DESIGN AND FABRICATION CLOTHES RACK

MUHAMMAD FAUZIE BIN ABU BAKAR @ NASIR

UNIVERSITI MALAYSIA PAHANG

DESIGN AND FABRICATION CLOTHES RACK

MUHAMMAD FAUZIE BIN ABU BAKAR @ NASIR

Report submitted in partial fulfillment of the requirements for the award of
Diploma in Mechanical Engineering

Faculty of Mechanical Engineering
UNIVERSITI MALAYSIA PAHANG

NOVEMBER 2009

SUPERVISOR'S DECLARATION

I hereby declare that I have checked this project report and in my opinion this project is satisfactory in terms of scope and quality for the award of Diploma in Mechanical Engineering.

Signature:

Name of Supervisor: CHE KU EDDY NIZWAN BIN CHE KU HUSSIN

Position: PTA COORDINATOR

Date:

STUDENT'S DECLARATION

I hereby declare that the work in this report is my own except for quotations and summaries which have been duly acknowledged. The report has not been accepted for any degree and is not concurrently submitted for award of other degree.

Signature:

Name: MUHAMMAD FAUZIE BIN ABU BAKAR @ NASIR

ID Number: MB07103

Date:

ACKNOWLEDGEMENTS

I would like to express my gratitude and appreciation to all those who gave me the possibility to complete this report. Special thanks is due to my supervisor, Che Ku Eddy Nizwan Bin Che Ku Husin whose help, stimulating suggestions and encouragement helped me in all time of fabrication process and in writing this report. I am very grateful to him for his patience and his constructive comments that enriched this project.

I would also like to acknowledge with much appreciation the crucial role of the staff in Mechanical Laboratory, who gave me a permission to use the laboratory equipment and also the machine and giving a permission to use all the necessary tools in the laboratory.

Special thanks to go to Mr.Rizal, as the assistant engineer, who has helping a lot and give some advice and share his knowledge on how to complete this task.

I also want to thank to all my friends for their support and help to complete the task and for sharing their knowledge on how to solve the problems. Finally, I thank my family for their continuous support and confidence in my efforts.

ABSTRACT

Clothes rack is very important for people to hang their clothes. Every clothes rack has different use and specific use. There are some common problem can be detect at the clothes rack nowadays such as don't have stopper, clothes easy to fall , heavyweight, only suitable for certain clothes, need many wheels, hard to cornering, not suitable for small area, cannot hang many things, unstable for heavy clothes like jacket, hard to manufacturer and expensive material. To reduce this problem, one new clothes rack will be development that have multi function and has not limited to do another task or job.

This project is about design and fabricates a new product of clothes rack that has multifunction. The clothes rack multi use and easy assemble. It's also must reduce the disadvantages of the clothes in the current market like have stopper, adjustable and easy manufacturer.

As the conclusion, this project had achieves its entire objective successfully. This project was done around thirteen week included almost all steps of the report such as literature review, design, fabrication process and others.

ABSTRAK

Rak pakaian sangat penting bagi manusia untuk menyangkut baju. Setiap rak pakaian ada kegunaan yang tersendiri. Terdapat pelbagai masalah biasa yang boleh didapati pada rak pakaian seperti tidak mempunyai penahan, pakaian mudah terjatuh, berat, perlukan banyak tayar, susah untuk membelok, tidak sesuai untuk kawasan sempit, tidak sesuai untuk sesetengah pakaian, tidak boleh menyangkut banyak baju, susah untuk dihasilkan dan bahan mentah yang mahal. Untuk mengurangkan masalah ini, satu produk baru akan dihasilkan dan ia mempunyai pelbagai fungsi serta tidak terhad kepada satu kegunaan sahaja.

Projek ini bertujuan untuk menghasilkan rak pakaian yang mempunyai pelbagai fungsi iaitu mudah di bawa ke mana sahaja dan mudah dipasang. Produk ini juga mestilah lebih baik daripada produk yang berada dipasaran semasa seperti mempunyai penahan dan mudah dihasilkan.

Sebagai kesimpulan, projek ini telah mencapai objektif dengan jayanya. Projek ini telah dijalankan selama tiga belas minggu mengikut langkah-langkah yang terdapat dalam laporan seperti kajian produk, rekaan, penghasilan dan sebagainya.

.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

Now day, clothes rack become the common facilities for human .They are many type of clothes rack in the world wide market like Rolling Clothing Rack, Double Bar H-Rack, Heavy Double Bar Rack and others. The main purpose of clothes rack invention is to help Muslim to put their clothes, Copiah, blazer, coat and prayer mat in the suitable place. Its can reduce space, more flexible, easy to move, more cheaper than others in the market.

As the result for the needed in community there are various type of portable or multi use clothes rack had been invented. Clothes rack has a multi function that can be use to hang various types of clothes, easy to move, can use in small area. It also comes in much type of size and design. From the analysis of advantages and disadvantages of the clothes rack in the current market, one new product will be developed to follow the specific and customer need.

1.2 PROBLEM STATEMENT

Clothes Rack is important for human to hanging their clothes. They are many types clothes rack like Double Bar H-Rack, Heavy Duty Double Bar Rack with V-Brace, Rolling Clothing Rack with Storage Shelf, Compact Rolling Clothing Rack with extensions, Display Clothing Rack with 2 Arms. Every Clothes Rack have different function and specific use. It's limited specification in design and use age. There are some common problem in can be detect in clothes rack such as don't have stopper, clothes easy to fall, need more space, old design, only for hanging clothes, very expensive product, heavy to carry and easy to corrosion to reduce this problem, one new clothes rack will be development that have multi function

1.3 PROJECT OBJECTIVE

The objective is to practice the knowledge and skill that had been gathered using academic research to born an engineer that have enough knowledge and skill.

1.3.1 SPECIFIC OBJECTIVE

The specific objectives of this product are:

i. To design a good, suitable and user friendly clothes rack.
ii. To fabricate the structure which can be suitable use in Masjid

1.4 PROJECT SCOPE

This project is about design and fabricates a new product of clothes rack that has multi function. The clothes rack must have good design, suitable for masjid, multi use and easy assemble. Its also must reduce the disadvantages of the clothes rack in the current market like have stopper, adjustable and easy manufacturer.

(i) Clothes rack must easy to move
(ii) To hang kopiah, songkok, prayer mat, blazer, kain pelekat and jacket.
(iii) Clothes rack must have multi use like can be hang kopiah, blazer, kain pelekat and more.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Nowadays, people use clothes rack to hang the clothes, tie, blazer and more. They are many type of clothes rack in the market like like Rolling Clothing Rack, Double Bar H-Rack, Heavy Double Bar Rack and others. Many clothes have been develop by specific job and design which can be use only to hang blazer, prayer mat, clothes, fez and more.

The purpose of this chapter is from the existing product, function of a new product of clothes rack can be developing according to the needed in the society. These new Clothes rack are being developed based on the advantages and disadvantages of the existing product in the current market. The new product of clothes rack also will be developed according to the objective of the project which is to design a good suitable and user friendly clothes rack and can donate or as a gift to masjid.

2.1.1 Clothes

A feature of nearly all modern human societies is the wearing of clothing or clothes, a category encompassing a wide variety of materials that cover the body.The primary purpose of clothing is functional, as a protection from the elements. Clothes also enhance safety during hazardous activities such as hunting and cooking by providing a barrier between the skin and the environment. Clothes incidentally also provide a hygienic barrier, keeping toxins away from the body and limiting the transmission of bacteria and viruses.

