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OPERATIONAL CONTROL AND MANAGEMENT OF SUBMERSIBLE PUMPS FOR OBSERVATION AND PRODUCTION WELLS

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Abstract

This work is devoted to innovative solutions for the application of software and hardware tools and ICT in the automation of internal irrigation networks, with the aim of creating remote monitoring and control for observation and working wells with submersible pumps via the farmer's personal Android device.

Keywords: vertical drainage well, automated process control systems, human-machine interaction, flexibility

Introduction

The rapid complication and expansion of production, the development of economic and mathematical management methods, and the introduction of digital technologies with high speed, flexible logic, and significant memory capacity into all areas of human production activity have served as the basis for the development of automated control systems that have qualitatively changed the formula for management and significantly increased its efficiency. The advantages of modern technologies are most evident in the collection, processing, and transmission of large amounts of information for the implementation of complex management laws. An automated control system is, as a rule, a “human-machine” system designed to provide automated collection and processing of information necessary for optimizing the management process. Unlike automatic systems, where humans are completely excluded from the control loop, an automated system involves active human participation in the control loop, which provides the necessary flexibility and adaptability.

Currently, hydromeliorative systems, and water management in general, are actively subject to the use of automated process control systems at their facilities. In this light, the work being done also pursues the above-mentioned goal. This approach makes it possible to create conditions for the organization of a complex of automated technological processes, which includes a person—a farmer—as an operator. In other words, the farmer operates at the third operator level of the automated process control system.

Main part

In the context of improving land reclamation conditions and limited water resources in the country, individual farmers are faced with the task of ensuring the effective functioning of vertical drainage wells and observation wells based on digital automation tools, with the targeted use of ICT and software and hardware control and management tools. The introduction of automated process control systems (APCS) for hydromeliorative systems, as is well known, provides for the operation of basic automation tools at individual wells, including observation wells. That is, each local well must be automated according to the established principle of "local automation with remote control and management." At the same time, control stations are used at individual wells to solve tasks in accordance with the established technical requirements for automated process control systems.

Here, it is necessary to focus on observation wells, which are considered an integral part of the overall drainage system and are included in the overall automation system when implementing the automated control system. Observation wells are constructed to monitor and study the dynamics of groundwater changes (at various levels) in controlled reclaimed areas. Changes in the water level in observation wells are used to assess the dynamics of the groundwater level. It is from these wells that information is obtained on the effectiveness of the automated vertical drainage system, and its operating modes and schedules are refined. For this purpose, level sensors are installed in the observation wells and, along with control, the transmission and reproduction of sensor readings to the control room is organised.

The entire range of tasks mentioned above, especially local and remote control in primitive conditions, requires a solution, and the wide range of possibilities offered

by modern software, hardware and communication technologies allows all these tasks to be solved at the level of innovation, for example, improving the quality of work by transferring dispatcher functions to the mobile phone of the official hydrometrician. At numerous farm facilities, the problem of remote operational control and management of submersible pumps, the condition and measurement of observation wells has not been solved, which has an extremely negative impact on the operation of the facility.

Some of the above materials were implemented in a practical trial solution at the VOS to implement a daily water use schedule using a single well. These solutions involved the algorithmisation of the management process based on a daily water use schedule, management software, the use of software and hardware, as well as information and communication technology methods and tools that allow farmers to both manage water supply and keep records of it using, for example, their personal smartphones.

The report outlines the technological conditions for operating the well and the water consumption schedule. A control algorithm and programme are developed, which are installed on the ATmega 8 controller integrated circuit. The programme is implemented on a submersible pump belonging to a specific farmer. Monitoring and control are carried out in an automated complex for management and control in a farm: 'ASUTP-mini', based on signals from the farmer's personal smartphone, or on site. An experimental laboratory stand has been created and preliminary tests have been carried out. The experimental stand includes a programmer, a computer with C++ programming materials, a programmable ATMEGA controller, simulating output hardware for pump control, and a model of an executive mechanism with a control system via ANDROID.

Conclusion

In conclusion, it is worth noting the economic and social effects, namely water savings in the internal farm network. For the farm part of the irrigation system, there is an opportunity for reporting with appropriate registration, water is saved within the farm, and 'documented' relations between the water consumer and the water supplier are created and can be implemented.

References

1. Vtyurin V.A. Automated control systems for technological processes SGLA. St. Petersburg 2006.
2. Usmanov A.M., Yadgarova D.B. Improvement of means and methods of automation and water accounting for internal irrigation networks. Research report/TIIM. 2016.