# SMART LAWN MOWER ROBOT

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# ABSTRACT

Cutting lawns at our leaving area is one of the important aspects . the lawns are cutted by human might involve risk. This project focuses on the development of a smart lawn mower robot to cut the lawns. The robot needs to satisfy certain criteria that are; portable, standard size, Bluetooth control system and can cut the lawns as defined area. The energy that we used for the robot is battery based energy which is DC supply. It also a robot that can reduce pollution instead of using gasoline/petrol based lawn mower.The aim of this report is to design and implement a smart lawn mower robot. The function of smart lawn mower robot is to cut the lawn process become easier than cutting the lawns manually. This robot is control by Bluetooth module and send the output to an Arduino. Next, this robot is used Arduino UNO to operate and the function of Arduino is control the movement of robot. Then, 3 to 4 DC motors is needed to connect with the Arduino and motor driver. In additional, the function of motor driver is to take a low-current control signal and the turn it into a higher-current signal that can drive a motor. After that, the DC motors is connect to two 15V battery as power supply. Moreover, the advantage of using this robot will saves our environment instead of using gasoline or patrol based energy, and also will help people who suffer cutting the lawn under the hot weather.

# *ABSTRAK*

*Memotong rumput di kawasan meninggalkan kami adalah salah satu aspek penting. rumput dipotong oleh manusia mungkin melibatkan risiko. Projek ini memberi tumpuan kepada pembangunan robot pemotong rumput yang pintar untuk memotong rumput. Robot perlu memenuhi kriteria tertentu; mudah alih, saiz standard, sistem kawalan Bluetooth dan boleh memotong rumput sebagai kawasan yang ditakrifkan. Tenaga yang kami gunakan untuk robot adalah tenaga berasaskan bateri yang merupakan bekalan DC. Ia juga merupakan robot yang dapat mengurangkan pencemaran dan bukannya menggunakan mesin pemotong rumput petrol / petrol yang berasaskan. Tujuan laporan ini adalah untuk merekabentuk dan melaksanakan sebuah mesin pemotong rumput yang bijak. Fungsi robot pemotong rumput yang bijak adalah untuk memotong proses rumput menjadi lebih mudah daripada memotong rumput secara manual. Robot ini dikawal oleh modul Bluetooth dan menghantar output kepada Arduino. Seterusnya, robot ini digunakan Arduino UNO untuk beroperasi dan fungsi Arduino mengawal pergerakan robot. Kemudian, 3 hingga 4 motor DC diperlukan untuk menyambung dengan pemandu Arduino dan motor. Tambahan pula, fungsi pemandu motor adalah untuk mengambil isyarat kawalan semasa yang rendah dan menjadikan ia menjadi isyarat semasa yang lebih tinggi yang boleh memandu motor. Selepas itu, motor DC menyambung kepada dua bateri 15V sebagai bekalan kuasa. Lebih-lebih lagi, kelebihan menggunakan robot ini akan menjimatkan persekitaran kita daripada menggunakan petrol atau tenaga berasaskan rondaan, dan juga akan membantu orang yang menderita merumput di bawah cuaca panas*

# DECLARATION

DECLACE THAT THIS REPORT IS BASED ON OUR OWN WORK WITH THE HELP OF INFORMATION FROM SOURCES THAT I HAVE INFORMED IN CONFESSION. CAN ALSO DECLARE THE RESULTS OF MY PROJECT WAS NEVER PRODUCED BY AND OTHER STUDENTS AS WELL AS FROM OTHER INSTITUTION

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KUGGEN A/L LOGANATHAN

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PREHMANANTHAN A/L BALASUBRAMANIAM

X

LAU WEI TEIK

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MR.HUZAIMI BIN MD HUSSIN
PROJECT SUPERVISOR

# Chapter 1

# (ITRODUCTION)

## 1.1 INTRODUCTION

Now days pollution is a major issue for the whole world. Pollution is manmade and can be seen in own homes. In case gas powered lawn mowers due to the emission of gasses it is responsible for pollution. Also the cost of fuel is increasing hence it is not efficient. So the smart lawn mower are introduced. The smart lawn mower robot can cut the lawns. The movement of the robot is controlled by Bluetooth which uses smartphones. The robot is to prevent environmental issues and helps people who cutting lawns under the hot weather. The smart lawn mower robot made for cut the lawns and reduce pollution and also help humans to make their work easier.

