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COMBINATION OF MECHATRONIC ENGINEERING AND ARTIFICIAL INTELLIGENCE TECHNOLOGY

ANNOTATION

This article discusses the main issues of artificial intelligence and its implementation in the daily life of people in the form of control systems of mechatronic systems.

Due to the intensive implementation of the latest achievements of scientific and technical progress, a new element base, new technologies for implementing the principles and laws of creating artificial intelligence appeared. Mechatronics is an independent fundamental technical science as the basis of modern technological equipment.

Mechatronics is one of the most promising engineering fields, which is a combination of interdisciplinary engineering courses such as mechanics, electrical engineering, electronics, robotics, computer science, control systems and product development. Therefore, in the modern conditions of technological development, industrial enterprises, including mining enterprises, are more in need of specialists with the skills of managing complex technological equipment and, at the same time, electropneumatics, electrohydraulics and electromechanics. In order to understand modern automation and mechatronics systems, one must not only have knowledge of their components, but also the ability to set up and adjust the operation of these systems. With the rapid development of scientific computing, artificial intelligence technology is widely used in mechatronics. The article describes the connection and combination of mechatronics engineering and artificial intelligence technology.

The methods of analysis, comparative analysis, and analytical research are aimed at determining the rationality of the combination of mechatronic engineering and artificial intelligence technology. The article discusses how mechatronics engineering using artificial intelligence technology can meet the development needs of modern society.

Key words: *mechatronics, mechatronic systems, sensors, electronics, control, computers, actuator, signaling device, programmable logic controller, electronic device, computer, integration, mechatronics, artificial intelligence technology*

Introduction. The unprecedented pace of technological progress has shown that we need to think about our lives differently. Especially with the perfect combination of artificial intelligence and mechatronics technology, traditional technology gradually becomes an accessory, and they are no longer determinants of product quality, but only resource allocators and coordinators. The boundaries between disciplines have become so blurred that it has paved the way for the introduction of new interdisciplinary research areas such as mechatronics, industrial automation, biotechnology and more. Possible reasons for mainstreaming these multi-directional areas could be:

– Because production processes in all industries are very complex, they require precision and highly skilled labor at all levels, resulting in advances in robotics, automation, control systems, and the use of advanced software and hardware to increase production;

Interdisciplinary engineering fields such as mechatronics combine engineering disciplines such as robotics, computer science, product design, control systems, electronics, and telecommunications with mechanical engineering to help engineers develop solutions and technologies that help solve tomorrow's problems.

The outstanding mathematician Norbert Wiener, the founder of the theory of cybernetics and artificial intelligence, proved that the same laws work in living organisms, machines and society. In his understanding, there was no insurmountable border between the human mind and the artificial mind of the machine. He proposed using the mechanisms of a living organism as a model for building a machine and a machine that would work similar to the human nervous system. He made a surprisingly accurate prediction of the mechatronic paradigm of the development of technical cybernetics, noting that computers are actively used for direct control of actuators [1, 2].

Mechatronics gave a "second breath" to cybernetics and ensured its "second birth", being the computer paradigm for the development of technical cybernetics. Today it is a young, independent, fundamental technical science.

Many engineering products that combine mechanical and electrical systems developed and manufactured over the past thirty years can be considered mechatronic systems.

Many processes in traditional manufacturing plants, which rely on the skills and experience of workers to ensure quality, are performed by mechatronics equipment more efficiently, better, and cheaper than manual labor. Compared to traditional mechanical engineering, mechatronics is the integration of artificial intelligence technology and mechanical engineering that performs the function of information communication, while traditional mechanical engineering is only concerned with energy and kinetic energy. Considering the need of manufacturing enterprises to meet the need to improve production efficiency and reduce labor costs while ensuring quality, the use of artificial intelligence, robotic products and efficient automatic collection, transportation and other operations is undoubtedly an excellent choice for enterprises. It also promotes the development of industrial automation and industrial production integrated process automation, the process can achieve optimal control. On the other hand, industrial robots can replace humans in performing some monotonous, frequent and repetitive long-term operations such as stamping, spraying, heat treatment, welding, coating, molding in hazardous environments in industrial production [3, 4].

