Design & Optimization of Advanced Seed Sowing Machine

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ABSTRACT

A semi-automated seed sowing machine used to control depth and distance between two seeds to be sowed depending on types of seed. This helps in proper utilization of the area and results in maximum productivity. Electronically (Arduino Uno and stepper motor) control the depth and distance to gain highest productivity. Useful in sowing seeds over a defined areai.e.infarmsorbackyards.Duetoefficientuse ofavailable area the requirement of other inputs like water, manure are less also naturally damage of seedlings at nursery stages are minimized. Reduces labor to its minimum. All this at a very optimumcost.

Keywords:*seed sowing, Ardino uno,high yielding*

1. INTRODUCTION

One of the most important occupations of Indian families is agriculture. In India, agriculture contributes about sixteen present (16%) of total GDP and ten present (10%) of total exports .Report from 2008 showed that India's population is growing at a higher rate than its ability to produce rice and wheat. Other recent studies showed that India can easilyfeed itspopulation andwillalsobeabletoproducewheatandrice for exports, if it can control food staple spoilage, improve its infrastructure and raise its farms production rates. Green revolution began in India with an objective to give more importance to Agriculture. Due to Green revolution that began in 1960s there was significant increase in the production of food crops. The development of improved methods in agriculture and high yielding varieties seeds, mainly wheat, had resulted into improvement in agricultural outputs .Poly house plays important role in green revolution. Polyhousefarmingisannewtechniqueinusedinrural India. It advantages over traditional farming is that it is less dependent on rain and makes optimum use of available resources like land andwater.

2. PROBLEM STATMENTS

With current manual seed sowing used problems faced are-

1. Human labour involved is veryhigh.
2. Non proper utilization of the available resources like seeds land water etc. hence loss inproductivity.
3. Due to high amount of time involved productivity ishampered.

3. OBJECTIVES

- Proper control over the distance between the seeds sown and the depth to which they aresown
- Reduce involvement of labour and cost related toit.
- Properutilizationofallavailableresourceslikeseed land water manure to gain highestproductivity

4. LITREATURE REVIEW

El-Shal (1987) reported that using the mechanical metering mechanisms because seed damage due to the frictionforces

betweenthemechanicalpartandtheseeds. He added that the pneumatic metering mechanisms may dealgentlywiththe

seedsandnodamageduring planting can occur. He also studied the effect of disc speed and vacuum suction on the see.

Seed uniformityfor sunflower and sesame seeds. It was found that best uniformity of seed distribution was obtained at

16- rpm disc speed for both seeds. The suitablevasuctions were 0.04 and 0.01 kg/cm2 forsunflower and sesame seeds,

respectively

Bosoi et al., (1987) reported that any planting machine must have hoppers with an optimum capacity in order to feed seeds uniformly and continuously to the seeds metering mechanism. They added that the trapezoidal form is the most widely used hoppers of planting machines.

Lan et al., (1999) developed an Opto-electronic seed spacing measurement system for fine seeds. This system measured time intervals between the seeds and detected front and back seed drop location events to determine the seed spacing uniformity of a planter in the laboratory. The space measurement obtained based on time intervals between seeds drop events were strongly correlated with the space measurements obtained on a greased belt test stand. They added that the accuracy of seed spacing is depending upon the size of theseeds.

5. WORKING

1. Power is supplied to the SMPS, Arduino and Suction pump simultaneously
2. SMPS converts the AC supply to DC supply and feed it to the motor's drivers
3. There are three Motor drivers to control the three Stepper motors involved each stepper motor controls X,Y,Z direction respectively.
4. These drivers are receiving instruction from the Arduino board about when to start and stop motors according to the program
5. The first motor attached to the base is required to control the Y direction movement
6. The motor rotates which is attached to a pulley which transmits power with the help of belt drive.
7. This moves the attached assembly in Y direction on the rails similarly the X and Z direction motions are controlled
8. There are two relay switches involved in order to control power supply and power cut to the vaccume generator.

