

DESIGN AND ANALYSIS OF SOLAR GRASS CUTTER

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Abstract: A Solar grass cutter is a machine that uses sliding blades to cut a lawn at an even length. Even more sophisticated devices are there in every field. Power consumption becomes essential for future. Solar grass cutter is a very useful device which is very simple in construction. It is used to maintain and upkeep lawns in gardens, schools, college's etc. We have made some changes in the existing machine to make its application easier at reduced cost. Our main aim in pollution control is attained through this. Unskilled operation can operate easily and maintain the lawn very fine and uniform surface look. In our project, Solar grass cutter is used to cut the different grasses for the different application.

Index Terms –Solar Grass cutter, surface look ,machine.

I. INTRODUCTION

Moving the grass cutters with a standard motor powered grass cutters is an inconvenience, and no one takes pleasure in it. Cutting grass cannot be easily accomplished by elderly, younger, grass cutter moving with engine create noise pollution due to the loud engine, and local air pollution due to the combustion in the engine. Also, a motor powered engine requires periodic maintenance such as changing the engine oil. Even though electric solar grass is environmentally friendly, they too can be an inconvenience. Along with motor powered grass cutter, electric grass cutters are also hazardous and cannot be easily used by all. Also, if the electric grass cutter is corded, mowing could prove to be problematic and dangerous. The prototype will also be will be charged from sun by using solar panel Solar energy is radiant energy that is produced by sun. Every day the sun radiates, or sends out, an enormous amount of energy. The sun radiates more energy in one second than people have used since the beginning of time. Where does the energy come from that constantly is being radiated from the sun? It comes from within the sun itself. Like other stars, the sun is a big ball of gases- mostly hydrogen and helium atoms. The hydrogen atoms in the sun's core combine to form helium and generate energy in a process called nuclear fusion. During nuclear fusion, the sun's extremely high pressure and temperature causes hydrogen atoms to come apart and their nuclei (the central cores of the atoms) to fuse to become one.

II. MODELING DESIGN IN PROE:

The software that will be used in this project are PROE and ANSYS. PROE will be used for designing the 3D model of the Solar Grass Cutting Machine. The ANSYS will be used to analysis of the solar grass cutter. (as shown in fig.

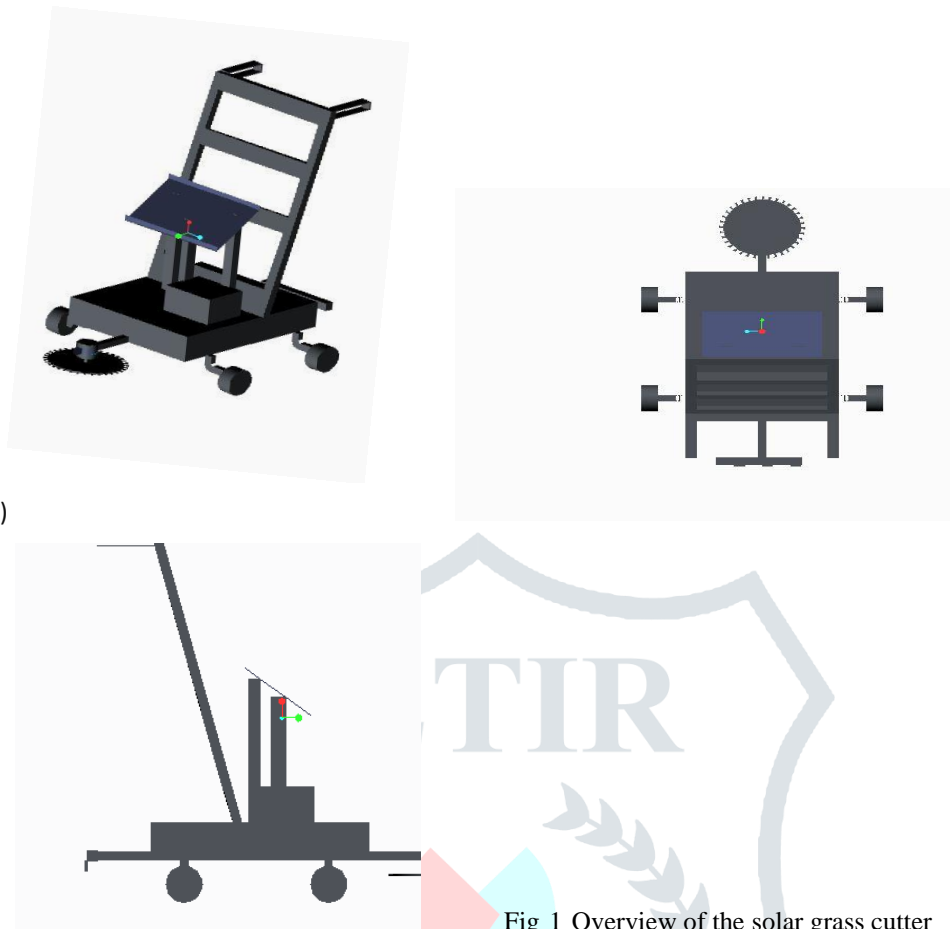


Fig 1 Overview of the solar grass cutter

III. DESIGN AND CALCULATIONS:

The project is designed to use the renewable source of energy as in solar energy and use it to drive a cutter fitted with different accessories and cut the lawn grasses and collect it too. The grass cutting blade of spiral shape is linked with the spur gear mechanism which is driven by a battery where the charge is stored via solar panel. The cutting blades are covered with a sheet metal so as not to let the cut grasses spread away and also a sheet metal basket is kept at the back end where the cut out grasses are collected. The whole structure is supported in a frame work of metal rods. Solar panel is fixed in the structure and is charged when the system is not working and the charge thereby is transferred to the battery by the circuit. The proposed design of the model is shown in the figure. For the starting up design, the sketch up software as shown in the Fig. 4 was used to build the body frame, which would allow it to know the dimensioning for the basket to hold the grasses and that for the blade section. Even though the real fabrication of the part is varying the original design, the main structure was retained from this preliminary concept. The main structure holds the chassis, the basket, blades, spur gears, solar panel. The main variation from the design was the placement of the solar panel which was fixed in the body

