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DESIGN AND FABRICATION OF DECORATIVE LAWN MOWER AND MULTIPURPOSE AGRICUTTER MACHINE

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ABSTRACT
It is proposed to develop a multipurpose agricutter machine and decorative lawn mover to perform various operations in lawns to decorate it. The design is such that it reduces cost and human efforts and performs tree operations in one set. The oscillating motion is given to cutter by cam follower arrangement to increase the cutting area of cutter. The cutter setup is flexible such it can place on handle by spherical joint and use as hedge cutter. It can also place in vertical direction to cut the feed of animals. These three operations perform on one machine which reduce requirement of indivisual machine for each operation. Senser is use to avoid damage to cutter by stones or any substance. This machine is useful for domestic purpose as there is no need to purchace uneconomical machines. It is eas to handle and use and compact in size with high efficiency

KEYWORDS: Lawnmower, hedge cutter, fodder cutter, senser.

INTRODUCTION
A lawn mower is a machine that uses a rotating blade or blades to cut a lawn at an even height .Lawn mowers employing a blade that rotates about a vertical axis at specific distance from ground are known as rotary mowers, while those employing a blade assembly that rotates about a horizontal axis are known as cylinder or reel mowers .Many designs have been made, each suited to a particular purpose. The small lawn mowers, handled by a human, are suitable for small domestic lawns and home gardens, while larger, self-contained, ride-on mowers are suitable for large lawns, and the largest, multi-gang mowers pulled behind a big machines, are designed for large expanses of grass such as golf courses and big parks. The different types of lawn mowers are as shown below.

Fig 1: Cylinder (reel) mower.

A cylinder (reel) mower manually operated showing a fixed cutting blade in front of the rear roller and wheel-driven rotary blades.

Fig 2: Reel mover with motive power of an engine

A rotary mower rotates about a vertical axis with the blade rotating at high speed and impact to cut the grass. This tends to result in a cut and bruises, shreds the grass leaf resulting in dis-colouration of the leaf ends as the shredded portion dies. Most rotary mowers has to be set at higherposition than cylinder equivalents to avoid scalping and of slightly uneven or irregular lawns, although some modern rotaries are provided with a rear roller to give a more formal striped cut. These machines can also cut lower (13mm) than a standard four-wheeled rotary.

OBJECTIVES

To develop and modify the lawn mower to increase cutting area by cam and follower arrangement. Hedge cutting mechanism allows to cutting decorative lawn. Fodder cutting mechanism allows easily cutting of fodder feeding for the animals. The safety sensor gives high safety to device as well a person, and prevents the cutter from being damage and increases its life.

LITARATURE REVIEW

Chaff cutter is a hay or straw cutting machine which is use in uniform chopping of the fodder for livestock or raw material to agro industry. They have replace different sources of chaff cutter by 1HP single phase which require low electricity and easily available anywhere so it is beneficial to farmer. By using different type of blades can obtain different types of chaff for animal. [1]

In this project they have automated the machine for trimming the grass. The device consists of linear blade which is operated with the help of motor powered by battery. The battery can charge by using power supply and solar panel. In case of any obstacle in the path it is sensed by using an IR sensor. [2]

The main objective of work is to develop manually operated rotary lawn mower. It has three wheels one front wheel and two rear wheels. The rear shaft is connected to compound gear train system. The wheels are rotating in forward motion converted in vertical motion through bevel gear drive. This lawnmower is economical for domestic purpose as no need of heavy machines. [3]

The objective of this paper is to control the robot by mobile phone (as transmitter) that makes call to mobile phone connected to robot. After answering the call, and in course of the call, if any button is press control corresponding to the button pressed is heard at the other end of the call. This tone is called duel tone multi frequency tone. Robot receives this DTMF tone with the help of phone track in the robot. This signals transmitted to micro controller by converting it into binary digits. [The micro controller pre programmed to take decision for any input or output to drive motor for forward or backward motion or a turn. The method is having good expected results. [4]