Today's electromechanical construction industry is based on the advanced science and technology of today's era and forms an intelligent system integrated with computer software and hardware. The emergence of the electromechanical integration system, on the one hand, is electromechanical construction projects to achieve scientific and standardized management, and on the other hand, compared with traditional mechanical and electrical construction project management, it is of great importance for future mechanical and electrical enterprises to enter a new era of economic value creation with confidence [5, 6].

Materials and methods of research. The research aims to determine the rationality of the combination of mechatronic engineering and artificial intelligence technology. Analysis, comparative analysis, analytical research methods were used during the research.

Results and their analysis. Mechatronics is one of the most promising engineering fields, which is a combination of interdisciplinary engineering courses such as mechanics, electrical engineering, electronics, robotics, computer science, control systems and product development. Figure 1 shows the integration of interdisciplinary engineering courses.

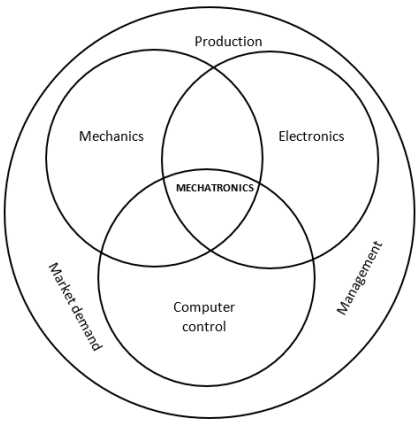

Figure 1 – Integration of subjects

The term "mechatronics" was coined in 1969 by Tetsuro Mori, an engineer at Yaskawa Electric Corporation. Since then, this interdisciplinary field has gradually achieved exponential growth in engineering-related sectors [6, 7].

Mechanical technology is the basis of mechatronics engineering. In the manufacturing process of the mechatronics engineering system, the classical mechanical theory and technology must rely on computer technology, artificial intelligence and expert system to form a new generation of mechanical manufacturing technology, including information exchange, access, operation, judgment and decision making. Artificial intelligence technology, expert system technology, neural network technology are computer information processing technologies. Control technologies implement high-precision positioning control, speed control, self-diagnosis and correction, reproduction, search, etc [8, 9].

Sensing technology is the sensing organ of the system and the main link in the implementation of automatic control and regulation. The stronger its function, the higher the system automation program. Modern technology requires the sensor to receive information quickly and accurately and to be able to withstand harsh environmental tests. This is the guarantee of the high level of mechatronics engineering system, servo system is a device and component of conversion from electrical signal to mechanical action, which has a decisive influence on the dynamic performance, control quality and function of the system [10, 11].

It is the correlation and combination of mechanical engineering and artificial intelligence technology according to the characteristics of mechatronics engineering. Mechatronics engineering not only involves communication of energy, kinetic energy and information, but also includes intelligent computer electronic information system. Compared to traditional mechanical engineering, mechatronics engineering is very different in terms of design and product specifications, it includes not only mechanical engineering but also computer technology, electronic engineering and other disciplines. Although the product structure of mechatronics has no other components, the internal structure of the product is relatively complex compared to the traditional mechanical engineering structure, which leads to the phenomenon of a small system of modern mechatronic engineering products, and the performance level has also been greatly improved [12].

Mechatronics strives to solve the challenges by introducing digital electronic units and control computers directly into mechanical units and systems. Effective implementation of this approach became possible due to the emergence of information and production technologies in recent years. The mechatronic approach to creating a new generation of machines is to transfer the functional load from mechanical components to intelligent (electronic, computer and information) components that can be easily reprogrammed for a new task and are relatively inexpensive. Thus, the functional analysis of production machines shows that the share of the mechanical part has decreased from 70% in the early 90s to 25-30% today [13, 14]. Figure 2 shows a characteristic graph showing the dynamics of this process in industrial machines over 30 years since the 70s.

