UGC & Govt. Approved

Sonargaon University (SU)

সোনারগাঁও ইউনিভার্সিটি (এসইউ)

Design and Fabrication of a Smart Solar Grass Cutter with Lawn Coverage

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

A Thesis

By

Bashir Ahammad	ID:ME:2101023036
Mohammad Saiful Islam	ID:ME:2101023039
Md. Azaharul Islam	ID:ME:2101023047
Md. Omar Faruq	ID:ME:2101023073
Khan Tanvir Hossain	ID:ME:2101023086

Supervised By

Md. Ahatashamul Haque Khan Shuvo

Assistant Professor

Department of Mechanical Engineering

Sonargaon University (SU)

Dhaka-1215, Bangladesh

September, 2024

APPROVAL

This is to certify that the project work entitle, "**Design and Fabrication of a Smart Solar Grass Cutter with Lawn Coverage**" has been carried out by **Bashir Ahammad (ID:2101023036), Mohammad Saiful Islam (ID:2101023039), Md. Azaharul Islam (ID:2101023047), Md. Omar Faruq (ID:2101023073), Khan Tanvir Hossain (ID:2101023086)** thereby declared that the work presented here is original work done by me and has not been published or submitted elsewhere for the requirement of a degree of Bachelor of Science (B.Sc.) in Mechanical Engineering in the year of 2024 Program in the Department of Mechanical Engineering, Sonargaon University of Bangladesh (SU) has been carried out under by supervisor.

BOARD OF EXAMINERS

_____ (Supervisor)

Md. Ahatashamul Haque Khan Shuvo
Assistant Professor
Department of Mechanical Engineering
Sonargaon University (SU), Dhaka -1215, Bangladesh.

_____ (External Member)

Name
Designation
Department of Mechanical Engineering

ACKNOWLEDGEMENT

First, we started in the name of almighty Allah. This thesis is accomplished under the supervision of **Md. Ahatashamul Haque Khan Shuvo,** Assistant Professor, Department of Mechanical, Sonargaon University. It is a great pleasure to acknowledge our profound gratitude and respect to our supervisor for this consistent guidance, encouragement, helpful suggestion, constructive criticism and endless patience through the progress of this work. The successful completion of this thesis would not have been possible without his persistent motivation and continuous guidance.

The authors are also grateful to **Prof. Md. Mostofa Hossain,** Head of the Department of Mechanical Engineering and all respect teachers of the Mechanical Engineering Department for their co-operation and significant help for completing the thesis work successfully.

[Authors]

ABSTRACT

From time immemorial, the sun has been the major source of energy for life on earth. The solar energy was being used directly for purposes like drying clothes, curing agricultural produce, preserving food articles, etc. Even today, the energy we originate from fuel-wood, petroleum, paraffin, hydroelectricity and even our food originates obliquely from sun. Solar energy is almost unbounded. The total energy we obtain from the sun far exceeds our energy demands. Ever since the industrial revolutions human have been dependent on fuels, electricity and wind energy. For human enlargement in many countries there is study and trials are going on the Solar energy and the wind energy, So we make our new concept solar powered grass cutting machine in these concept we cut grass on the agricultural products or on small plants in lawns and gardens. Remote controlled grass cutter can be described. The objective of this project is to discover the current issues in implementing the design of a solar powered grass cutter system for house gardens, and fields with a specified area. It has achieved by doing research on current issues in designing the mechanism with electronic control circuitry. The simplicity of making this automated grass cutter has made it very versatile and flexible. The main objective of this solar powered grass cutter machine is to cut grass using solar power or by using battery power which is stored by using solar panel. It is also very useful for low cost of fabrication and maintenance.

TABLE OF CONTENTS

Approval		ii
Acknowledgement		iii
Abstract		iv
Table of Contents		v
CHAPTER-1	**INTRODUCTION**	
1.1	General	1
1.2	Objectives	2
CHAPTER 2	**COMPONENTS AND CONSTRUCTION**	
2.1	Block Diagram	3
2.2	Require Instruments	3
2.3	Circuit Diagram	7
CHAPTER-3	**FUNDAMENTALS OF OPERATION**	
3.1	Working Principle	8
3.2	Complete Project Prototype Image	8
3.3	Methodology	9
CHAPTER-4	**LITERATURE REVIEW**	
4.1	Literature Review	10
CHAPTER-5	**RESULTS AND CALCULATION**	
5.1	Power Calculation	12
5.2	Cut of Area	14

