

Design & Development of Automated Solar Grass Cutting Machine

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Abstract-

Rapid growth of various high-tech tools and equipment makes our jobs done comfortable and sophisticated. The project aims at fabricating a grass cutting machine system which makes the grass cutter based motor running through solar energy. Power plays a great role wherever man lives and works. The living standard and prosperity of a nation vary directly with the increase in the use of power. The electricity requirement of the world is increasing at an alarming rate due to industrial growth, increased and extensive use of electrical gadgets. The best alternative source is solar energy.

Key Words: Solar Panel, 1293d driver, DC motor, Blades, node MCU, Battery.

1.INTRODUCTION

Now day's pollution is major issue for whole world. Pollution is manmade and can be seen in our homes. In case gas powered lawn movers due to emission of gases it is responsible for pollution. Also the cost of fuel is increasing hence it is not efficient. So the solar powered grass cutter is introduced. Solar powered grass cutter can be described as the application of solar energy to power an electric motor which in rotates a blades which does the moving on lawn. Solar energy is the renewable energy. It uses the photovoltaic panel to generate the energy needed to power the mover.

Grass cutter machines have become very popular today. Most common machines are used for soft grass furnishing. In our project Grass cutter machine we are aimed to develop for operation and construction. The main parts of the Grass cutting machines are DC motor of 75HP capacity, relay switch for controlling motor, Battery for charging it through solar panel. It is placed in a suitable machine structure. The motor have 18000rpm and it is connected to the electric supply by the use of a roll of wire. The motor rpm increased by the help of gears. Motor controlled by an electric switch for easy operation. The tempered blades are attached in this machine. which helps to cut the grass. The blade will get kinetic energy while increasing the rpm. The cutting edges are very smooth and accurate. Also Electric Grass Cutting Machines are much easier to be used in garden, lawn and grass fields. In order to the beauty of home-lawns and gardens, Grass cutting machines are the best available option in the industry. With the help of a lawn mower enhance 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 without any hassle. Now-a-days, there are plenty of options starting from the simplest push along mower to the most advanced electric grass cutting machine. According to world energy report, we get around 80% of our energy from conventional fossil fuels like oil (36%), natural gas (21%) and coal (23%). It is well known that the time is not so far when all these sources will be completely exhausted. So, alternative sources should be used to avoid energy crisis in the nearby future. So introduce solar energy for the machine process to work. A solar panel is a large flat rectangle, typically somewhere between the size of a radiator and the size of a door, made up of many individual solar energy collectors called solar cells covered with a protective sheet of glass.

1.1OBJECTIVES

- It is an eco-friendly, No pollution, less economical, Efficient, Unmanned vehicle.
- Without using any external power supply the machine is going to perform its own operation
- Using solar energy (renewable source), the battery will charge automatically.
- Whole object will be controlled through “IOT” (ESP8266) Wi-Fi module.
- By using blade material as stainless steel, there will no corrosion take’s place at blade.
- Through chain drive system the vehicle can move at any of surface contact.
- This vehicle has high torque so, I can move at negligible friction



1.2 PROBLEM DEFINITION

In olden days a skilled is necessary to move the grass cutter, and also external power supply is necessary, to overcome this problem, by using renewable energy[solar energy] and by implementation of automation through coding the machine is going to perform its own operation.

These grass cutters convert the solar energy into electrical energy by using solar panel. If battery (12v) is discharged then it can be charged by using AC supply. These electrical energy then stored in battery. This battery is then connected to node mcu module and nodemcu module is connected to both DC motor. Nodemcu module is having a function to supply the electricity to motors by using relays.

Node mcu module receive signal through controller and L293d supply electricity according to that motor. Then these motor is connected to wheel by gearing mechanism and wheel rotates. Due to wheel rotation the spiral cutter through gearing mechanism the spiral cutter also rotates. Due to this rotation of cutter the grass cutting operation can be done.

2 PROPOSED METHODOLOGY:

The portable Electric Grass cutter machine with solar power is used To fulfil the objectives of the proposed idea we need to understand the basic elements of few electronics like LM358 comparator, relay, solar panel, charging circuit, rechargeable battery, temperature sensor, geared DC motor, cutting blades etc.

2.1 Solar panels

the sun light as a source of energy to generate electricity or heat. A photovoltaic (PV) module is a packaged; connect assembly of typically 6x10 photovoltaic solar cells. Photovoltaic modules constitute the photovoltaic array of a photovoltaicsystem that generates and supplies solar 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 365 Watts (W). The efficiency of a module determines the area of a module given the same rated output – an 8% efficient 230 W module will have twice the area of a 16% efficient 230 W module. There are a few commercially available solar modules that exceed efficiency of 22% and reportedly also exceeding 24%. A single solar module can produce only a limited amount of power; most installations contain multiple modules. A photovoltaic system typically includes an array of photovoltaic modules, an inverter, a battery pack for storage, interconnection wiring, and optionally a solar tracking mechanism.

