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МОЛОДЕЖЬ. ОБЩЕСТВО. СОВРЕМЕННАЯ НАУКА, ТЕХНИКА И ИННОВАЦИИ

Материалы XXI Всероссийской научной конференции с международным участием бакалавров, магистрантов, аспирантов и молодых ученых (18 мая 2022, г. Красноярск)

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Hello, dear authors!

Communication in a foreign language is an integral part of training a specialist. For the scientific and technical sphere, knowledge of a foreign language is crucial in the context of growing scientific cooperation between countries and competition in the labour market.

The active exchange of ideas and scientific experience in the professional field is a prerequisite for professional growth and development, a foreign language being an important tool for transferring this knowledge.

The articles, which are being published, are considered to be the first step in science of the bachelor students, and more fundamental results are expected to be shown by the senior ones. Preparing an article for publication is really a serious and difficult process, which requires intellect, deep knowledge of the problem, patience, diligence, responsibility. Such features of character and specific approach to solving a problem will greatly help future scientists in their scientific research. The conference is a special and very important step towards opening new and promising horizons, what imposes responsibilities on the participants and sets more difficult and interesting tasks for future specialists in their scientific investigations.

We sincerely wish all the participants fruitful work, new discoveries and approaches that will contribute to the solution to the tasks assigned to our society and the formation of the scientific potential of young specialists. We wish you good luck in mastering scientific issues and foreign languages!

Sincerely yours,
Conference Organizing Committee

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POSSIBILITIES OF ENSURING THE SECURITY OF CORRESPONDENCE IN MESSENGERS

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Communication using messengers has become so familiar, besides, the declared encryption of correspondence evokes a sense of security. At the same time, none of us thinks about how securely the correspondence in messengers is protected. Meanwhile, scammers have come up with many methods to steal personal data and money through messaging apps. In addition, advertising companies can get access to the correspondence.

Keywords: messenger, correspondence, advertising, secret chat, server, program, storage.

ВОЗМОЖНОСТИ ОБЕСПЕЧЕНИЯ БЕЗОПАСНОСТИ ПЕРЕПИСКИ В МЕССЕНДЖЕРАХ

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Общение в мессенджерах стало настолько привычным, к тому же декларируемое шифрование переписки вызывает чувство безопасности. При этом никто не задумывается о том, насколько надежно защищена переписка в мессенджерах. Тем временем мошенники придумали множество способов кражи личных данных и денег через мессенджеры. Кроме того, рекламные компании могут получить доступ к переписке.

Ключевые слова: мессенджер, переписка, реклама, секретный чат, сервер, программа, хранилище.

The most popular messaging apps in Russia are WhatsApp, Viber, Telegram, Facebook Messenger, Skype, and Signal. Criteria can be used to determine how secure this or that messenger is.

End-to-end encryption. Many recent versions of popular messengers (WhatsApp, Viber, Signal) provide the so-called end-to-end encryption (E2EE) of correspondence by default. Telegram, Facebook Messenger and Skype provide end-to-end encryption only for secret chats.

Open source. It means that the application is available for review and security testing by external experts. This can help detect vulnerabilities and draw attention to program weaknesses. If Signal has open source both the server and client parts, then Telegram has the source code available only on the client side. Facebook – the parent company of WhatsApp – did not disclose the source code of the messenger. Storage of data and backups. Chat data in messengers can be stored on devices or cloud servers, both in encrypted and in plain text [2].

WhatsApp and Viber backups are stored in the cloud tied to the mobile operating system (Apple iCloud, Google Drive). However, end-to-end encryption of data stored in the cloud is not provided. Unlike WhatsApp and Viber, Telegram stores all messages and files of regular (non-secret) chats on a secure server. This means that you can access them from any connected device. Skype and Signal messengers do not provide backups at all.

Block screenshots of chats. Messengers Signal, Telegram, Viber either do not allow taking screenshots of correspondence in secret chats at all, or notify the sender that the recipient of the message has taken a screenshot.

Support for two-factor authentication. When activating two-factor authentication, you must additionally enter a password or code from an SMS message to gain access to the application.

Two-factor authentication can be enabled in the settings of Telegram, Signal, WhatsApp, Viber. Threats associated with the use of instant messengers. Messenger applications are actively used by cybercriminals to steal personal data, personal information, and bank card details.

So, what threats concern messaging programs:

Vulnerabilities. The most common mistakes in messenger applications are weak encryption algorithms, insecure implementations of the SSL protocol, the ability to create and listen to a voice connection before the user answers the incoming call.

Malicious links and files. Attackers use social engineering techniques to entice the victim to open a file or link. They often pose as bank employees.

Link preview. When receiving an incoming message containing a link or file, instant messengers form a small preview window with a brief description of the page or file – the so-called "preview".

Possibility of access to the correspondence of third parties. It is possible to use all known methods to protect your smartphone, but it is impossible to demand similar actions from interlocutors. There is no guarantee that someone else will not gain access to their devices.

To conclude, no instant messaging program provides 100 % protection against information leakage. All messengers have certain advantages and disadvantages. Some provide more mechanisms that allow the user to protect their data, others attract with their popularity. At the same time, the risk of transferring information to third parties exists in any case, no matter which messenger is chosen. Even end-to-end encryption and two-factor authentication do not guarantee absolute security.

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ANALYSIS OF MODERN TECHNOLOGIES OF REMOTE SENSING OF THE EARTH

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The article analyzes modern technologies of remote sensing of the Earth. The features of remote sensing of the Earth and the technologies by which it is carried out, the possibility of identifying unused and irrationally used lands, and also the use of unmanned aerial vehicles to identify irrationally used lands are considered.

Keywords: geodesy, technologies, remote sensing.

АНАЛИЗ СОВРЕМЕННЫХ ТЕХНОЛОГИЙ ДИСТАНЦИОННОГО ЗОНДИРОВАНИЯ ЗЕМЛИ

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В статье анализируются современные технологии дистанционного зондирования Земли. Рассматриваются особенности дистанционного зондирования Земли и технологии, с помощью которых оно осуществляется, возможности выявления неиспользуемых и нерационально используемых земель, и также применение беспилотных летательных аппаратов для выявления нерационально используемых земель.

Ключевые слова: геодезия, технологии, дистанционное зондирование.

Earth remote sensing data have become vital for mapping the features of terrestrial landscapes and infrastructures, managing natural resources and studying environmental change. Thanks to the creation of more advanced technologies for obtaining and automated thematic decoding of remote sensing data, high-resolution space imagery materials have become one from the fastest, most reliable and effective sources of information for monitoring the status and dynamic changes in land use. The article describes the importance of remote sensing of the Earth in the study of the state of the land. The topicality of the work is due to the fact that at present, the questions of rational land use are important, since as a result of land transformations in the late XX – early XXI centuries in our country there have been significant changes in the organization of legal and economic mechanisms for the economic use of land, which led to a significant reduction in agricultural land used and negatively affected the quality of the most valuable agricultural land. Features of remote sensing of the Earth.

Remote sensing of the Earth (ERS) – observation of the Earth's surface by ground, aviation and space vehicles equipped with various types of imaging equipment. Earth remote sensing spacecraft are used to study the natural resources of the Earth and to solve meteorological problems. CA for

exploration of natural resources is equipped mainly with optical or radar equipment. Remote sensing is a method of obtaining information about an object or phenomenon without direct physical contact with this object, provides the ability to obtain data on dangerous, hard-to-reach and fast-moving objects, and also allows observations over large areas of the terrain. Examples of remote sensing applications include monitoring deforestation (for example, in the Amazon Basin), the state of glaciers in the Arctic and Antarctic, and measuring the depth of the ocean using a lot. With the help of orbiting spacecraft, scientists have the opportunity collect and transmit data in different ranges of the electromagnetic spectrum, which, combined with larger-scale aerial and ground measurements and analysis, provide the necessary spectrum of data for monitoring current phenomena and trends in the field of geosciences, agriculture.

Methods of remote sensing. Remote sensing methods are based on the fact that any object emits and reflects electromagnetic energy in accordance with the characteristics of its nature. Differences in wavelengths and radiation intensities can be used to study the properties of a distant object without direct contact with it.

Photography. Photographic images of the Earth's surface are obtained from manned spacecraft and orbital stations or from automatic satellites. A distinctive feature of the spacecraft is a high degree of visibility, covering large surface areas with one image. Depending on the type of equipment and photographic films used, photography can be carried out in the entire visible range of the electromagnetic spectrum, in its individual zones, as well as in the near infrared (infrared) range. The scale of shooting depends on two important parameters: the shooting height and the focal length of the lens. Space cameras, depending on the tilt of the optical axis, make it possible to obtain planned and perspective images of the earth's surface. Scanner shooting. Currently, for filming from space, the most commonly used multispectral optical-mechanical systems – scanners installed on satellites for various purposes. With the help of scanners, images are formed, consisting of many separate, successively received elements. The term "scan" denotes the scanning of the image using a scanning element (swinging or rotating mirror), element by element viewing the area across the movement of the carrier and sending a radiant flux to the lens and then to a point sensor, which converts the light signal into an electrical one. This electrical signal arrives at the receiving stations via communication channels. The image of the terrain is obtained continuously on a tape made up of stripes – scans, stacked by separate elements – pixels. Scanner images can be obtained in all spectral ranges, but the visible and infrared ranges are especially effective. When photographing the earth's surface with the help of scanning systems, an image is formed, each element of which corresponds to the brightness of the radiation of the area located within the instantaneous field of view. Scanner image – an ordered packet of brightness data transmitted over radio channels to the Earth, which are fixed on magnetic tape (digitally) and then can be printed

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УДК 616-093/-098

METHOD FOR RAPID ASSESSMENT OF BACTERIAL ANTIBIOTIC RESISTANCE

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We have developed a method for determining the antibiotic resistance of bacteria based on the technique of scanning probe microscopy, where the determining parameter is the ratio of the length and width of the bacteria. This method is characterized by low cost and high speed of the study, which reduces the time of subsequent therapy.

Keywords: bacteria, antibiotic resistance, probe microscopy, express method.

МЕТОД БЫСТРОГО ИССЛЕДОВАНИЯ АНТИБИОТИКОРЕЗИСТЕНТНОСТИ БАКТЕРИЙ

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Нами разработан метод определения антибиотикорезистентности бактерий на основе методики сканирующей зондовой микроскопии, где определяющим параметром является соотношение длины и ширины бактерии. Данный метод характеризуется низкой стоимостью и высокой скоростью проведения исследования, что позволяет сократить время последующей терапии.

Ключевые слова: бактерии, антибиотикорезистентность, зондовая микроскопия, экспресс метод.

Antibiotic resistance is a special case of bacterial resistance to antimicrobials, where microbes develop mechanisms that protect them from the effects of antimicrobials. Infections caused by resistant microbes are more difficult to manage, requiring higher doses of antimicrobials, or alternative drugs that may be more toxic. Also, such treatment can be significantly more expensive.

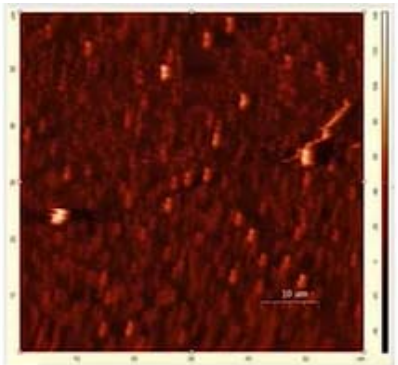

Figure 1

Every year more than half a million people die worldwide from infections caused by resistant microbes, and for many patients, the time of hospitalization increases [1].

The main way to determine the antibiotic resistance of bacteria at the moment is the inoculation method for sensitivity to antibiotics, and its most common variety is the disk-diffusion method of analysis [2]. For this analysis, microorganisms are colonized in a nutrient medium; disks impregnated with antibiotics are placed on top. Then the sowing is placed in a thermostat for 16–18 hours. Depending on the analysis, the results arrive in 2–3 days.

We have proposed the method for testing bacteria for antibiotic resistance which is based on the technique of scanning probe microscopy, where the determining parameter will be the ratio of the length and width of the bacterium. The imaging process is based on scanning the surface with a probe. In this case, it is possible to obtain a three-dimensional image of the surface with high resolution. Bacteria are stacked parallel without overlap on a specially embossed silicon, mica and phosphorus bacteria substrate using van der Waals forces. The intermediate result obtained on the example of Bifidobacterium Longum is shown in Fig. 1 with dimensions of 60 μm * 60 μm. Between 500 and 1000 bacteria are in sight, each of them is distinguishable and measurable, which achieves static reliability. Thus, it becomes possible to determine the size of bacteria using probe microscopy.

The research process is carried out as follows: bacteria are applied to a substrate with a certain geometric shape, then a probe microscope is installed and, scanning is carried out for 60 minutes. Bacteria and an antibiotic are also applied to the second substrate, and scanning is also performed with a probe microscope for 60 minutes. After that, the ratio of the length and width of the bacteria is determined, and the conclusion is made if the antibiotic has work or not.

The second and fourth figures clearly show the results of an antibiotic that disrupts cell wall synthesis. As a result, the growing bacterium is unable to build a new wall and dies. The third image shows the result of the action of an antibiotic that inhibits protein synthesis – violations occur when reading genetic information, and synthesis of inactive protein molecules takes place.

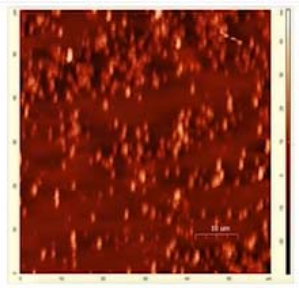

Figure 2

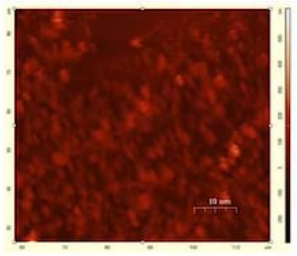

Figure 3

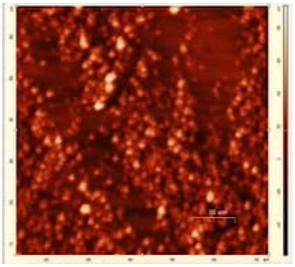

Figure 4

The advantages of this method are: low cost research; reducing the time and cost of antibiotic therapy; possibility of expanding the range of diseases, when antibiotic resistance can be tested in time (often, antibiotic resistance testing is not performed in the early stage of a disease due to the duration of the study).

This study was conducted on Bifidobacterium Longum, further research will be carried out on the breadth of this method.

Thus, this method has broad application prospects due to its low cost and shorter duration of the study while maintaining high efficiency.

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DEVELOPMENT OF UNDERWATER ROBOTICS AT RESHETNEV SIBERIAN STATE UNIVERSITY OF SCIENCE AND TECHNOLOGY

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The article deals with research and development prospects of underwater robotics at Reshetnev Siberian State University of Science and Technology, tests and competition results are presented.

Keywords: robotics, ROV, research, results, competitions, prospects.

РАЗВИТИЕ ПОДВОДНОЙ РОБОТОТЕХНИКИ В СИБИРСКОМ ГОСУДАРСТВЕННОМ УНИВЕРСИТЕТЕ НАУКИ И ТЕХНОЛОГИЙ ИМЕНИ АКАДЕМИКА М. Ф. РЕШЕТНЕВА

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В работе рассматриваются исследования, проектирование и перспективы развития подводной робототехники в Сибирском государственном университете науки и технологий им. академика М. Ф. Решетнева. Представлены результаты испытаний и участия в соревнованиях.

Ключевые слова: робототехника, ТНПА, исследования, результаты, соревнования, перспективы.

Underwater robotics is the science and practice of designing, manufacturing and application of robots in an underwater environment. Underwater robots are commonly referred to as: remotely operated underwater vehicles (ROV); autonomous underwater vehicles (AUV); gliders (underwater glider); drifters (e.g., Argo); towable and bottom-based complexes.

Currently students of Siberian State University under the guidance of A.S. Polyakova, working at the department of SOAR (Department of System Analysis and Operations Research) are creating underwater drones in the ROV class starting in 2020. Nowadays second and fourth year students are being involved in this area. They are developing ROVs for MATE ROV and ROBOSUB competitions. At these competitions, students test their skills in underwater robot design and programming. Such work creates experts in the field of further solution of the world's problems of cleaning up the ocean from plastic, food and chemical waste, petroleum products, and many other things that have a huge impact on the atmosphere and people.

ROV is the result of hard work, projects and research. After many tests in a variety of conditions, the vehicle showed good maneuverability, high speed and efficiency in carrying out the assigned tasks. Initially, our team wanted to create a small robot. It had six thrusters on it. After some discussions, we considered this option not to be rational. Finally, it was decided to create an ideal design

containing eight thrusters that had necessary characteristics. The robot production began with the analysis of the MATE competition challenge and the funds that were available. As a result, the decision was made to build the ROV that could accomplish all the necessary tasks in the allotted time, and with the ability to change payloads. The size and weight of the design, cost, labor intensity, technology availability, and safety were important to us. A list of necessary parts and components was made. At the second stage, a 3D model of the robot was created. The complete parts were printed according to this model and manufactured using a CNC milling machine and subsequently assembled, and a circuit diagram was developed. The third step was writing a program and testing the robot equipment. At this stage our university helped us by giving the permission to use a pool to test the robot at the weekend.

While developing the ROV several studies were also made, one of them was to compare the propeller parameters. Different shapes and sizes of propellers were 3D printed and then their strength was tested in water. The six-bladed looped propeller was the best, due to its unusual shape; it creates a powerful jet propulsion.

The qualifying stage of MATE was held in Vladivostok on May 6-10, 2021. There were some accidents at these competitions. On the first day the robot wiring broke, but it did not stop us from winning the first place in the competition to qualify for the international stage.

We had to participate remotely at the international competition, which was to be held in the U.S., due to the epidemiological situation in the world. But it did not prevent us from taking the 10th place in the top of leaders. In comparison, Skolkovo Labs took only 18th place the first time around. This event proves that our university stands out among others in the country.

The development of ROV at

Reshetnev Siberian State University of Science and Technology is going on today, so that in the nearest future it will also be able to take the first place in the top of the world leaders in the development of underwater robots.

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THERMAL INSULATION IN CRYOGENIC ENGINEERING

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This article is devoted to the study of the effectiveness of insulation in cryogenic equipment. The paper considers the main types of thermal insulation and areas of application of thermal insulation materials. Some problems of thermal insulation are presented.

Keywords: Cryogenic engineering, insulation, low temperatures, vacuum.

ТЕПЛОИЗОЛЯЦИЯ В КРИОГЕННОЙ ТЕХНИКЕ

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Данная статья посвящена исследованию эффективности изоляции в криогенном оборудовании. Рассмотрены основные виды теплоизоляций и области применения теплоизоляционных материалов. Представлены некоторые проблемы теплоизоляции.

Ключевые слова: Криогенная техника, изоляция, низкие температуры, вакуум.

The purpose of our study is to find out the effectiveness of insulation in cryogenic equipment. The methods of our research are observation, the study of scientific material. The level of this study is theoretical. The novelty of our paper is to study thermal insulation from a modern point of view.

The properties and thermal stability of low temperature equipment are highly dependent on the properties of the material used for the insulation. Cryogenic temperatures (below 100 °C) affect the materials used no less destructively than high temperatures. Thermal protection of low-temperature equipment must keep the negative temperature of liquid gases to increase operability, without allowing the surrounding heat to affect the equipment, thereby eliminating vaporization, as well as increasing pressure from inside the tank or pipeline. Compliance with these conditions guarantees the functionality of the equipment, saves energy resources and protects the operating personnel.

The most important parameters for thermal insulation are: 1) Thermal conductivity; 2) Ultra-low temperature resistance; 3) Preservation of material properties, at constant and cyclic temperature changes; 4) Low moisture absorption.

There are several types of low-temperature insulation: Low temperature insulation: perlite; Cryogenic (vacuum) low temperature insulation; Multi-layer low temperature insulation (non-vacuum); Cryogel is the latest generation of low temperature insulation.

Perlite is a gravel of aluminosilicate eruptive rocks that has been thermally exposed by heating to 900–1100 °C. As a result, the moisture inside the rock instantly evaporates, and the softened gravel bursts, increasing in size from 4 to 20 times, also disintegrating into smaller parts. In this case, the porosity of the material used reaches 40–90 %, which also increases the main thermal insulation properties of pearlite.

Cryogenic (vacuum) low-temperature insulation is a series of heat-insulating layers alternating with reflective films (foil) placed in a vacuum cavity between the inner (main) part of the vessel and the outer casing.

Low-temperature (non-vacuum) multi-layer insulation is distinguished from cryogenic (vacuum) insulation by the absence of the need to form a vacuum in the insulating cavity. When multilayer low temperature insulation is used, the selection of insulation material is determined by its lyophobic qualities. To ensure that non-moisture resistant materials do not lose their own heat-insulating qualities and do not collapse under the influence of low temperatures due to exceeding the maximum humidity, auxiliary measures are needed to protect them from getting wet.

Cryogel is one of the modern insulations in cryogenics. This is a material consisting of fiberglass with aerogel particles, which is covered with aluminum foil. This cryogel has unique properties and the main ones are: harmlessness, fire resistance, low weight, hydrophobicity, thermal performance, small volume, aesthetics, maintainability. Due to its properties, the cryogel got into the Guinness Book of Records.

Thermal insulation in cryogenics is used in equipment that produces oxygen (namely, in air separation plants and gasification plants), during transportation, to preserve the gasification of liquefied oxygen, in the insulation of pipeline fittings in plants.

Summarizing our scientific work, we conclude that thermal insulation in equipment is very important, safe and has great potential for use in the future.

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AERODYNAMIC INVESTIGATION OF AIR FLOW THROUGH ARCHIMEDEAN SPIRALS

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This paper presents the results of a study on the nature of the airflow around Archimedean spirals, intending to investigate the usability of spirals as turbulators in turbine blades of gas turbine engines (GTEs). A series of physical aerodynamic experiments were performed, including a CFD simulation. The efficiency level of the turbulator is proven.

Keywords: aerodynamics, Archimedean spiral, turbulator, turbine blade, CFD, turbine.

АЭРОДИНАМИЧЕСКОЕ ИССЛЕДОВАНИЕ ОБТЕКАНИЯ СПИРАЛИ АРХИМЕДА ПОТОКОМ ВОЗДУХА

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Данная работа представляет результаты исследования характера обтекания спирали Архимеда поперечным потоком. Для применения спирали как турбулизатора потока охладителя в лопатке турбины газотурбинного двигателя выполнена серия физических экспериментов и проведено численное моделирование обтекания спирали. Доказана эффективность такого типа турбулизатора.

Ключевые слова: аэродинамика, спираль Архимеда, турбулизатор, лопатка турбины, CFD, турбина.

When designing turbine blades for advanced gas turbine engines (GTEs), there are two main problems: increasing reliability and service life, while at the same time obtaining promising turbine efficiency values. If we consider the ways to solve these problems separately, then it is worth saying that the cooling systems used to increase the resource and reliability can negatively affect the efficiency of the turbine. At the same time, the desire to reduce coolant consumption to increase the level of efficiency does not always lead to promising levels of engine efficiency. Therefore, to solve the problems of designing cooled blades of advanced GTE turbines, it is necessary to look for new methods based on the latest research results in the field of GTE operation, in the fields of fundamental physics, aerodynamics.

The main reason for the failure of the blades of the first stage of the turbine of a gas turbine engine is the burnout of the blade where the temperature is highest [1].

The practice of designing cooling blades of GTE turbines provides the opportunity to use turbulators of various shapes in the internal channels [2; 3]. Ribs, pins, matrices, rods and et cetera are used. A new form of a turbulator is considered, which will make it possible to obtain the required

level of increase in the intensity of heat transfer without a critical decrease in the pressure of the coolant air to organize its effective release into the general flow path of the high-pressure turbine (HPT) while effectively removing heat. This model can be that of an Archimedean spiral.

To determine the efficiency of the spiral as a turbulator, an experimental study of the airflow behind the spiral was conducted. The spiral models were designed in Siemens Unigraphics (NX), then 3D printed. The experiment was carried out with an open wind tunnel. The spiral turbulator was installed in a cylinder located at the exit of the tunnel section. A wind tunnel with a low-pressure fan made it possible to obtain a reduced flow velocity in the outlet section $\lambda = 0.09…0.1$ at an overpressure $P_i = 230…980$ Pa.

The experiment was carried out at atmospheric pressure of B = 748 mmHg (99725 Pa) and a temperature of T = 240 C (297 K).

Three spirals were studied: spiral 1 – the distance between the turns $\Delta = 12.25$ mm; turn width b = 4 mm; the number of turns n = 3; spiral 2 – $\Delta = 8.2$ mm; b = 4 mm; n = 4; spiral 3 – $\Delta = 2.91$ mm; b = 4 mm; n = 7. The maximum radius of the spirals was 50 mm.

The pressure behind the spiral was measured using a computerized measuring unit. The pressure receiver was programmed to move along the spiral radius. For each radius, the receiver moves to the left (0 degrees) and then moves 10 experimental points towards 180 degrees. After passing each radius, the pressure receiver always returned to the centre. Pressure measurements were recorded for different radii.

An experimental study of the flow-through three spirals made it possible to conclude the high degree of turbulence of the flow at the back of the spiral. Installing the spiral directly next to the leading edge of a turbine blade creates a well-swirling flow that extends up the leading edge, which contributes to its intensive cooling. An experimental study of the structure of the flow through the spiral, carried out by the authors, showed that this type of turbulator allows a higher level of flow turbulence, which will lead to more efficient heat removal. The spiral turbulator is installed in the inner channel of the blade.

The comparison of the overpressure distribution behind the spiral in the case of using one spiral and a combination of three spirals showed several interesting results. The combination of three spirals reduces the flow pressure by almost half. One spiral allows us to get higher flow turbulence at an acceptable pressure level. Moreover, the points of local maxima and minima show a twist of the airflow in the direction of the twist of the spiral turns.

Vortices forming from neighbouring turns in some zones of the spiral very quickly merge into one. This gives stronger pressure pulsations in the peripheral zones of the spiral.

The dependence of the degree of unsteadiness of the flow behind the spiral on the distance between the spiral and the pressure receiver was also investigated. The study was carried out for spiral 2, the distance to the receiver varied from 40 mm to 240 mm. The averaged results of pressure measurements along the radius at an angle of 110, 111 and 112 degrees were obtained and compared.

Based on the experiment, an empirical formula was obtained that makes it possible to estimate the degree of unsteady flow pressure behind the spiral at a certain distance: $\Delta P = 40.783e^{0.0043x}$, where x is the distance from the spiral, ΔP is the maximum difference between local maxima and minima pressures.

This dependence will allow us to determine the efficiency of the spiral with the ratio of $\Delta / b = 2.05$, and also calculate the distance between the spirals when using a set of spirals.

The CFD simulation of the turbulent flow through the spiral was also conducted. For the purposes of conducting a CFD simulation in Autodesk CFD, spiral 3 was designed in a cylindrical channel and was imported into Autodesk CFD. A fine mesh of spiral 3 was created and boundary conditions were applied, including the corresponding turbulence model, flow parameters at the ends of the cylinder and properties of the working fluid.

The study showed that the spiral was able to provide a minimum pressure loss with high flow turbulence, which, in turn, is good for the release of cold air from the turbine blade.

As a result of modelling, the distribution of pressure fields and velocities of the working fluid flowing through the spiral were obtained. The spiral was able to provide a minimum pressure loss, which in turn is important for the coolant blowing process.

The results of CFD simulation and physical experiments were in good agreement with each other. The error in comparing the experiment with the CFD simulation accounted to only 12 %, this hints at the good reliability of the results.

In recent years, blades with tree turbulator rods have often been used. Examples can be found in the works [4; 5].

The disadvantage of this method of heat exchange intensification should be considered the negative influence of the rod configuration – stagnant zones form in the cavities between massive «branches» that reduce the total flow rate, which causes a decrease in the coolant flow rate and a decrease in cooling efficiency. If the coolant pressure is insufficient, it is difficult to blow the air into the general flow path of the turbine. Due to this, burns can follow, which can then damage the blades overtime [6]. The leading edge is a common part of the blade where burns occur.

On the basis of the above, it is proposed to design a cooling working blade of a gas turbine engine turbine with a hollow casing in which several spiral turbulator rods are vertically arranged along the height. The cooling air is received from the bottom part of the blade. This air gets turbulized when it passes through the spiral turbulators. This air is removed through film cooling holes located at the end of the blade.

The advantage of this design is the following. This design allows us to lower the temperature of the blade by increasing the turbulization of the coolant, and the configuration of the spirals allows us to spin the flow of cooling air, increasing its pressure, which then contributes to the high efficiency of the blade and, as a result, to its more intensive cooling effect.

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DEEPFAKE: AN ARTIFICIAL INTELLIGENCE THAT DISTORTS REALITY

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This article examines Deepfake technology, the impact of this technology on people's lives, and describes tips that can prevent the negative effects of this technology.

Keywords: Deepfake, GAN, Smart Augmentation.

DEEPFAKE: ИСКУССТВЕННЫЙ ИНТЕЛЕКТ ИСКАЖАЮЩИЙ ДЕЙСТВИТЕЛЬНОСТЬ

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В данной статье рассматривается технология Deepfake, влияние данной технологии на жизнь людей, а также описываются советы, которые могут предотвратить негативные последствия данной технологии.

Ключевые слова: Deepfake, GAN, Smart Augmentation.

The rapid leap in the development of technologies such as artificial intelligence (AI) has changed the way people think about aerating and absorbing new information. The combination of machine learning techniques has led to the emergence of “Deepfake” technology, the activities of which can create serious consequences in various spheres of human life. Deepfake is a combination of two words: deep learning and fake. The technology itself is a synthesis of two competing artificial intelligence algorithms: a generator and a discriminator. The two models compete with each other and are trained simultaneously. The generator creates samples, and the discriminator tries to find difference between the samples obtained from the training date and the samples provided by the generator. Afterwards, the discriminator classifies the obtained samples into real and fake ones. In order to better distinguish between the samples, the discriminator is updated on the next round of training. It’s important to note that the generator will update the generated samples depending on how well or not those samples fooled the discriminator [3].

The competition between the two models is based on the game theory term “Antagonistic Game” or zero-sum game. A game involves two or more players whose winnings are opposite [2]. For this algorithm the outcomes may be as follows. First: if discriminator successfully identifies real and fake samples, it will be “rewarded” – the classification parameters will not change. The samples of the generator in this case are completely updated. The second outcome: if the generator managed to fool the discriminator, it’s “rewarded” – its samples remain the same. The classified parameters of the discriminator are then updated [3]. Learning is that the discriminator need to learn how to cor-

rectly classify the samples, and the generator needs to create perfect copies from the resulting samples. Ideally, the discriminator should predict “not sure” in 50 % of cases, after that its training ends. It should be noted that at lower percentages the generator model also becomes workable [3]. The model described above is called “The Generative Adversarial network” (GAN).

Deepfake is most often used to create provocative multimedia information: video and audio recordings. With the spread of this technology, situations of “discretization” of public figures have become more frequent. Over the past couple of years, there have been dozens of cases in which the use of Deepfake undermined a person’s reputation. For example, in 2019 there was published a Deepfake-video in which the speech of Nancy Pelosi, Speaker of the U.S. House of Representatives, was altered to the point that users formed the opinion that she was intoxicated. The scandal caused by the video was resolved only after evidence emerged that the video had been generated.

Serious consequences of Deepfake technology have also been encountered at government levels. In March 2021, it was reported that the technology had succeeded in defrauding China’s government system, which accepted tax documents verified by biometrics. A group of attackers used preproduced Deepfake-video to forge tax invoices and profit from them. The damage was $76.2 million [7].

There have been cases of Deepfake use in Russia as well. Fraudsters made calls to bank customers who had the voice-recognition service connected knowing about connected service. The fraudsters recorded conversations with clients and then used the recordings to arrange loans. From a technical point of view, solutions to this technology are constantly being developed. Scientists from all over the world are interested in creating technologies to detect Deepfakes. In 2020, Facebook and Microsoft held a competition for developers, which was aimed at creating solutions to combat the technology of face substitution in video [5]. Examples were samples in which a real face and a face created by AI were missed, and then the mixing factors were used as the target label (Fig. 1).

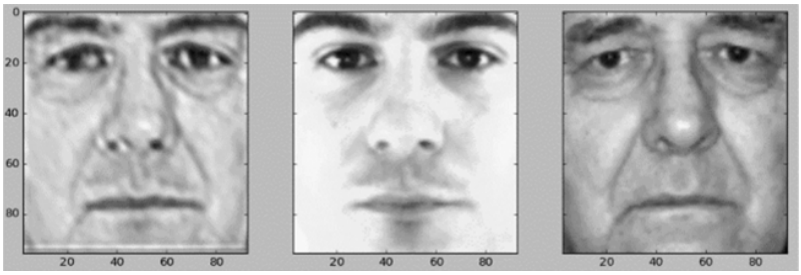

Fig. 1. The image on the left is the studied combination
of the two images on the right

During the competition, developers were able to achieve the following results: for a standard dataset recognition accuracy of Deepfake reached over 85 %, for a complex dataset, which used distracting components (such as filters or inscriptions) managed to achieve recognition accuracy of the technology a little over 65 % [5]. To minimize the treat of Deepfakes, McAfee has launched the McAfee Deepfakes Lab, which aims to focus expertise in data analysis and processing, as well as high-end tools to counter the threat of Deepfakes to individuals, organizations, and society at large to control the credibility of information. The lab combines deep learning methods to analyze and decipher convert patterns and recognize elements of video falsification, which occupy an important role in the identifying authentic multimedia information [4].

In today’s reality, Deepfake recognition technology has not yet reaches the level to fully ensure information security for humans. Since attacks by attackers may involve psychological manipulation of people in order to gain access to confidential information or fraud with the goal of making a profit, it’s recommended to follow some tips [6]: 1. Inform family, friends and co-workers about what Deepfakes are and what consequences you can expect from them. 2. Learn information about how to recognize Deepfakes and tell the rest of the people you know about it. 3. If it’s possible, keep an eye out for new ways of detecting Deepfakes and methods of combating them. 5. Critically

approach any multimedia data: check the reliability of sources, be able to analyze the information obtained and draw conclusions based on it.

It's important to remember that as Deepfake technology develops, the authors of this technology will continue to develop it in the same way. Therefore, the more knowledgeable person is about this, the harder it becomes for an attacker to get the information they want. The world of AI is expanding every year. The more it expands, the more problem are discovered in it that cannot be left unattended. Thorough research, testing and upgrading of algorithms can reduce the negative consequences, and as a consequence of this, create progressive technology and ways of interacting with humans that will help them, not harm them.

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TCP AND UDP PROTOCOLS

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This article discusses different approaches to the use of transport layer network protocols and their advantages and disadvantages.

Keywords: model OSI, network protocol, data, transmission.

TCP И UDP ПРОТОКОЛЫ

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В данной статье рассматриваются различные подходы к использованию сетевых протоколов транспортного уровня, их преимущества и недостатки.

Ключевые слова: модель OSI, сетевой протокол, данные, передача.

At present, world is unimaginable without communications. Tens of millions of devices around the world are connected by computer networks. All devices communicate according to the widely accepted OSI, or Basic Open Systems Interconnection Reference Model. This model defines the interaction of various network devices at seven layers – Media – (which includes physical, data link and network) and Host – (transport, session, presentation and application). In this article we will look at the two major transport layer network protocols, TCP and UDP, examples of their use, and compare their characteristics.

If we want to transmit data in computer networks, we will be forced to use transport layer protocols. These protocols allow us to ensure that the message reaches its destination and that the correct sequence of data transmission is maintained. However, the protocols have a number of differences, which allows them to be used profiled, each for its own purpose. TCP (Transmission Control Protocol) is a network protocol that is intended for connection. In other words, it requires a connection between two hosts before it can communicate. This connection is called a three-way handshake. This protocol is highly reliable as it does not lose data during transmission, requests acknowledgement of receipt from the receiving party and re-sends data if necessary. The data packets that are sent retain the order in which they were sent, i.e., we can say that the data transmission is ordered. The disadvantage of this protocol is the relatively low speed of data transmission, due to the fact that it takes longer to perform a reliable and ordered transmission than in the alternative protocol UDP. In addition, speed is also lost due to service messages that are sent along with the data stream. UDP (User Datagram Protocol), on the other hand, is simpler. It does not need to establish a connection between sender and receiver to transmit data. The information is transmitted without any pre-checking of the receiving side's readiness. This makes the protocol less reliable – some pieces

of data may be lost in transmission. In addition, data ordering is not maintained – inconsistent reception of data by the recipient is possible. On the other hand, the transmission speed of this transport protocol will be higher.

In conclusion, we would like to highlight a few basic points:

– Reliability:The TCP protocol is preferred in this case, due to acknowledgement of data receipt, resend if necessary, and the use of a tool such as timeout. The UDP protocol does not have such tools, and therefore the data sent may not arrive completely when received.

– Orderliness: Again, TCP is preferred because it guarantees that data packets are transmitted in the exact order in which they are sent. In the case of UDP this order is not respected.

– Speed: UDP will be in the lead here, as the heavier TCP protocol will take longer to establish a connection, acknowledge receipt, resend data, etc.

– Data transmission method: In the case of TCP, the data is transmitted in streams, the data fragment boundaries are unmarked. In the case of UDP, data is transmitted as datagrams – packets are only checked for integrity by the receiving side if a message is received. Also, data packets have certain boundary markings.

Comparing the two protocols, it is obvious that the TCP protocol is, so to speak, a «sniper».Aim, fire, lock hit, look for the next target. The UDP is more of a "machine gunner" – pointing a gun in the direction of the enemy and firing in bursts, not caring too much about accuracy. Just as both of these military specialties are important in the military, both of these protocols are important on the Internet. TCP is used wherever accurate and verifiable data transmission is required – for example for the sending of photographs or texts between users. UDP, on the other hand, is needed for voice communication, or when streaming video, such as from webcams or IP cameras.

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LAMINARIZATION TECHNOLOGY AS MEANS OF AIRCRAFT AIRFOILS DRAG REDUCTION

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The article deals with the method of airfoils laminarization as one of the means of reducing aerodynamic drag. The types of laminarization of aircraft surfaces are considered, as well as the positive and negative sides of the described technology application.

Keywords: aircraft, aerodynamic drag, fuel consumption, laminar flow, laminarization technology.

ТЕХНОЛОГИЯ ЛАМИНАРИЗАЦИИ АЭРОДИНАМИЧЕСКИХ ПОВЕРХНОСТЕЙ ВОЗДУШНЫХ СУДОВ КАК СРЕДСТВО СНИЖЕНИЯ ЛОБОВОГО СОПРОТИВЛЕНИЯ

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Статья посвящена методу ламинаризации аэродинамических поверхностей, как одному из средств снижения лобового сопротивления. Рассмотрены виды ламинаризации поверхностей летательных аппаратов, а также положительные и отрицательные стороны применения описанной технологии.

Ключевые слова: воздушное судно, аэродинамическое сопротивление, расход топлива, ламинарный поток, технология ламинаризации.

Working at construction of an efficient modern aircraft with minimal fuel consumption, aircraft designers of the world often apply specific innovations. To reduce aerodynamic drag, thereby reducing fuel consumption, aircraft designers consider using laminarization technology. In practice, this means making the delay in the onset of the laminar-turbulent transition on airfoils maximal; this transition means the formation of flow turbulences creating induced vortex drag. About 50 % of an aircraft's drag is frictional drag in the turbulent boundary layer. All modern serial aircraft of industrial application fly with turbulent boundary layers on their airfoils. If there is a possibility of making the boundary layer laminar, the drag can be decreased by 5–10 times. The aerodynamic drag coefficient Cx and fuel consumption will decrease accordingly. Even a conservative estimate of fuel consumption reduction for a short-haul aircraft is 11 %.

The main goal of controlling the unstable flow in laminar boundary layer on the surface of a body moving through air is maximum delay of the moment of its transition into turbulent state. It is well known that in the laminar flow on the aircraft wing the surface frictional drag is considerably reduced compared to that in turbulent flow. With laminar flow, there comes a decrease in surface

drag, which favorably affects the operation of aircraft. Due to the larger surface area captured by the laminar flow, the resistance of the air medium is reduced. This creates the basis for saving several tons of fuel per flight [1].

Laminarization technology was invented in order to maintain a laminar flow along the edge of the wing and eliminate vortex airflows. There are several types of laminarization: natural, artificial and mixed. It should be noted that for smaller aircraft (such as Sukhoi Superjet 100), the most promising is the natural laminarization of the flow, which is achieved only due to the shape of the wing profiles. For larger aircraft (such as MS-21, Tu-204), it is necessary to apply artificial laminarization, which induces the suction of the boundary layer of air through millions of micro-holes in the skin. Manufacturing of such a surface is technically difficult, moreover, microstructural holes may be susceptible to contamination and erosion, so additional methods of airfoil inspection will have to be introduced into regular AC maintenance procedures. A big problem is that it is almost impossible to laminarize the fuselage. However, for the wing, tail unit and engine nacelles, laminarization is quite applicable in the future.

In order to increase the aircraft aerodynamic quality coefficient (lift–to-drag ratio), the Central Aerohydrodynamic Institute experiments in modeling natural and artificial laminarization of the flow on various aircraft surfaces. A recent research in 2020 included a detailed study of laminar flow boundaries. The experiments performed with the use of a thermal imager confirmed the presence of extended laminar areas on the upper surface of the wing. The tests also detected zones of local separation that impaired the existing sufficient load-bearing properties of the wing. According to preliminary expert estimates, the applied technology allows to reduce the drag of the experimental aircraft by 10–15 % [2].

The aim of the European research project BLADE (Breakthrough Laminar Aircraft Demonstrator in Europe) of 2017 was a demonstration of the ultra-high quality of surface treatment necessary for the natural development of a laminar boundary layer, achievable in production and capable of preservation in aircraft operation. In the Airbus A340 model aircraft test, the laminar flow coverage on the upper plane of the wing cantilever was 70 %, and on the under-wing plane – 30 %. For a conventional aircraft wing, the laminar flow coverage area, depending on the design, ranges from 30 % to 50 % for the upper plane and up to 30 % on the under-wing plane. According to the data obtained during the research, it is possible to predict a reduction of the aerodynamic drag of the wing with the developed laminar flow by 15 %.

The consequences of the air resistance caused by premature transition of the laminar flow into turbulent are substantial from the point of view of economy. The presented technology provides reduction of the aviation fuel expenditures. The advantage of laminarization technology will certainly bring its results in the future of the aircraft. The prospects of this technology will help to prolong the aircraft endurance by years, saving on fuel consumption and spending the saved funds on scheduled maintenance.

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ROAD CONSTRUCTION AS A PART OF GEODESY

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The article analyzes the construction of roads in geodesy. It also describes how important geodesy is in the construction of roads on your own example of practical work.

Keywords: geodesy, construction, road, topographic survey, science.

СТРОИТЕЛЬСТВО ДОРОГ КАК ЧАСТЬ ГЕОДЕЗИИ

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В статье анализируется роль геодезии в строительстве дорог. Также описывается насколько важна геодезия в строительстве дорог на собственном примере практических работ.

Ключевые слова: геодезия, строительство, дорога, топосъемка, наука.

One of the most demanded high-tech industries in modern production is geodesy. At the same time with the construction survey work of a professional surveyor must be carried out. The science of geodesy appeared a long time ago and literally means “to divide the earth into parts” from Greek. Currently geodesy is used to study the size of the Earth as a whole, and its individual parts. So, in any construction, it is necessary to carry out high-quality measurements. Electronic or laser equipment is used for measurements and the results obtained are to be processed in special programs. In road construction geodetic surveys play an important role: 1. With the help of geodetic measurements the construction of highways is supported – the removal of the axis of the route, the removal of design marks in nature, the calculation of the volume of earthworks, the drawing up of executive schemes and more. 2. Geodetic expertise and surveys allow you to control the level of subsidence and deformation of roads. 3. Topographic surveys are used to create topographic plans, maps, and carry out the necessary calculations.

When erecting a roadbed geodetic support is needed to constantly monitor subsidence and deformations that may occur both during construction work and during operation. Before starting the construction of the road it is necessary to prepare all the project documentation. After that surveyors are engaged in preparatory work, during which a stakeout network is created. The results obtained in the course of geodetic surveys will further form the basis for accompanying road construction. Experts carry out work to determine the level of the position of the canvas, calculate the angles of turns of the future track. Geodetic work implies constant control over the development of pits, simultaneous calculations and verification of deviations from the design marks. This information is applied to the executive scheme, which will be further verified by the regulatory authorities. When

the road works are completed, a topographic plan is created with the new roads already plotted. Thus the importance of geodetic works in road construction can hardly be overestimated. For the construction of a new roadbed, which must meet all standards, a high-quality constant control is required. Geodetic measurements are the basis of the future construction process.

During the summer practice in geodesy our main task was to learn how to make a topographic base for future road design using specialized equipment. First of all, we split into groups and with the help of specials technicians broke the axis of the track, then leveled this section and also made a survey of a strip of terrain. So, in the end, we have achieved a solution to the task. In conclusion, we can safely say that our work is the foundation for the design of the future road.

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PLANNING AND GEODETIC BASIS FOR THE CONSTRUCTION OF AN INDUSTRIAL COMPLEX

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The article observes the role of the planned – geodetic basis in the construction of an industrial complex. The importance of geodesy in the construction of an industrial complex is described. Drawing up a planned basis and describing the steps of drawing up the basis in modern realities.

Keywords: geodesy, building complex, plan, site, relief, terrain, construction, coordinate grid.

ПЛАНОВО-ГЕОДЕЗИЧЕСКАЯ ОСНОВА ДЛЯ СТРОИТЕЛЬСТВА ПРОМЫШЛЕННОГО КОМПЛЕКСА

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В статье анализируется роль плановой – геодезической основы в строительстве промышленного комплекса. Описывается важность геодезии в строительстве промышленного комплекса.

Ключевые слова: геодезия, строительный комплекс, план, площадка, рельеф, местность, строительство, координатная сетка.

Geodesy is one of the ancient sciences of the Earth. Geodesy relies on the achievements of other sciences, such as mathematics, physics. From the economic side, the industrial complex is more important and many times more expensive in terms of construction, so mistakes during construction are not permissible. The structure of the planned geodetic basis consists of: theodolite passages, a construction grid, points on constructed structures, red lines or other lines of building regulation, triangulation networks. The main task in the design of industrial buildings and construction is the choice of a construction site in this area.

The site must meet the following operating conditions with minimal costs for preparatory work. The construction of an industrial complex is not feasible without a planning and geodetic basis. First you need to create a polygonometry project. A physical and geographical description of the area will be required, that is, to indicate the features of the relief, describe the hydrography, which soil prevails in the area, describe vegetation, indicate the presence of settlements, the road network, describe the climate in this territory.After that, conduct a topographic and geodetic study of the area. It is also required to conduct triangulation of the second category or polygonometry, depending on the type of terrain, if the terrain is closed, then we conduct polygonometry, if open, then triangulation.

The design of the triangulation of the second category is carried out on a topographic map of a scale of 1:10000. Before taking it out in nature, it is necessary to calculate the average square error and the relative error of the weak side of the triangulation. It is allowed to increase or decrease the scale of the topographic survey to the adjacent one, depending on the nature of the projected object, as well as man-made and natural conditions of the territory designated for construction. The weak side is in the middle of the triangulation network. To calculate the average quadratic error of triangulation on the map, it is necessary to measure the connecting angles with an accuracy of degrees.

Next comes the evaluation of the accuracy of the weak side and the leveling of the fourth class. Leveling of the fourth class is performed by leveling H-05. When leveling the fourth class, three-meter draughts are used. Before starting field work, the levelers are examined and verified. When leveling the fourth class, counts on the black and red sides of the rails are made by the middle stroke, and to determine the distances from the level to the rails, counts on the upper rangefinder and middle strokes on the black sides of the rails are used. At the end of leveling, a discrepancy is calculated along the line between the initial reference points, which should not exceed ±20 mm $\sqrt{L}$.

The next step is to build a construction coordinate grid. The breakdown of the construction grid on the ground is made from the existing geodetic points of triangulation, polygonometry on the territory. Initially, the construction coordinate grid is designed, according to the master plan, taking into account the following requirements: parallelism of the grid axes to the main planned axes of development, ensuring sufficient density of the grid, the distribution of points should be such that maximum safety is ensured during vertical planning.

Recently we can observe that the construction of engineering structures required geodesy to dramatically increase the accuracy of measurements. So when installing the equipment of powerful accelerators, it is necessary to take into account tenths and even hundredths of a millimeter.

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COMPARISON BETWEEN Q-LEARNING AND QUANTUM NEURAL NETWORKS ON SIMPLE MACHINE LEARNING TASK

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This article contains a basic information about quantum neural network and Q-learning, provides a quick introduction to these machine learning approaches and involves a comparison between those two methods on an example of a simple task from a machine learning library.

Keywords: quantum neural network, Q-learning, machine learning.

СРАВНЕНИЕ АЛГОРИТМОВ Q-ОБУЧЕНИЯ И КВАНТОВЫХ НЕЙРОННЫХ СЕТЕЙ НА ПРИМЕРЕ ПРОСТОЙ ЗАДАЧИ МАШИННОГО ОБУЧЕНИЯ

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В данной статье содержится основная информация о квантовых нейронных сетях и Q-обучении, да краткое введение в эти подходы к машинному обучению и включает сравнение этих двух методов на примере простой задачи из библиотеки машинного обучения.

Ключевые слова: квантовые нейронные сети, Q-обучение, машинное обучение.

Artificial intelligence (AI for short) is a branch of science that focuses on developing algorithms that can imitate the way that humans think and learn [1]. Reinforcement learning is an approach of machine learning that implies that agent – the machine, that tries to solve some sort of a task – does not know anything about the environment in which it operates. The agent takes rewards or penalties on its way to learn, depending on its actions in the environment [2].

Q-learning is a reinforcement learning policy that finds the best action that gives an agent the biggest reward among others possible actions. Quantum reinforcement learning is a merge of deep learning algorithms and reinforcement learning and it aims to develop agents that rely on quantum models of computation, especially on ideas of qubits, superposition and a lot of other really complex things, that quantum physics focuses on. But, of course, quantum supercomputers are still in development stage, so to actually try this at a non-quantum computer Google developed a library, that provides emulation of quantum dynamics basics – TensorFlow Quantum.

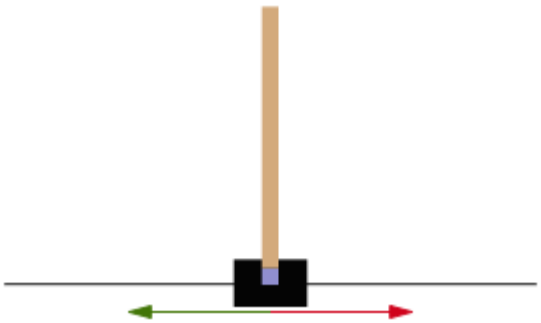

Fig. 1. CartPole task representation

Quantum neural networks and Q-learning are compared using the "CartPole" example from OpenAI machine learning library Gym. The task here is to find a way to balance the whole system, so that pole does not move 15 degrees from vertical and cart does not move far from initial position. Reward is based on the time that agent spends trying to balance the pole by moving left or right (Fig. 1).

To compare those two approaches in ability of reaching the same goal – maximizing reward – two algorithms were written in Python and then executed. Results of Q-learning algorithm are provided in Figure 2, results of quantum reinforcement learning algorithm – in Fig. 3.

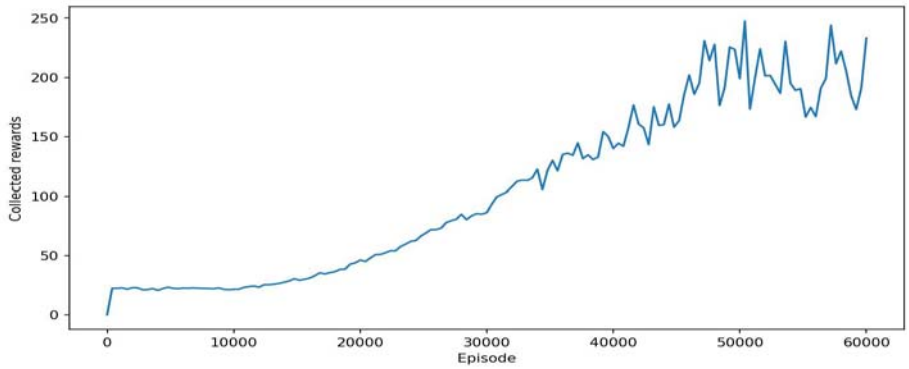

Fig. 2. Q-learning rewards

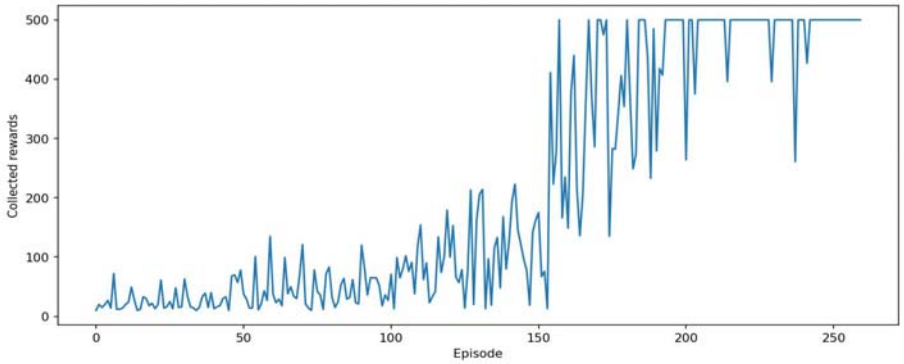

Fig. 3. QNN rewards

As seen from graphs above, the quantum neural network is more efficient in terms of learning how to get maximum reward learning in that particular environment, because it achieved the maximum reward value – 500 in this case, but has a larger spread of values on the learning curve.

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SPECIFIC FEATURES AND APPLICATIONS OF PRECISION AIR-CONDITIONING SYSTEMS

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This paper is devoted to precision air conditioners. This is refrigeration equipment that can always maintain the desired temperature and humidity in the room. Principles of operation of these air conditioners are considered.

Keywords: air conditioning, temperature, humidity, refrigerant, precision, microclimate, system.

ОСОБЕННОСТИ РАБОТЫ И ОБЛАСТИ ПРИМЕНЕНИЯ ПРЕЦИЗИОННЫХ СИСТЕМ КОНДИЦИОНИРОВАНИЯ ВОЗДУХА

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Данная статья посвящена прецизионным кондиционерам. Это холодильная техника, которая способна всегда поддерживать нужную температуру и влажность в помещении. Рассмотрены принципы работы этих кондиционеров.

Ключевые слова: кондиционирование воздуха, температура, влажность, хладагент, прецизионный, микроклимат, система.

The purpose of our research is to study and summarize information about industrial air conditioners. The level of this research is theoretical. The novelty of the study is to consider modern types of precision air conditioners. The priorities of modern society have changed and the requirements for cooling and air conditioning have increased significantly. An ordinary household air conditioner (split system) can cool the air inside the work room or at home and this is enough for most people. Rooms that emit much more heat require more serious solutions to this problem. Such premises contain very expensive equipment, ranging from server rooms to industries that require a constant, specific temperature. The efficiency of production and its performance will depend on the temperature that will be supplied to such premises. For example, the production of plastic products requires a temperature of 13 °C to 16 °C, if this temperature will be outside these temperature limits, the number of defective products will increase [1].

Precision air conditioners are refrigeration equipment that can always maintain the desired temperature and humidity in the room, with an accuracy of 0.5 °C and 2.5 % humidity. The name of these conditioners comes from the word "precision", meaning accuracy. These air conditioning systems are more expensive than conventional household air conditioners, but their task is completely different. The main advantage of precision air conditioners in comparison with split systems is that they are more reliable and designed for continuous operation [2].

The principle of operation of climatic equipment of this class, and any other is based on the conversion of refrigerant from liquid to gaseous state and vice versa. The transition from one state of matter to another is always followed by a change of the pressure inside the system. Freon in the gaseous state is pressured in the compressor and flows through a special connecting line to the condenser, which is located in another unit. After condensation, the actuation fluid carries off the heat and becomes a liquid. After that, the refrigerant enters the evaporator, where it is converted back into gas. After all the changes, the Freon goes into the compressor. The air circulates during the evaporation phase because the air given off by the room is blown through and cooled.

Precision climate systems are mainly designed for rooms that require regular and constant maintenance of air temperature and humidity.

We can distinguish groups of rooms that require such industrial systems: Cellular provider stations, because they have a very high heat load and are very picky about indoor humidity; Medical centers where surgical operations are performed; Premises with cultural objects: galleries, museums, archives. They need constant maintenance of a certain temperature and humidity to reduce the environmental impact on their safety; Information service rooms, because there is very expensive equipment there, if it breaks down, the company can lose a lot of profits; Industries based on working with low temperatures. For example, an ice cream factory or a plastic products plant.

Thus, we came to the conclusion that in a world where the number of electrified systems is growing every year, the number of companies that need a precise microclimate for their equipment is also increasing.

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WAYS TO INTEGRATE ARTIFICIAL INTELLIGENCE IN THE BANKING SECTOR

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The question of the ways of using artificial intelligence in the banking sector and the prospects for the development of technology is considered.

Keywords: intelligent systems, scientific and technological progress, technology, economy.

СПОСОБЫ ИНТЕГРАЦИИ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА В БАНКОВСКОМ СЕКТОРЕ

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Рассмотрен вопрос о способах применения искусственного интеллекта в работе банковского сектора и перспективы развития технологии.

Ключевые слова: интеллектуальные системы, банк, искусственный интеллект, научно-технический прогресс, технологии, экономика.

In the modern realities of the digital economy, the banking sector needs introducing new technological solutions to simplify the use of banking products, data protection, as well as analyzing pReferences in order to interest both existing and potential customers. In the process of digitalization, the use of artificial intelligence allows banks to optimize internal resources in various directions. Many players in the banking sector are already implementing machine learning technologies in such areas as risk analysis and automation of decision-making [1; 2], cybersecurity, personalization of banking offers for a specific client, as well as automation of standard operations and debt collection. The rapid development of digital resources and customer needs is pushing an increasing number of banks to introduce neural networks into their systems, the most successful of these projects are implemented by several major Russian banks, Sberbank, Alfa Bank and Tinkoff Bank. Let's look at the example of these companies, which areas have already been implemented and how banks plan to expand the use of artificial intelligence in the future.

At the World Economic Forum in Davos, the head of Sberbank, German Gref, said that in 2017 the bank managed to generate revenue of $50 million through the introduction of machine learning models by analyzing a huge amount of data and prototyping potential borrowers. Previously, people were engaged in routine data processing work, but now an automatic system is used for these purposes, the use of which has reduced the staff of middle managers by more than 60 percent. Ensuring the security of the data used by the bank also plays an important role. About eight thousand transac-

tions are carried out every second, and in order to ensure the security of these operations, various cybersecurity technologies are being developed using neural networks.

In order to simplify working with data, reduce the burden on employees by automating typical tasks, complexes for processing all kinds of similar operations are being developed. In 2016, Sberbank launched a so-called "robot lawyer" as a pilot project, which compiles statements of claim in the framework of working with individuals.

Given the rapid growth of the economy, the needs of customers are also increasing, which in some cases leads to an incorrect calculation of the debt burden and, as a rule, an increase in the growth of debt borrowed funds, in order to regulate this issue, reduce the debt burden on customers and repay debts, banks deploy software and hardware complexes to automate this type of activity. For example, Sberbank's debt collection subsidiary ActivBC has successfully developed and uses automatic communication systems with debtors in its activities, this allows eliminating the human factor and avoiding violations of the law. The successful application of these systems does not mean that everything goes without difficulties, the main problem of developing such solutions is the financial component, the work on the introduction of machine learning technologies requires not small investments from banks, primarily due to the lack of high-quality personnel. Qualified specialists working with systems based on artificial intelligence are in demand both in Russia and abroad, which in turn leads to competitiveness and an increase in the cost of their services, but at the same time it also brings considerable income, so the positive impact of using neural networks in their technologies pushes banks to improve them and distribute them to other areas of banking services that they provide.

The introduction of machine learning-based systems makes it possible to successfully exist in the market, helps in the development of the digital economy and solves a number of key needs of banks: increasing their potential, including by attracting new customers, improving the quality of services provided and increasing profits.

Thus, artificial intelligence technologies in the banking sector are one of the priority areas, the development and implementation of which benefits both banks and their customers, and the economy of the country as a whole.

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AN OVERVIEW OF DEEPFAKE TECHNOLOGY AND ITS IMPACT ON PEOPLE

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This article discusses Deepfake, its negative consequences, and how to recognize it.

Keywords: Deepfake, GAN, deceiving people, fraud, scam.

ОБЗОР ТЕХНОЛОГИИ DEEPFAKE И ЕЕ ВЛИЯНИЕ НА ЛЮДЕЙ

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В данной статье рассматривается технология Deepfake, ее негативные последствия, а также описываются способы распознавания данной технологии.

Ключевые слова: Deepfake, GAN, обман людей, мошенничество.

With the development of information technology around the world there began to develop artificial intelligence, which, as practice has shown, can be very useful for people. But with the development of artificial intelligence, new ways of deceiving people on the Internet based on the same artificial intelligence began to develop as well. A prime example of this is the technology called «Deepfake». The word «Deepfake» itself is composed of two other words: deep learning and fake [1]. Deepfakes use artificial intelligence technology to synthesize images or video, as a result of which one element is superimposed on another and a kind of combination of these elements is obtained.

We are used to photographs, video or audio being indisputable proof of an event or fact. Deepfakes destroy this notion by making the lie true and casting a shadow over people's reputations. It is not the most honest technology, a positive application of which is rather difficult to come up with. After creation of theDeepfakes they are uploaded online, and victims have to spend a lot of time and effort to repair their reputations [6]. There are many examples of deception not only of people, but also of various information technologies with the help of Deepfakes. On March 3, 2022, it was revealed that some Deepfake detection modules are set to outdated techniques. A team of researchers from the USA and China studied the susceptibility to Deepfakes of some face-based authentication systems. The study [4] found that most systems are vulnerable to developing forms of Deepfakes. In the course of study, Deepfake-based attacks were conducted using a special platform deployed in Facial Liveness Verification (FLV) systems. The study found that a limited number of Deepfake detection modules in such systems may have been configured with outdated techniques or may be too specific. Even if the processed videos seem unrealistic to humans, they can still bypass the current Deepfake detection mechanism with a very high probability of success.

Another example would be Deepfake voices. For instance, Deepfake voices can fool IoT devices and people after five seconds of training. Deepfake could fool Microsoft Azure about 30 percent of

the time and successfully fooled WeChat and Amazon Alexa 63 percent of the time. According to the developers SV2TTS, the program takes only five seconds to create an acceptable simulation. The program could deceive human ears – out of 200 volunteers asked to identify real voices among Deepfakes, the answers were wrong about half the time [4]. Also, Deepfakes can be used by fraudsters in banking crimes. In October 2021, it was revealed that criminals seized $35 million from a bank in the UAE by imitating the voice of the head of the bank using advanced artificial intelligence. They used Deepfake to mimic a legitimate commercial transaction related to the bank. The voice was used to trick the bank employee into thinking he was transferring money as part of a legitimate transaction. During the phone call, the voice claimed to be a director of a large company that the manager had previously spoken to. All of this is backed up by emails from the bank and its lawyer looking like the real deal, which were able to convince the branch manager that he was talking to a director and that the company was indeed in the midst of a large commercial transaction worth $35 million.

Generative adversarial network (GAN) is one of the algorithms of classical machine learning, learning without a teacher. The essence of the idea is the combination of two neural networks, in which two algorithms simultaneously work as a«generator» and a «discriminator». The generator's task is to generate images of a given category. The discriminator's task is to try to recognize the created image. So the generator generates certain images. For example, pictures that look like faces, and the discriminator tries to determine whether it was a face or not. And over time, the network learns so much that the generator generates very realistic faces [2].

Generative adversarial networks tend to mimic humans well, but some facial features still give them some problems, leaving many artificially created portraits with characteristic flaws around the teeth, eyes, and ears. Characteristic oddities can creep into clothing, accessories, or backgrounds, which can also be dealt with [3]. Fuzzy and surreal backgrounds are the first thing to look at. In this case, the tiles or joints in the wall behind the man seem to ripple and dissipate.

With the spread of Deepfake technology comes the danger of compromising any user whose picture or voice is in the public domain. It should not be forgotten that Deepfake technology is constantly improving and developing, and in a few years we can expect the appearance of such natural-looking or sounding fakes that they can only be detected after careful analysis using artificial intelligence.

The most promising uses of Deepfakes are political wars and fraud. In addition, given the constant improvement in technology, Deepfakes can also harm judicial practice – in terms of the credibility of audio and video evidence.

Currently, the information security market does not offer specialized solutions to protect against Deepfakes. The development of tools capable of recognizing fake content is still in its infancy. The only solution that currently exists is to inform users about new types of attacks and to be vigilant about any behavior that seems unusual [1].

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GEODETIC SURVEYS USING UNMANNED AIRCRAFT

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The article examines unmanned technologies for geodetic work, their advantages and uses.

Keywords: unmanned aerial vehicles (UAV), aerial photography, geodesy, cartography.

ГЕОДЕЗИЧЕСКИЕ ИССЛЕДОВАНИЯ С ПОМОЩЬЮ БЕСПИЛОТНЫХ ЛЕТАТЕЛЬНЫХ АППАРАТОВ

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В статье исследуются беспилотные технологии для геодезических работ, их преимущество и виды использования.

Ключевые слова: беспилотные летательные аппараты (БПЛА), аэрофотосъемка, геодезия, картография.

Geodesy, along with astronomy, is one of the most ancient and exact sciences. Geodetic research aims to measure the earth's surface using a complex of various scientifically based methods and display the results on maps and plans. Some also define surveying as the science of determining the position of points and the distance between them in two- and three-dimensional space. These measurements are needed not only as a source of knowledge about their own planet, but for solving important economic and engineering problems. Unmanned technologies are more and more infiltrating the industrial and research environment. They are beginning to be widely used in industry, construction, mining, as well as in geodetic research and cartography, which could not be an exception due to their specificity and widespread use of aerial photography. The introduction of unmanned aerial vehicles (UAVs) allows them to replace other flying vehicles (airplanes and helicopters, and sometimes even satellites) to perform surface surveys from above. That is, geodetic research using unmanned aerial vehicles is the same geodetic research, the only difference is that the main instrument is a UAV with a set of special equipment on board (and sometimes on the ground).

Modern unmanned aerial vehicles (UAVs) allow real-time monitoring of almost any infrastructure facilities located at a distance of up to several kilometers. Making a flight of a given route in automatic or semi-automatic mode, they receive accurate and reliable materials about the features of the terrain on which mining operations, construction work will be carried out, ground laser scanning will be carried out, and the condition of roads and railways and airports will be monitored.

The use of unmanned aerial vehicles, both in testing and in real conditions, has shown that they can collect data much faster than ground teams of even the most experienced surveyors with the most modern equipment. The superiority of UAVs over ground-based instruments can be traced es-

pecially clearly when research tasks require work in difficult terrain and weather conditions. If people find it difficult, and sometimes impossible, to get to the desired point on the ground, then this work for them will be successfully performed by UAVs. While traditional survey methods require careful measurement, preparation and planning, UAVs can collect comparable data in a much shorter time frame.

UAVs are unmanned aircraft on board. One of the varieties of unmanned vehicles is a quadcopter. The emergence of the first quadrocopters (multicopters) is associated with the development of helicopter construction. The first such aircraft, which had more than two propellers, was created and researched in 1992 by Georgy Botarez [2]. The development of quadrocopters received a new round of development in the 21st century, but they were piloted without human participation, that is, they were unmanned aerial vehicles.

The effectiveness of a geodetic UAV is determined by the presence of integrated or mounted specialized equipment. A well-chosen hardware complex allows you to perform several tasks at once in one flight. The number of devices and accessories necessary for the full operation of the drone includes: compact cameras for professional geodetic aerial photography, providing high quality and detailed images from a bird's-eye view; multispectral cameras for obtaining images in a wide spectral range during remote sensing; multifunctional thermal imagers with remote determination of the temperature of the areas of the studied surface or object. They are additionally installed on a quadcopter for geodetic survey in photo and video format.

In the process of researching and studying the use of UAVs, a natural question arises: how accurate is aerial photography from a drone? And what degree of accuracy can be achieved using new methods of collecting and processing information, that is, using unmanned solutions? Scientific research answers this question very simply: high accuracy is ensured with the help of UAVs, and this is the least time-consuming process.

Summing up, it is safe to say that using such modern means as unmanned aerial vehicles for geodetic survey of the terrain, the work can be done much faster, cheaper and more convenient. This statement is also true regarding the use of UAVs for dozens of other, very different tasks that require high-quality visual information from the air for their solution.

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APPLICATION OF CONVOLUTIONAL NEURAL NETWORKS IN THE PROBLEM OF RECOGNITION OF HANDWRITTEN NUMBERS

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Machine learning is currently an actively developing area of scientific research. The relevance of this article lies in the fact that the problem of recognizing handwritten characters is one of the most important in data processing. The abstracts describe the main methods used to recognize handwritten characters using neural networks.

Keywords: neural network, character recognition, Tensorflow, Keras, convolutional neural network.

ПРИМЕНЕНИЕ СВЕРТОЧНЫХ НЕЙРОННЫХ СЕТЕЙ В ЗАДАЧЕ РАСПОЗНАВАНИЯ РУКОПИСНЫХ ЦИФР

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В настоящее время машинное обучение является активно развивающейся областью научных исследований. Актуальность данной работы заключается в том, что задача распознавания рукописных символов является одной из основных в обработке данных.

Ключевые слова: нейронная сеть, распознавание символов, Tensorflow, Keras, сверточная нейронная сеть.

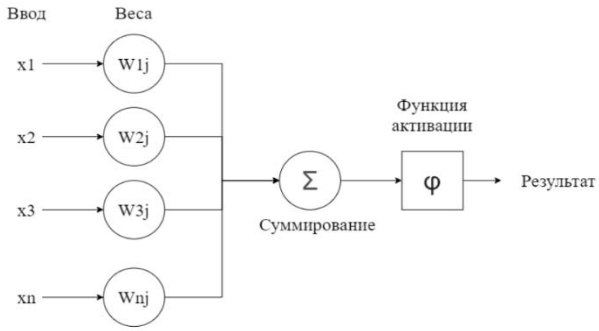
Machine learning is a data analysis technique that allows a machine, robot, or analytical system to learn independently by solving an array of similar data [1]. With the help of machine learning, artificial intelligence can analyze data, memorize information, make predictions, reproduce ready-made models and choose the most suitable option from the proposed ones. Machine learning methods make it possible to perform data analysis in all fields of science and technology, in particular in the analysis of satellite images, the search for promising deposits and pattern recognition.

Character recognition is one of the areas of pattern recognition, the task of which is to translate images of handwritten, machine or printed text into text data [2]. Text recognition in images is an important task of machine learning, as it allows you to organize convenient interaction with data: editing, analysis, searching for words or phrases.

Neural networks are so named because their internal structure resembles the human brain, consisting of neurons and synapses that connect them. Each neuron is activated by calculating the weighted sum of the input data and the subsequent result using a summing function. When a neuron is activated, it in turn activates the others, which perform similar calculations, causing a chain reaction between all neurons of all layers [3].

Let's consider the activation scheme through which each neuron passes in Fig. 1.

Initially, all input numeric values from incoming neurons are read, defined as x_1, x_2, x_3,…, x_n. The value of each input is multiplied by the weighted sum associated with this connection, desig-



The activation process of each neuron

nated as w_{1j}, w_{2j}, w_{3j},…, w_{nj}.. Then all weighted inputs are summed up and passed to the activation function, which reads this input and transforms it into a numeric value of k-nearest neighbors [4]. Thus, the resulting numeric value will be input for another neuron in another layer.

To implement the recognition of handwritten characters by a neural network, a programming language – Python, libraries – Tensorflow, Keras, Numpy, as well as the MNIST dataset were used. The MNIST database of handwritten digits contains 60,000 training images of handwritten digits from 0 to 9, as well as 10,000 images for testing. There are 10 different classes in the set. Images with numbers are presented in the form of 28*28 matrices, where each cell contains a certain shade of gray. After importing the libraries and loading the dataset, the transition to data preprocessing takes place. The next stage is the creation of a convolutional neural network model. It consists of convolutional and subsample layers. The model works better with data presented as grid structures. Then the model is compiled using the Adadelta optimizer. The model is trained using the model.fit() function in Keras. This function accepts the following parameters: training, validation data, number of epochs and sample size. There are 10,000 images in the dataset that are used to evaluate the quality of the model. The test data is not used during training, so it is new to the model.

Consider the learning process of a neural network with a sample size = 128 and the number of assemblies = 469 (see Table).

Neural network learning process

The Era of neural Network Learning	Neural network Losses	The accuracy of the neural network	Training time, sec.
25	36,04 %	89,76 %	1505
50	26,06 %	92,53 %	3050
75	21,27 %	93,70 %	4584
100	18,34 %	94,52 %	6169

In conclusion, I would like to say that the structure of a convolutional neural network was studied and analyzed in the work, followed by software implementation in Python, using Tensorflow libraries and methods. This neural architecture is capable of recognizing handwritten characters from an image.

The program demonstrates the ability of a convolutional neural network to recognize handwritten characters on images of the MNIST dataset with 94 % accuracy and 18 % loss. The neural network is able to recognize handwritten numbers, and therefore, similar approaches can be used in the future to solve practical problems related to the processing of handwritten characters.

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CURRENT PROBLEMS OF THE RUSSIAN FEDERATION IN THE FIELD OF CONFIDENTIAL DATA LEAKS

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The problem of information leakage, in particular personal data in the Russian Federation, is considered. The statistics of 2020 in the field of information security and leaks is considered. Examples of incidents with leakage of confidential information are given. The actual problem of the Russian Federation is shown and the ways to solve it are proposed.

Keywords: information leaks, personal data, indicators, data theft.

АКТУАЛЬНЫЕПРОБЛЕМЫ РФ В СФЕРЕ УТЕЧЕК КОНФИДЕНЦИАЛЬНЫХ ДАННЫХ

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Рассматривается проблема утечки информации, в частности персональных данных в Российской Федерации. Рассмотрена статистика 2020 года в сфере информационной безопасности и утечек. Показаны примеры инцидентов с утечкой конфиденциальной информации. Показана актуальная проблема Российской Федерации и предложены способы для ее решения.

Ключевые слова: утечки информации, персональные данные, индикаторы, кража данных.