Clothes also have important social and cultural functions. A uniform, for example, may identify civil authority figures, such as police and army personnel, or it may identify team or group or even political affiliations. In most societies, clothing is an aspect of norms of the society, in relation to standards of modesty, religious practices and social status. Clothing may also function as a form of adornment and an expression of personal taste or style. (John Travis,2003)

2.1.2 Prayer mat

Prayer mat is a piece of fabric to keep the worshipper clean and comfortable during the *sujud* (prostration to God) of salah (prayer). Figure 2.1 show example of prayer mat. The prayer mat has a very strong symbolic meaning and traditionally taken care of in a holy manner. Prayer rugs are usually made in the towns or villages of the communities who use them and are often named after the origins of those who deal and collect them. The exact pattern will vary greatly by original weavers and the different materials used. Some may have patterns, dyes and materials that are traditional/native to the region in which they were made. Typical prayer rug sizes are approximately 3 ft × 5 ft (0.91 m × 1.5 m) - 4 ft × 6 ft (1.2 m × 1.8 m), enough to kneel above the fringe on one end and bend down and place the head on the other. (Abbo Muhammed Samir, 2005)

Figure 2.1: Prayer mat,

Source: Bazaar perantau.com (2009)

2.1.3 Songkok

A songkok is a traditional Malay cap in the shape of a truncated cone, almost always made of black or embroidered felt, cotton or velvet. It is widely worn in Malaysia, Singapore, Indonesia, Brunei, the southern Philippines and southern Thailand, mostly among Muslims. It is sometimes called as *peci* in some parts of Indonesia and *kopiah* in Mindanao. It is ordinarily worn with the traditional outfit for Malay men. It is also worn by male Malays in formal situations such as wedding feasts, funerals or festive occasions such as the Muslim Eid ul-Fitr and Eid al-Adha and came to be associated with Islam in Malaysia. However in Indonesia, it is worn as part of the local dress and is also worn by non-Muslims. (Rozan yunus, 2007)

2.2 TECHNICAL REVIEW

2.2.1 Technical Drawing

Technical drawing, also known as drafting, is the academic discipline of creating standardized technical drawings by architects, interior designers, drafters, design engineers, and related professionals. Standards and conventions for layout, line thickness, text size, symbols, view projections, descriptive geometry, dimensioning, and notation are used to create drawings that are ideally interpreted in only one way.

A person who does drafting is known as a drafter. In some areas this person may be referred to as a drafting technician, draftsperson, or draughts person. This person creates technical drawings which are a form of specialized graphic communication. A technical drawing differs from a common drawing by how it is interpreted. A common drawing can hold many purposes and meanings, while a technical drawing is intended to concisely and clearly communicate all needed specifications to transform an idea into physical form. (Jefferis, 2005)

2.2.2 Product A

Figure 2.2 show this rolling clothing rack folds down to 5" high to fit in the trunk of a car, but is strong enough to hold up to 250 Lbs. Perfect for on the road salespeople or in the home as a standing coat rack. The clothing rack and can telescope up from 56 1/2" to 66", and telescope out from 51" to 74". It comes with 4" ball bearing casters and is made with 1" outside diameter chrome tubing. It's available with an optional display screen/bottom shelf. The base is 22 1/4" wide x 48" long.

Figure 2.2 Product A

Source : IKEA (2009)

2.2.3 Product B

Figure 2.3 show that the Product B also welded construction. Product dimensions are width: 23 5/8 " height: 75 1/4 ". For care instruction, wipe clean using a damp cloth and a mild cleaner and wipe dry with a clean cloth. These products are making by Steel, Pigmented epoxy/polyester powder coating. Advantages of this product are new design added, more space uses and lightweight. Disadvantages of this product are less clothes can hang and more expensive.

Figure 2.3 Product B

Source: IKEA (2009)

2.2.4 Product C

Cramped for space in a dorm or little apartment? This rack may be your new best friend. Designed to maximize every inch, stay sturdy, and offer two hanging options, this new Split Rail Z-Rack is like adding a second closet to a room. We can't help with the final exam cram session, but we can give you garment hanging space. That's the long and short of it. Figure 2.4 show the product C.

Figure 2.4 Product C

Source : IKEA (2009)

2.2.5 Product D

This three foot Z-rack, a multi-purpose clothing rack, is able to withstand just as much heavy use as its larger counterparts, but still fits easily into smaller spaces. The uprights still extend to a full five feet, providing a good amount of hanging space a solution that's both short and sweet. Figure 2.5 show the product D.

Figure 2.5 Product D

Source: IKEA (2009)

2.3 FABRICATION PROCESS

2.3.1 Metal Inert Gas Process

Gas metal arc welding (GMAW), sometimes referred to by its subtypes metal inert gas (MIG) welding or metal active gas (MAG) welding, is a semi-automatic or automatic arc welding process in which a continuous and consumable wire electrode and a shielding gas are fed through a welding gun. A constant voltage, direct current power source is most commonly used with GMAW, but constant current systems, as well as alternating current, can be used. There are four primary methods of metal transfer in GMAW, called globular, short-circuiting, spray, and pulsed-spray, each of which has distinct properties and corresponding advantages and limitations.

Originally developed for welding aluminum and other non-ferrous materials in the 1940s, GMAW was soon applied to steels because it allowed for lower welding time compared to other welding processes. The cost of inert gas limited its use in steels until several years later, when the use of semi-inert gases such as carbon dioxide became common. Further developments during the 1950s and 1960s gave the process more versatility and as a result, it became a highly used industrial process. Today, GMAW is the most common industrial welding process, preferred for its versatility, speed and the relative ease of adapting the process to robotic automation. The automobile industry in particular uses GMAW welding almost exclusively. Unlike welding processes that do not employ a shielding gas, such as shielded metal arc welding, it is rarely used outdoors or in other areas of air volatility. A related process, flux cored arc welding, often does not utilize a shielding gas, instead employing a hollow electrode wire that is filled with flux on the inside. (Minnick, William H.,2007)

Figure 2.6 Welding

Source: Wikipedia, Shielded Metal Arc Welding (2009)

2.3.2 Grinding Process

Grinding is a machining process that uses an abrasive wheel as the cutting tool.
A wide variety of machines are used for grinding. They include:

i. Hand-cranked knife-sharpening stones;
ii. Handheld power tools such as angle grinders and die grinders;
iii. Various kinds of expensive industrial machine tools called grinding machines
iv. The bench grinders often found in residential garages and basements.

Grinding practice is a large and diverse area of manufacturing and tool making. It can produce very fine finishes and very accurate dimensions; yet in mass production contexts it can also rough out large volumes of metal quite rapidly. It is usually better suited to the machining of very hard materials than is "regular" machining (that is, cutting larger chips with cutting tools such as tool bits or milling cutters), and until recent decades it was the only practical way to machine such materials as hardened steels. Compared to "regular" machining, it is usually better suited to taking very shallow cuts, such as reducing a shaft's diameter by half a thou.

Technically, grinding is a subset of cutting, as grinding is a true metal cutting process. Each grain of abrasive functions as a microscopic single-point cutting edge (although of high negative rake angle), and shears a tiny chip that is analogous to what would conventionally be called a "cut" chip (turning, milling, drilling, tapping, etc.). However, among people who work in the machining fields, the term *cutting* is often understood to refer to the macroscopic cutting operations, and *grinding* is often mentally categorized as a "separate" process. This is why the terms are usually used in contradistinction in shop-floor practice, even though technically grinding is a subset of cutting.

