# Design Model Share Blood Hospital Blood Bank and Blood Transfusion Unit, (Case Study: Aceh Province)

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**Abstract:** Healthy Indonesia Program became one of the programs in Nawa Cita Government of President Joko Widodo. One of the highlights to be improved in the program is the need for blood. The need for blood every year continues to grow, but every year the supply of blood is always reduced. In the province of Aceh lack of blood in hospitals has always been a problem for paramedics in taking medical action for patients who need blood when the action is taken. Implementation of e-government through the application of blood share will make it easier for hospitals to see the blood supply in UTD PMI and BDRS, and shorten hospital time to seek blood. In the application of blood share there is information on donor blood events and synchronization of volunteer donor data from UTD PMI and BDRS. The method used in this research is Design Science Research Methodology.

Key words: E-government, share blood, design science research methodology (DSRM).

## 1. Introduction

The need for blood every year continues to increase, by 2017 the needs of Indonesia's blood around 5.1 million pockets or 2% of the total population of Indonesia [1]. But the supply of blood components that can be met in 2017 only 4.1 million pockets. There are 1 million bags of blood that are less than the national blood requirement. In Thailand, the national blood center records their blood needs to reach 1,500 blood bags per day [2].

Government Hospital as well as Private Hospital every day need blood supply to perform medical action. However, the blood requirement is not available every day, this becomes an obstacle for the Hospital to perform medical action in the form of liver transplant surgery and heart surgery, accident cases, and leukemia patients [3], [4].

In Indonesia the party authorized to perform blood transfusion service has been regulated in the Regulation of the Minister of Health of the Republic of Indonesia No. 83 of 2014. They are the Blood Transfusion Unit (UTD), the Hospital Blood Bank (BDRS) and the Blood Transfusion Services Network. The UTD itself is only administered by the Government, Local Government, or PMI.

In Aceh Province, the party providing and managing blood for hospital needs is UTD PMI and BDRS. Government Hospital in Regency / City already have BDRS. But the BDRS has not been able to meet the needs of his blood. Every day the BDRS party lacks blood and asks to UTD PMI.

In Sri Lanka, when there is a shortage at the Hospital Blood Bank, they ask for a blood component, from the National Blood Center or from the main cluster center in the province. If the required blood is available,

the blood will be sent to the hospital's blood bank [5].

The absence of an application of blood supply information and blood demand has been one of the factors that slows the medical performance of medical treatment for patients who need blood [3], [4]. With the application of those who need blood can directly choose UTD PMI or BDRS who have blood stock and closest to them, then the absence of synchronization of donor data between UTD PMI and BDRS is also a problem, in recording the amount of donations that have been given by volunteer donors if they donate in different places.

## 2. Research Background

Healthy Indonesia Program became one of the programs in Nawa Cita Government of President Joko Widodo. Healthy Indonesia Program then became the main program of Health Development which then planned its achievement through Strategic Plan of Ministry of Health Year 2015-2019, then determined by Decree of Minister of Health R.I. Number HK.02.02 / Menkes / 52/2015 [6].

A safe and quality blood service is an integral part of reducing Maternal Mortality Rate (MMR). One of the causes of maternal death is bleeding. To prevent death, access to adequate blood services is required. This can be achieved if many volunteer donors routinely donate their blood, so the blood transfusion unit (UTD) and the Hospital Blood Bank (BDRS) can meet the blood needs of the hospital [7].

In Aceh efforts to make a good blood management application have been done by UTD PMI Banda Aceh. The application is used on mobile devices, and the application is only used for UTD PMI Banda Aceh and is not connected to BDRS. Then the existing applications are more directed to the application of blood information and the activities they do.

No	Topic	Author	Result
1	A standard compliant Blood Bank Management System with enforcing mechanism [8]	Amarjeet Singh Cheema, Siddharth Srivastava, P K Srivastava, Dr. B K Murthy	Discussed an architecture for a fault-tolerant deployment especially for rural and areas with sparse connectivity.
2	The Development Of Web-Based System For Blood Requisition Within Blood Supply Chain [2]	Wijai Boonyanusith, Phongchai Jittamai	the proposed web-based decision support system has an ability to fulfill blood at the faster pace compared to the current practice
3	Blood bank inventory management in India [9]	Harshal Lowalekar & N, Ravichandran	he demand supply gap in blood bank in India would be manageable only when effective and successful strategies are designed for blood donations
4	Design and Implementation of Automated Blood Bank Using Embedded Systems [10]	Bala SenthilMurugan L, Anitha Julian	Significant advantage is the fact that location details of prospective donors is taken into account by the algorithm
5	Effective Blood Bank Management Based On RFID in Real Time Systems [11]	Adarsh N, Arpitha J, Md. Danish Ali, Mahesh Charan N	Has reduced errors in blood transfusions and can see the stock of blood in real time

Research on blood bank has been done, following some research that has been done.

