

AUTOMATIC ROAD DIVIDER SHRUB LEAF CUTTING MACHINE

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ABSTRACT

The aim of this paper is to develop an alternative solution for conventional method for shrub cutting. Automatic shrub leaf cutting machine is the new innovative and effective concept mainly used for agricultural field. It is easier in construction and the working process is very easy and it is mostly used in the agricultural field for the cutting of crops cutting on road centre or garden. Nowadays most of the vehicles use the two wheel steering mechanism as their main handling system. But the efficiency of the two wheel steering vehicles is to be low compared to four wheel steering vehicles. Four wheel steering system can be employed in some vehicles to improve steering response, increase vehicle stability while moving at a certain speed or to decrease turning radius at low speed.

Keyword:Zero turning mechanisms, Frames, Rope drives, Cutter, Remote Control System

1. INTRODUCTION

‘Automatic road divided shrub leaf cutting machine’ is the new ingenious and effective notion mainly used for agricultural field. Our work should be completed in given time with precision so the term called automatic machines comes into play. Automatic machines are commonly utilized for the art of wing assembly, material handling and many things. As we know there has been significant increase in vehicular traffic. The main motto is to introduce automation and make this process cost effective. It is simple in construction and the working process is takes place by remote control. It is mostly used in the agricultural field for the cutting of shrub leaves cutting on road centre or garden. It is the conventional method of tree leaves cutting & machine aims at making the things simple and easy. The process involves cutting of tree leaves into pieces. The entire setup is mounted on the mechanical zero turning base with moving tire arrangement. Zero turn vehicle system is directly connected to steering system. Zero turning is done by turning drive wheels at the same rate in opposite direction. The vehicle in this case is rotates in 360 degree therefore it is very useful to turn the vehicle in narrow space. To overcome problem like vehicle management on narrow roads and during parking this system has been proposed. The process involves cutting of tree into pieces.. Many farmers feel difficult to spend time and money. The motors are easy and economical to buy. Thus overall system is cost effective if the benefits out of it are considered. Thus, by making the machine that operates user friendly invokes many farmers to feel happy.

1.1 PROBLEM DEFINITION

To control air pollution causes by automobiles some shrubs were planted on road divider, however after few years these tree will be expanding. Also the leaves of these shrubs disturbing to driver while travelling. Now a day, there has been considerable increase in vehicular traffic. This has resulted in raised concentration of air pollution like NO₂, SO₂, CO, CO₂ and interrupt particles. To reduce air pollution tree plantation is necessary. But after few years these shrubs will expanding and leave of shrubs caused disturbance to vehicles. So we came up with a machine to cut the leaves of shrubs in proper manner without disturbing the traffic.

1.2 OBJECTIVES

The objective of project paper is to introduce new innovative and effective concept mainly used for agricultural field. To promote use of mechanical and automatic parts in field machines. To reduce the traffic disturbance. To reduce human efforts to cut in proper manner. To make working process simple and easy can be control unskilful operator in any time.

2. COMPONENTS

A. FRAME:

The material of frame is 40C8. The frame of our machine is divided into Lower part frame and Upper part frame. The function of Lower part frame is to support the components like Two motor, Axle, Link are all mounted on lower frame and the Function of Upper part frame is to support the components like Arm plates, Rope are mounted.

B. ROPE AND PULLEY ARRANGEMENT:

Rope - The vertical movement of gripper is controlled by the rope. Pulley is driven by the motor in which the rope is wound on 1 side.

Pulley – On the shaft or axle a wheel known as pulley is mounted for support movement and change of direction of the taut cable along its periphery. In order to apply forces, transmit power and lift loads pulley is used. A rope or chain or belt runs into the groove of the pulley which is the drive element of the pulley system.

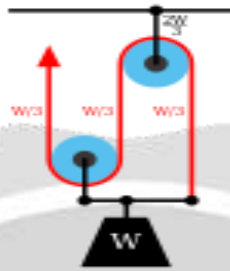


Figure 1- Rope and Pulley Arrangement

C. LEAD SCREW:

It also known as power screw or translation screw. It converts rotational motion to the linear motion and also the convert rotational force to a linear force.

Function – Large load carrying capability.



Figure 2 – Lead Screw

D. WHEELS:

The material used for wheel is Nylon. Four wheels are used in machine and it operated on motor.

Function – The main function of wheels is to transfer machine in one place to another.

E. CUTTER:

The material used for cutter is Carbide material. The speed of cutter is 60rpm.

