DESIGN AND FABRICATION OF VENTILATED CAT LITTER BOX

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BORANG PENGESAHAN STATUS TESIS

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SESI PENGAJIAN: 2009/2010

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DESIGN AND FABRICATION OF VENTILATED CAT LITTER BOX

MUHAMMAD ‘AFIF BIN MOHAMED AZMI

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

Faculty of Mechanical Engineering
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NOVEMBER 2009

SUPERVISOR DECLARATION

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

Signature :
Name of Supervisor : RAMLI BIN JUNID
Position :
Date :

STUDENT'S DECLARATION

I hereby declare that this thesis titled "*Design and Fabrication of Ventilated Cat Litter Box"* is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted for award of other degree.

Signature :
Name : Muhammad 'Afif bin Mohamed Azmi
ID Number :
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DEDICATION

To my beloved parents, Mr. Mohamed Azmi bin Ramli and Mrs. Roslindawati binti Mohd Nadzir, family and friends, without whom and his/her lifetime efforts, my pursuit of higher education would not have been possible and I would not have had the chance to study for a mechanical course.

ACKNOWLEDGEMENT

This project was conducted under the supervision of Mr. Ramli bin Junid in the Universiti Malaysia Pahang . I am very grateful for his patience and his constructive comments that enriched this research project. His time and efforts have been a great contribution during the preparation of this thesis that cannot be forgotten for ever.

I would like to thank lecturer and technicians at the faculty of mechanical for their valuable comments and sharing their time and knowledge on this research project during my last trip to submit the project. I also gratefully acknowledge the assistance of everybody who helped in the execution of this project in Universiti Malaysia Pahang.

I would like to thank Mr. Ramli bin Junid for general help with the facilities, who have given his full effort in guiding to achieve the goal as well as his encouragement to maintain our progress in track. I would to appreciate the guidance given by other supervisor especially in our project presentation that has improved our presentation skills by their comment and tips.

I also thank to Mechanical Students for their friendship and help when thinking through problems and for sharing their knowledge of experimental apparatus and computer systems. Finally, I thank to my family for their continuous support and confidence in my efforts.

ABSTRACT

Manufacturing process is a process of converting raw material into product. It can be described the transformation of materials into terms of greater value by means of one or more processing and/or assembly operations. The study of manufacturing was very important in order to carry out this project to ensure that student understand on what are needs to do. This project is focused on designing and fabricating the Ventilated Cat Litter Box. The main objective in this project is to design an cat box that has ventilation system apply on it. This project involves the process of designing the ventilated cat litter box by considering the shape, functionality, portability for people to use it and the manufacturing cost. The material of this design is easy to gain it, because it only using rectangular hollow steel and Perspex. So that the method joining that can be compatible in assembled this ventilated cat litter box is welding process and joining the Perspex to the frame is by using screw. This project also required analysis to ensure the strength and safety of the product meet the user need. After all processes had done, the development of this ventilated cat litter box may help us to understand the fabrication and designing process involved in this project. The manufacturing process included in this project is marking and cutting of material, machining, drilling, joining and finishing.

ABSTRAK

Pembuatan adalah proses penukaran daripada bahan mentah kepada sesuatu produk. Ia diklasifikasikan perubahan bahan kepada bahan yang lebih baik yang bermaksud melibatkan satu atau lebih proses penyambungan. Pembelajaran dalam pembuatan penting dalam projek ini untuk pelajar mengatahui sesuatu yang dikehendaki. Projek ini mengfokuskan mereka cipta dan mereka bentuk model pengudaraan dalam kotak kucing. Objektif utama mereka bentuk kotak kucing yang mempunyai sistem pengudaraan yang bagus di dalamnya. Projek ini melibatkan proses mereka bentuk kotak kucing dengan mengambil kira bentuk, fungsi, kemudahan-alihan, dan kos pembuatan bagi pengguna. Bahan untuk membuat produk ini senang didapati kerana menggunakan besi segi empat tepat yang berongga dan perspek. Oleh itu proses penyambungan yang sesuai untuk kotak kucing ini adalah proses kimpalan dan juga untuk menyambungkan perspek pada bingkai kotak kucing kita menggunakan kaedah penyambungan menggunakan skru. Projek ini juga memerlukan analisis bagi memastikan kekuaan produk dan memastikan keselamatan pengguna dipenuhi sebetulnya. Selepas semua proses yang dijalankan siap sepenuhnya, reka bentuk kotak kucing yang mempunyai sistem pengudaraan ini mungkin boleh membantu sesiapa untuk memahami proses penghasilan dan rekabentuk yang berkaitan dengan projek ini. Pembikinan projek ini dihasilkan menggunakan proses pemotongan bahan, pemesinan, menebuk lubang, penyambungan dan proses pengemasan.

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X	-	Multiplication
Mm	-	Milimeter
Kg	-	Kilogram
kW	-	Kilowatt
V	-	Voltage
A	-	Ampere
Hz	-	Frequency
W	-	Watt
Rpm	-	Revolution per minute

LIST OF ABBREVIATIONS

UMP	-	Universiti Malaysia Pahang
FKM	-	Fakulti Kejuruteraan Mekanikal
SMAW	-	Shield Metal Arc Welding
MIG	-	Gas Metal Arc Welding / Metal Inert Gas
CAD	-	Computer Aided Design
Etc	-	Et cetera
3D	-	Three Dimension

CHAPTER 1

INTRODUCTION

1.1 Introduction

Final year project is one of the subjects for this semester. In this subject, a project needs to do to fulfils the subject requirement .The current project is to design and fabricate a ventilated cat litter box. Together with the instructor, 1 student are required for accomplishing this project. This student must possess a very high discipline, willing to learn and self – motivated. A know – how to operate the MIG welding machine or SMAW welding machine is very helpful to the students for implementing this project. In this project the title is Design and Fabrication of the ventilated cat litter box by using various machines such as MIG welding machine and etc. The project involves the designing and fabricating of the ventilated cat litter box. Tests are required to be conducted and to verify whether the design of the ventilation system is working or not. Overall, this project will involve the development of skills in design ACAD and fabrication. Skill in drawing in ACAD program and operating the MIG welding machine is the most important and need to be improve when this project launched.

1.2 Problem Statement

(i) Current cat litter box do not has proper safety because of the sharp edges at the corners of its box.
(i) Current cat litter box is expensive but do not have function.
(ii) Current cat litter box is commonly do not have good technology in ventilation system that are apply inside the box.

1.3 Project Objective

(i) To design a ventilated cat litter box.
(ii) To fabricate a ventilated cat litter box.

1.4 Project Scope

(i) To come up with a designs of the ventilated cat litter box.
(ii) To sketch a few designs the ventilated cat litter box.
(iii) To choose the best design of the ventilated cat litter box by using Pugh concept selection method.
(iv) To design using 3D AutoCAD software.
(v) To cut the material by using cutting machine.
(vi) To drill material by using drilling machine.
(vii) To weld all parts by using MIG welding machine.

For this chapter, we can conclude this chapter can clear about the objective and do the project easily. In this day, we do not have new cat litter box that has a ventilated system so this project is to design and fabricate the new ventilated cat litter box. In conducting a project like this project, well arrangement of works is really important to keep the momentum of this study.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Since a day, people are always having a smell problem cause of cat litter box. This problem occurs especially to the pet owner. So, using a ventilated cat litter box can only overcome with this problem. Its mean, use this ventilated cat litter box only if we want to avoid the sell problem is happen. The function of the ventilated cat litter box is to remove the smell inside the cat litter box to the outside cat litter box using an exhaust fan through the elastic rubber tube. The rubber tube is function for transferred the smell that are connect started from cat litter box to outside the cat litter box, for example transfer the smell through the window. This application is almost as same as kitchen smoke absorb. From the statement above conclude that the ventilated cat litter box is good ventilated system that can transfer the smell to overcome the main problem, means avoiding the smell from getting spread away.

2.2 Ventilated cat litter box

In the days before commercial kitty litter, cat owners used cardboard boxes filled with dirt from the garden. That most were not happy with this arrangement was made evident when the first commercial cat litter was introduced. It was an immediate success. Litter made from many different materials are available, each more or less good for the health of your cat and the environment. These are available in supermarkets and pet stores, and on the Internet. When choosing a litter, consider its health and environmental effects and also your cat’s preferences.

