

# Hybrid Grass Cutter and Floor Cleaner Machine

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**Abstract:** Grass cutting is an important task in keeping the length of grass and other unwanted plants in proper length and keeping the area Clean, which requires a significant amount of time and effort. Manual grass cutting using a traditional grass cutter can be time-consuming and can result in environmental pollution. To overcome these challenges, a Hybrid solar grass cutter integrated with floor cleaner using various electronic and electrical components has been designed and implemented. This system provides an efficient and environmental friendly solution for grass-cutting and floor cleaning while reducing the workload of gardeners and landscapers. The solar panel provides the necessary power to operate the system, making it energy-efficient and environmental friendly. The system is also equipped with a rechargeable battery and Solar Charge controller that stores solar energy and can be used when there is no sunlight. The system is designed with height-adjustable features and speed controller features, which means that it can operate very conveniently

**Keywords:** Hybrid, solar, battery, grass cutter, floor cleaner, solar charge controller, DC motor, PWM speed controller

## I. INTRODUCTION

Grass cutter machines have become crucial in maintaining ground, lawns, yards, etc. and floor cleaner is also getting popular day by day. Consumers are searching for ways to reduce their carbon footprints. Moreover, environmental pollution keeps increasing and it can be experienced in our daily lives. Based on a study, it is reported that most of the citizens are utilizing non-renewable fuel in lawnmowers or grass cutters for their daily grass-cutting purposes. Thus, high maintenance is needed to maintain a lawn mower as it uses many mechanical parts. For instance, one should change the fuel or oil regularly so that the lawn mower works efficiently during the process of grass cutting. Furthermore, this will include extra costs since the fuel price has been increasing day by day. Much hard work is required for cleaning floor in traditional way. To overcome these issues, this work has been suggested an eco-friendly grass cutter and floor cleaner designed and fabricated to support green technology initiatives. In this study, a newly designed grass cutter and floor cleaner was fabricated and powered by a rechargeable battery. Besides that, the grass-cutting machine was fabricated at a low cost taking into consideration important aspects such as being lightweight, durability, 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 even length and floor cleaner is used for cleaning the floor. The working principle of the grass cutter and floor cleaner is to provide a high-speed rotation to the blades and cleaning disc, 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 (PWM) device, or a Solar charge controller for controlling charging and maintaining proper battery voltage. For safety operation, the motor will be controlled by a PWM speed controller device since the motor has a high rotational speed of 12000 RPM. As for the cutting head, nylon strings will be used as the trimmer instead of traditional cutting blades due to cost-effectiveness and flexibility. There are many variations of lawnmowers that exist in the global markets, which may not satisfy the performance and operational cost criteria.

OBJECTIVE

The objective of this project is to create an advanced hybrid grass cutter and floor cleaner machine that seamlessly combines the functions of grass cutting and floor cleaning for both outdoor and indoor maintenance tasks. By integrating these functions into a single unit, our goal is to optimize cost efficiency, space utilization, and user convenience, while ensuring compliance with safety regulations and environmental sustainability. To achieve this, we plan to incorporate eco-friendly technologies such as electric power sources and solar panels for charging, reducing our reliance on traditional power sources and minimizing our environmental impact. Additionally, we'll prioritize battery safety and electrical safety by using high-quality batteries with built-in protection features and adhering to safety guidelines for battery handling and installation. We'll also explore the use of lightweight materials to enhance maneuverability and reduce energy consumption. Furthermore, opting for DC motors instead of AC motors will offer advantages such as higher efficiency and compatibility with battery-powered systems, contributing to the overall performance of the hybrid machine.

