders and human errors which in turn puts human lives in peril. Another underlying problem with this framework is destitute productivity. The sheer time-consuming method of recovering blood, be it donor or recipient information takes a lot of effort. The information retrieval being such a time-consuming process makes it very hard for hospitals to save lives at crucial times. Information Security & Information backup is another additional point to consider as the papers and records are effortlessly stolen or misplaced. This makes it an untrustworthy framework.

The goal behind our project has been to provide a platform that has all the information regarding blood donation, registered donors, which may in turn help in providing fast blood delivery. We have put our efforts into researching all about blood management systems and practices and have used the knowledge in making our project the best of what it could be.

Every blood donation management system is required to accomplish some basic tasks. It has to have a mechanism for information exchange to be made available for donors, receptors, and other stakeholders. It must also ensure that the information regarding the blood inventory status of different stakeholders such as blood banks, hospitals are made available.

It was important for us to find the faults in the existing system so that we can find the solutions to the flaws and implement them in our project.

2.1 Existing system:

Researches have composed on the concept of blood bank administration frameworks with nearly all of them lauding computerization as an instrument to accomplish productivity and viability in this region though not looking at a few issues the framework may confront due to restrictions or abuse of functionalities. We looked at some of the systems we could discover.

"Benefits of Management information system in Blood Bank" by Vikas Kulshreshtha and Dr. Sharad Maheshwari [3] portrays the benefits of administration data framework in the blood banks. The paper is fundamentally centered on the blood bank administration data framework. It examines the recipients of the blood bank administration data framework. In "The Optimization of Blood Donor Information and Management System by Technopedia" by P. Priya and V. Saranya [4], they have proposed a proficient and solid blood donor data and management system based on GIS coordinates in an android portable application. The benefits given by the proposed system is necessary and profitable to the human being segment. "Blood Bank Management Information System in India" by Vikas Kulshreshtha and Dr. Sharad Maheshwari [5] presents the audit of fundamental highlights, merits, and demerits given by the existing web-based Data Framework for Blood Banks. This ponder depicts the comparison of the different existing framework

and give a few more thought for making strides in the existing framework. "Android Blood Bank" by Prof. Snigdha, Pratiksha Lokhande, Siddhi Kasar and Pranita More [6] depicts the android application which conveniently upgrades the data with respect to benefactors where the admin gets the complete data. The app gives a list of blood banks depending upon the user's location. "A Study on Blood Bank Management System" by A. Clemen Teena, K. Sankar, and S. Kannan [7] is an information administration framework. The framework will permit the authorized blood bank officer to log in employing a watchword and effectively manage the records of the blood benefactors and the patients in need of blood. In "MBB: A Life-Saving Application" by Narendra Gupta, Ramakant Gawande, and Nikhil Thengadi [8], they have proposed the framework that will connect all donors. The framework will offer assistance control, a blood transfusion benefit, and make a database to hold information on stocks of blood in each region as information on givers in each city. Moreover, individuals will be able to see which patients require blood supplies by means of the application. They will be able to enroll as donors and hence will get a request from their neighborhood clients who needs blood to give blood in cases of requirement. Pah Essah and Said Ab Rahman (2011) [9] proposed the development of a management information system to manage blood banks based on information of donor, recipient, and blood. E. M. S. S. Ekanayaka and C. Wimaladharma (2015) [10] developed a Blood Bank Management system to gather all the blood donors into one place automatically [11].

The existing system has almost everything when it comes to people donating blood at normal times. The users can view the information of the donors registered along with their name, address, contact information. The existing system shows blood donors in a vast spread area. Hospitals are contacting donors only when there is demand in need of blood. In spite of the obtainability of the potential blood donors but 10% of the general Indian population donates blood. Advancement in natural science has increased the blood demand and it's found that blood donors usually don't come to grasp the requirement for blood. These causes inspire us to grow a stronger system that will assist the present blood donation system

2.2 Limitations of Previous Systems:

In the previous systems searching for donors in a given area was a constraint. Availability of blood in major cities was not a huge problem as it is was agricultural and village areas. Data connection isn't economically viable to poor citizens. It is not always easy for hospitals and patients to contact the registered donors during emergency situations as the donors might not be in a situation to lift the call. There is no proper centralized database for registered donors.

