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Fabrication of Solar Grass Cutter

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ABSTRACT

The present technology commonly used for cutting the grass is by using the manually handle device. The project aims to fabricate a grass cutting machine system which runs with the help of motor by using the solar energy. The battery can be charge by using power supply and solar panel. Power plays a great role wherever man lives and works. The living standard and prosperity of a nation vary directly with the increase in the use of power. The electricity requirement of the world is increasing at an alarming rate due to industrial growth, increased and extensive use of electrical gadgets. The best alternative source is solar energy.

Keywords: Solar Panel, Solar charger (controller), DC motor, Blades, Battery.

I. INTRODUCTION

In the time where technology is merging with environmental awareness, consumers are looking for ways to contribute to the relief of their own carbon footprints. Pollution is manmade and can be seen in our own daily lives, more specifically in our own homes. Gas powered lawn mower are in 90% of U.S. home and they create 5% of the total U.S. pollution. And also for electrically powered mowers it consumes large amount of energy for the working. Nowadays everything going under automation so here also I tried to reduce the human effort for the mowing job. Green technology initiatives are being support by both the government and cooperates business. Our new design for an old and outdated habit will help both the consumer and the environment. This grass cutting device is solar powered which gets charged its battery while moves on the lawn from sunlight and also we can charge it manually from main supply.

Grass cutter machines have become very popular today. Most common machines are used for soft grass furnishing. In our project Grass cutter machine we are aimed to develop for operation and construction. The main parts of the Grass cutting machines are DC motor of .75HP capacity, relay switch for controlling motor, Battery for charging it through solar panel. It is placed in a suitable machine structure. The motor have 8000 rpm and it is connected to the electric supply by the use of a roll of wire. Motor controlled by an electric switch for easy operation. The tempered blades are attached in this machine. The raw materials mainly used are motor, switch, wheel, wire, solar panel, battery, square pipe, paint, and other standard item like nuts, bolts and reverts. The machines required for manufacturing includes welding machine, grinding machine etc.

Working principle of the grass cutter is providing a high speed rotation to the blade, which helps to cut the grass. The blade will get kinetic energy while increasing the rpm. The cutting edges are very smooth and accurate. Also Electric Grass Cutting Machines are much easier to be used in garden, lawn and grass fields. In order to enhance the beauty of home-lawns and gardens, Grass cutting machines are the best available option in the industry. With the help of a lawn mower which is a machine with revolving blades to help us cutting lawns at even length, people can easily maintain and beautify their lawns and gardens without any hassle.

Now-a-days, there are plenty of options starting from the simplest push along mower to the most advanced electric grass cutting machine. According to world en¬ergy report, we get around 80% of our energy from con¬ventional fossil fuels like oil (36%), natural gas (21%) and coal (23%). It is well known that the time is not so far when all these sources will be completely exhausted. So, alternative sources should be used to avoid energy crisis in the nearby future.

So introduce solar energy for the machine process to work. A solar panel is a large flat rectangle, typically somewhere between the size of a radiator and the size of a door, made up of many individual solar energy collectors called solar cells covered with a protective sheet of glass. The cells, each of which is about the size of an adult's palm, are usually octagonal and colored bluish black. Just like the cells in a battery, the cells in a solar panel are designed to generate electricity; but where a battery's cells make electricity from chemicals, a solar panel's cells generate power by capturing sun¬light instead.

II. METHODS AND MATERIAL

Solar Energy

Solar energy is very large, inexhaustible source of energy. The power from the sun interrupted by earth is approximately 1.8/10MW, which are many thousands of times larger than the present consumption rate on the earth of all energy sources. The quantum of energy India's land area receive from sun is equivalent to 15,000 time sits consumption requirement (500 billion kWh) as projected for 2004. In addition to its size, solar energy has two other factors in its favor. Firstly, unlike fossil fuels and nuclear power, it is an environmentally clean source of energy. Secondly, it is free and available in adequate quantities in almost all parts of the world people live. But there are some problems associated with its. The real challenge in utilizing solar energy is of and economic concern. One has to strive for the development of cheaper methods of collection and storage so that large initial investments required at preset in most applications are reduced, solar energy in India:

A large amount of solar radiation fall on India and for most of the country very few days are without sunshine. India lies within the latitude of 7 N to and 37 N with annual average intensity of solar radiation as500 to 600 cal/cm/day with more such insulations available in arid and semi-arid regions. Average solar radiation falling on India in arid and semiarid regions is 7.5 K w h/m/day. Solar energy 5× 10 K w h/year potential to meet basic energy needs of teeming millions who live in rural India. Solar energy is an important, clean, cheap and abundantly available renewable energy. The sun radiates heat and light. The heat, light received from the sun supports the environment on the earth through the following well known natural effects.

