DESIGN AND EXPERMENTAL WORK ON GRASS CUTTING MACHINE USING SOLAR ENERGY

Nagendra Akula[1],Dr. K. Rajagopal[2]
Research Scholar, JNTUK. Assoc. professor in mechanical engineering, St. Peter's engineering college [1]
Professor of mechanical engineering (Rtd), JNTUH, Hyderabad [2].

Abstract: Grass cutter machines have become very popular to-day. Most common machines are used for soft grass furnishing. In our project Grass cutter machine is aimed to Design and develop for operation and construction. The main parts of the Grass cutting machines are DC motor of 12V capacity, relay switch for controlling motor, Battery for charging it through solar panel. It is placed in a suitable machine structure. The motor has 1000 rpm and it is connected to the electric supply by the use of a roll of wire. The motor rpm increased by the help of gears. Motor controlled by an electric switch for easy operation. To 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. They are sometimes called photovoltaic cells because they use sunlight ("photo" comes from the Greek word for light) to make electricity (the word "voltaic" is a reference to electricity pioneer Alessandro Volta). The blade sits within a casing called a deck, which keeps the grass and other objects from flying in all directions when struck. The basic version of a rotary mower has a handlebar attached to it that the operator stands behind and pushes to make it move forward.

Keywords: Solar energy, electric motor, lades, deck, solar cells.

I. INTRODUCTION

1. Introduction of Elements

1.1 Rechargeable Battery :

Solar power can be stored in the rechargeable battery and can be further used for the grass cutting machine to run. A rechargeable battery, storage battery, or ac-accumulator is a type of electrical battery. It comprises of one or more electrochemical cells, and is a type of energy accumulator.

1.2 Relay:

A relay is an electrically operated switch. We use it in the grass cutting machine model for controlling the motor connected to blades as a switch. Many relays use an electromagnet to operate a switching mechanism, but other operating principles are also used. Re-lays find applications where it is

necessary to control a circuit by a low-power signal, or where several circuits must be controlled by one signal.

Fig : 1 Grass cutter

A Solar grass cutter is a machine that uses spiral roller blades to cut a lawn at a faster rate. Solar grass cutter can operate manually and motor driven. Reel cutter of the grass cutter is given adjustable height. 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 .we added remote control for unskilled person 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.

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 favour. 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.

II. WORKING PRINCIPLE

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.

Solar photovoltaic cells are essentially semi-conductors, which have electrical transmission properties like metal or salt water and insulators like rubber. Panels are constructed with sheets of doped silicon, primary element in beach sand with impurities added like phosphorus that allows electrons to flow. When the protons from the solar energy hit a photovoltaic cell, a flow of electrons starts which can be drawn off by a pair of wires, thereby creating direct current. A number of solar cells electrically connected to each other and mounted in a support structure or frame is called a photovoltaic

module. Modules are designed to supply electricity at a certain voltage. The current produced is directly dependent on how much light strikes the module.

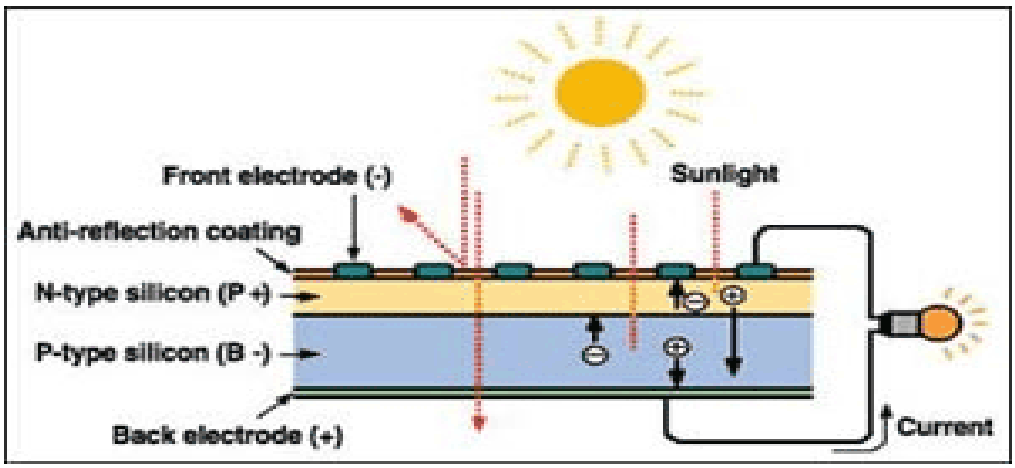

Fig .2.1

III. LITERATURE REVIEW

A Solar grass cutter is that uses 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, colleges etc.

