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Robotics In Agriculture

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Introduction

Agricultural scientists, farmers and growers are confronted with the challenge of producing more food from fewer resources sustainably to meet the demands of the estimated 9.8 billion population in 2050. The requirement for noticeably higher production yields is at the core of this situation. The design and development of agricultural robotics have been hastened by the integration of digital tools, sensors and control technologies, demonstrating tremendous potential and benefits in modern farming. Agriculture is increasingly becoming an interesting high-tech industry, attracting new professionals, businesses and investors. Technologies such as robotic arms, autonomous tractors and drones are being used in inventive and creative applications. Automation in agriculture has advanced due to a number of issues, such as a lack of available labour, rising consumer demand and expensive production costs. Automation and robotics are intended to save costs and time.

What are Agricultural Robots?

A robot is a mechanical and artificial agent, usually an electromechanical system. It is a device that makes complicated tasks perform easily because of software programming. Robotics is the branch of technology concerned with the design, operation, structural depositions, manufacture and application of robots. Robotics combines a wide range of disciplines such as electronics, Engineering, mechanics, mechatronics and software. An agricultural robot or Agribot is a robot used for agricultural purposes. Agricultural robotics is the use of automation in biosystems such as agriculture, forestry and fisheries. It is replacing conventional techniques to perform the same tasks efficiently. The incorporation of robotics in agriculture improves both productivity and working conditions for farmers and workers. Farming operations that are tedious, repetitive and slow to complete are automated by agricultural robots, freeing up the farmer's time to concentrate on increasing output yields as a whole.

Some of the most common robots in agriculture are used for:

- Ploughing and field preparation
- Sowing, seed mapping and planting
- Harvesting and picking
- Autonomous mowing
- Pruning and thinning

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- Weed mapping and weed control
- Spraying
- Disease monitoring
- Phenotyping
- Sorting and packing
- Utility platforms

Agricultural robots are generally designed to execute a 'main task', which is usually a specific agricultural task such as planting, weeding, pruning, picking, harvesting, packing, handling, etc. Agribot system requires the ability to perform several 'supporting tasks' such as localization and navigation, detection of the object to treat, the treatment or action to perform, etc., for performing main tasks. The 'supporting tasks' and the 'supporting' and 'main tasks' exchange information and directives. Each 'supporting task' manages one or more devices and subsystems, and a single device or subsystem may support many 'supporting tasks'.

