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SEMI AUTOMATED SOLAR BASED GRASS CUTTER

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Abstract: Rapid growth of various high-tech tools and equipment's makes our jobs done comfortable and sophisticated. The project aims at fabricating a grass cutting machine system which makes the grass cutter based motor running through solar energy. Due to the continuous increase in the cost of fuel and the effect of emission of gases from the burnt fuel into the atmosphere, this necessitated the use of the abundant solar energy from the sun as a source of power to drive a grass cutter. A solar powered grass cutter was designed and developed, based on the general principle of moving. 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 - cutting machine, solar energy, sliding blades

1. INTRODUCTION

The first lawn mower was invented by Edwin Budding in 1830, just outside Stroud, in Gloucestershire, England. Budding's mower was designed primarily to cut the grass on sports grounds and extensive gardens, as a superior alternative to the scythe, and was granted a British patent on August 31, 1830. In 1995, the first fully solar powered robotic mower became available. The mower can find its charging station via radio frequency emissions, by following a boundary wire, or by following an optional guide wire. This can eliminate wear patterns in the lawn caused by the mower only being able to follow one wire back to the station. A robotic lawn mower is an autonomous robot used to cut lawn grass. A typical robotic lawn mower requires the user to set up a border wire around the lawn that defines the area to be mowed.

1.1. OVERVIEW

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 panels.

1.2. AIM OF THE PROJECT

Nowadays, pollution is the major issue in the universe. In case gaspowered lawn mowers due to the emission of gases it is responsible for pollution. Also, the cost of fuel is increasing hence it is not efficient. Traditionally, lawn mowers are often clunky pieces of machinery that involve a lot of strength and energy to use. These present and high-tech grass cutters, however, have been creatively designed to make the whole landscaping process much simpler and easier for the user.

1.3. PROBLEM IDENTIFICATION

The past technology of grass cutting is manually operated by the use of hand devices like scissor, these results into more human effort and more time required accomplishing the work. Also in old methods lack of uniformity of the remaining grass. Also due to the use of engine powered machines increases the air and noise pollution also this grass cutter require maintenance. 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 specially in our own homes. Gas powered lawnmower is in 90% of India home and they create 5% of the total India pollution. Green technology initiatives are being supported by both the government and cooperates business. Our new design for an old and outdate habit will help both the consumer and the environment. In this paper, the solar-powered automatic grass cutter will relieve the consumer from mowing their own lawns and will reduce both environmental and noise pollution. This design is meant to be an alternate green option to the popular and environmentally hazardous gas-powered lawn mower. Ultimately, the consumer will be doing more for the environment while doing less work in their daily lives.

2. LITERATURE SURVEY

[1] Automated Solar Grass Cutter (February 2017)

Ms.Rutuja A. Yadav, Ms.Nayana V. Chavan, Ms.Monika B. Patil, Prof. V .A. Mane

In this paper they are trying to make a daily purpose robot which is able to cut the grasses in lawn. The system will have some automation work for guidance and other obstacle detection and the power source that is battery and a solar panel will be attached on the top of the robot because of this reduces the power problem. Automated solar grass cutter are increasingly sophisticated, are self-docking and some contain rain sensors if necessary, nearly eliminating human interaction. It works much the same as the Robomow with a boundary wire implanted at the border of your lawn.

[2] Design and Implementation of Automatic Solar Grass Cutter (April 2017)

Bidgar Pravin Dilip, Nikhil Babu Pagar, Vicky S. Ugale, Sandip Wani, Prof. Sharmila M.

This paper describes manually handled device is commonly used for cutting the grass over the field which creates pollution and loss of energy. Automatic solar grass cutter which will reduce the effort required for cutting grass in the lawns. Also solar power will be used to provide the driving force for the cutter and various sensors will be used to detect and avoid the unnecessary objects in the field during operation. It consists of microcontroller arduino ATmega328p, IR sensors, LCD display for better response and understanding to the user.

