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Automated Nursery Tray Feeder System

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ABSTRACT: India being the agricultural dependent country is facing many problem in the same field as due to lack of rain, skilled labour, lack of hybrid seeds, seed wastage etc., some of the problems can be solved by bringing automation to the agricultural field and modernizing the current agricultural practice. There are many methods to grow plant but the nursery system is the dominant one. The conventional method for seeding is the manual one, but it requires more time and the man power shortage is faced continuously. Today the environmental impact of agricultural production is very much in focus and the demands to the industry is increasing. Therefore, farmers have to use upgraded technology for cultivation activity like digging, seed sowing, fertilizing, spraying etc. There is wide scope of study for improving agricultural equipment since there is lack of man power in our country.

This paper, demonstrates The prototype of an Automated Nursery Tray Feeder System By this feeder system we can minimize the seed wastage as only one seed falls to the each tray cup maximize the production rate as it is automated the production rate is faster, the implementation of automation is done by means of conveyor belt motion through ladder programming and accuracy can be achieved by laser sensor and LDR this feeder system is more economical than any other model which serves the same purpose.

KEYWORDS: ladder programming, light defined resistor (LDR), cell production system, sapling transplants, Horticulture industry.

I. INTRODUCTION

Innovative idea of this prototype is to automate the process of sowing crops such as sunflower, baby corn, groundnut, vegetables like beans, lady's finger, pumpkin, also pulses like black gram, green gram etc can be planted using this system. It will reduce the human effort and increase the yield. The plantation of seeds is automatically done by using direct current (DC) motor. The distance between the two seeds are controlled and varied by using microcontroller. It is also possible to cultivate different kinds of seeds with different distance. The whole process is controlled by microcontroller.

In the past, vegetable transplants were either grown in greenhouses using flats or ground beds. Now most growers have made the transition to greenhouse- grown transplants using various types of containers, primarily

plug trays. Using this system, each transplant grows in an individual cell so there is less competition among plants and greater uniformity. Less labor is required for mixing and sterilizing soil, filling flats and pulling plants. Plug transplants establish better in the field because not damaged in pulling the transplants.

Good nursery hygiene is essential if disease free seedlings are to be produced for transplanting in the field. Planning is essential to maintain nursery hygiene and to ensure a high standard of plant health. A seedling nursery must be clearly separated from any other growing system or area and there must be strict control over entry to the nursery to limit the possibility of introducing pests and diseases. In other words, a nursery must be treated as a quantitative area, with

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restrictions on entry and movement inside the boundary. This applies to the people and the equipment that are used within the nursery environment.

II. EXISTING SYSTEM

The existing system has certain drawbacks of its own, it is not accurate as it has no sensors in it. the existing system contains more mechanical parts, and a complex nozzle design which gets blocked if operated for a certain time.

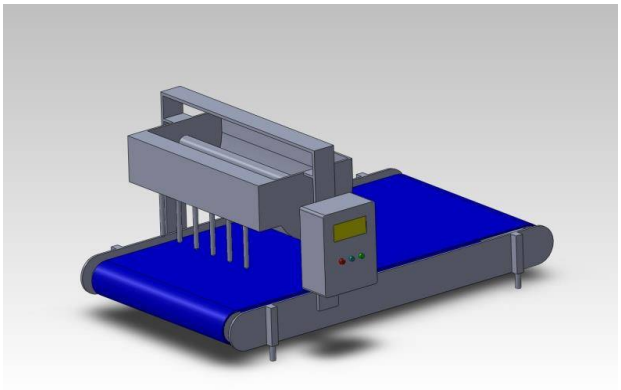

Fig 1: The complete design overview of the current system.

The major drawbacks in current system

1. The use of **NOZZLES** for the purpose of depositing seeds which is prone to wear and tear and the seeds gets struck which causes system failure.
2. The use of **AIR COMPRESSOR** for the purpose of picking up seeds which require high rate of synchronization which is very complex to achieve.
3. The use of **SHAFT** for delivery of seeds into the nozzles which will get wear and tear by course of time.
4. No **SENSORS** are used so lack of accuracy which leads to seed wastage.

At certain times these nozzles also tend to get stuck during operation of the system which results in seeds getting stored in the nozzle pipe which causes system failure. This mechanical part requires constant maintenance and replacement in order for the system to operate optimally.

