Design and Fabrication of Multipurpose Agriculture Machine

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***Abstract*— India is an agricultural country where 70% of the populations are dependent on agricultural performance. Also economically, farmers are very poor due to which they are unable to purchase tractors and other costly equipment hence they use traditional methods of farming. Essentially, a lot of farmers in India also use oxen, horses and buffaloes for farming. So, we are thinking that the efforts of man and animal can be replaced by advanced mechanization which will be adapted to small farmers from the point of view of the economy and effort. This project solves the basic problems faced by every farmer in order to perform different tillage operations at different crop stages and also going to address multiple problems faced by farmers. In any field there are different field operations to be performed at different stages of the crops, for example weeding, ploughing, inter cultivation, etc. In order to perform this farmer needs usage of cattle or labor, if he does not own any cattle, he under goes rental process where the farmer has to pay in bulk. We are therefore developing this equipment that will meet all these needs and resolve the problem of work. Accordingly, this multipurpose agricultural machine performs a quality function compared to any other equipment's in the market and the equipment is of low weight and compact in size. The machine reduces human power upto 50%. And requires less time than traditional techniques. So, in this way we can overcome the labour problem that is the need of today's farming in India by developing mechanized equipment's of low cost with high accuracy.**

***Index Terms*— Agricultural, India, farming, machine.**

I. INTRODUCTION

We all know that agriculture is the backbone of the Indian economy. "A man who can survive for three days without food for three days will quarrel, for a week will fight and for a month or so will die". Agriculture is the branch of science and art of farming which includes cultivating the soil, production of crops and raising the economy. It is the most important sector in the world. For many years, agriculture has been carried out in a small range cultivating between 2 to 3 hectares, with the help of human labor and traditional tools such as wooden plough, yoke, leveler, harrow, mallet, spade, big sickle etc. These are used inland preparation, sowing of seeds, weeding and harvesting. It is the most important sector in the world. For many years, agriculture has been carried out in a small range cultivating between 2to3 hectares, with the help of human labor and traditional tools such as wooden plough, yoke, leveler, harrow, mallet, spade, big sickle etc. These are used in land preparation, sowing of seeds, weeding and harvesting. Indian farmers cannot use modern agricultural techniques and equipment because these are too expensive and difficult to purchase. By inculcating scientific farming methods, we can get maximum yield and we can increase the quality of the crops which can save a farmer's life, but the majority of farmers are still using ancient methods due to lack of knowledge or lack of expenditure for utilizing modern tools Mechanized farming is the process of using agricultural machinery to mechanize agricultural labor, the substantial increase in productivity of agricultural workers in modern times, and mechanical machinery has replaced many agricultural jobs previously carried out by manual labor, either through working animals such as oxen, horses and mules. The whole history of agriculture includes numerous examples of the use of tools, such as hoe and plough. But the continued integration of machinery since the Industrial Revolution has enabled agriculture to become significantly less labor intensive, today's mechanized agriculture involves the use of tractors, trucks, combine harvesters, countless types of agricultural instruments, aircraft and other vehicles. Precision

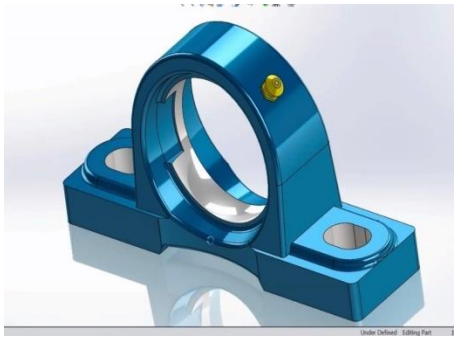
farming even uses computers associated with satellite imaging and satellite navigation to increase returns. Mechanization has been one of the main drivers of urbanization and industrial economies. In addition to improving production efficiency, mechanization promotes large scale production and may sometimes improve the quality of agricultural products. On the other hand, it can displace unskilled farm workers and cause environmental degradation, especially if it is applied in a short-term rather than holistic manner.

II. DESIGN AND ANALYSIS

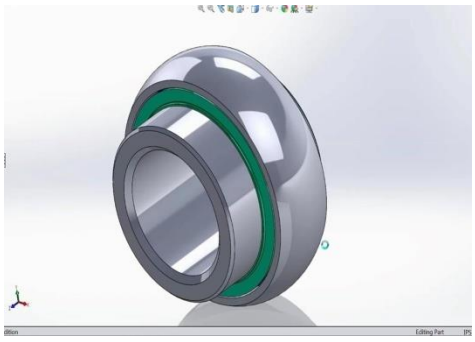
Software used for Design

The software used for designing is Solid works Student Edition 2018. Solid works is the most widely used 3D cad package in industry today. Different types of operations were used by this software. Software like this offers all kinds of design capabilities, from the selection of scale to the extrusion of objects. This software can convert all types of 3D drawings into 2Ddrawings.

