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DESIGN AND FABRICATION OF SELF-SUSTAINABLE LAWNMOWER WITH ADAPTIVE ATTACHMENT

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Abstract:

The rising costs of fuel and the environmental impact of gas emissions have prompted a shift toward renewable energy solutions in everyday applications. This project focuses on the design and fabrication of a solar-powered lawn mower, specifically engineered to address the needs of diverse user groups, including the elderly, children, and individuals with disabilities, who often face challenges in traditional lawn maintenance.

The conventional fuel-powered lawn mowers not only contribute to noise pollution but also result in local air pollution due to engine combustion. In contrast, electric mowers offer an eco-friendlier alternative. However, this project takes sustainability a step further by harnessing the abundant solar energy available.

The solar-powered lawn mower is designed around fundamental mowing principles and includes several key components such as Direct Current (D.C.) Motor, Rechargeable Battery, Solar Panel, Stainless Nylon wire (CUTTER), Control Panel (Arduino Board), Grass Collecting Chamber, Paint Marking Attachment.

The development process involves research, prototyping, and testing to optimize performance and user experience. By combining solar power with adaptive technology, this project not only offers a sustainable solution for lawn care but also enhances accessibility and usability for all individuals. Ultimately, the solar-powered lawn mower aims to reduce environmental impact while providing a practical and efficient tool for maintaining outdoor spaces.

Keywords — lawn mowers, Arduino, emissions, battery, solar panel,

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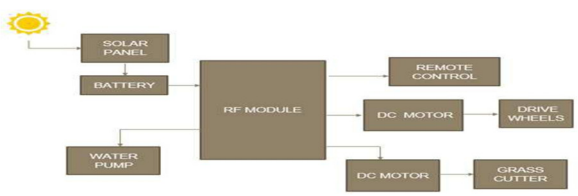
I. INTRODUCTION

A lawnmower is a device used to cut grass to an even height using one or more revolving blades. The purpose of a lawnmower is to maintain a lawn or other area of grass at a uniform height, typically for aesthetic or functional purposes.

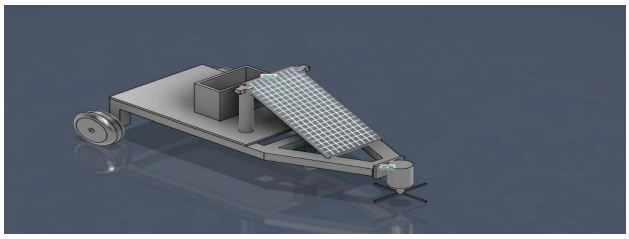
BLOCK DIAGRAM



3. METHODOLOGY

The methodology of the design and fabrication of the prototype is mentioned below.

3D- View of lawnmower



Figure,1 (Lawnmower 3d view)

COMPONENTS USED

Frame (Chases)

The chassis is fabricated from M.S square pipes. This is done for ease of fabrication, and to reduce the overall weight. The chassis was designed to take a static load of 3kg. The rear wheel which holds the motor and is bolted to the chassis. So that the driving motors can easily accommodate below the chassis. The chassis incorporates hole for attaching front globe wheel, and for attaching the lift structure.

Figure,2 (Metal channel)

Frame

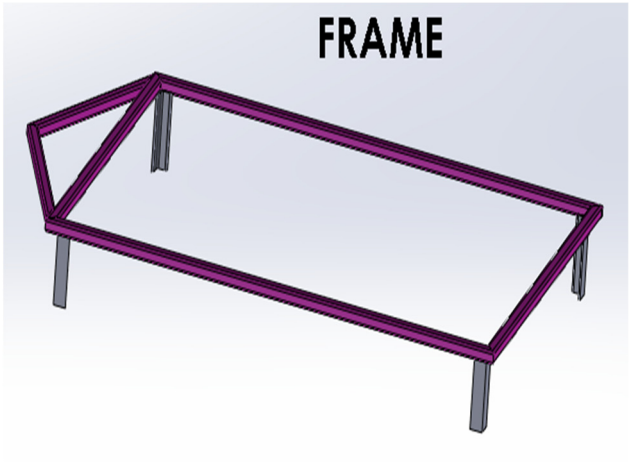


Figure.3 (Metal frame)

Creating a base frame for a robot typically involves cutting, welding, and joining pieces of mild steel to form a sturdy and durable structure.

Before any machining takes place, it's essential to have a detailed design plan for the base frame. CAD (Computer-Aided Design) software is often used to create detailed 3D models of the base frame, allowing for accurate planning and visualization before fabrication begins.

Next step is material selection. Mild steel is a common choice for constructing base frames due to its strength, durability, and weld ability. The thickness of the steel will depend on the size and weight requirements of the robot. Once the material is selected, it is typically purchased in sheet or bar form and then cut to size.

Cutting the mild steel into the required shapes and sizes is the first step in the fabrication process. The mild steel bars are cut using metal cut off saw by Bosch.

Welding the sawn off bars to create the structure is the vital part of fabrication. Here, we use MIG welding to weld the bars into the required structure. MIG welding offers several advantages for welding mild steel, including

- High welding speeds and efficiency, making it suitable for both thin and thick materials.

- Good control over the welding process, allowing for precise and clean welds.

