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Modelling of Wi-Fi Control Autonomous Weeder By Using Solidworks

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Abstract - The project involves designing a Wi-Fi controlled autonomous weeder system, which can be modeled in SolidWorks by focusing on key components such as the chassis, motor mounts, weeding mechanism, and power systems. The weeder's frame must be designed to house essential components like DC motors, the ESP32 microcontroller, and the battery, ensuring structural integrity and a 15 cm ground clearance. The motors are responsible for driving the wheels and operating the weeding mechanism, which needs to be modeled with precision to ensure efficient weed removal. The battery compartment should be sized to support a 4.5-hour operation, and a solar panel system must be integrated for recharging, improving operational time. The Wi-Fi module (ESP32) should be securely mounted to allow communication with an Android application, which sends commands to control the machine's movement. The assembly will also include necessary mounts for the microcontroller, motors, and solar panels, ensuring all parts fit and operate together smoothly. Once the components are designed, SolidWorks simulation tools can be used to check motion and test for any mechanical conflicts or performance issues, such as thermal stress or mechanical interference, before fabrication.

***Key Words*:** Solidworks, ESP32 microcontroller, Solar panel, Wi-Fi, Weeder

1. INTRODUCTION

This project focuses on designing a Wi-Fi controlled autonomous weeder for barren lands using SolidWorks to address the challenges of weed management in degraded areas. Barren lands often suffer from invasive weeds, which hinder soil fertility and plant regeneration. Traditional weed control methods, like manual labor and chemical herbicides, are inefficient and costly, making land recovery difficult. The solution lies in the development of autonomous systems that offer precision in weed removal, reducing the need for harmful chemicals and supporting environmental sustainability. The autonomous weeder will operate remotely via a Wi-Fi connection, controlled through an Android application, allowing for efficient and precise weed control. The design will include key components such as the frame, motors, weeding mechanism, microcontroller, and solar-powered battery system. By modeling this system in SolidWorks, the weeder's functionality and performance can be tested before fabrication, ensuring its suitability for barren land restoration and promoting natural land regeneration.

2. OBJECTIVES

- Design and simulate the autonomous weeder's components using SolidWorks for optimal performance.
- To incorporate a solar-powered battery system that supports continuous operation, optimizing the weeder's functionality for long-duration tasks on barren lands.
- To use SolidWorks simulation tools for validating the design's performance, testing for mechanical conflicts, thermal stress, and motion to ensure the system's operational efficiency before fabrication.
- To integrate an ESP32 microcontroller and Wi-Fi module for remote control of the weeder through an Android application, ensuring efficient and precise weed management.

3. PROBLEM STATEMENT

Barren lands are often plagued by invasive weeds that hinder soil fertility and prevent natural plant regeneration, making land recovery difficult. Traditional weed control methods, such as manual labor and chemical herbicides, are inefficient, costly, and environmentally damaging. There is a need for an innovative, sustainable solution to manage weeds more effectively. An autonomous, Wi-Fi controlled weeder could offer precise weed removal without the need for chemicals, while operating autonomously in barren areas. This project aims to design a weeder system that addresses these issues, improving land restoration and supporting natural regeneration in a cost-effective and eco-friendly manner.

4. METHODOLOGY

Wi-Fi-controlled weeder using SolidWorks, start by designing the core components, beginning with the robot chassis, which serves as the structural base for the system. The chassis should be lightweight but sturdy, designed with mounting points for the motors, wheels, cutting mechanism, and other electronics.

Next, model the wheels and axles, ensuring they are placed correctly for smooth movement and connected to electric motors that will drive both the wheels and the cutting mechanism. The cutting mechanism, such as rotating blades, can be created using revolved features for a circular design, and should be positioned to rotate freely without obstruction.

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Additionally, design the microcontroller housing and Wi-Fi module placement, ensuring adequate space for wiring and signal reception. Integrate motor drivers to control motor speed and direction, while ensuring the necessary circuitry and space for the components. Once the individual parts are designed, assemble them within SolidWorks, using mates to ensure correct positioning and verifying that there are no interferences between moving parts. The design can then be tested for functionality, such as wheel movement and blade rotation, ensuring everything works together smoothly. After final adjustments, generate 2D technical drawings and export the model for manufacturing or 3D printing, ready for the development of the Wi-Fi-controlled weeder system.

