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Real Time Blood Bank Inventory Management and Request System

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Abstract- Blood availability in emergency is a major obstacle in modern medical care systems. Without real time tracking these traditional systems are prone to the significant in matching supply with demand on that particular time, it effects lack of real time tracking, leads to inefficiencies in matching blood supply, improper communication, and less accessibility for the users. These limitations are often result in the delays that can seriously impact on patient medical care. This research proposes the Real Time Blood Bank Inventory Management and Emergency notification Alert to the System that integrates smart phone applications with a cloud-based data structure to check the blood availability and cooperation during emergency situations. This proposed application system uses the Node.js backend, Firebase Fire store database, and a smart phone base application to enable the real time happen at the exactly same time of blood availability of detailed list across multiple blood banks. It incorporates the advanced features such as multi sections search based on the blood type and location, emergency alert notifications, donor registration page, and the rol based access control for a secure operation. unfortunately, the blood bank application system that improves communication between the hospitals, donors, and blood banks through give control of all the parts of a platform. The act of putting a plan of this medical care system significantly improves the response time, improves transparency, and ensures enough utilization of the available blood resources. Experimental analysis the demonstrates faster access to the blood availability information and better coordination compared to traditional medical care systems. This research gives modern healthcare by giving data base, real time decision making and also providing a large scalable and reliable solutions for blood bank management system.

Keywords— Blood bank system, Medical application, Fire base, Node.js, Emergency notification system.

I. INTRODUCTION

Blood is the one of the most important medical resources in the healthcare system, required for during surgeries, accidents, and other emergency situations. However, the many healthcare departments are still relays on the manual method or semi digital methods to manage blood availability list, which leads to the delays, inefficiency, and sometimes loss of persons lives due to the unavailability or insufficient information of blood during critical emergency situations. These old traditional systems are lack of real time data base updates, proper cooparation between blood banks and hospitals at an emergency time, and quick access to the patients in needs. As a result, searching and identifying nearby blood availability becomes so difficult, especially during the emergency situations, where time is crucial part of the human life.to conquer these real time challenges, there is a need for the modern, digital solution that ensures to real time tracking, efficient communication, and also easy accessibility to the user. A smart blood bank management system can also significantly improve the process by connecting donors to the hospitals, and also blood banks on a single platform system. Such as system can also reduce the response time, improve transparency, and ensure that blood resources are used effectively and efficiently in life saving situations.

A. Description of the Project

The proposed system, titled Real time Blood Bank Management and Request System, is to designed to overcome from the limitations of an old traditional blood bank management medical approach. Existing systems are often to rely on manual or previous semi digital methods, which the lack of real time data organization, proper efficient communication, and also quick accessibility to the users. This limitation can also lead to the delay in emergency situations on the spot, it also directly affecting patient medical care and the survival rates of lives.

The proposed system introduces a full controlled modern digital platform that also integrates blood banks, donors, hospitals, and users into a unified environment. The system is well developed by using a mobile first approach, giving users to access the services through the Android or smart phone base application. In this backend is integrated uses the Node.js and Express, providing a large scalable and proper servers side frameworks. Fire base and Fire store is uses as the cloud database to give real time data to all synchronization across all over the connected devices of users.

This system supports the multi sections as search functionality, allowing the users to search for blood availability nearby based on blood type, city, and also state. This ensures that users can also quickly locate the nearest best blood bank with the required large amounts of resources. Additionally, this system gives the access users to submit blood requests, which are helps to processed and managed by administrative authorities. Donor can registration functionality is also provided, by allowing individuals to register and update to their availability for donation of blood in near area.

A key feature of this system is also the integration of the emergency notification alert to all mechanism. When a critical critical shortage of the specific blood type is detected all, the system will automatically generate alerts and sent notifications to the all's relevant users and registered donors in the system. This is significantly improved the response time and enhances the efficiency of the handling in emergency. Further information, the system is the most the system not support, the role base access to control ensures secure and the controlled operations. Different users, such as the administrators with donors, and general users, are also assigned to specific permissions. Security is so all further enhanced through the Firebase security and to secure the communication protocols to control panic. Over all of proposed system that provides a large scalable, efficient, and also the real time solution for the blood bank management. It also improves coordination among all of the stakeholders and reduces delays in emergency response, and ensures optimal utilization the of blood resources in emergency healthcare systems.

