

**Blood Donation Management System
for Ziyarat Al-Arabaeen:
A User-Friendly App.**

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Abstract:

A user-friendly Windows application known as “the Blood Donation Management System” was created using C# and SQL Server. The goal of this application is to handle donor information and blood inventory effectively. It provides a complete solution for blood banks and donation facilities to organize their processes and guarantee a steady stream of blood donation activities that could be utilized during the Arbaeen pilgrimage. By encouraging the crowds to donate blood, so that the blood banks may have sufficient amounts of different blood types. Also, in the case of a crisis, there will be an instant transfusion of blood if needed. The application's core feature include a blood inventory management that enables the blood bank authorized personnel to keep track of the availability of various blood types, while the application gives an accurate report of the blood stock. It offers up to date data on blood types quantities and expiration dates, ensuring that the blood supply is continuously kept at the best possible state for blood storage. The donor data management makes it possible to capture and maintain crucial donor information, including age, the time since the previous donation or surgery and donor’s contact information in case of lack of certain blood type, the donors may be contacted to donate one more time. This information are essential for preserving a large pool of candidate donors and guaranteeing a secure process of blood transfusions. Also the application contains user authentication to assure secure management of donors private information and preventing blood supplies from being drawn to black market. Information concerning donors and blood inventories are kept private and accurate due to the access control mechanism. On the home interface, the application facilitate navigation through the application’s modules using dashboard display.

Keywords: Blood donation, Management system, User-friendly App., Blood bank, Donor data, Donor engagement, Blood transfusion, Zeyart AL-Arbaeen.

1. Introduction

Healthcare facilities must manage blood donations and inventories in order to maintain a steady supply of blood for transfusions. It is essential to provide strong solutions that streamline the donor data management process and guarantee efficient inventory control given the improvements in technology and the rising demand for effective blood bank systems. By utilizing Visual Studio C# and SQL Server to develop and construct a blood donor data management system with group-based donation tracking and inventory control, this project seeks to overcome these difficulties [1].

Blood banks are essential to the healthcare system because they make it easier to collect, test, store, and distribute blood and its constituent parts. To guarantee the availability of suitable blood units when required, precise and effective monitoring of donor data and blood inventory is essential [2]. Additionally, it's crucial to have a proper donation interval for the blood donors' health and wellbeing. Therefore, it is essential to create a complete system that integrates inventory control, group-based monitoring, and donor information management [3].

Because of its flexibility and considerable efficiency, Visual Studio C# was preferred as the programming language to create interfaces for the application. The IDE provides a varied range of tools and frameworks that make it feasible to implement to build user-friendly interfaces for the application [4]. Also choosing SQL server as database management system based on its reliability of managing large-scale

databases and provide up to date centralized support for the blood and donor's data [5].

Creating this application to achieve an effective inventory control system based on blood types, inflict a minimum donation interval of six months, and construct a blood donor management system that allows for managing the donor's information. In the blood stock identifying the blood type will give precise report of the amounts of each blood type in the inventory[6].

The paper will provide a system architecture that trial the difficulties facing blood donation process, the rules, and the present blood bank systems. Utilizing well managed and good database management system for effective data storage and retrieval [7].

The application's ability to reliably store and retrieve donor data, enforce the donation interval limit, and maintain accurate inventory levels will all be tested using a variety of use cases. The system's performance will be assessed based on its capacity to manage multiple requests at once, maintain ideal response times, and guarantee data integrity [8].

By offering a complete blood donor data management solution, the study's results are anticipated to help blood banks enhance their systems [9]. Inventory control, group-based donation tracking, and efficient and dependable donor data storage will all be made possible by the combination of Visual Studio C# and SQL Server. The system that has been created will ultimately improve the effectiveness of blood donation procedures, streamline the administration of blood

inventories, and facilitate the prompt availability of suitable blood units for transfusion purposes [10].

2-Benefits of this study

For healthcare organizations as well as those engaged in the blood donation processes, the creation, and deployment of the blood donor data management system, combining group-based donation monitoring and inventory control, would result in considerable benefits. The initiative aims to overcome current blood bank system difficulties and provides the following advantages [11]:

1-Enhanced Efficiency in Donor Data Management:

The system's user-friendly interface will ease procedures like registration, appointment scheduling, and monitoring contribution history while streamlining the maintenance of donor information. Healthcare workers will have more time to concentrate on offering high-quality treatment and services by minimizing manual paperwork and administrative responsibilities.

