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Development of Product Availability Monitoring System In Production Unit In Automotive Component Industry

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Abstract. This paper described a methodology to monitor the availability of products in a production unit in the automotive component industry. Automotive components made are automotive components made through sheet metal working. Raw material coming into production unit in the form of pieces of plates that have a certain size. Raw materials that come stored in the warehouse. Data of raw each material in the warehouse are recorded and stored in a data base system. The material will then undergo several production processes in the production unit. When the material is taken from the warehouse, material data are also recorded and stored in a data base. The data recorded are the amount of material, material type, and date when the material is out of the warehouse. The material coming out of the warehouse is labeled with information related to the production processes that the material must pass. Material out of the warehouse is a product will be made. The products have been completed, are stored in the warehouse products. When the product is entered into the product warehouse, product data is also recorded by scanning the barcode contained on the label. By recording the condition of the product at each stage of production, we can know the availability of the product in a production unit in the form of a raw material, the product being processed and the finished product.
Key words: record; data base

1. Introduction

Lean Production System (LPS) is a production system that is characterized by a lean and agile condition. The basic principle of LPS is (1) making only products that can be sold in Just In Time, (2) only make the product with good quality, (3) making products in a cheaper method, and (4) building a strong industry quality that can respond to fluctuations in demand and environmental change.

The basic principle of the first LPS is to create only products that can be sold in Just In Time. This means that the product created must be in accordance with the order and completed within the specified time. To realize this need to know the quantity of products at any time either in the form of finished products, WIP, or still in the form of raw materials. In order for the quantity of products can be known at any time easily, need to be made a system that can monitor the quantity of products that are in a production system.

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To know the quantity of products, WIP, and raw materials easily at any time, need to be made a data base that can reflect the quantity of products, WIP, and raw materials. The data base should be updated every time there is a change in the quantity of products, WIP, as well as raw materials. Updates to the quantity of products, WIP, or raw materials shall can be made by each person involved in production activities and such updates can be made easily. With the data base that always follow the changes (up to date), the quantity of products, WIP, and raw materials can be known easily whenever needed. Thus production planning will become easier to do.

2. Problem-solving approach

This research is the first step of LPS design that will be applied to automotive supporting industries. The industry that became the object of research is the industry that produces automotive components with the base plate material. The industry has two production units separated by a considerable distance. The first production unit (location in Cibolerang) is tasked for preparing pieces of plates with a certain width. The second production unit (location in Cimahi) is tasked with processing the pieces of the plate into automotive components through several stages of the manufacturing process. Pieces of the plate from the first production unit are delivered to the second production unit by truck. The material flow in this industry can be seen in Figure 1.

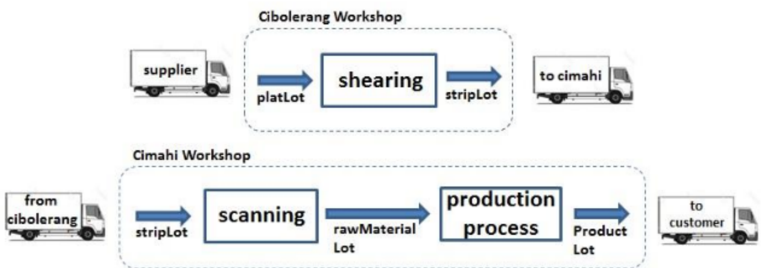

Figure 1. Material flow

The production unit in Cibolerang receives a lot of plate from raw material suppliers. A lot plates from suppliers are then labeled according to the type and size of the plates. When raw materials are needed in the form of pieces of plates of a certain type, thickness and width, plates of a certain type and thickness are cut into sections. These pieces of plates are grouped according to the type, thickness, and width of the pieces and each group is labeled. The pieces of plates that have fulfilled the specified amount are sent to the production unit in Cimahi.

