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Red Bank

Aryan Barnwal S[1], Utkarsh Kumar S[2], Vedang Nagar S[3], Dr. C.G. Balaji[4]

[1,2,3]UG Student, Department of Computer Science and Engineering, SRM Institute of Science and Technology, Ramapuram, Chennai, India.
[4]Assistant Professor, Department of Computer Science and Engineering, SRM Institute of Science and Technology, Ramapuram, Chennai, India.

Abstract
The Blood Bank MERN (MongoDB, Express.js, React.js, Node.js) Stack Project is an innovative and user-friendly web application designed to facilitate the process of blood donation, request, and management. This platform aims to bridge the gap between blood donors and recipients, making the blood donation process more efficient and accessible. Users can register accounts as donors or recipients by providing their personal details, blood type, and contact information. The authentication system ensures secure access to user accounts and prevents unauthorized access. Registered donors can view and update their profiles, including personal information, contact details, and blood donation history. Donors can schedule appointments for blood donation, and the platform will notify them of upcoming appointments. Recipients in need of blood can create donation requests, specifying the required blood type and quantity. The platform will notify eligible donors based on the requested blood type and location. The system maintains a real-time inventory of available blood units based on donor contributions. Donors' blood types are matched with recipients' requirements to facilitate quick and efficient blood allocation.

Keywords: Blood Bank, Mern Stack, Web Application, Blood donation, Donation request, Management, Blood donors, Blood type, Contact information, Authentication system, Profile update, Blood donation history, Appointment scheduling, Notification, Donation request,Blood quantity,Real-Time inventory,Eligible donors,Location,Blood units,Blood Allocation.

I. INTRODUCTION

In today's fast-paced world, access to timely and safe blood donations is a matter of life and death. The availability of blood can make a significant difference in emergencies, medical treatments, and surgeries. However, the process of connecting blood donors with recipients and effectively managing blood inventory has often been a challenge. To address this critical need, we present the "Blood Bank MERN Stack Project" – an innovative web application designed to revolutionize the way blood donation and management are handled.

Our project harnesses the power of the MERN (MongoDB, Express.js, React.js, Node.js) stack, combining modern technologies to create an efficient, user-friendly, and responsive platform. The goal is to bridge the gap between blood donors, recipients, and administrators, enabling seamless communication, timely donations, and effective inventory management.

Throughout this paper, we will explore the intricacies of Red Bank's development, from the initial idea and design concepts to the challenges faced during implementation. Moreover, we will discuss how the MERN stack played a pivotal role in shaping Red Bank into a feature-rich, user-friendly web application

that meets the ever-evolving needs of today's tech-savvy society. As we unravel the various aspects of this project, we aim to shed light on the potential and versatility of the MERN stack in modern web development.

Fig. 1. Blood Donation Camps being organized.

II. LITERATURE SURVEY

To identify instances of HIV transmission by antibody-negative donations (Ward et. al., 1988) investigate 13 persons seropositive for HIV who had received blood from 7 donors who were screened as negative for HIV antibody at the time of donation.

These donors had apparently been infected only recently, and so were negative at the time of blood donation according to available antibody tests. (Healy, 2000) study of blood collection regimes in Europe. When the Red Cross collects blood, donation is tied to religious activity and other volunteering, unlike state and blood bank systems. Methods and Results—(Ascherio et. al., 2001) study blood donations, which effectively reduce body iron stores, in relation to the risk of CHD among participants . Although the number of lifetime blood donations was strongly associated with lower plasma ferritin levels in a subsample, the blood donation was not associated with risk of myocardial infarction or fatal CHD. (Lyon et. al., 2005) study sonographic measurement of the inferior vena cava as a marker of blood loss. Persons who were younger than 18 years, who declined to participate or who did not meet blood center criteria for blood donation were excluded. The mean IVCi before blood donation was 13.3 mm (95% CI, 11.3-15.3 mm), but after blood donation was 8.13 mm (95% CI, 6.7-9.6 mm). (Godin et. al., 2008) examine the impact of completing a questionnaire about blood donation on subsequent donation behavior among a large sample of experienced blood donors. MAIN OUTCOME MEASURES Number of registrations at blood drives and number of successful blood donations were assessed using objective records both 6 months and 12 months later. (Hewitt et. al., 2014) report the prevalence of HEV RNA in blood donations, the transmission of the virus through a range of blood components, and describe the resulting morbidity in the recipients. The 79 donations had been used to prepare 129 blood components, 62 of which had been transfused before identification of the infected donation. From June 2012 through September 2014 (Moritz et. al., 2016) perform arrayed fluorescence immunoassays (AFIAs) for B. microti antibodies and real-time polymerase-chain-reaction (PCR) assays for B. microti DNA on blood-donation samples obtained in Connecticut, Massachusetts, Minnesota, and Wisconsin. Of 89,153 blood-donation samples tested, 335 (0.38%) were confirmed to be positive, of which 67 (20%) were PCR-positive; 9 samples were antibody-negative (i.e., 1 antibody-negative sample per 9906 screened samples), representing 13% of all PCR-positive samples. Other influential work includes (Popovsky et. al., 1995), (Ling et. al., 2000), (Eder et. al., 2008).

