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Developing a Comprehensive Solution for Collecting and Managing Data from Machines by Different Manufacturers

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Abstract. This research considers a telematics system which includes devices for tracking vehicles. The main purpose of the paper is to overview and select software. Existing software products for telemetry and monitoring are analyzed. Sustainable development is considered as a model of resource utilization, a model of human-nature interaction, a model of civilization development based on innovations and intellectual systems. Effective means of data collection, generalization and systematization in the field of agricultural mechanization, software complexes for data collection and management of machines by different manufacturers are analyzed, as well as an extensive group of software products for the sustainable development of agricultural infrastructure. Particular attention is paid to the need to determine the most appropriate ways to comprehensively solve the problem of collecting and managing data from machines by different manufacturers. The following methods are used for this: Method 1 - Send to Wialon. Some tracking systems have a relay function - sending online data about the desired vehicles to another tracking system using an agreed protocol. In other words, it is the ability to copy location information on both systems; Method 2 - WiaTag. For farmers who are not equipped with MTP Global Positioning System equipment, a solution is offered using the WiaTag mobile application. The Wiatag app is a free global positioning system tracker on a smartphone that does not require any costs to be installed on a car. It is considered appropriate to systematize the problems of sustainable development of the studied market in the form of a block diagram that differentiates and shows important characteristics of the role and position of subjects in achieving the main goal – the reconstruction of the agricultural machinery market and allowing for the means of innovative and technical restructuring of domestic agricultural production. At a certain stage of market development, it is necessary to proceed from the fact that each problem can be transferred from one block to another. The proposed solution to the problem of the lack of high-quality equipment, attractiveness in the domestic market, shown in the first block of the diagram, partially includes a solution to the problem of insufficient preferences for the domestic market on the part of the state. Machine-building enterprises and, as a result, solving the problem of the low level of technological equipment of domestic manufacturers.

INTRODUCTION

Sustainable, inexhaustible development is a model of the use of resources, a model of interaction between man and nature, a model of civilization development based on innovations achieved while meeting the vital needs of the modern generation. Protection of the environment, strengthening of personal and public health and the deprivation of such opportunities. From these general rules derive a number of guiding principles aimed at the modernization of state institutions, which must be recognized and implemented at all levels of the world community. The direction of

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modernization is not limited only to the economic system, but also to the development of science, culture and education, innovations and technologies, Information Technology, defense, security, etc., as well as in the social sphere, including regulation and control [1].

Today's achievements in the field of digital technologies are the driving force of the fourth industrial revolution (4IR). These include artificial intelligence (AI), the Internet of Things (IoT), machine learning, robotics, additive manufacturing (3D printing), the use of distributed ledger technologies (block chain) and quantum computers [2-19]. The introduction of nanotechnologies with the use of cognitive [20-35], social [36-45] and humanitarian sciences (convergent technologies) [46-61] makes a significant contribution to the achievement of progress.

These advanced technologies are innovative, fast-growing, deeply interconnected and interdependent. The unification of previously fragmented and separated scientific disciplines strengthens and develops science, technology, innovation, entrepreneurship and structural transformations [62-75]. Growing access to new technologies can bring numerous economic, ecological and social benefits, as well as ensure the implementation of the Sustainable Development Agenda for the period until 2030, the SDGs and the tasks set for it. New opportunities for data collection, management and analysis can make the decision-making process more flexible, effective and have a factual basis, which contributes to a more accurate measurement of progress in the context of the implementation of the SDGs [76-85]. New technologies are already helping to restructure business models and industrial processes. Companies can monitor the production process remotely and collect data in real time, as well as analyze and predict quality control problems and predict service needs. At the pace at which industry and business are adapting to the digital age, the advancement of IR is becoming increasingly necessary. The rapid spread of new technologies and their convergence require new standards for measurement values, data reliability, complex algorithms, statistical procedures, communication systems, and security. For example, digital technologies influence the sphere of activity and the role of metrological institutions, the energy sphere [86-110]. The green principles of sustainable infrastructure development in the field of agricultural mechanization are based on the concept of complex solutions for digitization and automation of processes, as well as data management of machines of different manufacturers. The implementation of green principles is carried out within the framework of the functioning of environmental protection and quality management systems, as well as the application of a complex solution for the collection and management of agricultural machine data [111-118]. The Sustainable Development Plan consists of the following points:

- Effective fiscal reform, consistently achieving CIS goals [119-135].
- Continue the dialogue between the state, civil society, business community, international organizations and other interested parties to ensure their high-quality participation in order to maximize the results of the CIS [136-142].
- To support effective regional cooperation with the countries of Central Asia and other international partners [143-148].
- Development of a strategy for sustainable development until 2030.