B. Scope of the Project

The scope of this proposed real time blood bank Inventory Management and Request System is extensive and also covers the multiple aspects of the healthcare management system, data processing, and also real-time communication. The system is designed to address the emergency issue of the blood availability by providing a large scalable and efficient digital platform for the managing blood bank operations in real time.

The primary scope of this system includes the real time tracking of blood providers list across multiple blood banks in nearby areas. The system ensures that, by any changes in blood availability, such as the donations or usage, are instantly updated by the centralized database system. This real time synchronization helps the users to access accurate and up to date with different information, which is essential during the emergency situations in real time. Another important aspect of this system is the ability to provide location base services on the system. Users can also search for available blood using parameters such as blood type, city, and state.

This feature helps a lot in identifying the nearest are of the blood bank with the required blood type, by the reducing their time required to locate resources during the emergency or critical situations. This system also supports by a comprehensive blood request that management process. Users can submit requests for that specific blood types that they searching for, including details such as urgency level

and its required units. These requests are stored in the system and also can be accessed by administrators and blood bank staff for the future processing. This ensures a real and standard structured and organized workflow of handling blood requests in critical situations. The donor management function is also within the scope of this system. Individuals can register as a blood donors and also update their availability status on their profile. This helps in maintaining a large database of potential donors who can be contacted during the critical situations. This system can also assist in the coordinating donation activities between the donors and blood banks.

A key feature that included in the scope is emergency notification alert system. When the shortage of a particular blood type is detected in the nearby locations in real time, specific area or the bank, the system generates the alerts and notifies the registered users and donors. This feature creats an important role in providing good response time and ensuring timely availability of the blood during critical situations in real time.

This system also incorporates rolebased access control to ensure the secure and efficient operations. Different types of users, such as the administrators, donors, and general users, are also assigned a specific roles and permissions. the Administrators have the authority to manage the blood bank data and other databases, monitor requests, and update inventory, while the general users can search and request blood on their device. From a technical point of view, the system is designed by using modern technologies such as Node.js, Express, and Fire base Fire store.

The use of cloudbased database to ensures scalability and allows the system to handle a large number of users and the data sufficiently. The mobile application interface ensures the accessibility and ease of use for all the stakeholders. The scope also includes the implementation of the secure authentication or securing and data protection mechanisms in meantime. Fire base Authentication is used to that ensure secure of user login and to the access control. All of this communication between the mobile application and backend server are secured by using the https protocols, that ensuring data securing and the quality securing of the system. In this system provides an analytical work capabilities that can help to administrators to understand blood usage patterns in the areas, donation trends, and system performance. These insights can be more used to improve the decision making and arrange the resource allocation in blood banks. The system also designed to the anytime and adaptable to the integration with other healthcare and medical systems.

It can also be extended to work with hospital management, government healthcare platforms, and also national blood bank networks. This helps to makes the system suitable for the large scale of deployment in both private and public healthcare sectors. The system supports the future improvement as integrating with the artificial intelligence for the amount of blood demand in the area, implementation of massages and call based alert system, and also increasing the services to other platforms such as apple ios.

These sub divisions are increase of the long terms applicability and also usefulness of this system. However, the scope of this system is limited to access the environments where internet connection is available, as real time synchronization depends on the cloud databased services. Despite of this limitation, the system provides the strong foundation for the modernized of blood bank management and to improving the healthcare services. Overall, this system covers a large range of the functionalities, including the real time inventory and management, request the handling's, donor cooperations, emergency notifications alerts, and secure the data management. It aims to be provided a sufficient, efficient, and scalable solution to the address the challenges of a real time blood availability in healthcare sectors. this helps to support to the person from person user like donors, like real time communications and some many with the help of artificial intelligence to shows the particular area and the location with the help of maps.

II. LITERATURE REVIEW

Recent studies show that how technology creating a great progress in helping to improve the blood bank systems. This is One of the most important study's done by J. Punitha Markavathi and Pandiarajan, [1] It explains the system that gather and connects donors, patients, and blood bank staff in one platform from all over the world, The system is very easy to register as donors, book appointments, and check the blood availability in a certain location.

They used blockchain modern technology to make this system look more secure and easy to use for users. In old traditional systems, data could be changed or misused, but in this new modern system keep records safe, clear and unchangeable. It also improves the communication between the users and also makes the whole process simple and efficient to use. Another study by Daksh Chordiya and others [2] this explains the application that can uses a perfectly organized database to manage the blood donation camps and inventory successfully.

