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Inventory Management Application of Drug using FIFO Method

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Abstract

Stock recording process and distribution are the essential processes of the inventory management process. It is about recording the incoming item and out. Stock must be carefully recorded so that there is no mismatch between the recorded value in the application and the availability at the warehouse. One form of item that must be properly recorded is medicine. In the health sector, the health office has arranged this activity. This process includes recording the distribution of drugs; recording drug purchases; and recording the amount of drug stock. This recording activity is related to the processing of inventory data. Inventory is an important thing to handle because it will affect the size and cost of planning operations and distribution activities later. There are 2 types of drugs distribution is determined by Minister of Health Regulation: FEFO (First Expired First Out) and FIFO (First In First Out). This research conducts a study to build and design an application for recording the management of drug stock using the FIFO method.

Keywords**;** *stock, inventory management, web application, fifo method, drugstore*.

I. INTRODUCTION

Inventory management is essential in almost every sector of industries. Especially in pharmaceutical services, inventory control must be implemented to make sure the stock availability. In public health government office, which handles the distribution process of drugs to the health center, stock management is very important to maintain the availability of drug material when required.

Several processes included in the distribution of drugs process in public health government office. These processes are: request for purchase, purchases from supplier, and distribution to the health center. This process is an annual & monthly process that sorted in the manual labor process. It takes time and having high risk in human error. This error happens almost in every batch transaction, which causes a lack of goods that can be stored at the drug store.

This paper conduct studies in inventory management control of FIFO method to minimum problems mentioned above. The objectives of this paper is an application's design in purchasing, storing and distributing drugs in the public health office. We hope this design can minimize error in the process of inventory control of drug store.

II. LITERATURE REVIEW

A. Inventory Control Management

Inventory control, that can be referred to stock control, is the process to monitor the stock, maintaining the number and keeping track of any excess or deficit of the goods. This process is separated into several methods that efficient in their own right. This method can be implemented on their own or mixed with each other. Each company has to decide on their own to fix this process in order to meet their [1] [2].

There are several methods that can be implemented in one company, for example: (a) minimum stock level method, which required minimum quantity to

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reorder & restock; (b) stock review method, that needs checking process in a regular interval time to place an order based on it; (c) just in time method, which arranged for the stock to be delivered if the stock reaches its minimum point; (d) batch control method, which can make company to place an order in a fixed interval time with fixed number of quantity; (e) FIFO method, that maintained the stock based on per date receive, which usually implemented for perishable item [2].

In the term of inventory accounting model, inventory control can be divided into 2 types: Periodic Inventory System, and Perpetual Inventory System. The former method will budge the cost of purchased into inventory account to match the cost of the ending inventory. Whereas the latter, provide a supplementary account that makes stock control is more maintain, such as providing information about what is purchased, sold, when it is sold, and what price it was sold [3]. Although there are several terms relate to inventory control, this paper focuses on the management of inventory control and omit the price that should be placed to the goods that will be sold.

B. FIFO Method

FIFO is an abbreviation for First-In-First-Out. In a relation to inventory control, FIFO method is a method that maintain the stock based on the date (received & sale). The first batch goods that received is the one that have to sale/distribute to customer. FIFO is categorized as the perpetual inventory system in the term of inventory accounting model. FIFO method will maintain the condition, that make sure the oldest stock is flushed out and inventory remain in hand is the fresh one. This is the reason why company using FIFO method, which is to keep the inventory fresh, or dealing with the stock which has limited shelf life [3].

C. FEFO Method

FEFO is an abbreviation for First-Expired-First-Out. It has almost the same characteristic to FIFO method. The difference is, this method is considered by the expired date, not the received date that used in FIFO method. FEFO method maintain the circulation of the goods that have period of durability. It is categorized as perpetual inventory system and has the same reason to implemented like FIFO method. It can keep the inventory freshness and dealing with the stock which has limited shelf life.

FEFO method is very useful to maintain the stock of groceries, medical product, pharmaceutical that can perish rapidly. The objectives of FIFO and FEFO method are almost the same, but FEFO method is guarantee the achievement of maintaining rapid perishable item than FIFO. Because, in FIFO the factor that determine the sale/distribution is in received date, and there are some condition, the goods that recently purchased have less expiry date than the old one [3]. Although FEFO is the most effective way in the term of goods that have expiry date, the process to maintain this needs much labor because the needs to arrange the goods and material after recording the purchase receipts, according to the expiry date.

