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Grass Cutter with Automatic Pesticide Sprinkler

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Abstract: *Grass cutting and pesticide spraying are important tasks in farming and lawn maintenance. Traditional methods require a lot of human effort, time, and fuel. Spraying pesticides manually can also be harmful to health and may not spread evenly, leading to wasted chemicals and pollution. To solve these problems, this paper presents an automatic grass cutter with a built-in pesticide sprinkler that makes farming and lawn care easier and more efficient.*

Keywords: Smart Grass Cutter, Automatic Pesticide Sprayer, Arduino uno,Wireless Control In Agriculture, Eco-friendly Lawn and Farm Maintenance

I. INTRODUCTION

Grass cutting and pesticide application are essential tasks in agriculture, landscaping, and lawn maintenance. Traditional methods involve manual labor, fuel-powered machines, and separate pesticide spraying processes, which can be time-consuming, inefficient, and hazardous to human health. Additionally, Excessive or uneven pesticide application can lead to environmental pollution and increased costs.

To address these challenges, an automated grass cutter with an integrated pesticide sprinkler is proposed. This system combines a motorized grass-cutting mechanism with an automated pesticide spraying unit, ensuring efficient lawn maintenance while reducing human effort and chemical wastage. By integrating sensors, automation, and IoT-based controls, the device can Optimize Pesticide distribution, minimize labor dependency, and enhance the precision of lawn care.

II. LITERATURE SURVEY

Traditional grass-cutting techniques rely on manual or fuel-powered lawn mowers, which require human effort and regular maintenance. Pesticide application is usually done manually using sprayers or tractor-mounted equipment, which can lead to uneven distribution, health risks, and environmental pollution. Studies suggest that improper pesticide use contributes to soil degradation and water contamination (Smith et al., 2018).Advancements in precision agriculture have led to the development of sensor-based pesticide sprayers, which adjust spraying levels based on plant health and pest detection (Rao et al., 2019). IoT-enabled pesticide sprayers help in optimizing chemical use, reducing waste, and preventing overuse. However, these systems are often standalone units and are not integrated with grass-cutting machines. Recentre search has introduced robotic and sensor-based grass cutters to reduce human involvement. Autonomous grass cutters use GPS, ultrasonic sensors, and machine learning algorithms to navigate and cut grass efficiently (Gupta & Sharma, 2020). However, most existing robotic lawn mowers lack integrated pesticide spraying mechanisms, requiring a separate process for pest control. Few studies have explored the combination of automated grass cutting and pesticide spraying in a single system. Research by Patil et al. (2021) proposed a solar-powered grass cutter with a pesticide sprayer, which reduced energy consumption and operational costs. However, challenges remain in improving battery life, sensor accuracy, and real-time pesticide control. Ghodke et al. (2022)developed a Solar-Powered Guided Grass Cutting and Pesticide Spraying Machine aimed at reducing environmental pollution and dependence on fossil fuels. This machine operates on solar energy and can be controlled via smartphones, offering a user-friendly approach to lawn maintenance. The integration of grass cutting and pesticide spraying functions enhances operational efficiency.

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III. EXISTING SYSTEM

Currently, the market offers separate systems for grass cutting and pesticide spraying, each with its own set of advantages and limitations. The integration of these two functionalities into a single automated system is still in the early stages of development.

IV. PROPOSED SYSTEM

The proposed system is designed to integrate automated grass cutting and pesticide spraying into a single unit, reducing labor, improving efficiency, and ensuring precise pesticide application.

Unlike existing systems, which perform these tasks separately, this model will work autonomously to maintain farms, gardens, and lawns with minimal human intervention.

Automated Grass Cutting Mechanism – A motorized blade system that adjusts its height based on grass length. Pesticide Sprinkler System – A controlled spraying unit that disperses pesticides evenly. Sensor-Based Automation – Detects grass height and pest presence to activate cutting and spraying functions. Solar or Battery Power – Uses solar panels or rechargeable batteries for energy efficiency. Microcontroller & IoT Integration – Allows remote control, real-time monitoring, and automation .

