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INTEGRATION OF WEED DETECTION TECHNOLOGY INTO A SOLAR POWERED GRASS CUTTER

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ABSTRACT

The integration of weed detection technology into a solar-powered grass cutter presents an innovative solution for sustainable lawn maintenance by enabling precise and efficient weed management. The weed detection system, which empowers the grass cutter to identify and selectively target weeds while mowing the lawn. By combining high-resolution cameras, computer vision algorithms, real-time monitoring, and data analysis, the solar-powered grass cutter optimizes weed control strategies, reduces chemical usage, and promotes environmentally-friendly practices. This technology allows the grass cutter to find and remove weeds while avoiding harm to the plants we want to keep. This has a number of advantages over traditional methods of lawn care. First, it is much more efficient. Weed detection technology can identify weeds with a high degree of accuracy, meaning that only the weeds need to be removed,saving time and effort. Second, it is more environmentally friendly. We will explain how it works and its benefits.

Keywords—WeedDetection,ImageProcessingc,ComputerVision,MachineLearning,GPSNavigation,SmartLawnCare

1. INTRODUCTION

Lawns often have unwanted weeds, and using chemicals to control them can harm desirable plants and the environment. We propose a solution using weed detection technology in a solar-powered grass cutter. This will help us manage weeds in a more sustainable way. Let's discuss how the system works. Weed detection technology is a rapidly developing field, with new advances stuff made all the time. One of the most promising applications of this technology is in the field of lawn care. By integrating weed detection technology into solar-powered grass cutters, it is possible to create machines that can automatically snift and remove weeds, while leaving the surrounding grass unharmed.This has a number of advantages over traditional methods of lawn care. First, it is much increasingly efficient. Weed detection technology can identify weeds with a upper stratum of accuracy, meaning that only the weeds need to be removed, saving time and effort. Second, it is increasingly environmentally friendly. Solar-powered grass cutters do not produce emissions, and they can be used in areas where traditional lawn superintendency equipment is prohibited. Third, it is increasingly effective. Weed detection technology can identify and remove weeds at a much older stage, preventing them from spreading and causing forfeiture to the lawn.The integration of weed detection technology into solar-powered grass cutters is still in its early stages, but it has the potential to revolutionize the way lawns are cared for. With remoter development, these machines could wilt the standard for lawn superintendency in the future.The integration of weed detection technology into a solar-powered grass cutter is a promising minutiae that has the potential to revolutionize the way lawns are cared for. With remoter development, these machines could wilt the standard for lawn superintendency in the future.

The first lawn mover was invented by Edwin Budding in 1830 in Thrupp just outside Stroud, in Gloucestershire,England. Budding’s mower was designed primarily to cut the grass on sports grounds and wide-stretching gardens, as a superior alternative to the scythe, and was granted a British patent on August 31, 1830. In 1995, the first fully solar powered robotic mower became available.The mower can find its charging station via radio frequency emissions, by pursuit a purlieus wire or by pursuit an optional guide wire. This can eliminate wear patterns in the lawn caused by the mower only stuff wordly-wise to follow one wire when to the station.A robotic lawn mower is an voluntary robot used to cut lawn grass.A typical robotic lawn mower requires the user to set up a border wire virtually the lawn that defines the zone to be moved.The robot uses this wire to locate the purlieus of the zone to be trimmed and in some cases to locate a recharging dock.Robotic mowers are capable of maintaining up to 20,000

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m2(220,000sqft) of grass. Automated solar grass cutter are increasingly sophisticated, are self-docking and some contain rain sensors if necessary,nearly eliminating human interaction.Robotic Lawn mowers represented the second largest category of domestic robots used by the end of 200Possibly the first commercial robotic lawn mower was the MowBot, introduced and patented in 1969 and already showing many features of today's most popular products.In 2012, the growth of robotic lawn mover sales was 15 times that of the traditional styles. With the emergence of smart phones some robotic mowers have integrated features within custom apps to adjust settings or scheduled moving times and frequency, as well as manually the mower with a digital.

