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A SOCIAL APPROACH FOR SMART BLOOD MANAGEMENT SYSTEM BASED ON MACHINE LEARNING

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Abstract:

In India, we have a majority of people who are affected by the existing healthcare system as it doesn't cater the services to all sections of the community. This is because of poor supply chain and resource management. Be it a major accident or chronic disease, Blood plays a vital role in the treatment process. Blood Transfusion is always carried out to save patient's life. We have blood banks on city levels like hospital-based blood banks which has limited resources. There is always a shortage of rare blood types like (AB+, AB-, A+, etc). This often leads to doctors/administration helpless, risking the life of patient. Sometimes people are asked to pay for blood in urgency which is totally illegal and contributing to the corrupt system. While these things occur in big cities and most often in government run hospitals, we can't imagine what will be the scenario in the remote parts of India where people don't have money and resources. We have a technology like internet for almost 25-30 years in the mainstream yet it is surprising that we don't have a full proof platform solving the common healthcare problem. We have

online platforms which assure you grocery and pizza deliveries in 30 minutes, ⁹ ironically for blood there is a big gap. The main motto of this research is to reduce the total time taken in the cycle from collecting blood from donors, its storage resulting in zero wastage, to supplying blood bags to interested hospitals. The study involves the latest technologies like Cloud computing, ² Mobile computing and Machine learning to enhance the management, performance and the quality of supply chain. Hence, designing a smart system that can make decisions based on AI and improve communication across the supply chain is of great importance.

Keywords: Cloud computing, Mobile computing, Machine Learning, Android, AI.

I. Introduction:

The rapid increase in number of trauma cases in recent times is huge, including people involved in road accidents, chemotherapy, dialysis, major surgeries, anaemia, sickle cell disease or cancer. Apart from these, there are a lot of critical cases in hospitals in which blood is required

in hefty amount that too very quickly to save patient's life. Blood is a major requirement in these scenarios [1]. Every hospital has to maintain a blood bank to take care of the blood requirements. The process of collecting, screening and storage of the donated blood bags is carried out by these departments. Nowadays, whenever need of blood arises relatives or friends of patients are asked to donate or find blood units of certain type. This is because of less supply of blood units, lesser donations through camp⁹ and the problem of storage of blood [2]. Internet of Things (IoT) has emerged as one of the new smart tools for the healthcare industry. IoT technologies requires a multi-step procedure to provide impactful solutions. Collecting data from different devices and sensors to analysing the big data helps in the betterment of existing system. The integration of IoT technologies in the existing healthcare system is a great transition. IoT provides compatibility to connect to available machines and devices to operate healthcare actions via the internet network. Blood is perishable, degrades over the time and poses a huge challenge of instant availability and storage. The massive growth and evolution of data has a sheer impact on medical industry. It has created a lot of challenges like collection of data, storage, transfer, pre-processing and analysis of big data [3]. A major revolution is arguably "big data", which consists of large amount of machine-readable data [4]. Machine learning (ML) finds pattern and association from the data, which enables healthcare professionals to predict and take precise decisions.

II. Machine Learning in Healthcare Systems:

² Machine learning (ML) technology allows machines to learn from current inputs to evaluate or predict situations. Machine

learning algorithms are classified as Supervised, Unsupervised and Reinforcement techniques. In the initial iteration of our project, we create¹ several aggregation functions while studying machine learning foundations; in order to achieve the best results, we use python libraries such as pandas, scit-learn, NumPy, matplotlib, and others to study current generated data sets to study the correlation between elements such as quantities, blood type, job, etc. Deep learning is one of the significant algorithms used in health care sector. The machine learning phase consists of data pre-processing and training. Classification of datasets and prediction can be attained by using appropriate ML (machine learning) algorithms. Classification, Clustering and Regression are some basic techniques used in machine learning.

III. Related Work:

This section shows the current developments in the specific field of Blood management and donation system.

E-Raktkosh is India's biggest and by far the most advanced blood management system (BMS) backed by NHM (National Health Mission) under the Government of India initiative. The core features of the system are Blood search availability, Blood bank directory, Blood donation camps, Donor login. People can login and find the availability of blood bags around them. There is also a portal for donors to donate blood which is not that perfectly managed. All the upcoming blood donation camps can be found on the dashboard. To sum up, many other small systems and E-raktkosh are providing solutions to enhance the whole process of blood donation and management but is partially solving the problem and have limitations. None of these apps focus on efficiency and accuracy, like providing the ability to

preserve blood to be available before the critical events occur, but the proposed system adds these extra features in addition to the common feature of connecting donators with patient. Additional advantages include the opportunity to choose the best and most relevant donors, including family members, local friends, and charity donors. These capabilities boost the availability of blood bags and the ability to save lives. For the purpose of solving difficulties with rare blood types, the suggested system uses artificial intelligence and machine learning, as well as cloud computing and IoT. In the existing system it is observed that the blood availability is only for the blood bags but not of the suitable donors.

