POLITEKNIK MALAYSIA
MUKAH

LEAF VACUUM AND SHREDDER MACHINE

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DEPARTMENT OF MECHANICAL ENGINEERING

POLITEKNIK MUKAH

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This report is submitted to the Department of Mechanical Engineering in partial fulfilment of the requirements for graduation Diploma in Mechanical Engineering

"We declare that this report is our own work except each piece that we have explained the source"

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PROJECT REPORT VERIFICATION

This report entitled "**Leaf Vacuum and Shredder Machine**" has been submitted and reviewed as to meet the conditions and requirements of project writing.

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First and foremost, we would like to thank the Institute of Polytechnic Mukah for providing a complete facilities and equipment in the accomplishment of the project.

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ABSTRACT

The project was applied from the observation on how Leaf Vacuum and Shredder Machine were useful in Polytechnic Mukah. There are a lot of trees in Polytechnic Mukah which causes the abundant of dried leaves that litters the ground. One of the conventional method to get rid of the dried leaves in Polytechnic Mukah is usually blow them by blower in one place then raking/swiping then and collect into bags. However, this method takes time and requires major effort. To solve this problem, there is where Leaf Vacuum and Shredder Machine is created. By vacuuming the dried leaves using Leaf Vacuum and Shredder Machine, the work of cleaning up dried leaves easy to implement. This machine also functional to shred the dried leaves until they turns into small pieces of debris. The purpose of shredding the dried leaves that had been vacuum is to reduce the storage of dried leaves. The scopes for this machine are, this machine is for use in small-scare like around Polytechnic Mukah area. The storage space can accommodate about 0.5 x 0.8m size of sack. This machine is only for vacuum and shred the dried leaves and cannot be run in rainy day. In literature review, the products that available in the market is compared to improve the product capability. Methodology research is done to create a planning, selection, flow chart as a guide for fabrication process and design of the machine. A test run is done for data analysis.

ABSTRAK

Projek ini dibuat melalui pemerhatian di mana 'Leaf Vacuum and Shredder Machine" ini amat berguna di Politeknik Mukah. Terdapat banyak pokok di Politeknik Mukah yang menyebabkan banyak daun kering yang berguguran di tanah dan tepi jalan. Anatara salah satu kaedah konvensional untuk membersihkan daun kering di Politeknik Mukah ialah dengan membawanya ke satu tempat dengan mesin "blower" dan menyapu lalu dikumpul ke dalam beg . Walau bagaimanapun, kaedah ini mengambil masa yang panjang. Bagi menyelesaikan masalah ini, "Leaf Vacuum and Shredder" telah dicipta. Dengan vakum daun kering menggunakan "Leaf Vacuum and Shredder", kerja membersihkan daun kering mudah dilakukan. Mesin tersebut juga berfungsi untuk mengisar daun kering sehingga menjadi serpihan yang lebih halus. Tujuan mengisar daun kering selepas divakum adalah untuk mengurangkan tempat penyimpanan daun kering. Mesin ini boleh digunakan di tempat yang berskala kecil sperti di Politeknik Mukah. Tempat penyimpanan dapat menampung kira-kira 0.5 x 0.8m saiz guni. Mesin ini hanya untuk vakum dan mengisar daun kering sahaja dan tidak boleh digunakan semasa hari hujan. Dalam kajian literatur, produk yang terdapat dalam pasaran sekarang ini telah dibandingkan bagi meningkatkan keupayaan mesin yang hendak dicipta. Metodologi dilakukan bagi membuat perancangan, pemilihan, carta aliran sebagai panduan untuk proses fabrikasi dan reka bentuk mesin. Satu ujian telah dilakukan untuk analisis data.

CHAPTER 1

INTRODUCTION

1.1 Introduction

There are a lot of trees in Polytechnic Mukah which causes the abundance of dried leaves that litters the ground. The conventional method to get rid of the dried leaves is usually blow them by blower in one place then raking/swiping them and collect into bags. However, this method takes time and requires major effort. To solve this problem, this is where Leave Vacuum and Shredder machine is created. Problem to be solve are such as:

i. The conventional method such as using rake to collect the dried leaves take to much time.
ii. Using blower make it hard to gather the dried leaves in one place.
iii. Disposing that leaves by burning them causes air pollution.

Hence, with this machine dried leaves can be disposed easily.

1.2 Background of Study/Project

Leaf blowers are widely use to get rid of dried leaves. A leaf blower is a tool that propels air out of a nozzle to move the dried leaves. Leaf blowers are powered by electric or gasoline motors. Leaf blower are typically self-contained handheld units, or backpack mounted units with a handheld wand. These are sometimes called "walk behind leaf blowers" because they must be pushed by hand to be operated.

Leaf vacuum are also not uncommon these day nears to dispose dried leaves. At the center of the vacuum is a small compartment containing a high speed fan, which is connected to intake and exhaust hoses. As the fan spins, air is pushed out of the small compartment and into the exhaust fan. With the air pushed aside, a tiny low pressure area (known as a partial vacuum) is left behind in the compartment. Suction is created when air rushes in through the intake hose to fill this area, and leaves ride this jet of air just like stream of water.

In this project, we create Leaf Vacuum and Shredder with 2 function that is vacuum the dried leaves and shred it into the small piles of debris. As a result, the workers at Polytechnic Mukah do not have to spend hours collecting the leaves or use many bags to pack the collected leaves. This machine works by capturing the leaves, shredding them and bagging them for mulch. The debris then can be recycled to be use as compost. This machine can solve the problem that workers n Polytechnic Mukah faces.

1.3 Problem Statement

Workers usually uses blower or rake to collect the dried leaves. Besides, collecting the dried leaves quite difficult to do and take a long time. Other than that, the way to solve the problem of collecting the dried leaves are more easier and fast by using the methods vacuum and shred. Therefore, leaf vacuum and shredder machine are created for solving this problem.

1.4 Objective of Study/Project

i. Vacuum the dried leaves
ii. Shred the dried leaves until it turn into a small piles of debris

1.5 Scope of Study/Project

i. For use in small-scale like around Polytechnic Mukah area .
ii. Only can be use on the flat area.
iii. Storage space can accommodate about 0.5 x 0.8m size of sack.
iv. This machine is only for vacuum and shred the dried leaves.
v. Cannot be run in rainy day.

1.6 Importance of Study/Project

Normally, leaves vacuum needs bigger storage for the dry leaves because of their size. Our machine works by shredding leaves into smallest pieces which do not need bigger space for storage and easily disposed. One of the advantages of our machine is as the dry leaves already gathered in small pieces they can be reused as compost to help plant grow. Another advantages is this machine could save a lot of time, the usual operation of a leaf blower usually involve gathering dry leaves on a spot and then they are collected into the storage like bag or plastics manual by using rakes. Our machine vacuum the dry leaves directly into the storage.

