Role of Robotic in Different Platform of Agriculture: Challenges and Future of Robotic

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Abstract— Nowadays, agriculture had become most important economic activities in the world and food industries. However, despite the increasing population, insufficient labour limiting factor for agricultural production. To solve the challenges or problem automation of agriculture is one of the best solutions. Here may be differ in infrastructure, production methods, so on. This reviews paper provides a study of different production platform/system of agriculture. Agricultural robots work in wide variety of environment/platform such as open field, greenhouse. Until now we can study the agriculture robots design to operate in only one types of environments, with no and limited capability. In this paper we discuss about the application of agriculture, state of art in agriculture platform, current system challenges and their performance in the different platform, future of robots agriculture in agriculture.

Keywords: Robotic, Urbanization, Automation, Harvesting

I. Introduction

Agriculture is one of the important parts in food industries. Agriculture has been the primary job of human beings. The main role of agriculture to provide the food supply in cities, town as well as raw material to the food industries Despite the growing population, expecting to reach almost ten billion people by 2050, there is a growing labour shortage in agriculture, due to an aging farmer population and urbanization. Over the last decade, urbanization in India has increased by almost 4 percent as more and more people leave the agriculture sector to find work in service(see fig no.1" https://www.ststista.com/statistics/271312/urbaniztion-in-india/"). That's why the manpower that are required to agriculture are reduce day by day. Those Remaining people has work in the agriculture facing the heath issue because of too much work.

To overcomes the problem of low manpower, reduce health issue of farmers etc. the concepts of robotic has arisen. Agriculture robot is also called as agribiont. Robots have many benefits for the agricultural industry and food industries, including a higher quality of fresh produce, lower production costs, and a decreased need for manual labour. Agricultural robots automate slow, repetitive, and dull tasks for farmers, allowing them to focus more on improving overall production yields. Some of the most common robots in agriculture are used for: Harvesting and picking. Weed control. Autonomous mowing, pruning, seeding, spraying, and thinning [1]. There are three different field on agriculture greenhouse, open field.

In last few years, lots of robots interesting and impressive harvesting agricultural robot designs.

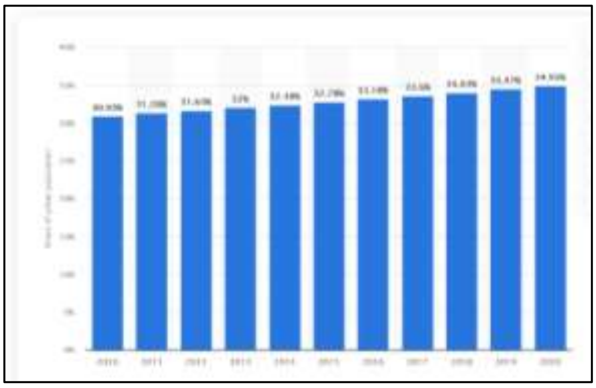

Fig. 1: (Indian degree of urbanization 2010 to 2020)(

This paper is organised as followed: - In the section II we discuss the application automation and robotic. Section III we are discuss about various field of agriculture. Section IV In that we see the current challenge. Section V we will see the future approaches of the field.

II. Application automation and robotic.

In agriculture, the automation of specific operations has enabled the farmer to manage the crop manufacturing efficiently with less electricity and cost. Factors such as lack of agricultural people in addition to the ageing farmer's populace and growing agricultural wage has made the farmers and researchers to play an pastime in the improvement of automation machine in agriculture. The implementation and improvement of agricultural automation has been carried out by independent robots and agricultural machineries such as tractor which normally connected with cultivator, planter, cultipacker and chisel plow. Figure 3 indicates countless agricultural robots and machineries which requires automation to beautify the effectivity of the agricultural operation[17].

Fig. 2: (different types of automation robots)[17]

Based on fig 2, the application of automation and robotics in agriculture can be varied significantly. The execution of agricultural operation needs to be carried out with the aid of exclusive robotics and vehicle structure based on the kind of land and operation requirement. [17].Different robotic and vehicle shape had its own hassle that need to be solved via using different machineries. The robotic structure has difficulty to execute intense operations in agriculture due to its sensitive characteristic in the direction of water and mud.

The automation and robotics in agriculture, the categorization was made based totally on exclusive agricultural operation.

A. Harvesting and Picking

Crop harvesting is one of those repetitive tasks that farmers must accomplish at the quit of the season. Often, thousands of pickers do the job for hours on give up until the whole lot ripe is off the plant.

