СЕКЦІЯ 6. AUTOMATION, INDUSTRY 4.0. ПРОМИСЛОВІ МЕРЕЖІ, КІБЕРФІЗИЧНІ СИСТЕМИ, ВЕЛИКІ ДАНІ, ІНТЕРНЕТ РЕЧЕЙ, МОБІЛЬНІ ТА ХМАРНІ СЕРВІСИ, ЗАСОБИ ДОПОВНЕНОЇ РЕАЛЬНОСТІ

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METHODOLOGY FOR THE CONSTRUCTION OF PREDICTIVE ANALYSIS SYSTEMS AS EXEMPLIFIED BY THE MINING EQUIPMENT IN THE CONDITIONS OF BIG DATA AND SIMULATION METHODS

The scientific methods aimed at introducing of IT for processing large volumes of data with distributed infrastructure based on intelligent agents and parallel algorithms are considered. The emphasis is made on innovative methods based on intellectual agents and principles of Industry 4.0. The implementation and simulation of parallel algorithms for processing big data and decision-making trees are carried out.

Keywords: Industry 4.0, Big Data, Predictive analysis, Simulation.

Currently, almost all elements of economic activity somehow exist according to the laws of macroeconomics. This is facilitated by the rapid development of international relations, the acceleration of logistics operations, political, religious, cultural integration and unification at the level of interstate relations and interactions (as a result of the evolution of state-formed market systems). At the same time, every year more and more significant influence on macroeconomics is played by minor global factors that were previously practically not taken into account, such as climate change, growth of the world population, etc. Thus, today, every company seeking to be efficient and profitable needs to focus not only on the laws of the domestic market, but also on global trends when building it's strategies and implementing tactical tasks [1].

All the above prerequisites gave rise to a new concept of production development, called Industry 4.0. Previous scientific and

technological revolution led to the automation of individual processes and devices, while Industry 4.0 provides for the end-to-end digitization of all physical assets and their integration into the digital ecosystem along with the assets of partners involved in the value chain.

The creation of the concept Industry 4.0 in the framework of solving the problems of managing modern technological processes and production had several basic prerequisites. One of them is related with the fact that the complication of the so-called material part of production, of course, also leads to the complication of the organizational component. It is becoming more difficult for a modern manager to make the right management decisions. In the progression, the variability of the applied goals, conditions, restrictions, and with them the scale of possible consequences, increases. Another important reason is the fact that in modern management conditions it is necessary not only to obtain statistics and analytics of production, but also to be able to predict using the obtained data. High-performance methods should be applied to isolate the most important and relevant information at the time of the decision, with the possibility of a predictive analysis of possible options for events.

In general, the mathematical model of each stage of the hierarchy can be viewed as a complex object of the mineral dressing technology and presented as a function of variables. Here, three types of actions serve as the input of the object:

1) uncontrolled (but monitored) input variables $Y = \{y1,...yr\}$ constitute a disturbance vector and, as a rule, characterize, as far as concentrating production is concerned, quality indicators of the source material to be processed and those of its intermediate products obtained during the concentrating process;

2) controlled input variables $U = \{u1,...,un\}$ constitute a control vector and characterize, as a rule, quantitative indicators (expenditure) of material and energy flows;

3) the uncontrolled factors $Z = \{z1,...,zk\}$ constitute an interference vector. Basically, this is a disturbance vector, about which the developer of the control system knows very little or nothing at all. Most often that vector is not taken into account at all.

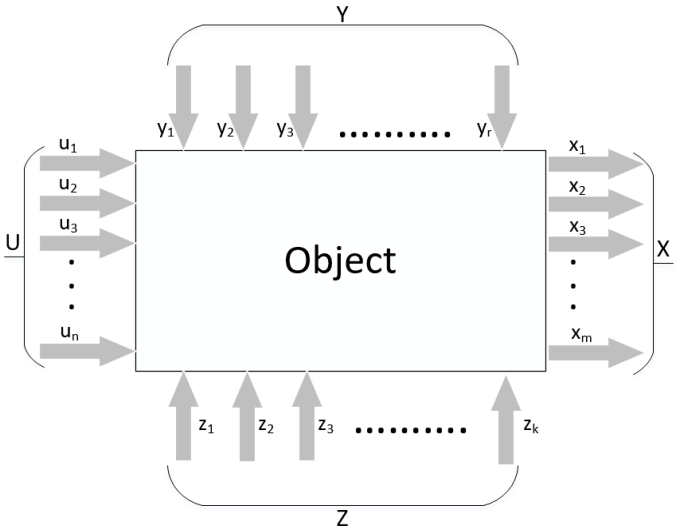

Fig. 1. The structure of a complex control object [2]

Monte Carlo simulation is a computerized mathematical technique that allows people to account for risk in quantitative analysis and decision making. The technique is used by professionals in such widely disparate fields as finance, project management, energy, manufacturing, engineering, research and development, insurance, oil and gas, transportation, and the environment.

Monte Carlo simulation furnishes the decision-maker with a range of possible outcomes and the probabilities they will occur for any choice of action. It shows the extreme possibilities—the outcomes of going for broke and for the most conservative decision—along with all possible consequences for middle-of-the-road decisions.

In terms of value, this criterion (1) can be expressed in terms of the amount of losses that a combine may incur as a result of a possible failure of an individual equipment segment [3].

$$S_y = (1-K_1)A \cdot K_{ГК}(1-K_2)Q_K \cdot T \Rightarrow \min \quad (1)$$

where K1, K2 – coefficients characterizing the share of costs due to a decrease in the quality of products and their quantity (due to failures); КГК – the coefficient of readiness of functionality of the plant; A – unit cost (UAH / t); QK – planned capacity of the plant (tons / hour); T - time of the plant for the year (in hours).

CONCLUSIONS

Should be considered that the exact calculation of the coefficients is quite difficult, due to the multi-factorial nature. Therefore, we investigated the possibilities for the approximate calculation of these quantities, by predicting the probability of equipment failures, as well as their possible consequences using simulation and statistical methods.

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МОБІЛЬНИЙ ДОДАТОК ДЛЯ КЕРУВАННЯ РОБОТОМ ЗА ТЕХНОЛОГІЄЮ ІОТ

Проведено дослідження сучасних актуальних технологій, які дозволяють створювати мобільні додатки, програмне забезпечення для мікроконтролерів та засоби зв’язку між ними, а також моделювання мобільного додатку для керування роботом через безпровідну мережу та модель робота для керування.

З кожним днем все більшого розповсюдження набувають різні роботи та механізовані пристрої, які можуть виконувати певну