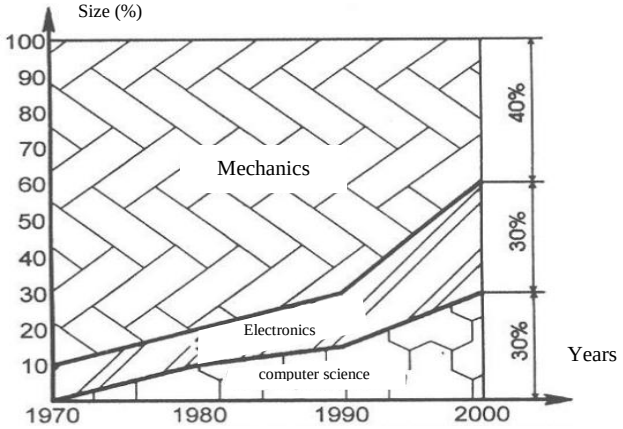

Figure 2 – Change in functional load of mechatronic system components

Analysis shows that in the early 1990s, the vast majority of machine functions (over 70%) were performed mechanically. In the following decades, mechanical components were gradually replaced - first by electronic, then by computer units. Currently, in mechatronic systems, the volume of functions is divided almost equally between mechanical, electronic and computer components. In addition, the

share of the computer part has doubled in recent years, and there is every reason to assume that this trend will continue in future technology.

Mechatronic systems take precedence in modern technological, automated equipment that works without human intervention and in all other areas. Unfortunately, there is a severe shortage of specialists who can operate such equipment, let alone build it.

In the 21st century, most operations in production are performed by intelligent machines - robots, and human functions have been reduced to controlling and monitoring the operation of automation on a computer monitor.

Modern mechatronic engineering technology is the product of the convergence and intersection of mechanical engineering, microelectronics, and information technology [15].

From automotive to aviation, oil and gas exploration and development, biotechnology, telecommunications, manufacturing, transportation, defense, and any other industry you can think of, mechatronics engineers are needed to increase productivity and profitability. These new opportunities in today's world have defined the future role and viability of mechatronics.

Figure 3 below shows a popular example of the usefulness of mechatronics - annual global shipments of industrial robots.

Figure 3 – Annual global shipments of industrial robots

It can make an intelligent decision to perform the work it is intended to do, thus making the overall production process much more economical and automatic.

The industrial automation market is growing at a rapid rate of over 6% annually and is expected to reach USD 149 billion by the end of the forecast period. Figure 4 shows the rapid growth of the industrial automation market. Cost reduction, high process efficiency and the ability to provide general information and start product development earlier are the major driving factors for this market [16].

Figure 4 - Industrial automation market

The combination of mechatronics engineering and artificial intelligence technology maximizes the performance of mechanical and electronic systems. The progress of artificial intelligence technology has promoted the development of the commercialization path, and the intelligent robot and distributed artificial intelligence technology have achieved great achievements in practical

applications. With the continuous development of computer technology, artificial intelligence technology has entered a period of stable development, realizing the development of artificial intelligence technology from one discipline to a separate discipline. Currently, artificial intelligence technology can implement the process of solving many tasks. Intellectualization, i.e., holographic systematization, describes the behavior state of the machine, imbibes methods and new design ideas from new disciplines such as computer science, mathematics, operations research, chaotic dynamics, artificial intelligence, and physiology to model and create human thinking [17].

The popularity of computer network technology is directly related to the penetration into the information society, and the development of artificial intelligence technology is directly related to the development of the information society [18]. The effective combination of artificial intelligence technology and intelligent technology in mechatronics engineering allows not only to efficiently process information, but also to create, control and diagnose problems for mechanical models. Mechanical input and output information is described due to the instability of mechatronics engineering. It mainly describes information by guiding mathematical equations, building rule bases and learning to generate knowledge. Although the traditional mechatronic system has strong density and precision, such a mechanical and electronic system cannot meet the development needs of modern society. It may only be suitable for systems with relatively little information.

