DIPLOMA IN MECHANICAL ENGINEERING

DJJ50193: PROJECT 2

SOLAR POWERED GRASS CUTTER

CLASS: DKM5A

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SESSION I: 2024/2025

DECLARATION OF ORIGINALITY AND OWNERSHIP

TITLE: SOLAR-POWERED GRASS CUTTER
SESSION: SESSION 1 2024/2025

1. We,
    1. MUHAMMAD DANISH IRFAN BIN SHAHRIZAL (24DKM22F1004)
    2. ISKANDAR HAQIIM BIN MUHAMMAD RASHIDI (24DKM22F1999)
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are final year students of Diploma of Mechanical Engineering, Politeknik Banting Selangor, located at Persiaran Ilmu, Jalan Sultan Abdul Samad, 42700 Banting Selangor Darul Ehsan.

2. We represent that the Project and the intellectual property contained there is original work / design without taking or imitating any intellectual property from other parties.
3. We hereby agree to relinquish the ownership of the intellectual property in 'the Project' to 'Politeknik' to fulfill the requirement for the award of Diploma in Mechanical Engineering to us

Subscribed and solemnly declare by the above named;

a. MUHAMMAD DANISH IRFAN BIN SHAHRIZAL
NRIC : 040830-14-0173 (.....)
b. ISKANDAR HAQIIM BIN MUHAMMAD RASHIDI
NRIC : 040922-14-0605 (.....)
c. RABIATUL SADIAAH BINTI MOHD SAMUN
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Before me, as supervisor of the project
DR. HARTINY BINTI ABD KAHAR

(.....)

ABSTRACT

In response to the growing demand for environmentally friendly lawn maintenance solutions, we decided to design and develop a solar-powered grass cutter. A **solar-powered grass cutter** is a **sustainable alternativ**e to traditional gas-powered lawn mowers. Traditional lawn mowers powered by gasoline engines contribute to air and noise pollution, prompting the need for alternative technologies that reduce environmental impact. The proposed grass cutter harnesses solar energy through photovoltaic panels mounted on its surface, converting sunlight into electrical power to drive its cutting mechanism. An electric motor, powered by the solar energy stored in rechargeable batteries, drives a cutting blade, enabling efficient grass cutting without emitting harmful emissions or relying on non-renewable energy sources. The design includes features such as ultrasonic sensors for sensing obstacles and avoiding them.Through efficient energy management and the utilization of durable materials, the solar-powered grass cutter offers a sustainable and low-maintenance solution for lawn maintenance. This research contributes to the advancement of eco-friendly technologies in the field of landscaping and promotes sustainable practices in lawn care.The important thing is this project is the better version from the previous version and we conclude that the project will succeed to perform better than the previous versions.

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CHAPTER 1
INTRODUCTION

1.0 INTRODUCTION

A grass cutter is a device used for cutting grass, such as a lawnmower or a grass trimmer. These machines come in various types and sizes, from push mowers to ride-on mowers, they are used to maintain lawns, gardens, parks, and other outdoor spaces by trimming or cutting grass to a desired length.

Figure 1.0: Lawnmower Machine

Based on **Figure 1.0** this was the example of a grass cutter. Grass cutting dates back to ancient times when manual tools such as sickles, scythes, and trimmer were used to trim grass. As the era becomes more sophisticated, there are more types of grass cutter such as trimmer, lawn mower and solar powered electric lawn mower. However these tools bring bad environmental impact because gas-powered mowers emit pollutants and contribute to air and noise pollution. They require regular maintenance, such as oil changes, spark plug replacements, and blade sharpening. Gas-powered mowers can be loud and disruptive to both users and neighbors. These tools are also labor-intensive and require physical exertion from the user to operate, which can be tiring, especially on larger lawns.

After doing some research we designed a new innovative grass cutter which is Solar Powered Grass Cutter. The design may include features such as ultrasonic sensors to avoid obstacles and control the machine, safety mechanisms, and rechargeable batteries for portability and ease of use. Overall, the solar-powered grass cutter offers an eco-friendly solution for lawn maintenance, reducing environmental impact while providing reliable performance.

1.1 BACKGROUND

Grass cutting as an occupation has roots dating back centuries, primarily associated with landscaping and groundskeeping. In ancient civilizations, individuals were tasked with maintaining gardens, parks, and ceremonial grounds, often using simple tools like sickles and scythes.These tools are labor-intensive and requires physical exertion from the userIn rural communities, grass cutting was integrated into traditional farming practices. Farmers would use hand tools to clear grass from fields and pastures, ensuring optimal conditions for crop growth and animal husbandry. Throughout history, grass cutting was predominantly a labor-intensive task performed by agricultural laborers, often as part of a broader range of farming activities. The work required physical strength and endurance, as well as skill in handling cutting tools. In formal gardens and estate landscapes of ancient civilizations, skilled gardeners were employed to maintain manicured lawns and ornamental grasses. Grass cutting became intertwined with horticultural practices aimed at creating aesthetically pleasing outdoor spaces.

Figure 1.1: Sythe

The Industrial Revolution in the 18th and 19th centuries brought about significant advancements in agricultural machinery and equipment. Steam-powered and later gasoline-powered machines revolutionized grass cutting, making it faster, more efficient, and less reliant on manual labor. Grass cutting became more widespread and refined with the emergence of lawn culture in the 19th century. Wealthy landowners and estates began cultivating expansive lawns as symbols of status and refinement, leading to the development of specialized lawn mowers and grooming techniques. As cities expanded and urbanization accelerated in the 20th century, grass cutting became integral to urban landscaping and municipal maintenance. Parks, public green spaces, and recreational areas required regular grass cutting to enhance their beauty and usability. The latter half of the 20th century saw the commercialization and professionalization of grass cutting services. Landscaping companies, groundskeeping crews, and municipal departments employed trained professionals equipped with a range of specialized machinery to provide grass cutting and maintenance services.

1.2 PROBLEM STATEMENT

a. Normal grass cutters rely on human power for operation and are labor intensive.
b. Relies too much on engine fuel, therefore produces air pollution.
c. Can cause injuries such as amputations and burns and health problems such as musculoskeletal strain and heat stroke.

Figure 1.2: Heat Stroke

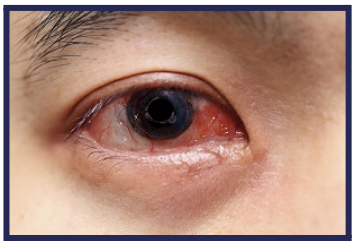


Figure 1.3: Eye Strain

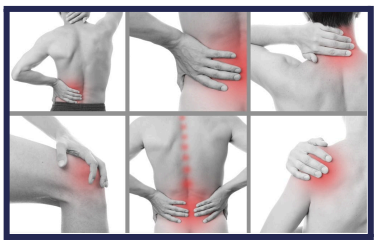


Figure 1.4: Body/Back Pain

1.3 OBJECTIVES

a. To design an alternative method for cutting grass efficiently.
b. To reduce environmental effects from fuel combustion and noise pollution.
c. To reduce workload (time & energy) required to do the cutting process.
d. To prevent injuries to the operator during the cutting process.

1.4 RESEARCH SCOPE

a. Solar-Powered Grass Cutter is used for cutting grass.
b. Size limit height (50-70 cm), length (75-95 cm), width (60-80 cm), weight (70-90kg) and power (500-700 Watt).
c. Limit of battery usage based on fully charged battery and duration (up to 6 hours and above full battery usage).

1.5 CONCLUSION

When doing this project, it's important to make significant advancements in eco-friendly landscaping technology. By harnessing solar energy, this innovation offers a sustainable solution for maintaining lawns while reducing carbon emissions and reliance on fossil fuels. With its efficient design and environmentally conscious operation, the new solar-powered grass cutter not only provides a practical solution for landscaping needs, but also contributes to the global effort towards a greener future.

CHAPTER 2
LITERATURE REVIEW

2.0 INTRODUCTION

There are various types of grass cutters available, each catering to specific needs and preferences. Traditional manual tools such as scythes and grass shears offer simplicity and versatility, suitable for small-scale lawn maintenance and precision trimming around flower beds and shrubs. On the other hand, motorized grass cutters like lawn mowers and trimmers provide efficiency and convenience for larger areas. They come in a range of models, including push mowers, self-propelled mowers, riding mowers, and string trimmers, offering options for different terrain and grass types.

2.1 RESEARCH WORK

2.1.1 ADVANTAGES OF GRASS CUTTER

1. **Efficiency**

   Grass cutters are designed to efficiently trim grass and vegetation, saving time and effort compared to manual methods like using scissors or shears.The efficiency of a grass cutter refers to its ability to effectively and quickly trim grass and vegetation while minimizing wasted time and resources. Key factors that contribute to the efficiency of a grass cutter include:

   a. **Cutting Width**: A wider cutting width allows the grass cutter to cover more ground with each pass, reducing the number of passes required to mow a given area and thereby saving time and energy.

   b. **Cutting Height Adjustment**: The ability to easily adjust the cutting height allows users to adapt to different grass lengths and terrain, ensuring an efficient and uniform cut across the entire lawn.

c. **Motor Power**: A powerful motor enables the grass cutter to tackle tough grass and weeds with ease, reducing the need for multiple passes and ensuring efficient operation even in challenging conditions.

2. **Uniformity**

Grass cutters provide a uniform and tidy appearance to lawns, gardens, and landscapes, enhancing the overall like:

a. **Aesthetics**: A uniformly cut lawn enhances the overall appearance of outdoor spaces, creating a visually pleasing and well-manicured landscape that adds curb appeal to residential properties and professional appeal to commercial settings.

b. **Healthy Growth**: Consistently cutting grass to the same height promotes uniform growth patterns and encourages healthy root development, leading to a lush and resilient lawn that is better able to withstand environmental stressors such as drought and disease.

c. **Professionalism**: A uniform lawn conveys an image of professionalism and attention to detail, whether it's for homeowners aiming to maintain a pristine yard or landscapers and groundskeepers responsible for maintaining public parks, sports fields, and other communal areas.