CHAPTER-6 **DISCUSSION**

6.1 Discussion 16

6.2 Socio Economic Environment Impact 16

6.3 Advantage 16

6.4 Application 17

6.5 Limitation 17

CHAPTER-7 **CONCLUSION**

7.1 Conclusion 18

7.2 Future Scope 18

REFERENCE 19

APPENDIX 21

CHAPTER 1
INTRODUCTION

1.1 General:

The automation is useful at various stages of human life. The beautiful evenly cut grass increases the beauteousness of any hotel, house, park, meeting hall etc. Hence uniform grass cutting is important to maintain the prestige of any house or hotel. The manual grass cutting is possible using human being but it usually consumes time and energy of human being. Also the manual grass cutting is inefficient and many time results in non-uniform structure of grass. Hence to avoid all these issues it is better to use automated grass cutting robot machine which can be operated through android phone.

The grass is a very common plant that grows naturally on earth which covers up to 40% of earth's land surface [1]. Grasses are highly beneficial to nature and to mankind. It provides food, fuel, medicine, shelter and transportation. It provides protection against soil erosion and improves air quality and filter pollution. While grasses improve both human and animal life it can also be a pest, invasive and bringer of death and destruction. Invasive grass species when dried can cause fire. Some grass species can kill plants by choking and displacing them and competing to the soil nutrients and water resources. The invasive and uncontrollable nature of some species of grasses can greatly impact the environment and the economy [2].

In order to address these issues, it needs scientific and technological solutions. The solution can either be through chemical, organic and/or mechanical means. The grass can be controlled chemically by herbicides; however herbicides cause injury to non-target plants. During the Vietnam War in 1961-1971, the Americans used the infamous herbicides called Agent Orange‘ to clear vegetation in large areas of Vietnam, Laos and Cambodia [3]. It did successful defoliation but it caused huge amount of destruction to agricultural land and forest. Other forms of killing weeds is by organic means, solutions such as vinegar, dish soap, Epsom salts and borax which are low cost and can kill weeds [4]. However, most of the organic weed killers are at a much lower strength compared to the harsh chemical-based solutions and it doesn't travel down the weed and attack the root system. This means the weed can start to grow back within a short period of time. There are many manual means of controlling grasses. In this solar based grass cutter, the advantage of powering a grass cutter by solar rather than by gasoline is mainly ecological. The advancements are mostly designed

to reduce the manual work and save power by utilizing the solar power to generate the electricity. This project is designed to reduce the labour power required in grass cutting at residences, agricultural areas etc.Here the solar energy generated from solar panel is stored in the battery and used to run DC motor in the system.The DC motor is attached with blade to trim the grasses.

1.2 Objectives:

The objectives of this project are:

I. To design and fabricate a Smart solar grass cutter with Lawn coverage.

II. To test the performance of Smart solar grass cutter with Lawn coverage.

CHAPTER 2
COMPONENTS & CONSTRUCTION

2.1 Block Diagram:

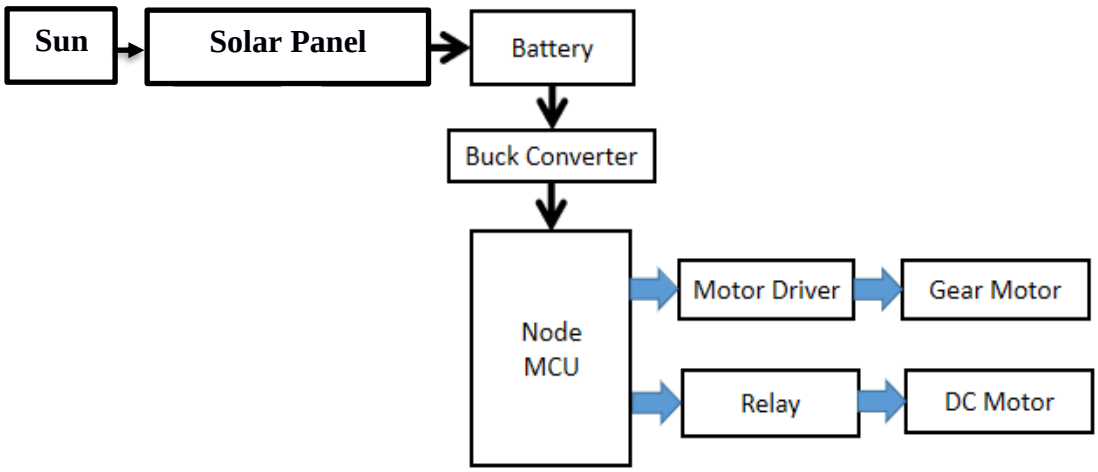


Figure : Block Diagram of Smart Solar Grass Cutter Machine.