2-Improved Donor Engagement and Participation:

Active donor involvement and participation in blood donation activities will be encouraged by the user-friendly system interface. Donors will have access to a practical platform where they can update their contact information, make appointments, and get alerts about new contribution possibilities. A greater sense of engagement and commitment will be fostered by improved communication between blood banks and donors.

3-Accurate Tracking of Group-Based Blood Donations:

The system will accurately record blood donations depending on the blood group of the donor by including group-based donation tracking. Having a minimum 6-month gap between donations can benefit donors' health and wellbeing and limit excessive blood loss. This function will help to keep a steady and dependable supply of blood units for transfusion needs.

4-Efficient Inventory Control and Blood Stock Management:

The inventory control module will make it possible to handle blood supply effectively. Real-time updates and precise inventory levels will be provided via automated deductions from the stock depending on the blood type indicated before each donation. The danger of shortages or wastage will be reduced thanks to this optimization, which will also promote the prompt availability of appropriate blood units for transfusion needs.

5-Enhanced Data Integrity and Security:

In order to guarantee the quality and consistency of donor information and inventory records, the project will put in place strong data integrity procedures. The system will safeguard confidential donor information by using cutting-edge security techniques including access limits and encryption. Data backups and recovery tools will also provide protection against data loss or corruption.

6-Contribution to Healthcare Services and Patient Care:

The newly created system for managing blood donor data will make a big difference in how well healthcare services are provided. It will help medical practitioners make wise judgments about managing blood inventory by giving blood banks an effective and dependable tool for operations. This will guarantee that adequate blood units are available for transfusion when necessary, improving patient care outcomes and helping to save lives.

Overall, this study results will be highly advantageous to hospitals, blood banks, donors, and patients. The project will encourage an atmosphere of enhanced healthcare service delivery and better patient care by streamlining donor data administration, assuring accurate monitoring of blood donations, improving inventory control, strengthening data security, and encouraging efficient blood bank operations.

3-Study Objectives and Problem Statement

Here, we discuss the study's goals and the issues with the current blood bank systems that were found. The following goals are the focus of the study:

1-Develop a User-Friendly Blood Donor Data Management System:

The main goal is to provide an intuitive and user-friendly interface that makes it simple for donors to sign up, change their contact information, schedule donations, and view their gift history. The method aims to promote engaged, active donor participation.

2-Implement Group-Based Donation Tracking:

The project will include tools for tracking blood donations depending on the blood type of the donor. In order to protect the health and wellbeing of donors, it will impose a minimum 6-month gap between donations. To prevent donations before the required amount of time has passed, exact records of donation dates and amounts will be kept.

3-Ensure Efficient Inventory Control:

for efficient management of blood supply it is crucial to create inventory control. Based on the blood type of each donation, the system will immediately update the inventory, providing precise and real-time tracking of the blood supply.

4-Ensure Data Integrity and Security:

To guarantee the constancy and accuracy of donor information and inventory data, it is important to utilize used authentication. The application will provide data integration, backup and recovery procedures to prevent data loss or corruption.

5-Conduct Comprehensive Testing and Performance Evaluation:

The application's functionality, reliability, and practicality must be tested regressively. By testing a number of use cases, including donor registration, inventory control, and data retrieval. The application's ability to manage many requests simultaneously, retain ideal response times, and assure data integrity under many load levels will be evaluated in terms of performance.

6-Contribute to the Improvement of Blood Bank Systems:

The goal of the application is to improve blood bank operations by offering a comprehensive solution for donor data management and inventory control. The application aims to increase efficacy, simplify procedures, and assure the rapid availability of suitable blood units for transfusion needs.

The existing applications handling blood donation process have several malfunctions that our application is trying to resolve:

1-Inefficient Donor Data Management: Traditional paper-based and manual donor data management procedures take a lot of time, are prone to mistakes, and are inefficient, which makes it difficult to

keep a donor database that is both structured and current.

2-Lack of Group-Based Donation Tracking: It is challenging to manage blood inventory among several blood groups since many existing systems lack group-based donor monitoring, which can cause imbalances and possible shortages.

