INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD)
© 2026 IJNRD | Volume 11, Issue 5, May 2026 | ISSN: 2456-4184 | IJNRD.ORG

SMART BLOOD BANK MANAGEMENT SYSTEM WITH AI-BASED DEMAND PREDICTION

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Abstract- In today's healthcare environment, there is a significant increase in the need for blood in healthcare systems. This calls for the development of an efficient and intelligent blood bank management system. The existing blood bank management system may not be able to efficiently track blood, may lead to delay in accessing information, and may also lead to blood wastage due to inefficient tracking. To improve the existing system, this paper proposes a Smart Blood Bank Management System using AI-based demand prediction. Using this system, donors can be effectively managed, blood stocks efficiently managed and blood types rapidly searched through an online system.

I. INTRODUCTION

As blood is a vital element for use in surgeries, treatments of emergencies and for a number of medical conditions; blood banks have traditionally kept track of their inventory using written records or through the use of very basic electronic methods. Managing donor information and blood stocks can be done more efficiently. However, the existing blood bank management systems do not use intelligent technologies to forecast the blood demand for the future. This project aims to develop a Smart Blood Bank Management System using Artificial Intelligence for blood demand prediction.

A. Objective

Developing an intelligent blood bank administration system with demand forecasting using artificial intelligence is the primary goal of the proposed project. In the healthcare sector, this proposal will develop a web-based blood donor and blood inventory management solution that optimally maintains records and manages blood stock.

B. Motivation

This project aims to improve the manner in which blood is managed within the health care system. Traditional ways of managing blood donor records and inventory has resulted in a decrease in how quickly blood is able to be provided for emergencies. As well, tracking of blood inventory is inefficient, resulting in wasted donated units due to expiration.

II. PROJECT DESCRIPTION

An Artificial Intelligence-enhanced Smart Blood Bank System for Prediction of Blood Product Demand. An Effective and Efficient Blood Banking Solution. Also, it will allow users to search the quantities of blood currently available for transfusion as well as to enter new data and edit existing data related to donors and blood supply.

A. Project Scope and Objective

The scope of this project is to create a smart blood bank management system that can be implemented in hospitals and blood banks to manage the data related to blood in an efficient manner. The smart blood bank management system will be able to manage the data of the donors, manage the stock of the blood, and also provide easy access to the availability of the blood through the web interface of the system.

III. TECHNICAL SPECIFICATIONS

The proposed Smart Blood Bank Management System is developed by utilizing modern web development tools to ensure efficiency, reliability, and ease of use. The backend of the system is developed using Python with Django framework for handling data processing and storage. The frontend of the system is developed using HTML, CSS, and Bootstrap.

A. Core Libraries and Frameworks

There are various Python libraries and frameworks that are utilized for the implementation of various functionalities within the system.

- NumPy is utilized for the performance of various numerical calculations and handling the data for the prediction module.
- Pandas is utilized for the analysis and handling of the historical blood data.
- Django is utilized as a backend framework for handling the application logic and the processing of the data.
- Matplotlib is utilized for the creation of graphical representations for the AI-based demand prediction.

IV. PROPOSED METHODOLOGY

The proposed Smart Blood Bank Management System using AI for demand prediction is based on a structured approach for blood-related data management and prediction of blood demands. First of all, the blood-related data of donors and blood stock, i.e., blood groups and units of blood collected, is stored in a structured database. The system uses Django for blood-related data management, i.e., adding, updating, and retrieving blood-related data in an efficient manner.

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V. ARCHITECTURE DIAGRAM

The architecture of the proposed smart blood bank management system with AI-based demand prediction has been developed in a way that it can manage the data efficiently and make intelligent predictions about the data. The proposed smart blood bank management system has different components that work in an organized manner.

A. User interface

The backend process for the Smart Blood Bank Management System is carried out using the Django framework, which oversees the main logic for the system. When a user wants to carry out some functions, for example, entering information for blood donors or stocks, the backend processes the information accordingly and saves it in the database.

B. Database management

The database management for the Smart Blood Bank Management System is done using SQLite, where all the information related to the donors and the blood stocks is maintained in a structured form. The database maintains information related to blood groups, availability of blood units, and collection.