The block diagram of the Smart Solar Grass Cutter Machine outlines a system that utilizes solar energy to power and control an automated grass-cutting machine. Here's a detailed description of each component:

2.2 Require Instruments:

Hardware

1. Solar Panel
2. Battery
3. Buck Converter
4. Node MCU
5. Motor Driver
6. Gear Motor
7. Blades
8. Relay

Software

- Arduino Software
- Blynk App

Details of Hardware:

1. Solar Panel: Converts solar energy from sun into electrical energy. This energy is essential for charging the battery, which will store the power needed to run the system.



Figure: Solar Panel

2. Battery: Stores the electrical energy generated by the solar panel. It ensures that the system has a continuous power supply even when direct sunlight is unavailable (e.g., during cloudy weather or at night).



Figure: Battery

Battery Specification

Voltage	3.7 V
Product Type	Lithium-Ion
Battery Capacity	2200mAh
Weight	45 g
Model Number	ICR 18650

3. Buck Converter: This component steps down the voltage from the battery to a lower, suitable level required by the other components in the system, particularly the microcontroller (Node MCU), motor driver, and other electronics. It ensures that the system operates efficiently by providing the correct voltage levels.



Figure: Buck Converter

4. Node MCU (Microcontroller Unit): The brain of the system. It processes inputs and controls the overall operation of the grass cutter. The Node MCU is responsible for:
Controlling the Motor Driver that regulates the speed and direction of the gear motor, which is responsible for moving the grass cutter.Activating the Relay that controls the DC Motor, which powers the grass-cutting blades.

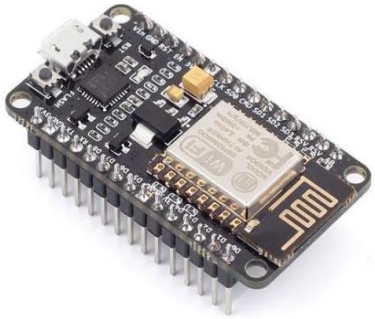


Figure: Node MCU

5. Motor Driver: This component drives the Gear Motor, which moves the grass cutter across the lawn. It receives commands from the Node MCU to control the forward, backward, or turning movement of the machine.

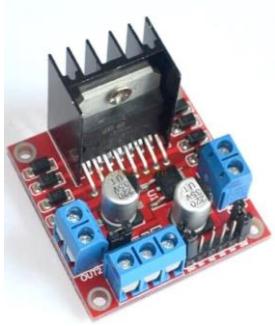


Figure: Motor Driver

6. Gear Motor: A type of motor that provides the mechanical movement of the grass cutter. The gear mechanism ensures that the machine moves with the appropriate torque and speed.



Figure: Gear Motor

7. Blades: Grass cutting blades are designed to provide a high cutting capacity in difficult conditions. The blades are made of high-quality materials that resist wear and tear, and they are sharpened to provide a clean cut.



Figure: Blades

8. Relay: The relay acts as a switch that is controlled by the Node MCU. It turns the DC Motor on and off.



Figure: Relay

Details of Software:

1. **Arduino Software:** The smart micro-controller unit named as Arduino Nano can be programmed with the Arduino software. There is no any requirement for installing other software rather than Arduino.

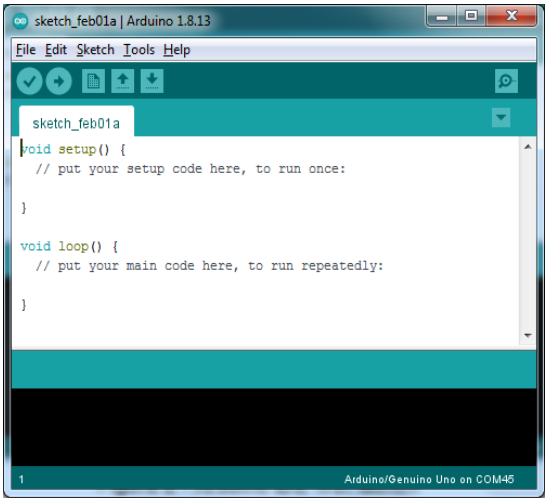


Figure: Arduino Software

2. Blynk App:

The Blynk app is a platform that allows users to create IoT (Internet of Things) solutions by connecting devices like sensors, microcontrollers, and smart devices to a cloud system. With Blynk, users can build mobile applications to control and monitor their hardware remotely through an intuitive drag-and-drop interface. It supports popular boards like Arduino, ESP32, and Raspberry Pi, making it ideal for hobbyists and professionals developing smart home projects, automation, and remote monitoring systems.

