Production and Machine Scheduling System Integrated with Materials Requirement Planning

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ABSTRACT

Production and machine scheduling is important for any corporation in order to meet the customers demand. Literatures show that integration between customer orders and materials availability is important combination. This paper presents the prototype for a production and machine scheduling system to improve and maximize the integration with materials requirement planning. In this paper, a software development life cycle was applied as the research methodology. The authors used unified modeling language for the analysis and design of the application. After requirements identification phase, the application prototype was built and presented to the application users. The results of this research are an application prototype that helps to record production data and could be accessed to know the production process integrated with materials requirement planning.

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1. INTRODUCTION

Production and machine scheduling is important for companies. There are times when the availability of the raw materials and the demand level of the final products do not match. The company has to fulfill customer orders because the number of customer orders improves the production process to meet the needs of customers. With a continuous production process, the company will face difficulties to monitor the production and raw materials inventory simultaneously. Ineffective machine scheduling in the company creates opportunity loss. To improve and maximize the production process, a company needs an application to plan an effective machine scheduling that integrated with materials requirement planning in the production process. This paper will answer the following research questions: (1) How to develop the production process and machine scheduling system for PT. X? (2) How to manage the production process and materials requirement planning with integrated application?

This research will analyze and designed a system that will help the recording of production data and can be accessed real-time. So, the company will know the productivity level for the next production process any time. Additionally, the system can help the machine scheduling that will be integrated and connected directly to the production and inventory system. To assist the owners of the company, the application will send the information to validate the production process carried out through short message services whether or not the owners are located at the office and factory.

2. RESEARCH METHOD

The production represents activities that transform inputs to outputs. There are several purposes of production is to add the value of goods or services, to change the shape of goods or services, to satisfy human needs, to expand employment opportunities, and to achieve maximum profits [1]. Production involves several components such as the raw materials as inputs, the manufacturing process depending on what industry this company is in, and the finished goods as the outputs.

Among many problems, the sale price of the company's products remains among the most difficult ones to handle. The selling price of the company's products can determine whether the company can survive the competition in the industry. Selling price that is too high can prevent public not to buy or reduce the number of products purchased which will limit its revenues and profits. In contrast, the selling price that is too low will prevent to achieve planned operating income. Therefore, setting the right price is very important for any companies. It is important, however to realize that production capacity does not simply reflect the actual production rates [2].

Scheduling is a process to manage the work sequence. This can be done with or without a computer system. The key to making an effective and efficient scheduling is the decision to determine who should be running the process and when or how long the process will be operated [3]. A good scheduling system should ultimately cater to the company's needs and available resources. Thus, a tailored scheduling system should be the best option when it is available.

There is a module that is called the Materials Requirement Planning (MRP) which manages the material level to be stored and to be ordered [4]. The MRP system may send daily planned orders to carry out a real-time production schedule. At the same, orders can be sent to suppliers in order to notify them for any purchase of raw materials. Briefly, MRP can be described as a computer modeling technique that allows a demand-driven production execution. It determines what to produce, when to produce and how much to produce at specific times [5].

Software Development Life Cycle (SDLC) models are tools to develop software in order to meet a business needs [6]. The SDLC was employed as the research methodology starting from a project initiated as a part of business process analysis, application design, application builds using programming language, testing, implementation and maintenance. The application was designed with Unified Modeling Language (UML). At the completion of the application were performed in order to achieve the intended quality.

3. RESULTS AND ANALYSIS

The following description illustrates the business process of PT.X. The production process starts from the owners plan to undertake the production of goods and identification of the raw materials needed for production. This information was deployed to the production department. The department of production receives a list of materials required and the availability of the raw materials required will check. If the raw materials are not sufficient to satisfy the customer orders, warehouse will notify the production department and notify the procurement staffs. The owner decided whether or not a procurement of raw materials or a rejection of the production should be made. If the raw materials are available, the warehouse will mark the raw materials to be used and prepare the raw materials. After all the raw materials available, the production department will process the raw materials accordingly. The results of the production process will be recorded and be given to the warehouse.

The machine scheduling process is part of the production process for determining which machine to be used in the production process, considering the duration of the production process. This process begins when raw materials are ready for production, continued by having the production machine staff to check the production plan. Afterward, the production staff will determine which machine to be used in accordance with the categories and types of production machines. Then, the department of production will set the hours that will not interfere with the other production schedule on the particular machine. Productions will be carried out in accordance with the schedule.

