Barcode System Ever Optimizes Inventory Warehouses

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Abstract: This research aims to observe the role of the Barcode System on the warehouse management system. The inventory process consists of receiving goods, finish goods storage, monitoring stock, and delivery process. The system used is FIFO (First In First Out), which means the item goes into the warehouse first are the goods that will send out first. The operation of the Barcode System uses a Scanner (barcode reader) which functions to send data information online which is connected to the server, and then it is stored in the database. In addition to using online application, there is also a desktop application that monitors the movement of stock in the warehouse. The Barcode System manages the process of receiving goods, finish goods storage, monitoring stock, and delivery process. Each of these processes is described in detail and setting up specific provisions in procedures (protection) as a guide so that the system expected response. It can minimize errors in the work process, and employees can work effectively dan efficiently. This research can be a guide and practical example for industry and organizations and some researchers to compare a computerized inventory management system using a Barcode System with a manual system. The implementation of the Barcode System provides benefits for all processes in the warehouse in optimizing inventory and as a way to get customer satisfaction

Keywords: *Barcode System, Warehouse Management System, Inventory, FIFO System*

INTRODUCTION

In the digitalization era, information technology has been applied in almost all sectors in Indonesia.With the intent of balance technology-based life and also for increasng quality and quantity of the all activities. These changes have affected the sectors of education, sports, health, industry, and so on. The industry sector has become one of many sectors that have rapid technological upgrading or development, implementing changes in the 4th industrial revolution, better known as Industry 4.0.

Based on the Mckinsey Global Institute statement, Industry 4.0 has a significant impact on the industrial sector, especially employment and human resources. The adoption of Industry 4.0 in the industrial system in Indonesia will change the pattern of work in industry, from labor-intensive (where humans do all processes) to the application of machines and

robots. This activity will certainly affect the amount of human power required in the industrial system. If applied globally, then the loss of employment will occur significantly. The company's manufacturing industry depends on the development of technology, which is useful for improving the production, process inventory, and sales of goods. The companies supply of goods has been competing to meet its customers by providing an optimum supply of goods by guarding the quality of product. The inventory process to ensure it sells at a maximum without any item missing.

One manifestation of the use of this technology is the Barcode System applied to the warehouse management process. The implementation of the Barcode System is intended to make the warehouse management process effective and efficient while still paying attention to the quality of goods as a form of commitment to satisfy customers satisfaction. The Barcode System becomes a filter that determines whether the product is worthy or not for market, and this process is included in the inventory process.

In common, the inventory stage is an essential process for every company. Because in this process, industry is challenged to meet customer needs by providing an optimum supply of inventory with good qualities. Ideally, the inventory process regulates the turnover of goods so that goods are traded to the maximum without any left, including controlling the quality of goods and adjusting them to the standards of consumer needs. Inventory regulates goods to be traded to the maximum before entering the expired (destroyed).

However, the problem that often arises in the inventory process is the lack of controlling in the receipt and distribution of goods to consumers. This problem has an impact on the non conforming product between the data and actual product. In addition to the storage process (Inventory), the goods are not correctly identified. Because there are no less industries that have warehouses with unsustainable allocation system, , so it takes longer to find goods with specific codes according to customer orders. Certainly, this is not efficient if the demand for these goods is needed in large quantities but in a limited time.

For this reason, the selection of the Barcode System in the inventory process can be used as a solution to this problem. The application of a Barcode System can help warehouse management in identifying or processing data from receiving goods to delivery of goods. Additionally, the application of the system can also perform traceability data to facilitate the tracking process if there is a problem with the distributed goods. Furthermore, the Barcode System is also helps to facilitate the retrieval with the distributed system. This system will be helpful when the goods are about to be removed from the warehouse and distributed. It will save more time because manual search is not required.

This research will discuss how the problem of monitoring the inventory system can be overcome by utilizing the Barcode System technology. The system used is expected to enable monitoring both on data receipt of goods, storage of goods, and delivery process. So that quality control and improvement of employee performance can be carried out correctly because employees can work more optimally, effectively, and efficiently. This plan is a manifestation of the company's commitment to satisfying customers and implementing industry 4.0 technology. The product used as a sample of the implementation of this Barcode System is the tire.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Previous research related to this research is "Performance Improvement of Inventory Management System Processes by an Automated Warehouse Management System"[5] about the use of barcodes to increase productivity in warehouse inventory systems. The main components of this system are barcode, scanner (barcode reader), server, and database. The system handles three phases of the inventory cycle: receiving, processing, and distribution (delivery). Implementing a Barcode System makes the entire process run precisely and accurately, and the presentation of data can be seen in real-time. In the following study, "The Implementation of Barcode on Warehouse Management System for

Warehouse Efficiency"[6], his research reveals that barcodes help integrate every process and increase efficiency in the warehouse management system.