- Temperature balance on the earth
- Photo-synthesis by biological plants production of oxygen and organic materials, production of organic chemicals and bio-mass.
- Wind due to unequal heating of water, land surfaces.
- Heating of ocean water: ocean thermal energy (OTEC)
- Waves in ocean: ocean wave energy
- Tides in ocean: ocean tidal energy (due to gravitational forces)

The sun produces enormous amount of energy of heat and light through sustained nuclear fusion reactions. The solar energy received on the earth in the form of radiation is used for heating and producing an electrical energy.

Among the non-conventional sources of energy solar energy is the most promising. Hence our project is based on the solar energy conversion to mechanical energy to run a normal grass cutter.

Table 1: Comparison

Sl. No	SOLAR SYSTEM	FUEL SYSTEM
1	Totally free from pollution	Pollution is a great factor
2	No fuel consumption	Fuel is the important need
3	No. of reciprocating parts are less	No. of reciprocating parts are more
4	Friction is greatly reduced	Frictions between the parts are high.
5	Low cast and maintenance	Maintenance is difficult & costly
6	Load carrying capacity is low	Load carrying capacity is high
7	Continuous ride for hours together is not possible	Continuous ride is possible
8	Ratio of speed reduction more when weight increases very much	Speed reduction ratio is less and it does not vary

Components Used

The main components of the solar powered grass cutter are,

1. Solar panels
2. Battery
3. DC motor
4. Blades
5. Solar charger

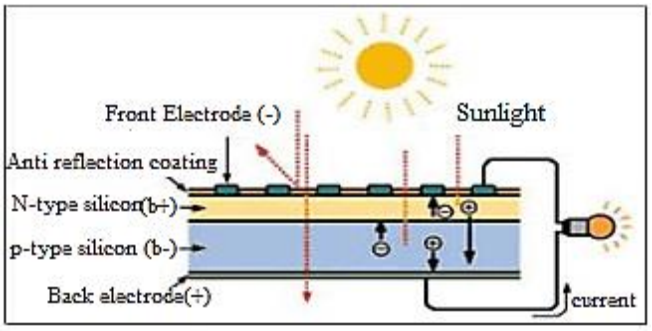
This are explained below one by one

1. Solar Panel

1.1 Photovoltaic Principles

The photo- voltaic effect can be observed in nature in a variety of materials that have shown that the best performance in sunlight is the semiconductors as stated above. When photons from the sun are absorbed in a semiconductor, that create free electrons with higher energies than the created there must be an electric field to induce these higher energy electrons to flow out of the semi-conductor to do useful work. A junction of materials, which have different electrical properties, provides the electric field in most solar cells for the photon interaction in a semiconductor. A solar cell consists of

1. Semi –conductor in which electron hole pairs are created by the absorption of incident solar radiation.
2. Region containing a drift field for charge separation.
3. Charge collecting front and back electrodes.



1.2 Photovoltaic Effect

The photo-voltaic effect can be described easily for p-n junction in a semi-conductor. In an intrinsic semi-conductor such as silicon, each one of the four valence electrons of the material atom is tied in a chemical bond, and there are no free electrons at absolute zero. If a piece of such a material is doped on one side by a five valance electron material, such as arsenic or phosphorus, there will be an excess of electrons in that side, becoming an n-type semi-conductor.

