ISSN: 3068-014X

Research Article

Archivos de Ciencia e Investigación

Solution of A Complex of Problems of Operational Planning and Management in The Conditions of A Mining Landmark in Azerbaijan

RAE Z.H. Aliyev* and G. I. Mammadova

Institute of Soil Science and Agro-chemistry of the National Academy of Sciences of Azerbaijan

***Corresponding Author**
RAE Z H Aliev, Institute of Erosion and Irrigation NAS of Azerbaijan, Azerbaijan.

Submitted: 2026, Jan 12; **Accepted**: 2026, Feb 19; **Published:** 2026, Mar 03

Citation: Aliev, R. Z. H., Mammadova, G. I. (2026). Solution of A Complex of Problems of Operational Planning and Management in The Conditions of A Mining Landmark in Azerbaijan. *Arch Cienc Investig, 2*(1), 01-07.

Abstract

The main direction of the economic and social development of the Republic of Azerbaijan is the intensification of agricultural production. Irrigation is a powerful means of intensifying agricultural production in the context of its specialization. In areas with insufficient moisture (especially typical for mountainous areas), irrigation is one of the decisive factors in growing high and stable crop yields. This requires the development of new technical solutions and the introduction of automated systems for low-intensity irrigation of agricultural crops that meet the requirements of ecology and environmental protection of their habitat, which makes it possible to improve the ecological state of irrigated lands and reduce water consumption. per unit of production and increasing the yield of individual crops in irrigated fields.

Keywords: Water Resources, Automated Control, Agricultural Production, Irrigated Land, Irrigation Optimization

1. Introduction

Irrigated soils in Azerbaijan cover 1.45 thousand hectares of area. It is believed that the factors that directly affect the increase in crop yields and the increase in productivity in this area of each hectare of arable land and agricultural land with minimal labor and resources also include the use of automation. Automated irrigation increases the efficiency of all intensification factors: clericalization, complex mechanization, varietal renewal, intensive technology, etc. It allows creating large zones of guaranteed production of agricultural crops. For all this, methods of correct regulation of water consumption and plant nutrition by means of irrigation, depending on weather conditions, are being studied.

To this end, we have developed and implemented in the production of the design of automated control systems for low-intensity irrigation systems based on an auto-oscillating micro-sprinkler, which has successfully passed the resource test, tested on cultivated soils under an orchard, in the Guba-Khachmas zone at the Shahdag foothills located above the sea level at an altitude of 600 meters with a slope of 0.02. (see the schematic diagram of the self-oscillating impulse sprinkler systems with automated control figure 1)

1.1 Designs and Functional Description of SMO AU

And so, for the operational control of weather conditions in the region, necessary for solving the problems of planning and operational management of irrigation of agricultural fields, measurement sensors with transducers are installed at the local hydrometeorological station for telemetric counting of measurements of the main parameters: (see. 2).

a) wind speed - V analog signal (TIT) with a period of recording parameter values in a cycle of 30 minutes.

b) air temperature - tv, analog signal (TIT) with a period of recording parameter values in a cycle of 30 minutes.

c) air humidity - Ww, analog signal (TIT) with a period of recording parameter values in a cycle of 30 minutes.

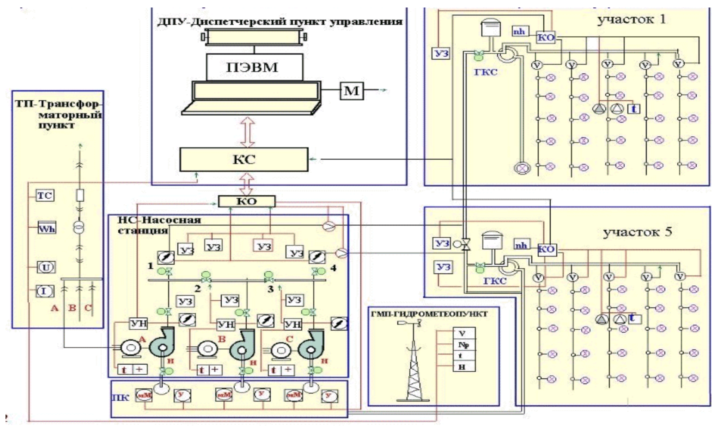

Figure 1: Schematic diagram of an impulse sprinkler system self-oscillating action with automated control

