

# TRAWA- AN AUTOMATED SOLAR GRASS CUTTER

<sup>[1]</sup>Hiba Hameed, <sup>[2]</sup> Krishna Priya Venu, <sup>[3]</sup> Naina Fathima Sayed, <sup>[4]</sup> Upasana Unnikrishnan,  
<sup>[5]</sup> Ms. Divya James

Department of Information Technology Rajagiri School of Engineering & Technology, A.P.J Abdul Kalam  
Technological University Kerala, India.

To access & cite this article

Website: [www.ijirmet.com](http://www.ijirmet.com)



## ABSTRACT

Grass Cutting machines are a popular technology with wide usage today. The old models of grass cutters used IC engines which has a negative impact on the environment. Also, the IC engine driven cutters are more costly and difficult to maintain. Other systems for the same purpose can be seen to be time consuming and requires a human to control the device throughout its activity. The paper presented here discusses our project which aims to construct a grass cutter which operates on solar energy, to provide an energy efficient solution. The project is a fully automated grass cutting robotic vehicle powered by solar energy that also avoids obstacles and is capable of automated grass cutting without the need of any human interaction.

**KEYWORDS:** Arduino, Automation, Grass Cutter, Obstacle Detection, Power Monitoring, Solar.

## I. INTRODUCTION :

The aesthetic value of the environment is an aspect that the present world gives prime importance to and regards it as a measure of the quality of life. Lawn Mowing contributes to the enhancement of the said aesthetic influence. Lawn mowing or grass cutting has in a way developed into an art. Advance in technology brought about changes in grass cutting tools and techniques as well. Early systems used machetes, hoes, and cutlasses etc. The systems eventually upgraded to motorized grass cutters.

The present world witnesses the harsh consequences of environmental pollution. According to a recent study that appeared in the European Health Journal, it is noted that air pollution kills more people than tobacco and the number of deaths associated with the fine particulate matter in the atmosphere globally is around 8.8 million which is twice more than that had been estimated previously. Therefore there is an inevitable need to shift to environment-friendly devices, tools, mechanisms and other technologies from the earlier fossil fuel and other non-renewable energy based and polluting solutions that are still in use more as of the current world scenario. For example, the more used Gas Powered Lawn Mowers emit exhausts which pollute the atmosphere.

They contribute to air and noise pollution. Hence functioning of such a device is a step towards damaging the environment. With the immense focus on researches for developing energy-friendly solutions, we know that the sun is an abundant and relatively infinite source of energy. Hence using Solar Energy is one way and the most brilliant way to go forward in an attempt to achieve the required solutions. Instead of developing gas-powered mowers, we can shift the mowers to derive its power from Solar Energy.

Traditional lawn mowers are heavy machineries that require a lot of manpower and energy for its basic functioning. The recent innovations in technologies allow us to automate various processes that might have earlier required a human for the operation. With the combined aim for building energy efficient and automated solution for lawn mowing, our project aims to prototype an

automated robotic grass cutter based on solar energy. The grass cutting robotic vehicle powered by solar energy also avoids obstacles and is capable of cutting grass without the need of any human interaction. The system will store its generated power in a battery. The power is generated with the help of solar panel that will be placed on the top of the robot.

The prototype will derive its required power from sun, which is captured using top mounted solar panels. It will have a rechargeable battery, different sensors, several dc motors, Arduino as well as an electrical outlet for emergency requirements only. The robot incorporates the concept of Internet of Things by communicating with other smart devices via Internet. A user can obtain information and analysis regarding the robot's power consumption, device status etc. via a user interface. It also lets user give commands to the robotic vehicle via the user Interface.

The removal of constant man power requirement in the model, becomes beneficial in the cases such as mowing large field areas, mowing in hot summers etc. Despite not being in direct contact with the robotic vehicle, the model gives a better connection with the operation of the robot, by enabling ten folds easier handling and controlling of the robotic vehicle.