1.7 Definition of terms / Operations

Our machine is powered by gasoline where as it inhale the dried leaves on the roadside. The machine uses a 5-horsepower engine @ 3000 rpm to rotate the propeller. When the propeller is rotate, it is produce vacuum to suck the dried leaves through the nozzle into the impeller then it get shredded by the shredder teeth of the blades before they are gathered in the storage. The maximum amount of dry leaves that can be stored is approximately according the size of given sack/bag . These collected dry leaves that had been shredder can be recycled to be use as compost

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The literature review is important and essential in the production of our design to fit the objectives of the project. This research ensures that the product produced is not identical or duplication of the product existed in the market. The data collected gives an idea to determine the best way for the product to function and run properly and without any problem. The materials, equipment or techniques that are used to produce a design that is more effective than the previous design.

Research and survey of the product in the market and article is important to understand the problem faced by the product and the reason for the product to be in demand. From the research, we are able to understand the function of each of the design of the product that will affect the performance also reduce the problem that may encounter in the course of the production process. This will help in the terms of creating a new idea or concept in the production of the project. Data and research have been collected to identify and have a better understanding of the flow and function of the product. Through these, research and data collection we can produces a good quality, more effective product that fulfill the satisfactory of users

2.2 Concept and Theory

According to the amount of dried leaves around the roadside of Polytechnic Mukah, the production of Leaf Vacuum and Shredder machine is needed. Workers in Polytechnic Mukah usually face the problem of having too many dried leaves during fall when the trees shed their leaves. This makes disposing all these dried leaves a challenge since it requires several bags or huge space to keep the leaves. This machine works by collecting the leaves and shredding them to a smaller piles which is easily stored and easily disposed. These smaller pile of leaves also can be recycled to turn into compost to fertilize plants.

According to the conditions of the area, the Leaf Vacuum and Shredder machine is necessary. We had design our machine which is walk behind type because it is easier to use at the roadside of Polytechnic Mukah. Its called by "Walk Behind" because it must be pushed by hand to be operated. It also designed with the hose that are removable from the nozzle, so it can vacuum in places that are difficult to clean such as under the tree.

The biggest advantage of our machine is it uses motor that is powered by gasoline because it is more powerful than using electric. If the volume of dried leaves that is going to be vacuumed are large, it is important to use gas to operate the machine. Another plus is that our machine do not need to plug the machine into an outlet when using a gas powered machine.

2.2.1 How to use Leaf Vacuum and Shredder Machine

1 Turn on the machine

The propeller start to move right away after the button is push so just on the button only when in use.

2 Vacuum the dried leaves

The propeller create the vacuum to vacuum the dried leaves.

3 Shred the dried leaves

The dried leaves get shred once they make contact with the blade of the propeller.

4 Storage for the dried leaves

The small debris are store in the removable storage.

2.3 Earlier studies

2.3.1 Leaf Blower

Before this, the workers of Polytechnic Mukah had been using blower to gather the dried leaves at one place before they collect the dried leaves using rake into a bag. A blower is a tool that propels air out of a nozzle to move the dried leaves and cutting grass. Leaf blower are powered by electric or gasoline motors. Gasoline models have traditionally been two-stroke engines, but four-stroke engines were recently introduced to partially address air pollution concerns. Leaf blowers are typically self-contained handheld units, or backpack mounted units with a handheld wand. Some units can also suck in leaves and small twigs via a vacuum, and a shred them into a bag.

The leaf blower was invented by Dom Quinto in the late 1950s. It was originally introduced to the United States as part of an agricultural chemical sprayer. Shortly there after manufacturers discovered that many consumers were removing the chemical dispensing parts from the device, leaving only the blower behind. Manufacturers then saw the potential of their invention as a common lawn and garden maintenance tool. Drought conditions in California facilitated acceptance of the leaf blower as the use of water for many garden clean up tasks was prohibited. Leaf blowers also save time compared to a broom. By 1990, annual sales were over 800,000 in the US and the tool had become a ubiquitous gardening implement.

Other functions beyond the simple use of garden maintenance have been demonstrated by Richard Hammond on the Brainiac television series, in which a man sized hovercraft was constructed from a leaf blower. Being both portable and able to generate wind speeds of between 140–270 miles per hour (63–121 m/s) and air volumes of 14 m^3 per minute, the leaf blower has many potential uses in amateur construction projects.

Figure 2.1 Hand Held Leaf Blower

Figure 2.2 Backpack Leaf Blower

2.3.2 Leaf Mulcher/Shredder Machine

Leaf Mulcher/Shredder machine is the one of the product in the marketing other than the leaf blower. This machine is only function to shred the dried leaves. Using this machine, you need to gather the dries leaves first into huge piles and then putting the piles into the Leaf Mulcher machine. The machine will shred the dried leaves into the small piles of debris.

Figure 2.3 Leaf Mulcher/Shredder Machine

2.4 Summary of Chapter

In terms of design, we took a few products from the market to give us some ideas on how to design our own product with full modification and addition. We try as much as we can to avoid making duplicate of marketed product. From this research and study we can have learn some ways on how does each of the mechanism work also the possibilities for improvement along with solutions to fix each of the product disadvantages.

Besides, this research has helped us to decide on how project product will look like and function. It also gives us some consideration on the surrounding, limitation and consumer demand on the product. We have learned the marketing view of the product where finally able to decide the design of our product according suitable with our scope.