6. DESIGN CALCULATION

- VaccumePump

Diameter of seed = 3 mm (from measurement using vernier calliper)

Area of nozzle is calculated asfollows $A = \pi/4 \times d^2$

$= \pi/4 \times (3)^2$

$= 7.068 \text{ mm}^2$

Mass of seed is measured by using electronic weighing machine which is given as follows

Mass ofseed = 0.2gm

Weightofseed $= 0.2 \times 9.81 \times 10^{-3}$

$= 1.96 \times 10^{-3}$ N

Force required (F) = weight

$= 1.96 \times 10^{-3}$ N

Pressure required $= F/A = 1.96 \times 10^{-3} / 7.068 = 0.277$ Mpa

As the diameter of seed changes pressure (Vacuum) required also changes.

Thus we have selected Vacuum Pump having operating pressure of 0.1-0.6 Mpa.

- Motorcalculations:

1) Stepper motor 1. (Y directionmotion)

W [total weight that has to slide (includes weight of slider

thatmoveverticallyand+nozzlesassemblies]=1.5to1.8kg

R= reaction to W

μ (coeff. of friction)= 0.5 F (frictional force)= μR

=0.5 X (1.8 X 9.81)

= 8.829N

D (dia. Of pulley) = 50mm = 0.05m (assumed) Now, required torque to rotate pulley is given as,

T= F X r = 8.829 X 0.025 = 0.2207 N-m (2.2207kg-cm)

Assuming FOS as 2 required torque = 4.4504 kg-cm

Thus, considering optimum performance, motor selected as 10 kg-cm torque

2) Stepper motor 2 (Z directionmotion)

This Stepper motor is responsible for vertical motion

W[totalweightthathastoslide(nozzlesassemblies)=0.5kg R= reaction toW_1

μ (coeff. of friction) = 0.5 F (frictional force) = μR

=0.5 X (0.5 X 9.81)

= 2.4525 N

d (dia. Of pulley) = 50mm= 0.05m

Now, required torque to rotate pulley is given as,

T= F X r= 2.4525 X 0.025 =0.061312 N-m (0.61312kg-cm)

Assuming FOS as 2 required torque =1.22625kg-cm

Thus, considering optimum performance, motor selected as 3.74 kg-cm torque

3) Stepper motor 3 (X direction motion) W [total weight that has to slide] =1kg R= reaction toW_1

μ (coeff. of friction) = 0.5 F (frictional force) = μR

=0.5 X (1 X 9.81)

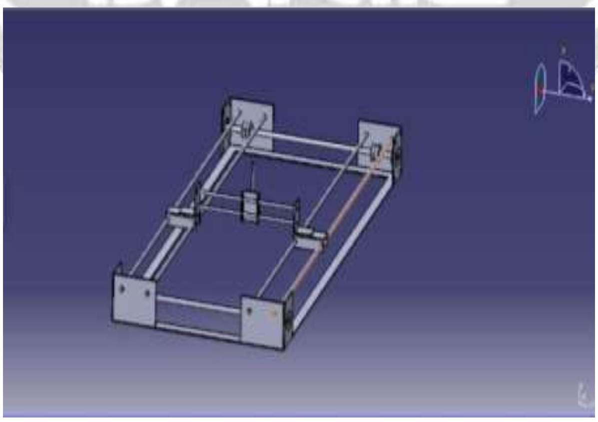

Fig1.CAD Part

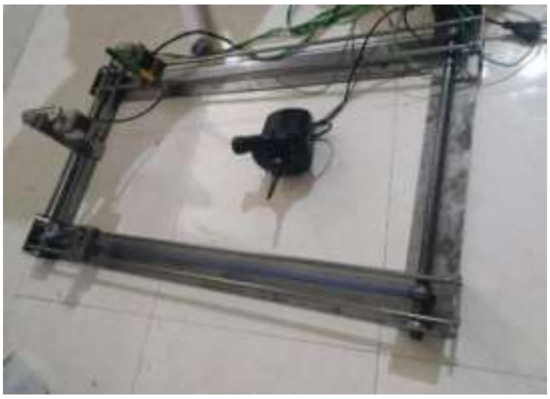

Fig2.Actual Assembly

The main components involved in electronic system are
= 4.905 N

d (dia. Of pulley) = 50mm = 0.05m

Now, required torque to rotate pulley is given as,

T= F X r= 4.905 X 0.025 =0.12262 N-m (1.2262kg-cm)