In effect, as of today, there are a wide variety of grass cutting and lawn mowing technologies with varied functionalities. However, most of the grass cutting solutions use Oil based engines for propelling and cutting purposes. This is resource intensive in terms of its non-renewable energy source and also most often require heavy maintenance. Other solutions tend to require a human to control the device throughout its activity. The present era looks at building green energy solutions to problems such as this which imparts high negative impact on the overall environment and resource scarcity.

## II. LITERATURE SURVEY :

Vicky Jain et al. [1] proposed a wireless grass cutter that uses solar panels for extracting photovoltaic energy. Hence batteries don't have

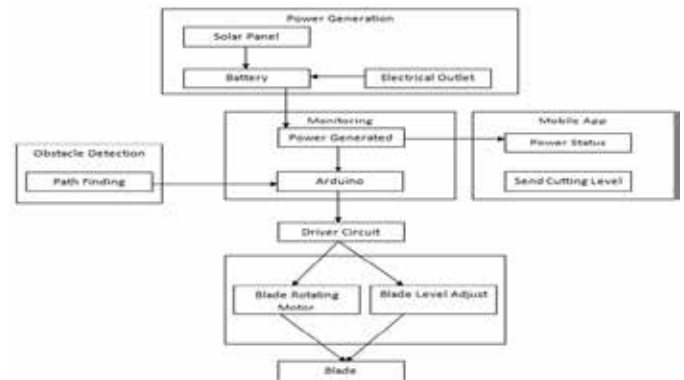
to be externally charged or replaced. The battery is continuously charged at constant voltage even when the grass cutter is working. It is a remote-controlled device. It makes use of two DC motors and hence both forward and backward motion of grass cutter is simultaneously possible.

Ashish Kumar et al. [2] discusses an experimental study of Solar Power Grass Cutter Robot. In this paper, the author explained how the solar plate placed above the grass cutter generates solar energy and uses the obtained energy for the functioning of the grass cutter. For preventing the battery from overcharging and over discharging, a voltage regulator or a charge controller is placed into the system which must be placed in a series. It specifies extensions to a simple model under the paper’s discussion such as using a driver circuit for controlling the speed of the motor as per the requirement. Other extensions can be the usage of LCD screens for status and energy generation monitoring purposes, provision of power banks to charge the machine instantly when there is a scarcity of solar energy such as during rainy seasons.

Pratik Patel, Ashwini Bhosale et al. [3] in their paper outlines non-solar energy based automated grass cutter. Automation is achieved through the use of different sensors. The feature that stands out in their model is the use of an LCD Screen and keypad system to allow users to provide input regarding the area to be cut in terms of X and Y axis. This allows for customizing the cutting patterns, for instance cutting the lawn area in shapes of letters or words.

T. Karthick, S et al. [4] in his paper fabricated grass cutting machine with rotary blades by using solar energy. The photovoltaic energy based system uses linear or rotary blades that slide linearly to cut the grass. The level at which the grass must be cut can be adjusted by considering ground clearance. The fabricated machine is more oriented towards providing a low cost and environment-friendly solution that can be used even by unskilled operators. It does not put forward automation and sets up a manually operated system.

### III. PROPOSED WORK :



The project proposed aims to construct a grass cutter which operates on solar energy, to provide an energy efficient solution. The robotic machine is expected to avoid obstacles and work without the physical intervention of the human user.

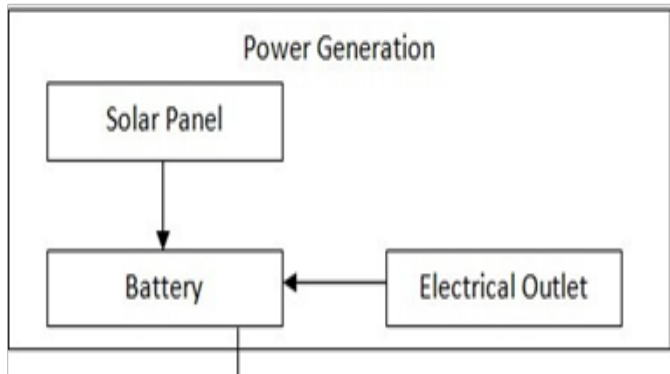
A solar panel is used to power a battery which can also be powered via an electrical outlet, just in case of emergencies. Arduino is used for computational and logic processing. The grass cutter and vehicle motors are interfaced to an Arduino board for conditional operation of all the motors i.e. motors for driving the device as well as the motor for rotating blades. An ultrasonic sensor is used for obstacle detection. On detecting an obstacle, the system is supposed to change its path to avoid collision with the obstacle. The height at which the grass is to be cut can be adjusted by changing the level of the blade as per the command user gives via a web interface. Power and other information about the working system can be displayed to the user via the web interface to give the user a better understanding of the system and its power usage.

