

Wireless Grass Cutter Based on Solar Energy

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Abstract: *This paper presents the fabrication and working of a smart solar grass cutter. In this work, we have developed a solar-powered lawn mower and thus saved energy by decreasing air pollution and reducing labour cost. In the old model, cutting iron was used. Due to its high environmental impact, it was the most expensive cutter used by the engine. We have utilized a microcontroller in our project to control the different lawn mower actions. Two DC gear motors are used to move the solar grass cutter, and one DC blade motor is used to cut the grass quickly. With current technology, this new prototype is designed as a remotely controlled grass cutter using Microcontroller. The Smart Solar tracker is controlled via Bluetooth by using a smartphone. The Solar Grass Cutter can run for more than two hours when the battery is completely charged.*

Keywords: Solar Grass Cutter.

I. INTRODUCTION

The manual handle grass cutter have been widely used by workers in various industry.so,workers may faced some serious health issue.In order to avoid these issue we proposed new model that is wireless grass cutter based on solar.The purpose of using these grass cutter is to reduce manpower,time and energy. The manual grass cutting is possible using human being but it usually consumes time and energy of human being here we are using the main systems which is required to develop grass cutter.The systems are Android system,solarsystem.And this grass cutter is fully automated.we are using the keywords-Bluetooth module,Ardunio,motordriver,solarpanel,lithiumbattery,sensors and DC motors. These are the main keywords which we are using in our project. The main aim of our project is to operate the grass cutter based on solar energy to create electricity. More solar energy is collected from solar panel in order to generate electricity.This grass cutter is very easy to use and handles to worker.

1.1 Problem Identification

The past technology of grass cutting is manually operated by the use of hand devices like scissor, these results into more human effort and more time required accomplishing the work. Also in old methods lack of uniformity of the remaining grass. Also due to the use of engine powered machines increases the air and noise pollution also this grass cutter require maintenance.

1.2 Purpose

The objective of our project is to design and automatic lawn mower which operates on solar energy and avoids the drawback of old lawn mowers. The purpose is to avoid energy crisis in India and reduces the human efforts, operating cost and maintenance cost. Also solar based grass cutter keeps the environment clean and healthy. It is used for cutting different types of grasses for various applications. The whole machine operates on the solar energy stored in battery. The IR sensor is used for the obstacle detection to avoid any damage of the human, object and animal. Also we are using relay to control the motor connected to blades as a switch. The prototype is charged from sun by using solar panel.

