

# Solar Powered Hybrid Lawn Mower based on Arduino

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**Abstract:** Owing to the fact that grass cutter machines are getting increasingly common in today's society. Pollution is human-made, which we can be seen in our daily life. Because the IC engine was employed in older models of lawn cutters, pollutant levels increased as a result of its environmental effect. A cutter powered by an IC engine is more expensive. The cost of maintaining a traditional machine is higher. To address these issues, we want to design a new type of grass cutter that works on solar energy and is more cost-effective than the previous model. Our project's goal is to create a solar-powered lawn cutter, which will save electricity and reduce the labor workforce.

**Keywords:** Solar, micro controller, Atmega328P, lawn cutter, Arduino, solar panels, sensors.

## INTRODUCTION

Grass cutter machines have become very popular today. Most of the time, grass cutter machines are used for soft grass furnishing. In a time where technology is merging with environmental awareness, consumers are looking for ways to contribute to the relief of their carbon footprints. Humans are the main source of pollution which can be seen in our daily lives. In this article, we are proposing a prototype which is a solar powered grass cutting machine. An automatic grass cutting machine is a machine that is going to perform the grass cutting operation on its own. This model reduces both environmental and noise pollution. This new design will eventually help the consumers at a low cost and reduced physical work force. This design is intended to be a green alternative to the commonly used and ecologically dangerous gasoline-powered lawnmower. In the end, consumers will do more for the environment while working less in their daily lives. The goal is to continue working on this project until an appropriate design can be created and then placed on the mark.

This system offers a fully automatic grass cutting system. The machine has a blade attached to it which will run at high RPM to chop the grass. The system includes sophisticated functionality that allows it to cover the whole area of a lawn or garden by employing an ultrasonic sensor to identify corners and mow the entire lawn or garden. This effective solution achieves this capability with the help of a microcontroller-based circuit. It's a battery-powered system with two batteries. The vehicle movement DC motors are powered by one battery, while the lawn cutter motor is

powered by the other. Also, the system uses a solar panel to demonstrate the charging of the vehicle's movement battery. The micro controller operates the vehicle movement dc motors as well as the grass cutter at the same time as monitoring the ultrasonic sensors. The micro controller smartly operates the dc motors using the motor driver IC to achieve the desired movement based on ultrasonic inputs. The system also uses a gyro sensor to achieve perfect 180 degree turns to achieve complete lawn/garden coverage. Thus this system allows for a fully automated grass cutting system without the need for any human intervention.

## Related Works

### A. Sivarao, T.J.S. Anand, Hambali, Minhat, Faizul

Their article gave a review of studies on autonomous tractors. An autonomous tractor may work without or with little human control since it is self-propelled and steered along a predetermined path. Such a solution can assist the agriculture industry since it cuts labor expenses and time while also increasing production efficiency by eliminating human mistakes. For a number of causes, many research and innovations have been done, with outcomes ranging from promising to impractical for commercial implementation. Sensors, global navigation satellite systems, machine vision, laser triangulation, and transmitters are among the devices used. As a result, we stayed away from solar-powered lawnmowers. The biggest advantage of using hydrogen instead of lawnmower run by gasoline is environmental. (9)

### B. Pratik Patil, Ashwani Bhosale, Prof. Sheetal Jagtap

The authors described about an automated lawn mower that will let customers trim their grass with minimum effort. It will recognize and avoid objects and people while mowing using a range of sensors. The major purpose of this autonomous lawn mower is for the user to utilize the keypad to specify the area to be mowed as well as the desired grass height. An ATmega328P microprocessor, multiple sensors, an LCD display, and a keypad are all included in this design.

### C. Ernest L. Hall

The Weed Eater, created by the Weed Eater Corporation, is another example of an autonomous grass cutting machine. The system is a solar-powered, emission-free mower that can run on its own. The robot features 34 iridescent solar cells implanted on top of the systems platform and can handle properties up to 13,500 square feet. The system works in the same way as the Grass Ranger, only it employs a cable that

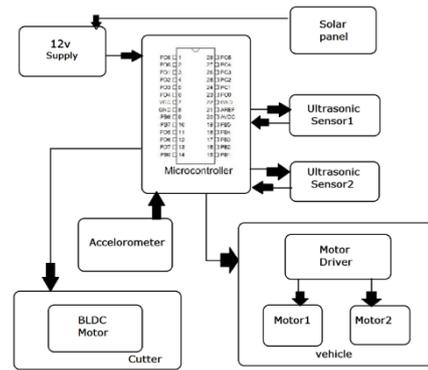
runs beneath a person's lawn. This cable, together with the sensors on the mower, allows the robot to move about while keeping the system on track.

