Solar Grass Cutting Machine With Sun Tracking Device

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Abstract

The Solar Grass Cutting Machine is a mechanical device that uses solar energy instead of electricity to cut grass and having the feature of sun tracking along-with it can make it more preferable over normal grass cutters. Fuel and electricity (motor powered engine) are used to power most grass-cutter equipment, which are both expensive and require a lot of maintenance. A solar powered grass cutter has been constructed in this research work, coupled with an innovation of sun monitoring, in order to keep the environment clean as well as reduce the use of fuel and electrical energy. Our major goal is to design and build a solar-powered grass cutter that can cut a variety of grassesfor a variety of uses, is economical, easy to use, environmentally friendly, and has a sun tacking feature.

Keywords: *Solar panel, solar charger, microcontroller, solar power, solar sensors, smart solar system, dual axis solar tracker, Arduino, cutting blades, Battery, tri-cycle pipes, high torque motors.*

1. Introduction:

The continuous increase in the cost of fossil fuel and the effect of emission of gases from the burnt fuel into the atmosphere, as well as deficiency in availability of electricity in various villages, necessitated the use of the abundant solar energy from the sun as a source of power to drive a lawn mower along with the feature of sun tracking. The first thing that we should discuss here is that why we need to have solar tracking. When the sun rises at morning time, and it is moving towards upper side, so in order to able to track the sun, we need to follow it not only as it moves from east to west, but also as it gradually increases in height i.e. as sun increases to its highest point of travelling in the sky. Hence for the purpose of tracking the sun not only from direction of east to west but also in the direction of north to south, we need to have a dual axis solar tracker. But the dual axis solar trackers cannot be employed in larger scales and there are certain reasons for the same.

Horizontal solar trackers track the sun when it rises and falls in the sky. It will move in north-south axis of rotation. Vertical solar trackers move in axis of rotation from east to west. The final type of solar tracker is dual axis solar tracker which we have used in our project. It is able to track the sun in east-west axis and also north to south axis. Although dual axis solar tracker is able to track the sun more accurately than horizontal and vertical solar tracker, there are some advantages and disadvantages with this type of sun tracker which is why it has not found widespread commercial application.

Common grass cutters moving with engine, standard motor powered engine, creates noise pollution due to the loud sound of the engine and also produces air pollution due to the combustion in the engine. Normally Power mowers are currently available in four basic designs: the rotary mower, the power reel mower, the riding mower, and the tractor. Most of the grass cutters available in the market are of IC engine types and runs on fuel, which release huge amount of carbon in the environment. Hence in this research paper, a solar powered grass cutter is designed and developed with sun tracking device, based on the general principle of mowing.

The designed solar powered grass cutter comprises of high speed direct current (D.C) motor, a rechargeable battery, a charge controller, solar panel, hydraulic rams, anemometer, solar sensor, solar tracker controller, a stainless steel blade. The sun, an average star is a fusion reactor that has been burning over 4 billion years, provides enough energy in one minute to supply the world's energy for one year. The designed solar energy powered grass cutter machine is based on the mechanism of the usage of the solar energy from the sun to power an electric motor connected in the system which in turn actuates the rotor blades which cuts the grass of the ground or the garden. It uses sliding blades to cut the grass and its construction is simple as well. The main concentration of this paper is to design and fabricate a solar powered grass cutter which is cost effective, easy to maintain, easy to use, can be used in the rural areas, and also having feature of sun tracking , thus contributing in the development of human society.

Fig 1.Working Model

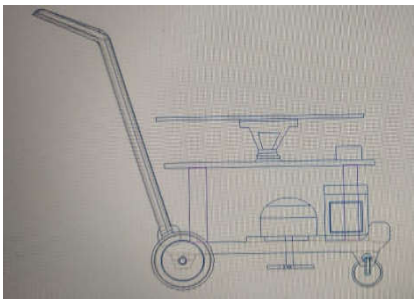

Fig 2. 3D Drawing of the Model

The sun being a renewable source of energy provides sustainable amount of the energy that is used for various purposes in the atmospheric system. The difference comes only in the application of that particular energy source. It is assumed as well as observed that a grass cutter using solar rays as the energy source will solve and address a number of issues that the standard internal combustion engine and electric motors lawn do not. It will help to reduce the air

pollution to a greater extent. Hence our project is mainly based on conversion of solar energy to mechanical energy for running a normal grass cutter.

2. Methodology:

For the fabrication of a solar powered grass cutter we referred to various literature as well research papers. We gathered and evaluated several ideas before designing and fabricating the grass cutter with sun tracking device. We also gathered information regarding lower latitude locations using horizontal solar tracker and higher latitude locations using vertical solar tracker and challenges faced by people by using them along with lawn cutters. Therefore based on these challenges, the idea of designing solar powered grass cutter with sun tracking device came about to address the problem. Solar energy, which is employed in our project and is very environment friendly and easy to manufacture, is an alternative to the usage of non-renewable and damaging fossil fuels according to studies.

