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Arduino-Based Grass Trimmer with Ultrasonic Sensor

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ABSTRACT:

Lawns and other grassy areas have always required extensive manual effort and significant amounts of time for maintenance. A self-sufficient, intelligent, and efficient robotic lawn mower is proposed in this project to address these issues; it makes use of ultrasonic sensors, servo motors, an L293D motor driver, and motors. The robot cuts grass securely by detecting obstacles with the help of the ultrasonic sensor. The Servo Motor is in charge of regulating the blade's height, which enables precise cutting on various surfaces. For effortless maneuvering and precise cutting, the L293D Motor Driver regulates the rotation of the wheels and blades. A dependable and energy-efficient operation is guaranteed by the motors, which power both the movement and the cutting mechanism. An Arduino microcontroller operates the cutting mechanism, analyzes sensor data, and regulates the navigation of this system. The automated design uses a battery-powered system to minimize environmental impact, decrease human work, and maintain regular grass upkeep. Intelligent lawn care may soon be a reality thanks to developments like internet of things (IoT) integration, solar power capacity, and artificial intelligence (AI)-driven route optimization.

INTRODUCTION

The objective of the design is to provide a mower that requires less upkeep, is easy to operate, portable, and sturdy. Also, it aims to examine several paths and figure out how to make the lawnmower's journeys as efficient as possible in terms of both time and energy. Square, spiral, and hybrid trajectories are among the many trajectories now under investigation. The whole operation is controlled by the microcontroller Arduino Uno R3, which has the planned path loaded into it. In order to automate the device, the path's design is critical. The automation of many technological processes is a rapidly expanding area of study. Because it helps farmers so much, automation is vital in agriculture. Lawn mowers used to be powered by hand-cranked implements. As a consequence, pollution and energy depletion were outcomes of using gas and petrol engines. It is time to replace the antiquated manual lawn mowers with

autonomous ones, which will run on batteries and use a guidance and obstacle detecting system. An ultrasonic object detector, a motor-driven linear blade tailored for grass cutting, and an Arduino UNO microcontroller board served as the system's principal controllers. Renewable energy sources power this entirely automated enterprise. A battery-operated, obstacle-avoiding, and autonomous lawn mower does all of its own cutting without any help from a human operator. Powering the system are 12-volt batteries. These are the motors that propel the vehicle and do the mowing. To keep the battery charged, we use a solar panel. An Arduino Nano is used as an interface between the mower and the vehicle's motors, giving it control over all of the motors. To aid with object detection, it is also used to connect an ultrasonic sensor. The bot utilizes light-dependent resistors (LDR) angled at the precise degree to trigger the start event in order to identify the limits. The robot will stop what it's doing and spin around in a full circle before moving on to the next row if it detects a laser on the other side. The bot continues forward motion while rotating clockwise by 90 degrees until it finds the next laser fence. When both lasers are detected at the same time, the event of cessation begins. The L293D9 is a controller for two motors. The robot is propelled forward by the System on a Chip (SoC) if no obstacles are identified. The user's input field is blank. If the ultrasonic sensor detects an obstruction, the System on a Chip (SoC) will stop the grass cutter's motor to prevent damage to any object, person, or animal. They put the river to use

Literature Review

Methodology

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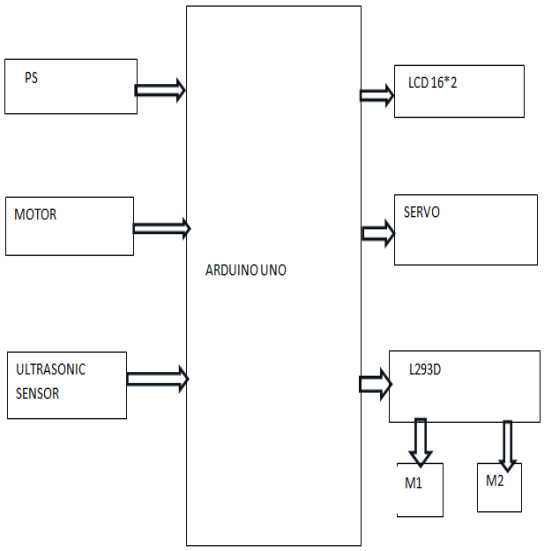