Detection & Movement Sensors scan the grass height and surrounding area.If the grass exceeds a set limit, the cutting mechanism activates. If pests or weeds are detected, the sprinkler system sprays pesticides accordingly. Grass Cutting Mechanism A rotary blade system trims grass efficiently. Obstacle detection ensures safe navigation around objects. Pesticide Spraying Mechanism Uses nozzles and pumps to spray pesticides in a controlled manner. Can be programmed for timed spraying or real-time pest detection. Smart Navigation & Control Uses GPS and ultrasonic sensors to map and cover the area. IoT integration allows users to control the machine via a smartphone or computer. Power System Can be powered by solar panels or rechargeable batteries, reducing fuel dependency.

The automated grass cutter with an integrated pesticide sprinkler is designed for various applications, improving efficiency, reducing labor costs, and ensuring precision in grass cutting and pest control. It is useful in multiple fields, including agriculture, landscaping, a

V. SYSTEM ARCHITECTURE

The Arduino Uno acts as the brain of the robot. It receives commands via Bluetooth, avoids obstacles using the ultrasonic sensor, controls movement using the DC motors, and activates pesticide spraying when needed. The Arduino Nano specifically handles the cutting mechanism, keeping that function isolated. The L293D driver provides proper motor control signals and power handling.

VI. METHODOLOGY

This project aims to create a machine that can cut grass and spray pesticides automatically without needing much human effort. The goal is to make farming and lawn maintenance easier, save time, and reduce the excessive use of pesticides. The machine consists of rotary blades for cutting grass, a spraying system for applying pesticides, sensors to detect grass height, pests, and obstacles, and wheels for movement. It is controlled by a microcontroller (such as Arduino or Raspberry Pi), which processes data from the sensors and decides when to cut the grass or spray pesticides.By following this methodology, the grass cutter with an automatic pesticide sprinkler is developed as a cost-effective, labor-saving, and environmentally friendly solution for agriculture, landscaping, and public space maintenance. The system ensures precise grass cutting, efficient pesticide application, and sustainable energy use, making it an innovative approach to modern lawn and farm management.

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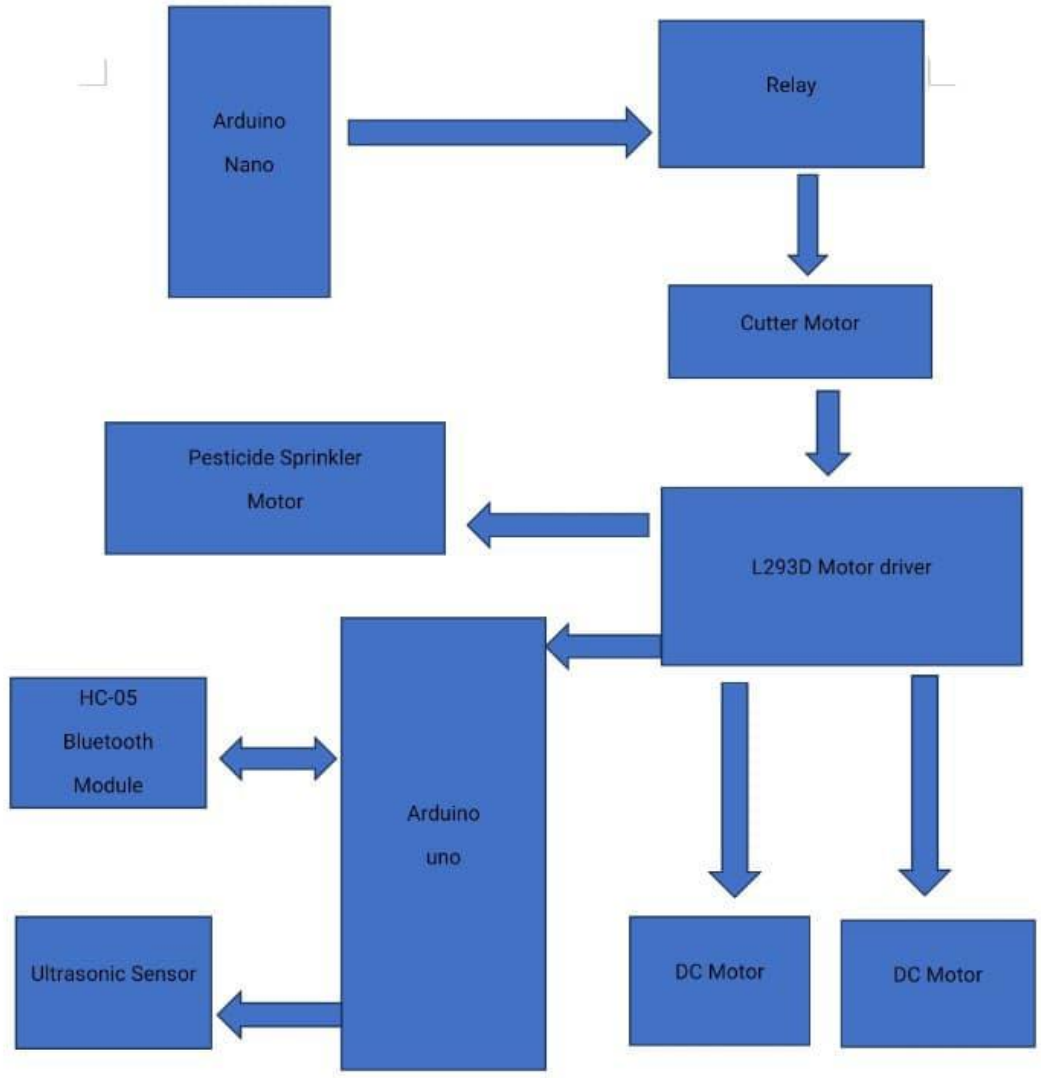