Here the main idea of their work is to reduce the gap between blood demand and supply in real time emergency situations, which every time happens due to poor management and old traditional methods. There system helps to storing and updating data so easily, making it faster and also more reliable. It includes the useful features like the sending notification alert to donors when they can donate the blood again, showing the nearby blood donation centres or camps, and making it to easier for patients to request blood. For this system they used IoT technology to provide fastest communication between the application and the user servers.

This allows faster data sharing and better coordination between users. this study shows the how a strong, clear database system can be improves efficiency, save real time, and support better blood management in medical support. This is another recent study's that shows proper blood banks management system is very important for saving lives in real time. a study by Sulaiman, Hamid, and Yusri, [3] it explains the how they improved of a web-based Blood Bank Management System to improve that how blood bags are managed by stored in real time. This system was designed for replace old traditional system that are less efficient and difficult to manage in critical times. they develop this application by using web technology like Java, (MYSQL), (JSP), (CSS), (html), and JavaScript. They used a structured development to build this system. this study shows that using web-based system can also improve productivity, organization, and stability in real time blood bank management.

This system helps to organize blood bank operations in a more standard way. It ensures that the blood bags are can handled carefully and managed properly, reducing the risk of errors in mean time. The system also increases data storage and also access to the user, making it to easier for hospital staff to manage the blood availability. This is another study shows that software base systems can helps to improve the management of blood banks system. a study by Zulkifli and his friend Hamid [4] this explains the web base blood bank management System is designed to manage the different operations at same time such as blood collecting, testing, storage, and delivery in real time. This system helps in the tracking blood availability lists, gathering donor information, and generating reports on it.

They also suggested that the converting this system into a mobile application could further improve ability and usability, as smartphones are the widely used. the study shows that web base system can also make blood bank operations faster, well organized, and easy to manage. Thes system is mainly run by the administrator, which it ensures proper monitoring and management to all activities at the same time. This results of their testing shows the system works efficiently, with perfect smooth data transfer and good performance. The application was developed by using (MYSQL) and (PHP), making it so simple and effective for using and managing blood bank data in real time. This is another recent study shows that how digital systems can greatly improve blood donor management and communication system. A study by Warnakulasooriya [5] this study explains that a web base blood bank and donor management system is designed to store the donor details in a fully digital form, removing the need for

paper base records. This system helps the hospitals quickly access the donor details, blood types, and patient information, making the process faster in the emergency situations.

They improve this communication between the donors, patients, and hospitals by storing all information in a packed database. It also allows users to donate blood any time easily and it helps the hospitals to manage and distribute the blood efficiently. This application was developed by using (AngularJS), (MySQL), and (HTML), ensuring that smooth data store the system focus on more security and reliability, ensuring the sensitive healthcare data base is protected. It also improves voluntary of blood donations by educating the people and start making the process simple. the study shows that web base system can make the blood management system faster, more secure, and more efficient in real time.

This is another recent study that show how digital transformation helps to improve blood bank operations at national level. A study by Jayawardana and Sapraz [6] that explains a complete centralized blood bank system that developed to solve the problems in old traditional methods. recently in many cases, the manual methods are causing delays, data errors, and the poor communication between the donors, hospitals, and blood banks in real time. Their system is providing a single platform to manage the donor registration, appointment scheduling, blood donation camps, and real-time blood bags tracking. This also make the entire process more efficient and well organized. It also helps to improve coordination between different users such as donors, organizers, and healthcare authorities in medical system.

By replacing the old traditional manual methods with a modern digital system, this system reduces the workload, reduces errors, and improve overall performance of the system. the study shows that centralized modern digital system can make blood bank management faster, more efficient, and very easy in large scale medical environments. This is another recent study that show technology can improve blood bank management methods. a study by Joly, Kavitha, and Arun Pradeep [7] this explains a smart modern blood bank system that helps to monitor and manage the blood availability in real time. The main problem addressed in this work is the unavailability of blood donors at the right time during critical situations. This system uses some sensors and devices such as the IR sensors, and Wi-Fi modules to track and manage the blood bags stock automatically. This reduces the errors that usually happens in manual methods and improve stability. This system also can update blood availability on a web page that allowing users to easily check nearby blood banks in real time.