Pieces of plates that have arrived at the Cimahi production unit are stored in raw materials warehouse. Data pieces of the plate should be recorded and entered into the data base. The data recording is done by scanning the barcode contained on the label affixed to each batch of plates. The pieces of the plate are then processed through several stages of the process until it becomes a product.

2.1. Class model to describe material flow

Changes due to material flows should be monitored easily and accurately. Therefore, every component involved in the flow of material needs to be modeled in the virtual world. Since the industry that became the object of research has two production units with different data bases, the model is made up of models that describes the production unit in Cibolerang and the model that describes the production unit in Cimahi.

The classes to describe the condition of production units in Cibolerang consist of suppliers, materialSpec, platLot, stripLot, shearingType and productType. The supplier class represents suppliers who supply raw materials. The materialSpec class represents the material specification of the plate. The platLot class represents a lot of plate material supplied by the supplier. The stripLot class represents pieces of plates which are the base material for automotive components. The shearingType class represents the piece type of plate. The productType class represents the type of automotive

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component. The classes to describe the condition of production units in Cibolerang can be seen in Figure 2.

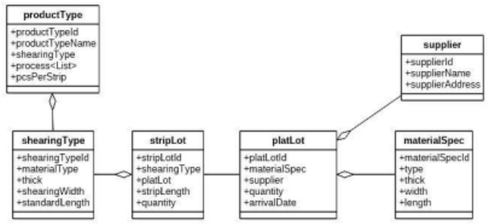

Figure 2. Classes in the Cibolerang production unit

The classes to describe the condition of production units in Cimahi consist of rawMaterialLot, productLot, productType, shearingType, process, customer, order, and orderProduct. The rawMaterialLot class represents the raw material in the form of plate pieces coming from the production unit in Cibolerang. The rawMaterialLot class is a transformation of the lotStrip class. The productLot class represents automotive components that are being made or finished in production units in Cimahi. The customer class represents the customer ordering certain types of products in a certain quantity. Order class represents orders from customers. The order Product class represents the specific product type ordered by the customer. The classes to describe the condition of production units in Cimahi can be seen in Figure 3.

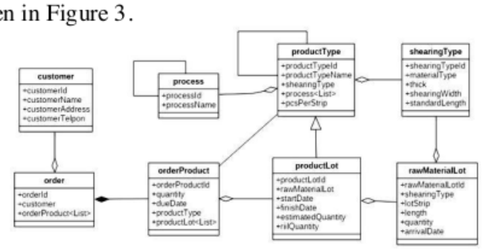

Figure 3. Classes in the Cimahi production unit

2.2. Programs that have been created

The main activity of the material flow from the receiving of plate material from the supplier to the delivery of the product to the customer consists of (1) receiving of plate material (platLot) from suppliers, (2) delivery of strips (stripLot) from production units in Cibolerang to production units in Cimahi, (3) receiving of pieces of plate (stripLot) in Cimahi production unit, (4) retrieval of plate pieces (rawMaterialLot) by the operator from raw material material warehouse, (5) product acceptance (productLot) in the product warehouse, And (6) delivery of products to customers. Activity (1) and (2) are conducted in the Cibolerang production unit, while activities (3) through (6) are conducted in the Cimahi production unit.

The program has not been able to record all data changes that occur on the activity (1) until the activity (6). This is because the information obtained from the industry being studied is still incomplete. The activities successfully recorded by the program to date are activities (2), (3), (4), and (5).

Programs are created using a programming language that supports data base applications and web applications. The data of each object of the class that has been depicted in figure 2 and 3 is stored in a data base. The data stored in the data base is obtained from several different locations. Data obtained in several different locations is sent to the server by utilizing web applications.

Recording of data that occurs on the activity (2) is performed by the administrative staff in charge of making documents delivery of goods. The administrative staff recorded all the pieces of plates (stripLot) to be delivered to the production unit in Cimahi. This record activity generates goods

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delivery documents (SURAT JALAN PENGIRIMAN) and some labels (KARTU INPUT RAW MATERIAL) affixed to each group of plates.

