POLITEKNIK SEBERANG PERAI

Wireless Grass Cutter

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ABSTRACT

The main objective for the Wireless Grass Cutter group is to design a lawn mower that incorporates all of the features from various types of lawn mowers, plus more. The group will create a remote-control lawn mower that utilizes each of the benefits, creating a safe, reliable and user friendly lawn mower. The project was done in two different stages. The first stage the group completed was the Remote-Control Lawn Mower. The second stage of their project was creating a Semi-automatic Lawn Mower. The remote-control lawn mower has been designed and built by many engineers throughout the years. There are many variations of the remote-control lawn mower, as people across the nation have attempted to advance the basic lawn mower by implementing the remote-control aspect. The Semi-automatic Lawn Mower was a lot more difficult to design and build. By integrating hardware and software, the students found just how much technology can be used to develop an outstanding project. The group went a step further by creating an even safer version of the mower. In addition, the autonomous version is also much more convenient for the user.

Keywords: Wireless, Lawn mower, Remote control.

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CHAPTER 1 INTRODUCTION

1.0 PROJECT INTRODUCTION

The project aims to cut the grass using only the remote control. A remote-control transmitter with 4 channel 315MHz used to control the machine grass. 4 channel is to forward, reverse, left and right. When the button is pressed forward, then the truck will move forward. When reversed, button is pressed, the truck will move reverse. When the left button is pressed, then the motor will forward right and left motor will reverse. Received signal will be send on Arduino. Arduino movement that will make the decision to be mad based on the remote pressed. For the cutting of grass, brush-less motor units are supplied with the controller used. This is as high-speed motor should be used to cut grass.

1.1 PROBLEM STATEMENT

Most of lawnmower today operates manually where human needs to control the machine directly in grass cutting activities. This requires a lot of energy if the area was too wide. The available lawn mower today uses petrol to operate the engine this can contribute air pollution. Automatic mower today requires a wire that surrounds the boundary of the yard. This wire was installed around the perimeter of the yard and the mower can sense this wire as the boundary. The mower will then turn a specified angle and then cut in a straight line until it hits either the boundary or an object, such as tree. It turns at the same angle again and will continue the same process. The mower will continue this process until the lawn is completely cut. There are a few drawbacks to this design. First, it requires a wire that needs to be implanted into the ground. Second, the lawn isn't cut in nice patterns that people wants. The mower constantly runs across the lawn in a different direction until it covers all of it, which will take hours to complete.

1.2 BACKGROUND RESEARCH

1.2.1 Existing Technology

Existing automated lawn mowers each have a distinct working principle, for instance the Robomow from Friendly Robotics (2011) requires the user to perform a onetime set up where the garden perimeter is set. The perimeter is set using a battery powered wire that is laid around the outer edges of the garden and any area where the robot is not to cover. Special sensors inside Robomow enable the wires to be recognized and the robot is therefore kept within the designated area. The robot travels on the garden in a systematic criss-cross pattern, as shown in Figure 1.2.1, several times from side to side to ensure that the entire area is covered and that the grass is cut from different angles (Friendly Robotics, 2011).