Block diagram

Working

By combining Ultrasonic Sensors, Servo Motors, L293D Motor Driver, and Motors, the suggested autonomous grass-cutting robot aims to provide a smart, efficient, and self-sufficient answer to lawn management. The robot can move securely and avoid collisions with things like rocks, garden furniture, or walls by using the ultrasonic sensor for real-time obstacle recognition. For safer and more efficient lawn cutting, this is a must-have. Importantly, the Servo Motor regulates the blade height, so the robot may mow the grass at varied heights according to the terrain and the user's choice. This allows the system to be adaptable and work with many kinds of grass. In order to maintain efficient mobility and accurate cutting, the L293D Motor Driver is in charge of managing the wheels and the grass-cutting motor. The system is completely autonomous and self-sufficient thanks to the Motors, which enable movement and grass cutting. The Ultrasonic Sensor and Servo Motor provide data to an Arduino microprocessor, which then allows the mower to drive autonomously, avoid obstacles, and change its height for the best possible cut of grass. This technology is a great substitute for conventional gas-powered lawnmowers since it is both economical and kind to the environment. This robotic lawn mower is perfect for commercial and residential properties alike because to its entirely autonomous operation, which cuts down on labor-intensive manual labor while simultaneously increasing productivity.

Arduino uno

A microcontroller board based on the Atmega328, the Arduino Uno is described in the datasheet. A 16 MHz crystal oscillator, 6 analogue inputs, 14 digital input/output pins (including 6 PWM outputs), 1 USB port, 1 power connector, 1 ICSP header, and 1 reset button are all part of it. All you need is a USB cable, an AC-to-DC converter, or a battery to get it going; it comes with everything you need to support the microcontroller.

Because it forgoes the FTDI USB-to-serial driver chip, the Uno stands apart from all previous boards. In its place, you'll find the Atmega8U2 configured to convert USB to serial. "Uno" signifies "One" in Italian and is chosen to commemorate the impending release of Arduino 1.0. Going forward, the Uno and version 1.0 will serve as the reference versions of Arduino. See the index of Arduino boards for a comparison with earlier generations; the Uno is the newest in a series of USB Arduino boards and the platform's standard model.

The USB port or an external power source are both viable options for powering the Arduino Uno. It chooses the power source mechanically. You may use a battery or an AC-to-DC converter (wall-wart) to power it from the outside (not via USB). It is possible to attach the adapter by inserting a 2.1mm center-positive connector into the power port on the board. The POWER connector's Gnd and Vin pin headers are suitable for inserting battery leads. The board is compatible with power sources ranging from 6 to 20 volts. But if the voltage is lower than 7V, the 5V pin could not give 5V and the board might become unstable. The voltage regulator might become too hot and ruin the board if you use more than 12V. A voltage range of 7 to 12 volts is suggested.

LIQUID CRYSTAL DISPLAY

In front of a light source or reflector, a thin, flat display device called a liquid crystal display (LCD) arrays a large number of color or monochrome pixels. Pile of liquid crystal molecules held aloft by two transparent electrodes and two polarizing filters, whose polarity axes orthogonal to one another, make up each pixel. If there weren't liquid crystals interposed, one would block the other from light. Light that enters one filter is able to pass through the other because the liquid crystal bends its polarity. A program's ability to communicate with the outside world depends on its input and output devices, which in turn rely on human communication. An LCD display is a typical accessory for controllers. The 16x1, 16x2, and 20x2 LCDs are among the most

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popular types of displays that are attached to the controllers. This equates to sixteen characters on a single line. The first set has 16 characters on each line while the second set has 20 characters on each line.

BUZZER

In a magnetic transducer, the circuitry includes an iron core, a yoke plate, a wound coil, a permanent magnet, and a vibrating diaphragm that can be moved. The magnet's field gently draws the diaphragm up nearer the core's surface. A positive alternating current (AC) signal causes the diaphragm to move up and down, which in turn vibrates the air. This is achieved by the current passing through the excitation coil, which forms a fluctuating magnetic field. A resonator, which is composed of a cavity and one or more sound holes, may amplify vibrations in order to generate a loud sound.