Recording of data occurring on the activity (3) is performed by the operator receiving the lot of pieces of plate (stripLot). Recording is done by scanning the barcode contained on the label affixed in each lot of metal strip. The operator enters the quantity of metallic lot pieces received. This activity produces a labell (KARTU LOT RAW MATERIAL) that will be attached to each appropriate lot raw material.

Recording that occurs on the activity (4) is performs by the operator who takes the lot of raw materials in raw materials warehouse. Operators enter the number of strips taken from the stack of raw materials that match the type of product to be made. This activity produces labels (KARTU LOT PRODUK) that will later be affixed to the stack of strips that will undergo several stages of the manufacturing process.

The recording that occurs in the activity (5) is performed by the operator receiving the completed product in the product warehouse. Recording is done by scanning the barcode contained on the label affixed on the lot of the product concerned. The operator enters the quantity of products received.

3. Testing the program

Programs that have been created need to be tested to determine the ability of the program to record data every time a material flow occurs. Testing the program includes data recording testing on activity (2), data recording test on activity (3), data recording test on activity (4), and data recording test on activity (5).

3.1. Testing of data recording on activity (2)

One of the interface of the program to record the data stripLot can be seen in Figure 4 (left). At the interface, the administrative staff enters the car license, delivery id, product type id, and quantity of stripLot. The data stripLot that has been listed can be seen in the table located at the bottom of the program interface. This program generates goods delivery documents (figure 4, center) and label (KARTU INPUT RAW MATERIAL) (figure 4, right) which amount corresponds to the number of stack of material shipped.

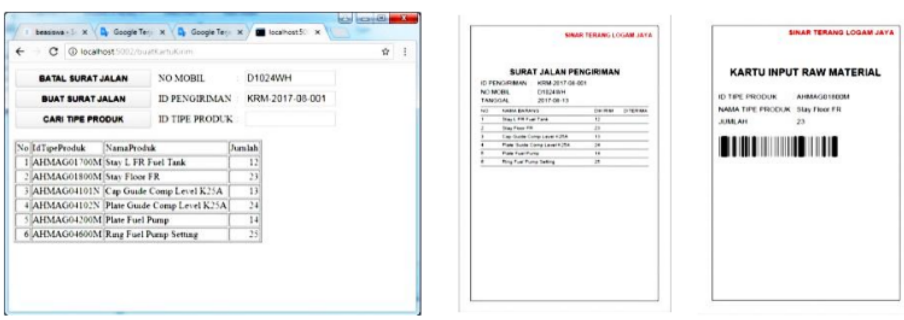

Figure 4. The program interface to record stripLot data, goods delivery document, and KARTU INPUT RAW MATERIAL

3.2. Testing of data recording on activity (3)

One of the interface of the program to record rawMaterialLot data can be seen in figure 5 (left). The interface appears after the operator receiving rawMaterialLot scans the barcode contained on KARTU INPUT RAW MATERIAL. The operator enters the quantity of metallic lot pieces received. This program generates KARTU LOT RAW MATERIAL (figure 5, right).

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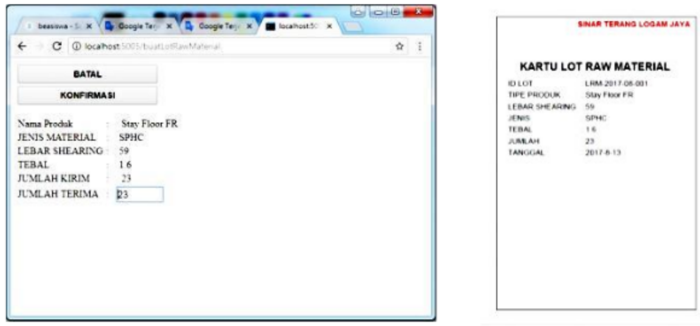

Figure 5. The program interface to record rawMaterialLot data and KARTU INPUT RAW MATERIAL

3.3. Testing of data recording on activity (4)

One of the interface of the program to record productLot data can be seen in figure 6 (left). The interface appears after the operator entered the identity of the product type to be created. In the interface there are some rawMaterialLot that can be taken by the operator to create the desired product that has been sorted according to the date of arrival. The operator selects the desired rawMaterial according to the order of arrival date. This program generates KARTU LOT PRODUK (figure 6, right).

