DESIGN AND DEVELOPMENT OF HAMSTERS CAGE

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for the award of the
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SUPERVISOR'S DECLARATION

We hereby declare that we have checked this project and in our opinion this project is satisfactory in terms of scope and quality for the award of Diploma in Mechanical Engineering

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STUDENT'S DECLARATION

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

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To all my beloved family

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I would like to express my gratitude and appreciation to all those who gave me the possibility to complete this report. Special thanks are due to my supervisor mr Muhammad Ammar b Nik Mu'tasim whose help, stimulating suggestions and encouragement helped me in all time of completing the project. I am very grateful to her patience and his constructive comments that enriched this project. His time and efforts have been a great contribution during the preparation of this thesis that cannot be forgotten for ever.

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I also thank to all my friends for their friendship and help when thinking through the problems and for sharing their knowledge. Finally, I thank my beloved family for their continuous support and confidence in my efforts.

ABSTRACT

The idea to design and development of hamster cage is come from supervisor that gives me this title and task for this project. To design and fabricated this hamster cage, it must be compare with other product that maybe available in the market. First, get an idea from internet, magazine, newspaper or other from available data. Form there the information and idea to design and fabricated can be created. Whole project involves various methods such as collecting data, concept design and fabrication process. The whole project involved various method and process that usually use in engineering such as concept design, analysis process and lastly fabrication process. This final year project takes one semester to complete. This project is individual project and must be done within this semester. In this project, students must able apply all knowledge during their studies in this Diploma of Mechanical Engineering course. Overall from this project, time management and discipline is important to make sure this project goes smooth as plan and done at correct time.

ABSTRAK

Idea untuk mencipta dan membangunkan sangkar hamster ini datang daripada penyelia yang memberi saya tajuk dan tugasan untuk projek ini. Untuk merekabentuk dan pembinaan sangkar hamster, ia hendaklah dibandingkan dengan produk lain yang mungkin berada dalam pasaran. Langkah pertama, dapatkan maklumat daripada internet, majalah, suratkhabar atau daripada sumber yang lain. Keseluruhan projek melibatkan pelbagai cara atau kaedah seperti mengumpulan data, rekabentuk konsep dan proses membina. Kaedah yang selalu yang digunakan dalam kejuruteraan seperti proses analisis juga digunakan. Projek akhir tahun ini mengambil satu semester untuk disiapkan. Projek ini adalah projek individu dan mesti disiapkan dalam semester ini. Didalam projek ini, pelajar mesti berupaya menggunakan segala pengetahuan yang mereka perolehi semasa pembelajaran mereka di dalam kursus Diploma Kejuruteraan Mekanikal ini. Secara keseluruhan daripada projek ini, pengurusan masa dan disiplin adalah penting dalam memastikan projek berjalan lancar dan siap tepat pada waktunya.

TABLE OF CONTENTS

CHAPTER 5 CONCLUSION AND RECOMMENDATIONS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 PROJECT TITLE

Design and Development of hamsters Cage

1.2 PROJECT SYNOPSIS

Many cage designs are manufactured. The basic cage used in most rabbit inches 5 wide, 25 inches long and 15 inches high. Most have rectangular sides (conventional style), but some have rounded tops (Quonset style). Doors may be hinged at the top, sides, or bottom.

Hamsters make a great pet and as an owner we should be aware of the basics to looking after them. We must keep the habitat clean to prevent the effected by virus. We must prepare a suitable cage to ensure the hamsters feel safe and comfortable.

1.3 PROJECT BACKGROUND

This project consists of the stage of design and development of an Hamster Cage. Simple analysis and collecting data to design a simple cage.

The project will be funded by the student final year project funding, University Malaysia Pahang (UMP) short term project funding as well as sponsorship obtained from industrial sponsors such as of equipments, products and also monetary funding.

1.4 PROJECT OBJECTIVE

1.4.1 General Objective

Diploma final year project objective is to practice the knowledge and skill of the 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 presentation and educate them to define their research in presentation .The project also will generate student 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 with minimal supervisory and more in and more independent in searching, detailing and expanding the experiences and knowledge.

Nevertheless this project also important to generate and increase interest in research work field.

1.4.2 Specific Objective

The final year project is:-

a) Design and development of a hamster cage
b) To fabricate the mechanical component.

1.5 PROBLEM STATEMENT

a) How to fabricate the good mechanical cage
b) make comfortable cage for hamster like their habitat
c) Make the cage for easy to use
d) Current market made from plastic plus metal
e) Quality

1.6 PROJECT SCOPE

The scope of this project will cover:-

a) Product design easy to use
b) fabricate the mechanical part of system
c) design using CAD software Solid Work
d) Knowledge in welding ,cutting and etc

1.7 PROJECT PLANNING

According to the Gantt chart from **Table 1**, this project has been started at the week 1 to week 3 to selecting the material by collecting data, information and literature review via internet, books, supervisor, and others relevant academic material that related to the title. Review and survey current design was started at this week. Then follow by 3 concept design which started on week 4. Then matrix chats on week 6. Design with sold work at week 7. Fabrication process which was started on week 9. Report preparation was started on week 11. Twice of presentations were held which are in week 7 and week 15. In details, **Table 1** represents the Gantt chart for the project.

