DESIGN AND FABRICATION OF SMART MOUSETRAP

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BORANG PENGESAHAN STATUS TESIS ◆

JUDUL: DESIGN AND FABRICATION OF SMART MOUSETRAP

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The purpose of this chapter is to explain about the project background, problem statement, project objectives, project scopes, flow chart of the project as well as Gantt chart to present the flow and overall process for this project.

1.2 PROJECT BACKGROUND

At nowadays market, there are various type of mousetrap that comes in different shape and specification. A mousetrap is specially designed to trap rodents like rat and mice and are usually set indoor where there is suspected present of rodents. However a larger mousetrap can be used to trap other animals like squirrels, small rodents and other animals.

In market, there are various type of mousetraps and has its own advantages and disadvantages. The most common type of mousetrap which is the spring loaded bar mousetrap are available all over and cheap but it is not safe to human where it can wedge our fingers because the toggle can be released easily if trigger.

Electric mouse traps which are the most effective mouse trap that can kill mouse instantly but it is expensive and depends on electric power. Live catching mousetrap which can works over and over again but it is also not safe to human being as it also can wedge our fingers accidentally. In order to solve this problem, the mouse trap that I design is considering all the current weakness. This mousetrap is safer to human and pets at home, easy to use and cheap.

1.3 PROBLEM STATEMENT

Most market products are not safe to human and pets at home for example the glue trap where pets at home might accidentally trapped in the glue trap or we will accidentally step on the glue trap. Some can be only use once and most of them can only catch up to one mouse. This can be an inconvenience if you have more than one mouse to be catch where you have to set your mousetrap over and over again. This can also be a problem if you are going to leave your house for days and your house is always being intruded by mouse. If you use alternative method for example a cat it will not only catch the mouse but will simply throw the dead mouse. This condition is not only will give out stinky smell but create a problem to our health as well.

1.4 OBJECTIVE

1. To improve product in the market to catch more than one mouse
2. To create a safe mousetrap for human and pets at home

1.5 SCOPE

1. The mousetrap is easy to use and not complicated
2. The mousetrap can be use oftenly
3. The mousetrap has no any poisonous or harmful substance use
4. The mousetrap will not injure the user

1.6 PROJECT FLOW CHART

Figure 1.1 and figure 1.2 shows the project flow chart and gantt chart which indicates the overall flow in conducting out this project.

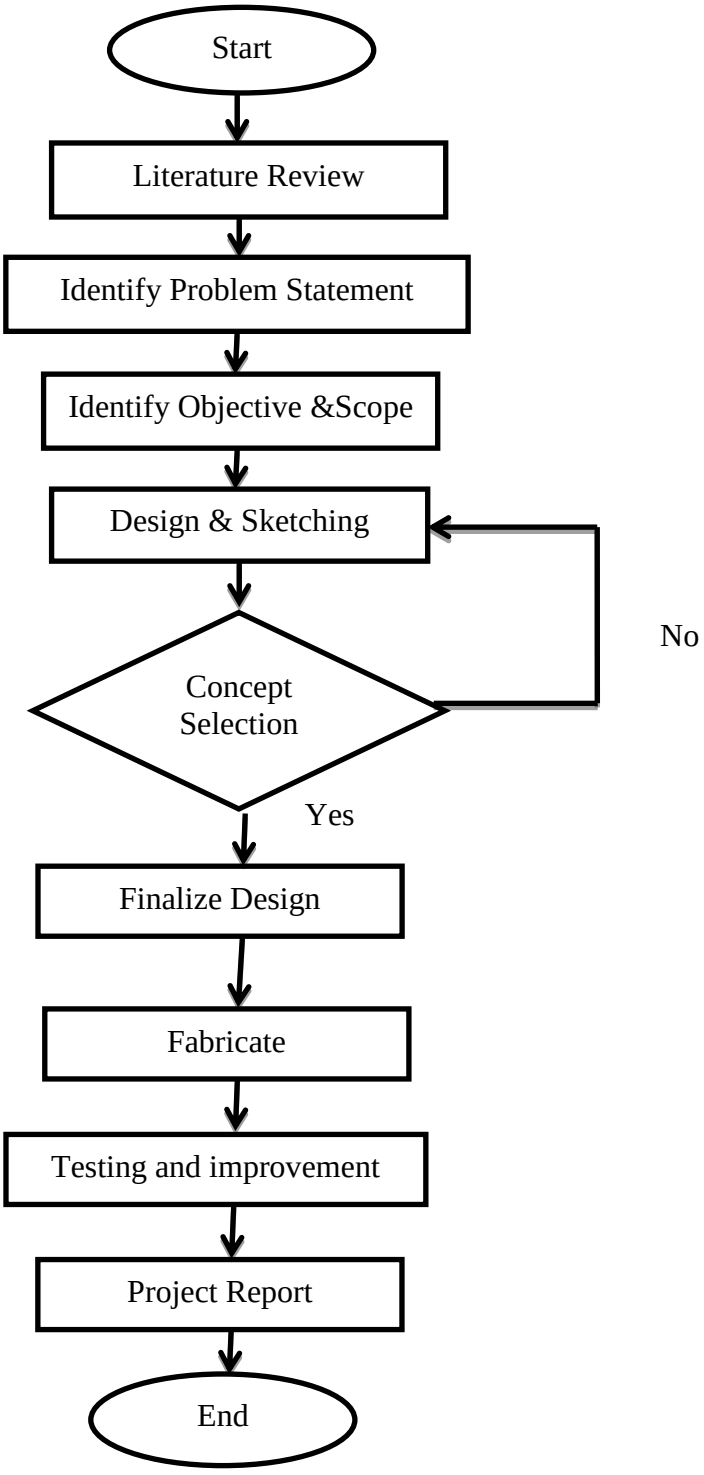

Figure 1.1: Project flow chart

1.7 PROJECT GANTT CHART

Task		Week														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Literature Review	Plan															
	Actual															
Problem identification	Plan															
	Actual															
Concept Design	Plan															
	Actual															
Finalize Design	Plan															
	Actual															
Analyze Structure	Plan															
	Actual															
Mid Presentation	Plan															
	Actual															
Fabrication	Plan															
	Actual															
Testing & Improvement	Plan															
	Actual															
Final Report Preparation	Plan															
	Actual															
Final Presentation Preparation	Plan															
	Actual															

Figure 1.2: Gantt chart

1.8 THESIS ORGANIZATION

Chapter 1 will explains about the introduction, project background, problem statement, objective, scope, project flow chart and project Gantt chart. This chapter planned about the flow of my project.

Chapter 2 which is the literature review mainly will explain about the advantages and disadvantages of market existing products and also the comparison between these products.

Chapter 3 which is the methodology and this chapter will explains about the concept design and also the finalize concept of the design. It also explains about the fabrication process and machining used.

Chapter 4 which is the results and discussion and this chapter will explains about the finalize product that have been made. The product is then being tested to find out its effectiveness in solving the problem statement.

Chapter 5 mainly explains about the conclusion and recommendation that can be made to the product.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter will explain about the history of mousetrap, about different between rat and mouse. This chapter also will explain about the literature review of all the market existing products. Mousetraps are usually set indoor where there is a suspected present of rodents. The examples of existing products are spring loaded bar mouse trap, live catching mousetraps, glue traps, electric mousetraps and disposable mousetraps. However these existing mousetraps have their own advantages and disadvantages.

2.2 HISTORY OF MOUSETRAP

James Henry Atkinson (1849-1942) was a British ironmonger from Leeds, Yorkshire who invented the mousetrap. Atkinson invented a number of items but his mousetrap known as “Little Nipper” which was patented in 1897 was the most well-known mousetrap ever invented. After making a number of versions he eventually came up with the Little Nipper which consists of a wooden base and a simple spring mechanism which triggered by the movement of the mouse. The Little Nipper can

slams shut in 38000s of a second and that record has never been beaten. Atkinson made the traps himself but later sold the rights to Welsh company and to Procter company for 1000 pounds for his 1913 patent mousetrap. The mousetrap has captured a sixty percent share of the British mousetrap market and an estimated equal share of the international market.

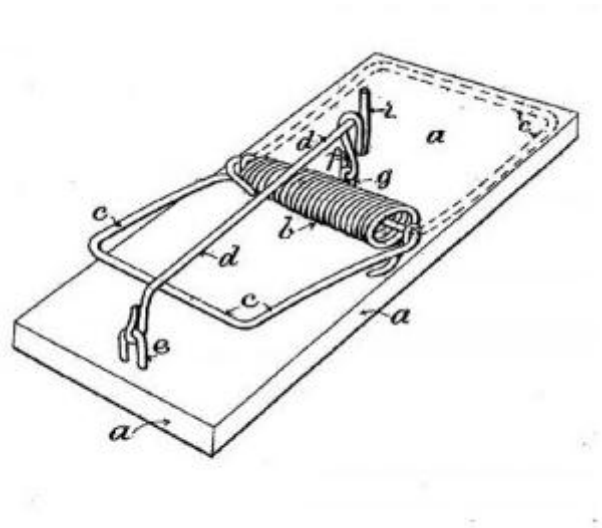

Figure 2.1: Little Nipper which was invented by James Henry Atkinson

Source: http://www.godsowncounty.co.uk/06/yorkshire/cat-and-mouse-inventions/

Nowadays Little Nipper mousetrap is also known as snap trap or spring loaded bar mousetrap which is available all over at the market. Spring loaded bar mousetrap mainly consists of several parts like hammer, spring, platform, catch and hold down bar.

i. Hammer: It is the part that kills the mouse which consists of a thin wire. This thin wire will hit the mouse and trapping it between the hammer and the platform. The hammer will break the mouse's neck or back depending on where the hammer hits the mouse.
ii. Spring: The spring is the part that holds the hammer down on the mouse. The spring is a wire or plastic coil and is placed just past the

centre of the platform. The ends of the spring can be secured with wire or the spring can be glued in place.

iii. Platform: The platform is the base of the mousetrap. Every parts are attached to the platform. The platform can be made from wood, plastic or metal. It is usually thin and lightweight. The platform is usually about twice as long as it wide.

iv. Catch: The catch is the part of the mousetrap that secures and releases the hold down bar. The bait is placed at the catch. The mouse must move this part of the mouse trap enough to engage the trap.

v. Hold down bar: The hold down bar is the part of the mousetrap that holds the hammer in the crocked position. It is a thin piece of metal that is strong and light. When the mouse moves the catch on the mousetrap, the hold down bar will move. The hold down bar then releases the hammer which kills the mouse.

