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# Design and Implementation of Automatic Solar Grass Cutter

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**ABSTRACT**: Presently, manually handled device is commonly used for cutting the grass over the field which creates pollution and loss of energy. Automatic solar grass cutter 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 a microcontroller Arduino ATmega328p, IR sensors, LCD Display for better response and understanding to the user. This paper will project the operation and working principle of the Automatic Grass cutter. Also, the design parameters are discussed in this paper.

**KEYWORDS:** Arduino ATmega328p, LCD Display, IR sensors

## I. INTRODUCTION

Nowadays, pollution is the major issue in the universe. In case Gas powered 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 involves 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. From robotic lawn mowers that can incredibly cut the grass for you to those that are cleverly powered by solar energy, these convenient and easy-to-use grass-cutting devices make straightening up your lawn more pleasing. The Grass Cutters use cordless electric mowers, trimmers and blowers powered by clean renewable energy generated by solar panels mounted on our trucks and trailers. We also use reel push mowers for smaller hard to access areas like pathways and parks. There's no oil, and no pollution. Just clean air, less noise, and green grass.

The other objective is that the automatic lawn cutter has to differentiate between grass and concrete while monitoring its surroundings continuously. We wanted an ultrasonic sensor to sense if the lawn cutter was heading into an object. Safety is the main concern while designing the lawn cutter. As it has blades we wanted our lawn cutter not to be in operating mode if it was being held in the air by the user. Knowing that the user would be randomly holding the lawn cutter we needed a sensor to detect orientation. The accelerometer was hence used in lawn cutter so that it will not operate when user hold it. An automatic lawn cutter will relieve the consumer from mowing their own lawns and will reduce both environmental and noise pollution.

### *A. Problem Statement*

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 lawnmower are in 90% of U.S. home and they create 5% of the total U.S. pollution. 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.

In this paper, solar powered automatic lawn mower 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

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environment while doing less work in their daily lives.

## II. LITERATURE REVIEW

The first lawn mower was invented by Edwin Budding in 1830 just outside Surround, in Gloucestershire, England Bedding 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.Bedding's first machine was 19 inches (480 mm) wide with a frame made of wrought iron. The mower was pushed from behind.

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. Rapid growth of various high-tech tools and equipment's makes our jobs done comfortable and sophisticated. The research work aims at fabricating a grass cutting machine system which makes the grass cutter based motor running through solar energy. Power plays a great role wherever man lives and works. The cutting mechanism is made of a flat blade rigidly fixed to the frame behind the spiral arrangement which is configured to contact at least one reel bar of the spiral blades during the rotation of the spiral mechanism

## III. METHODOLOGY

The design contains a microcontroller, multiple sensors, and a solar charging system. Adding these elements together, we get our robotic lawn mower. The sensors are the eyes of our Robot Initially, we had an idea what type of sensors we wanted to use. We used only an ultrasonic sensor to detect if the robot was heading into an object. Safety is the main concern when designing a robot with blades. We wanted our robot not to start operating if it was being held in the air by the user. Knowing that the user would be randomly holding the robot we needed a sensor to detect orientation. The power the system there are many options.

With recharging batteries, there are various chemistries but we decided to go with the one that work best with solar charging. The nickel-metal hydride (NiMH) was found to be the best because given a low charging current, it will not overcharge. Sizing the battery will depend on what we are powering, specifically the motors. Like batteries, there is a range of motors to choose from. We went with two 7.2V DC motors with integrated gear heads. The needed torque did not need to be a lot because we were going to have a small prototype. These motors have 100 oz-in torque which is plenty for our design. The block diagram of automatic solar grass cutter design is shown in figure 1.

Determining where to place our sensors is crucial to the overall effectiveness of our design. The solar panels were to be placed horizontal on the robot because to achieve maximum sun exposure. The microprocessor must be in the robot to protect it from the natural elements. ur ultrasonic sensor will be mounted directly in front of the robot for maximum detection.