In order to develop an intelligent analytical software platform for environmental safety assessment, forecasting and management of agroecosystems, transport systems, an analytical review of software complexes used in the Republic of Kazakhstan, the Russian Federation and abroad in this area was conducted, among which the most common are: "Ecology. 1C-KSU, ANT Agricultural Management System (Russia), CLAAS TELEMATICS (Germany), Agrotronik Rostselmash (Russia), AfiFarm by S.A.E. AFIKIM (Israel) and others. The following aspects are considered: purpose; type of software implementation (PC, WEB version, version for mobile devices); Availability, functionality of geographic information system. The analysis showed that there is an extensive group of software products for agriculture. Among the leaders with the highest functionality are CLAAS TELEMATICS, SmartAgro, AfiFarm, Agrotronik Rostselmash. Industry solutions are mainly used - for plant breeding, animal breeding. There are no special software tools for ecological safety assessment for agriculture.

The advantage of geographic information system technologies and special computer programs is the ability to process large volumes of information, the clarity of data presentation, and the ability to automate the process of creating maps. The collection and use of information requires the accumulated scientific knowledge base, which is the basis of the decision-making system, and the electronic database on the state and functioning of agroecosystems is a tool for designing ecologically clean agricultural production.

Digitization and automation of decision-making support processes in these subject areas is also one of the vectors for the development of agricultural production and environmental safety. The process includes as elements: monitoring of objects of agricultural production and analyzed agricultural land, development of recommendations for forecasting development and prevention of possible losses. Reasoned decision-making requires the use of various information and data, including monitoring systems, geo-information systems, statistical information resources, as well as mathematical models that provide forecasting of the development of conditions and solving problems by choosing the best of them, respectively, with a given set of criteria, solutions for minimization of potential costs.

The telematics system includes vehicle monitoring devices. They are usually installed directly on machines and allow you to send, receive and store telemetry data. They connect to the SIM card via on-board diagnostics (ODBII) or colic's CAN-BUS ports, and the built-in modem provides wireless connectivity.

The devices collect Global Positioning System data, as well as other lake-related data, and send it to GPRS (General Packet Radio Service), 4G, and mobile servers [1]. The server interprets the data and allows it to be displayed to users (logistics or managers) through a secure web application for smartphones and tablets. The purpose of the work: to find methods and technical solutions for collecting, accumulating and systematizing MTP data from different manufacturers.

Tasks:

- Consider existing telemetry and monitoring software products;
- Analyze effective tools for collecting, accumulating and systematizing data from the field of agricultural mechanization;
- To identify the approaches most suitable for the purpose of the work, which can comprehensively solve the problem of collecting and managing data from machines from different manufacturers [149].

MONITORING OF EQUIPMENT

Monitoring of equipment is tracking the movement of vehicles in real time and its effective work in the fields: speed and trajectory of movement; calculation of runs, working time, actually processed area; control of the fuel condition (level, consumption); consumption of fuel and lubricants planned and in fact; full working time.

The AGROTRONIC system allows you to control fuel spills, unauthorized unloading of harvesting machines, all types of downtime, improve the efficiency of agricultural machinery by analyzing working hours, optimize parameters through remote control of machines, and maximize productivity [150]. Improve machine operation, maintenance time, process analysis, planning and logistics, reduce fleet ownership costs and improve agricultural performance through performance comparison and parameter optimization [151].

The components of the system are a communication module (GPRS modem) installed on the on-board computer, an external GLONASS/GPRS antenna, an SD memory card and a SIM card. You can access the system from a tablet or mobile phone, as well as from a laptop or desktop computer.

Data Connect is a TELEMATIC feature available for every Data Connect device connected to the network, regardless of year of manufacture. There is no need to make changes to the device. The TELEMATICS system requires at least one CLAAS device with an active TELEMATICS license to display data from third-party devices [152]. No additional licenses are required. To exchange data from a CLAAS device to a third-party system via Data Connect, this device requires a valid TELEMATICS license. As with ISOBUS, customers can communicate through the interface and manage and monitor their entire fleet on the system of their choice.

Data Connect is an open source solution for all other interested vendors.

The following data is tracked: current location and road lines, speed, machine operating status, fuel levels and CLAAS, John Deere and CNH Industrial combines, forage harvesters and tractors. The AGCO Connect service allows you to coordinate, optimize and seamlessly connect your existing fleet of vehicles for more efficient maintenance management and remote monitoring of field equipment [153,154]. Data such as location, vehicle status, operating hours [155], and performance information are collected on the vehicle and sent wirelessly to a secure server.