They may not be aware if their litter is going to a landfill, but they may be finicky about how their litter smells and feels. Your cat will tell you they don't like it by their behaviour, so if you are having problems in this area, a switch of the type of litter you are using may solve it. Remember that your cat's nose is right down in the litter, so choose one without artificial scents and without much dust. If their litter box irritates their noses, they are not likely to want to use the box when needed. Given the choice, most cats prefer a litter that feels the most like sand over pellets, chunks and shreds. Find one that your cat likes and enjoys digging in and scoop it frequently.

Having a functional and effective litter box is important for all cats and their companions. Nobody likes the smell of a soiled box especially the cats. Cat companions generally choose a cat box and litter according to their own criteria: a box that minimizes odors is easy to change or scoop, limits tracking, and looks nice as part of the home decor. But cats want a box that is the right size for them to move around in and litter that doesn't smell and feels good against their soft paws. And they want it clean.

2.3 Type of cat litter box

There are many type of cat box, such as type of basket, house, or bin and etc. But in all of this type of cat box there is no cat box has good ventilated system so that not also the cat owner but cat also face the difficulty in facing the smell litter problem. So to overcome this problem is by installing or adding the ventilated system in the cat litter box.

The cat box is design to make sure the air flow from the box is going out through a pipe to another section. It is meaning the air is pumping from inside of the cat box by a fan go through a pipe that connected outside from our house or window so that the smell of the litter from the box is not distributed away inside our house because we usually put a cat box in our house. So we do not smell the smell from the cat litter inside our house.

Next, the detail will be explained according to the sketching that is the best design that has been chosen to fabricate.

Figure 2.1: Basket type

Figure 2.2: Box type using card box

Figure 2.3: Wood type box

Figure 2.4: Plastic type box

2.4 Type of material use

There are many materials that usually to made cat litter for example, Clay is the first commercial cat litter, and still the most common and widely available today, was introduced in 1947. Made from natural clay, extruded into pellets and dried, it is sold just plain and unscented, or with additives such as baking soda, chlorophyll fresheners, alfalfa, and essential oils. In 1984 it was discovered that when cats urinated in a particular type of clay, sodium betonies, the clay would form a clump, which was easier to remove from the litter box.

This product became even more popular than the original clay pellets and today 90% of all litter sold is made from clay. The problem with these products is they produce a lot of dust (although some brands claim that the type of clay they use produces a dust-free product), which contains silicon particles that have been established by the International Agency for Research on Cancer as a known human carcinogen. Clay particles tend to cling to your cat's fur and in-between their toes. In addition to leaving dusty cat prints on your floors, breathing these particles can cause respiratory infections.

A recent study actually found clay-based litter silica dust in cats' lungs, and that cats with respiratory disease had up to six times the amount of silica in their lungs as healthy cats. A product made for humans called Molten Absorbent is also made from the same ground clay as cat litter. It is manufactured for use in garages to absorb oil. This product must carry a warning label that reads, in part, "Aggregate contains crystalline silica. Crushing, grinding, or creating dust may cause exposure to a respiratory silicosis or cancer health hazard."

Since a study has now confirmed that this dust is present in the lungs of cats, it would be a prudent preventive measure to at least try another type of litter. It doesn't matter what type of clay is used all clay contains crystalline silica. The clumping

capability of sodium betonies is due to its ability to swell to 15-18 times its dry size when exposed to liquids. This characteristic is used to advantage in the absorption of cat urine, and as a sealant for ponds and dams. But when cats lick themselves clean and ingest the clay, it can prevent nutrient absorption and cause intestinal blockage as it swells when exposed to intestinal liquids.

Many veterinarians recommend not using clumping cat litter as the first litter for inexperienced young kittens, as they may experiment with the litter and eat it. Environmentally, much of the clay is strip-mined the US Bureau of Mines estimates that in 1994, approximately 1.5 million metric tons of clay were mined to make the absorbent type of cat litter alone. In addition, some clumping-type clay litters cannot be flushed. The same characteristic that causes the clay to clump also causes it to clog pipes. It then ends up in the trash can, which is not designed to contain animal waste, and eventually in the landfill, where it will never break down.

Some industry sources claim that cat litter accounts for more volume in landfills than disposable diapers. Check labels carefully as some contain sand so they can be flushed while others may clog pipes.

Next, new to the market is litter made from silica gel, an odorless mineral that is used in little packets to control moisture in packages containing vitamins, cameras, binoculars, and other products where moisture might cause damage. Silica gel litter is made from silica dioxide sand (the same material found in quartz), oxygen and water.

The gel contains millions of tiny pores that can absorb up to 40 times their weight in moisture. It comes in spheres (also called “pearls”), half spheres and crystal shapes. Some manufacturers add dyes and scents, so you want to watch out for, and avoid, those.

Manufacturers claim the "pearls" to be nontoxic and bacteria resistant. While it is initially more expensive than other type of litter, it is it actually more cost-effective

and labor-saving. Because the silica gel absorbs and holds moisture inside the balls, the same litter can be used odor-free up to a month for one cat without changing the material (the only maintenance needed is to remove the poop). The lightweight bags are easy to handle. This type of litter can be flushed. Cats like silica gel pearls and it doesn't track.

Others material are recycled newspaper. Litter in pellet form is available made from recycled newspapers. It is biodegradable, flushable, and burnable, and 99% dust-free. And it doesn't track like clay litters. Plant-based litters. These include litters made from corn, corncob, cornhusks, wheat by-products, wheat grass, beet pulp, oat hulls. My favorite litter is the most natural, unprocessed, and effective. It is plain ground corn cobs. They are a renewable resource and "recycle" a material that would have otherwise gone to waste. They have no odor themselves, are very absorbent and provide good odor control, don't produce as much dust as the clay types, and can be flushed.

Tops in the cat litter consumer comparisons is another corn litter, this made from crumbled, whole kernel corn. It has all the advantages of clay – outstanding absorbency, good clumping, low tracking, great odor control, and cats love it – without the dust. Its light to carry and flushable. The only minor disadvantage is that mold can grow in a warm moist environment such as a litter box. This is not a problem if you change the litter every few days, a practice that will also keep the box fresh.

Wheat husks are another organic waste product made into litter, mixed with all-natural bonding ingredients. Clumps form, but fall apart when scooped. Very good odor control. Can be flushed. Kenaf plant is a plant related to cotton and hibiscus. It is also used to make tree-free paper. The manufacturer claims the litter to be super absorbent, non-clumping, dust-free, and biodegradable.

Next beet pulp and wheat grass litters are not as good at controlling odors. Pine and cedar sawdust. Another "recycled" litter is made from pure pine sawdust from scrapped pine lumber. It is kiln dried and compressed into pellets that absorb many

times their weight in moisture before they break back down into sawdust. Because pine naturally absorbs and neutralizes ammonia, odor isn't just covered up by chemicals and perfumes, it's eliminated. My only concern about this was that pine is one of the woods that contain resins and other aromatic chemicals that have natural insecticidal and bactericidal properties that can kill insects and the bacteria that cause odor.

These same chemicals can also damage the respiratory tract, causing chronic respiratory disease, and asthma. In pine trees, the primary irritant is abietic acid, also known as sylvic acid. While abietic acid itself is relatively harmless, a number of compounds formed by air oxidation of abietic acid are potent allergens. Since many humans have sensitivities to pine aroma, cats may have such sensitivities as well. The manufacturer states, however, that any harmful aromatic hydrocarbons that might be present in the wood are processed out. Small amounts can be flushed, or used litter can be used as a biodegradable garden mulch.

Cedar is also used to make litter and has similar properties to the pine pellets. While also fragrant, there are no ill affects associated with its aroma. Odor control. Odor is Nature’s way of signalling that it’s time to change the litter, so you don’t want it covered up or absorbed. Scoop and change the litter frequently and there will be no build-up of the micro-organisms that cause odor. If there is a lot of odor, you might consider changing what you feed your cat.

For this chapter, we can conclude this chapter is a body of text that aims to review this project of current knowledge. Besides that, this chapter shows the project guidelines to generate this project successfully. From this chapter, it can give more information to do the project base on material selection and the design of the project.