[3] Solar Based Grass Cutting (January-June 2017)

Ms. Bhagyashri R. Patil, Mr. Sagar S. Patil

For human enlargement in many countries there are studies and trials going on the solar energy and the wind energy, so they made their new concept solar power grass cutting machine. In this concept they cut the grass on the agricultural land or small plants in lawns and gardens. The design of solar powered agricultural equipment will include direct current (DC) motor, a rechargeable battery, solar panel, a stainless steel blade and control switch. The automatic grass cutting machine is going to perform the grass cutting operation by its own which means no manpower is mandatory. The purpose of the project here is to design and build a remote controlled grass cutter. The device consists of linear blades and it does not get affected by climatic conditions. They have used many components for preparing grass cutter like DC Motor (3) for rotating the wheels and blade, wheels (4), battery, Solar panel, IR sensor, Collapsible blade. There are two main components such as transmitter and receiver. Transmitter continuously transmits the rays if any obstacle comes in front of grass cutter then the rays are reflected back towards the receiver.

3. COMPONENTS

3.1 HARDWARE REQUIREMENTS

The hardware components required for the project are listed as follows:

S.NO	COMPONENT TYPE
1	Solar panel
2	Charge Controller
3	Battery
4	Inverter
5	Relay Board
6	Dc Motor
7	Blades
8	Frame
9	Wheel
10	Pulley

Table 3.1 Hardware Requirements

3.1.1 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. A solar panel is a device that collects photons of sunlight, which are very small packets of electromagnetic radiation energy, and converts them into electrical current that can be used to power electrical loads.

3.1.2 CHARGE CONTROLLERS

Most stand-alone solar power systems will need a charge controller. The purpose of this is to ensure that the battery is never overcharged, by diverting power away from it once it is fully charged. Only if a very small solar panel such as a battery saver is used to charge a large battery is it possible to do without a controller. Most charge controllers also incorporate a low-voltage disconnect function, which prevents the battery from being damaged by being completely discharged. It does this by switching off any DC appliances when the battery voltage falls dangerously low.

3.1.3 BATTERY

An electric battery is a collection of one or more electrochemical cells in which stored chemical energy is converted into electrical energy. The principles of operation haven't changed much since the time of Volta. Each cell consists of two half cells connected in series through an electrolytic solution. One half cell houses the Anode to which the positive ions migrate from the Electrolyte and the other houses the Cathode to which the negative ones drift. The two cells are may be connected via a semi permeable membranous structure allowing ions to flow but not the mixing of electrolytes as in the case of most primary cells or in the same solution as in secondary cells.

3.1.4 INVERTER

A power inverter, or inverter, is an electronic device or circuitry that changes direct current (DC) to alternating current (AC). The input voltage, output voltage and frequency, and overall power handling depend on the design of the specific device or circuitry. The inverter does not produce any power; the power is provided by the DC source. A power inverter can be entirely electronic or may be a combination of mechanical effects (such as a rotary apparatus) and electronic circuitry. Static inverters do not use moving parts in the conversion process.

3.1.5 RELAY BOARD

Relays are simple switches which are operated both electrically and mechanically. Relays consist of an electromagnet and also a set of contacts. The switching mechanism is carried out with the help of the electromagnet. There are also other operating principles for its working. But they differ according to their applications. Most of the devices have the application of relays.

3.1.6 DC MOTOR

A **DC motor** is any of a class of rotary electrical motors that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.

3.1.7 BLADES

The blades are mounted according to the need. After the blade mount was finished being fabricated, I inserted it on the shaft. Then to make sure the mount was supported vertically drilled a small hole completely through the mount and shaft. This allowed me to insert a bolt as an added safety measure. It is easy to cut the grass and the moving the blades will be freely. The blades move with the help of DC motor which is connected with the blades, due to DC motor blades move very fast which uses to move the shaft. Motor capacity is 12 watts and there is a blade arrangement in front of the frame.

