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Environmental Friendly Solar Grass Cutter

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***Abstract*: Currently, manually handled devices works on non-renewable sources of energy. Automatic solar grass cutter focuses on the use of renewable source of energy which will help to reduce the emission of harmful gases which are emitted by the conventional grass cutter. Automatic solar grass cutter requires low maintenance and less human interface as compared to conventional grass cutter. Recently we are facing problems like air pollution, noise pollution, power cut problems, etc. In order to overcome these problems conventional grass cutter can be replaced by automatic solar grass cutter which is environmental friendly. In this project IR Proximity sensor are used to detect and avoid object/animal/human while operating. This machine consist of battery which charges simultaneously while operating. If the climatic conditions are not suitable for the solar panel to generate power and if the user wants to operate the machine at that time, then there is an alternative source of power through battery. Power consumption in this machine is less as compared to conventional grass cutter. The movement of the machine is totally controlled by automatic mode and manual mode. The main target of the machine is to reduce human efforts. This machine is operated with the help of Bluetooth. This design contains a Microcontroller ATmega 16, Sensors, LCD Display, Bluetooth Module, Solar panel, Battery, Motors.**

***Keywords*: Battery, Bluetooth module, LCD display, Microcontroller ATmega16, Motors, Sensors, Solar panel.**

1. Introduction

IC engine based manually traditional grass cutter are used nowadays. Over the field traditional grass cutting machine can create pollution and loss of energy. The effort required for cutting the grass in the lawns will be reduced by automatic solar grass cutter. Solar power which is available naturally will be used to provide the driving force for the cutter. The unnecessary objects while operating in lawn will be avoided and detected with the help of various sensors. Rapid growth of various high-tech tools and equipment makes our jobs comfortable and easy. This project's main objective is of fabricating a grass cutting machine system which makes use of the solar energy which is available without any cost. As there is continuous increase in the cost of fuel and the effect of emission of gases from the burnt fuel in the atmosphere, we decided to make an environmental friendly grass cutting system which uses solar energy. The other objective is that the automatic lawn cutter has to differentiate between grass and concrete while monitoring its surroundings continuously to avoid damage to the cutter.

We used ultrasonic sensors to detect if the lawn cutter was heading into an object. Safety is the major priority while designing the lawn cutter. The blades of lawn cutter should not operate in the air by the user. Sometimes if the user holds the device randomly, we have used a sensor to detect orientation. The accelerometer was hence used in lawn cutter so that it will not operate when user holds it. An automatic solar based cutter will help the consumer to avoid from mowing their own lawns and will reduce environmental and noise pollution.

2. Literature Review

There are studies and experiments going on for human enlargement in many countries on the solar energy, so we had made our concept of solar power grass cutting machine. The concept is as explained. We cut the grass on the agricultural land or small plants in lawns and gardens. The machine will include direct current (DC) motor, a rechargeable battery, solar panel, a stainless steel blade and control switch. External power supply and solar panel are used to charge the battery. For changing the direction of the cutting blade DC controllable motor is used. For preventing overcharging and discharging of battery which saves span of the battery the modern regulator is used. Due to globalization, the requirement of electricity for various industrial application, Solar panel, battery, DC motor, solar charger, etc is increased which are used for the fabrication grass cutter. The solar energy which is trapped in photovoltaic cells thus generates electricity. Solar panel is inclined at an angle of 45 degrees to absorb high intensity rays from the Sun. Circuit breakers are used to start or stop the motor. By considering ground clearance, they can adjust the height of the grass. Solar power division-based lawn mower which is operated manually with minimal effort. The predetermined program is feed into the system and robot moves as per predetermined pattern. The first lawn mower was invented by Edwin Budding in 1830, just outside Stroud, in Gloucestershire, England.

It took more than 20 years for further upgradation and innovations to create a machine that could be drawn by animals, and fifty years before a steam powered lawn mower was built. Silens Messor (meaning silent cutter) was introduced in the 1850 by Thomas Green Son of Leeds that used a chain drive to transmit power from the rear roller to the cutting cylinder.

