

## SOLAR POWERED AUTOMATIC GRASS CUTTER

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**Abstract** - In today's world, Automation is a very important part of invention. Presently, diesel operated devices are commonly used for cutting the grass over the lawn. Because of this, there is pollution and requires labour. The old grass cutters need to be replaced by automated one where system will work for guidance and obstacle detection using battery as a power source. A solar panel will be attached on the top of the robot which will charge the battery. This project aims at building a prototype of robot which is able to cut the grass in lawn. This project uses IR sensors, ultrasonic sensors, etc. for obstacle detection. This project aims at developing a portable solar operated grass cutting device. Solar panel is connected to the battery through charge controller. Which will charge the battery. The motor is connected to blade shaft by the help of belt drive. This will rotate the blade in high speed to cut the grass. This device will help in building of eco-friendly system.

**Key Words:** Aurdino, Sensors, Wireless Technology

### 1. INTRODUCTION

The lawn mower is an aid in the mundane task of grass cutting and tending to lawns. Due to the revolution of green movement in the present scenario the industries with major campus areas are changing the percentage of greenery in the campuses and increased greenery causes increased effort and money to tend to. In such cases the lawn mower proves to be a god sent. Due to increased availability of system on chips, the lawn mower can be automated very easily and also the reduced size and cost of Dc motors causes the system to be independent of fossil fuels to be able to tap into renewable energies. The presence of Ultrasonic sensors and light dependent resistors in a smaller and cheaper packaging cause the bot to be more aware of its surroundings.

Traditional design of lawn mowers had motored powered engines which required regular maintenance such as engine oil and greasing. They also created a lot of noise pollution and air pollution. In the cold and harsh environment the fossil fuel powered motors tend to freeze and not run. These problems are solved by using electric motors. They are also much greener because they use solar panel. The mower uses battery chorded system.

The solar powered grass cutter is a fully automatic robotic system powered by solar energy. It avoids obstacles and allows cutting the grass automatically without any human interaction. The system uses 12V batteries to power

the vehicle's motion engines and the blade engine. This system uses a solar panel to charge the battery and can also be charged externally. The motors are connected to a microcontroller through a driver. It controls the operation of all motors. It is also connected to an ultrasonic sensor for object detection. The microcontroller transmits the signals to the engines address if no obstacle is detected by the ultrasonic sensor. The ultrasonic sensor monitors the obstacles to avoid any damage to the object / man / animal. Also this project includes a design module which is used to design the grass.

### 1.1 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 lawn mower 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 out-dated habit will help both the consumer and the environment. Battery 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 environment while doing less work in their daily lives.

### 1.2 Objectives

The objectives of the proposed work is to the design and construct the automated grass cutting robotic vehicle powered by solar energy which avoids obstacles without the need of human interaction. The system uses 12V batteries to power the vehicle movement motors as well as the grass cutter motor. The system uses a solar panel to charge the battery and also an externally charging slot. The grass cutter and vehicle motors are interfaced to Aurdino that controls the working of all the motors.

### 1.3 Scope for the Study

To allow for greater flexibility in the design, a custom built platform will be used. Much experience has already been gained with the other sensors working on the first two generations of autonomous lawn mowers. This is the key system that will enable the mower to recognize objects, avoid them, and can move also in a pattern.

## 2. PROPOSED ARCHITECTURE

### 2.1 Aurdino Mega 2560

Aurdino can be used to develop stand-alone interactive objects or can be connected to software on computer (e.g. Flash, Processing, and Max MSP). The open-source IDE can be downloaded for free (currently for Mac OS X, Windows, and Linux). The Aurdino Mega is a microcontroller board based on the ATmega2560.