Based on these business processes, an application prototype has been developed. The following figures show examples of use case diagram (Figure 1) and class diagram (Figure 2) that are implemented in the application.
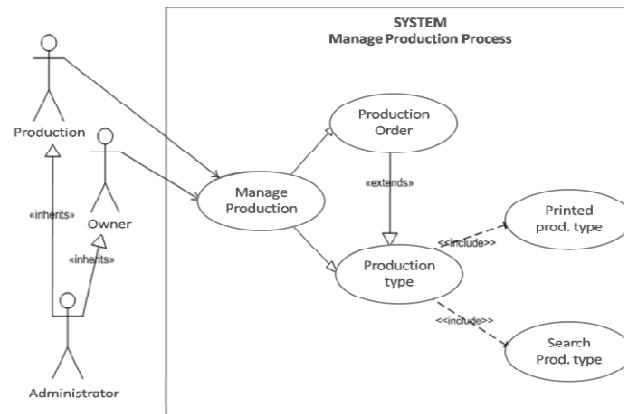
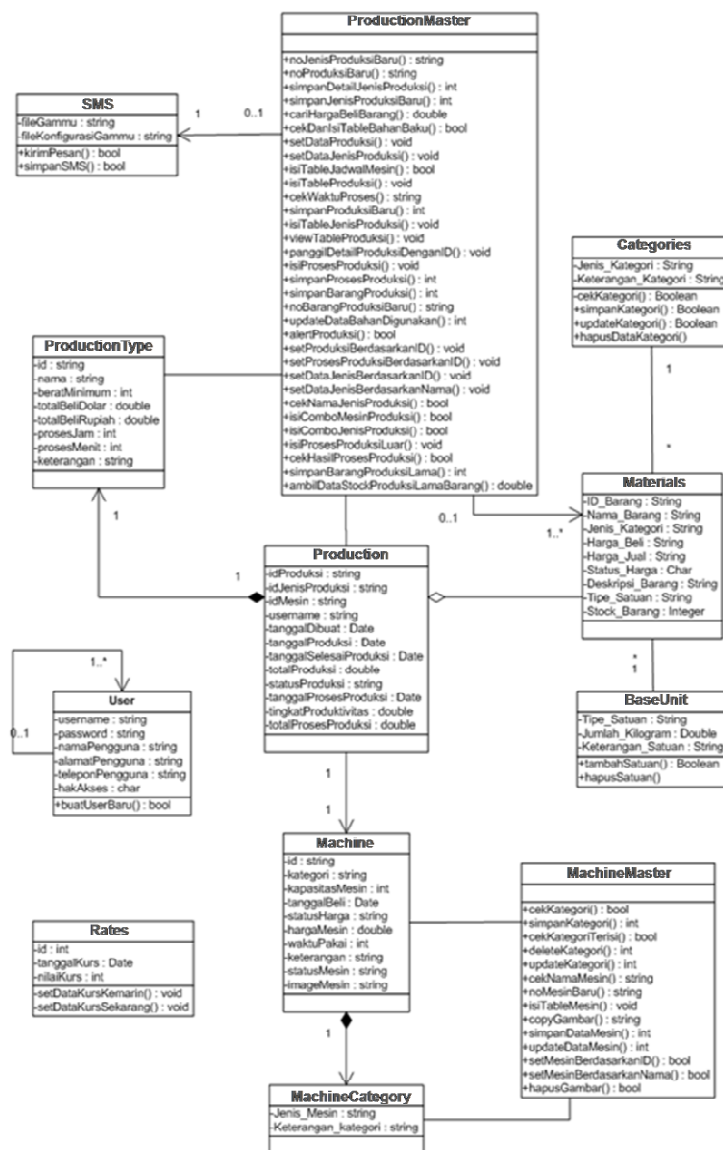Figure 1. Use Case Diagram – Manage Production Process

Figure 2. Class Diagram – Production and Machine Scheduling System

This section will explain the results of a system prototype developed in this research. Figure 3 shows machines information details to show that a particular machine is ready to be used for production.

Figure 3. Machine Information Details

Figure 4 shows an input form to set up the production type and the bill of materials for the materials requirement planning prior to the execution of production.

Figure 4. Materials Requirement Form

Figure 5 shows the production process information that consists of material selection, machine occupancy, order execution time set up, and production result confirmation after the production process is finished.

Figure 5. Orders Execution

Figure 6 shows the details of the production process that has been completed. The form consists of production id, production date, product name, expected production amounts, production result amounts, and the percentage of productivity.

Figure 6. Production Process Details

4. CONCLUSION

The application prototype resulted from this research show an ability to assist the recording of production data in real-time. The production department, warehouse management and owners can review materials availability and view the final confirmations after the completion of the production process. Owners can also gain information on the productivity level (in percentage). In addition, this application can assist machine scheduling as aligned with the production system and raw material inventory level. The

application can send information to the owners in order to validate the production process that has been carried out by sending short message services. With this service, owners can find out all production activities regardless of their location.

Recommendation for further development of this application are as follows. This application can be further developed as a real-time logistic information system. Further research is necessary to add an accounting module in order to integrate the financial functions into the system. In such addition it is expected that all activities can be controlled and computerize. Thus, the maintenance can be done periodically in an efficient manner considering that there will be major increases in the amount of transactions in the future.

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