2.3 DIFFERENCE BETWEEN RAT AND MOUSE

Many people often confuse between rat and mouse as they have similar in appearance. There are many differences between a rat and a mouse. The biggest difference is the size, colour, feet and ears. Figure 2.2 shows the difference between a rat and a mouse.

Figure 2.2: Difference between a rat and a mouse

Source: http://www.aaanimalcontrol.com/blog/mousevsrat.html

Table 2.1: Difference between rat and mouse

	Rat	**Mouse**
Size	8 inches body, 9 inches tail	3 inches body, 3 inches tail
Colour	grey with white bellies	brown with dark bellies
Feet	longer in proportion to body	shorter in proportion to body
Ears	large relative to the head	small relative to the head
Species	Black rat (Rattus Rattus), Brown rat (Rattus Norvegicus)	common house mouse (Mus Musculus)
Lifespan	average of 5 years	average of 2 to 3 years

2.4 PRODUCT REVIEW

This topic explains about the existing products in the market and comparison about their advantages and disadvantages.

2.4.1 Product A

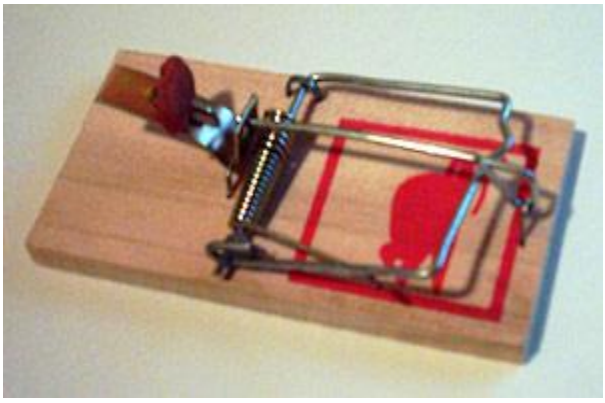

Figure 2.3: Spring loaded bar mousetrap

Source: http://upload.wikimedia.org/wikipedia/commons/6/68/Mausefalle_300px.jpg

Table 2.2: Product A overview

Design concept	Spring loaded and trip
Cost	$ 4.49
Materials	Wood and aluminium

Product A is known as spring loaded bar mousetrap and is made with a heavily spring loaded and a trip to release it. Bait such as cheese, chocolate, meat, peanut butter and others are being placed at the trip. When a mouse touches the trip, the spring loaded bar will springs down rapidly with great force and breaks the mouse's neck, ribs or skull. Dead mouse is disposed by pulling the bar. The advantages of this mousetrap are it is cheap, available all over, easy to use and can works over and over again. The disadvantages of this mousetrap are the toggle bar easy to be release accidentally and this can wedge and injure our fingers.

2.4.2 Product B

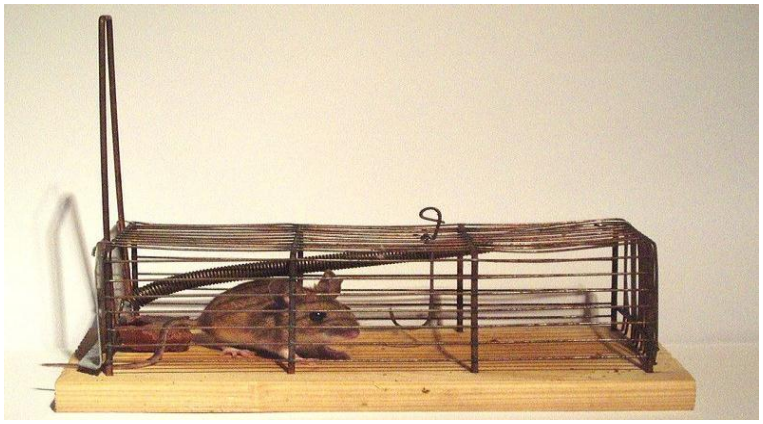

Figure 2.4: Live-catching mousetrap

Source: http://en.wikipedia.org/wiki/File:2005_mousetrap_cage_1.jpg

Table 2.3: Product B overview

Design concept	Hook and trip
Cost	$ 13.49
Materials	Mid steel

Product B is known as live catching mousetrap and is made of mild steel. It has a hook to hook the bait like meat, fruit and others. The door is stuck open by a rod that is attached to a trip. When a mouse enters and touches the bait it will trigger the trip and the rod is released so that the door will close shut and trap the mouse inside. The mouse is disposed by open the door and released away. The advantages of this mousetrap are it is cheap, easy to use, available all over and can works over and over again. The disadvantages of this mousetrap are it does not kill the mouse and the door can be easily getting shut accidentally and can wedge our fingers.

2.4.3 Product C

Figure 2.5: Glue traps

Source: http://en.wikipedia.org/wiki/File:Glue_trap_by_David_Shankbone.jpg

Table 2.4: Product C overview

Design concept	Sticky glue
Cost	$ 5.35
Materials	Natural or synthetic adhesive glue

Product C is known as glue traps and is made of natural or synthetic adhesive glue applied to cardboard, plastic trays or similar materials. Bait is placed at the centre or scent may be added to the adhesive by the manufacturer. When a mouse is trying to reach for the food that is being placed at the trap, it will get stuck on top of the trap. The mouse is dispose away together with the trap. The advantages of this mousetrap are cheap, available all over. It is also a hygiene mousetrap where the sticky glue will trap the mouse together with its mites and ticks. The disadvantages of this mousetrap are it can be only use once. It is also not suitable or not effective to be use at outdoors due to environmental conditions for example if the weather is too dry it will harden the glue or if the weather is too humid then the glue will get wet and not function properly.

2.4.4 Product D

Figure 2.6: Electrical mouse traps

Source: http://www.doobybrain.com/wp-content/uploads/2008/11/victor-electric-mousetrap.jpg

Table 2.5: Product D overview

Design concept	Electric shock
Cost	$ 86.50
Materials	Plastic, electrical circuit

Product D is known as electrical mousetrap and is made of plastic and electrical circuit. It is the most effective mousetrap to kill mouse instantly where it delivers a lethal dose of electricity when a mouse enters and completes the circuit by contacting two electrodes located either at the entrance or between the entrance and the bait. The advantage of this mousetrap is that it will kill the mouse instantly just after the mouse enters the trap. The disadvantages of this mousetrap are it is bigger in size compare to the other mousetrap. It is also expensive and is dependent on the electric power supply where it operates using electricity.

2.4.5 Product E

Figure 2.7: Multiple catch mousetrap

Source: http://www.domyownpestcontrol.com/images/victor_tin_cat_clear.jpg

Table 2.6: Product E overview

Design concept	Multiple trap
Cost	$ 18.99
Materials	Galvanized iron

Product E is known as multiple catch mousetrap. Its design concept is to catch multiple mouse where it will trap more than one mouse inside the mousetrap. The advantages are it can catch more than one mouse and can be use over and over again. The disadvantage of this product is it dint kill the mouse.

2.5 COMPARISON

Table 2.7 shows the comparison of all the existing products in the market. From the table, we can know the advantages and disadvantages of all the products. From here, we know that product B, product C and product E does not kill the mouse and product E can catch multiple mouse. Product A and product B has moderate ease of use and product C is not durable which mean that it can be only use once. Product D and product E has safety properties and product D is the biggest in size.

Table 2.7: Comparison between existing products

Aspect	Product A	Product B	Product C	Product D	Product E
Function (kill the mouse)	Yes	No	No	Yes	No
Multi-catch	No	No	No	No	Yes
Ease of use	Moderate	Moderate	Yes	Yes	Yes
Durability	Yes	Yes	No	Yes	Yes
Safety	No	No	No	Yes	Yes
Size	Small	Medium	Medium	Big	Medium

2.6 FABRICATION EQUIPMENT

There are various types of machining that will be used in carrying out the fabrication process. Below are details about the fabrication equipment used.

2.6.1 Shearing machine

Figure 2.8: Shearing machine

Source: http://image.made-in-china.com/2f0j00dMLaHqyUkZkF/Shearing-Machine.jpg

Shearing machine is also known as die cutting machine. It is a process used to cuts stock without the formation of chips or the use of burning or melting. If the cutting blades are straight the process is called shearing and if the cutting blades are curved then they are shearing-type operations. The most commonly sheared materials are in the form of sheet metal or plates however rods can also be sheared. Shearing-type operations include blanking, piercing, roll slitting and trimming. It is used in metalworking and also with paper and plastics. A blade is used to push the workpiece against the die which is fixed. This action will cause the material to experience shear stresses between the punch and the die.

2.6.2 Bending machine

Figure 2.9: Bending machine

Source: http://www.endmillwebsite.com/wp-content/uploads/2011/03/bending-machine.jpg

Brake or sheet metal bending is a metalworking machine that allows the bending of sheet metal. A cornice brake only allows for simple bends and creases while a box and pan brake also allows one to form box and pan shapes. It is also known as a bending machine or bending brake. The brake consists of a flat surface onto which the material is placed, and a clamping bar which will come down and hold the material firmly during the bend. This clamping action may be manual, automatic or operated using a foot pedal. The front, gate like, plate of the machine is hinged and may be lifted, forcing the material extended over a straight edge to bend to follow the plate. This bends can be to any angle up to a practical limit of about 120 degrees, somewhat more in the case of a bar folder.