The excess electrons will be practically free to move in the semi-conductor lattice. When a three valance electron material, such as boron dopes the other side of the same piece, there will be deficiency of electrons leading to a p-type semi-conductor. This deficiency is expressed in terms of excess of holes free to move in the lattice. Such a piece of semi-conductor with one side of the p-type and the other, of the n-type is called p-n junction. In this junction after the protons are absorbed, the free electrons of the n-side will tends to flow to the p-side, and the holes of the p-side will tend to flow to the n-region to compensate for their respective deficiencies. This diffusion will create an electric field from the n-region to the p-region. This field will increase until it reaches equilibrium for voltage, the sum

of the diffusion potentials for holes and electrons. If electrical contacts the connected through an external electrical conductor, the free electrons will flow from the n-type material through the conductor to the p-type material as shown in the figure. Here the free electrons will enter the holes and become bound electrons thus both free electrons and holes will be removed. The flow of electrons through the external conductor constitutes an electric current, which will continue as long as move free electrons and holes are being formed by the solar radiation. This is the basis of photo-voltaic conversion that is the conversion of solar energy into electrical energy. The combination of n-type and p-type semiconductors thus constitutes a photo-voltaic cell or solar cell. All such cells some rate direct current that can be converted into alternating current it desired. The photo-voltaic effect can be observed in almost any junction of material that have different electrical characteristics, but the best performance to date has been from cells using semiconductor material especially all of the solar cells used for both space and terrestrial applications have been made of the semiconductor silicon. Future cells may use such materials as the semiconductors like Gallium arsenate, copper sulphate cad sulphide etc. The device used to utilize the photovoltaic effect is solar cell.

1.3 Specifications

Array size : 35×30 cm Maximum Power : 10W Maximum Voltage : 16.5V Maximum Current : 2.9A No of modules : 1 Type : Poly crystalline

2. Battery

The batteries are used as a storage device for solar energy which can be further converted into electrical energy. The only exceptions are isolated sunshine load such as irrigation pumps or drinking water supplies for storage, for small units with output less than one kilowatt. Batteries seem to be the only technically and economically available storage means. Since both the photo- voltaic system and batteries are high in capital costs, it is necessary that the overall system be optimized with respect to available energy and local demand pattern. To be economically attractive the storage of solar electricity requires a battery with following particular combination of properties:

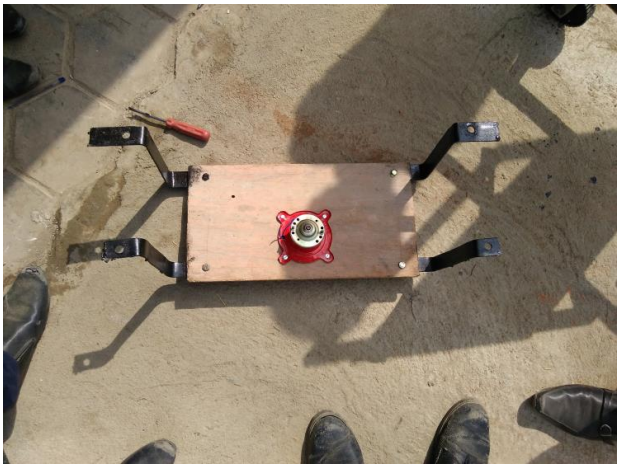
(1) Low cost
(2) Long life
(3) High reliability
(4) High overall efficiency

3. DC Motor

In the presented idea for grass cutter model we used DC motor interfaced with blades for cutting grass when operated. A dc motor uses electrical energy to produce mechanical energy, very typically through the interaction of magnetic fields and current-carrying conductors. The input of a DC motor is current/voltage and its output is torque (speed).

DC motor has many novel linear and rotary motors and at least one self-powering magnetic rotary device in motor uses a bidirectional “two particle” theory of magnetic flux showing the internal bidirectional energy flows in all potentials and fields. The motor utilizes controlled spin-waves and self-initiated precise ex-change forces, which are known to momentarily produce bursts of very strong force fields. In short, the motor

used to produce precisely located and directed sudden magnetic forces, using self-initiated nonlinear magnetic phenomena.