The proposed project will have different modules for tackling different functional requirements. The basic modules are Power generation, Power monitoring & decision, Obstacle detection, Blade control & User Interface modules.

#### POWER GENERATION

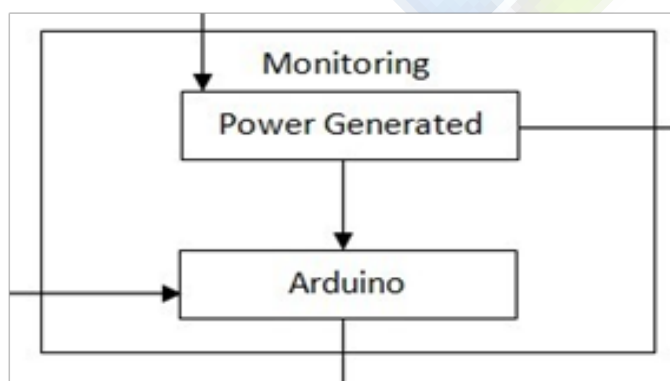
The functional aim of this module is to obtain solar energy and store the obtained energy in the battery in order to use it as the primary power source for the functioning of other modules. The

major components are Solar panel: which is required to convert photovoltaic energy to electrical energy, Solar charger: for storing the obtained electrical energy into the battery.



### MONITORING

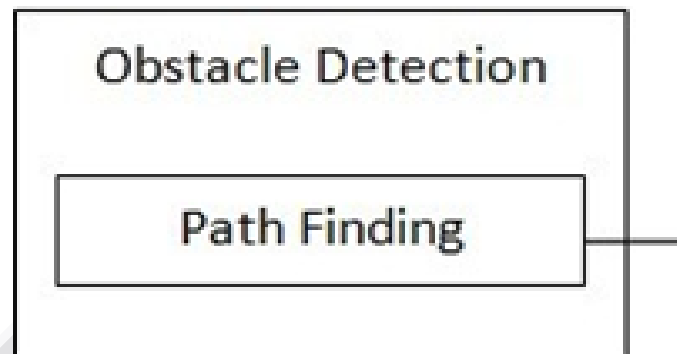
This module is responsible for most monitoring activities and subsequent decision making. Firstly it monitors the solar power generated and decides whether the required amount of energy is available in the battery. If not, the battery may be charged via an electrical outlet; however, it encourages waiting until the battery is fully charged using solar energy. The latter being the better solution even in terms of cost. This module also sends the monitored power data to the User Interface. It is also responsible for controlling blade height based on input from the UI module.



### OBSTACLE DETECTION

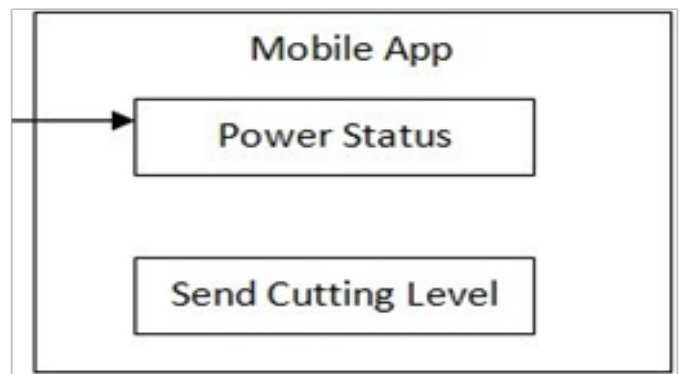
This module is used to give obstacle sensing capability to the robot which when detects the presence of an object while working, is able to avoid collision with that object and change its path automatically. Various complimenting materials have been used to make the