Artificial intelligence technology is basically an information processing method based on unknown and complex knowledge in the information processing process. Therefore, artificial intelligence technology and information processing technology will be an effective tool for analyzing mathematical equations in mechatronics engineering. The mechanical and electronic system created by artificial intelligence technology mainly includes neural network system and fuzzy reasoning system [19]. Fuzzy reasoning system refers to the modeling of human logical thinking to analyze the linguistic signals of the human brain, while the neural network system mainly analyzes the digital signals generated by the human brain by simulating the structure of the human brain, although the neural network system and the fuzzy reasoning system have similarities in the input and output of information, their differences also has:

– neural network system is fuzzy in physical sense and accepts point-to-point mapping, while fuzzy reasoning system has real physical meaning and accepts domain-to-domain mapping;

– the neural system and the fuzzy reasoning system store information in a correspondingly distributed and stable manner;

– In terms of information communication and computation, the connection between the neural network system and the fuzzy reasoning system is fixed and the amount of computation is different. Neural network systems are computationally intensive, while fuzzy reasoning systems are small. Therefore, the complex artificial intelligence technology system plays an important role in the mechanical and electronic system.

Modern engineering is dominated by the integration of electrical and mechanical components, and increasingly complex requirements are placed on the personnel who operate them. As a result, the organization of labor in the enterprise changes:

– in the first place are skills and knowledge of electronic control technology using computers and microcontrollers;

– Electropneumatics and hydraulics, in all its components, knowledge of electromechanics is required, which means knowledge of functional blocks and groups of elements, not individual parts.

– Electronic, mechanical and electromechanical components (components) are integrated with hydropneumatic equipment. Circuits are being replaced by electronic circuits, becoming smaller and smaller and becoming chips. In case of failure, individual components and groups of elements are no longer repaired, but replaced with new ones.

– Mechanical engineering enterprises need more "hybrid" specialists. Until now, they had to train their specialists in additional specialties of control engineering, hydropneumatic automation and electrical engineering.

But personnel training does not follow this pace. According to EU experts, the vocational education system in Europe lags behind the needs of industry by 12 years, in the USA by 15 years, and in EurAsEC by more than 30 years.

The development of technology has a direct impact on the employment of people, and therefore on their professional training. Figure 5 shows how employment by sectors of the working population has changed over the years.

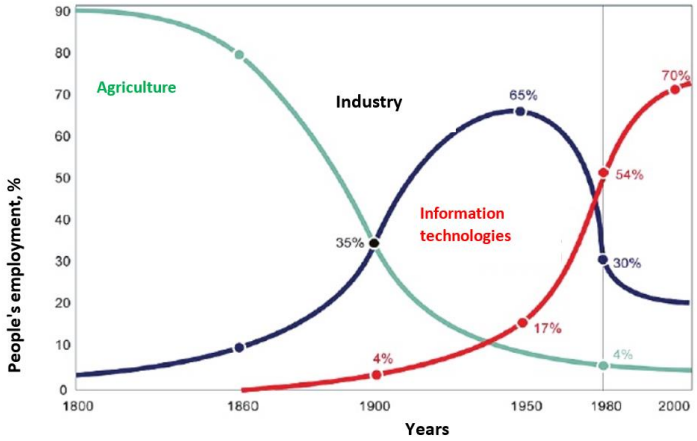

Figure 5 – Employment structure of the population in developed countries

The agricultural sector employs about 4% of the working population. On the other hand, information technology and service sector dominates among those employed today - more than 70%, and less than 25% work in industry.

The main reason for the decline in industrial employment is full automation! Today, only repair, construction and installation crews, folk crafts and exclusive ateliers work by hand. Everything else is pure automation or, in modern terms, robotics and mechatronics. And for automated production, everyone needs qualified personnel, that is, workers and specialists capable of installing, adjusting and repairing automated production. Today they are called mechatronics engineers.

