

DESIGN & FABRICATION OF FOLDABLE CHAIR

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ABSTRACT

Idea to design and fabricate a foldable chair is come from a supervisor that gives a task and a title for this project. To design and fabricate this foldable chair it must compare with the other product that available in market. To make sure the idea to design and fabricate the foldable chair is not used and in old idea, the information about current design for foldable chair must search or get from the internet. Form there the information and idea to design and fabricate a foldable can be created. It includes many things about foldable chair design that wanted to know. Whole of the project involve various methods like the concept design, the designing and also the fabrication process. Beside that in this project can bring a motivation and experience to conduct the various type of machine, train to work under the pressure, and also soft skill ability like time management, planning the task, negotiation skill and sell out the idea especially during work progress presentation.

ABSTRAK

Idea untuk merekabentuk dan menghasilkan kerusi mudah lipat telah dikeluarkan oleh penyelia yang memberikan tugas. Untuk merekabentuk dan menghasilkan kerusi lipat ianya hendaklah dibandingkan dengan rekabentuk yang lain yang terdapat dipasaran. Informasi tentang rekabentuk- rekabentuk baru diperolehi melalui pencarian di laman web- laman web, ianya untuk memastikan idea yang diperolehi tidak ketinggalan zaman atau telah digunakan oleh orang lain. Dari situ juga segala maklumat tentang rekabentuk dan idea- idea tentang penghasilan kerusi lipat dapat dilahirkan. Ianya mengandungi semua maklumat yang diperlukan. Keseluruhan projek melibatkan pelbagai proses seperti konsep rekabentuk, merekabentuk dan juga proses merekabentuk. Selain itu projek ini dapat memotivasikan diri dan memberi pengalaman dalam cara pengendalian pelbagai mesin, melatih bekerja di bawah tekanan dan juga dalam keupayaan "*Soft skill*" seperti pengurusan masa, merancang tugas dan kemahiran mempertahankan idea terutama ketika pembentangan perkembangan kerja.

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CHAPTER 1

INTRODUCTION

1.1 Project Synopsis

1.1.1 General Project Synopsis

This project was purpose to design and fabricate a foldable chair. This project involves designing and fabricating a foldable chair for couple. With a newly designed and fabricated a foldable chair it must include additional function to make it different from other product in market. As the Diploma final year project allocates the duration of one semester, this project focused on new design and additional function that can be added in product. With a newly designed and fabricated of foldable chair, testing is required to make sure that the new function is not offending their main function and to verify the design. Overall, this project will acquire the skills of design, analysis, fabrication and testing.

1.2 Project Scope of Work

- To design foldable chair for couple seat.
- Not for extreme using requirement.

- Make for people who wanted to save space or have a small space.
- Design and fabricate.

1.3 Project Objective

Basically this project is base on these objectives:

- To design and fabricate a foldable chair for couple seat.
- Also focuses on the other function that can be added to this product depend on their suitable.
- To produce and train student to capable of doing work with minimal supervisory and more independent in searching, detailing and expanding the knowledge and experiences.

1.4 Project Planning

Please refer to appendix A for reference to this below elucidation.

This project begun with made a research and search for information via internet, books, supervisor, and others relevant academic material that related to the title, this literature review takes about a three week. The findings of information not stop there. It continues along the way of this project because knowledge is so many to learn plus with the wrong information that gathered.

The first week also had to arrangement several meeting with my supervisor to be clearly about the scope of title, synopsis from previous research and tool requirement which included software (Solidwork, AutoCAD) or hardware (machining: punching or bending, fabricating: welding)

At second week have do schedule management for the project which included schedule management namely as Gantt chart (time management) and also flow chart (process management). This is done using Microsoft Office word. This takes a three week to accomplish.

The second week also have to submit the project title acceptance form and continue research in literature review of foldable chair and the method for the machining, the information was are more details on foldable chair model and the research of information, this takes a three week to be done.

The title are well clear at week third, it consist of scope and objective for the project. At this week, the meeting with supervisor only focused to choose the right design which is suitable for user and also quite strength, function ability and the additional function that can be added to make the product different with other product in market.