Table 1.1: Gantt chart

WEEK / TASK		1	2	3	4	5	6	7	8	9	10	11	12	13
MATERIAL SELECTION	Planned													
	Actual													
3 CONCEPT DESIGN	Planned													
	Actual													
MATRIX CHART	Planned													
	Actual													
CAD/ SOLIDWORK SOFTWARE	Planned													
	Actual													
FABRICATION	Planned													
	Actual													
REPORT PROJECT	Planned													
	Actual													
PRESENTATION PROJECT	Planned													
	Actual													

= PROGRESS PROCESS

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Hamsters are rodents belonging to the subfamily Cricetinae. The subfamily contains about 18 species, classified in six or seven genera. Because they are easy to breed in captivity, hamsters are often used as lab animals and kept as pets in more economically developed countries. Recently hamsters have become established as popular small family pet. They burrow underground in the daylight to avoid being caught by predators. They are most active around dusk and dawn, which has led many people to mistake them for being nocturnal. In the wild they will eat any wheat, nuts and small bits of fruit and vegetables that they might find lying around on the ground, occasionally eating small insects such as small crickets or mealworms. The name *hamster* is derived from the German word *Hamster*.

2.2 TECHNICAL REVIEW

2.2.1 Product A

Figure 2.1: product A

Product information

Specifications product A is 47x30x37cm. Material used in this product is wire and plastic material. The advantages in product A are very simple, light and easy to use. Then the disadvantages are not having a holder and wheels.

2.2.2 Product B

Figure 2.2: product B

Product information

Specifications product B is 47x30x39cm. Material used in this product is wire and plastic material. The advantages in product B are very simple, light, creative design and easy to use. Then the disadvantages is easy to damage when fall because it floor from plastic material.

2.2.3 Product C

Figure 2.3: product C

Product information

Specifications product C is from small to large for selecting. Material used in this product is plastic material only. The advantages in product C are making of high quality plastic; crystal wall can clear see what in side and easy to feed small animals such as Hamster mouse. Then the disadvantages are only plastic material and only one hamster in this cage material.

2.2.4 Product D

Figure 2.4: products D

Product information

Specifications product D is from large cage and suitable for tortoise, rabbits and hamsters. Material used in this product is metal and plastic material. The advantages in product D are making make of high quality stainless wire, have a drawer and have a tires. Then the disadvantages are large size, heavy cage and very simple design.

2.3 MACHINERY PROCESS

2.3.1 Welding

Process for joining separate pieces of metal in a continuous metallic bond. Cold-pressure welding is accomplished by the application of high pressure at room temperature; forge welding (forging) is done by means of hammering, with the addition of heat. In most processes in common use, the metal at the points to be joined is melted; additional molten metal is added as filler, and the bond is allowed to cool. In the Thomson process, resistance to an electric current, passed through the sections to be joined, causes them to melt. Other notable methods include the termite's process, oxyacetylene, electric arc, ox hydrogen, and the atomic hydrogen flame. In this last-named method, molecules of hydrogen gas passing through an electric arc are broken up into atoms of hydrogen by absorbing energy; when outside the arc, the atoms reunite into molecules, yielding in the process enough heat to weld the material. Another process, the argon-arc method, is widely used with metals such as stainless steel, aluminum, magnesium, and titanium, which require an inert atmosphere for successful welding. The use of argon prevents slag from forming in the weld and greatly increases the speed of the welding. Since most applications require that the welder manually feed a filler metal into the weld area with one hand while manipulating the welding torch in the other. However, some welds combining thin materials (known as autogenously or fusion welds) can be accomplished without filler metal; most notably edge, corner, and butt joints.

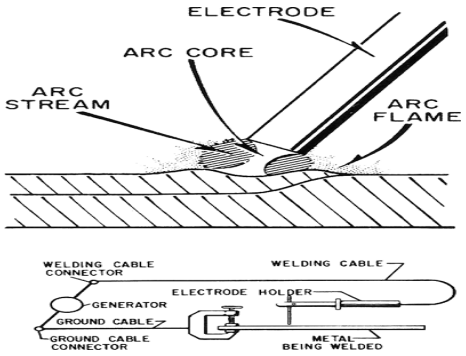

Figure 2.5: arc welding process

2.3.2 Equipment

The equipment required for the gas tungsten arc welding operation includes a welding torch utilizing a no consumable tungsten electrode, a constant-current welding power supply, and a shielding gas source.

Figure 2.6: PPE and welding equipment

2.3.3 Drilling process

Drilling is the process of using a drill bit in a drill to produce cylindrical holes in solid materials, such as wood or metal. Different tools and methods are used for drilling depending on the type of material, the size of the hole, the number of holes, and the time to complete the operation.

2.3.3.1 Operation definition

Hole making is one of the most important machining operations in the manufacturing process. Holes serve a variety of functions including but not limited to: fasteners for assembly, weight reduction, ventilation, access to other parts, or simply for aesthetics. Hole making or drilling is used in the production of almost any part conceivable and those that aren't drilled are made with machines that have been drilled.

2.3.3.2 Consideration for drilling

Because drilling can often be such a critical process there are a number of considerations that should be taken in order to ensure the most accurate drill hole possible

i. 'Walk' is common when drilling small diameter holes. It is advantageous to create a centering mark or feature during the casting or forging process. Creating a centering dimple with a centering punch will also reduce the tendency to 'walk'.
ii. The bottoms of the hole should match the standard drill point angles. Avoid flat bottom hole or odd shapes.
iii. Create through holes instead of blind holes when possible.
iv. If a blind hole must be drilled and tapped, it should be drilled deeper than the tapped depth.

v. Holes that need to be reamed must also be initially drilled deeper than the reamed hole depth.

vi. A part should be designed such that it won't need to be repositioned or manually moved during the drilling process. This also reduces production time and overall cost.

CHAPTER 3

METHDOLOGY

3.1 PROJECT FLOW CHART

From the flow chart, this project is started with introduction. In the introduction has a project background, objective and problem statement. The project background consists of the overall project we must do. And also, the problem statement is to find out the problem and why the product is design for.

