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Fabrication and Performance Evaluation of Automatic and Manual Hybrid Grass Cutting Machine

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ABSTRACT: As a result of the increasing prevalence of grasscutter machines in contemporary society. Contamination is human - made, which we should be visible in our regular routine. The environmental impact of the IC engine on earlier lawn mower models led to an increase in pollutant levels. A shaper fueled by an IC motor is more costly. The expense of keeping a conventional machine is higher. We want to create a new kind of grass cutter that uses solar energy and is cheaper than the previous model to fix these problems. Our's undertaking will likely make a sun based controlled grass shaper, which will save power and diminish the work labor force.

KEYWORDS: Solar, micro controller Arduino nano, solar panels, sensors.

I. INTRODUCTION

Pollution is currently the most pressing issue worldwide. Humans are to blame for pollution, which can be seen in our own homes. Because they produce gases, gas-powered lawnmowers were capable of causing pollution. Also, it's without a doubt wasteful because of the rising fuel costs. The utilization of daylight to drive an electric engine, which thusly moves an edge, is alluded to as a sun light based controlled grass trimmer. Nevertheless, those grass cutters are pricey. In any case, the power in our programmed grass shaper is battery-powered. This plan fills in as an option in contrast to an unsafe internal combustion lawnmower.

Additionally, it will be the alternative to the automatic solar lawn mower because of its higher price. As a result, an automatic lawn mower with a rechargeable battery can help users save money. Using their Android phone, the user of this auto matic grass cutter can cut the grass in the specified area by entering information. Additionally, this grass cutter's eyes are sensors that detect the height of the grass.

In order to determine whether the grass cutter was cutting into something, we required an ultrasonic sensor. When designing the grass cutter, safety is the primary concern. We wanted our grass cutter not to be in operating mode if the user was holding it in the air because it has blades. Realizing that the client would be haphazardly holding the grass shaper we really wanted a sensor to identify direction.

II. LITERATURE REVIEW

The current arrangement was supplanting the fuel-controlled engines to engine controlled which diminished contamination. As ordinary energy sources are running out and power is expensive, energy specialists have been contemplating the option accessible sources. The use of solar panels to generate electrical energy from the sun's rays has gained popularity.

Photovoltaic solar cells produce DC power, which can be used to power any DC load within its capabilities, such as wireless battery chargers and automatic lawn mowers. Indeed, even with an electric engine trimmer there actually was a disadvantage, an individual should be there to control the machine, this was tackled by presenting remote controlling of the machine utilizing far off gadget.

Researchers introduced an ultrasonic sensor that is used for obstacle detection. The robot will move forward until an obstacle is detected, so remote controlled machines are not completely devoid of human presence. This system had a problem in that there were no boundary conditions set, so even if the robot was on for a long time, the work might not be done.

Since grass and concrete have different water content, a humidity sensor was used as an improvement to differentiate between the two. However, this was not 100% accurate and may vary depending on the atmosphere's moisture content and the location. In this instance, boundary wires are used to establish boundaries so that the robot cannot cross them.

III. PROPOSED METHODOLOGY

Collecting the raw materials needed for fabrication of the hybrid grass cutting machine from various source.
 By using Soldering gun to Solder the electrical components to make strong and compact.
 Assemble the all components by various process.
 Test the hybrid powered grass cutter by considering various parameter like length and thickness of grass.
 Obtaining results can be tested materials and compare those.

IV. SCHEMATIC DIAGRAM

An Arduino nano micro controller, a 4DC motor, and a drive circuit are used in this proposed system. The system in this project is entirely powered by solar and battery power. The primary objective of this project is to cut cost and save time and effort. One ultrasonic sensor is shown in this block diagram, which we used to detect obstacles. When an obstacle is detected, the cutting action stops, and vice versa.

