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AUTONOMOUS ROBOT FOR GRASS CUTTER FOR LAWN MAINTENANCE

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Abstract: - In earlier days cutting or mowing a grass needs a lot of time and effort. Invention of new variety of mowing machines made the work much easier than before but even then, it is a time taking process and needs supervision. The small lawns of houses can be mowed by people by themselves but the bigger lawn need labor, in either situation the work requires time, effort or money. The solution to this problem is Automatic Lawn Mower. It saves our time, effort and labor cost. This machine is controlled by Arduino which takes feedback from some sensors and controls the movement and mowing process. The completely computerized solar based grass cutter is utilized for cutting the grass at various dimensions with no human intervention. The grass cutter is likewise equipped for evading any deterrents. The framework utilizes 12V batteries to control the vehicle motors along with the motor of the grass cutter. We also use a solar panel to charge the battery so that there is no need of charging it externally. The grass cutter and vehicle motors are interfaced to the ATMEGA family microcontroller that controls the working of the all the motors.

A standout amongst the most problems that are begging to be addressed with before renditions of grass cutting machines is that they were not robotized and constantly required the human support. This framework is utilized to conquer every one of the downsides of past frameworks like cutting grass on factor statures and not withstanding cutting on inclines and subsequently gives a full verification grass cutting vehicle.

Keywords: Arduino UNO, L293D, Framework, factor, ATMEGA family.

I. INTRODUCTION

A lawn mower is a machine that uses one or more revolving blades to cut a lawn to an even height. The blades may be powered either by hand; pushing the mower forward to operate the mechanical blade(s), or may have an electric motor or an internal combustion engine to spin their blades. There are several types of mowers, each suited to a particular scale and

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purpose. The smallest types are pushed by a human user and are suitable for small residential lawns and gardens. Riding mowers are larger than push mowers and are suitable for large lawns. The largest multi-gang mowers are mounted to tractors and are designed for large expanses of grass such as golf courses and municipal parks. But with advance muntin technology and things being converted to mobile and automatic these days, transition from traditional hand-guided or ride-on mowers to automatic electric mowers is beginning to take place. In 2012, the growth of robotic lawn mower sales was 15 times that of the traditional styles. It is predicted that if this growth continues at this rate, automatic lawn mowers may even surpass the sales of traditional lawn mowers in some places.

Automatic lawn mower is a machine that cut grass automatically. It can be stated as a machine or robot that helps people to do cutting grass work. The automatic lawn mower will do the cutting grass task with a preset setting by the user. Unlike other robotic lawn mowers on the market, this design requires no perimeter wires to maintain the robot within the lawn. Through an array of sensors, this robot will not only stay on the lawn, it will avoid and detect objects and humans. The concept of lawn mower started during the 19th century whereby the design of grass cutter pulls by an animal such as cow or buffalo. This animal will pull the grass cutter and the grass cutter will does its work cutting the grass along the way the animal walk. Due to animal cannot work for a very long period, human start to reduce the usage of animal and building a machine. So various types of lawn mower have been built over the course of time. Mostly theses have been manually operated but corresponding to the advancing of technology, latest lawn mowers work automatically. Sensor such as rain sensor, light sensor, ultrasonic sensor and infrared sensor has widely been used nowadays to enable the lawn mower to be more intelligent and work efficiently. Automated lawn mowers have been made available to the general public for over30 years but its widespread or public use on the other hand has been limited mainly Due to the current costs of such devices. Existing technology sell at around £899(INR 70000) or more (Lawn Mower Reviews, 2011) and considering the fact that the manual versions of these devices, the standard lawn mowers, sell at around £86(INR 5000) (Lawn Mower Reviews, 2011). Although the cost of labor would need to be added to that of the equipment, the latter is still a current viable and affordable option for most consumers will benefit from. The reason for robotic lawn mowers is an interesting area of research and work because there are numerous real-world benefits of having a machine that autonomously cuts grass, these include:

- ✓ Aid elderly users or those with disabilities who are unable to fulfill this task themselves.
- ✓ For users with a busy schedule and rarely find time to mow, etc.

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- ✓ Working range is increased due to absence of main supply wires.
- ✓ It reduces human effort. It is a device that can fit into just about everyone's lifestyle, therefore having a device that costs less, whilst accomplishing the same task as the higher end models is a great advantage in order to compete with the current market.