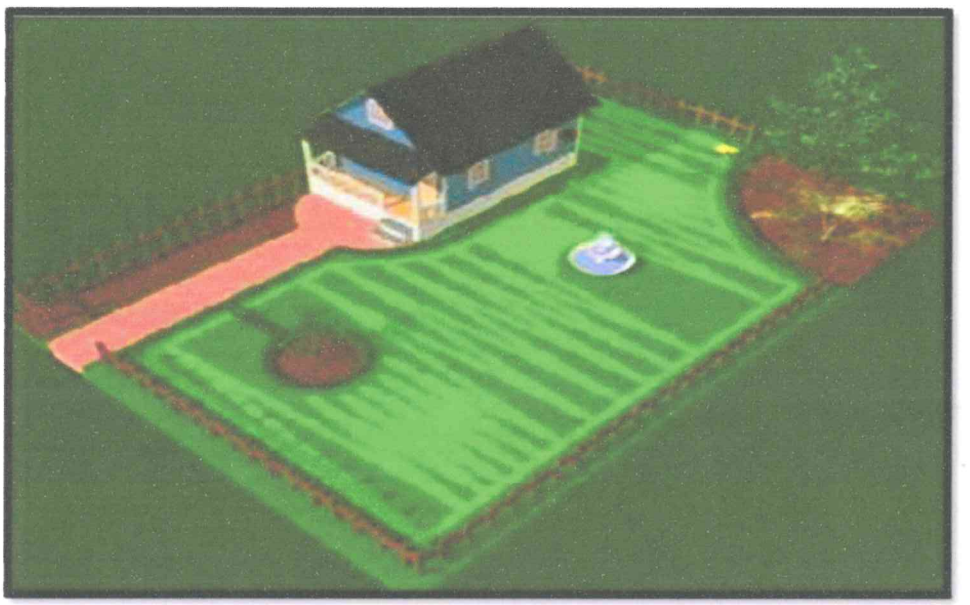

Figure 1.2.1 Systematic Criss-cross Pattern

Other technologies work around a similar principal as the Robomow, in the sense that it requires a perimeter wire to limit its cutting area. A difference between them may be added features and the cutting pattern, for instance the LawnBott and the Husqvarna both have a random operating principle (LawnBott 2011, p. 7 and 8), in the sense that they do not follow any specific cutting pattern as illustrated in figure above.

1.3 AIM OF STUDY

1.3.1 Objective

The objective is important to achieve the goal. The main objectives of this project are:

1. Identify the features that need to be modified or added for the Remote-Control Lawn Mower:
   a) wireless remote control
   b) power window (dc motor)
   c) lawnmower (body)
2. To provide facilities for grass cutting.
3. To learn how the motor is controlled by a remote control.
4. To know how the Arduino control the motor with a larger voltage.
5. To produce products that are competitive in terms of functionality.
6. To produce a design that combines mechanical, electronic and programming.

1.4 SCOPE AND LIMITATION OF PROJECT

1.4.1 Scope

This project taken place mainly at lawn such as football field, hockey field, garden and home side. This product be designed to compare the cost material and design. That only can take speed around 65km/h.

1.4.2 Limitation

One of the limitations of the design method is the distance determination, which includes precision and maximum distance that can be determined by the remote-control. The garden shape and dimensions also constitute a limiting factor for the system described on the present report; the reasoning behind this resides on the motion pattern chosen. For instance if the garden has rounded sides and other shapes other than part cubical, this system may leave parts of uncut grass in the garden area. A further limitation of the system is identified when obstacles are present in the garden area, where a method is to be identified for the system to continue with normal operation by finding a way around it.

1.5 SIGNIFICANT STUDY

The first lawn mower was invented by Edwin Budding in 1830 in Thrupp, just outside Stroud, in Gloucestershire, England. Budding's mower was designed primarily to cut the grass on sports grounds and extensive gardens, as a superior alternative to the scythe, and was granted a British patent on August 31, 1830. An early cylinder (reel) mower, showing a fixed cutting blade in front of the rear roller and wheel-driven rotary blades. Budding's first machine was 19 inches (480 mm) wide with a frame made of wrought iron. The mower was pushed from behind. Cast-irongear wheels transmitted power from the rear roller to the cutting cylinder, allowing the rear roller to drive the knives on the cutting cylinder; the ratio was 16:1. Another roller placed between the cutting cylinder and the main or land roller could be raised or lowered to alter the height of cut. The grass clippings were hurled forward into a tray-like box. It was soon realized, however, that an extra handle was needed in front to help pull the machine along. Overall, these machines were remarkably similar to modern mowers. Two of the earliest Budding machines sold went to Regent's Park Zoological Gardens in London and the Oxford Colleges. In an agreement between John Ferrabee and Edwin Budding dated May 18, 1830, Ferrabee paid the costs of enlarging the small blades, obtained letters of patent and acquired rights to manufacture, sell and license other manufacturers in the production of lawn mowers. Without patent, Budding and Ferrabee were shrewd enough to allow other companies to build copies of their mower under license, the most successful of these being Ransomes of Ipswich, which began making mowers as early as 1832. His machine was the catalyst for the preparation of modern-style sporting ovals, playing fields (pitches), grass courts, etc. This led to the codification of modern rules for many sports, including for football, lawn bowls, lawn tennis and others. The wireless grass cutter it's known for its multipurpose use in many different field. From this project, we create the portable wireless grass cutter that can be used for the use and convenience of the user. So the user does not have to stay under the sun and also can be control by remote. We also produce a user friendly project which enables the user to easily understand how the wireless grass cutter is used.

