

Design and Fabrication of Multipurpose Agricultural Machine

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Abstract—Agriculture is the backbone of India. The Multipurpose Agricultural Machine is used to ploughing the agricultural field and sow the seeds into the land for making lots of plant production in field. The model is proposed with the objective of establishing a ploughing, seeding and spraying processing. It is a mechanical device, in which the spraying machine is used to spray the water and chemicals to protect the plant. We can plough and plant different varieties using this machine. It also increases planting Efficiency and accuracy made from raw materials so it is much cheaper and more suitable for small-scale farmers. The advantage of this method, it reduces seeding and spraying time in land and reduces human effort. The cost of this machine is very low and easy to operate simple construction.

I. INTRODUCTION

Indian economy is based on agriculture. Farmers nowadays pay plenty of cash on machines that facilitate them decrease labor work and increase yield of crops. The machines offered for ploughing, seed sowing, spraying pesticides etc., but these machines to be operated by hand to perform the specified operations and furthermore separate machines used for each functions. In this project we are fabricating ploughing, seed sowing, spraying and harvesting machines functions are combined together into single machine. The ploughing machine is used to plough the agricultural field with various ploughing machine, the seed spraying machine is used to feed the seeds into land for making lots of plant production in agricultural field, the sprayer is used to spray the chemicals to protect the plant. The machine consumes electrical power as an input. The electrical power is with help of solar energy using solar panel. So this is very much useful in agricultural field and develops the ploughing, seed feeder and sprayer process in less cost and easier method.

II. LITERATURE SURVEY

[1]Veerasha.Get.al In this journal paper Conventional method of planting and cultivating the crops is a laborious process and hence for that reason

there is a scarcity of labors, this result in delayed agriculture to overcome these difficulties.[2]Dhatchanamoorthy.Net.al In this journal paper The design for automatic seed sowing equipment is made. The plough is designed and modified the currently available plough tool in such a way that it with stand the load.[3]BhushanDeshmukhet.alIn this journal paper the farming process, often used conventional seeding operation takes more time and more labor. The seed feed rate is more but the time required for the total operation is more and the total cost is increased due to labor, hiring of equipment. The conventional seed sowing machine is less efficient, time consuming. Today's era is marching towards the rapid growth of all sectors including the agricultural sector. The seed feed rate is more but the time required for the total operation is also more and the total cost is increased due to labor, hiring of equipment. This machine reduces the efforts and total cost of sowing the seeds and fertilizer placement. [4]Andure.M.Wet.alThe basic objective of sowing operation is to put the seed and fertilizer in rows at desired depth and seed to seed spacing, cover the seeds with soil and provide proper compaction over the seed. [5]KumawatMukesh.Met.al In this journal paper Sprayers are mechanical devices that are specifically designed to spray liquids quickly and easily. They come in a number of different varieties. In this project we'll take a look at solar operated mechanical sprayers. [6]Jayabalakrishnan.Det.al The overall goal of this project was to develop and evaluate the performance of a battery and pump mechanism indented for power-operated electrical spraying in sugarcane crop production. The specific objective of this project is to remove the pest by using power-operated pesticide sprayed rather than manually operated sprayers to reduce lime find increase work effort of labor.[7]Naveen.Get.al In this Multi-purpose agricultural vehicle which can dig the soil, sow the seeds, leveler to close the soil and pump to spray water. The whole systems of the vehicle work with the battery and solar power and the vehicle is controlled by toggle switch and advantages of these vehicles are hands-free and fast input operations. [8]Dr.Balaji.Ket.alA plough is a tool

implement used for initial cultivation to loosen or turn the soil in preparation for sowing seed or planting. Ploughs were traditionally drawn by working animals such as oxen and horses, but in modern farms are drawn by tractors. A plough may be made of wood, iron, or steel frame with an attached blade or stick used to cut and loosen the soil. The ploughing machine is operated by battery power. [9]Ujbaile.V.Net.al The ploughing machine is planned with semi automate it using engine, motors and power transmission equipment. The bike engine's power is used to help in cultivation of soil for farming Process. This can done through using power of engine to provide force to the tools so they can dig enough inside the soil so soil should be properly ready for cultivation. AsitDhawaleet.al In this sector, there is a lot of fieldwork, such as weeding, reaping, sowing etc. these operations previously were done by traditional equipment's. Also traditional ways are time consuming. To overcome this there is lot of machine work. Though they are costly for farmers. The project is to reduce the cost of machine and make simple to use and handle it.