CHAPTER 3

PROJECT METHODOLOGY

3.1 Introduction

In fabricate of ventilated cat litter box, there are several step must be follows. In this part, all students should be understand why chosen the material and why must chose the particular methods used to characterize the material. Methodology is important before make the product. In fabricating process, it is include about measuring, marking, cutting, welding, drilling, joining and finishing process. We should know a chronology of project until it finish. Others, students must clearly about the objects and equipment that used in making a project.

3.2 Project Flow Chart

From the flow chart below in (Figure 3.1), this project started with the design review about existing ventilated cat litter box then, study and makes a lot of investigation about cat litter box. This is including a study of the ventilation system of cat litter box, types of cat litter box material and their process to fabricate. These tasks have been done through study on the internet, books and others sources.

Then the information has been collected and gathered. After that, the project is continued with the design process. In this stage, the knowledge and lessons that have been studied will be applied. It is important to make a suitable design for the project. After several design sketched, design consideration have been made and one of the design have been chosen. The designs have been chosen by using Pugh's concept selection method. The selected sketch is then transferred to solid modeling and engineering drawing by using AutoCAD software.

When all the engineering drawing finished, the drawing was used as a reference for the next process, which fabrication stage. This process consist fabrication to all the parts that have been designed by the dimension using various type of manufacturing process. The manufacturing processes that include in this process are welding, cutting, drilling and etc.

During the fabrication process, if there is something wrong occur, such as not balance dimension so the process need improvement and go back to previous step, make a modification again. All the draft report and the related articles are gathered and hand over to the supervisor for error checking. The finish product will be compared with the report to make sure that there is no mistake on both project and report.

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

After all process mentioned above is done, all sources or ingredient for report writing are gathered. So, after the fabrication process, final report must be done before the final presentation. The report writing will be guided by Universiti Malaysia Pahang (UMP) final year project report writing. Preparation for final presentation is also being made by finished the slides show. The project ended after the final presentation and submission of the report.

In fabrication of ventilated cat litter box, there is a planning or project flow chart of the overall progress to assure the project can be finish on schedule:

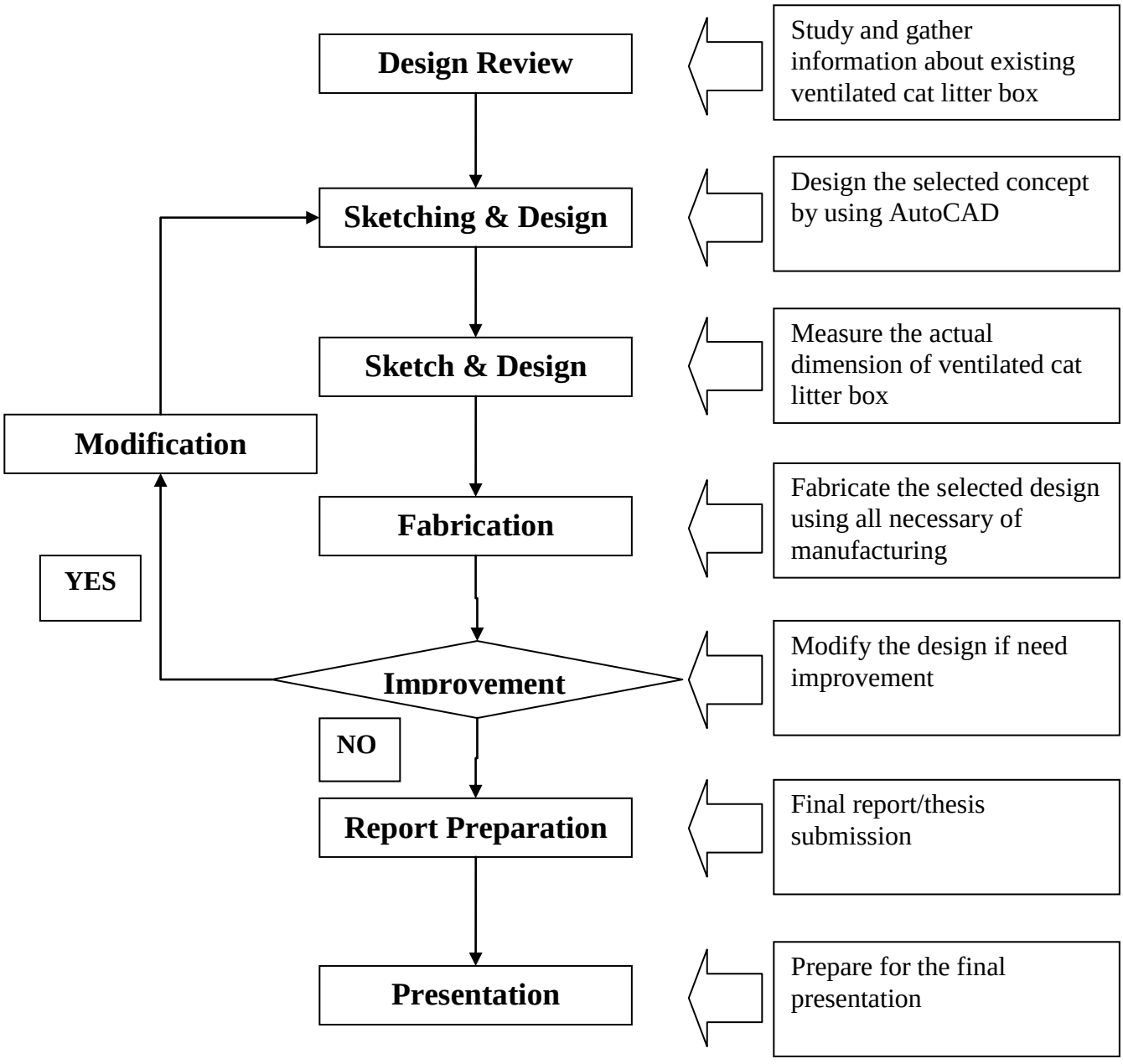

Figure 3.1: Project flow chart

3.3 Design

The Design and Fabrication of the ventilated cat litter box must be compliance to several aspects. The design consideration must be done carefully so the design can be fabricated and the parts are all functioning. The aspects that must be considered in designing the ventilated cat litter box:

(i) Strength: it is the one of important criteria in designing the ventilated cat litter box and showing the toughness of the design frame.
(ii) Durability: The system must have the durability to endure continuous force from crash
(iii) Material: Availability will be done of the challenges in design.
(iv) Cost: for minimal cost acceptable.
(v) Marketing: Design see simple and customer need.
(vi) Shape: The shape must be applied in big size and easy to state a pairs of shoe.

3.4 Drawing

The drawings are divided into two categories, which are:

(i) Sketching – All the ideas for the ventilated cat litter box fabrication are sketched on the paper first to ensure that the idea selection can be made after the selected design is choose.
(ii) AutoCAD Software – The selected design or concept sketched is transfer to solid modeling ad engineering drawing using AutoCAD software.

3.5 Sketching and Design Concept

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

The design in figure 3.2 (concept A) overall made from plastics except for their frame which is made from light steel. The advantage of this concept are its have a small fan a door and stable but the disadvantage of this design are it is to small and so strong.

The design in figure 3.3 (concept B) which is not good enough like a concept A. The size is still the same but concept B does not have a small fan but it fully ventilated. This design overall using steel material. It is same as concept A for their method joining which using welding process to fabricate it. This concept consist a lot of hole and a small door. It is still stable but it has poor ventilated system compare to concept A.

The design in figure 3.4 is a datum concept. This concept is very light so it is easy to move. The disadvantage of this concept is fully open so the smell can spread easily. Do not have door and so heavy because it's made from steel

The design in figure 3.5 is the final design and concept also calls concept D. This is a good ventilated cat litter box because it's has a good concept of ventilated system. All the material are made from rectangular hollow steel except the body parts. This concept using MIG welding machine for the method joining because it is the faster method. This concept consist a big door, excellent ventilation system, strong and very stable. It has excellent ventilation system because it has a very power full exhaust fan.

