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Production Scheduling Software Design Using First In First Out and Earliest Due Date Methods At PT. Synergy Gem Creations

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Abstract. PT. Kreasi Permata Sinergi is engaged in digital printing textile. This company processes fabrics for printing. The problem with this company is that the machine scheduling is still manual. This company also has special customers. This particular customer has to be produced before other normal customers so that the production division has difficulty scheduling machines. This study discusses the design of software for scheduling machines. The program used uses the First In First Out (FIFO) method and Earliest Due Date (EDD) which is adjusted to the conditions of the company. This program helps workers to streamline time in the machine scheduling process. In this program there are features to add, edit, or delete to make the scheduling process easier. The output of this program is a machine schedule that is ready to be printed to be given to machine operators.

INTRODUCTION

Production scheduling is the process of selecting, grouping, and timing in order to produce effective and efficient output. Each production activity requires scheduling to allocate the time, operators, machinery, and equipment used. It can be concluded that production scheduling plays an important role in the production process. At this time the scheduling of production in the company has not been done automatically through the program. The production division needs to manually schedule to schedule the production schedule. One of the scheduling errors is when the production division schedules the production schedule. Examples of errors in scheduling are production divisions less thorough in filling in or entering data, incorrect calculation processes, errors in making visuals such as charts or gantt-charts,and errors in sorting time. In addition, the production division has difficulty in resetting the scheduling in case of changes in scheduling. Even the production division can change the entire scheduling that has been scheduled. It's different if the production division uses a program. An error in using a program is when entering data.

The program the company needs is to minimize scheduling errors. The program can edit, enter orders, delete orders, and schedule orders. Manual scheduling becomes automated. The calculation process until visualization is automatic. If there is an error in entering the data then the production division can change the data. The process of calculation until visualization turns into the latest. Therefore, the importance of the role of technology in the scheduling process.

PT Kreasi Permata Sinergi is engaged in the field of digital printing textile. Customers who want to order products to this company can provide their own designs and own fabrics. If there is no design and fabric this company offers several designs and fabrics provided. This company has several customers who have often ordered to this company so that these customers have more priority than other customers. In the production process, the company must schedule production on several machines. This scheduling is based on the order of customers who order or can be said first in first out (FIFO). The process of scheduling this machine is still done with a handwritten manual on the board. Then switch the shower using Excel but it is still filled manually. This scheduling process sometimes occurs errors, starting from the calculation and the completion time of production. Customers who have ordered will be scheduled for production. But unlike customers who have often ordered or special customers, special customers get special services that the production takes precedence over ordinary customers. The scheduling of this machine

affects the deadline period that has been given by the customer. If it exceeds the deadline that has been set with the customer, the company will negotiate with the customer.

