

## Robot Based Variable Head Solar Grass Cutter Weed Trimmer Using Iot

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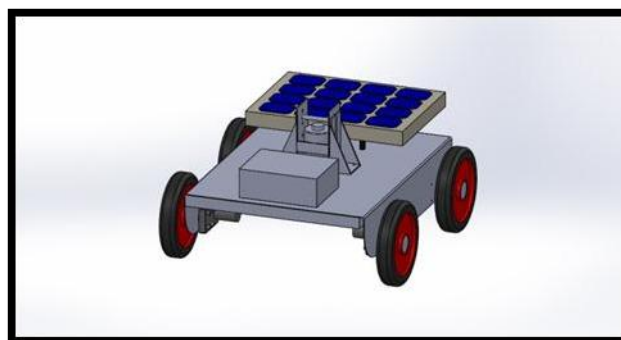
**Abstract:** In today's society, grass cutter machines are becoming increasingly popular. Pollution is generated by mankind, as our daily lives demonstrate. Older lawn mower models used the IC engine, which increased pollution levels due to its environmental impact. Using a cutter driven by an IC engine is more expensive, and maintaining the traditional equipment is likewise more expensive. To address these concerns, we want to build a new solar-powered lawn cutter that will be more cost effective than the previous model. This project's purpose is to make a solar-powered grass cutter. As a result, both power and labour are saved. This project uses an 8051 microcontroller to control the activities of a grass cutter. The grass cutter is self-contained and does not need to be operated by a professional. Another goal is for the automatic lawn mower to be able to tell the difference between grass and concrete while constantly monitoring its surroundings. An ultrasonic sensor was needed to identify if the lawn mower was about to collide with something. The fundamental consideration when designing a lawn mower is safety. Because our lawn mower contains blades, we didn't want it to work if the user was holding it in the air. Because we knew the user would handle the lawn mower at random, we needed a sensor to identify orientation. As a result, the lawn mower's accelerometer was modified to prevent it from working while the operator was holding it. By not having to mow their own lawns, consumers will save time and money, as well as reduce environmental and noise pollution.

**Keywords:** Microcontroller, Solar Power, Blade, Solar Energy, Motors, Ultrasonic Sensors are some of the terms used.

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### I. INTRODUCTION:

The fully automated solar grass cutter is a solar-powered lawn-mowing robotic vehicle that cuts the grass without the need for human interaction. 12V batteries power both the vehicle movement motors and the lawn mower motor. We also use a solar panel to charge the battery, removing the need for external power. The lawn mower and vehicle motors are both connected to an 8051 microprocessor, which controls all of the motors. It also has an ultrasonic sensor attached to it for obstacle detection.



Grass Cutter Machine (Fig.1)

The microcontroller drives the vehicle motors forward in the absence of an obstacle, and the sensor, an ultrasonic sensor, detects an obstacle between the range of the device or the path and stops the operation or the grass cutter to avoid any accident or injury to any object, animal, or human being. The automobile is then rotated by the microcontroller until it is clear. The grass cutter is then moved forward in the same direction. This solar-powered autonomous grass cutter concept will benefit consumers by preventing them from having

to move their lawns themselves, resulting in reduced pollution and noise. Finally, the customer will choose to be more ecologically responsible while working fewer hours each day.

To put it another way, there is a lot of work in progress, but there is still some labour power available that requires a significant amount of cash allocation for a tiny project. As a result, some effort must be replaced with something else in order to avoid a surplus of labour power, so we're striving to construct a robot that may be employed on a regular basis in our project. The project work will be conducted in accordance with the rules for application-based manufacturing for help and other difficulties, and the system will have some automated work recognition. The system's power source will be a battery, with a solar panel positioned on the machine's top. Using a typical motor-driven lawn cutter to move the grass cutters is a nuisance, and no one is thrilled about it. Grass cutting is challenging for the old and the young. Grass cutters that run on an engine emit noise pollution as well as local air pollution from the combustion engine. It requires frequent maintenance, such as oil changes, because it is motor-driven. Although electric solar grass is excellent for the environment, it can be inconvenient. Electric grass clippers are not only powered, but they are also dangerous and should not be used by everyone. Furthermore, carrying an electric lawn mower that is corded could be cumbersome and unsafe. The experimental product will also be charged using solar panels.