2. BLOCK DIAGRAM

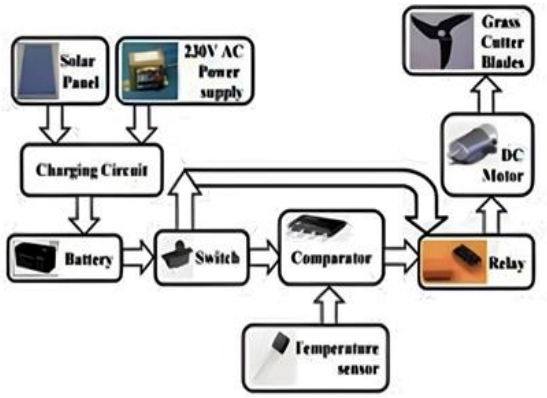

Fig.1. Block Diagram of Solar powered grass cutter

The designed model's block outline is shown in Fig1. Rapid growth of various high-tech tools and equipments makes our jobs done comfortable and sophisticated. The project aims at fabricating a grass cutting machine system which makes the grass cutter based motor running through solar energy. Power plays a great role wherever man lives and works. The living standard and prosperity of a nation vary directly with the increase in the use of power. The electricity requirement of the world is increasing at an alarming rate due to industrial growth, increased and extensive use of electrical gadgets. The best alternative source is solar energy.Weed cutter machines now days have become very user friendly.The main components of the Grass cutting machinesare DC motor, relay switch for controlling motor, Battery for charging it through solar panel. It is placed in a suitable machine structure. The DC motors are connected to the electric supply by the use of a roll of wire. The linear bladesare attached in this machine. Working principle of this robot cutter is providing a high speed rotation to the blade, which helps to cut the grass. The blade will get kinetic energy while increasing the rpm. The cutting edges are very smooth and accurate.

3. LIST OF COMPONENTS AND OVERVIEW

The list of elements that are required to develop integration of weed detection technology into a solar powered grass cutter as shown in the below table[I].

TABLE 1. List Of Elements that are Required

Component	Specification	Quantity
Solar Panel	6X10	1
DC Battery	230V/9V,50Hz	1
Controller	12V	1
Cutter Blade	10,000RPM, 1.5A	4
Camera Sensors	16MP	2
Computer Vision	-	1
Image Processor	-	1
GPS Tracker	-	1
Motors	1.5-1.7A	5
Weed Recogniser	-	1
Autonomous Navigation	-	1

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Some of the main components required are Solar anel, DCBattery CamerSensors, WeedRecogniser, CutterBlade, Image Processor and Controller. We will discuss briefly about the each and every component that is listed in the above table[I].

A. Solar Panel:

It is a photovoltaic (PV) module is a packaged; connect assembly of typically 6x10 photovoltaic solar cells. Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications.

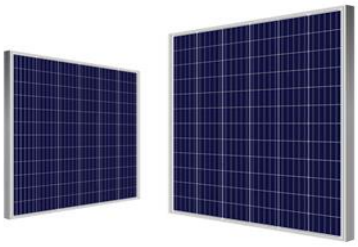

Fig.2. Solar Panel

B. DC Battery:

Solar power can be stored in the rechargeable battery and can be further used for the grass cutting machine to run. A rechargeable battery, storage battery, or accumulator is a type of electrical battery.It consists of one or more electrochemical cells, and is a type of energy accumulator,

Fig.3.DC Battery

C. Camera Sensors:

The solar-powered grass cutter is equipped with high-resolution cameras that take real-time pictures of the lawn while mowing. These cameras are important because they help identify and detect weeds on the lawn.The first step for a sensor is the conversion of photons of light into electrons (known as photoelectrons). The efficiency of this conversion is known as the quantum efficiency (QE) and is shown as a percentage.All the sensor types discussed here operate based on the fact that all electrons have a negative charge (the electron symbol being e–).

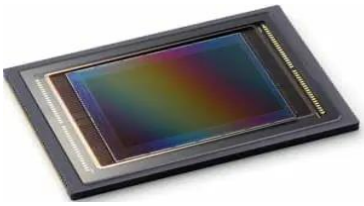

Fig.4.Camera Sensor

D. Weed Recogniser:

The computer vision system on the grass cutter can accurately find weeds in the lawn. It creates a weed map that shows where the weeds are located and how much they have spread.

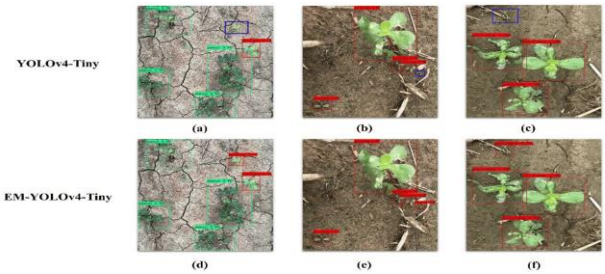

Fig. 5. Weed Recognition System

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E. Cutter Blade:

A Solar grass cutter is a machine that uses sliding blades to cut a lawn at an plane length. Plane increasingly sophisticated devices are there in every field. Power consumption becomes essential for future. Solar grass cutter is a very useful device which is very simple in construction. It is used to maintain and upkeep lawns in gardens, schools, college's etc. We have made some changes in the existing machine to make its using easier at reduced cost. Our main aim in pollution tenancy is attained through this. Unskilled operation can operate hands and maintain the lawn very fine and uniform surface look. In our project,-Solar grass cutter‖ is used to cut the variegated grasses for the variegated application.