METHODOLOGY

Research stage diagram can be seen in Figure 3

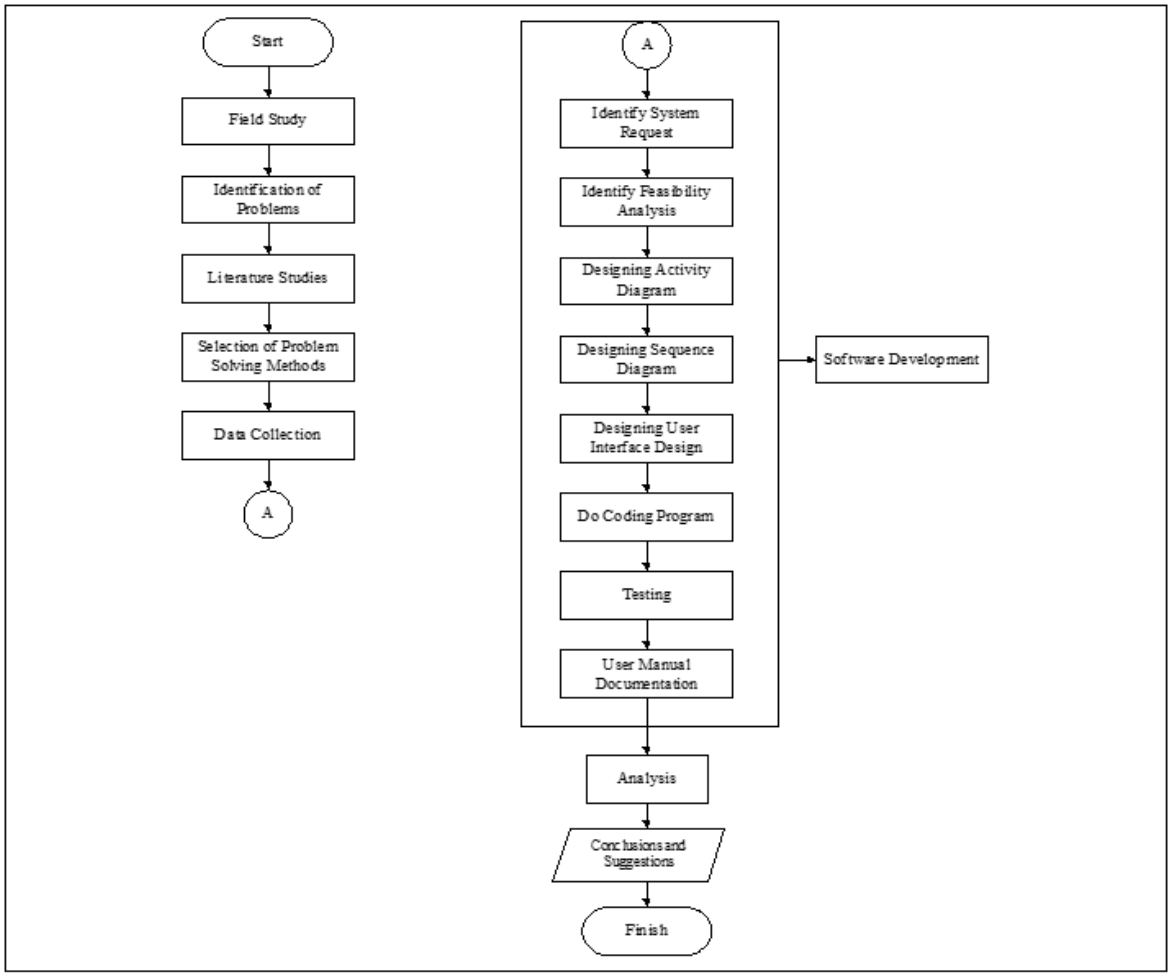

FIGURE 1. Research Stage Diagram

According[1], prototyping is a method of software development, which is a physical model of system work and serves as an early version of the system. The study was conducted using the System Development Life Cycle (SDLC) method. This research was conducted to design production scheduling software using the First In First Out (FIFO) and Earliest Due Date (EDD) methods at PT. Synergy Gem Creation can optimize scheduling process time. This methodology consists of System request, feasibility analysis, use case diagram, activity diagram, sequence diagram, user interface design, program coding, testing, and manual user documentation.

Scheduling

According to [2] scheduling is the work of a set of tasks to be allocated resources in a certain time with two important meanings as follows. Scheduling is a decision-making function for creating or determining schedules. Scheduling is a theory that contains a set of basic principles, models, techniques, and logical conclusions in the decision-making process that provide understanding in the function of scheduling.

System Request

System requests are useful for knowing the needs when designing a system. System request consists of project sponsorship, business needs, business requirements,and business value.

Feasibility Analysis

Feasibility analysis is used to analyze the feasibility of a system created. There are two feasibility analysis, functional requirements and non-functional requirements. Functional requirements need program features to be designed. While non-functional requirements are needed when operational, program security, and performance of the program.

Use Case Diagram

After making a system request and feasibility analysis of non-functional requirements, the next step is to create a use case diagram. Use case diagrams are useful to help in visualizing needs between users with the system or users with other users.

General Flowchart And Activity Diagram

Next create an activity diagram. This diagram is created after the use case diagram with the aim to show the activity of each process in the use case. Activity diagrams are created every single use case.

Sequence Diagram

Sequence diagrams are created after the use case diagram is complete. This diagram is used to describe the interactions, relationships, and methods of the system in the use case diagram. The use of this sequence diagram is almost the same as the activity diagram. One sequence diagram is created every use case.

User Interface Design

The next step is to create a user interface design. User interface design is made to make it easier for users to interact with the system and provide a lot of information that will be displayed by the system to the user. The creation of user interface design is done in excel using the features that have been provided by Excel. In addition to using features in excel, user interface design can be created using userform.