3-Inaccurate Monitoring of Donation Intervals: The quality of given blood units is compromised by the current systems' frequent inaccuracies in monitoring and enforcing minimum donation intervals, endangering the health of donors.

4-Inefficient Inventory Control: Blood shortages or surplus inventory can be caused by manual blood unit and stock level tracking, which raises expenses and compromises patient care.

A comprehensive blood donor data management system that incorporates group-based donation monitoring and effective inventory control is needed to address these issues. The project intends to increase the overall efficiency and effectiveness of blood bank operations by achieving these research objectives.

4. Methodology:

4.1. System Design: Overview and Database Structure

In order to effectively store and manage the data, a thorough database design is created during the system design phase [12]. The data model, which functions as a database design diagram and documents and illustrates the fundamental structure of the database, is a crucial part of this design. The Figure (1) gives a general overview of the system, including its architecture and user interfaces.

The system architecture is created to guarantee the seamless integration of diverse components, facilitating efficient processing and smooth data flow.

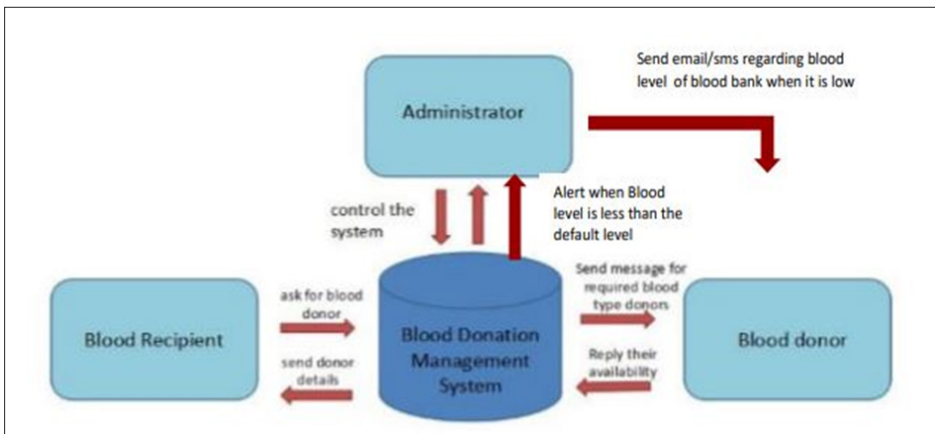


Figure (1) Overall System Architecture

4.2. Design and Implementation: User Interfaces

The user interfaces of the program are created to offer a fluid user experience and effective communication with the system. Below is a list of the key user interface modules:

1-Entry Interface:

Users are shown the entrance interface when the application is launched. Users are prompted to enter their login and password on this screen to authenticate. When the submitted credentials are successfully verified, the system allows access to the main program interface as shown in Figure (2)



Figure (2) Login Interface

2. Main Interface: Navigation and Functionality

All other interfaces in the program may be navigated through the main interface, which acts as the application's core hub. It offers users a tailored experience by displaying their authority, name, and

profile image. The main interface has seven buttons, each of which represents a different function, plus an exit button to end the program:

1. New Donor: registration process of new donors is achieved with this interface, giving essential information for the blood donation.
2. Old Donor: revealing the former donation history by the donor id and the possibility of new donation process, which is labeled "Old Donor."
3. Update Donor: any modification on donor data such as contact information and medical history.
4. Blood Stock: provide precise statics of the amount of each blood type in the inventory while withdrawal or donate.
5. Blood Product: details about various blood types and their expiry date that must be predetermined at the donation date.
6. Users: the users with permissions may access and manage user accounts.
7. Exit: this interface will terminate the application that may easily close it by pressing the exit button.

The main interface's simple design makes it easy to navigate and provides quick access to all features. The interface try for to increase user engagement and efficiency while engaging with the application.

