



Solar Based Grass Cutter

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Abstract—From ancient times, the sun has been a major source of energy for life on earth. Solar energy is a clean, freely available, and abundantly available renewable energy. It is also the most important of the non-conventional sources of energy since it's a non-polluting and therefore helps decrease the greenhouse effect. Solar energy is used for drying clothes, curing an agricultural product, storing food, etc. Even today, the energy we get from wood, gasoline, paraffin, hydropower, and even food comes from the sun. Solar power is almost limitless. The amount of energy we get from the sun satisfies our needs. Since the industrial revolution people have been relying on oil, electricity and wind power. Due to the continuous increase in the cost of fuel and the effect of emission of gases from the burnt fuel into the atmosphere, this necessitated the use of solar energy from the sun as a source of power. Talking about grass cutters that uses fuel for working, they emit gases contributing to the greenhouse effect as well as contributing to air pollution. Grass cutters operated through electric power also need manpower to operate. So, the best way to put an end to these problems is to use a grass cutter that uses renewable energy resources for its charging as opposed to an electric cable extension. Traditionally, grass cutters often clunky pieces of machinery that involve a lot of strength and energy to use. Most of the grass cutters used with gasoline and also need a lot of human effort. Grass cutters equipped with motors contribute to both noise pollution due to their loud operation and air pollution from the emissions produced during ignition. Additionally, motorized engines require regular maintenance, including oil changes. In contemporary times, pollution poses a significant global concern affecting every

corner of the world. Pollution, predominantly of human origin, is observable in our everyday experiences. The solar grass cutter serves as a mechanical implement employed for grass cutting, utilizing solar energy instead of electricity. The dangerous emissions generated by the gasoline spillage and that of the internal combustion engine into the atmosphere are eliminated. The solar powered grass cutter will help to reduce air pollution. **Keywords**—Renewable Energy, Hybrid Technology, solar power.

I. INTRODUCTION

Nowadays, pollution is one of the major factors of global warming as the usage of non-renewable resources is too excessive. Due to the emission of gases, gas-powered grass cutters contribute to pollution. The normal grass cutters have been broadly used recently by the workers in gardening of lawn. However, the manual operated grass cutters are absorbing a very large amount of energy and causing air pollution, grass cutters also generate so much of noise and vibration which straight to affect labors health. The normal grass cutter generates high noise and vibration. Also, the cost of fuel is increasing hence it is not efficient. Due to the emission of unwanted gases caused by global warming, an alternative was electricity and to derive electricity is solar energy. A solar-powered grass cutter operates by harnessing solar energy derived from sunlight. Solar panels are utilized by the devices, representing an optimal utilization of solar energy for electricity generation. Solar-powered automatic grass cutters are engineered for the purpose of trimming grass in various settings, including public spaces such as hotels, parks, and

colleges, as well as private properties like residences, gardens, and lawns.

With the rapid advancement of technology, conventional grass cutting methods are progressively being replaced by solar-powered alternatives in modern society. This transition offers considerable advantages, including reduced carbon emissions and long-term cost savings. Moreover, the adoption of automatic solar-powered grass cutters significantly minimizes human labor, thereby simplifying garden maintenance compared to employing manual laborers, especially in challenging weather conditions. The increasing popularity of grass cutter machines underscores the growing preference for eco-friendly solutions in various industries.

Pollution, largely attributed to human activities, pervades our daily lives. The proliferation of sophisticated high-tech tools and equipment has revolutionized our work processes, enhancing comfort and efficiency. As the world's industrial sector expands and the use of electrical devices becomes more widespread, the demand for electricity surges dramatically. In light of this escalating demand and the escalating costs and environmental impact associated with conventional fuel sources, harnessing ample solar energy presents an optimal solution. Embracing solar energy not only addresses the escalating fuel costs but also mitigates the detrimental effects of emissions from conventional fuel combustion on the environment. Grass cutters, also known as lawn mowers, come in various types to suit different needs and preferences. One common type is the traditional gas-powered lawn mower. These mowers typically feature a combustion engine fuelled by gasoline, providing ample power for cutting through thick grass and large lawns. They often come in self-propelled or push models, with varying cutting widths and adjustable height settings to customize the grass length. Another type is the electric lawn mower, which can be further categorized into corded and cordless models. Corded electric mowers require an electrical outlet and extension cord, offering consistent power without the need for refuelling. Cordless electric mowers, on the other hand, operate on rechargeable batteries, providing greater mobility and convenience as they can be used anywhere without worrying about cords. Electric mowers are generally quieter and produce fewer emissions compared to their gas-powered counterparts.

For smaller lawns or areas with tight spaces, reel mowers, push mowers, offer a manual alternative. These mowers feature a cylindrical blade mechanism that rotates as you push the mower, cutting grass with a scissor-like action.

