Development of Decision Support System for Scheduling Machine Loading by using Microsoft Office.

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June 2018

This final year design project report is submitted to
Universiti Sains Malaysia
As partial fulfilment of the requirement to graduate with honors degrees in
BACHELOR OF ENGINEERING (MANUFACTURING ENGINEERING WITH MANAGEMENT)

School of Mechanical Engineering
Engineering Campus
Universiti Sains Malaysia

Declaration

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

Signed …………………………………………….... (KHIEW FOOK YUN)

Date   ……………………………………………………

STATEMENT 1

This thesis is the result of my own investigations, except where otherwise stated.

Other sources are acknowledged by giving explicit references.

Bibliography/references are appended.

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STATEMENT 2

I hereby give consent for my thesis, if accepted, to be available for photocopying and for interlibrary loan, and for the title and summary to be made available outside organizations.

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Acknowledgement

I wish to express my sincere gratitude towards School of Mechanical Engineering, Universiti Sains Malaysia (USM) for providing this opportunity for the final year students to conduct the Final Year Project individually. The knowledge and skills that I have gained from this project has increased, which is important for me towards my future career later.

I would like to thank the person in charge in company A who is kind to do discussion, providing data and giving a task to modify the file given.

Besides, I would also like to thank my project supervisor, Dr. Amir Yazid Ali in providing this wonderful project topic entitled "Development of Decision Support System for Scheduling Machine Loading by using Microsoft Office.". His guidance and advices throughout this project have helped me to carry out this project smoothly, thus I could complete my project successfully within this limited time.

In addition, I am thankful to the coordinator of this course, as well as the lecturers from School of Mechanical Engineering, USM in conducting a few seminars talks such as explanation on Final Year Project and how to write a good thesis or report for our project work. The talks are so useful in guiding us towards successful in completing this course.

Finally, I take this opportunity to express my whole hearted thanks to all other persons who lend a big hand in helping me to complete my Final Year Project. The project is impossible to be completed without the help of anyone of you all.

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List of Abbreviations

CRP	Capacity Requirements Planning
MRP	Material Requirement Planning
SQL	Structure Query Language
MS	Microsoft
VBA	Visual Basic for Applications
EDD	Earliest Due Date
LPT	Longest Processing Time
SPT	Shortest Processing Time
FCFS	First-Come, First-Serve
CR	Critical Ratio
S/RO	Slack per Remaining Operations
DBMS	Database Management System
1NF	First Normal Form
2NF	Second Normal Form
3NF	Third Normal Form
ID	Identification
FYP	Final Year Project
WIP	Work in Progress
HMLV	High Mix Low Volume
HR	Human Resources
TAT	Total Available Time

DEVELOPMENT OF DECISION SUPPORT SYSTEM FOR SCHEDULING MACHINE LOADING BY USING MICROSOFT OFFICE.

RINGKASAN EKSEKUTIF

Industri perkilangan akan menerima sejumlah besar pesanan pelanggan mengikut keupayaannya untuk mencapai keuntungan perniagaan yang mencukupi, maka penjadualan pesanan adalah penting untuk menetapkan kerja ke pelbagai stesen di kilang. Malah, fail sedia ada Excel akan mengandungi banyak data yang disimpan dan banyak data dikehendaki diurus dengan teratur dan ini akan menyebabkan kegagalan Excel untuk mengemas kini maklumat baru dan lantas menyebabkan industri menghadapi masalah. Oleh itu, Microsoft Access diperkenalkan untuk digunakan dengan Microsoft Excel kerana kedua-dua alat tersebut adalah penting untuk diamalkan untuk menguruskan data pesanan pelanggan. Matlamat projek reka bentuk ini adalah untuk mencipta templat bagi menyimpan data dan menjadualkan pemuatan mesin dengan menggunakan Microsoft Access dan Microsoft Excel. Dengan menggunakan Microsoft Access, pangkalan data dibuat dan digunakan sebagai penyimpanan bagi syarikat untuk terus mengemaskini maklumat baru sebab rekod adalah bebas dalam pangkalan data dan tidak berubah mengikut masa. Penggunaan Excel dalam reka bentuk ini berfungsi untuk menjana output bagi penjadualan mesin. Kaedah-kaedah keutamaan seperti Earliest Due Date (EDD) dan Shortest Processing Time (SPT) adalah digunakan untuk menjadual pekerjaan. Secara umumnya, peraturan keutamaan SPT mendorong beban yang paling banyak melalui sistem untuk menyelesaikannya lebih pantas daripada peraturan EDD. Kelajuan boleh menjadi kelebihan, tetapi hanya jika beban boleh dihantar lebih awal daripada yang dijanjikan dan pendapatan yang diperoleh lebih awal. Walau bagaimanapun, peraturan EDD boleh menguruskan pekerjaan yang akan disiapkan tepat pada masanya. Semua keputusan adalah rujukan untuk syarikat bagi melakukan keputusan mengikut keutamaan kompetitifnya.

