International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 15 Issue 04 , April - 2026

Blood Radar: A Mobile Application for Real-Time Blood Donor Detection and Emergency Response

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Abstract: Getting blood during critical situations results to be an issue for many healthcare systems all over the world. Even though hospitals and blood banks have databases of their potential donors, the process of locating potential donors often gets delay due to communication issues and a lack of organization when it comes to finding donors. Mobile health, or mHealth, provides new opportunities for donor, patient and healthcare provider. This paper focuses on Blood Radar, a mobile application that allows users to find potential blood donors in their area anytime, as well as simplifying the emergency response for them. Features of the application include donor registration process, a way to search for donors based upon their blood type, a way to utilise the application to easily distribute emergency blood requests , in-app chat in order to communicate with other users and to be able to search based on location for the closest donor. The Blood Radar system also push notifications to registered donors. Blood Radar also will show if the donor is Active to donate for the patient as well as send educational content or information to the donor to encourage their participation. Based upon experimental results, Blood Radar can reduce the length of time for potential patients to contact their potential blood donors compared to current manual methods.

The study indicated that integrating mobile technology with the concept of social networking can improve the coordination between an emergency blood supply and the efficiency of the healthcare response.

Keywords - Blood donation, mobile health, location services, emergency healthcare, Android, Node.js, MongoDB, privacy, system architecture

I. INTRODUCTION

The use of blood transfusions is one of the most important part of modern medicine. Blood transfusions are frequently required for surgeries, sudden accidents, trauma and cancer patients, and mothers needing help during childbirth. The availability of blood is entirely dependent on people volunteering to donate blood since there is no way to artificially create blood. Health care systems around the world are facing difficulty in maintaining an adequate and enough blood, according to global health statistics.

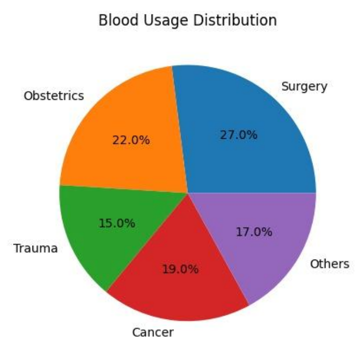

Fig.1. Blood Usage Distribution across medical domains.

As Shown in Fig. 1, Blood is required for multiple medical domains such as surgeries, trauma care, cancer treatment, obstetrics etc [1]. This distribution emphasizes the necessity for an efficient and responsive blood donor system.

In order to obtain blood, people need to address their needs through voluntary donations because they cannot manufacture blood artificially [2], there are a large number of blood product transfusions each year; however, there are still many areas where there is blood shortages due to a low number of individuals donating blood and inefficient blood donor tracking and management systems [3]. Blood donation systems have typically dependent on the fact that the majority of hospitals keep and maintain their own blood product inventories and that blood banks provide access to blood products. Hospitals first try to get blood from their own blood products, and if none are available, the hospital can try to find a donor through their local blood bank or by contacting their personal contacts, using social media, or using public announcements. Unfortunately, this process can be very slow and unreliable due to two factors: first, there are many more emergency requests for blood than donors who can assist; and second, the number of individuals with rare blood types is relatively small compared with all other blood types. The rise of mobile devices has provided new communication opportunities for the health care industry and for emergency response efforts. With nearly everyone owning and carrying a mobile phone that provides access to the Internet and the ability to determine a person's location and to communicate

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with that person's friends, family members, and co-workers, all of this has transformed the way that people communicate with each other. It should come as no surprise that mobile applications are excellent platforms for implementing real-time blood donor detection systems. Mobile health apps have already been used successfully in numerous healthcare fields, such as patient monitoring, telehealth, and emergency medical coordination; and research shows that mobile apps have an impressive record of increasing public engagement in healthcare efforts to provide people with access to digital platforms for sharing information and communicating with one another. [4]. Researchers and health organizations have become interested in how to integrate mobile technology with blood donation systems, and many apps have been created to allow for the storage of donor information, send out emergency blood donation requests, and facilitate communications between donors and potential recipients. These systems are designed to minimize the time it takes for emergency responders to find compatible donors during an emergency. The location-based donor identification feature is among the most exciting features of these mobile applications for donor management. Donors' location can be identified through Global Positioning Systems (GPS), enabling mobile apps to locate donors who are in close proximity to the patient or healthcare provider. Emergency notifications can then be sent to donors located within a specific area, thereby increasing the probability that donors will respond quickly to the emergency. [5].

