

“AUTOMATIC GRASS CUTTING AND FERTILIZER SYSTEM USING SOLAR”

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Abstract—This paper is about making a machine that can cut grass and spread fertilizer automatically using solar power. The machine runs on energy collected from a solar panel, so it does not need fuel or electricity from the grid. It moves on its own, cuts the grass evenly, and spreads fertilizer at the same time. Using solar energy makes it eco-friendly and cost-effective, while the automatic operation saves time and reduces the need for manual labour. This system is designed to help keep gardens, lawns, and small farms clean and healthy in an easy and sustainable way.

KEYWORDS: DC water pump, solar panel, two type of wheel, controller drive, cutter, fertilizer tank, charge controller, switch, battery.

INTRODUCTION

The automatic grass cutter and fertilizer system using solar energy is an innovative idea that combines clean energy with smart gardening solutions. In this system, solar panels provide power to run the cutting blades and control unit, which reduces the need for electricity or fuel. The machine not only cuts the grass automatically but also spreads fertilizer on the ground, helping plants grow in a healthy way. By using solar energy, it lowers running costs, saves electricity, and reduces pollution. This type of system is especially useful for parks, gardens, and agricultural fields where regular maintenance is needed. It is an eco-friendly, cost-effective, and time-saving method that supports sustainable living.

LITERATURE REVIEW

A review of past work on solar-powered automatic grass cutters shows a steady shift from simple, manually pushed mowers to compact robots that mow and fertilize with minimal human help. Early studies focused on using a small photovoltaic panel and battery to drive DC motors for the wheels and blade, proving that sunlight can meet the modest power needs of light cutting. Later prototypes added microcontrollers (like Arduino/ESP32), motor drivers, and sensors—ultrasonic or IR for obstacle avoidance, wheel encoders for speed control, and sometimes GPS or boundary wires for area coverage.

Researchers also tested different blades and chassis designs to balance cutting quality with energy use, and explored MPPT or basic charge controllers to protect the battery. On the fertilizing side, many designs use a hopper with a calibrated dispenser (rotary spreader or auger).



(Fig.1. DC Water Pump)

linked to the controller so dosing happens only after a pass is cut. Studies report good energy savings and lower emissions compared to fuel mowers, but also note gaps: uneven fertilizer distribution on slopes, limited runtime in cloudy weather, safety around spinning blades, and higher upfront cost. Recent papers suggest improvements via Li Fe PO₄ batteries, lightweight frames, better spreader calibration, and IoT logging to track coverage and fertilizer usage. [1]



(Fig. 2. Charge Controller)

Early research and simple prototypes showed that small solar panels plus a battery could reliably power the wheels and blade of a light mower. These first attempts proved the idea: sunlight can be stored and used to run motors long

enough for regular trimming in small lawns. The main focus back then was getting a dependable power source and a simple mechanical design that won't break under daily use.



(Fig.3.Solar Panel)

As electronics got cheaper, studies started adding microcontrollers (like Arduino) and basic sensors. These controllers let the machine make decisions — stop when it hits an obstacle, follow a boundary, or return to charge. Papers and projects from that phase compare different sensors (ultrasonic, infrared, bump switches) and show how each affects reliability and cost. The takeaway was that simple sensing plus a good control program gives a useful, low-cost automatic mover [2]



(Fig.4.Switch)

Power management became a big theme. Researchers compared battery types (lead-acid, NiMH, lithium variants) and battery-management techniques. Many designs included a charge controller or simple Maximum Power Point Tracking (MPPT) to get the most energy from panels. Studies repeatedly found that energy efficiency — from lighter frames to efficient motors — makes the system far more practical, especially on cloudy days or for larger areas.



(Fig.5.Fertilizer Tank)

For the fertilizing function, literature covers a few common approaches: a hopper with a calibrated outlet, a small auger, or a rotary spreader attached to the chassis. Most projects tie fertilizer release to the controller so it dispenses only during active passes, which saves material. Researchers test spreader calibration, particle size effects, and how terrain (slope, bumps) changes distribution. Many papers note that achieving uniform spread remains a technical challenge. Integration and path coverage are also well-covered. Some teams used simple random-bounce patterns (like early robot vacuums), while others implemented coverage algorithms, boundary wires, or GPS guidance for more predictable results. Studies that compared coverage methods show trade-offs: random patterns are cheap and robust, while guided patterns (GPS, SLAM) give better uniformity but cost more and need more complex software. [3]



(Fig.6. Battery)

Field tests and user studies often emphasize benefits and current limits. Solar-powered systems reduce fuel use and emissions and lower ongoing energy bills, but users worry about cutting power in bad weather, initial cost, and safety around blades. Researchers respond with hybrid designs (solar plus grid or small generator), safety cut offs, and modular components that are easier to maintain.