3. **Convenience**

Grass cutters offer convenience and ease of use, allowing users to maintain their lawns with minimal physical exertion and time investment. Using a grass cutter offers several conveniences:

a. **Time-saving**: Grass cutters, especially powered ones like lawnmowers, can significantly reduce the time and effort required to maintain a lawn compared to manual methods like using a scythe or shears.
b. **Ease of use**: Modern grass cutters are designed to be user-friendly, with ergonomic handles, adjustable settings, and safety features, making them accessible to a wide range of users.

2.1.2 DISADVANTAGES OF GRASS CUTTER

a. **Air Pollution**

One disadvantage of normal grass cutters is contamination of the outdoor environment to the atmosphere. Gas-powered lawn mowers can emit as much pollution in one hour as a car driven for 100 miles.

b. **Noise Pollution**

Another disadvantage of gas powered lawn mowers also contributes to noise pollution up to 100 decibels, equivalent to a chainsaw. This noise can be disruptive to humans and wildlife, causing hearing loss over time.

c. **Climate Changes**

Changes in temperatures and weather patterns. These traditional models are powered by a power lawn mower, which releases greenhouse gasses. Such as carbon dioxide, methane, and nitrous oxide, contribute to the warming of the earth's atmosphere.

2.1.3 DISADVANTAGES OF GRASS CUTTER TO HUMANS

1. **Cuts and Lacerations**

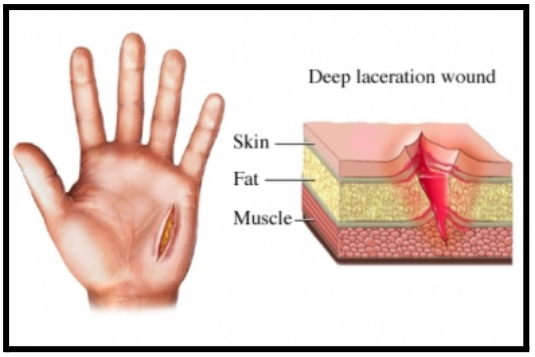


Figure 2.0: Hand wound

One of the most immediate dangers of grass cutters is the risk of cuts and lacerations. Whether manual or powered, the blades used in grass cutters are sharp and can cause serious injuries if they come into contact with skin. Cuts and lacerations from grass cutters can vary in severity. Minor cuts may only require basic first aid, such as

cleaning the wound and applying a bandage, while more severe lacerations may require medical attention, including stitches to close the wound. These injuries can occur due to various reasons, such as:

a. Accidental contact with the blades while the grass cutter is in operation.
b. Mishandling of the equipment, such as slipping or losing control of the cutter.
c. Carelessness, such as not paying attention to where hands or feet are placed while operating the cutter.
d. Inadequate safety precautions, like not wearing gloves or protective clothing.

Cuts and lacerations can occur on any part of the body that comes into contact with the blades of the grass cutter. However, the hands and fingers are particularly vulnerable due to their proximity to the cutting area. The depth of the cut or laceration depends on various factors, including the type of grass cutter, the force of the contact, and whether protective clothing or gear was worn. Cuts can range from shallow surface wounds to deep lacerations that penetrate multiple layers of skin and tissue.

While most cuts and lacerations heal without complications, there are risks associated with these injuries, such as:

a. **Infection**: If the wound is not properly cleaned and treated, it can become infected, leading to further complications.

b. **Nerve or tendon damage**: Deep cuts may damage nerves or tendons, leading to loss of sensation, reduced mobility, or other long-term issues.

c. **Excessive bleeding -** Depending on the severity of the laceration, there may be significant bleeding, which could require medical attention to control.

2. **Eye injuries from flying obstacles**

Figure 2.1.2: Eye infection

The second risk that is often flying debris, such as rocks or sticks, can cause serious eye injuries if proper eye protection is not worn. Even small particles of grass or dirt can cause irritation or scratches to the eyes. Flying debris, dust, or particles generated by the grass cutter can scratch the surface of the cornea, leading to corneal abrasions. These injuries cause pain, redness, and sensitivity to light. Corneal abrasions can usually heal on their own but may require medical attention to prevent infection or complications. Contact with chemicals used in gas-powered grass cutters, such as fuel or lubricants, can cause chemical burns to the eye's surface. Chemical burns are extremely painful and can lead to tissue damage, scarring, and permanent vision impairment as seen in Fiif not treated promptly and properly. Eye injuries from grass cutters are a significant concern and can result from various factors such as:

a. **Flying Debris -** Grass cutters, especially powered ones, can propel debris such as rocks, sticks, and grass clippings at high speeds. If these objects make contact with the eyes, they can cause a range of injuries, including scratches, abrasions, and more severe damage.

b. **Chemical Irritation -** Some grass cutters use chemical substances like fuel, lubricants, or cleaning agents. If these chemicals come into contact with the eyes, they can cause irritation, redness, burning, or even chemical burns.

c. **Blade Contact -** In rare cases, if the grass cutter malfunctions or is used improperly, the blades can make contact with objects or surfaces, causing them to break or shatter. These broken fragments can fly in various directions, potentially striking the eyes and causing injuries.

d. **Dust and Particles -** Grass cutting operations can generate dust, dirt, and small particles. If these particles enter the eyes, they can cause irritation, discomfort, and potentially scratches or abrasions on the surface of the eye (cornea).

e. **Impact Injuries** - Accidents or mishandling of the grass cutter can lead to direct impact injuries to the eyes. For example, if the grass cutter is dropped or falls over, it may strike the operator's face, resulting in eye trauma

3. Musculoskeletal strain

Figure 2.2: Body pain

Musculoskeletal strain while handling a grass cutter refers to the stress or injury that can occur in muscles, tendons, ligaments, and other soft tissues as a result of using improper technique or overexertion while operating the equipment. Symptoms of musculoskeletal strain can include pain, swelling, stiffness, weakness, and restricted range of motion in the affected area. These injuries can occur in various parts of the body, including the neck, shoulders, back, arms, wrists, hips, knees, and ankles.

Common causes of musculoskeletal strain while handling a grass cutter such as:

a. Incorrect Posture: Maintaining awkward or uncomfortable positions while operating the grass cutter can put undue stress on the spine, shoulders, and neck, leading to strain and discomfort.

b. Excessive Force: Applying excessive force while maneuvering the grass cutter, such as trying to cut through thick or dense vegetation, can strain the muscles and joints, particularly in the arms and wrists.

2.3 COMPARISON OF EXISTING AND NEW PROJECT

1. **Sickles**

Sickles typically consist of a curved metal blade with a sharpened inner edge, attached to a short wooden or metal handle. The curved shape of the blade allows for efficient cutting by capturing and slicing through vegetation as the sickle is swung. These sickles are commonly used for manual grass cutting in smaller areas where mechanized or motorized equipment may not be practical or accessible.

Before the advent of mechanized equipment, sickles were one of the primary tools used for cutting grass. Farmers and agricultural workers would wield sickles to clear grass from fields, pastures, and meadows, ensuring that crops could grow without competition from weeds and overgrown vegetation

Figure 2.3.1: Sickle

Figure 2.3.2: Sickle Cutting Grass

2. **Scythe**

The scythe consists of a long wooden shaft called a snath, which is typically curved and has a grip at one end for the user's hands. Attached to the snath is a curved blade, known as a blade or a sickle blade, with a sharp inner edge designed for cutting vegetation. The blade is usually mounted at an angle to the snatch, allowing the user to swing it in a smooth, efficient motion.A grass scythe is a traditional hand tool used for cutting grass . It consists of a long, curved blade attached to a wooden handle. The blade of a grass scythe is typically longer and straighter than that of a sickle, allowing for more efficient cutting over larger areas.

Grass cutting with a scythe typically involves swinging the blade in a wide arc, slicing through the grass at ground level. The curved blade and long handle of the scythe allow for efficient cutting over large areas, making it well-suited for clearing grass and vegetation in agricultural settings.

Figure 2.3.3: Scythe

Figure 2.3.4:Scythe Cutting Grass

3. **Trimmer**

A trimmer, also known as a string trimmer, weed eater, or weed whacker, is a versatile handheld tool used for cutting grass, weeds, and other vegetation. A trimmer typically consists of a long shaft with a handle at one end and a cutting head at the other.The cutting head contains a rapidly rotating nylon line or string, which slices through vegetation when it comes into contact with it. Some models may have metal blades instead of nylon string for cutting through thicker vegetation or tougher materials.

Other than that some trimmers may be powered by electricity, battery, or gasoline, with gasoline-powered models typically offering more power and mobility but also generating more noise and emissions.

Trimmers have become indispensable tools for maintaining lawns and landscapes, offering efficiency, versatility, and ease of use for a wide range of grass cutting and weed control tasks.

Figure 2.3.5: Trimmer Blade

Figure 2.3.6: **Trimmer Cutting Grass**

4. **Lawn Mower**

A lawn mower is a machine that is used to cut grass in a lawn. The blades of the lawn mower are generally powered by motor and are pushed forward manually.Made of blades on a revolving cylinders, they achieve clean cut by scissors action.

Lawn mowers have more features and functions such as, Allows users to set the cutting height to their preference. Some models are self-propelled, reducing the effort required by the operator. Some models are self-propelled, reducing the effort required by the operator.

