International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 3 Issue 5, August 2019 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Construction of Automatic Solar Lawn Mower

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How to cite this paper: Zin Mi Mi Ko | Zaw Myo Tun "Construction of Automatic Solar Lawn Mower" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-3 | Issue-5, August 2019, pp.816-819, **https://doi.org/10.31142/ijtsrd26522**

IJTSRD26522

ABSTRACT

Today, invention is very important and conventional machine was replaced by the automatic robot. The user can be controlled by using the remote or automatic mode. There are two ways which are automatic system and remote system to control the grass cutter robot. The grasscutter can be controlled by the remote technology or automatic technology according to the customer's desire. The power supply for the whole system is battery which can be charged by using the solar panel. By using 20W solar panel, the power consumption and the labor-hire can be reduced. And then, the system uses 12V battery to power the vehicle movement and cutting operation. Compass sensor is used to differentiate the direction for a grass cutter. The ultrasonic sensor is used as the eye of the smart solar grass cutter it can avoid the object in the path during the operation. This smart solar grass cutter is suitable for the unskilled person for cutting the grass. LCD display is used to show the instructions of the user and it can be understood by the customer.

KEYWORDS: *Solar Panel, Compass Sensor, Ultrasonic, LCD Display, Motor, Blade etc*

I. INTRODUCTION

During the operation, the vehicle moves forward until the sensor senses the obstacles. If the ultrasonic sensor detects the object, the grass cutter avoids it and move forward again. The compass sensor is used for designating the direction. Some of the inventions were damaged both the people and the environment. For example, conventional motor-powered grass cutters are inconvenient, due to the use of engine. Grass cutters moving with engine create noise pollution and local air pollution due to the combustion engine. And a motor-powered engine requires periodic maintenance such as changing the engine oil. [2]

Pollution is man-made and can be seen in our own daily lives, more specifically in our own homes. [1] People are interesting to maintain the environment that they live. In the early age, conventional grass cutting machine was widely used. Moreover, technology is merging with environmental awareness, consumers are looking for ways to contribute to the relief of their own carbon footprints. But now solar-based grasscutters (renewable energy) were replaced by the traditional lawn mower because the gas-powered grass cutters emit the gases which cause pollution. It is more efficient for the people and the environment, by using a solar power grass cutter which will be smart and which consumes less power for the environment and for the people.[3] Finally, it is designed and constructed that is not only for safety purpose but also for convenience. Ultimately, it will fulfill the consumer's desire and will help the environment. [1]

II. block diagram and methodology

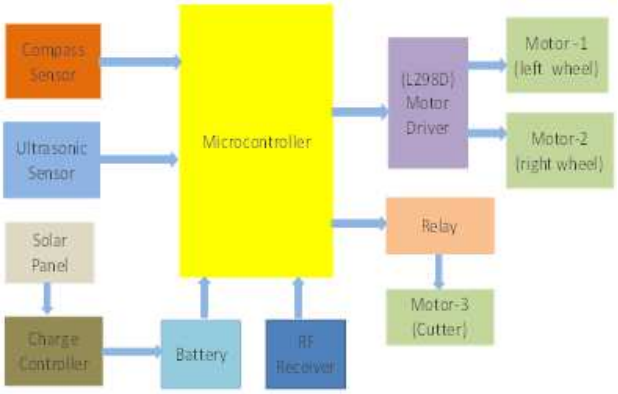

Figure1.Overall Block Diagram of Automatic Solar Lawn Mower

This automatic lawn mower consists of Ultrasonic sensors, Compass sensor, DC motors, RF module and Solar panel. In my system, there are automatic system and remote system. The solar panel (renewable source) used for the powering operation. The battery can be charged during the cutting operation. Solar grass cutter can operate in cloudy day or night if the battery is fully charged. Thus, we don't need to waste the time that is expressively charging of the battery and changing the engine oil. Smart solar grass cutter can be controlled by the remote. For the remote system, it consists of RF module (Transmitter/Receiver), Joystick, LCD Display, 12V Battery and Arduino. RF module used for wireless communication. The toggle switch is used for ON/OFF operation. The joystick is used to select the mode of operation and is used for the movement operations of the grass cutter (For example, left, right, forward, backward) in

remote system. And then, it is used for giving the instruction just like lengths and number of turns of the grass cutter in the automatic system. LCD Display shows the direction and instruction of the user not only the remote system but also the automatic system during the operation.