D. Entity Relationship Model

In information system modeling, the needs to design database model is mandatory. In order to communicate the database design that has to be implemented, entity relationship model is playing the important role [4]. There are several symbols that used in order to design an entity relationship (ER) model. Beside its symbol, ER model is also containing relation constraints and cardinality which determine relation table that have to be implemented.

Symbols that used in this paper are rectangle to describe an entity; ellipse drawing to show the attribute; rhombus to display a relation; and line

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with “n” or “1” symbol to establish the cardinality. The example of ER model can be seen in Fig 1. This figure shows the example of 2 entities which has “1-n” cardinality with few attributes among these entities.

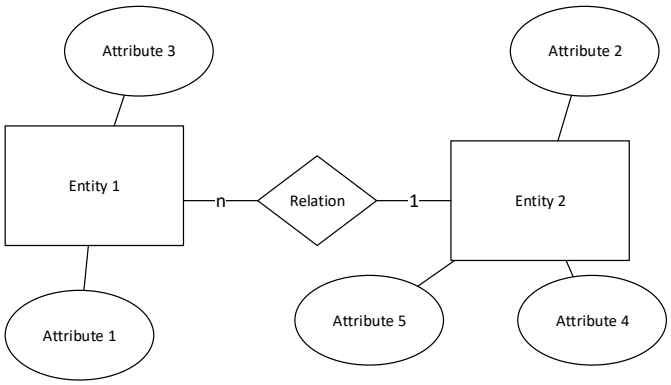

Fig. 1. ER Model Example

E. Cross-Functional Flowchart

As we proposed a system’s design in this paper, we will describe it in the context of visual design. Visual representation of modeling can be reviewed as an effective instructional method. In order to deliver it, cross-functional flowchart is used to show the whole process of the proposed system. Cross-functional flowchart is a modification of flowchart’s symbol with addition of swim lanes to better display and assess certain information [5] [6]. In this paper, we used flowchart symbols such as rectangle to describe process, rhombus as decision, terminator symbols, horizontal drums to show database/external data that we used, waving rectangle as a symbol to represent document/documents, trapezoid as manual process’s symbol, and swim lanes to separate the process of actor/user/system.

F. Use Case Diagram

Use case diagram is one of UML diagram that use to communicate design’s system. Features of the designed system and its interaction with users is the important thing to figure out in proposed an application’s system design. This general description is often pictured using use case diagram. It can represent initial description of a systems. Besides, it correlates with other diagram in UML such as sequence diagram and activity diagram [7].

Use case diagram visualize design system’s functionality in bird’s eye view behavior to show the interaction the application to the stakeholders or users. Because of the diagram shows general thing, it needs detail explanation to communicate the design. This detail can be seen in other document, which is a textual document, named use case scenario or use case specification or use case description. Use case scenario is an explanation textual from a set of interaction scenarios. Each scenario describes the sequence of actions/steps that are performed by the actor when interacting with the system, both successful and failed [8].

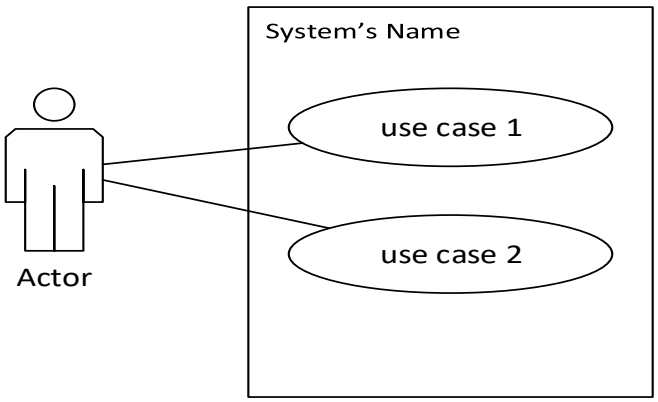

Fig. 2. Use Case Example

Commonly, use case diagram is used 3 symbols to describe a system’s design: stickman to represent actor, ellipse to show the use case (functional system’s behavior), and has it owns rule to describe and lines to connect the actor and the use case. Fig 2 shows the example of general UML use case.

