

Design and Development of Low Cost Ploughing, Rice Transplanting and Harvesting Machine- A Concept

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Abstract— Rice Farming being one of the major occupation in India and it's plays a important role in the Indian economy. It is very essential to discover and implement new idea in this field, through lot of work has been done in this area. It is unfortunate that, these ideas are not being implemented properly in actual field. This is due to high cost, small farming area and lack of mechanization. The Conventional method of ploughing, rice transplanting and cutting of crop is a laborious process and hence for that reason there is a scarcity of labor's and basically, many farmers use bullocks and buffalo for farming operation. This will not satisfy need of energy requirement of the farming as compared to other countries in the world. This result in delayed farming crop, loss of man power and reduces productivity. Production practices to overcome these difficulties, we are thinking that human and animal efforts can be replaced by some advance mechanization which will be suitable for small scale farmer from economical and effort point of view. So, we are developing this machine which will satisfy all this need and to solve labor problem. A design and development of ploughing, rice-transplanting and harvesting machine. This farming machine is doing three operations i.e. ploughing, rice-transplanting and crop cutting.

Keywords— Low Cost Farming Machine, Mechanical Engineering, Multipurpose Agriculture Equipment's, Rice Farming Machine, Small Farming Machine

I. INTRODUCTION

India is the largest farming country in the world after china. In total land of India the 60.43% land is used for farming and in which the 63% small and fragmented land holding. In spite of the large scale mechanization of agriculture in some parts of the country, most of the agricultural operations in larger parts are carried on by human hand using simple and convectional tools because of the high cost of machinery. Little or no use of machines is made in ploughing, transplanting and harvesting crops. This is specially the case with small and marginal farmers. Its results in low yields per capita labor force. The primary objective of this project is to design and development rice farming mechanical system which perform the ploughing, rice-transplanting and rice crop cutting operation by using only one power source the power source is used as a petrol engine and the attachment is the ploughing, rice-transplanting and harvesting equipment is attached or detached when its required for particular operation. The system is full flexible for small farming area and the making cost of system is low compare to the products are available in market.

1.1 Objective of Project

1.2 The primary objective of this project is to design and development rice farming mechanical system which perform the ploughing, rice-transplanting and rice crop cutting operation by using only one power source the power source is used as a petrol engine and the attachment is the ploughing, rice-transplanting and harvesting equipment is attached or detached when its required for particular operation. The system is full flexible for small farming area and the making cost of system is low compare to the products are available in market.

1.3 Machine Description

This machine is doing three operations i.e. ploughing, rice-transplanting and crop cutting. This farming machine is driven by 198.88cc petrol engine that means only one power source are used. The machine is divided into four parts, Part-1 is the main machine, in this the power is transmitted by wheel and another three equipment, the equipment is attached or detached when it's required. Part-2 is the Ploughing attachment in this attachment the ploughing (Land preparation and Mudding) operation we can perform. Part-3 is the rice transplanting attachment it reduces human error and increases productivity. Rice seeds are

placed in a seeding tray for 1-2 days and transplanted into the rice field by a transplanter. Transplanting is a method for the rice transplantation which increases rice growing rate. The equipment is used the concept of a quick return mechanism in order to transfer rice crop from seeding tray in the field with minimum damage. Part-4 is the harvesting equipment in this compact and can cut up to two rows of rice crops. It has cutting blades which cut the crop in a sliding motion.

1.3 Flied of Use and Benefits

Farming mechanization is an essential input to modern farming to decreases the human and animal effort and increases productivity. The need to mechanize the marginal and small farmer, and for inclusive growth of farm mechanization sector.

II. PROBLEM DEFINITION

2.1 Problem Statement

To Design and Development a Rice-Farming mechanical system for the Ploughing, Rice-Transplater and Harvester using only one power source (Petrol Engine) and it's working on Belt-Pulley, Sliding and Quick-Return mechanism, the system is flexible for small farming area.

2.2 Objectives:

1. To increases the productivity
2. Specially design for small farming areas to the flexible working.
3. Low cost
4. Multipurpose machine with difference attachment
5. Compact in size

III. METHODOLOGY

In order to overcome problems when manufacturing the system we making some step for manufacturing the system by using the standard procedure for manufacturing product, and by using this we improve productivity.