2021 showed that information leakage became a more burning issue than ever before. For example, let us take the most well-known cases of confidential data disclosure. On February 12, 2021, Yandex announced that almost 5 thousand users' personal data leaked. It all happened as a result of the fact that a company's employee had access to users' email mailboxes. Also on August 24, 2021, it was found out that Oriflame allowed a large-scale leak of 1.5 million passport data of Russian citizens. After that, they emerged in the public domain. According to Security Lab, after hackers hacked Oriflame servers, 4 terabytes of personal data (hereinafter PD) of the company's customers all over the world appeared to be in the hands of attackers.[1] Only a few of the most well-known cases of confidential information leakage that occur quite frequently in the modern digital field are described above. In 2020, the InfoWatch Expert and Analytical Center informed about 23952 information leakagesfrom commercial companies, government agencies and organizations. [2] Consequently, 11.06 billion of PD records and payment information were disclosed. These are names, surnames, email addresses, phone numbers, passwords, permanent residence data, social security numbers, bank card details and bank account information. In comparison with 2019, the amount of compromised data diminished by 25.5 %. Such a decrease may be the result of raising the level of

latent crime, that is, some leaks were hidden (were not recorded). The majority of crimes naturally occur in order to obtain funds in various ways; this is evidenced by the presence of specialized forums for the sale of information. Such actions may entail a fine of up to 200 thousand, or corrective labor for up to one year, or restriction of liberty for up to two years, or forced labor for up to two years, or imprisonment for the same period according to Article 137 of the Criminal Code of the Russian Federation "Violation of privacy."[3] In case if an attacker stole your card data, directly using your funds for his own purposes, then it is considered as a theft from a bank account and, accordingly, this offense will be qualified according to paragraph "d" h. 3 Articles 158 of the Criminal Code of the Russian Federation "Theft".[4] Consequently, the punishment may be the following: a fine of 100 to 500 thousand rubles, forced labor for up to five years with restriction of liberty for up to 1.5 years, as well as imprisonment for up to six years.

Due to an external intruder, 3.57 billion records were compromised in 2020 – 32.7 % of the general number of compromised records for the entire year. Accordingly, leaks provoked by an internal intruder accounted for 7.33 billion records, which is 67.3 % of the total. From this it can be concluded that about 2/3 of confidential information was leaked as a result of intentional and accidental actions of company personnel. We should also mention the fact that in July 2021, Russia was among world leaders in the amount of intentional leaks of information. There were79.7 % of intentional leaks in Russia in 2020, which was more than the global total of 76.8 %. [1] Thus, one can notice a rather big problem in the preservation of confidential data. Despite the fact that the number of publications on cases related to data theft in 2020 became twice as many as in 2019, the situation is not improving. If the information was leaked intentionally and using official position, Article 137 of the Criminal Code of the Russian Federation provides for a separate type of criminal liability.[2] It can be a fine from 100 thousand to 300 thousand roubles or deprivation of the right to hold certain positions for a period of two to five years, or forced labor for up to four years (with or without deprivation of the right to hold certain positions for up to five years), or arrest for up to six months, or imprisonment for up to four years (with deprivation of the right to hold certain positions for up to five years). The main target of intruders is the theft of PD. This is a consequence of a number of reasons, the main one of which can be considered an increase in the role of the type of such data. Using PD in the modern world, where remote work plays a huge role, scammers have more ways to monetize compromised data, for example, to apply for a loan or tax deduction and banal phishing.

The undisputed leader in data theft in 2020 was employees of mobile operators and mobile communication salons, as well as in 2019. The number of caught "breakers" who were part of professional groups is also not very high. As for government employees, they sell access to the databases they work with. One of the reasons for the leadership of employees of mobile operators is low wages and the desire of staff to get money at least in some way. This implies a fairly simple approach to the sale and the absence of conspiracy, which makes it relatively easy for law enforcement agencies to identify such incidents and bring them to court. There is a serious problem in this approach, because it is possible to detain only an office employee, and not the final buyer of confidential information.

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PASCAL AND C# PROGRAMMING LANGUAGES: A COMPARATIVE ANALYSIS

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In this article, a study was conducted on programming languages in order to train programmers to solve economic problems. The history of creation of such programming languages as C#, Pascal/Object Pascal is considered. A comparative analysis of the structure of these two languages was also carried out. The structure code used in these programming languages is given. After analyzing and comparing the C# and Pascal/Object Pascal languages, the most optimal and most suitable language for specialists who work in the economic field was identified.

Keywords: programming languages, learning, C#, Pascal, analysis, data types, comparison.

ЯЗЫКИ ПРОГРАММИРОВАНИЯ PASCAL И C#: СРАВНИТЕЛЬНЫЙ АНАЛИЗ

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В данной статье было проведено исследование по языкам программирования для того чтобы обучить специалистов по программированию для решения экономических задач. Рассмотрена история создания таких языков программирования, как C#, Pascal/Object Pascal. Были выявлены их недостатки и преимущества. Приведен в пример код структуры, который используется в этих языках программирования. После анализа и сравнения языков C# и Pascal/Object Pascal выявлен самый оптимальный и наиболее подходящий язык для специалистов, которые работают в экономической сфере.

Ключевые слова: языки программирования, обучение, C#, Pascal, анализ, типы данных, сравнение.

Now the world is hard to imagine without computer technology, mobile phones, various games and applications for them. All this is created using programming languages, of which there are approximately 700 pieces today, each of them has its own purpose. Some of them are used to write databases and information systems, and some are used to write a small application for the phone. With the development of programming languages, the demand for qualified specialists is increasing. Next, we consider a comparative analysis of several languages used in the field of training specialists in the economic direction. At the moment, the most frequently used ones are: C++, C#, Python, Pascal/Object Pascal, Java, 1C.

Usually, in schools and universities, acquaintance with programming begins with Pascal / Object Pascal and C #. It is these languages that became the basis for the analysis of this article. Compari-

son of these languages is carried out according to such criteria as: data types, applicability, how easy the language is to learn.

For other languages, Pascal/Object Pascal is the basis. This language was developed in 1968-1969 by Niklaus Wirth. The idea of creation came to him after he took part in the work of the committee for the development of the Algol-68 language standard. It was decided to name the language in honor of Blaise Pascal, known for his knowledge of physics, literature, mathematics and philosophy. Wirth first published a publication on language in 1970. The author indicated that the goal of its creation was to develop an easy-to-use, efficient and small language that will use structured data and structured programming. Advantages and disadvantages of the Pascal/Object Pascal language [1].

Pascal uses the following data types: integer, real, double, logical (true or false), character (char), string.

Consider an example of Pascal code:

```
program P1;
var x, y, c: integer; {variable description}
 begin {start of program}
x: = 2; {setting a value x}
y: = 3; {setting a value y}
c= x + y; {sum calculation}
write(c); {the result of the calculation is displayed on the screen}
end. {end of program}[2].
```

Advantages: Convenient development environment; Easy to learn; High compilation speed; High speed of compiled programs execution.

Disadvantages: Outdated interface; Pascal becomes more and more obsolete every year; It lacks the features necessary to create an application.

The C# programming language is also very popular for training specialists in the economic sphere. In 1998–2001, C# was developed by the well-known company Microsoft. The leaders were Anders Hejlsberg and Scott Wilthaumot. This language turned out to be quite successful and today is one of the most popular and comfortable to use. It has great opportunities that programmers successfully use. That is why this language is in high demand in the market. C# can also be used to create mobile applications or web services.

This programming language uses the following data types: int, float (fractional numbers), bool (logical values true or false), char (stores one character).

Consider an example of C# code:

```
using System;
class Program {
    static void Main(string[] args) {
      int x, z, y; x = 2;
      y = 4;
      z = x + y;
      Console.WriteLine(z.ToString());
    }
}.
```

Advantages: Simple code; Convenient debugging; Simple project assembly; The C# language is similar in syntax to C, C++ and Java; Combines the best ideas of modern programming languages.

Disadvantages: A newer version of Windows NT is required to use it. Takes up a lot of memory.

Thus, the analysis of programming languages showed that they differ in that one is a procedural-oriented language, and the other is an object-oriented one. In the labor market, preference is given to specialists in economic spheres who work in the C# language. But at the same time, it cannot be said that some programming language is better, since each of them has its own scope of application and purpose. To this day, languages are developing and increasing their functionality and opportunities. In general, despite the current level of development of information technologies, they do not

stand still and it is quite possible that in the near future we will be able to see such programming languages that can independently receive, process and transmit information in the form of thoughts, gestures, words and sounds.

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DESIGN AND IMPLEMENTATION OF AIR SEPARATION PLANTS

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The paper presents the issue of obtaining gases by passing air through air separation units. An example of the principle of operation of a cryogenic ASP is given.

Keywords: air separation plants, compressor, oxygen, air.

УСТРОЙСТВО И ПРИМЕНЕНИЕЕ ВОЗДУХОРАЗДЕЛИТЕЛЬНЫХ УСТАНОВОК

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В работе рассмотрен вопрос получения газов путем пропускания воздуха через воздухоразделительные установки. Приведен пример принципа работы криогенной ВРУ.

Ключевые слова: воздухоразделительные установки, компрессор, кислород, воздух.

The purpose of this study is to analyze the air separation system and the principle of its operation. The objectives of the research are: analysis of the design of the air separation unit (ASU) system, analysis of the relevance and scope of such systems. The following theoretical research methods were used in this work: analysis of scientific literature on the research problem; generalization and systematization of the results obtained; consideration of practical recommendations. ASUs are designed to separate air into components: oxygen, nitrogen, argon, neon, xenon, krypton. They allow complex separation of air with extraction of all its components by the method of low-temperature rectification. The oxygen produced has a concentration of at least 99.2 %, and nitrogen – from 98 to 99.9995 %. The main disadvantages of air separation units are the impossibility to use the equipment in standby mode when the consumption of obtained products stops and the need to stop the equipment for its warming up, repair and preventive inspection [1].

The technological line of the cryogenic ASU consists of the main technological equipment: The compressor provides an increase in the pressure of the source air, as well as cleaning from dust, mechanical impurities and droplet moisture. The air pre-cooling system based on a vapor compression refrigeration machine provides air cooling to a temperature of + 3... +7 °C. The complex purification unit is designed for adsorptive air purification from carbon dioxide, water vapor and hydrocarbons. The low-temperature unit provides the necessary conditions for the main technological processes of air separation. The expander unit makes it possible to obtain the cold reserve necessary for low-temperature rectification by expanding the bottom product from the rectification column. The rectification column is designed for the correct organization of heat and mass transfer during the implementation of low-temperature rectification of air to obtain separation products of high purity [2].

The cryogenic ASU operation mode consists of 5 stages: 1. Air compression. Air compression in a multistage turbocharger with intercooler and aftercooler. Removal of dust particles with an air filter at the compressor inlet. 2. Air preparation. Complex air purification from carbon dioxide, water vapor and hydrocarbons. Heated waste mixture for regeneration of the complex treatment unit. 3. Heat transfer. Air cooling almost to the liquefaction temperature due to heat exchange with the waste mixture and product nitrogen. 4. Getting cold. Cold production by expanding part of the bottom product from the rectification column in a turboexpander. The use of product nitrogen for the utilization of the work received in the turboexpander. 5. Rectification. Separation of liquefied air to obtain nitrogen and oxygen of high purity in the process of heat and mass exchange in a double rectification column.

Thus, air separation plants are the only way to carry out complex air separation with the extraction of all its components by the method of low-temperature rectification. Their relevance lies in the fact that these are the only installations that allow you to obtain oxygen in such a pure form, which is especially important at the moment in connection with the COVID19 pandemic situation.

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APPLICATION OF CRYOGENIC TECHNOLOGIES IN MODERN MEDICINE

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The paper considers the application of cryogenic technologies in modern medicine. Examples of practical application of these technologies in various fields of medicine are given. The advantages and disadvantages of their use are described.

Keywords: cryogenic technologies, cryomedicine, cryosurgery, cryotherapy, treatment.

ПРИМЕНЕНИЕ КРИОГЕННЫХ ТЕХНОЛОГИЙ В СОВРЕМЕННОЙ МЕДИЦИНЕ

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В работе рассматривается вопрос применения криогенных технологий в современной медицине. Приводятся примеры практического применения данных технологий в различных областях медицины. Описываются преимущества и недостатки их использования.

Ключевые слова: криогенные технологии, криомедицина, криохирургия, криотерапия, лечение.

Cryogenics is a branch of physics that studies the regularities of changes in the properties of various substances at low temperatures. Cryogenic technologies are widely used in such industries as agriculture, industrial production, aerospace engineering, etc. One of the topical areas is the use of cryogenic technologies in modern medicine.

The purpose of this paper is to study in detail cryogenic technologies used in medicine. The level of this research is theoretical. We used empirical and theoretical methods in our study. The research presented in this paper is relevant, because now this industry is actively developing both in Russia and abroad. The conclusions obtained in the work can be used by specialists in the field of medicine and refrigeration engineering.

Currently, cryomedicine is a field of scientific medicine, which is based on the use of cryogenic technology. The basis of cryomedicine is the application of extremely low temperature to combat various diseases. Cryomedicine mainly uses liquid nitrogen, liquid helium, etc. The therapeutic effect of cold on the human body was already noted by our ancestors. To strengthen the body, they tempered their bodies in different ways (swimming in ice-holes, wiping with snow, washing with ice water). Later the effectiveness of this method was scientifically proved. Short-term exposure to cold stimulates defense and recovery mechanisms. As a result, the immune system is strengthened, and all organs and systems begin to regenerate actively.

The main goal of cryomedicine is to keep the human body young and healthy, as well as to treat various ailments [1]. Cryomedicine includes such fields as cryosurgery and cryotherapy. Let's examine each of them in detail. Cryotherapy is a physical therapy procedure based on the body's response to hypothermia of the outer (receptor) layer of the skin. It is carried out with water-based refrigerants. During cryotherapy, the body surface is cooled in a short period of time by low and ultra-low temperatures (from -70 ° C to -130 ° C) so as to avoid frostbite of the skin surface and general hypothermia of the body. Cryotherapy uses a special medical device, a cryogenic sauna, which provides a physiotherapeutic effect of cryogenic gas on the patient's entire skin [2].

The areas of application of cryotherapy are as follows: Surgery: treatment of burn and incised wounds, erysipelas, bedsores and ulcers. Neurology: therapy of migraines, spastic hemiparesis, paraparesis, acute painful vertebrogenic syndrome, multiple sclerosis. Traumatology, orthopedics: therapy of tendons, ligaments, contractures, pathologies of soft and bone tissues, joints. Rheumatology: treatment of arthrosis, rheumatism, arthritis. There are two types of cryotherapies: general and local. The general one is carried out for 3 minutes in a cryo-chamber where the skin surface is cooled down to 0 degrees Celsius with a mixture of carbon dioxide and nitrogen -100...-140 0C. When exposed to temperature stress, the body activates a "mechanism" that stimulates defence functions and metabolic processes. The skin is not damaged in this way. Local cryotherapy involves cooling a small area of the skin immersed in a gas environment with a temperature of -110...-160 0 C. The procedure is recommended to be carried out in woolen mittens and socks to protect hands and feet from frostbite of the extremities and to use a cotton-gauze bandage to protect the respiratory organs.

There are the following advantages of the air cryotherapy machine: Environmentally friendly; Safety (short-term exposure to cold eliminates the threat of frostbite and complications); – Versatility (a wide range of therapeutic applications); No need for preliminary preparation for the procedure and subsequent rehabilitation.

Cryosurgery is another effective method of treatment in cryomedicine. It is used to treat tumors. The advantage of cryosurgery is the possibility of complete, painless and bloodless destruction of a given volume of tissue both on the surface of the body and in the depth of almost any organ without damaging the walls of large blood vessels. This method is simple, affordable and therefore has a high economic efficiency. In addition, it gives a good cosmetological effect, without leaving rough scars after the healing of lesions. Thus, cryomedicine is a promising field because it allows treating such diseases that conventional medicine cannot cure. In addition, cryomedicine strengthens the general condition and well-being of a person. We hope that in the near future, this field will become widespread in our country and advance our medicine to a potentially new level.

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PROSPECTS OF IMPROVING THE AIRCRAFT COURSE AND GLIDE PATH ALIGNMENT SYSTEM OF VISYAL INDICATION

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The authors analyze the possible application of a laser indication system for aircraft course alignment and landing, which could provide a higher level of flight safety and easier aircraft operation.

Keywords: Laser, glide path, system, course, indication.

ПЕРСПЕКТИВЫ СОВЕРШЕНСТВОВАНИЯ СИСТЕМЫ ВИЗУАЛЬНОЙ ИНДИКАЦИИ ВЫРАВНИВАНИЯ КУРСА И ГЛИССАДЫ ВОЗДУШНЫХ СУДОВ

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Рассматривается возможность применения системы лазерной индикации визуального ориентирования для выравнивания по курсу и посадки летального аппарата, которая способна обеспечить более высокий уровень безопасности полетов и простоты эксплуатации воздушных судов.

Ключевые слова: Лазер, глиссада, система, курс, индикация.

Almost all landings, with very few exceptions, are carried out with the aid of visual landmarks, regardless of how the initial stage of the landing approach was performed – under the rules of visual flight or by instruments. The sooner the pilot adapts to the flight dynamics at landing, keeping the runway and approach lights in sight, the more time there is to direct the aircraft to the correct glide path relative to the area of the intended landing, and to correct arising errors. This is especially important for high-speed and heavy aircraft, which have high inertia and proceed at high approach speeds when close to leveling. Introduction of visual optical systems applying laser-radio technologies, including the latest Russian-made element base, could provide an effective way of solving the problem of aircraft landing safety in both day and night-time conditions, poor visibility or electronic interference. Laser devices provide high spectral brightness, low angular divergence of radiation beam and increased penetrating power in conditions of poor visibility.

At this stage of air transportation development, replacement of the landing ILS (Instrument Landing System) with a laser system for visual indication of the course and glide slope "Glissada-M" could become a real technological advancement. This could be especially efficient for small Siberian airfields, such as, for example, Baikit airport, where the visual orientation landing system is supported only by signaling equipment of low-intensity lights "Svetlyachok" (Firefly). The use of "Glissada-M" would allow the aircraft to land in visibility conditions at minimum of the second or

even third category. Such a complex contains three laser beacons of six modules each. The beacons are mounted so that they could be specularly reflected on both sides of the airfield at a distance of 100 meters from the end of the runway, which greatly facilitates both approach and landing.

There will be three laser beams visible to the pilot at landing: one indicating direction, the second – showing landing course, the third – glide path plane. The glide path plane makes the determining of the real-time board attitude easier, as it provides two beams: the first (left) generates intermittent impulses twice per second, the second (right) – once a second. The course is marked by one beam switched on continuously. The complex can be controlled in two ways: by an engineer from thelighting equipment operation quarters of or by a landing ATC controller. The system bases on the application of affine descriptive geometry and the dispersion effect of the laser beam in the atmosphere; that makes it possible for the pilot to visually perceive the combination of rays in the form of a symbol accurately determining the position of the aircraft on the landing trajectory, as well as the touchdown point.

The introduction of such a system at airfields like Baykit is, certainly, a prospect for the future of airports working mainly with medium-haul and smaller aircraft, (now the introduction of such systems is too costly for locally used transport hubs). But in future such a method will increase capacity of smaller airports, especially with one-way method of takeoff and landing or located in mountainous territories. With the help of the laser-indicated course and glide path, it will be possible to land aircraft even from the side of the mountains, as well as to ensure a safer landing from the opposite side. In addition, this system does not require the installation of auxiliary equipment on board the aircraft, though providing a higher accuracy of landings, quick discern of deflection from the descent path. Other systems – radio engineering, instrumental – using the already installed onboard equipment of the aircraft, are definitely less effective.

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MODERN SPACE TECHNOLOGIES AND THE INTERNET OF THINGS

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The relevance of the use of Internet of Things technologies in the modern space sphere is considered. The projects the development and implementation of which are already being carried out by specialists in different parts of the world are presented.

Keywords: Internet of things, modern space technologies, development prospects.

СОВРЕМЕННЫЕ КОСМИЧЕСКИЕ ТЕХНОЛОГИИ И ИНТЕРНЕТ ВЕЩЕЙ

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Рассмотрена актуальность применения технологий интернета вещей в современной космической сфере. Приведены проекты, разработкой и реализацией которых уже занимаются специалисты в разных уголках мира.

Ключевые слова: интернет вещей, современные космические технологии, перспективы развития.

Introduction. The Internet of Things (IoT) is the concept of a network of data transmission of "things" among themselves. The word "things" refers to devices that autonomously transmit, process, analyze some data in real time, and also exchange them with each other. This concept is actively used in industry, smart home systems and other systems, and was developed in order to ensure the automation of technological processes and eliminate the need for human participation in this process [1].

Currently, IoT technologies are used in light and heavy industry, in the fields of transport, medicine, logistics, electronics, agriculture, real estate and in ordinary everyday life. Using IoT has not bypassed the space industry. The first thing to mention is smart things for astronauts. The life of astronauts is different from the life of an average person. Representatives of this profession, being in open space, seem to be in another – unusual for the inhabitants of the Earth – reality. They, like no one else, need super-technological devices that can facilitate their stay outside the Earth. To achieve this goal, various smart things are created for the needs of the conquerors of heavenly space.

One example of such smart things is smart shelves. They were developed by the rocket and Space Corporation "Energiya". The new cargo storage system is based on the concept of the Internet of Things. It allows astronauts to reduce the time when unloading transport ships. The next innovation is the "Orlan-MK" smart suit. It was developed in the Russian research and production enterprise "Zvezda" named after G. I. Severin. The suit for astronauts is equipped with an on-board

computer with a liquid crystal display that monitors the state of the spacesuit systems. If the oxygen consumption changes, the pressure level rises, the systems stop working, and the corresponding information appears on the monitor. The astronaut will also hear a beep. In addition, the system suggests what actions a person should perform before going into outer space.

Another innovation in the field of the Internet of Things is the “Chibis-M” Smart Pants. They were developed at RPE “Zvezda”. This "clothes" should reduce the negative impact of weightlessness on the bodies of astronauts. The device helps to achieve the effect of earth's gravity. Astronauts use it in preparation for their return to Earth. The trousers are equipped with a computer that is responsible for managing the invention. The cosmonaut, using a special monitor, monitors the operation parameters of the device [2].

One more concept is development prospects. This concept of IoT involves the integration of various devices into a network. Their number is constantly growing, which makes it necessary to increase the number of communication channels. Space satellites help solve this problem. Thanks to their work, the Internet of Things becomes independent of terrestrial and mobile networks.

Companies around the world are developing and implementing projects that involve using satellites to connect to the Internet of things. One of such companies is NASA that decided to bring the Internet of Things into space using wireless communications. So, in the spring of 2017, using the TechEdSat 5 satellite, NASA tested the Digi XBee wireless communication network. It can be used for vehicles that operate in orbit, as well as for the Exo-Brake system, capable of delivering cargo from space to Earth. During testing, TechEdSat 5 was launched into low Earth orbit from the International Space Station. The modules of wireless radio frequency communication installed on the device transmitted important data about the satellite every 10 seconds, including angular velocity, temperature level, atmospheric pressure, and magnetic field index. The information obtained can be used to design new satellites. Another such company is the private innovation company “Sputniks”, which, as a part of the Pulsar project, plans to deploy a constellation of 200 satellites in low Earth orbit. Their capabilities will be used for the Internet of things. If the project is successful, the Russian company intends to increase the number of spacecraft to 600. Sputniks experts predict that by 2025, up to 500 million terminals located on Earth will be able to connect to the Internet of Things through their satellites.

Conclusion. IoT technologies are gradually beginning to be introduced in various industries. The Internet of things in the space sphere is a bold confirmation of this. Today it is too early to speak about the full-scale use of these technologies in open space. However, there are prospects. In different parts of the world, specialists are already developing or implementing projects that should contribute to the fact that the IoT will soon "conquer" space.

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COUNTERMEASURES FOR REDUCING THE HARMFUL ECOLOGICAL EFFECT OF FLUIIDS USED FOR AIRCRAFT DEICING

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De-icing fluids are absolutely necessary in on-the- ground aircraft servicing procedures, but they are environmentally harmful as they contain a toxic substance. This paper examines the chemical composition of three different and most widely used deicing fluids ("Maxflight 04", "OCTAFLO EG", "Arctic DG"), and the measures necessary for reducing their negative effect on the environment.

Keywords: Deicing liquid, ecological, effect, concentration, substance.

СНИЖЕНИЕ ВРЕДНОГО ВОЗДЕЙСТВИЯ ПРОТИВООБЛЕДЕНИТЕЛЬНЫХ ЖИДКОСТЕЙ ДЛЯ ОБРАБОТКИ ВОЗДУШНЫХ СУДОВ НА ОКРУЖАЮЩУЮ СРЕДУ

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*Противообледенительные жидкости совершенно необходимы в наземной противообледенительной обработке возвушных судов, но поскольку они токсичны, их воздействие на окружающую среду весьма негативно. В данной работе рассматривается химический состав трех различных самых широко применяемых ПОЖ (“*Maxflight 04*”,”* OCTAFLO EG*”,”* Арктика ДГ*”) и возможности уменьшения их отрицательного влияния на окружающую среду.*

Ключевые слова: противообледенительная жидкость, экологический, влияние, концентрация, вещество.

Deicing fluid is a substance for on-the-ground anti-icing treatment of aircraft (AC) before flight. The fluid features a glycol-water mixture. It is expensive, but quite effective against ice deposits, and keeps the processed surface intact. Due to the presence of glycol, the freezing point of the mixture is significantly lower than that of water (up to –60 °C according to GOST 18995.5–73, up to -40 °C according to ASTM 1177–94). It is used to melt frozen precipitation (heating it up to +60…+70 °C) and to protect aircraft surfaces against the accumulation of precipitation (without heating).

Depending on the presence of the thickener, concentration and origin of the chemical, the fluids are divided into types I, II, III and IV, according to the increase in the content of deicer in them (type I: 60–70 %; type II: 70–75 %; III type: 75–85 %; IV type: 85–95 %). Maximal effect of the liquid is achieved due to high heating (up to 80 °C at the outlet of the sprayer). But glycols are toxic substances that kill, for example, fish, even when its concentration in the water is hard to detect.

In addition, the evaporation of the fluid increases air humidity. Typical aircraft treatment with deicing fluids in our conditions – for a single-stage treatment, an average of 150 liters of water is spent, and 75 liters Type I deicer, for two-stage treatment it makes 300 l of water and deicers of Type I – 150 l and Type IV – 150 l. For a comparative analysis of fluid compositions, the table below features three types of the most commonly used fluids, chosen on account of the Krasnoyarsk city location and its weather conditions:

Deicing Fluids Compared

	Active substance (%)	pH	Freezing temp.(C)
Maxflight 04	51,5	7,5	–36
OCTAFLO EG	88	7,8	–33
Арктика ДГ (Arctic DG	65	8,5	–50

The impact on the ecological situation is also aggravated by the use of spraying devices – most often used deicers like Vestergaard Elephant Beta and Safeaero SDI-218.

Vestergaard Elephant Beta comprises three tanks – the first, 4000 liters in volume, is designed for purified water; the second, of 2000 liters is filled with Type I fluid; the third tank of 800 liters – contains Type IV fluid. Thus, the total volume is 6800 liters.

Safeaero SDI-218 has a total tank capacity of 8400 l, but the unit itself is outdated and will probably soon come out of use due to low environmental friendliness and efficiency. It is slow in operation, its sleeves cannot be pointed accurately, that's why there is a considerable amount of working fluids that miss the AC surfaces and pollute the apron.

The effective measure in the present-day situation can be the allotment of specialized deicing areas on the territory of the apron, with a separate system of removing liquid waste. It must be a closed system comprising incinerators (pollutant deactivators). The construction of the deicing equipment should also be modernized for providing accurate surface spraying.

These measures certainly demand a significant administrative resource in the form of regulation of procedures affecting ecological situation in airports and control by competent authorities. In general, the problem is liable to complex technological solution, the introduction of which is only a matter of time.

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APPLICATION OF DEEP LEARNING METHODS FOR AUTOMATIC RECOVERY OF RESERVOIRS IN THE SECTION OF OIL AND GAS WELLS

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The article is devoted to solving the problem of automatic search of reservoir intervals according to geophysical well surveys (GIS) of oil and gas fields. This article proposes an algorithm that allows to automate the allocation of collector using deep-learning neural network technologies.

Keywords: Neural networks, convolutional neural network, binary classification, geophysical survey of wells, well logging, reservoir forecast.

ПРИМЕНЕНИЕ МЕТОДОВ ГЛУБОКОГО ОБУЧЕНИЯ ДЛЯ АВТОМАТИЧЕСКОГО ВЫДЕЛЕНИЯ КОЛЛЕКТОРОВ В РАЗРЕЗЕ НЕФТЯНЫХ И ГАЗОВЫХ СКВАЖИН

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Статья посвящена решению задачи автоматического поиска интервалов залежей по данным геофизических исследований скважин (ГИС) нефтяных и газовых месторождений. В данной статье предлагается алгоритм, позволяющий автоматизировать выделение коллектора с использованием технологий нейронных сетей глубокого обучения.

Ключевые слова: Нейронные сети, свёрточная нейронная сеть, бинарная классификация, геофизические исследования скважин, каротаж скважин, прогноз коллектора.

To date, the volume of data from geophysical studies of oil and gas wells is significantly increasing due to the increase in the intensity of production and exploration. There is an increasing need for the development and application of new methods and tools for data analysis in conditions of uncertainty caused by the significant complexity of the object of study.

This article discusses the use of convolutional neural networks of deep learning to solve the problem of separating interlayers into two classes: reservoirs containing oil, gas or water, and non-reservoirs. Automatic detection of reservoirs in wells using machine learning methods will help specialists significantly reduce the time to perform operations and more effectively analyze the interpretation results obtained. A great difficulty in training a neural network and predicting is created by the subjective nature of training sets containing labels belonging to the type of collector. It should also be noted that an additional error is caused by strong noise and a discrepancy in the scale of the measurement data of geophysical parameters.

The object of the study in this work is the productive layers of the Nizhnekhet suite of the Vankor oil and gas condensate field. The field is located in the north of the Krasnoyarsk Territory in the northeastern part of the West Siberian Plate. The Nizhnekhet suite is represented by a thickness of sand-silt-clay rocks. Reservoir layers of the Nizhnekhet suite of the Vankor field are represented by shallow-marine and coastal-marine facies complexes with wide development of barrier islands and coastal bank. Calcite, dolomite, a large amount of clay material and a siliceous substance is the cement of the rock [1].

The initial sample is formed on the basis of logging data from eight wells of one field. Fourteen features are used as parameters: gamma ray index (*d*GK), acoustic logging (AK), density logging (GGK-p), hydrogen content, and depth. Parameter values are linked by depth. It is necessary to pre-process the initial data to improve the accuracy of the classification result of reservoirs in interlayers. At the first step removes data containing gaps. Two out of ten wells are missing some data (all five types of lateral logs). In the data for these wells, measurements are either missing or the values are repeated many times, which is equivalent to the fact that there are no measurements. Most often, this situation occurs at the beginning and end of the interval.

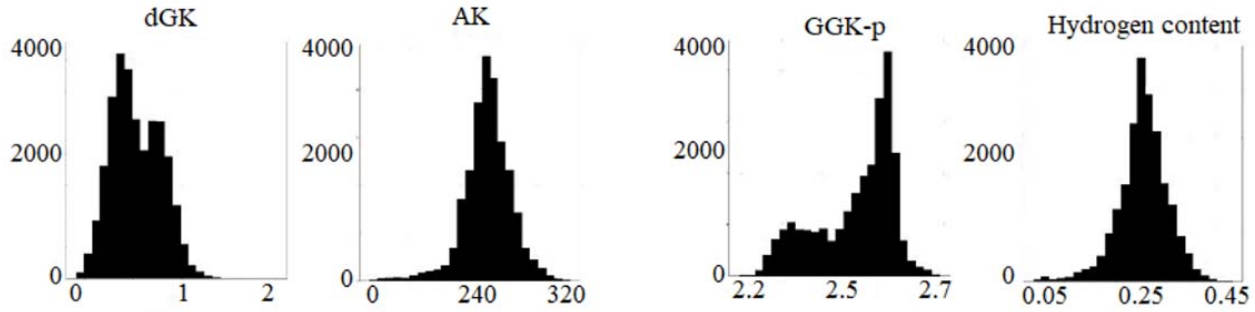

Fig. 1. Histograms of distributions of parameters dGK, AK, GGK-p, hydrogen content

Figure 1 shows that the diagrams for *d*GK and GGK-p show heterogeneity of data, and have explicit separability, while the rest of the graphs are homogeneous.

Two alternative approaches can be applied to solve the problem of automatic interpretation and identification of the reservoir: a point-by-point approach – the prediction of belonging to a class in the algorithm is issued for a data set linked by a certain depth, taking into account the values of the input parameters only for this depth; the interval approach differs from the point-by-point approach in that the classification procedure is carried out taking into account data for a range of depths above and below the desired point. In this case, a point is a vector of data obtained.

In the present work, both approaches were tested with subsequent comparison of their accuracy. The multiple cross-validation method was used to evaluate the algorithm.

In this work, for the problem of binary classification into “reservoir” and “non-reservoir”, three variants of the neural network architecture were considered: a neural network using a point-by-point approach of forward propagation; a convolutional neural network using a point-by-point forward propagation approach with convolution [2]; convolutional neural network using interval approach. The window size is nine dots, four dots before the current one and four dots after.

As a result, at the output, we obtain the probabilities of belonging to the classes. To assess the accuracy of the classification model, the F1 metric is used. The Micro parameter is a relative indicator of the assignment of points to the true class:

$$MicroF1\_score = 2 * \frac{Micro\_precision * Micro\_recall}{Micro\_precision + Micro\_recall}, \quad (1)$$

where micro precision is the precision of the micro parameter, micro precision is the completeness of the micro parameter.

The macro parameter imposes a penalty when the point belongs to the wrong class:

$$MicroF1\_score = \frac{1}{N}\sum_{i=1}^{N} MicroF1\_score(classi). \quad (2)$$

The Weighted parameter is a macro multiplied by the weights. Classes with small training sets have a smaller penalty. When classifying, where a point can belong to only one class, the micro parameter is taken as the classification accuracy (accuracy). The average forecast accuracy for the considered models is shown in the summary table.

Comparison of the results of the three algorithms

Method	micro	macro	weighted
a point-by-point approach without convolution	0.873	0.801	0.861
a point- by-point approach with convolution	0.856	0.777	0.843
interval approach	0.922	0.866	0.910

The table shows that, on average, the algorithm based on the interval approach shows better results compared to the algorithms based on the point-by-point approach. The minimum and maximum values of the micro parameter when using neural networks with and without convolutional layers differ slightly from each other.

As a result of solving the problem of classifying preliminary data processing was carried out, an algorithm based on the neural network classification method was developed and applied. Processing and analysis of the initial data showed the presence of noise and non-ideal linking of data in depth, which affect the result of creating and describing a generalized model for the transition from well logging data to predicting whether the data belong to the “reservoir” and “non-reservoir” classes in a pointwise algorithm. To solve the problem of GIS data classification, three variations of neural networks were considered, two of which are based on a point-by-point approach to data analysis, and the third one is based on an interval one. The accuracy of the prediction of the desired class is compared using the F 1 metric for the three considered variations of neural networks. The best result was shown by a neural network using an interval approach. The reliability of class prediction was 92.2 %. Thus, the obtained result demonstrates that the use of an algorithm based on an interval approach when classifying GIS data into classes is promising for solving problems of classifying reservoir types according to well geophysical surveys.

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TRANSPORT PROPERTIES OF MANGANESE SULFIDES WITH RARE-EARTH SUBSTITUTION

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As part of the study, the magnetoelectric properties of holmium-doped manganese sulfides (HoxMn1-xS) were measured at concentrations x=0.05, 0.1, in the external magnetic field H=12 kOe, and with a zero magnetic field, in the temperature range 80-380K.

Keywords: solid solutions, magnetoresistance, semiconductors.

ТРАНСПОРТНЫЕ СВОЙСТВА СУЛЬФИДОВ МАРГАНЦА С РЕДКОЗЕМЕЛЬНЫМ ЗАМЕЩЕНИЕМ

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В рамках исследования были выполнены измерения магнитоэлектрических свойств сульфидов марганца легированных гольмием ($Ho_xMn_{1-x}S$) с концентрациями x = 0.05, 0.1, во внешнем магнитном поле H = 12 kOe, и при нулевом магнитном поле, в температурном интервале 80-380K.

Ключевые слова: твердые растворы, магнитосопротивление, полупроводники.

Materials that exhibit strong dependence of conductivity on temperature in a narrow temperature range can be useful in creating components of sensor technology, magnetic memory, and spintronics. Such materials include manganese sulfide doped with holmium. This compound has fairly large magnetoresistance and belongs to the new sulfide compounds of holmium and manganese. Substituting divalent manganese with trivalent holmium ions also leads to significant changes in the magnetic properties of the system samples $Ho_XMn_{1-X}S$. This is manifested in the increase in magnetic susceptibility in the low temperature region, due to the ferromagnetic exchange interaction between manganese ions and holmium ions. As a result of the competition of exchange interactions, there is a rapid drop in the paramagnetic Curie temperature and a decrease in the effective magnetic moment. The competition of exchange interactions can lead to two options for the development situation: disappearance of the long-range magnetic order with the formation of a spin glass state; preservation of the magnetic order for one of the spin components with frozen transverse spin components (asperromagnetic state) [1].

To determine the nature of the state, measurements of the magnetic moment were carried out in a small frequency range (1 kHz, 10 kHz, 100 kHz).

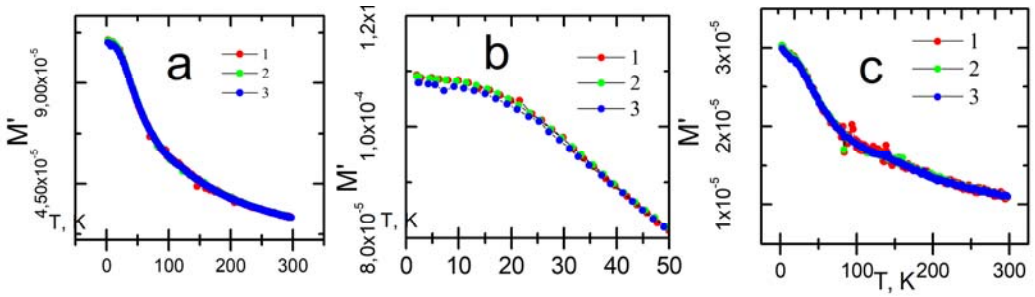

Fig. 1. The real part of the magnetic permeability (a, c) and imaginary parts (b) from the temperature for $Ho_xMn_{1-X}S$ with 0.1 (a,b), 0.05 (c) on three frequencies ω = 1 kHz (1), 10 kHz (2), 100 kHz (3)

For the spin glass state, the time interval in which the thermodynamic equilibrium is fixed is determined by the temperature. In this case, the magnetic characteristics depend on the frequency of the applied field. The magnetic moment in an alternating magnetic field, illustrated in Fig. 1, and below T = 30 K shows a frequency dependence. That is, the relative change in the magnetic moment Re(M (ω = 10 kHz) – M (ω = 100 Hz)) / Re (M (ω = 100Hz)) increases with increasing concentration of the alloying material and Re(M(T)) reveals a maximum at T = 5 K, which is absent in pure HoS.

The imaginary part of the magnetic moment practically does not depend on temperature and is Im (M (T)) ~10–7 for small concentrations x ≤ 0.1, while Im (M (T)) is qualitatively different in the low-temperature region (Fig. 1a) for a composition with a holmium concentration x = 0.3. The value of the imaginary part Im(M(T)) characterizes weakening of magnetic moment and increases with a decrease in temperature. The derivative dIm (M)/dT passes through the maximum temperature at T = 39 K at the field frequencies ω = 1 kHz and at T = 44 K at the frequency ω = 10 kHz. The substitution of manganese with trivalent holmium ions leads to electron doping, and in some cases, it can induce orbital ordering, which leads to splitting of the density of electronic states.

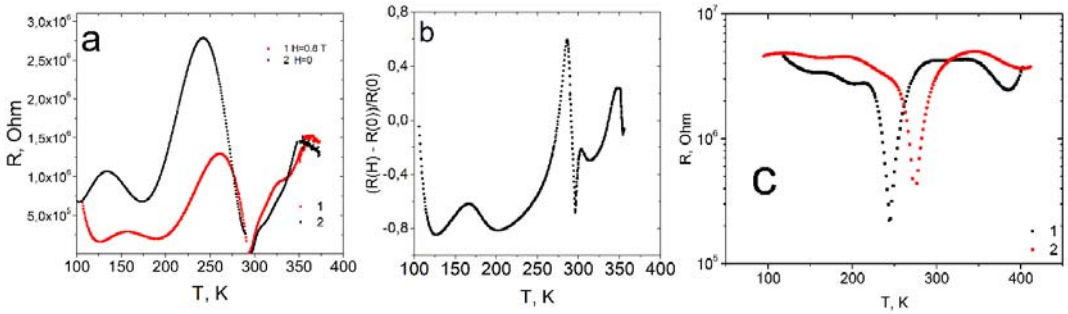

Fig. 2. Resistance $Ho_XMn_{1-X}S$ c x = 0.1 measured without the field (2) and in the magnetic field H = 8 kOe (1) (a). Magnetoresistance from temperature (b) Resistance for x = 0.05 (c) measured without the field c(1) and in the magnetic field H = 8 kOe c(2)

Magnetoresistance measured in the temperature range of 80–380 K for compositions with x = 0.05 and x = 0.1 indicates that in the obtained compounds for the temperature range 100 K – 300 K detects the effect of colossal negative magnetoresistance. The maximum value of HMS in the magnetic field H = 8 kOe (meaning δH, %) is –100 % for x = 0.05, and –80 % for x = 0.1, respectively. According to the results of the research, the main physical characteristics of the holmium-manganese sulfide system were obtained (see Table).

The shift of the derivative maximum of the imaginary part of the magnetic moment to the region of higher temperature with the increase in frequency is probably associated with the formation of metastable states and is the sign of spin-glass behavior. It is possible that the mechanism of spin relaxation is associated with the exchange interaction of localized and delocalized electrons, and as a result, the energy from the spin subsystem passes into the kinetic energy of current carriers [2].

Physical specifications

$Ho_xMn_{1-x}S$	ρ Ohms·cm, T = 300 K, H = 0	TN K	δH, % (H = 8 kOe)	– Θ K	a nm
I (X = 0.05)	2·107	145	100	140	0.5242
II (X = 0.1)	3·105	134	80	100	0.5256

The work was supported by the grant of the Russian Foundation for Basic Research No. 20-42-243002 r_mol_a.

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PROBLEMS OF INTRODUCTION OF ALTERNATIVE ENERGY SOURCES

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The purpose of the article is to analyze the possibility to replace traditional energy sources with alternative ones in the future with less risk. The author proves that at the moment 100 % effective analogues to traditional energy sources do not exist.

Keywords: alternative energy sources, traditional energy sources, electrical and thermal energy, energy profitability, intensive development of energy.

ПРОБЛЕМЫ ВНЕДРЕНИЯ АЛЬТЕРНАТИВНЫХ ИСТОЧНИКОВ ЭНЕРГИИ

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Цель данной статьи – проанализировать возможность замены традиционных источников энергии на альтернативные с меньшим риском в будущем. Автор доказывает, что на данный момент стопроцентно эффективных аналогов традиционным источникам энергии не существует.

Ключевые слова: альтернативные источники энергии, традиционные источники энергии, электрическая и тепловая энергия, энергоэффективность, интенсивное развитие энергетики.

Nowadays, the scientific world community is facing a global task – to weaken dependence on traditional energy sources. This problem is extremely important not only in political, economic, but also in environmental terms. The relevance of the article lies in assessing the possibility of replacing traditional energy sources with alternative ones.

Alternative energy sources are environmentally friendly, renewable resources, with the conversion of which, humanity receives electrical and thermal energy used for its own needs.

Currently, there are four main types of renewable energy sources: Wind energy; Geothermal heating; Solar thermal energy; – Micro-hydroelectric power plant. The quality of an energy source is determined by its energy profitability, that is, the amount of energy spent on its development and the amount of useful energy extracted from the source. According to scientists, there are internal and external threats in the production of energy from traditional sources. The internal reason lies in the fact that with such an intensive development of energy, based on carbon and hydrocarbon fuels (oil, gas etc.), its growth in 100 years may approach 100 TW – the maximum ecological value that the biosphere of the planet can withstand. As for external causes, experts associate them with cosmic danger.

According to scientists, the nearest inversion of the North and South magnetic poles will occur in about 2000 years. The Earth's magnetic field will disappear for a certain period of time, and the Earth will lose its magnetic protection from ionizing radiation, which is caused by solar flares and galactic radiation. The whole set of these problems is united by the fact that mankind needs alternative energy sources to solve them [1].

On October 8, 1975, academician Pyotr Leonidovich Kapitsa made a report in which, based on basic physical principles, he criticized all types of "alternative energy", with the exception of controlled thermonuclear fusion. The famous scientist's considerations were based on the fact that no matter what energy source we consider, it can always be characterized using two main parameters: the rate of energy transfer (propagation) and energy density – that is, its quantity per unit volume. The product of the two indicated quantities gives at the output the maximum power that could be obtained from a unit of surface when using one or another kind of energy. "Here the energy density is high, and the efficiency of such conversion is also high, reaching 70 percent or more. But the rate of its transmission is extremely low, limited by a very low rate of ion diffusion in electrolytes. As a result, the density of the energy flow turns out to be about the same as for the solar energy" [2].

Pyotr Kapitsa argued that humanity has only one way to provide technical benefits – controlled thermonuclear fusion of helium and deuterium.

Scientists who share Kapitsa's point of view adhere to the following arguments:

Modern solar and wind power plants do not require fuel to generate energy, but require energy costs for their production, installation and operation. Therefore, the most important parameter is the energy payback of the power plant; it will pay off for 6-16 years.

However, traditional power plants pay off much faster. Thus, a gas-fired power plant will pay off in 12 days of continuous operation, a coal-fired power plant in 2 months, a nuclear power plant in 2 months, and a hydroelectric power plant in a period of 2 to 3 years.

Taking into account the 70 % increase in electricity generation over the past 20 years with the existing energy payback of traditional power plants, it can be stated that more than 98 % of the energy produced by these power plants is spent on the needs of society, while less than 2 % is spent on the construction of new generating capacities. With this ratio, the capacity of solar-wind energy will double in about 600 years. While with the usage of traditional energy sources, the energy consumption will double as early as by 2060.

Obviously, for adherents of Kapitsa's ideas, the most important argument is that solar and wind energy is unable to be a self-sufficient energy industry, since it cannot pay for itself energetically to produce new capacities and maintain the existing level of benefits for the individual and society. This means that it can only claim the role of auxiliary energy, which is able to develop only at the expense of other, more powerful, energy sources.

Another group of scientists adhere to Tsiolkovsky's idea expressed in his work "The Future of the Earth and humanity": "Solar energy is the main thing, only we do not know how to use it ... Only our ignorance forces us to use fossil fuels"[3].

The search for clean energy leads to an awareness of the need to transfer the production of the most energy-intensive and environmentally hazardous materials, including electricity generation, into space with remote transmission to Earth. Konstantin Eduardovich Tsiolkovsky spoke about such a prospect back in 1928.

In Russia, as in other developed countries, the concept of a global space energy production system is being developed. The lighting system of the circumpolar cities at polar night from the orbit of the Earth was considered in a Technical Proposal developed in 1992 by the Keldysh Center and Korolev Rocket and Space Corporation «Energia». It was proposed to use such a system to illuminate Norilsk, as well as other cities in the period from November to February, starting from 8 a.m. to 4 p.m. local time. Illumination is produced by reflected sunlight using a flat thin-film reflector rotating in near-Earth orbit.

At the second stage of the space power supply system development, it is planned to organize in orbit the conversion of the energy of the solar light radiation into microwave energy, which is then "dumped" onto the Earth by a narrowly directed beam. This method of energy transfer is associated

with a certain environmental hazard, which can be avoided if microwave radiation with a wavelength of 0.5 cm is transmitted using a parabolic antenna to a receiving antenna (rectenna) located at an altitude of 10 km on a tethered balloon. Microwave radiation with the specified wavelength passes unhindered through the upper layers of the atmosphere, but at altitudes less than 10 km it is resonantly absorbed by oxygen molecules.

According to scientists, it is quite real to create a space segment of energy with a total received capacity on Earth at the level of 4 TW by the end of the XXI century. This will amount to 8 % of all primary energy capacity, taking into account the introduction of new technologies into the ground power industry. The reality of the project implementation depends on three factors: the number of equipped spaceports; the number and efficiency of launch vehicles; the optimal modularity of the space power plant.

But with all the optimistic forecasts, even with the overcoming of the most difficult tasks, there are still two problems, the solution of which can be sought only through the joint efforts of industrialized countries.

The first problem is associated with a noticeable environmental load on the biosphere, created by approximately 6,000 launches of launch vehicles per year. It should be compared with the environmental hazard generated by traditional technologies in energy and transport. The second problem is related to the need of expanding the list of countries using modern space technologies in the implementation of continuous reception and transportation of energy transmitted from space.

The use of new technology on a global scale is impossible without the coordinated activities of science and industry in various countries, which is, perhaps, the main problem. Therefore, at the moment, in our opinion, there are no effective analogues to traditional energy sources.

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ANALYSIS OF RELIABILITY OF GEODETIC INSTRUMENTS

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This article describes what equipment is geodetic. The classification of geodetic instruments is considered. The article pays special attention to the analysis of the method of periodic testing of the reliability of the considered devices.

Keywords: geodetic instruments, reliability, periodic inspection.

АНАЛИЗ НАДЕЖНОСТИ ГЕОДЕЗИЧЕСКИХ ПРИБОРОВ

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В данной статье описано какое оборудование является геодезическим. Рассмотрена классификация геодезических приборов. В статье выделяется особое внимание анализу метода периодической проверки надёжности рассматриваемых приборов.

Ключевые слова: геодезические приборы, надежность, периодическая проверка.

Geodetic instruments are special equipment with the help of which construction and installation works are carried out, marking the territory and monitoring the quality level of the works are performed. For devices of this type reliability is the most important quality for the effective implementation of their tasks.

Geodetic instruments are classified according to a number of parameters: the purpose of the instruments, the accuracy of their readings, the features of the design of the instruments, the level of automation of the instruments, the type and completeness of the information issued by the instrument. There are the instruments for measuring horizontal angles, as well as inclination angles, also ones for measuring exceedances of such indicators as the angle of inclination, the relative height of the object, that is, levelers. There are also devices for determining distances, such devices are called rangefinders. Depending on the accuracy, high-precision, accurate devices, medium-precision devices, as well as technical devices are distinguished [1].

The adequacy of their measurements depends on the reliability of the readings of geodetic instruments. In the reliability of the geodetic device, the accuracy of its readings is of the greatest importance. Therefore, the problem of analyzing the reliability of a geodetic instrument is the key for its adequate use. At the same time the difficulty is that for a successful solution, both practical and theoretical knowledge is needed in the field of geodetic measurements and construction production.

Now the verification of the reliability of geodetic instruments is carried out mainly by the method of periodic verification. This verification consists of the process of establishing correspondence of structural geometric relations of the instrument. The normal correspondence of the ratios

ensures the quality of the device as a whole. As a result, absolutely every geodetic device must be checked and also adjusted. Adjustment involves the elimination, correction of various inconsistencies of geometric relations in a certain device, namely in its design. It is important to understand that alignment makes sense only after verification, as a result of which unacceptable deviations in the parts and assemblies of the device were detected [2].

Verification is carried out by accredited metrological centers with an annual periodicity. However, as the practice has shown, often such a large interval between verification of the reliability readings of instruments is insufficient to carry out tasks in which geodetic instruments are used since these tasks require high metric accuracy.

For example, verification of an electronic tacheometer is carried out every year in a specialized accredited metrological laboratory with the mandatory issuance of a certificate. In the case of a tacheometer, there is a consistent level verification plan. First of all, the cylindrical level is checked, then an adjustment is supposed, after which identical manipulations with respect to the round level are carried out. There must be verification of the yarn grid, as well as further verification of the optical and laser center. After the there procedures, it is necessary to determine the collimation error, as well as the location of zero. The final step is to determine whether the tacheometer-reflector distance measurement is correct.

To ensure the required quality of construction, it is necessary to develop methods that will increase the reliability of geodetic measurements. At the same time, it will be of great importance to monitor the operability of devices directly when making measurements at the construction site, which should be carried out promptly, under operating conditions, using methods corresponding to measurement methods in construction and taking into account errors that have a significant impact on accuracy.

Thus, the inter-control interval can be from day to year and is set for specific operations. Geodetic equipment verification requires access to the services of an accredited metrological laboratory. Equipment verification is a set of manipulations, which are carried out in order to confirm compliance of measuring instruments with metrological requirements. Improved methods for determining the reliability of the equipment should be developed and implemented since geodesy is dealing with rather important issues.

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THE ROLE OF GEODESY IN ROAD CONSTRUCTION

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In modern conditions, the activity of a surveyor is an obligatory component of the road construction process, while the survey a surveyor is nothing more than the basis of a construction plan. The article contains the essence of the surveyor's work, their significance in road transport construction, the relevance of the issue under consideration.

Keywords: geodetic expertise, topographic survey, center work, highway, geodetic measurements, total station.

РОЛЬ ГЕОДЕЗИИ В СТРОИТЕЛЬСТВЕ ДОРОГ

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В современных условиях деятельность геодезиста является обязательной составляющей процесса дорожного строительства, при этом изыскания геодезиста есть ни что иное как основа плана строительства. Статья содержит суть работ геодезиста, их значение в дорожно-транспортном строительстве, актуальность рассматриваемого вопроса.

Ключевые слова: геодезическая экспертиза, топографическая съемка, автомобильная дорога, геодезические измерения, тахеометр.

The term «geodesy» means the science, the study, which is the determination of the shape, dimensions of the earth's surface, as well as the gravitational field. Within the framework of the geodetic research system, measurements are carried out, based on the latest maps of the map, profiles of various types.

Geodesy techniques take place in road construction. In the modern world the level and rates of urbanization are high, which explains the need for constant work on the development and design of the latest communication routes between cities and countries. In accordance with this statement, it becomes clear that the topic under consideration is quite relevant nowadays.

As a rule, the work carried out by a surveyor during road construction is divided into three successive stages. As the first stage of marking the locator of the future highway on certain terrain, the axis is also fixed. In addition at the initial stage a geodetic plan gives a visual representation of the required set and amount of work. The creation of this plan and the corresponding calculations are made on the basis of the fixed road networks. Extremely at this stage the features of the landscape of the territory.

The next stage of a surveyor's activity in the process of road support is considered to be a geodetic examination, which ensures control of the level of subsidence and deformation of the road.

The specialist must take into account the possible precipitation of the road surface. It is based on the results that a verdict is made about the possible deformation of the roadway [2].

As the final stage of the surveyor's mission, a topographic operation is perfumed. In addition this survey is applied for documentation. In the process of manipulation, the detailing of the main components is carried out [1].

In the process of carrying out the listed stages, such devices as an electronic total station are used. These devices provide an opportunity to stimulate and improve road works [1].

Geodesy makes it possible to calculate radii, levels, corner highways, develop recommendations related to leveling a construction site, analyze conditions in a given area, as well as control the correct choice of a place for building a road.

Thus the role of geodetic research in the design and construction of roads becomes obvious or cannot be overestimated. Thanks to geodesy, the necessary data is collected for the implementation of road construction projects. In addition modern geodetic equipment and technologies provide some guarantee of the safety of the future road, which is important for absolutely every passenger and driver of any vehicle.

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APPLICATION OF FUZZY LOGIC AND ARTIFICIAL NERUAL NETWORKS IN PID CONTROLLERS

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This article is concerned with fuzzy logic methods and artificial neural networks in the course of improving process control systems with the help of PID controllers. Conclusions about the importance of changing the control processes are made.

Keywords: PID controller, fuzzy logic, artificial neural networks, technological processes, control.

ПРИМЕНЕНИЕ НЕЧЕТКОЙ ЛОГИКИ И ИСКУССТВЕННЫХ НЕЙРОННЫХ СЕТЕЙ В ПИД-РЕГУЛЯТОРАХ

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В данной статье рассматриваются методы нечеткой логики и искусственных нейронных сетей в ходе совершенствования систем управления технологическими процессами с помощью ПИД-регуляторов. Сделаны выводы о значимости изменения процессов управления и, следовательно, увеличении производительности системы.

Ключевые слова: ПИД-регулятор, нечёткая логика, искусственные нейронные сети, технологические процессы, управление.

This assignment will address to the research work being actively conducted in the field of process control systems improving. This problem is considered quite relevant, since most of real control objects have nonlinear characteristics that change in service, while they are controlled with linear proportional-integral-differential (PID) controllers. The PID controllers are the most common universal automatic controllers, which are used, for example, in special furnaces, soldering irons, 3D printers, machine tools, gyroscuters, and of course in quadrocopters and airplanes with autopilot. Its applications in the management of nonlinear and complex systems often leads to a low quality of the regulation process, which is characterized by large values of overshoot, transient time, steady-state error, as well as low response rates and the need to constantly monitor and manually adjust the regulators. Improving the efficiency of management is currently an urgent problem in the conditions of increasing complexity of technological equipment, processes and systems. In designing of complex objects control systems, an important role is played by solving the problems of constructing adequate mathematical or simulation models and synthesizing control algorithms that provide solutions to problems in conditions of uncertainty.

Firstly let us look at one of the possible solutions to this problem; it is the construction of adaptive process control systems that automatically select the coefficients of the PID controller based on the methodology of fuzzy logic and artificial neural networks.

At this point it is important to say that fuzzy logic is used when there exists insufficient knowledge of the control object, but there is experience in managing it, in nonlinear systems, the identification of which is too time-consuming, as well as in cases where, according to the condition of the task, it is necessary to use the knowledge of an expert. The use of fuzzy logic makes it possible to reduce the degree of operator intervention in the control process and, therefore, allows the development of new control methods more adapted to the industrial environment. The properties of fuzzy logic to process incomplete information simulate human knowledge and provide informed solutions suggest its intensive use for real-time monitoring of technological processes, as well as solving problems related to the practical implementation of process control systems. Regulators built on the basis of fuzzy logic, in some cases, are able to provide higher quality indicators of transients compared to classical regulators.

The difference of PID controller with a controller based on fuzzy logic from others is that the gain coefficients in the proportional and integrating circuits of the controller are not static, i.e. they depend on the state of the system at the current time. This allows you to qualitatively change the control process, take into account the parameters of the signals in the system (the rate of signal change, acceleration), and also make the control process more adaptive. Fuzzy logic PID controllers are currently used in commercial systems to guide television cameras when broadcasting sports events, in air conditioning systems, when controlling car engines; for automatic control of the vacuum cleaner engine and in other areas.

To bring this paper to a close we summarise the main points: the construction of an adaptive fuzzy PID neuroregulator and its subsequent implementation make it possible to reconfigure the parameters of a linear PID controller and ensure the required quality of the transient process, increase the system's resistance to interference, increase the response rate, and thereby increase productivity, which, in general, leads to production optimization.

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Bachelors and Specialists' Research (Economists & Humanitarian students)

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INFLUENCE OF THE ENVIRONMENTAL FACTOR ON SOCIO-ECONOMIC DEVELOPMENT OF THE MACRO-DISTRICT

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The article deals with the socio-economic development of the western macro-district of the Krasnoyarsk Territory, on the example of individual districts. Today, the environmental factor is becoming a determining factor in the long-term development of any region.

Keywords: western macro-district of the Krasnoyarsk Territory, socio-economic development, environmental factor.

ВЛИЯНИЕ ЭКОЛОГИЧЕСКОГО ФАКТОРА НА СОЦИАЛЬНО-ЭКОНОМИЧЕСКОЕ РАЗВИТИЕ МАКРОРАЙОНА

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В статье рассмотрено социально-экономическое развитие Западного макрорайона Красноярского края, на примере отдельных районов. На сегодня экологический фактор становится определяющим в долгосрочном развитии любого района.

Ключевые слова: западный макрорайон Красноярского края, социально-экономическое развитие, экологический фактор.

The Western macro-district includes 10 municipal districts (Achinsk, Bogotolsky, Bolsheuluysky, Kozulsky, Novoselovsky, Nazarovsky, Birilyussky, Tyukhtetsky, Sharypovsky, and Uzhursky), 4 cities (Achinsk, Bogotol, Nazarovo, and Sharypovo), and the closed administrative-territorial formation (CATF) of the village Solnechny [1].

The macro-district provides all conditions for the harmonious functioning of industries. In the industrial complex, the branches of specialization are coal mining, metallurgical production, production of petroleum products and energy. The development of this complex is mainly due to the natural reserves of coal and the fuel-and energy complex. In the southern territory of the macro-district, a large number of enterprises of the agricultural sector are concentrated. Agricultural production is developing successfully due to favorable natural and climate conditions and the introduction of advanced technologies [2]. Social and economic development of the western macro-district for the last three years of seven municipal districts of the Krasnoyarsk Territory were considered as an example (see Table).

The population of the entire territory of the western macro-district is decreasing by 1.6–2 % over a three-year period. This is due to various factors: the spread of the coronavirus infection, the employment opportunities in existing enterprises, and the quality of life and living standards. The environmental factor (environmental pollution) is also becoming a key factor.

Socio-economic development of municipal districts of the Western macro-district of the Krasnoyarsk Territory for the period 2019–2021

Municipal district	Year	Population number	Unemployment rate, %	Number of small and medium-sized enterprises, units	Capita income, rub	Volume of goods produced, works performed and services rendered, thousand rub.	Volume of pollutants emitted into the air, tons
Birilussky	2019	9364	5,2,2	34	15878	43816	2600
	2020	9230	7,1	30	16569	33947	2574
	2021	9064	6,1	31	17771	36943	2602
Tyukhtetsky	2019	7808	2,6	181	11625	97167	2052
	2020	7695	2,5	170	11622	100756	2041
	2021	7588	3,1	181	11500	104285	2058
Sharypovsky	2019	14037	1,6	56	20760	2051968	7296
	2020	14012	1,5	57	22557	2208280	7440
	2021	14042	1,5	58	24078	2316095	7357
Bogotolsky District	2019	9487	1,3	16	15445	170071	12846
	2020	9253	4,7	16	16297	179103	12845
	2021	9168	4,7	17	17245	189713	12820
Bolsheuluisky	2019	7286	4,2	37	15500	475729	9041
	2020	7138	4,1	37	15000	525130	9093
	2021	7074	4,1	37	14500	544130	9150
Novoselovsky	2019	12655	1,1	31	18048	1493752	2885
	2020	12581	2,2	29	19408	1834101	3345
	2021	12409	1,1	29	18880	1617389	3126
Nazarovsky	2019	21350	0,7	28	20024	3069831	3216
	2020	20841	2,0	25	21561	3355160	3218
	2021	20423	0,8	25	22426	3098072	3221

By data of Krasnoyarskstat a sharp increase in the unemployment rate occurs in 2020, during the implementation of a set of measures to prevent coronavirus infection. As opposed to Nazarovsky, Novosyolovsky and Sharypovsky districts, where the unemployment rate declined and was the lowest, the situation in other districts had the opposite character. In Tyukhtetsky, Bolsheuluysky, Bogotolsky and Birilyussky districts, the unemployment rate in 2021 either increased or remained at the same level.

The number of goods produced, works performed, and services rendered in these municipal districts is increasing. The 2021 undervaluation is 6.88 % higher than in 2019. This generally improves the socio-economic situation of the districts.

One of the problems of socio-economic development of the Western macro-district is the ecological situation in the districts. According to the table, the largest volume of air emissions of pol-

lutants in tons is observed in Bogotolsky, Bolsheuluysky and Sharypovsky districts. At the same time, the volume of emissions increased over three years.

In general, studying the parameters of socio-economic development of seven municipal districts of the western macro-district in the Krasnoyarsk Territory, you can identify the relationship between them. The authors used correlation analysis for this purpose. In accordance with the Chaddock scale, the tightness (strength) of the correlation between the indicators is revealed. Between the population's income and the volume of goods (services) produced – very strong positive (0.94); strong positive (0.83) between the per capita income and the volume of goods (services) produced; between the population's income and the per capita income (0.78). These are objective patterns.

On the contrary, a strong negative correlation was found between the level of unemployment and the volume of goods (services) produced (- 0.71). Average negative correlation between the number of the population and the level of unemployment (- 0.62). Between small and medium-sized enterprises and those with a per capita income (- 0.58). This indicates that the number of subjects is insufficient Small and medium-sized enterprises have little impact on the socio-economic development of the western macro-district. Elimination of harmful industries that pollute the air and dump waste into water is the main environmental problem of Krasnoyarsk Territory. Since 2000, there has been a steady increase in the volume of pollutants released into the air.

The impact of the environmental factor on the socio-economic development of the macro-district is indisputable. The values of socio-economic indicators reveal the general picture of the population's life. The environmental factor in modern conditions determines the quality and standard of living of the population. Poor environmental quality leads to an increase in morbidity, a decrease in the birth rate and life expectancy of the population. This is generally reflected in all indicators of socio-economic development of the macro-region.

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NATIONAL HOLIDAYS OF THE UNITED KINGDOM AND THE RUSSIAN FEDERATION AS A MEANS OF ENCOURAGING INTEGRATION BETWEEN THE TWO NATIONS

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The article comprises an analysis of the most significant holidays in the United Kingdom and the Russian Federation. It discusses how common holidays bring together peoples with different mentalities. Cultural humanization only intensifies over the course of time, suggesting that tolerance and an ethical perception of the cultures of other peoples is being fostered.

Keywords: humanization, holidays, peoples, culture.

НАЦИОНАЛЬНЫЕ ПРАЗДНИКИ ВЕЛИКОБРИТАНИИ И РОССИИ КАК ИНСТРУМЕНТ МЕЖНАЦИОНАЛЬНОЙ ИНТЕГРАЦИИ

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В статье проводится анализ наиболее значимых праздников Соединенного Королевства и Российской Федерации. Общие праздники сближают народы с разным менталитетом. Культурная гуманизация с течением времени только усиливается, что позволяет судить о воспитании толерантности и этичного восприятия культуры другого народа.

Ключевые слова: гуманизация, праздники, народы, культура.

Recently, the development of universal human culture has rapidly accelerated and spread throughout the world, being passed on from one generation to another. Humanization intensifies with the continuous movement of time. Culture is intrinsically linked to globalization, meaning that it spreads from one region to another and unites peoples with different cultural values and worldviews. Culture acquires the status of a kind of monolith. Holidays are one of the parameters of the content of culture [1].

What does the concept of ‘holiday’ mean to people? In a broad sense, a holiday is a custom, tradition or cultural value for a person to which he pays due attention. A holiday is a part of a culture that can spread. People pass on patterns of behaviour to each other, just as parents pass on genes and traits to their children, and it is the same with holidays. As the English evolutionary biologist Richard Dawkins noted in his book The Selfish Gene, ‘Our culture develops according to the same laws as living organisms’ [2]. The holiday is one of the ways of interpersonal communication between people. Therefore, we should study different cultures and traditions and treat them with respect in order to achieve the humanization of different peoples, which will allow us to maintain peace on earth and remove communication barriers.

This work was written by analysing, comparing and researching the holidays in Russia and traditions and cultural identity in the development of the United Kingdom.

The Russian Federation is located in the north-east of the largest continent, namely Eurasia. There are 85 federal subjects in Russia. The population is multinational, so it has a large number of holidays. Russians respect and value both their own culture and the multinational cultures of other peoples. The United Kingdom is located in the British Isle. It consists of four historical nations known as England, Scotland, Wales and Northern Ireland. The peoples of these nations differ from one another, but are generally friendly and hospitable. The United Kingdom honours and appreciates its ancient traditions. In both states, people value their folk traditions. If we are looking for festivities that unite them, then New Year, Easter, Christmas and Mother's Day can be attributed to the most significant holidays.

Common features of the Russian New Year holiday include the tradition of decorating a New Year tree, usually a spruce. There is a magical character known as 'Ded Moroz', or 'Grandfather Frost'. Gifts are given to loved ones, and a festive meal is organized. In both cultures, people take to the streets for fireworks and festive processions. Although we are all different, New Year unites us all [3]! This is a significant and magical holiday date that begins on January 1 in the Gregorian calendar. This holiday brings people together. Russian people who are in the United Kingdom together with the British celebrate this holiday and vice versa in Russia. They sing cheerful songs together, sit together at the dinner table, exchange their traditions and customs, and their relationship becomes warmer.

For the British, Christmas is a more important holiday than New Year's. This is a joyful holiday when the whole family gathers for Christmas dinner, gifts are given and wishes are made. Both in Russia and in the United Kingdom, people traditionally receive guests, give gifts to children and adults, help the poor and the needy, go to church in honour of the holiday, use costumed rituals and celebrate in the family circle [3]. In Russia, Christmas is celebrated on January 7, and in the United Kingdom on December 25, but despite the different dates of the celebration, this holiday unites all Christian people who are exposed to Orthodoxy and Catholicism. This is the perfect holiday to unite and strengthen our relationships with people, as well as let go of all resentments. This holiday reminds people of the birth of the Saviour Jesus Christ.

The next special holiday in both cultures is Easter. This is a Christian holiday established in honour of the Resurrection of Jesus Christ, and it is also celebrated by both the Catholic and Orthodox Church. Easter is usually celebrated on the first full moon Sunday after the spring equinox [4]. This holiday can occur on any Sunday from March 22 to April 25 in the United Kingdom. Common features of the celebration include the painting of Easter eggs, the making of Easter cakes and the giving of gifts to each other. Egg fighting is also customary, as is the organizing of the festive meal. Religious holidays contribute to the cohesion of society as they remind people of their belonging to a particular religion.

In both states, Mother's Day is the most touching holiday. On this day, it is customary to congratulate mothers and pregnant women. Both in Russia and in the United Kingdom, this is a special holiday. On this day, people express their love, gratitude and appreciation to their mothers by showing kindness and giving gifts and flowers. This holiday is an example of how people treat mothers and women in general favourably. Mother's Day reminds us of women and that they play an important role in our world. We show love not only to our mothers, but also respect the mothers of other nations.

Also in both cultures there are similar holidays, such as May 1 (Spring and Labour Day) in Russia and May Day (connected to nature and rebirth) in the United Kingdom, Russia Day, marking the anniversary of the independence of Russia, and the Independence Day of Scotland, Day of Friendship and Unity of the Slavic Peoples and Commonwealth Day, and Day of Remembrance and Sorrow and Holocaust Remembrance Day for the victims of genocide in the Second World War.

Although each country has its own specific character of celebrations, the meaning and essence is the same, and such holidays allow culture to be unified, to be made the same for different peoples. It is much more pleasant to realize that, being in another country, you can celebrate a holiday in the company of local residents. Humanization is the only chance to be a family.

Comparing the cultures of both peoples, we can summarize that holidays play a special social role in the lives of both Russian and English people. First of all, they contribute to the humanization of both sides. Common holidays promote the rallying of peoples as they remove the social barrier and help relieve tension in adaptation and communication. They help make nations more united despite differences in mentality, and this is an integral part of the development of mankind as a whole. When different peoples share the same holidays, this contributes to the formation of a single culture. It does not matter what religion we have. In this case, our religion is humanity, meaning that we are all the same and we should not forget this.

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AN ANALYSIS OF THE FACTORS AFFECTING LANGUAGE ADAPTATION IN A FOREIGN LANGUAGE ENVIRONMENT

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This article examines the problems of overcoming the language barrier between speakers of different languages. The aim of the study is to identify factors affecting adaptation in a foreign language environment. The relevance of the study is determined by the need for foreign language skills and by the aspects of intercultural communication required to overcome difficulties when speaking face-to-face.

Keywords: adaptation, language barrier, learning English, communication, language skills.

АНАЛИЗ ФАКТОРОВ ЯЗЫКОВОЙ АДАПТАЦИИ В ИНОЯЗЫЧНОЙ СРЕДЕ

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В статье рассмотрены проблемы преодоления языкового барьера между носителями разных языков. Цель исследования – выявить факторы, влияющие на адаптацию в иноязычной среде. Актуальность исследования обоснована необходимостью владения иностранным языком и аспектами межкультурной коммуникации в условиях преодоления языковых трудностей при личной коммуникации.

Ключевые слова: адаптация, языковой барьер, изучение английского языка, коммуникации, языковые навыки.

We all know how difficult it is to overcome the language barrier between representatives of different nationalities and speakers of different languages. Language reflects the interaction between psychological, communicative, functional and cultural factors [1]. In this article, we will look at this problem in more detail.

In any natural history of the human species, language would stand out as the preeminent trait [2]. Adaptation is a process aimed at maintaining a state of stability, the essence of which is the adaptation of the organism to environmental conditions. It should be borne in mind that the social adaptation of children and adolescents consists largely in adaptation to school [3]. Adaptation occurs in almost everything that concerns people, and issues related to language are no exception.

Adaptation is a subject of study of a number of sciences, such as philosophy, sociology, social psychology and pedagogy because it determines the process and result of the establishment of relations between a person and the social environment. Adaptation processes have been in the focus of attention of both foreign and Russian scientists for more than 60 years. The two main concepts considering the adaptation strategies of a person involved in a new socio-cultural reality, namely the

concept of culture shock and the concept of the W-shaped adaptation curve describing the main phases of adaptation to the new culture (optimism, frustration and satisfaction), were formulated after World War II. In 1960, C. Oberg introduced the concept of 'culture shock' to denote the state of a person who finds himself in a foreign cultural environment.

When people come to another country, the language and traditions of its inhabitants often become a mystery to tourists. They do not understand why people do certain things, and as a consequence, the people of the other country seem strange to them.

Even under the most favourable conditions of contact, such as constant interaction, joint activities, relatively equal status and a lack of obvious distinctions, the immigrant or visitor may have difficulties and tensions in communicating with representatives of the host country.

Language adaptation is a process aimed at overcoming the language barrier. A language barrier is first and foremost a person's inability to communicate freely with native speakers, even if he or she potentially has a good command of the language. The language barrier is also related to difficulties in understanding foreigners in general. It is a psychological problem expressed in inner stiffness, or simply put, in shyness. In this condition, people think that they cannot speak the language, they have bad pronunciation, they make many mistakes and they look ridiculous. The result is silence and a preference to speak their own language or, at best, a few of the most common phrases of the target language.

Researchers believe that positive emotions remove communication barriers, stimulate memorization, and optimize the learning process. A lot of research has shown the dependence of psychological climate on the style of leadership, relationships, and, in turn, the dependence of the success of learning on the psychological climate. It is necessary to create such an environment in the classroom so that students have a need to be listened to and understood.

Since this problem goes back to school, we can conclude that this aspect of the study of a foreign language is neglected or not taken into account at all. Teachers are more willing to talk about a grammar rule than to talk about the culture of the country and its peculiarities. There is even a 'cultural studies' subject at Russian schools, but students do not get the necessary knowledge in it to facilitate the process of adaptation.

Throughout history, methods of overcoming language barriers have changed, but in practice, two of them are used most often. The first is involving students in role-playing in the language. The method is effective, but requires several teachers who know how to do it. Teachers jump, run and fall, for example, accompanying their actions with their names in the language they are learning. This method was created by our ancestors who used dances, movements and parodies to express their thoughts. The essence of the method is to force students into an unfamiliar environment in which the usual patterns of behaviour stop working and perception goes on a subconscious level.

The second method can be used independently. This is an information explosion, which is caused consciously. The task is to read at least 10-20 pages of text every day in the target language. In this case, you do not have to worry about reading comprehension. Attention is only paid to the volume of the text or texts. After about a week or two of this practice, the necessary amount of language is acquired, and is followed by avalanche-like progress. This method was invented in England several centuries ago to improve their language and memory skills. The second method can be applied in a modified version by watching films in the target language. At first you just need to watch one feature film a day, and the next week, you need to take a copy of the film for the deaf and dumb with subtitles and watch the entire film in start-stop mode, repeating all their phrases after all the characters. In this case, it is desirable to copy the pronunciation, intonation and gestures of the characters in the film.