Coding Program

The next step is coding programs. At this stage, I start programming. The programming language used is the VBA Language excel. The place to code programs is in excel. Excel already provides a place to put coding in excel. In addition, excel has also provided several functions so that the function can be directly used without having to create its own function.

Testing

Once the program has been finished, testing is carried out. This test aims to test the entire needs of the user to function properly. If something goes wrong then go back to the coding stage of the program. This process is done until all user needs are functioning properly. In addition, this test aims to match the user's convenience with the program. If the user is not comfortable in using the program then return at the user interface design or coding program stage. This test is done until all the needs on the program function properly and the user feels comfortable using the program.

RESULT

System Request

System request consists of project sponsorship, business needs, business requirements, and business value can be seen in Table 1

TABLE 1. System Request

System Request: Production Scheduling	
Project Sponsor :	CEO of PT. Kreasi Permata Sinergi
Business Needs :	This project was built to
1. Improve the efficiency of the production scheduling process	
Business Requirements:	
The system that supports the production scheduling process is	
1. Product search features to be scheduled	
2. Admin login feature that manages	
3. Edit production schedule feature	
4. Update feature on scheduling	
Business Value:	
1. Reduce production delays so that they are in accordance with the customer's deadline.	
2. Increase customer trust in the company	
3. Improve scheduling accuracy	
4. Streamline the scheduling process	

Feasibility Analysis

This feasibility analysis consists of technical feasibility, economical feasibility, and organizational feasibility can be seen in Table 2

TABLE 2. Feasibility Analysis

Feasibility Analysis
Technical Feasibility
Risks tofamiliarity with the application: 1. The production process division has experience in the field of production scheduling. 2. There is no division that develops the application of the scheduling process.
Risks tofamiliarity with technology: 1. The production process division mastered ms.excel 2. Admins managing customer orders simply master ms.excel
Risk tofamiliarity with project size: Moderate risk 1. The company does not yet have an IT division developer.
Compatibility with existing systems and infrastructure: The scheduling system is done now by writing on excel and there is no automation or software. So, it is highly compatible production scheduling system using VBA Excel.
Organizational Feasibility
Organizationally, the entire division uses ms.excel so the use of VBA excel will be quite easy. to apply and if there are new people it will be quite easy to provide training in using the software to be created.

Use Case Diagram

Use case diagram is used to describe all business requirements in system request. The use case diagram can be seen in the following image can be seen in Figure 1.