DEVELOPMENT OF DECISION SUPPORT SYSTEM FOR SCHEDULING MACHINE LOADING BY USING MICROSOFT OFFICE.

EXECUTIVE SUMMARY

Manufacturing industry will receive a large amount of customer orders according to its capacity to achieve enough business profit, so order scheduling is important to assign the production orders to various work stations in the plant. In fact, the existing file of Excel will contain clusters of data stored and the clusters of data are required to be managed orderly and this will cause to a failure for Excel to update new information which cause the industry to face problems. Therefore, Microsoft Access is introduced to use with Microsoft Excel because both tools are essential to be practised for managing the customer order data. The aim of this design project is to create a template for storing data and scheduling the machine loading by using Microsoft Access with assist of Microsoft Excel. By using Microsoft Access, database is created and used as a storage for the company to keep updating the new information since the records are free in database and kept unchanged overtime. Moreover, using Excel in this design made it easy to perform numerical calculations, format cells, and adjust layouts to generate the output for sequencing machine loadings. Priority rules such as Earliest Due Date (EDD) and Shortest Processing Time (SPT) were used for sequencing the jobs. In general, the SPT priority rule pushes most loads through the system to completion more quickly than will the EDD rule. Speed can be an advantage, but only if loads can be delivered sooner than promised and revenue collected earlier. However, EDD rule can manage the jobs to be completed on time. All the results are the reference for the company to do decision making according its competitive priorities.

Chapter 1 INTRODUCTION

1.1 Project Overview & Problem Definition

Generally, the load/unload station is the physical interface between the flexible manufacturing system and the rest of the factory. It is where raw work parts enter the system and finished parts exit the system. Loading and unloading can be accomplished either manually (the most common method) or by automated handling systems.

However, a load means the quantity of work. And allocating the quantity of work to the processes necessary to manufacture each item is called loading. [1]

It is performed in the Capacity Requirements Planning (CRP) of the manufacturing planning. Each item planned in Material Requirement Planning (MRP) is first explored to the processes necessary to manufacture it. Next loading is performed for the explored process. In loading, each load is usually piled up by time (hour), by which a setup time and a real operating time are determined. The real operating time may be set by manufacturing lot or by real operating time per item unit. In additional, the calculated load is piled up for a certain period.

Manufacturing industry will receive a large amount of customer orders according to its capacity to achieve enough business profit. Therefore, order scheduling is important to assign the production orders to various work stations in the plant. Now, the production orders are the loads that be the throughput to the machines. The order scheduling prepares a dispatch list that indicates which loads should be accomplished at the various work stations. It also provides information about relative priorities of the different jobs, for example, by showing due dates for each job. In shop floor control, the dispatch list guides the foreman to allocate resources to different jobs to comply with the master schedule.

In fact, the scheduling system will contain clusters of data stored and the clusters of data are required to be managed orderly. If fail to do so, the industry may face the problems in maximising of the utilisation of resources, minimising the processing and tooling costs and maximising the throughput rates. [2]

Hence, a relational database is introduced to be the warehouse of the data. It has advantages including rely on relational tables, utilize defined data schema and reduce redundancy through normalization. Therefore, a software called Microsoft Access is used to develop a template for the scheduling of machine loading according to the capacity. It is useful to make better decisions about how to run and improve their processes more efficiently and effectively. [4]

This design project is based on the machine capacity/scheduling report given by the industry base company, Company A. The purpose of this work is to organise and complete the customer orders in a timely, quality and financially responsible manner according to the machine capacity by calculating the total cycle time for each order. It is a kind of important tool and documentation of durations and sequences of all operations, in which to ensure that an order is completed within the contract time. If any delay or out of machine capacity is identified early in the planning and scheduling, corrective actions can be taken to complete the order on time.

Therefore, Microsoft Access is introduced to use with Microsoft Excel because both tools are essential to be practised for managing the customer order data in the machine capacity/scheduling report.

1.2 Problem Statement

- Finding and Choosing the techniques that are most suitable for storing and sorting data in Company A.

- Getting the most efficient/effective way to manage full capacity of machine loading in every machine for company A.

- Finding the way to manage the data for scheduling the machine loading with the use of Access and Excel.

It is critical to manage and monitor the data over-time for machine loading in Company A so that the customer order can be completed on time and at the same time having confidence from the customer to continue with the collaboration.

1.3 Objectives

The main objectives of this study are:

- To determine the techniques for storing and sorting data to manage full capacity of machine loading in Company A.

- To create a template for scheduling the machine loading by using Microsoft Access with assist of Microsoft Excel.

1.4 Scope of Work

The aim of this work is to create a template for scheduling the machine loading in company A. Samples of data are provided to help to simulate the real-time machine loading over-time. The methodology in using Microsoft Access is studied and used as a database storage for the company. Using the advantages of Microsoft Excel for calculation on the sequencing of the loads by inserting appropriate formulae.