Figure 2.3.7: Lawnmower

Figure 2.3.8: Man Using Lawnmower

5. **Solar Powered Electric Lawn Mower**

A more advanced and up to date version of the lawn mower was introduced in recent years (2016) named Solar Powered Electric Lawn Mower.nThis lawn mower was capable of mowing grass using solar and electric power as their main sources of energy and moves by controlling the electric motor (as seen at **Figure 2.10**). Solar panels mounted on the grass cutter's surface absorb sunlight and convert it into electrical energy, which is used to run the cutting mechanism.

Figure 2.3.9:Solar Powered Electric Lawnmower

Figure 2.4: Man Uses Solar Lawnmower

CHAPTER 3
METHODOLOGY

3.0 INTRODUCTION

The flow chart project, information collecting, and project research design are covered in this chapter. The research methodologies, whether quantitative, qualitative, or hybrid, will be described. The design sketching and details of the project that the students will build, showing how the project will look and what components it will have. The resources the students have selected, the production method, and the work routines are all covered. The material cost for each element will be shown. A Gantt chart will also be included in this chapter. From week one to week fourteen, it will display the development of the senior project. This work has been divided into stages based on the flow chart, including information gathering, market research, project research design, idea generation, design process, design detailing, design specification, and material selection. Each team member is contributing to the completion of their assigned task. Because of this flow method, the team members will be able to understand how to complete their tasks by switching between different processes.

3.1 FLOW CHART

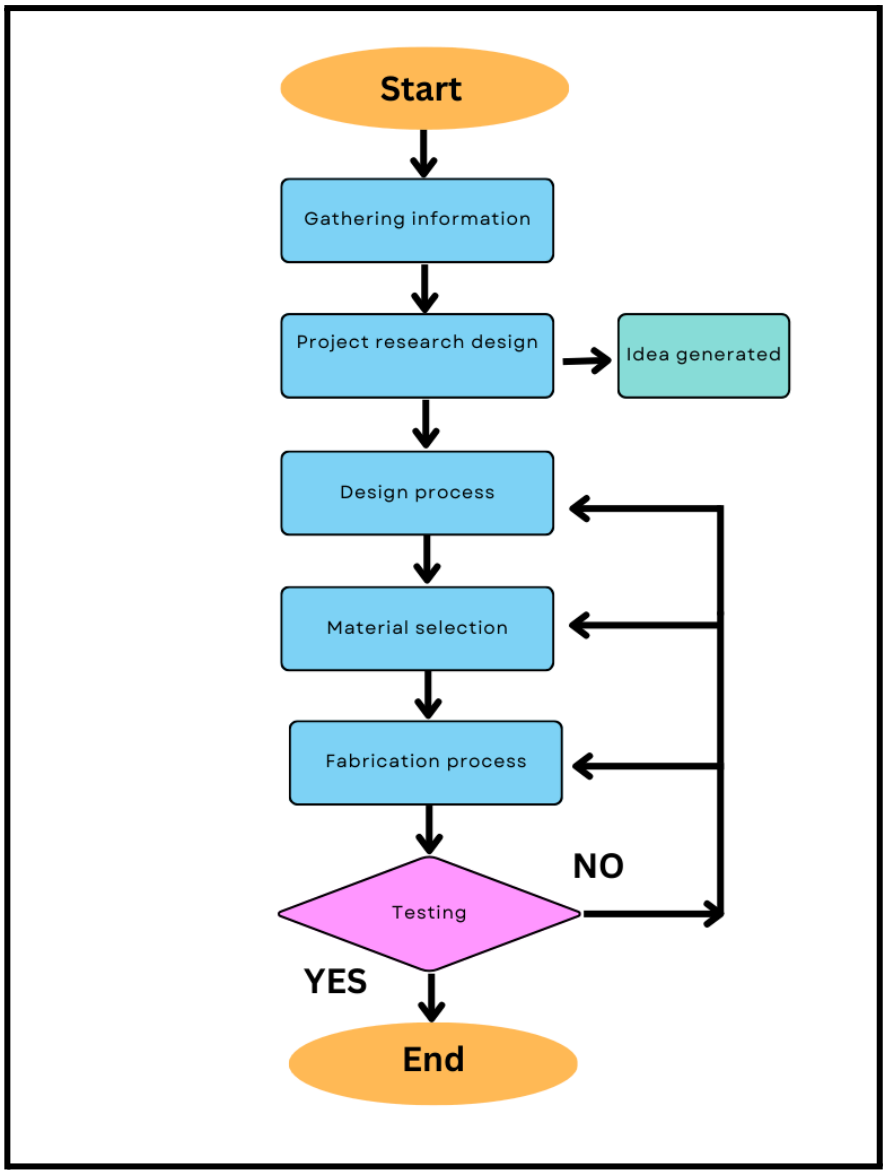


Figure 3.1: Flow Chart of Design Process

3.2 GATHERING INFORMATION

3.2.1 MARKET SURVEY

A market survey was conducted, and a total of 15 people responded to the questions we asked. Market research was delivered to Polytechnic Banting Selangor students and lecturers. The market study's questions are aimed towards respondents' exposure to grass cutters and their opinions on it. From figure 3.1, we asked about what people usually cut grass with. We can determine that the majority of people use grass trimmers the most.