DISCUSSION

In addition, when they occur, you can quickly identify problems with the device and start fixing them. AGCO Connect [156] smart farming solutions are available for the following major brands Challenger, Fendt, GSI, Massey Ferguson and Valtra.

On-board controller "AutoGRAPH-GSM" is a compact electronic recorder that records all movements of the vehicle [160,161]. The route in the device memory is a set of points, each of which is determined by satellites of the Global Positioning System or GLONASS navigation system, for which time and geographical coordinates are stored. Simultaneously with the recording of coordinates, a number of other parameters are recorded: speed, direction of movement, state of discrete and analog inputs of the controller. The collected data is transmitted via the GSM network of the mobile operator to a special data center server using GPRS packet data transfer technology, from where they can be received via the Internet for further analysis and processing using the AutoGRAPH program [157,158].

Vehicle control system sensors. The rotation sensor of the mechanism is used to determine the direction of rotation (movement) of the mechanism and its correspondence to the operation of the driven mechanism with the drive motor.

Parallel driving systems for agricultural machines - these systems are especially effective in combination with wide cutting units. With the help of satellite navigation systems, you can navigate both vertically and along a curve, which easily reduces the space between intersections and adjacent areas.

CAN-LOG 2 is a universal controller for monitoring the technical characteristics of a vehicle. Engine speed sensor. The engine clock sensor (optorelay) is a device that allows you to record the time the car engine is running. Allows you to control the operation of vehicles [159].

The air temperature sensor is an electronic device for measuring the ambient temperature, converting the measured value into a digital signal and sending it to a device connected via a 1-wire bus, etc.

SCOUT is a developer of satellite tracking systems for vehicles and a manufacturer of Global Positioning System /GLONASS equipment. Incomplete and inefficient cultivation of arable land and many other problems are solved using the equipment of the SCAUT precision farming system. Through the SCOUT monitoring system, the user can monitor the compliance of operators with the speed limit and field processing technologies. The system also provides information about where vehicles and equipment are performing effectively. Agricultural monitoring data helps to reallocate resources and improve work efficiency [160]. The principle of operation of agricultural machinery:

- Satellite control modules are installed in agricultural machinery
- Information from modules and sensors is sent to the server and processed in the SCOUT-Platform program.

The program has a system of detailed calculations [161,162]. This allows you to analyze the information received and make timely competent management decisions.

It is necessary to determine the most appropriate ways to comprehensively solve the problem of collecting and managing data from machines from different manufacturers; The following methods are used for this:

Method 1 – Send to Wialon. Some tracking systems have a relay function - sending online data about the desired vehicles to another tracking system using an agreed protocol. In other words, it is the ability to copy location information on both systems.

Method 2 – WiaTag. For farmers not equipped with MTP Global Positioning System equipment, we offer a solution using the WiaTag mobile application. The Wiatag app is a free Global Positioning System tracker on your smartphone that does not require any costs to install on your car [163-168].

CONCLUSION

We consider it expedient to systematize the problems of sustainable development of the researched market in the form of a block diagram, which differentiates and shows the important characteristics of the role and position of subjects in achieving the main goal – the reconstruction of the agricultural machinery market. Means of innovative and technical restructuring of domestic agricultural production. At a certain stage of market development, it is necessary to assume that every problem can be transferred from one block to another. For example, the solution to the problem of the lack of high-class equipment, attractiveness in the domestic market, shown in the first block of the scheme, partially includes the solution to the problem of insufficient preferences for the domestic market from the state. Machine-building enterprises (block 3) and, as a result, the solution to the problem of the low level of technological equipment of domestic manufacturers (block 2).

Thus, the main functions of the application include: determining the location and transferring the position to Wialon. This is enough to keep track of the progress of the transportation.

Thus, as the analysis showed, the problem of development of the domestic market of agricultural machinery (at all levels) is quite extensive. Therefore, the solution of these tasks should be based on the systematic study of market processes aimed at optimizing the organizational structure, institutions, quantitative and qualitative parameters of the market in accordance with the strategic task.

The analysis of existing intellectual, analytical software platforms for agricultural production showed the existence of a large group of software products for agriculture. Among the leaders with the greatest functionality, CLAAS, AGCO Connect, CAN-LOG2, Agrotronik ROSTSELMASH, etc. can be distinguished.

The system also provides information on the operation of vehicles and the quality of equipment. Data on agricultural monitoring contribute to the redistribution of resources and increase in labor productivity [170,171].

Thus, new standards are needed: the use of new devices, such as intelligent sensors. New connected networks of big data, cloud storage, distributed measurement systems. New software platforms for agricultural production, with the greatest functionality. New roles in the process of applying innovative technologies taking into account the requirements of legislation and market control support.

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