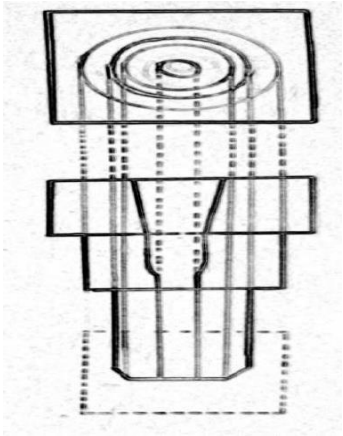

Fig 2: sketch of current nozzle.

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The motion of the nozzles is controlled via the use of an actuator that provides linear motion. These components have to be installed to each nozzle which in turn increases the cost of designing and maintenance of the nozzle system. If these were also to fail then replacing the actuators will take time as they have to be precisely adjusted to match the other actuators already present in the system.

III. PROPOSED WORK

The proposed design overcomes all the mentioned faults in the current system it mainly overcomes the drawback of empty fall and also synchronizes the tray cups and seed fall optimally. The design this system has also reduced the number of major movable mechanical components such as shaft, nozzles and also abandoned the use of an air compressor for the purpose of transfer of seeds. The proposed system block diagram is in fig 3..

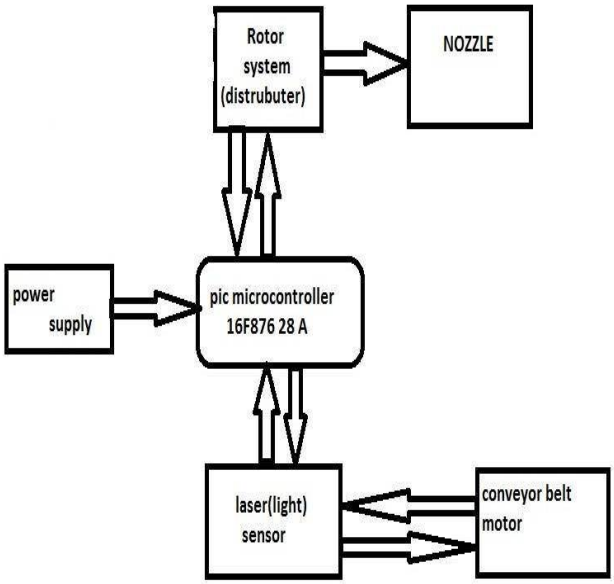

Fig 3: Block Diagram of tray feeder system.

The prototype design consists of rotor system, pic microcontroller, laser sensor, conveyor belt for tray movement microcontroller is programmed by ladder programming. the feeder system is less complex in design and consists of less mechanical parts. The most important part of the system are the LDRs which send signals to the PIC microcontroller so that it can control the entire operation
of the system.

IV. DESIGN AND IMPLEMENTATION

The following section gives the design and implementation of the proposed system:

A. ROTOR SYSTEM

The designed system has also reduced the number of major movable mechanical components such as shaft, nozzles and also abandoned the use of an air compressor for the purpose of transfer of seeds. Instead of such components it uses only one mechanism known as the **"SEED ROTOR".** The seed rotor is designed in such a way that the fall of

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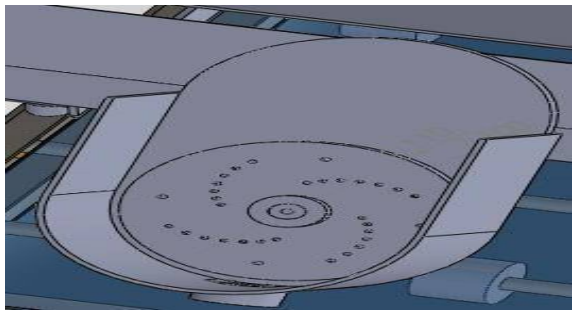

Fig 4: rotor system in the feeder system

Since the system is using this rotor mechanism the nozzle system no longer needs to be used hence reducing the overall cost of the system. Instead of nozzles the system makes use normal pipes for depositing seeds into the tray cups

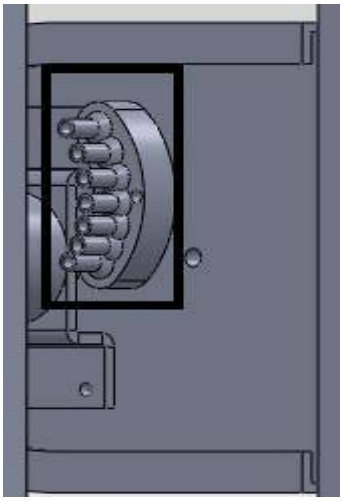

Fig 5:- Seed outlets connecting to pipes

The pipes that deposite the seeds are connected to the rotor system via the seed outlets at the base of the rotor system, these outlets are designed for seeds of certain range of sizes that can pass through them. If the size of seeds are larger than the range provided we simply change the rotor blade and the outlet part of the system.

