

AI Powered Solar Based Grass Cutter Machine with Camera Detection

Ms. Jayashri Mitta, Ms. Vaishnavi Khandekar, Ms. Mrudula Jagtap

Ms. Sushruti Dadhe, Prof. Nida N. Shaikh

Department of Electrical Engineering
Brahmdevdada Mane Institute of Technology, Solapur

Abstract: *The proposed project, "AI Powered Solar-Based Grass Cutter Machine with Camera Detection," presents an eco-friendly and efficient grass-cutting system powered by solar energy. The machine uses a solar panel to convert sunlight into electrical energy, which is stored in a rechargeable battery and supplied to the cutting motor. A real-time charging system helps monitor and manage the battery charging process, while the active load mechanism ensures efficient power utilization during operation. The system reduces dependence on conventional fuels and grid electricity, minimizes operating costs, and produces no direct emissions. The proposed grass cutter is designed to be lightweight, easy to operate, and suitable for gardens, lawns, agricultural fields, and other green areas. This project demonstrates the practical application of renewable energy in agricultural and landscaping equipment while promoting sustainable and environmentally friendly technology*

Keywords: *AI Powered Solar-Based*

I. INTRODUCTION

The Solar-Based Real-Time Charging Active Load Grass Cutter Machine is an eco-friendly and energy-efficient agricultural machine designed for cutting grass using solar energy. The system uses a solar panel to convert sunlight into electrical energy, which is used to charge a battery in real time. The stored electrical energy powers a DC motor that operates the grass-cutting blades. This machine reduces dependence on conventional fuels and helps minimize pollution, operating costs, and manual effort. It is particularly useful for maintaining lawns, gardens, farms, and other green areas.

II. PROJECT OVERVIEW

Objective: The Solar-Based Real-Time Charging Active Load Grass Cutter Machine is an autonomous, eco-friendly agricultural and landscaping robot. Unlike traditional battery-operated mowers that require long offline charging cycles, this system utilizes a real-time dynamic charging architecture.

Description: explains the processes of Solar Based Grass Cutter Machine designed to streamline lawn maintenance and agricultural field management. This project overcomes those limitations by integrating a real-time solar charging mechanism with dynamic active load balancing

III. PROBLEM STATEMENT

- **Environmental Pollution and High Carbon Footprint:** Traditional gas-powered grass cutters emit harmful pollutants (CO₂, NO_x) and contribute to noise pollution.
- **Downtime and Inefficient Battery Management:** Standard battery-operated mowers require frequent downtime for offline charging.
- **High Labor Dependency and Operational Hazards:** Manual push-mowers and manually guided machines expose operators to physical exhaustion



- Lack of Smart Monitoring and Precise Navigation: Most conventional grass cutters lack automated path navigation, obstacle detection, and environmental sensing capabilities, leading to uneven trimming, frequent manual collisions, and unmonitored hardware overheating.

IV. PROJECT SCOPE

Here is the comprehensive Project Scope for the Solar-Based Real-Time Charging Active Load Grass Cutter Machine, categorized into key dimensions for academic reports, documentation, and engineering proposals

V. METHODOLOGY

- Design Approach: Here is the structural Design Approach for the Solar-Based Real-Time Charging Active Load Grass Cutter Machine from proper planning for execution .
- Components/Parts Used: Solar panel, ESP.32 com Module, 4 Motors of 100 rpm, L293D motor driver, 12 V battery, ESP WROOM module, DC Motor, Temperature Sensor, Humidity Sensor, Pump, Blades Etc.
- Software Tools: Arduino IDE (v2.x): Primary Integrated Development Environment used to program both the ESP-WROOM and ESP32-CAM microcontrollers in C/C++

VI. WORKING PRINCIPLE

- Power Generation & Storage: The Solar Panel captures sunlight and passes DC power through a Charge Controller to safely charge a 12V Battery, which acts as the power hub for all motors and microcontrollers.
- Vision & Navigation Control: The ESP32-CAM Module processes real-time camera data for line following, object detection, and object tracking. It sends directional signals to the L293D Motor Driver to steer the four 100 RPM DC Motors.
- System Management & IoT: The ESP-WROOM Module serves as the central brain. It collects ambient microclimate data from Temperature and Humidity Sensors, outputs local updates to the 16x2 I2C LCD, and streams telemetry online via IoT.
- Actuator Execution: When commanded by the ESP-WROOM, two separate Relay Modules switch high-power loads on or off—one driving the high-speed 4000–7000 RPM Motor for the cutting Blades, and the other operating the liquid Pump.

VII. EXPECTED OUTCOMES

- Real-Time Environmental & Telemetry Logging
- IoT Wireless Connectivity
- Safe Load Switching
- Noise & Labor Reduction
- Zero Direct Carbon Emissions

VIII. APPLICATIONS

- Landscaping & Residential
- Agricultural & Farming
- Commercial, Sports & Municipal
- Smart Farming & Environmental

IX. FUTURE SCOPE

- Advanced Machine Learning & Edge AI Integration
- Enhanced Navigation & Dynamic Mapping
- Optimized Power & Efficiency Upgrades



- Autonomous Base Station & Mechanical Adjustments

REFERENCES

1. S. Athipatla, B. Kandati, S. Kanipaku and D. Kalluri, "Solar Powered Bluetooth Controlled Grass Cutting Robot," 2023 Third International Conference on Artificial Intelligence and Smart Energy (ICAIS), Coimbatore, India, 2023, pp. 1-7, doi: 10.1109/ICAIS56108.2023.10073789.
2. M. Keote, S. Daware, B. Sathawane, M. Nirvikar, S. Namdeo and S. Kumar, "Design and Development of Smart Grass Cutter Machine," 2025 5th International Conference on Pervasive Computing and Social Networking (ICPCSN), Salem, India, 2025, pp. 1751-1755, doi: 10.1109/ICPCSN65854.2025.11034862.
3. M. R. Habib et al., "PID Controller Based Automatic Solar PowerDriven Grass Cutting Machine," 2019 International Conference on Computer, Communication, Chemical, Materials and Electronic Engineering (IC4ME2), Rajshahi, Bangladesh, 2019, pp. 1-4, doi: 10.1109/IC4ME247184.2019.9036513.
4. J. Vishnupriyan, K. Selvaraj, K. Pradeepa, K. Chidambarathanu, V. Aakash and M. S. Kumar, "Intelligent Solar Powered Autonomous Mower," 2025 International Conference on Knowledge Engineering and Communication Systems (ICKECS), Chickballapur, India, 2025, pp. 1-5, doi: 10.1109/ICKECS65700.2025.11035393.
5. S. A B, S. Shetty, N. P. Shetty, P. S. Chandana, D. Shet and Shreyas, "Multipurpose Solar-Powered Agricultural Robot with ML-based Disease Detection," 2026 International Conference on Electronics and Renewable Systems (ICEARS), Tuticorin, India, 2026, pp. 43-51, doi: 10.1109/ICEARS67481.2026.11416659.