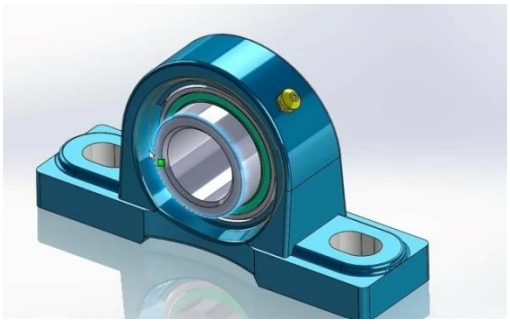
Design of Block



Design of Bearing

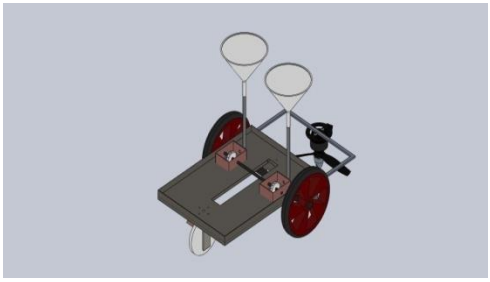


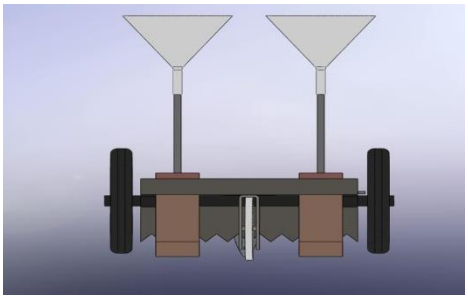
Assembled Pillow Block Bearing



Design of Weeder Fan

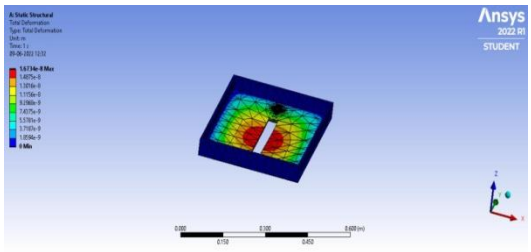
Assembly drawing of Machine



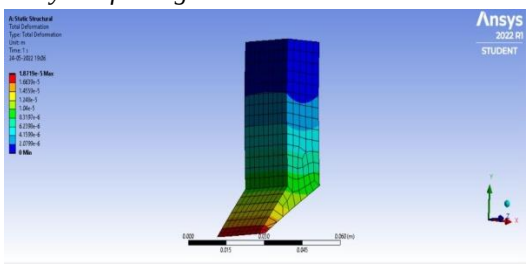


Simulation and Analysis

Analysis of Base



Analysis of Plough tool



III. CALCULATIONS

Theoretical Calculations

- Torque transmitted on the wheel:
- Tw=Kw*Wt*Rw
- Where Tw=Torque transmitted on the wheel
- Kw=Coefficient of rolling resistance (0.3for a wheel)
- Wt=Weight of the machine (15kgsapproximately)
- Rw=Radius of the ground wheel
- Therefore, we have Kw=0.3
- Wt=15kgs =15*9.81=147.15N
- Rw=350mm=0.35m
- Tw=Kw*Wt*Rw
- Tw=0.3*147.15*0.35
- Tw=15.450Nm
- Calculation of Power:
- $P=2\pi NT/60$
- P=(2*3.14*200*22.072)/60
- P=328.590W
- So, distance covered in one minute =67rpm*2πr
- Since, the wheel rotates at a speed of 1.25m/sec and this implies rpm of wheel=67
  =67*2*3.14*0.35
  =73.633metres
  =70-75metres approximately
- Feed rate of ploughing tool:
- Depth of cut=5cm
- Considered speed of the tool as 2.5km/hr=41.64m/min
- Number of tools=2
- Feed rate=Speed of tool* Depth of cut*Number of tools
- Feed rate=41.64*0.05*2
- Feed rate=4.164m2/min
- Calculations for Seeding:
- Speed=67rpm
- Row spacing=25cm
- Seed sowing time=2seed/sec
- Opening number=5
- Seed dropping per min=5*67/2=167seeds
- Therefore, If the speed of the wheel is 75m/min then for 75metres167seeds will bedropped
- Power required for weeding blade:
- Power required for weeding blade =Soil resistance*Area*Velocity
- Soil resistance (S.R)=1.05kgf/cm2
- S.R=1.05*9.81/0.0001=103.005N/m2
- Area(A)=Depth of cut (in mm)*width of cut (inmm)
- A=0.050*0.450=0.0225m2
- LinearVelocity=$\pi DN\mu/60$
- Where,μ=Co-efficient of friction=0.1
  - N=Speed of the weeding blade=4000Rpm
- Linear velocity=3.14*4000*0.1/60
- Linear Velocity=5.233m/sec
- Power= Soil resistance*Area*Velocity
- Power=103.005*0.0225*5.233 =12.128Kw