2.3 Circuit Diagram:

The schematic diagram here is representing the electrical circuit and the components of the project. Here we have used standardized symbols and lines.

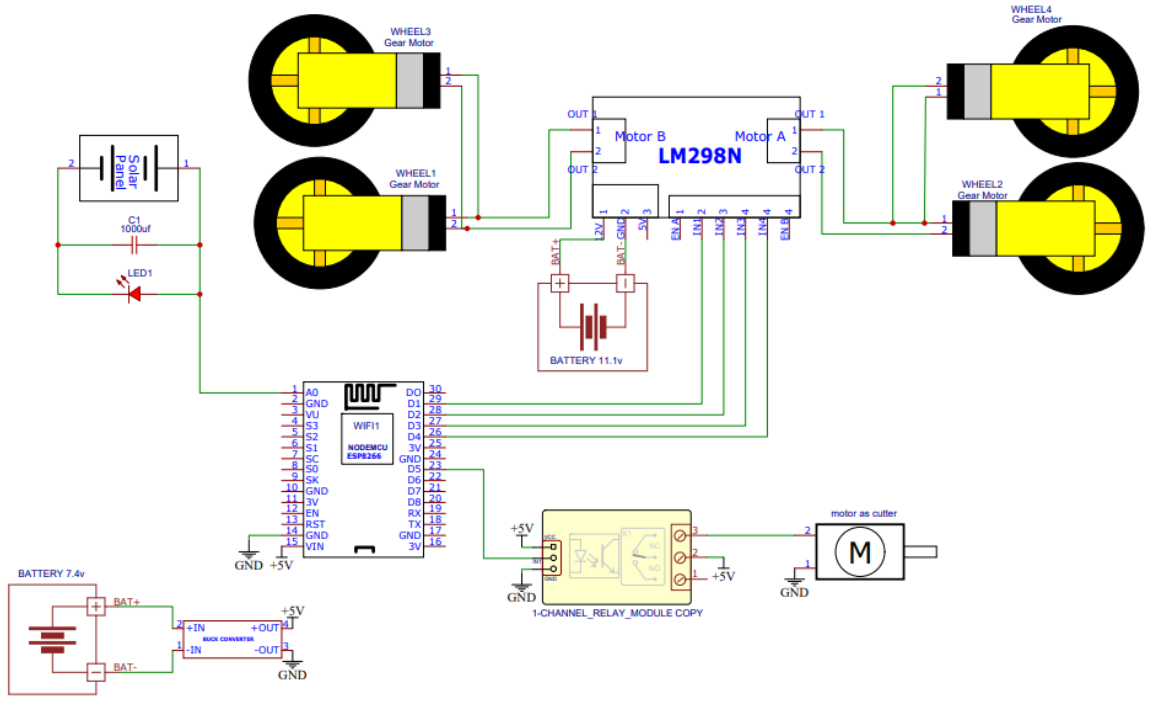


Figure : Schematic Circuit Diagram of the Project

CHAPTER 3
FUNDAMENTALS OF OPERATION

3.1 Working Principle:

- The system is powered by a **solar panel**.
- The energy from the solar panel is stored in a **battery** for continuous operation.
- The **Gear Motors** are used for movement.
- These motors are controlled by an **L293D Motor Driver**, connected to the **Node MCU** microcontroller.
- The motor driver allows the grass cutter to move **forward and backward**.
- A **relay** is placed between the **DC motor** and the **Node MCU** for control.
- This relay allows the control of a **12-volt grass cutter motor**.
- The system is connected to the **Blynk App** via the Node MCU.
- The grass cutter can be controlled using an **Android device** through the app.
- The entire system (motors, battery, electronics) is housed within a **pipe model**, which supports and encloses the smart grass cutter.

3.2 Complete Project Prototype Image:



Figure : Project Prototype Image

3.3 Methodology:

- Creating an idea for Design and construction of **Smart Solar Grass Cutter with Lawn Coverage**. And designing a block diagram & circuit diagram to know which components need to construct it.
- Collecting the all components and programming for the micro controller to controlled the system.
- Setting all components in a PCB board & soldering. Then assembling the all block in a board and finally run the system & checking.