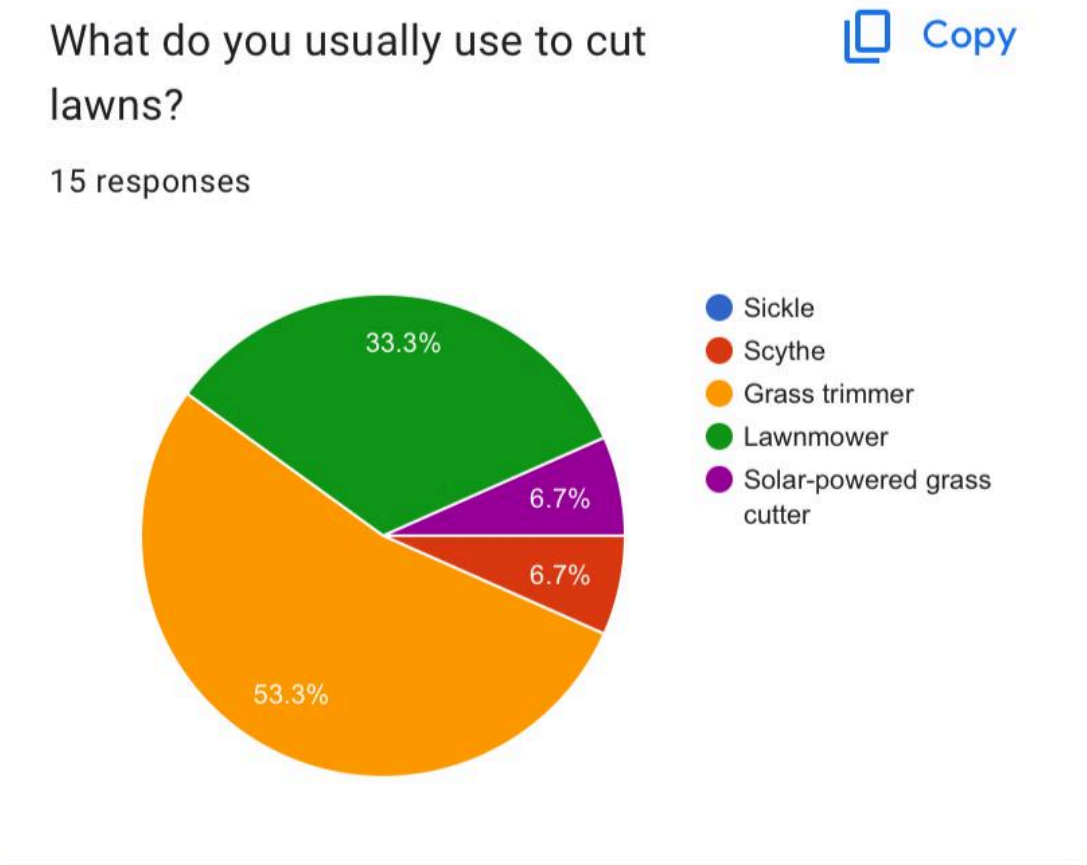


Figure 3.2.1: Number of people using different methods to cut lawns

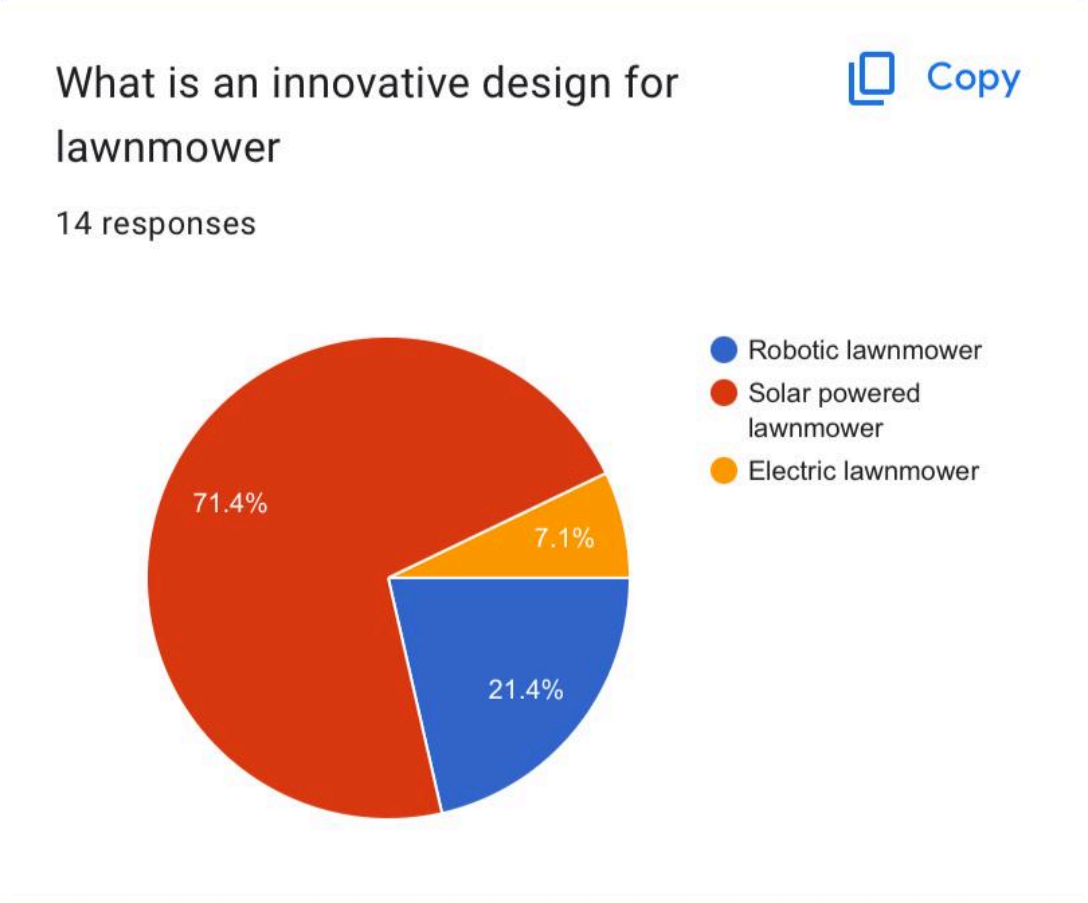


Figure 3.2.2: Number of people choosing the solar powered lawn mower as an innovative design

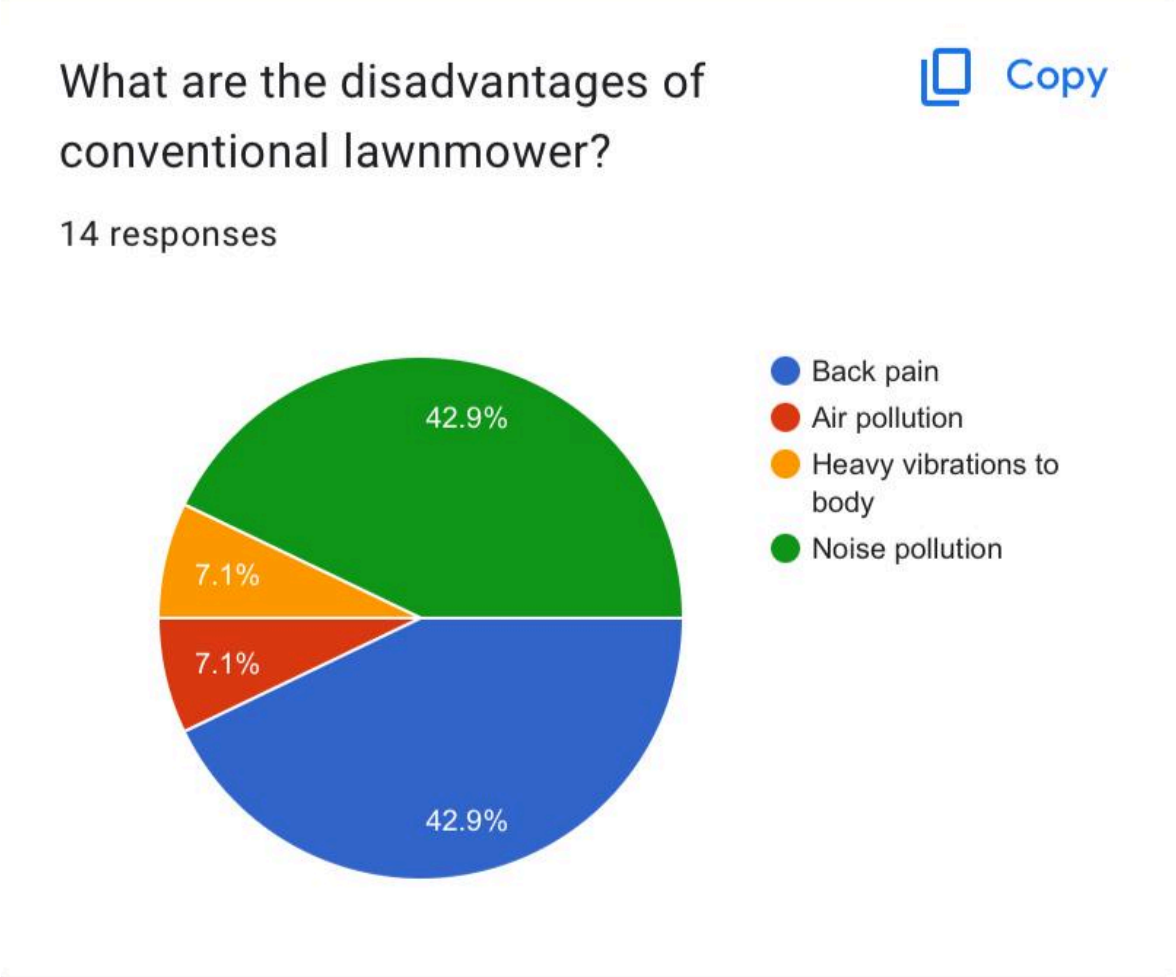


Figure 3.2.3: Disadvantages of lawn mowers.

3.3 DESIGN PROCESS

3.3.1 MORPHOLOGICAL CHART

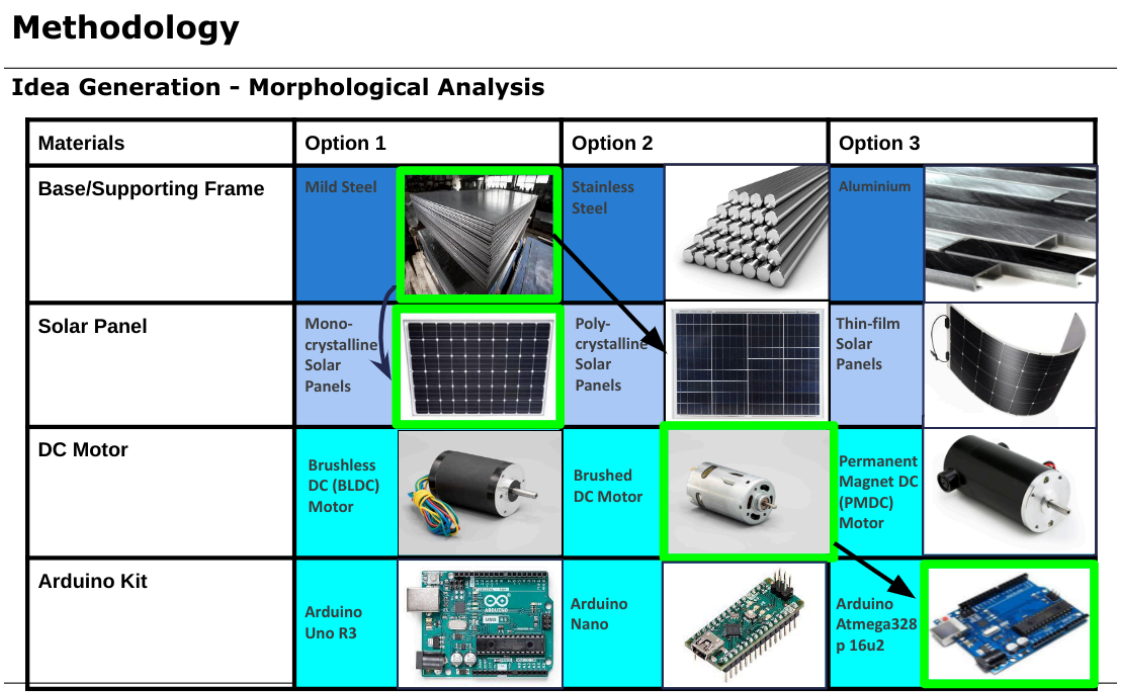


Figure 3.3: Material Selection (Morphological Analysis)