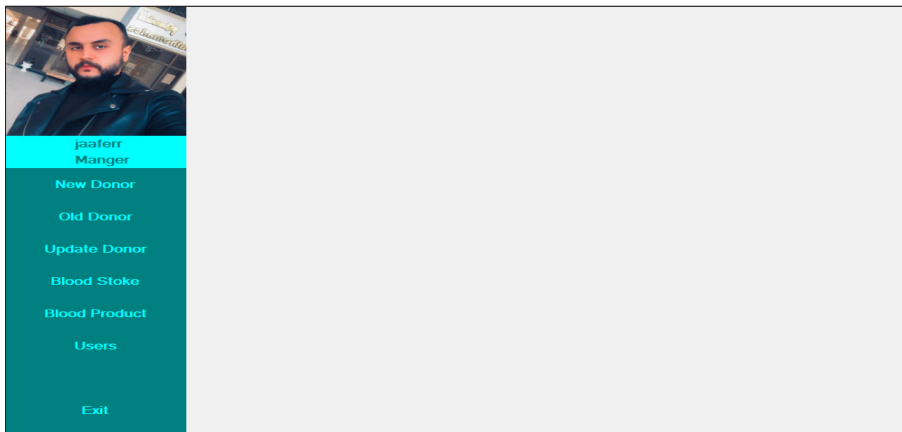


Figure (3) Home Interface

3. New Donor Interface: Adding and Managing Donor Data

A simple platform for registering comprehensive information of a new donor. Users can enter the donor's ID, name, age, blood type, donation date, medical background, number of donations, and contribution amount. The donor record in the database is securely populated with donor’s information, by clicking the save button, assuring thorough and well-organized record keeping.

The interface also features a handy delete option that may be used to get rid of a donor's data if necessary .With the aid of this capability, users may effectively manage the donor database and handle any necessary adjustments or changes.

The New Donor interface makes sure that the process of gathering and maintaining donor data is smooth and organized ,which improves the system's overall efficacy and structure.

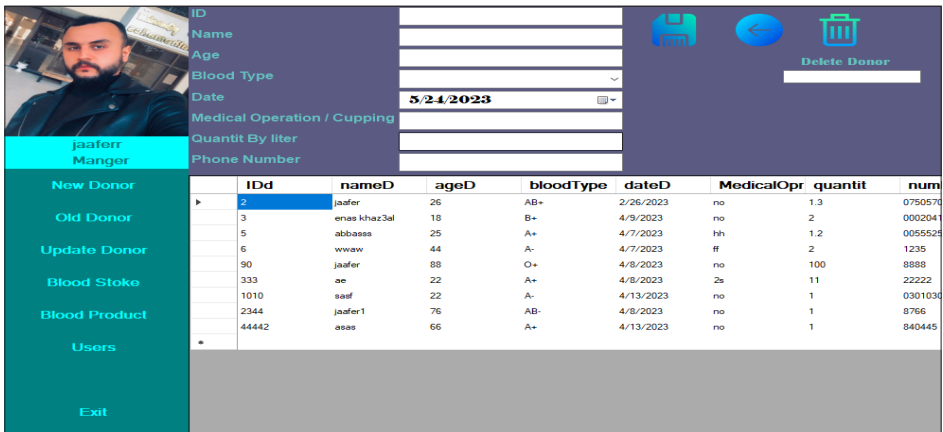


Figure (4) Home Interface

4. Old Donation Interface-6 :Month Donation Interval

Donors can make repeated donations through the gift interface as long as it has been longer than six months since their last gift .To maintain ethical and secure blood donation procedures ,the system strictly enforces this requirement.

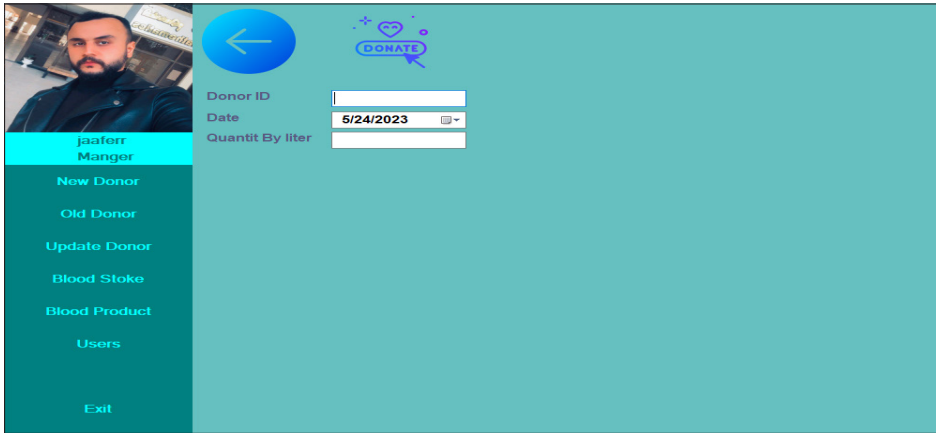


Figure (5) Old Donor Interface

1-Donor Data Modification Interface: Users can alter donor data using this interface in the event of mistakes or adjustments to certain criteria. Information about donors may be updated and edited by users with ease to maintain correctness and completeness, as shown in Figure (6).

