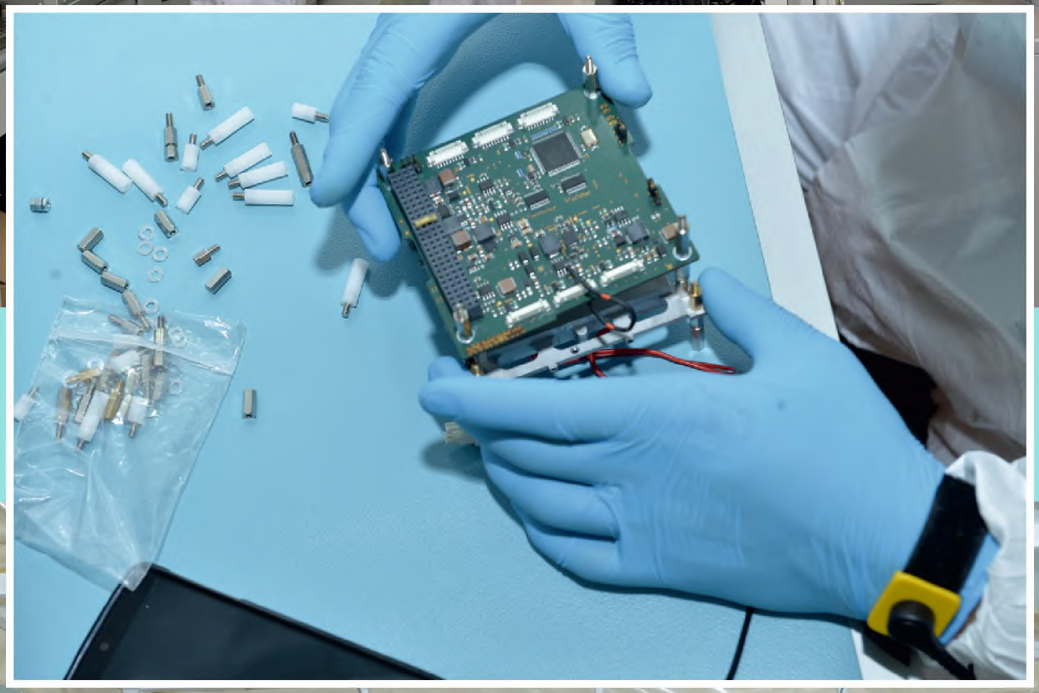
INNOVATIVE TECHNOLOGIES AND HIGH-TECH PRODUCTS OF AL-FARABI KAZAKH NATIONAL UNIVERSITY

Part 1

Almaty 2023



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Part 1

Almaty 2021

A NEW TECHNOLOGY FOR PRODUCING A SULFUR-CONTAINING DRUG

Priority direction: Geology, extraction and processing of mineral and hydrocarbon raw materials, new materials, technologies, safe products and structures.

Aim of the project: development of technology for the synthesis of drugs, materials and nanocomposites based on sulfur.

Relevance and novelty: today, more and more scientists are trying to direct the entire scientific potential to obtain samples for use in various fields of science and technology. These materials include nanocomposites based on sulfur and silver halides, as well as sulfur-containing preparations prepared on the basis of calcium polysulfide. The physical and chemical properties of the individual components of the above-listed materials differ significantly from each other, and their fields of application have a wide range: photocatalysis, biomedicine, plant growing, agriculture, construction, etc. Nanocomposites based on sulfur and silver halides are synthesized for the first time from DMSO solutions, and sulfur-based and metal compounds are obtained from polysulfide solutions. In addition, the technology for producing a sulfur-containing preparation is based on the use of raw materials from Western Kazakhstan (limestone-shell rock), as well as petroleum sulfur, which acts as a waste after oil purification.

Practical significance: the obtained nanocomposites based on sulfur and silver halides exhibit high photocatalytic activity, and the use of sulfur makes it possible not to use silver halides in large quantities. Also, some synthesized nanocomposites have shown themselves to be good antimicrobial and antifungicidal agents, which indicates their ability to suppress individual strains of microbes and fungi.

These materials proved to be plant growth regulators, as well as agents against phytopathogenic microorganisms. And as a hydrophobizer for building materials, which indicates the versatility of the samples.

The object of implementation: energy-saving technology for obtaining a highly dispersed sulfur-containing preparation based on Kazakhstan raw materials.

Prospects for implementation: the degree of implementation of the joint venture is at the level of pilot tests. The results of the research will form the basis for the creation of new high-tech drugs based on sulfur-containing nanocomposites and sulfur-containing drug.

Consumers: agricultural and agro-industrial complex, construction industry.

Competitiveness (Advantages of technology) and commercialization of the project: the development makes it possible to obtain universal materials for such areas as biotechnology, ecology, green chemistry, chemical technology, agriculture, construction industry, having a lower cost compared to analogues. And the effectiveness of the use of a sulfur-containing drug is due to more than its 2-fold low cost and environmental safety of use.

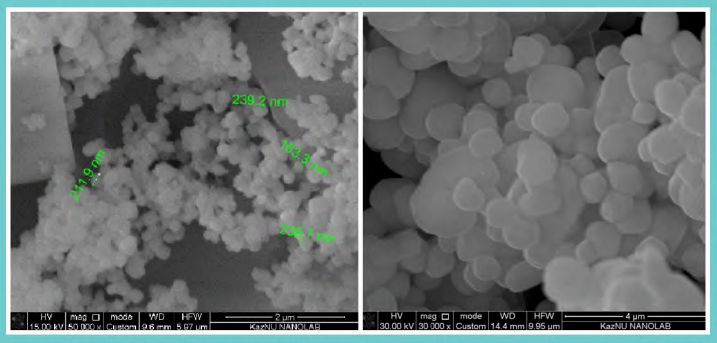

Figure 1. Micrographs of a nanocomposite based on sulfur and silver chloride

Figure 2. Effect of CP solution: (a) before treatment; (b) 14 days after treatment; (c, d) mechanization of spraying sulfur-containing drug

Investment amount – 200,0 mln tenge (455 520$).

Availability documents of title:

– Patent of RK №32802. «Dry construction mixture»;

– Patent of RK №4817. «Method for obtaining a solution of calcium polysulfide»;

– Eurasian patent №033075. «Method for obtaining sulfur nanoparticles from solutions in dimethyl sulfoxide»;

– Patent of RK №5241. «A method of obtaining of sulfur-containing nanocomposites»;

– Patent of RK №5287. «Method for producing needle nanocrystals of copper (II) sulfide»;

– Patent of RK №5037. «Method of processing phosphogypsum»;

– Patent of RK №5311. «Composition for hydrophobization of Portland cement building materials»;

– Patent of RK №5255. «Method for producing metal sulfide».

Availability of contracts, agreements with production and business:

– Memorandum of Cooperation from 02.02.2018 to 02.04.2021, LLP «Bacchus Global»;

– Agreement of intent on cooperation from 20.11.2019 to 20.11.2022, LLP "TseLSIM";

– Contract for the provision of services and R&D No. 9 from 03.03.2020 to 31.10.2020, LLP "TseLSIM";

– Contract for the provision of services and R&D No. 63 dated 02.27.2020 to 11.30.2020 LLP"ZKAP "Amiran".

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PILOT PRODUCTION OF NEW COMPOSITE MATERIALS BASED ON CARBON-MINERAL RAW MATERIALS OF KAZAKHSTAN

Priority direction: Geology, mining and processing of mineral and hydrocarbon raw materials, new materials, technologies, safe products and constructions.

Aim of the project: organization and development of experimental industrial production of rubber – technical and plastic products with Kazakhstan carbon-mineral raw material using.

Know-how: is the use of shungite as carbon black substitute for the rubber and plastic goods production.

Relevance and novelty: The main difference between the proposed products is the technical result achieved by using shungite (Bakyrchik deposit, East Kazakhstan region). Shungite is grinded to fraction of minus 80-100 microns, with carbon 10 ± 2% of the mass. Carbon is used as reinforcing filler for the production of elastomers-rubber products and composite materials-plastics based on polyethylene, polypropylene, etc.

In addition, a comparison of the obtained results of the products properties testing indicate that the strength properties of rubbers filled with shungite are higher than those of rubbers filled with shungite and kaolin. Taking into account the phase composition of shungite rocks, a filler based on them can be considered as a complex mixture of active and inactive fillers. Consequently, in the production of industrial rubber goods, it is possible to simultaneously replace both the active filler and the inactive filler (in this case, kaolin).

Practical significance: There are attractive price because of shungite addition, product quality, expansion of carbon fillers elastomers variety.

Expected results:

– production projects and a package of design documentation for a pilot industrial line for the rubber and plastic products production were developed;

– laboratory for quality control of raw materials and products during production was created;

– installation of the main and auxiliary process equipment was carried out and commissioning was carried out at the pilot industrial site of production;

– production site was put into operation;

– act of the main equipment of technological lines commissioning was drawn up;

– pilot batch of industrial rubber goods and polymer composite materials was obtained;

– physico-chemical characteristics of the developed materials with the issuance of test reports were determined;

– the Organization Standard “Rubber Wipers for Rods” CT 111040004929-TOO-01-2020; Certificate of Conformity “Rubber wipers for rods”; Organization Standard “Polymer boxes with shungite filling” CT 111040004929-TOO-01-2019; Declaration of Conformity “Polymer boxes with shungite filling”; Certificate of Conformity “Polymer boxes with shungite filling” were obtained;

– an application was submitted for obtaining the Eurasian patent for an invention “Rubber compound”;

– on an ongoing basis, work is being carried out to expand the range of produced rubber and plastic products.

Prospects for implementation: There are complex strategy of the domestic goods production was developed. Adding an innovative filler - shungite allows to obtain product of higher quality at lower prices. All of this allows to attract additional investments to expand the range of products and production capacity.

Consumers: farms and agricultural producers, manufacturers of plastic windows, medical organizations and consumers of medical services, road organizations, individuals.

Competitiveness (Advantages of technology) and commercialization of the project:

– use of the Bakyrchik polymetallic mine man-made dumps (shungite) as a reinforcing filler for the rubber and plastic products production;

– cost reduction of the final product by 20-25%;

– increasing of elastic-strength properties of rubber and life of plastic products.

Amount of income: ~ 20,0 mln tenge (45 552$).

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NANOMATERIALS FOR A WIDE RANGE OF APPLICATIONS

Priority direction: Geology, mining and processing of mineral and hydrocarbon raw materials, new materials, technologies, safe products and constructions.

Aim of the project: Creating the production of carbon nanostructured materials for a wide range of applications.

Know-how: The technological line of obtaining carbon nanomaterials is launched, equipped with CVD installations for the preparation of graphene-like materials and fullerene synthesis reactors that have no analogues in the Republic of Kazakhstan.

Relevance and novelty: In the future, carbon materials and composites due to a variety of properties will suppress the traditional materials from all spheres of life. At the same time, the synthesis of carbon materials fits into the emerging paradigm of promising models of "pure energy", alternative and "green" energy technologies. Therefore, at present, a very relevant area is the development of effective methods for obtaining new carbon nanocomposites of multipurpose destination, which have great potential of practical application.

Considering that at the moment there are a large number of carbon nanostructure synthesis methods, we have been designed and launched an installation that has an effective way to improve productivity by 5%.

Practical significance: Carbon nanostructures are applicable in various industries, as they are unique due to their properties and sizes. They can be used as: additives improvement of physico-mechanical properties of strength in various additives, paints, reinforcing materials; semiconductor materials to improve the properties of the conductivity of the elements; storages; sorbents, etc.

Expected results:

– lowering the cost of carbon nanomaterials compared with world counterparts while maintaining their high consumer characteristics;

– implementation of production in Kazakhstan;

– access to the market with domestic goods through the Internet trading;

– a possibility of Kazakhstani enterprises to move to a new level, due to the introduction of nanotechnology into production.

Object of implementation: fullerene soot, mixture of C60 and C70 fullerenes, C60 fullerenes, graphene oxide solutions, graphene powders, graphene on the substrate.

Prospects for implementation: The technology of obtaining carbon nanostructures will save the synthesis time, as well as consumable materials when burning. The introduction of such a type of materials will allow the country to become a new level of development, due to the substitution of imports.

Consumers: Chemical production, construction organizations, mechanical engineering enterprises, agriculture, aerospace industry, environmental protection, etc.

Competitiveness (Advantages of technology) and commercialization of the project: low costs, affordable price, a wide range of product applications, high quality guarantee, consumer consultation when using the product, fast delivery of goods, the possibility of selling goods in trial lots, no intermediaries.

Investment amount – 15,0 million tenge (34 164$).
Amount of income: – 2,0 million tenge (4 555,2$).
Availability of documents of title:
– Patent of the Republic of Kazakhstan for invention No. 32715 "Method of hydrogenation of nanostructured carbon materials and installation for its implementation";
– Innovation patent of the Republic of Kazakhstan No. 26247 "Method for producing graphane and graphane-like materials";
– Innovation patent of the Republic of Kazakhstan No. 28561 "Method for producing graphene";
– Innovation patent of the Republic of Kazakhstan No. 34285 "Method for the synthesis of fullerenes with automatic (preliminary) desorption of graphite electrodes".
Availability of contracts, agreements with production and business:
– Agreement on cooperation No. L-0316-GK/161 dated 09/01/2020 with the NJSC "M. Kozybayev North Kazakhstan University";
– Agreement on cooperation No. K-0316-GK/46 dated 03.09.19 with "PROM-TRADE" LLC (Moscow);
– Agreement on cooperation No. K-0316-GK/45 dated 07/10/19 with LLC Research and Production Enterprise "NanoKOR-Vostok" (Tomsk).
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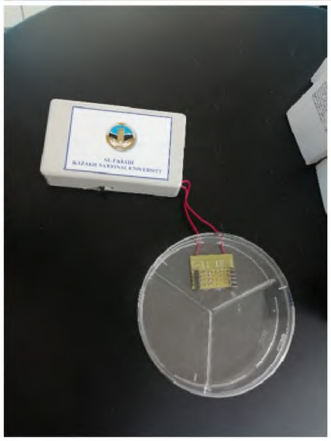

SMALL-SCALE PRODUCTION OF ENERGY-SAVING GAS-DISCHARGE LAMPS WITH INCREASED LUMINESCENCE INTENSITY BASED ON NEW TECHNOLOGIES

Priority direction: Energy and mechanical engineering.

Aim of the project: organization and putting into operation of small-scale production of energy-saving gas-discharge lamps with increased luminescence intensity.

Know-how: The use of innovative technology for increasing the power, such as the glow of gas-discharge lamps T5 and T6, based on the addition of nanoparticles to the volume of the gas discharge (into plasma). The technology has no analogues in Kazakhstan, protected by a patent of the Republic of Kazakhstan for an invention.

Relevance and novelty: the need for efficient use of energy resources through the transition to sustainable development and economy of consumed energy determines the relevance of this development. The novelty of the innovation lies in the technology of adding nanoparticles, which improve the technical characteristics of fluorescent lamps.