The Aurdino Mega 2560 is a microcontroller board based on the ATmega2560 (datasheet). It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

### 2.2 Solar Panel

The term solar panel is used colloquially for a photovoltaic (PV) module. A PV module is an assembly of photovoltaic cells mounted in a frame work for installation. Photovoltaic cells use sunlight as a source of energy and generate direct current electricity. A collection of PV modules is called a PV Panel, and a system of Panels is an Array. Arrays of a photovoltaic system supply solar electricity to electrical equipment. A 10w, 12v solar panel is used to serve the need.

### 2.3 Battery 12v, 8000mAh

A lithium-ion battery or Li-ion battery (abbreviated as LIB) is a type of rechargeable battery. Lithium ion batteries are commonly used for portable electronics and electric vehicles and are growing in popularity for military and aerospace application. A 12v, 8000mAh battery is used serve the need of this project.

### 2.4 Solar Charge Controller

A solar charge controller manages the power going into the battery bank from the solar array. It ensures that the deep cycle batteries are not overcharged during the day and that the power doesn't run backwards to the solar panels overnight and drains the batteries. Some charge controllers are available with additional capabilities, like lighting and load control, but managing the power is its primary job.

### 2.5 Ultrasonic Sensor

Ultrasonic sensors also called as level sensors measure distance by using ultrasonic waves. The sensor head emits an ultrasonic wave and receives the wave reflected back from the target. Ultrasonic sensor measure the distance to the target by measuring the time between the emission and reception. Here, in this project ultrasonic sensor is used to sense the obstacle if there is any, in front of the moving lawn cutter. If in case obstacle is detected by the sensor then the microcontroller stops the motors so as to avoid any damage to the object/human/animal coming.

### 2.6 RGB Sensor (TCS230)

The RGB sensor or colour sensor detects the colour of the surface, usually in the RGB scale. Colour is the result of interaction between a light source, an object and an observer. Here, it is used to detect the green colour, so that the lawn mower doesn't leave the grass surface.

### 2.7 Motor Driver

Motor drivers act as an interface between the motors and the control circuits. Motor require high amount of current whereas the controller circuit works on low current signals. So the function of motor drivers is to take a low-current control signal and then turn it into a higher-current signal that can drive a motor.

The motor driver used for this purpose is LN293D. The Fig. 3.7 shows the commonly used motor driver.

### 2.8 Servo Motor

A servo motor is an electrical device which can push or rotate an object with great precision. If you want to rotate and object at some specific angles or distance, then you use servo motor. It is just made up of simple motor which run through servo mechanism. Ultrasonic sensor is placed above the servo motor so that the ultrasonic sensor can look right and left to sense the obstacles.

### 2.9 Jumper Wire

A jump wire (also known as jumper wire, or jumper) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

### 2.10 Breadboard

A breadboard is a rectangular plastic board with a bunch of tiny holes in it. These holes lets to easily insert electronic components to prototype (meaning to build and test an early

version of) an electronic circuit like battery, switch, resistor, and an LED (light-emitting diode).

### 2.11 DC Geared Motor (12 V, 60 rpm)

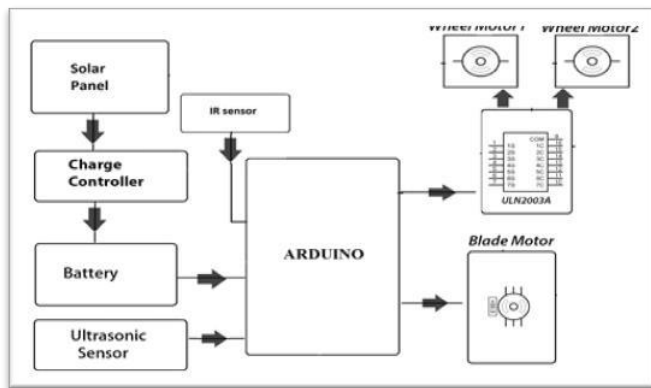
A geared DC motor has a gear assembly attached to the motor. These are primarily used to reduce speed in a series of gears, which in turn creates more torque. This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction. These motors are used for wheels.

