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Automatic Solar Grass Cutter

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Abstract - The escalating costs of fuel coupled with the environmental impact of gas emissions have propelled the exploration of alternative energy sources. Harnessing abundant solar energy has emerged as a viable solution, leading to the development of a solar-powered grass cutter. This innovative design integrates a direct current (DC) motor, rechargeable battery, solar panel, stainless steel blade, and control switch, operating on the principle of mowing. The DC motor drives the stainless-steel blade, facilitated by torque generated from the motor. Activation of the grass cutter is initiated through a switch, completing the circuit, and enabling current flow to the motor, facilitating the mowing process. Additionally, the system incorporates automation for guidance and obstacle detection, enhancing efficiency. Traditional motor-powered grass cutters pose various inconveniences, such as noise and air pollution, along with the need for frequent maintenance. Electric alternatives, though environmentally friendly, also present challenges, including hazards and limitations in ease of use. The solar-powered prototype offers a sustainable and user-friendly solution, with the added benefit of being charged by solar panels. This innovation addresses environmental concerns while providing a convenient and efficient grass cutting solution for users of all ages.

Key Words: Solar Power, Battery, Grass Cutter, Dc Motor, Mowing, Emission

1.INTRODUCTION

In large size of lawn in the park, schools, college are maintained manually. The gardener used hand scissors to cut and maintain lawn regularly which also takes more time. It is not easy and very difficult to maintain uniform size. Hence this works to make a solar grass cutter without any power source due to reduce the power consumption. The unskilled gardener is enough to operate the solar grass cutter.

Grass cutter machines have become very popular today. Most of the times, grass cutter machines are used for soft grass furnishing. In a time where technology is merging with environmental awareness, consumers are looking for ways to contribute to the relief of their own carbon footprints. 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, (non-renewable 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 relieve the consumer from mowing their own lawns 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 hope is to keep working on this project until a suitable design can be implemented and then be ultimately placed on the market.

2.1 OBJECTIVE

1. Solar energy is a renewable energy; it should be used effectively.
2. Controlling of pollution with the use of solar energy which is pollution free, and it also helps in controlling the global warming to some extent.
3. The cost of petroleum products is increasing from day to day. The petroleum is non-renewable source as we know, so before it gets over, we should practice the use of renewable sources.
4. Mower, whose construction is simple compared to other equipment.
5. With the use of solar lawn mower, risk of operating cost decreases as compared to petrol-based lawn mower.

2.2 METHODOLOGY

1. The source is driven from the solar energy using photovoltaic panel which charges the battery and is utilized for powering operation of the system.
2. Fix the required horsepower of the motor.
3. Design the required size of solar panel.
4. Determine the capacity of the battery.
5. Wheel movement and cutting operations are done using DC motors.

2.3 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 main function of the solar charger is to increase the current from the panels while batteries are charging, it also disconnects the solar panels from the batteries when they are fully charged and connects to the panels when the charging in batteries is low. The motor is connected to the batteries through connecting wires. Between these two

mechanical circuit breaker switches is provided. The designed solar powered grass cutter comprises of direct current (D.C) motor, a rechargeable battery, solar panel, a spring steel blade, and control switch. Mowing is achieved by the D.C motor which provides the required torque needed to drive the spring steel blade which is directly coupled to the shaft of the D.C motor. The solar powered grass cutter is operated by the switch on the board which closes the circuit and allows the flow of current to the motor which in turn drive the blade used for mowing. The battery recharges through the solar charging controller. Performance evaluation of the developed machine was carried out with different types of grasses.

2.4 COMPONENTS

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. Each module is rated by its DC output power under standard test conditions (STC), and typically ranges from 100 to 320 watts. The efficiency of a module determines the area of a module given the same rated output - an 8% efficient 230-watt module will have twice the area of a 16% efficient 230-watt module. A single solar module can produce only a limited amount of power; most installations contain multiple modules. A photovoltaic system typically includes a panel or an array of solar modules, an inverter, and sometimes a battery and/or solar tracker and interconnection wiring.