## **II. CREATING A PROBLEM:**

At a time when technology and environmental awareness are merging, consumers are looking for ways to lessen their personal carbon footprints. Humans produce pollution, which may be seen in our daily lives, especially in our houses. Gas-powered lawnmowers are prevalent in 90% of households with gardens, and they contribute 5% of total pollution. Green technology initiatives are supported by both the government and corporate sector. Our fresh design for an old and obsolete habit will benefit both the consumer and the environment. According to this assessment, the solar-powered autonomous grass cutter will save consumers time and money by eliminating both environmental and noise pollution. This design is meant to be a safer and more environmentally friendly alternative to the traditional gas-powered lawn mower. In the end, consumers will contribute more to the environment while working less.

A solar grass cutter is a machine that cuts a lawn at an even height with spinning blades. Rotary mowers have a blade that rotates around a vertical axis, whereas cylinder or reel mowers have a blade assembly that rotates along a horizontal axis. There have been numerous designs created, each suited to a specific purpose. The smaller varieties are appropriate for small residential lawns and gardens, while larger, self-contained ride-on mowers are suitable for vast lawns, and the largest multi-gang mowers are meant for large stretches of grass such as golf courses and municipal parks.

*The following are the issues with the available lawn cutter:*

1. Power consumption: available grass cutters are either petrochemical or electrically powered, consuming a significant quantity of conventional energy.
2. Human effort and safety: mowing operations must always be coordinated with a person to ensure effective mowing and, above all, safety.
3. Time consumption: mowing the field in various patterns and designs takes a long time and requires a lot of human effort.

## **III. COMPONENTS AND MATERIALS USED:**

All these components are described in this section.

### **3.1 Charging Station**

In fact, the highest voltage is around 0.6 volts when the circuit is open and no power is produced. When there is bright sunlight, the greatest power of a silicon cell occurs at an output voltage of approximately 0.45 volts; the current from a commercial cell is nearly 270 amperes per sq.-m of exposed surface. Thus, the power is  $0.45 \times 270 = 120$  watts. Solar energy reaches the top of the atmosphere at a rate of 1.353kW/sq.-m (Kalyan, 2013). A portion of this energy is reflected back into the space, and a current-controlling electric switch is attached to the circuit.

### **3.2 Battery**

Batteries come in a variety of voltages and ampere hours. The voltage and ampere hour rating were taken into account when deciding which one to employ. A 12V battery was chosen because the motor is 1.5hp. The ampere hour is a measurement of how long a battery will discharge when not charging. A 17-ampere-hour battery will provide 17 amps of electricity for one hour, although the motor requires less current.

### **3.3 Arduino**

The Arduino is the system's brain. Arduino is a single-board microcontroller that makes it easier to create interactive objects or settings. The Arduino was created in 2005 with the goal of providing an inexpensive and simple means for amateurs, students, and professionals to construct devices that interact with their surroundings utilising sensors and actuators.

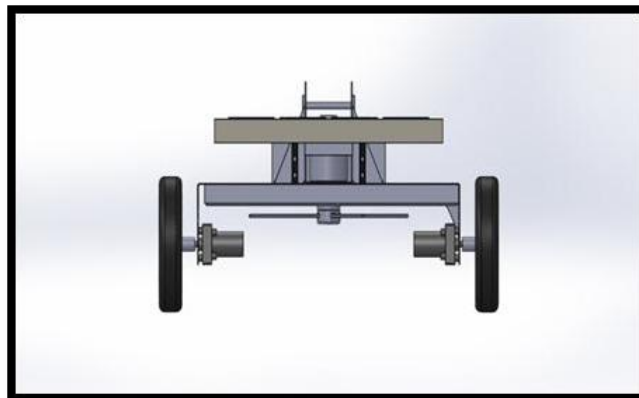
### **3.4 DC Motor**

Like magnet poles repel one other, while unlike magnetic poles attract each other in a DC motor. A current flowing through a wire coil produces an electromagnetic field aligned with the coil's centre. The magnetic field of a coil can be turned on or off by changing the current in the coil, or the direction of the generated magnetic field can be changed 180 degrees by changing the current in the coil. A simple DC motor includes a stator with a fixed set of magnets and an armature with two or more windings of wire wrapped in insulated stack slots around iron pole pieces (called stack teeth), with the wires' ends terminating on a commutator. A brushed DC motor has several advantages, including a low initial cost, great dependability, and easy speed adjustment. High maintenance and a short life period for high-intensity usage are disadvantages. The carbon brushes and springs that transport the electric current must be replaced on a regular basis, and the commutator must be cleaned or replaced. Components are required for delivering electrical power from the exterior of the motor to the rotor's spinning wire windings. Conductors make up brushes.