Rapid growth of various high-tech tools and equipment's makes our jobs done comfortable and sophisticated. The project aims is that a grass cutter system. Which makes the grass cutter based motor running through solar energy. Power plays a great role wherever man lives and works.The cutting is made of a flat blade rigidly fixed to the shaft of the dc motor to rotate the blades of cutter. The cutting effectiveness was achieved with a total power of 934.3watts at a rotary speed of 1500rpm of shaft. For designing of Lawn Cutter we referred various literature, papers etc. The review of previous method used given below: In this lawn mower uses an solar based energy source, which is easier to use, more advantageous comparing to other energy source especially for gas based source of power But our lawn cutter is not based on solar because of its cost and may create some complexity during working. So we avoided solar powered lawn mower. In this hydrogen based lawn mower, the advantage of powering a lawn mower by hydrogen rather than by gasoline is mainly ecological. We not used this for our lawn cutter because it is very old method and many overcome produced from this type lawn cutter. The self-powered design objective is to come up with a mower that is portable, durable, easy to operate and maintain. It also aims to design a self-powered mower of electrical source; a cordless electric lawn mower. The heart of the machine is a battery-powered dc electric motor. It is also useful method for our

lawn mower. It is similar to our lawn cutter using display and keypad. The present technology commonly used for trimming the grass is by using the manually handle device. In this project we have automated the machine for trimming the grass.

IV. LIST OF COMPONENTS

4.1 Components list

S.no	Item	Quantity	Remark
1.	DC motor	2	Rotating the blade
2.	Resistor	1	Resist the flow of cutter
3.	Battery	1	Power supply for motors
4.	Solar panel	2	Power supply for batteries
5.	Cutting blades	6	stainless steel resist wear
6.	Bag	1	To carry the equipment
7.	LED light	2	To lighting at dark time
8.	Nuts & Bolts	10	To joint the parts
9.	Male & Female joints	5	To connect the wires
10.	Switches	3	To ON & OFF of the circuit
11.	PVC pipes	6	Structural

Table 1: Components list for solar charged plant cutter


Components
Elbow
MALE JOINTS
FEMALE JOINTS
STRAIGHT JOINT
BATTERY
BATTERY CHARGER
12V SOLAR PANNEL
12V DC MOTOR
SWITCHES
T- JOINT

4.1. Solar panel

A **solar panel** is a set of solar photovoltaic modules electrically connected and mounted on a supporting structure. A photovoltaic module is a packaged, connected assembly of solar cells. The solar panel can be used as a component of a larger photovoltaic

system to generate and supply electricity in commercial and residential applications. Each module is rated by its DC output power under standard test conditions (STC), and typically ranges from 100 to 320 watts. The efficiency of a module determines the area of a module given the same rated output - an 8% efficient 230 watt module will have twice the area of a 16% efficient 230 watt module. A single solar module can produce only a limited amount of power; most installations contain multiple modules.

A photovoltaic system typically includes a panel or an array of solar modules, an inverter, and sometimes a battery and solar tracker and interconnection wiring. Polycrystalline PV cells connected in a solar module. Solar modules use light energy (photons) from the sun to generate electricity through the photovoltaic effect.

Fig .4.1 solar panel

4.2. Battery:

. Batteries are composed of one or more cells, each containing a positive electrode, negative electrode, separator, and electrolyte. Cells can be divided into two major classes: primary and secondary. Primary cells are not rechargeable and must be replaced once the reactants are depleted. Secondary cells are rechargeable and require a DC charging source to restore reactants to their fully charged state. Examples of primary cells include carbon-zinc (Leclanche or dry cell), alkaline-manganese, mercuryzinc, silver-zinc, and lithium cells (e.g., lithium-manganese dioxide,

lithium-sulphur dioxide, and lithiumthionyl chloride). Examples of secondary cells include lead-lead dioxide (lead-acid), nickel-cadmium, nickel-iron, nickel-hydrogen, nickel-metal hydride, silver-zinc, silver-cadmium, and lithium-ion. For aircraft applications, secondary cells are the most prominent, but primary cells are sometimes used for powering critical avionics equipment (e.g., flight data recorders).

