SOLAR POWER OPERATED GRASS CUTTER AND PESTICIDES SPREADER ROBOT

Nageswar B, Asst.Prof.
Department of Mechanical Engineering,
Mahaveer Institute of Science and Technology, Hyderabad.

E. Krishna Deepak, Asst. Prof.
Department of Mechanical Engineering,
Mahaveer Institute of Science and Technology, Hyderabad.

Abstract:
A Solar Powered Automatic Grass Cutting and Pesticide Spreading robot project is mainly to reduce the manpower and usage of electricity. Solar panel is used to provide the source to the battery charging. It is an automated system for the purpose of grass cutting. The source is drive from the solar energy by using solar plate. The system control is done by the Bluetooth control. Automation is achieved by using sensors and Bluetooth controls. Wheels and cutting operations are done using dc motors. DC battery is utilized for powering and standby mode operation of the system. The whole supply is provided through the battery and to charge the battery charger circuit is used to provide the charging for the battery. Also the second application is that the spreading of pesticide here we used the water pump with spreading nozzle.

INTRODUCTION

In Modern world, Automation robot is used in many of the fields such as defense, surveillance, medical field, industries and so on. In this project, the robot system is used to develop the process of cultivating agricultural land with the use of solar power. The aim of the project is to reduce the man power, time and increase the productivity rate. The entire basic robot works like harvesting, Grass cutting, water sprinkling and so on. Here the designing systems like plough the land, watering the plant or spraying the fertilizer and Cutting grass are preferred by this robot using Solar panel, battery, Rack and pinion and DC motor.

The device consists of Solar panel, Battery, Microcontroller, DC motors, motor driver, Bluetooth module, water pump. The controller works between each of them as an intermediary medium. The controller may thus be called a control panel. The controller may thus be called a control panel. The input module is nothing a switch board to which mobile transmitter is interfaced. When the user presses a switch the data will be transmitted over Bluetooth transmitter. The data will be received by the Bluetooth receiver and is fed to controller. The Microcontroller acts accordingly to program and switches the Relays to which Action to be operated like grass cutting, robot controlling, seed dropping, pesticide sprinkling etc.. The Microcontroller used in the project is programmed using Embedded 'C' language.

LITERATURE REVIEW

The condenser is a passive unit, also referred to as a condenser, and one that stores energy in the form of an electrostatic field that creates a potential (static voltage) across its plates. A capacitor consists of two parallel conductive plates in its basic form, which are not connected but are either electrically separated by air or by an isolating material called the Dielectric.

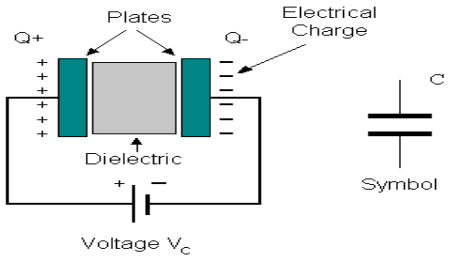


Fig 1: Construction Of a Capacitor

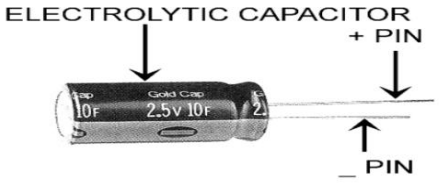


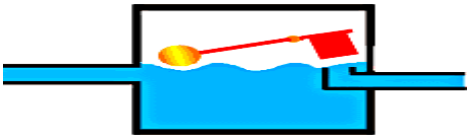
Fig 2 :ElectrolyticCapaticor

Units of Capacitance

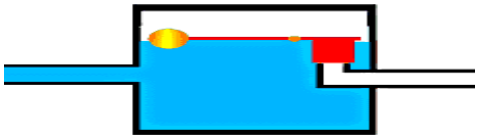
Microfarad (μF) 1μF= 1/1,000,000 = 0.000001 = 10^{-6} F
Nanofarad (nF) 1nF = 1/1,000,000,000 = 0.000000001 = 10^{-9} F
Pico farad (pF) 1pF = 1/1,000,000,000,000 = 0.000000000001 = 10^{-12} F

3.2 Operation of Capacitor

Think about the water that flows through a pipe. If we think of a condenser as a storage tank with an inlet and an outlet pipe, it is possible to demonstrate roughly how an electronic condenser operates. First, let's consider the case of a "coupling capacitor" where a signal from one part of a circuit to another is connected by the capacitor, but without allowing any direct current to flow.
If the present flow alternates between zero and a limit, our storage tank capacitor will allow the current waves to pass through.