Fig.6. Cutter Blade

F. Controller:

A DC motor is a mechanically commutated electric motorpowered from uncontrived current (DC). The stator is stationary in space by definition and therefore so is its current. The current in the rotor is switched by the commentator to moreover be stationary in space. This is how the relative wile between the stator and rotor magnetic.The motor used for the executive the cuter, the permanent dc motor with 12 v is used having the speed 2000rpm.this single phase motor work on the Fleming hand rule and generate electric current and this electric current converted to mechanical work like to rotate the stipule and cut the brush.

Fig.7. Controller

Solar Charge Controller is an electronic device that manages the power going into the shower wall from the solar array. It ensures that the deep trundling batteries are not overcharged during the day and that the power doesn't run when to the solar panels overnight and phlebotomize the batteries. Some tuition controllers are misogynist with spare capabilities, like lighting and load control, but managing the power is its primary job.

Fig.8. Solar Grass Cutter

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4. WEED DETECTION SYSTEM:

4.1 Camera Sensors:

The solar-powered grass cutter is equipped with high-resolution cameras that take real-time pictures of the lawn while mowing. These cameras are important because they help identify and detect weeds on the lawn.

4.2 Computer Vision and Image Processing:

The grass cutter has a smart computer onboard, which uses advanced computer vision algorithms. These algorithms analyse the pictures taken by the cameras using deep learning techniques. Their purpose is to distinguish between weeds and grass by examining their visual features.

Fig.9. Computer Vision and Image Processing

4.3 Weed Recognition and Mapping:

The computer vision system on the grass cutter can accurately find weeds in the lawn. It creates a weed map that shows where the weeds are located and how much they have spread.

5. NAVIGATION AND PRECISION WEED REMOVAL:

5.1 Autonomous Navigation:

The solar-powered grass cutter is designed with GPS and LiDAR sensors, which allow it to move on its own across the lawn. It follows a pre-set mowing pattern without needing human presence.

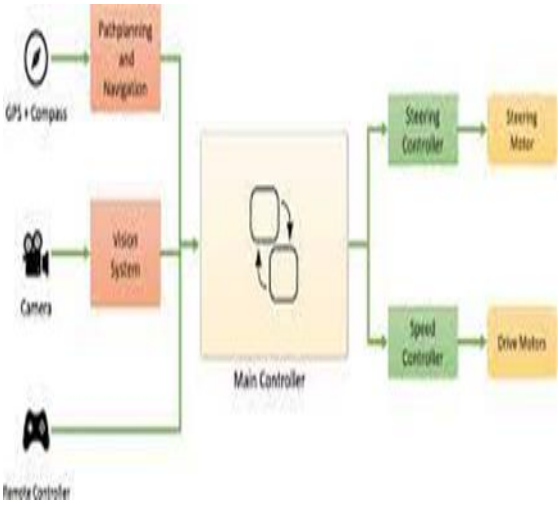

Fig.10. Autonomous Navigation

5.2 Selective Weed Removal:

When the grass cutter finds and identifies weeds on the lawn, it can move by itself to those areas. It uses robotic arms or special tools to specifically target and remove the weeds without causing any harm to the desired plants nearby. This way, it takes care of the weed problem while protecting the rest of the garden.

6. REAL-TIME MONITORING AND DATA COLLECTION:

While the grass cutter is working on the lawn, the weed detection system keeps a close eye on the area. It constantly watches for any new weeds that may appear and instantly updates the weed map with this information. Moreover, the grass cutter gathers data about how many weeds there are, where they are located, and the different types of weeds present. This data is stored for later analysis and study.

