A Sustainable Approach to Lawn Maintenance: Solar Grass Cutter Controlled via Node MCU

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ABSTRACT:

In the modern world, automation plays an important role in the present invention. Grass on grass is often More likely to be the same device now. This leads to pollution and the need for work. Older lawn cutters should be replaced with automatic models that use batteries as power sources for systems that identify obstacles and provide instructions. A solar panel is installed on the top of the robot to charge the battery. The purpose of this project is to create a prototype of a work robot that can mow grass on the grass. In this project, infrared, ultrasound, and other sensors will be used to identify obstacles. The purpose of this project is to develop portable, solar powered lawn mower equipment. The charge controller connects the solar panel to the battery.

Keywords: Grass Cutter, Solar, Wi-fi

Introduction

The lawn mower is a help in the boring chore of grass cutting and maintaining to lawns. As a result of the current green movement transformation, the industries with Campus green space percentages are shifting in significant regions. on campuses, and more greenery results in more money and work to take care of. In these circumstances, the lawnmower shows to be a gift from God. Because there is now more of With a chipset system, the lawnmower may be highly automated. readily, as well as the smaller and less expensive Dc motors induce the system's ability to tap into energy without the Need for fossil fuels towards sustainable energy sources. The bot is more aware of its surroundings because light-dependent resistors and ultrasonic sensors are combined into a more compact and affordable package.

A traditionally designed lawn mower showed electric engine that had to be maintained regularly with oil and fat. They also produced many atmospheric and noise pollution

Problem Statement

Traditional grass cutting methods are often labor-intensive, time-consuming, and dependent on fuel-powered machines, which contribute to environmental pollution and operating costs. While modern robotic grass cutters offer automation and smart features, they rely heavily on sensors and complex programming, making them expensive and difficult to maintain, especially in rural or low-income areas. There is a need for a simple, low-cost, and eco-friendly solution that does not require automation or sensor-based navigation. This project addresses the problem by developing a solar-powered grass cutter controlled manually via Wi-Fi using the ESP8266, eliminating the need for any sensors or automatic operation while still providing remote functionality and ease of use.Objectives

The goal of the proposed work is to develop and build a robotic vehicle for automatic lawn mowing that runs on solar power and avoids obstacles without the need for human intervention. Grass Cutter The engine and vehicle movement engine are equipped with this method of 12-V battery. The battery is charged by the system using both an external charging port and a solar panel. The Node MCU interface manages the operation of all the motors, including those in the vehicle and the lawn cutter.

Scope for the Study

There is more design freedom as the use of specially developed platforms is used. There is already much experience available with other sensors that work in the first two generations of autonomous lawnmowers. This is an important mechanism that allows the mower to recognize objects and move them in a patter n away from them.

PROPOSED ARCHITECTURE
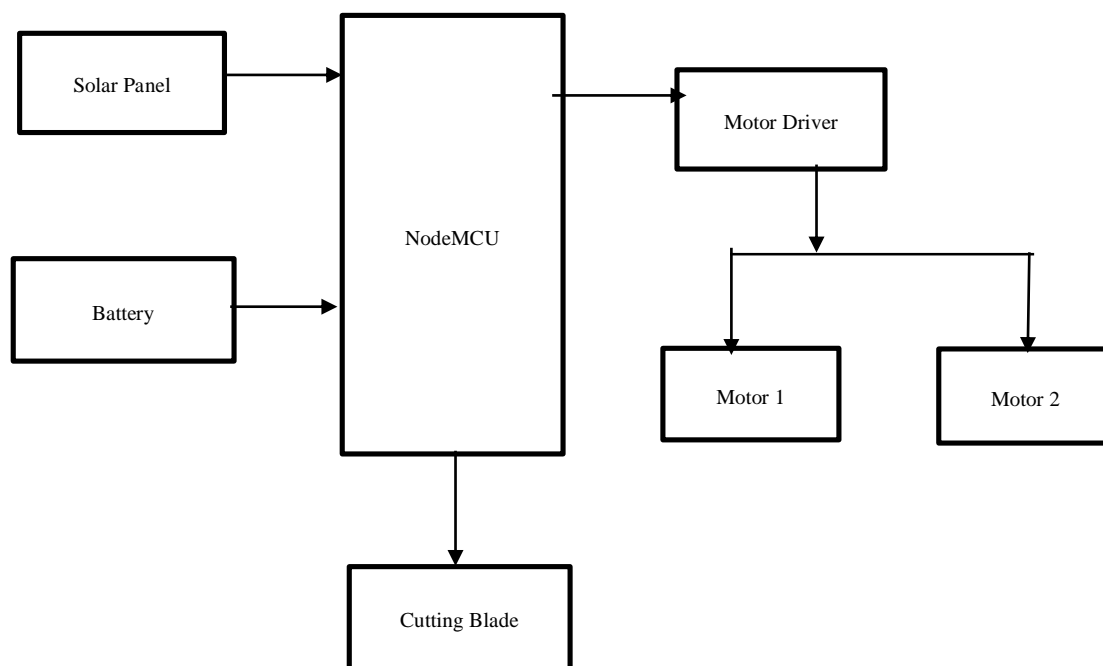
Figure 1 shows block diagram of proposed system

Figure 1 .block diagram of proposed system

NodeMCU ESP8266

A small development board based on the ESP8266 Wi-Fi microcontroller is called the NodeMCU 8266. It has many GPIO pins, built-in Wi-Fi, and can be programmed using the Arduino IDE or Lua. It makes sensor and actuator integration simple, making it perfect for Internet of Things projects. It is well-liked for home automation and prototyping and has USB interface for power and programming. It is backed by a strong community and a wealth of information.