2.6.3 Drill press

Figure 2.10: Drill press machine

Source:http://www.popularmechanics.com/cm/popularmechanics/images/2k/tb_lg_lg_woodtek-lg.jpg

A drill is a tool fitted with a cutting tool attachment or driving tool attachment, usually a drill bit or driver bit, used for drilling holes in various materials or fastening various materials together with the use of fasteners. The attachment is gripped by a chuck at one end of the drill and rotated while pressed against the target material. The tip and sometimes edges of the cutting tool does the work of cutting into the target material. This may be slicing off thin shavings, grinding off small particles, crushing and removing pieces of the workpiece, countersinking, counterboring or other operations. Drills are commonly used in woodworking, metalworking and construction. Specially designed drills are also used in medicine, space mission and other applications. Drills are available with a wide variety of performance characteristics such as power and capacity.

2.6.4 Angle grinder

Figure 2.11: Angle grinder

Source: http://metalworkingmachine.net/wp-content/uploads/2011/02/angle-grinder-.jpg

Angle grinder also known as a side or disc grinder is a handheld power tool used for cutting, grinding and polishing. Angle grinders can be powered by an electric motor, petrol engine or compressed air. The motor drives a geared head at a right angle on which is mounted an abrasive disc or a thinner cut off disc, either of which can be replaced when worn. Angle grinders typically have an adjustable guard and a side handle for two handed operation. Certain angle grinders, depending om their speed range can be used as a sander employing a sanding disc with a backing pad or disc. The backing system is typically made of hard plastic, phenolic resin or medium hard rubber depending on the amount of flexibility desired. Angle grinders may be used both for removing excess material from a piece or simply cutting into a piece. There are many different kinds of discs that are used for various materials and tasks such as cut off discs, abrasive grinding discs, grinding stones, sanding discs, wire brush wheels and polishing pads. Angle grinders are widely used in metalworking and construction as well in emergency rescues.

2.6.5 Rivet

Figure 2.12: Rivet

Source: http://img.ehowcdn.com/article-page-main/ehow/images/a07/67/m1/arrow-rivet-tool-instructions-800x800.jpg

Rivet is a permanent mechanical fastener. Before being installed a rivet consists of a smooth cylindrical shaft with a head on one end. The end opposite the head is called the buck-tail. On installation the rivet is placed in a punched or pre-drilled hole, and the tail is upset, or bucked. So that it expands to about 1.5 times the original shaft diameter, holding the rivet in place. To distinguish between the two ends of the rivet, the original head is called the factory head and the deformed end is called the shop head or buck-tail. Because there is effectively a head on each end of an installed rivet, it can support tension loads. However, it is much more capable of supporting shear loads. Bolts and screws are better suited for tension applications. Fastenings used in traditional wooden boat building, like copper nails and clinch bolts, work on the same principle as the rivet but were in use long before the term rivet came about and, where they are remembered, are usually classified among the nails and bolts respectively.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter will explain about the concept design that has been made in order to solve the problem statement. This chapter also will explain about how all the concept design being evaluate in order to get the finalize concept. Material selection and fabrication process also being discuss in this chapter about how the raw material being cut and shape into desired design.

3.2 SYNOPSIS

This topic will explain about the flow or step involve in designing out the finalize concept. The flows of the project methodology are as follow:

i. Identify the problem statement and find the solution
ii. Concept design and evaluation
iii. Finalize concept
iv. Material selection
v. Fabrication process and finishing

3.2.1 Methodology Flow Chart

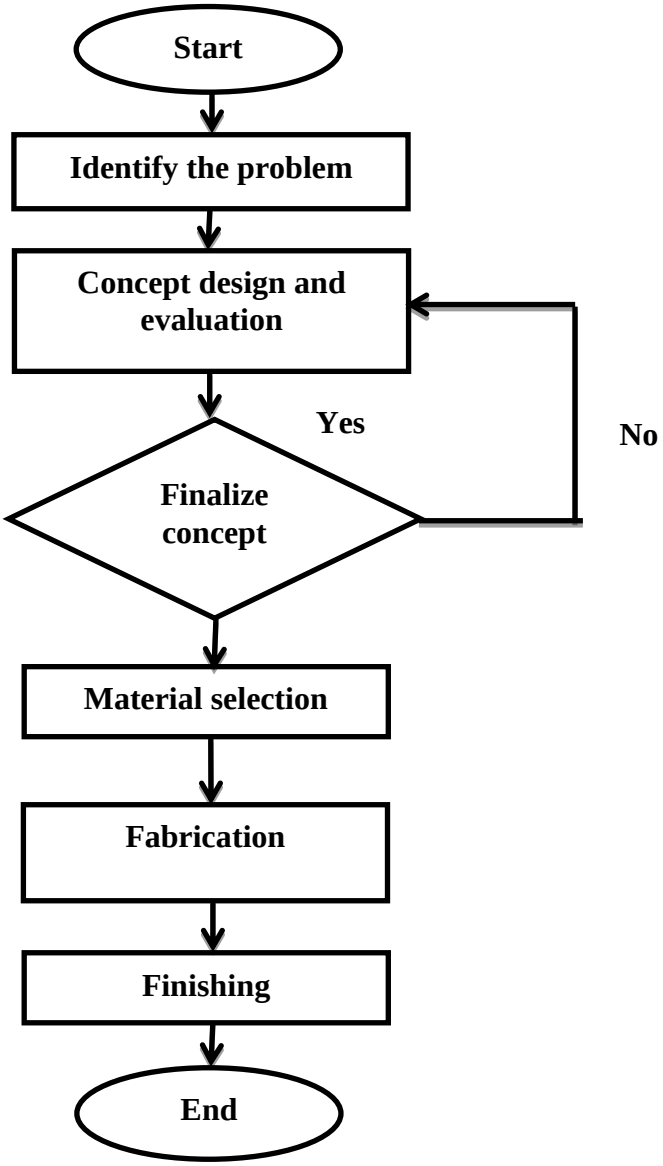

Figure 3.1: Methodology flow chart

From the methodology flow chart in Figure 3.1, the project has starts off with identifying the problem that is being faced by the customers. Here the problems that are being faced by customers are mousetrap that available in the market is not safe to be use by human and pets at home. In order to know what are the problems that being faced by the customers, literature review and research about the title is carry out. For example, I have survey and do some literatures review about the market

available product. Some dangerous mousetraps in the market that may harm the user and pets at home have been identified. After the problem have been identified, concept design is carry out in order to solve for the problem. In this project, four concept designs have been sketch out which is concept design A, concept design B, concept design C and concept design D and after that evaluation process is carry out. Concept screening and concept scoring are the method of evaluation that are being carry out to design out the finalize concept. Here all the concept design are being evaluate under certain criteria like ease of use, safety, durability, efficiency in catching mouse, size, ease of mouse dispose, ease to see caught mouse and appearance.

After finalize concept have been identified, material selection is the next process. Here galvanized iron 2.0mm is chosen due to its ease of fabrication and price where it is cheap. After suitable material is being select, fabrication process is then carry out. Here several of tool and machining process is carry out like cutting where the large sheet metal is being cut into smaller size, bending where all the sheet metal is being bend into desired shape using bending machine, drilling where few holes are being drilled on the sheet metal and the desired shape is being punched out using chisel, filling and grinding where it is used to remove burr or known as deburr process and much more. After that, finishing process is carry out. Here the product is being paint and shape edges are being file. All the concept design, evaluation process, finalize concept, bill of material and fabrication process are being explain in detail as below.

3.3 CONCEPT DESIGN

3.3.1 Concept A

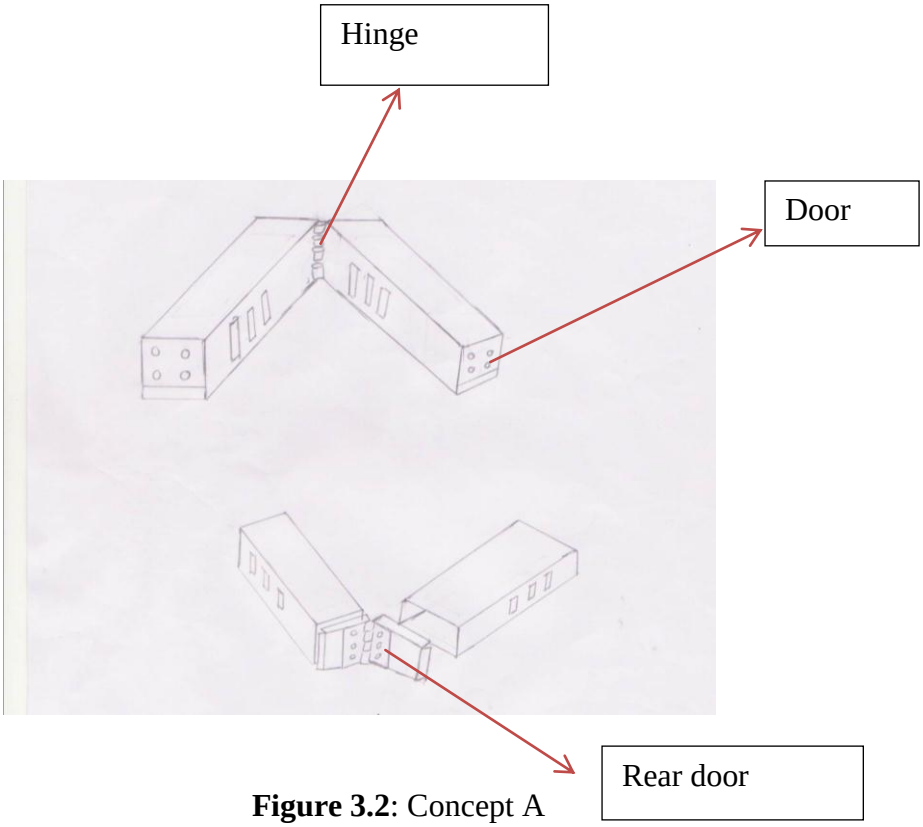

Figure 3.2: Concept A

Figure 3.2 shows the first concept design. It has a hinge in the middle which made it flexible and adjustable to be placed at the corner or along the wall as mouse like to run along the wall. It is like two mousetrap joining together which make it able to trap more than one mouse. It also has a rear door which acts like a socket that can be pull out. Bait like peanut butter is put at the rear door. The front doors have hole to let the odour diffuse out to attract the mouse. As the mouse enters it will trap the mouse inside. The advantages of this mousetrap is durable which mean that it can be use over and over again, small in size, safe to human and pets at home and easy to dispose the mouse. The disadvantages of this mousetrap are it is difficult to see the caught mouse inside and it does not have the ease of use.