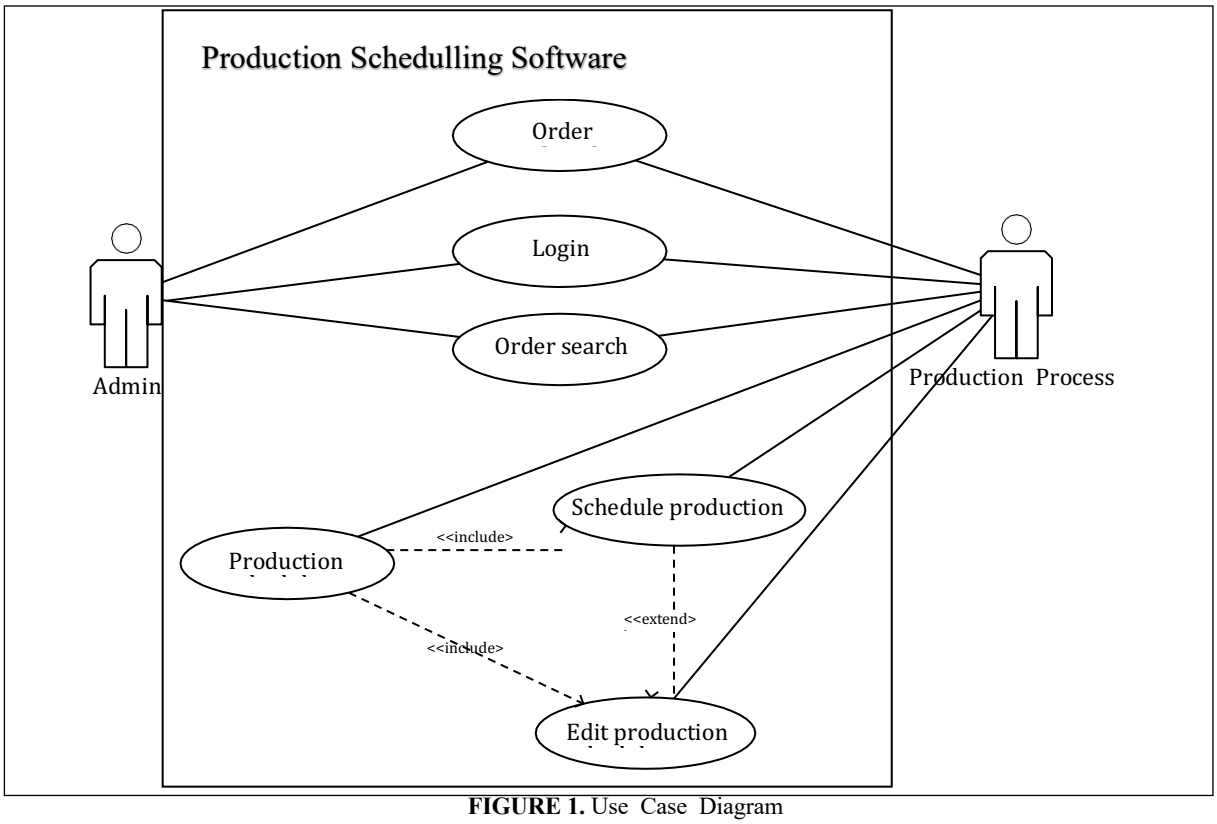

FIGURE 1. Use Case Diagram

Admins and production process divisions have accounts to log into the system. Admins can view databases and add database orders, while the production process division can only see the database and cannot add to the order database. The production process division can schedule according to the orders available in the order database. After scheduling if there is an error in determining the schedule, the production process division can change the order schedule. Admins can't schedule orders. The data search feature can be used by admins and production process divisions.

General Flowchart And Activity Diagram

The general flowchart is divided into two. The first flowchart describes the overall flow of the program. While the second flowchart describes the scheduling process on the program designed. The two flowcharts are related. The first flowchart is the main program flow can be seen in Figure 2.

