

Solar Powered Lawn Mower

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Abstract— The Solar-Powered Lawn Mower represents an innovative and sustainable approach to urban mobility. Leveraging advanced technologies and engineering principles, the paper aims to develop a solar powered lawn mower primarily by solar energy. Also aims to address environmental concerns associated with traditional models by reducing reliance on non-renewable energy sources. And addresses the growing need for sustainable urban transport solutions. It aligns with the global shift towards renewable energy adoption and showcases how advancements in solar technology, coupled with thoughtful design and engineering, can contribute to environmentally conscious mobility. The project envisions a future where solar powered lawn mower offer a practical and eco-friendly, embodying the fusion of green energy and cutting-edge design in environment.

Keywords— Solar Energy, Renewable Energy, Autonomous Lawn Mower, Energy Efficiency, Environmental Sustainability, Green Technology, Solar Powered Automation, Solar Energy utilization, Low Maintenance Lawn Mower.

I. INTRODUCTION

The use of solar power as an alternative source of energy has been in existence long before now but has not had diverse application methods due to other frequently used sources of energy. Solar energy involves the process of harnessing radiant light and heat from the sun using a range of ever evolving technologies such as solar thermal energy and photovoltaics. These technologies are broadly characterized as either passive solar or active solar depending on how the energy is converted to solar power. The effectiveness of these technologies have made solar energy a very important source of renewable energy and thereby giving room for new developments in its wide range application processes.

In the world today, world's power consumption is taking a shift from the use of common sources of energy such as fossil fuel and wood fuels to solar energy. The change in energy consumption trend was due to the awareness of fossil fuel pollution and its contribution to global warming, and also the fact that fuel energy is non-renewable and unsustainable. In Nigeria today, like most other developing countries, fossil fuel has been a basic source of non-renewable energy. Pending the fact that we import fuel there is always a tendency of a hike in the cost of fuel as a result of the country economic instability. Lawn maintenance is the art and vocation of keeping a lawn healthy, clean, safe and attractive, typically in a garden, park, institutional setting or estate. Man is constantly trying to adapt to his environment by creating a habitat suitable for his survival.

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II. STATEMENT OF PROBLEM

In the world today where technology is merging with environmental awareness, most people are looking for ways to contribute to the relief of their own carbon foot prints (Bidgar & Vickey, 2017).

Pollution is manmade, which can be seen in the day-to-day activities of man. In this part of the world, the most common types of lawn mowers are powered by gasoline engines which are hazardous to the environment thereby leading to global warming and depletion of the ozone layer. Gasoline powered mowers create noise due to the loud engine noise, and air pollution due to the combustion in the engine. Thus, gasoline powered lawn mower contributes to both air and noise pollution. Hence, alternatives to the use of non-renewable energy and polluting fossil fuels needs to be taken into consideration.

III. AIM AND OBJECTIVES

The aim and objective of this project is to design and fabricate a lawn mower which would be powered by solar energy in addition to the common gasoline engine. The specific objectives are as follows:

- i. To study the design of a solar lawn mower.
- ii. Fabrication of the solar lawn mower.
- iii. To analyze the solar lawn mower and compare its performance with gasoline operated mowers.

IV. SCOPE

This paper is mainly intended to design and fabricate a solar powered lawn mower which runs with renewable energy i.e., the solar energy. Several design factors should be taken into account for the economical and efficient development of a solar lawn mower. These are considerations that should be put in place during the fabrication process so as to ensure optimal productivity of the machine.

V. LITERATURE MAPPING

Solar energy is a time dependent energy that occurs at irregular intervals. Therefore, energy has to be stored so it can be readily available for use when there is no further supply of the sun energy. The solar panel (or photovoltaic cell) harnesses the solar energy when the sun is available during the day. The sun produces constant amount of energy with a solar radiation intensity of about 6.33×10^7 W/m² at the surface of the sun. Photovoltaic modules and arrays produce direct-current (DC) electricity and current combination. Solar photovoltaic cells are essentially semi-conductors, which

have electrical transmission properties like metal or salt water and insulators like rubber.

