POLITEKNIK MALAYSIA

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FACULTY OF MECHANICAL ENGINEERING

DIPLOMA IN MECHANICAL ENGINEERING

(PROJECT 2 DJJ 6143)

FINAL REPORT OF :

DEVELOPMENT PROTOTYPE OF SMART LAWN MOWER

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Diploma in Mechanical Engineering

VERTIFICATION PROJECT REPORT

Project report tittle 'Development Prototype Of Smart Lawn mower ' has been reviewed and confirmed as being eligible and project writing requirements specified

Reviewed by : .....

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ABSTRACT

An automatic lawn mower (smart lawn mower) is a machine which helps human to cut grass automatically. Rapid growth of various high-tech tools and equipment makes our job done comfortable and sophisticated. This project considers the implementation of a lawn mower which can be operated using wireless technology. Every action of the lawn mower is controlled by the arduino which eliminates the use of perimeter wires to maintain the lawn mower within the lawn. In addition, the project aims at fabricating a lawn mower which makes the grass cutter motor run through battery energy and also use an ultrasonic sensor to detect the obstacle. This project will reduce environmental and noise pollution.This prototype of smart lawn mower is user friendly and cost efficient.The project objective is to come up with a mower that is portable,durable,easy to operate and maintain and it also aims to design a self – powered mower of using a battery sources.

Keywords :

Wireless

Arduino

Battery

Ultrasonic sensor

ABSTRAK

Pemotong rumput automatik (pemotong rumput pintar) adalah mesin yang membantu manusia memotong rumput secara automatik. Pertumbuhan pesat pelbagai alat dan peralatan berteknologi tinggi menjadikan pekerjaan kami mudah dan selesa. Projek ini mempertimbangkan perlaksanaan pemotong rumput yang boleh dikendalikan menggunakan teknologi tanpa wayar. Setiap tindakan pemotong rumput dikawal oleh arduino yang menggunakan penggunaan wayar perimeter untuk mengekalkan pemotong rumput di dalam rumput. Di samping itu, projek ini bertujuan untuk membuat fabrik pemotong rumput yang menjadikan motor pemotong rumput berjalan melalui tenaga bateri dan juga menggunakan sensor ultrasonik untuk mengesan halangan. Projek ini akan mengurangkan pencemaran alam sekitar dan bunyi. Prototaip pemotong rumput pintar ini adalah mesra pengguna dan kos yang berpatutan. Objektif projek adalah untuk menghasilkan mesin pemotong yang mudah alih, tahan lama, mudah untuk dikendalikan dan diselenggara dan ia juga bertujuan untuk merekabentuk kuasa pemotong menggunakan sumber bateri.

Kata Kunci :

Tanpa wayar

Arduino

Bateri

Sensor ultrasonik

CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION

A lawn mower (also named as mower 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.

Two main styles of blades are used in lawn mowers. Lawn mowers employing a single blade that rotates about a single vertical axis are known as rotary mowers, while those employing a cutting bar and multiple blade assembly that rotates about a single horizontal axis are known as cylinder or reel mowers (although in some versions, the cutting bar is the only blade, and the rotating assembly consists of flat metal pieces which force the blades of grass against the sharp cutting bar).

There are several types of mowers, each suited to a particular scale and purpose. The smallest types, non-powered push mowers, are suitable for small residential lawns and gardens. Electrical or piston engine-powered push-mowers are used for larger residential lawns (although there is some overlap). Riding mowers, which sometimes resemble small tractors, are larger than push mowers and are suitable for large lawns, although commercial riding lawn mowers (such as zero-turn mowers) can be "stand-on" types, and often bear little resemblance to residential lawn tractors, being designed to mow large areas at high speed in the shortest time possible. The largest multi-gang (multi-blade) mowers are mounted on tractors and are designed for large expanses of grass such as golf courses and municipal parks, although they are ill-suited for complex terrain.

1.2 PROBLEM STATMENT

When talking about lawn mower it is certainly in our minds that only strong enough people can recognize this machine. This is because the lawn mower uses manual energy which are hard to handle also requires the expertise to handle it.With such a condition of the machine and with the size of the ball, it may require more than one worker and will also take a long time. With the hot weather in Malaysia, someone who uses this machine needs to weather the heat which can cause a person to be highly hydrated and likely to have skin diseases just to cut the grass. Through the study, the weather in today's world is very badly caused by the pollution often done by humans.

In addition, the cost of using this machine is high. Your power equipment engine, just like the gas engine in your personal vehicle, needs three things to run properly—air, fuel, and a spark to ignite the air and fuel mixture. If any of these elements are not supplied to the combustion chamber in the proper mixture and at the proper time, your engine will not run smoothly and may lose power.An open space full of grass will require at least twice a month to be cut. imagine that the area is just as big as a football field, it requires a lot of energy and a lot of fuel. Of course this thing will burden us.If the cost for a month is high, so we have to pay more for the cost to cut grass for a year and forever.

Furthermore, although the lawn machines are available in many designs, many machines lack of safety features. users need to use safety clothing while operating the machine, however, the safety features of the machine should also be taken care of. Because in can cause a bad injuries and maybe causing death. there have been numerous cases of death and accidents that occurred due to lawn Mower.

SEORANG pelajar perempuan terbunuh manakala dua rakannya cedera akibat terkena bilah pisau traktor mesin rumput yang melayang di Sekolah Menengah Kebangsaan (SMK) Tuanku Abd Rahman. Gemas. Tampin. pagi tadi

BERITA | MALAYSIA

Maut terkena bilah mesin rumput: Pihak kontraktor, pengurusan cuai - Mahdzir

Adie Sufian Zulkefli, Astro Awani | Mac 17, 2018 17:35 MYT

KUALA NERANG: : Hasil laporan penuh siasatan Jabatan Pendidikan Negeri Sembilan berhubung insiden pelajar maut terkena bilah mesin pemotong rumput di Sekolah Menengah Kebangsaan (SMK) Tuanku Abdul Rahman, Gemas, Negeri Sembilan pada 13 Februari lalu, mendapati wujud unsur kecuaian.

Jelas Menteri Pendidikan, Datuk Seri Mahdzir Khalid, pihak Kementerian Pendidikan mendapati ada unsur kecuaian di pihak kontraktor pembersihan dan pengurusan sehingga berlakunya kemalangan itu.

'Kita telah membaca laporan itu. Laporan tu mengesahkan ada kecuaian di pihak kontraktor dan juga di pihak pengurusan sekolah.

Warga Indonesia maut terkena serpihan batu mesin pemotong rumput

SEORANG pemotong rumput ditemukan maut disyaki terkena serpihan batu grinder mesin pemotong rumput di sebuah ladang - UTUSAN ONLINE / GAMBAR HIASAN

KUALA LUMPUR 17 Nov. - Seorang pemotong rumput ditemukan maut disyaki terkena serpihan batu grinder mesin pemotong rumput di sebuah ladang berhampiran Batu 29, Jalan Kuala Lumpur- Ipoh, Hulu Selangor dekat sini pagi tadi.

Ketua Polis Daerah Hulu Selangor, Superintenden Lim Bak Phai berkata, mangsa, Sumijo Sukardi, 63, ditemukan orang awam terbaring di ladang tersebut dan kemudian membuat laporan kepada pihak berkuasa kira-kira pukul 10.25 pagi.

"Hasil siasatan awal di tempat kejadian menemukan sebuah mesin potong rumput dan serpihan batu grinder yang mempunyai kesan darah bersebelahan si mati.

1.3.OBJECTIVES OF THE PROJECT

- To design and develop a prototype of lawn mower with more safety features.
- To fabricate and improve lawn mower that easily controlled..
- To test and investigate the function of prototype.

1.4. SCOPE OF THE PROJECT

- Design and build up lawn mower that can be controlled to cut grass in flat surface.
- Suitable to use at house area only.
- Not rechargeable battery (48 months battery lifetime).