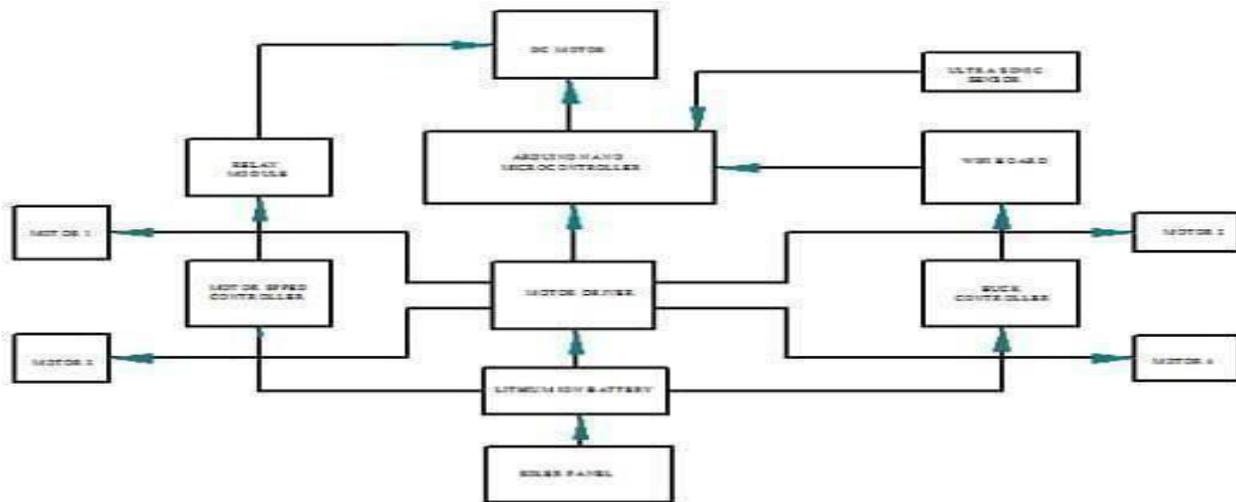


Fig 2.1 Schematic Diagram of Grass Cutting Machine

V. OBJECTIVES

Environmental Sustainability: Reduce carbon emissions and minimize the carbon footprint of traditional gas-powered lawn mowers.

Energy Efficiency: Harness renewable solar energy to power lawn care, decreasing reliance on fossil fuels.

Cost-Effective: Lower energy costs and extended battery life reduce expenses associated with lawn maintenance.

Improved Air Quality: Eliminate air pollutants and greenhouse gas emissions, contributing to cleaner air and a healthier environment

Reduced Maintenance: Solar mowers require less maintenance compared to traditional gas-powered mowers.

Aesthetic Appeal: Keep lawns well-manicured and visually appealing while embracing eco-friendly technology.

By adopting solar grass cutting, individuals and communities can contribute to a more sustainable future while enjoying the benefits of advanced technology!

VI. REQUIREMENT OF COMPONENTS

Battery: -

An electrical battery is made up of one or more electro chemical cells that are used to turn chemical energy that has been stored into electricity. Numerous household and industrial applications now rely on the battery for power. Limit of the battery 4.2 v and 4000 MAH A lithium-ion battery (Li-ion) is a type of rechargeable battery that uses lithium ions as its primary component. These batteries are commonly used in portable electronics, such as smart phones and laptops, as well as electric vehicles and stationary energy storage systems. The 4.2 volts refers to the maximum voltage that the battery can deliver when fully charged, while the 4000mAh capacity indicates the amount of charge that the battery can hold and deliver over time. In other words, this battery can supply a current of 4 amps for 1 hour or 1 amp for 4 hours before needing to be recharged. It is important to note that lithium-ion batteries should be handled with care and should not be overcharged, overheated, or punctured as they may cause a fire or explosion. Always follow the manufacturer's guidelines for charging and use of the battery.



Fig 4.1 Lithium-ion battery

Solar Panel: -

Solar (or photovoltaic) cells can be used to generate power through the photovoltaic effect in a solar panel. These cells are arranged in a grid-like manner on the surface of solar panels. As a result, another way to describe it is as a collection of photovoltaic modules mounted on a supporting structure. A photovoltaic (PV) module is a connected assembly of 36 solar cells. When it comes to wear and tear, these panels last a very long time. Solar panels degrade extremely slowly. Their effectiveness only decreases by one to two percent annually (sometimes even less). The majority of solar panels use crystallized silicon solar cells. The flow of electricity in and out of the utility grid is measured by a utility meter, which spins backwards (when you are producing more energy than you need) and forward (when you require additional electricity from the utility company). The two are offset ensuring that you only pay for the additional energy you use from the utility company. Any surplus energy is sold back to the utility company. This

system is referred to as "net-metering". As shown in figure 5.1

Solar Energy is measured in kilowatt-hour. 1 kilowatt = 1000 watts.