Figure 2.7 Grind

Source: Wikipedia, Grinder (2009)

2.3.3 Bearing

A bearing is a device to allow constrained relative motion between two or more parts, typically rotation or linear movement. Bearings may be classified broadly according to the motions they allow and according to their principle of operation as well as by the directions of applied loads they can handle. (Purtell, John (1999/2001))

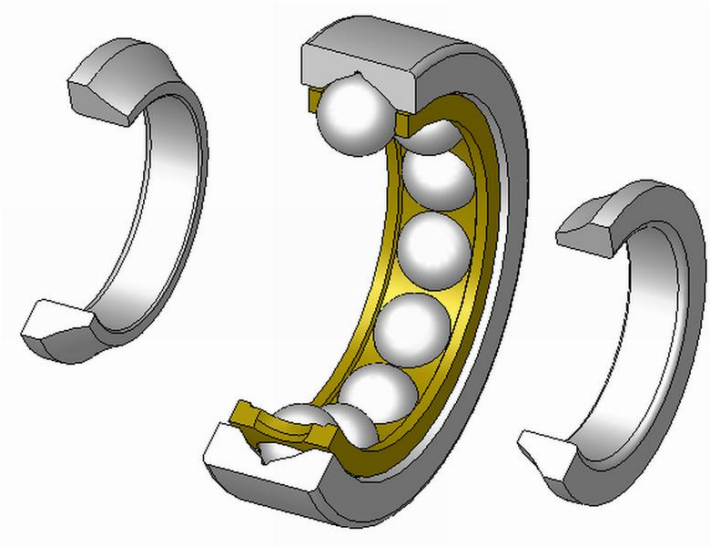


Figure 2.8 Bearing

Source : Wikipedia, Bearing (2009)

2.3.4 Wheel

A wheel is a circular device that is capable of rotating on its axis, facilitating movement or transportation while supporting a load (mass), or performing labour in machines. Common examples are found in transport applications. A wheel, together with an axle overcomes friction by facilitating motion by rolling. In order for wheels to rotate, a moment needs to be applied to the wheel about its axis, either by way of gravity, or by application of another external force. More generally the term is also used for other circular objects that rotate or turn, such as a ship's wheel, steering wheel and flywheel. (Douglas Harper,2001)

Figure 2.9 Wheel

Source: Wikipedia, wheel (2009)

2.4 MATERIAL SELECTION

2.4.1 Hollow bar

Hollow bar, otherwise known as seamless mechanical tubing, is a tubular product made with characteristics and properties suitable for subsequent transformation into a great variety of hollow products and cylindrical components for general engineering purposes. Carbon and alloy steel hollow bars are normally supplied as circular sections although other shapes are available.

Selection of the most suitable raw material for production of circular hollow components, whether the component is a plain bush or a complex precision part, should take into consideration the advantages in using hollow bar as feedstock. It is important to remember when comparing hollow bar and solid bar that the raw material cost is dependent on the length of material used to produce the component. Since the purchase price of raw material is based on weight, the price per length is an important factor. Hollow bar is preferred by many users because of significant savings on raw material cost and machining time. In many instances it is possible to choose a hollow bar with outside diameter and wall thickness very close to the finished dimensions of the component to be manufactured. The need for preliminary operations such as turning and boring is therefore substantially reduced or eliminated. Benefits are gained from reduction in setting-up time and machine cycle times, lower labor and overhead costs for each component, reduced tool costs, lower lubricant usage and machinery maintenance costs. Swarf handling problems are also simplified. (Dirk, 2002)

Table 2.1: A Comparison - Hollow Bar vs Solid Bar

Boring from hollow bar	***Drilling from solid bar***
No drilling is necessary and a shorter time cycle for the manufacture of each component is made possible.	Time is required for drilling from solid bar and the boring operation may still be required.
Boring from hollow bar creates less swarf resulting in low material wastage and less-frequent machine cleaning.	Drilling from solid bar creates an excessive amount of swarf resulting in high wastage and frequent machine cleaning.
Coolant may not be needed.	Coolant most likely required.

CHAPTER 3

METHODOLOGY

3.1 PROJECT FLOW CHART

From the flow chart, this project is started with literature review study. In the literature review study, a research on the existing product in the current market in Malaysia is done. The purpose of this research is to compare the advantages and disadvantages of the product in the current market base on the main objective of the project such as strength, material and others.

After the research on the existing product is done, three existing product in the current market is chosen base on the criteria given. One brainstorming session is done to develop a new idea for each product, base on their advantages and disadvantages. The advantages and disadvantages of this product are found using the sketch method. In this sketch method, the design on the concept will be perform to find their abilities and functions.

When the concept selection is done, the design is carried out for chosen new product. . If have any problem during the sketch go back to brainstorming and solve it. The purpose of this design is to make sure the product specification of the main objective of the project is followed, have reasonable price and material. After the final result of the design, one detail design will be developed in 2D or 3D drawing.

For the fabrication of the new product, the detail design of the concept must include the measuring and selections of the material to create this product. All the details

process to develop this product will be written in this chapter. It concludes all the name of the process and the material used.

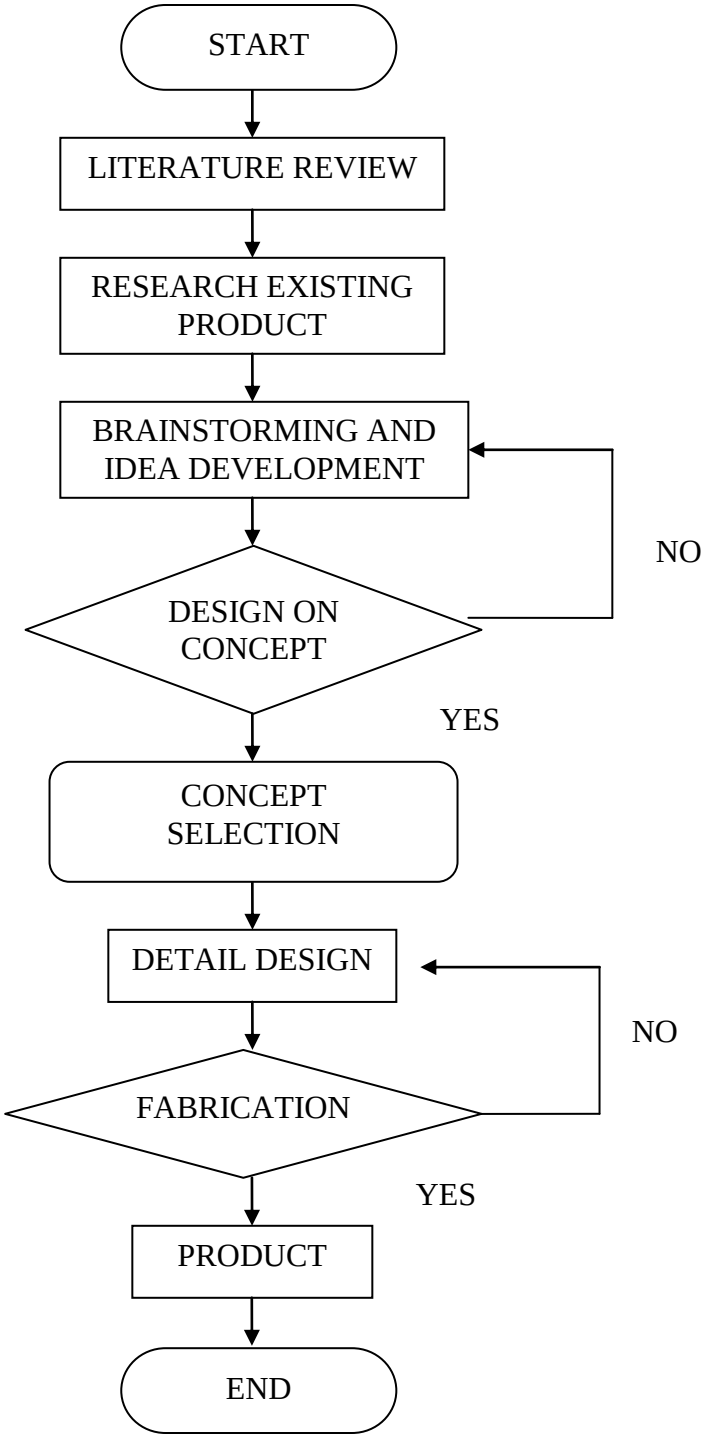


Figure 3.1: Flow Chart

3.2 DESIGN

To design a good product, there are several factors must be considered before designing the new product. This factor is concluding all aspect of the principle in the design. The factors are:

i. Ergonomic : This new product must be friendly use in the society, easy to use
ii. Strength : The body of the product is lightweight.
iii. Material : The material use to fabricate for this product can be found in the market.
iv. Cost : The cost of the material and process must be reasonable.
v. Environment : This product must have ability for suitable to use at all place such as laboratory, office and factories.