Berdasarkan penelitian para ahli Barcode diartikan dengan kode batang atau sejenis kode yang memiliki informasi tertentu [1]. Kode berbentuk garis hitam putih seperti contoh dalam Gambar 1, berguna sebagai media penyimpanan data identifikasi, inventarisasi, data pengiriman dan pelacakan barang. Data tersebut akan disimpan pada *database* yang berguna memudahkan dalam proses pengaturan persediaan barang di Gudang. Adapun untuk membaca barcode tersebut menggunakan alat scanner atau PDT (*Portable Data Transfer*). Transfer data diproses ketika alat scanner menembakkan laser kearah barcode, dari proses tersebut akan muncul informasi terkait dengan nama barang, jenis barang, lokasi penempatan barang, dan data keluar masuk barang.

Figure 1. Barcode
(Source : media.neliti.com)

All numbers of the above barcode classifies the followings:
1. '0' Number System Character (Code 3 of 9)
2. '12345' Company name
3. '67890' Product name
4. '5' Product name validation

Based on the research of specialists Barcode is defined as a bar code or a kind of code that has specific information [1]. The code is in the form of black and white lines like the example in Figure 1, and it is helpful as a media for storing identification data, inventory, shipping data, and tracking goods. The data will be stored in a user database to facilitate managing inventory in the warehouse, as for reading the Barcode using a scanner or PDT (Portable Data Transfer). Data transfer is processed when the scanner fires a laser at the Barcode. From that process, information will appear related to the name of the goods, the type of goods, the location of the goods, and the data for the goods in and out

Inventory is a general term that shows everything or organizational resources stored in anticipation of meeting demand [2]. It can also be defined with the management of products or goods that are stored, identified for use at a particular time, and for the benefit of the future. Inventory consists of 3 types: raw material inventory, semi-finished products, and finished good products. As a place for storing finished goods, the warehouse oversees regulating the flow of goods into, storage, and outgoing goods. In-process, several systems regulate the inventory process, namely by using the FIFO system (First In First Out) or using the FEFO system (First Expired First Out).

The FIFO system in the warehouse inventory helps manage the entry and exit of goods appropriately, assisted by implementing the Barcode System, making it easier to monitor, track and find out information related to the historical product. Certainly, this can improve work performance and productivity. It use to benefit the logistics departement to satisfy customer satisfaction and compliance the requirements of the Quality Management System.

The system works because the barcode is scanned with a scanner, and the scanned result of the barcode will be processed by the server using the internet network. The scanned data will be stored automatically in the Oracle database by maximizing the Java

programming language. Java is an object-oriented programming language, also known as Object-Oriented Programming (OOP). The system design can be seen in Figure 2.
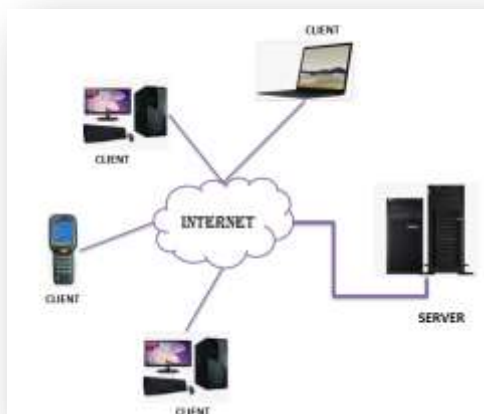

Figure 2. Design System
(Source : Analisis and Design, Jogiyanto Book)

METHODS

This research uses a descriptive research method that describes facts and information systematically, conceptually, and accurately. With three stages of research, data collection methods, comparative methods of measuring instruments, and implementation of the Barcode System. The data collection method used in this research is a literature study by collecting information based on books, journals, and other reading sources related to the research title. The method of measuring comparison instruments is to compare the literature study with previous research. Implementation of the Barcode System is to implement the entire inventory process from receipt of goods to delivery process.

