Such precision could allow the targeting of fertilisers and other inputs, and prevent run-off of excess chemicals into the local environment.

Farmers and agriculture service providers can expect even further improvements as GPS continues to modernize. It will enhance both the quality and efficiency of agricultural operations in the future.

1. Farmers use combine harvesters with satnav [Electronic resource]. – Mode of access: https://www.telegraph.co.uk/.../Farmers-use-combine-har... – Date of access: 21.03.2018

2. Twenty-first-century combines [Electronic resource]. – Mode of access: www.farmindustrynews.com/combines/twenty-first-centu....- Date of access: 21.03.2018

3. GPS for yield mapping on combines [Electronic resource]. – Mode of access: https://www.sciencedirect.com/science/.../pdf... – Date of access: 21.03.2018.

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NEW HORIZONS IN FARMING: SELF-DRIVING TRACTORS

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Engineers and researchers works to increase the level of autonomous machinery in agriculture and the best solution is to design and build robots capable to work continuously without human guidance. Robots deployed for agricultural purposes can deliver high accuracy and low costs while the farmers can have in real-time a situation of tasks already completed.

Robots could be designed to include many agricultural techniques using a limited set of tools and replacing the human laborers.

A fully autonomous agricultural robot should have the ability to understand the environment, work for an unlimited time without any operator intervention, capable for environment adaptation when changes occur, and to ensure the security for humans.

The number of commercial agricultural robots is still limited for a moment, but there is the assumption that in the near future their number will increase significantly.

Even is a tractor modified to work autonomous or a robotic platform powered by sunlight, in this article we make an overview of autonomous agricultural robots capable to recognize plants, works with high accuracy on large areas, and could be used for many agricultural operations.

Today engineers design a range of self-driving machinery.

Self-driving tractor Hortibot is used to remove weeds manually, spraying or cutting with flames or laser. Row by row the tractor navigates the entire field using vision system and positioning system. Starting from a corner of the field the robot cover each row and at the end of the rows turn back and enter to the next row. Using an ECO-DAN camera, GPS system, and a gyro sensor Hortibot can reduce the herbicide usage by 75 percent since it can recognize up to 25 different kinds of weeds and can use up to three methods to remove the weeds from the land.

The cell sprayer system is perhaps the most interesting method for removing the weeds. The system uses a camera for taking continuous picture of the ground and based on images analysis the system locate the crops and weeds. Once the weeds are located the system sprayed on a limited surface.

This method is very expensive in terms of time, this could be a big disadvantage, but is very friendly with the soil while this is not affected.

Self-driving tractor Hortibot can be operated remotely by an operator, and in case that is for the first time when the operator meet the robot, a short training is sufficient to operate the robot.

Targeting as a terminator for weeds, Lettuce Bot is an advanced agricultural robot used to exterminate the weeds without affecting the lettuce. Lettuce Bot has a complex vision algorithm that works in three steps to detect and then slice and inject a minimal quantity of herbicide in the soil that not affect the lettuce.

Three steps for detecting the weeds. Vision system has implemented three algorithms that work in three phases. First time is identified if the camera recognizes a plant, the second step is to determine if the plant is a lettuce or weed, and the third step is to determine the moment of execution. This vision system could be updated to work for other plants by adding a database to compare the images captured with the plant. Engi-

neers try to increase the production of the robot by increasing the speed up to 3 miles per hour while the accuracy remains at the same level.

Vitirover is a self-driving tractor designed to cut the grass and weeds between grape vines. Build by a French company the little robot uses a solar panel to produce energy to power the electric motor and electronic parts. Using a battery to store energy is not the best solution since the robot has to navigate on large areas.

As long as the sun is up the robot can work without pause and cut the grass and weeds at a speed of 500 meters in an hour.

For farmers are very important to use technology friendly with the grapevines. Vitirover uses sensors and GPS system that keeps the robot away from grape vines.

Take a series tractor, good one like John Deere brand and transforming into a robot is perhaps the simplest project to build an autonomous robot for several agricultural operations. With capacity for day and night working, the robot tractor uses the complex vision system, GPS system, a ground speed radar and one unit for inertial measurement that keeps the robot on the right paths in the field or an orchard.

Two color cameras are the eyes of the robot programmed to detect any obstacle. Designed to be used by a human driver, the tractor was changed with control systems for steering, braking and acceleration. All control systems working based on position system information and follow the path with speed range between 5 and up to 8 km/h.

Another French company and another vineyard self-driving tractor capable to pruning 600 vines in one day. Based on four wheels, Wall-Ye navigate on wine rows using six cameras and GPS system to know at every second the position in space.

Two arms are designed to prune vines and removing the unproductive young shoots. The same robot, but another sensor measures the soil conditions and the state of the grape vines.

In memory the robot stores the maps of the vineyard while the GPS system sets the position of the robot.

The six cameras used for vision and a complex algorithm are used to detect the grape vines and to prune the vines.

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According to above mentioned a self-driving tractor is a form of autonomous technology. It is considered self-driving because it operates without the presence of a human inside the tractor itself. Like other unmanned ground vehicles, they are programmed to independently observe their position, decide speed and avoid obstacles such as people, animals or objects in the field, while performing their task. They operate simply with the aid of a supervisor monitoring the progress at a control station or with a manned tractor in lead.

1. Robot Tractors to Work The Land [Electronic resource]. – Mode of access: https://www. intorobotics.com/autonomous-robots-for-large-scale-agriculture/. – Date of access: 21.04.2018.

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О МЕНТАЛИТЕТЕ НАРОДОВ ЮЖНОЙ АФРИКИ

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