To build a Autonomous Weeder we will need the following components

- ESP32Micro controller Board
- Cutting System(Blade & Motor)
- DC Motors
- Battery
- Solar Panal
- Chassis
- Wheels
- Other Hardware's(e.g., Screw, Nut & Bolts, etc.)

5. MODEL & DESIGN

FRONT VIEW OF MODEL

The front view of the 3D model offers a direct look at the autonomous weeding machine's frontal aspects. This view showcases the machine's chassis, including the weeding mechanism and the navigation sensors situated at the front. It provides a clear visualization of the machine's appearance from the vantage point of someone observing it head-on.

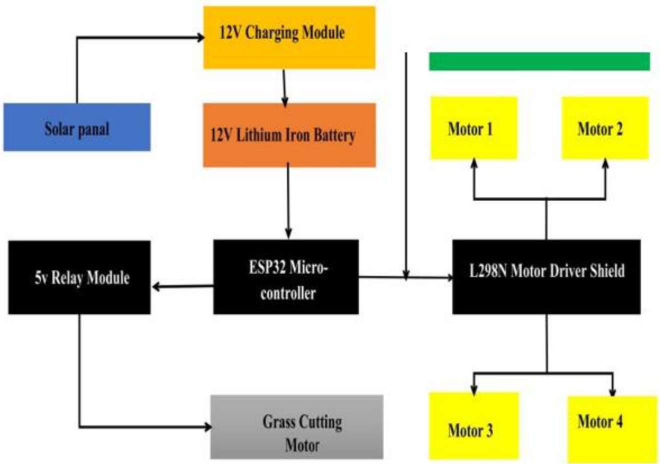


Figure 1.1 Block diagram

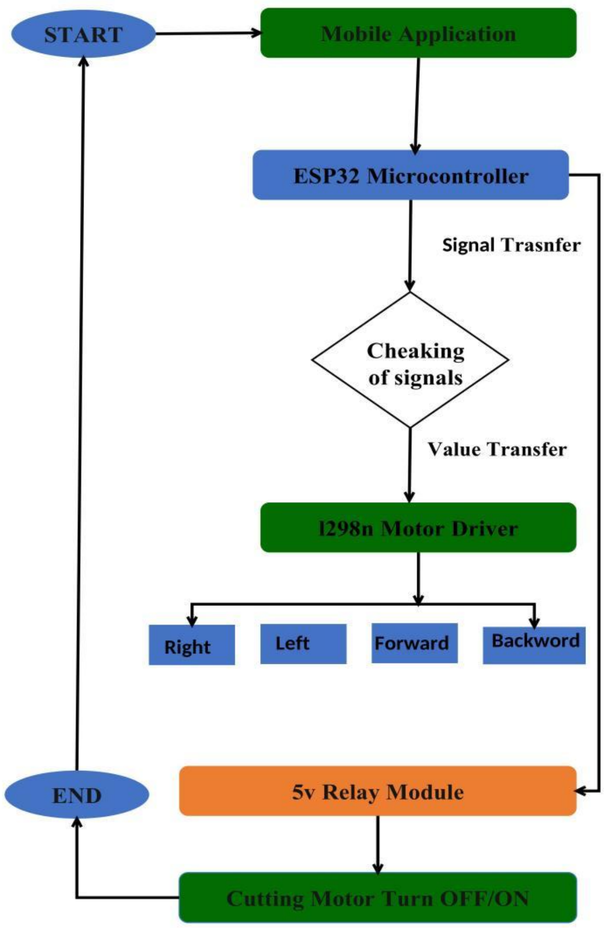
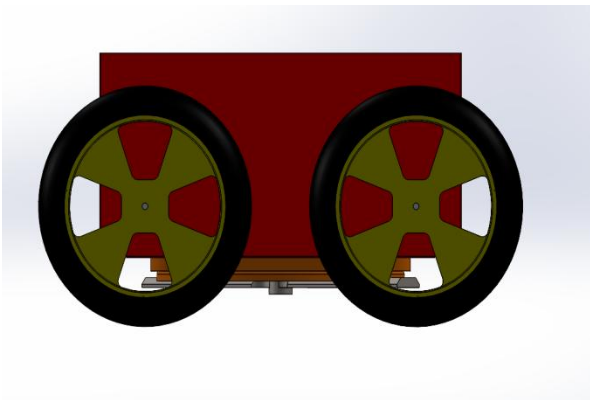


Figure 1.2 Work Flow diagram

TOP VIEW OF MODEL

The top view of the 3D model presents an overhead perspective of the autonomous weeding machine. This view allows you to see the layout of components from an aerial angle, revealing the arrangement of the robotic arms, the navigation system, and the power source. It is particularly useful for understanding the machine's spatial organization.



