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SOLAR-POWERED AUTONOMOUS GRASS CUTTING SYSTEM

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ABSTRACT

These days, computerization plays a vital role in various fields, including automation, which is rapidly growing. As a result, it plays a crucial role in human life. In the past, grass cutting was done manually, requiring human labor and fuel or energy for operation. This manual process led to fuel and energy loss and environmental pollution due to fuel consumption. The demand for electrical energy is increasing rapidly due to the growing use of electrical devices and large-scale industries. Solar energy is an ideal renewable energy source, especially considering the depletion of fossil fuels. Traditional grass cutters are expensive and have high maintenance costs. Therefore, there is a need to replace conventional grass cutters with new automated solar-powered grass cutters to overcome these drawbacks. This model is more economical compared to traditional ones. The main objective of this device is to create a grass cutter that operates on solar power, thereby conserving electrical energy and reducing human intervention. In this project, we utilize an Arduino UNO microcontroller to control the operations of the grass cutter. The grass cutter is equipped with an ultrasonic sensor for obstacle detection, a cutting blade for grass cutting, and DC motors for the robot's wheels. It is a fully automated and sustainable energy-based project. The grass cutter operates automatically, eliminating the need for skilled personnel to operate the device.

Key Words: Lawn, Automation, Solar Grass Cutter, Microcontroller, Motor, Solar Panel, Battery.

1. INTRODUCTION

Nowadays, pollution is a major issue worldwide. Gas-powered grass cutters contribute to pollution due to the emission of gases, making them environmentally unfriendly. Additionally, the rising cost of fuel makes them economically impractical. Traditional grass cutters are cumbersome and require a lot of strength and energy to operate. However, modern and high-tech grass cutters have been creatively designed to make the entire landscaping process much easier and more convenient for users. From robotic grass cutters that can efficiently trim grass to those powered by solar energy, these innovative devices offer clean air, less noise, and lush green lawns without the need for oil or fuel, thus reducing pollution. Another important objective is for the automated lawn cutter to be able to differentiate between grass and concrete while continuously monitoring its surroundings. Safety is a primary concern in designing the lawn cutter, especially since it has blades. It is crucial for the lawn cutter not to operate if it is lifted into the air by the user. Therefore, a device to detect orientation was incorporated into the design. An automatic lawn cutter can relieve consumers from the task of mowing their own lawns, thus reducing both environmental and noise pollution. The project utilizes an Arduino Uno microcontroller, electric motors, batteries, a motor driver, and a Bluetooth module. The project is divided into three categories: electrical, software, and mechanical. The electrical section includes components such as batteries and motors, with 12-volt 3 Ampere batteries connected in series. The motor driver controls the speed and direction of the grass cutter. The software section involves developing a mobile application for wireless transmission and programming the Arduino Uno microcontroller. An application is developed to control the grass cutter wirelessly via Bluetooth connection, and Arduino IDE is used to upload the code to the microcontroller. The mechanical section focuses on constructing the chassis and installing the wheels, blades, and caster wheels of the grass cutter. Overall, this project aims to provide a convenient and eco-friendly solution for lawn maintenance.

2. METHODOLOGY

2.1 Existing System

The grass cutter usually operates on fuels, resulting in high running costs. Conventional grass cutters are heavy machinery that require significant strength and energy to operate, leading to increased time consumption and noise production. Additionally, they demand more human effort and pose a risk of injury due to their weight. Pollution, primarily caused by conventional fuel and gas-powered grass cutters, is a major concern. Motor-powered push grass cutters have loud engines, contributing to both noise and air pollution through engine combustion. Similarly, electrical lawn mowers, along with motor-powered ones, are not easily integrated into daily life due to safety concerns related to belts and motors. Furthermore, these mowers fail to efficiently meet the needs of the elderly, young, or disabled individuals, resulting in dissatisfaction.. Gas-powered lawn mowers, which are also inefficient, contribute to air

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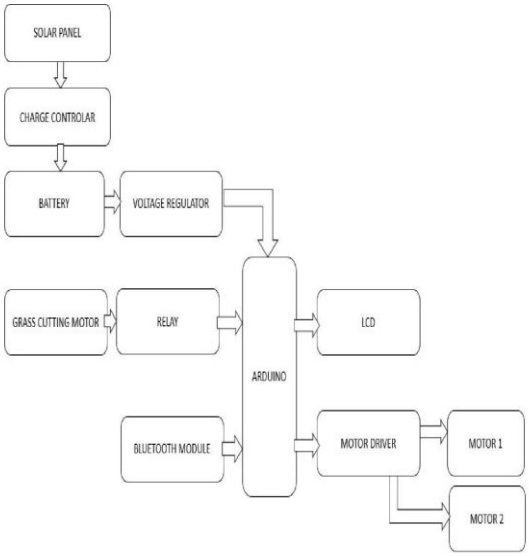
pollution through gas emissions. Additionally, the increasing prices of fuel and gases further exacerbate these issues.