However, care ought to be taken when harvesting so there are not too many robots harvesting each kind of plant. Farming and technological industries have been in a position to increase a few robots that can collect and choose produce. Produce ranging from berries to lettuce can be harvested by way of robots. Robotic machines can even harvest shrubs for humans to buy at nurseries. Each robotic must be specific and in a position to collect the objects without adverse them. These harvesters nevertheless have a long way to go, but once they're in a position to pick vegetables, fruits, and other flowers precisely, there will be less that goes to waste.In addition to an correct goal detection, the success charge of harvesting manner using agricultural robots in dense vegetation additionally depends on strong motion manipulate and end-effector placement at the goal fruit or vegetable Therefore, countless researches have been conducted in the previous years in robotic arm action planning for agricultural harvesting operation. In a movement scheduling machine has been efficaciously implemented to coordinate four robotic palms for independent kiwifruit choosing device with 51% success rate.[17]

B. Crop seeding

Many meals vegetation begin existence as seeds in a field. The typical approach for sewing seeds is to scatter them the usage of a "broadcast spreader" attached to a tractor. This throws many seeds round the field whilst the tractor drives at a regular pace. It is not a very environment friendly method of planting as it can waste seeds.

The autonomous precision seeding is a technological know-how that is used for the spreading of seeds. It uses geo-mapping science to locate the unique factors the place the soil exceptional is terrific and will assist in distributing seeds there only. This way, it turns into incredibly handy for the farmers to whole seeding in the places where there are higher prospects. The placement of these seeds is going to count number a lot as it will have a massive have an effect on on agriculture performance[18].

C. Nursey planting

Nurseries are the place seeds are grown into younger plants, which are later planted outside. Nursery plant life are frequently sold direct to buyers and panorama gardeners, however they are additionally the start of the food journey for some crops. There is a rising need for nursery automation. Companies like HETO Agrotechnics and Harvest Automation (who we added in a previous post) supply automation options for seeding, potting and warehousing dwelling plant life in greenhouses. [19]

III. Platform in Agriculture

A. Greenhouse

A greenhouse gives a included and managed environment for top of the line crop production. The enclosed structure allows to manipulate environmental factors, such as temperature, humidity, carbon dioxide, and to a positive prolong additionally the light level, to set superior prerequisites for year-round production[2]. there is a outstanding variation in the layouts of greenhouses, and specific greenhouses might also require unique robotic configurations. van Henten [10] and van Henten et al. [11] describe different activities in the course of the greenhouse manufacturing cycle, such as greenhouse preparation, planting, crop maintenance ,harvesting, which can probably be robotized. regarding selective harvesting of high-valued crops, a thorough overview of 60 robots developed in the past five a long time used to be made in...robotic configuration that may be useful in a greenhouse, is the slender three-wheeled Thorvald shown in Fig. (2). This robotic is made from one battery , one energy module, one steerage module and a set of passive wheels[3].

In the EU-FP7-project CROPS giant search for has been carried out on agricultural robotic. One of the purposes was once a sweet pepper harvesting robot. SWEEPER will use the technological expertise developed in CROPS to introduce, take a look at and validate a robotic harvesting reply for candy pepper under real-world conditions. The gadget composed of one 6 DOF industrial manipulator with a particularly designed give up effector, RGB-D camera with GPU computer, programmable good judgment controllers, and a small container to shop harvested fruit.

Fig. 3: three-wheeled Thorvald shown

Over a length of 4 weeks, the machine was once evaluated on 262 fruits [12] showing a harvest success rate of 61% in most fulfilling crop stipulations and 18% in contemporary industrial conditions, illustrating the need for cultivation systems that are particularly designed for robotic harvesting. The select success price ranged from 20% for the most complex situations with one ripe strawberry in a cluster of unripe fruits to a hundred percent for situations with one remoted ripe strawberry. In two-arm mode, cycle time of the system had 4.6s. For tomato harvesting, Ling et al. [13] developed a twin arm robot the usage of a binocular imaginative and prescient sensor for fruit detection and localization. In a greatly simplified experimental setup, the success rate of this robot used to be 87.5% with a harvesting cycle time excluding platform navigation of 29 s[2]

B. *Open field*

The greatest accomplishment of medieval agriculture was the open-field system of village farming developed with the aid of European peasants. That machine divided the land to be cultivated with the aid of the peasants of a given village into a number of giant fields which have been reduce into long, narrow strips. The fields were open and strips had been not enclosed. Peasants farmed each giant area as a community. Many open-field crops, such as wheat, maize, and potato, are being mass-harvested at a single second of time and with the destruction of the plant. For these crops, efficient mechanical harvesters exist. Robotic harvesting of open field vegetation poses greater challenges than the harvesting in protected crop manufacturing (greenhouse, indoor cultivation), in most cases due to environmental editions (light, wind, rain) and much less consistent plant improvement[2,14].

Different from greenhouse and orchard harvesting where harvesting robots normally take a look at the crop from the side, openfield. Harvesters generally take a top view. To mitigate environmental variations, most structures use a cover to guard direct sunlight and to defend towards rain.