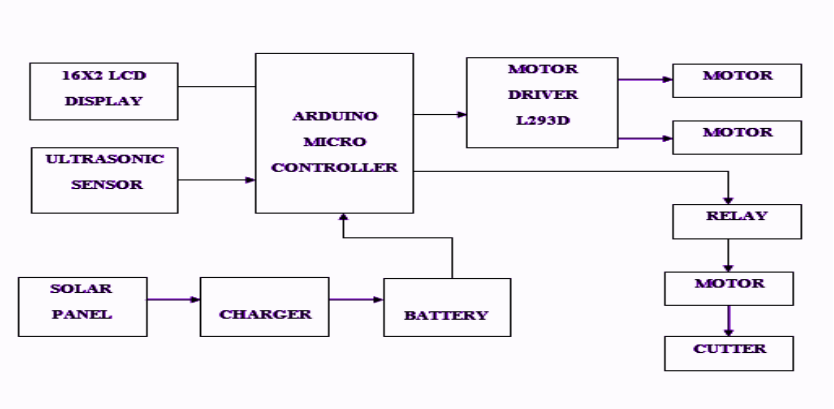


Fig.1: Block diagram of solar grass cutter

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*A. Component Description*

- *Solar panel:* A solar panel is set of solar photovoltaic modules electrically connected and mounted on 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.
- *Arduino ATmega328P:* Arduino is brain of overall system. Arduino is single-board microcontroller intended to make building interactive objects or environments more accessible. Introduced in 2005, the Arduino's designers sought to provide an inexpensive and easy way for hobbyists, students, and professionals to create devices that interact with their environment using and actuators
- *Solar Charger:* The circuit is self-explanatory. A 12 volt 5 Watt solar panel is used as the source of current. The cells in the panel are made up of semiconductor material which transforms light energy into electrical energy. When the sunlight is maximum, the solar module can generate around 16.5 volts at 400 mA. This current is used to charge the battery.
- *DC motor:* A DC motor relies on the fact that like magnet poles repel and unlike magnetic poles attract each other. A coil of wire with a current running through it generates a electromagnetic field aligned with the center of the coil. By switching the current on or off in a coil its magnetic field can be switched on or off or by switching the direction of the current in the coil the direction of the generated magnetic field can be switched 180°. A simple DC motor typically has a stationary set of magnets in the stator and an armature with a series of two or more windings of wire wrapped in insulated stack slots around iron pole pieces (called stack teeth) with the ends of the wires terminating on a commutator.
- Advantages of a brushed DC motor include low initial cost, high reliability, and simple control of motor speed. Disadvantages are high maintenance and low life-span for high intensity uses. Maintenance involves regularly replacing the carbon brushes and springs which carry the electric current, as well as cleaning or replacing the commutator. These components are necessary for transferring electrical power from outside the motor to the spinning wire windings of the rotor inside the motor. Brushes consist of conductors.
- *IR Sensors:* A Sensor converts the physical parameter (for example: temperature, blood pressure, humidity, speed, etc.) into a signal which can be measured electrically. Sensors are sophisticated devices that are frequently used to detect and respond to electrical or optical signals to detect and avoid the object to reduce the chances of failure of blade.
- 16*2 LCD Display: It is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly.

LCDs are accessible to display arbitrary images (as in a general-purpose computer display) or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements

*B.Design Parameter*

*1. Selection of electric motor*

A) 30 RPM DC motor SPEED = 30
B) RPM VOLTAGE = 12 VOLT
C) WATTS = 18 WATT

*2. Torque of the motor*

A) Torque = (P X 60) / (2 X 3.14 X N)
B) Torque = (18X 60) / (2 X 3.14 X 30)
C) Torque = 5.72 Nm Torque = 5.72 x $10^3$ N-m
D) The shaft is made of MS and its allowable shear stress = 42 MPa
E) Torque = 3.14 x fs x $d^3$ / 16 5.72 x $10^3$ = 3.14 x 42 x $d^3$ / 16 D = 8.85 mm

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F) The nearest standard size is d = 9 mm.

*3. Electrical (electric) power equation*

A) Power P = I × V Where V = 12 W = 18 I=18/12=1.5

B) A H.P = .02414

*4. Solar panel calculation*

A) VOLT = 12 V

B) WATT = 5 W

C) W = V X I 5 = 12 X I I = 5/12 I = 420ma

*5. Battery calculation*

A) BAH /CI = 8 ah/420ma = 19 hrs

B) To find the Current Watt = 18 w

C) Volt = 12v Current =?

P= V x I 18 =12 x I I = 18/12 = 1.5

D) AMPS battery usage with 1.5 AMPS

BAH /I 8/1.5 = 5.3 hrs.

*C. Comparison of Automatic Solar Grass Cutter with Conventional Grass Cutter*

TABLE I: COMPARATIVE STUDY

| CONVENTIONAL GRASS UTTER | AUTOMATIC SOLAR GRASS CUTTER | FACTOR |
|---|---|---|
| Causes more Pollution | Clean and Pollution Free | Pollution |
| More effort | Less effort | Effort |
| More | Less | Maintenance required |
| Not Available | Available | Remote control |
| More | Less | Noise |
| Less | More | Efficient |

## VII. CONCLUSION

In this paper, the work done on lawn mower will meet the challenge of environmental production and low cost of operation since there is no cost for fueling. This lawn mower has been developed for the use of residences and establishments that have lawns where tractor driven mowers could not be used. The machine's capacity is adequate for its purpose. The machine has proved to be a possible replacement for the gasoline powered lawn mowers. We are developed "Automatic Lawn Cutter" by using keypad and LCD display and for this we are using battery hence it works automatically.

## IV. FUTURE SCOPE

The work projected in this paper can be further improved by incorporating the some more modifications to obtain better results.Design of blades should be done based on types of grass is used to cut.

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