3.3 DRAWINGS

The drawing for this new product can be divided into two categories. The categories are:

i. Sketching : Firstly, the new product design will be sketch roughly on the paper because it is easy to modify the idea. After sketching process is done, one new design will be choose using the Pugh concept.
ii. AutoCAD practice : After the sketching and concept selection, the design will be converted into 2D and 3D drawing. In this drawing conclude size, material use, dimension and others.

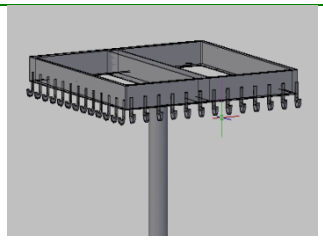
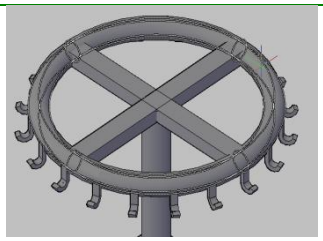
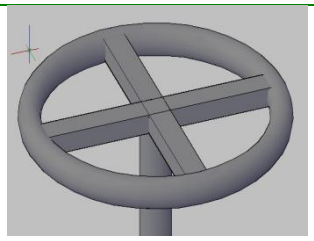
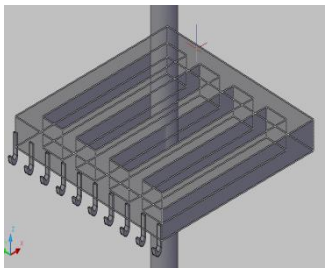
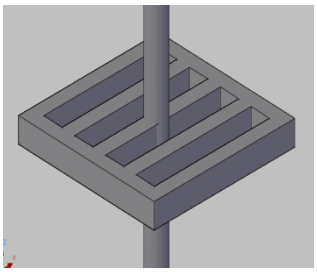
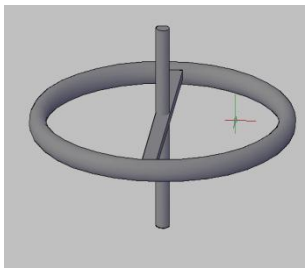
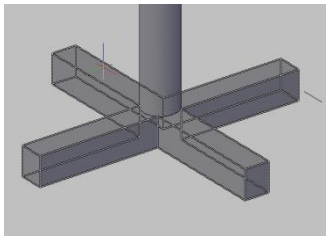
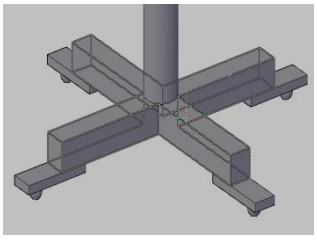
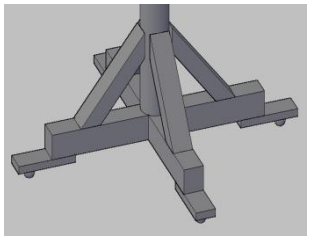
3.4 CONCEPT SELECTION DESIGN

From the existing ideas, only three sketching that had been chosen to be considered as the final ideas and this design sketch using AutoCAD software. This design had been chosen with used concept generation.

3.4.1 Concept Generation

Concept generation will show the main part of the design. It has three main parts which are top, middle and base. Combination of part A, B and C will produce the design

Table 3.1: Concept generation

PART	1	2	3
A (Top)			
B (Middle)			
C (Base)			

3.4.2 Concept A

Figure 3.2 show that there are several advantages of new product design for masjid firstly it don't have to use screw, ideal for hanging clothes, lightweight, easy to carry and can use in the small area

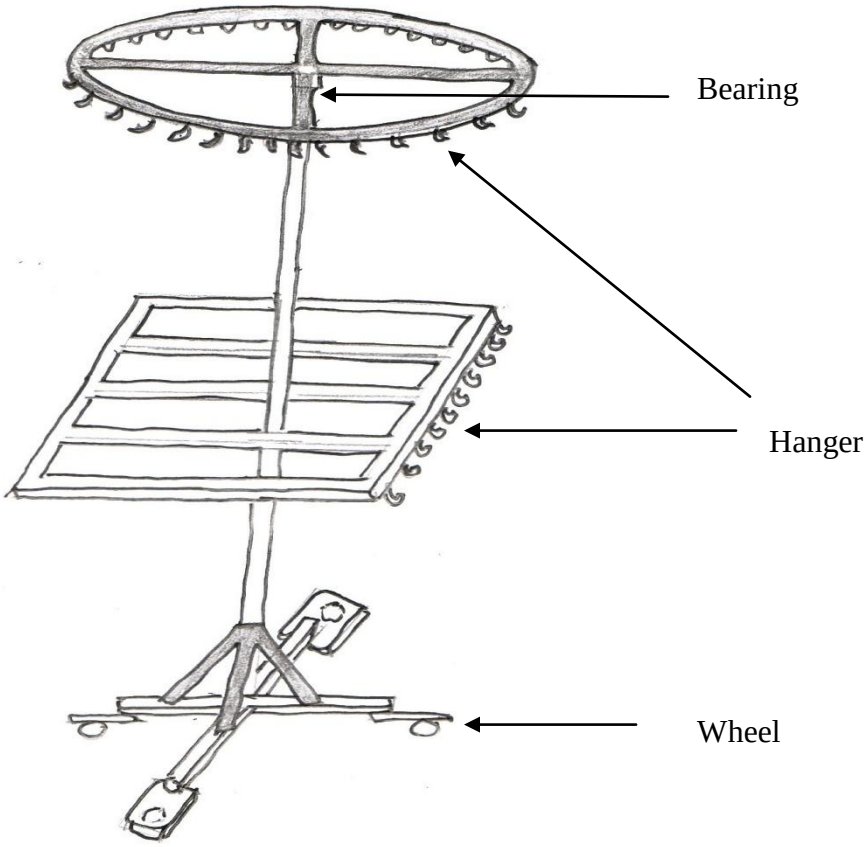


Figure 3.2: Concept A

3.4.3 Concept B

Figure 3.3 show that there are several advantages new product . Firstly are extra features, easy to cornering Suitable for small area, carry small things like clothes, sejadah, , and don’t have stopper.

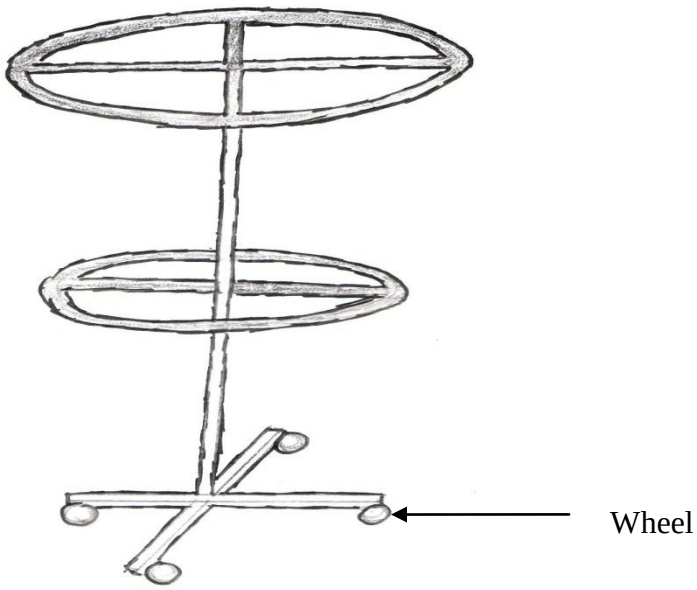


Figure 3.3: Concept B

3.4.4 Concept C

Figure 3.4 show that there are several advantages new product (clothes rack). Firstly are can put many things, stable for heavy force, don't need high force needed to push or pull the clothes rack, and suitable for masjid use.

