Design and development of seed sowing AGROBOT

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Abstract: In India, near about 70% people are dependent upon agriculture. So the agricultural system in India should be advanced to reduce the efforts of farmers. Various numbers of operations are performed in the agriculture field like seed sowing, weeding, cutting, pesticide spraying etc. Very basic and significant operation is seed sowing. But the present methods of seed sowing are problematic. The equipment used for seed sowing are very difficult and inconvenient to handle. So there is a need to develop equipment which will reduce the efforts of farmers. Through this paper, an attempt is made to design and fabrication of Agriculture Robot (AGROBOT). AGROBOT consists of Fire bird V robot and seed sowing mechanism. Seed sowing mechanism operated by rotor with four blades, rotor is driven with the help of motor. The mechanism is synchronized to Fire bird V robot. Seed chamber filled with seeds, is placed in an arena consisting of troughs and aisles. As soon as the program dumped into microcontroller, the bot starts navigating towards it. The bot aligns itself with the troughs as it moves through the aisle using the sharp sensors mounted on it. On reaching the trough, the bot activates a motor, attached with a rotor, to drop a single seed. Wheel encoder information is used to calculate the distance moved by the bot. This distance information is used to activate the seed mechanism so that the inter-seeding distance of the crop is maintained.

Index Terms **- Agriculture, AGROBOT, seed sowing mechanism, Fire bird V robot, Wheel encoder**

I. INTRODUCTION

Agriculture and farming is considered one of the most exhaustive works which requires a lot of effort to perform seeding, planting, weeding, spraying and harvesting. Robotics technology has helped us to improve the quality of our lives in different aspects. But still implementation of robots in the field of agriculture, especially farm activities, is a challenge for scientists and engineers. Robots can help us plant accurately, water accurately and also control weeds and pests more accurately. These all mean, higher quality products, cheaper food and less labour.

The idea of applying robotics technology in agriculture is very new. In agriculture, the opportunities for robot-enhanced productivity are immense – and the robots are appearing on farms in various guises and in increasing numbers. We can expect the robots performing agricultural operations autonomously such as spraying and mechanical weed control, fruit picking, watching the farms day & night for an effective report, allowing farmers to reduce the environmental impact, increase precision and efficiency, and manage individual plants in novel ways.

Developing advanced devices in agriculture is part of a larger project, named "Developing robotics assisted technology for farming". In the overall project, a new robotic technology will be developed to help farmers in weed control and planting for certain types of crops. This research can be broken down into a few sub-projects:

1) Navigation of wheeled robot in a semi-structured farm setting.

2) Designing tools (robotic arms) for robotic assisted farming (weeding, seeding, and planting this goal includes design and construction of ground engagement

3) Implementation of robotic assisted farming (i.e. navigation when the robot arm is engaged with the ground). The contribution of this project in the overall project is to design a seeding mechanism, with optimum manner which will result in minimum required force from the mobile robot while it performs seeding with accuracy.

The sheer urge to automate tedious and monotonous field job has led to the very development in the area of robotics. To mimic the human like operation is the core objective of any robot. Robotics is an “applied science” which can incorporate high-technology, electronics, mechanics, pneumatics, remote actuation and, of course, the technology of creating, designing, building, ‘manufacturing’ and applying robots and robotic systems. To effectively conceive and then implement robotic designs calls for more than a working knowledge of many separate ‘sciences’, including electronics, mechanics, servo-mechanisms, computers, programming and a logical, ordered mind, even when brainstorming.

Today agricultural robots can be classified into several groups: harvesting or picking, planting, weeding, pest control, or maintenance. Scientists have the goal of creating “robot farms” where all of the work will be done by machines. The main obstacle to this kind of robot farm is that farms are a part of nature and nature is not uniform. It is not like the robots that work in factories building cars. Factories are built around the job at hand, whereas, farms are not. Robots on farms have to operate in harmony with nature. Robots in factories don’t have to deal with uneven terrain or changing conditions. Scientists are working on overcoming these problems.