Practical significance: low volume of domestic production and a high share of imports in the lighting equipment market, including the market for fluorescent lamps, shows the practical importance of producing our own products.

Expected results: projected production volume of at least 50,000 units per year, with a subsequent increase to 100,000 units per year.

Object of implementation: small-scale production of energy-saving gas-discharge lamps with increased luminous intensity.

Prospects for implementation: creation of 10 new jobs, entry into the markets of the countries of the Customs Union and the CIS.

Consumers: wholesale buyers, in particular, intermediary companies, construction stores, specialized retail stores of lighting equipment; retail buyers represented by various organizations, shopping centers, business centers, universities; state institutions.

Competitiveness (Advantages of technology) and commercialization of the project: the presence of an innovative component of the proposed product, which provides a low cost price with high quality, is the main key to the competitiveness of products.

The main competitive advantages:

– low cost with its own production line;

– high luminous efficiency, exceeding the indicator of incandescent lamps by 3 times, energy consumption is up to 7 times lower;

– an increase in the glow intensity by more than one and a half times with the addition of nanoparticles in comparison with fluorescent lamps;

– safety due to the minimum amount of mercury in the composition.

Investment amount – 178,0 mln tenge (405 412,8$).

Production volume: about 50,000 units/year.

Availability of documents of title:

– Patent No. 29455 "A method for increasing the glow intensity of energy-saving gas discharge lamps";

– Certificate of conformity series KZ No. 0156618 dated November 26, 2020.

Availability of contracts, agreements with production and business:

– Agreement on mutual cooperation with NNLOT and SRI ETP, dated September 02, 2020;

– The contract for the purchase of goods with LLP "Institute of Applied Sciences and Information Technology", dated August 05, 2020.

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DEVELOPMENT OF NANOSTRUCTURED COMPOSITE MATERIALS BASED ON SILICON-CONTAINING AMORPHOUS DIAMOND-LIKE CARBON FILMS

Priority direction: Geology, mining and processing of mineral and hydrocarbon raw material, new materials, technologies, safe products and constructions.

Aim of the project: development of scientific fundamentals and synthesis technologies of nanostructured nanosized composite a-$C_{1-x}Si_x$<Rh_y> films with certain structural-chemical modification and predefined electronic properties. Composite amorphous DLC thin films will be synthesized by the method of magnetron ion-plasma co-sputtering of a combined target at direct current.

Know-how: manufacturing of composite Nanomaterials based on a-$C_{1-x}Si_x$<Rh_y> films will promote the development of new areas of nanoelectronics. Amorphous diamond-like silicon-carbon nanosized films can be of interest as non-crystalline wide-bandgap materials stable at high temperatures and radiation. All physical-chemical, mechanical, optical and electrical properties of a-$C_{1-x}Si_x$ films are structurally sensitive and depend on nanosized polymorphic modifications of SiC structural elements in the volume unit. Modification of a-$C_{1-x}Si_x$ by rhodium nanoclusters in non-equilibrium conditions can lead to the discovery of new phenomena and consequently extend application areas of similar composites.

Relevance and novelty: of the project are based on formation of amorphous nanosized nanostructured a-$C_{1-x}Si_x$ films with different polytypes of SiC in DLC matrix depending on synthesis conditions and concentration ratio C_{1-x}: Si_x. Investigation of the dependence of their electronic properties on silicon concentration and SiC polytype. And also, the influence of Rh nanoclusters on the structure of a-$C_{1-x}Si_x$ films and their electronic properties will be studied.

Production of the wide-bandgap, radiationally and chemically stable a-$C_{1-x}Si_x$ films will make it possible to create new heterostructures for HF thin-film nanotechnology, high-speed tenso-sensors and sensors, obtain new heterojunctions for nanoelectronics and new light-sensitive transition layers for solar energy. Nanostructured amorphous diamond-like carbon films with different silicon-carbon polytypes can become a new material in semiconductor electronics.

Practical significance: of the project consists in the development of production technology for amorphous nanosized and nanostructured DLC a-$C_{1-x}Si_x$<Rh_y> films with the formed atomic structure of SiC polytypes and rhodium nanoclusters. In addition, the production of wide-bandgap, radiationally and chemically stable a-$C_{1-x}Si_x$ films will allow to create new heterostructures for ultra-high-frequency thin-film nanotechnology, high-speed tenso-sensors and sensors.

Expected results: diamond-like a-$C_{1-x}Si_x$ films modified with rhodium nanoclusters will be synthesized and the effect of the nanoclusters on the structure and electronic properties of amorphous DLC:Si films will be defined.

Object of implementation: composite nanomaterials on the basis of diamond-like films.

Prospects for implementation: knowledge about the influence of conditions of the structure formation with a certain ratio of polymorph SiC structural units with rhodium nanoclusters will make it possible to more effectively adjust and control the electronic processes in composite amorphous diamond-like films. This in turn will lead to the extent of their application and creation of new multipurpose materials.

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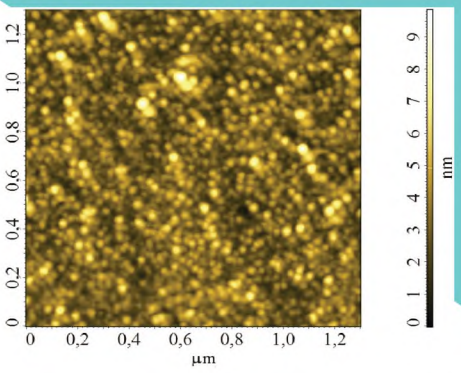

Figure 1. Amorphous diamond-like carbon film modified with tin nanoparticles

Figure 2. Argon ion discharge plasma in a magnetron used for the synthesis of diamond-like films modified with nanoparticles of different metals

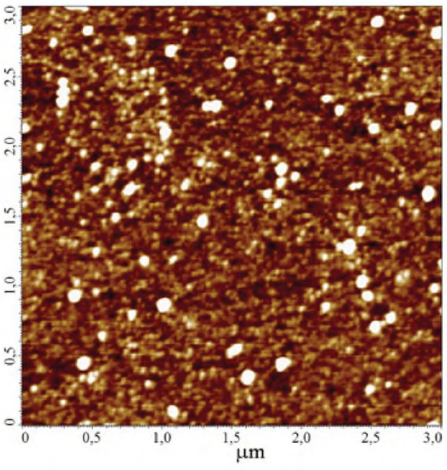

Figure 3. Structure of surface of silicon-containing diamond-like carbon film

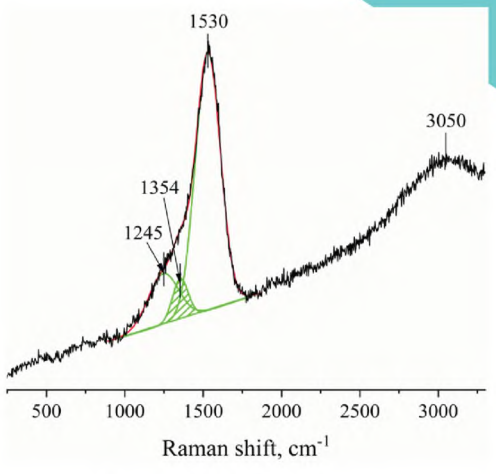

Figure 4. Raman spectrum of silicon-containing diamond-like carbon film

NEW BIOACTIVE MULTI-BOTANICAL PREPARATIONS FROM MEDICINAL PLANTS RESOURCES

Priority direction: Life and health science.

Aim of the project: the research project mainly focused on using serval selected bioactive medicinal plants, to generated new bioactive botanical oral supplement, determinate its chemical constituents, isolation of the main natural product leads, study their structure and pharmacological activities, run in vitro screening to develop new methods and techniques to create natural, safe multi-botanical preparation to defense against viral influenza, SARS, hepatopathy, gynecopathy and future human health threatened pandemics.

Know-how: in our proposed project, a botanical formula consisting of several medicinal and nutritional herbal supplements that are powerful against influenza, coronavirus, and natural products for woman's health and liver protection will be developed.

Relevance and novelty: a botanical formula against influenza virus and coronavirus will be created, consisting of powerful, safe medicinal and nutritional plant mixtures. To achieve this goal, biologically active complexes will be generated by means of extraction, and their in vitro biological activities will be conducted. A safe product from medicinal plants that provides short-term access to influenza virus and COVID-19 patients will be effective. Drugs made from medicinal plants are cost-effective compared to those methods of treatment that occur in modern conditions. These natural drugs possess certain level of influenza virus, SARS, hepatopathy, and gynecopathy resistance, provides protective method by positively influencing the immune system. Drug molecules with potential antiviral therapeutic activities will be determined, after which their structure will be optimized and their functions will be checked via *in vitro* experiments, followed by animal clinical trials.

Practical significance: implementation of this project will allow obtaining new biologically active complexes against influenza virus, coronavirus, and natural products for woman's health and liver protection, which are the main components in the production of new pharmaceutical products based on plant raw materials in the required amount. This will reduce the number of import-substituting medicines to the Republic Kazakhstan.

Expected results:

– collect the selected medicinal plants, and run initial preparation (cleaning, drying, grinding) of the raw materials in sufficient quantities for the planned scientific research;

– carry out extractions of the selected medicinal plants separately and partition the crude extract with different solvent system, study the chemical profiles of the collected plant materials and perform the required qualitative and quantitative analysis of their main bioactive constituents based on the guidance of the Pharmacopoeia of Kazakhstan;

– prepare authenticated ethanol and water extracts of the several proposed plants' mixture (In certain ratio based on traditional medicine and properties of medicinal plants) and run in vitro screening to select the most suitable candidate(s) for the proposed formula;

– identify and isolate the main bioactive compounds of the proposed botanical formula by using chromatographic, physico-chemical methods such as Column

Chromatography (CC), HPLC, Preparative HPLC, LC-MS; Structure elucidation of the main bioactive compounds by using modern chemical and physical methods such as HRMS, 1D and 2D NMR, ECD;

– evaluate in vitro screening for the optimal multi-botanical formula and its main bioactive constituents;

– utilize the data generated in research results to refine the formula composition to the most active ratio towards.

Object of implementation: new biologically active formulas based on plant raw materials of Kazakhstan.

Prospects for implementation: from an economic point of view, the project will make it possible to create new biologically active natural products necessary for obtaining phytomedicines with further introduction into medicine and will contribute to the accelerated innovative development of the economy of the Republic of Kazakhstan. In addition, the developed technologies will make it possible to introduce them into production, open new enterprises and jobs, increase profitability and obtain an economic effect of existing enterprises. The participation of young scientists in the project will improve the quality of education and the training of highly qualified specialists, which in the future will affect their career growth.

Consumers: research institutes, pharmaceutical companies, medical institutions, people for use against the spread of disease and for enhancing immunity.

Competitiveness (Advantages of technology) and commercialization of the project: obtaining phytopreparations and realize the commercialization possibility.

The main competitive advantages:

– New natural bioactive products – base on medicinal preparations;

– Structure elucidation and identification of the main bioactive compounds by using modern chemical and physical methods;

– Bio-screening;

– Create the relation between «Structure-bioactivity» of bioactive constituents;

– Obtaining new biological active complexes and phytopreparations from medicinal plant resources of Kazakhstan.

Investment amount – 150,0 mln tenge (341 640$).

Availability of contracts, agreements with production and business:

– The agreements are processing with organizations like «Elaman Med», «Kaz Biotech Group» LLPs.

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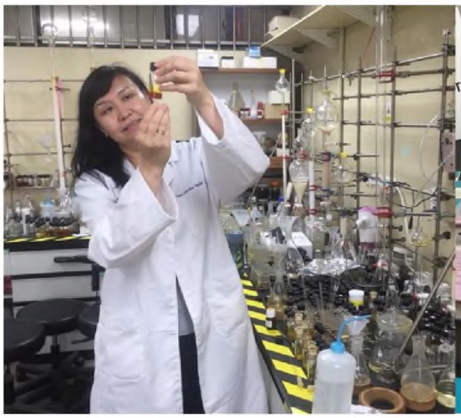

BIOLOGICALLY ACTIVE ADDITIVES AND BIOSTIMULATORS BASED ON MICROALGAE

Priority direction: Life and health science.

Aim of the project: to develop a technology for producing biologically active additives and biostimulators based on industrial-value microalgae strains.

Know-how: biologically active additives based on these organisms are natural, affordable, environmentally friendly prophylactic biological products that do not cause adverse reactions, do not have contraindications for use.

Relevance and novelty: food microalgae are a good source of proteins, essential amino acids, phytosterols, carbohydrates, vitamins, are characterized by a unique combination of biologically active compounds, polyunsaturated fatty acids with a high content of gamma-linolenic acid and many other healthy compounds. They, having unique biochemical and physiological properties, are sources of pigments such as chlorophyll, alpha- and beta-carotene, lycopene, lutein, zeaxanthin and astaxanthin, phycocyanin, which, having antioxidant and antitumor properties, are used in the medical, food, nutraceutical and cosmetic industries.

Practical significance: the favorable geographical location of our Republic of Kazakhstan, the relative simplicity of cultivating microalgae to obtain its biomass create the preconditions for the development of industries for the production of biologically active additives (BAA) and biostimulators based on them. It is shown that the use of microalgae in animal husbandry as a source of protein, vitamins and other physiologically active substances increases the resistance of animals to various diseases, primarily those associated with vitamin deficiency, accelerates metabolic processes, and thus contributes to an increase in the volume and quality of marketable products. In addition, it should be noted about the possibilities of creating new jobs at enterprises for the production of biological products, biological feeds and food supplements.

Expected results: a technology will be developed for the production of new biologically active additives and biostimulators based on industrially valuable strains of microalgae and their mass cultivation, their biological properties will be studied, the formulation and commercial forms of new biologically active additives and biostimulators will also be developed.

Object of implementation: biologically active additives and biostimulators based on microalgae biomass, containing essential amino acids, vitamins B, C, D, provitamin A, polyunsaturated fatty acids, carbohydrates, polysaccharides.

Prospects for implementation: the prospects of this project are determined not only by economic profitability, but also by the possibility of obtaining new, environmentally friendly, unique biological products based on microalgae. These facilities are simultaneously producers of new valuable products that are widely used in the food industry (as biologically active additives) and in the agricultural sector, in particular in animal husbandry, poultry farming, and fisheries (biologically active feed additives). At the same time, it should be borne in mind that obtaining biologically active additives based on microalgae can be economically

profitable, since it does not require expensive equipment and nutrient media for their cultivation.

Consumers: agro-industrial sector (poultry farms, pig breeding, livestock farms, aquaculture), food industry, pharmacology and medicine.

Competitiveness (Advantages of technology) and commercialization of the project: the competitiveness of this project is determined by the above unique properties of microalgae and the advantages of their cultivation technology (cheap nutrient medium, sun, not expensive equipment). In Kazakhstan, there are no enterprises for the production of biological products based on microalgae and other phototrophic microorganisms. The project has good commercial prospects and great potential for commercialization.

