DESIGN AND FABRICATION OF FLEXIBLE RACK FOR LECTURER USE

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ABSTRACT

The study of manufacturing was very important in order to carry out this project to ensure that student understand on what are needs to do. This project is about designing and fabricating the flexible rack for lecturer use to helps lecturer storing documents or paper works in their office more efficiently. This project involves the process of designing the rack by considering the shape and also the ergonomic factor for lecturer to use. After the design has completed, it was transformed to its real product where the design is used for guideline. This project also required analysis to make sure the strength of the product to ensure the safety for the user indeed of publishing. Numerous methods and process involve in this; project for instance shaping using bending machine. This project is mainly about generating a new concept of rack that would make storing documents at limited space become easier and more efficient. After all the process had been done, this rack may help us to understand the fabrication and designing process that involved in this project.

ABSTRAK

Pembelajaran mengenai proses pembuatan adalah amat penting dalam menjalankan projek ini bagi memastikan pelajar faham apa yang harus dilakukan. Projek ini ialah mengenai merekabentuk dan menghasilkan rak yang feksibel untuk kegunaan pensyarah menyimpan segala dokumen atau kertas kerja di dalam pejabat mereka secara teratur. Projek ini melibatkan proses merekabentuk rak dengan mengambil kira rupa bentuk dan juga faktor ergonomi untuk kegunaan pensyarah. Selepas proses merekabentuk disiapkan, ia akan diterjemahkan kepada produk yang sebenar berdasarkan rekabentuk yang telah dibuat. Projek ini juga memerlukan analisis bagi memastikan produk itu kukuh dan selamat kepada pengguna apabila siap kelak. Pelbagai kaedah dan proses terlibat dalam menghasilkan projek ini; sebagai contoh proses membentuk dengan menggunakan mesin membengkok. Keutamaan projek ini ialah menghasilkan konsep rak yang baru iaitu untuk menyimpan dokumen di dalam keadaan ruang yang terhad dengan lebih mudah dan lebih tersusun. Selepas segala proses yang terlibat selesai dilakukan, diharapkan penghasilan produk ini dapat memberi sedikit pemahaman dalam proses merekabentuk dan penghasilan yang terlibat.

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INTRODUCTION

1.1 Project Synopsis

1.1.1 General Project Synopsis

The project involves designing and fabricating a flexible rack for lecturer use. This rack would be entirely different from existing rack. As the Diploma final year project allocates the duration of 1 semester, this large man-hour project therefore requires significant efforts of the students to participate. Basically the entire flexible rack could be divided into three stages, which are concept review and development, designing and fabrication.

The flexible rack is equipped by using all necessary items and method for instance sheet metal, skills in manufacturing process by performs cutting process, bending process, drilling process and others. The advantages of the flexible rack to be developed can be seen in its flexibility to be moved and can be located at limited space such that, lecturer are offered to make their work easier since the rack will facilitate them to store items such as student's assignment and paper works.

The process of development is initiated from designing the shape of the rack by considering the function as well. In order to produce user friendly product that is suitable to the consumer, consideration to the ergonomic factor is taken into account.

t involves the measurement process before the materials are cut into pieces before oined together.

.1.2 Specific Project Synopsis

My project title is "*Design and Fabrication of Flexible Rack for Lecturer Use*". The project involves small review of the existing flexible rack and fabrication of the rack itself with concerns regarding strength, ergonomic factor, and convenience. New concept of rack is required to improve its functions. Overall, the project will meet acquire skills of design and fabrication.

.2 Problem Statement

The concept of the flexible rack is to facilitate lecturer for storing their ocument and paper works. This rack will primarily help lecturer especially lecturers f Faculty of Mechanical Engineering to store and arrange their document that's eed rack for convenience. Lecturers are facing problem while the need to store ocuments in limited space due to unavailability of existence rack. Thus, with the evelopment of this rack, it is hope that it can contribute to give them ideas how to vercome problem in storing documents by choose the better way in facilitate their outine at Universiti Malaysia Pahang especially for Faculty of Mechanical ngineering staff.

.3 Project Objectives

.3.1 General Objectives

Diploma final year project objective is to practice the knowledge and skill of ie student that have been gathered before in solving problem using academic

research, to born an engineer that have enough knowledge and skill. This project also important to train and increase the student capability to get know, research, data gathering, analysis making and then solve a problem by research or scientific research.

