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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

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ABSTRACT

From time immemorial, the sun has been the major source of energy for life on Earth. 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 the sun. Solar energy is almost unbounded. The total energy we obtain from the sun far exceeds our energy demands. Ever since the industrial revolutions humans have been dependent on fuels, electricity, and wind energy. For human enlargement in many countries, studies, and trials are going on Solar energy and wind energy, So we made our new concept solar powered grass cutting machine in this concept we cut grass on agricultural products or small plants in lawns and gardens. A 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. This has been achieved by doing research on current issues in designing mechanisms 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 panels. It is also very useful for low cost of fabrication and maintenance.

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CHAPTER 1
INTRODUCTION

1.1 General:

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

Grass is a very common plant that grows naturally on earth and covers up to 40% of the earth's land surface [1]. Grasses are highly beneficial to nature and to mankind. It provides food, fuel, medicine, shelter and transportation. It protects against soil erosion improves air quality and filters pollution. While grasses improve both human and animal life they 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 with 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].

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 herbicide called Agent Orange to clear vegetation in large areas of Vietnam, Laos, and Cambodia [3]. It did successful defoliation but it caused a huge amount of destruction to agricultural land and forest. Other forms of killing weeds are 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. There are many manual means of controlling grasses. In this solar-based grass cutter, the

The advantage of powering a grass cutter by solar rather than by gasoline is mainly ecological. The advancements are mostly designed to reduce manual work and save power by utilizing solar power to generate electricity. This project is designed to reduce the labor power required in grass cutting at residences, agricultural areas, etc. Here the solar energy generated from solar panels is stored in the battery and used to run the the DC motor in the system. The DC motor is attached to the 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 a Smart solar grass cutter with Lawn coverage.

CHAPTER 2

LITERATURE REVIEW

2.1 LITERATURE REVIEW:

G. Rahul describes the application of solar energy to power an electric motor which in turn rotates a blade that does the cutting of grass [R-1]. Bhosale Swapnil and Khadake Sagar explained that smart solar grass is an automatic system for grass cutting [R-2]. The source is driven by solar energy by using a solar panel from the panel and storing the voltage in the battery. The automatic grass-cutting machine is designed using a photovoltaic source and motor speed control. Ms. Yogita D.Ambekar and Mr. Abhishek U. Ghate describe the project as aims to make a grass cutter that operates on solar energy hence saving electricity and reducing manpower [R-3]. In this project, we use a microcontroller to control various operations of the grass cutter. P.Amrutesh, B. Sahar, and B.Venu proposed a smart solar grass cutter system in which there is a use of sliding blades to cut a lawn at an even length [R-4]. Unskilled operations can operate easily and maintain the lawn's 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 the future. Solar grass cutter is a very useful device that is very simple in construction. It is used to maintain and upkeep lawns in gardens, schools, colleges, etc. The rapid growth of various high-tech tools and equipment makes our jobs comfortable and sophisticated.

The project aims to fabricate a grass-cutting machine system that makes the grass-cutter-based motor run 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 934.3 watts at a rotary speed of 1000rpm of the shaft. For designing Automatic Lawn Cutter various literature, and papers were referred to. The review of the previous method used is given below: This lawn mower uses a solar-based energy source, which is easier to use, and more

advantageous compared to another energy source.

However, the lawn cutter is not based on solar because of its cost and may create some complexity during work.

In this hydrogen-based lawn mower, the advantage of powering a lawn mower with hydrogen rather than gasoline is mainly ecological. It not use this for our lawn cutter because it is a very old method and many overcome are produced from this type of 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 a useful method for our lawn mower. It is similar to the lawn cutter using a display and keypad.

