Design and Fabrication of Automatic Seed Sowing Machine

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Abstract: **In the agriculture process, often used conventional seed sowing process takes more time and more man power. The seed sowing rate is more but the time required for the total process and the cost is also increases due to labor, hiring of equipment. The conventional seed sowing machine is less efficient, more time consuming. Today's era is towards the rapid growth in the agricultural sector. To meet the future food demands, the farmers have to implement the modern techniques which will not affect the soil texture but will increase overall efficiency of the crop production. In the farming process, often used conventional seeding operation takes more time and man power. The seed sowing 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 distribution.**

Keywords - Seed sowing; farming; microcontroller; automatic

1. INTRODUCTION

The agriculture is the backbone of India. And for sustainable growth of India development of agriculture plays vital role. The India has huge population and day by day it is growing thus demand of food is also increasing. In agriculture we saw various machines. Also there traditional methods are there. Since long ago in India traditional method is used. Also India has huge man power. This manual planting is popular in villages of India. But for large scale this method is very troublesome. The farmer has to spend his more time in planting. But time available is less for him. Thus it requires more man power to complete the task within stipulated time which is costlier. Also more wastage happens during manual planting. Hence there is need of developing such a machine which will help the farmer to reduce his efforts while planting. This process of using machines is called as mechanization. Along with mechanization automation also helps to increase the efficacy of the process.

In the current generation most of the countries do not have sufficient skilled man power especially in agricultural sector and it affects the growth of developing countries. The main requirement of Automation is to reduce man power in our country; the buzzword in all industrial firms generally involves electrical, electronic component as well as mechanical part. Automation saves a lot of tedious manual work and speeds up the production processes. So it is a time to automate the sector to overcome this problem. In India there are 70% people dependent on agriculture. Seed has been an important agricultural commodity since the first crop plant was domesticated by pre-historic man. In this model seed sowing process is automated to reduce the human effort and increase the yield. The plantation of seeds is automatically done by using DC motor. The distance between the two seeds are controlled and varied using Microcontroller. It is also possible to cultivate different kinds of seeds with different distance. When the system reaches the end of the field we can change the direction with the help of remote switches.

2. PROPOSED WORK

This machine has very less cost. This planter is very simple to use hence, unskilled farmer is also able to handle this machine. We simplified the design also made it cheaper and affordable to every rural farmer. We made various adjustments and simplified it from controlling and maintaining point of view. In this design we connected drive shaft to metering mechanism which eliminates the attachments such as pulleys and belts system. DC motor drives the shaft of motor which is coupled with battery bank. As motor starts it moves this robot as well as operates the metering mechanism. Seed storage tank is connected at the top of the robot near rear wheels. The sensor is fitted to it which senses the level of seed in it and gives the alarm when the tank is empty. Front sensor serves the function of guiding the robot. As any obstacle comes in front of robot it gives the signal to the robot and diverts the path of robot. For every rotation of the wheel according to the adjustment it allows the definite seed to fall into the hoper so that there is no wastage of the seeds also the sowing process does smoothly. When the robot reaches at other end and when it completes task it creates an alarm so that we can provide required facility.

It works on simple mechanism, a battery operated D.C. moter is used transmits the rotary motion to the shaft with the help of chain drive, and there is another connection of sprocket and chain to the seed meter for the rotary motion. When the farmer puts seeds into the hopper, seed drops into the seed meter which is control by the rack and pinion arrangement mounted on the assembly. As the seed meter rotates, seed drops in the seed pipe, which is connected to the furrow opener for the seeding; there is furrow closer for covering the seeds by soil. There is another connection of D.C motor connected to spur and worm gear for steering mechanism connection of front wheel which is guided by microcontroller unit with the help of Bluetooth device via mobile phone.