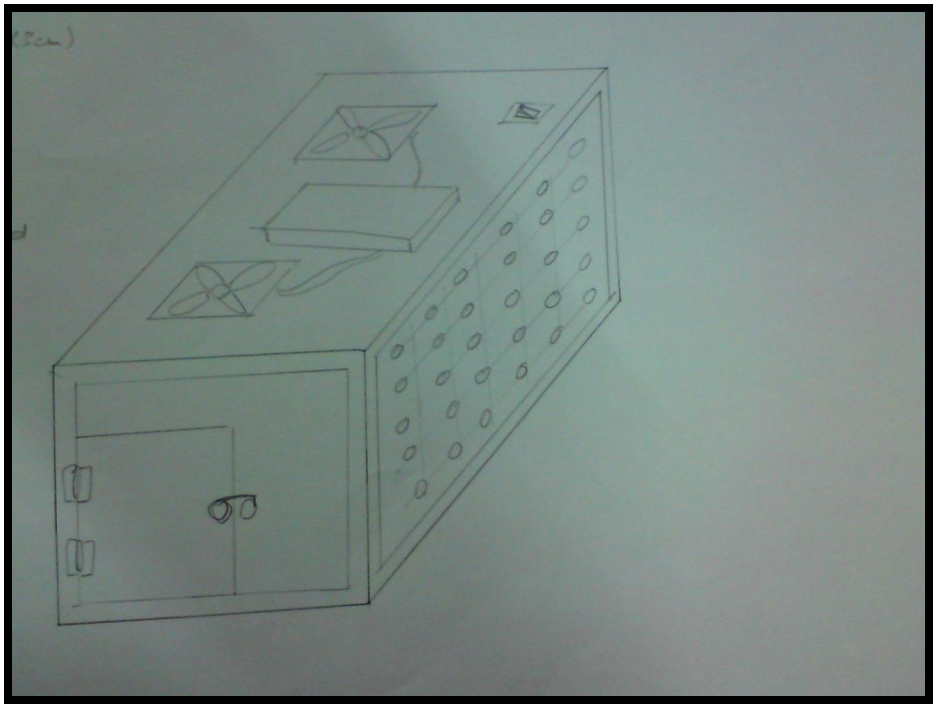

Figure 3.2: Concept A

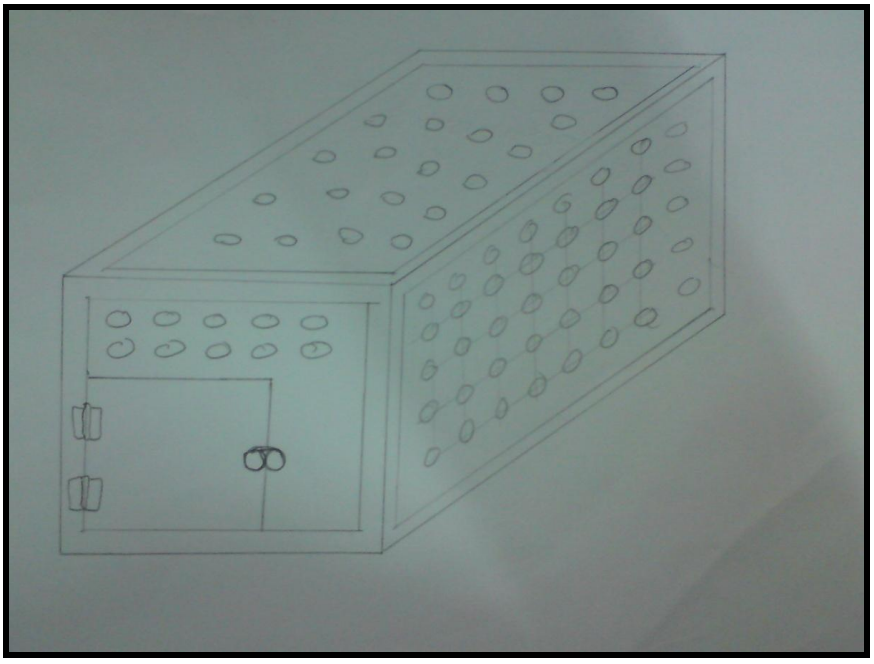

Figure 3.3: Concept B

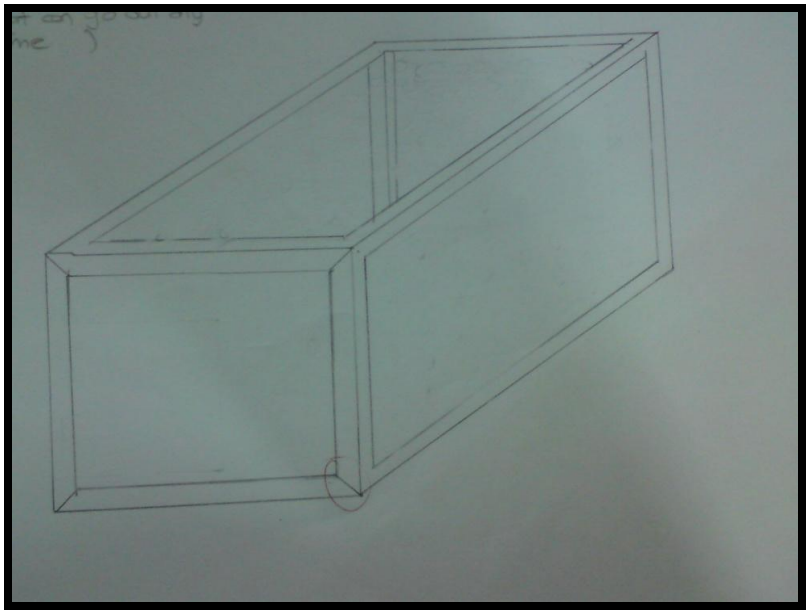

Figure 3.4: Concept C

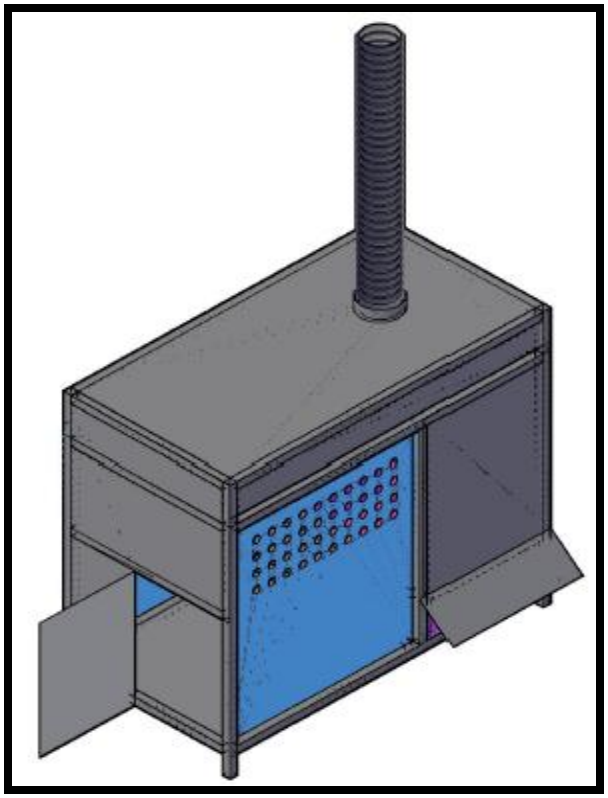

Figure 3.5: Concept D

3.6 Concept Generation and Evaluation

Four concepts for the ventilated cat litter box were developed. These are evaluated against the datum of the standard ventilated cat litter box with Pugh's Concept Selection.

Table 3.1: Pugh's concept selection method

Selection Criteria	Concept Variants			
	A	B (Datum)	C	D
Easy to move	+	0	+	+
Easy to handle	+	0	0	+
Easy to use	0	0	0	+
Ease of fabrication	0	0	-	0
Stability	0	0	0	0
Low cost	-	0	-	+
Durability	0	0	0	0
Safety	+	0	0	+
∑+	3	0	**1**	5
∑0	4	0	5	3
∑-	**1**	0	2	0
Net Score	2	0	-1	5
Rank	**2**	**3**	**4**	**1**
Continue	√	√	×	√

Note: + = better than 0 = same as

\- = worse than

Result: Study of the concept selection table shows that concept D score the highest net score. Therefore, concept D is the best concept to be fabricated.

From the concept of selection table, the advantages and disadvantages of the design can be outlined. Criteria or characteristics for the product to be fabricated are the important thing to be considered. The important criteria are ease to move, ease to handle, ease to use, ease to fabricate, stability, low cost, durability of the product, and lastly safety of each concept especially for product that should be design.

