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Issue Article

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PREVENTING ACCIDENTS AND ACHIEVING ECONOMIC EFFICIENCY THROUGH A MULTI-FUNCTIONAL DEVICE IN SUBSTATIONS WITH A VOLTAGE OF 110/35/6 KV

Abstract: *Currently, the energy system of Uzbekistan has a number of urgent problems related to the adequacy of distribution networks, electricity accounting systems, power transmission lines and reliability of transformers. One of the main issues is the introduction of automated information systems to monitor the state of the network in real-time, prevent accidents and effectively solve these problems. This article covers the analysis of technological processes of high-voltage substations, accident prevention, and economic efficiency with the help of multi-functional radio measuring devices.*

Key words: *electricity, distribution networks, measurement systems, signaling systems, automated information systems, technology, reliability.*
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Introduction

Main part.

In 2019-2021, a comprehensive program for digitalize zation of the electric power industry will be developed. Acceleration of the implementation of the project on the introduction of the automation system of resource management, production and con,trol processes (IT), dispatch control and data acquisition software-hardware complex (SCADA), the introduction of the automated system of control and accounting of electric energy specific activities, deadlines and sources of funding are provided [1]. In the new economic conditions, each kilowatt-hour of electricity should cost exactly as much, taking into account its cost and optimal profitability, and should be purchased by consumers or market participants in the amount that corresponds to their needs and economic capabilities [2]. The implementation of this rule requires the installation of a suitable device for each consumer, as well as in the system of electric

power plants (EES) that collects, processes and transmits this data to the ACSD database. Therefore, the essence of the new metering device for accounting for supplied and consumed electricity should be based on the principles of automated energy accounting and, in particular, on the concept of automated management and accounting systems of energy resources (ASKUE) [3].

Theoretical part.

At the current stage of electric power development, improving the energy efficiency of electric power generation, transmission and distribution is the most important task for the electric power system (EET) of every country [8]. This task is particularly important. It is relevant for Uzbekistan, which has energy-intensive production equipment commissioned in the 1960s and 1970s. Energy efficiency in the use of electricity is a quantitative assessment of the technological process that shows the level of technologies used for the conversion, production, transmission and distribution of electricity. The indicator of energy efficiency in the production and distribution of electricity is the total consumption of fuel in the EET, under the regulated conditions of its operation, the absolute or relative normalized value of the total losses of electricity and normative environmental parameters of electricity [4].

The development of the energy sector is related to the continuous growth of electricity production. Why do people consider electricity to be the primary form of energy? For easier use in production, distribution and production [5].

The purpose of the automated system. The distribution of electricity produced by consumers through high-voltage transmission lines is a classic example of complex technological processes that require centralized management and control methods. The concept of "reliability" is widely used every day in all areas of human activity (science, technology, everyday life, art, medicine, etc.), which gives rise to the breadth of its interpretation. However, a practical solution to some problems and sometimes clarifying their nature is completely impossible without clearly establishing certain concepts and relations between them, without showing some features and their quantitative description [9]. Therefore, it is appropriate to start the study of reliability by studying what is understood and what characteristics of reliability are used in solving the problems that arise in the process of creating and using artificial technical systems in general and electric power systems in particular [6] .

The issue of accounting for electricity is the most relevant in the current market relations. The main difficulty is that it is almost impossible to reliably estimate the loss of electricity in distribution networks with existing technical and organizational problems in the electricity accounting system. There are a number of current problems related to sufficiently high efficiency of electricity distribution networks [16-18]. These include:

- low reliability of electrical devices, associated with excessive wear and poor performance of electrical structures, automation systems, protection, alarm systems;
- lack of timely, reliable operational information about power system operating modes;
- low efficiency of quick management of electrical networks during planned switching and elimination of accidents;
- electrical energy losses at an unacceptable level;
- lack of electricity due to equipment failure and emergencies.

All the above problems are relevant and are widely discussed in our country and abroad. The task of ensuring the reliability of electrical equipment can be solved by replacing old equipment with new ones, but this method is associated with the need to spend a lot of money [14-15]. At the same time, the introduction of an automated information system to monitor power grid modes in real time can become an effective solution to these problems.

The purpose of the automated system. The process of distribution of electricity generated between consumers in connection with electric substations with high-voltage transmission lines is a classic example of complex technological processes that require methods, centralized management and control [19-21].

Characteristics.

- Works on GSM 900/1800 network.
- The server is connected to the GPRS channel using TCP/IP technology.
- It is connected to the server with ADSL and Internet technologies.
- Back up Server availability.
- Works with a maximum of 15 different calculators on one tire.
- The server has a database and records every 20 seconds of data coming from the smart device.