The most important thing is to be a kind and open person, then people will certainly understand and help you, even if they do not understand at all. Do not stress too much and try to be open with other people. It is very important factor to understand each other because mutual understanding is born out of trust and pure intentions.

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COMMUNICATION PORTRAIT OF A PERSONALITY AND ITS TYPES

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Most of the time a person spends in the process of communication. A person's success in all spheres of life depends on the process of communication. People should exchange information with each other in order to interact in the process of their existence. The purpose of this article is to study the theoretical aspects of the communication portrait of the personality.

Keywords: communication, communicator, communicative skills, personality, interlocutor.

КОММУНИКАЦИОННЫЙ ПОРТРЕТ ЛИЧНОСТИ И ЕГО ВИДЫ

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Большую часть времени человек проводит в процессе коммуникации. От этого зависит успех личности во всех сферах жизнедеятельности, в таких как: создание семьи, учёба, карьера. Люди должны обмениваться информацией друг с другом, чтобы взаимодействовать в процессе своего существования.

Ключевые слова: коммуникация, коммуникант, коммуникативные способности, личность, собеседник.

Even from birth a person needs communication to develop properly their mind, memory, and to have a healthy adaptation in the society. Therefore, the purpose of this article is to study the theoretical aspects of the personality's communication portrait, and to consider its types. Communication is the basis for the development of the society. Communication skills help people share knowledge, experience and activities.

V. B. Kashkin gives the following working definition of the term "communication": it is the exchange of thoughts, knowledge, feelings, and actions [1]. Since the process of communication is intrinsic to people, the concept of "communicative personality" is closely related to the previous definition. It represents a kind of unity of communicative acts, which are directed to other personalities. It usually includes several roles. For example, the same woman can be a lawyer, a business woman, a wife, a mother and a daughter.

It is worth saying that there are two types of people in communication: extroverts and introverts. Extroverts are very sociable and open people. They usually have a large number of acquaintances, but at the same time, all these acquaintances are not very reliable. In the society they often show their initiative. Introverts are the exact opposite of them. This is a withdrawn personality, rarely communicating on various topics.

There is reason to believe that extraversion and introversion depend to a large extent on the innate features of a person, such as the properties of the nervous system. In Merlin's laboratory a connection of high sociability with a weak nervous system was revealed. Later A.K. Drozdovsky confirmed it on a large sample [2].

It is known that each person has individual communicative skills, so we need to learn more about what they represent. K.K. Platonov considered communicative skills as skills which can help to shape the interpersonal relations, providing successful team work and team building [3]. Since all people have a different set of communicative skills, they can be divided into several types. There are different classifications of types of communicative personality. We will draw your attention to the fact that each personality can be attributed to one of the four types. The main types are considered in this article.

1. The dominant communicator. This is a person who tries by all means to seize the initiative, usually speaking louder than the others. When he wants to communicate, he doesn't explain but pushes his ideas into your head. This person usually interrupts the interlocutor at the beginning of the conversation, does not like to listen for a long time, but, if he listens, he often asks a lot of questions. He has a very stiff and assertive speech pattern. Sometimes he can be rude and very rarely admits his mistakes. But, on the other hand, these people tend to be good speakers and are able to lead other people. They also can quickly make decisions in difficult situations and take full responsibility. If you want to have a good communication with these people, try not to ridicule or suppress the techniques that they use, start talking, after a pause, and with a clearly formulated position and questions, have your own point of view and do not fall for their provocations.

2. A mobile communicator. This person enters the conversation very easily, interrupting important matters. But he can quickly interrupt the conversation, finding more interesting and important things to do. He speaks a lot, with interest and pleasure. Sometimes he forgets what he speaks about and changes topics. Like the first type, he does not like when the interlocutor formulates his idea for a long time, he tries to interrupt him. If he is not interested in the interlocutor's words, he shows it. He may begin to yawn, to straighten his clothes or to shift from foot to foot. To conduct a conversation with this person, it is best to adjust to his pace at the beginning of the conversation, and then gradually slow down the speed of his remarks. In most cases, the mobile communicator understands this and slows down.

3. A rigid communicator. This type of person usually has a hard time getting into a conversation with you. It takes him time to be involved in communication. It should be noted that it doesn't even depend on his character. He may be a determined and confident person. He listens very attentively, never interrupts, speaks slowly, and articulates his thoughts clearly. If you want to build a proper conversation with this type of interlocutor, do not interrupt him under any conditions, try to understand every idea that he is trying to explain to you. You should have patience and calmness. Each time, talking to him, you can train your endurance.

4. An introverted communicant. This type of communicant does not try to take the initiative in communication, but on the contrary, gives it to others. He is often very shy, modest and patient. He speaks softly, and allows people to interrupt him. If he is asked questions, he feels obliged to answer them immediately in order not to offend the interlocutor. Only in a habitual conversation he has courage and sometimes can even defend his point of view. While communicating with him, the interlocutor should encourage him. Otherwise, you risk underestimating the importance and value of the information the interlocutor wants to convey to you.

Having considered the types of communicators, it is worth noting that you should conclude who is in front of you only after repeated observations of the behavior of the person in the society.

In conclusion, I want to say that the communication portrait of a person is very important nowadays. Studying this topic will help you improve your communication skills and improve your communication process. If you know how to behave properly with your interlocutor, you will be able to take the conversation to the next level so that you both feel comfortable. Everyone interested in this topic, should take the time to improve themselves, and then the positive result will not be long in coming.

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'UNICORNS' AND 'DECACORNS': OVERVIEW OF MODERN REPRESENTATIVES

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The article identifies promising directions for creating new 'unicorns'. 'Unicorn' is a startup valued at over $1billion. The name 'unicorn' emphasizes that such companies are very rare. But in fact, in recent years, the number of 'unicorn companies' has grown very sharply. 'Decacorn' (Super Unicorn) is a 'unicorn company' with an estimated value of over $10billion.

Keywords: unicorns companies, decacorn companies, security market, IPO, venture capital, innovation.

«ЕДИНОРОГИ» И «ДЕДАКОРНЫ» – ОБЗОР СОВРЕМЕННЫХ ПРЕДСТАВИТЕЛЕЙ

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В статье определяются перспективные направления для создания новых единорогов. Компании «Единороги» – это стартап, оцененный более чем в 1 млрд. долларов США. Само название «единорог» подчеркивает, что такие компании очень редкие. Дедакорн (супер единорог) – компания-единорог, чья оценочная стоимость переваливает за 10 млрд. долларов США.

Ключевые слова: компании «единороги», компании «дедакорны», рынок ценных бумаг, IPO, венчурный капитал, инновации.

With the emergence of innovative companies and globalization, the urgency of the question 'Which innovative companies can be accepted by the market?' is growing. An important factor is the objectivity of the market assessment of the value of innovative companies. The most successful and fastest growing start-up companies are 'unicorns' and 'decacorns' [1].

Let us start with the origin of the term 'unicorn'. The term 'unicorn' was first used by Eileen Lee, the founder of Cowboy Ventures, in 2013. 'Unicorns' are privately owned start-up companies valued at more than $1billion and are initially funded by venture capital.

'Unicorn companies' tend to appear in the following industries: 1. On-Demand. These are technology companies that provide immediate service to their customers. These companies include: Uber, BlaBlaCar, Gett and other companies. 2. Fintech. These are financial and technological start-ups. They include: Stripe, Instacar and other companies. 3. Digital Media. These include: Bytedance, Kuaishou, Magic Leap. 4. E-commerce. These are Airbnb, Epic Games, Coupang. 5. Softwart. These are electronic developments like Snowflake, Palantir, Slack. 6. EdTech. They provide

e-learning. They include the following companies: Yuanfudao, BYJU'S, VIPKid, Udemy, Duolingo and other companies.

Speaking about 'Decacorns", they are companies that have reached the value of over $100 billion. Such companies are Facebook, Cisco, Apple, Oracle and Alphabet.

In 2018, Business Insider identified 4 main characteristics of 'unicorn companies': 1) Targeting end consumers – more than 62 % of 'unicorns' work in B2C, striving to create a product (or service) more understandable for their customers. For example, using mobile applications Uber allows you to quickly call a taxi, Airbnb – to book accommodation in an unfamiliar city, and Spotify – choose the right music. 2) 'Unicorn companies' have so-called 'disruptive innovations'. In other words, they destroy the usual ways of interaction. For example, Zoom and WhatsApp have become the 'killers' of SMS and mobile phone calls, creating applications where you can use the Internet for free video calls and text messages. 3) The companies use technological solutions – for example, more than 67 % of 'unicorn companies' develop their own software designed to solve specific problems. So Airbhb made it possible to reserve seats in one click. 4) 'Unicorn companies' make money on commissions and subscriptions. For example, Palantir distributes its antivirus and security software by subscription, Uber takes a commission for each order.

These features make 'unicorns' be different from the majority of tech startups.

As for the number of Russian 'unicorns', there are some obvious contenders: Avito, Mail.ru Group, Telegram, Playrix, Badoo, OCSIAL, Yandex, Yandex.Taxi [2]. These companies are on the Forbes list and are fairly large tech companies.

Nevertheless, in the history of Russian business, one company was noted for the status of a 'unicorn'. Thus, in October 2015, there was a major deal: the media holding Naspers bought out a majority stake in Avito, the company was estimated at almost 2.7 billion dollars. The classified was able to become a unicorn in just 8 years.

According to the definition introduced above, the company lost its unicorn status, as at the beginning of 2019 Naspers increased its stake in Avito and brought it to 99.6 %. There was at least one unicorn on the Russian market.

The Telegram messenger, created in 2013, has already managed to attract $ 1.7 billion to the company, which obviously makes it a contender for getting into the list of 'unicorns' of Russia, since the company has Russian technology with Russian founders Pavel Durov, but foreign jurisdiction prevents this.

Let us consider the most expensive startups in the world.

ByteDance owns Tik Tok, a service for creating and watching short videos. Their monthly audience is 1.5 billion active users from 150 countries. The company earns money through advertising and in-app purchases. ByteDance was founded in March 2012, and after 8 years, the company has reached revenues of $ 35 billion. The company is currently valued at $ 140 billion.

Online payment service Stripe even surpassed SpaceX by Elon Musk, who was one of its first investors. Stripe is a financial intermediary. The startup offers online store owners to quickly set up accepting online payments on the site. You do not need to open a bank account. If you have bought or sold anything online, your payment was probably processed by Stripe. The company is valued at $ 95 billion.

Elon Musk's space company has set a goal to cut the cost of space travel and colonize Mars. NASA, which SpaceX is partnering with, plans to send astronauts to the red planet as early as mid-2030. SpaceX is also earning Starlink, a satellite network to deliver high-speed internet to anywhere in the world. Such a company is valued at $ 74 billion.

Based on the analysis of the 'unicorn companies', it can be concluded that the largest share of companies with the value of more than $ 1 billion is in e-commerce, financial services and the creation of new products and services based on artificial intelligence. It is important to note that the presence of 'unicorns' and 'decacorns' on the market is the sign of the effectiveness of the national innovation system. Unfortunately, not all leading countries, including Japan, Russia and most of the members of the European Union, have realized their potential in creating 'unicorns' yet. But despite this fact, the world has a high level of development of national science.

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IMPROVEMENT OF ACCOUNTING IN THE CONTEXT OF SMALL ENTERPRISES

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The article brings to light the main errors of accounting at small businesses, outlines the nuances of errors, provides a scheme for the formation of accounting policy provisions, taking into account the influence of sectoral and regional features of the implementation of activities by small businesses and indicates solutions.

Keywords: accounting, small business, improvement, accounting policy.

СОВЕРШЕНСТВОВАНИЕ БУХГАЛТЕРСКОГО УЧЕТА В РАЗРЕЗЕ МАЛЫХ ПРЕДПРИЯТИЙ

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В статье выведены на обозрение основные ошибки ведения бухгалтерского учета на предприятиях малого бизнеса, обозначены нюансы ошибок, приведена схема формирования положений учетной политики с учетом влияния отраслевых и региональных особенностей осуществления деятельности предприятиями малого бизнеса и указаны пути решения.

Ключевые слова: бухгалтерия, малый бизнес, совершенствование, учетная политика.

During the nineties, there was continuous work to improve accounting in Russia, the application of international standards and financial reporting adopted in the world community. We started with the development and implementation of accounting methodologies for joint ventures, many of which appeared in the late eighties.

In 1992, a new chart of accounting accounts was proposed and applied. Experts propose to switch to the European structure of the chart of accounts, consisting of ten classes with three-digit numbering of codes of synthetic accounts, two or three reserve classes of accounts for the organization of management, including costing accounting. An unacceptable condition for such a transition is a complete change in the coding of the synthetic accounts used, which will entail the need to redo accounting computer programs, disorganize the work of accountants, auditors, tax inspectors and other interested parties. In this regard, a three-digit system of accounts was proposed, for example,

10.3 – Fuel materials, etc. The Regulation on Accounting and Reporting in the Russian Federation was approved. A new procedure for accounting for savings, financing capital investments and capital formation of organizations and enterprises is being introduced, opportunities are being created for accounting for operations for the capitalization of rental property, reserves for doubtful debts, settlements with shareholders, promissory note circulation and some other phenomena of the market economy [1].

Currently, the need for full-fledged management of the financial resources of the enterprise in order to use its capabilities as fully as possible in achieving the goals set by the company's management is becoming more and more clearly manifested.

The transition to a market economy requires any enterprise to increase the efficiency of production, the competitiveness of products and services based on the introduction of scientific and technological progress, effective forms of management and production management, activation of entrepreneurship, etc. An important role in the implementation of this task is given to the analysis of the economic activities of enterprises. With its help, a strategy and tactics for the development of the enterprise are developed, plans and management decisions are substantiated, control over their implementation is carried out, reserves for improving production efficiency are identified, the results of the enterprise, its divisions and employees are evaluated [2; 3].

Accounting can help in solving these issues, which can provide reliable and complete information about the activities of the enterprise for the analysis of the financial statements of the enterprise, compiled at the end of each reporting period.

The relevance of the work lies in the fact that in dynamically changing conditions, the organization of accounting must meet modern requirements, accounting in small enterprises should be as effective, efficient and reliable as possible.

Small business is one of the main components of a market economy, without which it is not easy to imagine the prosperity of all countries and their economies. Creating a perfect competitive environment, creating jobs, providing quality services and filling the market with a wide range of products that meet consumer demand largely depends on small businesses. To ensure sustainable economic development, the state should initially rely on small business as the most flexible and active sector of the economy.

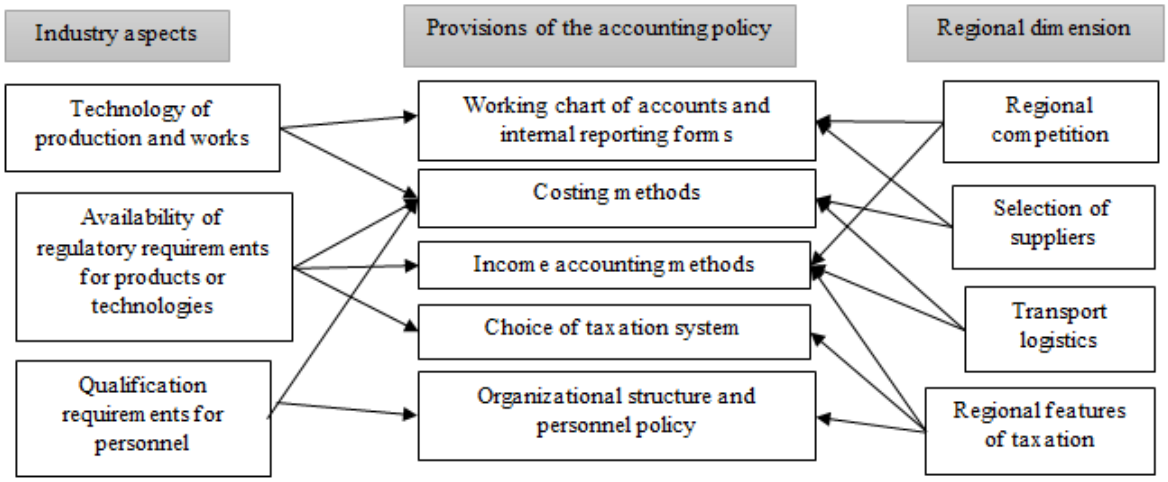
Despite the positive aspects of the organization of accounting in small businesses, today there are difficulties. First, this work takes a lot of time. Secondly, the owner is most often involved in the preparation of financial statements. These factors help to create a stereotype about the complexity and tediousness of the accounting process. As a result, it becomes apparent that it is necessary to develop and implement simpler, more convenient, more efficient and cheaper accounting systems that reduce the complexity of the work process and increase the competitiveness of small enterprises.

Many organizations in the accounting policy do not pay enough attention to the detailed description of accounting calculations of income, expenses and financial results. Also, the accounting policy of small businesses does not reflect the factors of influence of sectoral and regional features of the implementation of activities by small businesses. As factors hindering the development of small business, it is possible to single out restrictions in the field of antimonopoly legislation, which reduce competitiveness in comparison with large enterprises, a low level of qualification of personnel caused by the "desire to save", insufficient interest in investing in knowledge-intensive and innovative areas due to the lack of proper incentives. All the features analyzed above should be taken into account when developing an accounting policy in order to choose the most optimal option for methods of accounting and analyzing the results of small enterprises [4].

Picture 1 shows the scheme of formation of the provisions of the accounting policy, taking into account the influence of sectoral and regional features of the implementation of activities by small businesses.

The proposed interrelation of the components of the accounting policy and the regional and territorial factors affecting it will significantly increase the efficiency of accounting and analytical actions due to the fact that operational control over the ongoing changes is carried out. This approach

is particularly relevant for small enterprises that implement several different types of activities that require different methods of recognizing income and expenses, and consequently, different documentation and use of calculation and budgeting methods.



Scheme of formation of the provisions of the accounting policy, taking into account the influence of sectoral and regional features of the implementation of activities by small business enterprises

Analysis of the influence of external factors on individual activities will allow you to respond quickly and reduce or increase certain areas of work in order to increase your competitiveness. For the operational accounting of the organization's income, the accounting policy should specify the types of basic documents used in the settlement with customers, the procedures for filling out these documents and the master records used to settle with customers, the process for confirming overdue accounts of receivables and the procedure for its cancellation.

To address this issue, entities need to register these items in their accounting policies related to settlements with customers. In addition, there is the problem of slow organization of file sharing with wholesale buyers. To solve this problem, it is necessary to introduce the introduction of electronic document management. The formation of information in real time is an important point in accounting calculations [5]. The most important thing for the organization is to be as fast as possible, and this can only be achieved with the help of the latest computer technologies. This problem must be solved, because if there are errors in the original documents, the accountant will first find and correct the errors, and then it will be necessary to physically transfer these documents to the responsible person in paper form.

Very often, the chief accountant of a small enterprise does not exercise sufficient control over the maintenance of accounting discipline for accounting for calculations, income and expenses in the organization, since the accountant who is entrusted with these accounting areas makes a number of mistakes both in the preparation of primary documents and in compliance with the workflow schedule. The solution to this problem is to pay due attention to accounting, that is, how to control the accounting of settlements with customers and customers, whether the relevant documents were delivered on time for accounting, whether accounting documents are drawn up on time, and whether feedback was received from buyers and customers.

Also in enterprises there is a problem in the automation of accounting. The program "1C", used in organizations, is not updated on time, periodically there are problems. Speaking about the main trends in the development of integrated automation systems, we can highlight the use of the latest information technologies, further expansion of functionality, the implementation of new opportunities for adaptation to the needs of various groups of users and the development of mechanisms for interaction with other programs [1; 3–5].

It can be concluded that the organization of accounting is understood as a system of conditions and elements of building an accounting process in order to obtain reliable and timely information

about the activities of the enterprise and control over the rational use of production resources and finished products. The main components of the accounting organization system are primary accounting and document flow, inventory, chart of accounts of accounting, forms of accounting, forms of organization of accounting and computing work, the volume and content of reporting.

In the context of the use of various types of electronic computer technology, enterprises are increasingly using an automated form of accounting, which allows to improve the management and development of a market economy.

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BUSINESS MANAGEMENT IN THE CONDITIONS OF DIGITAL TECHNOLOGIES DEVELOPMENT

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The article discusses the importance of using digital technologies in various business areas. The concept of digital transformation, which contributes to the digital transformation of enterprises, as well as technologies such as Industry 4.0 and IoT, is considered.

Keywords: business management, digitalization, digital technologies, digital transformation, competitiveness, Industries 4.0, IoT, technological development.

УПРАВЛЕНИЕ БИЗНЕСОМ В УСЛОВИЯХ РАЗВИТИЯ ЦИФРОВЫХ ТЕХНОЛОГИЙ

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В статье рассматривается важность применения цифровых технологий в разных сферах бизнеса. Рассмотрено понятие цифровой трансформации, способствующей цифровому преобразованию предприятий, а также такие технологии, как «Индустрии 4.0» и IoT.

Ключевые слова: управление бизнесом, цифровизация, цифровые технологии, цифровая трансформация, конкурентоспособность, Индустрии 4.0, IoT, технологическое развитие.

In the modern world, more and more attention is paid to the field of IT. This is due to the changes taking place in the world of digital economic innovations, the digitalization of economic processes and the penetration of information technologies into all areas of activity. There are new requirements for the sources of competitive advantages of enterprises and effective concepts of their functioning and management [1].

Improving the efficiency of enterprises is one of the most important tasks of the modern economy. Its solution lies in increasing the competitiveness of companies, full or partial expansion of the range, technical re-equipment of production, minimizing costs, improving the structure and management methods, and introducing digital technologies [2].

Currently, entrepreneurial structures should constantly search for innovative solutions and business models based on digital technologies. Product development needs to be more flexible. Experiment with new business models, products, ideas and technologies. A passive position can lead to loss of competitiveness [3].

Digital transformation is the integration of digital technologies into all areas of business in order to change the way they function and deliver value to customers. It includes embracing cultural change, experimenting with new technologies, embracing failure, and inventing new digital

solutions. The key factor in digital transformation in the activities of business entities is the development of digital culture. In modern conditions, the digital economy is the main factor in the economic growth of national economies, industries and business structures.

Digital transformation can help transform a business to create value, gain a competitive edge, meet customer expectations, and increase revenue.

To improve information processing mechanisms, scientists, leaders and policy makers are calling for the digital transformation of companies, as envisioned by the principles of the fourth industrial revolution (Industry 4.0). Accordingly, in the view of Industry 4.0, the digitization of company processes can facilitate the integration of the functions of the firm and supply chain participants, so that the chain becomes a fully integrated ecosystem that is completely transparent to all participants – from suppliers of raw materials, components and spare parts to carriers of these materials and finished products. products and, finally, to consumers requiring performance.

The past year 2020 has made significant adjustments to the global economy, the main reason for the changes was the pandemic. During quarantine, many enterprises, having no stocks and reserves, were unable to adjust and modernize their activities, which contributed to their bankruptcy. But there are examples of positive dynamics among large companies. Many new “assistant” services have appeared that not only managed to maintain their positions in the market, but also scaled the business. One of the clearest examples is cloud technologies, which have existed on the market for many years, but it was during the era of the pandemic that their demand became visible, and sometimes even irreplaceable.

To date, the Internet of Things technology has become widespread, which can be considered as a global network infrastructure consisting of many connected devices that use sensor, communication, network and information technologies. The flow of data that underpins industrial IoT is predominantly unidirectional, flowing from the supply chain or marketplace to the cloud. Instead, cloud services not only receive real-time data from tags and sensors, but also provide information to SCM and marketing functions, store acquired knowledge, and allow members of the supply chain to access information in the cloud, thus managing the multidirectional flow of data/information. and serving for multiple functions. Big data analytics solutions are not directly used to manage knowledge flows. Rather, they transform information into knowledge that will be useful for better strategic integration of SCM and marketing functions.

Interest in cloud computing technologies is growing, and this is probably due to the emergence of modern high-speed networks that provide fast access to remote data. Therefore, it is important to keep up with their technological development in order to remain competitive in the market and embrace the latest technological advances.

Thanks to cloud services, you can set up a workflow in a remote format, organize communication between departments of the enterprise, gather employees in video and audio-conferencing systems, and thereby reduce the risk of infection. For example, the Zoom application, during the pandemic, attracted many new users, as all educational institutions were forced to go online. The same thing happened with online stores, online entertainment services (IVI, Okko, Start, TNTPremier, Netflix, etc.) and teamwork services.

The study found that 97 % of industrial leaders see digital transformation as an opportunity to increase productivity and grow their business. An important aspect of technological transformation is the modernization of the complex's operational scheduling, which should include the following components: 1. Resource allocation and status (RAS). An essential tool for real-time monitoring of overall health and resource allocation procedures. If it is assumed that this is a machine park, employees as resources, in this case the system automatically monitors their status, and the analysis is performed taking into account the available resources. 2. Operations/Detailed planning (ODS). Allows the system to carry out operational and detailed planning in order to optimize the existing production schedule and organize parallel work at existing production facilities. These measures will significantly reduce the time required to obtain the final product and reduce equipment downtime. 3. Control of production units (DPU). The procedure for organizing the work of the system in the field of the production process, supervisory control. This allows you to most effectively obtain

information about the production process (at the workshop level), i.e. makes it possible to make adjustments in real time, which contributes to the effective organization of the required range of work. 4. Control of documents (DOC). The document management system provides the necessary control over the content and flow of various documents for each manufactured product (for example, drawings, regulations, various technical documentation, etc.). This allows you to draw up working documents: work assignments, shift assignments, etc., and also allows you to change document templates. 5. Data collection/acquisition (DCA). It is a technology for collecting and storing data. All data necessary for the operation of the system is saved, including those that can be loaded from outside [3].

The high level of digitalization of business in the modern world, as a rule, is synonymous with the competitiveness and prospects of companies, industries and the national economy. The digital coefficient, which contains a comparative assessment of companies on four grounds: strategy, digital culture, competencies, organizational model, shows that enterprises that are more actively implementing digital solutions usually show better financial results. The mutual dependence of these factors, however, is not mandatory [2].

Thus, the ownership of digital assets gives any business an additional competitive advantage; in the near future, the level of competitiveness of companies will be determined precisely by the level of their digitalization.

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CONCERNING SLANG OF GENERATION "Z" AS A COMMUNICATION BARRIER

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This paper is devoted to the slang of generation Z as a communication barrier. In particular, English types of slang have been considered. The conflict of generations that exists at the moment can be resolved only if all its possible causes, including linguistic ones, are considered. Examining the Western slang of Generation Z, it is worth noting that the likely cause of the misunderstanding in the Western environment is the too rapid pace of digitalization and informatization.

Keywords: communication, generational theory, social generation, generation "Z", generation "Y", slang.

К ВОПРОСУ О СЛЕНГЕ ПОКОЛЕНИЯ "Z" КАК КОММУНИКАЦИОННОМ БАРЬЕРЕ

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В данной статье рассматривается сленг поколения "Z" в качестве коммуникационного барьера. В частности, были рассмотрен англоязычный сленг. Существующий на данный момент конфликт поколений может быть решен только в случае, если будут рассмотрены все возможные его причины, в том числе и лингвистические. Рассматривая западный сленг поколения "Z", стоит отметить, что вероятной причиной возникающего недопонимания в западной среде является слишком стремительный темп цифровизации и информатизации всех сфер общества.

Ключевые слова: коммуникация, теория поколений, социальное поколение, поколение "Z", поколение "Y", сленг.

Throughout the human history, the society has been developed according to its internal laws. From generation to generation, those social norms, rules and principles that were necessary for the successful existence of people were transmitted. Education and culture have always been main factors in the development of a society. None of this would have been possible without strong intergenerational communication. However, intercultural communication is currently experiencing a period of great misunderstanding caused by the conflict of generations. The conflict of generations manifests itself in the communication barrier. It is the question of finding out the causes and ways to overcome this barrier that is the problem of this research. The object of the research is slang of generation Z.

As a result of the study, it was found out that one of the reasons for the misunderstanding between generations can be the linguistic features of the speech of their representatives. The results of the research can be used in organizing and conducting further research in this area.

The term “generation” is explained as: 1) people of similar age living at the same time; 2) relatives of the same degree of kinship in relation to a common ancestor. Back in the Enlightenment era, the doctrine of the continuity of generations was born in Giambattista Vico’s works, which laid the foundation for the classical theory of generations.

In 1991 American scientists Neil Howe and William Strauss published their theory, the main object of which was the “generation conflict”, its causes, features, characteristics and values of different generations that lead to the conflict and clash of interests. These experts identified the term “social generation” as representatives of certain periods in history with similar values. N. Howe and W. Strauss defined the social generation as “a set of people born in one period that lasts 20 years and having a number of similar criteria: age position in history, which implies experiencing the same historical events at approximately the same age, common, unified beliefs and behavior patterns, and a sense of belonging to this generation” [2].

The scientists found out that the cyclical nature of history can be considered as segments lasting approximately 80–90 years, that is equal to one generation. Besides, within the framework of one cycle, the community of values is replaced on average four times, which makes it possible to single out four periods among one cycle.

According to Howe and Strauss’s theory of generations, we can distinguish the following: “Generation GI (“Generation of Winners”) – people born in 1900-1923; “Silent generation” – people born in 1923-1943; "Baby Boomers" – people born in 1943-1963; "Generation X" – people born in 1963-1982; “Generation Y (Millennium)” – people born in 1983-2000; "Generation Z (Alpha)" – children born by generation Y. [2; 4]

Generation “Y” (born in 1983–2000) is the generation whose representatives are currently mature people. It has witnessed a number of social upheavals and cardinal changes: the collapse of the USSR, terrorist attacks, military conflicts, the emergence and development of digital technologies. Generation "Y" is guided by such values as civic duty, high level of responsibility, certain moral qualities. For them, as a rule, excessive consumerism is not common, material wealth is not the end in itself.

Generation Z (Alpha) (born 2000–2020) is the youngest generation. Their characteristic feature is the active and advanced use of digital technologies from an early age. They are surrounded by a huge amount of information, so the ability to competently “screen out the unnecessary” is important for them. Another distinguishing feature of the “Z” generation is the lack of clear motivation and value orientations.

One of the reasons for the disagreements between these generations is the misunderstanding that occurs at the language level. And the reason for this is slang “a relatively stable for a certain period, widely used, stylistically marked (reduced) lexical layer (nouns, adjectives and verbs denoting everyday phenomena, objects, processes and signs), a component of expressive vernacular, included in the literary language, very heterogeneous in its origins, the degree of approximation to the literary standard, possessing pejorative expression" [3]. Since this vocabulary is inherent only to a particular social group, its meaning remains incomprehensible to representatives of other groups, which gives a reason to misunderstanding.

As for the Western generation “Z”, it is worth noting that the greatest spreading of slang occurred during the COVID-19 pandemic, when people were forced to spend a lot of time in the Internet. New phrases spread very quickly and became fixed in speech, complementing and even replacing each other. Let's view some of them.

Cancel culture is a phenomenon that has recently appeared in modern discourse. It is a form of online boycott, disapproval and censure of a person or actions of any public person, organization or company. It was during the pandemic that it gained particular popularity due to the increased influence of the media. *Finna* – formed as an abbreviation for "Feel like going". *Flex* – show off expensive things. Sometimes it can also be used in relation to personal qualities, when a person tries to

seem wittier than he really is. *Glow up* – transformation into a more attractive person. Presumably derived from the title of a song by famous rapper Chief Keef, "Gotta Glo Up One Day". Glow up videos are of special interest on social platforms like TikTok and YouTube. *TFW* is short for “that feeling when.”. Gained popularity after the appearance in the network of the meme "I Know That Feel Bro", where two people sympathetically hug each other. Nowadays, it is increasingly used to convey an exaggeration of something. *Wig* – used to express the highest degree of admiration. The word originated from the African American dialect, where it was very often used as slang. Currently, it is often used by fans in relation to their favorite artists. *Boujee* is a term that describes an arrogant person who loves extravagant things. It is an abbreviation for the well-known French word bourgeoisie. *Dms* is an abbreviation for "direct messages". Became incredibly popular on Instagram in 2013. Often used by dating app users. *Cringe, cringy* is a term used to express an incredible feeling of disgust or shame. *Vibe check* – means checking someone for "coolness", his personality and energy. It is typical for a situation of acquaintance with a new people [1].

Most of the above examples illustrate that Western slang is filled with new words and expressions due to the increasing influence of mass culture, the Internet and the media. Considering the emerging misunderstanding between the Western representatives of generations “Z” and “Y”, it is worth noting that its likely cause is rapid digitalization, which allows slang to quickly spread and become fixed in speech. Older people are simply not keeping up with these changes.

In conclusion, the author has shown that one of the causes of the conflict of generations is a language communication barrier caused by the active use of slang words and expressions. It has been also revealed that the vast majority of slang is borrowed from the English language. It is necessary to point out that in order to level the resulting misunderstanding, more research should be done on the modern version of the English language in order to keep up with rapidly changing trends.

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THE INFLUENCE OF SOCIAL NETWORKS ON THE VALUE SYSTEM OF SOCIETY

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The article describes the influence of social networks on the value system of society. Every day people use social networks. The most frequent changes in the behavior of people who use social networks on a daily basis are considered.

Keywords: social networks, influence, person, information, personality.

ВЛИЯНИЕ СОЦИАЛЬНЫХ СЕТЕЙ НА СИСТЕМУ ЦЕННОСТЕЙ ОБЩЕСТВА

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В статье рассказывается о влиянии социальных сетей на философию поведения личности. Каждый день люди пользуются социальными сетями. Рассматриваются наиболее частые изменения в поведении людей, которые используют социальные сети каждый день.

Ключевые слова: социальные сети, влияние, человек, информация, личность.

Social networks are a virtual space that exists online, this space allows you to create social connections, make friends, communicate via the World Wide Web and search various information what is happening in the world. This topic is relevant today, because such phenomenon as social networks is now rapidly developing and progressing in public life. "Virtual communication plays an important role in the life of society inviting more and more members" [1]. Social networks are gaining a huge number of people. And this is not surprising, because it is very convenient to communicate via the Internet on the various sites. Social networks help people to communicate even overlong the distance.

Nowadays modern people cannot imagine their life without at least one account in any social networking sites. Modern person becomes very dependent on social networks. Therefore, communication via the Internet is developing rapidly. How do social networks attract people? Is it good when people are always online and "sitting" on different sites for longer time? How do social networks influence personality psychology? Can a person and his worldview, society be under the influence of the Internet?

To answer these questions, it is necessary to consider the specific features of human behavior and society. The human behavior is changing under the influence of social networks. Social networks attract people with their ease of use, a large number of resources for learning something and the opportunity to spend interesting their free time. Of course, there are some benefits from spending time in the Internet. For example, you can find many training and development programs in the

Internet. But there are many disadvantages due to the fact that social networks take a part of individual's free time. A person starts feeling lonely and being reserved, when he fails to communicate with people around him in real life. "Social networks are the way to get rid of loneliness, to escape from reality" [2].

Social networks promote bad habits, and since it happens very often people can be under the influence of social networks and begin to inculcate such behavior to themselves and others.

Also social media can cause procrastination. The personality begins to postpone his important business at the last moment. When a person does his job, without rest and break, strenuously at the last moment, he experiences stress. A person's nervousness may affect his behavior towards others.

Lack of sleep and its effect on the human body can begin to destroy a human personality. People who often read news in social networks might be easily manipulated, since they cannot distinguish fiction from truth. And they are ready to believe everything they are told. In addition, with frequent viewing of news in the social media feed, people may forget how to focus on something specific, this leads to lagging behind society. "An endless stream of short posts influences how we perceive information".

People's worldview is changing. When a person seeks to share his emotions, he begins to publish meaningless photos and stories from his life. People want to convince everyone that they have an interesting life. People stop getting sincere emotions.

To sum up, we can say that social networks have some advantages, such as overlong the distance communication and of learning, and disadvantages, such as loss of concentration, procrastination, lack of sleep, and so on.

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DEMOGRAPHIC PROBLEMS IN RUSSIA

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Demographic problems have always taken a special place in the socio-economic development of the country. The threat of a fall in the birth rate, an increase in mortality rate, a population decline and ageing are considered to be key problems in the development of the Russian economy.

Keywords: birth rate, mortality rate, natural population decline, demographic problems.

ДЕМОГРАФИЧЕСКИЕ ПРОБЛЕМЫ В РОССИИ

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Демографические проблемы всегда занимали особое место в социально-экономическом развитии страны. Угроза падения рождаемости, увеличения смертности, сокращение численности и старения структуры населения рассматриваются как ключевые проблемы развития экономики России.

Ключевые слова: рождаемость, смертность, естественная убыль населения демографические проблемы.

All over the world, demographic indicators characterizing the status of the population and its reproduction are one of the main indicators of the socio-economic development of the country.

Demographic research serves to develop demographic policy and workforce planning.

It is important to understand that economics and demography are closely connected with each other. Due to a current decrease in the level of real income of the population, an increase in the level of social tension, real inflation and unemployment, uneven distribution of population, urbanization, a difference in the conditions of regional development, the qualitative potential of our country's demography has been significantly reduced.

On March 11, 2020, WHO declared an outbreak of coronavirus infection. The COVID-19 pandemic has taken over the whole world, and it has significantly affected all spheres of human life. Russia, like all countries of the world, faced not only financial and economic problems, but also demographic ones. The COVID-19 pandemic has become a new threatening factor that could change the demographic situation in Russia.

To reflect the current situation of population changes in the Russian Federation for the period from 2018 to 2021 according to the Rosstat data, the main indicators shown in Table were analyzed [1].

It can be seen from Table 1 that for the period from 2018 to 2021 the total population of Russia has been decreasing. There is a catastrophic situation – the number of deaths is increasing every year, and the number of births is decreasing. And the gap between these two indicators is growing.

Changes of the population of Russia for the period from 2018 to 2021

Year	Population of Russia						
	Number of people, in persons	Number of births, in persons	Number of births, in %	Number of deaths, in persons	Number of deaths, in %	Natural population's decrease, in persons	Natural population's decrease, in %
2018	146 900 000	1 599 000	1,088	1 785 724	1,216	186 724	0,127
2019	146 762 909	1 481 074	1,009	1 798 307	1,225	317 233	0,216
2020	146 748 000	1 306 000	0,890	1 810 000	1,233	688 700	0,469
2021*	146 238 000	106 603	0,073	219 769	0,150	113 166	0,077

*Rosstat data that are presented for January-February 2021.

According to Rosstat, the total number of deaths in Russia during the period of acute coronavirus infection in 2020 increased by 18 % year-on-year, or by 323.8 thousand people, reaching 2,124 million deaths. The birth rate for the 12 months of 2020 decreased by 3.3 % year-on-year. Of course, the main impact of the pandemic was manifested in an increase in the mortality rate. There are several reasons for the decline of the birth rate in Russia. They include poor environmental conditions, a decline in real income of the population and poor quality of medical care. According to the registry Office, the drop in the number of births in January 2021 was 13 % less than in January last year [2].

Nominal amount of GNP in 2018 was 103.861 trillion rubles, in 2019 – 109.361 trillion rubles, in 2020 – 106, 606 trillion rubles. That is, in 2019 there was a slight economic growth of 2.0 %, but in 2020 there was a noticeable decline of 3.1 %. This trend continues in 2021 when GNP in January of 2021 decreased by 2.4 % compared to January of 2020. GNP per capita is also steadily falling. If in 2019 this indicator was 745,158 rubles, in 2020 this indicator decreased by 2.6 % and amounted to 726,460 rubles [3].

As of January 2021, the unemployment rate in the Russian Federation was 5,8 %, which was also facilitated by the COVID-19 pandemic. Real income of the population for 2020 decreased by 3,5 %.

Thus, it is possible to identify the main demographic problems in Russia.

Low birth rate, which has decreased by almost 30 % over the past 15 years. To increase the birth rate, in addition to the existing Maternity Capital Programs and child benefits, it is necessary to give young mothers the opportunity to combine work and family, to study and work remotely. It is also necessary to provide young families with affordable housing and accelerate the construction of preschool institutions. According to A. Raksh, an independent demographer, the Maternity Capital Program has a lot to improve. In order for «maternity capital» to really change the demographic situation in the country, it is necessary to invest about five trillion rubles annually to support families and fertility.

Extremely high mortality rate. The mortality rate in Russia is 1.6 times higher than in developed countries. To reduce mortality, it is necessary to systematically improve the health of the nation, improve the quality of medical care. Almost 60 % of all deaths accrue to diseases of the cardiovascular system, about 15 % – to oncological diseases and 4 % – to respiratory and digestive diseases.

Low life expectancy in our country. According to this indicator, Russia has dropped from 35th place to 142nd place in the world. To solve this problem, we have to actively promote a healthy lifestyle. If people lead a healthy lifestyle, then in six years' time life expectancy will increase by 2,5 years. Anti-smoking and anti-alcohol measures as well as expansion of the scale of medical examinations and the system of social services for the elderly will also make an invaluable contribution.

To sum up, we can say that in the second decade of the 21st century, the number of births will be the lowest in the entire history of the country, as each subsequent generation becomes smaller than the previous one. In Russia, there has not been a total fertility rate of 2.1 children per woman for a

long time, so that the generation of children will be at least approximately equal to the generation of parents in number. In any case, the population of Russia will decrease. The question is how fast it will happen.

Decrease in population, natural decline and ageing of the country's population in general are threats to Russia's economic and national security. A positive and stable economic and demographic situation is a necessary condition to ensure national security and improve the standard of living of the population. Population ageing increases social tension, burdening the country's economy, its pension system, the health and social security system, creating in its turn a problem of pension and benefit funding. Moreover, the decline in the amount of the gainfully employed population creates an acute shortage of labour. Changing the structure of state budget expenditures should improve this situation. Increasing expenditures on the national economy, education and health care together with decreasing expenditures on national defence will have a positive impact on GNP growth. It is investment in human and physical capital – supporting the population, small and medium-sized businesses and leading sectors of the economy – that contribute to economic growth in Russia.

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LOANWORDS IN RUSSIAN AND ENGLISH AS A RESULT OF INTERCULTURAL COMMUNICATION

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In this work we examine the issue of borrowings in Russian and English as a result of intercultural communication. The cultural diversity of the modern world contributes to the natural development of the language, which acts as a main means of implementing the communicative processes of various national cultures.

Keywords: the Russian language, the English language, Anglicism, Russicism, loan word, intercultural communication.

ЗАИМСТВОВАНИЯ В РУССКОМ И АНГЛИЙСКОМ ЯЗЫКАХ КАК РЕЗУЛЬТАТ МЕЖКУЛЬТУРНОЙ КОММУНИКАЦИИ

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В данной работе рассматривается вопрос о заимствованиях в русском и английском языках как результате межкультурной коммуникации. Культурное многообразие современного мира способствует закономерному развитию языка, который выступает в качестве основного средства реализации коммуникативных процессов различных национальных культур.

Ключевые слова: русский язык, английский язык, англицизмы, русизмы, заимствование, межкультурная коммуникация.

Borrowings of foreign words or phrases in languages have existed for a long time. It is not always possible to track the way of appearance of certain loanwords in a language. Logically, a question arises, whether it is good or bad that new words from another language appear, sometimes replacing or displacing native words and designations. The opinions of linguists differ: on the one hand, the language is losing its roots and its peculiarity, sometimes changing beyond recognition. For one, V. I. Dahl wrote that the language determined our belonging to a particular group of people and elimination of native words would not help us better understand the meaning of foreign words, on the contrary, it would prevent us from being understood by others and argue us to be very limited people [1]. On the other hand, the language needs to develop and be able to exist in the modern world. For instance, I. I. Sreznevsky stated that the past was something that had to be held by force and there was no place for the past in the present time [2].

In Russian there is such a phenomenon as Anglicism. Anglicisms are words that came into the Russian language from the English language, similar to the original in sound, or modified according to the rules of the Russian language, for easier understanding of the loan words by native Russian

speakers. Especially in recent times, the language has become saturated with English words. This can be due to the popularization of the English culture, thus the influence exerted on modern Russian is intensified. We observe the examples of this influence in the sphere of modern technology, as well as in modern cinema. Undoubtedly we can see the widespread and strong influence of English-speaking culture on the Russian language. Thus, Anglicisms in the Russian language can be divided into following groups according to their semantic meaning:

– cookery, including words, names of dishes that were cooked at first only in the English-speaking area and were common from English-speaking countries, and therefore have no analogues in the Russian language. Most often they are introduced into Russian, preserving their sound, e.g. *cheeseburger*;

– fashion words that have an analogue in Russian, but due to the influence of fashion trends, are used to a greater extent than the Russian ones, e.g. *teenager, creative*;

– culture – Anglicisms that came due to cultural trends that appeared and spread from English-speaking countries, most often having no analogues in the Russian language, *gentleman*;

– the modern world words that came into the Russian language as a result of the development of modern technologies started in English-speaking countries, so the names were originally given in English. Although these words may have analogues in Russian, but they will most likely not be correct and bulky, e.g. *internet*, *computer, printer*;

– sports names can be placed in a separate category, due to the strong popularization of English-language names during the formation of world sports games. Many names in sports are Anglicisms, although they may have Russian analogues, but due to the fact that people are used to Anglicisms, such words are not changed to Russian analogues, e.g. *football*, *timeout, match*.

However, we should not forget that intercultural communication is a two-way process, and therefore English also has words borrowed from the Russian language [3]. They are often called Russianisms. The appearance of Russian words can be traced back to the 14th century, when there was trade between Britain and Russia. At that time, the word “sable” entered the English language. Sable in Russian means a small wild animal with warm fur and it was his skins that were bought by the British in the 14th century, but over time this word in English became synonymous with black. Sometimes loanwords may not be originally Russian, but since they have been “processed” by the Russian language, they can be considered Russianisms.

Russianisms can be divided into:

– temporary or historical words associated with the peculiarities of the development of the Russian nation and state, which are also features of the development of this people in the first place, although they have similarities with other historical events, therefore their meaning is the same as in the Russian language. Sometimes they are used in the modern world to refer to similar historical phenomena. We can include words like *bolshevik* – a member of the Bolshevik Party (originally a member of the revolutionary majority of the Russian Social Democratic Labor Party, headed by V. I. Lenin), a follower of Bolshevism, a communist; *duma* – the names of various institutions in tsarist Russia (representative, elective, legislative, deliberative, administrative ones); *soviet* – a representative body of the state power, one of the forms of political organization of society; *tsar* – in Russia in 1547–1721 the official title of the head of the state;

– cookery words are the most common Russianisms, which is due to the peculiarities of the Russian cuisine. Since there are no analogues of dishes names in the English language, due to the peculiarities of the appearance and distribution of dishes that are part of the Russian culture, the names enter the language almost unchanged, however, it is possible to explain what they mean with the help of analogues from the English cuisine, although it is not always possible. Examples of these words include: *pelmeni* meaning meat dumpling, *okroshka* – cold *kvass* soup with chopped vegetables and meat; *varenyk* – curd or fruit dumpling,;

– the Russian idea means something that was invented in Russia and became widespread, while having an unofficial name in Russian, which also became an unofficial name in other languages, e.g. *kalashnikov* – a machine gun designed by Mikhail Kalashnikov and put into service in the USSR;

– associations are words that in Russian meant one thing, but acquired a new meaning in English, associated with the original one, e.g. *pogrom* – used in relation to the oppression of any group;

– features of the area – words that were taken from the Russian language due to the fact that it was inherent in Russia at a certain time and, when trading in Britain, at one time it was imported mainly from this territory, e.g. *siberibe* – a sort of ruby; *sable* – the skins of these animals in the 14th century were imported into Britain from trade with Russia;

– features of the structure of the country – words associated with the special structure of Russia and therefore do not have a direct translation in English, e.g. *okrug* – administrative-territorial unit of Russia.

Having analyzed all the things mentioned above, we can draw the conclusion that intercultural communication is a two-way process and there is the influence of languages on each other through history. Thanks to the loan words, we can better understand the relationship between cultures in a given period of time. Moreover, language and culture are closely interconnected, so learning a foreign language we have an excellent opportunity to learn more about the culture of a foreign country.

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METHODS OF INCREASING MOTIVATION IN THE PROCESS OF ENGLISH LANGUAGE LEARNING

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The article deals with issues surrounding the motivation of students in different fields of study. The results of the conducted survey show that increasing student motivation is important in optimizing the learning process and in the effective teaching of students. However, despite the need for various specialists to have knowledge of foreign languages and to understand their meaning, students continue to experience difficulties in language learning.

Keywords: motivation, students, learning English, questioning, professional occupation, methods of motivating.

ИНСТРУМЕНТЫ ПОВЫШЕНИЯ МОТИВАЦИИ В ПРОЦЕССЕ ОБУЧЕНИЯ АНГЛИЙСКОМУ ЯЗЫКУ

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В статье рассмотрены проблемы мотивации студентов, обучающихся по различным направлениям подготовки. Результаты проведённого опроса показали, что повышение мотивации студентов имеет значение для оптимизации учебного процесса и эффективного обучения студентов. Однако, несмотря на необходимость знания иностранного языка специалистами различных сфер деятельности и понимания его смысла, студенты испытывают трудности с изучением иностранного языка.

Ключевые слова: мотивация, студенты, изучение английского языка, анкетирование, профессиональная деятельность, методы мотивации.

Today, the issue of learning English is taking on new significance as it becomes necessary to know the language due to active international integration. At the same time, students do not always understand the importance of learning English and are not ready to take it seriously. The relevance of this topic focuses primarily on the fact that the motivation of students is an integral component of learning a foreign language, whether it is a basic course, intermediate or advanced. Currently, it is necessary to provide motivation so that the study of an academic subject has a special personal meaning for the student.

The quality of higher education depends not only on the applied pedagogical technologies, but also on the attitude of students to the acquired speciality and the desire to master it. If a student has chosen a profession as a result of his interests and inclinations, has an adequate idea of the future professional activity and sees the prospects for professional self-realization, of course, this has a

positive impact on the results of his educational activities. However, it is worth considering the fact that a lack of motivation can lead to a decrease in interest in disciplines that are not directly related to their future profession. Practice shows that students who do well in disciplines connected to their speciality often have problems learning a foreign language, but even those students who consider English as their main subject may have difficulty learning it. The reason for this phenomenon lies not only in the objective complexity of learning a foreign language, but also in the lack of students' desire to acquire high-quality knowledge in this discipline, lack of perseverance in achieving this goal and unwillingness to make significant volitional efforts, that is, in low motivation to learn a foreign language. Based on this problem and its relevance, we decided to conduct research interviewing 30 students of different specialities.[1]

We conducted a questionnaire consisting of eight questions among students of the

Reshetnev Siberian State University of Science and Technology. The survey will allow the importance of the English language to be analysed for three different specialities at the university, namely linguistics, management and mechanical engineering. Thanks to the survey results, we will be able to identify ways to motivate you to learn English. Based on the answers, we showed a percentage ratio associated with the sources of motivation [1–3].

Based on the results, for the largest group of students (28.6 %) the study of English is mandatory It is also perceived as an interesting discipline by 26.5 % as well as an opportunity to expand contacts by 26.5 %. Those who study English as a ‘hobby’ mostly study at the Faculty of Linguistics [4].

It is worth noting that students are aware of the importance of a foreign language for their future professional occupation since the aim of ‘getting a degree of higher education’ is mentioned less and less, and the aims of ‘using the knowledge gained in the right situation’ and ‘using the knowledge gained in the future profession’ appear more often [5].

During the research, we also asked students to assess their level of knowledge. Most linguistics students have B2 level, and students of the Faculty of Management assess their knowledge at the B1 level. However, students with a technical speciality have A1 level [6].

Recognizing the importance of the English language in the future, students face a number of difficulties in learning. Lack of time (64.5 %) is the main obstacle in language learning. Lack of practice is also a learning difficulty, and, in addition, it concerns a speciality where English is the main discipline. When analysing the answers to this question, we have identified a tendency that students of mechanical engineering note the inefficiency of teaching methods, as well as their irregularity [6].

In order to determine the most effective methods with students, we analysed the students' responses. The largest number of students believe that teachers should pay more attention to speaking (71 %). The use of video files (54.8 %) and the development of a foreign language for use in a future profession are also a priority in language learning [6].

The main motivation for students of all specialities to learn a language is the opportunity to communicate with foreigners (71 %), to read books (51.6 %) and to watch films in the original language (58.1 %).

After analyzing the motivation of students, the main factor influencing the study of English is awareness of its significance in the future.

To prevent obstacles, we suggest the following methods of motivating students:

1. In the course of the study, it was revealed that the main reason for learning English is the use of the knowledge in future work, and in this regard, we propose adapting the learning process to the profile of the student's speciality. Students of technical specialties need to implement analytical tasks, for example, describing graphs. Students at the Faculty of Management can be interested in approaches to management tasks in English. Linguistics students can be offered the staging of a scene based on the works of English authors.

2. A special computer program could be designed or selected for students of Elementary, Pre-Intermediate, Intermediate, Upper-Intermediate and Advanced levels. A variety of information will ensure the assimilation of the learning material, and the maximum approximation to the real situation will increase interest in learning the language.

3. It is important to provide students with the opportunity to choose the form of work (individual or in a group) and ways to present their results (for example, a report with a presentation or a speech). This method will help to include everyone in the task in a convenient and engaging way for students.

4. It is necessary to include video and audio materials in lessons. It will be most effective if such materials are selected in advance by the student with additional task development. For example, a mechanical engineering group might produce a video showing metal cutting with an explanation in English. This method allows the student to choose for himself what he wants to study on a given topic, which leads to an increase in his motivation.

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DIFFICULTIES IN STUDYING THE DISCIPLINE FOREIGN LANGUAGE FOR SPECIAL PURPOSES

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The article discusses the difficulties that a university student faces when studying a foreign language for special purposes. The features of this discipline are presented. The ways of overcoming difficulties in teaching and studying the discipline are analyzed.

Keywords: foreign language for special purposes, difficulties, university students, terminology.

ТРУДНОСТИ В ИЗУЧЕНИИ ДИСЦИПЛИНЫ ИНОСТРАННЫЙ ЯЗЫК В ПРОФЕССИОНАЛЬНОЙ СФЕРЕ

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В статье рассматриваются трудности, с которыми сталкивается студент высшего учебного заведения при изучении иностранный язык в профессиональной сфере. Представлены особенности данной дисциплины. Анализируются способы преодоления трудностей в преподавании и изучении дисциплины.

Keywords: иностранный язык для специальных целей, трудности, студенты вуза, терминология.

Nowadays new approaches to training specialists in various fields are required. The goal of studying a foreign language by students of non-linguistic specialties is to achieve a level sufficient for its practical use in future professional activities. Professionally-oriented training provides a professional direction not only in the content of educational materials, but also in activities that form professional skills.

It is no longer enough for a specialist to be able to read and translate professional texts, but also to be able to use a foreign language in various fields of activity. So, for example, professionally oriented communication can take place in formal and informal situations, in the form of conversations with foreign colleagues, speeches at conferences, writing business letters and e-mail. Therefore, the content foreign language teaching should be professionally and communicatively oriented.

Professional orientation of education requires integration of a foreign language with specialized disciplines, careful selection of the content of educational materials. Educational materials should be focused on the latest achievements in a particular field of activity, reflect scientific discoveries, innovations relating to students' professional interests of, give them the opportunity for professional growth.

When studying the discipline of foreign language for special purposes, the following tasks should be solved: development of communication skills by types of speech activity (speaking, lis-

tening, reading, writing). Successful mastering of speech skills consists in the ability to conduct a conversation on various topics, exchange information of a professional nature, the ability to make a report, to express one's point of view; mastery of certain linguistic knowledge (knowledge of phonetic phenomena, grammatical forms, word-formation rules), which are acquired throughout a course; formation of socio-cultural knowledge that introduces students to the culture of other countries; mastering professional vocabulary, special terminology in a foreign language.

During the time allotted for studying a foreign language at a university, it is impossible to master all the terminology, so it is very important for students to develop skills in working with special dictionaries, glossaries, reference books on their specialty.

The essence of professionally-oriented teaching of a foreign language lies in its integration with special disciplines in order to obtain additional professional knowledge and form professionally significant personality traits. It is very difficult to implement. Teachers of language classes have a linguistic and pedagogical education and do not know specific professional vocabulary, often have no idea about the communication needs of the profession. Due to the lack of experience and special knowledge, teachers face a number of difficulties: psychological, linguistic, methodological, etc. Another problem is the lack of modern textbooks and teaching aids.

A teacher of a professionally oriented foreign language has to study the basics of the specialty. This can also be done during classes with students, which will serve as an additional motivation for students in studying this subject. Students will deeply feel the connection of subjects and the need to master a foreign language.

Thus, there are several ways to solve the difficulties that arise: – use materials in foreign language classes that introduce the basic concepts of the specialty; – create situations in which students could use theoretical knowledge on specialty to solve practical problems at a foreign language class; – use materials already known to students, but presented from a different point of view; – be prepared for the fact that students can correct teacher’s mistakes; – use the help of a subject teacher preparing for classes.

To solve problems in studying the discipline of a professionally oriented foreign language for special purposes, the teacher is required to possess certain knowledge in this professional field, the desire to improve teaching process, interest in practical application of knowledge by students, both in the field of a foreign language and in the professional field, a creative approach to implementation of an educational process.

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TECHNOLOGIES IN CUSTOMS

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The article tells about the use of automated information systems and technologies in customs. They also become a necessary component of customs authorities and participants in foreign economic activity.

Keywords: information technologies, customs authorities, electronic declaration, automatic registration, automatic release.

ТЕХНОЛОГИИ В ТАМОЖЕННОМ ДЕЛЕ

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Статья повествует об использовании автоматизированных информационных систем и технологий в таможенном деле. Так же они становятся необходимой составляющей таможенных органов и участников внешнеэкономической деятельности.

Ключевые слова: информационные технологии, таможенные органы, электронное декларирование, автоматическая регистрация, автоматический выпуск.

Over the years, information technologies are becoming more in demand in everyone's life. Information technologies are used in various spheres of human life. So the customs sphere is no exception. One of the most important tasks is to increase and simplify the interaction between people who participate in foreign economic activity and the customs authority.

Information technologies can increase the effectiveness of control over those who take part in foreign economic activity, and contribute to the simplification of the customs operation. Also, the speed of customs operations is an important part of the inspector's work. The first innovation was electronic declaration in customs, which appeared in 2002.

However, it became possible to provide information about transported goods on the Internet only in 2008. And since 2014, electronic declaration has become mandatory.

Electronic declaration is a technology that allows you to remotely submit a declaration of goods to customs authorities and carry out customs clearance via the Internet in accordance with the Order of the Federal Customs Service of the Russian Federation No. 52 of 24.01.2008.

The appearance of automatic registration dates back to 2015-2016. Automatic registration was created to minimize attempts to customs officers to interfere with the declaration in every possible way during registration. Absolutely any declaration that meets the relevant criteria and is not associated with the occurrence of any risk can pass this registration [1].

The very first automatic release of the declaration was made in 2015. The process from registration to release took no more than two minutes. Thanks to this system, Customs authorities can devote more time and attention to risky shipments. The emergence of electronic declaration centers was the result of the use of auto registration technologies and the issuance of declarations. Thanks to these technologies, the time of customs clearance is reduced, customs authorities are relieved of the need to work with paper documents, which reduces the possibility of corruption risks. At the same time, electronic declaration helps to accelerate the development of remote customs payment processes. Since 2001 that customs payment cards have come into circulation. Nowadays, two payment systems are actively used, which are provided by LLC "Customs Card" and LLC "Multiservice payment System": Customs card and Round Card. To get access to the systems listed above, you should only have a customs card issued by credit organizations [2].

The use of the described information technologies when submitting declarations in electronic form, automatic registration and issuance, remote payment of payments greatly simplifies the implementation of customs operations. The use of information technologies increases the speed and improves the quality of customs operations, which leads to an increase in the comfort of customs administration and interaction between business and customs authorities.

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CONNECTION OF PHILOSOPHY AND EDUCATION

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The place of philosophy in modern education is investigated. This not only shows the general relationship between education and philosophy, but also shows how important philosophy is for certain aspects of educational practice.

Keywords: philosophy, education, upbringing, worldview, knowledge, wisdom, critical thinking, academic discipline.

СВЯЗЬ ФИЛОСОФИИ И ОБРАЗОВАНИЯ

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Исследуется место философии в современном образовании. При этом не только проявляется общая взаимосвязь между образованием и философией, но и показывается насколько важна философия для отдельных аспектов образовательной практики.

Ключевые слова: философия, образование, воспитание, мировоззрение, знания, мудрость критическое мышление, учебная дисциплина.

The modern world is a place of cardinal social changes associated with the processes of informatization, digitalization and globalization. These processes, of course, are reflected in the educational environment, including in relation to certain disciplines, the ratio of education and upbringing, the understanding of the need to fill curriculum with certain material. And one of the painful issues of modern education is the need to allocate a considerable part of time to comprehend philosophical knowledge and concepts.

In the domestic education system, where there is a clear trend towards the gradual disappearance of philosophy from the educational process: the philosophical sections in the school course of social science are being reduced, the volume of teaching hours for studying philosophy in higher educational institutions is steadily decreasing. This situation today is a weighty argument to prove the thesis about the lack of demand for philosophy in the age of pedagogical technologies and education reform.

In fact, philosophy and education have been continuously linked for thousands of years. And, perhaps, that only thanks to their close relationship, human civilization was able to reach the modern level.

After all, philosophy is not only a systematic study of higher realities in the Universe, but it is also the formulation of the foundations of our beliefs, the very essence of man, an attempt to clarify and substantiate them with the help of reason. Just as natural philosophy becomes the basis of

Western science, so the philosophical traditions of communication between the student and the teacher give rise to the whole mass of educational traditions. Often great philosophers were also great educators. Here it is enough to recall the examples of Socrates, Plato, Aristotle, and other "fathers of philosophy", who generously shared their thoughts with the younger generation [1].

The connection between education and philosophy, these are not only events of the distant past, a number of exalted representatives of the new and latest European philosophy: Rousseau and Diderot, Kant and Hegel, Dewey and Solovyov, are known not only for their philosophical, but also educational ideas.

Modern education is based on the “unshakable” foundation of the exact sciences, which makes it possible to obtain a strong professional specialist and researcher without resorting to excessive abstract philosophical theorizing at all. However, the importance of the philosophical approach was not denied by the greatest minds who became famous in the field of exact sciences.

First of all, teachers and students should be able to critically assess the diversity of information, and the ability to isolate alternative, more desirable options and ways to achieve goals. In addition, the struggle for the best performance forces students to enter into fierce competition with each other, forgetting about the humanistic nature of education.

Modern education requires the preparation of not a professional functionary capable of performing a given set of actions but the competence of a professional capable of making an informed choice and being responsible for it”. This requires a serious rethinking of education, the basis for which philosophy can provide [2].

Thus, philosophy in modern education, despite the fact that its importance is often underestimated, should occupy a central place. Education does not just mean going to school and getting dry knowledge. To become educated for a person means, first of all, learning to think and become a full-fledged person. And here it turns out that education and philosophy are inseparable. Since the goals of education and the goals of philosophy largely coincide – this is the formation of an understanding of the world around us and the person himself. Any division of philosophy and education hinders the integrity of the worldview and narrows the horizons of both the student and the teacher.

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ON BUSINESS ANGELS

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Today, humanity has entered a "transitional period" of its existence. Attracting a business angel to finance a project is a great chance to start and, subsequently, promote your business in the absence of a material base.

Keywords: business angels, requirements, arbitrator, fund, financing.

О БИЗНЕС-АНГЕЛАХ

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Сегодня человечество вступило в «переходный период» своего бытия. Привлечение бизнес-ангела для финансирования проекта – это отличный шанс начать и, впоследствии, раскрутить свой бизнес при отсутствии материальной базы.

Ключевые слова: бизнес-ангелы, требования, арбитр, фонд, финансирование.

In the development of innovations the focus is on business angels and their role. Attracting a business angel to finance a project is a great chance to start, and subsequently, promote your business in the absence of a material base. Innovative activity is a very risky and complex type of business, which is characterized by a complex of scientific, financial, commercial, organizational and technological measures aimed at commercialization of accumulated knowledge, equipment and technologies.

The sources of innovation activity can be the following: the company's own funds, contributions, issue of securities and shares, funds on an irrevocable basis, borrowed funds – budgetary, commercial, banking. But the most optimal option for a novice entrepreneur is the help of a business angel.

A business angel is the first arbiter who imposes strict system requirements on a project, but from the point of view of bureaucracy, it is less demanding than venture funds [2]. In general, the difference between different types of investors can be defined as follows: venture capitalists are professionals in the field of technology and risk management, they look at postponing business processes, private equity funds, they are more advanced financiers. As a rule, a middle-aged person with average experience and professional education is considered a business angel in Russia. Many of them have extensive or average experience in their own companies or in the management of organizations and enterprises, and they also have a high personal value. There are more than 50 people in Russia.

The most important distinguishing feature of business angels is their use of only their own funds, which they dispose of independently, respectively, at their own risk. Very often, businessmen who

have already retired become such saviours. The next important difference is their desire to finance the project at the development stage. And the last important difference is the size of the amount of money that they provide to their favorites. If you can get up to $10 million in a large fund, then there is no need from a single angel, since most often the size of their contribution to a start-up company is approximately $10 and $500 thousand.

Business angels help the management to accumulate knowledge and experience. Their main contribution is their ability to bridge the gap between the initial capital and later investments. Moreover, they are useful in their ability to help expand the circle of contacts and establish connections, this is especially important when a firm needs to provide contacts with additional capital and subsequent financing [1]. There is only one significant disadvantage for the company – business angels take a controlling stake in the company in most cases. The idea of all business angel clubs is to bring together those people who are interested in trying themselves in a new direction – investing in high-tech young projects. They discuss various scenarios for the development of technological projects with high commercial potential, new business strategies that are already working and earning.

The study, which was published in the journal Business Venture, suggests that business angels most often rely on the individual characteristics of an entrepreneur when making any investment decisions [2]. The entrepreneurs who show a higher level of interest in their company in the future can receive the most favorable attitude of a business angel. They also make investment decisions based on a set of heuristic methods. They consider proposals based on eight criteria: market readiness to accept the product, new product development stage, intellectual property protection, the probability that customers will accept the innovation, the path to the market for the business model, market potential for growth, relevant experience of the management team within the enterprise, the validity of financial modeling.

According to experts, private investments in Russia amount to about $ 1 million, that is, three times the volume of investments of venture funds, and the number of potential business angels is several tens of thousands of people.

Now business angels are in great demand because they are some kind of "saviors" for many firms and enterprises. The development of direct investment is currently one of the priority directions of the state innovation policy, a prerequisite for which is the activation of innovation and increasing competitiveness. There are excellent opportunities for investment in Russia. It is only important to develop effective mechanisms to stimulate it. The prospects for development largely depend on the state of the scientific and technical sector of the economy: the level of applied research and the possibilities of industrial implementation of advanced technologies, as well as the market potential of manufactured products.

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COMPARATIVE ANALYSIS OF COMPUTER GAMERS' SLANG IN RUSSIA AND THE USA

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This paper examines the essence of slang, the connection between computer gamers' slang both in Russia and English-speaking countries including USA, the expansion of the vocabulary of a single group of people and the impact of new words that came from gamers' world on people who are far from games. Most games are made by English speaking developers and Russian gamers borrow a lot of English words while playing.

Keywords: slang, borrowings, computers, gamers, research, analysis.

СОПОСТАВИТЕЛЬНЫЙ АНАЛИЗ СЛЕНГА КОМПЬЮТЕРНЫХ ИГРОКОВ В РОССИИ И США

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Данная статья рассматривает суть сленга, взаимосвязь между сленгом компьютерных игроков России и англоязычных стран, расширение словарного запаса отдельно взятой группы людей и влияние новых пришедших из мира геймеров слов на людей, далеких от игр. Большинство игр создаются англоязычными разработчиками, а русские игроки во время игры заимствуют много английских слов.

Ключевые слова: сленг, заимствования, компьютеры, геймеры, исследование, анализ.

The problem of this research is how the slang of computer gamers is formed in Russia and English-speaking countries including USA. The object of the study is computer gamers' slang in Russia and the United States. Computers and professions which are closely related have been playing a great role in our lives for a long time. There is at least one computer in every house, the number of PC users is rapidly increasing along with the growing popularity of the Internet and computer games. Such changes affect the vocabulary and infiltrate common usage as well.

Technologies are continuing to develop, taking roots in education, medicine, communication and other areas and giving rise to new terms. However, the sphere of entertainment is of particular interest. When we talk about entertainment function of technology, we often mean computer games [3].

Most games are made by English-speaking developers, and Russian-speaking gamers are forced to get into another language. It caused a huge stream of new words that do not have Russian equivalents. The vocabulary of a part of the population has been expanded. Perhaps this is precisely the reason for good knowledge of modern English by Russian young people. But more than that, the

gamers have the list of their own expressions which has grown to such an extent that there is nothing wrong with calling it a slang.

The concept of slang is very flexible, and often different interpretations of this word contradict each other. Many researchers have tried to explain this concept (O. S. Ahmanova, V. A. Homjakov, C. Fries, R. Spears, etc.), but their opinions on this issue vary greatly. Lots of slang definitions are offered.

1. Conversational version of professional speech. 2. Elements of the conversational version of a particular professional or social group, which get into the literary language or into the speech of people who are not directly related to this group and acquire a special emotional and expressive coloring in these languages [1].

Difficulties in the concept of slang are caused by the fact that different researchers either include non-standard vulgar and obscene lexicon in it, or believe that it is only literary ironic expressions. Slang can be considered as the language of poorly educated people [4].

Slang exists in almost every language and is linked with different activities. Let's take a closer look at computer slang. It can be divided into several categories. N.V.Vinogradova created a convenient classification, subdividing slang into: 1. Direct transliteration, in which there is a direct consonant translation. For example, Russian “геймер” from English “gamer” (computer game player), “лут” from “loot” (game items). 2. Selection of a homonym from the Russian language. For example, Russian “дед”, derived from “dead”, “сало” from “silence” (game restriction for the player). These words are completely different in meaning from Russian homonyms. 3. Russification of the English word, in which it is distorted. For example, Russian “донатить” (or “донить”) from the English word “donate”, “дамаг” from “damage”. 4. Abbreviations with usage of the words first sounds in expressions. For example, BTV – “by the way”, TMI – “too much information” [2].

For a more familiar sound, foreign words are changed for a simpler pronunciation. For example, nouns have case endings: “leave” – “ливер” (a player who abruptly leaves the game), “scream” – “скример”, “скримак” (suddenly appearing scary frame in horror games, accompanied by a frightening sound), “heal” – “хилка” (curing).

From the previous examples, it is easy to judge basic characteristics of slang. A number of researches single out the following features: 1. Slang does not apply to literary vocabulary. Due to the tension during the game, gamers often use obscene language. 2. Slang is used mainly in verbal speech. P.A.Gorshkov who was the author of “Internet slang for hackers and gamers” agrees that game slang can be both verbal and used in written chat. 3. Slang vocabulary serves as a means of expressing emotions and has many different shades, as it is used in jokes, neglect and even rudeness. Especially emotionality is shown in the level of the game assessment. A weak gamer can be obnoxiously called “нуб” (from the English “noob”, “newbie” – "новичок"), and a strong gamer is a “про” or “имба” (from the English “professional” and “imbalanced”). 4. For the most part, gamer slang is incomprehensible to the majority of people due to the fact that this vocabulary is borrowed from another language. Moreover, peculiar words and expressions are often used not in their direct meaning. For example, the word “хп”, which came from the English “hit points” (HP, health points), “экспа” from the English “experience”. 5. Slang is constantly changing and expanding, keeping up with the development of society. With the release of new popular games, the gamers' language expands. For example, the word "хэдшот" from the English "headshot" (hit in the head) has become widespread with the emergence of shooter games such as Counter Strike, CS:GO, Overwatch, Doom, etc. 6. Slang is characterized by brevity, which allows to tell more information with just one word. Often this can be seen in “chat” communication, where expressions are compressed to a minimum. The conditions in which a gamer spends more time in the game than in the communication itself force users to increase the speed of receiving and transmitting information. Due to this, slang often tends to simplify and minimize language means and consists of unusual abbreviations and shortenings. For example, GG – good game, BB – bye-bye, 4U – for you, G2G – gotta go, sus – suspiciously, mob – monster (game enemy), etc. [3; 4].

In conclusion, we would like to add that a person who is far from computer games can meet gamers’ language everywhere especially in teenagers’ speech both in Russia and abroad. Computer

slang is constantly updated with new language units due to the convenience of brevity, simplicity and emotionality. It has already become a part of our daily life, but still requires further research. As a result of the study, the essence of gamer slang and the ways of its formation have been revealed and the ways of practical use of slang expressions have been considered.

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SIMILARITIES AND DIFFERENCES OF RUSSIAN AND ENGLISH MENTALITIES

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This article deals with the Russian and English mentalities, their degree of influence on native speakers, their national and psychological characteristics and the importance of mental differences studies. Nowadays, the degree of development of interaction between different cultures, nations and nationalities is steadily increasing. However, there is a problem of understanding the peculiarities of the national mentality. There is an opinion that the native language of any nation affects their mindset and social behavior. As a result, differences in social interaction can produce some misunderstandings between nations that negatively impact on the perception of cultures.

Keywords: mentality, similarities of Russian and English mentalities, differences of Russian and English mentalities, language, culture, social interaction.

СХОДСТВА И РАЗЛИЧИЯ РУССКОГО И АНГЛИЙСКОГО МЕНТАЛИТЕТОВ

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В данной статье будут рассмотрены русский и английский менталитеты, их степень влияния на носителей языка, их национальные и психологические особенности, а также рассмотрена важность изучения ментальных особенностей наций. В настоящее время степень взаимодействия разных культур, наций и национальностей с каждым годом возрастает. Однако существует проблема понимания особенностей национального менталитета. Существует мнение, что родной язык какой-либо нации влияет на мировоззрение и особенности поведения в обществе. Различия культур и социального взаимодействия могут повлечь за собой некоторое недопонимание между народами, что в свою очередь ведет к негативным последствиям и рождает неверное представление о различных культурах.

Ключевые слова: менталитет, сходства русского и английского менталитета, язык, культура, социальное взаимодействие.

The problem of this research is how languages (Russian and English) can affect people and their life perception. The object of this study is native Russian and English speakers. The concepts of "mentality" or "mindset" come from the Latin word "mens" – consciousness, mind. In the dictionary of S. I. Ozhegov, the concept of "mentality" is defined as: "Perception of the world, mindset" [2].

It is a mindset, a special way of thinking, a spiritual disposition of a person or a group of people. The mentality is often expressed in the speech constructions of native speakers, in speech expressions and national ways of social communication.

People cannot exist without a language, just as a language cannot exist without people. These two concepts cannot be imagined without each other, because if there are no people, there are no languages as well, and people without languages are an inexplicable phenomenon, since even the most ancient homo sapiens had a special language of communication. Each nation gives life to their language and brings to it its own distinctive features, which are expressed in the grammatical structure, spelling, pronunciation of words, etc.

