Design Analysis and Modification of Agriculture Vehicle

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Abstract— India is an agriculture based country in which, 70% of people depends on the outcome of farming. Nowadays, advancement of the agriculture vehicles is mandatory. After containing the data for the project from the ground level we found that the agriculture vehicle must modified in some manner. Farmers are facing so many problems regarding to agriculture vehicle. So our approach with this project is to make a reliable solution for the farmers regarding to agriculture vehicle and reduce the work of the farmers. Indian agriculture industry is very large so it is obvious thing that need of the agriculture vehicle and equipments is very large. With the coming of the Industrial Revolution and the development of more complicated machines with newer technologies.

Key words: Front Axle Modification, Height Increments, Tractor Modification

I. INTRODUCTION

Indian agriculture industry is very large so it is obvious thing that need of the agriculture vehicle and equipments is very large. With the coming of the Industrial Revolution and the development of more complicated machines with newer technologies. Agricultural machines have been designed for practically every stage of the agricultural process. They include machines for tilling the soil, planting seeds, irrigating the land, cultivating crops, protecting them from pests and weeds, harvesting, threshing, grain, livestock feeding, and sorting and packaging the product. List of agricultural machinery are Tractor, solid cultivation, planting, fertilizing and pest control, irrigation, harvesting, milking, loading, linkage machinery. So we can say that the implementation of the agriculture vehicle is essential and revolutionary with selecting this project we believe that we can implement and develop vehicle and we can be the helping hand to reduce the work of the farmers. Our motive by selecting the project is to do the innovation with hierarchical equipments and provides the solutions of problems of the farmers with minimum cost and affordability.

Some research paper we are refer and this are following :-

- [1]"Shape Optimization Of Front Axle Support Of Tractor: Development of a component is a long process which requires number of tests to validate the design and manufacturing variables. The bracket which is optimizing in this project is very complex due to its robust design so it is difficult to design thorough mathematical calculations. In order to optimize it finite element method is used.
- [2] Analysis and Design of Tractor Rear Axle using Finite Element Method review: An Axle shaft is a rotating member usually of circular cross-section (solid or hollow), which is used to transmit power and rotational motion in machinery and mechanical equipment in various applications. An axle is a central shaft for a rotating wheel.
- [3]A Comparative Study of CNC Part Programming Addressing Energy Consumption and Productivity: This paper reports on a comparative study realized to contrast between the part code generated by two different CAM systems and one part program generated by the authors. This comparison addresses in particular tool path, but also includes number of lines, cycle time and energy consumption.
- [4] An improved tractor having a front section pivotally coupled to a rear section wherein the front section has a radiator, front wheels, and a tilt able cab. Wrapped around the radiator at the extreme end of the front section is a combination bumper and storing area for hydraulic fluid.
- [5]Peculiarities of wheel interaction with the terrain for 4WD tractors working with front-mounted loaders. When tractor wheels are loaded by a vertical forces that do not correspond to the specified proportions, deformations of front and rear tires also do not correspond to the specified proportions, and this leads to a kinematic discrepancy because of change in ratio between driving wheels' rollingra diuses.

A. Problem Summary

The farmer has such kind of problem to remove the unwanted grass growing between the two rows of the crops like cotton plants. So we increase the height of tractor. So it can be easily pass over the plant and made a modification cultivator which can be fitted in our modification tractor. There are many kinds of problem in farm equipments and the farmers have to suffer a lot of problems and disadvantages, in which we want a tool problem, and as a tool we take the tractor. All the systems in the tractor have developed very recently, but there is still a lot of things that can make a lot of changes. When we remove weeds from the tractor, the crop in the field is damaged. Such as the collapse of the plant or crushing. So that we will change the tractor's Front axle's spindle and rear wheel hub assemblies and increase the height, this will make the price cheaper and easier to design. Doing this will stop the crushing of plants, help to sprinkle pesticides and it will be easier to cultivate.

B. Purpose

General-purpose tractors are also called row-crop tractors. They can perform nearly all of the functions of a utility tractor, but are better suited for use with row crops such as beans, beets and carrots. They are built to have more clearance between the tractor base and the row crop, thus minimizing damage done to crops during tilling for weeds and harvesting. They are also designed specifically to straddle crop rows, which also minimizes damage.

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C. Tractor Information

In this project we will implement some of the tractor parts as we want the elevated height of the tractor for fulfill the application of the farmer at the lowest cost modification in the existing tractors that they have. The tractor parts which will be modified is the front axle spindle which is use to steer the front wheels and as well as support the front wheel hub. And the second part is reduction unit of the rear drive which is use to convert the speed in torque. Basically we select the NEW HOLLAND brand for our project. Our project is done on the tractor NEW HOLLAND 3630 TX/3030. This tractor has all that required specification that we want in our project. Also it is suitable for land requirement of Gujarat region. It can easily modified as per our requirements of the project and modification cost is very low for this tractor as its has parts like this.



Fig. 1: Tractor

II. LIST OF THE PART

A. Front Spindle

This part is mounted on the front axle of the tractor. It is use for the support the front wheel hub and it also steer the vehicle. The front wheel mounted on the hub and the hub is mounted on the spindle

B. Reduction unit

Reduction unit is placed after the axle shaft. It includes the bull gear in it which is further connected to the rear wheel. It is nothing but a speed to torque converter. Not all the tractors have this type of assembly. But now days so many types of manufacturer provides this assembly in the tractor.



