

Design and fabrication of remote controlled lawn mower

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Abstract

An automatic lawn mower is a device or a robot which helps human to cut grass automatically. Rapid growth of various high-tech tools and equipment makes our job done comfortable and sophisticated. This project considers the implementation of a robot which can be operated wirelessly using Bluetooth technology. Every action of the lawn mower is controlled by the microcontroller which eliminates the use of perimeter wires to maintain the robot within the lawn. In addition, the project aims at fabricating a lawn mower which makes the grass cutter motor run through solar energy.

The electricity requirement of the world is increasing at an alarming rate due to industrial growth, increased and extensive use of electrical gadgets. Hence solar energy is the best alternative source. This project will reduce environmental and noise pollution. This prototype is user friendly, cost efficient and environmental friendly.

Keywords: grass cutter, solar, motor, battery, arduino, etc.

1. Introduction

Moving the grass cutters with a standard motor is inconvenient, and no one takes pleasure in it. Classical grass cutters with heavy engines create pollution due to the combustion in the engine. Motor powered engines require periodic maintenance such as changing the engine oils etc. If electric grass cutter is corded, moving could prove to be problematic and dangerous. Along with motor powered lawn mowers, electric lawn mowers are also hazardous and cannot be easily used by all. Also, if the electric lawn mower is corded, mowing could prove to be problematic and dangerous. The self propelling electric remote control lawn mower is a lawn mower that has remote control capability.

The main objective of our project is to develop a lawn mower which reduces human effort so that elderly users can fulfill their tasks by themselves. The working range is also increased due to absence of main supply wires.

2. Working Principle

The working principle of solar grass cutter is it has panels mounted in a particular arrangement at an in such a way that it can receive solar radiation with high intensity easily from the sun. These solar panels convert solar energy into electrical energy. This electrical energy is stored in batteries by using a solar charger. The motor is connected to the batteries through connecting wires. The designed solar powered lawnmower comprises of direct current (D.C) motor, a rechargeable battery, solar panel, a stainless steel blade and control switch. Mowing is achieved by the D.C motor which provides the required torque needed to drive the stainless steel blade which is directly coupled to the shaft of the D.C motor.

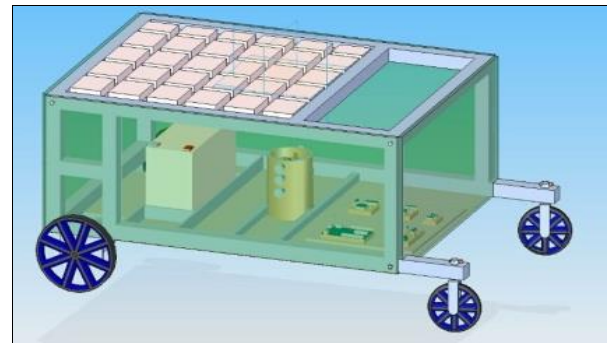


Fig 1: 3D model of the lawn mower

The movement of the lawn mower is controlled by a microcontroller which uses Bluetooth technology. In our project, we have used Arduino 1.0.5 IDE compiler for wireless operation.



Fig 2: Working model

3. Components used

3.1 Solar Panel

A solar panel is a set of solar photovoltaic modules electrically connected and mounted on a supporting structure. A photovoltaic module is a packaged, connected assembly of solar cells. The solar panel can be used as a component of a larger photovoltaic system to generate and supply electricity in commercial and residential applications.



Fig 3: Solar Panel

In our project a 12V, 10W solar panel whose dimension is 11.5*11.5 inch is used and the total number of solar cells used are 81.

3.2 Battery

The sun is shining. They do not store energy, therefore to ensure flow of electricity when the sun is not shining, it is necessary to store some of the energy produced. The most obvious solution is to use batteries, which chemically store electric energy. Batteries are groups of electro chemical cells (devices that convert chemical energy to electrical energy) connected in series. Battery cells are composed of two electrodes immersed in electrolyte solution which produce an electric current when a circuit is formed between them. The current is caused by reversible chemical reactions between the electrodes and the electrolyte within the cell. Batteries that are re-chargeable are called secondary or accumulator batteries. A 12V, 7.2Ah lead acid battery is used in our project to store solar energy.