A growing trend for blood donation platforms is the addition of social networking features as an element within the application. Emergency requests for blood can be disseminated using social media; supporting the idea that community-based communications networks provide essential support for recruiting donors. By integrating these communication features into the mobile application, an increase in donor engagement and participation is expected. These advancements still face some challenges such as limited means of communication and poor methods for sorting through donors and lacks of secure systems for authenticating users. In addition, many of these applications do not provide a method for facilitating real-time communication between a donor and recipient after a request has been accepted. This research proposes a new solution - Blood Radar is a social media based mobile application that will assist an emergency response to find compatible blood donors in real-time. By using mobile technologies and distributed communication methods, Blood Radar will provide an effective method for utilizing blood donation systems.

II. RELATED WORK

Wide study has been undertaken regarding the use of mobile software for establishing effective blood donation management in health information science pathways. Initially, mobile programs were implemented to accomplish gentle tasks involving donor records (storing information of each donor) and allowing for basic methods to discover matches between donors based on their blood types. The most significant development in this field came about with mobile phone applications that automatically notify potential donors in emergency circumstances. These applications periodically send booster signals to a centralized server when a match is found for a donor and allow the application to identify the nearest compatible donor at the time of the request [6]. Further studies on how comprehensive blood donation applications developed and how they functioned showed that many of them had simple functionalities including: donor registration, blood type search abilities and limited notification capabilities. However, few of the applications under review contained any advanced means of communication between emergency responders and donors, or were able to provide real-time information about donor location [7]. In conclusion, there are numerous paths of research currently underway to create management systems for blood donors based on the Android platform that can work in conjunction with databases from both hospitals and the mobile application. Such systems allow users to search for donors by geographical location and gives basic contact information for the purposes of contacting a potential donor [8].

Researchers have been investigating ways to integrate mobile applications with web-based blood donation coordination systems. Hospitals and clinics can use centralized databases to access all blood requests from both donors and recipients, thereby allowing volunteers that register on these platforms to receive notifications about available donation opportunities [9]. Machine learning and data analytics techniques have been applied in healthcare settings in order to help provide insight into how donors are likely to behave and to optimize blood donation campaigns. This technology analyses historic donation data and user behaviour patterns to identify which potential donors will respond positively to an emergency donor request [10]. Another area of exploration is the use of Internet of Things (IoT) technologies in healthcare communication systems. IoT-based healthcare architectures have been created to enable real-time communication and monitoring among medical devices, healthcare providers, and patients via cloud-based platforms [11]. Additionally, privacy and security are critical considerations for blood donation systems. Information about donors can include sensitive personal information such as contact details and medical history. Therefore, appropriate authentication methods and data protection strategies must be used to ensure that donor information does not get misused [12]. Although many of the studies outlined above have contributed significantly to improving blood donation management systems, most do not have integrated communications channels, meaning that there is no way for donors and receivers to communicate with each other after the recipient accepts a blood donation request. Moreover, the majority of models do not use the networking

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capabilities of social connectivity as a way to improve engagement from potential donors. In response to this, the Blood Radar architecture will combine mobile health technologies, social communication mechanisms, and location-based services into one cohesive platform.

III. PROBLEM STATEMENT & MOTIVATION

Traditional ways for finding compatible blood donors during medical emergencies such as blood banks, personal friendships, or social media sites, are limited by both structural and operational constraints. Most blood banks struggle with a lack of available donations, and they do not have the ability to determine, in real-time, what voluntary donations are available, or how close those volunteers are.