(Fig.7.Cutter)

Recent directions in the literature point toward smarter, lighter, and more connected machines: better batteries (longer life, lighter weight), improved fertilizer metering, IoT telemetry for monitoring and scheduling, and machine-learning methods to recognize grass height or obstacles. There's also growing interest in standardizing safety features and proving reliability in long-term trials, since many academic prototypes don't transition smoothly to mass production. [4]



(Fig.8.Controller Drive)

In short, the literature maps a clear path: validate solar power for mowing, add simple control and sensing for autonomy, solve power and spreader accuracy issues, and then refine for cost, safety, and scalability. The core open problems researchers still write about are consistent fertilizer distribution, dependable operation in variable weather, and making the systems affordable for wide adoption.[5]

METHODOLOGY

The working of the automatic grass cutter and fertilizer using solar begins with a solar panel that captures sunlight and charges a rechargeable battery. This stored energy is used to run the motors that move the machine and rotate the cutting blade. A microcontroller acts as the brain of the system, receiving input from sensors to detect obstacles or boundaries so the machine can change its path safely. The grass is cut automatically as the machine moves forward. At the same time, a small fertilizer container with a controlled outlet is connected to the system, which spreads fertilizer evenly on the ground after cutting. The combination of solar power, smart control, and automatic spreading makes the system energy-efficient, eco-friendly, and less dependent on man

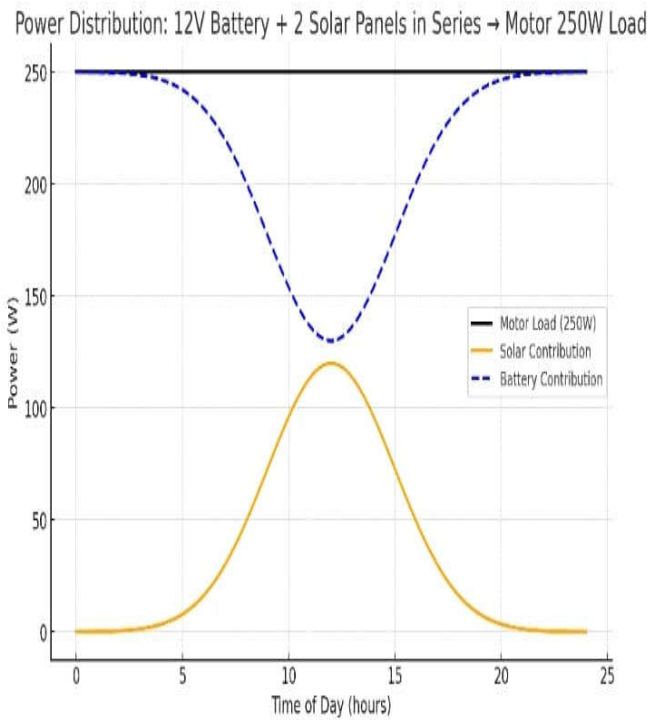
RESULT

The result of the automatic grass cutter and fertilizer using solar showed that the system can successfully cut grass and spread fertilizer without much human effort. The solar panel was able to provide enough energy to run the motors and blade for regular lawn or field use, which reduced the need for electricity or fuel. The sensors helped the machine avoid obstacles, making it safer and more reliable. The fertilizer container worked effectively, releasing fertilizer in a controlled way while the grass was being cut. Overall, the machine reduced time, saved energy costs, and proved to be eco-friendly since it ran completely on renewable solar power. The outcome also highlighted that such a system can be useful for small farms, gardens, and public parks, where regular maintenance is needed but manual labor is time-consuming and expensive.

ANALYSIS AND DISCUSSION

The analysis of the automatic grass cutter and fertilizer using solar shows that combining solar energy with automation can make grass maintenance easier, cheaper, and more sustainable. The solar panel and battery system provided enough power for cutting and movement, which proved that renewable energy can replace fuel-based machines for small- to medium-sized areas. The use of sensors made the system smarter by preventing collisions and ensuring smoother operation. The fertilizer spreading mechanism worked in a simple but effective way, though some tests showed that distribution could be uneven on rough or sloped ground. From discussion, it is clear that this design saves labor, reduces electricity or fuel cost, and lowers pollution compared to traditional machines. However, factors like cloudy weather, battery capacity, and the durability of blades need improvement for long-term use. Overall, the project demonstrates that a solar-powered automatic grass cutter with fertilizer attachment is practical, eco-friendly, and has potential for wider use with further refinements.

CONCLUSION



The automatic grass cutter and fertilizer using solar is a smart and eco-friendly solution for maintaining lawns, gardens, and small fields. It works by using solar energy to power the cutting blade and movement, which reduces dependency on fuel and electricity. The system not only cuts grass but also spreads fertilizer at the same time, saving both time and effort. With the help of sensors and a control unit, it can work with less human involvement and ensure safety while operating. The project shows that such a machine can reduce costs, support clean energy use, and make land maintenance more efficient. Although

improvements are still needed for battery life, fertilizer spreading accuracy, and performance in cloudy weather, the system has strong potential for practical use in everyday life.

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