CHAPTER 3

METHODOLOGY

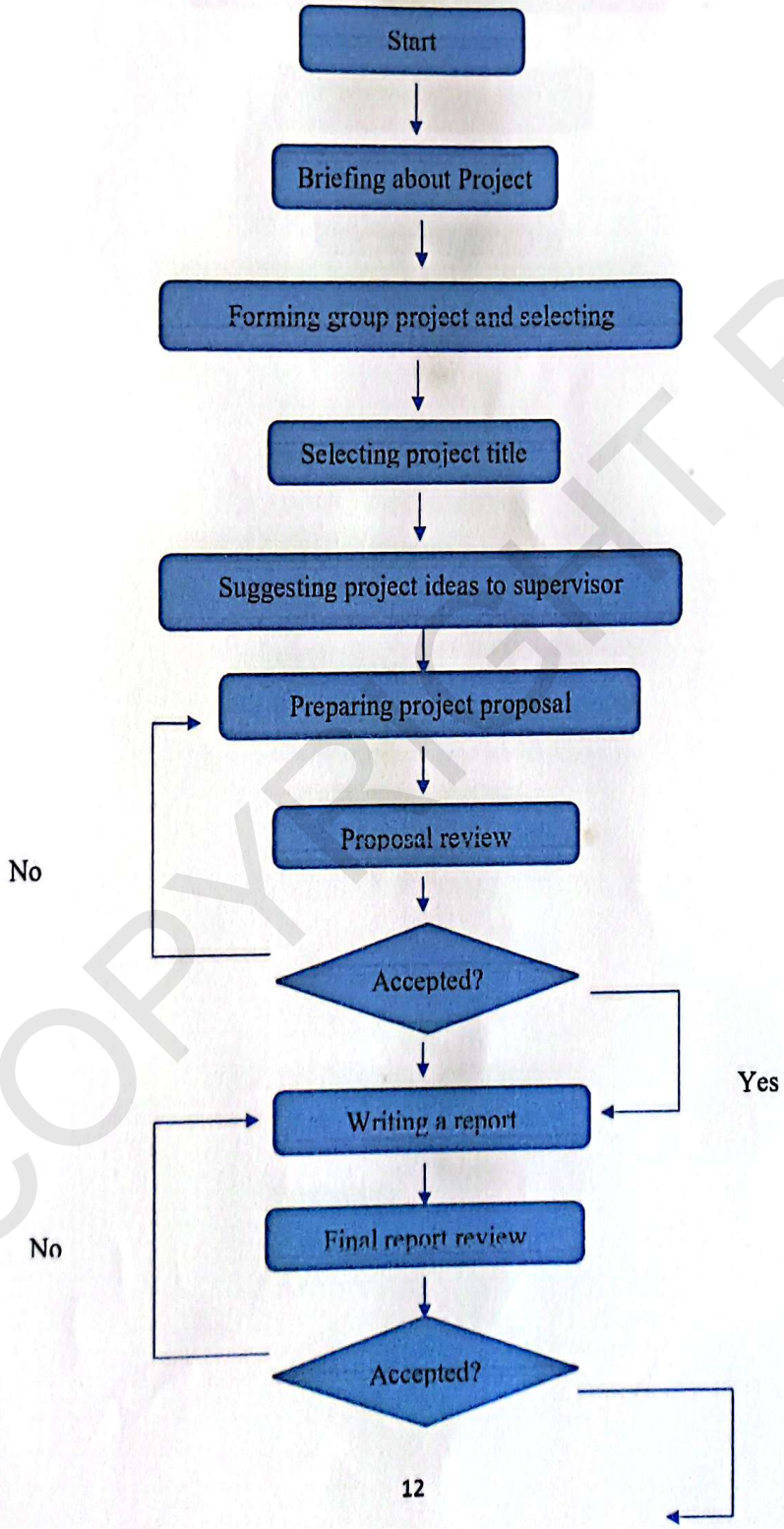
3.1 Introduction

Methodology research is referring to the most suitable method used to carry out a research to determine the most effective procedure and process to answer the problem of the research. This chapter consists of introduction, design research, research instrument, analysis data method and conclusion. The subtopic of the chapter depending on the project types. Most of the research might need a further discussion in detail about the design and research instrument.

Basically methodology is an interpretation in detail the flow, process and research done in order to produce a product. The reason methodology are required is so that the objectives and goal that had been set by the student are able to be achieved by the end of the course. The research method of the project are divided into a few stages where the first stage is having a discussion with supervisor to identify the types of project that are going to be presented according to theme given which is "Controller"

The design and procedure of making the product are stated in detail and arranged accordingly in the right order. This shows the method used and ways the on how the product is able to function based on proper selection and brainstorming. All the small details are put into consideration as it will effects the performance of the product. Each of the development of the processes are stated in order for better understanding of what is the production processes are going through in order to finally finished the product.