Fig- 1: Solar panel

2. Battery

Solar cell modules produce electricity only when the sun is shining. They do not store energy, therefore, to ensure flow of electricity when the sun is not shinning, 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. As the battery is being charged, electric energy is stored as chemical energy in the cells. When being discharged, the stored chemical energy is being removed from the battery and converted to electrical energy. In East-Africa, the most common type of secondary battery is the Lithium iron battery.

Fig- 2: 12V Battery

3. DC Mototrs

A DC motor is a mechanically commutated electric motor powered from direct current (DC). The stator is stationary in space by definition and therefore so is its current. The current in the rotor is switched by the commentator to also be stationary in space. This is how the relative angle between the stator and rotor magnetic flux is maintained near 90 degrees, which generates the maximum torque. DC motors have a rotating armature winding (winding in which a voltage is induced) but non-rotating armature magnetic field and a static field winding (winding that produce the main magnetic flux) or permanent magnet. Different connections of the field and armature winding provide different inherent speed/torque regulation characteristics. The speed of a DC motor can be controlled by changing the voltage applied to the armature or by changing the field current. The introduction of variable resistance in the armature circuit or field circuit allowed speed control. Modern DC motors are often controlled by power electronics systems called DC drives.

4. Blade

A blade is that portion of a tool, weapon, or machine with an edge that is designed to cut and/or puncture, stab, slash, chop, slice, thrust, or scrape surfaces or materials. The blade is seldom sharp enough to give a neat cutting. The blade simply tears the grass

resulting in brown tips. However, the horizontal blades are easy to remove and sharpen or replace. Existing engine trimmers suffer from high initial cost, high levels of engine noise, high fuel consumption rates and high operator's fatigue in long-run. 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. A blade may be made from a flaking stone, such as flint, metal (usually steel), ceramic, or other material.

5. STM32

The STM32 is a family of 32-bit microcontrollers manufactured by STMicroelectronics. These microcontrollers are widely used in various applications, including consumer electronics, industrial automation, automotive systems, and more. STM32 microcontrollers offer a wide range of features, including high performance, low power consumption, and a rich set of peripherals such as timers, UARTs, SPI, I2C, ADC, DAC, USB, and Ethernet interfaces. They are based on the ARM Cortex-M processor architecture and are available in different series, each tailored for specific applications and performance requirements. The STM32 series includes Cortex-M0, Cortex-M3, Cortex-M4, and Cortex-M7 cores, offering different levels of performance and capabilities.STM32 microcontrollers are supported by a comprehensive development ecosystem, including development boards, software development tools, and libraries, making them popular choices for both professional developers and hobbyists. They are programmed using various Integrated Development Environments (IDEs) such as STM32CubeIDE, Keil µVision, and IAR Embedded Workbench, with support for various programming languages including C, C++, and assembly language.

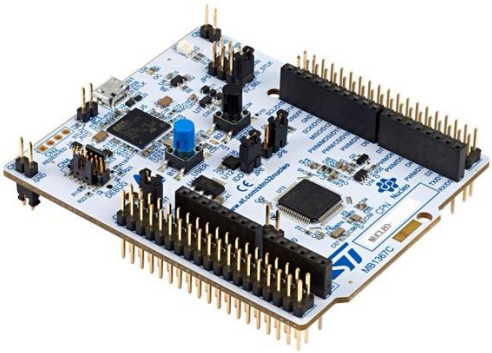


Fig- 3: STM32

6. Ultrasonic Sensor

The HC-SR04 ultrasonic sensor uses SONAR to determine the distance of an object just like the bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package from 2 cm to 400 cm or 1" to 13 feet. The operation is not affected by sunlight or black material, although acoustically, soft materials like cloth can be difficult to detect. It comes complete with ultrasonic transmitter and receiver module.