Mechatronics engineers' careers focus on a variety of roles that involve working very closely with mechanical, electrical, electronic, and control and manufacturing teams, which are fundamental to product development. Common responsibilities of a mechatronics engineer may include:

– Automation of existing production processes;
– Analysis of viability of new and existing equipment;
– Simulation modeling of engineering systems;
– Integration of systems that increase productivity and productivity;
– Development and creation of new products;
– Solving complex engineering problems using mechanical, electronic and computing technologies.

Mechatronics engineers are needed in every industry vertical. They are in high demand in various industries, from aerospace to automobiles.

The conducted analysis shows that any modern automated equipment (from a washing machine to a space station) can be represented as a set of elements:

– "machine brain" is an electronic device (computer, programmable logic controller) that receives signals from sensors and control buttons, processes them and sends them to the operating device (drive, signaling device, etc.);

– "machine muscles" - drives providing mechanical movements (electrical, hydraulic and pneumatic drives);

– "sensory organs" - sensors, buttons and limit switches that collect information about the state or parameters of the mechanisms of the technical (mechatronic) system and send them back to the "brain" - an electronic device in the form of input signals.

An important element of mechatronics are "sensors" - sensors, non-contact limit switches, pressure switches and a compressor [20].

The control system ("brain of the machine") is implemented on the basis of relay-contact electromechanical elements (buttons, relays, pulse counters) with the possibility of retrofitting with a programmable logic controller.

Conclusion. In conclusion, any automatic system in any field works step by step.

In any case, in order to understand modern automation and mechatronics systems, it is necessary not only to know their components, but also to be able to set up and adjust their operation, that is, the complex interaction of mechatronic system components with each other [21].

Mechatronics engineering using artificial intelligence technology can meet the development needs of modern society. With the rapid development of computer network technology, not only great achievements have been made in science and technology, but it brings a new look to everyday life. The global economy and production are connected by various networks, and competition between enterprises also faces networked globalization. Once a new mechatronics engineering product is developed, if its quality is reliable, it will sell well all over the world. Due to the further popularity of the network in the world, all kinds of remote control technologies related to the network will continue to develop, because the terminal equipment of remote control is the engineering products of mechatronics. Therefore, mechatronic engineering products will inevitably evolve towards network globalization.

The considered theoretical analysis and monitoring led to the conclusion that the mechatronic system has a great future.

REFERENCES

1 Rothful, M. Systems engineering in the design of mechatronic systems [Text] / M.Rothful,.M. Lasa, P. Heinkel, H Tirgari // Int. J. of Vehicle Design -2019.-№2.- P.12-14.

2 Zhang, S. EFDEX: A Knowledge-Based Expert System for Functional Design of Engineering Systems [Text] / S.B. Zhang, G. A. Tor, Y. Britton, M. Deng. // Engineering With Computers. – 2018.-№4. – P.67-68.

3 Walters, R.M. A conceptual study for a computer-based tool to support electronics design in a mechatronic environment [Text] / R.M. Walters, D.A Bradley, A.P. Dorey, // Microprocessors and Microsystems.- 2020.-№ 2.- P.90-91.

4 Brunetti G. A feature-based approach towards an integrated product model including conceptual design information [Text] /Brunetti, G., Golob B.// Computer-Aided Design. – 2018. -№14.- P.102-103.

5 Diaz-Calderon, A. Automatic generation of system-level dynamic equations for mechatronic systems [Text] / A. Diaz-Calderon, C. Diaz-Calderon, J. P. Paredis, K. Khosla // Computer-Aided Design. – 2019.- №5.- P.56-57.

6 He, Y. Automatic Control, Mechatronics and Industrial Engineering / Y. He X. Qing London, New York: Taylor & Francis; 2019.

7 Williams, N. Mechatronics, August 17, 2021 Current Trends and Future Technologies in the field of Mechatronics [Text] / N.Williams. //Global J Technol Optim. – 2021.-№12.-P. 269 .

