



FINAL YEAR PROJECT REPORT

MECHANICAL LAWN MOWER

MECHANICAL ENGINEERING DEPARTMENT

DATE: 27 NOVEMBER 2020

CLASS: DKM5C

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sebagai memenuhi sebahagian syarat penganugerahan Diploma
Kejuruteraan Mekanikal**

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II

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sebagai penyelia projek pada tarikh:

III

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Alhamdulillah, In the name of Allah the most gracious and the most precious, first and foremost, I would like extend our deepest praise to Allah SWT who given us the patient, strength, determination, obstacle that helping us to think wisely in making a decision and courage to completed this project . Next, we would like to thank the Polytechnic Sultan Salahuddin Abdul Aziz Shah for giving us the opportunity to produce this proposal by providing facilities such as a library to enable us to obtain reference material related to our subject under the Project 1 subject.

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ABSTRACT

This project is a mechanical lawn mower. This machine has blocks and wheels, in which there are blades that will serve as lawn movers when push. For the convenience of the user, the handle is fixed to the body and can be adjusted to desired height. Although the mechanical lawn mower was the first version when the lawn mower was created, what is interesting here is that we will created a portable lawn mower suitable for use by housewives or smallholders. One of the problem is the existing machine its generator motor which takes a long time to turn on and using a fuel. Next, the objective of this research is to create a mechanical lawn mower with improve the machine without use fuel. The study of methodology is careful planning throughout this semester. To facilitate the implementation of the final project, the methodology must be set as best as possible. Based on the research findings, it can ease a human burden. This mechanical lawn mower can be folded and stored in an available bag. Finally, the suggestion is that every innovation we make must have its own approach and benefits, so our idea to create a mechanical lawn mower is a good idea.

ABSTRAK

Projek ini adalah mesin pemotong rumput mekanikal. Mesin ini mempunyai blok dan roda, di mana terdapat bilah yang akan berfungsi untuk memotong rumput semasa menolak. Untuk kemudahan pengguna, pemegangnya dipasang pada badan dan boleh disesuaikan dengan ketinggian yang diinginkan. Walaupun mesin pemotong rumput mekanikal adalah versi pertama ketika mesin pemotong rumput dibuat, apa yang menarik di sini ialah kita akan membuat mesin pemotong rumput mudah alih yang sesuai untuk digunakan oleh suri rumah atau pekebun kecil. Salah satu masalahnya ialah mesin yang ada motor penjana yang memerlukan masa yang lama untuk menghidupkan dan menggunakan bahan bakar. Seterusnya, objektif kajian ini adalah untuk membuat mesin pemotong rumput mekanikal dengan memperbaiki mesin tanpa menggunakan bahan bakar. Kajian metodologi dirancang dengan teliti sepanjang semester ini. Untuk memudahkan pelaksanaan projek akhir, metodologi mesti ditetapkan dengan sebaik mungkin. Berdasarkan hasil kajian, ia dapat meringankan beban manusia. Mesin pemotong rumput mekanikal ini boleh dilipat dan disimpan di dalam beg yang ada. Akhirnya, cadangannya adalah bahawa setiap inovasi yang kita buat mesti mempunyai pendekatan dan faedah tersendiri, jadi idea kita untuk membuat mesin pemotong rumput mekanikal adalah idea yang baik.

VI

CONTENT

CHAPTER	CONTENT	PAGES
	<ul style="list-style-type: none"> • Front Page • Declaration Of Ownership And Copyright • Acknowledgement • Abstract • Abstract (Malay Version) • Contents • List Of Table • List Of Figures 	<p style="text-align: center;">I II III IV V VI VII VIII</p>
1	<p style="text-align: center;">INTRODUCTION</p> <p>1.1 Research Background</p> <p>1.2 Problem Statement</p> <p>1.3 Research Objective</p> <p>1.4 Research Questions</p> <p>1.5 Scope Of Project</p> <p>1.6 Significance Of Research</p> <p>1.7 Chapter Summary</p>	<p>1-2 3 4 4 4-5 5 6</p>

	LITERATURE REVIEW	
2	2.1 Introduction	7
	2.2 Type of Lawn Mower	8
	2.3 Material	9-11
	2.4 Method of Lawn Mower	12
	2.3 Material Selection	13-15
	2.4 Chapter Summary	16
	METHODOLOGY	
3	3.1 Introduction	17
	3.2 Flow Chart	18
	3.3 Flow Chart Explanation	19-21
	3.4 Fabrication Process and Making	22
	3.5 Product Testing	23
	3.6 Final Touch Up Project	23
	3.7 Gantt Chart	24
	3.8 Conclusion	25
	FINDINGS AND ANALYSIS	
4		26
	4.1 Introduction	27-31
	4.2 Respondent Demography Profile	32
	4.2 Estimated Cost	33
	4.3 Chapter Summary	33
	DISCUSSION AND CONCLUSION	
5	5.1 Introduction	34
	5.2 Discussion	34
	5.3 Suggestion	34
	5.4 Chapter Summary/Conclusion	35
	• REFFRENCES	35