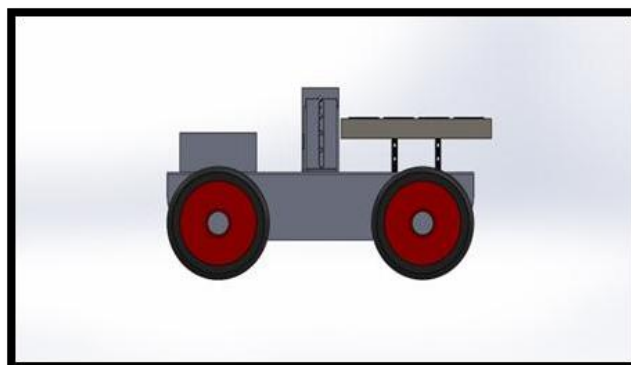
### **3.5 Infrared sensors**

A sensor turns a physical parameter (such as temperature, blood pressure, humidity, speed, and so on) into an electrical signal that can be monitored. Sensors are advanced devices that are regularly used to detect and respond to electrical or optical signals in order to identify and avoid objects and lessen the likelihood of blade failure.

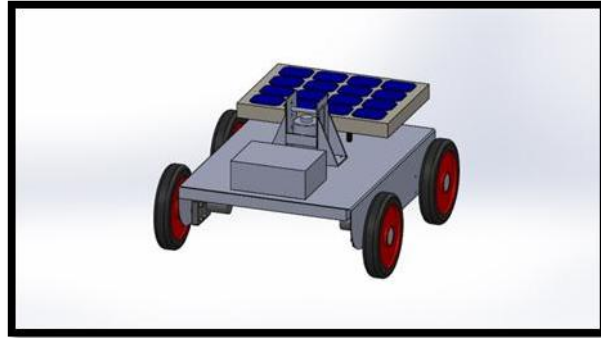
## **IV. MODEL-ILLUSTRATION:**



Front View (Fig. 4.1)



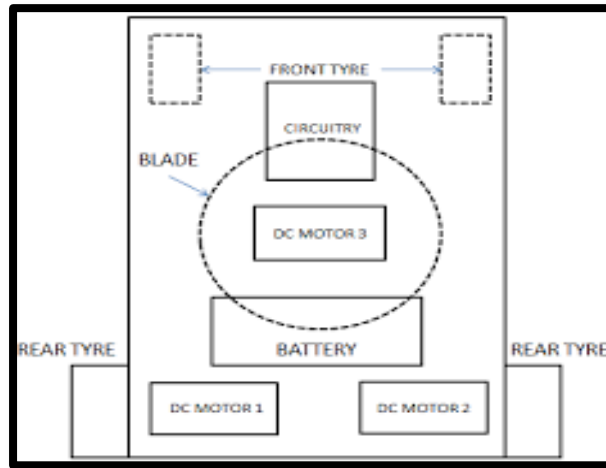
Aerial View (Fig 4.2)



Three-dimensional view (Fig 4.3)

**V. OTHER COMPONENTS AND DESIGN WORK:**

In this study, we developed a device that can cut grass with a changeable head and is powered by solar energy. The following component was utilised in this machine.



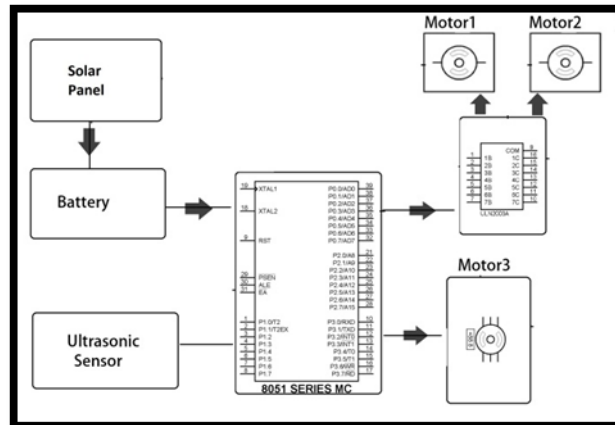
Smart solar grass cutter design and development (Fig 5.1)