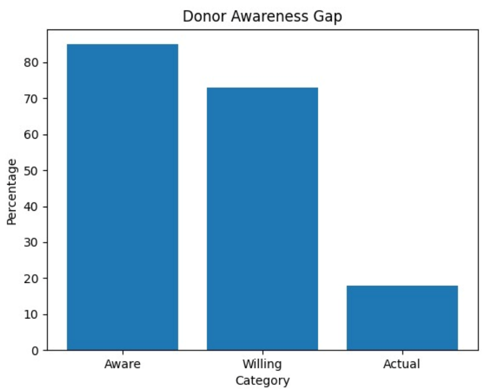

Fig. 2. Donor awareness vs participation gap

As shown in Fig. 2 Although a lot of people are aware of blood donation from significant awareness campaigns, there remains a gap between the number of people who actually donate blood. Approximately 85% of people are aware about blood donation and around 73% shows willingness, only a few people (approximately 18%) actually donate blood [13]. This difference indicates there are inefficiencies in the current system, highlighting the need for real-time, accessible platforms such as Blood Radar to bridge this gap.

Requesting blood donations through social media is also restricted by the need to request blood donations via a manual process, which involves an unpredictable number of responses. Therefore, the time when a donor is requested to give blood may not align with the availability of a suitable donor. In addition, there is a delay in notifying potential donors of their eligibility and no systematic filtering system that allows for blood group compatibility and geographic proximity, thus requiring additional time to obtain transfusions that can potentially save lives. All of these limitations create prolonged response times and lower the potential for effective responses in emergency conditions related to transfusions, thus reducing the likelihood of receiving timely medical treatment [14].

To address these challenges, the proposed Blood Radar system has an advanced capability to use smartphones to connect blood donors with patients and medical professionals. Using location tracking, real-time communications, and compatibilities in blood match types, the Blood Radar allows medical professionals and patient family members to quickly find compatible blood donors near them based on their blood match type and last known location and broadcast an emergency notification of needing contiguous blood donors to multiple people who are eligible to donate. The Blood Radar system is designed in such a way that give users a very easy way to send an emergency broadcast request for a blood donor with minimal ability to interact with complex processes. The Blood Radar platform incorporates privacy mechanisms that minimize the amount of personal identifying information that may be disclosed, requires secure encrypted data transfer between users, and that any information about a potential blood donor that is provided to others only when the potential donor's consent is obtained. The cloud-based structure of the Blood Radar platform will support the use of thousands of concurrent users, while at the same time maintaining detailed event logs of all requests and consent. Therefore, ensuring that the entire blood donation ecosystem is transparent, accountable, and ethically monitored.

III. PROPOSED SYSTEM

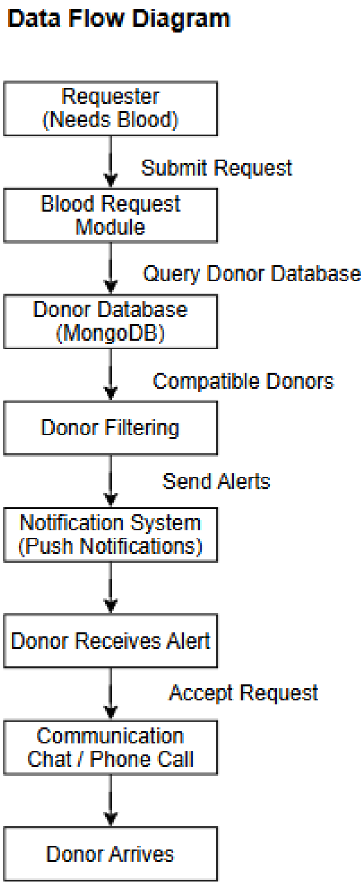

Fig. 3. Data Flow Diagram

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 15 Issue 04 , April - 2026

The Blood Radar architecture consists of three primary layers:
1. Mobile Application Layer
2. Backend Service Layer
3. Database Layer

In addition to these layers, the Blood Radar system will utilize a distributed mobile healthcare architecture to support real-time blood donation detection and emergency notifications. This architecture will provide a unified digital platform for communication between the patients, donors and the health care organizations. This multi-tiered architecture will support scalable communication between mobile clients and their server infrastructures, and efficient data storage and retrieval. The use of a layered architecture also allows for enhanced scalability, maintainability and performance of mobile health applications when compared to developing mobile health applications using a monolithic (single-tiered) architecture [15].