Chapter 2 LITERATURE SEARCH

2.1. Technical Review

Development of a schedule system for machine loading is needed for which requires the collection of work and operation data over time. However, existing scheduling system only allows for recording of the latest status of the order in Microsoft Excel. Excel has the advantages to make it easy to store data, perform numerical calculations, format cells and adjust layouts to generate the output. Unfortunately, there is a limitation in Excel for the flexibility of spreadsheets. Although it is easy to create formulas, reference cells, copy and paste data, and link worksheets and spreadsheets together, but spreadsheets become more difficult to change and manage as the work gets more complex. While spreadsheets are ideal for creating one-time analysis, they become problematic as the data grows and evolves over time. As new rows and columns get added, summary ranges and formulas may need to be modified or new formulas created, data and formulas are not updated consistently. And these mistakes will lead to bad results and decisions. The challenges of spreadsheets are due to the difficulty maintaining them accurately over time and scaling the volume. [3][6]

2.1.1 Overview of Microsoft Access

Microsoft offers free runtime versions of Microsoft Access. The users can freely run an Access desktop application without purchasing or installing a retail version of Microsoft Access which is with license. Developers can freely distribute created databases to unlimited number of end-users. [11] The most important features in Access are tables, queries, forms and reports, and even connect them using macros. The concept of Access also helps end users for accessing data from any source. The import and export of data to many formats including Excel, Outlook, ASCII, dBase, Paradox, FoxPro, SQL Server, and Oracle. A lot of effort has been put by Microsoft into making Access to be the most powerful and easiest consumer database programs. Because Access is part of Microsoft Office, users can use a lot of techniques with Microsoft Word and Microsoft Excel.

Figure 2.1: Logo of Microsoft Access

2.1.1.1 Advantages of using Microsoft Access
Access is the database package within the Microsoft Office suite. Below is a list of what are the benefits and advantages of using Microsoft Access.

1. Quick and easy to create database systems.

Microsoft Access is an excellent tool for creating database systems using various wizards to speed up the process of creating a database application, and a vast array of readily available functionality. For an expert programmer specialising in MS Access, development time is approximately half that needed for creating the same system using a different platform. It is cost-saving.

2. MS Access produces flexible and adaptable database systems.

It is still much quicker to modify things in Access than it is in other packages. And if users need to add new bits into system they can often be integrated as quickly as creating something new. In practice, this means that Access is perfect for the real-life business world. Things change, and system can change with them without costing any things else and without long time delays.

3. Well-known so can get help and support easily.

Access and its VBA programming language are known by many developers, programmers and software companies. This means that if users create a system using MS Access, users will not be stuck with the person who created it for them as well as the source files are kept. These will be .mdb or .accdb files; .mde or .accde files are not source files and cannot be examined or amended by another programmer. A reputable developer will always make sure that users have the source files and that users know it.

4. Microsoft Access has been around for a long time, so expertise is not going to disappear.

Access was already around since 1980s. It has always been included as part of Microsoft Office, and this is not going to disappear any time soon. Access is a great choice if really want a system that is going to have longevity.

5. Part of the Microsoft Office is fully integrated with the other MS Office packages, like Word, Excel & Outlook.

With exporting data and reports to Excel for ad hoc analysis or turning an Access report into a pdf and attaching it to an email using the standard menus within Access. Via programming users can export data to specific file layouts or templates to satisfy the requirements of other systems; trigger emails from actions taken in a database; link and import data from external files automatically into an Access database; and so on.

2.1.2 Reasons to use MS Access with MS Excel

Here are eight reasons why using Excel and Access together makes lots of sense.

•Reason 1: Access is designed for all kinds of users.

When simple tables happen to evolve into multiple tables of related data, Access is the first choice to create a database application. Although Excel is widely used to store data and often solve simple database problems, but Excel is a flat file database, not a relational database. Unlike Excel is a simple spreadsheet layout, Access is organized differently with several interrelated objects.
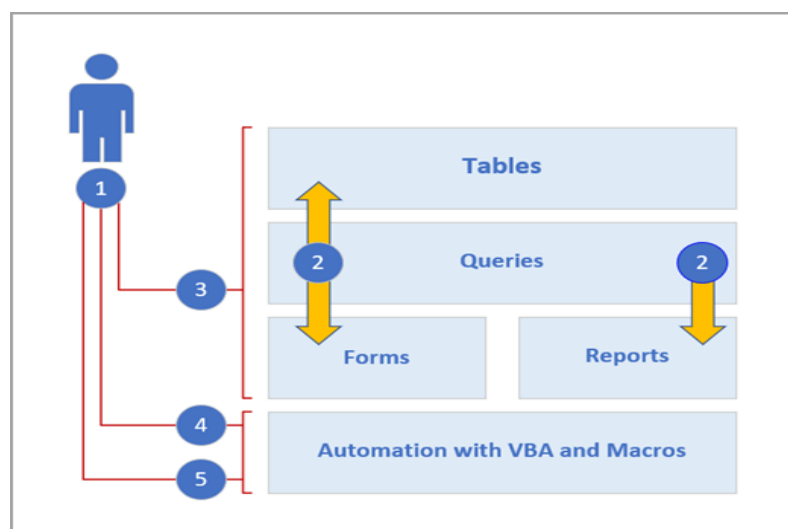
Figure 2.2: The uses of Access and kinds of users.