1.5. CONTRIBUTION

There are many smart lawn mower now are widely use in this era but most of the current lawn mowers are manual. This project will help to make it easier to use the lawn mower. It was because this project will use a remote control to control the lawn mower which is will reduce a manpower, It is also use an electronic motor that uses a battery that does not need to be recharged many times this feature will save the cost of fuel consumption. Additionally, this project will also build a better safety features to prevent injuries.

1.6 .CONCLUSION

In conclusion, through the research done to produce this project, we can overcome the problems faced by grass machine users and improve existing lawn mowers to make it easier to use. Although the main purpose of this machine is to cut the grass, this project will also ensure that this machine is able to reduce the accident or injury to the user thus the machine will be accompanied by a complete design and safety features.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION (Prepared by Muhammad Afif Bin Hairon Anuar [08DKM17F1215])

At the initial stage of the project, the literature review is the previous study including information gathering from sources such as the internet and resources that are relevant to our tests. Collection information from literature studies is especially important as a first step research. It also identifies the major issues associated with research done.

This chapter discusses the concepts thoroughly. Based on the internet, reference books and observations. The purpose of this discussion is to describe the existing design and to see how far the project can be implemented. Our group is innovating a project design is in terms of lawn mower. Most of the production of the lawn mower project only uses the manual method or need manpower to drive the machine.So,we produce a quicker and quicker lawn mower machine in mechanical terms.

The purpose of this discussion is to describe the method used in designing project models. Uses of equipment and components that have a relationship with the design chosen to meet the criteria as a student Diploma in Mechanical Engineering.

General issues of issues or areas of focus should be identified thus providing the appropriate context for literature review. Term "Literature" means a review article referenced to understand and study research problems. Literature study is used to provide a study with to see the research done in the field of study and not just summarizes the studies conducted by other researchers. Overall trend suggestive titles in theory, methodology, evidence and conclusions. To clarify yet the projects that have been produced here are about carabunggi and advantages "Smart Field Mower" which is produced in comparison with a tool is already available in the market today.

2.2 PREVIOUS RESEARCH

LAWN MACHINE

A lawn mower also named as mower 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.

Two main styles of blades are used in lawn mowers. Lawn mowers employing a single blade that rotates about a single vertical axis are known as rotary mowers, while those employing a cutting bar and multiple blade assembly that rotates about a single horizontal axis are known as cylinder or reel mowers (although in some versions, the cutting bar is the only blade, and the rotating assembly consists of flat metal pieces which force the blades of grass against the sharp cutting bar).

(Fig 1)
Backpack Lawn Mower

There are several types of mowers, each suited to a particular scale and purpose. The smallest types, non-powered push mowers, are suitable for small residential lawns and gardens. Electrical or piston engine-powered push-mowers are used for larger residential lawns (although there is some overlap). Riding mowers, which sometimes resemble small tractors, are larger than push mowers and are suitable for large lawns, although commercial riding lawn mowers (such as zero-turn mowers) can be "stand-on" types, and often bear little resemblance to residential lawn tractors, being designed to mow large areas at high speed in the shortest time possible. The largest multi-gang (multi-blade) mowers are mounted on tractors and are designed for large expanses of grass such as golf courses and municipal parks, although they are ill-suited for complex terrain.

(Fig 2)
Hand push Lawn Mower

Our project is to produce a lawn machine that can be controlled through the font. In addition, every material used will be made an improvements for example the body of the lawn mower, the type of cutter used and the suitable energy source used for our innovation.

2.3 HISTORY

The first lawn mower was invented by Edwin Budding in 1830[1]. Edward Beard Budding was born in 1830, in Stroud City,Gloucestershire, England. Since childhood he has had the talent as an inspirational idea. Both his parents and his father were farmers living in Stroud, Glouchestershire. Despite being in the poor, his parents are willing to go to Budding to get the title of the creator. Before creating a lawn mower, Budding worked as a cloth cutter in a garment fabric store in Chalford. In the middle of busy in cutting cloth, he still thought of the idea of creating something useful for public benefit.

(Fig. 3)
Edward Beard Budding

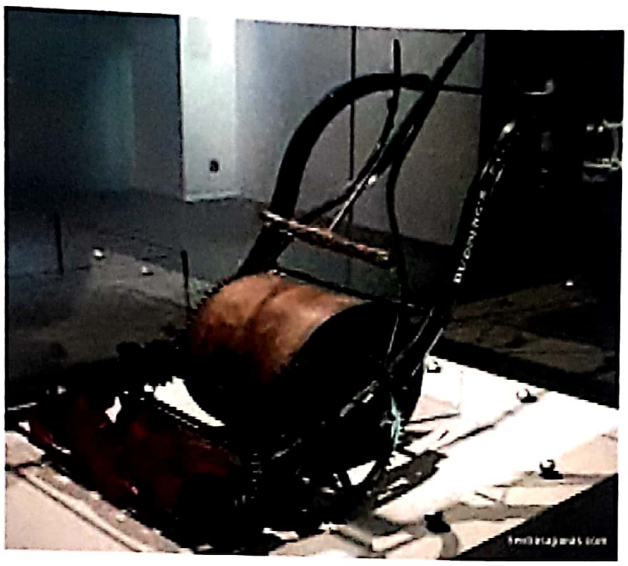
Budding's mower was designed primarily to cut the grass on sports grounds and extensive gardens, as a superior alternative to the scythe, and was granted a British patent on August 31, 1830 [2].

Budding's first machine was 19 inches (480 mm) wide with a frame made of wrought iron. 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; 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.[3]

Two of the earliest Budding machines sold went to Regent's Park Zoological Gardens in London and the Oxford Colleges.[4] 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.[3]

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.



(Fig 4)
Lawn Mower Created by Edwar Beard Budding

It took ten more years and further innovations to create a machine that could be drawn by animals, and sixty years before a steam-powered lawn mower was built. In the 1850s, Thomas Green & Son of Leeds introduced a mower called the Silens Messor (meaning silent cutter), which used a chain drive to transmit power from the rear roller to the cutting cylinder. These machines were lighter and quieter than the gear-driven machines that preceded them, although they were slightly more expensive[3].The rise in popularity of lawn sports helped prompt the spread of the invention. Lawn mowers became a more efficient alternative to the scythe and domesticated grazing animals.

Manufacture of lawn mowers took off in the 1860s. By 1862, Ferrabee's company was making eight models in various roller sizes. He manufactured over 5000 machines until production ceased in 1863. The first grass boxes were flat trays but took their present shape in the 1860s. James Sumner of Lancashire patented the first steam-powered lawn mower in 1893. His machine burned petrol and/or paraffin (kerosene) as fuel. These were heavy machines that took several hours to warm up to operating pressure[6]. After numerous advances, these machines were sold by the Stott Fertilizer and Insecticide Company of Manchester and Sumner. The company they both controlled was called the Leyland Steam Motor Company.

Around 1900, one of the best known English machines was the Ransomes' Automaton, available in chain- or gear-driven models. Numerous manufacturers entered the field with petrol (gasoline) engine-powered mowers after the start of the 20th century. The first was produced by Ransomes in 1902. JP Engineering of Leicester, founded after World War I, produced a range of very popular chain-driven mowers. About this time, an operator could ride behind animals that pulled the large machines. These were the first riding mowers.

(Fig.5)
Commercial lawn mower in use April 1930 in Berlin.

The first United States patent for a reel lawn mower was granted to Amariah Hills on January 12, 1868[7]. In 1870, Elwood McGuire of Richmond, Indiana designed a human-pushed lawn mower, which was very lightweight and a commercial success. Amariah Hills went on to found the Archimedean Lawn Mower Co. in 1871.

