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Design and Development of a Solar-Powered Lawn Mower

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Abstract - This project presents the design and development of a solar-powered lawn mower that utilizes renewable solar energy as its primary power source. The aim of the project is to provide an eco-friendly and cost-effective alternative to conventional lawn mowers that rely on fossil fuels or grid electricity. The system integrates a solar panel, a lithium-ion battery, a DC motor, and cutting blades to perform grass-cutting operations efficiently. The solar panel converts sunlight into electrical energy, which is stored in the battery and used to drive the motor. Experimental observations show that the device can operate continuously for approximately one hour on a full charge, with improved performance under direct sunlight due to continuous charging. The system is lightweight, portable, and easy to operate, making it suitable for small-scale applications, especially in areas with limited electricity access. The project demonstrates the potential of solar energy in developing sustainable and user-friendly mechanical systems.

Key words; Solar energy, renewable energy, Solar panel, lawn mower, eco-friendly devices

INTRODUCTION

The future of global energy systems is increasingly oriented toward renewable resources, with solar energy emerging as one of the most promising solutions. Growing concerns over global warming, climate change, and environmental degradation have intensified the need to reduce dependence on fossil fuels such as coal, oil, and natural gas. These conventional energy sources are not only finite and subject to depletion but are also major contributors to greenhouse gas emissions and air pollution, posing serious threats to ecological balance and human health [1]. In response to these challenges, countries around the world are actively transitioning toward cleaner energy alternatives. India, in particular, has demonstrated strong commitment to renewable energy adoption. In 2018, the Government of India set an ambitious target of achieving 175 GW of renewable energy capacity, including 100 GW from solar power. This target was later expanded to 450 GW, reflecting both the urgency of the energy transition and the nation's confidence in renewable technologies [2]. Such initiatives highlight the critical role of solar energy in achieving sustainable development goals and reducing carbon footprints.

Solar energy offers several advantages that make it especially suitable for widespread adoption. It is abundant, inexhaustible, and environmentally friendly. In a country like India, which receives high solar irradiance for most of the year, solar power has immense potential for decentralized and large-scale applications. Unlike wind energy, which is geographically constrained to specific regions such as coastal or high-altitude areas, solar energy can be harnessed across a wide range of locations, including rural and urban settings [3]. According to the International Energy Agency, renewable energy currently accounts for approximately 26% of global electricity generation, and this share is expected to grow significantly in the coming decades [4]. This increasing contribution underscores the global shift toward cleaner energy systems and reinforces the importance of continued innovation in solar-powered technologies.

In this context, the development of solar-powered devices- such as a solar-powered lawn mower- represents a practical and sustainable application of renewable energy. Such innovations not only reduce reliance on fossil fuels but also promote energy efficiency and environmental conservation at the local level. In this context, small innovations such as solar-powered devices can play an important role. A solar lawn mower is one such application that reduces dependence on fuel and electricity while promoting clean energy usage.

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PROJECT DESIGN AND METHODOLOGY

System Design

The solar-powered lawn mower is designed as a compact, energy-efficient device that utilizes solar energy for grass-cutting applications. The system integrates mechanical, electrical, and renewable energy components to achieve sustainable operation. The overall design focuses on simplicity, portability, and low energy consumption.

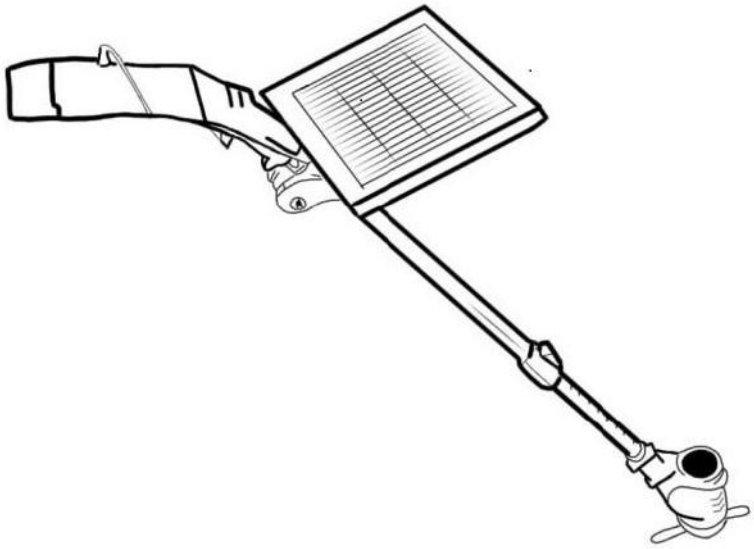

Figure 1- Illustration of solar powered lawn mower

Components Used

The major components of the system are as follows:

1. **Motor with Cutting Blades**
   A DC motor is used to drive the cutting mechanism. The motor is coupled with interchangeable blades designed for different types of vegetation, such as grass, herbs, and small shrubs. The selection of blade type allows flexibility in operation and improves cutting efficiency.

