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ОГЛАВЛЕНИЕ

3

6

7

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STEERING WHEEL ARRANGEMENT OF A FORMULA 1 RACING CAR

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Don't click without a hint! What are all these buttons and levers on the steering wheel of Formula 1 for?

The steering wheel of any Formula 1 car is the realm of levers, buttons and petals. But what do they all mean and what secrets are hidden in the "steering wheel"?

In modern Formula 1 cars, the steering wheel is more like a steering wheel. The wheels turn at a limited angle, and it is not necessary to intercept the "steering wheel" – to turn a maximum of three quarters of a turn in each direction, a full circle is no longer needed, therefore the steering wheel is truncated from above and below, and rubberized sectors are made on the sides for better grip with racing gloves.

In addition, this allows you to meet the standard of the international automobile Federation of the FIA for leaving the cockpit in 7 seconds – during this time you need to unfasten your seat belts, remove the steering wheel, get out of the car and install the steering wheel back [2]. Therefore, a mount is installed on the steering column, on which the steering wheel itself is mounted with a round latch – in addition to the physical connection with the shaft, it also provides the docking of electrical connectors with the electrics of the car.

Well, the Renault team made it possible to understand the detailed design of the steering wheel of a modern Formula 1 car, which provided the Renault R.S.18 steering wheel for study, and the team's engineers acted as guides to the controls.

The first thing that catches your eye is the display and a row of LEDs above it and on both sides of it. The screen displays a lot of information about the operation of the car's systems, instructions from the FIA, a flag alarm and even some kind of messenger, since on the pit wall it is possible to send short coded messages on various topics to the pilot's monitor:

from problems with the car to changes in tactics. In Renault, pilots have the ability to switch between three pages on the display.

LEDs on the top of the steering wheel display the engine speed and notify the moment of gear change, three diodes on the right inform about the state of the battery level of the hybrid system, and three diodes on the left show when DRS can be activated – and at the moment when they light up, a buzzer is triggered in the pilot's headphones, so that the moment of turning on the wing can be determined and by ear [1].

Below the display is a Renault branded diamond. Moreover, this is only now a sticker, and before there was a full-fledged nameplate, but it was abandoned in 2015 – then the display from the front wall of the cockpit moved to the steering wheel and it was necessary to choose: either a pretentious logo or a large diagonal screen.

The largest switch is located in the center of the steering wheel. As you can see in the photo, it is a rotating selector that can be set to 14 different values. And if in Renault each of the sectors means one thing, then in the other team both the names and the essence of these meanings are different.

Actually, in each color sector, some kind of message from the racer to the team is encrypted, which only the pilot and his racing engineers can decrypt.

As a rule, we are talking about transmitting data about a malfunction or technical problem with a particular machine system. And no matter how I tortured Renault's engineers, they mysteriously smile and say – the meaning of these abbreviations remains a mystery to the pilot and his team of engineers.

But, apparently, using the switch, you can report, offhand, problems with tires, gearbox, aerodynamics, and this is only if we talk about those designations that are obvious.

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EVOLUTION AND IMPACT OF SPORTS TRAINING EQUIPMENT

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Sports training equipment plays a crucial role in improving the safety, performance, experience of sportsmen across different disciplines. From rudimentary tools used centuries ago to up-to-date technical advances of nowadays, the change of athletic equipment mirrors the advancement and recreation sophistication themselves. The given essay investigates the historical development, kinds, importance, influence of training equipment on sportsmen' accomplishment and the sporty landscape in general.

Sports training equipment historical evolution. The history of this type of equipment goes back to ancient cultures, where rudimentary implements were implemented for preparing sportsmen for competitions [1, p.10]. Ancient Greeks, renowned for the athletic prowess, employed simple training tools, for instance, weights, stone throwing, wrestling. Similarly, in ancient China, martial artists practiced with wooden dummies and basic weapons to hone their mastery. During the Renaissance period we can observe witnessed enhancements of athletic equipment, the emergence of rudimentary gymnasiums and the utilization of the main apparatuses such as ropes, weights, bars. Nevertheless, in the Industrial Revolution period the important steps were conducted in athletic equipment. The refinement of modern materials and manufacturing processes permitted for the athletic equipment mass production, resulting in expanded availability and standardization.

Types of sports training equipment. Such type of equipment encompasses a diverse range of tools and devices designed to rise athletes' physical conditioning, performance, skill development. They are the following:

- muscle training equipment: category comprises weights, resistance bands, medicine spheres, and devices like running track trainers and exercise bikes employed to improve muscular power, stamina;

- biomechanical analysis tools: modern technologies such as movement grab methods, force plates, clothing sensors give an opportunity for sportspersons and physical education instructors to examine movement patterns, detect biomechanical flaws, and upgrade means for superior performance;

- restoration and recovery aids: gear like foam rolls, compression garments, and cryotherapy chambers facilitate post-exercise restoration and injury recovery, ensuring sportsmen keep peak physical state;

- protective gear: helmets, pads, braces, and other protective equipment are essential for reducing the hazard of injury through exercising and tournament, particularly in contact sports like football, rugby, and martial arts.

Significance and influence of sports training equipment. The significance of sports training equipment widens outside mere facilitation of physical preparation; it profoundly impacts sportsmen' performance, safety, and entire sporty culture.

- injury prevention: protective gear and biomechanical analysis tools play a pivotal role in minimizing the risk of injuries, thereby ensuring athletes' longevity and sustained participation in their respective sports. By identifying biomechanical imbalances coaches may proactively meet injury predispositions and enhance athletes' durability [2, p.59].

- accessibility and inclusivity: the democratization of sports training equipment has made athletic pursuits more accessible and inclusive, enabling individuals from diverse backgrounds to engage in sports and physical fitness activities. Whether through community sports programs, school facilities, or commercial gyms, the availability of training equipment fosters widespread participation and fosters a culture of health and wellness.

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ROBOTIZATION AND ITS APPLICATIONS

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The history of robots begins long before the 20th century. The first robots were the so-called "automata". The name comes from a Greek word that means "self-propelled" [1].

Automatons were dolls that, thanks to a mechanical drive, were capable of performing various actions: moving their arms and legs, turning their heads, opening and closing their eyes, archery, and they could even write texts on a list of paper with a pen.

The development of technology leads to the fact that robots are becoming an integral part of our lives. Robots are used in various fields, from practical medicine to high precision engineering. For instance, in spite of all their imperfections, applied robotic devices can diagnose diseases, create personalized treatment plans, follow the prescribed instructions and move without human intervention.

Robotization is the displacement of people from the production process, replacing them with automated and robotic machines and production lines, which frees up resources for the development of the service sector.

Robotization is often used and especially highly valued in engineering manufacturing, but this does not exclude it from participating in other areas.

However, despite the fact that robots are now enjoying great success, they, like any other technology, have their pros and cons. The main advantage of robotization is that specialized equipment can be easily reconfigured and reprogrammed to work with completely different scope of products or parts. To do this, you just need to change the control program and this can be done as many times as necessary. Other benefits include: productivity, accuracy and precision, improved product quality, reduced health risks, and so on [2].

Cons are also an integral part. Probably one of the most significant disadvantages is the emergence of technological unemployment. Most people are wary of robots in production, as there is a fear that they will displace humans and become the main workforce, thereby leaving people without jobs and livelihoods.

The main disadvantages are as following: the mandatory implementation of a strict computer system and direct dependence on it, the complexity of control, and training of personnel for new working conditions.

The practical applications of robotics are vast and varied. Robots have the potential to demonstrate meaningful solutions and benefits in a large number of areas. These include areas such as industry, medicine, logistics and housing and communal services, agriculture and social services.

Autonomous robots are robots that perform scheduled actions or tasks with a high degree of autonomy. Autonomous robots have broad potential in many areas. They are able to make decisions and act independently of the constant control of a person. Autonomous robots have broad potential in many areas. They are able to make decisions and act independently of constant human control. Here are a few areas where autonomous robots could be used: research missions; autonomous cars and transport; logistics and warehouses; medicine and healthcare; industry and production.

With the development of Industry 4.0, it is likely that robots will soon manage larger facilities or even entire production will be controlled using autonomous systems. But at the moment, autonomous work using robots without human intervention is not entirely realistic, so it should be stressed that in many cases human intervention is absolutely necessary. Unlike robots, people have thinking and awareness, which helps them avoid large losses in stressful situations that were not at all planned.

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GROSS DOMESTIC PRODUCT

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Various things and actions near us are included in Gross Domestic Product (GDP) and it is an important factor of describing the economic situation. Moreover, GDP indicates the amount of services and goods in countries. In Belarus, GDP makes up to 68.21 billion of USD and in comparison to GDP of the U.S., it's around 23.32 trillion of USD.

There's literally no difference between the value of services and goods whether they have either good or bad impact on the environment, society, etc. Every payment, every bought item in the shop, every salary and every investment counts. Someone's expense is always someone's earning, so, if study the GDP of any country closely, besides the current situation you can also see the potential outcomes of situation the country can soon turn out to be in.

But here's one problem with the information content the GDP indicates – it includes only goods and services that have their influence on the economy. Money usage is a great way to scale, but not everything in the world can be translated to cash. For example: if you're helping your parents with cleaning the apartment, washing the dishes and doing the laundry you're still working, but all of these activities don't have any contribution to GDP, because it's not done for money. Same goes to volunteer services, personal care and charity [1].

There are different ways to compute GDP, but there's a popular equation: *GDP = Consumption + Investment + Government spending + Net exports*.

Consumption means consumer spending – bought goods and services. In most developed countries this part of GDP can make up to 50%.

The next part goes to investment. This part is measured using the data about how much business is spending by people on land, equipment and buildings. It can also include a huge investment – getting a house or

apartment. Investment can help if the economy has problems. Usually, the reason of problems is that companies are not spending it on various important things like production, equipment and machinery.

The part "Government spending" consists of all money that governments (local, state and national) spend on schools, defense and improvement of public services. There are a dozen opportunities for government to spend on, it depends a lot on how this country approaches to public services and goods. Take for example France can be perfect example of how much can government spend for it to make it worth around the half of GDP.

There remains the last part of the GDP – net exports. For the most of the countries they are negative, because they import more goods than they export.

All countries are getting information which shows how much people invest, export, consume and spend. GDP becomes a data that helps to measure the economic wealth of countries and makes it possible to be compared one to another. GDP is able to grow if an economic situation is good, otherwise GDP growth contracts. If 50% or even more of GDP growth is negative this economic condition is called recession. Even the GDP can't show a full economic state of a country. A lot of critics think that it's not enough to count manufacturing and production, while forgetting about the digital part of economy.

Well-being of people and economic equality of their life cannot be fully measured by GDP. While seeing GDP of the country you may think that all people there are rich, but even this wealth can be spread unevenly. Also, GDP will not count child care volunteering and so on. Of course, it will not factor in pollution or not legal activity, although some economists have other alternatives that can show the quality of life [2].

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SMART MANUFACTURING

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Nowadays, you can more and more often hear or read somewhere on the Internet about such a concept as "Smart Manufacturing". Smart manufacturing represents the most intensive use of network and information technologies, as well as cyber-physical systems at any stage of the production of a particular product.

Smart manufacturing is an enterprise production system that is capable of taking into account the context, and is also capable of assisting humans and robots in solving certain problems, through the widespread introduction of information technology into production and management systems.

Any enterprise can organize the work of "smart production". To do this, it is necessary to analyze the work of production and identify what tasks a machine can cope with no worse than a person. For example, a robot can cope with such a task as regulating the power of devices during the production process, etc. Afterwards, the enterprise needs to purchase the necessary equipment and configure it for the needs of the production process.

The main goal of introducing "smart manufacturing" to enterprises is to improve all competitive advantages of enterprises through the use of the latest technologies. In the modern world, along with smart production, the concept of "Lean Manufacturing" is increasingly gaining popularity.

The practical organization of production is of particular importance in the development of the economy of the Republic of Belarus. At the moment, there are several approaches and tools for practically increasing the use of certain organizational and economic resources of an enterprise. One of the most common practices is the concept of "Lean Manufacturing". By introducing the tools of this concept into the enterprise, it becomes possible to make practical changes and implement a new ap-

proach to organizing the production process and identifying hidden resources to improve the efficiency of production and economic activities.

Lean manufacturing is an industrial management system aimed at identifying losses during the production process and eliminating them through special measures. The lean manufacturing concept considers tools such as the 5C system, the Kanban system and post planning [1].

The 5C system implies the organization of the employee's workplace and implies the sequential implementation of certain stages: "Sorting"; "Maintaining order"; "Keeping it clean"; "Standardization'; "Improvement".

The Kanban system includes the organization of production and supply and aims to supply a certain number of resources at a certain time. Post planning is a type of production planning based on the production and delivery of a certain number of components and materials to a production line post.

An example of the application of the Lean Manufacturing concept is the Management Company of the Belkommunmash Holding [1].

An integral part of smart manufacturing is artificial intelligence (AI). One of the main areas where artificial intelligence is showing its strength is in pre-production. It is in the process of pre-production that artificial intelligence is most effective, since most stages are very labor-intensive and involve the use of a large amount of time and financial costs.

Organization of production preparation includes the following stages: research, design, technological and organizational.

During the pre-production process, artificial intelligence can be introduced into most of the listed stages

In the economic sphere, smart manufacturing provides some advantages, among which are: an in-depth division of labor with an increase in the length and flexibility of global and industry production chains, which leads to lower costs and product values.

There are also some problems and risks of introducing smart manufacturing and industrial Internet technologies. The main risk is the high costs of implementing and updating system equipment. As a rule, this leads to material problems for the company, in particular for small and medium-sized enterprises.

The second is the threat of cybersecurity. Due to the use of multiple devices connected to the Internet, it can become a target for cyber-

attacks and confidential security leaks. This contributes to economic losses and loss of company reputation.

The introduction of smart production leads to a reduction in personnel, and this leads to the replacement of labor-intensive processes, therefore, to a reduction in jobs in the enterprise. From the above, it follows that a smart enterprise can become a source of social problems and increased unemployment.

There are several ways to reduce risks and ensure the efficiency of a smart enterprise:

a) an attempt to develop and implement cybersecurity protocols, thereby trying to protect the enterprise production from cyber-attacks and information leaks;
b) use machine learning and artificial intelligence algorithms to detect problems and prevent cyber-attacks;
c) collection of information from smart manufacturing systems, as well as data analysis, which can help the company identify problem areas in production processes. After which it is fashionable to take measures to solve them;
d) process modeling to improve and optimize processes, which will allow companies to evaluate their impact on product quality.

When comparing the pros and cons of the topic raised, it is advisable to refer to numbers from real statistics. In 2020, the study "The Global IoT in Manufacturing Market Size, Share & Trends Analysis Report by Component, by Application, by Region, and Segment Forecasts, 2020-2027" showed that the IoT in Manufacturing market was valued at US$27.77 billion in 2019 and was expected to grow to US$83.21 billion by 2027 [2].

Although smart manufacturing has its downsides, its implementation in manufacturing will only improve the economy.

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ENGINEERING ECONOMICS

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Engineering economics is an important and multilateral sphere of knowledge that has a high level of demand, meaning in the modern world. The study in this area is aimed at assessing and improving the efficiency of processes related to the adoption of engineering solutions and control of resources, taking into account economic views. Engineering education plays an important role in this issue, without which there would be no people extolling new ideas in engineering economics.

The engineering economics is an intersectoral knowledge system and methodology, which is focused on an analysis with high quality, and effective adoption of engineering solutions, taking into account economic factors. The main purpose of the engineering economics is to determine the most favorable and alternative options in the con-text of limited resources, depending on the time value of money.

The main objectives of the educational discipline are to study engineering education and its functions in the modern world; to study the definition of "engineering economics"; to consider the position of the time value of money and rules for choosing alternatives; to study the principle of incremental analysis and optimization principles; to consider the devices and strategies of engineering economics; to give examples of the application of engineering economics [1].

The innovation in the research lies in the development and adaptation of modern strategies and devices of engineering economics to modern challenges and technological solutions. This includes integrating environmental and social aspects, taking into account global challenges and creating more accurate and flexible models for assessing the financial performance of projects. The object of study is engineering projects, processes and resources, and their relationship with economic views. The

scope of engineering economics contains a wide range of spheres and activities, including the following factors:

1. Analysis of investment projects. Engineering economy is used to determine the financial rationality of investments in new technologies, equipment, construction and other engineering projects.

2. Design and optimization of systems and processes, Evaluation of economic aspects. When designing systems, production processes and supply helps to achieve more efficient use of resources and reduce costs.

3. Risk management. Engineering economy allows you to analyze the risks and uncertainties associated with engineering solutions, and develop strategies and solutions for their mitigation or management.

4. Evaluation of the value of the life cycle. Engineers can use engineering economy methods to assess the full cost of the product or system throughout its life cycle, including operation, maintenance and disposal.

5. Environmental and social stability. Engineering economy allows taking into account environmental and social factors when making engineering solutions, contributing to sustainable development and social responsibility.

6. Optimization of resources. Analysis of economic factors helps engineers to optimize the use of resources such as materials, energy and time to achieve better results [2].

Thus, the engineering economics is an important part of engineering education and engineering practice, helping engineers to make informed well-balanced decisions, taking into account both technical and economic aspects.

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AUTOMOTIVE ENGINE

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An essential component of the contemporary automobile sector is vehicle engines. They are devices that transform fuel chemical energy into the mechanical energy required to move a vehicle forward. For millions of people worldwide, automobile engines are essential because they provide mobility and transportation.

Over a century of invention and advancement in technology has gone into the development of vehicle engines. There have been several stages of evolution, ranging from the first steam-powered mechanical devices to the most potent engines of today. The development of gasoline and diesel engines, the creation of internal combustion, and the incorporation of cutting-edge technology for improved efficiency and environmental safety are important turning points in the history [1].

Numerous factors can be used to categorize automotive engines. The kind of fuel utilized is one of the criteria. Diesel engines run on compressed air and diesel fuel, while gasoline engines run on a mixture of gasoline and air. Electric engines only run on electricity; hybrid engines run on a combination of electricity and fuel. Car engines can also be categorized according to whether they run on internal combustion or electric power.

Internal combustion is the process by which fuel's chemical energy is transformed into mechanical energy and powers automobile engines. The four primary steps of this process are the intake, compression, power stroke, and exhaust. *Intake*: at this point, the intake valve allows the air-fuel mixture to enter the engine cylinder. The mixture is then able to flow inside the cylinder as a result of the piston moving downward and producing a low-pressure area. *Compression*: as soon as the cylinder is filled with the air-fuel mixture, the piston rises, compressing the mixture. This raises the temperature and density of it, intensifying the effects of

the future combustion. *Power Stroke*: in gasoline engines, the spark plug ignites the air-fuel combination during this stage; in diesel engines, auto-ignition does the same. Gases suddenly expand as a result, applying pressure that pushes the piston downward and produces mechanical work. *Exhaust*: as the piston rises, the exhaust gases finally leave the cylinder through the exhaust valve. By doing this, the engine's exhaust gases are removed, readying it for the following cycle of operation [1].

Numerous technological advancements have been made in modern car engines to increase their effectiveness, dependability, and environmental safety. Electronic fuel injection systems are noteworthy improvements that offer enhanced precision and efficiency in fuel distribution. By using exhaust gasses to raise intake manifold pressure, turbocharging technology increases engine power while consuming less gasoline. Systems for variable valve timing are also essential for maximizing engine performance.

In the present world, the environmental characteristics of car engines are becoming more and more significant. Pollutant emissions, including hydrocarbons and nitrogen oxides, have an effect on the environment and air quality. To lessen the negative consequences, a number of technologies are being developed, such as exhaust gas recirculation systems, catalytic converters, and various exhaust gas cleaning techniques.

The future of automotive engines is directly related to innovation and the never-ending quest of performance and environmental safety improvements. Important areas of development include autonomous engine management systems, the incorporation of network technologies and the Internet into automobiles, and the move toward alternative energy sources including electric and hydrogen-powered engines [1].

Within the contemporary automobile business, vehicle engines are essential. The efficiency and environmental safety of automobiles are shaped by their development and advancements. For this subject to continue advancing, it is essential to comprehend the fundamentals and classification of automotive engines in addition to technical advancements and environmental factors.

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HISTORY AND ACHIEVEMENTS OF THE INSTRUMENT MAKING INDUSTRY IN BELARUS

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The history of the instrument-making industry in Belarus has a long and rich history, dating back to the times of the Soviet Union. During the existence of the USSR, Belarusian instrument-making enterprises were actively involved in various sectors of the economy, such as aviation, defence, medical, and others. This involvement helped establish Belarus as a significant player in the manufacturing and development of various types of instruments, contributing to the country's industrial capabilities and technological advancements.

After Belarus gained independence in 1991, the instrument making industry continued to develop and modernize. Currently, Belarusian instrumentation companies like Belsantekhmontazh and Gomselmash Instruments are at the forefront of producing cutting-edge medical devices such as MRI machines and ultrasound equipment, contributing significantly to the healthcare sector both domestically and internationally. Additionally, companies like BelOMO specialize in the manufacturing of high-tech measuring instruments like precision optical equipment used in aerospace applications, showcasing the country's expertise in advanced technology.

The industry's growth has also led to collaborations with global partners, enhancing Belarus' reputation as a hub for innovative instrumentation solutions. JSC Minsk Instrument-Making Plant is renowned for its precision engineering and cutting-edge technologies in the field of instrument-making. The plant's product range includes high-precision pressure gauges, temperature sensors, and industrial automation systems tailored for sectors like automotive and aerospace [1].

JSC Research and Production Association "Pribory" in Minsk has been a key player in the sector for over four decades, boasting cutting-edge technology and a skilled workforce of over 500 engineers and tech-

nicians. The company's flagship products include advanced digital multimeters, precision oscilloscopes, and industrial automation systems that are renowned for their accuracy and durability. Aside from its manufacturing prowess, "Pribory" is actively involved in collaborative research projects with leading universities and scientific institutions, driving innovation and pushing the boundaries of instrument technology. With a strong commitment to quality and innovation, JSC Research and Production Association "Pribory" continues to set benchmarks in the field of measuring and control equipment, cementing its reputation as a global leader in the industry.

JSC Lida Electromechanical Plant, founded in 1959, is a leading manufacturer of electronic components in Belarus, serving industries such as telecommunications and automotive. The company's industrial automation devices are known for their precision and reliability, used in various sectors including manufacturing and energy. Moreover, their power equipment, including transformers and switchgear, meets international standards and is exported to countries in Europe and Asia [2].

Belarus has made significant strides in instrument making, notably highlighted by the creation of the first Belarusian computer in 1954, marking a significant milestone in the country's technological advancement. As one of the leading electronics manufacturers globally, Belarus has solidified its position as a key player in the industry, exporting high-quality electronic products to various nations. The year 2021 saw a remarkable achievement with 401 patents registered for ground-breaking inventions in the field of instrumentation, showcasing commitment of Belarus to innovation and technological progress. Furthermore, the establishment of the National Technopark in 2011 has been instrumental in fostering a conducive environment for nurturing startups and driving advancements in instrument engineering, reflecting Belarus' dedication to cultivating a thriving tech ecosystem.

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INFLATION: DEFINITION AND TYPES

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Inflation is a rise in the general level of prices [1, p. 134]. Inflation is caused by the overflow of money circulation channels with excessive money supply in the absence of an adequate increase in the commodity supply. Inflation is not an increase in the cost of living, but is essentially a fall in the value, or purchasing power of money. It should be noted that inflation cannot take place under natural commodity exchange as it does under the circulation of gold and silver. Under paper circulation, money is a symbol, not the real wealth that causes inflation. In other words, inflation is not a natural process (if inflation is considered an economic phenomenon), it is directly related to human activity.

Types of inflation can be divided by the degree of occurrence and by the rate of growth. Depending on the degree of occurrence, there are two types of inflation: open inflation and controlled inflation. Open inflation occurs in markets where prices move freely. It is characterized by a rise in prices and a depreciation of the currency. Open inflation cannot destroy the market mechanism, but it can strongly distort it. The economy continues to respond to market signals and adapts to different markets. Controlled inflation occurs in a hidden form and is characterized by a decline in product quality, an increase in shortages and an increase in queues. In this type of inflation, prices and incomes are completely controlled by the state and frozen at a certain level. At the same time, however, the causes of inflation persist and government measures are futile. Controlled inflation disrupts the self-regulation of the market mechanism and leads to the expansion of the "black market" [1, p.140].

Depending on the rate of growth, there are three types of inflation: moderate ("creeping"), rapid and hyperinflation. Moderate inflation is characterized by low growth in the consumer price index (up to 10% per year) and the preservation of the value of money. This type of inflation is safe for the economy and is a target for every state. Galloping inflation is

characterized by a significant increase in the consumer price index (up to 200% per year), which accelerates the conversion of money into goods. This type of inflation is dangerous for the economy and requires significant inflationary measures. Hyperinflation is characterized by a significant increase in the consumer price index (more than 200% per year), an increase in the amount of money in circulation, a disproportionate difference between commodity prices and wages, deterioration in the social welfare of the wealthy and the collapse of large companies. This type of inflation is a very serious problem for the state and its economy and therefore requires decisive anti-inflationary measures.

As mentioned earlier, moderate inflation is the most acceptable. Inflation is necessary to some extent to stimulate the economy and make the best use of limited resources. Moderate inflation through a moderate increase in prices can increase profit margins, stimulate production, increase payment turnover and enhance investment activity. However, if moderate inflation remains weak, it can have negative effects on the national economy (e.g. price increases lead to devaluation, incentives for labor activity weaken). Inflation turns from a temporary engine into a brake, increasing economic and social instability, destroying normal socio-economic relations and weakening the main drivers of economic growth. Inflation destroys economic relations and weakens the main drivers of national economic growth [1, 134].

Inflation, like many other phenomena, has consequences for society and the national economy. These consequences occur in all cases, regardless of the type of inflation and economists should take them into account when formulating anti-inflation measures. Let us consider some of the social and economic consequences of inflation: devaluation of monetary income of citizens, businesses and the state; weakening the incentive to save money; penetration into the functioning of the credit money system; creation of tensions in international economic relations; redistribution of income and wealth between lenders and borrowers; reduction of physical production (reduction in the quantity of goods and services).

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CURRENT PROBLEMS AND POTENTIAL OF MECHATRONICS DEVELOPMENT IN THE MODERN WORLD

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Mechatronics is a field where knowledge about the creation and development of technical systems combining mechanical elements, electronics, software and automation is integrated [1].

The current concepts in mechatronics that are widely used for describing technical areas of application are: *robotics*, one of the key areas in mechatronics is the creation and programming of robots capable of performing a variety of tasks in various fields such as industry, medicine, service and others; *integrated systems*, modern mechatronic systems are becoming more compact and versatile, which significantly increases the productivity and efficiency of technical devices.; *artificial intelligence and machine learning*, the application of artificial intelligence and machine learning methods in mechatronics allows you to create systems with self-learning algorithms, which makes them more adaptive and flexible.

Among the prospects for the development of various concepts in mechatronics can be mentioned the following:

1. Nanotechnology in mechatronics: The introduction of nanotechnology will make it possible to create more compact and energy-efficient mechatronic devices, opening up new opportunities for innovation.

2. Internet of Things (IoT): The fusion of mechatronics with the Internet of Things network contributes to the development of smart devices capable of autonomously interacting with each other, which is extremely important for the development of smart cities and industrial enterprises.

Concepts in the field of mechatronics continue to evolve, and their development is aimed at improving the efficiency, accuracy and functionality of technical systems. One of the important areas of research is the development of more flexible and adaptive mechatronic systems that can quickly adapt to changing environmental conditions.

The integration of the latest technologies, such as artificial intelligence, the Internet of Things, nanotechnology and robotics, allows to create unique technical solutions capable of solving complex problems in various fields of application. The development of mechatronics is also aimed at reducing the cost of production and maintenance of systems, increasing reliability and safety, as well as improving the user experience [1].

Thanks to the constant improvement of the methods of designing, modeling and controlling mechatronic systems, today we see more and more innovative and promising developments that become the basis for the future development of technology and technology. It is important to maintain active interaction between scientists, engineers and specialists in various fields in order to advance the boundaries of knowledge and create unique technical solutions that can change the world for the better.

Mechatronics is a key area in modern technology, covering a wide range of applications, ranging from industrial robots and autonomous vehicles, to medical devices and home robots. The prospects for the development of mechatronics are associated with the constant improvement of the technical characteristics of systems, as well as the creation of innovative solutions to increase efficiency and ease of use.

An important aspect of modern mechatronics is also the consideration of environmental aspects and sustainable development. The development of energy-efficient mechatronic systems capable of reducing resource consumption and reducing environmental impact is becoming an increasingly urgent task.

Given the rapid development of technologies and breakthroughs in the field of artificial intelligence, we can expect further expansion of the capabilities of mechatronic systems and their applications in various industries. It is important to continue research and innovation in the field of mechatronics in order to ensure the progressive development of technology and society as a whole.

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УДК 339.138
DIGITAL MARKETING IN PERSPECTIVE

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Digital marketing (DM) is modern marketing that is used to help companies develop their online product and manage their business online [1].

DM, although it has some disadvantages compared to traditional marketing, has the following advantages over it: high speed of information dissemination, accurate product testing, low costs, and it is easy to evaluate the effectiveness of marketing. For this reason, it is necessary to highlight the main points of its development in the near future.

If we talk around the world, the demand for marketing is undeniable. It is impossible to make a good production of any product without marketing, so marketing will be needed at any time.

Digital Marketing gained its popularity due to the pandemic in 2020, where most companies switched to online promotion of their products. And given that the number of people connected to the Internet is growing every year, there are assumptions that digital marketing will become dominant.

Nowadays, due to the introduction of technology in everyday life, digital marketing has gained a lot of development. According to scientists, the share of digital marketing could grow by 14% between 2023 and 2028. Also, at the moment, approximately 51% of the world's population uses social networks, which is just one component of DM tools.

To the question of whether artificial intelligence can replace marketers, the answer is probably no. Artificial intelligence can only work with what has already been created. Undoubtedly, he will be able to help with the analysis of any data, but he will not be able to come up with any new approach to marketing or to completely new products.

Now there are about 400 vacancies for marketing specialists in Belarus, which shows that there is quite a high demand for it.

Further development of marketing will require exploring new ways and means of distributing and using marketing, improving current tools and looking at the demand for products in the global market. Great importance should be given to digital marketing because of the adoption of technology and its benefits can be spread anywhere in the world without difficulty.

In 2022, specialists from the BSEU conducted a study on marketing. The main goal was to compare various marketing metrics in 2021 and 2022. The results were positive. The number of enterprises that report high marketing development has increased (from 36.4% to 41.8%). In more than 50% of the surveyed enterprises, special attention is paid to marketing. With its help, companies forecast demand, look at and compare their company with others, evaluate and improve their products. Also, the main types of marketing enterprises identified were digital marketing (especially SMM and branding). For this reason, businesses will focus on strengthening various SMM strategies, expanding the use of multi-channel marketing (It consists of interacting with the consumer through various channels (digital and traditional)) [2].

The main problem in the development of enterprise marketing is the lack of specialists and funds allocated for its development. However, 35% of enterprises responded that there were no significant difficulties for its development.

The main situations in which businesses believe that their company needs a marketer can be represented in the form of the following diagram.

Thus, the most important situation for the demand for marketing is the search for new approaches to attract and retain consumers (49.9%), followed by a decline in demand (40.7%), changes in logistics methods (34.9%), budget cuts and revisions partnerships (29.9% each).

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THE IMPACT OF MECHATRONICS ON THE ECONOMY

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In the world of modern technologies, mechatronics is one of the key industries involving the integration of mechanical, electrical and computer systems. This term, which originated in Japan in the 1970s, has firmly entered the lexicon of engineers and designers, emphasizing the importance of integrating various disciplines to create innovative products. Mechatronics, synthesizing mechanics, electronics and computing technology, plays an essential role in the transformation of production processes and the economic environment as a whole. Its impact extends far beyond technical engineering, having a profound impact on the economies of various countries and the global market [1].

Improving Productivity and Efficiency: mechatronics provides automation, optimization and management of production processes, which leads to an increase in the overall productivity of enterprises. The integration of modern technologies makes it possible to significantly reduce the production time, reduce energy and material costs, and bring production facilities to a new level of efficiency.

Reducing Costs and Increasing Competitiveness: optimization of production processes, control over product quality and resources, as well as improved automation of tasks contribute to reducing enterprise costs. This, in turn, makes products more competitive in the market, allowing them to retain and expand their share in the economic sector.

Formation of New Market Trends: the development of mechatronics stimulates the emergence of new market opportunities and trends. Innovative products and services entering the market thanks to mechatronic solutions create new demand segments, increase competition and promote diversity and development of business models.

Technological Leadership and Stimulating Innovation: mechatronics is a catalyst for technological development and innovation. The devel-

opment of new technologies, autonomous systems and smart devices allows companies to be at the forefront, ensuring long-term technological leadership and contributing to innovative development in general.

Economic Growth and Job Creation, Demand for Qualified Specialists: the development of electronics requires highly qualified specialists in engineering, electronics, programming and automation. This leads to an increase in demand for specialized professionals, which in turn contributes to the creation of new jobs.

Increasing Demand for Specialized Knowledge, Growth of Professional Niches: the field of mechatronics creates new professional niches that require in-depth knowledge and competencies in various fields. Specialists specializing in mechatronics have the opportunity to develop in specialized areas, which expands the range of professional opportunities and contributes to the formation of new jobs.

Automation and Robotization: creation of jobs in the service sector; the widespread introduction of robotics and automation in various industries leads to the creation of jobs in the service sector, programming, and technical support.

Integration with Artificial Intelligence and Machine Learning: the synergy between mechatronics and artificial intelligence technologies leads to intelligent systems capable of autonomous decision-making and adaptive behavior. The fusion of these disciplines opens up new horizons for smart technologies and autonomous devices. Integration with Artificial Intelligence and Machine Learning: The synergy between mechatronics and artificial intelligence technologies leads to intelligent systems capable of autonomous decision-making and adaptive behavior. The fusion of these disciplines opens up new horizons for smart technologies and autonomous devices [2].

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AUTONOMOUS VEHICLES

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In today's world, drones have an extremely wide range of applications. They can perform various tasks such as surveillance, monitoring, cargo delivery, and even combat operations. Essentially, the operation of drones is based on several components that interact with each other to ensure that the drone can perform various tasks safely and efficiently [1].

Sensors: drones are equipped with various sensors such as GPS, accelerometers, gyroscopes, and cameras. The sensors collect information about the position and environment, which allows the drone to assess the situation and make decisions. *Communication systems*: drones can be controlled via radio or satellite. This allows the operator to remotely monitor the drone's flight and tasks, as well as feedback and data from on-board systems. *Navigation*: one crucial component of drone technology is navigation systems. Drones utilize GPS and other navigation tools to accurately determine their position in the sky and navigate through various terrains. These systems ensure that drones can reach their destinations safely and efficiently, even in challenging conditions. *Autopilot*: drones are equipped with specialized autopilots that control flight and perform tasks without human intervention. The autopilot receives data from sensors and processes it to determine the direction and speed of the flight. To process information and make decisions, drones use special algorithms and software that allow them to automatically perform tasks and react to changes in the environment.

Drones are propelled by the engines installed on them, which create the thrust needed to lift the drone into the air and propel it in the desired direction. Usually electric, internal combustion or jet engines are used, depending on the type of drone and its purpose. In the case of multicopters, for example, electric motors are used to control the rotation of the propellers or blades, creating lift.

As far as the application of drones is concerned, firstly they can be used in war zones or areas with high levels of pollution. Secondly, drones can work much faster and longer than humans, as they don't get tired and don't need breaks. Also, the use of drones can reduce the number of employees thus decreasing personnel costs and improve the quality of tasks [2].

However, drones also have their disadvantages. One of the major concerns is the issue of security and privacy. There is a risk of hacking and hijacking of drones, which can lead to negative consequences ensuring secure use by terrorist acts. In addition, there are a number of ethical and legal issues regarding the use of drones. For example, how to resolve controversial situations where a drone makes life and death decisions, how to ensure accountability for the actions of autonomous systems, etc.

Here's a list of the biggest drone manufacturers. *DJI Innovations*: a Chinese company that is one of the leaders in the production of unmanned aerial vehicles (drones). DJI manufactures a wide range of drones for a variety of purposes including professional photography, agro-culture, search and rescue, and even entertainment. *Boeing*: an American aviation company that manufactures unmanned devices including unmanned trucks, aircraft for military use, and other autonomous technologies. *Northrop Grumman*: Another major American drone manufacturer that specializes in military drones such as the Global Hawk and X-47B.

Overall, drones and autonomous systems represent a huge potential and offer incredible opportunities for various industries and sciences. However, in order to use them profitably, strict safety measures, ethical rules and laws must be in place, and there must be a sufficient level of human control and oversight. It is important to remember that technology should serve people, not replace them.

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CNC MACHINE TOOLS

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CNC (Computer Numerical Control) machines are high-tech gear in which the actuators are controlled naturally [1]. The actuators controlled by a particular program serve for inciting the working component of the machine, which is the rule of CNC hardware operation. Depending on the reason of the machine instrument, the working component can be a shaft, bore or punch. The armada of machine device hardware with CNC is gigantic and different. It would be sufficient to list as it were the foremost essential ones, among which are turning, processing, crushing, metal-cutting, boring machines, which are separated into numerous sorts and adjustments. Complex and different generation requires similarly complex hardware. In any case, with all the assortment of sorts and models, the rule of operation of CNC machines is decreased to the nearness of program that sets the calculation of the machine.

The CNC framework incorporates:

administrator support, which is outlined to control the machine in manual mode when planning the machine to work agreeing to the program. It permits to enter the machine control program, set the modes of its operation, in case of crisis closed down the machine for investigating;

administrator board (show) appears current data around the machine operation and the program being executed. The administrator can outwardly screen the advance of the innovative operation, see messages around mishaps and malfunctions;

controller, which may be a microchip with the program of the machine. This gadget serves, for occurrence, for setting the direction of the working apparatus development, for commands of innovative operations, for changing the control programs;

ROM (Read Only Memory, changeless memory gadget) could be a lasting memory that's aiming for long-term capacity of framework pro-

grams and constants characterizing the arrangement of the given machine; data in ROM can be read-only;

Smash (Irregular Get to Memory) is outlined for short-term capacity of framework and control program records utilized at the current minute; Slam is outlined to store data that changes amid program execution, it is utilized both for composing and perusing data [2].

CNC machines do not require tall capability of a master as in machine administrator, it is sufficient to prepare the work force to control the program. The preferences of CNC frameworks are: 1) higher efficiency of the hardware; 2) combination of flexibility and exactness of machining; 3) rearrangements of the generation prepare; 4) little variety of item quality inside one clump of generation; 5) fast changeover of hardware and move to generation of other items; 6) straightforwardness of machine tooling; 7) ease of support and operation.

At the same time, the most inclinations of CNC advancement are: disentanglement of equipment and program parts of the frameworks; full compatibility with past advancements (to run already created programs); accentuation on the advancement and enhancement of program (and hence development of the usefulness of existing NC systems); smooth advancement of specialized arrangements (rather than progressive changes) of the equipment portion of the frameworks; openness of frameworks – for producers of machine apparatus hardware it implies wide conceivable outcomes for free alteration [3].

To summarize, CNC machines are present day hardware that permits you to guarantee high labor efficiency with great quality of work. The utilization of such machines altogether increments the general level of product generation culture.

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MECHATRONIC SYSTEMS
IN THE AUTOMOTIVE INDUSTRY

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Mechatronics emerged as a group fusion from connecting separate parts of mechanics and microelectronics. One of the most popular options for determining mechatronics is this: Mechatronics is a scientific and technological branch that works to build and maintain computer-controlled machines. All mechatronic systems of vehicles for active purposes are divided into 3 main groups: engine control systems; box and frame control systems; internal equipment and body control systems. The engine control system is a set of devices responsible for the formation of an air-fuel mixture and the supply of a spark at the right time.

As for the box and frame control system, it can be divided into two parts:

a) the undercarriage which is directly responsible for the movement, the adherence of the wheels to the road and their operation. The wheels are driven by the action of torque transmitted by the motor. This process is also called transmission. Visually, the running system consists of a frame, suspension, and wheels as they are. The processes of movement are controlled by the steering wheel (steering system) and the brake mechanism. Another definition of undercarriage: undercarriage is a set of mechanisms that ensure that the vehicle moves smoothly on roads and turns. The suspension is responsible for driving without shock and vibration-a complex of car elements located under the body of the car, which includes guides and damping components [1].

b) the gearbox which is a device with a mechanism that provides changes in torque gears, including the speed of rotation, reverse movement. The gearbox can be found in two basic variants: 1) manual transmission: to operate it, the driver must press the clutch pedal himself. The driving speed, the current gear, the engine load are all controlled by the

driver. Despite this, the design of the mechanism itself is quite simple and intuitive; 2) automatic transmission: the mechanism of the automatic transmission is more complicated than the manual transmission; it is larger and more expensive. There is no clutch pedal, and the load on the engine and the choice of the appropriate speed determines the unit itself. This is convenient for drivers who just sat behind the wheel and are not completely confident in their capabilities [2].

New technologies have introduced intelligent programs into the movement of the car that optimize driving by creating a number of additional parameters that are very important in our case. Among them, longitudinal acceleration, transverse acceleration, speed of movement, speed of movement of the brake pedal, fuel supply can be distinguished. This development makes it possible to optimize the movement of the car both for driving in the necessary road conditions and for driving in your own style.

Next, we will describe the most comfortable mechatronic systems of the car-the control system of internal and body equipment (the former has become the most relevant nowadays). Control systems of interior and body equipment are designed to increase the comfort and customer value of the car. Depending on the class of the vehicle, electronically controlled devices such as the air conditioner, dashboard, Cathode Ray Tube (CRT) – based multifunction information system, compass, headlights, intermittent wiper, burned-out lamp indicator, reverse obstacle detection device, anti-theft devices, communication equipment, central locking of door locks, power windows, variable position seats, seat belts, etc.

Thus, it can be concluded that mechatronics covers not only such wide areas as mechanics and electronics, but also makes an invaluable contribution to the development of such an industry as the automotive industry.

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ARTIFICIAL INTELLIGENCE AND ITS BENEFITS

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Artificial intelligence (AI) has gigantic potential to benefit the society. At the same time, the colossal benefits raise a number of complex issues. For this reason, occasions are being held to quicken the advancement of arrangements to AI challenges, giving key stakeholders the opportunity to talk about the leading measures to back AI development that meet rising moral prerequisites around the world. This set of imaginative thoughts and recommendations from a few of the driving AI specialists will offer assistance realize the gigantic potential of AI innovation to make strides and rearrange people's lives [1].

AI is an intrigue science with numerous approaches that points to create computer frameworks to illuminate issues that require insights. The term can moreover be connected to any machine that shows traits associated with human insights, such as the capacity to memorize. The term isn't very redress: it would be more rectify to speak of cognitive technologies. The perfect of manufactured insights is that, from a huge number of alternatives, it chooses the most excellent one to realize its objective. A department of AI is machine learning, which creates computer programs that can consequently learn and adjust to modern information without human help. Profound learning strategies give programmed learning by ingesting colossal sums of unstructured information such as content, pictures or recordings.

AI must: be socially valuable: dodge making or fortifying unjustifiable biases; pass security testing; consider protection plan standards; keep up tall guidelines of the logical community; and be accessible for use in understanding with these standards.

AI ought to not be utilized to hurt society, and there ought to be an unthinkable on utilizing fake insights to cause any hurt to people; to form weapons or anything that might straightforwardly hurt others;

reconnaissance frameworks that abuse universally recognized norms; purposes that are opposite to universal law and human rights.

In terms of advancement, it's one of the foremost genuine deterrents is the need of information. In most cases, secret or commercially touchy information that may be utilized for the public is secretly claimed and closed to non-governmental organizations. In other cases, valuable data is blocked off due to the need of activity of bureaucrats.

Another common impediment is the issue of actualizing the so-called "final mile" [2]. Indeed in cases where information is accessible and the innovation is prepared for utilizing, the need of a great pro can make it troublesome to use AI, particularly these days the least level of instruction in this field has expanded essentially. Companies that contract such pros can address the deficiency of talented workers in terms of upgrading and realizing the capabilities of manufactured insights by committing time and assets to instruction and proficient advancement.

AI has made its way into numerous zones of our lives, from self-driving cars to voice assistants. One of the foremost fervently wrangled issues is the plausibility of supplanting people with AI in education.

The fundamental advantage of using AI within the pertinent field is its capacity to handle a huge sum of data and exchange information. Computers can learn from huge sums of information and store data without impediment in memory. This permits them to rapidly analyze data and give exact answers to students' questions. In expansion, AI is able to supply personalized learning custom fitted to each student's foundation and characteristics. However, in spite of all the points of interest, there are a few impediments of supplanting people with AI in learning. Firstly, an vital viewpoint of instruction is the interaction between a teacher and a student. People are able to tailor the approach to each student, set up an emotional connection and fortify intrigued within the subject. AI, in spite of the fact that it incorporates a huge sum of information, cannot pass on warmth and consideration, which altogether limits its adequacy within the instructive process. In expansion, the utilize of AI may restrain the improvement of certain abilities that can only be procured through viable implies. In education, it is vital to memorize how to apply it in hone. AI isn't competent of instructing understudies through practice, cooperation and talk, which may decrease the improvement of inventive considering in understudies. In spite of the

fact that AI has certain preferences, supplanting instructors with AI may result within the misfortune of an critical human component within the instructive prepare. People can give not as it were data, but moreover inspiration, passionate back, and a different see of the world. When planning modern learning frameworks, the utilize of AI must be considered and encouraged in a way that reestablishes the balance between human and innovative commitments to instruction.

There are a few regions where AI is being utilized. The foremost common illustrations can be discourse acknowledgment that is speech-to-text transformation used to perform voice looks or make content messages more available. Client beneficial may be a chatbot that answers habitually inquired questions, gives personalized counsel, and recommends products based on demands. Computer vision could be a framework that extricates data from pictures, recordings, and other visual information and after that performs suitable activities such as looking the Web for a comparable item. Proposals based on search history, location visits, calculations offer assistance distinguish information patterns that will permit you to create the leading advancement methodology. Robotized stock exchanging – optimizing stock bundles. Extortion discovery makes a difference as you distinguish suspicious exchanges in banks and money related issues [1].

And in conclusion, it should be pointed out that the quickened development of human advance makes it conceivable to broadly utilize AI to benefit the society. AI is now profoundly inserted in our society: keen domestic frameworks, virtual associates, cars utilizing manufactured insights, video reconnaissance and customization of news entrances are already widely utilized.

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THE PROBLEMS OF ALTERNATIVE ENERGY SOURCES IN BELARUS

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In the modern world the relevance of the issue of development of alternative energy sources is becoming more and more obvious. The desire to reduce dependence on fossil fuels, reduce greenhouse gas emissions and ensure energy security leads to the search for new, sustainable energy sources. However, countries where industry is not developing as rapidly as in developed Western countries, such as Belarus, face a number of specific problems that make the transition to alternative energy sources difficult. In this essay, we will discuss the problems of alternative energy sources in Belarus.

One of the key factors hindering the development of alternative energy sources in Belarus is the problem of limited resources. For example, in Belarus the amount of sunlight during the year is limited due to the climatic peculiarities of the region, and this makes solar panels less efficient compared to other regions where solar activity is higher. The need for certain climatic and geographical conditions for efficient utilization of wind energy makes the implementation of this type of energy challenging. In order to increase the efficiency and competitiveness of alternative energy sources in a resource-constrained environment, targeted investments in research and development and infrastructure projects are needed. Insufficiently high level of infrastructure development, the lack of specialized production facilities and qualified specialists also makes it difficult to implement alternative energy on a large scale. Moreover, the high technological requirements for alternative energy sources can increase production costs and make them less competitive in the market. To overcome these limitations, increased investment in technology development, training and specialized infrastructure are needed.

The next serious obstacle is economic inefficiency. The high investments required to build and maintain alternative energy infrastructure

may not be economically viable in a context of limited resources and economic instability.

Moreover, the low efficiency of energy production from alternative energy sources, especially when conventional energy sources are available at lower prices, makes them less attractive for investors and consumers. The solution to this problem requires the search for new business models capable of ensuring the economic sustainability and competitiveness of alternative energy sources.

The lack of a transparent and stable government policy on alternative energy, as well as insufficient funding for programs and projects in this area also limit investment opportunities and slow down the pace of development of alternative energy sources.

To overcome this problem, the government should strengthen efforts to create incentives for investment in alternative energy sources, including through the development of special programs and support measures.

Finally, lack of public awareness, misconceptions about the advantages and possibilities of energy from alternative energy sources, mistrust and uncertainty about their efficiency and economic feasibility also hinder the successful development of alternative energy in Belarus. To address this problem, it is necessary to conduct information campaigns, educational activities and disseminate information about the benefits and opportunities of alternative energy sources.

Overall, the development of alternative energy sources in Belarus faces a number of serious challenges, including limited resources, technological constraints, economic inefficiency, lack of government support and lack of public awareness. However, with appropriate measures and investments in the development of this industry, it is possible to overcome these challenges and ensure a sustainable and clean energy future for the country.

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UNLOCKING BELARUS' NUCLEAR POWER POTENTIAL: PROSPECTS AND PATHWAYS

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Belarus, situated in Eastern Europe, is making significant strides in its energy sector, particularly in the realm of nuclear power. With an aim to diversify its energy sources and reduce reliance on imported fuels, Belarus has embarked on an ambitious journey to develop its nuclear power infrastructure. This article delves into the prospects for the development of nuclear power plants in Belarus, exploring the current status, challenges, and potential pathways forward.

Belarus entered the nuclear energy arena with the construction of the Belarusian Nuclear Power Plant (BelNPP) in Ostrovets, located in the Grodno region. The first unit of the BelNPP, featuring a Generation III+ VVER-1200 reactor, commenced commercial operation in November 2020, marking a significant milestone in Belarus' nuclear energy aspirations. The second unit is also under construction and is expected to become operational in the near future.

The prospects of nuclear energy in Belarus are significant. With its own indigenous nuclear capabilities, Belarus can mitigate geopolitical risks associated with energy imports, ensuring a stable and uninterrupted energy supply for its growing economy. As the world moves towards decarbonization and combating climate change, nuclear power emerges as a vital tool in reducing greenhouse gas emissions. By investing in nuclear energy, Belarus can significantly curb its carbon footprint, aligning with global climate objectives and fulfilling its commitments under international agreements such as the Paris Agreement.