The system is designed and assembled on the basis of telemechanics equipment. After pre-design research, a technical specification was developed according to the geographical conditions and requirements of the communication channel [10]. During the preparation of specifications, the typical structure of the system underwent a number of changes during the design phase. Changes were mainly required in the organization of the communication channel. Communication with CP is carried out by air, there are no wired channels [11]. A number of difficulties arose here due to the distance of the Klyuchevaya checkpoint from the dispatch center (DP). The solution was found by changing the structure of the system and creating an additional intermediate channel, as well as reducing the distance

in the radio channel [12-13]. Taking into account the requirements of the automated system, a set of technical tools was selected for the main DP, intermediate DP, control points and automated workstations (AIS) equipment of users [7].

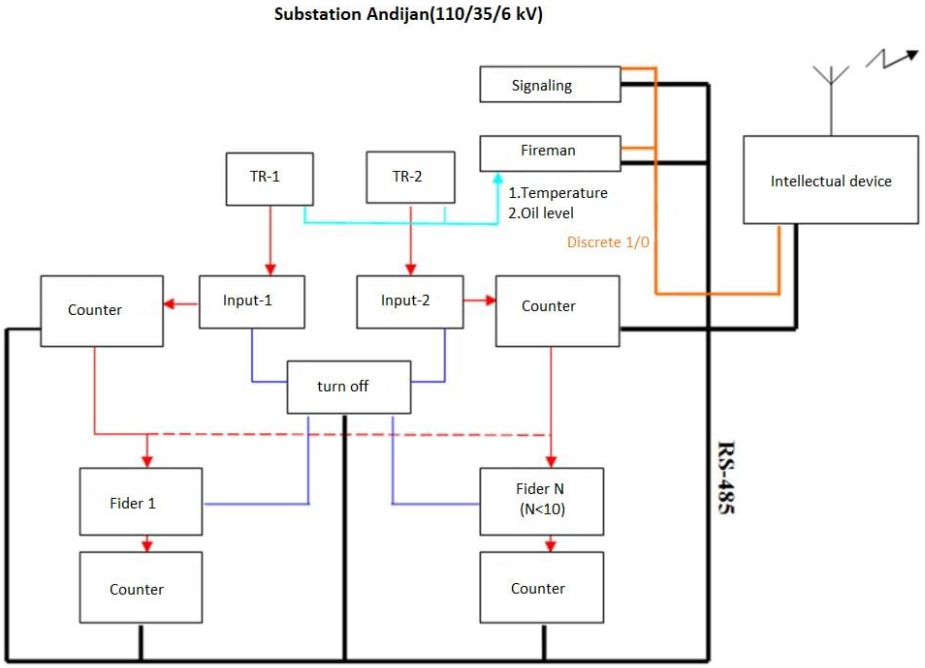

Figure 1. Scheme of the structure of the substation.

Counters included in the program.

- HOLLEY DTS541 / DTS 541U / 531/581;
- HOLLEY DTSD546 / 536/535;
- Energomera (All)
- Mercury 230/234 AR-00-R/C
- Stone electric device TE-73 S-1-3
- DDS 28 and TE-102
- It is possible to add other types of counters.

Information from the meter.

- Current (phases A, V, S).
- Voltage (phases A, V, S).
- Active power, kW (phases A, V, S).
- Reactive power, kvar (phases A, V, S).
- Total power, kVA (phases A, V, S).
- Frequency.
- Input/output active energy, kW/h (+W/-W).
- Input/output reactive energy, kVar/h (+Q/-Q).
- Angles between phases.
- Angles between current and voltage.

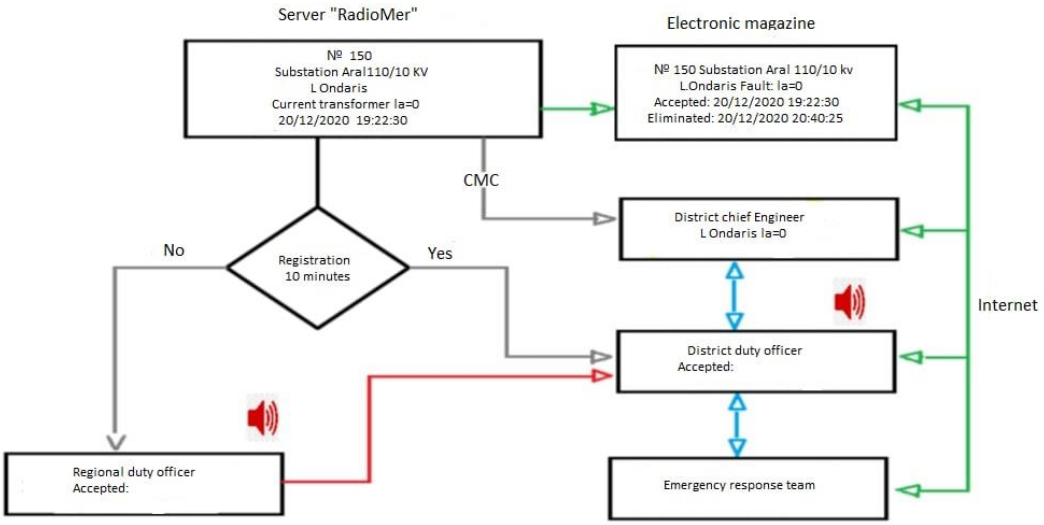

Figure 2. Error recording and elimination algorithm.

