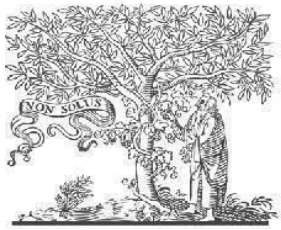
International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

COPY RIGHT



ELSEVIER SSRN

2024 IJIEMR. Personal use of this material is permitted. Permission from IJIEMR must be obtained for all other uses, in any current or future media, including reprinting/republishing this material for advertising or promotional purposes, creating newcollective works, for resale or redistribution to servers or lists, or reuse of any copyrighted component of this work in other works. No Reprint should be done to this paper; all copy right is authenticated to Paper Authors

IJIEMR Transactions, online available on 18th October 2024. Link

https://ijiemr.org/downloads.php?vol=Volume-13 &issue= Issue 10

DOI:10.48047/IJIEMR/V13/ ISSUE10/38

Title: "AUTOMATIC SOLAR GRASS CUTTER ROBOT"

Volume 13, ISSUE 10, Pages: 241- 248

Paper Authors
D Venu, Konkati Vinay

USE THIS BARCODE TO ACCESS YOUR ONLINE PAPER

To Secure Your Paper as Per UGC Guidelines We Are Providing A ElectronicBar code

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

AUTOMATIC SOLAR GRASS CUTTER ROBOT

[1]Mr D Venu,[2]Konkati Vinay
[1]Assistant Professor, Department of ECE, Sree Chaitanya College of Engineering, Karimnagar
[2]Student, Department of ECE, Sree Chaitanya College of Engineering, Karimnagar

ABSTRACT:
Traditionally, mowing grass by hand was tedious labor that was repetitious. The researchers discovered that air pollution is caused by a lawn cutting equipment that runs on gasoline or diesel. The lawn cutters of the past should be replaced with cleaner models that run on sustainable energy sources like solar power. In order to further reduce the need for human labor, the solar cutter will be completely automated, using both solar and battery power. The Arduino UNO serves as the system's brains; a motor driver drives the system's wheels and a blade cuts grass.

I. INTRODUCTION

One of the main issues that has plagued humanity and caused havoc with life is pollution. Any lawn mower that runs its engine on fuel, such as gasoline, diesel, or petroleum, pollutes the air and creates a lot of noise. People who are close to the lawnmower may have health issues as a result of the environmental harm this produces. Therefore, it is essential to utilize an environmentally friendly lawnmower powered by an electrical source that is renewable. Nowadays, with the advancement of technological research, it is very simple to construct an autonomous lawnmower employing sensors and microcontrollers. In other words, trimming the lawn only requires little to no effort. Thus, it is possible to construct an automatic solar-powered lawn cutter. The major energy source for the solar grass cutter is solar energy, which powers one motor for cutting the grass cutter and two motors for moving the grass cutter. With an IR sensor, obstructions may be avoided while moving.

II. LITERATURE SURVEY

In a research published in November 2008, Yang, Xia, recently suggested a comprehensive deficiency area model for subterranean force cable in conveyance framework using voltage and current estimates at the sending-end. The study uses a circulating parameter technique to simulate a problematic subterranean cable framework using a proportionate circuit research. It also introduces the investigation of succession organizes in a three-stage arrangement using limit conditions. The system is made up of a laser transmitter and receiver using the examination. And the laser emits a burst of electromagnetic radiation, which is reflected by the barrier and reflects light that is sent to the controller by the Zig Bee communication module. In this instance, the motorist was able to make the decision to minimize the accident.

1. Westrom, provided in February 1997, explains how an accurate count of the area of the cable deficiency may be obtained by employing a heartbeat generator device to infuse a succession of tweeted beat streams into the blamed cable shortly after the

occurrence of the cable defect. The term'shortcoming separation locator' has been applied to it.

2. In August 2000, Zhao, W. provided an improved approach to the cable defect area framework, which essentially consisted of the wavelet research, voyaging wave standard, and synchronized testing technique. In addition to providing an overview of the new plan and a prologue to three important techniques, this study gives a definitive wavelet analysis of broken transient waveforms and determines the optimal wavelet levels for this particular use case.

3. In January 2007, Gilany et al. published a wavelet-based problem area conspiracy for developed cable frameworks that synchronizes advanced inadequacies The cable's two endpoints provide access to recorded data. In multiend developed cable frameworks, the wavelet peculiarity identification hypothesis is used as an excellent sign handling tool to evaluate the area of the problem.