In the literature review study, a research on the existing product in the current market. The purpose of this research is to compare the advantages, disadvantages and design of the product in the current market base on the main objective of the project such as development and design hamster cage.

After the literature review is method. The first method is sketching manually on A4 paper, 3 concept design into A4 paper and select the best design was choose. The advantages and disadvantages of this product find using the sketch method. In this sketch method, the design on the concept will be perform to find their abilities and good concept.

When this concept selection is done, an analysis of design is done on the cost and failures to the new product choose. The purpose of this analysis is to make sure the product followed the main objective of the project. One detail design will be develop (2D or 3D drawing).

After all the drawing is finalized, the drawing used as a reference for the next process, which it is fabrication stage? This process is consists fabricate all the parts that have design before by following all the dimension using various type of manufacturing process. The manufacturing process included in this process is welding by using MIG and arc welding to joining, cutting by using disc cutter, drilling and others.

The analysis on the product to see the stress and material used. In stress we test the product by the throwing on the floor and take a height as parameter. In the material used we resource a part of weld by cosmos in solid work.

Then, all 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, preparation for presentation slides for the final presentation for this project.

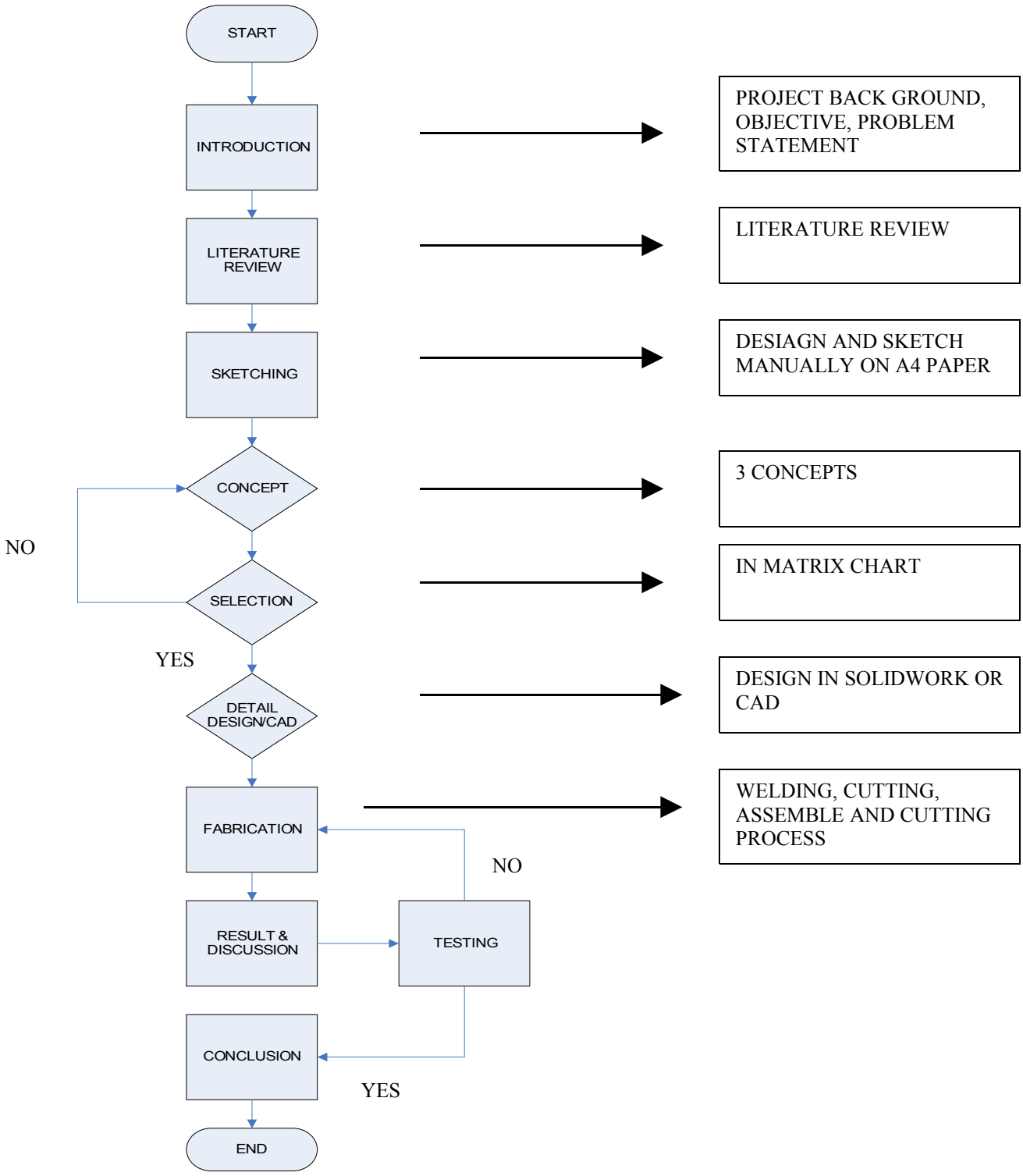

Figure 3.1: flow chart

3.2 DESIGN

To design a good product, there are several factors must be consider 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 and easy to use.

ii) Strength:

- The body of the product is some heavy. It because to stabilize of product.

iii) Material:

- The material use to fabricate for this product can be found at the market

iv) Cost:

- The cost of the material must and process is reasonable.

v) Environment:

- This product must have ability for suitable animal pet like hamsters and it can use for other small animals.

3.3 DRAWING

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 in the paper Because easy to modify. After sketching process done, one new design will be choosing using the Pugh concept.

ii) Solid work practice: After the sketching and concept selection, the design will be Convert into 2D and 3D drawing. In this drawing conclude Size, material use, dimension and others.