According to the table, study of the concept selection shows that concept D scores the highest positive signs. Therefore concept D is the best concept to be produce. As we can see on the figure in concept D, the structure frame is more stable compare with others concept. This concept also more durable because it using rectangular hollow steel. The ventilated cat litter box on the concept D more effective and very suitable to use as a cat litter box. Because of all stated above, concept D is the best selection to be fabricate the ventilated cat litter box.

3.8 Computer Aided Design Drawing

After the selected design was choose, now the selected design or concept sketch is transfer to solid modelling and engineering drawing using AutoCAD software. The design is separated into part by part and the dimensioning process is firstly sketched on paper. The dimensioning is base relevant dimensions and also referring to the existing cat litter box. So that the design is fit into others part.

After dimensioning, the engineering drawing of the design is drawn using AutoCAD application. At this stage solid modelling method is used. Part by part solid modelling created according to the dimension done before, after all part created, the 3D model is assembled with each other base on the design below show he actual design of the ventilated cat litter box.

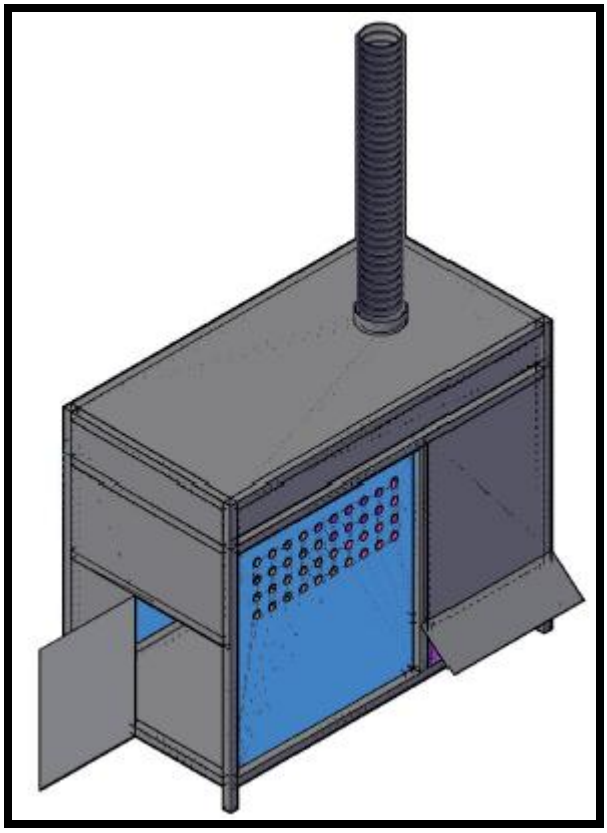

Figure 3.6: Ventilated Cat Litter Box

3.9 Design Specification

Based to the drawing and sketching selection, after generated and evaluated the best concept selection. The concept D is the best design that can be fabricated. Below is the detail product design specification of the concept D.

3.9.1 Material

All the material for the frame or chassis is using rectangular hollow steel. This is type of the beam for the design needed:

T**able 3.2:** Bill of Material

No.	Part	Dimension /length (mm)	Quantity
1	Hollow rectangular bar (20x20x20)mm	500	9
2	Hollow rectangular bar (20x20x20)mm	360	2
3	Hollow rectangular bar (20x20x20)mm	800	6
4	Hollow rectangular bar (20x20x20)mm	700	4
5	Hollow rectangular bar (20x20x20)mm	550	2
6	Hollow rectangular bar (20x20x20)mm	340	2
7	Exhaust Fan	30X30	1
8	Perspex	4X6 feet	3
9	Elastic rubber tube		1

3.10 Fabrication process

Fabrication process is difference from manufacturing process in term of production quantity. Fabrication process is a process to make only one product rather than manufacturing process that focus to large scale production. In the project fabrication process needed to make the all body of ventilated cat litter box, fabrication process was used at the whole process.

In making the design become a real product, several processes have been used to fabricate the ventilated cat litter box, which is;

(i) Measuring: Measuring the material (material) into dimension needed.
(ii) Marking: Mark the material after measuring it.
(iii) Cutting: Cut the material into part according to dimension needed and cutting the specimen to the shape that needed by using Vertical Band Saw Machine.
(iv) Welding: Make some welding to the product.

(v) Joining: Join the entire product to get a shape needed by using rivet tools or join by a screw.

(vi) Grinder: Grinder the product according the shape needed.

(vii) Finishing: File the surface that unneeded and spray the product by using the suitable colour.

3.11 Equipment required

There are a few equipment, material and machine that I use in this fabrication to complete and finish the product (ventilated cat litter box), which is;

(i) Perspex (2.0mm thickness) as a main material.

(ii) Wire - To connect the all electrical component system in apparatus.

(iii) Exhaust Fan system – As an ventilation system.

(iv) Vertical Band Saw Machine – Use to cut Perspex according the shape needed.

(v) Rivet – Use as joining the Perspex with other Perspex to create a door to get the complete product..

(vi) Welding machine – Use an extra joining process to the product.

(vii) Connector – Use to connect the wire.

(viii) Switch – To open and close a complete circuit system.

3.12 Figure of work

(a) **(b)**

Figure 3.7: Cutting process

Figure 3.8: Welding process

Figure 3.9: Joining process

Figure 3.10: Grinding process

CHAPTER 4

RESULT AND DISCUSSION

4.1 Introduction

This chapter is about result and discussion the project encounter before, during and after the project finish. For this part, the result is come from what is the how came after finish the simple of ventilated cat litter box. Besides that, from this chapter is also about discussion. It discusses about the completed fabrication, types of defected, product specification and cause of problem of the project. The analysis also was helped to give improvement of the ventilated cat litter box. It also will show the product defected and how to troubleshoot the defect.

At the same time, this analysis also to compare between of the product specification was target and product specification when completed fabricate. After finish fabrication process, the product has been analyzed. At this stage, all information about this product is collected and gathered. It is important to classify the product before it can be used.

4.2 Result

The Whole Product Review

The complete fabrication of the Ventilated Cat Litter Box is shown on figure below :

Figure 4.1: Isometric view

Figure 4.2: Front view

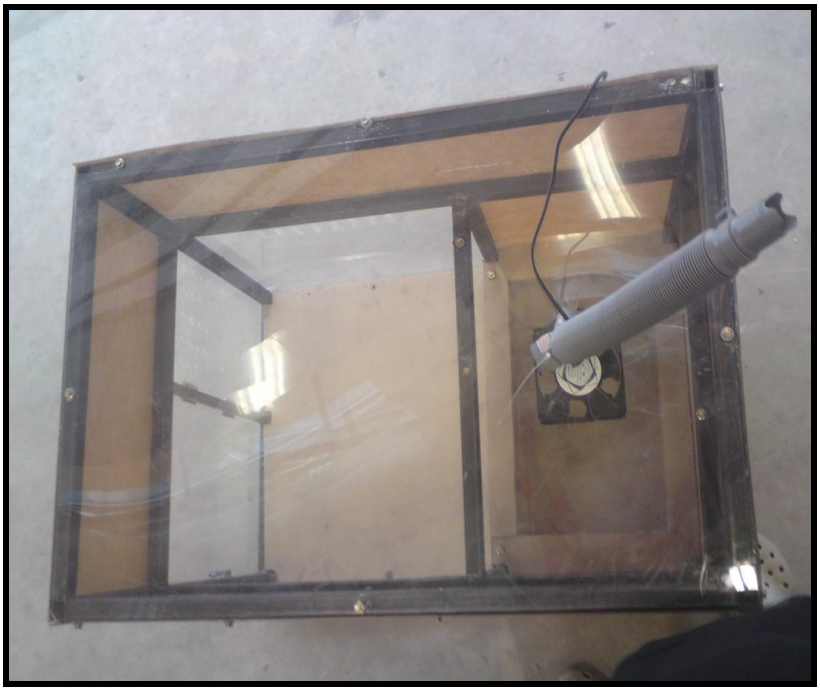

Figure 4.3: Top view

Figure 4.4: Side view

4.3 Product Specification

This is another example of analysis process. The product is classify to several category such as weight, colour, wide, height, and other else. The product specification is shown on table below.

Table 4.1: Product Specification

Categories	Result
Totally Length, mm	850
Totally Width, mm	550
Totally Height, mm	700
Weight, kg	20
Maximum power of Exhaust Fan used, watt	100
Element of ventilated	Exhaust fan
Main raw material	Zinc sheet metal
Colour	Yellow

4.4 Working Hour

Table 4.2 shows the work time those require to fabricate the Ventilated Cat Litter Box during each process.