However, there is a steady current, only the initial short bust will flow until the floating ball valves closes and stop further flow.



So a coupling capacitor makes it possible to move by "alternating current" and when the waves go up and down, the ball valve does not get a chance to close. A constant current, however, rapidly fills the tank so that all flow ceases.
"The result is to "smooth all ripples" when a capacitor is used to decouple a circuit. Although dc flows smoothly, any ripples, waves or current pulses are transmitted to the field.

3.3 Regulation

Regulation is the method of translating a changing voltage to a constant regulated voltage. We use voltage regulators for the control phase.

3.4 Voltage Regulator

A voltage regulator with only three terminals (also called a 'regulator') appears to be a simple unit, but it is actually a very complex integrated circuit. A changing input voltage is transformed into a constant 'regulated' output voltage. Voltage Regulators are available in a variety of outputs like 5V, 6V, 9V, 12V and 15V. The voltage regulator series is designed to provide a positive input. The LM79XX series is used for applications which require negative input. By using a pair of 'voltage-divider' resistors, the output voltage of a regulator circuit can be increased.

3.5 Resistors

A resistor is a two-terminal electronic device that generates a voltage proportional to the electric current passing through it through its terminals in accordance with Ohm's law:

$$V = IR$$

3.6 Theory of operation

3.6.1 Ohm's law: The conduct of an ideal resistor is determined by the relationship described in the law of Ohm: V =IR

The law of Ohm states that the voltage (V) through a resistor is proportional to the current (I) by which the resistance is the constant of proportionality (R).

3.6.2 Power dissipation

The power dissipated by the resistor (or the resistance counterpart of the resistor network) is measured using the following calculations:

$$P = I^2R = IV = \frac{V^2}{R}$$

Fig 3.3: Resistor

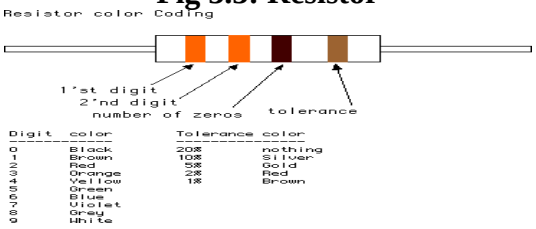


Fig 3.4: Color Bands in Resistor

3.7 Microcontroller outline with its basic elements and internal connections

A microcontroller alone is not enough for a genuine application. Besides a microcontroller, we need a program to be implemented and a few more elements that make up the logic of the interface to the regulatory elements (which will be discussed in later chapters).

The contents of two memory locations are inserted by the program and their total is shown on port A. The first line of the program refers to transferring the contents of the memory location 'A' to one of the central processing unit registers. We will also transfer it into the other register of the central processing unit as we need the other data as well.The next instruction instructs the central processing unit to add the contents of the two registers and to send the output to port A in order to make the amount of that addition available to the outside world. The program that works on its solution will be larger for a more complicated question. Programming can be performed in many languages, which are the most widely used languages, such as Assembler, C and Basic.

4.1 Bluetooth

Product Description

1. Mainstream CSR Bluetooth chip, Bluetooth V2.0 protocol standards
2. Serial module operating voltage 3.3V.
3. The baud rate for 1200, 2400, 4800, 9600, 19200, 38400 and users can be set
4. Core module size:28mmx15mmx2.35mm.
5. Working current: 40mA
6. Sleep current: <1mA
6. For the GPS navigation system, utility meter reading system, the industrial field, collecting and controlling system.

