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Solar Powered Grass Cutter

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Abstract: *A solar-powered grass cutter is an eco-friendly alternative to conventional grass-cutting machines, which typically depend on fossil fuels. This project explores various factors like design, working principle, and advantages of a solar grass cutter, highlighting its environmental benefits, cost-effectiveness, and sustainability. The solar grass cutter operates using photovoltaic (PV) panels that convert sunlight into electrical energy. This electrical energy is stored in a rechargeable battery, which provides the power to a motor connected to rotating blades for cutting the grass. The system is manually controlled. Unlike conventional lawnmowers, this system produces no harmful emissions, reduces noise pollution, and lowers operational costs. Key components of the solar grass cutter include the solar panel, battery, DC motor, and cutting mechanism. The efficiency of the system depends on factors such as solar panel capacity, battery storage, and blade design. Additionally, integrating automation features like obstacle detection and remote control operation and grass collection can improve performance and user convenience. By reducing dependency on fuel sources, it promotes environmental conservation and supports green energy initiatives. This study concludes that solar grass cutters are a viable solution for small- to medium-scale lawn maintenance, particularly in regions with ample sunlight. Future improvements could include enhanced battery technology, AI-based navigation, and self-charging mechanisms for increased efficiency and autonomy.*

Keywords: Solar grass-cutter, lawn-mower, eco-friendly, cost-effective

I. INTRODUCTION

Pollution has become a major global issue, affecting both the environment and human health. One significant contributor to pollution is the use of gas-powered lawnmowers, which release harmful emissions into the atmosphere. Additionally, the rising cost of fuel makes these machines less economical. To overcome these drawbacks, solar-powered lawn cutters have been developed. These devices harness solar energy to operate an electric motor that powers the blade for grass cutting. Since solar energy is a renewable resource, it provides a sustainable alternative to conventional fuel-powered equipment. Traditional lawn mowers, whether push-type or riding models with combustion engines, generate noise pollution and emit harmful gases. Maintaining these machines requires regular servicing, such as oil changes, which can be both time-consuming and costly. While electric lawnmowers offer an eco-friendly option, they come with their own set of challenges. For instance, corded electric lawnmowers may pose a safety hazard and limit mobility. To address these concerns, a self-propelled electric lawn mower with remote control functionality has been developed. This advanced prototype integrates robotic technology with user-friendly features, making lawn maintenance more convenient and efficient. It is designed to be cost-effective, safe, and highly efficient while reducing the need for manual labour, ultimately cutting down on labour expenses. Although electric and solar-powered lawnmowers provide an environmentally friendly solution, they may still present some limitations. This research paper aims to overcome these challenges by introducing an autonomous solar-powered grass cutter. The proposed system will enable users to maintain their lawns effortlessly with minimal physical effort, making it accessible to a wider range of individuals, including the elderly and those with disabilities.

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II. WORKING COMPONENTS

The main components of the solar powered grass cutter are

(a) Solar panels

(b) Brush less DC motor

(c) Blades

(d) Battery

A lawn mower or grass cutter is composed of several key components, including an induction motor, a battery, an alternator, three collapsible blades, and a link mechanism. The power and charging system are designed to keep the battery charged using an alternator while the machine is in operation. The core of the system is a D.C. motor, which provides the necessary force to drive the collapsible blades. The mower functions through the combined action of the rotating blades and its forward motion. An electrical switch is used to connect the induction motor and the battery, ensuring a complete circuit for operation. To enhance safety and efficiency, an infrared (IR) sensor is incorporated to detect obstacles and prevent potential damage. Additionally, the cutting height can be adjusted using a shaft-fitting mechanism, allowing for customized grass trimming. The solar-powered grass cutter operates with a compact yet efficient engine, generating enough torque to rotate a sharp horizontal blade that trims grass upon contact. A protective deck surrounds the blade, preventing grass clippings from scattering. Typically, the motor is positioned on top of the deck and supported by four wheels for smooth maneuverability. This mower utilizes solar energy by harnessing power from a photovoltaic panel. By relying on solar energy as its primary power source, this design addresses the limitations of traditional lawnmowers that use internal combustion engines or electric motors. A solar-powered mower eliminates the need for fuel, reducing the inconvenience of refuelling trips and the risks associated with gasoline spills. Additionally, it significantly cuts down air and noise pollution compared to conventional mowers. Furthermore, using a solar-powered mower lowers maintenance and operational costs, making it an environmentally friendly and cost-effective solution for lawn care.