2.3 Proposed System and Advantages:

All the records are computerized and stored in a well-maintained database. Anyone can visit the website and easily register themselves for donating blood in need. Hospitals and patients can search for donors in their desired location by typing in a landmark as a keyword.

The system we are proposing will be centralized. That means it will be a single system with a lot of people looking out for different purposes though all using the same modules with varying functionalities. The proposed system can be accessed by anybody with an internet connection and a web browser

This system is very User-friendly and interactive between the donor and the recipient. The system avoids wasting time for people to visit the hospitals during covid times and register themselves for blood donation. Records for hospitals and recipients are effortlessly available at all times. It is not always feasible for donors to be available at all times or lift the calls during emergency times. Our system allows the donor to know the emergency by sending a web notification to the recipient. If there are no donors available at the emergency hour at the nearest area, the patient/hospital can send the urgency through a group that consists of all the same blood type donors from the same city. This enables the hospitals to get in contact with the donors who don't live in the same area but are ready to donate. Provides security to data through authorization.

2.4 Challenges/Issues faced in BMS:

2.4.1 Tackling fake donors: During the registration phase, we make sure they upload all the supporting health and proof documents. The desired donor can proceed to the registration phase only if they pass the factors required to donate blood.

2.4.2 Tackling fake requests: In order to prevent the issue of fake callers demanding blood, a password facility is provided. The donors can also check the profile of the person who requested blood.

2.4.3 Updating database: It is mandatory for the registered donors to update their information every 35 days to show that they still free from diseases and are clean to donate blood.

2.5 Stakeholders:

Stakeholders are sources who are responsible and accountable for the success of the website and the organization.

2.5.1 Admin: Admin manages donors, system Users, and the smooth functioning of the website. The admin can add or remove any user from the system anytime whenever required and also carry out other necessary actions required.

2.5.2 User: In this module, the user can create an account if he/she desires to donate blood. To uniquely identify the user, they are given a username and password. The user needs to authenticate himself by providing unique identification proofs. Donors can get the information from the news regarding blood donation camps from the news dropdown. The user will be notified whenever there is an emergency.

2.6 Details about Blood:

The various constituents of blood are represented as follows:
2.6.1 Plasma - The medium in which the blood cells are transported around the body.
2.6.2 Red blood corpuscles- It carries oxygen.
2.6.3 Platelets- Which facilitates blood clotting and also the need for blood transfusion
2.6.4 White blood corpuscles- This is the part of the immune system.
2.6.5 Haemoglobin- Which is an essential chemical in the body and carries oxygen from the lungs to other parts of the body.

2.7 Factors and constraints to be considered to register:

The respected donor should be aged between 18 and 60 years only. Haemoglobin should not be more than 12.5g/dL. A Donor should weigh more than 45 kg. Before donating blood, the donor's body temperature and blood pressure should be normal. The donor should be free from diseases from the past 3 years. Most importantly the donor should not be addicted to drugs.

III. MODULES

3.1 Blood Type
Our website has this functionality to let the users and needy search for the specific type of blood they are looking for. Here we are passing the POST request where initially the search form along with the donor list gets executed by fetching details from the search and the Dreg categories from the database. Then validation takes place by purifying the post request with the Dreg data, if the request   is valid then the filtered data from Dreg gets placed in a dictionary and return to the page through rendering.

3.2 Area Wise Search
We have also integrated a search bar for people looking for blood nearby. This we have done considering the fact that a lot of people need blood urgently and have no time to wait for it. With this functionality, they can search and acquire blood near them and save precious time.

It's a similar parallel process/request which travels along with POST request as a common request for blood and area-wise searching match where algorithm makes sure whether two parameters has been filled or not through the model library parameters which is one of the most powerful validators. If both values entered match the data of Dreg in the database, then the search gets executed precisely. The interface of the blood donation management system implementing the area wise search is shown in Figure 3.1
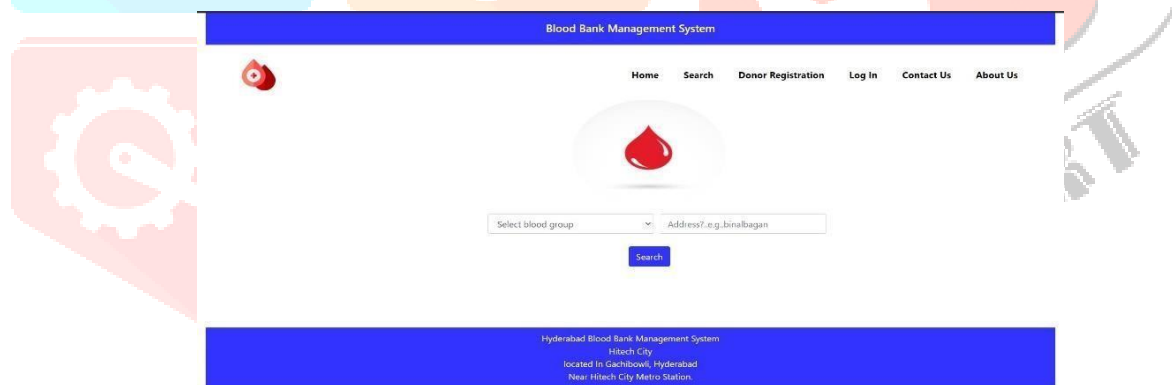