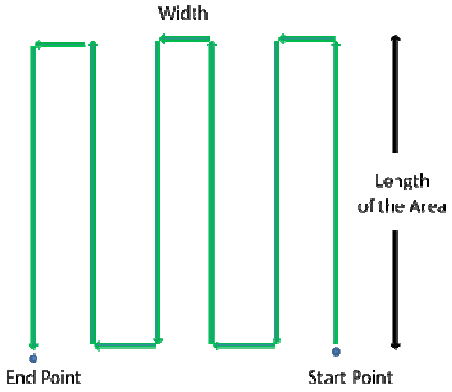

Figure2.Rectangular Path without Obstacles

The design of the path plays a vital role in the automation of the device. The rectangular pattern is a zigzag kind pattern. Firstly, the customer will choose the length and width of the cutting area from the joystick. Then, the robot starts from one corner and moves at a constant velocity until it reaches the boundary in a zigzag manner as shown in fig. This is the automatic system without objects detection from the ultrasonic.

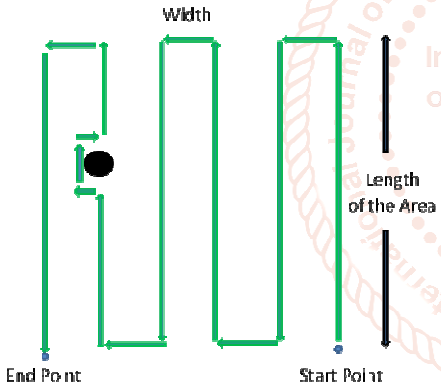

Figure3.Rectangular Path with Obstacles Detection

When the ultrasonic sensor detects the object, the grass cutter turns left, move forward a little then turns right, move forward a few seconds and then turns right, move forward till the original path after it is going to the forward direction again during the operation in the grassland. If the cutting area is finished, the automatic lawnmower will stop the operation. In this system, the compass sensor that designates the direction and ultrasonic sensor that senses the objects are mainly used for the automatic system.

III. component description

The main components of the smart solar grass cutter are-

A. Solar Panel
B. Arduino Uno
C. Compass Sensor
D. Ultrasonic Sensor
E. DC Motor & Gear DC Motor
F. Motor Driver
G. RF Module
H. Blade
I. Mechanical Arrangement

A. Solar Panel:

Figure4.Solar Panel

This 20W solar panel is applied for the whole power supply system. The solar panel is used to capture the radiation of the sun to convert into electric energy. Thus, it is suitable for the system and the environment because it is renewable energy.

B. Arduino UNO:

Figure5.Arduino UNO

Arduino Uno is a brain of the system which controls all operations and is a microcontroller board based on8-bit ATmega328P microcontroller and is used in the main component of the base station (BS).

Specifications:

- Operating voltage :5V
- Input voltage (recommended) : 7V to 12V
- Input voltage (limits)-6V to 20V
- Digital I/O pins: 14 (out of which 6 provide PWM output)
- Analog I/O pins: 6 (AO-A5)
- DC current per I/O pin: 40mA
- DC current for 3.3V pin: 50mA
- Frequency(Clock speed) : 16 MHZ

C. Ultrasonic Sensor:

Figure 6.Ultrasonic Sensor

Ultrasonic sensor uses as the eyes of the lawn cutter. When the automatic grass cutter is facing the object or boundary of the grassland, this sensor detects and avoids them.