RESULT AND DISCUSSION

This research aims to analyze and identify the application of the Barcode System in the inventory process. The implementation of the Barcode System supports implementing the FIFO (First In First Out) system to optimize the Inventory process. To get information on this matter, the authors carry out the stages of research methods so that the resulting to get data to be accurate and measurable.

The scope of the Inventory process is the receiving process, the storage process, the goods preparation process, and the delivery process. The role of the Barcode System in the process of receiving goods is to identify the name of the goods, the quantity per rack, and the storage area allocation. In storage area, the Barcode System is useful as a visualized storage location guide on computer. Preparing goods process, the Barcode System is useful for preparing goods according to shipping documents, at the same time, in the delivery process, the Barcode System is useful to ensur that the items are delivered according to the shipping document. The following is a flowchart on the warehouse inventory system; see Figure 3.
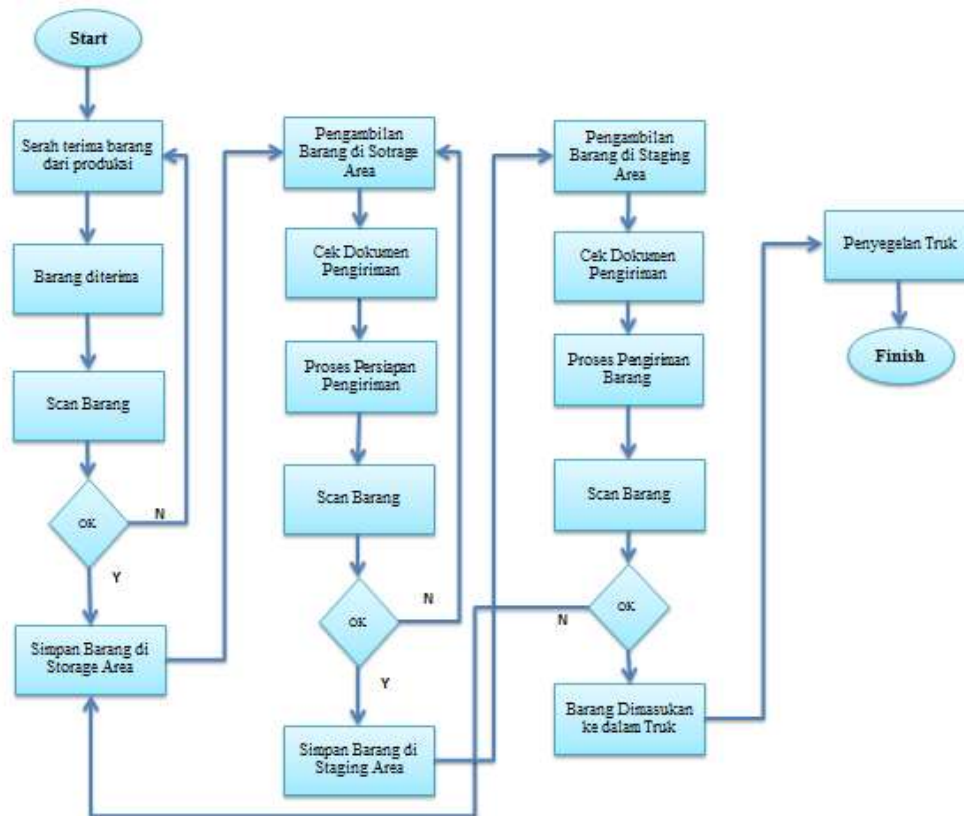
Figure 3. Flowchart of Warehouse Inventory Process.

The method used in implementing the Barcode System is by using scanner, as shown in Figure 4, which is used to transfer data into the database. The process involves firing a laser beam into the Barcode section, and then the data will be entered and read in the desktop application that has been installed on the computer. The application will display information related to the name of the item and the size of the item, based on the processing module listed in the application. Record data can also be viewed in the application. The application used in the Visual Foxpro programming language. The data is generated in Real-Time, which makes it easier to monitor data entering and leaving the warehouse and monitoring quantity of stock in the warehouse in an up to date. Accordingly, inventory process can be appropriately monitored, it can improve or optimize the Inventory process.