3.4 SKETCHING AND DRAWING SELECTION

3.4.1 Concept A

There are several advantages at concept A. It has a holder, heavy, stabilize and easy to finish this product.

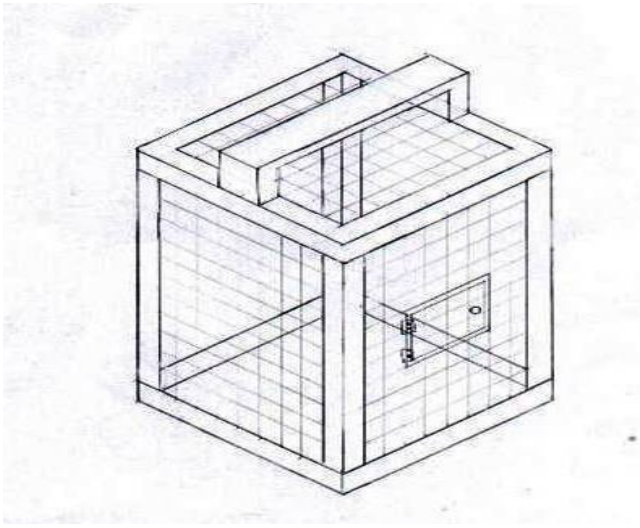

Figure 3.2: show a concept of box

3.4.2 Concept B

There are several advantages at concept B. It has a roof, foot, big area and heavy.

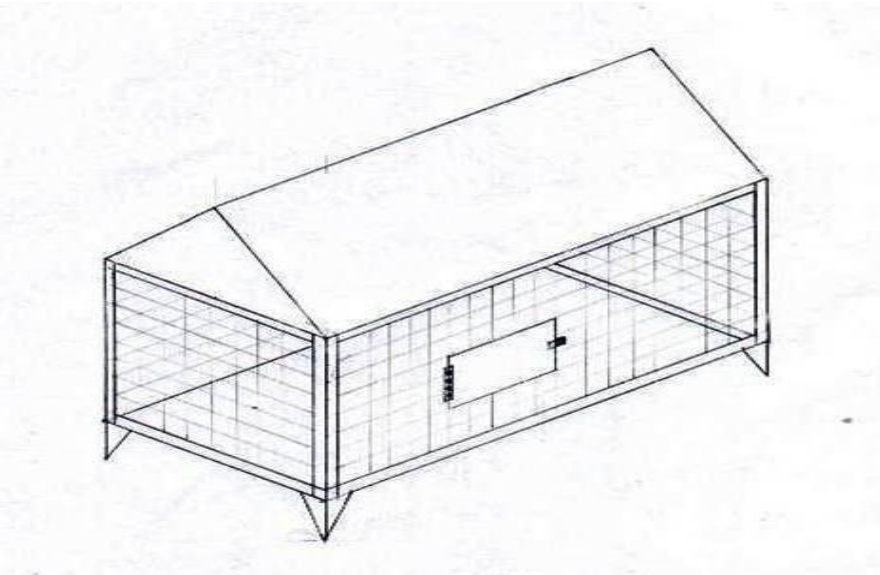

Figure 3.3: show a concept of chicken cage and large

3.4.3 Concept C

There are several advantages at concept C. It is simple product then have a drawer easy to clean a cage.

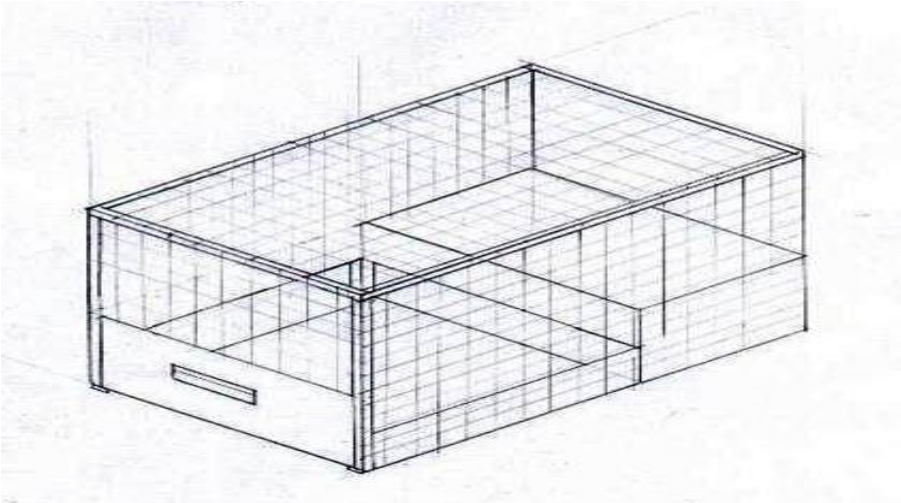

Figure 3.4: show a concept of table

3.5 CONCEPT GENERATION AND EVALUATION

Table 3.1: table of matrix chart

	CONCEPT			
CRITERION	1	2	3	BEST CONCEPT
EASE TO HANDLING	****	***	***	1
EASE TO USE	***	**	*****	3
EASE TO HOLD	****	****	***	1
MANUFACTURING EASE	***	**	**	1
STABILITY	****	**	*****	3
STRENGTH	**	***	****	3
EFFICENCY	***	***	****	3
LIGHT WEIGHT	*	***	**	2
COST	***	****	***	2
MATERIAL USAGE	***	*****	****	2
DURABILITY	***	***	****	3
HAS A ROOF	*	*****	*	2