II. BLOCK DIAGRAM

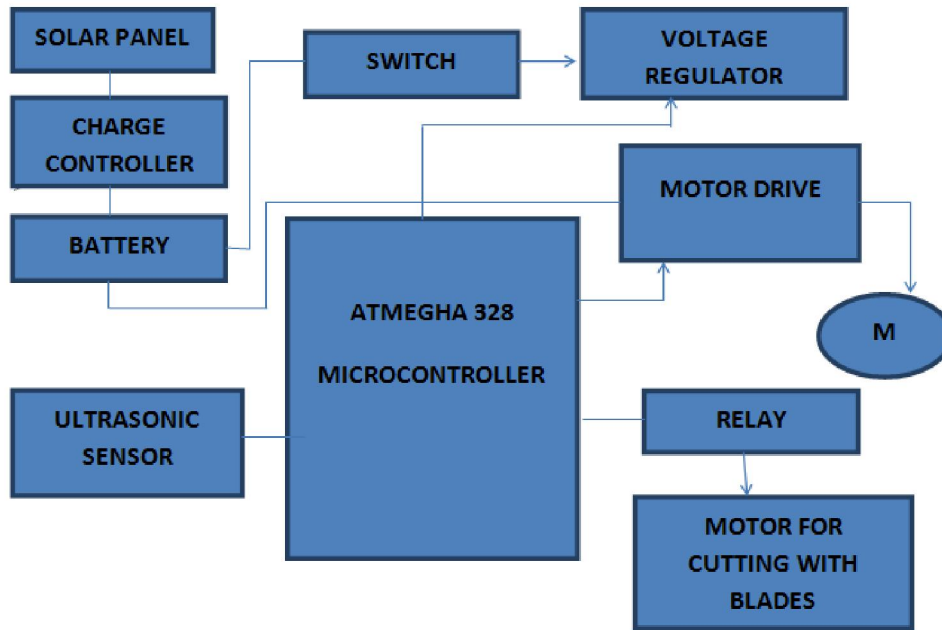


Fig (2.0): Block Diagram for Solar Based Grass Cutter

2.1 DESCRIPTION OF BLOCK DIAGRAM :

1. ATmega328P Microcontroller:

The ATmega328 is a single-chip microcontroller created by Atmel in the megaAVR family manufactured by Microchip Technology. It is commonly used in various electronic projects and is particularly well-known as the microcontroller used in the Arduino Uno board.

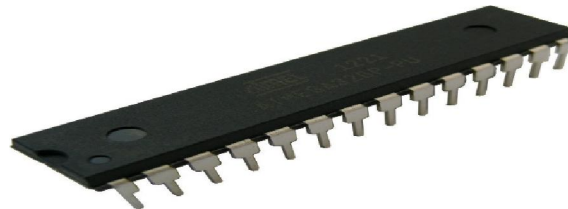


Fig (2.2.1): ATmega328P microcontroller

Features:

The Atmel 8-bit AVR RISC-based microcontroller combines 32 KB ISP flash memory with read-while-write capabilities.

1 KB EEPROM, 2 KB SRAM, 23 general-purpose I/O lines, 32 general-purpose working registers.

3 flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8 channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and 5 software-selectable power-saving modes.

The device operates between 1.8 and 5.5 volts. The device achieves throughput approaching 1 MIPS/MHz

2. Solar Panel:

Photovoltaic solar panels absorb sunlight as a source of energy to generate electricity. A photovoltaic (PV) module is packaged, connected assembly of typically 6x10 photovoltaic solar cells. The most common application of solar panels is solar water heating system.



Fig (2.2.2): Solar panel

3. Ultrasonic Sensor:

Ultrasonic transducers or ultrasonic sensors are a type of acoustic sensor divided into three broad categories: transmitters, receivers and transceivers. Transmitters convert electrical signals into ultrasound into electrical signals, and transceivers can both transmit and receive ultrasound. In a similar way to radar and sonar, ultrasonic transducers are used in systems which evaluate targets by interpreting the reflected signals.

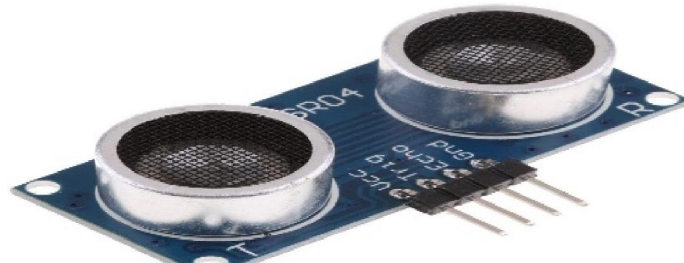


Fig (2.2.3): Ultrasonic Sensor

Features:

- Supply voltage:5v(DC)
- Supply current:15mAmp.
- Modulation frequency:40Hz.
- Distance:2cm-400cm.
- Accuracy:0.3cm.
- Output:0-5v.

4. Battery:

Battery is used for solar energy which can be further converted into electrical energy. The battery should require following: properties:

Long life

High reliability



Fig (2.2.4): Battery

5. Relay

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch. Relay are used where it is necessary to control a circuit by a separate low-power signal. An SPST relay or single pole single throw relay is a device that has only one input and one output. It only connects or disconnects only one contact when it

is operated. Including the coil terminals, it has a total of four terminals. The SPST relay can control a single electrical or electronic circuit. It generally provides a switching function or on/off function as an electrical switch provides, just the difference is, and it is controlled by an electrical or electronic signal.