At this week the sketch should finish with the right dimension and have to be approved by the supervisor. The engineering drawing was use Solidwork software to generate 3D model to design the model of project. Please refer to appendix B for 3D model of the project. The model for this project consists of one sheet metal of stainless steel and ten square hollow steel:

- Sheet metal: 2440 x 1550 x 1.5 (mm).
- Square hollow steel: 400 x 25 x 25 x 1.5 (mm)
- Square hollow steel: 316 x 25 x 25 x 3 (mm)

The sketching and measurement consideration of the project takes about four weeks to be done. It complication because of what are the available material at the lab and another else the problem should consider what are the appropriate method to be machining and also consist finalize design for product.

The week fifth should to find the material which right and suitable on design and machining. Actually the materials at the lab mostly under name by specific supervisor,

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Firstly chair is used as a place where we can sit on it to study or relax. We already know that chair is a product that can make as a thing for relax and make clarity and it is a pleasure when we can use it anywhere and anytime we need. To fill the wish, many companies have design and fabricate a foldable chair for user easier to bring it anywhere they need and anytime.

This project provides a critical and creative thinking to create a new design. Beside that it also improving knowledge and thinking that we know the way to produce the product in manufacture.

2.2 Paper Review

2.2.1 Pre Review

Most of the foldable chair today has a design that require it to bring anywhere and light weight. Beside that it a trend to put another function in foldable chair to make it more function ability and agronomic design.

Although it has a more function it not an easy work to design in other it can fold. The fold had a many way depends on the manufacture. Although it has many design in market but today people more attractive with something that we call as a special design like additional function on the foldable chair or it does not as a chair but it can used in another way like as a bag, table, umbrella and many other thing.

This project focuses further on redesign and fabricates the current model of foldable chair and it also allowed to used and test for strongest, stability and the function.

2.2.2 Foldable Chair Review and Description

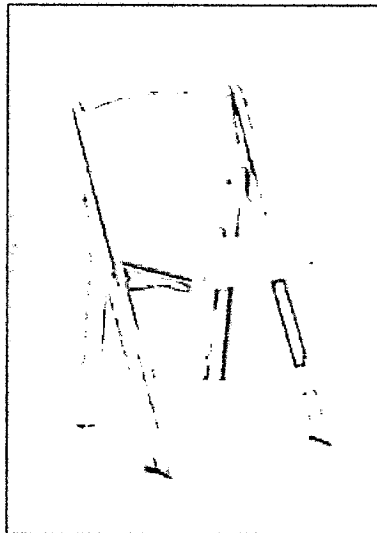


Figure 2.1: DuraMax resin folding chair [1]

Figure 2.1 is showing a foldable chair models that call DuraMax resin folding chair. The characteristics of this product are premium resin construction for long lifetime and superior straight leg design for a “study” comfortable feeling. It also cleaner looking chairs because of non-stick, anti-static finish and has an UV treated to eliminate fading or discoloration. Than it stack 30 chairs high for efficient transportation, or 40-50 chairs high for storage and available in White, Black, Grey and Taupe [1].

Benefits from the product is lightweight, durable design for greater comfort and safety it also in high quality plastic so it's perfect for all indoor and outdoor events. Besides that it designed to blend with existing wood or resin folding chairs to ease replacement schedules and it no sanding or painting required [1].



Figure 2.2: SwiftSet Folding Chair [2]

Figure 2.2 is showing a SwiftSet folding chair. This product design with a pleasing design and able to handle demanding seating jobs, the popular SwiftSet folding chair is a durable option for those desiring a folding chair that is comfortable, durable and easy to store. Convenient handle is used for fast, one-hand setup and takedown. SwiftSet is strong but light-weight over 25% lighter than other comparable folding chairs [2].