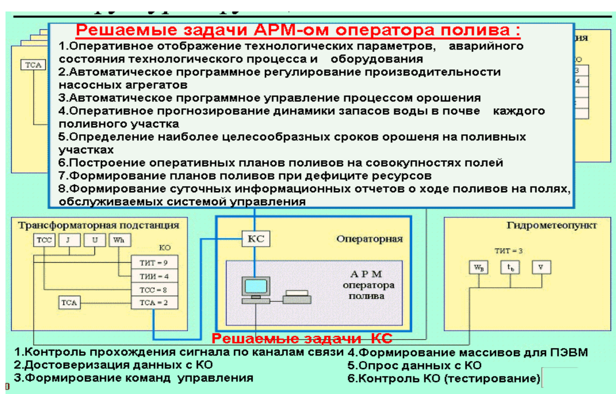

Figure 2: Structural and functional diagram of the automated process control system for irrigation

The counting of the parameter values in the telemetric code is carried out by an intelligent object controller (CO) installed in the transformer station through a radio channel that communicates with the transducers. In the CO, the counted telemetry codes undergo primary processing, averaging and are recorded in the operative memory, where they are stored until they are counted out by the communication controller (CS) installed in the operational control room of the technological process (ASMO) - the operator room.

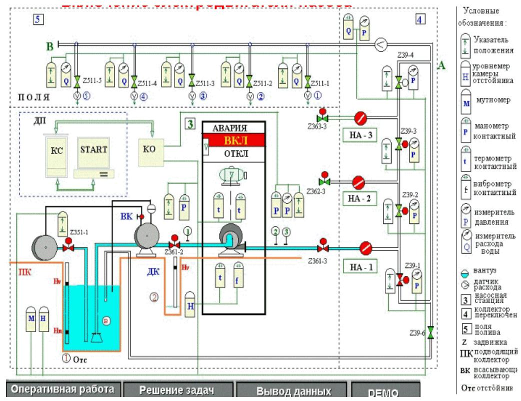

Figure 3: Switching on the pump motor

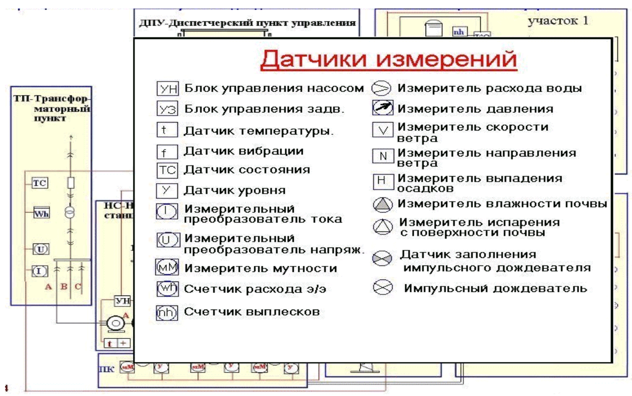

Figure 4: Schematic diagram of a pulse sprinkler automated control systems

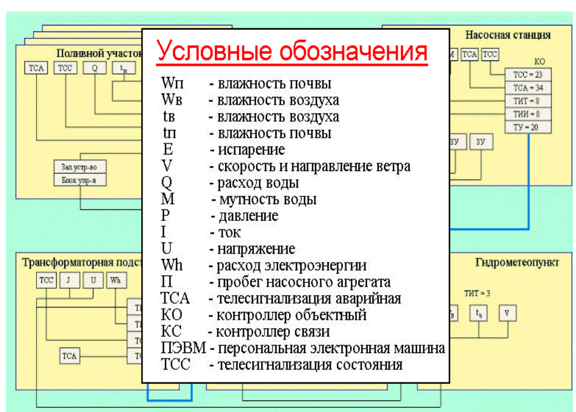

Figure 5: Structural and functional diagram of the APCS for irrigation

To control and manage the power supply of the ASMO facilities and metering the power consumption at the transformer station (TP) (see the structural diagram of the irrigation automated process control system), transducers are installed:

a) measuring the voltage at the input to the TS - U (analog signal (TIT);

b) measuring the load of consumers - IU (analog signal (TIT);

c) metering of electricity consumption - Wh (discrete integrated signal - TII;

d) control of the position of the switches (turning on - turning off electrical consumers) - SS

(discrete signal TCC position).

The report of the parameter values in the telemetric code is carried out by the intelligent object controller (CO) via local wired communication channels and, after their primary processing and averaging, are recorded in the RAM for monitoring and controlling the technological process of water intake, sedimentation tanks (treatment facilities) and a pumping station (devices for water pressure rise in pipelines), transducers are installed (see the structural and functional diagram):

a) turbidity of water in sedimentation tanks - M (analog signal TIT, read in a cycle of 30 min);

b) the water level in the settling chambers - H (analog signal TIT, read in a cycle of 30 min);

c) water pressure - P installed on the discharge of pumps, collection and distribution manifolds (analog signal TIT, read in a cycle of 30 min);

d) measuring the load of electric motors - I (analog signal TIT, read in a cycle of 30 min);

e) valve positions - ПЗ (discrete signal TCC, read in 1 s cycle);

f) the positions of the power switches – VP- (discrete signal TCC, read in a cycle of 1 s);

g) alarm – AC (discrete signal TCA, read in 1 s cycle, priority);

h) measuring the flow rate of water supplied by the pumps and in the distribution pipeline - Q (integrated signal of TII processed in a cycle of 1 hour). (Figure 4.)

Monitoring of the soil condition and control of the technological process of irrigation is carried out for individual irrigation fields based on measurements of agrophysical and technological parameters by transducers:

a) soil moisture VLP- (analog signal TIT with recording in a cycle of 30 min);

b) evaporation of water from the soil surface - ISP -- (analog signal TIT with recording in a cycle of 30 min);

c) soil temperature - to- (analog signal TIT with recording in a cycle of 30 min);

d) water consumption for irrigation through the distribution pipeline of the site - Q - (integrated signal with a record in a cycle of 30 min);

e) switching on the GCS - discrete signal readable in a cycle of 30 s;

f) positions of switching valves - (discrete signal of the TCC position - reading cycle 30 s).

The signal report in the telemetric code is carried out by the intelligent object controller of the field via radio communication channels and, after their primary processing and averaging by the processor, are recorded in the RAM

1.2 Entering operational data into a computer and forming a database (OBD)

The data recorded in the operative memory of the object controllers (CO) are counted out programmatically via radio and wire communication channels by the communication controller (CC) connected to the computer of the dispatching point (DP) (see Schematic diagram of the low-intensity irrigation system with automated control, Figure 1), according to given regulations and are recorded in its operative memory in the structure of a telemetry file (see. Information support). The computer, according to the exchange programs, reads out the data from the operating memory of the CS, recodes them and writes them into the operational database, from which it displays them in real time for display on mnemonic diagrams, and after linearization and averaging, the data on their codes are programmatically recorded into the storage databases, the structures of which are given in information support, and this forms the Data Bank of the complex of ASMO tasks. [1,3].

1.3 Information flowsFlows of the Automated Low-Intensity Irrigation System (ASMO)

Before recording to the Data Bank, the measurement data flow is analyzed according to the specified algorithms and, if the analysis results have deviations from the settings specified in the settings, it is written to the operational control base (OCU) of the technological process (see Figure 6.). The operational control base is programmed according to the cycle specified in the regulations by the control module for technological directions and, if there are deviations in the data records, generates a control signal in this direction to the required executive body.