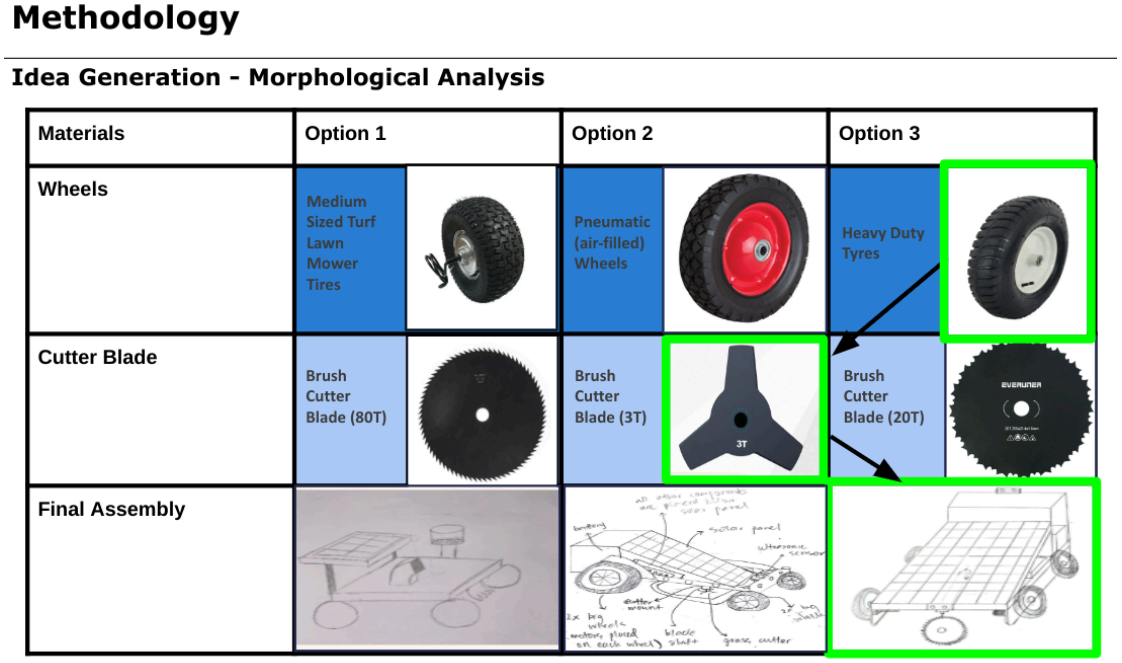


Figure 3.3.1: Material Selection into Final Assembly

3.3.2 IDEA PROPOSED

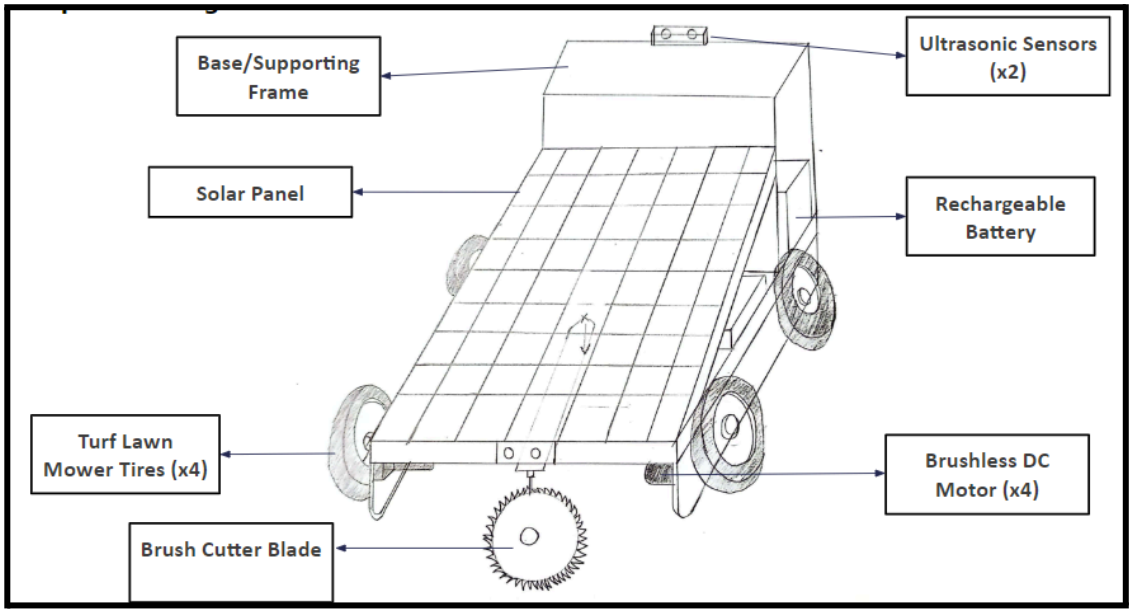


Figure 3.3.2: Initial Drawing Design

3.3.3 SELECTED CONCEPT

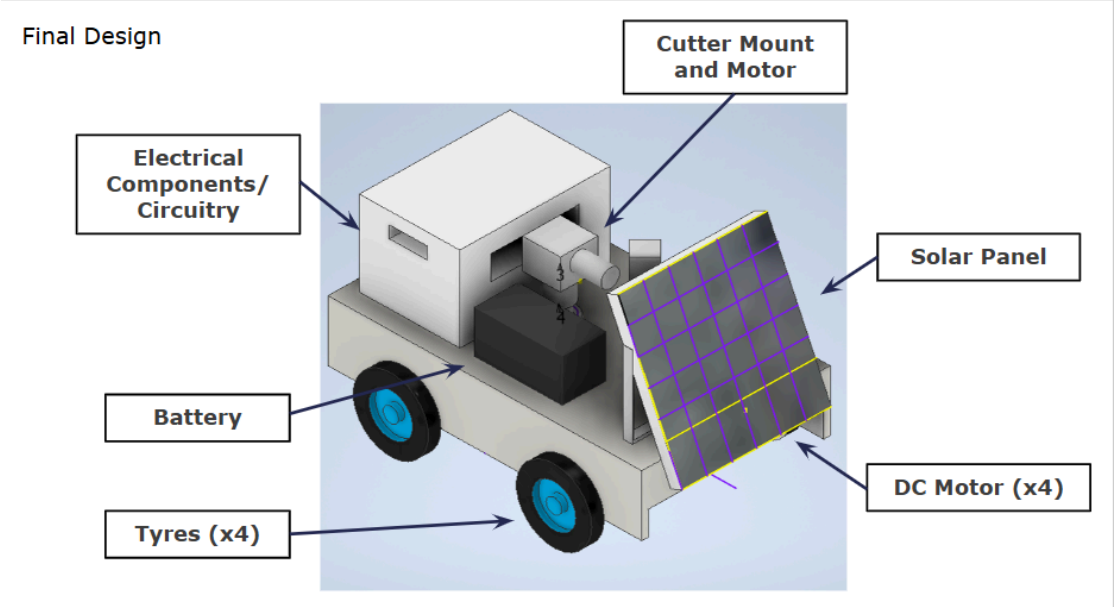


Figure 3.3.3: 3D Drawing Design

a. Using a set of geared motors with wheels, mild steel frame, ultrasonic sensors, controller, batter and solar panel as the main mechanisms.

b. Vehicle is mounted with 4x geared motors to the wheels to move easily through rough/tall surfaces and avoid getting stuck.

c. The motors are placed underneath the solar panel which is then integrated into the body.

d. High torque speed motor is placed in the center along with the cutter blade.

e. All of these above are powered by a solar panel which is placed on top of all the components and a rechargeable battery for efficient battery storage and for longer use.

3.3.4 DETAILED DESIGN

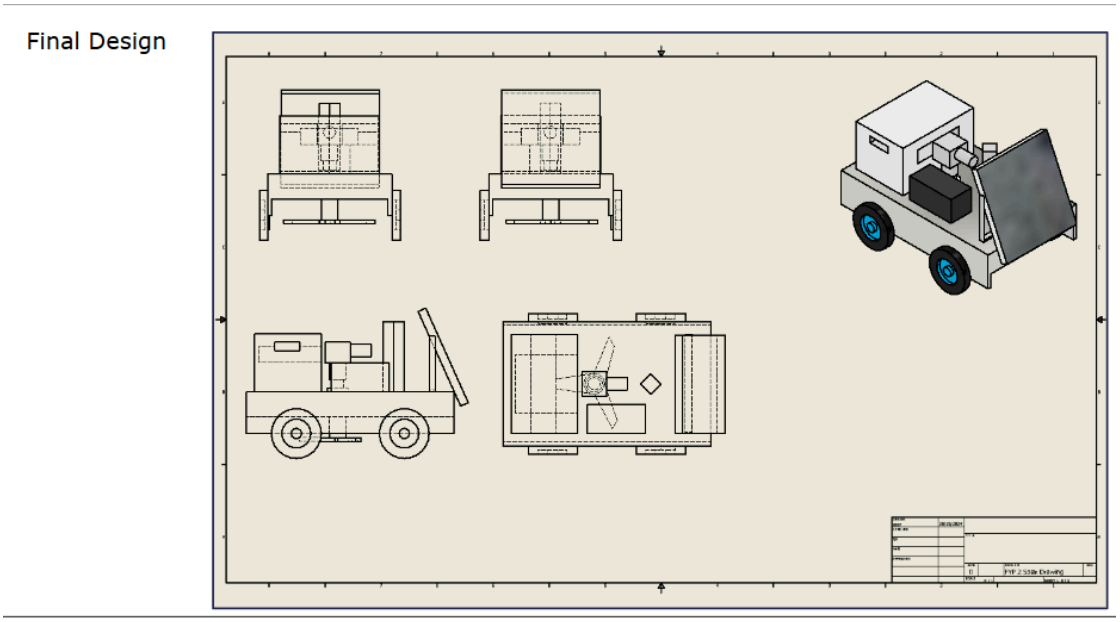
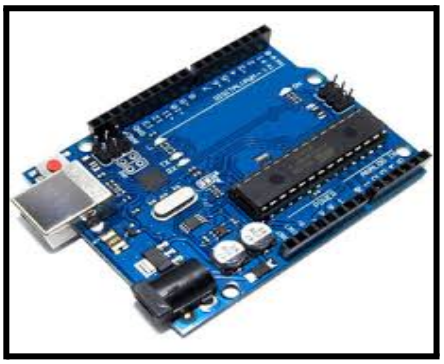


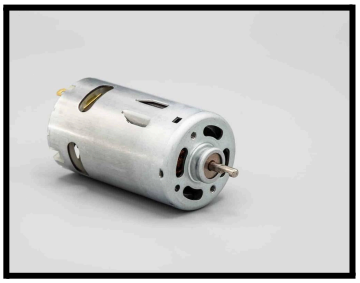
Figure 3.3.4: Final Drawing

3.4 MATERIAL

3.4.1 MATERIAL SELECTION

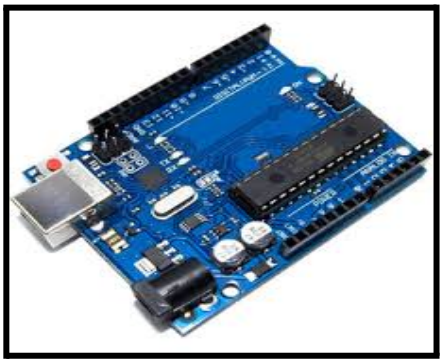
Table 3.4.1: Material Selection

No	Material	Description
1.	Mild Steel 	Used to make the base frame and supporting frame. Advantages: i) Light ii) Malleable
2.	Mono-crystalline Solar Panel 	The energy that is stored into the battery which runs the machine. Advantages: i) Low panel cost ii) Durable and lasts a long time
3.	Arduino Atmega328p 16u2 	Create instructions on arduino coding apps then upload to the board. Use Blynk coding language. Advantages: i) Low cost ii) Easy for beginner to assembly iii) Compact size