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BIOPREPARATION FOR PURIFICATION OF SOIL AND WATER FROM OIL CONTAMINATION

Priority direction: Geology, mining and processing of mineral and hydrocarbon raw material, new materials, technologies, safe products and constructions.

Aim of the project: creation of production for obtaining microbial preparations for the restoration of diseased and contaminated soils, as well as for agriculture.

Relevance and novelty: pollution of the natural environment with oil and oil products today is one of the complex and multifaceted problems of ecology and environmental protection. No other pollutant can be compared in terms of the latitude of distribution, the number of pollution sources, and the levels of chemical loads on all components of the landscape.

Production of biological products based on microorganisms, adapted to the soil and climatic conditions of different regions of the Republic of Kazakhstan. The estimated production volume per year will be determined taking into account the size of the market and exports.

Practical significance: biological products based on destructor strains are adapted to the soil and climatic conditions of the oil-producing regions of the republic. Designed for cleaning soil and water from oil and oil products pollution in order to improve the ecological situation of the environment and reclamation of oil-contaminated lands. When using the drug, the processes of biodegradation of hydrocarbons led to the effective cleaning of the soil from oil hydrocarbons and the improvement of its ecological state. The introduction of the drug into the oil-contaminated soil increased the efficiency of the processes of biodegradation of petroleum hydrocarbons; the loss was more than 85%.

Working out the use of experimental samples of biological products in order to obtain the required level of productivity of high quality agricultural crops, preserve and increase soil fertility, protect the environment from pollution is an important stage in their development.

Object of implementation: microbial preparation.

Prospects for implementation: the preparation for cleaning is applicable in practice for the technology of recovery of oil-contaminated soils, neutralization of oil-contaminated soils, liquid drilling waste and solid combustible oily waste. Microbial preparations for the agro-industrial complex will provide import substitution in the agricultural sector related to ensuring the food security of the region and the country. Organization of obtaining pilot batches of various biological products based on microorganisms for cleaning contaminated soils with pollutants and for agro-industrial enterprises.

Consumers: oil production and refining industries of the Republic of Kazakhstan, agro-industrial enterprises, nature protection services, the private sector.

Competitiveness (Advantages of technology) and commercialization of the project: the transition to a "green" economy, associated with the creation of environmentally friendly technologies and products such as microbial preparations to clean up pollution and improve soil fertility, are designed to help and ben-

efit nature, improving the ecological state of disturbed lands. An innovative, modern and safe biological product will be in demand for enterprises of the oil and gas sector as one of the leading sectors of the economy of the Republic of Kazakhstan.

Investment amount – 230,0 mln tenge (523 848$).

Availability of documents of title:

– Patent of the Republic of Kazakhstan No. 32017 «Microbial preparation for cleaning oil-contaminated soils, oil sludge and water surfaces»;

– Patent of the Republic of Kazakhstan No. 32019 «Microbial preparation for cleaning oil-contaminated soils, oil sludge and water surfaces».

Availability of contracts, agreements with production and business:

– Cooperation agreement with business partner «KazEcoSolutions» LLP.

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soil before cleaning **soil after cleaning**

SOLVENT-FREE ACRYLATE PAINTS WITH IMPROVED CHARACTERISTICS

Priority direction: Geology, mining and processing of mineral and hydrocarbon raw material, new materials, technologies, safe products and constructions.

Aim of the project: creation of a pilot production of solvent-free acrylate paints with improved characteristics.

Know-how: paints that do not contain a solvent, but at the same time have improved characteristics.

Relevance and novelty: acrylic paints are widely used in industry and for household purposes as building and structural composite materials. The market for acrylate paint in Kazakhstan is mainly represented by only one type – water-based acrylic paint. The main disadvantages of water-based acrylic paint, even after a short period of use, are mold, cracking and flaking, smudges, swelling, chalking, shrinkage or shrinkage, fading, flaking and sagging. The use of composite paints and varnishes based on new acrylic paint is economically profitable, since it requires minimal production costs, and the physical properties of the resulting product can be adapted for specific operating conditions. The new acrylic paint proposed in the project will solve the above problems due to the quality of acrylic polymer resins and the absence of organic solvents and water in the paint production technology.

Practical significance: the creation of a pilot production based on the developed technology for obtaining a solvent-free acrylate paint will allow the introduction of new import-substituting high-performance paints and varnishes on the Kazakhstan market. Unlike the well-known analogs of industrial paints (acrylate, epoxy and polyurethane), the developed technology will make it possible to obtain a new environmentally friendly acrylate paint without the use of solvents, with higher performance characteristics.

Expected results: a pilot production facility for solvent-free acrylate paint produced under the WARDA STAR® trademark will be set up. The resulting paints will be fast curing with increased mechanical strength, resistant to chemicals such as acids and alkalis. The resulting paint will be used as an anti-corrosion coating for metal surfaces, as concrete coatings for parking lots, shopping centers, industrial enterprises and any other premises with increased requirements for the mechanical strength of coatings.

Object of implementation: solvent-free acrylate paints.

Prospects for implementation: Within the framework of the project, it is planned to create a pilot plant for the production of acrylate paints with a capacity of up to 50 tons/year. After the successful launch of production and the development of contracts for products within 5-7 years, it is planned to increase production to 150 tons/year.

Consumers: construction organizations, warehouses, kindergartens, schools, shopping centers, etc.

Competitiveness (Advantages of technology) and commercialization of the project: is to obtain paints for the industrial sector using moderate temperatures without the use of highly corrosive chemicals, which will reduce the cost of the resulting acrylic syrup for paints.

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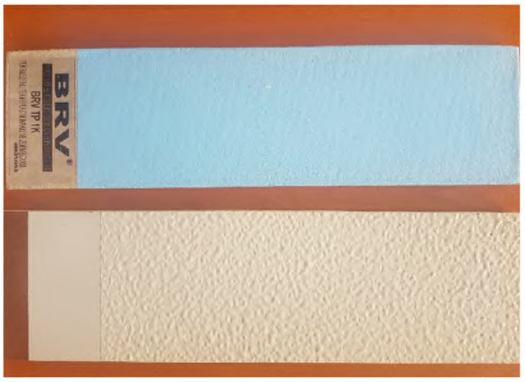

HYDROGEL FORMS OF ANTISEPTICS

Priority direction: Geology, mining and processing of mineral and hydrocarbon raw material, new materials, technologies, safe products and constructions.

Aim of the project: development and implementation of hydrogel forms of antiseptics containing silver nanoparticles.

Know-how: method of obtaining hydrogel forms of antiseptics containing silver nanoparticles.

Relevance and novelty: infectious diseases are the second leading cause of death after cardiovascular disease and the first cause of premature death in the world. To solve the problems of ensuring the prevention of infectious diseases in the context of integration into the global economic space, the Republic of Kazakhstan needs to develop technologies of innovative, new highly effective disinfectants and sterilizing agents. The introduction into the practice of medical disinfection of a large number of disinfectants, differing in their consumer properties, has made the actual problem of their optimal choice. For the successful implementation of disinfection measures, a clear focus is required on the search for an optimal composition that meets high efficiency, penetrating ability into tissues with low toxicity to the body. This determines the high relevance and novelty of this project, within the framework of which it is planned to implement the technology for the production of an innovative form of broad-spectrum antiseptics in the form of hydrogel sprays, ointments and bandages containing silver nanoparticles along with the traditional antiseptic substance. It is expected that the combination of hydrogel forms of an antiseptic and silver nanoparticles in one composition will be accompanied by a synergistic positive effect and provide their high antibacterial and antiviral activity.

Practical significance: jointly with LLP «Asem» (Shymkent), it is planned to implement the technology for the production of new hydrogel forms of antiseptics containing silver nanoparticles.

Expected results:

– the formulation of hydrogel sprays, ointments and dressings will be developed, containing silver nanoparticles along with the traditional antiseptic substance;

– a technology for the production of hydrogel sprays, ointments and bandages containing antiseptic substances and silver nanoparticles will be developed.

Object of implementation: hydrogel sprays, ointments and bandages containing, along with the traditional antiseptic agent, also silver nanoparticles.

Prospects for implementation: production of hydrogel sprays, ointments and dressings containing antiseptic agents and silver nanoparticles will be organized at the production facilities of «Asem» **LLP**.

Consumers: medical institutions, catering establishments, shopping centers, etc.

Competitiveness (Advantages of technology) and commercialization of the project: has a high competitiveness and prospects for commercialization.

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INNOVATIVE HARDWARE AND SOFTWARE COMPLEX FOR STUDYING THE FUNDAMENTALS OF ELECTROMAGNETIC PHENOMENA

Priority direction: Information, communication, and space technologies.

Relevance and novelty: the complex is designed for students to study the basics of the phenomena of electricity and magnetism in the school physics course. A more visual demonstration of the studied laws of physics, a modern approach with the use of hardware and software, integration with information technologies is offered.

Practical significance: the laboratory complex is a good, applied tool in the educational process. Possessing several indisputable advantages, such as compactness, mobility and autonomy, the complex is indispensable for the low-cost equipment of secondary schools and colleges, as well as for conducting classes related to the departure of the teacher to the student's home.

Expected results: projected production volume of at least 400 units per year, with a subsequent increase to 1000 units per year.

Object of implementation: small batch production of laboratory complexes for studying the phenomena of electricity and magnetism in the course of physics.

Prospects for implementation: creation of 10 new job places, entry into the markets of the countries of the Customs Union and the CIS.

Consumers: public and private secondary and secondary specialized educational institutions, educational centers, specialized study groups.

Competitiveness (Advantages of technology) and commercialization of the project:

– hardware and software complex allows to carry out more than 20 laboratory works;

– has an autonomous battery power supply of 12 V;

– in one of the versions it has an LCD display for displaying data;

– there are several stages of protection (against short circuit, excessively high/low voltage, etc.);

– can be connected to a PC for data transmission and processing;

– compliance with Kazakhstani norms and training standards.

Key benefits:

– low cost in comparison with offers on the market;

– mobility and compactness (the whole complex fits into a portable suitcase weighing no more than 7 kg and with dimensions no more than 40x30x15 cm);

– autonomy (the ability to work without external power supply and thanks to the built-in rechargeable battery);

– scalability (the ability to increase the amount of work performed);

– the ability to adapt to specific customer requirements;

– warranty and post-warranty service on the territory of the Republic of Kazakhstan.

Investment amount – 20,0 mln tenge (45 552$).
Production volume: 400 units/year.
Availability of documents of title:
– Patent of the Republic of Kazakhstan No. 32281 “Laboratory installation for schools for the study of electrical and electromagnetic phenomena”.
Availability of contracts, agreements with production and business:
– Memorandum of mutual cooperation with LLP “Institute of Applied Sciences and Information Technologies”, dated October 02, 2020.
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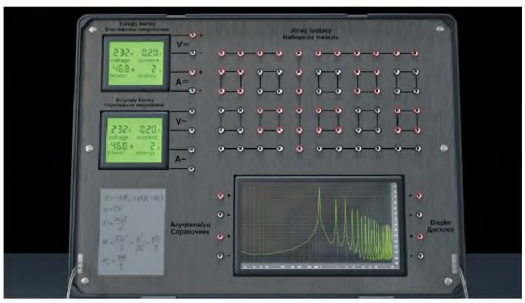

SUPERCAPACITORS BASED ON DOMESTIC NANOCOMPOSITES

Priority direction: Geology, mining and processing of mineral and hydrocarbon raw material, new materials, technologies, safe products and constructions.

Aim of the project: development of the technological foundations for the creation of supercapacitors based on domestic nanocomposites of graphene and manganese dioxide and the study of their physical, electrical, and operational properties.

Know-how: high electrical capacity, which is equal to 1200 F/g, simplicity of the manufacturing process and low cost.

Relevance and novelty: with the advent of a large number of electronic equipment, the modern world needs power sources. Safe and environmentally friendly, supercapacitors can replace heavy batteries, increase storage capacity in the absence of an external power supply with a fast charging system.

Raw materials like graphene and manganese dioxide are cheap raw materials for supercapacitors. This project belongs to the field of research in nanoscience and nanotechnology, which are currently being intensively developed. The problem of energy storage is very relevant today. Cell phones, electric cars, laptops, unmanned aerial vehicles need light, capacious energy storage.

Practical significance: he results of the research within the framework of this Project can be used to create power supplies, which can be further used in smartphones, in electric vehicles, in unmanned aerial vehicles due to their low weight, size and high capacity.

Expected results: ready-made batteries for mobile devices will be created.

Object of implementation: supercapacitors.

Prospects for implementation: the introduction of supercapacitors into smartphones and / or unmanned aerial vehicles (drones).

Consumers: all areas of technology that use electricity as a "green energy": micro- and nanoelectronics, air industry.

Competitiveness (Advantages of technology) and commercialization of the project:

– lightness (the batteries have a smaller mass);
– capacity (higher than that of ordinary capacitors);
– charge-discharge time.

Availability of documents of title:

– Patent of the Republic of Kazakhstan No. 33405 "Method of creating supercapacitors based on graphene oxide and manganese dioxide".

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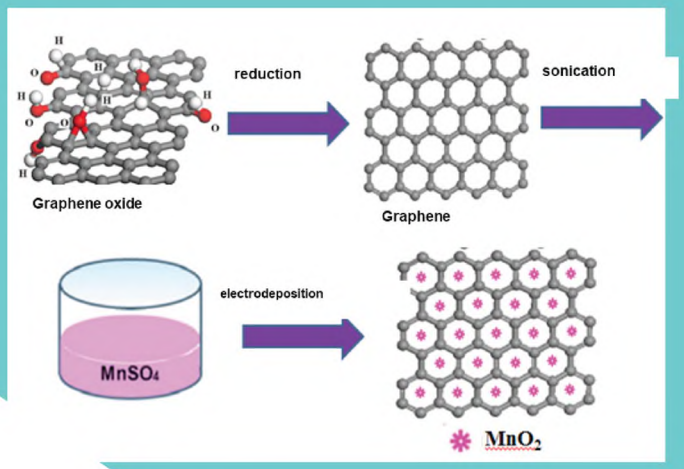

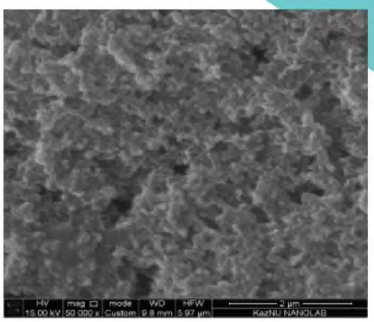

Figure 1. SEM image of the original carbon substrate before synthesis

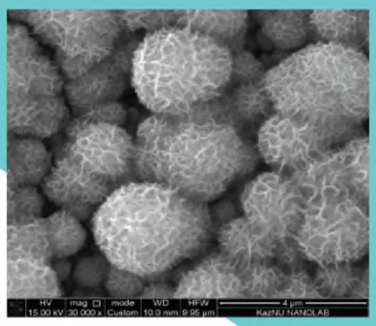

Figure 2. SEM image of graphene-MnO_2 after 40 minutes of deposition

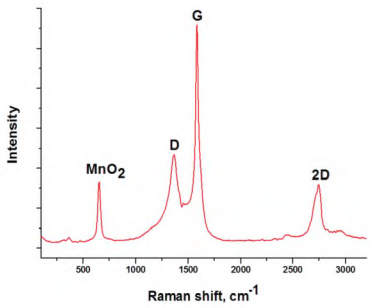

Figure 3. Raman spectra of graphene-MnO_2 electrode

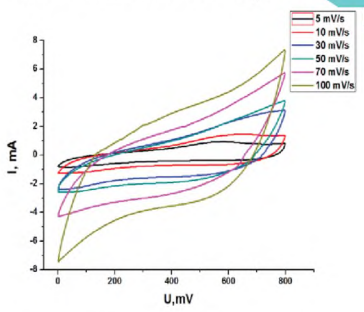

Figure 4. CV characteristics of graphene-MnO_2 electrode

DEVELOPMENT OF HOLOGRAMS TO PROTECT COINS, BULLIONS, PRECIOUS ITEMS AGAINST FALSIFICATION

Priority direction: Geology, mining and processing of mineral and hydrocarbon raw material, new materials, technologies, safe products and constructions.