In order to see the influence of the language on the mentality we must point out the general characteristics of Russian and English mentalities. There were lots of specific research in which each participant answered the question: “What are the distinctive features of the Russian mentality? As a result of the survey, it was revealed that almost everyone named the following marks: Russian – open soul, sensuality and sincerity, revealed negativism, gloomy face expression, hospitality, smile is not a sign of politeness, etc. [3].

The same question in regard of the British was asked. During the survey, it became clear that the British are presented to the participants as accurate, punctual, restrained, polite, pragmatic. Almost everyone added that the British have a special sense of humor.

And there is an interesting comparison between Russian and English gesture of smiling. The smile is a phenomenon that is at the center of the communicative difference between representatives of English and Russian cultures. Smile at a meeting means showing your politeness and respect to the interlocutor. Smiling at a meeting is in the blood of the British. Russians, on the other hand, rarely smile at strangers. They are not always ready to answer a smile with a smile. There is a special proverb in Russia: “Laughter for no reason is a sign of foolishness.” A Russian smile is always sincere. It is an indicator of both a good mood and a good attitude towards a person [1].

However, more often Russian employers force staff (consultants, waiters, salespeople) to smile at customers at the entrance. Russians adopted this manner from the West, believing that friendly treating customers will increase their sales. But not many people succeed in smiling at visitors. Often the insincere smiles of the staff look very fake, which can even scare away potential buyers.

The culture of collectivism values equality, respect for elders, disregard for one's own desires, and a more respectful attitude towards others. Career growth often depends on personal relationships between colleagues. For a Russian person, the status of an individual is never prevailed over society. This feature of the mentality is reflected in the phraseology and spelling of the language. There is a saying: "I am the last letter of the alphabet," which expresses the attitude of a collectivist culture. «I» in this expression is referred to Russian letter «Я» that is the last letter in the Russian alphabet. And also the letter «Я» means the English word «I». It means that a person shouldn`t be arrogant and shouldn`t pay much attention to them. In Russian, the pronoun, which differs in capitalization, is only “You” – a respectful appeal to another person or group of people [4].

Then we consider the grammatical aspect in both languages. Residents of the UK are distinguished by accuracy and pragmatism. They perceive the passage of time in a special way. For them, time is linear. It is divided into certain segments that are interconnected. The British are convinced that for every business there is a place and a time. This vision of the world and time reflects the grammatical structure of the English language. In English there are 12 tenses that are strictly marked. You can’t “mix” tenses in one sentence or even text, unlike the Russian language.

There are only three tenses in Russian (past, present and future). The Russian language allows you to "mix" different tenses in one sentence, for example: «Маша вошла в комнату сестры и увидела, что сестра смотрела мультфильм, хотя она обещала, что она будет убирать комнату». The past, present and future tenses are used here, which is impossible for English. For comparison, in the English version this sentence would look like this: "Masha came in the sister’s room and saw that her sister was watching cartoons although she had promised that she would clean the room." In this sentence, all actions are represented by varieties of past tenses (Past Simple, Past Perfect…) [4].

An example of the influence of English pedantry can be seen in the grammatical structure of the English language. In English, there is only direct word order. For example, the phrase "Я работал в школе 3 года" would only be correctly translated as "I have been working in school for three years". You can’t rearrange the words in any way, otherwise it will be wrong.

There is no direct word order in Russian. It would be correct to say: "Я работал в школе 3 года" or «Я 3 года работал в школе». All of these are correct translations. Such grammatical rules of the Russian language may indicate the historically established habits of the Russian soul to be in the "endless expanse".

If you look at the geography of Russia, you can see that this is the largest state in the world. It has been the biggest one throughout history. The phenomenon of the "broad Russian soul" occurs on the basis of the memory of ancestors and the habit of seeing the endless lands of the motherland. Russians often have a tendency to be extreme in something: either freedom of action, deeds and lifestyle, or complete restrictions in everything. The English are more practical and rational, which is reflected in their national language.

Thus, we have examined and compared Russian and English mentalities, and also revealed the influence of the mentality or character of the nation on the language. Lifestyle and a special worldview form unique differences in the cultures of different peoples. People give life to the language, thereby reviving its "lifeless" constructions, introducing popular expressions, a special grammatical structure of the language and spelling. All these things together create a unique language that expresses the mentality of its people. In the conclusion, we believe that these distinguishing mentality marks between two nations can be one of the main problems in the intercommunication, causing possible misunderstanding. Future surveys and better learning of these peculiarities might eliminate national prejudice and minimize misconceptions between the Russians and the British.

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COMPARATIVE CHARACTERISTICS OF RUSSIAN AND ENGLISH PROVERBS

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The comparative characteristics of Russian and English proverbs are discussed in the article. Some examples of proverbs on certain topics in Russian and their analogues in English are presented and analyzed. The study of these proverbs will reveal which moral values, traditions and customs are inherent in both nations, and which of them are their distinctive characteristics. The differences in proverbs are predetermined by historical and geographical factors that influenced the formation of the mentality of the Russian and English people.

Keywords: proverb, people, cultural values, similarities and differences, labor, money.

СРАВНИТЕЛЬНАЯ ХАРАКТЕРИСТИКА РУССКИХ И АНГЛИЙСКИХ ПОСЛОВИЦ

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В статье рассмотрены сравнительные характеристики русских и английских пословиц. Представлены и проанализированы некоторые примеры пословиц на определенные темы в русском языке и их аналоги в английском. Исследование данных пословиц позволит выявить какие моральные ценности, традиции и обычая присущи обоим народам, а какие являются их отличительной характеристикой. Различия пословиц предопределено историко-географическими факторами, которые повлияли на становление менталитета русского и английского народов, что находит подтверждение в языковой форме.

Ключевые слова: пословица, народ, культурные ценности, сходства и различия, труд, деньги.

A proverb is a short saying in which folk wisdom is expressed in an instructive form. Oral folk arts of different nations have absorbed their wisdom, culture, traditions and customs from time immemorial. And the path of each of the nations along its historical path will diverge, even in the same period of time. Accordingly, moving away from each other, the generation of different values and views on social processes in the society begins.

People have always treated proverbs in a special way: they were taught at school, told to children, used in everyday situations. According to the words of the famous Russian writer M. Sholokhov, the greatest wealth of the people is their language, as it includes countless treasures of human thoughts and experience which have been accumulating for thousands of years [1].

In our work Russian and English proverbs are presented and analyzed and their comparative characteristics are discussed. Firstly, it is necessary to consider under what conditions proverbs appeared in both languages.

Two impact factors can be considered. The first factor is linguistic borrowing. This is due to the fact that both nations were part of a huge state, such as the Roman Empire, so they somehow inherited their cultural and religious values and traditions.

Secondly, the religion of the compared nations is also common; it is Christianity, which also influenced their worldview at the linguistic level. For example, the Russian proverb "Добрая слава лучше богатства" and the English one "A good name is better than riches" just retell the parable from Solomon's sayings "A good name is more desirable than great riches; favor is better than silver and gold" [2].

The topic of proverbs has always caused a lot of controversy among various authors. Russian and English proverbs are associated with 65 different social groups by their origin, and English proverbs trace the worldview of a person who occupies a certain position in the society and values their reputation. But Russian proverbs are born in the folk environment; they reflect the mind, ingenuity and national-specific features of the life of people of different classes. In this regard, English proverbs are often neutral in social characteristics, are more abstract in nature, contain more abstract vocabulary. Russian proverbs reflect folklore creativity to a greater extent and go back to folk colloquial speech, which at the linguistic level is manifested in the use of vernacular, emotionally-colored vocabulary, expressive and figurative means, rhythmic organization of proverbs, sound repetitions, rhyming lines [3].

In this paper three themes of proverbs have been compared and discussed: 1. friendship; 2. labor; 3. money.

Let us start with the proverbs about friendship. As you know, English society is a society of individuals who unite only to fulfill some goal or task, and Russian society is a collective in which the public prevails over the individual.

These differences are also related to natural factors. The proof will be the different climate, which has long been manifested in Russia with strong frosts and snows, and the mild climate of England. Consequently, when members of the society in ancient times were able to survive in harsh weather conditions thanks to mutual assistance, this gives each individual a great value of friendship. Examples of similar proverbs about friendship in Russian and English are given below:

1. A friend in the court is better than a penny in the purse. – Не имей сто рублей, а имей сто друзей. 2. Old friends and old wine are best. – Старый друг лучше новых двух. 3. Is not a good friend that speaks well of us behind our backs. – Хороший друг в лицо ругает, а за глаза хвалит.

In addition to positive proverbs about friendship in English, there are many negative proverbs on this topic, for example: 1. Friends are thieves of time. 2. Self done is well done. 3. Everybody's business is nobody's business.

Thus, in Russian proverbs, friendship plays a greater role and is of more important value than in the English society.

Now let's turn to the proverbs reflecting the attitude to work. In spite of the fact that in Russian proverbs work appears as a more exhausting and difficult occupation than in English proverbs, they mean that it is necessary to work to get something, because laziness leads to poverty and hunger. Some of the examples of English proverbs with Russian analogues on the topic of labor are presented below:

1. He who would catch fish must not mind getting wet. – Чтобы рыбку съесть, надо в воду лезть. 2. No gain without pain. – Нужно наклониться, чтоб из ручья напиться. 3. No bees no honey, no work no money. – Без труда меду не едят. 4. He that would eat the kernel must crack the nut. – Не разгрызешь ореха – не съешь ядра. Russian and English languages have many similar proverbs about human labor, which is proof of the diligence and incentive to work not only of British, but also of Russian people.

A distinctive feature of Russian proverbs about work is their purpose related to the topic of food, i.e. the concept of "если потрудиться, можно заработать еды".

1. На полатях лежать – ломтя не видать. 2. Как потопаешь, так и полопаешь. 3. Что посеешь, то и пожнешь.

Thus, it can be concluded that for both nations, the meaning that you need to work hard to get something is quite significant in this topic.

Finally, the proverbs about money are considered. In the modern world, money plays an incredibly significant role. At the same time, for all people, they represent completely different things in their lives. Some people perceive money as a means that gives them the benefits of life, and they are willing to do anything for money, but other people don't consider money as the most important thing in their lives.

In English, the main core in the topic of money is made up of proverbs that glorify the power of money. Here are some examples: 1. A golden key can open any door. 2. Riches have wings. 3. If money go before, all ways lie open.

The second significant topic is the incentive to earn money: 1. Money makes the man. 2. Money makes the old wife trot.

Some proverbs in English prove that money does not always have a positive effect on a person: 1. Money is a good servant but a bad master. 2. Money is the fruit of evil as often as the root of it. 3. Money often unmakes the men who make it.

It can be concluded that in English proverbs money plays the role of a man's master, in Russian proverbs the opposite is true: a person appears as the master of money. And, perhaps, most of the proverbs about money in the Russian language tell about money as a source of misfortune, for example:

1. Деньги, что каменья: тяжело на душу ложатся. 2. Где деньги говорят, там правда молчит. 3. Деньги суть жизнею войны. 4. Не в деньгах счастье.

But there are proverbs with positive meanings:

1. Живется, у кого денежка ведется. 2. Затем деньги и круглы, чтоб веселей катиться. 3. Без денег день худенек.

A distinctive feature of Russian proverbs about money is that in a number of proverbs there is a religious theme expressed through certain words:

1. Грехов много, да и денег вволю; 2. Бог любит веру, а деньги счет, деньга попа купит и бога обманет; 3. Пусти душу в ад – будешь богат.

This fact testifies to the exceptional role of religion in the life of the Russian people's life.

Based on the presented research, it can be concluded that the examples of proverbs that exist in Russian and English languages have both similar and distinctive features. In any case, the folklore of both nations helps to understand the soul of people, to see the historical events that took place with them, which influenced the formation of the nation and the state, to understand the way of life and working conditions, to see their attitude to life.

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PERCEPTION EFFICIENCY OF STUDY MATERIALS IN DIFFERENT FORMS OF THEIR PRESENTATION

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The research theme in this article is the students' perception level of educational materials given in visual, auditory and textual forms of presentation. The author analyses perception of educational information in the English language by university students of technical fields of study. All respondents have an intermediate level of language proficiency. The aim of the research is to find the most efficient way to present educational materials.

Keywords: perception, English language, university students, study materials, visual, auditory and textual information.

ЭФФЕКТИВНОСТЬ УСВОЕНИЯ УЧЕБНОЙ ИНФОРМАЦИИ ПРИ РАЗЛИЧНЫХ ФОРМАХ ЕЁ ПРЕДЪЯВЛЕНИЯ

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Исследуемой темой в данной статье является уровень восприятия студентами учебных материалов в визуальной, звуковой и текстовой формах предоставления. Автор исследует восприятие учебной информации на английском языке студентами технических специальностей. Все респонденты исследования имеют уровень владения языком intermediate. Целью исследования является выявление наиболее эффективного способа предъявления учебной информации.

Ключевые слова: восприятие, английский язык, студенты университетов, учебные материалы, визуальная, звуковая и текстовая информация.

The problem of the research described by the author is to find the most effective way to present study materials in English for their better perception by students. In the process of this research we observed the scientific articles that are connected with the topic of our research [1; 2]. The respondents with the same level of language proficiency were chosen from the technical faculties of Samara State Technical University. The language proficiency level of the respondents was determined by the test that was worked out by the professors of Samara State Technical University. There were 150 respondents in this research. It is essential that every respondent had the same language level and the same professional interest. Every presentational form of educational materials whether it is visual, auditory or textual had the same information. Textual information was taken from the official site of the British Council [3]. This kind of information was specially prepared for the students with the intermediate level of English. Auditory and visual types of information were made by the

author and voiced by the native speaker. Both auditory and visual types presented the same information that was in the original text. The information given in these forms was about planning your own business with the tips on how to make it successful. The choice of this information is based on the university curriculum.

Respondents of this research were divided into the groups of 5 people. Each group was given one of the presentational forms. Every form of presentation had 10 groups of people working with in it. Every participant had a card where they needed to rate 3 aspects of their perception of the information given. Respondents had to write how much they liked the information (emotional component), if they remembered and understood it well (cognitive component), and if they would use this information in their future career (behavioral component). Every rate of those aspects was written on a scale from 1 to 10. Another rate of respondents' perception included expert assessment. This mark was also given on a scale from 1 to 10. This rate was based on a test that participants did after they had filled in their personal opinion concerning emotional, cognitive and behavioral component. This test was developed for the experiment by the experts from university.

The tables below show the analysis of emotional, cognitive and behavioral components (personal perception of students) and the expert test. The verification result was made with correlation analysis between the results of the survey and the marks of the expert test. The software package Statistica 10.0 was used to make this analysis. It is necessary to understand if there is a connection between personal perception marks of the students and different forms of study materials presentation.

Table 1

Textual Presentation

Spearman's rank correlations. Noted correlations are significant at p <.05000				
	Emotional	Cognitive	Behavioral	Expert test
Emotional		0,180992	**0,578065**	0,136640
Cognitive	0,180992		**0,445022**	0,250502
Behavioral	**0,578065**	**0,445022**		0,276861
Expert test	0,136640	0,250502	0,276861	

Review: It can be clearly seen in Table 1 that cognitive and emotional aspects of the individual perception are connected with each other. It is necessary to take it into consideration while planning lessons with reading focus. This table also shows that expert test marks and individual marks of the respondents do not match. In order to reveal true results for individual marks educators should give their students proper measurements of the tests and class work. This preparation will lessen the chance of a conflict with the results from surveys and tests.

Table 2

Visual Presentation

Spearman's rank correlations. Noted correlations are significant at p<.05000				
	Emotional	Cognitive	Behavioral	Expert test
Emotional		**0,510155**	**0,540539**	**0,341845**
Cognitive	**0,510155**		**0,332298**	**0,443343**
Behavioral	**0,540539**	**0,332298**		**0,494533**
Expert test	**0,341845**	**0,443343**	**0,494533**	

Review: As it can be seen in Table 2, all components of individual perception are connected with each other. However, it is unclear how reducing one aspect will change the score of the other ones. We can also see that these aspects are connected with the expert mark and this can be very efficient for students to accept their results.

Review: In Table 3 it can be seen that all individual marks have correlations between them. We can also see that the expert test marks are not connected with the individual marks and this is the

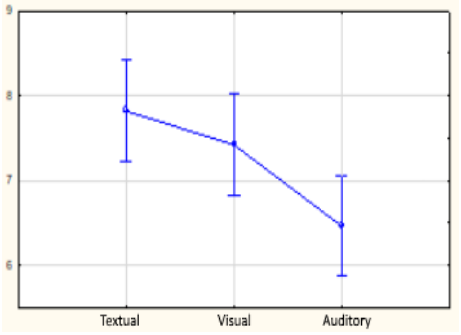
reason to continue this research. The main problem with this type of presentation is the possibility of having bad sound quality because of technical issues.

Table 3

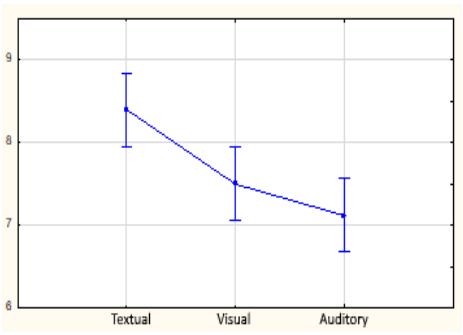
Auditory presentation

Spearman's rank correlations. Noted correlations are significant at p<.05000				
	Emotional	Cognitive	Behavioral	Expert test
Emotional		**0,453770**	**0,833232**	0,142485
Cognitive	**0,453770**		**0,482638**	0,272222
Behavioral	**0,833232**	**0,482638**		0,054095
Expert test	0,142485	0,272222	0,054095	

With such results it can be supposed that the visual presentation would be the most efficient. However, the analysis of variance clarified the conclusion of this research. Only statistically significant differences are shown in the graphs below.



Graph 1



Graph 2

The result of cognitive individual marks selection is presented by Graph 1. This graph shows that students get more knowledge from reading than visual and auditory presentation forms. Graph 2 reveals expert assessment based on the test. It shows that the textual form of presentation was understood better.

It can be concluded that the textual form of study materials is the most efficient one among the three forms that were presented above. Textual form shows better results concerning both individual marks and expert test marks. The auditory form of presentation turned out to be the most difficult one for understanding. These findings can be used by educators who work with different types of study materials at technical universities. Even though using new technologies is becoming a trend everywhere, we can admit that traditional methods are still the most efficient ones.

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THE IMPACT OF THE PANDEMIC ON THE HUMAN RESOURCE MANAGEMENT

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This research expresses the course taken in the human resource management field under the influence of the COVID-19 pandemic and the measures taken to protect the individual, organization, the country's economy, and the paths to goal-setting in the economic and social sphere in general

Keywords: personnel management, pandemic, assessment, employer, personnel.

ВЛИЯНИЕ ПАНДЕМИИ НА СФЕРУ УПРАВЛЕНИЯ ПЕРСОНАЛОМ

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В данном исследовании выражено направление развития сферы персоналом под воздействием пандемии COVID-19 , Из-за которой, вынужденно, были приняты меры по защите личности, организации, экономики страны, а также были пересмотрены пути к целеполаганию в экономическо-социальной сфере в целом.

Ключевые слова: управление персоналом, пандемия, работодатель, оценка, персонал.

The coronavirus pandemic and the actions taken to mitigate negative impacts have already affected approaches to HR management. An increase in the time spent under severe restrictions leads to the fact that economic and labor subjects not only adapt to new conditions, but also change the tools and the target settings used to achieve the goals. In the recent period, it is difficult for the management of an organization to fully predict the consequences of COVID-19.

Assessment of the impact of the pandemic on various areas of society is still far from complete; however it is impossible to deny its influence. Analytical reports of the company transform the business strategies under the new conditions, but the majority of modern research in this area is aimed at "covering the situation from above", by changing economic relationships, forms of interaction between people, employees and employers, often resulting in remote working. There is practically no "view from below", from inside the organizations that are forced to start working in catastrophically limited conditions [1]. The pandemic has forced employers to refuse to pay bonuses on a legitimate basis, as well as to reduce staff costs. In practice, companies are temporary refusing to pay long-term bonuses because the pandemic and self-isolation have forced them to save resources; taking this into account, there are no incentives to motivate the staff. In order to increase labour productivity, incentives are necessary. At the moment, it has become popular to compensate the staff for a salary cut by providing them with the opportunity to work remotely, but this will clearly not be enough, given the fact that the employers are subject to additional obligations to compensate for remote work costs. In the future, more flexible approaches will be introduced in this area. It will

be possible to choose the forms and indicators for which bonuses will be paid depending on the position level. The pandemic has provided companies with a very powerful incentive to eliminate top-heavy staffing departments that only perform a supporting function. Social business programs will have a more targeted approach: support costs will be strictly targeted, grant-based. As a result, we should expect a counter strengthening of conservative sentiments among the population and authorities, who, in turn, will try to compensate for social tensions in the regions of presence [2].

The analysis carried out in the field of HR management and the possible consequences of the pandemic on HR management have demonstrated that management will never be the same as it was before the COVID-19. The changes associated with the coronavirus have had a transformative impact on the field of HR management: organizations have abandoned inefficient tools, and development in certain areas has also been suspended. It can be assumed that in the near future either a return to traditional practices is possible, or a very rapid development of new practices. The pandemic, in general, has showed the limitations of market approaches to solving problems in the face of global threats. Under these conditions, the task of HR managers together with their teams is to prepare for a further transformation of the situation, both from a technical point of view as well as from the point of view of reflective management.

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DRILL CULTURE AS A MODERN YOUTH MOVEMENT

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This paper is devoted to such cultural phenomenon as drill, tells about the origin of the movement and the impact it has on society currently. The author gives examples of the use of drill slang and notes the existing problems that the presented musical direction generates. The attitude of the older generation to drill slang is described as well; the question is raised about the viability of the movement itself and whether it carries the danger noted by the media and opponents of drill as a cultural and linguistic phenomenon.

Keywords: drill, slang, foreign language, research, youth movement.

DRILL CULTURE КАК СОВРЕМЕННОЕ МОЛОДЕЖНОЕ ДВИЖЕНИЕ

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Данная статья посвящена такому культурному явлению как drill, подробно рассказывается о происхождение самого движения, какое влияние оно оказывает на общество в наше время. Автор приводит примеры использования дрилл-сленга, а также отмечает существующие проблемы, которые порождает представленное музыкальное направление. Описывается отношение к дрилл-сленгу старшего поколения, а также поднимается вопрос о состоятельности самого движения и не несет ли оно той опасности, которое отмечают СМИ и противники дрилла как культурного, так и языкового явления.

Ключевые слова: drill, сленг, иностранный язык, исследование, молодежное движение.

The problem of this research is the use of drill slang in the media space and its direct impact on young people. The object of the study is the carriers of this slang, since the presented musical movement itself is quite young and is actively spreading among young people. Understanding the history of the appearance of drill slang will help to understand not only the characteristics of its representatives, but also help to understand what they are trying to say, helping to avoid linguistic and cultural misunderstanding in the communication.

In the modern media space, one cannot fail to note the importance of slang. It is an integral part of culture and has the feature of self-actualization. Slang has a special place in music, often in rap and hip-hop genre, and there are special historical and cultural reasons for this. Media attention is drawn to the language spoken by gang members and fans of the musical genre that represents them – UK Drill, the successor to Trap Rap (The Trap is a slang nickname for the area where drugs are sold). Drill slang has been adopted and included by hyper-local urban gangs in the poorer parts of London [1].

If an uninformed person hears the word drill, he will often present an exaggerated image of a rich, hard-lived, gang member who is characterized by excessive boastfulness, glorifying murder, violence and drugs.

Drill is a type of rap music that first originated in the south side of Chicago. Its main distinguishing feature is its cruel and gloomy content, which is not surprising, because the musician tells us about of street gangs' life, which are often involved in gunfights and drug sales. Initially, the word "drill" was used in a sexual context (1600s), then it spilled over into the meaning of "shooting" – to shoot, attack (1700s), in addition to this, it has a number of other slang meanings [2].

As you know, Chicago is one of the most criminal cities in the United States and constantly beats the records for the number of people killed on the streets (up to 600 people a year).

The pioneers of American drill are Chief-Keef, Young Chop, Fredo Santana, Lil' Reese, but Pacman is considered the "godfather" – he also coined the term drill for this rap sound.

Drill texts are filled with harshness, social injustice, nihilism. Drill itself was born in 2012 in Chicago, and then smoothly flowed onto the streets of London and began to develop rapidly there, acquiring features already characteristic of UK Dtill. Grime (garage) is the "father" of UK Drill. They differ not only in musical style and appearance, but also phonetically, as UK drillers read in MLE (Jafaican) dialect.

For more than 10 years, there has been a war between gangs, of which there are more than 200, on the streets of London. A surge in violence was recorded in 2017 and has not stopped to this day. This confrontation between the gangs of London is called – beef.

The gangs are mostly made up of people from Africa, the Caribbean and the Middle East. They exist on a territorial basis, that is, each gang is located within its own area, trades in illegal substances and arranges stabbings and shootouts with neighboring groups. Gang war is becoming a big problem for London, 2011 was the bloodiest in 11 years – 143 dead. 2021 broke the record for teenage deaths. There are many reasons for this increase in violence – a declining economy, unemployment, cuts in the police force, marginalization of neighborhoods – but some have blamed drillers for this, arguing that this culture romanticizes and calls for violence. Drillers themselves claim that they are nothing more than describing the events that take place around them. It is difficult to understand where the violence in the lines is fiction, and where real events are described, and the texts of some drillers coincide with their actions, moreover, there is a manifestation of non-verbal violence in the videos of the driller, where they gesture with a knife or shoot at opponents. For example, OFB's Jadon O'Neill-Critchlow (SJ) used to read about eliminating enemies in his tracks, and in 2019 he got a life sentence for murder. He was then 17 years old.

It should be noted that many drillers are active members of organized crime groups in our time, sadly, often these are children under 15 years old who have only three ways to get out of the gloomy world into which their parents brought them: trafficking in illegal substances and have a connection with crime gangs, try your luck and go to a big sport (football), or become a driller. The manner of communication of representatives of this subculture may differ so much that it may seem to a native speaker a completely different language or something funny and completely frivolous, far from the real language. It is known that slang expressions can go away with the era, but some lexical units are fixed in the language, the same thing happened with drill slang.

To refer to friends and buddies, they use words such as: GM (gang member), Akhi, Mains, Slime, Active, Dilligent, Bredrin, to refer to active gang members – OJ (on job), fam, cuz, blud, bruv, very cool (in a good way) – Mazza/Mzzaleen, Ments (by mental), wildly cool – Sav (by Savage) Dat's saaaav, fam! Girl, hot girl – ting (as the trunk is called), yat, scrum; A girl of skinny forms – a spinner (the so-called revolver); Hottie – SIM card; Donut (patty, wass) – idiot, loser; gem – weakling; Moist – pathetic, cowardly, disgusting; Snitch – snitch, woodpecker (at the very bottom of the gang); Bookie / buki – suspicious; Bitz / Endz – district (in a good way); Trap / Grubby – district (not in a very good way, ghetto); Trappin – live in the ghetto / sell illegal substances; Codes – district (by postal code); yard – home; pave (from pavement) street; patch – the territory assigned to the gang; field – dangerous territory; Opp (from opposition) – enemy; Opp-block – enemy territory; Capture enemy territory – fishing, lurking, sliding, gilding; stepping on

toes – disassembly with the enemy; Ding dong – small local fight; Bally / Bali – balaclava; Bars – lyrics from UK Drill songs; Rep (from reprezent) – to support; Shout – testify respect in the track; Throwing up signs – gestures in clips; Police officers – Askari, Old Bills, Jakes, Popo, Feds; Flashed – stopped by the cops; Bagged – tied; Prison – box, landing, slamer, pen, can; Go to jail – birded off/birded up, boxed in/boxed off; blow/cutting/dashing/dash/leggin (it)/skate/ skeet/ ten toes – run away to hide; breeze off – disappear from the city / escape from the law; Money – Elizabeths, Lizzies, papers, papes, Ps, gwop; Giraffe, Rack, Stack – 1000 pounds, monkey – 500 pouds; dealer – roadman; on the road – drug trafficking; ketchup/sauce – blood; Tanned – bloodied; Skeng – weapon; for pistols: burner, hand ting, iron, joint, leng, mash, matic, scram, stick, strally, trey, tum-tum, wap; Mop – large trunk; Knife.

Nowadays, drill culture is a youth movement whose slang is widespread throughout London. Young people are adopting the style of dressing, using slang expressions, as well as the pronunciation characteristic of drillers in real life, which makes older generations' ears ring. Defenders of the language argue that it is necessary to eradicate the use of such vocabulary among youth; many schools impose a ban on the use of certain phrases during the educational process.

In conclusion, we can note that drill slang mixes the jargon of American hip-hop with Caribbean expressions transferred and adapted to the linguistic realities of London (by one of the most famous Yardie bands of the 1980s). Drill slang is a part of the life of modern youth, and the language itself is constantly evolving along with the native speakers of the language itself. No matter how cruel and gloomy the message of the representatives of this musical genre may seem, it has the right to further existence and development, despite all the existing accusations against it.

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Wissenschafts- und Forschungsarbeiten auf Deutsch

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ANPASSUNGSPROBLEME DER RUSSISCHEN STUDENTEN AN DEN UNIVERSITÄTEN IN DEUTSCHLAND

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Dieser Artikel befasst sich mit den Herausforderungen der Anpassung russischer Studenten, die nach Deutschland gezogen sind, um ihr Studium fortzusetzen. Die durchgeführte Umfrage hat dazu beigetragen, die großen Probleme und Nachteile des Studiums an deutschen Universitäten zu identifizieren.

Suchbegriffe: Anpassungsprobleme, Bildungssystem, Studenten.

ПРОБЛЕМЫ АДАПТАЦИИ РОССИЙСКИХ СТУДЕНТОВ В УНИВЕРСИТЕТАХ ГЕРМАНИИ

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В данной статье рассмотрены проблемы адаптации российских студентов, которые переехали в Германию, с целью продолжить обучение. Проведенный опрос помог определить основные проблемы и недостатки учебы в немецких университетах.

Ключевые слова: проблемы адаптации, система образования, студенты.

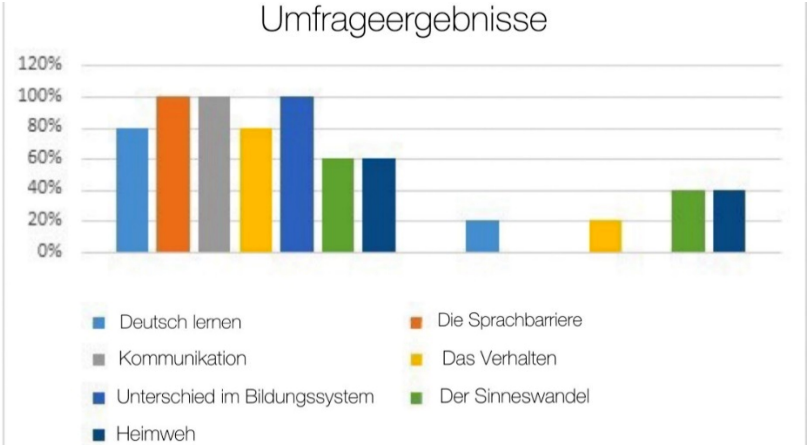
Moderne Ausbildung im Voraussetzung der Integration internationaler Kommunikation gibt eine gute Möglichkeit im Ausland zu studieren sowohl berufliche interkulturelle Erfahrungen zu bekommen. Unsere Erforschung zeigt die Herausforderungen der Anpassung der russischsprachigen Studenten in der interkulturellen Kommunikation. Die Relevanz dieses Themas zielt auf eine effektive Weiterbildung zukünftiger Fachkräfte ab. Auch eine erfolgreiche Anpassung hilft dem Studierenden sich schnell in den Lernprozess eingebracht zu werden. Das Ziel dieses Artikels ist einige Herausforderungen denen Studieren in einem anderen Land begegnen vertraut zu machen [1–3].

Wir haben unter russischen Studenten, die nach Deutschland gezogen sind, eine Umfrage durchgeführt. Die Umfrage besteht aus 11 Fragen. An der Umfrage beteiligten sich die Studenten, die an folgenden Universitäten wie der Technischen Universität Chemnitz, der Universität Augsburg und der Ludwig-Maximilians-Universität studieren. Unsere Fragen spiegeln eher psychologische Aspekte wider. Basierend auf den Antworten haben wir eine Analyse der Anpassungsprobleme durchgeführt und einen Prozentsatz gezeigt. Die Ergebnisse zeigten folgende Herausforderungen für Studenten, die nach Deutschland zum Zweck des Studiums verreist sind. Das erste Problem ist die Sprachbarriere. Das enthält die Unfähigkeit des Menschen, spontane Sprache wahrzunehmen und zu reproduzieren, die aufgrund der Unsicherheit über seine Sprachkenntnisse entsteht. Der Grund dafür ist der Mangel an dem Sprachpraktikum und Kommunikation [4; 5].

Das zweite Problem ist der Wechsel des Bildungssystems. Das Bildungssystem in Russland unterscheidet sich erheblich vom Bildungssystem in Deutschland. Der erste Unterschied ist die Auswahl der erlernenden Fächer. Der zweite Unterschied ist eben das Lehrerverhältnis zu den Studenten. Zeitweise entsteht ein Unverständnis des Materials, das in den Unterrichten beigebrach wird. Auch gibt es jeweils Schwierigkeiten bei der Aufgabenerfüllung [5].

In Ergänzung dazu haben die Studenten soziokulturelle Probleme. Das heißt Mangel an der Bereitschaft und Fähigkeit des Studenten seine interkulturelle Kommunikation auf der Grundlage des Wissens von der Kultur des Landes, Tradition, Mentalität, Normen der Etikette, soziale Bedingungen und Sprachverhalten der Muttersprachler zu entwickeln [5].

Und der Schlusspunkt zeigt uns psychophysiologische Probleme. Das heißt die Neuordnung der Persönlichkeit unter den Bedingungen der anfänglichen Anpassung und dazu die Anpassung an die Bedingungen der fremdsprachigen Umgebung. Im Allgemeinen bildet die Sprache das Denken und wenn der Mensch in einer anderen Sprache überlegt, bekommt alles um ihn herum eine besondere Bedeutung [6].



Umfrageergebnisse

Über 80 % der 60 befragten Studenten lernten Deutsch schon mehrere Jahre und ihr Sprachniveau war höher als A2. Aber die Erfahrung hat gezeigt, dass die Notwendigkeit alle Kenntnisse in die Praxis umzusetzen, ruft eine Sprachbarriere hervor, die direkt mit Angst und Unsicherheit im Sprachumfeld verbunden ist. Trotz der guten Beziehungen zu den Studienkollegen und Lehrern hatten 46 von 60 befragten Studenten haben Schwierigkeiten mit der Kommunikation und mit dem Verständnis. Es ist eine erwähnenswerte Tatsache einen Unterschied erkennen, dass sich das Bildungssystem in Deutschland und Russland auf die Leistung der Studenten auswirkt. Zum Beispiel die Möglichkeit und Unmöglichkeit der Fächerauswahl und das Verhältnis der Lehrer zu den Studenten. Nach circa sechs Monaten beginnt der Student sich schneller an das Sprachverhalten anzupassen, schneller die Gedanken zu formulieren und korrekt darzulegen. 70 % der befragten Studierenden zogen einen Schluss daraus, dass sich ihre Weltanschauung radikal verändert hat, einige wegen des Verhaltens der Anderen geschlossener geworden sind und einige ihre Gefühle offener zum

Ausdruck gebracht haben, ohne Angst vor der Verurteilung in der Gesellschaft zu haben. Weniger als 30 % hatten Heimweh. Die Umfrage ergab jedoch, dass mehr als 70 % der Studierenden verstehen für welche Ziele sie in einem anderen Land sind.

So müssen die Studierende, die in Deutschland eine Ausbildung bekommen, eine Sprachbarriere überwinden so auch Lern- und Kognitionsschwierigkeiten, soziokulturelle, psychophysiologische Schwierigkeiten lösen. Diese Anpassungsprobleme der Studenten werden durch die Einbeziehung der Persönlichkeit in ein neues soziokulturelles und pädagogisch-kognitives Umfeld verursacht. Um eine Konfrontation mit der Sprachbarriere zu vermeiden so eben die Rede des Lehrers und der Studienkollegen weiter zu verstehen, sollte man sich im Voraus vorbereiten, zum Beispiel, deutsche Filme anschauen, so auch mit Muttersprachlern kommunizieren und unbedingt kulturelle Aspekte erlernen. Das Wichtigste ist, sich ein Ziel zu setzen und es zu verfolgen. Je klarer Sie den Grund verstehen, warum sie in einem anderen Land sind, desto einfacher wird die Anpassung. Die Worte des deutschen Philosophen Immanuel Kant sind eine Bestätigung dafür: „Jeder Mensch muss mit seinen Mitmenschen kommunizieren, unabhängig von ihrer Herkunft und ihrer Hautfarbe, und handeln und sich entsprechend dem verhalten, was er von sich selbst erwartet“.

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FACTORS IN THE FORMATION OF REGIONAL INNOVATION INFRASTRUCTURE

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The article discusses various approaches to identifying the main factors in the formation of regional innovation infrastructure. It also examines the relationship between innovation infrastructure and economic growth.

Keywords: innovative infrastructure, factors of formation, innovations, economics.

ФАКТОРЫ ФОРМИРОВАНИЯ РЕГИОНАЛЬНОЙ ИННОВАЦИОННОЙ ИНФРАСТРУКТУРЫ

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В статье рассматриваются различные подходы к выявлению основных факторов формирования региональной инновационной инфраструктуры. Также исследуется взаимосвязь между инновационной инфраструктурой и экономическим ростом.

Ключевые слова: инновационная инфраструктура, факторы формирования, инновации, экономика.

At present, the successful economic policy of the region can be evidenced by how developed its innovative infrastructure is, since it is the development and widespread use of innovations that increase the competitiveness of the territory and affect the innovative economy of the state as a whole. That is why the contribution to research activities in the regions is so important.

An innovative infrastructure is understood as a set of organizations that contribute to the implementation of innovative projects, including the provision of management, material and technical, financial, information, personnel, consulting and organizational services [1]. The innovation infrastructure is the link between the results of scientific research and the market, the state and the business sector of the economy. The purpose of the formation of the innovative infrastructure of the region is the integration of regional, municipal authorities, organizations of the scientific and technical sphere and entrepreneurs.

Foreign experience can be presented in the form of the following conclusions based on the results of the development of innovative infrastructure:

1. The common thing for many countries that do not have a unified approach to the formation and development of the innovation infrastructure of the region (USA, France, Sweden, Great Britain, Germany) is an increase in the innovative activity of economic entities, the transfer of high technologies to the real sector of the economy, stimulation of the interaction of research institutions, entrepreneurs and regional authorities.

2. The trend towards the formation and development of innovative infrastructure facilities contributes to the development of an innovative economy.

3. A stable complex of components of the innovation infrastructure: the system of generation and transfer of knowledge, government support, infrastructure, the production of high-tech innovative products is a common model for the formation and development of the region's innovation infrastructure.

4. Entrepreneurs involved in the creation of science-intensive and high-tech products are provided with a multi-level degree of state support.

5. Formation of relations between regional companies, research institutes and government agencies (both within the region and with other (knowledge-intensive) regions) contributes to the creation of high-tech products and their commercialization in international markets [2].

A.G. Novikov, PhD student at the Management Department of the Financial University under the Government of the Russian Federation, considers the following factors that will positively affect the development of innovation infrastructure in Russia, based on the analysis of foreign experience: unification of scientific, technical, entrepreneurial activities and government agencies; formation and development of scientific, technical and innovative activities of organizations of science and industry; attraction of investments in the development of scientific, technical and innovation activities; an increase in the production of innovative products that are competitive in the foreign and domestic markets; stimulating the active development of small and medium-sized businesses engaged in scientific, technical and innovative activities; development of interregional and international scientific and technical cooperation; unification of regional scientific and industrial resources and their use in priority areas of development of the region; transition of organizations to active innovative functioning; support by local and regional authorities of developments in the field of high technologies in order to enter the domestic and foreign markets; protection of the results of intellectual activity on an institutional and legal basis [3].

Considering all of the above, the following list of factors can be drawn up that have a positive and negative effect on the formation of an innovative infrastructure:

1. The structure of the region's economy. This factor affects which objects of innovative infrastructure can be more in demand, and therefore guarantee more efficient operation of the infrastructure as a whole.

2. Industry composition. The factor influences the direction of activity of the objects of innovation infrastructure.

3. The volume of innovation. This factor allows you to track the efficiency of the innovation infrastructure and take actions to form it more successfully.

4. State policy in relation to innovation infrastructure. This includes various benefits, subsidies, various types of support from the region, the willingness of the authorities to support the creation of objects of innovation, as well as provide the necessary functions (for example, coordination of activities).

This factor can both positively and negatively affect the formation of infrastructure, if the government is not ready to develop this direction in the region. 1. The number of potential consumers. This factor reflects economic dependence: demand creates supply. 2. The quality of education.3. The readiness of the region to exchange experience with others and apply successful projects for the development and formation of an innovative infrastructure.

Thus, the formation of the innovation infrastructure of the region largely depends on the region itself. Its needs and willingness to change.

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RESEARCH ON PRECISION MARKETING USING DATA MINING TECHNOLOGY

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This paper briefly introduces the data mining method based on CRISP-DM, and realizes the promotion of data business for the purpose of precise marketing with the example of mobile phone information business.

Keywords: Data Mining, Precision Marketing, CRISP-DM.

ИССЛЕДОВАНИЕ ТОЧНОГО МАРКЕТИНГА С ИСПОЛЬЗОВАНИЕМ ТЕХНОЛОГИИ ИНТЕЛЛЕКТУАЛЬНОГО АНАЛИЗА ДАННЫХ

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В этой статье кратко представлен метод интеллектуального анализа данных, основанный на CRISP-DM, и реализовано продвижение бизнеса данных с целью точного маркетинга н примере информационного бизнеса мобильных телефонов.

Ключевые слова: интеллектуальный анализ данных, прецизионный маркетинг, CRISP-DM.

Introduction. Data business promotion should be customer-centred, take consumer insight as a means, and conduct user behavior analysis and preference analysis. According to specific business problems and goals, business people need to formulate targeted marketing strategies, assist enterprises to innovate existing marketing models, so as to achieve refined operations.

Data mining technology analyzes and extracts implicit, credible, novel and effective information from massive data. The more commonly used methodology in data mining technology is CRISP-DM (Cross-industry Data Mining Standard Process), which emphasizes that data mining methods should be a complete process from understanding business needs.

1. Application of data mining technology in telecom business marketing

At present, data mining technology is more and more widely used in the marketing of data business, for example, it plays an important role in customer segmentation, tariff plan formulation and partner analysis.

1.1. Customer segmentation

Through data mining, many elements of customers are grouped, and a customer segmentation model is established to help market personnel understand the overall composition of customers, the characteristics of customer groups using various tariff marketing cases, the characteristics of cus-

tomer groups at various consumption levels, and the customers of each credit level, group characteristics, etc. It is significant to provide support for customer precision marketing and refined management.

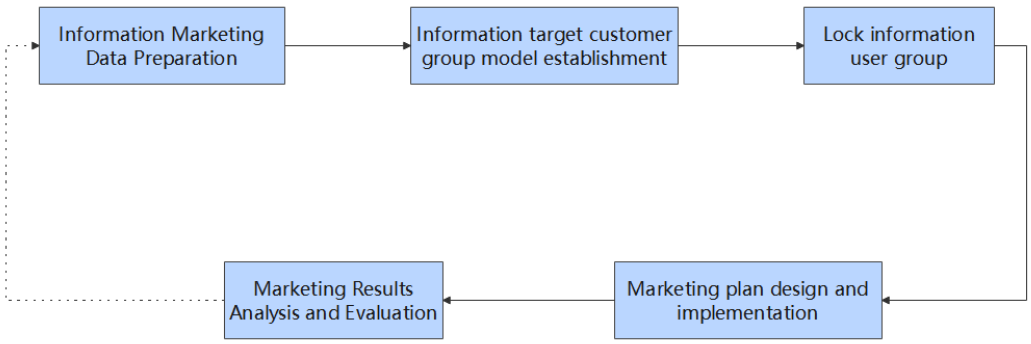
1.2. Development of tariff marketing plan

Starting from the design of the tariff marketing case, combined with the analysis of the impact of the tariff marketing case, key business indicators, tariff system structure provide support for the design optimization and information sharing of the tariff marketing case.

1.3. Partner analysis

With the development of data services, telecommunications companies are faced with more and more relationships between partners. Factors that affect marketing include market environment, customer needs, and business expansion plans. By analyzing the development of its own business and the customer development, trends and anomalies of its partners, it seeks out high-quality partners. At the same time, by analyzing some abnormal behaviors of partners, it can provide early warning of behavior and take corresponding measures.

The specific information precision marketing process model is shown in Figure.



Process map of information precision marketing

2. Examples of refined marketing of mobile phone information business

The purpose of precision marketing is to "deliver the right content to the right user at the right time". The theoretical basis for refined marketing of information mainly includes: people who love fashion, people who like news, and people who use mobile phones specially designed for information. These people are generally more willing to accept information promotion activities or receive similar information.

2.1. Information marketing data preparation

According to the analysis of information business. The data to be prepared includes:

Basic attributes of customers: name, gender, age, etc.

Customer business usage attributes: download information, application pReferences, SMS bills, information complaints and suggestions, etc.;

Customer consumption attributes: customer ARPU and data service expenses in the current month and the past three months.

2.2. Marketing plan design and implementation

According to the information target user segmentation results, the researchers need further study of the user behavior characteristics, and design a differentiated marketing plan according to their characteristics. The content of the marketing plan mainly includes target customers, product fees and marketing channels. After designing the marketing plan, we carry out the marketing activities and promotional activities of the CRBT promotion according to the marketing timing given by the plan, appropriate electronic or physical channels, and precise target customer groups, so as to improve the marketing effect. After the marketing campaign is over, it is also necessary to focus on feedback, revise the model accordingly, and initiate multiple batches of marketing campaign design

and execution. The execution of all key activities in this process is an iterative process in the whole marketing life cycle, so that thorough understanding of customers can be obtained during the activities, and then the marketing plan can be continuously optimized.

2.3. Analysis and evaluation of marketing results

The evaluation of the effectiveness of the implementation of the marketing plan is an important part of the marketing management process. By receiving feedback information, customer attribute data are combined in a subsequent period of time, the rationality of the customer segmentation model is evaluated, and the model parameter configuration is adjusted. Thereby, the accuracy of the model is improved. Statistics on the implementation of activities of different customer groups are carried out by means of reports and other means, and the plan effectiveness and implementation success rate of each activity are obtained. By establishing a marketing management information process, a business closed-loop management corresponding to the marketing system is formed.

Conclusion

To sum up, the precise marketing of data business uses data mining technology as a means to accurately predict the potential user group of a specific business product and quantify it in the form of probability. The research explores the potential of existing customers and reduces sales costs; it recommends products to the right customers through the right channel at the right time, improving marketing efficiency and customer perceived value. increasing customer satisfaction.

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DESIGNING ACCESS CONTROL AND MANAGEMENT SYSTEM IN AN ORGANIZATION

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This paper talks about the importance of using access control and management systems in organizations, provides statistics on the ACMS market, provides a short description of existing systems, and describes important design stages in an organization.

Keywords: design, access control and management system, ACM systems, statistics.

ПРОЕКТИРОВАНИЕ СИСТЕМЫ КОНТРОЛЯ И УПРАВЛЕНИЯ ДОСТУПОМ В ОРГАНИЗАЦИИ

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В данной статье рассказывается о важности применения систем контроля и управления доступом в организациях, приводится статистика на рынке СКУД, приводится краткое описание существующих систем, а также описываются важные этапы проектирования в организации.

Ключевые слова: проектирование, контроль и управление доступом, системы КУД, статистика.

Enforcing security, preventing information leakage, and monitoring the performance of staff are the most important problems in many companies today.

Protection of any object includes some stage, the number of which depends on the level of security of the object. At the same time, in all cases, the most important stage is the access control and management system (ACMS) in the object.

A well-organized ACM system with modern technical items will allow solving problems of safety and efficiency.

According to Market Research Reports, Marketing Research Company [1], the global market of ACM systems will grow by more than 60 % by 2024, it will increase from $7.5 billion in 2022 to $12.1 billion by 2024. Analysts attribute the growth of the market to the demand for solutions to control the growth of crime around the world, technological advances and the introduction of wireless technologies in security systems, growing urbanization in developing countries.

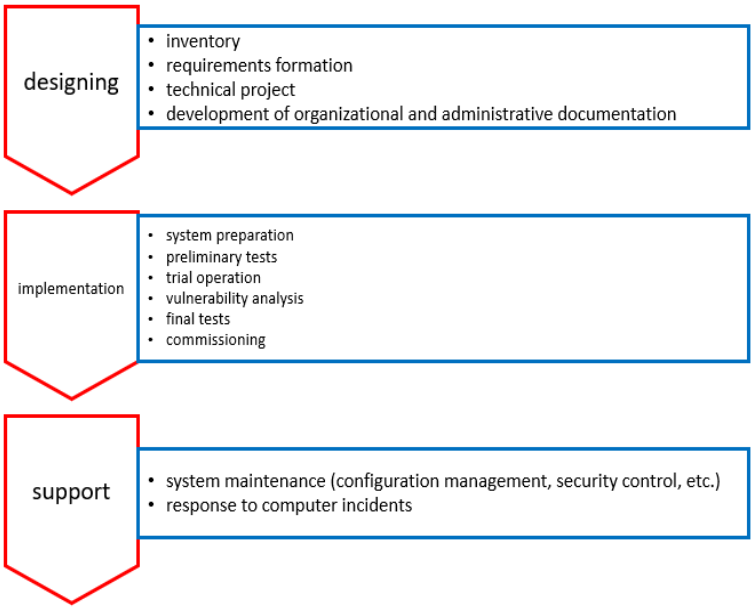
Any ACM system it is a software and hardware complex. It used to restrict access, and identify persons who are located on the territory of the object. Often, when designing an ACM system, other tasks are also solved, including the formation of a customer base. The main elements of systems include user identifiers, identification devices, controllers and actuators.

Consider the documents about access control and management systems.

The first and main document is the national standard of the Russian Federation «Access control units and systems. Classification. General technical requirements. Test methods». This document discusses the classification of access controls and controls.

The next document is the national standard of the Russian Federation «Control access systems. Controlled barrier units. General technical requirements. Test methods». The document describes with details the technical requirements for ACSM.

The Department of State Protection of Property of the Ministry of Internal Affairs of the Russian Federation developed recommendations «Selection and application of access control and management systems. Recommendations». It provides detailed recommendations on the selection, placement and installation of ACSM. When designing an ACM system, it chosen implementation method, ACM systems can be manual, mechanized, automated and fully automatic. The type and complexity of ACM system directly affects the design cost.



Planning scheme

The need to develop individual modes of operation, functioning algorithms, the work of system administrators, tactics of use and interaction, distinguishes the ACM system from other security systems. When designing, considerable attention is paid to the description of the tactics of the system, the explanation for design decisions, and the descriptive part of the project. When accepting a project, the customer must pay special attention to the specified sections of the project.

Designing of ACM systems can divide into the next stages:

– inspection of the object before design;

Studying the customer's business processes, restricted access zones, the object working time. Distance measurement, studying the design features of buildings, determining the types and the possibility of installing ACMS actuators. Search for the most convenient and optimal cable route routes.

– preparation of technical specifications for the design;

Description of the general concept of the ACM system, a list of threats to the security of the object and methods of protection, a description of security tactics. The list of business tasks to be solved by the system: time tracking, parking management, work with visitors, etc. The terms of reference indicate the technical parameters and indicators that you want to achieve.

Equipment locations diagrams, mounting methods and methods for installing actuating devices, electrical equipment connection diagrams, cable routes, methods for commissioning and testing the complex, maintenance procedures.

As a result, there should be a complete model of how the future system will work. In complex and large projects, when one talk about new construction or reconstruction, project documentation for ACMS will allow to correctly set the task and plan the construction works (see Figure).

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ON THE PROBLEMS OF CHINESE STUDENTS STUDYING IN RUSSIA

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Currently, international students studying in Russia originate from more than 170 countries. The number of students from China totals 22,000, accounting for more than 10 % of the total number of full-time international students in Russia, making it the second largest country of origin. In order to increase the internationalization of Russian universities, to work towards obtaining a market for the internationalization of higher education, to strengthen mutual understanding between Russia and China and to increase the exchange of students between Russia and China, it is very important to discuss the situation of Chinese students studying in Russian universities.

Keywords: Chinese students, Russia, internationalization, pandemic, cultural adaptation, language

О ПРОБЛЕМАХ ОБУЧЕНИЯ КИТАЙСКИХ СТУДЕНТОВ В РОССИИ

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В настоящее время в России обучаются иностранные студенты более чем из 170 стран мира. Количество студентов из Китая насчитывает 22 000 человек, что составляет более 10 % от общего числа иностранных студентов очной формы обучения в России, и делает Китай второй по величине страной. В целях содействия дальнейшему росту числа китайских студентов, обучающихся в России, интернационализации российских университетов, и для укрепления взаимопонимания между Россией и Китаем, очень важно обсудить положение китайских студентов, обучающихся в российских вузах.

Ключевые слова: китайские студенты, Россия, интернационализация, пандемия, культурная адаптация, язык.

The number of Chinese students applying to study in Russia has increased despite the pandemic. With the increasing popularity of knowledge-based economy and the internationalization of higher education, the education of international students has become the focus of attention of higher education in various countries [1].

More and more young people take studying abroad as one of their life plans. Although the continued global spread of the new crown pneumonia epidemic since 2019 has brought some negative impact on students' choice to study abroad, the demand of Chinese students for internationalized and high-quality education has not fundamentally changed, and studying abroad is still an important development direction, only that it will be delayed during the spread of the global pandemic.

According to a number of Russian universities and some Russian media, despite being under the new Coronavirus pandemic, the number of Chinese students applying to Russian universities has increased. According to Russian experts, this is a reflection of the strong foundation of Russian-Chinese cooperation.

Chinese students generally assess their stay in Russia positively and express their intention to work in our country after graduation, or at least maintain regular business relations with it. For the most part, they do not master the Russian language very well, but are able to find employment. China is ready to use the services of Russian universities more widely, but Russian universities, apparently, are not ready for this [2].

Chinese students in Russian universities often choose to major in economics and linguistics, but most of them do not intend to work in this field, since after graduation they usually intend to engage in joint trade operations [3]. Mr. Yurkevich, Director of the Center for Asian Studies at the RUDN University, points out that the low motivation of Chinese students to study Russian is due to the fact that the existing Diaspora organizations are able to meet the needs of their social contacts with their compatriots and that their knowledge of Russian is sufficient for dealing with administrative bodies. On the other hand, Chinese students in Russia are willing to socialize with their compatriots in order to relieve their loneliness, but they do not know that this way of communication between compatriots is not at all conducive to socialization in Russia, and we find that this also forms an obstacle to learning a foreign language, which can have a negative impact on the completion of studies and academic life, and therefore presents an unpromising situation in terms of socialization and education [4]. The process of teaching Chinese university students in Russian universities consists of three components: education, learning, and cultural adaptation. For Chinese university students Russian as a foreign language is intended for intercultural communication, while at the same time it is the main means of obtaining professional qualifications.

To develop Russian-Chinese economic cooperation, there is a particular need for extensive communication in the field of engineering and technology. It is relevant to develop the ability to cooperate with teams of other cultures, to establish long-term relations with them, i.e. to develop strategic potential. Since Chinese university students have great problems in interaction with Russian university students and have difficulties in integrating into society and into the university community, it is necessary to teach them non-verbal means of communication, the peculiarities and traditions of Russian culture [5]. Chinese students' adaptation to academic and social life in Russia as well as psychological adaptation, social environment and interpersonal communication, and rules and regulations is good. Although some international students have minor psychological problems, which do not affect the overall situation that Chinese students can basically adapt to Russian social life. Hopefully, the impact of the pandemic will begin to subside in 2022 and will gradually normalize the situation. The main problems are: language barriers, lack of understanding teachers' lectures, low participation in academic activities, and sometimes homesickness and loneliness. On the one hand, these problems are caused by the poor language communication ability of some international students, which makes transnational cultural communication and transnational cultural interaction difficult; on the other hand, different cultural backgrounds and cultural differences are the main obstacles for Chinese international students to adapt to culture. The necessary language tutoring and cultural popularization for international students before studying abroad play an important role in promoting cross-cultural communication among Chinese students. It is necessary for Chinese students to improve their transnational cultural adaptation ability and transnational cultural communication ability in their life so that they can adapt to Russian life faster.

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A DOUBLY IMPROVED WHALE OPTIMIZATION ALGORITHM

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The traditional Whale Optimization Algorithm (WOA) is prone to local optimality and its convergence speed is slow. An improved Whale Optimization Algorithm is proposed to improve the accuracy and convergence speed in finding the optimal position compared to the traditional Whale Algorithm and other intelligent optimization algorithms.

Keywords: whale optimization algorithm; convergence speed

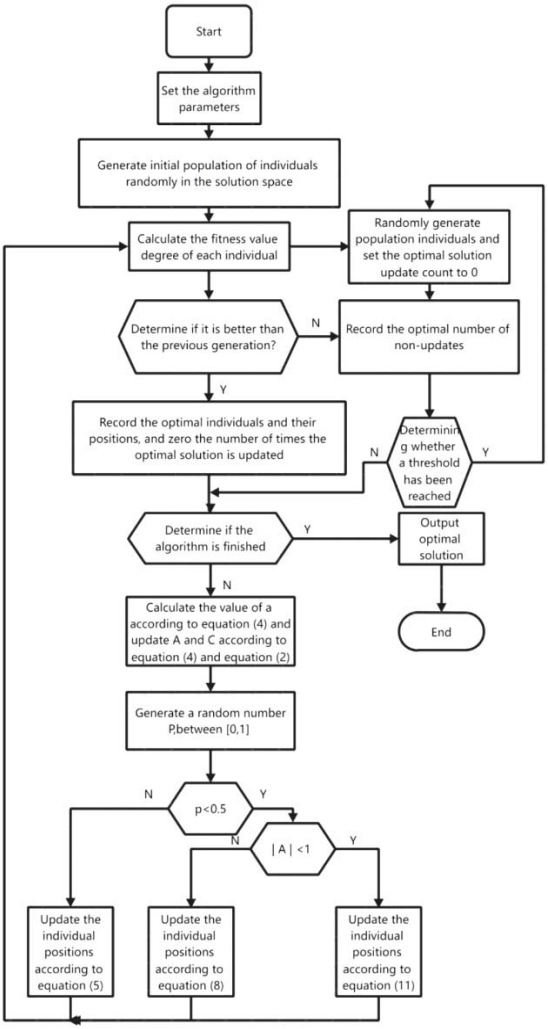

Fig. 1. Algorithm flow chart

1. Double-improvement whale optimization algorithm

The Whale Optimisation algorithm is slow to converge, prone to local optima and prone to premature convergence during computation, and it is proposed to improve the Whale Optimisation algorithm using a non-linear convergence factor and adaptive weights [1]. The algorithm flow in this paper is shown in Fig. 1.

The non-linear convergence factor is unbalanced between the global exploration and local exploitation capabilities of the whale optimisation algorithm in the process of finding the optimal solution [2]. For the analysis of the whale optimization algorithm, the convergence factor $\vec{\alpha}$ decreases linearly from 2 to 0 as the number of iterations increases, which also makes the speed of the iteration of the algorithm become relatively slow; at the same time, the algorithm can only search for the answer close to the local optimal solution when the algorithm is solving the optimal locally, and the local search for the optimal cannot have better results. In this paper, a nonlinear convergence factor is proposed [3] to address this problem. The specific formula is as follows:

$$\vec{\alpha} = 1 - \sin(t * (\frac{2}{Max\_iter})). \qquad (1)$$

Max_iter is the maximum number of iterations and t is the current iteration number of iterations.

1.2. Adaptive weighting strategy

The whale optimization algorithm performs local position development at a later stage of the computation easily fall into local optimum, and also particularly prone to early convergence For this

reason, an adaptive weighting strategy is proposed, in order to enable the algorithm to The adaptive weighting strategy is proposed in order to enable the algorithm to maintain the diversity of the population and to be able to jump out of the local optimum in time. The adaptive weighting strategy function is formulated as follows:

$$\omega = 1 - \frac{e^{\frac{t}{Max-iter}} - 1}{e - 1}. \tag{2}$$

$$\vec{X}(t+1) = \vec{\omega} \bullet \vec{X}^*(t) - \vec{A} \bullet \vec{D}. \tag{3}$$

$$\vec{\mathrm{X}}(\mathrm{t}+1) = \vec{\mathrm{D}} \bullet e^{bl} \bullet \cos(2\pi l) + \omega \bullet \vec{X}^*(t). \tag{4}$$

2. Experimental results and analysis

2.1. Test functions

In order to verify the performance of the CWOA in seeking the optimal solution in this paper, four benchmark test functions selected with reference to the literature were used for numerical simulation experiments, the specific test functions are shown in Tab. 1, $F_1 \sim F_4$ are unimodal functions used to test the algorithm's local optimisation seeking capability.

Table 1

Test function

Test functions	Range	Theoretical optimal
$\mathrm{F}_1 = \sum_{i=1}^{n} x_i^2$	[-100,100]	0
$F_2 = \sum_{i=1}^{n} \lvert x_i \rvert + \leftarrow \prod_{i=1}^{n} \lvert x_i \rvert$	[-10,10]	0
$\mathrm{F}_3 = \sum_{\mathrm{i}=1}^{n} (\sum_{j=1}^{n} x_j)^2$	[-100,100]	0
$F4 = \max\{\lvert x_i \rvert\}, 1 \le i \le n\}$	[-100,100]	0

2.2. Parameter setting and analysis of experimental results

In order to ensure the fairness and rationality of this experiment, the utility parameters of all the algorithms in this experiment are configured in a uniform way, and the parameters are set: In the modified whale optimization algorithm $\mathrm{k} = 2, d = 0.5, b = 1, \vec{r} = random$ [0;1], the value of $\vec{\alpha}$ decreases linearly from 2 to 0.

Two population intelligence algorithms were selected for the experiment, namely PSO, FFA and the basic Whale Optimisation Algorithm (WOA) were selected as improved The comparison experiments of the improved whale optimisation algorithm were conducted. All the used population size was set to 30, the maximum number of iterations that could be performed was set to 500The other private parameters of the algorithms were set according to the References.

The experimental results of the four test functions are shown in Table 2, and the results are shown in Fig. 2. The convergence speed of CWOA is significantly better than that of PSO, FFA and WOA in the function change curves of $F_1 \sim F_3$, and the convergence speed of CWOA is in the middle of all the algorithms compared in the function change curve of F_4. The convergence speed of the CWOA is in the middle of all the algorithms compared. The convergence accuracy of the CWOA is the highest and the stability of the algorithm is the best.

Table 2

Comparison of experimental results

Functions	PSO		FFA		WOA		CWOA	
	Running time	Optimum value	Running time	Optimum value	Running time	Optimum value	Running time	Optimum value
F_1	0.94	51.57	0.66	5112.67	0.84	0	0.72	0
F_2	1	20.35	0.74	45.69	0.90	0	0.73	0.01
F_3	1.22	5089.29	0.84	20492.72	1.10	110894	8.87	10005.10
F_4	0.98	16.29	0	27.93	0.84	78.12	0.8	56.63

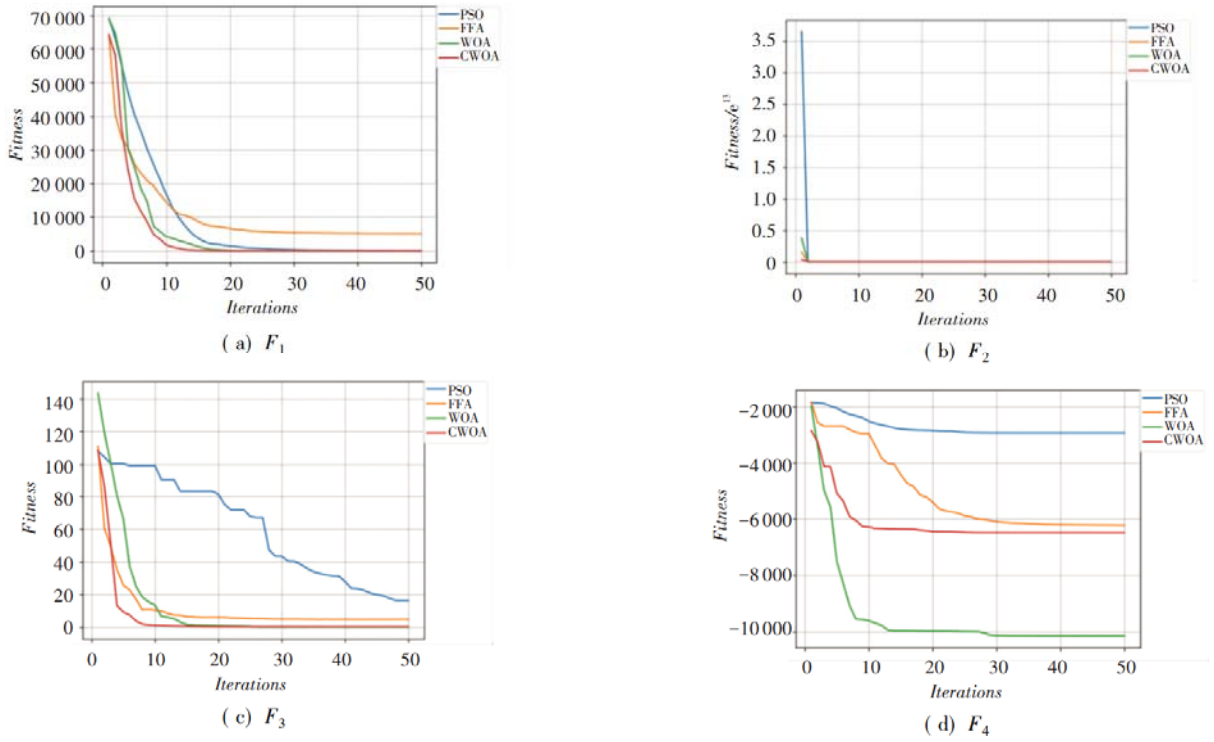

Fig. 2 F_1~F_4 test function algorithm performance test diagram

3. Conclusion

The whale optimization algorithm is a kind of optimization algorithm with bionic search, but it still has some limitations when optimizing some complex functions, it is easy to fall into local optimum and the convergence speed is relatively slow. The non-linear convergence factor solves the problem of imbalance between the algorithm's global exploration ability and local exploitation ability in computation, and the adaptive weighting strategy allows the algorithm to maintain population diversity and to jump out of the problem of falling into local optima in time. The results show that the improved whale optimisation algorithm can break the restriction of being trapped in a local optimum, achieve faster convergence and solution accuracy, and provide better global search and local exploitation capabilities than the other three algorithms, demonstrating the effectiveness of the proposed improvements to the whale optimisation algorithm.

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УДК 658.5

APPLICATION OF BUSINESS PROCESS MANAGEMENT IN CHINESE ENTERPRISES

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Business process management belongs to the category of business process change, which is an extension of business process reorganization, business process innovation. Enterprises should take full advantage of the informationization of business process management system and gradually realize the comprehensive docking and data sharing with the existing information system of enterprises to achieve the purpose of enhancing management and improving efficiency.

Keywords: business process management, Chinese enterprises, informatization, data sharing, management.

The business process management system is an information system that realizes the comprehensive integration of the internal business management process of the enterprise. According to the changes of the business process, it promotes the corresponding optimization and adjustment between the user and the system. It can realize information transmission, data synchronization, business monitoring and continuous optimization of enterprise business processes through the internal network or the Internet, realize comprehensive docking and data sharing with the company's existing information systems, coordinate the resources of various application systems, and achieve cross-application and cross-department process operations across suppliers and customers.

To ensure the implementation of enterprise management systems and systems through professional information systems, there is a need to standardize enterprise operations, and improve the level of enterprise management process – standardization and systematization. Development – through the integration of existing information systems, data sharing and other functions are realized, the processes of existing independent information systems are effectively organized and managed, the current situation of decentralized business management is changed, complex business processes are decomposed, the operation of business processes is standardized, and the Enterprise operation and management costs, effectively monitor and optimize business processes, and gradually accumulate basic business process data to form data support for decision-making and assessment [1].

Since the reform and opening up, China has made great efforts in corporate management, promoted internal restructuring, and conducted extensive research with countries around the world. According to the company law and related policies, the following aspects are used to improve enterprise management. Conceptually: abandon the concept of "product economy" that was previously planned by the government, and set up a concept of independent operation of a "market economy" [2]; angle of open concept. In terms of internal leadership system: further improve and carry forward the company's innovative internal leadership system of "carrying forward the political central role of the party organization, establishing and completing the factory manager responsibility system, and relying on the working class wholeheartedly". In the aspect of enterprise asset management: gradually establish an indicator system that can fully provide feedback on asset management results, create incentives, risks and strengthen constraints and other mechanisms, and strive to invigorate management. In terms of capital: carry out activities such as digging deep into potential, innovating and innovating, controlling costs and quality control [3]. BPM technology is well estab-

lished as an accepted concept in countries with high levels of economic development, and many companies keen on change are exploring the possibility of establishing, upgrading, and completing a new set of business processes to accomplish established strategic goals. The cost of automating and digitizing business processes for Fortune 500 companies is well over $2 billion per year, and the use of revised business processes to improve productivity is, of course, a prerequisite for not shaking up the current business. The newest information system will be the new IT product market with BPM technology as the center and enterprise business process as the foundation, and this concept has been widely recognized.

Of course, BPM technology has been introduced into the country for a relatively short period of time, but in view of the increasingly large business processes, there are many huge business processes within and between enterprises to be managed, in view of this situation, the application of BPM technology in China is quite broad prospects. However, if the use of ERP technology to change the business model of the entire enterprise, for this change employees may be reluctant to accept or may be powerless, so there will be many obstacles to the process of ERP. Thus, in order to promote the implementation of BPM, you can first automate one or two processes, and then automate more processes, not all processes are automated at once. This approach is more favourable both for enterprises and employees.

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ELECTRICITY CONSUMPTION ASSESSMENT MODEL BASED ON STACKING ENSEMBLE LEARNING ALGORITHM

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The paper deals with a machine learning approach able to significantly improve the process of electricity consumption forecasting. The prediction accuracy of traditional machine learning algorithms often depends on specific problems, it means either high bias or noticeable overfitting tendency. Ensemble learning achieves significant improvement in the classification effect by synthesizing the prediction results of several base classifiers.

Keywords: machine learning, ensemble, prediction, classification, base classifier.

1. Introduction.

People are inseparable from electricity; electricity is one of the important resources in people's life. The dataset in this paper is the electricity consumption of a city in one year. By analyzing this data set, it is possible to predict the electricity consumption of the city, so as to determine which month it belongs to. In this paper, a two-layer ensemble classifier is built based on the stacking ensemble algorithm framework. The primary learner uses four non-parametric machine learning algorithms with high prediction accuracy. Non-parametric methods make no assumptions about the distribution of data and can well capture complex nonlinear relationships in large samples, high-dimensional data [2]. The secondary learner adopts Logistic regression, the traditional statistical method [1]. Although the classification accuracy of Logistic regression is lower than some non-parametric algorithms, it is easy to operate and has good stability, which can effectively reduce the risk of overfitting of the ensemble model.

2. Ensemble Model

Ensemble learning obtains a learner with stronger prediction performance by appropriately combining several weak learners. Figure 1 shows the general structure of ensemble learning. Each base learner is generated from the data by a specific learning algorithm, and then goes through an appropriate combination strategy to get the final prediction model. The prediction effect of ensemble learning mainly depends on two aspects: one is the prediction accuracy of the base classifier [3]. Obviously, the higher the classification accuracy of the base classifier, the better the effect of ensemble learning; another important aspect is that the diversity of base classifiers, the so-called diversity is to hope that all base learners can have certain differences from each other. If all base learners produce the same prediction results, the prediction performance of the ensemble model will not improve, but will increase the complexity of modeling. Therefore, we hope that different base learners can be "good but different", so as to achieve strong association and complementary advantages between different base learners. Bagging and boosting are the two most representative ensemble learning algorithms. Bagging and boosting are generally based on a single machine learning algorithm, such as a decision tree model. Stacking improves the generalization performance of classifiers by combining multiple machine learning algorithms. It first trains a primary learner from the original training set, and then uses the prediction results of the primary learner as features to train a secondary model. For example, the simplest secondary model is to simply vote on the results of

multiple primary base learners. Stacking relies on the differences of different learning algorithms to ensure the diversity of base learners, and integrates the prediction results of different base learners in the best way through secondary learners.

We first take some preprocessing measures on the original data, and then divide the data into two parts: training set and test set, to train the model and predict the results respectively. In order to compare the prediction effects of Stacking, Bagging and Boosting, we use Bagging's representative algorithm RF (Random Forest) and Boosting's representative algorithm GBDT (Gradient Boosting Tree) as the components of the primary learner, the other two primary base learners are the classic machine learning classification algorithms SVM (Support Vector Machine) and ANN (Artificial Neural Network), and the secondary learners use the Logistic regression algorithm with high stability.

3. Empirical Analysis

This study uses the electricity consumption Data Set from UCI. It contains 1729 samples and 9 variables, and the meaning of each variable is as follows: 1.Date Time: what month.2.Temperature: Weather Temperature of Tetouan city. 3.Humidity: Weather Humidity of Tetouan city. 4.Wind Speed: Wind Speed of Tetouan city.5.general diffuse flows : electric power noun.6.diffuse flows:electric power noun.

We used stratified random sampling to divide the original data into training set and test set in a ratio of 3:1. The establishment of the model is mainly accomplished by RapidMiner software. For all base learners, the grid search method of cross-validation is used to determine the values of important hyperparameters. The classification accuracy rate and AUC value were selected as the evaluation indexes of the model. The classification accuracy rate is the proportion of the number of correctly classified samples to the total number of samples, reflecting the overall classification accuracy of the model. AUC value represents the area under the ROC curve of the model and is often used to judge the merits of a binary classifier. It is a comprehensive measure of the classification accuracy of positive cases and negative cases. AUC value ranges from 0.5 to 1, and the closer it is to 1, the better the effect of the classifier is.

model	Classification accuracy		AUC value	
	Training set	Testing set	Training set	Testing set
SVM	81.84%	81.76%	0.7830	0.7303
RF	99.32%	82.12%	0.9995	0.7741
ANN	83.31%	80.85%	0.8152	0.7583
GBDT	83.22%	82.29%	0.8191	0.7885
Simple voting	91.20%	82.24%	0.9616	0.7873
acking ensemble mo	94.66%	85.31%	0.9711	0.7901

Among the 6 models in Figure 3, the first 4 models are the four single primary classifiers that we use to build the ensemble model, and the fifth model simple voting method adopts the "soft voting" strategy, that is, the arithmetic average of the output probability of all primary classifiers is calculated, and then the appropriate threshold value is selected to predict the results. The last model is the two-layer ensemble model we built based on Stacking. In this model, the output probability of the primary learner is also used to train the secondary learner, which contains more patterns and information found in the data by the base classifier than the binary classification results generated by the primary classifier.