The most common application of solar panels is solar water heating systems.

The price of solar power has continued to fall so that in many countries it is cheaper than ordinary fossil fuel electricity from the grid. Solar cells and solar panels have lots of uses. They are in everyday things like calculators, watches, and flashlights. There are solar-powered toys, radios, and MP3 players. There are solar-powered cell phones and pagers. Using solar power with devices like these means you never have to worry about batteries. Solar panels are sometimes used to make the electricity to light up road signs and bus stops. They may make the electricity that makes roadside emergency phones or parking meters work. Even some ATMs (machines that let you get money from or put money into your bank account) have solar panels.



Fig. Solar panel

2.2 Rechargeable Battery:

Solar power can be stored in the rechargeable battery and can be further used for the grass cutting machine to run. A rechargeable battery, storage battery, or accumulator is a type of electrical battery. It comprises of one or more electrochemical cells, and is a type of energy accumulator. It is known as a secondary cell because its electrochemical reactions are electrically reversible.

2.3 L293D MOTOR DRIVER

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC. The L293d can drive small and quiet big motors as well, check the Voltage Specification at the end of this page for more info.

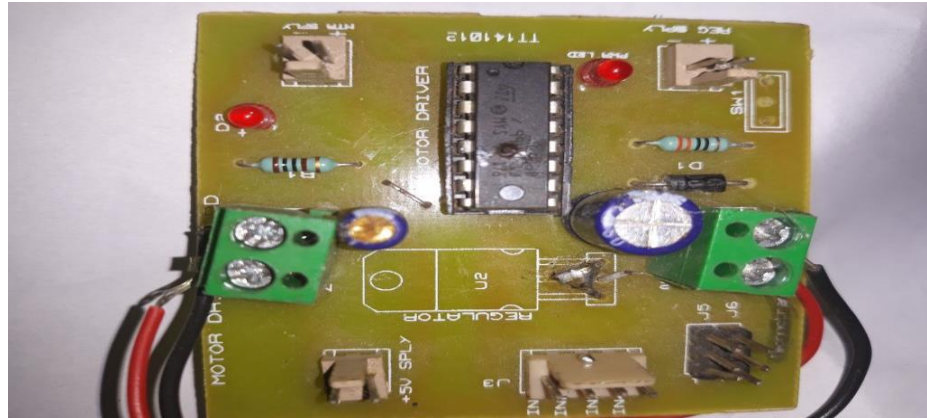


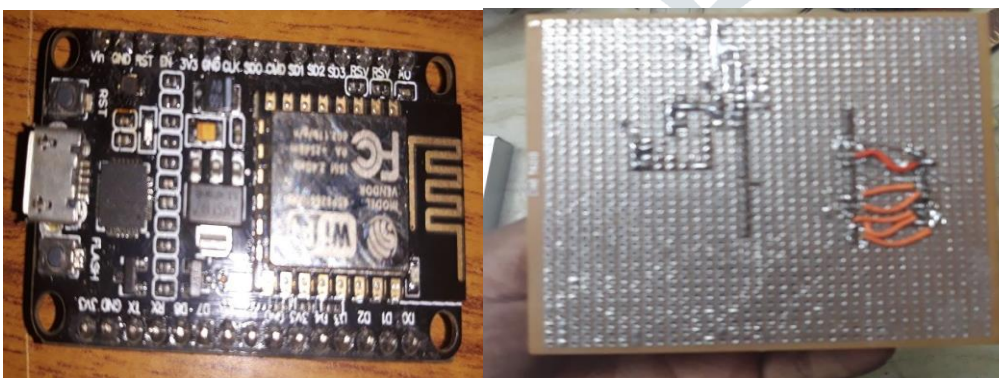
Figure: 4.11 L293D

The L293 and L293D devices are quadruple high current hard drivers. The L293D is designed to provide bi directional drive currents of up to 1A at voltages from 4.4 to 36 V. The L293D is designed to provide bi directional drive currents of up to 600-m A at voltages from 4.5V to 36V. Both devices are designed to drive inductive loads such as relays, solenoids, DC and bipolar stepping motors as well as other high current/high voltage loads in positive supply applications.

Each output is a complete totem-pole drive circuit, with a Darlington transistor sink and a pseudo-Darlington source. Drivers are enabled in pairs with drivers 1 and 2 enabled by 1,2 EN and drivers 3 and 4 enabled by 3 and 4 EN the L293 and L293D are characterized for operation from 0°C to 70°C.