4.4. Male & Female dc joints:

In electrical and mechanical trades and manufacturing, each half of a pair of mating connectors or fasteners is conventionally assigned the designation male or female. The "female" connector is generally a receptacle that receives and holds the "male" connector. On occasion, the terms "male" and "female" are respectively referred to as the A and B ends, though the names of some standards conflict with this as they contain the letters A or B within the name; unambiguous, though rare, terms include plug and socket or jack.

Fig .4.4.male & female dc joints

4.6. Cutting blades:

Cutter blades are the cutting components of grass cutter. They are usually made of stainless steel metals as they must be able to withstand high-speed contact with a variety of objects in addition to grass. The materials used (as well as size, thickness, and design of the blades) vary by manufacturer. Thickness of cutting blades is 3mm.lenght is 12mm.The cutter consist of 3 blades.

Fig.4.6.cutting blades

4.7. Dc Motor :DC motors were the first type widely used, since they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight motor used for portable power tools and appliances.

Larger DC motors are used in propulsion of electric vehicles, elevator and hoists, or in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications.

Fig .4.7 Dc motor

V. PROPOSED DESIGN OF PLANT CUTTER

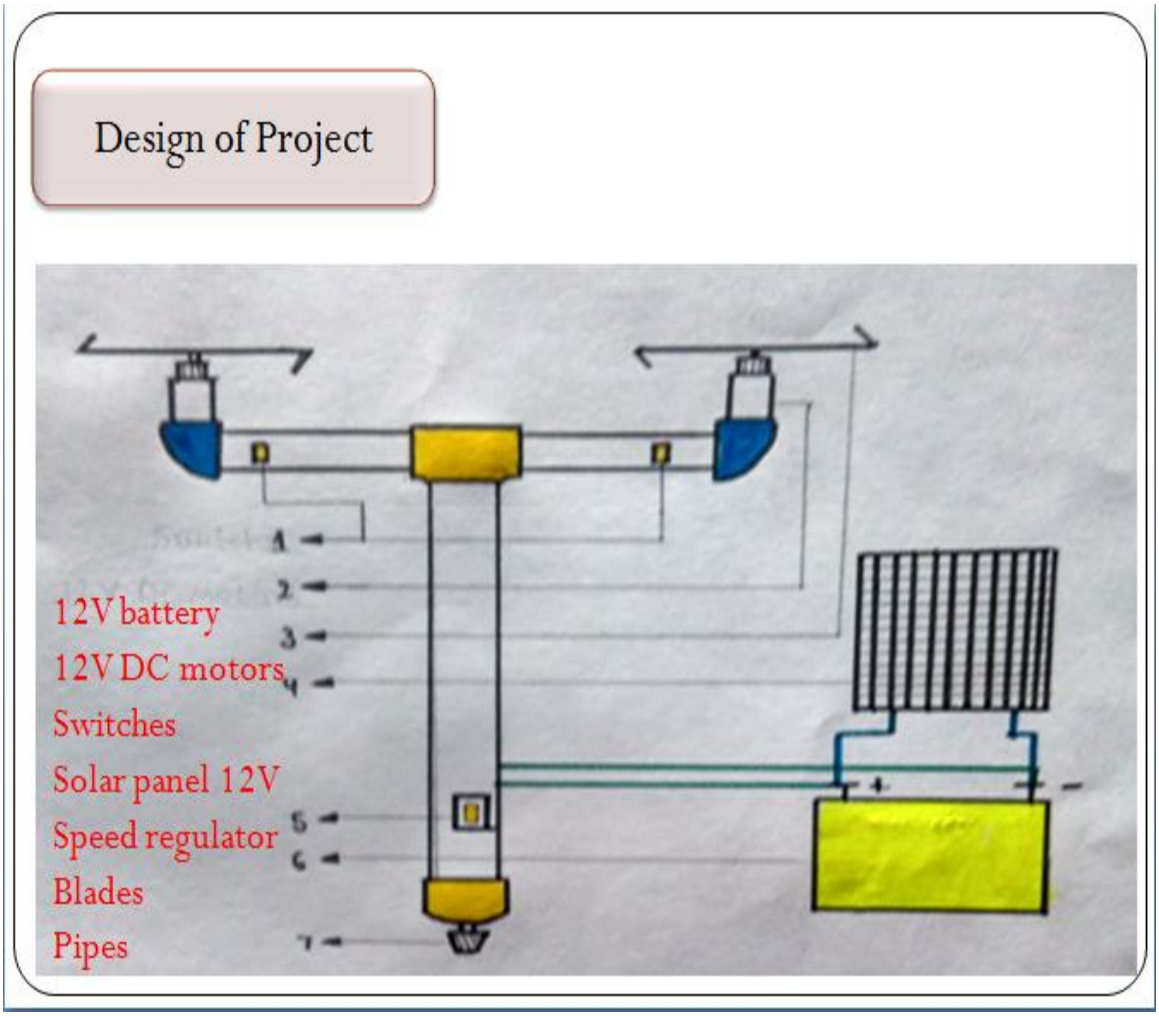

Fig 5.1 design diagram

5.1. Operation principle:

Electrical energy of the battery is converted to mechanical energy through a set of blades designed to achieve cutting operation. The electric circuit ensures power transfer from the battery

to run the D.C. motor, whilst the solar panel power to continuously recharge the battery while in operation. The cutting blades tap power from the D.C. motor. When the power switch is on, the electrical energy from the battery powers the motor which in turn actuates the blades. The solar panel generates current to recharge the battery, thereby compensating for the battery discharge. The rotating blades continuously cut the grass as the Operating by the hand. And it consists of LED lights it used to work at dark time.

Fig .5.0 Cutter design

VI. DESIGN, CALCULATIONS, GRAPHS

6.1 Formulas and graph:

P= (2ΠNT)/60

P – POWER

N-SPEED

T - TORQUE

For Solar Panel

Duration (AM/PM)	Power(volts)	Torque (N-m)	
		Blade – 1	Blade – 2
9:00	12.8	0.0614	0.1621
10:00	13.2	0.1024	0.1575
11:.00	13.8	0.1038	0.1607
12:00	14.2	0.1043	0.1576
1:00	15.1	0.1068	0.1602
2:00	14.3	0.1050	0.1587
3:00	13.6	0.1047	0.1623
3:30	13.1	0.1060	0.1692

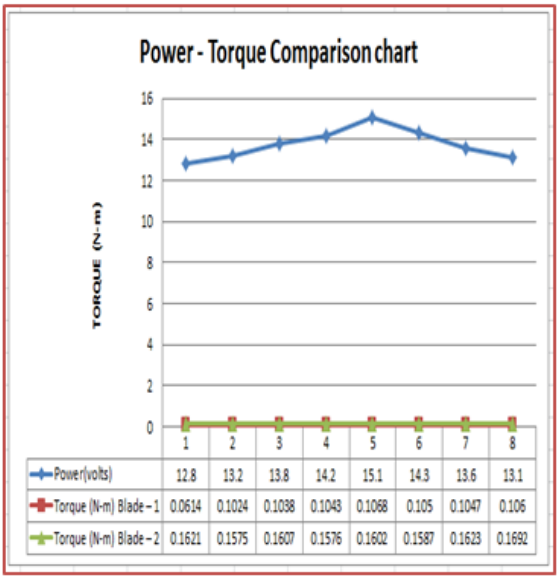

Table .6.1

For Solar Panel

Duration (AM/PM)	Power(volts)	Speed of motor (RPM)	
		Blade – 1	Blade – 2
9:00	12.8	1990	750
10:00	13.2	1230	800
11:.00	13.8	1269	820
12:00	14.2	1300	860
1:00	15.1	1350	900
2:00	14.3	1300	860
3:00	13.6	1240	800
3:30	13.1	1180	740

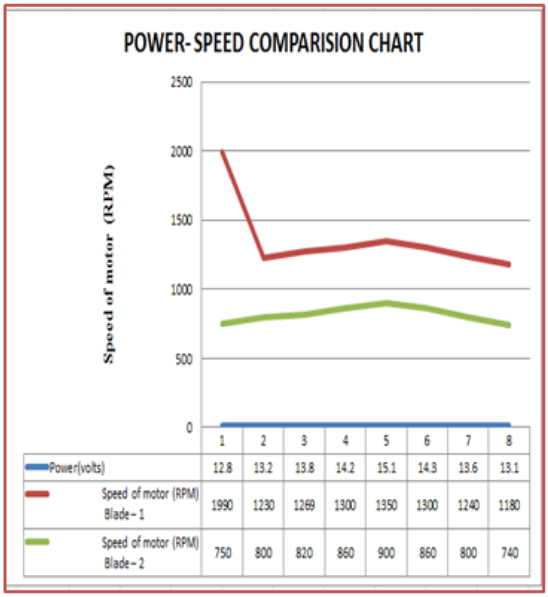

Table .6.2

With Battery :