Figure 3.1: The screenshot gives a front-end view of the search page.

3.3   Donor Registration Form
Donors can be divided into returning donors, who donate on an almost regular basis, and walk-in donors, who are entering the system occasionally or for the first time.

We have integrated a form for donor parties to register themselves as donors. The form will ask the name, gender, date of birth, number, email, address, last donate month, health information etcetera. We have applied all types of constraints in the form so that false or wrong information is cast aside.

Same post request is used initially data gets filled into the parameters through validation and must and should fields, later as usual data gets connected and stored in Dreg category of the database if all the valid and verify conditions of the library models has been satisfied. After the successful render summarized data gets visible on the screen.

Here POST requests have been used mostly as the POST carrier request in the message body provides the most secured way of transferring data from client to HTTP protocol by
-never caching process
-requests do not remain in the browser
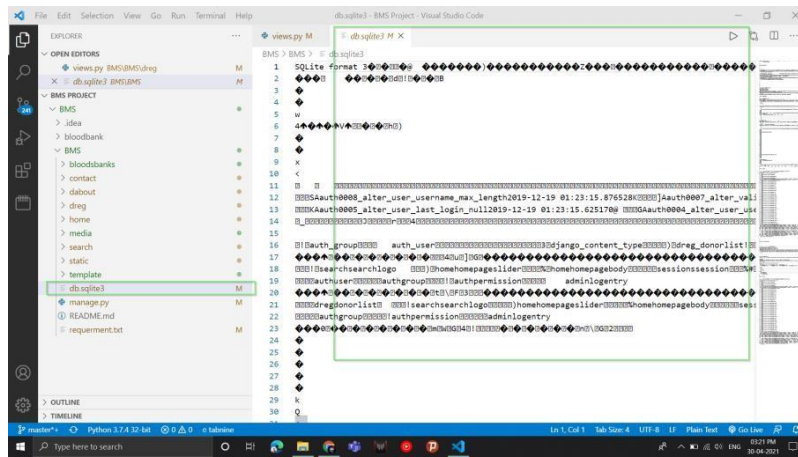-these requests can't be bookmarked
-it has no restrictions on data length

Figure 3.2: The screenshot shows our encoded data in database.

3.4 COVID NEWS API

Here the server has the duty to fetch the COVID API through the request library and later it gets converted to JavaScript object notation which decreases the weight and makes it simple to work with the data. Here data gets cleaned till a request status of 200. And now cleansing of the data gets provoked where each column gets stored as an array of lists which are later assigned to a dictionary. Finally, data gets returned and rendered to the page.