In the United States, gasoline-powered lawn mowers were first manufactured in 1914 by Ideal Power Mower Co. of Lansing, Michigan, based on a patent by Ransom E. Olds. Ideal Power Mower also introduced the world's first self-propelled, riding lawn tractor in 1922, known as the "Triplex"[8][9] . The roller-drive lawn mower has changed very little since around 1930. *Gang mowers*, those with multiple sets of blades to cut a wider swath, were built in the United States in 1919 by the Worthington Mower Company.

2.4 TYPE OF MACHINE AND CUTTER

2.4.1 Cylinder or reel mowers

A cylinder mower or reel mower carries a fixed, horizontal cutting blade at the desired height of cut. Over this is a fast-spinning reel of blades which force the grass past the cutting bar. Each blade in the blade cylinder forms a helix around the reel axis, and the set of spinning blades describes a cylinder. [6] The basic push mower mechanism is also used in gangs towed behind a tractor. The individual mowers are arranged in a "v" behind the tractor with each mower's track slightly overlapping that of the mower in front of it. Gang mowers are used over large areas of turf such as sports fields or parks. [6]

(Fig. 6)

2.4.2 Rotary mowers

A rotary mower rotates about a vertical axis with the blade spinning at high speed relying on impact to cut the grass. This tends to result in a rougher cut and bruises and shreds the grass leaf resulting in discoloration of the leaf ends as the shredded portion dies. This is particularly prevalent if the blades become clogged or blunt. Most rotary mowers need to be set a little higher than cylinder equivalents to avoid scalping and gouging of slightly uneven lawns, although some modern rotaries are fitted with a rear roller to provide a more formal striped cut. These machines will also tend to cut lower (13 mm) than a standard four-wheeled rotary.

(Fig. 7)

2.4.3 Gasoline (petrol)

Most rotary push mowers are powered by internal combustion engines. Such engines are usually four-stroke engines, used for their greater torque. (Although a number of older models used two-stroke engines), running on gasoline (petrol) or other liquid fuels. Internal combustion engines used with lawn mowers normally have only one cylinder. Power generally ranges from two to seven horsepower (1.5 to 6.75 kW). The engines usually have 19 a carburetor and require a manual pull crank to start them, although a starters offered on some models. Some mowers have a throttle control on the handlebar with which the operator can adjust the engine speed. (Fig.8) The first gasoline-powered lawn mower, 1902.

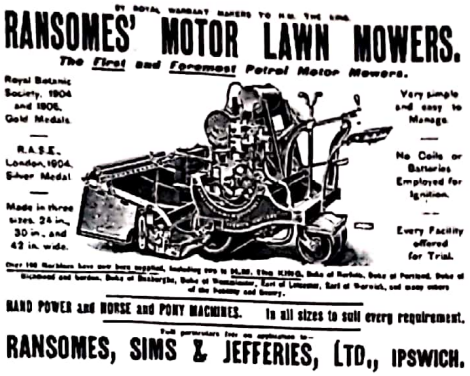


Figure 8
The first gasoline-powered lawn mower, 1902.

Other mowers have a fixed, pre-set engine speed. Gasoline mowers have the advantages over electric mowers of greater power and distance range. They do create pollution due to the combustion in the engine,(Fig. 5) and their engines require periodic maintenance such as cleaning or replacement of the spark plug and air filter, and changing the engine oil.[7][8]

2.4.4 Electricity

Electric mowers are further subdivided into corded and cordless electric models. Both are relatively quiet, typically producing less than 75 decibels, while a gasoline lawn mower can be as loud as 95 decibels or more. [9]

(Fig. 9)

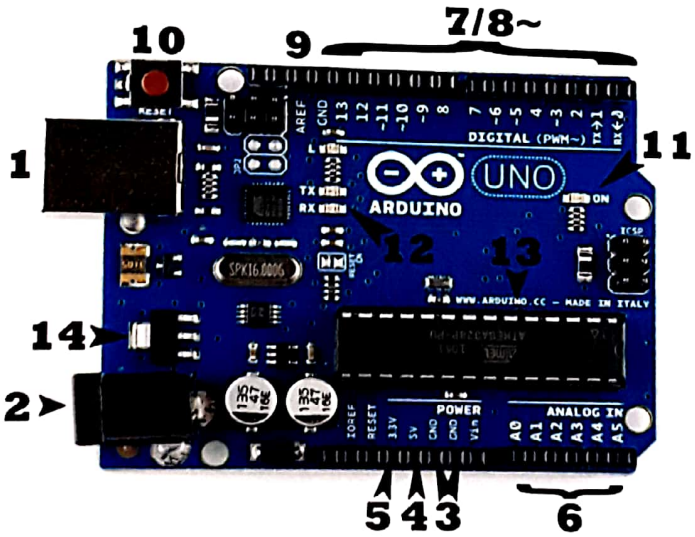
2.5 RESEARCH ON MATERIAL USED

1.Arduino

Arduino is an open-source platform used for building electronics projects. (Fig.10) Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware which called a programmer in order to load new code onto the board

The arduino we use is intended to receive data from the smart phone connected between the bluetooth signal. It also can manipulate and control components such as motors.



(Fig.10)
Arduino

Componet of Arduino :

1.USB Connection
Serves as a place to supply power by using a USB cable from wall power supply.

2. Barrel Jack
Terminated the power supply.

3. Ground
There are several ground pins on the arduino and any of it can be used to the circuit.

4. 5 Volts
Supply 5 volts of power.

5. 3 Volts
Supply 3 volt of power.

6. Analog
The area of pins under the 'Analog In' label (A0 through A5 on the UNO) are Analog In pins.It obtain the value of an analog signal. This function convert the value of of the voltage on an analog input pin and returns a digital value.

7. Digital
used for both digital input like telling if a button is pushed and digital output

8. Pulse-widht Modulation(PWM)
Drive a motor at various speed.The frequency of the signal on most pins is approximately 490 Hz

.

9. Analog References
set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.

10. Reser Button
Pushing it will temporarily connect the reset pin to ground and restart any code that is loaded on the Arduino. This can be very useful if the code does not repeat, but you want to test it multiple times.

11. Power LED Indicator
This LED light up whenever the plug of Arduino into a power sources.

12.TX RX LEDs
TX is short fro transmit and RX is short for receive. there are two places on the Arduino where TX and RX appear,once by digital pins 0 and 1. These LEDs will give us some nice visual indications whenever our Arduino is receiving or transmitting data

13. Main Integrated Circuit

As the brain of the Arduino. This can be important, as you may need to know the IC type (along with your board type) before loading up a new program from the Arduino software.

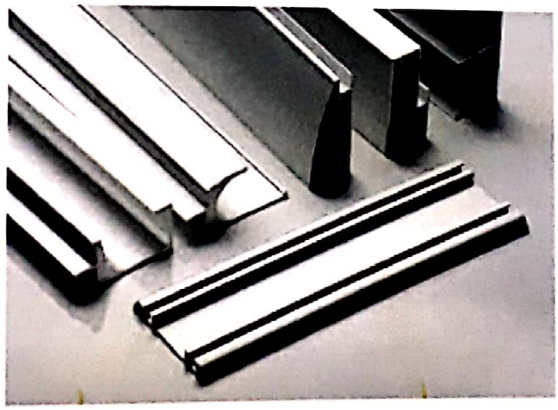
14. Voltage Regulator

Controls the amount of voltage that is let into the Arduino board.Act as a kind of gatekeeper. It will turn away an extra voltage that might harm the circuit.It has its limits,cannot hook up the Arduino to anything greater than 20 volts.