## 3. Methodology

## 3.1. Design Science Research Methdology (DSRM)

The methodology in this research is Design Science Research. This research method was originally proposed by [12] with the following research steps:



Fig. 1. Design science research methodology.

## 3.2. Research Stages

- 1) *Identification of problems*. In this section the problem to be studied in the research is identified first and then begin to collect data, literature, and interviews. From the results of data collection we will find what points will be discussed in the study.
- 2) *Set Goals for Solutions*. At this stage we must determine what solution is proposed in doing research on the problems found. The solution offered is Prototype Share Blood Application which will be tested at UTD PMI, BDRS, hospital and will be managed by Dinas Kesehatan Provinsi Aceh, Indonesia.
- 3) *Design and Development.* At this stage the researcher will determine the design and development solution based on what has been analyzed before. In this section we created a model of search, demand, blood distribution, management of blood donor events and the management of donor data.

# 4. Analysis and Design System

The following is the analysis and design of the system for the application of blood share of the Science Design Research methodology:

# 4.1. Identification of Problems

The current problem in blood management in Aceh Province is the absence of an information system on the availability of blood in UTD PMI and BDRS that can be seen by hospitals and communities. Then the absence of synchronization of donor data that has donated blood, and the absence of information donor blood event that is widespread and easily accessible by the community also be the cause of at least volunteer donors who participate in every blood donor event.

To explore these problems can be collected data, literature, and interviews with UTD PMI and BDRS related to information on blood availability, donor data that has donated blood in both places and blood donation events that will be conducted by UTD PMI and BDRS.

# 4.2. Set Goals for Solutions

The proposed solution to the above problem is to create one prototype of share blood application. In this application is planned to load the blood stock information system available at UTD PMI, BDRS, hospital. Then from this application the hospital who want to seek and ask for blood can directly choose the UTD PMI or BDRS nearby who have the blood stock they need.

This blood-searching system is very helpful to the parties in need, because it can save time to find the necessary blood needs. Then in the application of blood share there is also synchronization of data donors who have donated blood in UTD PMI or BDRS and blood donor event information to be held.

# 4.3. Design and Development

From the analysis of the above problems can be described the proposed use case diagram for the application of blood share is as follows:



Fig. 2. Use case diagram share blood.

Users who can access this application is divided into 5, namely General, Priority, Hospital, BDRS and UTD PMI. Here's the activity of each user of Use Case Diagram share blood system:

1) General user

Check the blood stok

Can see blood stock available in UTD PMI, BDRS and Hospital.

Car unit schedule

Can see the car unit schedule made UTD PMI.

Donor event

Can see event donors made by UTD PMI and BDRS.

List of donors volunteer

Family patients who need blood but in UTD PMI and BDRS are not available, then they can look for volunteer donors from the database available on the system, then take them to UTD PMI or BDRS to donate blood.

2) Priority user

Login

Login needs to be done by the priority user to view personal data related to blood donor.

Check the blood stok

Can see blood stock available in UTD PMI, BDRS and Hospital.

Car unit schedule

Can see the car unit schedule made UTD PMI.

Donor event

Can see event donors made by UTD PMI and BDRS.

List of donor volunteer

Families of patients who need blood but in UTD PMI and BDRS are not available, then they can look for volunteer donors from the database available on the system, then take them to UTD PMI or BDRS

to donate blood.

Data of donor priority

Data of donor priority include donation history, number of donations, date of return of donation, blood donor community.

Logout

User exits the system.

3) Hospital User

Login

Login needs to be done by the user hospital to update the blood stock and request blood.

Check the blood stok

Can see available blood stock in UTD PMI and BDRS.

Update check the blood stok

To update the availability of blood stock in the hospital.

Request blood

Hospitals can make requests for blood to the nearest UTD PMI or BDRS that have the required blood stock.

List of donor volunteer

The hospital needs blood but in UTD PMI and BDRS are not available, the patient's family can look up volunteer donors from the database available in the system and take it to UTD PMI or BDRS to donate blood.

Logout

The user exits the system.