Table 4.2: Working Hour

Work	Time (days)
Measuring and marking the material	1
Cutting the material	1
Deburring the surface of the part	1
Welding the frame	2
Joining the plastic cover	3
Finishing	1

4.5 Technical of Equipment

There are several specifications that must be considered when using machinery or equipment. When fabricate the Ventilated Cat Litter Box several equipments are used such as floor cutter disc, hand grinding machine, SMAW and MIG welding machine. Below show the specifications each of the equipments:

Table 4.3: Machine Specification

	Hand Grinding Machine	Floor Cutter Disc	MIG Welding Machine
Voltage (V)	240	230-240	240
Ampere (A)	2.9	10	2.9
Frequency (Hz)	50-60	50/60	50-60
Watt (W)	670	2300	670
Rpm (rev/min)	11000	3500	11000
Diameter (mm)	100	355	100

4.6 Purchase Parts

Rectangular hollow steel can find and get in from mechanical laboratory, but some of the material is need to buy such as the thing that doesn't have in mechanical laboratory. So table 4.3 shows the purchase parts:

Table 4.4: Purchasing material

Parts	Price	Quantity	Total
Perspex	RM65.00	3	RM195.00
Ensile	RM1.00	4	RM4.00
Screw	RM0.20	30	RM6.00
Exhaust Fan	RM31.25	1	RM31.25
Elastic Rubber Tube	RM18.00	1	RM18.00

4.7 Discussion

4.7.1 Types of Defected

After finish fabrication process, many types of defected was occur. It happens from fabrication process and the weakness using several machine and tool. At the same time, this event can give someone more experience and knowledge.

4.7.1.1 Appearance

(i) The pattern of weld

The pattern of weld on the frame looks like bubble. This is because the movement of hand together with nozzle is not constant. The movement of nozzle also too slow and it causes the weld metal is too much and no constant.

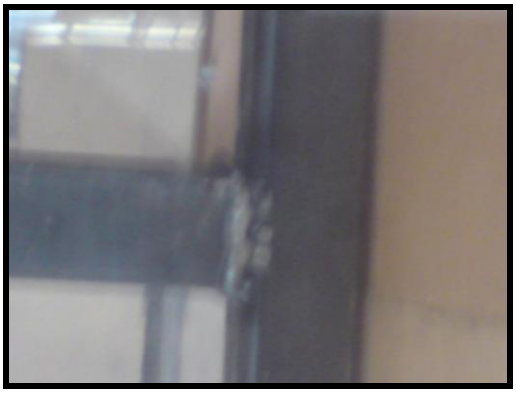

Figure 4.5: Pattern of weld

(ii) Part not joint perfectly

The part not joint perfectly. It shows the frame is not accurate in 90 degree so it causes the frame not perfectly rectangular. It is because the parts not arrange well before start the welding process.

(iii) Sharp edge

The hollow steel is sharp in it edge because it not grinding well. This can causes injury.

Figure 4.6: Sharp edge

4.7.1.2 The analysis of ventilation system

This analysis is about how the ventilated cat litter box is working when the exhaust fan is switch on and how the air is flow is transfer from outside and inside of the box.

(i) When the exhaust fan is ON, the exhaust fan will absorb the air inside the box. It will cause the pressure inside the box absorb the air from outside of the box enter into the box.

Figure 4.7: Intake hole

(ii) The air that has been absorbed by the exhaust fan will flow through it and enter the hole at the roof of the cat box.

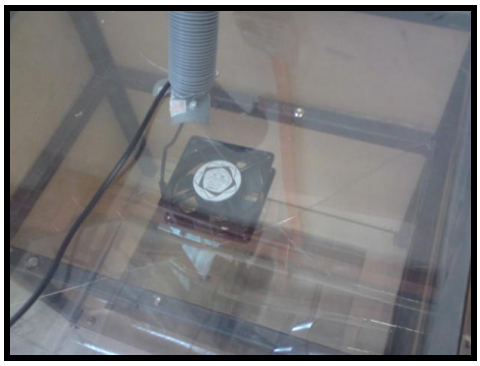

Figure 4.8: Exhaust Fan

(iii) After the air was entered the roof, as we know that when the air is full in the roof box it will go out through a hole that are connected by the elastic rubber tube so that this is the way we can transfer the smell of cat litter.

Figure 4.9: Elastic Rubber Tube

4.7.2 The Project Problems

(i) Literature Review

The problems exist when I get the title of the final year project and how to find information about the Ventilated Cat Litter Box. It also include the material choose and process fabrication for the project. It very hard to decide which material are the best choice and setup the machine to fabricate the product. The main problem is limited resources such as books and internet connection problem

(ii) Designing and Sketching

It is very hard to choose the best design because we don't have any reference as needed. The student had to sketch as many as they can design to make the best design. If the design is totally from student its means that there are no references can be referred. All the drawing and dimension need to generate by student.

(iii) Material Preparation

To prepare the material it is so hard to find the best material that suitable at UMP Mechanical Lab. The rules to get some materials are very tight and entail more procedure. The material also hard to fine and some of the part needed a budget to buy it. The preparation also must follow the schedule to make the product done at the time.

(iv) Fabrication Process

The problem occurs when the joining process and welding process started. It is because it very hard to make the product parallel for each side. MIG welding machine also doesn't have enough quantity for student user.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter will discuss about the problems encountered during the whole project was been carried out. In this chapter also will discuss about the conclusion of the project, and the recommendation concluding all the process involved.

5.2 Conclusion

As a conclusion, overall perception of the project carried out was good. All the objectives of this project are accomplished, which are to design and fabricate the Ventilated Cat Litter Box that is suite to its application especially for welding using SMAW in FKM lab.

Purpose of the diploma final year project is to increase knowledge by searching information in the book or internet and also to increase communication skill like in presentation and after meeting with supervisor every week. Besides that, it can increase student capability to make good report thesis or technical writing and able to doing work with minimal supervisory and more independent.

The aspects that must be considered in designing the Ventilated Cat Litter Box are strength, material needs, safety and etc. Drawing divided two categories, which are

sketching and CAD drawing. Four concepts for the Ventilated Cat Liter Box were developed (shows at chapter 3) and the result, concepts D are been choose.

Most of the material used in this cat litter box is mild steel and most of the type is rectangular hollow steel. But still use another material like Perspex. For rectangular hollow steel, it can be finding and get at (FKM) lab but for the things it perforce to purchase such as Perspex and etc.

After designing phase, comes fabrication process. The process that involved are measuring, marking, cutting, joining, drilling, grinding, welding and finishing. After measured and marked process, the materials is cut by using floor cutter disc and weld the parts by using SMAW or MIG welding machine. But for assembled the Perspex, fastening method is used.

Ventilated Cat Litter Box is a product that functions as a cat house that have the ventilation system apply inside the cat house we called it Ventilated Cat Litter Box. Basically the parts of Ventilated Cat Litter Box are frame, door, frame cover, tube hose, fan and etc. The Ventilated Cat Litter Box will primarily help pet keepers such as cat owner to overcome the smell problem that cause by the cat house. The size of Ventilated Cat Litter Box was measured, which are external length is 850mm, external width is 550mm, external height is 700mm. This Ventilated Cat Litter Box weight is 15kg.

Overall from the result obtain, these project can be conclude as a success project as it achieve the entire objective, which is to design and fabricate a Ventilated Cat Litter Box.

5.3 Recommendation

5.3.1 Facilities

Based on the progress of the project that had been done, so many things in facilities aspects can be improve especially in machining process. At this time, some machine such as (MIG) welding machine are not enough to support student's learning and do project. So the faculty especially must provide more MIG welding machine for student user because the amount of student is increase by a year.

5.3.2 Student budget

Some of the materials also need the student to buy by themselves, such as the material that doesn't have in the mechanical laboratory. As For the budget, the faculty should provide the budget to student at first so they can complete their project without any delay due to costing problem. Precise planning of the work progress will make sure that the project can be done in a shorter time. Excellent time management can guaranty that any of students task to complete in a time as scheduled and will also give them more time to focus on others subject.