III. DESIGN OF HARDWARE

This chapter briefly explains about the Hardware. It discuss the circuit diagram of each module in detail.

ARDUINO UNO

A microcontroller board based on the ATmega328 is called the Arduino Uno (datasheet). It has a 16 MHz ceramic resonator, 6 analog inputs, 14 digital input/output pins (six of which may be used as PWM outputs), a USB port, a power connector, an ICSP header, and a reset button. It comes with everything required to support the microcontroller; all you need to do is power it with a battery or an AC-to-DC converter or connect it to a computer via a USB connection to get going.The FTDI USB-to-serial driver chip is not used by the Uno, setting it apart from all previous boards. As an alternative, it has the Atmega16U2 (or Atmega8U2 up to version R2) configured as a serial-to-USB converter. The 8U2 HWB line on the Uno board is pulled to ground by a resistor, which facilitates DFU mode entry. The Arduino board now includes the following updates:

• 1.0 pin out: two further new pins, the IOREF, are positioned next to the RESET pin, the SDA and SCL pins that were introduced, and they enable the shields to adjust to the voltage supplied by the board. Shields will eventually work with both the Arduino Due, which runs on 3.3V, and the boards that utilize the AVR, which runs on 5V. The second pin is unconnected and set aside for future uses.

• A more robust RESET circuit.

• The 8U2 is replaced with an ATMega 16U2.

"Uno" is an Italian word for one, and it was chosen to commemorate the impending introduction of Arduino 1.0. Going future, the Arduino reference versions will be the Uno and version 1.0. The Uno is the most recent in a line of USB Arduino boards and the platform's standard model; see the index of Arduino boards for a comparison with earlier iterations.

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

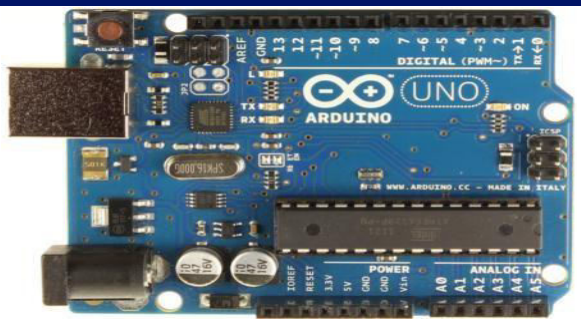


Fig: ARDUINO UNO

POWER SUPPLY:

The purpose of the power supplies is to convert the high voltage AC mains energy into a low voltage supply that is appropriate for use in electronic circuits and other devices. One may disassemble a power supply into a number of blocks, each of which carries out a specific task. "Regulated D.C. Power Supply" refers to a d.c. power supply that keeps the output voltage constant regardless of differences in the a.c. main or the load.

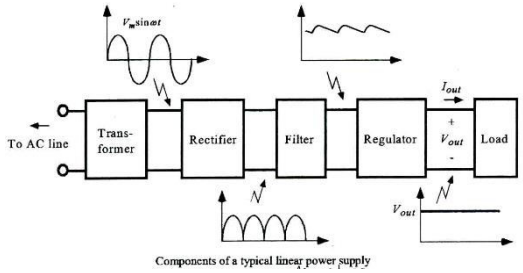


Fig: Block Diagram of Power Supply

LCD DISPLAY

The model shown here is the one that is most often utilized in practice due to its cheap cost and enormous potential. Its HD44780 microcontroller (Hitachi) platform allows it to display messages in two lines of sixteen characters each. All of the alphabets, Greek letters, punctuation, mathematical symbols, etc., are shown. Furthermore, it is possible to show custom symbols created by the user. Some important features are the automatic changing of the message on the display (shift left and right), the presence of the pointer, the lighting, etc.