III. RELATED WORKS

There are several studies to describe the inventory control management for storing drug. Ibrahim et al [9] explained possible problems to the drug that is not stored using certain method such as First In First Out (FIFO), First Expired First Out (FEFO), or alphabetical order system. Their research evaluates the distribution and storing process at RSUP Prof

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DR. R.D Kandou Manado using descriptive and evaluative observational method.

Other studies about storing drug and the distribution process is conducted by H. Asyhari [10]. In his studies, an observational process is performed at the pharmacy. His studies show that 7 of the 9 parameters to store drugs have been fulfilled. These parameters cover First in First Out (FIFO) stored drugs, First Expired First Out (FEFO) system, stored according to dosage forms, stored alphabetically, narcotics and psychotropic drugs stored separately in special cabinets.

In the handbook of health systems in action [11], the process to store medical product is explained. Commodities and medical supplies without expiry date store in FIFO method, and use FEFO method to store the goods with expiry date. There are principles of good storage: stacking according manufacturer's directions, lower shelves for liquid product, stored product in appropriate temperature, stored highed-value product in appropriate security, disposing expired product with its appropriate procedure, store commodities in FEFO method, and make sure label arrangement is visible. Besides storing in FIFO or FEFO method, there are additional common classification system to store the drugs. The systems are: in alphabetical order, by dosage form, or by therapeutic category. This can be applied for smaller stores & dispensaries. For larger stores, classification can be arranged by: health system level, frequency of use, or random location. The latter system works best with a computerized warehouse management system.

IV. PROPOSED METHOD (IMPLEMENTATION)

In this paper, we conduct a study about storing drug in warehouse of public health office. Drug that store in this institution will be distribute to health center that affiliated with the health office by region. Fig 3 shows the process of goods supplies, and Fig 4 shows the process of good's distribution.

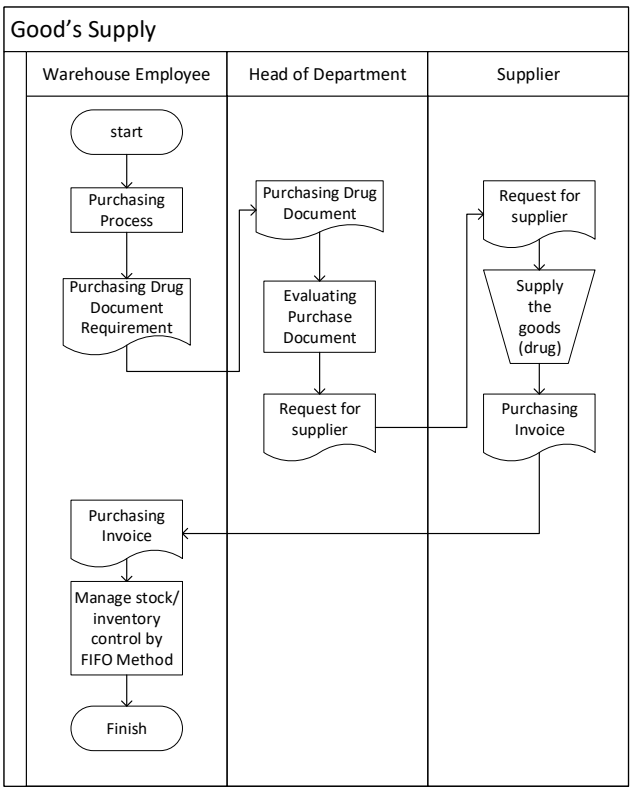

Fig. 3. Good's Supply Process

The process starts with the process of purchasing arrangement from the warehouse employee. The warehouse employee managed the drug delivery request data which will then be printed. This printed document will be submitted to the head of department. Then the head of department will evaluate the request and handed it over to the supplier. Supplier will supply the goods, and after the item arrives, the warehouse employee manages the data supply into the system's application that implemented FIFO method storage system. The arrangement of the drug will be handle manually based on the record of the system.