III. PROBLEM STATEMENT

The challenge is to develop a MERN (MongoDB, Express.js, React.js, Node.js) Stack web application that effectively connects blood donors, recipients, and administrators, revolutionizing the way blood donation and management are handled. The application should address the following problems:

Inefficient Matching Process:Currently, the process of matching donors with recipients is manual and time-consuming.Donors and recipients lack a platform to connect quickly and efficiently, leading to delays in acquiring necessary blood.

Limited Accessibility to Information:Donors and recipients lack a centralized platform to access information about blood availability, donation history, and upcoming appointments.

This leads to uncertainty and challenges in coordinating donation efforts and meeting urgent blood requirements.

Lack of Real-Time Inventory Tracking: Blood banks struggle with tracking available blood units in real-time, leading to overstocking or wastage of blood.An efficient system to monitor blood inventory and expiration dates is needed to optimize blood utilization.

IV. EXISTING SYSTEM

In existing there is no proper care about the people who donate blood to patients. In case if the donor has or had any medical problem and comes toward to donate blood to the patient then it may lead to threat. Hence medical history of donor should be updated.

Medical histories would be like:

- A person who have anemia should not donate blood.
- Donor who having diseases that are transmissible through blood are not request to donate blood.
- People who are unweighted for height from their height should not donate blood.
- pregnant women or recent child birth women should not donate blood.

Thus the above following reason are not updated in existing system. This type of information are not provided in existing system this may lead to dead in person. The donor and patient's body condition will not match at all the time .here it contain two aspects volunteer's location the distance between the user location and volunteers.

V. PROPOSED SYSTEM

To address the limitations of the current system, we propose the development of an integrated blood donation and management system. The proposed Blood Donation Website is designed to provide an efficient and user-friendly platform for connecting donors to healthcare professionals. This system offers three main features, each serving a distinct role.

1. Donor interface:

The blood donation system encompasses a range of essential features, including user registration and authentication via database for secure access. It captures comprehensive donor information, such as names, contact details, and specific blood types. Users can submit blood donation requests, fostering efficient donor-to-recipient matching. Donors benefit from a personalized dashboard offering insights into their donation history, while a user-friendly blood type selection interface simplifies the donation process. Donation history and records are meticulously maintained, allowing donors to monitor their contributions.

The system generates analytical reports and visualizations for insights into blood type distribution and donor impact. Additionally, it facilitates the registration and communication of blood donation organizations. Donors can plan their contributions through a donation routes system, and a user logout feature ensures secure session termination. Verification via email enhances trust and security, and notifications keep users informed about donation events, blood type matches, and contribution updates.

2. Admin Interface:

Upon logging in, the admin is presented with a comprehensive dashboard offering an overview of the system's operations. The admin can access and manage a list of registered blood donation organizations, facilitating effective collaboration, and communication. Additionally, they have access to a detailed donor list, which includes personal information and blood type, aiding in donor management and communication. Admins can monitor donations made through both organizational and hospital routes separately, ensuring efficient oversight of blood donation activities. To maintain accuracy, a donation verification feature allows the admin to validate donations made through organizations or hospitals. Furthermore, communication tools are in place to facilitate essential announcements, updates, and coordination with organizations, donors, and hospitals for blood donation events.

