

Agritech Automation on Seeding and Fertigation: A Revolution in Agriculture

Tarak Doshi¹, Jay Joshi², Ritesh Vyas³, Prit Upadhyay⁴

¹ Mechanical, Vadodara Institute of Engineering,
Vadodara, Gujarat, India

² Mechanical, Vadodara Institute of Engineering,
Vadodara, Gujarat, India

³ Mechanical, Vadodara Institute of Engineering,
Vadodara, Gujarat, India

⁴ Mechanical, Vadodara Institute of Engineering,
Vadodara, Gujarat, India

Abstract

India is an agriculture driven country. Farming practices throughout the world, including India, has revolutionized food production, enabling it to maintain pace with the population growth. The objective of the research is to develop a unified farming system which includes crinkle system, seeding system and fertigation system using latest electronic neural system (run by microcontroller) with mechanical skeleton. The research will discuss the application of our unit in Indian agriculture for cotton, different oil seeds & corn. Moreover, the research emphasizes on enhancement of crop quality; precise application of agrochemicals and preservation of operator comfort with economy and safety. In this unit, various mechanical components (like chassis, pneumatic system etc.) and electrical components (like microcontroller, encoders, sensors etc.) are used.

Keywords: crinkle, seeding, fertigation, encoder, pneumatic system, Microcontroller.

1. Introduction

Current agriculture system is very time consuming and also not so accurate. The farmers have to give maximum effort to all activities which is very tedious. In this substandard system, single farmer can't do all activities within a prescribed time, so they have to employ number of workers for same. Currently farmers are facing many problems like: 1) Nitrogen Lumps: which is the result of the unequal distribution of the fertilizers. 2) Dispensing of more than one seed in the furrow, especially in the crop of cotton and corn. Farmers have to dig out the extra seeds from the one place. Moreover, they may feel shortage of seeds. 3) All seeds are not sown in the equal and proper

depth. Many seeds flow out of soil during monsoon when not sown properly in depth.

Robotics and automation can play a significant role in society, meeting 2050 agricultural production needs. For six decades' robots have played a fundamental role in increasing the efficiency and reducing the labour work with high accuracy of work completion. In past twenty years, a similar trend has started to take place in agriculture, with GPS and vision-based self-guided tractors and harvesters already being available commercially. More recently, farmers have started to experiment with autonomous systems that automate or augment operations such as pruning, thinning, and harvesting, as well as mowing, spraying, and weed removal. The idea is to transfer applied research and technologies to the farmers in various states across India. Diverse technologies are demonstrated to the farmers so that they can choose the technology that suits them best and maximize their yield and profits.

The present invention introduces the field of automation that will automate the major portion of current agriculture system. The invention is ecofriendly. It improves the process of seeding, fertilizing and furrowing activities which are the most basic activities of agriculture.

It specifically is a device that provides:

1. Time management system to the farmers during farming,
2. Perfection in counting equidistance of seeds and equal depth of seeds automatically.
3. Accuracy in all farming activities.
4. Economic environment to farmer.