These machines were not heavier and quieter than the gear-driven machines that preceded them, although they were slightly costlier. The spread of invention was prompted due to the increase in popularity of lawn sports. For domestic grazing animal's lawn mowers became a more efficient alternative. Since 1935 the roller drive lawn mower has upgraded not much effectively. Those with multiple sets of blades to cut a wider area are called Gang mowers built by USA in 1920 by Mower company. This paper describes manually handled device is commonly used for cutting the grass over the field which creates noise and air pollution and loss of renewable source of energy. We made a device which will reduce the effort required for cutting grass in the lawns. The driving force for the blades and battery recharge will be available due to solar energy. Various sensors will be used to detect and avoid the unnecessary objects in the field during operation. The lists of components used for this project are microcontroller Arduino ATmega328p, IR sensors, LCD display for better response and understanding to the user. In this paper we have analyzed the principle of working and operation of the Automatic Solar Grass Cutter which is environmentally friendly. The other objective of the cutter is to differentiate between grass and concrete while monitoring its surroundings continuously. We wanted an ultrasonic sensor to sense it the lawn cutter was heading into an object. Safety is the major priority while designing the lawn cutter. As it has blades we wanted that lawn cutter does not operate if someone lifts the machine. The design contains a microcontroller, multiple sensors and a solar charging system. Adding these elements together, they got there robotic lawn mower. Sometimes if the user holds the device randomly, we have used a sensor to detect orientation. We have used the following battery which is best. The nickel-metal hydride (NiMH) was found to be the best because given a low charging current, it will not overcharge.

CELL TYPE	CRYSTALLINE SILICON		THIN FILM		
	Monocrystalline	Polycrystalline	Cadmium Telluride	CIGS	Amorphous Silicon
EFFICIENCY (avg.)	14 – 17.5%	13 – 15%	9-11%	10-12%	5 – 7%
HIGH TEMP. PERFORMANCE	drops 10-15%	drops 20%	0% drop	0% drop	0% drop
OPTIMAL TEMP.	Performs well in cool weather, but poorly in extreme heat	performs well in cool weather, but poorly in extreme heat	performs well in hot weather, even extreme heat	performs well in hot weather, even extreme heat	performs well in hot weather, even extreme heat
COST	most expensive crystalline silicon	cheapest crystal-line silicon	cheaper than crystalline silicon—most cost-effective thin film	cheaper than crystalline silicon	cheaper than crystalline silicon
ADDITIONAL DETAILS	oldest solar cell technology and most widely used	economical choice due to its cost to performance ratio	cadmium is toxic, though very small amounts are used	some CIGS panels have posted impressive 20% efficiency figures	requires a lot of roof space and can take longer to install than other cell technologies

Sr.no	Conventional Grass Cutter	Solar Grass Cutter
1	Works on non-renewable fuel sources	Works on renewable fuel resources
2	Emission of gases leads to air pollution	Emission is not present thereby no pollution
3	Engine sound creates noise pollution	Comparatively less sound is generated
4	Periodic maintenance is required of fuel engine	Environmental friendly & low maintenance
5	Power consumption is more	Power consumption is less

A. Solar panel

- A 50-watt solar panel cannot handle much at all. But if it is used to charge a battery, after a period of time, the accumulated stored energy can be used to operate many small appliances. Solar 50 watt monopanels are made of A grade mono perk cells and ultra-cleared tempered glasses that does not break easily and gives 22W.
- The values of these three potentiometers are inversely mapped to the motors placed in shoulder joint and elbow joint of output such that if the console is pushed down, or to the side, the arm at the output will move in the same manner.
- Scissor like setup is connected to the top of upper metal segment with three potentiometers perpendicular to each other to record movements in the three axis. These values are mapped directly to the three motors placed at the wrist join in output.

Fig. 1. Solar panel

Load Calculation:

$$P=V.I$$

Here,
P= load (Power)
V=Voltage
I= Current
For each motor: P= 12×1.5=0.018 KW

So, total load= 18+18+18=54

Battery Capacity:
For given capacity C and discharge current I, time will be:

$$t = C / I$$

t= time,
C= Capacity,
I= discharge current.

B. Battery

To power electric devices an electric battery is used it is a device consisting of one or more electrochemical cells with external connections. An electric battery has two terminal namely cathode(positive) and anode(negative). The flow of energy is delivered through the terminal marked is the source of electrons that when connected to external circuit.

Electrolytes are able to move as ion within when battery is connected to external circuit which allows chemical reactions to be completed at separate terminals and hence delivering energy to external circuit. To perform work the current flow out of the battery through the movements of the ion within the battery.

Fig. 2. Battery

C. Motors

The Mega Torque Planetary Encoder DC Motor containing planetary gear with RS-775 WC as base motor of 110RPM is a unique system which enables you to get the stall torque of the motor even while using the motor at lower RPM. For RPM initiating from 0 to highest rpm possible as per ratio of gears in gear box, you can achieve the stall torque of the DC motor. A usual DC motor is not sufficient to achieve desired torque at lower speeds because as you vary the input provided to the motor driver the output power is reduced. However, the Mega Torque Planetary Encoder DC Motor with planetary gear system, along with the DC servo drive the encoder feedback is a unique system which will allow to achieve maximum rated torque at lower speeds along with perfect position and multi motor co-ordination. 42mm diameter planetary gearbox gives breaking torque upto 212kgcm. Rated torque of this motor is 89Kgcm at rated 258RPM. This motor has 495 Line optical encoder. This being a Quad Encoder requires 1986 Pulses Per Revolution of the base motor. Gear ratio is 1:61. The Optical encoder coupled with the base motor is a quad encoder which provides 1,20,586 Counts per Revolution (CPR).