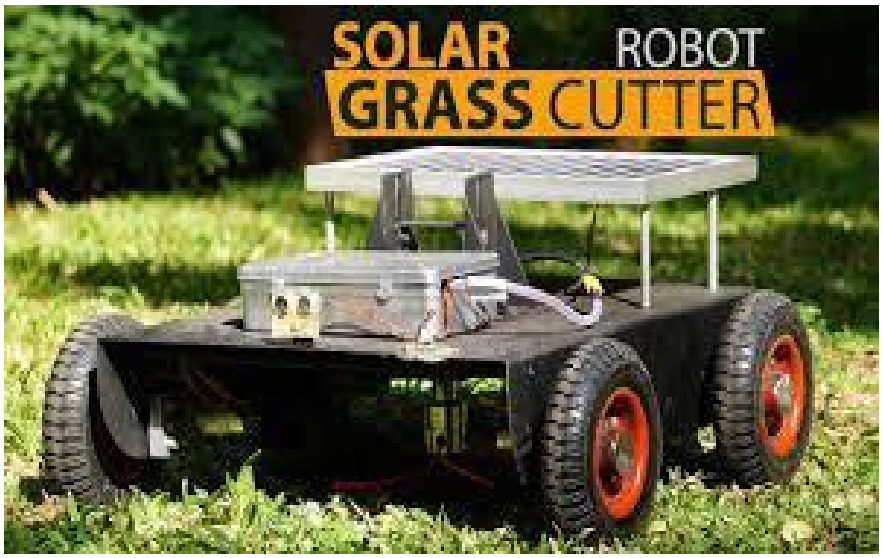

Fig 1 Grass Cutter Overview

II. RELATED WORK

1. Voice Controlled IoT Based Grass Cutter Powered by Solar Energy.

Voice-controlled IoT-based grass cutters powered by solar energy are gaining popularity in the international market. Conventional grass cutting machines typically rely on internal combustion engines, which contribute to increased pollution levels. This work aims to reduce the use of non-renewable resources and develop an eco-friendly automated grass cutter powered by solar energy. By reducing the amount of human effort required to cut grass, this technology promises to make grass cutting more efficient and sustainable.

2. DESIGN AND IMPLEMENTATION OF SOLAR GRASS CUTTER.

The design and implementation of a solar grass cutter aims to address the inefficiencies of manually operated grass cutting devices that contribute to pollution and energy loss. By utilizing solar power, the automatic solar grass cutter can effectively reduce the effort required to cut grass in lawns. The technology also incorporates various sensors to detect and avoid obstacles during operation, resulting in a pollution-free and electricity-saving approach. The use of solar energy as a renewable source of energy is a significant advantage that reduces human efforts in grass cutting activities.

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3. Solar Powered Automated Lawn Mower.

The solar-powered automated lawn mower project aims to develop a grass cutting machine system that runs on solar energy. The rising cost of fuel and the negative impact of fuel emissions on the environment have made it necessary to explore alternative energy sources. By utilizing the abundant solar energy from the Sun as a source of power, the project aims to reduce the negative impact of fuel emissions on the environment while providing an efficient way to cut grass.

4. Lawn Mower–An Automated Machine.

The lawn mower, also known as a lawn cutter, is a mechanical device designed to cut grass in lawns. With advancements in robotics, automated lawn mowers have been developed to perform the same task automatically using different sensors and electrical components. These machines offer an efficient and convenient way to maintain the appearance of lawns without requiring manual effort.

5. Optimal Path Planning of Lawn Mower Based on Trajectory Tracking Control in Civil Aviation Airport.

This paper describes the design of a large intelligent mowing robot that utilizes mobile robot technology and real-time kinematic global positioning systems. To achieve its intended application, path planning and trajectory tracking control are essential. Firstly, the paper outlines the functions of each subsystem and establishes the robot's kinematic model using Ackerman model. Secondly, the paper proposes a round-trip straight path planning and trajectory tracking control algorithm based on GPS information in the polygon working area. This approach enables the robot to efficiently navigate and mow the designated area.

III. RESEARCH METHODOLOGY

A battery, an ARDUINO microcontroller, a motor driver, dc motors solar power grass cutting robots is an ongoing process, with numerous companies and research institutions working to improve the technology and capabilities of these machines.one area of research is focused on improving the efficiency of the cutting mechanism. Researchers are exploring various cutting technologies, such as multi-blade cutting systems, to improve the precision and effectiveness of grass cutting. Additionally, they are experimenting with different cutting heights and patterns to optimize the performance of the machine. Another area of research is focused on

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improving the autonomous navigation and obstacle avoidance capabilities of the machine. Researchers are developing advanced sensors and mapping software that allow the robot to navigate through complex terrains and avoid obstacles in real-time. This will allow the machine to operate more efficiently and effectively, reducing the need for manual intervention. Energy storage is another area of research, with companies exploring various battery technologies to improve the power storage and management capabilities of the machine. This will allow the robot to operate for longer periods without requiring recharging, and will help to ensure that the machine is always operating at optimal performance levels. another area of focus is on improving the overall durability and reliability of the machine. Researchers are exploring new materials and manufacturing techniques to create machines that are more robust and resistant to wear and tear. This will help to extend the lifespan of the machine, reducing the need for frequent maintenance and replacement. research and development on solar power grass cutting robots is an ongoing process, with numerous companies and research institutions working to improve the technology and capabilities of these machines.