## II. METHODOLOGY

The hybrid grass cutter comprises a rectangular frame with a handle, a DC gear motor, sheet metal components, tires, a solar panel, and a battery. During operation, solar energy collected by the panel is stored in the battery for future use. The cutter utilizes an eliminator to convert AC current, facilitating the cutting process. Operating the machine is simple: the operator pushes it in the desired direction, then activates the motor. Once the motor is switched on, the cutting blades, attached to the motor shaft, engage with the grass, effectively trimming it as the machine moves forward

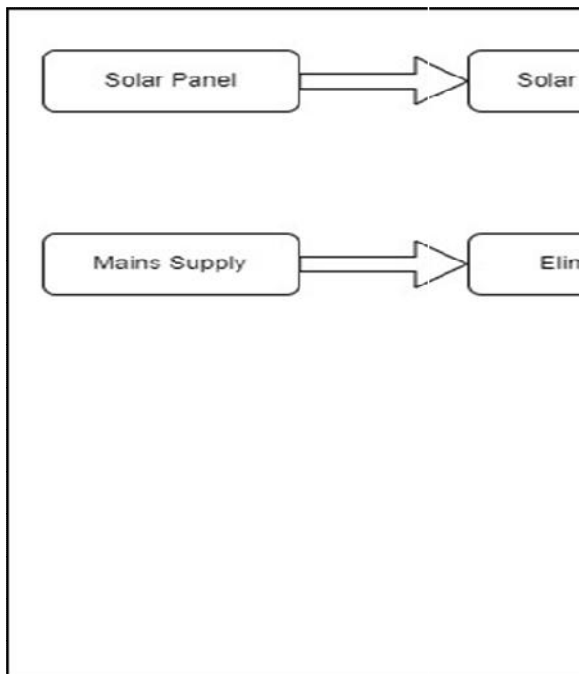


Fig-1: Flowchart of methodology

## III. LITERATURE SURVEY

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 [4]. 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. Nowadays, solar energy has been known as a renewable energy source. It is an alternative energy to fossil fuel and it can be collected from renewable resources such as sun, wind, and hydro. This paper introduces a new development of grass

cutters [1]. This project is also integrated with floor cleaners [5]. Named Hybrid Solar Grass Cutter and floor cleaner, by uses solar irradiance as a primary energy source and battery as a secondary source with the presence of a solar panel. This hybrid grass cutter and floor cleaner prototype is developed to reduce air pollutants and improve the current design specifically the blade position based on the previous studies. Hybrid means it can be operated with solar panels and also on a battery [2]. These days we are facing problems like pollution, power cut problems, etc. To overcome these problems, we have thought about a device, which can perform its functions without causing any of these problems. This project aims to develop a portable solaroperated grass-cutting device, as there is a power shortage. So, we have decided to make a solar energy-operated device. This paper summarizes and reviews technological development for making efficient and cost-effective grass cutters by designing and modifying the traditional grass cutter into a hybrid [4]. We aim to study the various developments in the grass cutter machines and their performance. We are trying to make a new innovative concept mainly used in the agricultural field. We are going to fabricate the grass cutting machine for the use of agricultural fields, to cut the crops in the field as well as to cut the grass [3]. In this paper, they have prepared a manually operated grass cutter with different blades to increase the efficiency of cutting. For adjusting the height reel cutter is a component placed on the grass cutter. This grass cutter is used to cut the grass uniformly and also it can cut the different types.

#### IV. PROBLEM STATEMENT

In the past, grass cutting was primarily done manually using hand devices such as scissors and knives. This method demanded significant human effort and consumed more time to complete the task. Additionally, the results often lacked uniformity in grass length. The introduction of engine-powered machines exacerbated environmental concerns, as they emitted air and noise pollution. Moreover, these machines necessitated regular maintenance, including cleaning or replacing air filters, engine oil, and spark plugs. The associated costs of such grass-cutting machinery were also considerably high.

Current grass cutting and floor cleaning equipment often require separate machines, which is costly and space-consuming. There's a need for a single machine that can handle both tasks efficiently, while being safe, eco-friendly, and easy to use. Our challenge is to create a hybrid machine that combines these functions seamlessly, saving time and resources for users.