Aim of the project: creation of nano/micro-reliefs on the surface of bullions, coins and jewelry made of precious metals (gold, silver, etc.) in the form of holographic structures to give products enhanced protective and aesthetically attractive properties.

Know-how: absence of this technology on the CIS market.

Relevance and novelty: The proposed technology for applying rainbow holograms is characterized by high productivity, better resolution (≈10 nm) and low cost, depending on the mechanical indentation of a hard stamp, which makes only 7-10 prints and is not used further. In addition, branding of own products is currently a trend.

Practical significance: The invention relates to the field of nanolithography, namely to the technology of transferring nanorelief on various surfaces and can be used in mints in the form of a protective holographic pattern, in photolithography for making masks, in creating rainbow holograms, holographic gratings, in creating integrated circuits.

Expected results: application of holograms in real production.

Object of implementation: hologram.

Prospects for implementation: applying a hologram on a coin, bottle, etc.

Consumers: mints, various industries producing any unique product.

Competitiveness (Advantages of technology) and commercialization of the project: the technology developed in the course of this project differs in that it has a higher resolution in comparison with existing methods without the use of thermal action and at lower exposure doses of 1-150 $\mu C/cm^2$, which together leads to a decrease in the time of the obtained relief or other a given image.

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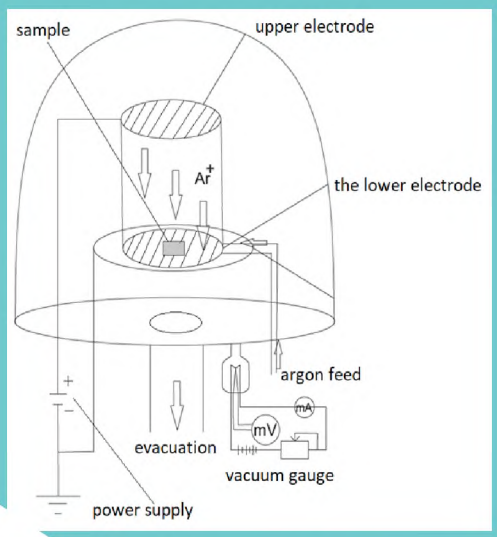

Figure 1. Diagram of an experimental setup for dry vertical etching

Figure 2. Optical micrograph of the applied target image

Figure 3. The obtained hologram on the polymer

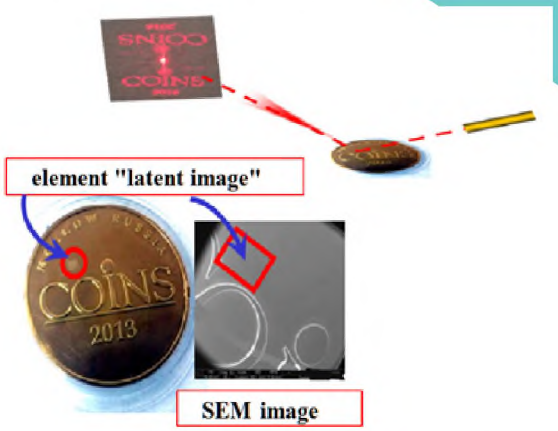

Figure 4. A real hologram as a security element «hidden image»

STRUCTURAL AND PHASE TRANSFORMATIONS AND RELAXATION PROCESSES IN THIN FILMS OF CRYOVACUUM CONDENSATES OF GLASS-FORMING ORGANIC MOLECULES

Priority direction: Scientific research in the field of natural sciences.

Aim of the project: is to study the processes of formation of glass-forming cryovacuum condensates of organic molecules and the properties of thin films, as well as thermally stimulated structural-phase transformation and isothermal relaxation processes condensed at low temperatures of samples.

Know-how: a comprehensive study of the properties of glass-forming substances in close proximity to space.

Relevance and novelty: understanding the mechanism of formation of unregulated condensed media and the relaxation processes that take place in them is one of the priorities of modern physics and physicochemistry. The ability to obtain fundamentally new results in this area allows you to consciously consider the choice of technology for obtaining these materials. This project solves these problems due to low temperature conditions, which are often based on the development of space technology. The results obtained in the project should contribute to the understanding of the physical basis of the formation and relaxation of glassy states of matter under deep vacuum and low temperatures.

Practical significance: in the study of the properties of thin films of glass-forming molecules obtained from the gas phase under the control of temperature and sedimentation rate. As a result, information can be obtained on the role of the molecular structure of the test substance and the rate of formation of unregulated states, as well as the effect of the mobile interface on the glass transition temperature and relaxation time parameters.

Expected results: leads to the acquisition of new fundamental information on the formation processes and properties of cryocondensed glass-forming systems at low temperatures, as well as the relaxation processes that occur in the studied samples. These results can be used in astrophysical research, modeling the processes of mass transfer in the world.

Consumers: low-temperature physics, as well as the international scientific community in the field of astrophysics and astronomy.

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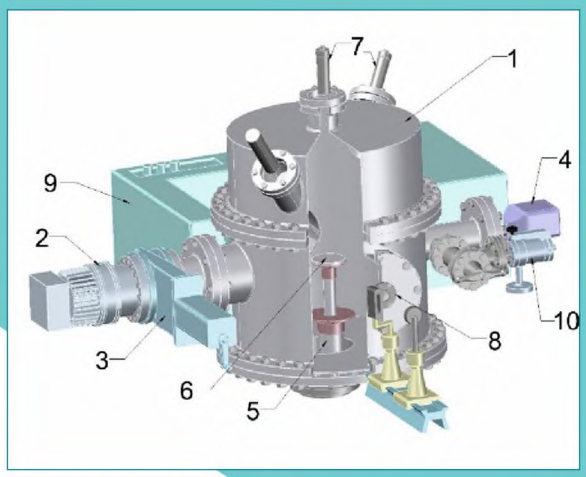

Figure 1. Experimental device for cryovacuum condensation

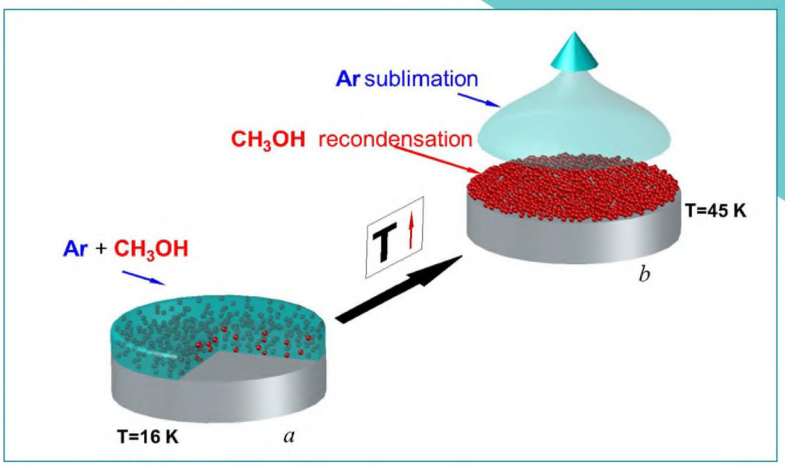

Figure 2. Scheme of the condensation process

AUTONOMOUS INFORMATION SYSTEM FOR DELIVERING MULTIMEDIA CONTENT TO MOBILE DEVICES VIA WI-FI NETWORK

Priority direction: Information, communication, and space technologies.

Aim of the project: development of an information system implemented in a compact and portable device for broadcasting (and managing) multimedia content (presentation, audio and video broadcasting, etc.) via a Wi-Fi wireless network from one mobile device to others (laptop, tablet, smartphone, TV screen, etc.) for organizing conferences (presentations).

Know-how: today, thanks to information technologies, the process of informatization of all industries is underway. In this regard, the proposed project is a new "digital service in healthcare and education" and in other industries..

Relevance and novelty: the novelty of the proposed project is an inexpensive, easy and convenient way to implement a multimedia content delivery system along with built-in support for wireless network interfaces. For example, in the basic version, the system deployed on a compact hardware platform is self-sufficient and is capable of organizing the delivery of multimedia content to the mobile devices of students attending a streaming lecture or seminar. Features of this device: mobility (lightweight and portable device), relatively inexpensive (the average price will vary from 50 thousand tenge) and ease of settings (does not require the installation of specialized software on mobile devices to use the system).

Practical significance: the practical significance of the results obtained during the implementation of this project is undoubtedly important, which will have a positive impact on the development of information technologies in the implementation of the national policy of "Digital Kazakhstan", provide high-quality training of competitive personnel, increase the contribution of science to the development of the country's economy, strengthen the scientific potential and status of a scientist.

Expected results: the project proposes an innovative method of broadcasting (and managing) multimedia content from one mobile device to another (tablet, smartphone, laptop, etc.) via a Wi-Fi network. Features of this device: mobility (lightweight and portable device), relatively inexpensive (the average price will vary from 50 thousand tenge) and ease of settings (does not require the installation of specialized software on mobile devices to use the system). At the end of the project, it is expected to create 3 device models: Wi-Fi presenter (basic for 10-20 users, medium for 20-50 users and premium for 50 or more users) with various functionalities.

Object of implementation: a technique for implementing the delivery of multimedia content to mobile devices via Wi-Fi.

Consumers: educational organizations, from secondary schools to universities, as well as organizations that conduct conferences, seminars, trainings, individuals who are individually engaged in conducting lectures, seminars and trainings.

Competitiveness (Advantages of technology) and commercialization of the project: inexpensive, easy and convenient way to implement a multimedia content delivery system along with built-in support for wireless network interfaces.

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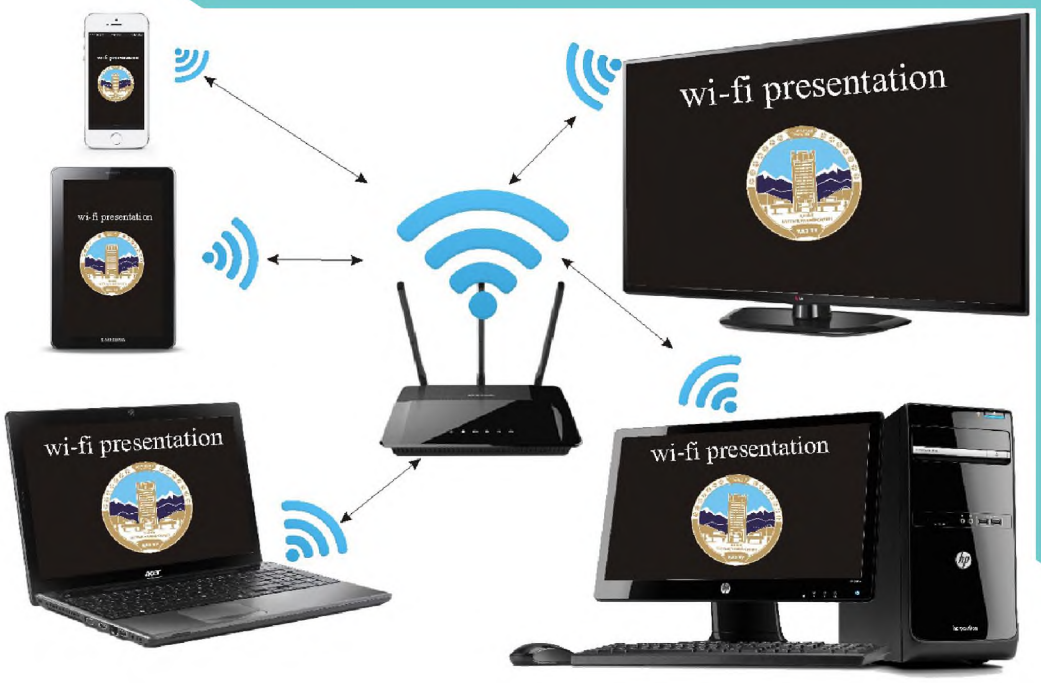

SENSOR FOR FIRE AND GAS SAFETY

Priority direction: Geology, mining and processing of mineral and hydrocarbon raw material, new materials, technologies, safe products and constructions.

Aim of the project: study of structural, optical and electrical properties of silicon nanostructures, creation of a selective sensor based on porous silicon and silicon nanowires and study of its technical characteristics.

Know-how: the current-voltage characteristics of porous silicon with a coplanar configuration of contacts have been experimentally investigated for the first time. It is shown that, with an appropriate configuration of contacts, such structures form a volt-ampere characteristic of oppositely connected diodes.

It was found that the volt-ampere characteristic of such structures stabilized during the day; the dispersion dependences of the capacitance and conductivity of porous silicon and silicon nanowires have been obtained experimentally in the frequency range from 1 kHz to 1 MHz. It was found that the optimal operating frequency of gas sensors based on porous silicon and silicon nanowires is 1 kHz.

Relevance and novelty: high rates of economic and energy development all over the world lead to an increase in pollution in the environment and a deterioration in the ecological state of nature. There is a growing demand for cost-effective, sensitive, selective and fast-response nanomaterial sensors. In this regard, the problem of creating chemical sensors based on nanostructured silicon is a promising problem.

A technological regime for the deposition of porous silicon films with a high photoluminescence intensity in the etching regime with a low current density (1 mA / cm2) has been developed.

For the first time, the current-voltage characteristics of porous silicon with a coplanar configuration of contacts have been experimentally investigated. It is shown that, with an appropriate configuration of contacts, such structures form the volt-ampere characteristic of oppositely connected diodes. It was found that the current-voltage characteristic of such structures stabilized during the day.

The dispersion dependences of the capacitance and conductivity of porous silicon and silicon nanowires have been obtained experimentally in the frequency range from 1 kHz to 1 MHz. It was found that the optimal operating frequency of gas sensors based on porous silicon and silicon nanowires is 1 kHz.

Practical significance: the results of the study allow the creation of cost-effective, highly selective gas sensors based on silicon nanostructures.