S.No	Blade – 1	Blade – 2	Power(volts)	Torque (N-m)	
1.	2100	1300	12	B1- 0.054	B2- 0.088

Table .6.3

Cutter Advantages & Limitations

Advantages:

1. Easy to move from one place to another place.
2. Compact size and portable.
3. Operating principle is simple.
4. Non-skilled person also operate this machine.
5. It can be easily disassemble.
6. Cutter can be used at dark time also by using LED lights.

Limitations

1. Large time required to remove the grass
2. Manually operated
3. Difficult to operate in rainy seasons

Applications

1. Garden works.
2. Play grounds.
3. Colleges, school.
4. Fields.

VII. METHODOLOGY

Methodology:

The Solar grass cutter is made up of an induction motor, a battery, an solar panels three collapsible blades. The power and charging system comprises of an alternator which charges the battery while in operation. The D.C. motor forms the heart of the machine and provides the driving force for the collapsible blades. This is achieved by the combined effect of mechanical action of the cutting blades.

. The system is powered by an electrical switch which completes the circuit comprising the induction motor and the battery. And cutter can be disassemble parts of the equpiment to carry easily to any place. And cutter consists of one LED light it is used to work at dark times.

Assembly:

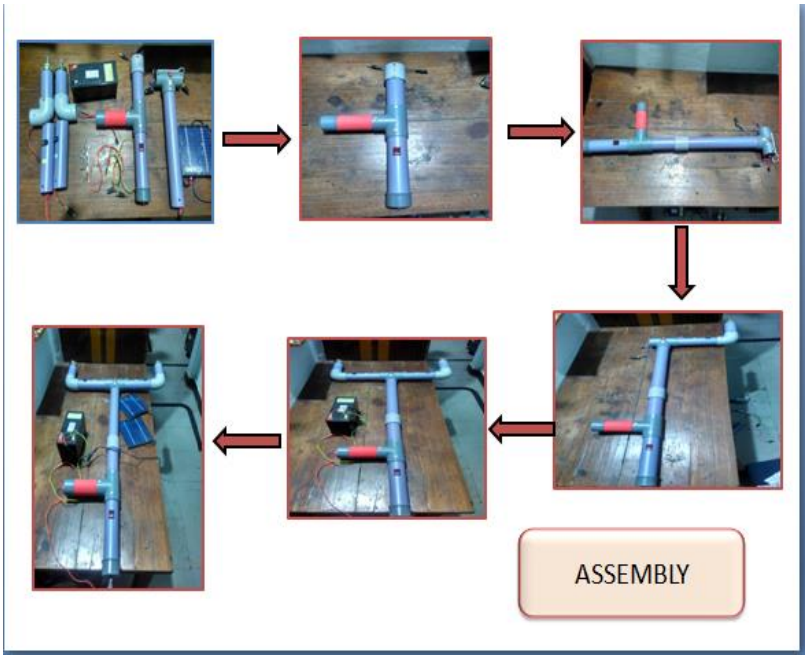

Fig. 7.1. Assembly

VIII. CONCLUSION

1. Robotics is very vast field which comes with different combinations of technology this will helps to reduce the human effort and gives maximum m efficient output for the work.

2. Nowadays lot of energy is wasted for mowing lawn in different areas of the world and also takes lots of human effort for the work.

3. The main aim of this project is to make a solar powered plant cutter system. Which will helps to mows the lawn in different design with lesser human effort.

4. Advantages of this system are used components are of low cost so and in bulk production doesn't makes any difference.

5. But the disadvantage is that sometimes the removal of grass

ACKNOWLEDGMENT

The preferred spelling of the word "acknowledgment" in American English is without an "e" after the "g." Use the singular heading even if you have many acknowledgments. Avoid expressions such as "One of us (S.B.A.) would like to thank ." Instead, write "F. A. Author thanks ... ." **Sponsor and financial support acknowledgments are placed in the unnumbered footnote on the first page**.

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