

Solar Operated Grass Cutter

Vishal B. Patil	ADCET,Ashta
Indrajeet R. Dhokate	ADCET,Ashta
Prasad S. Ghadge	ADCET,Ashta
Aniket S. Shirke	ADCET,Ashta
Sameer B. Tembore	ADCET,Ashta

Abstract

The present technology commonly used for cutting the grass is by using the manually handle device. In this project we have automated the machine for cutting the grass. The device consists of blade which is operated with the help of the motor the power supply for the motor is by using battery. The battery can be charge by using solar panel. The battery charging and discharging can be controlled by using the Arduino based charge controller. In case of any obstacles in the path it is sensed by using an IR sensor. In future the automation of the device will play a vital role in world wide.

Keyword:-Solar panel, Arduino based charge controller, BLDC. Motor, Battery, Blades etc

Introduction: -

The energy plays a very important role in everyone's life. The Grass cutting machines are become very popular now days. Conventional motor powered grass cutters are inconvenient, due to use of engine. Grass cutters moving with engine create noise pollution and local air pollution due to the combustion engine. Also, a motor powered engine requires periodic maintenance. Even though electric solar grass cutter is ecofriendly, because solar is a clean source of the energy.

Working principle of the grass cutter is to provide a high speed rotation to the blade, which helps to cut the grass. The cutting edges are very smooth and accurate. Also electric grass cutting machines are much easier to use in garden, lawn and grass fields. In order to enhance the beauty of home-lawns and gardens, Grass cutting machines are the best option available in the market. With the help of a grass cutter which is a machine with revolving blades to help us cutting lawns at even length, people can easily maintain and beautify their lawns and gardens. The proposed solar grass cutter are solar panel, arduino based charge controller, battery, dc motor for grass cutting, geared dc motor for wheels, infrared obstacle sensor etc. The raw material used are wheels, wires, metal frame, plywood, remote, display etc. Unskilled operation can operate easily and maintain the lawn very fine and uniform surface look.

Objectives:-

The objective of the proposed work is to the design and construct the solar grass cutter is a fully automated grass cutting robotic vehicle powered by solar energy that also avoids obstacles without the need of any human interaction. The system uses 12V batteries to power the vehicle movement motors as well as the grass cutter motor. We also use a solar panel to charge the battery so that there is no need of charging it externally. The grass cutter and vehicle motors are interfaced to Arduino that controls the working of all the motors.

It is also interfaced to an IR sensor for object detection. The Arduino controller moves the vehicle motors in forward direction in case no obstacle is detected. On obstacle detection IR sensor monitors it and the controller thus stops the grass cutter motor so as to avoid any damage to the object/human/animal. Controller then turns the robotic vehicle off until it gets clear of the object and then moves the grass cutter in forward direction again.