2. Body framed

Aluminium

The main structural frame of the mower onto which the other parts of the mower are mounted. The frame is that provides a base unit that all of the components/subsystems are mounted on. The aluminium frame will be designed to provide adequate sectioning for the separate subsystems. The rear wheel motors are mounted to the rear exterior section of the frame. The Batteries will have a separate compartment for mounting and secured safely. The Frame is to be composed of 1.7"x1.4". Aluminium was chosen due to its strength and availability.(Fig.11)



(Fig.11)
Aluminium

3. Blade

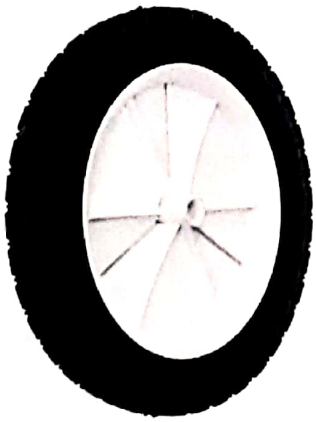
Consist of blades that are attached to a vertically rotating shaft, to the downward direction. The blades rotate, creating a cutting motion.(Fig.12)

(Fig.12)
Cable tie

We chose cable tie as a blade because its durable,low cost,easy to get and most importantly can cut the grass just like the sharp steel blade.

4. Wheel

These help propel the mower in action. Generally, our lawn mowers have four wheels. The diameter of the wheel is 8 inches. A Base Frame with Four Wheels of the Lawn Mower The wheels having rubber gripped, for better moving on grass. We are using plastic wheels for reducing the cost of lawn mower.(Fig.13)



(Fig.13)
Wheel

5. Motor

The power source of a lawn mower that is powered by electric. The electric motors for lawnmowers are typically 24V DC motor. (Fig. 14) The benefits of the electric motors are that they run very quietly and they do not take up too much space on the mower chassis.

(Fig.14)
Motor

6. Battery

For this project, a Lithium battery or batteries will be needed to provide 24V to the electric motors and another 250 Watts of power to the mower in order to run these system.(Fig. 15)

Features:

Voltage – 24V,

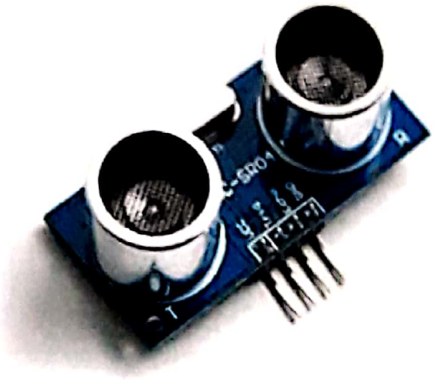
Weight – 1.05 Kg.,

Height – 7.1875 inches

(Fig.15)
Battery

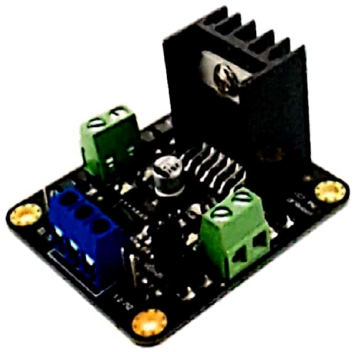
7. Ultrasonic sensor

Ultrasonic sensor used to detect an obstacle when the lawn mower is running.(Fig.16) Its function to detect the obstacle and give remind to Arduino to stop and turn the lawn mower to the other side.So,we chose the ultrasonic sensor because its suitable with our project idea in making a smart lawn mower.



(Fig.16)
Ultrasonic Sensor

8. Motor Drive



(Fig.17)
Motor Drive

A motor controller is a device or group of devices that serves to govern in some predetermined manner the performance of an electric motor. use a different controller from the tyre controller to avoid interruption to the arduino and smooth movement of the machine.

2.6 SPECIFICATION

Voltages	24	**Features**	Automatic,four wheel,height blade adjustment
Assemble Hight		**Cordless**	yes
Assemble Width		**Included**	Batteries
Assemble Depth		**Charge Time (hours)**	12
Lawn Mower Type	Sensor	**Fuel Type**	Reachargeable Battery
Maximum Cutting Height (inches)	5.5	**Run Time (min.)**	120
Product weight (kg)		**Front wheel size diameter**	
Speed of electric motor	3000 r.p.m.	**Rear wheel size diameter**	
Start type	Electric	**Total number of wheel**	4

(Table No. 1)
Specification of Smart Lawn Mower

CHAPTER 3

METHODOLOGY

3.1. INTORDUCTION (Prepared by Jeeneat Jupline [08DKM17F1230])

This final project flow chart. First of all is gathering fellow group members to study user requirements for design lawn mowers using the motors. Then create a list design problems encountered. Next, design the project again and conducting an assessment and selection of concepts and estimating the cost is required to turn on this tool. Lastly, the test runs and performs final repaire when there are some mistakes and shortcomings that can not be detected before the test was done in a project produced before is presented to the panel of assessors appointed by the department for assess the results of this project.

3.2. FLOW CHART & DESCRIPTION

The research will be carried out in four stages (methods) as follows:

Stage 1: Literature review

This stage involves a literature review on the current status of lawn mower available in market . this research is to find out the need, design and material used. All previous reported project and research based on lawn mower system will be studied.

Stage 2: Design Process

The design process is to identify the ideal design. This is to ensure the product can be run in easy and good condition. The design research is also to find the design that giving the safety environment to the user.

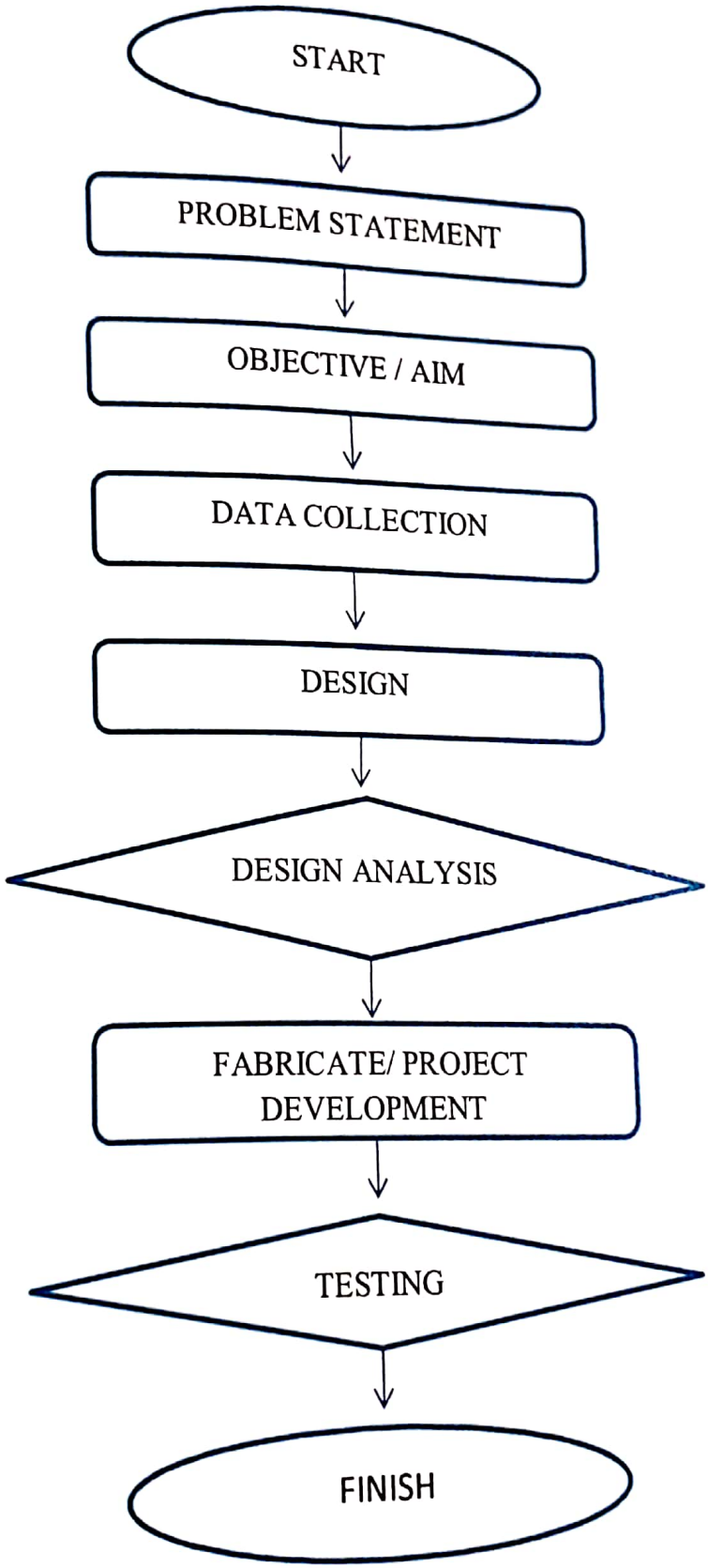
Stage 3: Product development

After component and design has been identify, assembly process is started.