Filtering numbers and giving permission to other systems (access) the.

• Intelligent device has the ability to filter phone numbers, which allows the system to work continuously, and it is possible to receive information only through the phone number entered in the memory.

• Program programs of Holley , Energomera, Mercury, Alpha and other meters have the ability to receive information from the meters through an intelligent device [14-15].

Warning, security and fire safety. Through the "Radiomer" intellectual device , you can receive information from the transformer temperature, gas protection, object protection, fire safety (sensor) devices from the station and send this information to the stored phone numbers in the form of a message (SMS) . It is possible to move. If the load of the transformer increases in 2 stages, the SMS j is installed and the unrated feeders installed and inserted after the are turned off.

Step 1: To the duty, district or city chief engineer.

2nd stage: To the provincial emergency chief of staff.

All information is recorded in the telematics database.

Feeder shutdown system. Using a special computer in the dispatcher's home, the dispatcher can turn off the feeder at the required substation with the password given to him.

• Deletions are automatically noted in the server log that they were deleted by the dispatcher.

• Additional discrete input/output unction.

• The smart device has additional discrete input and output ports that can be used for additional data acquisition or processing in the future.

Primary server and secondary server.

• smart device starts up, it will connect to the main server. If the primary server goes down, it will automatically connect to the secondary server. To improve and stabilize the connection, the main server and secondary servers must be connected to different Internet providers.

• The IP addresses of the servers should be static. 213.230.91.140 (RadioMer.uz)

• Web Server and its feaures .

• The fastest and easiest way to get information these days is certainly web sites on the Internet. Another good advantage of web servers is the possibility to get information in the way the user wants, via phone , tablet and similar devices .

The automated system of monitoring power grid modes is designed to perform the following tasks and functions:

• Structure scheme of the substation.
• Structure diagram of the system.
• Characterization of intellectual impact.
• Counters.
• Information from counters.
• A memory.
• Filter numbers and allow other systems (access).
• System password.
• Types of website access permissions.
• Warning, protection, and fire safety.
• Extinguishing system.

- Additional discrete inputs/outputs
- Technical parameters of the substation.
- Error reporting.
- Primary server and secondary server.
- Web Server and its utilities.
- Pod st ancy Balance.
- Real-time telemetric balance
- Consumers' "personal cabinet"
- Methodology of concentration of electric energy flow.
- RaioMer_UDS client program and its features.
- Electronic mnemonic.
- Substation grouping (on 110kV line).
- Limit statistics of feeders in the substation..
- RadioMer devices.
- Malfunctions.

Economic analysis.

- providing centralized management and control of complex regimes of electric networks, which are distributed in large numbers, but connected by a single technological process;

- Effective control of power grid modes from the power supply, where the necessary information must come from the control point of the power grid;

- processing information about the current status of managed objects and providing them in a user-friendly form;

- collection of control and command data at the pace of the current controlled technological process, which means a minimum delay in the transmission of information and control actions;

Ensuring a high level of reliability of information delivery and its reliability, because the damage caused by the transmission of incorrect orders or other urgent messages and the transmission of these messages can lead to large economic losses and in some cases emergency situations. The automated system must meet the following operational requirements:

- the reliability of information transmission and its reliability must be ensured for the radio channel in conditions characterized by a high level of interference;

- to provide reliable information from the points of the power grid to the control center and provide this information to the dispatcher in a way that can quickly and accurately respond to deviations from the power supply regime;

- Save the full amount of data collected in the CP and automatically save the event log;

- the human-machine interface of software (software) must be responsive;

- equipped with automatic fault alarm and self-management functions of the device that maintain the operation of individual boards and blocks;

- the automated system should also allow relatively simple reconstruction when expanding (increasing) the volume of information and ensure compatibility with existing communication channel systems and equipment;

- the automated system must work in different environmental conditions: high humidity, and wide temperature range.

Features of the smart device

Works on GSM 900/1800 network;

C DMA channel using T C P / IP Internet technology ;

connects to the server using ADSL or Internet;

- RS485 interface;

- One bus has a maximum of 15 different counters;

use of counters ;

HOLLEY DTS 541 / DTS 541 U / 531/581;

HOLLEY DTSD546 / 536/535;

All energy counters ;

Mercury AR-00-R / S ;

All counters of Toshelektroapparat;

ALFA counters coming soon;

- reading, saving, and transferring the following meter parameters;

Indicators of active and reactive meters of forward and reverse electricity directions;

Phase power, current, and voltage;

Power factor cos φ?

(Depending on the type of counter, you can enable other parameters)

Conclusion: All the above problems are relevant and are widely discussed in our country and abroad. The reliability of electrical equipment can be solved by replacing old equipment with new ones, but this is associated with the need to spend a lot of money. At the same time, an effective solution to these problems can be the introduction of an automated information system for real-time monitoring of power networks.

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