The project also will educate the student in communication like in a presentation and educate them to defend their research in the presentation. The project also will generate students that have capability to make a good research report in thesis form or technical writing. This project also can produce and train student to capable of doing work with minimal supervisory and more independent in searching, detailing and expanding the experiences and knowledge.

1.3.2 Specific Project Objectives

The specific project objectives are:

i. To design flexible rack that is suite to its application especially for storing documents.

ii. To fabricate and introduce the new concepts and ideas for future prospect of rack.

1.4 Project Scopes

The project scopes are elaborations on achieving the project objectives. Thus, the first scope is to gather literature reviews that are valuable data to consider the variable designs of the flexible rack in terms of its function and method to produce.

Secondly, the sketching and designing processes are focus on using sketches and SolidWorks software in creating the design of the rack.

Next, to fabricate the designed model, the material has to have optimum specifications and will be fabricated using all the appropriate manufacturing process which are cutting, bending, drilling and others.

Finally, testing and evaluation process for the fabricated model which is simulation of the model has to be in line with the expected function.

1.5 Project Schedule

According to the table 1 below, this project is begun with using literature review via internet, books, supervisor, and others relevant academic material that related to my title, this literature review takes about 3 weeks. The reviews not stop there. It continues along the way of this project because knowledge is so many to learn.

On the week 3, design and sketching will be starting. In this task, several designs of flexible rack will be sketch. This task takes time about 2 weeks. From the four design of flexible rack, new design will be made to improve the current design. Then, the new design is draw by using SolidWorks software. This task finishes on week 6.

The progress is continues with material preparation. In this task suitable and strength material will be chosen. This progress also involves measured structure and cutting process. This task takes time about 2 weeks.

The fabrication process is schedule to takes on the next week but because of fabrication process is have a lot of part to fabricate and cutting. The process is scheduled to take about four weeks. Next, this schedule comes with assembly, painting and finishing.

Next task is the thesis writing. This task will start on week 9 until week 14 to accomplish. The report is guided by UMP Thesis Writing Guide and also the

guidance of my supervisor. Due to all problems we had when doing the project the management has agreed to extend the time to submit the report. All the task is scheduled to take about fourteen weeks overall.

Table 1.1: Project schedule

Scopes / Project Activities	**Week(s)**													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Literature Review	x	x	x	x										
Sketching and design			x	x	x									
Design using SolidWorks					x	x								
Material Preparation						x	x							
Fabrication								x	x	x				
Evaluation & improvement										x	x			
Thesis writing							x	x	x	x	x	x	x	

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Rack basically used as place to store items. It will facilitate to store items in proper way and more efficient. Racks come in a wide variety of shapes, height, and materials, depending on their origin, style, and intended use. All racks are composed of a flat horizontal surface and a base with one or more supports, or legs. Rack can be freestanding or designed for placement against a wall. The basic material used at the early of rack fabrication overall source using from wooden. The wooden is still used as the important source for nowadays rack fabrication but it was known as plywood which have more toughness and strength compared with usual wood. The other material used in rack fabrication such as aluminium, iron, solid rubber and others. Most of rack is put on the table. Therefore, the design and size are really important and must be consider as the factors to create it. Too much space will limit the usage of a table. Rack also used as something that could be made as decoration on the table.

Product Review

.1 Rack Types and Functions

i. File rack

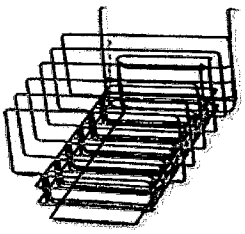

Figure 2.1: File rack

File rack is a rack that typically used to store file. This rack is limited only to e file folder. This rack can be arranged to sit on desk or office table.

ii. Display rack

Figure 2.2: Display rack

Display rack is a rack that used to display items (e.g. magazine). Magazine s are the perfect solution for keeping brochures, pamphlets and other printed erial organized and well presented.

iii. Paper trays

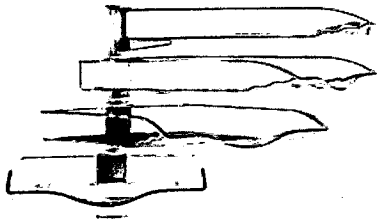

Figure 2.3: Paper trays

A paper tray is a tray used to store papers or documents. These paper trays are perfect for desktop file organization and personal efficiency.