Expected results:

– samples of porous silicon and silicon nanowires will be obtained by methods of electrochemical and metal-induced chemical etching;

– the structural, optical and electrical properties of the obtained samples will be investigated;

– the features of electrical conductivity in porous silicon and silicon nanowires will be experimentally revealed;

– the possibilities of using the obtained samples in the manufacture of sensitive and selective chemical sensors will be studied;

– selectivity parameters for such types of organic compounds as ethanol, methanol, acetonitrile, chloroform and toluene will be determined.

Object of implementation: sensor installation.

Prospects for implementation: upon successful implementation of the project and release of ready-made sensors, it is advisable to replace imported sensors with domestic ones in all industries.

Consumers: city fire services and gas companies.

Competitiveness (Advantages of technology) and commercialization of the project: works at room temperature, fast response time and low cost.

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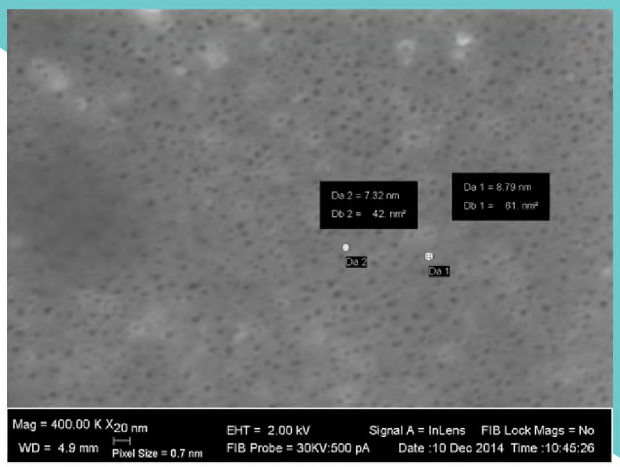

Figure 1. Surface morphology of a gas sensor based on porous silicon

Figure 2. Installation for measurement of gas-sensitive properties of a sensor

IBOX AIR – PORTABLE AIR QUALITY ANALYZER

Priority direction: Information, communication, and space technologies.

Aim of the project: implementation of an autonomous air quality analysis device with the ability to transfer data to a cloud.

Know-how: air quality data processing module uses big data processing and machine learning techniques. The data stored on the server is processed by mathematical models, which in turn allows:

– visualize the ecological picture of the city on the map;

– to identify the dynamics of changes in pollution (direction of the spread of pollution);

– build forecasts for further changes, taking into account various factors.

Relevance and novelty: the rapid growth of urban areas and industrial sites increases the importance of environmental control and monitoring. Using sensors it is possible to measure air quality and organize statistics of environmental pollution. This, in turn, will allow you to monitor the state of the environment, identify the dynamics of change and take effective measures to improve the ecological state of the city.

Practical significance: big data processing methods that extract structured information from data received from sensors in real time allow monitoring the current state of the ecological environment and predicting future changes, taking into account certain factors. Thus, within the framework of the concept of a smart city, it is possible to develop an effective tool to support decision-making in the management of the environmental development of the city and will be useful to any device user.

Expected results: the developed device in the hands of users who measure air in everyday life will compile a map of the environmental picture wherever there are users, including indoors.

Consumers: individuals, athletes, people who care about their health and their families, residents of private houses heating houses on solid fuel, allergy sufferers, etc.

Competitiveness (Advantages of technology) and commercialization of the project: the device will not be expensive in comparison with foreign counterparts; in addition, it will be possible to analyze fine particles. Monitoring services will use artificial intelligence to predict changes in the environmental situation.

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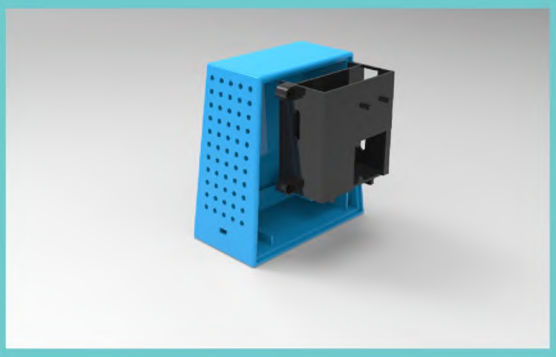
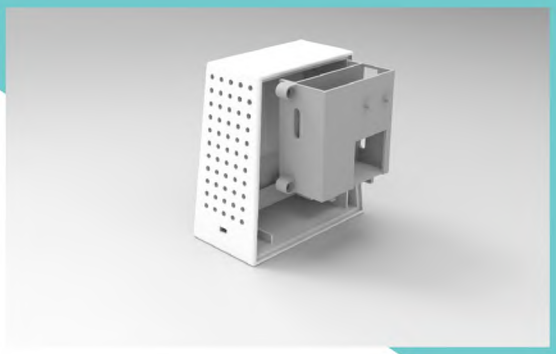




COMPREHENSIVE AUTOMATION OF THE ACTIVITIES OF HIGHER EDUCATIONAL INSTITUTIONS, R&D INSTITUTIONS AND IMPLEMENTATION OF DIGITAL SERVICES

Priority direction: Digital technologies (3D-printing; online trading; mobile banking; digital services, including in healthcare and education).

Aim of the project: providing effective information support for the management processes of educational institutions by introducing a cloud-based system for automating the educational process.

Know-how: the system of automation of the educational process will ensure the formation of a unified information space of higher and secondary special education, with the possibility of providing digital services to end consumers of educational services.

Object of implementation: IPC "UNIVER 2.0", IS "SCIENCE", IS "E-Services", IS "Indicative planning", IAS on the PowerBI platform.

Consumers: higher education institutions, colleges, research institutes.

Technology advantages:

– extended package of various system modules;

– reliability and availability of the system 24/7;

– security of operations and storage of user data;

– adaptation of functionality depending on the needs of a particular educational institution.

Investment amount – 220,0 million tenge.

Availability of documents of title:

– Copyright certificate No. 360 "Information analytical system" Science ";

– Copyright certificate No. 361 "System of indicative planning and rating assessment of the university's activities";

– Copyright certificate No. 2501 "Information system for the integration and synchronization of data from automation systems of financial and economic processes and the educational process";

– Copyright certificate No. 2586 "Information system of educational electronic document management E-Services";

– Copyright certificate No. 2799 "Information system of the automated educational process".

Availability of contracts, agreements with production and business:

– Agreement No. 200113-OD-2 dated 01/13/2020 with the Almaty Kazakh-German University;

– Agreement No. 02-02 dated 02/28/2020 with the Almaty Technological University;

– Agreement No. 03-03 dated 03/30/2020 with A. Myrzakhmetov Kokshetau University;

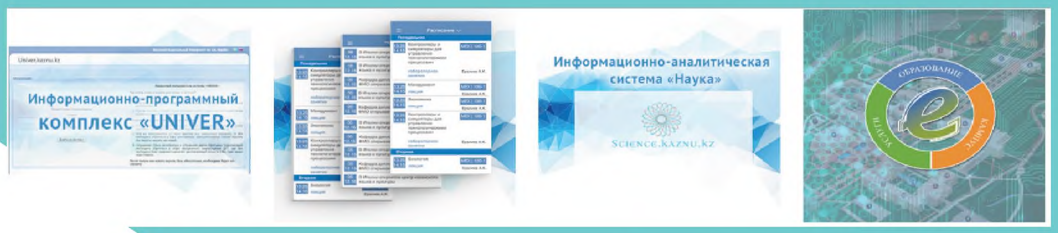
– Agreement No. 200194 dated 05/18/2020 with the Kazakh National Women's Pedagogical University;

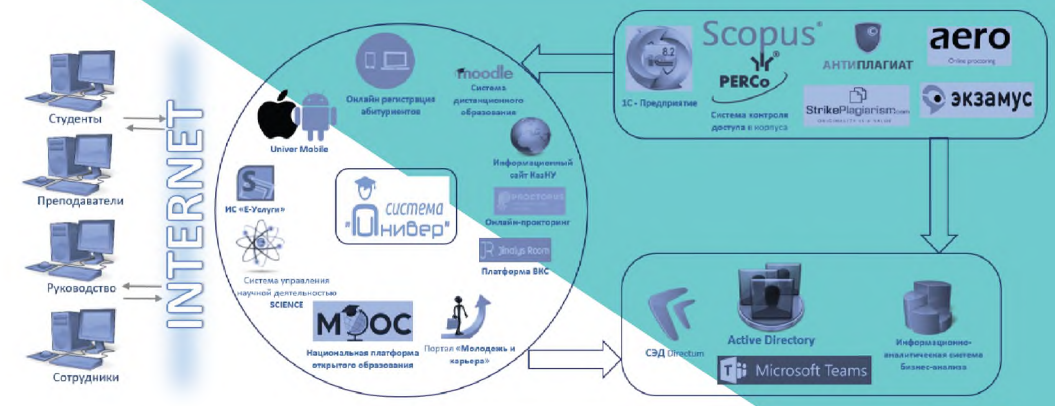
– Agreement No. 26051 dated May 26, 2020 with Epigraph LLP;

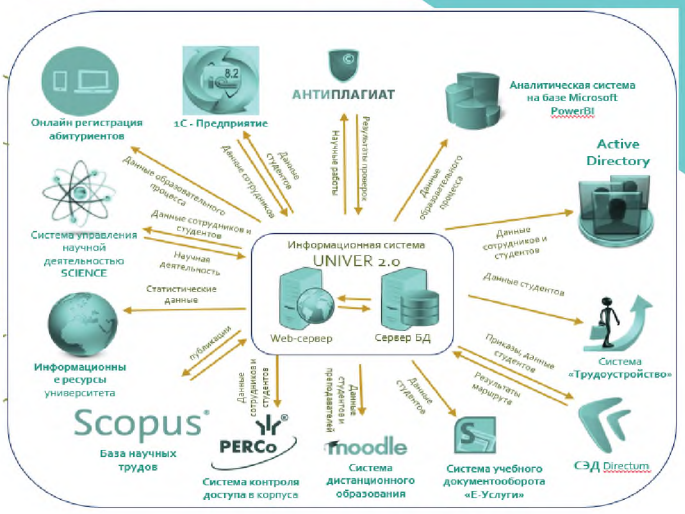
– Contract No. 200189/00 dated 09.06.2020 with KSTU;

– Agreement No. 256 dated 09.06.2020 with the Eurasian Law Academy named after D.A. Kunaev, and other agreements.

Contact details: Erlan.Kistaubayev@kaznu.kz.







TRACKER COV | KZ

Priority direction: Information, communication, and space technologies.

Aim of the project: development of a mobile application that allows you to undergo mobile diagnostics of your health status by passing a survey for symptoms responsible for COVID-19 diseases, which makes it possible to undergo daily registration of your symptoms and a quick response if you suspect COVID-19.

Know-how: this mobile application helps to track COVID-19 symptoms in the form of daily records for the purpose of early warning of seeking medical help, as well as the ability to automatically call an ambulance.

Relevance and novelty: in the context of a global pandemic, it is relevant to use mobile applications in the Kazakh language to track symptoms for suspected COVID-19, the diagnosis recommendation algorithm is based on the Kazakh RVI protocol.

Practical significance: using this application, you can go through a dynamic survey system, and based on the results of the questionnaire, you can get recommendations and see the results tracker, in order to quickly respond to suspected COVID-19.

Expected results: using this application, you can:

– take a symptom questionnaire;

– get recommendations on the outcome of the survey, such as:

– seek medical help at the clinic at the place of attachment, on suspicion of a diagnosis of COVID19;

– urgently call an emergency ambulance;

– self-isolate for 14 days and undergo a PCR test for COVID19;

– see the results tracker;

– download a detailed symptom report in PDF format;

– track statistics on the COVID-19 situation in Kazakhstan.

Object of implementation: platform for mobile applications available in Kazakhstan (Play Market).

Prospects for implementation: popularization of the mobile application for download.

Consumers: all citizens of Kazakhstan who have access to the application.

Competitiveness (Advantages of technology) and commercialization of the project: The Tracker COV KZ Android application is aimed at teaching users how to monitor their health and seek medical help when symptoms of coronavirus infection appear. The application does not pretend to be a method for determining the exact disease and does not give a medical opinion, but only gives recommendations on the need to seek medical help.

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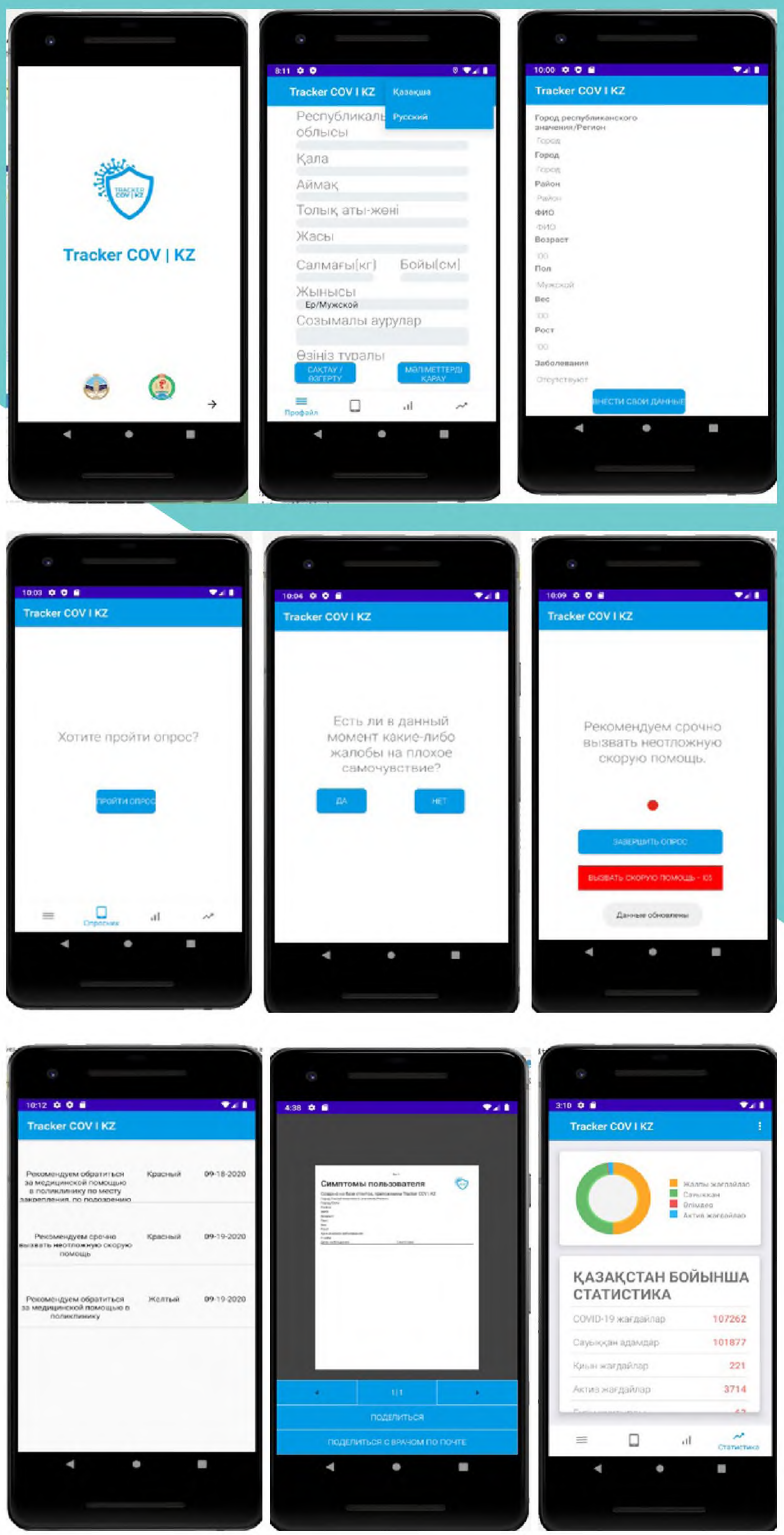
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ВНЕСТИ СВОИ ДАННЫЕ
Хотите пройти опрос?
ПРОЙТИ ОПРОС
Опросник
Есть ли в данный момент какие-либо жалобы на плохое самочувствие?
ДА
НЕТ
Рекомендуем срочно вызвать неотложную скорую помощь.
ЗАВЕРШИТЬ ОПРОС
ВЫЗВАТЬ СКОРУЮ ПОМОЩЬ - 03
Данные обновлены
Рекомендуем обратиться за медицинской помощью в поликлинику по месту закрепления, по подозрению
Красный
09-18-2020
Рекомендуем срочно вызвать неотложную скорую помощь
Красный
09-19-2020
Рекомендуем обратиться за медицинской помощью в поликлинику
Желтый
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Симптомы пользователя
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ПОДЕЛИТЬСЯ
ПОДЕЛИТЬСЯ С ВРАЧОМ ПО ПОЧТЕ
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Сауыққан адамдар
101877
Қиын жағдайлар
221
Статистика

JINALYS ROOM – KAZAKHSTAN ONLINE VIDEO CONFERENCE SYSTEM

Priority direction: Information, communication, and space technologies.