As the process data of country and state gets fetched, cleaned, and stored to uplift the precise result. Data of the world get updates for every 24 hours which includes columns such as Country, country code, total cases, total deaths, total recovered, date, and states of India updates for every 20 min which includes columns such as Province/State, confirmed total deaths, total recovered, active cases. Figure 3.3 shows the work flow of how COVID news API is implemented in the website.
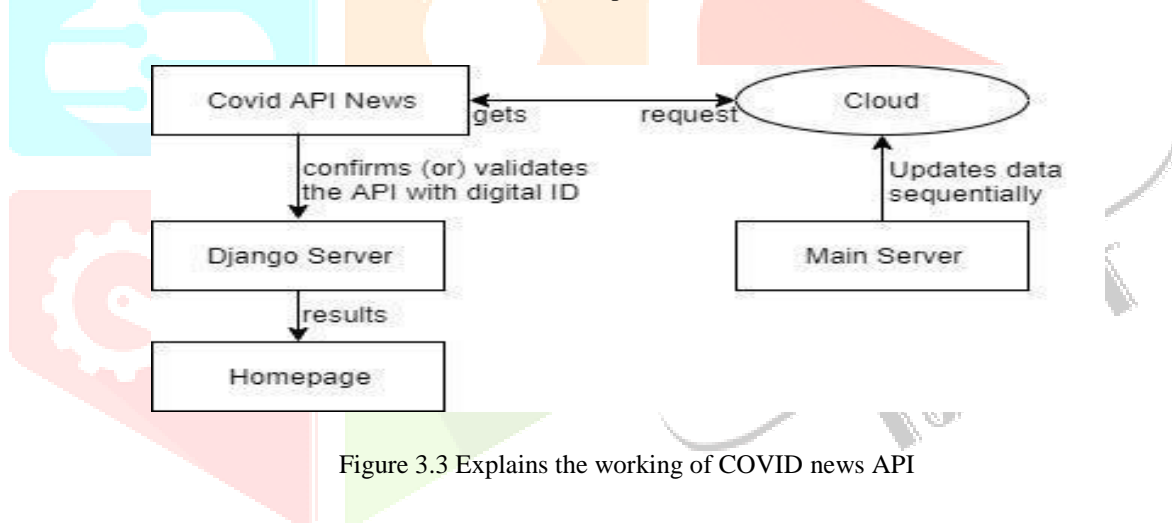

Figure 3.3 Explains the working of COVID news API

IV. BASIC FRAMEWORK

The system manages blood collection, inventory management, distribution, donor management along with a prior analysis report about the success probability and feasibility of any proposed blood donation camp. The whole system is an integration of some web-based user interfaces, and underlying databases.
Different components are briefly discussed next.

4.1 Django Framework Apps:

Models.py: Defines user, app, and website data fields.
Views.py: Used to analyze, wrangle, modify, and validate the data as per user need.
URLs.py: Used to store all the URL of apps used.
Tests.py: Used to test the apps.
Apps.py: Used to declare apps.
Admin.py: Used to register apps. It has access over all data.
Settings.py: Store all defined configuration and directory. It links all the files.
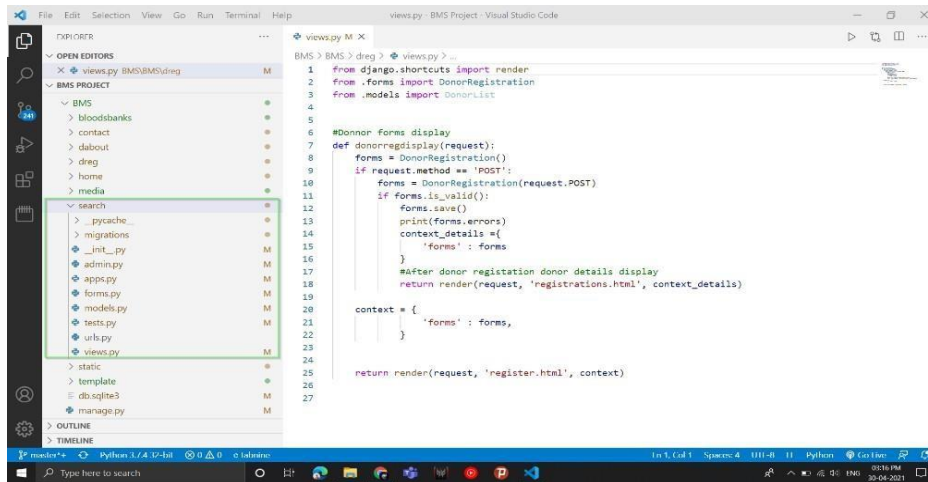Manage.py: It is the root of the application used to launch apps.

Figure 4.1: The screenshot above shows the implementation of various apps.