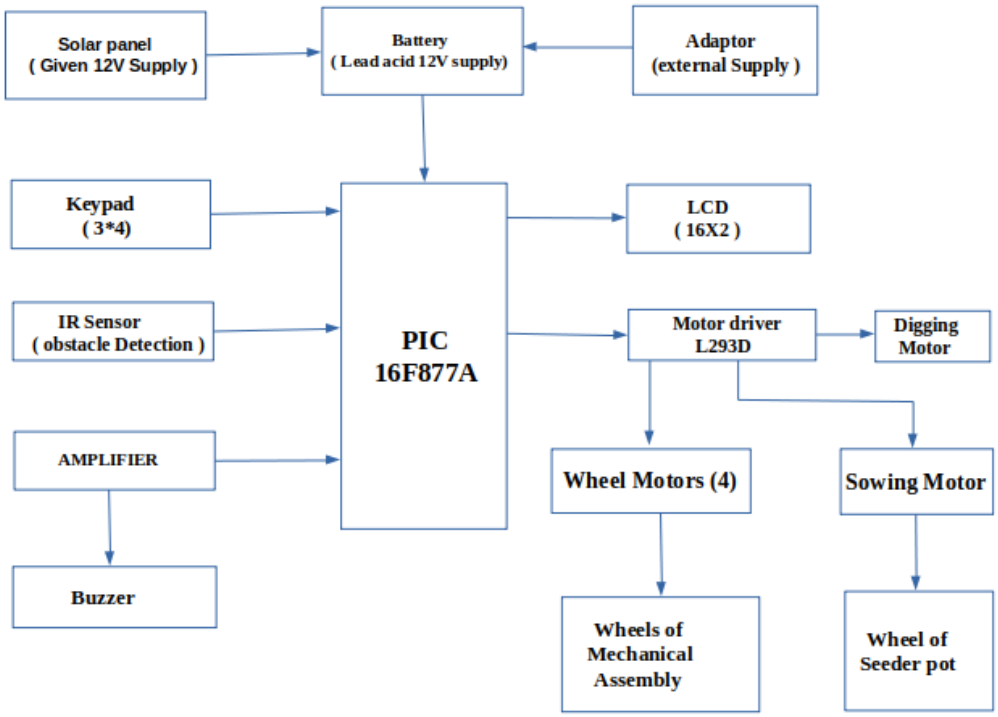


Fig 1 Architecture of proposed system

3. FACTORS AFFECTING SEED SOWING:

Mechanical factors, which affect seed germination and emergence are:

1. Its depth should be uniform with regard to placement of seed
2. It should be distributed uniformly along the rows.
3. Its transverse displacement with regard to row also considered.
4. Loose soil getting is also prevented.
5. Soil is covered uniformly over the seed.
6. Fertilizer is mixed with seed during placement in the furrow.

To fulfilling above factors we get best performance of the seed drill or planter. To improve the performance we need to optimize the above factors also so that we get desired efficacy from the system in economical way. Its design is simplified and components are selected to suit the need of the corps. In the working of the robot seed drill or planter also plays vital role in manipulating the physical environment. The metering system allows the metered or required quantity of the seed in the farm. This system also serves the seed so that seed should not be damaged while working.

Table1. Details for planting seed

Vegetable	Distance between Plants (cm)	Planting depth (cm)
Asparagus	30	2.5-4
Beet	3-5	1.5
Broccoli	45-60	0.5-1.5
Cabbage	45	0.5-1.5
Carrot	3-5	1.5
Cauliflower	45-60	0.5-1.5
Corn	15-25	2.5
Okra	30	2.5
Onion	5-8	1.5-3
Pepper	60	1.5
Potato	25-30	10
Radish	2.5	1.2

Table 2 Size of different seed

Seed name	Diameter(mm)
Arugula	2.5
Beet	7.5
Broccoli	3.5
Cabbage	3.5
Carrot	3.5
Cauliflower	3.5
Corn	13.5
Cucumber	9
Lettuce	6
Okra	7.5
Onion	6
Pea	10
Radish	4
Sun flower	2.5

4. DESIGN OF SEED SOWING MACHINE

Following figure shows the complete drawing of the sowing machine. While designing the mechanism physical conditions as well as the requirements both are considered. Hence this machine is able to plant the seeds in the required way.

Following are the major parts which are used in this machine.

1. Structural frame
2. Battery powered wheels
3. DC Motor
4. Seed storage tank.
5. Seed sowing disc
6. Seed bucket.
7. Seed chamber.

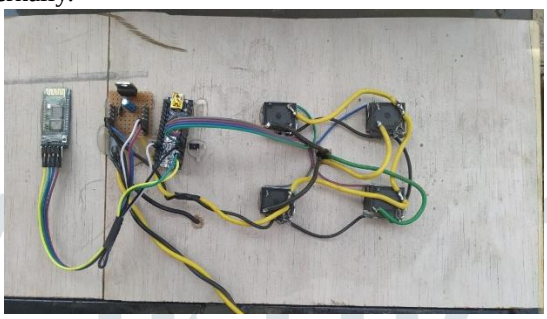
8. Plough.
9. Solar panels
10. Micro Controller

5. PRINCIPLE OF OPERATION:

It works on simple mechanism, a battery operated D.C. motor is used transmits the rotary motion to the shaft with the help of chain drive, and there is another connection of sprocket and chain to the seed meter for the rotary motion. When the farmer puts seeds into the hopper, seed drops into the seed meter which is control by the rack and pinion arrangement mounted on the assembly. As the seed meter rotates, motor connected to spur and worm gear for steering mechanism connection of front wheel which is guided by microcontroller unit with the h seed drops in the seed pipe, which is connected to the furrow opener for the seeding; there is furrow closer for covering the seeds by soil.