3. Hospital Dashboard:

The hospital-focused features in the system encompass a dedicated dashboard that offers a snapshot of blood donation activities, including the total collected units, pending requests, and recent donations. Hospitals can efficiently register donors and collect blood while maintaining detailed donation records for transparency. Real-time availability of different blood types aids inventory management, and hospitals can handle donation requests from consumers and organizations, accepting or rejecting them based on availability and medical criteria.Hospitals also ensure the safety and quality of donated blood through testing. The system verifies donor authenticity, enhancing the integrity and security of the blood donation process.

4. Organisation Interface:

The Organization Route of the Blood Bank App empowers organizations to efficiently manage blood donation activities. This includes a dedicated dashboard for monitoring donations and requests, donor registration, comprehensive donation records, real-time blood type availability tracking, and secure communication with donors. Ensuring blood safety through testing, donor authentication, and efficient inventory management, the route also provides access to insightful reporting and ensures compliance with relevant regulations for safe and transparent blood collection.

VI. METHODOLOGY

This paper represents a blood donation management system using modern technologies with a step-by-step methodology as discussed below:-

1. Concept & Design:

The increasing popularity of the React framework has led to faster, more dynamic, responsive, and user-friendly front-end development. However, many websites continue to rely on outdated technologies, which poses a significant obstacle for a critical blood management system that requires swift blood transfusion.

This paper introduces a comprehensive blood management system, built using the MERN stack, with dynamic API support.

2. Stakeholders of the application:

Users (Donors): Individuals interested in donating blood. New users must complete the registration process by providing an email address and password for authentication. Once registered, they will receive an email to update their profile, which is a prerequisite for being considered as potential blood donors. The admin will review and verify their information before adding them to the donor database along with their respective blood types. Returning users can simply log in using their registered email and easily select the nearest blood donation event to schedule their donation, making the process convenient and free of paperwork.

Users (Patients): Individuals requiring blood in emergency situations. Patients also have the option to log in or sign up, following the same steps as the donor users. Upon logging in, they can access the blood request page within the application. On this page, they are required to enter their blood type and location. Upon clicking the search button, a list of hospitals or other users with matching blood types that are available will be displayed. Patients can then contact these individuals or facilities to arrange for blood transfusions. Additionally, if needed, they can reach out to us for assistance in the delivery process.

Hospitals: Any healthcare facilities can complete the registration process by providing accurate information, and once verified, they become registered users. In emergency situations, they can reach out to other hospitals or individual users to request blood. If a registered hospital has compatible blood in stock, they will be displayed on blood bank, making their availability visible to others in need.

Blood Camps: Any blood donation event or camp has the option to register with us by providing accurate details, and upon successful verification, they are added to the registered list. When users search for nearby blood camps on Blood Bank, the registered camps are displayed as available options for them to choose from.

Administrator: The admin is responsible for overseeing and managing every aspect of this app, including all its departments and layers. The admin has the authority to control, create, update, delete, and verify user, hospital, and blood camp records as necessary.

All these distinct modules are interconnected as React components, which are in turn linked to Redux, a state management tool. Redux serves as a centralized store that connects the entire application. Some components can modify the state within this store, while others can access the state of various components, allowing for the seamless sharing of data across different parts of the application.

API requests are managed by the Express server, which is built using Node JS. Database connectivity is established through MongoDB using Express, and all NoSQL queries are executed and returned to the client in JSON format. React smoothly renders this data. The JSON format is also utilized for handling search algorithms related to blood type compatibility and HTTP request queries for hospitals or blood camps stored in the user's state.

Express is also employed for session management and cookie handling. Axios and HTTP requests are utilized to store all the data in the database. This data can be further utilized for medical and research

purposes related to blood. End-users of registered hospitals and donors are provided with email, phone call, and location services.

Implementation & Method:

The paper provides a comprehensive overview of the web application development process, delineating the various phases, including front-end (client-side) development, back-end (server-side) development, and ultimately, ultimately runs on local host:3000.

