Blood Bank Information System Based on Cloud In Indonesia

**Muhammad Nur Sahid Ramadhan^{1*}, Arinda Amyus¹, Ahmad Nurul Fajar¹,
Sfenrianto Sfenrianto¹, Abiyyu Fawwaz Kanz¹, Moh Sukron Mufaqih¹**

¹Information Systems Management Department, BINUS Graduate Program – Master of Information Systems Management, Universitas Bina Nusantara, Jakarta, Indonesia

Abstract. In the health industry, the development of technology makes all of its related activities easier and faster. Cloud computing can facilitate controlled distribution of blood by using an information system. The problems that occurs in the distributions of blood at the hospitals in Indonesia are sometimes the distributions are not controlled, so the blood may run out of stock caused by inequality of blood needs, difficulty in finding blood donors, and don't have an integrated system. The purpose of this study is to propose a connecting system that integrates Indonesian society who can be personal donor to help blood supply availability of UTD PMI using BBIS (Blood Bank Management System) based on cloud computing. The research methodology is collecting data with a systematic literature review and referring to previous studies, related to the current conditions in Indonesia. The result in this study is to propose Blood Bank Information System (BBIS), featured of application, dashboard, module and network architecture.

1. Introduction

Blood bank in hospital has a very important role. Blood bank ensures that blood supply of every blood type available all the time in case it needed urgently. [1] explain the blood bank is the place where blood supply collected from blood donation event and stored properly. Generally, [2] also explain that blood bank system consists of an independent blood centre which is in charge in collecting, storing and distributing human blood. Indirectly, this has become an important matter to update blood supply and distribute the blood supply for those who need it. On this case, Indonesia has significant increase of population. This population surely has high life expectancy rate. On their daily activities, accident may happen, or surgery could have been performed. Because of that, ready or not, hospital must prepare for extra blood supply [3]. According to [4], blood bank or transfusion unit should be developed, tested, and evaluated on emergency situations, policies, processes and procedure to prevent, reduce, prepare, and response quickly during recovery from disasters and emergency situations itself, due to technology. Statistic shows that every two seconds, there are people who need blood transfusion [5]. In Indonesia, in case hospital were running out of blood supply, they will make a blood request to UTD PMI after the doctor approves it. As the procedure, UTD PMI receive their blood supply from personal donor whether it is from blood donation event or the personal donor voluntary who came to local or nearest UTD PMI.

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In all of these processes, the continuity of blood supply in the blood bank depends on three main actors. They are hospitals, UTD PMI, and personal donors. Unfortunately, in reality, there are still many cases about lack of blood supply or even their unavailability in various hospital in Indonesia. When the blood supply is low while condition is on the high demand, urgency of blood supply for patient is crucial. Delayed process could result death of patient.

Currently, the use of cloud computing has been increasing in various companies and fields. Cloud computing can be used as a place to manage data and application using a computer that has authorized access. [6] It refers to IT services by combining hardware and software based on computer demand (request information) on an internet network with a self-service mode where any devices are used.

2. Related Work

On [7] journal, it was described that the proposed blood bank system was connecting between blood bank and personal donor by sending a message to regular/permanent donor who has been registered before. On this journal [8] users can search donor by the nearest location from them by using GPS (Global Positioning System). After the information sent, the closest donor will get an alert for blood donor needs.

Blood bank android-based application on cloud computing has been done by the previous study [9]. Blood donor information and optimization management system also has been done by Priya et al [10]. The smartphone application is being developed to allow searching for voluntary donor nearby, followed by communication between donor especially on the emergency situations [11]. In this article, [12] Catassi and Petersen described computerized blood bank inventory. The purpose is to control the distribution of blood bank and hospital. It is possible to monitor daily blood status. Mittal and Snotra [13] on their research explain the availability of blood supply during emergency situations is highly important for patients in need. Blood donor centre exist to fulfil this need. But whether personal donor and medical facility, there is no available media to connect them directly. That is why personal donor and the medical facility should be connected. In the other case [14], Ali et al propose a blood bag system. It is a web-based system which connect with the central database to control all data from the blood bank and blood donation campaign. Basically, this system identifies donors, tests and stores blood bags, and deliver them to patients. Blood bag system supports donor and blood bank to help patients in needs of blood donation by centralized control system which can arrange all transfusion process. Every process recorded in the database. With huge data and information, Blood Bank Information System will be very useful that can be managed as decision making system [15].

3. Methodology

In this section, the authors collect data with a systematic literature review, also refer to previous studies, related to the current conditions in Indonesia. Several studies from UTD PMI and hospitals performed, especially in operational activities in blood banks and blood donors. By matching those previous studies, the authors are trying to connect them to the case in Indonesia, by adding features to get better result. Since everything are collected, the authors draw a conclusion which refers to the proposed application that will be described at fourth chapter.

4. Result and Discussion

In Indonesia, the connection between hospitals, UTD PMI, and the personal donor has not been developed yet. Hospital has their own blood bank facility to fulfil their operational needs. But when hospital running out of the specific type of blood, there are three options to get it. First, hospital can ask it from the patient's family member. Second, they can request from UTD PMI, and the third is from the personal donor. See the current system in figure 1. That's how requesting blood based on the procedure to UTD PMI. And for personal donor who wants to donate their blood, see the figure 2. The mechanism of blood supply now is depending on blood donation event by UTD PMI. On this situation, UTD PMI should always organize blood donation event to restock blood supply, so in case they face emergency situation, blood supply will be available. When specific blood type is needed, hospital should check blood supply first on their blood bank and then UTD PMI. This is inefficient because it takes more time when the patient is on critical condition and immediately need blood

supply from UTD PMI, but they have low or empty supply. The purpose of the system from this research is developing an application to integrate hospitals, UTD PMI, and personal donors in Indonesia. The application is using web-based and mobile application by using cloud computing technology. As you can see on figure 3 about general display of proposed application where hospitals system, UTD PMI system, and personal donor devices are connected by cloud computing system by using application called Blood Management Information System (BBIS).