1. Use Access in three ways: as an occasional user, a power user, or a developer.

2. Tables, queries, forms, and reports build upon each other and make up the heart of a database application.

3. Occasional users have wizards, property builders, the Office Fluent user-interface, and Excel-like features to quickly get a job done.

4. Power users have macros, the property pane, expressions, and database design tools to delve deeper and do more.

5. Developers can work with modules and develop VBA code to create custom database solutions and deploy runtime applications.

•Reason 2: Copying an Excel worksheet to an Access datasheet.

Copying data from Excel to Access is a good way to start. An Access table can be created and displayed in datasheet view, which closely resembles an Excel worksheet. Common table creation tasks can be done right in the datasheet view. This includes defining a data type, a field name, or a new field. Access can function automatically if data has headers, make good guesses at using the correct data type, and create an Access table when copying data from Excel and pasting it into Access.

•Reason 3: Sharing data by linking to an Excel worksheet from Access.

Use an Access link when planning to keep the data in Excel, but also regularly leverage some of the many Access features. When linking to an Excel worksheet or a named range, Access creates a new table that is linked to the Excel data. If users want to add, edit, or delete data, they make the changes in Excel, and refresh (or re-query) the data in the Access table. However, users cannot edit the contents of the table in Access. With data linked to Excel, users can create reports, queries, and read-only forms in Access.

•Reason 4: Moving data by importing Excel data into Access.

When importing data, Access stores the data in a new or existing table without altering the data in Excel. In Access, users can import any or all the worksheets in an Excel workbook in one operation. The Import Wizard walks through the import steps and helps users make important decisions about whether to change data types and add headers. If encountering errors when importing the data, Access alerts users and saves the errors in a table so that they can quickly find and correct them. Once the data is imported, it is now native to Access, and users can use datasheets and forms to add, edit, and delete the data. After importing the data, users can decide whether to delete the data from Excel. It is usually a good idea to have only one location for updating the data.

•Reason 5: Connecting to Access data from Excel.

Users can also reconnect Access data to Excel by creating a connection in Excel, often stored in an Office Data Connection file (.odc), to the Access database and retrieve all data from a table or query. Whenever the Access database is updated with new information, Excel Workbooks can also be automatically refreshed from the original Access database after connection done.

•Reason 6: Using Access reports with Excel data.

Once data is in Access, the marvellous array of report creation and customization tools can be used. Simple reports, group and summary reports, mailing labels, graphical reports and sub-reports can be easily created using Access.

•Reason 7: Using Access forms with Excel data.

Once data is in Access, the marvellous array of form creation and customization tools can be used. Simple forms, tabbed forms, continuous forms, popup forms, modal dialog boxes and sub-forms can be easily created using Access. A split form which displays a synchronized datasheet and form view can also be created. Besides, once a polished form is created, it is easy to scroll, filter, and even search the data behind the form by using the standard navigation buttons and search box at the bottom of the form.

•Reason 8: Filtering, sorting and querying in Access is like Excel.

In Access, Excel users can filter and sort data in a datasheet view without having to re-learn a completely new user interface. The icons, command menus, commands, criteria, and dialog boxes are very similar, whether working with text, numbers, dates, or blanks. [5]

2.1.3 Scheduling by sequencing job:

Sequencing is accomplished by specifying the priority rules to use to release jobs to work center. Priority rules are especially applicable for process-focused facilities. Priority rules try to minimize completion time, number of jobs in the system and job lateness while maximizing facility utilization.

The most popular priority rules are:

- **Earliest Due Date (EDD)**

Some workshops sequence jobs by earliest due date. Sometimes called due date assignment, it places the highest priority on processing jobs with the earliest due dates. Job shop quality performance can be measured by the number of late jobs, the average tardiness across late jobs or the average tardiness across all jobs.

- **Longest Processing Time (LPT)**

The longest processing time approach to job sequencing assigns the highest priority to jobs with the longest processing time. By scheduling the longest job first, schedulers can reduce the number of outstanding long jobs at the end of the job schedule. The completion time for the last jobs—which are among the shortest in length—is also reduced.

- **Shortest Processing Time (SPT)**

Another method of job sequencing based on job completion time, the shortest processing time method assigns jobs with the shortest processing time first. Like the LPT scheduling method, SPT requires an initial time estimation for each job. SPT reduces average flow time for jobs, according to Kenneth R. Baker in "Management Science."

