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AUTOMATIC SOLAR GRASS CUTTER

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ABSTRACT

The fully automated solar grass cutter is a fully automated grass cutting robotic vehicle powered by solar energy that also avoids obstacles and is capable of fully automated grass cutting without the need of any human interaction. The system uses 6V batteries to power the vehicle movement motors as well as the grass cutter motor. 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 an 8051 family microcontroller that controls the working of all the motors. It is also interfaced to an ultrasonic sensor for object detection. The microcontroller moves the vehicle motors in forward direction in case no obstacle is detected. On obstacle detection the ultrasonic sensor monitors it and the microcontroller thus stops the grass cuter motor to avoid any damage to the object/human/animal whatever it is. Microcontroller then turns the robotic as long as it gets clear of the object and then moves the grass cutter in forward direction again.

Keywords: Solar-Powered, Automatic, Grass Cutter, Lawn Mower, Renewable Energy, Eco-Friendly, Battery-Operated, Smart Sensor, Obstacle Detection, Solar Panel.

I. INTRODUCTION

Moving the grass cutters with a standard motor powered grass cutters is an inconvenience, and no one takes pleasure in it. Cutting grass cannot be easily accomplished by elderly, younger, grass cutter moving with engine create noise pollution due to the loud engine, and local air pollution due to the combustion in the engine. Also, a motor powered engine requires periodic maintenance such as changing the engine oil. Even though electric solar grass is environmentally friendly, they too can be an inconvenience. Along with motor powered grass cutter, electric grass cutters are also hazardous and cannot be easily used by all. Also, if the electric grass cutter is corded, mowing could prove to be problematic and dangerous. The prototype will also be will be charged from sun by using solar panels.

II. LITERATURE REVIEW

In the study of D. Satwik et al design and fabrication of a lever operated solar lawn mower, the main objective was to cut grass at different heights. The proposed lawn mower had a spur gear displacement mechanism in which the rotor blade height can be adjusted by using the lever attached to it and that can proportionally change the height of the grass cut of the lawn and required grass cut can be achieved and this process of adjustment will be completed in less than 20 seconds. The components used in machine fabrication include; DC motor, battery, solar panel, spur gears, wheels, ultrasonic sensor, Arduino board and a rotor blade.

In this process, an electric brushless motor is taken to drive the rotor blade and solar energy is used to drive the motor. The batteries perform charging and discharging action between the solar panel and the motor. The actual mechanism lies between the rotor and the motor using spur gears for the power transformation. The motor runs 45min continuously until the batteries are depleted. The batteries require 23 hours to recharge completely, 10watt solar panel is used and it takes 4 days considering 6 hours direct sunlight per day to charge complete two batteries. The arduino board is an open-source computer software program used to control the speed of the motor manually. The corresponding required program is written and dumped into board. In front of the machine is an ultrasonic sensor that provides signal to prevent collision between the machine and obstacles during the cutting operation. The sensor provides signal to the arduino board before the time of collision (below 30cm from the obstacle). Buzzer receives a signal from the board and produces alarm that

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prevents the collision. Spur gears were used to transmit power between motor and the rotor. Contact stresses acting on the teeth of their respective spur gears were calculated theoretically using Hertz and AGMA equation.

III. SCOPE OF PROJECT

Scope of this project is to design and fabricate a lawn mower which would be powered by solar energy in addition to the common gasoline engine. The specific objectives are To study the design parameter of a solar Operated grass cutter. Fabrication of the solar Operated grass cutter. Testing of the solar Operated grass cutter To analyse the solar Operated grass cutter and compare its performance with gasoline operated solar Operated grass cutter.

IV. METHODOLOGY

Design Consideration:

Several design factors should be taken into account for the economical and efficient development of a solar lawn mower. These are considerations that should be put in place during the fabrication process so as to ensure optimal productivity of the machine. Listed below are the design consideration:

1. The blade geometry and shape.
2. Materials consideration of the blade.
3. The R.P.M consideration.
4. The deck size.
5. The power rating of the solar panel.

Considering the design for the proposed lawn mower, the blade to be used is a flat shaped blade. They are generally referred to as standard blades engineered to provide enough lift to move the grass out of the mower deck area. Other blade shapes like tapered blade and sickle bar blade can also be used for the mower, but flat blade is preferred for this project because of it mass which is suitable considering the size and weight of the machine and speed of the motor. Tapered and sickle bar blades have higher cutting pressure but relatively low mass. The shaft rotating the blade has a high mass so the blade has to have a relative high mass to prevent the blade from wobbling. The material to be used for the desired flat blade is mild steel. Mild steel has strength and weight that can transmit the same speed as that of the motor which makes it suitable considering the size of the deck and shaft rotating the blade. Stainless steel and angle bar iron can also be used for the blade construction due to their durability and long life span. But mild steel is preferred mainly because of strength and its high resistance to corrosion.

V. WORKING

Coming to the working of solar powered grass cutter, it has panels mounted in a particular arrangement at an angle of 45 degrees in such a way that it can receive solar radiation with high intensity easily from the sun. These solar panels convert solar energy into electrical energy as studied earlier. Now this electrical energy is stored in batteries by using a solar charger. The main function of the solar charger is to increase the current from the panels while batteries are charging, it also disconnects the solar panels from the batteries when they are fully charged and also connects to the panels when the charging in batteries is low.

APPLICATIONS

- Used in gardens.
- Used in play grounds.
- Road side grass and small plant cutting.
- Nursery applications.

ADVANTAGES

- They can be installed and pulled by hand.
- Low maintenance
- Unattended operation
- Long life
- Compact size and portable

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- Easy to move from one place to another place
- Operating principle is simple.
- Non-skilled person also operate this machine

DISADVANTAGES

Solar energy makes use of a renewable natural resource that is readily available.

- Large time required to remove the grass
- Manually operated
- Difficult to operate in rainy seasons

VI. CONCLUSION

- The design parameters of the solar grass cutting machine were studied and stress analysis was done on certaincomponents parts of the machine
- The solar grass cutting machine was fabricated
- The solar grass cutting machine was tested and was effective enough to cut all types of grass at different heights.
- Comparative study was done between the solar grass cutting machine and conventional gasoline operated mowers.

Conclusively, the design of the solar grass cutting machine is generally environmental friendly and also encourages environmental sustainability due to zero production of greenhouse gases, it also cost effective as solar panel requires little to no service cost compared to conventional gasoline operated lawn mower.

VII. FUTURE SCOPE

Scope of this project is to design and fabricate a lawn mower which would be powered bysolar energy in addition to the common gasoline engine. The specific objectives are To study the design parameter of a solar Operated grass cutter. Fabrication of the solar Operated grass cutter. Testing of the solar Operated grass cutter To analyze the solar Operated grass cutter and compare its performance with gasoline operated solar Operated grass cutter.

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