Despite the promising prospects, Belarus faces several challenges in the development of nuclear power plants. Public acceptance and perception of nuclear energy play a crucial role in its development. Belarus needs to engage in comprehensive public outreach and education initiatives to address concerns regarding safety, environmental impact, and

nuclear waste management, fostering trust and confidence among the populace.

Establishing a robust regulatory framework is imperative to ensure the safe and secure operation of nuclear power plants. Belarus must strengthen its regulatory institutions, enhance transparency, and adhere to international standards and best practices in nuclear safety and security.

Collaboration with international partners and organizations can facilitate knowledge transfer, technology exchange, and capacity building in the nuclear domain. Belarus should leverage partnerships with experienced nuclear nations and engage with multilateral institutions such as the International Atomic Energy Agency (IAEA) to enhance its nuclear capabilities.

To realize the full potential of nuclear power in Belarus, the following pathways can be pursued. First of all, Belarus should continue to invest in the expansion and modernization of its nuclear infrastructure, including the construction of additional nuclear power plants and the deployment of advanced reactor technologies. Secondly, implementing stringent safety measures are paramount for instilling public confidence and ensuring the safe operation of nuclear facilities. Belarus should invest in comprehensive training programs, emergency preparedness, and continuous safety assessments to uphold the highest standards of nuclear safety. Thirdly, engagement with international partners, including neighboring countries, regional organizations, and global nuclear forums, can facilitate knowledge sharing, regulatory harmonization, and mutual assistance in the development and management of nuclear energy projects.

In conclusion, the prospects for the development of nuclear power plants in Belarus are promising, offering a sustainable pathway towards energy security, economic growth, and environmental stewardship. By addressing challenges, fostering public trust, and embracing international cooperation, Belarus can harness the full potential of nuclear energy and contribute to a cleaner, more sustainable future.

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TRENDS IN IT BUSINESS DEVELOPMENT IN BELARUS

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Information technology (IT) is one of the main factors in the economy of any country, as well as Belarus. Actively developing IT trends are able to influence not only the employment and GDP of the country, but also the country's position in the international scene. In this essay, we will discuss the trends in IT business development in Belarus.

First at all, there are a lot of possibilities for IT education in the Belarus. Anyone can choose courses according to one's preferences and get useful and professional skills. All Belarusian universities offer both higher and post-graduate education in various IT fields. After graduating from university, students become efficient and productive specialists. Competition arises among them for the right to be the best, and this is an excellent opportunity for small and large companies to acquire a sufficient number of specialists in demand.

Secondly, there is a tendency towards expanding relations with foreign countries for joint cooperation. Belarus is becoming an attractive destination for companies from other countries looking for quality IT services at competitive prices. This is an important fact, since it is possible to attract foreign specialists who will share their experience with others, which will increase efficiency. Belarusian IT companies successfully work with customers from all over the world, which contributes to the growth of this area and increasing its international competitiveness.

The third trend is the development of the digital economy, electronic money and accounts. The digital infrastructure of Belarus is progressively developing, which contributes to the growth of online businesses and provides new opportunities for IT entrepreneurs. Today, the process of transition from paper bills to electronic money is inevitable and predictable, and Belarus is not lagging behind in this.

The fourth tendency is an increase in demand for specialists in the field of advanced technologies. Progress does not stand still, and every

year interested specialists implement their ideas and projects, creating new goods, services and products that successfully occupy worthy positions in the global IT market. In Belarus, as mentioned earlier, highly qualified IT specialists are trained, who also have the opportunity to improve their skills and gain work experience, which creates fortunate conditions for the development of these areas both within the country and abroad.

One more point is consolidating the positions of Belarusian IT companies in the global business and labor market. Regardless of the type of activity of companies, such as software development or teaching programming to young people, business in the IT field is attractive and in demand today. More and more Belarusian IT companies are achieving results and success abroad and are increasingly expanding their presence in the world, which affects the increase in IT services and attracting foreign investment, as well as the development of the information society.

Thus, Belarus has everything necessary for creating and developing an IT business. The presence of an educational base, cooperation with foreign countries, the demand for Belarusian specialists and the development of the digital economy are factors indicating its dynamic development and prospects in the future. Today, these components must be used simultaneously, otherwise the efficiency and competitiveness of the country's IT sector will be lower than in other countries. To do this, it is enough to change in time with the circumstances and trends of the outside world and then there will be success. As Winston Churchill said: «The only way a man can remain consistent amid changing circumstances is to change with them while preserving the same dominating purpose» [1, p. 43].

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THE IMPACT OF ARTIFICIAL INTELLIGENCE ON MODERN HEALTHCARE SYSTEMS

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This article delves into the burgeoning influence of artificial intelligence (AI) in revolutionizing healthcare systems worldwide [1]. It explores the manifold ways in which AI technologies are being integrated to improve diagnostics, treatment, patient care, and overall healthcare outcomes.

The study encompasses an in-depth analysis of AI applications in healthcare, their potential benefits, ethical implications, and the challenges associated with their widespread adoption.

Artificial intelligence is increasingly permeating various facets of the healthcare industry, offering innovative solutions for complex issues such as disease diagnosis, treatment optimization, patient monitoring, and administrative processes.

This article aims to provide a comprehensive overview of the current landscape of AI in healthcare and its potential to transform the sector.

The article delves into specific AI applications, including machine learning algorithms for disease diagnosis, natural language processing for clinical documentation, predictive analytics for identifying high-risk patient populations, and robotics for surgical procedures.

It explores how these technologies are enhancing accuracy, efficiency, and patient outcomes while also addressing the challenges and limitations associated with their implementation.

In addition to highlighting the transformative potential of AI in healthcare, the study addresses the ethical considerations and regulatory frameworks that govern the deployment of AI technologies.

It sheds light on issues pertaining to patient privacy, data security, algorithmic bias, and the need for transparent and accountable AI systems in healthcare settings.

Drawing from empirical evidence and case studies, this article presents real-world examples of successful integration of AI in healthcare, showcasing instances where AI-driven innovations have led to improved diagnosis, personalized treatment plans, and operational efficiency in healthcare delivery.

The potential trajectory and advancements in AI technology within healthcare could be explored. This may include the integration of AI with emerging technologies such as Internet of Medical Things (IoMT), blockchain for secure health data exchange, and virtual healthcare assistants.

Furthermore, the impact of AI on precision medicine and its potential to tailor treatment plans to individual patients based on their unique genetic makeup and health history could also be discussed.

It is important to address the potential risks and challenges associated with the widespread adoption of AI in healthcare. This may include the ethical implications of AI decision-making in critical healthcare scenarios, the need for transparent AI algorithms, and the potential displacement of certain healthcare roles due to automation.

Additionally, cybersecurity concerns related to the protection of sensitive health data in AI-driven systems should be highlighted.

An examination of the global perspective on AI adoption in healthcare could provide valuable insight.

This may encompass a comparative analysis of how different countries are approaching the integration of AI in their healthcare systems, considering factors such as regulatory frameworks, infrastructure readiness, and cultural acceptance.

The article concludes with an in-depth synthesis of the key insights, emphasizing the need for a balanced approach in leveraging AI to advance healthcare while mitigating potential risks.

It underscores the importance of interdisciplinary collaboration among healthcare professionals, technologists, ethicists, and policymakers to ensure that AI technologies are deployed responsibly, ethically, and for the betterment of global healthcare.

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THE IMPACT OF ARTIFICIAL INTELLIGENCE IN BUSINESS

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In recent times, Artificial Intelligence (AI) has surged as a transformative catalyst, reshaping conventional business frameworks and methodologies.

Through an intricate exploration of AI technologies' transformative capabilities, this report endeavors to illuminate their ramifications for future competitiveness and sustainability within the global marketplace. Witnessing an unparalleled surge in adoption and expansion across various domains, AI offers unprecedented avenues for streamlining processes, refining decision-making mechanisms, and propelling innovation within organizational settings.

With AI's pervasive infiltration into the business milieu, it becomes imperative to decipher its implications for strategic delineations, market dynamics, and organizational efficacy. This report aspires to dissect the evolving role of AI in business endeavors, thereby shedding light on its transformative prowess and its potential contributions to future competitive prowess and sustainability.

The assimilation of AI technologies into business frameworks has heralded significant enhancements in operational efficiency, productivity, and cost-effectiveness. Through automation, AI streamlines repetitive tasks, curtails human fallibility, and amplifies process efficiency, thereby equipping organizations with the tools to attain operational excellence and secure a competitive edge within dynamic market ecosystems. From streamlining supply chain management to augmenting customer service realms, AI-infused solutions optimize workflows, refine resource allocation strategies, and fortify overall organizational performance, thereby fostering sustained growth trajectories and bolstering profitability metrics.

A cornerstone of AI's integration into business landscapes lies in its capacity to augment decision-making paradigms and inform strategic

initiatives. By parsing voluminous datasets, discerning patterns, and proffering predictive insights, AI empowers managerial cadres to make well-informed decisions, navigate risks astutely, and capitalize on nascent opportunities amidst evolving market dynamics.

Facilitated by advanced analytics and real-time data processing capabilities, AI empowers organizations to glean actionable insights into consumer behavior, market trends, and competitive landscapes, thereby enabling agile decision-making frameworks and facilitating the formulation of adaptive strategies. AI-driven technologies assume a pivotal role in revolutionizing customer engagement strategies and delivering tailored experiences across diverse touchpoints. Leveraging sophisticated data analytics and machine learning algorithms, organizations can gain profound insights into customer predilections, anticipate evolving needs, and customize products and services accordingly. By harnessing AI-driven chatbots, virtual assistants, and recommendation engines, businesses can elevate customer satisfaction indices, nurture brand loyalty, and precipitate revenue augmentation, thereby securing a competitive foothold within saturated market realms.

In summation, Artificial Intelligence epitomizes a seismic shift in the modus operandi of businesses, catalyzing innovation, and fostering heightened competitiveness within the global arena. Through the embracement of AI-driven technologies, organizations can unlock a myriad of growth avenues, operational efficiencies, and value propositions, thereby positioning themselves for enduring success and competitive ascendancy in an era characterized by digital ubiquity and data-centric paradigms.

However, the realization of AI's full potential mandates a strategic approach, ethical stewardship, and sustained investments in talent cultivation and cybersecurity frameworks, thereby ensuring the responsible deployment of AI and maximizing its dividends for enterprises and society at large.

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AUTOMATION OF TECHNOLOGICAL PROCESSES IN THE ENERGY SECTOR

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Fig 1. City in the future

At the moment, the energy sector is actively developing in the Republic of Belarus and this profession is in economic demand in our country, and it is understandable: because my future profession combines such an important aspect as automation, without which the development of any important area for our country in the age of high information technologies is not possible (Fig.1). I would also like to note that, in addition to engineering disciplines, we study many humanities, that at the end of the course of study we can also be not only engineers of our specialty, but also hold managerial positions, this is evidenced by the statistics of graduates, which is available on the BNTU website, which is quite impressive.

Graduates of my specialty receive higher education with the qualification of engineer (Fig.2). These are specialists who can work in the field of electronics, electrical engineering, microprocessor technology, including work with customizable controllers, data transmission through all kinds of communication channels, and also know how to interact and create databases, database systems, computer networks, using modern information technologies and programming methods for work related to design, adjustment, installation and operation of modern automated systems for processing and presentation of information.

Fig. 2. Jobs in the energy sector

In the current conditions, in order to take a leading position in the market, enterprises need to quickly respond to the constantly changing environment, produce a diverse range of products, as well as accurately comply with the timing and volume of orders. Without modern industrial automation, it is impossible to meet all these requirements.

A lot of money is really invested in automation in our country, but its efficiency is invaluable, because we, the people, are able to make a process automatic.

Investing in something new, and I believe this is fundamental for the successful, long-term development of our country, and ourselves as a whole. I really like the fact that I have a great prospect of becoming a versatile engineer who will be able to work in many areas of the energy sector, work where it is interesting, and most importantly, where it is needed not only here and now, but also with a bias towards the future.

CYBERPHYSICAL SYSTEMS: BENEFICIAL PENETRATION

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Cyberphysical systems (CPS) are considered to be a rather complicated ambiguous notion as they are located at the intersection of various subject areas and influence different spheres of peoples' lives. A cyberphysical system can be viewed as a set of closely interrelated computational and physical elements possessing the competences of getting real-time data from the surrounding environment and applying this information for subsequent optimization of the management procedures [1].

Several basic technological conditions can be distinguished in the context of CPS designing and engineering. Firstly, there is a constantly growing number of devices with embedded data processing and storing capabilities and rather branched sensor networks efficiently implemented in practically all developed smart systems and structures as well as enhanced medical care facilities and smart homes. Secondly, there is commonly observed insertion of separate components into much larger systems, such as IoT, World Wide Sensor Net which helps to gain better results and higher productivity. Thirdly, there is an evident limitation of people's memory and cognitive possibilities, that unfortunately develop much slower than those of an intelligent machine. Thus, of course, we are likely to face the situation when humans can no longer perceive and analyse the scope of information necessary to make quick and well thought out decisions and they will have to delegate some of their responsibilities to the CPS, thus eliminating the person from the management loop. However, in certain situations CPS can stimulate and improve person's disquisitive powers therefore we can say that there is an evident need to create interactive frames combining the cooperation of a person and a CPS both sharing their abilities and functionality.

As we have already mentioned above, the operating principle of cyberphysical systems depends entirely on the interconnection and interaction of their physical and computational elements. Artificial intelligence,

performing the function of the system's brains, receives initial data from various input devices, primarily sensors, processes and analyzes this data, and then applies them to subsequent control of physical environment. Based on this interaction, the cyberphysical system can demonstrate high efficiency and reliability under permanently altering conditions, with the operation cycle "Management – data acquisition – data handling – management" achieving highly effective results and each time creating new benefits [1].

For example, Toshiba Company practically implements the principle of cyberphysical systems in its virtual power plant project, which uses Internet of Things technologies to coordinate the operation of the frame consisting of distributed energy sources (solar, hydrogen and wind energy), electric vehicles working on it and energy accumulation/storage units. Using data from IoT devices and AI technologies creates possibilities for enhancing efficiency of energy consumption by the system, predict its development scale and ultimately achieve maximum energy savings.

Among other applications of cyberphysical systems, it is necessary to mention autonomous navigation and vehicle control systems that have the ability to receive real-time road information from other traffic participants and urban road infrastructure in order to choose the most optimal route taking into account the current traffic situation, prevent accidents and ensure the safety of all road users; medical equipment that is capable of remotely monitoring the physical conditions of patients, helping in diagnosing illnesses and conducting surgical operations and manipulations, as well as which can be used to create simulations of situations in order to study the abilities and capabilities of the human body. It can definitely be said that the use of cyberphysical systems facilitates people's lives, increases their standard of living, and creates conditions for the further development and improvement of intelligent systems.

The ability to "make people's lives better and easier" with the help of these systems can be perfectly illustrated by the example of smart cities. According to research statistics, Singapore is considered to be the most intelligent city in the world, while the government, scientists, and programmers are making every effort to further implement the Smart Nation project, which is a joint program of Singapore authorities to develop and improve urban infrastructure. Many innovative start-ups are jointly looking for solutions affecting almost all areas of daily life of city residents:

from law enforcement agencies involved in detecting offenses and taking measures to anticipate and prevent them due to the implementation of a developed autonomous video surveillance system in the city to the management of the urban transport network, as well as energy and water resources distribution, and healthcare. And this brings its own rewards, for example, the traffic management system helps Singapore drivers save thousands of hours a year, and according to the safety ranking made by Economist Intelligence Unit, Singapore is recognized as the safest city in the world due to its extremely low crime rate.

Another option for a "smart" approach to urban planning is the city of Masdar in the United Arab Emirates, which is being built near Abu Dhabi. According to the views of the local authorities Masdar is supposed to become an eco-city that totally meets its needs with renewable energy sources, fully recycles all produced waste and completely abandons traditional modes of transport in favour of public and personal autonomous transport. Of course, the latest technologies, including cyberphysical systems, will be used in Masdar to effectively manage resources and traffic flows.

Summing up, it should be noted that in the last decade cyberphysical systems have made a big leap in their development, which was facilitated by an increase in the number of intelligent devices and systems as well as sensor networks being developed, and their natural integration into larger, more complex systems. But according to Toshiba technical director, Doctor Shiro Saito, the transition to open innovation is very important for the future of these systems. "It is extremely important not to fall into the trap of wanting to achieve everything on your own," he notes [1]. Therefore, companies engaged in the development and implementation of such systems actively invest in the development of modern technologies, support and study all innovative ideas related to artificial intelligence, and cooperate widely with research and educational institutions. The task of such companies is to make the most effective use of modern products and techniques to solve urgent daily socio-economic issues.

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MONEY AND THEIR FUNCTIONS IN MODERN CONDITIONS

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Currently, the topic of money stands as the most significant one matter not only for nations and states but also for individual enterprises and individuals themselves.

Money serves as a means to facilitate exchanges, rendering exchanges in the form of commodities and money: C-M-C, where C represents commodities and M signifies money. Money embodies a distinct and versatile commodity suitable for payments, calculations, and exchange for various goods and services [1].

The application of monetary resources and the intricate dilemmas intertwined with it hold a pivotal role within the operations of economic agents, encompassing not only individual enterprises and citizens but also distinct governmental bodies and nations. Esteemed scholars across diverse fields such as philosophy, history, psychology, and economics devote special attention to examining this paramount issue. Money serves as a fundamental component within the economic life of society and in the relationships among the participants in the processes of reproduction. Money is an essentially integral part of every country. Dollars, euros, francs, rubles, pounds – all these function as a means of payment, accumulation, and circulation. Money stands as a unique tool devised by humans.

Money, despite its positive attributes, carries a downside. Its profound impact on individuals, both beneficial and detrimental, is significant. Overabundance in certain nations can lead to inflation, while some individuals succumb to excessive greed due to its influence.

To tackle the challenges associated with money, governments must carefully regulate its production, and individuals should exercise prudence in earning and spending it.

In today's world, money reigns supreme as an indispensable means for survival. Its significance is paramount, especially in economic discourse, where theories are intricately woven around its essence. The evolution of the economic landscape introduces novel forms of money, streamlining transactions and enhancing overall quality of life [2].

Price, the measurement of goods in monetary terms, is deter-mined by the labor invested in their production and sale, as dictated by societal norms.

The movement of prices adheres to the law of value. Prices are shaped within the marketplace and fluctuate based on the equilibrium between supply and demand, influenced by both the value of goods and the value of currency. When market dynamics fail to match supply with demand, prices deviate from their intrinsic worth, signaling imbalances in production to producers.

Price serves not only as a means to compare labor products but also as fractions of a specific monetary commodity, such as silver or gold. To standardize prices across goods of differing values, they are converted into a common monetary unit.

This standard, often rooted in a metal currency, acts as a benchmark for pricing goods. Money possesses various functions encompassing stability, resilience, and constancy.

In a gold-based system, the pricing standard was established by equating the monetary unit to a specific quantity of gold.

Money defines itself through its primary functions. The primary functions of money include: measure of value; medium of exchange; means of payment; store of value (savings).

The interconnectedness of these functions underscores the essence of money in contemporary economies. Scholars and experts widely regard it as the bedrock of the global economic framework. Devoid of money, the very foundation of economy, production, and industry would crumble, highlighting its status as one of humanity's most seminal inventions.

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УДК 330.33
CIRCULAR ECONOMY: THE PATH TO SUSTAINABLE DEVELOPMENT THROUGH THE 10 PRINCIPLES

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In order to switch to the circular economy model, it is necessary to comply with its basic principles. However, the understanding of them varies greatly among different researchers.

The authors not only name a different number of basic principles of circular economics, but also assign different interpretations.

The most popular categorization, especially in mass media, is 3R: reduce, reuse, recycle [1]. Later studies added additional principles, and 3R was expanded to 4-5R (Shishmareva, A. V.) [2], 7R [3] and finally to 10R (Sohal, A.) [4]. The classification of W. J. W. Vermeulen, D. Reike and S. Vitjes [5] gives an idea of the specific practices of the circular economy:

R1 – Refuse: refusal to use hazardous raw materials or any primary raw materials; avoiding raw material losses through redesign of production processes.

R2 – Reduce: using fewer raw materials per unit of production; or, according to Gâf-Deac I. I., "dematerialization".

R3 – Resell/Reuse: reuse of returned goods or goods with damaged packaging; repeated reuse of packaging; use of recycled materials.

R4 – Repair: transfer of decommissioned products to repair centers; ensuring easy repair of goods.

R5–Refurbish: The overall structure of a large-sized multi-component product remains unchanged, while many components are replaced or repaired, resulting in an overall improvement in product quality.

R6 – Remanufacture: the entire structure of the multicomponent product is disassembled, checked, cleaned and, replaced or repaired.

R7 – Repurpose: products or components are adapted to perform another function.

R8 – Recycle materials: processing of mixed flows of products after consumption or waste streams after production using expensive technological equipment, including crushing, remelting and other processes to obtain (almost) pure material.

R9 – Recover of energy: extraction of energy contained in waste by burning it combined with the generation of energy, purified water or the use of biomass.

R10 – Re-mine extraction of raw materials after the landfill stage; high-tech mining in landfills or urban environments.

Thus, the transition to a circular economy requires an extensive analysis of material flows in order to explore the opportunities of a circular economy in order to introduce ideas for reorganization of business in order to maintain the value of resources.

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COMPUTER VISION SYSTEM OF INTELLIGENT MOBILE WHEELCHAIR

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Nowadays advanced technologies in mechanical engineering lead to improving of mobile wheelchairs constructions. Recently, technologies based on machine learning methods have started to spread widely. Since some people with mobility impairments don't have ability to use manual controls, they require alternative ways to control the movement of their wheelchair.

There are some alternative methods of successful wheelchair motion control. The first way is founded on using of switch built into the back of the chair and controlling of movement by the head or chin [1].

Another way is voice control and BCI (Brain Computer Interface), which pick up signals from the brain through certain stimulation of eyes and control movement using brain signals [1], [2].

The most perspective way of control based on pattern recognition is related with a video cameras employment [3]. Today this technology is the most effective among the others, because it has fewer disadvantages related with imperfections in its construction [3]. A lot of research is dedicated to the development of new algorithms for image processing and decision-making for trajectory planning.

In this thesis the author provides a brief overview and analysis of technical solutions for computer vision systems for mobile wheelchairs.

One of the variants of using computer vision to control a wheelchair movement is the eye tracking system proposed in the article [3]. This system consists of an eye tracking database, preprocessing, eye movement direction estimation and a wheelchair motion control system.

A video camera located at a distance from the body is directed at a person sitting in a wheelchair and transmits his image in real time to the machine learning computing module. This module sends the processed

image to the neural network to obtain the expected direction of eye tracking and transmits the signal to the motion controller. The mobile controller processes the received signal and, depending on the position of the eyes, generates a control signal to the electric wheel drive regulators.

Thereby, the angular speeds and rotation direction of the wheels are changing as well as the position of the wheelchair. The user's eyes conditions and the direction of wheelchair movement are updated on the display in real time [3].

A block diagram of a computer vision intelligent control system of a wheelchair based on eye tracking is shown in Fig. 1.
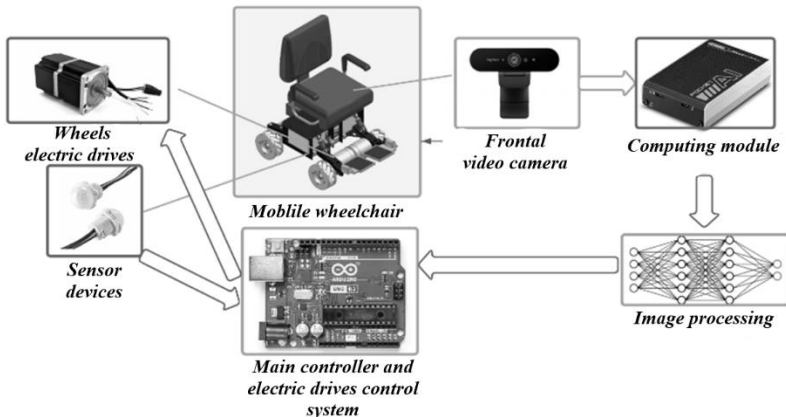
Fig. 1. Block diagram of an intelligent eye tracking system in a mobile wheelchair

After image processing by the mobile computer the command is sent to the main controller to transform the signal into the angular speed of the electric wheel drives and the wheelchair position.

The wheelchair navigation system with a video camera installed in front of the wheelchair user to collect control information is expressed through the horizontal glance direction to guide movement and the blink timing command for commands such as «move forward», «move backward» and «stop» [3].

The same principle proposed in the article [4] is based on egocentric wearable device – a webcam attached on a person's cap or another head-gears. To control a wheelchair movement using egocentric camera control, a person moves his head within a small range to control a virtual

joystick. This joystick tracks head movement and shows information on the front-facing display.

The movement of the human head is insignificant. The front display provides feedback, helping the user to control the robot's motion state and affect it using voice input [4].

The advantage of egocentric control of the wheelchair video camera [4] is the camera ability to monitor the information in user's real-time.

In contrast, front-facing cameras make it very difficult to recognize gestures and faces in real time, and hands-free control methods require the user's full attention while moving.

The disadvantage of such computer vision systems with a front-facing video camera and the movement formation by assessing the glance or facial expressions of a person is the inability of the user to communicate with others while controlling the chair [1]. Also, there is a probability of unplanned wheelchair movement during a random change of the person's face position.

Thus, there are several types of computer vision solutions for autonomous movement control of intelligent wheelchair. The most promising direction in this field is an egocentric control of a video camera.

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LIFE OF CADETS IN KAZAKHSTAN AND BELARUS

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Nowadays it is impossible to imagine life without the military. The military is the face of the country, its pride. Society respects and values such people, because they are often ready to take very serious steps, risking their lives, for the good of their Motherland. But not every person can become a military man. In any country in the world, only a few are accepted into special military institutions. Those who are able to show flexibility, endurance, readiness to make the right decision at any time in a difficult situation, while maintaining calmness, being fearless in battle, especially courageous, and being prepared for difficult working conditions. Also, a military man must have excellent physical fitness and good psychological health.

But even despite such difficulties, many teenagers make a conscious, serious choice: they devote their lives to serving the Motherland and become cadets. Thanks to this, you can build not only a successful career, but also your personal life.

Now let's compare military students' training in the Republics of Belarus and Kazakhstan.

Civilian youth submit an application to the military units of the Republic of Kazakhstan at their place of residence. Next, candidates arrive to take the entrance exams upon written notification from the Military Institute. Already at the Military Institute they are provided with a hostel and free three meals a day. Candidates must bring toiletries, sportswear and shoes.

Applicants undergo professional selection. Candidates pass physical training standards, undergo a medical examination by doctors of the Military Institute and the military medical commission of the National Guard, including a psychological examination for military-professional orientation. All these indicators are considered at a commission meeting.

Recruitment of cadets into military educational institutions of the Republic of Belarus is slightly different from recruitment in the Republic of Kazakhstan. Future cadets submit an application before a certain deadline to the military commissariats of their city. Medical examinations and psychological tests are also carried out there. Based on the results of this examination, they are given a verdict: are they suitable for training in a particular military specialty

As for girls at the faculties of military educational institutions, there are no differences in their recruitment in Kazakhstan and Belarus. They can enter certain specialties by participating in a separate competition. As a rule, few girls are recruited, so the competition is very large. The list of specialties for which girls can apply has now been expanded. Thus, girls, along with boys, have the opportunity to receive additional education in a military specialty close to the profile of the educational institution.

Basic training is not an easy undertaking; it is daily hard work. Officially, basic training is a soldier's initial preparation for military science. He is introduced to military regulations and given basic skills in shooting and marching. Basic training in the Republic of Kazakhstan and the Republic of Belarus has virtually no differences. They have a similar daily routine, which includes getting up, exercising, studying, meals, self-study, and personal time.

Upon completion of Basic Training in Kazakhstan, cadets make a forced march, covering a 40 km path from the field training camp to the Academy. Both boys and girls do an excellent job and on time: 30 days of preparation were not in vain. And in Belarus, cadets centrally go to the training ground or shooting range, perform exercises that they were previously taught during fire training. They also pass control standards in physical education. In both states, the training camp ends with the solemn ritual of the future officers taking the Oath. First-year students will say special words of allegiance in the presence of the commander of the military educational institution, honored guests, as well as their family and friends.

Having entered a military university in any country, the life of a cadet is radically different from the life of an ordinary student. The daily life of a cadet follows the same daily routine. After all, as the great commander. A.V. said. Suvorov: "Discipline is the mother of Victory," discipline and tradition are the basis of everything.

УДК 811.111:339.133.3
THE UNEMPLOYMENT RATE IN
THE REPUBLIC OF BELARUS

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The labor market is an integral part of the market economy and represents a socio-economic form of labor movement. In the labor market, the interaction of owners of means of production with employees takes place, in which demand and supply for labor are formed. At the present stage of development in the Republic of Belarus, the following trend can be traced in the labor market: the demand for applicants in various professional fields exceeds the supply.

Over the past few years, there has been a high demand for employees in the field of sales, information technology, transport, construction, manufacturing, as well as the supply of vacancies for working specialties. The leading position in the structure of vacancies continues to be consistently occupied by the professional field of "Sales". In 2021, the "Sales" were followed in the top 5 by such areas as "Information Technology, Internet, communications", "Working staff", "Transport, logistics" and "Production". In many ways, this trend is dictated by events related to the COVID-19 pandemic and the restrictive measures the period from 2020 to 2022, there is a strong interest among both employers and job seekers in remote work. This is evidenced by the growth of activity taken in vacancies with a remote work schedule. In addition, the development of information technology has made possible to actively hire workers from other regions of the country, since there is no need to allocate separate jobs for a number of specialties [1].

The priority areas of policy in the field of employment promotion include:

• Ensuring equal employment opportunities for all citizens and foreign citizens, stateless persons permanently residing in the country, regardless of gender, nationality, age, social status and religion;

- Compliance with the voluntary nature of work;
- Free expression of the will of citizens when choosing the type of employment;
- Providing social protection in the field of employment;
- Coordination of activities in the field of employment with activities in other areas of economic and social policy.

The socio-economic policy of the Belarusian state is aimed at ensuring effective employment of the population in the republic, reducing unemployment, and increasing incomes of the population. Due to the stable operation of the economy and the manageable situation in the labor market, a systematic reduction in unemployment is achieved. Work is actively underway to support the entrepreneurial initiative of citizens, create new jobs, implement measures to stimulate labor mobility of citizens, promote employment of people who have physical disabilities, and encourage employers who employ young professionals without work experience to jobs in order to acquire skills of actual work in production [2].

Unfortunately, the unemployment rate in the Republic of Belarus is quite high and is about 4.5% at the beginning of 2022 [1].

The fact of unemployment means that the proportion of people who do not have a job and are actively looking for it is quite significant.

The unemployment situation can be caused by various factors, such as economic difficulties, changes in the labor market and other circumstances.

It is important to pay attention to this indicator and take measures to reduce the unemployment rate in the country and to study carefully the situation with this phenomenon.

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УДК 811.111:339.133.3
THE IMPORTANCE OF FINANCIAL LITERACY
FOR A PERSON

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Financial literacy is an important skill that is of great importance to every person. It is also a sufficient level of knowledge in the field of finance, which allows you to correctly assess the situation and make a reasonable decision. Possessing this quality allows a person to make informed decisions related to managing personal finances, investing and planning for the future.

In today's world, financial literacy has become increasingly important due to the increasing complexity of financial markets, the variety of financial products and services, and changes in the economic environment. Having financial literacy allows a person to understand the basic principles of money management, budget planning, effectively use credit products, invest and plan for retirement.

So, where does financial literacy begin?

This issue is extremely important in the modern world, where the ability to manage your finances is becoming increasingly important to achieve financial stability and well-being.

First, financial literacy begins with understanding the importance of managing personal finances. This includes understanding your income, expenses, assets, debts, as well as the ability to budget and manage money.

Secondly, the beginning of financial literacy is associated with the development of basic financial knowledge. This may include learning the basics of finance, learning how to calculate interest, understanding investments and risks, and basic taxation.

Additionally, financial literacy begins with developing financial skills and habits. This includes the ability to plan for the future, manage debt effectively.

It is also important to note that the beginning of financial literacy is associated with constant learning and self-improvement in the field of personal finance. This may include reading specialized literature, attending financial seminars and webinars, and consulting with financial experts. Thus, financial literacy begins with understanding the importance of financial education, lifelong learning, and developing financial knowledge and skills. This is a key step towards achieving financial stability and prosperity in the modern world.

Increasing the level of financial literacy is the key to stability and prosperity. Having learned to manage money correctly, a person gains:

• Financial freedom. Material independence allows you to realize many cherished desires.

• Calmness and confidence in the future. Only necessary purchases are included in the budget. Knowledge and flexible thinking help you adapt to any situation.

• Discipline. This quality helps to systematize all areas of life.

• Respect. Sincere admiration expressed by others significantly increases self-esteem. In addition, people, seeing before them an example of success achieved through self-discipline, understand that everyone can put their finances in order.

• Happiness. Anyone who has got rid of material problems believes in himself, boldly sets ambitious goals, helps others and worries less about the future. Developing financial literacy not only helps you manage your money more effectively, but can also positively impact many aspects of your personal life.

First of all, through the ability to plan and make informed financial decisions, you will be able to have more control over your life. This, in turn, can lead to improved relationships with loved ones and reduced stress in your life. Additionally, developing financial literacy can help you achieve your goals and dreams, such as buying a house or traveling to another country.

It is also important to understand that effective financial management can significantly improve your well-being. Better money management skills can help you save money on purchases and services, as well as optimize your spending overall. So, developing financial literacy has many benefits that can affect many aspects of your life. Don't be afraid to learn and strive to develop your financial knowledge to improve your life.

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THE ORIGINS OF BANKING

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Banking is one of the oldest sciences. It contains the experience of banking institutions over many centuries and sets out the basic principles of the banking system as it developed in all periods of world history.

The word "bank" comes from the Italian word "banco", which means "table". In ancient times, at one table where people gathered, a certain number of people made simple barter transactions using various types of coins (silver, gold and copper), and also handed over valuable goods for a certain period of time to merchants. Such exchanges contributed to the development of trade relations. According to scientists, barter relations were formed in antiquity, namely in slave-owning societies (III century BC); in the 6th century in the ancient Vilonia state, the exchange of goods between people began to develop rapidly and reached an even higher level in the 14th century; in the 16th century in Venice and Genoa there was a constant exchange between people [1]. This also meant that trade between people expanded and developed: in the 20th century, exchange relations between people gradually moved from commodity relations to monetary relations. Money began to be used not only as a means of payment, but also as a means of circulation.

When the first banks used money, they used ships, houses, slaves, and property as collateral. As the business sector developed, banks began to demand repayment (withdrawal) of loans [1]. This became the beginning of the commodity theory of money. Subsequently, this fee increased over the years, and it was precisely this fee that provided the main profit of the bank - its initial capital.

Lending was the bank's first and most useful business. As the second stage developed, banks began to engage in new types of business, such as clearing operations, cashless clearing operations and deposit policy.

Banks are legal entities that collect non-fixed funds of their clients (institutions and individuals) on the basis of the principle of free lending

to institutions, companies, organizations, enterprises, entrepreneurs, individuals and the state on terms of urgency, payment, security, targeted destination and return [1]. In addition, being financial institutions in the economy, banks also carry out operations such as securities transactions, mutual payments and current accounts.

The growing importance of banking institutions is because they play a crucial role in the flow of funds in the state. Banks coordinate the movement of funds in the state, establish the circulation of funds and credit relations, carry out settlement transactions, and provide funds to the national economy conduct transactions with securities and act as issuers.

Firstly, banks are intermediary organizations and perform various tasks. Secondly, banks are enterprises and produce their own products. The commodity used in this business is money (local and foreign currency). Thirdly, the bank's sellers and buyers are its clients.

In addition, in accordance with the Law, for example, of Turkmenistan, "On Credit Institutions and Banking Activities", regulatory legal acts of the Central Bank of Turkmenistan and other regulatory documents, banks provide their clients with non-traditional services, such as preparation of official documents, planning (business plans) and consulting, forms of payment, training and other services. This is non-interest income for the bank and means that contracts and constant contacts with client's play an important role in the bank's activities. They are reliable and mutually beneficial.

Thus,

- the product produced by banks is another product – money in the form of services;

- banks have the right to issue, sell and buy securities and shares in accordance with the law; they also have the right to hold securities of other organizations and individuals and sell them at the request of their clients;

- banks are also known as brokerage houses because they buy and sell government funds and these transactions generate interest income for the bank.

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WE ARE THE PATRIOTS

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Patriotism has always been of great importance for every country; therefore, great attention is paid to it when educating people. Patriots have always been the engine of the state, as they have lived only for the benefit of the motherland. Now patriotism has its own meaning for everyone. For some people, it is love for the motherland, for others it is love for their family. For most of us it is love for our small homeland, the place where we were born; while for the rest, especially for the servicemen, it is selfless service to the country, readiness to protect it at any time if necessary. Over the time, patriotism has lost its significance for the average person. Nowadays, unfortunately, there are fewer and fewer true patriots of their country who are ready to selflessly serve for the benefit of their people and country, but still there are such people.

Military personnel can be considered a fairly vivid example of a patriot. By definition, a serviceman is obliged to be a patriot, always be ready to protect the country and its interests. From history, it can be understood that there are and have been a huge number of true patriots among the military, ranging from ordinary soldiers to generals.

Everybody knows that there is a special kind of a serviceman that every officer has gone through, and this is a cadet. Cadets are those people who have sacrificed many things to serve their country and people. They give their best years of life to the service of the motherland, go through various trials and hardships, realizing that they are doing this for the benefit of their country. The very education of cadets, first of all, is based on patriotism. All kinds of educational and ideological events are constantly held, which instill real patriotism in the cadets. Their course of study necessarily includes subjects and classes that teach them to love their country and to know its history. Cadets always participate in all patriotic events of the country. One example is parades.

The parade is very important from the point of view of the patriotism of the event. Cadets prepare for it long before it begins, it is very hard work, training takes place during the day and sometimes at night, on a regular basis. And although the preparation is very difficult, every cadet gives his best, realizing what pride it is and what importance it has for the country.

A cadet, like every military man in general, is a true patriot of his country. Despite all the difficulties, problems and fatigue, the cadet is always ready to follow all the lawful orders he is given, spending his best years of life on it. Once I.V. Stalin told: "Cadets should be respected at least for the fact that they give their Homeland the most valuable thing – their youth".

But besides the cadets, there is another special kind of soldier who gives up his childhood to serve his country in the future. These are the cadets of Minsk Suvorov military school (suvorovets). Suvorovets have been studying for many years to serve their country from a young age, since childhood they have been going to duties, sleeping in barracks, living according to the interior guard regulation, fulfilling all orders given to them. This is a really difficult test for such a young person, taking into account that at this time all young people of his age are resting, freely doing what they want and do not live according to the daily routine. But this is patriotism, because every suvorovet gives himself entirely to his country. Suvorovets, like other military personnel, participate in parades with adults, and even better, because they always start the parade. Suvorovets participate in absolutely all patriotic events of the country. This all makes them real patriots. As a graduate of the Minsk Suvorov Military school, I personally understand all this, how difficult it is, but still having become the cadet of the Military Technical Faculty, I am eager to further serve my Homeland.

In conclusion, I would like to say, that a soldier is a real example of a patriot. He is always ready to defend the sovereignty, territorial integrity and constitutional order of his country, selflessly serve for the benefit of the people. Every soldier takes the oath, committing himself to do all this. Everyone should understand that a military man is the first one who will come to protect it from the enemy, despite the situation and his personal problems. This is the meaning of patriotism for me, namely, to constantly serve my Homeland and be ready to do everything for my country at a difficult moment for it.

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CRYPTOCURRENCY

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Like the rest of the world, the currency does not stand still and also develops. Despite the creation of electronic computers, cryptocurrency as an independent term began to be used and established after publishing an article on the Bitcoin system of cryptocurrency, published in 2011 in the Forbes magazine. Cryptocurrency continues to occupy a significant place in the modern financial system, attracting the attention of both investors and criminals. One of the serious challenges facing the participants in the cryptocurrency market is an increase in the number of cases of fraud in this area. Fraudulent actions in the cryptocurrency industry take various forms, pose a threat of not only financial security, but also confidence in digital assets.

As with any other new project, everyone wants to make money. In this regard, the creation of a huge number of coins on different platforms is associated, and even famous people launch them. But there are still major giants that in the near future no one will be able to replace.

Bitcoin, created in 2009, became the first cryptocurrency and still maintains the highest popularity. The currency was developed by Satoshi Nakamoto – it is believed to be a pseudonym for a person or group of people, and the exact identity of the developer remains unknown. The Ethereum blockchain platform was developed in 2015. It has its own cryptocurrency Ether (ETH) or Ethereum. It is the most popular cryptocurrency after Bitcoin. Ripple is a distributed ledger system founded in 2012. Ripple can be used to track various types of transactions, not just cryptocurrencies. The company behind the Ripple platform has worked with various banks and financial institutions [1].

Despite the fact that most people are skeptical about electronic currency, you can buy with it. Websites of technology companies and e-commerce, luxury goods, you can also insure yourself with cryptocurrency. If you want to pay with cryptocurrency in a store that does not

accept it directly, you can use a cryptocurrency debit card, for example, BitPay in the USA.

Today there are many crypto billionaires. Changpeng Zhao is the world's richest crypto businessman, the creator and CEO of the world's leading cryptocurrency trading platform Binance, who is also the 19th richest person in the world.

At the end of 2021, the 30-year-old businessman moved from Hong Kong to the Bahamas, a more crypto-friendly region, with his crypto exchange FTX, founded with Gary Wang.

In April 2021, the CEO and co-founder of Coinbase led a direct listing of the cryptocurrency exchange, which was valued at $100 billion. While the company's market capitalization today is about half that amount, it is enough to make Armstrong the third richest person in the cryptocurrency world.

Cryptocurrency investment scam. Cryptocurrencies have become the object of attention not only of investors, but also of scammers in various countries, including the Republic of Belarus.

The relative anonymity and decentralized nature of cryptocurrencies make them attractive to criminals looking to gain unauthorized wealth. In this regard, there is a need to study and combat cryptocurrency fraud in the Belarusian context and the military financiers should be aware of this matter.

One of the most common types of fraud in the cryptocurrency sphere is "phishing" - a type of attack aimed at obtaining confidential information from users, such as logins, passwords, seed phrases, etc. Fraudsters can use phishing sites, emails or social media posts to trick users into gaining access to their cryptocurrency assets.

In addition to phishing, cases of fraud through pyramids or quick profit schemes using cryptocurrencies are also relevant in the Republic of Belarus. Often, scammers offer to participate in dubious investment projects with promises of high returns, but in the end, they disappear with the invested funds.

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BICYCLE IN HUMAN LIFE

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Perhaps one of the most unique and versatile inventions of man is the bicycle. Anyone can ride it, from children as young as 4 years old to older people 70-80 years old.

Officially, the year of birth of the bicycle is considered to be 1817, when the German baron Karl Dreze filed a patent for the Laufmaschine (German "jogging machine"). This model did not have pedals: to move, you had to push off with your feet. After which he gained wide fame and love throughout the world.

But why do people love this invention?

At first, healthy life. During cycling, blood and blood flow supply to the brain increases, which activates receptors and promotes the creation of new brain cells in the hippocampus, the area responsible for memory. It's no wonder that many creative people use cycling to stimulate thinking.

At second, community. A bicycle also has a positive effect on the social side of your life. Cycling is a great way to meet other people who can become friends because you share common interests.

At third, attention. Riding a bicycle is very useful for training your eyes, since you have to constantly monitor the road, switching your gaze from object to object.

At fourth, a particular benefit for children. A bicycle allows you to take children away from modern gadgets and gives them the opportunity to take a breath of fresh air.

So, this invention is really good for our health, not only physically but also mentally. Many creative people prefer to relax by cycling.

Jack London rode every day and once said that it fills life with meaning. He advised driving at breakneck speed for three hours a day and taking a bath upon returning home.

In 2016, Kanye West was in the clinic due to a nervous breakdown, and after being discharged he went for a bike ride.

Katy Perry prefers to ride alone, but ten years ago, she, in the company of then-husband Russell Brand, confidently travelled around New York.

One of the major advantages of the popularity of bicycles is the environmental benefits. The use of this type of transport reduces the volume of harmful carbon emissions by 10,000 tons per day, the publication reports. Given these figures, the popularization of bicycles and the development of appropriate infrastructure are priorities.

In Belarusian cities, the coverage of territories by bike-sharing services is expanding, and the number of charging stations for electric bicycles is also increasing.

The "Belarusian" bike ride is timed to coincide with National Unity Day, which the country celebrates on September 17. In 2023 the bikers rode a symbolic distance – exactly 17 kilometers – to the Trostenets memorial complex. Everyone could take part in this event, at the final point of the route there was a prayer for the unity of Belarus, peace and creation.

There is another wonderful example of using the bicycle. On the 22nd of September Belarusians celebrate Car-Free Day. On this day we give up our personal cars, use public transport, and most importantly, take out our favorite bicycles. With these actions we significantly reduce energy costs, reduce the burden on the environment and get the opportunity to enjoy a wonderful autumn day.

The feast is needed not only to express your concern about the ecology of cities or problems of urban infrastructure. This day gives us the opportunity to look at our daily routine differently. A car, indispensable on long trips, may not be so necessary for a simple trip to the store, or to get to work.

To develop a healthy lifestyle, cycling clubs are being created in Belarusian schools, new bike paths are being built in city centers. Every young family today can have a great time on a bike ride in the park.

In conclusion, it should be noted that cycling is a wonderful activity which not only helps improve your health but also brings you a lot of fun and positive emotions. Therefore, if you have not yet tried this extraordinary activity, it is recommended to do so as soon as possible. Well, just buy a bicycle and go ahead!

NEW TECHNOLOGIES

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We are the generation of the 21st century – the era of scientific and technological progress, therefore technology occupies an important place in our lives. And without them we simply cannot imagine our existence.

Progress is a necessary companion for man. Tools, wheels, machine tools, steam engines – humanity never stands still. And if previously new technologies did not appear so often, in our time the number of useful inventions is increasing every day. New technologies are replacing old ones: today the Internet will not surprise anyone, but driverless cars are a source of great admiration.

I consider myself very lucky to live in the age of technology, the age of amazing inventions and discoveries. Today technology surrounds me everywhere, and I really like it. After all, the purpose of technology is to introduce innovative, improved solutions into the daily life of every person, so that their existence becomes easier, more interesting or more efficient.

For example, the greatest invention, in my opinion, the Internet, has given the world incredible opportunities and changed the life of every person. The advent of the Internet has changed the course of life in literally all areas – business, education and absolutely all other industries. Now many people can work, buy almost everything, study and much more without leaving home or, for example, being in another country.

Many of us have smartphones, laptops, tablets, wireless headphones, speakers and other devices that we easily use every day without even realizing it. The Internet allows us to communicate remotely with friends and keep abreast of all the events happening in the world. Using special applications, we can make and pay for purchases, control household appliances and interactive games, monitor traffic in the city, etc.

I'm glad that technology doesn't stop and continues to amaze almost every day. New and improved models of cars, smartphones and computers appear. Completely new gadgets are being invented, new technological processes are being invented that make our world more and more modern. For example, we are on the cusp of self-driving cars, artificial intelligence, the transition to renewable energy, and much more. All this will allow people to work less and engage more in creativity, family, travel, communicate more, etc. Now humanity stands on the threshold of a new era. The development of artificial intelligence is in full swing. And the possibilities of this technology are truly endless.

Wondering what incredible technologies await us in the future? Probably one of these inventions will be teleportation. Distances will no longer matter; in a second you can be anywhere. So, for the weekend you can fly to relax at sea on the other side of the world. Although why limit yourself to one planet? Along with the development of teleportation, space tourism will also develop. On the same weekend, you can fly to another galaxy to watch two suns or a black hole set. Of course, new technologies will be so fantastic that they will be difficult to predict.

Technology makes our lives much easier. They save time, open up access to new information and expand your circle of acquaintances. Medical technologies keep people healthy and make it possible to take care of their loved ones even from a distance. But all this has a downside. A person becomes too dependent on various devices and stops relying on himself. Therefore, today the loss of a phone can be a real tragedy for many of us, just like a power outage or Internet connection. Instead of doing useful things, people spend time studying other people's pages on social networks and watching various videos on Youtube. We began to communicate less in person and lost interest in books. This can also be seen as a negative consequence of technological progress. However, I am a supporter of the further development of science and the emergence of new developments that can change people's lives for the better.

I think each of us must make his own choice and understand what is important to him personally. I myself definitely won't neglect meeting with friends and going to the library, because it helps me recharge with positive energy and feel uplifted, which technology is not yet capable of giving to a person. But nevertheless we, first-year military students, try to employ all modern technologies available at the Department of Military Engineering.

MILITARY FINANCIERS

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Military financiers are specialists involved in the financial management and control of military organizations and the armed forces. They ensure effective financial management, plan budgets, control expenses and income, and carry out financial analysis and reporting. Military financiers have special education in finance, accounting, economics or financial management. They may also receive specialized military training to better understand the specifics of financial management of military organizations.

Military finance officers are responsible for managing the financial operations of military organizations and armed forces. They oversee budget planning, financial reporting, auditing, and financial analysis to ensure the efficient use of resources and compliance with financial regulations. Military finance officers typically have a background in finance, accounting, economics, or financial management. They may also receive specialized military training to understand the unique financial management requirements of military organizations.

The duties of military finance officers include developing financial plans, monitoring expenditures, managing cash flow, and ensuring financial accountability. They play a crucial role in maintaining financial stability and transparency within military units and supporting overall mission readiness. In short, military finance officers are essential in overseeing financial operations, ensuring compliance with financial policies, and supporting the financial health of military organization

The tasks of military financiers include ensuring financial stability and efficient use of resources to maintain the country's defense capability. They can also participate in developing financial strategies, monitoring budget execution, and preventing financial abuse and corruption. Thus, military financiers play an important role in ensuring financial sta-

bility and effective financial management of military structures. The role of military financiers includes the following aspects:

1. Financial planning: military financiers develop budgets and spending plans for military organizations, taking into account the needs for equipment, weapons, training and other resources.

