

DEVELOPMENT OF LIFT MACHINE (USING CABLE AND PULLEY)

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In the praise of Allah, the Beneficent the Merciful-who showed the path of righteousness and blessed me to get the strength to embark upon this task of peeping into the realms of facts and events.

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ABSTRACT

Idea to development of lift machine (using cable and pulley) is come from the FKM lecturer that gives a task and a title for this project. This project focuses in design, fabrication and analysis the mechanical part of machine and the system at the lift machine body. To achieve this project objective, this lift machine body structure and pulley system need to concern some other criteria such as strength, safety and ergonomic design. This project flow must start from design, analysis, and lastly fabrication process

Before develop the lift machine (using cable and pulley), it must compare with other product (forklift) in market. It is because to study the customer need and to create a new design with new feature.

Diploma Final Year Project will cover for the whole last semester, before go to the industrial training to complete this project. This is an individual task and must do by ourselves. This is also one of opportunity to student to show or to apply their knowledge also skill in using manufacturing process and mechanical design software in complete this project. Time management and a good planning also important to make sure the entire plan are in their way. Lastly, discipline needed to complete this project.

ABSTRAK

Idea untuk membangunkan mesin pengangkut barang (menggunakan kabel dan pulley) datang daripada pensyarah FKM yang memberi tugas dan tajuk untuk projek ini. Projek ini memberi tumpuan kepada mereka cipta, memasang dan menganalisis mesin bahagian mekanikal dan sistem yang terdapat pada badan pengangkut barang tersebut. Untuk mencapai objektif projek ini, struktur badan dan sistem yang terdapat pada badan pengangkut barang tersebut haruslah berkaitan dan memenuhi beberapa kriteria seperti kekuatan, keselamatan dan reka bentuk yang ergonomik.

Sebelum pembangunan pengangkut barang di mulakan, ia mestilah di buat perbandingan di antara produk yang telah sedia ada di pasaran. Ini kerana untuk mengkaji tentang keperluan pengguna dan untuk menghasilkan bentuk baru dengan ciri-ciri yang baru.

Projek tahun akhir diploma ini akan meliputi sepanjang semester akhir sebelum pergi ke latihan industri untuk di siapkan. Ini adalah tugas individu dan harus di siapkan sendiri. Projek ini juga salah satu peluang untuk pelajar menonjolkan diri mereka dan menggunakan ilmu serta teknik mereka dalam menggunakan proses pembuatan dan software mekanikal yang telah mereka pelajari untuk menyiapkan projek tahun akhir ini. Pengurusan masa dan perancangan yang baik juga penting untuk memastikan setiap yang dirancang berjalan mengikut jadual. Disiplin dan dedikasi juga diperlukan untuk menyiapkan projek ini.

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CHAPTER 1

INTRODUCTION

1.1. PROJECT SYNOPSIS

The project contains of designing the mechanical part of machine and to fabricate the mechanical part of the system of the lift machine. There are difference between this lift machine and the current lift machine in market. The design of this lift machine will be more user friendly in handling and use. To achieve the objective of this project, it need a lot of knowledge and skills such as solid works 2006, MDSolid software, welding skill, drilling, grinding, and fastener.

1.2. PROJECT PROBLEM STATEMENT

According to the market lift machine, basically the lift machines nowadays are provided using the hydraulic system and other complex system. What try to do in this task is try to develop lift machines that not use the hydraulic system but more to the conventional system. The system that will use is only use the pulley system to lift the material. The problem statements as follows:

- a) The emplacement of forklift not portable because difficult to move and not adjustable
- b) many product (lift machine) designing in a big range of load
- c) The maintenance of forklift is high cost and take time
- d) The system of other forklift are complex and difficult to maintenance

1.3. PROJECT OBJECTIVE

The purpose of this project is to practice a student that has been gathered before in solving problem using academic research and also to gain knowledge and skills. This project also important to train and increase the student capability to get information, research, data gathering and then solves a problem by doing the calculation. The final year project also will generate students that have capability to make a good report in thesis form or technical writing. It also can train student to create in design, fabricate and analysis a new thing. The other thing, final year project will teach student to doing a task with independently in searching and expanding the experience and knowledge. So the objectives of this project are:

- a) To design and development lift machine (using cable and pulley)
- b) To lift a material (load) to other place
- c) To fabricate and make analysis to the body of lift machine including analysis of mechanical part of machine and the system of mechanical part.
- d) To lift a load not more than 20 kg.
- e) To apply the knowledge and skill manufacturing process
- f) To modification of lift machine structure

1.4. PROJECT SCOPE

From the title that has been given, the development of this project must include how to design the mechanical part of machine and how to fabricate the system of this mechanical part. It also needs some knowledge and skill to finish the project. There is some other guide must followed to finish this project.