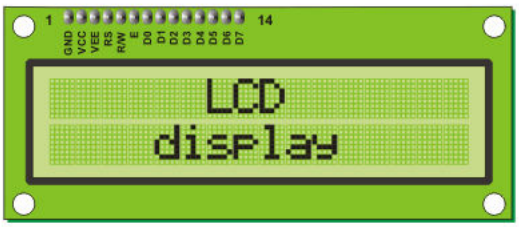
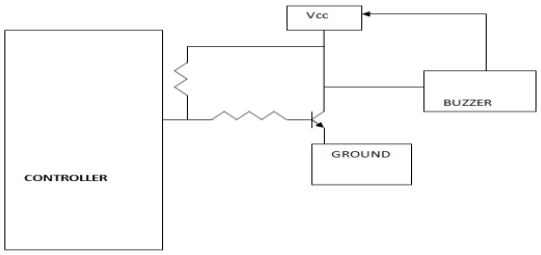


Fig: LCD

BUZZER

Digital systems and microcontroller pins lack sufficient current to drive the circuits like relays, buzzer circuits etc. While these circuits require around 10milli amps to be operated, the microcontroller's pin can provide a maximum of 1-2milli amps current. For this reason, a driver such as a power transistor is placed in between the microcontroller and the buzzer circuit.



Solar panel :

A solar panel may be any of three types: a solar hot water panel, a photovoltaic (PV) module, or a group of solar PV modules installed on a supporting structure and electrically linked. A PV module is a solar cell assembly that is linked and packed. For both commercial and residential use, solar panels may be utilized as a part of a larger photovoltaic system to create and deliver power. Each module is assigned a rating based on its DC output power, which normally falls between 100 and 320 watts under conventional test settings. Given the

same rated output, a module's efficiency dictates its size; for example, a 230-watt module with an efficiency of 8% would have double the area of a module with an efficiency of 16%. A small number of solar panels are on the market with efficiency levels higher than 19%. Most solar setups consist of many modules since a single module can only provide a certain amount of electricity. An inverter, a panel or array of solar modules, a battery, a sun tracker, and connecting wire are the standard components of a photovoltaic system.

Through the process of photovoltaic effect, solar modules employ light energy, or photons, from the sun to create electricity. The vast majority of modules employ thin-film or wafer-based crystalline silicon or cadmium telluride cells. Either the top layer or the rear layer of a module might be the structural (load-bearing) element. Additionally, cells need to be shielded from moisture and mechanical harm. The majority of solar modules are inflexible, while those that are based on thin-film cells are semi-flexible. In 1958, these primitive solar panels saw their first usage in orbit.

To give a specified current capacity, electrical connections are built in parallel or series to provide the necessary output voltage. Silver, copper, or other non-magnetic conductive transition metals may be included in the conducting wires that remove the current from the modules. Electrical connections between the cells and the rest of the system are required. Externally, MC3 (older) or MC4 connectors are used by common terrestrial use photovoltaic modules to provide simple, weatherproof connections to the rest of the system.

In the event that a partial module shade occurs, bypass diodes may be added inside or used externally to enhance the output of the lighted module parts.

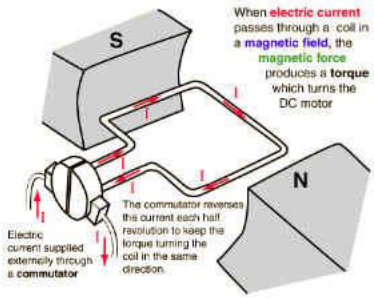
L293D:

Half-H drivers with triple high-current include the L293 and L293D. With voltages ranging from 4.5 V to 36 V, the L293 is intended to provide bidirectional driving currents of up to 1 A. Up to 600 mA of bidirectional driving current may be achieved with the L293D at voltages ranging from 4.5 V to 36 V. In positive-supply applications, these devices are intended to drive inductive loads such solenoids, relays, dc, and bipolar stepping motors, in addition to other high-current/high-voltage loads. Every input is compatible with TTL. With a pseudo-Darlington source and a Darlington transistor sink, each output is a full totem-pole driving circuit. Drivers 1 and 2 are enabled by 1,2EN, while drivers 3 and 4 are enabled by 3,4EN. Drivers are enabled in pairs. The corresponding drivers are

activated and their outputs are active and in phase with their inputs when an enable input is high. These drivers are disabled and their outputs are turned off and in the high-impedance condition when the enable input is low. Each pair of drivers creates a full-H (or bridge) reversible drive appropriate for solenoid or motor applications when the right data inputs are provided.

DC MOTOR

A DC motor is intended to operate with DC electricity. Michael Faraday's homopolar motor, which is rare, and the ball bearin motor, which is a recent invention, are two instances of pure DC designs. The two most popular forms of DC motors are brushed and brushless, which are not strictly speaking DC machines since they require internal and external commutation, respectively, to produce an oscillating AC current from the DC source.