Front-End or Client-Side Development:

React JS is heavily employed for crafting the front-end, coupled with CSS and some HTML-5. The React component tool is utilized to create a variety of custom components such as InventoryModel.js, server.js, Consumer.js, App.js, Packagelock.json and others, which are interconnected to ensure a seamless user experience. CSS and JavaScript play a crucial role in enhancing the app's responsiveness on various device sizes.

To add special effects, buttons, forms, cards, and more, Material-UI and React Bootstrap are integrated. React Router Dom is used to establish different routes and links, providing a swift and seamless transition between routes, akin to a native app experience in the browser without any jarring blank page transitions. For data connectivity within distinct React components, Redux Centralized store is implemented. Redux offers a dispatcher that triggers actions in the store to update the state, ensuring consistent data throughout the entire application. Axios is utilized on the client side to make API requests.

Back-End or Server-Side Development:

The backend is constructed using Express in conjunction with Node. It involves the creation of a RESTful API that supports GET, POST, DELETE, and UPDATE routes through Express. This API is responsible for handling client-initiated HTTP requests for data transactions with the database. To manage sessions, cookies, and password encryption (salting and hashing), Passport and npm packages are employed. Session management is achieved through token serialization and de-serialization. Diverse algorithms are employed to respond to various queries, with JavaScript in Express serving this purpose. Additionally, Express is connected to Python to provide data analysis and reports for further research and medical purposes. All back-end code is written in JavaScript and Express to handle precise API requests and address warnings associated with deprecated npm packages.

MongoDB is chosen as Blood Bank’s database for several reasons, such as its flexibility, dynamic nature, and user-friendly development environment. MongoDB Atlas is used for deploying and scaling the database in the cloud. It offers a free option (community server only) with multi-cloud data distribution across 75+ cloud regions, ensuring security for sensitive data, and is designed for developer productivity and optimal performance. The database is divided into four collections: hospitals, blood camps, users, and articles. Each collection serves a specific purpose, containing data and functions according to the app's requirements.

The hospital collection provides a list of registered hospitals along with their details and available blood types, which can be accessed by users searching for blood on the app. The blood camps collection contains details about registered blood donation camps, including location and scheduling information for donors.

The users collection includes a list of all registered users, complete with their details, so that individuals in emergencies can contact them. Lastly, the articles collection contains a list of articles related to blood donation and blood-related topics for general reference. Data is primarily stored and transported in a NoSQL JSON format between the app and MongoDB Atlas, with Express serving as the platform for this data exchange.

VII. RESULTS

1. Login*:*

The login page for a blood bank should be a user-friendly and secure gateway to the system. It typically includes options for email and password login, with the possibility of using OAuth for added convenience. It should also feature password recovery and reset options. The page must be designed with clear instructions, responsive design, and robust security features, including encryption and strong password requirements. Privacy policies, consent agreements, and access controls for different user types should be in place. Multi-Factor Authentication (MFA) can provide an extra layer of security. Ensuring compliance with data protection regulations, accessibility, and compatibility with various web browsers is essential. Frequent testing and user feedback help maintain and improve the login experience**.**

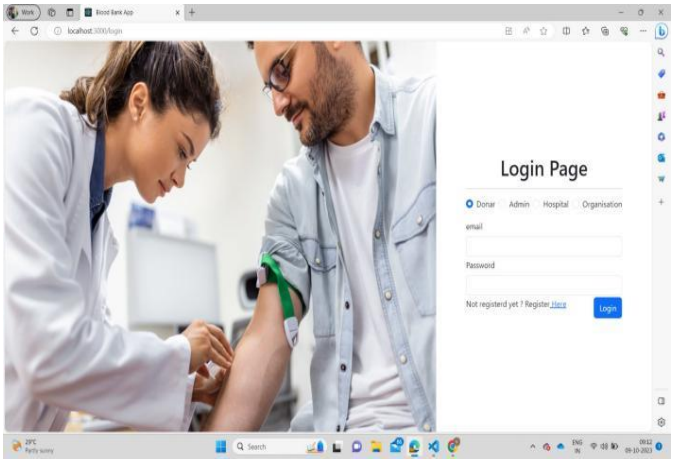

Fig. 4. Login Page

2. Register:

A registration page in a blood bank app collects user details like name, email, and address, along with creating a secure password. Users select their role (e.g., donor, patient) and agree to terms. Email verification is crucial. After registration, users may provide additional details, including their blood type and contact preferences. Security measures and communication preferences should also be considered.