3.2 Project Planing (Flow Diagram)



Yes

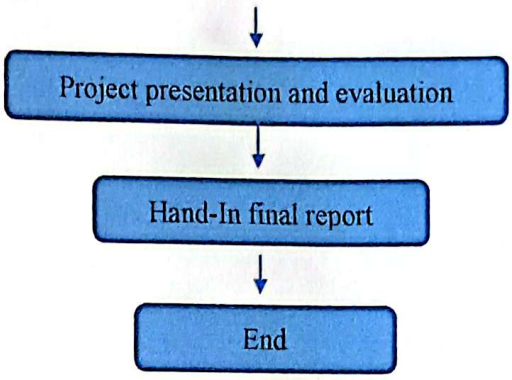


Figure 3.1 Project Planning Chart

3.3 Project Design

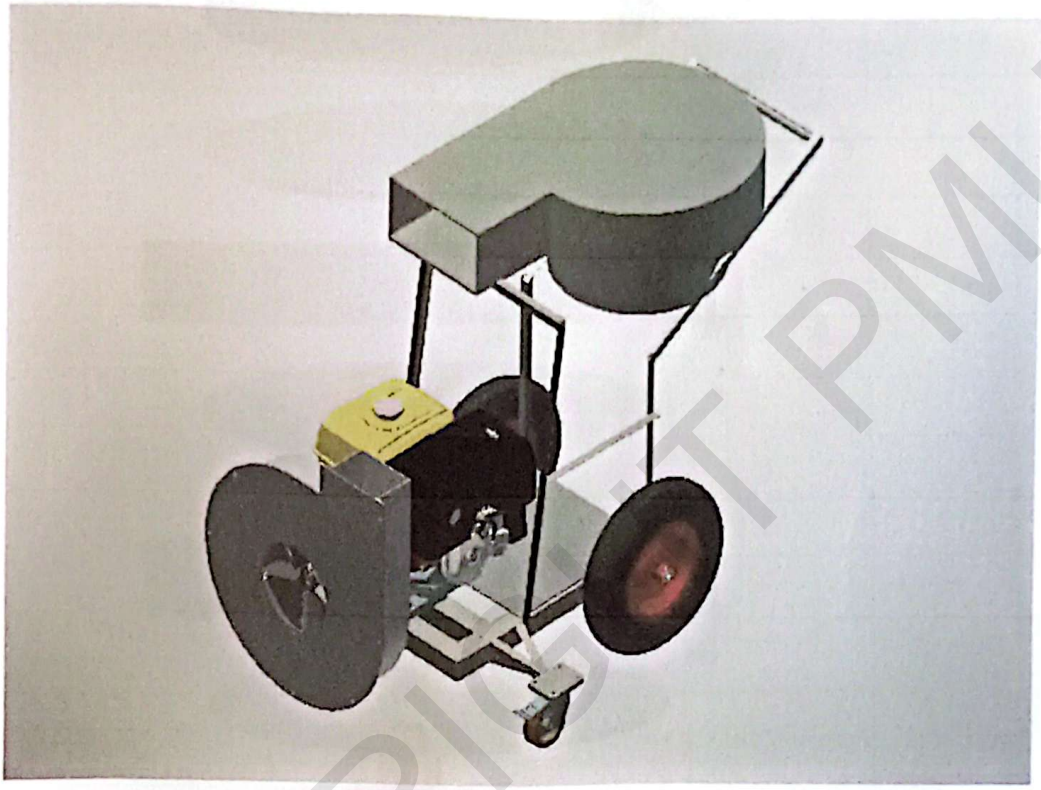


Figure 3.1 Design Project

3.3.1 Design Flow Process

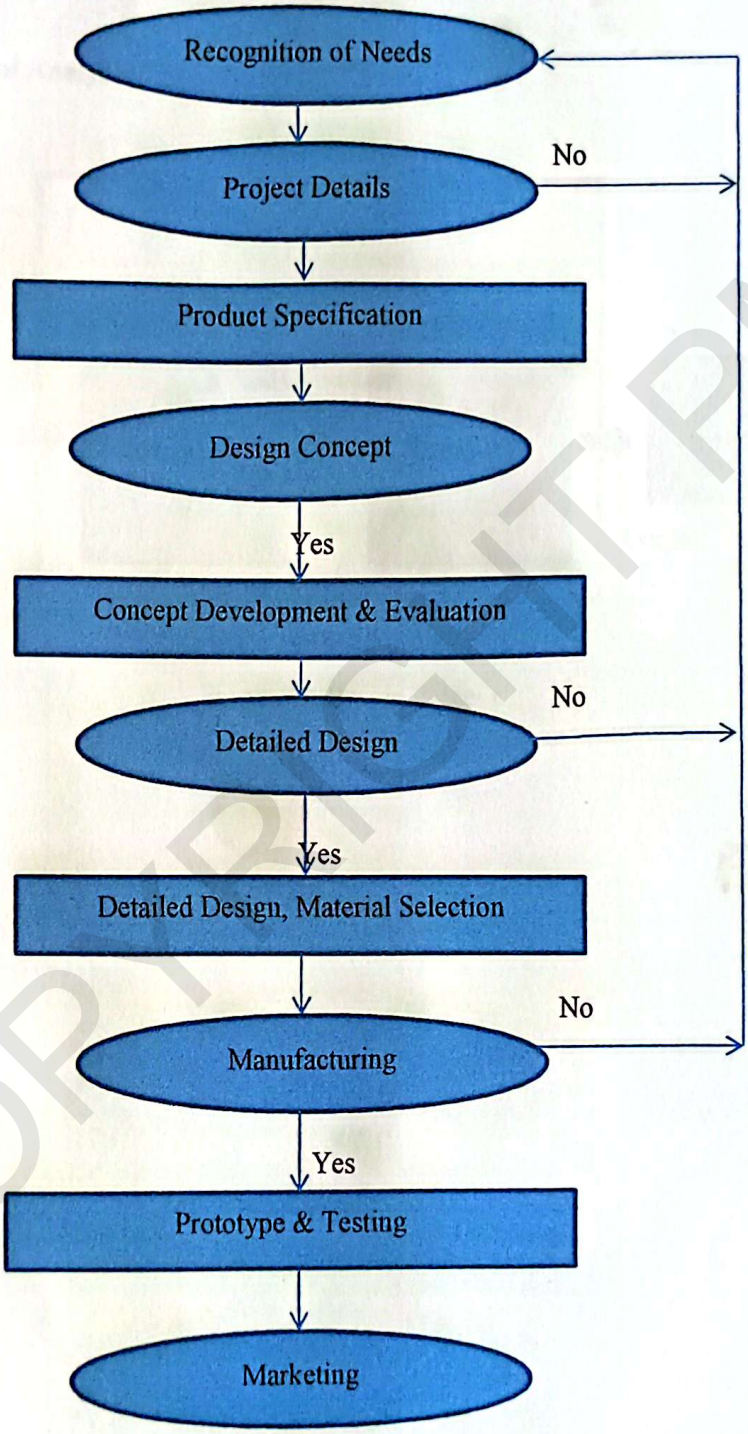


Figure 3.3 Design Flow Chart

3.3.2 Concept Generation

1. **Functional Analysis**

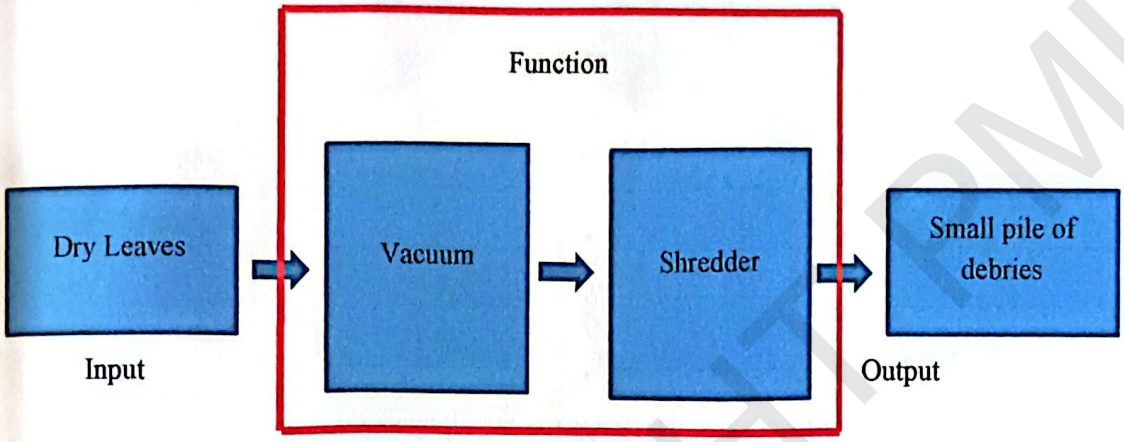
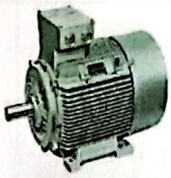
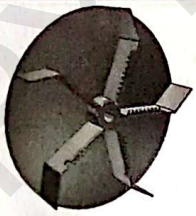
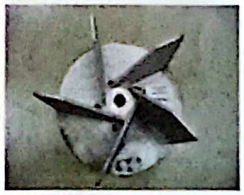


Figure 3.4 Design Process

2. Morphology Diagram

Table 3.1 : Morphology Diagram

Concept	Option 1	Option 2	Option 3
Type of engine	 Gasoline engine	 Electric motor	
Type of back wheel		 Flat Free	
Type of front wheel			
Type of impeller			
Storage			

3. Concept Evaluation

Table 3.2 : Pugh's Method

No.	Criteria	Weight	Option 1	Option 2	Option 3
1.	Size	6	+	+	+
2.	Function	5	+	+	-
3.	Cost	2	-	-	+
4.	Easy to Attach	6	+	+	+
5.	Easy to Dettach	6	+	+	+
6.	Long Life	8	+	-	-
7.	Light Weight	3	-	+	+
8.	Sharpness	10	+	-	-
9.	Power	9	+	+	-
	Total -		2	3	4
	Total +		7	6	5
	Overall Score		5	3	1
	Overall Weight Score		45	15	-15