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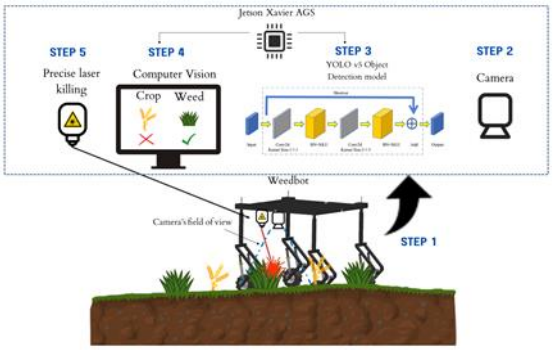

Fig.11. Real Time monitoring and data collection

Data Analysis And Optimization

The information collected by the solar-powered grass cutter is carefully studied to find better ways to handle weeds. By analysing this data, the weed detection system becomes more precise, helping it to spot weeds even more accurately. The data also helps in planning better paths for the grass cutter to move around the lawn. Overall, this analysis improves the effectiveness of weed control, making the whole process of managing weeds much more efficient.

7. CIRCUIT DIAGRAM AND ITS OPERATION

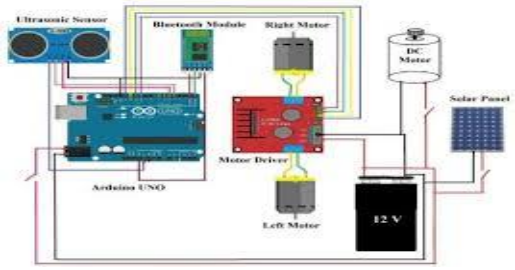

Fig.12. Basic circuit diagram of Solar Grass Cutter

Aurdino contains Micro controller required 5V DC Supply for operation, we used ISB +5V Power from PC or External +5V power supply via CN10.External Power and USB power cable be selectable via J1.There is need of 12V external Power supply for relay's and its driver circuits.

Operation:

A grass cutter that runs on solar power and has a weed detection system is a smart and eco-friendly way to take care of lawns and gardens. It uses sunlight to operate the device and can find and get rid of weeds that are not wanted. Here's how it works in basic terms: The grass cutter moves around using solar energy, and it has a special system that can spot and remove weeds from the lawn or garden.

Fig.13. Solar Grass Cutter

Solar Power Generation:

The grass cutter has solar panels that catch sunlight and turn it into electricity. This electricity is kept in batteries, which then power the grass cutter and its electronic parts.

Electric Motor and Cutting Blades:

The grass cutter has a motor that makes the cutting blades move. This motor gets its power from the stored solar energy in the batteries. The cutting blades can be designed in different ways, like rotating blades or a spinning string trimmer, depending on how the grass cutter is made.

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Weed Removal Mechanism:

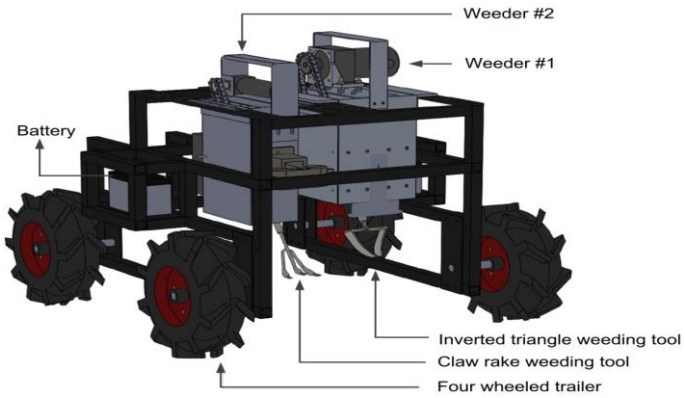

Fig.14. Weed Removal Mechanism

Once the weed detection system finds weeds in the area, the grass cutter's control system turns on the weed removal process. The way it removes the weeds can be different depending on how the grass cutter is made. But may include options like:

a. Precision Cutting:

The grass cutter can change its cutting height or blade setup to specifically target and remove the weeds without affecting the rest of the grass.

b. Manual Override:

Sometimes, the grass cutter may notify the user when it detects a weed. Then, the user can choose to either guide the cutter manually to remove the weed or let the automated system handle it.

c. Herbicide Spray:

In some cases, the grass cutter might have a small system to spray herbicides on the detected weeds. This system is designed to focus only on the weeds. However, this approach needs to be handled carefully to make sure it doesn't harm the environment or other plants that are not weeds.

Fig.15.Herbicide Spray

Continuous Operation:

The grass cutter moves in an organized way all over the lawn or garden. It keeps looking for weeds and cuts the grass whenever necessary. While it's working, the solar panels are always charging the batteries, so the grass cutter can keep running for a long time without stopping.

Safety Features:

The grass cutter should have safety features like sensors to detect obstacles and avoid hitting objects or people while it's moving. This helps prevent accidents and keeps everyone safe during its operation.