2. Financial control: they monitor the implementation of budgets, control expenses and income, analyze financial indicators and take measures to use resources effectively.

3. Financial Reporting: military financiers prepare financial reports and documentation for internal management and external auditors, ensuring transparency and accountability in financial transactions.

4. Financial planning in crisis situations: They are involved in the development of financial strategies and measures to ensure financial stability in times of crisis or military action.

5. Financial discipline: military financiers ensure compliance with legislation and regulations in the field of financial management, preventing corruption and abuse. Thus, the role of military financiers is to ensure financial stability and effective management of resources to ensure the country's defense capability.

In the Republic of Belarus, military financiers play an important role in ensuring financial stability and effective financial management of the armed forces. They are engaged in budget planning, control of expenses and income, preparation of financial statements, as well as compliance with financial discipline. Military financiers in Belarus work in the Ministry of Defense and other military organizations.

Military financiers are responsible for the proper allocation of financial resources to provide the armed forces with modern equipment, weapons, as well as for the education and training of military personnel. In addition, military financiers in Belarus can participate in the development of financial strategies and measures to ensure financial stability in crisis or conflict situations. They can also be involved in preventing corruption and abuse in financial management. Thus, military financiers in our country perform important functions to ensure financial stability and efficiency. They play a crucial role in maintaining financial stability and transparency within military units and supporting overall mission readiness. In summary, military finance officers are essential in overseeing financial operations, ensuring compliance with financial policies, and supporting the financial health of military organizations.

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TYPES OF TIMING DRIVES: REVIEW AND ANALYSIS

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The timing drive is a crucial component of an internal combustion engine responsible for controlling the opening and closing of valves.

There are several types of timing belt drives available, including belt and chain drives, and drive combination. Each type has its unique features, advantages, and disadvantages you need to consider while choosing the most suitable option based on specific requirements and operating conditions.

The belt drive for the timing system consists of a belt, pulleys, and a tensioner. The belt is typically made of rubber with textile inserts or steel reinforcement.

Belt drives are easier to install and maintain compared to other drive types. They provide smoother and quieter operation of the timing system, which is essential for driver and passenger comfort. These belts are less expensive to manufacture and replace compared to chains.

However, the belt drive also has some drawbacks. It has limited strength compared to chains and may require more frequent replacement. Besides, under high loads or improper installation, the belt may slip on the pulleys, leading to timing system failure.

The chain drive for the timing system consists of a chain, sprockets, guides, and a tensioner. The chain is usually made of special steel, providing strength and durability. Chain drives are highly resistant to wear and can last longer than belt drives. They can transmit high torque and ensure precise valve control even under extreme conditions.

However, the chain drives also have some drawbacks. They require a more complex tensioning and lubrication system, which may result in additional maintenance costs.

Chain drives are typically heavier compared to belt drives, which can negatively impact the overall engine weight and vehicle efficiency. Be-

sides, they can generate more noise and vibrations compared to belt drives.

The drive combination for the timing system is a combination of belt and chain drives. In this configuration, the belt is used to transmit power from the crankshaft to the camshaft, while the chain is used to transmit power from the camshaft to the valves.

The drive combination combines the advantages of both types of drives: enhanced reliability and quieter operation. The drive combination is often more reliable as the belt and chain work in a complementary manner, ensuring stable power transmission.

The use of a belt in the drive combination helps reduce noise and vibrations.

However, the drive combination has some drawbacks:

-    more complex design. The drive combination requires a more complex tensioning and lubrication system since it involves two types of drives.

-    higher costs. The drive combination may be more expensive in terms of production and maintenance compared to individual belt or chain drives [1].

The choice between belt and chain drives, and drive combination for the timing system depends on various factors, including requirements for reliability, durability, noise, costs, and operating conditions.

Belt drives are typically preferred for simple and cost-effective applications, chain drives are better to use in high-load and demanding conditions, while the drive combination can be a good compromise, providing reliability and noise reduction.

When selecting a timing drive, it is recommended to consider the specific requirements and characteristics of each particular case [2].

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УДК 662.75
BIOFUELS: POTENTIALS AND SOLUTIONS

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Diesel pollution is typical for all-natural environments - air, soil and water. It occurs in different ways, but has the same effect on the change of population mortality - it increases with the growth of petroleum fuel consumption. One possible solution to this problem is biofuel.

Biofuels may be used in cars, trucks, airplanes, and marine transportation as an alternative to traditional petroleum fuels. It can be used to generate electricity and heat on farms and industrial plants. Sometimes biofuels can be used to heat and power buildings.

The most popular types of biofuels are biodiesel and bioethanol.

Ethanol can be obtained from biomass by hydrolysis and fermentation of sugars. To extract sugars from the biomass, it is pretreated with acids or enzymes to reduce the size of the feedstock and restore the structure of the plant. Cellulose and hemicellulose are broken down by enzymes or dilute acids to sucrose, which is then digested into ethanol.

Biofuel feedstocks include vegetable oils: rapeseed, soybean, peanut, palm, sunflower, olive, and animal fats. Thus, the source of biofuels is a renewable resource, and the plants that serve as feedstock for biofuels improve the structural and chemical composition of soils in crop rotation systems.

Plant-based biofuels are the cheapest and most accessible renewable sources of energy. Plants provide a large increase in biomass, ten times higher than the consumption of fossil fuels, but unlike petroleum, plants absorb carbon dioxide from the air to grow, so burning biofuels does not cause the greenhouse gases accumulation in the atmosphere [1].

Biofuels can be used either blended with conventional fuels or in pure form to replace these fuels. For example, biodiesel can be added to conventional diesel fuel or used instead of it in certain proportions, and bioethanol replaces gasoline.

The potential reduction of greenhouse gas emissions is one of the main reasons, especially in Europe, for using biofuels as an alternative to conventional transportation fuels. In other countries, biofuels are supported to a greater extent because of their potential to increase energy security, i.e. to reduce dependence on energy imports.

According to the International Energy Agency, there was a significant increase in biodiesel and renewable diesel production in 2021 compared to 2019. This growth is driven by demand for renewable diesel in the US and biodiesel in Asia.

In Belarus, biomass accounts for 97% of renewable energy sources. Mainly, it is wood, and about 3% is solar and wind energy. Fuel pellets made from local fuel have become a promising area [2]. Biofuels play an important role in agriculture and energy sector. Biofuels are produced in the country from agricultural crops such as rapeseed, sunflower, and others. Biofuels are used to produce biodiesel, electricity and heat.

In addition, a program of the Belarusian government encourages the production and use of biofuels as part of sustainable development and reducing dependence on petroleum products.

Despite the benefits, biofuels have disadvantages. Growing plants for biofuel production can be competitive with food production and can increase food prices. It requires large areas of land, which can strain and destroy ecosystems. Growing plants for biofuel production uses large amounts of water, which can result in water scarcity and conflicts over water. In addition, growing plants for biofuels may require the use of fertilizers and pesticides, which can lead to soil and water pollution. Biofuel production can cause soil erosion processes.

However, despite all the advantages, the production and use of biofuels requires careful analysis and consideration of their potential negative impacts on the environment, social welfare and economy.

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INNOVATIVE TECHNOLOGIES IN
AUTOMOTIVE INDUSTRY

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The automotive industry is in a period of intense technological progress, which is transforming cars from a means of transportation to centers of innovation and technological advancements. The use of the latest technologies in the production and design of automobiles not only increases their efficiency, but also opens new horizons for the development of the entire industry.

One of the most significant developments in the automotive industry in recent years has been the electric revolution. Leading car manufacturers are actively investing in the development and production of electric cars, as well as creating the necessary infrastructure for their maintenance and battery charging. The introduction of electric car technologies requires not only the development of highly efficient and environmentally friendly engines, but also the creation of advanced energy storage systems, as well as the development of charging infrastructure.

Another key area of development for the auto industry is the use of autonomous technologies. Manufacturers are increasingly incorporating self-driving systems that allow cars to move around without constant monitoring by the driver. This requires the use of advanced sensors, cameras, radars and lidars, as well as the creation of machine learning and artificial intelligence algorithms to process data from the devices [1].

Also, an important part of innovation in the automotive industry is the development of the Internet of Things (IoT) and communication systems. Modern cars are equipped with network modules that allow them to communicate with other devices and systems. This opens up a wide range of possibilities for creating smart vehicles that can adapt to different conditions on the road.

Communication systems also play a key role in ensuring safety and comfort in cars. They allow the vehicle to receive data on road conditions, weather forecasts, as well as information on traffic jams and emergencies. This helps drivers make more informed decisions and avoid potentially dangerous situations.

Robotic systems are used to perform various tasks in the production process, from assembly and welding to machining and packaging. This increases the speed and accuracy of production and improves the working environment for employees.

In the area of materials and manufacturing technologies, innovation plays an important role in the automotive industry. The use of lightweight and strong materials such as carbon fiber and aluminum contribute to the energy efficiency and performance of automobiles. Additionally, the use of 3D printing and other advanced manufacturing technologies helps reduce manufacturing costs and speed up the development of new models [2]. 3D printing technology is becoming increasingly popular in mechanical engineering. It enables the creation of complex parts that were previously difficult to produce. This reduces the development time and improves flexibility in manufacturing.

With the growing awareness of climate change, automakers are increasingly turning their attention to creating sustainable solutions. This includes switching to electric and hybrid engines, as well as developing more efficient waste management and recycling systems, and creating green manufacturing processes.

These and other innovations continue to change the engineering industry, making it more efficient, environmentally sustainable and competitive. The use of innovative technologies in the automotive industry presents the industry with great opportunities for growth and modernization. From electric vehicles to autonomous technologies, from the Internet of Things to new materials, all of these innovations are contributing to safer, more efficient, and more sustainable vehicles that will change the way we think about transportation and mobility in the future.

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HOW CAR MANUFACTURERS TAKE CARE OF
THE ENVIRONMENT

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Pollution of the environment by harmful substances emitted by cars is considered the most urgent and serious problem in the modern world. A car is a very convenient, comfortable and fast means of transportation both in the vicinity of a small town and over long distances. But using them in such large quantities brings great harm to the environment.

One of the main causes of environmental pollution is the release of harmful substances into the atmosphere, such as nitrogen oxides, hydrocarbons, carbon dioxide and others. All these substances are very dangerous for both animals and plants, as well as for humans. Such substances pollute the air very much, contribute to the formation of acid rain and smog. All this has a great impact on human health, in particular on the respiratory and cardiovascular systems, can cause allergic reactions of the body, as well as other serious diseases.

One of the most harmful and dangerous substances that a car emits into the atmosphere when the engine is running is nitrogen dioxide. There are very few nitrogenous compounds in the fuel itself, but at high engine operating temperatures, oxygen begins to react with nitrogen in the atmospheric air, and harmful substances are released during their reaction, they are also called exhaust gases. This problem is typical for diesel engines. But chemical engineers took care of this problem and found a way out how to protect nature from such dangerous substances.

The AdBlue reagent is an additional liquid that is used to clean exhaust gases. This liquid colorless reagent is an aqueous solution consisting of high-quality and purified urea, namely 32.5%, and demineralized water by 67.5%. It is manufactured according to the requirements of the ISO 22241 standard [1].

What is urea? It is an organic chemical, its chemical formula is CH_4N_2O. Urea consists of carbon, nitrogen, oxygen and hydrogen atoms. It is a colorless crystals or white powder, very soluble in water.

AdBlue is a modern environmental lifesaver. It is a liquid additive used to reduce emissions of hazardous substances released by diesel engines.

AdBlue reduces nitrogen oxides in diesel exhaust by more than 90%. This reagent is fed into the exhaust gases using a complex SCR system. When reacting with nitrogen oxides, this liquid creates pure nitrogen and water vapor.

Over time, the car gets rid of the purified exhaust gases.

This technology, using urea neutralization of nitrogen oxides, is called Selective Catalytic Reduction (SCR). It is known to be actively used by a large number of large automotive companies, both for trucks and passenger cars.

There is a separate tank in the car for AdBlue, which is located next to the fuel tank. It is important to know that in order to simply start the car engine, the tank is to be always filled with AdBlue of the required licensed quality.

The use of licensed quality is justified by very serious requirements for the purity of the product since the SCR technology is very sensitive to minimal contamination. And because of this, the slightest impurities will cause the entire system to fail. In this case, the car engine cannot even be started. To do this, the exhaust gas purification system continuously monitors the level in the tank, the amount and dosage of AdBlue.

AdBlue and SCR technology are an easy solution to a modern and urgent problem. Only the joint efforts of many large automotive companies and chemical engineers will make it possible to cope with the vehicle air pollution problem and ensure a healthy and safe environment for future generations.

It is also necessary to improve and modernize technologies so that cars in the future are considered to be the most environmentally friendly means of transportation.

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УДК 004.8

ARTIFICIAL INTELLIGENCE IN CARS

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Artificial Intelligence (AI) is transforming transportation by optimizing traffic flow, creating autonomous vehicles, and enhancing safety systems. In contemporary technologies, AI predicts maintenance needs and prevents accidents. Looking ahead, AI will advance autonomous systems, personalize mobility services, integrate with smart infrastructure, and promote environmental sustainability. AI is reshaping transportation for efficiency, safety, and sustainability.

Autonomous vehicles rely on sensors like cameras, radar, and lidar to perceive surroundings. Artificial intelligence processes this data for real-time decisions on steering, acceleration, and braking, enabling autonomous navigation. Leading autonomous vehicle developers include Tesla, Waymo, Uber, Cruise (a subsidiary of GM), Aurora, and Zoox [1]. Each presents different approaches to autonomous vehicle technology for cars, trucks, and even flying taxis.

Advantages include enhanced road safety, increased efficiency (e.g., reduced travel time and fuel consumption), and improved accessibility for people with disabilities. However, risks such as potential cyber-attacks, legal issues, and ethical and social concerns regarding safety and reliability exist with autonomous transport.

Smart city systems utilizing AI for traffic management optimize road traffic by analyzing real-time data from various sources, predicting congestion, regulating traffic lights, and optimizing routes. Examples include traffic prediction systems like Google Maps and Waze, adaptive traffic signal control systems like SCATS, and route optimization platforms like TomTom and Moovit [2]. These systems reduce travel time, congestion, fuel consumption, and improve air quality while enhancing road safety. However, challenges include reliance on accurate data, pri-

vacy concerns, high implementation costs, and the risk of technological disruptions or cyber-attacks.

AI optimizes logistics through demand forecasting, route planning, and warehouse management. For instance, it predicts demand accurately, helping companies like Amazon and Walmart optimize inventory levels. AI also optimizes delivery routes for companies like UPS and FedEx, reducing fuel costs and delivery times.

Additionally, it improves warehouse efficiency, reducing costs and enhancing order fulfillment accuracy. AI offers benefits like increased efficiency and reduced costs, but challenges include the need for high-quality data and initial investment costs. Careful implementation is crucial for successful integration.

AI enhances transportation safety and reliability by preventing accidents, predicting technical failures, and ensuring cybersecurity. For instance, AI analyzes real-time sensor data to detect hazards and alert drivers or autonomous vehicles, as seen in Tesla's Autopilot system [3]. AI also predicts technical failures by analyzing sensor data, enabling proactive maintenance to ensure the reliability of transportation systems. Additionally, AI-driven cybersecurity solutions protect against cyber threats, such as hacking attempts on autonomous vehicles or traffic management systems. Overall, AI offers promise in improving transportation safety and reliability, but ongoing research is needed for effective implementation.

AI enables personalized transportation solutions by analyzing user preferences and real-time data, seen in ride-sharing platforms like Uber. Companies like Waymo and Cruise are developing AI-driven autonomous vehicles for personalized transport. Benefits include convenience and efficiency, but risks include data privacy concerns and questions about system reliability and safety. Ethical issue is crucial for its success.

Hypersonic transport vehicles, like the Hyperloop, operate on the principle of vacuum tubes where capsules move at high speeds due to reduced air resistance. These systems employ magnetic levitation to keep the capsule inside the tube and electric motors for propulsion. Potential applications of hypersonic technologies such as Hyperloop include high-speed passenger transportation for long distances, significantly reducing travel time between cities. Additionally, hypersonic systems can be utilized for freight transportation, accelerating deliveries and reducing logistics costs.

However, the development of hypersonic technologies faces several challenges and opportunities. These include the need for infrastructure investments, the development of safe and reliable life support systems, and addressing legal and regulatory issues associated with the introduction of new transportation modes. At the same time, the advancement of hypersonic technologies opens up prospects for creating new markets and innovations in transportation, providing environmentally cleaner and more efficient transportation methods [4].

In summary, artificial intelligence (AI) plays a pivotal role in modern and future transport technologies, revolutionizing various aspects of transportation. From optimizing traffic flow and enhancing safety to enabling autonomous vehicles and personalized mobility solutions, AI promises to reshape the transportation landscape. However, as AI continues to evolve, it presents both opportunities and challenges, including the need for ethical implementation, addressing privacy concerns, and ensuring reliability and cybersecurity. Overall, the integration of AI into transportation systems holds immense potential to improve efficiency, safety, and sustainability, driving innovation and transforming the way we travel in the years to come [5].

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SOLAR ENERGY USE EFFICIENCY IN TRANSPORT

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Solar energy is certainly one of the most promising renewable energy sources today. As the development of cars and other electric vehicles only increases, the next logical step is the ability to charge them in a more environmentally friendly way thanks to solar energy.

In recent years, technology in mechanical engineering has been developing at a breakneck pace. Combined with the depletion of natural resources, switching to electric vehicles seems like a more than reasonable choice for humanity. It can be noted that although electric vehicles require a lot of electricity to operate, they are a less polluting mode of transport. But today we know how to produce electricity from renewable energy sources, i.e. solar energy [1].

Charging stations powered by photovoltaic panels can be used as slow or fast charging for all electric vehicles, regardless of their brand. This solution is often intended for individuals: you will have to install your own panels and charging station for your own consumption.

There are several methods for charging electric vehicles using solar panels, these are virtual solar charging and direct self-consumption.

The first method uses a virtual storage system, which is sometimes used for self-consumption PV installations. The principle is to feed excess electricity directly into the grid so that it can be used and therefore not wasted. Essentially, energy is not "stored" but is an alternative to using batteries, which are in limited production. The goal here is to use this virtual storage to power electric charging stations in close proximity to the PV park. Through these terminals it will be possible to charge cars. Some companies have already started developing similar projects, such as Tecsol and Sunchain with Mobelsol.

The second way to charge electric vehicles with solar energy is through direct self-consumption. This involves installing solar panels

directly at the charging point to power the charging stations. This is a solution that can be particularly effective for companies with a large area, especially on the roof of premises where many panels can be installed. Some also choose to build EV parking areas that can accommodate solar panels, such as at carport level. Thus, there may be enough power to power charging stations. Example: SAP in France.

The introduction of solar panels makes it possible to increase the range of vehicles and at the same time do without recharging traction batteries from a traditional electrical network.

The use of solar panels is a far-reaching trend in the energy sector, but, unfortunately, many conditions do not allow transport to immediately switch to the use of such systems.

Firstly, good battery performance is ensured only in clear and sunny weather. Secondly, this is the financial side of using solar panels, despite the fact that the energy is generated for free, the solar panels themselves are not cheap.

Untreated solar panels can cause hazardous environmental consequences due to the harmful substances they contain, such as cadmium, lead and fluorine compounds, which can dissolve and pollute the environment [2].

The question is, are solar cars a dream or a reality? Modern technology is far from allowing a vehicle to run solely on solar energy. The main problem is the lack of space, since full self-consumption will require much more than one or two solar panels. However, some companies, such as Hyundai and Lightyear, are developing hybrid models that can add several miles to your driving range. In any case, it is now difficult to expect the development of 100% solar cars in the near future. Let's see what happens in a few decades.

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INTEGRATING MODERN TECHNOLOGIES INTO SUPPLY CHAIN

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Supply chains in today's world are becoming increasingly complex and dynamic. This is increased global competition and because of rapid advancement of technology.

Integrating modern technologies into the supply chain management represents a necessity for companies in order to remain competitive. Below the main trends and challenges of this process are mentioned:

1) artificial intelligence (AI) is involved in the entire supply chain, not only in inventory optimization and demand forecasting, but also in resource management and logistics in general. Machine learning algorithms and data analytics allow companies to adapt to variable market conditions, predict customer needs, and optimize production processes. The application of AI also helps automate routine tasks, which frees up resources for more strategic actions [1];

2) internet of things (IoT). The Internet of Things plays a key role in increasing transparency and efficiency in supply chains. Sensors and special devices connected to the network can help companies track the movement of goods. But this is not their main function, with their help it is possible to control the storage conditions and the condition of the equipment. This does not only enable rapid response to problems, but also prevents loss and damage to goods;

3) blockchain technology. With the help of this technology, the company will provide itself transparency and security to the supply chain.

The decentralized and impossible to change nature of blockchain ensures data reliability, allowing all supply chain participants to monitor and confirm transactions.

This is extremely significant for international shipments, where participants may be located in different jurisdictions and documentation is often at risk of tampering or loss.

The logistics supply chain may face some problems, even in spite of the potential benefits:

– cultural and organizational obstacles: work processes and corporate culture also require the introduction of new technologies. Some employees may experience resistance to new systems and procedures [2];

– data security: as the volume of data transmitted and stored in logistics chains increases, the risk of information leakage increases. Companies should pay special attention to data security and protection against cyber-attacks and information leaks.;

– integration of legacy systems: many companies face the problem of integrating new technologies due to the use of outdated information systems. This can require significant investment in infrastructure upgrades and staff retraining;

– training and supporting staff: employee training and a support system are essential to the successful implementation of new technologies. Management must actively support the change process and provide resources for training.

In conclusion, it is necessary to say that integrating modern technologies into the supply chain represents not only an opportunity to improve efficiency and reduce costs, but also a necessity to remain competitive in a rapidly changing business world. Properly harnessing the potential of these technologies requires not only technical skills, but also managerial flexibility and a willingness to change. Companies that can successfully overcome the challenges of integrating technology into their supply chains will gain a significant advantage in the marketplace [3].

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CHOICE OF CARGO ROLLING STOCK

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Rolling stock is the main element of transport logistics. It is part of the transport system designed for the movement of goods and passengers.

The rolling stock consists of a variety of vehicles. Vehicles are technical devices used for carrying goods and passengers, they are motor vehicles such as tractors, self-propelled road-building machines, aircraft, ships, railway rolling stock. There can be road and off-road vehicles.

The rolling stocks of road transport are cars, articulated lorries, trailers and semi-trailers. The rolling stock is used for transport and non-transport functions: transportation of goods, passengers and special equipment for various operations [1].

The choice of rolling stock depends on the weight of the cargo to be transported. The carrying capacity of the rolling stock is divided into different categories:

- rolling stock of especially small capacity. It includes cars with a capacity of 0.5 tons;

- rolling stock of light capacity. It includes cars with a capacity of 0.5 to 2 tons;

- rolling stock of medium carrying capacity. It includes cars with a capacity of 2.1 to 5 tons;

- rolling stock of high carrying capacity. It includes cars with a capacity of 5.1 to 15 tons;

- rolling stock of particularly large carrying capacity. It includes cars with a capacity of more than 15 tons [2].

There is another classification of the rolling stock depending on the type of cargo transported. The first one is a general-purpose truck. These are on-board trucks carrying all types of goods in pack-ages.

To carry liquid goods, a tank-vehicle or a tractor with a tank-trailer are used. If bulk cargo is required to transport, dump trucks are used. A dump truck is a car with a special body for bulk cargo, intended for side and rear unloading.

Refrigeration vehicles or road trains with a refrier trailer are used for the transport of heat-sensitive goods. The refrigerant maintains the desired temperature for the products throughout the transport time [3].

There are separate vehicles for the transport of logs, such cars are called logging trucks. They are often equipped with manipulators for loading logs onto the trailer.

There is also a specialized transport required for transporting a certain type of cargo, e.g. a garbage truck. The category «off-road mobile machinery» is a vehicle with or without bodywork, which is not designed to carry goods on the road.

Freight in rail transport is carried by freight trains. The locomotive can pull cars, for different types of cargo. There are different types of wagons: tanks for liquid goods, bulk wagons for semi-wagons, platforms for very large and heavy loads. In maritime transport, different types of cargo are carried by different vessels. Tankers are used for liquid cargo. Container ships or barges are used for goods in packaging [4].

Thus, the main parameters for the choice of rolling stock are the volume and mass of the cargo, the type of cargo, as well as the conditions of carriage. Depending on the task, road, rail and sea transport is used.

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УДК 656.7

UNMANNED AERIAL VEHICLES

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Unmanned aerial vehicles are a mechanism that implements specific goals without the presence of personnel on board. The UAV has an engine and rises into the air due to the action of aerodynamic forces. Regulation occurs in a speed coordinate system. This system involves expansion along three axes: x (in the direction of movement), y (perpendicular to the Ox axis), z (directed along the wing).

UAVs are superior to manned aircraft in lower maintenance costs. Quadcopters, multicopters, fixed-wing aircraft and helicopter-type unmanned aerial vehicles are among the most common uncrewed devices. Autopilot, control center where the drone operator is located, sensors that provide maximum navigation accuracy and prevent collisions, a communication system without which remote control would be impossible, a power source, a navigation system, a propulsion system – all this is an integral part of this device.

Drones are used in various spheres of life: military, civil, scientific, etc. The main methods of their use are photo and video shooting, which allows you to create high-quality photos and videos even at high altitudes. Data collection, searching for people, mining, cargo transportation are actively used in the fields of energy, construction, architecture, geodesy and logistics. This innovation is often used as single-use or multiple-use targets. Drones are a great aid for emergency services because they provide a wide view of the area [1]. But there are also disadvantages to using this technology: people become unemployed whose work was based on driving; possible device hacking, surveillance, loss of private information, puts people at risk if the drone is operated by a person without experience.

There are many subtypes of drones that are special in their own way. For example, multi-rotors with multiple spinning propellers are gaining fame for their stability in the air; fixed wing drones, they have fixed

wings, and their distinguishing feature is the ability to cover long distances; designed for take-off and landing, single-flow, single-rotor drones are stable and smooth when moving through the air. Also, such a device differs in weight and size: microdrones are considered the lightest and most compact, their weight is up to five hundred grams, and their diagonal is up to one hundred millimeters; mini-drones are also small, weigh reaches up to five hundred grams, and with a diagonal reaches up to two hundred and fifty millimeters; heavy drones are extremely large, their weight starts from three kilograms, and diagonally starts from five hundred and fifty millimeters [2].

The improvement of innovative technologies does not stand still. Every year new devices appear that become smarter and more efficient in their work. Let's take a look at some of them: AI drones. This technology can detect other drones during flight and allows data to be analyzed and recorded on the ground; portable interceptor drone – the UAV allows you to destroy other drones, land on an inclined surface, and much more [3].

There are certain standards for the use of drones in each country. The purposes of introducing such rules are diverse. They are used to protect airspace, private property, public safety.

Protection of personal data is a key problem when using an unmanned aerial vehicle. Since this device is equipped with cameras, it can take pictures and record videos, which helps in collecting various information: they can collect personal data, disclose trade secrets, find out the geographical location of something. Another problem is secure data transfer, as hackers can easily hack the device and use it for personal purposes.

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УДК 339.562.2
CHANGES OF CARGO FLOWS IN THE REPUBLIC OF BELARUS AND THE RUSSIAN FEDERATION

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It isn't a secret that the movement of cargo flows is one of the essential parts of today's world economy. Millions of tons are delivered every day in each part of the world.

Historically, a huge amount of the cargo flows has been connecting West Europe and CIS region. But, nowadays, the trend has changed. More and more cargo changed its direction. In essence, the end consumers are still the same, but the supply chain has increased several times, that's why transport costs are increasing too.

For example, oil trade. Before 2022 Russia was able to trade with European countries using pipelines «Druzhba» and «Yamal-Europe». The main customers were Poland, Czech Republic, Slovakia, Germany and Hungary. Under the sanctions Russia redirected its oil to the South and East.

In 2023 the main consumers of the oil were China, India and Turkey. In fact, that year India and China imported about 90% of all Russian oil. They, in turn, sold the given oil to Europe. Therefore, the supply chain has grown and transport costs too.

Under the sanctions the movement of cargo flows has changed in Belarus too. In 2023 Belarus completely reoriented trade flows from the West Europe by increasing the share of export to the East by 14%. It happened due to increased supplies to Russia and Asian countries. Exports from Belarus to Asia increased by 1.5 times, North and South America – 1.4 times [1].

As an alternative the «North – South» transport corridor can be used. The «North – South» transport corridor, which the shippers want to use for the delivery of goods from Russia to India, remains the most promising destination for cargo transportation. The path will pass through Iran

and Azerbaijan. The new corridor reduces the delivery time from Russia to the western regions of India by at least two weeks (Fig.1).

The problem is that the future of the «North-South» corridor is mainly linked to the railway and maritime section of the Caspian Sea [2].
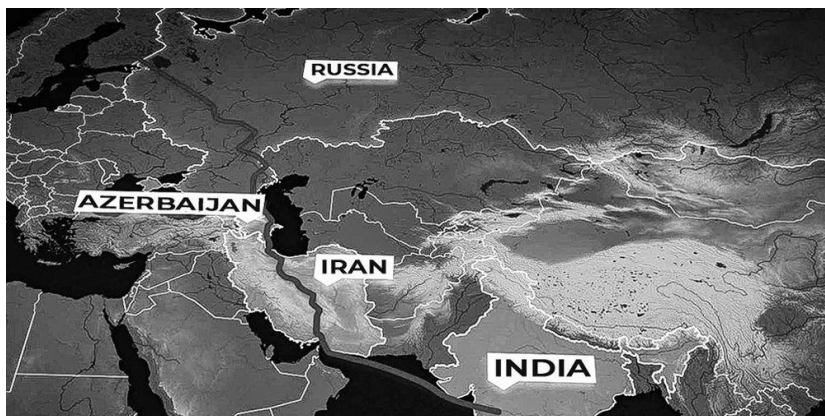
Fig. 1 – «North – South» transport corridor [3]

That's why, today, due to the geopolitical situation in the world, commodity flows are changing their direction, that leads to the development of new routes for transportation.

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FATIGUE MONITORING SYSTEM
AS A WAY TO MAKE THE ROAD SAFER

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The driver fatigue monitoring system is something that has just recently appeared on the market and is ready to boost sales. This system has many advantages, but one of the most important is that it can easily prevent an accident by monitoring the driver's face and eyes.

Driver fatigue is one of the most common causes of accidents after a long day of work or a long trip. This fatigue is the reason that the driver may gradually fall asleep during the trip or lose control of the car due to a drowsy state. Scientists have been thinking about solving this problem for a long time. And recently, a new device that monitors facial expression and eyes in order to get rid of this problem has appeared on the market. The device has received a simple name, i.e. a driver fatigue monitoring system.

A driver fatigue monitoring system is a technology that is used to determine the level of fatigue and attention of the driver while driving a vehicle [1]. This device looks like a video recorder and monitors the driver's face. The device will play a sound signal to prevent a possible accident if it detects from eye movements and facial expression that the driver is distracted or falling asleep. In addition to the driver control, this system also monitors the force of pedal pressure and the amplitude of the steering wheel movement [2], which allows to predict the movement of the car and what can be expected in the near future.

There are also certain types of this device, which monitors not only fatigue, but also traffic violations, for instance, talking on the phone while driving.

Despite the fact that the system has only recently appeared, some car brands are already successfully integrating this function into a new car

model. These car brands are Mercedes-Benz, Volkswagen, Skoda, Volvo, etc.

In the same way, improvements to the already created system are gradually being implemented in order to maximize road safety.

This system is mainly aimed at controlling driving alone, because when traveling with passengers, the probability of an accident due to fatigue is significantly reduced, as in this situation passengers do not allow the driver to fall asleep. It is no less useful if the issue concerns public transport or truckers. In both cases, drivers are behind the wheel for a long time. With longer transportation, human attention becomes significantly worse. The most important aspect is public transport, because in it the drivers are responsible not only for themselves, but also for the passenger he is driving. Therefore, the implementation of this system into public transport will be the best solution for the passenger's safety.

The driver fatigue monitoring system is a very important invention that will make road traffic safer. In addition to the fact that this system monitors the driver's facial expressions and eyes, it can also monitor other factors of traffic violations or fatigue when travelling long distances.

It is also important that this system is beginning to spread throughout the world. Therefore, more and more roads are becoming safer and better. In addition, this system has many analogues. Perhaps in the near future this system will be in every car. Many people will be no longer afraid of the roads, because the risk of getting into an accident will be significantly reduced.

Many people will decide to buy a car because they will be sure that fatigue after a hard day will not affect the safety of other people. The number of advantages of this system is very large, which indicates innovation.

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УДК 656.13
INTELLIGENT TRANSPORT SYSTEMS

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Transport system is an integral part of people's life. All of us use transport directly or indirectly every day: to get to the right place, or to deliver something. To ensure uninterrupted traffic flow we should get rid of traffic jams, reduce the number of accidents and simply make conditions for drivers and pedestrians more comfortable. Intelligent transport systems (ITS) are used for this purpose in majority of modern countries.

According to ERTICO (European Association of ITS), ITS will increase the capacity of the road network by 20% without reconstruction and construction of new structures, significantly reduce the number of accidents, reduce CO_2 emissions, and reduce the loss of time when traveling during each person's lifetime by one year [1].

An intelligent transport system is the instrumentation used to equip roads with traffic lights, "smart stops", surveillance cameras, information boards, and software that combines this equipment into a single system and allows it to be controlled. The history of ITS begins from the 80s of the twentieth century in countries such as the USA, Japan and a number of other countries. In the 90s, after Europe had implemented Intelligent transport systems and European Commission had adopted the concept of ITS development, three main ITS development centers appeared in Europe, USA and Asia [2].

Today in South Korea a lot of attention is paid to 5G and Vehicle-to-everything (V2X). Initially, this system was used to reduce the number of accidents on the road. But in November 2022, the Koreans switched to experiments with autonomous vehicles. At the moment, self-driving buses travel along the roads of Seoul. And although there is still a driver there, it is planned to abandon it in the future [3].

Sitraffic Fusion, an adaptive traffic management solution, has been operating in London since 2020. It is part of a larger traffic optimization system Real Time Optimiser (RTO) that controls city traffic lights.

Previously, RTO relied on SCOOT, a system of simple transmitters hidden in the road that could detect approaching traffic. The new cloud solution uses more data sources, including those from connected vehicles, and flexible algorithms. This allows you to minimize delays and waiting times at traffic lights.

As for the Republic of Belarus, if we compare the ten-month period for 2023 and the same period in 2022, there is a decrease in the number of accidents by 6.8%. And these are changes only in a year. Over the period from 2015 to 2023, the death rate in road accidents decreased by 34% [4]. The intelligent transport system of Minsk is currently represented by such subsystems as an automated traffic management system, an automated public transport dispatch control system, a video surveillance system in places of people mass gathering, a speed camera system, an accident control and route guidance system, a freight transport traffic management system, and a parking space management system.

Based on all the above it can be said that ITS has an extremely positive effect on the road situation, and the development of such systems did not stop a dozen years ago, but continues successfully to this day.

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УДК 811.004.896
THE USE OF ADVANCED ROBOTIC SYSTEMS IN THE AUTOMOTIVE INDUSTRYOF THE REPUBLIC OF BELARUS

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A robotic system is a system that includes robots, working elements of robots, as well as devices, equipment and sensors necessary for the correct operation of the system. A robot is an automatic, stationary or mobile mechanism, mainly consisting of an actuator and a programmable control device. An industrial robot is one of the components used to create flexible automated production.

One of the industries where robotic systems are most actively used is the automotive industry. Leading enterprises are: Minsk Automobile Plant, Belarusian Automobile Plant (the holding's management company is OJSC BelAZ), Amkodor, Belkommunmash and the newest enterprise - BelGee. The list of manufactured goods is very voluminous, it includes passenger cars, buses and electric buses, underground, road construction, special equipment, and mining dump trucks.

Using the example of the Belarusian-Chinese joint venture BelGee, we will consider the use of robotic systems as part of automated production.

The presence of all the necessary world-class certificates proves the effective and competent use of all provided tools and capabilities, so this enterprise is a good example for considering the use of a robotic system.

To meet all necessary standards, increase the quality of products and speed of production, the plant uses an automated assembly process. The entire process is carried out by robots, with quality control through data collection, which is transmitted to engineers in the quality department [1].

The first step in assembling a car is welding. This is the most robotic area in the plant, 26 KUKA robots are installed on the main welding line, this has led to the fact that about 90% of welding work is performed by robots.

The stage begins with welding the elements of the engine compartment and parts of the underbody.

The entire process is carried out manually using an adaptive welding system from Bosch. Before the body enters the main assembly line, a VIN code is applied to the future car, which is subsequently used to identify the car. Next, the body blank is transported to the main welding line (Fig. 1), where the entire body is assembled in a fully automatic mode. The last part of this stage is manual modification, due to the limited mobility of the manipulator.

Fig. 1. – KUKA robots on the main welding line

The second stage is placing the body in a protective gas environment to strengthen the main seams, using robotic welding with consumable electrodes.

The next step is preparation for painting. In the paint shop, workers hang up equipment to keep doors and hoods open. Next, a manual pressure wash is carried out to wash away the debris that is formed during the welding process. After this comes the degreasing stage, consisting of three successive stages: phosphating, applying a cataphoric coating, and ultrafiltration in a special solution. To apply the coating to the outer surfaces of the body, modern Durr (Fig. 2) robots with complex kinematics

are used, which apply a base coat of paint, then primer, then varnish, and the car is sent to the varnish drying oven [2].

Fig. 2. – Durr robots

After the drying stage, the body enters the polishing and grinding line, where the final external modification of the body takes place. Next, the car enters the assembly shop, where the installation of the car's interiors, gluing of glass, installation of the chassis, fuel and brake systems takes place. Assembly is carried out manually or using the KUKA robot.

The use of robotic systems has made it possible to achieve efficient competitive production.

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GH-6 'GOSHA' DROWSY-STRUCTURE ROBOT

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Today there is an increasing adoption of robotics-related technologies in the industry. One of the troubles that require solutions in manufacturing is the transportation of goods and construction [1].

Despite significant technological progress, the full automation of all warehouse processes and construction sites does not seem feasible at present. Even the most advanced equipment requires human involvement to extent. Operators are still necessary for performing complex tasks. Typically, only specific areas can be automated in a warehouse setting. However, warehouse automation offers several advantages: reducing personnel costs, increasing the efficiency and speed of tasks and optimizing warehouse space. Partial automation on construction sites can accelerate construction, improve the quality of structures, and enhance safety measures during the construction process.

We would like to dedicate this article to our fellow student Daniil Ruselevich who at the age of 18 has already succeeded in the field of constructing robotic systems and designed a robot named Gosha.

The GH-6 "Gosha" robot is a robot with a mechanism for movement designed in the form of spider limbs. The use of a platform equipped with a system of 6 prosomatic drives ensures maximum mobility in uneven and unprepared terrains for movement.

This system comprises a complex of integrated various sensors and robotic devices, whose main task is to enhance the efficiency of cargo storage and transportation, as well as to catalog data on the condition of these goods. Integrating this robotic system can not only achieve more efficient operation of the enterprise but also enhance safety for employees and maintain the integrity of the cargo.

Due to the flexibility of all its 'elements', this swarm system can be integrated into various fields of activity: large-scale manufacturing, small enterprises, various small warehouse spaces, as well as flexible

production, as the system can adapt to different conditions either by user request or automatically. By using a single central control node for the swarm, optimal quality and performance of the system have been achieved.

At present, it can confidently be said that the project may be in demand in various areas within Belarus. For instance, in construction and logistics across different enterprises. The utilization of the GH-6 "Gosha" system will not only enhance the efficiency of the enterprise but also make it safer. Due to the multifunctionality of the system, the devices can be used not only for transporting goods. With the installation of appropriate modules, the devices can perform various tasks involving interaction with the external world: surveillance, security, search operations, communication, surface processing, etc.

In the future, there are plans for modifying the systems to allow for the installation of a computer vision system for the GH-6 "Gosha" and lower-ranked devices. This will expand the capabilities of the system in terms of managing its components. Additionally, there are plans to manufacture attachments for installing tools on the limbs, which will further enhance the capabilities of this robotic system in interacting with the external world.

In conclusion, robot Gosha has proven to be more than just a technical device but a true friend and assistant to its creator. Gosha demonstrates how robotics can make our lives better and more convenient.

Gosha the robot is just one example among many potential robots that can change our lives. It's important to keep track of technological advancements, learn how to use them, and create a world where robots and humans coexist in harmony and understanding. Let your imagination soar, as the future of robotics is incredibly exciting and full of incredible possibilities. Artificial intelligence is our future [2].

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CRAWLER PLATFORM CP-02 «VASILISK»

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Crawler platform CP-02 «Vasilisk» – robotic device made on a crawler base, is designed for movement on hard drive territories (forest, quarry, collapse, peat marshland and etc.), and also for work on these territories. CP-02 is manufactured also for being a worker's assistant on construction sites, during transport on hard drive roads [1].

This platform can work with the control panel (manual control), as well as in offline mode. Also this platform can work together with other elements of the system «Collective», for example HEXOCH-06 «GOSHA» and wheel versatile platform WVP-01 «FEOFAN». For example, using several CP-02 «Vasilisk» equipped with manipulators and several WVP-01 «Pheophan» you can organize a logistics line for transportation of some items from point A to point B, as well as their storage.

One of the features of this robotic crawler is using various actuators, for example manipulators, ladles, buckets, capsule drums with liquid, sprayer and ambient sensor sets (temperature, humidity, carbon, pressure end etc.). It is also possible to combine different actuators on the same platform or on several platforms.

Examples of using actuators:

1. Manipulator. It can be used for small cargo transportation (such as boxes, small tools, items, parts), as well as for directly using various tools (such as screwdriver, sprayer, dremel, welding machine, 3D printer nozzle, caulking gun).

2. Bucket. It can be used for clearing rubbles, snow, leaves, sand, soil.

3. Cargo compartment can be used for storage of various items for transportation.

4. Liquid capsule drum can be used for storage of liquids and pressure capsule.

This device is designed to work together in the robotic swarm system "Collective", which means interaction with robotic complexes of the "Collective" system and others, as well as with people.

The model of this device is made by using 3D printing technology to debug basic power elements until ready-made samples are manufactured for mass production. This approach helps save time, resources, and financial means during the robotic device debugging phase.

At the moment, the prototype is equipped with an electric motor, a battery, basic sensors in the form of ultrasonic rangefinders, a radio module and a feedback module.

In the future, the production of a full-scale prototype of a crawler platform with a load capacity of over 15 kg is planned [2].

Robots, that are made on crawler platforms, are also used by the military. These systems are used for reconnaissance, mine laying and deactivation as well as for direct combat operations. Also these platforms can be used to perform rescue operations on fires, collapses, territories prone to chemical or radioactive contamination.

The use of such systems can improve the productivity and safety of many human activities.

Eventually, in the process of developing this robotic device, it will be possible to integrate these systems into the daily lives of the citizens of the Republic of Belarus.

In the end, with the further development of this robotic device, it will be possible to integrate these systems into the daily life of the citizens of the Republic of Belarus, which will positively affect the safety and quality of life of our citizens, making it more convenient, efficient, easier and better.

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ELECTRIC DRIVES AS THE BASIS OF ROBOTICS

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It is well-known that robotics field is aimed at creating intelligent machines which will be able to help people in different ways, to enhance the safety and productivity of human work and, in general to improve the quality of people's lives. And, of course, automated electric drives are a key element in robotics. They provide movement and control of robots by converting electrical energy into mechanical energy. This allows robots to perform various tasks such as moving, lifting and lowering loads, turning, etc. [1].

The electric drive consists of the following main components:

Electromechanical and mechanical converters: They convert electrical energy into mechanical energy, ensuring the movement of the robot's executive organs.

Control and information devices: They control and regulate the operation of the electric drive, providing precise and flexible control [2].

Here are some specific roles that electric drives play in robotics:

Movement: Electric drives convert electrical energy into mechanical energy, which allows the robots to move. This may involve moving a robot arm, turning a wheel, or lifting and lowering an object.

Control: Electric drives allow precise control of the movement of robots. By precisely controlling the speed and direction of the electric drives, robots can perform complex tasks.

Flexibility: Electric drives can be easily programmed and controlled, which means they can be used in a wide range of applications. This makes them ideal for use in robotics, where flexibility and adaptability are vitally important.

Efficiency: Electric drives are generally more efficient than other types of drives. This means that they use less energy to perform the same amount of work [3, 4].

Many innovative trends are observed in the field of electric drives and robotics:

New designs of electric drives (gearless and oil-free technologies), energy-saving (high overload capacity, extended speed control range, high dynamic characteristics of a drive), application of new materials (gallium nitride (GaN) and graphene), etc. [5].

These innovations in the field of electric drives and robotics open up new opportunities for industrial development and improving the efficiency of production processes.

It is safe to say that electric drives play a key role in the future of robotics. This area, which is one of the fastest growing, provides many perspectives for specialists. This makes the specialty in demand both among applicants and for the economy.

It should also be noted that knowledge of foreign languages, especially English, can help future engineers better understand the technical aspects of working with electric drives and robots, as well as improve their professional skills.

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UNICELLULAR LOGISTICIAN

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Physarum Polycephalum, which is also referred to as slime mold, is a species of myxomycetes of the Physara family. This unicellular organism is of interest to urban designers and scientists because of its abilities, such as finding a way out of a maze and building efficient transport networks [1].

Scientists say that the intellectual abilities of the slime mold bring it closer to the highest socially organized insects. Physarum Polycephalum, like any other system, is trying to achieve a certain goal. The organism's goal is survival which is achieved by organizing the consumption and distribution of nutritious substances through its entire body in the most effective way. It leads to the formation of complicated geometric patterns.

In experiments, small pieces of the Physarum Plasmodia were placed in a maze. As soon as the entire space of the maze had been filled by the plasmodia, two blocks with crushed oatmeal were placed at the entrance and exit.

After a relatively short period of time, the cytoplasmic strands in the dead-end and longer passages thinned and disappeared whereas the plasmodia then formed a single thick strand along the shortest path between food sources. Based on this, the scientists concluded that the Physarum has primitive intelligence [2].

Nevertheless, in some cases, plasmodia choose a longer path since the choice of the path occurs in one step without calculating all possible solutions. When there are more than two nutrition sources, the organism is capable of creating transport networks that are not inferior to those created by humans.

In 2010, Japanese scientists conducted an experiment in which they scattered oat flakes across the map of Japan including Tokyo and thirty-

six other large cities. In an attempt to find the oat, Physarum spread itself into a network that was «comparable in efficiency, reliability and economy» to Japan's railway system [3].

With the help of similar experiments, scientists also managed to imitate the transport systems of Great Britain, Portugal and some other countries.

The fact that the unicellular organism has no nervous system that could cause intelligent performance makes scientists interested in understanding the rules which can determine its behavior. Scientists are trying to model the slime mold using a number of simple rules. For example, Physarum Polycephalum has been modeled as a system of differential equations.

However, these models do not really explain the internal nature of the Physarum's intelligence. More research needs to be done, and more data about the slime mold's behavior needs to be collected to build more realistic models, therefore, nowadays, researchers are investigating the network structure of laboratory-grown Physarum.

Although Physara are organisms that have little to do with economics, their ability to build high-performance transportation networks can be adapted for economic purposes.

Studies have shown that the transport networks created by these logistically smart organisms can be more efficient and economical than human-developed transport networks. The abilities of the Physara can have practical application in the field of logistics where route optimization and cost minimization are the key factors of success.

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COMPARATIVE ANALYSIS OF SUSPENSION AND DAMPING SYSTEMS: PNEUMATIC SUSPENSION, ADAPTIVE DAMPERS, ELECTRIC SUSPENSIONS

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Suspension and damping systems play a key role in the comfort, handling, and safety of a vehicle. The purpose of the suspension is to make driving smooth and keep the car from body roll (tilt) during acceleration, cornering and braking. In fact, the suspension elements accomplish several tasks. They increase comfort while driving which is achieved by damping vibrations, jolts and shocks; they stabilize the position of the car body during ride; minimize wheel stress; monitor the geometry of wheel position and movement. The study and comparative analysis of different types of suspension and damping systems make it possible to determine their advantages and disadvantages in various operating conditions in order to comply with specific requirements of the driver and the vehicle.

A pneumatic suspension uses compressed air to maintain the optimal level of a vehicle suspension. It consists of pneumatic springs that can be inflated or deflated to adjust the height of the vehicle and stiffness of the suspension. Advantages of this type suspension include provision of a smooth and comfortable vehicle motion, adjustable suspension stiffness as well as a possibility to change clearance. As far as its disadvantages are concerned, a more complex structure of pneumatic suspension requires additional maintenance, higher installation and repair costs. This type suspension can be applied in a variety of vehicle types: premium-class automobiles, trucks, buses, and specialized transport vehicles [1].

Adaptive dampers are a technology that enables a vehicle suspension to adapt to various road conditions and driving styles. Based on signals from the automobile sensors, adaptive shock absorbers can respond to road irregularities, turns and braking enhancing stability and safety of the vehicle. Strong points of adaptive dampers are primarily revealed in au-

tomatic adjustment of both stiffness and shock absorber stroke depending on road conditions and the driving style. Improved handling and stability seem just as beneficial. On the other hand, there are certain drawbacks such as the higher cost of adaptive dampers compared to regular dampers, and the risk of electronic malfunctions. Adaptive dampers are most commonly installed in high-end cars, sports cars, and commercial vehicles [2].

An electric suspension is a technology that uses electric drives to adjust the height of the vehicle suspension and the stiffness of the damping. This system enables quick and precise changes in suspension characteristics depending on road conditions and the driving style. Electric suspensions foster extra stiffness, thus improving comfort and stability on the road. They can also be integrated with other systems of automobile safety and control to optimize overall performance. The possibility of fast response to changes in road surface, ability to individually adjust each wheel, improved dynamics and handling are obvious strengths which make this technology a much-preferred choice for premium-class vehicles. However, it is also characterized by complexity of the electronic system, a possible risk of malfunction, expensiveness and high maintenance costs. Electric suspensions are especially practical in electric and hybrid vehicles, as well as in some sports and conceptual models [3].

