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Robotization in Agriculture

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The latest trend in automation is to increase the application of industrial robots. These units are used to load and unload parts in connection with a variety of machines. What sets the latest industrial robots apart from their predecessors is that they can be programmed to perform many different operations. They function with speed and efficiency of an automation until built for a specific task, yet when job has been done, they can be moved to another location and reprogrammed to perform another task.

Automation is moving forward confidently, involving various areas, and farming is no exception. Thanks to agriculture, we receive nourishment and liveliness for our survival. Moreover, since the world population is expected to reach 9 billion by 2050, agricultural production must be doubled to satisfy needs. Productivity should be increased by 25% to achieve this goal. Thanks to the introduction of robotics, you can easily achieve the expected result.

An agricultural robot was made for farming purposes. Basically, robots are used for complex of work at the final stage of agriculture. It includes harvesting a mature crop from the fields, delivering it to the place of post-harvest processing, post-harvest processing itself, and delivering the crop to storage. The main tasks of this technique are controlling of weed, seed planting, harvesting, environmental observation, study and analysis of soil conditions.

New technologies such as tractors without drivers, sprayers, robots that pick fruits or vegetables and shear ships will replace farmers and workers. Before starting work, some factors have to be considered, for example the size and color of the fetus. In addition, the use of this technique is well applicable in other garden work, namely, automatic watering, weeding, cutting plants. The introduction of such robots in agriculture provides many advantages including the high quality of fresh products, because the amount of pesticides is minimized. The production costs become lower. In such process, human labor is practically not used. When designing and creating robots, it is necessary to take into account some factors, namely, affordability, maximum efficiency, the area in which the robot will be used, and the plant cultures that it will collect.

There is another unique and also multi-functional type of robots – drones. Thanks to the built-in cameras, GPS drones receive high-resolution crop images, providing workers a bird's-eye view, which allows them to see where crops are healthy and where they need care. Drones have chips that warn them about bad weather. If the weather is bad they will fly to special stations to recharge and send data for analysis. Drones take pictures from a height, create 3D maps, plant seeds, apply fertilizers and chemicals, control crops, and help control animals in agriculture. It is possible that in the near future they will vaccinate.

The use of drones reduces the time resource for much work and increases the efficiency of certain processes. The devices are equipped with special features that pinpoint the infected areas of crops, pinpoint fertilizers and water the plants. For three hours, a drone can sow 10 km^2 of land. It will take a person a day to do that kind of job.

Robots for mechanical and auto weeding and spraying use databases of weed description. These robots can easily

recognize and destroy weeds, distribute chemicals to fight with them. It helps ordinary plants to stay alive.

Auto steering and autonomous navigation is performed by GPS technology used by farmers. This type of robots is equipped with special accuracy sensors to overcome hilly terrain, pits and obstacles on the road easily.

Harvesting robots pick different crops with robot arms. In 2016, nearly 7 million tons of apples were harvested on American plantations. All work was done manually. The hourly wage is growing, but there is still an acute shortage of workers. This type of robot is fitted with a high-pixel camera to spot the object. After accurate analysis, the robot uses a gripping tool that can grab the product in the right place and tear it off with the right strength and hardness. Researchers study the movement of a person's hand and, using a different set of algorithms, try to repeat it to improve machine performance.

The machine moves with the help of a rail located between the rows. Thanks to integrated cameras and the ability to recognize images, the technique detect the target and distinguish the degree of ripeness of the fetus.

Regarding the speed of work, it is worth noting that so far people are managing faster than a robot, on average it takes 3-4 seconds to pluck a fetus and put it in a basket. However, the machine has an advantage - the ability to work 10 hours without rest, sleep, lunch break. An electronic assistant can pick up tomatoes even at night. This is due to the fact that the robot illuminates itself with a light bulb. Man only sort out the collected fruits.

Greenhouses are fitted with robots that have optical cameras, sensors. These machines are programmed for the following actions: first, you need to determine the type of fetus, then the degree of maturity. After that, the machine draws up a plan for harvesting this fruit. It sounds quite impressive, but the

robot is capable of more, for example, to monitor the phytosanitary state of plants. Usually, farms regularly inspect plants with specially trained people, but it is impossible to inspect each plant daily, more often than once a week. The robot can inspect plants more often, and their creators are currently developing a system for monitoring plants in the greenery.

There are also many useful technologies in livestock: animal feeding machine, milkmaid bots, robots stall-cleaners etc.

Robotics reduces the number of pesticides and harmful chemicals; it is not only a financial bonus but also helps to reduce agricultural impact on environment. These technologies make farming more ecologically friendly. Finally, agriculture is one of the major industries in which data analysis techniques are widely used for improving production and efficiency. Farming operations can be improved dramatically by systematic data collection. In general, the use of robotics increases productivity, solves lack workers problem, allows controlling the quality of plans, saves soil condition, reduces energy consumption, and automates livestock care.

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