iv. Bulk storage rack

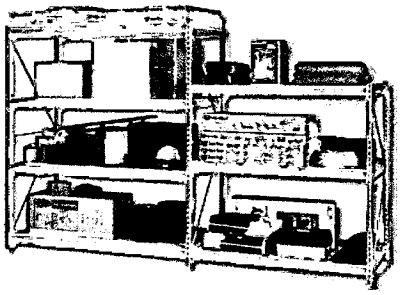

Figure 2.4: Bulk storage rack

Bulk storage rack is a rack that can carry major loads items and are available in variety of sizes and shelving options. Designed for hand loading of heavy-weight bulky items, these racks can handle a variety of sizes, shapes and lengths with both front and rear accessibility.

v. Newspaper rack

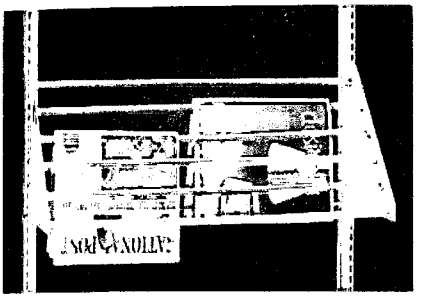

Figure 2.5: Newspaper rack

Newspaper rack is a rack for keeping newspaper easily. Newspaper storage racks are just another accessory that can be added to the library shelving. Place the daily newspaper on the hanging rack with the back issues from the month on the shelves below.

vi. Wall rack

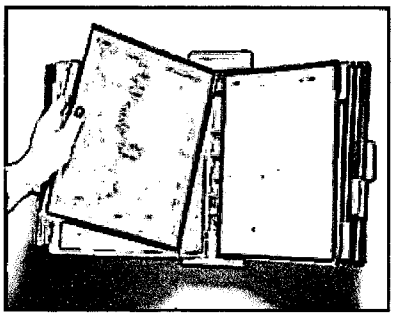

Figure 2.6: Wall rack

Wall rack is a storage system to keeps documents in limited space and easy to share documents with co-workers. A wall organizer expands work area and keeps important documents protected, yet easy available.

CHAPTER 3

METHODOLOGY

3.1 Project Flow Chart

For the diagram as shown as below, the project starts with literature review and research about the title. This consist a review of the concept of rack, rack system, rack features and type of rack used in various fields such as office, garage and others. These tasks have been done through research on the internet, books and others sources.

After gathering all the relevant information, the project undergoes design process. In this step, from the knowledge gather from the review is use to make a sketch design that suitable for the project. After several design sketched, design consideration have been made and one design have been chosen. The selected design sketched is then transfer to solid modeling and engineering drawing using SolidWorks program. The materials and the measurement needed for the rack listed down and calculated to give an ergonomic shape of the rack.

Next, after the needed material is listed, acquisition step take places. There are only a few materials that need to bought such as screws, hinges and others finishing product. Some of the needed material is well-prepared by the university.

After all the parts needed had been gathered, the project proceeds to next step that is fabrication process. The finished drawing and sketching is used as a reference by following the measurement and the type of materials needed. The fabrication

process that involved is cutting, bending, drilling and others. After every process was finished, the parts are checked to make sure that the output of the process obeys the product requirement.

If all the parts had been processed, the parts are joined together to produce full-scaled rack. Here come the testing and evaluation process. The rack will be test to see if it fulfills the requirement such as ergonomic aspect, safety, strength and maneuverability. During the testing, if problem occur such as malfunction or unstable platform, the rack will step back to the previous process, where the error is fixed. The rack is expected to have an error that may cause the part to be re-designed and re-fabricate again. The rack may be finished by doing some finishing process such as spraying and others.

After all the parts had been joined together, here comes the last phase of process that is data discussion. In data discussion, the draft report and all the related articles are gathered and hand over to the supervisor for error checking. The finish product will be compared with the report to make sure that there is no mistake on both project and report.

After the product and the report had been approved by the supervisor, the report is rearrange and print out to submit at the supervisor, the project coordinator and faculty of Mechanical Engineering. In this stage, the final presentation was also being prepared and waited to be present.