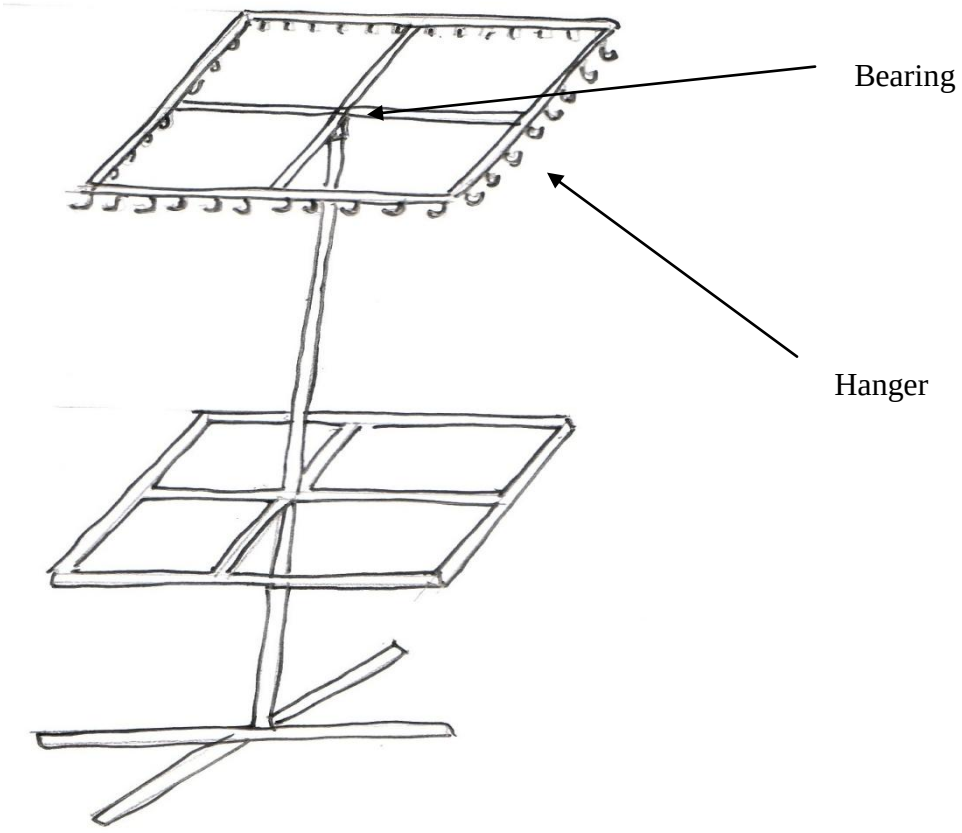


Figure 3.4: Concept C

3.5 CONCEPT GENERATION AND EVELUATION

The final concept was chosen after process selection design. The concept A was choosing as a final design. Below show the drawing final design of the clothes rack using the AutoCAD software. (Pugh Style Solutions Chart)

Table 3.2 : Pugh Concept

Criteria	**A**	**B**	**C**	**Best Concept**
Lot of function	****	***	**	A
Easy to use	****	***	*	A
Stability	***	****	***	B
Strength	****	***	**	A
Safety	***	****	*	B
Easy to move	****	***	***	A
Manufacturing ease	***	**	****	C

Concept	**A**	**B**	**C**
Total	5	2	1
Rank	1	2	3
Select	√	X	X

Conclusion : Option A are viable, they should be pursued in earnest

3.6 COMPUTER AIDED DESIGN DRAWING

Figure 3.5 show that there are several advantages of the product A such as have stopper, can hang many clothes, multi functions, extra features, can use in the small area, and easy to move. It is also can be whirl in part A because it has bearing.