2. **Height-Adjustable Shaft**
   The mower is equipped with an adjustable shaft mechanism that enables the user to vary the cutting height. This feature ensures adaptability to different lawn conditions and user preferences.

3. **Handle Assembly**
   An ergonomically designed handle is provided to facilitate ease of control, manoeuvrability, and user comfort during operation.

4. **Solar Panel and Lithium-Ion Battery**
   The system incorporates a 10V solar panel based on Photovoltaic Effect principles. The panel converts solar energy into electrical energy, which is stored in a rechargeable lithium-ion battery. The battery acts as an energy buffer, ensuring continuous operation even when sunlight is not immediately available.

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Figure 2- Picture of the designed model of the solar powered lawn mower

WORKING PRINCIPLE

The operation of the solar lawn mower is based on photovoltaic energy conversion. When sunlight falls on the solar panel, it generates direct current (DC) electricity through the photovoltaic effect. This electrical energy is stored in the lithium-ion battery for later use. When the system is switched on, the stored electrical energy is supplied from the battery to the DC motor. The motor converts electrical energy into mechanical energy, causing the attached cutting blades to rotate at high speed. The rotating blades perform the cutting action on grass and small vegetation.

METHODOLOGY

The development and operation of the solar-powered lawn mower follow a systematic methodology:

1. **Energy Collection and Storage**
   Solar energy is captured through the solar panel and stored in the battery. Proper alignment and exposure to sunlight are ensured to maximize energy absorption.

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2. **Power Transmission**
   The stored electrical energy is transmitted from the battery to the motor through a controlled switching mechanism.
3. **Mechanical Operation**
   The motor drives the cutting blades, enabling efficient trimming of vegetation. Blade selection is based on the type and density of plant material.
4. **Performance Duration**
   The system is capable of operating for approximately one hour on a full battery charge. Under continuous sunlight conditions, the mower can operate for extended periods, as simultaneous charging and discharging of the battery occur.

RESULTS AND OBSERVATIONS

The developed solar-powered lawn mower was tested under typical outdoor conditions to evaluate its performance and efficiency. The following observations were recorded:

- The device demonstrated effective cutting performance for grass and small plants, with consistent blade rotation and satisfactory trimming quality.
- The system operated continuously for approximately one hour on a fully charged lithium-ion battery, indicating adequate energy storage capacity for small-scale applications.
- Under direct sunlight, the operational efficiency improved due to simultaneous energy generation and consumption. This resulted in extended working duration compared to battery-only operation.
- The mower was observed to be lightweight and ergonomically manageable, allowing easy handling and control. It was found suitable for users of varying age groups, including young students.
- The system operated entirely on solar energy, eliminating the need for fossil fuels or external electrical power sources during use.
- Minimal noise and vibration were observed during operation, enhancing user comfort and reducing environmental disturbance.

ADVANTAGES

The solar-powered lawn mower offers several practical and environmental benefits:

- **Portability and Ease of Use**
  The compact and lightweight design allows convenient handling and transportation.
- **Cost-Effectiveness**
  The absence of fuel requirements significantly reduces operational costs over time.
- **Environmentally Friendly Operation**
  The system produces zero emissions, contributing to reduced air pollution and supporting sustainable practices.
- **Energy Efficiency**
  Utilization of solar energy ensures efficient use of a renewable and abundant energy source.
- **Low Maintenance Requirements**
  The simple design with fewer mechanical and electrical components minimizes maintenance needs.
- **Multipurpose Functionality**
  The interchangeable blades enable the device to cut grass, herbs, and small shrubs, increasing its versatility.

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CONCLUSION

The solar-powered lawn mower developed in this project demonstrates a practical application of renewable energy in a simple mechanical system, offering a clean and sustainable alternative to conventional fuel or electricity-based lawn mowers. By utilizing solar energy for operation, the device reduces dependence on non-renewable energy sources while also lowering environmental pollution and operating costs. The prototype shows satisfactory performance in cutting grass and small plants, with the added advantage of portability and ease of use, making it suitable for areas with limited or unreliable electricity supply. Overall, the project highlights the potential of solar energy in developing efficient, eco-friendly, and user-friendly technologies for everyday use, while also providing opportunities for further improvements in efficiency, storage capacity, and design optimization.

REFERENCES

[1] Intergovernmental Panel on Climate Change, *Climate Change 2021: The Physical Science Basis*, Cambridge University Press, 2021.
[2] Ministry of New and Renewable Energy, "National Solar Mission and Renewable Energy Targets," Government of India, 2018–2021.
[3] National Institute of Solar Energy, "Solar Resource Assessment in India," Government of India.
[4] International Energy Agency, *Renewables 2023 Report*, IEA Publications, 2023.

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Ethical Approval:
NA