The automated solar lawn cutter is a fully automated solar-powered grass-cutting robotic vehicle that can avoid obstacles and cut grass without the need for human interaction. 12V batteries power both the vehicle movement motors and the lawn mower motor. We also use a solar panel to charge the battery, removing the need for external power. All of the motors are controlled by a microprocessor from the 8051 series. The microcontroller pushes the vehicle motors forward in the absence of an obstacle.

| Sr.No | Item              | Quantity | Remark   |
|-------|-------------------|----------|--|
| 1     | DC Motor          | 2        | Rotating the wheel   |
| 2     | DC Motor          | 1        | Rotating the blade   |
| 3     | Wheel             | 4        | Moving the robot   |
| 4     | Battery           | 1        | Power supply for motors  |
| 5     | Solar panel       | 1        | Power supply for batteries   |
| 6     | Ultrasonic sensor | 1        | Obstacle detection   |
| 7     | Collapsible blade | 3        | High carbon steel resist wear  |
| 8     | Robot Body        | -        | Outer structure  |
| 9     | others            | -        | other Item like screws and bolts, bearings, supporting frame, base frame |

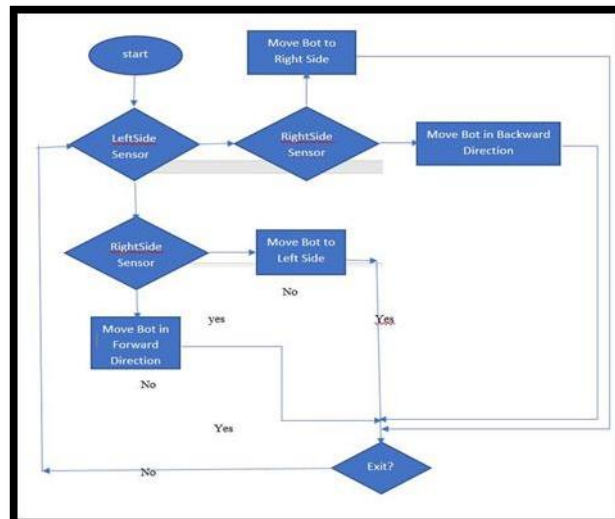
Components of a Grass Cutter (Table 5.1)

A belt connects the lawn cutter and vehicle motors. When the Ultrasonic sensor detects an obstruction, the grass cutter motor is turned off by the microcontroller to prevent injury to the object, humans, or animals. Before sending the lawn cutter forward again, the microcontroller spins the vehicle till it clears the item.



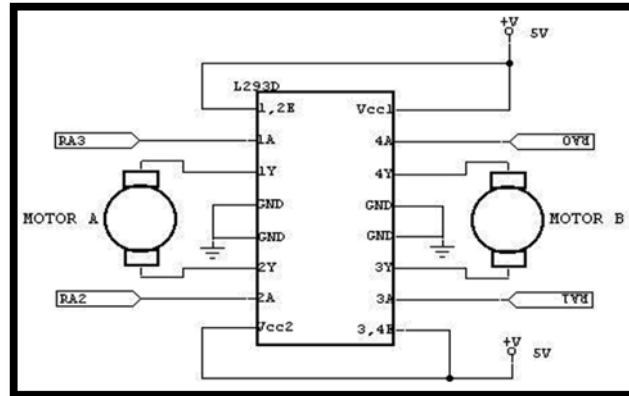
Proposed System Block Diagram (Fig 5.2)

### VI. METHODOLOGY:



Grass Cutter Algorithm (Fig. 6.1)

The rechargeable batteries are charged using a 10 watt solar panel. The solar panel can provide up to 18 volts and 580 milliamps of power. A charging circuit is required between the solar panel and the batteries. A voltage regulator regulates the voltage to 15 volts, one transistor amplifies the maximum current to the circuit, and diodes are all part of the charging circuit. The entire circuit is powered by a 12 volt battery, and the cutting blade is powered by a 12 volt battery. When an interrupt or barrier occurs, the ultrasonic sensor detects the impediment and delivers feedback to the microcontroller, which then turns left or right according to the programmer. After a little while, it senses again, and the identical operation is performed. If it detects nothing in the ultrasonic range, it advances until it finds something. B Two DC motors rotating at 100 rpm propel the robot. The motors are driven by a motor driver (L293D). Another name for it is H-Bridge. The use of a motor driver is necessary since DC motors require a minimum input voltage of 9 volts. We'll need 9 to 12 volts to drive the motors because the microcontroller only outputs 5 volts. As a result, we use a motor driver that accepts 5 volts as an input and drives the motors with 12 volts. The L293D motor driver controls only two motors, each of which can move in both directions. The cutting blade is used to cut the grass. To cut any type of grass, we needed a high-rpm motor; therefore we used a 1400 rpm motor for the cutting blade. A rechargeable 12 volt battery powers the motors. Bot and cutting blade movement are controlled by separate DPDT switches.