CHAPTER 3
COMPONENTS & CONSTRUCTION

3.1 Block Diagram:

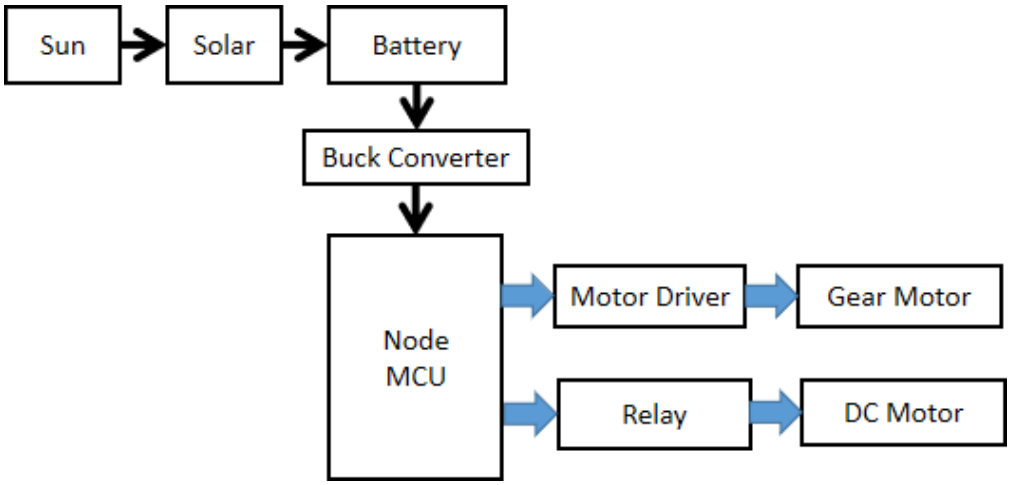


Figure 3.1.1: Block Diagram of Smart Solar Grass Cutter Machine.

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:

3.2Require Instruments:

Hardware

3.2.1 Solar Panel

3.2.2 Battery

3.2.3 Buck Converter

3.2.4 Node MCU

3.2.5 Motor Driver

3.2.6 Gear Motor

3.2.7 Blades

3.2.8 Relay

Software

- Arduino Software
- Blynk App

Details of Hardware:

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



Figure 3.2.1 : 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 3.2.2 : 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 3.2.3 : 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.

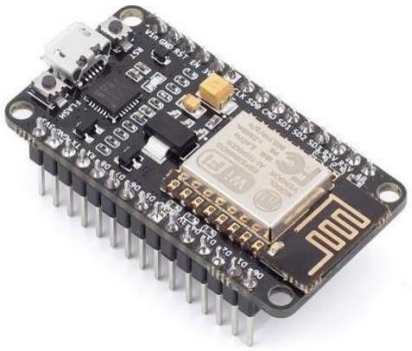


Figure 3.2.4 **:** Node MCU (Microcontroller Unit)

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.

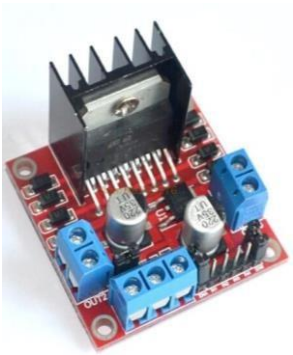


Figure 3.2.5 : Motor Driver

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 3.2.6 : 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 3.2.7 : Blade

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

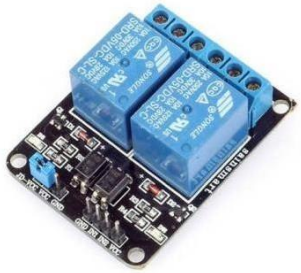


Figure 3.2.8 : Relay

Details of Software:

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

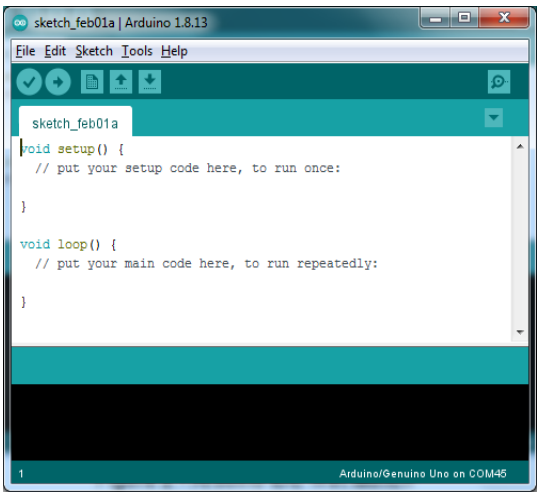


Figure 3.2.9 : Ardino software

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.