System Development:-

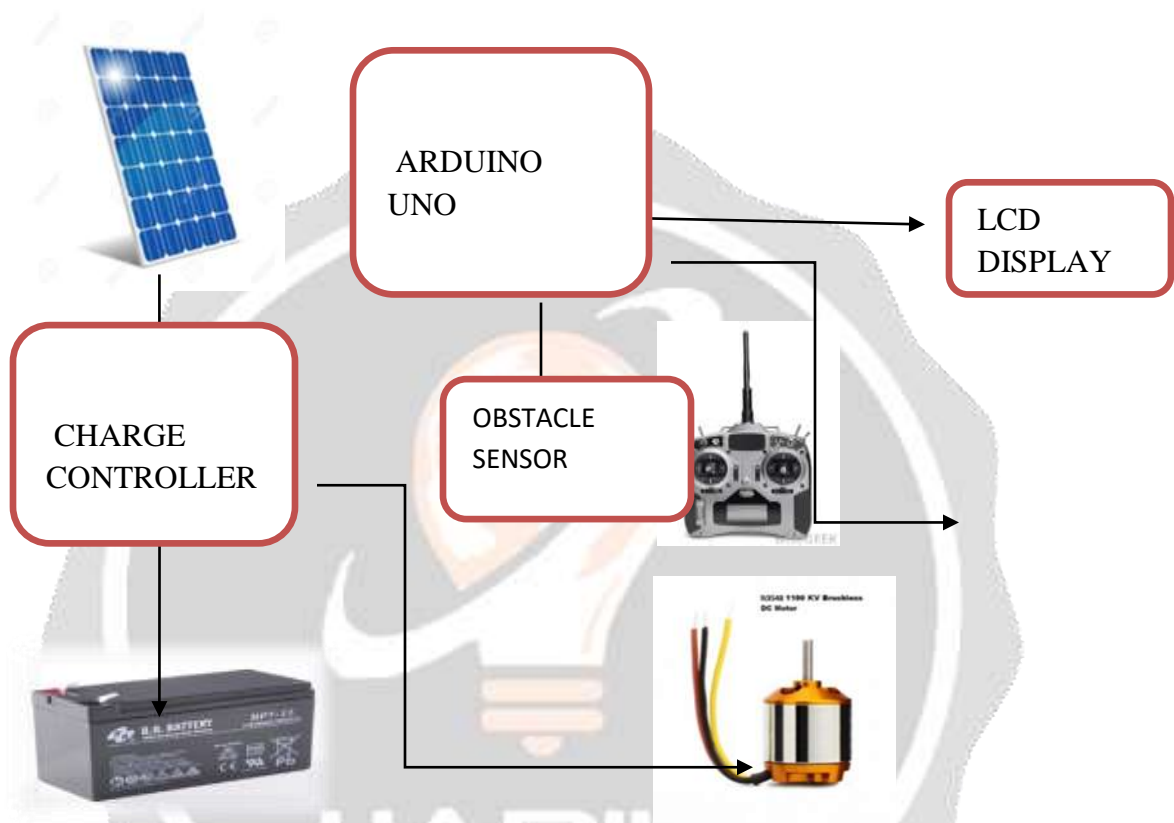


Fig.1.1 Hardware model of solar operated grass cutter

Working principle of the grass cutter is providing a high speed rotation to the blade, which helps to cut the grass. Also electric grass cutting machines are much easier to be used in garden, lawn and grass fields. The main parts of the grass cutting machine are solar panel, arduino based charge controller, battery, dc motor for grass cutting, geared dc motor for wheels, infrared obstacle sensor etc. Grass cutter machines have become very popular today. Pollution is man-made and can be seen in our own daily lives, more specifically in our own homes. Herein, we propose a model of the automatic grass cutting machine powered through solar energy, (nonrenewable energy).

Automatic grass cutting machine is a machine which is going to perform the grass cutting operation on its own. This model reduces both environment and noise pollution. Our new design for an old and outdated habit will help both customer and the environment. This project of a solar powered automatic grass cutter will fulfill the consumer requirement and will reduce both environmental and noise pollution. This design is meant to be an alternate green option to the popular and environmentally hazardous fuel powered lawn mower. Ultimately, the consumer will be doing more for the environment while doing less work in their daily lives

The main components of the solar powered grass cutter are

- Solar panels
- Arduino based charge controller
- BLDC. Motor
- Battery

- Blades
- Mechanical Arrangement

Solar Panel:-

A solar cell is a P-N junction diode under light illumination with a very large surface area. When Solar light or photons are fall on the cell produces two types of electrons, negatively and positively charged electrons in the semiconductors. Negatively charged (-) electrons gather around the N-type semiconductor while positively charged (+) electrons gather around the P-type semiconductor. When you connect loads such as a light bulb, electric current flows between the two electrodes.



Fig 3.1 Photovoltaic cells views

Photovoltaic Principles:

The photo voltaic effect can be observed in nature in variety of materials that have shown best performance in sun light is the semiconductors as stated above. When the photons from the sun absorbed in a semiconductor, that creates free electron with higher energies then the created there must be an electric field to induce these higher energy electrons to flow out of the semi-conductor to do useful work. A junction of materials, which have different electrical properties, provides the electric field in most solar cells for the photo interaction in a semiconductor.

Arduino based Charge Controller:-

Charge controller is an important part of all power systems that charge the batteries, whether the source is photovoltaic. Its sole purpose is to keep the batteries safe for the long time. In other terms, it is a regulator that goes between the solar panels and the batteries. They are used to keep the batteries charged at peak without overcharging or deep discharging of the batteries.

Working of Charge Controller

The switching section is used to connect or disconnect panel or battery. In this charge controller P-channel MOSFET is used for switching action. The combination of arduino and MOSFET is used to control the load operation of the charge controller. Positive terminal of the solar cell is connected to source terminal of the MOSFET through diode. The output signal of the arduino is given to base terminal of the transistor through resistor. Two transistors are connected in Darlington formation. Darlington connection is used to increase the beta gain of the circuit. Then output of the Darlington pair is given to gate terminal of the MOSFET. According to battery requirements MOSFET will act as switch between control circuit and battery

Fig.1.2 shows battery-solar panel connection to charge the battery. In this way transistor are used to control the charging process. Positive end switching is also used here which is shown in this figure. So negative end of

battery is connected to negative end of solar panel. Arduino takes the decision whether to connect or disconnect these two by the help of the program written on it. If everything is okay then a signal is sent from the arduino to establish the connection between battery and panel. By this way battery is charged to its full state. If the condition is not fulfilled then a signal from the arduino is sent to the transistor to disconnect the battery.