Reel mowers are eco-friendly, as they don't require electricity or gas, and they offer a quieter operation. When the requirement of more physical effort to operate, reel mowers provide a precise cut and are often preferred for their simplicity and environmental benefits. Overall, the choice of grass cutter depends on factors such as lawn size, terrain, and personal preferences regarding power source and maintenance.

II. OVER VIEW

A solar-based grass cutter represents an innovative and sustainable approach to lawn maintenance, utilizing renewable solar energy to power its operation. At its core, the system comprises essential components such as solar panels, a solar charge controller, and a lithium-ion battery. The solar panels capture sunlight and convert it into electrical energy, which is then regulated by the charge controller to ensure efficient charging of the battery. This battery serves as a reliable energy storage unit, allowing the grass cutter to operate continuously even in low-light conditions or during nighttime, reducing dependency on conventional energy sources.

The brain of the solar-based grass cutter is the Arduino microcontroller, which orchestrates the functionalities of the system. It receives inputs from various sources, including sensors and user commands transmitted via the Bluetooth module. This Bluetooth connectivity enables remote monitoring and control, enhancing user convenience and accessibility. The Arduino interprets these inputs and coordinates the operation of the motor driver, which controls the movement of the grass cutter through its four DC gear motors. These motors enable precise navigation across diverse terrains, ensuring efficient grass cutting.

Moreover, the relay module plays a crucial role in managing the cutting mechanism of the grass cutter. The DC motor, powered by the lithium-ion battery, drives the cutting blades. The relay, controlled by the Arduino, regulates the power supply to the DC motor, allowing for the selective activation or deactivation of the cutting blades as needed. This feature optimizes energy usage and enhances the efficiency of grass cutting operations, contributing to overall sustainability. In summary, a solar-based grass cutter offers a sophisticated, environmentally friendly solution for lawn maintenance, utilizing renewable energy sources and advanced control technology to deliver reliable and efficient performance.

III. OBJECTIVE

The aim of this project is to create a solar grass cutter powered by solar energy, addressing the limitations of conventional lawn mowers. The objective is to mitigate power outages, minimize manual labor, decrease operational expenses, and enhance environmental and health preservation. The heart of the project is the microcontroller which decides the various actions. The motor driver executes these orders by changing the power and polarity of the motors. The system relies on 11.1V batteries to operate the vehicle movement motors and the grass cutting motor. Additionally, a solar panel is utilized to charge the batteries, eliminating the need for external charging. The grass cutter and vehicle motors are connected to an 8051-family microcontroller, which governs the operation of all motors. The microcontroller moves the vehicle motors in forward direction through the controlling of the person through their smartphone.

IV. BLOCK DAIGRAM

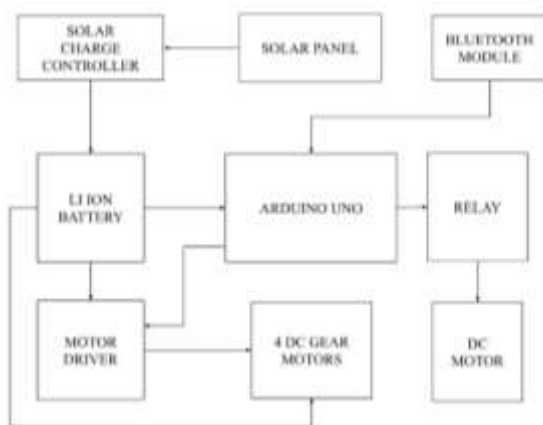


Fig. 1: Block Diagram of Entire System

The block diagram of a solar-based grass cutter demonstrates the integration of various components to efficiently utilize solar energy for grass cutting tasks. At the forefront is the solar panel array, which captures sunlight and converts it into electrical energy. This energy is then regulated by the solar charge controller to ensure optimal charging of the lithium-ion battery. The battery serves as an energy storage unit, storing the harvested solar energy to power the grass cutter's operations, providing continuous functionality even during periods of low sunlight or at night.

The Arduino microcontroller acts as the central processing unit of the grass cutter system, controlling and coordinating the operation of its

various components. It receives input signals from sensors and user commands via the Bluetooth module, allowing for remote monitoring and control of the grass cutter's functions. The Arduino then interprets these inputs and sends appropriate commands to the motor driver, which in turn manages the movement of the grass cutter via the four DC gear motors. These motors are responsible for propulsion and steering, enabling the grass cutter to navigate through the terrain with precision and efficiency.

Additionally, the relay module is utilized to control the operation of the cutting mechanism, which is driven by the DC motor. The relay, under the control of the Arduino, regulates the power supply to the DC motor, allowing for the activation or deactivation of the cutting blades as required. This feature enhances the efficiency of grass cutting operations by enabling the grass cutter to selectively engage the cutting blades, conserving energy when not in use. Overall, the block diagram illustrates a sophisticated solar-powered grass cutter system that maximizes energy efficiency and operational effectiveness while minimizing environmental impact.