#### V. DESIGN AND FABRICATION



Fig-2: side view of frame



Fig-3: back view with components

**VI. WORKING PRINCIPLE**

Hybrid solar grass-cutter projects typically involve integrating solar power with a battery-powered or direct supply-powered grass-cutting machine to improve efficiency and reduce environmental impact. The working of the hybrid solar Grass cutter is as follows.

Firstly, Solar panels capture sunlight, converting it into electrical energy through the photovoltaic process. The electrical energy is directed to power essential components, including a DC-to-DC converter, a motor, and a controller. The output from solar panels is given to the PWM Solar Charge Controller. The charge controller regulates the ampere and voltage that is delivered to the loads and any excess power is delivered to the battery system so the batteries maintain their state of charge without getting overcharged or overcharged.

The battery, motor, and solar panel are connected to the Solar charge Controller through switches for switching purposes. Switches are used to switch ON or OFF the connection when needed.

When the Switches are turned ON. When the DC Motor switch is ON themotor in turn drives the linear blades for precise and efficient grass cutting. The DC motor is the motor that converts the direct current into mechanical work i.e. Rotation work. While the Speed motor can be controlled using a PWM speed controller. The Speed controller works by increasing or decreasing the current according to the speed needed while keeping the voltage across the motor constant. In case of no Sunlight Battery can also be charged with an External Battery charger or SMPS charger, which uses the main supply as input and Gives proper DC output for systemic charging of the battery. The SMPS converts AC or DC input to fixed DC output.

Excess energy is stored in the battery, ensuring continuous operation during periods of low sunlight, making the grass-cutting machine reliable and versatile. The battery works i.e. charges and Discharges due to chemical reaction inside the battery.

In this way, the complete system works Systematically to make the grass cutter work properly.

**VII. COMPONENTS USED**

Item Number	Part Name	Specification	Quantity	Material
01.	Square Rods	2.7*2.7*013 cm	10 ft	Mild Steel
02.	Blades	32 cm	1	Steel
03.	Cleaner Mop Attachment	28 cm	3.6 ft	Plastic, Fibres & Cloth
04.	Bearings	OD 4cm ID 1.5 cm	4	Chrome Steel
05.	Nut	M 10	6	Mild Steel
06.	Bolt	M 10	6	Mild Steel
07.	Electric Cable		10 meters	Copper
08.	Wheel	Diameter 22 cm	4	Rubbers
09.	Switch	-	2	Plastic
10.	Solar Charger	12 V	1	Plastic
11.	Solar Panel	12V, 5W	1	Scilicon
12.	Battery	12V, 7.5 Ah	1	Lithium Ion
13.	Motor	12V, 800rpm	1	Magnetic Steel

**VIII. RESULT**

The hybrid-powered grass cutter has been fabricated and tested through multiple trials, with results summarized in the tables below:

Table 1: Test for mower blades

Sample Plot	Height of Grass Before Mowing (mm)	Height of Grass After Mowing (mm)	Expected Height of Grass After Mowing (mm)
Trail 1	111	92	85

Sample Plot	Height of Grass Before Mowing (mm)	Height of Grass After Mowing (mm)	Expected Height of Grass After Mowing (mm)
Trail 2	97	89	85
Trail 3	92	90	85
Trail 4	81	81	85

Table 2: Test for trimmer blades

Sample Plot	Height of Grass Before Mowing (mm)	Height of Grass After Mowing (mm)	Expected Height of Grass After Mowing (mm)
Trail 1	92	34	30
Trail 2	89	32	30
Trail 3	90	33	30
Trail 4	81	32	30

Key observations and recommendations from the tests are as follows:

- The cutting area (battery duration) is influenced by lawn conditions, grass density, moisture content, grass length, and cutting height.
- Frequent switching on and off during cutting will reduce battery duration.
- To enhance cutting efficiency, it is advisable to mow more frequently and maintain a normal walking pace.
- The minimum cutting length for mower blades is 3 inches, and for trimmer blades, it is 1 inch. Battery runtime ranges from 2 to 4 hours on a fully charged battery, depending on grass conditions and density

