Solar Seed Sowing Machin with Attached Sensor

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Abstract - The agricultural robot is used to reduce human efforts made by farmers during farming. There are many aspects to the future of this Agrobot. Agriculture is considered one of the most important economic activities in India. The bot uses various techniques that help us track the various activities involved in the farming process such as soil moisture level, soil type, different nutrient levels in the soil, suggestion of the crop to be cultivated. The multi functionality of the robot will also help the farmer use the same robot to extract weeds, maintain records on soil data, and make it available at any time as it will be stored in a cloud server. Farmers using bots will be easier to monitor the field.

1. INTRODUCTION

In the current generation most of the countries do not have sufficient skilled man power specifically in agricultural sector and it affects the growth of developing countries. So it's a time to automate the sector to overcome this problem. In India there are 70% people dependent on agriculture. So we need to study agriculture. Innovative idea of our project is to automate the process of ploughing and sowing seeding such as sunflower, corn, groundnut and vegetables like beans, lady's finger, pumpkin and seed of wheat etc.

1.1 MAIN FEATURES OF INDIAN AGRICULTURE

- **Source of livelihood:**

Agriculture is the main occupation. It provides employment to nearly 61% persons of total population. It contributes 25% to national income.

- **Dependence on monsoon:**

Agriculture in India mainly depends on monsoon. If monsoon is good, the production will be more and if monsoon is less than average then the crops fail. As irrigation facilities are quite inadequate, the agriculture depends on monsoon.

- **Labour intensive cultivation:**

Due to increase in population the pressure on

land holding increased. Land holdings get fragmented and subdivided and become uneconomical. Machinery and equipment cannot be used on such farms.

1.2 MAJOR CHALLENGES FACED BY INDIAN AGRICULTURE

- **Stagnation in Production of Major Crops:**

Production of some of the major staple food crops like rice and wheat has been stagnating for quite some time. This is a situation which is worrying our agricultural scientists, planners and policy makers. If this trend continues, there would be a huge gap between the demand of ever growing population and the production.

- **High cost of Farm Inputs:**

Over the years rates of farm inputs have increased. Farm inputs include fertilizer, insecticide, pesticides, HYV seeds, farm labour cost etc. Such an increase puts low and medium land holding farmers at a disadvantage.

- **Soil Exhaustion:**

Soil exhaustion means loss of nutrients in the soil from farming the same crop over and over again. This usually happens in the rain forest.

- **Depletion of Fresh Ground Water:**

Most of the irrigation in dry areas of Punjab, Haryana and Western Uttar Pradesh was carried out by excessive use of ground water. Today fresh ground water situation in these states is alarming. In the coming few years if this type of farming practice continues, these states are going to face water famine.

Crop	Production rank	Productivity rank
Paddy	2nd	30th
Wheat	2nd	22nd
Maize	7th	35th
Total cereals	3rd	36th
Groundnut	2nd	40th
Rapeseeds	3rd	28th
Pulses	1st	44th
Potato	4th	26th
Fruits	2nd (10 per cent share)	-
Vegetables	2nd (9 per cent share)	-

Table 1. 1: Global ranking of India in farm production and productivity

Average size of farm holdings gradually reduced from 2.58 ha to 1.57 ha. Small and marginal farmers have limited resources especially in rain-fed regions where only animal power is used resulting in low productivity. Though agricultural production is high, per hectare productivity is much lower than world average. There is an urgent need to increase productivity. The above table 1.1 shows the global ranking of India from farm production and productivity.

1.3 Problem Statement:

Agriculture is a very important sector in Indian economy. Most of the livelihood in India depends on agriculture. As the knowledge based farm labours are less, the requirement for them is high and their wages are increasing. Traditionally farming is done by human being with the help of bullock carts, tractors and tillers etc.

The main problem in agricultural field includes lack of labor availability, lack of knowledge regarding soil testing, increase in labor wages, wastage of seeds and more wastage in water. The idea of applying robotics technology in the field of agriculture is very new. In agriculture, the opportunity for robot-enhanced productivity is more and the robots are appearing on farms in various guises and in increasing numbers.