4) BDRS user

Login

Login needs to be done by BDRS users to update the blood stock, request blood, receive blood request from the hospital, event donor updates, check of notification of blood stock, event donor update, donor volunteer list update, data update of donor priority.

Check the blood stok

Can see available blood stock at UTD PMI and Hospital.

Update the blood stock

Updating blood stocks in BDRS.

Request blood

BDRS can request blood to the nearest UTI PMI if blood in BDRS is lacking.

Provide of blood

Parties that supply blood to the hospital based on demand for blood from the hospital.

Check of notification of blood stok

Check the messages displayed by the system related to existing blood stock.

Donor event

Donor event is done by BDRS as well as gift sharing and awards for donors.

Update donor event

Event donor updates are conducted by UTD PMI as well as gift sharing and awards for donors.

List of donor volunteer

A list of volunteer donors who are willing to be called to donate blood when the blood requirement is not available.

Update list of donor volunteer

Update list of donor volunteers who are willing to be called to donate blood when the blood requirement is not available.

Data of donor priority

Data of donor priority include donation history, number of donations, date of return of donation, blood donor community.

Update data of donor priority

Update data of donor priority include donation history, donation amount, donation return date, blood donor community.

Logout.

Exit the system.

5) UTD PMI user

Login

Login needs to be done by user UTD PMI to update the blood stock, receive blood request, update the car unit schedule, update donor event, update list of donor volunteer, update data of donor priority. *Check the blood stok* 

Can see blood stock available in BDRS and hospital.

Update the blood stok

Performed an update of blood stock available at UTD PMI.

Provide of blood

Parties that supply blood needs to hospitals and BDRS based on demand for blood.

Car unit schedule

Blood donor activities outside UTD PMI, usually these activities are conducted in communities, government and private offices, coffee shops, markets and hubs.

Update the car unit schedule

To update the schedule of blood donor activities outside the PMI UTD to be implemented.

Donor event

Donor event is done by UTD PMI as well as gift sharing and awards for donors.

Update donor event

Update event donors to be done UTD PMI.

List of donor volunteer

List of donor volunteers who are willing to be called to donate blood when the blood requirement is not available.

Update list of donor volunteer

Update list of donor volunteers who are willing to be called to donate blood when the blood requirement is not available.

Data of donor priority

Data of donor priority include donation history, number of donations, date of return of donation, blood donor community.

Update data of donor priority

Update data of donor priority include donation history, donation amount, donation return date, blood donor community.

Logout

Exit the system.

The following sequence diagram from the application design model share blood Unit Blood Transfusion Red Cross Indonesia (UTD PMI) and Bank Blood Hospital (BDRS).



Fig. 3. Sequence diagram share blood.

In this blood share application consists of five users, the user has the rights and responsibilities respectively. We take for example, the workings of hospital users from the picture sequence diagram above. To make a blood request, the hospital logs into the system. Then see where the stock of blood is available, whether UTD PMI or BDRS. If the selected location is UTD PMI, then the hospital may send the requested blood request. If the blood PMI UTD is not available, the hospital can divert the blood demand to BDRS. However, if both places were not available, the hospital could look for donors from a volunteer donor database who can donate blood.

The advantage of this system is to make it easier for the hospital to get the needed blood. The hospital can choose the location of the provider and blood manager closest to them. If the nearest location of blood is not available, then the hospital can look for alternatives to the PMI or other BDRS UTD or contact volunteer donors who can donate their blood. Demand for blood can also be done by BDRS to PMI, because BDRS duty to meet the needs of blood in the hospital itself.

## 5. Conclusion

From the results of the above discussion, with the application of blood share, hospitals that need blood is very easy to get it and they can also choose the nearest UTD PMI or BDRS location to request the blood needed. This application also makes it easier for UTD PMI and BDRS to contact volunteer donors, if the blood in both places is not available and the need for blood is needed. This application has also unified all donor database in UTD PMI with donors in BDRS. So every donor who has donated his blood will be automatically updated in one database application of blood donation. Then from this application also, the

public can see the stock of blood available in UTD PMI, BDRS and blood stock in hospital and can see the blood donation event to be held. The advantages of this application is that the hospital can directly select the location of the nearest PMI or BDRS stock of blood, as well as synchronization of donor data from UTD PMI and BDRS. For further development, the authors hope this application can be developed with the application of artificial intelligence in the system to find the blood stock in UTD PMI or BDRS closest to the hospital in need of blood.

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