IV. SYSTEM ARCHITECTURE

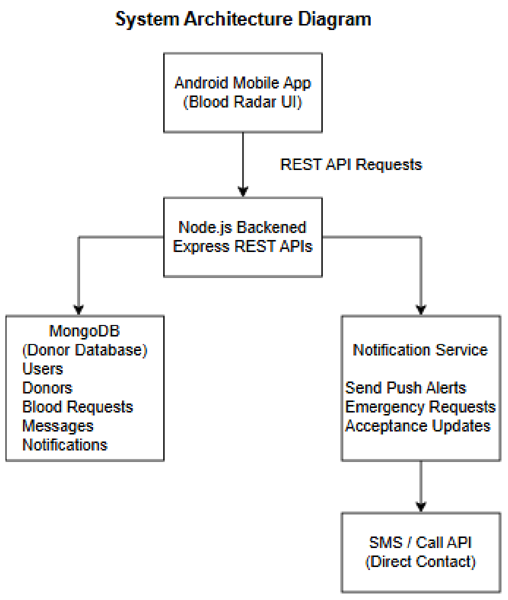

Fig. 4. System Architecture Diagram

A. Mobile Application Layer

The user interface for donors and requesters interacting with the Blood Radar system is provided by the mobile app that has been created using Android Studio (a development platform for high-performance mobile applications).
Users can perform several functions through the mobile app, including

- Register as a blood donor
- Search for blood donors by blood type
- Send urgent blood requests
- Accept or refuse blood requests
- Contact blood donors via chat or Call.

Mobile apps designed to facilitate emergency communication within healthcare must have simple interfaces and fast access to the essential functions to reduce response time in emergencies [16].

B. Backend Service Layer

The backend services have been built with Node.js and utilizing the Express.js framework, providing RESTful APIs for communication between the mobile application and the Blood Radar server infrastructure. The backend system is responsible for performing several critical operations, including

- User authentication
- Maintaining a database of blood donors
- Processing blood requests
- Distributing notifications

The REST architecture allows for scalable communication between distributed apps and has been commonly used in current healthcare software systems [17].

C. Database Layer

The backend database is implemented via a NoSQL document-based database (MongoDB) that enables users to store flexible forms of data. The database system is designed to deliver an organized and efficient way to store the data of the user; specific user data is found in the donor profile, records of requests, chat logs and notification logs, each representing a user.
An important rationale for using NoSQL databases in the healthcare industry is that they support flexible schemas and provide a highly scalable solution for storing large amounts of data [18] so several distributed healthcare applications can use NoSQL databases.

V. SYSTEM DESIGN & IMPLEMENTATION

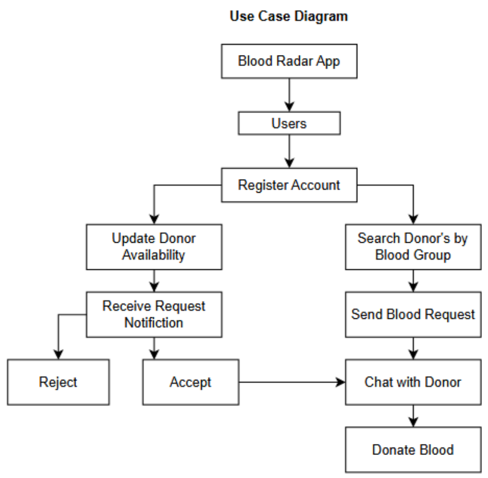

Fig. 5. Use Case Diagram

1. Registration: Minimal information is needed for registration like Full name, Phone number, Password, Blood type, and City. In addition, there is one optional field entitled “About Me” (your bio) that can also be provided by the user.