4.	Brushed DC Motor 	For the movement of the wheels. Advantages: i) High torque ii) Good speed control
5.	Heavy Duty Tyres 	Wheels for smooth movement. Advantages: i) Stability ii) Maneuverability
6.	Brush Cutter Blade (3T) 	To cut grass smoothly with sharp teeth. Advantages: i) Effortless cutting ii) Fast speed

3.4.2 MATERIAL COST

Table 3.4.2: Material Costing Calculation

No	Material	Cost
1.	Mild Steel 	Unit – 5 feet Cost per unit – RM 12.50 / 1 feet Total – RM 62.50
2.	Polycrystalline Solar Panel 	Unit –1 Total - RM 32.55
3.	Arduino Atmega328p 16u2 	Unit – 1 Total – RM 60.91

4.	Brushed DC Motor 	Unit – 4 Cost per unit – RM 25//unit Total – RM 100
5.	Heavy Duty Tyres/Wheels 	Unit – 4 Cost per unit - RM 24.90/unit Total – RM 99.60
6.	Brush Cutter Blade (3T) 	Unit – 1 Total – RM 13.50
	Total	**RM 603.00**

3.5 - GANTT CHART

From Figure 3.5.1: Gantt Chart below, shows our planning and execution of our report writing.

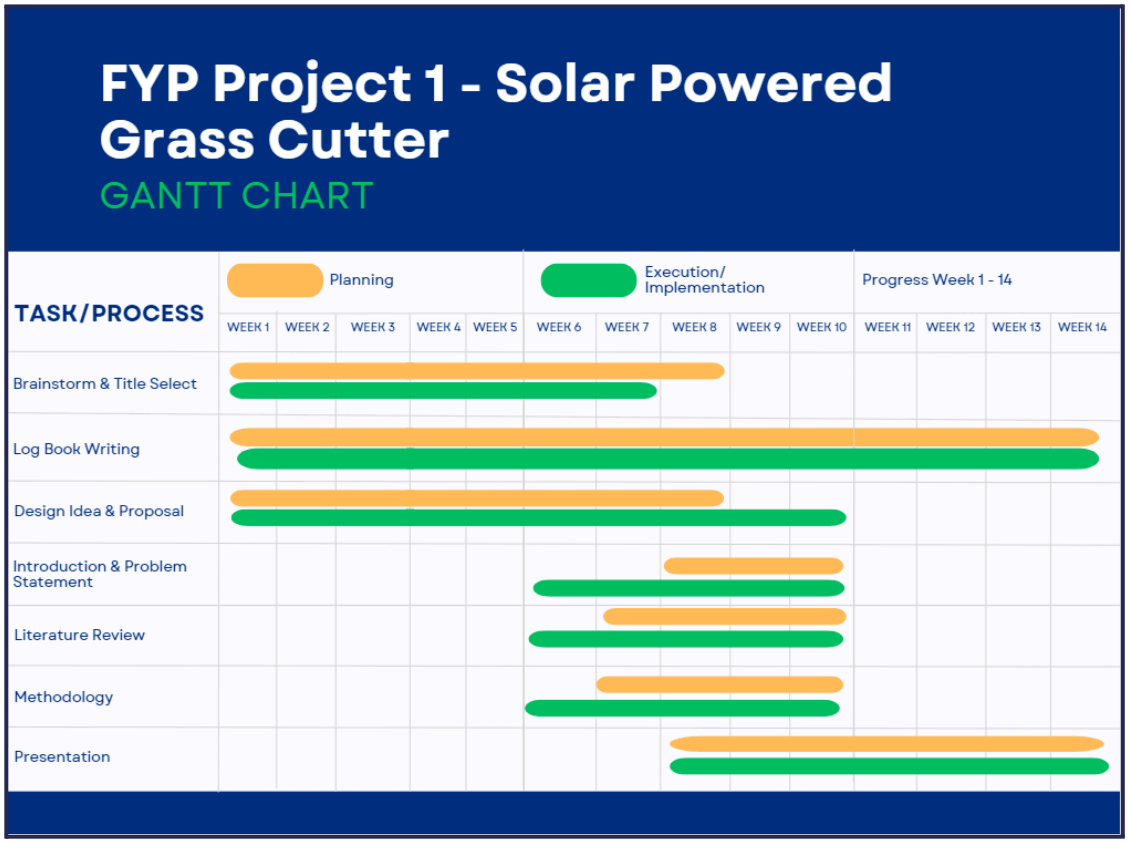


Figure 3.5.1: Gantt Chart 1

From **Figure 3.5.2: Gantt Chart 2** below, shows the project has been handled and monitored since week 1 until week 14 for our project.

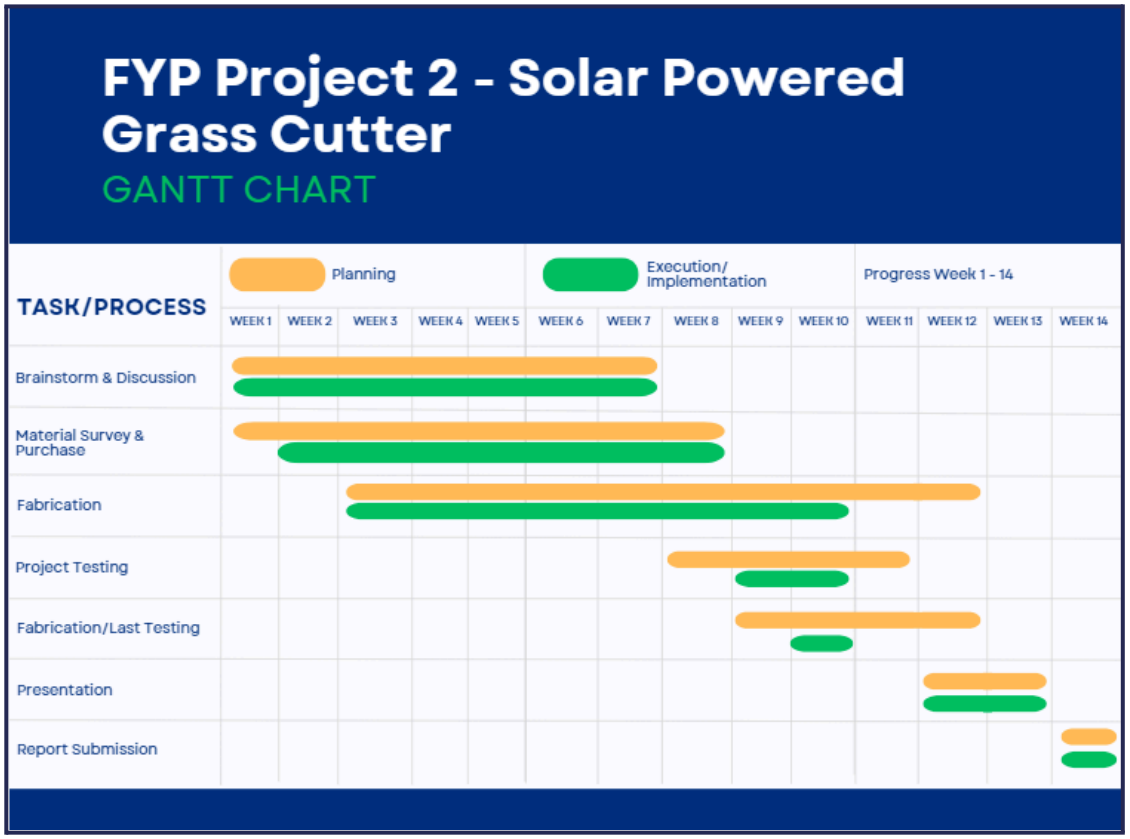
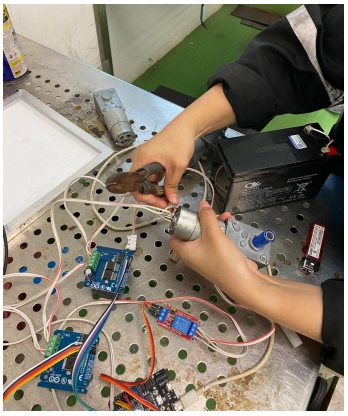
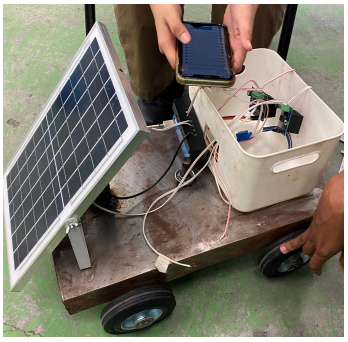


Figure 3.5.2: Gantt Chart 2

3.6 WORKING PROCEDURE

Table 3.6.1 Activities and Procedures

Activities	Picture	Description
Cutting Metal Frame		Using a metal-cutting saw to cut metal pieces that will form the base or frame of the grass cutter
Grinding Metal Edges		Using a bench grinder to smooth and shape the metal edges.
Assembling the Frame with Wheels		The metal pieces are assembled into a rectangular frame, with wheels attached at each corner.
Drilling Holes for Mounting		Drilling holes in the metal plate to mount the solar panel bracket.