This system that helps blood donation sectors quickly and share information about the blood stock that they need supply during urgent situations. the study shows that IoT base systems is to make blood bank management more accurate, efficient, and responsive in critical cases to save the lives. another research shows that improving database system can also to help solve the blood shortage problem. a study by Mishra, Sainani, Kurup, and Kumar [8] this explain a blood bank management system is designed to improve the inventory control and encourage blood donation in real time.

This system is mainly focus on organizing data proper standard, so that blood donor information can store and accessed quickly in emergency situations. This system also helps the donors by sending notification reminders and updates about donation events and camps, which leads to encourage regular blood donation in nearby areas.

For patient it makes the process of requesting the blood easier and faster, especially during critical situations. this system also improves efficiency, reduces time, and supports with better coordination between the donors and the recipients. This study shows that this technology can also play an important role in major solving medical challenges and creating a strong blood donation system. another research studies shows that how online system can improve the blood bank management and also emergency response. a study by Nadaf, Namdas, Pacharne, and Ahire [9] this explain the online blood bank management system designed to replace the old traditional paper written methods.

This system connects the hospitals, donors, and patients through an organized web platform and app, making the process faster and more likely easy to find at critical times. This system also includes features like blood donors alist tracking, donor registration, notification alert system, and request for blood processing. It automatically matches the donor and recipient base on the blood type and it surrounding location, which helps to save in real time during emergencies situations. They used this secure database and modern digital system that ensures data safety and smooth database performance.

Testing results that show better response in time, improve the accuracy, and high user satisfaction. this study shows how the digital platforms like this can make blood bank systems more efficient, reliable, and easy for users to use in real time. This is another recent study that show how web base system can improve blood donation and inventory management in modern era. a study by the suresh babu and arun kumar, [10] this research explains that how Blood Bank and Donation Management System developed to manage the donor data and blood inventory properly. This system provides the single platform that can both donors and administrators can interact easily in critical situations.

This system allows the donor to register and check eligibility and also view donation information, while the administrators can manage the blood bags stock, donor record and hospital request in real time. this system uses (HTML) for the front end and (SQL) for the database for storing and managing the data secure. This modern system helps to reduce the manual work, reduce human errors and ensure timely availability of the blood. the study shows that this digital system can also make blood bank operations more organized, reliable and easy to use.

III. SYSTEM ARCHITECTURE

A. Overall System Design (Fig. 1)

This proposed system is designed by using a multilayer standard mappind to ensure it properly, measurable in real time situations. This system mainly consists of the three major components of mobile application, backend server and cloud base database. The components work together to provide a seamless and the dependable blood bank management system in emergency.

This mobile application system acts as user interface that allowing users to search for the blood availability it sends requests, and register as donor. It developed using Android technology and it provide simple and user's friendly interface. The backend of this server is built using the (Node.js) and (Express) which handle all the business logic and (API) communication between the mobile app and the modern database.

This system uses the fire base fire store as the cloud base database to store all the information that such as blood bank details of the user, donor data and blood request. real time data organization it ensures that by any changes in blood donor or available list are instantly updated across all over the devices. This help's the users to access the accurate and time to time update information during emergency situations. This system also includes the authentication module that using fire base authentication to ensure the secure login and role base access control. Different users such as the admin and also regular users have the different permissions within the management system.

Additionally, the system integrates features like multi-parameter search, emergency alerts, and geolocation services. These features improve the efficiency of finding blood and responding quickly in critical situations. Overall, the system design focuses on providing a fast, secure, and scalable solution for managing blood bank operations effectively.

B. Feature Extraction and Processing Pipeline (Fig. 2)

- This system takes basic related information from the user, blood type, location and it request detail and send it through a series of clear steps:
- Step 2.1 - Data Input Collection This system collect's the basic related information from the user.it includes blood type, city, state and it request details from users can also provide donor registration details, All the inputs are

taken to the mobile application. This step ensures accurate in real time data collection.