Very less Researchers have presented agriculture devices in which a robot machine. The different sensors are used to control different parameters of robot for sowing the seeds by using microcontroller. At the end of field using remote switch and the position of wheels changed. Seeds are empty alarm is detected. Another research presented a multi-class image segmentation to automate fruit segmentation. The proposed algorithm is applied to fruit segmentation, the problem for a robotic agriculture observation mission. The aim to provide yield estimation with high correctness as well as robustness against fruit variance. Another Researchers developed a system which is solar based automatic seed sowing. In village the farmers mainly income depends on the agricultural source. Automatic seed sowing machine is fulfil the digging, seed sowing, water pouring and fertilizing by using solar energy. This automatic

seed sowing machine is help to the farmer. And also they can perform their regular cultivation activity as well as saves fuel up to larger extent. At the same time by using solar energy environment pollution can be reduced.

II. PROPOSED AGROBOT

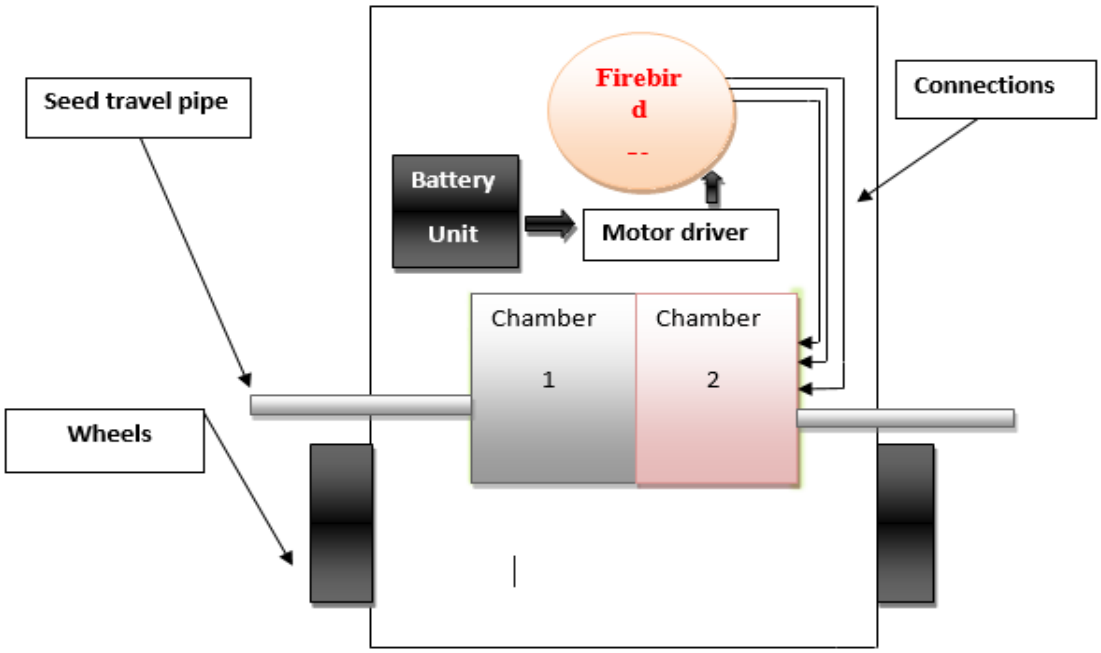
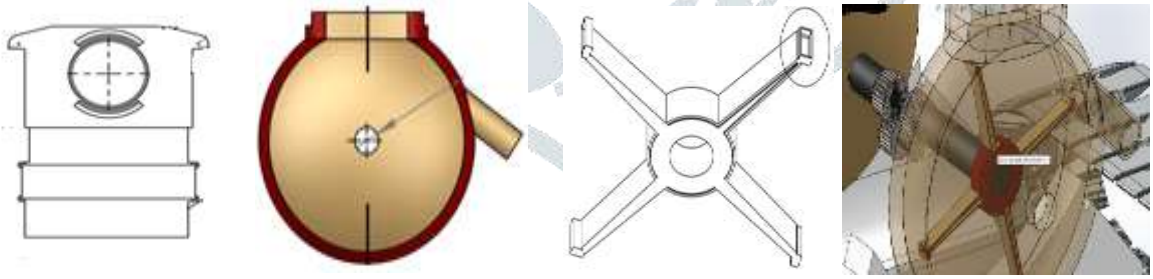