It can be seen from Figure 3 that the classification accuracy of RF on the training set is the highest, almost reaching 100 %. The classification accuracy of the simple voting method and the Stacking ensemble model also exceeds 90 %, and the classification accuracy of the other three models is lower than 85 %. On the test set that can better reflect the generalization ability of the model, the Stacking ensemble model has the highest classification accuracy, reaching 85.31 %, which is 3.02 % higher than the best single classifier GBDT, RF has a good performance on the training set but only have classification accuracy of 82.12 %, indicating that RF has a certain degree

of overfitting. The classification accuracy of the simple voting method on the training set and prediction set reached 91.20 % and 82.24 %, respectively, which was higher than the average classification accuracy of 86.92 % and 81.76 % of the four single models, this shows that simple ensemble can also improve the classification effect to a certain extent. However, the classification accuracy of the simple voting method in both the training set and the test set is significantly lower than that of the Stacking ensemble model, it is shown that by training the logistic classifier of the second layer, a better combination for the primary learner can be produced. The results of the AUC value also show that the Stacking ensemble model has the best generalization performance.

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УДК 331.

USE OF SOCIAL NETWORKS IN COVERAGE OF THE ACTIVITIES OF STATE BODIES OF THE KYRGYZ REPUBLIC

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The effectiveness of government agencies and how the public perceives it directly depends on the role of communications, because this is one of the important indicators of success. However, the sudden outbreak of the coronavirus pandemic around the world has made its own adjustments to the work of government agencies and the coverage of their activities. It was the coronavirus pandemic that clearly pointed out the gaps in informing citizens and pointed out the necessity *to pay attention to internal and external communications.*

Keywords: pandemic, coronavirus, information, press service, information department, public, government, communications, tools, social networks, Facebook, Instagram.

ИСПОЛЬЗОВАНИЕ СОЦИАЛЬНЫХ СЕТЕЙ В ОСВЕЩЕНИИ ДЕЯТЕЛЬНОСТИ ГОСУДАРСТВЕННЫХ ОРГАНОВ КЫРГЫЗСКОЙ РЕСПУБЛИКИ

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Эффективность деятельности государственных структур и то, как её воспринимает общественность, напрямую зависит от роли коммуникаций, потому как это является одним из важных показателей успешной работы. Однако внезапная вспышка коронавирусной пандемии по всему миру внесла свои коррективы в работу государственных органов и освещение их деятельности. Именно пандемия коронавируса наглядно указала на пробелы в формате информирования граждан и указала на необходимость уделения внимания внутренним и внешним коммуникациям.

Ключевые слова: пандемия, коронавирус, информирование, пресс-служба, информационный отдел, общественность, государственные органы, коммуникации, инструменты, социальные сети, Facebook, Instagram.

The COVID-19 pandemic, in addition to becoming a cause for crisis in many sectors, also clearly demonstrated the importance of state communication with civil society to build tasks for the implementation of anti-crisis measures. At the same time, the main task of developing a communication strategy for the country department becomes a direct function of the information department, or as it is also called the "press service."

The press service or information department of a state or municipal body is at the forefront of public relations, faces new trends – economic, social and technological challenges. Being in an in-

formational tone and always alert, effectively build communications and using suitable tools to implement the goals of the organization is a key task of the modern and competent press service.

The systematic contacts of the press secretary with journalists underline the management's concern to continuously inform the public about the goals and content of their activities. Meetings with media representatives implement the information function of the press secretary. However, it was the press secretaries, press services and information departments of state bodies, first of all, faced obstacles in the prompt transfer of information due to the outbreak of the coronavirus epidemic around the world, in the Kyrgyz Republic, including. The introduction of restrictions on mass gatherings and movements caused the cancellation of numerous press conferences, briefings, press tours, meetings with representatives of the media and online publications.

According to reports by international observers, most of the media in the Kyrgyz Republic have previously encountered significant difficulties in obtaining information from government agencies. In addition, the current situation was also aggravated by the pandemic, which subsequently made its own adjustments to the procedure for the work of information departments.

However, the information departments of many state bodies quickly found a way out of the situation and in practice began to apply innovative approaches in their work. For example, the Ministry of Health and Science of the Kyrgyz Republic, which at that time was in the center of attention of the entire civilian community of the country, as well as understanding the need to inform citizens at the republican level, applied the format of online briefings. So, with a minimum number of human contacts, using Internet platforms like YouTube, Facebook and others, the state department was able to promptly notify the audience about the current situation associated with the spread of coronavirus infection.

Of course, during the pandemic, the possibilities for remote interaction of the state, citizens and business with each other have significantly expanded. Because during the period of quarantine restrictions and remote work, it was still required to ensure the functioning of state authorities and system-forming organizations, their performance of functions, the refusal of which is impossible even during the period of self-isolation, including functions in demand during the pandemic. In such a situation, the format of the work of the Central Commission for Elections and Referendums of the Kyrgyz Republic can be considered.

For the Kyrgyz Republic 2020-2021 have become a busy period for election campaigns. During these two years, during which the covid-19 pandemic raged around the world, the Central Commission for Elections and Referendums of the Kyrgyz Republic managed to hold such large-scale elections as: early presidential elections in the Kyrgyz Republic, referendums, elections of local deputies all over the country, elections of deputies to the Jogorku Kenesh of the Kyrgyz Republic and others. At the same time, the election management body, together with the Ministry of Health and Science of the Kyrgyz Republic, carried out its activities.

It is generally accepted that during the preparation and organization of the voting day of the CEC of the Kyrgyz Republic, it is necessary to conduct numerous trainings and seminars for candidates, political parties and other subjects of the electoral process. An equally important part of the activity of the elected body is also informing voters, which is carried out in order to increase voter turnout on election day. This means that the need to cover the activities of the CEC of the Kyrgyz Republic is especially increasing. However, what to do if there are specific restrictions and sanitary and epidemiological measures that must be observed for national security.

In this case, the work of the Central Election Commission of the Kyrgyz Republic switched to a remote format of work. Meetings of the CEC of the Kyrgyz Republic, working groups began to be held online with a live broadcast to ensure reliable and transparent activities of the elected body. The planned seminars, master classes, meetings and trainings were also held online. At the same time, this format of work did not in any way affect the effectiveness of the work carried out. The activities of the elected body were promptly published on the official website of the CEC of the Kyrgyz Republic, in online publications, as well as on social platforms.

Social networks have become a frequent tool for municipal administrations, state bodies and various organizations. In practice, the information departments of the departments realized that with

the help of social networks, several tasks can be solved at once – this is informing the public, dialogue with the audience and receiving feedback.

According to a 2017 study by SIAR, number of Internet users is 30.6 % of the kyrgyz citizens. In this case, it can be assumed that over the past 5 years, the above figure has noticeably increased, as has the need for information consumption through social networks.

According to the National Statistical Committee of the Kyrgyz Republic, cited in 2020, 99 % of Kyrgyz people are covered by mobile networks, of which 70 % have access to high-quality 4G Internet, which means they have access to the network web or, more simply, consume information from easily accessible sites.

President of the Kyrgyz Republic Sadyr Japarov is considered an active user of social networks such as Facebook and Instagram. On the official pages of S. Japarov, currently, there are about 480 thousand subscribers. The authenticity of the head of state's accounts was confirmed by the presidential press secretary in April 2021, at a time when his pages received verification (authenticity) on Facebook and Instagram. S. Japarov himself in his interviews with media representatives reported that he monitors social networks to identify problems and issues that concern the Kyrgyz people.

Currently, most government entities have their official social media pages. Realizing the fact that the presentation of information on such platforms differs from traditional voluminous information, information departments in the Internet space publish their materials in an accessible language and in a short form, attracting more interest in information from their audience than if it were published on the official website of the department.

Modern Internet technologies perform important functions as the development of publicity and information openness leads to an increase in the level of trust in the activities of power structures and the possibility of publishing in most social networks, the most demanded information spreads exponentially. Awareness of such factors determines the use of these tools by authorities and government officials.

Based on the above facts, it can be assumed that traditional media have already ceased to be fundamental in the concept of obtaining and disseminating reliable information about an event. The information departments of state and municipal bodies recognized the need to develop their format of work in accordance with modern needs and introduce a new format of work on new types of information receipt and exchange, the basis for which was the Internet and social networks.

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FEATURES OF HUMAN CAPITAL MANAGEMENT AT THE ENTERPRISES OF ROCKET AND SPACE COMPLEX

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Reasonable management of human capital helps to maintain financial and economic stability of a company, increase financial and economic characteristics of development, improve an innovative climate, form a corporate culture and a positive image of a company.

Keywords: human capital management, knowledge-intensive enterprise.

ОСОБЕННОСТИ УПРАВЛЕНИЯ ЧЕЛОВЕЧЕСКИМ КАПИТАЛОМ НА ПРЕДПРИЯТИЯХ РАКЕТНО-КОСМИЧЕСКОГО КОМПЛЕКСА

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Разумное управление человеческим капиталом содействует поддержанию финансово-экономической стабильности компании, увеличению финансово-экономических характеристик развития, развитию инновационного климата, формированию корпоративной культуры и положительного имиджа компании.

Ключевые слова: управление человеческим капиталом, наукоемкое предприятие

A knowledge-intensive enterprise is an industrial production in which the output of products is associated with the need for more theoretical calculations, scientific research and experiments [1].

The purpose of the study is to identify the features of human capital management of knowledge-intensive enterprises.

The mechanism of human capital management is implementation of managerial actions, consisting of such stages as analysis of external environment, strategy development, planning and design of labor processes, formation, accumulation and reproduction of human capital, evaluation of the effectiveness and return on investment in human capital.

Examples of methods and technologies, the use of which involves the mechanism of human capital management, are the following: a) management by goals, compatibility of the company's goals and personnel: HR strategies, strategic objectives and criteria for evaluating labor results; b) assistance to the individual development of each employee to increase the effectiveness of collective activities: training and development of personnel, talent management; c) investments in the quality and development of human capital: motivation, personnel evaluation, remuneration system, corporate culture, value system formation, health maintenance; d) organization of activities: selection, hiring, adaptation of personnel.

Purposeful formation and development of a specific type of human capital enriches the management mechanism and thereby makes it possible to safely regulate numerous difficulties associated with increasing the competitiveness of the company, the use of the latest modern technologies, increasing efficiency and productivity.

Conditions for effective human capital management [2]:

– investing in the quality and development of human capital contributes to an increase in labor productivity;

– combining the goals of each individual employee with the goals of a company;

– development of an appropriate system of personnel training, advanced training and talent management system that stimulate innovative activity of employees;

– development of corporate culture as an effective management tool that increases labor productivity and forms a positive image of a company;

– formation of health capital and investment in it focusing on maintaining health and efficiency of personnel, which prolongs functioning time of human capital;

– development of motivating factors in order to develop the required qualities and abilities of employees, creation of a favorable socio-psychological climate in the team, creative mood in work;

– building a remuneration system taking into account the principles of staff motivation, evaluation criteria and appropriate remuneration are being developed that stimulate personal development, innovative activity and accumulation of work experience;

– introduction of a human capital monitoring system and methods for assessing its condition to get a real result from its application and evaluate the effectiveness of the human capital management system.

In the theory of human capital management, today, in the conditions of innovative development, several key areas have been formed in which human capital is considered as a basic one:

a) human resource management (staff intellectualization): the approach to human resource management in the conditions of innovative development, its basis is high-tech, knowledge-intensive production, requiring highly qualified employees. First of all, the approach is based on development management, improvement of quality characteristics. In the conditions of innovative economic development, the strategic importance of human resources is increasing, investments in their development are more important than investments in production.

The specifics of innovative human capital management in the company lies in the development of areas of formation, development and application of high-quality human capital, in creating a favorable innovation climate for the full professional, intellectual and creative return of employees in the innovation process, in motivating and stimulating innovative behavior of personnel.

At the moment, experts and practitioners consider intellectual, creative abilities, creativity of the staff as the main competitive advantages of the company. The functions of personnel management include the development of creative, intellectual abilities of the company's employees, as well as the attraction of talented employees, which gave rise to such a direction in management as talent management;

b) management of intellectual objects (knowledge, intellectual capital, intellectual resources, etc.) [3]: approach to knowledge management is the study of effective ways of accumulating and applying knowledge in innovative production; approach to intellectual capital management is to study the difficulties of increasing the value of company assets, managing "collective internal energy", the impact and evaluation of intellectual capital on innovative development; approach to intellectual resource management is continuous improvement and search for the latest management methods, creation of conditions under which the intellectual abilities of personnel develop, introduction of management technologies, research of new forms of communication with the external and internal environment; approach to managing creative resources. Creative resources are the ability of employees to be creative, innovative. Creativity involves creating something new, not just the ability to think.

The purpose of the system is timely provision of innovation processes by personnel with the required qualifications, necessary knowledge, skills, intellectual and creative abilities. Based on the fact that the needs of knowledge-intensive enterprises are regularly increasing, the quality

and volume of human capital should also increase regularly in order to meet the necessary conditions for innovative development.

At the same time, the analysis of the human capital management system is impossible separately from the reproduction process in the company. Since human capital directly guarantees the implementation of the innovation process, the human capital management system should be included in the company's innovation cycle as a creative and intellectual support of the innovation process.

Thus, based on the considered approaches to human capital management, it can be concluded that the approach to human capital management of knowledge-intensive enterprises is a reproductive process of forecasting, planning, formation, development, use of human capital to ensure the innovation process in the innovation cycle of the company.

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FEATURES OF THE TRANSMITTED INFORMATION BY YOUR PHONE

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The paper considers the features of the interaction of the phone with base stations. The information transmitted by the base station phone is described. Data interception devices are considered, with the help of which it is possible to identify the owner of the phone.

Keywords: smartphone, basic-station, IMSI, TMSI, GSM, IMSI-catcher, 2G, 3G, network, connection, data, information.

ОСОБЕННОСТИ ПЕРЕДЕВАЕМОЙ ИНФОРМАЦИИ ВАШИМ ТЕЛЕФОНОМ

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В работе рассмотрены особенности взаимодействия телефона с базовыми станциями. Описана информация, передаваемая телефоном базовой станции. Рассмотрены устройства перехвата данных, с помощью которых можно идентифицировать владельца телефона.

Ключевые слова: смартфон, базовая станция, IMSI, TMSI, GSM, IMSI-перехватчик, 2G, 3G, сеть, соединение, данные, информация.

Every day you spend a lot of time on your smartphone display when you're chatting or just surfing the internet. But do you know how your phone really works?

When your phone is switched on it continuously sends weak beacon signals to the nearest base station or stations. The base stations provide cellular and wireless connectivity for your phones. When your phone transmits a signal, the base station transmits a response signal whose strength is indicated by the number of "bars" on your phone's screen. No "bars" means no signal.

To maintain confidentiality, the transmitted signals to stations contain an International Mobile Subscriber Identity (IMSI). The IMSI is usually 15 digits long, but can be shorter. For example: 250-XXX-XXX-XXXXX. The first three digits are MCC (Mobile Country Code). In the example, 250 is Russia. It is followed by MNC (Mobile Network Code). A Mobile Network Code can have two digits for European or three for North American standards. All subsequent digits are the MSIN (Mobile Subscriber Identification Number).

There are devices capable of intercepting this identifier. They are called IMSI-catchers. It is a device that masquerades as an ordinary base station. The ability of the phone itself to connect to a fake base station is due to the security vulnerability of the GSM protocol. In addition, in GSM (2G) networks only the mobile phone has to authenticate itself (it is not required to do so from the cell tower) and therefore it can easily be misled, including by disabling data encryption on it. UMTS (3G) universal mobile phone system, on the other hand, requires two-way authentication; however,

it can be circumvented by using the GSM compatibility mode present on most networks. 2G networks are still widespread – operators use GSM as a back-up network in places where UMTS is not available. Thus, with this device, it should not be difficult to identify who owns the mobile phone.

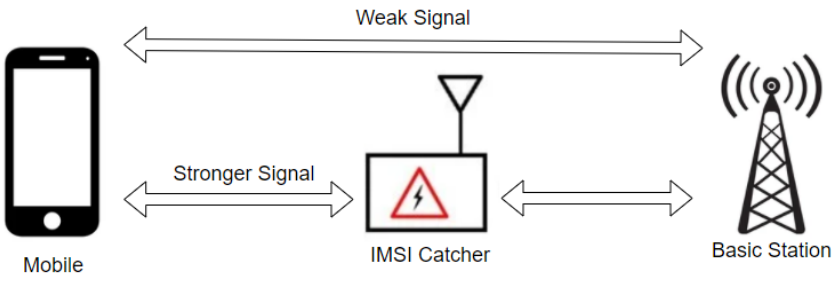

Fig. 1. How works IMSI-catcher

In 2014, for example, a scandal erupted in three Scandinavian countries – Norway, Sweden and Finland – after journalists from the Norwegian newspaper Aftenposten measured electronic traffic in the government quarter of Oslo, where, apart from the prime minister's office and parliament, the embassies of several major countries are located. One of the fake base stations was located in front of the Russian embassy in Oslo, making it possible to monitor the phone traffic of its employees. The Norwegian Security Police (PST), at the request of Aftenposten, verified the information and confirmed the presence of false base stations in the government quarter and an investigation into the espionage proved by journalists was launched. After Aftenposten published the IMSI trap signals stopped. The Norwegian journalists were followed by their Finnish and Swedish colleagues. False base stations of unknown origin were also detected in government quarters in Helsinki and Stockholm. The US and its own police are named as the most likely hosts of the traps. Earlier, Edward Snowden stated that the US National Security Agency makes extensive use of IMSI traps both to track possible terrorists (similar installations operate at all US airports) and to spy on officials of other states, including allied ones. IMSI traps are available on the open international market, but are banned from sale in Nordic countries.

As a result, it can be said that your phone transmits a unique code that is received and recorded by several stations at once. Therefore, anyone viewing the station's data files will see the temporary Mobile Station Identifier (TMSI) of every subscriber in the area at any given time. For example, law enforcement agencies can request this data from the mobile operator, including information about the identity of each individual subscriber.

If you only look at the data from one base station, you can only find out that someone has passed by and transmitted that station's signal. However, with data files from several stations it is possible to locate the person. This is because the mobile device usually sends signals to three or more base stations at once. It is enough to get hold of the data files of these stations and compare the levels of signals they receive. Then triangulate to calculate a person's almost exact location. In this way, your basic, everyday device is actually a tracking device.

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METHODS OF ACOUSTIC CHARACTERISTICS EXTRACTION IN DIGITAL PROCESSING OF SPEECH SIGNALS

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The paper considers the existing methods of extraction and analysis of speech characteristics due to such physiological properties of the speech tract as formants, spectrum envelope, pitch frequency. The main approaches described in the article for extracting acoustic speech features for the purpose of speaker recognition can be useful in the field of information security when designing voice automatic systems based on biometric technologies.

Keywords: linear prediction, speech characteristics, cepstral analysis, spectral centroid, wavelet analysis.

МЕТОДЫ ИЗВЛЕЧЕНИЯ АКУСТИЧЕСКИХ ХАРАКТЕРИСТИК ПРИ ЦИФРОВОЙ ОБРАБОТКЕ РЕЧЕВЫХ СИГНАЛОВ

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В работе рассмотрены существующие методы извлечения и анализа речевых характеристик, обусловленных такими физиологическими свойствами речевого тракта, как форманты, огибающая спектра, частота основного тона. Описанные в статье основные подходы извлечения акустических признаков речи с целью распознавания диктора могут быть полезны в области информационной безопасности при проектировании голосовых автоматических систем, основанных на биометрических технологиях.

Ключевые слова: линейное предсказание, речевые характеристики, кепстральный анализ, спектральный центроид, вейвлет-анализ.

Introduction

The existing growth of the biometrics market at the domestic and global level indicates the active introduction of this technology into everyday life. One of the most popular biometrics is voice recognition, and therefore, an actual problem is to improve the quality of personality recognition and reduce the number of spoofing attacks [1].

Speech characteristics

The combination of signs of physiology and behavior ensure the individuality of the voice. Anatomical features of the speech tract are more reliable signs, since diction, intonation, pronunciation, rhythm and other behavioral signs are caused by social factors and, depending on the situation, are quite variable. Therefore, algorithms for measuring acoustic characteristics are more often used for automatic recognition. The speech wave in the framework of the acoustic theory of speech is con-

sidered as a result of the sound sources and filters operation. At the same time, for automatic recognition of speakers, in digital signal processing through spectral analysis, the characteristic features of a particular person's voice are obtained. The main frequency of the voice is the frequency of the first harmonic of the spectrum. It determines the pitch of the voice, which is influenced by the gender and age of the speaker.

Linear prediction

The method principle is to approximate the speech signal by a linear combination of the preceding sections of the signal. The creation of speech is considered as the excitation of the speech tract by random noise for non-vocalized speech segments or by a sequence of impulses for voice speech [1].

Cepstral analysis

Finding the cepstral coefficients is the predominant algorithm for processing speech signals in automatic systems. The cepstrum is the logarithm of the spectrum of the timeline spectrum, which is defined as

$$c[n] = F^{-1}\{log|F\{x(n)\}|\},$$

where F and F^{-1} are the forward and inverse discrete Fourier transform.

Initially, the speech signal is preprocessed by a filter that amplifies the high frequencies of the spectrum reduced during speech reproduction. Next, the signal is divided into frames – identical consecutive overlapping time sections. A smoothing window function is used to reduce signal distortion. The spectrum is found for each window through the Fourier transform, multiplied with the spectrum of the accepted set of filters to average values in a certain frequency band. The logarithm of resulting envelope of the spectrum is found, and then a discrete cosine transformation is performed which is the final step to determine the cepstral coefficients. The most common in digital processing of speech signals are mel-frequency cepstral coefficients (MFCC), for which speech frequencies are presented from the position of psychoacoustic hearing – pitch. However, in MFCC little attention is paid to the structure of the speech tract and its length, which makes it relevant to use linear frequency cepstral coefficients (LFCC), when finding which filters are evenly distributed over the entire linear frequency band. There are also cepstral coefficients of a rectangular set of filters (RFCC – rectangular filter bank cepstral coefficients), Gammatone-frequency cepstral coefficients (GFCC), perceptual linear prediction (PLP), each of which has certain features and advantages [2].

Spectral centroid

Spectral centroid frequency(SCF) is the weighted average frequency for the considered sub-band. In each sub-band, the normalized energy of the frequency components is represented by a weighted average frequency. The SCF varies depending on the fundamental tone and harmonic structure, and it is possible to estimate the approximate position of the formants, which represent peaks in the neighboring sub-band. SCM (spectral centroid magnitude) – the amplitude of the spectral centroid, is a weighted average value of the amplitude for a given range.

Wavelet analysis

Wavelets are scalable basic transformation functions of a certain form. They allow the most informative analysis of complex real signals, which require processing by time and frequency characteristics [2].

Wavelets are applied by multiscale signal processing. The signal is analyzed in different magnifications with different degrees of detail. The wavelets are formed from the base function ψ, which is called the parent wavelet, and are a family of functions $\psi_{j,k}(t)$:

$$\psi j,k(t) = 2j,k\psi(2jt - k), \qquad j,k \in Z,$$

where Z is the set of integers, j is the scale factor and k is the shift factor.

The discrete wavelet transform (DWT) structures a binary tree that displays a recursive decomposition of lower frequency ranges, but features of high-frequency sub-bands are necessary for

speaker recognition. With the help of a pair of low- and high-pass filters, such decomposition is carried out by means of a wavelet packet transform (WPT).

Conclusion

A brief overview of the existing methods for extracting acoustic characteristics was carried out in this study. The main purpose of the work is to help choosing the technology when designing an important element of the speech system.

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INFORMATION SECURITY IN SMALL AND MEDIUM-SIZEDCOMPANIES/ENTERPRISES

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The article presents an algorithm for improving information security in medium and small business companies. The main threats arising in various enterprises associated with internet criminals and methods of their prevention are considered.

Keywords: information security, small and medium-sized companies, website hacking, viruses, data loss, threats.

ИНФОРМАЦИОННАЯ БЕЗОПАСНОСТЬ МАЛОГО И СРЕДНЕГО БИЗНЕСА

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В статье представлен алгоритм по повышению информационной безопасности в компаниях среднего и малого бизнеса. Рассмотрены основные угрозы, возникающие в различных предприятиях, связанных с интернет преступниками и методы их предотвращения.

Ключевые слова: информационная безопасность, малые и средние компании, взлом сайта, вирусы, пропажа данных, угрозы.

Nowadays, information technologies are developing quite rapidly. For example, according to the company 1C-Bitrix: Site Management [1] at the time of 2009-2010, about twenty percent of Russian companies used their own website. In 2014, research in the same field, but already by the 2GIS IT company [2] showed that fifty Russian companies already have their own website, and that the number of companies' websites has more than doubled in five years. To this day, such studies are yet to be conducted, but it is safe to say that every year there are more and more companies and organizations that put information about their business on the Internet. With the same confidence, we can hypothesize that the absolute majority of companies employ their own IT technology, which, in other words, means technologies and products which has purpose to create, process, store, extract and exchange all kinds of electronic data and information. This definition also fits both as an automated workplace consisting of one a personal computer, as well as a whole system of servers, websites, platforms, information systems, and so on. From the point of view of an information security officer, all that is listed above needs to be protected properly protection, as it is vulnerable to according threats.

Thus, according to the results of the NAFI study: "Almost half of small and medium-sized businesses in Russia faced various information threats in 2017", according to Sberbank analysts in

2018, the number of information attacks directed at small and large enterprises equaled, while, according to a study by Kaspersky Lab [3] in 2019, only 7 % of small enterprises have a higher than low level of information security. In addition, 10 system (technical) administrators who do not work in it companies were interviewed during this study.

Let us list the most important threats to small companies: • Site hacking; • Virus and malware infection; • Data loss from cloud and internal databases.

The object of the study were two companies: Promstroy certification LLC and SMK-Center LLC. At the moment, according to the algorithm described in the article, their data has never been exposed (since the last information failure in October 2017).

The result of the study is a gradual algorithm for improving the information security of the company based on the main threats to the companies of the above business segment:

Firstly, the fact of hacking the website, with subsequent manipulation of the company's data. According to NAFI for 2018, every fifth website of Russian companies was attacked from the outside.

Let us figure out what the main danger of the first threat is. The hacking itself is aimed at gaining access to users' personal accounts and their confidential information, thereby making it possible to act on their behalf, carry out financial fraud and put the company's reputation at risk.

The solution is to update passwords once a month. Logging into an internal account only from the work network. As well as setting up secure access via HTTPS, this is done so that the data transmitted through your site is encrypted and cannot fall into third hands.

It should also be indicated that it is better to log in to an internal account only from a working PC. The threat of hacking the site is also increased by the fact that small businesses cannot allow each employee to have a working PC, and the threat of infection / obtaining a password from an individual user with his PC is much higher than if he had a separate computer for work.

The second problem from our algorithm is infection with viruses and malware. The main danger is the ransomware virus. Cyberterrorists encrypt PC hard drive data and demand payment for decryption. A ransomware virus can be infected not only by installing a fake program, but also by opening attachments in an unfamiliar email.

The solution may be to notify all employees about the danger of opening suspicious attachments in emails. In addition, it is very important to update the software. The fact is that the catastrophic ransomware viruses WannaCry and NotPetya exploited a vulnerability in the Windows operating system, which was fixed long before these attacks began, thereby, a huge number of users could be safe if they updated the Windows version in time.

The third, often encountered problem is the loss of data. Many companies duplicate their data on cloud storage. Accordingly, getting access to the cloud by attackers can undermine the company's work. Also, many companies set up synchronization with local disk and cloud to work remotely. This is dangerous, because when data changes in the cloud, there is a danger of changing all the company's data.

Let us consider possible solutions to reduce the risk of "Brute force" attack. User is required to set up password expiration, then it requires more time for password guessing. User should also specify the possibility of rolling back the entire system (website, databases), which is useful against all hacker attacks (for small and medium-sized enterprises, this is much easier to do than for large corporations). In addition, and also, the simplest is the "complex" administrator password a, it is necessary to complicate password guessing.

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УДК 303.732

ABOUT THE ANALYSIS OF COMMODITY SALES ON E-COMMERCE PLATFORM

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There is a set of data on the sales of a food item on two Chinese e-commerce platforms (Tik Tok and Kuai shou). Divide it into different clusters through data mining for data analysis and prediction. In this way, it analyzes the eating habits and logistics characteristics of local China.

Keyword: e-commerce, data mining, clusters, data analysis.

Currently, fast-developing world, online shopping has become an indispensable part of people's lives. Online e-commerce platforms have gradually surpassed brick-and-mortar platforms. At the same time, the development of logistics is also based on the continuous increase of online e-commerce platforms.

At present, especially the most popular short video platform (Tik Tok), can also be used as an e-commerce platform. Through the combination of video and online sales, many people have been provided with employment opportunities. Through the existing data mining [1] methods, consumers can be analyzed more accurately and quickly, therefore, it could provide different decision-making for merchants.

The data analyses the sales order of a special food in August. It contains basic data: platform, sales volume, sales area. Among them, there were 10,752 sales orders in the current month, and the sales volume of each order are ranged from 1 to 10, which were sent to 21 different provinces in North and South China. However, because the data are not intuitive and cannot be directly analyzed, the data are optimized and adjusted. The optimization is as follows: 1. Change the single sales data to numerical type, which truly reflects each sales (range 1 to 10); 2. Change the data of the e-commerce platform to binary type, which are 1 (Tik Tok) and 2 (Kai shou). 3. Change the data of sales area to numerical type, it depends on the distance from the place of delivery (1 for the nearest, 23 for the farthest). 4. Add binary data. According to the geographical location of China, the receiving place is divided into 1 (south) and 2 (north).

Mainly, through the machine learning clustering method, it is divided into three clusters, and each cluster has different characteristics. Since the number of samples and characteristics are known, after many tests, the k-means algorithm is selected.

Among the advantages: 1. System clustering method can classify variables or records, K-means [2] method can only classify records; 2. The K-means method requires the analyst to know in advance how many categor the sample is divided into; 3. The requirements for multivariate normality and homogeneity of ies variance are high.

The result obtained is as follows fig. 1.

Cluster Composition Proportion Table

Cluster	Count	Fraction
1	2241	0.208
2	2253	0.210
3	6258	0.582

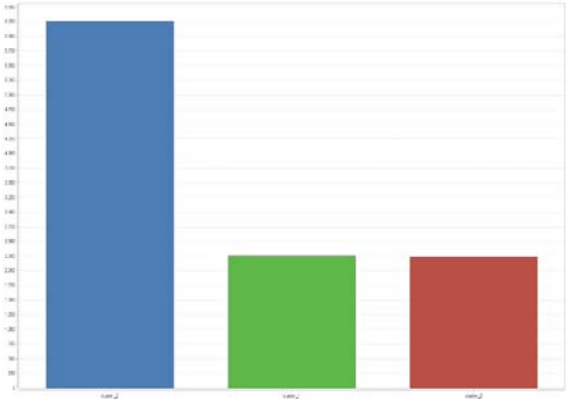

Fig. 1. Cluster classification results

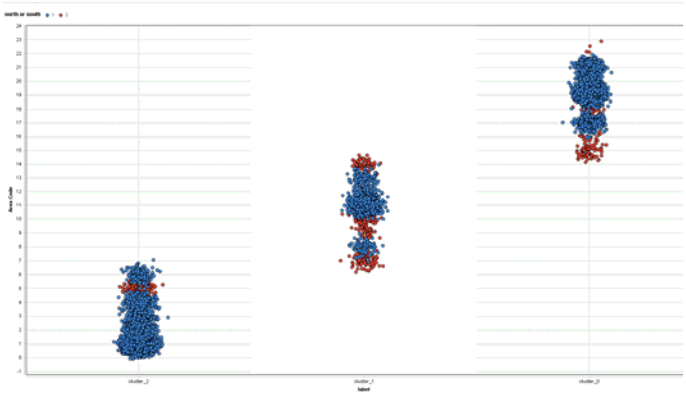

Fig. 2. Cluster scatter plot

Through clustering and data analysis:

1. Because the place of delivery is in the south, the sales place is still mainly in the south, and the closer the place is, the more similar the food culture is Fig. 2.

2. Compared with the impact of short videos, the sales volume on the Tik Tok's platform is still far greater than the sales volume of Kuai shou. Because the more popular the platform is, the more people will pay attention. 3. Customers, who purchase a lot of goods at a time, are located far away from the place of shipment. Due to the huge population flow in China, customers who choose to buy may be because of their love for the food because they have flowed out from the place of origin.

Therefore, through data mining [3] and analysis, combined with various machine learning algorithms. We can help very easily in various fields. Businesses can also make different plans and adjustments at any time through data analysis to achieve maximum benefits.

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METHOD FOR OBTAINING SECURE S-BOXES BASED ON THE INTEGRATION OF BOOLEAN FUNCTIONS

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On the example of the algorithm "Magma" described in the symmetric key block cipher standard GOST 34.12–2018, the article describes the method by which it is possible to formation secure S-boxes from existing ones using the algorithm for integrating Boolean functions with several arguments.

Keywords: Boolean function; directional derivative of Boolean function; integration of Boolean function; cryptographic criteria of Boolean function; S-boxes.

МЕТОД ПОЛУЧЕНИЯ НАДЕЖНЫХ БЛОКОВ ЗАМЕН НА ОСНОВЕ ИНТЕГРИРОВАНИЯ БУЛЕВЫХ ФУНКЦИЙ

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На примере алгоритма "Магма", описанного в стандарте блочного шифрования ГОСТ 34.12–2018, статья описывает метод, с помощью которого возможно получение надежных блоков замен из уже существующих с использованием алгоритма интегрирования булевых функций от нескольких переменных.

Ключевые слова: булева функция; производная булевой функции по направлению; интегрирование булевой функции; криптографические свойства булевой функции; блоки замен.

A cryptographic S-box (substitution-box) is an important component of any block cipher algorithm. An S-box replaces a block of multiple input bits with another block of bits, and this operation must be one-to-one. Therefore, an S-box is the lone component in a cryptosystem that gives rise to a nonlinear mapping between inputs and outputs.

An S-box is essentially a Vectorial Boolean function. In other words, it is a set of multiple Boolean functions with the same number of arguments. Not only the secret key determines encryption crypto-resistance. The cryptographic criteria of an S-box also have a significant impact. Therefore, it is very important that the algorithm uses S-box with "good" cryptographic properties.

In Russia, the symmetric key block cipher standard GOST 34.12–2018 has been adopted [1], which describes two algorithms: the block cipher algorithm with a block size of n = 128 bits ("Kuznyechik") and the block cipher algorithm with a block size of n = 64 bits ("Magma"). Both algorithms are widely distributed. The standard for each algorithm S-boxes that can be used, but they have low cryptographic strength. Public S-boxes can be used for personal purposes, but large organizations should not use them. An S-box must be kept secret in the same way as key information.

The article describes a way to form a set of Boolean functions from S-boxes by integrating Boolean functions using the example of S-boxes described in the standard for the "Magma" algorithm.

As part of the work, the method was developed that uses an algorithm for integrating Boolean functions, with the help of which it is possible to obtain new ones from some given Boolean functions. This method narrows the scope of the search for Boolean functions that have the desired cryptographic properties.

The result of integrating any Boolean function for which integration along the direction u is possible is not a single function, but a set of Boolean functions whose cardinality is $2^{2^{n-1}}$, where n is the number of arguments in the function. Thus, there are $2^{2^{n-1}}$ different Boolean functions in total, for which the derivatives in the same direction are equal, among all Boolean functions with n arguments. In this case, the cryptographic properties of derivative largely depend on the cryptographic properties of the original Boolean functions. Since there is a relationship between the properties of a Boolean function and its derivative, it is possible to obtain a function with the necessary cryptographic criteria from several derivatives taken in different directions.

This method makes it possible to find suitable Boolean functions very quickly by significantly narrowing the search area.

The block cipher algorithm "Magma" is a Feistel network of 32 rounds. The S-boxes have 4 input bits and 4 output bits. That is, each S-box is 4 Boolean functions with 4 arguments. In total, there are 65536 Boolean functions with 4 arguments. Brute-force with verification of their cryptographic qualities will take a lot of time.

Table 1 shows the values of the S-boxes described in standard GOST 34.12–2018.

In total, these S-boxes contain 5 Boolean functions that satisfy the strict avalanche criterion. All 32 functions are balanced and their nonlinearity is 4. The algebraic degree of most of the Boolean functions found is 3, however, there are 5 functions for which this cryptographic criteria is equal to 2, which significantly reduces the cryptographic strength of the entire S-box.

Based on these S-boxes, a search for new Boolean functions was carried out. As a result, 172 balanced Boolean functions with nonlinearity equal to 4 were found, for which the strict avalanche criterion is satisfied. These functions turned out to be enough to form a set of new 8 S-boxes shown in Table 2.

Table

Original S-boxes

S_0															
12	4	6	2	10	5	11	9	14	8	13	7	0	3	15	1
S_1															
6	8	2	3	9	10	5	12	1	14	4	7	11	13	0	15
S_2															
11	3	5	8	2	15	10	13	14	1	7	4	12	9	3	0
S_3															
12	8	2	1	13	4	15	6	7	0	10	5	3	14	9	11
S_4															
7	15	5	10	8	1	6	13	0	9	3	14	11	4	2	12
S_5															
5	13	15	6	9	2	12	10	11	7	8	1	4	3	14	0
S_6															
8	14	2	5	6	9	1	12	15	4	11	0	13	10	3	7
S_7															
1	7	14	13	0	5	8	3	4	15	10	6	9	12	11	2

Table 2

New S-boxes

S_0															
5	13	14	8	10	12	1	0	9	6	11	2	15	7	3	4
S_1															
2	6	0	9	13	15	8	10	11	4	3	12	5	1	7	14
S_2															
12	8	1	11	3	9	14	15	10	5	2	7	0	4	6	13
S_3															
4	2	5	13	12	3	10	11	7	14	1	6	9	15	0	8
S_4															
11	7	8	2	14	6	12	13	0	15	4	3	1	5	10	9
S_5															
14	6	12	9	11	0	15	5	1	2	13	10	4	8	7	3
S_6															
6	10	7	5	1	3	11	8	13	0	9	4	14	2	15	12
S_7															
3	9	2	14	15	8	1	4	12	13	7	5	10	0	11	6

Besides the fact that all functions satisfy the strict avalanche criterion, among the functions that make up the new S-boxes, there are only 4 with an algebraic degree equal to 2. Therefore, the resulting S-boxes have better cryptographic qualities than the original ones.

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TRENDS IN THE SCIENTIFIC AND TECHNOLOGICAL DEVELOPMENT OF THE PRODUCTION OF HOUSEHOLD REFRIGERATION EQUIPMENT

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The article presents the trends of scientific and technological development of the production of household appliances.

Keywords: scientific and technological development, household refrigeration, refrigeration equipment.

ТЕНДЕНЦИИ НАУЧНО-ТЕХНОЛОГИЧЕСКОГО РАЗВИТИЯ ПРОИЗВОДСТВА БЫТОВОЙ ХОЛОДИЛЬНОЙ ТЕХНИКИ

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В статье представлены тенденции научно-технологического развития производства бытовой техники.

Ключевые слова: научно-технологическое развитие, бытовая холодильная техника, холодильное оборудование.

The industry of household refrigeration equipment is rapidly developing. Many enterprises in the segment of household refrigeration equipment have chosen a strategy to improve the design and information content of products, while others focus on quality and service.

In the coming years, refrigeration equipment will be improved in the direction of reducing dimensions and weight based on the use of new thermal insulation and structural materials, improving noise and energy characteristics, equipment equipment with aggregated refrigerating machines, widespread use of electronic monitoring and control devices. Work is being carried out to improve the temperature and humidity conditions in the cooled chambers, to create low-temperature equipment for intensive cooling of products using air coolers [1].

In the global refrigeration industry, there is no common understanding and approach to solving the environmental problems that have arisen, which forms the first trend in the scientific and technological development of the production of household refrigeration equipment – strengthening the environmental safety of household refrigeration equipment by increasing the efficiency of technological processes and improving production technology.

Since the beginning of the XXI century, first of all in the mechanical engineering of developed countries, a recycling trend has gradually begun to form, the essence of which is to ensure the use of such materials and such methods of their processing that allow the reuse of parts, components of equipment and machines based on the use of effective recycling technologies. Such a trend, aimed

at ensuring conditions for the complete disposal of packaging materials, develops when using biodegradable materials.

The second trend is the introduction of more complex information technologies (control and measuring devices, automation tools) in the operation of household refrigeration equipment.

To date, almost every major manufacturer of refrigeration equipment has at least one model of a "smart" refrigerator. The new "smart" refrigerator has a microcomputer. The purpose of a microcomputer is to perform a number of tasks. These include: processing of readings from sensors, making appropriate decisions according to them; connection to a Wi-Fi network to be able to remotely control all refrigerator settings via the Internet network, as well as interaction with other devices with the status of "smart"; a wide variety of applications to run on the touch screen.

Most often, the necessary electronic components are produced not by manufacturers, but by computer companies. Intel, Microsoft, Amazon, IBM have already become famous among them [2].

The third trend in the scientific and technological development of household refrigeration equipment is to increase energy efficiency.

Refrigeration equipment consumes approximately 20 % of the electrical energy produced. Therefore, increasing energy efficiency is a priority in creating a new generation of household refrigeration equipment. This goal can be achieved by implementing three technological directions: Constructive improvement of the elements of refrigeration equipment (new types of thermal insulation, changing the thickness of the walls of thermal insulation); Use of new alternative working bodies (solutions of refrigerants/oils); Introduction of nanotechnology [3; 4].

Over the past 10 years, successful examples of the use of quantum technologies in cooling solids have appeared in science.

One such example is the work of researchers from the National Institute of Standards and Technology (NIST), who demonstrated a solid-state refrigerator using quantum physics in micro- and nano-structures to cool a much larger object to extremely low temperatures.

Another elegant way to use quantum technologies to generate cold was proposed by researchers from the University of Michigan — Pramod Reddy, Edgar Meyhofer and their colleagues. It is based on a widespread device – an LED (LED). Physicists report this in their message in Nature.

The fourth trend is the improvement of the design of household refrigeration equipment.

The role of the design of household items is increasing all over the world. Most foreign manufacturers of household refrigeration equipment diversify the design of their products to cater to the needs of all consumers. An example of a diversified household refrigerator design model is the modular refrigerator of the Austrian company Electrolux, designed by Stefan Buchberger – Flatshare [4]. A feature of its design is a combination of style and maximum ergonomics, the ability to lay out a refrigerator and use each module separately.

The fifth trend is the improvement of after-sales service, the creation and expansion of a network of service centers in the territories of consumer countries.

In addition to the deployment of production on the territory of consumer countries and global exports, among the leading enterprises in the field of production of household refrigeration equipment, over the past decade, there has been a tendency to create a network of after-sales service centers (warranty and post-warranty) on the territory of consumer countries. The presence of official service centers on the territory of the consumer's country solves the problem of availability of high-quality maintenance (repair) of refrigeration equipment. In the absence of such networks, consumers have to turn to unofficial services, the quality of which is much lower than official centers, or send equipment to the manufacturer's country through official sales centers – which negatively affects demand. The presence of after-sales service centers on the territory of consumer countries is necessary to maintain a decent level of competitiveness of products on the international market.

The sixth trend is the modernization and disposal of old equipment.

Thus, the trends of scientific and technological development of the production of household refrigeration equipment are: strengthening the environmental safety of household refrigeration equipment by increasing the efficiency of technological processes and improving production technology; introduction of more complex information technologies (control and measuring devices,

automation tools) in the operation of household refrigeration equipment; improving energy efficiency; improving the design of household refrigeration equipment; improvement of after-sales service, creation and expansion of a network of service centers in the territories of consumer countries; modernization and disposal of old equipment.

As mentioned above, the refrigeration industry is developing rapidly, in these conditions it is extremely important for Russian manufacturers not to stand still now – not to increase, but to reduce the lag behind the world leaders in the scientific and technological development of household refrigeration equipment. The Government of the Russian Federation should clearly see this and use more tools of state support and stimulation of scientific and technological development of enterprises of complex household appliances. It is necessary to study the successful foreign and domestic experience in stimulating and supporting the scientific and technological development of enterprises, adjust (adapt) it and use it in the conditions of the modern Russian market economy.

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IMPLEMENTATION OF THE HUMAN-MACHINE INTERFACE IN THE INTERNET OF THINGS

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This paper discusses possible ways to implement a human-machine interface in modern Internet of things systems.

Keywords: human-machine interface, voice control, Internet of Things.

РЕАЛИЗАЦИЯ ЧЕЛОВЕКО-МАШИННОГО ИНТЕРФЕЙСА В СИСТЕМАХ ИНТЕРНЕТА ВЕЩЕЙ

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В данной работе рассматриваются возможные способы реализации человеко-машинного интерфейса в современных системах Интернета вещей.

Ключевые слова: человеко-машинный интерфейс, голосовое управление, Интернет вещей.

The development of microelectronics, digital circuitry and communication technologies, as well as various sensors and actuators, made possible the emergence of the so-called Internet of Things (IoT for short), which is a set of devices that interact with the outside world, as well as exchanging signals with each other via a network data transmission without human intervention. However, a person is not completely excluded from such interaction – he is assigned the function of controlling or managing terminal devices, but such interaction is minimal and occurs sporadically. For this reason, almost all Internet of Things devices either do not have an interface for human interaction at all, or these interface capabilities are extremely simplified – they look like LED indicators and microswitches (buttons) or a small LCD screen with touch control; for some IoT devices, this function is performed by a web interface or a separate mobile application that runs on a smartphone or tablet. However, in most cases, even these types of interface are redundant or inapplicable for constructive or financial reasons.

The main ways of interaction between a person and devices of the Internet of things include: voice interface, control using a liquid crystal touch screen, as well as physical control of switches, be it buttons, switches, triggers.

Previously, controlling a device with your voice was only possible in science fiction. Until recently, it was considered the field of artificial intelligence. However, with the development of GI technology has become more common, people are increasingly enjoying the benefits of this non-contact technology.

Synthesis is one of the forms of speech processing associated with the task of reading the electronic text recorded in its memory by the subscriber system. There are several methods for speech synthesis. The first of these is to build words by combining phonemes and allophone. The resulting phonemic sequence, after choosing the pitch and intonation, turns into speech. With this approach, quite understandable speech is generated, but it is clear to the listening user that they are being spoken by a robot. The second method of speech synthesis is to simulate it using a model of the human vocal tract [1].

Speech recognition (also "automated speech recognition", "computer speech recognition", or "speech to text") is a technology for recording human speech as text. Speech recognition should not be confused with voice recognition: speech recognition is aimed at converting spoken speech into text, while voice recognition is used to identify individual users by voice.

The following is a brief description of the most popular methods: natural Language Processing (NLP): Although NLP is not a required algorithm for speech recognition, this branch of artificial intelligence focuses on human-computer interaction through speech and text.

Speaker diarization (or splitting): Speaker splitting algorithms detect and split the speech stream into segments based on the number of speakers. This helps programs to more effectively isolate individual participants in a conversation and is often used in contract centers to separate the speech of customers and sales agents. [2]

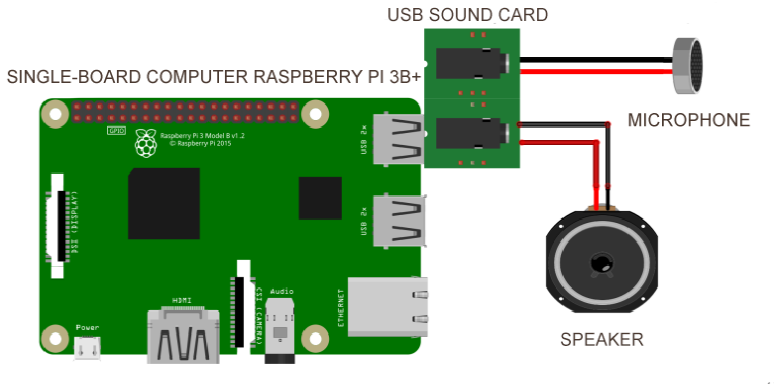

Fig. 1. Speech synthesis and recognition devices based on the single-board computer Raspberry Pi 3

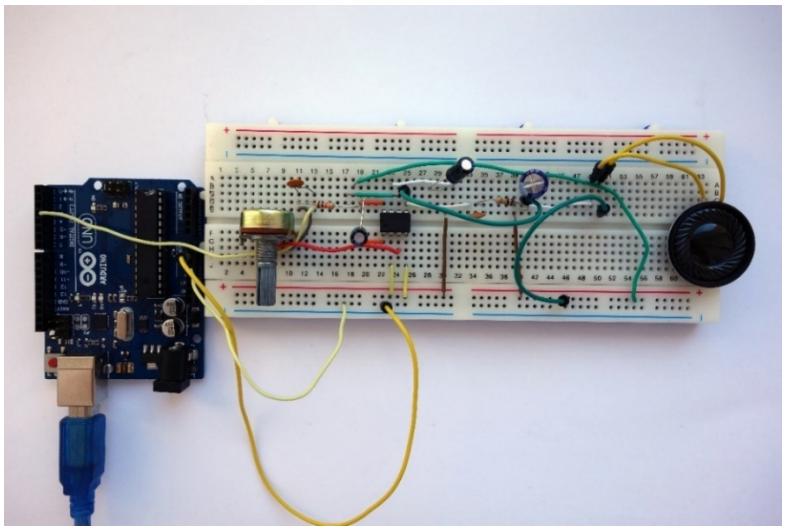

Fig. 2. Device based on Arduino UNO microcontroller

A speech synthesis and recognition device consists of the Raspberry Pi computer itself, a sound card with a USB interface and a microphone connected to it for recognition and a speaker for outputting synthesized speech.

The speech synthesis device includes the following blocks: the microcontroller board itself, a set of wires, a set of resistors with a resistance of 10 kOhm and 100 kOhm and a variable resistance resistor for using it as a device volume switch, a set of capacitance capacitors, a low-frequency amplifier LM386, speaker.

In conclusion, it should be noted that this type of interface: firstly, must be able to recognize voices, taking into account intonation, accent and some speech defects, and also generate answers by adding words in accordance with the rules of the language. Secondly, it must be trained to recognize natural speech: when asking someone a question, we do not adhere to a certain formulation, we simply ask a question. Thirdly, the system must have sufficient vocabulary and a comprehensive understanding of grammatical structures to be useful for a wide variety of tasks given by different users.

But it is worth noting some disadvantages of this method. For example, incorrect transmission, if necessary, of any graphic objects or tables, as well as a very large amount of voice information, due to its continuous flow and not being displayed in a graphical form for memorization.

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BLOCKCHAIN AND CRYPTOCURRENCY IN THE INTERNET OF THINGS

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The work investigates the essence of the Internet of Things as a system of combining physical objects to interact with each other without human interaction. This paper presents a more detailed description of the Internet of Things and the classification of cryptocurrency systems. The necessity of using blockchain and cryptocurrencies in the Internet things is indicated. I

Keywords: Internet of Things, cryptocurrency, blockchain, cyber-physical systems.

БЛОКЧЕЙН И КРИПТОВАЛЮТА ИНТЕРНЕТ ВЕЩЕЙ

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В данной работе исследуется сущность интернет вещей, как системы объединения физических предметов для взаимодействия друг с другом без взаимодействия человека. В статье представлено более подробное описание интернет вещей и классифицирование систем криптовалют. Обозначена необходимость использования блокчейна и криптовалют в интернет вещах.

Ключевые слова: интернет вещей, криптовалюта, блокчейн, киберфизические системы.

According to the generally accepted definition, the Internet of Things (IoT) refers to the concept of a computer network of physical objects (things) equipped with built-in technologies for interacting with each other or with the external environment. The organization of such networks is considered as a phenomenon capable of reconstructing economic and social processes and excluding human (intermediary) participation from them [1].

Devices, vehicles, household appliances, portable electronics, thermostats, mobile phones – all these elements are designated by the word "things" when referring to the Internet of Things. In fact, "Internet of Things" is a generalizing phrase used to refer to the growing number of digital devices that can connect to a larger communication network.

At the same time, it is necessary to understand that IoT is not only a refrigerator that orders your favorite food by itself, or a kettle that boils water on command from a smartphone. These are also smart sensors in the fields and drones with cameras that allow you to monitor the state of the soil, as well as sensors in public transport and unified systems for monitoring the life of the city. In other words, in a few years the world around us will become the Internet of Things [1].

The Internet of Things was discussed as a network of smart devices back in the 1980s. Today, IoT includes artificial intelligence, real-time analytics, machine learning, tracking systems and cloud storage. Automation has opened up more devices for daily personal and corporate use than

ever before, and with the growth of more technological innovations, new ways of interacting between them are emerging. These methods are becoming more complex and more interconnected, pursuing the main goal: to improve the existing infrastructure and create a system capable of storing data without human intervention [2].

It is important to note that the network provides a private blockchain, not a public one. The structure looks like this: blockchain containing transactions; gateway for device management; network administrator who adds devices and users to the blockchain; a regular node (user) that stores blocks; a device (sensor, phone) that does not store blocks.

In this work, the issue of the essence of the Internet of Things was considered, the classification of cryptocurrency and blockchain systems was analyzed, and advantages and disadvantages of the above mentioned systems in the Internet of Things were determined. This analysis helped to conclude that there is an objective need to use these systems.

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THE ADVANTAGE OF USING THE ENSEMBLE METHOD OF TIME SERIES FORECASTING

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The article discusses the methods of forecasting time series, determining their pros and cons, as well as the advantages of the ensemble method.

Keywords: time series, forecasting method, neural network, machine learning.

ПРЕИМУЩЕСТВО ПРИМЕНЕНИЯ АНСАМБЛЕВОГО МЕТОДА ПРОГНОЗИРОВАНИЯ ВРЕМЕННЫХ РЯДОВ

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В статье рассматриваются методы прогнозирования временных рядов, определение их плюсов и минусов, а также преимущества ансамблевого метода.

Ключевые слова: временной ряд, метод прогнозирования, нейросеть, машинное обучение.

Introduction. A time series is an ordered sequence of values of an indicator over several time periods[1]. The main characteristic that distinguishes a time series from a simple data sample is the specified measurement time or the number of changes in order.

Time series analysis extracts meaningful statistics and other characteristics of a dataset to understand it. Time series analysis can help to make more accurate predictions, but this is not necessarily the main purpose of the analysis. In practice, a suitable model is selected for a given time series and (in the case of supervised learning) the corresponding parameters are evaluated using known data values, the time series analysis process consists of methods that try to understand the nature of the series and are often useful for future forecasting and modeling.

Forecasting methods. he main statistical methods of forecasting time series are [2]: the method of trend selection (time smoothing), regression, autocorrelation, adaptive (moving averages), the method of harmonic analysis, singular spectral analysis, bootstrap (numerical multiplication of samples) and neural network. The ideology of these methods is briefly described below, the basic definitions from mathematical statistics are given and the basic equations of the corresponding models are given

The moving average (MA) model consists in the fact that to determine the properties of a time series for the purpose of a short-term forecast, a sample of the latest data for a certain period of time is taken. A modification of the MA model is a weighted MA scheme, when the current level is estimated by the weighted average of all previous levels, and the weights of observations decrease as they move away from the last level, i.e. the information value of observations is recognized the

greater the closer they are to the end of the observation interval. But the disadvantage of the method is the shortening of the smoothed series compared to the actual one, and therefore the loss of information

Neural network methods use a mathematical model of neural networks, on the basis of which the brain of humans and other living beings functions. The basis of the network is a neuron – a device that has an input, it converts the received signal and transmits it to the output and then further along the network to the neurons connected to it. The network is configured for use by training — the network is trained on the basis of known examples (values of a series), receiving rewards for the correct answer (for example, a forecast) or an answer within accuracy and punishment for an incorrect answer. Thus, the resulting answer is probabilistic in nature. The peculiarity of the neural network is that the creator does not need to know the regularities of the series when training the network, it learns by itself, using examples. This is also the weak point – the network can give very accurate answers without specifying how they turned out, representing a "black box". The neural network approach is often very effective in cases where other methods are unworkable, it is tolerant to an acceptable number of erroneous training examples, but it also has weaknesses. These include the relativity of the answers given, the high computational cost of training, and the lack of guarantees of the acceptability of the result of using the method.

Autoregression. For the application of autoregressive models, it is desirable to have a time series, the autoregressive function of which has a small number of maxima and decreases quite quickly with an increase in the autocorrelation step. If there is a cyclicity of data that changes over time, then it is usually not possible to completely eliminate it by various smoothing methods. In this case, autocorrelation models are applied at the stage of qualitative analysis, the accuracy of which should be improved using other approaches.

Fourier. The Fourier analysis is the most suitable[3]when studying time series for predicting natural phenomena. This method eliminates misconceptions or false theories about the presence of certain rhythmically changing quantities, their effectiveness and interrelation. All taken together, this analysis makes it one of the most important tools of scientific research. The disadvantages of this method include the dependence of the obtained periodicities on the length of the original series. A series of observations should always contain an even number of values, since when decomposed into a Fourier series, the time series is represented as the sum of the arithmetic mean of the data series (x) for the period (p), (n / 2 – 1) – the number of sines and (n / 2) – the number of cosines.

Ensemble method. Neural networks are quite popular. Their main advantage is that they are able to generalize rather complex data on which other algorithms show poor quality. But if the quality of the neural network is still unsatisfactory, it is advisable to use ensembles of neural networks.

An ensemble of machine learning algorithms is the use of several (not necessarily different) models instead of one. That is, first we train each model, and then we combine their predictions. It turns out that our models together form one more complex (in terms of generalizing ability — the ability to "understand" data) model, which is often called a meta-model. Most often, the meta-model is no longer trained on our initial data sample, but on the predictions of other models. It seems to take into account the experience of all models, and this allows you to reduce errors.

There are three reasons why an ensemble of models can be better than individual models included in the ensemble: 1. Statistical reason. The use of an ensemble of models averages the error of each individual model and reduces the influence of instabilities and randomness in the formation of hypotheses. Solving classification and regression problems is a search for hypotheses about the properties of the system or about the next state of the system. Hypotheses are put forward and evaluated for this purpose. 2. Computational reason. Most often, neural networks are trained by gradient algorithms, which may not fall into the point of the global minimum of the error function, but fall into the points of the local minimum. Ensembles of models trained on different subsets of the initial data have a greater chance of finding the global optimum, since they are looking for it from different starting points. 3. Representative reason. The combined hypothesis may not be in the set of possible hypotheses for the basic classifiers, i.e. by building a combined hypothesis, we expand the set of possible hypotheses.

Several approaches are applied to the construction of ensembles of models. Most often, the ensemble consists of basic models of the same type, which are trained on different data. Three approaches are used to form the ensemble output under certain conditions of the model outputs.

1. Voting. It is used in classification tasks. The class that was issued by the simple majority of ensemble models is selected.

2. Weighted voting. It differs from a simple vote by assigning weights (points) for the results of different models. The scores take into account the accuracy of different classifiers.

3. Averaging (weighted or unweighted). It is used when solving a regression problem with the help of an ensemble, when the outputs of the models will be numerical. The output of the entire ensemble can be defined as a simple average of the outputs of all models. If weighted averaging is performed, the outputs of the models are multiplied by the corresponding weights.

Conclusion

The paper analyzes the methods of forecasting time series, the ensemble method, determines its advantages over other methods, the main of which is the generalization of a large amount of fairly complex data, on which other algorithms show poor quality.

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INFORMATION AND COMMUNICATION SUPPORT OF THE ORGANIZATION'S PROJEC TACTIVITY

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The article presents materials on information support of project activity. The elements of information support and its main stages are revealed. To improve efficiency of information project support information transparency is required.

Keywords: communication activities, information support, information transparency

ИНФОРМАЦИОННО–КОММУНИКАЦИОННОЕ СОПРОВОЖДЕНИЕ ПРОЕКТНОЙ ДЕЯТЕЛЬНОСТИ ОРГАНИЗАЦИИ

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В статье представлены материалы по информационному сопровождению проектной деятельности. Выявлены элементы информационного сопровождения и его основные этапы. Показано, что для максимального повышения эффективности сопровождения информационных проектов необходима информационная открытость.

Ключевые слова: коммуникационная деятельность, информационное сопровождение, информационная открытость

In the modern world of information, communication activities cover all socio-economic spheres of society. Currently, every business project needs information and communication support. At the same time, the term “information support” does not have a specific definition.

It should be noted that advertising and PR can be considered as information support technologies, since the definition of PR includes a “communicative management function” [1] and “a management function that helps to establish mutually beneficial relationships and support between organizations and the public, which can lead to both success as well as failure" [2].

There are many distinctive features of social and commercial projects. The distinguishing features are goals, tasks that are taken into account when conducting information support, as well as technologies, information support resources, through which more information can be delivered.

Information support of project activities consists of such elements as determining target audiences and priority communication channels, media planning, publications in the media, preparing and running promotions, PR campaigns, press events, etc.

Dzyaloshinskiy I. M. and Dzyaloshinskaya M. I. note that the tasks of information support should maximally satisfy public interest in a certain project [3]. Depending on the specifics of the project, various technologies are used to bring information to a consumer.

A wide range of information dissemination (press releases, peer reviews, interviews, legends necessary for social networks) is considered to be an important aspect. The conditions for submitting information should include its uniqueness, regularity of its updating, reasonableness and constant feedback. To maximize effectiveness of supporting information projects, information transparency is necessary, which can be achieved by the possibility of full access to the necessary information.

Thus, information support helps to highlight the project, event, fact as much as possible. Information makes it possible to make decisions supported by awareness of what is happening. And as a result, the task of information support is to satisfy interest in the project, which involves informationdissemination that satisfies public interest as much as possible, as well as increases information availability of a project.

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COMPARATIVE ANALYSIS OF FACIAL RECOGNITION METHODS

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This paper analyses different methods and techniques that are the most efficient and accurate ones in terms of creating multi-factor based face validation systems and ensure increasing effectiveness as well as minimizing the risk of unauthorized premises access.

Keywords: face recognition, face detection, access control, facial recognition algorithms.

СРАВНИТЕЛЬНЫЙ АНАЛИЗ МЕТОДОВ РАСПОЗНАВАНИЯ ЛИЦ

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В данной статье анализируются различные методы и приемы, которые являются наиболее точными с точки зрения создания многофакторных систем распознавания лиц, и которые обеспечивают повышение эффективности и снижения риска несанкционированного доступа в помещения.

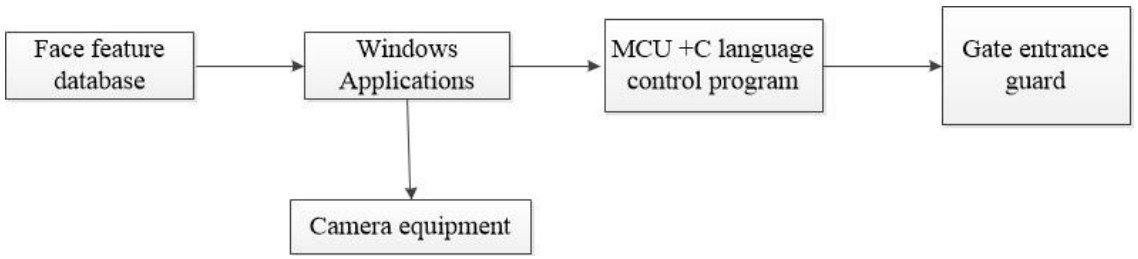
Ключевые слова: распознавание лиц, определение лиц, контроль доступа, алгоритмы распознавания лиц.

Face recognition is a modern technology that uses face image of someone to verify his or her identity by finding this person in a given photos database. It becomes very practical nowadays in access control systems because it does not require any physical interaction for gaining access. Moreover, these systems only require a camera for recognition and are easy to install and implement. That is why they are already in use by companies as access control to their offices, in home automation systems, etc. Various methods for face validation-based authentication systems have been applied in a number of access control applications. However, using only one biometric factor such as facial data may limit accuracy and use, and it is not practical in a real environment[1].

Nowadays face recognition system has wide application value and market prospect. So the problem of carrying out face recognition quickly and efficiently has become the most important issue at present. For higher education institutions, this technology can be applied in integration with the access control system by using a face as the second identifier in addition to campus cards that students and teaching staff use. Face recognition is a kind of biometric technology. It is based on some facial information people see, such as a pair of eyebrows, a pair of eyes, nose, mouth and other facial information to identify the location of authentication. The technology is aimed to collect images or video streams containing face feature points through camera to build face feature template database.

Then the detected person is compared with the feature points in the database, and the similarity value is used to determine the recognition result. The face recognition system consists of face image acquisition, face detection, face image preprocessing and face feature comparison.

A typical face recognition access control system is usually composed of hardware and software. The hardware includes: camera, main circuit control board, gate main machine. Software includes: face recognition, database reading and writing, communication with the lower computer. The main job of the access control system for face recognition is to collect face images, and then match the face images in the database after processing them. If the matching result is correct, the access control gate will be opened, as shown in Figure [2].



Technical diagram

Face recognition is achieved by calculating the correlation between the input image and the template image. However, there probabilities of failures due to the fact that there are vulnerabilities in any access control system. At present different methods are being introduced to decrease them and ensure higher accuracy of the systems. S. Shavetov and V. Sivtsov suggest a spoof detection method so that the system does not react to every approach to bypass the system like showing a photo of an allowed person shown on a phone's screen [2].

Some researchers propose a two-factor authentication system with an additional factor, a QR code technology to improve accuracy. Attendance is registered through an application on students' smartphones by scanning a QR code that appears on the teacher's projector screen. The instructor generates a QR code through the teacher's system, and a different QR code is generated every five seconds to prevent misuse [1].

At present the most popular face recognition algorithms are considered to be the following: the flexible comparison method on graphs, the principal components method, the Viola-Jones method, the support vector method, and the method of generating barcodes from a face image.

The essence of the flexible comparison method on graphs is to represent faces in the form of graphs with weighted vertices and edges. At the recognition stage, one of the graphs is the reference and remains unchanged, the other is deformed in order to best fit the first one. Gabor filters are used to calculate feature values in some local area of the graph vertex by convolution of pixel brightness values. The main idea of the principal components method is to represent images of faces as a set of principal components of images called proper faces. Proper faces have the property that the vectors of the face correspond to similar forms. The calculation of the principal components is reduced to the calculation of the eigenvectors and eigenvalues of the covariance matrix, which is calculated from the images. For each face image, from 5 to 200 main components are calculated. The recognition process consists of comparing the main components of an unknown image with the components of all known images.

The application of the support vector method to the problem of face detection is to search for a hyperplane in the feature space separating the class of face images from the images of "non-faces". This method is a powerful classifier used at the face recognition stage. The algorithm can be trained by any of the existing methods of face detection in the image.

These methods of face recognition show approximately the same accuracy indicators under normal conditions – full-face capture, neutral lighting, absence of noise, etc. However, in real authentication systems it is quite difficult to meet these requirements. The comparison of these methods is

carried out under the influence of dynamics of faces, changes in brightness, the presence of noises and turns of the face, as well as aging of a face. An analysis of the effectiveness of recognition algorithms is given in Table.

Results of effectiveness of facial recognition algorithms in different working conditions

Algorythms / Conditions	Method of bar-codes generating	Flexible comparison method on graphs	Principal components method	Viola-Jones method	Support vector method
Dynamics of faces	100 %	90 %	75 %	98 %	97 %
Changes in brightness 20 %; 40 %	82 %; 50 %	53 %; –	50 %	72 %; 70 %	55 %; 39 %
Presence of noises	78 %	81 %	86 %	94 %	80 %
Aging	100 %	–	50 %	–	–

The analysis of facial recognition methods has shown that there is no ideal method that would not have an error in real working conditions. Therefore, the use of two-factor systems will be the most effective and justified in terms of eliminating errors in the operation of facial recognition systems for controlling access to the premises.

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ANALYSIS OF ACTUAL AND REQUIRED FUNCTIONALITY LEVELS OF AEROGEO AIRCRAFT FLEET

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The article presents an analysis of the actual and required levels of serviceability of the fleet of aircraft according to the statistical reporting of form No. 34 GA of the AeroGeo aviation enterprise.

Keywords: actual serviceability, required serviceability, annual fund, statistical reporting, quarterly fund, total downtime.

АНАЛИЗ ФАКТИЧЕСКИХ И ПОТРЕБНЫХ УРОВНЕЙ ИСПРАВНОСТИ АВИАПАРКА ВОЗДУШНЫХ СУДОВ АВИАПРЕДПРИЯТИЯ «АЭРОГЕО»

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В статье представлен анализ фактических и потребных уровней исправности парка летательных аппаратов по статистической отчетности формы №34 ГА авиапредприятия «АэроГео».

Ключевые слова: исправность фактическая, исправность потребная, годовой фонд, статистическая отчетность, квартальный фонд, суммарные простои.

The purpose of the work is to analyze the efficiency of the use of the fleet of aircraft according to the statistical data of the airline.

The paper calculates the required and actual levels of serviceability and efficiency of the use of the helicopter fleet of the AeroGeo aviation enterprise according to statistical data for the period from the first quarter of 2016 to the first quarter of 2020. Statistics contain data on the quarterly time spent by aircraft in certain operating conditions during the study period [1]. The study was carried out according to the method of MGTU GA [2] for the following types of aircraft presented in Table.

Types of aircraft involved in calculations

Types of aviation equipment	Mi-2	Mi-8T	Mi-8MTV
Number of units	4	15	1

Based on the data on the state of the fleet, the indicators of the actual serviceability of the K_{SERV} were determined – the ratio of the time during which the aircraft is in good condition, expression 1, as well as the $K_{\sum}$, the indicator of the total unit time spent, expression 2, expressed as a percentage:

$$K_{SERV} = \frac{T_{QT} - T_{FT} \cdot K_{DT}}{T_{QT}}, \quad (1)$$

$$K_{\Sigma} = K_{SD} + K_{DF} + K_{DT}. \quad (2)$$

The following values were used in the expressions: T_{FT} – flight time; K_{DT} – coefficient of specific downtime for technical reasons; T_{QT} – quarterly time fund; K_{DF} – downtime during flights, K_{SD} – serviceable downtime at the base airport.

Then, the arithmetic means values of the K_{SERV} serviceability indicators and the total specific downtime of the K_{Σ} were calculated according to expressions 3 and 4.

$$K_{\Sigma} = \frac{\sum_0^i K_{\Sigma}^i}{N}, \quad (3)$$

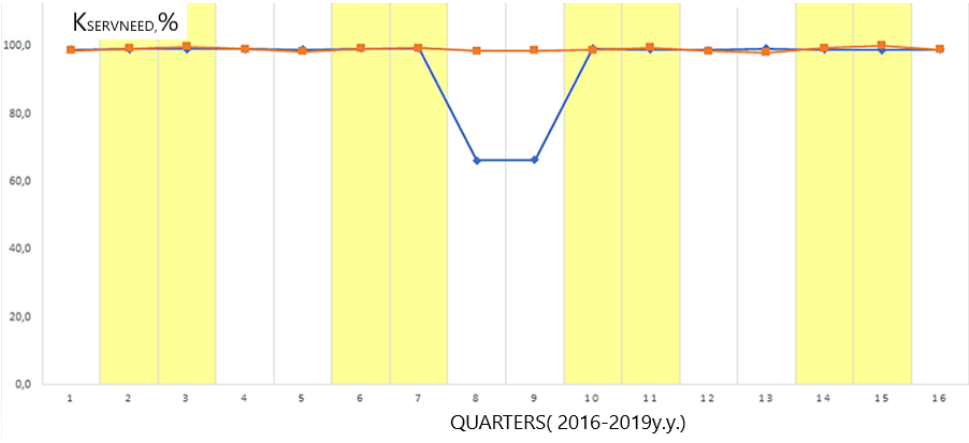
$$K_{SERV} = \frac{\sum_0^i K_{SERV}^i}{N}, \quad (4)$$

where i is the number of aircraft types, and N is the number of sides, for each type of aircraft.

The required level of serviceability of the fleet of $K_{SERVNEED}$ aircraft, expression 5, is determined for the planned period of operation, depending on the planned flight hours on the list fleet of a certain type of aircraft.

$$K_{SERVNEED} = \frac{T_{QT} \cdot N - T_{YEAR}^{PLANE} \cdot K_{DT}^{PLANE}}{T_{QT} \cdot N} \cdot 100\ \%. \quad (5)$$

It is shown that the value of the $K_{SEVNEED}$ depends on the estimated planned flight, the quarterly time fund and the number of aircraft fleet boards. By setting various parameters of the planned raid, certain values of the $K_{SERVNEED}$ were obtained for the period under consideration. Based on the obtained values, graphs of the dependences of the $K_{SERVNEED}$ on the operating time were constructed. For clarity, the graph shows the actual value of the K_{SERV}, Figure.



Graph of the dependence of the required and actual serviceability coefficients on the operating time of the AeroGeo airline

As a result of the analysis and comparison of the actual and required levels of serviceability for the AeroGeo airline for the period from the first quarter of 2016 to the first quarter of 2020, it is shown that the actual serviceability during this period corresponded to the required one.

To improve the level of serviceability of aircraft in the AeroGeo airline, it is necessary to:

a) reduce the time spent by aircraft waiting for repairs;
b) reduce maintenance downtime;
c) monitor the availability of spare parts;
d) increase the volume of air transportation; e) employ highly qualified specialists.

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ANALYSIS OF APPROACHES TO CONDUCTING AN AUDIT IN RUSSIA AND ABROAD

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The situation in the world market reflects that foreign companies, as a rule, occupy the leading positions. This is also typical for Russian audit firms, which are clearly inferior to foreign ones in the competition, in view of the obvious difference in methods. The purpose of this article is to conduct a comparative analysis of Russian and foreign audits and draw conclusions.

Keywords: Audit, technological audit, analysis.

АНАЛИЗ ПОДХОДОВ К ПРОВЕДЕНИЮ АУДИТА В РОССИИ И ЗА РУБЕЖОМ

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Ситуация, сложившаяся на мировом рынке, отражает, что лидирующие позиции как правило занимают зарубежные компании. Это характерно и для российский аудиторский фирм, которые в конкурентной борьбе явно уступают зарубежным, в виду явного различия методик. Цель данной статьи провести сравнительный анализ российских и зарубежных аудиторских проверок и сделать выводы.

Ключевые слова: аудит, технологический аудит, анализ.

The main need to adopt foreign audit methodology is due to the creation of such a mechanism for establishing new Russian auditing standards and their practical functioning, which would allow, within the time frame provided for the implementation of International Standards on Auditing (ISA) in auditing practice, to approve their national standards and put them into effect at the same time with international. It is also more rational to expand the boundaries of the use of the sampling method of audit in order to ensure its greater efficiency while maintaining the established level of quality. Therefore, it is necessary to provide appropriate information technology conditions. Next, let's compare the Russian and foreign approaches to auditing.