CHAPTER 2: LITERATURE REVIEW

This chapter will focus on the literature review. It will introduce the history of the technologies, the first invention, and the safety issue and environment impact.

2.1 Introduction

In the course of a project, various measures must be taken from the beginning until the completion of a project. To obtain satisfactory results, the studies on the project must be made in advance of start of its designs, problems, until the operating system. For this purpose, systematic planning should be arranged to obtain the desired results. It starts from the idea created and ends with the production of design. The success of design also depends on the creativity of designers and use of appropriate technology to meet the user needs effectively in terms of functionally, ergonomics, and aesthetic. Design work and study is an ongoing process that involves creative problem solving activities, known as the literature review.

2.2 The history of Lawn Mower

A lawn mower (mower, etc.) 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 muscle, 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 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.

2.3 Invention

An early cylinder (reel) mower, showing a fixed cutting blade in front of the rear roller and wheel-driven rotary blades. The mower was pushed from behind. Cast-iron gear wheels transmitted power from the rear roller to the cutting cylinder, allowing the rear roller to drive the knives on the cutting cylinder. Another roller placed between the cutting cylinder and the main or land roller could be raised or lowered to alter the height of cut. The grass clippings were hurled forward into a tray-like box. It was soon realized, however, that an extra handle was needed in front to help pull the machine along. Overall, these machines were remarkably similar to modern mowers.

2.4 Safety Issue

Rotary mowers can throw out debris with extreme velocity and energy. Additionally, the blades of a self-powered push mower (gasoline or electric) can injure a careless or inattentive user; as such, many come equipped with a dead man's switch to immediately disable the blade rotation when the user is no longer holding the handle. They also should demonstrate proper judgment and maturity. Persons using a mower should wear heavy footwear, eye protection, and hearing protection in the case of engine-powered mowers.

2.5 Environmental Impact

Another estimate puts the amount of pollution from a lawn mower at four times the amount from a car, per hour, although this report is no longer available. Mowers also create significant noise pollution, and could cause hearing loss if used without hearing protection. This can be avoided through the use of reel mowers or by using cheap, easily obtainable hearing protection such as earplugs or earmuffs.

2.6 Previous Research Automatic Grass Cutter

2.6.1 Manual Grass Cutter.

The mower was pushed from behind. Iron gear transmitted power from the rear roller to the cutting cylinder, allowing the rear roller to drive the knives on the cutting cylinder. Another roller placed between the cutting cylinder and the main or land roller could be raised or lowered to alter the height of cut. The grass clippings were hurled forward into a tray-like box. It was soon realized, however, that an extra handle was needed in front to help pull the machine along. Overall, these machines were remarkably similar to modern mowers

Figure 2.6.1 Manual Grass Cutter

2.7 DC Motor

DC motors consist of rotor-mounted windings (armature) and stationary windings (field poles). In all DC motor, except permanent magnet motors, current must be conducted to the armature windings by passing current through carbon brushes that slide over a set of copper surfaces called a commutator, which was mounted on the, tor. The commutator bars are soldered to armature coils. The brush commutator combination makes a sliding switch that energizes particular portions of the armature, based on the position of the rotor. This process creates north and south magnetic poles on the rotor that are attracted to or repelled by north and south poles on the stator, which

are formed by passing direct current through the field windings. It was this magnetic attraction and repulsion that causes the rotor to rotate.

2.8 The Advantages

The greatest advantage of DC motors may be speed control. Since speed was directly proportional to armature voltage and inversely proportional to the magnetic flux produced by the poles, adjusting the armature voltage andlor the field current will change the rotor speed. Today, adjustable frequency drives can provide precise speed control for AC motors, but they do so at the expense of power quality, as the solid- state switching devices in the drives produce a rich harmonic spectrum. The DC motor has no adverse effects on power quality.