VII

LIST OF TABLE

CONTENTS	PAGE
Table 2.2.1 Type of Lawn Mower	8
Table 3.4.1 Gantt Chart	24
Table 4.3 Cost Estimated	32

LIST OF FIGURES

CONTENTS	PAGE
Figure 2.2.1 Square Hollow	9
Figure 2.2.2 Round Hollow	10
Figure 2.2.3 Blade	10
Figure 2.2.4 Wheel	11
Figure 2.2.5 Spur Gear	11
Figure 3.3.4.1 Stainless Steel	20
Figure 3.3.4.2 Aluminium Alloy	21
Figure 4.2.1 Pie chart	27
Figure 4.2.2 Pie chart	28
Figure 4.2.3. Pie chart	29
Figure 4.2.4 Pie chart	30
Figure 4.2.5 Pie chart	31

CHAPTER 1

INTRODUCTION

1.1 RESEARCH BACKGROUND

A lawn mower (also named as mower, grass cutter or lawnmower) is a machine utilizing one or more revolving blades to cut a grass surface to an even height. The height of the cut grass may be fixed by the design of the mower, but generally is adjustable by the operator, typically by a single master lever, or by a lever or nut and bolt on each of the machine's wheels. The blades may be powered by manual force, with wheels mechanically connected to the cutting blades so that when the mower is pushed forward, the blades spin, or the machine may have a battery-powered or plug-in electric motor. The most common self-contained power source for lawn mowers is a small (typically one cylinder) internal combustion engine. Smaller mowers often lack any form of propulsion, requiring human power to move over a surface; "walk-behind" mowers are self-propelled, requiring a human only to walk behind and guide them. Larger lawn mowers are usually either self-propelled "walk-behind" types, or more often, are "ride-on" mowers, equipped so the operator can ride on the mower and control it. A robotic lawn mower ("lawn-mowing bot", "mowbot", etc.) is designed to operate either entirely on its own, or less commonly by an operator by remote control.

In the past and even until now, cutting of grasses in the schools, sports tracks, fields, industries, hotels, public center, etc. Was done with a cutlass. Although this method is manual cutting but it have a lot of benefits. Also accuracy in cutting level was observed using the manual cutting method. This work deals with the cutting of verdant (shrubs, grass, flowers, leaves of trees) and also with the design of the machine, its efficiency, rigidity, mode of operation and the selection of materials. The design gives a greater degree of flexible mobility and interchangeability. The aim of this work includes, but not limited to the following term. Example to reduce cost of cutting and also to beautify the environment.

The presence of this grass machine can help ease the burden of humans .So we are planning and decide to create a more effective and efficient Mechanical Lawn Mower for use in the appropriate place. This Mechanical Lawn Mower comes with a blade that can cut the grass evenly. Nor does it use any fuel to turn it on. So in this way it can save costs. Next, we also planning to upgrade this Mechanical Lawn Mower in a safety way. So were going to come up with a portable lawn mower that can be folded and stored in an existing bag. With this innovation, it not only makes it easier for users to store it but it also guarantees a user safety.

1.2 PROBLEM STATEMENT

The lawn machine we use today is an automatic lawn mower that makes it easy for humans. But there are still some disadvantages to the lawn. Some of the auto lawn mowers that use the motor will cause difficulty in starting the engine. It also takes a long time to turn on or start. So this problem will be affect to lawn mower user to use it because it will waste time. We have planning to create a lawn mower that only uses gear. The gear acts as a force to rotate the blade while pushing the lawn.

Besides, the problem we have when using the lawn is the lawn mower we use today will produce noise. This is a little bit interfere with other people's hearing. It can also be categorized as sound pollution. So by using a mechanical lawn mower it will not produce noise that will disturb the hearing of others. In addition, air pollution problems will also occur if we use a lawn mower that uses the engine. So we can solve this problem with a mechanical lawn mower that only uses the gear to rotate the blade.

Then, another problem is the lawn mowers nowadays mostly use fuel. A costs for having a lawn mower using fuel is a bit expensive compared to ordinary lawn mowers. So, here we can reduce the cost because the mechanical lawn mower does not use any fuel and it can save your money. This is because, not everyone is able to have a lawn mower using the engine. This is one of the factors we want to create a mechanical lawn mower to help less fortune.

1.3 OBJECTIVE PROJECT

The objective to this research are:

- To design the mechanical grass cutter that have a faster starter to start the machine.
- To design the mechanical grass cutter that doesn't have any kind of pollution such as sound pollution.
- To design the grass cutter that can start without using any kind of fuel. So the cost of the consumption of this grass cutter is cheaper.

1.4 RESEARCH QUESTIONS

This study will answer the following research questions:

- What is the advantage of a mechanical lawn mower?
- Does this mechanical lawn mower reduce your costs compared to a auto lawn mower?
- Is it easy for us to use lawn mower using mechanical systems? (without motor)

1.5 SCOPE OF PROJECT

Have you ever thought about what to expect from your backyard besides a beautiful place to chill? The answer to that is the healthier body. If you think this statement is heading to the suggestion that you do the grass-cutting and grass-picking manually under the intense exposure of sunlight to get that healthier body, you are partially wrong.