Fig- 4: Ultrasonic Sensor

7. Bluetooth Module

Bluetooth is fast, low-power, and like Wi-Fi you can communicate with such devices straight from a computer or a mobile device because you usually have Bluetooth integrated in your device. The other cool thing is that with this project, you will be able to change the sketch running on your Arduino via Bluetooth, without having to plug any cables.

8. L298N

This allows you to control the speed and direction of two DC motors, or control one bipolar stepper motor with ease. The L298N H-bridge module can be used with motors that have a voltage of between 5 and 35V DC.

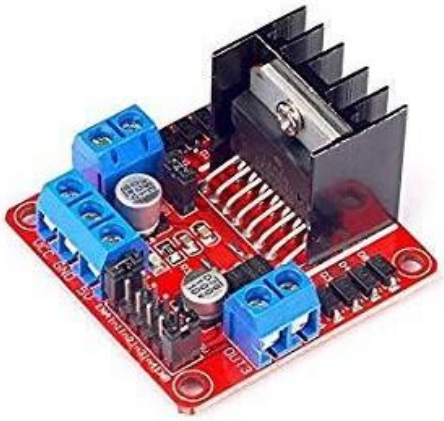
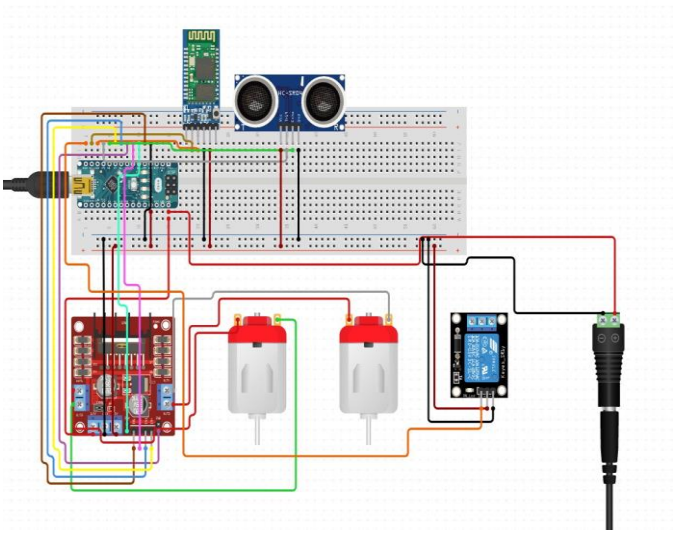
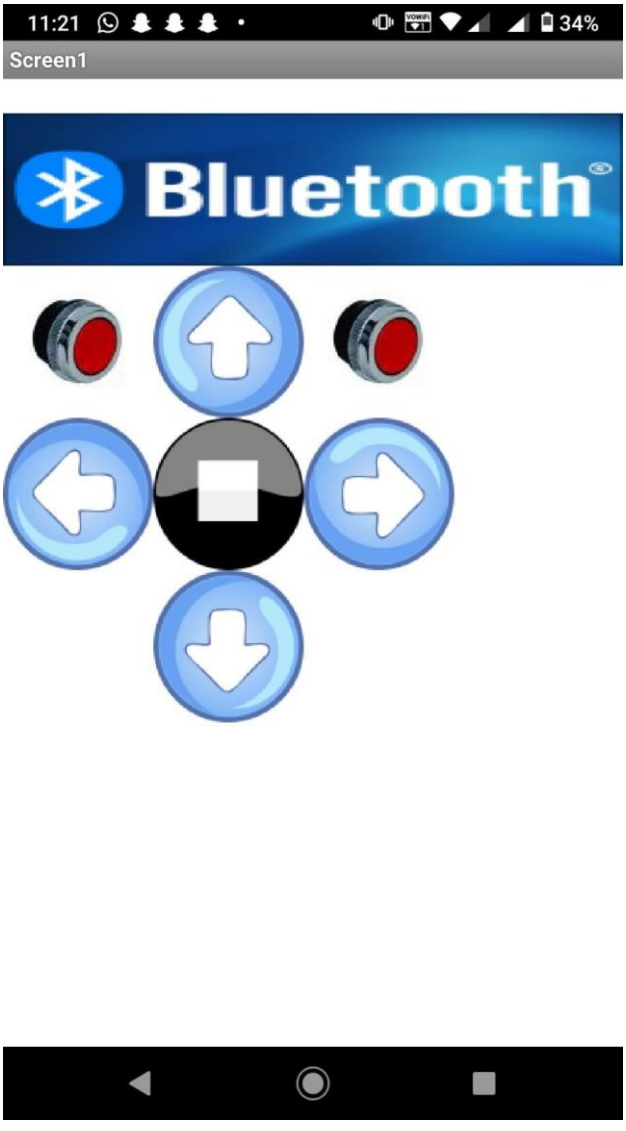