A lawn mower is a machine utilizing one or more revolving blades to cut a lawn 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 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, unpowered 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.

## Invention

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-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.

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.

## Further improvements

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.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. 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.

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.In 1870, Elwood McGuire of Richmond, Indiana designed a human-pushed lawn mower, which was very lightweight and a commercial success. John Burr patented an improved rotary-blade lawn mower in 1899, with the wheel placement altered for better performance. Amariah Hills went on to found the Archimedean Lawn Mower Co. in 1871.

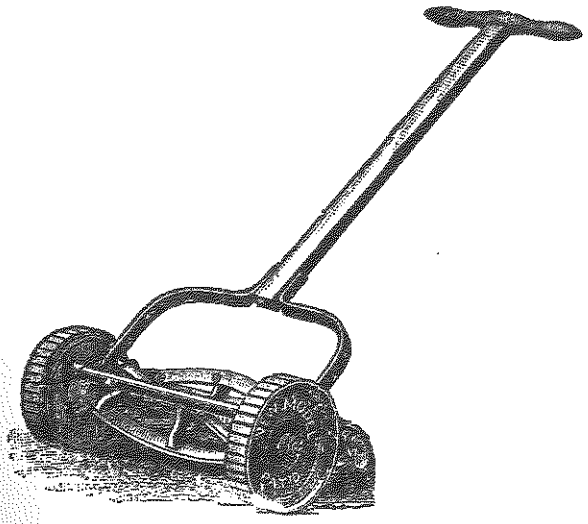
In the United States, gasoline-powered lawn mowers were first manufactured in 1914 by Ideal Power Mower Co. of Lansing, Michigan, based on a patent by Ransom E. Olds. Ideal Power

Mower also introduced the world's first self-propelled, riding lawn tractor in 1922, known as the Triplex.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.

**Types of Lawn Mowers**

A typical modern gasoline/petrol powered rotary "push mower", which has self-powered cutting blades, but still requires human power to move across the ground. "Walk-behind" mowers can be self-propelled, only requiring a human to walk behind and guide the mower. Mowers of the type displayed usually vary in width from 20 to 24 inches.


A residential riding or ride-on" mower.



An early cylinder (reel) mower, showing a fixed cutting blade in front of the rear roller and wheel-driven rotary blades.

## 1.3 Problem Statement

In our life, the use of robotics in certain places is becoming more popular in recent years. Therefore, the reason of this is to design and implement arduino based on reliable and high performance robotic system for mobile robots such as smart lawn mower. The robot is capable to cut the lawns into standard size. The purpose of this robot is to reduce pollution instead of using gasoline /patrol based energy. The next reason build this smart lawn mower robot can make humans work easy on cutting lawn. Because they are cutting the lawns under hot weather which can cause skin burn. Moreover the problems that can cause by robot is blade failure. Because during cutting the lawn if the blade hit the stones it might be the cause for the blade failure.

## 1.4 Objective Project

There are three objectives that need to achieve at the end of this project.

- To design a robot can cut the lawn as defined area.
- To design a robot that can reduce pollution.
- To design a smart lawn mower robot by using Arduino UNO and Bluetooth module.

## 1.5 Research Questions

However with the continuous development, several resources also make the arbitrary abuse. Oil coal resources are depleting shortages of energy and serious pollution.

In the 20th century, energy crisis is any great bottleneck (or price rise) in the supply of energy resources to an economy. It usually refers to the shortage of oil and additionally to electricity or other natural resources. An energy crisis may be referred to as an oil crisis, petroleum crisis, energy shortage, electricity shortage or electricity crisis.

The near future, the petroleum crisis already is a very big problem. Globality by way of disburden, they would increase the petroleum price, and debase their expense. Still got another country, "hit sb. when he's down" increase the petroleum price, and gain profit. Market failure is possible when monopoly manipulation of markets occurs. A crisis can develop due to industrial actions like union organized strikes and government embargoes. The cause may be over-consumption, ageing infrastructure and sometimes bottlenecks at oil refineries and port facilities restrict fuel supply. That crisis involves the industry, business, carrying trade, until economic policy.