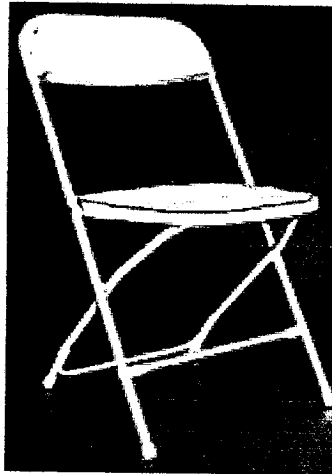


Figure 2.3: ProLite Poly fold chair [3]

Figure 2.3 is showing a ProLite Poly fold chair. Mity-Lite's new ProLite Poly fold chair combines the strength of metal with the lightweight durability of plastic. In fact, the advanced design enables our chair to hold 1000+ lbs making ProLite the strongest poly fold chair on the market. The durable powder coated frame is resistant to chipping, and the rugged plastic seat [3].



Figure 2.4: Hand-Embroidered portable chair [4]

Figure 2.4 is showing a Hand-Embroidered portable chair. It also called Chic Seat: Hand-embroidered seater with a high gloss lacquered wood frame in apple green; cream seaters are removable for cleaning[4].



Figure 2.5: Oak Deck chair by Sutton Bridge [5]

Figure 2.5 is showing an Oak Deck chair by Sutton Bridge. The Sutton Bridge Oak Deck chair reinterprets the classic director's chair design with a little more room in the seat, contemporary styling, inventive architecture, and lighter weight. Toss it in the trunk for tailgating parties, picnics or the kids' soccer games it weighs just 12pounds, and folds flat for easy transport and storage [5].

Sunbrella fabric will not fade or stretch like canvas. Built with Kentucky Oak, mortise and tenon joinery and a polurethane finish for lasting beauty and strength. In testing, the 1 1/2" solid oak frame supported over 700 pounds and the seat withstood more than 50,000 cycles of pummeling from a 125-pound sandbag [5].

Seat Length: 18". SeatWidth: 19". Seat Height: 16 1/2". Overall Height: 35".
Chair Weight: 12 lbs [5].

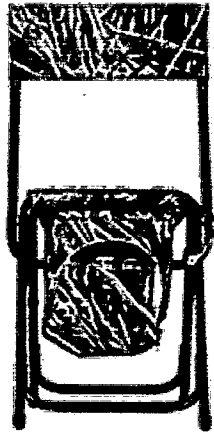


Figure 2.6: Sportsman cooler chair by TravelChair [6]

Figure 2.6 is showing the Sportsman cooler chair by TravelChair. It's allows a wide stance and 18" height allows to relax and be on target while a backrest provides all day comfort. Integrated cooler keeps lunch, or doves, fresh. Mossy Oak Shadow Grass keeps a low profile in anything from marshes to wheat fields [6].

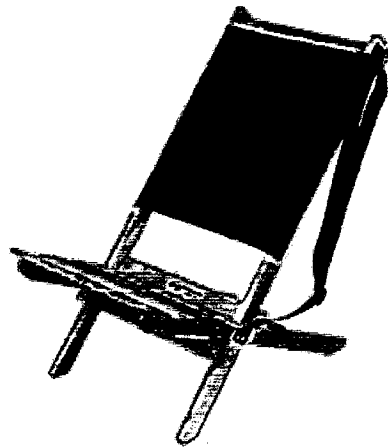


Figure 2.7: Two Piece portable chair by Blue Ridge Chair [7]

Figure 2.7 is showing a Two Piece portable chair by Blue Ridge Chair. The ideal chair for people on the go. An innovative design makes it the perfect companion for an outdoor concert, sporting event, or day at the beach. The included carrying strap makes it the perfect portable chair [7].

The sturdy two-part construction is certified to hold up to 300 lbs., and it takes only seconds to disassemble, making it easy to pack out of your campsite or store away in the car trunk. The finest materials and craftsmanship go into every chair [7].

Handcraft from rich grained solid Ash hardwood finished with Danish Oil, stainless steel hardware and a heavy polyester seat back. This item will offer years of dependable comfort [7].