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B.Microcontroller unit connections

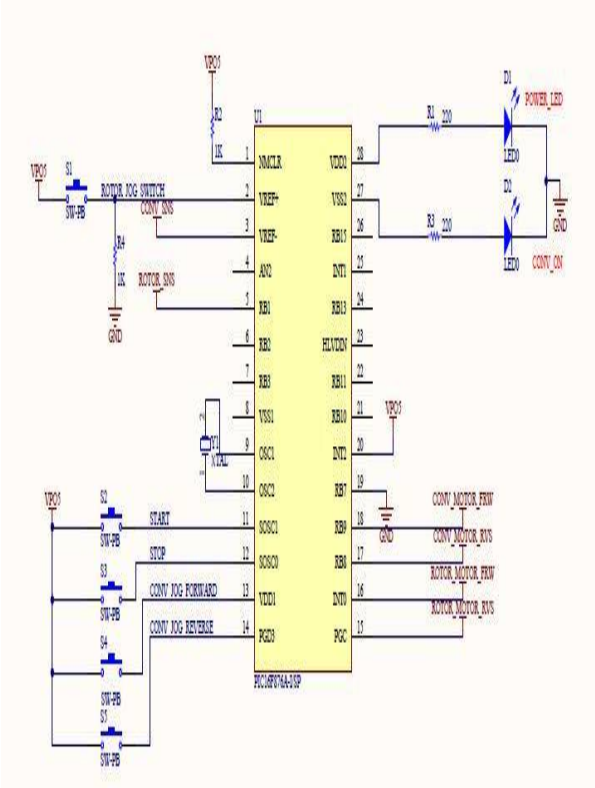

Fig 6: connection diagram of microcontroller

The START connection is given to pin **11**.The STOP connection is given to pin **12**.The CONVEYOR MOTOR control connections are given to pins **13** and **14**.The output signals to the two motors are given them through these configured pins Pin **15** for reverse motion control of the motor**.** Pin **16** for forward motion control of the rotor motor**.** Pin **17** for reverse motion control of the conveyor belt motor. Pin **18** for forward motion control of the conveyor belt motor. The remaining connections are the basic connections of the PIC micro-controller they are Pin **1** is for power supply. Pin **20** is for power supply. Pin **19** is for ground connection. Pins **9** and **10** are for the crystal oscillator used by the micro-controller for frequency input.

C. LASER AND LDR

The use an LDR sensor in the seed rotor system as to indicate that the seeds are perfectly aligned and ready to fall through the pipes

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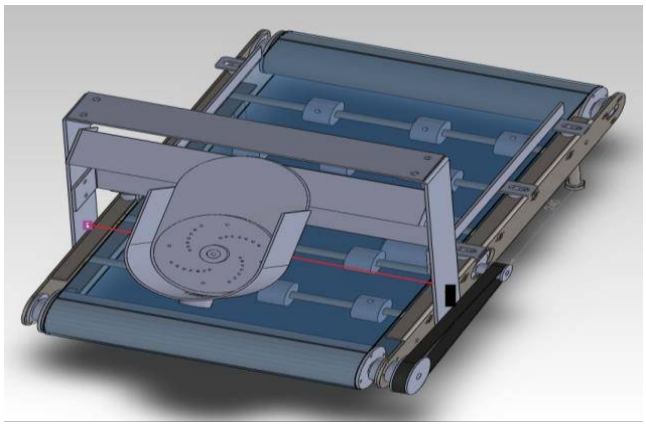

Fig 7 :Laser and ldr sensors in the model

The use an LDR sensor in the seed rotor system as to indicate that the seeds are perfectly aligned and ready to fall through the pipes. Here the system is given a certain amount delay for the seeds to fall into the tray cups after which the next row of empty tray cups allign under the pipes.The “Seed Holes” are which collect the seeds from the container and then drop them into the pipes via the outlets. The hole for LDR sensor is used so that ample amount of light falls on sensor so that the microcontroller knows that the seed holes have been aligned onto the outlet holes and thus do further processing.

The system makes use of another LDR sensor on the conveyor belt system to indicate the presence of tray cups under the pipes. When this LDR senses the presence of these cups then rotor rotates to fill them with seeds and move the tray forward.