Yes, it is suggested that you soak in the sunlight to help you sweat more. But, doing all the yard-care activities can be frustrating, and it will drain your energy in no time. Using the lawn mower, however, will change the rest of the scenario as you no longer have to do all the hard works. You still get the chance to move your body in a way that it does not force your body.

The scope and limits to this research are:

- i. Lawn mowers are only suitable for home area which has 20x13 square fit.**
- ii. This mechanical lawn mower is suitable used by housewives to do house chores.**
- iii. This Lawn Mower also can used by gardener which have a small garden at house.**
- iv. We also used high quality stainless steel blade to ensure every cuts neat and evenly.**

1.6 SIGNIFICANCES OF PROJECT

Every innovation we create must have its own approach and benefits, so our idea of creating a mechanical lawn mower is a good idea. It also can help the underprivileged because the price are affordable and also give benefits to consumer. With this portable Mechanical Lawn Mower, it can ease the consumer to bring it everywhere. It can prevent us from injured because its safety. This is because this mechanical lawn mower is stored in an existing bag.

1.6 CHAPTER SUMMARY

In this chapter, the studies was explained about its origin of ideas and inspirations. All the stated objectives can be achieved through problem statement. Thus, with this mechanical lawn mower we can create an innovation that give benefits to everyone. This mechanical lawn mower is not only useful for lawn mower user but housewives also can use it as well. This is because this lawn mower is portable and not too heavy. Next, the scope of this project explains about this mechanical lawn mower operator and the extent of the suitable area for this machine. The conclusion is, this lawn mower can give a good impact and advantages to the user.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Literature means research articles that are referred to understand and study the research issues. The literature review is used to provide contextual studies by looking at the research that has been conducted in the field of research and not just summarizing the research conducted by other researchers.

In addition, through the study of the literature the researcher can also identify the weaknesses and strengths of the resulting project. Therefore, the literature review is important as it can be used from several aspects as a guide and reference for the researcher in completing this study. The contents of this chapter may contain a brief introduction to the subject of the study, concept or article related to, previous studies related to the field of study and summary of this chapter. The general topic of the issue or area of interest needs to be identified and then provide the appropriate context for the literature review.

In the year 1830, the first Lawn Mower was invented by the English engineer Edward Budding. He first thought of the idea after he saw a machine in a local cloth mill. Budding realized how the same mechanism that was being used to trim cloth to give it a smooth finish after weaving could be used for cutting grass as well. Early 1900s Steam Lawn Mowers which used light weight petrol engine or steam power units appeared on the scene in the 1890s. While steam mowers worked great, by the early 1900s, the petrol powered lawn mowers won over the market. But now, our project will make a best lawn mower which is more to easy use a housewife to do house chorus.

This chapter contains the different types of materials to meet the necessary features of this project. As stated this project needs to meet the objective features in order to solve the problem. It will also state the materials selected for the project. Each material we choose is the best and meets the requirements.

2.2 TYPE OF LAWN MOWER

There are basically two different lawn mower types: reel mowers and rotary mowers. Reel mowers make precise clean cuts on grass blades using the scissor-like action of a cylinder of rotating blades. They may have 2-6 of these rolling blades which are usually turned by the axle of the mower's wheels. Available as tow behind attachments for lawn tractors, gas or electric powered or manual push models, reel mowers are generally less noisy and create less pollution than rotary mowers. Reel mowers can also cut grass to short heights better than rotary mowers. However, reel mower blades can be difficult to sharpen and maintain.

A Rotary mowers usually have one blade which rotates very fast. Rotary Mower is a mower in which the blade spins horizontally (east to west) and uses a sucking and tearing action to cut the blades of grass. The design is simple and adapts very well to small engines. Rotary mowers can cut a wide variety of grass conditions. There are usually powered by gas engines or electric engines and the most common mowers used by home owners. Among those are as shown in Table 1.

Table 2.2.1 : Types of Lawn Mower

Types of Lawn Mower	Feature
 <p>Reel mower</p>	<ul style="list-style-type: none"> • Blades spin vertically • Use a spinning/scissoring action to cut the grass • Healthier for the lawn
 <p>Rotary mower</p>	<ul style="list-style-type: none"> • Single blades spin horizontally • Uses more of a tearing action

2.3 MATERIAL

The material selected must be in accordance with the required features such as product durability, reasonable cost, guaranteed product safety level and more.

1)

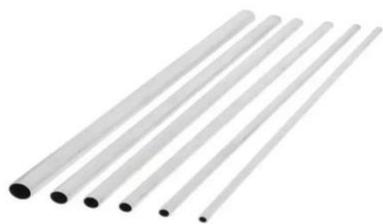


Figure 2.2.1: Square Hollow

Hollow steel is a type of hollow shape so it has a lot of flexibility when used for some types of construction. More precisely this shape of steel is like a long pipe that has a rectangular cavity, so it is not uncommon for many people to call this iron a square hollow.

This hollow iron has many uses. Not only as a ceiling support, but also as a material for making canopies, fences, minimalist sidewalks, fences and so on. It is even used as a main ingredient in the installation of gypsum panels and GRC panels. Because it is shaped like a rectangular pipe, it is also widely used as a contemporary interior and minimalist style furniture.