As a first criterion, consider the timeliness of updating audit standards. As international practice shows, ISA is revised as necessary, taking into account new requirements for audit quality and on the basis of generalization of established practice. In Russia, the practice of untimely revision or adoption of new FRAAS (Federal Rules for Auditing Activity Standards) is widespread in comparison with ISA. With regards to the procedure for introducing foreign standards into auditing practice, the following are the following: when the ISA is approved, timeframes from one to two years are given for their development and implementation. When the FRAAS are approved by a decree of the

Government of the Russian Federation, the period of their mandatory application, as a rule, is 10 days after their official publication. Considering such a criterion as the significance of an audit of internal control, ISAs suggest that an essential element of an audit to assert with reasonable certainty that the TSF is reliable is a comprehensive assessment of the organization's internal control. In Russian practice, more attention is paid not to the analysis of internal control, but to the verification of the correctness of accounting and compilation of the TSF. Another significant criterion is the sampling method, one of the audit methods used both in Russia and abroad. However, if in international practice it is considered as an advantage of verification, since it is more economical and accurate, in Russian practice it is considered as an inevitable minus of verification, since it is not accurate enough. An interesting question is what is focused on when conducting an audit in Russia and abroad. In Russia, the business transactions themselves are checked, i.e. turnovers on accounting accounts are considered as the basis of the client's financial position. Abroad, the items of the balance sheet and the income statement are checked, i. e. the balance is considered as the basis for the customer's financial position.

Thus, the modern concept of the development of regulation of audit activity in Russia can be characterized as a synthesis of predominantly state control and self-regulation. In world practice, there is also a convergence of forms of regulation of auditing, caused by the need to tighten requirements for the transparency of financial statements of public companies and the quality of their audits. In this regard, a system of new regulations has been developed, formalized in the United States within the framework of the adopted Sarbanes-Oxley Act, and in Europe, similar measures are provided for in the 8th EU Directive.

The goal of the International Auditing and Assurance Standards Board is to enhance the consistency of auditing practices and related services around the world by developing provisions on various auditing and assurance issues and promoting their worldwide acceptance.

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WASTE WATER TREATMENT OF TIMBER INDUSTRY ENTERPRISES BY FLOTATION METHOD

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The article discusses the effectiveness of innovative technology for cleaning recycled industrial water in the production of wood fiber boards by wet method, as well as capturing secondary wood fiber and returning it to the main production. A method of pressure flotation is proposed for cleaning recycled water from pollutants and capturing secondary wood fibers.

Keywords: innovative development, innovative technology, wood waste, flotation, timber industry.

ОЧИСТКА СТОЧНЫХ ВОД ЛЕСОПРОМЫШЛЕННОГО ПРЕДПРИЯТИЯ МЕТОДОМ ФЛОТАЦИИ

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В статье рассматривается эффективность инновационной технологии очистки оборотных промышленных вод в производстве древесноволокнистых плит мокрым способом, а также улавливания вторичного древесного волокна и возврата его в основное производство. Предложен метод напорной флотации для очистки оборотных вод от загрязняющих веществ, улавливания вторичных древесных волокон.

Ключевые слова: инновационное развитие, инновационная технология, древесные отходы, флотация, лесопромышленное предприятие.

In a market economy, the successful functioning of industrial enterprises is largely due to the effective mechanism of their innovative development. The study of economic practice shows that the importance of innovation for industrial enterprises in modern conditions is constantly growing.

The introduction of innovative technologies in an enterprise is a very complex process that requires taking into account all the factors that can affect the effectiveness of technological development. At the same time, without technical improvement of production, it will be more and more difficult for an enterprise to compete in the market. Therefore, it is imperative to improve the forms and methods of organizing production, introduce more modern technological equipment, and develop scientific and technical potential. The development of world and domestic industrial production, its current state and prospects indicate the need for the introduction of a resource-saving, environmentally and economically sound approach, and the organization of industry – waste-free (low-waste) production.

Today, methods of purification of industrial waste water are actively developing, but this problem has not been fully solved at the timber industry enterprises, since, due to the technological

process of these industries, consuming large volumes of water, they have a high degree of their pollution, thus causing the most significant damage to the environment.

Water supply for wood-fiber board manufacturing enterprises is carried out with water from rivers and nearby water bodies. The industrial sewerage system is discharged into a common sewage collector. The water is drained into the sewerage system periodically when the pool of circulating water is flushed.

During the study, the analysis of the technological process of the fiberboard production workshop of the woodworking plant of the Krasnoyarsk Territory was carried out. The analysis showed that the technology used is reliable and is entrenched in many forestry enterprises. However, we can conclude that this technology is not effective from the point of view of innovative development of technology. This conclusion is supported by the problem of the formation of a large amount of wood waste in the wastewater of the enterprise, which exists at many forestry enterprises. Since phenol-formaldehyde resins are used in the production of fiberboard, the problem of wastewater pollution has not yet found a solution at the enterprise.

It is necessary to improve the filtration process of fresh and recycled water used for industrial needs in order to purify the waste water of the enterprise and maximize the use of wood waste contained in water. One of the main products of the timber industry in the Krasnoyarsk Territory is wet fiber boards of the T grade (Group B). Its production is carried out in the fiberboard production department of the woodworking plant. Wet production requires 2,000 m^3 of water per ton. slabs, of which 27.99 m3 are fresh and the rest is recyclable.

Consumption of fresh water per hour is 286.7 m^3, discharge of water, which contains contaminants, into the sewerage system is 319.6 m^3/hour. The main pollution of wastewater from wood fiber production is suspended and soluble organic substances, their content in the wastewater of the plant is approximately 595.54 tons per year. Dumping fiber with wastewater is a serious problem with both negative environmental impacts and economic losses.

Fiber recovery is of great technological and economic importance. Extraction of wood fibers from discharged waters will maximize the use of raw materials for which costs have already been made. Another advantage is a reduction in the consumption of fresh water per unit of plates produced, due to the more complete use of recycled water. In addition, a decrease in the content of fibrous substances in waste water creates favorable conditions for the subsequent treatment of waste water at treatment facilities [1].

Since the main source of wastewater is excess circulating water, in an amount of 200 m^3/hour, and containing a large amount of clean, well-prepared fiber that got into the circulating water during dehydration of the web in the register section of casting machines, it is advisable to ensure that it is purified. For the purification of recycled water, it is proposed to place a TF type pressure flotation unit in the fiberboard production workshop of a woodworking plant. Forced flotation is a process in which air, dissolved in water at high pressure, is used to float contaminants to the surface. When air and water are mixed under pressure, air dissolves in water in an amount proportional to the pressure value. Upon subsequent release of pressure, air is released from the mixture, forming microscopic bubbles, which are released to the surface, carrying suspended contaminants with them.

Flotation machines TF serve for purification of industrial and municipal waste waters from many types of suspended solids, oil products, BOD, COD, synthetic surfactants and other contaminants. They can be used as the primary and only stage of treatment, and also as additional equipment to improve the quality of water treatment. Structurally, the TF skimmer is a circular tank made of stainless steel, on top of which a rotating bridge structure (bridge) is installed [2].

Having studied the technology of collecting wood waste from industrial effluents using a flotation unit, it can be concluded that this method is fully suitable for the implementation of wastewater treatment of an enterprise.

The quality of the fiber caught by the skimmer corresponds to the fiber of the main composition in the production of fiberboard. The caught wood fiber can and should be returned to the main production in front of the casting machine, without disrupting the technological process of fiberboard

production and without changing the temperature regime of pressing the boards. This approach to the use of wood waste at the enterprise is the most appropriate.

A project was developed to introduce a wastewater treatment system and wood fiber recycling into the technological process at a timber processing enterprise. The project involves the placement of a TF type flotation unit in the fiberboard production department of a woodworking plant. Most of the suspended solids, namely wood fibers, are in the circulating water tanks. It is planned to place pumps near the tanks, supplying excess circulating water to the unit's reservoir. Water, together with wood fibers, undergoes purification, that is, the flotation process. Thus, the project does not imply interference in the technological chain of fiberboard production, but only increases the volume of raw materials for production. Moreover, costs have already been incurred for this raw material, and the same raw material is irretrievably lost when discharging wastewater.

Obviously, in the current situation, each forestry enterprise must maximize the use of all wood resources, including wood waste. The considered system of pressure flotation can be implemented at the enterprises of this industry, which will not only increase the volume of production, but also reduce the harm caused to the environment. The main prospect for the development of wastewater treatment, including industrial wastewater, is the integrated use of physicochemical and biological methods. New norms and rules for enterprises in the field of wastewater discharge are closely related to the development of innovative technological solutions and equipment, which allows organizing effective disposal and treatment of industrial wastewater. However, in Russia there are many timber industry enterprises built in Soviet times, for such enterprises the introduction of such an innovative technology as flotation treatment is a necessary step in the development of production.

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RESEARCH ON PROJECT APPLICATION OF ERP FINANCIAL MANAGEMENT IN ELECTRIC POWER ENTERPRISES

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At present, power companies are facing high-intensity competitive pressure. In order to better achieve their own sustainable development, they need to optimize their operation and management models. As the top priority in the operation and management of electric power enterprises, financial management will inevitably attract great attention. This paper introduces the ERP financial management model and discusses its project implementation and application.

Keywords: Electric power enterprises, ERP, financial management, projects, measures.

At the current stage of the deepening development of my country's market economy, the power industry has also undergone great changes, the competition pressure of power companies is greater, the traditional monopoly business model has been broken, and higher requirements have been placed on the operation and management of power companies [1]. For the operation management of electric power enterprises, in order to ensure a more reasonable operation, it is urgent to take effective control measures in terms of enterprise income, cost, profit, assets and liabilities, cash flow status, etc. and real-time financial information so as to play a guiding role in various business activities of the enterprise. However, at present, the traditional financial management model has been difficult to adapt to the current development demands of electric power enterprises, the implementation and application of ERP financial management project is extremely necessary, and has high research and promotion value.

ERP financial management is mainly based on systematic management ideas. Within the whole group, it establishes operational business applications through business classification, and provides a management platform for decision-making means for enterprise employees and decision-making layers, including human resources, finance, materials, sales, equipment, project management and other functional modules, through the intensive management and control of the system, realize the shared services of the group or region, and realize the integration of business and finance. For the application of ERP financial management mode in electric power enterprises, it has become an important way that is different from traditional means [2]. Its practical application shows the following characteristics: ERP financial management can better realize the integration of capital flow, logistics and information flow; collaborative processing ensures more efficient and orderly operation management; the application of ERP financial management shows stronger integration characteristics, which can comprehensively use a variety of technical tools and information methods to achieve optimal control of traditional management objectives, and ultimately improve the overall financial management efficiency and level; ERP financial management shows strong flexibility in practical application, and can feed back relevant information in a more timely and efficient manner to ensure more reasonable operation and management of power enterprises, and plays a prominent role in forecasting and decision-making; ERP can provide a more refined form of cost control, and cost control plays an important role in improving the competitiveness of enterprises.

The application of ERP financial management projects in power enterprises has stronger advantages over traditional financial management models [3]. In practical applications, it can not only promote the development of power enterprise informatization, but also help to exert information

sharing and application value, and become the optimization of future power enterprises from the perspective of financial management personnel of electric power enterprises, because relevant staff are currently facing higher work pressure, the financial information to be processed is more complicated, and the corresponding business processing is more difficult, and some obvious problems are likely to occur. However, after the application of ERP financial management projects, financial managers can obtain real-time business information with the help of ERP information system integration, whether it is information collection, transmission and analysis applications, it can show stronger convenience. While reducing the workload of financial management personnel, it can also better ensure the accuracy of information, especially in the processing of reports and accounting, it can automatically capture and establish data warehouses through data, reducing the need for financial personnel to prepare reports and accounting. It can provide a basis for the use of big data technology for financial analysis in the future. From the perspective of the development of electric power enterprises, the marketization of electric power trading makes electric power enterprises face greater competitive pressure. As a key link, financial management should be highly concerned. It is necessary to promote relevant financial information to better serve the operation and management of electric power enterprises. The application of ERP financial management project can play an obvious advantage in this aspect, and play the role of financial budget and cost control to better serve the operation and management of power enterprises. It can obtain more comprehensive and rich financial data information, and then can better realize the optimization assistance for all aspects of its own decision-making, which promotes higher operating efficiency of power enterprises. Finally, the application of ERP in financial management can better play this role. Two advantages are: through the establishment of multi-dimensional budget and refined cost control, cost control and analysis can be achieved.

The implementation and application of ERP financial management projects in power enterprises often need to focus on the reconstruction of the financial accounting process, so that the financial accounting process is more in line with the new requirements and can show a stronger role value in the new model. The application of ERP financial management projects in electric power enterprises needs to fully consider the comprehensive reconstruction of the financial accounting process, and strive to better share data with the help of information technology. With the help of the centralized control system, the entire application process of financial data information can be taken into account and processed. Capabilities and information feedback mechanisms can be optimized.

The implementation and application of ERP financial management projects in electric power enterprises often need to focus on budget management, which is also the core task of financial management. With the help of comprehensive budget management, the operation of electric power enterprises can be better optimized, which is conducive to the improvement of final economic benefits. Based on the implementation of comprehensive budget management in the implementation of ERP financial management projects in power enterprises, it is necessary to first make unified planning based on the whole company, and clarify the specific requirements and goals of budget management, and then carry out follow-up work purposefully to ensure that budget management can be implemented to achieve optimal control at the economic level. Budget management provides budget preparation, control and execution analysis, supports multi-scheme and multi-version management in the process of budget preparation, provides the process of preparation, approval and repeated revision between upper and lower levels, and supports bottom-up summarization and top-up budget management TTo sum up, in the current stage of the optimization and development of the financial management of electric power enterprises, the implementation and application of ERP financial management projects has attracted more and more attention. At the same time, it focuses on the optimization and control of the whole process of financial management, effectively integrates business and finance, reconstructs the financial accounting process, does a good job in comprehensive budget management, and plays the core role of financial management in enterprise operation and management.

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E-COMMERCE CUSTOMER DIVISION AND PERSONALIZED RECOMMENDATION SYSTEM BASED ON DATA MINING TECHNOLOGY

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On the basis of summarizing related research at home and abroad, this paper enumerates two typical application examples of data analysis and mining in the refined operation of e-commerce websites: one is to use the K-Means cluster analysis method of SPSS to conduct customer analysis. Subdivision, classification and classification, different marketing strategies are adopted for customers of different levels; one is the application of recommendation system based on big data analysis and mining in e-commerce websites.

Keywords: operation; electronic recharge card; RFM model; K-Means clustering; personalized recommendation

1. Overview

1.1. Research background

The competition of modern business is very fierce, customer resources have become an important asset of e-commerce companies , and they are the assets of the best value, and customer groups often determine the life and death of modern e-commerce companies. Providing customers with the goods and services that customers need is only the most basic benefit for the e-commerce industry. Facing increasingly fierce market competition, e-commerce companies must shift their focus from profits or products to customers. Major e-commerce platforms will also use buyer information.

Preference tags, user browsing behavior data and purchase transaction data such as buyer search, favorites, and adding to shopping carts are extended to make judgments and make personalized recommendations for buyers.

1.2. Research status

1.2.1. Current status of foreign research

Foreign data mining technology has been used for a long time. The well-known story of "beer and diapers" is a marketing myth. "Beer" and "diapers" are two seemingly unrelated products. Selling together and obtaining good sales income, in fact , the method to study the correlation between "beer and diapers" is shopping basket analysis. King" . As the world's largest retail supermarket chain, WalMart uses data mining technology to obtain the conclusion that the WalMart branch with good diaper sales also has high beer sales.

1.2.2. Domestic research status

Data mining can facilitate enterprises to better understand the market, and many domestic enterprises have gradually begun to implement data-based operations. Especially in the application of e-commerce companies is extremely important. For most e-commerce companies, the marketing cost of acquiring traffic and new users is getting higher and higher, and it is difficult to continue to rely solely on the previous "burning money" for subsidies and price wars to open up the market. E-commerce companies have to transform old ideas and find ways to move from marketing ideas to customer marketing ideas.

1.2.3. Research significance

Through big data analysis and mining methods, e-commerce companies can better understand customers, meet customers' individual needs through refined operations, and focus on mining the lifetime value of a single customer. While meeting the individual needs of customers, it creates more profits for the e-commerce platform.

2. Divide customers – RFM model

According to research by Arthur Hughes of the US Database Marketing Institute, there are 3 magic elements in the customer database that make up the best metrics for data analysis:

Last consumption (Recency)

Frequency of consumption

Consumption amount (Monetary)

These three elements are the RFM model, an important tool and means to measure customer value and the ability of customers to create benefits. The above three indicators will subdivide the dimensions into 5 subdivisions, so that 5x5x5=125 types of users can be subdivided, and then precise marketing according to each type of user... Obviously, 125 types of users are beyond the calculation scope of the ordinary human brain, and more Not to mention customized marketing strategies for 125 types of users. In practice, we only need to divide each dimension into two points (number 1 means good, 0 means bad), so we still get 8 groups of users (111, 101, 100, 110, 011, 001, 010, 000) in three dimensions, and we can easy to read.

3. Cluster Analysis – K-Means Clustering

Customer classification is the most common analysis requirement in e-commerce. In addition to using the enterprise's customer data and transaction data for RFM analysis, this study can also use the clustering analysis function of SPSS for analysis. The following uses the clustering analysis method of SPSS – K-Means clustering as an example.

Cluster analysis is used to discover different customer groups and to characterize different customer groups through purchasing patterns. It is an effective tool for market segmentation, but also for studying consumer behavior and finding new potential markets. At the same time, it is an exploratory analysis. In the process of classification, people do not need to give a classification standard in advance. Cluster analysis can start from the sample data and automatically classify. It can automatically classify a batch of sample data according to its multiple characteristics, according to the degree of intimacy in nature (the overall degree of difference in the characteristics of each variable) without prior knowledge (without pre-establishing classification standards), resulting in Multiple classification results.

Now we have collected some buyer data of an "electronic recharge card flagship store" (see Appendix 1 for data) for analysis, there are 4 variables in total: customer ID, number of purchases, total transaction amount, and the time interval of the last purchase. Applying SPSS for cluster analysis needs to meet two preconditions: 1. There is no strong linear correlation between the variables. 2. There is no order of magnitude difference between the variable values.

Standardized variables were analyzed using the K-Means clustering function of SPSS. In order to avoid too many groups, and the understanding of the customers of each group is unclear, here the number of clusters is set to 3, and the cluster analysis is run to obtain the result:

Table 1

Cluster analysis results: ANOVA

	clustering		error			
	standard error	df	standard error	df	F	Sig.
Last purchase time interval	141777480.216	2	115882.482	497	1223.459	.000
Number of transactions	612.330	2	1.168	497	524.123	.000
total transaction amount	4980.407	2	88.871	497	56.041	.000

The F-test should only be used for descriptive purposes because the clusters have been chosen to maximize the difference between cases in different clusters. The measured significance level is not corrected for this, and therefore cannot be interpreted as a test of the hypothesis that the cluster means are equal.

From the data in Table 1 after the operation, the single factor analysis is performed by category grouping. From the size of the F value, it can be seen that the latest purchase time interval (F value

is 1223.459) contributes the most to the clustering results, followed by the total transaction amount, The F value is 524.123, and each variable has a significant contribution to the clustering, and the difference between each category is significant.

Table 2

Cluster Analysis Results: Comparison of Means

serial number	Last purchase time interval	number of transactions	total transaction amount
1	7.03	3.85	1895.91
2	3.14	14.14	5884.57
3	22.56	1.58	323.01
total	32.83	6.52	2701.16

Combined with the data from the cluster analysis results, we divide buyers into three categories. The second category is the smallest, only 7. They have the characteristics of many transactions, high total transaction amount and short time interval between the latest purchases. These buyers should be important value customers (111), and they are VIP customers of enterprises. Special attention should be paid, special VIP customer service channels should be set up, and problems such as disputes and complaints from these buyers should be resolved first, so as to maintain their loyalty to the website;

The number of buyers in the first type is 34, the number of transactions and the total amount of transactions are relatively low, and the time of the last purchase is relatively far away. It is an important customer to maintain (011) and an important development customer (101) , and the company needs to take the initiative to keep in touch with him , should strengthen interaction, maintain their activity and improve user stickiness through marketing methods such as new products, promotions and promotions information notification;

The third type of buyers has 459 buyers, with low transaction times but high consumption amount. The most recent purchase time is far away, and they may be buyers who are about to lose or have already lost. This is an important factor for enterprises to retain customers (000), and timely take action to maintain or wake up, understand the reasons for buyer churn by sending coupons, questionnaires, customer service follow-up, etc., and take targeted improvement measures.

Table 3

Initial cluster center

	clustering		
volume	1	2	3
number	3060.00	7360.00	6.00
time	3.00	16.00	1.00
	1.00	5.00	30.00

Table 4

Number of cases in each cluster

clustering	1	34.000
	2	7.000
	3	459.000
efficient		500.000
missing		.000

This experiment is only An RFM model simply divides customers in marketing , but there is still some room for improvement: customer segmentation only considers three variables: the number of transactions, the total transaction amount, and the time interval between the last purchases. There are too few reference variables and the division is not detailed enough .

In the operation analysis of a real e-commerce platform, variables related to user behavior such as user login, likes, favorites, repurchase rate, shopping cart addition, order days, and comments can be added to build a more complex membership rating system. In the operation process, according to the marketing activities of different themes, customers are identified and subdivided, and then the marketing plan is formulated in a targeted manner. The cost of developing a new user is several times the cost of maintaining an old user. Therefore, after recruiting new users for each activity ,

enterprises hope to increase the actual income brought by users in the life cycle through data analysis and mining. value, ensuring that your marketing strategy achieves maximum ROI. By establishing a model, cluster analysis, association rules and other methods are used to analyze the characteristics of user churn, analyze the reasons for churn, and divide users into different stages of "customer life cycle" (see Note 1.) according to the law of user life cycle . Intervene in a timely manner for silent users and those about to be lost, implement corresponding wake-up and retention strategies, operate more refined, cultivate user loyalty, and maximize the "customer life cycle value" for the enterprise (see details for details). Note 2).

4. Personalized Recommendations

Among the current recommendation algorithms, the most widely used are content-based recommendation and user-based collaborative filtering (UserCF) algorithms.

1) Content-based recommendation is the basic recommendation strategy. If you have browsed or purchased a certain type of content, other content of this type will be recommended to you. The advantage of content-based recommendation is that it is easy to understand, but the disadvantage is that the recommendation is not intelligent enough, and the diversity and novelty are insufficient. For example, if a user wants to buy a DSLR one day, but buying a DSLR is not a frequent behavior, and he buys a high-end DSLR, then the next recommendation to the user is a high-end DSLR, and the recommended conversion rate will be much lower. Or recommend it based on browsing history, but if I have already bought the item and recommend it to me, the possibility of repeat purchases will be much lower.

2)The user-based collaborative filtering (UserCF) algorithm evaluates the similarity between users through the user's behavior on different content, and makes recommendations based on the similarity between users. This part of the recommendation is essentially to recommend to the user things that are of interest to people who are similar to this user. For example, the movies people may once like (watch many times) are all sci-fi movies, such as Alien, Terminator, Star Wars, etc. Through data analysis, we found people who have watched Alien, Terminator, Star Wars. Like them, we have found out that they often watch avenger movies, then we can suppose that anyone will probably like to watch avengers, then we could recommend to see films about avengers to other people.

5. Conclusion

The sustainable development of e-commerce platforms is inseparable from good operation management, which will also affect the sales of goods and consumers' recognition of the goods themselves to a large extent. Correct analysis of customer life cycle value and the use of personalized recommendation systems in refined operations can comprehensively understand customer needs and the value of customers, more efficiently match buyers with the products they want, and improve user experience. For merchants, mining information about enterprises from massive data can also allow merchants to deliver traffic to target users more precisely, help enterprises formulate strategies, customer value analysis and data mining will become the survival and enhancement of enterprises. A powerful weapon of competitiveness.

To sum up, in the era of big data, only by attaching importance to the value of data and implementing data analysis and mining into daily refined operations can stores better enhance their competitiveness and establish a stable store image on the basis of establishing a good store image source of customers.

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ANALYSIS OF CROSS-MARKET CONTAGION PATHWAYS OF LIQUIDITY RISK IN CHINESE COMMERCIAL BANKS

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With the in-depth development of the interbank lending market, the flow of funds of commercial banks often brings risk contagion. Therefore, this article uses theoretical analysis and literature research, sorts out and summarizes the three main contagion channels of the liquidity risk of Chinese commercial banks across the market, which is helpful for the development of relevant risk prevention and control.

Keywords: commercial banks, liquidity risk, cross-market contagion, contagion route, risk.

As the center of the financial system, commercial banks have liquidity risk as their most basic and deadly risk. Therefore, ensuring sufficient liquidity is crucial to maintaining the stable operation of the financial system. Looking at the development of China's financial market, the "money shortage" event in 2013 caused by the relative shortage of currency in the circulation field has a profound warning significance [1]. This has made us realize how quickly liquidity risks are contagious among financial markets and have a serious impact.

The essence of liquidity risk contagion across markets is a risk spillover effect. That is, when a financial market suffers from a shortage of liquidity and affects its own business stability and other problems, other financial markets also have liquidity problems through some means, resulting in increased correlation between financial markets and adverse impacts on other financial markets, which in turn cause phenomenon of loss. For example, when a commercial bank encounters a liquidity crisis, the interbank offered rate in the interbank market will inevitably increase accordingly. At the same time, when stock prices, interest rates, exchange rates, etc. have corresponding changes related to them, it can be considered that a cross-market contagion of liquidity risk has occurred.

If there is liquidity risk in commercial banks as the center of the financial system, it will inevitably spread to other financial markets. Therefore, this article uses theoretical analysis and literature research methods to consult a large number of relevant documents, sorts out and summarizes the three main contagion channels of the liquidity risk of Chinese commercial banks across the market, which is helpful for the development of related risk prevention and control.

The fundamental reason why liquidity risk can be transmitted through the information channel is the asymmetry of information. When a bank becomes insolvent due to poor operations and other reasons, a run is bound to occur [2]. But even if the bank does not have insolvency problem, due to the serious information asymmetry between depositors and banks, it is difficult for depositors to obtain the relevant real information to understand the real operating condition of the bank at the moment and to analyze the bank's asset quality effectively. Therefore, when the news of a bank's poor operation spreads in the market, it will cause depositors to panic about the safety of their own deposits, and also cause other depositors to worry about their own bank's operation, which will directly lead to depositors willing to withdraw money from the bank, thus causing a run on the bank. Even if some rational depositors who have information about the bank can make a correct judgment, they will make a run on the bank to ensure the safety of their deposits due to the occurrence of the run. In this way, even banks in good operating condition may have liquidity problems, thus causing liquidity risk to spread from one bank to the banking system.

In the context of financial reform and financial innovation, China's financial market is developing rapidly and the innovation of financial products is escalating. In order to meet the return needs and risk pReferences of different investors, the variety of financial products is getting richer and richer. Therefore, financial innovation products have strong development potential and market competitiveness. At the same time, financial innovation products connect various parts of the financial market as intermediaries, such as commercial banks, stock market, bond market, etc., and thus become a channel for cross-market flow of funds between financial markets. For example, securities investment funds, private equity funds, umbrella trusts and other businesses that have emerged in recent years are typical cross-market financial innovation products [3]. The development of financial liberalization has also made the boundaries between financial marketMarket-subject contagion refers to the changes in prices in other financial markets caused by asset price fluctuations in one financial market. In 2007, the People's Bank of China promulgated the Measures on Interbank Lending, which allowed all banking financial institutions and the vast majority of non-bank financial institutions to enter the interbank lending market. Financial institutions can form business transactions among themselves through the interbank lending market and generate complex debt-creditor relationships, while non-bank financial institutions can also make stock investments and bond investments. Therefore, the debt-claim relationship generated by financial institutions because of borrowing and lending makes the interbank lending market one of the main ways of risk contagion.

If a commercial bank has liquidity difficulties due to its poor operation, one of the means for the bank to reduce its funding to other financial markets for its own operation is to raise the interbank lending rate, which directly leads to the financing difficulties of non-bank financial institutions due to the increase of interbank lending rate. Then the liquidity risk of commercial banks will be transmitted to the capital market through the interbank lending market, realizing the cross-market contagion of liquidity risk. Therefore, the interbank lending market is also one of the main transmission channels.

In summary, the three main transmission channels of cross-market transmission of liquidity risk for Chinese commercial banks are: information transmission, financial product transmission and market entity transmission. Since commercial banks are increasingly connected to other financial markets through interbank lending, there will be more transmission channels for liquidity risk in the future. Therefore, in order to prevent the occurrence of financial crisis and at the same time promote the stable and healthy development of China's financial market, it is crucial to prevent the cross-market contagion of commercial banks' liquidity risk.

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REASONS FOR THE BAN ON CRYPTOCURRENCY MINING IN CHINA AND POSSIBLE CONSEQUENCES

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The Chinese government has once again taken a firm stance and decided to step up its policy against bitcoin mining out of concern for retail investors, digital yuan issuance, and environmental concerns. This may cause problems for crypto in the short term, but in the long term, it may make crypto more efficient as well as centralized.

Keywords: bitcoin; mining; cryptocurrency mining; consolidation of virtual currencies.

ПРИЧИНЫ ЗАПРЕТА МАЙНИНГА КРИПТОВАЛЮТЫ В КИТАЕ И ВОЗМОЖНЫЕ ПОСЛЕДСТВИЯ

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Китайское правительство заняло твердую позицию и решило усилить свою политику в отношении майнинга биткоинов, заботясь о розничных инвесторах, выпуске цифровых юаней и экологических проблемах. Это может вызвать проблемы для криптовалюты в краткосрочной перспективе, но в долгосрочной перспективе это может сделать криптовалюту более эффективной и централизованной.

Ключевые слова: биткоин; добыча; майнинг криптовалюты, консолидация виртуальных валют.

China's State Council stated in May ordering a crackdown on cryptocurrency mining and trading. The statement was sent abroad to dozens of cryptocurrency companies. It is important for China that resources and infrastructure are not used for speculation, but the real economy. Beijing believes that the digitisation of currency is objective progress, but that this progress should be under the control of the state [1]. China is already ahead of other countries in terms of national digital currency development. But cryptocurrencies and digital renminbi are different. As bitcoin mining is a decentralised process, the exodus of miners away from large Chinese mining pools will not bring much of a shock to the bitcoin mining system. Some of the mining sites located in the country have now relocated their miners to Middle Eastern countries such as Iran, which generate electricity through natural gas resources, to get cheaper electricity prices. In this flow, the mining industry, once criticised for being centralised, is also gradually becoming geographically decentralised due to cost and profit considerations.

Firstly, Bitcoin mining uses a huge amount of power, which increases as the price of Bitcoin rises. It requires computers to run at high capacity for long periods. Bitcoins are created or "mined" by high performance computers, often located in data centres in different parts of the world, which

compete to pack blocks through complex hashing operations (the SHA256 algorithm twice), a process that requires significant use of electricity [2].

Secondly, China's main source of low-cost electricity is hydropower, so most of the bitcoin mines will be built in the remote mountains of Sichuan and Guizhou, where hydropower plants are well developed. This means that some of the electricity used does not pass through the main grid, and it also causes huge inconvenience to the government in terms of statistics and regulation. Some criminals have been stealing pads to supply electricity to the mines for personal gain, causing huge losses to the country [3]. In China, electricity prices are divided between periods of high and low water, with the high water period generally starting in May of the year.

Finally, bitcoin mining will produce a lot of electronic waste, the average life of the equipment is only one and a half years, as the performance requirements of hardware equipment such as mining machines and graphics cards are getting higher and higher, consuming more and more electricity, however he only has one use mining will become electronic waste after the update, and is expected to increase a lot in the future after the number of bitcoins is halved.

According to the latest data from Cambridge University, the US has become the world's largest market for bitcoin mining. The US now holds a 35.4 % market share after a large number of miners left China following the Chinese government's ban on mining earlier this year. Kazakhstan and Russia follow the US with shares of 18.1 % and 11 % respectively.

Chinese mines have shut down completely, and as Chinese mining pools now account for more than half of the world's total bitcoin mining capacity, China is not a core hub of bitcoin network nodes, despite the large amount of computing power and some of the largest mining pools in the network coming from China.

Some miners have had no choice but to go offshore. "A lot of people go to Kazakhstan, it's easier to get there from the Xinjiang side, and it's probably easier to transport miners. While a ban on mining would certainly have a huge impact on China's mining industry, and could potentially kill the industry overnight, this is only a short-term issue, and in the long term, China's ban on cryptocurrency "mining" will have a significant impact on the goal of fully controlling energy consumption and achieving the goal of "peak carbon and carbon neutrality".

Going forward, banning the environmental impact of cryptocurrency "mining" could achieve China's goal of "striving to achieve carbon peaking by 2030 and carbon neutrality by 2060" and reduce energy consumption, which would certainly have a positive impact on China's environment. This will certainly have a positive impact on China's environment.

There is no doubt that China has been one of the most active regions for bitcoin development and that bitcoin plays a huge role in the cryptocurrency mining industry. A ban on bitcoin "mining" in China would destabilize the industry and its growth. But it's not just China's ban that's causing panic in the market. Despite China's important role, the Bitcoin white paper has made it clear that this is about developing Bitcoin into a world currency, which is bigger than the macro scale of a specific country or region, and that China is developing a real economy where virtual currencies are not destined to compete with the digital yuan. So even if China banned all bitcoin mining the impact on bitcoin would only be phased. For China, a ban on cryptocurrency "mining" would have a short-term impact on the industry, but in the long term it would reduce the energy consumption and carbon emissions generated by mining, change backward production capacity and bring about a better ecological environment for the future.

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FACTORS FOR ASSESSING THE SCIENTIFIC AND TECHNOLOGICAL POTENTIAL OF KNOWLEDGE-INTENSIVE ENTERPRISES

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This article considers the problem of assessing the scientific and technological potential of knowledge-intensive enterprises. Various evaluation factors that affect the scientific and technological potential are highlighted and described, because this is what predetermines the available opportunities for achieving the overall objectives of the enterprise.

Keywords: knowledge-intensive enterprises, scientific and technological potential, evaluation methodology, design of your thesis, abstract, foreign language, research.

ФАКТОРЫ ОЦЕНКИ НАУЧНО-ТЕХНОЛОГИЧЕСКОГО ПОТЕНЦИАЛА НАУКОЕМКИХ ПРЕДПРИЯТИЙ

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В данной статье рассматривается проблема оценки научно-технологического потенциала наукоёмких предприятий. Выделяются и описываются различные факторы оценки, которые влияют на научно технологический потенциал, ведь именно он предопределяет имеющиеся возможности для достижения общих целей деятельности предприятия.

Ключевые слова: наукоёмкие предприятия, научно-технологический потенциал, методика оценки, оформление тезисов, аннотация, иностранный язык, исследование.

The role of technology in modernization of enterprises and economy as a whole is enormous. Within the framework of the change of technology there are wavelike changes, which are manifested in the change of technological modes, which represent a specific macroeconomic complex of technologically interconnected productions.

An indispensable condition for the development of production is technological progress, the determining stage of which is technological modernization. Almost all technical and economic indicators of enterprise functioning and, as a consequence, its competitiveness directly depend on the level of technology, management and technology in production. Technology, organization and technique are an integrated whole [1].

Process of analysis of necessity of implementation of technological modernization is a huge process, which affects a whole range of enterprise activities. Creation of competent methodological approach to the assessment of scientific and technological potential of the enterprise becomes a determining step in assessing the need for technological modernization.

The process of modernization of knowledge-intensive enterprises is closely related to the formation of an effective and competent structure of production, predetermined by the processes of substitution of effective factors of production by inefficient technologies and resources. In this regard, there is a need to assess scientific and technological potential of enterprises in order to understand the need to implement technological modernization.

Scientific and technological potential determines the ability of an enterprise to generate new technical and scientific ideas, to carry out their technological and scientific design and development, and to implement them in their activities. It predetermines the available opportunities to achieve the overall objectives of the enterprise. The competitiveness of the enterprise directly depends on this potential [2].

Scientific and technological potential of production characterizes the use of the main factors of production through a significant number of indicators. The great potential of scientific and technological development is a strategic resource of the enterprise, which ensures its stability in the constantly changing conditions of development and allows it to become a winner in the competitive struggle [1].

It is important to note that none of the single indicators can fully characterize such a significant concept as scientific and technological potential of a company. The objectivity of reflection of the existing level of scientific and technological development at the enterprises and, accordingly, understanding of the necessity of modernization, or continuation of work at the existing level, depends on the effective choice of indicators.

The most important internal factor in the development of scientific and technological potential of an enterprise is the innovativeness of its internal environment. The formation of such an environment implies: a significant qualitative change in the level of the enterprise's own developments; reduction of the terms of introduction of innovations; provision of the institute's priorities in the field of protection of intellectual property rights; efficiency of transformations aimed at creation of competitiveness.

The modern organizational structure of technological capability is the creation of innovative complexes that combine research, technological and manufacturing enterprises. This allows a systematic approach to the formation and implementation of innovative projects. Modern trends are the introduction of self-supporting principles of interaction between the enterprises included in the innovation complex. It means that profit from realization of innovations is distributed between the enterprises of the complex in accordance with invested labor. It is very important that all structural subdivisions of the complex would be interested in the end result – commercial success of innovations.

Factors affecting the scientific and technological potential of the enterprise

Factors		
Positive impact on the scientific and technological potential of enterprises		Obstacles to the development of scientific and technological potential of enterprises
External factors	Internal factors	
Susceptibility of the external environment to innovation	Innovativeness of the internal environment of the enterprise	Lack of own financial resources for the development and implementation of innovations
		High costs of innovation and long payback periods
Targeted milestones	Interaction with competing corporations	Limited financial support for innovation activities of enterprises
		Unresponsiveness of enterprises to innovation
Key areas of technological progress of industries	Russian and international science and technology cooperation	Lack of highly qualified personnel
		Underdevelopment of innovation infrastructure
		There is weak motivation for the work of scientists, engineers, and inventors in innovative activities

Factors hindering the development of technological capability enterprises: lack of own financial resources for the development and implementation of innovations; high costs of innovation and

long payback periods; limited opportunities for financial support of innovation activities of enterprises; insensitivity of enterprises to innovation; lack of highly qualified personnel; underdevelopment of innovation infrastructure; weak motivation of scientific, engineering and technical personnel and inventors in innovation activities.

The scientific and technological potential of the enterprise directly depends on financial investments and consists of the accumulated amount of knowledge, provision of specialists and their qualification, as well as experience in innovation activity [2].

Due to all of the above it is possible to make a table in which the analysis will be carried out on the factors negatively and positively influencing the scientific and technological potential of knowledge-intensive enterprises.

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Post-Graduate Students' Research (Economic & Humanitarian Fields)

УДК 330

PSYCHOLOGICAL AND PEDAGOGICAL CONDITIONS OF THE DEVELOPMENT OF PROFESSIONAL COMMUNICATIONS IN PERSONALIZED LEARNING

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The article is devoted to an overview of the current psychological and pedagogical conditions in different approaches to learning. This article deals with the problem of theoretical substantiation of psychological and pedagogical conditions for the development of professional communications in personalized learning on the example of students learning a foreign language.

Keywords: personalized learning, learner-centered approach, system-activity approach, psychological and pedagogical conditions, communication, subjectivity.

ПСИХОЛОГО-ПЕДАГОГИЧЕСКИЕ УСЛОВИЯ РАЗВИТИЯ ПРОФЕССИОНАЛЬНЫХ КОММУНИКАЦИЙ В ПЕРСОНАЛИЗИРОВАННОМ ОБУЧЕНИИ

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Статья посвящена обзору современных психолого-педагогических условий в разных подходах к обучению. В данной статье рассматривается проблема теоретического обоснования психолого-педагогических условий развития профессиональных коммуникаций в индивидуализированном обучении на примере студентов, изучающих иностранный язык.

Ключевые слова: персонализированное обучение, личностно-ориентированный подход, системно-деятельностный подход, психолого-педагогические условия, общение, субъектность.

Modern education sets the goal of developing personal potential in which self-esteem is more important than a general assessment and the depth of knowledge and the ability of self-education are more important than focusing on common standards. Today personalized learning is becoming especially relevant that assumes the ability of the student to independently build the trajectory of the

educational process. The term “personalized learning” is relatively recent and based on various sources can be expressed as “learning in which the learning pace and learning approach is optimized for the needs of each student.” [3]

In connection with this there is a number of identified contradictions between: the need for the development of educational independence, building parity relations, meaningful communications and the traditional model for learning which is characterized by object-subject relations; the realization of the goal of education and the realization of the student's own goals; the active nature of the activity in personalized learning and the predominant reproductive nature of the activity in the educational process [2; 4].

The purpose of the research work is to theoretically substantiate the psychological and pedagogical conditions for the development of professional communications in personalized learning on the example of students learning a foreign language [7].

The object is the development of professional communications in the educational process.

To determine the principles and conditions of personalized learning, it is necessary to give a brief description of the system-activity, learner-centered and personalized approaches and then point out their similarities and differences.

The system-activity approach can be characterized by the following features: 1) Knowledge is acquired in the process of independent search activities; 2) subject-subjectivity – it considers the joint activities of the teacher and the student and the role of the teacher is that he acts as a facilitator; it implies: 3) a chain of sequentially implemented learning tasks; 4) and appeal to a variety of sources of information and forms of organization of work at different levels; 5) development of such skills of students as reflection, teamwork and an objective assessment of their own and others' activities 6) focus on the experience and needs of learners. [6]

The following can be stated regarding learner-centered approach: it includes 1) a large number of creative tasks; 2) subjectivity in the choice of goals, forms, methods of organizing the learning process; 3) non-authoritarian character of interaction; 4) support for the needs of students in the implementation and of their intellectual needs; 5) supporting proper conditions for the development of individual characteristics [10].

Personalized learning is characterized by: 1) continuity – the learning process does not last within a certain course and the amount of material but constantly; 2) the opportunity of cooperation between individuals, groups of students and the teacher on a partnership basis; 3) using technology as an auxiliary tool for cohesion; 4) responsibility for one’s decisions; 5) independence – students’ control of the learning process, which allows them to set the pace of learning for themselves and focus on their needs as well as the practice of setting long and short-term goals; 6) relevance – knowledge is needed not to get an assessment but to gain useful practical experience; 7) feedback is provided not only with the teacher, but also with other students [5].

The main similarities and differences of the system-activity, learner-oriented and personalized approaches were also highlighted. Similarities include: the non-authoritarian nature of learning, the usage and combination of various forms, methods of teaching technologies (which in a personalized approach are perceived as an auxiliary tool for rallying students), the use of information that corresponds to the interests and actual needs of students. Among the differences we can see the following: the independence in personalized learning is expressed not only in learning activities but also in the formation of goals, the choice of forms and methods of teaching. The second difference is a greater degree of responsibility for their decisions, especially for building long and short-term goals. This also determines the continuity of learning which is limited neither by one course nor by the educational goals.

The professional communications were chosen due to the fact that in the modern world most tasks including scientific ones are solved through communication within the circles of specialists in which there are certain rules of interaction that makes it possible to speak of interdisciplinary. [11]

The term “professional communications” means a professionally conditioned process of information transfer in various areas of cognitive, labor and creative activities aimed at professional development within professional communities in which there are certain rules of interaction.

Professional communications are characterized by several components: first of all, motivational – the desire for professional activities including internal ones in other words tasks stimulate the process of cognition so mastering is necessary to solve the problem which leads to internalization – through it the student comes to self-realization like a professional. The cognitive component helps to achieve it – the knowledge of the forms, types and means of professional communication increases its effectiveness, and the activity component, which includes skills such as constructive, organizational and gnostic [1; 8].

Through individual work, for example, creating a project on the presentation of their city as a tourist destination students, who are divided into groups and each consists of 3–4 people, divide subtasks among themselves e.g. stories about the history of the city, sights, etc., so that there is the transition from individual work to cooperation. In addition, there is a transition from individual work to simple, and then complex cooperation [9]. The reflective component involves understanding one's experience for self-control and self-knowledge. Reflection is carried out on the basis of a discussion of the results of their work with other students.

Thus, productivity is achieved by an expanded reproduction of knowledge in other words creatively.

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USING SOCIAL PLANNING FOR REGIONAL DEVELOPMENT

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The article substantiates the role of social design in maintaining the effective management of the socio-economic development of the Russian Federation constituent entities. The main directions of the region development with the help of federal programs are identified on the example of the Krasnoyarsk Territory. The methodology for assessing the overall development of regions is presented and the role of social design in the sustainable development of the Krasnoyarsk Territory is analyzed.

Keywords: region, social design, state program, assessment of the region development.

ИСПОЛЬЗОВАНИЕ СОЦИАЛЬНОГО ПРОЕКТИРОВАНИЯ В РАМКАХ РЕГИОНАЛЬНОГО РАЗВИТИЯ

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В статье обоснована роль социального проектирования в поддержании эффективного управления социально-экономическим развитием субъектов РФ. Выделены основные направления развития региона с помощью федеральных программ на примере Красноярского края. Представлена методология оценки общего развития регионов и проанализирована роль социального проектирования в устойчивом развитии Красноярского края.

Ключевые слова: регион, социальное проектирование, государственная программа, оценка развития региона.

In the modern theory of regional development, there are many approaches to the definition of the concept of region. In accordance with the document "Fundamentals of the Russian Federation State Policy of Regional Development for the period up to 2025", the region is a part of the Russian Federation territory within the borders of the territory of the Russian Federation subject [1]. This document also provides the concept of the state policy of regional development, which is understood as a system of priorities, goals, objectives, measures and actions of federal public authorities for the political and socio-economic development of the Russian Federation subjects.

According to the established practice of planning in Russia, the social development of regions is carried out through the formation of a strategy for the socio-economic development of the territory. State programs are the main instruments of Russian Federation socio-economic development state management. They are aimed at the socio-economic development of the Russian Federation subjects. It includes measures to regulate and coordinate activities to achieve the goals of the relevant territory socio-economic development, the implementation of complex projects not related to any state program, and aimed at the integrated development of the economy and the social individual sectors. These state programs should reflect analytical and reference measures implemented in the relevant territory within the

framework of sectoral state programs, as well as expenditures of the Russian Federation federal and regional budgets, and budgets of state extra-budgetary funds and legal entities corresponding to such measures. To date, the Krasnoyarsk Territory participates in 29 state programs in three areas [2]:

1) high quality of life – 17 state programs; 2) developed economy – 8 state programs; 3) effective state and municipal management – 4 state programs.

It is worth noting that the financing of a certain program and a set of its projects depends on the social significance of the project and its effectiveness. In conditions of limited budgets of all levels of the budgetary system of the Russian Federation, the approach becomes preferable, according to which target programs are developed for individual elements of the social complex of the region. The most important areas of social development of the Krasnoyarsk Territory are [2]:

1) development of the social support system for citizens: increasing the effectiveness of social support measures for citizens by strengthening targeted social assistance, as well as improving the quality and accessibility of public social services; 2) development of healthcare: increasing life expectancy by providing affordable and high-quality medical care; 3) development of education: ensuring high-quality education that meets the needs of citizens and the long-term objectives of the development of the economy of the Krasnoyarsk Territory, as well as state support for orphans, children left without parental care, recreation and health improvement of children in the summer.

Currently, there is a tendency for the transition of the national economy from an extensive path of development to an intensive one. In other words, production volumes are increased not by increasing capacity, but by increasing the manufacturability of processes. It should be noted that social development is an important part of assessing the innovative development of the region. In accordance with the rating of innovative development of Russian regions, the evaluation criteria contain such indicators as [3]:

1) assessment of educational potential; 2) the potential of digitalization of the population; 3) the main macroeconomic indicators; 4) assessment of the level of scientific research and development.

Based on the above socio-economic criteria for the innovative development of Russian regions, it is possible to draw certain conclusions about the level of development and the impact of social design in the regional management system. Thus, from the point of view of the quality of innovation policy, the Krasnoyarsk Territory is among the top five regions of Russia. However, in terms of socio-economic conditions and the innovation activity index, it occupies only 19th and 25th places, respectively. Thus, social design as a process of creating benefits for thepopulation can be an important tool for improving the effectiveness of implemented federal and regional programs.

It is worth noting that the Krasnoyarsk Territory ranks 8th in the final ranking of the subjects of the Russian Federation in terms of the value of the Russian regional innovation index in 2018-2019. During the period from 2017 to 2019, the Krasnoyarsk Territory strengthened its position in the rating by 4 positions, which in turn indicates the effective implementation of national programs. This indicator was achieved, including through the development of social infrastructure in the province.

Thus, a distinctive feature of the strategic planning of the social and economic development of the region is a high focus on the coordination of the social interests of various groups located in this territory. Therefore, all interested parties should take part in the process of planning social development: regional authorities, local self-government bodies of municipalities of the region, commercial organizations and public associations operating in the region, as well as its population.

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ASSESSMENT OF THE STATE OF SATELLITE COMMUNICATION IN KAZAKHSTAN AND THE PROSPECTS FOR ITS DEVELOPMENT

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This article discusses the state of the space communication segment of Kazakhstan, its place in the structure of telecommunication technologies and the market. Also, the business aspects of the provision of space communication services in market conditions and in terms of performing the functions of a national operator are considered in general terms.

Keywords: space communication industry of Kazakhstan; satellite communication in Kazakhstan; KazSat; telecommunication services market in Kazakhstan.

ОЦЕНКА СОСТОЯНИЯ СПУТНИКОВОЙ СПУТНИКОВОЙ СВЯЗИ КАЗАХСТАНА И ПЕРСПЕКТИВЫ ЕЕ РАЗВИТИЯ

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В настоящей статье рассматривается состояние сегмента космической связи Казахстана, его роль в структуре телекоммуникационных технологий и рынка. Также внимание уделено бизнес-аспектам оказания услуг космической связи в рыночных условиях и в рамках выполнения функций национального оператора.

Ключевые слова: отрасль космической связи Казахстана, спутниковая связь в Казахстане, KazSat, рынок телекоммуникаций в Казахстане.

Today, the space communication industry in Kazakhstan is represented by the «KazSat» space communication system. The system was created on the basis of the Republic Kazakhstan Government Decree, December 30, 2003 № 1355.

The system includes geostationary communication satellites «KazSat-2» and «KazSat-3», which are owned by the national operator of space communication systems (hereinafter referred to as the national operator) [1].

The national operator provides its customers – telecom operators (including television companies and some government agencies) – services of affording a satellite communication channel in the form of a transponder capacity on space vehicles. The total capacity of the «KazSat» satellite constellation is 2160 MHz [2].

Affording satellite resources in the form of a communication channel, measured in bandwidth in MHz, admits customers to use the purchased transponder capacities with greater or less efficiency. This option appears depending on the equipment they use on Earth – the terrestrial segment of the space communication system.

For today, the loading of the satellite communication channel, organized by the national operator, is about 74 % of its maximum capacity [3]. At the same time, the load level fluctuates between 70-80 % without significant growth. Individual deviations may occur in the case of an operational connection on a non-permanent basis, for example, when organizing a live broadcast or connecting a mobile hotspot within the coverage area.

One of the explanations for the lack of the increase dynamics in the load share is the legislative restriction of the activities of the national operator within the B2O market.

Many space communication systems operators have the opportunity to enter the next levels markets and provide telecommunication services in the B2B, B2G, B2C segments in addition to providing satellite capacity, communication channels.

However, such a «deepening» into the telecommunication market for the national operator remains impossible due to the current antimonopoly legislation of the Republic of Kazakhstan.

Thus, at present, there is a clear delineation of segments of the telecommunication market in Kazakhstan. The national operator provides satellite communication channels to telecom companies that share the retail market.

The telecommunication services market in Kazakhstan has been showing active development over the past few years, especially since the beginning of the pandemic in 2020 [4].

Income from the «KazSat» space communication system in the structure of the hole telecommunication industry's income is, on average, about 0.77 % [5].

Also, it should be taken into account that the capacity of the «KazSat-2» and «KazSat-3» satellites in the aggregate is estimated at about 5 Gbps. The total capacity of Kazakhstan communication channels, mainly consisting of trunk channels of the largest operators in Kazakhstan (Kazakhtelecom JSC and Transtelecom JSC), is about 1.5 Tbps. From this it follows that with a physical share in the total bandwidth, the share of satellite communication is only 0.33 %.

Thus, a noticeable difference between revenue share and physical share can be observed, indicating the high cost of satellite communication compared to terrestrial solutions such as fiber optics and radio relay.

The most dynamic development of telecommunication services in Kazakhstan mainly takes place at the upper levels of the basic reference model of open systems interaction (hereinafter referred to as the OSI model), namely at the representative (sixth level) and application level (seventh level). The upper layers of the OSI model do not load the backbone network so much, so they don`t greatly affect traffic. At the same time, in 2021, there was a significant increase in mobile Internet speed from an average of 20 Mbps to 31 Mbps, or by 55 %.

Thus, the KazSat system, operating at layers 1 to 4 (physical, channel, network and transport) of the OSI model, with its current capacities, still meets the current market needs without much additional effort. Adaptation of new technologies is carried out on the equipment in the B2O and B2B segment.

With all the advantages of satellite communication, in particular, non-attachment to the geography of service delivery, high cost is the main restraining factor.

For example, under the auspices of eradicating the digital divide in the Republic of Kazakhstan on October 04, 2018, the public-private partnership project “Providing broadband access to rural settlements of the Republic of Kazakhstan using the technology of fiber-optic communication lines” was launched. The project is planned to be implemented in the period 2018-2032 and is expected to have an impact on about 2.4 million people – potential consumers of telecom services [6]. And this is more than 10 % of the total population in Kazakhstan.

As part of the project, it was decided to use satellite technologies for those settlements, bringing fiber optics to which has become extremely unprofitable for terrestrial telecommunication operators due to their remoteness and / or low population density.

Thus, due to the fact that the cost of satellite communication has become relatively commensurate with fiber-optic communication for some settlements, the price factor was leveled for the customer, represented by the state, as the party subsidizing the project.

It is necessary to recognize – at present, there are no obvious prospects for the growth of the space communication segment of Kazakhstan. According to the market trends toward increasing the efficiency of communication channels through various types of compression, encoding and logging data streams, as well as the widespread expansion of the coverage area of fiber optic networks in Kazakhstan, it would be most reasonable and logical to change the view about space communication in general.

The national operator is a subject of the quasi-public sector with 100 % participation of the state in the share capital, created to operate the national space system, and, at the same time, is an ordinary participant in market relations and not related to monopoly entities. This position is not conducive to development as a commercial company. Any expansion of activities will be regarded as unfair competition, and, therefore, there are a legislative restrictions on the provision of other related communication services.

And using other income tools which available to companies those who not affiliated with the state, such as financial activities, is strictly regulated and limited by Kazakhstan laws within the framework of state property management, which includes the share capital of the national operator.

Such internal conflicts of interest within the framework of one company, which represents the entire segment of Kazakhstan's space communication alone, naturally does not contribute to development.

In this regard, in order to resolve some of the constraining factors of development, and expand the prospects for the further existence of the domestic space communication system, it is required to make a revision of the goals and objectives that the state sets for the national operator.

This, for example, it can be issued as a change in expectations from the operation of the «KazSat» space communication system, expressed in physical terms or specific tasks tied to social indicators and indicators dictated by government needs.

For example, the January 2022 events showed the need for the state to have not even a sovereign, but an independent radio and telecommunication systems in terms of ensuring national security, where satellite communication is one of the most conforming technical solutions.

Considering all of the above, a turning point is coming for the Kazakhstan satellite communication market, when it is necessary not only to plan the modernization of technological equipment and technologies, but also to introduce new approaches to organizing activities, attract new technologies and find entry points to new markets within the permissible competence of the national operator.

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УДК 330

DISCLOSURE OF THE CONCEPT OF "EFFICIENCY" AND METHODS OF EFFECTIVENESS EVALUATING

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The article presents the results of the study for the concept of "efficiency", which is applicable to innovation programs. The typology and classification of innovation programs effectiveness has been conducted. The characteristics of possible methods used in evaluating the effectiveness these programs are considered.

Keywords: efficiency; effectiveness of innovation programs; efficiency assessment; methods of efficiency assessment; innovation programs.

РАСКРЫТИЕ ПОНЯТИЯ «ЭФФЕКТИВНОСТЬ» И МЕТОДЫ ОЦЕНКИ ЭФФЕКТИВНОСТИ

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В статье представлены результаты исследования понятия «эффективности», которое применимое по отношению к инновационным программам. Проведена типология и классификация эффективности инновационных программ, а также рассмотрена характеристика возможных методов, применяемых при оценке эффективности этих программ.

Ключевые слова: эффективность; эффективность инновационных программ; оценка эффективности; методы оценки эффективности; инновационные программы.

The concept "innovation programs" represents a complex of innovation processes and activities that: are coordinated by resources, deadlines and performers of their implementation; provide effective tasks solutions for introducing new technologies and developing new products.

Innovation activity for domestic enterprises is becoming an important attribute of successful business management. Considering that the implementation of innovation programs relates more to the project activities of commercial organizations, then, accordingly, it is essential to evaluate the effectiveness.

The concept of "efficiency" and the methods of its evaluation are the subject of the scientific research. The relevance is attributed to the above-mentioned factors.

Consequently, the object of the scientific article is to conduct a research analysis of the theoretical characteristics of the concept "efficiency", which is applicable against innovation programs.

In our opinion, the concept of an innovation program effectiveness is one of the most controversial issues in innovation management. The need to assess the effectiveness of an innovation program arises in the following cases: when there is a choice in innovation programs; when financial

resources for innovation program implementation are limited; when it is necessary to assess the effectiveness of the implementation of an innovation program.

The concept "efficiency", which is applicable to the innovation program, is necessary to imply a category reflecting the compliance of the innovation program with the established goals and interests of its participants.

For each stakeholder of the organization, the evaluation of the innovation program effectiveness may be varied. For example, an innovation program effectiveness can be assessed using quantitative and qualitative characteristics. In addition, the evaluation of an innovation program effectiveness may depend on the nature of the purposes that are set during the development and implementation of the project.

Table presents the classification of the types of effectiveness that can be applied when evaluating innovation programs.

Types of the innovation program effectiveness

Social efficiency	Evaluation of the impact effectiveness on the social aspects of the organization's activities
Economic efficiency	Evaluation of revenues effectiveness and expenses reflection
Technological efficiency	Evaluation of program technological impact on the organization's activities
Budget efficiency	Assessment of the budget program correlation and financial charges of the innovation program

The main requirement for the success of an innovation program is its economic efficiency, the assessment of which is the basis of economic analysis, control and management of project activities. The completing stage of project management is the implementation of an innovation program [3].

According to generally accepted principles, economic efficiency is the ratio of income and costs. Thus, the economic efficiency of innovation programs is the correlation of the income that an organization receives from the implementation of its program and the capital costs that were invested for the organization of this innovation project.

The first purpose in assessing an innovation program effectiveness is to determine the discount rate. In order to determine it, it is necessary to use the method of determining the weighted average cost of capital WACC [1].

$WACC = Ke(E/V) + Kd(1-T)(D/V)$, where

Ke – the cost of the company's equity;

Kd – the cost of company’s debt capital;

E – the amount of the company's own funds;

D – the amount of borrowed company's funds;

V – the total amount of the company's funds;

T – the tax rate calculated from the company's profit.

In order to determine the cost of the company's equity, it is possible to use the capital asset valuation model (CAPM), which is based on the company's capital valuation [2].

Summarizing the results of the study, it can be implied that the concept of an innovation program efficiency means compliance with the established goals and interests of its participants. Economic, social, technological and budget efficiency are distinguished.

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METHODS TO SUPPORT HIGH-TECH PRODUCTION OF CIVIL PRODUCTS

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The article deals with the research analysis method characteristics of the high-tech production of civil enterprises for the Russian Federation economy. The relevance of the research is due to need to develop the sector of high-tech production of civilian products to ensure the competitiveness of the Russian economic system and its business entities.

Keywords: high-tech production, civilian products, support methods, stimulation of high-tech production.

МЕТОДЫ ПОДДЕРЖКИ ВЫСОКОТЕХНОЛОГИЧЕСКОГО ПРОИЗВОДСТВА ГРАЖДАНСКОЙ ПРОДУКЦИИ

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Научная статья посвящена проведению исследовательского анализа характеристики основных методов поддержки высокотехнологического производства гражданской продукции предприятиями экономики Российской Федерации. Актуальность исследования на выбранную проблематику обусловлена необходимостью развития сектора высокотехнологического производства гражданской продукции для обеспечения конкурентоспособности российской экономической системы.

Ключевые слова: высокотехнологическое производство, гражданская продукция, методы поддержки, стимулирование высокотехнологического производства.

In the contemporary period of the world and national economy, the high-tech sector of civilian products plays a significant practical role in shaping the size of the gross domestic product. This is due to the sixth techno-economic paradigm and the fourth technological revolution. Consequently, the structures of the digital economy are emerging. The advancement of innovations, information technologies and digital systems stimulates the scaling and development of business, producing high-tech products.

In Russia the development of high-tech companies, for example, is characterized by the volume of production of innovative goods, services and works dynamics, which for the period from 2010 to 2020 showed raising from 1.243 trillion rubles to 5.189 trillion rubles. The dynamics of the size of enterprises' spending on innovation activities over the similar period demonstrates an increase from 0.4 trillion rubles to 2.134 trillion rubles as well. There was a gradual increase annually in both cases [1].

Considering that the high-tech production of civilian products faces a number of urgent problems, it is crucial to search for mechanisms to their solving. Among such approaches is the formation of support methods from the state and regional authorities of the Russian Federation subjects.

1. Government funding of innovative projects and economic entities of high-tech production. This method is carried out in accordance with the legislation of the Russian Federation at the expense of the budgets of the subjects of the Russian Federation, local budgets by providing grant-in-aid, budget investments, state and municipal guarantees for the obligations of small and medium-sized businesses [2].

2. Support of economic entities of high tech production through cooperation with commercial banks. Loans are provided in accordance with the Government of the Government of the Russian Federation No. 1764 of December 30, 2018: subjects can obtain a loan for investment purposes (from 0.5 million rubles to 2 billion rubles for up to 10 years);

– subjects can obtain a loan to replenish working capital (from 0.5 million rubles to 500 million rubles for up to 3 years).

3. Tax stimulation for innovation. In current practice, the following mechanisms of tax incentives for high-tech production of civilian products are used [3]: writing off expenses, the object of which is the volume of investments and the growth rate of investments; tax research loan, the object of which is the investments volume and public-private partnership; special modes of depreciation of fixed assets, the object of which are investments in expensive equipment.

Accordingly, the main methods of supporting high-tech production of civilian products in Russia include government funding, support for business entities through cooperation with commercial banks, as well as tax stimulation for innovation.

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УДК 330

THE RELATIONSHIP BETWEEN TECHNICAL KNOWLEDGE MANAGEMENT AND THE CORE COMPETITIVENESS OF HIGH- TECH ENTERPRISES

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With the advent of the era of knowledge economy, high technology plays an increasingly important role in promoting the high-speed growth of the national economy. Due to the rapid changes in the high-tech product market, the product life cycle is shortened, and the competition is fierce. Technical knowledge management plays a very important role in improving the competition of enterprises, so it is necessary to analyze how technical knowledge management can promote the core competitiveness of high-tech enterprises.

Keywords: Technical knowledge management, high-tech enterprises, core competitiveness, enterprise development factors

ВЗАИМОСВЯЗЬ МЕЖДУ УПРАВЛЕНИЕМ ТЕХНИЧЕСКИМИ ЗНАНИЯМИ И ОСНОВНОЙ КОНКУРЕНТОСПОСОБНОСТЬЮ ВЫСОКОТЕХНОЛОГИЧЕСКИХ ПРЕДПРИЯТИЙ

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С наступлением эпохи экономики знаний высокие технологии играют все более важную роль в содействии быстрому росту национальной экономики. Из-за быстрых изменений на рынке высокотехнологичной продукции жизненный цикл продукции сокращается, а конкуренция становится жесткой. Управление техническими знаниями играет очень важную роль в повышении конкурентоспособности предприятий, поэтому необходимо проанализировать, как управление техническими знаниями может способствовать основной конкурентоспособности высокотехнологичных предприятий.

Ключевые слова: управление техническими знаниями, высокотехнологичные предприятия, базовая конкурентоспособность, факторы развития предприятия.

To clarify the essential connection between technical knowledge management and the core competitiveness of high-tech enterprises, we must first clarify the connotations of the concepts of technical knowledge management and core competitiveness of high-tech enterprises. Technical knowledge management means that enterprises promote the sharing of technical knowledge to the greatest extent through the collection, selection, absorption, transformation, learning, accumulation, dissemination, application, integration, innovation, and protection of technical knowledge, and supplemented by management methods such as human resource management organization construction and information system use. It is necessary to use and enhance team wisdom to improve work effi-

ciency and reduce innovation costs, so as to achieve continuous technological innovation of the enterprise, improve the market adaptability of the enterprise and create customer value.

The so-called core competitiveness of high-tech enterprises is the unique ability of high-tech enterprises to coordinate different production skills, organically combine various technologies in the process of production and operation, and achieve through technological innovation in the process of long-term knowledge learning and accumulation, the ability to obtain excess profits. This concept highlights several characteristics of the core competitiveness of high-tech enterprises: innovation, uniqueness, accumulation, integration and ductility. The formation of these characteristics maintains and enhances the technical knowledge management that relies on high-tech enterprises.

High-tech enterprises can obtain excess profits from their innovation, and the realization of technological innovation of enterprises mainly depends on the accumulation of enterprise technical knowledge and the integration and application of new technologies. The current stock and structure of technical knowledge of an enterprise determines the ability of the enterprise to discover innovation opportunities and allocate innovation resources; the acquisition, transformation, absorption and integration of new technologies determines the enterprise's ability to turn innovation opportunities into innovation reality. High-tech enterprises also obtain excess profits from the reduction of innovation costs and the improvement of innovation success rate. Technological innovation is a long-term, high-risk engineering innovation that is difficult to solve. The inefficiency and high internal friction of management are often prolonged. The R&D cycle increases corporate costs and reduces corporate profits. The dissemination, sharing and integration of technical knowledge, the construction of learning organizations and the application of information technology can effectively improve innovation efficiency and innovation success rate.

The development of an enterprise requires uniqueness. What is easy to imitate will soon lose its competitive advantage, and core competence must be difficult to imitate and replace. The protection measures for knowledge in technical knowledge management ensure that the core technology is difficult to be copied and imitated.

At the same time, in the process of an enterprise development experience is accumulated, and the core competence is the result of accumulation over time. The accumulation of less and more, and the gradual expansion of the learning and accumulation of technical knowledge is path-dependent. On the basis of the existing knowledge stock, continuous selection, learning, and absorption of new Technology. With the increase of technical knowledge, old and new knowledge is continuously cross-reconstructed and transformed into new technical capabilities, and the core capabilities of enterprises are gradually enhanced.

The unique advantages of enterprises often come from the complementary integration of various knowledge. The integration of technical knowledge in technological innovation is conducive to the concentration of professional advantages of various technical knowledge and provides conditions for complementary advantages.

Core competencies must be able to derive a series of new products and services to occupy new markets. The management of the innovation system in the technical knowledge management enables the innovation to develop and extend continuously on the existing basis, which provides the conditions for the expansion of the core competence.

It can be seen from the above elaboration that there is a close connection between the technical knowledge management and the core competitiveness of high-tech enterprises. Through the development of technical management, the core competitiveness of the enterprise is derived through human resource management, organizational management, corporate culture creation, and the use of technical tools. At the same time, by developing the core competition of high-tech enterprises, it will form a technological competitive advantage that is difficult to imitate from other enterprises, and play an all-round role in the enterprise's decision-making, R&D, production, marketing, service and other fields, making it more innovative, high-quality and cheaper than competitors. One should carry out these important strategic activities to achieve market dominance.

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THE PATH OF INNOVATION DEVELOPMENT OF CHINESE INDUSTRIAL ENTERPRISES

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With the rapid development of the economy, this article explores the problems and measures of innovation and development of Chinese industrial enterprises, and through the analysis, provides help for the innovation and development path of industrial enterprises, so that Chinese industrial enterprises have better development and innovation.

Keywords: Chinese, industrial enterprises, innovation development, path.

ПУТЬ ИННОВАЦИОННОГО РАЗВИТИЯ КИТАЙСКИХ ПРОМЫШЛЕННЫХ ПРЕДПРИЯТИЙ

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В данной статье исследуются существующие проблемы и необходимые меры при внедрении инноваций на китайских промышленных предприятиях в условиях быстрого развития экономики. Проведение такого анализа необходимо при выборе технологий внедрения инноваций для наиболее эффективного развития промышленных предприятий Китая.

Ключевые слова: Китай, промышленные предприятия, инновационное развитие, путь.

With the international market undergoing continuous transformation, it has become increasingly difficult for industrial enterprises to develop internationally. The industrial revitalization strategy pursued by developed countries has led to the rejuvenation of industrial capacity abroad, which has affected the competitiveness of our industrial enterprises in the international market. In addition, the capacity structure of industrial enterprises has undergone certain changes. With the gradual loss of the advantages of land and cheap labor, the increase of production costs in China has also caused the investment scale and speed of foreign capital to become smaller and slower, or even no longer invest, which, together with the industrial revitalization strategies of developed countries, has seriously affected the distribution position of China's industrial enterprises in the international market [1].

From the development mode, most industrial enterprises in China are labor-intensive industries, manufacturing industries and other backward industries that cannot meet the economic development, and lack of high-tech enterprises. From the development speed, industrial enterprises are no longer high growth development speed. In addition the backwardness of the market system and mechanism. Enterprises can not timely adjust the development mode, development goals, development speed, no own industrial core, no core technology, resulting in no driving force for enterprise production [2].

Trade barriers exist in international trade transactions. A large number of traditional industries in excess capacity, unable to use foreign trade to sell their products out, which leads to industrial enterprises vulnerable to economic changes. Together with the disinvestment and non-credit transactions of some foreign investors, which increase the magnitude of corporate indebtedness, as well as the heavy domestic tax burden, leading to increased corporate debt [3].

In the process of actively completing industrial transformation, industrial enterprises should strengthen the mastery of core technologies, enhance technological innovation, and become an industrial enterprise with advanced technologies. It is necessary to pay attention to the improvement of industrial technology leveland to focus on the quality of production capacity, and achieve a quality and innovative industrial enterprise. Attention should also be paid to the cultivation of highly skilled personnel and the improvement of professional skills and quality education of production employees to improve the talent structure of the enterprise.

Industrial enterprises should reform and innovate their internal industrial production, optimize their product structure, eliminate traditional products, innovate in their products, and rediscover the dominant position in the industry, which is conducive to improving competitiveness. By carrying out exchange seminars at home and abroad, and then adjusting the transformation of industrial structure, we can improve the international comprehensive competitiveness of industrial enterprises.

In a strong market for industrial enterprises, it is important to find the right development goals. The goal of high-end development also enables industrial enterprises to achieve corporate upgrading and technological innovation, to devote more energy to improving the quality of production rather than the speed of production, to meet the needs of the industrial market, and to develop international market [4].

The development of industrialization is extremely complex, and the linkage of industrial production is even more important. First of all, it is necessary to develop the management system of production factors, to promote the scientific and rational allocation of production factors, so that the products in the production process meet the quality regulations and improve production efficiency. Secondly, we should develop a management system to improve the market access system, strengthen the order of the protection market, eliminate industrial enterprises that do not meet the standards and norms, and strengthen the integration and planning of industrial enterprises.

In the case development becomes slow, industrial market competition is fierce, production is backward, that is why it is necessary not only to provide government's guidance and related economic support, but also there is a need for enterprises to complete internal industrial transformation, product upgrading, and what is more importantly, optimize industrial structure and develop management mode. Therefore, the innovation and development of industrial enterprises should be self-reliant, establish confidence in technological innovation, set innovation goals, and strive for higher benefits on the way of innovation and development.

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Post-Graduate Students' Research (Technical & Scientific Spheres)

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INVESTIGATION OF THE COMBUSTION PROCESS OF GASEOUS, LIQUID AND SOLID FUELS

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This article is devoted to the study of combustion process of gaseous, liquid and solid fuels. The basic concepts and methods of combustion are considered. The paper presents the main types of combustion process as well. Understanding the main features of the combustion process of various fuels will make it possible to organize combustion most efficiently, to increase the efficiency of existing power machines and installations.

Keywords: combustion, fuel, energy sources, gaseous fuels, liquid fuel, solid fuel, power machines, efficiency.

ИССЛЕДОВАНИЕ ОСОБЕННОСТЕЙ ПРОЦЕССА ГОРЕНИЯ ГАЗООБРАЗНЫХ, ЖИДКИХ И ТВЕРДЫХ ТОПЛИВ

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Статья посвящена исследованию процессов горения газообразного, жидкого и твердого топлива. Рассмотрены основные понятия и способы сжигания. Представлены основные типы процесса горения. Понимание основных особенностей процесса горения различных топлив позволит наиболее эффективно организовать сжигание, повысить эффективность существующих энергетических машин и установок.

Ключевые слова: горение, топливо, источники энергии, газообразное топливо, жидкое топливо, твердое топливо, энергетические машины, эффективность.

Energy industry is the basis of the economy of any country. The task of power engineering is to convert any energy (mechanical, molecular, nuclear, etc.) into electrical and thermal energy and vice versa. The efficiency of the work of industry, agriculture, the financial sector, and the service sector depends on the quality of an energy sector.

Energy industry includes objects of fuel productivity, its transportation and use at power plants, combined heat and power plants, heat points. Now energy accounts for 33 % of Russia's industrial production. Energy products are main export item (66 %) of Russia, they provide a significant portion of foreign exchange earnings.

Currently, there are significant energy problems in this area that can lead to serious crises. People are trying to find optimal ways of energy production that would be beneficial in all respects: ease of production, cheap transportation, environmental friendliness, replenishment. Further the development of modern energy industry is associated primarily with the solution to its inherent and accumulated problems over the past time. One of the most important problems of our time is the rational economical use of fuel [1].

Combustion is one of the main energy generation processes. Combustion processes are used in power plants, heating systems, and propulsion systems. Combustion is a rapidly occurring chemical oxidation process accompanied by the release of heat [2]. From the point of view of physics, during combustion, the mass of the fuel is converted into thermal energy in accordance with the law $E = mc^2$.

The purpose of this work is to study the features of the combustion process of solid, liquid and gaseous fuels. The methods of analysis of technical information, methods of mathematical modeling are used in the work. The results obtained in this work can be used to optimize power machines and installations using the combustion process.

According to the state of aggregation, organic fuel can be liquid (oil, gasoline, kerosene), gaseous (natural gas, propane, butane, coke oven gas), solid (coal, peat, shale). In Russia, the following fuel balance is now observed: 37 % – liquid fuel, 24 % – gas, 24 % – coal. The simplest process is the combustion of gases. The main condition for gas combustion is the presence of oxygen (and therefore air). Without the presence of air, gas combustion is impossible. In the process of gas combustion, a chemical reaction of combining oxygen in the air with carbon and hydrogen of the fuel occurs. The reaction occurs with the release of heat, light, as well as carbon dioxide and water vapor [2].

The combustion of liquid fuels always occurs in the vapour phase, therefore the process of droplet combustion is always preceded by the evaporation process. Generally, in a high-temperature environment, a drop of liquid fuel is surrounded by a certain zone saturated with its vapour, on the outer surface of which a spherical combustion zone is established around the drop.

Solid fuel has the most complex mechanism of combustion. The combustion process of solid fuel consists of two stages: combustion of volatiles and combustion of a fixed residue (carbon). The combustion of the fixed residue begins only after the combustion of volatile substances comes to an end. By this time, the particle warms up to a high temperature, and as the amount of volatiles and, consequently, the thickness of the boundary burning layer decreases, oxygen begins to gain access to the hot carbon surface.