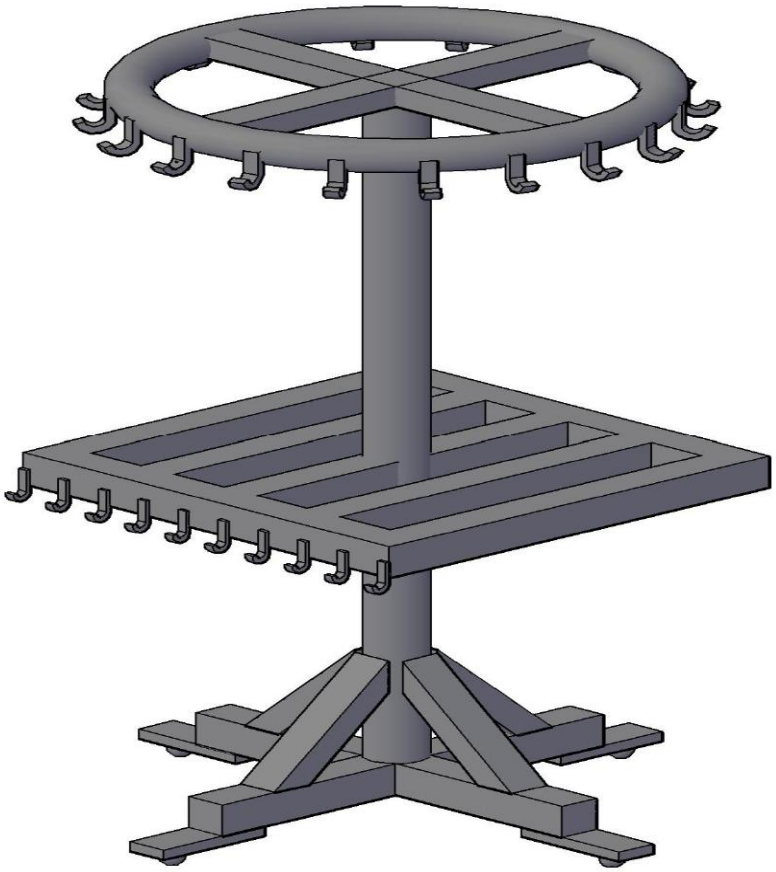


Figure 3.5 3D drawing

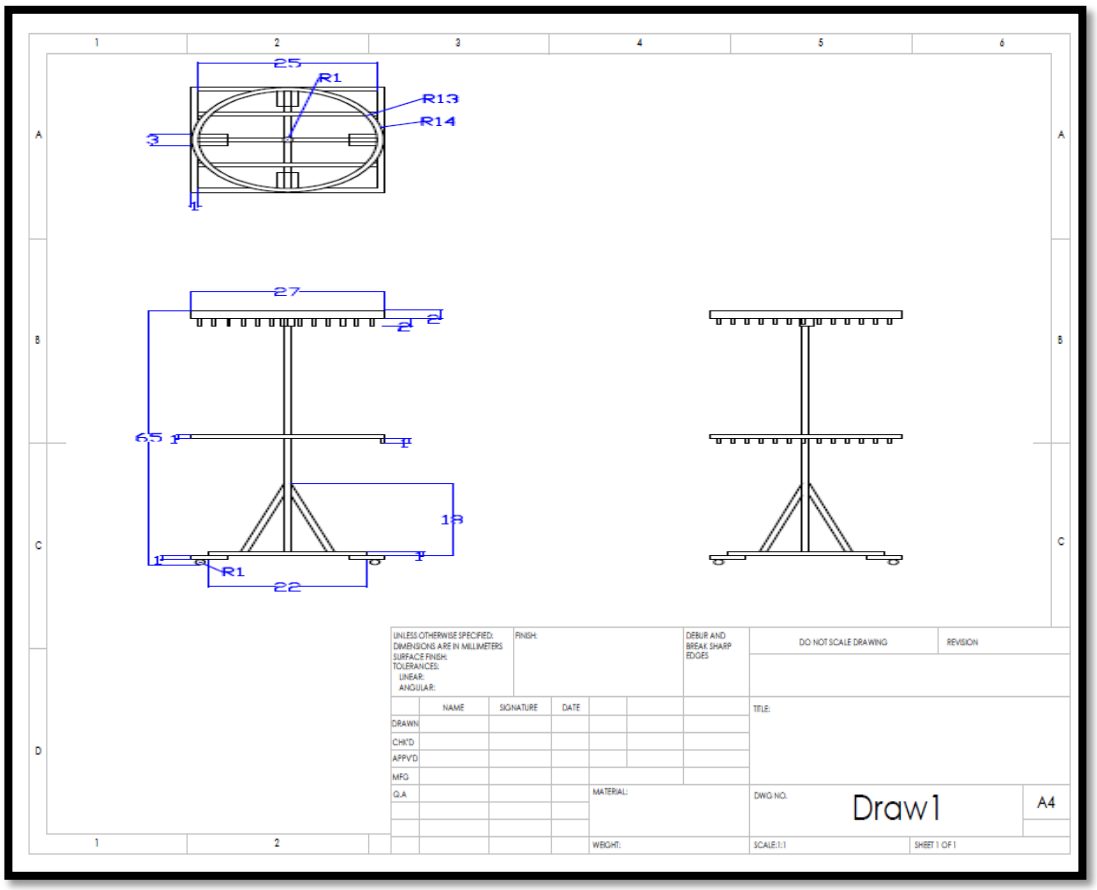


Figure 3.6 : 2D Drawing

3.7 BILL OF MATERIAL

Table 3.2 show that the component to make a clothes rack. The material used for the bone is steel. This product also use bearing to make it whirl in part A

Table 3.3 : Bill of materials

Material	**Number of material**
Square tube	1”x 1”=1
Angle Bar	2” x 2” = 1/2
Round bar	ǿ 1” = 1
Wheel	4
Bearing	1
Electrode E6013	5kg
Rubber lid	4

3.8 FABRICATION PROCESS

In the fabrication, there are many process involve to develop the product such as drilling, grinding, joining and others. Figure 3.6 shows flow chart for the fabrication in this project.

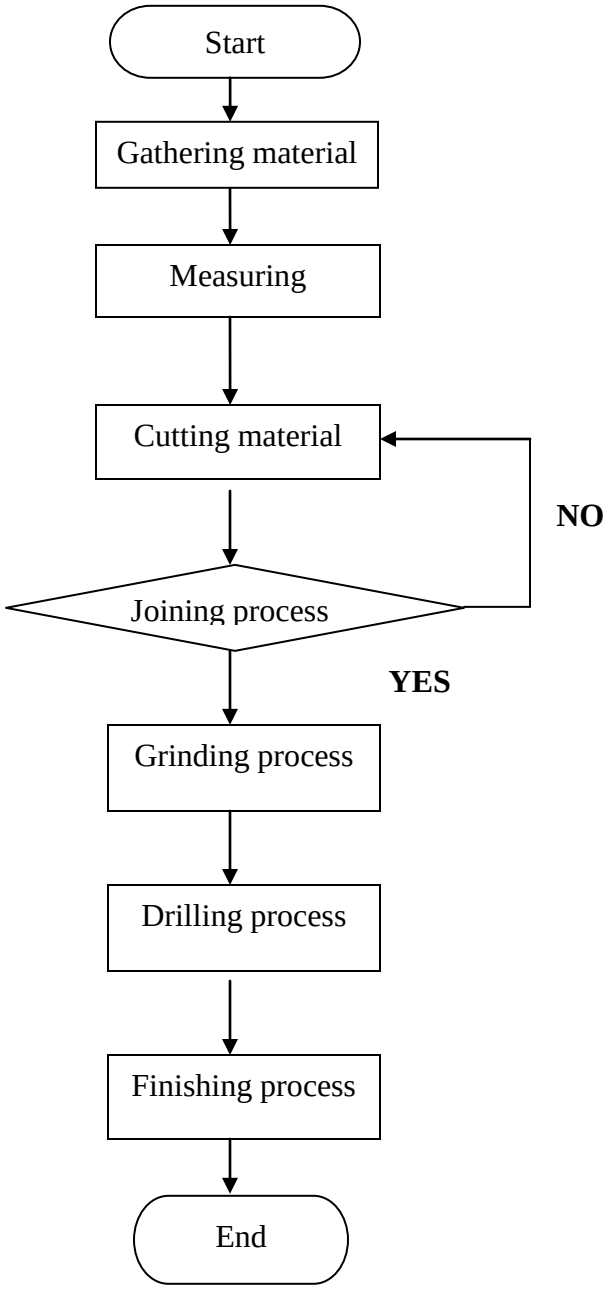


Figure 3.7: Fabrication process

Description of fabrication process as following:

i. Gathering material : There are several type of material such as hollow bar, angle bar and plate used.
ii. Measuring : To measure the length, width and height of the product. Use measuring tape.
iii. Cutting material : Cut material into the wanted shape. Using bendsaw machine and grinding machine.
iv. Joining process : Process to join two material together using arc welding and MIG welding. Also use bolt and nut.
v. Grinding process : Process to make difficult shape, and clean the bead.
vi. Drilling process : Process to make a hole for bolt and nut using drilling machine.
vii. Finishing process : To enhance aesthetic value by painting and surface harp edge smoothing to make it safe to use.

3.8.2 Gathering Material

At this stage, all material need for the fabrication process is gather such as hollow bar, angle bar and aluminum plate. Figure3.7 show the material in the lab that can be use for the project. Some of the material don't have in the lab like bearing and wheel, so this part is buy at hardware shop.

Figure 3.8: Type of material

3.8.3 Measuring

When all material is chosen, second step is to measure the actual size for the product and chassis.

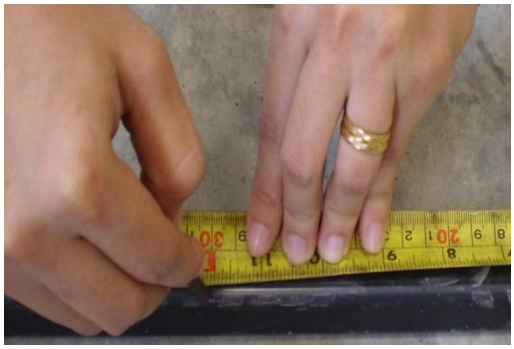


Figure 3.9: Measuring dimension of the product

3.8.4 Cutting Material

After measure the material size, the material was cut using hand bendsaw machine and grinding machine. Figure 3.9 show how to cut material. For more safety, glasses and glove must be use.

Figure 3.10: Cut material into the wanted shape

3.8.5 Joining Process

Joining Process is process to join two material using ARC welding and MIG Welding. For more protection and safety for human, head sheild, apron, google and others PPE equipment not to be forget. Figure 3.10 show that joinig using MIG process

Figure 3.11: Process to join material

3.8.6 Grinding Process

This grinding process is a process to make a difficult shape at the chassis like special curve and clean the bead. Figure 3.11 show how to grind and make smooth surface.

Figure 3.12: Process to make difficult shape, and clean the bead.