Stage 4: Evaluation

Complete prototype will be test and the performance will be evaluated. If fail, modification and repair will be held and the test is repeat until successful.

Methodology flow chart



➢ Problem statement

No.	Problem statement	explanation
1	Manual lawn mower is hard to use	- uses manual energy which that make it hard to handle also requires the expertise to handle it. - the cost using manual lawn mower is high because it use fuel to run the machine. - lack of safety features.
2	Flat tires is hard to handle.	- very dangerous and hard to handle in the highway. - course death case due to tire repair in highway.
3	Onion peeler	- Industrial requirements.

We have submitted three problem statements. Based on discussions with the team and our supervisor we have decided to choose the first problem statement which is the lack to handle manual lawn mower.

➢ Objective / Aim

The objective of our choice is to design and develop a prototype of lawn mower that is easy to use and with more safety features. We aim to fabricate and improve the use of automatic lawn mower. Last but not least to test and investigate the function of prototype.

➢ Data collection

This level is to do a research about lawn mower that already in the market and suggest by user or researcher. It is include the need, design, material and other thing that we need to know about lawn mower. We also collecting data from manual survey to make sure our project can be fabricate and use in the future.

- Design

To find the ideal design that can help the product run in a good condition and easy to use.

- Design analysis

finalist and choosing the best design to make sure we achieve the objective of this project.

- Fabricate / project development

Build the project within the base. The process start with fabricate the body, coding the movement and sensor, fabricate the tires, fabricate the electrical part with mechanical parts until it can be run by pressing the start button.

- Testing

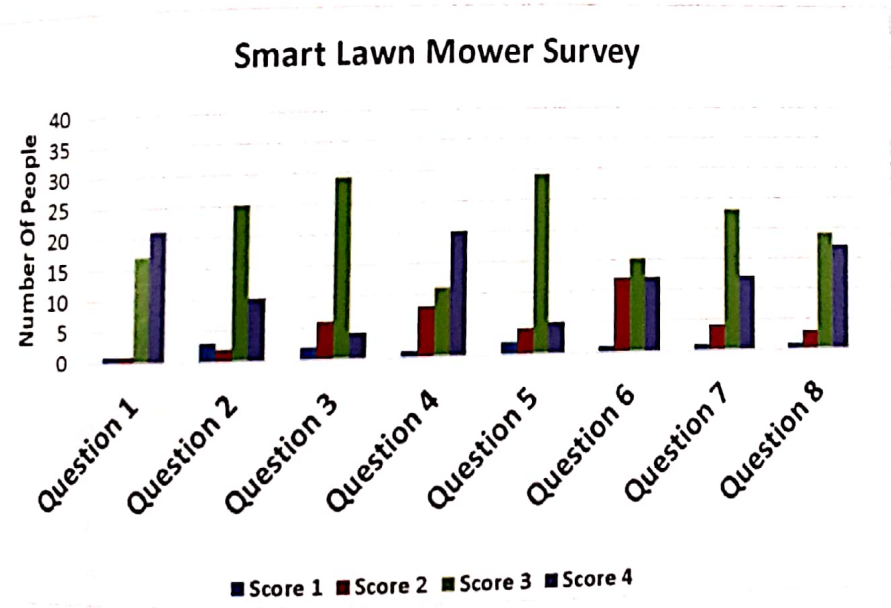
As soon the lawn mower is completed fabricated , it must put in a test in order to achieve the objectives of the project. If any failure occurs, the product need to be restored and some upgrades are needed base on the result of the test.

3.3. PROJECT SURVEY

Question and analysis 1

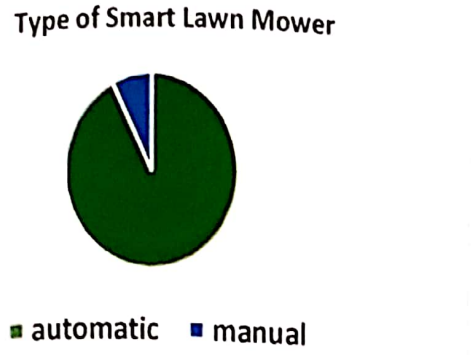
CRITERIA	SCORE
Strongly disagree	1
Disagree	2
Agree	3
Really agree	4

NO.		1	2	3	4
1.	Manual smart lawn mower use more human energy.				
2.	Manual smart lawn mower takes a long time to cut large area				
3.	Manual smart lawn mower need high expertise.				
4.	Manual smart lawn mower causing high sound pollution.				
5.	Manual smart lawn mower is lack of safety features.				
6.	Automatic Smart lawn mower need high maintenance cost.				
7.	Automatic smart lawn mower is Eco friendly.				
8.	Automatic smart lawn mower have a good cutting result				



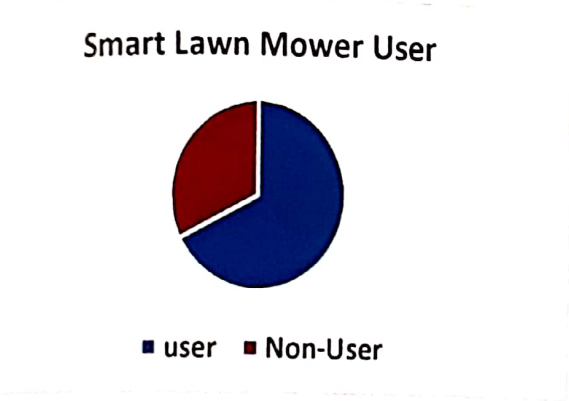
Question and analysis 2

From your opinion which type of machine is easier to use ( ) automatic ( ) Manual



Question and analysis 3

User or Non user?



The bar chart illustrates the number of people answering eight different information in eight different question. This survey is answered by 40 people with majority is male. The age of the people who answer the survey is majority 21 years old to 40 years old. More than half from this group of people is Lawn mower user.

