



Solar Powered Autonomous Grass Cutting Robot

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ABSTRACT: Solar Powered Autonomous grass cutter is mainly used for cutting grass of the lawn or ground which will mainly operate on solar power energy for that we are using solar panel. This system will also operate on a battery that will also be charged through solar energy rather than using any external power. In this IR sensors are also used to detect any object/human /or animal while cutting the grass so to avoid them. The main objective of this Solar Powered Autonomous grass cutter is that the user can specify the area that is to be cut and also the height of grass as per there requirement by using the IR remote.

KEYWORDS: Grass cutter, IR Proximity sensor, DC motor, LCD display, IR Remote, IR decoder, Colour Sensor.

I. INTRODUCTION

Now a day's pollution is a major issue for whole world. Pollution is manmade and can be seen in own homes. In case gas, powered lawn mover's due to the emission of the gases it is responsible for pollution. Also, the cost of the fuel is increasing. Hence it is not efficient. So, the solar powered autonomous lawn cutters are introduced. Solar powered lawn mower can be described as the application of solar energy to power an electric motor which in turn rotates a blade which does the moving of a lawn. Solar energy is the renewable energy. Motor power push lawn mowers create noise pollution due to the sound of engine, And local air pollution due to the combustion in the engine. Also, a motor-powered engine requires periodic maintenance such as changing the engine oil even though electric lawn mowers are environmentally friendly, they too can be an in convenience. Along with motor powered lawn mowers, electric lawn mowers also hazardous and cannot be used by all. The project is an autonomous solar grass cutter that will allow the user to the ability to their grass with minimal effort. Robots are often expensive and costly which often discourages people from buying costly robotic devices. An autonomous robot can mow the lawn of a given specific area of the garden without any human supervision.

II. LITERATURE SURVEY

1)IEEE –" Design and Modelling a Prototype of a Robotic Lawn Mower" (2008)

In this paper, the Robot is controlled by PIC 16F877A & C++software language. This is 3-wheel Lawn mower. The result of this project is that, it will reduce human efforts while grass cutting as well as it can be used for transporting small objects, vacuum cleaning, etc.

2) Srishti Jain, Amar Khalore and Shashikant Patil, "Self-Efficient and Sustainable Solar Powered Robotic Lawn Mower", International Journal of Trend in Research and Development, Vol-2, Issue-6, pp- 294, 2015-

In this project, Atmega 328 is used as brain of the system. Here, IR sensor is used for obstacle detection. To drive the system, 4 motors are used along with L293D motor driver IC.



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- 3) "A Review on Smart Solar Grass cutter with Lawn Coverage" (2017) Imperial Journal of Interdisciplinary Research (IJIR)-

Moisture based sensors used for measure humidity. Ultrasonic sensor for obstacle detection from (2-400) cm. Due to ultrasonic sensor give high accuracy & stable Reading. It operates at night time also because of facilities to charge the batteries.

- 4) "Grass Cutting Machine by Solar Energy Power". May 2017 (International Journal & magazine of engineering, technology, management & research)

They are focused on force which is required to cut the grass force is require for moving should be greater than 10 newtons. Precise torque and speed control without sophisticated electronics.

- 5) "Solar Grass Cutter Robot with Obstacle Avoidance". April 2017 International journals for engineering science And computing (IJESC).

They have used micro controller board of design is Arduino Uno, which is open source platform used for building the electronic projects. They conclude that, the robot is used to reduce pollution due to gas and petrol engine, it reduces risk for user.

- 6) Ashish kumar chaudhari 1, Yuvraj sahu 2, PrabhatKumar Dwivedi 3, Harsh Jain4, "Experimental study of Solar Power Grass Cutter Robot", IJARIE-ISSN (O)-2395-4396, Vol-2, Issue-2, pp- 68, 2016-

In this paper, comparator and relays are used. Here, temperature sensor is also used for detection Of surrounding temperature. For this system, external power supply is also given along with solar panel to Charge the battery.

- 7) "A Portable and Automatic Weed Cutter Device". (IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE))

They have used GSM module. This vehicle is easy to operate, pollution free and automatic. As this cutter vehicle design is automatic, reduce the manual efforts. This system leads to improve the agricultural production.

- 8) 1Ms. YadavRutuja A., 2Ms. ChavanNayana V., 3Ms. Patil Monika B., 4Mr. V. A. Mane, "AUTOMATED SOLAR GRASS CUTTER", Volume 2, Issue 2, pp- 65, 2017-

In this robot, 8051 microcontroller is used for interfacing of different devices. Here ultrasonic sensor is used for obstacle detection. There are 3 motors used along with motor driver IC to drive the system.

- 9) Dipin.A 1 and Dr. Chandrasekhar. K 2, "Solar Powered Vision Based Robotic Lawn Mower", Vol. 2, Issue 2, pp: 53-56, Month: April 2014 - June 2014-

Here, Pic- 16f877A is used as a control unit along with zigbee module. 3 sensors are used in this system- humidity, PIR & ultrasonic.

- 10) Bincy Abraham1, Darsana P S2, Isabella Sebastian3, Sisy N Joseph4 Prof. George John P5, "Solar Powered Fully Automated Grass Cutting Machine", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 6, Issue 4, pp- 2520, April 2017

In this paper grass cutter and vehicle motors are interfaced to pic microcontroller that controls the working of all the motors. It is also interfaced to an ultrasonic sensor for obstacle detection. The microcontroller moves the vehicle motors in forward direction in case no obstacle is detected. On obstacle



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detection the ultrasonic sensor monitors it and the microcontroller thus stops the grass cutter motor to avoid any damage to the object/human/animal whatever it is and it also provides an alarm. Microcontroller then turns the vehicle as long as it gets clear of the object and then moves the grass cutter in forward direction again otherwise it changes the direction.

- 11) Sachin Prabha¹, Dattatray G. Biradar², Sachin Panshette³, Veerbhadrapa.T⁴ 1,2, 3M. Tech student, 4Assistant Professor, "SOLAR GRASS CUTTER MACHINE", Volume 3, Issue 10, pp- 2702, June-2016.

In this paper they are using the handle or frame. Which is depend on the size of the lawnmower. They are also using a bearing which is machine part, which support a moving element and confines its motion. DC motors are used for movement of wheels.

- 12) Baharuddin Mustafa, Aladin Zayegh, Rezaul K. Begg, "Ultrasonic & Infrared Sensors Performance In Wireless Obstacle detection system", First international conference on Artificial intelligence, modeling & simulation [IEEE], pp-439, 2013-

In this paper they are using the ultrasonic sensor and the infrared sensors for the mobile application for distance measurement. Its accuracy is 95% to 99%. The drawback is that minimum size of obstacle is 5cm x 5cm.the conclusion of that is both the sensors are able to detect obstacle within their usable range with percentage of accuracy.

III. RELATED WORK

In this project, we are designing an automatic lawn mower which operates on solar energy and avoid the drawback of old lawn mowers which use the electricity. It will detect obstacle by IR sensor to avoid the damage of human, object and animal. It is also considered that it should be moderately cheap and easy to implement with the help of the microcontroller. The fuel consumption will also be avoided which will lead to environment friendly nature.

Handling of this robot is very easy actually it will be light weight portable machine. it is also provided with remote control to move this robot manually to its destination. A normal TV IR remote is used for this purpose. The channel up and channel down key of the TV remote can be used for moving robot forward and backward. the volume (+) and volume (-) keys can be used for to move the robot left and right the menu button can be used to stop the robot. Channel no.2 and channel no.8 buttons will be used for adjusting height of grass cutting level.

The another exiting feature of this robot is the green grass sensor you don't have to give turn command manually the sensor will detect end of the grass and it will Automatically turn the robot to cut the remaining grass. The robot needs not to be charged regularly, the solar panel will take care of it.

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IV. BLOCK DIAGRAM

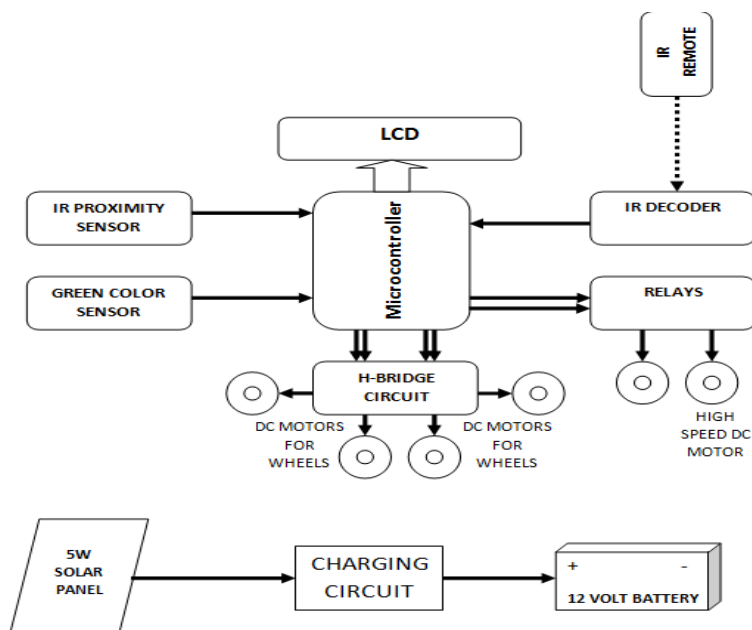


Fig. 1 Block Diagram

This system will be lawn moving robot or vehicle which will have four wheels. Two wheels on the left side and two wheels on right side all the four wheels will be powered with four 45 rpm,6v dc geared motors.

This motor will be controlled by the signal coming from the microcontroller. This will be a H-bridge circuit using IC L239D which will be used as driver circuit for the four motors the microcontroller will gives signal to this four motors depending upon the signal coming from the IR remote control.in manual mode commands will be given through this IR remote controller by the user we will need IR recorder circuit to convert IR signal to electrical signal the IR recorder will consisting of IR sensors and decoder IC the communication between microcontroller and IR decoder is U-ART communication or serial communication.

16*2 LCD display is used to display the commands that robot is executed. It will also display the output of the sensor. A IR proximity sensor will be placed on the front side of robot. It will detect any obstacle that will come in its path. A green colour sensor will be placed under the robot .it will detect the grass on the ground. The grass cutting motor will be a high-speed dc motor (around 1000rpm). a cutting blade will be attached to its rotating shaft. The cutting height of the grass will depend on the position of the motor. This motor can be move up & down using another DC motor (30rpm) which will be having a high torque but low speed. rack & pinion arrangement will be used to do this. these two motors will have required greater current so we will use relays to control them.

A solar panel (5W,10v ,0.61A) will be placed on the top of the robot so that it can take energy directly from sun. these solar panel consist of photovoltaic cells which generates voltage depending upon the incident solar rays on the panel. These generated energy is stored in rechargeable battery (6v/4.5AH) this will also give mechanical stability to the robot. Battery will work about 4hrs when it is fully charged. at the night time when there are no sun rays that time this battery will give power to the robot.



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IV. SYSTEM SPECIFICATION

There are different components are used in this system to run the robot. The specifications of these components are as follows:

- 8052 Microcontroller:8052 is the main controller of the system. It will control all the operations of robot. It is the 40 pin IC which includes 4 ports i.e. port0, port1, port2 and port3.
- Liquid Crystal Display(LCD):In this system, 16*2 LCD is used. It will display the actions which are performed by the robot. The LCD is used for the user convenience.
- Driver IC:Two 16 pin driver ICs are used in this system to enhance the current to the motors. The current supplied by the microcontroller is about 5 mA. The power transistors used in the driver IC will enhance the current and it will increase up to 1A which is sufficient to drive all the motors.
- IR Remote:The IR remote is used when there is need of manual operation of the robot. It is used to transmit the digital signal to IR decoder. This signal contains the commands which are to be given to robot, such as turning on/off, directions, cutter movements, etc.The range for IR remote to transmit the signal to the IR decoder is about 30 feet.
- IR Proximity Sensor:IR proximity sensor is used to detect and avoid the obstacle which comes in the path of robot. This will avoid the damage of any object, animal or human due to the robot. This sensor will transmit an EM signal continuously. When any obstacle comes in the path of the robot, the EM signal will return back and transmitted to the microcontroller and it will be avoided by the robot. The obstacle will be detected in the 1-meter range of the system.
- Colour Sensor:Colour sensor is used to detect the green colour of grass so that the cutter will only cut only green grass. Basically, the color sensor have 4 selection input pins i.e. S0, S1, S2,S4 in which S0 & S1 are used for selection of output frequency and S2 & S3 are used for photodiode type selection i.e. which color sensor should be chosen. For selection of green color sensor, S2 & S3 both should be kept high.
- Battery:The battery is used to store the electric supply which is given by the solar panel, so that the current and voltage will be passed to the robot as per requirement. Also, at night or rainy days, when the sufficient sunlight is not available, then the supply stored in battery will be given to the robot. The battery selected is of 6V, 4Ah. It will work for 4 hours when it is fully charged.
- Solar Panel:Solar panel is used for the electricity generation. Due to this, the pollution and external electricity generation will be eliminated. The solar panel used in the system is of 5W power which generates the output voltage of 12-18 V, and the maximum current of 0.61A.
- Motors:There are total 6 DC motors used in the system. 4 motors of 45 rpm are used to run the wheels of robot, 1 motor of 30 rpm is used for the up-down movement of cutter and 1 high speed DC motor of 1000 rpm is used for at the cutter to run the cutting action. These motors will receive the input voltage of 5-6V and 100 mA each.

Table I: Simulation Parameters

Parameter	Value
IR remote	30 feet
IR Proximity sensor	1 m
Battery	6v
Solar panel	5W, 12V,0.61A

V. RESULT

Our project entitled “solar powered autonomous grass cutting robot” is successfully completed and the results obtained are satisfactory. It will be easier for the people who are going to take the project for the further modifications. This project is more suitable for a common man as it is having much more advantages i.e. no fuel cost, no pollution and no fuel residue, less wear and tear because of less number of moving components and this can be operated by using solar energy. This will give much less physical exertion to the people and can be easily handled. This system has the

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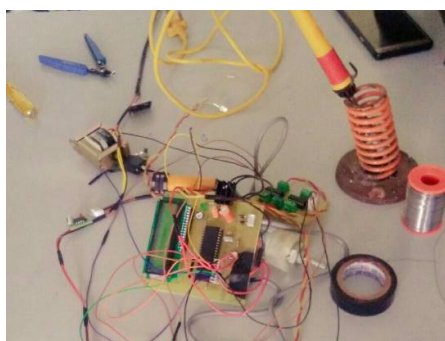
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facility of charging the batteries while the solar powered grass cutter is in motion. So, it is much more suitable for grass cutting also. The same thing can be operated in night time also, as there is a facility to charge these batteries in day light.

By Switching The Motors Rotating In Forward direction and The Grass Cutting Motor Activates, The Blade Which Is Fine-tuned To The Grass Cutting Motor Cut The Grass, If Any Obstruction Comes In The Way Then The IR Sensor Detects The Impediment And Sends The Signal To The Microcontroller Then As Per The Given Program The Micro Controller Transmute The Rotation Of One Of The Motor Then Two Motors Rotates In The given Directions. The project can be implemented in three phases:



(a)



(b)



(c)

Fig. Project Work

VI. CONCLUSION

Robotics is very vast field which comes with different combinations of technology this will helps to reduce the human effort and gives maximum efficient output for the work, nowadays lot of energy is wasted for mowing lawn in different areas of the world and also takes lots of human effort for the work. The main aim of this project is to make a solar powered autonomous grass cutting robot which will helps to cuts the lawn in different design with lesser human effort. Advantages of this system are used components are of low cost so and in bulk production and adding of few more sensors doesn't makes any difference. By using this system, we can preserve the non-renewable sources of energy such as petrol, gasoline etc. We can also reduce various forms of pollutions such as air pollution and noise pollution. Electricity is saved as we utilize solar energy that is renewable source of energy and is present in abundance.



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REFERENCES

1. Taj Mohammad Baloch & Thien Ching Kae, "Design & modelling prototype of a robotic lawn mower". University Technology PETRONAS, 31750 Bandar Seri Iskandar, Perak Darul [IEEE], 2008.
2. Srishti Jain, Amar Khalore and Shashikant Patil, "Self-Efficient and Sustainable Solar Powered Robotic Lawn Mower", International Journal of Trend in Research and Development, Vol-2, Issue-6, pp- 294, 2015.
3. Amol T. Bagul¹, Shivani G. Deore², Ashish D. Dhage³ & Prof. S. S. Bhardwaj⁴, "A Review on Smart SolarGrass cutter with Lawn Coverage", Imperial Journal of Interdisciplinary Research (IJIR), Vol-3, Issue-5, pp- 438, 2017.
4. E Naresh, Boss Babu, "Grass Cutting Machine by Solar Energy Power" International Journal & magazine of Engineering, technology, management & research, Vol-3, Issue-5, pp- 302, May 2017.
5. G. Manoj Kumar¹, G. Sravanthi², J. Ankamma Chowdary³, D. Aparna⁴, V. Ajay Kumar⁵, "Solar Grass Cutter Robot with Obstacle Avoidance". International journals for engineering science and computing (IJESC), April 2017
6. Ashish kumar chaudhari¹, Yuvraj sahu², PrabhatKumar Dwivedi³, Harsh Jain⁴, "Experimental study of Solar Power Grass Cutter Robot", IJARIE-ISSN (O)-2395-4396, Vol-2, Issue-2, pp- 68, 2016.
7. Ashwini D. More¹, Sayali N. More², Varsha V. Shetty³, Shweta V. Patil⁴. "A Portable and Automatic Weed Cutter Device", IOSR Journal of Electrical and Electronic Engineering (IOSR- JEEE), pp- 14, 2017.
8. 1Ms. YadavRutuja A., 2Ms. ChavanNayana V., 3Ms. Patil Monika B., 4Mr. V. A. Mane, "AUTOMATED SOLAR GRASS CUTTER", Volume 2, Issue 2, pp- 65, 2017.
9. Dipin.A 1 and Dr. Chandrasekhar. K 2, "Solar Powered Vision Based Robotic Lawn Mower", Vol. 2, Issue 2, pp: 53-56, Month: April 2014 - June 2014.
10. Bincy Abraham¹, Darsana P S², Isabella Sebastian³, Sisy N Joseph⁴ Prof. George John P⁵, "Solar Powered Fully Automated Grass Cutting Machine", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 6, Issue 4, pp- 2520, April 2017.
11. Sachin Prabha¹, Dattatray G. Biradar², Sachin Panshet³, Veerbhadrapa.T⁴ 1,2, 3M. Tech student, 4Assistant Professor, "SOLAR GRASS CUTTER MACHINE", Volume 3, Issue 10, pp- 2702, June-2016.
12. Baharuddin Mustafa, Aladin Zayegh, Rezaul K. Begg, "Ultrasonic & Infrared Sensors Performance in Wireless Obstacle detection system", First international conference on Artificial intelligence, modelling & simulation [IEEE], pp-439, 2013.

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