Function – It used for cut the leaf of shrubs.



Figure 4- Cutter

F. Motor:

Electric DC motor is used. In a machine we used 7 DC motor and they are directly connected to the A.C power supply.\

Voltage: 12 Volt

Speed: 700 rpm



Figure 5 - Motor

G. Battery:

Voltage: 12 Volt

Capacity: 30 Amp

Long life and chargeable (6 hrs)



Figure 6 - Battery

3. DESIGN CALCULATION

a) CUTTER CALCULATION:

Maximum force acting on shrub for cut the leaves = maximum load sustain by leaf \times gravitational force

$$F = mg = 2 \times 9.81 = 19.62 \text{ N, Hence strength of the shrub is } 19.62 \text{ N}$$

b) DESIGN OF UPPER MOTOR:

Let the torque on cutter motor of cutting leaves = 2kg approx T_a , Nm

We require 500 rpm motor.

$$\text{Total Torque, } T = 2 \times T_a = 2 \times 2 \times 9.81 = 39.24 \text{ Nm}$$

$$P = \frac{2\pi NT}{60} = \frac{2\pi \times 500 \times 39.24}{60 \times 1000}$$

$$P = 2054.60 \text{ W} = 2.054 \text{ KW}$$

0.20 kg cm, 500rpm D.C. motor.

c) WHEELS:

Assume total Weight of the body = 30kg

Weight on each wheel = 7.5 kg

In market available wheel is $d = 80$ mm

These wheels is capable for 7.5 kg so we selected rubber wheel

d) TORQUE ANALYSIS:

Power,

$$P = \frac{2\pi NT}{60}$$

$$102.73 = \frac{2\pi \times 10 \times T}{60}$$

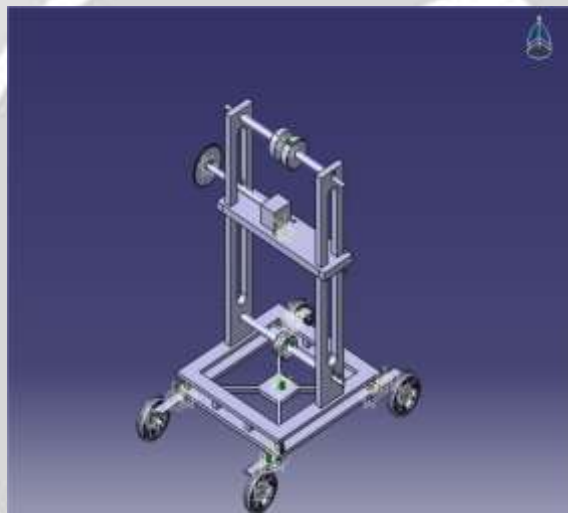
$$T=98.09 \text{ Nm}$$

Considering 25% overload

$$T = 1.25 \times T = 1.25 \times 98.09$$

$$T = 122.62 \text{ Nm}$$

4. WORKING



Actual prototype assembly model drawn in CATIA V5

In this project we are using the multi agricultural cutter for shrub cutting. It consists of simple cutter and the other components used are motor and rotating disc arrangement. Here the motor works with the help of electric power supply. On the motor shaft we have the arrangement of rotating disc. The rotating disc arrangements are running like a cam. The cutters are fixed on the top of the ram arrangements. The lead screw rotates in clockwise direction initially by the motion of DC motor. The nut coupled with the thread of lead screw also rotates in up and down direction accordingly. The two inductive type proximity sensors are located at the extreme end of the lead screw.

When the sensor detects the nuts, signal is send to the microcontroller and relay due to which the base motor changes its direction. The motor which attached with the blade rotates continuously with high speed required for cutting the shrubs. The sensor position is adjusted according to the height of shrubs. The machine is designed with initial cutting from top position and continues its movement in downward direction. Once it reaches the bottom end, proximity sensor detects the signal and nut moves in upward direction. In this manner the shrubs are cut from top to bottom.

5.CONCLUSION:

A system featuring user friendly steering mechanism has been introduced. This paper focused on shrub cutting and mechanism required for it which offers feasible solutions to a number of current manoeuvring limitations.

6.FUTURE SCOPE

This system can be effectively applied in the field of farming and on domestic level easily. On the other hand it does not affect traffic problems and pollution free working makes it more reliable. Zero turn mechanism used in the system will help in reducing parking problems in compact spaces and will be convenient in robots made for indoor navigation system.

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