*	VERYPOOR
**	POOR
***	MEDIUM
****	GOOD
*****	VERY GOOD

CONCEPT	1	2	3
TOTAL BEST CONCEPT	3	4	5
SELECT	X	X	√

3.6 COMPUTER AIDED DESIGN DRAWING

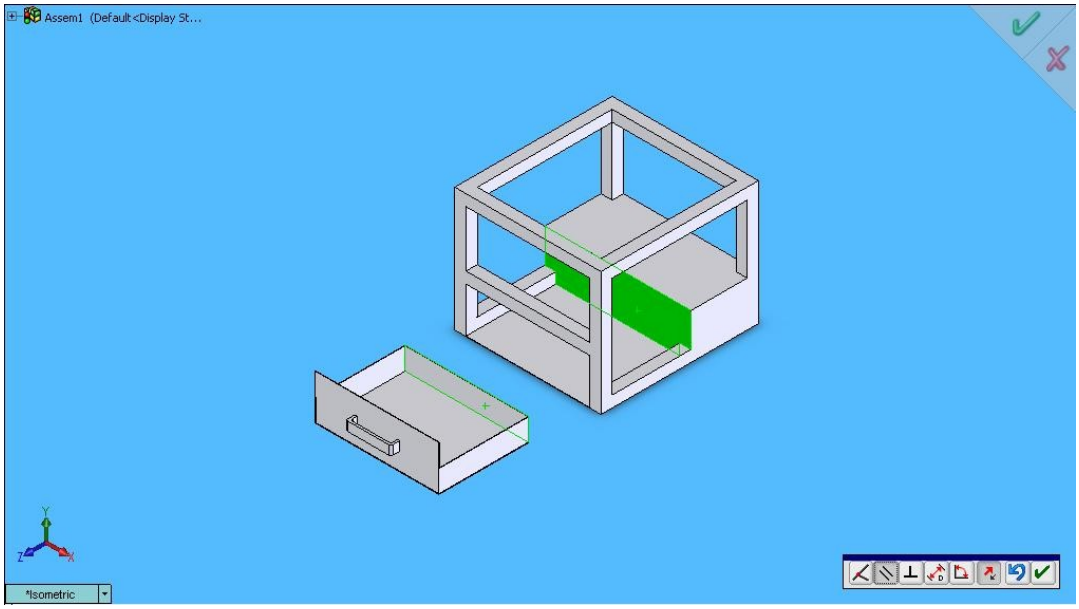

Figure 3.5: Solid work software

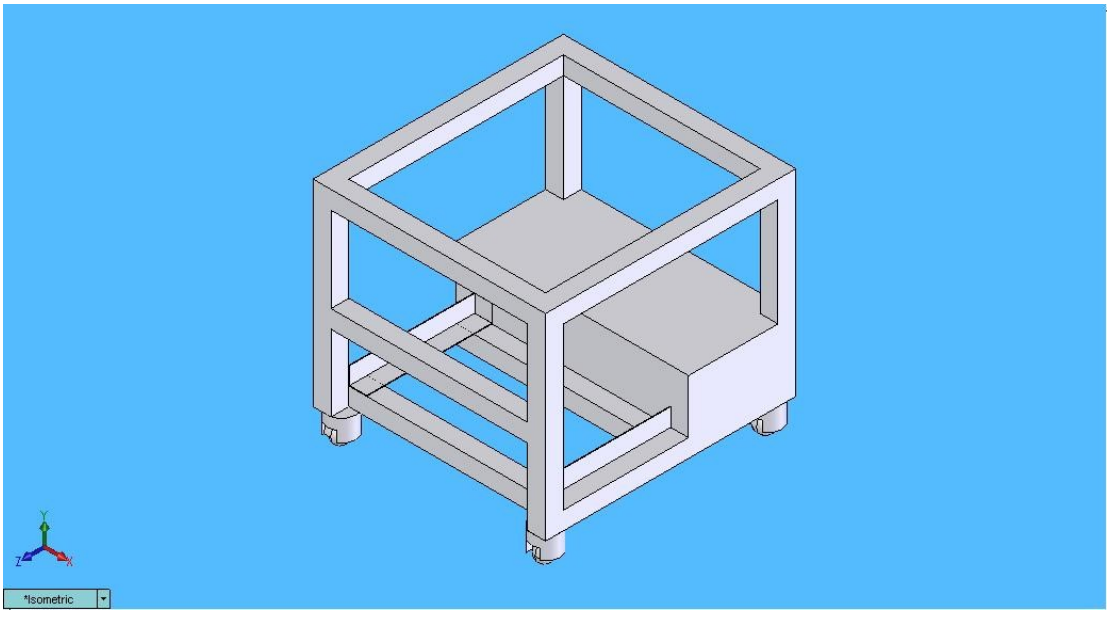

Figure 3.6: Solid work software

3.7 FABRICATION PROCESS

In the fabrication, there are many process involve to develop the product such as cutting, joining, drilling and others.

3.7.1 Process involve

i. Gathering material:

process select type of material is such as hollow bar, and plate.

ii. Measuring:

process to measure the length, width and height of the product. Use measuring tape or ruler.

iii. Cutting material:

process to cut material using the Ben saw and grinding machine then cutting plate with cutter machine.

iv. Joining process:

process using arc welding and MIG welding.

v. Grinding process:

process to make difficult shape to make sure safe to hold.

vi. Drilling process:

process to make hole for foots using drilling machine.

vii. Finishing process:

process to exchange aesthetic value; painting, surface sharp edges to make sure it safe to use.

3.8 ANALYSIS

3.8.1 Stress

The stress analysis is done by throwing the product to the ground by measure the height as parameter. We can see the product is good to put at height area and good quality when it go down freely.

3.8.2 Material used

The analysis of cosmos is analysis to the weld part. We can see the strongest a part at product. The weld part is very important because the main body is joining by welding process.