3.4 PROJECT DESIGN

First Design

Figure 3.4.1

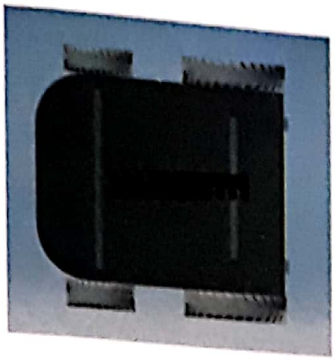


Figure 3.4.2

Figure 3.4.3

Final Design

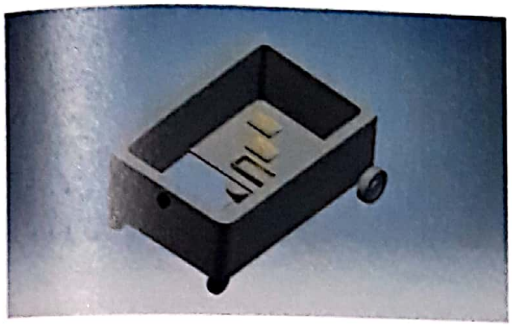


Figure 3.4.4

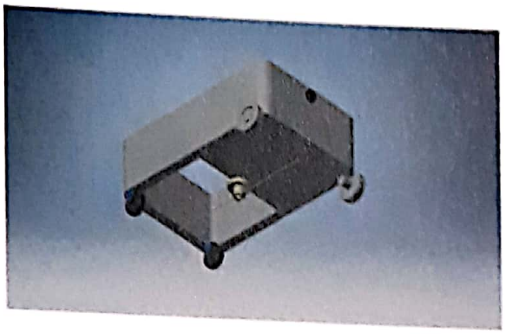


Figure 3.4.5

Figure 3.4.6

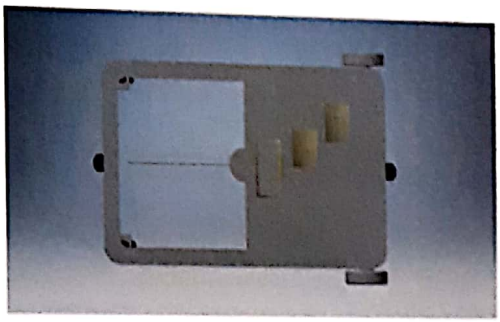
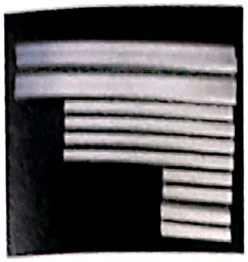
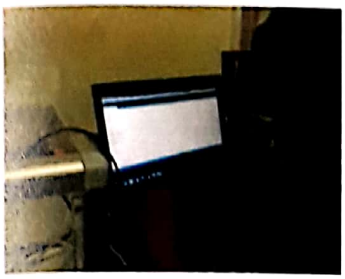
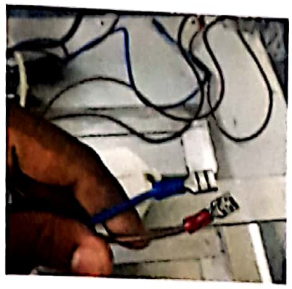
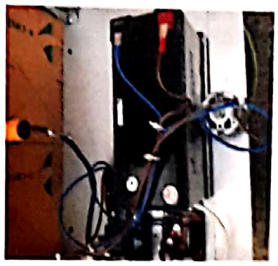
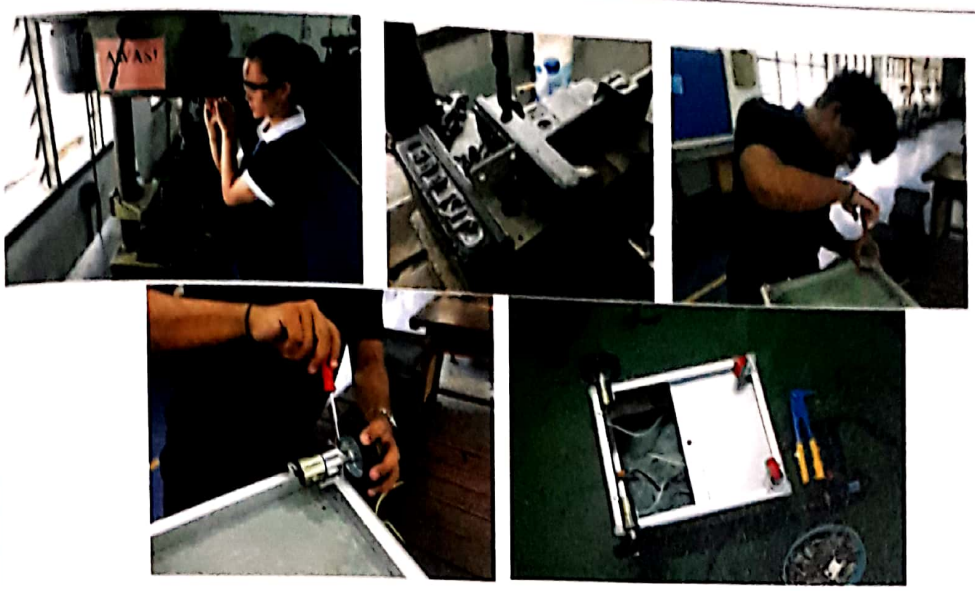
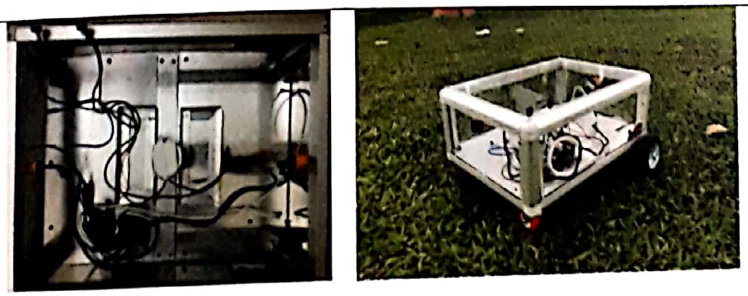


Figure 3.4.7

3.5 PROJECT OPERATIONAL

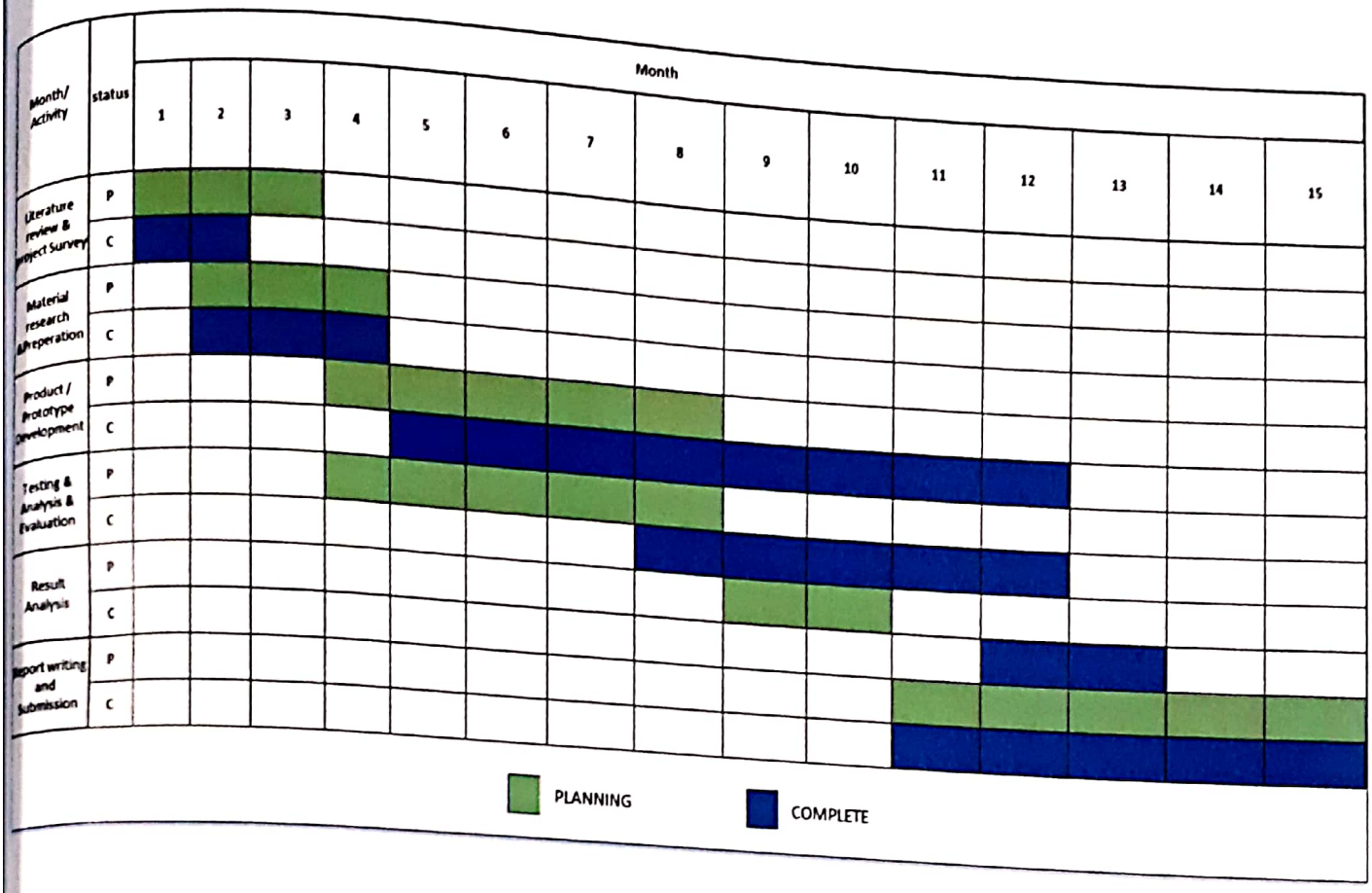
stage	Operational / Process
1	   • Cut the aluminium to the specific parts • Combine parts that have been cut.
2	   • Setting and coding the the electrical component
3	   • Installing sensor to the body that have been fabricate • Installing motor shaft to the body that have been fabricate