5.1 HARDWARE DESCRIPTION:

PIC16F877A Micro controller PIC16F874A/877A devices are available in 40-pin and 44-pin packages. It controls all the devices in the systems which are connected externally.



5.2 TECHNICAL SPECIFICATIONS:

Operating Frequency is DC – 20 MHz Program Memory 8 K. Data EEPROM Memory 256 Bytes. Data Memory 368 Bytes. I/O Ports A, B, C, D, and E. Timers available in pic16F877A are 3. 10-Bit Analog-to-Digital Module 8 Input Channels.

- Type: Character programming controller
- Display format: 16 x 2 characters.
- Built - in controller : ST 7066
- Duty cycle: 1/16
- 5 x 8 dots include cursor.
- It requires 5V power supply.
- DC Motor Driver (L293D): The L293D is required for driving the motor. It is a motor driver IC. IC L293D is an H-bridge IC.
- IR Sensor: We are using IR sensor for obstacle detection. Also we are use it to detect the seed pot is empty or not.

5.3 Keypad:

We are using 3*4 keypad to entering the seed to seed spacing. It consists of 12 buttons arranged in a form of an array containing four rows and three columns.

5.4 LCD (LIQUID CRYSTAL DISPLAY):

LCD is required to display all the data. Whatever you will enter through the keypad, it will be displayed on LCD. LCD will also display the battery level.

6. DESIGN PARAMETERS:

6.1 Design of Frame

Frame design for safety FOR 33*18*3 square angle mild steel channel
b = 330mm, d= 180 mm, t = 30 mm.
Consider the maximum load on the frame to be 20 kg.
Max. Bending moment = force*perpendicular distance = 20*9.81*400
M = 78480 N-mm
We know,

$$\frac{Mb}{I} = \frac{\sigma b}{y}$$

M = Bending moment, I = Moment of Inertia about axis bending. y = Distance of the layer at which the bending stress is consider (We take always the maximum value of y, that is, distance of extreme fiber from N.A.), E = Modulus of elasticity of beam material

$$I = \frac{b.h\text{^}3}{12} = \frac{330*180\text{^}3}{12}$$

$$I = 4950 \text{ mm}^4$$

$$\sigma b = \frac{MY}{I}$$

$$I = \frac{78480*12.5}{4950}$$

$$\sigma b = 198.18 \text{ N/mm}^2$$

The allowable shear stress for material is

$$\sigma all = \frac{\sigma yt}{fos}$$

Where σyt = yield stress = 210 MPa = 210 N/mm² and FOS is factor of safety = 2

So σall= 105 MPa = 105 N/mm²
Comparing above we get, σb< σall i.e 45.22 < 105 N/mm²

6.2DC motor:

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor.

Specification of DC motor:

Volts =12 volt
Current =1 amps
Speed 100 rpm ns
No of wheels =04
No of pulleys = 02
Gear ratio = 1.5
Diameter of Gear = 90mm

Selection of electric motor

DC motor SPEED (N) = 1250
RPM VOLTAGE (V) = 12 VOLT
Power = 18 WATT
Torque of the motor

$$\text{Torque (T)} = \frac{(P \text{ X } 60)}{(2 \text{ X } 3.14 \text{ X } N)}$$

$$= \frac{(18\text{X } 60)}{(2 \text{ X } 3.14 \text{ X } 1250)}$$

= 0.1375Nm i.e. Torque = 137.5 N-mm

6.3 Wheels:

The rim of the wheel is made from a mild steel plate made up of iron 6 inch wide and 4 mm thickness. It is bent and welded to form a circular form of 508 mm diameter. The periphery is fitted with 05 numbers of lugs at equal spacing. The lugs are of square form of 5 inch mm side. It reduces the slippage while moving in the field. The distance between the holes in the seed metering disc depends upon the diameter of the ground wheel.

7. CONCLUSIONS

This seed plantation machine has great potential for increasing the productivity of the planting. Till now tractor was the main traction unit for nourishment in farming. With the adaptation of this seed planting machine its purpose will be done. Hence there is need to promote this technology and made available to even small scale farmers with affordable prices. This machine can be made by raw materials also which saves the cost of whole project and is easily manufactured in available workshops. The only cost is of metering device and sensors. Hence by using this machine we can achieve flexibility of distance and control depth variation for different seeds. Hence usable to all seeds.

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