In conclusion, a comparative analysis of the above-mentioned systems facilitates the choice of the best option for specific needs of the vehicle and the motorist. Thus, to increase comfort and stability on rough roads, the pneumatic suspension can be chosen, whilst adaptive dampers or electric suspensions can be preferred for a sporty driving style.

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MARKETING COMMUNICATIONS IN BELARUS

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In current marketing, the company's communication with customers seems even more important than forming a product, setting the optimal cost for it and ensuring its accessibility to target customers. It is relevant to consider well-established principles of the state, its culture, uniqueness and lifestyle of its population, otherwise any marketing strategies are meaningless, hence, segmentation is the foundation for the development of marketing communications enabling to obtain the essential information on the socio-economic and psychological characteristics of the company's target audience [1]. Integrated marketing communications is a particular planning concept aimed at evaluating the strategic roles of each area and find an appropriate combination of them in order to improve communication programs with clients [2].

Since the beginning of the 21st century, the state of things in respect of marketing communication market of the Republic of Belarus has been characterized as follows: the number of advertising agencies has increased, new TV channels, radio stations and print media as well as new media technologies, and technical capabilities of national information agencies have been introduced [3]. According to a brief evaluation of the advertising market in Belarus, it can be assigned the status of a developing one. Among business areas that contribute to marketing communications, one can specify the development of markets for food, engineering products, banking services, innovative technologies, building materials and construction services, pharmaceuticals, tourism, communications, etc. Advertising, often identified as the primary component of marketing communications, is divided into types. Advertising on television is the most preferred method of communication chosen by national manufacturers since 99% of the Belarusian population uses television services in one way or another. The next popular type is advertising in print media

which is still widely used in the Republic of Belarus due to an increase in the number of magazines and periodicals, an increase in the quality of printing, and the low cost of advertisements in the Belarusian mass media – a heavyweight attraction for advertisers and advertising producers. The third type is outdoor advertising including advertising on transport which is currently used by 80 different organizations. And the remaining type is the Internet engaged by more than half of the population of the Republic of Belarus. Like any branch of the economy, marketing communications in our country have a number of problem areas. Belarusian advertising service market is dominated by development competition which is different from competition in developed countries. More attention is devoted to the price fight than to the quality of the performed work and the staff proficiency. Belarus also needs to develop representative advertising. The President of the Republic of Belarus considers: "Our work on the Internet is extremely weak in terms of image resources for product promotion. It is necessary to create an exporter's face in the network that would arouse the interest of partners. Today we are already late with this, and tomorrow it will be completely late." Another important problem is the low cost of advertising. In other countries, the cost of advertising is more than 100 US dollars, while in Belarus it is 5-10 US dollars [4].

Summarizing all the above, we conclude that although Belarusian advertising market uses all kinds of information dissemination tools and the number of marketing communication tools has grown significantly, Belarus still lacks elaborate advertising campaigns.

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ENVIRONMENTAL COMPONENT OF THE LOGISTICS INDUSTRY

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Basic logistics issues include determining what to purchase, the volume of purchases, selecting suppliers, and purchasing terms. However, modern logistics is expanding the scope of its interests touching upon important considerations related to the environmental situation in the world. The reason is that vehicles, which play a key role in supply chains, are the source of 60% of air pollution and in the future, the growth of maritime and, in particular, air transport may have a significant impact on the level of emissions from the transport sector [1].

Another major environmental challenge for the logistics sector is the consumption of non-renewable resources, especially fuel. Despite the increasing promotion of electric vehicles, the logistics sector still relies heavily on fossil fuels for large-scale transportation modes such as cargo airplanes or container ships. However, new technologies can offer potential solutions to mitigate negative effects.

Environmental logistics is an approach that encompasses measures ensuring the movement of materials during any production processes until they are transformed into products and production waste which are then followed by the recycling or safe disposal of the latter in the environment. Below, there are some of the prospective environmental solutions introduced by this type logistics.

One way to contribute to environmental protection is to apply more sustainable modes of transportation. Various transportation means have a different impact on the environment. Thus, for long-distance shipping, using rail or ships can be the most eco-friendly option in the supply chain. Electric and hybrid vehicles are also emerging as more sustainable alternatives, especially for local deliveries. In 2022, 5.2 million Battery Electric Vehicles and 1.9 Plug-in Hybrid Electric Vehicles were sold worldwide. These vehicles can achieve net zero emissions if the energy

they use comes from renewable sources. Producing less air pollution and being quieter than conventional engines, these can be a preferable choice for a more environmentally-responsible logistics.

Implementation of sustainable supply chains requires the consideration of the amount of waste generated by the logistics industry. This can be accomplished by minimizing plastic packaging or replacing them with biodegradable alternatives. Various types of eco-friendly containers are available in the market, such as paper, glassine and seaweed envelopes, cellulose and cornstarch packaging, and paper tapes. It is imperative to introduce recycling into practice: using wooden pallets or packaging made of recycled plastic, for instance [2].

Another environmentally friendly and cost-efficient solution is to optimize product loads per shipment or kitting, which involves assembling individual items or component parts into a ready-to-ship package instead of sending them separately. Consolidating shipments enables full utilization of the transport containers and prevents excessive pollution or expenses.

Route optimization software is a tool that can enhance the environmental performance of logistics operations by analyzing critical factors such as vehicle availability, traffic conditions, and labor availability for loading and unloading. By means of automated route planning, logistics operations can reduce the travel distance and time of their vehicles, which, in turn, can lower carbon emissions and fuel consumption.

To summarize, since environmental issues are at the top of today's agenda due to the current context of climate change and environmental deterioration, sustainable logistics should play a crucial role facilitating transportation while minimizing its ecological footprint. There are many possible solutions for transportation companies to reduce their environmental impact at the same time saving their money and resources.

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VARIETIES AND COMPLEX APPLICATIONS OF ROBOTS AND COMPUTER TECHNOLOGY

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Computer technology and robotics play an important role in the development of mankind in the modern world. They are aimed at the development of technological process, analysis and systematization of a large amount of data. With the help of these objects, complex tasks that can be inefficiently formed by traditional methods are solved.

The development of robotics leads to the creation of intelligent and autonomous machines that perform a variety of tasks in industry, healthcare, service and education. Robots help in determining the accuracy of targets, increase productivity and find various solutions to improve working conditions.

Industrial robots focus on tasks in manufacturing while service robots are in the field of maintenance. Such robots are widely used in the modern world (robot vacuums, kitchen robots, robot diagnosticians). Some models can be programmed to perform several tasks. For example, Promobot V.4 performs the function of a tour guide and a policeman. Various additional devices can be installed on robots: a printer, a document scanner, a bank terminal and others, which make them essential in different spheres.

Nowadays, teamwork of robots is often engaged to solve complex problems with simple methods. Robots diagnose hard-to-reach objects, monitor environmental objects, collectively perform security functions and patrols [1]. Multi Robot Systems research is conducted at the University of Alberta in Edmonton, USA by studying the collective behavior of robots by developing systems of multiple robots. The project focuses on the challenges of collective decision making [2].

Computer technology has the function of storing, transmitting, processing and reproducing information. In today's world, most of us can't

imagine our lives without computer technology. Computer technology allows storing and processing a large amount of information, analyzing the customer market, thus helping manufacturers to know what to offer the customer and how to attract them, finding quick ways to solve various problems without using traditional methods. In today's world, mass-markets are creating their online stores. Many people take advantage of this opportunity to save their time [3].

Computer technologies such as artificial intelligence (AI), data analytics and cloud computing also play an important role in today's world. AI makes it possible to automate decision-making processes, analyze large amounts of data and predict trends, which make businesses more efficient and competitive. Cloud technologies, in turn, provide access to data and applications from anywhere in the world, improving business mobility and flexibility. However, along with the opportunities presented by robotics and computing technologies, numerous challenges and risks can occur. For example, the possibility of robots to replace the workforce raises discussions about the future of labor relations and social justice. In addition, cybersecurity and data protection issues are becoming increasingly important in the digital transformation of society.

Thus, robotics and computer technology have great potential to improve the way people live and work, but their application requires careful consideration of ethical, social and legal aspects to ensure the sustainable and harmonious development of society.

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STONES WITH UNUSUAL PROPERTIES

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Various stones and minerals are widely used in jewelry production because of their beauty. Most stones look similar: clear or tinted, reflective, without any unusual optical effects. The difference between many of them is the chemical composition, hardness and transparency or "clarity". However, there are stones that do not fit this description, they are not transparent or have various inclusions, but this does not make them less valuable. On the contrary, such features make these stones rare and desirable. The first of such stones is opal. Its features are opalescence, play of color and luminescence [1]. The color of opal glare depends on the base tone of the stone. There are light, dark and black opals. Opals are formed from a solution of silicon dioxide and water: the water seeps through the sandstone, raising tiny particles of silica [2]. Opal is part of the skeletons and shells of many organisms. Due to the fact that their skeletons are made of opal, the remains of these algae and animals are perfectly preserved to this day. Some opal fossils are up to 500 million years old. Silica can completely replace the trunks of dead trees and form the so-called "woody opal", which is usually called petrified wood [3]. Now opals are mined in different regions of the world: Australia and Ethiopia, Mexico, USA, Peru, Brazil, Indonesia, New Zealand, Madagascar, Czech Republic, Slovakia and Russia [4].

The next rare and very unusual stone is the star sapphire, an opaque sapphire with an asterism effect (the pattern of a 6-pointed star). During the growth of this stone in natural conditions, rutile needles form a unique optical effect. Such sapphires can be of various colors. In very rare cases, sapphires have a double asterism [5]. Deposits of star sapphires are found in Sri Lanka, Vietnam, Australia, Myanmar, USA and China [6].

Another unique stone is alexandrite. This amazing and rather expensive stone has many unusual properties. For example, the alexandrite

effect, which exactly is what the gem is named after. This means that alexandrite can change its hue depending on the light. Some stones are endowed with an equally entertaining "cat's eye" effect. It is as if a thin strip of light is hidden inside them. The mineral alexandrite is mined in various countries, including Russia, Sri Lanka, Brazil, and African countries [7].

One more unique stone – sphene. Sphene is a fairly rare stone, also known as "titanite" because of the titanium it contains. Sphene is most often found in yellow and green shades. The purer the color of the stone, what means the less brown impurities it contains, the more valuable the stone is. Sphene is unique due to its pronounced luster, almost like a diamond, and dispersion, as a result of which the sphere has highlights of bright green, yellow, red and other colors. Jewelry with sphene should be worn very carefully, as this stone is very easy to scratch, because the hardness of the sphere on the Mohs scale is between 5 and 5.5 units. For comparison, the hardness of glass on the same scale is 6-7 units. Sphene is mined in such countries as Brazil, Russia, Pakistan, Madagascar, Burma, India, Kenya, Austria, USA and others [8].

Different inclusions can also give stones an unusual appearance, for example, rutile or crystals of various minerals. Rutile is a substance that is often found in the world of gemstones. Rutile is a mineral composed mainly of titanium dioxide. Its refractive index is one of the highest of all known minerals, ranging from 2.616 to 2.903. Rutile is most often the cause of asterism and iridescence. Also in some minerals rutile is present in the form of thin needle-like inclusions, which can look like stars or threads [9]. Inclusions in crystals of one mineral can be crystals of another. This happens when, for example, a crystal of emerald or tourmaline begins to grow quartz crystals, as a result, one crystal is inside the other as an inclusion. In some cases, these stones look very unusual and can be highly prized.

Another thing that can make almost any gemstone better is the cut. The best cut is chosen for each stone, taking into account features such as the size, shape, and refractive index of the stone. The cut that makes gemstones shine.

There are many types of cuts, the most common being: diamond cut, marquis (boat or seed cut), pear (resembles a drop), oval, princess (square or rectangle), octagon or emerald cut (rectangle with truncated corners, has an octagonal outline), heart, trillion (triangle), baguette and

cushion [10]. These types of cuts can be called "traditional" cuts. In addition to them, there are also fantasy cuts, which are a combination of various techniques of standard cuts.

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EPOXY RESIN AND ITS APPLICATIONS

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The use of epoxy resin has become a real know-how in the work of modern designers and carpenters. The unique properties of this material open up new horizons for creativity and allow you to create exclusive, unusual products. Now many people work with it, as they did in their time with polymer clay, felting or decoupage [1].

High-strength compounds were discovered in 1908 by the Ukrainian chemist N.A. Prilezhaev. At first they were used in industry, but over time they found application in everyday life [2].

Applications include:

• Construction: Used as an adhesive for bonding structural elements, for sealing joints, and as a component in poured floors.

• Industry: Applied in the manufacturing of varnishes, paints, sealants, and adhesives.

• Crafts and Repairs: Popular in hobbies and crafts, for example, for creating jewelry and interior items.

• Shipbuilding: Utilized in the construction of ship and boat hulls.

• Automotive Industry: Used for repairing car bodies [3].

On the eve of World War II, after research conducted in the United States and Europe, the production of epoxy resins began. In 1947, the first resins were produced on an industrial scale. More than 13.6 thousand tons of resin were produced in 10 years. In the future, the production level will only increase [4].

Today, epoxy resin is used to create jewelry, interior objects, and even as an artistic material for creating paintings and sculptures. It allows you to bring to life the most daring concepts of creative people thanks to its plasticity and transparency [5].

Types of Epoxy Resins are the following: 1) Aliphatic: These have good flexibility and resistance to ultraviolet light. 2) Bisphenol-based: The most common type, used to create strong and rigid polymers. 3) Novolac: Characterized by high temperature resistance. 4) Glycidyl: Used to produce electrical insulating materials. 5) Acrylic epoxy: Employed to improve adhesion to various surfaces [3].

Despite its unique properties, high-strength resin is a synthetic material that is difficult to biodegrade. Therefore, it is important to take a balanced approach to its use and disposal. Since in a liquid state it can be highly toxic, it is necessary to use protective gloves, a respirator and work in a well-ventilated area [2].

Epoxy resin is a versatile material that opens up endless possibilities for us from jewelry and accessories to countertops and decorative interior elements. However, it is necessary to take into account that working with epoxy resin requires attention to detail and a careful approach.

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WATCH STONES: ELEGANCE AND PRACTICALITY

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The watch is a great technical invention with a long history. Stones are an important component of modern watch movements. Watch stones are not just an attractive watch frame, but a necessary part of the mechanism that directly affects the quality.

In the NIHS 94-10 standard, adopted in 1965 by the Swiss organization Normes de l'industrie Horloge Suisse, the function of watch stones is defined as follows: «To stabilize friction and reduce the degree of wear of the contacting surfaces of the mechanism» [1, p.78].

Nowadays synthetic rubies are used as stones (the name jevels – precious) is fixed behind them, but the first watches were equipped with expensive stones in the mechanism and appeared in 1704.

The ingenious idea of using natural rubies in the internal mechanism of the watch is inherent in the Englishman George Graham [2]. He became famous for his invention of the free anchor escapement mechanism, which is still widely used today. Graham was the first to realize that by reducing the coefficient of friction, high quality could be achieved. He is credited with many pocket watches that utilized only the modern technology of the time. And from 1725 onwards, all of his watches featured real rubies.

There are 4 types of watch stones: through, overhead, pallets and pulse. Through stones take on loads in the axial supports, overhead ones reduce the friction that occurs in the places where the moving parts of the caliber interact with each other. Pallets ensure stable operation of the anchor fork. Pulse stones are balance ellipses, that is, they transfer energy to the balance regulator.

Natural rubies are immensely expensive. The extraction of natural minerals is done by manual method. The method is the same as it was hundreds of years ago. The disadvantage of this method is that the probability of damaging or breaking a ruby is very high. The process requires

a great deal of physical strength. However, it requires a special permit, which costs a lot of money. However, even here man has proved himself. Ruby is the first gemstone that could be reproduced in the laboratory. Artificial stone is neither physically nor chemically different from natural stone, but its price is much lower. A successful experience belongs to the French scientist Auguste Verneuil [3], who managed to create a completely artificial large corundum ruby. Nowadays, artificial ruby is the perfect material that is used in watches [4]. Its excellent characteristics ensure high wear resistance, great hardness, ease of processing and the possibility of extremely high quality polishing. But this is not the only thing that makes artificial ruby so sought after. It results in the smooth and flawless operation of all watch mechanics.

It is not uncommon to see the inscription 17 (or another number of stones) on the dial of a watch. Rubies in the mechanism can carry both a working and aesthetic purpose. For example, a luxury wristwatch may have as many as one hundred stones under its cover, but only one-fifth of them have the function of reducing wear on the drive axles.

Thus, watch stones are a vivid example of combining functionality and artistic creativity in the field of technical devices.

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PALLADIUM JEWELRY

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«Modern jewelry industry, in addition to the traditional using of alloys based on gold, silver and platinum, use the "new" material. Thus, one of the areas is the using of alloys based on palladium as an alternative to platinum and white gold» [1, p. 24].

Many people are familiar with the metals that are usually used to make jewelry – silver and gold. However, palladium, for some reason, remains undervalued. Palladium was first discovered by the English chemist William Hyde Wollaston in 1803. Slowly, people began to make jewelry and special laboratory glassware from it. It can also be added to various alloys to make thermostats. This metal is most often used in creating electrical equipment. Palladium, which looks like platinum with its silver-white color, has high wear resistance, which makes it an excellent material for jewelry. Palladium belongs to the platinum group of metals. This metal is lighter than platinum, which allows you to create voluminous jewelry with less weight, while maintaining high quality [2].

Palladium has been present in the jewelry industry for a long time. At the end of the 19th century, jewelers created jewelry from this metal. During World War II, when the platinum was needed for the military industry, palladium became a good substitute for it. But there are two factors that contributed to the disappearance of this metal from the market in the 2nd half of the 20th century: the complexity of production and the growing demand for gold jewelry [2].

Recently, palladium has been used in the jewelry industry not only as an additive to create "white gold". Jewelry made of palladium alloys not only has the properties of products made of platinum and gold, but also sometimes surpasses them.

Due to its high plastic properties, palladium and alloys based on it are used in the production of semi-finished products. Of particular interest is

the production of thin-section wire, which is later used in chain binding, which is the most labor-intensive technology [1].

It is impossible to buy products made of "pure" palladium. The metal is used only in an alloy with ruthenium and nickel. Otherwise, the product will not hold the given shape. The most common samples of palladium are 950, 850 and 500. It has gained such popularity because of its ability to increase in size if the fingers become thicker [3].

The advantages of palladium jewelry are as follows: high strength, resistance to mechanical damage, hypoallergenic, light weight, no darkening over time. The only disadvantage of palladium jewelry is the need to update the polishing in order to maintain the gloss of the surface [4].

Recent research shows that palladium strengthens and increases the melting range as a secondary component in alloys. Alloys where palladium is used as the main component contain copper and sometimes tin to produce durable alloys with relatively high corrosion resistance. Palladium is less biologically dangerous than other elements such as nickel or silver [5].

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LAPIS LAZULI AS AN OBJECT OF JEWELLERY ART

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Lapis lazuli is a semi-precious stone with a blue or bluish colour that belongs to the class of silicates, subclass tectosilicates, crystallising mainly in cubic singony, a hexoctahedral symmetry class (Fig.1). Oddly enough, lapis lazuli is not a gem itself. In nature it is found as veins within marble, self-contained crystals do not exist - or they occur as an exception.

Fig. 1 – Lapis lazuli

Lapis lazuli is an opaque mineral (some species are translucent) with a glassy, silky and oily lustre, a density of 2.38 to 2.42 g/cm3, and a hardness of 5.5 on the Mohs scale (because of its low density and hardness, lapis lazuli is easy to cut). It has a rakish or granular fracture. In

artificial light, lapis lazuli is almost lustrous, but in bright sunlight it sparkles. Under ultraviolet light, the mineral will glow orange in colour. The optical character of lapis lazuli is isotropic, sometimes changing to anomalous anisotropy (differences in the properties of the medium). It has a refractive index of 1.498 to 1.522. The birefringence of this mineral is anomalously weak. Dichroism: weak (yellowish-green), and light dispersion: 0.018 (BG) or none at all [1].

Lapis lazuli is divided into several types characterised by the content of calcite and pyrite impurities in different percentages, colour and properties of the mineral itself. Afghan lazurite and Chilean lazurite are two of the best known and highest quality sources of this mineral [2]. Afghan Lapis Lazuli is characterised by its translucency and deep blue or deep blue colour. It often contains pyrite, which gives it its characteristic golden lustre. Chilean lapis lazuli is darker, with a greenish tinge. It contains both pyrite and calcite, but in small quantities, which makes it usually more transparent than Afghan lapis lazuli. This makes its lustre less oily and more glassy. In turn, Afghan lapis lazuli is divided into three other types: nili, asmani and sufsi. The most valuable of them is nili, because its rich, dense blue colour and homogeneous surface with occasional veins of pyrite. It is also worth mentioning Baikal lazurite, which is also in demand.

The name of this mineral is derived from the Persian word "lazurite" (blue). The name finally took hold in the 18th century. This stone was highly prized in ancient times. The Bible states that the sacred laws of Moses were inscribed on slabs of this stone. In the time of Pliny, this mineral was called sapphire [3]. In Babylon, Assyria, and Egypt, lapis lazuli was considered one of the most expensive stones. Even in ancient China, lapis lazuli was highly prized. It was considered a symbol of power. In Europe, lapis lazuli was used to paint frescoes. In Russia, icon painters also crushed "lazurik" and mixed it with egg yolks for painting. The paint was saturated and did not fade in the sun. Lapis lazuli was considered the stone of the emperor and was highly valued.

The very process of lapis lazuli mining should also be noted. First, geologists and mineral experts search for lapis lazuli deposits. Usually, lapis lazuli is found in rocks such as granite, slate or limestone. Once a deposit is identified, exploration is carried out to determine the exact location and depth of the lapis lazuli. This may involve drilling wells and conducting geophysical surveys. Open pit mining or underground mines

are often used to extract lapis lazuli. In the case of open pit mining, the rock is excavated from the surface, while underground mining uses shafts and tunnels up to 25 metres long. Once the mine is developed, the extraction of lapis lazuli begins. The lapis lazuli ore is extracted from the ground and transported to the surface for further processing. The extracted ore contains not only lapis lazuli, but also other minerals and impurities.

Therefore, the ore is treated with special methods to separate the lapis lazuli from other materials. After ore beneficiation, lapis lazuli undergoes a cleaning and treatment process. This may include removing dirt, sand and other impurities, as well as polishing and treating it to give it a lustrous sheen. It is important to note that mining lapis lazuli can be a difficult process due to its brittle nature.

The faceting of lapis lazuli takes place in six stages. First, the raw stone is cleaned of dirt, dust and other impurities. Then it is examined for defects, cracks and inclusions. The master cutter marks on the surface of the stone the places where facets or chamfers will be located. The stone is cut into pieces using diamond discs or other tools to facilitate subsequent processing. The craftsman begins to create the main facets and chamfers on each of the pieces of stone - this stage is called rough cutting and helps to determine the final shape of the stone. After rough cutting, the craftsman moves on to creating more precise and detailed facets and facets, this is done using smaller and more precise tools. The last stage of cutting is polishing: the stone is treated with special materials to give it a shiny and smooth surface.

Thus, lapis lazuli is a versatile mineral that is actively found among jewellery, used both for inlaying and creating unique costume jewellery.

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EVOLUTION OF JEWELRY PRODUCTION TECHNOLOGIES

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Jewelry has had a significant impact on human civilization since time immemorial. Archaeological finds show that jewelry was worn as far back as the Paleolithic period, which dates back more than 40,000 years. Jewelry was closely associated with religion and spirituality in many ancient societies. For example, the ancient Egyptians considered jewelry to have magical and protective properties and therefore integrated it into their religious practices. Likewise, the Greeks incorporated jewelry into their religious ceremonies and took inspiration from mythological creatures when creating their jewelry. Moreover, jewelry has been used as a symbol of wealth and social status in many cultures throughout history. In addition to its cultural and symbolic meaning, jewelry has also served a practical purpose throughout history. For example, brooches were used to fasten clothes, and earrings were worn to keep hair out of the face. Even today, jewelry retains its position as a significant element of human culture. Many people wear it as a form of personal expression, a fashion statement, or to commemorate emotional moments. Although the styles and materials used in jewelry may have changed over time, their value and significance remain the same [1].

The history of jewelry is quite extensive and multifaceted and originates in Ancient Egypt, where the main list of jewelry began to form: bracelets, rings, earrings, necklaces and tiaras. It was at this time that they mastered methods of polishing stones, which were first ground with hard sandstone and then wiped with wet leather; glass and enamel were created; The foundations of jewelry making were laid. One can also mention the Sumerian culture, which also excelled in jewelry. Archaeologists found gold and silver figurines and inlaid jewelry. From which we can conclude that Sumerian jewelers were skilled craftsmen and mas-

tered the technique of processing gold and silver, and knew how to forge and inlay their products with precious stones [2, p.18].

Then we can highlight the period of Ancient Rome, where some of the main techniques of jewelry production were relief chasing, metal casting and shiny bas-relief in stone. As in Ancient Egypt, enamel was actively used. The most popular at that time were rings, which mostly served as personal seals [2, p.20].

However, in Ancient Rome they used not only casting, but also foil manufacturing technology. Since gold has always been an expensive material, ancient craftsmen began to take advantage of its plasticity and covered various objects with gold foil. The production process of this foil was very long and labor-intensive. But in the Middle Ages, this process was optimized and, foil began to be made by passing the material through special shafts.

Jewelry making in the Middle Ages can be divided into several periods. During the 14th century, decorative elements inconsistent with each other in composition and color were common in jewelry: enamel, metal reliefs and precious stones. The ornaments feature a variety of stylized geometric shapes with a small amount of detail. Jewelry from the 11th century was characterized by a combination of silver, gold and bright, irregularly shaped stones. Most often, amethysts, rock crystal, emeralds, and sapphires were used in products in Europe [2, p.21].

If we talk in general about technology, it can be noted that in the Early Middle Ages, stone processing became more complicated: the stone was ground for a long time on fine-grained sandstone, and then polished on a lead tile with brick flour or crushed rock crystal. Grinding wheels made of sandstone, similar to millstones, or lead and leather-covered wooden wheels for polishing were also used. It is also worth mentioning that it was in Europe in 1456 that the lapidary Louis de Berquin discovered that crushed diamond was an unrivaled cutting tool. He also revealed the unique properties of diamonds – refracting light when they are cut [3]. And although there are many versions as to who and when invented diamond cutting, it was in medieval Europe that cutting technology made great strides forward. Already in the 17th century, cut diamonds became the main decoration.

Speaking further about the evolution of jewelry production technologies, without going into technical details, we can mainly highlight fashion, which changed from century to century. For example, in the 17th

century, items made of diamond, pearl, ruby and topaz were in fashion. Decorations were made in the form of flower bouquets. In the Victorian era, amethyst, garnet, and sapphire became fashionable. And decorations in the form of various animals. At that time, fashion was dictated by those who could afford all these decorations, namely those from royal families or those close to them. However, when the situation changed, the era began to dictate fashion; examples of this include the Art Deco style, the decorations in which seemed to repeat the catchy but strict architecture of the buildings.

During the Second World War yellow gold came into fashion as other materials were used to create weapons. From the 1950s to the present day jewelers all over the world have been developing various designs from a variety of materials for all types of buyers.

Speaking about jewelry production technologies of our time, it will be obvious to talk about high-precision instruments and measuring devices that modern jewelers use. 3D- modeling should be also mentioned. In addition to devices, new processes are also being invented, for example, electroplating, which makes it possible to coat various objects with metals using electricity. If we talk about something unusual, it is nanotechnology that allows you to interact with materials at the atomic level. Right now, these technologies are being used to create new types of gemstones.

To summarize, we can say that jewelry production technologies have evolved in every significant period of human history and have always kept pace with the times. Looking at modern technologies, we can conclude that this will continue to be the case.

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HYDROELECTRIC POWER GENERATION: LEVERAGING GRAVITY AND WATER FOR RENEWABLE ENERGY

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Dams transform the landscapes around us, repurposing rivers and supplying energy to countless households worldwide. These massive structures of civil engineering have existed since the dawn of civilization and are now essential in generating electricity on a global scale, accounting for 16% of the world's electricity output [1]. At first look, dams might seem like just large barriers preventing floods, but they, and especially hydroelectric power plants within them, leverage one of the most plentiful resources on Earth: gravity.

Hydroelectric facilities utilize the potential energy of water stored by dams, capturing the energy of water as it descends. This process involves turbine generators that convert the water's kinetic energy into mechanical one, which is then transformed into electrical energy with remarkable efficiency. Contemporary hydroelectric installations can convert the dam-stored water's energy into electricity with up to 95% efficiency, a significant contrast to the roughly 50% efficiency of top fossil fuel power plants [2]. Dams, together with their hydroelectric facilities, vary greatly in size and power output, ranging from small structures powering a handful of homes to giants like China's Three Gorges Dam that powers whole cities. Let's delve into how these power plants operate. Modern hydroelectric installations comprise two primary components:

1. A dam: Dams create a large reservoir of potential energy by collecting water at high altitudes. Besides generating energy, dams help manage water flow and store energy for future use;

2. A turbine: Acting much like a water-powered windmill, the turbine converts the dam-released water flow into mechanical energy. The moving water forces the turbine to spin, harnessing the kinetic energy of the water [1].

Understanding these elements highlights the ingenious use of nature's forces in producing clean, renewable energy through the strategic management of water resources facilitated by dams. Generators within hydroelectric plants capture the mechanical spinning motion from the turbines and transform it into electricity. The mechanism of action in these generators mirrors the functioning of generators in various contexts, not exclusive to hydropower scenarios. Subsequently, power transmission lines are tasked with delivering the generated electricity from the dam and its accompanying power plant directly to residential areas and other locations in need of energy. By proceeding with the discussion of a dam's energy-producing capabilities, several factors dictate the amount of electricity a dam can generate. These include the height of the water drop, the volume of water flowing, and the efficiency at which the turbines and generators operate. Key aspects to consider are that the greater the height from which the water falls, the more potential power it generates due to gravity's influence, accelerating at 9.81 meters per second squared. Consequently, a dam standing 100 feet tall would possess double the energy-generating potential of a 50-foot dam [2].

Moreover, the volume of water plummeting significantly affects a dam's ability to produce energy. While the height determines the potential power, the actual energy output hinges on the volume of water descending at that height. Unfortunately, the volume of incoming water, dictated by natural flow into the reservoir, is largely beyond human control. However, by regulating the flow towards turbines, dam and hydroelectric plant managers can somewhat influence electricity production rates, akin to charging and depleting a battery. Ultimately, the efficiency of the turbines and generators plays a crucial role.

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MATHEMATICAL MODELING OF RANDOM PERIODIC EVENTS

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Any random event can be foreseen and calculated with the help of universal science called "Mathematics". Let's take for example "Ergodic Markov chains."

Markov chain is a sequence of some random events. Its possibilities only depend on previous state of some system but also they don't depend on events that were before events of previous state.

Ergodic Markov chains only consist of ergodic states and events. That means that system can go to the next state and go back to the previous state. Even if the system in the last state it can come back to the first state after some events or steps.

Ergodic Markov chains are used for modeling and calculating periodic random events such as economic or technical problems: efficiency of economic plan, proving or disproving great performance of machine. But method works if enough observations are made [1].

To show the work of ergodic Markov chain let's examine abstract gas stations with two service channels and three places in line. Let our system be ergodic so we could use ergodic Markov chains. Let A be the intensity of cars arriving at the stations and let's B be car refueling intensity. The values of A and B are known from observations and statistical findings, let A be 1 and B be 1/3. Our system has 6 conditions:

1 – two service channels are free;
2 – one service channel is taken;
3 – two service channels are taken and no cars in line;
4 – two service channels are taken and one car in line;
5 – two service channels are taken and two cars in line;
6 – two service channels are taken and two cars in line.

To simplify these conditions, they are collected into one "graph". Graph is a mathematical picture of a real system (Fig.1).
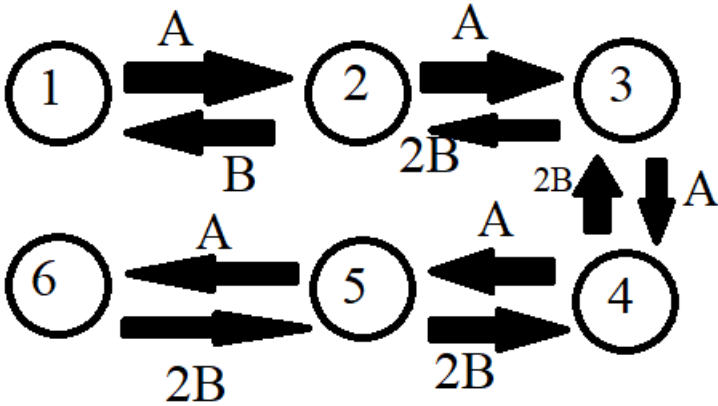
Fig. 1. The Graph of the System

With the help of the graph mathematics makes up differential equations. The solution of the equation system is possibility diagram.

So how do we make up differential equations?

The graph depicts six states and for them we have six possibilities.

For example, let's look at the first possibility – the possibility that our system will be in first state.

In the first differential equation the derivative of the first possibility equals intensity that go to the first state multiplied by the possibility of the other state from which the event goes minus the intensity that go from our state multiplied by our state [2]:

$dp_1/dt = -A*p_1(t) + B*p_2(t)$

If follow such rules for the other states, we will get this system of differential equations:

1. $dp_1/dt = -A*p_1(t) + B*p_2(t)$
2. $dp_2/dt = A*p_1(t) + 2B*p_3(t) - (A + B)*p_2(t)$
3. $dp_3/dt = A*p_2(t) + 2B*p_4(t) - (A + 2B)*p_3(t)$
4. $dp_4/dt = A*p_3(t) + 2B*p_5(t) - (A + 2B)*p_4(t)$
5. $dp_5/dt = A*p_4(t) + 2B*p_6(t) - (A + 2B)*p_5(t)$
6. $dp_6/dt = A*p_5(t) - 2B*p_6(t)$

But also we must consider that the sum of all possibilities equals one:

$p_1 + p_2 + p_3 + p_4 + p_5 + p_6 = 1$
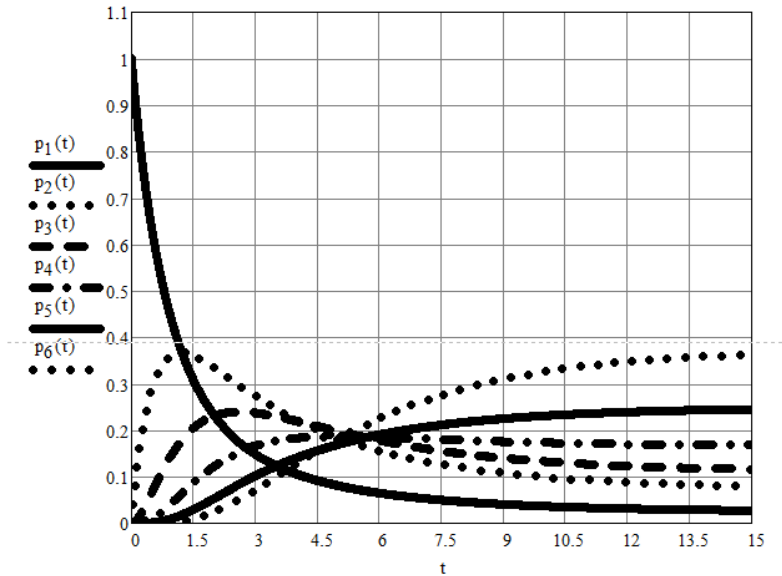
Fig. 2. The Diagram of the System

If we look at the diagram (Fig.2) we can see every possibility strives for exact number and these numbers can be calculated. If we turn our differential equations into simple that equals zero, we can find full possibilities of the system. The solution of the system: 2.5%, 7.4%, 11.1%, 16.6%, 25%, 37.4%. As we can see the possibility of the last condition is significantly big, thus we can say that our gas station is not very effective. So, the owner should provide more service channels or more places in line.

Conclusion: Mathematics is a very powerful system that can predict random events with enough observations of course.

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THINKING LIKE A SCIENTIST

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During studying at the University, we are doing many science activities. To work like scientists, we have to think like them. In this article we will describe what the scientific method is.

For example, our group is going to do an activity on the chemistry of food. The objective of the activity is to study bread mold. The latter grows best in a warm, moist environment. It is easy to moisten bread and place it in a covered dish. The problem is keeping the dish warm over the weekend, when there is no heat. The solar heating walls may give us an idea about how to solve this problem. Maybe the dish with moistened bread can be kept warm with solar heat. But what substance is best for storing this heat after the sun goes down? We might decide to do an experiment to answer this question. An experiment is a scientific test designed to give information under carefully controlled conditions [1].

The success of an experiment often depends on how the question it tests is stated. The more limited the question, the easier it is to set up an experiment to answer it. "What substances store heat best?" is too broad a question. Many substances can be solutions and we couldn't test them all. Some students might think that water is a good substance for storing heat. Others might guess that gravel is better. Now we can ask a more limited question. "If heat can be stored, which is better for the purpose: water or gravel?"

Once the question is stated, we can form a hypothesis. It is an educated guess about the answer to a problem or question. A hypothesis for this question might be: "Gravel stores heat better than water." Now that we have a hypothesis, we can test it. Before testing our hypothesis, we should find out what is already known about the question. We might go to the library and read articles or books on materials that store heat. The information might even suggest ways to set up our experiment.

Suppose we and our groupmates are ready to test the hypothesis. To do the experiment, the students could be divided into groups. All of them are measuring out the same mass of each of the materials to be tested. One group puts water in a beaker. A second group puts an equal mass of gravel in its beaker. A third group puts nothing in its beaker. Each group places a thermometer in its beaker and then places its beaker in an oven set at low heat. When the temperature reaches 70°C, the students remove the beakers.

As the beakers are removed from the oven, each group reads the temperature in its beaker. Each group records this observation in a table. They put this first reading in the space marked Time = 0 minutes. They continue to record temperatures every 20 minutes. When the beakers cool to room temperature, they stop recording.

The temperatures written in the table are the data of the experiment. Data are the measurements and information that a scientist gets from an experiment. Careful observation is needed to get the best data possible from an experiment.

Why did the groups use the same mass of each substance? Using different masses might have changed the data. The data from an experiment done in this way might lead us to a false result. The data could differ, too, if the groups had used different kinds of containers. Starting the tests at different temperatures could also have given misleading results.

Mass, starting temperature, or any condition that can be changed is a variable. In a well-planned experiment, a variable is changed only to test the hypothesis. In this experiment, we are interested in only one variable: the materials used. The experiment can be a fair test of this variable only if we keep all the other conditions the same for each beaker.

The empty beaker is a control setup. A control is an extra setup in which all the conditions are the same except for the variable being tested. The control does not contain the variable being tested. Using a control makes sure that any changes seen in the other setups are due only to the variable being tested.

After taking our data, we compare it with that from the other groups to see which material stayed warm the longest. These results may support the group hypothesis or disprove it. Whatever the result, the group may be able to draw a conclusion from the experiment. A conclusion is a judgment based on the data gathered in an experiment. Our conclusion should be an answer to the question asked by the group.

Many times, the data taken in an experiment are numbers. It is often hard to draw a conclusion from a table of numbers. For this reason, scientists often graph their data. A graph is like a picture of the numbers. Such a picture often shows a pattern that we cannot see in the numbers themselves [1].

After graphing their data, the groups compare their results. The patterns in the graphs show that the beaker with the water stayed warm longer. These results show that the original hypothesis was incorrect. The groups conclude that water seems to be a better heat-storing material than gravel.

Our group can now use its conclusion to try to find a way to keep the bread mold warm. Perhaps the group might float the dishes in a tub of hot water. Or they might want to try another method. To find the best design for a water heater, the group will have to do more tests. These tests will use the results of the first experiment.

Scientists usually repeat experiments many times to make sure the data are accurate. If the results are the same over and over again, the conclusion may be stated as a law.

A scientific law is a statement that describes how something behaves. A law does not explain why something happens. It only describes what happens. For example, after repeating our experiment several times we might be able to state a law. "Water stores heat better than gravel."

We may want to know why our experiment turned out the way it did. We may form a hypothesis to explain the results. Our hypothesis might be "The air spaces in gravel make gravel lose heat faster than water." We may want to experiment to test this hypothesis.

If our explanation passes many such tests, we might state a theory. A theory is an explanation for the way something behaves. Our theory might be "materials lose heat in air spaces." Most scientific theories are changed or replaced many times.

These changes result from new data that do not agree with the established theory.

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УДК 621.311.25
THE INFLUENCE OF FUEL OIL ON THE ENVIRONMENT AND THE HUMAN BODY

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Nowadays it is impossible to imagine a world without energy: electric, thermal, nuclear, etc. Our world depends on all sorts of energy to power utilities, be it fossil fuels, renewables or kinetic energy sources. Our energy needs have increased greatly since the Industrial Revolution and the existence of power plants has allowed people to freely use these types of energy for their own needs. This is an unconditional progress in the development of mankind, but today's energy industry cannot be called absolute perfection, because it causes a variety of problems related to environmental violations, with effects on the human body and health, with a shortage of energy resources and competition for them.

Reserve fuel plays an important role in power plants, so that the stations can operate smoothly. One of the types of such fuel is fuel oil. The latter has a high density and a lower heat of combustion compared to other fuels, so burning in small sizes allows you to generate a large amount of electricity.

Despite the advantage of generating large amounts of electricity, fuel oil has a number of disadvantages. It is a residual product of oil refining and, like any petroleum product, has a negative impact on human beings and nature [1].

According to the degree of exposure, fuel oil is a low-hazard substance for humans and belongs to the 4th hazard class of petroleum products. However, fuel oil vapors are highly toxic and have a poisonous effect on the human body. The combustion products of fuel oil contain carbon dioxide, nitrogen and carbon oxides, sulfur and methane. Vapors enter through the respiratory system, irritate the mucous membranes and eyes. They act like narcotic substances and affect the central nervous system: increase excitability, cause general weakness and dizziness, raise the heart rate. Other symptoms include the appearance of cough, runny

nose, chest and throat pain. Also, fuel oil harms the human body and in contact with the skin degreases and dries, which leads to dermatitis.

As mentioned earlier, fuel oil has a negative effect not only on the human body, but also on nature. At the time of combustion, a large amount of sulfur and other chemical elements are released into the environment, which contributes to environmental disruption. For example, fuel oil has a negative effect on the soil because it destroys and hurts living organisms, significantly changes the structure and chemical composition of the soil, especially its properties as a nutrient medium for plants, which is why their roots do not receive enough moisture. For reservoirs, fuel oil is also dangerous, because when fuel oil gets on the surface of the water, a specific film forms on it, which disrupts any exchange of matter, energy and moisture with the atmosphere. In addition, fuel oil gives the water a peculiar smell that causes disruption of the vital activity of aquatic inhabitants.

To solve the problems of pollution, some power plants are already being modernized in order to minimize the use of fuel oil and even its complete absence. The modernization makes it possible to increase the efficiency of heat and electric energy production and completely switch the plant to using natural gas as fuel. Such reconstruction was carried out at Chelyabinsk CHP-1 and had a positive effect on the environment: emissions of pollutants into the atmosphere were reduced by 4,500 tons per year, the volume of wastewater significantly decreased [2].

Fuel oil has good indicators as a burned fuel, however, one should not forget about the risks arising from the combustion of this substance. The solution to this problem will be to use as little fuel oil as possible, since abandoning it and switching to a full gas cycle will be the most progressive way to improve environmental performance. It will reduce risks and at the same time ensure the reliability of energy supply to consumers and increase the efficiency of generation.

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УДК 621.355.9
GRAVITATIONAL ACCUMULATOR

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Engineers are trying to answer one of the most pressing questions related to our renewable energy – how to store it? The electricity generated by wind and solar farms is not available when the sun isn`t shining or the wind isn't blowing, so with no way to store energy, anything that isn't used immediately is wasted [1].

Gravitational accumulators are an innovative energy storage technology based on the use of gravitational potential energy. This technology offers an efficient and environmentally friendly way to store energy that can have a significant impact on the development of renewable energy sources. The principle of operation of gravitational accumulators is based on the lifting or lowering of large masses using electromechanical devices. When energy is available, the mass is raised, converting it into potential energy. When energy is needed, the mass is lowered, converting potential energy back into electrical one. This means that we can store the energy produced by solar panels and wind turbines, and then release this electricity into the grid in the evening, when the load increases due to increased electricity consumption by people returning home from work. The main advantages of gravitational accumulators include high efficiency, long service life, absence of harmful emissions into the environment, and relatively low operating costs. This technology can be used for storing energy from solar and wind installations, as well as for balancing load in power grids.

According to the creators of the system, its efficiency is 75%. That is, the battery returns about 75% of the accumulated kinetic energy. Of course, it is desirable to increase this figure, but for this kind of storage, 75% is an excellent result. The advantage of the system is that it is simple, reliable, assembled from local components, including blocks, and can work in any climatic conditions without special control and sophisticated climate equipment [1].

The approximate cost of a gravitational accumulator can vary depending on its power, size, and technical specifications. Typically, the price of such devices can range from hundreds of thousands to several million dollars. According to known projects, one of the largest gravitational accumulators in the world is the Energy Vault project in Switzerland. Energy Vault built its first prototype in 2018, and its technology is based on using heavy blocks for energy storage. The accumulator consists of towers in which blocks are raised and lowered, converting mechanical energy into electrical one. Such projects demonstrate the potential of gravitational accumulators in energy storage and their importance for the development of sustainable and efficient energy supply systems.

Countries around the world are increasingly focusing on gravitational accumulator projects due to their efficiency and potential for sustainable energy storage. Some of the countries where gravitational accumulators have been built or planned include:

1. Energy Vault – a major gravitational accumulator project that was developed in Switzerland and has gained international attention for its innovative technology;

2. Italy is also performing research and projects on gravitational accumulators as part of its strategy for developing renewable energy sources;

3. China is actively developing its energy sector and adopting new technologies, including gravity batteries, into its energy infrastructure;

4. The United States of America are carrying out research and pilot projects on the use of gravitational accumulators to enhance the reliability and efficiency of energy systems.

Gravitational accumulators represent a promising direction in the field of energy and can become an important element in creating a sustainable and efficient energy supply system.

Thanks to their reliability, cost-effectiveness, and environmental safety, this technology has the potential to become a key component of future energy systems.

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ENERGY CONSERVATION AND EFFICIENCY: HOW TO IMPROVE RESOURCE USAGE

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Energy is an important component in the contemporary world, supporting economic growth, social comfort, and environmental sustainability. However, the constant expansion in power demand has led to different environmental and social issues, including air and aquatic pollution, global warming, and climate change. Therefore, improving energy efficiency has become a major concern for governments, businesses, and individuals worldwide. Energy conservation and energy efficiency are crucial topics in today's world as we strive to decrease our environmental impact and ensure sustainable development. By improving the way we use energy resources, we can not only reduce our carbon footprint but also save money and create a more secure energy future. In this article, we will explore the importance of energy conservation and energy efficiency, as well as ways to enhance the utilization of resources.

As for the concept of energy efficiency, this term deals with the capacity of a system or procedure to exploit energy resources efficiently, resulting in enhanced productivity and reduced ecological influence. This entails optimizing the utilization of accessible resources, minimizing wastage, and enhancing performance [1].

There are seven ways to improve energy efficiency:
1) To use LED lights;
2) To measure your energy consumption;
3) To focus on insulation;
4) To choose the right ventilation system;
5) To buy certified equipment;
6) To calculate your return on investment;
7) To consider upgrading to LEED [2].

Energy conservation involves reducing energy consumption through behavioral changes and technological advancements. By simply turning

off lights when not in use, using energy-efficient appliances, and insulating buildings properly, we can significantly decrease our energy usage. Energy efficiency, on the other hand, focuses on getting more output from the same input of energy. This can be achieved by upgrading equipment, optimizing processes, and adopting innovative technologies. It is important to use modern technologies such as thermal insulation, energy saving windows, LED lighting and smart energy management systems. Attention should also be given to energy efficiency in transport, including the development of electric vehicles, public transport and bicycle lanes. One of the key benefits of energy conservation and energy efficiency is the reduction of greenhouse gas emissions. By using less energy, we can decrease our reliance on fossil fuels, which are major contributors to climate change. Additionally, energy conservation and efficiency measures can help lower energy bills for households and businesses, making it a win-win situation for both the environment and the economy. To improve the utilization of energy resources, it is essential to raise awareness about the importance of energy conservation and efficiency. It is important to perform education and awareness-raising campaigns to raise awareness of the need for energy conservation, measures taken by the State to promote energy efficiency and save money resources with the right energy consumption. Investing in research and development of clean energy technologies is also crucial for achieving long-term energy sustainability.

In conclusion, energy conservation and energy efficiency are vital strategies for enhancing the utilization of resources and mitigating the impacts of climate change. By implementing these measures on a global scale, we can create a more sustainable future for generations to come. It is up to each individual, business, and government to take action and make a difference in how we use and manage our energy resources.

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УДК 690.92
SOLAR POWER DEVELOPMENT IN BELARUS

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Solar power is one of the most promising and pollution-free energy sources in the world. The use of solar energy has seen a fast development of technologies recently. More and more states are recognizing the importance of switching to renewable energy sources and investing in the development of solar power. One of the countries that are rapidly developing this technology is Belarus.

A lot of solar power plants have been created in Belarus. Solar energy is currently used mainly for small installations on the roofs of buildings or for heating water. Owners of private houses are often interested in such installations. The main goal is to save on the cost of gas, electricity from the local power grid and other energy resources.

Not only ordinary citizens are interested in the production of solar energy, but also large enterprises. Thus, a 55 MW power plant was built in Rechytsky district on the area of more than 115 hectares by order of "Belorusneft". This large area is occupied by 218,000 solar panels created at an enterprise in Slovenia, which is engaged in the creation of installation systems and photovoltaic modules. All works were accompanied by scientific support from the Institute of Energy of the National Academy of Sciences of Belarus. According to the state program "Energy Saving", it is planned to build solar power plants with a total capacity of at least 250 MW [1].