3.3.2 Concept B

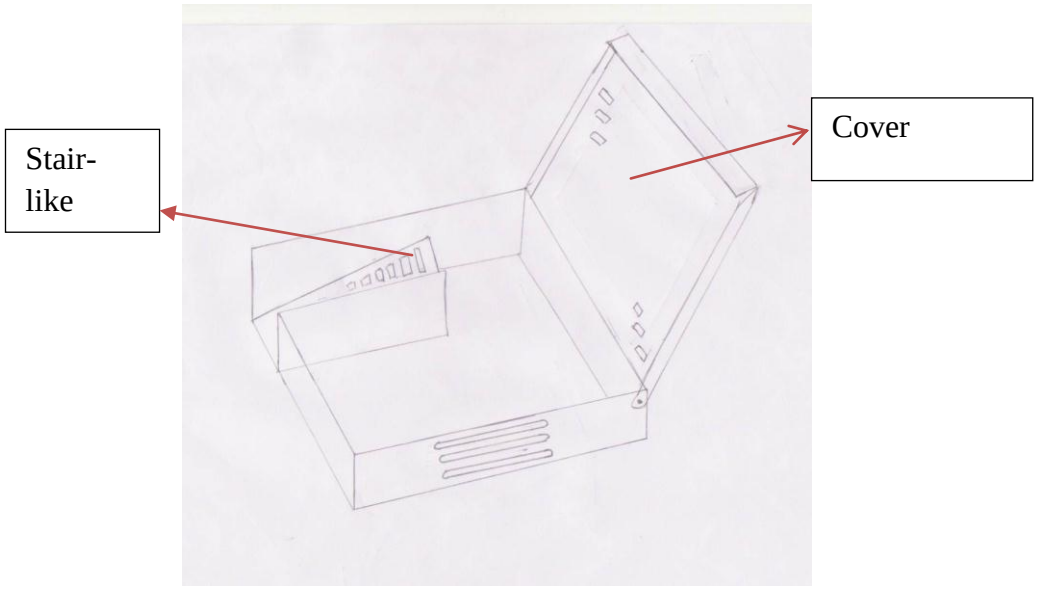

Figure 3.3: Concept B

Figure 3.3 shows second concept design. It is a box like which has a cover to close it. The mousetrap door is a stair like which allow the mouse to enter as it trying to reach for the food inside and as it reaches the end of the slope it will fall to the container which trap it inside. Bait like peanut butter, chocolate bar or meat can be placed inside the mousetrap to attract the mouse. The trapped mouse can be dispose by open the cover. The advantages of this mousetrap are it is easy to use, safe to human and pets at home. It is also durable where it can be use over and over again. The disadvantages of this mousetrap are it is difficult to see the trapped mouse inside and it is also does not have the ease to dispose the mouse.

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3.3.3 Concept C

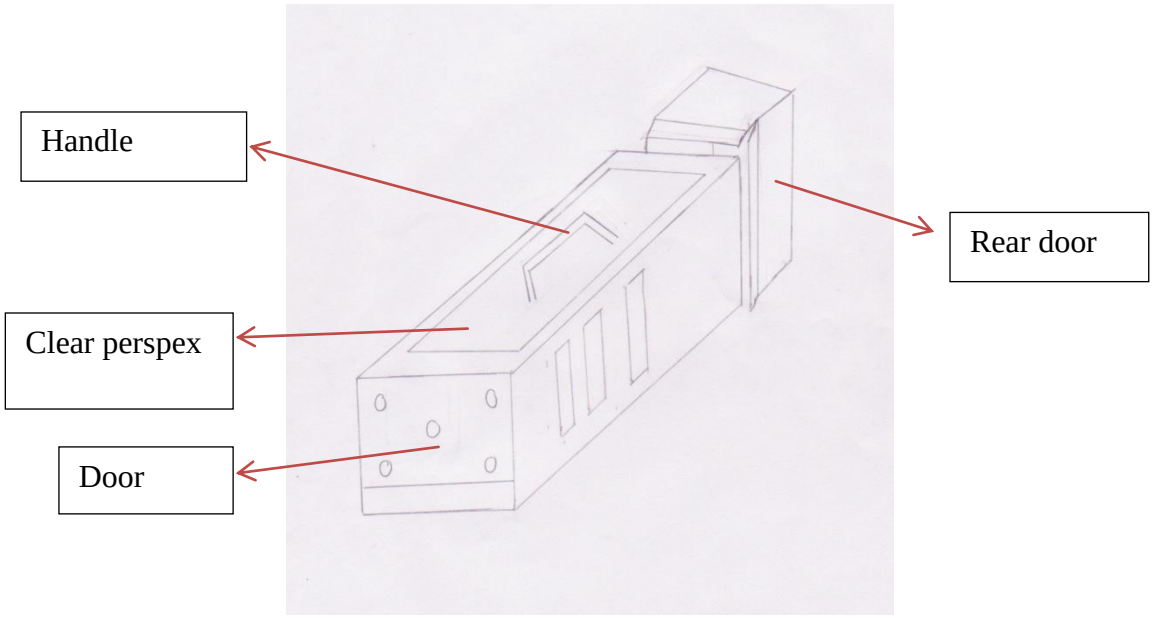

Figure 3.4: Concept C

Figure 3.4 shows the third concept design. It has two doors which is front door and rear door. The rear door is like a socket which can be pull out and bait like peanut butter is being placed at here. The mouse will enter from the front door in order to reach for the food and the mousetrap will then trap the mouse inside. The mousetrap also consists of a handle for the ease to dispose mouse. It also consists of a clear Perspex lid to see the caught mouse inside. The advantages of this mousetrap are it is easy to dispose the mouse as it consists of a handle. The handle also make an ease in carrying the mousetrap, it is also safe to human and pets at home, can be use over and over again and it is also small in size.

3.3.4 Concept D

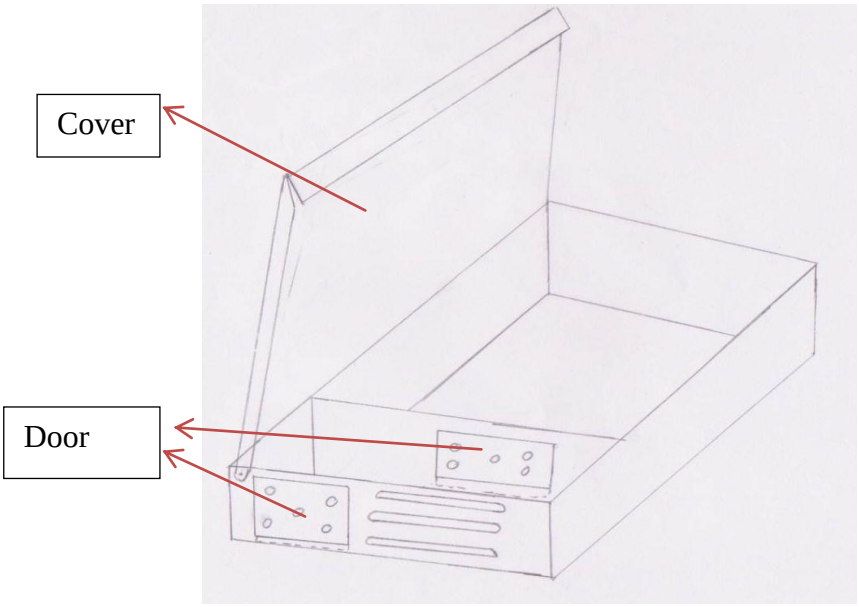

Figure 3.5: Concept D

Figure 3.5 shows the fourth concept design. It is also a box like mousetrap which consists of two doors. These two doors are to make sure that the captured mouse will have no chance to escape. For example if there is only one door and there is one mouse being trapped inside and as there are another mouse trying to enter the mousetrap, it will squeeze its body and the door will be let open. Thus this will give the chances for the inside mouse to escape out. Bait like peanut butter, cheese, chocolate bar and meat can be placed inside the mousetrap. The mousetrap is then put aside to let the mouse enter and trap it inside. The mouse is dispose by open the cover. The advantages of this mousetrap are it has the ease of use, safe to human and pets at home and can be use over and over again.

3.4 EVALUATION PROCESS

After four concept designs have been sketch out, the next process will be evaluation process to sort out the criteria of each concept. After screening concept is done the evaluation process is then further to scoring process. At here, the process will determine which concept designs are to be developed.

3.4.1 Concept Screening

Figure 3.6 below shows the concept screening process. Each concept design will be evaluate according to the selection criteria which is ease of use, safety, durability, efficiency, size, ease of mouse dispose, ease to see caught mouse and appearance. Figure 2.4 which is the live catching mousetrap is taken as the reference in screening out the design concepts. Design concept that has the same selection criteria to the reference will be given a (0) sign, (-) is given to the design that has bad criteria than the reference and (+) is given to the design that has better criteria than the reference. Then the sum of (+), (-) and (0) is calculated. Net score is obtained by minus away the (+) sign with the (-) sign then the concept is ranked. Here concept design C ranked the first followed by D, A and finally B. Concept B is decided not to continue as it only has the net score of 1. Design concept C is then combined with design concept D and design concept A will continue to the scoring process.