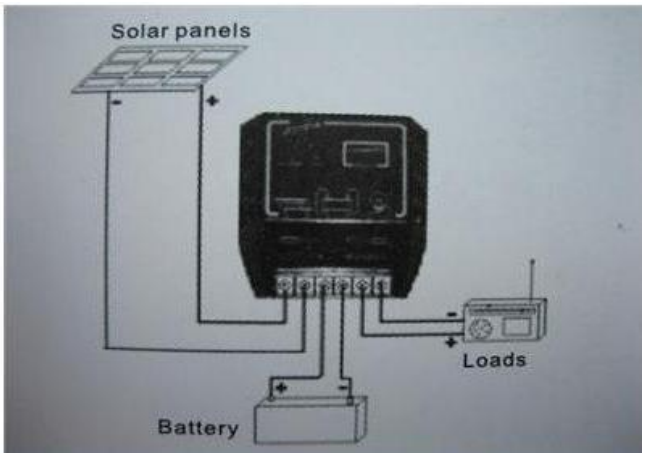


4. Blade

5. Solar Charger

The power charge regulator is also known as charge controller, voltage regulator, charge-discharge controller or charge-discharge and load controller. The regulator sits between the array of panels, the batteries, and the equipment or loads.

By monitoring the voltage of battery, the regulator prevents overcharging or over discharging. Regulators used in solar applications should be connected in series: they disconnect the array of panels from the battery to avoid overcharging, and they disconnect the battery from the load to avoid over discharging. The connection and disconnection is done by means of switches which can be of two types: electromechanical (relays) or solid state (bipolar transistor).



Solar chargers should never be connected in parallel. In order to protect the battery from gasification, the switch opens the charging circuit when the voltage in the battery reaches its high voltage disconnects (HVD) or cut-off set point. The low voltage disconnects (LVD) prevents the battery from over discharging by disconnecting the load. The most modern regulators are also able to automatically disconnect the panels during the night to avoid discharging of the battery. They can also periodically overcharge the battery to improve their life, and they may use a mechanism known as pulse width modulation (PWM). Solar charger has three light indicators. The first light blinks when the batteries are charging by using solar energy. The second light glows when the charging in the batteries is very low. The third light glows when the batteries are fully charged and an extra load (charging) is applied on the batteries.

III. RESULTS AND DISCUSSION

Design Analysis

The shearing force of most annual and perennial grasses found on most lawns is usually between 9.2N ~ 11.51N

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

Assume F = 11 N

$$F = T/R$$

Where T = Shaft torque;

R = Radius of cutting blade=12cm

$$T = F \times R$$
$$T = 11 \times 0.12$$
$$T = 1.32 \text{ Nm}$$

But shaft power is given by;

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

Where P = Power developed by shaft;
T = Torque required; and
N = Shaft speed in Rev/min = 8000 rpm

$$P = \frac{2\pi NT}{60} = 2\pi NT/60$$
$$P = \frac{2 \times \pi \times 8000 \times 1.32}{60}$$
$$P = 1105.84 \text{ watt}$$

1 Selection of electric motor:

1.1 8000 RPM DC motor

SPEED = 8000 RPM
VOLTAGE = 12 VOLT
WATTS = 1105.84 WATT

1.2 Electrical (electric) power equation:

Power $P = I \times V$
Where
V = 12
W = 18
I=18/12=1.5 A
H.P = .02414

1.3 Solar panel calculation:

VOLT = 16 V
WATT =10 W
W = V X I
10= 16 X I
I = 0.625
I = 625ma

1.4 Battery calculation:

BAH /CI = 7.2 ah/625ma = 11.5hrs
To find the Current
Watt = 18 w
Volt = 12v
Current =?
P= V x I
18 =12 x I
I = 18/12 = 1.5 AMPS
BATTERY USAGE WITH 1.5 AMPS

BAH /I
8/1.5 = 5.3 hrs.

IV. CONCLUSION

Our project entitled Fabrication of solar powered grass cutter is successfully completed and the results obtained are satisfactory. It will be easier for the people who are going to take the project for the further modifications. This project is more suitable for a common man as it is having much more advantages i.e, no fuel cost, no pollution and no fuel residue, less wear and tear because of less number of moving components and this can be operated by using solar energy. This will give much more physical exercise to the people and can be easily handled.

In the presented paper provides the fabricated information about the "Fabrication of Solar grass Cutter" which was designed such that the solar plate generates solar energy and utilizing this energy for running the grass cutter motor. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Thus the project has been successfully designed and tested.

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