This includes improving the cutting mechanism, autonomous navigation and obstacle avoidance, energy storage, durability and reliability, and incorporating artificial intelligence and machine learning. As this technology continues to evolve and improve, we can expect to see even more sophisticated and intelligent lawn care machines that offer a sustainable and efficient solution to the challenges of lawn maintenance. Finally, there is research being conducted on the use of artificial intelligence and machine learning to improve the overall performance and efficiency of the machine. This includes developing algorithms that optimize the cutting patterns and navigation routes of the machine, as well as improving the accuracy of obstacle detection and avoidance.

Data Collection and Preprocessing

These are crucial steps in the development of solar power grass cutting robots. These steps involve gathering and preparing data from various sources to ensure that the machine can operate efficiently and effectively. Data Collection:

- One of the primary sources of data for these robots is environmental data, such as temperature, humidity, and sunlight intensity. This data can be collected using sensors installed on the machine or through weather data APIs.
- Another important source of data is terrain data. This includes information on the slope, terrain roughness, and obstacles in the area where

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the robot will operate. This data can be collected through surveys or using mapping technologies such as LIDAR or GPS.

- Additionally, the machine will require information on the specific grass cutting requirements, such as the desired height, cutting pattern, and frequency of mowing. This information can be gathered through surveys or consultation with lawn care experts.

Data Preprocessing:

- Once the data has been collected, it must be preprocessed to ensure that it is accurate and usable by the machine. This involves several steps, including cleaning, normalization, and feature engineering.
- Cleaning involves removing any outliers, missing data, or irrelevant information from the dataset. This ensures that the data is accurate and reliable.
- Normalization involves scaling the data to a common range or format, which makes it easier to compare and analyze.
- Feature engineering involves selecting the most relevant features or variables from the dataset and creating new features that may be useful for the machine.

For example, the machine may require information on the distance to obstacles or the slope of the terrain, which can be calculated using the raw data collected.

Statistical tools and econometric models

It can be used to analyze the relationship between various input factors such as weather conditions, grass height, and cutting patterns, and the output factor of grass cutting efficiency. This can help identify which factors have the most significant impact on the performance of the machine and can be used to optimize its operation. Another statistical tool is time series analysis, which can be used to identify trends and patterns in the data over time. This can be useful in predicting future trends in grass growth and weather patterns, which can be used to optimize the scheduling of the machine's operation Econometric models can also be used to evaluate the cost-effectiveness of solar power grass cutting robots compared to traditional lawn care methods. This involves analyzing the costs and benefits of using the machine, including initial investment, maintenance, and operational costs, and comparing it to the costs of traditional lawn care methods such as manual mowing or gas-powered mowers. This analysis can help determine the potential economic benefits of using the machine and identify ways to optimize its cost-effectiveness. In addition, simulation models can be used to

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evaluate the performance of the machine in various scenarios and optimize its operation.

These models can simulate various environmental conditions, cutting patterns, and obstacle avoidance scenarios to determine the optimal settings for the machine. Overall, statistical tools and econometric models can be valuable in analyzing and optimizing the performance and cost-effectiveness of solar power grass cutting robots. By using these tools, researchers and developers can identify ways to improve the efficiency and effectiveness of the machine and create a more sustainable solution to the challenges of lawn maintenance.

IV. RESULTS AND DISCUSSION

Testing and Evaluation

Solar powered grass cutter robot project that uses Arduino. However, in general, a solar powered grass cutter robot using Arduino would likely use a combination of solar panels to generate power, an Arduino board to control the robot's movements and cutting mechanisms, and sensors to detect obstacles and ensure the robot stays within a designated cutting area. The performance of such a project would depend on a variety of factors, including the quality of the materials used, the programming of the Arduino board, and the efficiency of the solar panels. Additionally, the size and complexity of the cutting area, as well as the type of grass or vegetation being cut, could also impact the robot's performance. Overall, a well-designed and properly executed solar powered grass cutter robot project using Arduino could potentially provide a sustainable and efficient alternative to traditional lawn care methods. However, as with any engineering project, there may be challenges and limitations to consider, such as the cost of materials and the technical expertise required to build and program the robot.

Fig 2 Solar based grass cutter running photo

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V. CONCLUSION

Robotics is a quickly developing field which can utilize the innovation to lessen the human work. This grass Cutter will address the difficulty of minimal effort of activity since there is no expense for fuel. The machine is a conceivable swap for the fuel-controlled grass cutters. The principle point of this project is to make a solar powered mechanical grass trimmer framework which will trim the garden in various patterns with lesser human exertion. Advantage of this framework is, utilized parts are of minimal effort and a couple of more sensors can be added to make the framework progressively productive.

FUTURE SCOPE

- Size can be reduced to make it compact.
- Efficiency can be improved by increasing the battery capacity.
- More sensors can be incorporated for accurate results and improved automation.
- Programming can be enhanced to make the device perform different operations

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