The largest solar power plant in Belarus is "Solar II". It is located in Brahin, Gomel region, in the most southern region of the country. According to the source, 1,900 hours of sunshine are concentrated in this region annually. The solar panels are connected with a 730 km long cable. Direct current is converted using inverters. The voltage rises to 20 kV at substations. The received electricity is transmitted via a 4.5 km long line to the nearest substation. The main feature of "Solar II" is its

location. It is situated on lands unsuitable for agriculture owing to the accident at the Chernobyl nuclear power plant. Thus, the previously abandoned land becomes involved in the Belarusian economy again [2].

Solar panels are harnessed not only to generate huge amounts of electricity for businesses, offices, and private houses. There are a lot of examples where the connection to the main electrical system is not required, but only one or more panels need to be installed:

1) Home Systems (solar electricity, solar batteries, solar generators, solar ventilation, solar water heating, active or passive solar water heater systems, solar-powered pumps);

2) Solar Lighting (solar landscape lighting, solar security lighting, solar holiday lights, indoor solar lighting);

3) Solar Appliances (solar oven, solar cooler, solar portable Bluetooth speaker, solar flashlights and lanterns, wireless solar keyboard, solar umbrellas, solar-powered Wi-Fi garbage bins);

4) Solar Beautification (solar garden decorations, solar bird feeders, solar water fountain, solar-powered irrigation controllers);

5) Solar Wearables (solar bike helmet, solar headset, solar textiles, solar earbuds, solar watches, solar backpacks) and the like [2].

So, the development of solar energy in Belarus is of great importance both from an environmental and an economic point of view. Solar power can become a major factor for the sustainable country development and the improvement of its ecological conditions. However, despite the positive changes in this area, the share of solar power in the Belarusian energy system remains insignificant. In general, solar energy has potential to be developed in Belarus, and further expansion of the use of this energy source can help to reduce the dependence on imported power sources and to decrease greenhouse gas emissions.

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MODERN ENERGY

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Energy is one of pivotal factor of our civilization. Its multifaceted nature covers a wild range of resources, technology and applications, which contribute to society nowadays. This article delves into the complexities of modern-day electricity, analyzing its historical evolution, contemporary challenges and destiny potentialities. An energy source is a natural source or resource from which we obtain the energy we need to run our lives. This power can be used to light our homes, move our cars, heat water or charge our electronic devices and household appliances [1].

In last centuries energy has been a driving force behind technological progress. From the harnessing of hearth in prehistoric instances to the advent of fossil fuels at some stage in the Industrial Revolution, the quest for dependable and efficient energy sources has fashioned the direction of human development. This ancient trajectory has witnessed a slow shift from traditional biomass and fossil fuels towards renewable and sustainable power sources.

Currently the sources of electricity are the following:

1. Fossil Fuels. Their three major types (coal, oil, and natural gas) are non-renewable energy sources that were formed from ancient plants and organisms millions of years ago. They are also the largest carbon dioxide emitters and greenhouse gas contributors, which lead to climate change, air pollution and global warming.

2. Renewable Energy Sources include: Solar power. It is generated by converting the energy of the Sun directly into electricity due to photovoltaic effect; Wind energy. The latter is produced by turning the kinetic energy of moving air into electricity; Hydropower, including tidal energy, is generated by the energy of flowing water; Geothermal energy. It is produced by using heat energy from the Earth; Biomass (organic matter burned as a fuel) is a clean, renewable source of energy that comes from

the Sun, plants, algae and organic materials, such as wooden, vegetation and animal waste, via approaches along with combustion, gasification and anaerobic digestion [1].

3. Nuclear Energy. It is generated by means of harnessing the power launched from nuclear reactions. Nuclear power plants use nuclear fission to provide heat, which is exploited to produce steam that spins turbines. Nuclear energy is a low-carbon power supply, but it additionally increases concerns about nuclear waste disposal and environment protection from them. Despite considerable improvements in energy production and distribution, modern-day society faces a myriad of demanding situations related to power.

This includes:

1. Depletion reserves of fossil fuels;
2. Environmental degradation due to fossil fuels use;
3. Intermittency and variability of renewable power sources;
4. Increasing global electricity demand;
5. Energy poverty in developing regions.

The addressing of those challenges calls for a multifaceted method that encompasses technological innovation, reforms in some spheres and global cooperation. Combining energy and Artificial Intelligence (AI) opens up new opportunities for the energy industry. But what is most important — its implementation can solve existing problems and allow control of consumption.

Now about 60% of all generated electricity energy is wasted. But wasted energy represents billions of dollars spent on generated energy that we have not consumed.

AI can monitor the entire chain and identify potential problems that need optimization. However, the conclusion of a sustainable and equitable electricity future depends on the collective efforts of governments, industries and people.

In conclusion, by embracing innovation, we hope that in near future we will be able to harness this electrical energy to create a sustainable and rich destiny for generations to come back.

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FINANCIAL LITERACY

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In our ever-evolving global economic landscape, the concept of financial literacy has become increasingly pivotal. As individuals and societies grapple with intricate financial structures, it is imperative to recognize the profound impact that financial knowledge and acumen can have on one's personal and professional life. Financial literacy extends far beyond basic money management skills. In this era of constant economic flux, the ability to make well-informed and judicious financial decisions is a skill set that can profoundly shape an individual's financial well-being [1]. As we embark on this exploration of financial literacy, it is crucial to unravel the layers of its importance, examining how it contributes not only to personal financial success but also to the overall resilience and vibrancy of economies.

The basic concepts should be covered first. Budgeting and saving are fundamental pillars of financial literacy, serving as important tools for people to effectively manage their finances and build a secure financial future. Understanding these components and incorporating them into financial planning is critical to achieving financial stability, growth and long-term prosperity. Let's dive into each of these aspects:

a) Budgeting. It is the cornerstone of financial management, providing the basis for allocating income to various expenses and financial goals. A well-written budget takes into account both fixed expenses (such as rent/mortgage, utilities and insurance) and variable expenses (such as groceries, entertainment and discretionary expenses). By tracking income and expenses, people gain insight into their spending habits and can identify areas where they can make adjustments to align with their financial goals. Budgeting helps people live within their means, avoid accumulating debt, and prioritize savings.

b) Savings. Saving involves setting aside a portion of your income for future use, emergencies, or specific financial goals. It is a fundamental

practice that forms the basis of financial stability and sustainability. Savings provide a financial cushion to cover unexpected expenses, avoid debt, and achieve financial aspirations. People can use a variety of savings strategies, including creating an emergency fund, automating savings through payroll deductions or automatic transfers, and setting specific savings goals (for example, for a down payment on a home, vacation, or education). Developing a consistent savings habit, regardless of income level, is critical to achieving financial security and flexibility [1].

Nevertheless, there are five topics that are truly useful, but not everyone pays attention to them:

1. Investing;
2. Saving;
3. Insurance;
4. Taxes and tax planning;
5. Retirement planning.

Investing involves putting money into financial assets with the expectation of generating returns over time. It is a powerful wealth-building tool that enables individuals to grow their financial resources and achieve long-term financial goals such as retirement, education, or wealth accumulation. Common investment vehicles include stocks, bonds, real estate. Understanding investment principles, risk tolerance, and diversification strategies is essential for making informed investment decisions. By investing wisely, individuals can potentially generate passive income, beat inflation, and build wealth over the long term. There is a diverse array of investment options available to individuals seeking to grow their wealth or achieve specific financial goals. The choice of investment depends on factors such as risk tolerance, financial objectives, and time horizon.

Saving is a fundamental financial practice that involves setting aside a portion of income for future use, emergencies, or specific financial goals. It is a crucial component of personal financial management and provides individuals with a financial cushion, stability, and the ability to work towards achieving both short-term and long-term objectives. Here are key aspects of saving: financial goals, regular contributions, cutting unnecessary expenses, avoiding high-interest debt.

Insurance is a financial arrangement that provides protection against the risk of financial loss. It involves the transfer of risk from an individual or entity to an insurance company in exchange for payment of pre-

miums. The primary purpose of insurance is to offer financial security and mitigate the influence of unexpected events or losses. Insurance companies use underwriting to evaluate the risk associated with insuring a particular individual or entity. Factors such as age, health, driving record, and location are considered in determining premiums. The risk assessment helps insurers set appropriate premiums and determine the likelihood of claims.

Taxes are a crucial aspect of personal and business finances, representing a mandatory contribution to government revenue. Tax planning involves making strategic decisions to optimize financial outcomes within the framework of applicable tax laws. Effective tax planning can help individuals and businesses minimize their tax liability while remaining compliant with tax regulations.

Retirement planning is a comprehensive financial process that involves setting aside savings and making strategic decisions to ensure a financially secure and comfortable retirement. It encompasses various aspects, including savings, investment, budgeting, and consideration of social security and other retirement benefits.

In conclusion, financial literacy stands as a cornerstone of individual and societal well-being. The ability to understand and navigate the intricacies of personal finance empowers individuals to make informed decisions, cultivate financial stability, and work towards long-term prosperity. As demonstrated by the various facets of financial literacy, the benefits extend far beyond mere monetary gains. Financially literate individuals are better equipped to weather economic uncertainties, plan for the future, and contribute positively to the overall economic landscape. Therefore, fostering financial literacy is not just a personal endeavor but a collective investment in building resilient and prosperous communities. By prioritizing financial education and embracing the principles of financial literacy, individuals and societies can navigate the complexities of the financial world with confidence and create a path towards a more secure and sustainable future.

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DIGITAL FOOTPRINT: PRESENT AND FUTURE

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Nowadays, a modern user leaves a digital footprint every day. Sometimes a modern person does not even know about its existence, and if people guess, they do not notice how they easily leave it on the global Internet. Currently with the development of modern information technologies, the digital footprint is becoming an increasingly important aspect of our lives. The first reputation about a person appears on the trail: according to their statements on the Internet, their photos, and so on.

In order to make it easier to understand what a "digital footprint" is, we will simply designate it. It is the data that the user leaves while applying the Internet. All this information is now collected and processed by Artificial Intelligence (AI).

Every time you use the device, do not forget about the digital footprint. Often, the person who left it may want to delete it- but this, unfortunately, will not work.

The digital footprint can be active and passive. The passive digital footprint includes your Internet Protocol (IP) address, cookies, and data from mobile apps. With this type of tracking, information is saved and enters the network without the user's knowledge.

An example of this is the location, the time when the users visited the site, what they were looking for on the Internet. The users themselves leave an active digital footprint on the global Internet by uploading videos to video services and social networks such as YouTube, VKontakte, Telegram and the like. Every day, the active digital footprint grows due to the transfer of videos, photos and other files that you can leave on the global Internet.

A fingerprint (Browser Fingerprint) is a unique identifier for the configurations of a web browser and an operating system, which is formed based on the collected data by various tracking technologies. You can

avoid data fingerprints thanks to Virtual Private Network (VPN) and proxy servers. There is an option to manually change the time on your device, the language of the search engine and many other options to avoid or reduce the number of browser fingerprints [1].

Where does it come from? Data is collected through clicks on links, likes, online purchases, banking applications, and browsing resources on the Internet. A person who uses the app to track their health (often in conjunction with special bracelets or watches) further expands their digital footprint. A special place should be given to cookies and data that the users themselves publish and leave on the Internet. Cookies are a tool that helps resources track user activity on websites. Moreover, you need to pay attention to trackers – this is a special program that collects data about the sites that you visit and then it helps the system to show the user personal ads.

The digital footprint has both positive and negative aspects. It should be noted that usually users leave information about themselves on social networks and other sites: surname name, father's name, date of birth, city, hobby, bank card number and so on. These data are actively exploited by scammers who use a variety of schemes to deceive, and subsequently use a person for their own purposes (money transfer, transmission of any data, and the like. Unfortunately, despite the fact that information work is actively carried out with the population, allegations of fraud by telephone or Internet scammers are regularly received.

The active consumers of this resource are, of course, advertising agencies and other representatives of the advertisement industry. Every click on the link, every like, every view is read and the advertiser shows exactly the advertisement that users will be interested in and with some probability will attract and force them to click on it. This opportunity provides more and more ways for "total surveillance".

As Maxim Emm, an expert in the field of information security and technology, stated: "These technologies, if we talk about Facebook, will primarily be used to more accurately sell their ads" [2].

The protection of personal data is becoming an increasingly important task in the world of digital footprint.

As users, we must actively monitor our data and use privacy settings on various platforms to restrict access to our information. In addition, companies and organizations must strictly comply with the rules for maintaining the security and confidentiality of user data. Modern securi-

ty systems can only help us, but the last word remains with the human user. There are several methods to protect your digital footprints. The main thing in the security system is you should not leave any unnecessary information about yourselves on the global Internet [1].

It is worth taking a careful approach to choose a browser that you will later use for your tasks. It is not recommended to apply public Wi-Fi networks, even ordinary users can look at devices connected to a given point, and scammers can find out users' personal data, as well as redirect to fake social networking sites and other popular services or applications. It is worth logging in to the site using a username and password, but not authorization via social networks. You can reduce your digital footprint, but not delete it in any way. You must first delete all cookies that are stored on the device, because they store your passwords, your bank card data. It is also worth deleting the history of your search engine, since it is through it that scammers and other people can learn a lot, if not everything, from your state of health to your hobbies.

One rule should be remembered: "The less your data is stored on the Network, the lower the risk of theft". You should remove inactive accounts from your online applications or services. Moreover, they also contain information about your bank cards, phone number, and some even have your residential address, place of work or study, and numerous other data.

We come to the conclusion: now the digital footprint is all around us and it is difficult, even impossible, to avoid. You should not be afraid to use the modern Internet, although you should be careful when clicking on the link. There are a lot of ways for you to protect yourselves, but the main thing is to remember about digital etiquette, to know and to follow it. If you comply with it, you will significantly reduce your digital footprint, scammers will not be able to apply any data, because you will not even leave them on the global Internet.

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УДК 338.2
THE ROLE OF AI IN AUTOMOTIVE ENGINEERING

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The integration of artificial intelligence (AI) into the automotive industry has significantly transformed vehicle design and manufacturing processes. In the early stages of car manufacturing, AI is instrumental in design optimization. Complex algorithms analyze vast datasets, considering factors such as aerodynamics, safety, and fuel efficiency. The results are vehicle designs that are not only visually appealing but also functionally superior [1, p. 12].

AI-powered Computational Fluid Dynamics (CFD) simulations are crucial for optimizing vehicle aerodynamics. By analyzing airflow around the vehicle, engineers can reduce drag, improve fuel efficiency, and enhance overall performance [2]. AI is at the core of autonomous vehicle development. LiDAR, radar, and cameras rely on AI for real-time object recognition. These perception systems enable autonomous vehicles to navigate safely by identifying pedestrians, other vehicles, and road signs [3]. Self-driving cars learn from vast data sets, adapting to changing road conditions and unexpected scenarios. AI algorithms make split-second decisions to ensure passenger safety. AI permeates various aspects of automotive manufacturing: streamlines supply chain processes, predicts demand, optimizes inventory and reduces costs. Machine learning algorithms detect defects during production, ensuring high-quality vehicles. AI transforms the passenger experience by tailoring in-car features, entertainment, and comfort settings based on individual preferences. By analyzing sensor data, AI predicts component failures, enabling proactive maintenance.

As AI becomes ubiquitous, ethical considerations arise. Developers must address biases in AI models to ensure equitable outcomes. Balancing data utilization with privacy protection is critical. Developers must actively address biases in AI models. Fairness ensures that AI systems do not discriminate based on race, gender, or other protected characteris-

tics. Transparency involves making AI decisions interpretable and understandable to users [1, p. 12].

Stricter regulations and robust security measures are necessary to safeguard user data. Beyond design, AI significantly impacts the manufacturing floor. Predictive maintenance, powered by AI, revolutionizes how manufacturers manage equipment reliability.

By analyzing sensor data from production lines, AI predicts equipment failures before they occur. This proactive approach minimizes downtime, reduces maintenance costs, and ensures uninterrupted production. AI algorithms inspect components during production. They meticulously analyze every weld, seam and joint. If any defects are detected, the system immediately flags them for further inspection. This real-time defect detection ensures that only high-quality parts make it into the final assembly.AI tailors in-car features based on individual preferences. From infotainment settings to climate control, vehicles adapt to each driver's needs. Whether it's adjusting the seat position or suggesting personalized music playlists, AI ensures a seamless and enjoyable driving experience [2]. AI powers ADAS features like adaptive cruise control, lane-keeping assistance, and automatic emergency braking. These systems enhance safety by assisting drivers in avoiding collisions and maintaining safe distances.

In conclusion, AI is the driving force behind the automotive industry's evolution. As OEMs embrace this transformation, collaboration, innovation, and ethical awareness will shape the future of mobility.

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ROBOTICS: ROLE, PROSPECTS AND PROBLEMS

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Robotics and computer technology are two key areas of modern technological progress. The development of computer technologies such as artificial intelligence and machine learning, together with advances in robotics, has led to new opportunities and challenges. In this article, we consider the interaction between robotics and computer technologies, as well as their prospects and challenges for the future of society.

Robotics and computer technology are closely related and interact with each other. Computer technologies such as artificial intelligence and machine learning are key tools for the development of intelligent robots. Robots, in turn, use computer technology to analyze data, make decisions, and complete tasks [1, p. 120].

Zurich scientists and engineers were able to create a biorobot that has no analogues. It is based on the human principle, as well as the distinctive qualities of flexible joints of tissues and muscles. In Japan, female robots have long been a daily occurrence, serving as wives or household helpers. This innovation has become the norm for agriculture, where even the land is processed by robotic tractors. In the USA, robotics technologies have become a natural part of the military–industrial complex - military complexes are constantly being introduced into the army, actively replacing manpower. In addition, robots are actively used in the space industry. Scientists tirelessly continue their research, creating unique artificial intelligences and continuing to improve robotic technology, attracting the attention of all mankind. The only thing left to believe is that advanced technologies will remain under the control of mankind and will only benefit [2, 76].

Robotics and computer technologies are used in many activities. In the industrial sector, robots can automate monotonous and dangerous work, improve production efficiency and safety. In medicine, robotics helps in complex surgical operations and rehabilitation of patients. In the

field of maintenance, robots can serve as waiters, consultants, and even household assistants [1, p. 128].

A number of problems related to the development of robotics and computer technologies have been found. One of them is the ethical aspect. The development of autonomous robots raises questions of responsibility for their actions and possible consequences. There are also dangers regarding the replacement of humans with robots in some traditional fields of work, which can lead to increased unemployment and specific problems. Robots and autonomous systems can collect and process large amounts of data. There are questions about privacy and data protection. It is necessary to develop mechanisms to ensure the confidentiality of data and prevent their abuse [3, p. 76].

Despite the challenges of robotics and computer technology, there are huge prospects for the future of society. Robots can become indispensable assistants in many cases, improving people's quality of life and productivity. In medicine, they can reduce the risk of errors and improve the availability of treatment. In the field of ecology, robots can be used to combat environmental pollution.

In conclusion, it is necessary to say that robotics and computer technology interact and enrich each other. The use of these technologies in various activities can lead to increased efficiency, safety and better quality of life. However, it is necessary to take into account the ethical aspects and social consequences of such development. In general, robotics and computer technologies have great potential for the progress and development of society, and their further development requires attention and a balanced approach.

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DEVELOPMENT OF IT BUSINESS IN BELARUS

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In recent years, Belarus has seen a noticeable development in the IT business sector, and this is reflected in several striking trends indicating the growth prospects of this area.

Firstly, it is worth noting the growing number of IT startups and companies in Belarus. Young specialists and entrepreneurs see huge potential in the IT sector, so they are actively attracting investments and developing innovative products and services.

Secondly, Belarus is becoming more and more attractive for foreign investors in IT. Belarusian IT companies deserve to be recognised internationally and offer high quality services to customers. This attracts the attention of global players in the industry and contributes to the growth of exports of IT services and the development of international co-operation.

Finally, the development of IT education and increasing the human resource potential is another important trend in Belarus. The country is actively investing in education and creating specialised educational institutions and training centres for IT specialists. Special attention is paid to the organisation of various events, such as conferences and seminars, which facilitate the exchange of knowledge and experience between professionals and the formation of a new generation of highly qualified IT specialists [1].

Of course, despite the good forecasts, we cannot say that everything is going so perfectly. Sometimes there are a number of events that cause development in the IT sphere to come to a halt.

The Belarusian IT services market is facing serious problems that have a negative impact on its competitiveness. Many companies in Belarus suffer from a low level of service quality and weak competence of specialists. This puts them at a disadvantage and prevents them from retaining clients in the market.

One of the reasons for this situation is the lack of trained personnel. Despite investments in IT education, Belarus lacks highly qualified specialists. The problems are related to the adaptation of educational programs to modern market requirements and the lack of attractive conditions for young specialists.

The lack of competent specialists leads to low quality of services and limits the opportunities of Belarusian firms. Clients are becoming more demanding and are looking for more qualified service providers. As a result, Belarusian firms lose their competitive position in the market and have difficulties in retaining existing clients [2, p.13].

To remedy the situation, attention should be paid to adapting educational programs to the requirements of the modern market. Providing attractive conditions for young professionals and government support for the industry can also help attract and retain talented IT specialists.

Without solving these problems, the Belarusian IT services market will continue to remain uncompetitive and will lose opportunities for growth and development. It is necessary to take urgent measures to raise the level of competence of specialists and make the Belarusian IT industry more attractive for clients and talented professionals. This will contribute to the development of the industry and create a favourable business environment in Belarus.

In general, the trends of IT business development in Belarus point to stable growth and prospects for further development of the industry. The government, business community and educational institutions actively cooperate to create a favourable environment for innovation and growth of the IT sector in the country. Thanks to this, Belarus strengthens its position on the global map of the IT industry and attracts even more investments and talented people.

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THE ROLE OF BOARDER GUARDS IN THE GREAT PATRIOTIC WAR

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On May 28, our country celebrates the Day of the Border Guard. It was on this day in 1918 that the Decree of the Council of Commissars established the Border Guard of the RSFSR. And border guards guarded the borders of the USSR, and now they are guarding the border of the Republic of Belarus. The border troops showed themselves most heroically during the Great Patriotic War.

During the Great Patriotic War, the border guards took the first blow of the enemy. Most of them died on June 22, 1941. The outposts fought an unequal battle with the enemy, but none of them surrendered, and did not retreat without orders. On the first day of the war, 485 outposts entered the battle. The Germans allotted 30 minutes to capture the outpost, but some of them held out for a couple of months. More than 100,000 soldiers in green caps fought on the fronts of the Great Patriotic War, and more than 200 became Heroes of the Soviet Union. It was the border guards who forced the Germans to hide from bullets in the first battles, bowing to the Soviet land. On June 22, about 85,000 border guards of the western border took a sudden blow from the fascists. At the beginning of the war, the state border was guarded by about 670 outposts. All frontier outposts staunchly defended the sections of the border entrusted to them, most of them fought from several days to several months.

But there was a section of the border that the enemies were not able to cross. The garrison of the Brest Fortress covered itself with un-fading glory. The Nazis planned to take the fortress on June 22 by 12 in the morning. In the fortress they were opposed by 500 border guards, among whom were the personnel of the 9th outpost of the Brest border detachment, led by Lieutenant A.M. Kizhevatov. German divisions besieged the fortress, losing thousands of soldiers and officers. The border guards resisted until July 20, 1941, as evidenced by the inscription made on July

20, 1941 on the wall of the casemate: "I am dying, but I do not surrender! Goodbye Motherland!"

Border guards demonstrated immeasurable courage and heroism in the battles for the Motherland. The border guards fought bravely on Belarusian land. Here are some examples.

For example, the outpost of Senior Lieutenant Sivachev, which was located in the forest, was attacked by enemy sabotage detachments at 3:45 a.m., the border guards held the defense for 12 hours, everyone died.

The outpost of Lieutenant V.M. Usov was located near the Yuzefatovo monastery, a total of 30 border guards repulsed enemy attacks for 10 hours, when they ran out of cartridges, they went to the bayonet, 2 people survived. Lieutenant Usov was awarded the title of Hero of the Soviet Union and one of the outposts bears his name.

The outpost of Senior Lieutenant F.P. Kirichenko fought with the Germans until the evening of June 22, after the order to retreat, the border guards fought their way out of the encirclement. Senior Lieu-tenant Kirichenko was killed on the outskirts of the outpost, 150 Germans were killed.

The outpost of Lieutenant V.G. Maliev was located on the Bialystok salient and held out for 14 hours, repulsed 5 attacks and only by order the fighters withdrew, 13 people survived. When the enemy entered our land, all border guards from the first seconds to the very end fulfilled their military duty, remained faithful to the oath. Many of them lost their lives in the battles for our Motherland. The border guards of other outposts also stood to last, and no one left without an order. Only a few survived, although by the beginning of the war the Belarusian border district numbered about 20 thousand people.

Many of them lost their lives in the battles for our Homeland. And our memory of them will live forever

79 years have passed since the end of the war, but the memory of these heroes will forever remain in the memory of the people, whose names are an example of selfless loyalty to military duty, fearlessness, indestructibility of spirit and love for the Motherland.

Brest fortress also remains in our memory as a witness of heroism of the Belarusian border guards who were among the first to hold the defense against the enemy.

We must remember our history! There is no future without past!

УДК 623.438.3
THE ROLE OF INFORMATION SYSTEMS IN THE MILITARY

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Every day the introduction of information technologies into various spheres of our life becomes more popular and relevant. Among other things, the military sphere has not been spared from such a trend. The military information systems concept defines information technology as a set of documented methods, techniques and tools for processing information, including application software, and standardized procedures for their use.

In today's world, as a result of the globalization process, the traditional arms race has been replaced by the struggle for dominance and control of information in the information war. The growing importance of the globalization process in contemporary society is directly linked to the overall economic development of countries. The economic interests' ancient powers led to the creation of the Silk Road, an intercontinental maritime trade route. Initially, economic relations were limited by the quantity of goods and the time required for transport. With the development of communication systems and information technology, cross-border enterprises appeared.

Global economic interests are also taken into account in the management of military groups of armed forces regardless of their location.

Information systems are becoming an important tool for turning not only states but also potential adversaries into allies and friends.

Today, non-military information systems also create entirely new conditions and opportunities for improving the effectiveness of command and control of units and weapon groups. However, these conditions make the chain vulnerable to the stability of command and control systems, even under positive enemy influence.

Modern warfare involves many similar processes (surveillance, reconnaissance, navigation, etc.). At the same time, they are carried out in a very short time with the use of high-precision weapons. Thus, in-

formation technologies have encompassed both human resources, technologies and material objects, and become the main component of modern military strategy and tactics.

At the moment, information technologies are present in all armies of the world, including the Armed Forces of the Republic of Belarus. This has fundamentally changed the nature of warfare. Nowadays, to be able to handle weapons and equipment skillfully, one needs a higher technical education and excellent experience. With the help of these technologies, the armed forces of various countries use drones quite extensively for reconnaissance and missile and bombing attacks.

Intelligence, analysis, decision-making and communication with combat resources must be done in real time and with minimal delay. Massive concentrations of equipment and soldiers, traffic jams and complex logistics will be replaced by small mobile units equipped with advanced information technologies and capable of remotely controlling robotic firepower.

The military-industrial complex and advanced troop management systems are currently developing. Military science is also making an important contribution to this process. Research and development work is carried out, during which reasonable requirements for the prototype to be developed are determined. Analysis of modern experience has shown that successful military operations require comprehensive real-time information support for combat operations, which is no longer possible without modern information technologies. The consequence of inefficient information work today is the loss of personnel, weapons and equipment, which largely determines the success or defeat in war.

Thus, one of the most important directions for improving the com-bat capability of the Armed Forces is the informatisation of the military sphere and the introduction of information technologies. This causes drastic revolutionary transformations and leads to a change of priorities. Information technologies play a vital role in providing military security of any state. The role of these modern technologies in military sphere is constantly increasing with the development of globalization. Information systems have become a powerful means of influence on the enemy, as well as the state in order to transform it into an allied or friendly one. Belarus shows itself honorably on the world market of military information technologies.

УДК 621.43.01
THE INTERNAL COMBUSTION ENGINE

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The internal combustion engine (ICE) is the most common type of engine in the world. It powers airplanes, ships, boats, and other vehicles as well as agricultural machines and, of course, cars. ICE plays an important role in military technologies. Let's take a closer look at how it functions.

As for the basic principles of operation of internal combustion engines, the main component of it is one or more metal cylinders in which fuel is combusted.

There is a piston within the cylinder, whose diameter is slightly smaller than that of the cylinder. This allows the piston to move freely within the cylinder. The piston is a metal cylinder, surrounded by a spring-loaded piston ring that is inserted into the rod. The purpose of it is to prevent the entry of gas formed during the combustion of fuel into the space between the piston and the cylinder wall [1, p. 205]. The piston is connected to a metal rod (also known as a "finger"), which transfers vertical force from the piston to the crankshaft. Two upper channels in the cylinder are sealed off by valves.

The fuel and air mixture is supplied through an intake duct, while the exhaust products are released through another outlet channel. There is a spark plug located in the upper portion of the cylinder. This component plays a crucial role in igniting the combustible mixture, as sparks are produced at a great distance between the electrodes within the candle. The first piston engine was created in 1807 by François Isaac de Rivaz.

Let's look at the principle of operation of this device. When only the intake valve in a cylinder opens, and the piston moves toward the crankshaft, the atmospheric pressure drastically increases the amount of air expelled into the space from the cylinder. The air flows out of the nozzle (the carburetor tube) at a high speed and mixes with gasoline. As a re-

sult, a combustible mixture of gasoline and air is created. The spark from the spark plug ignites the mixture, creating a micro-explosion, which in turn causes the incandescent combustion products (gas) to spread and be pushed by the piston. This process produces a useful output. The internal energy from the gas mixture is transformed into mechanical energy by the piston. The piston transfers power through a connecting rod connected to the crankshaft. It creates a crank that transfers this force to the wheels (screws, propellers, etc.)

A four-stroke internal combustion engine has a single-roller machine. However, different types of engines for cars, tractors, and other vehicles with 4-, 6-, and 8-cylinder engines, have been invented. The operating cycle of a cylinder consists of four strokes: intake stroke, compression stroke, combustion stroke, exhaust stroke. We consider that only one of these strokes is useful (essential). Therefore, the engine comprises four cylinders that operate alternately, such that at least one cylinder is active during each engine cycle. There are several types of internal combustion engines in use. In addition to conventional internal combustion gasoline engines, there are other less popular engine types that also have certain advantages [2, p. 24].

In order to ensure the continuous operation of an internal combustion engine in a vehicle, it is crucial to remember that the engine's cooling system, fuel supply system, air supply system, and exhaust sys-tem must also function effectively. In modern vehicles, the computerized control unit plays a significant role in monitoring and managing the parameters of these important systems.

This computerized unit provides for each system to operate at optimal levels, thus contributing to the overall efficiency of the vehicle. It is essential to maintain and service these systems regularly to ensure optimal performance and longevity of the engine [3, p. 9].

The ICE is an amazing device that changed the world.

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THE DEVELOPMENT OF MILITARY FINANCIAL SYSTEM

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Military financial system required the creation of specialized management bodies. In Russia, the first such an organ appeared in the era of Peter, in 1700, by his order, in connection with the active formation of the regular army. Under his leadership, a Special Order (later Military) functioned, in which a commissariat expedition was charged with collecting revenue for the maintenance of the army and monitoring the distribution of funds. The Tsalmeister expedition was responsible for paying salaries to military personnel.

As the armed forces grew and became more complex, various types of salaries were introduced depending on rank and position, as well as compensation, benefits, bonuses and pensions. Cavalry officers could boast of the highest earnings in the royal army.

The financial departments of the Russian Empire carefully recorded all expenses, paying special attention to expenses for military operations. For example, the war with Napoleon Bonaparte (1812-1814) cost the defense budget a whopping 157 million rubles, of which almost half went to pay allowances.

With the formation of the Red Army, a new stage began in the development of military financial authorities. In 1918, Lenin approved a decree establishing the Workers' and Peasants' Red Army (RKKA), according to which Red Army soldiers were entitled to a monthly salary of 50 rubles.

When wounded fighters were paid this amount for another two months. During the Civil War, the Bolsheviks established a number of economic departments under the Council of People's Commissars (SNK), including the Finance Department, the Main Field Treasury, and treasury units at the army, division, and detachment levels.

In particular, on the eve of the war, the people, despite the beginning of a possible war, did not spare anything for their homeland, and in the

first hours of it, people donated their last acquired money through the system of state labor savings banks and branches of the state bank to protect their land. In general, it was nothing surprising since our people were always ready to give away their last shirt, last golden cross, if only their homeland would remain intact.

By the beginning of the Second World War and the Great Patriotic War, the number of armed forces of the USSR increased sharply. This contributed to an increase in defense spending, since everyone had to be paid a salary.

Subscriptions to government bonds and cash and clothing lotteries brought about 86 billion rubles to the state budget.

Another important part of this process was the withdrawal of sur-plus cash in the USSR, which was not supported by anything, and was an important means of combating inflation, inevitable in connection with the war.

Every day of fighting was paid for with the blood of soldiers; it is priceless how many losses there were during these two wars!

But there was also a waste of money: every day of the war cost approximately 388 million rubles.

This means that for the entire time of the war, funds were accrued to the budget from lottery tickets, government loans, and the conscientious people (not counting donations to the Defense Fund), the country fought for almost 223 days out of 1418 days of the Great Patriotic War!

After the Great Patriotic War, the damage left behind by the Nazis amounted to about 2 trillion 600 billion rubles.

After the Great Patriotic War:
• 1710 cities were destroyed,
• more than 70 thousand villages were burned (most of them were burned along with their inhabitants,
• 27 million people were killed,
• 25 million were left homeless,
• 32 thousand factories were destroyed, this caused enormous damage to the economy our country.

After the war, the fascists left a huge mark on the territory of the Soviet Union. They destroyed almost everything that was possible. It took decades to get out of this situation. A lot of money from the country's budget was spent to provide all people with home.

УДК 355/359

MILITARY TECHNOLOGY TRENDS.

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Over the past 20-30 years, new technologies, especially in the field of communication, have seriously changed our lives. People are actively exploring high-tech and the military sphere. We can say with confidence that an era of high-tech trends in the development of means and methods of armed struggle is being established. And all thanks to new technologies. A lot has appeared that can change the usual picture of military operations beyond recognition.

And so, the first breakthrough is drones. Initially, the drone was conceived as a weapon. The first working product, the Kettering aerial torpedo, was developed in 1917 in the USA. Modern drones have come a long way thanks to the development of microelectronics. The unmanned aircraft fleet includes multicopters, fixed-wing drones, single-rotor drones, unmanned helicopters and hybrids. There is a real military unmanned revolution in this area.

Recently, the secret Russian jet drone S-70 "Okhotnik" developed by the Sukhoi Design Bureau was presented to the public. This is the first domestically produced heavy drone that can carry hypersonic missiles. The range of tasks performed by combat drones is almost limitless. This includes reconnaissance and aerial photography, guidance and target designation, striking targets and electronic warfare.

Military lasers are becoming no less important. The Russian division of the Strategic Missile Forces has already used laser systems on combat duty. Their task is to cover the mobile Yars ground-based missile systems when they move into position areas to launch missiles. One can only assume that the laser beam is capable of quickly and effectively destroying air targets that threaten missiles.

Today, radio communications remain the main means of communication among troops. But it does not stand still and satellite communications are already being actively used, and not only for communication

with the high command, as it was before, but also for exchanging data with troops, crews of armored vehicles on enemy territory, and for controlling the same drones.

Virtual technologies are increasingly being introduced into systems for troop and weapon control, target designation, guidance, and navigation. Devices are being developed that display data about the combat situation directly on the fighter's glasses. For example, they can broadcast images of enemy troops located behind a hill.

If we hear the phrase "virtual reality" somewhere, then computer games come to mind first. Nevertheless, the very idea of a device that would immerse a person in conditions indistinguishable from reality continued to live. In 1979, the first VR helmet appeared, similar in functionality to modern models. This is VITAL - a flight simulator that tracked the user's head and eye movements. The image was generated by a computer and projected onto CRT displays built into the helmet's goggles. It was also included a microphone and headphones for communicating with the operator. These days, VR/AR technology is being used around the world to train soldiers. The main areas of application are simulating real military equipment for training pilots, drivers and technicians, training in combat conditions, training recruits, training medical personnel to behave in stressful situations and simulating operations involving different types of troops.

Virtual or augmented reality technologies are used everywhere, from a parachute jump simulator to a full-fledged war simulator.

Artificial intelligence is also used in military. Artificial neural networks (ANNs) consist of many digital computing elements. Their main difference from conventional computational algorithms is the ability to draw fairly correct conclusions on the task based on existing, often incomplete, data. Thanks to artificial intelligence, it has become possible to detect the desired objects at sea and on land and monitor their movements, draw a map of the area and assess the operational situation without human intervention. ANNs are capable of falsifying photos, videos and other information, so that it is almost impossible to distinguish it from that created by humans. ANN can also be used in electronic warfare and planning military operations from a single command center.

Military technologies are becoming increasingly popular and can lead to large-scale transformations in the military which ever seen in human history.

УДК 004.33
DIGITAL TECHNOLOGIES IN THE MODERN WORLD

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A hundred years ago, no one would have thought that robots, technology, and modern scientific achievements would surround us everywhere. Now they have made our lives much easier, most of the actions are performed by robots: cashless payment at the checkout, robots-vacuum cleaners, smart homes, gadgets, wireless Internet, unmanned vehicles, artificial intelligence and much more.

Digital technologies are modern technologies with a huge amount of information for transmission, processing and storage on electronic media. Digital technologies are used in all spheres of public life: in education, business, training, manufacturing, medicine, and art. With the creation of all these technologies, the term digitalization appeared.

Digitalization is the process of transferring data into electronic form using digital symbols.

Digitalization goals:
• High-quality provision of services
• Efficiency of business processes
• The possibility of creating new technologies
• The possibility of creating innovations and the development of science
• Reliable data protection
• Control from anywhere in the world
• Collection, storage and processing of information

Digital technologies are our step into the future. They will make our lives simpler and more exciting. At the moment, it's hard to imagine how many new opportunities await us.

An important problem is the development of artificial intelligence. Artificial intelligence is able to solve absolutely all problems and issues

instead of a human, but it does not have feelings and emotions. So, what happens if artificial intelligence replaces human?

First, it is necessary to take into account that the number of work places will be significantly reduced, as robotics will replace people. Because of this, there may be problems with unemployment.

Secondly, these are problems with security, cybersecurity, and privacy. Data leakage will occur, and privacy may be violated.

Thirdly, it is the regulation of artificial intelligence. It is necessary to develop such regulation of all processes in order to eliminate all errors.

Digitalization has a huge number of advantages, but despite this, it also has a number of disadvantages. The advantages and disadvantages are presented in Table 1.

Table 1. Advantages and disadvantages of digitalization in the modern world

Advantages	Disadvantages
Saving time. Reducing the use of paper. The availability of information at any time. Improving market production. Decreased mental activity. Business improvement.	Decreased mental activity. Data information leak. Learning new skills. The cost of improving technology. Program failures. Threats to cybersecurity. Pollution of nature.

After analyzing all the advantages and disadvantages, we can conclude that digital technologies are a step towards the modern future, but it is necessary to implement them correctly. Only man can rule the world, make life easier for himself, create inventions and innovations. Digitalization is spreading all over the world. It is more developed in countries such as Norway, Sweden, Switzerland, Denmark, Finland, Singapore, South Korea and others The Republic of Belarus has a significant place on the world stage. It cooperates with a huge number of countries, which allow it to borrow new ideas in the field of innovation and robotics. This affects the prosperity of our country and brings it to a higher level. Now a huge number of companies are working in the IT field. The state actively participates in the development of the economy and creates all the necessary conditions.

УДК 004.8, 004.93, 355/359
THE USE OF ARTIFICIAL INTELLIGENCE FOR MILITARY PURPOSES: PROBLEMS OF THEORIZATION AND LEGAL REGULATION

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Artificial intelligence in the military field offers several potential benefits. One major advantage is its ability to process and analyze vast amounts of data quickly and accurately. This can help military personnel make informed decisions and devise effective strategies. AI systems can also automate certain tasks, freeing up human resources for more complex and critical operations. Additionally, AI can be used in areas such as surveillance, reconnaissance, and targeting, enhancing the military's situational awareness and precision. However, the integration of AI in the military also presents challenges and risks. One key challenge is ensuring the reliability and security of AI systems.

The monograph «A New Fire: War, Peace and Democracy in the Age of Artificial Intelligence» (2022), authored by Ben Buchanan and Andrew Imrie, has become a striking example of this interest [1]. In the paper, the authors state that autonomous weapons controlled by artificial intelligence, are becoming increasingly more accurate, efficient and dangerous compared to weapons, controlled by people, and they are targeting this future of war. This opinion is also supported by other scientists and experts. Russell described a scenario where a small autonomous quadcopter could be equipped with an explosive device capable of destroying a city's infrastructure and killing all males be-tween the ages of 16 and 60, or all Jewish citizens in Israel.

Autonomous weapons will become more accurate, faster and deadlier.

It is important to note some points:

1.   Ethical issues: The use of autonomous combat systems based on AI raises issues of responsibility for the actions of such systems. Who is

responsible for mistakes or harm? How to ensure that the actions of autonomous systems comply with international norms and laws of warfare?

2.   Data Security: The use of AI for military purposes requires protection from cyber-attacks and preventing the possibility of hacking or manipulation of data, which could lead to unpredictable consequences on the battlefield.

3.   Invention of fresh threats: With the advancements in AI technology, there are new threats that involve using AI to build cyber weapons, manipulate information, and launch attacks.

4.   Disadvantages and errors of AI: Despite the high accuracy and speed of data analysis, AI is still prone to errors and shortcomings. Incorrect interpretation of data or insufficient training of the system can lead to incorrect decisions.

5.   Regulation and control: It is important to develop international standards and rules for the use of AI, for military purposes to ensure, transparency, accountability and control over its use.

The use of artificial intelligence in military operations is a complex issue that requires comprehensive and in-depth analysis. The goal is to get maximum benefit from this technology while minimizing any possible risks.

Therefore, our task is to develop artificial intelligence, taking into account ethical, legal and security principles, to ensure the safety and effectiveness of its participation in military activities.

The use of Artificial Intelligence in military affairs, brings new opportunities and challenges on the path to victory.

So, we can see that the world is on the threshold of a new era of warfare. We consider that artificial intelligence is extremely important for the military because it can greatly simplify the execution of many tasks. Some dangerous tasks that are usually performed by live soldiers can be assigned to robots.

It is important to develop these technologies ethically. It is important to adhere to strict regulations and guidelines for the use of autonomous systems.

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TECHNOLOGIES IN OUR LIVES

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What are the technologies? These are the devices that we use for our specific purposes. In simple words, these are all the electronic devices that we use every day. In our opinion, technology now plays a huge role in our lives. It is used wherever it is more convenient for people. Cars, planes, machines, ships, factories work with the help of technologies developed by an ordinary person. Technology greatly simplifies our lives. In fact, a person can do whatever he wants with the help of technology. Even if you take the Internet, for example. This is one of the best technologies that man has ever developed. With the help of the Internet, we can find absolutely any information. Or with the help of cars, buses, trams, trolleybuses, we can move very quickly around the city or in any locality. And with the help of airplanes and ships, we can travel around the world and visit the most beautiful and exotic countries of our planet.

Let's imagine for a moment that technology and everything connected with it would disappear from our lives. Would our lives change? Certainly, we cannot even imagine how people would live in one-story houses or farmsteads that their parents would build. Everyone would get ready to go to work much earlier than usual, because there would not be means of transportation, for example, public transport or simply everyone's working day would start later. Everyone would work in their garden and would run their own household. This is roughly what life was like 500 years ago. They developed technologies. So it is possible to live without technology but it is a little difficult, because you have to do a lot of things yourself. On the one hand this is bad, on the other hand it is go.

And what about the phones? Let's be honest no modern child can live without his phone for a day. Phones are used mainly for games, because you can find absolutely any game there, from shooting games to adventures. Or vice versa, we can download some kinds of quiz and learn a lot

of new and interesting things. In general, phones have be-come an excellent babysitter for children. Is it good or bad, we think this issue can be discussed over the years? Anyway, someone will be for it, someone—against it.

Also even if you take an ordinary job at a factory or enterprise, now an ordinary worker needs to be very good at working with a computer and the device on which he will work at the factory because now all factories are automated. It helps us to perform a difficult job. For ex-ample, the mining industry, the construction of some huge buildings without modern technologies would be almost impossible and very difficult. Let's imagine the construction of some multi-stored building that takes place without a truck that brings sand, a crane that lifts all materials to a great height, an excavator that digs to a great depth. All this is being built thanks to technology. Now we can't even imagine life without it. Personally, we quickly chose a profession that we like. We are studying automated electric drives. We understand that everything is automated and a specialist who understands some peculiarities is much appreciated.

Everything has advantages and disadvantages. In the case of technology, the pros outweigh the cons. But there are still minuses, there is nowhere without them. One of the biggest disadvantage is increased loneliness. As technology advances, people begin to feel lonely. And this is very sad. The entire modern generation lives in a virtual world, goes out, meets each other and spends time together less and less. We want to notice that live communication is an important component of our life, which helps a person to maintain his morale. You should have more control over screen time and interact with people more often. Don't waste your precious time and energy on toys like electronic de-vices and video games. We hope that you will listen to us.

In conclusion, we want to say that now the world is not standing still and continues to develop, and technologies are constantly evolving. We think that in the near future all technologies will reach a new level, much higher than it is now, all work will be done instead of us, for example, modern robots, cars will not be operated by a worker. Although now such machines have already been invented that can move independently for a certain time.

The new technologies in our lives have changed it radically. Now we cannot live without them! It is necessary to improve technologies constantly.

TECHNOLOGIES IN ANCIENT ROME AND THEIR IMPACT ON THE MODERN WORLD

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Ancient Rome is one of the most important civilizations in the history of mankind. He had a huge impact on the development of culture, law, architecture, politics, technology and many other aspects of our lives. The Roman Empire existed for more than 1,000 years and left us many valuable legacies. Ancient Rome was famous for its numerous inventions and technologies that had a significant impact on the modern world. It was their inventions and technologies that gave rise to many modern devices and ideas. And now let's consider look some of them.

The Romans were the first to build large cities using their ingenious engineering, architecture and culture. At that time, Roman cities already had public toilets and baths, sewage systems and fountains, but none of these things would have been able to function without aqueducts. It was this invention that made it possible to transport water over long distances and provide cities with clean drinking water. This important invention became the basis for the development of water supply infrastructure in modern cities. These large-scale structures stretched hundreds of kilometers to the east and supplied water to dozens of Roman cities. However, aqueducts were not invented by the Romans, but appeared earlier in Egypt and Syria. But it was in the Roman Empire that aqueducts reached their greatest development. The most popular artificial material is concrete. The window from which each of us looks at the world stands on a concrete foundation, high-rise buildings, platinum, nuclear power plants and many other structures. 4.5 billion concrete products are produced per year. Simple and cheap material contributes to the rapid growth of cities, and thanks to it, engineers can turn their ideas into reality. But the demand for this material appeared relatively recently, or rather in the middle of the eighteenth century, thanks to Ancient Rome. Concrete was not

invented in Ancient Rome but it was the recipe of Roman concrete that scientists all over the planet became interested in. That is why people can see thousands of buildings built fifteen hundred years ago, which preserved and perform their functions even now. For example, the city of Pantheon, which is located in the center of Rome, will soon turn 1900 years since its construction, and there are a lot of such structures: The Colosseum built in 80 AD, the Amphitheater of Pula built in 68 AD, and so on. The compressive strength of Roman concrete is comparable to that of modern concrete.

In ancient Rome, roads played an important role in the functioning of the state. They were used not only for movement, but also as a link between different parts of the empire. Rome's roads were known for their durability and quality, which allowed the empire to effectively manage its territories. The Romans laid 80.5 thousand kilometers of fortified stone roads throughout Europe and Asia. Roman roads were built skillfully and wisely. They were lined with stone and had special water drainage systems, which gave them strength and durability. Each road had its own caretaker who monitored its condition and carried out regular maintenance.

One of the most famous roads in ancient Rome was the Appian Way, built in the III century BC. This road connected Rome with the southern lands and became an image of the power and greatness of the Roman Empire. The Appian Way was an important trade route through which trade was conducted between the cities. Today, the roads of Ancient Rome remain one of the most revered engineering structures of antiquity. Their strength and durability are an example for modern engineers, and their story continues to inspire and impress people around the world.

Thanks to the inventions of the ancient Romans, their civilization flourished. Their ability to build roads, aqueducts, arches and amphitheaters made their empire one of the most powerful in the world. Ancient Roman inventions and innovations did not collapse with the Roman Empire. Their technologies and engineering achievements became the foundation for future civilizations, and their contribution to the development of architecture, engineering and civil engineering remains a great legacy for all mankind.

Their legacy continued to inspire future generations to create new technologies and achievements. People from all over the world continue to explore and admire ancient Rome technologies.

THE USE OF ARTIFICIAL INTELLIGENCE IN MODERN CONDITIONS

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Since ancient times people tried to make their life easier with the help of different inventions. Ancient man used tools and traps for hunting, fire for cooking, a wheel for transportation, and so on. But people didn't want to stop inventing, they went further. For many centuries, they lived with the idea of automating various processes so that they would take place without their intervention. In our time, this idea is accomplished with the help of various installations which operate independently from the human and programs that control them. But in or-der to operate the installation a person must have a lot of knowledge in the required field. But thanks to artificial intelligence, this task (as well as many other tasks) becomes much easier.

We are sure that many people have heard about artificial intelligence. Many students are using AI for various purposes. For example, we can remember the chat GPT, which became widely known because of its easy-to-use. All you have to do is make a request and it will exe-cute the task using its knowledge base. It can answer questions, write a code, or even have a meaningful dialogue with you.

Artificial intelligence is a technology that mimics human behavior to perform tasks and learn progressively using the information which it collects. They are categorized into strong and weak. A strong AI is an intelligent algorithm that is designed to solve several problems at the human level and above. You can consult it as a real expert. This AI is able to respond to human emotions what is very surprising. It is very often used for solving such problems as writing texts, translating texts into different languages, drawing diagrams, and so on. Weak AI, unlike strong AI, is narrowly focused. An example is a camera with built-in AI used for face recognition.