Assuming FOS as 2 required torque =2.4524kg-cm

Thus, considering optimum performance, motor selected as 3.74 kg-cm torque

7. COMPONENTS AND ASSEMBLIES

The main components involved in mechanical system are

1. Baseplate
2. Steppermotor
3. Slidingshaft
4. Nozzleassembly
5. Beltdrive
6. Pulleys
7. Driveshaft
8. Steppermotor
9. ArduinoUNO
10. Moisturesensor
11. Switched Mode Power Supplies(SMPS)
12. DC relay
13. Motordriver

Fig3. Electronic circuit

8. ADVANTAGES AND FUTURE SCOPE

- Proper utilization of area and other required resources such as water manureseeds.
- Reduces labor cost and involvement of humans in sowingprocess
- Controls depth and distance between the seeds to gain highest productivity also naturally damage of seedlings at nursery stages areminimized

The system can be improved by adding subsystems likewater spray and weeds elimination by adding sensors like moisture sensor and cameras to detect weeds. Further the capacity can be increased by adding extra nozzles and the system can be made fully automated and can be made to control through Bluetooth orWi-Fi.

9. CONCLUSION

Hence the seed sowing machine is able to control the depth and distance between the sowing seeds which is very helpful in
plant growth and this is made available at comparatively low cost

10. REFERENCES

[1] BarutZB;OzmerziA(2004).Effectofdifferentoperatingparameters on seed holding in the single seed metering unit of a pneumatic planter. Turk. J. Agric.,(28):435-441.

[2] Chhinnan M S; Young J H; Rohrbach R P (1975). Accuracy of seed spacing in peanut, planting planting Transactions of the ASAE,18(1):828-831.

[3] El-Sahrigi A F (1985). Scio-economic evaluation of farm machinery introduced in project villages from 1980 to 1984. Working paper No (19). Ministry of Agriculture,Cvacuumo, Egyp

[4] Giannini G R; Chancellor W J; Garrett R E (1967). Precision planter using vacuum for seed pickup. Transactions of the ASAE, 10 (5): 607-750.

[5] D. Ramesh , H.P. Girishkumar,JULY 2014" Agriculture Seed Sowing Equipments: A Review" , ISSN N0.:2278-7798,Volume3.

[6] B.Shivprasad, M. Ravishankara, B.Shoba.,2010 "Design And Implementation Of Seeding And Fertilizing Agriculture Robot" , Volume 1(3)190-213.

[7] Ani, O. A., B. B. Uzoejinwa and N. F. Anochili (2016) design, construction and evaluation of a vertical plate maize seed planter for gardens and small holder farmers. Nigerian Journal of Technology (NIJOTECH) Vol. 35, No. 3, July 2016, pp. 647 – 655

[8] Prof. Mayuri Wandhare "Seed Sowing Fertilizer Drilling Machine" IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 3 Issue 4, April 2016

[9] D.Ramesh "Development Of Agriculture Seeding Equipment" International Journal Of Informative & Futuristic Research An Enlightening Online Open Access, Refereed & Indexed Journal Of Multidisciplinary Research Volume -1 Issue -10, June 2014.

[10] A.R. Kyada& D. B Patel,DEC 2014 "Design And Development Of Manually Operated Seed Planter Machine" of Lecture 5th International & 26th All India Manufacturing Technology, Design and Research Conference (AIMTDR 2014) , IIT Guwahati, Assam, India. Vol 2

[11] B.Shivprasad, M. Ravishankara, B.Shoba.,2010 "Design And Implementation Of Seeding And Fertilizing Agriculture Robot" , Volume 1(3)190-213.

[12] D. Ramesh , H.P. Girishkumar,JULY 2014" Agriculture Seed Sowing Equipments: A Review" , ISSN N0.:2278-7798,Volume3.