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АНАЛІЗ СУЧАСНИХ СИСТЕМ КОНТРОЛЯ ПОДАЧІ ЕЛЕКТРОЕНЕРГІЇ ДЛЯ ПІДПРИЄМСТВА

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Анотація. В роботі розглянуте актуальне питання аналізу сучасних систем контролю подачі електроенергії, їх цілі, переваги та недоліки. Використання автоматизованих систем обусловлено їхньою зручністю використання, якості та швидкості реагування.

Ключові слова: Електромережа, патент, штучний інтелект

ANALYSIS OF MODERN ELECTRICITY SUPPLY CONTROL SYSTEMS FOR ENTERPRISES

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Abstract. The paper considers the current issue of analyzing modern electricity supply control systems, their goals, advantages and disadvantages. The use of automated systems is due to their ease of use, quality and speed of response.

Keywords: Power grid, patent, artificial intelligence

The modern energy sector of Ukraine suffers greatly from constant shelling. When transformers and power plants are out of order, the problem of constant voltage surges and its absence for a very long time arises. To solve this problem, it is first necessary to analyze modern methods of controlling electricity supply. Improving and implementing these methods will help improve the quality of electricity for production and ordinary consumers.

It is necessary to analyze modern methods of controlling electricity supply and the tasks they perform. The main tasks that need to be investigated:

- Stabilizing voltage in the network;
- Transferring data on the state of the power grid;
- Predicting accidents.

As a monitoring system device, we will consider the patent “IoT based energy monitoring system” [1]. The proposed solution is based on the rejection of bulky wired communications in favor of a distributed network of wireless sensors. This architecture involves installing sensors directly at load nodes, which collect and transmit real-time data on active and reactive power to a centralized cloud server. The key feature of this method is the ability to detect anomalous consumption of individual machines or production lines, which was previously impossible due to the lack of detailed accounting. From a technical point of view, this allows implementing a monitoring strategy without laying expensive cable lines and stopping production for installation. This approach not only provides the ability to remotely monitor the state of the power grid at the enterprise without physical intervention of personnel in dangerous areas, but also significantly improves the convenience of implementing the system. In addition, the speed of operators' response to emergency situations increases, since the localization of the breakdown occurs instantly at the software level.

The next level of system evolution is the transition from passive monitoring to active control,

which is clearly illustrated by the patent “Method and system for dynamic intelligent load balancing” [2]. In this paper, the authors propose a solution to one of the most common problems of distribution networks - phase imbalance. The developed dynamic switching algorithm is based on constant load analysis and automatic switching of single-phase consumers between phases A, B and C in real time using microcontroller control. For an industrial enterprise, the implementation of such a system is of critical importance, since it means a significant reduction in electricity losses arising from the flow of equalizing currents in the neutral wire. Moreover, it contributes to increasing voltage stability, which is a necessary condition for the correct operation of sensitive electronic equipment and CNC machines. The hardware implementation of this method, which includes a control module and a switching relay block, is shown in Figure 1.1.

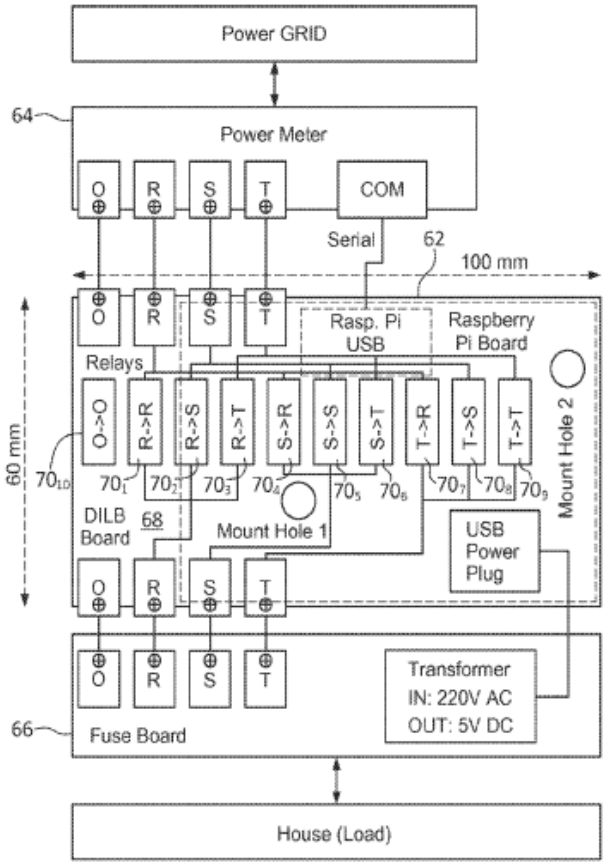

Figure 1.1 – Block diagram of the hardware implementation of the balancing system

The pinnacle of intellectualization of power systems is the use of predictive analytics. The authors of the third patent under consideration, “Machine learning for power grid” [3], propose the use of artificial intelligence (AI) algorithms for in-depth analysis of the state of the power grid. The essence of the method is that thanks to machine learning, the system is able not only to record errors, but also to predict failures that may occur in the future. Analyzing patterns of micro-changes in voltage or current, AI looks for correlations with a database of already known emergency scenarios, detecting the first signs of equipment degradation even before it fails. It is worth noting that despite its high technological attractiveness, this approach has a significant barrier to entry. As the authors of the development note, a complete modernization of the infrastructure for such tasks requires enormous investments, which can reach about 1.5 trillion dollars on the scale of the national network. Therefore, at this stage, this method is more designed for large-scale infrastructure projects (Smart

Grid at the country or city level), and not for local systems of individual medium-sized enterprises, although the trend towards cheaper technologies may change this situation in the coming years.

CONCLUSIONS. Summarizing the analysis of modern electricity supply control systems and a review of the patent base, we can conclude that there is a fundamental transformation of approaches to energy management at industrial facilities. Traditional methods, which were based exclusively on commercial accounting and manual control, are finally giving way to intelligent automated systems.

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