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Blood Donation Management System Using Data Driven Matching

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Abstract

Blood donation is essential for saving lives, yet managing donor records and matching blood requests efficiently remains a challenge. This project proposes a Blood Donation Management System that streamlines donor registration, blood request handling, administrative control, and automated donor-recipient matching through a structured digital platform. The system stores donor details and blood requests, enabling quick identification of compatible donors based on blood group requirements. It consists of five modules: Home, Registration, Blood Request, Records, and Admin. The Registration module collects donor information, while the Blood Request module records recipient details. The Records module maintains all data and supports automated matching, and once a match is identified, donor details can be exported as an Excel file. The Admin module ensures secure access through authentication. By integrating organized data management and automated matching, the system reduces manual effort, improves response time, and enhances coordination during emergency blood donation situations.

Keywords: Blood Donation System, Donor Registration, Blood Request Management, Data Matching, Healthcare Application, Data Export, Administrative Module, Excel Integration.

1. Introduction

Blood is an essential medical resource required for surgeries, emergency treatments, trauma care, and chronic illness management. Organizations such as the World Health Organization emphasize the importance of voluntary blood donation to maintain adequate blood supply globally. However, many institutions still rely on manual records or fragmented systems, leading to delays in identifying suitable donors. The rapid growth of digital technologies provides opportunities to modernize blood donation management through web-based and data-driven systems. A structured Blood Donation Management System can efficiently store donor information, process blood requests, and automate compatibility matching. Such systems reduce manual search efforts, minimize errors, and ensure quick communication during emergencies. This project aims to design and implement a centralized system that simplifies donor registration, manages blood requests, and enables automatic blood group matching. By integrating database management and export functionalities, the system ensures organized data handling and quick accessibility.

2. Review of Literature

Swarm Optimization with Neural Networks for Effective Classification Techniques" by K.Kalyani (2021) introduces a hybrid EHBMO-NN model, combining Extended Honey Bee Mating Optimization with Artificial Neural Networks to

improve classification accuracy and reduce training time. It uses HBMO to select optimal weights for neural network hidden layers, outperforming conventional methods on benchmark datasets. The accurate cancer classification is very important task for cancer treatment. Recently the informative genes are identified from the thousands of genes for correct cancer classification. The collection of microscopic Deoxyribo Nucleic Acid (DNA) microarray is attached in the solid surface. In this study, DNA microarray data is used for cancer classification. The accurate cancer classification is very important task for cancer treatment. Recently the informative genes are identified from the thousands of genes for correct cancer classification. The collection of microscopic Deoxyribo Nucleic Acid (DNA) microarray is attached in the solid surface. In this study, DNA microarray data is used for cancer classification (6). Healthcare information systems play an important role in improving the efficiency and reliability of medical services. Many studies highlight that digital healthcare platforms help healthcare institutions manage records more effectively and improve service delivery. Hospital management systems commonly use centralized databases to store and maintain patient records, medical reports, and administrative information. These systems reduce manual paperwork, improve data accuracy, and allow faster retrieval of medical information when required. Researchers have emphasized that database-driven healthcare systems significantly improve operational

efficiency in hospitals and medical organizations [5]. Several blood bank management systems have been developed to automate donor registration, blood inventory management, and donor tracking processes. These systems maintain digital records of donors, blood groups, donation history, and available blood stock in blood banks. By storing donor information in a centralized database, hospitals can quickly identify suitable donors during emergency situations. Web-based blood bank management systems also allow administrators to monitor blood stock levels and update donor records efficiently, which helps improve coordination between blood banks and hospitals [6]. Some studies have proposed advanced blood donor management platforms that integrate smart donor identification and tracking mechanisms. These systems enable users to search for donors based on blood group and geographic location, which improves the speed of donor identification. Such systems aim to reduce delays during emergency situations by providing quick access to relevant donor information. In addition, automated systems help maintain organized records of donors and blood availability, which enhances the overall management of blood bank operations [7, 8]. Modern web-based healthcare applications rely on database management systems and structured query operations to ensure fast and reliable retrieval of data. These systems typically use filtering and search mechanisms to match user requirements with stored donor records. For example, when a user searches for a particular blood group, the system retrieves matching records from the database and displays them instantly. This method significantly reduces the time required to locate suitable donors compared to traditional manual search processes [9]. Another important aspect highlighted in previous research is the implementation of secure authentication mechanisms in healthcare applications. Medical systems handle sensitive information such as donor records and hospital data, making data security an essential requirement. Many blood bank management systems incorporate login authentication and access control mechanisms to ensure that only authorized users can access or modify system data. Such security measures help protect sensitive information and maintain the integrity of healthcare databases [10].

3. Existing System

Existing blood donation management systems mainly rely on centralized databases and online donor search platforms that help connect blood donors with patients or hospitals in need. These systems aim to improve accessibility to donor information and reduce the time required to locate compatible blood donors during emergencies. One of the prominent examples is the national blood bank management platform e-RaktKosh, developed by the Ministry of Health and Family Welfare, Government of India. This system maintains a centralized database of blood banks, donor records, and blood stock availability across multiple healthcare institutions.