One exciting and large-scale experiment was carried out in Tokyo. Artificial intelligence was used to automatically control a chemical plant for 35 days. It was realized that AI, based on self-learning, could be safely applied to plant control. It was demonstrated that this technology could manage operations that were beyond the capabilities of automated protocols and, until now, required manual control. Thanks to the experiment, the quality of products was improved, the cost of resources and the total time of all processes were reduced. Although the experiment was successful, it did not completely eliminate human intervention. During the experiment, when it was raining, the air temperature changed and the workers had to enter new configuration and out-put values.

Another good example of artificial intelligence usage is Canon, which invented an advanced Assisted Defect Recognition system that brought a new level of quality control to its production centers.

Canon combines human experience, analytical information and artificial intelligence (including machine learning, computer vision and predictive modelling) to improve the accuracy and efficiency of ma-chine part testing.

Canon products are carefully inspected using industrial radiography (X-rays) and internal structure images to check for faults each part and its internal structure.

Using computer vision and machine learning, the Assisted Defect Recognition technology system analyses images of inspected components, automatically identifies potential defects (even those that may go undetected by the human eye), and learns and improves the accuracy of the recognition technology using human correction data.

Artificial intelligence is one of the most significant and promising technologies of our time, which affects all spheres of human life. Thanks to its capabilities in analyzing enormous data, processing automation, forecasting and decision-making, AI is becoming an integral part of the modern world, providing revolutionary changes in business, medicine, education, transport and other industries. The application of artificial intelligence allows companies to optimize business processes, improve the quality of products and services, increase employee efficiency, reduce production costs, make correct decisions, and reach new levels of development.

However, to maximize the benefits of AI technologies, it is important to be mindful of the negative aspects of using AI.

THE USE OF UAVS IN THE ARMED FORCES

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It's no secret that military affairs are a whole independent science. Like any other field of knowledge, they are constantly developing and enriching. In the modern world, the use of advanced technologies plays a significant role in the development of the Armed Forces; such innovations including the use of UAVs (unmanned aerial vehicles). UAVs in the armed forces are becoming increasingly popular and widespread, as their use in military operations can increase the efficiency and safety of performing various tasks, as well as reducing risks to human life.

The UAV is a multifunctional combat unit that can have varying degrees of autonomy - from remotely controlled to fully automatic. UAVs can be used for the following purposes:

1. Intelligence and surveillance. UAVs can be used to collect intelligence information, monitor enemy positions and their movements, and detect targets in hard-to-reach places [2].

2. Fire control and target designation. The UAV provides search, detection and identification of targets, preparation of weapons for firing, guidance, fire adjustment and solving the problem of hitting a target with fire.

3. Strikes at ground and sea targets. To carry out strikes, UAVs are divided into attack drones and kamikaze drones. Attack drones can be equipped with guided bombs, cluster bombs, incendiary devices, air-to-surface missiles, air-to-air missiles, anti-tank guided missiles and other types of precision-guided munitions, autocannons and machine guns. Kamikaze drones have a combined warhead to destroy manpower and lightly armored vehicles.

4. Electronic warfare. UAVs can be used to jam radio communications, radar and other electronic systems.

5. Delivery of goods. UAVs can be used to deliver ammunition, medical equipment, food and other necessary supplies to frontline positions.

Modern drones have high-quality technical equipment, surpassing classic manned vehicles in several factors:

1. Savings on operation. The production of UAVs costs tens of times less than modern aircraft; the flight does not require special training or the participation of pilots.

2. The ability to simultaneously perform several tasks such as: reconnaissance, coordination, information, attack, cargo transportation.

3. Removing the problems of the "human factor". During combat operations, the pilot receives high overloads, which are imposed on the psyche when it is necessary to make an important decision in a short period of time. With the use of drones, this problem is not relevant, since the actions of the drone are programmed or controlled by an operator who is not in danger and is able to reason rationally.

4. No risk to human life. The drone flies without human participation in combat, where the military personnel lives are at risk.

Currently, active work is underway to reduce the size of drones and their functionality. Reducing the size, we will reduce cost and maneuverability. Work is also underway on using a group of drones to achieve set of goals. During the flight, the devices exchange information with each other and distribute tactical missions.

Unmanned aerial vehicles have become an integral part of the armed forces of many countries in recent decades. Their use plays an important role in ensuring the safety and effectiveness of military operations. With the development of technology and the advent of GPS, the production and use of drones has received a new round of development [1]. Modern devices are distinguished by high autonomy, the ability to land independently, perform tactical tasks in combat and stay in the air for more than 12 hours. UAVs are superior to traditional manned vehicles in cost, mobility and overall effectiveness in military environments. But we must not stop there!

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THE DEVELOPMENT OF THE TECHNOLOGICAL PROCESS OF GRAPHICS AND CENTRAL PROCESSORS

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In this paper, an analysis of the development of the technological process in the production of processors over the past 13 years has been carried out. In computer technology, the technological process is measured in nm. Previously, the numbers characterizing the nanometer process corresponded to the resolution of the lithographic equipment; later it was the gate length of the transistors used in the processor chip [1]. The length of the gate decreased along with other parts of the transistor. Subsequently, the gate length began to decrease faster than other parts of the transistor. Since then, the binding of the gate size to the technological process has become inaccurate, since it no longer reflects the real increase in the density of transistors on a chip. This is currently a more complex characterization1. In other words, the nanometer process does not describe the dimensions of transistors. This is a relative indicator that determines the density of transistors compared to the previous technological process [1].

The production and specifics of the technological process are kept secret, so in this article, we cannot analyze the physical principles underlying these processes, but we can trace the evolution of the technological process. Picture shows data on Intel core i7 (Fig. 1) [2].
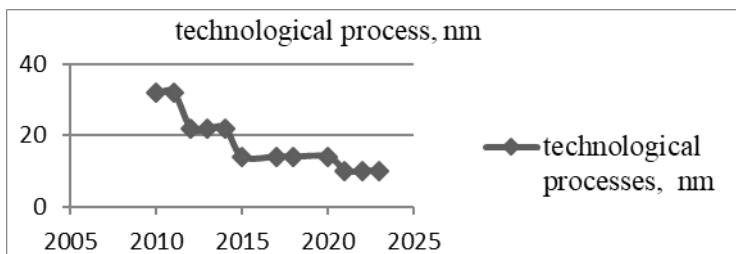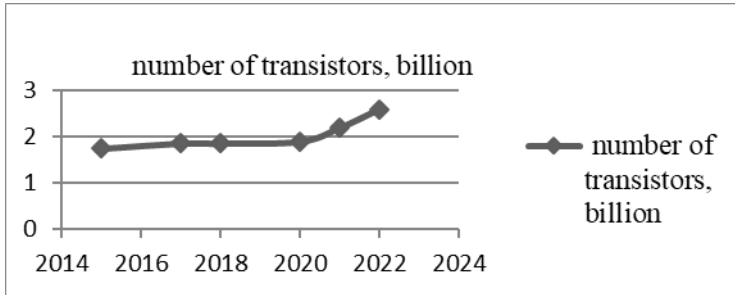
Fig 1. Evolution of technological processes Intel core i7

Let's now look at Figure 2, where is depicted a similar evolution in the production of chips for video card processors. Before comparing graphs and the development of the technological process, it should be noted that it is not correct to directly compare the development of the technological process of video card processor chips (GPU) and processor chips (CPU). The architecture and tasks of these chips differ fundamentally. The GPU specializes in graphics processing and parallel computing. Its main task is to provide visual reproduction, graphics rendering, and simultaneous execution of complex calculations. In turn, the central processor is the real brain of the computer, responsible for managing a variety of tasks. But we can assess the speed, scale, and turning points in the evolution of the technological process. Below graphs of the evolution of the technological process for GPU based on Nvidia graphics cards, namely for older generation models [2].

195
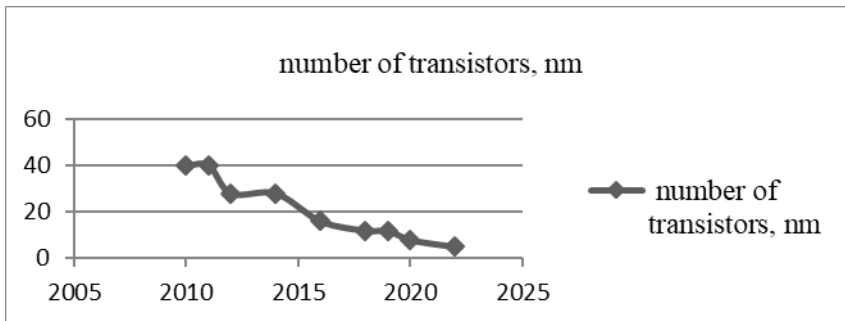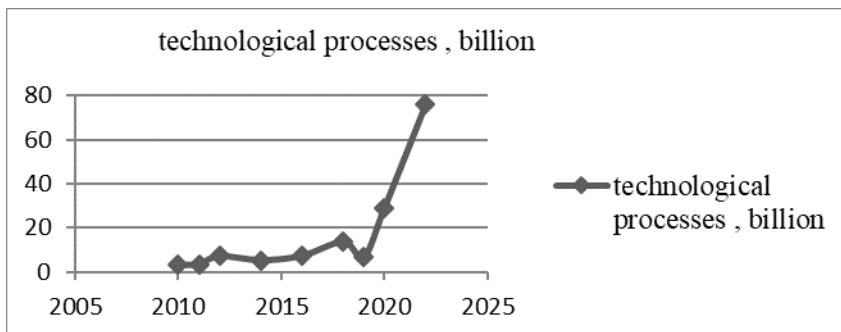
Fig 2. Evolution of technological processes GPUs

The main and general conclusion will be that the person has succeeded in developing the process. At the moment, it's hard to imagine what to expect in the future. In the development of the process in CPU, it can be said that a person has reached such a level that development slows down. But the main announcement for the next two years remains 4-6-nanometer processors. A 4-6-nanometer process has already been achieved in GPUs, and 1.4-3-nanometer technologies have already been announced. Now it's clear why the number of transistors in GPUs is an order of magnitude higher compared to CPUs. It can also be noted that the development of the technological process is very important for humanity. From it, one can establish a connection with ecology and human health. Thanks to the development of the technological process, it is possible to reduce energy consumption without losing productivity, which will have a very positive impact on ecology.

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УДК 004.03

PROCESSORS: TYPES, PROPERTIES AND PRODUCTION METHODS

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Micro and nano processors are the foundation of almost all electronics. The processor is one of the key components of a computer, responsible for executing logical, arithmetic operations, and control operations that are written in machine code. Processors are typically made from silicon, which has an atomic crystal lattice that meets the necessary requirements for producing microchips and processors of almost any configuration. The practical capabilities of processors have evolved rapidly, with a significant increase in the number of cores and the emergence of hybrid processors based on chips that integrate both traditional processor cores and graphics processor cores.

A microprocessor is a programmable device designed to process digital or analog information, perform input data processing, execute arithmetic, logical, and other various operations, and provide results according to the commands it receives from memory. The CPU of a microprocessor resolves several key tasks in a wide range of applications. It is used to transfer data between RAM and other components of a personal computer. The CPU also coordinates information between internal and external storage devices, ensuring seamless multithreaded and multiprogramming system operation by decoding machine code.

A nano processor is a small and energy-efficient processor made possible by nanoscale structure technology. It is used in devices with limited resources such as tablets, mobile phones, smart watches, and other mobile devices. One of the main benefits of nano processors is their small size, providing excellent mobility and low power consumption. They also have advantages in terms of manufacturing cost and low heat dissipation, making them particularly suitable for use in resource-constrained devices. Nano processors are capable of processing large amounts of information and performing heavy computations on par with more power-

ful and larger processors. They are equipped with all the essential functions, such as multimedia capabilities, graphics processing, power management, and interfaces for communication with other devices. Over time, the development of nanoscale technology has reached a level where a vast number of devices are starting to use these processors due to their reliability, cost-effectiveness, and performance. In general, nano processors represent a technical solution for manufacturing modern mobile devices, providing high performance with minimal power consumption. With their help, devices become more durable, functional, and user-friendly.

The basis of all processors are crystals. The essence of creating crystals lies in the production of physical inconsistencies, which are the individual elements of the electrical circuit - transistors, diodes, resistors, capacitors, and other components.

The production of processors consists of more than three hundred operations, resulting in the formation of over 20 layers into a complex three-dimensional structure. The initial material for microchip crystals are 200-millimeter polished silicon wafers. Several hundred microchips are grown on a single wafer. As a result, the polished wafer is covered with a fascinating microscopic pattern. To achieve this result, about 20 layers with numerous physical properties are applied to the wafer. After all the actions leading up to the photolithography method, 20 different masks are sequentially created, which must have a deviation from each other of no more than 0.1 micrometer. As a result of many operations in growing the crystals, four to five layers of metallization are applied to the wafer to connect the individual elements of the microchip. Then testing is conducted. After that, the wafer is cut into separate crystals, each of which is placed in its own housing with reliable external contacts.

Ultimately, the processors undergo comprehensive testing under conditions of temperature, mechanical, and humidity loads. And now we can implement the resulting product into devices.

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INVENTORY MANAGEMENT AND WAREHOUSE OPERATIONS OPTIMIZATIONS

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Inventory management and warehouse operations optimization are critical aspects of efficient functioning in any organization, especially in the field of engineering economics. Having the right inventory management strategy allows improving the level of customer service, reducing storage costs, and minimizing operational expenses. At the same time, optimizing warehouse operations helps ensure more efficient resource utilization and enhance overall production efficiency.

Efficient inventory management helps reduce costs by avoiding overstocking or understocking of goods. Overstocking ties up capital in inventory that could be utilized elsewhere. On the other hand, understocking can result in missed sales opportunities and dissatisfied customers.

One of the key tasks in inventory management is developing an optimal inventory level. On the one hand, having excess inventory in the warehouse can lead to increased storage costs, a higher risk of product obsolescence and loss. On the other hand, insufficient inventory can cause production delays and a decrease in the level of customer service. Thus, the primary goal of inventory management is to strike a balance between sufficient inventory levels and minimizing associated costs [1].

Various methods and models are utilized to achieve the optimal inventory level, taking into account factors such as demand size, lead time, order costs, carrying costs, and risks associated with demand fluctuations. For example, the Economic Order Quantity (EOQ) model allows determining the optimal order size by minimizing the total costs of ordering and holding inventory. This model is based on finding the balance between ordering costs and carrying costs [2].

However, inventory management is not limited to determining the optimal inventory level. Ensuring continuous supply and timely delivery of goods is also a crucial aspect. Methods such as demand forecasting and

sales planning are utilized to predict future organizational needs and take proactive measures. Classification methods for inventory are also widely used to identify which items require more stringent control and management, while others efficiently meet customer demand.

Optimizing warehouse operations also plays a vital role in inventory management. The goal of warehouse operations optimization is to maximize the efficiency of warehouse resource utilization, including space, workforce, and equipment. This can be achieved through proper organization and structuring of warehouse processes, automation of warehouse operations, and the implementation of modern technology [3].

Managing the flow of materials is one of the key aspects of warehouse operations optimization. Tracking and controlling the movement of goods from suppliers to customers not only accelerates operational processes but also reduces the risk of loss or damage to products.

Moreover, efficient inventory management and warehouse operations drive operational excellence by fostering a culture of continuous improvement and innovation.

By implementing lean principles, optimizing inventory turnover, and investing in automation technologies, businesses can enhance productivity, reduce operational costs, and unlock new opportunities for growth and expansion. The importance of optimizing inventory management and warehouse operations cannot be overstated. It is a strategic imperative for businesses seeking sustainable success in today's dynamic and competitive business landscape.

By prioritizing efficiency, agility, and customer-centricity, businesses can unlock value, drive profitability, and thrive in an ever-evolving.

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INERTIAL NAVIGATION SYSTEMS

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A GPS is very good at giving us directions and helping us with navigation. However, when you lose signal or it gets interrupted by something, Inertial Navigation System (INS) comes to help. This is similar to most of the basic principles compiled in order to do something not so simple.

If you need to calculate your movement, you need three things. First of all, you need to get your acceleration, which you can measure with accelerometer. Then you get direction of yaw, and we measure it with gyroscope. In flying vehicles, we also need to know pitch and roll, which are also measured with gyroscopes. From this data you will know how you are moving, but not where are you heading to. INS can't tell your position currently, but if you know it from maps or by other means, it can calculate that.

Let's take a closer look at the instruments, which INS uses to do all that work.

Accelerometer working principle is very simple. If we place a mass at the scales, it has some weight, which is calculated by acceleration times speed. When vehicle is not moving, acceleration is 9.8 m/s^2. But when accelerating, this number will be the sum of the acceleration of gravity and the acceleration of vehicle, and the weight will be increased. Measuring this increase, we can get the number we need.

The other method is two springs which balance the proof mass, and it works similarly. When vehicle moves, proof mass stays behind for some time [3].

Gyroscope's principle is like spinning top toy. It works on conservation of the angular momentum [2].

So, when the device or the entire plane tilts, the gyroscope remains in its place relative to the horizon. With several gyroscopes in different positions, we can measure yaw, pitch and roll.

Once we get this, we can learn other things. Just integrate the acceleration once, and you will get the speed, and then again – you will have the starting position [3].

Let's consider a few examples. Soviet INS named "Globus" was used to calculate the position of the spacecraft in orbit. It will be shown on miniature globe and with latitude and longitude indicators on the left and on the top.

On the globe there are dots with NASA tracking sites and big cities all around the world. Then there is another indicator under the globe – it shows when the spacecraft will enter the light or shadow.

"Globus" also provides you with information such as the landing angle, to calculate that you need to turn the switch using the "МП", "З" and "ОТКЛ" written above.

The first is to select a landing site, the second shows position over the Earth and the third is to disable it. This INS was used on "Soyuz" spacecraft in 1967 in the Apollo-Soyuz mission [4].

In conclusion, the Inertial Navigation Systems are astonishing examples of electromechanical engineering, and with the development of new technologies they are getting better and better. Some details change, but the principle remains the same.

Modern aircraft, spacecraft and sea transport cannot be imagined without this technology.

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TYPES OF AUTOMATIC TRANSMISSIONS

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Automatic transmission is becoming increasingly popular today. This is quite understandable as it is much more convenient for everyday use, and many of its "teething problems" from the early years have long been solved. Modern automatic transmission can be extremely fast as well as extremely efficient. There are several different types of AT, each with its own features and advantages.

1. Torque Converter Transmission (TCT). TCT is one of the most common types of automatic transmissions. It uses a hydraulic system to control gears, providing smooth and comfortable gear shifts. Hydromechanical AT usually has a wide range of gears and can be easily adapted to various types of engines. Operating principle: TCT uses pressurized hydraulic fluid to control gear shifting mechanisms. When the driver presses the gas or brake pedal, sensors send signals to the hydraulic system, which then shifts gears according to the current speed and driving mode of the vehicle. Advantages: TCT has several advantages, such as smooth gear shifts, high driving comfort, adaptability to various road conditions and driving styles. It also usually has a wide range of gears, making them versatile for different types of vehicles. Disadvantages: One of the main disadvantages of TCT is power loss due to the hydraulic system, which can lead to a slight increase in fuel consumption compared to other types of AT. It may also be more complicated to maintain and require more frequent technical servicing.

2. Automated Manual Transmission (AMT). AMT is a combination of mechanical and automatic transmission. It uses computers to control gear shifting, providing fast and precise gear changes. AMT can be equipped with manual control modes, allowing the driver to choose gears manually. Operating principle: AMT uses electronic and mechanical devices to control gear shifting. It is similar to manual transmission but

does not require driver intervention for gear shifting. Instead, the control system (robot) automatically shifts gears based on algorithms and data on current driving conditions.

Advantages: AMT has several advantages, such as fast and precise gear shifts, fuel savings due to engine optimization, the ability for manual control mode for a sporty driving style, as well as convenience and comfort in daily use.

Disadvantages: One of the main disadvantages of AMT is expensive maintenance and repairs due to the complexity of the system and the higher amount of electronics. Some models may also exhibit delays or jerks during gear shifts, which can be irritating for the driver.

3. Continuously Variable Transmissions (CVT). CVT uses a special system of belts or chains for smooth gear changes without stepped shifting. This provides smoother acceleration and fuel efficiency. CVT also has the ability to automatically adapt to the driver's driving style.

Operating principle: CVT uses metal chains or belt that connect two cones with variable diameters. Varying the diameter of the cones changes the gear ratio, allowing smooth regulation of speed and torque output. This enables continuously variable gear to work without jerks or delays.

Advantages: CVT has several advantages, such as smooth and continuously variable gear, optimal use of engine power through constant adjustment of the gear ratio, fuel savings due to engine optimization at different speeds, and a high level of comfort while driving.

Disadvantages: Some drivers may experience some weird sensation during acceleration due to the lack of clear gear steps. Additionally, CVT may be less suitable for vehicles with high engine torque or for a sporty driving style due to the peculiarities of the system.

Thus, it is possible to conclude that the main types of automatic transmissions have their own peculiarities that make them suitable for different types of vehicles and driving styles. Understanding the differences between these types of AT will help drivers choose the most suitable option for their vehicle without hindering the basic performance of a vehicle.

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WORKING OF AIRBAG SYSTEM

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In an extreme situation, the airbag system protects a person from a fatal impact on the dashboard, steering wheel, windshield and other parts of the car interior. And airbags are triggered not only when the car collides with another object. In case of a strong impact of the car, the corresponding sensors send a signal to the airbag control module, which determines the severity of the collision with the help of algorithmic calculations. Several kinematic parameters such as acceleration, velocity, jerk, path, energy density, etc. are evaluated. These values determine whether the safety system is triggered or not. If they are above the preset thresholds, the module eventually commands the detonator to open the airbags. In this case, as a result of a chemical reaction, an air bag made of nylon fabric is instantly inflated with gas from a cylinder - ozone or argon. After that, the filled bags are gradually deflated at a certain speed due to small ventilation holes. It is important that the system has time to work in the shortest possible time, before a person comes into contact with an obstacle in the car interior. As a rule, this moment varies within 15-30 milliseconds. The first models of the safety system did not take into account the individual characteristics of the passengers. Later, manufacturers took into account possible differences in size and weight of people by creating a "smart" generator. In it, two squibs are triggered, the first of which triggers 80% of the gas, and if the cushioning is insufficient, a secondary filling occurs to increase the rigidity of the cushion. The mechanism only triggers properly if the driver and passenger are wearing a seatbelt. Each manufacturer has its own airbag system settings. As a rule, airbags react to a direct frontal collision of the car with a rigid obstacle at speeds above 22 km/h, as well as a tangential impact to the front of the car, directed within a 60-degree sector. But that's not all. The airbag system can be triggered by a hard landing after a ski jump or a fall

into a ditch, by hitting a curb or other heavy and solid object or a bump, and even by hitting a deep pothole. The airbags may not deploy depending on the force and direction of the vehicle's impact with the obstacle: for example, when an oblique front end collision is accompanied by longitudinal deceleration. In this case, the parameters may not exceed the set value at which the airbags will deploy. In modern cars, the electronics independently diagnose the airbags by scanning all components of the airbag system. If a malfunction or incorrect operation is detected, a corresponding signal appears on the instrument panel. It looks different for different manufacturers, but most often it is airbag or SRS inscriptions or an icon with a sitting person. Such an indicator lights up in test mode when starting the engine and if it does not go out, there is a problem in the system, although theoretically the cause may be in a simple malfunction of the bulb. In any case, this is an alarm bell and a serious reason to urgently contact a car service, where specialists with the help of appropriate equipment will carry out the necessary diagnostics. And it is better to refuse from various ways to cope with it on your own. Owners of used cars with decent mileage and unknown history should be most concerned about this. Most often there are two reasons for the malfunction of this function - the end of the expiration date or the absence of airbags due to the fact that they have worked and someone has already been safely saved. It is not a secret that in most cases on the restoration of the car, which has been in an accident, try to save as much as possible, and such repairs are often cosmetic in nature. In such a situation, the installation of expensive airbags is usually not included in the plans, and to silence the on-board computer, which controls their technical condition, it is not difficult for a specialist. There are a lot of ways to imitate the operability of the safety system. In addition, instead of real airbags, masters may put a simple piece of cloth for disguise. So the risk of buying a car without airbags on the secondary market is extremely high, so when choosing a car with mileage, you can't do without qualified help. All that an ordinary buyer can do in such a situation is to conduct a more thorough visual inspection of the interior to detect suspicious signs.

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DESIGN AND PRINCIPLE OF OPERATION
OF THE BRAKING SYSTEM

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At the heart of every car's preventing energy lie essential factors: the brake mechanism and the brake actuator. When it is necessary without delay to halt the car's movement, the brake mechanism interacts with the brake actuator to provoke the braking system. Regardless of its precise design and implementation, the brake mechanism generally incorporates two critical factors: a movable aspect and a set counterpart. As the wheel rotates, the movable element engages, at the same time as the constant element stays desk bound. It's the friction generated between those elements that enables speed discount and in the long run brings the automobile to a halt. In drum and disk brake configurations, the movable factors are the drum and disk, respectively, while the desk bound elements are the pads [1].

Drum brakes, a century-antique invention, function a drum affixed to the wheel housing pads and hydraulic cylinders that press towards the drum's interior. Despite their age, many automakers still utilize drum brakes for rear-wheel programs.

Disc brakes are found on most vehicles today. They are mounted on the front axle and often the rear as well. To stop a wheel (and your car), a disc brake uses a caliper fitted with brake pads to grab a spinning disc or rotor. In assessment, disk brakes rent a metallic disk set up at the wheel and a caliper geared up with pads. These pads clamp onto the disk, inducing braking force. Introduced in the mid-twentieth century, disk brakes rapidly supplanted drum brakes in passenger motors as a result of their advanced overall performance [1]. Disk brakes offer superior heat dissipation compared to their drum opposite numbers, thanks to stepped forward airflow around the pads and disk. However, they demand extra force software, frequently necessitating the inclusion of an air booster

[1]. The brake actuator serves because the middleman among the brake pedal and the braking gadget, translating pedal input into braking force. Hydraulic systems make use of brake fluid for this cause, whilst mechanical setups hire steel cables. Hydraulic actuation systems function numerous key additives: the brake pedal, fundamental brake cylinder, brake fluid reservoir, wheel cylinders (commonly integrated into calipers for disk brakes), hydraulic strains, and optionally, a pneumatic booster. The operation of hydraulic brake systems is relatively straightforward: when the pedal is depressed, hydraulic pressure is transmitted to the main cylinder, initiating fluid flow to the wheel cylinders. This action activates the brake pads, allowing the vehicle to slow down or stop. Upon releasing the pedal, return springs reset the brake pads, restoring the pedal to its normal position and functionality. Modern vehicles contain diverse supplementary structures to beautify braking efficacy. Prominent amongst those are ABS (anti-lock braking device), EDS (electronic differential lock), ESP (digital stability software), EBD (electronic brake-force distribution), BAS (brake help machine), amongst others. These structures collectively make a contribution to safer and greater controlled braking overall performance. In the eternal brake debate, absolutes remain elusive. Drum brakes, plagued by overheating, sluggish drying, and excess weight, stand in contrast to their disc counterparts. Yet, discs, prone to expansion in heat, forfeit their parking prowess, a critical flaw in their design. This divergence underscores their distinct roles: discs, efficient but confined, and drums, impractical yet indispensable for parking safety. Despite advancements, drum brakes persist in modern cars, often relegated to the rear while discs dominate the front. Even in sportier models, where discs reign supreme, a solitary drum brake lingers, a nod to the essential task of parking [1].

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DEVELOPMENT AND APPLICATION OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN LOGISTICS

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The logistics industry is seeing increased interest in the development and implementation of artificial intelligence (AI) and machine learning (ML). These technologies are playing an increasingly important role in optimising processes, improving efficiency and reducing costs. Let's look at a few key aspects of this trend:

1. Demand forecasting and planning: Applying AI and MO to analyse demand data for goods and predict future needs allows companies to more accurately plan inventories, delivery routes and resource allocation;

2. Route and schedule optimisation: AI algorithms help optimise delivery routes by taking into account various factors such as traffic, weather conditions, fuel costs and time constraints. This helps to reduce travelling time and avoid delays;

3. Inventory and warehouse management: Using AI to analyse sales and delivery data can optimise stock levels in the warehouse and minimise storage costs;

4. Improving the efficiency of loading and unloading processes: The introduction of robots and AI-driven automation systems is helping to improve loading and unloading processes, reducing the time it takes to complete tasks and reducing the risk of errors;

5. Monitoring and detection of abnormal situations: AI-driven monitoring systems provide continuous tracking of logistics operations and automatic detection of potential problems such as cargo loss, damage or delays;

6. Delivery Cost Forecasting and Tariff Optimisation: AI algorithms analyse data on market trends and carrier tariffs to help companies forecast delivery costs and optimise tariffs;

These technologies continue to evolve rapidly, and their use in logistics will continue to grow, contributing to smarter. The world of logistics has identified broad areas of development impacting logistics operations and supply chains around the world. Here are some of them:

1. Digitalisation and automation: Advances in technologies such as the Internet of Things (IoT), artificial intelligence (AI) and machine learning (ML) are facilitating the digital transformation of logistics processes, resulting in increased efficiency and reduced costs;

2. Sustainability and environmental responsibility: There is a growing focus on environmental sustainability in logistics, including reducing carbon emissions, optimising routes to save fuel;

3. Multimodal transport networks: Developing infrastructure to integrate different modes of transport (road, rail, water, air) to provide efficient global transport networks;

6. Security and risk management: In light of global threats such as cyber-attacks, geopolitical conflicts and pandemics, the development of security and risk management strategies to ensure the continuity of logistics operations is of particular importance;

7. Demographic Change and Population Growth: Increasing populations and denser cities require the development of new delivery and freight management methods to ensure logistics efficiency in urban areas.

The issues that have been considered above can be seen as a reflection of the complexity and dynamics of modern logistics, which requires a constant focus on innovation, sustainability and global trends, especially nowadays in highly developing situation.

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CONTAINER TRANSPORT SYSTEM
AS A MEANS OF SAVING RESOURCES

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Analyzing the transportation of goods as one of the constituent elements of the transport system, it can be argued that container transportation today occupies a leading position in the delivery of goods around the world.

The use of containers has also facilitated the globalization of trade by enabling goods to be transported across long distances more easily and quickly. Container ships, trains, and trucks can carry large quantities of goods in a single journey, making it possible to move goods between continents in a matter of days or weeks.

Furthermore, containerization has enabled the development of intermodal transportation networks, where goods can seamlessly transition between different modes of transport such as ships, trains, and trucks.

The breadth of use of this type of transport is due to its efficiency, which lies in its main advantages:

1) Reduction of container transportation costs due to fast cargo handling (loading, unloading), which, in turn, reduces the cost of delivery. As a result, the speed of cargo delivery in containers is 30-40 km per day higher compared to the delivery of goods in small batches.

2) The container ensures the integrity of the cargo and protection from various weather conditions, as the container is completely closed and sealed.

3) The use of container modules and their standardization allows us to automate the entire process of container cargo handling.

4) Containers are standardized in size and connection devices, which also unifies the mechanisms for unloading and loading containers.

The container is a small storage module that reduces the need for storage space and at the same time allows you to transport goods without boxes, in workshop or lightweight packaging.

The packaging of the goods is an obligatory stage of preparing the goods for transportation. When transporting goods, the packaging of goods is carried out using boxes. A box is the main element of a package, which is a special product for placing certain products. The following types of boxes are used for cargo transportation: boxes, barrels, pallets, bags, drums, etc. Most of them are made of lumber. As you know, lumber is a woodworking product, the raw material for the production of which is the wood of any tree. Consequently, the use of containers made of high-quality alloy steel reduces the consumption of most types of boxes.

A container terminal is an element of the container transportation system, the purpose of which is to transform container flows when transferring them from one type of transport to another.

The purpose of such a transformation of cargo flows is to ensure the most efficient further transportation of goods, goods and materials.

The container terminal is mainly located in the port area. This is due to the fact that special container cargo ships are used for mass transportation of containers. Modern container ships have an exhaust gas recirculation system, which helps to reduce harmful emissions into the atmosphere and saves fuel by increasing the capacity of the power plant.

Automation of the container terminal, first of all, involves saving human resources. Modern organizations are increasingly dependent on the ability of employees to effectively use their abilities and intelligence for the benefit of production. Due to the period of innovation, modern workers are focused not on their ability to work, but on its result; not on labor, but on consumer value embodied in certain products and technologies.

Thus, it can be underlined that automation of a container terminal is an example of the result of the activity of "knowledge workers"

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IMPORTANT ASPECTS OF THE SAFE TRANSPORTATION OF DANGEROUS GOODS

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Transporting dangerous goods is an important aspect of modern logistics that requires special attention and safe delivery methods. Dangerous goods can pose a serious threat to human health, the environment and infrastructure in general, so their transportation is subject to strict rules and regulations.

The transport of dangerous goods is not only of commercial importance, but also of critical importance to society as a whole. or example, many industries, such as the oil and gas industry, the chemical industry, and the medical industry, require the transport of dangerous goods to ensure proper functioning. However, it is important to understand that improper transportation of dangerous goods can have catastrophic consequences.

Dangerous goods can range from explosives and toxic substances to radioactive materials and infectious substances [1]. Transportation of such cargo requires special expertise, certification and training of personnel in order to minimize risks and ensure the safety of all participants in the process.

One of the key aspects of safely transporting dangerous goods is choosing the appropriate vehicle and packaging. Shipments must be packaged in accordance with international standards to prevent possible leaks or accidents during transportation.

Another important aspect of the safe transport of dangerous goods is compliance with all necessary documentary formalities and licenses. Proper documentation, including waybills, safety certificates, hazardous substance permits and other documents, ensures transparency and control over the transport process, and ensures compliance with all necessary rules and regulations.

It is also important to ensure that vehicles and equipment for the transport of dangerous goods comply with the necessary standards and requirements. Specialized containers, tanks, vans and other vehicles must comply with all safety standards and undergo regular inspection for serviceability.

In addition, it is also important to take into account the characteristics of the route and the conditions for transporting dangerous goods. It is necessary to design optimal routes with minimal risk to the environment and people, provide the necessary conditions for storing and transporting dangerous goods, and also monitor the implementation of all safety measures and requirements.

Another important aspect of the safe transportation of dangerous goods is the training and certification of personnel involved in their transportation. Drivers, warehouse workers and logistics specialists must be well prepared to work with dangerous goods, know the specifics of transporting each type of hazardous substances and be able to respond to emergency situations.

An important element of the safety of transporting dangerous goods is also the training of personnel in the rules of handling hazardous substances, techniques for preventing accidents and incidents, as well as methods for responding to emergency situations [2]. Regular training and practical exercises allow personnel to be prepared for any possible situations and ensure a high level of safety during the transportation of dangerous goods.

Thus, transporting dangerous goods is a responsible task that requires an integrated approach and compliance with all necessary safety measures. Compliance with rules and regulations, professional staff and the use of modern technologies help reduce risks and ensure the safety of both our society as a whole and the environment.

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THE DEVELOPMENT OF IT-BUSINESS IN BELARUS

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IT-business is one of the sectors of the Belarusian economy that is steadily growing. The country has a high level of education and literacy of the population, which is why Belarus is rich in skilled labor. A favorable investment environment, tax, customs and other preferences provided by the Hi-Tech Park, proper legislative regulation – all this contributed to the emergence of successful IT-companies that have gained worldwide fame. So Decree №12 "On the Hi-Tech Park" in 2005 and Decree №8 "On the development of the digital economy" in 2017 were passed [1, 2]. These documents established the legal basis for creating conditions in Belarus that would attract foreign IT-companies and foreign investments in the Belarusian IT-sector.

At the moment, there is the following pattern in the segmentation of the IT-market. 66% of companies name outsourcing as their main activity. IT-outsourcing is the process of transferring the maintenance of computer and office equipment into the hands of a company specializing in this field. Most often outsourced are: software development, call centers, protection against viruses, spam and other online threats, website hosting, servers and applications, disaster recovery. This can be either a partial or full transfer of functions, depending on the current situation in the organization. 16% of the organizations are mixed-model companies, 13% are the development center of foreign companies, 3% are other services and 2% are Hardware. The financial situation of Belarusian companies has deteriorated in the context of six months, but it is better than a year ago. So, if in the spring of 2022 63% of companies spoke about the deterioration of the situation, then in the spring of 2023 46% of companies feel a negative trend. For comparison, in 2021, 11% of respondents noted a drawdown in finances.

The last year has further stimulated companies to open foreign representative offices: if in the spring of 2022 59% of companies had a legal entity outside Belarus, then by the spring of 2023 81% of foreign companies had opened legal entity in Belarus. Another 10% are planning to open it. The share of exports in companies' revenue remains relatively stable: more than 70% of 82% of companies, which correlates with the figures of the last year and a half.

A smaller percentage of companies than six months ago faced the loss of customers amid sanctions. If in 2022 there were more problems with customers from Western Europe, now the USA market is becoming the most problematic. Despite the circumstances, the companies manage to maintain positions in global markets: in the traditional top of the USA, Western Europe, the CIS and Northern Europe. Geopolitical processes stimulate the development of new markets: in six months, the Middle East has displaced Canada in the ranking, and Australia – Southern Europe. 41% of companies already have sales offices in locations closer to the client by the spring of 2023, compared to 31% six months ago. Circumstances also stimulated a larger percentage of respondents to pay attention to the CIS market (14.8% now versus 11% in autumn 2022).

Thus, in conclusion it should be thoroughly stressed the fact that despite all possible attempts to slow down the development of IT-technologies and business in the Republic of Belarus, this sphere continues to develop and occupy a niche in the global IT-services market. The development of this area significantly increases the level of technological progress in Belarus.

In addition to all mentioned above, the ongoing modernization will help to create a positive reputation image of the republic abroad, which contributes to international cooperation and undoubtedly help to support the image on the highest possible level.

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THE ORGANIZATIONAL STRUCTURE OF A MOTOR TRANSPORT COMPANY

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The organizational and production structure of a motor transport company is understood as a set of rolling stock engaged in the transportation process, whose activities are aimed at storing rolling stock and performing necessary work to maintain and partially restore its operability, refueling with fuel and lubricants, providing equipment, spare parts and materials, energy and other types of work; and their interrelationships among themselves, the forms of construction, subordination in accordance with the purpose and functions performed.

A motor transport company is an independent business entity, the purpose of which is to meet the needs for passenger and freight transportation.

The main tasks of a motor transport company are organization and execution of transportation in accordance with the plan and tasks; storage, maintenance and repair of rolling stock; material and technical supply of the enterprise; maintenance and repair of buildings, structures and equipment; recruitment, placement and professional development of staff; organization of labor, planning and accounting of production and financial activities.

There are three main services in the structure of a motor transport company: operational, technical and economic service.

The operational service of a motor transport company is engaged in the scientific organization of the transport process and the effective use of vehicles. It finds and studies opportunities for the most efficient transportation at the lowest cost. In general, at a motor transport company, the operation service is designed to ensure full satisfaction of the needs of customers.

The technical service of the motor transport company considers the issues of maintaining vehicles in technically sound condition and ensuring the development of the production base, as well as manages the material and technical supply of the enterprise.

The economic service provides planning of the production activity of the enterprise and its analysis. The main processes of the production activity of a motor transport company are main production, auxiliary production, maintenance production, production management.

The main production in road transport is the performance of transportation, which is crucial for a motor transport company. However, the main production needs maintenance and execution of a complex of auxiliary works. Auxiliary production of a motor transport enterprise is a set of production processes that have their own result of labor in the form of a certain technical readiness of the rolling stock, which is used in the main production. Service production does not create a material product. It provides the main and auxiliary production with energy resources, information services, and controls the quality of maintenance and repair.

Thus, the optimal organizational structure of a motor transport company is one of the conditions for the effectiveness of its activities. But even with a properly organized management system, no motor transport company will be able to carry out its activities without the leading profession for such enterprises – the driver. Therefore, one of the most important tasks of a motor transport company is the proper organization of the work of drivers, since their work largely determines the fulfillment of the transportation plan, and consequently, meeting the needs of customers, and the efficiency of the enterprise.

Thus, in the end it is important to mention that the motor transport company is the most important link in the country's transport infrastructure as well as in the functioning of this system as a whole?

Taking into account not only mechanism but also drivers as the most valuable assets before considering the thorough functioning of a motor company, it is important to evaluate all possible risks and benefits that might help succeed.

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ENHANCING EFFICIENCY AND COLLABORATION IN MARITIME FREIGHT LOGISTICS

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Sea freight coordination is a critical element of global trade and supply chain management. It involves the organization, synchronization and implementation of the movement of goods by ships across oceans and seas. Maritime logistics plays a key role in facilitating international trade, linking markets and ensuring efficient and cost-effective transport of goods around the world.

One of the fundamental aspects of maritime cargo logistics is the optimization of routes and transportation schedules to reduce transit time and costs. Strategic planning is vital to selecting the most efficient shipping routes, ports and modes of transport to ensure fast delivery of goods. Cargo consolidation and containerization are important practices in maritime logistics to maximize the use of ship capacity and optimize loading and unloading processes [1].

Moreover, sound risk management is critical in maritime logistics to mitigate potential problems such as adverse weather conditions, piracy, port congestion and regulatory compliance issues. Robust risk assessment strategies and contingency plans help companies protect their supplies and ensure the continuity of their supply chains. In terms of benchmarking, companies in the maritime industry can use external benchmarking to compare their performance indicators with those of the leading shipping companies in the market. This benchmarking process helps identify areas for improvement, implement best practices, and improve operational efficiency and competency. Additionally, collaboration and partnerships with key stakeholders in the maritime supply chain are essential for smooth coordination and information sharing. By developing strong relationships with shipping lines, port operators, freight forwarders and customs authorities, companies can optimize their logis-

tics operations, reduce transit times and improve the quality of service for their customers.

Overall, digitalization and sustainability trends in maritime cargo logistics are changing the industry landscape, driving innovation and paving the way for a more efficient, sustainable and connected global trade network. Adopting these trends will be critical for companies to remain competitive, adapt to changing market dynamics, and thrive in the evolving maritime logistics environment.

The digitalization of maritime shipping brings innovative technologies and innovative solutions to improve the efficiency and sustainability of the industry. The introduction of digital platforms, Internet of Things devices and artificial intelligence systems is changing approaches to transporting goods across seas and oceans [1].

In addition, the introduction of digitalization in maritime logistics optimizes processes and increases collaboration between stakeholders. The use of digital platforms and electronic documentation promotes seamless communication and transparency throughout the supply chain. This digital transformation not only speeds up decision making, but also minimizes errors and delays, ultimately leading to increased efficiency and productivity. Adopting digital technologies in maritime logistics is essential to remain competitive in a rapidly evolving industry and meet the needs of modern customers.

Digitalization of maritime logistics makes it possible to track and control shipments in real time, which increases transparency and efficiency throughout the supply chain. Automated processes such as digital documentation, e-way bills and online customs clearance streamline operations and reduce paperwork [1].

In conclusion, ocean freight logistics is a multi-faceted field that requires strategic planning, effective execution and continuous improvement. By applying best practices, leveraging technology and developing collaborations with industry partners, companies can optimize their maritime logistics operations; achieve cost savings and sustainable growth in the global market.

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ENVIRONMENTAL IMPACT OF THE TRANSPORTATION OF DANGEROUS GOODS

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Transporting hazardous goods has a significant impact on the environment due to the potential risks associated with spills, leaks, and accidents involving these materials. Hazardous goods, also known as dangerous goods, can include chemicals, gases, flammable liquids, explosives, radioactive materials, and more. When not properly handled or transported, these substances can pose serious threats to ecosystems, wildlife, and human health not only at the moment. Transportation of dangerous goods is the process of moving materials that may pose a threat to the health and safety of people, the environment and property.

The transport of dangerous goods can be carried out by various modes of transport, including cars, trains, aircraft and ships. It requires special packaging, labeling and documentation, as well as trained personnel who must be aware of all the rules and procedures associated with the transport of dangerous goods.

The stages of organizing the transportation of dangerous goods by road are as follows:
- cargo analysis and definition of hazard class;
- drawing up a route;
- selection and preparation of vehicles;
- preparation of necessary documents;
- cargo handling: marking, responsible storage;
- customs escort [1].

Before starting the transport of dangerous goods, it is necessary to check all packages and labels, as well as prepare all necessary documents.

The main requirements are presented for documentary support of goods and labeling:

– determining the hazard class of the cargo, applying information signs to the container in accordance with the established marking rules;

– the presence of an emergency card for cargo with a degree of danger;

– information plates on the car;

– an information card for traffic police officers that determines the procedure for their actions in the event of an accident.

Vehicle and itinerary requirements:

– availability of special installations for the transportation of certain classes of dangerous goods;

– compliance of the car with the technical requirements defined in the rules of transportation;

– coordination of the route with the authorized bodies;

– compliance with the rules of transportation: speed limit, escort by traffic police if necessary.

During transportation, you must follow all the rules and procedures related to safety, as well as monitor the condition of the cargo. It should be urgently mentioned that in the event of an emergency, the driver must know how to act correctly in order to minimize the risks to the environment and people. Transportation of dangerous goods by road requires a high degree of responsibility and care on the part of the carrier and the driver. However, subject to all safety rules and regulations, such transportation can be safe and efficient.

In conclusion, it should be underlined that the transportation of hazardous goods has a significant impact on the environment, posing risks to ecosystems, wildlife, and human health. Also, it is possible to mention that it is essential for companies and regulatory authorities to prioritize safety, compliance, and environmental protection in the transport of dangerous goods to minimize these risks and protect the planet.

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ELECTRIC MOTORS IN TRANSPORT TECHNOLOGY

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Many people mistakenly believe that internal combustion engine vehicles came before the electric car, but in fact it was exactly the opposite. Already many years ago, in countries such as Russia, the USA, and Hungary, there were attempts to create something vaguely similar to an electric car. But it was a technique with low power, small amount of horsepower, small capacity, difficult to use. A similar electric car appeared back in 1828. Hungarian inventor Anjos Jedlik built an electrically powered cart that looked more like a skateboard than a car. But despite this, the invention served as a strong impetus for the development of a similar area of engineering.

Nowadays electric motors are gaining more and more popularity. This is due to the advantages over internal combustion engines due to the absence of emissions, dynamism and lack of noise. The advantages also include low maintenance costs, preservation of residual value during resale, high security and much more. Electric motors are distributed to various types of transport, such as: electric scooters, electric motorcycles, electric scooters, electric trucks, electric buses, water transport with electric motors and electric vehicles. The next type of transport that is offered for sale is car companies such as:

BMW Group (owns BMW, Mini and Rolls-Royce),

Daimler AG (owns Mercedes-Benz and Smart),

General Motors (owns Buick, Cadillac, Chevrolet and GMC), Volkswagen AG (owns Audi, Bentley, Bugatti, Lamborghini, Porsche and Volkswagen), Tesla and many others.

Electric water transport is becoming very popular. More and more companies are creating vehicles with fairly good technical characteristics. Electric hydrocycles, for example, can reach very high speeds - up

to 100-120 km/h, but in this they are inferior to gasoline ones, which reach 200 km/h. Jet skis with an electric motor are cheaper to operate.

Charging a battery costs much less than the cost of fuel to run an internal combustion engine. Also, having a gasoline engine, you need to constantly monitor the filter and do not forget about changing the oil. Electric motors and engines have not yet fully taken over transportation technology. For example, a cruise ship or large cargo ships with an electric motor do not yet exist. Electric motors are not yet able to cope with too long distances and heavy loads. But it is quite possible that the creation of a stronger battery will be in the future in the coming years, since shipbuilding is now developing progressively.

The qualities of a car with an electric motor are almost the same as water transport: silence, environmental friendliness, high speeds, low operating costs. So, no matter what type of transport you want, if you need the above qualities, think about choosing an electric motor in your vehicle. Today, the issue of ecology is being discussed very vigorously. Various protests in defense of nature occur quite regularly, so that people pollute the environment less, and so that various enterprises take action regarding air pollution and toxic emissions. In modern world, innovation in the field of electric motors is quite a good event; and many professionals are very pleased to learn that more and more manufacturers are creating "green" transport. As it is listed (mentioned) above, environmental friendliness is not the only reason for its creation; electric transport has many advantages. It is important to underline that many people are conservative in their preferences, and will choose internal combustion engines for a very long time, but it is believed that soon the advantage will be on the side of electric motors. People would like to see not only vehicles with electric motors, but also many enterprises trying to at least to a lesser extent switch to electric motors or generators.

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CONTRIBUTION OF IBM WATSON TECHNOLOGY TO THE AUTOMATION OF LOGISTICS PROCESSES

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Nowadays advanced technologies such as artificial intelligence (AI), cloud computing and big data analysis attract great attention and are being implemented by enterprises in almost all sectors of the national economy. These technologies are aimed at reducing human intervention in production processes, improving the efficiency of computing and reducing the operating costs of enterprises [1].

Currently enterprises are aware of the need to increase productivity, scale and automate their workflows. As a result, there is a growing need for applications and services based on artificial intelligence. This increase in attention and popularity has also led to competition in the field. At the same time, with the help of an enterprise solution such as IBM Watson, a large number of business problems can be implemented, optimized in terms of trust, transparency and scalability. The Watson system is an IBM package of services for the development of artificial intelligence. The essence of the system is to help logistics enterprises to effectively use information sources. It is also possible to use the information provided by IBM to analyze the logistics activities of the organization. This opportunity allows you to predict the future results of the enterprise. It is necessary to consider in detail how IBM Watson can affect the operation of the enterprise:

1) The first thing to consider is the possibility of increasing the efficiency of the enterprise. When using this system, it is possible to devote much more time to processing information rather than searching for it. Watson Discovery comes to the rescue, which allows you to determine all the available data of the enterprise, and then, based on the data provided, to predict the performance of a particular organization.

2) The next point is the excellent satisfaction of the customer base. The company should understand that each client has its own uniqueness. This has a huge impact on the decision to buy a product or service from a client. For customer satisfaction, the Watson Assistant system is introduced, which allows you to contain detailed information about the client base, implement a dialog interface in any application.

3) By introducing an understanding of ever-changing obligations into the IBM system, the system will begin to understand that data must be strictly protected from unauthorized persons. This method helps the enterprise to analyze and then minimize the risks in its activities. IBM Security is thoroughly studying the situation about threats that can potentially harm the enterprise. As a result, organizations are in a comfortable position, which is due to knowledge of their risks and security [2].