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2. Creating requests: Donors create requests by selecting the Blood type and Urgency (LOW, MED, or HIGH manually and submit a request.
3. Donor Dashboard: The donor dashboard allows the donor to view requests in the order of which they were received and to accept/decline them, the donor has access to tools/guidance to check the location of the requester, methods of contacting the requester, and any other relevant information they may need to process the request.
4. Messaging Chat: The ability to message was added, the messaging system is encrypted. however, messages are not saved permanently; they will be saved temporarily, stored for the duration of a session.
5. For notifications: With each request, the donor receives notifications of the requester, the distance from where the blood is needed, and further, when he/she accept a request to proceed further.

By using push notification services, donors will be able to receive alerts about emergency blood requests instantly via real-time alert notifications directly to their mobile devices, ultimately increasing donor response [19].

VI. PERFORMANCE EVALUATION

Multiple methodologies such as determining how quickly your Blood Radar System detects donors, the time it takes to notify you when donor was detected and/or send you a response are analysed to evaluate system performance. A common aspect of cloud-based platforms in healthcare is that they can scale easily and reliably into larger distributed applications and handle more users than ever before without sacrificing performance [20].

AI methods used in healthcare include providing analytic support for clinical data collected through the use of electronic medical records (EMRs) by using machine learning techniques and providing tools that enable decision-making using data collected in the various locations of the healthcare system. Therefore, the use of AI within a blood donation system will allow for better donor predictions and improved emergency response strategies for blood donation based upon the data collected [21].

Communication protocols within the healthcare industry must be secure in order to ensure that an end-user's sensitive data is not accessible, and therefore, it is important to include the ability to communicate securely between all stakeholders in the healthcare delivery process [22].

VII. Comparative Analysis with Existing Systems

Textual summary of Table: Blood Radar differs from SMS based donor apps and traditional SMS based systems by providing Low Latency Push Messaging, Acceptability and Decline Workflows with Secure Chat, and Donor systems such as BLOODR and BloodGo have demonstrated similar core functionality, but often are not as geospatially precise as Blood Radar or have weaker privacy models than the ones incorporated into Blood Radar [23]. Although SMS systems and social media can be used to appeal to a large audience for donations, they tend to have less targeted approaches to reaching potential donors, which increases the burden on donors [24]

Key differentiators:

Trade-offs Between Precision and Reach: Blood Radar focuses on precision and targeted outreach to potential donors in order to reduce the burden on them.

VIII. LIMITATIONS

1. **Adoption dependency:** Adoption depends on there being enough donors who are registered and active within a particular geographic area to provide a critical mass of potential users of the Blood Radar application; therefore, its potential will depend on the number of donors who are registered and active in that area.
2. **Connectivity & battery constraints:** In low connectivity areas, the time it takes for push notifications to be received by the user may be delayed; to mitigate this, the application has included adaptive sampling and offline fallback mechanisms.
3. **Clinical verification:** The Blood Radar application does not replace professional medical evaluation or triage of patients; improper use can create logistic inefficiencies.
4. **Evaluation scope:** While both simulations and pilot tests show potential, additional extended field trials at a variety of geographical locations and clinical environments are needed to verify their clinical effectiveness.

IX. FUTURE SCOPE & ENHANCEMENTS

1. **AI-driven availability prediction:** Historical donor response patterns can be used to predict donor response – based on the identified availability of each donor – at the required time and to target the appropriate number of donors via the multi-channel approach of multicast.
2. **Integration with hospital systems:** HL7/FHIR adapters must integrate with existing hospital systems to allow for inventory status checks of blood products at blood banks and to verify all available transfusion locations prior to commencing a transfusion.
3. **Cross-platform clients:** Support cross-platform clients (i.e. iOS) via mobile and web app (PWA).
4. **Privacy enhancements:** Enhance user privacy by using geo-indistinguishability and differential privacy in anonymous analytics.
5. **Offline and mesh support:** Provide offline and mesh support (i.e. use Bluetooth LE or peer-to-peer

notifications) during periods of network connectivity failures due to power outages or natural disasters.