3.3.3 Design Specification

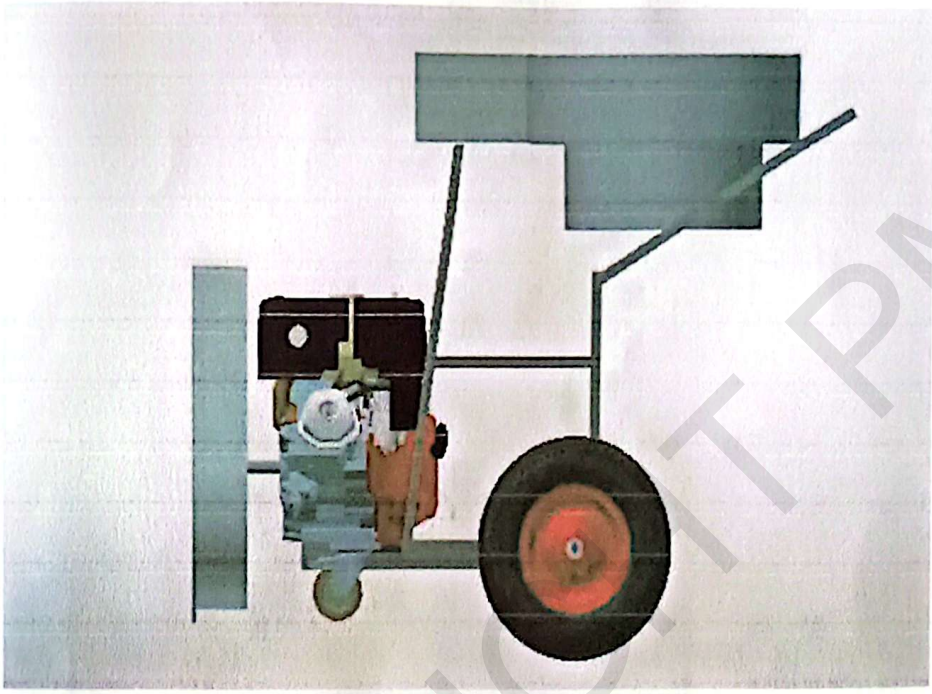


Figure 3.2 Side View

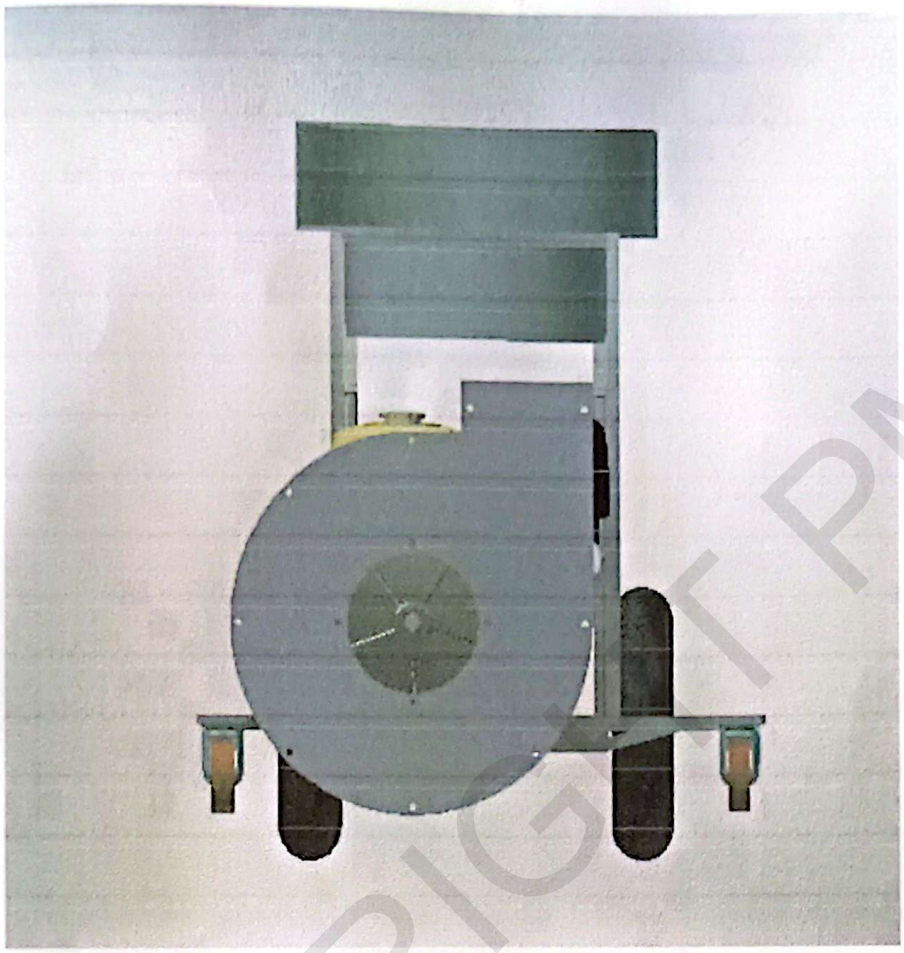


Figure 3.3 Front View

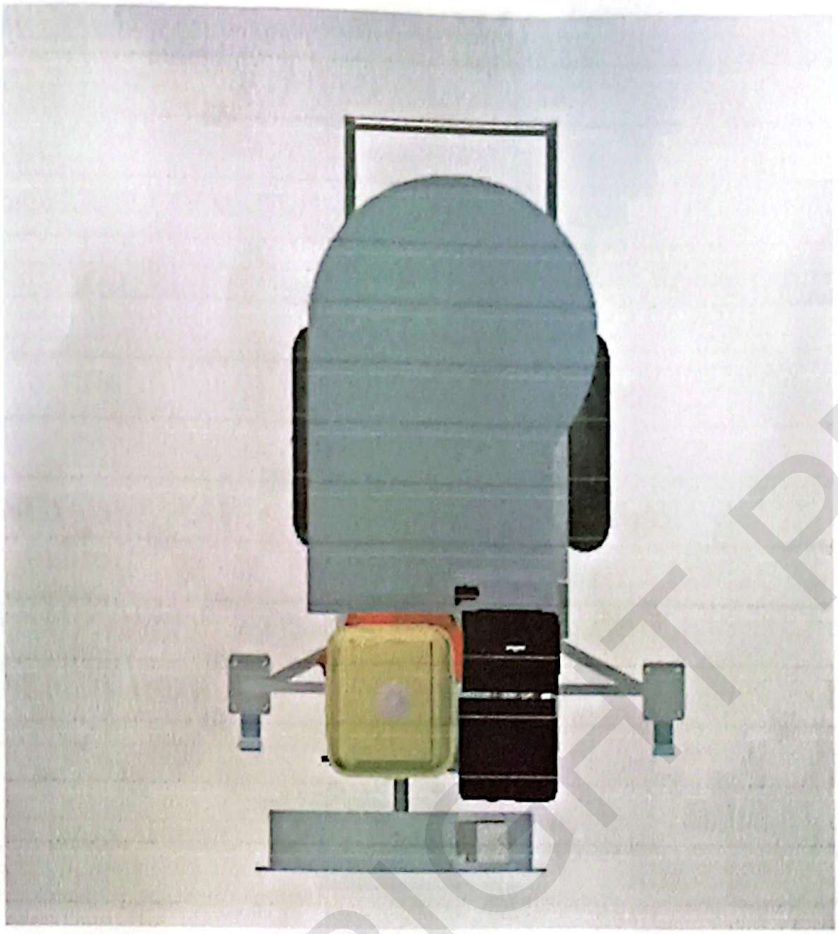


Figure 3.4 Top View

3.4 Design Consideration (Cost, Safety, Ergonomic)

1. **Cost**

Table 3.3 : Bill Of Material

No.	MATERIAL	UNIT COST	TOTAL COST	QUANTITY
1.	HOLLOW SECTION MILD STEEL	RM25	RM25	3m
2.	MILD STEEL PLATE 6m	RM180	RM180	2 unit (750mm x 750mm)
3.	HOLLOW TUBE PIPE 2m	RM15	RM15	1 unit
4.	BOLDS AND NUTS	RM6	RM6	1 box
5.	WHEEL	RM165	RM330	2 unit
6.	BACK WHEEL	RM30	RM60	2 unit
7.	NET	RM5	RM10	1 unit (2m)
8.	HOSE	RM20	RM20	4in x 10ft
9.	FIBER GLASS	RM21	RM42	430g
10.	RESIN	RM22	RM66	3 bottles
11.	ENGINE	RM 476	RM476	1 unit
12.	PLYWOOD	RM45	RM90	2 unit (8ft x 4ft)
Total = RM1320				

2. **Safety**

   i. The propeller are not exposed; it is located in the body.

      The propeller is covered.

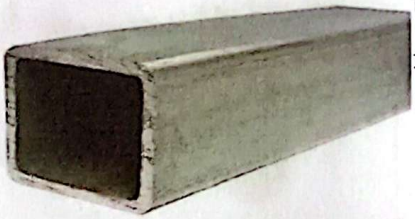
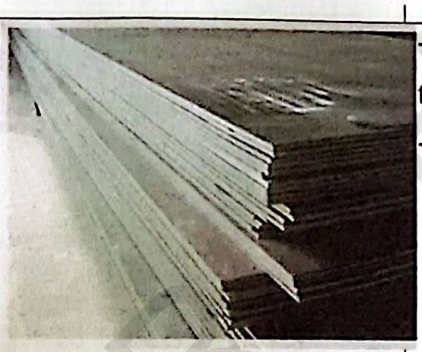
3. **Ergonomic**

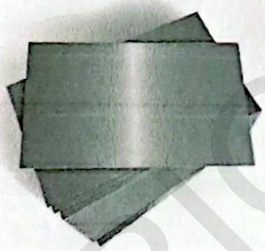
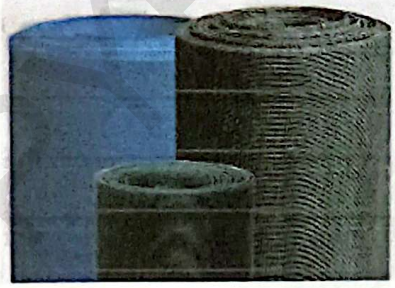
   i. Rubber hand

3.5 Material Selection

3.5.1 Function

Table 3.4 : Material Selection

NAME	DIAGRAM	Function
1. Hollow Section Mild Steel		Used to create the mesh frame of the body
2. Mild steel plate 6m		-To mold the body over the base. -To fabricate the impeller.
3. Round Bar Mild Steel		To make shaft
4. Bolt and Nuts		To connect the metal plate

5. Wheel (contain brake)		To move the machine
6. Hollow Tube Pipe 1.6m		To be use to fabricate the handle for the machine
7. Aluminium Sheet 1.6		To cover the inner part of vacuum
8. Net		To prevent the dried leaves from blow out as the air vents out

`9. Fiber Glass		To fabricate the vacuum case and nozzle

3.5.2 System Analysis

A gasoline is a type of internal combustion engine that burns gasoline for fuel. It uses a spark ignition system to generate an electrical charge with spark plugs that ignites the fuel and air inside a cylinder resulting in fuel combustion. The fuel is then heated and expands inside the cylinder, generating mechanical energy.

In gasoline engine, the fuel and air are premixed before compression occurs. This is how gasoline engines differ from diesel engines, another type of internal combustion engine, in which the air is first compressed and then the fuel added at the end of compression stroke.

3.5.3 Manufacturing Process

Table 3.5 : Manufacturing Process

No of step	Figure	Description
1.		Welding -Weld the hollow section mild steel to create the mesh frame of the body.
2.		Grinding -Grind the blades to get a smooth surface.
3.		Cutting -Cut the plywood to make the casing of vacuum cover and storage cover.

4.		Coating =Vacuum cover and storage cover are coating by fiber glass.
5,		Assemble -Assemble all the parts into the frame.

3.6 Summary of Chapter

The planning and process to create a product have been shown and stated in detail. The types of material, design, cost and material selection of the product design have been made. A design has been selected and discussed ways of how the product will function are stated.

CHAPTER 4

RESULTS

4.1 Introduction

In this chapter the results of the data analysis are presented. The data were collected and then processed in response to the problem posed in chapter 1 of this dissertation. The results are being collected by using Leaf Vacuum and Shredder Machine, the work of cleaning up dried leaves easy to implement and the purpose of shredding the dried leaves that have been vacuum is to reduce the storage of dried leaves. Data analysis are recorded by reading in 3 times of the machine to vacuum and shred the dried leaves.

4.2 Data Analysis Result

Table 4.1 : Data Result

Times (min)	Weight of Leaves (kg)
15	1
30	1.5

4.3 Summary of chapter

Data analyses are done by running a test run on the machine. The data from a test run are recorded in order to be analysed. The result will effect the objectives of the project and this data could act as a proof that the product has achieved its objectives.

CHAPTER 5

CONCLUSION

5.1 Introduction

This chapter is concludes the overall chapter of this report. It includes the discussion, conclusion and recommendation of the project. Conclusion is made based on the overall process and result of the project after it is done.

5.2 Discussion

In general, we have change a little bit on our project design for some purpose. First problem that we have absorbed was the front part of the machine are too heavy. Before this, we only used plywood as a base. Then we changed it to mild steel plate to gain the weight at the back part. We also elevate the front part so that it can support the load.

Other than that, we do not has the large nozzle. So that we replace with the flexible hose. The flexible hose has it own advantage. The hose can be easier to vacuum the dried leaves at the place that difficult to clean such as under the trees.