4	 ● Cutting and drilling the aluminium ● Install motor and tires.
5	 ● Cutting and Drilling cable tie holder ● Install the cable tie to the body
9	 ● Final product ready to be test ●

3.6 PROJECT BUDGET

MATERIAL	COST
Aluminium (2 X 2)	RM 40.00
Motor Shaft	RM 18.00
Motor Drive	RM 12.50
TT Gear motor Drive 6V (4pcs)	RM 74.00
Cable Tie (6,12 inch per pack)	RM 9.90 + 20.00
Wheel (4pcs)	RM 55.00
Battery	RM 65.00
Switch Button	RM 6.70
Wire Jumper	RM 4.80
Ultrsonic Sensor	RM 3.20
Arduino Uno	RM 24.80
TOTAL	**RM 333.90**

3.6 PROJECT PLANNING



3.7 chapter 3 : summary

In conclusion, through the research done to produce this project, we can overcome the problems faced by grass machine users and improve existing lawn mowers to make it easier to use. Although the main purpose of this machine is to cut the grass, this project will also ensure that this machine is able to reduce the accident or injury to the user thus the machine will be accompanied by a complete design and safety features.

CHAPTER 4

RESULT & ANALYSIS DATA

4.1 INTRODUCTION (Prepared by Zakwan Azyb Bin Zulkifly [08DKM17F1178])

This chapter combine data and analysis of movement of the prototype and the grass cutting parttern. This data and analysis are very important for this project to achieve the objective and scope of the project. This data indicate the successful, accuracy and precision of cutting grass and the movement. After getting all of this data, we analyze every single possible to make it more accurate and effective.

4.2 MODEL AND ACTUAL

Computer software is used in this project to modeling and design this prototype. Theres is much computer software and each of them has their own function. Human used computer software to create their desidn of a model. With computer software, we can perform our task efficiently and fast. Autocad Inventor has been used for the modeling of this project.

Figure 4.2.1

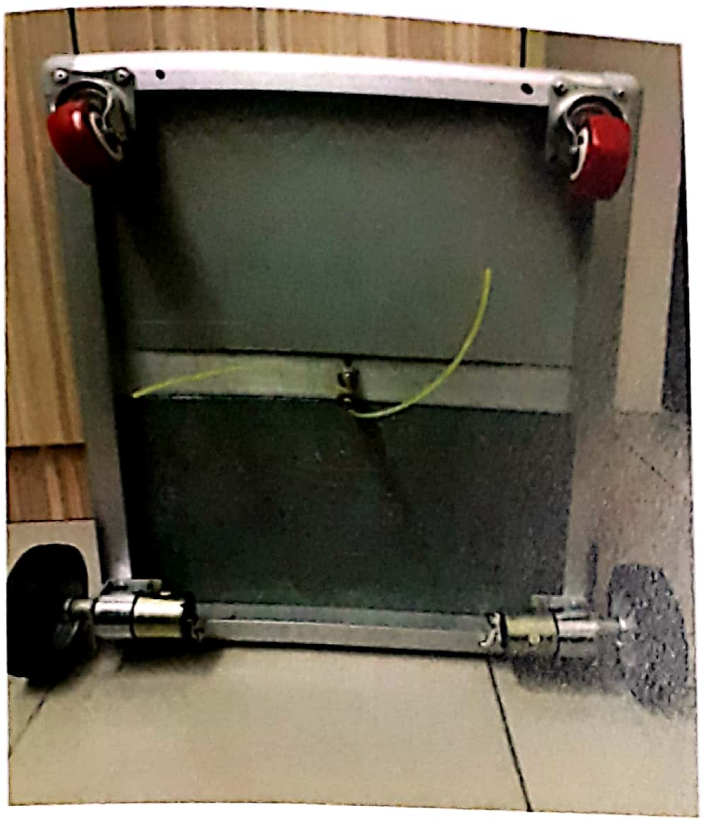


Figure 4.2.2

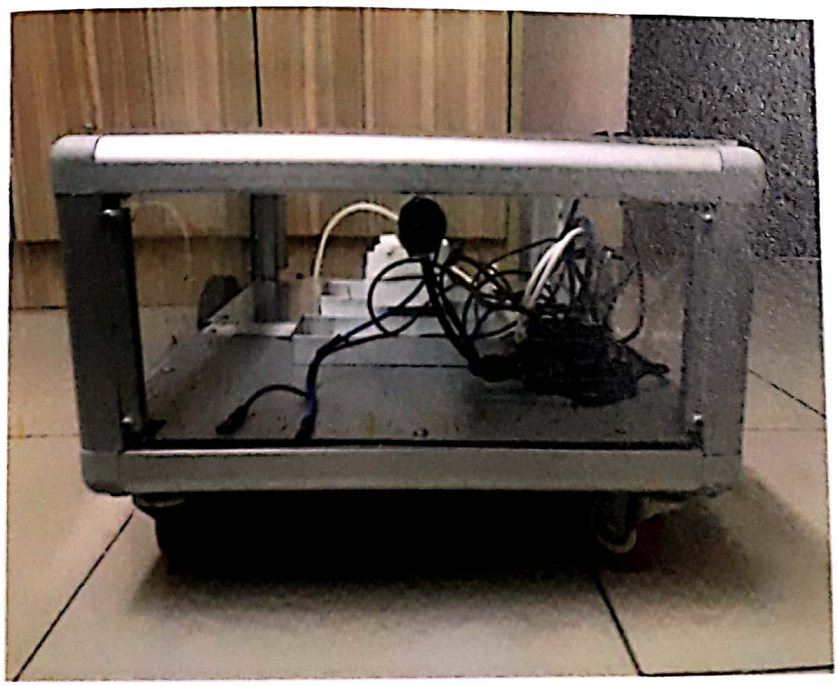


Figure 4.2.3

Figure 4.2.4

4.3 FIELD TESTING

we run this test to study the movement of the machine and quality of the cutting grass.From this test also we gain data about the durability and how long it can work at a time.we run this test on a flat surface and on the grass.

Figure 4.3.1 (Movement Test)

Figure 4.3.2 (Durability test)

Figure 4.3.3 (Cutting Test)

4.4 PERFORMANCE FACTOR

The prototype has to be evaluated on some factors to find out its working efficiency or if it is convenient or not practically. Some of the factor are :

- **Cutting time**
  It is one of the basic and most important factors as how much time does the device take to cut the required or pre set area of the garden. As time is the most valuable resource these days, this factor becomes most important in determining the usability of the device.

- **Cut grass condition**
  Whether the cut made to the grass is clean or not and if the grass cut is uniform or not are two very important factors in determining the usage of the device as the desired outcomes are uniform cutting and clean cutting of the grass.