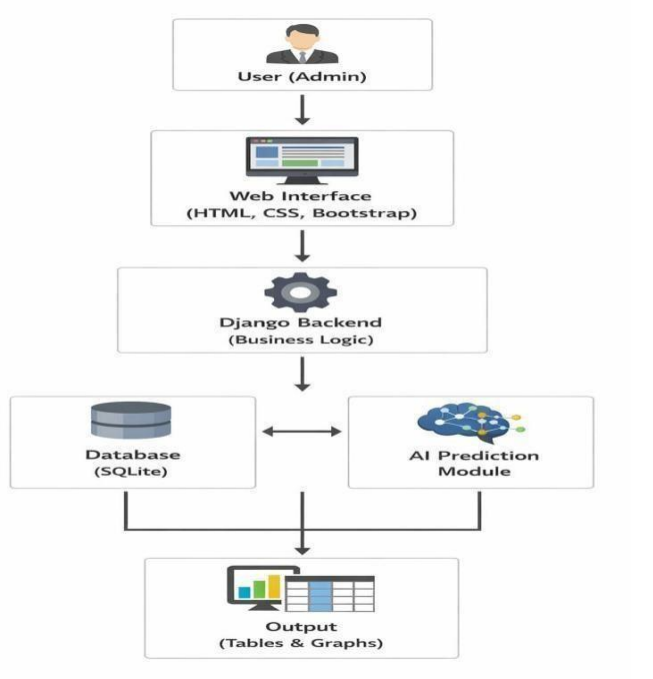

Figure 1 Architecture diagram

VI. INPUT DATA DESCRIPTION

The input data for the proposed Smart Blood Bank Management System would include the data related to the information of blood donors and blood stock. This may include details about blood groups and the stock available in terms of units and dates on which blood was collected. This data would be obtained through the interface provided with the proposed system and would be processed further for action. The data would be validated properly during the input phase to ensure accurate data is obtained for action. This data would be used for further analysis by the AIbased system for future requirements.

A. Data source

The input data is obtained from the donor data and blood stocks available in the system. The input data contains real-time data as well as historical data that is necessary for blood stock management.

B. Data Attributes

The dataset used for the Smart Blood Bank Management System has various key attributes that are necessary for the management of bloodrelated information. In addition, the donor information attribute, which includes the name and phone number of the donor, is necessary for the efficient management of the blood units and the prediction of blood requirements.

C. Data format

The data stored in the Smart Blood Bank Management System can only be categorized as positvely structured through the use of a relational database. In this instance, data is stored in a 2-dimensional or tabular format; where each instance of a particular entry is stored in a single row, each instance of an element of that entry is stored in an separate column.

D. Data validation

Data Validation for The Smart Blood Bank Management System ensures that any information entered into a database is correctly and completely validated before being allowed into the database. The system validates the information entered during the data inputprocess, for example, the blood groups, units, and dates.

VII. PSEUDOCODE AND IMPLEMENTATION

Pseudo code can be defined as a simple and structured manner for describing a system, while implementation can be defined as the actual development of a system through the use of programming languages and other related tools.

A. System Initialization

System initialization is done, and all the necessary components are connected

B. Data Input

Data input for the donor information, blood stocks,

blood group, units, and date of collection, etc., is done through the interface.

C. Data Validation

Data validation is done for the accuracy and correctness of the input data.

D. Search Operation

Searching for the availability of blood stocks based on the blood group is done.

E. Expiry Monitoring

Monitoring of blood stocks approaching expiry for minimizing blood wastage is done.

VIII. OUTPUT ANALYSIS

Output Analysis refers to the evaluation and interpretation of the output produced by the system to assess the performance and effectiveness of the system.

A. Blood Stock Display

The system will display the blood stocks available for a particular blood group in a structured format by using a table.

B. Expiry Monitoring Output

The system will identify the blood units nearing their expiration dates and display them to the user to prevent blood wastage.

C. AI Prediction Results

The AI system will generate the predictions for the blood units required in the future by using the existing blood units.