3.3 DC Motors

A DC motor is a mechanically commutated electric motor powered from direct current (DC). In our project we have used two types of motors namely high torque motor and high speed motor. Two high torque motors are used for the rear wheels whereas the high speed motor is used for the functioning of the blade.

The high torque has a speed of 200rpm and the high speed motor has a speed of 1000rpm and will be connected to a motor controller which will be in turn connected to Arduino which controls each and every movement of the lawn mower.

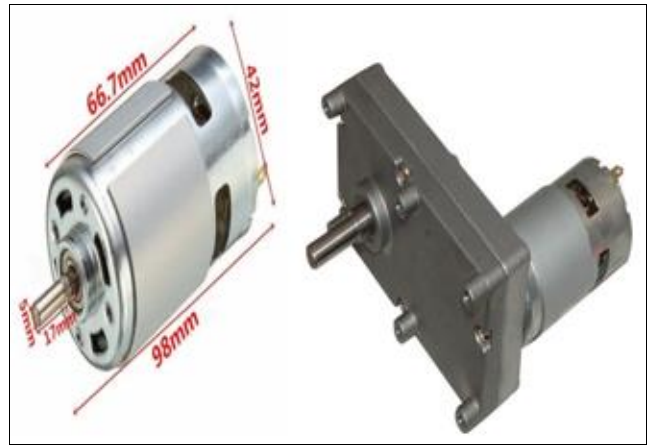


Fig 4: High speed and high torque motors

Power required for driving the lawn mower,

$$P=F*V$$

Force,

$$F=m*g$$

Where,

m=mass of the lawn mower in kg

g=acceleration due to gravity in m/s²

$$F=8*9.81=78.48N$$

$$\text{Velocity}=\pi dn/60$$

$$V=\pi*0.14*30/60=0.219m/s$$

$$\text{Power}=F*V=78.48*0.219$$

$$P=17.18W$$

Hence power required to drive the lawn mower=17.187W

Power produced by the wheel motors,

Speed of the drive motor=200rpm

Mass=0.65kg

Torque T=F*r

$$\text{Force}=m*g=0.65*9.81=6.37N$$

r=perpendicular distance=0.07m

$$T=6.37*0.07=0.4463Nm$$

$$\text{Power } P=2\pi NT/60$$

$$P=2\pi*200*0.4463/60=9.347W$$

1 wheel motor power=9.347W

2 wheel motor power=18.70W

Hence total power produced by the wheel motor=18.70W

3.4 Arduino 1.0.5 IDE

Arduino 1.0.5 IDE is a software to program the Arduino UNO. This software is an open source and can download from the web for free. Arduino 1.0.5 IDE have their own programming library which is simple and user-friendly. All the coding is given as well as example. With the existing of library, the user does not need to have a great knowledge on c

programming to write Arduino program.

The specifications are:

- Name: Arduino UNO
- Board: atMEGA328
- Pins: Digital I/O 14 Analog Pins 6
- Voltage: 5V
- Clock Speed: 16 MHz



Fig 5: Arduino UNO

3.5 Blades

Mower blades are the cutting components of lawn mowers. They are usually made of sturdy metals as they must be able to withstand high-speed contact with a variety of objects in addition to grass. The materials used (as well as size, thickness, and design of the blades) vary by manufacturer.



Fig 6: Blade in our project we have used a stainless steel blade and the diameter of the blade is around 165mm.

4 Conclusion

Our project entitled Fabrication of solar powered grass cutter 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. Manual work is removed by the implementation of Bluetooth control. The lawn mower can be further developed by implementing sensors so that any obstacles in the path can be sensed.

5. References

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