2.9 The drawbacks

Power supply, initial cost, and maintenance requirements are the negatives associated with DC motors.

- Rectification must be provided for any DC motors supplied from the grid. It can also cause power quality problems.
- The construction of a DC motor was considerably more complicated and expensive than that of an AC motor, primarily due to the commutator, brushes, and armature windings. An induction motor requires no commutator or brushes, and most use cast squirrel-cage rotor bars instead of true windings - two huge simplifications.
- Maintenance of the brush/commutator assembly was significant compared to that of induction motor design. In spite of the drawbacks, DC motors are in wide use, particularly in niche applications like cars and small appliances.

2.9.1 Permanent Mamet motors

Here, permanent magnets instead of armature windings are mounted on the rotor. Since the magnetic field produced on the rotor is limited in strength and was not controllable, permanent magnet motors are typically small and produce little horsepower.

2.9.2 Series Motors

Series motors connect the field windings in series with the armature. Series motors lack good speed regulation, but are well-suited for high-torque loads like power tools and automobile starters because of their high torque production and compact size.

2.9.3 Shunt Motors

Shunt motors use high-resistance field windings connected in parallel with the armature. Varying the field resistance changes the motor speed. Shunt motors are prone to armature reaction, a distortion and weakening of the flux generated by the poles that result in commutation problems evidenced by sparking at the brushes. Installing additional poles, called interpoles, on the stator between the main poles wired in series with the armature reduces armature reaction.

2.9.4 Compound Motors

Here, the concept of the series and shunt designs are combined. The Figure above shows one way of wiring a compound motor with interpoles. The blue lines indicate the shunt field, the red lines designate the series field and the green lines show the interpole windings in series with the armature.

After more than a century, DC motors are still in. widespread use, and thanks to niche applications that show no signs of disappearing, they'll be around for many years to come.

2.10 Mower Blade

The blade located on this mower is like the blade on any regular lawn mower. This mower will accept any regular 14" (14 inch) mower blade. Here are a few steps to check on the sharpness of the mower blade:

- Ensure that the mower is turned off and remove the battery
- Tilt the lawn mower on its side to reveal the undercarriage of the mower

- Loosen nut holding blade in place and remove blade
- Inspect the sharpness of blade (Doesn't need to be razor sharp but still needs an edge)
- If blade is dull, either buy new blade or sharpen the old blade.
- Replace blade and tighten nut.
- Place mower upright and re-insert battery.

2.11 Safety Precaution

Safety is a primary concern for the robotic lawn mower. The mower has two different types of kill switches that play an important role in the safety aspect of the mower. The first is a mower blade kill switch which is located on the remote control to stop the blade. This switch is a user operated switch and could be used in the event of an emergency situation. There also is a manual kill switch that is located on the mower to turn off the mower for storage. Lastly, a bumper was constructed onto the mower which detects when there is a foreign object in the mower's path. With these safety features, users still must take precautions when using this lawn mower. The lawn mower has a sharp blade that should not be operated by children. Users should remove any objects from the lawn that may cause interference to the mower before use. Users should not use this lawn mower around pets or children. Users should not operate electric lawn mower in standing water or during inclement weather. The lawn mower should only be used on a grassy area. Users should take precautions when installing invisible fence. Do not operate lawn mower unsupervised.

2.12 Conclusion

In the presented paper provides the fabricated information about the "Fabrication of Grass Cutting Machine" which was designed fully wireless and the battery is main energy for running the grass cutter motor. Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC's with the help of growing technology, the project has been successfully implemented. Thus the project has been successfully designed and tested. It can also be extended using driver circuits for controlling intensities, speed levels of the motor. Extensions using Wireless remote controls like RF, zigbee, Wi-Fi networks through which the grass cutter. This lawn mower will meet the challenge of environmental production and low cost of operation since there is no cost for fueling. A lawn mower has been developed for the use of residences and establishments that have lawns where tractor driven mowers could not be used.

CHAPTER 3: METHODOLOGY

3.1 Introduction

The methodology is related to lighting devices, components, methods, procedures, rules and techniques. For conducting and completing a project successfully, several aspects of the method or procedure must be known in advance. Therefore, aspects and methods for implanting a project is to identify equipment and components required in the course of project creation.