IR SENSOR

Infrared is a energy radiation with a frequency below our eyes sensitivity, so we cannot see it

Even that we can not "see" sound frequencies, we know that it exist, we can listen them.

Even that we can not see or hear infrared, we can feel it at our skin temperature sensors.

When you approach your hand to fire or warm element, you will "feel" the heat, but you can't see it. You can see the fire because it emits other types of radiation, visible to your eyes, but it also emits lots of infrared that you can only feel in your skin.

INFRARED IN ELECTRONICS

Although infrared is readily created and immune to electromagnetic interference, making it a useful tool for communication and control, it is not ideal; infrared emissions from other sources may also include other wavelengths of light, which might interfere with infrared transmission. As an example, consider the sun, which produces radiation with a broad spectrum.

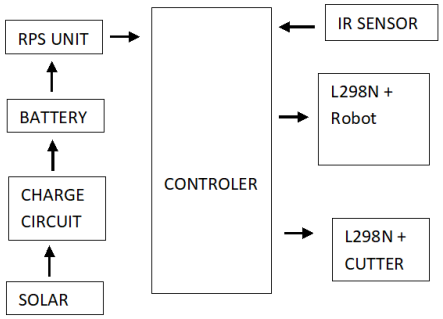
The market saw the introduction of inexpensive infrared diodes (emitters and receivers) as a result of the experimentation with extensive infrared use in TV/VCR remote controls and other applications.

You should now consider infrared to be merely "red" light. The "on" or "off" radiation in this light might convey diverse signals to the recipient.Anything that radiates heat, such as our bodies, lights, stoves, ovens, friction between your hands, and even hot water from the tap, may produce infrared radiation.

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

IV. BLOCK DIAGRAM AND HARDWARE DISCRIPTION

BLOCK DIAGRAM:



The **Automatic Solar Grass Cutter Robot** is an innovative solution designed to automate lawn maintenance by using solar energy to power the system. This robot is equipped with sensors and an Arduino microcontroller to navigate and cut grass efficiently. Below is a detailed explanation of how this system works, along with the components involved.

System Components

1. **Arduino Microcontroller**: Acts as the central processing unit, controlling the robot's movements and operations.
2. **Solar Panels**: Harvest solar energy to charge a rechargeable battery, which powers the robot's motors and electronic components.
3. **DC Motors**: Used for driving the wheels and rotating the cutting blades.
4. **Grass Cutting Blade**: A rotating blade that cuts the grass as the robot moves.
5. **Ultrasonic Sensors**: Detect obstacles in the robot's path and help it navigate around them.
6. **IR Sensors**: Can be used to define boundaries and prevent the robot from going out of the designated area.
7. **Motor Driver (H-Bridge)**: Controls the direction and speed of the motors based on commands from the Arduino.
8. **Rechargeable Battery**: Stores solar energy for powering the robot during operation.

Working Steps

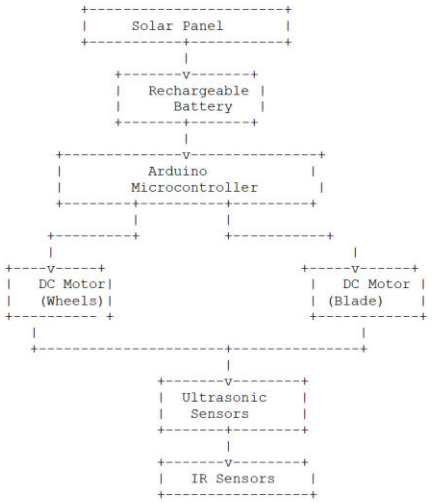
1. **Power Supply Initialization**:
   - The robot is powered by solar panels that charge the rechargeable battery. This renewable energy source allows the robot to operate continuously during daylight hours without needing a power outlet.
2. **System Initialization**:
   - Upon powering up, the **Arduino** initializes all connected components, including motors, sensors, and communication modules (if any).
   - The system checks the battery level to ensure sufficient power is available for operation.
3. **Obstacle Detection**:
   - **Ultrasonic sensors** mounted on the robot continuously emit sound waves and measure the time it takes for the echo to return. This helps the robot detect obstacles in its path.
   - When an obstacle is detected within a predefined distance (e.g., 30 cm), the Arduino processes this data and adjusts the robot's course to avoid collisions, either by stopping or changing direction.
4. **Boundary Detection**:
   - **IR sensors** can be used to define the working boundaries of the robot. They detect specific markers (e.g., white tape) placed around the perimeter of the lawn.
   - If the robot approaches the boundary, it will change direction or stop to avoid leaving the designated area.