	Concepts				
Selection criteria	**A**	**B**	**C**	**D**	**Ref**
Ease of use	_	+	_	+	0
Safety	+	+	+	+	0
Durability	+	+	+	+	0
Efficiency (number of mousses catch)	_	_	_	+	0
Size	+	0	+	0	0
Ease of mouse dispose	+	_	+	_	0
Ease to see caught mouse	_	_	+	_	0
Appearance	+	+	+	+	0
Sum +'s	5	4	6	5	
Sum 0's	0	1	0	1	
Sum –'s	3	3	2	2	
Net score	2	1	4	3	
Rank	3	4	1	2	
Continue?	YES	NO	COMBINE	COMBINE	

Figure 3.6: Concept screening

3.4.2 Concept Scoring

		Concepts			
		A		**E**	
Selection criteria	**weight**	**Rating**	**Weighted score**	**Rating**	**Weighted score**
Ease of use	20%	3	0.6	4	0.8
Safety	10%	4	0.4	4	0.4
Durability	10%	4	0.4	4	0.4
Efficiency(number of mousses catch)	25%	2	0.5	4	1
Size	5%	2	0.1	3	0.15
Ease of mouse dispose	10%	2	0.2	4	0.4
Ease to see caught mouse	15%	2	0.3	4	0.6
Appearance	5%	4	0.2	3	0.15
Total score		2.7		3.9	
Rank		2		1	
Continue		No		Develop	

Figure 3.7: Concept scoring

Figure 3.7 above shows the concept scoring process. Here, concept design C and D is being combined due to its certain criteria where concept design C has the ease of mouse dispose and ease to see caught mouse but concept design D does not have. Concept design D has the ease of use and efficiency to catch mouse but concept design C does not have. The combined concept design C and D is named as concept design E. Next, concept design A and concept design E is being evaluate under certain criteria where all the criteria is given weight and rating. Weight is given based on percentage and rating is given out of five stars. Then the weighted score is then calculated by multiply the weight with the rating. Total score is then calculated by adding up all the weighted score then the concept designs are ranked. Here the combined concept E has the highest total score and ranked the first. Thus it will be develop as the finalize concept.

3.5 FINALIZE CONCEPT

Finalize concept is develop after the screening and scoring concept. Finalize concept is the concept that has taken all the criteria into consideration.

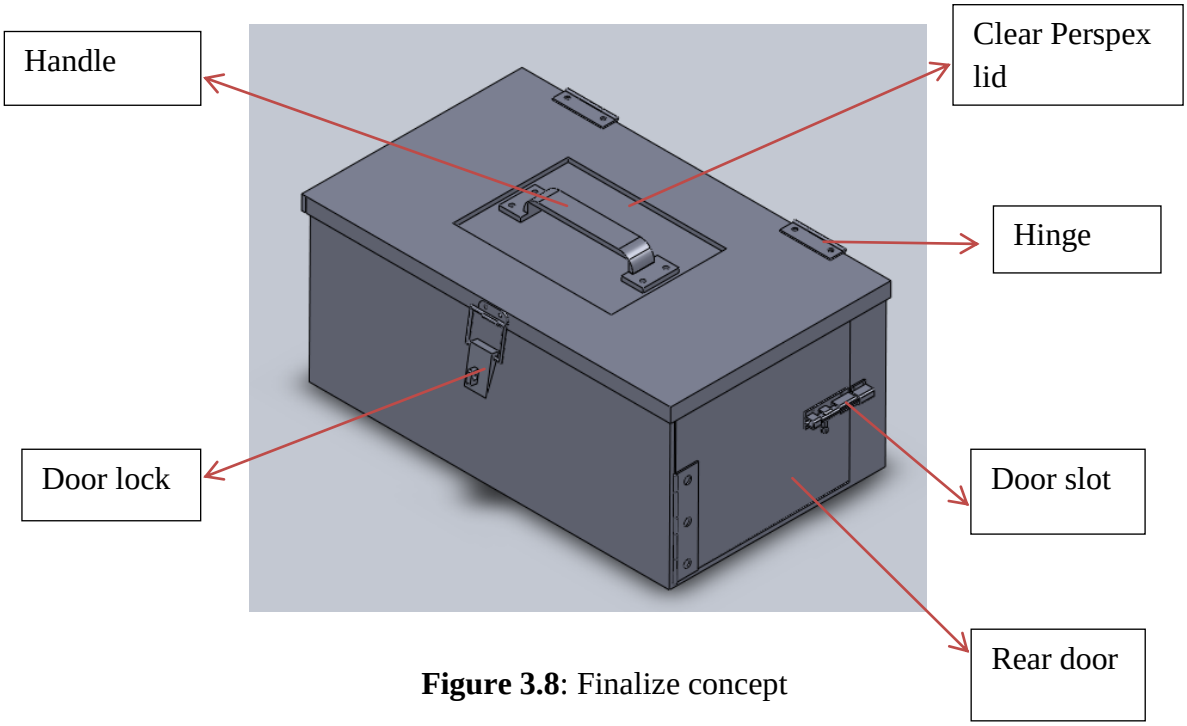

Figure 3.8: Finalize concept

Figure 3.8 shows the finalize concept that has been developed. The finalize concept consists of three doors. The rear door is to dispose the mouse and the two clear Perspex lid doors is for the mouse to enter. It also consists of a handle for the ease of dispose and to carry the mousetrap. It also consists of a clear Perspex lid on top of the cover to see the trapped mouse inside. The advantages of this finalize concept are it is safe to human and pets, easy to carry and dispose the mouse and also easy to use. The disadvantage of this mousetrap is that it is big in size.

3.6 BILL OF MATERIAL

Bill of material is to show the materials needed and also its dimension and quantity.

Table 3.1: Bill of Material (BOM)

Parts	Material	Dimension (mm)	Quantity
1	Galvanized iron	370 x 250	1
2	Galvanized iron	194 x 107	2
3	Galvanized iron	125 x 100	1
4	Galvanized iron	50 x 107	1
5	Galvanized iron	60 x 107	1
6	Galvanized iron	270 x 150	1
7	Perspex	65 x 65	2
8	Perspex	150 x 130	1
9	Hinge	65 x 40 x Ø 5	1
10	Hinge	35 x 20 x Ø 5	4
11	Handle	100 x 25 x Ø 5	1
12	Door slot	50 x 20 x Ø 3	1
13	Door lock		1

3.7 FABRICATION PROCESS

After finalize concept and bill of material have been determined, the next process is the fabrication process. This process is about how a raw material is being transform into a product which is the finalize concept. There are many method used in fabricating the product. The processes involved are as below:

a) Material selection

The material being used in fabricating the mousetrap is galvanized iron 2.0mm. Galvanized iron is the most suitable material as it is cheap and easy to fabricate compare to other materials.

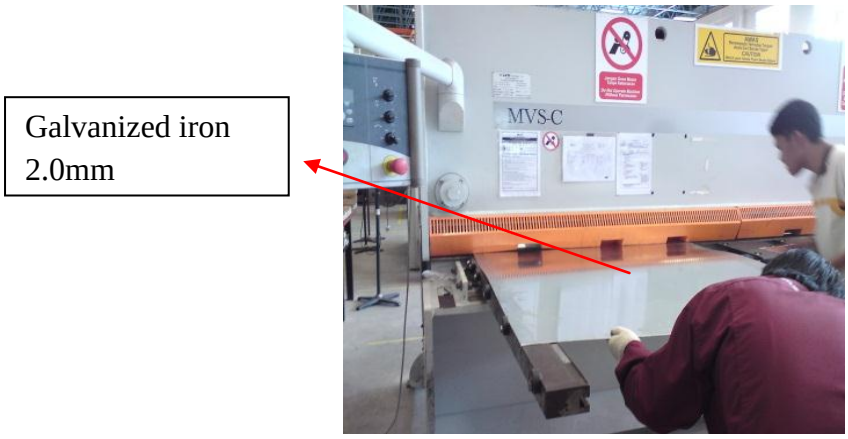

Figure 3.9: Galvanized iron sheet metal

b) Cutting process using shearing machine

The large sheet metal is then measure and mark according to the dimension stated in the bill of material. The sheet metal is then cut according to required size by using the shearing machine.

Figure 3.10: Shearing machine

c) Cutting process using vertical bend saw

Sheet metals that are in small scale which cannot be cut by using the shearing machine are cut by using the vertical bend saw.

Figure 3.11: Vertical bend saw machine

d) Bending machine

After finish with cutting process, the sheet metal then undergoes bending process. Here bending machine is used to bend the sheet metal into required shaped.

Figure 3.12: Bending machine

e) Drilling process

Drilling process is then carried out by using the drill press. Few holes is drilled on the sheet metal then the required shaped is punch out by using a puncher.

Figure 3.13: Drill press

f) Grinding process

Grinding process is carry out to remove away the burr which is also called a deburr process. Grinding process is also used to remove small portions or parts of the material.

Figure 3.14: Grinding process

g) Joining process

After all the sheet metals have been cut and bend into desired shape. It is then join together by using rivet as the fastener.

Figure 3.15: Rivet

h) Filling process

Filling process is also carried out in the fabrication process. Filling process is used to remove the burr and also as part of the finishing process.

Figure 3.16: Filling process

i) Finishing process

As for finishing process, a spray is being used to make the product more attractive and to cover the product from rust.

Figure 3.17: Finishing process

CHAPTER 4

RESULTS AND DISCUSSION

4.1 INTRODUCTION

This chapter will explains about the finalize product that have been fabricated. This chapter also will explains about the specification of the product in details like its weight and also its working mechanism. Cost analysis also will be explained in this chapter.

4.2 RESULT

The finalize product is a box like mousetrap with black in colour that consists of three doors. Two front doors is made of small clear Perspex and a rear door which is used to dispose the trapped mouse inside. It also consists of a clear Perspex on top of the cover for the ease to see the trapped mouse inside. A handle is also being fixed to the cover so that it has the ease to dispose the mouse and to carry the mousetrap. Figure 4.1, figure 4.2 and figure 4.3 below show the isometric, interior and back view of the product.