2.4 NODE MCU

The Node MCU is an open-source firmware and development kit that helps you to Prototype your IOT product within a few Lua script lines. It includes firmware which runs on the ESP8266 Wi-Fi SOC from if Systems, and hardware which is based on the ESP-12 module



Nodemcu

2.5 DC motor:

In the presented idea for grass cutter model we used Johnson DC motor interfaced with blades for cutting grass when operated. A dc motor uses electrical energy to produce mechanical energy, very typically through the interaction of magnetic

fields and current-carrying conductors. The input of a DC motor is current/voltage and its output is torque (speed). Johnson motor has many novel linear and rotary motors and at least one self-powering magnetic rotary device Johnson uses a bidirectional “two particle” theory of magnetic flux showing the internal bidirectional energy flows in all potentials and fields. The motor utilizes controlled spin-waves and self-initiated precise exchange forces, which are known to momentarily produce bursts of very strong force fields.

3. CALCULATIONS

Rated power max =5 watts from solar panel

From battery: Power = voltage x current

$$= 12 \times 1.3$$

$$= 15.6 \text{ watts}$$

Total power required for whole vehicle:

For 1 motor [100 rpm]

$$\text{Power} = 12 \text{ volts} \times 0.3 \text{ amps}$$

$$= 3.6 \text{ watts}$$

For four motors power required =4xpower required for 1 motor

$$= 4 \times 3.6$$

$$= 14.4 \text{ watts}$$

Estimation of life of battery duration E= 1 hour [approx]

From solar panel it takes time to charge =3 hours

4. GRASS CUTTER BLADE ANALYSIS IN ANSYS:

A static structural analysis determines the displacements, stresses, strains, and forces in structures or components caused by loads that do not induce significant inertia and damping effects. Steady loading and response conditions are assumed; that is, the loads and the structure's response are assumed to vary slowly with respect to time. The types of loading that can be applied in a static analysis include Externally applied forces and pressures Steady-state inertial forces (such as gravity or acceleration) Imposed (nonzero) displacements Temperatures (for thermal strain)

5. RESULT AND DISCUSSION

The project was aimed providing a simple and much efficient way for cutting the grass. The first thing for this project is to make all the input and output ready.



Fig 8.1 : shows the structure of our project.

It was implemented and works as expected and has proved to be verified.



5.1 Comparison Between Existing & Present Model

CONVENTIONAL GRASS CUTTER	SOLAR AUTOMATIC GRASS CUTTER	FACTOR
Cause more pollution	Clean and less effort	Pollution
More effort	Less effort	Effort
More	Less	Maintenance required
Not available	Available	Remote control
More	Less	Noise
Less	More	Efficient

Mathematical calculations of cutting operation:

Width of the vehicle : 0.28 meters

For 1 minute it moves: 3 meters

$$\begin{aligned}
 \text{Total area occupy} &= \text{width} \times \text{length} \quad \text{m}^2 \\
 &= 0.28 \times 3 \text{ m}^2 \\
 &= 0.84 \text{ m}^2
 \end{aligned}$$

For one hour area occupy = $60 \times 0.84 \implies 50.4 \text{ m}^2$

6. CONCLUSION

Our project entitled Fabrication of solar powered grass cutter is successfully completed and our project entitled Fabrication of solar powered grass cutter is successfully completed and 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. This will give much more physical exercise to the people and can be easily handled. As we are nearer to Equator, the solar energy (nonconventional energy) is vastly available, so it is easy to charge the battery and is also pollution free. But the initial investments of the solar

powered grass cutter are high.

At present in order to curtail global warming and ozone depletion, the Government of India is offering subsidy for the solar equipments. The industries are producing these components in mass productions, so the cost of the system may come down. So in future it is expected to run all equipments by using solar energy. This system is having facility of charging the batteries while the solar powered grass cutter is in motion. So it is much more suitable for grass cutting also. The same thing can be operated in night time also, as there

is a facility to charge these batteries in day light.

7. SCOPE OF FUTURE WORK

We completed our project successfully with the available sources. If high watt panel are used then machine can be applicable during night time for garden, because it can store more power. Grass cutting can be made more efficient by adding more motor with blades in the front side of the machine. Programming can be enhancing to make the device performance for different operation.

Efficiency can be improved by increasing the battery capacity; this can be further improved by incorporating the following modifications to obtain better results. and speed of motor is reduce because we have used heavy material and this material can be replaced by using light weight material .and design of blades should be done based on types of grass is used to cut.

The project which we have done surly reaches the average families because the grass can be trimmed with minimum cost and with minimum time finally this project may give an inspiration to the people who can modify and can obtain better results.

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