Figure 4. Scanner (Barode Reader)

(Source : Datalogic.com)

Application Results

Based on the research done, the results are in the form of a web-based (online) inventory system application and a desktop application. Making an inventory application using the Java programming language and visual FoxPro, then using an Oracle database as a data storage. The data input and output process use barcode, where the data update process is carried out online via a web server. This process makes it easier for users to get stock information and goods turnover in real-time.

Application Discussion

The inventory system application is separated into two parts, including the incoming and outgoing processes. The incoming process includes the process of receiving goods and storing goods, while the outgoing process includes the process of preparing for delivery and delivery process. For the entire inventory process monitored on the desktop application, the access rights to use the application are determined according to their respective sections. The Monitoring Barcode System is controlled by the system admin, who is responsible for determining how to use web-based and desktop applications.

Implementation of The Web-Based Application Module (online)

In this module, the user uses a web application using the Scanner by entering the specified address, while the module display is as shown in Figure 5.

Aplication Inventory Control	
1	Penerimaan Barang
2	Alokasi Penyimpanan
3	Persiapan Pengiriman
4	Pengiriman Barang

Pilihan 1

Figure 5. Application Module (online)

1. Receiving Product Module

The section product rerceive are responsible for using this module. It works by entering the Employee Identification Number (NIP) and scanning the rack barcode on the Menu page. The scan process in this section aims to determine the number of goods that enter the warehouse. In this module, there is information in item code and quantity, making it easier to deliver product from the production department to the warehouse. The product receipt module is as shown in Figure 6.

Figure 6. Receiving Product Module

2. Storage Alocation Module

This module is used by the Stock Control section, which monitoring quantity of stock in the warehouse. Using it is by entering the Employee Identification Number (NIP) and scanning the shelf barcode in the Menu section. The scan process in this section ensures that the items to be stored are following the placement settings, according to the storage racks. On the menu, there is information in the form of item codes and item storage allocations. The goods storage allocation module is as shown in Figure 7.

Figure 7. Storage Alocation Module

3. Delivery Preparation Module

This module is used by the delivery preparation section, which prepares the goods for the customer. Using it is by entering the Employee Identification Number (NIP) and Sales Order number (SO) in the Menu. The data input process in this section aims to ensure that the goods prepared are following the order specifications. Delivery preparation module as shown in Figure 8

Figure 8. Delivery Preparation Module.

4. Delivery Process Module

This module is used by the delivey process section, which is in charge of carrying out delivery process. Using it is by entering the Employee Identification Number (NIP) and Sales Order (SO) number in the menu. Was be prepared in the process of delivery product according to the shipping documents. The delivery process module is as shown in Figure 9.

Figure 9. Delivery Process Module.

Desktop Application Implementation

On the login page from menu apllication. Users are required to enter a username and password according to the settings that have been set. This information is used for the login process, as shown in Figure 10

Figure 10. Login Page.

1. Receiving Product Menu

The receiving product menu monitors the data of goods entering the warehouse from the goods scanning process that the operator has carried out by checking the suitability of the goods code and the number of goods, as shown in Figure 11.

Figure 11. Receiving Product Menu

2. Storage Alocation Menu

The Storage allocation menu serves to find out the location of the product that have been stored in the database. Storage allocation is significant as an information medium for the following process, namely in the delivery preparation process, so that the process can be carried out quickly and efficiently, as shown in Figure 12.

Figure 12. Storage Alocation Menu.

3. Monitoring Stock Menu

The Monitoring stock menu functions to find out the number of stock items. This menu is used as a parameter to plan the delivery of product. Besides that, it can also know the amount of stock based on the item code, as shown in Figure 13

Figure 13. Monitoring Stock Menu.

