

# DESIGN AND FABRICATION OF SMART AUTO-GRASS CUTTER FOR ANALYZING ITS PERFORMANCE



DEPARTMENT OF MECHANICAL ENGINEERING SONARGAON UNIVERSITY(SU)

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May 2022

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A report submitted to the Department of Mechanical Engineering, Sonargaon University, Bangladesh in partial fulfillment of the requirements for the award of degree of Bachelor of Science in Mechanical Engineering.



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## **Abstract**

Grass cutter machines have become very prevalent currently. A grass cutter machine is a device that help human to cut grass automatically, The design objective is to come up with an apparatus for cutting grass that is portable, durable, easy to operate and maintain.

In this project, a grass cutter is developed with several features. The movement of the auto grass cutter is based on a path planning technique. The cutter machine consists of four main wheels with two of the wheels at the front and another two is back. We recommend a model of the grass cutting machine powered through battery. This model reduces both environment and noise pollution.



## Acknowledgement

All praise to Allah, who is the lord of the worlds and prayers peace be upon Mohammad Rasulullah (S.A.W), who is the messenger of Allah. Alhamdulillah, with Allah's blessings and guidance. We have completed this project great even through there are many hardship and obstacle along the way (like covid-19).

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Last but not the least, we would like to thanks and best wishes to all of our group members and friends who supported us whether directly or indirectly on this project, Their help was so supportive and claimant of praise.

## **Declaration**

We hereby declare that we have formed, completed and written the thesis entitled “Design and fabrication of smart Auto-Grass cutter for Analyzing its performance” in Mechanical Engineering for the degree of B.Sc. It has not been submitted to any other University/College/Organization or Institute previously for an academic qualification or for Professional degree.

The information derived or materials of function found by any other researcher are mentioned by reference.

We also take charge of the ensure the university. We will be responsible if even the slightest damage or loss is done.

# Chapter-01

## Introduction

### 1.1 introduction:

We heard about the world like smart homes, smart streets, smart cities etc. Many homes have smart functions like turning on and off the lights with voice and many other functionalities. Many cities are also leading towards smart constructions like smart cities and smart streets, automatic street lights, automatic parking systems are some of the examples of smart city planning.

This is only because of the smart technology. The technology helps to communicate between hardware. It helps in robotics also in this project, we are discussing about **"Design and Fabrication of Smart Auto-Grass Cutter for Analyzing its performance"**. It is also called as lawn mower. It is a machine which is used for cutting grass. A grass cutter is a machine that can cut grass of any height using one or more rotating blades. A hand operated blade that can collect energy by pushing or it can be driven by an electric motor or an internal combustion engine. Some grass cutter can cut grass and collect it or scatter it on the ground. There are two main types of blades used in it. A machine driven by a single blade that can rotate on only one axis is called a spinning machine. There are different types of cutters for different works. The smallest type of muscle-powered type is used to clean backyards and gardens. The large cutters are used to clean golf courses and city gardens. the main aim of our project is to come up with a cost efficient grass cutter. Modern gas powered and electric powered grass cutters cut grass with a single blade revolving at a high speed parallel to the ground.

Despite the obvious advantages of grass cutters, noise and vibration are two of the associated health hazards while using manually propelled type which may have irreversible impairment on human health. Lawn maintenance workers generally spend about 8 to 9 hours exposed to sound level above 85 dB and only a few employees wear hearing protection.

Generally, in areas like ours, the conventional methods of grass cutting involved the use of cutlasses, which never give the maximum satisfaction. Moreover, it is strenuous, time and labour intensive. Therefore there is the need to develop and fabricate a grass cutter which can take care of this operation easily. The objective of this project is to design and fabrication of smart auto-grass cutter which is affordable by common man.

## 1.2 Background

Formal cutters with neatly manicured grass began appearing in France in the 1700s, tended to by grazing animals or hand-cut with shears and scythes. In 1830, Englishman Edwin Bear Budding was granted the



**Figure 1.1: Edwin Bear Budding first grass cutter**

patent for the first mechanical grass cutter, based on a tool used to uniformly cut carpet and comprised of a series blades around a cylinder. Nearly 40 years later,

The reel grass cutter came to the United States. Initially made to be horse drawn, Elwood McGuire of Richmond, Indiana designed the first widely popular human power push grass cutter. Budding's first machine was 19 inches (480mm) wide with a frame made of wrought iron.

In 1832, Ransomes of Ipswich (under license) began to make Budding's cutter. This company is today the world's largest manufacturer of grass.

In 1840, early models of horse drawn cutters were designed which of course had previously taken two people to push as it is cast iron. This did not seat everyone as the horses would trample gardens with their hooves. As a result, the horses had to wear leather booties to prevent impressions on the grass which sounds like a challenge in itself to organize.



Figure 1.2: Ransome's Motor Lawn Mowers

In 1859, Budding's patent on the grass cutter was terminated and Thomas Green created the silens messor. Meaning 'silent operation' which was an immediate success, using chains to transmit power from rollers rather than gears.

It was more quiet than those before it. You could also get add-ons such as a clipping box. This was one of the first commercially successful cutters, over a million were produced until World War Two when production stopped.

In 1870, Elwood McGuire designed a push cutter that was much lighter with less moving parts more functional for the everyday person.

In 1890, steam powered grass cutters were invented, this was quite a bulky machine with a water boiler, steam cylinders and a seat to ride up top. It took longer to heat the steam than to cut the grasses, so gasoline powered cutters rose in popularity over steam.

In 1919, The united states manufactured a gasoline powered cutter thanks to colonel Edwin George.

However, being created around The Great Depression, it didn't take off straight away. It wasn't until after world war two that it rose in popularity.

In 1930, The electric powered cutter, also rotary cutting blades were developed, but again were not mass produced due to a lack of demand at the time.

In 1960, variations with lighter plastic were continually adjusted into what we see today.

We can see the evolution of cutters from scissors, to manpower, horses, steam, gasoline and plastic, but the original design has stuck to what we see today and many people still purchase cutters that have the some design from 100 years ago.

### **1.3 Objectives:**

In the past, several investigation were made in the grass cutter industry at USA, Germany etc. Nigerian market, from which this production is a development of already existing ones. It was localized to smite our environments condition aim and objectives of the investigation on the project are nominated below. The design objective is to come up with a cutter that is portable, durable, easy to operate and maintain. It also aims to design a self- powered cutter of electrical source; a cordless electric grass cutter.

