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SOLAR POWERED GRASS CUTTING ROBOT

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Abstract:

The Bluetooth Controlled Solar Grass Cutter is a smart and eco-friendly robotic system designed for automated grass cutting. The system integrates an Arduino-based controller, DC motors, an L298 motor driver, and a cutting motor, all controlled via a mobile application through Bluetooth communication. The robot operates on solar power, ensuring sustainability while reducing dependency on manual labor for grass cutting.

Keywords — **Bluetooth Control**, **Cutting Motor, Mobile Application, Bluetooth Communication**

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I. INTRODUCTION

Maintaining lawns and grassy areas requires regular trimming, which can be time-consuming and labor intensive. Traditional lawn mowers require manual operation or fuel-based power, which increases maintenance costs and environmental impact. This project introduces an automated, Bluetooth-controlled, solar-powered robotic grass cutter that allows users to control the device remotely for the access with via mobile phone through Bluetooth .

II. OBJECTIVE

Design and develop a robotic grass cutter powered by solar energy. Enable remote control functionality using a mobile application and Bluetooth. Incorporate a cutting motor for effective trimming of grass. Ensure energy efficiency by utilizing solar panels for power. Develop an automated, low-maintenance, and cost-effective solution for grass cutting effectively at any place where the Bluetooth acts as a connection for the mobile app. Cutting Height Accuracy Achieve a cutting height accuracy of ±1 cm.

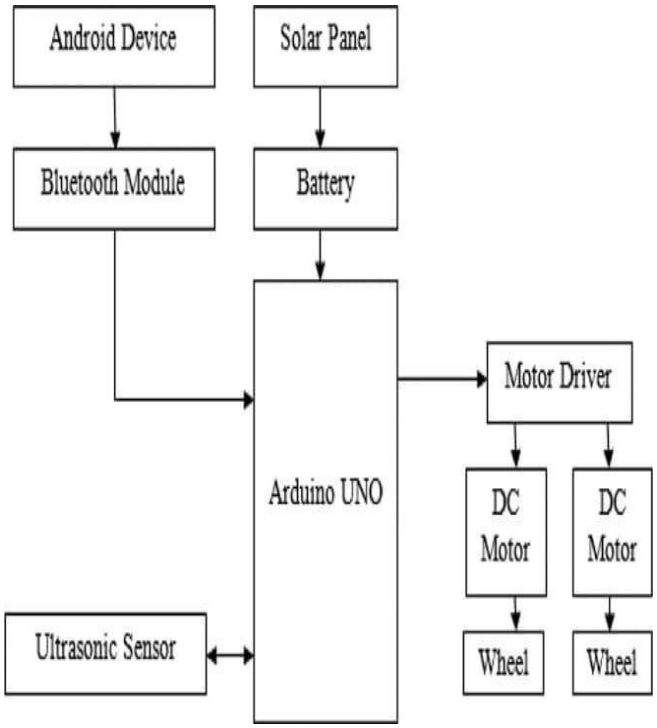
Grass Cutting Efficiency Cut grass at a rate of at least 100 square meters per hour. Navigation Accuracy Navigate through the lawn with an accuracy of ±5 cm.

III. PROPOSED SYSTEM

Proposed Method Description: The Bluetooth Controlled Solar Grass Cutter is a wireless, user-controlled robotic system that runs on solar energy. The Arduino-based microcontroller receives commands from a mobile app via Bluetooth, controlling the DC motors and cutting mechanism. The solar panel charges the battery, ensuring an uninterrupted power supply. The system uses an L298 motor driver to regulate the movement of the robot and the operation of the cutting motor. Arduino initializes all components Mobile app connects to the robot via Bluetooth The user sends movement or cutting commands through the mobile app.

The L298 motor driver controls the DC motors for movement and the cutting motor for trimming.