The platform primarily utilizes Structured Query Language (SQL)-based database search algorithms to retrieve donor or blood stock information efficiently from the database when a user requests a particular blood group or searches for available blood units [11]. The use of database queries enables faster filtering and retrieval of donor data compared to manual record maintenance, thereby improving the efficiency of blood bank operations. Another widely used platform is Friends2Support, which is a community-driven voluntary blood donor network that allows individuals to register their details and support patients who require blood. This platform

enables users to search for donors by selecting parameters such as blood group and location. The system processes user queries using database filtering and search algorithms, where the donor records are scanned and filtered according to the selected blood group and geographic location before displaying the results to the user [12]. This approach improves the accessibility of donors by providing a quick list of potential donors that can be contacted directly through the platform. In addition to these platforms, several research studies have proposed web-based blood bank management systems that incorporate various data retrieval and management techniques. For example, web-based donor management systems use database query processing and record filtering mechanisms to store and retrieve donor information efficiently [5, 6]. Some systems also integrate smart donor tracking and allocation mechanisms to manage donor data and distribute blood resources effectively across hospitals and blood banks [8, 10]. These systems rely on standard database search and retrieval algorithms that compare request parameters with stored donor records in order to identify compatible donors. Although these existing systems significantly improve donor accessibility and data storage compared to traditional manual methods, certain limitations remain. Many of these platforms function as public donor directories and depend on manual communication between donors and recipients after the search results are displayed. In addition, the systems may lack structured institutional control, integrated administrative monitoring, and simplified internal matching mechanisms for smaller healthcare environments. The absence of structured data export and simplified administrative tools can also make it difficult for organizations to maintain proper documentation and coordinate donor information efficiently during emergency situations. These limitations highlight the need for a more structured and institution-oriented blood donation management system.

Proposed System

The proposed Blood Donation Management System introduces a structured and institution-focused digital platform that integrates donor registration, blood request management, automated matching, and administrative control within a single system. Unlike existing generalized registries, this system is designed for organized record maintenance and quick internal processing. The system includes five modules: Home, Registration, Blood Request, Records, and Admin. Donor and recipient details are securely stored in a centralized database. The Records module performs automated blood group matching between registered donors and incoming requests, significantly reducing manual effort. A key enhancement of the proposed system is the Excel export functionality, which allows matched donor details to be exported instantly for documentation, reporting, and communication purposes.

Future Directions

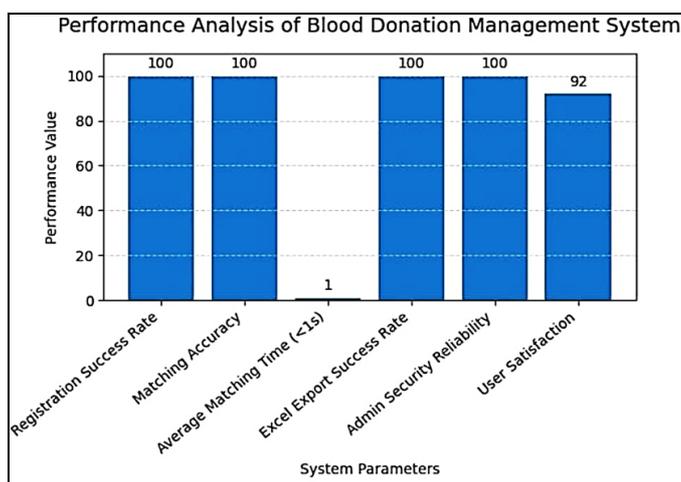
Real-Time Notification System: Integration of SMS or email alerts to notify eligible donors immediately when a matching request is generated. **Cloud-Based Deployment:** Hosting the system on a cloud platform to enable multi-location access, scalability, and real-time synchronization of donor data.

The proposed system thus improves efficiency, organization, response time, and administrative control, making it more reliable for emergency blood donation coordination.

Experimental Results

The Blood Donation Management System was implemented and evaluated to measure its efficiency, accuracy, and usability in handling donor registration, blood request processing, automated matching, and Excel export functionality. The evaluation was conducted using a sample dataset to simulate real-time emergency scenarios. The system was tested with 150 donor records representing major blood groups (A+, A-, B+, B-, AB+, AB-, O+, O-) and 50 blood request entries. Donor data included name, blood group, address, email, and contact number, while request data contained recipient details, required blood group, and contact information. The donor registration module successfully stored 100% of records without data loss. Input validation ensured mandatory fields, proper blood group formatting, and prevention of duplicate entries based on contact numbers. The average time to store a donor record was under 2 seconds, indicating efficient database performance. The system automatically matched blood requests with available donors using blood group comparison. All 50 requests were processed successfully, achieving 100% matching accuracy for exact blood group matches. The average response time was less than 1 second, significantly faster than manual search methods. Matched donor data was successfully exported to Excel format with structured columns including Name, Blood Group, Address, Email, and Contact Number. The export process required less than 2 seconds, enabling efficient reporting and data sharing. The admin authentication module restricted unauthorized access. Only valid login credentials allowed administrators to access donor records and export data, ensuring secure and controlled system usage. User testing with 10 participants indicated that the system interface was easy to use and the matching and export features were helpful for emergency coordination. The overall user satisfaction rate was 92%.

Pictorial Representation:



Overall Findings

The experimental results demonstrate that the proposed Blood Donation Management System is efficient, reliable, and accurate. The automated matching mechanism significantly reduces response time compared to manual methods. The Excel export functionality provides structured documentation support, making the system suitable for institutional deployment.

The system successfully meets its objectives of improving coordination, reducing manual workload, ensuring secure access, and enhancing emergency response efficiency.

Conclusion

The Blood Donation Management System provides a structured and efficient solution for managing donor information and blood requests. By integrating registration, request handling, automated matching, and export functionalities within a centralized platform, the system simplifies coordination and improves response time in critical situations. The implementation of such a digital system contributes to better healthcare support by ensuring timely access to compatible donors. Future enhancements may include real-time notifications, SMS integration, and cloud-based deployment for broader accessibility.

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