

Paper on Design, Development and Fabrication of Solar Operated Lawn Cutting Machine

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Abstract- In Today's world due to increase usage of fossil fuels the problems arising like global warming , ozone layer depletion. Thus renewable energy resources plays a role of path finder for the present and future generations. Solar energy which is abundantly and freely available can be used for various applications such as lawn mower. The solar powered lawn mower is designed and developed based on the general principle of mowing. Grass cutter works in open environment so it is possible to access solar rays in day time to charge battery on lawns at the time of working of machine. Solar energy is converted into electricity to charge battery. Mechanical energy of motor is used to drive rotary blades. By providing sufficient clearance between stationary and rotary blades grass cutting is done.

Keywords: Solar Energy, Photovoltaics, Lawn mower, Design and fabrication.

1.INTRODUCTION

Grass cutter machine can easily found in hardware shop with reasonable price. Today ,there are many machines are available in the market with different specifications. But still they can be improved ergonomically and economically. Such as factors like blade shape and material of blades, flexibility etc. this model follows Design for Manufacturing and Assembly (DFMA) methodology. Therefore one of the DFMA approaches Lukas Hull DFA are implemented in order to improve the product development process and reduces manufacturing cost. It is because the lot of cost is involved in the manufacturing and assembly of a product.thus solar powered lawn mower is energy and well as cost effective.

1.1Problem statement-

Lately , we usually see the grass cutter machine was used at the housing park and residence bungalow . the commercial are like industry area, we usually see the manually and conventional method was used grass cutter machine was used the fuel as source of power. The cost of fuels which are being used for cutters are also increasing. Thus our aim is to study alternative source of power like solar energy. In addition to this modification will be done to the blade to use different material and non hazardous to the operator. Also the price of our model is less than the available market cutters. Thus providing user friendly and pollution free lawn mowers.

1.2 Objectives-

01. To study design parameter of solar grass cutter.
02. To analyze the solar grass cutter machine and compare its performances with the available traditional cutters.

2. WORKING -

The working of solar panels is based on principle of photoelectric effect . Thus producing electricity by using light energy. Panels are placed inclined on the frame . the charging circuit is needed for the charging the battery and through battery we are running the dc motor and thus converting the electrical energy to mechanical energy. Here the speed of dc motor controlled by the control system and finally cutter get the power from motor, and we have given the cutter height setting facility, so we use to cut the grass at different height and also provide wheel to frame, for easy to travel on lawn.

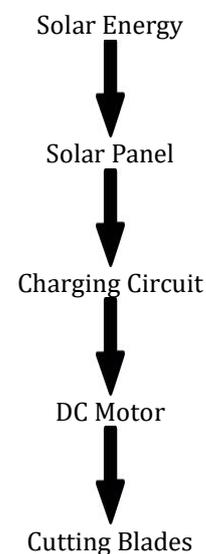


fig 1. flow diagram for working of lawn mower

Material and Methods-

In designing the cutting blade, the force required to cut the lawn as well as the force acting on the blade was considered . the force required by any sharp object to have impact on the grass is less than 10 newton. It is also dependant on the height , density and the area covered by

the object (Atkins,1984). Therefore ,in designing the blade of solar powered lawn mower ,the force required for effective mowing should be greater than 10 newton.

A stainless steel is used in the construction of the cutting blade because of its strength and weight which can transmit same speed as that of DC motor or a little less cause of friction.

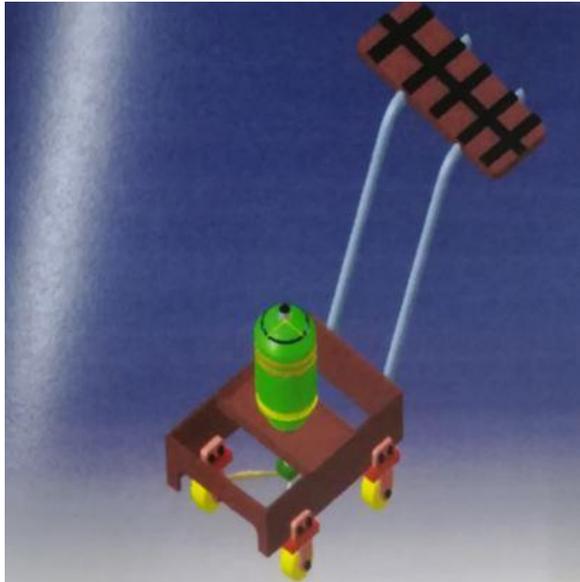


fig.2 CATIA design of the mover

Calculations-

Dimensions of the blade-

Length = L = 450mm

Breadth = B = 40mm

Thickness = T= 1mm

Density = 7992 kg/m³

Selected motor speed = n =600 rpm

Acceleration due to gravity = g= 9.8 m/s²

Volume of blade = L * B * T

$$V= 0.45*0.04*0.001 = 1.8* 10^{-5} m^3$$

2) mass of the blade = Density * volume

$$= 7792 * 1.8* 10^5 =0.14 kg$$

3) Weight of Blade= W = mg

$$= 0.14*9.81 = 1.4 N$$

4) Angular velocity of the Blade = $\omega = 2\pi n/60$

$$= 62.83 \text{ rad/sec}$$

5) Torque = T = r * W

$$= 225 * 1.4 =315 \text{ N-mm}$$

6) Power = T * ω

$$=315*62.83*10^{-3} =19.8 \text{ watt}$$

Thus power required to motor for driving the blade at selected speed and dimensions is 19.8 watt.



Fig 3. Actual model of the lawn mower

Component list-

Sr No.	Component	quantity
01.	Solar panel (10 watt)	2
02.	Battery (12V 7.5Ah)	1
03.	DC motor(500rpm, Torque-15kg-cm)	1
04.	Charging circuit	1
05.	Cutter	1
06.	wheel	4

Advantages-

1. Pollution free
2. Low cost of operation
3. Simple in construction
4. Efficiency is high than usual mowers

Applications-

1. Used in gardens
2. Used in playgrounds
3. Roadside grass and small plants cutting
4. Nursery applications

3. CONCLUSIONS

In the world today , all machines are designed with the aim of reducing or eliminating greenhouse gas emissions which is the major causes of climate change. This solar powered lawn mower will meet the challenge of environment production and low cost of operation since there is no cost for fueling. A solar powered lawn mower has been developed for the use of residences and establishments that have lawns where tractor driven mowers could not be used. The machines capacity is adequate for its purpose. The machine has proved to be a possible replacement for the gasoline powered lawn mowers.

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