- Step 2.2 - Data Validation: This system checks this whether the entered data is correct or not. It also verifies the required fields as like blood type and location in nearby area, Invalid or the incomplete user data is rejected by the system.it improves system dependency. It ensures only the valid user data is processed.
- Step 2.3 - Data Processing: This backend server checks the validated data. It's also applie's the business logic using the (Node.js) and (Express).it requests are prepared for the database interaction of the user. This system decides they what action to perform in particular situations. This step control's the system workflow of the data.
- Step 2.4 - Database Filtering: The system filters data based on user input. It checks blood availability in the database. Results are filtered by location and blood type. Only related data is selected. This improves search accuracy.
- Step 2.5 - Real Time Update Handling: The system checks for real time updates in inventory. Any recent changes are included in results. Data is synchronized across all devices. This ensures time to time information. It is important during emergencies.
- Step 2.6 - Result Generation: The system will prepare the final output for the user. It also includes available blood banks and details. request the status is also processed. results are to formatted clearly. This step ensures useful output.
- Step 2.7 - Output Display: The results are sent to the mobile application. Users can view available blood and details. The interface displays clear information. Users can take further actions if needed, This will completes the process.
- Step 2.8 - Alert and Notification: If there is a shortage, alerts are triggered. Notifications are sent to donors and user devices. Emergency situations are handled quickly. This will improve response in real time. It supports critical medical needs.

C. Central Management System Architecture

This central management system architecture is the proposed modern blood bank management system is designed for the provided a unified, efficient and also real time platform for the managing all blood bank operations at same time. This system that follow's the organized approach where all the data and the process are controlled through by a single cloud databased infrastructure. This architecture that ensures the better coordination between the users, donors, hospitals and administrators in real time.

The core of this system is cloud database, Fire base and Fire store, which stores all the important information such as the blood availability list, donor details, user data and blood bags request. The centralized database the allows real time data access and synchronization across all over the connected devices. Whenever the any update is made, such as the new blood bags stock or the request it is automatically reflected throughout the management system. This system is supported by the backend server that built using the Node.js and Express in the system. This backend also acts as central controller that process all the requests, applies business logic and manage the communication between the mobile application and also the database. It ensures that the all operations are performed efficiently and securely by the system.

This modern mobile application serves as the frontend interface through the which user interact with the system. The users can also search for blood bags availability and send requests, and register as donors in the application. This application communicates with the backend using RESTful APIs, that ensuring smooth and organized data flow through entire system. The security is the key component of this architecture.

The fire base authentication is used to verify the user identity and provide the role base access controls. The different users such as the administrator and general user have the different permissions and ensuring that the sensitive data is protected by the system. This system is also integrated additional features like the real time notifications alert, emergency alert and geolocation services on the

device. These features enhance that the functionality of this system by giving response time and helping users so quickly locate nearby blood banks in real time. Over all this centralized architecture improves the system performance, reduces data that being unnecessary and ensure the reliability. It also provided a scalable solution that can handle the large number of users and also can be expanded in future. The architecture plays the important role in improving the blood bank management and supporting lifesaving operations during the emergency in real time.

D. Key Architectural Advantages

- This proposed blood bank management system that offers the several architectural advantages that improve the overall performance, scalability and reliability of the system. The system that follows a organized and multilayer architecture, that which ensures the proper separation of the concerns and efficient handling of the operations. This each component that including the mobile application, backend server and cloud database, it works independently while maintaining the communication of the system.
- The one of the major advantages is the real time data organization that using Fire base and Fire store. This allows all the users to access the latest updated information about the blood availability without any delay in real time. Whenever the data is updated in the database, it instantly reflected the across all over the connected devices, This making the system highly responsive during emergency live saving situations.
- This uses the Node.js and Express in the backend that provides the high performance and scalability. This backend efficiently handles the multiple of user that requests simultaneously and process them using the RESTful APIs. This ensures the perfect communication between the mobile application and the cloud database of the system.
- The other important advantage of the use of cloud base infrastructure. Since the system is hosted on the cloud and it removes the need of the physical storage and also reduces the maintenance costs of the medical system. It also ensures the high availability and the reliability of the system in real time.
- The security is a key strength of the architecture. The Fire base authentication that provides secure login functionality and also role base access control of the system. This ensures that only authorized users can be access or modify the data, that protecting sensitive healthcare information of the system.
- This system is very highly user friendly due to the mobile based interface of the application. The users can be easily search for the blood, send request and receive notification alerts. This integration of geolocation services will help the users to find nearby blood banks quickly in real time.
- This architecture that supports modularity allowing it easy for updates and future enhancements of the application. This new features such as the AI based prediction or advanced analytics can be the integrated

