A Light Weight Solar Powered Lawn Mower

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ABSTRACT

High effect of emissions of gases after the combustion of fuel and gradually increase in the cost of fuel has always been a huge problem for both environment and human being. Power consumption become more important .so it is very necessary to use renewable energy. This lawn mower was totally based on sun as an energy source, which is considered as a renewable energy resource, it is off very light weight and reduces atmospheric pollution too. The weight of lawn mower was around 5 kg, it can be easily portable, ease to use, even an unskilled person can also use it.

The fabrication of light weight solar powered lawn mower comprises of following components namely- a (50 Hz, 1 HP Dc Motor), (12V,7.0AH Rechargeable Battery), (Stainless-steel blade 0.8T), (On-off Control Switch) and (Solar Panel). The lawn mower has a 360-degree rotating panel arrangement in such a way that it can receive a high intensity of solar radiation from sun. The solar panels convert solar energy into electrical energy, the electrical energy get stored in a rechargeable battery. when switch is on, circuit get closed and it allow the current to flow in the dc motor, the dc motor can be adjusted to considerable length it can be manually adjusted up to 5 cm, the supply of power from the battery is given to the dc motor, the shaft of dc motor start rotating with which stainless steel blade is coupled, which has very sharp edge it also starts rotating with the shaft and cut the grass at an even length.

Keyword: - *Emission, Solar Power, Adjustable Mower, Battery, Pv Panel*

1. INTRODUCTION

As we all known that the non -renewable energy resources such as coal, gasoline, natural gases, nuclear energy etc. Once they used, they get exhausted & take millions of years to form due to which, there is continuous increase in the cost of fuel.

The exhaust gases which coming out after the combustion process into the atmosphere causes air pollution, the main objective of this research is to reduce the emission [1] of harmful gases & to make light weight of Lawn mower. so, there is a need to use of renewable energy resources.

The solar lawn mower is a mechanical device used for upkeeping lawn with the help of solar energy as a source of power to drive the lawn mower instead of using electrical energy [2]. The solar lawn mower contains of Pvc pipes, direct current motor, a rechargeable battery, pv panel, a stainless-steel blade and switch.

A Light Weight Solar Powered Lawn Mower was designed and developed, on a principal that it has a panel arrangement in such a way that it can receive more solar radiation at a high intensity from the sun. The lawn mower was operated by the switch, when switch is on, it will close the circuit and allows the flow of current to the motor from the rechargeable battery, which in turn drive the blade used for mowing. The battery is a rechargeable battery get recharge through the solar energy. The unskilled worker can easily operate this device.

Here few designs requirement that must satisfy the study objectives which are:

1.To design a solar powered lawn mower which is light in weight.
2.Cost Effective.
3.Feasible in size.
4.Operate in varieties of applications.
5.Environmentally friendly [3].

2. MATARIAL AND METHOD

On the study, material such as Pvc Pipes were considered in fabrication of a light weight solar powered lawn mower. A hollow pvc pipes of width 1 mm and length of 3.6576 m was used in the construction of the frame. However, a Pvc pipes has light weight, provide great support to the structure, very cheaper, easy to connect and easily available in the market. The frame provides support to the dc motor, battery, as well as handle, frame to connect the pipes with each other t-joint and elbow are used.

Fig -1: Moveable mechanism of solar panel

Solar energy is a renewable energy resource [4]. Solar panels (also known as "PV panels"[5]) are used to convert light from the sun, which is composed of particles of energy called "photons", into electrical energy. The solar panel mounted in vertically upward direction with 360-degree rotation mechanism in such a way that it can received maximum amount of solar radiation at a high intensity from the sun. A battery is used to store the solar energy which will converted into electrical energy. Batteries are available in various voltages. A 12V ,7.0AH battery is used because of its cost and availability.

A Dc motor is any of a class of rotary electrical motors that converts direct current electrical energy into mechanical energy. when a magnetic field and an electric field interact, a mechanical force is produced. The Dc motor **or** direct current motor works on that principle.

The blade is connected to the shaft of dc motor, when the shaft of motor rotates the blade also rotates. Blade is a tool with a sharp edge that is designed to cut surface or material. Lawn Mower has sharp, spinning blades that cut the grass and its roots.

Table -1: Components of lawn mower

Items	Quantity
Pvc Pipes	1
Solar Panel	1
Dc Motor	1
Cable	1
Switch	1
Battery	1

2.2 Method

To design light weight solar powered lawn mower [6] various literature and paper are referred, different -different ideas were collected from different sources. To minimize the challenges which coming out in terms of electricity and gasoline, the idea of solar powered lawn mower was developed. Other than this it has one more importance that is, its light weight.