CHAPTER 4

LITERATURE REVIEW

4.1 Literature Review:

G. Rahul describes the application of solar energy to power an electric motor which in turn rotates a blade which does the cutting of grass. Bhosale Swapnil ,Khadake Sagar explained that the smart solar grass is automatic system for the purpose of grass cutting. The source is driven from the solar energy by using solar panel from the panel and store the voltage in battery. The automatic grass cutting machine is designed using photovoltaic source and motor speed control. Ms. Yogita D.Ambekar, Mr. Abhishek U. Ghate describes the aim of project is to make the grass cutter which operates on solar energy hence save the electricity and reduces manpower. In this project we use microcontroller for controlling various operation of grass cutter. P.Amrutesh, B.Sagar, B.Venu proposed smart solar grass cutter system in which there is an use of sliding blades to cut a lawn at an even length .Unskilled operations can operate easily and maintain the lawn very fine and uniform surface look.

A Solar grass cutter is a machine that uses sliding blades to cut a lawn at an even length. Even more sophisticated devices are there in every field. Power consumption becomes essential for future. Solar grass cutter is a very useful device which is very simple in construction. It is used to maintain and upkeep lawns in gardens, schools, colleges etc. Rapid growth of various high-tech tools and equipment’s makes our jobs done comfortable and sophisticated.

The project aims at fabricating a grass cutting machine system which makes the grass cutter based motor running through solar energy. Power plays a great role wherever man lives and works. The cutting mechanism is made of a flat blade rigidly fixed to the frame behind the spiral arrangement which is configured to contact at least one reel bar of the spiral blades during the rotation of the spiral mechanism .The cutting effectiveness was achieved with a total power of 934.3watts at a rotary speed of 1000rpm of shaft. For designing of Automatic Lawn Cutter various literature, papers were referred. The review of previous method used given below: In this lawn mower uses an solar based energy source, which is easier to use, more advantageous comparing to other energy source especially for gas based source of power .But the lawn cutter is not based on solar because of its cost and may create some complexity during working .

In this hydrogen based lawn mower, the advantage of powering a lawn mower by hydrogen rather than by gasoline is mainly ecological. It not used this for our lawn cutter because it is very old method and many overcome produced from this type lawn cutter. The self- powered design objective is to come up with a mower that is portable, durable, easy to operate and maintain. It also aims to design a self- powered mower of electrical source; a cordless electric lawn mower. The heart of the machine is a battery-powered dc electric motor. It is also useful method for our lawn mower. It is similar to the lawn cutter using display and keypad.

CHAPTER 5
RESULT AND CALCULATION

5.1 Power Calculations:

a) Solar Panel output

- Power output of solar panel: 20W (given)

Energy collected per hour:

$$E_{\text{solar}} = P_{\text{solar}} \times t = 20\ \text{W} \times t$$

Where t is the time in hours. For example, in one hour of full sunlight:

$$E_{\text{solar}} = 20\text{Wh}$$

b) Battery Capacity

- Battery rating: 12V, 2200mAh(or 2.2 Ah)

Energy stored in battery:

$$E_{\text{battery}} = V_{\text{battery}} \times \text{ Capacity } = 12\ \text{V} \times 2.2\text{Ah} = 26.4\text{Wh}$$

This means your battery can provide 26.4 watt-hours of energy when fully charged.

c) Grass Cutter Blade Motor Power Consumption

- Blade motor rating: $12\ \text{V}, 3000$ RPM

Assuming a typical small DC motor power consumption for this type of application, we can estimate the motor draws about 5A under load.

Power consumption of blade motor:

$$P_{\text{blade}} = V_{\text{blade}} \times I_{\text{blade}} = 12\ \text{V} \times 5\ \text{A} = 60\ \text{W}$$

d) Movement Motor Power Consumption

- Movement motor rating: 12V, 500 RPM (gear motor)

Assuming the movement motor draws about 2 A :
Power consumption of movement motor:

$$P_{\text{movement}} = V_{\text{movement}} \times I_{\text{movement}} = 12\ \text{V} \times 2\ \text{A} = 24\ \text{W}$$

2. **Operating Time Calculation:**

Now, let's calculate how long the battery can power the grass cutter under typical operating conditions. We'll assume both motors are running simultaneously.

Total power consumption:

$$P_{\text{total}} = P_{\text{blade}} + P_{\text{movement}} = 60\ \text{W} + 24\ \text{W} = 84\ \text{W}$$

Battery operating time: The operating time can be calculated using the energy stored in the battery and the total power consumption.

$$t_{\text{battery}} = \frac{E_{\text{battery}}}{P_{\text{total}}} = \frac{26.4\text{Wh}}{84\ \text{W}} \approx 0.31\ \text{hours} = 18.7\ \text{minutes}$$

So, the grass cutter can operate for approximately 18.7 minutes on a fully charged battery.

3. **Charging Time via Solar Panel:**

If the solar panel is charging the battery, let's calculate how long it would take to fully charge the battery.