PRACTICAL CALCULATIONS

- Torque transmitted on the wheel:
- Tw=Kw*Wt*Rw
- Where Tw=Torque transmitted on the wheel
- Kw=Coefficient of rolling resistance (0.3 for a wheel)
- Wt=Weight of the machine (12kgs approximately)
- Rw=Radius of the ground wheel
- Therefore, we have
- Kw=0.3
- Wt=12kgs =12*9.81=117.72N
- Rw=355.6mm=0.3556m
- Tw=Kw*Wt*Rw
- Tw=0.3*117.72*0.35
- Tw=12.481Nm
- Calculation of Power:

- $P=2\pi NT/60$
  Where, N=Speed of the wheel=1m/sec=53.64rpm
  T=Torque transmitted on the wheel=12.481Nm

- P=(2*3.14*53.647*12.481)/60
- P=70W
- So, distance covered in one minute =53.64rpm*2πr =53.64*2*3.14*0.3556 =59.893metres
  - =55-60metresapproximately
- Feed rate of ploughing tool:
- Depth of cut=5cm
- Considered speed of the tool as 2.5km/hr=41.64m/min
- Number of tools=1
- Feed rate=Speed of tool*Depth of cut*Number of tools
- Feed rate=41.64*0.05*1
- $\text{Feed rate}=2.082 m2/min$

- Calculations for Seeding:
- Speed=53.64rpm
- Row spacing=25cm
- Seed sowing time=2seed/sec
- Opening number=5
- Seed dropping per min=5*53.64/2=134seeds
- Therefore, if the speed of the wheel is 60m/min then for 60metres167seeds will be dropped
- Power required for weeding blade:
- Power required for weeding blade=Soil resistance*Area*Velocity
- Soil resistance (S.R)=1.05kgf/cm2
- S.R=1.05*9.81/0.0001=103.005N/m2
- Area(A)=Depth of cut (in mm)*width of cut (in mm)
- A=0.050*0.450=0.0225m2
- Linear Velocity=$\pi DN\mu/60$
- Where,μ=Co-efficient of friction=0.1
  - N=Speed of the weeding blade=4438Rpm
- Linear velocity=3.14*4438*0.1/60
- Linear Velocity=5.8063m/sec
- Power=Soil resistance*Area*Velocity
- Power=103.005*0.0225*5.8063
- Power=13.456Kw

IV. CONCLUSIONS

- Based on the design, the overall output of the machine will meet the needs of small farmers as they are unable to buy expensive farm equipment.
- The machine required less human power and less time than traditional techniques, so if we make it on a large scale, its cost will be dramatically reduced, and we hope that will respond to the partial impetus of Indian agriculture
- It is useful for seed sowing, inter-cultivating, ploughing as well as weeding at minimum cost for the farmer so that he can afford it.
- The equipment will result more helpful when it is used in moist soil for weeding purposes, due to moisture content present in the soil the weed cutter can easily penetrate the soil and hence will easily accomplish the weeding process.
- The performance of the equipment will increase when it is operating on the smooth surface or less uneven surface and also it will be more effective when it is used on the crops with the same height and have fewer gaps between two crops.
- Multipurpose agricultural machine is a single system which contains multi attachments and can be easily assembled and dismantled comfortably and this equipment weight is around8 to10 kg thus it can be carried easily in farmland.

V. FUTURE SCOPE

- More operations can be included to the vehicle like pesticide sprayer, tiller and many other machines for various operation.
- We can connect the sensors to this machine so that it can control some of the parameters.
- The machine can also be attached with the tractor.
- The tyre can be changed according to the type of the land.
- In this machine instead of so wing in two rows it may be increased further.
- In our machine farmer is walking with machine during seed so wing and ploughing, providing eating arrangement into the machine will be beneficial.
- By increasing he equipment strength and quality so it speaks, we can have multipurpose agricultural equipment lifetime usage.

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