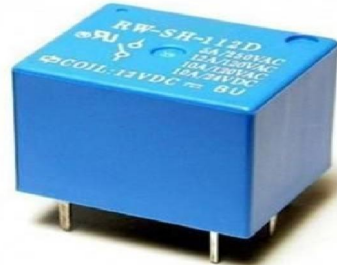


Fig (2.2.5) Relay

6. Motor Driver

L298N dual H- bridge motor driver was used, which control's the speed and direction of vehicle. The module can drive the DC motor whose voltage in between 5V to 35V, with a peak current up to 2A. Motor driver connects the Dc motor (wheels), to the micro controller. It controls the wheel motion as per the program fed to the microcontroller.

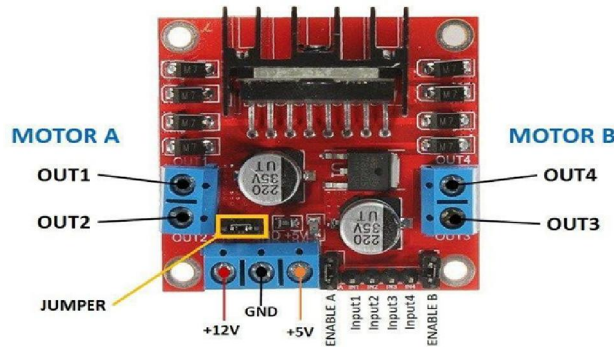


Fig (2.2.6): Motor Driver

7. Liquid Crystal Display (LCD)



Fig (2.2.7): 16x2 LCD Display Module

A Liquid Crystal Display (LCD) is a thin, flat display device made up of any number of colour or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other.

8. DC Gear Motor (Wheels):

It is generally a DC motor with a gearbox attached to it, which were used for the wheel rotation. DC motor used with 60 rpm of each, which helps the wheel to rotate slowly, so that it covers the area of the grass to be cut. Four DC gear motors were used for four wheels. The DC motors shaft of 5mm with 3mm drilled hole, then shaft was inserted into the holes made in a chassis and fixed with the help of threads. Shaft were designed to withstand the weight of the chassis.



Fig (2.2.8) DC Gear Motor(Wheels)

9. DC Motor (Blade):

DC motor was connected to the blade and placed in front of the vehicle. For the grass to be cut efficiently blade has to rotate at very high speed for this purpose DC motor of 2000 rpm was selected. DC motor takes the power from the battery.



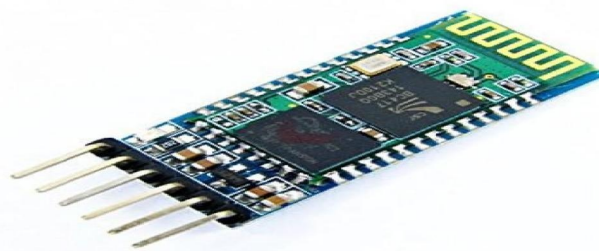
Fig (2.2.9) DCGearMotor(Wheels)

10. Bluetooth Module

To setup wireless serial communication, HC-05 Bluetooth module is used. It is most demanding and popular due to its low price and extremely high features. Modes can be changed using AT commands. The slave mode in HC-05 cannot initiate a connection to another Bluetooth device but can accept connections. The diagram of Bluetooth module is shown in figure