Aim of the project: development of a national online video conferencing system (video call, chat, shared screen) as an online communication platform providing interactive interaction between two or more remote users, with the ability to exchange video and audio information in real time, the functions of a recording storage system, messaging, and with support for various API services for integration with corporate information systems.

Know-how: the information system "Jinalys Room" has been developed, which allows to be integrated with various LMS systems to form a single digital ecosystem of the educational process.

Relevance and novelty: in the light of the situation with the COVID-19 pandemic, it became necessary for the videoconferencing system services, since in the current situation we see that not a single educational process automation system had a videoconferencing system module.

Practical significance: the practical significance of the project lies in the design and development of a module of our own development of localization of video conferencing into the Kazakh language; video session data handler; API service for integration with the Kazakh LMS system "Univer 2.0"; a module for managing the profile of an authorized user in the corporate information system; a web conference planner integrated with the schedule of students' classes; user activity analytics service; distributed infrastructure of the system on the servers of the KazNU Data Processing Center, which allows you to distribute the call to the web conference, thereby ensuring the optimization of Internet traffic.

Expected results:

– national online videoconferencing system in the Kazakh language, integrated into an automated educational process control system;

– distributed infrastructure of videoconferencing for the effective organization of online training in order to optimize Internet traffic through localization in Kazakhstan;

– conducting online meetings and video conferences without a limit on the number of connections, with the ability to exchange messages during the session;

– service model of technical support of the developed system, on the example of use in the educational process of Al-Farabi KazNU.

Object of implementation: videoconference system.

Prospects for implementation: mass implementation of the IS "Jinalys Room" in the educational process of educational organizations, as one of the main components of the digital learning ecosystem.

Consumers: educational institutions, government agencies, business organizations, etc.

Competitiveness (Advantages of technology) and commercialization of the project: distributed infrastructure of the IS "Jinalys Room" based on an open source solution, deployed on Kazakhstani servers, has the advantage of ensuring the efficiency of data transfer and the quality of the video session, as well as inte-

gration with the educational process management system, thereby forming a single digital ecosystem of the educational process.

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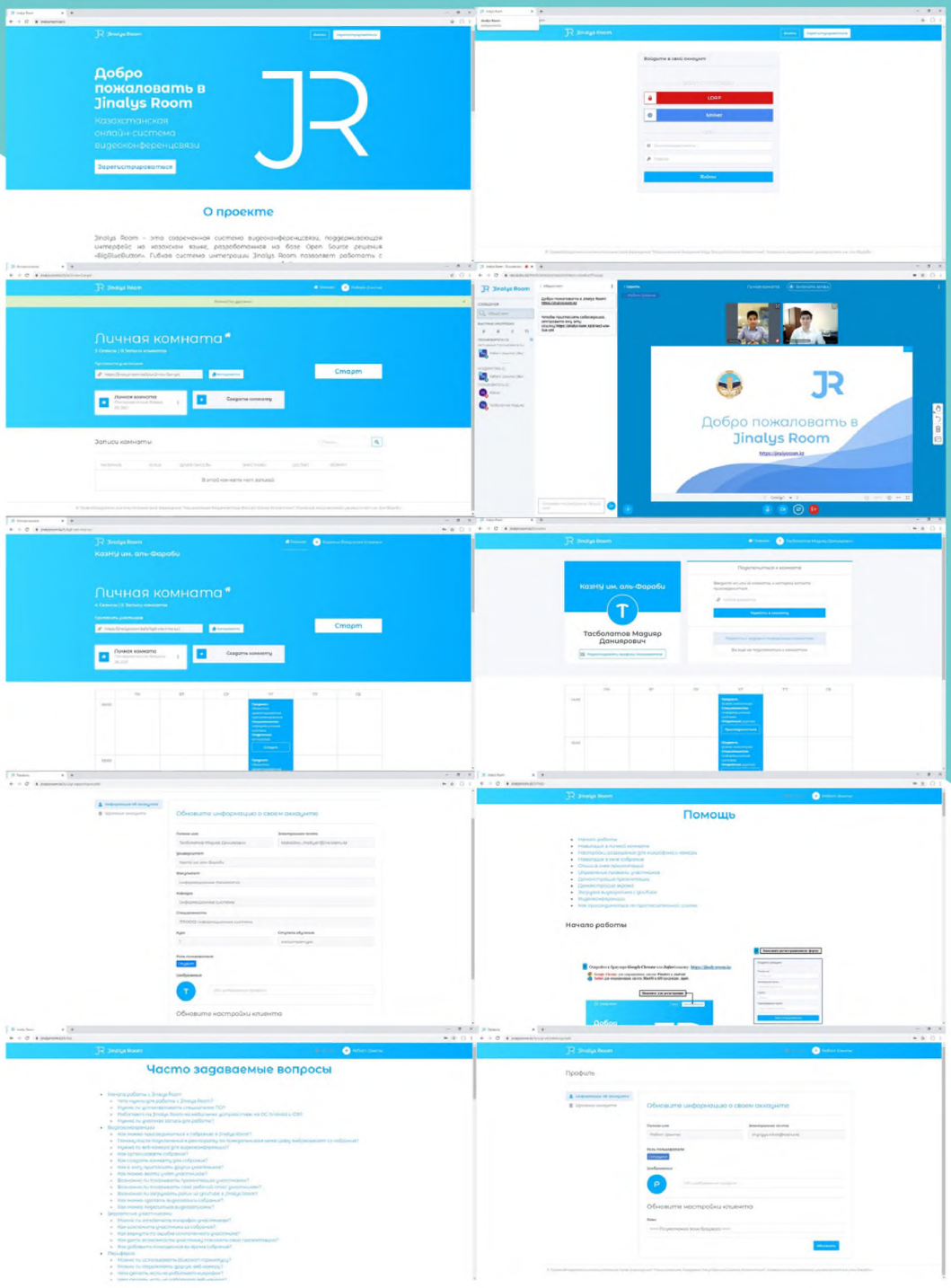

OMSYSTEM – INFORMATION SYSTEM FOR MONITORING OPINIONS

Priority direction: Information, communication, and space technologies.

Aim of the project: providing a service for monitoring social networks and content analysis of the Internet space for in-depth analysis of unstructured information using artificial intelligence technologies.

Know-how: OMSystem is the first domestic information system for monitoring opinions, which allows you to monitor web resources and social networks with a subsystem for modeling social well-being of society, by assessing the sentiment of messages/opinions, and supports the tonal dictionary of the Kazakh language, built using machine learning algorithms.

Relevance and novelty: As a result of the development of social networks, the media, blogs, web resources, there is a need for a tool for determining the assessment of the emotional color of the sentiment of texts, messages, the possibility of conducting a reputation audit in real time, identifying reputational and information threats, criticism, negativity, disinformation. In this regard, monitoring of social media, content analysis, mood analysis, assessment of the social well-being of society are relevant.

Practical significance: of the OMSystem lies in:

– automation of routine operations of information space monitoring, such as search, processing of a large amount of information;

– tracking brand mentions;

– operational monitoring of social networks on a hot topic;

– analysis of opinions of user perception of events in society;

– identifying sources of negativity and heated discussions;

– tracking the dynamics of user engagement in the topic;

– assessment of the level of social well-being in society.

Expected results:

– daily monitoring of the information space and social networks;

– analysis of mentions of a brand, events, activities;

– in-depth and overview social media analytics on the topic;

– analysis of mood and assessment of social well-being of society;

– quick access to monitoring results (type of SaaS system);

– automatic delivery of a report to e-mail for a specified period of time;

– calculation of social well-being of society (based on 8 socio-economic indicators);

– search for valuable insights.

Object of implementation: opinion monitoring system.

Prospects for implementation: This project will allow to develop a new direction of the market of software solutions - the development of an information system for monitoring opinions and social networks for processing and analyzing text data using artificial intelligence technologies, in order to obtain information on assessing user perception of content and assessing the social well-being of society.

Consumers: government bodies, government agencies, business organizations, experts.

Competitiveness (Advantages of technology) and commercialization of the project: foreign software solutions (Hootsuite, Socialmention, BuzzLook, IQBuzz, Socialbakers, Keyhole, Brandwatch, YouScan, etc.) allow using social networks to solve a wide range of business tasks: combating fraud, brand management, advertising goods and services, creating new distribution channels, and etc. The developed information system OMSystem will allow not only monitoring social networks and Internet resources, but also using the module for modeling social well-being and analytical reports to identify the reasons for user opinion and using the linguistic constructor module to train the system for more accurate results.

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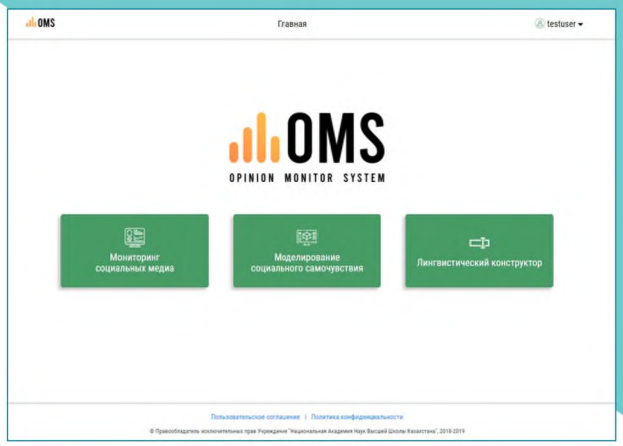

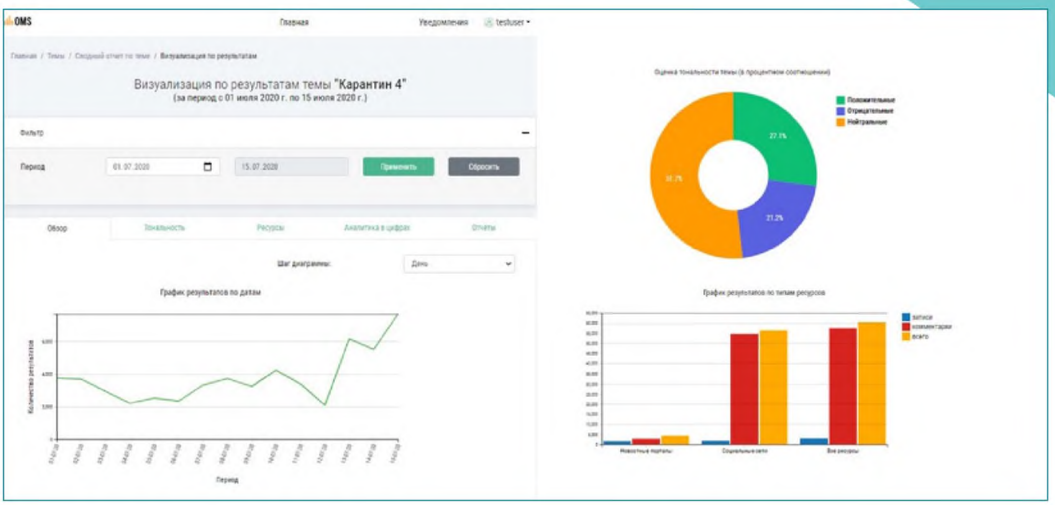

IMAGE RECOGNITION MACHINE VISION

Priority direction: Information, communication and space technologies.

Aim of the project: Real-time face recognition in low light, different angles and with recognition accuracy (above 90%).

Know-how: System helps to identify the object under investigation in a matter of seconds with great accuracy.

Relevance and novelty: The results of research work are relevant in automated systems for the classification and processing of big data, and in robotics.

Practical significance: In megalopolises and strategic facilities require robotic monitoring systems for moving and stationary objects, as well as warning systems and early response to certain unauthorized actions of objects.

Expected results: Application of robotic systems for monitoring and analyzing large video data in real time in future SMART cities of Kazakhstan.

Object of implementation: System pattern recognition.

Prospects for implementation: Expanding and strengthening ties with research, production, commercial and other institutions and organizations.

Consumers: government agencies to reduce the administrative burden of law enforcement. Internal affairs bodies for the introduction of digital technologies in the field of public safety and digitalization of activities. Places of mass congestion (airports, train stations, metro, etc.) to ensure public safety, due to the growing threat from criminal and extremist organizations. Urban infrastructure (security, law and order, monitoring of protected areas, objects, etc.). Educational institutions (higher education, college, school, etc.) and educational centers.

Competitiveness (Advantages of technology) and commercialization of the project: The main advantages of our technology are: Use of a new generation neural network (the neural network is resistant to noise); Real-time face recognition; Face recognition in low light, from different angles, etc.; Recognition accuracy (above 90%); Does not require physical contact with the device; Contrast and image quality; API (Application Programming Interface) / SDK (Software Development Kit) available for partners and external systems.

Investment amount – 10,0 mln tenge (22 776$).

Availability of documents of title:

– Copyright Certificate No. 1464. “Farabi Vision”.