This can make it easier for us to know and understand each use of the equipment and components. To ensure the project runs smoothly without causing any problems, we have divided the process into several stages. This is intended to ensure a systematic implementation process and directly to avoid confusion.

Project planning:

- Understanding the concept and theory of the project
- Prepare the Gantt Chart for guidelines and progress of the project

Finishing

- Presentation of the project.

3.2 The Main Component

The main option of electric and electronic components are the types of components that are using in the circuit. The main components are:

- Arduino Uno
- Arduino Shield PS2
- Motor Driver LM298
- Battery 12V
- DC Motor
- Gear DC Motor

3.2.1 Arduino Uno

The function of Arduino Uno is segmenting code into functions allows a programmer to create modular pieces of code that perform a defined task and then return to the area of code from which the function was "called". The typical case for creating a function is when one needs to perform the same action multiple times in a program. In this project, the Arduino Uno is used as the brain that designs as programmed and interacts with the laser with proper connections with components.

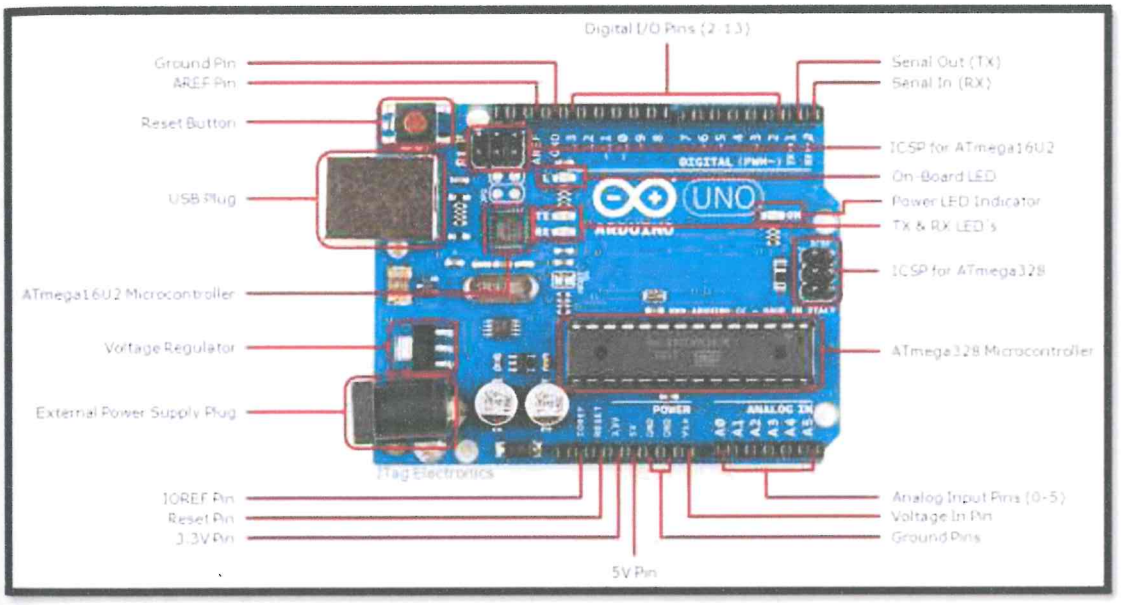

Figure 3.2.1 Arduino Uno

3.2.2 Cytron PS2 Shield

Cytron PS2 Shield offers a compact yet reliable PS2 Controller Converter for user. Cytron PS2 Shield is powered from Arduino main board. With Cytron PS2 Shield Reading Joy-stick and button's state of PS2 controller will be as easy as reading UART data. It offers a standard connector for PS2 controller to plug-in, either wired or wireless. Shield-PS2 has stackable side headers which allows for more Arduino shields to be stacked on top of it. Besides, user has option to use either hardware or software UART with Arduino's main board to communication to get the PS2 controller status. Shield-PS2 reset is connect to Arduino's analog pin 1 (A1). User can pull down this analog pin to reset the shield.