- **First-Come, First-Serve (FCFS)**

Many workshops employ the first-come, first-served job sequencing method, which processes job orders in the order of them arrive at the production center. Arrival time is the determinative factor in this scheduling rule, which is also referred to as first-in, first-out. It is sometimes described as the simplest job sequencing rule. For example, unlike SPT and LPT scheduling methods, no time estimation is required for FCFS scheduling.

- **Preferred Customer Order**

The preferred customer order approach prioritizes jobs from preferred customers and can be useful tool for building customer loyalty.

- **Critical Ratio (CR)**

The critical ratio (CR) is calculated by dividing the time remaining until a job's due date by the total shop time remaining for the job, which is defined as the setup, processing, move, and expected waiting times of all remaining operations, including the operation being scheduled. The formula is

$$CR = \frac{\text{Due date} - \text{Today's date}}{\text{Total shop time remaining}}$$

The difference between the due date and today's date must be in the same time units as the total shop time remaining. A ratio less than 1.0 implies that the job is behind schedule, and a ratio greater than 1.0 implies that the job is ahead of schedule. The job with the lowest CR is scheduled next.

- **Slack per Remaining Operations (S/RO)**

Slack is the difference between the time remaining until a job's due date and the total shop time remaining, including that of the operation being scheduled. A job's priority is determined by dividing the slack by the number of operations that remain, including the one being scheduled, to arrive at the slack per remaining operations (S/RO).

$$S/RO = \frac{(\text{Due date} - \text{Today's date}) - \text{Total shop time remaining}}{\text{Number of operations remaining}}$$

The job with the lowest S/RO is scheduled next. Ties are broken in a variety of ways if two or more jobs have the same priority. One way is to arbitrarily choose one of the tied jobs for processing next.

2.2 Design Requirement

2.2.1 Creating Databases Using Microsoft Access

A database is a tool for collecting and organizing information. Microsoft Access is a computerized database management system (DBMS) which enables to collect vast amount of data to be organised into categories of related information. It allows to store, organise, manage data and then retrieve and present it in different formats and reports.

The first step for planning a database is to consider the purpose so that it accommodates all data-processing and reporting needs. Then, the information need to be categorized by dividing into subjects such as Products or Orders, which become the tables in database. Data is stored in rows and columns in a database table. The row of table is a record while the column is a field. If a table named "Customer List", each record (row) contains information about a different customer and each field (column) contains a different type of information about a customer, such as contact number and address. In a table, there is only a primary key. A primary key is a column that uniquely identifies each row. Besides, the table provides 11 data types for each field (column) to match the information it will store. A data type controls the type of data a field will contain. Table 2-1 describes the types of data that each field can store.

Table 2-1: Types of data stored in fields.

Data Type	Description
Short Text	The most common data type for fields. Can store up to 255 characters of text, and numbers (or a combination of both).
Long Text	Stores large amounts of text—up to 1 gigabyte (GB) —but only the first 64,000 characters of text, and numbers (or a combination of both) will be visible on the screen.
Number	Stores numeric data that can be used in mathematical

	calculations.
Date/Time	Stores date and/or time data.
Currency	Stores monetary data with precision to four decimal places. Use this data type to store financial data and when you don't want Access to round values.
AutoNumber	Unique values created by Access when you create a new record. Tables often contain an AutoNumber field used as the primary key.
Yes/No	Stores Boolean (true or false) data. Access uses 1 for all Yes values and 0 for all No values.
OLE Object	Stores images, documents, graphs, and other objects from Office and Windows-based programs.
Hyperlink	Stores links to websites, sites or files on an intranet or Local Area Network (LAN), and sites or files on your computer.
Attachment	You can attach images, spreadsheet files, documents, charts, and other types of supported files (up to 2 GB per record) to the records in your database, much like you attach files to email messages.
Calculated	Stores an expression based on two or more fields within the same table. Example using concatenation operator (&): First: John Last: Derenzo Full Name stored as: [First]&" "&[Last]

However, most databases will have more than one table. A relational database is important to store information in separate tables and these tables are connected by a defined relationship that ties the data together. Relationships among database tables help ensure consistency and reduce repetitive data entry. This can prevent the likelihood of errors due to duplicate information or redundant data. Normalization is the process of applying rules to ensure that information items are divided into the appropriate tables. Typically, the first three normal forms are applied for normalization. The following is a summary of the first three normal forms:

- **First Normal Form (1NF):** This form divides each field according to its smallest meaningful value, removes repeating groups of data, and creates a separate table for each set of related data.

- **Second Normal Form (2NF):** With this form, each non-key column should be fully dependent on the entire primary key. Create new tables for data that applies to more than one record in a table and add a related field to the table.

- **Third Normal Form (3NF):** Use this form to remove fields that do not relate to, nor provide a fact about, the primary key.

2.2.2 Creating Database Tables:

There are 3 ways to create database table which are using templates, import objects or data from other sources or even create new databases. Access offers a variety of templates to get started. Some templates are immediately available for use whereas others can be easily downloaded from the internet. If we have existing data, it is easier to create a blank database because it would eliminate the work to adapt existing data to the template's defined structure.