(1) Bluetooth serial interface module

Industrial level: HC-03, HC-04(HC-04-M, HC-04-S)

Civil level: HC-05, HC-06(HC-06-M, HC-06-S)

HC-05-D, HC-06-D (with baseboard, for test and evaluation)

(2) Bluetooth adapter

HC-M4

HC-M6

The serial port line is replaced by the main feature of the Bluetooth serial module, such as:

1. There are two MCUs who want each other to connect. One connects to the master Bluetooth device and the other connects to the slave device. If the pair is made, their relation can be constructed.

This Bluetooth communication, like RXD, TXD signals, is similar to a serial port line connection.And they can use the serial Bluetooth module to connect with each other.

2. When the MCU has the Bluetooth salve module, computers and smart phones can communicate with the Bluetooth adapter. A virtual communicable serial port line between the MCU and the device or smart phone

is then available.

3. Safe devices, such as Bluetooth printer, Bluetooth GPS, are mostly the Bluetooth devices on the market. So we can use the master module to pair and interact with them.

The function of the Bluetooth Serial module does not need a drive and can communicate with another serial Bluetooth unit. However, there are at least two conditions for contact between two Bluetooth modules:

5.1 DC motor and Motor Driver

A DC motor uses electrical energy, usually through the interaction of magnetic fields and current-carrying conductors, to generate mechanical energy. An alternator, generator or

dynamo performs the reverse operation, producing electrical energy from mechanical energy. It is possible to operate certain types of electric motors as generators, and vice versa. A DC motor's input is current/voltage and its output is torque velocity.

Fig 5.1: DC Motor

There are two fundamental components of the DC motor: the revolving part that is called the armature and the stationary part that contains wire coils called the field coils. The stator is also called the stationary component. A picture of a typical DC motor is shown in the figure, a picture of a DC armature is shown in the figure, and a typical stator image is shown in the figure.

5.2 Operation

In modem industrial applications, the DC motor you will find operates very similarly to the simple DC motor mentioned earlier in this chapter. An electrical diagram of a simple DC motor is shown in the figure. Note that the DC voltage is directly applied to the winding of the field and the brushes. As a coil of wire, the armature and the field are both seen. In later diagrams, to control motor speed, a field resistor will be inserted in series with the field.

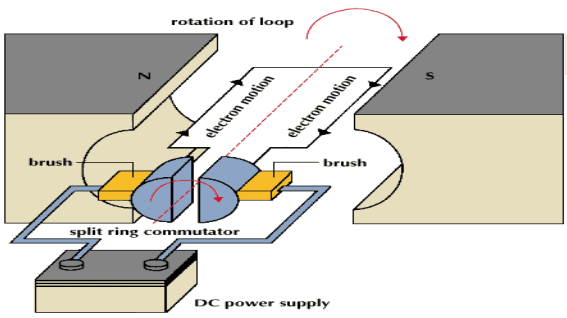


Fig 5.2.1: Operation of a DC Motor

In the armature and field coil, the magnetic field causes the armature to begin spinning. This occurs by the unlike magnetic poles attracting each other and the like magnetic poles repelling each other. The commutator segments will also start to shift under the brushes as the armature starts to rotate. As an individual commutator segment moves under the positive voltage-linked brush, it will become positive, and it will become negative when it moves under a negative voltage-linked brush. In this way, the commutator segments continually change polarity from positive to negative.

5.3 DC water pump

"Your centrifugal pump will give you completely trouble free and satisfactory service only on the condition that it is installed and operated with due care and is properly maintained"Your centrifugal pump will only provide you with completely trouble-free and satisfactory service if it is installed and operated with due care and properly maintained. Despite all the operation and maintenance treatment, engineers frequently face the declaration that "the pump has failed i.e. it can no longer be kept in service" Just one of the most common conditions for taking a pump out of operation is the inability to deliver the desired flow and head. There are other many conditions in which a pump, despite suffering no loss in flow or head, is considered to have failed and has to be pulled out of service as soon as possible. These include seal related problems (leakages, loss of flushing, cooling, quenching systems, etc), pump and motor bearings related problems (loss of lubrication, cooling, contamination of oil, abnormal noise, etc), leakages from pump casing, very high noise and vibration levels, or driver (motor or turbine) related problems. **Note:** In terms of fluid feet, i.e. head, all types of energy involved in a liquid flow system are expressed.