1.4 Problem Solution:

In recent years there are many agricultural robots which can perform only single or dual tasks. We are improving the robot by designing a agricultural robot for spraying water, seeding, mulching and cutting operation. More than 42% of the total population in the world has chosen agriculture as their primary occupation. In recent years, the development of autonomous vehicles in agriculture rational and adaptable vehicles.

In the field of agricultural autonomous vehicles, a concept is being developed to investigate if multiple small autonomous machines are more efficient than traditional large tractors and human force. These vehicles should be capable of working round the clock all year round, in most weather conditions and have the intelligence embedded within them to behave sensibly in a semi-natural environment over long periods of time, unattended, while carrying out the useful task. There are a number of field operations that can be executed by autonomous vehicles, giving more benefits than conventional machines.

1.5 Existing System:

Many agriculture operations are automated nowadays and many automatic machineries and robots available commercially. Some of the major operations in farming which are under research and automation are seeding, weeding and spraying processes. When it comes to designing a robot for automating these operations one has to decompose its idea into two considerations which are agriculture environment in which robot/system is going to work and precision requirement in the task over traditional methods. Based on this for seeding process, considerations which are taken into account in terms of environment are robot must be able to move in straightway properly on bumpy roads of farm field, soil moisture content may affect the soil digging function, sensors to be selected for the system must be chosen by considering farming environmental effects on their working.

Apart from these three other requirements are in terms of accuracy required in the task and these are: digging depth, particular optimal distances between rows and plants for certain type of crop, rows to be sown at a time and accurate navigation in the field. Whereas the other processes like weeding, spraying and harvesting, for which functioning depends on seeding stage by knowing the exact location of crop and then making those operations on it accordingly. So the major stage of all subsequent operations is maintaining a precision in seed sowing process.

1.6 Limitations:

1. It costs a lot of money to make or buy robots.
2. They need maintenance to keep them running.
3. The farmers can lose their jobs.
4. The robots can change the culture / the emotional appeal of agriculture.
5. Energy cost and maintenance.
6. The high cost of research and development.
7. Lack of access to poor farmer.

2. LITERATURE REVIEW

[1] Amritanshu Srivastava *et. al* (2014) worked together and published and research paper which deals with the robot which performs operation like soil, moisture testing, seeding, spraying pesticides, removes compost from the field and it also performs obstacles avoidance operation and metal detection in the path. The robot is controlled using cell phone using DTMF technique. Because of using DTMF technique it overcomes the range or distance problem of using Bluetooth or RF module which having limited working range.

[2] Gulam Amer *et. al* (2015) motivates to develop a agrobot integrated system which uses Wi-Fi to communicate between two robots, which perform activities like seeding, weeding, spraying of fertilizers and insecticides. It is controlled using Arduino Atmega2560 controller and powerful Raspberry pi minicomputer to control and monitor working of robot. It has hexapod body which can move in any direction as per required. It has ultrasonic proximity sensor to avoid the obstacles in the path, and underbody sensor system to detect that seed is planted or not. It can dig a hole in soil plant seed in it n cover the hole again with soil and necessary pre emergence fertilizers applies on it, and move on along with communicating with other robot near to it using Wi-Fi.

[3] M. Priyadarshini *et. al* (2015) dealt with command based self-guided digging and seed sowing rover, a sensor guided rover for digging, precise seed positioning and sowing has been proposed to reduce the human effort and also to increase the yield is presented. The rover's navigation is performed by remote guiding devices fortified with the positioning system. It uses Arduino Atmega2560 controller and ultrasonic radar sensor for obstacle avoidance. It is controlled using wireless module that can be control by PC/ TAB/ Mobile. It gives acknowledgement massage of seed tank empty or full to the farmer.

[4] Akhila Gollakota *et. al* (2011) they made the agrobot which perform only two operations digging hole in field that is ploughing in the field and then planting a seed at a regular interval and cover the plough area with soil. To drop the seed stepper motor is used and to dig a hole spike wheel is used. The PSOC controller from cypress is used to control all the operation.