Three lookup initiatives aimed to enhance a selective harvesting robotic for brassica vegetation (specifically broccoli and cauliflower). Kusumam et al. [14] developed a 3D-vision algorithm using laptop studying to discover broccoli heads in

RGB-D images. Blok et al. [15] studied the detection of broccoli heads the use of deep studying with a precise focal point on the generalization of the technique to the selective harvesting of new cultivars. Klein et al. [16] introduced a feasibility study for the improvement of a selective harvesting robot for cauliflower. Their prototype robot consisted of an aluminum body with LED lights, three RGB-D cameras for crop detection and maturity evaluation, and two dexterous robotic arms to reduces and pick the cauliflower.

Foglia, Reina [2] developed a prototype robot for the se lective harvest of radicchio. The robotic consisted of a manipulator and gripper with an embedded RGB digital camera

The photograph evaluation was once based on coloration filtering and morpho logical operators. The gripper had two bucket-like slicing fin gers that had been precipitated through the resistance of the soil to reduce the radicchio 10 mm underground. In laboratory conditions, the detection error was once less than 6.3% with an average harvest time of 6.5s.

IV. CHALLENGE OF ROBOTIC IN AGRICULTURE

The nature of their contribution will differ across agricultural types, i.e., crops, cattle and aquaculture, and from phenotyping through to important production activities. Across this spectrum there are many ways that robots ought to contribute, both economically (e.g., developing and harvesting extra correctly and cheaply), ecologically (e.g., decreasing and disposing of the use of chemicals, while supporting to preserve soil health) and ethically (e.g., increasing animal welfare via monitoring and well-timed intervention

The major obstacle is the improvement of systems adapted to the agricultural conditions, due to the fact there are many elements of computerized and robotics (used in enterprise and clever cities) that are very good, but when they are phase of the agricultural world with the first-rate susceptibility of the agricultural products in spoiling of the most diverse forms, issues occur. Addressing the social, legal and moral implications of self-sustaining robots is arguably a greater undertaking than the development of the science itself [6].

High charges to undertake robotic technologies presents a large barrier to entry for farmers, specifically in growing countries. For example, robotic planters should raise water or pesticides with giant weight; the hardware should be built differently, which effects in higher expenses to make it a large size. Technical issues and breakdown of tools additionally current high costs to restore for such specialized equipment. In order to utterly make use of farm automation, farmers will need to mix their understanding and experience with these new technologies.

V. FUTURE OF ROBOTIC IN AGRICULTURE

Today, it's the 2nd largest market for professional robotics and estimated to be really worth $2.75 billion. According to many researchers, the agricultural robot's market must have an annual increase price of over 20% until 2022[8]. It is the future, and the robotics in the future can be "glimpsed" like a wave to surf, a wave that we do not be aware of for sure the place it goes, we only have a "hunch", at first it will take us to the beach, however we are now not certain, the only sure bet we have is that this wave is irresistible and inexorable, and we will be taken and the future will come, these who surf will be able to suppose about the subsequent step, the next wave[7] A huge vary of applied sciences will allow the transition of agricultural robotics into the field. Some technologies will want to be developed mainly for agriculture, while different technologies already developed for other areas ought to be adapted to the agricultural domain, for example, autonomous vehicles, synthetic Genius and machine vision. Here we quickly evaluation the modern-day [9] status, opportunities and benefits of more than a few enabling applied sciences from hardware to software, multi-robot structures and human-robot systems. Due to the introduction of cellular agricultural robots, there would be a massive replacement of the heavy, large tractors will slow, light and small robots which do not require manpower. There would be no compaction of soil, the plants will get extra interest and it is these are also less in phrases of cost. If the machines are large, then the compaction of soil takes vicinity and the flora do now not like This particular problem will be eradicated through the usage of the GPS machines which are controlled. but with the introduction of cellular agribionts, there is a nevertheless higher solution. In future lots of new agriculture robotic concepts will introduced in the field of AI, deep learning, machine learning.

The goal of robotics in agriculture is to ease the laborious and repetitive work for farmers and others who work in agriculture. In the future, farmers and technicians are hoping to advance the competencies of robots further.

Robots are assisting to make precision farming a reality. These robotic purposes will help reduce food and water waste and restrict the number of pesticides or herbicides used on farms as well. As technology advances, so does the agricultural quarter to feed the world.

VI. CONCLUSION

Robotics and automation in agriculture plays a main position in retaining the food protection in the future. Minor improvements have been made to the mechanical format based on experience from operation in the area and from various rebuilds. The intention is to minimize the construct time and build cost to a minimum, as this will allow low fee swarms of high quality robots. Several challenges are nevertheless handy to be resolved through agricultural researchers and a number of intensive researches are performed to investigate the purpose and options to the challenges. By combining all the technologies developed for every operation, a systematic self-sustaining agricultural robotic device may additionally be designed in the future for developing a strong and efficient agricultural robotic machine to be implemented widely to the farmers at some stage in the world with the fundamental objective to produce excessive quantity of agricultural output in retaining meals safety in the future.

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