

# Online Blood Banking Management Solution Using Frame-Based Approach

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**Abstract**— Blood banking is the process of collecting, separating and warehousing blood. There are numerous file-based repositories of blood bank management that exist for storing data for blood bank ecosystem such as hospitals and centers. This functions for maintaining the information of donors, availability of blood, and transaction information. Currently, these systems are effort intensive, costly, and failed to achieve efficiency in terms of its filtering mechanism which makes repository penetrating faster and reliable. This paper introduces a new design for blood banking ecosystem with proper filtering solution using frame-based approach. The system has three major features: (1) blood camp setup module, (2) stocks management module which includes the blood donation and blood releasing, and (3) the filtering system module which shows the nearest blood camp with the available blood type based on the patients' needs. Also, with the use of frame-based approach as filtering method, the system is more efficient and reliable compared to other blood banking repository systems. The system's functionality was tested for its efficiency, usability, and reliability and the results are revealed in the survey. Conclusions and future work were also provided in this paper.

**Index Terms**— blood banking, filtering solution, repository, online, CMS.

## 1 INTRODUCTION

In the Philippines, people are challenged every year with the diseases that need blood transfusions [1]. Blood is used to treat different patients. Data from the Philippine Red Cross reveals that the country needs 118 blood units every hour, 2,832 units every day, and 1 million blood medical conditions such as anemia, cancer and blood disorders; those undergoing surgery (including cardiac surgery and emergency surgery); and those mothers that suffered blood loss after childbirth. units every year. Last year, the country was able to collect 771,000 blood units and for this year, 1 million blood units are targeted for collection [2]. Blood can be classified into four main types with negative and positive variations. There are also other relevant information needed to consider such as blood sugar content, antibodies, donors primary test results, and so on to match a donor to a recipient [3]. Hence, there is an absolute need for these data and information to be stored and maintained with high security and integrity. Blood bank storage and management involve keeping records of blood available as well as information regarding the donors of the blood and also hospitals and patients that are in need of the blood. Blood donation is a very delicate process and therefore, should be managed and controlled with high caution. The existing blood bank repository is file-based. All data and information regarding blood, donors, and recipients are kept in spreadsheets, papers, and files arranged in alphabetical or numeric order [4]. While this seems to be effective, this makes data and information retrieval difficult and time consuming. The process of searching for blood, donor, or recipient information is a tedious process considering also the urgency and constrains in resources. As the number of blood collection increases, a systematic handling of blood is a must. There is a huge challenge finding where people could find the needed blood. This problem is manifested in the way that requestors are reaching every blood bank through calls or by personally visit blood banks to check the availability of blood. Thus, the

process takes a lot of effort, money, and time in the search of blood for the purpose of saving lives. This paper discusses the design and development of an online application that will help not only the people who seek for blood but also the blood banks to automate the way they manage their repository. The target beneficiary of this application is all the Filipinos in the Philippines particularly those who are located in the National Capital Region. There is always undeniable possibility for blood banks to lack volume of some blood groups, leaving patients stranded; consequently, some lives have been lost this way.

### 1.1. Contribution of the Study

This research aims to provide possible solution to the existing problem faced by blood bank management of repository and donation camps. Specifically:

1. Design a blood banking management solution to handle all activities of blood bank.
2. Develop a CMS-based repository for controlling, updating and managing data and information online.
3. Use frame-based approach as filtering techniques faster searching and retrieval of the nearest blood camp.
4. Evaluate the system's performance through usability, reliability, and efficiency.

## 2 METHODOLOGY

To further understand and achieve the goal of the study, this section reviews the related literature that paved the way to the decisions and processes used in the current study.

### 2.1 Existing System

Kannan and his colleagues [5] wrote about blood bank management systems and they all agreed that bringing it into the digital world would make it easier for hospitals in managing the inventory of the availability of blood for patients, as well as for patients for the sole purpose of not wasting time, energy, and effort in going from one to another hospital in search for the blood type that they need [6].

Sulaiman, Abdul, and Yusri [7] proposed the development of a blood bank data management system as a solution to prevent near miss events and improve record retrieval. Their argument is that the computerization and fast retrieval of records will improve the efficiency of blood bank operations [8]. Pah and

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Said [9] also proposed the development of a management information system to manage blood bank based on information of donor, recipient and blood. Their system has three modules: the donor module, patient module and blood module [10]. However some crucial issues are left aside in this approach, for instance the person who is responsible for administration of the system. A solution to preventing missed events or blank records, improving record retrievals, and having a blood bank data management system are very important because simply these can and will improve the efficiency of blood bank operations.