robot communicate with all its parts or components and to make it run. It uses ultrasonic sensors. Ultrasonic sensors have a variety of applications such as distance measurement, obstacle avoiding and anti-collision detection, measurement in automotive parking assistance systems etc. Ultrasonic sensors are more reliable since it almost always insensitive to factors such as dust, smoke, mist, vapor, light etc. It is also a cost-effective solution for distance sensing, level, and obstacle detection compared to IR sensors which can be used for the same.



### MOBILE APPLICATION/ WEB APPLICATION AS USER INTERFACE

This module provides an Interface between the robot and the user. For the sake of mobility and user friendliness a mobile application can be preferred over web application. Nevertheless, a Web Application may suffice. The user can give commands for controlling blade height and speed to the robot as well as obtain information regarding the power generated and utilized by the robot.



### E. Blade Module

Based on the height decision from the

monitoring module which in turn is received from the user interface upon user input, the driver circuit controls two different motors: Blade Rotating Motor & Blade level Adjust Motor, required for actuating the blade rotation and blade level.

#### IV. COMPARATIVE STUDY :

##### TYPES OF LAWN MOWERS

###### Self Propelled Lawn Mower

Self-propelling lawn mowers derive the force required to enable its forward motion from a motor. However, it does not have self-steering capability. Therefore, a human user is mandatory for steering and guiding the mower as required by the user. They are available as a single speed or variable speed mowers. They have higher cost and maintenance requirements when compared to push mowers. Most of them are Gas Powered.

###### Push Mower

Push mowers derive the forward momentum for its motion when a human user pushes it. Push mowers do have engines, however, the power generated is used for cutting the grass. Push Mowers too mandatorily requires human intervention for fulfilling its basic operation. They can have varying engines and weights. Most often the weights lie in the range of 60-70 pounds.

###### Reel Mower or Cylindrical Mower

Reel lawn mowers is environment friendly compared to other mowers since they don't require any engines for neither forward push nor cutting grass. Hence no amount of gas, oil, or electricity is used. However, it heavily draws energy from the user as it needs the user to guide and drive the device by hand. It is time-consuming. It is quiet while functioning.

###### Hover Mowers

A hover mower uses the hovering technique

much like hovercrafts. They ride on a cushion of air created between the mower and lawn. They have better maneuvering capabilities since it allows for side-to-side motion along with the forward and backward motion. Hence they can be used at spots where the other types of mowers cannot usually get to. Their functioning differs from a rotary blade and wheel based ones.

###### Robotic Lawn Mowers

Most robotic lawn mowers require confining the lawn area to be mowed within a boundary wire. These mowers are then programmed to cut the grass according to the user's requirements. It is relatively silent while functioning. But reviews point out that many users find the installation and programming of robotic lawn mowers challenging. They often have other features that enhance the user experience.

###### Lawn Mower Power Types

###### Battery Power

Compared to gas-powered lawn mowers, the battery-powered lawn mowers are light in weight and much quieter. In this model, the battery has to be recharged before each use. The duration of charging, battery life etc. depends on the individual models. Like all batteries, the battery used in these mowers has to be replaced eventually since charge cycles lead to deterioration in their charge capacity. Battery life can be extended by proper maintenance.

###### Electric Power

Electric power based mowers can be either corded or cordless depending on whether or not an electric wire is connected to the mower throughout its functioning. If an electric wire connection is maintained while mowing the lawn, it is corded. Else, they are cordless and can be pushed around freely. They too are quieter, simpler and lighter in comparison to gas-powered mowers. Corded mowers can prove to be challenging because they limit the area of mowing to the radius of the cord length. However, cordless mowers power depletes as it mows. This may result in breaking off the mowing in between to replenish the power. Some electric

powered mowers may be equipped with a battery.