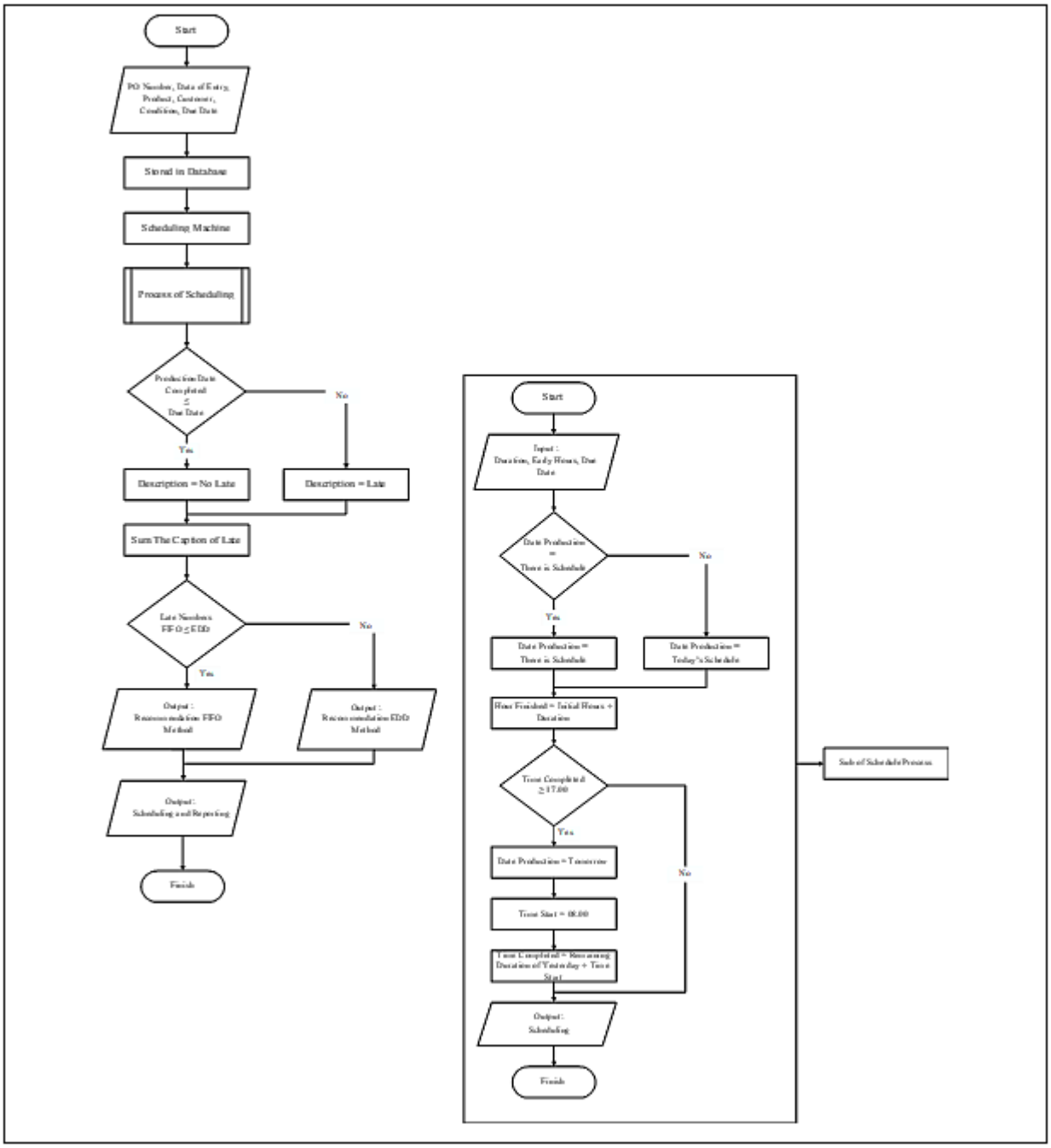

FIGURE 2. Flowchart General Program

The program is run after which it is logged in using a username and password. After that enter po number data, date of entry, product, customer, customercondition, and due date. Next the program will store the data in the order database. Then the production division chooses the engine to be scheduled. There are two engines, the TS300 and TS55. Next is the schedule process. After the scheduling process is complete there is an output in the form of scheduling and reports.

In this scheduling process the program will request input duration, initial hours produced, and due dates. The program will check the scheduling. If there is already a previous scheduling then the production date continues from the previous date. If there is no previous production date then the production date becomes the current date. Next determine the finished production clock by adding the initial hour with the duration. If the finished production

hours exceed 17.00 WIB then continue with tomorrow. The clock starts at 08.00 WIB adjusted to the company's operating hours. Then the finished production clock is the clock 08.00 WIB plus the rest of the duration on the previous day. The scheduling process is complete.

Activity diagrams are created after the use case diagram. This diagram describes every use case in the use case diagram. This diagram contains six use cases in the use case diagram. The activity diagram consists of an order database, login,ordersearch, schedule production, edit production schedule, and production schedule. An overview of each activity diagram can be seen in the Figure 3.

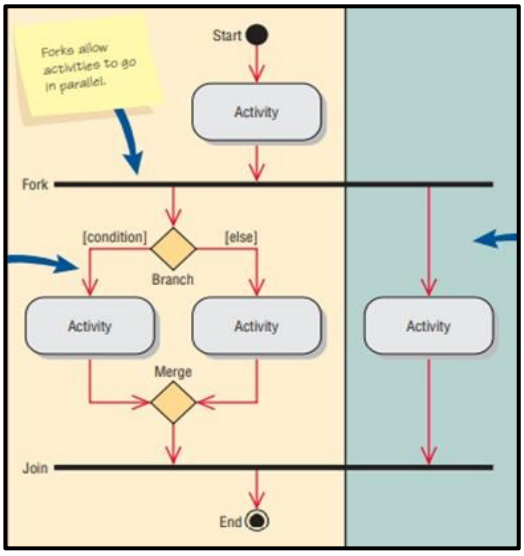

FIGURE 3. Activity Diagram

This sequence diagram is created after the use case diagram is completed. This diagram is to describe the scenario in the use case diagram. The description of each use case is described in this diagram. In the use case diagram consists of six use cases so that in the sequence diagram there are six sequence diagrams. The sequence diagram consists of an order database, login, order search, schedule production, edit production schedule, and production schedule. Each use case will be described and described. An overview of each sequence diagram can be seen in Figure 4.