- a) **Literature review** – including all the information from internet that is related with this project. Such as;
 - i. The history of forklift

- ii. The type of forklift
- iii. The pulley system
- iv. Machinery process used

b) Design concept

- i. Sketch the new design of forklift (consists of 3 designs). It base on customer needs
- ii. Evaluated the designs and come out with the new design (final concept)
- iii. Using the solidwork software, make the isometric, orthographic and 3D drawing

c) Fabrication

- i. In fabricate the forklift, the material used ; steel bar, hollow, pulley, rope, wheel, bearing
- ii. the process used in fabrication :
 - Welding: in this process, it uses to combine many part of material in the forklift fabrication
 - Drilling: to make a hole on the material
 - Fastening: combine some other part such as between the engsel and the hollow steel bar using screw, bolt

d) Report writing

- i. Report writing will covered for the whole work progress from start until the end of the work

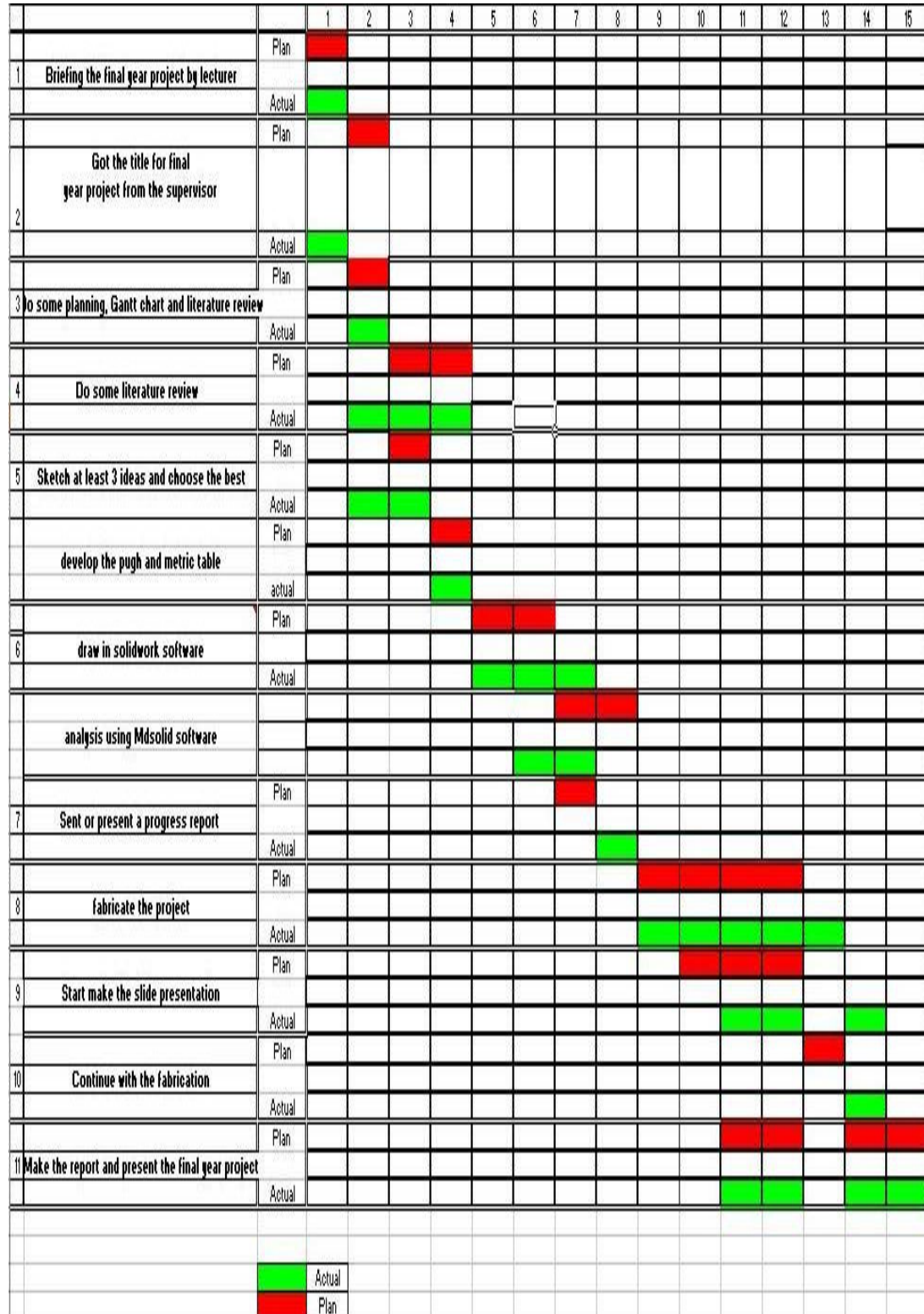
1.5 PROJECT BACKGROUND

Basically, the purpose of development of lift machine is too used to lift and transport a material to other place. Lift machine also called a forklift, lift truck, a high/low, a stracker-truck or a side loader. The modern in lift machine was developed in the 1920s. The lift machine has since become an indispensable of equipment in manufacturing and warehousing operation.

In this final year project, the design of this lift machine should be creative, simple, user friendly and use the minimum cost especially the material cost.

1.6 PROJECT SCHEDULE

Table 1.1: Gantt chart



Referring the gantt chart in **table 1.1**, this final year project (FYP), start with some introduction or briefing by supervisor. Beginning week, need to do some schedule management for this project that covered for the whole week. It will be apply in Microsoft excel to make a gantt chart.

After that, this project continuing with some literature review about the title. In this literature review, it is about to find or to gather all the information related with this project. Find the type, design, and the system used on the development of lift machine (forklift). It is also including the differences for each design in marketing. All the information gathers from internet, journal, reference book and people.

