

Robotic Importance in the Agriculture Industry: Cultivating Ideas for a Better Tomorrow

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SUMMARY

An agricultural robot is also called as an agribot or agbot. This is a robot which is autonomous and is helpful in farming. It helps the farmer to raise the crops efficiency and also reduces the need for manual labour to the farmer. In the coming generations, we can expect that the tilling, sowing, harvesting and many other farm works will be done by these agricultural robots individually. Even the weeding, control of pests and diseases will be taken care of by these agricultural robots. These agricultural robots are equipped with arms which are specialized, end effectors and many other tools in order to work on several tasks related to agriculture. The agricultural robots can also get connected to the wireless sensor networks and by using the drones, these robots will collect a huge amount of information or data. The trend of using agricultural robots will be increased to a wide extent in order to replace manual labour.

INTRODUCTION

A robot is a mechanical, artificial agent and is usually an electromechanical system. It is a device that, because of software programming, makes complicated tasks easy to perform. Agricultural robotics is the use of automation in bio systems such as agriculture, forestry, and fisheries. It is replacing the conventional techniques to perform the same tasks, with efficiency. Applying automation to agriculture has helped create several advancements to the industry while helping farmers save money and time. In the present days, robots are used for pricking fruits, milking of cows and rearing of sheep and they are found to be successful in those tasks. There are many thousands of robotic milking parlours in the world right now and the mobile robots are standing as help to the farmers in the automation of tasks which include pushing of feed and the cleaning of manure. The farmers face a lot of problems while working in the field. Cost is the main thing in order to keep the farmer in the competitive market and for that the cost of operations has to be reduced at a maximum level. Robots are the ones which offer services in a professional way and can automate the tasks which are very difficult manual. These are used in the agricultural lands and they are also completely autonomous.



History of Agricultural Robots:

- The revolution in agriculture has started in 1752 and ended in the year 1900 when agriculture has changed in America in a drastic way.

- The main reason for the occurrence of a revolution in agriculture is due to the introduction of the machines.
- A machine which is well known has been introduced at this time and its name was Eli Whitney's cotton gin.
- It is the first machine which has been used in agriculture. This machine was introduced in the year 1794 on the 14th of March by Eli Whitney. This machine has the ability to isolate the cotton seed from the cotton fibre and it has the record of creating up to 50 pounds of cotton in one day. This fifty pounds per day is equal to almost hundreds of man-hours. The cotton gin is the first machine which has given way to several modern machines in Agriculture.
- Robotics was first developed in agriculture in the early times of the year 1920.
- The research has taken place to give a start to the automatic guidance to the vehicle and that was about to take a shape. This research has given rise to developments in the years between 1950 and 1960.
- The advancements happened to get the agricultural vehicles which are autonomous. This particular concept has not been that perfect as the vehicles were in need of a cable system for their guidance along the path they travel.
- Agricultural robots have continued their development in the form of technologies in multiple sectors as well. In the 1980s, after the computers were developed, the guidance for the vision of the machine was made possible.
- Other developments took place in the following years in the form of orange harvesting with the help of agricultural robots in countries like the USA and France.
- For decades, agricultural robots have been used for the indoor industries and for the outdoors, it has always been tough to incorporate as they are termed as the more complex ones to develop. The security concerns, difficulty in picking crops, varying conditions of environment leads to the unpredictability of the use of these robots.

Why Agricultural Robots are preferred?

We can expect the robots to perform 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.

Types of Field Robots used in Agriculture applications

Agricultural robots offer a service which is completely professional and these are the ones with automating the tasks which are found difficult for a human. These robots are used in the farms. These robots are used in several applications and agriculture is one among those applications. The agriculture industry faces a lot of problems. Pricing needs to be competitive on a global scale, creating constant pressure to reduce operating costs.

There are several types of robots which are being used in the field of agriculture and there are many new solutions which are getting developed with time. Out of all those, 8 types of agricultural robots have become popular and those are listed below:

- **Precision Agriculture:** these field robots are used on small farms or vineyards and enable precision agriculture techniques. Often, they're used to autonomously monitor soil respiration, photosynthetic activity, leaf area indexes (LAI) and other biological factors.
- **Pollution Monitoring:** some field robots are now equipped to monitor the pollution created by agriculture at the ground level. These robots measure carbon dioxide and nitrous oxide emissions so that farmers can reduce their environmental footprint.
- **Livestock Ranching:** a new type of field robot is used to herd livestock on large ranches. These robots also monitor the animals and ensure they're healthy and have enough area to graze.
- **Weed Control:** field robots for weed control can autonomously navigate a farm and deliver targeted sprays of herbicides to eliminate weeds. This approach reduces crops' exposure to herbicides and helps prevent the growth of herbicide-resistant weeds.