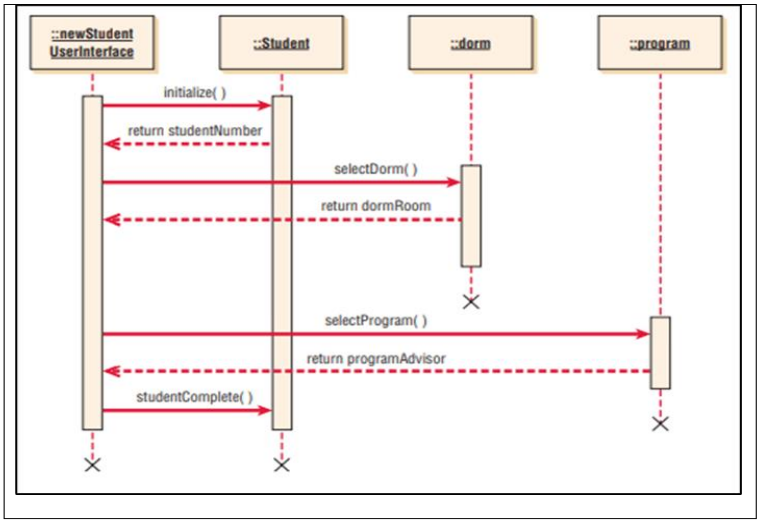

FIGURE 4. Sequence Diagram

User Interface Design

According to [3], user interface design is the way programs and users interact. User interface design is the visual part of software, websote, and applications that interact directly with the user and how it displays the information displayed. The user interface design at the design stage can be seen in Figure 5 through Figure 8.