The project continued with design the concept of lift machine. The designs come out using from all data collection, Pugh concept and metric link before this. Try to evaluate or analysis the mechanical part of machine and the system for each design come out. From the all source, develop (engineering drawing) the final concept. Once again make an analysis to the final design body and to the pulley system.

After all information, data and detail drawing are improved, the fabrication process stage start. As the reference, we look at detail drawing to fabricate. The dimension and the material are already list on the drawing. In the fabrication of the lift machine, it's need us to apply many knowledge and skills such as; welding, fastening, drilling and cutting the material.

Lastly, the final report writing and prepare the final presentation. This takes about one week to arrange and accomplish. A report is guided by UMP thesis format and also guidance from supervisor. Due to all problems that student facing, the management have agreed to extend the time to submit a report and presentation. All task scheduled is take around fourteen weeks to complete

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

A Forklift truck also called a lift truck, a high/Low, a forklift, a stacker-truck, or a sideloader is a powered industrial truck used to lift and transport materials. The modern forklift truck was developed in the 1920s by various companies including the transmission manufacturing company Clark and the hoist company Yale & Towne Manufacturing.[1] The forklift truck has since become an indispensable piece of equipment in manufacturing and warehousing operations.

2.2 HISTORY

a) THE BEGINNING – 1945-1964

In 1929, Hyster Company is already built. This company is one of the earlier company that make the lift machine with the original machine were steel and lumber carries. The lumber carries is a version of a straddle truck that continued in production, with upgrades of course.

The first actual lift machine was built is in 1935 based on a reversed tractor chasis. The range was broadened again with the “Karry krane”. It used during world war 2 by American.