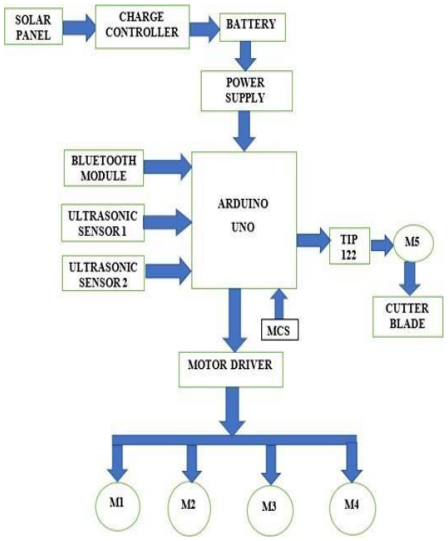
2.2 Proposed System

Our proposed project aims to develop a programmable automatic grass-cutting robot powered by solar energy, eliminating the need for manual grass cutting. Operable wirelessly via an Android App using Bluetooth technology from a safe distance, the robot features an adjustable cutting blade to accommodate varying grass lengths. Users can remotely maneuver the robot to desired locations in the garden using the mobile application. Upon selecting the desired cutting pattern through the app, the system initiates grass cutting at the specified time. To ensure safety, the robot is equipped with front-positioned sensors for barrier detection. In the event of obstacles detected by IR obstacle sensors during traversal, the robot autonomously avoids collision by executing a right turn or halting. The primary objective of this project is to alleviate the user's burden of manual grass cutting while enhancing safety measures.



To address the environmental and noise pollution associated with manual grass cutting, we propose the development of a versatile grass cutting robot controlled via a Bluetooth Android mobile application in conjunction with Arduino. Unlike conventional remote-controlled robots limited by a specific remote, our approach eliminates this constraint, reducing the risk of control loss due to remote misplacement or damage. By integrating Ultrasonic sensors, our system can detect obstacles in the robot's path, halting both its motion and cutting action to prevent accidents. In Automatic Mode, the grass cutter operates autonomously, adjusting its path around obstacles as needed. In Manual Mode, users can assume direct control through the Android App, navigating tight spaces or irregular terrain with ease. The app features buttons for left, right, and reverse controls, offering users flexibility and precision in operation. To power the system, a solar panel is utilized, with excess energy stored in a battery for continuous operation, even during adverse weather conditions. A charge controller ensures a consistent power supply for battery charging. Central to the system's operation is Arduino, which orchestrates all functions of the grass cutting robot.

3. CIRCUIT DIAGRAM



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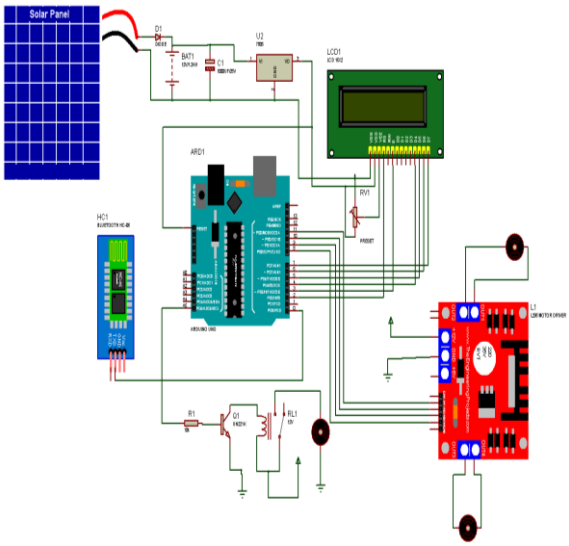
4. MODELING AND ANALYSIS