### LITERATURE SURVEY

This lawn mower employs a solar-powered energy source, which is easier to operate and has more benefits than other energy sources, particularly gas-powered sources of electricity. However, due to the high cost of solar, our lawn cutter does not utilize it and may cause some complications when in operation. As a consequence, we avoided lawnmowers driven by solar energy. The most significant benefit of utilizing hydrogen instead of other fuels is that it is more environmentally friendly grass without human assistance and is powered by solar energy to charge its batteries. The vehicle is smart," in the sense that it can think for itself through the use of sensors, allowing it to avoid any and all impediments it may find in a lawn. (10) gasoline to run a lawnmower is environmental. We haven't utilized this for lawn cutter because it's an outdated approach with a lot of problems. The manual handle device is currently the most often used technology for lawn trimming. We have automated the grass-trimming machine in this project. The gadget comprises of a linear blade that is driven by a motor, which is powered by a battery. A power supply and a solar panel can be used to charge the battery. The presence of any obstructions in the path is detected using an infrared sensor.

### PROPOSED ARCHITECTURE

We propose a completely automated lawn cutting device that can. It cuts grass without the need for human intervention and charges its batteries using solar energy. The vehicle is "smart," in the sense that it can think for itself through the use of sensors, allowing it to avoid any and all impediments it may find in a lawn. The technology incorporates 12V batteries that power both the blades' motor and the wheels' movement, allowing the machine to travel around the grass. One of the features we've added to the system is the use of solar panels to charge the batteries, which eliminates the need for any external wiring, which may be a pain on the ground. The whole system is controlled by an ATmega328P micro controller, which is configured to operate all of the system's motors and sensors. Object detection is done with the help of an ultrasonic sensor. The robot will continue to travel ahead as long as it does not come across an obstacle (such as a tiny animal or an object). If and when necessary, the vehicle may also operate under human direction. We've also included cutting-edge Bluetooth technology, allowing us to operate the robot with our own telephonic gadgets.



COMPONENTS USED

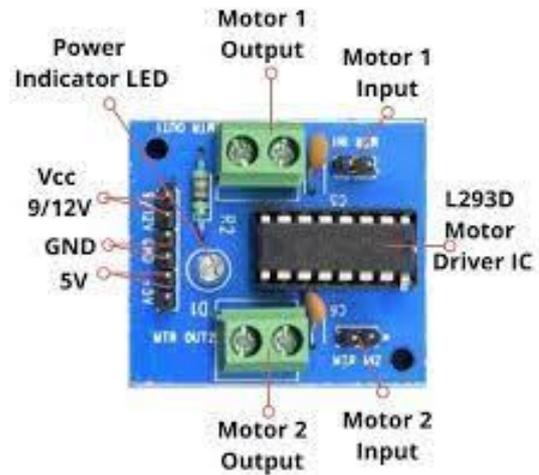
### D. Solar Panels

A solar panel is made up of solar (or photovoltaic) cells that may be used to generate power via the photovoltaic effect. On the surface of solar panels, these cells are organized in a grid-like arrangement. As a result, it may alternatively be defined as a collection of photovoltaic modules put on a supporting framework. A photovoltaic (PV) module is a 610 solar cell packed and linked assembly. These panels are extremely durable when it comes to wear and tear. Solar panels deteriorate at a glacial pace. Their efficacy drops by only one to two percent every year (at times, even lesser). Crystallized silicon solar cells are used in the most of solar panels.