## IX. CONCLUSION

In today's world, there is a pressing need for machines that mitigate greenhouse gas emissions, a major contributor to climate change. Addressing this challenge, a hybrid operational grass cutter has been developed to offer environmentally-friendly production and cost-effective operation, eliminating the need for fueling. Specifically designed for residences and establishments with lawns unsuitable for tractor-driven mowers, this hybrid cutter boasts sufficient capacity for its intended purpose. By combining both mower and trimmer functionalities into a single setup, it significantly reduces operational costs and effort compared to using separate equipment. Moreover, it operates on both DC and AC current, presenting versatility in power sources. With proven efficacy, this machine emerges as a promising alternative to gasoline-powered lawn mowers.

In conclusion, this hybrid grass cutter represents a harmonious blend of cutting-edge technology and user-centric design. Its integration of solar power, traditional energy sources, and intuitive operation makes it a practical choice for graduates seeking efficient lawn maintenance solutions. By streamlining the grass-cutting process while minimizing environmental impact, this innovative tool exemplifies the potential of sustainable engineering in everyday applications.

## X. FUTURE SCOPE

Human ingenuity continually drives the development of increasingly refined techniques, balancing aesthetics and economic viability. While our project was completed successfully with available resources, the outcomes and enhancements have fallen short of expectations. To achieve superior results, the following modifications can be implemented: Enhancing efficiency through the augmentation of battery capacity.

Employing lightweight materials for the frame and handle to reduce overall assembly weight.

Utilizing high-strength cutter blades and increased power output to extend the machine's utility across various agricultural applications, such as shrub, maize, and cane cutting.

Transitioning from manual operation to remote control automation to alleviate the manual pushing effort.

Further enhancing efficiency by augmenting battery capacity and refining blade design.

**ADVANTAGES**

- The device operates in an entirely eco-friendly manner, ensuring no adverse effects on the environment from the grass cutter.
- Combining both mower and cleaner functionalities into one device streamlines operations and reduces the need for separate equipment.
- The device can simultaneously perform both cleaning and mowing actions, enhancing efficiency.
- With mower and cleaner integrated into a single setup, costs are minimized, resulting in cost-effectiveness.
- It offers versatility in power sources, capable of operating on both solar energy and electric power.

**REFERENCES**

- [1] Aman Agrawal, Alok Kumar, Amit Kumar, Pushpendra Tyagi, Aman Singh Kalhans, "Automated Solar Grass Cutter" 32 X GJRA - GLOBAL JOURNAL FOR RESEARCH ANALYSIS, VOLUME-7, ISSUE-2, FEBRUARY-2018.
- [2] Miss. Shradha Sharad Meghpuje, Mr. Hrithik Kisan Lokhande, Mr. Nilesh Dadaso Patil, Mr. Shahrukh Salim Makandar, Mr. A.C. Daiv, "Smart Hybrid Fully Automatic Solar Grass Cutter," International Journal for Multidisciplinary Research (IJFMR), Volume 5, Issue 3, May-June 2023
- [3] Mr. D. Balaji, T. Naveen Kumar Reddy, K. Bhanu Prakash Reddy, P. Manjunath Reddy, P. Chandu Kumar, V. Anil," Development of Solar Grass Cutter for Agriculture Applications" Journal of Emerging Technologies and Innovative Research (JETIR), 2024 JETIR April 2024, Volume 11, Issue 4
- [4] Ms. Yadav Rutuja A., Ms. Chavan Nayana V, Ms. Patil Monika B, Mr. V. A. Mane, " AUTOMATED SOLAR GRASS CUTTER", International Journal of Scientific Development and Research (IJS DR)Volume 2, Issue 2, (Feb 2017).
- [5] Suraj Kumar, Bhupendra Singh Niranjana, Chandra Shekhar Azad, Arti Pandey," AUTOMATIC AND PHONE CONTROLLED SOLAR GRASS CUTTER AND ROOM CLEANER", International Research Journal of Engineering and Technology (IRJET), Volume: 07 Issue: 04 | Apr 2020