The solar power lawn mower was designed and develop based on general principle of moving. The designed solar power lawn mower comprises of direct current motor, needed to drive the stainless steel blade which is directly coupled to shaft of dc motor. The battery recharges through the solar charging controller. Performance evaluation of develop machine was carried out with different types of grasses. [5]

Modification of lawn mower into harvester machine has been done by Indonesian center of agriculture machinery development. This machine was designed for demands for simple harvesting machine that cost less than IDR5 million/unit, and inspired by the innovation of small harvest machines that have been widely traded by china. The modification were done by replacing cutting blade on the lawn mower with rotary blades, adding a guider and driving force to drive cutting , put the engine in straight line with the blades, and adding an operator belt carrier for easy operation.[6]

The graying of the farming population is progressing recently in Japan. more people of advanced age are working on farm, and products that can be handled easily by beginners are in demand .almost all motive power sources of handle brush cutters are compact two stroke engines that are started in the aurthodocs way by pulling the cod of recoil starter by hand .[7]

This paper give solution based on behavior best approach to robotics developed at MIT. Then adding behavior for goal selection, goal sikking, an obstacle marking, a lawn mower which is both efficient can be created. The conclusion is that the new system should perform quite well. [8]

PROBLEM STATEMENT

For the domestic purpose and in villages, people cannot spend more money on heavy machineries. Hence we want to develop such a machine which consist multi operation capabilities and cut the more efficiently with less efforts and half time.

Our daily busy schedule demands for a machine which does different type of work with minimum time. The arrangement which consist more operation means multipurpose can help in it.

Today's lawnmower only cuts the grass on ground but we want to upgrade it to multipurpose. It will consist grass cutter which cuts the grass with less efforts and half time, hedge cutter which cuts the plant decoratively in various shapes (square, round etc.), and fodder cutter which cuts the food for animal.

SYSTEM DESIGN

- prime mover selection

Motor is a Single phase AC motor, Power 150 watt; Speed is continuously variable from 0 to 3000 rpm. The speed of motor is vitiated by means of an electronic speed vitiated. . Motor is a commentator motor i.e., the current to motor is supplied to motor by means of carbon brushes. The power input to motor is varied by changing the current supply to these brushes by the electronic speed aviator; there by the speed is also is changes.

- Design of spiral bevel gear

Gear Data**:**
No. Of Teeth = 50
Pressure angle = 20^0
Ration m_{ug} = Ng/Nap = 50 /18 =2.78
Shaft angle = 90^0
Gear Pitch angle = 19.8^0
Diametric pitch = 2.3 mm
Face width = 13mm
Specification of motor for power tool:
Voltage = 230 V
Power = 150 Watt
Speed = 3000 rpm
No pure torsional load @ 3000 rpm will be as follows
$P = 2\pi NT/60$
$T = 60 \times P / 2\pi NT = 60 \times 150 / 2 \times \pi \times 3000$
$= 0.47746$N-m
M = Thrust x perpendicular distance
= 374x32.7
= 12229.8N-mm

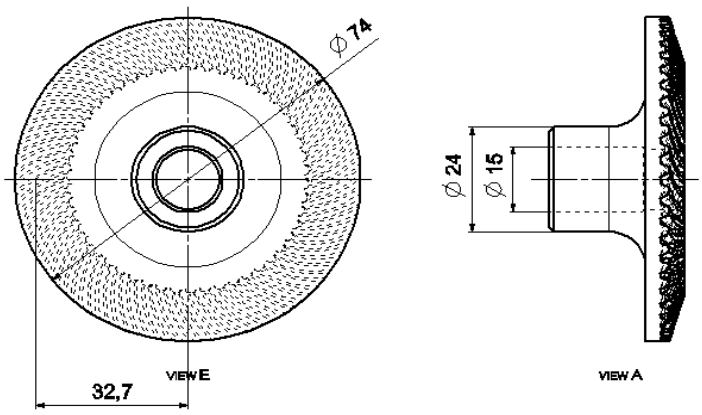

Fig 3: reference diameter

As per ASME code the values for Suddenly applied load with minor shocks

Km = Combined shock and fatigue factor for bending = 2.0
Kt = Combined Shock and fatigue factor for torsion =2.0