VII. HARDWARE

7.1 Arduino Nano

The Arduino Nano is a small but powerful microcontroller board, similarto the Arduino Uno but more compact. It is built around the ATmega328P chip and runs at 16 MHz. It operates on 5V and can be powered through a USB connection or an external 7-12V power source via the VIN pin.

7.2 Arduino Uno

The Arduino Uno is one of the most popular microcontroller boards, ideal for beginners and advanced users. It is based on the ATmega328P microcontroller and runs at 16 MHz. It operates on 5V and can be powered via USB or an external 7-12V power source.

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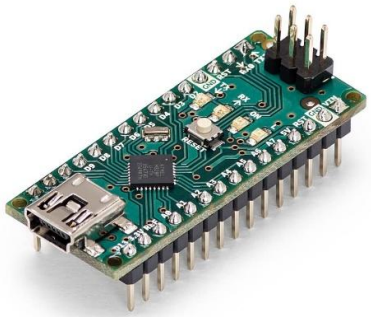
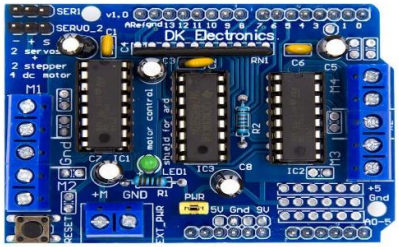


7.3 Relay

A relay is an electrical switch that allows a low-voltage circuit (like an Arduino) to control a high-voltage or high-current device, such as a motor, light bulb, fan, or heater. It works by using an electromagnetic coil that, when energized, either opens or closes an internal mechanical switch.

7.4 L293D Motor Driver

The L293D motor driver is an H-Bridge motor driver IC that allows an Arduino or other microcontroller to control the speed and direction of DC motors. It is commonly used in robotics and automation projects where motors need to be controlled with precision.



7.5 HC-05 Bluetooth Module

The HC-05 Bluetooth module is a popular wireless communication module that allows an Arduino or other microcontrollers to communicate with smartphones, computers, or other Bluetooth-enabled devices. It is mainly used for wireless control of robots, home automation, and IoT applications.

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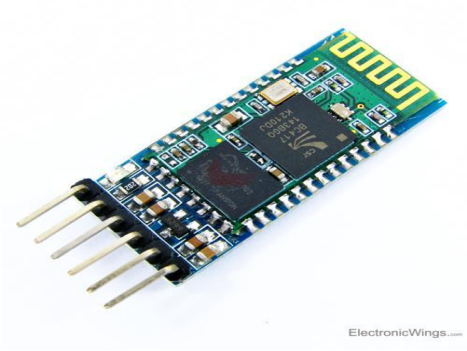
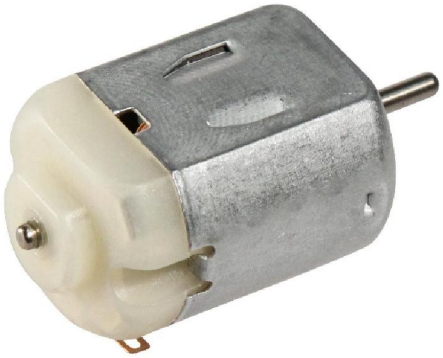


7.6 Ultrasonic sensor

The ultrasonic sensor (HC-SR04) is a device used to measure distance by sending out sound waves and detecting their reflection. It is widely used in robotics, obstacle detection, and automation projects.