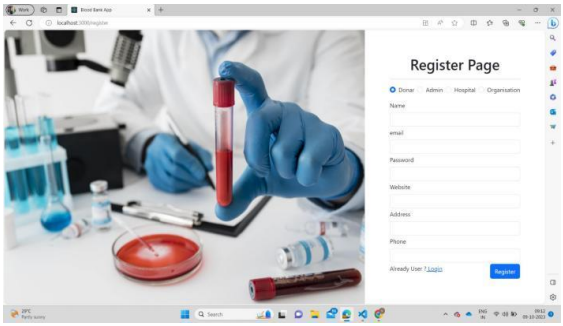

Fig. 5. Registration Page

3. Admin Dashboard:

1. **Admin Welcome Dashboard:**
   Upon logging in, the admin is greeted with a dashboard providing an overview of the system.
2. **Organization List:**
3. Admin can access a list of registered blood donation organizations, including their names and contact information. This helps in managing and collaborating with these organizations effectively.
4. **Donor List:**
   The admin has access to a comprehensive list of registered donors, containing their personal information, contact details, and blood type. This list assists in donor management and communication.
5. **Hospital List:**
   This feature allows the admin to view a list of hospitals or healthcare facilities that are associated with the blood donation process. Admin can see the hospitals where users have donated blood through the hospital route.
6. **Organization Donations:**
   Admin can access a list of blood donations made through the organization route, allowing them to monitor and manage the donations made via affiliated organizations.
7. **Hospital Donations:**
   Admin can view a separate list of blood donations made through the hospital route, helping them keep track of blood donation activities in healthcare settings.
8. **Donation Verification:**
   Admin can verify and validate the authenticity of donations made through organizations or hospitals to ensure transparency and accuracy in the records.
9. **Communication Tools:**
   Implement communication tools to allow the admin to contact organizations, donors, and hospitals for important announcements, updates, or coordination of blood donation events

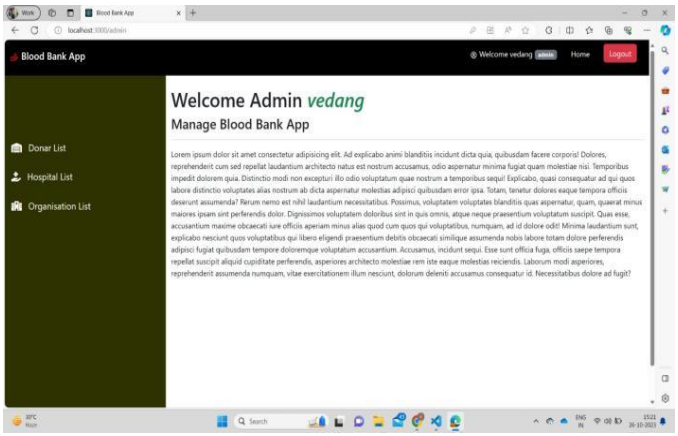

Fig. 5. Admin Dashboard

4. Donor Dashboard:

1. **User Registration and Authentication:**
   Allow users to register and authenticate themselves using their email addresses. This ensures that only authenticated donors can access the application.
2. **Donor Information Management:**

Capture and store detailed information about blood donors, including their name, contact information, and blood type (e.g., B+, AB+, AB-, O+).

3. **Blood Donation Request:**
   Enable users to submit requests for specific blood types they require, ensuring a seamless donor-to-recipient matching process.
4. **Donor Dashboard:**
   Provide donors with a personalized dashboard that offers at-a-glance analytics about their donation history, such as the number of donations, types of blood donated, and recipient organizations.
5. **Blood Type Selection Card:**
   Implement a user-friendly interface for donors to select the blood type they want to donate, making the donation process easy and intuitive.
6. **Donation History and Records:**
   Maintain a comprehensive donation history for each donor, allowing them to track their previous donations and the organizations they donated to.
7. **Analytics and Reports:**
   Generate analytical reports and visualizations to provide insights into the distribution of different blood types and the impact of donor contributions.
8. **Organization Management:**
   Facilitate the management of blood donation organizations or centers, allowing them to register, verify, and communicate with donors effectively.
9. **Donation Routes:**
   Implement a system to manage donation routes, which can include details about upcoming donation events, locations, and schedules, making it easier for donors to plan their contributions.
10. **User Logout:**
    Include a logout button to ensure user sessions can be securely terminated, protecting their personal information.
11. **Donation Verification:**
    Implement a process to verify the authenticity of donors through their email addresses, ensuring a higher level of trust and security in the system.
12. **Notifications and Alerts:**
    Send notifications and alerts to donors regarding upcoming donation events, matching blood type requests, and updates on their contributions.