Fig. 2: Front spindle and its position



Fig. 3: Front spindle with assembly



Fig. 4: Reduction gear

III. INFORMATION OF TRACTOR SPECIFICATION

Engine Rated RPM :	2300
HP :	55
Fuel Type :	Diesel
No. of Cylinder :	3
Torque :	1500
Air Cleaner / Filter :	Dry type, 2 Elements with Pre Cleaner
Fuel Tank Capacity :	60 Liters
Transmission Type :	Constant mesh
Drive :	2WD
Max Speed :	3.08-31.30 kmph
Max Reverse Speed :	2.8-8.79-14.98 kmph
Power Take Off(P.T.O rpm) :	540
Steering Type :	Power
Brakes Type :	Oil Immersed Multi Disc Brakes
Clutch Type :	Double
Total Weight :	2060 Kg
Wheel Base :	2045 mm
Ground Clearance :	445 mm
Turning Radius of Brakes :	3190 mm
wheel Size Front :	7.5 x 16
Wheel Size Rear :	16.9 x 28
Wheel Size Rear :	16.9 x 28

Table 1: Tractor specification

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The above table indicates the engine specification of the tractor as well as tractor specification which are important research for our project

IV. RESULT

After a long thought we came up on this issue. Front Spindle and rear Gear assembly coming in the tractor, can do in an increase height of the tractor. At present, the spindle in which the tractor is being used, we have to use a longer spindle than that.

A. Front Axle Spindle



Fig. 5: Front axle spindle

B. Rear Hub Assembly

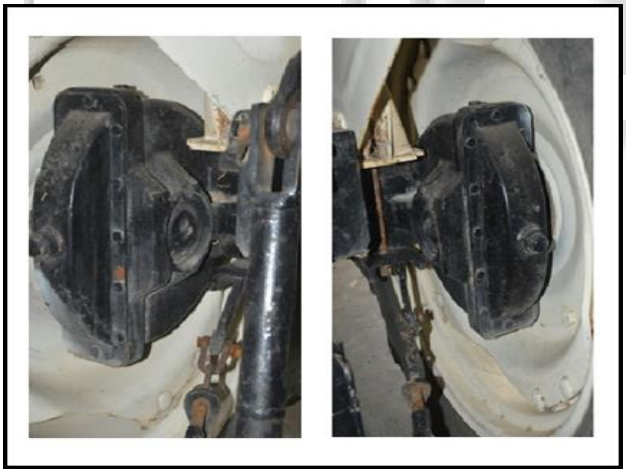


Fig. 7: Rear hub assembly

The rear gear assembly has a driver shaft and driven shafton which the Bull Gear and the Pinion are mounted. Bull gear has 72 teeth and pinion has 12 teeth. And it's also call speed reduction unit, speed reduction unit is very important unit for tractor because tractor must need the torque to work in farm
with high power. The speed reduction unit in the rear part which can be changed to position of gear and increase the height. Like now gear's meshing condition is horizontal but we changed into vertical and get height difference

We had a basic initial three idea from which we decided to make a change in Rear Hub and the Axle because there were many probes in the other two ideas. Such as the air suspension was very expensive and lowered capacities air suspension only the ups and downs were rising when we had to increase touring efficiency too. To change the Russian tire, the tractor would have to make changes in the fabrication and body work and also bought new Russian wheel set so it's also costly. Indian farmer can't afford this highly expensive price to bought new parts for it. So we just thought of moving forward on this idea to modify the rear hub (gear assembly) and front axle spindle.

C. Simulation of Front Axle

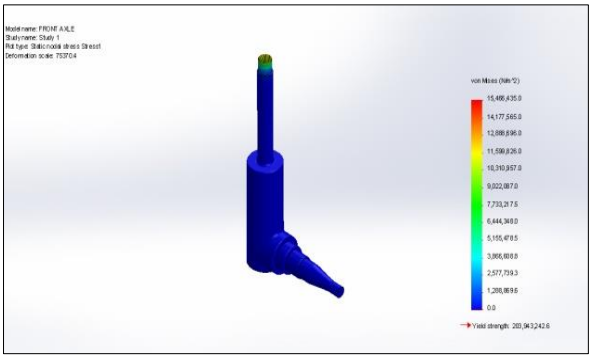


Fig. 8: Front axle-Study 1-Stress-Stress1

MdInf_SldBd	Treated as	Volumetric Prop.
	Solid Body	Mass:8.96804 kg Volume:0.00113952 m^3 Density:7870 kg/m^3 Weight:87.8868 N

Table 2: Current configuration

V. CONCLUSION

In our project, we conclude that we should have to do modification on the front spindle and rear axle hub. We tried to think on different ideas of elevating the tractor but it will be more efficient to do modification in front axle and rear hub instead of put a Russian wheels and air bags suspensions. Because of these ideas the cost factor increases so high and also the hidden factors are there. With the modification in the front spindle, we will increase its height and done simulation in it for surety of ours and as well as the rear axle housing provided by the company itself, its gears are mashing each other in horizontal axis. By moving the whole housing in 90 degree and mashing those gears in vertical axis will give appreciated increment in the height. Associate with this height we will decide the height of the modified front axle. We will try our best to make our project in commercial use with making the physical model of the front axle.

ACKNOWLEDGEMENTS

We take an opportunity to acknowledge and extend our heartfelt gratitude to our guide, Prof. S.D.Baldha who is most responsible for help to over complete this work. He showed to different ways to approach the problems and the need to be persistent to accomplish over goal. His discernment in the choice of topic, his confidence in over when we doubted over self and his admirable guidance are

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some cogent reasons that make over aver that without his support this would be a chimera. We all also thankful to Mr Chndrakantgiri Goswami, That was an amazing parson, he can provide his workshop and Valuable time and knowledge about over project. We also thankful Head of Department of Mechanical Engineering for cooperation and support to complete this work. We can also like to express thanks to DSTC, JUNAGADH providing necessary facilities. We can also convey my thanks to HOD, staff members and lab technicians of Department of Mechanical Engineering for their continues support.

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