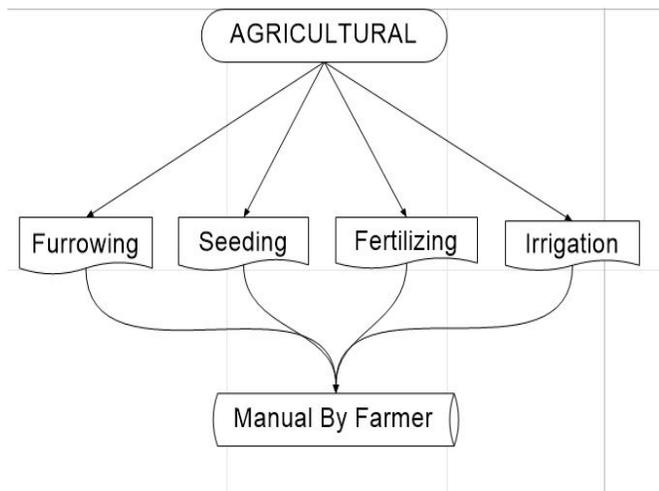
2. Objective

The main objective is to manufacture a system which can perform furrowing, fertigation and seeding as a single unit which minimizes the effort given by the farmers and give maximum productivity to them. Moreover, it minimizes the concentration of Nitrogen in the farm fields by fertigation unit and feeds the seed at desired equal distance which is the prime requirement in the production of the crops like; cotton, corn, oil seeds etc. (Kharif crops). It also closes the furrow without affecting the position of the seeds and retain their equal depth in the furrow. The most important motive of this system is to reduce the time with accuracy.

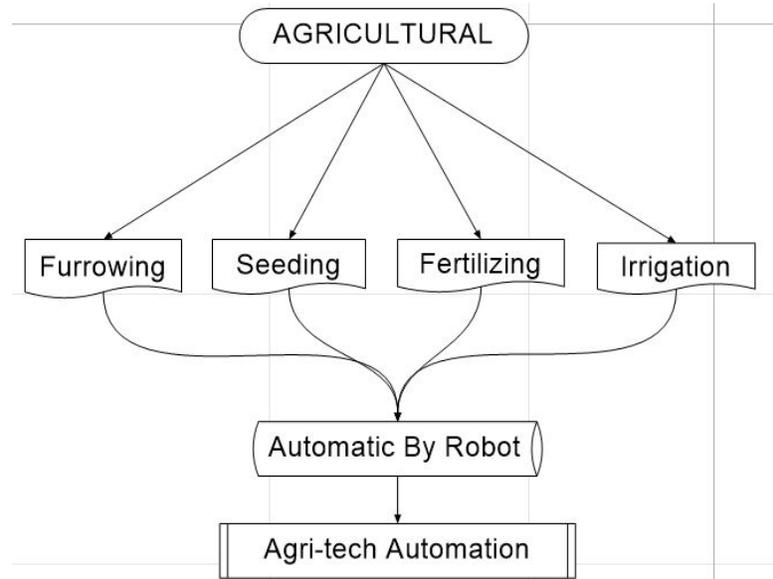
There are many objectives as follow:

- 1.To achieve Perfection in counting equidistance of seeds and equal depth of seeds because entire task is performed automatically.
- 2.Accuracy in all farming activities.
- 3.Provide economic environment to farmers.
- 4.To optimize the quantity of the fertilizer. Thereby reducing overuse of fertilizers and thus preventing land pollution.
- 5.To reduce the man power during the farm field activity.

- **Chart of current agricultural activity (Manual by Farmer)**



- ✓ **Chart of Agritech Automation activity (By automation)**



3. Table and Figures

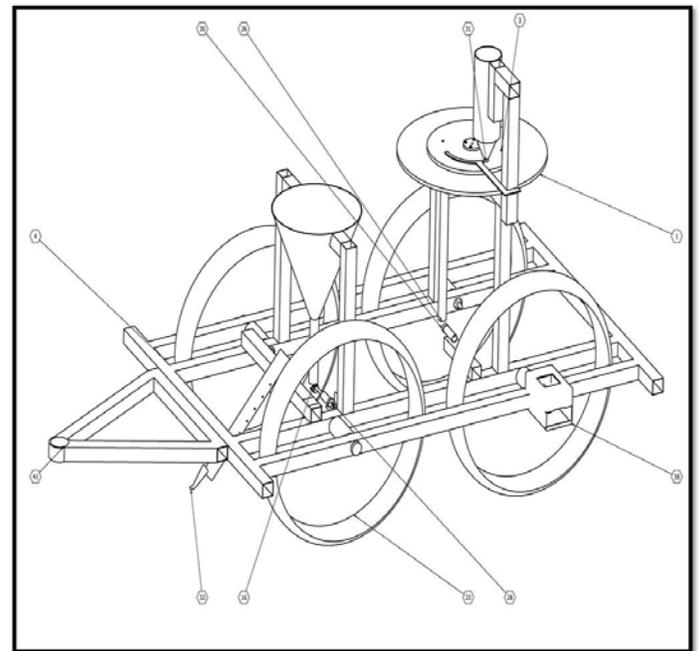


Fig 1. Design Model of Agritech Automation System.