4.2 Web Interface

It is a website that can be accessed from anywhere by anyone with an internet connection and web browser. This website will be used by common users/ blood donors/ receivers, Blood banks operators/dealing clerks, registered blood donation camp organizers, nodal hospital officials, central monitoring or nodal agency as well as system administrators for many different purposes. Most of the use cases are easy to identify and already proposed and implemented. In our web interface we have three essential modules that form the framework namely Blood Inventory Management, Donor Management, and Administration Portal.
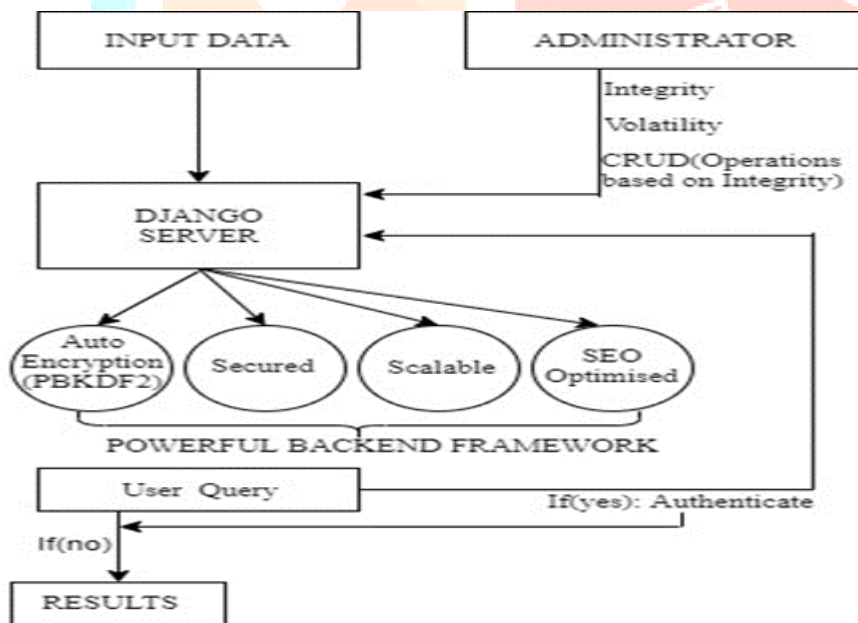

Figure 4.2 Explains the workflow of the website with features of Django

4.2.1 Blood Inventory management deals with the supply and demand of different blood units as well as blood components in an integrated manner. This type of website is already proposed and implemented in some selected places. It also keeps track of expiry date and proper maintenance and component separation of blood and can be used by blood banks as well as associated hospitals.

4.2.2 Blood donor management is similar to user registration and their profile maintenance on any social site. Common users can register themselves for donating blood voluntarily by visiting the web module and registering themselves on the portal. There will be UID-based basic profile details (such as name, address, age sex, blood group, etcetera) and the records will be kept in the Administration Portal.

4.2.3 Administration Portal is like a key bridge that can have all kinds of access/permissions to the database through the Django server as shown in Figure 4.3. In this, we will have the Authentication and Authorization column where user modes are divided based on their properties.

Then there are other categories where the added data through the user and the admin stored data gets biased based on their criteria to meet.

Figure 4.3 The screenshot above gives a representation of Django Administration.

V. OHER USES/SCOPE OF WEBSITE

Our website receives useful data related to blood donation and reception in an integrated manner and helps in making intense situations better. In terms of coordination and fast reaction (that gets to be most imperative to spare the most extreme number of casualties) amid incidents, our framework with analytics will be able to bring the right citizens to the right place at the right time to offer assistance. Our website can also be used in camps as it asks for data to understand eligibility (initially based on the last donation date and minimum gap between two consecutive donations eligibility will be derived, later other medical conditions will be considered by attending doctors in health camps) for donation. In the future, if during any checkup or treatment some infection or any such medical condition is detected then the concerned MP (medical practitioner) will update us and we will update our website accordingly.

In our future work, we plan to explore the generic mathematical model along with different donor groups using data mining tools and analytics. We are also focusing on implementing an application based on the website that will further help with connectivity to wider masses.

VI. CONCLUSION

The proposed system provides a web-based application that is acutely useful for emergency services. It will come very useful in urgent times by providing donors information filtered by area and blood type. It allows the donors to communicate with other donors using our ChatBot API to inform them about emergencies. The system consists of a well-maintained database to keep all the registered records. It also provides news and information about the ongoing coronavirus pandemic. In the end, it provided us the knowledge regarding the latest technology required to build a web-based application. During the building of this project, it provided us an awareness of how blood donation can save lives. This inspired us to donate blood at regular times and also motivate and persuade our fellow citizens to donate blood. A database has been set up to store historical data related to donation and reception of blood and also to store data from camps so as to take future decisions based on concrete analytical results.

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