

AGRI ROBOTICS IN SUSTAINABLE AGRICULTURE

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It may be hard to believe but the fact is Agriculture in the future will see increasing use of scientifically precise farming techniques, where an Agriculture Robot- called Agribots automate tasks for a farmer, boosting the efficiency of production and reducing manual labor. Also at the same time, we all aware of the chemicals used in the production of crop yields and ultimately into the food chain which degrades the quality of food and demands for sustainable agriculture to achieve ever tastier and higher quality produce. So finding the best way to deal with these issues and to meet the environmental pressure and challenges, Agribots and its Artificial Intelligence would try to improve and balance sustainability. The main focus is achieving desired yields in an environmentally sustainable way, with a

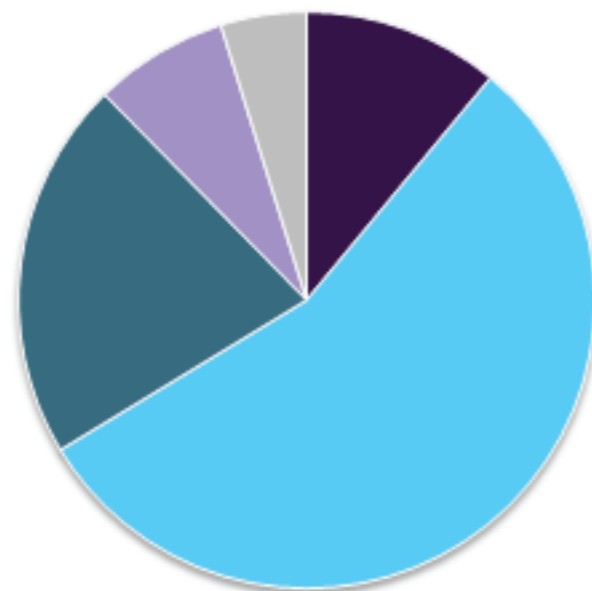
continuous flow of reducing the use of chemicals Automation, mechanizations, and technologies within agriculture is nothing new along with the industrial revolution but robotics in the field is still a matter of discussion in developing Nations.

Agri-robotics doesn't mean a single machine working under a farmer but a series of different devices including a robot, base station, drones, field sensors used for harvesting, picking, fertilizing, seeding, pruning, sorting, and packaging. Few examples of Agribots are such as; Weed Control Machine, Harvest CROO (Computerized Robotic Optimized Obtainer), Autonomous tractors, Forester robots, etc. Harvesting and picking are the most popular ones in robotic applications due to their speed and accuracy.

With the help of Agribots one can find out the yield that shall be produced, its suggestions to reduce the crop being left in the field, period of crop, cropping system that needs to be followed or either crop rotation, etc to maintain imperishable land use and eventually to sustainable agriculture. Using an algorithm, the robots predict what shape and color the plant should have and when they ripe. Not only these 'Vision systems' determine the location and ripeness of any crop in harsh conditions, including the presence of dust, temperature swings, varying light intensity, and movements created by wind. With all these interesting facts there comes Remote Sensing which helps inland mapping, assist in chemical, physical, and structural properties. Now, this is likely to attract attention that through remote sensing we can measure cellulose, pigments (chlorophyll, carotenoids), lignin, proteins, oil, nonstructural carbohydrates per surface area, canopy

coverage, etc. when we focus things minutely on the opportunities within the sector increases, the same applied to two broad sectors; Robotics – Sustainable Agriculture. Undoubtedly 'Crop growth and productivity monitoring and stimulation using Remote Sensing', 'Role of Artificial Intelligence in crop state evaluation' is the most appealing topics. Crop identification, crop condition assessment, identification of pest and disease infestation, crop acreage estimation, crop nutrient deficiency, crop yield modeling and production forecasting, soil mapping, irrigation monitoring, drought assessment, and suggestions of crop intensification...all these collectively accompanies in providing background to sustainable agriculture in farming by allowing farmers to reduce environmental impact, to increase precision and efficiency and manage individual plants in novel ways. A robot use sensors to observe each plant also measure it's doing