Fig (2.3.0) Bluetooth Module

III. WORKING PRINCIPLE OF THE SYSTEM



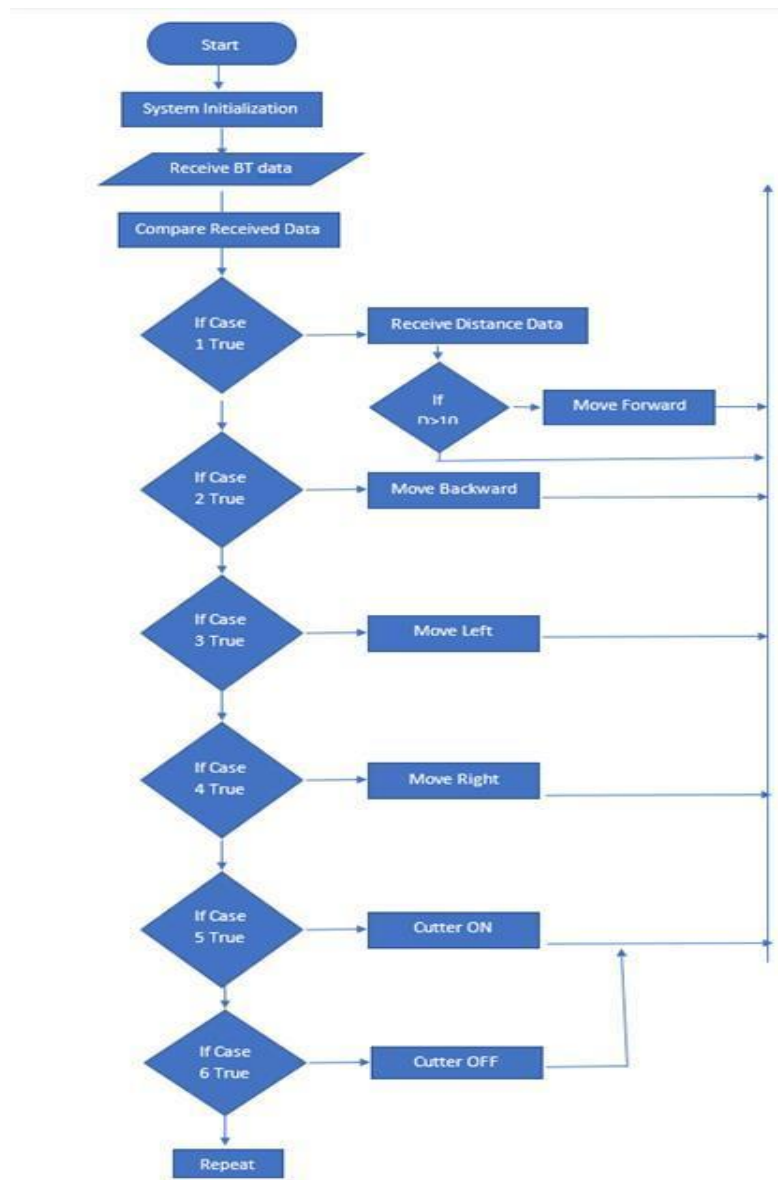
The Fig (2.0) shows the block diagram of “Wireless Grass Cutter based on Solar”. At first, solar panel will receive the sun rays, which produces electricity due to photovoltaic effect. This produced electricity gets stored in the battery. The power from the battery is given to the microcontroller (Arduino UNO) which controls the functioning of the device in order to operate it automatically. The machine uses ultrasonic range sensor, which detects the obstacles within the range of 20cm and protect the vehicle against damage, by sending signal to microcontroller, later it will send the signal to motor driver to take deviation. The machine is fed with a program (Embedded C). Such that, initially vehicle will move in a straight path, as the fence is detected vehicle will take 180° rotation on the right and again it takes the straight path and move in another line so that all area of the lawn gets covered. Four DC gear motors are used which are connected to the four wheels of the vehicle, two on left and other two on right, which helps in rotation of the wheels and gear motor are driven by the motor driver, which in turn connected to the microcontroller.

