Sensor Based Multipurpose Agricultural Cutter

Prof.J.P.Wagh[1], Aishwarya Chaudhari[2], Nikita Gaikwad[3], Shital Kolekar[4], Neha Kothule[5]

[1]Asst. Prof., Dept. of Mechanical Engineering, PCCoE, Nigdi, Pune, Maharashtra, India-411044

[2,3,4,5]Student,,Dept. of Mechanical Engineering, PCCoE, Nigdi, Pune, Maharashtra, India-411044

Abstract - ***T****he other machines that are used in agriculture or gardening are the hedge trimmer and the fodder cutting machine. These machines are also available in market as special purpose machines dedicated to a single task. These are special purpose machines that is used to cut lawn grass only, thus there is a need of lawn cutting, a special purpose machine that can do three functions namely , lawn cutting, hedge trimmer and fodder cutter all in one machine. By mere modification of changing location of the cutter the machine should function and perform above mentioned operations, thus saving cost of machines and better utilization of facility. This report describes the design of the sensor based multi-purpose agriculture cutte****r****.*

Key Words**: Grass Cutter, Agriculture Cutter, Sensor , Multi-purpose Cutting.**

1.INTRODUCTION

A lawn mower is a machine that uses a revolving blade or blades to cut a lawn at an even height .Lawn mowers employing a blade that rotates about a vertical axis are known as rotary mowers, while those employing a blade assembly that rotates about a horizontal axis are known as cylinde*r* or reel mowers .Many designs have been made, each suited to a particular purpose. The smallest types, pushed by a human, are suitable for small residential lawns and gardens, while larger, self-contained, ride-on mowers are suitable for large lawns, and the largest, multi-gang mowers pulled behind a tractor, are designed for large expanses of grass such as golf courses and municipal parks.

1.1 Methodology

Design Methodology for Design and development of the sensor based multi agri cutter :

- Kinematic linkage design and drawing of mechanism for eccentric, movable arm bracket, movable blade arms , etc using 'Kinematic overlay method'.The kinematic linkage drawing will be developed in 2-d using Auto-Cad software
- Design an selection of the motor for cutter according to power
- Design of motor spindle
- Design selection of bearings
- Design of main shaft
- Design selection of ball bearings for wheel
- Design selection of oscillator arm
- Design of hinge pin

1.2 Scope of paper

- Increases labor comfort , labor efficiency
- Prevents damages to hands, joints etc as minimal vibrations are transmitted
- High torque of device permit variety of cutting and shear operators effortlessly.
- Simple system to implement.
- Solar power is clean and pollution free
- Very low pay back time ...cheap running cost as solar power is free
- Application to open field vegetable farming sector

- Application to open field horticulture farming sector
- Application to open field floriculture farming sector

2. WORKING

- When the vehicle is pushed forward.
- The rear wheel rotates the axle and the face cam which makes the roller follower to move to and fro and there by the cutter assembly to oscillate.
- This makes the lawn cutter to cover double the area that was possible by the Conventional lawn mower, thus completing the work in half the time.

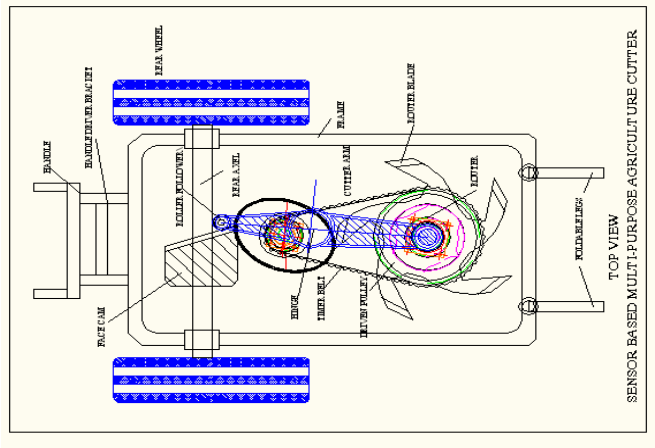

Fig-1: Sensor Based Multi-Purpose Agriculture cutter

[3]This arrangement is used in the form of a photo-electric sensor which senses any object in the cutting area , which may cause an accident. The sensor senses this object , gives a warning using the warning system , the warning is both audio (noise /alarm) and visual (Blinking lamp).At the same time the electrical circuit used will stop the cutter motor hence , the chance of accident are reduced such as a person coming in front of the lawn mower or a stone/object coming in path of the agri-cutter**.**

3. DESIGN CALCULATION

1. INPUT SHAFT:

Motor Torque= 0.159N-m

Design Torque, T_{design} =0.525 N-m

Diameter,d = 3.0 mm

2. WHEEL SHAFT BEARING: (LH&RH)

Radial load, FR= cutter force =10.5N

Life of Bearing=436 mrev

Capacity of Bearing, C=79.6N

3. BRAKE DISKHUB:

Torsional Shear,fs_{act} = 0.536 N/mm^2

4. CAM PLATE:

Torque at wheel, T = 25 x 10^3 N-mm

Torsional Shear, fs_{act} = 0.00135N/mm^2

5. ROLLER FOLLOWER:

Torque at wheel shaft, T=0.7 x 10^3 N-mm

Torsional Shear, fs_{act} = 0.04/mm^2

6. FOLLOWER ARM:

Force, f =17.5 N

Torque, T=2450 N-mm

Allowable shear stress, fs_{all}= 97.5 N/mm^2

Diameter, d = 5.09 mm

4. DESIGN VALIDATION

Analysis using ANSYS software package .The critical parts of the machine are to be analyzed using software simulation. We have taken help of the ANSYS software package for the same. the most critical sub assembly that needs to be analyzed is the follower arm Assembly. All the major operating forces are acted on this assembly Therefore, we have simulated this assembly in ANSYS.