The simulation operates in two modes: automatic and semi-automatic. In automatic mode, the system responds to output from the IR sensor, detecting obstacles in its path. In semi-automatic mode, the system follows user commands transmitted via the Android app through a Bluetooth connection. In automatic mode, the wheels and blade motor continue running while the IR sensor detects obstacles. Two manual switches are incorporated into the simulation to demonstrate the sensor's functionality. If an obstacle is detected on the right, the machine veers left; if it's on the left, it veers right. If obstacles are detected on both sides, the machine halts. Subsequently, the machine can be controlled via the Android app (semi-automatic mode). In semi-automatic mode, user commands are entered through the virtual terminal of the Bluetooth module. When the user inputs commands such as "1, 2, 3, 4, 5," the motor executes corresponding movements.

1-forward movement

2-reverse movement

3-left movement

4-right movement

5-halt

In the forward motion, when the user inputs "1" through the virtual terminal, both the left and right motors rotate anti-clockwise. Conversely, in reverse motion, triggered by the command "2," both the left and right motors spin clockwise. Upon receiving the command "3," the left motor rotates anti-clockwise while the right motor moves clockwise, causing the machine to turn left. Similarly, when the input is "4," the left motor rotates clockwise and the right motor anti-clockwise, facilitating a right turn. Lastly, upon inputting "5," both the motor wheels and the cutter blade come to a halt position, stopping the machine's movement

4.1 Simulation Results

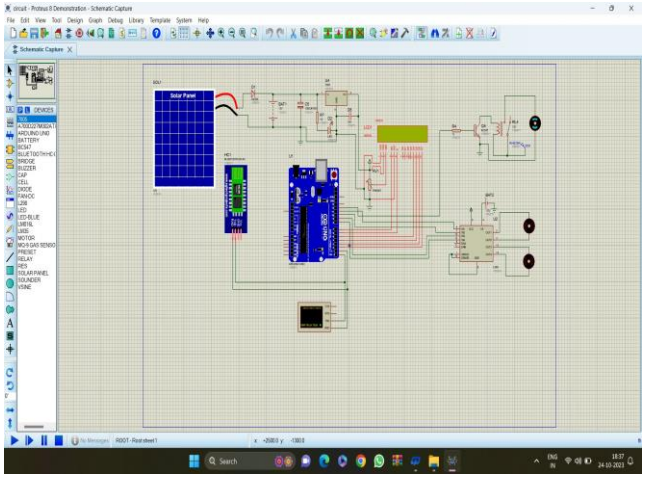


Fig.1 Automatic mode detection

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In automatic mode, the grass cutter's operation is guided by the obstacle detection sensor, as depicted in Figure 3. Switches are employed to detect obstacles, with the left obstacle switch triggering the grass cutter's left wheel motor to rotate clockwise and the right wheel motor to rotate anti-clockwise, thus enabling movement towards the right direction. In the simulation, when the right switch is turned on to indicate obstacle detection, the left wheel motor rotates anti-clockwise, and the right wheel motor rotates clockwise, prompting the grass cutter to move towards the left direction. Conversely, when the left switch indicates obstacle detection, the grass cutter moves towards the right direction.

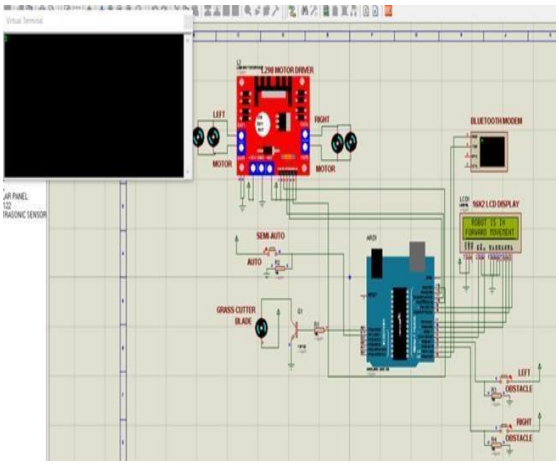

Fig.2 Forward Movement

When the user inputs the command "1" via the virtual terminal, depicted in Figure 4, both motor wheels rotate in a clockwise direction, causing the grass cutter to move forward. Conversely, when the user commands a reverse movement, indicated by input "2," both wheel motors rotate anti-clockwise, resulting in the grass cutter moving in reverse. For a leftward movement, triggered by the command "3," the left wheel motor rotates anti-clockwise while the right wheel motor rotates clockwise, directing the grass cutter towards the left direction. Similarly, when the user inputs "4," signifying a rightward movement, the grass cutter moves accordingly, facilitated by the rotation of the wheel motors.