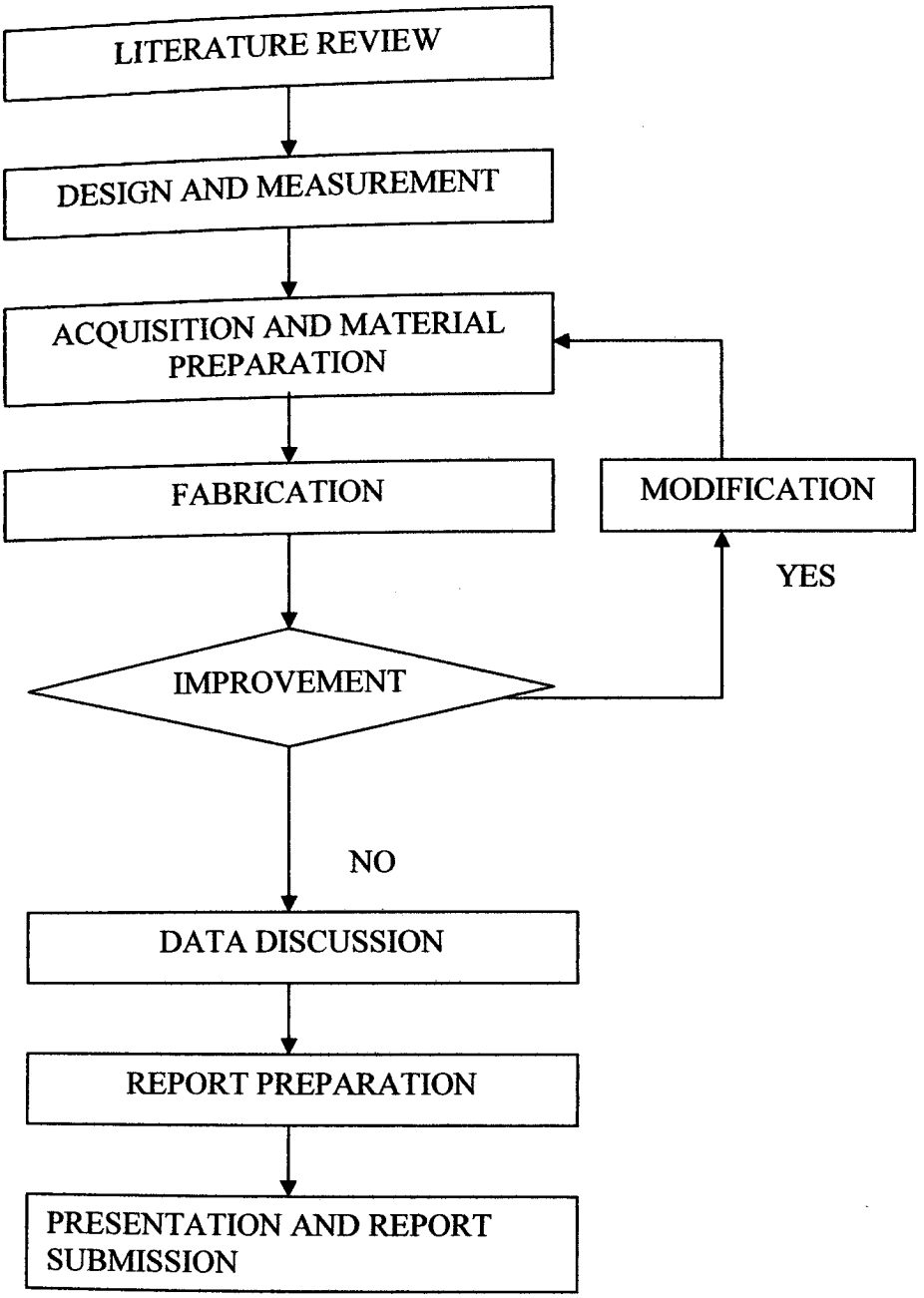

Figure 3.1: Flow chart

3.2 Design and Sketching

3.2.1 Introduction

The Design of the flexible rack must be compliance to several aspects. The design consideration must be done carefully so the design can be fabricated and the system functioning. The aspect that must be considered in designing the flexible rack is this rack must have an attachment to make it very flexible. From aspect material, that flexible rack must be lighter than existing rack and have more strength. The toughness of flexible rack will be the most important criteria in designing the flexible rack. Ergonomic factors also need to be considered which means the rack must be user friendly as easy and convenience. The rack also must be suit to environment so that the rack must be suitable to be use in limited space. The cost of the whole system must not exceeded budget given and must be reasonable. The design cost must also efficient and reduce waste and losses.