4) Watson can be used to create customized training programs, provide interactive training materials, and test staff knowledge. It can also analyze training results and provide recommendations for improving training programs. Watson helps companies retain and develop their talent, increase productivity and improve employee performance. The most important thing IBM Watson can offer an organization is the complete preservation of information from third parties. Most artificial intelligence technologies share their customer base for developers to help improve service. But it's not about IBM Watson. This technology fully stores information only for its owner, thereby attracting more and more logistics enterprises to introduce this technology into their activities. Companies that enter the market using technology IBM Watson become more competitive and attractive to global business. In general, the IBM Watson software package has huge potential in logistics and can greatly help modern companies reduce costs, increase efficiency and improve customer experience as part of optimizing logistics activities in supply chains.

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ICONIC CAR MODELS

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Iconic vehicles have perpetually captivated the hearts of fervent enthusiasts and casual onlookers alike, transcending their utilitarian functionality to ascend as enduring symbols of innovation, design brilliance, and cultural significance. This essay endeavors to plunge into the rich tapestry of automotive history, meticulously exploring some of the most iconic cars and the profound impact they have indelibly left on society.

One such timeless emblem of automotive ingenuity is none other than the Volkswagen Beetle. Springing forth from the fertile imagination of Ferdinand Porsche in the 1930s, the Beetle swiftly became synonymous with virtues such as dependability, accessibility, and its unmistakably unique design. Its odyssey from its humble origins in pre-war Germany to its triumphant global acclaim in the post-war era unequivocally solidifies its status as an enduring icon cherished for its practicality and distinctly recognizable silhouette.

In a divergent vein, the Ford Mustang emerges as an indomitable colossus in the pantheon of iconic cars. Bursting onto the scene in 1964, the Mustang encapsulated the very essence of the American muscle car ethos with its potent amalgam of power, style, and affordability. Its revolutionary design and attainable price point struck a resonant chord with consumers, metamorphosing it into a potent symbol of freedom and individuality. Despite traversing the vicissitudes of changing tastes and technological advancements, the Mustang has steadfastly retained its iconic stature throughout the decades.

At the pinnacle of automotive opulence rests the Ferrari 250 GTO, revered as much for its scarcity as for its ethereal beauty and unparalleled performance. Epitomizing the zenith of luxury and exclusivity, the 250 GTO's sinuous lines, formidable engine, and storied racing pedigree have elevated it to the hallowed echelons of a covetable masterpiece.

With a production run restricted to a scant 36 units, each commanding astronomical sums at auctions, the 250 GTO stands as a resplendent beacon of automotive aspiration and desire.

Beyond their visually resplendent allure, these iconic cars have woven themselves into the very fabric of society and culture, serving as wellsprings of inspiration for innumerable artistic expressions and evoking a profound sense of nostalgia across generations. Moreover, they have served as transformative agents for innovation in automotive design and technology, incessantly pushing the boundaries of what is achievable in terms of performance and aesthetics. An additional significant aspect to consider is the profound influence of iconic cars on automotive design and technology. These vehicles have not only captured the hearts of enthusiasts but have also served as pivotal moments in the evolution of automotive innovation, setting new standards and pushing the boundaries of what is achievable in design and performance.

From the Volkswagen Beetle's pioneering engineering to the Ford Mustang's revolutionary combination of style and affordability, and the Ferrari 250 GTO's relentless pursuit of automotive excellence, these iconic cars have inspired generations of designers and engineers to strive for greatness. Their lasting legacy extends beyond their aesthetic appeal, driving continual progress in automotive design, technology, and performance.

In essence, iconic cars like the Volkswagen Beetle, Ford Mustang, and Ferrari 250 GTO transcend the mere realm of transportation, embodying the quintessence of human ingenuity and the eternal allure of the open road. As we ponder the ever-unfolding panorama of transportation, it behooves us to unequivocally recognize and reverentially celebrate the timeless legacy of these indomitable automotive icons.

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HOW OVERNIGHT SHIPPING WORKS

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In today's hyper-paced global landscape, the efficiency of businesses is intricately tied to the rapidity at which they operate. Nowhere is this principle more evident than in the operations of transportation companies, where speed is paramount. Among the array of delivery options available, overnight shipping stands out as a beacon of swift logistics, providing a solution for the urgent transportation of goods.

Alternatively known as next-day shipping, express shipping, or one-day shipping, overnight shipping offers a lifeline for the expedited delivery of critical materials, time-sensitive documents, and perishable items. Given the intrinsic value and urgency associated with these commodities, air transport emerges as the preferred mode of conveyance, deemed safer and more expedient than ground transportation.

It is imperative to note that the efficacy of overnight shipment hinges upon meticulous scheduling and adherence to strict timelines. Typically, parcels must be scheduled for pickup or drop-off within a designated timeframe, often in the late afternoon or early evening. Subsequently, they undergo processing and transportation throughout the night, ensuring delivery before the close of the following business day [1].

While all overnight shipping services boast remarkable celerity, the standard delivery window typically extends until approximately 4 PM on weekdays. For those seeking even swifter delivery, expedited options are available at an additional cost, including the possibility of weekend or holiday delivery.

Despite its ubiquity in modern commerce, overnight shipping conceals a complex tapestry of logistical orchestration, technological prowess, and advanced resource management [2, p. 323]. Behind the scenes, an intricate network of hubs, aircraft, and ground vehicles collaborates seamlessly to facilitate the seemingly miraculous journey of a parcel from one corner of the globe to another in a matter of hours.

The successful execution of overnight delivery mandates meticulous adherence to thoroughly calculated schedules and routes. Even the slightest deviation or delay can cascade into a significant extension of the delivery timeline. As such, the process of shipping a parcel overnight entails a meticulous sequence of distinct steps.

Initiating the process, the shipper must arrange the shipment within the carrier's stipulated timeframe for overnight orders. Subsequently, the items are thoroughly packaged, with labels affixed as necessary. The shipper then arranges for either pickup or delivery to a designated carrier spot, ensuring timely collection on the same day. Upon retrieval, the carrier assumes responsibility, scanning, sorting, and subsequently loading the parcel onto an aircraft destined for one of the carrier's major hubs.

Upon arrival at the hub, the parcel undergoes another round of scanning and sorting, further streamlining its journey towards its ultimate destination. When a parcel finds itself still far from its ultimate destination, logistics dictate its transfer onto another aircraft destined for a secondary hub. As the parcel draws closer to its final stop, it undergoes yet another transition, this time onto a truck, poised to make the last-mile journey to the recipient's doorstep [1].

The utilization of overnight shipping, while entailing a higher cost, yields manifold advantages for businesses when employed judiciously. Firstly, in scenarios where time sensitivity is paramount, such expedited services facilitate the prompt delivery of emergency supplies, critical medications, just-in-time inventory, or vital documents, ensuring they reach their intended destination well before the close of the business day [2, p. 323, 325]. This expeditiousness is pivotal in maintaining operational continuity and averting potential disruptions.

Secondly, the adoption of overnight shipping invariably leads to heightened levels of customer satisfaction, a cornerstone of any successful business endeavor [2, p. 323]. With the proliferation of online commerce, consumers have come to expect swift delivery of their purchases. The absence of expedited shipping options may deter potential buyers, leading to abandoned shopping carts and diminished brand loyalty. By offering overnight shipping, businesses can assuage these concerns, bolstering customer confidence and fostering long-term patronage.

Moreover, the expediency afforded by overnight shipping extends beyond mere convenience, enabling the transportation of perishable goods to distant locales. Whether it be delicate flowers, temperature-

sensitive foods, or other perishable items, overnight shipping ensures their timely delivery while preserving their freshness and integrity. This capability broadens the market reach for businesses dealing in perishable goods, enhancing their competitiveness and customer appeal.

Furthermore, the adoption of overnight shipping serves as a strategic tool for mitigating operational costs, particularly in terms of inventory management. By expediting the movement of goods through the supply chain, businesses can reduce their reliance on extensive storage facilities, thereby minimizing overhead expenses associated with warehousing. This streamlined approach to inventory management not only optimizes resource utilization but also enhances overall operational efficiency, positioning businesses for sustained growth and profitability in an increasingly competitive landscape [1].

So, for instance, FedEx, a prominent global courier enterprise, possesses a fleet larger than the combined total of aircraft operated by Emirates, Etihad, and Qatar Airways, making it an outstanding cargo airline worldwide, with 700 aircraft traversing over 220 nations, transporting millions of parcels daily. Most of these flights are routed through the company's hub airports, strategically located worldwide, facilitating efficient sorting and transfer of packages between flights. Thus, the remarkable pace of FedEx's operations is underpinned by extensive air networks that seamlessly link nations every day [3, p. 11, 14, 68].

Eventually, through meticulous adherence to protocol and the seamless coordination of myriad logistical elements, the marvel of overnight delivery is realized, epitomizing the pinnacle of efficiency in contemporary commerce.

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EXPECTED POTENTIAL FOR TRANSPORT LOGISTICS

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The development of logistics infrastructure plays a huge role in maintaining sustainable and balanced economic growth at the national level. This key factor influences a country's long-term prosperity by ensuring the efficiency and speed of movement of goods, materials and information throughout the territory. Thanks to a developed logistics system, companies can improve their competitiveness and stimulate economic development by attracting investment and new business opportunities. Well-organized logistics not only reduces costs and increases productivity, but can also optimize the use of resources, reduce the negative impact on the environment and improve the quality of services for consumers. All this together contributes to the sustainable and balanced economic growth of the country, allows it to successfully compete in the international arena and ensure the well-being of its citizens. It is evident that the transport logistics industry is facing new challenges and opportunities as technologies evolve, consumer behavior changes, and markets globalize. Digitization and process automation are key trends that will shape the future of transport logistics. The implementation of modern digital technologies such as transport management systems, Internet of Things, and artificial intelligence allows companies to optimize delivery routes, improve demand forecasting, and enhance the efficiency of logistical operations.

Another important direction in the field of transport logistics is sustainable development. With growing societal awareness of environmental issues and strict regulations on environmental protection, companies are increasingly focusing on implementing environmentally sustainable approaches in logistics.

The use of electric vehicles, adoption of alternative energy sources, and route optimization to reduce emissions are just a few examples of

steps towards more environmentally responsible transport logistics. The impact of globalization on the development of transport logistics is undeniable. The expansion of international trade volume increasingly pushes towards the creation of efficient international logistics networks and strategies capable of guaranteeing prompt and reliable delivery of goods worldwide. One very promising direction for expanding capabilities in the transport industry today is the promotion of multimodal transportation.

The advantages of this approach, which involves successful integration of various modes of transport - road, rail, sea, and air, including the ability to form the most optimal logistical chains, accelerate delivery times, and minimize costs.

In conclusion, the expected future potential for the development of transport logistics are closely linked to the integration of cutting-edge technologies, sustainable growth, progress in multimodal transportation, and adaptation to global market changes. Only companies willing to embrace change and accept innovations will be able to achieve a new, unparalleled level of competitiveness and efficiency in this field.

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A DEVICE FOR TELEPORTING DANGEROUS GOODS

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"Flash Port" is an elegant high-tech capsule capable of instantly transporting dangerous goods from one place to another without harming the environment. This nanotechnology can be used in various spheres of human activity: first of all, in logistics centres, customs points, construction companies, as well as for transporting laboratory equipment and medicines. This nanotechnology opens us a huge range of opportunities in the development of not only logistics, but also other areas that are remote from logistics activities.

"Flash port" is not a huge capsule like a lift that will deliver your things to any place, as it is imagined by half of the globe. It is a nanotechnology designed in the shape of an elongated transparent cylinder, based on quantum entanglement - the binding of particles at any distance - to safely "teleport" a customer's goods to a specified location.

There's nothing complicated about the instructions for using the Flash Port, as all you need to do is specify your destination on the touchscreen and press the "Go" button. Within minutes, your goods will be delivered safely to their destination. There are currently 200,000 exclusive delivery locations available for teleportation, but Flash-port says it will increase that number to millions in the coming years [1].

"Flash-port"" provides transportation service for a variety of goods: hazardous, gaseous, liquid, solid and more. The price for trans-porting your cargo varies depending on the type of cargo.

Price segment of services:
Dangerous goods – $150,000;
Gaseous – $100,000;
Medical equipment – $100,000;
Machinery shipments – $100,000;
Liquid – $70,000;

Solids – $50,000.

And that's the only downside to this development - the price may exceed your expectations.Flash port does not cause air pollution, including nitrogen oxides and particulate matter, and does not contribute significantly to global warming due to carbon dioxide emissions, unlike traditional transport. The company provides services not only for transporting goods but also for recreational purposes. If you are tired of going to technical museums, you can visit the secret place where "Flash Port" is located. The experts will tell you about the device of this technology, and you can also visit inside a cylindrical capsule. The cost of such entertainment is $20, and students and schoolchildren will be given a 50% discount. At the end of the tour, you will receive a keychain in the form of a smaller version of the "Flash Port" as a gift and our company will treat you to delicious desserts in the form of a cylindrical capsule. The company has great news for travelling enthusiasts. The company is developing a teleportation system not only for logistics, but also for travelling. Imagine that you're travelling from one point of the world to another will take a couple of minutes. "Flash Port" will provide comfort and different types of services. At the touch of a button on the touchscreen display, you can be in the holiday of your dreams in just a few minutes, but it will be much cheaper, but realistic enough [2].

This development will provide complete convenience, simplify hours of work, bring distant places closer and save time that people can spend on what matters most to them. The development also brings our world ever closer to the inevitable future, which is nothing short of exciting. We look forward to users being able to experience the "Flash Port" and enjoy this new invention of mankind. This technology will undoubtedly expand the horizons of promising high-quality delivery of hazardous goods of any classes and dimensions.

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PROMISING FUTURE FOR AUTONOMOUS VEHICLES IN LOGISTICS: CHALLENGES AND OPPORTUNITIES

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Logistics plays a key role in the modern economy. It ensures the efficiency of long-distance transport and the transport of goods and cargo. Thanks to the development of technology and the introduction of innovative solutions, logistics transport has become faster and more reliable.

The introduction of modern technologies and innovative solutions helps to improve the shipping and transport process and optimise costs. One such innovative approach in logistics is the use of autonomous vehicles. They are increasingly finding their way into logistics chains. For example, autonomous vehicles are already widespread in various logistics centres and warehouses [1].

One of the key features of autonomous vehicles is their ability to continuously learn and improve. They can accumulate experience and data from their journeys, analyse it and use the knowledge gained to make more accurate and efficient decisions in the future. It is because of their ability to improve that autonomous vehicles will be discussed in this article today.

Autonomous vehicles are a technological breakthrough that is changing the way we think about transport. They are vehicles capable of travelling without human intervention, using various technologies and artificial intelligence.

Autonomous vehicles use artificial intelligence algorithms to analyse and process the collected data, make decisions and control traffic. They can perform functions such as controlling acceleration, braking, turning and selecting the optimal route. Their main goal is to ensure safe and efficient movement of people and goods without the need for a driver. They can be used in a variety of industries, including road transport, freight transport, public transport and even aviation [2].

Now let's look at the benefits of autonomous vehicles in logistics:

- Automation and increased productivity: allow automation of various tasks such as moving goods, sorting and packing.

- Reduced risks and errors: the use of machines reduces risks associated with human error, such as errors in navigation, steering and task execution.

- Improved safety: autonomous machines have the ability to operate in hazardous or hard-to-reach areas where it can be dangerous for humans.

- Optimising resource utilisation: machines can be programmed to optimise the use of resources such as fuel, energy and time.

- Improved customer service: shipments can be delivered faster and more accurately, resulting in customer satisfaction and increased customer loyalty [3].

Unmanned logistics has applications in various fields and offers many possibilities, so now let's look at some examples of the application of devices in unmanned logistics:

- Unmanned trucks: unmanned trucks equipped with special sensors and control systems can automatically transport goods over long distances. They can optimise routes, avoid traffic jams and accidents, and save fuel.

- Unmanned drones: they are widely used in unmanned logistics to deliver small loads. They can deliver parcels, medical supplies, food and other goods to hard-to-reach or remote areas.

- Automated warehouses: they use various devices such as automated forklifts, conveyors, robot manipulators others to automate the storage and movement of goods.

- Smart containers and packaging: smart containers and packaging are equipped with sensors and monitoring systems that allow you to track the location and condition of your cargo in real time [4].

The application of devices in unmanned logistics presents a number of challenges and problems:

- Safety: vehicles and robots must be able to avoid obstacles, prevent collisions and ensure the safety of surrounding people and property.

- Technical challenges: they require complex technical infrastructure including sensors, cameras, navigation and communication systems.

- Regulation and legislation: appropriate rules and regulations need to be developed that define rules of use and liability for potential accidents.

- Challenges to technology acceptance: some people may fear job losses or doubt the reliability and effectiveness of such systems.

Now let's look at the unmanned logistics opportunities that may become part of everyday life in the near future:

- Autonomous vehicles: these vehicles can autonomously deliver goods without human intervention, reducing labour costs and increasing the speed and accuracy of delivery.

- Robotic warehouses: robots will be able to move and sort goods, pack and prepare them for dispatch.

- Intelligent management systems: artificial intelligence will be able to analyse data on cargo, routes and delivery conditions, predict possible problems and make decisions to optimise logistics processes [5].

Autonomous vehicles are a modern trend that uses devices to automate and optimise the delivery and storage of goods. The use of such machines in logistics can reduce costs, increase efficiency and improve the safety of operations. However, there are challenges and issues such as reliability and safety of the devices, as well as ethical and regulatory issues. In the future, the use of autonomous vehicles will continue to evolve and become an integral part of the modern delivery and logistics industry.

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HOW TO BE EFFICIENT AND INNOVATIVE IN LOGISTICS

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Logistics plays a key role in the modern economy. It ensures the efficiency of long-distance transport of goods and cargo. The introduction of modern technologies and innovative solutions helps to improve the shipping and transport process and optimization costs. High-quality logistics allows you to increase the efficiency of transportation, reduce costs and, as a result, make prices more favorable for the buyer [1].

In this article we will consider current innovative technologies in logistics, their application and development prospects.

Internet of Things (IoT) is one of the key innovations widely used in logistics. It allows you to collect data on the location and condition of cargo, vehicles, warehouse stocks and other elements of the logistics chain in real time. Thanks to this, companies can track the movement of goods, control storage and transportation conditions, optimize delivery routes and manage inventory more efficiently. The client can also track the location of his cargo, its condition and receive operational information about a particular product in warehouses. The use of drones and unmanned vehicles in logistics also presents significant potential for improving delivery processes. With autonomous vehicles, companies can shorten delivery times, reduce transportation costs and improve customer service. Drones can be used to deliver small parcels to hard-to-reach areas, while unmanned vehicles can be used to transport large shipments over long distances. It is also a great advantage that the delivery will go directly from the sender to the recipient along the shortest routes. Consequently, such delivery will be the fastest, most comfortable and safe [2].

Artificial intelligence (AI) technologies are playing an increasingly important role in logistics, helping companies automate decision-making processes, optimize delivery routes, forecast demand and manage inventory. Machine learning systems and optimization algorithms can analyze

large amounts of data, identify patterns and trends, and make decisions based on predictions. This helps to reduce employee costs and eliminate human error, such as calculation errors or inattention. It can also offer the most suitable offer for each client [2].

Digital platforms and online marketplaces also play an important role in modern logistics, enabling efficient interaction between producers, suppliers and consumers. Electronic trading platforms, warehouse and transport management systems, and digital services optimize ordering, shipping and tracking processes, improving customer service and reducing time and costs. Today, it is the most popular and efficient way to transport goods from suppliers to consumers. Online marketplaces are at the very top of the market as they offer the most convenient selection of goods from anywhere you are and the most convenient payment and delivery [1].

One of the promising areas of innovative technologies in logistics is the use of augmented reality (AR) and virtual reality (VR) to train personnel, plan delivery routes, and create interactive tools for managing warehouse operations. AR and VR make it possible to visualize data on cargo, stock and transport in real time, improving decision-making and increasing the efficiency of staff work, eliminating the human factor and inattention.

Another prospect for the development of innovative technologies in logistics is the use of robotic systems to automate warehouse operations. Robot forklifts, automatic sorting systems, unmanned vehicles - all this allows companies to increase the productivity of warehouse operations, reduce labor costs and shorten order processing time [2].

In conclusion, innovative technologies provide companies with a competitive advantage and improving supply chain efficiency and reliability. The application of technologies mentioned above allows optimizing logistics processes, reducing time and financial costs, improving customer service and creating new opportunities for business development.

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MINIMIZING RISKS IN LOGISTICS
AS PART OF THE ECONOMIC PROCESS

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Today, an unexpected factor called risk can suddenly arise in any field of human activity. Logistics activities are not something special, there are also many situations associated with risks. When organizing transportation, people working in the logistics sector are highly responsible, which naturally implies the occurrence of certain risks.

Logistic risk is a certain type of risk that occurs in any branch of logistics activity. It covers all stages of the supply chain from the beginning of the production of services and all kinds of goods to the moment of their delivery to the final consumer, including storage and transportation to the final buyer.

Risks affect the parameters of the movement of commodity flows, and this, in turn, leads to disruptions in the organization of the supply chain. In addition to monetary losses from losses and fines, the logistics company faces consequences that are difficult to deal with immediately. These include: termination of the continuous production and maintenance process, reduction of services, loss of partnerships or modification of the partnership agreement, a drop in revenue from the provision of services. Figure 1 shows how a failure in the supply chain affects the efficient operation of the enterprise.

It must be said that many situations that cause risks cannot be predicted. Therefore, organizations cannot expect what they will have to face at any given time. However, enterprises can effectively respond to these situations, which helps to stay in the same position and continue to develop.

To minimize risks during transportation of products, enterprises prefer to use the services of insurance companies. The insurance company guarantees coverage of the losses incurred by the logistics organization.

At the moment, insurance companies are of leading importance for the company in any transportation.
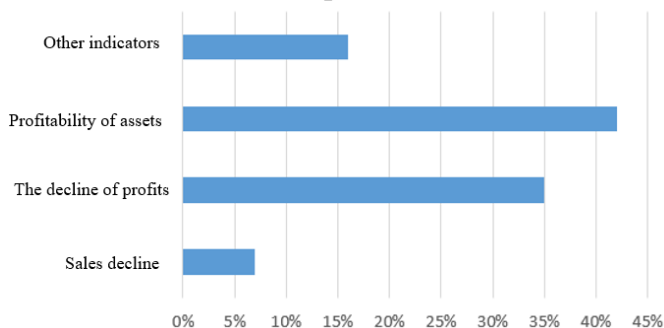

Fig. 1 - The impact of a supply chain failure on enterprise performance

Cargo insurance will always be an urgent decision on the part of the company. An insurance fund is created to compensate for damages arising in various situations. The purpose of insurance in logistics is the opportunity for suppliers to compensate for their costs of loss or damage to goods. This is a multi-level process in which all participants in the transportation are interested in the safety of the cargo. It is necessary to mention cases when it is profitable to draw up an insurance contract:

1) A full accounting of the characteristics of the cargo was carried out, all the rules of transportation on the part of the supplier were studied.

2) The carrier must ensure that the vehicle fully complies with maintenance standards and transportation requirements for various types of goods.

In this article, possible types of risks in logistics activities, types of insurance during cargo transportation were considered. It must be said that the main goal of the company is to deliver goods on time and in the right quality. Therefore, you need to be able to anticipate possible risks and use the services of insurance companies in advance. This will ensure the protection of all participants in the transportation.

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IMPORTANT ISSUES OF INTRODUCTION OF INNOVATIVE TECHNOLOGIES IN TRANSPORTATION

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The introduction of various innovative technologies has a strong impact on the development of transport processes, increases the efficiency and interest of customers of transport and logistics companies. Modern innovative technologies in the field of transportation are transforming our world, making it more convenient, safe and efficient. From the development of autonomous vehicles to smart logistics management systems, technology is changing the way we think about the transportation of goods and passengers. In this article, we will look at how innovations in transportation can affect logistics operations and our lives in general.

Transport innovations are the introduction of new knowledge, the improvement of technologies aimed at solving social and environmental problems, increasing productivity and reducing production and time costs in the transport system.

The goals of transport innovation:

1. The transition of the transport system to a more advanced technological level of freight and passenger transportation, including competitive automation and informatization of all departments of the transport system.

2. The transition from automation of individual processes to absolute automation in order to reduce the cost of manual labor and time costs. Ignoring this task reduces profits and reduces competitiveness due to low labor productivity.

3. Improving efficiency and reducing the cost of transportation.

4. Creation of environmentally friendly transport with the potential for high-speed traffic is one of the priority areas.

The first interesting development I want to introduce is called hyperloop. The idea was voiced by the owner of SpaceX and Tesla Corpora-

tion, Elon Musk. The appearance of the transport resembles a capsule. The movement and braking is provided by electromagnetic cannon.

The vacuum train can move without air resistance, which ensured the development of exorbitant speeds. This was achieved thanks to a magnetic or air cushion. The lack of friction of the rail wheels reduced the load on the entire structure and acted as an "accelerator". But, unfortunately, the project was closed due to some reasons. If the project had been launched, the locomotive would have accelerated faster than an airplane and easily overtook the fastest trains.

The next innovative development is called autonomous transport. Autonomous vehicles are the biggest innovation of the future for many car manufacturers. Self-driving cars can significantly change logistics, primarily by automating and improving the efficiency of transportation processes. Some of the major changes that may occur include: increased safety, save time and resources, increasing the flexibility and scalability of logistics companies.

Despite all of the above advantages, it will take a lot of time and money to implement self-driving cars. A whole infrastructure should be implemented, starting from specially designed and marked roads, ending with processing and responding to non-standard situations. Nevertheless, many processes in modern cars are already automated.

In conclusion, the introduction of innovative technologies in the field of transport logistics is an important issue for the further development of the industry and increasing the competitiveness of companies. Many logistics companies have already started actively researching and implementing self-driving cars. This will help to reduce costs, increase the speed of delivery and improve the quality of customer service. Also there are also negative sides, such as the risk of unemployment, mass layoffs of an employee. But this process cannot happen instantly, but only gradually. This is a very long implementation process, during which many other changes will occur, due to which most of the negative consequences will not affect society and the world around it.

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MECHANIZATION OF LOADING AND UNLOADING OPERATIONS: EFFICIENCY AND SAFETY TRANSPORTATION

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Mechanization of loading and unloading operations is a key element in optimizing freight transportation processes. The use of equipment and technologies allows for improving efficiency and safety in carrying out these tasks. One of the main ways to mechanize loading and unloading operations is the use of lifting equipment, such as winches, lifts, cranes, etc. These devices help to quickly and safely lift and move various loads, providing comfortable conditions for company employees and ensuring cargo safety. By reducing the physical efforts of operators, these enhancements significantly contribute to increasing the efficiency of loading and unloading processes. The use of modern lifting equipment also allows for increasing the speed of task execution, reducing the time spent on loading and unloading operations, and minimizing the risk of potential injuries to employees. Through the automation and mechanization of these processes, companies can significantly reduce labor costs and increase overall productivity.

An important component of mechanizing logistics operations is the use of specialized transport vehicles such as vans, trucks, wagons, containers, etc. Accelerating and simplifying loading and unloading operations is facilitated by specialized equipment, such as ramps, belt conveyors, further enhances the efficiency of these processes. By streamlining and expediting the movement of goods, these technologies save time and resources, ultimately benefiting logistic operations.

The safety of workers involved in loading and unloading operations cannot be compromised. Manual labor often exposes workers to hazardous conditions, including heavy lifting, repetitive motions, and the

risk of accidents. Mechanization serves as a viable solution to mitigate these risks and ensure worker safety.

By replacing manual lifting with machines, the physical strain on workers is significantly reduced. Forklifts and palletizers are capable of lifting heavy loads, eliminating the need for workers to engage in intense physical labor that can lead to injuries. Moreover, the risk of accidents, such as falls or collisions, can be minimized through the use of automated systems that operate with enhanced precision and without human error.

Furthermore, mechanization can improve safety by creating better ergonomic conditions for workers. Manual labor often requires workers to adopt uncomfortable postures or exert excessive force, leading to musculoskeletal injuries. Automated systems, on the other hand, are designed to optimize ergonomics, reducing the risk of such ailments and promoting a healthier work environment.

In addition to equipment and technology, specialized packaging and containers are vital for maintaining the integrity and safety of goods during loading and unloading. These containers are specifically designed to withstand external pressures and ensure the cargo's protection and security. As a result, they significantly enhance the efficiency and reliability of freight transportation by providing safe transport.

The use of loading and unloading scheduling software has become indispensable for logistics companies involved in freight transportation. This software plays a critical role in optimizing the planning and coordination of loading and unloading activities, thereby ensuring smooth operations and timely deliveries.

One of the key advantages of using loading and unloading scheduling software is its ability to streamline the process by effectively allocating resources, such as trucks, warehouses, and personnel. By creating optimized schedules, companies can minimize idle time, reduce waiting periods, and improve overall productivity.

Furthermore, this software offers the capability to monitor and track shipments in real-time, offering valuable insights into the progress of each delivery. These insights allow companies to promptly tackle any potential problems that may arise, including delays or disruptions, and implement necessary measures to ensure timely and efficient delivery.

Moreover, the utilization of loading and unloading scheduling software aids companies in enhancing customer satisfaction by ensuring

the timely and unharmed delivery of goods. By streamlining the transportation process, companies can meet and exceed customer expectations, foster trust, and bolster their reputation within the market.

Mechanization of loading and unloading operations also contributes to improving working conditions for employees, reducing the risk of injuries and accidents in warehouses and ports.

Automated systems allow for optimizing processes of storage and movement of goods, increasing the efficiency of warehouse space utilization, and reducing time losses in searching for and moving products. Thanks to mechanization, companies can increase their productivity, reduce costs on labor resources and equipment maintenance. This helps improve financial performance and competitiveness of the company as a whole.

It is important to note that the implementation of modern technologies and equipment also contributes to reducing the negative impact on the environment by reducing emissions and energy consumption. Hence, having thoroughly and profoundly investigated the issue, it is possible to conclude that mechanization of loading and unloading operations not only improves logistics and cargo transportation processes but also promotes more efficient and environmentally friendly use of resources.

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THE EFFICIENCY OF BELARUS TRANSPORT INFRASTRUCTURE FOR FREIGHT

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Transport infrastructure plays a crucial role in the economic development and effective operation of freight transport. In the case of the Republic of Belarus, a country with a favorable geographical location and transport route, it is important to consider the efficiency of its infrastructure for freight transport.

Belarus has a developed transport network, including roads, railways, airways, and waterways. Road transportation occupies a leading position in the country's transportation system, which explains the significant share of freight transport by road. The railway network is also widely used for transporting goods both within the country and for export.

One key indicator of the efficiency of transport infrastructure for freight transport is the accessibility and condition of roads. It is important to note that despite the large distances and favorable transport connections with neighboring countries, the quality of road surfaces and infrastructure requires further improvement. Various initiatives for road modernization and construction are already underway in the country, but they require further development and funding.

Another aspect of transport infrastructure efficiency is logistics. Effective management of freight transport, route optimization, coordinated interaction between different modes of transport, and the application of modern technologies and tracking systems all affect the speed and cost of freight delivery.

Freight transport also plays an important role in the economy of the Republic of Belarus, so the efficiency of transport infrastructure directly impacts the country's competitiveness and its possibilities in the international market. It is important to continue working to improve and develop transport infrastructure, as well as refine approaches to logistics and

freight transport organization, to ensure a stable and efficient transport system in Belarus. Measures to increase the efficiency of freight transport through road infrastructure improvement include not only road repair and construction but also the implementation of modern technologies and innovations. An important aspect is the use of traffic management systems, such as intelligent traffic signals, surveillance cameras, GPS systems, and smart road signs. These solutions help optimize traffic flow, prevent road incidents, and improve overall freight transport efficiency. In addition, the implementation of digital platforms and remote monitoring technologies can reduce time and costs in logistics operations, improve delivery time forecasting, and prevent possible delays. For example, a comprehensive solution - Smart road. Solutions for "Smart roads" allow to increase driver safety, manage traffic flows and road infrastructure efficiently, and provide data collection and processing from sensors and cameras. Additionally, smart road solutions utilize advanced technologies such as Internet of Things (IoT), artificial intelligence, and big data analytics to optimize traffic management, improve road conditions, and enhance overall transportation efficiency. The development of road infrastructure also requires attention to environmental aspects. The use of technologies that reduce harmful emissions, the use of alternative fuels, and the development of environmentally friendly transport vehicles contribute to improving the ecological sustainability of freight transport. The final step in increasing the efficiency of freight transport through road infrastructure improvement is the enhancement of the quality control system for road works and providing support and training for road workers and engineers. This will help improve the quality of road surfaces, prevent road transport incidents, and ensure the safety of freight transport.

Thus, an analysis of the state of Belarus' road infrastructure and its impact on the efficiency of freight transport allows for the identification of key issues and directions for further action. Through the integration of modern technologies, an ecological approach, and professional management, significant improvements can be achieved in the conditions for freight transport in the country, which, in turn, contributes to economic development and enhances competitiveness in the global market. Enhancing the connectivity of Belarus' road network with neighboring countries will also be a key to further improving trade relations and economic development in the region.

ADVANCEMENT IN ELECTRIC TRANSPORT DEVELOPMENT

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Cars are undeniably one of the most popular and comfortable options for traveling. However, despite their many advantages, they also come with a number of significant disadvantages, with the most serious one being the detrimental impact they have on the environment. Additionally, cars have become increasingly expensive over the past decade due to the rising costs of petroleum products. These issues have prompted developed countries to focus on developing and producing more affordable and environmentally friendly vehicles, which are gradually forming a sustainable transportation system [1].

Currently, electric transport stands out as one of the most promising sectors within the automotive industry. With the growing interest in eco-friendly solutions and the escalating environmental concerns, electric vehicles are gaining popularity at an impressive rate. In this article, we will explore the current technologies in the field of electric transport, examining the latest developments and discussing the prospects for its future growth and advancement. With each passing day, electric transport is becoming more common in our country. This is due to its many advantages, but at the same time we should not forget about its disadvantages. Also, one of the decisive factors for buying an electric car is its ease of bringing it to our country due to the fact that China has started making electric cars in huge quantities.

Let us now consider some of the advantages of electric transport that make it promising for further development:

- One of the main advantages of electric transport is its environmental friendliness. Electric cars and other modes of transport run on electric energy, which is produced in most cases without emitting harmful substances into the atmosphere. Thus, the use of electric transport helps to

reduce pollution and meets global requirements for reducing greenhouse gas emissions.

- Lower operating and maintenance costs are another advantage of electric vehicles. An electric motor does not require as many spare parts as a conventional internal combustion engine and does not need regular oil changes, filters and other consumables.

- Comfort is another advantage of using electric vehicles. Electric vehicles run smoother and quieter than internal combustion engine vehicles. Most electric cars are equipped with modern safety and control systems, which increase the comfort and convenience of driving.

- The final benefit that can affect the development of the country as a whole is new opportunities for the economy: the opening of electric vehicle manufacturing plants contributes to the development of the country and the creation of new jobs [2].

Electric cars are the most common type of electric transport. Examples of models include Tesla Model X, Mercedes-Benz EQS and others.

The peculiarity of electric cars is the absence of harmful emissions and higher economy compared to cars with internal combustion engines. At the same time, the limited range of travelling on a single charge is the main disadvantage of electric vehicles.

Electric buses are also a promising mode of transport. They can operate in urban environments without emitting harmful emissions, helping to reduce pollution and improve the quality of life for city dwellers. Examples of models include the BYD K9, MAZ 303E10 and others [3].

A well-developed charging infrastructure is necessary for the efficient use of electric vehicles. There are several types of chargers, such as conventional socket, fast charging and supercharging. Each type of charger has different characteristics and charging time. Charging infrastructure can be installed in car parks, petrol stations, city streets and other places. However, not all countries have sufficiently developed charging infrastructure for efficient use of electric vehicles [4].

At the moment, charging infrastructure is being developed in Belarus, but we should not forget about electric vehicle batteries, which have not yet been safely recycled.

Intensive research into new battery and charger technologies is currently taking place. New technologies should improve charging efficiency and extend the range of journeys on a single charge.

States and companies are also actively supporting the development of charging infrastructure. Some countries provide government support for the installation of charging stations and the development of electric transport. Electric transport can also be introduced in various areas such as freight transport, taxis and even aviation. This opens up new perspectives for the use of environmentally friendly transport [5].

Electric vehicles have many advantages such as environmental friendliness, economy and comfort. However, the limitations of electric vehicles, such as their limited range and underdeveloped charging infrastructure, do not allow them to fully replace internal combustion engine vehicles.

However, despite all these advantages and disadvantages, it should be pointed out that the main advantage of owning an electric car: the government provides benefits and subsidies for the purchase and operation of electric cars, making them more affordable for the population.

Overall, the transition to electric transport is an important step towards greener and more sustainable mobility, but a full transition to electric vehicles will not happen soon enough because many people are not ready for change.

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SYSTEMS FOR CONTROL OF GOODS MOVEMENT IN INTERNATIONAL TRANSPORTATION

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Trade between different countries is an integral part of the world economy. To ensure the efficient and safe movement of goods across borders, a stable and effective system for controlling the movement of goods in international transport is necessary.

The goods movement control system includes several stages, from customs clearance of cargo to its delivery to its destination. Each stage has its own characteristics and requires an appropriate approach. The first stage is customs clearance of the cargo. At this stage, documents are checked for compliance with the requirements of customs laws and regulations. The presence of prohibited goods in the cargo is also checked. Various methods are used for this, including X-rays, magnetic resonance imaging and other technologies. The second stage is cargo transportation. At this stage, goods are transported from the origin to the destination. To ensure safe and efficient transportation, various modes of transport are used such as automobiles, trains, ships and airplanes. The third stage is warehousing. Once the cargo arrives at its destination, it can be stored in a warehouse for further processing and distribution. Various methods are used to control warehouse storage, including video cameras and monitoring systems. The fourth stage is delivery of the goods to the final consumer. At this stage, the goods are delivered to the final consumer. Various methods are used to ensure safe and efficient delivery, including courier and postal services [1].

Product control systems in international transport are an important tool for ensuring the safety and efficiency of goods transportation. They allow you to track the movement of goods from the sender to the recipient, monitor their quality and condition, and also respond in a timely manner to possible problems.

One of the most common systems is the GPS tracking system. It allows you to determine the location of cargo in real time and receive information about its movement. GPS tracking allows you to accurately determine the location of your cargo in real time. To do this, it is necessary to install a special device with a GPS module on the cargo, which will transmit information about its movement via satellite communications. Data on the location of the cargo can be obtained via the Internet or a mobile application, where they will be displayed on the map as a point with coordinates. GPS not only provides vehicle location, but also enables the use of fleet management systems. Fleet managers can create geofences to notify them when vehicles pass certain locations. Fleet management systems also optimize route planning using real-time location data and help track driver schedules. Thus, GPS tracking helps monitor the route of cargo and respond promptly to possible problems or delays in delivery.

RFID (Radio Frequency Identification) is a technology that allows the use of radio frequency signals to identify objects: a method for automatically identifying objects, in which data stored in so-called transponders, or RFID tags, is read or written using radio signals. In international logistics, RFID is used to improve supply chain management processes and improve the efficiency of goods delivery. RFID tags can be installed at every stage of product delivery - from the warehouse to the final recipient. This allows you to control the movement of goods, track their condition and promptly respond to possible problems. For example, using RFID technology, you can track the movement of cargo in a warehouse, monitor its quality and condition, and determine the optimal delivery time. RFID can also be used to automate processes in warehouses, speed up the shipping process and reduce delivery time. Overall, RFID technology is an effective tool for supply chain management and improving the efficiency of goods delivery in international logistics [2].

Another important system is the electronic document management system. Electronic document management system (EDS) is a system (computer program, software, etc.) that allows you to organize and automate work throughout their entire life cycle. The main functionality of the EDMS should include the ability to create, modify, store and route documents, as well as a number of service capabilities, such as search, classification, etc. It allows you to automate the process of preparing documents for the transportation of goods, which speeds up the delivery

process and reduces the likelihood of errors. An electronic document management system (EDMS) in international logistics allows you to automate the process of information exchange between supply chain participants. It ensures fast and secure transfer of documents such as invoices, delivery notes, quality certificates, etc., and also speeds up the data processing process and reduces the likelihood of errors in information processing. Using the EDMS, you can monitor the status of cargo at every stage of its movement from sender to recipient. This increases the efficiency of the entire logistics system and reduces the costs of its operation. To do this, you must have access to the system and know the transaction number or cargo identification code. In the EDMS you can see information about the location of the cargo, its date of dispatch and delivery, as well as the condition of the packaging and labeling. All this data helps control the quality of services and make prompt decisions in case of problems or delays in cargo delivery [3].

The system for controlling the movement of goods in international transport is an integral part of the effective management of logistics processes. It allows you to timely track the movement of goods at all stages of delivery, minimize the risks of loss or damage to goods, and also improve the quality of customer service. Thanks to the use of a product distribution control system, it is possible to significantly reduce delivery time, improve the accuracy of forecasting demand for goods and optimize logistics costs. In addition, it should be noted that the product distribution control system must be flexible and adaptive to changing market conditions and customer needs. This is achieved through the use of modern technologies and tools [4].

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ENGINEERING ECONOMICS AND ITS SUBJECT OF STUDY

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Let me welcome everyone and introduce myself - my name is Vlad, I am 18 and I'm currently a 1st year student of engineering economics. Someone might think that this specialty is a little bit controversial and silly. But I would like to present some information about student`s life in BNTU and engineering economics in particular. So, as the name suggests, I am taking a course both on economic and technical disciplines. And now I am going to narrate you about a few of them and about my specialty in general.

First of all engineering economics is a branch of economics that deals with the application of economic principles to engineering projects and decision-making. It includes the analysis of costing, benefits, and risks associated with engineering projects, along with the evaluation of various options and alternatives to find out the most cost-effective solution. Engineering economics also plays a crucial role in project management by helping engineers efficiently and effectively distribute resources by considering factors such as time value of money, inflation, taxes, and depreciation. Also throughout the project lifecycle, economic engineers have the ability to create project budgets, accurately estimate costs, and monitor financial performance [1].

This allows them to make necessary adjustments to keep the project financially on track. Furthermore, engineering economics helps engineers assess and mitigate risks associated with engineering projects. By conducting risk analysis and incorporating risk management strategies into their decision-making process, engineers can minimize the potential negative impact of uncertainties on project costs and outcomes. This allows them to make more informed decisions that reduce financial risks and improve the likelihood of project success. But in order for a specialist to be able to do all this, he should first have a good knowledge of the subjects taught at the university. And now I will tell you about them.

1. Business Economics: This course provides students with an understanding of the basic principles and concepts of business economics. They study how businesses function and how they make decisions about production, marketing and finance.

2. Financial Management: Students in this course learn how to manage the finances of an enterprise, including evaluating financial performance, making financing decisions, managing risk, and developing strategies to achieve financial goals.

3. Accounting: This course teaches students the basics of accounting. They learn how to keep accounting records, how to prepare financial statements and how to analyse financial data.

4. Marketing: This course teaches students the basics of marketing. They learn how to conduct marketing research, how to develop marketing strategies and how to manage marketing campaigns.

5. Information Technology: This course teaches students the basics of information technology. They learn how to use computer programmes and systems to manage finances, marketing and other aspects of business.

In conclusion, engineering economics is a vital aspect of the engineering profession that combines economic principles with engineering problem-solving to make informed financial decisions. By analyzing costs, benefits, risks, and profitability of engineering projects, engineers can optimize resource allocation, improve project outcomes, and ensure long-term sustainability.

Through the use of tools such as cost-benefit analysis, net present value analysis, and sensitivity analysis, engineers can evaluate the financial implications of their decisions and make strategic choices that benefit both the project and the organization.

Ultimately, engineering economics enables engineers to not only design and implement successful projects but also to maximize their economic impact and contribute to the growth and success of the engineering industry as a whole.

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MODERN TRANSPORT TECHNOLOGIES

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Transport plays an important role in our lives, providing mobility, connectivity and economic development. With advances in technology, we are seeing significant changes in transport that are revolutionising the way we move people and goods. Over the years, we have witnessed remarkable advancements in transport technologies, reshaping the way we travel and revolutionizing our world.

The main purpose of the transport industry is to unite different sectors of the economy of all regions of the country into a single whole by means of communication routes of different types of transport.

Transport also satisfies the needs of people in travelling and contributes to the improvement of the living standards of the population. Providing international division of labour, tourism and cultural relations, transport plays an important role in the world economic process and international relations. Ensuring the defense capability of the country is also largely determined by the state of the transport system, its ability to provide timely military transport.

According to statistics, 90% of accidents in the world are caused by human error, meaning that the most unreliable and dangerous part of driving a car, truck or bus is the human being.

In 2016, Elon Musk stunned the automotive world by announcing that from now on, all of his company's cars would come with the equipment necessary for "complete self-driving". "You'll be able to take a nap in the car while it drives you to work," he promised. The car will even be able to drive cross-country without people inside the vehicle [1].

In addition to being considered safer, the automatic driving system is able to calculate the most favourable driving mode in advance, which will reduce fuel consumption. The biggest benefit from such implemen-

tation is planned to be received by companies that are engaged not in passenger, but in freight.

However, there are some technical and legal challenges to the development of unmanned vehicles. In particular, the issues of safety, liability for accidents, and the regulation of traffic rules for such vehicles require serious attention and the development of relevant laws and technologies. Nevertheless, the use of unmanned vehicles in public transport has great potential to improve the quality of life in cities, reduce harmful emissions and provide safer and more efficient transport. Transport is a significant source of carbon emissions and air pollution. However, modern transport technologies have the potential to mitigate these environmental impacts. The introduction of electric vehicles reduces dependence on fossil fuels and therefore reduces greenhouse gas emissions.

Another recent innovation in transport, electric vehicles have been gaining significant popularity in recent years due to their ability to reduce carbon emissions and dependence on fossil fuels. These vehicles run on battery-powered electric motors, offering a sustainable alternative to traditional internal combustion vehicles. The increased availability of charging infrastructure and the development of longer-lasting batteries have broadened the appeal and practicality of electric vehicles. By providing cleaner air and reducing greenhouse gas emissions, electric vehicles are contributing to a cleaner and more sustainable future.

Modern transport technologies are changing the way we move, offering sustainable, efficient and innovative solutions to the challenges of the transport industry. Electric vehicles, autonomous vehicles are revolutionising the industry, promoting sustainability, efficiency and accessibility. Reduced fuel and maintenance costs, lower emissions, access to government benefits and increased comfort during journeys all make the use of electric vehicles a profitable and efficient choice for many car owners. When implementing these technologies, it is important to continue to invest in research and infrastructure to maximise their potential benefits. In this way, we can create a future where transport is not only efficient, but also environmentally friendly and accessible to all.

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TECHNOLOGICAL INNOVATIONS
IN THE AUTOMOTIVE INDUSTRY

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The automotive industry is experiencing a significant transformation fueled by technological innovations, which are altering our perceptions, designs, and interactions with vehicles. Among these innovations, self-driving cars and electric motors emerge as groundbreaking advancements poised to redefine the future of transportation. As society contends with challenges like traffic congestion, pollution, and road safety, these technologies offer hopeful solutions that aim to improve mobility while tackling urgent environmental and societal issues.

Self-driving cars, also known as autonomous vehicles, mark a fundamental shift in automotive technology. Leveraging breakthroughs in artificial intelligence, sensor technology, and computing capabilities, these vehicles have the capacity to navigate roads safely and efficiently without human intervention. With the potential to reduce accidents, enhance traffic flow, and increase accessibility for individuals with mobility limitations, self-driving cars hold the promise of transforming urban mobility and transportation systems worldwide.

Self-driving cars, also known as autonomous vehicles, signify a revolutionary advancement in automotive technology. Equipped with state-of-the-art sensors, artificial intelligence algorithms, and advanced computing capabilities, these vehicles possess the ability to navigate roads independently. The emergence of self-driving cars brings the potential for improved safety, streamlined traffic patterns, and greater accessibility. However, the integration of self-driving cars on a large scale requires careful consideration of regulatory requirements, ethical concerns, and ongoing technological enhancements.

The transition to electric motors represents a significant departure from conventional internal combustion engines, presenting cleaner and

environmentally sustainable options. Electric vehicles (EVs) operate on rechargeable batteries and emit zero emissions, effectively addressing worries related to air pollution and climate change. Progress in battery technology has resulted in extended driving ranges and quicker charging durations, enhancing the practicality of EVs for daily transportation needs. Nonetheless, hurdles like infrastructure expansion, battery expenses, and concerns over driving range still impede widespread acceptance. Apart from self-driving cars and electric motors, numerous other technologies are positioned to transform the automotive industry. Innovations in connectivity enable vehicle-to-vehicle communication and seamless integration with the digital environment, offering the potential for improved safety and enriched driving experiences. Progress in materials science, including the utilization of lightweight composites, aims to boost fuel efficiency and sustainability. Additionally, exploration of alternative fuels and powertrains, such as hydrogen fuel cells and biofuels, provides opportunities to diversify energy sources and reduce environmental impact.

However, fully realizing the potential of these advancements requires united efforts to overcome a range of obstacles. It is essential to establish regulatory frameworks ensuring the safe and ethical implementation of self-driving cars, along with enhancing infrastructure to facilitate the widespread adoption of electric vehicles. Additionally, addressing concerns related to cybersecurity, privacy, and societal acceptance plays a vital role in building trust in these emerging technologies.

In light of these challenges, collaboration among industry stakeholders, policymakers, and society at large is essential. By collectively addressing regulatory, infrastructure, and societal challenges, we can unleash the transformative power of self-driving cars, electric motors, and other innovative technologies, shaping a future where transportation is safer, cleaner, and more accessible for everyone. As the technologies advance and become ingrained in our everyday routines, they hold the potential to redefine our mobility habits and interactions with vehicles.

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USE DRONES TO DELIVER GOODS

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Drones are unmanned vehicles capable of performing a wide range of tasks, including cargo delivery. This is a promising trend that is attracting the attention of both government and commercial organisations. Transporting goods using drones has a number of advantages, including saving time and money, accessibility to places with limited access, and reduced environmental impact [1].