5.3.3 Future work

For the future work, overall perception o the project carried out was good. Due to some confusion, my project was started late but still finish on time. If more time given and all the machine in FKM lab can be use, the Ventilated Cat Litter Box will have great feature and more technology. Thus the Ventilated Cat Litter Box was fabricated with light yet high strength material such as Perspex, the Box also has a nicer looks and more ergonomics, to produce more accurate solutions, and thus reduce the cost of manufacturing process. Therefore further research on material used and design is very important. As far as I am concerned, this project has certainly interested me to learn more in this field of engineering.

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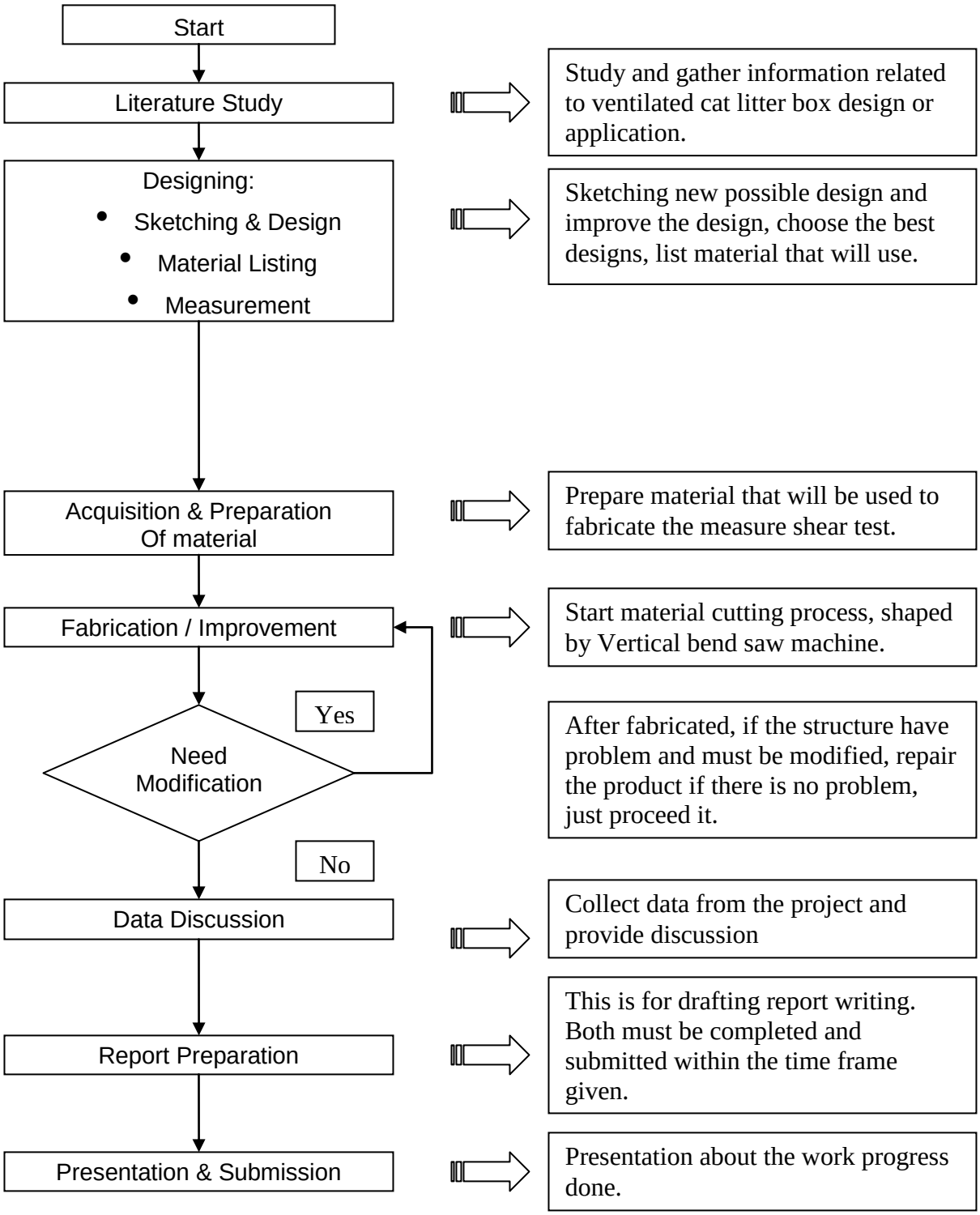
APPENDIX A

BIL	ACTIVITIES	WEEKS													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Choose a title and briefing by supervisor	o													
		x													
2	Draft and search scope with a literature review		o	o											
			x	x	x										
3	Write a objective and problem statement		o	o	o										
				x	x										
4	Sketch and design selection project and discuss with supervisor			o	o										
					x										
5	Choose a final concept and draw using AutoCAD software				o	o									
					x	x	x								
6	Analysis concept and prepare first half presentation						o								
							x								
7	Finalize design						o								
							x								
8	Start fabrication process							o	o	o	o	o	o		
									x	x	x	x	x	x	
9	Write a final report			o	o	o	o	o	o	o	o	o	o	o	
					x	x	x	x	x	x	x	x	x	x	
10	Prepare Final Presentation													o	o
															x