Welding the Frame		Welding to join metal pieces securely.
Wiring and Assembly		Connecting wires and components, including a motor, battery, and possibly a microcontroller
Testing and Monitoring		Using a smartphone to monitor or control the setup

CHAPTER 4

RESULT AND DISCUSSION

4.0 DESIGN

This solar-powered grass cutter is also an example to sustainable development by utilizing renewable energy, directly supporting several Sustainable Development Goals.Based on our project, we made some differences from existing products to make it more efficiently used. The use of lightweight materials resulted in an overall weight of 50kg, ensuring that the cutter maintained stability during operation. This design choice minimized vibrations and contributed to consistent cutting quality. One of the standout features of this design is its capability for remote operation via a mobile app. Users can control the grass cutter directly from their smartphones, allowing for easy management of cutting schedules and adjustments to settings. This integration of technology enhances user convenience and fosters a more interactive lawn care experience.

The figure below shows the completed product:

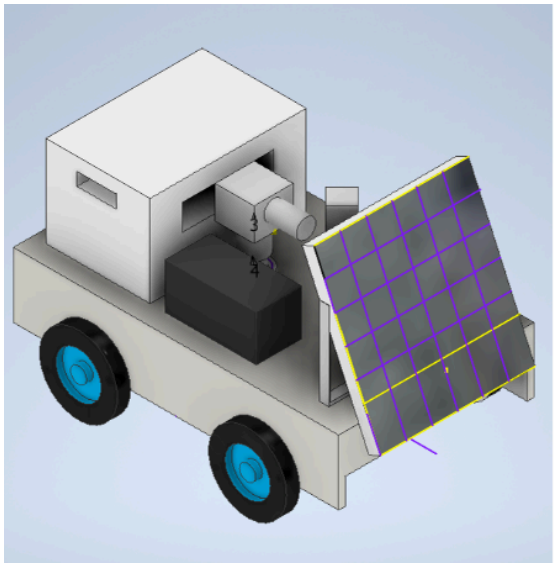


Figure 4.0.1: Final 3D Drawing

Figure 4.0.2: Final Project Outcome

4.1 ENGINEERING DRAWING

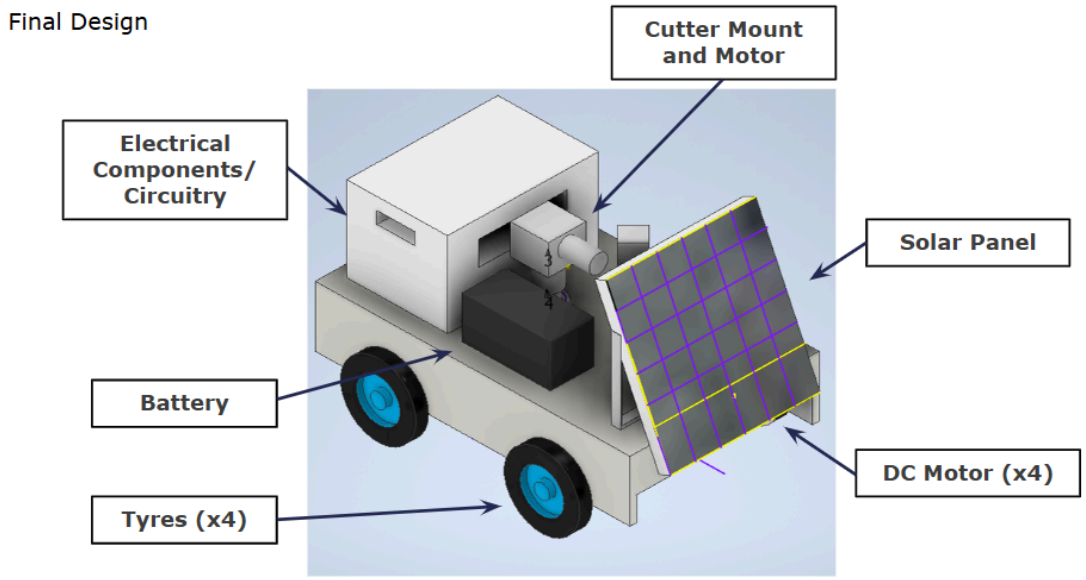


Figure 4.1.1: 3D drawing (Top View)

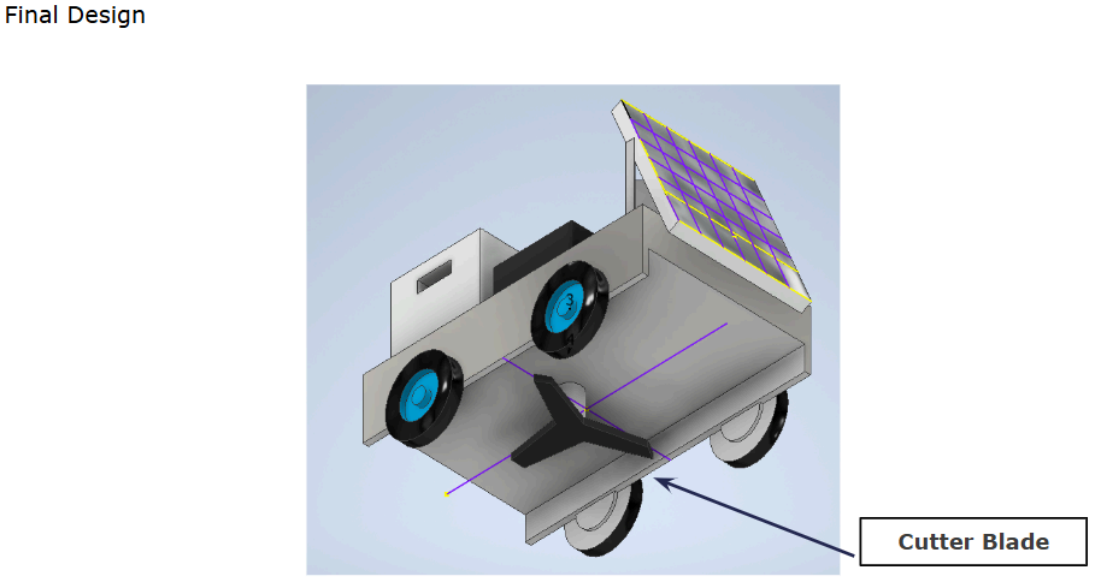


Figure 4.1.2: 3D drawing (Bottom View)

4.2 MANUAL OPERATION

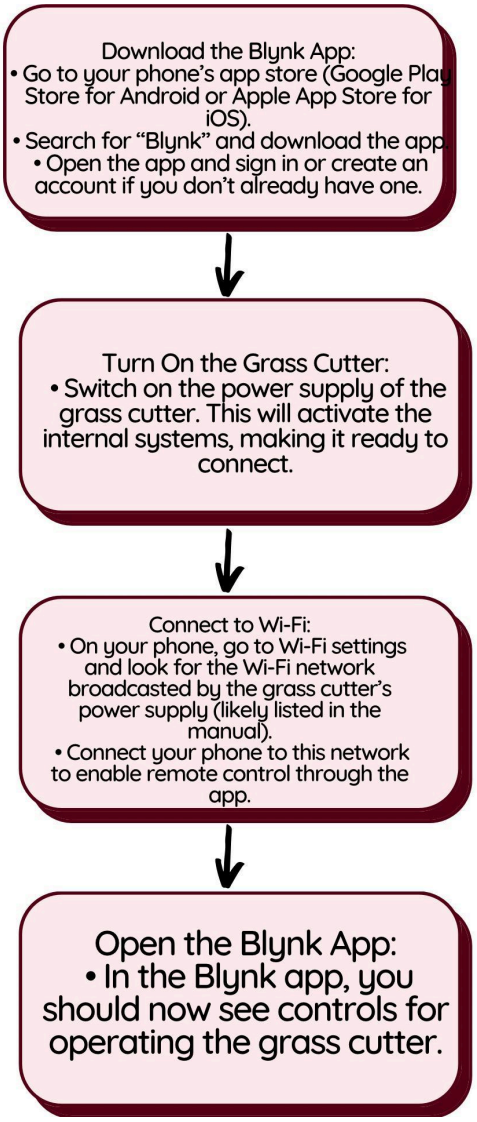


Figure 4.2.1: Manual Operation

4.3 TECHNICAL ANALYSIS

1. Solar panel: Polycrystalline solar panel for energy generation.
2. Battery: 12V battery to store excess energy and charge the motors.
3. Solar power controller: To manage the flow of electricity to the battery.
4. Grass cutting blade: 3T blade to trim the grass.
5. Esp32: Control the movement of motors and connect the machine to the user's smartphone to control the whole system.
6. Motors: To move the wheels and power the blade, controlled by the user's smartphone.

4.4 RESPONDENT FEEDBACK

We gathered this data from the users by using surveys conducted on Google Forms.