5.3 Recommendation

As what we have absorbed on our project, there is some improvement that should be applied. First, the impeller is too heavy. We want to make it more lighter because it can easier to vacuum the dried leaves.

Next, we want to make the larger nozzle where the hose is remover from the nozzle. It can be easy to vacuum the dried leave on the roadside or wide area. While when we want to vacuum the dried leaves at the difficult place, we can vacuum it using hose.

Less but not least, we want to install the emergency button for safety. If there is accident happen, we can just press the emergency button.

CONCLUSION

It can be concluded that this project is success. We had done a test run where the machine is accomplished the objective that is to vacuum the dried leaves and in the same time shred it into the small pieces. It can be proved from the video that we recorded.

REFERENCES

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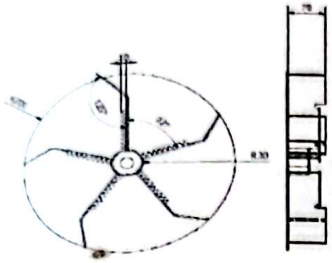
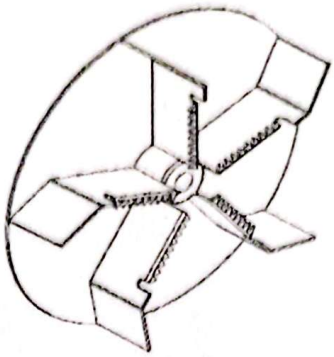
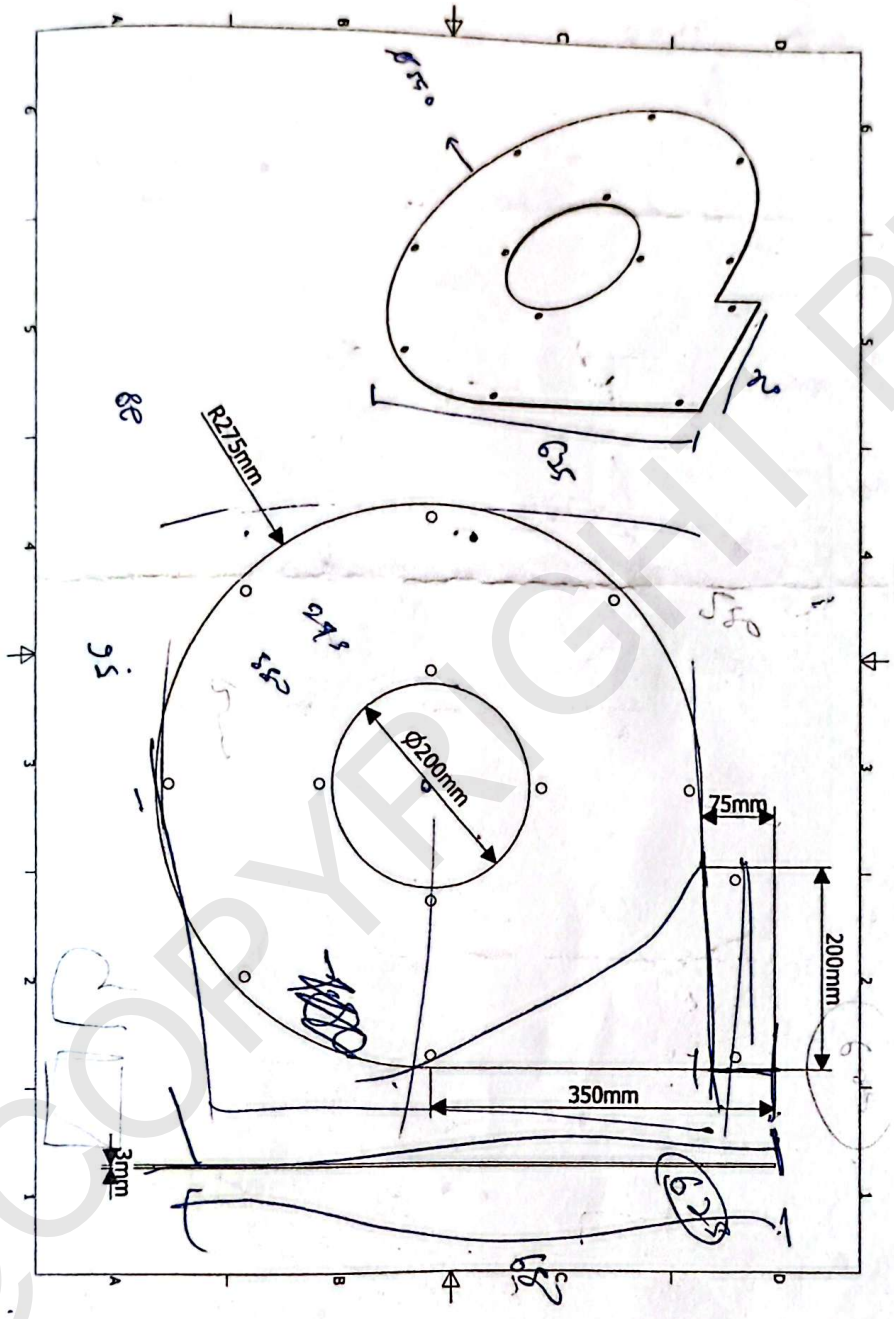
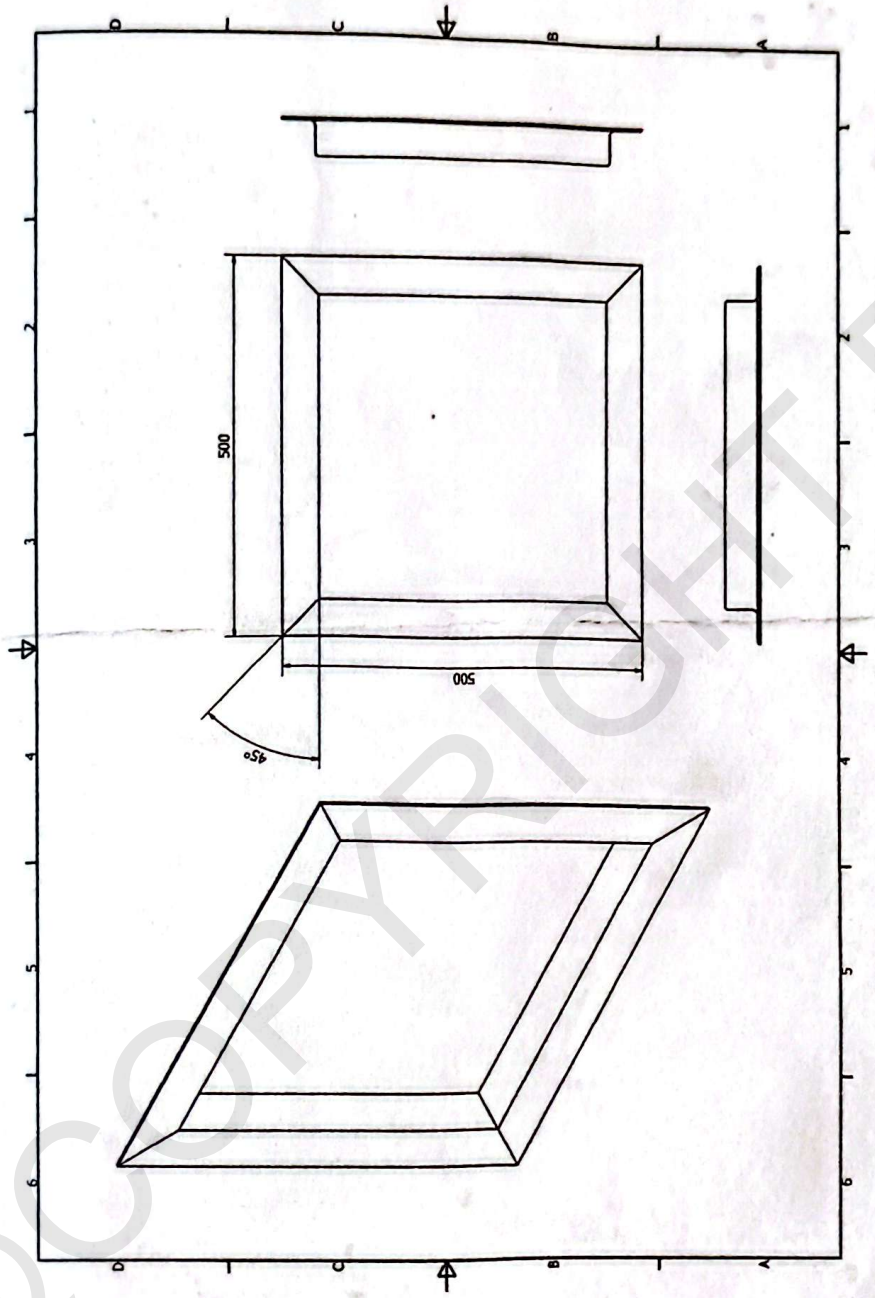
3. Matthew (September 6, 2013) "In Lawn Care, Lawn Care Products, Lawn care Tips Lawn Care, Lawn Care Products, Lawn Care Tips 0" http://blog.lawneq.com/category/lawn-care-tips/
4. Chainsaw Journal (July 2, 2016) "Hitachi Leaf Blower – RB24EAP / Best Leaf Blower" http://www.chainsawjournal.com/hitachi-leaf-blower/