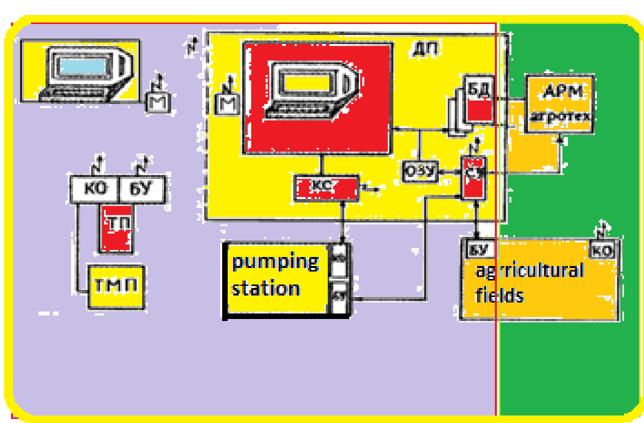

Figure 6: Block diagram of information flows

Legend: BU - control unit, DP - control room, DB - Data Bank, OBU - operational control base, SU - control station, UP - remote user.

2. Organization of Data Collection and Transmission Via Internet Channels

2.1 Conditions for Organizing Data Exchange

1. The exchange of data on the operation of the irrigation system is carried out through the World Wide Web.

To do this, you need to connect the modem through a computer to the telephone network and obtain the right to access the Internet from the provider.

This condition applies to each subscriber.If these conditions are met, the computer of the "Center" can be connected to computers in the irrigation areas of the regions of Azerbaijan and other states.

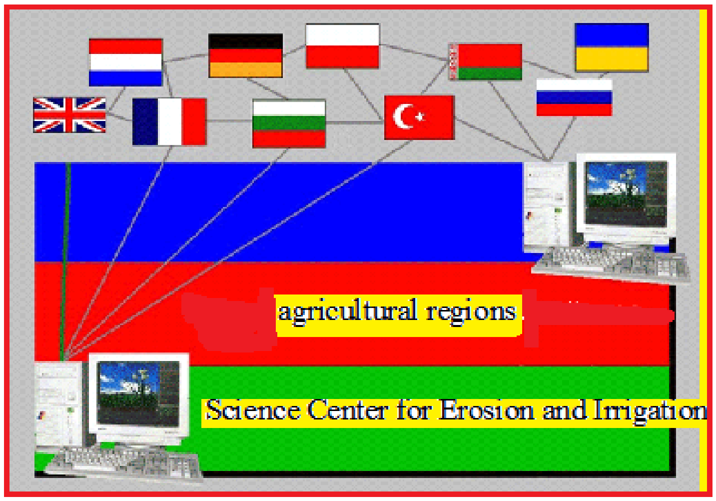

Figure 7: Conditions for organizing data exchange via the Internet

2. The site of the irrigation system is being organized, the visitors of which will see: the latest data on the state of the system, interactive pages created using the PHP technology, promptly exchange data and messages in real time.

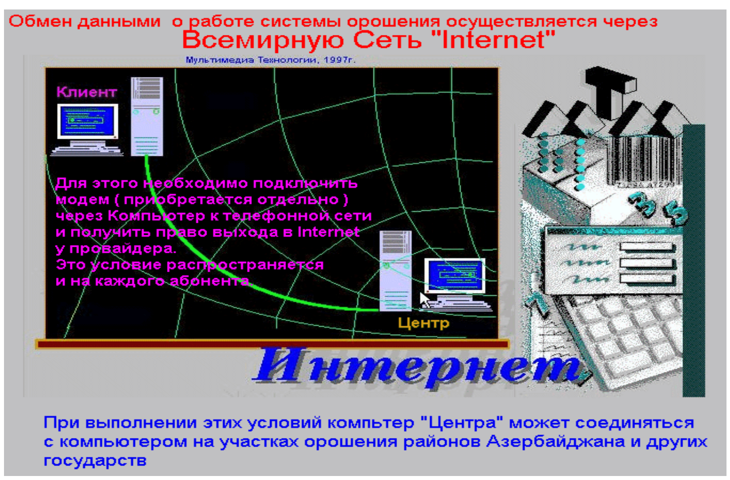

Figure 8: Conditions for organizing data exchange in the Information Processing Center.