[5] B. Shiva prasad *et. al* (2014) analyzed the effect of robot performing soil moisture test, Ph measurements, seeding and fertilizing using Arduino328 is live streamed to see the operation of robot, the camera is mounted on robot, by live streaming it is possible to control the direction of it instead of making it path follower or line follower. The robot is controlled by remote which is connected through internet using Raspberry pi. Up to this point only seeding and fertilizing techniques are discussed now we see about harvesting techniques. Motivation for the

[6] research is to decrease harvesting cost and increase the value of their product to the consumer. Conventional harvesting method is highly labor intensive and inefficient in terms of both economy and time. Machine harvesting systems are a partial solution to overcome these issues by removing fruits from the trees efficiently thus to reduce the harvesting cost to about 35-45% of total production cost.

3. AGRICULTURE

3.1 Introduction

Agriculture is the art and underlying science in production and improvement of field crops with the efficient use of soil fertility, water, labor and other factors related to crop production. It is the most important enterprise in the world. About 70% of Indian populations are either farmers or involved in some agricultural related activities.

3.2 Steps Involved in Agriculture

3.2.1 Seed Selection

Seeds are the fundamental requirement in most of the agricultural process. Before beginning with the cultivation, selecting the best quality seeds is a challenging task for the farmers. Because only the good quality of seeds give an expected result or yield. Therefore, farmers have to choose suitable seeds from the variety of options available in the market. Below figure 3.1 shows the selection of seeds.

Figure3. 1 :Selection of seeds

3.2.2 Seed Preparation

Seed preparation is an important step that can optimize seed germination and survival rate. These treatments are presumed to improve water infiltration rates and reduce the bulk density of the rooting media following soil reconstruction. The soil and the planting technique must assure that good soil-seed contact is achieved. Below figure 3.2 shows the cleaning of seeds before sowing.

Figure3. 2 :Seed preparation

3.2.3 Sowing

Sowing is placement of seed in the seed bed at an appropriate depth where the soil environment is ideal for optimum germination and crop stand establishment. Optimum time of sowing for each crop has been well established, through many dates of sowing experiments for each of the agro-climatic zones in the country. Optimum time of sowing also varies with rainfall**.** Below figure 3.3 shows the sowing of the land.

Figure3. 3 :Sowing

4. OBJECTIVE

Main objective of automating the seeding operation is to make it more efficient and accurate in its working over traditional seed sowing methods. There are three major distances in seed sowing operation and these are digging or sowing depth for seeds, distances between two crops and two rows.

Agrobot consists of which are needed to be fabricated as parts of the main assembly.

Following are the parts of prototype agrobot to be fabricated.

- Chassis – fabrication of chassis consists of plywood .
- T-shaped stand – fabrication of T-shaped stand consists for which solar panel is to be fixed.
- Seed spreader tool – fabrication of seed dispensor.
- Apart from the parts said above certain materials and components are required during main assembly of agrobot such as threaded bolts for fastening etc.
- Connect the wires from solar panel to battery and battery to DPDT switches and on to DC motors.
- Finally, agrobot is ready. We can use this agrobot where the farmers are ready for seeding the field.

5. AGROBOT

5.1 Fabrication Process:

In this chapter we will be discussing the fabrication of the agrobot. In this fabrication process, have used certain materials and also different processes such as sawing, cutting, drilling and fastening are used. Most of the fabrication is done. Following figure 5.1 shows the end product of Agrobot.

Figure 5. 1: Agrobot

The wood is cut into the desired dimensions to create the chassis. To mount the motors and T- shaped stand to the chassis, U-clamps, L-clamps are used and to fix these clamps fasteners are used. And for this purpose, holes are drilled at the measured locations on the chassis.

5.2 Components Used For Agrobot:

- Dc motors
- Battery
- Submersible pump
- Solar panel
- DPDT switches

5.2.1 DC Motor

Figure 5. 2: 12v DC motor

A direct current (DC) motor is a type of electric machine that converts electrical energy into mechanical energy. DC motors take electrical power through direct current, and convert this energy into mechanical rotation.DC motors use

magnetic fields that occur from the electrical currents generated, which powers the movement of a rotor fixed within the output shaft. The output torque and speed depends upon both the electrical input and the design of the motor.