Solar panels are constructed with sheets of doped silicon, primary element in beach sand with impurities added like phosphorus that allows the flow of electron. To charge the battery, a solar panel is expected to tap the solar energy from the sun and convert it to electric energy that will be put away in the battery connected to it. At the point when the protons from the sunlight-based energy hit a photovoltaic cell, a progression of electrons begins which can be drawn off by a connected wire, this generates direct current. Various sun-oriented cells electrically connected with one another and mounted in a support structure or edge is known as a photovoltaic module. Modules are intended to flexibly supply a specific voltage. The current created is predominantly proportional to the amount of light striking the module.

A charge regulator that will be wired between the solar board and the battery is likewise required. The reason for the controller is to prevent the battery from the solar panel when there is no insulation or production of electricity. It likewise prevents excessive charging when the battery gets fully charged and furthermore controls the voltage getting to the battery. In selecting the solar panel, the following were considered;

- i. The average sun hours per day (insolation)
- ii. Battery capacity
- iii. Current draw of the motor.
- iv. Mower operation duration

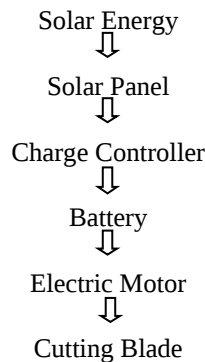


Fig. 1 Flow diagram of Solar powered lawn mower

VI. DESIGN CONCEPT

In carrying out the design, several considerations were made which include the shape of the blade, material of the blade, the speed of rotation of the electric motor, the size of the frame, the power rating of the solar panel and the output capacity of the battery. Fig. 2 shows the sketches considered before the final design.

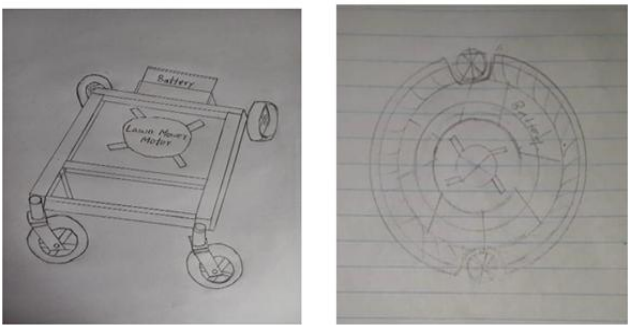


Fig. 2 Considered Design Concepts

As for the figure 2, one is a box type lawn mower and the other is circled machined design. Box type mower has the ability to turn the wheels in 360 degrees and it is easy to manufacture. But there are some disadvantages of this design such as it has no proper place to attach the motor and handle in the design sketch. And the main disadvantage is it has very less protection to the user. The circled lawn mower has only two wheels and it has no place to attach the solar panel which is a main disadvantage of the design. And it will be difficult to withstand for the load of the battery, motor, handle and deck with only two wheels. Therefore, figure 3 is chosen as the finalized design. Considering the design for the proposed lawn mower, the blade to be used is a flat shaped blade. They are generally referred to as standard blades engineered to provide enough lift to move the grass out of the mower deck area.