3.8.7 Drilling Process

Drilling process is a process to make a hole at the angle bar. This process is done using drilling machine.

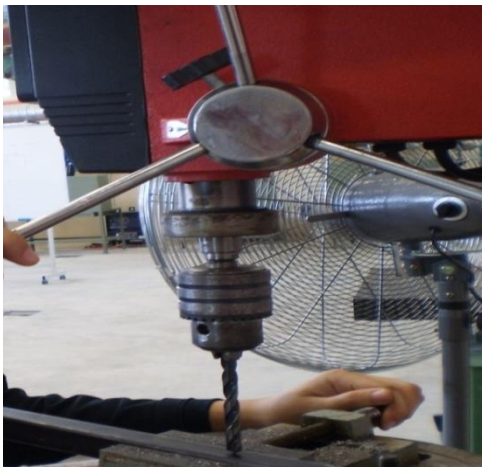


Figure 3.13: Process to make a hole

3.8.8 Finishing Process

Finishing process is a process to enhance aesthetic value at the product such as painting and sharp edge smoothing.

Figure 3.14: To enhance aesthetic value

CHAPTER 4

RESULT AND DISCUSSION

4.1 FINAL PRODUCT

The product was finally fabricated. The step of fabrication is followed according to the project planning with literature review, design and sketching, technical drawing and solid modeling using AutoCAD application, fabrication process with cutting, drilling and joining.

4.1.1 Result after finishing

Figure 4.1 show the Part of the clothes rack with their function. This clothes rack can be whirl at Part A and can easy to move at Part C.

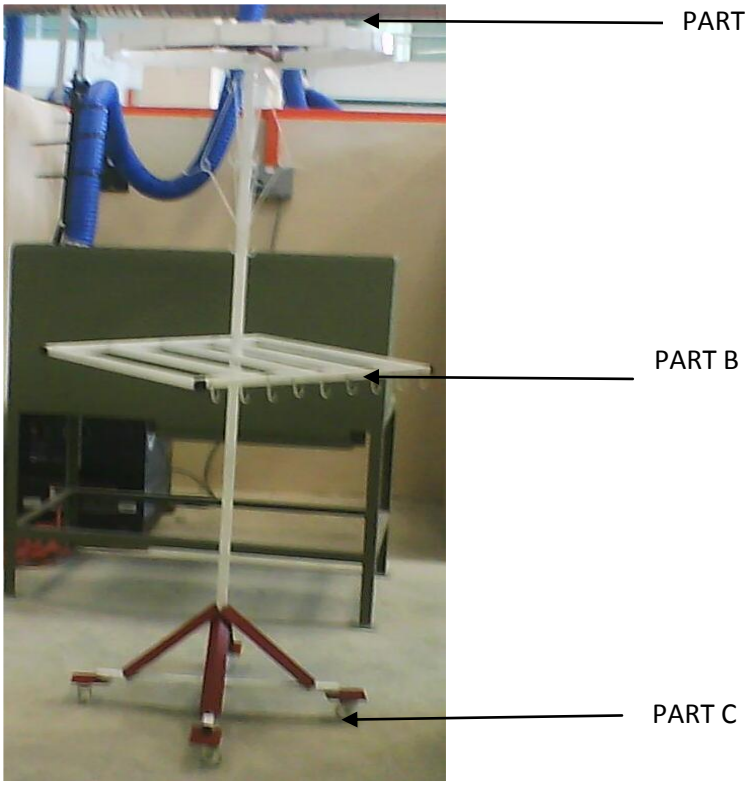


Figure 4.1: Complete clothes rack

4.2 PRODUCT SPECIFICATION

The specification of this product includes the weight, color, wide, height and others. The purpose of this specification is to control the quality of the product and as the guide for the fabrication process.

Table 4.1: Product specification

Category	**Total**
Weight	40kg
Colour	White red
Wide	27’
Height	6”

4.2.1 Bearing

Figure 4.2 show a bearing is a device to allow constrained relative motion between two or more parts, typically rotation or linear movement. The function in this project is it can whirl the part A.

Figure 4.2: Bearing

4.2.2 Wheel

A wheel is a circular device that is capable of rotating on its axis, facilitating movement or transportation while supporting a load. The function is it can easy to move the clothes rack in part C.

Figure 4.3: Wheel

4.2.3 Hanger

Part A

Figure 4.4 show the hanger to hang clothes like jacket, blazer, coat and jubbah. This part also can be whirl to make easier for human to take their clothes.

(i)

(ii)

Figure 4.4: Part A

Part B

Figure 4.5 show the part that can be use to put prayer mat and kain pelekat. It also use to hang Copiah, songkok, prayer mat and kain pelekat.

(i)

(ii)

Figure 4.5: Part B

4.3 DISCUSSION

This chapter is about the discussion of the flow process from the beginning till the end of fabrication. Discussion of this project can be divided into two parts. First is about the problem at the beginning until the finishing of this product and second is about type of defect on the final product.

4.3.1 Type of Defect

There are so many things happen in fabrication such as defect. This defect happens because lacks of skill to operate a machine such as when handling ARC welding and MIG welding machine. Although these problems happen, it can give an experience to avoid the same problem to be repeated again in the future. There is few type of defect occur during the fabrication.

4.3.2 Gap

Figure 4.6 showed a gap between the parts. This happen because welding process is done on inflate floor. Therefore the chassis is not well aligned.

Figure 4.6: Gap

4.3.3 Bead

Figure 4.7 is shown a defect on the holder joining. The bead is not trim well after finish welding process. The electrode use in this welding is not suitable for this material. Insufficient experience to handle also caused of the defected.

Figure 4.7: Bead

4.3.4 Problem in Progress

Many problems occur in progress to design and fabrication of this table such as gather raw material, literature review, design and fabrication.

4.3.5 Literature Review Problem

The problem during literature review is mainly about the difficulty to know about the title such scope, concept, and idea development. At this stage, the scope, concept and idea development needs many references and comparison. So many researches have to be done to get idea development and to find the advantages and disadvantages product in current market.

4.3.6 Fabrication Problem

Material is the most important part for fabrication and it does also can be the biggest problem in the fabrication process. To get material a research must be done to get a suitable material. The measurement must be accurate with the design that we need to fabricate.

4.4 TESTING

This process is done after the fabrication of the clothes rack is finished. The purpose of the testing is to find if the clothes will be fall or not.

Figure 4.8: Clothes Rack

4.5 SAFETY

Safety is very important in industries. It's also known as OSHA (Occupational Safety and Health). With the safety is stressed the function of clothes rack become more comfortable and efficiency.

4.5.1 Rubber lid

Figure 4.9 is show about the rubber lid at the holder of the clothes rack. Using this rubber lid, its can avoid an unneeded or unexpected accident happen when use this clothes rack because of the sharp edges. It's also can comfort to the user.

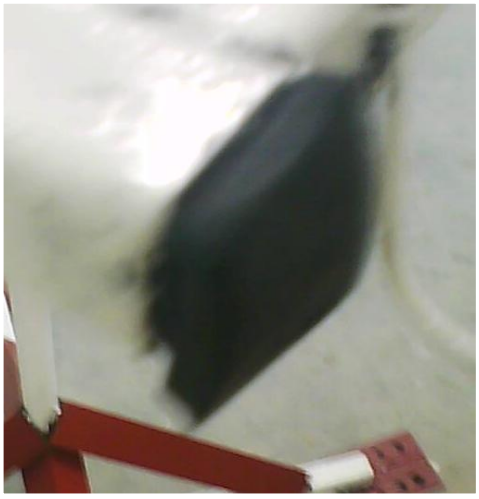


Figure 4.9: Rubber Lid

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

This chapter is about problems the project encounter before, during and after project. This chapter also will discuss about the conclusion of the whole flow of the project from the planning project, literature review, and design of the product and fabrication of the product.