2.2.3 Sorting and Filtering Data and Setting Field Viewing Options Within a Table:

Sorting within a table displays all the records in the table in the order that have been selected. Access can sort text, numbers, or dates in ascending or descending order. Besides, the records also can be sorted on multiple fields. The primary sort field is called the outermost field while the secondary sort field is called an innermost field.

A filter is a set of rules for determining which records will be displayed. When a filter is applied, Access displays only the records that meet filter criteria; the other records are hidden from view. Once the filtered records are displayed, you can edit and navigate the records just as you would without a filter applied. Filters remain in effect until the object is closed. You can toggle between views, and the filter settings will stay in effect.

Sometimes the view of a table's data need to be changed to more efficiently to find the information easily. It may be helpful to freeze First Name and Last Name fields, so the information can be fixed on the screen and then horizontally scroll and view other pertinent fields, like E-mail or Telephone Number, to get a better view of data. You can also hide those fields that may distract you from getting a better view of the data. For example, if you are interested in viewing just a person's name and telephone number, you may decide to hide all fields except First Name, Last Name, and Phone Number.

2.2.4 Table Relationship:

Creating relationships among these tables allows Access to bring that information back together again through objects such as reports and queries so that information from several tables can be displayed at once. Three types of relationships in Access tables: one-to-one, one-to-many, and many-to-many.

- In a one-to-one relationship, both tables have a common field with the same data. Each record in the first table can only have one matching record in the second table, and each record in the second table can have only one matching record in the first table. This type of relationship is not common, because information related in this way is usually stored in the same table.

- A one-to-many relationship is more common, because each record in the first table can have many records in the second table. For example, in a Customers table and an Orders table, one customer could have many orders. The Customer ID would be the primary key in the Customers table (the one) and the foreign key in the Orders table (the many).

- In a third type of relationship, called a many-to-many relationship, many records in the first table can have many records in the second table.

2.2.5 Creating Forms:

A form is a database object that can be used to enter, edit, or display data from a table or query. Forms are used to control access to data by limiting which fields or rows of data are displayed to users. For example, certain users might need to see only certain fields in a table. Providing those users with a form that contains just those fields makes it easier for them to use the database. Think of forms as windows through which people see and reach database in a more visually attractive and efficient way. **Form tool** can be used to create a form with a single mouse-click. When using this tool, all the fields from the underlying data source are placed on the form. Access creates the form and displays it in Layout view. We can begin

using the new form immediately, or we can modify it in Layout view or Design view to better suit our needs. We can also delete a form to remove it permanently from the database.

Design view gives a more detailed view of the structure of form than Layout view. The form is not actually running when it is shown in Design view, so the underlying data cannot be seen while making design changes.

The **Blank Form tool** creates a new form in Layout view. This can be a very quick way to build a form, especially if planning to put only a few fields on a form. Click the Blank Form button to quickly create a new blank form in Layout view. This allows to make design changes to the form while viewing the underlying data.

Another method of building a form is to use the **Form Wizard** tool. The Form Wizard allows to select the fields that will appear on the form, choose the form layout (which determines the positioning of controls, objects, and data on a form), and choose a predefined style, if desired.

2.2.6 Creating Reports:

A report is a database object that is used to organize, and display data pulled from tables and queries. A report can be created using the Report button, Report Wizard button, Report Design button, and Blank Report button, depending on the amount of customization desired. We can also create labels using the Labels button. After creating a report, we can instantly apply a Theme to create a professional look. Reports are commonly used as formatted hard copies of table or query data. The purpose of a report is to allow users to view data, not edit it. A report's **record source** is the table or query that provides the data used to generate a report.

2.2.7 Creating and Modifying Queries:

A query is a set of instructions used for working with data. Creating a query is like asking the database a question. Running a query performs these instructions and provides the answers. We can sort, group, or filter the results that a query return. There are several different types of queries. Basic queries can be used to extract useful information from one or more tables in the database, while more advanced queries can be used to manipulate data in tables (for example, create, copy, modify, delete, or find duplicate or unmatched table data).

A **select query** is the most basic type of Access query. It creates subsets of data that we can use to answer specific questions or to supply data to other database objects such as forms and reports. The data is displayed in Datasheet view without being changed. A query is a powerful and versatile database tool. Queries differ from sort or filter commands because they can be saved for future use and can utilize data from multiple tables or other queries.

A query can get its data from one or more tables, from existing queries, or from a combination of the two. The tables or queries from which a query gets its data are referred to as its **record source**. When one table provides the information that needed, a simple select query can be created using the Query Wizard. A query can also be used to find records with duplicate field values in a single table.

Chapter 3 METHODOLOGY (DESIGN DESCRIPTION)

3.1 Overview (Flow Chart)

The aim of this design project is to develop a decision support system for scheduling machine loading. A systematic methodology has been outlined to ensure that the progress of the project will be able to run smoothly and can be completed on time. (Figure 3.1)

START

Phase 1
- Preliminary work.
- Find company and contact with person in charge.
- Discussion and selection on a topic to be studied.