APPENDIX









POLITEKNIK MALAYSIA
MUKAH

MECHANICAL ENGINEERING DEPARTMENT

GANTT CHART
CODE: DJJ6143
COURSE : PROJECT 2

SESSION: JUNE 2017

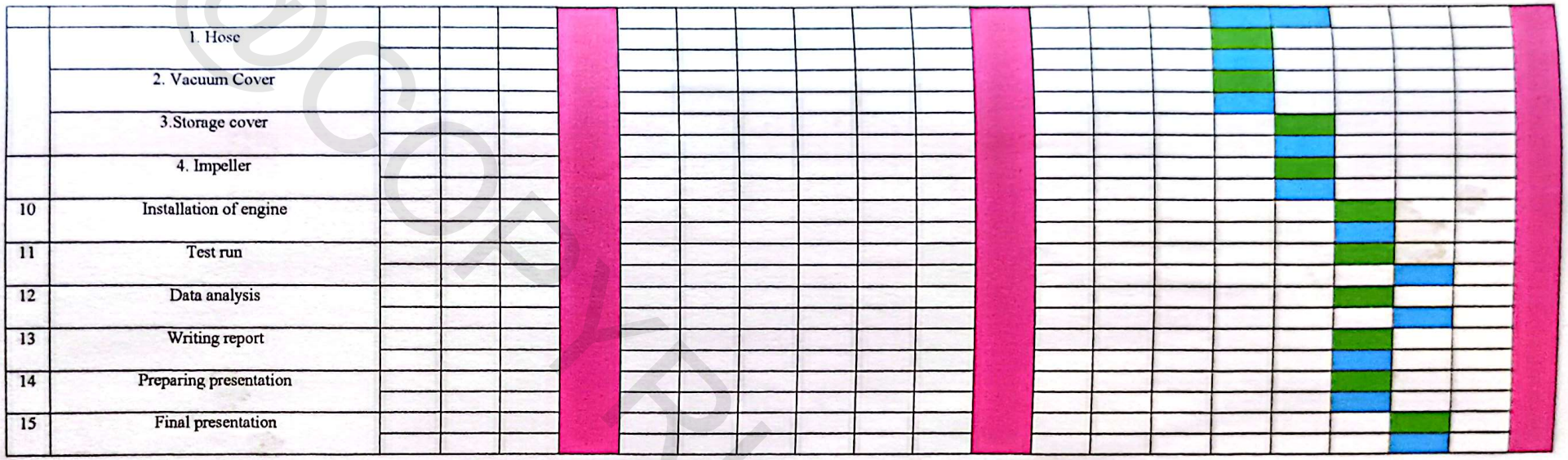
	JUNE				JULY				AUGUST			SEPTEMBER						OCTOBER		
	REG	W1	W2		W3	W4	W5	W6	W7	W8		W9	W10	W11	W12	W13	W14	W15	W16	
M	5	12	19	26	3	10	17	24	31	7	14	21	28	4	11	18	25	2	9	16
T	6	13	20	27	4	11	18	25	1	8	15	22	29	5	12	19	26	3	10	17
W	7	14	21	28	5	12	19	26	2	9	16	23	30	6	13	20	27	4	11	18
T	8	15	22	29	6	13	20	27	3	10	17	24	31	7	14	21	28	5	12	19
F	9	16	23	30	7	14	21	28	4	11	18	25	1	8	15	22	29	6	13	20
S	10	17	24	1	8	15	22	29	5	12	19	26	2	9	16	23	30	7	14	21
S	11	18	25	2	9	16	23	30	6	13	20	27	3	10	17	24	1	8	15	22

	Activities/tasks
1.	Registration week
2.	Project 2 briefing
3.	Planning
4.	Measuring the items
5.	Cutting the items
	1. Mild Steel for base
	2. Mild Steel Plate for impeller and blades
	3. Plywood for casing
6.	Making a shaft
7.	Welding
	1.Base
	2. Frame
8.	Coating with fibre galass
9.	Assemble the items

SPECIAL BREAK

MID SEMESTER BREAK

SPECIAL BREAK II & FINAL EXAMINATION JUNE 17



: PLANNING

: ACTUAL