Figure 4.1: Isometric view

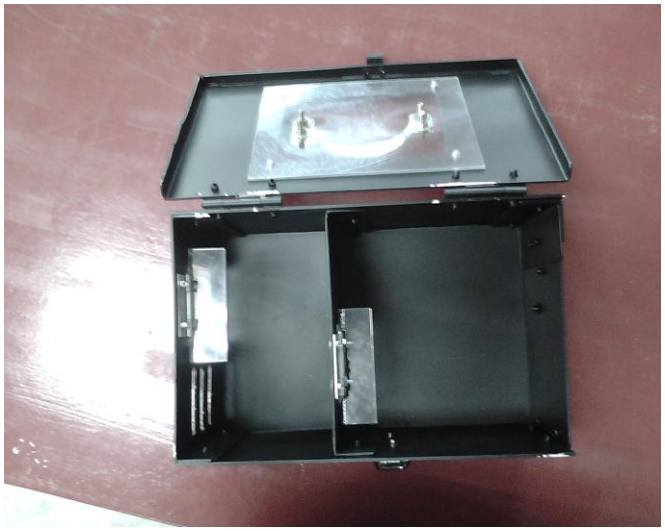

Figure 4.2: Interior view

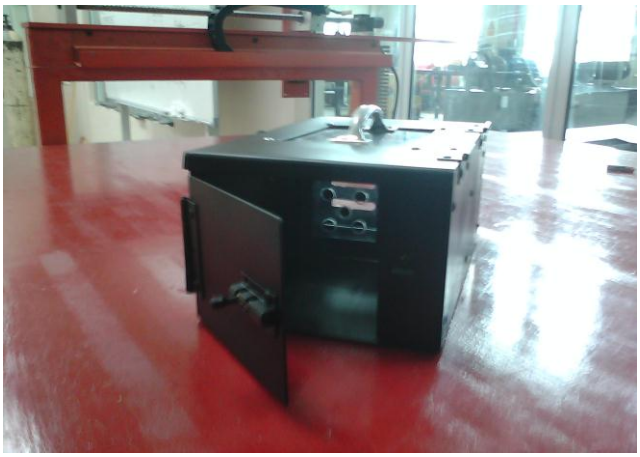

Figure 4.3: Back view

4.2.1 Product Specifications

The specifications of the product are shown in table 4.1 as below:

Table 4.1: Product specifications

Specifications	Results
Length	250 mm
Width	150 mm
Height	112 mm
Weight	1.20 kg (real weight)
Colour	Black
Maximum of mouse can be trap	4

The mass estimation and moments of inertia that has been estimated by using the software Solidworks also shown in figure 4.4 as below:

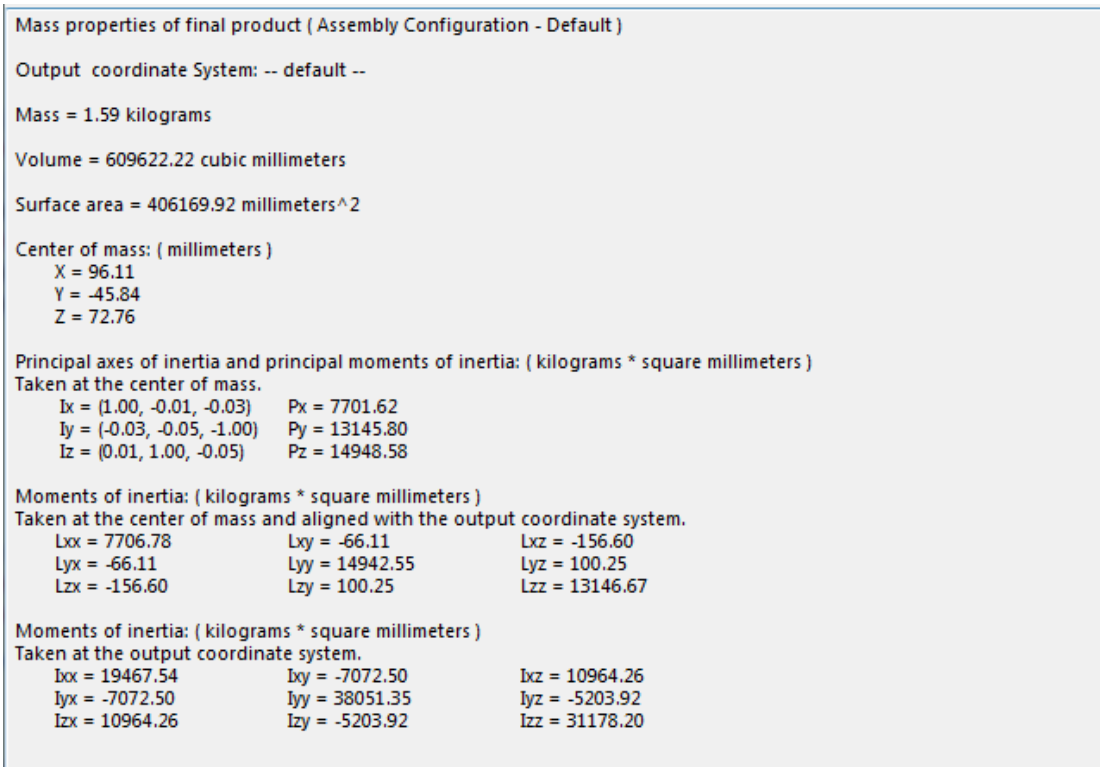

Figure 4.4: Solidworks estimation

4.2.2 Working Mechanism

The final product also has tested in a box with hamsters in order to determine its efficiency and effectiveness in trapping a mouse. This experiment is also to show its working mechanism in trapping mouse. The working mechanism is as below:

a) Putting the bait

First of all, the door lock is open so that the cover of the mousetrap can be open and bait is put at the second box.

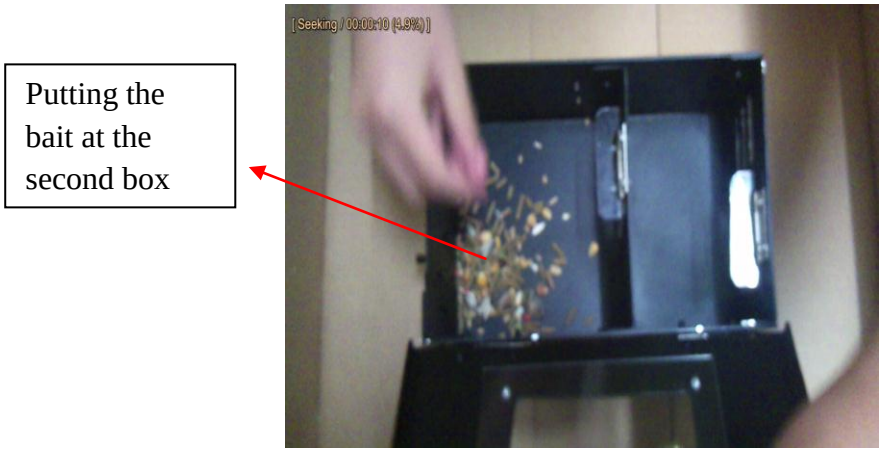

Figure 4.5: Putting the bait

b) Releasing of first mouse

The cover of the mousetrap is then closed back and the first mouse is released into the box and is observed.

Figure 4.6: Releasing of first mouse

c) Releasing of second mouse

The second mouse is then released and is observed.

Figure 4.7: Releasing of second mouse

d) Entered of first mouse

After a few minutes of observation, the first mouse finally entered the mousetrap and straight away to the second portion of the mousetrap.

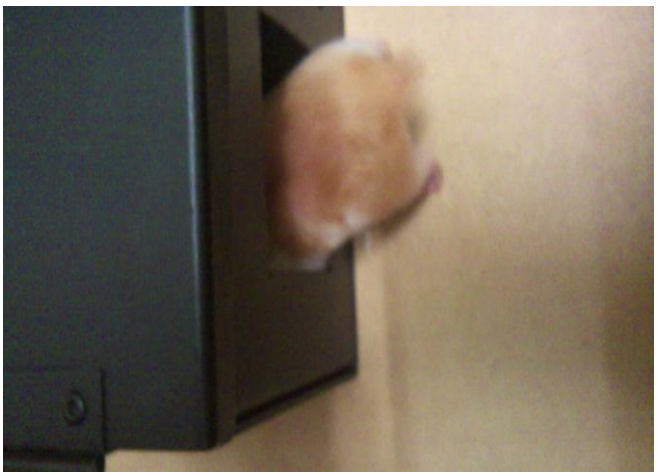

Figure 4.8: Entered of first mouse

e) Entered of second mouse

Next, the second mouse entered the mousetrap and to the second potion. Now, both the mouse had been trapped inside the mousetrap. This also shows that the mousetrap can catch up to more than one mouse where it can trap up to maximum of four mouse.

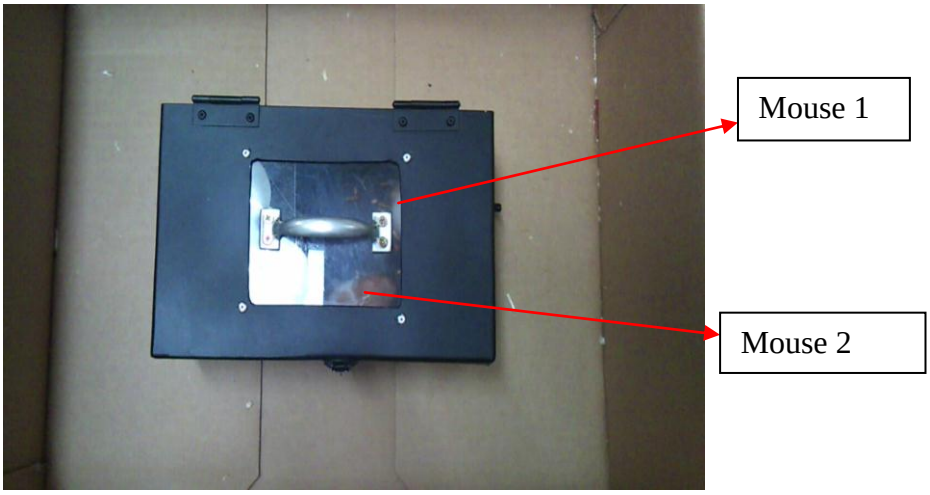

Figure 4.9: Entered of second mouse

f) Dispose the mouse

Both of the mouse is then dispose away by opening the rear door and is thrown away.