Understanding the laws of the combustion process will allow us to do the following: to organize the most efficient combustion of various fuels; to increase the intensity and efficiency of the existing combustion methods; to outline the ways for the development of more modern methods of incineration. The priority task for the development of the Russian energy sector should be the introduction of more efficient and environmentally friendly technologies for burning gaseous, solid and liquid fuels using both the accumulated foreign experience and advanced domestic developments.

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PRODUCTION CYCLE OPTIMIZATION PLAN BASED ON DATA MINING METHODS

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This article provides a list of the main tasks that need to be solved in the process of optimizing the stages of the production cycle in the automotive industry using the developed simulation model. The collection and processing of information using methods of intelligent analysis will simplify the process of identification, calibration and verification of the model.

Keywords: automotive industry, optimization, data mining, production cycle, simulation model.

ПЛАН ОПТИМИЗАЦИИ ПРОИЗВОДСТВЕННОГО ЦИКЛА НА ОСНОВЕ МЕТОДОВ ИНТЕЛЛЕКТУАЛЬНОГО АНАЛИЗА ДАННЫХ

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В данной статье приводится перечень основных задач, которые необходимо решить в процессе оптимизации этапов производственного цикла в автомобильной промышленности с использованием разработанной имитационной модели. Сбор и обработка информации с использованием методов интеллектуального анализа упростят процесс идентификации, калибровки и верификации модели.

Ключевые слова: автомобильная промышленность, оптимизация, интеллектуальный анализ данных, производственный цикл, имитационная модель.

The modern automotive industry is a very complex production, which is faced with an acute issue of adaptation to dynamically changing conditions. In the competitive struggle in the global market, enterprises have to manage risks and solve tasks such as improving productivity, quality, flexibility, environmental friendliness and safety of production. To solve these problems, optimization of all stages of the production cycle is required, aimed at improving the quality of management decision-making and minimizing all production costs. In this regard, it is necessary to use modern solutions, such as data mining [1].

The peculiarities of the automotive industry make this area ideal for the application of data mining technologies. This is due to the fact that the technological process is characterized by reproducibility and controllability, any deviations from the norm will affect the quality of the final result, which must meet the specified criteria. Due to this, statistical stability is created in industrial production, which is important for classification work. This allows you to get significantly better results than when predicting the outflow of bank customers or analyzing medical data. As an example, it is possible to predict the quality of products depending on the measured parameters of the

technological process. In addition, data analysis in industrial production serves as a source of information for analyzing the stages of the production cycle and building various simulation models based on them. In this case, the collection and processing of information using data mining methods can simplify the process of identification, calibration and verification of the model [2].

Data mining methods are a valuable tool for managing and processing extremely large flows of information. One of the ways to process such a large amount of data is the use of Predictive analytics and maintenance (PdAM). PdAm collects data such as temperature and sound, using special sensors (for example, ultrasonic or vibration sensors) to determine patterns and the current state of the working line at all stages of the production cycle. Tasks of predictive analytics: intervention before the machine is damaged; reduced downtime; increased security; defect analysis; increase in production productivity. Data analysis is performed in accordance with the methodology of the Cross Industry Standard Process for Data mining (CRISP-DM).

The development and research of methods and algorithms for optimizing the stages of the production cycle of the automotive industry based on data mining is an urgent scientific and technical task.

The main goal is to increase efficiency and reduce production costs in the automotive industry by optimizing all stages of the production cycle based on data mining methods.

To achieve this goal, it is necessary to solve the following tasks: 1) Analyze existing methods and algorithms of data mining. 2) To develop a formal model of the production cycle in the automotive industry, taking into account the existing production process. 3) To develop a generalized simulation model of the production cycle in the automotive industry, which allows a comprehensive analysis of processes with different characteristics and to test various optimization methods using data mining. 4) Develop an algorithm for optimizing the stages of the production cycle in the automotive industry and investigate its effectiveness in a simulation model. 5) To test a simulation model of the production cycle in the automotive industry when solving the problem of optimizing and improving the efficiency of existing production processes.

It can be concluded that the practical significance of the results of the work lies in the possibility of applying the developed model of the production cycle in the automotive industry, taking into account the existing production process and showing its applicability for optimization at all stages of the production cycle. Including a demonstration of the capabilities of the simulation model, when optimizing the stages of the production cycle for various tasks on the example of a car manufacturing plant [4].

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PRODUCTION MODERNIZATION TOOLKIT FOR THE TRANSITION TO INDUSTRY 4.0

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Standard approaches to organizing production are at their peak. Constant optimization and scalability leads to the situation of impossibility of further high-quality development of the enterprise. The way out in this situation is the complex introduction of information technologies and innovative approaches.

Keywords: automation, artificial intelligence, digitalization, production.

ИНСТРУМЕНТАРИЙ МОДЕРНИЗАЦИИ ПРОИЗВОДСТВА ДЛЯ ПЕРЕХОДА В ИНДУСТРИЮ 4.0

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Стандартные подходы к организации производства находятся на пике своих возможностей. Постоянные оптимизации и масштабируемость приводит к ситуации невозможности дальнейшего качественного развития предприятия. Выходом в таком положении является внедрение комплекса информационных технологий и инновационных подходов.

Ключевые слова: автоматизация, искусственный интеллект, цифровизация, производство.

The fourth industrial revolution or Industry 4.0 implies a fundamentally new approach to production. An approach based on the massive introduction of information technology into industry, large-scale automation of business processes and the spread of artificial intelligence.

The advantages of the Fourth Industrial Revolution are obvious: an increase in competitiveness, a decrease in the use of human resources in hazardous conditions, an increase in the overall level of productivity, the creation of fundamentally new products, etc [1].

The term Industry 4.0 itself was introduced in 2011 in Germany and was applied in relation to the technologies of "smart" factories. The principles on which the Fourth Industrial Revolution is built [2]: compatibility (all interactions between equipment, machines, sensors, devices and people must occur via the Internet of Things); transparency (all information about all processes at the enterprise is recorded and stored in the virtual space); technical support (delegation of routine tasks from person to computer and gradual replacement of employees in hazardous areas with autonomous systems); decentralization of managerial decisions (reducing the distance in the managerial staff and striving for complete automation).

Like previous industrial revolutions, this one transforms not only production, but also all social life – the economy, relationships between people, everyday life and culture. For a qualitative trans-

formation, an integrated approach of various innovative technologies is required. List of key technologies for modernization of production:

1) Additive manufacturing or 3D printing. This technology is the creation of a part by adding layers. In production, this technology is able to simplify the creation of parts of non-standard shapes and sizes;

2) Autonomous guided vehicles. This technology is effective in the transportation and subsequent management of goods in production. The technology will improve the efficiency of the internal supply chain and, as a result, be able to increase overall productivity;

3) New materials. The use of new materials has great potential to improve production efficiency. Due to the influence on the quality characteristics of the product, changes in cost, duration of operation, maximum load limits, environmental friendliness and the nature of service occur;

4) Robots. In the context of Industry 4.0, robots need to move to the next level, that is, become more flexible and autonomous to solve individual tasks. As a result of expanding the list of possibilities for the functioning of robots in production and reducing human risks;

5) Digital platform. A digital platform is needed to address vertical and horizontal integration challenges. Creating a convenient digital environment for all stakeholders will strengthen links between structures, reduce the time for information exchange and improve overall production efficiency;

6) Cybersecurity. This is a logical development of the overall security of the enterprise. In the context of digitalization, the importance of this technology does not raise questions. The goal of cybersecurity is to protect information and respond to cyber threats;

7) Blockchain. This technology works on the principle of using blocks of information that are confirmed by other participants. This creates the impossibility of changing information and at the same time maintains a chain through which any event can be tracked. Blockchain creates conditions for reliability, increases system stability, improves security, and also enables scalability and autonomy;

8) Internet of things. This technology consists in connecting each device in the network with sensors to collect information, which can later be used both for making instant decisions and for forecasting;

9) Modeling and simulation. The concept of modeling is to create a digital twin of the required element or structure and further experiment with it without jeopardizing production;

10) Virtual and Augmented Reality. Peripheral equipment improves communication between the real and virtual world. This technology will have a positive effect on personnel training, quality control, product testing, etc.;

11) Big data analysis. This technology implies the collection of data, their subsequent aggregation and processing in conditions of constant growth. The analysis is carried out using special software and has a close relationship with other key technologies. This technology will make it possible to process a huge amount of information that a person could not process and give appropriate results for planning and forecasting;

12) Cloud. This technology allows you to unload your own servers, improve the availability of information within the production and improve communication with stakeholders. Cloud technology can have a positive impact on overall production performance and also effectively interact with other digital technologies;

12) Artificial Intelligence. This technology got the opportunity for its development, including through the development of some of the technologies listed earlier, but at the same time it can stimulate the introduction and have a positive effect on the operation of all technologies. The technology is aimed at automation, expansion of capabilities and continuous improvement of the operation of individual elements of the process or the system as a whole.

The modern world offers many tools for the implementation of the concept of Industry 4.0, which allow modernizing the digital supply chain, transforming production, improving customer focus and linking all aspects of an organization's activities into one single system.

Provided the introduction of even a part of the technologies, the enterprise is able to obtain the following advantages:

– dramatically increase productivity and automation (businesses can use data to make decisions about various operations, improving forecast accuracy, ensuring on-time deliveries and generating profit-optimized plans);

– resilience and flexibility in any market or economic environment (enterprises are shaping the digital supply chain of the future using the most modern planning tools);

– the confidence needed to explore new business models and quickly seize opportunities (with Industry 4.0 tools, businesses reduce costs, increase market efficiency, and connect supply chains by sea, land and air);

– green and sustainable solutions without sacrificing profitability (Customers are increasing their efficiency and profitability because of digitalization, ensuring that they meet their environmental goals without compromising other business goals such as profitability and scalability).

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APPLICATION OF ADDITIVE TECHNOLOGIES IN MECHANICAL ENGINEERING FOR THE MANUFACTURE OF FORMING EQUIPMENT

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The article discusses the process of using additive technologies in the manufacture of large-sized shaping equipment (FD). It is supposed to reduce the production time and labor costs of workers by using non-traditional technological systems in the manufacture of the FO model, which has qualitatively new properties and capabilities.

Keywords: shaping equipment, 3D model, additive technologies, 3D printing.

ПРИМЕНЕНИЕ АДДИТИВНЫХ ТЕХНОЛОГИЙ В МАШИНОСТРОЕНИИ ДЛЯ ИЗГОТОВЛЕНИЯ ФОРМООБРАЗУЮЩЕЙ ОСНАСТКИ

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В статье рассматривается процесс применения аддитивных технологий при изготовлении крупногабаритной формообразующей оснастки (ФО). Предполагается сократить сроки изготовления и трудозатраты рабочих путем применения нетрадиционных технологических систем при изготовлении модели ФО, которая имеет качественно новые свойства и возможности.

Ключевые слова: формообразующая оснастка, 3D-модель, аддитивные технологии, 3D-печать.

Additive manufacturing, or 3D printing, is the process of creating three-dimensional objects of almost any geometric shape based on their digital models, with the required set of properties. The concept of 3D printing is based on the construction of an object with successively applied layers that display the contours of the manufactured model, as a result of layer-by-layer addition, you can get a part that is no different from a part obtained by the same casting or milling. The most common method of 3D printing is the extrusion method according to technology (FDM – "Fused Deposition Modeling" or FFF – "Fused Filament Fabrication"). The popularity of the method is due to the rather low cost of equipment and consumables for printing [1].

Every year the cost of a 3D printer is gradually decreasing, while the quality of the final product, positioning accuracy and printing speed, on the contrary, are rapidly increasing [2]. As the industry

develops, it becomes possible to use and introduce new materials for 3D printing, as well as their combination with existing materials opens up great prospects in industry. Nowadays, using additive technologies, it is possible to manufacture products from both metal and polymeric materials.

Shaping tooling is made using 3D printing using FDM technology using 3D printers, by melting a plastic filament in an extruder and layer-by-layer growth of the product by melting the material onto the working surface layer by layer, recreating the shape of the electronic model. The material used is modern modified high-temperature engineering plastics reinforced with carbon fibers.

The simplified process in this technology can be described in the following steps: 1) Designing the structure of the 3D model; 2) Selection of equipment for 3D printing; 3) Refinement of the electronic 3D model for 3D printing; 4) Convert 3D model to G-code and prepare it in slicer software for 3D printing.

For 3D printing, a 3D model of the FO was designed, which was used as an initial electronic model for 3D printing, a 3D model of the tooling is shown in Fig. 1.

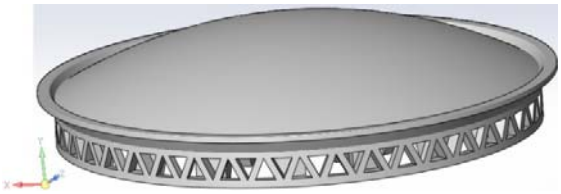

Fig. 1. 3D model of the tooling

The 3D model of the tooling consists of a shaping surface (FOP), which includes a shaping curved part repeating the geometry of the product made with it, passing into an auxiliary rectilinear part, which ends with a bead. The FOP of the tooling is installed on the support structure, on the back side of which, along the line equidistant to the boundary of the transition of the curved part to the rectilinear part, a base with technological holes in the form of triangles is installed, designed to lighten the weight of the structure. Additionally, the base is reinforced with a supporting frame in the form of a lattice of stiffeners, the design of which is shown in Fig. 2.

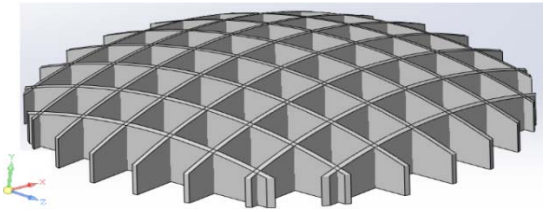

Fig. 2. Stiffening rib support frame

For 3D printing, among Russian manufacturers, a 3D printer was chosen that allows printing large-sized objects of complex shape with high detail accuracy. The printer is equipped with automatic calibration, a heated working table up to 110 □C, with a maximum extrusion temperature of 310 □C, a closed working chamber, the possibility of installing a second extruder, a cooling system for extruders, with a printing layer thickness of 0.02 mm and with the ability to adjust the printing speed in wide range from 40 mm/s to 150 mm/s. It has the largest print working area among analogs and is capable of working with engineering plastics using FDM and FFF technologies.

For the production of FO on this equipment, the 3D model was divided into six parts (segments), with the subsequent assembly of these segments into a single structure. A 3D model of one of the segments is shown in Fig. 3.

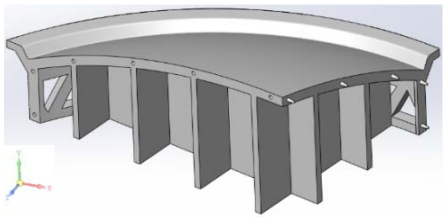

Fig. 3. 3D model of the tooling segment

To increase the accuracy of centering and to exclude the end movement when connecting the segments to each other, a conical connection with an interference fit was used. This type of connection ensures the centering of the mating segments by pressing the outer cone into the inner one, which depends on the difference (before assembly) of the diameters of the inner and outer cones in their cross-sections, which are aligned after fixing the axial position. With a conical connection, it is not required to apply large forces for the connection, and it is also allowed to perform (if necessary) a single disassembly, before applying the adhesive composition to the end surface. Thanks to these properties, it is possible to obtain high-strength adhesive seams with a gap of the order of 0.1 mm.

The 3D model of the segment created using the CAD system was prepared for printing using the CAE system, in the STL format was loaded into the slicer software, in which it was converted into

G-code, then its 3D digital model was processed. The estimated print time for the segment was 49 days, 18 hours. The number of layers when printing is 1,147 pieces. The weight of the printed segment model, taking into account the material of the supports, was 305 kg, without the supports, 208.5 kg. According to this principle, the rest of the FO segments are printed. The total time for the manufacture of 6 segments on one 3D printer, taking into account its settings and preparation for printing, will be 1 year. In this case, the estimated weight of the rig, excluding the support material, will be 1,271 kg.

Layer-by-layer production using the FDM or FFF technology allowed removing most of the design and manufacturing restrictions, which significantly accelerated the design process for new products. The variety of materials used makes it possible to print functionally new elements of shaping equipment that can withstand the effects of aggressive environments, high temperatures, and intense mechanical stress.

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SOLUTION OF THE PROBLEMS OF SEMI-NATURAL TESTING OF THE SYSTEM OF ORIENTATION AND STABILIZATION OF A SPACE VEHICLE USING A STARRY SKY SIMULATOR BASED ON PROJECTION SYSTEMS

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The structure of the spacecraft is described, the principles of determining the orientation of the spacecraft are described, the main principles of testing the system of orientation and stabilization of the spacecraft, the structure of the starry sky simulator based on projection systems are considered. The principle of its operation and functionality are described.

Keywords: starry sky simulator, dynamic tests, spacecraft.

РЕШЕНИЕ ЗАДАЧ ПОЛУНАТУРНЫХ ИСПЫТАНИЙ СИСТЕМЫ ОРИЕНТАЦИИ И СТАБИЛИЗАЦИИ КОСМИЧЕСКОГО АППАРАТА С ИСПОЛЬЗОВАНИЕМ ИМИТАТОРА ЗВЕЗДНОГО НЕБА НА ОСНОВЕ ПРОЕКЦИОННЫХ СИСТЕМ

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Описывается структура космического аппарата, описываются принципы определения ориентации КА, рассматриваются основные принципы отработки системы ориентации и стабилизации КА, структура имитатора звездного неба на основе проекционных систем. Описывается принцип его действия и функциональные возможности.

Ключевые слова: имитатор звездного неба, динамические испытания, космический аппарат.

In our time, there is a constant development of spacecrafts (SC) in the direction of their functional purposes, the complication of the applied and the introduction of newer on-board systems, instruments and mechanisms.

One of such systems is the spacecraft system of orientation and stabilization (SOS). The SOS of a modern spacecraft is a complex high-precision system consisting of many devices and functional connections between them. The SOS uses various methods to determine the orientation of the spacecraft in relation to the Sun, Earth, planets and stars.

Now the determination of orientation by stars is a decisive aspect in many spacecraft flights. Since stellar instruments are the most accurate.

One of the main stages in the design and development of a spacecraft orientation and stabilization system at ISS JSC is the stage of developmental and autonomous tests on a complex modeling stand built on the principles of half-life modeling [1].

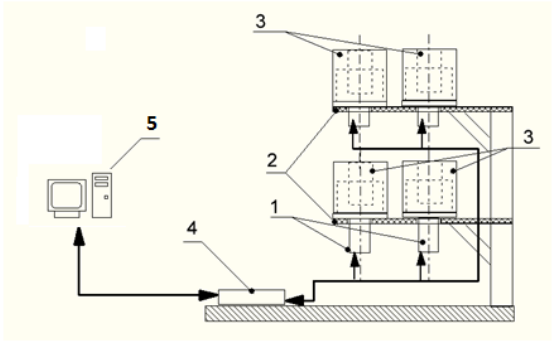

Fig. 1. The structure of the starry sky simulator based on projection systems:
1 – Optical block SSD 348K; 2 – Mounting plate; 3 – Optical module SSS PS; 4 – Electronics unit SSD 348K, 5 – Control and testing equipment. systems

This stage involves the use of simulators of external influences in order to create an environment for the functioning of the system, close to the operational one. At the same time, the effectiveness of tests directly depends on the reproduction of external influences.[2].

At the moment, ISS JSC is armed with a starry sky simulator based on projection systems (SSS PS). The structure of the simulator is shown in fig. 1.

SSS PS is a powerful intelligent equipment designed to test modern star trackers. The main solution underlying the development of the simulator is an inverted simulation method [4], in which the required movements are performed not by the device installed on the simulator, but by a reference landmark, in this case, this is a section of the starry sky, simulated by a matrix radiation source. Simulation of the movement of the starry sky is similar to the angular movement of the spacecraft in orbit and is achieved thanks to specialized software.

Fig. 2 shows a general view of the SSS PS using the example of 2 optical blocks.

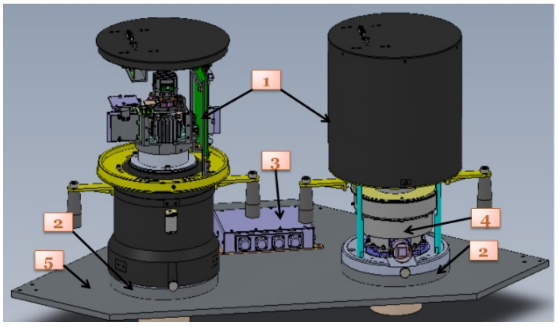

Fig. 2. Starry sky simulator based on projection:
1 – Optical module; 2 – Docking module; 3 – Electronics block SSD 348K; 4 – Optical block SSD 348K; 5 – Plate systems

SSS PS provides:

1. static and dynamic simulation of parts of the starry sky;
2. imitation of light interference and backlight.

SSS PS allows setting:

1. general background on simulated images;
2. the size of the simulated Stars;
3. upper limit of magnitude;
4. external factors: Sun, Earth, etc.

SSS PS allows you to carry out the following types of checks:

- static simulation of any real parts of the celestial sphere.

The advent of a starry sky simulator based on projection systems made it possible in the laboratory to carry out optical simulation of parts of the starry sky with an error of less than 10 arcsec. seconds for all optical units SSD 348K. Also, the use of SSS PS made it possible to test promising modifications of the 348K device.

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APPLE FRUITING ANALYSIS AT THE COLLECTION GROUND OF THE V. M. KRUTOVSKY BOTANICAL GARDEN

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The article presents the results of studying the variability of apple trees in terms of summer (Grushovka Moskovskaya, Nobilis, Papirovka) and winter varieties (Bismarck, Reinette Bergamot, Antonovka Kamenichka), growing at the collection ground of the upper terrace at the Vs. M. Krutovsky Botanical Garden. The variety productivity for the period from 2014 to 2019 is analyzed. The most promising apple varieties are identified for further breeding research.

Keywords: apple tree, summer variety, winter variety, productivity, variability

АНАЛИЗ ПЛОДОНОШЕНИЯ ЯБЛОНИ НА КОЛЛЕКЦИОННОМ УЧАСТКЕ БОТАНИЧЕСКОГО САДА ИМ. В. М. КРУТОВСКОГО

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Приводятся результаты изучения изменчивости яблони по урожайности летних (Грушовка московская, Нобилис, Папировка) и зимних сортов (Бисмарк, Ренет бергамотный, Антоновка каменичка), произрастающих на коллекционном участке верхней террасы Ботанического сада им. Вс. М. Крутовского. Дан анализ продуктивности сортов за период с 2014 по 2019. Выделены наиболее перспективные сорта яблони для проведения дальнейших селекционных исследований.

Ключевые слова: яблоня, летний сорт, зимний сорт, урожайность, изменчивость.

Productivity is the most important property that characterizes varieties of fruit culture. Good fruiting is the indicator of the plant condition and the influence of external factors [2].

The rich gene pool of an apple tree in the collection of the Vs. M. Krutovsky Botanical Garden serves as a base for breeding studies. Many studies are aimed at analyzing the patterns of fruiting dynamics of various apple varieties in order to select the most promising genotypes for obtaining offspring with high valuable indicators [1; 2]. The apple tree is characterized by the periodicity of fruiting, which makes it possible to identify individual varieties and biotypes with short inter-harvest periods [2; 3].

The purpose of the research is to study the variability of the yield of various apple tree varieties growing in the upper terrace of the Vs. M. Krutovsky Botanical Garden. The method of model branches according to Potapov is used to calculate the yield [4]. Object of research is apple trees of cultivated summer varieties (Grushovka Moskovskaya, Nobilis, Papirovka) and winter varieties (Bismarck, Reinette Bergamot, Antonovka Kamenichka), growing on the territory of the collection

garden ground. The collection garden ground has an area of 1 hectare and it is divided into 75 sites, consisting of three representatives of the same apple variety. An analysis of the productivity of apple varieties is presented for a six-year period from 2014 to 2019 (see table).

Productivity of apple varieties on the collection ground for 2014–2019

Variety	Year	Number of apples, pcs.		
		minimum	maximum	average
Summer varieties				
Grushovka Moskovskaya	2014	124	124	124
	2015	8	415	138
	2016	59	194	97
	2017	41	41	41
	2018	140	392	196
	2019	2	444	222
Average value over 6 years				136,3
Nobilis	2014	400	400	400
	2015	550	550	550
	2016	426	426	426
	2017	18	18	18
	2018	1	1	1
	2019	480	1052	526
Average value over 6 years				320,2
Papirovka	2014	2	2	2
	2015	21	21	21
	2016	29	29	29
	2017	50	50	50
	2018	25	266	67
	2019	2	483	242
Average value over 6 years				68,5
Winter varieties				
Antonovka Kamenichka	2014	19	45	22
	2015	120	494	165
	2016	215	215	215
	2017	34	34	34
	2018	63	302	101
	2019	32	693	231
Average value over 6 years				128,0
Bismarck	2014	24	24	24
	2015	15	15	15
	2016	51	51	51
	2017	44	44	44
	2018	12	204	651
	2019	4	316	105
Average value over 6 years				148,3
Reinette Bergamot	2014	151	151	151
	2015	54	54	54
	2016	132	132	132
	2017	26	26	26
	2018	2	307	102
	2019	8	89	30
Average value over 6 years				82,5

Among all summer varieties the Nobilis variety demonstrates high yields. The maximum number of fruit was recorded in 2019 and amounted to 1052 pieces. Among the winter varieties, the maximum number of fruits is observed in the Antonovka Kamenichka variety – 693 pcs. (2019). The minimum number of fruit is found in summer varieties: Papirovka – 2 pcs. (2014 and 2019), Grushovka Moskovskaya – 2 pcs. (2019) and Nobilis – 1 pc. (2018). Also, the minimum number of

fruits was found in the winter variety Reinette Bergamot – 2 pcs. (2018 г.). Annual fruiting with various intensity is noted as a result of studying the yield variability of the apple tree at the collection garden of the Vs. M. Krutovsky Botanical Garden. Selected varieties can be recommended as parent specimens to obtain hybrid offspring with high adaptive and economically valuable traits.

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SELECTION OF FAST-GROWING AND HIGH-YIELDING SPECIMENS OF SIBERIAN CEDAR PINE IN GEOGRAPHICAL PLANTATIONS IN THE ARBORETUM OF RESHETNEV UNIVERSITY

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The selection of Siberian pine specimens characterized by rapid growth, increased yield and a short intercropping period, growing in group plantations of the Arboretum of Reshetnev University was carried out. Selected trees should be multiplied by grafting and used to create high-yield artificial plantings of different target orientation: for fast growth and seed productivity.

Keywords: Siberian pine, geographical origin, selection, yield, biometric indicators.

ОТБОР БЫСТРОРАСТУЩИХ И ВЫСОКОУРОЖАЙНЫХ ЭКЗЕМПЛЯРОВ СОСНЫ КЕДРОВОЙ СИБИРСКОЙ В ГЕОГРАФИЧЕСКИХ ПОСАДКАХ ДЕНДРАРИЯ СИБГУ ИМ. М. Ф. РЕШЕТНЕВА

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Проведен отбор экземпляров сосны кедровой сибирской, характеризующихся быстрым ростом, повышенной урожайностью и коротким межурожайным периодом, произрастающих в групповых посадках дендрария СибГУ им. М.Ф. Решетнева. Отселектированные деревья следует размножать прививкой и использовать для создания высокопродуктивных искусственных насаждений различной целевой направленности: на быстроту роста и семенную продуктивность.

Ключевые слова: сосна кедровая сибирская, географическое происхождение, отбор, урожайность, биометрические показатели.

Fast-growing Siberian pine trees of different geographical origin were selected in the group plantings of the Arboretum of Reshetnev University. Some selected trees growing in the outermost rows, due to less competition for illumination, form much larger trunk diameters and crowns, having a height equal to or less than the average values [2]. Individuals within the group, with greater competition for light energy, form a greater height with smaller diameter of the trunk and crown (Table 1).

Selected specimens of Siberian pine trees of different geographical origin by biometric indicators exceed the average values for the variants for most of the studied indicators. Some specimens are distinguished by the excess in the complex of indicators. These are such trees as 30-1, 30-20, 35-5 (Biryusinskoye origin), 34-1, 34-2 (Tomskoye), 36-29 (Chitinskoe).

We selected specimens of Siberian pine trees characterized by the best yield in 2019–2020, which formed a total of 15 to 41 cones. The indicators of the number of cones and the size of the yield are characterized by a close relationship [3]. Most of them are also characterized by a short intercrop period: they form cones annually (Table 2).

Table 1

Selected trees by biometric indicators

Geographical origin / tree number	Height		Diameter of the trunk		Diameter of the crown	
	m	% to X_{av}	sm	% to X_{av}	m	% to X_{av}
Komi / 6-1	11,6	109,4	23,8	108,2	5,2	100,0
Komi / 6-5	10,5	99,1	25,3	115,0	6,4	123,1
Komi / 6-13	11,4	107,5	27,0	122,7	5,1	98,1
Average for the variant	10,6	100,0	22,0	100,0	5,2	100,0
Biryusinskoye / 30-1	10,7	107,0	27,7	129,4	6,3	123,5
Biryusinskoye / 30-20	10,4	104,0	32,7	152,8	8,3	162,7
Biryusinskoye / 35-5	10,4	104,0	32,6	152,3	8,2	160,8
Average for the variant	10,0	100,0	21,4	100,0	5,1	100,0
Tomskoye / 34-1	11,1	118,1	24,6	121,2	4,9	114,0
Tomskoye / 34-2	10,4	110,6	22,8	112,3	4,8	111,6
Average for the variant	9,4	100,0	20,3	100,0	4,3	100,0
Chitinskoe / 36-7	11,4	112,9	22,1	102,3	4,8	98,0
Chitinskoe / 36-14	11,2	110,9	23,1	106,9	4,9	100,0
Chitinskoe / 36-29	10,4	103,0	32,7	151,4	6,6	134,7
Average for the variant	10,1	100,0	21,6	100,0	4,9	100,0

Table 2

Selected trees by yield

Geographical origin	Tree number	Number of cones by year of formation, pcs.		
		2019	2020	Total for two years
Komi	6-1	16	–	16
	6-2	12	3	15
	6-4	20	5	25
	6-5	25	16	41
	6-10	28	7	35
	6-11	20	3	23
	6-12	16	9	25
	6-13	14	7	21
Biryusinskoye	35-1	5	23	28
	35-2	12	17	29
	35-3	18	–	18
	35-4	8	20	28
	33-2	9	6	15
Tomskoye	18-1	25	12	37
	18-2	18	11	29
	18-4	25	9	34
	34-32	19	–	19
	34-5	12	17	29
	34-6	4	13	17
	34-11	12	9	21
Chitinskoe	36-1	6	11	17
	36-18	6	12	18
	36-28	9	6	15
	36-29	4	25	29
	53-9	16	7	23

Selected specimens of Siberian pine trees in terms of growth and yield are of great breeding value. It is advisable to propagate them by grafting [1] and use them to create high-yield plantation crops of different target orientation: for fast growth and seed productivity.

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SPECIES DIVERSITY OF SHRUBS IN NATURAL LANDSCAPES OF KRASNOYARSK AND ITS GREEN ZONE

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To create decorative and durable plantings and increase the ecological efficiency of urban greening objects in large industrial centers, high-quality planting material adapted to local geographic conditions and technogenic loading is needed. The article presents the species diversity of shrubs in the natural landscapes of Krasnoyarsk and its green zone.

Keywords: shrubs, landscape, technogenic, geographic conditions.

ВИДОВОЕ РАЗНООБРАЗИЕ КУСТАРНИКОВ ЕСТЕСТВЕННЫХ ЛАНДШАФТОВ ГОРОДА КРАСНОЯРСКА И ЕГО ЗЕЛЕНОЙ ЗОНЫ

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Для создания декоративных и долговечных насаждений и повышения экологической эффективности городских объектов озеленения в крупных индустриальных центрах необходим качественный посадочный материал, адаптированный к местным географическим условиям и техногенным нагрузкам. В статье представлено видовое разнообразие кустарников естественных ландшафтов города Красноярска и его зеленой зоны.

Ключевые слова: кустарники, ландшафт, город Красноярск.

The relevance is due to insufficient study of the possibilities of using shrubs to improve the quality of the urban environment. To create decorative and durable plantings in city squares and parks, to increase the environmental efficiency of urban landscaping facilities, especially in large industrial centers such as Krasnoyarsk, you need high-quality planting material adapted to local geographic conditions and technogenic loading. The limited assortment and quantitative lack of shrubs in city landscaping leads to the absence of an important shrub layer in the urban landscaping system. Insufficient representation of shrubs in city landscaping, poor knowledge of their growth and development does not allow their high-quality implementation on the objects of landscaping of the city.

The urban greening system, as a whole, and its individual objects, with a rational organization, has a significant impact on the most important indicators of the quality of the environment. The problem of ecological optimization of the urban environment in order to create in them sanitary, hygienic and aesthetic conditions favorable to humans is one of the main goals of urban planning in general and green construction in particular [1].

Landscape resources, on the basis of which urbanized complexes are created, predetermine the boundary conditions for their technogenic transformation. The most stable and conservative block

of system-forming factors of the natural environment is the geomorphological framework of the territory. The territory of the study area is characterized by a significant variety of relief. Krasnoyarsk and its green zone are located at the junction of three geomorphological countries: the West Siberian Plain, the Central Siberian Plateau and the Altai-Sayan mountainous country. The northwestern part of the city of Krasnoyarsk is located within the Krasnoyarsk forest-steppe foothill plain. The territory of this natural district is located at the junction of the West Siberian lowland and the foothill plain of the Eastern Sayan. The valley of the Yenisei River runs along its eastern outskirts, numbering nine terraces of varying preservation, on which the main part of the city is located. The climatic features of the city of Krasnoyarsk and its suburban area are determined by its position in the temperate climate zone with a pronounced continental character. This is due to the location of this territory almost in the center of the Asian continent and remoteness from water surfaces. The vegetation cover in the study area was formed under the influence of the structural and climatic features of the area and is represented by three zonal-belt ecosystems: taiga forests, subtaiga forests and forest-steppe.

Forest-steppe ecosystems are confined to the lower altitude level and occupy almost the entire territory of the hilly plain. Plots of meadow (grass-forb) and true (wormwood-grass, turf-grass) steppes are spatially combined with small tracts of birch and pine forests, forming zonal forest-steppe complexes. The territory of the steppes is currently almost completely plowed up. On steep insolated slopes in the valleys of the Yenisei, Kachi, Esaulovka rivers, small outlines of stony steppes stand out. Sparse herbaceous groups of steppe and mountain-steppe species, thickets of shrubs and rare birch forests are confined to the concave landscape elements.

Subtaiga forest ecosystems are represented by pine, less often larch, forests and birch and aspen forests derived from them. They are confined to the foothills and low mountains of the Eastern Sayan, as well as small massifs are represented on the Kemchug Upland. Subtaiga forests are distinguished by high productivity of forest stands. However, at present, their areas have been significantly reduced due to felling, the creation of artificial plantations and economic development. This has led to the fact that the subtaiga and taiga territories, which are heavily modified by anthropogenic impacts, adjacent to the railway, now have an almost forest-steppe appearance. Taiga ecosystems are mainly represented by mountain taiga forests. In taiga forests, spruce is mainly confined to river valleys; in subtaiga and forest-steppe, small river valleys are occupied by spruce and birch forests. Due to the fact that the territory of Krasnoyarsk is located at the junction of three physical and geographical countries, these zonal landscape subdivisions have transitional features.

Analysis of dendroclimatic resources in combination with the landscape features of the territory shows that the study area is very heterogeneous. The specifics of landscape resources must be taken into account when greening the city and creating plantings in its green zone. The choice of the species composition of plants for landscaping the city of Krasnoyarsk is due to the location of the city at the junction of landscape zones from taiga to dry steppes, the climatic characteristics of which differ significantly, especially in terms of temperature and humidity conditions. We have analyzed the shrub layer in each landscape zone located in the region of Krasnoyarsk and in its suburbs.

The landscape of the dark coniferous taiga of the Kuisum mountains is located within the city limits in the area of the Bobrovy Log fan park and the western part of the Sverdlovsk region. The shrub layer in this zone is represented by common mountain ash (Sorbus aucuparia L.) and white dogwood (Swida alba). The landscape of mountain light-coniferous taiga is represented on the Torgashinsky ridge, within the city limits it is the eastern part of the Sverdlovsk region. The main shrubs in this type of landscape are spiny rose (Rosa acicularis), bird cherry (Padus avium), Siberian mountain ash (Sorbus sibirica), white dogwood (Svidina) (Swida alba), common raspberry (Rubus idaeus). On the flat relief of the ancient terraces of the Yenisei and hilly-ridged watersheds, the landscape of the subtaiga is located, within the city limits these are the areas: Vetluzhanka, pos. Udachny, Akademgorodok, Studgorodok, Siberian Federal University, Ecopark Gremyachaya Mane, Fruit and Berry Station. Shrub layer – oak-leaved spirea (Spiraea chamaedryfolia), common raspberry (Rubus idaeus), tartar honeysuckle (Lonicera tatarica), rock currant (Ribes atropur-

pureum), needle-leaved rose, (Rosa acicularis), bird cherry (Padus alba), woolly willow (Salix dasyclados), black cotoneaster (Cotoneaster melanocarpus).

The landscape of the forest-steppe foothill plain, representing the hilly relief of the watersheds and the flat relief of the upper terraces of the Yenisei, is located in the northwestern part of the sub-urban zone of the city, is characterized by sufficient moisture, the growing season of this territory is provided with sufficient biological resources, includes types of landscapes of the northern and southern forest-steppe. Within the city limits, these are the areas: Upper Bazaikha, Akademgorodok, Studgorodok, the state university area, microdistrict. Solnechny, BSMP, Vetluzhanka, Nikolaevskaya Sopka. The vegetation of this type of landscape is meadow-steppe, birch and aspen groves, groves of birch and birch-larch forests, birch-pine groves on the northern slopes. The shrub layer is represented by such species as Spiraea hypericifolia, Rosa acicularisand others.

The landscape of the high and low floodplains of the river (embankments and islands of the Yenisei River) has meadow-marsh, meadow, shrub vegetation and poplar park forests, thickets of currants from Ribes nigrum and Ribes hispidulum, sea buckthorn (Hippophaer hamnoides), apple trees (Malus baccata).

Thus, when designing landscaping objects, it is necessary to take into account the compliance of the natural and climatic characteristics and ecological properties of plants, decorative features, rules for care, possible volumetric and spatial indicators, taking into account landscape zones and man-made loads of the urban environment.

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APPLICATION OF DIFFERENTIAL EVOLUTION FOR PARAMETER OPTIMIZATION IN ARTIFICIAL INTELLIGENCE METHODS

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Differential evolution is a tool for solving multivariate optimization problems. But it is not only an independent method, but is also used to find optimal values in approaches based on artificial intelligence methods. The efficiency of combining differential evolution with genetic programming and decision trees is considered.

Keywords: differential evolution, genetic programming algorithm, decision tree.

ПРИМЕНЕНИЕ ДИФФЕРЕНЦИАЛЬНОЙ ЭВОЛЮЦИИ ДЛЯ ОПТИМИЗАЦИИ ПАРАМЕТРОВ В МЕТОДАХ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА

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Дифференциальная эволюция – это инструмент для решения задач многомерной оптимизации. Но он является не только самостоятельным методом, но и используется для поиска оптимальных значений в подходах на основе методов искусственного интеллекта. Рассматривается эффективность объединения дифференциальной эволюции с генетическим программированием и деревьями решений.

Ключевые слова: дифференциальная эволюция, алгоритм генетического программирования, дерево решений.

To date, such an optimization method as differential evolution has gained wide popularity. Differential evolution (DE) is a method of multivariate stochastic optimization of functions of real variables, which uses the ideas of evolutionary algorithms. A population in the DE algorithm is a set of vectors from R^n, in which each variable of this space corresponds to its attribute. The algorithm parameters are the population size N, the mutation strength $F \in [0; 2]$ and crossover probability P [1].

The DE method is used not only as an independent tool in solving optimization problems, but also in synthesis with the methods of machine learning and artificial intelligence [2]. Consider the effectiveness of such an application.

In works investigating the application of the genetic programming (GP) algorithm for solving the identification problem, optimization of numerical coefficients and initial conditions of differential equations is required [3; 4]. In Table 1 compares the following approaches: an identification approach based on a self-configuring GP algorithm and a steepest descent method, and an approach that combines GP and DE.

Table 1

Comparison of the effectiveness of approaches to identification based on the GP algorithm

	GP+ steepest descent method	GP+DE
1	0.0013	0.0000
2	0.0072	0.0000
3	0.0037	0.0000
4	0.1047	0.0001
5	0.0077	0.0000
6	0.0983	0.0001
7	0.0065	0.0000
8	0.1200	0.0000
9	0.1742	0.0002
10	0.0084	0.0000
11	0.0035	0.0000
12	0.3202	0.0002
13	0.1462	0.0000
14	0.0893	0.0000
15	0.2540	0.0000
16	0.2985	0.0046
17	0.2562	0.0095
18	0.3724	0.0103
19	0.0566	0.0011
20	0.1499	0.0017

Consider another way to use DE, but this time we will explore how DE can affect machine learning methods when solving various classification problems [5]. Decision trees are an effective tool in the field of information technology for data analysis. However, the decision tree algorithm uses brute force to optimize thresholds, which makes the decision tree algorithm greedy. To optimize the threshold values, the DE method (modified algorithm) was used and the results obtained were compared in Table. 2.

Table 2

Comparison of the efficiency of standard and modified decision trees

	ID3		CART	
	Standard	Modified	Standard	Modified
1	0.711	0.718	0.655	0.711
2	0.794	0.784	0.77	0.799
3	0.978	1	0.978	1
4	0.454	0.74	0.419	0.762
5	0.885	0.922	0.893	0.918
6	0.778	0.84	0.79	0.802
7	0.842	0.854	0.846	0.861
8	0.808	0.798	0.76	0.817

Based on the conducted studies, it can be concluded that the use of the DE method has significantly increased the effectiveness of approaches based on artificial intelligence methods.

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ANALYSIS OF THE STATE OF THE INFORMATION SYSTEM OF MACHINE-BUILDING INDUSTRY ENTERPRISES ON THE EXAMPLE OF JOINT STOCK COMPANY "KRASMASH"

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The article discusses the problems of the existing approach of automating business processes at enterprises of the machine-building industry. An example of the current information landscape of a machine-building industry enterprise is described, reflecting the inefficient structure of information systems and the resulting problems. A method for solving the described problem is proposed.

Keywords: automated system, software, digital transformation, enterprise management, cost, efficiency assessment.

АНАЛИЗ СОСТОЯНИЯ ИНФОРМАЦИОННОЙ СИСТЕМЫ ПРЕДПРИЯТИЙ МАШИНОСТРОИТЕЛЬНОЙ ОТРАСЛИ НА ПРИМЕРЕ АО «КРАСМАШ»

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Рассматривается проблематика существующего подхода автоматизации бизнес-процессов предприятий машиностроительной отрасли. Описан пример действующего информационного ландшафта предприятия машиностроительной отрасли, отражающий не эффективную структуру информационных систем и возникающие в следствии этого проблемы. Предложен способ решения описанной проблемы.

Ключевые слова: автоматизированная система, оценка эффективности, программное обеспечение, стоимость, управление предприятием, цифровая трансформация.

Many enterprises of the machine-building industry do not have an effective automated control system, which leads to the creation of unfinished fragments of information infrastructure and application systems that cannot be effectively applied in the practical activities of the enterprise [1].

At the same time, enterprises incur additional costs for duplicating system functions that a complex information system could perform, and servicing time-consuming data exchange procedures [2-3]. This approach is characterized by low availability of information: the necessary data is in the database of several information systems, but they are contradictory. Specialists of departments can use data from the systems, but they reach the management with delays, which is unacceptable for operational analysis and decision-making.

We could consider the existing information structure of a large enterprise of the machine-building industry. The production control unit includes an automated control system for technological processes and production. This system allows to keep records of data of normative and reference

information, technological preparation of production, production planning, preparation, management, and dispatching, inventory management and quality management, as well as cost management and calculation of the cost of finished products.

The enterprise management unit is represented by automation systems for accounting of financial and economic activities of the enterprise, such as 1C and BOSS HR Officer. This block reflects the regulated accounting of the enterprise, sales and procurement management, settlements with counterparts, cash flow accounting within the framework of 275-FZ, salary calculation, time sheet, personnel accounting, staffing and personnel process management.

Simultaneous use of several automated systems, each of which functions independently of the others, results in the following consequences: 1. special procedures are needed for data exchange between systems, the implementation of which involves technical, organizational difficulties and additional costs; 2. the information necessary for making strategic and operational management decisions is stored in various systems and it is not aggregated, which also requires additional time and resource costs for its processing and analysis; 3. difficulties in the administration and maintenance of various systems, which leads to an increase in the total cost of their ownership; 4. simultaneous existence of different versions of documents, making it difficult to obtain up-to-date data; 5. difficulties in maintaining a chronology of work with documents.

The approach proposed to solve the described problems is commonly called complex automation. Complex automation involves the simultaneous implementation of a number of modules of the integrated control system. The priority of the direction should be chosen after a full analysis of the enterprise business processes (their complexity, interconnection, etc.) and the impact of each of them on the final financial result of the company.

Further work will be associated with the identification and description of the most important processes and operations, on the basis of which the priority tasks of automation will be determined.

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TRENDS IN INCREASING THE FROST RESISTANCE OF ELASTOMERIC MATERIALS

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The paper describes the basic trends of combining low-compatibility polymer bases in rubber formulation aimed at improving the properties of materials designed for low-temperature service.

Keywords: elastomeric materials, frost-resistance, compatibilizer.

ТЕНДЕНЦИИ В ПОВЫШЕНИИИ МОРОЗОСТОЙКОСТИ ЭЛАСТОМЕРНЫХ МАТЕРИАЛАХ

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В работе описаны тенденции по совмещению малосовместимых полимерных основ в рецептуростроении резин, направленные на повышение характеристик материалов, предназначенных для эксплуатации при низких температурах.

Ключевые слова: эластомерные материалы, морозостойкость, компатибилизатор.

Elastomeric materials are thermosetting materials forming networks of both physical and chemical bonds. They are based on natural and synthetic rubbers, and are cross-linked using sulphur, peroxides and other vulcanising systems. Since elastomeric materials have highly elastic properties, their use is widespread in many industries.

Due to the possibility to combine polymer matrix based on different rubbers, vulcanizing system, filler, technological additives and manufacturing regimes, it is possible to obtain materials with specified properties in a wide range of operating conditions. However, the production process of elastomeric products is characterised by multiple stages, rather high energy and labor costs. Therefore, rational choice of materials and processing modes are the key parameters to produce competitive products with the required operational characteristics.

One of the important issues of polymer industry is to expand the application limits of existing and sufficiently produced materials on the market. The possibility of imparting a set of required properties by combining and modifying thermodynamically incompatible rubbers is a promising area of research dedicated to the development of new formulations for the manufacture of elastomeric products. In order to achieve optimum rheological and deformation strength properties, a combination agent (compatibilizer) is added into the system.

The processability and operational characteristics of compositions, including those based on elastomers, are determined by the ratio of the three states of the polymer mixture components. The state in the form of particles of different sizes, representing a separate phase, as a true solution, and in the form of a transition layer, formed due to segmental solubility. The ratio of these states depends on the thermodynamic characteristics of the components and on the mixing conditions [1].

A theoretical comparison of solubility parameters makes it possible to assess the ability to combine polymers. However, the theoretical assessment may differ from the practical results due to the large number of factors affecting the mixing conditions and the inconstancy of the raw material properties. Therefore it is of high scientific interest to investigate even thermodynamically incompatible systems, introducing different types of compatibilizers to ensure maximum achievement of all required properties.

The monograph by Yu. N. Kahramanly presents the results of compatibility and strength characteristics of such incompatible polymer systems as polyolefins with styrene plastics and polyamide with styrene plastics. Investigations in this area allow to create technologically compatible polymer compositions designed for the production of foam-polymer materials [2].

Kiselev V. Ya.studied adhesion characteristics of mixed substrate by the example of a mixture of incompatible rubbers, namely, composition based on NR and NBR-40, as well as PIB-200 and NBR-40. The obtained results show the influence of the elastomeric mixtures nature on the adhesion properties of mixtures of incompatible rubbers, their ratio and viscosity [3].

As for increasing the frost resistance of elastomeric compositions, various scientists worked in this field for a long time, e.g. Kurlyand S. K., Bukhina M. F. Petrova N. N. and others. Generally, when creating new elastomeric compositions and researching their ability to withstand low temperatures up to minus 65 °C, aggressive environments and elastic-strength deformations, they follow the concept of choosing a frost-resistant rubber. This choice is based on the fact that when an elastomeric composition is used in cold climates. This mainly depends on the glass transition temperature and frost resistance coefficient of the rubber. Among the available rubbers meeting the requirements above, butadiene-nitrile rubbers with low nitrile acrylic acid content are often selected both for the production of already known brands of oil and gas resistant rubbers and for compatibility studies with other polymers.

Thus, the authors [4] modified the butadiene-nitrile rubber with small siloxane additives. By the experimental results, the provision of fluorosiloxane rubbers of SLMTFR-K-50 and SLMTFR-K-100 allows to improve physical and mechanical properties. By M. D. Sokolova [5], there is the possibility of modifying elastomeric composites based on butadiene-nitrile rubber with UHMWPE (ultra-high molecular weight polyethylene) polymer filler; this modification improves the characteristics of the complex.

Many studies devoted to frost-resistant elastomeric materials based on propylene oxide and epichloride rubbers. For example, dwells on the combining of propylene oxide rubber at glass transition temperature minus 74 °C with thermoplastic polytetrafluoroethylene. This led to the series of cold-resistant elastomeric compositions resistant to oil and attrition. The combination of propylene oxide rubber with epichlorohydrogenated rubber with a glass transition temperature as low as minus 78 °C made it possible to obtain oil and fuel resistant elastomers with high elasticity and strength properties.

Therefore, the scientific works become the basis for new research and also enable technologists to select the best possible rubber compound formulations without changing the usual production cycle. It also completely meets the material requirements of this particular industry.

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AUTOMATION OF THE EDUCATIONAL PROCESS OF PRESCHOOL INSTITUTIONS

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This article reveals the importance of process automation in the development of information systems. The research also determines the prospects of using intelligent multimedia technologies to improve the functionality and efficiency of the educational process.

Keywords: automation, design stages, multimedia, educational process, training, information system, intellectualization.

АВТОМАТИЗАЦИЯ ОБРАЗОВАТЕЛЬНОГО ПРОЦЕССА ДЕЯТЕЛЬНОСТИ ДОШКОЛЬНЫХ УЧРЕЖДЕНИЙ

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В данной статье раскрывается важность автоматизации процессов при разработке информационных систем. А также определяются перспективы использования интеллектуальных мультимедийных технологий для повышения функциональности и эффективности образовательного процесса.

Ключевые слова: автоматизация, этапы проектирования, мультимедиа, образовательный процесс, обучение, информационная система, интеллектуализация.

In modern society, information systems are developing every day. Multimedia technologies are increasingly being used. There exist different interactive and computer games, 3D-format, intelligent systems – without all of them, it is still difficult and almost impossible to imagine the life of a modern person. But multimedia acts not only as entertainment, and above all, it is convenience, functionality, as well as the effectiveness of use in the educational process.

Any system is called multimedia if it has an impact on several channels of perception at once: text, audio, video, the possibility of interactive learning in the process of playing or learning [1]. The next, more advanced level of multimedia can be considered an intelligent system. They are not only able to broadcast information, but they can also manage it centrally.

The use of multimedia technologies opens up new opportunities in the management of the activities of an educational institution, and also develops the creative abilities students. The information that is transmitted using multimedia resources affects all human senses. It is thanks to the simultaneous impact on various channels of perception that the software product turns into a powerful didactic tool. The task of multimedia technologies is to provide information in various ways. The addition of various video materials to the software, the sound accompaniment of texts, the use of high-

quality graphics and animation allows you to make the software product informative and easy to understand.

Educational systems using multimedia technologies contribute to the preparation of the younger generation for life in modern information conditions. Multimedia possibility of such systems will help users easily perceive various information, understand the impact of information on the psyche, master the ways of communication with the help of technical means. Using of multimedia technologies as a means of improving the effectiveness of education will have a positive impact on the activities of a children's educational institution.

Timely processing of information contributes to the improvement of the organization of production, operation and long-term planning, forecasting and analysis of activities, what makes it possible to successfully compete in the market. Each organization strives to minimize the cost of time, material and labor resources in the course of its activities and simplify the process of information processing. These tasks can be solved with the help of automated information systems.

Using of databases and information systems becomes an integral part of the successful functioning of the organization. In this regard, the development of principles for the creation and effective use of appropriate technologies and software products is becoming increasingly relevant: database management systems, *CASE*-design automation tools and many others.

Such an information system will allow you to automate the document flow as well as the processes of activity of a preschool educational institution [2].

Automation of preschool educational institution management will allow:

1. Automatize and optimize the main information processes between a preschool educational institution and educational management organ;
2. Structure the information and make it more convenient and accessible for analysis;
3. Improve the efficiency and quality of work of employees of preschool educational institutions.

The most important factor determining the efficiency of information systems is a systematic approach to solve information support tasks. Systematic approach involves a comprehensive consideration and solution of economic, technological, psychological, engineering and social problems. This allows to approach the issue of creating an integrated management system, combining horizontal integration (coordinating decision-making with all the necessary information circulating at a certain hierarchical level) with vertical integration.

In accordance with state standard 20914-75, the following stages of designing automated control systems can be distinguished:

1. Pre-project stage;
2. Design stage;
3. Integration.

The pre-project stage includes a pre-project study and the development of a technical specification for an automatic control system. The most important result of this stage is the description of the goals and objectives of the information system; development of general requirements for the creation of an information system; development of a research plan, overview and clarification information management models; structure and functions of the organization, list of tasks that need to be automated; approximate composition of technical means; technical and economic characteristics of the information support system [3].

The design stages are related to the development of technological and operational projects. Development of the terms of reference includes the study of existing facilities of the institution and its management systems. To solve the problems of information support, the analysis of information flows is carried out, classification and coding systems, analysis of document forms and database management systems, studying the structure of existing databases and methods of their integration.

Is very important to analyze in detail all the information used when developing a technical project, including completeness, consistency, no redundancy and duplication, and is also important to develop forms of output documentation.

At the stage of working design, one of the main stages is the development of documentation on information support, the purpose of which is to create the necessary software, preparation of reference and production information on the technical characteristics of the machine carrier for initial loading of the information base, as well as the release of the necessary working documentation, including user instructions and operating instructions. At the same stage, it is advisable to develop and approve the regulations on the database administrator. The documentation should contain: technical design of the information system; description of the organization of the information base; description of the classification and coding system; list of source data; list of output documents; description of local databases; form of output documents [2].

The implementation stage of the automated information system includes the implementation of the main implementation measures; recruitment and training of staff; preparation of premises and technical means. At this stage, the pilot operation of the system is also carried out by solving specific tasks and analyzing test results.

There are not enough human resources to perform operations so quickly and efficiently, and most importantly in a timely manner, as an automated system would do. But it is worth noting that no automated information system will work so accurately without a human guiding hand. Intelligent methods of information processing allow to make the interface of multimedia systems cognitive and as user friendly as possible. Such systems are able to adapt to human capabilities, optimize the communication process – perceive natural language in the form of speech and text, memorize and analyze user characteristics, on the basis of what to give hints, explanations, offer information of interest to the user, effective ways to solve problems and much more.

Thus, the introduction of artificial intelligence into multimedia systems opens up broad prospects for their development and comprehensive use. After all, the main task of the intellectualization of multimedia technologies is to facilitate human life, which makes it possible to optimize the necessary processes and make them more functional, thereby reducing time and financial costs.

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BENEFITS OF USING SIMULATION

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This paper reveals the importance of simulation modeling for creating complex models of phenomena or processes. The article provides an example of a tool for creating a model. In addition, the advantages of using this method are shown in comparison with analytical modeling and the specifics of its application.

Keywords: simulation modeling, discrete-event modeling, agent-based modeling, system dynamics modeling.

ПРЕИМУЩЕСТВА ИСПОЛЬЗОВАНИЯ ИМИТАЦИОННОГО МОДЕЛИРОВАНИЯ

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В данной работе раскрывается значимость имитационного моделирования для создания сложных моделей явлений или процессов. В статье приведен пример инструмента для создания модели. Помимо того показаны плюсы использования данного метода, по сравнению с аналитическим моделированием и специфика его применения.

Ключевые слова: имитационное моделирование, дискретно-событийное моделирование, агентное моделирование, системно-динамическое моделирование.

To date, the use of simulation modeling is one of the highest priority methods for assessing risks in processes, but the use of a simulation model does not exclude the need to use analytical models. The main idea of simulation modeling is that the behavior of the system is studied based on the sets of rules entered by the user, and then the result of the analysis is examined and the most suitable optimal variant is selected. Mathematical statistical methods, such as variance, distribution function, mathematical expectation and probability density, are used to the results of simulation modeling.

Simulation modeling is a research method in which the subject of research is replaced by a model. A simulation model is a model based on a set of changeable rules that allows you to change the probabilistic characteristics. This model provides a large selection from which you can choose the right one. The purpose of the simulation is to obtain the studied parameters on the basis of known or assumed values of the basic parameters [1, 2]. Simulation modeling is able to visualize the processes of the system, schematically depict its structure and present the results in a graphical form.

The company mainly uses AnyLogic software. AnyLogic is the only multi-method tool that combines all existing simulation methods. AnyLogic includes a graphical modeling language that

allows the user to expand their created models. A large set of 3D visualization and interactive animation tools in AnyLogic significantly improve the visual perception of models and serve for their verification. Decision support systems based on AnyLogic serve as a benchmark against which it is convenient to play “what-if” scenarios, fix deviations and analyze causes.

The advantages of using simulation modeling are:

- Formulation of additional questions to the customer on an unfamiliar subject area at the stage of compiling the model "as is";
- The simulation model allows, in principle, to describe the simulated process with greater adequacy than others;
- Visualization of processes;
- Getting preliminary data and compare it with real data; etc.

There are also several difficulties in the use of simulation modeling:

- It is impossible to simulate all the subtleties of a realistic system, and what the user simulates will differ from reality;
- The task of a specialist is, in the context of a certain enterprise, to learn how to model a realistic activity so that its simulation gives a given error for the calculated parameters; etc.

As a result, we can conclude that simulation modeling may be the only option for solving the problem of setting problems and observing phenomena in realistic conditions. The simulation method is used when and only when the analytical solution of the problem of studying the given object is difficult or impossible.

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GROWING CAPACITY OF SIBERIAN CEDAR PINE SEEDLINGS WITH CLOSED ROOT SYSTEM ON DIFFERENT COMPOSITIONS OF COCONUT SUBSTRATES

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The effect of different variants of substrates based on coconut fibers on biometric parameters and growing capacity of Siberian pine seedlings with closed root system was tested. The excess of growing capacity of seedlings on coconut substrates with the addition of vermiculite, peat or mycorrhiza was detected. Application of pure coconut substrate or in combination with perlite has no stimulating effect on seedling growth.

Keywords: Siberian pine, seedlings, closed root system, substrate, growing capacity.

ЭНЕРГИЯ РОСТА СЕЯНЦЕВ СОСНЫ КЕДРОВОЙ СИБИРСКОЙ С ЗАКРЫТОЙ КОРНЕВОЙ СИСТЕМОЙ НА РАЗНЫХ СОСТАВАХ КОКОСОВЫХ СУБСТРАТОВ

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Испытано влияние разных вариантов субстратов на основе кокосового волокна на биометрические показатели и энергию роста сеянцев сосны кедровой сибирской с закрытой корневой системой. Выявлено превышение энергии роста сеянцев на кокосовых субстратах с добавлением вермикулита, торфа или микоризы. Применение чистого кокосового субстрата или в сочетании с перлитом не оказывает стимулирующего действия на рост сеянцев.

Ключевые слова: сосна кедровая сибирская, сеянцы, закрытая корневая система, субстрат, энергия роста

Cultivation of planting material of the main forest-forming species with a closed root system is a promising direction of silvicultural production. In Russia, the use of this type of planting material was initiated since the middle of the XX century [1], but at that time, this method was not widely used. At present, the technologies of cultivation of planting material with a closed root system are being improved. Many factors influence the success of growing this type of planting material, the composition and quality of the substrate is one of them.

In recent years there has been an increasing amount of research in many countries into the selection of substrates that are full substitutes for the peat used in most mixes for the closed root system seedlings. One of the popular substrate to replace peat mixtures is coconut fiber [2]. The main characteristics of coconut substrate are considered to be the optimal ratio of moisture to air in its volume and the cation-exchange capacity (buffering capacity) [3].

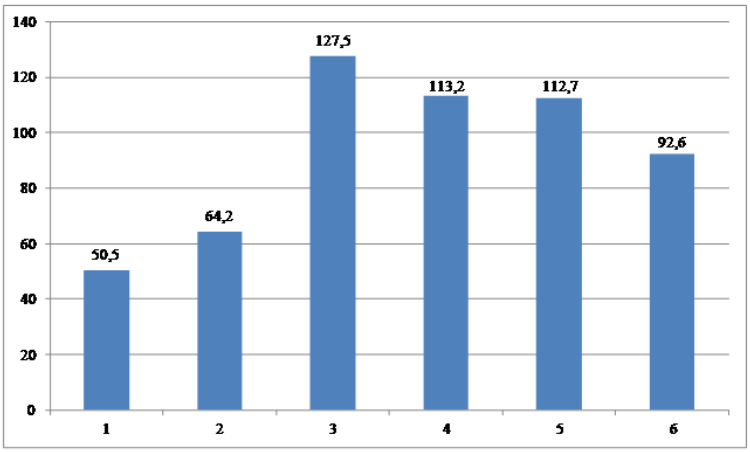
Coco-based substrate was used during the cultivation of planting material of Siberian pine with a closed root system in this research work in six variants (1 – without additives, 2 – with the addition of perlite (12 %), 3 – with vermiculite (12 %), 4 – in a mixture with mycorrhiza, 5 – in combination with peat (50 %), 6 – with the addition of perlite (5 %) and vermiculite (5 %).

Seeds of Siberian cedar pine for sowing were collected in the Yemelyanovsky forestry in Krasnoyarsk Territory, underwent trench stratification, and were sown in June 2021.

By the end of the vegetation period of the first year of the seedlings' life, their height on average was 2.9±0.18 cm, varying by experiment variants from 2.4 to 3.4 cm. Stem diameter at the root neck on average was 1.7±0.06 mm. The diameter value varies from 1.4 to 2.0 mm depending on substrate composition (see Table).

Biometric indicators of seedlings on different substrates

Substrate composition		$X_{av.}$	± σ	± m	P, %	V, %	T_{fact} under t_{05} = 2,04
Seedling height,cm							
1	Coconut substrate without additives	2,4	0,59	0,15	6,1	24,3	4,44
2	Coconut substrate + perlite 12 %	2,8	0,76	0,17	5,9	26,6	2,43
3	Coconut substrate + vermiculite 12 %	3,4	0,71	0,16	4,7	20,9	–
4	Coconut substrate + mycorrhiza	2,7	0,56	0,21	7,9	20,8	2,61
5	Coconut substrate + peat	2,9	0,82	0,22	7,6	28,3	1,85
6	Coconut substrate + perlite 5 % + vermiculite 5 %	3,3	0,74	0,14	4,4	22,4	0,51
Diameter at the root neck, mm							
1	Coconut substrate without additives	1,4	0,25	0,06	4,4	17,5	6,03
2	Coconut substrate + perlite 12 %	1,5	0,21	0,05	3,3	14,6	6,12
3	Coconut substrate + vermiculite 12 %	1,9	0,16	0,04	1,9	8,4	0,93
4	Coconut substrate + mycorrhiza	2,0	0,20	0,08	3,8	10,1	–
5	Coconut substrate + peat	1,9	0,33	0,09	4,6	17,1	0,92
6	Coconut substrate + perlite 5 % + vermiculite 5 %	1,6	0,20	0,04	2,3	11,9	4,28



Growing capacity of seedlings with closed root system depending on substrate composition

Seedlings grown in substrates in combination with vermiculite (variants 3 and 6) were characterized by greater height, a satisfactory growth was noted in the fifth variant – in combination with peat. Larger values of trunk diameter were noted when combining coconut substrate with mycorrhiza, with peat and vermiculite (variants 3, 4 and 5, respectively).

A. V. Zhigunov considered the growing capacity, which is a derivative parameter from the height and diameter of the seedling trunk, as the optimal

indicator characterizing the growth of seedlings with closed root system [1]. The seedling growing capacity varied from 50.5 to 127.5 (see Figure).

It was found that seedlings of 3, 4 and 5 variants with coconut mixture with vermiculite, mycorrhiza or peat as a substrate have the highest growing capacity. It should be noted that the addition of perlite to the substrate does not have a stimulating effect on the growth of seedlings.

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INTELLIGENT SYSTEMS IN PRODUCTION PROCESSES

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This study examines the participation of various intelligent systems, in particular artificial intelligence, when using them in production processes, as well as their impact on the industrial industry as a whole.

Keywords: intelligent systems, production, industry, artificial intelligence.

ИНТЕЛЛЕКТУАЛЬНЫЕ СИСТЕМЫ В ПРОИЗВОДСТВЕННЫХ ПРОЦЕССАХ

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В исследовании рассматривается использование различных интеллектуальных систем, в частности искусственного интеллекта, в производственных процессах, а также их влияние на промышленную отрасль в целом.

Ключевые слова: интеллектуальные системы, производство, промышленность, искусственный интеллект.

Complex automation has recently been the main course of development of all industrial sectors. Enterprises use those solutions that rely on massive, communicating, distributed computing systems. They not only control the production cycles, but are also closely integrated into technological processes with increased flexibility and efficiency to improve the quality of products. With the development of artificial intelligence, the possibility of creating automation systems of completely new levels has become real.

At the moment, the work of these systems is tied to the accuracy of calculations and the logic of decision-making, that is, on a pre-selected model that reveals the production processes. By analyzing the situation in real time, the AI learns to adapt to unforeseen circumstances associated with changing the parameters of both the controlled object and its environment. Now the system can change the control algorithms, looking for more effective and acceptable solutions [1].

There are several features of the operation of intelligent production systems: there are no set coordination and control algorithms or only its rudiments have been formed; availability of various data collection systems; analysis of a variety of data, from symbols and texts to images and video sequences; the choice consists of a variety of possible and previously undefined options.

In manufacturing, artificial intelligence finds application at such business levels as:

– design level. This increases efficiency in the development of both new and old products, a thorough analysis of requirements and assessments for parts and spare parts is carried out;

– logistics level. The accuracy of the construction of transportation routes allows you to reduce the delivery time of raw materials, the stages of shipments and delivery are tracked at all stages. AI can anticipate fluctuations in shipment volumes and facilitate interaction with suppliers and customers;

– the level of production. Process coordination improves, intelligent assistants reduce the risk of employee errors, as well as the amount of time that goes into downtime, the level of enterprise security, quality control and analysis of the condition of tools and equipment increases;

– the level of promotion. Forecast of future order volumes, pricing management and analysis of how customer satisfaction correlates with the quality of products and services.

It is worth noting that the introduction of artificial intelligence does not require a large-scale restructuring of all business processes. There are already solutions that optimize already established systems with the achievement of new quality as a result, which is possible thanks to a smooth, phased implementation [2].

Absolutely any system with AI can be represented as a combination of simple elements of agents, each of which solves its own small range of tasks. At the same time, they can work in their own separate environment, that is, both without knowing about the existence of other agents, and work together, coordinated with the exchange of results in a common information space.

Unfortunately, to date, the share of the introduction of artificial intelligence in the Russian industry is extremely small, but they fully prove their technological effectiveness. The largest mining and processing factories and plants can act as customers. They have already implemented systems with monitoring of industrial safety of personnel, analytical control by means of video surveillance over the quality of products and the condition of equipment.

It was found out experimentally that the introduction of AI into enterprises pays off quickly enough. For example, if these solutions in the field of occupational safety are put into operation, it will significantly reduce the level of injuries by almost half due to the use of analytics in the compilation of heat maps, analysis of the availability of personal protective equipment and more careful monitoring of areas with increased danger.

RPA in tandem with artificial intelligence is actively used in the circulation of electronic documents, which makes it possible to speed up the processing of letters and free employees from monotonous operations. In ITSM systems, the time spent on processing documentation can be reduced by up to 75 % when creating reports and banking transactions.

Today, AI is the main direction in the development of control systems, it allowed us to squeeze the maximum out of existing ones and create new ones with unprecedented efficiency. According to forecasts, enterprises will be able to create inexpensive, high-quality products and automatically, quickly change production cycles and a wide selection of products. So, the number of companies that are not interested in artificial intelligence is rapidly approaching zero.

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SIMULATION MODELING OF PRODUCTION PROCESSES AT THE ENTERPRISE

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The article discusses the concept of simulation modeling, its types and tools for modeling production processes at enterprises. As well as the advantages and disadvantages of using a simulation model of production processes are given.

Keywords: simulation modeling, discrete-event modeling, system dynamics, agent-based.

ИМИТАЦИОННОЕ МОДЕЛИРОВАНИЕ ПРОИЗВОДСТВЕННЫХ ПРОЦЕССОВ НА ПРЕДПРИЯТИИ

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В статье рассматривается понятие имитационного моделирования, его виды и средства моделирования производственных процессов на предприятиях. А также приведены преимущества и недостатки использования имитационного моделирования производственных процессов.

Ключевые слова: имитационное моделирование, дискретно-событийное моделирование, системная динамика, агентный подход.

To date, simulation modeling is a generally accepted method for studying difficult dynamic systems. Simulation modeling is used in various areas of business, science, and also in production. In Western Europe and the United States, the simulation method is developing more actively than in Russia.

Simulation modeling is a research method when the system under study is replaced by a model [1; 2]. Simulation models are a "executable" model with a set of changeable rules and the ability to set probabilistic characteristics. Simulation models produce many solutions from which it is possible to choose the optimal one. There are three types of simulation modeling: discrete-event modeling, system dynamics, agent-based.

Discrete Event Simulation – A simulation that shows only the key actions of the simulated system, this type of simulation is great for manufacturing processes.

System dynamics is a model where graphic diagrams are built, and then, based on these diagrams, the model is simulated on a computer. This type of modeling makes it possible to detect causal relationships between objects and phenomena. With the help of system dynamics, models of business processes are built.

Agent-based modeling is a simulation that is used to study the behavior of agents. The purpose of agent-based models is to obtain representations of the behavior and interaction of agents acting at

the micro level on macro-level indicators. An agent is a certain entity with activity, independent behavior, which makes decisions based on the introduced rules.

AnyLogic is the only multi-method tool that combines all existing simulation methods.

According to the logic of excel, we have a data set for input, there is a certain language for describing processes or systems, after entering the data we launch the model, and it starts moving through time points, there may also be forks in the system, for example, if we have sufficient inventory in the warehouse, then we make the shipment, and if not, then we take another optimal solution. At the same time, the parameters in the model can also be set by probabilities, for example, a truck from Moscow goes according to the standard of 7 hours, or it can go with a certain probability, for example, time can be evenly distributed from 7 hours to 15 hours. We can stop the model at a specific time point and look at the result for that period of time.

AnyLogic includes a graphical modeling language that allows the user to expand their created models. A large set of 3D visualization and interactive animation tools in AnyLogic significantly improve the visual perception of models and serve for their verification. Decision support systems based on AnyLogic serve as a benchmark against which it is convenient to play "what-if" scenarios, fix deviations and analyze causes.

Advantages and disadvantages of using a simulation model of production processes:

Advantages:

- An excellent assistant in making sensible tricky decisions;
- Replacement of real experiments. saving money, time and resources spent experimenting;
- Possibility to conduct virtual researches with "what-if" scenarios; etc.

In conclusion, it can be said that almost any situation can be simulated with the help of simulation, for example, the expansion of production areas, the construction of new workshops, the placement of jobs, the layout of equipment, the productivity of production, and the verification of the correctness of decisions.

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DIGITAL TECHNOLOGIES OF INTELLECTUAL ANALYSIS OF INFORMATION DATA IN THE ORGANIZATION OF DIGITAL MANUFACTURING OF SPACECRAFT

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The article provides an analysis of the need to create digital production at the enterprises of the rocket and space industry in order to improve the quality of finished products and, as a result, increase competitiveness in the world market.

Keywords: digital technologies, intellectual analysis, information data.

ЦИФРОВЫЕ ТЕХНОЛОГИИ ИНТЕЛЛЕКТУАЛЬНОГО АНАЛИЗА ИНФОРМАЦИОННЫХ ДАННЫХ ПРИ ОРГАНИЗАЦИИ ЦИФРОВОГО ПРОИЗВОДСТВА КОСМИЧЕСКИХ АППАРАТОВ

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В статье приводится анализ необходимости создания цифрового производства на предприятиях ракетно-космической отрасли в целях повышения качества готовых изделий и, как следствие, повышения конкурентоспособности на мировом рынке.

Ключевые слова: цифровые технологии, интеллектуальный анализ, информационные данные.

Creating necessary conditions for the development of digital production, in which digital data is a key factor in all areas of the creation of complex technology, increases the competitiveness of enterprises, which ensures economic growth and national sovereignty.

In the modern world, the analysis and processing of big data has become an urgent necessity. Traditional approaches to the analysis of information data cannot provide the maximum possible data coverage, a systematic approach, the establishment and tracking of relationships between a large number of parameters and other important aspects. In turn, the ability to track and identify new trends in the creation of space technology is paramount, since it is necessary to maintain the positions of Russian enterprises as innovative organizations, as well as in the creation of competitive spacecraft at the international level.

The production of complex science-intensive products, such as space technology, requires the use of many constituent elements and includes a large number of different production processes (design, construction, manufacture, testing, operation and disposal). At the same time, the quality and reliability of newly created products can be very sensitive to deviations in the characteristics of any element of spacecraft and changes in the technological processes being used. That is, at first sight, minor changes and deviations can have a disastrous effect on reliability and quality. At the

same time, it is important to understand that such changes and deviations are inevitable, since on the one hand they are the result of necessary constant development and improvement of industrial technologies, and on the other hand they can occur unpredictably, for example, as a result of the change of suppliers, modernization of equipment in production or the influence of human factor. Therefore, in order to improve the reliability and quality of products, automatic detection and analysis of the maximum possible number of deviations that occur, which affect the characteristics of the product and may indicate defects that lead to a decrease in reliability, is required.

Since it is impossible to know in advance which characteristics of the product will be affected by a particular change in the technological process or parameters of any of the spacecraft elements used, especially if it occurs due to a random combination of circumstances, it is necessary to obtain and analyze the maximum possible amount of information at all stages of the product life cycle. At the same time, huge amounts of data arise that cannot be effectively analyzed by a person. Systems using data mining algorithms should be used to process and analyze such data arrays.

The methods of intelligent analysis allow you to establish and track the relationship between a large number of parameters, make it possible to automatically process archives of accumulated data and extract useful information from them, allow you to take into account the results of mathematical modeling and identify deviations indicating possible hidden defects. In the future, such systems will make it possible to predict the period of active existence of spacecraft, which can help reduce the cost of insurance premiums. The digital technology of intelligent analysis of information data is the most important technology for forecasting the directions of innovative development of space technology, on the basis of which the technology of forecasting the active life of new generation spacecraft will be built.