In response to the petroleum crisis, the principles of green energy and sustainable living movements gain popularity. This has led to increasing interest in alternate power/fuel research such as fuel cell technology, liquid nitrogen economy, hydrogen fuel, biodiesel, solar energy, geothermal energy, tidal energy, wave power, and wind energy, and fusion power.

Why do this project has been chosen? It is because the smart lawn mower can reduce the pollution towards the environment. So the lawn mower does not need any sources that cause pollution.

## 1.6 Research Scope

Research scopes are important in order to design this project, and it is required to analyse the project. The scopes will cover design and programming of a mobile robot. Part of design will include the application of drawing software such as electric and electronic part are related in programming where are needed to develop the interface between programming, electronic circuit and mechanical system. The scopes of this project are:

I. The system of the lawn mower is control by using smart phones by connecting to the Bluetooth module.
II. It will cut the lawns on defined area such like housing area, school compound.
III. To develop Smart lawn mower robot is only for outdoor.

## 1.7 Research Interests

The research interest of this is to make sure our project works efficiently without any hesitation. Next , it must be not pollute our environment and must cut the lawn as defined area. Next to help human from getting burn by the sun.

## 1.8 Definition of term/surgery

Electrical energy of the battery is converted to mechanical energy through a set of blades designed to achieve cutting operation. The electric circuit ensures power transfer from the battery to run the DC motor. The cutting blades tap power from the DC motor. When the power switch is on, the electrical energy from the battery powers the motor which in turn actuates the blades. The solar panel generates current to recharge the battery, there by compensating for the battery discharge .The rotating blades continuously cut the lawn as while it is moving.

## 1.9 Conclusion of the chapter

As the summary of this chapter1 smart lawn mower is great robot to reduce pollution towards the environment The smart lawn mower cannot cut the lawns during rainy season. Due to prevent from the components getting damaged. This smart lawn mower robot is robot that can control the movement uses the smartphone and everyone can operate this robot easily and portable to have it in their homes. Furthermore the chapter explained about the history and the types of lawn mowers. Next, the objectives of this were given clearly about the project which is, to cut the as defined area and to reduce pollution.

# Chapter 2

## (Literature view)

## 2.1 INTRODUCTION

Lawn mower robot have become very popular today. Most of the times, lawn mower robot are used for soft grass furnishing. In a time where technology is merging with environmental awareness, consumers are looking for ways to contribute to the relief of their own carbon footprints. Pollution is man-made and can be seen in our own daily lives, more specifically in our own homes. So the smart lawn mower were invented. This lawn mower robot can cut the lawns efficiently. The energy that uses for this robot is battery based energy which is easier to use, more advantageous comparing to other energy source especially for gas based source of power .This robot designed to come up with reduce pollution ,the robot can work efficiently and cut the lawns as defined area. The heart of the machine is a battery-powered dc electric motor. It is also useful method for our lawn mower. The device consists of linear blade which is operated with the help of the motor the power supply for the motor is by using battery. The battery can be charge by using power supply. The robot manually controlled by humans using smart phone.