- **Nursery Automation:** field robots can be used in crop nurseries, primarily to move plants around large greenhouses. These robots create major efficiencies for crop nurseries and help address a growing labor shortage.
- **Crop Harvesting:** for harvesting crops, specialized field robots can work around the clock for faster harvesting, in some cases completing the same amount of work as approximately 30 workers.
- **Fruit Harvesting:** field robots are starting to be used to harvest fruit in addition to crops. Fruit harvesting is notoriously difficult for robots. These field robots are equipped with advanced vision systems to identify fruits and grasp them without damaging them.
- **Planting and Seeding:** an emerging application, field robots with 3D vision systems can now accurately plant and seed crops for optimal growth, primarily for lettuce farming and vineyards.
- **Milking:** Finally, we have seen a great development using collaborative robots to help in the milking process on dairy farms. [This case study by Universal Robots](#) shows how a UR5 can be used to spray disinfectant on the cow's udders in preparation for milking.
- **Shepherding and Herding:** Although most agricultural robots are currently applied in crop growing, there have been a few emerging applications within sheep and cattle farming. Farmers in both [New Zealand](#) and [Ireland](#) have been seen using drones to round up their sheep over long, difficult terrain.
- **Crop Monitoring and Analysis:** Monitoring huge fields of crop is a big job. New sensor and geomapping technologies are allowing farmers to get a much higher level of data about their crops than they have in the past. Ground robots and drones provide a way to collect this data autonomously. Drone companies like [Precision Hawk](#) offer farmers combined packages which include robotic hardware and analysis software.
- **Fertilizing and Irrigation:** Irrigating and fertilizing crops has traditionally used a lot of water is quite inefficient. [Robot-Assisted Precision Irrigation](#) can reduce wasted water by targeting specific plants. Ground robots autonomously navigate between rows of crop and pour water directly at the base of each plant. Robots also have an advantage as they are able to access areas where other machines cannot. For example, corn growers face a problem that the plants grow too quickly to reliably fertilize them. .
- **Crop Weeding and Spraying:** Spraying pesticides and weed killers onto fields is not only wasteful, it can severely harm the environment. Robots provide a much more efficient method. The concept of micro-spraying could significantly reduce the amount of herbicide used in crop growing. Micro-spraying robots use computer vision technology to detect weeds and then spray a targeted drop of herbicide onto them. [AG BOT II](#) is a solar powered robot which uses this technique. Some weeding robots don't even need to use chemicals. [RoboCrop](#), for example, uses computer vision to detect plants as it is pushed by a tractor. It then automatically hoes the spaces between plants to uproot the weeds.
- **Thinning and Pruning:** Thinning involves reducing the density of plants so that each has a better chance of growing. Pruning involves cutting back parts of plants to improve their growth. The [LettuceBot](#) thinning robot received an award this year for "outstanding product innovation in agriculture." It uses computer vision to detect lettuce plants as it drives over them and decides in that moment which plants to keep and which to remove. Pruning is a complex job and the most notable attempts to automate it have come in the wine industry. [Wall-Ye](#) is an autonomous vineyard robot able to prune grape vines.
- **Autonomous Tractors:** Several of the robots I've mentioned are attachments to a tractor. As humans usually drive the tractors, the robots are designed to adapt to the speed that the human is driving. However, fully-autonomous tractors are also becoming popular.

Advantages

- They are also capable of mowing, spraying pesticides, finding diseases or parasites, and performing mechanical weeding. This has helped to protect our environment by reducing the amount of harmful chemicals released in the air.
- Not only are they used in agriculture, but also in forestry, green house, horticulture etc. Farmers are interested in using robots to tend fields of crops, pick fruit, or even maintain animal.
- Experiments are being done to produce world's smallest, weightless robot for using them as scouts in fields.

- Using robots means the opportunity of replacing human operators, which provides effective solutions with return on investment.
- Robots are useful when the duties, that need be performed, are potentially harmful for the safety or the health of the workers, or when more conservative issues are granted by robotics.
- Heavy chemicals or drugs dispensers, manure or fertilizers spreaders, etc. are activities more and more concerned by the deployment of unmanned options.
- The Robot does not get sick or tired and does not need time off.
- Because machines can be made lighter and cheaper if the drivers seat, controls and cab can be eliminated. It can be used in various fields like agriculture, medicine, mining, and space research .
- It can be sent to another planet to study their environmental conditions. The machines could easily work around trees, rocks, ponds and other obstacles. Small suburban fields could be worked almost as efficiently as large tracts of land.
- Agricultural robots are capable of collecting crop and soil samples. They are small in size, which allows them to be able to accumulate data close to the crops.

Disadvantages

- One of the key disadvantages of driverless machines for agriculture is liability Access to the technology.
- Not currently scale neutral.
- Better sensors would help.
- Improved scouting programs would be essential.
- Nevertheless, a periodic human presence in the field is likely to be necessary for the near future.
- Robots could change the culture /emotional appeal of agriculture.
- Energy issues, costly

CONCLUSION

The robot for agricultural purpose an Agrobot is a concept for the near the performance and cost of the product once optimized, will prove to be work through in the agricultural spraying operations. Workload on the farmers is decreased and health problems also. Successful in constructing robot which can be travelled on rough surfaces also and weighing enough load of compressor and other equipments. Successful in developing a robot whose construction is enough to withstand the challenges of the field. Sure about that once this concept will be presented in a manner suitable to Indian market, it will definitely help in bringing down the 15% molality rate found in the Indian farmers associated with the agricultural spraying operation

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