To improve the quality and reliability of the space technology being created, it is necessary to create and implement systems that provide full control and data collection throughout the product lifecycle (PLM technologies) in interconnected databases. At the same time, the systems being created should use data mining and mathematical modeling tools. For maximum effect, intelligent analysis should take into account data on all stages of the product life cycle, while all types of information in the complex should be analyzed.

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ALGORITHMS FOR TESTING SPACEWIRE EQUIPMENT IN COMPLIANCE WITH RMAP PROTOCOL SPECIFICATION

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SpaceWire is a technology that provides high-speed transmission of information on board of the spacecraft. There are a number of transport protocols that can be used in combination with SpaceWire. Remote memory access protocol is one of such protocols; it allows to write and read data from the remote SpaceWire node. This article presents the developed testing algorithms to check the support of the key mechanisms of the protocol by the device where the Remote memory access protocol controller is implemented.

Keywords: spacecraft, onboard equipment, testing algorithms, SpaceWire, Remote memory access protocol.

АЛГОРИТМЫ ТЕСТИРОВАНИЯ ОБОРУДОВАНИЯ SPACEWIRE НА СООТВЕТСТВИЕ ТРЕБОВАНИЯМ СПЕЦИФИКАЦИИ ТРАНСПОРТНОГО ПРОТОКОЛА RMAP

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SpaceWire – технология, обеспечивающая высокоскоростную передачу информации на борту космического аппарата. Существует ряд транспортных протоколов, которые можно использовать в сочетании со SpaceWire. Протокол удаленного доступа к памяти – один из таких протоколов, позволяет записывать и считывать данные из памяти удаленного узла SpaceWire. Для того, чтобы протестировать поддержку ключевых механизмов протокола устройством, в котором реализован контроллер Протокола удаленного доступа к памяти, были разработаны алгоритмы тестирования, представленные в данной статье.

Ключевые слова: космические аппараты, бортовая аппаратура, алгоритмы тестирования, SpaceWire, Протокол удаленного доступа к памяти.

Remote memory access protocol (RMAP) performs the functions of a transport layer operating on top of the SpaceWire protocol stack (ECSS-E-ST-50-12C standard [1] and the SpaceWire-RUS draft standard), and it can be used to configure the network, monitor nodes and transfer data between them. According to the ECSS-E-ST-50-52C standard [2] the protocol implements the transmission of 3 types of commands:

1. write command;
2. read command;
3. read-modify-write (RMW) command.

Also, the RMAP standard regulates the algorithms of actions that must be worked out by the equipment in case of an error during the execution of a write, read or RMW command.

In this article, testing algorithms are considered to determine the correctness of the execution of all 3 RMAP commands, as well as the correctness of the actions of the equipment in the event of an error.

Therefore, test algorithms were developed and implemented in the form of a program to test SpaceWire equipment for compliance with the protocol standard:

1. Testing write command and errors that appear during its execution;
2. Testing read command and errors that appear during its execution;
3. Testing RMW command and errors that appear during its execution;

The workplace presented in figure 1 was assembled to implement these tests.

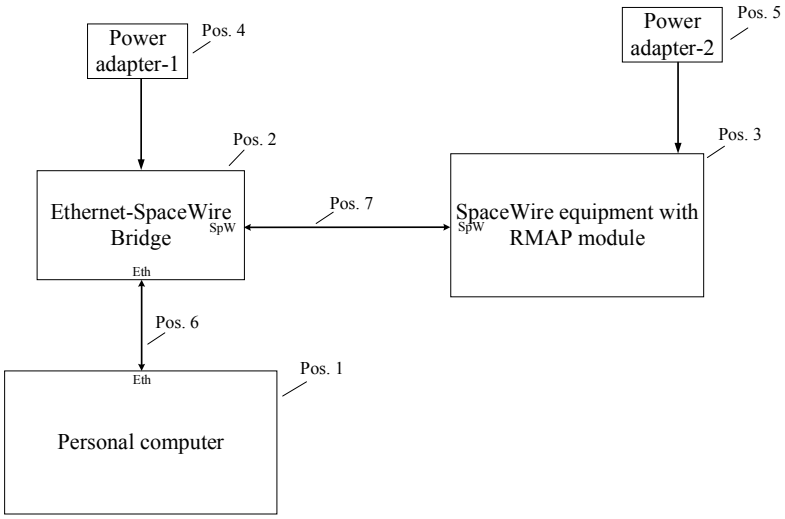

Fig. 1. Workplace for testing the mechanisms of the RMAP controller

Special software (SS) has been developed to interact with an operator. This SS permits to make all necessary configuration of the testing equipment, realize all types of tests and make a conclusion about correctness operation of the equipment in accordance with the specification. These actions are performed using a console user application [3].

As an example, it is proposed to consider the algorithm for testing the write command. A connection is being established between the tested equipment and the interface bridge. If after a certain specified time the connection hasn't been established (via the transmitter/receiver line), then information is recorded in the log: there is inability to establish a connection; the function exits. If the connection has been established, the error code N = 0 is set, which corresponds to the correct write command. A fixed write command is generated on the interface bridge. Next, this command is sent. The tested equipment, after accepting the command, must process it and send a confirmation packet. Confirmation packet has got a status bit in their structure, which can be used to understand what errors appeared during the execution of the command. If the expected status is correct, information is recorded in the log: the equipment responds correctly to the error N. The next cycle starts with N equal to 1, which means the "Incomplete header" error. This continues until N reaches its limit value. If a response to a command with an incorrect error status comes to the interface bridge for a particular cycle, then information is recorded in the log: the equipment does not respond correctly to the error N. Therefore, after passing all the cycles, all information about the test results will be recorded in the log. For read and RMW commands, the algorithm is similar. When the function exits at any stage of the test, the hardware and the interface bridge software are completely stopped.

The block diagram of this testing algorithm is shown in figure 2.

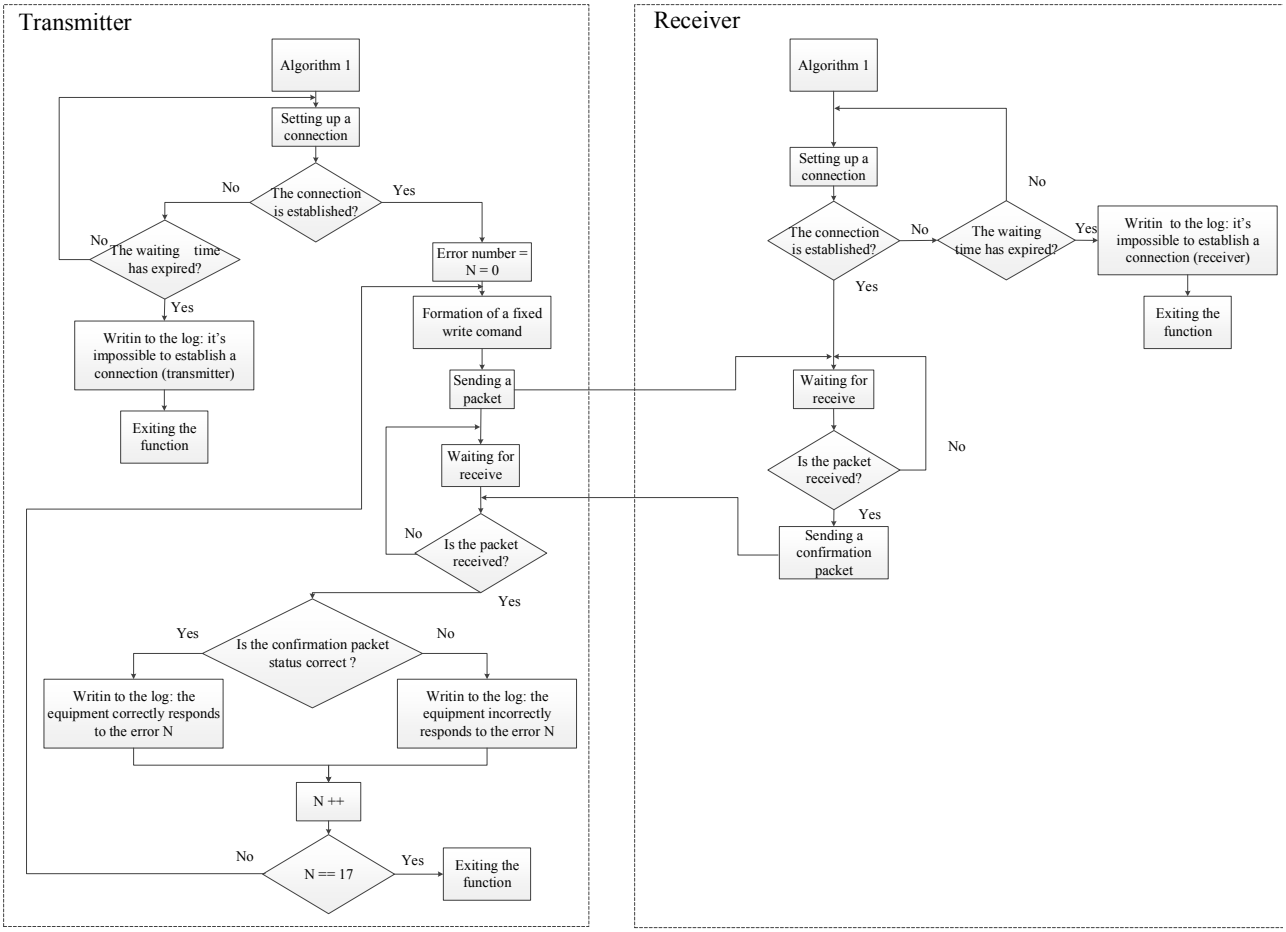

Fig 2. Block diagram of the algorithm for testing the write command of the RMAP transport protocol

The development of algorithms was carried out using the SpaceWire switch, with the RMAP controller block implemented in it. The switch successfully accepted write, read and RMW commands, and also responded in accordance with the standard to most of the errors entered. Those errors to which the switch responded incorrectly were described separately in the technical documentation for it.

New algorithms for testing the RMAP specification are planned to develop in the future:

1. Checking the reaction of SpaceWire equipment to responses to write, read and RMW commands.

2. Checking the reaction of SpaceWire equipment to errors in responses to write, read and RMW commands.

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ANALYSIS OF THE OPERATION OF THE «EXPLUATANT» USER MODULE FOR MAINTENANCE OF AN-24/26 AIRCRAFTS

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To ensure the required level of aircraft flight safety, various modules are used in civil aviation. The user module «Expluatant» is a software in which all units and devices installed on the aircraft are recorded. However, the system does not automatically take into account the remaining resource and does not inform about the expiration of the service life.

Keywords: aircraft, maintenance, « Expluatant» module, malfunction.

АНАЛИЗ РАБОТЫ ПОЛЬЗОВАТЕЛЬСКОГО МОДУЛЯ «ЭКСПЛУАТАНТ» ДЛЯ ПРОВЕДЕНИЯ ТЕХНИЧЕСКОГО ОБСЛУЖИВАНИЯ ВОЗДУШНЫХ СУДОВ ТИПА АН-24/26

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Чтобы обеспечить требуемый уровень безопасности полетов воздушных судов в гражданской авиации используются различные модули. Пользовательский модуль «Эксплуатант» является программным обеспечением, в котором ведется учет всех агрегатов и устройств, установленных на воздушное судно. Однако система, автоматически учитывающая оставшийся ресурс, не информирует пользователя об истечении срока службы.

Ключевые слова: воздушное судно, техническое обслуживание, модуль «Эксплуатант», неисправность.

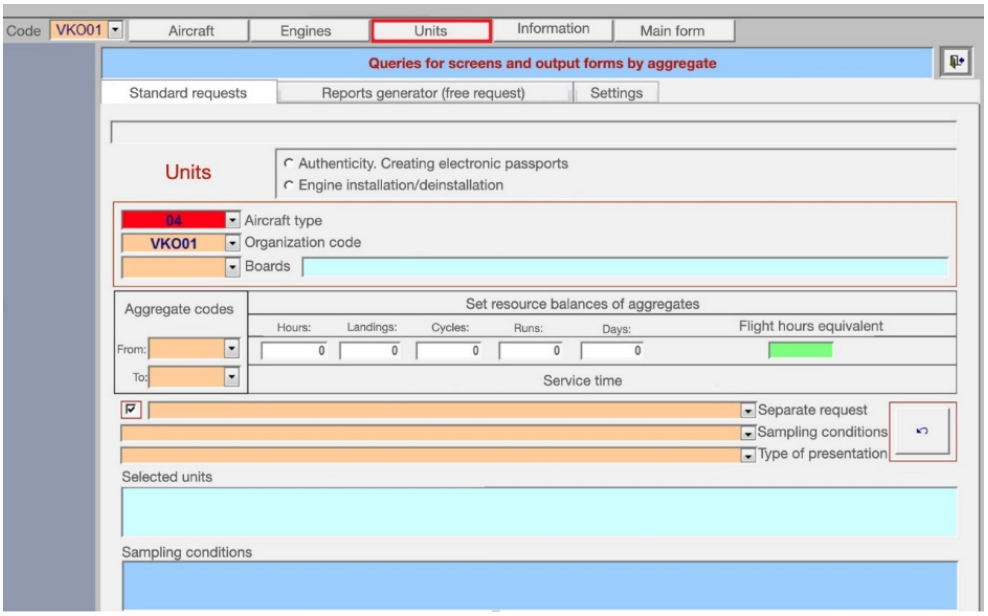
The user module of the information system «Expluatant» (that means «Operator») is a set of regulatory and technical base and it is an automated software used by airlines to carry out maintenance and repair of aircraft.

The airline's specialists enter information about the operated aircraft into this module about their products and aggregates. The information concerning maintainable products is downloaded according to the passport (for engines and airframe – according to the form): the dates of manufacture and certification, the date of the last repair of the unit /product, the number of launch.

Figure 1 shows the window of the software package for accounting products/aggregates of aviation equipment in the user module «Expluatant».

The user downloads information about non-repairable units and products into the «Expluatant» system to account for their presence on the aircraft. Such units change at the end of their service life, therefore, they work until failure. Operational statements are not issued for the replacement of these units/products.

For An-24/26 aircraft, there are several forms of operational maintenance: A1, A2 and B. For each of these forms, there are operational statements that the production and dispatch department issues to the employees of the engineering service. To carry out the work on the A1 form, one operational statement is issued to check the preparation of the aircraft for flight. Forms A2 and B are issued with a package of documents containing a list of works that must be performed in order to release the board.



General view of the user module «Expluatant»,
subsection «Accounting of aircraft products».

When issuing order cards, an error may occur, the cause of which may be both the «human factor» and an insufficient level of automation of the program. With the help of the module, the user uploads a list of aggregates and products for checking from the system to a specific form, displaying the parameters of the resource state. That is when performing for example, Form B, the user uses the module to check the resources of aggregates and products only for this form of technical maintenance.

But at the same time, the unit, which maintenance should be carried out in a more labor-intensive form, for example, in the form of B-200, in the usual form of B, any of the resources may run out: flight hours, calendar or landing cycle. In order to exclude the expiration of the service life, the user needs to upload information about all units assigned to the aircraft. This operation is time-consuming to check. If the user makes such an uploading and finds an aggregate that is not suitable for the ongoing form of maintenance, but which has one of the operating parameters, then the user issues the work to the engineering service to perform on the nearest form of maintenance.

Regardless of when work is to be carried out on this unit, after the work is carried out according to the passport, the data in the module is updated.

Table 1 below shows an example with statistics showing how many aggregates were not detected during Form B for the period from 01.09.2021 to 16.10.2022.

Statistics of undetected aggregates during Form B on An-24/26 aircraft from 01.09.2021 to 16.10.2022

Number of undetected units by service life	The number of undetected units by operating time	The number of undetected aggregates in the work cycle
10	14	5

The user module «Expluatant» has a number of advantages in use – the module facilitates the work of the production and dispatch department when processing the technical base, allows to

quickly find out the passport data of the unit. But the module also has a drawback – the program does not notify the user in a timely manner that a certain unit has one of the operating parameters. At the stage of issuing works to engineering personnel, the user may make a mistake and the unit with incorrect parameters, therefore, the unit will not be serviced on time. This factor directly affects flight safety.

In the information system «Expluatant» when adjusting the algorithm of the module, it is advisable to make the following changes:

– Informing a user when logging in about the expiration of the resources of aggregates and products;

– Recommending the inclusion of a unit/product in the nearest form of maintenance;

– Informing the user on the removal and dispatch of aggregates and products for repair.

Improvements of this kind will increase the awareness of users about the current technical condition of aircraft and the validity of decisions on their maintenance, which will reduce risks in the planning and organization of work on air transport.

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USING A KNIFE HEADSET WITH A SPATIAL ARRANGEMENT OF KNIVES FOR GRINDING FIBROUS MASS

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The article presents the main parameters of the grinding process using knife sets with different knife designs. It also describes the features of grinding fibrous semi-finished products in a disc mill using a headset with a spatial arrangement of knives in three XYZ planes.

Keywords: grinding, pulp and paper production, grinding set, disc mill, fibers, fiber semi-finished product.

ИСПОЛЬЗОВАНИЕ НОЖЕВОЙ ГАРНИТУРЫ С ПРОСТРАНСТВЕННЫМ РАСПОЛОЖЕНИЕМ НОЖЕЙ ДЛЯ РАЗМОЛА ВОЛОКНИСТОЙ МАССЫ

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В статье приведены основные параметры процесса размола с использованием ножевых гарнитур с различным построением ножей, описаны особенности процесса размола волокнистых полуфабрикатов в дисковой мельнице с применением гарнитуры с пространственным расположением ножей в трех плоскостях XYZ.

Ключевые слова: размол, целлюлозно-бумажное производство, размалывающая гарнитура, дисковая мельница, волокна, волокнистый полуфабрикат.

The basis for the production of paper and cardboard is the grinding process. Changing its parameters allows to change the properties and characteristics of the resulting materials in a wide range. Equipment for grinding fibrous semi-finished products is a continuous machine. It can consist of knife and knifeless types according to the nature of the impact on the processed raw materials [1].

The grinding of fibers is carried out in continuous machines (in conical, cylindrical and disc mills). The complexity of the grinding process is due to the structure of plant fibers, on the one hand. On the other hand, it is due to various phenomena (that is not yet fully understood) occurring in a water-fiber suspension [2]. There are many theories of vegetable fiber refining that describe the phenomena affecting the properties of the resulting product. But modern ideas about the process of refining paper mass do not fully solve the problem of implementing an ideal industrial refining to meet modern requirements for product quality.

Changing the grinding parameters allows to modify the properties and characteristics of the resulting materials in a wide range. The main controlled parameters are the specific pressure, the duration of grinding, the clearance of the inter-knife cavity, and the mass concentration (that is also an auxiliary parameter). The remaining parameters practically remain constant. For maximum paper strength, the fibrous material should not be strongly ground. It is necessary to affect the fiber in the

way that permits the hemicelluloses (which contain in its outer layers) be released, the outer layer of the secondary wall can be partially or completely destroyed, and the middle layer remain intact.

The most common grinding units in the preparation of fibrous mass are disc mills, the principle of operation of which is based on the technology of crossing knives and rubbing surfaces. The main working body of a disk mill is a set with knives located on it, which have a rectilinear shape of the cutting edges. Headsets are different in profile, pattern and geometric features of the knife surface. Traditional headsets are made in one piece, which excludes the multi-variant execution of the grinding surface pattern and changing some grinding parameters.

The Department of Machines and Apparatuses of Industrial Technologies of the

Reshetnev Siberian State University of Science and Technology has designed and manufactured a disc mill set with original geometrical characteristics of the knife surface, which allows changing both the pattern of the knife set itself and the inter-knife grinding cavity. The grinding set consists of five rings of the rotor disc and five rings of the stator. The second and fourth ones can be interchanged, which modifies the pattern and grinding plane.

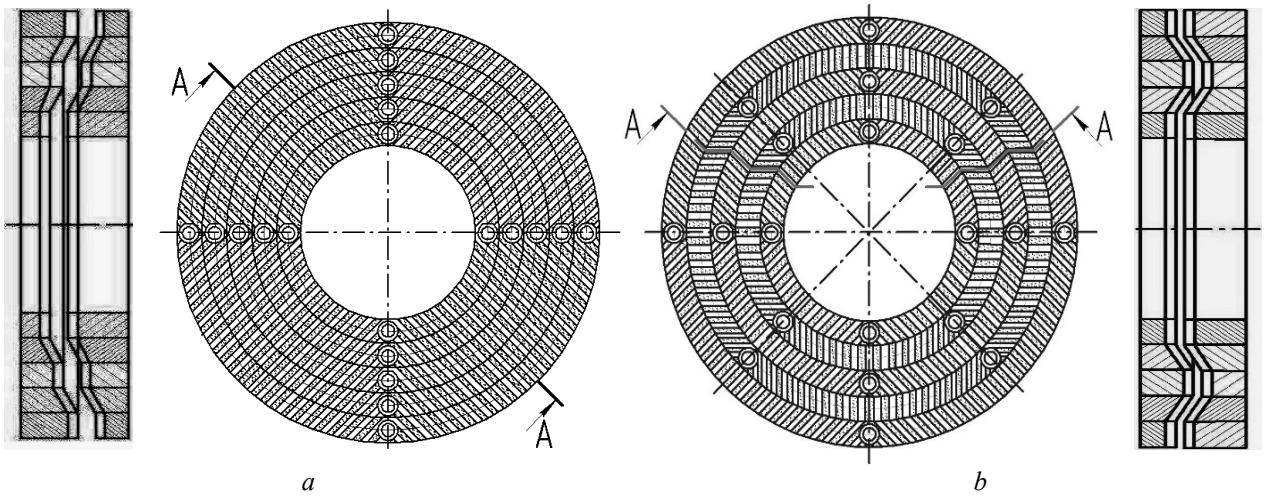

Fig. 1. Grinding set with original geometrical characteristics of the knife surface

Due to the design features it is possible to create a rectilinear shape of the knives from the input of the pulp to the output (Fig. 1, a). It is also possible to set the shape of the knives similar to a "herringbone". To do this, we need to turn the rings to a given angle and fix the pattern (Fig. 1, b).

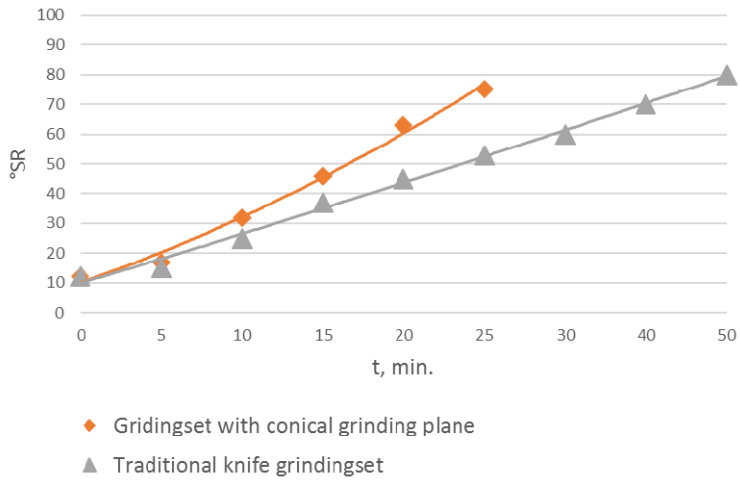

Fig. 2. The graph of the dependence
of the grinding degree on time

Studies of the influence of the grinding inter-knife working cavity on the quality of the processed fibrous material were carried out with a special laboratory unit. The material to be ground was a suspension of sulfate cellulose with a concentration of 2 %. During the experiment, the working gap between the disks was set to 0.2 mm, the rotor speed was 2000 rpm. Also, the geometric characteristics of the grinding chamber between the knives were changed. During the tests, it was possible to find out that the increase in the degree of grinding is ensured when using a grinding set with a conical inter-knife cavity with indicators 2 times higher compared to a traditional set (Fig. 2).

Knife grinding set with a spatial arrangement of knives improves the quality of grinding due to a change in the path of passage of the fibrous mass through the inter-knife cavity. It also reduces energy consumption due to the most complete use of the mechanical energy of the action on the fibrous semi-finished product, and increases the productivity of the grinding process.

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DIAGNOSTICS OF FLIGHT CONTROL SYSTEMS USING AN INPUT SIGNAL MODULATOR

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Modern civil aviation aircraft are piloted either manually or using an autopilot. Manual and autopilot systems act on the controls. These systems are complex, and errors can occur in many phases of operation, including the processing of input signals. To reduce the risk of such an error, this paper proposes the concept of a device that can detect a possible malfunction in the preflight phase.

Keywords: aircraft, autopilot, diagnostics, maintenance, controls.

ДИАГНОСТИКА СИСТЕМ УПРАВЛЕНИЯ ПОЛЕТОМ С ИСПОЛЬЗОВАНИЕМ МОДУЛЯТОРА ВХОДНЫХ СИГНАЛОВ

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Современная авиатехника гражданской авиации пилотируется вручную, либо с использованием автопилота. Системы ручного и автоматического управления воздействуют на органы управления. Эти системы являются сложными, и в них могут возникать ошибки на различных этапах работы, в том числе и на этапе обработки входных сигналов. Для уменьшения вероятности возникновения такой ошибки в данной работе предлагается концепция устройства.

Ключевые слова: воздушное судно, автопилот, диагностика, техническое обслуживание, органы управления.

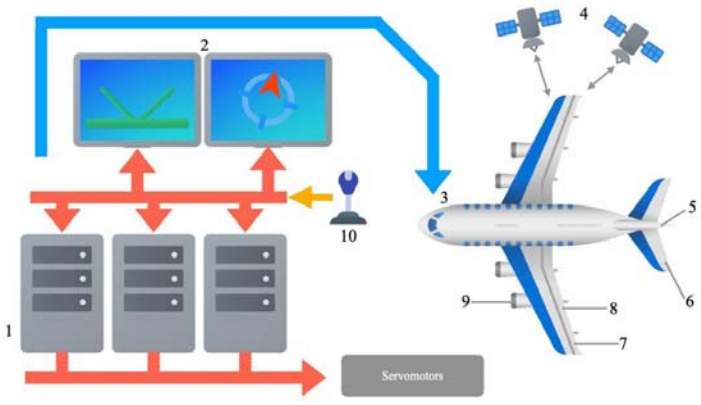

Fig. 1. Autopilot scheme of work

The aircraft autopilot is designed to stabilize all flight parameters and steer on a set course. The speed and altitude designated by the human pilot is maintained. Before switching the aircraft to autopilot mode, it is necessary to bring the aircraft into a steady flight condition without sliding or stalling the machine. After the aircraft has stabilized on all planes, the automatic control system can be activated, but regular monitoring of the indicators should be carried out thereafter.

The autopilot of the aircraft flies it along a set route, using the complex information of navigation devices, its own and ground sensors, which analyze the flight. This system controls all units of the aircraft. Landing systems operate on the same principle, which conduct landing approach with high accuracy indicators without any action of pilots [1].

Figure 1 shows a standard operating scheme of the autopilot. Pre-calculated flight parameters are entered into the aircraft computers (1). The displays (2) show the position of the aircraft, its intended route and altitude. Changes in the aircraft's position in space are recorded by instrumentation and signals from them are fed to the autopilot systems.

The figure shows the Global Navigation System (GSS) (4). The receiver is located on top of the hull (3). The computers monitor the route and automatically make the necessary changes by signaling the servomechanisms that control the rudder (5), elevator (6), ailerons (7), flaps (8) and engine throttle settings (9) If necessary, the pilot can turn off the autopilot at any time and switch to manual control (10).

Since the autopilot is a complex system, errors in operation can occur at various stages, including the stage of processing input signals from sensors of instrumentation equipment.

Since the instrumentation of modern aircraft is mostly digital, a variety of input and output signals can be recorded in the device memory as reference signals and used to test the ability of the autopilot system to correctly process these signals.

This device can modulate digital signals, which will be fed to the autopilot during the test.

Figure 2 shows a block diagram of the autopilot operation when the modulator is connected. During the flight, the autopilot is connected to the instrumentation and various sensors, according to the readings of which, it determines further effects on the controls through the operation of the servomechanisms. When the modulator is connected during the preflight check, the autopilot system is on, but the input signals come from the modulator and not from the instrumentation. The output signals of the autopilot go to the same modulator, after which it is compared with the reference signal and the test result is given [2].

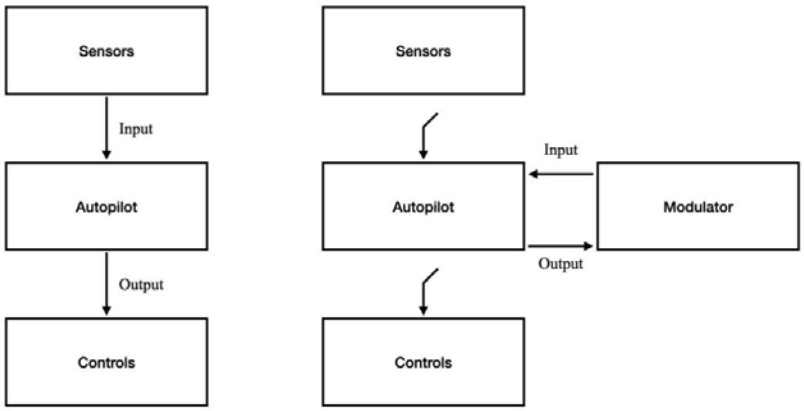

Fig. 2. Block diagram of the autopilot operation when the modulator is connected

Figure 3 shows a scheme for checking the correctness of the autopilot by processing the input signals.

When the modulator is connected, the autopilot automatically switches to the test mode. When the instrument test is turned on, the microcontroller sends a signal to the ROM to transmit two signals. One signal goes to the instrument and is a binary code simulating an external action. The second signal goes to the digital comparator and is the reference signal that should be output by the instrument for a given external action. The digital comparator also receives the signal produced by the autopilot, and then the two signals are compared. The comparison result is fed to the indicator, which will display information about the device's operability.

Implementation of the technical possibility to connect the modulator will allow at the stage of preflight check to avoid the presence of errors in the autopilot operation during the flight, which will make the flight safer.

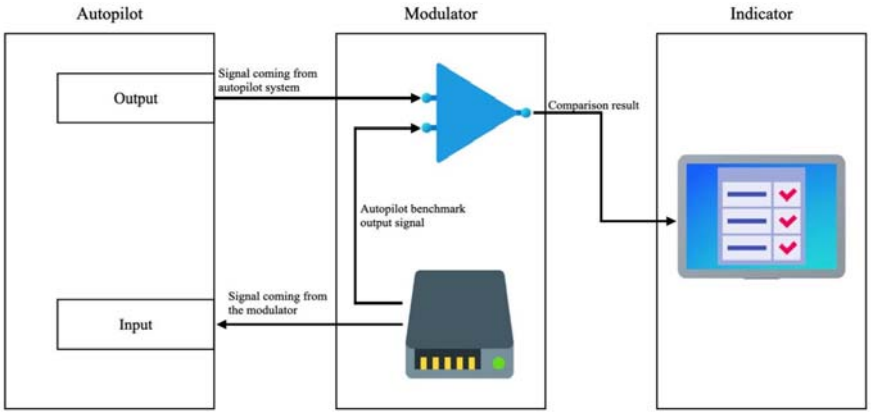

Fig. 3. Schematic diagram of checking the autopilot operation

A similar approach can be used to check the manual flight control system operation – the modulator simulates the control stick deviation signal after the output signal arrives with the reference signal stored in the modulator memory. If there is no difference, or it is within nominal limits, the indicator will indicate that the manual control system is working properly.

The concept of using the modulator for performance diagnostics described in this paper can be applied to other systems on board an aircraft. Non-contact sensors can also be used for on-line monitoring of the pilot's status [3].

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METHOD OF GLUELESS CONNECTION OF HONEYCOMB BLOCKS FOR OBTAINING HONEYCOMB FILLER

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Space designers are faced with the task of finding solutions aimed at reducing the mass of spacecraft without losing their main characteristics. One of the options for reducing the mass of spacecraft load-bearing structures based on honeycomb panels is to reduce the mass fraction of glue in the adhesive joints of structural elements without losing strength and rigidity.

Keywords: honeycomb panel, power structure of the spacecraft.

МЕТОД БЕСКЛЕЕВОГО СОЕДИНЕНИЯ СОТОВЫХ БЛОКОВ ДЛЯ ПОЛУЧЕНИЯ СОТОВОГО ЗАПОЛНИТЕЛЯ

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Перед конструкторами космической отрасли стоит задача по поиску решений, направленных на уменьшение массы КА без потери их основных характеристик. Одним из вариантов снижения массы силовых конструкций КА на основе сотовых панелей является уменьшение массовой доли клея в клеевых соединениях конструктивных элементов без потери прочности и жесткости.

Ключевые слова: сотовая панель, силовая конструкция космического аппарата.

Power structure of the spacecraft of a modern non-pressurized spacecraft consists of a spatial set of honeycomb panels located and interconnected in a certain sequence [1]. The honeycomb panel consists of two skins, between which there is honeycomb filler, which is connected to the skins using glue (2-6).

The honeycomb blocks in the joint area are connected using embedded fasteners made in the form of a key. The edges of the honeycomb blocks and the place of installation of the dowels are machined, which provides preliminarily the mating of the dowels with the blocks to be connected to each other. A tight connection is formed due to the difference in technological tolerances at the processed edges of honeycomb blocks and dowels. If the landing at the junctions of the honeycomb blocks is with a gap or a tight transitional one, this can lead to:

- an increase in the overall dimensions (creeping) of the honeycomb blocks, after it is installed on the sheathing of the honeycomb panel, which violates the geometry of the honeycomb panel.
- a decrease in the strength and rigidity of the honeycomb panel in the gaps between the honeycomb blocks and the formation of defects such as non-adhesion of the honeycomb panel, the forma-

tion of dents, etc., which also leads to a decrease in the strength characteristics of the honeycomb panel.

An example of a glueless connection of honeycomb blocks to each other is shown in Fig. 1.

Advantages of glueless connection of honeycomb filler:

1. The mass fraction of glue in the spacecraft load-bearing structure is reduced by eliminating the glue tape.

2. The cost of manufacturing honeycomb panels is reduced due to the elimination of expensive glue tape.

3. Eliminate non-technological (manual) operations with the adhesive film in the manufacture of a web from a honeycomb filler and are replaced by automated machining of the edges of honeycomb blocks, which reduces the cost of its production.

4. The limitation on the number of joints of honeycomb blocks among themselves is removed, which leads to rational use honeycomb filler and a decrease in the share of material costs.

5. It becomes possible to connect polygonal honeycomb blocks, which also leads to the rational use of honeycomb filler and a decrease in the share of material costs.

6. It becomes possible to use the remains of honeycomb blocks for the manufacture of dowels, which also leads to the rational use of honeycomb filler and a decrease in the share of material costs.

7. It becomes possible to improve the geometric parameters of the panel, since materials with different coefficients of linear thermal expansion (aluminum foil and adhesive film) will not be used.

The declared characteristics of the proposed technology are confirmed by calculations and the manufacture of a prototype. (Fig. 2).

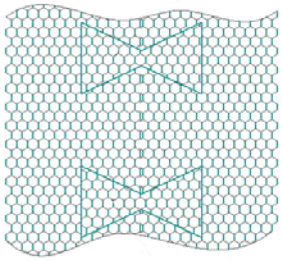

Fig. 1. Glueless connection of honeycomb blocks

Fig. 2. Prototype

A decrease in the mass of structures made of honeycomb panels is confirmed by the calculations of the used adhesive composition for the manufacture of honeycomb panels for spacecraft based on a medium-class platform (Express-1000). Minimization of the remains of honeycomb filler in the manufacture of honeycomb panels is provided for due to that, after laying out the honeycomb blocks on the skin and cutting off the technological allowances, the residues are used for the manufacture of connecting elements (dowels). In addition, honeycomb blocks rejected after stretching with the use of glueless technology after trimming the defective area can be used for the manufacture of honeycomb polute as oversized blocks. (since there is no need to minimize the number of honeycomb joints). This can result in reduction in honeycomb residue.

The use of a glueless connection of honeycomb filler in the manufacture of long honeycomb panels allows to reduce the panel weight, while increasing manufacturability (decreasing production time) and reducing the cost of manufacturing honeycomb panels by eliminating expensive adhesive tape.

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APPLIED PROGRAMS FOR SIMULATION MODELING IN THE ECONOMIC FIELD

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The article considers the concept of a working simulation model and the stages of its formation. There are also examples of tools that can do this, such as flow diagram tools, dynamic modeling tools, and discrete event simulation tools.

Keywords: simulation modeling, working simulation model, dynamic modeling tools, tools based on flow diagrams, discrete event simulation tools.

ПРИКЛАДНЫЕ ПРОГРАММЫ ДЛЯ ИМИТАЦИОННОГО МОДЕЛИРОВАНИЯ В ЭКОНОМИЧЕСКОЙ ОБЛАСТИ

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В статье рассмотрено понятие работающей имитационной модели и этапы ее формирования. Существуют также примеры инструментов, которые могут это сделать, например инструменты блок-схем, инструменты динамического моделирования и инструменты моделирования дискретных событий.

Ключевые слова: имитационное моделирование, рабочая имитационная модель, средства динамического моделирования, средства на основе блок-схем, средства дискретно-событийного моделирования.

Simulation modeling is a study technique in which the system itself is replaced by a model as close as possible to the given parameters, which describes the processes as they would proceed in reality in order to obtain data about this system. Modeling can be divided into four stages of formation:

1) model organization; 2) model execution; 3) analysis of output data; 4) evaluation of possible alternative routes.

A working simulation model must accurately mimic the processes taking place in the company [1; 2]. This is done by passing through theoretical events in a reduced time mode with a visual display of the production process using animation[1].

BPR (Business Process Reengineering) is faced with the task of achieving at least one or, if possible, all of its goals: improving the quality of service; reduction of time for processing processes; increase in productivity; reduction of downtime; reducing the cost of resources for core activities; reducing the cost of maintaining the inventory warehouse.

Mark Youngblood, author of Eating the Chocolate Elephant, lists 32 different ways to achieve these goals. Some of these principles form the basis of industrial systems design. These principles

have been applied in manufacturing processes for more than a decade. Some of them are used not only in production, but also in business process reengineering: Connection of duplicating functions; Reducing the volume of products created; Formation based on demand; Transfer to subcontractors of inefficiently performed functions; Formation of broadly directed teams.

To date, there are a large number of software tools whose main task is to model business processes. For the most part, these products represent business processes in the form of various geometric shapes. Individual intermediate functions are displayed as a series of arrows and boxes. Also, each program provides for the analysis of various parameters, the extent of which depends on the methodology underlying the program. All tools can be divided into three groups:

Tools based on flow diagrams. These tools are needed to create flow diagrams, to describe the functions being executed and to determine their sequence. Flow diagram models are methodology independent and also easy to learn. But this is also their weakness, since their ease of use stems from the limited ability to model and analyze. An example of this type of modeling is the following programs: Process Charter and Optima.

Dynamic modeling tools. The next in terms of functionality are analog simulation programs that have the ability to show the dynamics of the created processes and systems. Models built in such programs may consist of different levels, stacks, threads, converters, and various other logical processes. Programs for this type of models: ithink and PowerSim.

Discrete event simulation tools. One of the most developed and technologically advanced simulation software is discrete-event simulation software. The capabilities of these programs include modeling the flow of objects and the ability to create a full-fledged animation, for a visual assessment of the various parameters set by the user. Examples of such programs are ServiceModel and SIMPROCESS [2].

Based on all of the above, I would like to emphasize that the choice of a program for modeling should always come from the immediate need for certain parameters that the end user wants to track in the built model. Each of the programs has both its pros and cons, so before you start modeling, you need to familiarize yourself in detail with the possibility of each of them.

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УДК 004

MODERN DATA PROCESSING METHODS

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The article discusses the concept of big data and methods for their analysis, such as Data Mining Technology, Predictive Analytics Method, Statistical Analysis Principle and Data Combination and Integration Method.

Keywords: analysis, method, data, process.

СОВРЕМЕННЫЕ МЕТОДЫ ОБРАБОТКИ ДАННЫХ

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В статье рассматриваются понятие больших данных и методы их анализа, среди которых технология интеллектуального анализа данных, принцип статистического анализа и другие.

Ключевые слова: анализ, метод, данные, процесс.

Big data contains information that can span thousands of terabytes. In addition, this information must be kept up to date. For example, data obtained from call centers, social networks, stock market trading data, and so on [1].

Data Mining Technology

The method involves finding certain patterns in raw data using data mining. Data mining is used to: finding anomalous data in the information flow when analyzing anomalies; identification of factors influencing parameters using regression analysis; distribution of data into groups with similar characteristics, ie. data classification [1]; Predictive analytics method.

Simply put, a forecasting method. With enough up-to-date information, you can make a forecast and answer the question: "How can events develop in the future?". The principle of predictive analytics is as follows: first you need to examine the data for the previous period; find patterns or other factors that will show the result; and then use a neural network and math to create a model that can make predictions [2].

Forecasting methodology to be used in a wide variety of fields. For example, predictive analytics helps to detect and prevent fraudulent activities in a bank or insurance company. In medicine, based on the patient's data, a predictive analysis is carried out, which well determines his vulnerability to a particular diagnosis.

Principle of statistical analysis. The essence of this method is to collect data, study them on the basis of certain parameters and find the result, defined as a percentage. This method has one disadvantage – not full accuracy of data in small samples. Therefore, to find the most correct results, it is necessary to collect more initial data.

Some marketing research methods, such as a/b testing, involve statistical analysis. A/B testing is usually used to increase conversions, and the test itself consists of comparing two groups: a control group, which is not subject to change, and a second group, which was similar in impact (for example, it was shown in different ad formats) . This test will allow you to understand which goals you achieve best.

To find statistical information, use: correlation analysis to determine the dependence of data on each other; percentage of results analysis; dynamics of the sequence, which allows you to assess the severity of the change in certain conditions, as well as over a certain period of time.; method of combining and integrating data.

In almost all cases, big data comes from different sources, i.e. the data has a heterogeneous format. It makes no sense to add this data to a single database, since they are not interconnected.

In order to use information from different sources, it is necessary to use methods such as:

- bringing data into one format by converting the document, translating text, numbers in accordance with the text template;
- additional information is filtered and removed from memory if it was not available for analysis.

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THE IMPORTANCE OF HIGH-PERFORMANCE MODELING FOR DATA-INTENSIVE APPLICATIONS

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The article explores the possibilities of using high performance computing to perform complex applications in various scientific and technical fields.

Keywords: big data, high-performance computing, hardware accelerators.

ВАЖНОСТЬ ВЫСОКОПРОИЗВОДИТЕЛЬНОГО МОДЕЛИРОВАНИЯ ДЛЯ ПРИЛОЖЕНИЙ С БОЛЬШИМ ОБЪЕМОМ ДАННЫХ

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В статье исследуются возможности использования высокопроизводительных вычислений для выполнения сложных приложений в различных научных и технических областях.

Ключевые слова: большие данные, высокопроизводительные вычисления, аппаратные ускорители.

The era of big data presents high-performance computing (HC) with an enormous challenge: how to effectively turn huge and often unstructured or semi-structured data first into valuable information and then into meaningful knowledge. High-performance computing tools and technologies are increasingly required in a rapidly growing number of data-intensive fields, from the biological and physical sciences to socio-economic systems. Thus, the era of big data also offers amazing opportunities for HPC to expand its reach and increase its social and economic impact [1].

High Performance Computing (HPC) is at the heart of large-scale processing of complex, data-intensive tasks to enable complex applications in various scientific and technical fields such as high energy physics, genomics, systems and synthetic biology, industrial automation, socioeconomic data analytics and medical informatics. This has led to a significant improvement in understanding of areas ranging from the evolution of the physical world to human societies. Application performance in HPC systems is currently heavily dependent on remote and local data movement overheads (network messages, memory and storage access) [2]. This poses new challenges for high performance computing modeling and programming languages to improve data locality where possible and provide fast data transfer where needed.

With the advent of hardware accelerators (GPUs, FPGAs), pay-per-use cloud services, and the increased performance of general-purpose processors, high-performance computing has become available to many scientific disciplines.

COST Action IC1406 promotes interoperability between the HPC community (both developers and users) and modeling disciplines where the use of HPC tools, technologies and methodologies is still new. Data-intensive areas make the issue of efficiency especially relevant for tasks such as multi-dimensional and multi-layer integration and accelerated model development. In addition, these complex systems do not lend themselves directly to modular decomposition, which is an important condition for parallelization and, therefore, support for high-performance computing. They often require a significant amount of computing resources, with datasets scattered across multiple sources and geographical locations.

Modeling and simulation (MS) are considered important tools in science and technology to inform the prediction and analysis of complex systems and natural phenomena. Modeling traditionally solves the problem of complexity by increasing the level of abstraction and aiming for a meaningful representation of the domain. This has led to a difficult trade-off between accuracy and efficiency. In other words, the properties of a system can be studied by reproducing (that is, modeling) its behavior through its abstract representation. Perhaps the application layer context should be reconsidered. For example, a Monte Carlo simulation must receive input data, store intermediate results, and filter and combine output data in a correct and reliable manner. Thus, modeling and modeling approaches are particularly affected by the data flow phenomenon, as they must use large datasets to increase resolution and scale, and to distribute and analyze data at different stages of the modeling-analysis pipeline.

Both BB and MIS are well-established research areas in their own right. However, their better integration, aimed at applications from different areas, will bring significant progress in solving big data problems. COST Action members are collaborating on a unified framework to systematically advance M&S and big data supported by leading HPC-enabled models and tools through a coordinated effort of HPC and simulation experts.

The main goal is to create a long-term, sustainable, reference network of research links between the BB community on the one hand and the multiple MIS research communities dealing with big data issues on the other hand. Such links provide a new and permanent basis for collaboration between the BB and MIS communities, spanning both academia and industry in Europe and beyond, with a common goal: to turn vast amounts of raw data into useful knowledge.

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RHEOLOGICAL EVALUATION OF SILICONE NANOCOMPOSITES MODIFIED WITH CARBON ADDITIVES FOR TECHNOLOGICAL PROCESSING

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The paper presents the results of a study of the viscosity of silicone nanocomposites modified with carbon additives. The viscosity of silicone nanocomposites up to 3.5 Pa×s is suitable for impregnation of fibrous materials. The use of silicone nanocomposites with a viscosity over 3.5 Pa×s makes it difficult to process such material by contact molding and vacuum infusion methods.

Keywords: viscosity of nanocomposites, modification with carbon additives, contact molding, vacuum infusion.

РЕОЛОГИЧЕСКАЯ ОЦЕНКА СИЛИКОНОВЫХ НАНОКОМПОЗИТОВ, МОДИФИЦИРОВАННЫХ УГЛЕРОДНЫМИ ДОБАВКАМИ, ДЛЯ ТЕХНОЛОГИЧЕСКОЙ ПЕРЕРАБОТКИ

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В работе представлены результаты исследования вязкости силиконовых нанокомпозитов, модицифированных углеродными добавками. Вязкость силиконовых нанокомпозитов до 3,5 Pa×s является подходящей для пропитки волокнистых материалов. Применение силиконовых нанокомпозитов с вязкостью свыше 3,5 Pa×s затрудняет переработку такого материала методами контактного формования и вакуумной инфузии.

Ключевые слова: вязкость нанокомпозитов, модификация углеродными добавками, контактное формование, вакуумная инфузия.

To obtain an electrically conductive polymer, electrically conductive additives are used, but the introduction of carbon fillers leads to an increase in the viscosity of the mixture. In this regard, the processing of such material by contact molding and vacuum infusion methods may be difficult. Chursova L.V. et al. [1] formulated the requirements for the viscosity of the epoxy binder for the RFI (Resin Film Infusion) process: viscosity at an impregnation temperature of no more than 2 Pa×s, the viscosity increase time to 2 Pa×s is at least 60 min. Silicones with a viscosity of 3.5 Pa×s are difficult to use for impregnating fibrous materials, but their use is possible as a gasket in the manufacture of composites [2]. The optimal values of the viscosity of technological processing for silicone are 1 – 3.5 Pa×s [2; 3]. Thus, one of the key issues in the processing of nanocomposite polymers is the search for the optimal viscosity of the material.

Objects and methods of research. Elastosil 604 silicone compound manufactured by Wacker was used as a binder. The electrically conductive additives are listed below:

1. Single-walled carbon nanotubes manufactured by OCSiAl (SWNT);
2. Multi-walled carbon nanotubes manufactured by NanoTechCenter LLC (MWNT);
3. Graphene/MWNT produced by NanoTechCenter LLC
4. Concentrate based on single-walled carbon nanotubes MATRIX 601 (Matrix) manufactured by OCSiAl.

The viscosity of nanocomposites was studied using a rotary rheometer DHR-2 manufactured by TA Instruments. The conductive additives concentration is present in weight percentages.

The viscosity dependence on the shear rate was determined in the range of the rotor frequency from 0.01 Hz to 100 Hz. The samples were tested at a temperature of 25 °C.

The Figure 1 shows the results of rheological evaluation of silicone nanocomposites with SWNT, MWNT, Matrix, as well as the neat silicone.

The addition of any electrically conductive filler leads to an increase in the viscosity of the neat silicone. It follows from the data obtained that samples with graphene/MWNT filler have the lowest viscosity. With its significant addition (5 %), the viscosity of the silicone nanocomposite is only 1.18 Pa×s. The greatest increase in the viscosity of the nanocomposite is observed with the introduction of SWNT. In such a sample, the viscosity increases to 3.5 Pa×s with a content of only 0.1 % filler and it becomes technologically difficult to process.

The results show that the addition of more than 1 % Matrix is impractical for technological processing, because the viscosity increases significantly.

The introduction of an electrically conductive additive MWNT in an amount of 1 % will allow to obtain a nanocomposite material suitable for processing by any of the above methods.

The viscosity of silicone nanocomposites up to 3.5 Pa×s is suitable for impregnation of fibrous materials. The use of silicone nanocomposites with a viscosity over 3.5 Pa×s makes it difficult to process such material by contact molding and vacuum infusion methods. It is worth noting that the use of all the additives studied makes it possible to obtain an electrically conductive silicone material.

Acknowledgements

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MAJOR TYPES OF WORKING BODIES USED AT VIBRATION POLISHING PROCESS

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The article provides a brief description of vibration polishing method. The main types of materials used at vibration treatment are considered. The paper also shows key forms of grains applied in vibropolishing.

Keywords: vibration treatment, abrasive granules, roughness.

ОСНОВНЫЕ ВИДЫ РАБОЧИХ ТЕЛ, ПРИМЕНЯЕМЫЕ В ПРОЦЕССЕ ВИБРАЦИОННОГО ПОЛИРОВАНИЯ

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В данной статье представлено краткое описание метода вибрационного полирования. Рассмотрены основные виды материалов, используемых при вибрационной обработке, а также показаны различные формы гранул, применяемые при виброполировании.

Ключевые слова: вибрационная обработка, абразивные гранулы, шероховатость.

Fig. 1. Forms of abrasive grains on a ceramic bond

Nowadays, the method of vibration polishing of gas turbine engine blades (GTE) is widely used in aircraft engine building. Operational parameters of modern gas turbine engines, their resource and performance reliability are largely determined by finishing treatment quality of edges, working surfaces and fillet radiuses of working and straightening blades of compressor and turbine. A considerable attention is paid to finishing operations in order to ensure appropriate characteristics of blades. At the same time, roughness of machined surface (from Ra0.8 μm) is generally achieved by grinding and polishing parts manually on polishing headstocks. However, it does not guarantee stability of geometry variables, does not exclude possibility of burns but contributes to the formation of compressive stresses of different magnitude and sign [1].

One of the widely used methods is automated vibration polishing with abrasive grains in special vibration

machines. Vibration polishing is a high-performance tooling method. Its advantages include high productivity, no risk of burns and elimination of the influence of manual labor of polishers and locksmiths on the processing effect. Vibration polishing is the final operation of technological process for compressor blades. Geometrical dimensions of blades‘ outer contour and surface condition parameters are finally formed at this stage.

Various materials are used in production of working bodies for vibration processing [2].

Abrasive grains on a ceramic bond. This is the most common type of working bodies. There are grains with different types of configurations. Grains also differ in abrasive grit sizes. Electrocorundum is most often used as an abrasive. The density of these grains is in the range from 2.4 to 3.6 g/cm^3. Main configurations of grains on a ceramic bond are shown in Figure 1.

Abrasive grains on a plastic bond. These grains have a lower density. It varies from 1.5 to 1.85 g/cm^3. The hardness of plastic bond is also lower in comparison with ceramic bond. This property can be useful in number of cases, for example, when machining heavy parts with featheredge. Main configurations of grains on a plastic bond are shown in Figure 2.

Fig. 2. Forms of abrasive grains on a plastic bond

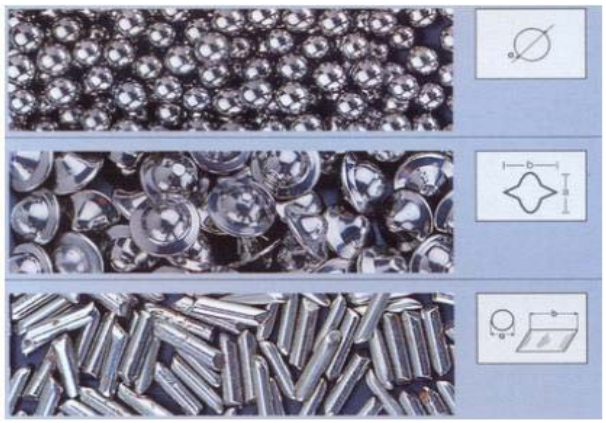

Fig. 3. Working bodies made of stainless steel in the form a globe, satellite, pin

Fig. 4. Crushed corn

Fig. 5. Crushed walnut shell

Fig. 6. Wooden cubes

Specially made abrasive grains of regular geometric shape including abrasive particles are used at vibrogrinding operations. The material of these abrasive particles is a grit or grinding dust imbedded in a bonding material.

Working bodies made of stainless steel. These working bodies improve surface roughness due to the deformation of initial microrelief from numerous overlapping impacts. Figure 3 shows main configurations of steel working bodies.

Working bodies on an organic basis. They are biodegradable and non-toxic materials. They are widely used for finishing operations in souvenir and jewelry industry, in processing of plastics, as well as non-ferrous metal working. Figures 4, 5, 6 show main types of working bodies on an organic basis.

A variety of abrasive pastes and dust are used in vibration polishing, in addition to working bodies.

In conclusion, the currently presented range of abrasive grains mass-produced by various companies makes it possible to process most types of parts and solve all common technological problems. There are criteria that determine the ability of an abrasive grain to perform technological problems, such as: size; configuration; abrasive material; abrasive grain sizes; packing density of abrasive grains; bonding material.

All these characteristics should be taken into account by manufacturing engineer in the process of selecting abrasive grain type.

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CREATING A CASE DIAGRAM IN UNIFIED MODELING LANGUAGE FOR VISUALIZING THE STRUCTURE OF THE ACCEPTANCE TESTING PROGRAM FOR HOUSEHOLD REFRIGERATORS

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The use of UML (Unified Modeling Language) is actively used in the field of software development. This thesis will consider the possibility of presenting a program to implement the idea of introducing a new method for conducting acceptance tests for «Biryusa» household refrigerators. We will use Case Diagram to show the body of the program and try to make it understandable not just for qualified programmer but also to the user of the developed system.

Keywords: Unified modeling language, case diagram, acceptance test for household refrigerators.

СОЗДАНИЕ ДИАГРАММЫ ВАРИАНТОВ ИСПОЛЬЗОВАНИЯ НА УНИФИЦИРОВАННОМ ЯЗЫКЕ МОДЕЛИРОВАНИЯ ДЛЯ ВИЗУАЛИЗАЦИИ СТРУКТУРЫ ПРОГРАММЫ ПРОВЕДЕНИЯ ПРИЁМО-СДАТОЧНЫХ ИСПЫТАНИЙ БЫТОВЫХ ХОЛОДИЛЬНИКОВ

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Использование языка UML (унифицированный язык моделирования) активно применяется в области разработки программного обеспечения. В данном тезисе будет рассмотрена возможность представления программы по реализации идеи внедрения новой методики проведения приёмо-сдаточных испытаний бытовых холодильников «Бирюса». Мы будем использовать диаграмму вариантов использования, чтобы показать тело программы и попытаться сделать его понятным не только для квалифицированного программиста, но и для оператора разработанной системы.

Ключевые слова: унифицированный язык моделирования, диаграмма вариантов использования, приёмо-сдаточных испытаний бытовых холодильников.

Choosing the diagram type

Unified Modeling Language (UML) is a general-purpose modeling language in the field of software engineering[1]. The main aim of this language is to provide a standard way for programmers to visualize the design of the system's work. It is a diagram language and the type of diagram the

user can choose according to the purpose of the diagram. Some types of diagrams can be used to create code automatically but in this thesis, we will not use this function as our system has many nuances that should be strictly controlled by a qualified programmer.

Case diagram is used to make accent on the user of the system (operator) also known as actor in the language of UML. It should show the actions of this person in details. The devise that has the ability to make decisions can also have the role of the actor. In our case it is PLC (programmable logic controller). Operator can communicate with controller with the help of the operator's panel, in other words – HMI (Human-Machine Interface). In Case diagram HMI has the main role as it helps "actors" to communicate.

Description of the system [2]

The system consists of the following elements:

- Refrigerators that come to the testing station (we have to check the correctness of their work);
- Power control devices (check the consumed active power of each refrigerating device);
- Sensors that check the position of the refrigerator;
- Controller (compares the graph of the consumed power with the allowable range for that exact refrigerator model);
- Operator (distantly controls the work of the system, makes decisions if it is necessary).

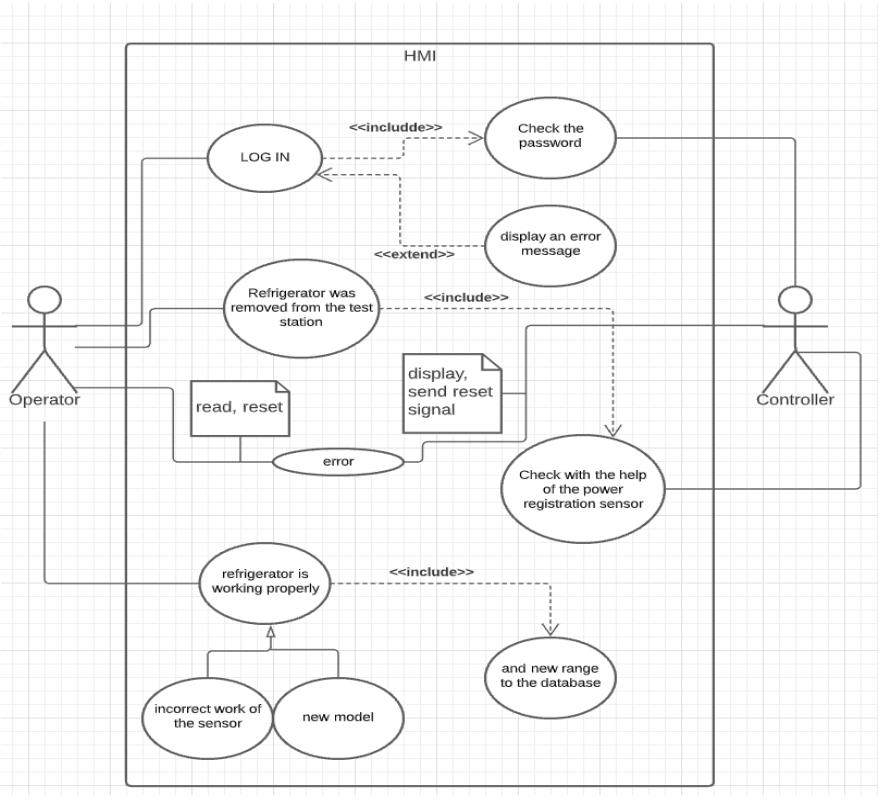
The refrigerating device correct work should be proved by the system. The main point here is that the graph of the consumed active power should be equal for all refrigerators of the same model with the small allowable ranges. Controller checks it and if the form of the graph is different asks the operator what to do with the incorrectly working device.

Operator in this case can:

– sent the refrigerator to some extra trials that last from 1 to 3 days where the full information will be received and if the correct work is proved add this power characteristics to the database,

– some reasons of the incorrect work of the device look quite similar on the graph so the operator can instantly guess the reason of the incorrect work and to send the refrigerator to the repairmen station.

Knowing this we make a Case diagram in the LusidChart program (see Figure). This software provides the ability to make different types of diagrams online [3].



Use Case Diagram made in LucidChart.

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THE TECHNOLOGY FOR MANUFACTURING A FLEXIBLE WAVEGUIDE WORKPIECE FROM COPPER ALLOY BY LASER WELDING

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Currently, at the JSC academician M. F. Reshetnev Information Satellite Systems, a number of research works are being carried out to obtain a technology for laser welding of workpiece of flexible waveguide sections, including the development of tooling, control methods and theoretical calculation of welding modes.

Keywords: workpiece, laser welding, flexible section, copper alloy.

ТЕХНОЛОГИЯ ИЗГОТОВЛЕНИЯ ЗАГОТОВОК ГИБКИХ ВОЛНОВОДОВ ИЗ МЕДНОГО СПЛАВА ЛАЗЕРНОЙ СВАРКОЙ

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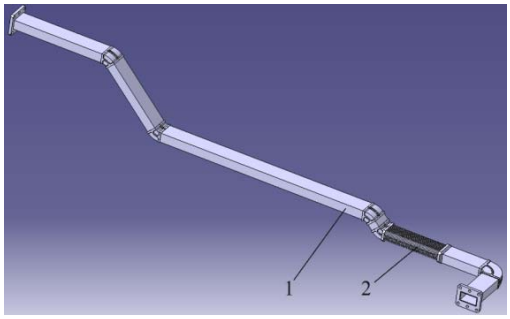
В настоящее время на предприятии АО «ИСС» имени академика М. Ф. Решетнева проводится ряд исследовательских работ по получению технологии лазерной сварки заготовок гибких волноводных секций, включающий в себя разработку оснастки, методики контроля и теоретический расчет режимов сварки.

Ключевые слова: заготовка, лазерная сварка, гибкая секция, медный сплав.



Section of a waveguide distribution path:
1 – rigid section; 2 – flexible section

The characteristics of space communications are largely determined by the characteristics of their antenna-feeder devices (AFD), such as waveguide distribution paths used to transmit high-frequency energy in electronic equipment. The main advantage of the use, which is a wide frequency range, providing the ability to receive an unlimited number of telephone and television channels.

The metal waveguide path of spacecraft is a guiding system for multiple reflection of waves and interference of reflected waves inside a closed metal pipeline, the length of which can exceed 2 meters, and the length of the

straight section can be more than 1.5 meters, consisting of rigid and flexible waveguides (see Figure) [1; 2].

Flexible waveguide section (FWS) is one of the elements of the waveguide path being used to compensate for installation inaccuracies arising from the summed technological deviations; reducing the number of joints in the feeder path; under dynamic loads affecting the spacecraft during its withdrawal from the Earth's field of action; compensation of temperature deformations arising when the spacecraft is in orbit [3].

The FWS design is a product manufactured in the form of short sections, up to 500 mm, from an aluminum, bronze or copper corrugated tube, the dimensions and shape of the internal section of which depend on the operating frequency range and flanges connected by high-temperature soldering. Flexible waveguides are designed for multiple bends in stationary systems. Bending and twisting of the waveguide is carried out during the installation of the feeder path on site.

The main element of hot water supply is a corrugation with strict requirements of design documentation such as roughness Ra 0.25 and elimination of any metal defects. The frequency of the inner surface is caused by the requirements of the radio-technical parameters of the transmission of electromagnetic waves.

To obtain a corrugation, seamless pipes can be used, followed by drawing to the size of the waveguide, which requires additional equipment and technological operations for heat treatment. Another way to obtain corrugation is to weld longitudinal seams of sheet workpiece on a wedge mandrel with further corrugation.

When using the FWS laser welding method, it is necessary to find a solution for the design of technological equipment, a theoretical calculation of welding modes and the development of requirements for control of workpieces.

Currently, at the jsc "ISS" JSC Academician M. F. Reshetnev Information Satellite Systems" a number of research works are being carried out to obtain a technology for manufacturing hot water supply with specified design requirements for welded hot water supply billets with the thickness of 0.1 mm from the copper alloy called BrB2 DPRNM GOST 1789–13. The use of workpieces obtained by the method of pulsed laser welding makes it possible to reduce the number of technological operations in manufacturing waveguides and using additional equipment.

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УДК 004.932

DETECTING FAKE FACE IMAGES USING DEPTH AND MOTION EVALUATION

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This article shows the advantages and disadvantages of face recognition as means of authentication in access control systems and describes a method for detecting fake face images using depth and motion evaluation.

Keywords: authentication, face recognition, fake images, presentation attacks, face depth.

ОБНАРУЖЕНИЕ ПОДДЕЛЬНЫХ ИЗОБРАЖЕНИЙ ЛИЦ С ПОМОЩЬЮ ОЦЕНКИ ДВИЖЕНИЯ И ГЛУБИНЫ ЛИЦА

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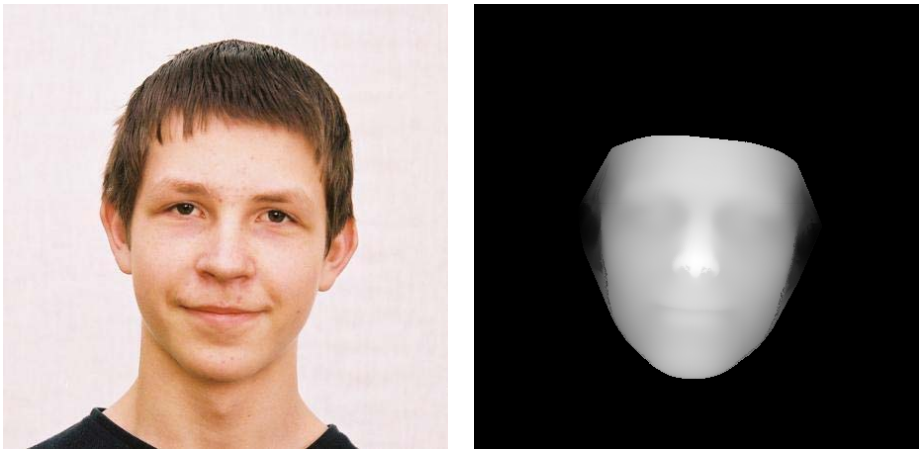
Описаны преимущества и недостатки распознавания лиц как способа аутентификации в системах контроля доступа. Рассмотрен метод обнаружения поддельных изображений лиц с помощью оценки движения и глубины лица.

Ключевые слова: Аутентификация, распознавание лиц, поддельные изображения, внешние атаки, глубина лица.

The most reliable and secure employee authentication method in organizations and factories is biometric authentication or just biometrics. There is a whole list of biometric characteristics like fingerprints, iris, face, voice, gait, etc. [1]. The most natural, convenient, and fast way of authentication is face recognition. Face recognition became irreplaceable in many access control systems. Despite the fact that there is a lot of research and commercial developments in this area, not all exploratory questions are answered. For example, there is a problem of defending against unauthorized attacks [2]. Attackers can easily fool face recognition systems using external attacks, such as printed photographs, high-quality videos, and 3D masks. In order to defend against such attacks, one may use many various methods of protection against face spoofing. This article will describe one of them, as presented in.

It is obvious that authentic face images contain information about the depth of the face, while fake face images in the forms of printed and reproduced images only contain information about the planar depth. However, the depth information is more obvious in sequenced frames. The architecture in [3] consists of two modules. One of them is a single frame module, which focuses on searching for spoofing signals with static depth control. The second module is multiframe, and consists of a functional block with optical flow guided feature block (OFFB) as a short-term movement module and convolutional gated recurrent blocks (ConvGRU) for modeling the long-term movement.

A dense alignment method PRNet is used to analyze the depth of a face image (see Figure). This method projects a 3D shape of the whole face onto the UV space. This method allows one to get a group of vertices $V_{n\times 3,}$ which represent n 3-dimensional coordinates of the face's key points. Because these coordinates are thinned out compared to the 2-dimensional plane image, they are interpolated to get dense face coordinates. By mapping and normalizing interpolated coordinates onto a 2-dimensional image the generated depth map of the face can be represented as $D \in \mathbb{R}^{32\times 32}$.



Face image before and after processing using PRNet.

Two databases OULU-NPU [5] and SIW [6] were used to test this architecture. OULU-NPU is a high-resolution database consisting of 4950 authentic and fake videos. SIW database contains 4478 real and fake videos in 1080p HD resolution, with the authentic videos being more prevalent with various distances, poses, lighting, and facial expressions. Experimental results show that motion and depth analysis is effective in distinguishing an authentic image from the fake one.

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PROMOTION OF ADVERTISING FOR PREVENTION OF FIRES IN THE TERRITORY OF THE STOLBY NATIONAL PARK

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Forest fires are a significant threat to nature conservation. Fires cover large areas and have a destructive effect on shrubs and forest stands. They damage the organic layer of the soil, threaten settlements and wild animals. Most wildfires are caused by humans. First of all, this is violation of fire safety rules.

Keywords: anthropogenesis, propaganda, protection, fires.

ПРОПАГАНДА РЕКЛАМЫ ДЛЯ ПРЕДУПРЕЖДЕНИЯ ПОЖАРОВ НА ТЕРРИТОРИИ НАЦИОНАЛЬНОГО ПАРКА СТОЛБЫ

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Лесные пожары являются существенной угрозой сохранению природы. Пожары охватывают большие площади и оказывают разрушительное воздействие на кустарники, древостои. Оказывают повреждение органического слоя почвы, угрожают населенным пунктам и диким животным. Большинство природных пожаров возникает по вине человека.

Ключевые слова: антропогенность, пропаганда, защита, пожары.

A human, being an integral part of nature, constantly influences it in one way or another. Anthropogenic hazards are directly related to the manifestation of the human factor, due to the measure and degree of the person's readiness for action and behavior in certain environmental conditions.

There are several impacts of anthropogenic hazards. Direct exposure is targeted at living organisms, the examples are unsustainable fishing and hunting. Accidental exposure is carried out by changing landscapes, the physical state of the atmosphere and water bodies.

Accidental exposures occur in nature under the influence of human activity, but were not foreseen and planned by him in advance: the spread of pests, parasites, unforeseen consequences caused by deliberate actions in nature, draining swamps, building dams, plowing virgin lands and other activities.

The studies have established that the main factor in the manifestation of anthropogenic hazards is human error generated by the causes of various origins. Analyzing the information, it can be assumed that the anthropogenic factor caused 40 % of forest fires in Siberia and the Far Eastern Federal District. The reasons are different. In the current format, these are mainly natural factors such as dry thunderstorms, but up to 40 % are mainly anthropogenic factors.

Human faults are thrown cigarette stubs, abandoned bonfires, but also thrown bottles, including plastic ones, which can often be a source of combustion in sunny weather. It is important to note that in non-fire seasons – early spring and autumn – the anthropogenic factor usually becomes the cause of 80 % of forest fires. One of the most significant and key tourist destination is developed in the Krasnoyarsk Territory. It is the Stolby National Park, which is amazing in its beauty and diversity. This is the oldest specially protected natural area in Russia, created in 1925 on the initiative of local residents to preserve the nice place from the barbaric logging and natural stone extraction. The national park is located on the northwestern spurs of the Eastern Sayan. Its area is 48,066 hectares. The territory stretching for 34 km from north-west to south-east is a typical area of a mid-mountain taiga landscape. The maximum height is from 200 to 840 m above sea level.

Fires, which in the first half of our century covered a significant part of the protected area, played a significant role in the formation of the territory. At present fires are, as a rule, localized. Almost all of them are concentrated in the recreational area and are caused by tourists.

The recreational area is located in the area closest to the city. This zone has the largest recreational load. It is open to both individual and group visits. There are frequent fires here. Near the popular rocks, the paths become denser, turning into a completely cut-out area, where not only vegetation, but also the soil cover has been destroyed. Soil density in the most visited places increases by 90 %, moisture permeability decreases hundreds of times. This contributes to the formation of temporary streams that erode residual soil cover. One of the acute problems of recent times is the increasing amount of household waste. In general, the recreational influence affects less than 4 % of the total area of the national park. In the rest of its territory, ecosystems are presented in their natural form.

Another anthropogenic factor affecting all natural complexes is general technogenic pollution. However, despite the close proximity of the national park to the industrial center with annual emissions of up to 200 thousand tons of pollutants into the atmosphere, the overall state of its protected natural complexes can be characterized as satisfactory. This phenomenon is due to the significant (about 550-650 m) excess of most of the territory of the national park over the city and the favorable direction of the wind rose. The assessment of the ecological state of the environment of the national park under anthropogenic impact is based on the results of a five-year multifaceted monitoring, during which observations were carried out at 35–45 permanent points. The points located at a distance of 10-30 km from the southwestern boundaries of the park characterized the near background.

Possibility and efficiency of using fire-prevention propaganda means.

The purpose of fire-prevention propaganda is to convince people of the need to comply with fire safety measures. Fire propaganda should solve the following tasks: to introduce into people's minds the understanding that there is a problem of wildfires, to instill in the population a sense of responsibility for their actions.

The territory of the national park directly borders on the valleys of the Bazaikha and Mana rivers. The location of housing stock near the territory, as well as the development of tourist routes and mass recreation areas, can cause significant damage to nature. The beauty of nature and the scale of the area attracts visitors.

In this case, it is impossible to completely exclude the natural factor contributing to the occurrence and spread of fires. The terrain also depends on this, as the sun heats the surface of the earth, the layers of air near the earth are heated and rise upward. Exposure and steepness of slopes also matter. The fire easily spreads up the slope. The steeper the slope, the steeper the speed.

In the ideal case, the effectiveness of fire-prevention propaganda appeal arouses interest, desire and stimulation of action.

Nowadays one of the most effective is the fire-prevention propaganda in the USA, which is carried out under the symbol 'Smokey Bear'. Smokey Bear is the US Forest Service's mascot, created to educate society about the dangers of wildfires. The Smoky Bear's motto – 'Only you can prevent forest fires' was created in 1944 by the Ad Council. In 2001 it was changed into, 'Only you can prevent wild fires'. According to the data, the messages of 'Smokey Bear' are known by 95 % of adults

and 77 % of children in the United States. The Smokey Bear's name and image are protected by US federal law. One of the main advantages of the bear's visual appeal is its personification of the 'Only you' appeal.

On the territory of the Stolby National Park, fire-prevention propaganda measures are being taken to prevent fires. There are a number of competitions among schoolchildren, as well as events and seminars on forest fire prevention, a fire safety information bulletin is systematically published, where the number of fires, the number of deaths and injuries on the territory of the Krasnoyarsk Territory is given in figures.

The need for promotional advertising is necessary and important. Our task is to effectively show the public the consequences of the fire through the media, banner posters, pop-up ads on social networks, etc. First of all, it is necessary to target it at children and adolescents. It is at this age that the attitude towards the founding environment is formed, and we need to educate the younger generation to respect the forest.

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