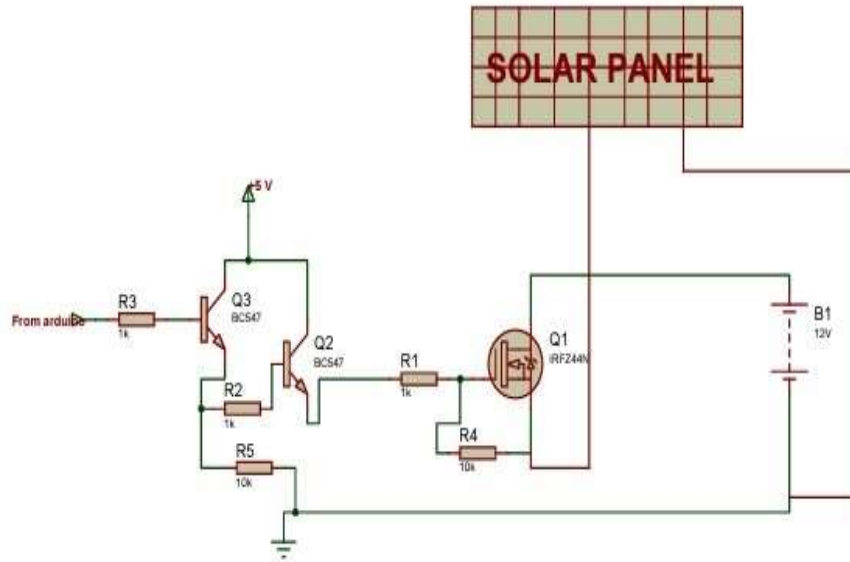


Fig 1.2 Circuit diagram of charge controller

Brushless DC motor

Brushless Direct Current (BLDC) motors are one of the motor types rapidly gaining popularity. BLDC motors are used in industries such as Appliances, Automotive, Aerospace, Consumer, Medical, Industrial Automation Equipment and Instrumentation. As the name implies, BLDC motors do not use brushes for commutation; instead, they are electronically commutated. BLDC motors have many advantages over brushed DC motors and induction motors.

A few of these are:

- Better speed versus torque characteristics
- High efficiency



- Long operating life
- Noiseless operation
- Higher speed ranges

In addition, the ratio of torque delivered to the size of the motor is higher, making it useful in applications where space and weight are critical factors.

Battery

Solar cell module produces electricity only when the sun is shining. They do not store energy. It is necessary to store some of the energy produced. The most obvious solution is to use batteries.



Fig 3: Battery

Storage battery is device in which electrical energy is stored in the form of chemical energy. Solar cell module produces electricity only when the sun is shining. They do not store energy. It is necessary to store some of the energy produced. Hence most obvious solution is to use batteries. The batteries are used as a storage device for solar energy which can be further converted into electrical energy. Batteries are used for storage purpose. Since both the photo- voltaic system and batteries are high in capital costs.

Obstacle Sensor

Ultrasonic ranging module HC - SR04 provides 4cm - 7cm non-contact Measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit



Fig 3.8 Obstacle Sensor view

Connection of wires:

- 5V Supply

- Trigger Pulse Input
- Echo Pulse Output
- 0V Ground

Blades

A blade is that portion of a tool, which is used to cut the grass. The blade are mounted according to the need. However the Horizontal blades are easy to remove and sharpen or replace the Existing engine trimmer suffer from High initial cost, high level of engine noise, high fuel consumption rate and high operators fatigue in long run.

Various critical factors governed by the motor speed considered in choosing the blade material, they include:

- The weight of the blade material
- The strength of blade material
- The blade size in length
- The blade size in thickness
- Safety to the user

Apart from the factor considered, the need for an sharpened material was also considered in case of maintenance, So as to achieve maximum efficiency from the motor. Hence the whole grass cutter blade must be absolute sharp. Sharpening is done quite by grinding. The blade has to mounted firmly shaft of the motor so as to guarantee maximum safety and regular

Advantages:-

- Ecofriendly System.
- Portable.
- Unskilled person can operate this grass cutter.
- Running cost is less.

Applications:-

- To cut the lawn in play ground.
- To cut the unwanted grass garden.
- Agricultural purpose

Conclusion:-

Robotics is very vast field which comes with different combination 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 grass cutting 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 automated robotic grass cutter system which will helps to cut the grass in different design with lesser human effort. Advantages of this system are used components are of low cost so and in bulk production.

Future Scope:-

- Programming can be enhanced to make the device perform for different operations.
- We can install the grass collector to collect the grass, instead of leaving behind it.
- If panel used of high watt, then the machine can be used during night time for garden lighting or room lighting, because we can accumulate more power. And at night time however you keep it apart. So the power in the battery can be used for this intention.

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