2)



Figures 2.2.2: Round Hollow

Round hollow is a type of building material widely used for a variety of purposes. For example to make fence poles, roofs, building materials, gas pipelines, air conditioners, and furniture. Round hollow has a long round shape and a distinctive color of black.

3)



Figure 2.2.3: Blade

Blades are a type of hand tools used in agricultural activities including cutting grass or harvesting crops. It looks like a crescent moon, and the inside is sharp. This device has now been widely replaced by tractors and other automated machines, but it continues to be used in some parts of Europe and Asia. Blades are used for various uses such as cutting grass, cutting twigs and other things. The sharp blades will cut the grass cleanly without tearing & ripping. Sharp blade also cut the grass uniformly.

4)



Figure 2.2.4: Wheel

Wheel is a material used in this project so that the project can move and function. The wheels also come in many sizes. So choosing the right wheel size for this project is an important factor in producing the perfect project.

5)



Figure 2.2.5: Spur gear

Spur gear is the most common type of gear. They have straight teeth, and are mounted on a parallel shaft. Spur gear is used in many devices you can see, such as electric screwdrivers, wind alarm clocks, washing machines and clothes dryers.

2.3 METHOD OF MECHANICAL LAWN MOWER

A. Assembly project

There are several methods for making mechanical grass machines. First we have to cut the body part of the lawn with the right size. For example measuring 60cm long and 50cm wide. Then cut it with a cutting machine.

The next method, once cut, the body parts of the lawn should be welded together with the handle. The hollow steel must be welded to the bottom of the handle so that it can attach to the lawn.

Third method, the method of mounting the wheel on the body parts of the lawn. By making holes on either side we can place tires or wheels to allow the grass machine to move. The way is to attach the round hollow to the two sides and then attach the wheel to the round hollow. So, grass machines can move anywhere when they are rejected by the user.

Next, gear assembly. The method of mounting the gear is to attach the gear to the round hollow so that the gear can work when there is movement on the wheel. Lastly fabrication process. We started spraying red paint on our project for a better finish. We spray it so that the project looks beautiful, glossy, and neat.

2.4 MATERIAL SELECTION

A. SQUARE HOLLOW

➤ *Advantages Square Hollow :*

- Have a better quality.

Various layers of this type of iron are indispensable for satisfactory results. Usually there is not much iron that can withstand a fire attack, but it is able to withstand its dense layers.

- Quick and easy installation.

The advantages of this one are of particular interest to construction workers. That's because installing it fast and easy will not take much time. The hollow textures are easy to form and apply, and this is all due to the material content of the product.

- It's not easy to experience erosion

Many of the major problems with iron are corrosion, and this will make the performance of the steel unattractive and easy to break. Therefore, if you use a blank type galvalume, the risk of corrosion will be less because of the aluminum and silicone layers present.

➤ *Disadvantage Square Hollow :*

There are no product has a level of perfection of up to 100%, of course there are still some loopholes or deficiencies, and this kind of iron. Among its advantages, this iron has its disadvantages, such as:

- If you want to make designs that carry a lot of weight, you cannot use this type of iron. Because, actually, this type of iron is not too heavy to bear the burden. That's because there are several layers in it.
- The size of the iron is not too long, only about 6 meters. In fact, this steel is usually only used for the construction of fences or ceilings that are not too long. However, if you want to make a roof-like design or need a longer size then you can use other types. Actually it can be connected using welding but it is still not satisfactory.

B. STAINLESS STEEL BLADE

➤ *Advantages of Blade:*

- The blades machine can cut the grass uniformly and smoothly.
- The blades has a very efficient and accurate efficiency point with one push of the lawn.

➤ *Disadvantage of Blade:*

- The blades may endanger the user's safety in case of incomplete installation.
- The blades can also rust if they are not cleaned or maintained.

C. Aluminium Alloy

➤ *Advantages of Aluminium Alloy*

- Higher specific strength
- Higher specific stiffness
- Improve high temperature creep resistance
- Improve wear resistance

➤ *Disadvantage of Aluminium Alloy*

- Lower toughness and ductility
- Prone to corrosion

2.5 CHAPTER SUMMARY

In conclusion, after conducting a study on the materials and components needed to build this project, it was found that components with appropriate specifications should be used to prevent accidental accidents. In addition, the projects we create can reduce fuel costs compared to existing projects. It also reduces the noise that can disturb the home compared to existing projects. At the same time, the materials used for existing project repairs are significantly higher than our project cost.

