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Agricultural Robotics

*Dr. Ritika Singh
Assistant professor, School of Agriculture, Abhilashi University

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Introduction

Farming is a major occupation in many regions of India, and more than 60 % of India's population is involved in agriculture. Effort and hard labor in crop fields are required with varied intensities/skills to match yield expectations for increasing demand.

In past few years, agriculture has witnessed a series of mind blowing inventions and improvements to the way crops were raised and utilized. Now, science and technology has shaken hands with agriculture and some wonderful inventions like sensors with irrigators, GPS based Harvesters, Grafter, Auto seeding units, Drones (UAV), Satellite Imaging has helped in reduction of physical effort and improving production quality and efficiency. Robotics in Agriculture (Robo-culture) is a concept of immense significance at global level. It is a kind of revolution that has begun for the benefit of farmers and human population around the world.

Robotics Mechanism and Their Impact

1. **Drones**

To achieve sustainable agricultural data that allows agronomists, agricultural engineers, and farmers to help streamline their operations, using robust data analytics to gain effective insights into their crops.

- Crop monitoring, for example, is made easier by using drone data to accurately plan and make ongoing improvements, such as the use of ditches and evolving fertilizer applications.
- Products can be accurately traced from farm to fork using GPS locations for every point in the journey, rather than more traditional time and labor-intensive data collection.
- Crucially, the high-resolution nature of drone data can be used to assess the fertility of crops, allowing agricultural professionals to more accurately apply fertilizer, reduce wastage, and plan and troubleshoot irrigation systems

2. **Sensors Based Irrigation (Smart Irrigation)**

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In the semi-arid areas/ rain fed agriculture marginal farmers and small farmers who cannot afford to pay for powered irrigation, heavily depend on the rainfall for their crops. It is observed that farmers have to bear huge financial loss because of wrong prediction of weather and incorrect irrigation method.

- To improve the efficiency of irrigation systems and prevent the non-optimal use of water need focus on implementing an intelligent irrigation system which will enable irrigation farmers to optimize the use of water and only irrigate where and when need for as long as needed.
- Whenever there is a change in temperature and humidity of the surroundings these sensors senses the change in temperature and humidity and gives an interrupt signal to irrigate.
- These sensor technology found to be suitable for collecting real time data for different parameters pertaining to weather, crop and soil helps in developing solutions for majority of the agricultural processes related to irrigation and other agricultural processes.
- The development of wireless sensor applications in agriculture makes it possible to increase efficiency, productivity and profitability of farming operations.

3. Paper Pot Systems For Faster And Environment Friendly Propagation

While comparing with conventional plastic pots papers pots pose no harm to the environment. The paper pots will decompose in the soil when planted directly in the land/field. Study shows that the carbon foot print on paper pots is more than 20% lower compared to plastic pots.

- Less carbon
- Compostable
- Improved crop timing with uniformity in plant sizes
- No transplant shock
- Healthier & faster with improved Quality of plant than plastic pots.

4. Sensor Based Grafting Units (Automatic Grafting Robots)

Grafting enhances the resistance of plants to different biotic and abiotic stress conditions like soil and airborne pathogens, temperature, salinity, heavy metals, and water stress. Weeds like parasitic plants can also be controlled using plant grafting.

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- It is helpful in improving the health of plants, their yield, and product quality, as well as the extension of harvesting time and postharvest life.
- It restricts input of agrochemicals against soil borne pathogens and is, therefore, considered an environment friendly cultivation technique, which is strongly recommended for integrated crop management systems.
- 600-700plant can be grafted /hour with grafting robot.

5. Advanced Combine Robot Harvesting System

Currently, there is a great downfall in the number of farmers in India. In addition, the young generation is losing their interest in farming due to high demand of incessant labor on field. To overcome this problem, the possible solution is to employ agricultural robot in actual field, including robot tractor, robot combine harvester and so on.

- This robot relies on an AGI GPS receiver and IMU for position and posture data. It is controlled via CAN BUS. A RTK-GPS receiver embedded with an IMU was used.
- By using data provided by this device, the computer in the combine harvester can calculate lateral and heading error, and then steer the machine. A straight running test was conducted to evaluate the accuracy, and the result showed that this robot can be applied.

Conclusion

By the end of 2050 human population may reach to 9 billion which means we have to produce commensurately higher quantity of food grains. Production of food grains could be enhanced by adopting several methods such as expanding cropping zones, wherever possible, intensifying the crop production trends, finding substitutes to food grains (e.g., fruits) etc. Whatever the alternative, we have to achieve the goal with least disturbance to environmental parameters and with best efficiency possible with regard to use of natural resources and some of the options available are introduction of precision farming techniques, mechanization and robotics that adds to efficiency of crop production systems.