IV. Proposed System:

Design for Smart blood management system (SBMS) is a very simple and efficient approach consisting of an online modern day mobile application. SBMS comprises of four components and databases at its core. The Donors, Patients, Hospitals, Blood donation camps are the core components [15] SBMS. The overall objective of this system is to refine the existing process of blood management and add more feasibility to the ecosystem. We all know the power of social media platforms like Facebook, LinkedIn, Twitter and its development in recent days. All these platforms have highly impacted the world. Research reveals that on an average people are spending 144 minutes per day on social media. People are easily influenced and are getting all the updates, latest news on these platforms. Initially we have built our system on this social approach where user logs in on the platform and put up a simple request as a patient or an announcement as a donor and it gets posted on the wall. This wall is same as the feeds of major social networking platforms. The

post is shared by the social network and if it is verified by the hospital, it gets a verified sign on the post. This helps in accessibility using the ML algorithm same as when we update our profile picture on any platform. The system also has a separate platform for emergency requirements which is ordered by ML algorithms.

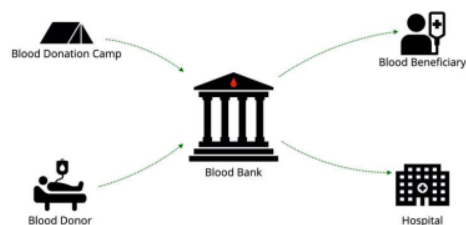


Fig.1. General Architecture

Donors comprise of the existing donors with a good past record, especially people who are actively participating in blood donation camps. All the body vitals and details are rechecked and updated every month. The system constantly takes input and improves itself after the successful blood exchanges [1]. In the existing system we don't get the donor's information, we only get the limited blood bags in the blood banks. But from our proposed system we can directly match a patient with a donor exactly like the Tinder match. All the healthcare solutions are designed and built for giving a fast and efficient treatment solution. The proposed system is Patient-centric and provides solutions by reducing the current time-cycle. The requirements posts are studied and analysed with certain keywords and the model trains time to time [2]. Hospitals enjoy a superior position in this system as we have a verification system for hospital registration process. Verified hospitals can easily find blood bags and donors as all the hospital and emergency requirements are put up on the different

wall [3]. Blood donation camps need to be done in the right and most efficient way. The Machine learning algorithms study geolocations and how often the requirements are posted. The monthly camps are set up after predicting the best date to manage blood bags more efficiently. Inventory and location tracking is constantly done and inputs are taken to improve the prediction [4].

V. Smart Blood Donation System (SMBS) Architecture:

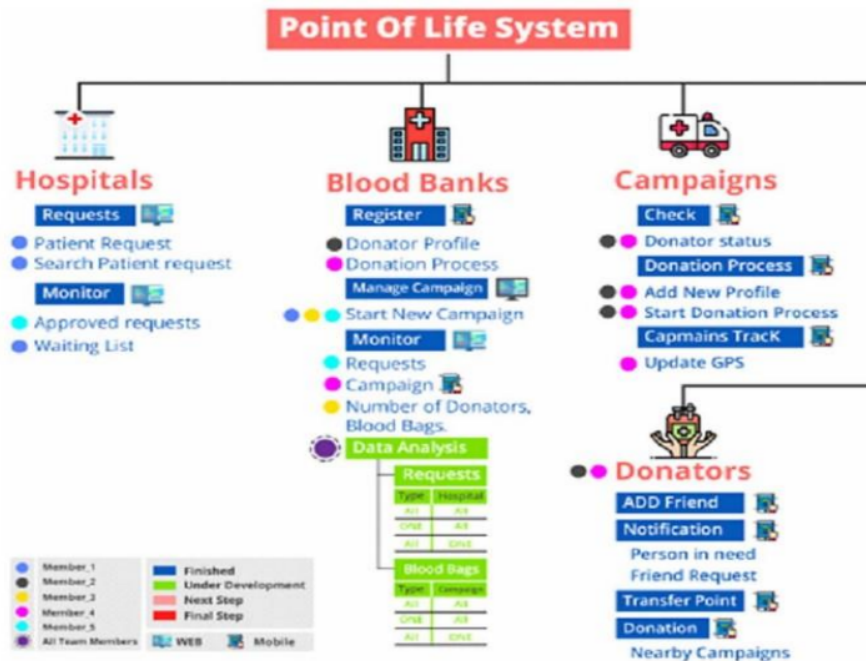
The modern architecture brings together the core components of system to the same interface through the mobile application. To create accurate and efficient datasets we have four different databases of the core components. The proposed system has the following key components:

Instant Search: This module takes the geolocation of the user and finds the suitable options from the database.