DC motor is connected to the blade, which is placed on front side of the vehicle and helps in rotation of blade. The motor is fixed to blade, which is mounted on an adjustable plate such that the blade height can be adjusted from 10mm to 70mm from the ground level. Blade is designed in such a way that it cuts the grass efficiently. Two switches are used

one for switching the microcontroller and another to switch a DC motor that is used for blade rotation. Considering environmental awareness, WGC is most efficient and eco-friendly which overcomes the drawbacks of fuel-based grass cutters such as (i) fuels, which are non-renewable, (ii) Need proper maintenance, such as lubricants. WGC machine was designed by considering important aspects such as efficient, accuracy, eco-friendly, durable and low cost. The major components of Fully Automated Solar Grass Cutter model are solar panel, batteries, microcontroller, sensors, motor driver, DC motors and blade. The abundant solar energy was collected, with the help of solar panel which was used as a source of energy. Sensor was used to detect the obstacles in the path of the vehicle and sends the signal to micro-controllers, then micro controller sends the signals to motor driver so that wheels would take the deviations, which helps in avoiding the damage to the vehicle. Two types of DC motors were used based on the requirement of rotational speed.

The DC motors with 60 RPM were used to move the vehicle and DC motors with 2000 RPM was used for the blade rotation. The blade of the prototype can be adjusted based on the height of the grass need to be remove. The minimum height of grass can be cut with this prototype is 10 mm and maximum height up to 75mm.

IV. FLOW CHART



V. ADVANTAGES

This solar grass cutter minimizes the efforts of human being.

- It saves human time.
- It saves electricity and money.
- Uses advanced technology.
- Less maintenance
- Cost effective & durable.
- Eco friendly
- Pollution free
- Portable
- No long wires connected.

5.1 Disadvantages

- Must be used properly during rainy seasons.
- Should be handled carefully.

VI. APPLICATIONS

- Home Gardens
- College Grounds
- Function Halls
- Farms
- Playgrounds
- Lawns etc.

VII. RESULT

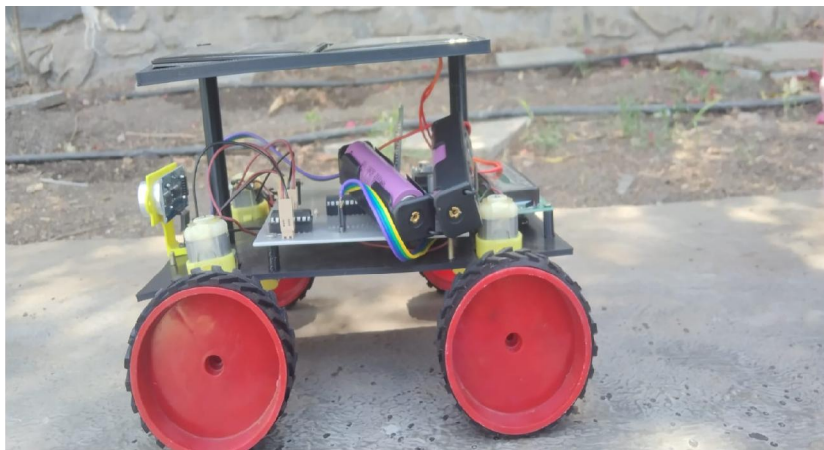


Fig 7.1 Wireless Grass Cutter based on solar energy

The project aims to use renewable energy sources like solar energy it is used to store in the battery and to operate a cutter equipped with various accessories. The Grass cutter takes the power supply from battery and cut the grass. The wireless grass cutter based on solar is shown in above fig 7.1. The DC motor, powered by a battery, where the charge is kept via a solar panel, has a spiral shaped grass cutting blade. By using this grass cutter we can uniformly cut the grass of lawn.

VIII. CONCLUSION

Reviving all the literature survey and by knowing our needs, suitable design of solar grass cut was made. The components were chosen based on the design requirement and considering few of the other parameters in order to meet all the constraints. Based on the revive prototype model of the hardware and software system along with the ultrasonic

sensor were demonstrated and required output was obtained. The blade was designed in such a way that, it can cut the grass efficiently and height from the ground level can be adjusted from 2mm to 70mm. A panel is placed in a position where it can obtain maximum energy of the sunlight. So, among eco-friendly grass cutter this device is the efficient one.

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