CHAPTER 3

METHODOLOGY

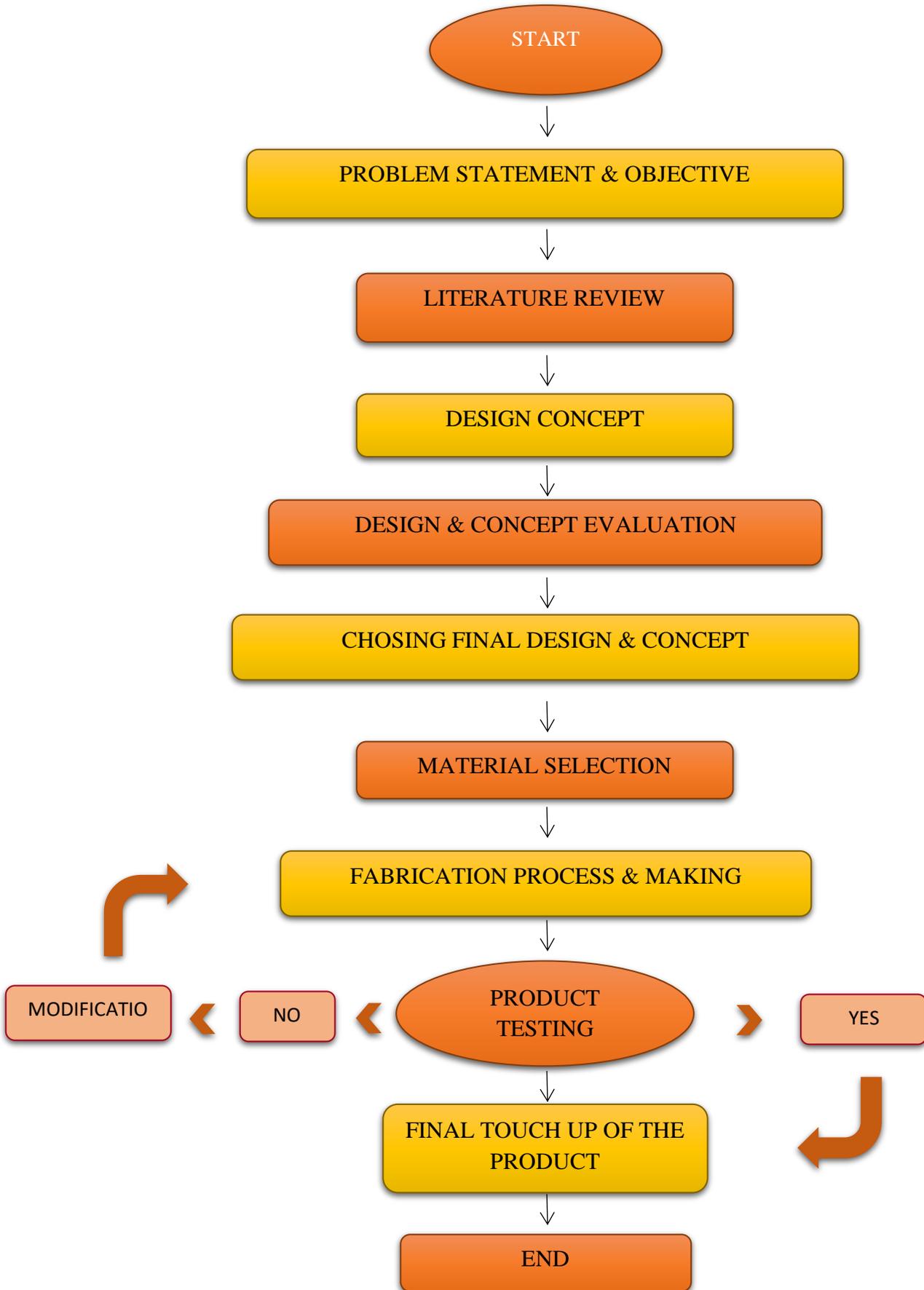
3.1 INTRODUCTION

Methodology is a method and technique for designing, collecting and analyzing data to produce evidence that supports a study. Methodology describes how a problem is studied and why a method and technique is used.

Methodological studies are a rigorous planning in the course of this semester. In order to facilitate the final project journey, the methodology must be set as best as possible. With this, every step of the journey of this project will not fall short of the set path or more precisely the end result of the study will meet the needs of the problem to be solved. Therefore, it is very important to know and understand in depth each of the processes involved in structural engineering studies.

In this chapter, there will be a lot of information about processes and travel through the production of our final project. There is a flow chart that shows how we are doing the whole project. This flow chart describes the process we take. Next up is the Gantt Chart, which will showcase and plan for 13 weeks on the journey of our final year project.

3.2 FLOW CHART



3.3 FLOW CHART EXPLANATION

3.3.1 PROBLEM STATEMENT

- The grass cutter we used now has a motor so it takes a long time to start.
- The grass cutter that we used recently is so noisy and sometime it disturb people hearing. This problem can be categorized in sound pollution problems.
- The grass cutter we used nowadays are using fuel. Therefore the cost of using this grass cutter is quite expensive.

3.3.2 LITERATURE REVIEW

- We explain the background of mechanical lawn mowers from the founders since 1990.
- In this literature review we also talk about the materials we use in the production of mechanical lawn mowers.
- We started a project called a mechanical lawn mower.
- Our project priority is to make it easier to cut the lawn at home, school or anywhere. We created this project not only for men but for women

3.3.3 DESIGN CONCEPT

- We discussing about the materials and design to make sure that our project could be produced in good order.