III. WORKING PRINCIPLE

The solar grass cutter functions by utilizing solar panels strategically arranged to maximize the absorption of solar radiation. These panels convert sunlight into electrical energy, which is then stored in rechargeable batteries through a solar charger. This setup ensures a continuous power supply, allowing the mower to function even in the absence of direct sunlight. The solar charger plays a crucial role in regulating the charging process by enhancing the current from the solar panels, disconnecting the panels once the batteries are fully charged, and reconnecting them when the charge level decreases. The motor is connected to the batteries via electrical wiring, with a mechanical circuit breaker switch installed in between. This switch is responsible for starting and stopping the motor. Once activated, the motor transmits power to the mechanism that drives the blade, allowing it to slide against a fixed blade to cut the grass efficiently. Key components of the solar-powered lawnmower include a direct current (D.C.) motor, a rechargeable battery, a solar panel, a stainless-steel blade, and a control switch. The D.C. motor provides the required torque to rotate the blade, which is directly attached to the motor's shaft. The rechargeable battery stores the energy harnessed from the solar panel, ensuring a steady power supply for the mowing process. The control switch allows users to operate and manage the lawnmower efficiently. To start the mower, the control switch closes the circuit, enabling the current to flow to the motor, which then drives the blade for grass cutting. The rechargeable battery is recharged through a solar charging controller that efficiently captures and stores solar energy. To assess the performance of the solar-powered lawnmower, tests were conducted on different types of grass to evaluate its efficiency and cutting capability under varying conditions.

IV. WORKING OF SOLAR GRASS CUTTER

The solar grass cutter operates by utilizing solar panels arranged in a way that maximizes exposure to high-intensity sunlight. These panels convert solar energy into electrical energy, which is then stored in rechargeable batteries via a

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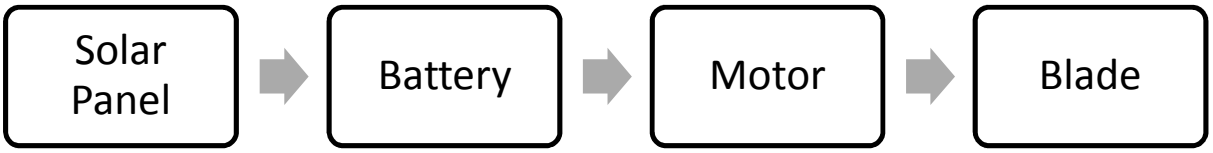
solar charger. The primary function of the solar charger is to regulate the charging process by increasing the current flow from the panels, disconnecting them once the batteries are fully charged, and reconnecting them when the battery level is low. The motor is linked to the batteries through electrical wiring, with a mechanical circuit breaker switch installed between them. This switch controls the operation of the motor by enabling or disabling power flow. Once the motor is activated, it transmits power to the cutting mechanism, causing the blade to move against a fixed blade, effectively trimming the grass. The solar-powered lawnmower consists of key components such as a direct current (D.C.) motor, a rechargeable battery, a solar panel, a stainless-steel blade, and a control switch. The D.C. motor generates the necessary torque to drive the stainless-steel blade, which is directly attached to its shaft. The mower is operated via a control switch that closes the circuit, allowing current to flow to the motor and power the blade for mowing. The rechargeable battery is replenished through a solar charging controller, which efficiently harnesses solar energy. To assess the efficiency of the machine, performance tests were conducted on various types of grass to evaluate its cutting capability under different conditions.



V. RESULTS

The manufacturing of the solar-powered grass cutter has been successfully completed, and the results obtained have been satisfactory. This project serves as a foundation for further improvements and modifications by future developers. It is a practical and efficient solution for everyday users due to its numerous advantages, such as eliminating fuel costs, reducing pollution, and minimizing maintenance needs due to fewer moving parts. Powered by solar energy, this system is both cost-effective and environmentally friendly. Additionally, it provides a physical activity component for users while remaining easy to operate. A key feature of this design is its ability to charge the batteries while in motion, ensuring continuous operation. Furthermore, the mower can also be used at night, as the batteries can be charged during the day for later use.

VI. CONCLUSION

The Scotch yoke mechanism used in this project did not achieve the expected efficiency. This efficiency can be improved by incorporating an alternative mechanism. Additionally, the motor's speed was reduced due to the use of heavy materials, which can be replaced with lighter alternatives to enhance performance. The design of the blades should also be optimized based on the type of grass being cut to improve cutting efficiency. This project offers an affordable and time-saving solution for households, making lawn maintenance more convenient and cost-effective.

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