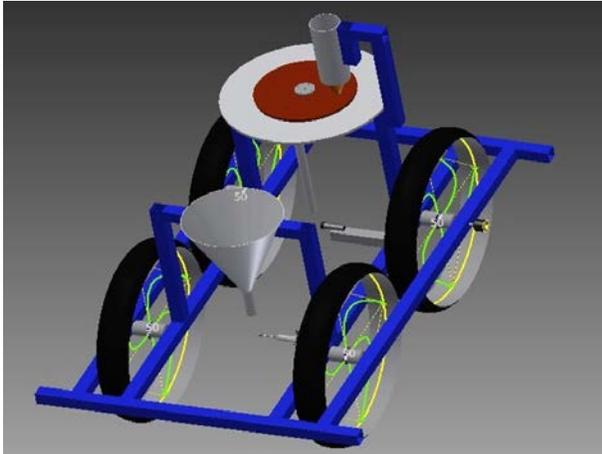


Fig 2.: Cad Model

I. Part Design



Fig 3 Explosion View

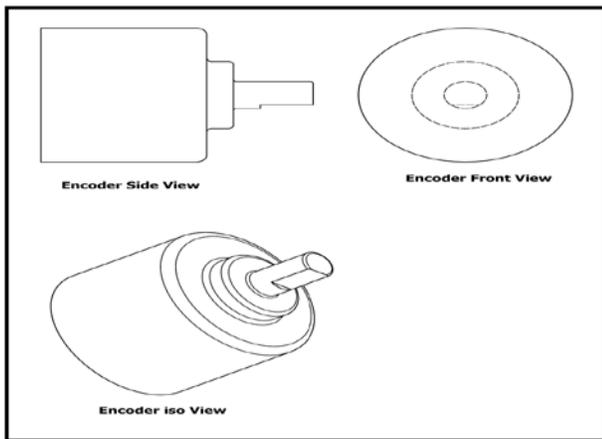


Fig 4 Encoder Views

<u>Part List as Per Model</u>			
<u>ITEM</u>	<u>QTY</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
1	1	Fix disk	500 mm Dimension
2	1	Motor shaft	Aluminum, Required Dim.
3	1	Seeding Disk	300 mm Dimension
4	1	Chassis	M.S. 1000 mm Length
11	2	Supporter2	Cross Support
12	1	Support3	Main Cross Support
16	1	Fertilizer Hopper	Sheet Foil Req. Dim.
17	1	Funnel Support	Cross Support
18	1	Funnel Support	Main Horizontal Support
23	4	Wheels	As per Req. Dimension
24	1	Encoder	Autonics (No. E40S 8 – 100 – 3 – T – 24)
25	1	Motor	Johnson 10 RPM
26	1	Seeds Passage	PVC 20 mm OD
28	1	Pneumatic system	Jenetics 25*50
29	1	Sensor support	M.S. Cross Section
30	1	Sensor	Proximity Capacitive
31	1	Seeds Hopper	Plastic Bottle

Table No.1: List Item According to Fig 1.