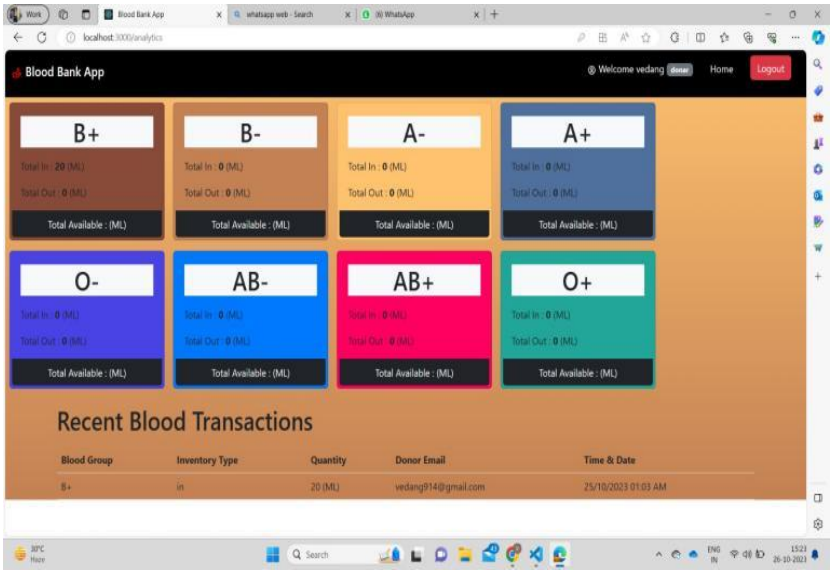

Fig. 6. Donor Dashboard

5. Hospital Dashboard:

Create a dedicated dashboard for hospitals that provides a snapshot of their blood donation activities, including the total units of blood collected, pending requests, and recent donations.

Blood Collection and Donor Registration:

Hospitals can register donors and collect blood from them using a user-friendly interface that records donor information and the type of blood donated.

Donation Records:

Maintain a comprehensive record of blood donations made at the hospital, including donor details, date of donation, and blood type, for transparency and traceability.

Blood Type Availability:

Display the availability of different blood types in real-time to help hospitals manage their inventory efficiently and respond to urgent requests.

Donation Requests:

Hospitals can receive and manage blood donation requests from consumers and organizations, with the ability to accept or reject requests based on availability and medical criteria.

Communication with Donors:

Enable hospitals to communicate with donors regarding appointment schedules, reminders, and post-donation follow-ups.

Blood Testing and Safety:

Hospitals can perform necessary tests and ensure the safety and quality of donated blood before it is used for medical purposes.

Donor Authentication:

Verify the authenticity of donors to maintain the integrity and security of the blood donation process.

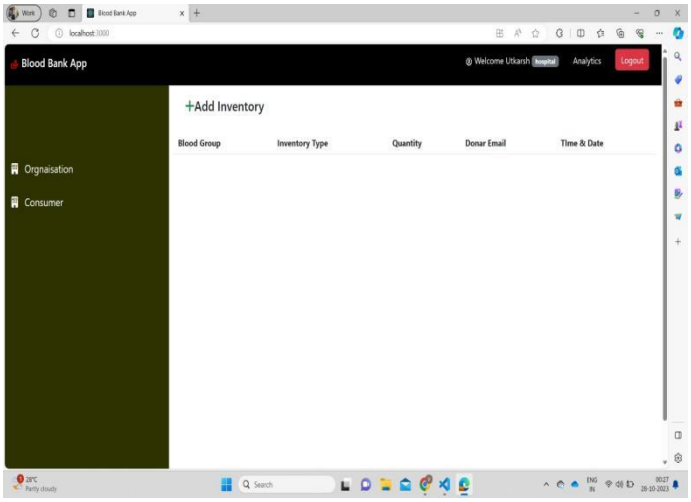

Fig. 7. Agent Dashboard

VIII. FUTURE WORK

In terms of future work for blood bank systems, there are several areas that can be explored for further enhancement and development:

1. **Advanced Matching Algorithms:** Implement more advanced blood type matching algorithms to ensure precise compatibility between donors and recipients, thus reducing the risk of transfusion-related complications.
2. **Machine Learning and Predictive Analysis**:Utilize machine learning and data analytics to predict blood demand, optimize inventory management, and identify trends in blood donation patterns.
3. **Block-chain Technology:**Consider adopting block-chain technology to improve the traceability and security of blood donation and transfusion processes, ensuring the integrity of the supply chain.
4. **Mobile Applications:** Develop dedicated mobile applications for donors, patients, and hospitals to streamline the donation process, making it even more user-friendly and convenient.
5. **Telemedicine Integration:** Integrate telemedicine capabilities for remote consultations and medical assessments related to blood donation, particularly during the donor screening process.
6. **Remote Monitoring and IoT:**Implement IoT devices for remote monitoring of blood storage conditions and real-time alerts for any deviations, thereby enhancing the safety and quality of stored blood.
7. **Artificial Intelligence for Data Analysis:**Employ AI for in-depth analysis of blood-related data, which can contribute to early detection of diseases and efficient blood allocation.
8. **Global Blood Bank Networks:**Establish international networks of blood banks for seamless cross-border blood sharing during emergencies and shortages.
9. **Regulatory Compliance:**Ensure continued compliance with evolving healthcare regulations and data protection laws, such as HIPAA and GDPR.
10. **Public Awareness Campaigns:** Develop and execute public awareness campaigns and educational initiatives to promote regular blood donation and emphasize its critical role in saving lives.
11. **Integration with Wearable Devices:** Explore integration with wearable devices to encourage donors to participate and receive real-time updates on their health and blood donation history.
12. **Biometric Authentication**: Enhance security by implementing biometric authentication methods, such as fingerprint or facial recognition, for donor and patient identification.

13. **Collaboration with Healthcare Institutions:**Strengthen collaboration with healthcare institutions to improve the coordination of blood donation efforts and ensure that hospitals receive the required blood products promptly.

As technology and healthcare practices continue to evolve, the blood bank system can adapt and evolve to meet the changing needs of donors, recipients, and healthcare providers while maintaining the highest standards of safety and efficiency.

IX. CONCLUSION

In a comprehensive conclusion, blood bank systems stand as a critical cornerstone of healthcare infrastructure, steadfastly supporting the mission to save lives. These systems have traversed a remarkable journey, evolving into sophisticated, user-centric platforms that empower donors, patients, and healthcare professionals alike.

Through robust technology integration, blood banks have become more efficient and accessible, ensuring the prompt and safe supply of blood for patients in need. The marriage of cutting-edge search algorithms and data analytics promises a future of even more efficient and effective matching and inventory management. Enhanced security measures and block-chain technology offer increased transparency and trust throughout the blood donation and transfusion processes.

As we look ahead, the possibilities for blood bank systems are boundless. Mobile applications, telemedicine, and remote monitoring have the potential to revolutionize blood donation and storage, making the process more convenient and secure. Artificial intelligence and wearable devices offer opportunities for early disease detection and personalized health insights. Collaborative global networks can ensure that no patient goes without life-saving blood in times of crisis, transcending borders and saving lives worldwide.

Moreover, the continued dedication to regulatory compliance and public awareness campaigns ensures that the blood bank systems of tomorrow will maintain the highest standards of safety, ethics, and community engagement.

In essence, blood bank systems are not just a technological marvel; they are a testament to our collective commitment to the sanctity of life. They are the bridge that connects the generosity of donors with the urgent needs of patients, and they exemplify the remarkable potential of technology to make a profound and positive impact on public health. As we advance into the future, the journey of blood bank systems promises to be one of continuous evolution, innovation, and, above all, the unwavering mission to save lives.

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