- Minimal post-weld clean-up, as it produces minimal spatter and slag.

The next step in fabricating the grass cutter robot involved gathering all the necessary components, including an Arduino board for controlling the robot's functions, motors for movement, a sturdy chassis to hold the components, and a cutter mechanism for cutting the grass. The circuit diagram provided a blueprint for understanding the connections between these components, ensuring a systematic approach to assembly.

With the components in hand, the next phase was to assemble the robot's physical structure. Stability and proper placement of components were crucial considerations during this process. Careful attention was paid to mounting the motors securely to the chassis, positioning the cutter in an optimal location for effective detection, and integrating the robot movement mechanism in a way that facilitated quick and efficient deployment.

Once the physical structure was in place, the motors, flame sensor, and fire extinguisher mechanism were connected to the Arduino board according to the circuit diagram. This step involved ensuring proper wiring connections and adhering to the specifications outlined in the diagram. Thorough testing was conducted at each stage to verify the integrity of the connections and prevent any potential issues down the line.

With the hardware assembled and connected, the next crucial step was programming the Arduino board to enable the robot's autonomous functionality. The code was designed to enable the robot, move towards the grass plant using the motors, and activate the cutter mechanism to cut the grass plant. Careful consideration was given to optimizing the code for responsiveness and accuracy, ensuring that the robot could effectively navigate its environment and perform its grass cutting duties.

Wheel

3 wheels used for movement of the grass cutter robot mechanism. One pair is fitted on both sides of the rear side and screwed with motor shaft. hence when the motor rotates wheel also rotated for movement. On front side side of chassis fitted with bearing inside the bore of wheel to get friction free turn movement of wheels. The bottom figure shows the wheel.

SPECIFICATION OF WHEELS

i) Material- polypropylene co-polymer wheels
ii) Diameter- 150mm
iii) Thickness-30mm
iv) Bearing used- ball bearing v) colour - black

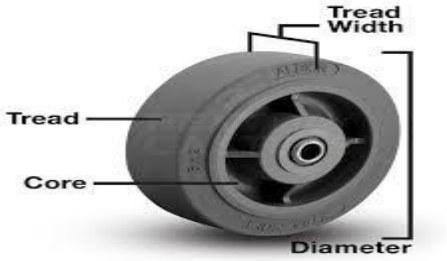


Figure.4 (Wheel)

TYPES OF WHEEL MATERIAL

1 Filled rubbers

In tyres rubbers are usually filled with particles like carbon black or silica. They consist of a tread and a body. The tread is the part of the tire that

comes in contact with the road surface. The portion that is in contact with the road at a given instant in time is the contact. Treads are often designed to meet specific product marketing positions.

2 Polyurethane

Polyurethane (PUR and PU) is a polymer composed of a chain of organic units joined by carbamate (urethane) links. While most polyurethanes are thermosetting polymers that do not melt when heated, thermoplastic polyurethanes are also available. The main ingredients to make a polyurethane are isocyanates and polyols. Other materials are added to help processing the polymer or to change the properties of the polymer.

3 Steel

Steel is an alloy of iron, with carbon being the primary alloying element, up to 2.1% by weight. Carbon, other elements, and inclusions within iron act as hardening agents that prevent the movement of dislocations that naturally exist in the iron atom crystal lattices**.**

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WORKING PRINCIPLE

The solar-powered lawn mower is designed around fundamental mowing principles and includes several key components such as direct current (D.C) motor, rechargeable battery, solar panel, stainless steel blade, control panel (Arduino board), grass collecting chamber, paint marking attachment. when the sun rays are collect the solar panel then the heat energy is converted in to electrical energy and its stores to the rechargeable battery. The current is operating all the units. Two drive wheel motors are used to propel the lawnmower. One D.C. motor is used to operate the grass cutting wire / blade. One paint roller is fitted on the rear axle (dead axle) the paint tank is fitted on above the chassis and the paint is flow from the tank to paint roller using gravity. When the control switch is on, the current flow from the battery to relay and the relay is supplied to the current to arduino board. The aruduino board controls the drive wheels and grass cutting motor. If the grass cutting motor not in use only drive motor operates by using arduino programme.

CONCLUSIONS

Bluetooth based solar grass cutter is the machine which not only make good uses of IOT but also based on the need of current scenario that is to minimize the dependency on renewable sources of energy. It fulfils the dual purpose of reducing human efforts as well as the use of energy source which is available in abundance.

Not only skilled but unskilled persons can also operate the device easily using an application in mobile phones and can control it in simple touch.

In a nutshell, it is an economical method as compared to an existing method if it is produced on large scale. Also it provides flexibility to the user controlling it.

REFERENCES

[1] M. S. N. F. N. Mohammad Rubaiyat Tanvir Hossain, “Design of an IoT Based Autonomous vehicle with the Aid of Computer Vision”, International Conference on Electrical, Computer and Communication Engineering (ECCE), 2017

[2] Muhammad Wasif, “Design and Implementation of Autonomous Lawn-Mower Robot Controller”, Department of Electrical Engineering University of Gujrat, 2011

[3] Yuki Iwano Takshi Hasegawa, Akihiro, Tanaka, “Development of the trimmer-type mowing system