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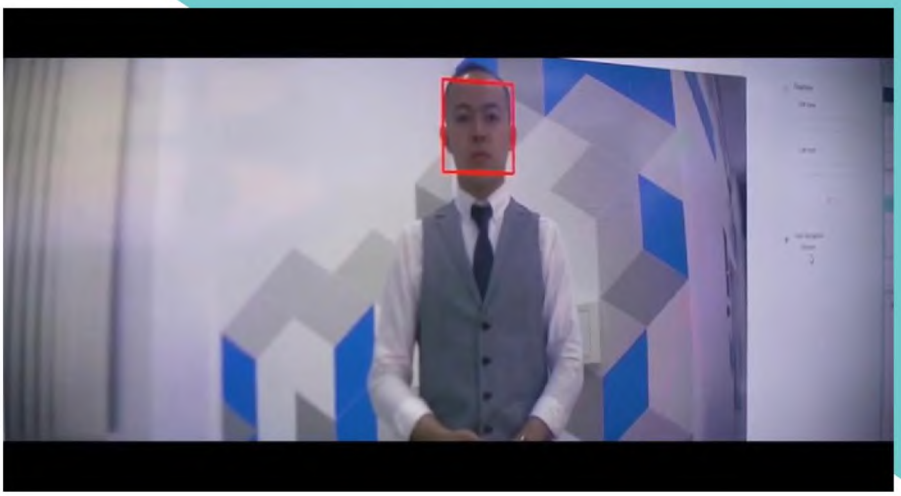

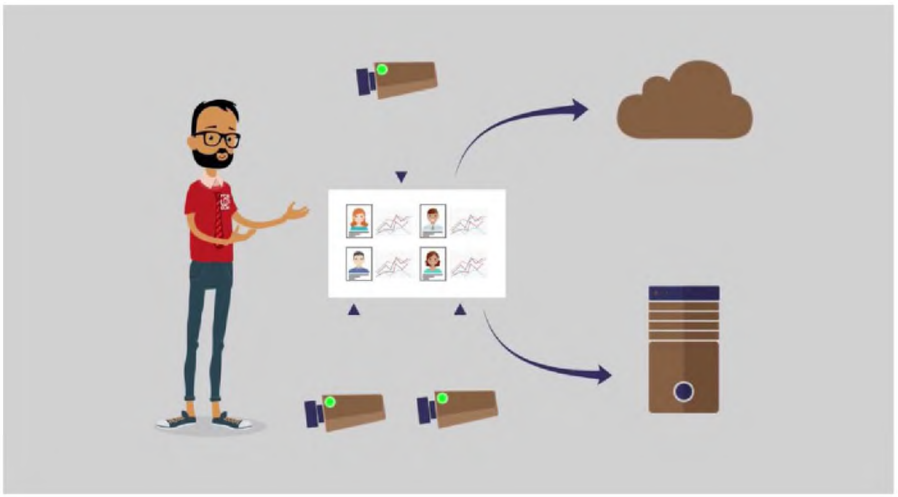

DATA ENCRYPTION DEVICE

Priority direction: Information technologies.

Aim of the project: development of an encryption device based on programmable logic integrated circuits.

Know-how: One of the significant advantages of hardware encryption (compared to software) in information and communication technologies is high performance. In addition, the hardware implementation of the cryptoalgorithm ensures its integrity, and encryption and key generation is implemented in the encryption board itself, and not in the computer memory. The second important advantage is that the application of the algorithm itself is protected. These advantages of hardware encryption have led to interest in the hardware implementation of cryptosystems.

As modern security protocols become more algorithm independent, a high degree of flexibility with respect to cryptographic algorithms is desirable. A promising solution that combines high flexibility with the speed and physical security of traditional equipment is the implementation of cryptographic algorithms on reconfigurable devices such as programmable logic integrated circuits. In this work, an encryption device is developed using PLIC.

Relevance and novelty: with the development and complication of means, methods and forms of automation of the processes of collecting, storing and processing information, their vulnerability increases. The relevance of research in this area is characterized by the provision of confidentiality and information protection.

Various algorithms and methods of data encryption are known to protect information. In the RSE "Institute of Information and Computing Technologies" KN MES RK researched and developed an encryption algorithm and electronic digital signature. The essence of these studies is that new block symmetric encryption algorithms using modular number systems have been developed, analyzed and software implemented. The work is aimed at the development of the development of domestic information security systems and the creation of software and hardware systems for the purpose of their practical use.

Practical significance: the results of this work can be used in the development of a built-in encryption unit for modern personal computers.

Expected results: developed and tested an encryption device using PLIC. In the process of implementing this device, methods of multi-threaded parallel computation were applied with the formation of information modules based on a random number generator. This encryption method not only speeds up the whole process, but also increases the cryptographic strength of the ciphertext.

The developed PLIC-based encryption device for high-speed data encryption can be built into personal computers, and with the hardware implementation of the block of a set of irreducible polynomials, as well as the generation of keys and implementations of the encryption block with a pipelined organization, autonomous high-performance encryption devices can be built on their basis.

Object of implementation: PLIC-based encryption device.

Prospects for implementation: PLIC-based encryption device for high-speed data encryption can be built into personal computers.

Consumers: autonomous communication systems.

Competitiveness (Advantages of technology) and commercialization of the project: data encryption accuracy up to 99.99%.

Investment amount – 10,0 mln tenge (22 776$).

Availability of documents of title:

– Patent of the Republic of Kazakhstan for invention No. 34691 "Conveyor multiplier of polynomials modulo irreducible polynomials".

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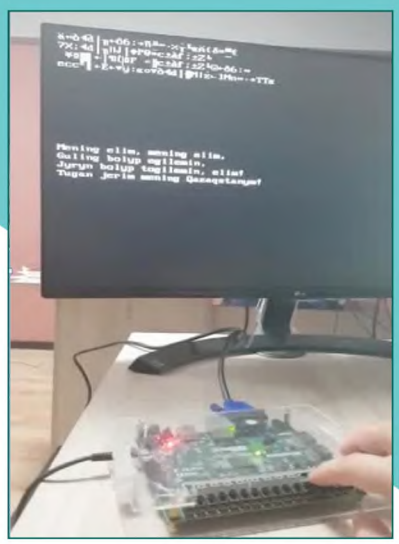

Figure 1. Operation of the hardware and software cryptosystem

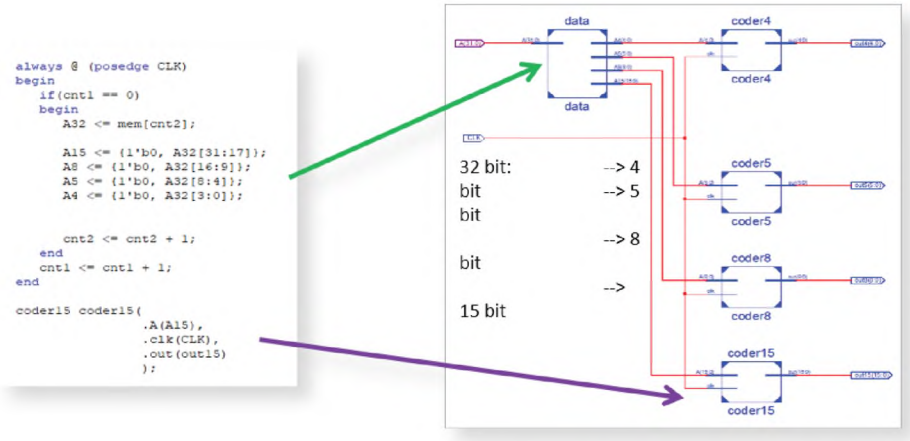

Figure 2. Hardware implementation of the encryption and decryption algorithm based on PLIC of Xilinx of the Artix 7 family

CAR CATEGORIES CLASSIFICATION BASED ON DEEP LEARNING NEURAL NETWORKS

Priority direction: Information, communication and space technologies.

Aim of the project: to develop a hardware device to classify categories of cars using an artificial neural network.

Know-how: a human brain contains trillions of special cells called neurons. They connect to hundreds of trillions of nerve fibers called synapses. The large network of neurons formed in this way is responsible for all the phenomena called thoughts and emotions, as well as for the whole variety of sensorimotor functions. The use of neural networks is widespread in Western countries. Today, many problems in the world are solved with the help of artificial intelligence. One of them is the classification of various items. In this work, the classification of car types into four categories is carried out using an artificial neural network. Vehicle classification is very important for analyzing the behavior of vehicles in an intelligent transportation system.

Relevance and novelty: in the last decade, the spectrum of artificial neural networks in the world has been rapidly developing. The relevance of research in this area is characterized by the use of many different neural networks. These include image recognition, object detection, function approximation, adaptive control, prediction, expert systems, associative memory, and many other applications. Classification of objects in an image into categories is also one of the applications of artificial neural networks. Vehicle classification is very important for analyzing the behavior of vehicles in an intelligent transportation system. This study examines neural network architectures for vehicle type determination.

Practical significance: the results and studies obtained can be used in intercity statistics systems (for example, control of the entry and exit of vehicles from the city, depending on the type of vehicle).

Expected results: the neural network architectures created for image classification are fully analyzed. Methods of training a neural network model based on a recognized neural network architecture are considered. The required programming language for the software section was selected and its characteristics were considered. A neural network model for the classification of car images has been implemented. For this, a collection of car images was created and the best quality images analyzed. The programming code for training the model was developed in the Python programming language. After studying the network model, a classification was carried out according to the type of vehicle. The classification accuracy ranged from 90 to 99.99%.

Object of implementation: video surveillance devices with artificial intelligence software.

Prospects for implementation: integration with I/O routes in large cities or with Sergek systems.

Consumers: city traffic safety services.

Competitiveness (Advantages of technology) and commercialization of the project: detection accuracy increased from 90% to 99.99%.

Investment amount – 1,0 mln tenge (22 77,6$).

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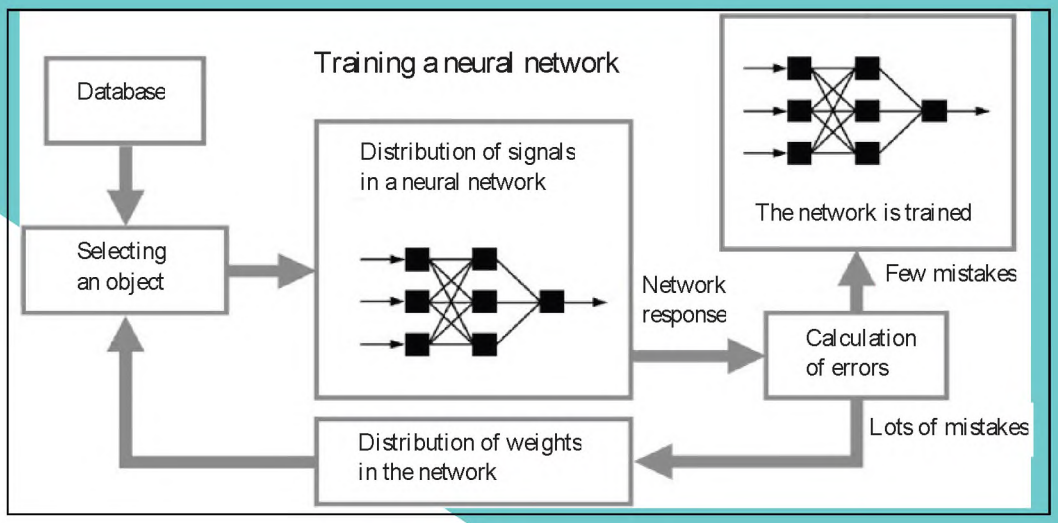

Figure 1. Neural network learning process

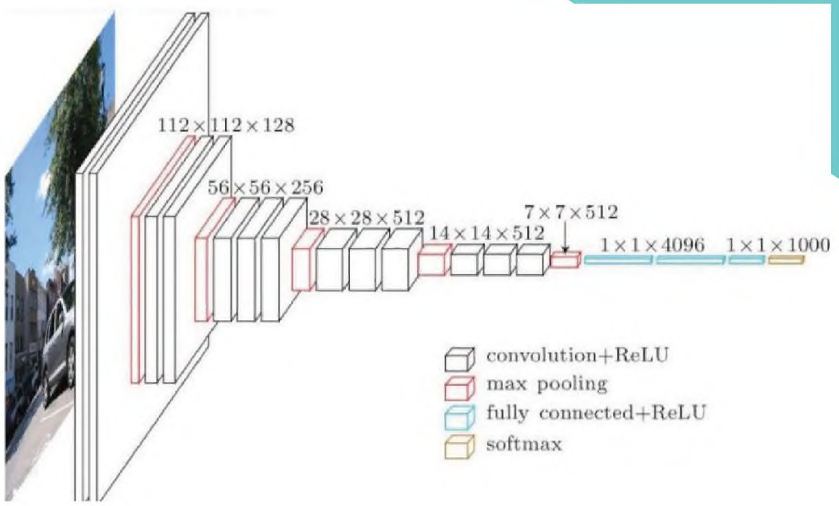

Figure 2. VGGNet neural network architecture

«QUATPOINT» CHARGING SYSTEM

Priority direction: Energy and mechanical engineering.

Aim of the project: development of technology for the production of charging stations for electric vehicles.

Know-how: a charging station controller with an adaptive charging mode has been developed, which allows you to slowly increase the charging current and monitor the network voltage. The controller program and circuit are completely developed by our specialists.

Relevance and novelty: there are about 300 electric vehicles in Kazakhstan today, and this number will only grow. The development of electromobile transport goes hand in hand with the development of a network of charging stations. To solve this problem, for the first time in the Republic of Kazakhstan, a technology for the production of mode 2, mode 3 charging stations has been developed.

Practical significance: already today, dozens of electric vehicles are charged from our charging stations in the Republic of Kazakhstan.

Expected results: in the near future, it is planned to establish mass production of charging stations to meet the growing demand in the Kazakhstan market.

Object of implementation: charging stations in Almaty (for owners of electric vehicles: nissan leaf, kia soul ev, jaguar i-pace), in Nur-Sultan (for owners of electric vehicles: Tesla model 3, model x, Hunday Ioniq, BMW i3), in Aktau (for owners of electric jac ev6).

Prospects for implementation: his technology can be scaled across cities, which will allow each city to have its own production facility for charging stations.

Consumers: The potential market for products can be divided into two categories: legal entities (B2B) and individuals (B2C).

B2B. This market segment can cover: residential complexes (KSK, private parking lots), development companies (design organizations, construction companies), legal entities with an electric car park, dealer companies.

B2C. The main advantage of this sector is that the profit from each product is greater due to retail sales and the ability to establish a direct connection with the consumer.

Competitiveness (Advantages of technology) and commercialization of the project: Our technology for the production of charging stations will allow us to compete with foreign products in terms of price category, since our products are at least 2 times cheaper than their foreign counterparts at a price. This technology has been commercialized, there is a legal entity, a trademark has been received, a patent for an invention, our products have been tested and have a safety certificate TR CU 004/2011 "On the safety of low-voltage equipment".