### 2.12 12 V DC Motor

DC motors are compact and display high output, and their speed is easy to control. They may be driven by battery or any other power supply and are therefore easy to use. This motor construction utilizes permanent magnet so that the motor produces high torque with high efficiency. This motor used as a blade motor for cutting the grass.

## 3. IMPLEMENTATION AND WORKING

### 3.1 Block Diagram



### 3.2 Working

The automated solar powered grass cutter has panels mounted in a particular arrangement in such a way that it can receive solar radiation with high intensity easily from the sun. The 10 watts solar panel is used to charge the batteries which are rechargeable. The solar panel gives maximum 18v and 580mA of current. This electrical energy is stored in batteries by using a charge controller. A solar charge controller manages the power going into the battery bank from the solar array. It ensures that the deep cycle batteries are not overcharged during the day and that the power doesn't run backwards to the solar panels overnight and drains the batteries. It also disconnects the solar panels

from the batteries when they are fully charged and also connects to the panels when the charging in batteries is low. The system uses batteries to power the vehicle movement motors as well as the grass cutter motor. The motors are connected to the batteries through connecting wires. The movement of bot is done by using the two DC motors of 60 rpm. The motors are driven by using motor driver (L293D). It is also known as H-Bridge. The main purpose of using motor driver is because that DC motors require the minimum voltage as 9v as input. But the microcontroller gives output as only 5v so we require 9v to 12v for driving the motors. So we use motor driver which takes 5v as input and gives the 12v for motors. The L293D motor driver drives only two motors which can move in both directions. A cutting blade is used to cut the grass. The blade is fixed to the shaft of the blade motor. A highspeed motor is used to run the blade motor so that blade cuts the grass efficiently. The motor runs directly by 12v rechargeable battery. From the blade motor, the power transmits to the mechanism and this makes the blade to rotate with high speed and thus cut the grass. The mower continues this process until it completes the job.

The grass cutter and wheel motors are interfaced to an Aurdino mega 2560 that controls the working of all the motors. It is also interfaced to an ultrasonic and RGB sensor for object detection and designing purpose of the grass. The microcontroller moves the vehicle motors in the forward direction in case no obstacle is detected. Aurdino takes the input from the ultrasonic sensors, when any interrupt or obstacle occurs. The ultrasonic sensor senses the obstacle and gives feedback to microcontroller. According to the program which was given to microcontroller it turns left or right. It waits up to some delay and senses again and same procedure repeats. If no detection occurs to ultrasonic range then it moves forward until it finds an obstacle. If in case obstacle is detected by the sensor then the microcontroller stops the motors so as to avoid any damage to the object/human/animal coming. The RGB sensor or colour sensor detects the colour of the surface, usually in the RGB scale. Colour is the result of interaction between a light source, an object and an observer. Here, it is used to detect the green colour, so that the lawn mower doesn't leave the grass surface.

## 4. CONCLUSIONS

A workable solar powered automatic grass cutter prototype is focusing on the renewable energy as the primary sources of energy have been successfully fabricated with high working efficiency. Therefore, it can be concluded that the developed design of the proposed solar powered automatic Grass Cutter has achieved the main objectives and it can be further developed by industry. Smart Solar Grass Cutter is able to reduce the air pollution and also it is a user-friendly device. The grass cutter is suitable to be used for small application due to the shortest operating time, but it is not suitable for tall height grasses. This project is more

suitable for a common man as it is having much more advantages such as, no fuel cost and no pollution. Less wear and tear because of less number of moving components and this can be operated by using solar energy. This grass cutter occupy less space and light in weight and as it uses nonconventional source of energy, running cost is zero. It has facility of charging battery externally so that the power is sufficient enough to perform the operation. For future work, few recommendations can be made to develop a better device. The motor for the blade should have both high speed and torque. Higher capacity of rechargeable battery can lead to more operating time.

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