3.3.4 MATERIAL SELECTION

a) **Stainless Steel Blade**



Figure 3.3.4.1 Stainless Steel Blade

As you can now gather, stainless steel does in fact contain carbon in its makeup. What differentiates stainless steel from regular or carbon steel is chromium. Chromium is a metallic alloying element which has a silvery sheen, resists tarnishing, and has a high melting point. What it primarily imbues into steel is corrosion resistance. That means a stainless steel blade is going to stand up much better to rust than, say, one made from just carbon steel. But, it too has downsides.

For instance, stainless steel is much more malleable, springy, and less brittle than carbon steel, but that also means that it is prone to deformation and is actually harder to sharpen. The upside to that is that it is more chip resistant and it will retain an edge for longer. Remember, however, stainless steel is not rustproof. Without proper care, all steel can rust – such is the nature of iron. So, even if you find a knife with an incredibly high chromium content, constant exposure to humidity or water without any care will absolutely cause it to rust. It may just take longer.

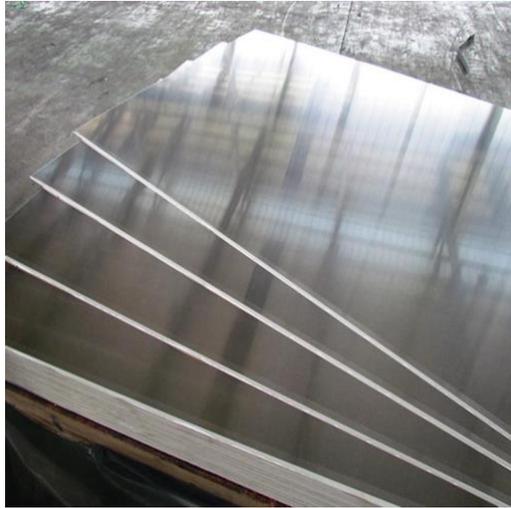
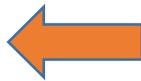
b) Aluminium Alloy

Figure 3.3.4.2 Aluminium Alloy

Aluminium Alloy decks are arguably the premium choice material of the three. They have advantages of both the others such as plastics or steel, featuring the strength and quality of steel and the corrosion resistance of composite plastics. You will find aluminium alloy decks on many top mowers and it is long-lasting and hard wearing. Aluminium, is a little more brittle than steel and does not have the same impact resistance as steel, but is usually a premium product and likely to be made from premium quality components.

The durable nature of aluminum alloy makes maintenance of aluminum alloys relatively easy. This property is particularly useful when aluminum is used as a material for machinery and various manufacturing equipment.

3.4 FABRICATION PROCESS AND MAKING



3.5 PRODUCT TESTING

The special feature of the project is it's a portable that can be mounted on, can foldable and store in bag. This product also offers an affordable price while it is free from maintenance, as a result it can save the cost by more than 50% from its rival. This mechanical lawn mower has gear and this gear will move the cutting blade when we push the lawn mower. The blade will cut a grass at speed and cut evenly. Although this lawn machine is mechanical, but it has many advantages such as cost savings, doesn't require fuel, avoids noise pollution, doesn't take long to turn on and so on. Finally, it can be concluded that the stated objectives were achieved and implemented effectively.

3.6 FINAL TOUCH UP OF THE PROJECT

After completed our process to making the project, we start painting our mechanical lawn mower at the body. We also try our project at grass for its cutting successful or not. Our project has been done and we have submit our project video to supervisor.

3.8 CONCLUSION

The conclusion that can be made in this chapter is that, after conducting the study of this chapter and gaining the knowledge, how to make the project clearer, more detailed and easy. This simplifies the work that goes into project development. The data that has been collected and analyzed is very important in making this final project. These data are collected through a variety of ways such as browsing the internet, reading some related books, in stores and through information from lecturers. This chapter also describes the cost of materials, quantities, prices and overall cost allocated to complete this project. Design study conducted it helps to simplify the process of designing how to fit in and not spend too much and the materials you want to use are easy to find. In addition, this chapter will also know the specifications of the materials available in the market as well as the different prices accordingly different shops. Material selection factors are also very important in the production of this project. This is because choosing the wrong item will cause damage to the project. Failure in this appropriate selection not only will it cause damage to the project but it will also result in higher costs of purchasing new material as a result of the damage caused by the wrong selection of materials.

CHAPTER 4

FINDINGS AND ANALYSIS

4.1 INTRODUCTION

This chapter combines all the analysis and important data of Mechanical Lawn Mower and also its materials calculation. The data and analysis is very important to ensure the objective and scope of this project successful. After that, when the data analysis achieves the goals, this shows our project was successful. So, we have decided to collect all of the relevant data to investigate each case in order for this project to work smoothly.

The results obtained in this chapter are the results obtained from the questionnaires and experiments that have been conducted in the study area. Data resulting from experiments in the study area are analysed in more detail to draw conclusions based on the objectives of the study that have been stated.

The study was conducted using about 100 respondents from the users of mechanical lawn mowers.

