International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 06 | June 2020 www.irjet.net p-ISSN: 2395-0072

IOT BASED SOLAR POWERED ROBOTIC LAWN MOWER

Niveditha.V.S[1], Nivethitha.K[2], Priyadharshini.V[3], Sowmya.V[4]

[1]*UG Student, Department of ECE, KGISL Institute of Technology, Coimbatore, Tamilnadu*
[2]*UG Student, Department of ECE, KGISL Institute of Technology, Coimbatore, Tamilnadu*

Abstract - *Lawn maintenance is a tedious task that requires watering, mowing and fertilizing to be carried out at regular intervals to maintain a healthy lawn. Significant wastage and pollution occurs due to improper lawn maintenance practices. With many repetitive and routine tasks being replaced by robotic systems, lawn maintenance could also be achieved using a robotic system that would limit wastage and pollution, ensure a healthy lawn and reduce the work content of the lawn owner. This research presents a prototype robotic system developed to water a lawn efficiently by measuring soil moisture levels. The system comprises a tethered mobile platform and a watering system. The mobile platform is capable of measuring the soil moisture levels at a required depth and controls the water delivery based on pre-set moisture requirements. A novel Coverage path planning (CPP) algorithm was developed to account for the constraints posed by the tether and navigate to all accessible areas within a given lawn layout. The CPP algorithm uses a priori map consisting of environment data and prevalent static obstacles. This paper presents a fully autonomous system, which is able to water the lawn, traversing the path generated by CPP algorithm. The control system of the robot was developed using the Robot Operating System (ROS). The control system is designed in three layers. The higher level provides path planning and decision making, the mid-level provides communication with the hardware and carries out mandatory calculations and the lower level performs reading of sensor inputs and controlling of actuators. The developed platform was tested carrying out area coverage while watering a test area.*

Key Words: **Arduino ATmega328p, LCD Display, IR sensors, Node MCU, Solar panel**

1. INTRODUCTION

This work focuses on the development of a fully autonomous lawn mower that can be used by people with limited mobility. The lawn mower can be set to cover a predefined area autonomously or it can be controlled manually via mobile-phone, which allows the user to remotely control the lawn mower in any direction, turn the mower motor at a desired speed, and adjust the grass cutting height. In autonomous mode, the user can also define the area to be mowed and program the grid pattern the lawn mower will follow. Once the prototype was completed, the lawn mower was field tested to verify the overall functionality and accuracy of the autonomous mission plan and to determine the overall runtime battery life. Results of the fully-functional prototype demonstrate a successful autonomous operation.

1.1 Objective

The specific objective of this project was to develop an automatic lawn mower robot which would be able to help users in cutting the grass in gardens. The robot was made able to cover a specific area of flat land by avoiding any obstacle along the way. It was also considered that it should be moderately cheap and easy to implement with the help of the Arduino. Instead of requiring small details to be specified, the task in this project was carried out by considering the essential design features so that the installed system was able to autonomously execute its job in a manner that satisfies its desired task.

1.2 Existing System

In this system lawn mower, it covers the lawn area and operates complex, a visual, wireless, autonomous mower system via machine vision is designed. Firstly, collect the image information of locale dynamically by the real-time camera which erected on the high bracket, and display on the monitor of PC, then draw a few mowing range or mowing patterns of mower by mouse in the host computer software. Secondly, the host computer software analyse the data. Finally, convey the action signal to the actions required lawn mower to finish the mowing task. The experimental results show a high level of automation from the proposed lawn proposed lawn mower system, which has the function of avoiding obstacle automatically and covering the target lawn area completely.

Disadvantages:

- This lawn robot can only monitor on PC
- Programming the controller is very difficult.
- The structure of this system very complex and difficult to achieve

2. PROPOSED SYSTEM

- In this project Arduino-uno microcontroller is used which controls the entire robotic lawn by the instructions fetched in it.

- Ultrasonic sensor is used to detect the obstacle in the Lawn, when obstacle is detected the Robotic lawn stop moving.
- The movement of the lawn robot is controlled by motor driver which is connected to the motors attached to the wheels.
- Solar panel and Rechargeable battery are used to provide sufficient energy for the lawn robot by sunlight (Renewable energy resources).
- The chopping of the leaves is achieved by the cutter which is attached to motor and a relay.
- Another microcontroller namely Node MCU is used to operate the lawn robot using IOT from longer distance.

Advantages of the Proposed System

- The Monitoring and controlling of the Lawn robot is achieved using wireless is achieved using IOT.
- This Robot runs in Renewable energy (Solar power) with rechargeable battery.
- Automatic obstacle detection and avoidance is achieved.

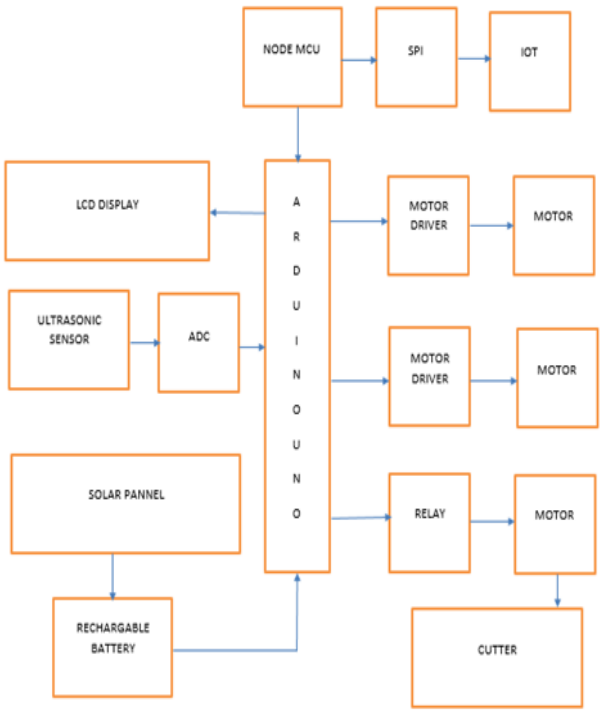

Fig -1: Block diagram of the system

2.1 Algorithm and Working Principle

In this project Arduino-uno microcontroller is used which controls the entire robotic lawn by the instructions fetched in it. Ultrasonic sensor is used to detect the obstacle in the Lawn, when obstacle is detected the Robotic lawn stops moving. The movement of the lawn robot is controlled by motor driver which is connected to motors attached in the wheels. Solar panel and Rechargeable battery is used to provide sufficient energy for the lawn robot by sunlight (Renewable energy resources).The chopping of the leaves is achieved by the cutter which is attached to motor and a relay .Another microcontroller namely Node MCU is used to operate the lawn robot using IOT from longer distance.

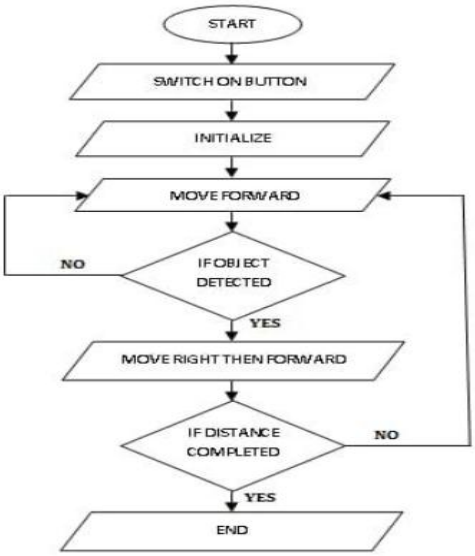

Fig -2: Flow chart of the system

3. SIMULATION

The motors are connected with the driver shield and all the other components are attached with the chassis. Ultrasonic sensors are used to detect the objects, IR sensors can also be used for obstacle detection. In this system left, right and front directions are considered. When the ultrasonic sensor detects any object at a distance of 15 cm, the robot stops and the ultrasonic sensor looks around left and right directions ie, 0-180 degrees with the help of the servo motor. The system compares the distance of left and right directions and the direction which has maximum distance without any objects is considered by the robot and it turns to that respective direction.

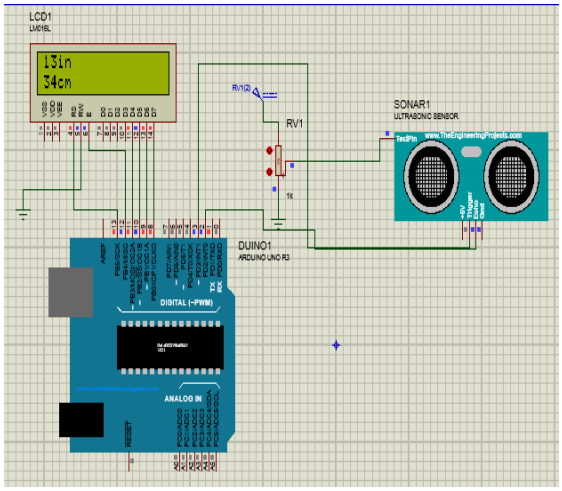

Fig -3: Simulation

4. RESULTS

After software simulation all the components of the system are assembled and tested. During testing the ultrasonic sensor continuously detects the obstacles in front of it. The sensor measures between 0 – 180 degrees. The robot takes ten different values at ten different directions in between 0-180 degrees to analyze the situation.

5. CALCULATIONS

- The calculations are made from the robot's motion and its RPM and RPS are determined under loaded conditions.
- The maximum RPM of the motor used is 100 RPM and the diameter of the wheel is 7cm. RPM = 1/60 RPS
- RPM – Rotations per minute
- RPS – Rotations per second d = P*N
- d=distance covered by the wheel mounted to the motor
- P=perimeter of the circular wheel(2πr)
- N= No of Rotations made by the motor V = d cm / t sec
- d=distance covered by the wheel mounted to the motor;
- t= Time taken for the robot to cover a distance 'd';
- Radius of the wheel = 7cm/2= 3.5cm;
- Perimeter of the circle = 2*3.14*3.5= 21.98cm;
- Rotations per second = 100/60 = 1.6 RPS;
- Distance covered by the wheel mounted to the motor per second =21.98*3.5=76.93cm
- Speed of the motor=76.93cm/s.

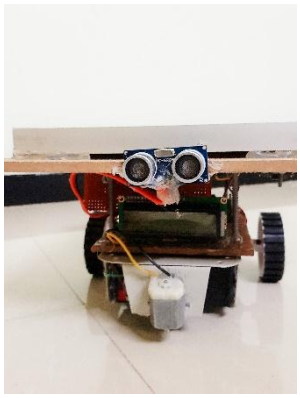

Fig -4: Robot image

6. CONCLUSION

In this paper, the work done on lawn mower will meet the challenge of environmental production and low cost of operation since there is no cost for fueling. This lawn mower has been developed for the use of residences and establishments that have lawns where tractor driven mowers could not be used. The machine's capacity is adequate for its purpose. The machine has proved to be a possible replacement for the gasoline powered lawn mowers. We are developed "Automatic Lawn Cutter" by using keypad and LCD display and for this we are using battery hence it works automatically.

REFERENCES

[1] Wasif, M. (2014). Mower Robot Controller, (September-2011). https://doi.org/10.1109/ICET.2011.6048466
[2] Ramlee, R. A., Othman, M. A., Leoung, M. H., Ismail, M. M., & Mohsin, M. (2017). International Journal of Advance Engineering and Research Android based Home Automation System via Wi-Fi, 674–676.
[3] Elshafee, A., & Hamed, K. A. (2012). Design and Implementation of a WiFi Based Home Automation System, 6(8), 1074–1080.
[4] Polytechnic, L. S. (2014). Design And Development Of A Solar Powered Lawn Mower, 5(6), 215–220.
[5] T.Salonidis et al., "Distributed Topology Construction of Bluetooth Personal Area Networks," Proc. IEEE Infocom 2001, IEEE Communication Society, New York, 2001.
[6] "Smart Solar Grass Cutter Robot for Grass Trimming" by Ashish kumar chaudhari, Yuvraj sahu, Pramod kumar sahu, Subhash Chandra verma
[7] "Design and Implementation of Automatic Lawn Cutter" by Pratik Patil, Ashwini Bhosale, Prof. Sheetal Jagtap.

[8] IJIRST "Modification of Solar Grass Cutting Machine "by Praful P. Ulhe, Manish D. Inwate and Fried D. Wankhede Krushnkumar S. Dhakte
[9] Bravo, R., "Tired From Mowing the Lawn", Journal of Pediatric Health Care, 24: 2010, 123–126.
[10] Scherer, E. "Humanoid Robots for Human Life Support", Proceedings of IFAC Conference on Supplemental ways for improving International stability through automation 15-17 June 2006, Ed. P. Kopacek, 101 – 105, Elsevier.
[11] Arkin, E.M., Fekete, S.P., Mitchell, J.S.B. "The lawnmower problem", Proceedings of the 5th Canadian Conference on Computational Geometry, 1993, 461-466.
[12] Pansire, D.G. "Self-propelled Self-guiding Lawn Mower." U.S. Patent 4, 1980, 180,964