Working Of Dc Motor:

The term 'DC motor' is used to refer to any rotary electrical machine that converts direct current electrical energy into mechanical energy. DC motors can vary in size and power from small motors in toys and appliances to large mechanisms that power vehicles, pull elevators and hoists, and drive steel rolling mills.

DC motors include two key components: a stator and an armature. The stator is the stationary part of a motor, while the armature rotates. In a DC motor, the stator provides a rotating magnetic field that drives the armature to rotate.

A simple DC motor uses a stationary set of magnets in the stator, and a coil of wire with a current running through it to generate an electromagnetic field aligned with the centre of the coil. One or more windings of insulated wire are wrapped around the core of the motor to concentrate the magnetic field.

5.2.2 Battery :

Figure 5. 2: 12v 1.4AH lead acid battery

A battery can be defined as; it is a combination of one or more electrochemical cells that are capable of converting stored chemical energy into electrical energy. Simply said that the battery is a storing device to store the energy.

In this project we are using a 12Volts battery for the running of coin based sensor mobile charging project. The capacity of this battery is 12V 1.4 AH

5.2.3 Solar Panel:

Solar panels are those devices which are used to absorb the sun's rays and convert them into electricity or heat. A solar panel is actually a collection of solar (or photovoltaic) cells, which can be used to generate electricity through photovoltaic effect.

These cells are arranged in a grid-like pattern on the surface of solar panels. Thus, it may also be described as a set of photovoltaic modules, mounted on a structure supporting it. A photovoltaic (PV) module is a packaged and connected assembly of 6×10 solar cells. When it comes to wear-and-tear, these panels are very hardy. Solar panels wear out extremely slow. In a year, their effectiveness decreases only about one to two per cent (at times, even lesser).

Figure 5. 3: Solar panel

5.3 Preparation Of Chassis:

1. The chassis is made with wood of dimensions of 400*300*12 millimetres length, width and thickness respectively.

2. This agriculture robot having four wheels for the movement purpose. we have used U clamps to hold the motors to the chassis to which the wheels are attached.

3. The wheels are made of plastic and has the diameter of 70 mm, thickness of 22.5 mm.

4. The placing of each motor to the chassis has specific location. The dimensions of motor placing from each corner is 50*10 millimetres length and width respectively.

5. The motors are used to rotate the wheels are of 12v, 60 rpm type.

6. Wires of required length are soldered to the motors. On the left side both motors are attached to the battery in parallel connection.

7. Similarly, the motors are connected in parallel connection on the right side.

8. A 300*50 millimetres size wood is added at the front of the chassis and is fixed to the chassis using screws. L-clamps are also used to provide extra support.

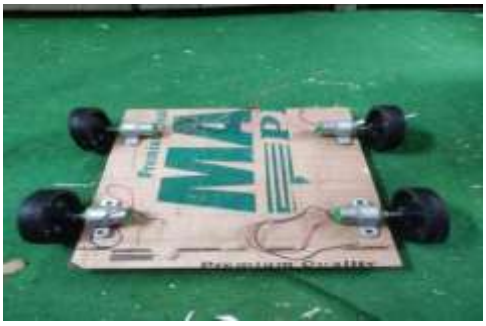

Figure 5. 4: Chassis with wheels

1. A P.E.T bottle is used for the seeding purpose. Some holes are made in the P.E.T bottle for the seeds to fall out, at certain distance from each other.

2. 9V, 45r.p.m motor is used for the seeding purpose. whenever the motor rotates the bottle also gets rotated. With every one complete rotation made by the bottle, the seeds will fall out through the holes.