For the design certain parameters such as the main body structure, the position of components is needed to be considered. A pvc pipes was used in the fabrication of body structure because of its light weight, great strength and easily available in market at an affordable price. Fabrication was done in mechanical engineering workshop at United College of Engineering and Research.

A light weight solar powered lawn mower works on a principal that it has a panel arrangement in such a way that it can receive more solar radiation at a high intensity from the sun. The panel convert the solar energy into electrical energy and that electrical energy get stored in a 12V rechargeable battery from the battery a 12V dc motor is connected, through connecting wires and stainless-steel blade is coupled with the dc motor.

3. WORKING

Coming to the working of solar powered grass cutter machine, in which a solar panel, dc motor,12v rechargeable battery a diode and stainless-steel blade are comprises. The whole-body part of the grass cutter is made up with hollow square bar and they are connected with each other with the help of t-joint & coupling which provide support and strengthen to the body. In this four-caster wheel are used which is mounted at the lower part of the body through which grass cutter body will along with the blade. It has a solar panel mounted vertically upward in a particular arrangement. The mounted solar panel has a moveable mechanism, it can be adjusted according to sunlight directions in such a way that it can receive solar radiation with high intensity easily from the sun. Now these solar panel convert solar energy into electrical energy and then electrical energy is stored in a 12v battery. A diode is used, which do not allow the battery to give reverse power to the panel. The Dc motor is connected to the battery with the connection wires, between these two, mechanical circuit breaker switch is provided. It will start and stop the working of the motor. The motor is mounted in vertical downward and fixed in a T-shape joint. From the shaft of motor, a stainless-steel blade is connected from the motor, the power transmits to the mechanism and this makes the blade to slide on a fixed blade and this make to cut the grass at an even length.

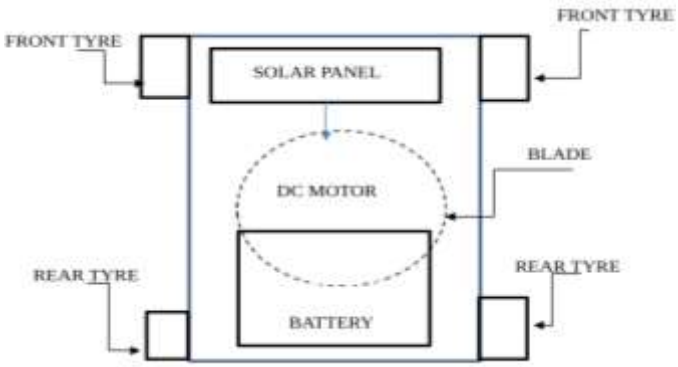

Fig -2: Block Diagram of a Lawn Mower

3.1 Result and Discussion

3.1 Torque and Power of a Motor with no Load Conditions

$$P = V \times I$$

=12×2.5

=300W

N= 1200 RPM

Then,

$$P = \frac{2\pi NT}{60}$$

=300×60=2×π×1200×T

T=2.387 N-m

3.2 Torque and Power of a Motor with Load Conditions

$$P = V \times I$$

=12×1.1

=132W

N=800 RPM

Then,

$$P = \frac{2\pi NT}{60}$$

=132×60= 2×π×800 ×T

T=1.575 N-m

Pvc pipes was used to reduce the weight of lawn mower, it is easily available in market. The solar panel of 1000v ,2.93A was suitable for lawn mower. Because of its price and availability, a battery of 12 V ,7.0AH was used.12 v dc motor speed around 12000 rpm was taken for the project and it was found to be affordable and easy to mount. on seeing stainless steel blade was very easily available and can be very easily connect or replace with the shaft so it was used. Power and torque to motor with no load condition was 300 W and 2.387 N-m and on giving load, power of motor was 348 Wand torque was 1.575 N-m. The complete design and fabrication of light weight solar powered lawn mower was presented in fig3.

Fig -3: Light Weight Solar Powered Lawn Mower

4. CONCLUSIONS

The light weight solar powered lawn mower is focusing on its light weight and the use of renewable energy resources.it is environmentally friendly, produces less noise and can be achieved at an affordable cost. the lawn mower can work up to 2-3 hr. continuously when battery is fully charged. lawn mower has height of a 1.5 m and total weight around 5 kg which make its easily workable and portable. Due to the adjustable height of motor, it can cut the grass up to 5 cm in a length. The machine is used to cut different grass even in cloud day too when there is no sun so it can also be used to maintain and upkeep lawn even in those places where there is no electricity.

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