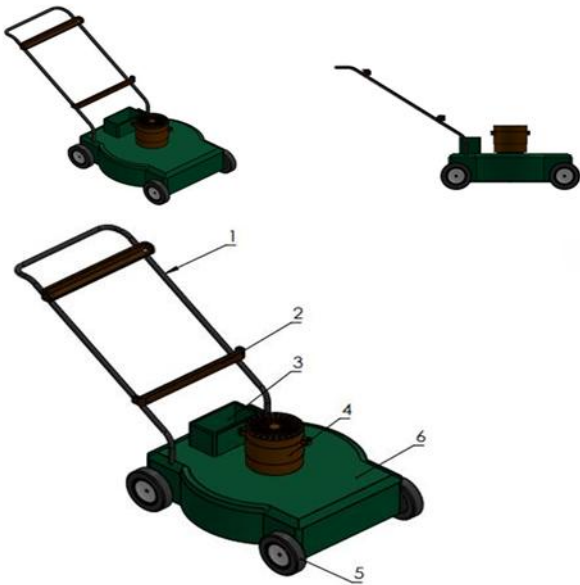


Fig. 3 Finalized Design of the Lawn Mower

TABLE I: MATERIAL SELECTION

S/N	COMPONENTS	MATERIAL	REASON FOR THE SELECTION
1	Handle	Carbon Steel (SS)	Strength, Durability
2	Solar Panel Support	Carbon Steel (SS)	Strength, Durability
3	Battery	12V, 40Ah battery	Rechargeable, Durability and Economical
4	Motor	DC motor	Economical
5	Wheel	Polyurethane	High strength, Act as a shock absorber
6	Base Plate (Frame)	Carbon Steel (SS)	Strength, Durability
7	Blade	Carbon Steel (SS)	Strength, Durability
8	Wheel support	Alloy Steel (SS)	Corrosion Resistance, Hardness
9	Solar Panel (In between solar support)	100W	Functionality

VII. WORKING PRINCIPLE

In the proposed of solar powered lawn mower, batteries are charged by the sun and then used to drive the selected electric motor, which in turn activates the blade as the mower is driven. The controlling device of the whole system is provided using switch ON the DC motor interfaced with grass cutting blades. The air is sucked into the blade's center and forced downward as the blade rotates, creating an area of high air pressure beneath the machine. By lifting the mower when air is added, this high-pressure rating generates lift and makes the mower easier to manage. The lawn mower blades, which are connected to the rotating electric engine, cut the grass as the mower moves. The electrical circuit ensures that solar power from the sun is sent through a charge controller to charge the battery, which in turn giving power to run the electric motor. At the same time, the solar panel power will continually replenish the battery while it is in use. When the power switch is activated, the battery's electrical energy drives the motor, which then activates the blades. In order to make up for the battery discharge, the solar panel produces current to recharge the battery. A lawnmower deck with a handle, a 12-volt electric motor, a 12-volt battery, and a blade make up the solar lawnmower. The battery is charged using a charge controller that is placed independently. The photovoltaic cell, the solar panel produces current when light strikes its surface. The battery is charged using a 100-Watt solar panel. The electric motor, which serves as the brain of the device, propels the blade.

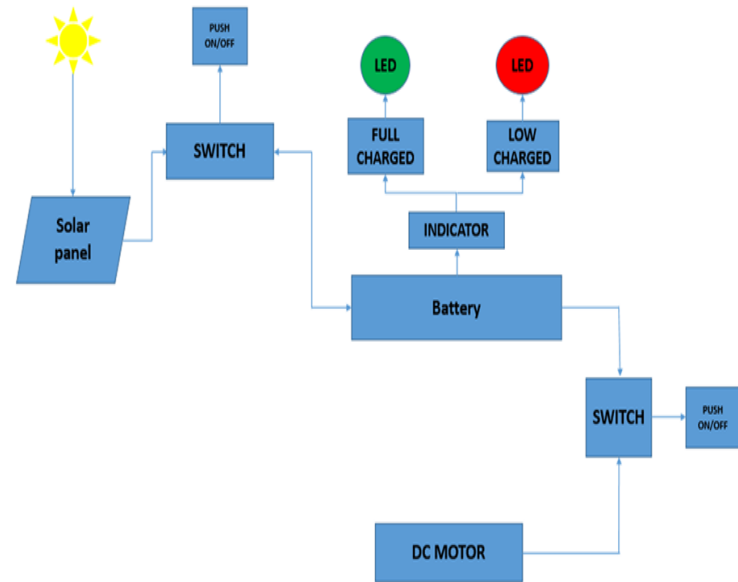


Fig. 4 Block Diagram for the internal operation of the solar powered lawn mower

VIII. CONCLUSION

Over the last few decades, machines are designed with the aim of reducing or eliminating greenhouse gas emissions which is the major cause of climate change due to global warming. The improved solar powered lawn mower will meet the challenge of environmental pollution and also low cost of operation since there is no cost for fuelling which is the goal of this project. The solar powered lawn mower was developed for the use of residences and establishments that have lawns where tractor driven mowers could not be used. The machine's capacity is adequate for this purpose. The field efficiency of the machine was 96.7% which is relatively high.

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