There are several aspects that are the main focus, namely:

1. Demographics of Respondents (gender and age)
2. General view of the study
3. Respondents' perspective on Mechanical Lawn Mower: -
 - i. Shape
 - ii. Function
 - iii. Materials used
 - iv. Advantage

4.2 RESPONDENT DEMOGRAPHY PROFILE

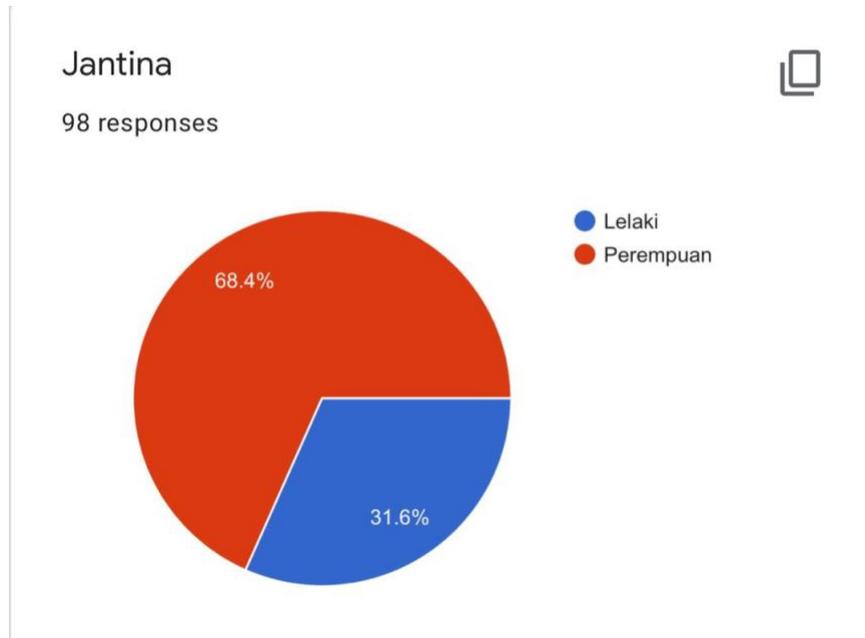


Figure 4.2.1

Figure 4.2 shows a total of 98 respondents who responded to the study conducted. A total of 31.6% of respondents were 31 men while 68.4% of respondents were 67 women. The number of female respondents is high because a large number of respondents are those who use lawn mowers more than men. Most women are more active mowing the lawn in their lawn.

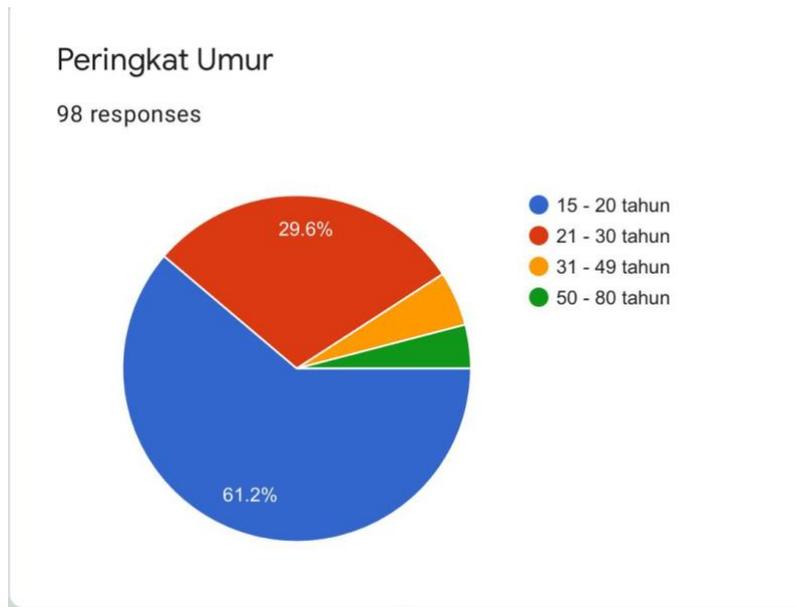


Figure 4.2.2

Furthermore, the results of the study found that a total of 60 respondents, namely 61.2% aged between 15-20 years more answer this questionnaire. This is because they are the younger generation today who are more aware of the surrounding environment. In addition, a total of 29 respondents, namely 29.6% aged 21-30 years. Most of them are young people who have experience in the use of lawn mowers. Furthermore, a total of 9 respondents consisted of ages 31-80 years which is 9.2%. It consists of elderly citizens who are knowledgeable about this lawn mower.



Figure 4.2.3

The diagram above shows the analysis of respondents who have used a lawn mower. It is the result of a questionnaire that was distributed to the respondents. A total of 33 respondents that is 33.7% who have used lawn mowers while a total of 65 respondents that is 66.3% who have never used lawn mower

