INTELIGENT SYSTEMS USED IN MODERN AGRICULTURE

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ABSTRACT

Digital agriculture is the perfect integration of digital technologies in crop and animal management and other agricultural processes. For farmers, digital farming offers the opportunity to increase production, save long-term costs and eliminate risk. Agricultural researchers see it as a data collection tool that has the ability to simplify data collection and analysis, improving predictive skills when it comes to crop management, animal behavior and production. A digital agricultural system is a database that includes not only different types of data relevant to agriculture, from soil conditions to market assessment, but also optimal decision-making functions that help to take the best measures in a series of processes. The paper presents a brief summary of new technologies in agriculture.

INTRODUCTION

Digitalization represents the socio-technical process of applying digital innovations, a trend that has become more and more present in recent years. Digitization includes phenomena and technologies such as large databases, the Internet of Things (IoT), augmented reality, robotics, sensors, 3D printing, system integration, artificial intelligence, machine learning, among others.[5]

A digital agricultural system is a database that includes not only various types of information relevant to agriculture, ranging from soil conditions, weather conditions to market assessment, but also optimal functions that help make the best decisions in a series of production and marketing processes. Such a system is an important

tool for managing agricultural risks, which can help assess the risks of climate change, develop an income protection plan for producers and generate a soil management plan. [9]

Plant production varies from year to year, being significantly influenced by fluctuations in climatic conditions and especially by the occurrence of extreme weather events. Climate variability affects all sectors of the economy, but agriculture remains the most vulnerable, and the impact on it is more pronounced today, as climate change and variability are becoming more pronounced.[4]

Digitalization is expected to radically transform everyday life, and production processes in agriculture, food supply systems and bioenergy see the first changes in this regard.[8]

Precision farming means mainly consist of a combination of new technologies with sensors, satellite navigation, positioning technology and the use of databases to influence farm decision-making. The aim is to save costs, reduce the impact on the environment and produce more food.

MATERIAL AND METHOD

There are several types of remote sensing systems used in agriculture but the most common is a passive system that senses the electromagnetic energy reflected from plants. The sun is the most common source of energy for passive systems. Passive system sensors can be mounted on satellites, manned or unmanned aircraft, or directly on farm equipment. [1].

Agricultural machines with RTK (real-time kinematic) systems (Fig.2) are equipped with GPS (global positioning system) and sensors. The farmer constantly receives new information in real time via the on-board computer. Based on these data, farmers can identify, plan and implement measures adapted to individual conditions. Such measures include planting depths, optimal sowing and partial surface treatment.

As the tractor travels in the field, the information in the digital fertilizer register is transmitted to a computer-assisted fertilizer distributor. [10]

The wavelengths used in most agricultural remote sensing applications cover only a small region of the electromagnetic spectrum. Wavelengths are measured in micrometers (μm) or nanometers (nm). An μm is about .00003937 inches and 1 μm equals 1,000 nm. The visible region of the electromagnetic spectrum is from about 400 nm to about 700 nm. [6]

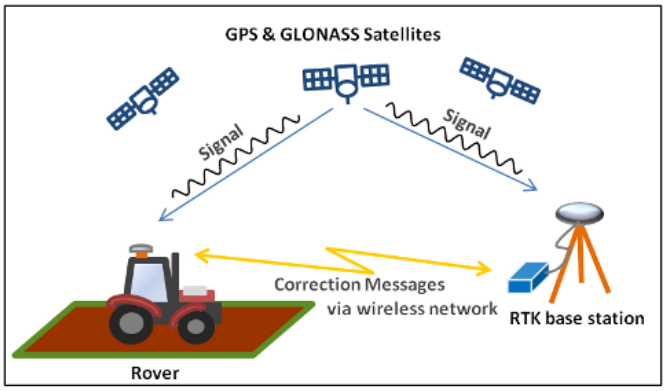

Fig.2 – RTK system

RESULTS AND DISCUSSIONS

A system equipped with GPS (global positioning system) RTK (real-time kinematic) technology has been used for the precise application of herbicides along crop rows, without reducing the effectiveness of in-line chemical control treatment, while providing savings of approximately 50% of the herbicide. The savings of applied chemicals have not only reduced production costs, but also reduced the environmental impact caused by the chemical. Moreover, the use of this system has led to a reduction in the manpower required to control weeds on average to 15.3 hours per hectare for conventional treatment and from 13.2 hours. [7]

To effectively control weeds, intelligent systems perform: control guidance devices (mechanical or thermal),detection and

identification of weeds, their removal and possible mapping them. Their identification is based on colors, dimensions and space.[3]

Fig. 5 – Tractor equipped with weed control system

The rotation of the disc is controlled as it crosses the field to align / synchronize the section of crop plants (detected by optical recognition) represented by the green bottles, thus avoiding crop damage, while the weeds are cut.

Fig. 4– Weed control system

By scanning a crop using visible light and near-infrared light, drone-attached cameras can identify plants that reflect different amounts of green light and NIR (near-infrared) light. This information can produce multispectral images that track plant changes and indicate their health.[2]

CONCLUSIONS

Thanks to the new technologies on the market lately, agricultural engineers can play an important part in feeding people more efficiently and with less damage to the environment.

Improving accuracy and efficiency in agricultural operations has already helped increase crop yields and reduce labor inputs. Technopolises and incubation centers of universities will be able to transform the accumulated scientific knowledge into enterprises and create a digital agriculture-focused ecosystem.

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