The use of unmanned aerial vehicles (drones) for cargo delivery is one of the most promising trends in the modern world. Drones, controlled autonomously or along predetermined routes using GPS and other sensors, are capable of transporting a variety of goods over various distances. Pizza, medicine, clothing, and even books can all be delivered by drones, providing a logistics chain in a faster and more efficient way. Drone delivery has several advantages over traditional delivery methods. Firstly, speed. Drones are immune to traffic, traffic, and other obstacles, allowing them to deliver goods faster. Amazon, for example, claims to be able to deliver orders weighing up to 2.5kg in 30 minutes or even faster. Secondly, cost-effectiveness. Drone delivery can significantly reduce costs due to lower energy consumption compared to ground transport. Drones do not require drivers, couriers and other staff, which also helps to reduce costs. In addition, the use of drones can simplify the logistics chain by reducing the number of intermediaries. Experts' estimates show that the last mile cost of delivering a shipment weighing no more than 2kg using drones is about $0.1, while ground delivery of the same shipment costs between $2 and $82.The third advantage of drone delivery is environmental friendliness. The use of drones reduces the emission of carbon dioxide and other harmful substances into the atmosphere. Drones run on electricity or renewable energy sources, unlike ground transport that consumes petrol or diesel. In addition, drones gen-

erate less noise as they fly at low altitude and are small in size and weight compared to cars and other modes of transport [2].

Finally, drone delivery has social relevance. It can significantly improve people's quality of life, especially in remote and developing regions without well-developed infrastructure. Drones can deliver life-saving goods such as medicines, vaccines, food and water to places where they are most needed. Drones can also be useful in rescue operations, searching for missing people and other emergency situations.

Despite the promising potential of drone delivery, this method has faced a number of problems and challenges that need to be addressed and regulated. For example, the legislation of most countries does not provide for a clear legal status and regulation of drone delivery. Issues of remote control, flights without a human on board, safety and liability for possible accidents and incidents require special rules and standards to be developed and implemented taking into account the interests of all stakeholders: manufacturers, operators, consumers, authorities and the public [3].

Therefore, the potential for drone cargo delivery is promising, but it necessitates additional investigation, the establishment of legal frameworks and benchmarks, and the conquering of imminent obstacles in order to seamlessly incorporate this approach into a contemporary logistics apparatus [4].

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SITUATIONAL APPROACH IN TRANSPORT MARKETING

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The situational approach in transport marketing is a strategy based on adapting marketing actions to changing situations and contextual conditions in transport and logistics. This approach takes into account various factors such as seasonal fluctuations in demand, changes in the economic environment, technological innovations and the competitive environment.

The theoretical basis of the situational approach includes the application of concepts such as segment-oriented marketing strategy, market research, statistical data analysis and the principles of flexibility and adaptation.

The main aspects of the situational approach in transport marketing include:

1. Identification of market segments: Based on data analysis, companies identify the most promising market segments where there is a need for their transport services;

2. Adapting marketing strategies: Companies adapt their marketing strategies and tactics based on changing market conditions and competitive environment;

3. Price and promotions management: Taking into account the situational context, companies determine the optimal prices for their services and develop promotions and special offers to attract customers;

4. Flexible planning of advertising campaigns: Companies respond to changes in the situation by reconfiguring advertising campaigns and channels of communication with clients;

5. Optimisation of marketing communications: With the use of modern technology and tools, analytics companies are adapting their communication strategies to maximise the impact on their target audience.

Current development topics in this area may include:

1. Data and analytics integration: Using big data and analytics to better predict demand, identify customer needs, and manage marketing campaigns;

2. Personalisation and customisation of services: Advances in technology allow companies to create personalised and customised offers for customers, taking into account their individual needs and preferences;

3. Optimising multimodal transport networks: Marketing strategies should take into account the diversity of transport modalities and offer customers the best options for delivering goods;

4. Environmental Responsibility and Sustainability: With the growing emphasis on environmental sustainability, companies should integrate a message of environmental responsibility into their marketing strategies.

5. Innovation in marketing and advertising: The introduction of new technologies, such as virtual and augmented reality, provides new opportunities to develop creative marketing campaigns and capture customer attention;

6. Customer Experience and Feedback Management: An important aspect of the situational approach in transport marketing is the active management of customer experience and feedback.

Companies should endeavour to create positive and memorable customer interaction experiences, and use feedback effectively to improve their services.

In conclusion it should be underlined that all these aspects reflect the importance of adaptability and flexibility in transport marketing and the urgent need for persistent and continuous development and innovation to compete successfully and highly efficient in the current global market that is, undoubtedly, a key to success.

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INNOVATIVE TECHNOLOGIES IN THE FIELD OF TRANSPORT

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The development of transport technologies plays a key role in today's world, affecting the mobility of people and goods, the economy, the environment and public welfare.

Transport of the future is the concept of innovative and sustainable technologies aimed at improving mobility, reducing environmental impacts and increasing user comfort.

Innovative technologies in the field of transport cover a huge amount of different engineering solutions and scientific developments. They include stand-alone transport systems, electric cars, "smart" transport infrastructure, green technology development, and more.

Autonomous vehicles represent one of the most promising areas in transport. The basic operating principles are based on the use of sensors, cameras and artificial intelligence systems to ensure the safe movement of cars without human intervention.

One of the key areas where intelligent systems are emerging is movement control. With machine learning and big data analysis algorithms, you can optimize traffic flows, predict traffic jams and accidents, and control traffic lights to minimize waiting times.

Artificial intelligence systems allow the creation of cars, buses capable of making decisions on the road, adapting to conditions and ensuring the safety of passengers. For example, automated information systems can provide passengers with up-to-date information about schedules, delays, and help with the selection of optimal routes.

Electric cars, in turn, are environmentally friendly alternatives to traditional combustion vehicles. The development of battery technology, increased power reserve and expansion of charging station infrastructure help to stimulate a more environmentally friendly mode of transport.

The development of intermodal transport systems that integrate different modes of transport (cars, trains, planes, ships) helps to optimize transport and reduce travel time.

Engineers and inventors have developed drones that will be able to transport goods and passengers. This is still only in the process, however - it can significantly reduce the use of cars, which will lead to fewer emissions of various substances. From an economic point of view, it is profitable. The safety of people's travel and cargo transportation will also be ensured.

These new technologies are significantly changing the way in which the transport industry operates, making it more sustainable, safe and convenient for all participants. It is important to consider not only the benefits but also the potential risks and challenges associated with the introduction of new technologies in the transport sector.

The development of green technologies that reduce carbon dioxide and other harmful substances is also an important area of innovation in transport. This includes the introduction of biofuels, electric transport, hybrid engines and other innovative solutions.

Innovation in transport continues to grow, creating new opportunities for more sustainable, safer and an efficient transport system capable of meeting the needs of modern society.

Integrating advanced technologies into urban infrastructure to create "smart" cities where the transport system will be linked to other aspects of urban life, such as energy, waste management, education and health.

However, the introduction of new technologies also presents challenges in terms of the need to upgrade infrastructure, ensure cyber security and train personnel to work with new technologies.

As it is possible to mention in the conclusion, the development of transport technologies cannot be halted, due to the fact that it will enable society to become more environmentally sustainable and improve the quality of life of its people despite having to overcome any obstacle that might appear during the application of any technology that was mentioned above.

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ADVANTAGES AND DISADVANTAGES OF LIQUID AND AIR COOLING SYSTEMS

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When the tractor is running, it is necessary to maintain the optimal engine temperature, otherwise the engine will overheat. When overheating, the wear rate of parts (cylinders, pistons, etc.) increases and this happens due to the fact that engine parts begin to interact with hot gases, as a result of which the lubricant of the parts burns out, as well as fuel consumption increases.

The negative consequences of overheating can be avoided if the hot engine parts are cooled [1, 2].

Engine cooling eliminates overheating problems, but the engine must not be overcooled. If the engine is overcooled, engine power and heat is lost.

At low temperatures, fuel is difficult to ignite and does not burn well. Furthermore, overcooling increases wear [1, 2]. Liquid and air cooling system is used to maintain the optimum engine temperature at all times [1, 2, 3].

A *water cooling system* uses antifreeze or water as a coolant. There are two types of water systems, which are distinguished according to the method of water circulation: thermosiphon and forced cooling systems. In a *thermosiphon cooling system*, water circulation occurs due to the different densities of hot and cold water. T

he advantages of such a system are simplicity of construction and effective engine warm-up at start-up. Such a system is used on starting engines PD-10U, P-350, P-23. In a *forced cooling system* water circulation occurs due to the action of the water pump, which distributes water through the water distribution channel into the engine jacket. The heated water flows into the radiator, where it is cooled and returns back to the pump. This system is used on D-36, D-24 and D-14 engines [1, 3, 4].

The essence of the *air cooling system* is that the cylinders are designed in such a way that their heads are marked with ribs that are located along the direction of air flow. Thanks to the ribs, the area of the heated surface that comes into contact with the air increases, so the heat output is better. The ribs can be positioned both along and across the cylinder. The air system has advantages and disadvantages. The strength of this system is that it is simple and reliable, because this whole system is a ribbed cylinder.

However, despite its simplicity, there are significant disadvantages of this system. They are low efficiency and impossibility of its use on powerful engines, the reason for which is the low heat capacity of air and for that reason poor heat dissipation. T-25A and T-40 M tractor engines use the air cooling system [1, 2].

Water cooling increases heat transfer, resulting in lower heat stress of parts, better filling of cylinders, pistons can be installed with less clearance, which reduces oil consumption, but at the same time *air cooling* is used more frequently than water cooling.

Air-cooled engines have smaller dimensions and weight, as in this system there are no parts of water cooling (radiator and engine jacket), easier to maintain, the engine is more wear-resistant, as it warms up quickly after start-up and is more sensitive to changes in ambient temperature; in addition, the starting qualities of the engine with a good warming of the air sucked into the cylinders is better. Hence, air-cooled motors are beginning to be used on tractors [2, 3, 4].

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DESIGN AND OPERATION FEATURES OF REDUCERS

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A mechanical reducer is a mechanism for transmitting and changing torque with one or more mechanical gears [3, p. 2]. The main characteristics of a mechanical reducer are efficiency, gear ratio, transmitted power, maximum angular speeds of shafts, number of driving and driven shafts, type and number of gears and stages.

Reducers use gears to convert rotational motion from one axis to another. When the wheel on the input shaft interacts with the gear on the output shaft, the rotation speed decreases and the torque increases. This allows machine operators to convert high-speed motor rotation into higher output torque. Usually, a reducer is a device that converts high revolutions of the input shafts into lower revolutions of the output shafts, increasing the torque. A reducer that converts low revolutions to higher ones is usually called a multiplier. A reducer with a stepwise change in angular velocity is called a gearbox, and a reducer with a stepless change in angular velocity is called a variator.

Reducers can be of different types, each of which is designed for specific purposes. We can classify reducers depending on the type of gears used in the kinematic scheme, number of stages and relative position of the geometric axes of the input and output shafts. Depending on the gears used, the following types of reducers are distinguished: cylindrical, conical, conical-cylindrical, worm, cylindrical-worm or worm-cylindrical, planetary, cylindrical-planetary, conical-planetary, worm-planetary and wave [2, p. 2–3]. And this whole structure is usually enclosed in some kind of rigid body.

According to the shape of the gear, it can be divided into cylindrical gears, bevel gears and bevel-cylindrical gears. The transmission can be divided into expansion type gearboxes, direct-flow and with simultaneous shaft input. Reducers can also be divided into single-stage and multi-stage depending on the number of transmission stages. Some reducers

can be used to transmit or redirect rotational motion in the opposite direction. This is necessary for most mechanisms, especially in vehicle systems and industrial equipment. Reducers can help in load balancing in mechanical systems and provide overload protection.

The high torque and low speed are ideal for transporting heavy loads or preventing overloading. Reducers have a number of advantages: increased torque, the ability to operate at lower speeds, better ability to withstand mechanical loads, increased energy efficiency (efficiency of about 98%), high load capacity (they can transmit high power with almost no loss), weak heating (due to the high efficiency, all energy is transferred to its intended purpose and it does not dissipate and does not turn into heat), high reliability, high kinematic accuracy due to the low backlash of the output shaft. These advantages make gear reduction motors ideal for industrial machines, conveyor belts, heaters and many other devices.

In addition to the advantages, they also have some disadvantages: the design of reducers in some cases can complicate and weigh down the system (increased radial and axial loads, as a result of which the mechanism transmits less power), they may require additional maintenance.

Reducers, also known as gear reduction motors, are modular combinations. They combine a motor and gearbox. Reducers are important connecting elements to ensure the compatibility of motors and mechanical systems used in various industries [1, p. 111].

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УДК 535
USE OF LASERS IN SURGERY AND DERMATOLOGY

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A new chapter for surgeons has begun with the emergence of industrial lasers. At the same time, the advancements in laser metal processing have been invaluable.

The tissue must absorb this laser radiation, otherwise there is no effect. The most popular type of laser in surgery is carbon dioxide. An alternative type of laser that can be utilized is monochromatic, that is, it heats, destroys or welds certain biological tissues by using a specific wavelength of light. For example, the argon laser beam passes freely through the frosted vitreous body and gives off its energy to the retina, the wavelength used is a color which is close to red.

Carbon dioxide lasers are suitable for most applications, such as when you need to cut or weld fabrics of different colors to each other. However, herein raises another problem. Tissues saturated with blood and lymph, contain a lot of water, which causes laser radiation to lose energy. It is possible that increasing the energy the laser beam can resolve this issue, however, this leads to tissue burning. The creators of surgical lasers must resort to different techniques, which greatly increases the cost of the equipment [3].

One such technique is inspired by metal welders, who have long known that when cutting a stack of thin metal sheets, it is necessary that they fit snugly together, and when spot welding, additional pressure is needed the parts to be welded to come into contact.

This method was adapted to be used in surgery: Professor O. I. Skobelkin and his co-authors stipulate that when welding tissues, slight force must be applied to them to force out the blood. In order to perform this new method, a new array of instruments was designed and created, which are in use to this day in gastrointestinal surgery and operations on the biliary tract, spleen, liver, and lungs [1].

The use of lasers in dermatology is caused by the occurrence of allergic reactions to drug treatment. Nowadays, He-Ne lasers, argon, CO_2, neodymium and semiconductor lasers are used in dermatology. They are used to treat trophic ulcers, eczema, neurodermatitis, psoriasis, lichen planus, viral and benign skin lesions.

In practical medicine, laser radiation is used mainly for: stimulation of disturbed metabolic processes and tissue trophism, coagulation of the lesion.

Under the influence of radiation, the regenerative process is activated, pain in the lesions decreases and disappears, itching stops, and the exchange of cellular elements is activated. Along with local, general changes in metabolism and reactions in the body are also detected.

A feature of low-intensity laser irradiation is that gross destructive changes do not occur in the skin, activation of metabolic and regenerative processes is observed in the irradiated area and the body as a whole [2].

Laser therapy treatment reduces inflammation and analgesic effect in the patient's body, which leads to more active recovery. It should be noted what kind of reaction this treatment causes. It has been revealed that laser exposure does not have a negative effect on humans, but, on the contrary, stimulates the healing of damaged areas.

The biological effect of laser treatment is to enhance metabolism. Molecules that can absorb light give off the resulting energy to other molecules. This process creates a regeneration effect, which is noted in the treatment of many diseases.

Laser therapy has found wide application in medicine. It promotes a favorable course of pathological processes and accelerates the recovery process of patients.

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USE OF UAVs IN MINING

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UAVs are unmanned aerial vehicles, which are autonomous robotic systems. The most important task of these advanced devices is to perform a flight according to a given program in automatic or semi-automatic mode. UAVs and ground-based unmanned technologies are increasingly penetrating various manufacturing and mining industries.

Since many processes in mining endanger human life and health, this is the area where automation of various tasks such as object observation, building 3D space models, researching disaster sites, underground mines, etc. is needed. It is dangerous and time-consuming to perform these tasks by human forces.

But unmanned aerial vehicles can cope with some problems of mining and geological prospecting without personal human participation. Today UAVs allow solving very important tasks for mining, for example: geological exploration and mapping - accurate, up-to-date geometric data on the surface of an open pit, section, mine; 3D space modelling - surface model with spatial resolution of 1 cm; round-the-clock control and protection of objects due to thermal imaging, infrared cameras and additional lighting devices; control of tailings dumps; exploration of underground and abandoned mines; ensuring safety of mining and labour protection; improvement of mining operations; improvement of the quality of mining operations. Drones perform these tasks with better quality and speed than other known methods. The use of drones in surveying can reduce the time of data collection and processing from several days to one hour [1].

UAV models of the earth's subsurface are more accurate and detailed than those obtained by ground surveys. Thanks to unmanned aerial systems, it is possible to gain full control over a mineral deposit. The surveying of quarries is done in great detail. The result is a detailed grid in centimetre spatial resolution. 3D models are formed by combining the

aerial survey from a UAV and the total station survey of the quarry, which is carried out from the ground. Using this data, the programme automatically calculates the extraction volume and the amount of losses. The condition of the quarry terrain can also be obtained from UAVs.

For timely preparation of mining technical documentation and monitoring of the mining process in open-pit mining, UAVs can be used at the stage of early detection of deviations in operation and emerging threats. Having created a digital model that reflects the current status of work, mining technicians can improve safety and reduce costs on control processes. Early detection of abnormalities and correct assessment of the quarry will ensure rapid response and more effective planning works.

Using an unmanned complex, it is possible to solve a number of research problems, for example, studying the dynamics of ventilation of quarries after blasting works, remote mapping of crack systems on quarry benches for the purpose of analysis stability of its sides. In addition to shooting in the visual range, it is possible to use multispectral sensors to solve problems such as searching for minerals, analysis of the rock composition of already discovered deposits [2].

The use of UAVs allows you to quickly and accurately map and monitor the territory of enterprises, as well as solve a wide range of mining and geodetic tasks, including volume calculations mine workings, performing land management work, constructing sections, searching for fracture zones and tying wells, creating large-scale cadastral and topographic plans.

In recent years, there has been a rapid development of UAVs in the mining industry. With the release of new aircraft, they are equipped with advanced optical and geodetic technologies that improve the quality of aerial photography.

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3D PRINTING: DEFINITION, TYPES AND PROCESSES

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3D printing, also known as additive manufacturing, is a manufacturing process in which a 3D printer creates three-dimensional objects by depositing material in layers, according to a digital 3D model of the object. 3D printing makes it easy for anyone to create objects of all shapes, even in the comfort of their own home. Unlike the huge machines found in factories, today's desktop 3D printers are compact, cheap and simple enough to get started without extensive training.

3D printing is in high demand across industries including prototyping, healthcare, automotive, education, architecture, consumer goods, electronics, tooling, defense, and food for applications such as rapid prototyping, personalized products, lightweight component manufacturing, and construction of complex structures.

At the moment there are 7 types of 3D printing: binder jetting, direct energy deposition, material extrusion, material jetting, powder bed fusion, sheet lamination, VAT polymerization [1].

Due to the capabilities of the technology enabling the creation of small quantities and production within the company's facilities, this method is well-suited for prototyping. This implies that products can be developed more swiftly compared to conventional manufacturing methods, and without depending on external supply chains.

Because the process of 3D printing is based upon computer aided designs, any product alterations are easy to make without impacting the manufacturing cost. It allows users to produce items that have geometries which are difficult or impossible for traditional methods to produce.

3D printing facilitates the production of parts with tailored properties by offering the flexibility to utilize specially engineered materials, such as those with high heat resistance or water repellency, catering to diverse application needs beyond conventional plastics and metals [2].

Mechanical engineers must adjust to the evolving environment by mastering 3D printing technologies, software, and materials, as doing so is vital. Those engineers who can effectively utilize additive manufacturing will position themselves as pioneers of innovation, spearheading the design of products and systems previously deemed unattainable.

Despite its numerous advantages, 3D printing also presents certain limitations including high initial investment costs for equipment and materials, as well as challenges associated with achieving production-scale efficiency, thereby posing barriers to widespread adoption in certain industries.

In recent times, there have been extraordinary advancements in 3D printing technology. The range of materials available has expanded beyond plastics to include metals, ceramics, and bio-inks.

Cutting-edge printing methods like multi-material and multi-axis printing have opened up fresh avenues for innovation. Moreover, the incorporation of artificial intelligence and machine learning has improved the accuracy and effectiveness of additive manufacturing processes [3].

In conclusion, 3D printing stands as a transformative technology poised to revolutionize numerous faces of human endeavor, offering unparalleled versatility, customization, and efficiency across industries, thereby heralding a future where innovation knows few bounds, ultimately enriching the lives of individuals worldwide.

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SEARCH QUERIES

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This research paper examines the importance of search queries in the context of contemporary information retrieval on the Internet. The paper explores the key features of query formation and classification, as well as the application of search queries in various domains such as cybersecurity, medicine, business, and tourism. The study is based on the analysis of search query data and their utilization in different search engines. The research confirms that search queries are crucial tools for precise and efficient information retrieval on the Internet.

In the modern world, the Internet has become one of the primary sources of information for users worldwide. Search queries are an integral part of the information retrieval process on the Internet and play a significant role in the accuracy and effectiveness of obtaining desired results. This paper analyzes how search queries are formed, classified, and their application in different domains [1].

Search queries are formed by users who input keywords or phrases into a search engine. However, many users may not know how to construct an effective search query. Therefore, search engines employ various approaches to enhance search results, including autocomplete and recommendations based on previous queries. For instance, Google search engine employs sophisticated algorithms that focus on semantic understanding and contextual relevance in generating search queries. Leveraging natural language processing (NLP) techniques, Google analyzes the user's query to decipher its intent and context.

The process of search queries involves the following steps: the user enters a query, the search engine analyzes and matches the query with its index, ranks the results, displays them on the search engine results page, the user selects and clicks on a relevant result, interacts with the website, and may refine or enter a new query if needed. Search queries can be

classified based on different criteria. One of the primary methods of classification is the presence of specific intent, which can be categorized as informational, transactional, and navigational. Informational queries aim to acquire specific information, transactional queries focus on performing specific actions, while navigational queries target the search for a particular website or resource [2].

In the field of cybersecurity, search queries play a crucial role in detecting and preventing various threats. Analyzing search queries helps identify potentially dangerous or malicious activities and facilitates research for the development of new security measures.

Medical queries allow patients to quickly find information about symptoms, medications, treatments, and medical services. It helps patients make informed decisions and access up-to-date and reliable information, while also assisting medical professionals in improving the quality of care provided [3].

In business and tourism, search queries play a significant role in market research, competitiveness analysis, consumer demand research, and the development of marketing strategies. Analyzing search queries helps identify trends and popular customer needs, enabling enterprises to efficiently plan and promote their services.

Search queries are vital components of information retrieval on the Internet. This research paper has provided the analysis of the query formation and classification process, as well as its application in various domains. The study demonstrates that search queries are powerful tools for precise and efficient information retrieval and find applications in diverse fields such as cybersecurity, medicine, business, and tourism.

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ITERATIVE DEEPENING A* SEARCH ALGORITHM

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The IDA* (Iterative Deepening A*) algorithm is a search algorithm that combines the advantages of both depth-first search and A* search. In this paper, we provide a comprehensive overview of the IDA* algorithm, its underlying principles, advantages, and applications. We also discuss its implementation, optimization techniques, and compare it with other search algorithms [1].

Search algorithms are fundamental in solving various computational problems, particularly in artificial intelligence and computer science. One such algorithm is IDA*, which is an extension of both depth-first search (DFS) and A* search algorithms. It was introduced by Richard Korf in 1985 as a memory-efficient alternative to A* search, while still maintaining completeness and optimality.

The IDA* algorithm is an iterative deepening variant of the A* search algorithm. It performs all operations that A Star does, but it takes less memory [1]. The IDA* algorithm works by gradually increasing a threshold value until a solution is found. At each iteration, it performs a depth-first search limited by the current threshold. If a solution is not found within the threshold, the threshold is increased, and the search continues. This process repeats until a solution is found. Next, the implementation of pseudocode is provided.

Pseudocode realization:

```
function IDA*(node, cost, threshold)
f=cost+heuristic(node)
if f>threshold
return f
if node is goal
return FOUND
min_cost=∞
for each successor of node
```

```
new_cost=cost+distance(node, successor)
result=IDA*(successor, new_cost, threshold)
if result==FOUND
return FOUND
if result<min_cost
min_cost=result
return min_cost
```

Several optimizations can be applied to improve the efficiency of IDA*. These include using iterative deepening, memory pruning techniques, and efficient heuristic functions tailored to the problem domain [2]. IDA* offers several advantages over traditional search algorithms. Unlike A* search, IDA* does not require storing all generated nodes, making it memory-efficient. Additionally, it guarantees optimality without the need for extra memory. However, it may explore the same nodes multiple times, leading to potentially higher time complexity compared to A* search [3].

IDA* has been successfully applied in various domains, including puzzle solving, route planning, and optimization problems. Its memory-efficient nature makes it suitable for resource-constrained environments, such as robotics and embedded systems.

In conclusion, the IDA* algorithm provides an efficient and memory-conscious solution to search problems. By iteratively deepening the search space and utilizing heuristics, it strikes a balance between completeness, optimality, and resource utilization. Its versatility and effectiveness make it a valuable tool in the arsenal of search algorithms.

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REVOLUTIONISING SMART HOMES

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Artificial Intelligence, also known as AI, represents a paramount field within the realm of computer science dedicated to crafting sophisticated software engineered to bestow machines with cognitive capacities akin to those of human beings [1].

This concept traces its origins back to classical antiquity, a period when philosophers endeavored to delineate and conceptualize the intricacies of human cognition. However, it wasn't until the latter part of the 20th century that the nomenclature "artificial intelligence" was officially coined, marking the advent of contemporary AI marvels [1].

The enduring impact of AI in the domain of smart homes is unequivocally incontrovertible. Smart homes stand as an epitome of human ingenuity, reflecting a pinnacle innovation geared towards engendering enhanced convenience and comfort in residential abodes. The infusion of Artificial Intelligence imbues the smart home experience with an unparalleled dimension. Notwithstanding its initial exorbitance and scarcity, technological strides have rendered AI more attainable and cost-effective for an increasingly broad demographic [2].

AI is poised to revolutionize the realm of residential energy conservation. The ubiquity of smart meters and thermostats attests to this progress. These sophisticated contrivances diligently scrutinize household temperature levels and energy consumption patterns, extolled for their efficacy in promoting energy savings and monetary frugality. A prime exemplar is the commercially accessible Google Nest smart thermostat, renowned for optimizing energy efficiency. Future implementations are slated to evince heightened intelligence and sophistication [1].

Artificial Intelligence holds the potential to oversee and deconstruct energy usage, discerning problematic areas like operational inefficiencies. Integrating smart sensors and AI functionalities into household appliances enables continuous performance monitoring, with data seam-

lessly relayed to a central hub facilitated by an interconnected network [1].

Beneficiaries of AI-pioneering smart homes stand to relish freshly prepared culinary delights, courtesy of state-of-the-art robotic kitchens, irrespective of their hectic schedules. These culinary marvels, facile to command, dispense hygienic dishes personalized to the homeowner's palate preferences. A diverse repertoire of recipes reflects the reliability and sophistication underpinning this futuristic gastronomy [2].

AI-integrated windows proffer the allure of thermal equilibrium, adeptly responding to external climatic conditions and air quality thresholds. Leveraging AI technology, these windows deftly mitigate glare, modulate air conditioning systems to attain optimal temperatures, and interface with other smart devices to fortify home monitoring and security measures [2].

The burgeoning prevalence of internet-connected devices underscores the burgeoning ascent of the Internet of Things (IoT) within the smart home milieu.

Current market trends spotlight an array of interconnected appliances such as refrigerators, fire alarms, and door locks, while ongoing developmental endeavors promise even greater integration.

Harnessing the potential of AI within these devices heralds a future where homes resonate as hyper-connected enclaves, imperceptibly attuned to homeowners' routines and predilections [1].

Ultimately, the conjunction of IoT-connected devices, the advent of 5G technology and high-speed internet, the advent of smart voice assistants such as Alexa and Cortana, and an expansive network of perceptive sensors enveloping domiciles – all unified under the tutelage of cutting-edge AI systems – foreshadows the emergence of a future smart home ecosystem seamlessly interwoven into the fabric of lives.

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SUPPORT VECTOR MACHINE: THE MACHINE LEARNING ALGORITHM

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Support Vector Machines (SVM), introduced by Vladimir Vapnik and Alexey Chervonenkis in 1992, belong to a family of supervised learning algorithms primarily employed for classification and regression tasks. These algorithms aim to identify an ideal hyperplane dividing diverse groups in an n-dimensional space, thus enabling accurate predictions concerning unknown data points. Over recent years, SVMs have garnered considerable attention owing to their remarkable ability to manage high-dimensional data along with impressive efficiency across varying contexts. This article aims to delineate the core principles governing SVMs, elucidating their merits, demerits, extensions, competing strategies, and eventual implications.

One of the key strengths of SVM is its ability to handle non-linear relationships through the use of kernel functions. These functions transform the input data into a higher-dimensional space where a linear separation is possible. Common kernel functions include linear, polynomial, radial basis function (RBF), and sigmoid. SVM has several advantages over other machine learning algorithms. It is effective in high-dimensional spaces, even when the number of dimensions exceeds the number of samples. SVM is also memory efficient, as it only uses a subset of training points called support vectors to define the decision boundary.

At heart, SVM seeks to construct a model capable of discerning whether a provided sample stems from either Category A or Category B via discovering the most suitable border - referred to as a hyperplane - demarcating these groupings inside the p-dimensional real coordinate space (R^p). By situating this division equidistant from separate clusters, we optimize the margin – defined as the shortest distance amidst any point within each cluster and our chosen hyperplane. Such positioning

enhances the likelihood of successful generalizations pertaining to previously undiscovered observations, ultimately minimizing overfitting concerns.

Furthermore, contrary to simple linear boundaries, employing kernel functions facilitates SVM models to tackle nonlinear challenges proficiently. Through mapping low-dimensional inputs onto elevated feature spaces, ostensibly complicated non-separable entities transform into linearly distinguishable ones [1]. In addition to classification tasks, SVM can also be used for regression by modifying the loss function to minimize deviations from a given target value rather than predicting class labels. SVM excel in their adaptability to diverse data types, robustness against overfitting, competence in high-dimensional spaces, proficiency in handling nonlinear relationships

However, SVM often struggle to complicate some ambiguous problem. For example, exorbitantly extensive repositories occasionally impede direct application of SVM due to inherent memory restrictions as well as memory capacity and restriction where archiving every instructional specimen might not consistently prove tenable, notably when confronted with monumental databanks.

Researchers have developed refined versions of classic SVM like LS-SVM, Nu-SVC, RAE, and WSVM to address computational challenges, optimization difficulties, customization needs, and performance enhancements in various scenarios. Also there are various alternatives to SVM that much powerful and can replace it one and for all. Most of them are already well-known in limited circles like Decision Trees (DT), Random Forests (RF) and Naive Bayes (NB) which offer alternative solutions to similar challenges with varying trade-offs in interpretability, precision, computational requirements, and assumptions.

Overall, SVM is a versatile and powerful machine learning algorithm that can be applied to a wide range of problems. Its ability to handle high-dimensional data, non-linear relationships, and its flexibility in parameter tuning make it a popular choice for many practitioners in the field of machine learning.

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ARTIFICIAL INTELLIGENCE IN HEALTHCARE

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Artificial Intelligence (AI) is a smart artificial neural brain which mimics human thought process, and acts in a human-like way. It doesn't have any physical form: bones and muscles. However, it is able to receive data from environment on its own or combined with other technologies (e.g. sensors, geolocation, robotics). AI can perform tasks that would otherwise require human intelligence or intervention.

The scope of AI applications is growing nowadays. Significant results have been observed in healthcare over the past few years. According to the research results that were published by some scientists they have developed an algorithm for predicting abnormal pressure during surgery. They used AI which analyzed information of blood pressure spikes for 500 thousand minutes. It can right predict blood pressure spikes in 84% of cases, 15 minutes before the dropping in blood pressure and in 80% of cases, 5 minute before the dropping in blood pressure. The researchers believe that the algorithm can be used during operations to reduce the likelihood of complications [1].

Another advantage of AI is to help doctors before and after treatment. It is also making a mark in the operating room. Surgeons are using robotic arms controlled by AI. It performs delicate surgeries with incredible precision. These robots never get tired, ensuring that every movement is perfect. This means safer surgeries and quicker recovery for patients.

Artificial Intelligence has access to the Internet that helps to find the best way for treatment. It analyzes all medications that are in a database and selects that suits for you. It's like a super-advanced doctor by your side. This makes life much easier but need to consider that it will select medications for the diagnosis which you have established yourself, but a qualified specialist also will consider your previous diagnoses and medications which you used previously [2].

Next, it also helps to save time for unnecessary and routine works for doctors. AI automates all this process and saves money which would be spent on the work of doctors. Some healthcare organizations use Robotic Process Automation (RPA) to improve patient experience and everyday operation of their facilities. RPA is a technology used for automated processing of business tasks.

To all the advantages of AI, there are disadvantages in using and integration it into the life of people and doctors. Although AI is a robotic process, when diagnosing, it will not take into account that the information could be outdated, also it will not be based on the lifestyle of the patient. The patient also cannot identify all the symptoms that he has [3]. Moreover, chat-bots cannot study the patient's condition, detect seizures prematurely, increasing or decreasing in blood pressure.

AI is very vulnerable to hackers' attacks, which become much more sophisticated every year.

It is necessary to use chat-bots with caution and also consult with doctors. Therefore, millions of dollars are spent on the protection and maintenance of Artificial Intelligence every year.

As with many other industries, AI is supposed to change the healthcare landscape over the coming years. In addition to improving health facility operations, patient diagnoses, treatment plan development, and overall health outcomes, it is expected that AI will help with the development and discovery of new medical cures [4].

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THE CREATION HISTORY OF A SMART HOME SYSTEM

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The evolution of technology has ushered in an era where the concept of a smart home system has become increasingly prevalent. This innovative integration of various devices and appliances within a household, interconnected through the Internet of Things (IoT), promises unparalleled convenience, efficiency, and security for homeowners. The creation of a smart home system entails the synchronization of disparate components such as lighting, heating, security cameras, and entertainment systems into a cohesive network that can be controlled remotely via smartphones or other smart devices. Smart home is a high-tech system that allows you to fully automate all home processes. Within its framework, existing communications are combined into a single whole, and they are managed using artificial intelligence. It can be configured and programmed according to several scenarios, and the main task of a smart home is to ensure the safety and comfort of users [1].

The idea that a house should take over and act automatically and independently has been around for a long time. And in 1939 an article appeared in Popular Mechanics Magazine about "The Electric House of the Future". The author, George H. Bucher, describes a networked house in which doors would open automatically, guests would be personally greeted by the house via an intercom, and the lighting would change according to the needs of the occupants [2].

The origin of truly networked buildings can only be found in the 1960s. At that time, fault reporting systems were implemented in larger building units for the first time using conventional electrical installations.

Although it was never commercially sold, the ECHO IV, developed in 1966-1967, was the first smart device. This clever device could compute shopping lists, control the home's temperature and turn appliances on and off. The Honeywell Kitchen Computer, developed a year later,

could store recipes and assist with meal planning. Unfortunately, a few models were sold because the device required programming. At that time the average user could have hardly managed it.

The programmable logic controller (PLC) came onto the market in 1973 and has been used to control smart homes since then. It relies on a central unit that controls all of the connected peripherals. The foundation of a smart home system lies in the connectivity facilitated by IoT technology. Devices embedded with sensors and actuators communicate with each other and with a central hub, enabling seamless interaction and automation. For instance, smart thermostats can adjust temperature settings based on occupancy patterns detected by motion sensors, optimizing energy usage while maintaining comfort. Similarly, smart lighting systems can be programmed to adapt to natural light levels or user preferences, enhancing ambiance and reducing electricity consumption.

With the release of X10 in 1975, a communication protocol for home automation, the smart home came to life. X10 sends 120 kHz radio frequency bursts of digital information onto a home's existing electric wiring to programmable outlets or switches. These signals convey commands to corresponding devices, controlling how and when the devices operate. A transmitter could, for example, send a signal along the house's electric wiring, telling a device to turn on at a specific time [3].

In 2005, the home automation company Insteon introduced technology that combined electric wiring with wireless signals. Other protocols, including Zigbee and Z-Wave, have since emerged to counter the problems prone to X10.

The first smart TVs were released in 2007. They offered integrated internet-connected services, such as streaming and access to user-generated content. One of the primary benefits of a smart home system is the enhanced convenience it offers to homeowners. Through centralized control interfaces such as smartphone apps or voice-activated assistants, individuals can remotely monitor and manage various aspects of their home environment. Whether adjusting room temperatures, remotely accessing surveillance cameras, or setting up automated routines for household chores, the ability to control disparate devices from a single platform streamlines daily routines and enhances overall quality of life.

In 2011, the newly founded Nest Labs released its first smart product, the Nest Learning Thermostat. The company also created smart smoke and carbon monoxide detectors and security cameras. In 2014, Amazon

Echo, Amazon Alexa and Apple HomeKit were introduced, making a giant leap in voice-enabled smart devices. By 2010, using at-home wireless Internet to run your systems became more prevalent — it just made everything more manageable, especially with smart home thermostats! And since the technology was advancing, a new method of power data collection became available. This means smart homes could track how users operate the system and provide analytics. These analytics made it much easier to make changes to your smart home automation so it can run smoother! In 2016-2018, the arrival of smart speakers, such as Google Home, Google Nest, Apple HomePod and Sonos signaled a significant shift in how users interacted with smart home devices [3].

Today's smart homes are more about security and living greener. Obviously, the integration of smart security features reinforces the safety of residential premises. Real-time monitoring of entry points, coupled with motion-activated alerts and video surveillance, provides homeowners with invaluable peace of mind. In the event of suspicious activity or emergencies, immediate notifications can be sent to authorized users or emergency services, mitigating potential risks and facilitating prompt response measures. Our smart homes are sustainable, and they help ensure that our homes aren't expending unnecessary energy.

In conclusion, the creation of a smart home system represents a paradigm shift in residential living, offering unparalleled convenience, efficiency, and security to homeowners. By harnessing the power of IoT technology, disparate devices and appliances can be seamlessly interconnected, enabling centralized control and automation of various home functionalities.

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CREATING IMAGES WITH NEURAL NETWORKS

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Nowadays, neural networks have very wide applications, including creating images. This process, often called neural style transfer, has revolutionized the way we think about art and technology.

A neural network is a machine learning type where a computer program mimics the human brain. Each network consists of artificial neurons that mimic human ones. These are software modules or nodes that interact and exchange information to solve a task. A basic neural network contains three layers of artificial neurons. The input layer processes external information, analyzes or classifies it, and passes it to the next hidden layer. This layer analyzes the output data of the previous layer, processes it, and passes it further to the output layer which gives the final result after processing all the data.

Neural networks are large systems of polynomial formulas with many variables. They require training with input data (like pixel color or letter codes) to produce an output (like object type from an image or a line of letters in another language).

It should be noted that training involves adjusting the coefficients within the network's formulas using a special algorithm until the network can accurately identify the input data. This process is repeated millions of times with different training images. The trained network, often referred to as a "model", doesn't store all the examples shown during training. Instead, it generates a value from the input data based on patterns identified during training.

By the mid-2010s, scientists and programmers had developed fast algorithms and selected good sets of training images to streamline the creation of image-recognizing neural networks.

By early 2021, the integration of BTM and the use of intermediate values of neural network formulas were combined by scientists and programmers. The challenge was to figure out how to use the codes of text

characters and picture pixels simultaneously in the neural network formulas so they wouldn't interfere with each other, but would be encoded in similar number formats and could participate together in the same formulas.

The intermediate results of applying pre-trained networks for both text and pictures will be similar-looking numbers, encoding some details of the content of the original input data.

This led to the creation of DALL-E, Midjourney, and several other large "multimodal" transformer models. The term "multimodal" denotes that they work with input data of several different formats or "modes". The models themselves are massive multi-terabyte files of formula coefficients. Powerful expensive video cards are used for fast simultaneous calculation of millions of formulas.

Midjourney is able to create something completely new and unique, because random number generators are used in the algorithms. The model has derived and fixed in itself three types of patterns: human language; the appearance of the world as a person sees it; connections between language and images. There are millions of these patterns, and their combinations - the factorial of these millions. The model derived them from data available on the Internet, since the Internet is a repository for an enormous amount of data. Midjourney composes patterns about our world, which it drew from our texts and pictures, adds a little randomness from the random number sensor, and generates a picture that best "according to humanity" corresponds to the entered phrase taking into account all additional settings.

In conclusion, the use of neural networks in creating images has opened up a new frontier in the intersection of art and technology. Through the process of training and manipulating these networks, we have been able to generate images that are not only visually appealing but also carry the distinct styles of different artworks.

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UNVEILING THE CRAFT OF GAME DEVELOPMENT

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In the intricate world of game development, creativity dances with technology, weaving an immersive tapestry that captivates players worldwide. At its core lies the mastery of programming languages, the digital alchemy that transforms ideas into interactive experiences. From the humble beginnings of text-based adventures to the sprawling landscapes of modern open-world epics, the journey of game development is one of continual evolution and innovation. Programming languages stand as the pillars upon which virtual realms are built, each offering a unique set of strengths and capabilities. C++, with its raw power and performance, has long been the cornerstone of AAA game development, allowing developers to squeeze every ounce of potential from hardware. Yet, in the realm of indie games and rapid prototyping, the elegance and simplicity of languages like C# and Python have found their foothold, empowering creators to bring their visions to life with agility and ease.

One notable example of C# in game development is the critically acclaimed game "Hollow Knight." Developed by Team Cherry, "Hollow Knight" showcases the power and versatility of C# in crafting immersive gaming experiences. From intricate level design to seamless gameplay mechanics, C# facilitates the realization of the developers' creative vision. As for Python, it has gained traction in recent years, owing to its simplicity and ease of use. Python's readability and concise syntax make it an attractive option for prototyping, game scripting, and rapid development cycles. One significant example of Python's utility in game development is "Toontown Rewritten". A fan-made revival of Disney's "Toontown Online" this multiplayer online game utilizes Python for scripting and backend development. Despite being a community-driven project, "Toontown Rewritten" exemplifies Python's capability to handle complex game mechanics and networking functionalities.

Both C# and Python offer unique advantages and cater to different aspects of game development. In terms of performance, C# typically outperforms Python due to its compiled nature and optimized execution. This advantage is particularly evident in resource-intensive gaming applications where real-time rendering and responsiveness are paramount. However, Python's interpreted nature and dynamic typing facilitate rapid iteration and experimentation during the early stages of game development. But game development is more than just lines of code; it is a symphony of artistry and technology. Behind every pixelated landscape or intricately crafted character lies the creative genius of artists, writers, and musicians, each contributing their brushstroke to the canvas of virtual worlds. Collaboration is the heartbeat of the industry, as programmers, designers, and creatives unite to breathe life into digital dreams. Game engines serve as the crucible in which these elements converge, providing a robust framework for development and unleashing the full potential of modern hardware. Unity, Unreal Engine, and others stand as titans in this arena, offering a suite of tools and features that empower developers to push the boundaries of what is possible. As the industry hurtles forward, propelled by technological advancements and the insatiable appetite of players, new challenges and opportunities emerge on the horizon.

Virtual reality, augmented reality, and cloud gaming promise to redefine the very fabric of interactive entertainment, blurring the lines between the digital and the tangible.

In this ever-shifting landscape, one truth remains constant: the magic of game development lies not just in the ones and zeroes of code, but in the boundless creativity and imagination of those who dare to dream. It is a realm where science and art intertwine, where passion and perseverance fuel the journey from concept to reality.

And as the digital frontier continues to expand, so too does the potential for innovation and wonder, promising a future limited only by the depths of our collective imagination.

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MECHANICAL ENGINEERING TECHNOLOGY

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Infrared Thermal Imaging is an excellent condition monitoring tool to assist in the reduction of maintenance costs on mechanical equipment.

Thermography applications:

1. Motors: Overheating of windings and bearings, blockages in cooling passages, friction, damping, material deformations, brush contact problems, rotors.

2. Ovens, furnaces, kilns, pipes: location and severity of damaged insulation, location of steam leaks in buried steam lines.

3. Drives/conveyors, pillow blocks, couplings, gears, power transmission belts, pulleys, shafts: overheated bearings or rollers, misalignment of shaft, pulley or coupling, lubrication failure uneven pressure.

4. Mechanical drive turbines and small turbine generator units, gas turbine, exhaust ducts: high lube oil temperature, high bearing temperatures, faulty stop/control valve operation, uneven metal temperature, leaking shaft seals, gas turbine firing conditions, including deterioration in firing chambers, cross firing tubes.

5. Pumps/compressors/fans/blowers: overheated bearings, high compressor discharges temperature, high oil temperature, and broken or defective valve.

Improved Troubleshooting

Infrared Thermal Imaging definitely should be one of the tools that are selected for motor and rotating equipment inspection. Thermographic examination can help technicians use the other tools, such as vibration analysis, more effectively. If a thermal anomaly is found, then the other tools can be employed to help isolate the cause of the problem [1].

Vibration analysis is one of the most important and effective methods of detecting the health of machinery. Vibration data can help us identify faults or detect warning signs of potential failures. It can also aid in the detection of misalignment or unbalance of assets such as bearings and

rotating pieces of equipment. By looking at vibration data, we can also identify high and damaging levels of vibration.

Vibration monitoring and analysis can be used to provide early indicators of failures in motors, rotary based systems or structures that resonate during normal operation.

Measure vibration is:

Sampling rate required, Vibration amplitude, Sensitivity, Number of axes, Weight, Mounting options, Environmental constraints, Signal conditioning.

The characteristics of vibration are: Peak amplitude, crest factor, phase, velocity, acceleration, kurtosis, standard deviations, resonance.

The benefits of monitoring mechanical vibration are: By tracking assets over time, we can determine what is normal behaviour for a system.

By using analytical methods such as Fast Fourier Transforms or Power Spectral Density – allowing us to get a deeper insight into the vibration trace – we can focus our attention and spend our efforts on a specific area. We can identify mechanical unbalance, looseness or unexpected vibration levels, as well as obtaining early indications of wear and fatigue of a system [2].

Mechanical equipment condition monitoring and fault diagnosis techniques generally contain lubricating oil analysis.

Oil analysis provides a nondestructive testing diagnostic method for predicting possible impending failure and for avoiding catastrophic failures long before they occur and furthermore tends to determine the frequencies of oil changes and the remaining life of oil with the consequence of reducing maintenance costs and downtime.

Oil analysis can be sorted into two categories, namely physical and chemical analysis and WDA analysis [3].

Oil testing

Oil testing or Oil analysis is the process of analyzing the physical, chemical, and performance characteristics of different types of oils, such as crude oil, refined petroleum products, lubricants, and edible oils. Oil analysis is a routine activity for analyzing oil health, oil contamination and machine wear.

The purpose of an oil analysis program is to verify that a lubricated machine is operating according to expectations. When an abnormal condition or parameter is identified through oil analysis, immediate actions can be taken to correct the root cause or to mitigate a developing failure.

There are three main categories of oil analysis: fluid properties, contamination and wear debris.

Fluid Properties

This type of oil analysis focuses on identifying the oil's current physical and chemical state as well as on defining its remaining useful life (RUL).

Contamination

By detecting the presence of destructive contaminants and narrowing down their probable sources (internal or external), oil analysis can help answer questions such as: 1. Is the oil clean? 2. What types of contaminants are in the oil?

Wear Debris

This form of oil analysis is about determining the presence and identification of particles produced as a result of mechanical wear, corrosion or other machine surface degradation.

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ENGINEERING AND PROSPECTS FOR THIS TYPE OF ACTIVITY

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The rapid development of technology and the use of computers in machine tool industry have opened up many new and interesting professions in the manufacturing sector. To succeed in the machine tool industry, you must keep up with modern technology and the ever-increasing use of computers. People, those who graduate from school can find employment in an average of seven positions during their lifetime, some of which do not even exist today. The industry is always looking for talented young people, creative, precise and taking responsibility without hesitation. Purpose every person involved in the machine tool industry must produce the best quality products within a reasonable period so that the industry can be competitive with domestic and foreign ones.

Many quarries are available in the metalworking industry. Machine tool industry workers benefit the economy by providing the skills needed to manufacture aircraft, household appliances, cars and industrial equipment. A person's skill, initiative and qualifications will determine what career suits him best. The machine tool industry offers many interesting opportunities for anyone who is willing to take on the challenge of working to tight tolerances to produce precise and complex details. One of the best ways to learn any trade is through an apprenticeship program. An apprentice is a person who is hired to learn a craft under the guidance of an experienced craftsman. The apprenticeship program is developed in conjunction with and under the supervision of the commission. The program typically lasts two to four years and includes both on-the-job and on-the-job training. Instruction and related theory or classroom work, usually conducted at a community college. This period time may be reduced through completion of approved courses or previous work experience in exchange.

To qualify for an apprenticeship program, a person must have a high school diploma or equivalent. Requires several years of mathematics, including algebra, geometry, and trigonometry. Good skills readings are necessary for successful completion of relevant theoretical courses, as well as for understanding some complex machine tool manuals required for modern machine tools.

Machine operators are typically evaluated and paid according to their job classification, skills, and knowledge. A Class A operator has great skills and knowledge than operators of classes B and C. For example, a class A operator after 1–2 years of training should be able to drive the car. With the continued development of numerically controlled and programmable machines, Robots will provide fewer jobs for manual operators. However, machine operators who undergo technological courses to improve your skills, can become operators of CNC turning centers program controlled (CNC). The tool and die maker is a highly qualified a craftsman who must be able to make various types dies, molds, cutting tools, fixtures and fittings. These tools can be used in mass production metal, plastic and other parts.

However, those who specialized in only one technology must have some knowledge beyond their field specializations. For example, a machine tool specialist must have knowledge about industrial machines and production processes to know the best method for producing a product.

The technician can obtain the qualification of a technologist after at least one year of on-the-job training with a technologist or engineer. To obtain the necessary training and knowledge in the field of programming, many professional technical schools, colleges and universities offer CNC programming courses control).

Many companies producing CNC machines offer short-term training workshops specifically designed for their machines. The technologist works at a level between certified engineer and technician. Most technologists graduate from community or technical colleges.

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