3.1 Methodology

Here we used following methodology to develop the system by increasing the productivity, decreases the manufacturing time and cost. The steps are following

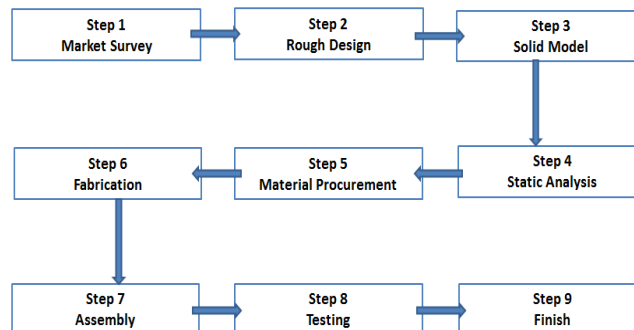


FIGURE 1: Steps of Manufacturing

3.1.1 Step 1 Market Survey

In market survey we search all the equipment available in market related to our project topic, their cost and availability. Also we visited Agriculture Science Centre, Kosbad Hill, Dahanu and Agriculture Research Centre, Palghar for getting more information related to our project and its very useful to us for finalize the project.

3.1.2 Step 2 Rough Design

After market survey we making rough design of the project for the better understanding of its construction and working.

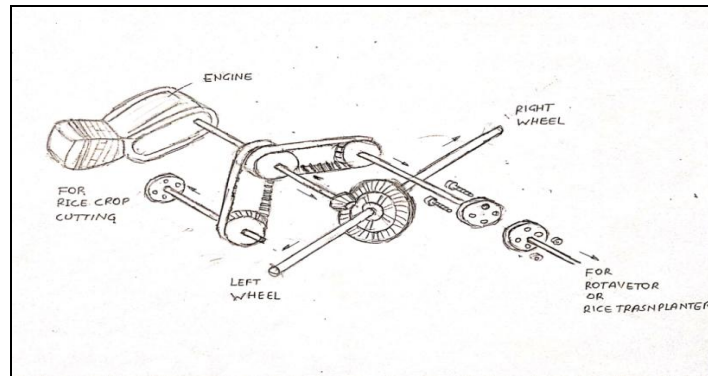


FIGURE 2: Rough Design

3.1.3 Step 3 Solid Model

The solid model is finalized model of project by using this model we confirm the dimension and the motion of equipment's. By solid modelling of project we visualise how project is look after manufacturing. Here we used Solidworks software version 2018 to create solid model.