8 Pengcheng, Liu,M. A survey on underactuated robotic systems: Bio-inspiration, trajectory planning and control [Text] / Pengcheng, M. Liu, Nazmul Huda,Li Sun, Hongnian Yu// Mechatronics. – 2020. - №12.

9 Pawlak, A. M. Sensors and actuators in mechatronics [Text] / A. M. Pawlak // London, New York: Taylor & Francis; 2016.

10 Ollero, A. Mechatronics, robotics and components for automation and control IFAC milestone report [Text] / A. Ollero, S. Boverie,R. Goodall,J. Sasiadek,H. Erbe,D. Zuehlke// Annual Reviews in Control. – 2006.

11 de Silva, C. W., Mechatronics: Fundamentals and Applications [Text] / de Silva, C. W., Khoshnoud F., Li M., Halgamuge S. K. // London, New York: Taylor & Francis. - 2015.

12 Pawlak, A. M. Sensors and actuators in mechatronics [Text] / A. M. Pawlak // London, New York: Taylor & Francis; 2016.

13 Yamaguchi, T., Hirata M., Pang C. K. High-Performance Motion Control of Mechatronic Systems [Text] / T. Yamaguchi, M. Hirata, C. K. Pang High London, New York: Taylor & Francis; 2014.

14 Grabchenko, A.I., Vvedenie v mehatroniku [Text] / A.I. Grabchenko, V.B. Klepikov, V.L. Dobroskok, G.K. Kryzhnyj, N.V. Anishhenko, Kutovoj Ju.N. Pshenichnikov, D.A. Garashhenko Ja.N // Izdatel'stvo : Har'kovskij politehnicheskij institut God : 2014 S. 264

15 Luo, S. Robotictactileperceptionof object properties [Text] / S. Luo, J. Bimbo, R. Dahiya, H. Liu // : A review

16 Perepelkin, M.A. Mehatronika cherez prizmu nauk. [Text] / M.A. Perepelkin // Gornaja promyshlennost'.- 2020-№1. – S.160-163.

17 Yang, G. Future Mechatronics and Automation. [Text] / G. Yang // London, New York: Taylor & Francis; 2015.

18 Stromov, V.Ju. Model' organizacii nauchno-issledovatel'skoj dejatel'nosti studentov v vuze [Text] / V.Ju. Stromov, P.V. Sysoev // Vysshee obrazovanie v Rossii. – 2017. – № 10. – S. 75–82.

19 Allen, G. Mechatronics Engineering: A Critical Need for This Interdisciplinary Approach to Engineering Education [Text]/ G. Allen // Proceedings of the IJME–INTERTECH Conference on Synergistic Integration of Mechanical Engineering with Electronics. – 2006. – P. 1–21.

20 Ostojic, G. Mechatronic Education at Faculty of Technical Sciences Novi Sad [Text] / G. Ostojic, V. Jovanovic, D. Kozak et al. // Tehnicki Vjesnik. – 2015. – № 22 (3). – P. 709–715.

21 Cabibihan, J.J. Effectiveness of student engagement pedagogies in a mechatronics module: A 4-year multi-cohort study [Text] / J.J. Cabibihan // Journal of the NUS teaching academy. – 2013. – № 3 (4). – P. 125–149

ТҮЙІН

Бұл мақалада жасанды интеллект және оны адамның күнделікті өміріне мехатрондық жүйелерді басқару жүйесі түрінде енгізу туралы негізгі мәселелер талқыланады.

Ғылыми-техникалық прогрестің соңғы жетістіктерін қарқынды енгізуге байланысты жаңа элементтік база, жасанды интеллект құрудың принциптері мен заңдылықтарын жүзеге асырудың жаңа технологиялары пайда болды. Қазіргі технологиялық жабдықтардың негізі ретінде дербес іргелі техникалық ғылым – мехатроника қарастырылады.