Charging time:

$$t_{\text{charge}} = \frac{E_{\text{battery}}}{P_{\text{solar}}} = \frac{26.4\text{Wh}}{20\ \text{W}} = 1.32\ \text{hours}$$

So, it would take about 1.32 hours to fully charge the battery using the 20 W solar panel under ideal sunlight conditions.

4. **Efficiency Considerations:**

In real-world conditions, losses occur due to heat, friction, and inefficiencies in the motor and charging circuits. Let's assume the overall efficiency is about 80%.

Effective operating time: Adjusting for efficiency:

$$t_{\text{effective}} = 0.31\ \text{hours} \times 0.8 = 0.25\ \text{hours} = 15\ \text{minutes}$$

Therefore, in practice, your grass cutter may operate for around 15 minutes.

5.2 Cut of Area:

a) Data analysis

- Speed of the grass cutter is 0.5 meters per second.
- Width of the cutting blade is 0.2 meters (20 cm).
- The cutter can run for 15 minutes (0.25 hours) on a fully charged battery.

b) Grass Cutting Area per Second

The area cut per second can be calculated by multiplying the speed of the grass cutter by the width of the cutting blade:

$$A_{\text{per second}} = S \times W$$

Where:

- $S = 0.5$ m/s (speed of the grass cutter)
- $W = 0.2$ m (width of the cutting blade)

$$A_{\text{per second}} = 0.5 \text{ m/s} \times 0.2 \text{ m} = 0.10 \text{ m}^2/\text{s}$$

c) Total Grass Cutting Area in 15 Minutes

Now, let's calculate the total area the grass cutter can cover in the 15 minutes of operation time.

Since 1 minute $= 60$ seconds, 15 minutes $= 900$ seconds.

$$A_{\text{total}} = A_{\text{per second}} \times \text{time} = 0.10 \text{ m}^2/\text{s} \times 900 \text{ s} = 90 \text{ m}^2$$

d) Model for Cutting Area with Different Times

You can create a table that shows how much area can be covered over different operating times:

Operating Time (minutes)	Total Area Cut ($\mathbf{m}^2$)
5	30
10	60
15	90

e) Model for Cutting Area with Different Speeds

We can also create a model that shows how the cutting area changes with different speeds. For example:

Speed (m/s)	Total Area in 15 min(m^2)
0.3	54
0.5	90
0.7	126

f) Efficiency and Performance

In practice, factors like uneven terrain, grass density, and motor power fluctuations will affect performance. If you assume 80% efficiency (real-world conditions), the effective area covered would be reduced accordingly:

$$A_{\text{effective}} = 90\ m^2 \times 0.8 = 72\ m^2$$

So, under typical conditions, the grass cutter might cover around 72 square meters in 15 minutes.

CHAPTER 6
DISCUSSION

6.1 Discussion:

From the received data during the tests, it has been seen that the total machine consumes a little amount of power which is so effective and cost saving. The discharge rate is so adequate and small in value on the other hand charging capacity is remarkable and is too fast along the requirement. There is no noise during grass cutting and rotating the machine. A little problem arises there and that is the low rpm of torque motor though it has a benefit also and for the low rpm the machine moves slowly but cut the grass smoothly.

6.2 Socio-Economic and Environmental Impact:

Socio-Economic Impacts:

1. **Job Creation:** Development and maintenance of solar grass cutters can create jobs in manufacturing, tech support, and maintenance.
2. **Cost Savings:** Reduces long-term costs for homeowners and businesses by eliminating fuel and reducing labor costs.
3. **Energy Independence:** Reduces reliance on fossil fuels, promoting energy independence for users.

Environmental Impacts:

1. **Reduction of Carbon Emissions:** Solar-powered operation decreases greenhouse gas emissions compared to gasoline-powered mowers.
2. **Noise Pollution Reduction:** Generally quieter operation leads to less noise pollution in residential areas.
3. **Promotes Renewable Energy Use:** Encourages adoption of solar energy technology, contributing to broader renewable energy goals.

6.3 Advantage:

The project has a major application in the

- Smart Connectivity (IoT Feature).
- Provides Flexibility (Day night use & charging while operating).
- Economical (No fuel cost, Easy maintenance).
- User-friendly (Can be control from android mobile)
- Reduce Power consumption using solar power

6.4 Application:

The project has a major application in the

- Industrial Uses
- Household Uses
- Parks and Public Spaces
- Educational Institutions
- Sports Fields (e.g., Football, Baseball, Cricket)
- Agricultural Lands and Farms
- Hotels and Resorts

6.5 Limitations:

It is a demo project so we found some limitation. In future we will work for reduce this kind of limitation. These limitations are –

- Solar panel cannot charge the battery in cloudy weather.
- Initial cost is high.
- Cannot detect obstacles.