3.9 BILL OF MATERIAL

Table 3.2: bill of materials

Material	**Number of material**	**Price**
Hollow bar	6m	RM50.00
Wheels	4	RM9.00
Iron plate	1 (900mmx950mm)	RM10.00
Aluminum plate	1 (560mmx420mm)	RM15.00
Rivet	16	RM1.60
Wire	2meter	RM15.00
Hasp	2	RM1.70
Paint	1	RM6.00
Lashing tape	6meter	RM6.00
TOTAL		RM103.80

3.10 Electrical components

In this product has an electrical component as a lock a drawer. The electrical components from relays, switches, circuit board, wired, and motor. Before make a circuit in circuit board we design a diagram and testing a circuit.

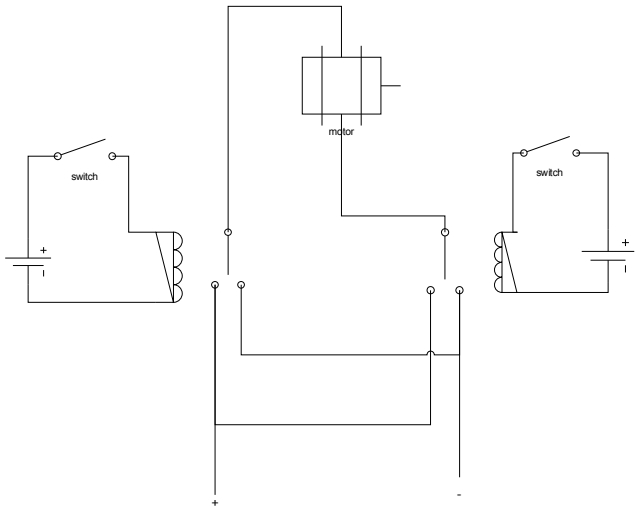

Figure 3.7: diagram a circuit

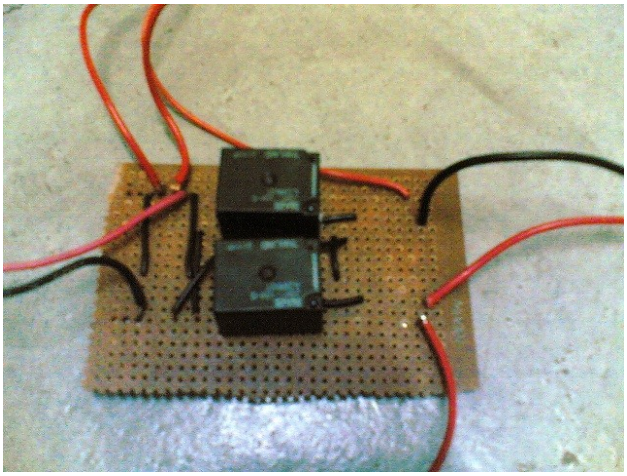

Figure 3.8: circuits at board

Figure 3.8 to show a circuit at board. It has two relays and wires. This circuit can operations a lock by motor.

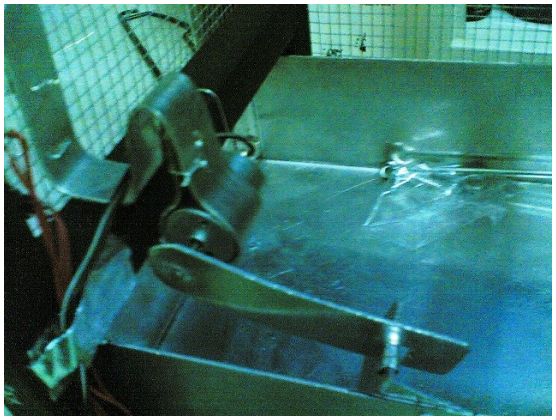

Figure 3.9: motor designs for lock drawer

Figure 3.9 show the motor design for lock a drawer. The main component is motor. Motor can operate up and down.

Figure 3.10: switch up and down lock

Figure 3.10 show the switch up and down. When press button the motor can operate.

3.11 SAFETY OF PRODUCT

To safety a product we use a lashing tape. It because to make sure the product can use and hold from danger.

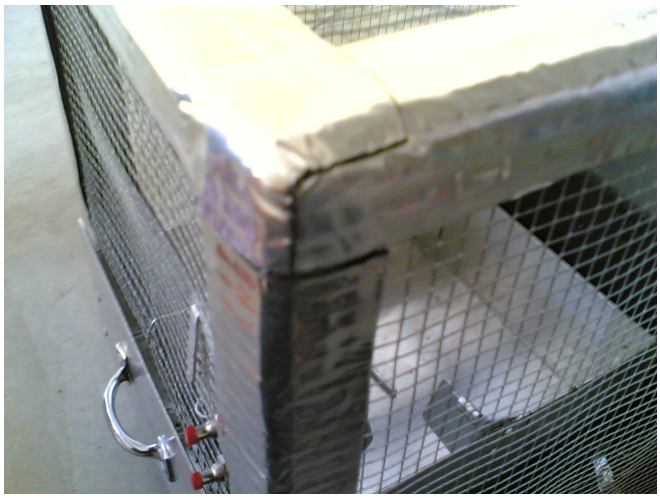

Figure 3.11: safety for hold

CHAPTER 4

RESULT AND DISCUSSION

4.1 FINALIZED PRODUCT

Figure 4.1 orthographic view

The product was finally finished following step by step from the project planning with literature review, design and sketching, technical drawing and solid modeling using solid work application, fabrication process with cutting, drilling and joining.