## GAS POWERED

Gas-powered lawn mowers don't have to be charged. Also, they are not limited to the range that can be covered using a corded electric mower. Despite its powerful performance, it requires frequent engine maintenance to keep up their performance and to enhance longevity. In terms of negative environmental impact, gas-powered mowers tend to be less environment-friendly. They are a non-renewable energy source, costly and also contribute highly towards noise pollution compared to other types of mowers.

**Compared to the above systems, the proposed system has following advantages:**

- Uses easily available Arduino for computation and processing.
- Abundantly available and relatively untapped potential of Solar Energy is used as primary power source enabling an energy efficient and environment friendly solution in comparison to the gas, electric or oil powered lawn mowing machineries.
- The existing environment friendly systems most often require a human to control it while the proposed system automates the mowing activity without the need of any human intervention.
- The new technological advance such as Internet of Things concept is incorporated to inform the user about the functioning of the system and related analytics via widely available mobile smart phones, desktops and laptops.

## V. CONCLUSION :

In a resource scarce environment as of this era, there is a crucial focus towards development of energy efficient and environment friendly buildings, devices, mechanisms etc. With the development of technology, we are moving towards better energy friendly solutions. The project under discussion, a

fully automated solar grass cutter is a step towards the same. By incorporating the newest technologies, the solar grass cutter can be resource friendly while at the same time improving the various aspects of grass cutting. The project brings about an automated solution, thereby reducing the time required for lawn mowing, and does not waste or require heavy human

## VI. REFERENCES :

1. Vicky Jain, Sagar Patil, Prashant Bagane, Prof. Mrs. S. S. Patil "Solar Based Wireless Grass Cutter", International Journal of Science Technology and Engineering, Vol. 2, 2016, 576-580.
2. Ashish Kumar Chaudhari, Yuvraj Sahu, Prabhat Kumar Dwivedi, Harsh Jain, "Experimental Study of Solar Power Grass Cutter Robot" International Journal of Advance Research and Innovative Ideas in Education, Vol. 2, 2016, 68-73.
3. Pratik Patil, Ashwini Bhosale, Prof. Sheetal Jagtap, "Design and Implementation of Automatic Lawn Cutter", International Journal of Emerging Technology and Advanced Engineering, 2014.
4. T. Karthick, S. Lingadurai, K. Muthuselvan, M. Muthuvanesh, C. Pravin Tamilselvan, "Grass Cutting Machine Using Solar Energy", International Journal of Research in Mechanical, Mechatronics and Automobile Engineering, Vol. 2, 2016, 1-5.Y.
5. S. V. Palve, K. Panchal, R. Chipkar, Ajay P., G. L. Sonawane, "Solar Powered Automated Grass Cutter Machine" in International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 05 Issue: 04 | Apr-2018 www.irjet.net p-ISSN: 2395-0072.
6. Praful Ulhe, Manish D. Inwate, Fried D. Wankhede, Krushnkumar S. Dhakte, "Modification of Solar Grass Cutting Machine", International Journal for Innovative Research in Science & Technology, Vol. 2, 2016, 711-714
7. Tushar Baingane, Sweta Nagrale, Suraksha Gumgaonkar, Girish Langade, Shaila Ramteke, Prof. V.M.Dhumal, "Review on Fully Automated Solar Grass Cutter" in International Research Journal of Engineering and Technology (IRJET)