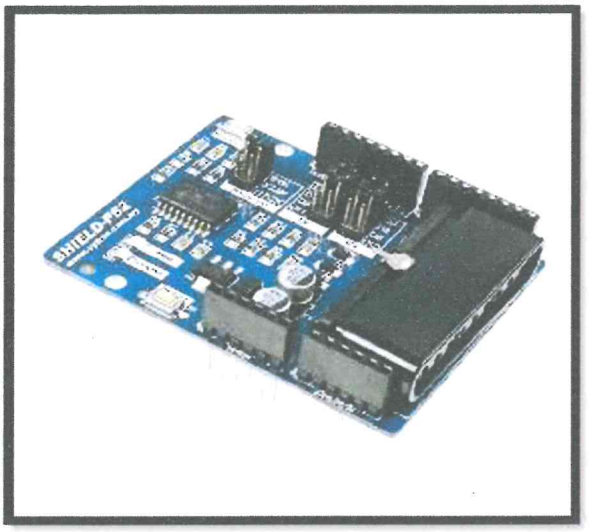

Figure 3.2.2(a) Cytron PS2 Shield

Figure 3.2.2(b) PS2 Controller

3.2.3 L293D Motor Driver IC

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC. Dual H-bridge Motor Driver integrated circuit (IC). The l293d can drive small and quiet big motors as well, check the Voltage Specification at the end of this page for more info.

It works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to be flown in either direction. As you know voltage need to change its direction for being able to rotate the motor in clockwise or anticlockwise direction, hence H-bridge IC are ideal for driving a DC motor.

In a single L293D chip there are two h-Bridge circuit inside the IC which can rotate two dc motor independently. Due its size it is very much used in robotic application for controlling DC motors. Given below is the pin diagram of a L293D motor controller.

There are two Enable pins on l293d. Pin 1 and pin 9, for being able to drive the motor, the pin 1 and 9 need to be high. For driving the motor with left H-bridge you need to enable pin 1 to high. And for right H-Bridge you need to make the pin 9 to high. If anyone of the either pin1 or pin9 goes low then the motor in the corresponding section will suspend working. It's like a switch.

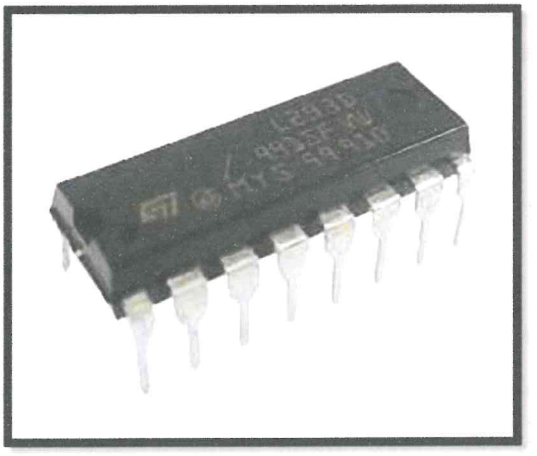

Figure 3.2.3 IC L293D

3.2.4 Dc Motor

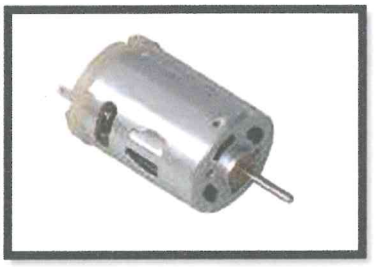

Figure 3.2.4 DC Motor

A DC motor is any of a class of electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor. Most types produce rotary motion; a linear motor directly produces force and motion in a straight line.

3.2.5 Battery 12V

Figure 3.2.5 Battery 12V

Despite having a very low energy-to-weight ratio and a low energy-to-volume ratio, its ability to supply high surge currents means that the cells have a relatively large power-to-weight ratio. These features, along with their low cost, makes it attractive for use in motor vehicles to provide the high current required by automobile starter motors.

