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Solar Powered Automated Lawn Mower

Mr. Vitthal K. Khemnar[1], Mr. Shekhar S. Pawar[2], Mr. S. S. Uagale[3], Mr. S. S. Pagar[4], Mr. V. S. Navare[5]

[1]*Assisant Professor, Department of Mechanical Engineering, Sir Visvesvaraya Institute of Technology, Nashik*
[2,3,4,5]*Students, Department of Mechanical Engineering, Sir Visvesvaraya Institute of Technology, Nashik*

Abstract - *Good growth of various high-tech efficient tools and equipment makes our jobs done comfortable and sophisticated. These days we are facing the problems like pollutions, power cut problem etc. In order to overcome these problems, we have thought about the device, which can be performing its functions without causing any of these problems. The project aims at fabricating a grass cutting machine system which makes the grass cutter-based running through solar energy. Due to the continuous increase in the cost of fuel and the effect of emission of gases from the burnt fuel into the atmosphere, this necessitated the use of the abundant solar energy from the Sun as a source of power to drive a grass cutter. A solar powered grass cutter was designed and developed, based on the general principle of mowing. This project is deal with designer of solar powered grass cutter comprises of direct current (D.C.) motor, are chargeable battery, solar panel, a shearing action blade and IOT based control system. The solar powered grass cutter is operated by the switch on the board which closes the circuit and allows the flow of current to the motor which in turn drive the blade used for mowing all the switching is automatic and can be done through the smart devices. The battery recharges through the solar charging controller. Performance evaluation of the developed machine was carried out with different types of grasses. The performance is more efficient than conventional rotating cutters. Which require the less energy for cutting the same grass.*

Key Words: Cutter, Solar Panel, DC Motor, lead acid battery

1.INTRODUCTION

A lawn mower (also named as mower or lawnmower) is a machine utilizing one or more revolving blades to cut a grass surface to an even height. The height of the cut grass may be fixed by the design of the mower, but generally is adjustable by the operator, typically by a single master lever, or by a lever or nut and bolt on each of the machine's wheels.[3] The blades may be powered by muscle, with wheels mechanically connected to the cutting blades so that when the mower is pushed forward, the blades spin, or the machine may have a battery-powered or plug-in electric motor. The most common power source for lawn mowers is a small (typically one cylinder) internal combustion engine. Smaller mowers often lack any form of propulsion, requiring human power to move over a surface; "walk-behind" mowers are self-propelled, requiring a human only to walk behind and guide them. Larger lawn mowers are usually either self-propelled "walk-behind" types, or more often, are "ride-on" mowers, equipped so the operator can ride on the mower and control it. A robotic lawn mower ("lawn-mowing bot", "mowbot", etc.) is designed to operate either entirely on its own, or less commonly by an operator by remote control. [1]

Two main styles of blades are used in lawn mowers. Lawn mowers employing a single blade that rotates about a single vertical axis are known as rotary mowers, while those employing a cutting bar and multiple blade assembly that rotates about a single horizontal axis are known as cylinder or reel mowers (although in some versions, the cutting bar is the only blade, and the rotating assembly consists of flat metal pieces which force the blades of grass against the sharp cutting bar).

2. HISTORY & BACKGROUND

There are several types of mowers, each suited to a particular scale and purpose. The smallest types, non-powered push mowers, are suitable for small residential lawns and gardens. Electrical or piston engine-powered push-mowers are used for larger residential lawns (although there is some overlap). Riding mowers, which sometimes resemble small tractors, are larger than push mowers and are suitable for large lawns, although commercial riding lawn mowers (such as zero-turn mowers) can be "stand-on" types, and often bear little resemblance to residential lawn tractors, being designed to mow large areas at high speed in the shortest time possible. The largest multi-gang (multi-blade) mowers are mounted on tractors and are designed for large expanses of grass such as golf courses and municipal parks, although they are ill-suited for complex terrain. Dipin and Chandrasekhar [8] explained that the Solar Powered Vision Based Robotic Lawn Mower is an autonomous lawn mower that will allow the user to the ability to cut their grass with minimal effort. Unlike other robotic lawn mowers on the market, this design requires no perimeter wires to maintain the robot within the lawn and also with less human effort in the manual mode operation. They studied that there is some preset pattern installed in the robot, in the automatic mode operation no human effort needed for the operation and helps to cut different patterns in the lawn very easily with less time. Through an array of sensors safety takes major consideration in the device, this robot will not only stay on the lawn, it will avoid and detect objects and humans. And also, it detects the land boundaries and start mowing upon the predefine pattern with the help of installed camera and MATLAB programming.