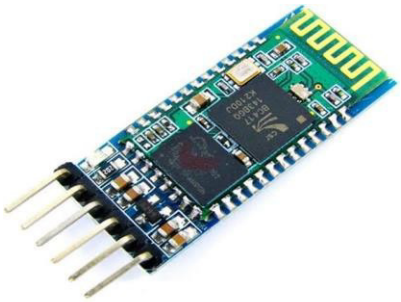
The solar panel continuously charges the battery The user can either manually control the robot or set it to an automated cutting mode The robot stops when the user commands it or when the battery is low.



IV . COMPONENTS

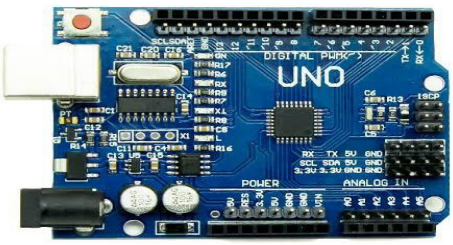
Bluetooth Module (HC-05)

This module allows wireless connection, which gives the user the opportunity to monitor and control the system remotely off a smartphone or PC Communication device over project is based on wireless communication between micro controller and mobile phone. But alone micro controller is not able to communicate directly to the android mobile phone.



Ardunio Uno

The Arduino Uno is a series of open-source microcontroller board based on a diverse range of microcontrollers (MCU). Arduino is open source physical processing which is base on a microcontroller board and an incorporated development environment for the board to be programmed. Arduino gains a few inputs, for example, switches or sensors and control a few multiple outputs, for example, lights, engine and others. Arduino program can run on Windows, Macintosh and Linux operating systems (OS) opposite to most microcontrollers' frameworks which run only on Windows.

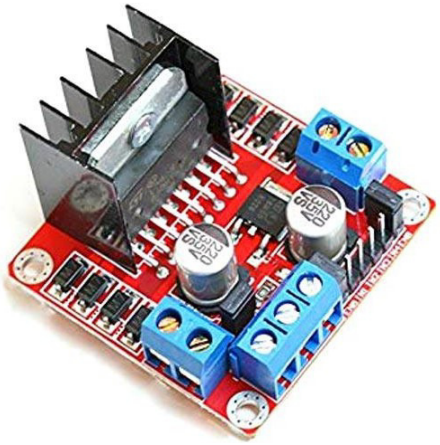


Solar Panel

A solar panel is a device designed to capture sunlight and convert it into electricity through the photovoltaic (PV) effect. They are a clean and renewable source of energy, helping to reduce dependence on fossil fuels and lower greenhouse gas emissions.

L298 Motor Driver

A motor driver controls the speed, direction, torque, and other parameters of an electric motor. It acts as an interface between the motor and a control system, like a computer or microcontroller To transfer to a device located many meters away, the serial method is used. The data is sent one bit at a time. Here not 8bit data is send 2 extra bit are send along with it .this two bit are called start bit and stop bit. These tow bit are used so synchronization can be done between transmitter and receiver.

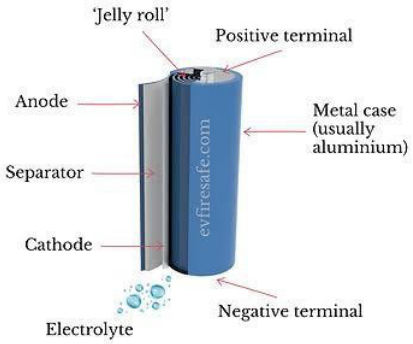


DC Motor

A direct current (DC) motor is a type of electric machine that converts electrical energy into mechanical energy. DC motors take electrical power through direct current, 60RPM Centre Shaft Economy Series DC Motor is high quality low cost DC geared motor. It has steel gears and pinions to ensure longer life and better wear and tear properties. The gears are fixed on hardened steel spindles polished to a mirror finish. The output shaft rotates in a plastic bushing The whole assembly is covered with a plastic ring. Gearbox is sealed and lubricated with lithium grease and require no maintenance. The motor is screwed to the gear box from inside.

18650 Lithium Ion Battery

The 18650 Cell is a Li-ion type battery which has found its application in many fields such as Portable electronics like torch lights, Electric Vehicles/Cars like Tesla and much more. The main reason for this battery being successful is its properties compared to its competitors. These properties include current carrying capability, voltage, cycle life, storage life, safety, and operating temperature and much more. Below table shows the comparison between popular batteries for key parameters.