Wall: All the requirements and announcements are constantly posted here. This is the main gateway to get leads. We plan to create walls based on geolocation of users to optimize the system in future.

Posts: This functional component helps a lot in the machine learning and training the data sets. Posts are of two types either a requirement or announcement as a donor. These posts have filtering options for better results.

The relation between different entities helps acquire large amount of data sets on blood bank and donor's current requirements, predicting the next step, and making proactive decisions. Integration with blood banks allows us to not focus on making a new ecosystem but to organize it in an accurate and efficient manner. Information such as geolocation of patients and donors can be found through direct network integration. Direct social relationship between individuals is improved



dramatically. Every patient or recipient know from whom they are getting blood and that too in real time.

VI. System Design:

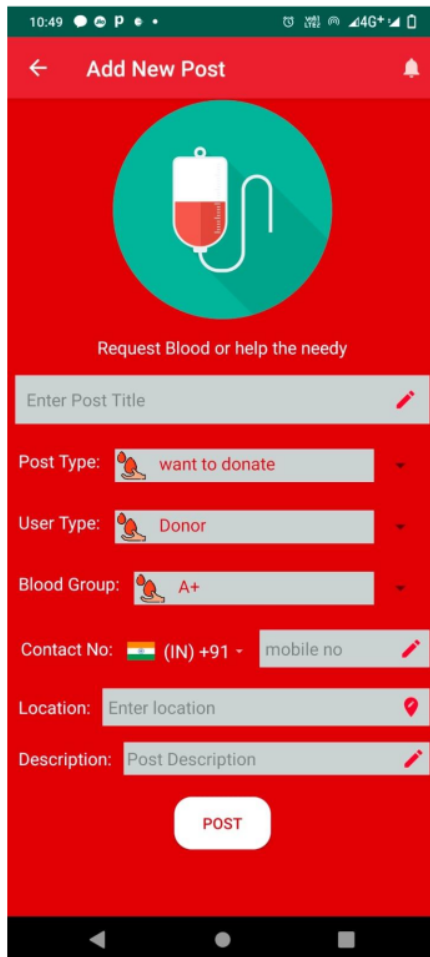


Fig.3. UI Design

1.1 Android Studio:

Android is a popular operating system for mobile and handheld devices based on Linux OS. It is officially owned and published by Google. Android Studio is the official IDE (integrated development environment) for Android OS released by Google, designed for developing Android applications. Android supports development in Java language.

1.2 Firebase:

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Firebase is a Backend as a Service (BaaS) solution offered by Google. It caters development for all platforms including Web, iOS and android. It provides tools for tracking analytics, reporting and fixing app crashes. It has its own database, authentication, hosting and different APIs. It also offers the modern day Realtime database.

VII. Conclusion and Future Work:

In Recent times, the medical industry is rapidly adopting clinical data, either from various surgeries, incidents or a general practise to predict types of requirements, diseases, and trends in the medical sector. Usage of IoT and big data analytics is the next big step. The availability of blood becomes very necessary for various healthcare services—including Blood transfusion techniques, surgeries, treatments for cancer, trauma cases, organ transplantation. We have designed a Smart blood management system using the Machine Learning algorithms. 16
The architecture facilitates a direct communication between the donor and recipient through the social platform to increase the efficiency and decrease the time cycle of the entire process. It also makes a central database and gives a single platform to use, makes use of the blood information scattered among local blood banks. People in the community can use the mobile application to be a part of this system with regards to comfort and convenient. This application notifies donors on urgent blood donation calls, search for the closest available blood bag or donor, and proceeds smoothly.

In future, we plan to develop a more efficient blood supply chain which can reduce the time. For now, we only have a

web interface and we are totally dependent on leads from the community and other health organizations. We wish to integrate the proposed system with our very own designed blood supply chain, where we will predict the locations of small blood banks and the location of central blood bank by analysing the big data and Machine Learning algorithms.

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