V. METHODOLOGY

Regarding the operation of the solar-powered grass cutter, it features panels arranged at a 45-degree angle to maximize exposure to intense solar radiation from the sun. These panels convert solar energy into electrical energy, a process previously examined. The generated electrical energy is then stored in batteries via a solar charger. The primary role of the solar charger is to amplify the current from the panels during battery charging. Additionally, it disconnects the solar panels from the batteries upon full charge and reconnects them when battery levels are low. The motor is linked to the batteries via connecting wires, with a relay positioned between them. This relay controls the motor's activation and deactivation. Power is transmitted to the mechanism, causing the blade to glide along the fixed blade and cut the grass.

While the Arduino programming environment is primarily based on C++, you can still write Arduino programs using C language syntax. The Arduino IDE pre-processes your C code before compiling it, so you have access to many Arduino-specific functions and libraries even if you're writing in C. In the project, the

program is done by C++ program. The battery is connected to the 12v and ground of motor driver. 4 Motors are connected to the motor driver. 5v and ground is connected Arduino of 5v and ground. For signals, we have connected output 9, 10, 11, 12 of Arduino and input to the motor driver 1, 2, 3, 4. For grass cutting, we have used 5v motor and 5v DC relay. From relay we have connected to the Arduino output of 8.

the solar-based grass cutter delivers reliable performance, reduced operating costs, and minimal environmental impact, making it a sustainable and efficient solution for lawn maintenance.

The 10 watts solar panel is used to charge the batteries which are rechargeable. the solar panel gives maximum 18v and 580mA current, we need charging circuit between solar panel and batteries. The charging circuit has voltage regulator which regulates voltage to 15v and one transistor to amplify the maximum current to circuit and diode is used. we use 12 voltage battery for entire circuit and another 12v volts for cutting blade. The movement of bot is done by using the 4 DC motors of 100 rpm. The motors are driven by using motor driver (L293D). It is also known as H-Bridge.

The main purpose of using motor driver is because that DC motors require the minimum voltage as 9v as input. But the microcontroller gives output as only 5v so we require 9v to 12v for driving the motors. So, we use motor driver which takes 5v as input and gives the 11.1v for motors. The L293D motor driver drives only two motors which can move in both directions. And the cutting blade is used cut the grass.to cut any type grass we need high rpm motor, so we used 1000 rpm motor for cutting blade The motors run directly by 11.1v rechargeable battery.

VI. RESULT AND DISCUSSION



Fig.2: Outcome of Solar based Grass Cutter

SL NO	BUTTON	RESULT
1	RIGHT	GOES RIGHT
2	LEFT	GOES LEFT
3	FORWARD	GOES FORWARD
4	BACKWARD	GOES FORWARD
5	CUT	URNS THE BLADE

Table 1: outcome

The result of a solar-based grass cutter equipped with components such as solar panel, solar charge controller, lithium-ion battery, Arduino, Bluetooth module, motor driver, four DC gear motors, relay, and DC motor is a highly efficient and environmentally friendly grass cutting solution. With solar panels harnessing renewable solar energy and a sophisticated control system managed by the Arduino microcontroller, the grass cutter operates autonomously, utilizing stored energy from the lithium-ion battery for continuous cutting even during periods of low sunlight or at night. The Bluetooth module enables remote monitoring and control, enhancing user convenience and accessibility. The precise movement control facilitated by the motor driver and DC gear motors ensures accurate navigation across various terrains, while the relay-controlled cutting mechanism optimizes energy usage by selectively engaging the cutting blades. Overall,

VII. CONCLUSION

The project aims to mitigate greenhouse gas emissions, recognized as a primary factor driving climate change. Developed for residential use, institutions, and fields with lawns unsuitable for traditional grass cutters, the solar grass cutter fulfills its intended purpose effectively. Demonstrating feasibility, it stands as a practical substitute for gasoline-powered lawn mowers. Configured to harness solar energy, the device utilizes solar electricity to operate the grass cutter motor. Additionally, it is engineered to seamlessly integrate all necessary hardware components.

VIII.FUTURE SCOPE

The future scope of solar-based grass cutters is promising and holds potential for further advancements in technology and adoption. One avenue for future development lies in enhancing the efficiency and effectiveness of

solar panels and energy storage systems. Ongoing exploration aimed at enhancing solar panel efficiency and augmenting the energy storage capabilities of lithium-ion batteries holds the potential to advance grass cutting solutions, making them more dependable and environmentally sustainable. Additionally, advancements in materials science may enable the development of lighter and more durable components, contributing to improved performance and longevity of solar-based grass cutters.

Moreover, integration of artificial intelligence (AI) and machine learning (ML) technologies can revolutionize the capabilities of solar-based grass cutters. AI algorithms could enable autonomous operation and adaptive decision-making, allowing the grass cutter to optimize its cutting patterns based on environmental conditions, terrain variations, and grass growth rates. Such advancements would not only boost efficiency but also diminish the necessity for human involvement, thereby rendering lawn maintenance more convenient and accessible for users.

IX. REFERENCES

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