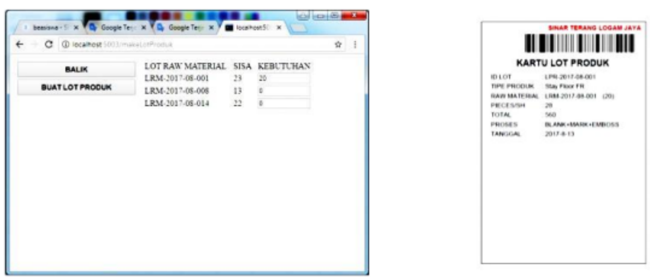

Figure 6. The program interface to record productLot data and KARTU LOT PRODUK

3.4. Testing of data recording on activity (5)

One of the interface of the program to record productLot data can be seen in figure 7. The interface appears after the operator scans the barcode contained on KARTU LOT PRODUK. The operator enters the quantity of product received on the product quantity input box. The quantity of products entered according to the real amount of product received.

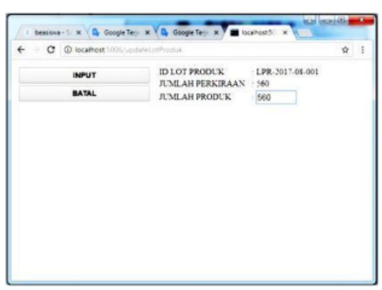

Figure 7. The program interface to record productLot data

4. Discussion

stripLot shipped from the Cibolerang production unit to the Cimahi production unit is automatically recorded in the existing data base in the Cibolerang production unit. In addition to data stripLot, delivery time can also be recorded automatically. rawMaterialLot which is a transformation of stripLot can also be recorded automatically on the existing data base system in Cimahi production unit. In addition to rawMaterialLot data, the reception time can also be recorded automatically. By comparing the acceptance time of rawMaterialLot with stripLot delivery time it is possible to estimate the time interval required to deliver the stripLot from the production unit in Cibolerang to the production unit in Cimahi.

The rawMaterialLot data can be compared with the useRawMaterialLot data so that the remaining rawMaterialLot can be obtained. The remainder of each rawMaterialLot can reflect the amount of product reserves of a certain type which is still a basic material.

When data recording on activity (4) is performed, productLot data is automatically recorded in the data base. Data finishDate and realQuantity still empty. productLot whose data finishDate and riilQuantity are still empty describe WIP of a certain type of product.

When data recording on activity (5) is performed, the data finishDate and the realQuantity of the lotProduct will be filled automatically. The productLot for which the finishedDate and realQuantity data are already filled describes the number of completed products of a certain type of product.

5. Conclusions

From the results of tests that have been done, it can be concluded several things:

1. Monitoring system that has been made can record the number of products that have been made, WIP, as well as raw materials to make each automotive component. Thus the number of products, WIP, or raw materials for each type of component can be known easily and accurately.
2. The monitoring system that has been created can also record the time required to make each type of automotive component. By knowing the timing of each type of component, it is possible to estimate the targets that can be obtained at specified intervals.

Monitoring system that has been made still needs to be developed further. The development that will be done is:

1. Making a program that can record the arrival activity of raw materials.
2. Create a program that can record the product delivery activity.
3. Develop an existing monitoring system to monitor machine activity, operators, or use of tools required for production activities.
4. Adding the scheduling function and control function on the system that has been created.
5. Adding a function to overcome the interference on the production system.

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