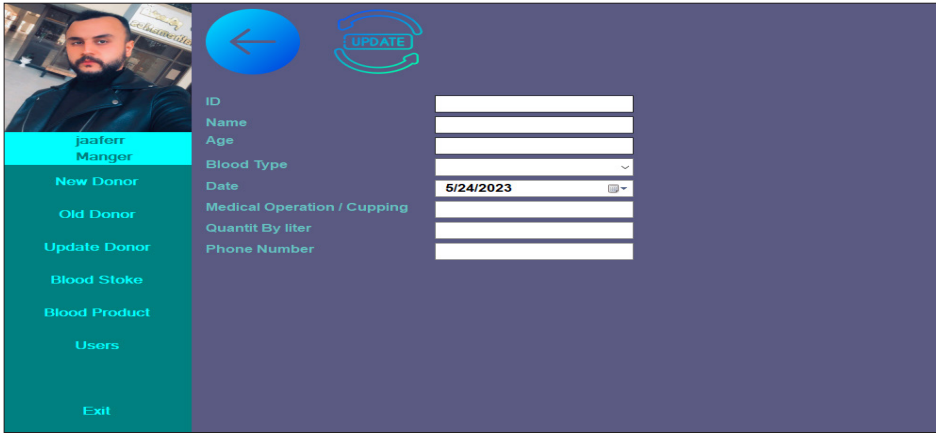


Figure (6) Update Donor Interface

2-Blood Stock Interface: The Blood Stock interface shows the quantities that are currently available for each blood type. It provides real-time data regarding blood stock levels by retrieving this information from the database's "BloodStorage" table, as shown in Figure (7).

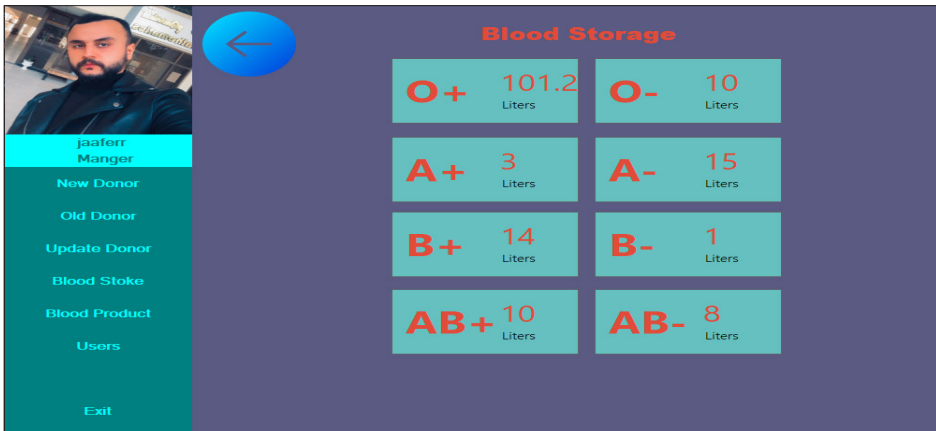


Figure (7) Blood Stoke Interface

3-Blood Withdrawal Interface: Users can extract blood from the storage using this interface. The technology automatically lowers the stock for that blood group in the storage when a set amount is taken out of a certain blood group, as shown in Figure (8).