Solar Panel

The term "solar panel" is used colloquially to describe a   photovoltaic (PV) module. The location of the solar cells placed in the installation framework is called a PV module. Solar cells Generate direct current by using sunlight as an energy source. Arrays are systems of PV panels, and PV panels are collections of PV modules. Arrangement of solar power generation of solar energy to generate electrical equipment. To meet the demand, a 10w, 12v solar panel is employed.

Motor Driver(L289N)

The engine and control circuits are connected to each other with the motor driver. The controller circuitry operates with low current signals, but the engine requires a large amount of power. Therefore, the driver's task was a small regulatory signal, which was converted into a higher power signal that provided electricity to the engine.

DC Geared Motor (12 V, 300 rpm)

A gear assembly is attached to the motor of a geared DC motor. These are mostly employed to increase torque by slowing down a sequence of gears. This notion in which a vehicle's speed is decreased via gears, but Its torque increase is referred to as gear reduction. These motors are employed in the construction of wheels.

2.5 Battery:-

The battery is a crucial component of the solar- powered grass cutter as it stores the energy generated by the solar panel and supplies it to the motors and controller during operation. A 12V 7Ah rechargeable lead-acid or lithium-ion battery is recommended for this project due to its balance between capacity, size, and availability.

2.6 Chassis and Wheels

The physical frame that holds all components together. The chassis must be strong enough to support the battery, motors, and blade assembly.

IMPLEMENTATION AND WORKING

Working

The solar-powered grass cutter operates using energy harnessed from a solar panel, which charges a rechargeable battery. This battery powers the entire system, including the NodeMCU (ESP8266) microcontroller, wheel motors for movement, and a cutting blade motor. The system is controlled manually via Wi-Fi using a smartphone. The NodeMCU creates a wireless access point or connects to an existing Wi-Fi network, allowing the user to control the robot through a mobile app or web interface. Commands like forward, backward, left, right, and blade ON/OFF are sent to the NodeMCU, which then activates the respective motors through a motor driver module (L298N). The absence of sensors means that the cutter relies entirely on user input for movement and blade operation, offering a simple, cost-effective, and eco-friendly solution for basic lawn maintenance.

In order to safeguard user safety and preserve the equipment, safety measures can also be added, such as automatic shutdown mechanisms that activate when the cutter is tilted or raised. All in all, this initiative is a perfect example of how sustainability and technology can coexist, providing a workable way to manage gardens while encouraging environmentally responsible behavior. It is a promising advancement in the field of automated gardening equipment because of its versatility and astute navigation.

RESULT

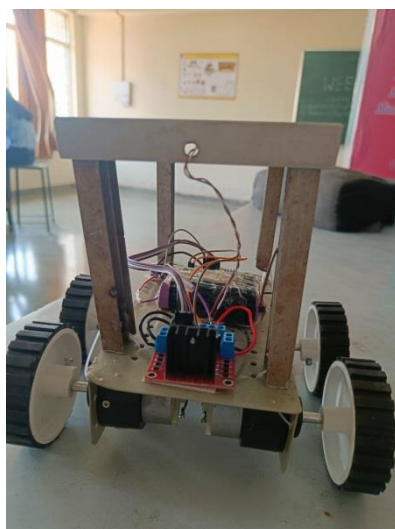Figure 2 shows front view of Solar Powered Grass Cutter

Fig 2: front view of Solar Powered Grass Cutter

The project titled "Solar Powered Grass Cutter Robot Using ESP8266" was successfully implemented, meeting the defined objectives. The robot operates on solar energy and is controlled manually via the ESP8266 NodeMCU module, without incorporating any sensors or automation features. During testing, the robot was able to perform fundamental movements such as forward, backward, left, and right using wireless commands from a web interface or mobile application connected to the ESP8266 over Wi-Fi. The cutting mechanism, powered by a solar-charged battery, efficiently managed to trim grass in small lawn areas. The inclusion of a solar panel not only reduced dependency on conventional electricity but also made the system eco-friendly and sustainable. The robot uses a simple chassis with four wheels driven by DC motors controlled through an L298N motor driver module. This mechanical and electrical setup ensured the robot had stable movement and good maneuverability on grassy surfaces.

CONCLUSIONS

The working solar-powered automatic lawn cutter prototype focuses on renewable energy as the main energy sources have been constructed successfully and have high operational efficiency. Thus, it can be concluded that the proposed solar-powered automatic grass cutter's developed design has achieved its main objectives and that industry may keep refining it. A simple device that can also reduce air pollution is the Smart Solar Grass Cutter. The grass cutter performs effectively in light-duty situations because to its brief operating time, but it is not suitable for thick grasses.

This concept is suitable for a typical person, as there are so many additional benefits, such as reducing pollution and minimizing fuel costs. Less mobile components and electricity can be supplied using solar power, reducing wear. This lawn mower consumes unconventional energy, making it light, compact and has no operational costs. You can load the battery outside to make sure there is enough power to finish the allocation. You can make some recommendations for the future. Research to develop better devices. High speed and blade engines need to supply torque. Capacity of charge batteries can last longer

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