The heart of the machine is a battery-powered DC electric motor. It comprises of a system of speed multiplication pulleys which drive the cutting blades and the charging unit comprising of a 12V alternator and a lift mechanism meant to alter the height of cut. This is achieved by means of a system of pulleys with minimal slip effect; collapsible blades to reduce the common problem of wear. The use of collapsible blades and incorporation of an alternator for recharging the battery make the design unique such that no engine is involved. Thus, the machine is considered highly efficient and is readily adaptable to different cutting conditions.

\* The objective of this paper is to design and fabricate a grass cutter which operates on android app and avoid the drawback of old grass cutter.

\* The main objective is to reduce human efforts by using fully automatic grass cutter.

\* The project is powered by 12V DC battery hence the consumption of fossil fuel is reduced.

\* The other objectives is that the automatic grass cutter has to differentiate between grass and concrete which monitoring its surroundings continuously.

\* To analyze the selected design by using cutting speed, feed rate and machining time.

#### **1.4 Importance Of The Project To Society**

Generally, this project has a great effect on the development and maintenance of any community in the societies, which one mounted below.

1. Cutting grass of secondary, primary and tertiary fields thereby reducing human effort made.
2. Great portion of farmland can be cut or brushed with and grass cutter in one day.

3. This project reduced the number of personal that need in a particular farm operates.
4. Improved food production in society.
5. To reduce manpower.
6. To improve the economy of any country.
7. Provision of foreign Exchange in the countries.
8. To reduce exportation costs to our country.
9. To encourage pupils, and students to be regular and the school, because no ore cutting of grass with a cutlass by pupils or student.

### **1.5 Problem Statement:**

In the 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. Gas powered grass cutter are in 90% of U.S home and they create 5% of the total U.S pollution. Green technology initiatives are being support by both the government and cooperates business.

Our new design for an old and outdated habit will help both the consumer and the environment. Battery powered auto-grass cutter will relieve the consumer from cutting their own lawns and will reduce both environmental and noise pollution.

This design is meant to be an alternate green option to the popular and environmentally hazardous gas powered grass cutter. Ultimately, the consumer will be doing more for the environment while doing less work in their daily lives.

### **1.6 Conclusion**

A grass cutting machine is a type of machine that uses one or more than one blades for cutting a grass surface to a uniform height.



The height of the cut grass is fixed by the design of the this machine. The type of grass cutting machine you want to buy depends on your needs.

If someone wants to buy a good grass cutting machine ensure that have the right knowledge about all the right factors that should utilize when they are in the market for buying the machine. Without proper information, they might end up buying the wrong one. Have a look at some of the top benefits.

# Chapter-2

## Literature Review

### 2.1 Introduction

Grass cutter machine designed by Edwin Beard have been in existence since the early 1800s. Machines for grass cutting is popular amongst workers in agriculture, gardening, landscaping, horticulture, etc. There are conceptually two types of cutter: the reel/cylindrical and the rotary cutters. The cylindrical cutters are made up of blades mounted on a rotating cylinder that produces clean trim by scissors action. Design and Construction of Automated grass cutter. For its operation, a stationary metal bar known as bed knife is placed on the ground, Grass is cut by the shearing action of the blade(s) against the bed knife. Rotary cutter are usually powered either by an electric motor or an internal combustion engine and are generally moved manually, leaving the engine or motor to rotate cutting blades. Despite the obvious advantages of grass cutter, noise and vibration are two of the associated health hazards while using manually propelled type, which may have irreversible impairment on human health. In workplaces there are health and safety requirements for those affected by noise and vibration, but for public or occasional users there is no legislation mitigating against the potential health hazards for vibration. Cutter maintenance workers generally spend about nine (9) hours exposed to sound levels above 85 dB, and only a few employees wear hearing protection. Some of the works done on health hazards resulting from lawn mowers and possible improvements are briefly discussed. Investigated noise produced from cutting blades, noise levels at different frequencies and possible solutions for damping the vibration of cutting blades and made comparisons on the risk factor associated with workers working on different lawn maintenance machines. These health challenges are overcome by the use of autonomous grass cutters.

It reduces human intervention to remote control mechanism, completely expunging a user from the hazardous noise, vibrations and possible fumes that manual machines produce. A further improvement is the predominant use of DC motors and batteries as against internal combustion engines. Developed a grass cutter that needs no human interaction except when its being placed in the work area. The machine uses sensors to provide a microcontroller within cutting area, and the machine determines the path to take, evaluate its position and stops once the task is accomplished. Produced a survey on robotic grass cutters and enumerated their comparative advantages over one another.

Although existing grass cutters perform the task of trimming grass, their operations are accompanied by health hazards. However, the invention of automated grass cutter helps reduce high-level noise and operator's fatigue experienced by use of pre-existing grass cutting machines. There are different models produced commercially and they are available for purchase, but these grass cutters require a boundary wire to be installed around the perimeter of the lawn area. Came up with a concept that eradicates the use of perimeter wire for a robot car with the use of sensors for obstacle detection and avoidance. Developed an automatic grass cutter that employs the use of different sensors to detect and avoid objects and humans while working. The user specifies the area to be mown and the desired grass height. Through the use of a keypad. Developed an autonomous grass cutter but retains the ability to be used manually where users specify how the lawn should be cut. When in the automatic mode, it requires no perimeter wires to keep the robot within the lawn, and requires very little human effort for operation.

## 2.2 Literature Review

**Prof. C.J. Shende:** In this paper, they have prepared manually grass cutter device which is capable to cut the grass. This device consists of linear blades and it does not affected by climatic conditions. The main objectives of this paper in to more the grass cutter is different directions. By using link mechanism the height of the cut can be adjusted. The unskilled labour can easily operate this device.

**C.B. Mills:** Today, New technology is bringing us improved cutter versions. Low emission gasoline engines with catalytic converters are being manufactured to help reduce air pollution. Improved muffling devices are also being installed to reduce the noise pollution. Battery powered cutters are also becoming practical. Although slightly smaller with an average cutting swath, of only 17-19, These new cutters will quietly cutting grass without the common cloud of blue smoke hanging in the air, for about an hour per charge, prices are comparable to a high and gasoline powered cutter.