Features:

- Operating voltage: 5V DC
- Operating current: 15mA
- Measuring angle: 15 degree
- Trigger input single:10µs
- It produces a 40k Hz sound wave.
- Ranging distance2cm~4m (or) 1''~13''

D. DC gear motor:

Figure7.DC Gear Motor

This two DC gear motor is used for the movement operations of the robot's wheel. These two are driven by the motor driver L298 D. It is a high speed, high torque, low power consumption, low noise and simple machine. It features are ne structure, easy maintenance, long service life.

Specifications

- Model : DC motor RS-555
- Rated voltage : DC 12V
- No-load speed: 3000-3500 rpm/min
- Load speed: 40rpm/min
- Weight: 502g
- Size :Diameter 37mm,Length 65mm

E. DC Motor

Figure 8.DC Motor

Blade motor used for cutting the grass and speed of these motor is 3550 rpm/min. Thus it is more speed than the other motor. The cutting operation stops while the ultrasonic sensor senses the object. If not, the vehicle cuts the grass.

F. Compass Sensor

Figure9.HMC 5983 Compass Sensor

It used for controlling the direction of the grass cutter. It has an output degree of 0, 90, 180, 270, etc. We can make the direction of the system left or right and forward or backward by designing the degree.

G. RF Module (433MHz)

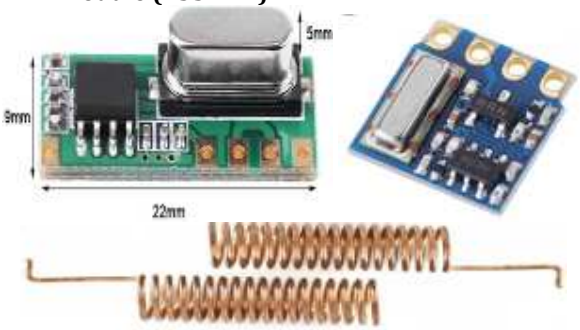

Figure10.RF Module

RF module is used as the remote control for the smart solar grass cutter. This module is a simple wireless communication to transmit information within a short distance. It can reach up to 100 meters theoretically. But practically we can hardly get about 30-35 meters in the normal test condition.

IV. application

The lawnmower can be used in various are:

- In Grassland at university and departments of the office.
- In the backyard or garden at home.
- In Public Parks to remove the unwanted grass/weeds.
- Playground like, cricket ground, football ground, etc.

V. flow chart

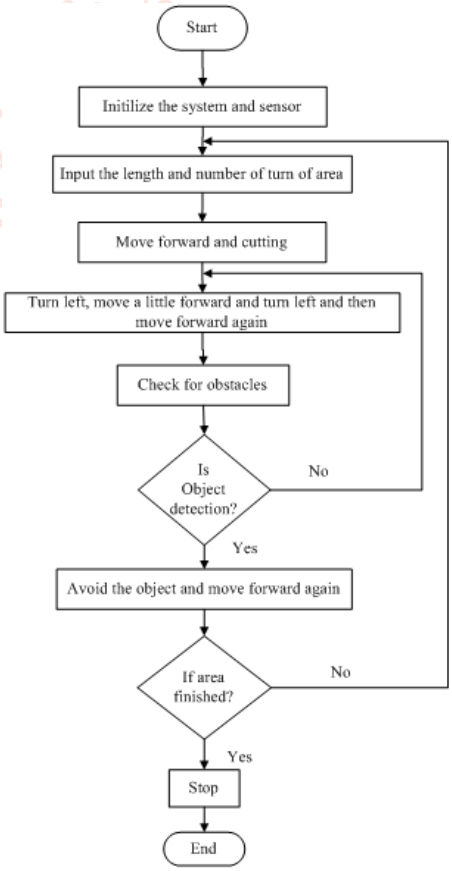

Figure 11.System Flowchart of Automatic Solar Lawn Mower

For the automatic system, the working principle of solar grass cutter is very simple because it works on the rectangular pattern. The automatic lawn mower is going to the rectangular path and cutting the grass when the consumer gives the instructions from the remote. If the cutter is heading to the objects during the operation, it will avoid the obstacles and then continue moving.