Agriculture robot market, by application



- Field Farming
- Dairy Management
- Animal Management
- Soil Management
- Crop Management

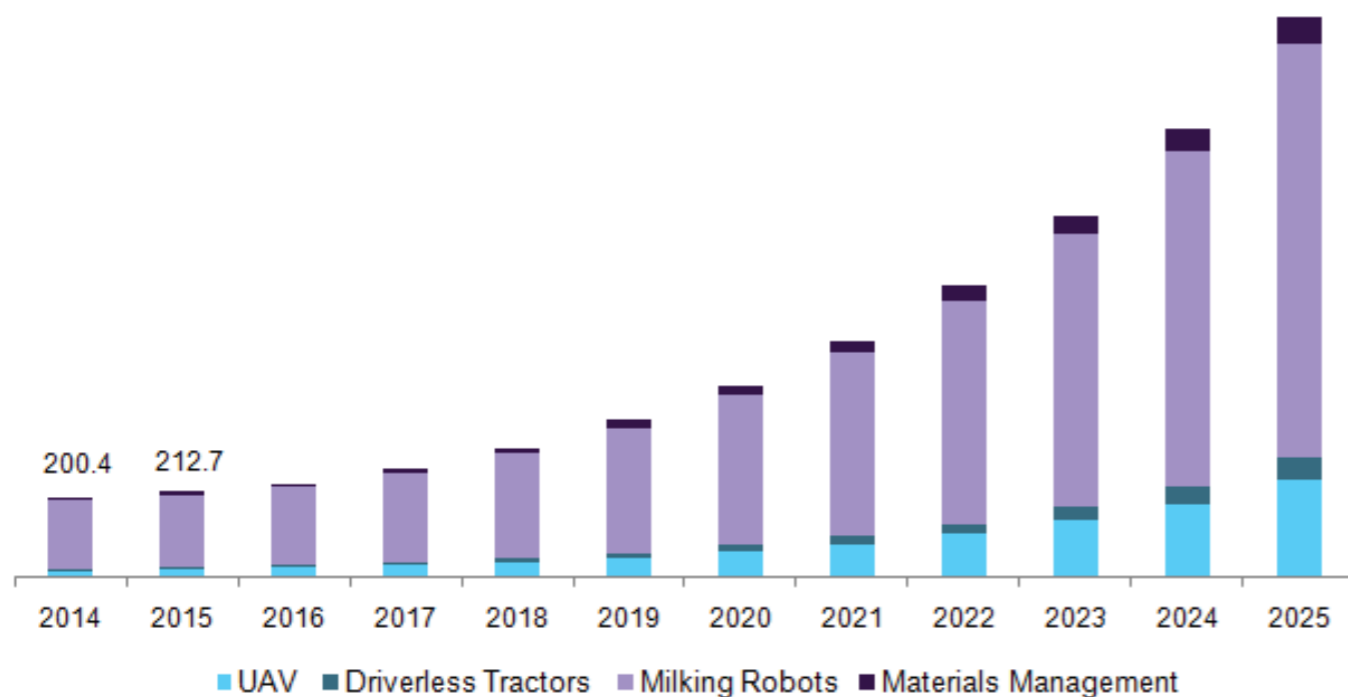


The pressure on agriculture is mounting. Firstly, the population is growing around the world! reflecting its increasing food demands. Experts may easily feed alarming population or solve this burning issue by simply introducing several numbers of agricultural Revolutions into the field which may rapidly enlarge the yield or agriculture produce through adding several more amounts of chemicals and fertilizers but it won't protect the land and environment at any cost, substantially to humans and its co-competitors in the food chain. Unambiguously it also degrades the soil, affects soil food web, topsoil depletion, downscale of groundwater, water scarcity, reduction in soil microorganisms, etc leaves nothing for future generations. Yes! Agree, Chemicals and fertilizers are quite beneficial and it loses one's appetite, it meets the need of the greater population, it may doubles the yield but it is nowhere guaranteed for its food quality. Remote sensing can cope up