**Davidge E D:** “ I’m planning on moving my entire fleet to propane. Not only is it better for the environment, it also increases my productivity. I’m saving money on fuel, and labour cost as well, since my crew isn’t spending time filling up at the pump. Propane has no additives and is a clean burning system. I save on maintenance since there is no carburetor or fuel filter to maintain.

**Edwin Beard Buddin:** Budding obtained the idea of the grass cutter after seeing a machine in a local cloth mill which used a cutting cylinder mounted on a bench to trim cloth to make a smooth finish after wearing.

Budding realized that a similar concept would enable the cutting of grass if the mechanism could be mounted in a wheeled frame to make the blades rotate close to the grass’s surface.

**MS. Lanka Priyanka:** In this paper, they have fabricated grass cutting machine with tempered blades are attached to the grass cutter. This grass cutter is manually operated as well as automatic operated. The materials commonly used GI sheet, motor, wheel, A1 sheet, switch, wire square pipe and insulating material.

**P.Bulski:** Bulski identify the second created by the machine is making noise pollution. He research on sound created by the machine and giving the result how to remove the sound while cutting the grass of lawn or ground. As looking to the petrol engine it make air pollution to environment so from my recommendation it should be implement on electric operated grass cutter.

**Praful P.Ulhe:** In this paper, they have prepared manually operated grass cutter with spiral roller blade due to spiral blades increases the efficiency of cutting. For adjusting the height reel cutter is component placed on gray cutter. This grass cutter used to cut the grass uniformly and also it can cut the different types of grasses.

**Ransomes:** The first was produced by Ransoms in 1902. JP Engineering of Leicester, founded after world war 1, produced a range of very popular chain-driven cutters. About this time, an operator could ride behind animals that pulled the large machines. These were the first riding cutters. In the United States, Gasoline powered Lawn mowers were first manufactured in 1914 by Ideal Power cutter.

**Thomas Green & son:** He introduced a cutter called the silent 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 proceeded them, although they were slightly more expensive.

The rise in popularity of lawn sports helped prompts the spread of the invention. Grass cutters became a more efficient alternative to the scythe and domesticated grazing animals.

## **2.3 Conclusion**

Due to the power demand we choose the renewable energy. So there is no running cost. Our project entitled Manufacturing of solar powered grass cutter is successfully completed and the results obtained are satisfactory. It will be easier for the people who are going to use this project for the further modifications.

This project is more suitable for a common man as it is having much more advantages i.e. no fuel cost, no pollution and no fuel residue. This system is having facility of charging the batteries while the solar powered grass cutter is in motion. So it is much more suitable for grass cutting also. The same thing can be operated in night time also, as there is a facility to charge these batteries in day light.

The DC motor is operated in low power with high efficiency. The battery is charged by the solar panel in a constant voltage. We met all the requirements and completed our goals for this project.

This project eliminated the physical power required in pushing the mower without sacrificing safety.

#### 3.1 Introduction

Grass cutter machines have become very essential to our daily living in maintaining the yards. Furthermore, environmental awareness on usage of grass cutting machines has caught a great interest among consumers. As a result, consumers are searching for ways to reduce and solve their own carbon footprints. Moreover, environmental pollution keeps increasing and it can be experienced in our daily life, particularly in our homes. Based on a study, it is reported that 70% of Malaysian home citizens are utilizing fuel powered grass cutter for their daily grass cutting routine. Thus, high maintenance is needed in order to maintain a grass cutter. For instance, one should change the fuel or oil regularly so that the grass cutter works efficiently during the process of grass cutting. Furthermore, this will incur extra variable cost since the fuel price has been increased lately. In order to overcome these issues, an eco-friendly grass cutter needs to be designed and fabricated in order to support the green technology initiatives. In this study, a newly designed grass cutter was fabricated which powered through a rechargeable battery. Besides that, the grass cutting machine was fabricated at low cost by taking consideration on important aspects such as lightweight, durable, and environmental friendly. A lawn mower is a machine that uses cutting blades or strings which is used to cut the grass in gardens or yards at an even length. The working principle of the grass cutter is to provide a high speed rotation to the blades, which aids in cutting the grass through generated kinetic energy. The main parts of this prototype lawn mower consist of a DC motor, a pulse width modulation device for controlling the motor, bicycle frame and wheels as the body structure, and a rechargeable battery.

For safety operation, the motor will be controlled by a android device as since the motor has a high rotational speed.

Besides that, since the motor delivers a minimum torque value, it is much more suitable since it is lighter in weight. With reference to current literature availability, there are many variation of grass cutter that are exist in the global markets, which may not fulfil the performance and operational cost criteria.

The main concentration of this study is to design and fabricate a grass cutter which is cost effective, feasible and easy operation. With the help of this portable grass cutter, consumers can easily maintain and beautify their yards and gardens without any hassle.

### **3.2 Idea About Grass Cutter**

An electric Grass cutter is more suitable and easy to use than the grass cutter with an engine, so we can making an electrical grass cutter with an electrical motor, which is providing the high speed rotation to the blades, cordless electric cutters are powered by a 12V rechargeable batteries.

Typically, more batteries mean more run time or power. Batteries can be in the interior of the grass cutter or on the outside. If on the outside, the depleted batteries can be quickly swapped with recharged batteries. Cordless cutters have the maneuverability of a gasoline powered cutter and the environmental friendliness of a corded electric cutter.



### 3.3 Types Of Grass Cutter

There are many types of Grass cutter nowadays used in general. They are as follow:

1. Walk-Behind Cutter
2. Riding Cutter
3. Tow-Behind Cutter
4. Rotary Grass Cutter
5. Cordless grass cutter
6. Hover grass cutter
7. Petrol grass cutter
8. Push grass cutter
9. Electric grass cutter