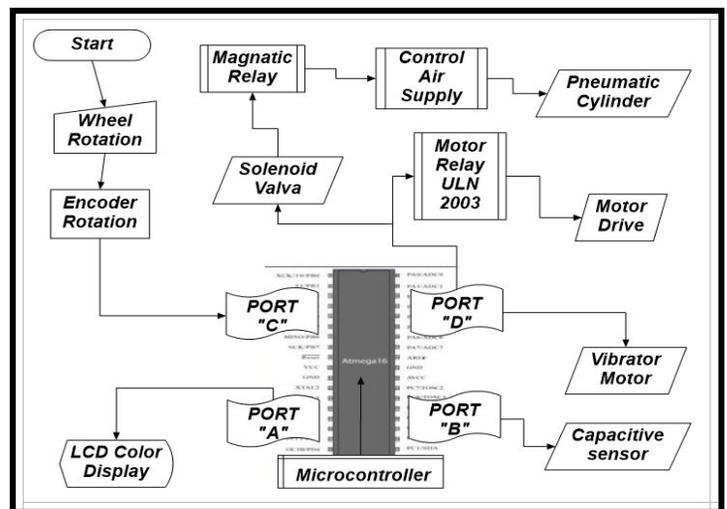


Fig 5 Circuit Diagram of Activity

4. Detailed Description of Invention

Agriculture planting method continue to emerge in response to unrestricted adoption of crop production techniques with great reduction in dependence on agronomics of the soil and two types of soil in the farm field, No-tilled and tilled soil. In the case of kharif crop, tilled soil is more suitable than the no-tilled soil. No-tilled soil is typically more structurally stable and have soil particles accumulated by old roots and other organic substance making molecular attraction, binding the particles together.

The present invention relates to a tilled soil opener, seeding machine and fertilizing unit having one row of unit, synchronized with each other by electrical and feedback system. Agritech unit places the seed at desire depth of furrow with the help of indexed furrowing tool and maintains the homologous distance between two seeds, more specifically in the case of kharif crops by use of feedback system like encoder. The machine associates with the furrowing tool, seeding mechanism and fertilizing system via communication with each other.

The furrow opener tool designed as per the requirement of the depth comprises the indexing system. Indexing system used to manually change the depth of the seed placement into the furrow. The another advantage of this unit is, when the whole system is transported from one field to another field the tool is at the upper most position with the use of indexing unit. This tool is indexed about 40mm. Various holes are provided in the indexing system with spacing of 40mm to change the depth of furrow as per the requirement.

Seeding mechanism consists of two disks: one disk is stationary and another one is rotated by the use of metal gear DC motor drive. The motion of the DC motor drive is then controlled by the electrical circuit system controller (AT MEGA 16). This microcontroller receives the signal from encoder which is mounted at the rear rotating wheel. The stationary disk is mounted at the frame of the device and this frame is mounted on the chassis. The stationary disk has a central 16mm diameter hole drilled, for dropping of seeds to the furrow of farm field.

In crops like cotton, maize, oil seeds, etc. to employ predefined distance between two seeds, the seeding unit contains four 8mm holes in 6mm thick rotating disk. The holes are drilled in such a manner that the distance between two seeds (158mm-1mm Tolerance) is maintained. The holes are made tapered so that it gives easiness to take the position of the seed into the hole for dragging.

It is also possible that two or more seeds gets stuck in the hole of rotating wheel, blocking the entire system. To prevent this, the invention employs one vibratory motor

attached with the seed hopper so that one seed gets perfectly positioned in to the hole. As a result, one seed is dropped at one time. Also this vibratory motor is synchronized with the encoder feedback system. So that when the whole system is in running condition then and only then vibratory motor is started, otherwise it stays stopped to optimize the power consumption.

Present invention employs rotary encoder which is the heart of the whole system. It is used as a feedback system of the entire mechanism. It takes rotary motion of the wheel as input and converts it into analog signal which is given to the electrical system and it is stored in microcontroller. The rotary encoder is used as following specification. E 40S8-100-3-T-24 means

1. Encoder has diameter 40mm.
2. S8 stands for 8mm diameter shaft.
3. 100 pulse per revolution.
4. It has three outputs that are A, B and Z.
5. Output type is totem pole.
6. 12-24 Volts DC Power Supply.

The encoder has starting torque 70 gm.-cm and rotor inertia maximum is 80gm-square cm. Maximum RPM can be 5000.