IX. SCREENSHOTS AND GRAPHS

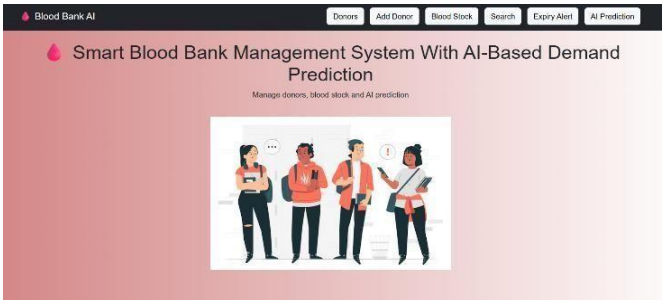

Fig 2: Home page

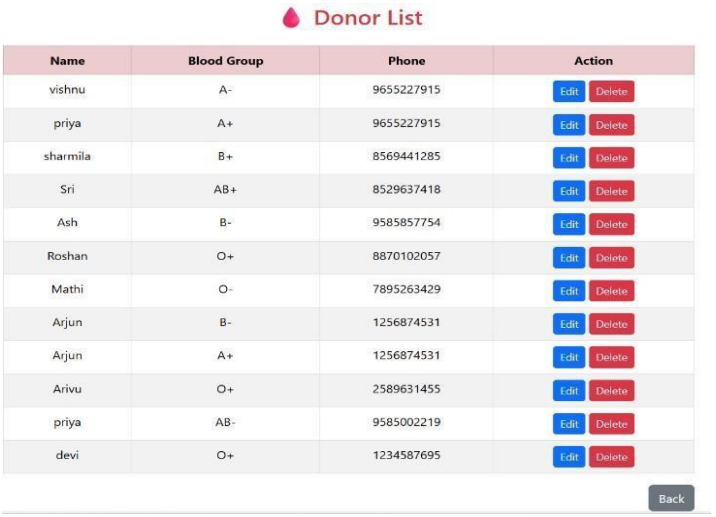

Fig 3: Donor list form

Fig 4: Search blood group

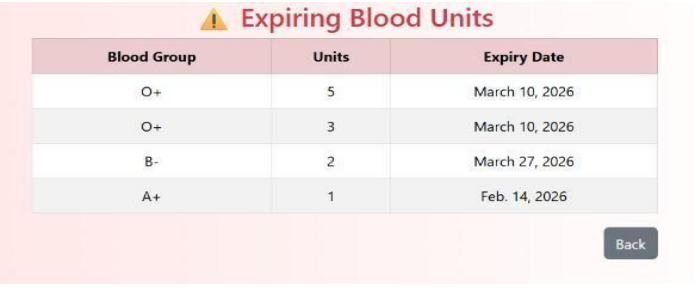

Fig 5: Expiring Units

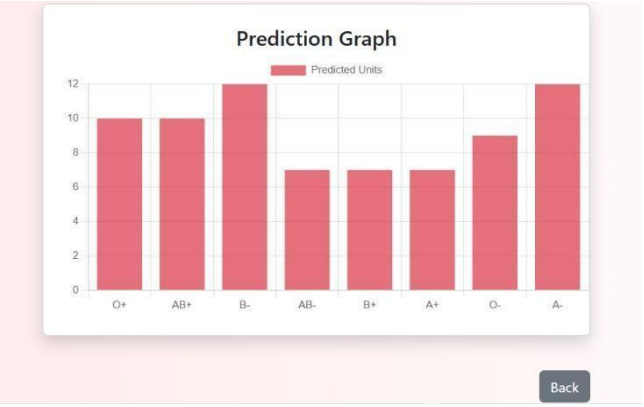

Fig 6: Prediction Graph

X. CONCLUSION

The proposed Smart Blood Bank Management System using AI-based demand prediction is an efficient tool for the management of blood bank activities. The system is successful in the management of donor information, blood stock management, and search using a user- friendly interface. The system is also helpful in the reduction of blood wastage by maintaining the blood stock levels and indicating the critical levels. The addition of AI-based prediction is an added advantage for the system for future use.

XI. REFERENCES

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