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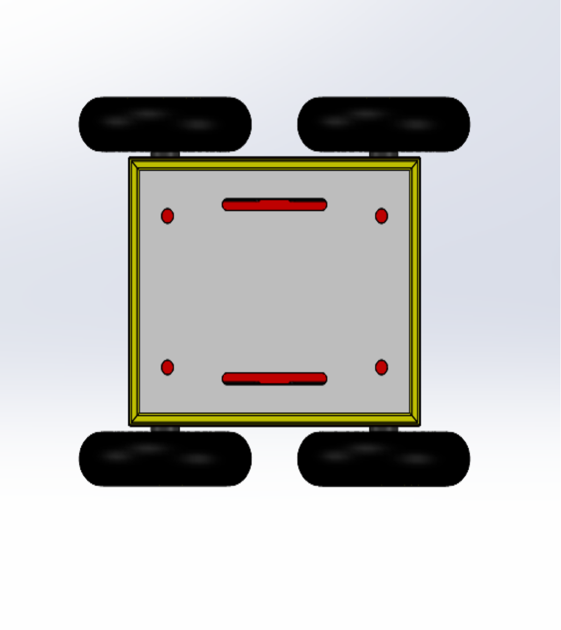
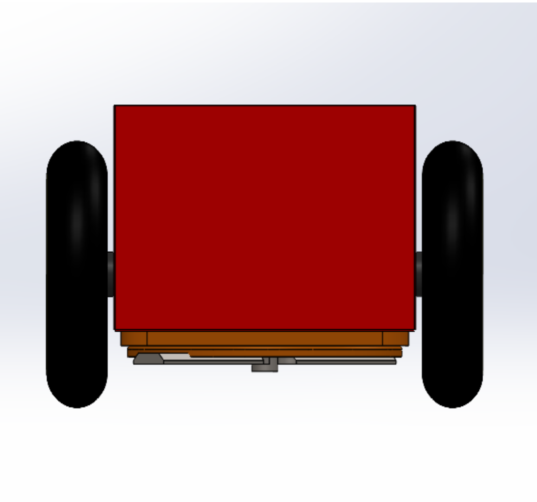


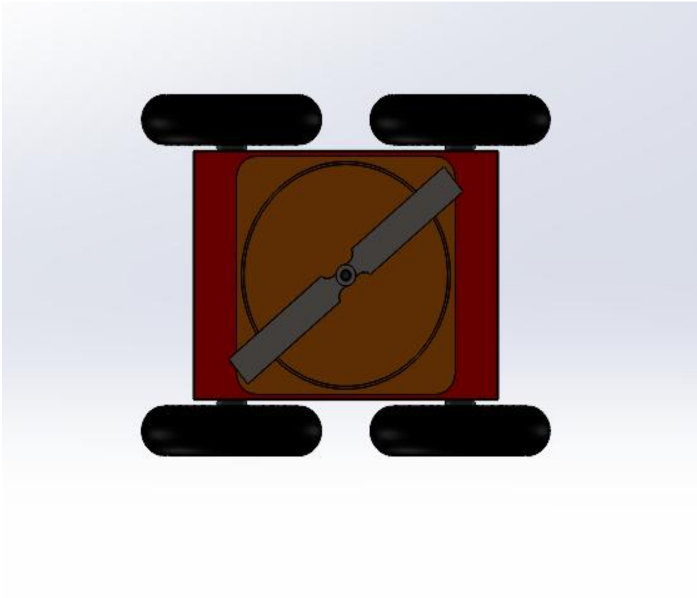
SIDE VIEW OF MODEL

The side view of the 3D model offers a profile view of the autonomous weeding machine. It reveals the machine's lateral features, including its height and length. This view is essential for assessing the machine's overall dimensions and how various components are aligned along its side.