#### 1. Walk-Behind Cutter



Figure 3.1: Walk-Behind Cutter

❖ **Now types of Walk behind Grass cutter**

- Gas Powered Grass Cutter
- Electric Grass Cutter
- Manual Grass Cutter

❖ **Gas Powered Grass Cutter**



Figure 3.2: Gas Powered Grass Cutter

❖ **Electric Grass Cutter**



Figure 3.3: Electric Grass Cutter

## ❖ Manual Grass Cutter



Figure 3.4: Manual Grass Cutter

## 2. Riding Cutter



Figure 3.5: Riding Cutter

## 3. Tow-Behind Cutter



Figure 3.6: Tow-Behind Cutter

#### 4. Rotary Grass Cutter



Figure 3.7: Rotary Grass Cutter

#### 5. Cordless grass cutter



Figure 3.8: Cordless grass cutter

#### 6. Hover grass cutter



Figure 3.9: Hover grass cutter

## ❖ Another Types Of Grass Cutters

### Commercial Zero-turn cutter



Figure 3.10: Commercial Zero-turn cutter

### Robotic Grass Cutter



Figure 3.11: Robotic Grass Cutter

### A zero-turn mower



Figure 3.12: A zero-turn mower

## An Ursus tractor-pulled mower



Figure 3.13: An Ursus tractor-pulled mower

## Tractor Pulled Mower With Long Arm



Figure 3.14: Tractor Pulled Mower With Long Arm

## Types Of Blades :

### 1. Taper Shaped Blade



Figure 3.15: Taper Shaped Blade

### 2. Straight Shaped Blade



Figure 3.16: Straight Shaped Blade

### 3. Larger Blade



Figure 3.17: Larger Blade

### 3.4 Working Principle

Arduino UNO microcontroller based Bluetooth control grass cutter consists of a motor, gear arrangement of a cutting tool. For this system the power get from the 1100 MAH battery. By using Bluetooth module, forward, reverse, lift and right direction can be controlled. Assemble the machine, make the necessary connections and upload the code to Arduino UNO microcontroller. If someone understand the HC-05 Bluetooth module tutorial, then understanding the Bluetooth controlled grass cutter project is very easy.

For this project Android app is available in google play store. From the Arduino UNO microcontroller it is fed from the relay if any fault occurring in the electronic switches it will rectify by using a relay operation in it. Finally the DC motor in connected to the cutting tool and it starts working.

### Project pictures

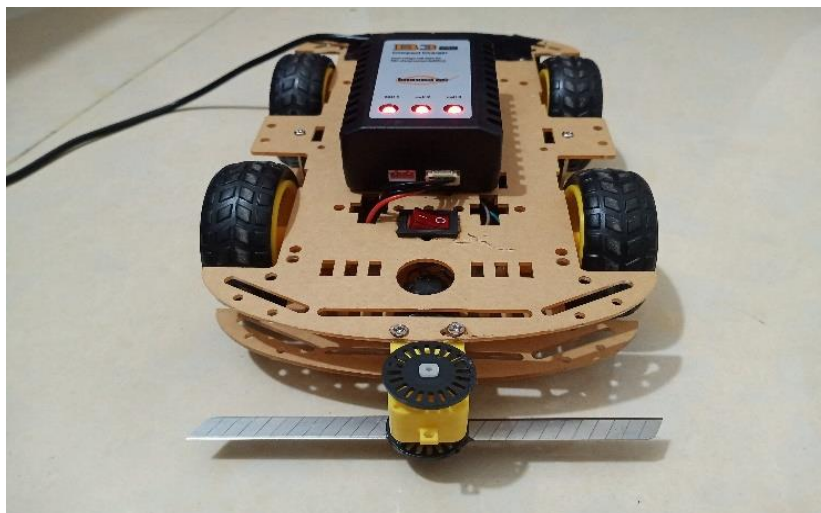


Figure 3.18.(1): Project picture



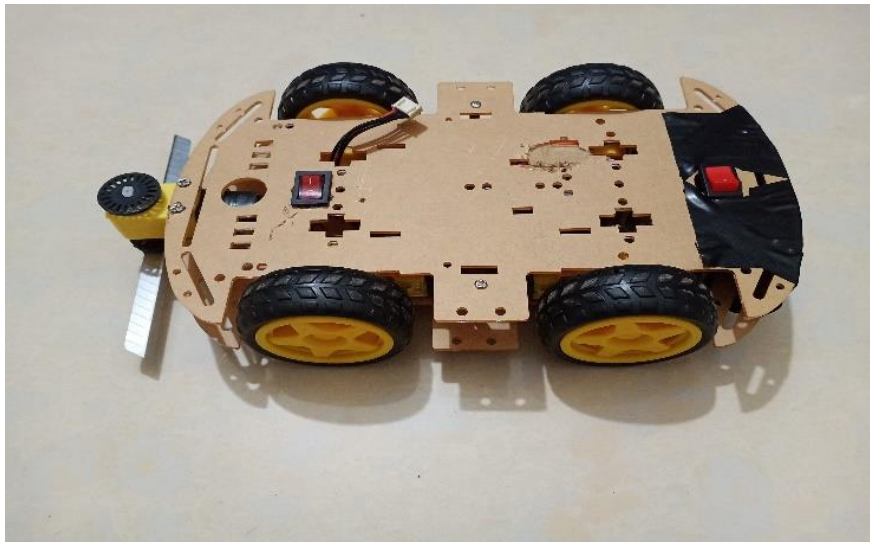
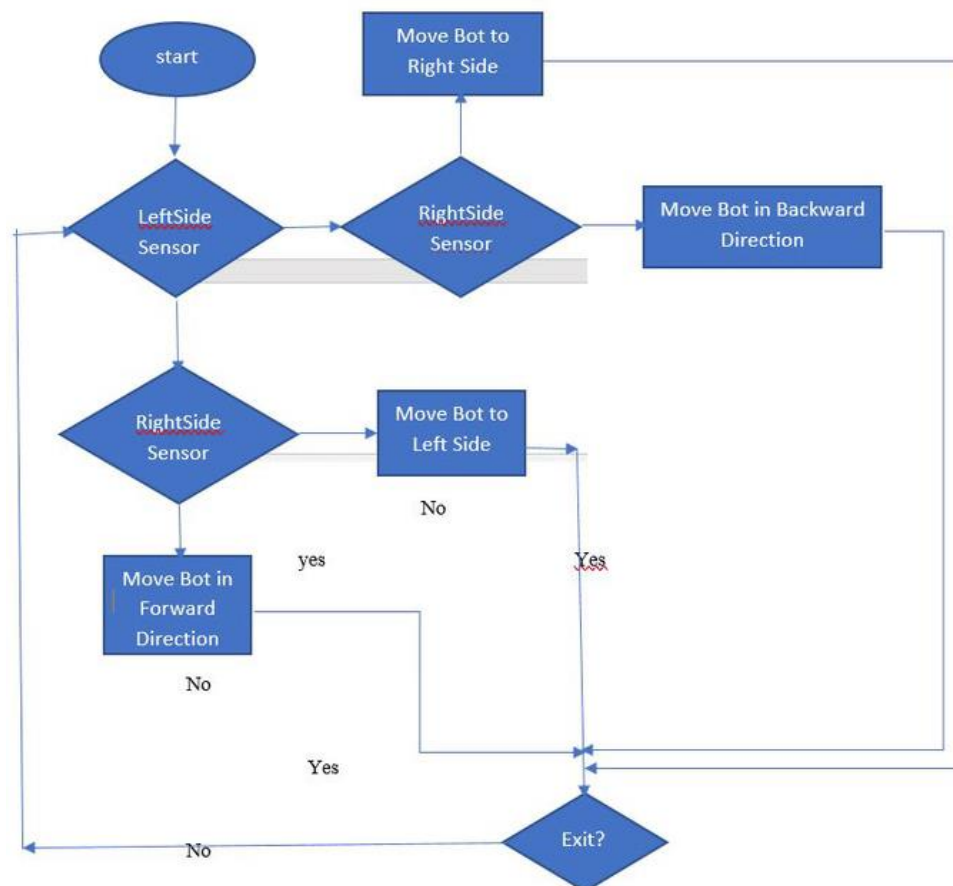
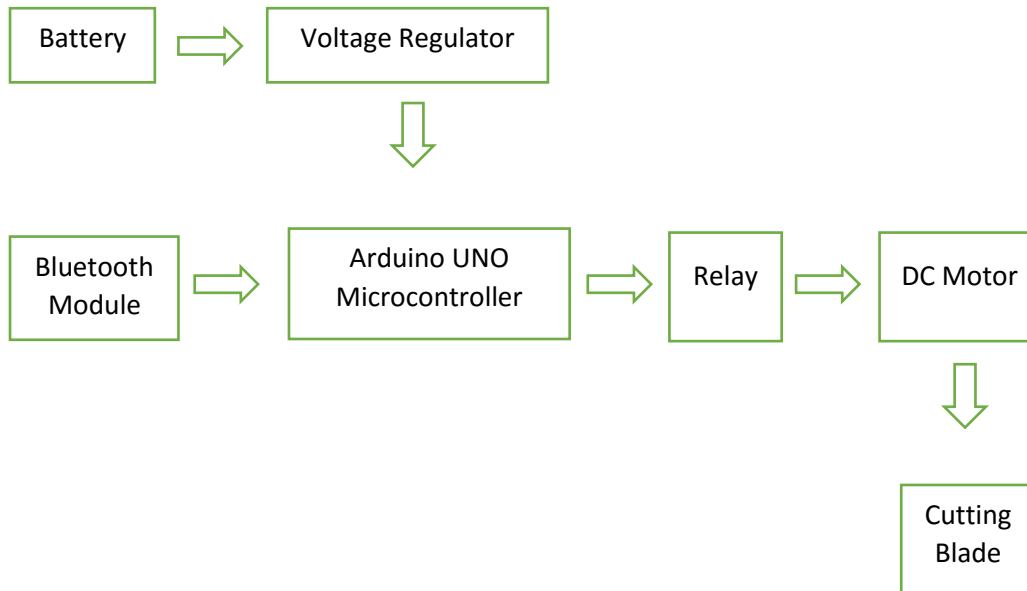