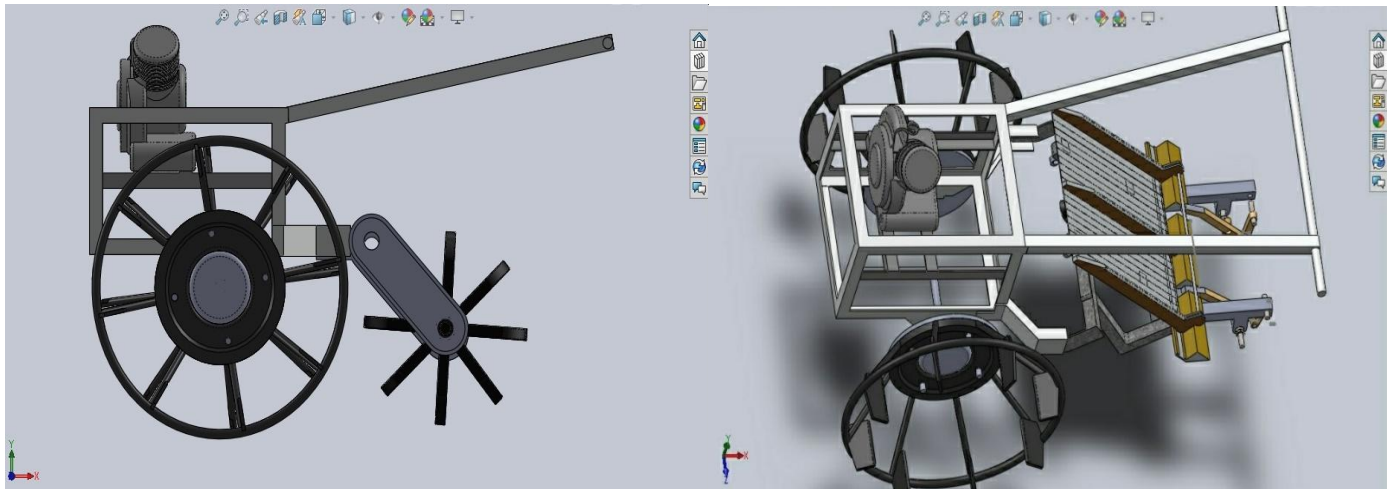


FIGURE 3: Solid Model

3.1.4 Step 4 Static Analysis

The main purpose of analysis is to check the machine is withstand with the given load or not without making actual model. For analysis of project we used Solidworks Simulation software version 2018.

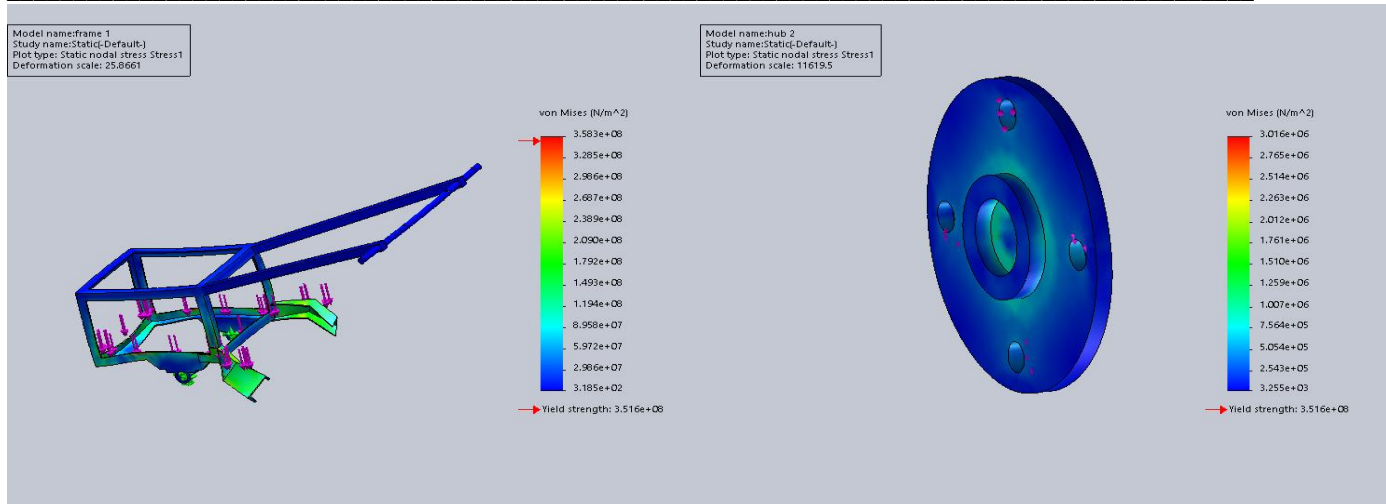


FIGURE 4: Static Analysis of Chassis and Hub

3.1.5 Step 5 Material Procurement

Following material and part are required for the manufacturing the system

**TABLE 1
 REQUIRED MATERIAL AND PARTS**

Sr. No.	Part Name	Sr. No.	Part Name	Sr. No.	Part Name
1	Engine	8	Spur/ Helical Gears	15	L-Section
2	Cage Wheel	9	Pulley	16	C-Channel Section
3	Bearing	10	V-Belts	17	Square Shape Section
4	Rotavetor Shaft	11	Sprocket	18	Metal Sheet
5	Transmission Shaft	12	Chain	19	Flange Coupling
6	Constant Velocity Joint	13	Clutch	20	Metal Pipe
7	Bevel Gear Set	14	Brakes	21	Nuts and Bolts

3.1.6 Step 6 Fabrication

The fabrication is the actual manufacturing process of the project according to the specification. In fabrication we making chassis, hub, transmission part, rotavetor part, transplanting equipment part, harvesting equipment part etc.