## 2.2 CONSEPT / THEORY

Main components of the smart lawn mower robot are,

(1) Arduino UNO

(2) DC motor

(3) Bluetooth Module

(4) IC L293D

(5) POWER SUPPLY(9V BATTERY) WITH CONNECTOR AND STRAP

(6) JUMPER WIRE

(7) KCD1-101 10 AMP ROCKER SWITCH

(8) Blade

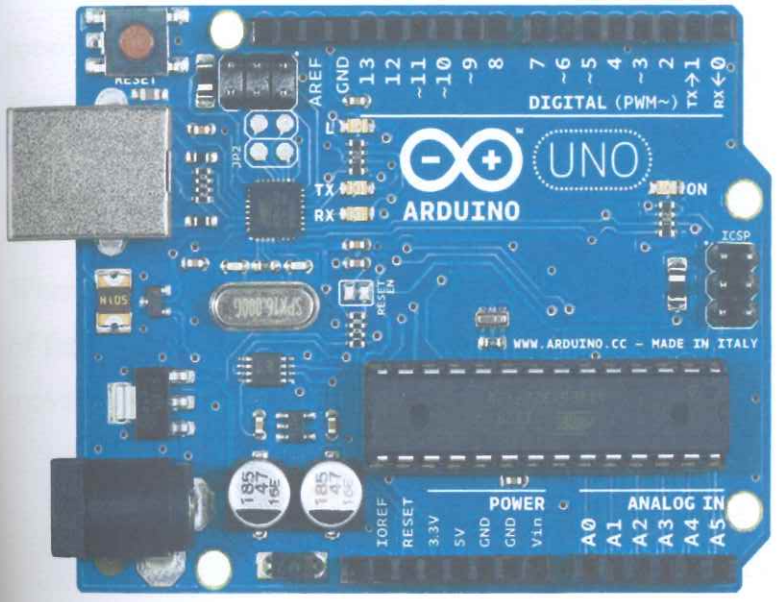
(9) Cooling Fan

(This are explained below one by one )

### 2.2.1 ARDUINO UNO

The Arduino Uno is a microcontroller board based on the ATmega328. The Arduino Uno have 14 digital input or output pins, 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. To start the Arduino, must connect to a computer with a USB cable; power it with a AC to DC adapter or battery. Next, range of external supply voltage that operate the board is 7 to 12V. The board will be unstable when supply less than 7V because the 5V pin supply less than 5V. Hence, the voltage regulator may overheat and damage the board when supply more than 12V. Then, the power pins are VIN, 5V pin, 3V3 and GND. The function of VIN is allow external power source supply the input voltage to Arduino board. The 5V pin is to power the microcontroller and other components on the board. After that, the 3V3 pin is a 3.3V supply that generated by on-board

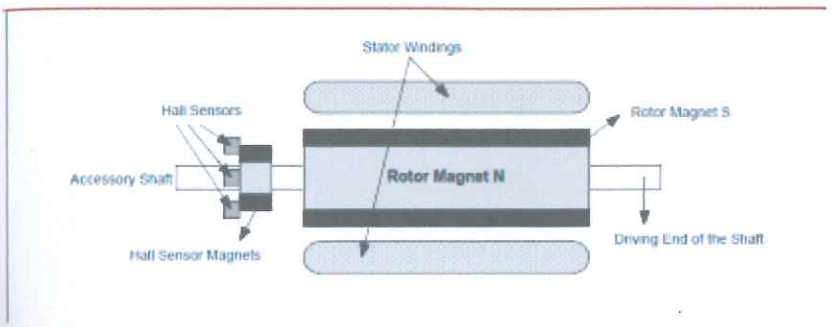
regulator, the maximum current draw is 50mA; GND is ground pin. Moreover, the board has 32KB flash memory, 2 KB SRAM and 1 KB EEPROM. Each 14 digital pins are operated at 5V and can provide or receive maximum of 40mA. Besides that, pin 0 and pin 1 are used to receive(RX) and transmit(TX) TTL serial data, pin 2 and pin 3 are used to trigger an interrupt on low value, a rising or falling edge, or change in value. Pin 3,5,6,9,10 and 11 is to provide 8-bit Pulse-width modulation output. For support Serial Peripheral Interface communication, pin 10,11,12 and 13 are used. Lastly, pin 13 is connected with LED, the LED will light on when the pin is HIGH value; the LED will light off when the pin is LOW.




### 2.2.2 D.C MOTOR

This is a relatively new class of motors whose application have been increasing at a rapid rate each year, due to both declining costs as well as increasing functionality. A brushless DC motor is similar to that brush DC motor in that it has an internal shaft position feedback which tells which windings to switch on at which an exact moment. This internal feedback gives both the brush DC motor and brushless DC motor their unique characteristics. Linear speed-torque curves which are well suited for speed and position control and high starting torque. The internal feedback is accomplished in a brush type DC motor with the mechanical commutator (a series of copper bar which are insulated from each other) and the mechanical brushes through

which the current is fed into the commutator bars and switched sequentially into the appropriate winding in the armature.