## 2.2 Proposed System

Below is the design for the proposed system that can be a solution to the problems that blood banking management system faces today. In the paper written by Maheshwari (2016), it was stated that having a blood bank management information system has three beneficiaries: donors, seekers, and blood bank [11]. It benefits the donors because they can check their blood status through the blood bank management information system, the seekers will have extra ease with finding blood through the system and, and the blood bank will have less tedious works since the system is automated and does not require too much paper which is the cause of delay to the patients or seekers. The system will be an online-based Content Management System (CMS) with centralized repository. This means that it will have a single server to store all data and information and to accommodate different types of users all accessing the same information and a number varying functionalities. The CMS will address issues on administrative responsibilities since this eases management and controls activities through its user-friendly API. One of the important things that the existing blood bank management system lacks is the fast retrieval of information through speed searching and filtering of blood camp. This missing functionality will be addressed with the implementation of a frame-based approach. This approach allows the system to generate immediate frames of data for smooth and faster transaction. Also, providing important information about the availability of their required blood type, the blood center in which it is available and transaction information. Receptors can also communicate real time with donors and blood centers. In case of an unavailable type, the system will give the receptors the chance to post a general request that can be seen by anybody willing to be a donor. For the donors, they will have access to important information on blood donation process and requirements as well as the location of blood camps or blood donation campaigns. They can also be able to register as a regular donor. This provides a vital link that is lacking in the existing systems. On the blood bank side, they will have access to the donor information, recipient data and respond to various requests or make donation appointments. They can also create an event with donors and to organize blood donation campaigns or create an awareness and attract more donors. They can also be able to have a real-time access and update on their blood repository because of the CMS.

## 3 METHODOLOGY

### 3.1 Research Design

For the development of the system, the researcher used Scrum Methodology shown in Figure 1.



Fig. 1 Scrum Methodology

The proponents used Scrum methodology [12]. Scrum software development model begins with a brief planning, meeting and concludes with a final review. This methodology is used for fast development of application which includes a series of iterations to achieve the requirements of the system. There also sprint meetings every day, a short meeting, commonly 5 to 10 minutes, where the team could talk about the status of the project. Answering only three primary questions on “what did you accomplish yesterday?”, “What are your activities today” and “What are your plans for tomorrow?”. This software cycle will repeat until the development concludes. The proposed system will be online so the researchers used Laravel as the web-based framework and will be accessed on WWW platform through HTTP protocol. HTML5 and CSS were used to develop the user interface for the application while latest Xampp 7.1.33 version and composer were used to implement the backend functionalities. For the filtering function, the researchers used the location of the finder and all of the available camps. This will function well with the help of frame-based approach. The researcher used quantitative approach to evaluate system performance. In this case, evaluation sheet were distributed to the IT professionals and calculated the results.

### 3.2 The Developed System

The Online Blood Banking Management Solution using Frame-based Approach consists of the following main modules:

- Camp Management
- Event Management
- Donor Management
- Blood Repository Management
- Patient Management
- Camp Search Management
- Reports

Sample screenshots of the developed system were shown in figure 2-9 respectively.



Fig 2 Camp Management

Figure 2 shows the camp management module that is intended for the configuration of the camps in the system. This includes the creation, modification and disabling or enabling the camps.

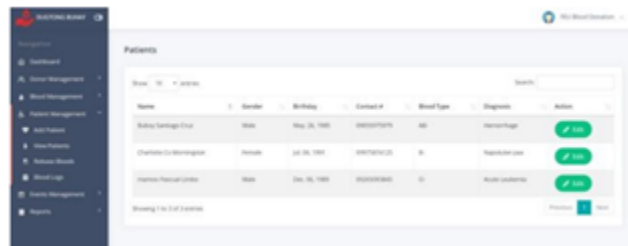


Fig 6 Patient Management

Figure 6 shows the patient management module that is intended for the patient management. This module will enable the camp to register patients that are requesting the blood bags.



Fig 3 Event Management

Figure 3 shows the event management module that is intended for the events or announcements. This module will enable the camp to create an event that will appear in the homepage of the system.

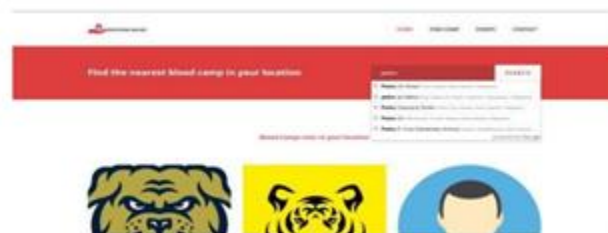


Fig 7 Camp Search Management

Figure 7 shows the camp search management module that is intended for the searching of the nearest blood camp location from the user.