CHAPTER 7
CONCLUSION

7.1 Conclusion:

Our project, **Design and fabrication of a smart solar grass cutter with lawn coverage** has been successfully completed with satisfying results. This grass cutter is easy for others to modify and improve. It offers many advantages, such as no fuel cost, no pollution, and low wear and tear due to fewer moving parts. It runs on solar energy, which is making it easy to charge the battery. Although the initial cost is high, the long-term benefits are significant, as it helps reduce global warming and pollution. The cutter can even charge its batteries while in use and can be operated at night, making it a practical tool for grass cutting.

7.2 Future Scope:

The model can be improved by making some changes in the hardware and components. Some suggestions are given below-

- Advanced AI Integration.
- Energy Efficiency Improvements.
- Environmental Monitoring Sensors.
- Enhanced User Interfaces.

REFERENCE

1. G.Rahul, “Grass cutting machine by solar energy power”, ISSN no:2348-4845,international journal and magazine of engineering, technology management and research.

2. Bhosale Swapnil, Khadke Sagar, “Solar powered automatic grass cutter”, ISSN:2395-0056,volume no:04 issue:05,may 2017,International research journal of engineering and technology.

3. Ms.Yogita D. Ambekar, Mr. Abhishek U. Ghate, “Solar based grass cutter”, ISBN:978-93-86171-31-3, 26 Feb 2017, International conference on recent trends in engineering, science, Humanities and management.

4. P.Amrutesh,B.Sagar,B.Venu, “Solar grass cutter with linear blades by using scotch yoke mechanism ”, ISSN:2248-9622,volume no:4 issue: 9, September 2014, International research journal of engineering and application.

5. Firas B. Ismail, Nizar F.O. Al-Muhsen, Fazreen A. Fuzi, A. Zukipli, “Design and Development of Smart Solar Grass Cutter”, International Journal of Engineering and Advanced Technology, pp 4137-4141, ISSN: 2249 – 8958, Volume-9, Issue-2, December 2019

6. Bincy Abhraham, Darsana P S, Isabella Sebastian, Sisy N Joseph, Prof. George John P, “Solar Powered Fully Automated Grass Cutting Machine”, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, pp 2520-2524, Vol. 6, Issue 4, April 2017

7. Mallikarjun Mudda, VishwaTeja, Srujan Kumar, Praveen Kumar, “Automatic Solar Grass Cutter”, International Journal for Research in Applied Science & Engineering Technology, pp 1148-1151, Volume 6, Issue 4, April 2018

8. Rishabh Gupta, Shubham Singh, Prateek Diwedi, Ravi Singh, Shubham Singh, Prof. Om Prakash Umrao, “Solar powered Automatic Grass Cutter”, International Research Journal of Engineering and Technology, pp 2554-2556, Volume: 05, Issue:04, Apr-2018

9. Sagar V. Palve, Kunal Panchal, Rahul Chipkar, Ajay Patil, Ganesh L. Sonawane, “Solar Powered Automated Grass Cutter Machine”, International Research Journal of Engineering and Technology, pp 2318-2321, Volume: 05, Issue: 04, Apr-2018

10. Anuradha Kadam, Vrushali Khadake, Snehal Nalawade, Karishma Mujawar, Nilofar Mulla, “Automated Solar Operated Grass Cutting Machine”, International Journal of Advance Research in Science and Engineering, pp 11-18, Volume: 07, Special Issue: 03, Feb-2018

11. Ms. Bhagyashri R. Patil, Mr. Sagar S. Patil, “Solar Based Grass Cutter: A Review”, International Journal of Electrical and Electronics Engineers, pp 134-138,Volume: 09, Issue: 01, Jun-2017

12. M. Manimegalai, V. Mekala, N. Prabhuram, D. Suganthan, “Automatic Solar Powered Grass Cutter Incorporated with Alphabet Printing and Pesticide Sprayer”, In 2018 International Conference on Intelligent Computing and Communication for Smart World (I2C2SW), pp. 268-271. IEEE, 2018

13. Ashish kumar chaudhari, Yuvraj sahu, Prabhat kumar Dwivedi, Harsh Jain, “Experimental study of Solar Power Grass Cutter Robot”, pp 68-73, Vol-2, Issue-2 2016