2.3 Basic Parts

- Surface chair: Usually made from wood, aluminum, metal and plastic polymer that joined with bolt and nut, rivet and welding with frame and leg.
- Leg: Usually use wood or steel because it has good strength to support heavy load that apply over a surface chair. It is joining with frame surface chair or directly with surface chair at below.
- Arm: Arm is function to lock leg chair and support the chair to become stable. Usually it uses a small rectangular bar or sheet metal. It must join with surface chair and their leg.

CHAPTER 3

PROJECT METHODOLOGY

3.1 Project Flow Chart

In fabrication foldable chair, there is a planning for overall progress to assure that project can be finish on schedule.

From the figure 3.1, the project starts with get the title project from supervisor and find the literature review and research about the title. This consist a review of the foldable chair current design in market. 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 as the datum 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 the transfer to solid modelling and engineering drawing using Solidworks and AutoCAD program.

After the engineering drawing finished – include detail design and drawing and approved by supervisor, the drawing was used as a reference. Than find the material that wanted to be used and suitable to fabricate the product. Than goes for the next process which is fabrication process. This process is consists fabricate the parts that have design

before by following the dimension using various type of manufacturing process. The manufacturing process included in the process is cutting, drilling, punching, bending and welding. For through all this fabrication process, it used varied machine such as disc cutter machine, punching machine, bending machine, drilling machine and Metal Inner Gas (MIG) welding. During the fabrication process, if there is something wrong occur such as not balance dimension so the process stop and go back to previous step, check the drawing back. For this project, the earlier design was changed when it go for fabrication process because the difficulty to fabricate using the available machine, the change of design around 50 % from earlier design.

After the fabrication process, comes testing process. The testing is to gathered information about strength, hardness, and load can it holds for design that has been fabricated. The test process just to testing whether the product are functioning or not. If this foldable chair and their other added function are working, it will go through the next process that is evaluation process. And if the foldable chair and their additional function is not working properly there should begun again with the design and improvement process. Based on this project the testing process was failed where this foldable chair is too heavy to carry because of using wrong material. The solution is this product must add the wheels to make it easy to bring anywhere. Than other improvement has been added to make sure this product can performs their functions without any problems.

After the process mentioned above is done. All the material for report writing is gathered. The report writing process will be guided by the UMP final year project report writing. This process also included the presentation slide making for the final presentation of the whole project had been done.

The project ended after the submission of the report and the slide presentation has been present.