3.1.8 FRAME

External Frame Work: The external frame work is having 135 cm cylindrical hollow pipes are welded. At the end of the pipe we have attached electric motor with gears arrangement and shaft to the blades. **Solar Frame Work:** To avoid weight on the frame the solar panel is separated from the panel. The solar panel is 12 watts which is connected to the battery.

3.1.9 WHEEL

In its primitive form, a **wheel** is a circular block of a hard and durable material at whose centre has been bored a hole through which is placed an axle bearing about which the wheel rotates when torque is applied to the wheel about its axis. The wheel and axle assembly can be considered one of the six simple machines. When placed vertically under a load-bearing platform or case, the wheel turning on the horizontal axle makes it possible to transport heavy loads.

3.1.10 PULLEY

A **pulley** is a wheel on an axle or shaft that is designed to support movement and change of direction of a taut cable or belt, or transfer of power between the shaft and cable or belt. In the case of a pulley supported by a frame or shell that does not transfer power to a shaft, but is used to guide the cable or exert a force, the supporting shell is called a block, and the pulley may be called a sheave.

4. WORKING PRINCIPLE

Solar powered grass cutter comprises of direct current (D.C) motor, a rechargeable battery, solar panel, a stainless steel blade and control switch. The solar powered grass cutter is operated by the switch on the board which closes the circuit and allows the flow of current to the motor which in turn drive the blade used for mowing. The battery recharges through the solar charging controller. Performance evaluation of the developed machine was carried out with different types of grasses. Grass cutter or lawn mowing with a standard motor powered lawn mower is an inconvenience, and no one takes pleasure in it. Cutting grass cannot be easily accomplished by elderly, younger, or disabled people. Motor powered push lawn mowers and riding lawn mowers 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 lawn mowers are environmentally friendly, they too can be an inconvenience. Along with motor powered lawn mowers, electric lawn mowers are also hazardous and cannot be easily used by all. Also, if the electric lawn mower is corded, mowing could prove to be problematic and dangerous.

5. DESIGN DATA

Rated Voltage	12	24	V
No load Current	≤ 2.5	≤ 1.3	A
No load Speed	90 ± 10	90 ± 10	rpm
Rated Current	≤ 8	≤ 4.5	A
Rated Speed	65 ± 15	64 ± 15	rpm
Stall Current	≤ 25	13	A
Stall Torque	≥ 8.0	≥ 8.0	N.m
Noise	≤ 55	≤ 55	dB
Noise	≤ 55	≤ 65	dB

Table 5.1 Design Data

5.1 RESULTS AND CALCULATIONS

- Solar Panel Rated Power = 20 W
- DC Motor Rated Voltage = 24 V, Rated Current = 1.6 A
- DC battery Rated Voltage = 12 V, Ampere hour = 7 Ah
- Assumptions:
 - Solar Panel Efficiency = 18%
 - DC Motor Efficiency = 85%
 - Battery Charging/ Discharging efficiency = 95%
 - Operating hour per day = 1 hr
- DC Motor power = $24 \times 1.6 = 38.4$ W
- DC Motor Output Power supplied to wheel and the blades = 38.4×0.85 W = 32.64 W Output Power of the Solar Panel = 20×0.18 W = 3.6W
- Time required to fully charge the battery = $(12 \times 7) / 3.6$ hrs = 23 hrs (approx.)
- Output Power of the DC Battery supplied to the motor = $0.95 \times 12 \times 7$ Wh = 79.8
- Wh Input Power requirement of the DC Motor per day = 38.4×1 Wh = 38.4
- Wh Number of days the DC Motor can be operated when the battery is fully charged = $79.8 / 38.4 = 2.078$ days = 2 days (approx.)