Force required by cutting blade to shear the grass is given by;

$$F = T/R \dots (1)$$

Where,

T = Shaft torque

R = Radius of cutting blade But shaft torque is given by;

$$T = P/2\pi N \dots (2)$$

Electrical Power is given by; $P = I * V \dots (3)$

Torque of motor is given by; $P = 2\pi INT / 60 \dots (4)$

$$T = (P * 60) / (2\pi IN)$$

3.1 Design Parameter

3.1.1. Selection of electric motor

A) DC motor SPEED (N) = 1250

B) RPM VOLTAGE (V) = 12 VOLT

C) WATTS = 18 WATT

3.1.2. Torque of the motor

A) Torque (T) = $(P \times 60) / (2 \times 3.14 \times N)$

$$= (18 \times 60) / (2 \times 3.14 \times 1250)$$

$$= 0.1375 \text{ Nm}$$

i.e. Torque = 137.5 N-mm

B) The shaft is made of MS and its allowable shear stress = 42 MPa

3.1.3. Electrical (electric) power equation

A) Power (P) = $I \times V$

Where, V = 12 V

$$P = 18 \text{ W}$$

Then, $I = 18/12 = 1.5 \text{ A}$

3.1.4. Solar panel calculation

A) VOLT = 18 V

B) WATT=10W

C) $W = V \times I$

$$10 = 12 \times I$$

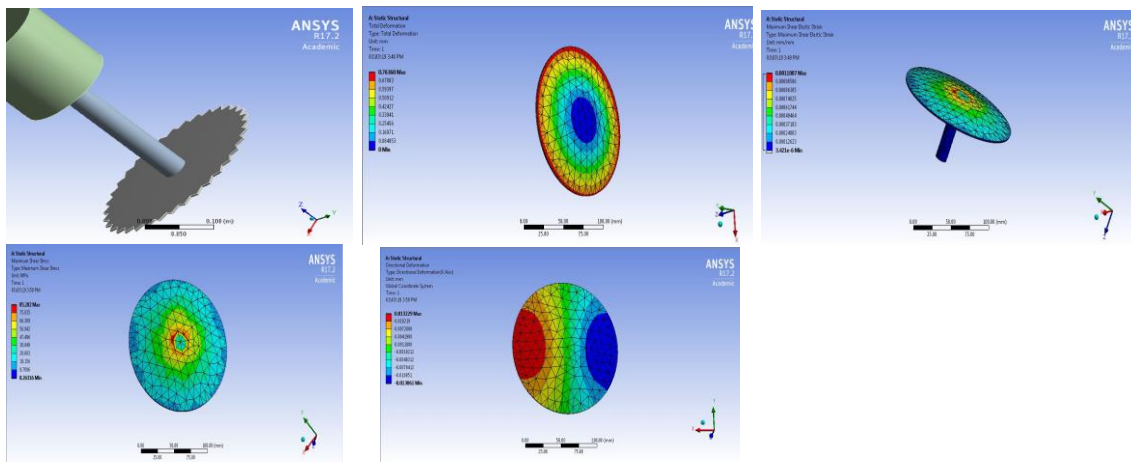
$I = 10/12 = 0.833 \text{ A}$ i.e.

$$I = 833 \text{ mA}$$

IV.RESULTS AND DISCUSSION:

EXPERIMENTAL ANALYSIS USING ANSYS:

THERMAL ANALYSIS ON BLADE:



Material Data

Alternating Stress Pa	Cycles	Mean Stress Pa
3.999e+009	10	0
2.827e+009	20	0
1.896e+009	50	0
1.413e+009	100	0
1.069e+009	200	0
4.41e+008	2000	0
2.62e+008	10000	0
2.14e+008	20000	0
1.38e+008	1.e+00 5	0
1.14e+008	2.e+00 5	0
8.62e+007	1.e+00 6	0

TABLE 1
Structural Steel > Strain-Life Parameters

Strength Coefficient Pa	Strength Exponent	Ductility Coefficient	Ductility Exponent	Cyclic Strength Coefficient Pa	Cyclic Strain Hardening Exponent
9.2e+008	-0.106	0.213	-0.47	1.e+009	0.2

TABLE 2
Structural Steel > Isotropic Elasticity

Temperature C	Young's Modulus Pa	Poisson's Ratio	Bulk Modulus Pa	Shear Modulus Pa
	2.e+011	0.3	1.6667e+011	7.6923e+010

TABLE 3
Structural Steel > Isotropic Relative Permeability

Relative Permeability
10000

CONCLUSION:

A Solar Grass Cutting Machine with several features has been proposed. Several related works has been studied in order to gain idea on how to build an Wireless Operating Solar Grass Cutting Machine.. All the technique used are mainly aim for the shortest path, consume less energy.The performance of this machine is slightly away from the desired requirement.Therefore some recommendation has been list out for future improvement.

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