3.2.2 Design

Actually for this project, the attachment must be design for the existing rack which is found at UMP Mechanical Lab itself. The idea is to join the attachment to the existing rack to make it to be flexible rack. So here only design for the attachments is need to be considered. Here is the design of the existing rack:

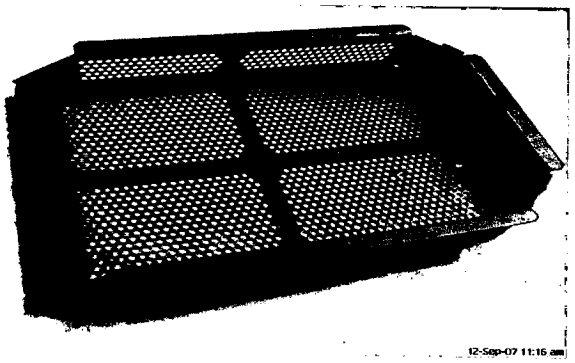

Figure 3.2: Existing rack

3.2.3 Drawing

The drawings are divided into two categories, which are sketching and 3D drawing. Firstly, all the ideas for the rack fabrication are sketched on the paper first to ensure that idea selection can be made after this. Then, the final idea is drawn into the 3D drawing format with details features by using SolidWorks software.

3.2.4 Design Specifications

The design of the flexible rack must be considered that it can endure several specifications, which have three platform racks. It will have the basement, upper rack and side rack. The basement is the important platform, because it has to support the upper rack and also will be attached with lot of attachments. Then, for the upper platform, it can fold in and out when needed. It also will be attached with some attachment to make sure it can fold in and out easily. Side's platform also can fold in and out when needed. Lastly, this rack must capable to store a lot of documents and paper works, so the size must be really sure.

3.2.5 Sketching

From the existing ideas, only four sketching that had been chosen to be considered as the final ideas, which are:

i. Design 1

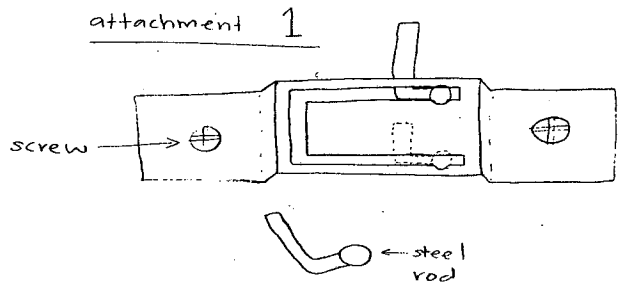

Figure 3.3: Attachment 1

This is the first design for the attachment. It works by using 'L' shape steel rod. The rod can be slide from down to above. The advantages of this design are, it so practical and easy to use and also easy to fabricate. But, still the mechanism of this design is not very proper. It is because, when the steel rod is slide up, it can not stay to support the upper rack. Material that used on this design is steel rod and zinc 2.0mm.

ii. Design 2

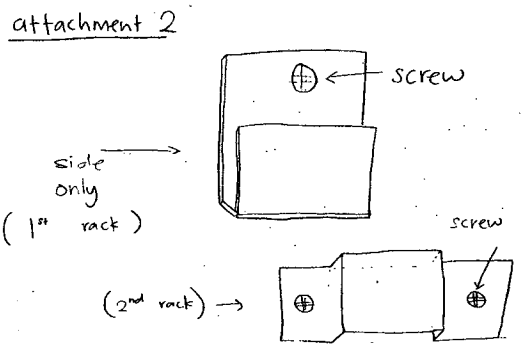

Figure 3.4: Attachment 2

This design is look simpler. It will be attach to the side rack. It is easy to use, just fold the second rack which is side rack to the basement rack. Advantage of this design is, easy to fabricate. Also, no need much time to fabricate. Material that used on this design is aluminium 1.0mm.

iii. Design 3

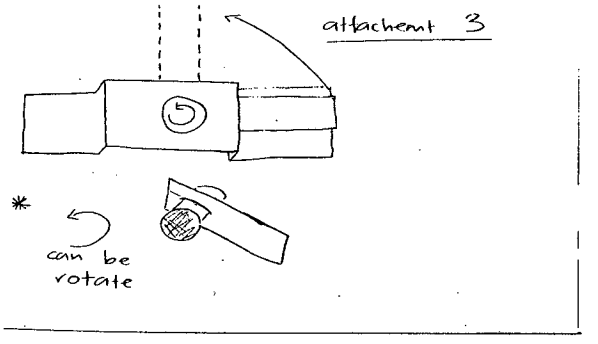

Figure 3.5: Attachment 3