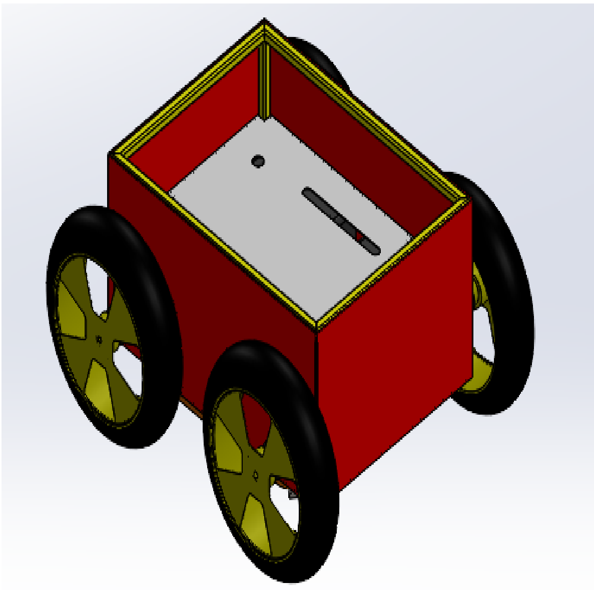
BOTTOM VIEW OF MODEL

The bottom view of the 3D model provides a perspective from underneath the machine. This view is crucial for understanding the clearance and ground contact points, which are essential for navigation and ensuring the machine's stability over uneven terrain. It showcases the underside components like wheels, sensors, and protective shields.



ISOMETRIC VIEW OF MODEL

The isometric view of the 3D model offers a three-dimensional representation that combines various perspectives. It provides an angle that shows the machine from both the front and the sides simultaneously. This view highlights the overall shape and structure of the weeding machine in a visually engaging manner.



6. CONCLUSIONS

Wi-Fi-controlled weeder system using SolidWorks offers a practical and innovative solution for automated weed cutting. By integrating key components such as a sturdy robot chassis, electric motors, a cutting mechanism, and a microcontroller with Wi-Fi communication, this project leverages modern technologies to create an efficient, wireless, and easily controllable gardening tool. The process of modeling the system in SolidWorks ensures precise design, optimized movement, and effective integration of all components, from the mobile interface to the motor drivers. With successful assembly and functionality testing, this Wi-Fi-controlled weeder system has the potential to revolutionize lawn care, offering convenience, precision, and automation in outdoor maintenance tasks. The project serves as a foundation for future advancements in robotic gardening tools, with possibilities for further enhancement in performance and usability.

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REFERENCES

[1] D.C. Slaughter, D.K. Giles, D. Downey, "Autonomous robotic weed control systems," University of California, Biological and Agricultural Engineering, Davis, United States, 2008, 61(1), pp. 63-78.

[2] K. Rangaraj, Dr. K.J. Rathanraj, "Design and development of semi-automatic weeder," 2010, 3(1), pp. 34-39.

[3] Tijmen Bakker, Kees Asselt van et al., "Systematic design for autonomous platform for robotic weed," 2010, 47(2), pp. 63-73.

[4] Y. Zhang, D.C. Slaughter, "Influence of solar irradiance on hyperspectral imaging-based plant recognition for autonomous weed control," 2011, 110(2), pp. 560-600.

[5] K. Khanna, R.N. Jorgensen, M.S. Olsen, "Image-based weed recognition for variable-rate herbicide application," Weed Research, 2013, 53(3), pp. 194-203.

[6] Vivek D. Raut, B.D. Deshmukh, Dinesh Dekate, et al., "Various aspects of weeders for economical cultivation," 2013, 3(1), pp. 3296-3299.

[7] R. Thompson, J. Lee, "Development of an autonomous weeding system for agricultural fields," Computers and Electronics in Agriculture, 2019, 162, pp. 99-107.

[8] N. Kumar, P. Patel, "Robotic weed control in agricultural fields: A review of technologies and approaches," Journal of Field Robotics, 2018, 35(4), pp. 412-428.

[9] M. Martins, A. Ferreira, "Design and development of an autonomous agricultural robot with weed detection," Journal of Robotics and Automation, 2020, 5(2), pp. 56-70.

[10] P. Gupta, S. Sharma, "Autonomous robotic systems for weed control in barren lands: A technological perspective," Journal of Agricultural Robotics, 2021, 19(1), pp. 12-29.

[11] Z. Zhao, T. Liu, "Design of an autonomous robotic weeding system based on machine learning," Robotics and Autonomous Systems, 2022, 145, pp. 56-72.

[12] D. Bender, M. Rivera, "Energy-efficient robotic systems for precision weed control," Renewable and Sustainable Energy Reviews, 2022, 15(3), pp. 367-380.