Figure 3.18.(2): Project picture

### 3.4.1 Flow Chart



### 3.4.2 Block Diagram



### 3.5 Working Performance:

Length of the vehicle = 10 inch.

Width of the vehicle = 6 inch.

Height of the vehicle = 2.5 inch.

Height of the blades from surface = 0.7 inch and 10 inch.

Bluetooth Range = 75 ft.

Now,

Length of the space = 11 ft

Width of the space = 1 ft

→ Area of the space =  $(11 \times 1)$  ft<sup>2</sup>

= 11 ft<sup>2</sup>

In,

1 minute cut the grass = 11 ft<sup>2</sup>

60 minutes cut the grass = (60×11) ft<sup>2</sup>/h

= 660 ft<sup>2</sup>/h

= 61.4 m<sup>2</sup>/h

→Working Performance per hour = 61.4m<sup>2</sup>/h.

### **3.6 Applications**

If you live in a home with a yard, you probably use at least one kind of grass cutter to keep your yard looking beautiful. Grass cutters have different intended uses and come in many types and sizes, but all have roughly the same use to keep the grass trimmed. Whatever, your grass cutter needs a tool stands ready to help you do it. Choosing the right grass cutter for the task makes the work easier and leads to satisfying results. Grass cutter are the most common kind of grass cutter that most homeowners use. Cutters may be rotary types, where blades swirl horizontal to the ground, or reel cutters where blades cut vertically. Typically gas or electric powered, rotary cutters may be self-propelled or rely on manpower to make them move. For large areas, reel cutters are pulled behind lawn tractors. Smaller versions are manually pushed across lawns. Grass cutters are designed to keep grass cut short, but a good rule is to never cut off more than one-third of the height of your grass. Most cutters have levers that allow you to raise or lower the cutting blades to cut the grass to your desired length.

Such as-

\*It is suitable for small residential lawns and gardens.

- \* It is widely used to cut small grasses and it can also be used for cutting small plants.
- \* It is also used for trimming grass of play grounds and sports ground.
- \* In short, agricultural, in gardens, big lawns, for hospital, for college, for small farm, for nurseries.

### **3.7 Conclusion**

Main Drawback of the Subsisting System is it need a separate person to operate the Robot, so to overcome this drawback a system was implemented for fully automated battery powered grass cutter. As the technology is getting advanced, features of grass cutters are also enhanced.

The designed Model is highly efficient and accurate as it detects the objects and stops the movement. Thus, the Design and implementation of the project has been successful.

Since there is no cost of fuel and any kind of pollution as the present system uses battery as a power source, the designed Robot will meet the Challenge of low cost of operation and a renewable energy.

## Experimental Procedure

### 4.1 Introduction

Traditionally and even now in many places like an institution, organization, sports ground, industries, hotel, public center etc, cutting of grasses was done with a cutlass. This manual method is time-consuming and also inaccuracy level of cutting is observed. With the advent of technology, cutting of grass done with single or more blades to cut the grass surface to a uniform height. Normally, the height of the grass cutting will be adjusted or fixed from the operator end either by lever or nut adjusted to the machine wheels. This trims the grass utilizing very little time and also optimizes the human power involvement to a minimum level. Based on the one requirement several types of Grasscutter are available to assist one in having the best Grasscutter. Even the power source for the grass cutter plays a vital role while designing the best tool for the user end. Technology oriented cutting down the grass has been implemented adopting modern energy sources such as petrol, electricity, propane etc.