Planning	**o**
Actual	**x**

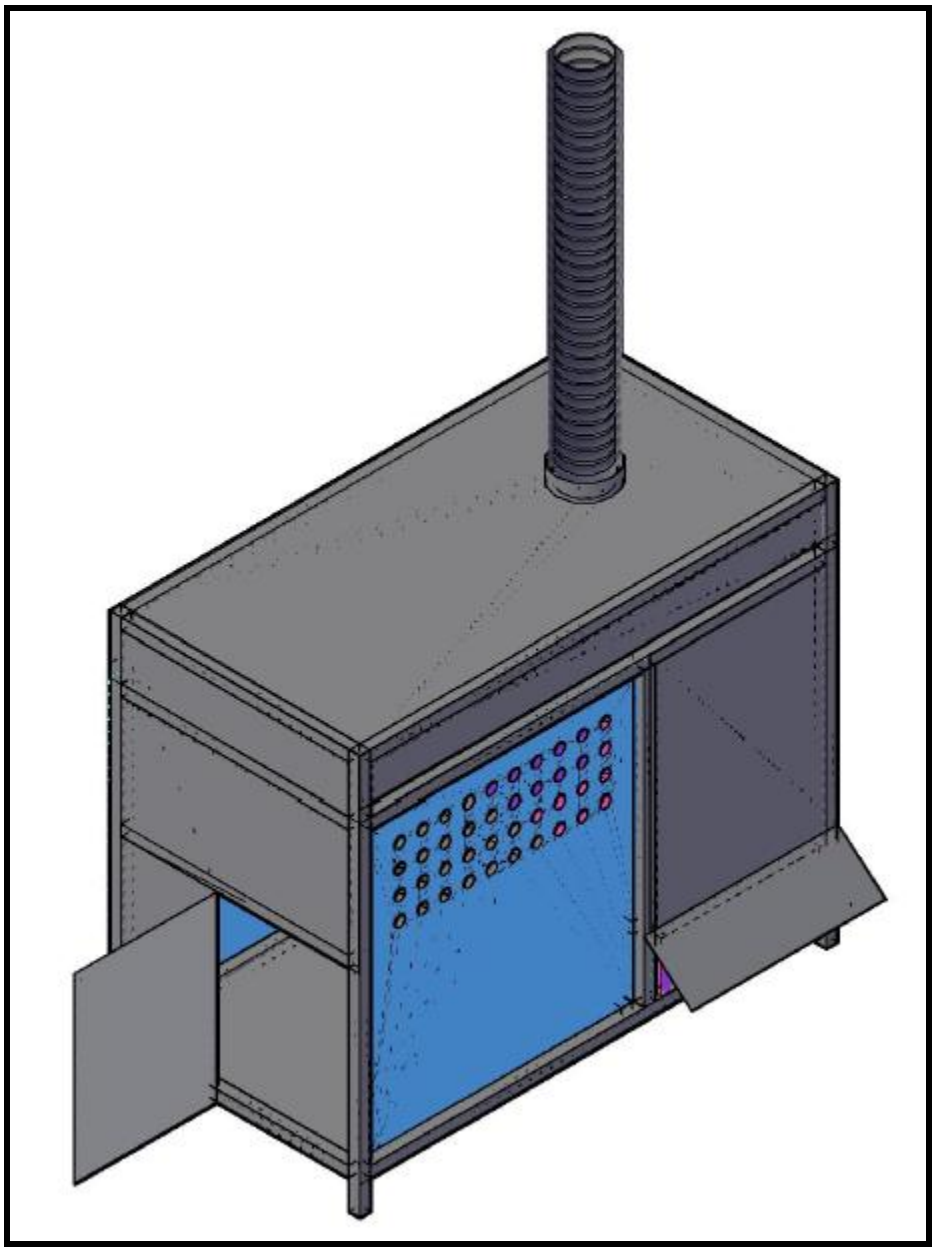
Gantt chart

APPENDIX B

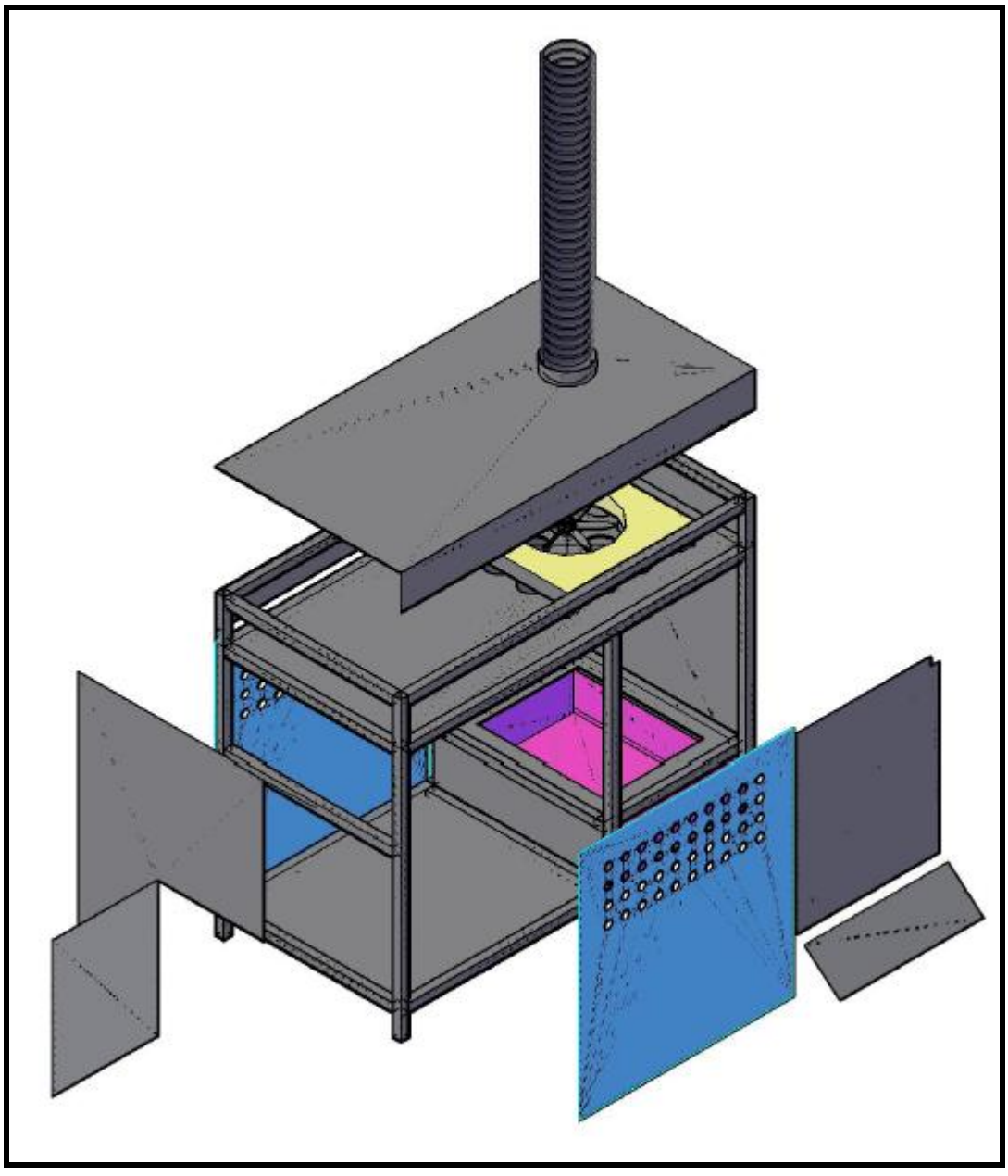


Project Flow Chart

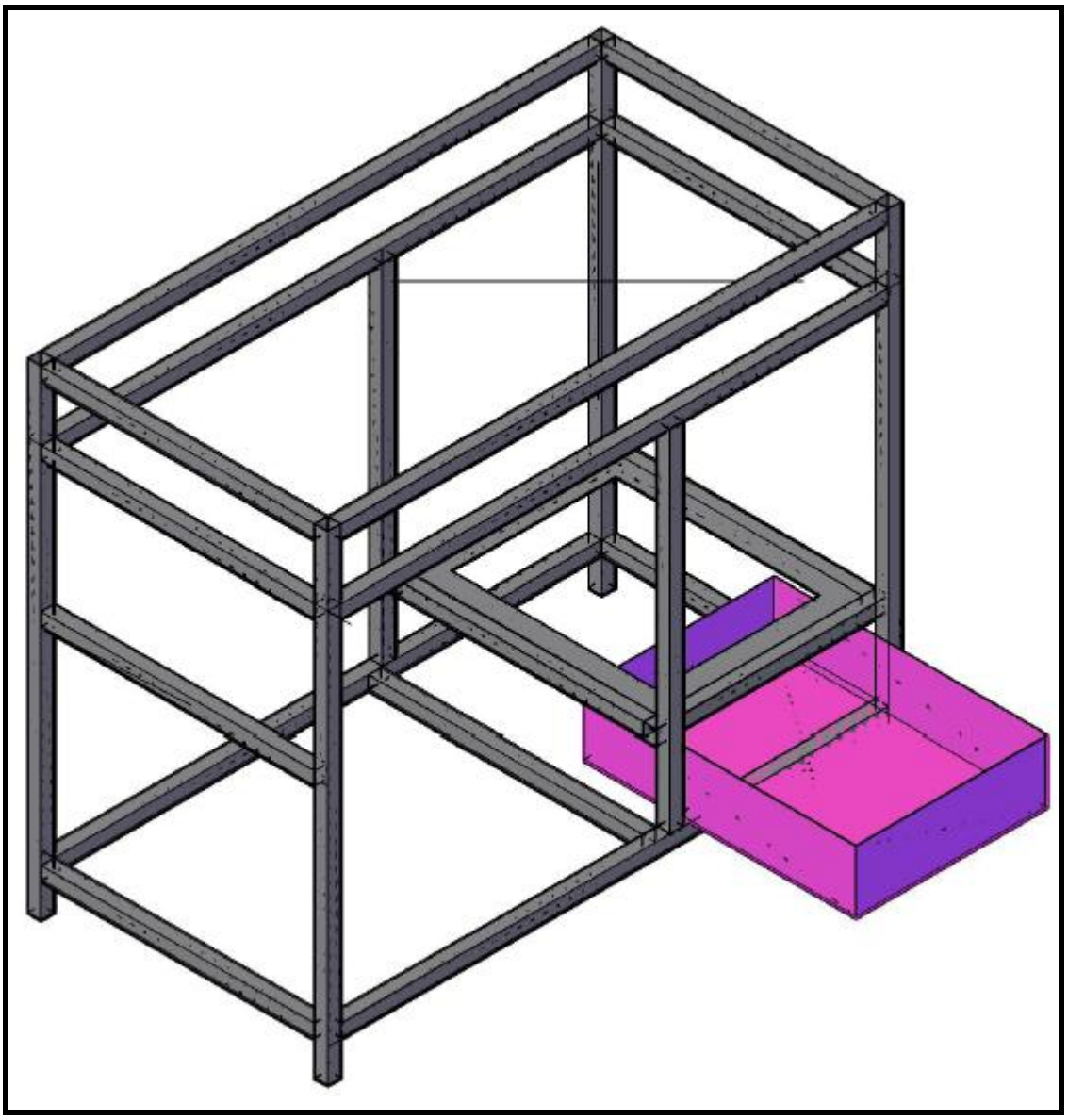
APPENDIX C



APPENDIX D



APPENDIX E



APPENDIX F