FIGURE 5. UI: Login

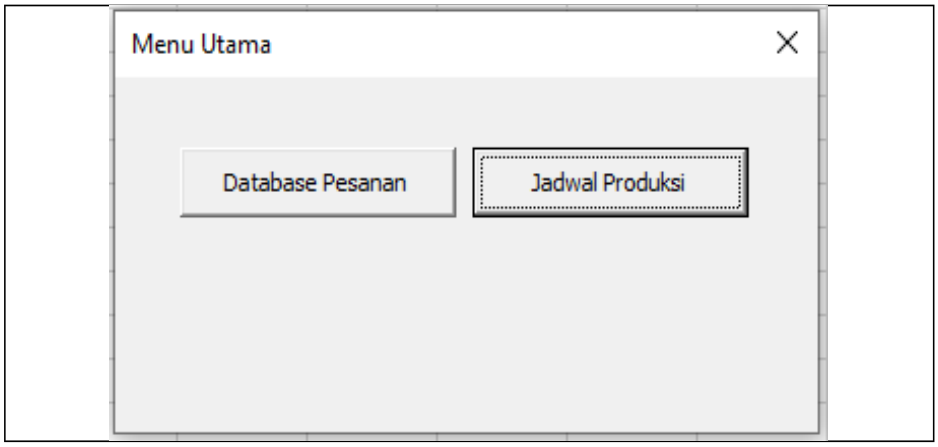

FIGURE 6. UI: Main Menu

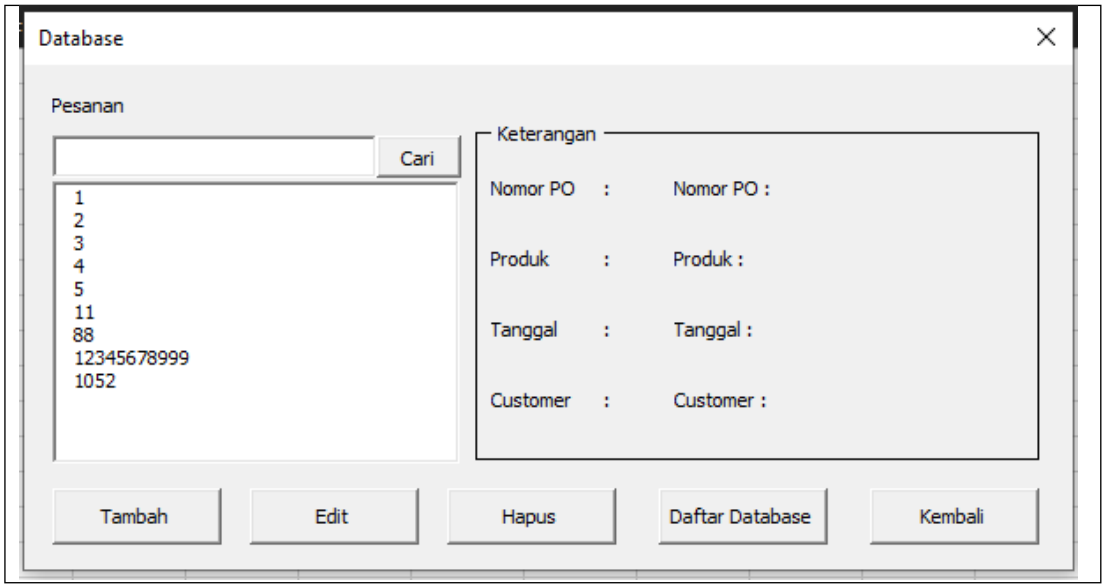

FIGURE 7. UI: Database Menu

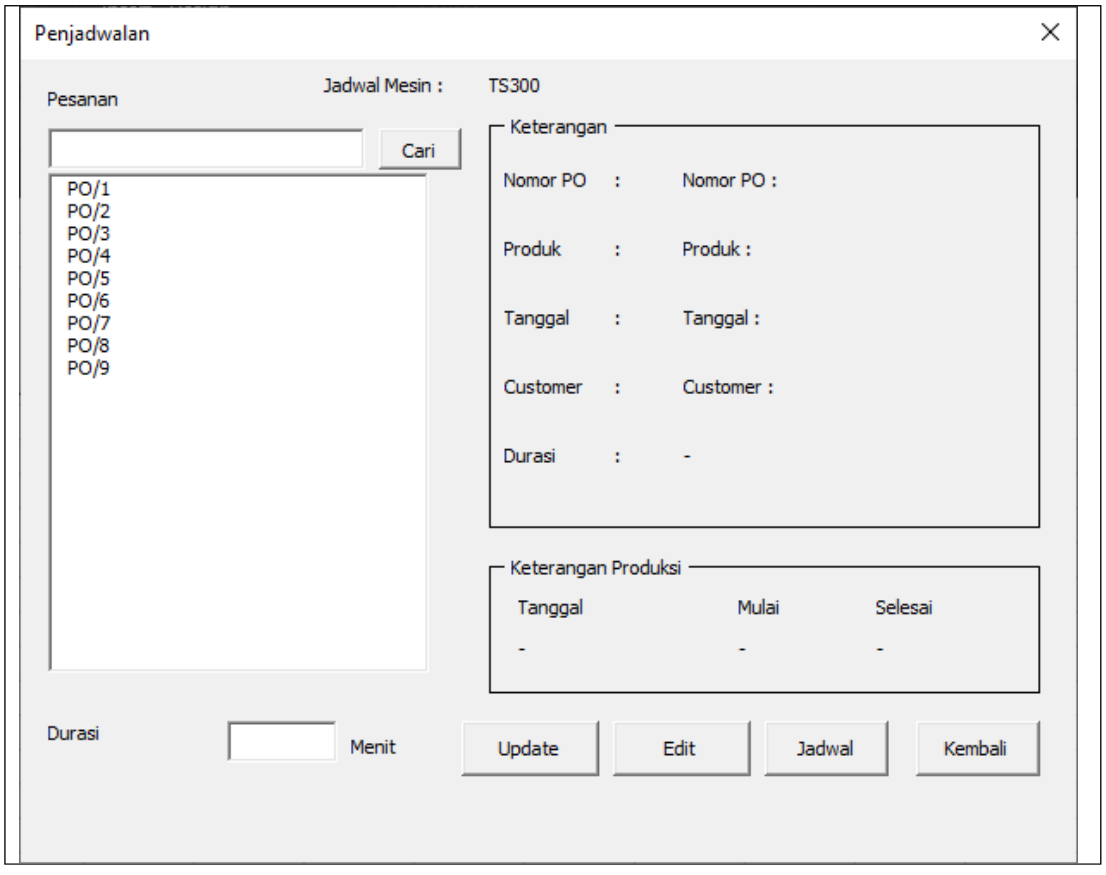

FIGURE 8. UI: Scheduling Menu

Data Modeling

The data model used is to use relational databases because excel is a set of cells consisting of rows and columns. Therefore, relational databases are used because they are effective to apply to excel. The data will be stored in the database. The order database can be seen in Table 3.