- e-ISSN: 2395-0056 Volume: 05 Issue: 02 | Feb-2018 www.irjet.net p-ISSN: 2395-0072
8. <https://www.homestratosphere.com/types-of-lawn-mowers>
  9. Ramyar rzgar Ahmed and Rahim Jafar Mahammad Sharif, 2018. "The Effect of Tuition Fees on University Applications and Attendance: Evidence from the Kurdistan Region private Universities", Qalaa Zanist Journal, Volume 3, Issue 4.
  10. Dr. S. Rabiyyathul Basariya, and Dr. Ramyar Rzgar Ahmed, 2019. "The Influence of 'Adventure Tourism Activities' in promoting tourism business in mountain stations", African Journal of Hospitality, Tourism and Leisure, Volume 8 (2).
  11. Dr. S. Rabiyyathul Basariya, and Dr. Ramyar Rzgar Ahmed, Nov 2018. "A Study On consumer satisfaction and preference of colour TV brands in Chennai city", International Research Journal of Management and Commerce, Volume4, Issue 10.
  12. Dr. S. Rabiyyathul Basariya, and Dr. Ramyar Rzgar Ahmed, "A Study on Attrition: Turnover intentions of employees", Jan 2019. International Journal of Civil Engineering and Technology (IJCIET), Volume 10, Issue 9.
  13. Dr. S. Rabiyyathul Basariya, and Dr. Ramyar Rzgar Ahmed, 2019. "The Influence of 'Adventure Tourism Activities' in promoting tourism business in mountain stations", African Journal of Hospitality, Tourism and Leisure, Volume 8 (2).
  14. Dr. S. Rabiyyathul Basariya, and Dr. Ramyar Rzgar Ahmed, Nov 2018. "A Study On consumer satisfaction and preference of colour TV brands in Chennai city", International Research Journal of Management and Commerce, Volume4, Issue 10.
  15. Dr. S. Rabiyyathul Basariya, and Dr. Ramyar Rzgar Ahmed, "A Study on Attrition: Turnover intentions of employees", Jan 2019. International Journal of Civil Engineering and Technology (IJCIET), Volume 10, Issue 9.
  16. Dr. S. Rabiyyathul Basariya, and Dr. Nabaz Nawzad Abdullah, Dec 2018. "A STUDY ON CUSTOMER'S SATISFACTION TOWARDS E-BANKING", International Research Journal of Management and Commerce, Volume 5, Issue 12,
  17. Dr. S. Rabiyyathul Basariya, and Dr. Nabaz Nawzad Abdullah, Dec 2018. "A STUDY ON CUSTOMER'S SATISFACTION TOWARDS E-BANKING", International Research Journal of Management and Commerce, Volume 5, Issue 12,
  18. Dr. S. Rabiyyathul Basariya, "Scope of the Indian Retail Market", International Journal of Retailing and Rural Business Perspectives, Volume 4, Number 3, July -Sep-2015. ISSN No: 2279 0942.
  19. Sivarao, T J S Anand, Hambali, Minhat, Faizul , "Review of Automated Machines towards Devising A New Approach in Developing SemiAutomated Grass Cutter ", International Journal of Mechanical and Mechatronics Engineering IJMME-IJENS, 2010.
  20. Ms Lanka Priyanka ,Mr Prof J Nagaraju ,Mr Vinod Kumar Reddy, "Fabrication of Solar powered Grass Cutting Machine", International Journal & Magazine of Engineering, Technology, Management and Research ,2015.
  21. Ernest L. Hall, " A Survey of Robot Lawn Mowers", Ernest L. Hall,06 October 2015.
  22. Patil. Self-Efficient and Sustainable Solar Powered Robotic Lawn Mower in International Journal of Trend in Research and Development(IJTRD). Vol.2(6), December 2015.
  23. Ms. Rutuja A. Yadav, Ms. Nayana V. Chavan, Ms. Monika B. Patil, Prof. V .A. Mane. Automated Solar Grass Cutter in International Journal of Scientific Development and Research(IJSDR). Vol.2, February 2017.
  24. Bidgar Pravin Dilip, Nikhil Bapu Pagar, Vickey S. Ugale, Sandip Wani, Prof. Sharmila M. Design and Implementation of Automatic Solar Grass Cutter in International Journal of Advanced Research in Electrical(IJARE). Vol.6, April 2017.
  25. Ms. Bhagyashri R. Patil, Mr. Sagar S. Patil. Solar Based Grass Cutting in International Journal of Electrical and Electronics Engineers (IJEED). January-June 2017.