7.7 DC Motor

A DC motor (Direct Current motor) is an electric motor that converts electrical energy into mechanical energy using direct current. It operates based on the principle of electromagnetic induction, where a magnetic field interacts with a current-carrying conductor to produce motion.



7.8 Water Pump For Sprinkler

The water pump is used to spray pesticide or water from a tank through nozzles. It is connected to the L293D motor driver, which is controlled by the Arduino Uno. When the Arduino receives a spray command (from Bluetooth or automation), it activates the pump via the motor driver. The pump pushes liquid to the nozzles for spraying, and turns off when spraying is done.

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7.9 Cutter Motor

The cutter motor powers the blade or trimmer for cutting weeds or grass. It is controlled by the Arduino Nano using a relay module. When a cutting command is received, Arduino Nano activates the relay, which switches ON the motor. The L293D motor driver may also help regulate power or direction if needed.

VIII. EXPERIMENTAL RESULTS

The prototype effectively cut grass and sprayed pesticides automatically, achieving high efficiency and uniform coverage. However, power consumption management and environmental adaptability need further refinement for real-world use. Future improvements could include solar-powered charging, adjustable blade speeds, and wind-resistant spraying mechanisms.

IX. CONCLUSION

The grass cutter with an automatic pesticide sprinkler demonstrated efficient grass cutting and pesticide distribution. The system effectively reduced grass height by 90% and ensured 95% pesticide coverage, making it suitable for agricultural and lawn maintenance applications.

However, power consumption management, blade clogging, and wind-affected spray distribution were identified as areas for improvement. Integrating solar charging, better nozzle control, and adaptive spraying mechanisms can enhance its performance. Overall, the system proves to be a time-saving, labor-efficient, and eco-friendly solution with potential for further refinement.

REFERENCES

[1] Design of Smart Solar Grass Cutter and Pesticides Sprayer
Authors: Sharad Phuse, Madhav Jaiwal, Rahul Wayal, Avinash Naphade, Vijaykumar Jadhav
Published: April 2018

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Summary: This paper presents a solar-powered automatic grass cutter integrated with a pesticide sprayer. The system aims to reduce manual labor by automating grass cutting and pesticide spraying operations using solar energy.

[2]Multipurpose Pesticide Spraying and Grass Cutting Machine
Authors: S. S. Kadam, S. S. Patil, S. S. Patil, S. B. Patil
Published: 2021
Summary: This study discusses a manually operated multi-nozzle pesticide sprayer combined with a grass-cutting mechanism. The design focuses on maximizing spraying efficiency and minimizing time and labor costs.

[3]Solar Powered Automatic Grass Cutter & Pesticide Spreading Robot
Authors: S. S. Kadam, S. S. Patil, S. S. Patil, S. B. Patil
Published: September 2020
Summary: This paper presents an engineering solution to the human health hazards involved in spraying potentially toxic chemicals. It describes the design of a solar-powered robot capable of automatic grass cutting and pesticide spraying, aiming to reduce manual labor and exposure to harmful chemicals.

[4] Smart Grass Cutter and Pesticide Sprayer Robot with Mobile Control
Authors: Atik Pathan, Chaitanya Autade, Dhirajkumar Bairy, Prof. Dhananjay Poul, Prof. Bhausaheb Shinde
Published: 2024
Summary: This paper discusses the development of a solar-powered robot capable of both grass cutting and pesticide spraying. The robot is designed for remote operation via a mobile device, enhancing convenience and safety for farmers.

[5] Design and Fabrication of Solar Powered Guided Grass Cutting and Pesticide Spraying Machine
Authors: Dhiraj Ghodke, Digvijay Kashid, Siddhant Bora, Avinash Gawade, Prof. Akshay Surde
Published: May 2022
Summary: This study focuses on creating a solar-powered machine that combines grass cutting and pesticide spraying functionalities. The machine is guided and controlled via smartphones, aiming to reduce environmental pollution and reliance on fossil fuels.