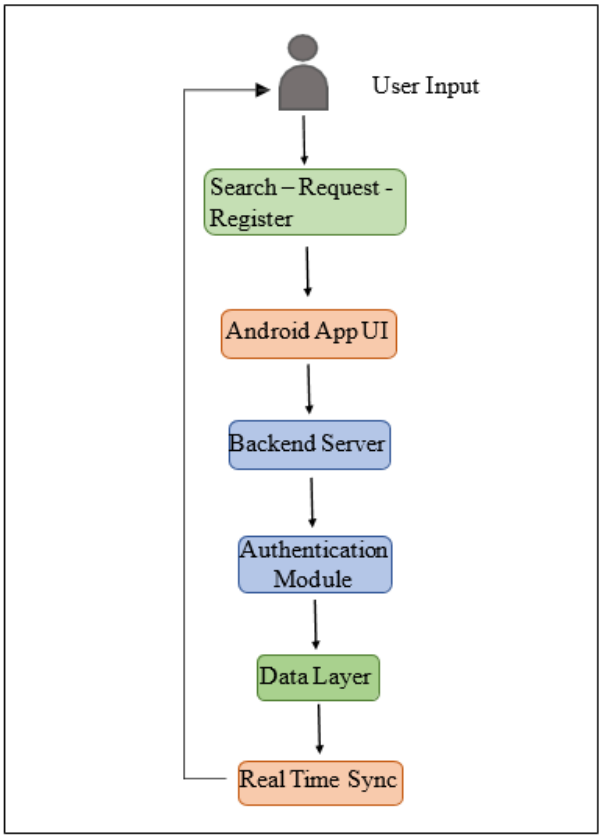

Fig. 1. Overall system architecture

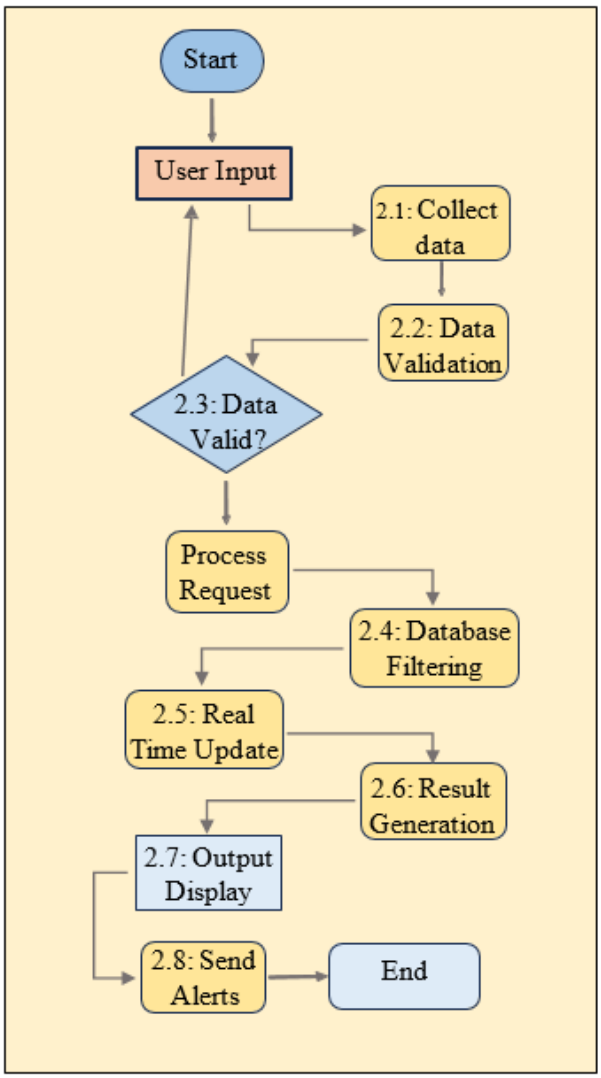

Fig. 2. Process Pipeline

IV. QUANTITATIVE ANALYSIS

- The connected with the amount analysis of the proposed blood bank management system evaluates the its performance in the terms of its response time, accuracy, data processing efficiency and real time sync. This system was tested by using multiple user requests and the cloud database operations to measure the effectiveness and compared to old traditional medical system.
- First the response time of the system is the significantly increased due to the use of the Node.js backend and the Fire base and Fire store database. The average reaction time for searching the blood availability is observed in between 1–2 seconds, whereas old traditional health systems may take the several minutes to manual processing. The improvement is critical during the emergency situations where quick decision making is required in critical situations.
- Secondly this system demonstrates the high accuracy of data retrieval. By using the cloud database filtering based on the blood type and location the system will ensures that only the relevant results are displayed to the registered user. The accuracy rate of the matching blood availability may estimate to be above 90%, By reducing the errors and by improving reliability in real live situations.
- The real time organization feature of the Fire base and Fire store will play's a major role in the system performance. Any update in the blood inventory is immediately it reflected across all over the devices, that ensuring the users always to receive time to time information update. This also reduces the chances of the outdated and incorrect data as being used.
- This system also shows the efficient of handling multiple users simultaneously. The backend server can process the multiple requests without any delay, by making it scalable for the large scale of usage. The testing show that the system can be handle concurrent requests effectively with the minimal performance delay.
- In the terms of a data processing the system will efficiently validate and process the user input through the multiple steps such as the validation date to date, filtering and also result generation. The each step of this optimized to reduce the processing time and improve the system throughput.
- Additionall'y the notification alert system that ensure the faster response in the emergency live saving situations. Alerts are the triggered instantly when there is the shortage of the blood and improving the coordination between the donors and recipients.
- Overall quantitative of results indicate that proposed system outperforms old traditional system methods in terms of the speed, accuracy and also efficiency. The use of this modern

technology such as Node.js and Fire base enables a scalable and the reliable solution for the real time blood bank management.

V. RESULT

This developed Blood Bank Management System was successfully implemented and also tested using the Android mobile application we integrated with a Node.js backend and the Firebase Firestore cloud database. This system provide the smooth and user friendly interface is easy to use for managing the blood availability and also requests in emergancy situations.

This developed application that includes the user registration module. where the new users can also create an account by entering their basic details such as email and password and name, blood group. This feature ensures the secure access and also allows users to join the system so easily. The registration process is very simple and efficient, making it accessible for the all type of users.