4. Delivery and Delivery Preparation Menu

The Delivery and Delivery Preparation menu serves to find out which SO number has finished the goods preparation process, and then the delivery process is carried out. This menu is used to monitor the preparation delivery for the delivery process and ensure that the delivery plan on that day has all been sent, as shown in Figure 14.
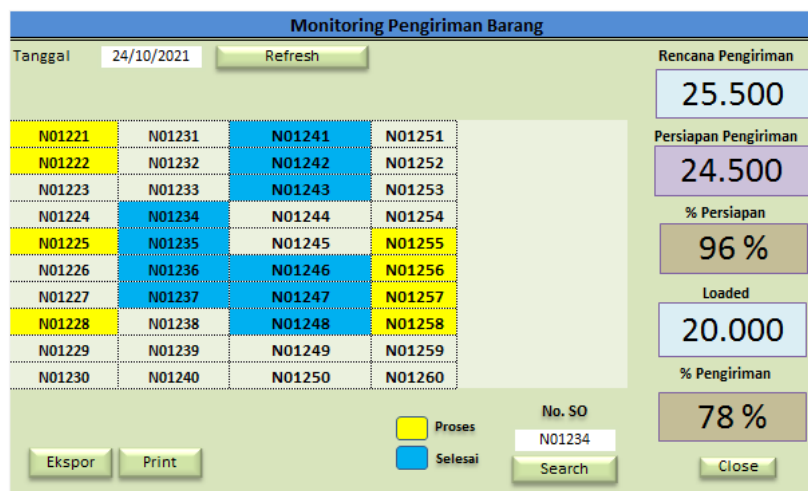

Figure 14. Delivery and Delivery Preparation Menu.

Application of Barcode 5G-Based

Currently, technology infrastructure has developed very rapidly compared to before. Technology makes objects around can communicate with each other. Starting from the Auto-ID Center, a technology based on Radio Frequency Identification (RFID) [3], assigns a unique code to each object that makes the object have its own identity. The development of the internet is also a supporting factor for the development of communication between these objects, where the internet acts as a collaborator between objects and makes it a database with identity information from these objects. Barcodes become one of the mediators between objects and their identity information or unique codes.

The implementation of the Barcode System development in the future will be more advanced along with the implementation of the 5G (Fifth Generation) network. With the 5G network, the data transfer process will take place very quickly so that the data generated is in real-time. Predicted progress in the next 5 to 10 years, the Barcode System will be widely used by industry to achieve the company's goals to become an innovative industry, or industry 4.0. Industry 4.0 refers to a series of emerging innovations in advanced automation, machine vision, Big Data, cloud computing, and machine learning that will revolutionize manufacturing. Industry 4.0 shows tremendous potential to increase productivity, reduce waste, improve product quality, increase manufacturing flexibility, reduce operating costs, and deliver many other benefits down to the very bottom of the factory. If industry 4.0 is combined with 5G, it will create an industry with access and industrial speed that is effective, efficient, and ideal.

For the implementation of 5G, companies must remain flexible and adaptable to adapt and immediately take advantage of renewable technologies. Investing in modular mobile technology can help prevent falling behind on the technology adoption curve caused by custom-built devices. Since the change from 4G to 5G is not economic, companies need to spend more effort implementing this system. Not only for companies and industries, but the system in Indonesia must also be ready to apply renewable technology so that it is always up to date and not left behind. The development of technology is very rapid in this era, making these goals can be achieved easily. Tamim Arab experimented in 2018, which he

uploaded on his youtube channel [4]. The video shows a simulation of an RFID system combined with a Barcode System and a robotic system to support warehouse management. This experiment shows that the robot can arrange items according to the information inserted in it. So that warehouse management can be implemented efficiently by only utilizing robotic technology, called the ASRS System (Automated Storage and Retrieval System). The ASRS system is very useful in implementing the FIFO system. All goods turnovers can be appropriately monitored and can save time in all stages of the inventory process.

CONCLUSION

Based on this research, it is concluded that the application of the Barcode System in inventory management in collaboration with the web-based applications (online) operation through the scanner media and desktop applications can assist users in supporting the work process and assisting in the process of goods monitoring, both in the process of goods receiving to the delivery process. The benefits of using the Barcode System in the Incoming process (receiving, storing) is the suitability of the number and code of goods between the receiving document and the actual goods specification, as well as the suitability of the allocation of goods storage between the data on the desktop application and the actual in the field, so that the searching process for specific goods can be done by fast. In the Outgoing process (delivery preparation, delivery), the goods are sent to follow the shipping documents (no wrong code, quantity). This system can monitor data in real-time because the data stored in the database is well distributed on desktop applications, which is very helpful in implementing the FIFO system in the warehouse. It is expected that the goods stored in the warehouse can continue to be traded without any leftovers or entering an expiration date. In addition, barcodes containing information on goods can assist users in providing goods according to the quantity and specifications requested. Therefore, it can create trust and satisfaction from customers. The application of the Barcode System is one way of digitizing information in the inventory management process.

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