4.1. The following results are plotted from the analysis:-

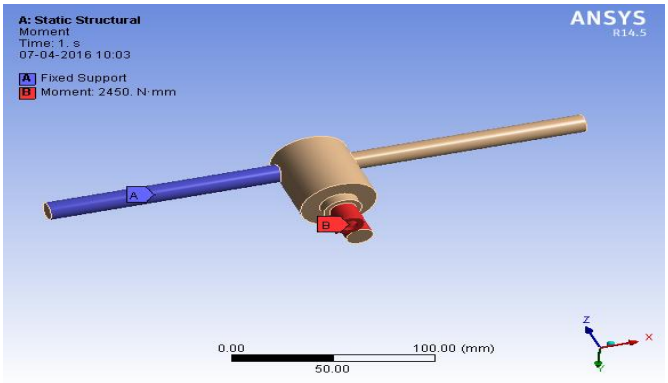

Fig.- 2: Loading conditions of Follower Arm

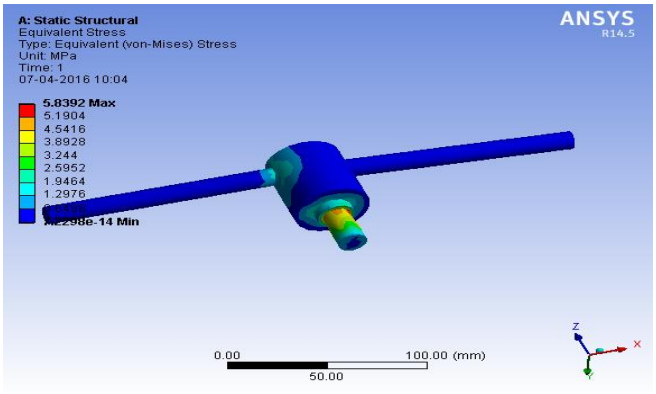

Fig-3: Equivalent stress on Follower Arm

other components also analyzed and tested for required conditions.

5. ACTUAL FABRICATED MACHINE

Fig-4: Manufactured Machine

Rotary mower rotates about a vertical axis with the blade spinning at high speed relying on impact to cut the grass. This tends to result in a rougher cut and bruises and shreds the grass leaf resulting in discoloration of the leaf ends as the shredded portion dies. This is particularly prevalent if the blades become clogged or blunt. Most rotary mowers need to be set a little higher than cylinder equivalents to avoid scalping and gouging of slightly uneven lawns, although some modern rotaries are fitted with a rear roller to provide a more formal striped cut.

5.1 Advantages

1. Oscillating cutter mechanism used in the lawn mower arrangement enables to cover double the area in one pass….hence work is completed in half the time.

2. Grass height can be adjusted during lawn moving application.

3. No separate power arrangement is used for oscillation….the forward motion of the vehicle is used for producing the oscillating motion…hence the power is saved.

4. Safety arrangement used is adjustable from 50 to 500 mm, hence proper safety is achieved.

5. Warning using audio and visual signal alerts the operator in time so also the motor power is auto cut-off hence no damage to the cutter.

6. Hedge grass cutter finds application in gardening application also for compound weed trimming.

7.Fodder cutter is fast in operation as compared to the manual cutter .

8. Fodder cutter comes with safety arrangement ….which avoids accidents.

5.2 Test Results:

Results were obtained with the following values:

Distances	Performance	Remark
5mm	Motor stops working because of obstacles	Sensor worked
25mm	Motor stops working because of obstacles	Sensor worked
50mm	Motor still working in presence of obstacles	Sensor does not worked

Table 1: Sensors test data

6. CONCLUSION

This chapter summarizes the test results obtained and places the findings from the tests.

1. The area covered by machine will be more instead of one line pass so time consuming.

2. The provisions on the Machine is such that by simply changing the position and doing some necessary arrangements the various operations can be performed.

3. With the help of sensor can avoid accidents.

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BIOGRAPHIES


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Mrs. J. P.Wagh
Asst. Prof. PCCOE,Pune.
Working in area of Design, Optimization in composite materials.

Aishwarya Chaudhari
Undergraduate Mechanical Engineering student

Nikita Gaikwad
Undergraduate Mechanical Engineering student

Shital Kolekar
Undergraduate Mechanical Engineering student

Neha Kothule
Undergraduate Mechanical Engineering student