Solar-powered grass cutters with weed detection systems are a green and self-sufficient way to take care of outdoor areas. They reduce the need for manual work and decrease the use of fossil fuels, which is good for the environment. However, it's crucial to make sure the weed detection system works well and that the weed removal process is efficient and precise. This ensures that the desired plants stay healthy, and it helps to protect the environment for the long term.

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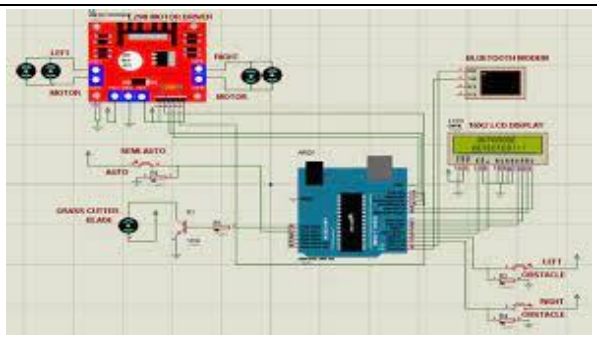

Fig.16. Schematic diagram of solar grass cutter

The solar-powered grass cutter constantly watches the lawn and gives immediate updates on any weed infestations it detects. This helps in taking quick action to deal with the weeds as soon as they are spotted.

8. RESULT AND DISCUSSIONS

Humans have the tendency unchangingly trying to develop more modified techniques with increasing the aesthetical squint and economic concern. Therefore, there is an increasing scope towards resurgence and urging in whatever we have created. The robot weed cutter has various applications and future advancements can be done. Some of the future perspectives to reform this robot are mentioned below:

1) The weight of the robot can be reduced by using light weight material for the stand the cutter turnout and the product can be modified.

2) Upper quality stipule cutter with upper mechanical strength can make it workable in threshing sector like tree cutting, shrubs cutting, cane cutting, maize wearing etc.

3) Can be totally run on solar power in view of energy conservation.

4) The welding for the folding of stand can be washed-up for transportation point of view.

5) Benefits of Using Weed Detection Technology in a Solar-Powered Grass Cutter:

Fig.17. Benefit of Solar grass cutter

8.1 Precision Weed Control:

By using weed detection technology, the grass cutter can specifically target and remove weeds. This helps protect the plants you want to keep and makes your lawn healthier overall.

8.2 Reduced Chemical Usage:

By selectively removing weeds, the need for using herbicides is reduced. This, in turn, helps decrease environmental contamination, making it better for the environment.

8.3 Sustainable Lawn Maintenance:

Using solar power for lawn maintenance helps to make it more sustainable. It reduces the release of greenhouse gases and lessens our reliance on fossil fuels, making it better for the environment.

8.4 Time and Labour Savings:

The grass cutter works by itself, and with the help of weed detection technology, it can take care of weed management tasks without needing much human involvement. This saves a lot of time and effort that would otherwise be required for managing weeds manually.

8.5 Real-Time Weed Management:

The solar-powered grass cutter constantly watches the lawn and gives immediate updates on any weed infestations it detects. This helps in taking quick action to deal with the weeds as soon as they are spotted.

9. CONCLUSIONS

By adding weed detection technology to a solar-powered grass cutter, we get an effective and environmentally friendly way of managing weeds. The grass cutter uses advanced cameras, smart algorithms, and real-time monitoring to accurately control weeds. This technology represents a big step towards greener lawn maintenance, making the environment healthier and your landscape more beautiful. Solar powered weed wearing robot is urging and can be efficiently used for agricultural purpose. Robot weed cutter is a forfeit friendly robot that reduces man labour, no fuel cost, no pollution, no fuel residue, less wear and tear because of less number of moving components and this can be operated by using solar energy.

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10. REFERENCES

[1] P. Amrutesh Int Journal of Engineering Research and Applications ISSN:22489622, Vol 4,Issue 9(Version 3),September 2014.

[2] Non-Conventional Energy sources by G. D. RAI, [Khanna Publishers]

[3] Tao Liu, Bin Zhang, Jixing Jia Electromagnetic navigation system design of the green, house spraying robot IEEE (2014).

[4] K. Prema, N Senthil Kumar, S S Dash, Sudhakar Chowdary, Online Control of remote operated agricultural Robot using Fuzzy Processor and Virtual Instru-mentation IEEE (2012).

[5] Self-Efficient and Sustainable Solar Powered Robotic Lawn Mower, International Journal of Trend in Research and Development, Volume2(6), ISSN:2394-9333 http://www.ijtrd.com.

[6] Robert Zondlo, U.S. Patent 5,461,292, Remote controlled Guidance system for working vehicle, October 24,1995.