Мехатроника - ең перспективалы инженерлік салалардың бірі, ол механика, электротехника, электроника, робототехника, информатика, басқару жүйелері және өнімді әзірлеу сияқты пәнаралық инженерлік курстардың бірігуі болып табылады. Сондықтан технологиялық дамудың қазіргі заманғы жағдайында өнеркәсіптік кәсіпорындар, оның ішінде тау-кен кәсіпорындары күрделі технологиялық жабдықтарды басқару дағдылары мен бір мезгілде электропневматика, электрогидравлика және электромеханикалық білімі бар мамандарға көбірек мұқтаж. Заманауи автоматика мен мехатроника жүйелерін түсіну үшін олардың құрамдас бөліктері туралы білім ғана емес, сонымен қатар осы жүйелердің жұмысын орнату және реттеу мүмкіндігі болуы керек. Ғылыми есептеулердің қарқынды дамуымен жасанды интеллект технологиясы мехатроникада кеңінен қолданылады. Мақалада мехатроника инженериясы мен жасанды интеллект технологиясының байланысы мен үйлесімі сипатталады.

Зерттеудің талдау, салыстырмалы талдау, аналитикалық зерттеулер әдістері мехатроникалық инженериясы мен жасанды интеллект технологиясының үйлесімінің ұтымдылығын анықтауға бағытталады. Мақалада жасанды интеллект технологиясын қолданатын мехатроника инженериясы қазіргі қоғамның даму қажеттіліктерін қанағаттандыра алатыны талқыланады.

РЕЗЮМЕ

В данной статье рассматриваются основные вопросы искусственного интеллекта и его внедрения в повседневную жизнь людей в виде систем управления мехатронных систем.

Благодаря интенсивному внедрению последних достижений научно-технического прогресса появилась новая элементная база, новые технологии реализации принципов и законов создания искусственного интеллекта. Мехатроника - самостоятельная фундаментальная техническая наука как основа современного технологического оборудования.

Мехатроника — одна из самых перспективных инженерных областей, представляющая собой сочетание междисциплинарных инженерных курсов, таких как механика, электротехника, электроника, робототехника, информатика, системы управления и разработка продуктов. Поэтому в современных условиях развития техники промышленные предприятия, в том числе и горнодобывающие, более нуждаются в специалистах, владеющих навыками управления сложным технологическим оборудованием и одновременно электропневматикой, электрогидравликой и электромеханикой. Для того, чтобы разбираться в современных системах

автоматики и мехатроники, нужно не только знать их составляющие, но и уметь настраивать и настраивать работу этих систем. С быстрым развитием научных вычислений технология искусственного интеллекта широко используется в мехатронике. В статье описывается связь и сочетание мехатроники и технологий искусственного интеллекта.

Методы анализа, сравнительного анализа и аналитического исследования направлены на определение рациональности сочетания мехатронной инженерии и технологий искусственного интеллекта. В статье рассматривается, как мехатроника с использованием технологии искусственного интеллекта может удовлетворить потребности развития современного общества.

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БАТЫС ҚАЗАҚСТАН ОБЛЫСЫ КӨПБЕЙІНДІ АУРУХАНАСЫНЫҢ ТАҒАМТАНУ БЛОГЫНА ХАССП ЖОСПАРЫН ҚҰРУ
DEVELOPMENT OF THE HACCP PLAN AT THE CATERING UNITS OF THE MULTIDISCIPLINARY HOSPITAL OF THE WEST KAZAKHSTAN REGION

АННОТАЦИЯ

Емдеу-профилактикалық мекемелерде ұйымдастырылатын емдік тамақтану науқастардың денсаулық жағдайын көтеру үшін орасан зор үлес қосады. Науқастарды кешенді емдеуде тамақтанудың дұрыс ұйымдастырылуымен қоса, оның қауіпсіздігі мен сапасына да көңіл бөлген жөн. Азық-түліктің дұрыс өңделмеуі, технологиялық процестің ретсіздігі, шикізатты сақтау мен тасымалдау шараларында кездесетін қателіктер есебінен дайын өнімнің сапасы нашарлайды, қауіпсіздік дәрежесі төмендейді және әртүрлі аурулардың ушығуына