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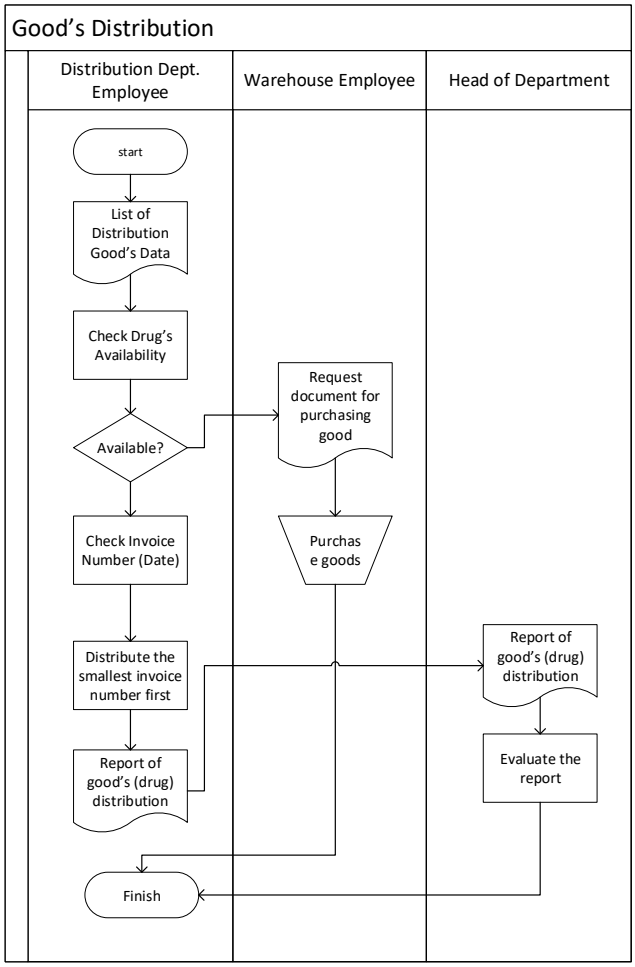

Fig. 4. Good's Distribution Process

The process starts from the list of drugs that are in the distribution department employee, then the employee will check the availability. If available, the employee will print the drug invoice out which is presented with inventory reports for the leader. If not available, process will be handled by warehouse department employee. The checking process of invoice number is the process that implement the FIFO method. This can be implemented because, in the invoice number, there is information that have to managed such as good's purchase date, number of batches, and expiry date of the drugs.

For these processes, we proposed design systems using UML Use Case Diagram. It will cover 3 actors: warehouse department employee, distribution department employee, and the head of departments. For each actor, has their own behavioral function as we can see in table 1

TABLE I. Actor's Behavior

No.	Actors	Behavioral Function
1.	Warehouse Department Employee	Manage drug's master data in the application (read, create, update, & delete drug's data); manage purchasing data (search, read, create, update, & delete purchasing data); Search by date purchasing data; check purchasing repot (read & print report).
2.	Distribution Department Employee	Manage health center data in the application (read, create, update, & delete health center data); manage distribution process data (create, read, update, & delete distribution process data), check detail list of distribution process; and manage inventory (drug) stock.
3.	Head of Department	Manage user's application (read, create, update, & delete employee's data); Manage role of each user's application; Manage master of supplier's data (read, create, update, & delete supplier's data); evaluate purchasing document & distribution document; check statistic (report document) of purchasing & distribution pocesses.

Based on the actor's description and the behavior function above, use case diagram is shown in Fig 5.