III. PROBLEM IDENTIFICATION

Agriculture is a most important Sector in India economy. In India most of families depends on agriculture. As the knowledge about advanced farming is less for laborIn agriculture field we Separate machine for ploughing, seeding, harvesting, spraying pesticide. The agriculture machine are larger in size and cost of the machine very high. Now-a-days there is Scarcity of labors and increasing labor cost.

IV. DESIGN AND CALCULATION

Solar panel:

3 watts solar panel

Solar panel output power = watts*solar panel 1hr of sunshine*0.85

$$= 3*1*0.85$$

output power in one hour = 2.4 WH

Battery:

12 volt, 7 amps

battery watts = volt*amps

$$= 12*7$$

$$= 84 \text{ watts}$$

Motor:

Speed = 30 RPM

Voltage = 12 Volt

Power = 18 Watt

Torque of the Motor:

$$\text{Torque} = (P \times 60) / (2 \times 3.14 \times N)$$

$$\text{Torque} = (18 \times 60) / (2 \times 3.14 \times 30)$$

$$\text{Torque} = 5.72 \text{ N-m}$$

$$\text{Torque} = 5.72 \times 10^3 \text{ N-mm}$$

Water pump:

12 volt, 70 psi, 4 liter per minute

Spurgear:

Diameter of the Shaft from Motor to Gear

Given data:

Power = 18 W

Speed = 30 rpm

$$\text{Torque} = (P \times 60) / (2 \times 3.14 \times N)$$

$$\text{Torque} = (18 \times 60) / (2 \times 3.14 \times 30)$$

$$\text{Torque} = 5.72 \text{ Nm}$$

$$\text{Torque} = 5.72 \times 10^3 \text{ Nmm}$$

The shaft is made of MS and its allowable shear stress = 42 MPa

$$\text{Torque} = 3.14 \times fs \times d^3 / 16$$

$$5.72 \times 10^3 = 3.14 \times 42 \times d^3 / 16$$

$$D = 8.85 \text{ mm}$$

The nearest standard size is $d = 9 \text{ mm}$.

Dimension of pinion:

$$D_p = m T_p = 2 \times 24 = 48 \text{ mm}$$

$$D_p = 48 \text{ mm}$$

$$D_g = m T_g = 2 \times 96 = 192 \text{ mm}$$

Tangential load on the tooth (Ft):

$$F_t = 477.45 / m$$

$$F_t = 1592.35 / 2$$

$$F_t = 239 \text{ N}$$

Calculation:

No of teeth on pinion = 24

No of teeth on gear = 96

Solutions:

$$\text{Pitch line velocity} = v = (3.14 \times D_p \times N_p) / (60 \times 1000)$$

$$\text{Pitch line velocity} = v = (3.14 \times m \times T_p \times N_p) / (60 \times 1000)$$

$$\text{Pitch line velocity} = v = (3.14 \times m \times 24 \times 30) / (60 \times 1000)$$

$$v = 0.0377 \text{ m m/s}$$

Assuming steady state load conditions and 8-10 hour of service per day then the service factor $C_s = 1$ (from data book)

Then the tangential tooth load:

$$F_t = (P \times C_s) / V$$

$$F_t = (18 \times 1) / 0.0377 \text{ m}$$

$$F_t = 477.45 / \text{m N}$$

Also the tangential load using Lewis equation

$$F_t = f_0 \times C_v \times b \times 3.14 \times m \times y$$

Where

$$\text{Velocity factor} = C_v = 4.5 / (4.5 + V)$$

$$\text{Velocity factor} = C_v = 4.5 / (4.5 + 0.0377\text{m})$$

$$\text{Tooth form factor } y_p = 0.154 - (0.912/T_p)$$

$$\text{Tooth form factor } y_p = 0.154 - (0.912/24)$$

$$y_p = 0.116$$

similarly

$$\text{Tooth form factor } y_g = 0.154 - (0.912/T_g)$$

$$\text{Tooth form factor } y_g = 0.154 - (0.912/96)$$

$$y_g = 0.1445$$

$$f_0 \times y_p = 42 \times 0.116 = 4.872$$

$$f_0 \times y_g = 42 \times 0.1445 = 6.069$$

From the above value the pinion is weaker.