Figure 2.1 block diagram of AGROBOT

Agriculture robot can be control by firebird V of ATMEGA2560. In AGROBOT the major components are arranged as shown in Figure 2.1. Here it consist of 12V DC voltage rechargeable battery with 600mah output is connected to L293D motor driver which is connected to 12V 30 rpm motors as output device and connected to the firebird V of ATMEGA2560 model to the LP3 and LP4 ports. Here the core mechanism will have chamber 1 and 2 which picks and transfers to the place. Each chamber should have its own individual rotor shafts connected. The internals connections should be made with the male to male wires connecters. Synchronous between wheels are maintain by using IR sensor and encoders therefore its can operate in agricultural field easily. Seed can be drop to field by using mid van rotor at accurate location. IR sensor and ATMEGA microcontroller features will help in dropping the seeds at prescribed position.

III. DESIGN OF SEED SOWING MECHANISM

3.1 Components of seed sowing mechanism



a **b** **c** **d**

Figure 3.1 seed sowing mechanism a) Base part b) Rotor body c) Mid van d) Assembly view

Seed sowing mechanism figure3.1 shows the complete parts 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. Basic part is outer shell which has inlet to pour seeds. Second part is rotor body which has two outlets for dropping the seeds. Third component is mid van consists of four blades, blade is going to lift the seed from tank and push at outlet rotor body as per required time and placement. Base part, robot body and mid van was designed in CAD software. Assembly is carried out base part is attached to rotor body and mid van is arranged with the help of bearings. Base part has a hole on top side of the part to pour seeds which is acted as inlet for system. Rotor body has extend tube which is allowed to drop the seed on corresponding side acted as outlet for the system. Mid van consisted four blades, blade is going to collect the seed from bottom of the tank and after rotating van blade reaching outlet seed is thrown. Same configuration was attached on both sides in order to drop the seeds on right and left sides correspondingly. The mechanism is working with the help of fireboard V ATMEGA microcontroller. The encoder is helping to execute the seeds at precise position for dropping the seeds. Shafts and bearings are used for executing the mechanism.

3.2 Firebird V ATMEGA2560 robot

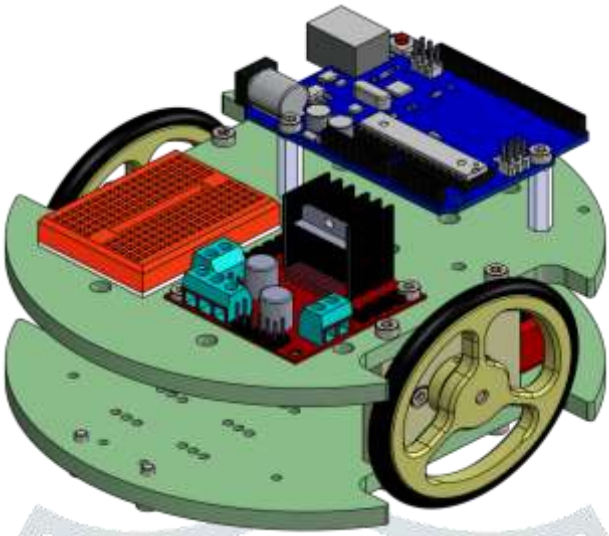


Fig 3.2 CAD model of Fire bird V ATMEGA2560 robot

Fire bird V ATMEGA2560 robot consists of Arduino 2016 processor, socket head cap screw iso type, motor holding bearing, Arduino chip 2016, battery 12V 850mAh, breadboard mini 2016, L298N 2016 motor driver, steel ball roller, port switches, motors, rubber rings, shaft holders, upper chip holder, motor set holder, lower chip holder. These advanced specifications of Fire bird V ATMEGA2560 robot will help to achieve any kind task easily.