Petrol-powered Grasscutter pushes the rotary cutters powered by an internal combustion engine of four-stroke used for maximum torque and cleaner combustion. The power consumption generally ranges from equipped with a single-cylinder having a carburetor, so the engine needs to be started in manual pull crank method even though few models provided with an electric starter. Electric-powered Grasscutter is available with two types such as corded and cordless electric Grass cutter both producing an average of fewer than 75 decibels compared to more than 95 decibels of petrol-powered Grass cutter.

Corded Grass cutter limits its range depending on the cable wire availability and also may lead to being hazardous when Grass cutter accidentally moves over the cable wire, which leads to a chance of high risk of receiving electric shock to the user. Cordless Grass cutter uses rechargeable batteries to deliver power to the Grass cutter, more number of batteries leads to more run time of Grass cutter.

But these are more expensive and disposal of worn-out batteries is problematic. Compared to petrol-powered Grasscutter even the performance is less considering the parameter of the same weight.

In this paper, a new approach is proposed for cutting grass based on battery powered Grass cutter, with minimal intervention of human involvement. The connection of physical things that are embedded with electronics components and software to enable greater services for the connected things with applying computation and analysis. Here our proposed model aims at designing and developing to operate with highly versatile, much durable, highly comfortable, powerful and avoiding obstacles in the path.

## **4.2 Construction**

I wouldn't go into the details of the construction of the robot as your robot chassis might be different from mine and you can easily figure it out how to build the robot from the available parts and possible cable management for making the robot more appealing. Coming to the design of the circuit, first is the HC-05 Bluetooth Module. The +5V and GND pins of the Bluetooth Module are connected to +5V and GND of Arduino. Since I will be only transmitting data related to the Robot's movement from Android Phone to Bluetooth Module and do not intend to receive any data from Arduino, I will connect only the TX pin of the Bluetooth Module to RX Pin of Arduino.

This RX pin of Arduino is based on Software Serial library (Pin 2 and Pin 3 are configured as RX and TX on Arduino). The RX pin of the Bluetooth is left open.

Now, the L298N Motor Drive Module. Digital I/O Pins 9 through 12 of Arduino are configured as input pins of the Motor Driver and are connected to IN1 through IN4 of the L298N Motor Drive Module. Both the Enable Pins are connected to 5V through provided jumper.

The robot chassis which we are using in this Bluetooth Controlled Robot Car project is supplied with 4 geared motors. Since L298N has slots for only two motors, we have joined the left side motors as one set and the right side motors as other set and connected both these sets to the output of L298N Module.

### 4.3 Circuit Diagram

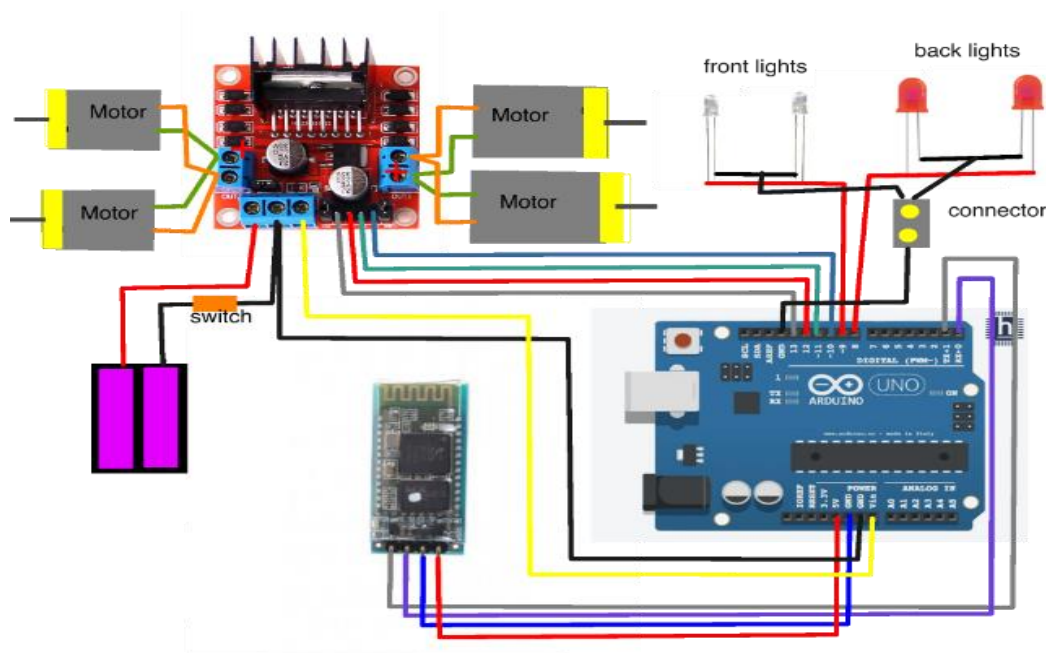


Figure 4.1: Circuit Diagram for Grass cutter.

#### **4.4 Hardware Specifications:**

- \* 4 wheels with (body case)
- \* Arduino UNO Microcontroller
- \* Motor Driver Shield L298N
- \* Hc-05 Bluetooth module
- \* 12 volt Battery & Connector
- \* Connecting wires- male to female+male to male
- \* On/off switch
- \* Gear motor
- \* 1100 MAH battery
- \* Soldering iron

#### **4.5 Hardware implementation**

##### **4.5.1 Arduino Uno Microcontroller:**

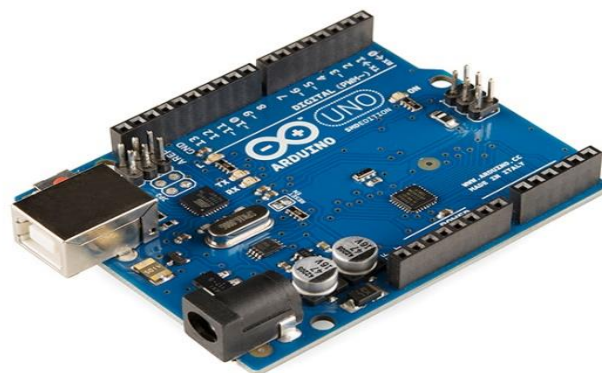


Figure 4.2: Arduino Uno Microcontroller



The Arduino UNO is an open –source microcontroller board based on the microchip ATmega328P microcontroller and developed by Arduino.c.c. The board is equipped with sets of digital and analog input/output pins that may be interfaced to various expansion boards and other circuits.