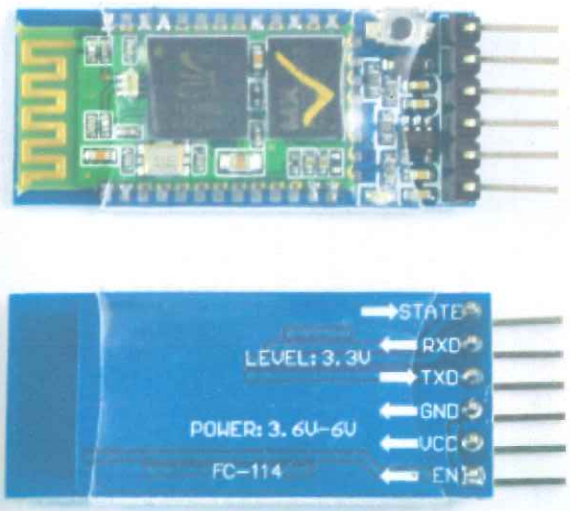

speed controller works by varying the average voltage sent to the motor. It could do this by simply adjusting the voltage sent to the motor, but this is quite inefficient to do. A better way is to switch the motor's supply on and off very quickly. If the switching is fast enough, the motor doesn't notice it, it only notices the average effect.

When we watch a film in the cinema, or the television, what you are actually seeing is a series of fixed pictures, which change rapidly enough that your eyes just see the average effect - movement. Your brain fills in the gaps to give an average effect.

### 2.2.3 HC-05 Bluetooth module

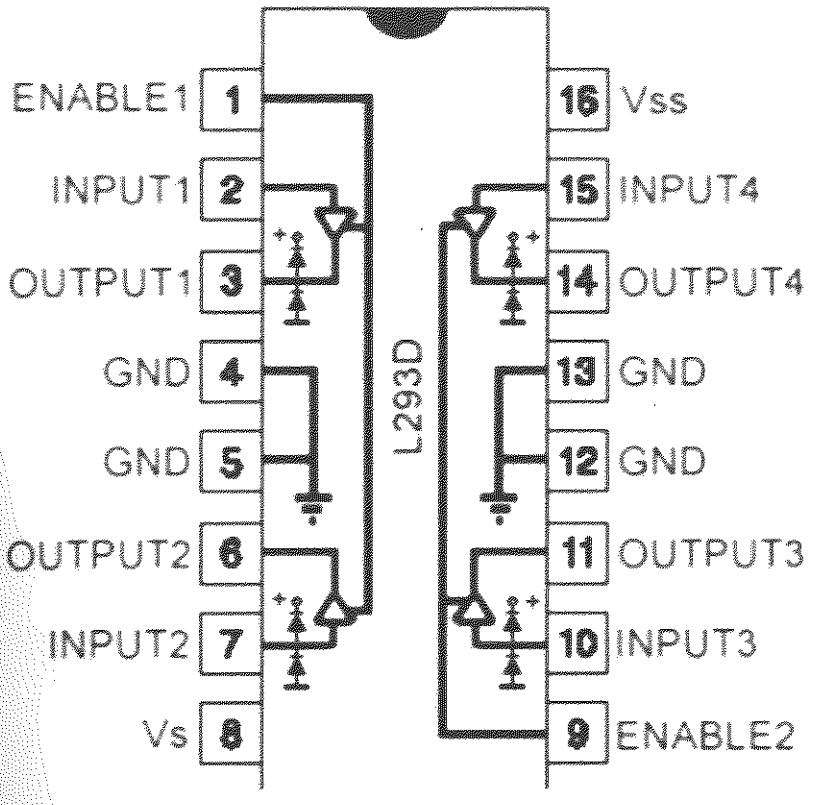
HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module,designed for transparent wireless serial connection setup.The HC-05 Bluetooth Module can be used in a Master or Slave configuration, making it a great solution for wireless communication.This serial port bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR

Bluecore 04-External single chip Rluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature).