3.3 Design of AGROBOT

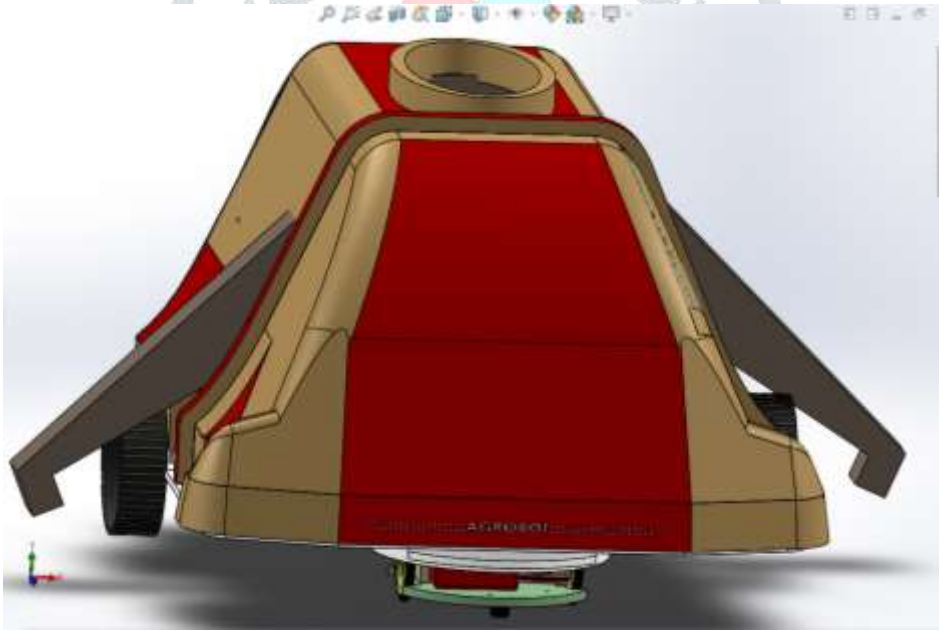


Figure 3.3 CAD model of AGROBOT

Figure 3.3 shows complete model of AGROBOT desiged with the help of CAD software.AGROBOT consising of seed sowing mechanism and fire board V bot. Bot attached in the front wheel position, Bot guide the seed planter with the help of back wheels. Main body is attached seed sowing mechanism which is top side hole inlet and both sides of robot outer tubes as outlets for dropping the seeds. Important part is Fire bird V ATMEGA2560 robot is attached at front portion of the AGROBOT. Back side of the wheels will help to roll the entire system to follow the Fire bird V ATMEGA2560 robot. Encoders are attached at the wheels of Fire bird V robot, one wheel rotation of wheel counted and based on the information program is written. The black line follower program is written in arduino chip and executed.

IV. RESULTS AND DISCUSSION

AGROBOT design was made in CAD modeling software then fabrication of proposed model was developed. Finally Fire Bird V is attached to AGROBOT model and program was written for the black line sensor, motors, seed picking mechanism motors and there time interval of the rotating frames in milli seconds and successefully executed as shown in figure 4.1

Figure 4.1 Developed prototype of AGROBOT

Challenges that we had faced during our implementation were:

a) Dropping the seeds one by one (Requirement: Bot should not drop more than one seed at a time)
b) Alignment of the BOT, Due to the additional weight added by the mechanism caused problem in moving around curves

A mechanism had to be used, that could dispense the seeds one by one. The mechanism had to consume minimal energy and had to be simple enough to be implemented in a robust manner. Various mechanisms like vacuum based pick with robotic arm, robotic arm with gripper were considered, but later discarded because of feasibility in terms of power consumption and complexity. A simple and a robust mechanism involving a circular wheel with buckets and a servomotor attached with a flap mounted was developed which could perform the job of dispensing robustly and efficiently. Alignment of the BOT was a challenge because of following reasons:

i) Sharp sensors are very sensitive
ii) The wheels could not be rotated by precise amounts

Conclusion

Through this paper we made an effort to overcome some problems in agriculture. The rapid growth in the industries is influencing the labors who are situating in the villages to migrate to the cities. This will create the labor problem for the agriculture. The wages for the labor is also more. As the prices of commodities such as food grains, fuels, cloths and other essentials of daily life is increasing rapidly the labors demand for the more wages from the owners. These factors influencing the farmers who are interested in agricultural activity to leave their land uncultivated. By implementing this project in the field of agriculture we can help the farmers in the initial stage of agriculture i.e. during the seeding and fertilizing. This project can be a better substitute for the human who performs the seeding, fertilizing and removing weeds. The system that is developed is fully automatic except for the part where the user gives the command to start sowing the seeds. The fact that sharp sensors for navigating through the troughs encourages its applicability in the actual greenhouse environment, along with white line tracer. If the line is missed or stained, information from the sharp sensor can be used to navigate independently.

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