Figure 2.1: YT40 truck

The other popular truck of the day was the YT40. These forklifts could lift almost 2000kg and were great general purpose trucks



Figure 2.2: This old forklift surviving shows the 1954 Christmas party at Gough's Auckland branch in Stanley Street



Figure 2.3: Old Hyster

In **Figure 2.3**, the old Hyster, reports that it's still on the original engine

Beginning in 1947, Gough Gough & Hamer also started importing Hyster-Ransomes Electric forklifts. Formed after Hyster took over the British Ransomes company, Hyster-Ransomes became a popular addition to Gough's product lineup. When Hyster started designing and manufacturing its own electric forklifts in 1964, the Ransomes name disappeared. The first New Zealand Hyster-Ransomes customer was Christchurch's D.H. Brown, who operated a flourmill on Moorhouse Ave. In 1947, they took delivery of a Hyster Ransome TE1H 1 Ton Platform Truck.



Figure 2.4: The electric forklift in 1947

b) 1964 till present day

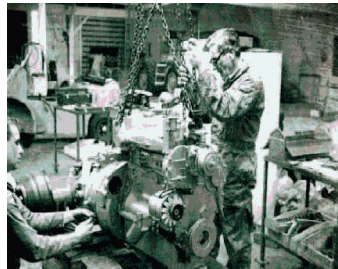


Figure 2.5: The earlier engine

According to the **Figure 2.5**, here is the earliest known photograph (although undated) of Hyster manufacture in NZ. An engine and drive train is being assembled for installation into an H50F, a model built between 1965 and 1972.



Figure 2.6



Figure 2.7

According to the **Figure 2.6** and **Figure 2.7**, the containers of forklift Components arriving at Ensors Rd are unpacked by an H50F



Figure 2.8

At the **Figure 2.8**, a lineup of trucks inside the brand new site at Hornby includes a couple of H275H 12 tonners, as well as a fleet of 4 tonne "XL's".

c) **Forklift Trucks— the Backbone of the Industry**

Around the time of the First World War, machines were designed with an electrical platform that could be raised or lowered. The war effort sprouted other new innovations, including a bomb-handling crane with a power lifting mechanism, considered to be the first electric lift truck.



Figure 2.9: Bomb crane

At the **Figure 2.9**, the Baker Rauch & Lang Company developed and built a bomb-handling crane with a power lifting mechanism—the first electric lift truck. Designed to handle large artillery shells, these trucks represented the dawn of a new era and industry. 1915 (photo courtesy of Linde Baker)

2.3 PRODUCT REVIEW

a) Design type

The following is a list of the more common lift truck types. It is arranged from the smallest type of lift to largest:

- i. Hand pallet truck
- ii. Walkie low lift truck (powered pallet truck, usually electrically powered)
- iii. Rider low lift truck
- iv. Towing tractor
- v. Walkie stacker
- vi. Rider stacker

b) Lift machine type

i. Manual pallet jack

A pallet jack, also known as a pallet truck or pump truck, is a tool used to lift and move pallets. The front wheels are mounted inside the end of the forks, and as the hydraulic jack is raised, the forks are separated vertically from the front wheels, forcing the load upward until it clears the floor. The pallet is only lifted enough to clear the floor for subsequent travel. A manual pallet jack is a hand-powered jack.

ii. **Powered pallet jack**

Powered pallet jacks are motorized to allow lifting and moving of heavier and stacked pallets.

These generally contain a platform for the user to stand while hauling pallets around a warehouse or loading/unloading trucks. The powered pallet jack is generally moved by a throttle on the handle to move forward or in reverse and steered by swinging the handle in the intended direction. Some contain a type of deadman's switch rather than a brake to stop the machine should the user need to stop quickly or leave the machine while it is in use.

iii. **Quick lift pallet trucks**



Figure 2.10: Quick lift pallet trucks

The lift machine shown in **Figure 2.10** above has a simple design and it's easy to user in handling this lift machine type.

The features of this lift machine are the maximum capacity of this lift machine to load the material is around 2500 kg or 5500 lbs. It's also has a perfect ergonomic design handle offers excellent and comfortable grip in all situations and temperatures. This lift machine also has a good outstanding maneuverability with 220 degree turning angle even in the tightest space such as inside trailers.

Beside that, this product also low weight and makes the pallet truck very handy to use. And the last one, this lift machine is completed with overload relief valve. This is for safety if there are too many loads and it's to prevent damage to equipment

iv. **Lift table**



Figure 2.11: Lift table

The lift machine in **Figure 2.11** also known as lift table. It's design to work in heavy-duty steel construction. It made from strong metal wheels with polyurethane.