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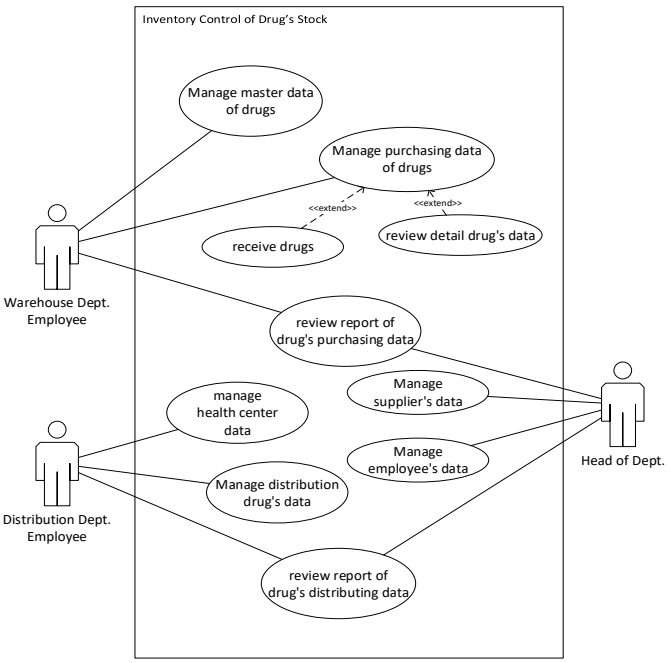

Fig. 5. Use Case Diagram of System's Design

In the use case diagram above, we can see the interaction of each actor and its behavior function in the system/application's design. There are 3 actors that connected to each use case that show its responsibilities in the application (behavior function). There are 2 use cases that have the association to 2 users. Head of department has responsibilities to review the report of each user role employee (warehouse dept. and distribution dept.).

In order to manage data that being saved in the application, we make an ER model to show how each entity interact with other. This ER model can be shown in Fig 6. In the Entity Relationship (ER) model, there are 6 entities which are related to each other. These entities will be converted into 8 tables that used for data storage. These entities are: (1) employee, (2) purchase, (3) supplier, (4) supply, (5) distribution, (6) health center, (7) drug, and (8) detail distribution.

V. CONCLUSION & FUTURE WORKS

In this paper, we proposed a system's design to make sure FIFO method is implemented in the process of managing data. Inventory control that implemented in this design will make sure the stock is managed effectively. For future works, it needs to combine with classification method to store goods physically using barcode system and FEFO method.

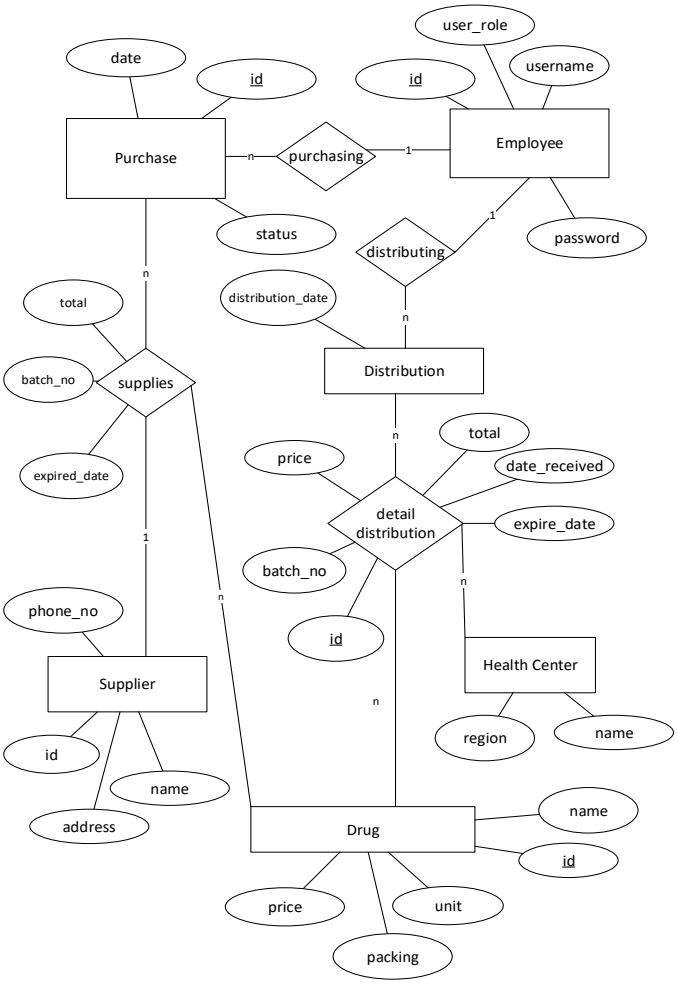

Fig. 6. ER-Model

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