This DC motor is perfect for accurate speed applications and multimotor robotic platforms where speed and position co-ordination is important. This motor serves for critical applications where dual motors working at same speeds are important for the working of the system. Also it gives a very fine tuning to achieve required speed control using the high number of counts which are availaible with the coupled encoder.

D. Bluetooth Module

- HC-05 is a Bluetooth module used for wireless communication with Bluetooth enabled devices (like smartphone, Bluetooth controller). It communicates via Bluetooth frequency with microcontrollers using serial communication (USART).
- Default settings of HC-05 Bluetooth module can be changed using certain ATcommands according to user application.
- As HC-05 Bluetooth device has 3300 mV level for RX/TX (receiver/transmitter) and microcontroller can detect 3300 mV level, so, there is no need to shift TX voltage level of HC-05 module. But we need to shift the transmiter voltage level from microcontroller to RX (receiver pin) of HC-05 module.

Fig. 3. Bluetooth module

3. Methodology

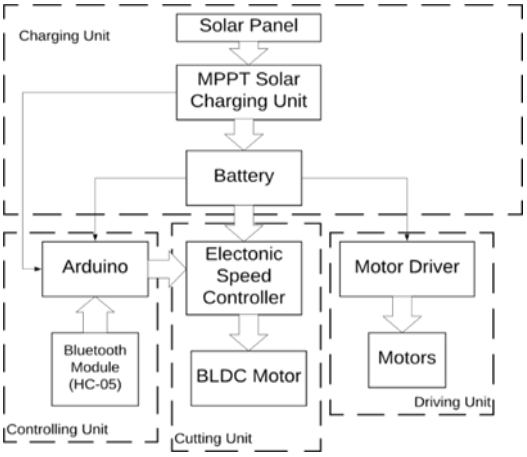

Fig. 4. Block diagram

When sun light hits the photon shit the solar cell, they knock electrons from their atoms. An electric circuit is formed when conductors are attached to positive and negative sides of cell. When electrons flow transmit through such a circuit, they generate electricity. More than cells make up a solar panel, and multiple panels (modules) can be wired together to form solar array. The more number of panels you install the more energy you can expect to generate. Photovoltaic (PV) solar cells are made up of many solar cells. Solar cells are made of silicon, like semi-conductor. They are constructed with positive and negative layer, which PV panels generate direct current (DC) electricity. Electrons flow in one direction around the circuit with the help of DC electricity. For a PN junction in a semiconductor the photo voltaic effect can be described easily.

Each one of the four electrons of the material atom in an intrinsic semi- conductor such a silicon are tied in a chemical bond and there are no free electrons at the absolute zero. If a piece of such electron is doped on one side by five valance electron material, such as arsenic or phosphorous, there will be an excess electron in that side, becoming an n-type semi-conductor. The excess electrons will be free to move in the semi-conductor electrons. The three valance electron material boron dopes the other side of the same piece which creates deficiency of electrons leading top-type semi- conductor.

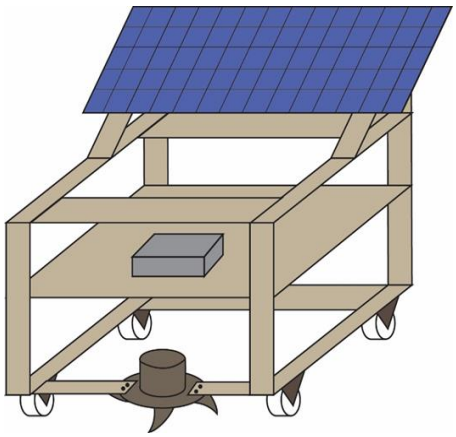

Fig. 5. Solar grass cutter

4. Conclusion

Due to power demand we choose solar energy which is a renewable source of energy and hence there is no running cost. Our project entitled Android app operated solar powered grass cutter is successfully completed and results obtained are satisfactory. This project is more suitable as it is having much more advantages i.e. no fuel cost, no pollution and no fuel residue. There is a facility of charging the batteries while operating the device. The DC motor in low power with high efficiency. This project eliminates the physical power required in pushing without sacrificing safety.

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