3. DESIGN OF COMPONENTS

A. Cutter

The cutter is main component which actually cut the lawn. It will be mounted on face side of the lawn mower. The cutter design consists of two components namely base and upper cutter. The lower cutter called base is to grab the grass like in comb in it and hold it straight while cutting. Besides holding it performs one more operation helping cutting upper cutter. The motor will be mounted base cutter which will help to reciprocate laterally upper cutter on it. The cutter will be rested on base cutter and the contact between them is very smooth. The friction between these upper and lower cutters is kept minimal by optimizing design. The upper and lower cutters are fairly similar in design with slots made by milling. The slot will be of rectangular shape which are of 5mm in breadth. And the slots lie throughout the length of blade and the studs are provided to hold the cutter on chassis. The lower base will be mounted on the chassis and the upper base is fixed on the lower base by mean of hinge type joints which give only one degree of freedom to the upper blade. The cutter act as a scissor lime multiple scissors working to gather as it makes a sense because our ancestors taught us to cut grass first hold it and then cut it same wise, we cut the grass. The lower cutter holds the grass and then upper cutter cuts the grass. Then it cuts the grass with excellent perfection. In rotary cutters the cutter is unable to cut the grass uniformly because the cutter itself bents the grass and that's why the cutting becomes inefficient .in this cutter this problem is solved and the base part of cutter thus it holds the grass to cut it. The grass cutter material selection will be done on basis of the strength of the grass to be cut the different grasses has different tensile and lateral strength this all parameters depends on the nature condition in that particular area so material should be accommodate to all the type of grasses so that in polymers the thermosetting polymers can be used and in the metals aluminum of brasses and bronzes can be uses to avoid the corrosion because in case of copper and iron the problem of the corrosion will be there because the dew drops will be there on grass and the grass itself release the liquids water while cutting and the mover have to work in the sunny environments the corrosion rate are higher in the sunny environments. To avoid this, aluminum and thermosetting polymers will be the perfect choice for the cutter.

B. Chassis

Chassis mainly consist of frame and components like solar panel, battery, wheels, motors, etc. Frame is made from hollow pipes of lightweight material.[1] It will provide housing for battery and collect lawn which is cut. On top of the frame solar panel is to mounted to collect solar energy. Chassis is divided in two compartments for battery and to store the collected lawn. Stress concentration is well distributed to carry the loads of other components and the collected lawn. Wheels are placed so that they carry load concentration evenly. Chassis have mechanism to adjust the height of cutter for desired cutting or cutting in aesthetic manner.

4. FIGURES AND TABLE

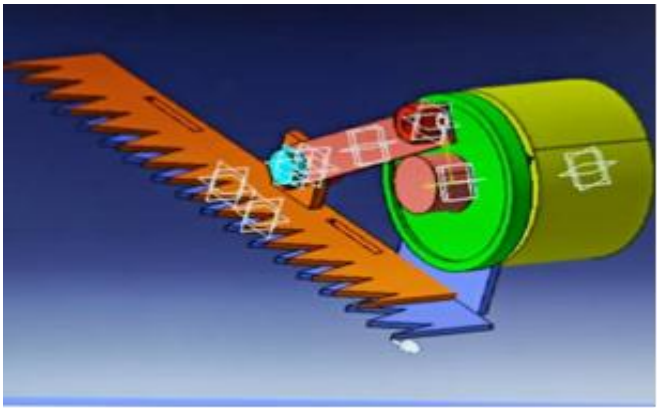

Fig. No. 01: Pro-E Model of cutter

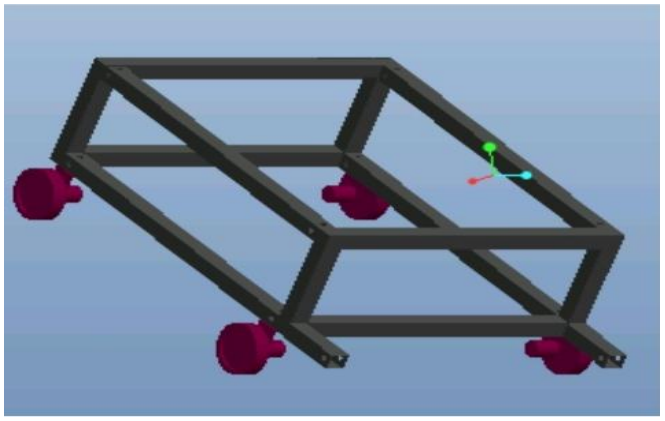

Fig. No. 02: Pro-E Model of Chassis

5. OTHER COMPONENTS

A. Node MCU

It is open source Iot based platform which runs esp8266 wifi SoC from Espressif system, and the hardware which is based on ESP-12 module. It is default firmware. It provides access to 12 GPIO pins and the connections can be done with this pin and this runs on 3.7V and the input can be given from the Vcc pin. [4] The program uploaded through Arduino IDE sketching software and the connecting is provided by micro-usb.

B. Motor Control Unit L298N

L298N is capable of controlling multiple motors at same time with providing alternate polarities. This is with the help of embedded dual H bridge configuration. It supplies required input power to the motors. Also provides power input to firmware like Arduino, Node MCU, etc. It can take inputs in the range 3V to 35V and produce 5V power supply for Node MCU or Arduino up to the current rating of 2A. [6]

6. CONCLUSION

The mower gives very precise cutting of grass due to adjustable blade design. As per design optimizations lawn mower consumes less power. The cost is also less due simple construction of chassis. The cost will be reduced even more for mass production. The mower is also efficient for commercial use for big lawns.

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BIOGRAPHIES

Mr. Vitthal K. Khemnar holds master degree in Mechanical Engineering. He completed his master's degree from Savitribai Phule Pune University, Pune. He has published 07 research papers in various national and international journals. He is also member's various professional bodies such as ISTE, ISME, IAEng, IFERP.