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Blood traceability system for Indonesian blood supply chain

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Abstract

The availability of blood bags, adequate quality and quick distribution factor are critical factors in serving demands of blood bags in Indonesia. Indonesian Red Cross Society (Palang Merah Indonesia/PMI) as the holder of the authority to manage the blood bags from the supply of donors until distribution to the hospitals. Many experts believe that the blood traceability system has capability to increase the availability of blood bags and satisfy the quality of blood bags. The objective of this paper is to design the smart blood traceability system to integrate blood bags operations from the major actors in Indonesian blood supply chain. The Architecture of Indonesian blood traceability system has been made with regard to the entire supply chain actors follows the needs and the existing processes. Barcode technology is used to support the data entry of smart blood traceability system. The coding of blood products and shipping has been created using Barcode tags. The smart blood traceability system model was designed using the use case diagram, class diagram and others diagrams in UML approach. The Bloodtrace software was developed and was conducted the try out in one PMI regions in Jawa Timur.

1. Introduction

The Blood bags are a unique perishable products and not ordinary products. Life time of the blood bags product is 21 days and are categorized as a perishable products [1]. The Blood bags aren't produced like manufacturing

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perspective because blood's supply from donors need the willingness and require a period of time to taken again (at least 3 months). [1] pointed out that the characteristics of the blood bags products are the their demands are stochastics and the supply of donor is irregular. In ASEAN countries (e.g., Malaysia and Singapore), their governments given the authority for National Red Cross to manage the blood bags from donors until are transfused to patients in hospitals. The Indonesian Red Cross Society (Palang Merah Indonesia/PMI) is an organization has mandate from Ministry of Indonesian Health as an official institution to manage and distribute the bloods bags in Indonesia.

In managing the blood bags by National Red Cross, the human errors problems are still frequently happen in some activities of supply chain players (donor, national Red Cross, and hospitals). [2] pointed out that the biggest risks to recipients of blood transfusion is human error besides incorrect the blood components and errors in medication administration. In Indonesia, the unavailability of blood bags is critical problems that was solving with Indonesian Red Cross. [3] reported that they often found one district were experiencing a shortage of blood bags but in other districts there have still blood bags stocks. Delays in delivery of blood bags to hospitals who need blood is also still happen. The coordination and integration using an information system can reduce the existing problems in managing Indonesian blood supply chain. Indonesian Red Cross as main players in the blood supply chain need a new information system that has capability to integrate all players in the blood supply chain from taken blood of donor until distribute blood bags products to hospitals.

Blood traceability system is a type of the information system that is able to manage and track the blood bags in the blood supply chain players. The National Red Cross in several countries such as Malaysia, Singapore and Thailand have implemented the blood traceability system. [4] and [5] believed that the benefits of blood traceability system are to (1) reduce human error, (2) improve monitoring of blood bags, (3) improve the safety of patients and medical staff and (4) improve the efficiency of the management of blood bags.

The smart blood traceability system is a types of blood traceability system that has web-base (online) platform and is supported with the automation identification (auto-ID) technology such as barcodes and radio frequency identification (RFID). RFID technology has more benefit and wider application than barcode technology in healthcare [6, 7]. RFID application could be implemented in healthcare such as newborn, patients in emergency and surgery operation room, medical staff, blood bags, medicine drugs, medical records, medical equipment, and others assets [8,9]. Some advantages of the smart blood traceability compared with blood traceability system manual such as (1) is an integrated capable of data for the entire supply chain actors with diverse location/distance, (2) the accuracy of data input to the data donors, blood bags and shipping, and (3) easier to trace and monitor the blood bags products. The auto-ID technology will support the accuracy of data input and real time condition also could be reached. The selection of appropriate auto-ID technologies is to pay attention for the accuracy of entry data and the cost factors. The appropriate auto-ID technology that is used to the smart blood traceability system is stages in design of blood traceability system that should be conducted by manager/ project leader.

Designing software for blood traceability system is relatively complex. Many players/users, activities, types and the amount of information that should be managed in using blood traceability software. In Indonesia context, Indonesian Red Cross (Palang Merah Indonesia/PMI) is the main players in Indonesian blood supply chain. Some activities in internal PMI are needed from receiving the blood bags from donors until deliver to hospitals. The individual and groups donors, blood bank in hospitals, hospital (without blood bank) and PMI other regions are also the players in Indonesian blood supply chain. Various of information in blood traceability system that should collected, shared and analyzed among players in the blood supply chain such as type of blood (0, A, B, AB), rhesus (negative and positive), free of diseases (e.g., HIV, syphilis, and others), blood bags products (e.g., hemoglobin, platelets) and others information every day. As we know, a previous research is limited investigate the benefits and implication of blood traceability system implementation in each players of blood supply chain.

In existing condition, a few PMI regions such as PMI Surabaya and Sidoarjo have the blood information systems. The capability of their blood information system do not integrate among players in blood supply chain. The smart blood traceability system as part of the blood information system that has the ability to integrate among players in blood supply chain. This system should be used by Palang Merah Indonesia to enhance their blood information system. The purpose of this study to design and develop the smart blood traceability system as part of the blood information system for Indonesian blood supply chain. The expected of this study is to increase the capability of PMI and Indonesian hospitals in order blood safety and operations more efficient and effective.