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

5. **Grass Cutting Operation**:
   - The robot moves across the lawn, powered by the DC motors that drive the wheels.
   - The **cutting blade**, powered by another motor, rotates as the robot moves. The Arduino controls the motor speed and the timing of the blade operation.
   - The robot can be programmed to follow a specific cutting pattern (e.g., zigzag or spiral) to ensure even cutting of the grass.
6. **Autonomous Navigation**:
   - The robot continuously navigates the lawn, using data from the ultrasonic and IR sensors to adjust its path.
   - The Arduino processes sensor inputs in real time, allowing the robot to move efficiently around obstacles and along boundaries while ensuring comprehensive coverage of the grass.
7. **Charging Cycle**:
   - When the battery level is low, the robot can return to a designated charging station (if implemented) to recharge itself using solar energy.
   - Alternatively, the system can be designed to operate primarily during daylight, using sunlight for energy without needing to return to the charging station.

Block Diagram

Below is a simplified block diagram illustrating the components and flow of information within the solar grass cutter robot:



Block Diagram Explanation:

1. **Solar Panel**: Captures solar energy and charges the rechargeable battery.
2. **Rechargeable Battery**: Stores energy for powering the Arduino and motors.
3. **Arduino Microcontroller**: Controls the entire system, processes sensor data, and manages motor operations.
4. **DC Motors**: Drive the wheels for movement and power the grass cutting blade.
5. **Ultrasonic Sensors**: Detect obstacles in the robot's path and help avoid collisions.
6. **IR Sensors**: Define the boundaries of the lawn and ensure the robot stays within designated areas.

Advantages of the System:

- **Eco-Friendly**: Utilizes solar energy, reducing reliance on non-renewable power sources.
- **Automated Operation**: Frees users from the manual task of mowing the lawn, providing convenience.
- **Efficient Coverage**: Capable of navigating around obstacles and

following specific cutting patterns, ensuring an even cut.

Limitations:

- **Solar Dependency**: The robot's operation is limited to sunlight availability, which can restrict usage during cloudy weather or nighttime.
- **Obstacle Sensitivity**: The effectiveness of obstacle detection can be affected by environmental conditions (e.g., rain, dirt on sensors).
- **Cutting Efficiency**: The robot may struggle with tall or thick grass, requiring regular maintenance and adjustment of the cutting blade.

V. CONCLUSION:

The Arduino-powered Automatic Solar Grass Cutter Robot is a creative and environmentally friendly way to maintain your grass. The robot offers an effective way to maintain lawns with little assistance from humans by integrating solar power, obstacle detection, and autonomous navigation. As technology develops, solar-powered robotic systems' capacity for gardening and landscape management may be further enhanced by advancements in sensor accuracy and battery efficiency.

REFERENCES:

[1] Vicky Jain ,"Solar based wireless grass cutter",", International Journal of Science, Technology and Engineering, Volume 2, 2016, 576-580.

[2] Ashish Kumar Chaudhari "Solar Powered Fully Automated Grass Cutting Machine", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, pp 2520-2524.

[3] G. Rahul,"Grass cutting machine by solar energy power", ISSN no:2348-4845,international journal and magazine of engineering, technology management and research.

[4] Ms. Lanka Priyanka," Fabrication of Grass Cutting Machine," International Journal and Magazine of Engineering, Technology, Management and Research, Vol. 2, 2015, 386-390.

[5] Ms. Bhagyashri R. Patil, Mr. Sagar S. Patil, "Solar Based Grass Cutter: A Review", International Journal of Electrical and Electronics Engineers, pp 134-138, Volume: 09, Issue: 01, Jun-2017.

[6] Mrs.Melba D' Souza Ms. Vaidhavi B.Naik Ms. Rucha V Bicholkar, "Automatic Solar Grass Cutter", IJSTE – international Journal of Science Technology & Engineering | Volume 3 | Issue 09 | March 201.