$$\text{Tangential tooth load} = f_0 \times C_v \times b \times 3.14 \times m \times y$$

$$477.45 / \text{m} = 42 \times (4.5 \times 10 \text{ m} \times 3.14 \times m \times 0.116)$$

$$2148.525 + 17.99 \text{ m} = 688.76 \text{ m}^3$$

Solving the equation

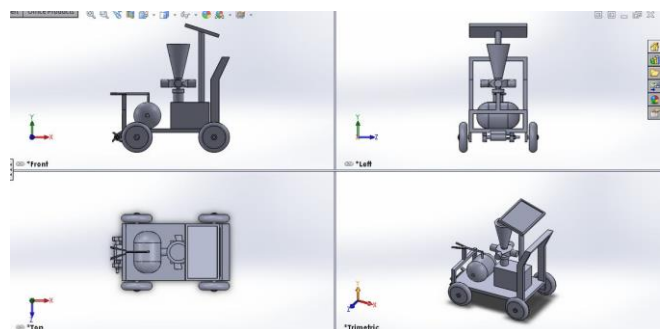
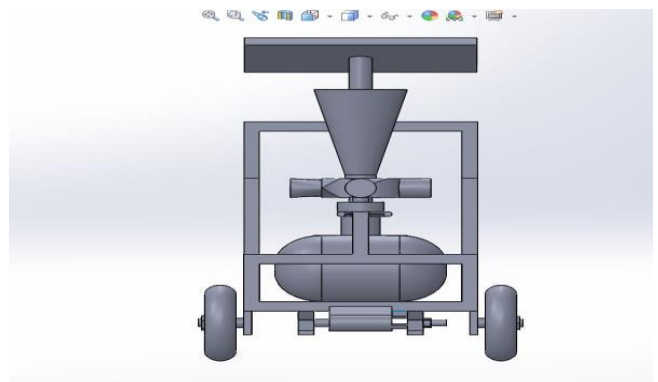
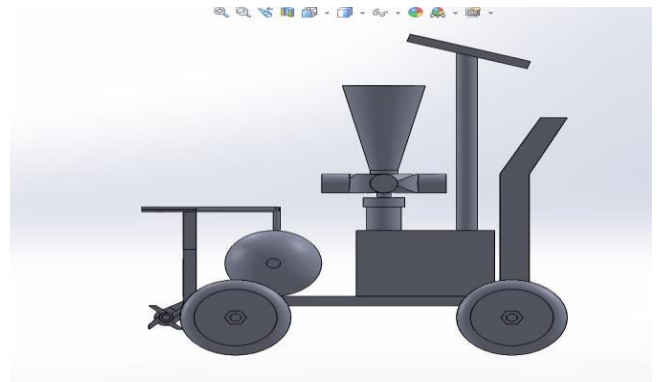
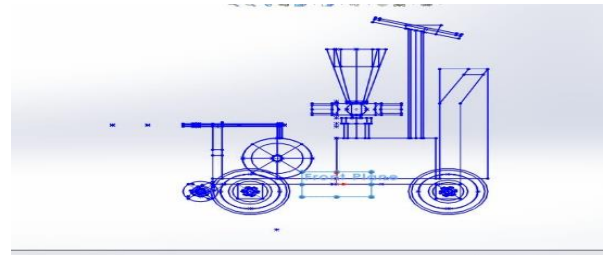
$$m = 1.467 \text{ mm}$$

$$m = -0.733 \text{ mm (negelecting)}$$

Take $m = 2 \text{ mm}$

$$\text{Face width } b = 10 \text{ m} = 10 \times 2 = 20 \text{ mm}$$

DESIGN:



V. CONCLUSION

Thus Innovative agriculture multipurpose machine has markable achievement in agriculture field. Using this inspireidea project of machine, They can use less time in seed sowing, water spraying and multi plough attachment process reduces lot of laborer cost. Agriculture three in one machine is fabricated which can be used to sow seeds into the land after weed cutting and water spraying operation. The project is fully a design by running solar power. The cost of this machine is very low and easy to operate anyone in the field.

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