Figure 1. Current system hospital to UTD PMI **Figure 2.** Current system blood donation for personal donor

4.1. Blood Bank Information System

This Blood Bank Information System (BBIS) is connecting hospitals, UTD PMI, and personal donor within one web-based and mobile application. Web service, database service, and transaction-based service are the ideal applications for cloud computing [16]. It is also can be easy to use whether using personal computer or portable devices. This application offers simplicity for hospitals on accessing and requesting blood supply to UTD PMI or directly to personal donor. It also equipped with other supporting function.

Figure 3. Proposed architecture

Figure 4. Function of blood bank information system

As you can see, BBIS not only the connector of the hospitals, UTD PMI, and personal donors to patient who need blood donation, but also can show the current blood supply. Therefore, it can be monitored before it runs out. When the hospital has authorization to request blood supply, it can arrange directly to order blood packs for blood supply, even though the blood supply has not yet

empty, to prevent or just to maintain stability of blood supply. On figure 4, you can see BBIS can be accessed using personal computer or portable devices (laptop, tablet, smartphone). It shows what function of BBIS has; hospital can monitor blood supply of UTD PMI and other hospital, hospital can make a blood supply request to UTD PMI or other hospital, direct message that involving the hospital, UTD PMI, and personal donor, notification to personal donor for blood donation event, all data recorded into cloud storage that can be easily accessed by hospital or UTD PMI (blood supply, medical history, donor history, and personal information of donor), push notification will show up when there is a donor request, selected donor will directly be guided by using tracking GPS to hospital or UTD PMI has requested before, UTD PMI or hospital can register new donor, record medical history and donor history of donor in one database and search nearby location of donor within maximum location range 10 km from hospital or UTD PMI. This application can be used by doctors, nurses, patients and personal donors themselves. This application is designed with three main dashboards, namely dashboards for hospitals, UTD PMI, and personal donors as you can see on figure 5 below. Based on the BBIS dashboard, each module has a function. This function is a feature of this BBIS. The module can be seen in figure 6.

Figure 5. BBIS dashboard

Figure 6. BBIS Module

4.2. Cloud computing infrastructure

Cloud computing is a model for enabling portable and convenient on-demand network access to a shared pool of configurable computing resources, such as network, server, storage, application, and services [17]. Cloud computing has various type of model. It can be Software as a Service (SaaS), Platform as a Service (PaaS) or Infrastructure as Service (IaaS). Model used on this research is IaaS. Developer of BBIS rent a computer as database storage and BBIS can make custom requirements such as upgrading or adding storage capacity, Random Access Memory (RAM) or even processor to increase response speed of the cloud computing. The benefit of using IaaS is the security of data on cloud computing, and then saving cost because no need to buy server or perform maintenance system. Cloud computing also accommodating data storage with large capacity, the system allocating resource can be managed easily and data or information can be provided easily to access on real time. IaaS also can be hosted for data storage. A virtual data stored can be found in the BBIS that can be accessed through a virtual machine and various integrated applications that can be accessed by both providers and users. Overall, it can be illustrated at figure 7. Each hospital, UTD PMI, and personal user connected through internet service to the cloud server.

This would help and increase effectiveness and efficiency of hospital or patient when blood donation is needed. They can directly check into BBIS and will get the information about blood supply they need and the nearest location they can get for the blood. The use of BBIS already answers the problem of blood supply availability on hospital blood bank. Hospital blood bank has the right access to UTD PMI blood supply and prevent condition where it runs out or even empty.

4.3. Comparison on current system and proposed system

The following table provide the comparison between current system and proposed system. Overall, current system still manually method and there is no interconnection using application based on web service or mobile service. This proposed system referring to digital transformation.

Table 1. Feature comparison between current system and proposed system

Feature	Current system	Proposed system
Inventory monitoring on blood bank among hospitals and UTD PMI using application		
Requesting blood application		
Chatting application		
Blood donation event info		
Notification when donor needed urgently using application		
Finding nearest donor on application		
Managing data medical history blood donor		
Registration of personal donor		
Tracking selected hospitals or UTD PMI using GPS		
Sharing database		
Web service and mobile service		
Database on cloud server		

5. Conclusion

The purpose of this research is proposing a connecting system that integrates Indonesian society who can be personal donor to keep blood supply availability of UTD PMI using BBIS (Blood Bank Management System) based on cloud computing. BBIS also can help a lot of people who need blood donor because it is easy for this application to know which people can be a donor without waiting whether a patient in an emergency situation or not. The proposed system for applying cloud computing is by using Infrastructure model as a Service (IaaS). IaaS is cloud computing which provides IT infrastructure such as data centre facility, storage, server, the grid for virtualized server, and networking component on the cloud system managed by third-party. It can also be upgraded such as improvement of storage capacity, amount of RAM, the processor or even the existing network. BBIS provide access

to information for every actor. Further research will apply BBIS based on cloud computing and evaluate its effectiveness.

6. References

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