VI. result and discussion

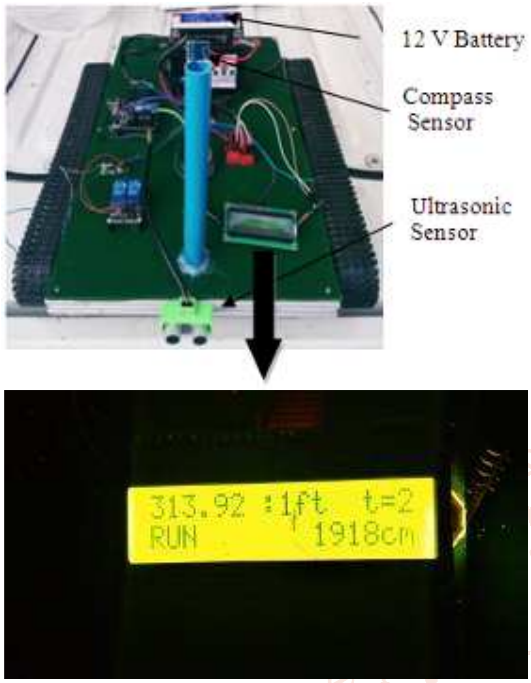

Figure12 (a) Testing the Movement Condition of the Automatic Solar Grass Cutter

First, the user will choose the mode of operation manual or automatic. If the customer wants to choose the manual mode, push the joystick to the right. Moreover, the user can select an automatic system by pushing the joystick to the left. Finally, the automatic grass cutter works according to the instructions of the user. The LCD display will show the running direction of the compass sensor, remaining lengths and number of turns of the cutting area and distance of the ultrasonic during the cutting operation. Thus, the user can easily know the condition of the grass cutting operation.

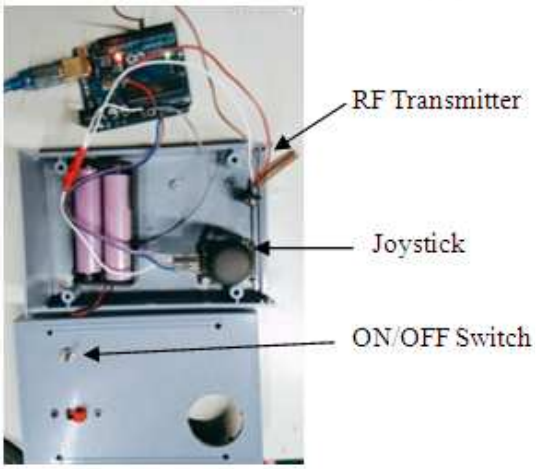

Figure12 (b) Hardware Construction of Remote Control

In this remote control, there are five components that are the battery, toggle switch, transmitter, Arduino and joystick. The joystick is the main function because it can be controlled the direction and movement of grass cutter. Therefore, from this Joystick, the user can choose the mode of operation because there are two systems which are manual and automatic mode.

Figure 12(c). Hardware Construction of Solar Based Grass Cutter

This smart solar grass cutter is compact size thus it can carry easily from one place to another place. Solar based grass cutter even can be used at night when it was filled the energy. Thus, it can suitable the football ground and grassland in front of the home.

VII. Conclusion

The automatic solar grass cutter was successfully and completely constructed. This system can help the user that is an unskillful person. The customer can easily use this grass cutter because it has a remote and automatic system. Solar energy (clean and renewable source) used for powering operation system of the lawnmower. Thus, this system will prevent and maintain the environment. Moreover, the automatic system of the grass cutter could effectively help to cut the grass in a rectangular path with lesser human effort.

Acknowledgment

The author thanks U Zaw Myo Tun, Associate Professor, Department of Electronic Engineering for kind permission to prepare for this paper, for his valuable suggestion, supervision, encouragement and sharing he experience to write this research. And also, the author is also thankful to all of her teachers from the Department of Electronic Engineering, Mandalay Technological University.

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