5. RESULT AND DISCUSSION

The proposed grass cutter incorporates sensors to navigate obstacles and adjust its movement accordingly in automatic mode. Alternatively, in the semi-automatic mode of operation, the machine responds to user commands transmitted through the Bluetooth-enabled mobile app.

6. CONCLUSION

A solar-powered grass cutter has been developed to address the needs of residences and establishments with lawns unsuitable for tractor-driven mowers. This machine, equipped with sufficient capacity for its intended purpose, presents a viable alternative to gasoline-powered grass cutters. By harnessing renewable energy sources, we have eliminated ongoing running costs, making our project, titled "Automatic Solar Powered Grass Cutter," accessible for further modifications. With advantages such as zero fuel costs and minimal pollution, this solution is particularly well-suited for the average individual.

Additionally, the capability to charge the battery while in operation and operate during nighttime hours ensures the machine's longevity. Our innovative design offers economic viability and user-friendliness, featuring live streaming and remote control capabilities, even from distant locations.

7. REFERENCE

[1] T. Karthick, S. Lingadurai, K. Muthuselvan, M. Muthuvanesh, "Grass cutting machine using solar energy", International Journal of Research in Mechanical, August 2021.

[2] Aditya S. Rajmani, Appaji N. Gaonkar, Ajay Darak, "Design and Fabrication of Hybrid Operating Grass Cutter", International Journal of Engineering Research & Technology, May 2020.

[3] M. Manimegalai, V. Mekala, N. Prabhuram, D. Saganthan, "Automated solar powered grass cutter", IEEE Explorer, December 2018.

[4] Bidgar Pravin Dilip, Nikhil Bapu Pagar, Vickey S. Ugale, "Design and Implementation of Automatic Solar Grass Cutter", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, April 2016.

[5] Asish Kumar Chaudhari, Yuvaraj Sahu, Pramod Kumar, Subhah Chandra Verma, "Smart Solar Grass Cutter Robot for Grass Trimming", International Journal of Advance Research and Innovative Ideas in Education, 2016.

[6] Vicky Jain, Sagar Patil, Prashant Bagane, S. S. Patil, "Solar Based Wireless Grass Cutter", International Journal of Science Technology and Engineering, May 2016.

[7] Mike McRoberts, "Arduino starters kit manual", Earthshine Design, 2009.

[8] Agarwal, M. P., "The solar entrepreneur's handbook", Wise Publications, Solar Energy, S. Chand & Company Ltd, New Delhi, 1983.

[9] https://www.studentsheart.com/how-to-interface-ir-sensor-with-arduino/ https://www.theengineeringprojects.com/2015/12/arduino-library- proteussimulation.html/

[10] Shankarappa Jogur, Venkatesh T, Tenzin Tenpa , Prof. Pradeep Vinhuti, “Solar Based Grass Cutter Using Zigbee”, International Journal of Advanced Research in Science, Engineering and Technology, pp 3997-4001, Vol. 4, Issue 5 , May 2017 .

[11] Aditya S. Rajmani, Appaji N. Gaonkar, Ajay Darak, Akshay Joshi, Prof. Vinay M. Murgod, “Design and Fabrication of Hybrid.Operating Grass Cutter”, pp 795-799, Vol. 8 Issue 05, May-2019.

[12] Neha, Syeda Asra, “Automated Grass Cutter Robot Based on IoT”, International Journal of Trend in Scientific Research and Development, pp 334-337, Volume 2, Issue 5, Aug 2018.

[13] K. Sravan Kumar, Abdul Sharif, Surya, “Design and Fabrication of International Journal & Automated Grass Cutting Machine by Using Solar Energy”, Magazine of Engineering, Technology, Management and Research, pp 153-159, Volume 4, Issue 4, April .

[14] Tushar Baingane1, Sweta Nagrale2, Suraksha Gumgaonkar3, Girish Langade4, Shaila Ramteke5 Prof.V.M.Dhumal6, “Review on Fully Automated Solar Grass Cutter”, International Research Journal of Engineering and Technology (IRJET) Volume 5, Issue 2, Feb 2018.