Fig- 5: L298N

2.5 CIRCUIT DIAGRAM



2.6 APP INTERFACE



2.7 OPERATION

The electricity is produced when sun light falls on the solar cells causing the electrons move around them. The action of electrons starts an electric current. The convection of sun light into electricity takes place instantly. There are no mechanical parts to wear out. The rays coming from sun are made to fall on the solar panel. The solar panel is kept at an angle perpendicular to sun rays such that maximum rays are falls on the panel, energy receiving from sun used to produce electricity and stored in a battery.

Electrical energy of the battery is converted to mechanical energy through a set of blades designed to achieve cutting operation. The electric circuit ensures power transfer from the battery to run the D.C. motor, while the solar panel power to continuously recharge the battery while in operation. The cutting blades get power from the D.C motor. When the power switch is on, the electrical energy from the battery powers the motor which in turn actuates the blades through the motor drive. The solar panel generates current to recharge the battery, thereby compensating for the battery discharge. The rotating blades continuously cut the grass as the mower is propelled forward and the cut grass,

The working of solar grass cutter, it has panel mounted on top of model in a particular arrangement such that angle of inclination is 45 degrees hence it can be receiving high intensity solar radiation easily. Solar panel converts solar energy into electrical energy. This electrical energy is stored in the battery. The motor is connected to the battery through connecting wires. The cutting blades tap the power from dc motor and which in turn actuates the blades and hence rotating blades cut the grass.

3. RESULTS

4. CONCLUSIONS

This system is very simple to use and cost effective, since it is much more advantageous, i.e., without any cost fuel, no pollution and no fuel residue, less wear because of a smaller number of moving parts and may be operated using solar energy. It can easily be addressed. This system can charge the battery while the solar energy cutting grass is moving. So, it is much more suitable for cutting grass, too. The output of this project can be improved by increasing reducing costs, increasing the efficiency of the blades and weight reduction. The sensors are not affected to the environment and animals.

It is very useful for the user. The DC motor maintains a constant speed in load condition used. The battery is charged by the solar panel on a stable trend. The output of the photovoltaic panels is different, but Arduino is to act as a voltage regulator and took a different input from the photovoltaic and give the performance stable.

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REFERENCES

1. Darwin Ramos and Jessie Lucero proposed "A solar powered automatic lawn mower". Sanjose state university, electrical dept in 2009.

2. Guo-shing Huang and Keng-Chih Lin proposed "Intelligent auto saving energy robotic lawn mower". IEEE transaction on robotics. Pg 4130 to 4136 In 2010.

3. Tanimola Department of Agricultural & Bio - Environmental Engineering Lagos State Polytechnic, Ikorodu, Nigeria Volume 5, Issue 6, June-2014 ISSN 2229-5518.

4. Amons (2013). Electricity Generation from Solar Energy, Technology and Economic Woodbank Communication Ltd, South Crescent Road, Chester CH4 7AU United Kingdom.

5. Vishal Danve Electronics Department KC College Of Engineering & Management Studies & Research Kopri, Thane (E), Maharashtra, India ISSN: 2320-8163, Special Issue 39 (KCCEMSR) (March 2016), PP. 3943.

6. "Design and implementation of autonomous Lawn Mower Robot controller".

7. Non-Conventional Energy sources by G.D.RAI, Khanna Publishers.