- **Human and obstacle detection and avoiding**
  Since the device is to be made automatic, this factor is important as it is directly related with the cutting time. If the device avoids the obstacles frequently and easily, it will reduce the cutting time and the entire work will be done in lesser time. Also it will help in saving the energy required.

- **Cutting pattern**
  Cutting pattern is an important part because if the mower does a crisscross pattern, it will cross same area of grass more than once resulting in the more time taken for cutting and hence more energy consumed.

- **Power requirements**
  Power requirements are easily one of the most important factors in deciding the efficiency of the device. The power required will decide the cutting time for required area and also the cutting area in given period of time.

4.5 ANALYSIS DATA

4.5.1 Patch of the prototype

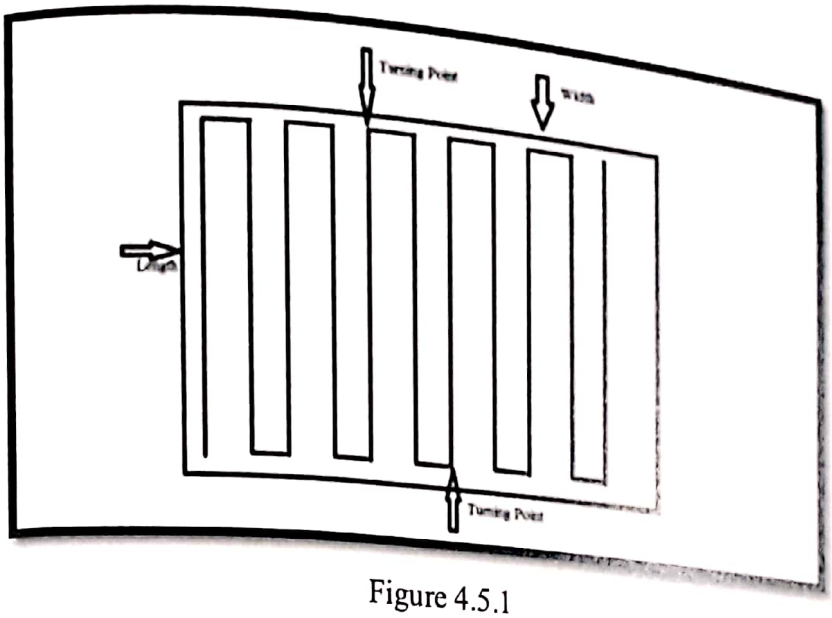
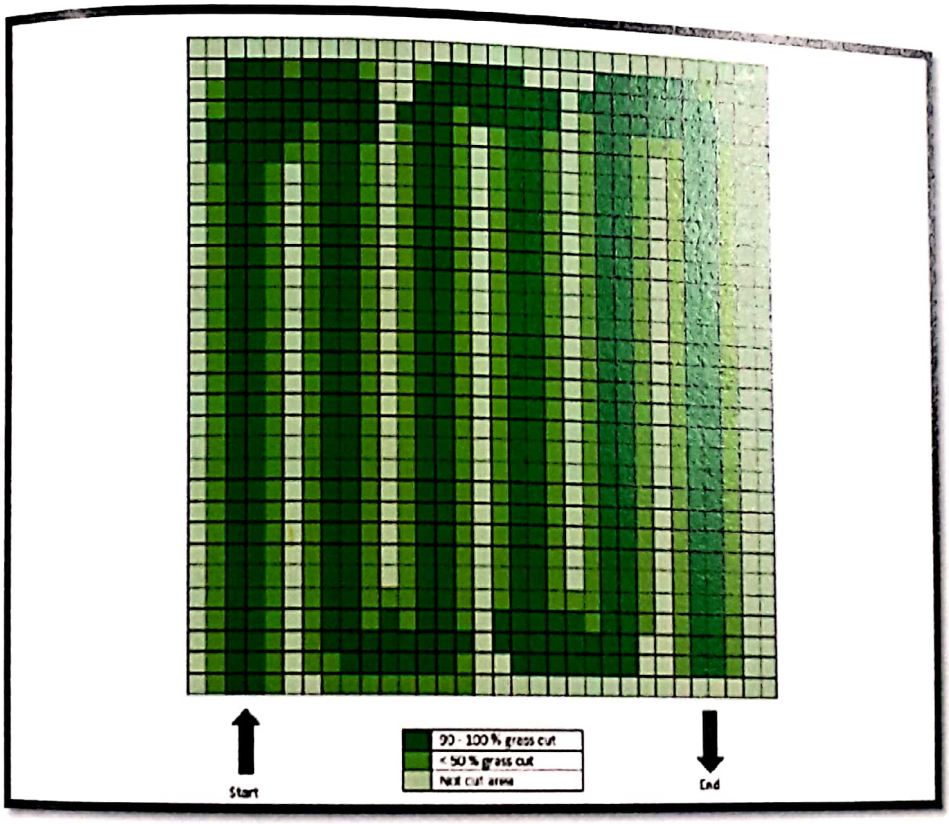


Figure 4.5.1

4.5.2 Graph of grass cut



4.6 CHAPTER 4 : SUMMARY

As conclusion, after this project have been done for the test run, all the data that have been collect are very useful for the real type of project. Although, this project only prototype, the data and calculation alongside with analysis is very useful to be use for the real project and improvising the project.

CHAPTER 5

DISCUSSION, CONCLUSION AND UPGRADE PLAN

5.1 INTRODUCTION

This chapter combine the discussion, conclusion and upgrade plan for this project. From the data from the test run of the project, the analysis have been done. Thus, the discussion for the problem that show up at the test run, data and analysis will be compact in this chapter. Plus, the conclusion that will be made from the discussion and upgrade plan for the future project either prototype or real project.

5.1 DISCUSSION AND UPGRADE PLAN

The performance of this machine is slightly away from the desired requirement. Therefore some recommendation has been list out for future improvement.

- **Hardware improvement**

The design of the machine may undergo some changes such as larger the cutting blade so that the diameter is almost the same size of the width of the machine. The increase of the diameter of the blade making larger area will be cover when cutting operation is done. Special wheel can be applied such as wheel with some thorn which will grip the grass stronger to prevent slipping occur. Higher torque motor would be recommended so that it can help to maintain the machine to move at slower speed and overcome friction between the machine and grass surface

- **Software improvement**

This system need more advance software to perform more accurate. GPS system may apply on this project so that it can gain more accurate position for path planning. Controller such Artificial Intelligent (AI) can also apply so that it have the ability to make decision whether the grass need to be cut or memorize which part no need to cut and continue to next area.

5.3 CONCLUSION

After all discussion through the analysis of data, we can conclude that this project give a lot of benefit to the public. Through the research done to produce this project, we can overcome the problems faced by grass machine users and improve existing lawn mowers to make it easier to use. Although the main purpose of this machine is to cut the grass, this project will also ensure that this machine is able to reduce the accident or injury to the user. Hopefully, this project will be continue and upgrade for the better goods.

REFERENCE

1. M. Wasif (2011). Design and Implementation of Autonomous Lawn-Mower Robot Controller. 2011 7th International Conference. 5-6 September. Emerging Technologies (ICET), 1-5.

2. Smith, J., S. Campbell, and J. Morton. (2005). Design and Implementation of a Control Algorithm for an Autonomous Lawn Mower. Circuits and Systems. 7–10 August. Midwest Symposium, 456-459

3. Ousingsawat, J. and M.G. Earl. Modified Lawn-Mower Search Pattern for Areas Comprised of Weighted Regions. American Control Conference. 9-13 July. 918-923.

4. http://en.wikipedia.org/wiki/Robotic_lawn_mower

5. http://www.robomow.com/robomow/howitworks/

6. http://www.open-electronics.org/a-robotic-lawn-mowers-powered-by-solar-energy-with-an-arduino-heart/