Phase 2
- Preparation of literature search and research plan.
- Study and learn the usage of Mircosoft Access.
- Selection of priority rules for sequencing machine loading.

Phase 3
- Identify all the objects for tabulation.
- Create a draft database to store the data using Access.
- Development of the system for scheduling using Access and Excel.

Phase 4
- Evaluation of the performance of template for decision support.

Phase 5
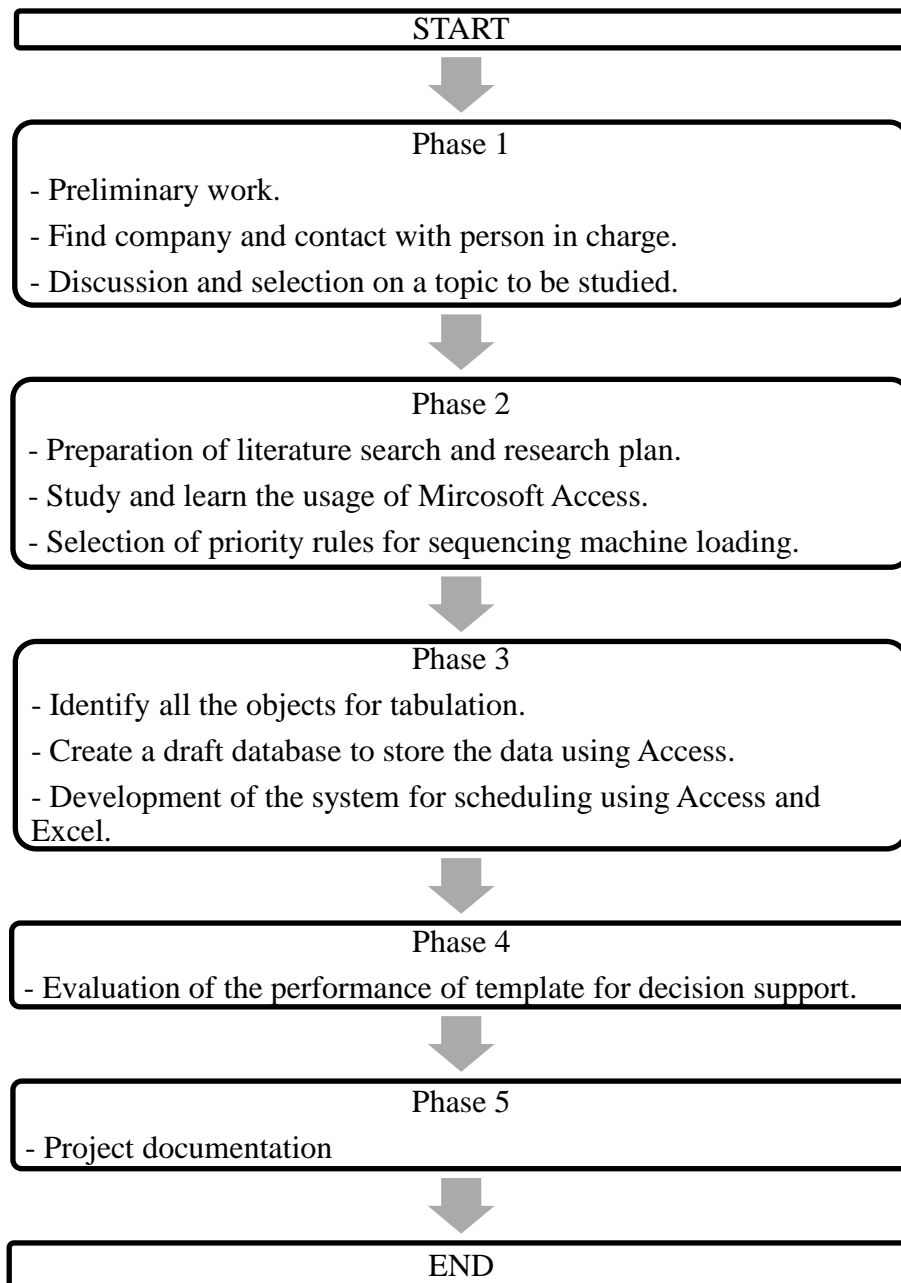- Project documentation

END

Figure 3.1: The flow chart for the progress of design project.

3.2 Detailed Description

3.2.1 Phase 1: Preliminary Work

The project began with the preliminary works before starting the progress of whole projects. Therefore, the main objective here is to find a company/industry that can support the FYP execution. However, the most important criteria are based on the questions: "What company want to do?" and "What is/are the output(s) that can be obtained by the company after the completion of the FYP?". There were some problems while carrying the jobs such as waiting for reply, communication problem, etc and the way to overcome the problems. Finally, a task to modify a template for machine loading base on the work in progress (WIP) was given.