14. Shankarappa Jogur, Venkatesh T, Tenzin Tenpa , Prof. Pradeep Vinhuti, “Solar Based Grass Cutter Using Zigbee”, International Journal of Advanced Research in Science, Engineering and Technology, pp 3997-4001, Vol. 4, Issue 5 , May 2017

15. Aditya S. Rajmani, Appaji N. Gaonkar, Ajay Darak, Akshay Joshi, Prof. Vinay M. Murgod, “Design and Fabrication of Hybrid Operating Grass Cutter”, pp 795-799, Vol. 8 Issue 05, May-2019

16. Neha, Syeda Asra, “Automated Grass Cutter Robot Based on IoT”, International Journal of Trend in Scientific Research and Development, pp 334-337, Volume 2, Issue 5, Aug 2018

Appendix

Programming Code:

```
#define BLYNK_TEMPLATE_ID "TMPL6kZ2fL0Ma"
#define BLYNK_TEMPLATE_NAME "solar grass cutter"
#define BLYNK_AUTH_TOKEN "VQdPhKfg4i4q8XCKQfs_tptPXEhmiG7C"

int in1 = D1;
int in2 = D2;
int in3 = D3;
int in4 = D4;
int blade = D5;
int solar;
float input_voltage = 0.0;

/* Comment this out to disable prints and save space */
#define BLYNK_PRINT Serial

#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>

// Your WiFi credentials.
// Set password to "" for open networks.
char ssid[] = "abcde";
char pass[] = "12345678";

int motorState = 0; // Variable to store the motor state

BLYNK_WRITE(V1)
{
  motorState = param.asInt(); // Get the value from the virtual pin V1

  if (motorState == 1) { // If motorState is 1, rotate clockwise
    analogWrite(in1, 255);
    analogWrite(in2, 0);
    analogWrite(in3, 255);
    analogWrite(in4, 0);
  } else { // Otherwise, stop the motors
    analogWrite(in1, 0);
    analogWrite(in2, 0);
    analogWrite(in3, 0);
    analogWrite(in4, 0);
  }
}
BLYNK_WRITE(V2)
{
  motorState = param.asInt(); // Get the value from the virtual pin V2
```

```
  if (motorState == 1) { // If motorState is 1, rotate counterclockwise
    analogWrite(in1, 0);
    analogWrite(in2, 255);
    analogWrite(in3, 0);
    analogWrite(in4, 255);
  } else { // Otherwise, stop the motors
    analogWrite(in1, 0);
    analogWrite(in2, 0);
    analogWrite(in3, 0);
    analogWrite(in4, 0);
  }
}

BLYNK_WRITE(V3)
{
  motorState = param.asInt(); // Get the value from the virtual pin V3

  if (motorState == 1) { // If motorState is 1, rotate reverse
    analogWrite(in1, 120);
    analogWrite(in2, 0);
    analogWrite(in3, 0);
    analogWrite(in4, 120);
  } else { // Otherwise, stop the motors
    analogWrite(in1, 0);
    analogWrite(in2, 0);
    analogWrite(in3, 0);
    analogWrite(in4, 0);
  }
}

BLYNK_WRITE(V4)
{
  motorState = param.asInt(); // Get the value from the virtual pin V4

  if (motorState == 1) { // If motorState is 1, rotate forward
    analogWrite(in1, 0);
    analogWrite(in2, 120);
    analogWrite(in3, 120);
    analogWrite(in4, 0);
  } else { // Otherwise, stop the motors
    analogWrite(in1, 0);
    analogWrite(in2, 0);
    analogWrite(in3, 0);
    analogWrite(in4, 0);
  }
}
BLYNK_WRITE(V5)
{
  int pinValue5 = param.asInt(); // assigning incoming value from pin V1 to a variable
  digitalWrite(blade,pinValue5);
```

```
  // process received value
}

// Modify other BLYNK_WRITE functions accordingly
WidgetLCD lcd(V0);
void setup()
{
  // Debug console
  Serial.begin(9600);
  pinMode(A0, INPUT);
  pinMode(in1, OUTPUT);
  pinMode(in2, OUTPUT);
  pinMode(in3, OUTPUT);
  pinMode(in4, OUTPUT);
  pinMode(blade, OUTPUT);

  Blynk.begin(BLYNK_AUTH_TOKEN, ssid, pass);
}

void loop()
{
  Blynk.run();

  int analog_value = analogRead(A0);
  input_voltage = ((analog_value * 6.0) / 1024.0) * 2;
  Serial.print("solar:");
  Serial.print(input_voltage);
  delay(50);
  lcd.print(2, 0, "Solar:");
  lcd.print(9, 0, input_voltage);
  delay(500);
}
```