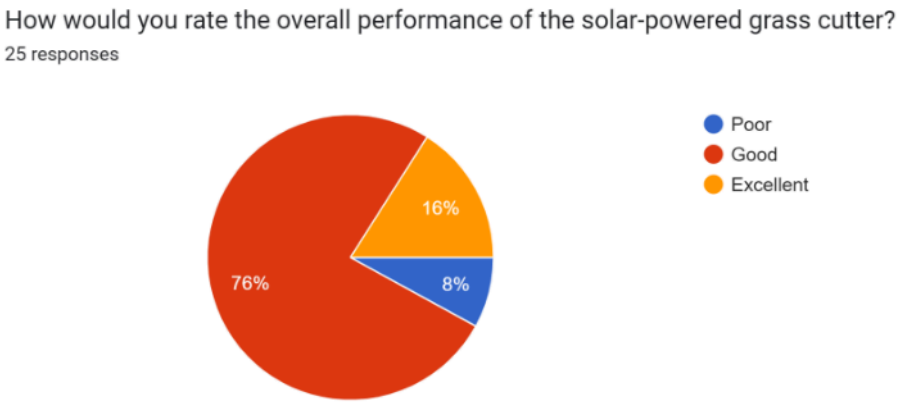


Figure 4.4.1: Respondents Survey on Google Form

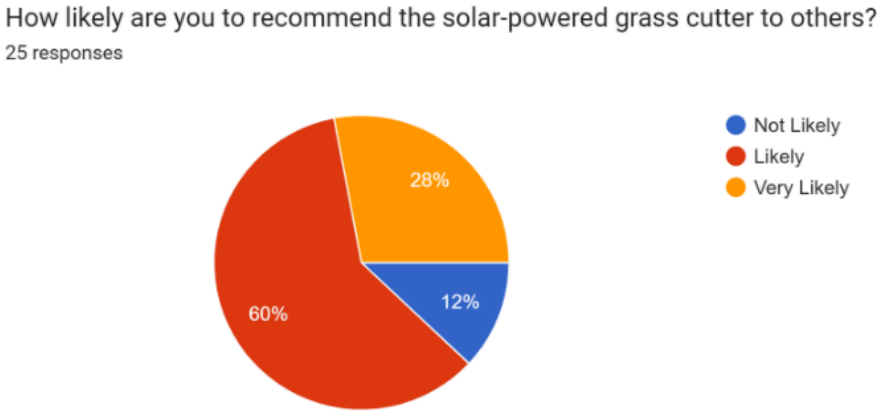


Figure 4.4.2: Likely to recommend solar powered grass cutter

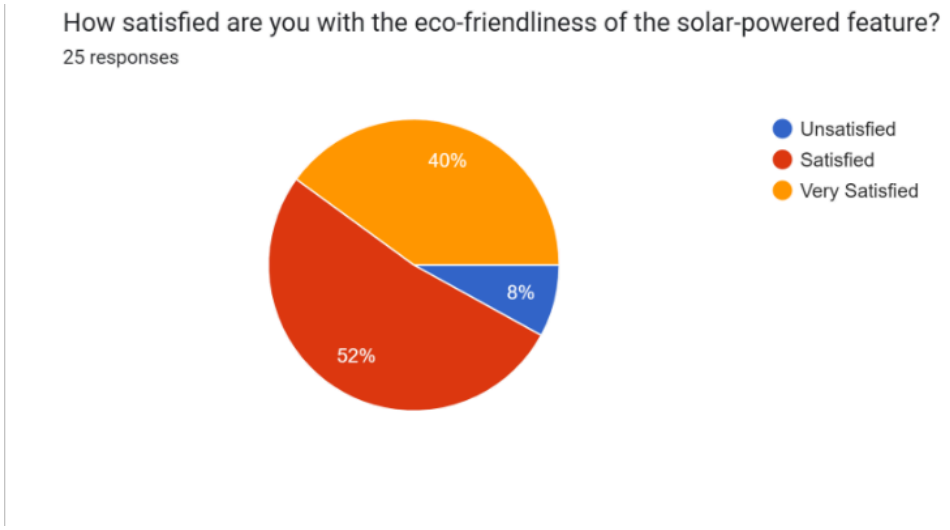


Figure 4.4.3: Satisfaction with eco friendliness

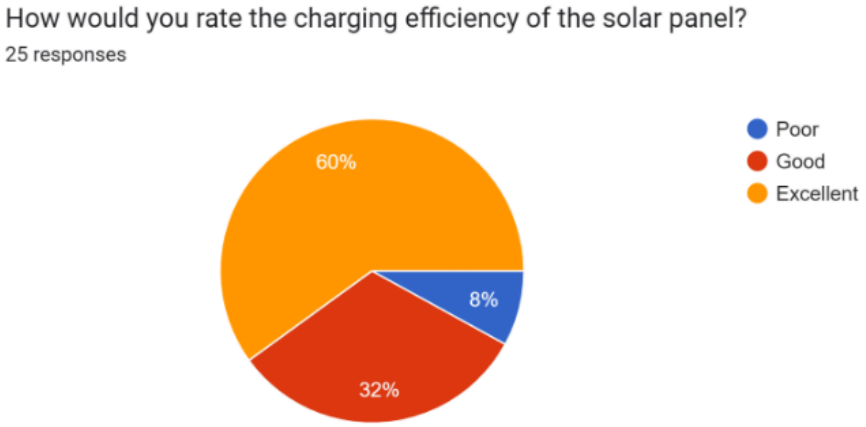


Figure 4.4.4: Respondents survey on Google Form

4.5 COSTING ANALYSIS

No.	Material/Component	Price Per Unit (RM)	Unit	Total Price (RM)	Source
1.	Mild Steel	31.25/meter	2	62.50	YOS Steel Sdn Bhd
2.	Solar Panel	32.55	1	32.55	Shopee
3.	DC Motor	25	4	100	Shopee
4.	Arduino Kit	60.91	1	60.91	Shopee
5.	Heavy Duty Tyres/Wheels	24.90	4	99.6	Shopee
6.	Cutter Blade (3T)	13.50	1	13.50	Shopee
7.	ESP32.20 Pin	12.50	2	25	Shopee
8.	Battery	40.82	2	81.64	Shopee
9.	Wire Cable Jumper	0.80	40	32	Shopee
10.	H-Bridge Motor Driver	17.88	2	35.76	Shopee
11.	40 Pin Jumper Dupont Wire	4.70	3	14.1	Shopee
12.	8 Ways Channel Opto Isolator	5.62	1	5.62	Shopee
Total				RM563.18	

Table 4.5.1: Costing Analysis

CHAPTER 5
CONCLUSION AND SUGGESTION

5.0 INTRODUCTION

In this chapter, we discuss the problems during building our project and the improvements that we can make in the future. Overall, this experience leads to us learning a lot on how to handle a project, creating a new machine design and problem-solving skills. We gain a lot of knowledge that is helpful in the future.

5.1 DISCUSSION

During building our project, there were many issues and several challenges that we faced. One of the main issues was a design problem with the blade. Our motor couldn't fit the blade because the shaft was too big. Secondly, the battery capacity was not compatible with our coding and solar. A solar-powered grass cutter needs to store energy to operate when there’s insufficient sunlight. Selecting a battery with sufficient capacity is crucial, but these batteries can be heavy and expensive, which might add overall weight to the machine. Thirdly, motor efficiency. The efficiency of the motor plays a big role in ensuring the system works optimally. The motor’s voltage didn't match the output voltage of the battery or solar system, leading to power loss and insufficient power.

5.2 IMPROVEMENT AND SUGGESTION (RECOMMENDATIONS)

There were many improvements that we can do with an appropriate budget. Firstly, creating a more thorough design overall about our machine, especially the blade. Secondly, the related problems with the solar-system, battery and motors. Using a matched voltage level between the motors and battery, so it will run efficiently. Better wiring is also needed between the solar panels, battery and motors. Lastly, during heavy cutting load, the battery may not be able to run the motor, using a higher-capacity battery such as lithium-ion can store more energy and handle higher power loads to support the motor. However, a bigger battery leads to it being more heavy, the design of our machine should be able to withstand it better than before.

5.3 CONCLUSION

In conclusion, our journey in developing the solar-powered grass cutter has been both exciting and rewarding. This innovative device not only represents a step forward in sustainable lawn care but also highlights the potential of renewable energy in our everyday lives. By using solar power, we're taking a significant step toward reducing our environmental impact and promoting a greener future. Our grass cutter also has one of the best features of our grass cutter is that the user can control it with your phone through a mobile app. This means users can easily manage their lawn care from anywhere, making the task simpler and more convenient.

CHAPTER 6
REFERENCE

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PROJECT GROUP INDIVIDUAL TASK DISTRIBUTION TABLE

PROJECT TITLE: SOLAR POWERED GRASS CUTTER

SUB CHAPTERS	DESCRIPTION
NAME OF STUDENT: MUHAMMAD DANISH IRFAN BIN SHAHRIZAL	
3.2-3.3	METHODOLOGY: 3.2 GATHERING INFORMATION 3.3 DESIGN PROCESS
3.4	MATERIAL SELECTION
3.5	GANTT CHART
NAME OF STUDENT: ISKANDAR HAQIIM BIN MUHD RASHIDI	
3.1	METHODOLOGY: INTRODUCTION
3.2-3.4	METHODOLOGY: 3.2 GATHERING INFORMATION 3.3 DESIGN PROCESS 3.4 MATERIAL SELECTION
3.6	METHODOLOGY:REFERENCES
5.0-5.3	CONCLUSION AND SUGGESTION: 5.0 INTRODUCTION 5.1 DISCUSSION 5.2 IMPROVEMENTS 5.3 CONCLUSION
6.0	REFERENCES

NAME OF STUDENT: RABIATUL SAADIAH BINTI MOHD SAMUN	
1.1-1.5	**INTRODUCTION:** **1.1 INTRODUCTION** **1.2 BACKGROUND** **1.3 PROBLEM STATEMENT** **1.4 OBJECTIVE** **1.5 RESEARCH SCOPE**
2.1-2.3	**LITERATURE REVIEW:** **2.1 INTRODUCTION** **2.2 RESEARCH WORK** **2.3 COMPARISON EXISTING AND NEW DESIGN**
3.1	**METHODOLOGY: FLOW CHART**

PROJECT SUPERVISOR VERIFICATION:

…….

NAME: