Automatic Lawn Mower

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Abstract: In earlier days cutting or mowing a grass needs a lot of time and effort. Invention of new variety of mowing machines made the work much easier than before but even then it is a time taking process and needs supervision. The small lawns of houses can be mowed by people by themselves but the bigger lawn need labor, in either situation the work requires time, effort or money. The solution to this problem is Automatic Lawn Mower. It saves our time, effort and labor cost. This machine is controlled by Arduino which takes feedback from some sensors and controls the movement and mowing process.

Keywords: Lawn Mower, Arduino, Sensors.

I. INTRODUCTION

Everything in the world is rapidly converting into automatic from the auto correction of words in mobiles to the gear shifting in the vehicles. In this new revolution the electronic equipment and machines are also being automated with help of microcontrollers and sensors. An Automatic Lawn Mower, as the name suggest, is also a modified lawn mower which works on its own without any supervision. This is automation is achieved by using Arduino and some sensors. This machine works on its own completely saving our time and energy but can also be operated using our mobile.

II. RELATED WORK

The design objective is to come up with a mower that is portable, durable, easy to operate and maintain. It also aims to study different paths and come up with optimal route planning with minimum working time and minimum energy usage by the lawn mower. Various paths like square, spiral, combination of both square and spiral are being studied. The path to be travelled is preprogrammed in microprocessor Arduino Uno R3 which acts as a controller throughout the operation. The design of path plays a vital role in automation of device. [1]

Automation is rapidly growing in technology. So automation plays a vital role in agricultural field which is helpful for the farmers. In the earlier days, the grass cutters used were manually handheld devices. Because of this, there was pollution and loss of energy as they used gas and petrol engines. So the old grass cutters need to be replaced by automated ones, where the system will work for guidance and obstacle detection using battery as a power source. And it used Arduino UNO microcontroller board as the main controller of the system, Ultrasonic sensor for object detection NODE MCU for Wi-Fi connection, a linear blade for cutting the grass, and a motor drive for the Robot. This is fully automated and renewable energy based project. [2]

The solar lawn mower is a fully automated grass cutting robotic vehicle powered by solar energy that also avoids obstacles and is capable of fully automated grass cutting without the need of any human intervention. The system uses 12v batteries to power. The vehicle movement motors as well as the grass cutter motor. We use a solar panel to charge the battery. The grass cutter and Vehicle motors are interfaced to an Arduino Nano that controls the working of all the motors. It is also used to interface an ultrasonic sensor for object detection. The SoC moves the bot in the forward direction in case no obstacle is detected. On obstacle detection; the ultrasonic sensor monitors it and the SoC thus stops the grass cutter motor to avoid any damage to the object/human/animal whatever it is. In order to detect the boundaries the bot uses Light dependent resistors (LDR) on a right angle to trigger start event. The detection of the laser on the other side triggers the bot to stop and turn a right angle clockwise and and move to next row. The bot takes another right angle turn clockwise and moves forward till the next laser fence is detected. The detection of both the lasers simultaneously triggers the stop event. The L293D9 bi-motor controller/driver is used. [3]

Robot is a reprogrammable, multifunctional device which is primarily designed to do work like human such as pick and place, loading and unloading, surveillance, health care, industrial, aerospace application. Robots can perform dangerous and accurate work to increase the productivity as they can work 24 hours without rest. This paper deals with the design and control of automated vehicle type robot which can move in desired direction and captures pictures and videos of required location. An android application has developed using MIT App inventor and a Bluetooth communication is made with robot which interfaces with microcontroller to control its speed and direction. Aim of this work is to design and control the motion of robot using bluetooth device of an Android phone. [4]
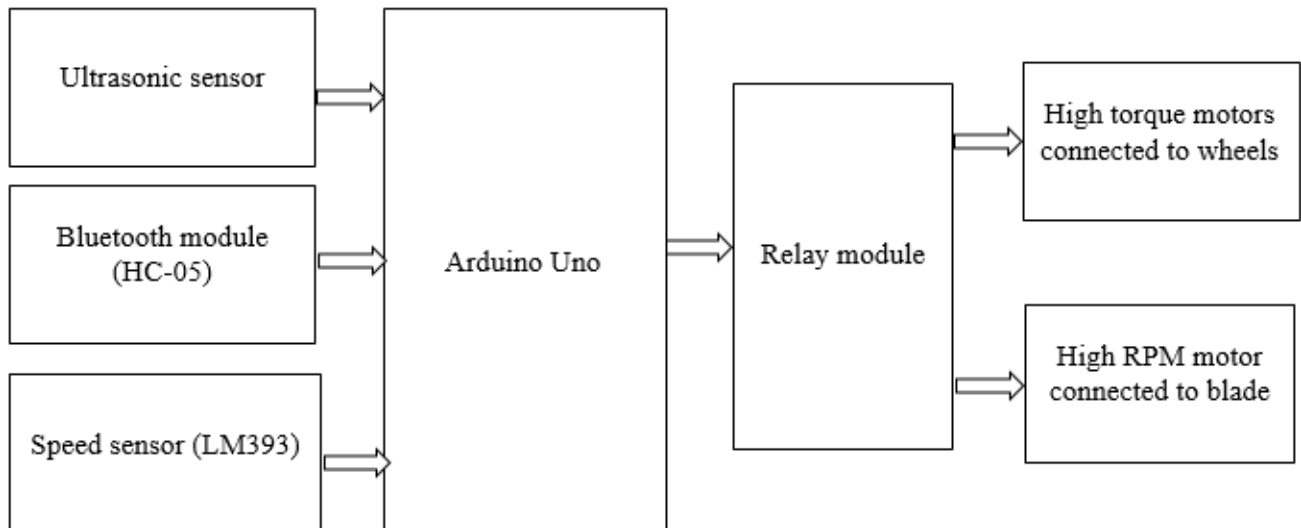
III. BLOCK DIAGRAM AND COMPONENTS

Fig.1 Block diagram of automatic lawn mower

The block diagram shows the flow of information either from the sensor to the Arduino or vice versa. The sensor gives the feedback to the Arduino and it commands the relay according to the received feedback. The relay module is the link between the Arduino and motors of wheels and blade and acts according the commands of the Arduino. All the sensor which provide the Arduino with feedback and the relay are powered from the Arduino pins, whereas the Arduino and the motors are powered from a 12v battery. The supply of the power from the battery to the Arduino is continuous but the power supply the motors is controlled by the Arduino with the help of the relay. Therefore relay is like switch that is used by the Arduino to control the movement and mowing mechanism of the mower.

COMPONENTS USED:

1. Ultrasonic sensor

Fig.2 Ultrasonic sensor

Ultrasonic sensor is the one which senses the objects in front of it and can is also capable of measuring the distance. The sensor itself cannot give us the distance in meters or centimeters but it gives the output as raw value which can be converted into desired using respective formulae. So this sensor is mounted on the lawn mower in order detect the obstacles. The sensor continuously sends the information with a very short span that even when someone suddenly gets in front of the mower it senses it and the Arduino halts the mower. Therefore this sensor not only makes the Automatic Lawn Mower collision free but also safe.

2. Servo motor

Fig.3 Servo motor

A Servo motor is a motor with has a controller attached to it due to which the microcontrollers like Arduino can control the movement of the shaft of this motor. The Servo here used is capable of rotating 0 to 180 degrees and the angle of halt can also be controlled by the microcontrollers. This motor is installed in order to rotate the ultrasonic sensor to different directions in order to detect obstacles in every direction as it lacks the ability to rotate. The Servo is also has a gear arrangement which provides it a high torque making it immobile in the absence of command from microcontroller or while in idle position.
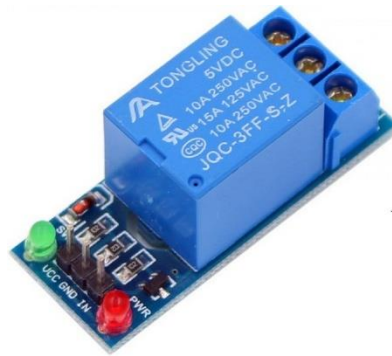
3. Relay module

Fig.4 Relay module

   A Relay module is a device which allows microcontrollers with low power rating to control flow of current in the higher power rating circuits. In simple words relay is a switch which is controlled by the Arduino to control the flow of current to the motors. The works similar to that of an electromagnet. When the Arduino sends the signal to the relay it actually sends a small voltage of 5v to low voltage side which is sufficient to power a small electromagnet and it attracts a piece of metal and aligns it in a position so that it makes the contact so that current flows on the high voltage side. As soon as the Arduino stops sending the command the electromagnet loses power and the metal piece get to normal position due to a spring attached to it.

4. Bluetooth module

Fig.5 Bluetooth module

   A Bluetooth module allows the Arduino to connect with other devices wirelessly by means of a Bluetooth connection. This device helps us to command the Arduino and move the mower according to our will. The Bluetooth module can be directly connected to the mobile but to send the commands to the Arduino an application related to the module must be in our android device. There are lot of such applications available in the Google play store. Once installed the movement of the mower can be fully controlled.
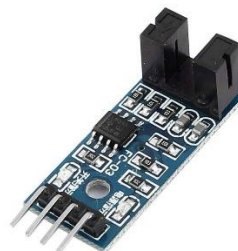
5. Speed sensor

Fig.6 Speed sensor

   A Speed sensor consists of a groove in which Infrared waves are send from one side and is received by a Photo transistor. A grid plate wheel which can be fixed to a motor shaft will be placed in that groove. As the motor rotates the grid plate also rotates creating continuous interruption to the Photo transistor. These interruption are noted and are used to determine the distance covered by the mower, which helps in creating the paths for the movement of the mower in specified manner.

 IV. WORKING

   The Automatic Lawn Mower moves automatically without supervision and it is safe due to the collision free mechanism. It follows a certain path of zigzag manner which can be altered by modifying the program in the Arduino. The mower has both the wheels coupled with high torque DC motor with a low rpm which allow it to properly mow the grass and move on uneven terrain

with ease. The mower blade is coupled to a high rpm motor which results in proper mowing. The Automatic Lawn Mower has two modes of operation one is the automatic mode and the other is manual mode.

In automatic mode the mower moves on its own in a certain path and is stopped only when it faces any obstacle. When the mower comes to halt even the blade stops rating as the obstacle might be a person. Then it checks on the either sides for the obstacle and continues to move in obstacle free direction. It comes to complete halt when it is blocked from the three sides i.e. front left, right and continuously checks for the obstacle free side.

In manual mode the mower can be controlled by a android mobile. Firstly an application of Bluetooth must e installed and then the mobile should be paired to module and we are ready to command the mower.

V. DISCUSSION

1. Advantages

- No need of supervision as it is collision free.

- The automation save the labor cost and also the time.

- Safer and reliable.

- Cheaper and negligible maintenance cost.

- Software modification can be easily done.

- Manual mode helps user to make the mower work according to his commands.

- No need of physical work as the manual mode is remote controlled.

2. Disadvantages

- Deviation from the course in automatic mode results in ineffective work.

- Switching on and off the device is manual.

- Cannot sense the progress of the work.

- Covering it from all the sides brings the working to halt as it is incapable of finding new ways to move.

3. Conclusion

The Automatic Lawn Mower is a smart device which saves time and despite its limitations it is perfectly suitable for small lawns with closed circumference. Its model can be modified into other similar machines with less changes. The manual control does not need any special practice and can be handled even by children. Anti-collision keeps it safe from damage and also from the danger. As it is a complete electrical machine there is no problem of pollution and can be charged from the small sources. Its compact size make it possible to fit it narrow places. The low speed wheels make the mower to cut the grass efficiently. It can also be made a multipurpose machine like pest sprayer, floor cleaner etc. with slight modifications. Therefore it could be one of the essential equipment of future homes.

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