Figure 4.10: Dispose of trapped mouse

4.2.3 Cost Analysis

The estimated price for the product also have been calculated based on the material used not including labour cost, machining cost and others. The estimated price is shown in table 4.2 as below:

Table 4.2: Price estimation

Part	**Dimension/Unit**	**Price**
Galvanized iron	1069mm X 821mm	RM 44.20
Perspex	215mm x 195 mm	RM 3.35
Handle	1 unit	RM 3.00
Door lock	1unit	RM 4.60
Door slot	1 unit	RM 4.50
Screws	8 unit	RM 1.87
Hinge	5 unit	RM 6.43
Spray	1 unit	RM 7.90
	Total price	**RM 75.85**

4.2.4 Stress Analysis

Fracture analysis also have been carried out by using the Solidwork Simulation Xpress software to study the maximum load of the handle can support. The maximum load applied to the handle is 12.5568N. The total weight of the mousetrap is 1.2kg and the maximum weight of total of four mouse are 0.08kg. By using the formula F=mg, the total weight of the mousetrap and four mouse are added together and is multiply by 9.81N. As a result the handle is safe for use and can support the whole weight of the mousetrap and mouse as the result only shows green colour which mean that it only experience a little stress. If the result is red or orange

colour, the handle is experiencing a great stress which may lead to break due to some time. The stress analysis contour of the handle is shown in figure 4.11 as below.

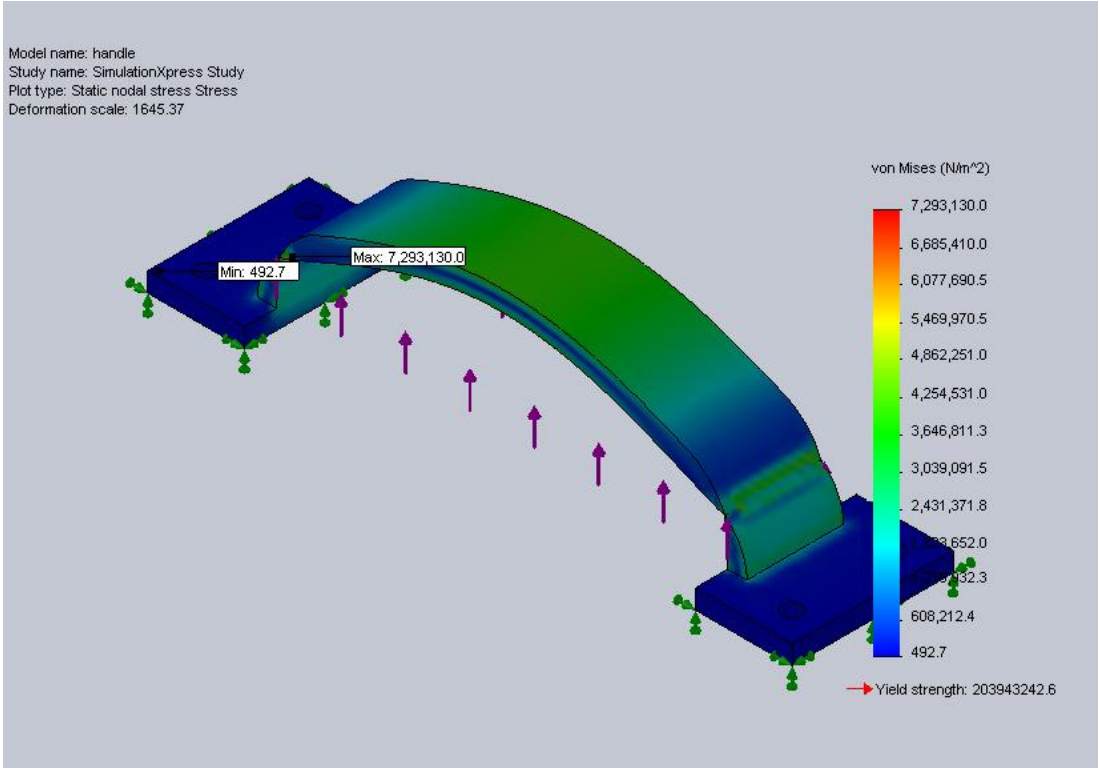

Figure 4.11: Stress analysis of the handle

Table 4.3: Result of stress analysis of the handle

Name	Type	Min	Max
Stress	Von Mises Stress	492.673 N/m^2	$7.29313x10^6$ N/m^2

Table 4.4: Tensile test analysis of the handle

Property Name	**Value**
Elastic modulus	2×10^{11} N/m^2
Poisson's ratio	0.29 NA
Mass density	7870 kg/m^3
Tensile strength	3.569×10^8 N/m^2
Yield strength	2.0394×10^8 N/m^2

4.3 DISCUSSION

This topic will explain about the advantages and disadvantages of the mousetrap, problem faced during fabrication and also type of defect in the fabrication.

4.3.1 Advantages and Disadvantages

There are several advantages and disadvantages of the product. The advantages of the product are as below:

i. Easy to carry and dispose the trapped mouse as it consists of a handle at the top of the cover compare to other market available mousetraps.

ii. Easy to see the trapped mouse inside as the top cover is covered with a clear Perspex.

iii. The mousetrap also easy to dispose as the rear door can be open to release away the mouse.

iv. The mousetrap can trapped up to maximum of four mouse.

The mousetrap also consists of several disadvantages. The disadvantages are as below:

i. The mousetrap does kill the trapped mouse.

ii. The size of the mousetrap is too big which make it cannot be place at a places which required small space.

iii. The colour of the mousetrap which is black colour makes it difficult to see the trapped mouse inside.

iv. The second door inside the mousetrap makes it has a small interior compartment.

4.3.2 Type of Defect

There are also several defects in the product. These defects occur due to the lack of fabrication skill and knowledge. The types of defects in the product are as below:

i. The cutting of the Perspex is not straight which make it looked not attractive. This defect is due to the improper cutting and also improper use of cutting tool.

ii. There are also some gaps at the joining parts of the mousetrap. This defect occurs due to the improper bending angle.

4.3.3 Problem Faced

There are also several problems faced during the fabrication process. Material is the most important part of fabrication and it is also the biggest problem in the fabrication process. Searching for the most suitable material has always be the problem. Research and information finding must be carry out in order to get the most suitable materials. Wrong material used will affect the fabrication process and will lead to problems in the future.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

This final chapter explains about the conclusion and recommendation of the product. The conclusion made consists of concluding all the process involved and the overall sequence about the project. There are also some recommendations in hope that the product can be improved in term of several aspects.

5.2 CONCLUSION

As a conclusion, the objectives of this project which is to improve product in the market to catch more than one mouse and to create a safe mousetrap for human and pets at home has been successfully achieved where the product designed has minimize the risk of dangerous to human and pets at home and it also can catch up to more than one mouse. Throughout the whole process in completing the project, I have been through a lot of obstacles like getting the raw materials and time given to complete the product. Its take me a lot of hardship, skills and knowledge in getting the product done. This project also have tough me a lot of valuable experiences like

skills in fabrication and also self-discipline like getting things done according specific time.

5.3 RECOMMENDATION

There are also some recommendations or improvements that can be done in order to make the mousetrap more useful. The recommendations are as below:

i. Design

The design of the mousetrap maybe can be improve to make it more attractive and also the colour of the mousetrap which is in black colour. This colour makes the mousetrap difficult to see the trapped mouse inside as it is almost the same colour with the mouse. Thus the mousetrap should be painted in other colour.

ii. Space

The design of the mousetrap can only catch up to maximum of four mouse. Thus a bigger space or a bigger mousetrap can be design so that it can catch more mouse.

iii. Trapping mechanism

The two doors trapping mechanism design are not really working as sometimes the mouse will only goes into the first door and not entering the second door. The design of second door also has limited the space to occupy more trapped mouse.

iv. Material selection

Material used to make the mousetrap also should be lighter and cheaper.