Circuit of a Motor Driver (Fig 6.2)

**VII. RESULT:**

We discovered a variety of results, as well as some experimental data, which is mentioned below.

| Sample plot    | Average height of grass before moving (mm) | Average height of grass after moving (mm) | Expected height of grass after moving (mm) |
|----------------|--|---|--|
| Elephant grass | 224  | 90  | 100  |
| Stubborn grass | 234  | 92  | 100  |
| Spare grass    | 111  | 70  | 80   |
| Carpet grass   | 70.5                                       | 56.5                                      | 50   |

Grass Cutting Results (Table 7.1)

By evaluating the above data, we discovered that the grass height is the same as the variable head height that we previously adjusted, and that cutting the grass takes less time and power, resulting in increased overall efficiency.

And here are the final photos of the functioning project, which is running well and producing satisfactory results.

**VIII. CONCLUSION:**

It will be easier for others who take up the project to make changes in the future. This project is more suitable for the common person because it offers numerous advantages, including no fuel costs, no pollution, no fuel, less wear and tear due to fewer moving parts, and the ability to run on solar energy.

This will give people significantly greater physical activity and is easily controllable. This setup may charge the batteries while the solar-powered lawn mower is running. As a result, it's significantly better for mowing the lawn. The same thing may be done at night because these batteries have the ability to be charged and reused.

**IX. FUTURE PLANS:**

Light sensors are used to fasten the solar panel. As a result, depending on how the sun is positioned, the panel will be tilted so that the sun rays strike the solar panel normally (at 90 degrees). This would allow the device to capture solar energy at any time, even when the sun's light is weak. The machine can be used at night for garden illumination or interior lighting because a high-wattage panel can accumulate more electricity. You keep it separate at night, though.

As a result, we can make use of the battery's power for this purpose. One of the valves in the pipe can also be used for gardening, i.e. pouring water for plants. We can move files, books, and other goods from one site to another in the office or elsewhere by connecting one box type transporter from one location to another after adjusting for efficiency. On a small scale, grass cutting can be utilised more successfully in rice harvesting.

**APPLICATIONS:**

- For a cricket pitch.
- All playgrounds and gardens.

**ADVANTAGES:**

- Small and compact size.
- It is simple to transfer from one location to another.

- The operating premise is straightforward.
- This machine can also be used by non-skilled individuals.

**REFERENCES:**

- [1] Jadaun, Abha, Satish Kumar Alaria, and Yashika Saini. "Comparative study and design light weight data security system for secure data transmission in internet of things." *International Journal on Recent and Innovation Trends in Computing and Communication* 9, no. 3 (2021): 28-32.
- [2] Alaria, Satish Kumar, Vivek Sharma, Ashish, and Vijay Kumar. "Design Simulation and Assessment of Prediction of Mortality in Intensive Care Unit Using Intelligent Algorithms." *Mathematical Statistician and Engineering Applications* 71, no. 2 (2022): 355-367.
- [3] Aditi Vijay, Ashutosh Gupta, Ashwani Pal, B Sriswathi, Geetika Mathur, Satish Kumar Alaria, "IoT SOCIAL DISTANCING & MONITORING ROBOT FOR QUEUE", *International Journal of Engineering Trends and Applications*, Vol-8, Issue-4, PP- 20-25, 2021.
- [4] <https://www.goodenergy.co.uk/how-do-solar-panels-work>
- [5] <https://robu.in/working-principle-of-dc-motor>
- [6] <https://www.microcontrollertips.com/principle-applications-limitations-ultrasonic-sensors-faq>
- [7] <https://www.ijedr.org/papers/IJEDR1702016.pdf>
- [8] [https://www.researchgate.net/publication/325221845 Automatic Solar Grass Cutter](https://www.researchgate.net/publication/325221845_Automatic_Solar_Grass_Cutter)
- [9] <https://www.ijeat.org/wp-content/uploads/papers/v9i2/B4920129219.pdf>
- [10] <http://ijariie.com/AdminUploadPdf/Experimental study of Solar Power Grass Cutter Robot ijariie1674.pdf>