Te = Sq.rt [$(Km \times M)^2 + (Kt \times T)^2$]
Te = 24458.00002 N-mm

Material selection

Designation	Ultimate Tensile strength N/mm^2	Yield strength N/mm^2
EN 24	800	680

As Per ASME Code; Considering 18% of ultimate tensile strength
$\Rightarrow fs_{max} = 108 N/mm^2$

Check for torsional shear failure:-

$$T = \frac{\pi \times fs}{16} \left\{ \frac{Do^4 - Di^4}{Do} \right\}$$

$$24458.00002 = \frac{\pi \times fs}{16} \times \left\{ \frac{24^4 - 15^4}{24} \right\}$$

$fs_{act} = 10.18 N/mm^2$
As; $fs_{act} < fs_{all}$

$\Rightarrow$ Gear is safe under torsional load

- Design of cam plate

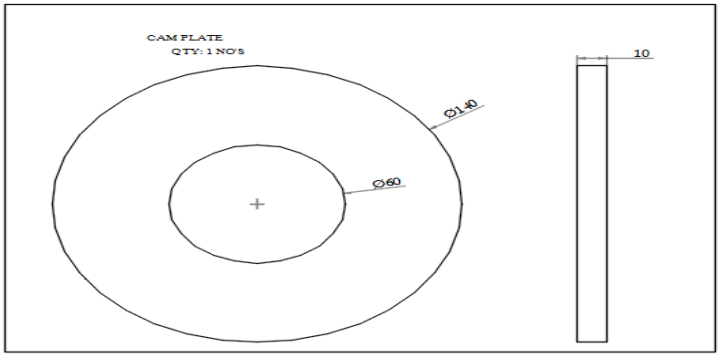

Fig 4: Cam plate material selection.

Designation	Ultimate Tensile strength N/mm^2	Yield strength N/mm^2
EN 24	800	680

As Per ASME Code;

$fs_{max} = 108\ N/mm^2$

Considering that the diameter of wheel is 250 mm and the force exerted by hand push is 200 N the torque at wheel shaft will be

$T = 200 \times 125 = 25 \times 10^3$ N-mm

Check for torsional shear failure:-

$$T = \frac{\pi \times fs}{16}\left(\frac{Do^4 - Di^4}{Do}\right)$$

$$25 \times 10^3 = \frac{\pi \times fs}{16}\left(\frac{140^4 - 60^4}{140}\right)$$

$fs_{act} = 0.048 N/mm^2$

As; $fs_{act} < fs_{all}$

$\Rightarrow$ Cam is safe under torsional load

- Cylindrical Sensors with Built-In Amplifiers

Fig 5: sensor

1. Mounting size hole: 18.5 mm
2. Voltage: 230 Volt AC
3. Sensing distance:

Minimum = 1.5mm

Maximum: 3.5mm

This is selected for two reasons:

a) Because inorder to operate minimum distance should be 1.5 mm

B) DC sensors with higher range are very costly (5000+)

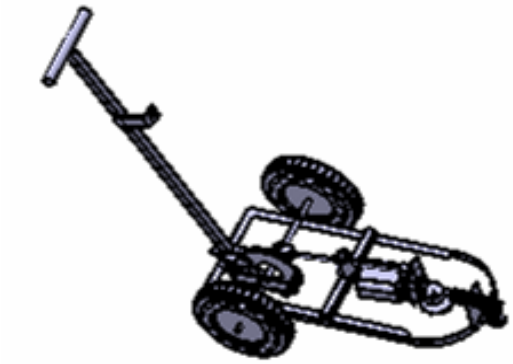

Fig 6: 3D CAD Model

A= Heat Transfer

ΔTm = Logarithmic mean Temperature Difference = (Ts1-Tt2)-(Ts2-Tt1)

CONCLUSION

The project is successfully developed to add most possible features there by the objectives of

1. High area of coverage
2. Safety of device and persons
3. Oscillation mechanism to cover maximum area
4. Fodder cutting mechanism
5. Hedge cutting mechanism

Are fulfilled so also the strength analysis, manufacturing drawings, fabrication, and assembly and testing is done.

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