4.2 STRENGTH OF PRODUCT

Table 4.1: strength analysis

Height (meter)	Repetitive time
0.2	5
0.3	4
0.4	3
0.5	2

This is a strength analysis result done by throwing the product to the ground by measure the height as parameter.

4.3 COSMOS ANALYSIS

The cosmos analysis is to test strength of weld product by CAD software. The main part is very important to get a good product.

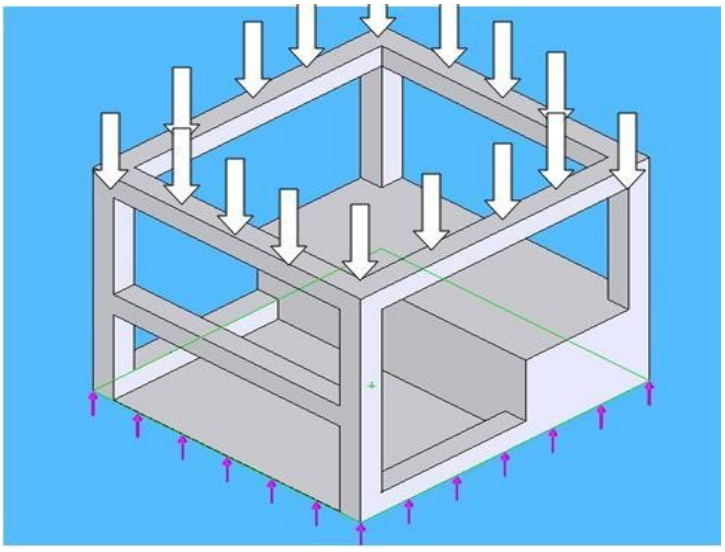

Figure 4.2: arrow to test strength

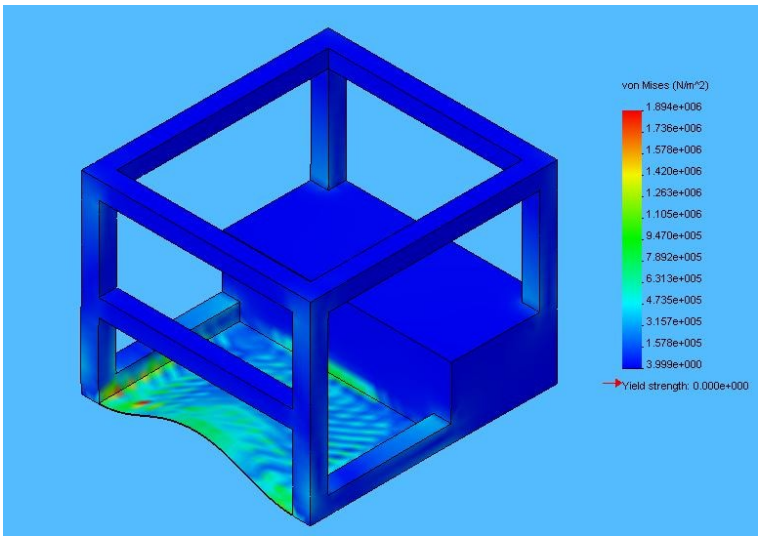

Figure 4.3: cosmos analysis view

Figure 4.4: test strength at side

Figure 4.4 show the test strength. It can show the result this product is strong and stabilize.

4.4 PRODUCT SPECIFICATION

This hamster's cage has the specific part to concentrate such as weight, color, wide, height and other. The purpose of this specification is to control the quality of the product and as the guide when do fabrication process.

Table 4.2: product specificity

Category	Total
1. Weight	15kg
2. color	Black
3. Wide	350mm x 325mm
4. Height	275mm
5. Convenience	Easy to use, has a store for store a hamster's food and has wheels.

4.5 DISCUSSION

This chapter is about the discussion of the flow for process of the project for the literature review, and concept selection, analysis of design and fabrication. Discussion of this project can be dividing into two parts. First is about type of defect on the final product and second is about the problem in progress start with literature review until fabricate and finish this product.

4.5.1 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, its ca gives an experience to avoid the same problem to be repeat again at the future. There are some of defect happen on the product bellow:

4.5.1.1 Weld uncompleted

The figure 4.7 is weld not complete. It is because the material selection to join with two parts is important. In this case one material is slim and hollow bar is thick. It have not perfect weld.

Figure 4.5: weld uncompleted

4.5.1.2 Join wire

Figure 4.8 is problem about join a wire. In this case have a problem it cannot weld with TIG or ARC welding process. The to join the wire with another wire.

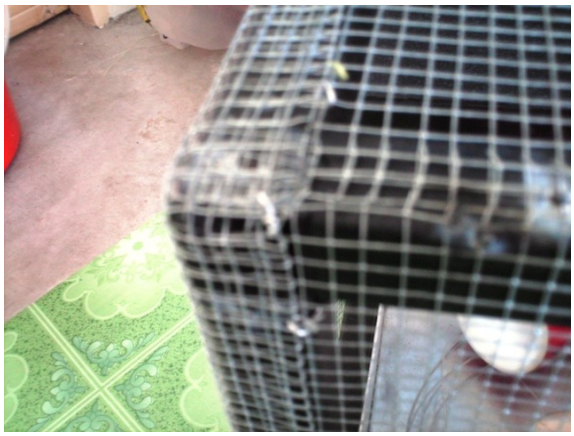

Figure 4.6: join wired

4.5.2 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.

4.5.2.1 Fabrication problem

Material is the most important part of fabrication and it can also be the biggest problem in the fabrication process. To get material a research must be done to get a suitable material. At this stages the problem is material order is not available then we take another material to finish a product. But design is same. Then the problem from not select a true material can make a difficult problem to fabricate a product.