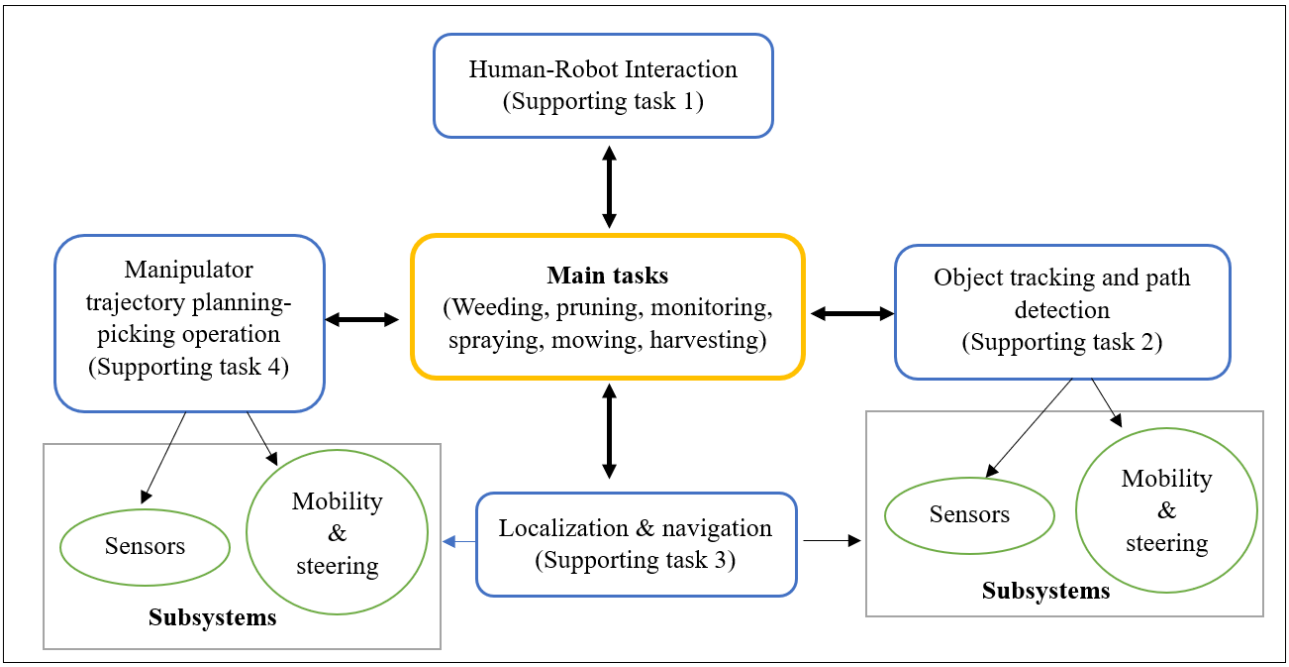

Fig. 1. Structure of robot systems to perform agricultural tasks

Parts of Robots

1. **Sensors:** Sensors send information in the form of electronic signals back to the controller
2. **Controller (computer):** It is the brain of the robot. Controller also allows the robot to be networked to other systems, so that it may work together with other machines, processors or robots.
3. **Drivers/Actuators:** It is the engine of the robot
4. **Arms:** The arm is part of a robot that positions the end-effectors and sensors to do their preprogrammed business.
5. **End effectors:** It is the last link (or end) of the robot. In a wider sense, end effectors can be seen as the part of a robot that interacts with the work environment.

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Types of robots used in agriculture

- Demeter for harvesting
- Weed controller
- Forester robot for cutting wood, and pruning of X-Mas trees and harvesting pulp and hardwood in the forests.
- Robot mowers
- Fruit picking robots
- Cattle grazing and automatic milking robots
- Flying robots to spread fertilizer/ drones
- Robo suit: designed to pull radishes
- Viti rover solar robot: weed remover robots use solar energy to work

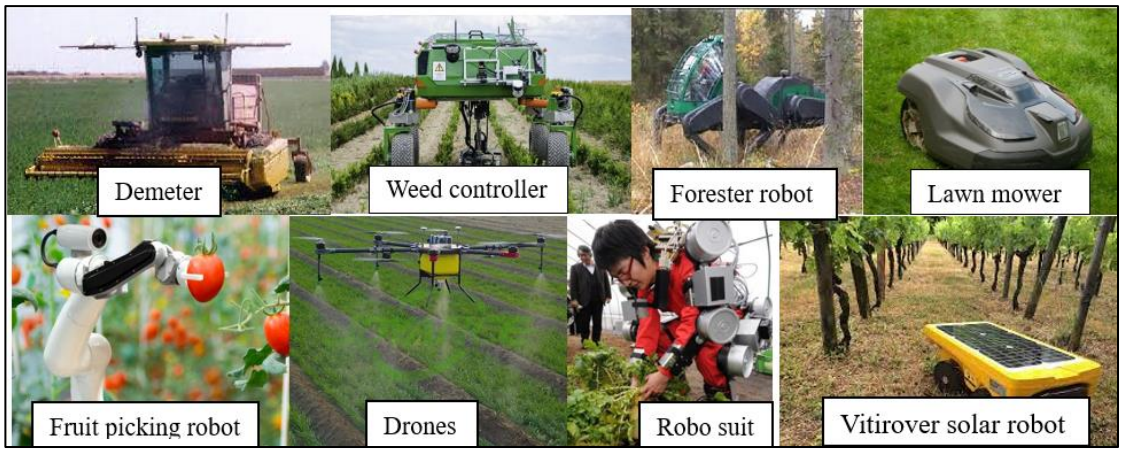

Fig. 2. Types of robots

Scope of farm robots in India

India is one of the world's developing nations, where only urban and semi-urban residents may take advantage of web-based communications and their numerous advantages. In India, most of the farm operation is done by using the tractor as a prime mower and attaching different implements. At present, intercultural operations are mostly carried out with manually operated tools like wheel hoes and weeders, which are highly popular for horticulture crops and paddy fields. Many small and large parts of farm equipment have been developed by our researchers and farm equipment companies for use in conventional farming, but precision farming requires some sort of robotic and pneumatic mechanisms. Inventors from remote areas have invented some spectacular inventions. Remote electric motor control is possible using mobile devices, which is helpful for farmers in the summer when the power supply is unpredictable.

Conclusion

Robots and intelligent automation systems are often exceedingly complicated since they are made up of multiple different subsystems that must be integrated and appropriately synchronized in order to perform duties flawlessly as a whole and successfully communicate essential information. Robotics will undoubtedly usher in the agricultural revolution. The autonomous robot has the potential to work in precision agriculture with ongoing monitoring using various sensing technologies, which provides various crop status parameters for better crop

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remedies, including micronutrient availability, biomass index, status of pest and disease, water stress, thermal stress, etc.

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