### 2.2.4 IC L293D

L293D is a dual H-bridge motor driver integrated circuit (IC). The motor driver takes a low-current control signal and provides a greater-current signal because it act as current amplifier. There are 4 input pins for this L293D Motor Driver IC which are pin 2 and 7 on the left;pin15 and 10 on the right. Then, the left input pins regulate the rotation of DC motor connected across left side and right input pins for motor on the right hand side. After that, VCC pin16 is the power supply for internal operation. The maximum voltage range is from 5V until 36V. VCC also need 5V to internal operation and this voltage not used by L293D. Next, VSS is a separate provision to provide motor supply and this voltage used by L293D to drive the motor. The VSS motor supply provide 9V to operate 9V motor in this project. The maximum voltage for VSS is 36V. The maximum current that can supply by VSS is 600mA per channel. After that, for Pin1 and Pin9 are "Enable" pins, these two pins are connected to positive 5V for the drivers to function. When these two pins pulled low, the outputs will be turned off to stop the motors. Moreover, the Pin4, Pin5, Pin12 and Pin13 connected to microcontroller's ground. Furthermore, Pin3, Pin6, Pin11, and Pin14 are output pins. The Pin3 and Pin6 for first motor, Pin11 and Pin14 for second motor. Lastly, Pin 8 is to power the two motors and connected to a secondary battery. The maximum supply voltage is 36V.

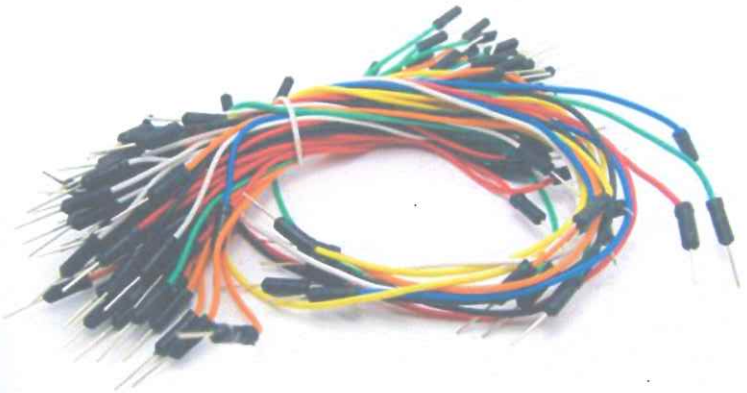



### 2.2.5 POWER SUPPLY(9V BATTERY) WITH CONNECTOR AND STRAP

The 9V battery was introduced for the early transistor radios. Next, it has a rectangular prism shape with rounded edges and a polarized snap connector at the top. This type of battery are commonly used in walkie-talkies, clocks and smoke detectors. Then, the battery has both terminals in a snap connector on one end. The smaller circular (male) terminal is positive. Meanwhile, the larger hexagonal or octagonal (female) terminal is negative. This type of battery also can connected to each other in series form to provide higher voltages. After that, a problem with this style of connector is that it is very easy to connect two batteries together in a short circuit. This situation will cause the both batteries discharge quickly, generate heat and possibly causes a fire. So, the function of strap are reduce the potential of short circuit, insulates and shields the battery snap-on connector contact and prevents dust, dirt or physical damage. Lastly, the strap provide excellent strength and low contact resistance, the wire also soldered to increase reliability.

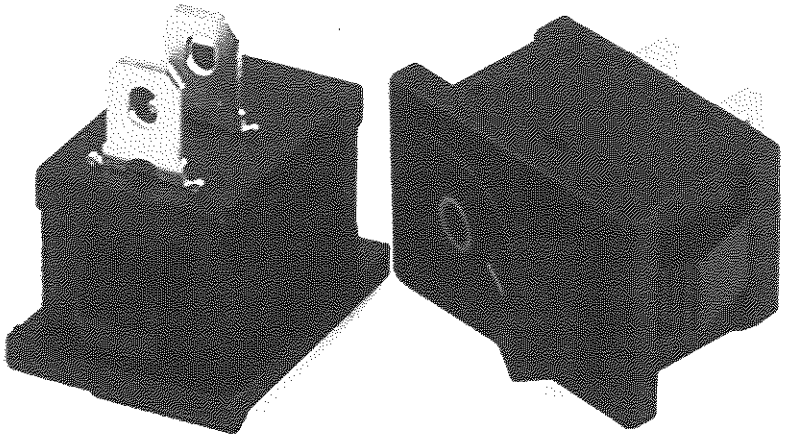

### 2.2.6 JUMPER WIRE

A jumper wire is an electrical wire with a connector or pin at each end. Next, the function of jumper wire is used to interconnect the components of a breadboard, other prototype and test circuit internally or with other equipment and components without soldering. Then, individual jump wires are fitted by insert the end connectors into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment. After that, the categories of jumper wire are male to female, female to female and male to male. In additional, jumper wire is different in color and size which is depends on the uses. In breadboard, jump wire is used to establish connections between the central micro controller and other devices such as button and sensor. Lastly, the jumper wire should always be placed on the component side of a circuit board during assembly.