with all these and can recommend the limited and appropriate use of chemicals. Secondly, it is absolute that consumers want sustainably produced food therefore currently focusing on robotics along with good plans with agricultural Revolutions might help in getting the actual data of every inputs and requirement of each crop to achieve the goal of meeting society's present food and textile needs without compromising the future generations to meet their own needs. If in case farmer stops using pesticides, they will have to keep up more surveillance on their crops which increase man-hours cost whereas robots take over into this by keeping a much better eye on crops than a human can. In a discussion of livestock, there are already robots for milking cows and many more.

Admittedly, robotic agriculture would never be able to do without farmers entirely, machines can take over heavy work but farmers will still have to keep an eye on everything. These advances with robots also have a downside, since simple task are a part of automated fieldwork all that remains are the difficult task which could be carried out by robots but keep under the supervision whether it cleans the surrounding or possibly carrying out maintenance. Another downside for robotic agriculture is such as it is costlier to implement, complexity is increased, increases the risk of unemployment. and robots run with power but

is more than 65%. Besides these, it is debatable that it has major disadvantages in comparison to its negatives such as Elimination of labor or self-employment, chemicals application can be reduced in a large percentage, it will bring revolution in farming, youth involvement would be more and robotics gives us perfect results that perhaps increases the quality of food and focus more sustainable utilization of resources for current and future generation. There are few types of robots like Pre-Programmed robots which may be included in biotechnologies, mechanical arms on an automation assembly line, etc. Humanoid Robots that mimic human behavior, Human-Robot Interaction (HRI) is an extensive and diverse research topic for the last few years. HRI may get into every field of agriculture including sustainability and subsequent decades would be passionate one towards agriculture and promisingly more will be the voluntariness for agriculture sector where we will be benefited through the collaboration of humans and robots interaction in some way. Autonomous robots are already in the field and followed by many, these robots are usually designed to carry out the task in an open environment. These autonomous robots move fast which can be dangerous for humans, therefore human supervision is necessary from every point of view. Over the whole extent, robots and machine learning are helping



methods that take farming inside and to new heights to conserve resources, minimize chemicals and shorten time to market. For achieving sustainability, we can get fresh options and ideas from traditional growers, vertical farmers, and greenhouses, the world's population should be able to eat better, cleaner, and worth affordably. Status in India; there is a lot of hurdles taken in the agricultural sector in all countries especially in India, According to some daily report farming is decreasing in our country. The agricultural sector act as a backbone of the country but nowadays farmers are reducing more in number by mentioning repeated common reasons that it is no longer profitable and it's becoming risky day by day. India is still a developing country, still trying to support the entire population. Figures below showing the market of agricultural robots in succeeded country.

It is written in the hope that this will boost up the discussions of robotics in the varied fields of agriculture or sustainable agriculture and hopefully would be followed by different organizations to execute into the field. This is a challenging task but everyone benefits from it, it will provide new insights and ultimately lead to better and more sustainable agriculture. The future is high tech, our country has the knowledge of indigenous methods of farming

and would be greatly benefited including that side into robotics and will surely be empowered to produce more with less resource for more sustainable future for all of us!. This agricultural sector and industries will learn 'to do more with less' by adopting efficient production methods. Robotics for good quality food, less wastage, limited resource use, avoiding soil nutrient depletion could furrow the way to a brighter future. Artificial intelligence and robotics are for the new challenges.

Finally, Agribots or robotics in agriculture has both boon and curse but comparing its positives to negative it poses major advantages, farmers may be poor would not be able to buy these costly systems rather government could provide financial support, aid organizations, private enterprises and could grab attention from academic institutions and may come up with some good plans for its country and to save its resources. Education may be a barrier for farmers before but current generations are learning although separate sessions can be conducted to make farmers aware of robot control. The goal should be an improvement of both crop performance and environmental quality. Our ancestors saved more than a handful of things for us, now it's our responsibility to protect for future generations.