1 kilowatt-hour (kWh) = the amount of electricity required to burn a 100-watt light bulb for 10 hours. About 30% of our total energy consumption is used to heat water

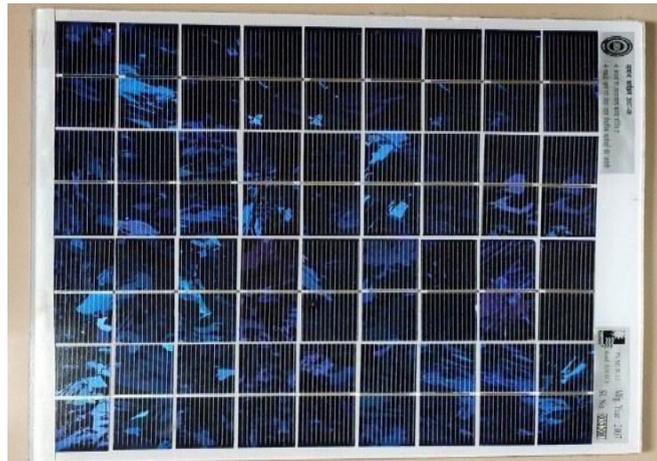


Fig 4.2 solar panel

Ultrasonic Sensor: -

An ultrasonic sensor is a device that measures distance from an object by using ultrasonic sound waves. A transducer in an ultrasonic sensor sends and receives ultrasonic pulses that convey environmental data. The closeness of an object. Ultrasonic sensor provides a very low-cost and easy method of distance measurement. This sensor is perfect for any number of applications that require you to perform measurements between moving or stationary objects. Naturally, robotics applications are very popular but you'll also find this product to be useful in security systems or as an infrared replacement if so desired. You will definitely appreciate the activity status LED and the economic use of just one I/O pin as shown in the figure 5.5 The ultrasonic sensor measures distance using sonar; an ultrasonic (well above human hearing) pulse is transmitted from the unit and distance-to-target is determined by measuring the time required for the echo return. Output from the ultrasonic sensor is a variable-width pulse that corresponds to the distance to the target.



Fig 4.3 ultrasonic sensor

Micro controller Arduino: -

The Arduino Nano is a small, low-cost micro controller board that is based on the Atmel ATmega328P micro controller. It is similar in functionality to the Arduino Uno, but with a smaller form factor and a few differences in its pin layout.

The Arduino Nano is a popular choice for hobbyists and electronics enthusiasts due to its compact size and low cost. It can be used to build a wide range of projects, from simple LED displays and motor controllers to more complex robots and automation systems.

The board has 14 digital input/output pins, 8 analog inputs, and a 16 MHz quartz crystal. It also includes a USB connector for programming and power, as well as a voltage regulator to provide a stable 5V supply.

Features:

Provides precise, non-contact distance measurements within a 2 cm to 3 m range

Simple pulse in/pulse out communication

Burst indicator LED shows measurement in progress

20 MHA power consumption

Narrow acceptance angle

pin header makes it easy to connect using a servo extension cable, no soldering required.



Fig 4.4 Micro controller Arduino nano

E Node MCU Module:

The Node MCU is an open-source development board based on the ESP8266 Wi-Fi module. It is designed to make it easy for developers to create IoT (Internet of Things) projects and connect them to the internet.

The Node MCU board includes a micro controller, flash memory, Wi-Fi module, and several I/O pins for connecting external sensors, actuators, and other components. It also has a USB port for power and communication with a computer.

The Node MCU board is programmed using the Lua scripting language, which is a lightweight and easy-to-learn language that is well-suited for IoT applications. Developers can use Lua scripts to read sensor data, control actuators, and communicate with web services and other devices on the internet.

One of the key advantages of the Node MCU board is its low cost and ease of use. It is an ideal platform for hobbyists, students, and developers who want to create IoT projects without the need for extensive hardware and software knowledge.

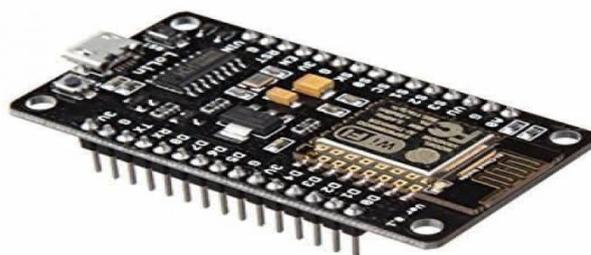


Fig 4.5 Node MCU Module

F Relay:

Relay is an electrical device that acts as a switch to control the flow of current in an electrical circuit. It is typically used to control a circuit that has a higher current or voltage than what the controlling circuit can handle directly. A relay consists of an electromagnet, a set of contacts, and a spring. When an electrical current flows through the coil of the electromagnet, it creates a magnetic field that pulls on the contacts, causing them to close or open, depending on the design of the relay. Relays are commonly used in a variety of applications, such as in industrial control systems, automotive electronics, and home automation systems. They can be used to control motors, lights, heaters, and other electrical devices, and are often used to provide electrical isolation between circuits to improve safety and reduce the risk of electrical shock.



Fig 4.6 Relay

G. DC Motor

An electric motor that runs on direct current (DC) electricity is known as an own A DC motor. The operation of any electric motor is based on straightforward electromagnetism.