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, analysis and fabrication of the product.

5.2 PROJECT PROBLEM

The project problem is the literature review. The concept and ideas review for this project is same design. Students should come with their ideas on the project.

Designing and sketching is important the first step to make a product. The problem in designing and sketching because of the idea were from the student directly, so there are no references that can be referred. All the drawing and dimension need to generate by student itself.

Fabricating process of the product facing some problems because of slackness of training, machine problem, the joining finishing was not so god but yet can still reliable.

5.3 CONCLUSION

As the conclusion, from the result, something can be changes. Design and development of hamsters cage is successfully. This project was done around thirteen week included almost all steps of the report such as literature review, design, fabrication process and others.

5.4 RECOMMENDATION

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

a) The planning and Gantt chart of the project must be done before project started.
b) The budget for the final year project needs to increase. It's because student can design more advance product base on material available in laboratory.
c) The task for every student must be explaining more detail within first and second week by supervisor. This information will briefly the student about the project and speedy their progress.
d) Instructor in charge for the machine must always available at the laboratory. Its can easier student to get permission to use machine faster.

5.5 FUTURE WORK

Future planning for this hamster cage can add a new design and has a more function. This project can be use by the student to gain knowledge and understanding of mechanical process of machining such as bending, drilling and other. In the future this hamster cage has a multi function, light, easy to use and can use other pets.

REFERENCES

(1) http://www.pet-cage.com/product/EN/product_list.asp?type_id=26 dated on September 10th 2008

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(3) http://furioustuscadero.blogspot.com/2007/05/rage-in-cage.html dated on September 21st 2008

(4) http://en.wikipedia.org/wiki/Welding dated on September 26th 2008

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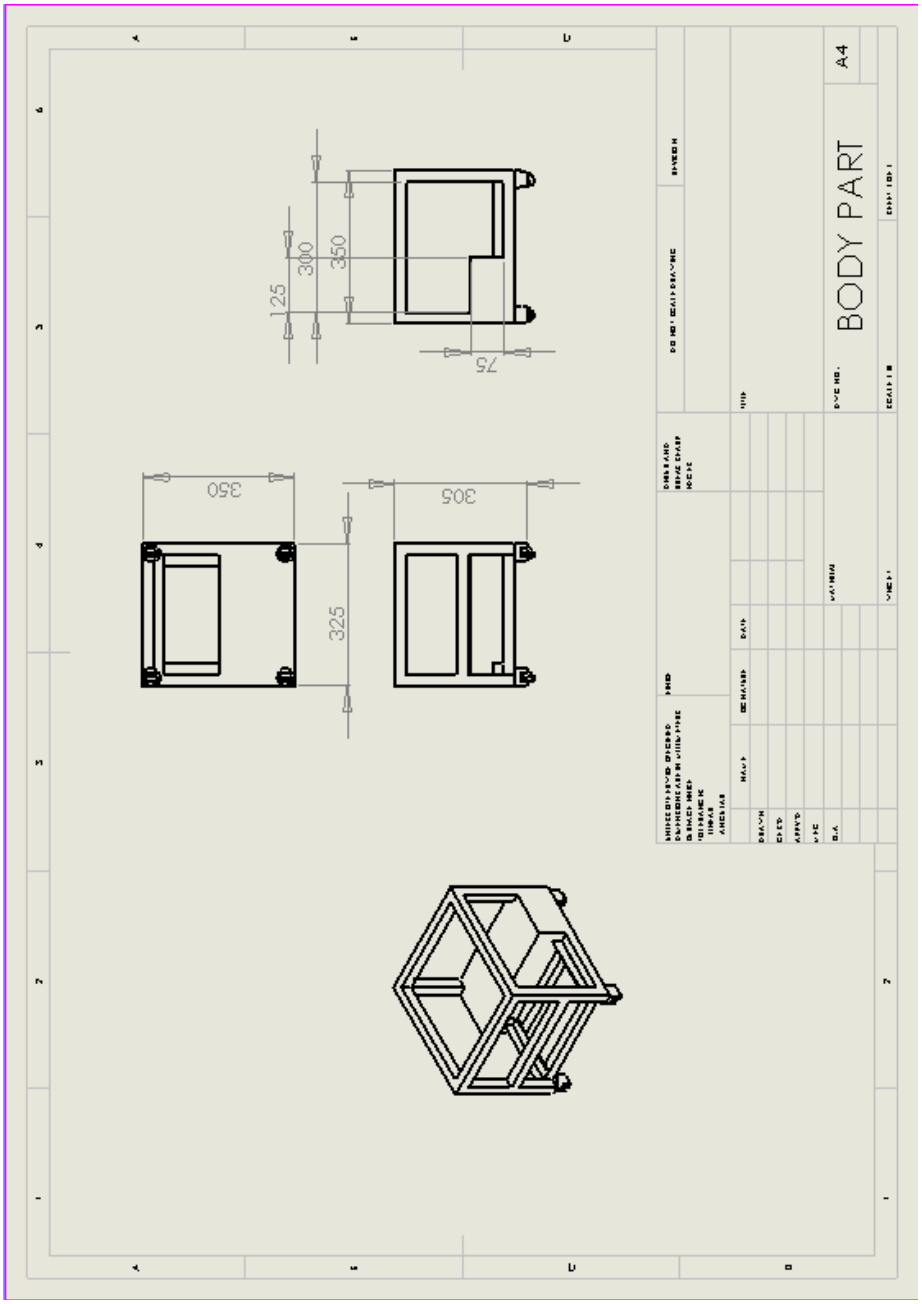
APPENDIX A

Solid Work 2D Drawing (body part)



APPENDIX B

Solid Work 2D Drawing (drawer)