#### 4.5.2 DC motor:



Figure 4.3: DC motor

A direct current (DC) motor is a type of electric machine that converts electrical energy into mechanical energy. DC motors take electrical power through direct current, and convert this energy into mechanical rotation.

#### 4.5.3 LiPo Battery:



Figure 4.4: LiPo Battery

A lithium polymer battery, or more correctly lithium-iron polymer battery (abbreviated as LiPo, LIP, Li-poly, lithium-poly and others), is a rechargeable battery of lithium-iron technology using a polymer electrolyte instead of a liquid electrolyte. High conductivity semisolid (gel) polymers from this electrolyte.

#### 4.5.4 L298N Motor Driver Module

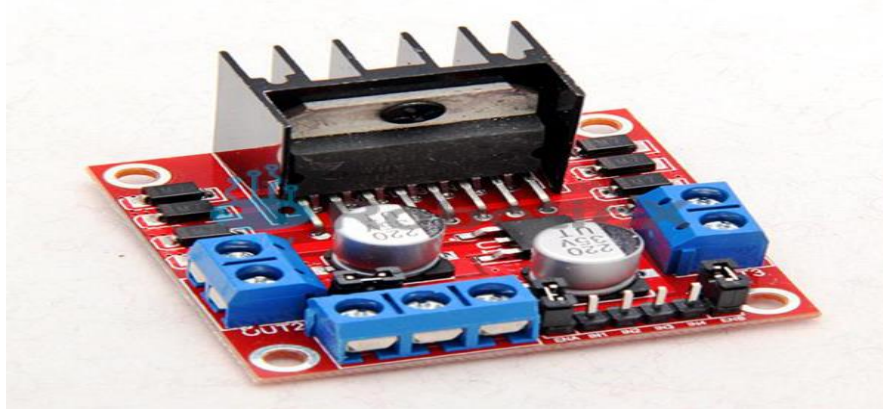


Figure 4.5: L298N Motor Driver Module

A DC motor controller manipulates the position, speed, or torque of a DC-powered motor and easily reverses, so the DC motor drive current runs in the opposite direction. Enjoy higher starting torque, quick starting and stopping, reversing, variable speeds with voltage input and more.

#### 4.5.5 Wheels:



Figure 4.6: Wheels

Typical rear wheel sizes can range from 7" to 12", and typical front wheel size ranges between 6" to 9". The most common bore diameters sized are 3/8", 1/2", and 5/8". Typical push cutter widths are 1.5", 1.75" and 2" wide.

#### 4.5.6 HC-05 Bluetooth module:

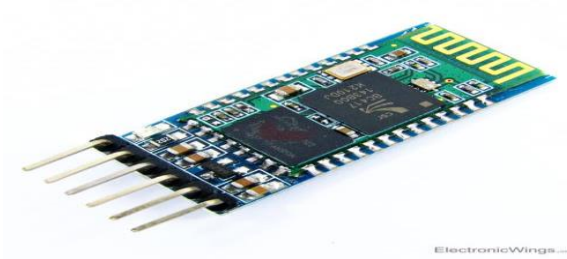


Figure 4.7: HC-05 Bluetooth module

Bluetooth module (Bluetooth module) refers to the basic circuit set of the chip with integrated Bluetooth function, used for short-range 2.4G wireless communication module. For the end user, the Bluetooth module is a semi-finished product.

#### 4.5.7 Connecting wires- male to female

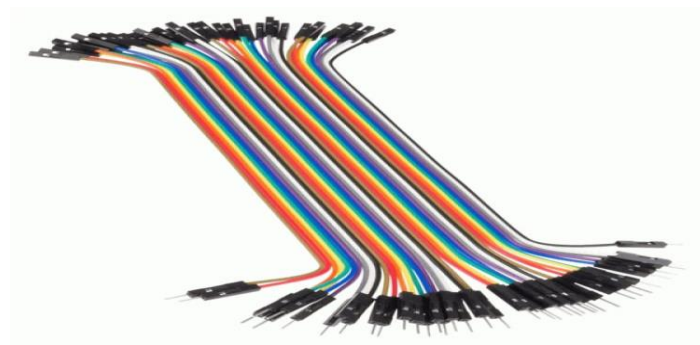


Figure 4.8: Connecting wires- male to female

A jumper wire is an electric wire that connects remote electric circuits used for printed circuit boards. By attaching a jumper wire on the circuit, it can be short-circuited and short-cut (jump) to the electric circuit.

#### 4.5.8 On/Off Switch



Figure 4.9: On/Off Switch

A power symbol is a symbol indicating that a control activates or deactivates a particular device. Such a control may be a rocker switch, a toggle switch, a Push-button, a virtual switch on a display screen, or some other user interface.

The internationally standardized symbols are intended to communicate their function in a language-independent manner.

#### 4.5.9 Soldering Iron



Figure 4.10: Soldering Iron

A soldering iron supplies the heat that melts the solder. It consists of a tip, which you apply to the metal parts you want to solder together, and an insulated handle so that you can hold the iron. There are several variations of soldering irons.

## 4.6 Software Implementation:

```
char command;
```

```
void setup() {
```

```
pinMode(7,OUTPUT);
```

```
pinMode(6,OUTPUT);
```

```
pinMode(5,OUTPUT);
```

```
pinMode(4,OUTPUT);
```

```
Serial.begin(9600);
```

```
}
```

```
void loop() {
```

```
if (Serial.available() > 0) {
```

```
command = Serial.read();
```

```
Serial.println(command);
```

```
if(command=='F')
```

```
{
```

```
digitalWrite(5,0);
```

```
digitalWrite(4,1);  
digitalWrite(7,0);  
digitalWrite(6,1);  
}  
else if(command=='B')  
{  
digitalWrite(5,1);  
digitalWrite(4,0);  
digitalWrite(7,1);  
digitalWrite(6,0);  
}  
else if(command=='L')  
{  
digitalWrite(5,1);  
digitalWrite(4,0);  
digitalWrite(7,0);  
digitalWrite(6,1);  
  
}  
else if(command=='R')  
{  
digitalWrite(5,0);  
digitalWrite(4,1);  
digitalWrite(7,1);  
digitalWrite(6,0);
```

```
}  
else if(command=='S')  
{  
digitalWrite(5,0);  
digitalWrite(4,0);  
digitalWrite(7,0);  
digitalWrite(6,0);  
}  
}  
  
}
```

## **4.7 Conclusion**

From above analysis we concluded that conventional grass cutter occurring more vibration. So we need to damp by using vibration isolation materials and by locating the place where to damp or fabricate the cutter fully balanced.

