iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** IV **Month of publication:** April 2019

DOI: https://doi.org/10.22214/ijraset.2019.4025

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 7 Issue IV, Apr 2019- Available at www.ijraset.com

A PLC Based Solar Powered Automatic Lawn Mower

Vijay Mithari[1], Rahul Jadhav[2], Ajit Shinde[3]
[1, 2]*Student,* [3] *Assistant Professor, EE Department, Sanjay Ghodawat Institute, Kolhapur, Maharashtra, India*

Abstract: ***In today's world, Automation is a vital a part of a world. Presently, manually operating machines are normally used for cutting the grass in the field. In the era where technology is emerging with more people are getting awared about environment, people are wanting different ways to contribute relief to their own carbon footprints.The previous generation grass cutters have to be compelled to get replaced by machine-driven one wherever system can work on its own and produce lesser pollution. This paper describes a lawn mower powered by the solar energy that is able to detect the obstacles and can operate autonomously. For this lawn mower PLC is utilized which will act as a brain of the entire system. Every action of the lawn mower is monitored by the PLC with the help of the sensor.***
Keywords: Solar Panel, Battery, Cutter, Motor, Sensor

I. INTRODUCTION

Now a days, pollution is that the major issue in the world. The sun is the major supplier of non conventional energy to earth. we can make use this solar energy for giving power to the new high tech grass cutting machines. Traditionally, lawn mowers are big machinery that needs a lot of strength and energy to use. An electrical mower operating on non- conventional solar energy can be easier to use. It'll eliminate those extra visits to the gasoline station for fill-ups.The unskilled gardener is enough to control the grass cutter. Most significantly it eliminates the emissions of an internal combustion lawn mower that are principally liable for environmental pollution and causes the green house gas effect believed to be responsible for increasing the global warming of our planet. As technology is up day by day the normal grass cutters should be get replaced by the economical, power saving and efficient one. Autonomous Solar Lawn Mower is a automated grass cutting robotic vehicle powered by solar energy that conjointly avoids obstales and is capable of cutting grass. The system will have some automation work for assistance and other obstacle recognition. Cutting of a grass can not be effortlessly accomplished by elderly, younger. Grass cutter moving with engine which creates noise pollution due to the loud engine, and local air pollution due to the combustion in the engine. Also, electric grass cutters are also risky and cannot be easily used by all. Also, if the electric grass cutter is corded, moving could be challenging and unsafe. So it is more efficient to use a solar power grass cutter which will be smart and which consumes less power.The prototype model will be charged by using solar energy. The design of a autonomous lawn mower includes D.C. motor, a rechargeable battery, solar panel, a stainles steel blade and control switch. The automatic grass cutting machine is going to perform the grass cutting operation by its own which means no human power is required. This will be better because man power is not essential in managing cutter on those hot sunny summerdays, where you will prefer not to be out in the sun.The remote will permit the user to control the speed and direction of the lawn mower. The reason for robotic lawn mowers are an interesting area of research and work because there are numerous real-world benefits of having a machine that autonomously cuts grass, these include: Aid elderly users or those with disabilities who are unable to fulfill this task themselves, For users with a busy schedule and rarely find time to mow, etc. Also Working range is increased due to absence of main supply wires. It is a device that can fit into just about everyone's lifestyle, therefore having a device that costs less, whilst accomplishing the same task as the higher end models is a great advantage in order to compete with the current market.

II. EXPECTATIONS FROM PROTOTYPE MODEL

There are many desirable properties in this device some of which are listed as –

A. Should be capable of cutting the grass properly
B. Should operate automatically
C. Should be light weight
D. Should work effectively in sensing the obstacles

©IJRASET: All Rights are Reserved

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 7 Issue IV, Apr 2019- Available at www.ijraset.com

III. LITERATURE SURVEY

A. Author studied solar powered vision based Robotic Lawn Mower.This robotic mowing device was solar powered and its battery gets charged from sunlight while mowing on the lawn or even manually. Ultrasonic sensors were used for avoiding obstacles and humidity sensor for checking humidity level in the lawn. Passive infrared sensor (PIR) was used to detect human interaction near the device in operation. Android smart phone was used for capturing images of the lawn as per requirement.The design is built on a mobile robot which communicates with a computer through a zigbee module. A GUI (Graphical User Interface) has been created in MATLAB for the selection of cutting design/pattern of the lawn by the operator.

B. Author introducs the concept solar power grass cutting machine. In this concept they cut the grass on the agricultural land or small plants in lawns and gardens. The design of solar powered agricultural equipment will include DC motor, a battery, solar panel, blade and control switch. The device consist of linear blades and it does not affected by climatic conditions. They have used many components for preparing grass cutter like DC Motor for rotating the wheels and blade, wheels, battery, Solar panel, IR sensor, Collapsible blade. There are two main components such as transmitter and receiver. Transmitter continuously transmits the rays if any obstacle come in front of grass cutter then the rays are reflected back towards the receiver. The receiver receives the signal in the serial form from encoder but microcontroller requires parallel data for communication so receiver sends data to decoder to convert data in the parallel form and then it is passed to microcontroller.

C. The author studied on design and development of a solar powered lawn mower. They tried to achieve a solar powered lawn mower model that uses solar energy to run the electric motor. The electric motor is coupled to the cutting blades. The photons from the sun hit the photovoltaic cell and as a result, flow of electrons starts leading to direct current. They performed a detailed analysis to estimate the torque produced and whether it is sufficient to perform intended work.

D. Author performed design and fabrication of kever operated solar lawn mower and contact stress analysis of spur gears. They tried to develop a height adjustable mechanism for cutting blade. The mechanic involves a pair of spur gears of different face width and a lever which adjust the rotor height such that the smaller apur gear slides on the face of larger spur gear. An arduino was used to control the speed of the blade and obstacle detection. Solar panel receives sunlight and powers the battery which in turn runs the electric motor.

E. In this paper they are trying to make a daily purpose robot which is able to cut the grasses in lawn. The system will have some automation work for guidance and other obstacle detection and the power source that is battery and a solar panel will be attached on the top of the robot. The system uses 12v batteries to power the vehicle movement motors as well as the grass cutter motor. The cutter and motors are interfaced to an 8051 microcontroller. The microcontroller moves the vehicle motors in the forward direction in case no obstacle is detected. If in case obstacle is detected by the sensor then the microcontroller stops the grass cutter motor so as to avoid any damage to the object/human/animal coming.

F. This paper proposes a solar powered vision based robotic lawn mower. Unlike other robotic lawn mowers in the market, this design requires no perimeter wires to maintain the robot within the lawn and also with less human effort in the manual mode operation. Through an array of sensors safety takes major consideration in the device, this robot will not only stay on the lawn, it will avoid and detect objects and humans. Here they used a 12v 310mA solar panel in their project. There are 24 solar cells on the solar panel, each contributing to 0.5v each. They could attach a battery but as the lead acid rechargeable battery used is rated 12v 1.2Ah,it won't be overcharged due to the small output of solar panel. To detect the obstacles, they used IR sensors which has 1m 555 IC. There are two sensors, one on each side. This is because in case the obstacle is on the left then it will move in right direction and if the right sensor detects the obstacle then it goes towards the left.

IV. PROBLEM WITH EXISTING TECHNOLOGY

A. The size and shape of the garden

As wires have to be placed in the area to be covered by wired electric lawn mower the cost of the entire system may be considerably higher depending on the size. In the case of many plants being in the middle of the garden area, the setup can become cumbersome.

B. Damage or Faults

The damage can be from any origin for example, pets can dig up and damage the wire, over time due to weather it can wear off, amongst others. A fault on the wire can provide incorrect information to the device and as consequence the device will not work as expected.

©IJRASET: All Rights are Reserved

C. Pollution Problem

The lawn mower based on IC engine to which cutting blade is attached uses fuel to run the engine. The burning of fuel causes the air pollution. Also it produces a lot of noise which is annoying.

V. METHODOLOGY

The smart grass cutter system puts forth a completely automated lawn mower mechanism. The robotic vehicle is equipped with a blade that allows for grass cutting at high RPM.

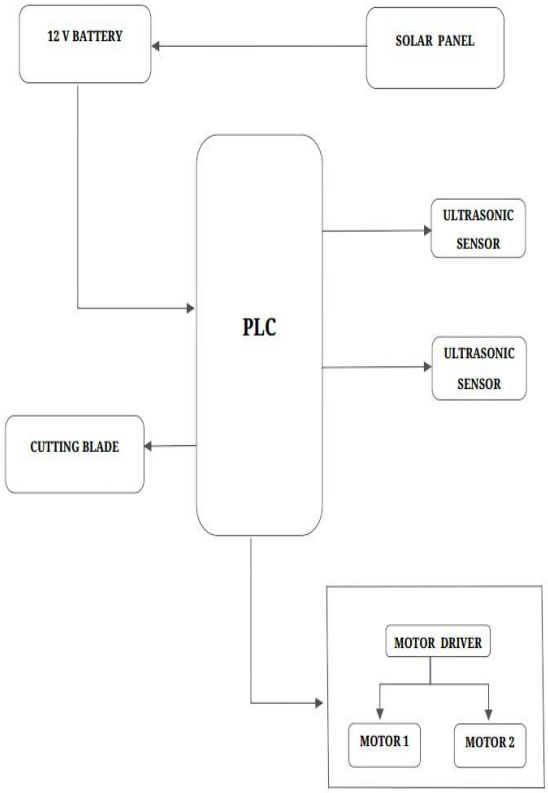


Figure 1:- Block Diagram

This efficient system uses a PLC based circuit in order to achieve this functionality. It is a battery operated system that uses two batteries. One battery is used to run DC motors and the other one is used to power the grass cutter motor. The PLC operates the vehicle movement dc motors as well as the grass cutter at the same time as monitoring the ultrasonic sensors. The PLC smartly operates the dc motors using the motor driver IC to achieve desired movement based on ultrasonic inputs.

The main mechanism of this system are,

A. Collision Detection Mechanism

This is used to detect the obstacles in the path of device. This is to be achieved with the help of sensors or micro switches. The difference between the two is that whereas in case of collision detection sensor, there will be no physical contact with the obstacle, it will not be the same if micro switches are to be used. In case of micro switches, there will be collision with the obstacles and then the device will turn away from it.

B. Grass Cutting Mechanism

This is most vital part of the device. This mechanism is to be used to cut the grass, which is the primary function of the lawn mower. The number of cutting blades can be used depending on the requirement. Also the motion of the cutter can be controlled with help of timer as to when to switch it.

©IJRASET: All Rights are Reserved

C. Motor Controller

It has the ability to control the direction of the motor which is used to control motors in autonomous robots.

Sr. No.	FACTORS	SOLAR BASED GRASS CUTTER	IC ENGINE BASED GRASS CUTTER
1	Pollution	No	Causes the pollution
2	Fuel	NO Fuel Consumption	Requires fuel for its operation
4	Cost	Low	High
5	Maintenance	Low	High
6	Load Carrying Capacity	Low	High

Table 1:- Comparison Between Solar & IC Engine Powered Lawn Mower

III. COMPONENTS USED

1) Solar panel:- Soalr panel absorb the sunlight as a source of energy to generate electricity. Solar energy is an important, clean, cheap and easily available renewable energy source. Among the non conventional sources of energy solar energy is the most promising.

2) Battery:- larger the battery, the more energy it can store. A 12 V deep cycle battery is used. These batteries were designed to be fully discharge and then replenished without any damage to the electrolytes or internal plates. Depending on the size of the battery, it takes a of 5-8 hours to charge a dead battery from a solar panel that produces 1 Amp of current.

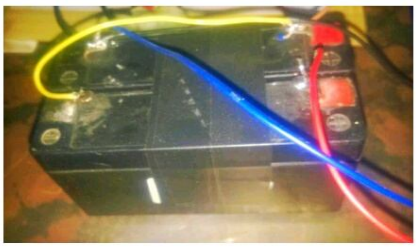


Figure 2:- 12 V Battery

3) Charge Controller:- These units will automatically disconnect the battery from the solar panel once the battery is fully charged. A unit with a MPPT circuit will also maximize the energy from solar panel. If more than one panel is used, make sure that it can handle the total amount of current from all of the solar cells put together.

4) Ultrasonic Sensor:- An Ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back.



Figure 3:- Ultrasonic Sensor

©IJRASET: All Rights are Reserved

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 7 Issue IV, Apr 2019- Available at www.ijraset.com

5) *Cutting Blade:* This will be used for the primary function of the mower i.e. to cut the grass. Depending on the design, more than one cutter can be used in synchronization as well. Also, cutters with different shape or number of blades can be used for the purpose of getting the required cutting speed.

6) *DC Motor:* There are various voltage input for DC motor and the common voltage input for DC motor are 3V, 5V, 12V, and 24V. DC motor provide excellent of controlling the speed wheel is a circular component that is intended to rotate on an axle bearing.



Figure 4:- DC Motor

7) *Wheels:* These will be required for the motion of the body of the robot. The selection of the wheels depends on the shape and size of the grass. It will also depend on the required ground clearance of the robot. As threads of the tires can contribute significantly to the performance of the mower, great caution is necessary during the selection of the particular tires.



Figure 4 :- Wheels

IV. CONCLUSION

This paper review methodology used in Automated solar grass cutter. As the technology is getting to a new heights, existing lawn mower technology should also be improved. Different technologies discussed above has its own positive and negative points and by analysing them we can develop a smart and more efficient autonomous solar grass cutter.It has also been observed that the technological variations of commercially available lawn mower are not abundant. Most of the lawn mowers are powered by the IC engine and operating cost of this is around Rs.400-600/- per day excluding labour charges. It is expected that low cost improved manual / electric lawn mower once developed, the operating cost for such system will be reduced in future. A solar powered autonomous lawn mower will help to reduce cost of operation, produces zero pollution and promotes the use of renewable energy sources.

©IJRASET: All Rights are Reserved

REFRENCE

[1] A.Dipin and T.K .Chandrashekhar , ―Solar powered vision based robotic lawn mower,‖ International Journal of Engineering Research and Reviews ,vol. 2, pp: 53-56, April 2014 - June 2014.

[2] Bhagyashri R. Patil, Sagar S. Patil. Solar Based Grass Cutting in International Journal of Electrical and Electronic Engineers (IJEEE). January- June 2017.

[3] O. A Tanimola, P. D Diabana, and Y. O. Bankole ,―Design and development of a solar powered lawn mower,‖ International Journal of Scientific & Engineering Research, vol. 5,June-2014.

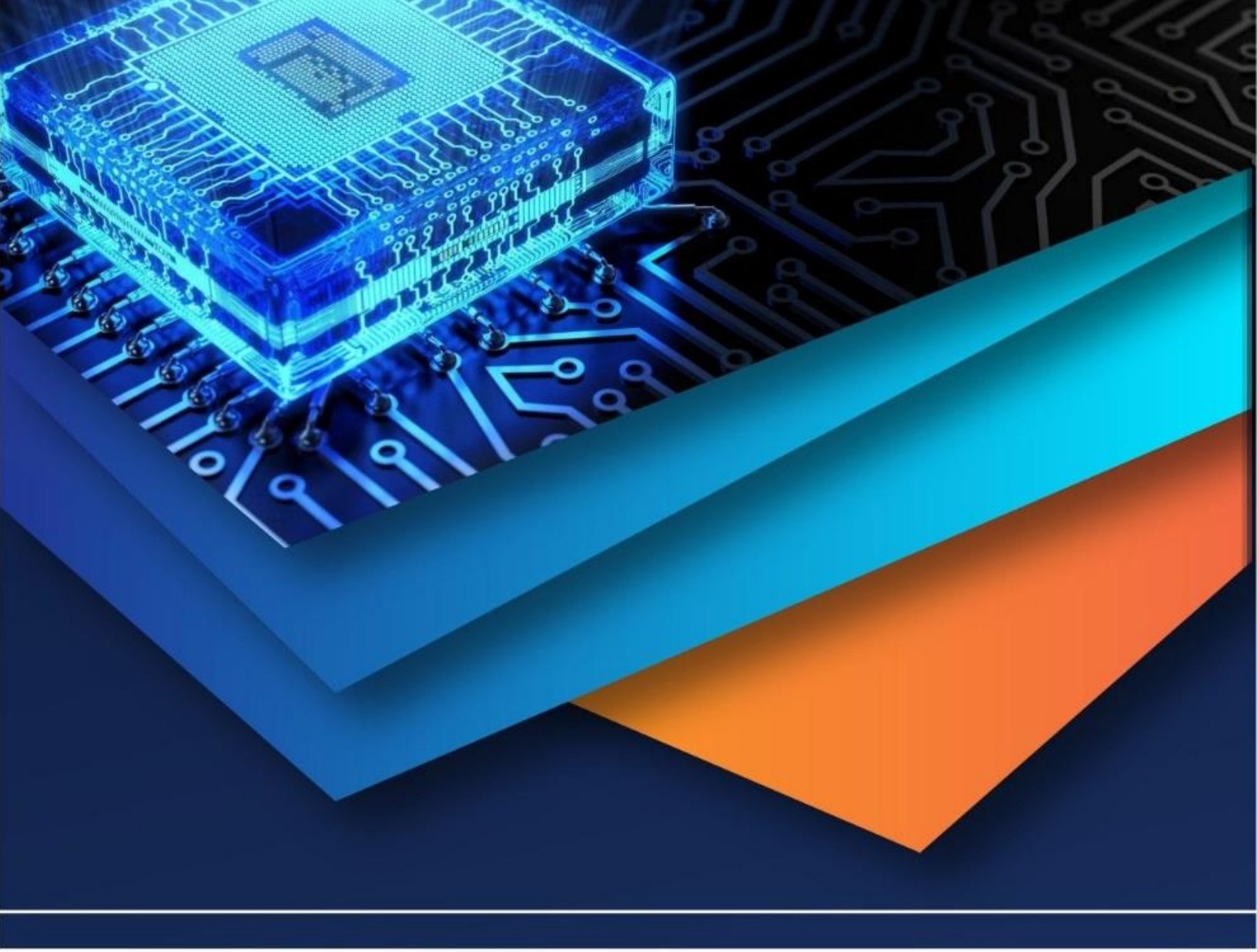
[4] JD.Satwik, N.Ramalingeswara Rao, SreeramReddy, ―Design and fabrication of lever operated solar lawn mower and contact stress analysis of spur gears," International Journal of Science, Engineering and Technology Research, vol. 4, August-2015.

[5] Rutuja A. Yadav, Nayana V. Chavan, Monika B. Patil, Prof. V. A. Mane. Automatic Solar Grass Cutter in International Journal of Scientific Development and Research (IJSDR) Vol.2, Feb 2017.

[6] Ray Jarvis, A tele-autonomous heavy-duty robotic lawn mower, proc. 2001 Australian conference on Robotics and Automation Sydney, Nov 14-15,2001

[7] S. Sujendran, P. Vanitha , "Smart Lawn Mower for Grass Trimming," IJSR ,vol 3, Issue 3, March 2014

©IJRASET: All Rights are Reserved



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)