5.2 CONCLUSION

As the conclusion, the project to fabricate the clothes rack that suitable and user friendly was achieves the main objective successfully. Furthermore, other objective in this project that to design a clothes rack that has a lot of function was also achieves successfully. The function of this clothes rack is it can be assembly or disassembly follow type of area condition. This clothes rack also have achieves its objective to fabricate a functional clothes rack with extra features successfully. There are various types of the extra features at the clothes rack such as have an adjustable stopper at the wheel, can be whirl and easy to move. This project had achieves its entire objective successfully. This project was done around thirteen week included almost all steps of the report such as literature review, design, fabrication process and others.

5.3 RECOMMENDATION

This is several recommendations to express for myself and the faculty for future final year project:

i. The clothes rack also can be height adjustable to allow children to more easier to hang their clothes.
ii. A small lamp can also be attached to the rack to allow users to more easier when use the clothes rack in the night or dark place.
iii. The clothes rack also can be flip into small size that suitable in small area

REFERENCE

Bazar Perantau, 2009. Prayer Mat (online).http://www.bazarperantau.com (22 November 2009)

Wikipedia, 2009. Clothing (online).http://en.wikipedia.org/wiki/Clothes (20 November 2009)

Wikipedia, 2009, Prayer rug (online).http://en.wikipedia.org/wiki/Prayer_mat (20 November 2009)

Wikipedia, 2009, Songkok (online) http://en.wikipedia.org/wiki/Songkok (20 November 2009)

Wikipedia, 2009 Technical Drawing (online) http://en.wikipedia.org/wiki/Technical_drawing (19 November 2009)

IKEA, 2009 Rigga Clothes rack (online) http://www.ikea.com/us/en/catalog/products/16684783 (18 November 2009)

Wikipedia,2009 Grinder (online) http://en.wikipedia.org/wiki/Angle_grinder (18 November 2009)

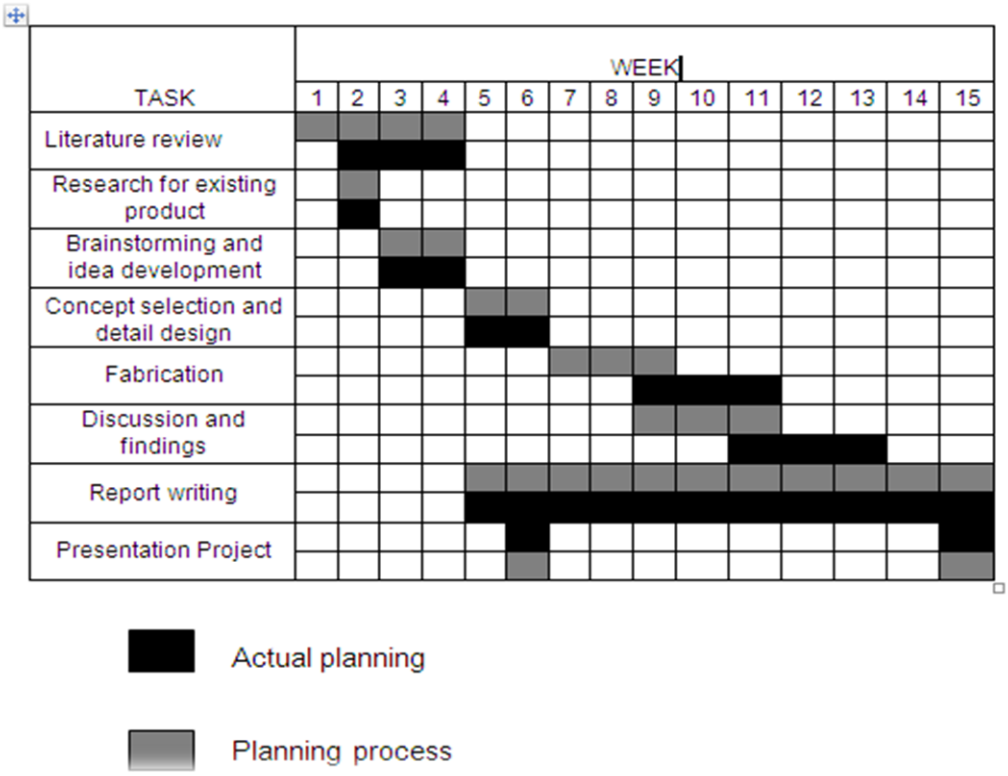
Wikipedia, 2009 Wheel (online) http://en.wikipedia.org/wiki/Angle_grinder (18 November 2009)

Wikipedia, 2009 Bearing (online) http://en.wikipedia.org/wiki/Bearing (18 November 2009)

Wikipedia, 2009 Shielded Metal Arc Welding (online) http://en.wikipedia.org/wiki/Shielded_metal_arc_welding (18 November 2009)

APPENDICES A

Project Gantt Chart



APPENDICES B

Final Product

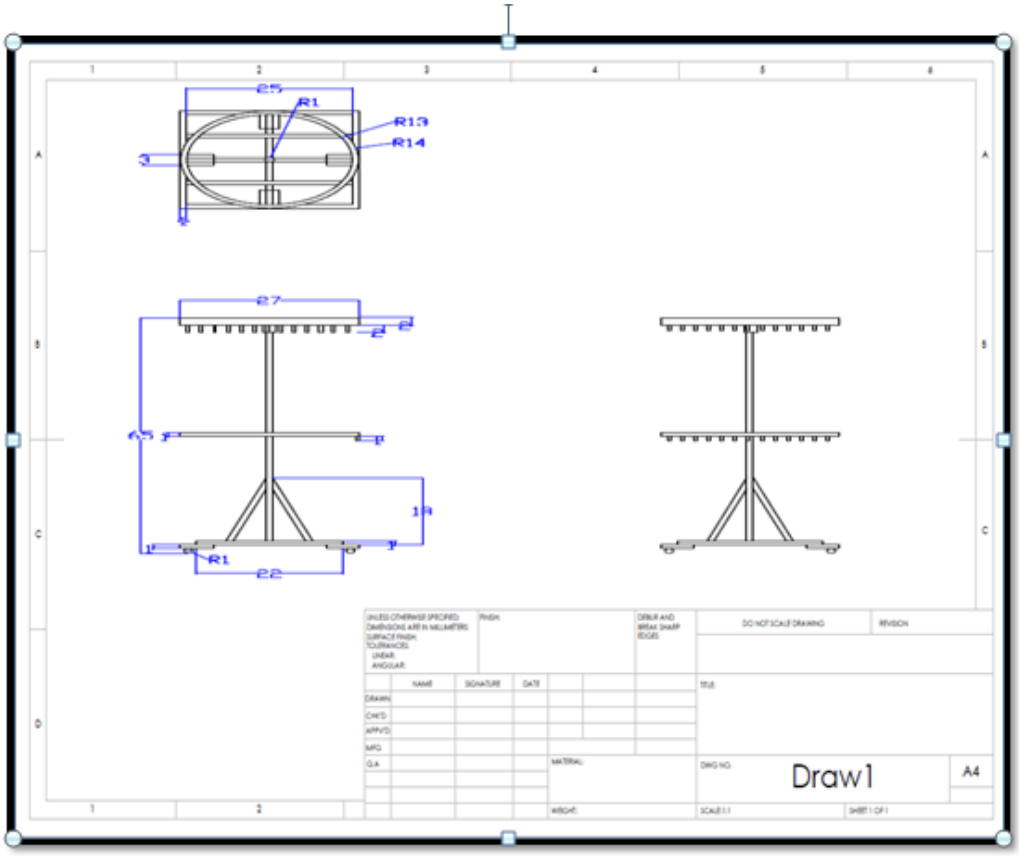


Figure 3.6 : 2D Drawing