3.3 Circuit Diagram:

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

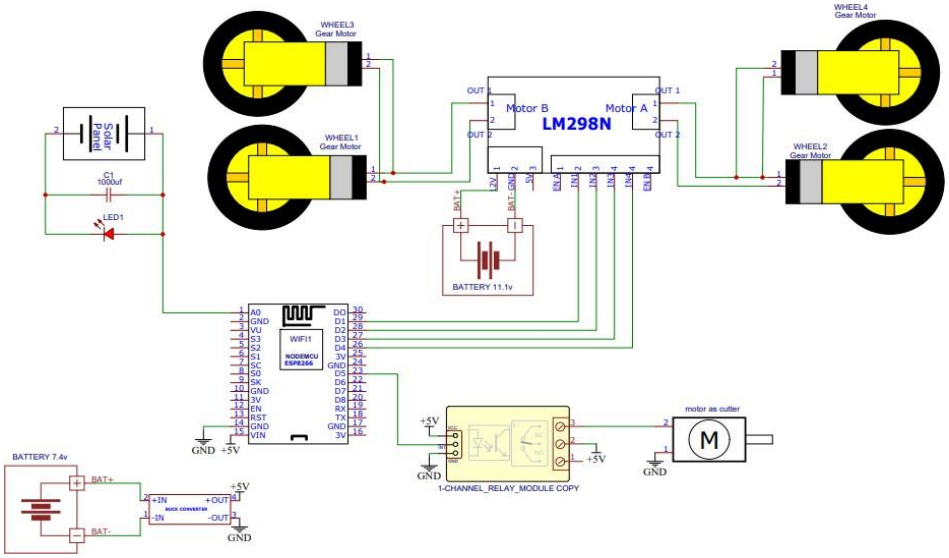


Figure 3.3.1: Schematic Circuit Diagram of the Project

CHAPTER 4
METHODOLOGY

4.1 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.