First, discussion on the subject that is suitable for being the FYP was carried out with internship supervisor. It is called "Production/Aggregate planning in High Mix Low Volume (HMLV) manufacturing". However, it is not the critical problem for the company and it is not a direct industry-based project, so the title is rejected. The communication media such as WhatsApp and email were being used to contact the company and request for the permission to obtain the data. The email was sent through HR department to the person in charge. Besides, the person in charge was also changed to another person so need to have extra explanation on the purpose to meet them. In additional, face-to-face communication had been carried out twice to confirm the duty/task for me to complete.

After confirming the task, the next activities carried out were finding the theories and methods for the machine loading and literature searching for the techniques to store the data and even knowing the relational database concepts.

3.2.2 Phase 2: Searching, Studying and Selecting.

After confirming the topic to be studied, the steps of searching, studying and selecting are being carried out so that the best way of development of decision support system for scheduling machine loading can be applied.
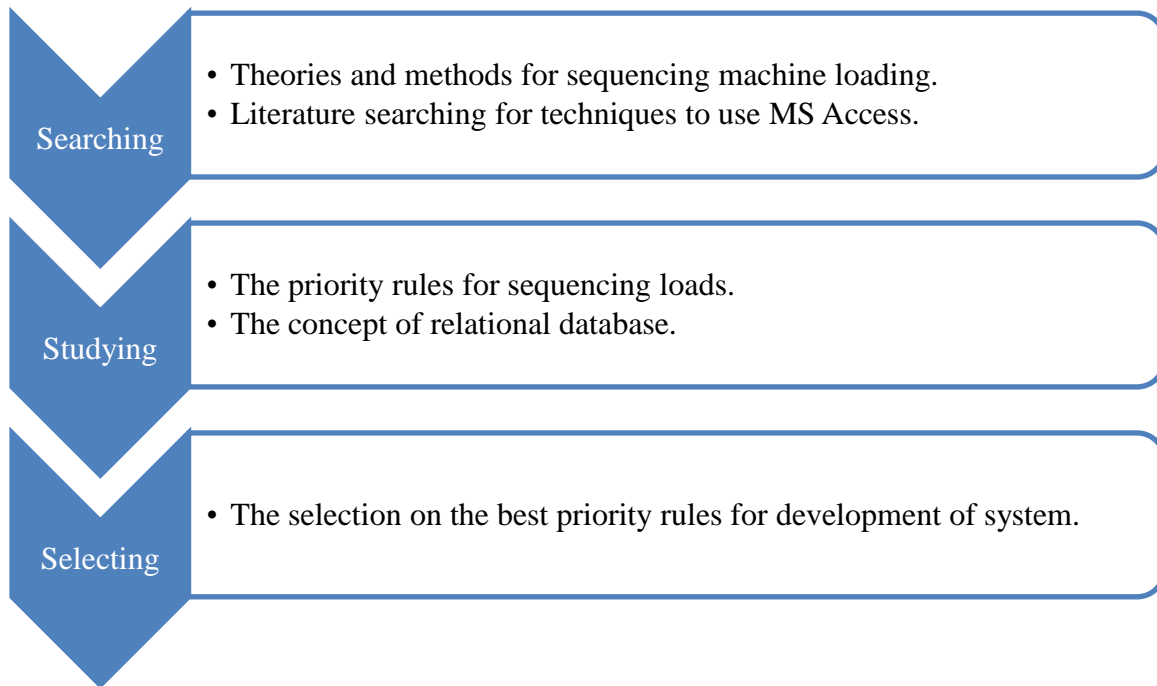

Figure 3.2: The steps of searching, studying and selecting.

3.2.2.1 Searching step

For finding the best way of sequencing rules, searching engine of website and books are being used. The methods for sequencing the machine loading are listed out. The sequencing rules are also known as the priority rules which include 7 rules. In additional, the manual of using MS Access is also be search for better knowing the techniques for creating database because the manual contains step-by-step method for beginning level to intermediate level users.

3.2.2.2 Studying step

From the searching results, every finding need to be studied so that the results can be understand and used. For the priority rules, the advantages and disadvantages for any single rule are shown out. The way to apply the rules for optimization of machine loading also been studied. For the MS Access part, we need to study the finding manual to understand the behind-the-scenes functionality of the database. Examples shown can easily help beginners to learn better and teach skills that can be used in organizations of any size. The manual found containing three parts. Part 1 explains how to get data into a database and how to get information out of a database. Part 2 discusses ways to ensure that the data in related tables is accurate, how to use queries to extract data from related tables, and how to create forms and reports that use related tables. Part 3 covers more advanced Access techniques, including securing the database and customizing the program to fit the way users work.

3.2.2.3 Selecting step
Choosing the Rules for Sequencing

Priority rules are especially applicable for process-focused facilities such as manufacturing job shops. The rules try to minimize completion time, number of jobs in the system, and job lateness while maximizing facility utilization. However, no one sequencing rule always excels on all criteria. Therefore, discussion was carried out to meet the needs of company.