6. **Blockchain audit trails:** Implement blockchain technology to provide optional immutable audit and consent logs for regulatory compliance.

X. CONCLUSION

In this article, we introduced Blood Radar: A Mobile Health Software Application for the Real-Time Detection of Compatible Blood Donors and Coordination of Emergency Response Operations. This mobile platform incorporates Android technologies, RESTful web services, and a scalable database architecture to support effective donor management and communication.

And results suggest a significant improvement in both the efficiency of blood donor detection and the efficiency of communicating with donors during emergency situations as a result of using mobile applications.

Future research will be directed at the incorporation of machine learning algorithms for the prediction of potential donor availability, and the implementation of blockchain technology for the secure management of healthcare data.

XI. REFERENCES

[1] World Health Organization, “Blood safety and availability,” Fact Sheet, 2022.

[2] World Health Organization, Blood safety and availability, WHO Report, 2023.

[3] S. Ouhbi et al., “Free blood donation mobile applications,” Journal of Medical Systems, vol. 39, 2015.

[4] L. Li et al., “Mobile applications for encouraging blood donation: A systematic review and case study,” Digital Health, vol. 9, 2023.

[5] R. Das et al., “GPS-enabled blood donor search system,” IEEE International Conference on Smart Healthcare, 2017.

[6] S. Turhan, “An Android application for volunteer blood donors,” CS & IT Conference, 2015.

[7] S. Ouhbi et al., “Analysis of blood donation mobile applications,” Journal of Medical Systems, 2015.

[8] C. R. Salankey et al., “Blood Beacon Android application for blood bank management system,” IRJET, 2020.

[9] V. K. Tatikonda and H. El-Ocla, “BLOODR: blood donor and requester mobile application,” mHealth, 2017.

[10] M. Maraz et al., “Machine learning-based donor response prediction,” Future Generation Computer Systems, 2021.

[11] M. J. M. Chowdhury et al., “IoT-based smart healthcare monitoring system,” IEEE Access, 2019.

[12] J. K. Patel et al., “Secure healthcare data management systems,” ACM Transactions on Computing for Healthcare, 2022.

[13] World Health Organization, “Global status report on blood safety and availability,” WHO, 2021.

[14] I. Maglogiannis and S. Hadjiefthymiades, “Location-based services for emergency medical incidents,” Computers in Biology and Medicine, vol. 37, 2007.

[15] D. Gupta and S. Rani, “Cloud-based healthcare architecture,” IEEE Access, 2020.

[16] A. Sharma et al., “Mobile health applications in emergency response systems,” IEEE Reviews in Biomedical Engineering, 2020.

[17] P. Taylor et al., “Smartphone-based healthcare communication systems,” IEEE Communications Magazine, 2021.

[18] K. Zhang et al., “Distributed healthcare systems architecture,” IEEE Transactions on Services Computing, 2022.

[19] P. Bhattacharya et al., “Smart health monitoring using IoT,” IEEE Internet of Things Journal, 2021.

[20] R. Kumar et al., “Artificial intelligence in healthcare systems,” Artificial Intelligence in Medicine, Elsevier, 2021.

[21] A. Al-Zoubi et al., “Mobile crowdsourcing system for blood donation,” IEEE Systems Journal, 2019.

[22] M. Smith et al., “Secure distributed communication in healthcare networks,” IEEE Security & Privacy, 2022.

[23] “BloodGo: Transforming Blood Donation Services through Mobile-Enabled Platforms,” SSRN preprint, 2024. [Online]. Available: https://papers.ssrn.com/.

[24] A. Almetwally, M. Mustafa, A. Youssef, “Design of SMS-based automated blood bank using embedded systems,” IJERT, 2014.