V. WORKING OF PROPOSED SYSTEM

The feeder system is designed in such a way that the signals that are given to the microcontroller from the LDR is what controls the movement of trays and fall of seeds into the tray cups. In this model the movement of trays and fall of seeds is controlled automatically by using the signals that the microcontroller gets from the LDR sensors. The power supply to the controller is from the black box which holds all the necessary circuits within it. The whole prototype model can be put up in a flowchart which is explained in fig 7.

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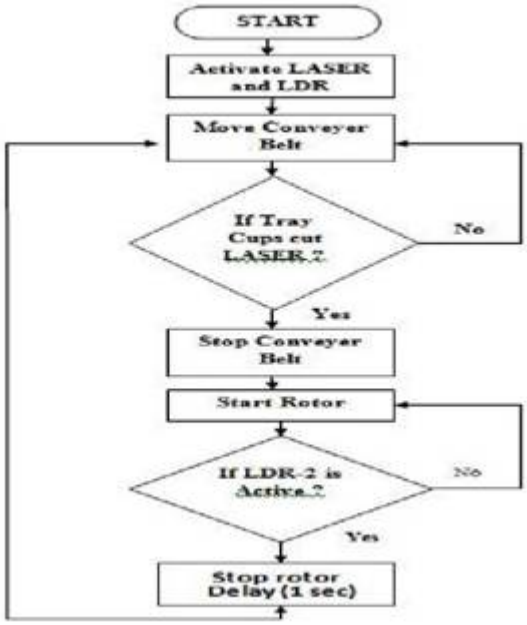

Fig 8 flow chart of tray feeder system

Step 1: The system power supply is turned on and the nursery trays are fed.

Step 2: The conveyor belt starts moving and carries the trays to the pipes.

Step 3: Check if LASER light is cut, if yes stop movement of tray, if no repeat step 2.

Step 4: Start the rotation of the rotor.

Step 5: Check if light falls on LDR-2, if yes stop rotor, if no repeat step 4.

Step 6: After certain delay repeat step 2.

The complete protocol tray feeder system runs with the same algorithm.

VI. RESULT OF PROPOSED SYSTEM

Fig 9 shows the setup of the proposed system which contains complete working model of the feeder system. Tray feeder system objectives are satisfied as by using this system we can reduce the amount of seed wastage and thereby reducing the seed wastage of hybrid seeds and the feeder system helps in increasing the production rate. The challenge was to create a cost-effective feeder system.

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Fig 9: Implemented System Setup

The whole objective is achieved with the following ways. We achieved the movement of trays with the help of conveyor belt system which is powered by 10 rpm.

Fig 10:rotor wheel with seeds.

Rotor wheel starts rotating then the seeds starts to fall in the tray pot which is exactly aligned by conveyor belt, Seeds exactly fall on the aligned tray pots and to achieve forward moment of the trays light defined resistor comes into action where light defined resistor is fixed in the rotor part when rotor wheel rotates for one rotation the light defined resistor is exposed to light the conveyor belt motor is powered by one step.

Fig 11: Electronic Circuits In The Feeder System

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Microprocessor is the core of the electronic system as it contains the plc programming which is converted into hex file, the sensor circuit is responsible for the laser sensor and its working and relay circuit is responsible for manual switching and manual control of the whole system.

VII. CONCLUSION AND FUTURE SCOPE

The drawbacks of the current system have be as one can see these drawbacks reduce the efficient working of the system and also increase the cost of maintenance. In order to overcome these drawbacks, the new system has reduced the number of mechanical parts and also makes uses of sensors. By making use of the new seed dispensing rotor design the overall seed wastage has reduced and also this dispenser can be modified for various sizes of seeds and types of seeds This project aim at efficient working of the nursery tray feeder system and also reduces the cost of production and maintenance of the system as compared to the current system. The major improvements over the current system are as follows:-

1. Design of new seed dispensing unit controlled only by a single geared DC motor.
2. Incorporations of the LASER and LDR sensors for improved control of seed fall.
3. Removal of unnecessary mechanical parts such as shafts and nozzles for seed dispensing, also removing the air compressor from the entire system.
4. Making use of a PIC microcontroller for controlling
all the different moving parts of the system.

The proposed system is efficient when considered for small scale nurseries and can be very helpful in their endeavor for increase in production of saplings. But for large scale nurseries that governments employ for providing saplings to the farmers this system is not enough hence the system can be modified and could incorporate the following:-

1. Make use many seeds dispensing units so as to increase the overall speed of production.
2. The system can also be modified in such a way that it could put the right portions of sand and coco peat into the tray cups.
3. Also the system can make use of sprayers after the dispensing unit for the purpose of spraying fertilizers on the cups.

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