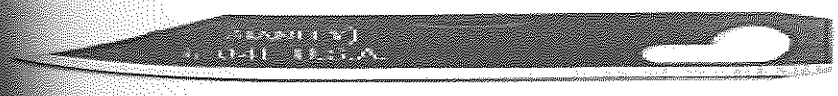
### 2.2.7 KCD1-101 10 AMP ROCKER SWITCH

KCD1-101 miniature rocker switch offer a high switching current in a compact design. It is a snap-in mounted rocker switch and contain high mechanical life in a rugged nylon 66 housing. Next, it has a high quality for long life at heavy loads and industry-standard mounting dimensions. The project used this switch for the function of switch on and switch off. Then, this rocker switches also can be used in a variety of applications, example: water dispenser and extension socket and so on. After that, the switch terminal is brass with sliver plated and the switch operation is on-off. This switch have two different rating, 10A with 125 AC voltage and 6A with 250 AC voltage.



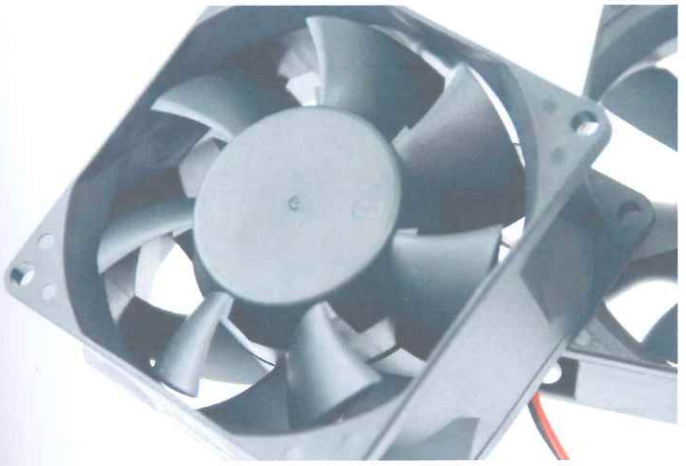
### 2.2.8 Blades

A blade is that portion of a tool, weapon, or machine with an edge that is designed to cut and/or puncture, stab, slash, chop, slice, thrust, or scrape surfaces or materials. A blade may be made from a flaking stone, such as flint, metal (usually steel), ceramic, or other material. Here we used two blades i.e fixed blade and sliding blade.



### 2.2.9 Cooling Fan

A cooling fan is any fan inside, or attached to, a robot case used for active cooling, and may refer to fans that draw cooler air into the case from the outside, expel warm air from inside, or move air across a heat sink to cool a particular component.



## 2.3 PREVIOUS RESEARCH

Earlier research is the research where comparison with the system or the robot that has already been produce as a guideline and references based on the project that will developed. At the same time with the research that done, can increase the quality and the stability of the project that developed . The industrial robot is considered to be a mechanical devices which can carry out the human jobs in dangerous and hot weather areas. This is to stop danger on the human's life. Moreover, robots can repeat the job task more frequently with precision and shorter time. The smart lawn mower robot is operated manually by humans. In this new millennium, technology has been developing rapidly and every day, new invention appeared in order to make human life easier. The smart lawn mower robot itself is in evolution to make it intelligent to cut the lawn. Some of those robots had been already produced.

## 2.4 CONCLUSION OF THE CHAPTER

This chapter explain about the literature review of the project. Which stands from detail about the components and their functions. The main components that used in this project is Arduino uno as main board, dc motors , blade and as listed above there. All these components are playing main role in smart lawn mower robot. It is great to understand about their function because it will be helpful if any errors occurs on the robot.