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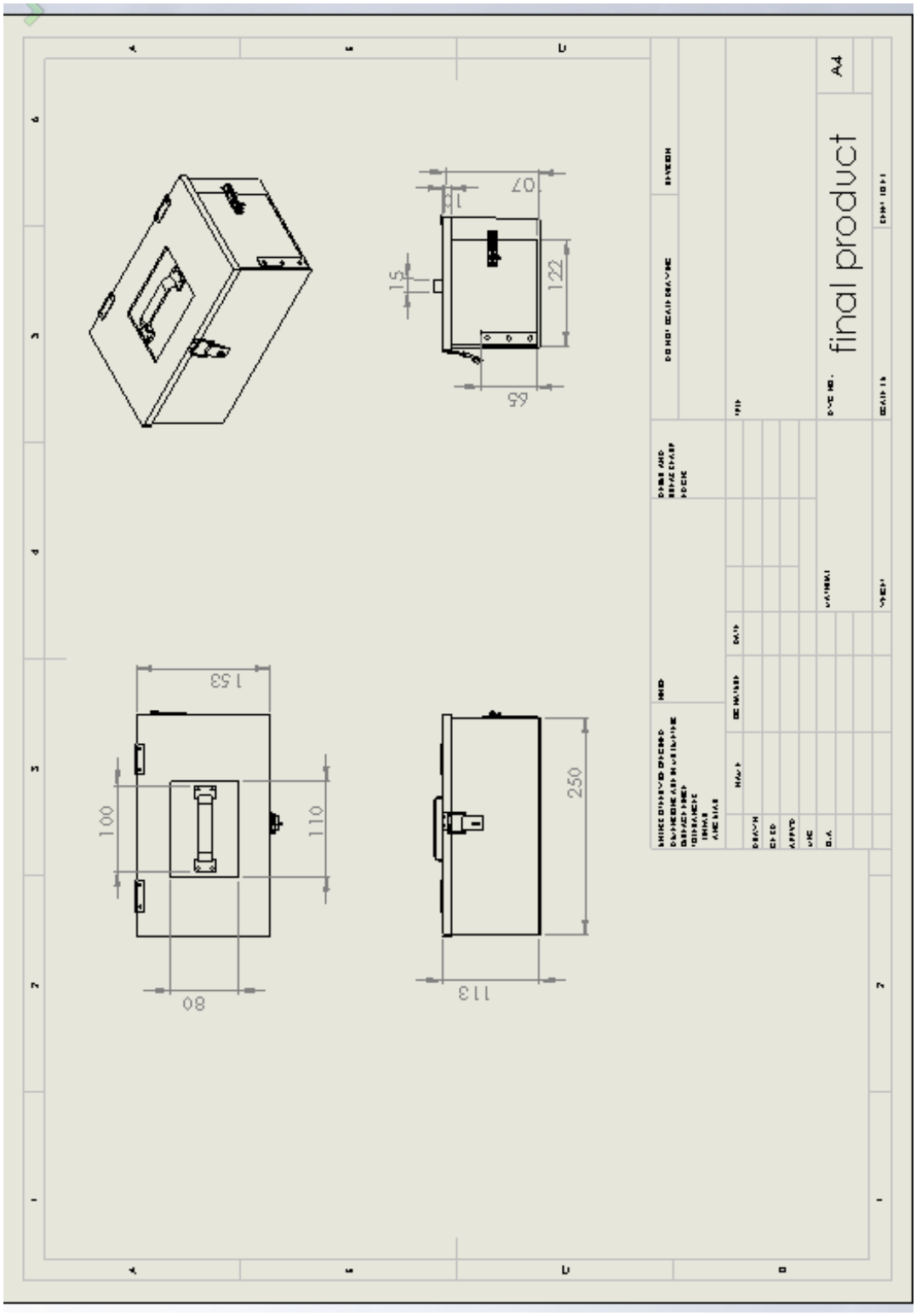
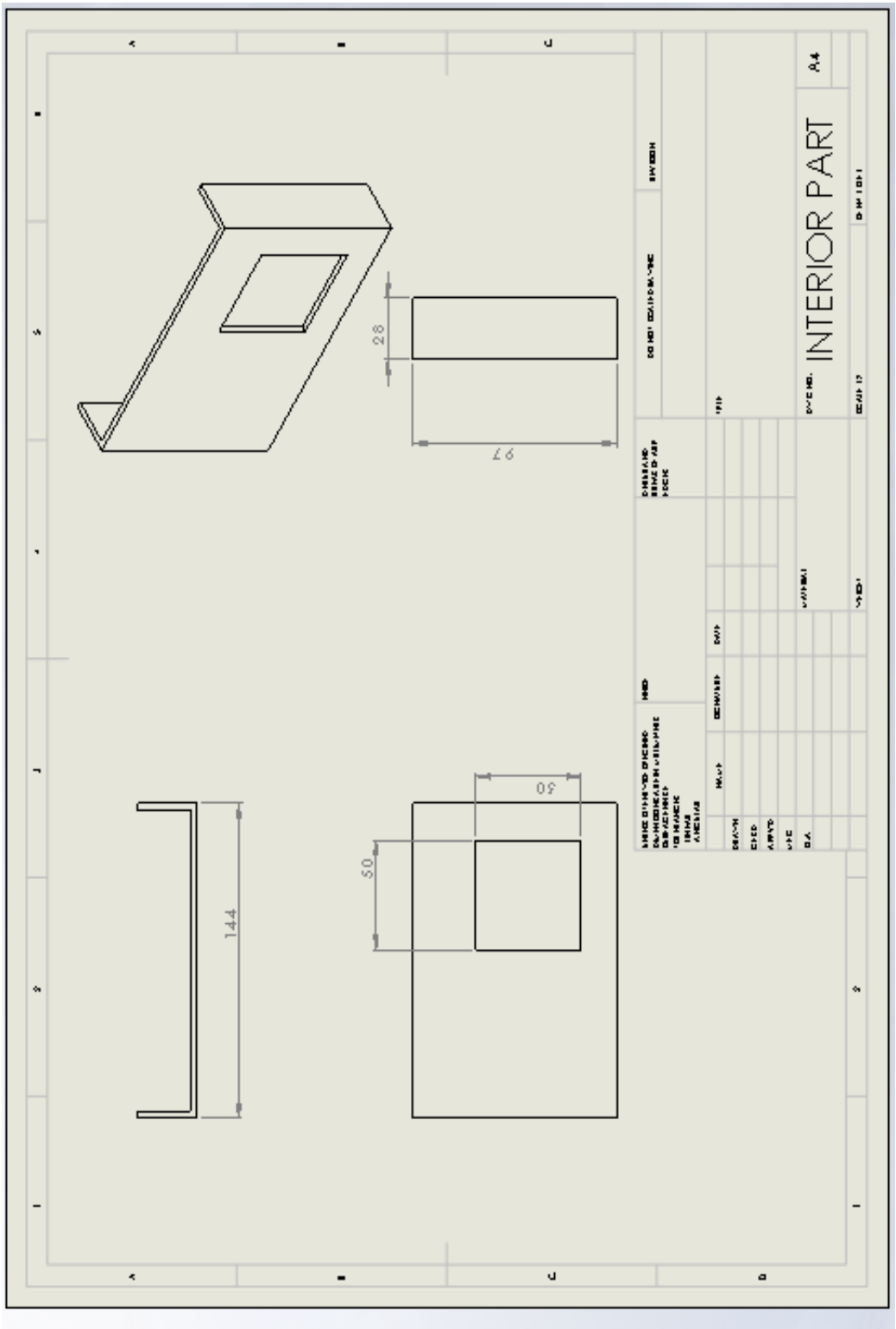
APPENDIX A



APPENDIX B



VORATHIN A/L EPIN	DIPLOMA IN MECHANICAL ENGINEERING	2011	UMP

DESIGN AND FABRICATION OF SMART MOUSETRAP

VORATHIN A/L EPIN

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

Faculty of Mechanical Engineering
UNIVERSITI MALAYSIA PAHANG

DECEMBER 2011

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: EN ZULKIFLI BIN AHMAD @ MANAP
Position: LECTURER
Date: 23 DECEMBER 2011

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 of Diploma in Mechanical Engineering.

Signature:
Name: VORATHIN A/L EPIN
ID Number: MB09102
Date: 23 DECEMBER 2011

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My sincere thanks go to all my lab mates and members of the staff of the Mechanical Engineering Department, UMP, who helped and give more idea to me while make this project and made my stay at UMP pleasant and unforgettable.

I acknowledge my sincere indebtedness and gratitude to my parents for their love, dream and sacrifice throughout my life. I acknowledge the sincerity of my parents, who consistently encouraged me to carry on my higher studies in Malaysia. I cannot find the appropriate words that could properly describe my appreciation for their devotion, support and faith in my ability to attain my goals. Special thanks should be given to my committee members. I would like to acknowledge their comments and suggestions, which was crucial for the successful completion of this study.

ABSTRACT

The objective of this thesis is to design and fabricate a smart mousetrap to improve product in the market to catch more than one mouse and the mousetrap is safe for human and pets at home. This mousetrap is easy to use and not complicated. It also can be use oftenly, which mean that it can be use over and over again. The mousetrap also has no any poisonous or harmful substance use and the most important is that the mousetrap is safe to human where it will not injure the user. It also can catch up to maximum of four mouse. The material used in fabricating this mousetrap is galvanized iron sheet because the galvanized iron is cheap and easy to fabricate. Other materials that are used in fabricating this mousetrap are Perspex, fastener such as screws and rivet, handle, lock and door slot. The process have been involved in the project are cutting, bending, drilling and riveting. Solidwork Simulation Xpress software is used to simulate the stress analysis on critical part of the mousetrap. From the observation, handle support will be a critical part to sustain a maximum load. Lastly, the objective of this project has been achieved where the mousetrap can catch up to more than one mouse and it is safe to be use where it does not bring harm or any injury to the user and also pets at home.

ABSTRAK

Objektif projek ini adalah untuk mereka dan membuat satu perangkap tikus untuk menambah baikkan perangkap tikus yang sedia ada di pasaran dan perangkap tikus ini juga tidak membahayakan binatang peliharaan di rumah dan juga manusia. Perangkap tikus ini juga mudah digunakan dan boleh digunakan berulang kali. Perangkap tikus ini tidak menggunakan sebarang bahan kimia atau bahan beracun sebagai umpan dan yang paling penting adalah perangkap tikus ini tidak mendatangkan sebarang bahaya kepada pengguna. Perangkap tikus ini juga boleh memerangkap tikus sehingga empat ekor. Bahan yang diggunakan untuk membuat perangkap tikus ini adalah besi galvanized kerana besi ini amat murah dan senang untuk dibentuk. Bahan lain yang digunakan untuk membuat perangkap tikus ini adalah Perspex, pengikat seperti skrew dan juga rivet, pemegang, selak pintu dan juga penguci. Process yang terlibat dalam membuat perangkap tikus ini adalah memotong, membentuk, menebuk lubang dan juga rivet. Solidwork Simulation Xpress juga digunakan untuk menganalisa tekanan di tempat kritikal perangkap tikus tersebut. Berdasarkan pemerhatian, pemegang merupakan tempat yang paling kritikal untuk menampung beban maksima. Akhir sekali, objektif projek ini telah tercapai di mana perangkap tikus ini boleh menangkap lebih daripada seekor tikus dan juga selamat untuk digunakan.

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