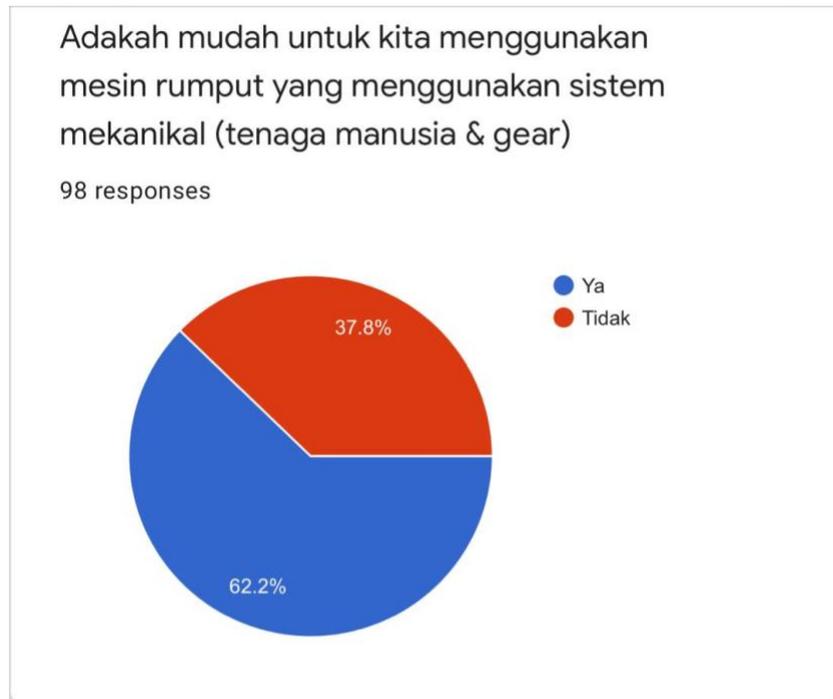


Figure 4.2.4

The next question asked to the respondents is whether it is easy for users to use lawn mowers that use mechanical systems. A total of 61 respondents, 62.2% said that this mechanical lawn machine is easy to use while a total of 37 respondents, 37.8% said that it is not easy to use a mechanical lawn mower.



Figure 4.2.5

Furthermore, the results of the questionnaire found that these mechanical lawn mowers can reduce costs compared to lawn mowers that use fuel. A total of 83 respondents, 84.7% agreed that this mechanical lawn machine can reduce consumer costs. A total of 15 respondents, 15.3% did not agree that this mechanical lawn mower is cheaper than a lawn mower that uses fuel.

4.3 ESTIMATED COST

No	Materials / Equipment	Quantity	Price/Unit	Total
1.	Square Hollow	1 unit	RM30	RM30
2.	Round Hollow	2 unit	RM16	RM32
3.	Wheel	4 unit	RM22	RM88
4.	Blade	1 unit	RM10	RM10
5.	Aluminium alloy	2 pieces	RM20	RM40
6.	Bevel Gear	1 unit	RM20	RM20
Total				RM330

Table 4.3 shows the cost of materials allocated to implement the Mechanical lawn mower project.

4.4 CHAPTER SUMMARY

The conclusion is that in this chapter we can see some questionnaire studies conducted on some respondents for us to know about their opinions regarding this mechanical lawn machine. By doing this questionnaire we can further improve the project we created.

CHAPTER 5

DISCUSSION AND CONCLUSION

5.1 INTRODUCTION

Based on the results obtained in Chapter 4, a discussion of the finding is presented in this chapter. The findings from the study are used to discuss whether the proposed hypotheses are supported. All research questions will be answered subsequently and finally the achievement of research objectives are determined. Vendors are provided with managerial implications and recommendations, to enable them to draft appropriate strategic in gaining consumers' intention to purchase lawn mower. Finally, the contributions of the study are discussed based on theoretical, methodological, practical approaches and end with suggestions for future research.

5.2 DISCUSSION

Generally this mechanical lawn mower is a lawn mower specially created or specifically for housewives or smallholders. We have discussed and conducted product testing to ensure that the mechanical lawn mower works well within the prescribed scope of only being able to mow the law at an area of 20x13 hectares only. And the test shows the set scope is true and quite accurate. But to improve our products to be more effective we need to add some gears to the cutting part so that this machine can work more smoothly effectively.

5.3 SUGGESTION

This mechanical lawn mower is a machine that works to cut grass evenly at a certain area. So there are some suggestions for improvement to make this mechanical lawn mower more effective, example:

- Make a more sophisticated lawn mower to cut beautiful lawn mowers and machines with less noise pollution.
- Enlarge the iron on the handle so that it does not break easily
- Add machine safety system

5.4 CONCLUSION

The use of this machine for physical use of grass provides the opportunity for the user to maintain and enhance their healthy lifestyle, while also having the potential to help reduce environmental impacts related to air pollution such as human health, animals and plants, depletion of ozone layer, acid rain, greenhouse effect and global warming and so on. Users can reap the benefits as mentioned above, especially for environmental impact prevention, and possibly for treatment the purpose is, as consumers take a proactive approach to health as they are aware that some pollution can reduce the risk of chronic disease. To achieve this goal, this thesis has taken the initiative to study factors of buying this physical grass machine to housewives, farmers, lawn mowers and other public persons.

REFERENCES

1. https://en.wikipedia.org/wiki/Lawn_mower
2. <http://www.fredshark.net/?p=83>
3. <https://www.popularmechanics.com/home/lawn-garden/a27194487/how-to-sharpen-lawn-mower-blades/>
4. <http://www.aluminium-alloys.com>
5. <https://mowdirect.zendesk.com/hc/en-gb/articles/201583933-What-are-lawn-mower-cutting-decks-made-of->