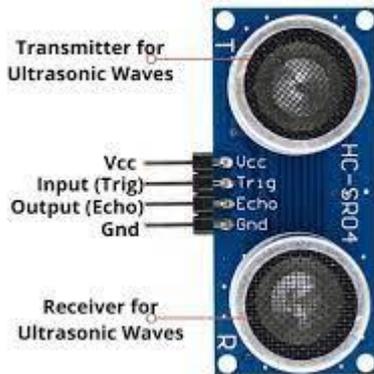
### E. Atmega328P Micro Controller

Atmel's mega AVR series includes the ATmega328, a single-chip micro controller (later Microchip Technology acquired Atmel in 2016). It has an 8-bit RISC processing core based on Harvard architecture. Microchip's Atmega328P is a high-performance, low-power controller. Atmega328P is an AVR RISC microprocessor with an 8-bit resolution. Because it is used in Arduino boards, it is the most popular of all AVR controllers. Atmega328P is a micro controller chip with 28 pins. Many of the chip's pins have many functions.



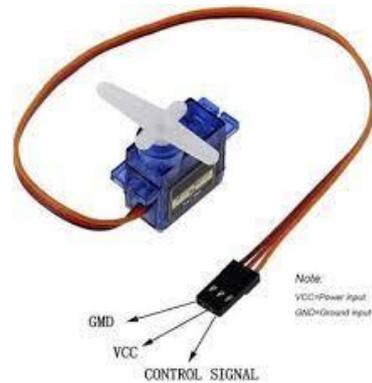
**F. Ultrasonic Sensors**

An ultrasonic sensor is a device that uses ultrasonic sound waves to determine the distance to an item. In an ultrasonic sensor, a transducer emits and receives ultrasonic pulses that carry information about the environment. the proximity of an item. High-frequency sound waves reverberate off of surfaces, creating different echo patterns. Ultrasonic sensors function by emitting a sound wave that is above the human hearing range. The sensor's transducer functions as a microphone, receiving and transmitting ultrasonic sound. To deliver a pulse and receive the echo, our ultrasonic sensors, like many others, employ a single transducer. The sensor measures the time between delivering and receiving an ultrasonic pulse to estimate the distance to a target.



**H. Servo Motor**

A servo motor is a rotary or linear actuator that provides for exact angular or linear position, velocity, and acceleration control. An appropriate motor is connected to a position feedback sensor. It also necessitates a complex controller, which is frequently a separate module created exclusively for servomotor usage. Although the word servomotor is typically used to refer to a motor that may be utilized in a closed-loop control system, it is not a specific kind of motor. Robotics, CNC machinery, and automated manufacturing are all applications that employ servomotors.



**G. Accelerometer**

An Accelerometer is a device that measures how fast something is moving. [1] Proper acceleration is the rate of change of velocity of a body in its own instantaneous rest frame, as opposed to coordinate acceleration, which is the rate of change of velocity in a fixed coordinate system. An Accelerometer at rest on the Earth's surface, for example, will detect an acceleration owing to Earth's gravity of  $g$   $9.81 \text{ m/s}^2$  straight upwards (by definition). Accelerometers in free fall (dropping at a rate of around  $9.81 \text{ m/s}^2$ ), on the other hand, will read zero. Accelerometers offer a wide range of applications in business and science. Inertial navigation systems for aero planes and missiles employ very sensitive accelerometers. Accelerometers measure vibration in spinning equipment. They're found in tablet computers and digital cameras, and they keep pictures on screens upright. Accelerometers aid in the stabilization of unmanned aerial vehicles.

**I. Bluetooth Module**

A Bluetooth module is basically a hardware element that dispenses a wireless item to work with any computer, accessory or peripheral such as a wireless headphone, a cell phone and so forth. It is wireless communication through serial communication which makes it easier to interact with a controller or an IC.



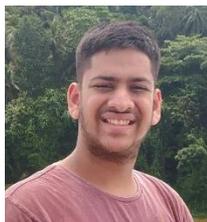
## CONCLUSION

To conclude, we plan on introducing a hybrid lawn mower (i.e., with the capacity of being run on its own and being handled by a person, if needed) which will be enabled by solar energy. Our addition of the Bluetooth module to the previous model will enable customers to control the robot with their cell-phones or radio controllers, as required. With the use of Arduino instead of conventional electricity, the circuit is quite straightforward, and no complicated wiring has been introduced, enabling the user to remedy any issues that may come up. Catching up to the recent advances in technology, the robot will be light weight, easy to handle and even easier to use.

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