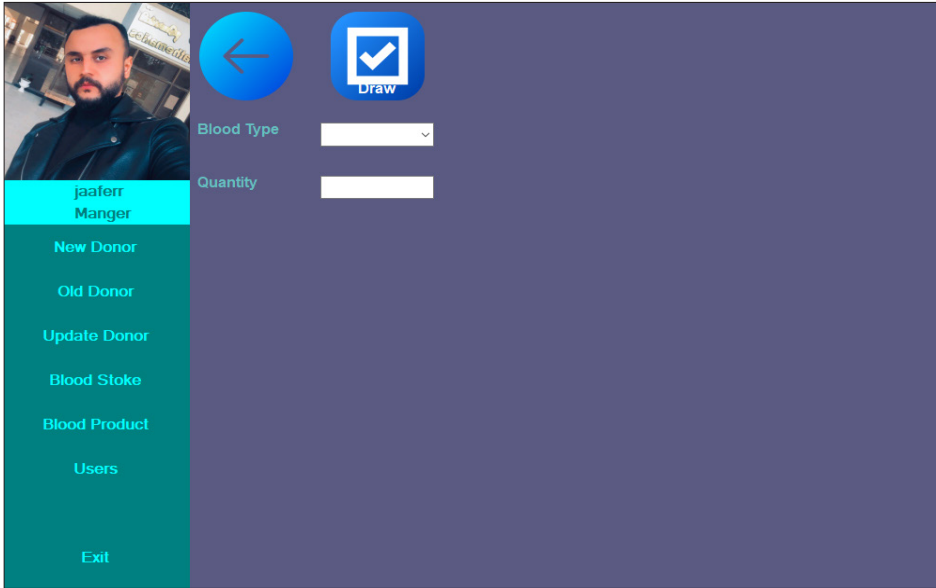


Figure (8) Blood Product Interface

4-User Management Interface: Users can add new users to the program using this interface so they can utilize the application. Users with the necessary authority can effectively manage user accounts, as shown in Figure (9).



Figure (9) Users Interface

5-User Data Update Sub-Window: Users can edit a user's data by clicking the update button in the user interface, which causes a pop-up sub-window to appear. The "users" table in the database is queried for user data using the distinct ID number, making user data maintenance simple, as shown in Figure (10).

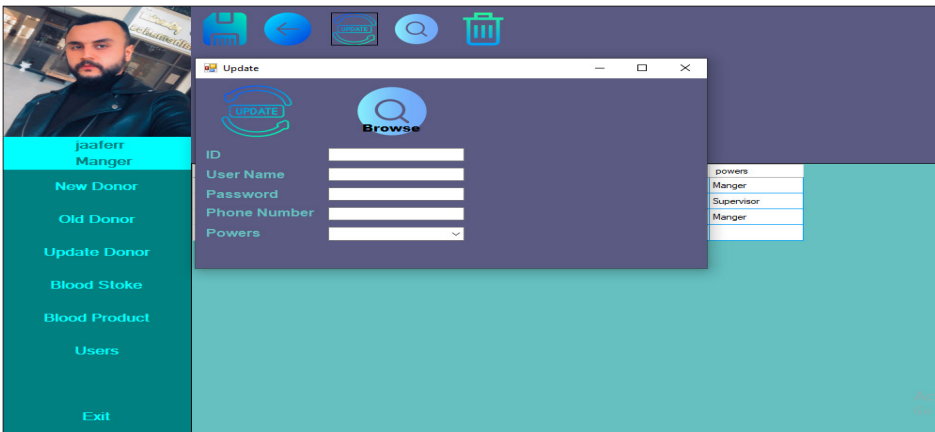


Figure (10) Update Users Interface

5-Conclusion and Future Work

The problems with the current blood bank systems were effectively resolved by the blood donor data management system. Donors may quickly register, change their information, and check their gift history with a user-friendly interface. The system imposed a minimum donation interval of 6 months for donor safety and used group-based donation tracking to assure precise blood supply levels. The inventory control module improved the management of the blood supply, increasing the effectiveness of blood bank operations. In future work the blood donor data management system has chances to be expanded and improved in a number of areas going future, including the advanced data analytics and machine learning approaches may be used to improve blood supply chain management by providing useful insights into donor behavior, blood consumption trends, and inventory predictions .Mobile application by creating a mobile application ,donors will be able to easily access the system ,get alerts ,and remain involved in the blood donation procedure .Integration with health systems connecting the system to electronic health records and hospital information systems can give users a complete picture of patient data and transfusion requirements .Security enhancements continuously improving security measures ,such as encryption and multi-factor authentication, will safeguard donor data and protect against unauthorized access. Collaboration and data sharing establishing collaborations with other blood banks and healthcare institutions for data sharing can improve blood supply availability and overall system efficiency .The blood donor data management system may continue to develop by taking these factors into account in further work ,giving blood banks and healthcare facilities even more effective and dependable support.

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