6. WORKING OF AGROBOT

Four DC motors are used for driving the four wheels of vehicle. These four motors gives the directions like forward, backward, left and right For these directions of movements we used two DPDT switches. If we have press two switches at a time front side, then the robot will move forward. If we have to press two switches at a time back side, then the robot will move backward direction. If we have to press one switch is front side and another switch is back it will make a turn. If you do not press any switch the robot should be in stable condition. V-shaped arms for Agrobot are used, closing of which will dig the soil and opening of it will release the soil to cover the pit. DC motors of arms and wheels are directly connected to DPDT switches to enable them rotating in both clockwise and anticlockwise direction. A single DC motor is required for the movement of V- shaped arms as ploughing. The movement of the ploughing motor is also operated by another DPDT switch. Seed tank and water tank are connected for storage of seeds and water respectively. A DC motor is connected for rotating wheel mechanism to drop the seeds. Submersible entirely waterproof DC water pump is used for pouring the water.one more DPDT switch is required for performing both seeding and watering operations. Input of crop type is given manually by selecting one of the four input switches. We are using an X principle while connecting the DPDT switch. This principle gives the both directions to the motors when we are using throwing two directions.

through a motor. The amount of depth it is digging can be obtained from the calculations.

6.2.2 Seed Sowing

The seeds are stored in a small container and it is closed with a small flip. This flip is controlled by the motor to open and close the container. The motor is capable of rotating to 360 degrees.

6.2 Operations Performed By The Agrobot

In this chapter we have discuss about working and operations that are to be performed by this robot are as follows.

6.2.1 Ploughing

The ploughing tool can be operated in three modes namely on, off and mid. The microcontroller will receive the command to work on any of these three modes and it directs the plugging tool to plough the field accordingly.

Ploughing is one of the first steps in farming. During this process we till the land and make it ready for the seed sowing. By tilling we mean that a plough will be used which will have teeth like structure at the end and will be able to turn the top layer of soil down and vice-versa. One end of the frame, cultivator is fitted which is also driven by dc motor and

CONCLUSION AND SCOPE FOR FUTURE WORK

Main objective of automating the seeding operation is to make it more efficient and accurate in its working over traditional seed sowing methods. There are three major distances in seed sowing operation and these are digging or sowing depth for seeds,

Traditional methods include broadcasting manually, opening furrows by a country plough and dropping seeds by hand, and dropping seeds in the furrow through a bamboo/meta funnel attached to a country plough (Pora). For sowing in small areas dibbling i.e., making holes or slits by a stick or tool and dropping seeds by hand is practiced.

distances between two crops and two rows.

This can be interpreted as row and column distance. Experiments are done on the wet soil and distances covered by the robot are compared with predefined optimal distances. Accuracy obtained is satisfactory and can be improved by utilizing more mechatronics design methodology, modern controllers and advanced information systems.

Conclusion

An autonomous robot is developed to perform the complex farming task of seeding. Agrobot in this project is designed to perform sowing only for four crops: cotton, maize, soybean, wheat. Row and column distances required for these four crop types are modeled in the system. With slight variations of few centimeters in the distances defined robot successfully covers distances between crops and their rows.

Navigation technique using IR sensors in Agrobot is easier and less bulky over other existing agriculture robotic systems. Ease of handling and precision working makes this agriculture robot real aid for farmers. Less complexity in the mechanical design and simpler navigation technique makes the system of lower cost and less bulky compared to conventional tractors. Also, the coverage area by the robot is restricted because of its dependence
on DC battery. Other crop types can be included

by modeling their required optimal distances.

Scope For Future Work

In this project we tried to present related work of agricultural robot as labour problem can be reduced as compared to the manual and tractor based sowing time, energy required for this robot machine is less. At the same time by using solar energy environment pollution can also be reduced.

Future agriculture will use sophisticated technologies such as robots, temperature and moisture sensors, aerial images, and GPS technology. These advanced devices and precision agriculture and robotic systems will allow farms to be more profitable, efficient, safe, and environmentally friendly. From high- tech greenhouses to cloud seeding, here's how agricultural robots are helping farmers fill labor shortages and our supermarket shelves. Robots pick apples, gather strawberries, harvest lettuce and strip away weeds. Drones gather aerial images that help farmers quickly assess crop health.

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