3. Components Evaluation:

Solar grass cutter is basically a machine which is cutting the grass with the electricity which is produced by the solar cells and solar trackers are basically tracking the sunlight. As per the present efficiency of solar cell the most optimized mechanism used in the tracking industry is the single axis mono-line trackers which is basically moving east to west. In the utility sector we do not talk about dual axis solar tracker, because if we look at the maths the operational cost vs the payback period of a dual axis solar tracker doesn't work out. Dual axis systems are way more complicated and very costly to maintain with respect to the output they will increase of a solar power plant. In this project we worked upon designing a solar grass cutter with sun tracking device in order to increase the efficiency of solar grass cutter.

3.1 Solar Panels: A solar panel, solar electric panel, photo voltaic (PV) module or solar panel is an assembly of photo-voltaic cells mounted in a framework for installation. Solar panels collect clean renewable energy in the form of sunlight and convert that light into electricity which can be used to provide power for electric loads. Solar panels are composed of several individual solar cells which are themselves composed of silicon, phosphorus, and boron. Solar panels absorb the photons and in doing so initiate the electric current. In our project we have used solar panel of brand Elecssol 50W 12V high efficiency solar panel.

3.2 Solar charge controller: A solar charge controller is an electronic device that manages the power going into the battery bank from the solar array. It ensures that the deep cycle batteries are not overcharged during the day and that power doesn't run back to the solar panels overnight and drain the batteries. Some charge controllers have other features, such as lighting and load control, but their primary function is to manage power. In our project we have used solar charge controller of brand magideal LCD display 10A 20A amp solar USB charge controller, Regulator 12V/24V.

3.3 High speed DC motor: This device converts electrical energy stored in the battery into mechanical energy which is used to run the cutting blades. It is done through the generation of magnetic field by means of current flowing into one or more coils.12V-3500 rpm high torque dc motor is used in our project for the movement of stainless steel blades.

3.4 Battery: The solar energy that will be turned into electrical energy is stored in a battery. Solar panel produce electrical energy only when sun is shining and do not store that energy.

So, therefore in order to store that electrical energy and allow the motor to run the blades it is necessary to use a battery which chemically store the electrical energy. We have used 12V-5mAh battery in our project.

3.5 Arduino UNO: Arduino is a microcontroller based on the Atmega 328 that was created by arduino cc. This board includes all of the capabilities needed to run the controller and may be linked to a computer via USB cable to upload code to the controller using IDE software.

3.6 Sensors:4 LRD(light sensors) are connected at the corner which are acting as a sensor which decides that what will be the direction of the rotating module, whether it is going to be up-down motion or whether it is going to be east-west orientation .

3.7 Servo motors: Servo motors are electrochemical devices that transform digital pulse inputs into incremental shaft rotation. It's employed in applications that require precise positional control. A number of electromagnetic coils are used to control it. Below the structure i.e on the downside of solar cells there is a mechanism of 2 servo motors and the mechanism which is providing it a flexibility up and down, to and fro is actually a mechanism which is being is used to control the camera on the drones.

4. Working principle:

The arrangement of solar grass cutter with sun tracking device is in such a way that it can receive solar radiation with high intensity from the sun. When the solar radiation falls on the solar cells, it converts solar energy into electrical energy which is stored in the batteries by using the solar charger, whose main function is to increase the current coming from the panel while the batteries are charging and to ensure that the batteries are not overcharged so that there is no loss of electricity. The dc motor is connected to the battery using connecting wires and between them there is a mechanical circuit breaker in order to start and stop the working of the motor. Thus from this motor power transmits to the system and makes the blade to rotate and cut the grass.

The main light sensors are LDR sensors, and two servo motors are attached to the system that supports the solar panel and moves it in the direction where the solar radiation intensity is highest. Four LDRs are divided into top, bottom, left and right of the solar panel.

The analogue readings from two top LDRs and two bottom LDRs are compared for east west tracking, and if the top set of LDRs receives more light, the vertical servo moves in that direction, and at the same time if the servo rotates the panel in that direction if the bottom LDRs receive more light.

The angular deflection of a solar panel is determined by comparing the analogue signals from two left LDRs and two right LDRs. If the left set of LDRs receives more light than the right one, then the horizontal servo moves in that direction, and vice versa if the right set of LDRs receive more light.

5. Conclusion:

The solar grass cutting is very easy to use and it will be very helpful for the environment as it will reduce air pollution and also with this paper will be helpful in designing solar trackers on a large scale in order to increase the efficiency of the solar panel.We developed a model of

automatic tracking system to maintain vertical contact between solar panels and sunlight, increasing solar energy usage and photovoltaic power generation system efficiency.

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