TABLE 3. Database View

PO number	Date	product	Customer	Condition	Due Date
PO/1/7	07-Jul-2021	mask	dadan	Normal	7/10/2021
PO/2/7	07-Jul-2021	shirt	didin	Normal	7/10/2021
PO/3/7	07-Jul-2021	mask	dudun	Normal	7/10/2021
PO/4/7	07-Jul-2021	mask	two	Normal	7/10/2021
PO/5/9	09-Jul-2021	trousers	Did	Priority	7/9/2021
PO/6/9	7/9/2021	trousers	sukijem	Normal	7/12/2021
PO/9/9	7/9/2021	Futsal shirt	sutisna	Normal	7/12/2021
PO/7/9	7/9/2021	trousers	sukijang	Priority	7/9/2021

The data will be normalized 1-NF, 2-NF, and 3-NF. Normalize a 1-NF data table if each data attribute has a single value in a single row. Normalization of 2-NF data each attribute is broken down based on primary key. The purpose of breaking down attributes based on primary keys is to facilitate data renewal. Normalization of 3-NF of each primary key does not depend on other attributes. The results of data normalization can be seen in Figure 9.

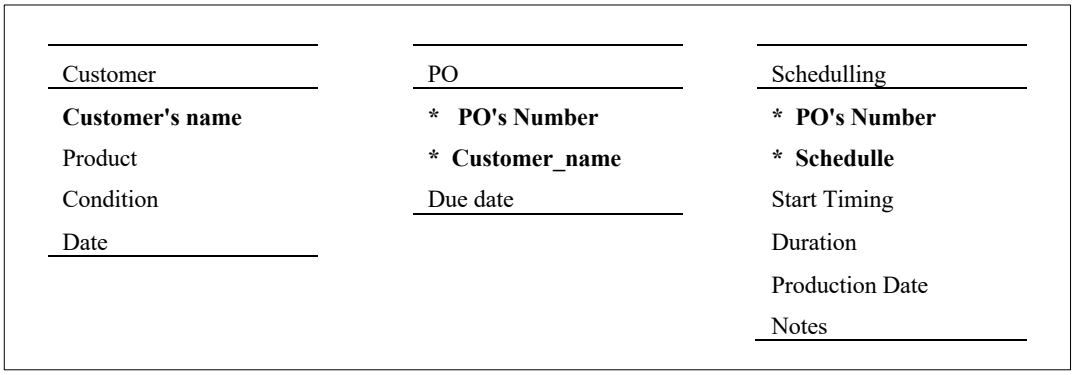

FIGURE 9. Normalization Data

Coding Program

According to [4] Visual Basic is a program to create Microsoft Windows-based applications quickly and easily. Visual basic provides tools for creating simple applications to complex or complex applications for both companies / agencies with larger systems" The language used is a VB language that is integrated into excel applications.

Testing

According to [5] software testing is a critical element of software assurance and presents a basic review of specifications, design and coding. Testing can also be interpreted by the process of executing a program with the intent and purpose of finding errors. Testing is done using the black boxmethod. This method tests all functional

requirements, non-functional and all features. This test is done with the production process division and admin. This method uses a user acceptance test to determine the test results. The test results can be seen in Table 4

TABLE 4. User Acceptance Test

No	Question	Valuation			
		A	B	C	D
1	Is this program easy to use?	3			
2	Is the menu easy to understand?	3			
3	Is data filling easy?	3			
4	Is the login feature optimal?	3			
5	Is the database editing feature optimal?	3			
6	Is the feature removing the database optimal?	3			
7	Does the feature add an optimal database?	3			
8	Is the feature of scheduling orders optimal?	3			
9	Is the edit order schedule optimal?	3			
10	Is the schedule report feature optimal?	3			
11	What is the optimal method recompendaing feature?	3			
12	Is this program good enough?	3			

Testing is done at the company. The user acceptance manual is filled in by three related people. All three give value to the user acceptance manual. After processing data the result is 100% so no repair or subsequent iteration is needed.

CONCLUSION

Test results on the design of production scheduling software at PT. Creation of Synergy Gems. This program produces production schedule reports and this program can facilitate the scheduling process that was originally done manual calculations become more automated with this program. The methods used in this scheduling are First In First Out (FIFO) and also earliest due date (EDD) calculations used can run well.

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