6. PROJECT IMAGE

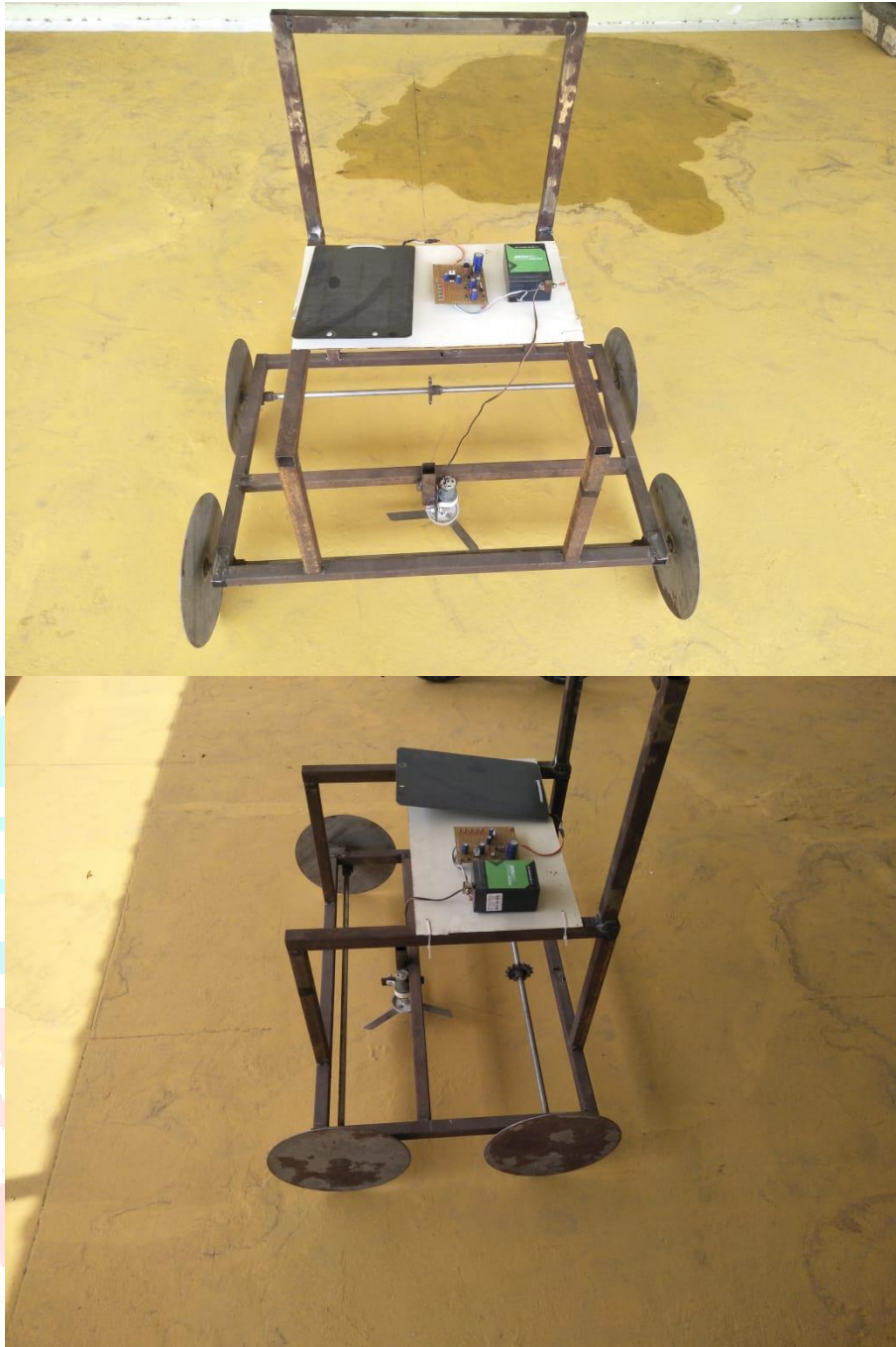


Fig 6.1 Project image

7. CONCLUSION

Our project entitled solar based grass cutter is successfully completed. It will be easier for the people who are going to use project for further modification. This grass cutter occupy less space and light in weight and as it uses nonconventional source of energy hence running cost is zero. It has facility of charging battery while grass cutter is in the working condition. The cost of solar based grass cutter is less than the market grass cutter. Grass cutter is used to keep the lawn clean and uniform in schools, gardens and playgrounds.

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