This blood management system also provide a login interface, where the users can securely log in by using their details. Firebase Authentication is used to be validate user identity and also provide the role base access. This ensures that only the authorized users can access the system features, improving security and reliability of the system. The main application dashboard (home screen) will display nearby blood banks along with their availability status with the use of location.

The users can search for the blood based on blood type and location on this application. The system is also integrates the location base services which help the users to find the blood banks in nearby areas of their location. This feature uses the geolocation to show the closest available blood sources to the user and making it so useful during the emergency situations. Additionally this application includes the emergency request feature that treggers the alert notification, which allows the users to request the blood instantly. When a request is made the system process it quickly to the system and update the database in real time. This feature will improves the response time and it helps in critical situations.

- The screenshots below showes the working of this system :

- Fig. 3:- User Registration Screen,
- Fig. 4:- User Login Interface,
- Fig. 5:- Blood Availability Dashboard with Nearby Location Feature.

These results will shows the fully functional with responsive system that capable of handling the real time blood bank operations very effectively. This system increases availability and it also reduces the delay and improves the coordination between the user and blood banks. The inclusion of the location base search, further strengthens of the system by helping users to quickly identify the nearest available blood resources on the application using geolocation.

Fig. 3. User Registration Screen

Fig. 4. User Login Interface

Fig. 5:- Blood Availability Dashboard with Nearby Location Feature.

VI. CONCLUSIONS

This blood bank management system has been successfully structured set of challenges of the blood availability and the management in critical lifesaving situations. By combining the smart mobile application with an (Node.js) backend and the Fire base Fire store cloud database and the system provided a real time, efficient and user's friendly solutions for the blood bank operation. This system gives users to search for the blood base on type and their location, register as donors and send emergency alert, request quickly for the blood. The inclusion of real time data organization, ensure that users always receive accurate and time to time information to the users. the integration of location base service can help users to identify the nearby blood banks and significantly improving the response time during critical situations in real time. The use of Fire base Authentication improves the system security by providing secure login to the user and role base access control to the users.

The backend efficiently processed user request and manages the data through (RESTful-APIs) system, ensuring that smooth communication between all components of the application system. this experimental results and number of the analysis show that the system has improved response time, accuracy and also overall efficiency compared to old traditional methods.

This application is easy to use for the users, scalable and capable of handling the multiple users at a time.In conclusion, this developed application system provides a reliable and effective solution for the modern blood bank management system. It also reduces the manual effort, minimizes delays and improves coordination between the donors, recipients and blood banks. This system has the more potential to save the lives by ensuring timely availability of the blood during emergency situations.

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