4.2 Complete Project Prototype Image:

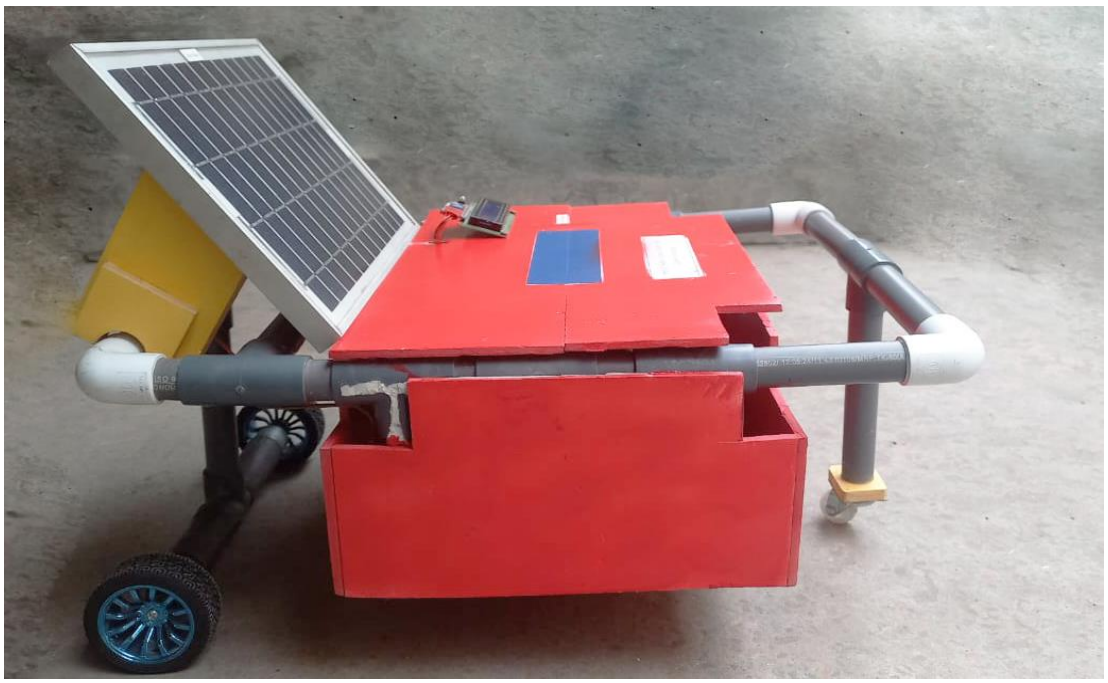


Figure 4.2.1: Project Prototype Image

4.3 Methodology:

Creating an idea for the Design and construction of a **Smart Solar Grass Cutter with Lawn Coverage**. And designing a block diagram & circuit diagram to know which components need to be constructed.

- Collecting the all components and programming for the microcontroller to control the system.

- Setting all components in a PCB board & soldering. Then assemble the all blocks in a board and finally run the system & check.

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

- The speed of the grass cutter is 6.5 meters per minute.
- The 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 = 6.5 m/min (speed of the grass cutter)
- W = 0.2 m (width of the cutting blade)

$$A_{\text{per minute}} = 6.5 \text{ m/min} \times 0.2 \text{ m} = 1.3 \text{ m}^2/\text{min}$$

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.

$$A_{\text{total}} = A_{\text{per minute}} \times \text{time} = 1.3 \text{ m}^2/\text{min} \times 15 \text{ min} = 19.5\text{m}^2$$

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	6.5
10	13
15	19.5

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/min)	Total Area in 15 min(m^2)
4.5	13.5
6.5	19.5
7.5	22.5

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:

$$A_{\text{effective}} = 19.5 \text{ m}^2 \times 0.8 = 15.6 \text{ m}^2$$

So, under typical conditions, the grass cutter might cover around 15.6 square meters in 15 minutes.

5.3 Cost Analysis:

Table 01: Instrument list with Cost

Sl.no	Particulars	Specification	Qty.	Unit Price (Taka)	Total Price (Taka)
1	Node MCU	ESP8266	1	950	950
2	DC Motor	12V	1	1300	1300
3	Relay		1	350	350
4	Solar Panel	20 W	1	850	850
5	Motor Driver IC	L293D	1	450	450
6	Gear Motor	500 R.P.M	2	1600	3200
7	Battery	3.7V	5	200	1000
8	Blades		2	150	300
10	Others			5000	5000
				Total	13400/=

CHAPTER 6

DISCUSSION

6.1 DISCUSSION

From the received data during the tests, it has been seen that the total machine consumes a small 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 rotation of the machine. A little problem arises there and that is the low rpm of the torque motor though it has a benefit also and for the low rpm, the machine moves slowly but cuts the grass smoothly.

6.2 SOCIO-ECONOMIC ENVIRONMENT IMPACT:

Socio-Economic Impacts:

1. **Job Creation:** The 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 controlled 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 limitations. In the future, we will work to reduce these kinds of limitations. These limitations are –

- It is a demo project so its accuracy is 85%.
- In cloudy weather, power will not be produced from solar.
- Project work may be delayed for the blue tooth connection.

CHAPTER 7
CONCLUSION

7.1 Conclusion:

Our project, **Design and fabrication of a smart solar grass cutter with lawn coverage** has been 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 makes 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, the 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, the 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 Abraham, 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 motor state = 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.ascent(); // 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);
}
```