A DC motor is an electric motor that runs on direct current (DC) electricity. In any electric motor, operation is based on simple electromagnetism as shown in the figure 5.4(a) and 5.4(b).

The type of motor used is DC squared geared motor.

Specification:

12V

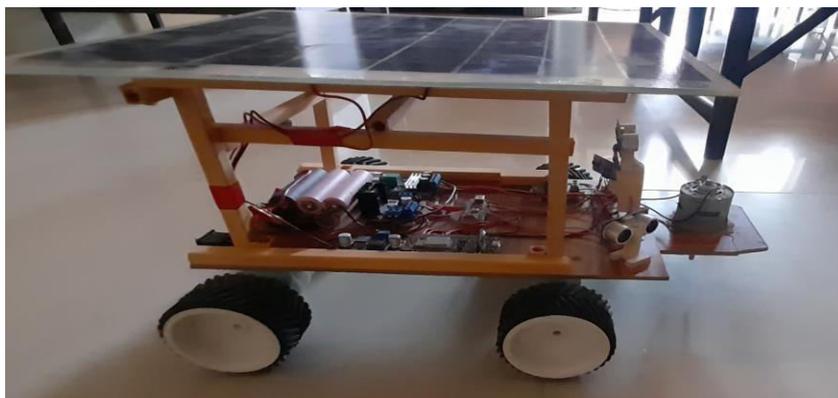
Four of 100 rpm and one of 10000rpm

46mm extended transmission shaft



Fig 4.7 DC Motor

Assembled model



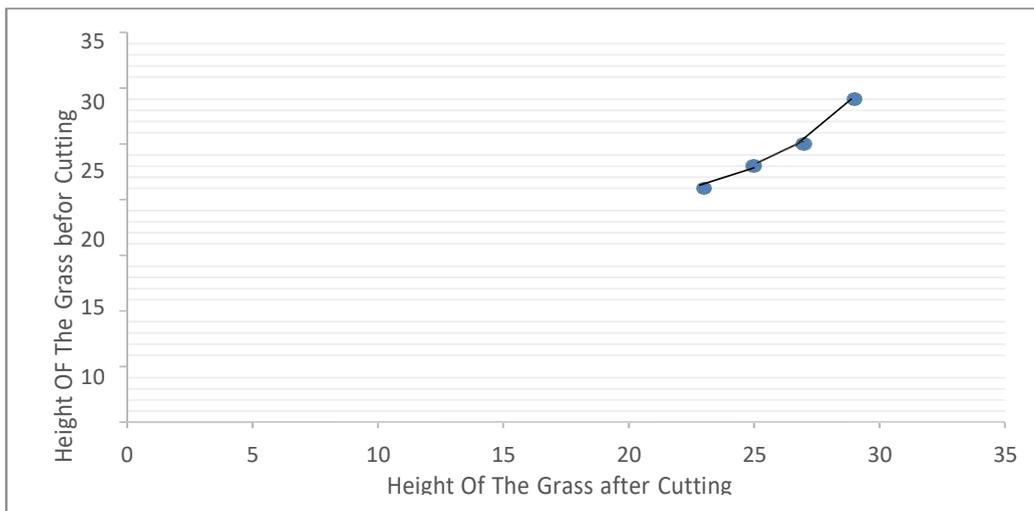


Result: -

Parameter 1 : - Cutting speed of blade of blade is 450 rpm

No of Trails	Height of the Grass Before Cutting	Height of the Grass After Cutting
Trail 1	28	26
Trail 2	26	24
Trail 3	24	22
Trail 4	22	20

Table 5.1 Parameter 1 Test and Result



Graph 5.1 Parameter 1 Test and Result

The above fig shows the schematic representation of graph. X- axis indicate the height of the grass after cut, Y- axis indicate the height of the grass before cut.

Cutting speed of blade of blade is 450 rpm.

The run time of the battery is around 50 minutes for a fully charged battery depending upon the density of grass to be cut.

VII.CONCLUSION

In conclusion, solar grass cutting is a revolutionary and eco-friendly approach to lawn care that offers numerous benefits for the environment, cost savings, and increased efficiency. By harnessing the power of solar energy, individuals and communities can:

- Reduce their carbon footprint and contribute to a sustainable future
- Enjoy cost-effective and quiet lawn maintenance
- Increase productivity and efficiency with automated mowers
- Improve air quality and public health
- Embrace innovative technology for a better tomorrow

As the world continues to shift towards renewable energy sources and sustainable practices, solar grass cutting is an excellent example of how small changes can make a significant impact. Join the movement towards a greener, cleaner, and more sustainable future with solar grass cutting!

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