V. WORKING

Solar-Powered Grass Cutting Robot is an autonomous robotic system designed for cutting grass efficiently using solar power. It integrates a battery system, Bluetooth communication with a mobile app, a motor driver, a relay for controlling the grass cutting motor and blade, robot is powered by solar energy, making it eco-friendly and self-sustaining for extended periods of operation.

The main body of the robot, which houses the electronics, battery, and cutting mechanism.

[1] Initialization: The robot is initialized and programmed with the lawn's dimensions and cutting schedule.
[2] Navigation: The robot uses its sensors to navigate the lawn, avoiding obstacles and staying within boundaries.
[3] Cutting: The cutting blades are activated, and the robot begins cutting the grass to the programmed height.
[4] Charging: The solar panel charges the battery during operation, extending the robot's runtime.
[5] Return to Base: When the battery is low or the cutting cycle is complete, the robot returns to its base station for recharging.
[6] GPS: The robot uses GPS to determine its location and navigate the lawn.
[7] Map Generation: The robot generates a map of the lawn, including obstacles and boundaries.
[8] Path Planning: The robot plans its cutting path to ensure efficient coverage of the lawn.
[9] Obstacle Avoidance: The robot uses sensors to detect and avoid obstacles, such as trees, gardens, and slopes.
[10] Collision Detection: The robot is equipped with sensors to detect collisions and stop the cutting blades.
[11] Lift Sensor: The robot has a lift sensor that stops the cutting blades if the robot is lifted or turned over.

VI. ADVANTAGES AND APPLICATIONS

1. **Zero Emissions**: Solar-powered grass cutting robots produce no emissions, reducing greenhouse gas emissions and air pollution.
2. **Renewable Energy**: Solar power is a renewable energy source, reducing dependence on fossil fuels and mitigating climate change.
3. **Noise Reduction**: Solar-powered robots are quieter than traditional gas-powered lawn mowers, reducing noise pollution.
4. **Lower Operating Costs**: Solar-powered robots eliminate fuel costs and reduce maintenance costs.
5. **Increased Efficiency**: Solar-powered robots can optimize cutting routes and schedules, reducing energy consumption.
6. **Longer Lifespan**: Solar-powered robots can have a longer lifespan than traditional lawn mowers, reducing replacement costs.
7. **Autonomous Operation**: Solar-powered robots can operate independently, freeing up time for other activities.
8. **Improved Safety**: Solar-powered robots reduce the risk of accidents and injuries associated with traditional lawn mowing.
9. **Easy Maintenance**: Solar-powered robots often have simple, tool-free maintenance and repair.
10. **Increased Property Value**: well-manicured lawn maintained by a solar-powered robot can increase property value

VII. CONCLUSION

The Bluetooth Controlled Solar Grass Cutter is a successful integration of renewable energy, wireless technology, and automation. It offers a practical, eco-friendly, and user-friendly solution for lawn maintenance, addressing the growing need for sustainable and efficient tools in everyday life. This project highlights the potential of combining solar power with smart automation to create innovative, low-cost, and environmentally conscious devices. Future improvements, such as obstacle detection and autonomous navigation, could further enhance its functionality and applicability. Overall, this device serves as a promising step toward greener and smarter technologies.

VIII. FUTURE SCOP

Solar-powered grass cutting robots could be used for large-scale commercial landscaping applications, such as parks, golf courses, and sports fields. Modified versions of the robot could be used for agricultural applications, such as crop monitoring, pruning, and harvesting. Solar-powered robots could be used for disaster response and recovery efforts, such as clearing debris and restoring power. Solar-powered robots could be designed to incorporate carbon sequestration technologies, such as carbon capture and storage. Robots could be designed to detect and avoid wildlife, reducing the impact of lawn maintenance on local ecosystems. Solar-powered robots could promote sustainable lawn care practices, such as reducing water consumption and using eco-friendly fertilizers.

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