3.2.6 Grass Cutting Blade

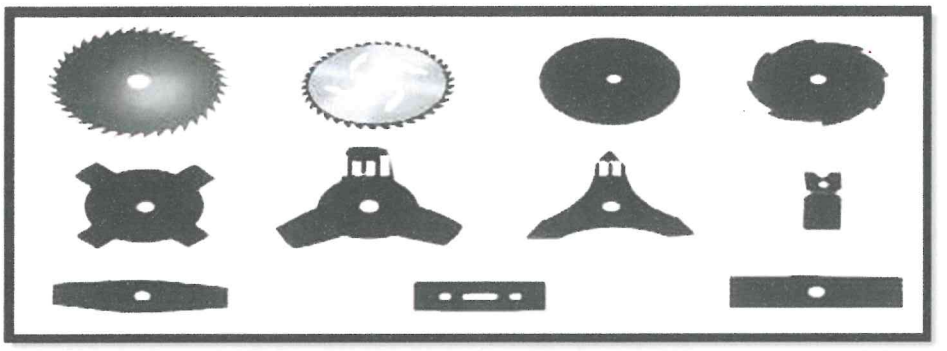

Figure 3.2.6 Grass Blade

1. **Reel or cylinder blades**

   Used in reel or cylinder mowers, cylinder blades are composed of three to seven helical blades welded in a horizontally rotating cylindrical reel, creating a scissor-like cutting action. Unlike other types of mower blades, reel/cylinder blades cannot be replaced; therefore, a broken blade requires replacement of the entire mower. For dull or rusty blades, cleaning and sharpening kits are available.

2. **Deck blades**

   Also known as the standard or straight mower blade, this is the most commonly used blade on rotary mowers.

3. **Mulching blades**

   A mulching blade, also known as an all-purpose blade, features a curved surface which allows it to work in three ways: lifting, mowing, and mulching. First, the blade pulls the grass up and cuts it. Then, clippings are sucked inside the deck and are chopped into tinier pieces. Finally, the blade's innermost curve produces air pressure to blow the small clippings out, where they are used to feed the soil.

4. **Lifting blades**

   The lifting blade features a slightly curved surface which creates a vertical upward airflow that lifts the grass up and is assumed to provide a cleaner result than the other types of blades.

5. **Low-lift blade**

   Low suction power; recommended for mowing terrain with sandy soil.

6. **Medium-lift blade**

   Medium suction power; uses less horsepower than high-lift blades.

7. **High-lift blade**

Provides the greatest suction power among the three lifting blades, but also requires the most horsepower. This is the best blade for cutting tall, compact grass.

3.2.7 Relay

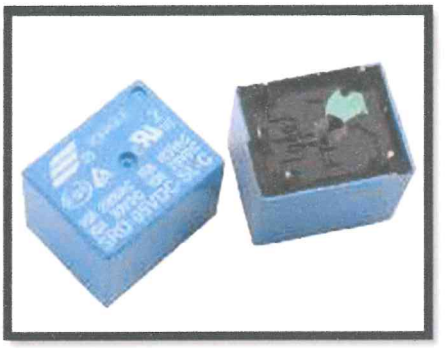

Figure 3.2.7 Relay SRD-05VDC

Relay an electrical device, typically incorporating an electromagnet, that is activated by a current or signal in one circuit to open or close another circuit.

3.2.8 Resistor

Resistors are electronic components which have a specific, never-changing electrical resistance. The resistor's resistance limits the flow of electrons through a circuit. They are passive components, meaning they only consume power (and can't generate it). Resistors are usually added to circuits where they complement active components like op-amps, microcontrollers, and other integrated circuits. Commonly resistors are used to limit current, divide voltages, and pull-up I/O lines. Resistor can be divided in to two groups:

I. Static Resistor

II. Variable Resistor

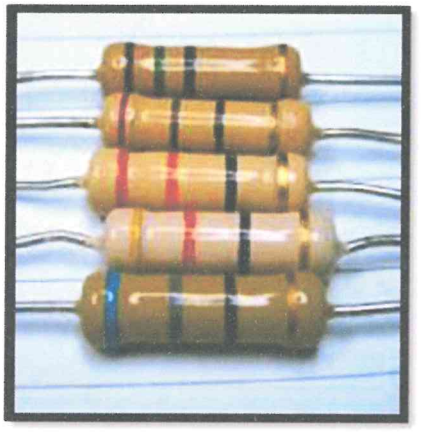

Figure 3.2.8 Resistor

3.3 FLOW CHART

Flowchart plan of the project