Fig 4 Donor Management

Figure 4 shows the donor management module that is intended for the creation and modification of donors within the camp.



Fig 8 Reports

Figure 8 shows the blood releasing processing report, this includes the filtering and matching of the available blood stocks to the needed blood of the patient. The researchers used frame-based approach for the searching of camps. Frame-based approach is a filtering method that uses more than one constraints to achieved the desired result. In this filtering method, the system will look first at the blood inventory across all the blood camps and match it with the required blood [13]. It will have an initial result of the blood banks having the matched blood type, then it will compute using the API used selecting which blood bank is nearest to the location of the requestor. Given the screenshot, the researchers used blood type, the repository, blood bank, and the location as the constraints for this filtering method.

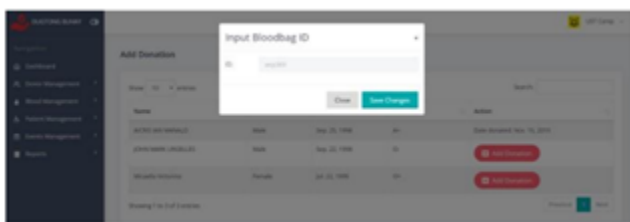


Fig 5 Blood Repository Management

Figure 5 shows the blood inventory management module. This module will enable the camp to add new blood donation by storing to the blood bag with its unique blood bag id.

## UPCOMING EVENTS



Fig 9 Sample Events Posted

Lastly, figure 9 shows the created events in the camp and displayed it in the event's page.

The population of the study was the college students from first year to fourth year level with Mathematics Education courses enrolled in Bachelor of Secondary Education program in the City College of Calamba. The researchers used stratified sampling technique and computed to have 158 students from a population of 255, however, the actual participants became 118 since questionnaires from some fourth year respondents were not retrieved because they graduated already, while some lower year levels transferred from another school.

#### 4 RESULTS AND DISCUSSIONS

This phase of the study set out to recognize the performance of the developed system by its usability, reliability and efficiency. To evaluate the overall functionality of the system, the evaluation form was distributed to different IT Professionals of FEU Institute of Technology. The results were tabulated and analyzed using statistical methods. To better understand the gathered results, discussions below are shown and elaborated through tables and further explanations.

TABLE 1  
ATTRIBUTES OF CLEVELAND DATASET

Respondents	Frequency	Percentage
IT Professors	7	100%
Technical Experts	3	100%

Table 1 shows the frequency distribution of respondents. There are two types of respondents these are the IT Professor from CCS Department and Technical Experts from the CSO Department of FEU Institute of Technology.

TABLE 2  
LIKERT SCALE

Scale	Range	Verbal Interpretation
5	4.51 – 5.00	Excellent
4	3.51 – 4.00	Very Good
3	2.51 – 3.50	Good
2	1.51 – 2.50	Fair
1	1.00 – 1.50	Poor

The table above is used to verbally interpret results from the respondent's evaluation.

TABLE 3  
OVERALL RESULTS

Factors	Mean	Interpretation
Usability	3.86	Very Good
Reliability	4.92	Excellent
Efficiency	4.47	Excellent
TOTAL	4.48	Very Good

Table 3 shows the actual results of tabulated data based from

the respondents. The following are revealed in the survey: for the usability performance factor, the mean response is 3.67; for the factor of reliability with the mean 4.92; for the efficiency, with the mean of 4.67, with the overall mean of 4.48 with verbal interpretation of Very Good.

Therefore, the developed system shows excellent performance in terms of reliability and efficiency while an improvement on factors for usability is necessary

#### 5 CONCLUSIONS AND FUTURE WORK

This sections concludes this study based on the gathered data from the accomplished evaluation. Each question from each category evaluates the system based on the study's objectives. According to the results and findings of this research study, the team was able to comply with the objectives written as contributions of the paper. Based on the results, usability having weighted mean of 3.83 was due to lack of mobile application. However, the system is reliable and efficient. The researchers recommend to explore and develop the system in other platforms like mobile application. Having mobile application will improve the usability of the system. Also, there are various additional features that can be added to the system. The filtering system can be improved by adding more variables to the filter. The integration of SMS notification can also be a feature for the system. It is when the donor's blood is received by a patient there will be a SMS notification like telling "Hey! Your blood saves a life."

#### 5 ACKNOWLEDGMENT

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