FIGURE 5: Fabrication

3.1.7 Step 7 Assembling

After fabrication next step is assembling in this the all parts and equipment are assemble

3.1.8 Step 8 Testing

When all parts are assemble we tested them for the checking the equipment's its proper working or not.

3.1.9 Step 9 Finish

In the finishing of the project we do final touches of the project by polishing and painting.

IV. CONCLUSION

This farming machine has considerable potential to greatly increase productivity of rice crops. So, We are design and developed ploughing , rice transplanting and harvesting rice farming machine which will do multiple-operation i.e. ploughing, land preparation , mudding, rice transplanting and rice crop cutting . The machine solid model is successfully tested on motion analysis and stress, strain and displacement simulation. After the solid model testing we started the actual manufacturing process of build the machine.

REFERENCES

- [1] Charwak, M. Kunar, S. Kumar, and M. Kumar, "Design And Fabrication of Crop Cutting Machine," IJERT, Jun. 2019. vol.08, Issue.06, pp. 171-176
- [2] A. B. Mule, P. T. Sawarkar, A. A. Chinchghare, and A. N. Bhiwapurkar, "DESIGN AND FABRICATION OF HARVESTING MACHINE," IRJET, Jan. 2018. vol.05, Issue.01, pp. 501-505
- [3] A. Bangura, Z. Zuoxi, and J. Jundong, "A Research On Rice Transplanter Fitted with Seeding Number Counting Device ,," ScienceDirect, 2018. pp. 256-261
- [4] R. Krishnan, R. S. Vishnu, H. M. T, and B. R. Rao, "Design And Fabrication of A Low-Cost Rice Transplnting Machine," IEEE, 2017, pp. 14-17
- [5] V. Deshpande, S. Menashi, S. Jagatap, N. Belkud, and P. Doddamani, "DESIGN & FABRICATION OF AGRICULTURE EQUIPMENT," IRJET, May 2017. vol.04, Issue.05, pp. 2827-2830
- [6] T. O. Terefe, "Design And Development Of Manually Operated Reaper Machine," IJARP, 2017. vol.01, Issue.02, pp. 15-21
- [7] M. shahid M. sadik Shaikh and H. A. Hussain, "Design and Fabrication of Multipurpose Farming Machine," IJSART, Sep. 2017. vol.03, Issue.09, pp. 35-48

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- [8] P. Lao-anantan, K. Sukvichai, and P. Sripadugtham, "Development of a Motion Controller for a Parachute Rice Sprout Transplanter," IEEE, 2016.
- [9] S. L. Kadu, G. B. Kadam, K. P. Jaduav, V. S. Gawade, A. Garje, and A. Gosavi, "Design, Development and Operation of 3.5 HP Power Tiller," IJRRCE, Sep. 2015. vol.02, Issue.01, pp. 149-154.
- [10] S. Chertkiattipol, T. Niyampapa, W. Jantaradach, and K. Saensuwan, "The performance of rotary power tiller using prototype rotary blade in dry landfield," MIJST."Nov.2008, Special Issue, pp. 17-26.
- [11] Dhanesh D. Patil, Dr. Mangesh R. Phate, "Design development of rice planter machine," IJIR,2016, vol.37, pp. 395-410.
- [12] SK Mohanty, JN Mishra, MK Ghosal, " Ergonomical evaluation of paddy transplanting operation in odisha" International journal of Agriculture Engineering, 2012, vol.05, Issue.02, pp. 153
- [13] Thomas Edathiparambil Vareed, "Development of a mechanism for transplanting rice seedling", Mechanism and machine theory, 2002 vol.37, Issue.04, pp. 395-410
- [14] P Ojha, S Kwatra, " Development of msd among the farm women involved in traditional and mechanized method of rice cultivation of northern india", Indian Journal of Traditional Knowledge, 2016, vol.15, Issue.01, pp.163-166
- [15] Vineet Sharma, Shanank Singh, Rakesh Kumar, " Comparative study on mechanical transplanting and direct seeding of rice", Institute of Agriculture Engineering, Scientific Journal, Agriculture Engineering, 2014, vol.04, Issue.02