Further we also concluded that waste collecting is difficult while operating the grass cutter. So it reduces the operating time.

# Chapter-5

## Result and Discussion

### 5.1 Introduction

Product lifecycle is being reduced drastically due to rapid changes in technology and customers requirements. The global marketplace is changing so rapidly that industrialist needs to adopt new strategies to respond customer's requirement and in order to satisfy.

The market needs more efficiently and quickly. Many companies especially in Japan, USA and Europe have already started to implement techniques and tools that would enable them to respond more quickly to consumer's demand in delivering high quality product at reasonable costs. The delay in time-to-market can be interpreted as a loss in profit. Currently, the implementation of Design for Manufacturing and Assembly methodology are applied either manually or computer-aided. Most of the applied interested in implementing are hindered by lack of clear guidelines or procedure sand no integration of isolated design and manufacturing teams. The advantages of the integration are to decrease the number of part design and indirectly to reduce cost and time. At the same time, it fulfills customer's requirement. In this project, it has been applied in design and development the grass cutting machine. The design also must be concerned to the requirement of the methodology in order to achieve high rank of market selling.

### 5.2 Advantages

- \* No fuel consumption and No pollution.
- \* compact size and portable.
- \* Operating principle is simple.



- \* No skilled person can also operate this machine.
- \* Low cost.
- \* Easy construction.
- \* No power is required.
- \* Highly reliable.
- \* High efficiency.
- \* Light weight and portable.
- \* No injury to the operator.
- \* Less noise.
- \* Time consumption for cutting the grab is less.
- \* Less space is required.
- \* Highly versatile.
- \* Highly comfortable.

### **5.3 Disadvantages**

- \* Maintenance is needed.
- \* Repairing and replacing is not an easy task.
- \* The range of the Bluetooth communication is limited.
- \* Make sure that sufficient power is provided to all the modules especially the Bluetooth module. If the power is not sufficient, even though the Bluetooth module powers on, it cannot transfer data or cannot be paired with other Bluetooth devices.

## 5.4 Result And Discussion

Our Project entitled “Design and fabrication of smart Auto Grass cutter for Analyzing its performance” is successfully completed and the results obtained are satisfactory. It will be easier for the people who are going to take the Project for the further modifications. This project is more suitable for a common man as it is having much more advantages i.e. no fuel cost, no pollution, and no fuel residue, less wear and tear because of less number of moving components and this can be operated by using Android phone and Battery. This will give much less physical exertion to the people and can be easily handled. This system has the facility of charging the batteries. So it is much more suitable for grass cutting.

We have completed our project successfully with the available sources. But the results and modification are not up to the expectations.

In Future we can implement grass cutter by specifying the area that is to be cut and also the height at grab as per the requirement. The project which we have done surely reaches the average families because the grass can be trimmed with minimum cost and with minimum time.

Finally, this project may give an inspiration to the people who can modify and can obtain better results.



Figure 5.1.: Project picture



Figure 5.2.: Project picture

## 5.5 Future Scope

We have completed our project successfully with the available sources. But the results and modification are not up to the expectations. In future, We can implement grass cutter by specifying the area that is to be cut and also the height of grass as per the requirement. The project which we have done surely reaches the average families because the grass can be trimmed with minimum cost and with minimum time. In future what we can develop in this project -

- ❖ Programming can be enhanced to make the device perform for different operations.
- ❖ We can install the grass collector to collect the grass, instead of leaving behind it.
- ❖ If panel used of high watt, then the machine can be used during night time for garden lighting or room lighting, because we can accumulate more power. And at night time however you keep it apart. So the power in the battery can be used for this intention.

Finally, this project may give an inspiration to the people who can modify and can obtain better results.

## 5.6 Conclusion

In a nutshell, the grass cutter has been designed, fabricated and tested which meets all the above mentioned. Moreover, the usage of this machine makes the grass cutting process faster by reducing the cutting time. Besides that, it is lighter, environmental friendly and cost effective which is helpful for non-commercial use (home users) in maintaining and trimming the grass in gardens, home, or yards.

Robotics is very vast field which comes with different combination of technology this will helps to reduce the

human effort and gives maximum efficient output for the work, Nowadays lot of energy is wasted for grass cutting

in different areas of the world and also takes lots of human effort for the work. The main aim of this project is to

make a battery powered automated grass cutter system which wills helps to cut the grass in different design with lesser human effort. Advantages of this system are used components are of low cost so and in bulk production.

### 6.1 Limitations

There are several notable limitations in the report :

- The proposed specifications were developed for use as design specifications, not for evaluation of existing structure.
- Due to constraints of time ,the sample size is limited.
- As the questionnaire was condensed; certain factors could not studied in depth.
- Most of the information provided in the project report is collected from different projects.
- The time allotted for projects was 12 months.

### 6.2 Conclusion

We have presented a detailed description of fabrication of grass cutter. In this, we concluded that the modern grass cutter machine having better efficiency as compare to old machines it consumes non-renewable sources of energy received from battery far exceeds our energy demand. It meant to be an alternate green option to the popular and environment hazardous gas powered grass cutter and reduce human effort.

No skilled person also handle it easily by using Android app and control with in less time.

It is highly efficient and accurate this method is having good expected results.

Moreover, the usage of this machine makes the grass cutting process faster by reducing cutting time.

Besides that, it is lighter, environmental friendly and cost effective which is helpful for non-commercial use (home users) in maintaining and trimming the grass in gardens, home, or yards.

It has a minimum noise level and does not have any known negative effort on either the environment or the operator. This grass cutter with several features has been proposed. Several related works has been studied in order to gain idea on how to build the grass cutter.

Which will bring revolution in agricultural field. In the nearest future a deformable grass cutter can be designed so that the vehicle can be used on any type of field. This project helped us to improve our practical knowledge and also to express a new idea on the workshop.

Finally, this project may give an inspiration to the people who can modify and can obtain better results.

However by completing this project, we feel that our aim and objectives of the project is fulfilled.

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