ESP8266 Wi-Fi Module

This project revolves on this. The module plays a crucial role in the project as it is centered on WIFI control of appliances. A low-cost Wi-Fi chip with full TCP/IP capability, the ESP8266 Arduino compatible module has an amazing built-in MCU (Micro Controller Unit) that allows you to control I/O digital pins using a simple programming language that is almost pseudo-code like. The Chinese company Es press if Systems is situated in Shanghai and makes this gadget. In August 2014, this chip made its debut in the ESP-01 version module manufactured by the third-party company AIThinker. The MCU can establish basic TCP/IP connections and connect to WiFi networks with the help of this little module. In his Many hackers and tech enthusiasts were interested in exploring and using it for a wide range of projects because to its tiny size and very inexpensive pricing (1.7$ to 3.5$). Since it has been so successful, Espressif has released other variants with varying proportions and technological specs. Among the following is the ESP32. Numerous projects and applications, such as home automation, may be found online.

RELAYS

Many household and commercial equipment, as well as industrial control systems, make use of electrically controlled switches called relays. By using a relay, two independent voltage sources may be isolated from one another; in other words, a little quantity of voltage or current on one side can manage a big amount of current or voltage on the other side, and vice versa.

Ultrasonic Sensor

One tool that may estimate the distance to an item using ultrasonic sound waves is an ultrasonic sensor. Simply put, an ultrasonic sensor is... A transducer allows the device to transmit and receive ultrasonic pulses, which in turn provide data on the proximity of an item. When high-frequency sound waves travel over different surfaces, they create unique patterns of reflection called echos.

To operate, ultrasonic sensors emit a sound wave at a frequency that is audible to humans but not to other creatures. The sensor's transducer takes the role of a microphone, transmitting and receiving ultrasonic waves. A single transducer is used to transmit a pulse and receive the echo by our sensors, as is common with many others. By timing how long it takes for an ultrasonic pulse to travel from source to receiver, the sensor may calculate the distance to an object. An ultrasonic sensor relies on this procedure.

SOFTWARES

The Arduino platform is an open-source, user-friendly hardware and software environment for prototyping. It is comprised of a programmable circuit board (also called a microcontroller) and an Integrated Development Environment (IDE) called Arduino that is pre-made for writing and uploading code to the physical board.The main characteristics are:
• Many sensors can send signals in digital or analog formats to Arduino boards, which may then be used to activate motors, control LEDs, establish connections to the cloud, and much more.
• The Arduino IDE (also called "uploading software") allows you to command your board's operations by communicating with the microcontroller on the board. • A separate device, known as a programmer, is not required to load fresh code into an Arduino board, in contrast to most prior programmable circuit boards. The usage of a USB connection is all that is required. • The Arduino IDE employs a streamlined version of C++, which facilitates programming learning. Last but not least, Arduino offers a standardized form factor that simplifies the microcontroller's tasks.
Now that we know what the Arduino UNO board is and how it works, we can go on to setting up the

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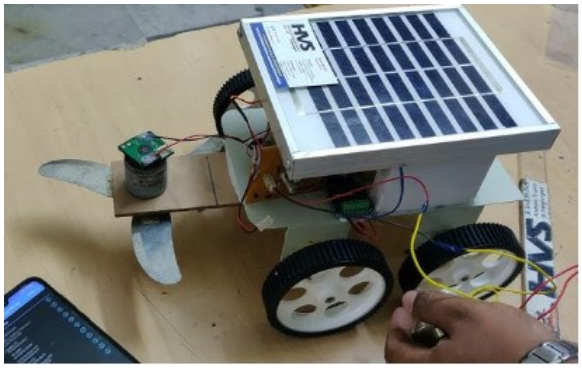
Arduino IDE. As soon as we figure this out, we can upload our software to the Arduino board.

RESULTS

Model



CONCLUSION

An intelligent and effective method of autonomous lawn upkeep is offered by the Automatic Grass Cutting Robot. Incorporating motors for cutting and movement, L293D motor drivers for motion control, Servo motors for height adjustment, and Ultrasonic sensors for obstacle detection, the system guarantees accurate, efficient, and autonomous grass trimming. This technology makes lawn care easy and effective by detecting obstacles in real-time, navigating smartly, and adjusting the blades automatically, unlike conventional lawnmowers. Further improving both cost-effectiveness and eco-friendliness is the battery-powered design. Internet of Things (IoT) connection for remote monitoring, artificial intelligence (AI) terrain mapping for better navigation, and solar-powered charging for more eco-friendly could be some of the future upgrades. As a cost-effective, user-friendly, and ecologically responsible solution, this technology is a giant leap forward in the direction of completely automated, smart lawn management.

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