3. With the help of Skype 3, users can talk on the phone and, when using television cameras, see each other, and with streaming video programs, view the state of the site.

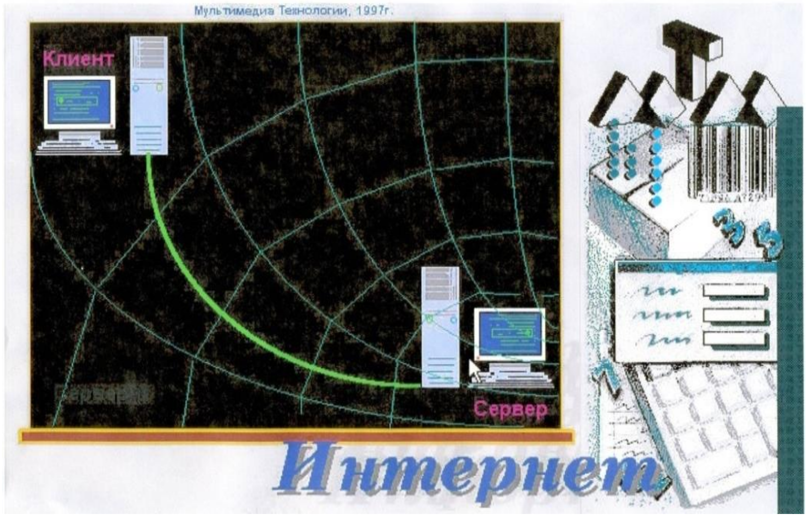

Figure 9: Organization of Data Exchange

4. Using the LAN Talk program (figure), system users can exchange messages over the Internet.[1,4,5]. It should be noted that peer-to-peer programs can be used to exchange large amounts of data, such as report files. For example, the Shareaza program (figure) allows users to connect with each other without going to special sites.

Figure 10: Exchange of messages by users using Lan Talk programs

References

1. Land Code of the Republic of Azerbaijan. Baku 1999.
2. Aliyev Z. H., Aliyyev B.H. “. Optimization of swarm systems “ / The patent № P 20020232, Baky 2002 i silt.
3. Aliyev B.H., Aliyev I.N. Aliyev Z. H., / “ To the car pulsed rain machine “ / № P Patent 20020179, Baky, 2002, or
4. Aliyev Z.H., Aliyev B.H.” Pulsed water discharger Patent No. P 20020196,Baky 2002, Ill.
5. Aliyev Z. H., Aliyev B. H., Nuriev Ch.Sh. / “ Slow rainfall systems “ Patent No. R.990100 Baka 1999-s il.
6. Aliyev B.H., Aliyev Z.N. Problems of water supply of mountain slopes of Azerbaijan and ways to solve it. Baku, Publishing house “Tereggi” 2012. 450 p.
7. Aliev Z.H. et al. Scientific substantiation of rational irrigation technology for the regions of mountain agriculture in the Republic of Azerbaijan // Ecology anagricultural plants” Azerbaijan Agrarian Scientific Journal, 2006 No. 3-4. p. 208-209.
8. Qashqai P.M. Water balance of the Greater Caucasus (within the Azerbaijan SSR), Baku 1973
9. Gul K. K., Lappalainen T. N., Poluzhkin V. A. Caspian Sea: // VINITI abstract collection. - M., 1970.- 236 p.
10. Dolgopolov KV, Fedorova EF Water is a national property. –M .: Knowledge, 1973. 53 p.
11. Losev KS, Gorshkov VG, Kondrat’ev K. Ya. Et al. Biological productivity of the Caspian Sea. - Moscow: Nauka, 1974 . 245 p.

12. Lebedev G.V. Irrigation, microclimate, water regime and plant productivity. M. Nauka, 1986, p. 178