6.1 Solar panel

Photovoltaic Cells: Converting Photons to Electrons

The solar cells you see on calculators and satellites are also called photovoltaic (PV) cells, which transform sunlight directly into electricity, as the name implies (photo meaning 'light' and voltaic meaning 'electricity'). A module is a group of cells attached electrically and packaged into a frame that can then be grouped into larger solar arrays

(more commonly known as a solar panel).

All PV cells also have one or more electric fields that serve to cause electrons released in a certain direction by light absorption to flow. Together with the voltage of the cell (which is the product of its built-in electric field or field), this current determines the power (or wattage) that can be provided by the solar cell.

6.2 Solar Panel Setup

The use of batteries requires that another part called a charge controller be mounted. If they are not overcharged or depleted too much, batteries last a lot longer. That's what it does with a charge controller. The charge controller doesn't let current from the PV modules continue to flow into them until the batteries are fully charged. Similarly, several charge controllers would not enable further current to be drained from the batteries before they have been recharged after the batteries have been drained to a certain predetermined amount, regulated by measuring battery voltage. For a long battery life

, the use of a charge controller is important.

A PV system needs very little maintenance once installed (especially if no batteries are used) and can provide electricity for 20 years or more cleanly and quietly.

6.3 Categories of Solar Panel

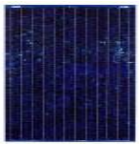


Fig 6.1 .polycrystalline module

A variety of different crystals are made of polycrystalline (or multicrystalline) modules, fused together to form a single cell (hence the name 'multi'). Because of the lower cost of producing cells, they have long been the most common type of solar module. Recently, monocrystalline prices have decreased, making them more common in the residential market.

Fig 6.2 Polycrystalline cell

The construction of these various crystals gives a clear crystal grain or a 'metal flake effect' to the solar panel, as you can see in the image (left). They are marginally cheaper to produce than Mono panels, but less effective as well (anywhere from 0.5 percent to 2 percent less efficient depending on the manufacturer). This is because electrons can be trapped by the crystal grain boundaries, which results in lower efficiency.

The BP Solar modules installed by the Enviro Group are approximately 13.5% effective (meaning that if 100 Watts of potential solar energy strikes the panel, it will produce approximately 13.5 Watts of solar electricity).

These panels are very popular in Australia, and offer a good balance of value vs performance.

6.4 MONOCRYSTALLINE MODULES

Fig 6.3 Monocrystalline cell

As the name suggests, Monocrystalline is built using one single crystal, cut from ingots. This offers a uniform appearance around the module for the solar panel. Such crystals are very rare, and it is more costly to produce the method of 'recrystallising' the cell

.

With the cost of manufacturing monocrystalline cells going down every year, this technology is now the most commonly available in Australia. They are still more costly, but can be up to 2 percent more effective than polycrystalline. EnviroGroup uses SunOwe (14.5%) and Suntech (16.5%) monocrystalline solar modules for our installations.

Fig 6.4 Monocryatalline

With the patent pending Pluto technology, Suntech has recently made some exciting advances in monocrystalline performance. Special texturing technology, with lower reflectivity, means that even without direct solar radiation, more sunlight can be absorbed during the day, and thinner metal lines on the top surface limit loss of shade. Importantly, at the University of New South Wales, the method was developed and has achieved laboratory efficiency of 25 percent and approximately 19 percent checked efficiency. These panels will be more costly, but they will give much more solar power for less solar panel area.