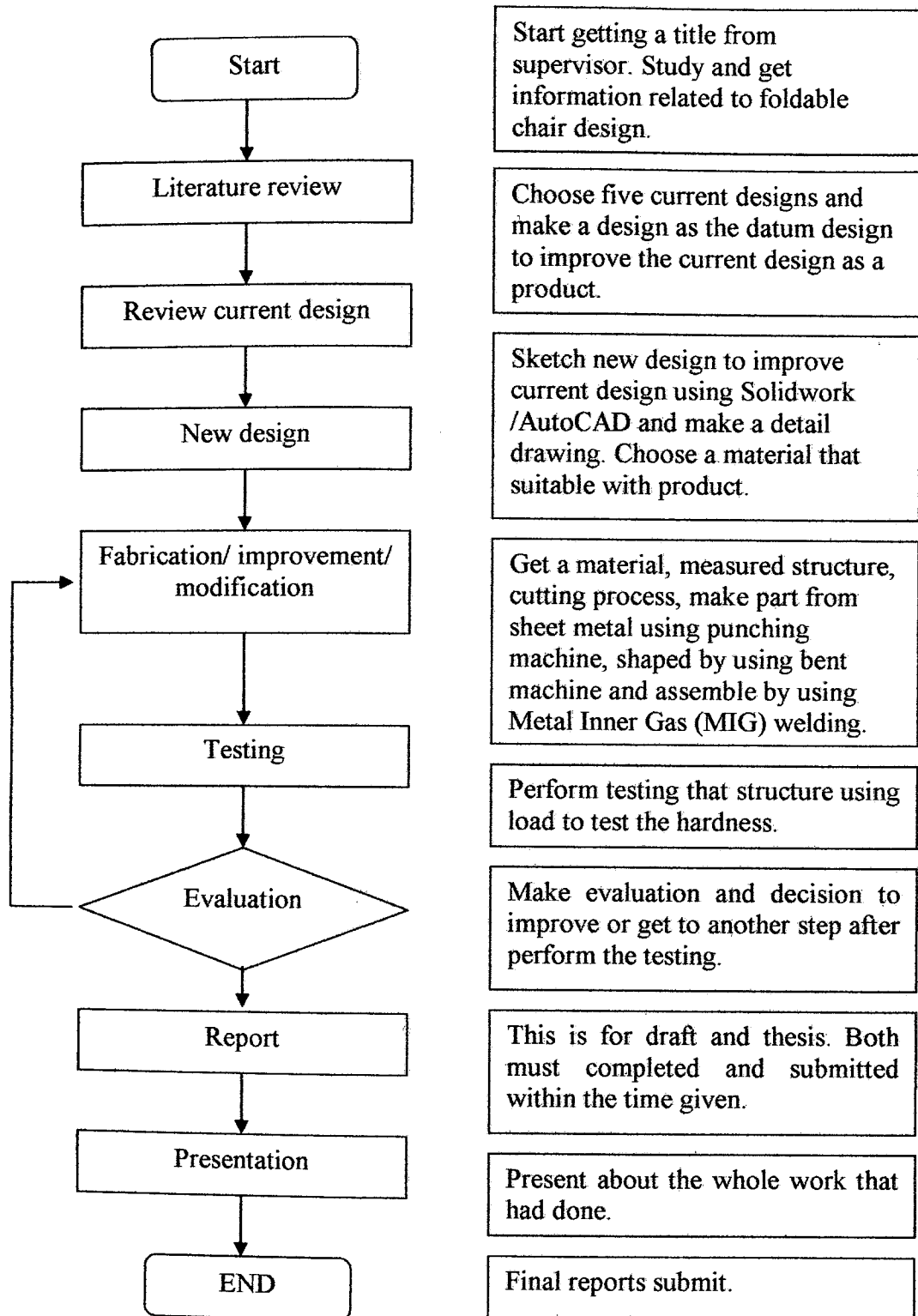


Figure 3.1: Project flow diagram

3.2 Product Design Specification

3.2.1 Concept A

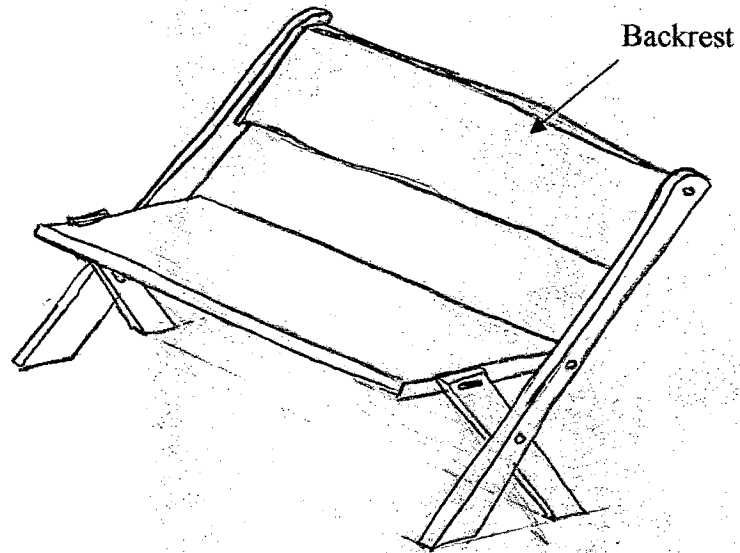


Figure 3.2: Concept A

Figure 3.2 show a design of concept A. Design look simple and good looking. But it's unstable design and cannot fold into small part. It make from wood that know as a light material. Advantage for this design it look nice but more likely not for bring anywhere because of their design cannot fold this chair into small part.

3.2.2 Concept B

Figure 3.3 show a concept B for foldable chair design. This concept is a datum concept that has used their design as first concept to create the idea to make additional