The machine can be pulled by tractor or bullocks. The rotation of the wheel starts, encoder takes the wheel RPM as input and converts it into analogous system. This analog signal converts into digital signal by electrical circuit system containing micro-controller and ultimately by this encoder. The DC motor drive of seeding mechanism is controlled by the micro-controller too. This motor drive is controlled in such a manner that it drops one seed at one time and also maintains the distance between two seeding actions. Also this encoder gives analog signal to micro-controller which controls the pneumatic relay and thus air cylinder operates to employ the fertilizing action of optimized quality at seeding area. This pneumatic system works maximum at pressure of 6 bars. Present invention contains the cylinder of 20mm bore and 50mm stroke length and have 6mm tubing. It employs 5/2 (2 position 5ways) spool type solenoid double-acting valve having 12 or 24 volts DC operated pneumatic relay. Pneumatic relay takes pulse from the micro-controller to operate pneumatic cylinder electrically.

Present invention introduces the AT MEGA 16 microcontroller. It is the Brain of the whole system. It receives the data or signals from the encoder and sensor and actuates the motor drive of the seeding unit and the pneumatic cylinder of the fertilizing unit. In this system we are using self-configured development board having power system, controller unit, 4 relay systems and ULN 2008.

5. Limitation

1. That device works on battery so it can charge or recharge after some time.
2. Sometime furrowing tool is damaged when any heavy rock is present.
3. Also this device does not run in very wet or large quantity of water on soil because the tire of that device may stop in it.
4. And this device must have any pulling tool like tractor or bullock.

6. Future Enhancement

1. Such type of device is used for the farming activities so, mainly this type of system is used at the farm fields.
2. Also this type of system is used to motivate the people through the tree plantation program. Such type of system can introduce in this type of program.
3. We can provide an array of robots to fulfill agritech purpose.
4. Furrowing will also be done by the hydraulic robot.
5. Crop cutting process will also be done by such unit.
6. Extra unwanted grass cutting.
7. Some crops in which no seeding is there but the plants have been sown by the humans will also be carried out by robot technology so Rice transplantation can also be done by such unit.

4. Conclusions

Agritech Automation is the unique system which comprises the various mechanisms working simultaneously. Also these all mechanical apparatuses are depending on each other and operated along with the electronics apparatus. Mechanisms comprise, 1) furrower tool: to produce the crinkle on the soil. 2) Fertilizing Vanes: to spread out the uniform flow of the fertilizer 3) seed dropping mechanism: To dispense the one seed at a one time. 4) Nozzle

assembly: Produces the spray of water for irrigation purpose. 5) Furrow closing apparatus: for the safe closing of furrow.

This all apparatus is arranged in a one unit and work along with the sensors, encoders, microcontroller, 12-volt battery DC supply etc. So we can conclude that such type of machine provides motivational force to the farmers and also to the citizens in the tree plantation program. So such type of system provides revolutionary technique in the agriculture for the easy and effective crop production.

7. Acknowledgments

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Tarak Doshi has received a Degree in Mechanical Engineering from Vadodara Institute of engineering (GTU) in 2015. His research interests are Mechanical Design, Robotics Automation, Automobile, Embedded System, Production and so on.

Jay Joshi has received a Degree in Mechanical Engineering from Vadodara Institute of engineering (GTU) in 2015. His research interests are Kinematics of Machine, Automobile Engineering, Manufacturing & Production, Theory of Machines, Robotics, and Analysis & Simulation and so on.

Prit Upadhyay has received a Degree in Mechanical Engineering from Vadodara Institute of engineering (GTU) in 2015. His research interests are in Production Processes, Metallurgy, Internal Combustion engine & so on.

Ritesh Vyas has received a Degree in Mechanical Engineering from Vadodara Institute of engineering (GTU) in 2015. His research interests are in Production Processes, Metallurgy, Maintenance field & so on.