6.5 Equivalent circuit of a solar cell

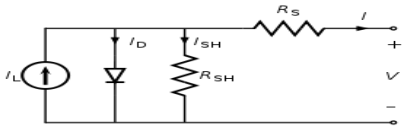


Fig 6.5 Circuit of a solar cell

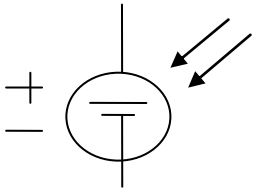


Fig 6.6 Schematic symbol of a solar cell

The schematic symbol of a solar cell

1. Photons in sunlight hit the solar panel and are absorbed by semi conducting materials, such as silicon.

2. Electrons (negatively charged) are knocked loose from their atoms, enabling them to flow to produce electricity through the material. Due to the special composition of solar cells, only allow the electrons to move in a single direction. In a silicon solar panel, the complementary positive charges that are also produced (like bubbles) are called holes and flow in the direction opposite to the electrons

.

3. Solar energy is converted into a usable amount of direct current by a variety of solar panels (DC).

6.6 Solar energy

Since ancient times, solar energy, radiant light and heat from the sun have been harnessed by humans using a variety of ever-evolving technologies. Along with secondary solar resources such as wind and wave power, hydroelectricity and biomass, solar radiation accounts for much of the renewable energy available on earth. Only a tiny fraction of the available solar energy is used.

Depending on the way they absorb, transform and transmit solar energy, solar technologies are widely defined as either passive solar or active solar. In order to harvest electricity, active solar techniques require the use of photovoltaic panels and solar thermal collectors.Passive solar techniques include orienting a building to the Sun, selecting materials with favorable thermal mass or light dispersing properties, and designing spaces that naturally circulate air.

Fig: 6.7 Solar cell/ plate

The opaque materials in the form of non-water based pigments, or...

it may be utilized by exposing the plate through a transparent film with

artwork on it. The film may be created by drawing on acetate, photocopying or scanning and printing on film, or darkroom techniques.

Applications of solar technology

Average insulation showing land area (small black dots) required to replace the world primary energy supply with solar electricity. 18 TW is 568 Exajoule (EJ) per year. Insulation for most people is from 150 to 300 W/m² or 3.5 to 7.0 kWh/m²/day.

For practical purposes, solar energy refers specifically to the use of solar radiation. However, both non-geothermal and tidal renewable energies derive their energy from the sun.

6.7 Battery

A sort of electric battery is a rechargeable battery, storage battery, or accumulator. It includes one or more electrochemical cells, and is a form of accumulator of energy. It is known as a secondary cell because its electro chemical reactions are electrically reversible.

The US National Electrical Manufacturers Association has estimated that U.S. demands for rechargeable batteries is growing twice as fast as demand for non rechargeable.

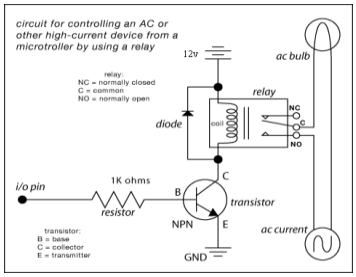
6.7.1Charging and discharging

The positive active material is oxidized during charging, producing electrons, and the negative material is decreased, absorbing electrons. In the external circuit, these electrons constitute the current flow. As in lithium-ion and nickel-cadmium cells, the electrolyte may serve as a simple buffer for internal ion flow between the electrodes, or it may be an active participant, as in lead-acid cells, in the electrochemical reaction.

Fig 6.8 charging and discharging device

6.8 Relay

A relay is a switch that is electrically operated. To operate a switching mechanism, many relays use an electromagnet, although other operational concepts are also used. Relays distinguish applications where a low-power signal is required to control a circuit, or where multiple circuits must be controlled by a single signal. To protect electrical circuits from overload or faults, relays with calibrated operating characteristics and often multiple operating coils are used; in modern electrical control systems, these functions are performed by digital instruments, still called 'protection relays.'



6.8.1 Types of relays

1. Simple electromechanical relay

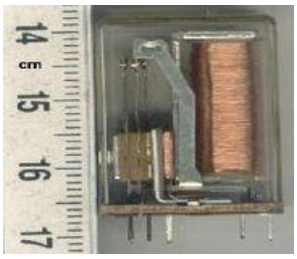


Fig 6.8..1 electromechanical relay

An adaptation of an electromagnet is a simple electromagnetic relay, such as that taken from a car in the first image. It consists of a wire coil surrounding a soft iron core, an iron yoke that provides a low magnetic flux reluctance path, a movable iron armature, and a series of contacts or sets; two in the pictured relay. This ensures the continuity of the circuit, which is soldered to the PCB, between the moving contacts on the armature and the circuit track on the printed circuit board (PCB) through the yoke.

2. Basic design and operation

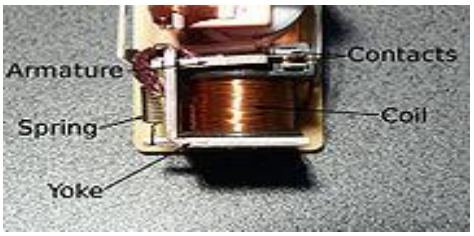


Fig 6.8.2 Design of relay

The resulting magnetic field attracts the armature when an electric current is passed through the coil, and the resulting movement of the movable contact or contacts either makes or breaks a connection with a fixed contact. If when the relay was de-energized the collection of contacts was closed, then the motion opens the contacts and breaks the connection, and vice versa if the contacts were open. When the coil current is shut off, the armature is restored to its relaxed state by a force approximately half as intense as the magnetic force. Usually this force is provided by a spring, but gravity is also used commonly in industrial motor starters. Most relays are manufactured to operate quickly.

Applications of Relays

- Control a high-voltage circuit with a low-voltage signal, as in some types of modems or audio amplifiers,
- Control a high-current circuit with a low-current signal, as in the starter solenoid of an automobile,
- Detect and isolate faults on transmission and distribution lines by opening and closing circuit breakers (protection relays),

Fig 6.8.3 Amplifier

- If the two are at different potentials, separate the controlling circuit from the controlled circuit, such as when controlling a mains-powered system from a low-voltage switch. As low voltage wires are easily mounted in partitions, which can also be relocated as needs change, the latter is often used to monitor office lighting. They may also be controlled by room occupancy detectors in an effort to conserve energy,

Results

The project "Solar power grass cutter and pesticides spreader robot" was designed to operate multi functional robot wirelessly using Bluetooth technology.

The used battery was charged for about four 04 hours and we are getting an output of work for one 01 hour. And we are adding pesticides sprayer for spreading pesticides on field.

Conclusion

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC's with the help of growing technology, the project has been successfully implemented. Thus the project has been successfully designed and tested.

Future Scope

This system can be improvised by adding additional tools like ploughing, leveling etc.. We can use WI-FI technology

to increase the controlling distance. We can add Camera to monitor the surroundings.

References:

1. P. Amrutesh, B. Sagar and B. Venu, Solar Grass Cutter With Linear Blades By Using Scotch Yoke Mechanism, International Journal of Engineering, Research and Applications, Vol.4,2016,2248-9622.

2. E. Naresh, Boss Babu and G. Rahul, Grass Cutting Machine By Solar Power, International Journal and Magazine of Engineering, Technology, Management and Research, Vol.3, 2016,2348-4845.

3. Sujendran S. and Vanitha p., Smart Lawn Mower for Grass Trimming, International Journal of Science and Research, Vol.3, 2014, 2319-7064.

4. Praful P. Ulhe, Manish D. Inwate, Fried D. Wankhede and Krushan kumar S. Dhakle, Modification of Solar Grass Cutting Machine, International Journal for Innovative Research in Science and Technology,Vol.2,2016,2349-6010.

5. Vicky Jain, SagarPatil, Prashant Bagane, Prof. Mrs. S .S. Patil, Solar Based Wireless Grass Cutter, International Journal of Science, Technology and Engineering ,Vol.2,2016,2349-784X.

6. Sultan Mohyuddin, Digesh K D, Vivek T K, Nazeya Khanam F and Vidyashree H V, Automatic Grass Cutter, International Journal of Science, Technology and Engineering ,Vol.2,2016,2349-784X.