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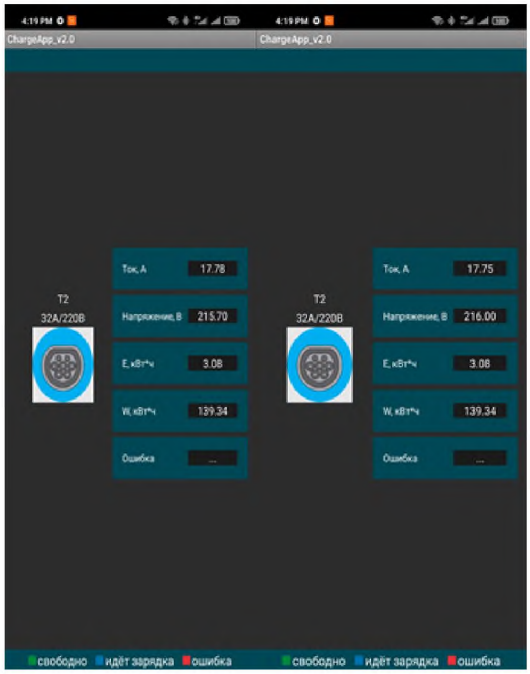
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QHAT POINT

INSULATED CONTAINER MOBILE HYBRID POWER PLANT

Priority direction: Energy and mechanical engineering.

Aim of the project: creation and production of a mobile power plant with a hybrid energy generation and storage system.

Know-how: The technological line of obtaining carbon nanomaterials is launched, equipped with CVD installations for the preparation of graphene-like materials and fullerene synthesis reactors that have no analogues in the Republic of Kazakhstan.

Relevance and novelty: the mobile power plant is designed for the rapid deployment of uninterruptible power supply 220V or 380V (depending on the configuration) of consumers with a capacity of 3 kW and more.

The hybrid power generation and storage system allows the load to be powered by solar and wind energy on a continuous basis. In the event of a prolonged absence of solar and wind energy, power is supplied in an economical mode from a 6 kW reserve gasoline generator.

Competitiveness (Advantages of technology) and commercialization of the project:

– the weight of the equipped container, depending on the configuration, can be from 1.5 tons and more. To be transported to the place of operation by truck;

– the system is completely ready for operation, does not require any additional work. Solar panels and wind turbine are mounted on a container and folded for transportation;

– the power plant can be operated in an open area, protected from atmospheric precipitation.

Principle of operation: MAC inverter generates 220 V (or 380 V, depending on the configuration) from the energy stored in the battery. At the same time, in the daytime, the batteries are fed by the KES solar controller from solar panels. If there is not enough energy and the voltage on the battery drops to the specified lower value, MAC will give a command to start the electric generator. At the same time, when the container heats up to the set temperature, the automatics will open the shutters and turn on the exhaust fan.

Characteristics:

– Generated power, kW*h/day – 10;
– Rated power, kW – 2;
– Maximum power kW – 3;
– Peak power, kVA – 3.8;
– Solar panels power, kW – 2;
– Battery capacity, A*hour – 300 Ah*24 V;
– Operating temperature range – from -25 to +55 °C.

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SEASONAL ACCUMULATION OF SOLAR THERMAL ENERGY

Priority direction: Energy and mechanical engineering.

Aim of the project: development of a technology for seasonal accumulation of solar thermal energy (SSTE) for heating and hot water supply to the veins of houses and districts.

Know-how: The technology being developed is intended for heating and hot water supply of large rooms and buildings based on a geothermal heat accumulator (GTA) and for a short-term accumulator (KVA) using high-density energy storage materials (MSE-HD). The process of accumulation and storage in underground borehole heat exchangers of a heated coolant by means of solar energy takes place regardless of seasonal fluctuations in sunlight.

Relevance and novelty: the ecological situation in large and industrial cities of Kazakhstan shows the need to develop programs at city and republican levels to reduce emissions into the atmosphere, and thereby, increase the level of use of "clean" energy. The novelty of the research lies in the use of a high-density energy storage material (MCE-HP) to improve the efficiency of the system.

Practical significance: the developed technology allows accumulating solar heat in the summer for use in the heating season, as well as accumulating daily solar thermal energy for hot water supply.

Expected results: as a result of the project, a technology has been developed for accumulating solar thermal energy for heating and hot water supply of large-scale buildings and residential areas. The proposed technology can be combined with an existing heating system.

Object of implementation: solar thermal energy storage technology.

Consumers: residential areas, industrial facilities, greenhouse complexes, mosques and other consumers of thermal energy.

Competitiveness (Advantages of technology) and commercialization of the project: Today, in Kazakhstan, prices for energy from alternative sources compete poorly with prices for energy obtained by traditional methods.

The lack of experience in the widespread use of technologies for obtaining and using energy from renewable sources and the relatively high cost of such technologies raises doubts among potential customers.

However, the existing environmental problems indicate an urgent need to reduce emissions into the atmosphere by switching to alternative energy sources.

At the same time, the state actively supports the development of renewable energy sources in Kazakhstan and is considering various methods to accelerate the introduction of renewable energy sources in the country's energy sector. In June 2020, an agreement was signed on the development of a program of incentives and assistance in the development of renewable energy projects, signed by Damu Entrepreneurship Development Fund JSC and the United Nations Development Program (UNDP), which will give a new impetus to the use of renewable energy projects.

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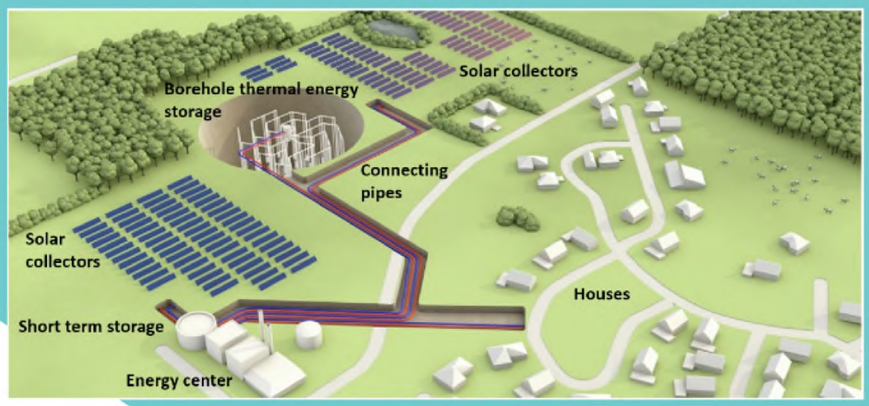

Figure 1. Schematic model of the technology for seasonal accumulation of solar thermal energy

Figure 2. Construction of a ground heat accumulator

Figure 3. Solar collector system for collecting solar thermal energy

Figure 4. Integration of a short-term battery with SASTE technology

DISPOSAL OF OFF-SPEC BROWN COAL OF THE REPUBLIC OF KAZAKHSTAN WITH RECEIVING OF FUEL BRIQUETTE

Priority direction: extraction and processing of mineral and hydrocarbon raw materials, new materials, technology, safe products and structures.

Aim of the project: to develop an environmentally safe technology for processing off-spec brown coal with receiving a high-calorie fuel briquette.

Know-how: the difference between the project idea and existing analogues lies in the uniqueness and diversity of the most useful mineral deposit – brown coal of the Republic of Kazakhstan. The technology being developed, the optimal technological parameters, the charge composition, the concentration of binding reagents are determined by the chemical composition, physical and mechanical properties of the coals.

Relevance and novelty: The total coal reserves stands at 170 billion tons and the explored ones come to 60 billion tons in Kazakhstan. 12.1 billion tons of them is brown coals. 30-40% is becoming the unclaimed coal fines, which are stored in dumps, negatively affecting the environment.

The novelty of the proposed object technology is that the issues of production cost reduction, simplification of the method of obtaining briquettes, waste disposal are solved, and at the same time the quality and technical characteristics of the briquette do not get worse. In addition, one of the advantages of the proposed Project is the use of an easily accessible and cheap material selected from domestic waste products that do not require additional mixing preparation operations, and the physico-chemical and mechanical properties of which predetermine a positive effect on the quality of briquettes - their strength.

Our technology solves the problem of disposal of brown coal waste from coal mining enterprises; obtaining fuel briquettes from a coal mine with improved consumer qualities; improving the environmental situation of the region; increasing the assortment of let out production of the section; additional income; import substitution; competitiveness.

Practical significance: Kazakhstan has a huge fuels and minerals base of stone and brown coals, which creates good preconditions for the development of coal processing industries. The formation of fine breeze during the extraction of brown coal causes the search for new ways to effectively use coal fines and waste from other industries. The technology and equipment offered by us solve the issues of disposal not only coal slacks, but also to produce a coal product with new consumer properties.

Expected results: utilization of off-spec brown coal will allow for obtain products that will be necessary in the domestic sectors, the agro-industrial sector and metallurgical enterprises.

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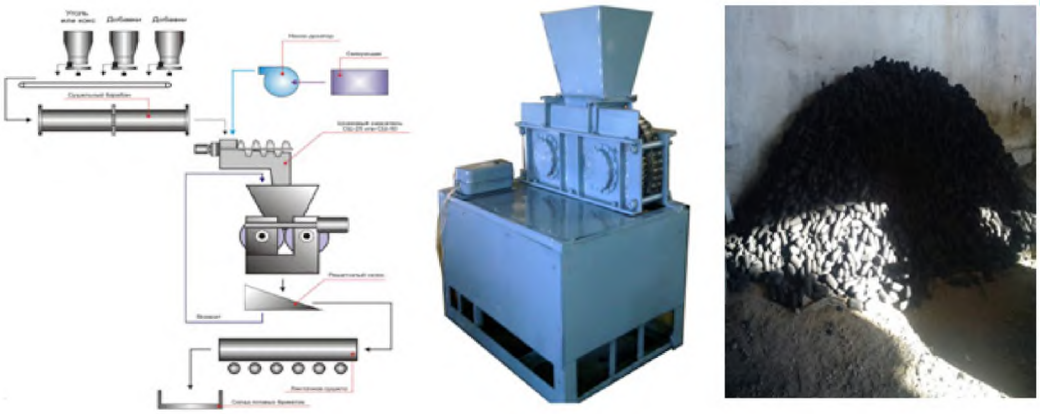
Appearance of briquettes

Burning of briquettes from Oi-Karagai coals with binding polyethylene terephthalate



Installation for briquetting of coal fines

PLASMA-CHEMICAL PROCESSING OF CARBON-CONTAINING WASTE

Priority direction: Energy and mechanical engineering.

Aim of the project: development and implementation of a technology for plasma-chemical processing of solid carbon-containing waste, including household, medico-biological and agricultural waste to increase the environmental and economic efficiency of waste disposal.

Know-how: use of electric arc plasmatrons for processing carbon-containing waste in a plasma-chemical reactor.

Relevance and novelty: relevance is due to the need to utilize the ever-increasing generation of carbon-containing waste in housing and communal services and basic industries in Kazakhstan.

The novelty of the plasma technology for processing carbon-containing wastes lies in the complete conversion of the carbon contained in them into carbon monoxide and the possibility of neutralizing any toxic substances. The technology consists in the thermochemical decomposition of the organic part of the waste to an atomic state, and their inorganic component is converted into a melt and vitrified. Waste decomposes under the influence of the plasma flow from the plasma torch. The average mass temperature of the plasma flow is 3000–6000 K. Plasma waste processing ensures reliable destruction of toxic dioxins, benzo (a) pyrene and furans.

Also new is an electric arc plasmatron with an unlimited service life of electrodes protected by a renewable nanocarbon coating.

Practical significance and expected results: according to the Ministry of Energy of the Republic of Kazakhstan, the country has accumulated more than 27 billion tons of waste, of which 97 million tons are household waste. The technology of plasma-chemical processing of waste will make it possible to dispose of waste without damaging the environment with the simultaneous generation of heat and electric energy from it.

Object of implementation: enterprises of housing and communal services, hospitals, veterinary clinics, pharmaceutical enterprises and enterprises of the agro-technical complex and woodworking in Kazakhstan.

Prospects for implementation: The prospects for the introduction of plasma technology for waste processing are determined by the large amount of generated and accumulated waste. In total, by 2030, Kazakhstan plans to increase the share of waste recycling from 2 to 40%.

Consumers: enterprises of housing and communal services and agriculture, pharmaceutical and biomedical industries.

Competitiveness (Advantages of technology) and commercialization of the project: The advantage of the plasma technology for processing carbon-containing wastes from traditional firing methods is the high temperature level in the plasma reactor, which provides an almost complete conversion of the carbon contained in them into carbon monoxide and allows you to decompose any toxic substances. The synthesis gas formed as a result of gasification consists mainly of hydrogen (35-45%) and CO (25-35%). This makes it possible to use it as a working

medium for gas turbines, gas-piston generating sets and waste heat boilers for generating electrical and thermal energy.

Availability of documents of title:

– Patent of the Russian Federation for invention No. 2541349 "High-resource electric arc generator of low-temperature plasma with protective nanostructured carbon coating of electrodes";

– Patent of the Republic of Kazakhstan for invention No. 23797 "High-resource plasmatron and a method for producing nanostructured carbon black";

– Patent of the Republic of Kazakhstan for invention No. 34093 "Method for plasma-thermal processing of medico-biological and other wastes and a device for its implementation".

Availability of contracts, agreements with production and business:

– Based on the results of EXPO-2017, an agreement was signed with National Generation LLC on long-term cooperation on the introduction of a plasma-chemical method for the disposal of carbon-containing waste.

Contact details: ust@physics.kz

Plasma-chemical reactor with an operating electric arc plasmatron

PLASMA-FUEL SYSTEMS FOR INCREASING THE PERFORMANCE OF THERMAL POWER PLANTS AND DUST BOILERS

Priority direction: Energy and mechanical engineering.

Aim of the project: development and development of PFS technology to improve the environmental and economic indicators of TPPs and pulverized coal boilers. The technology consists in plasma ignition of coal using a plasma torch installed on a pulverized coal burner.

Know-how: plasma ignition of coal provides replacement of expensive fuel oil when firing up boilers and stabilization of the combustion of a pulverized coal torch with cheap steam coal. The technology makes it possible to obtain highly reactive fuel from any coal, consisting of combustible gas and coke residue. The use of electric arc plasmatrons to increase the environmental and energy efficiency of the ignition of solid fuels at thermal power plants.

Relevance and novelty: The relevance of the plasma technology for the ignition of solid fuels is due to the low quality of power-generating coals in Kazakhstan and the emerging shortage of heating oil in connection with the transfer of Kazakhstan's oil refineries to deep processing of oil (up to 82%).

The novelty of plasma technology lies in the use of plasma torches for ignition of solid energy fuels instead of oil nozzles and gas burners traditionally used for kindling and lighting pulverized coal boilers.

Practical significance and expected results: with the introduction of plasma technology for ignition of coal at 239 operating pulverized coal boilers in Kazakhstan, the economic effect is estimated at 65 billion tenge per year. The use of plasma technology for ignition of coal increases the environmental and economic indicators of TPPs and pulverized coal boilers (reduces mechanical unburning of fuel and reduces harmful emissions of nitrogen oxides, sulfur and vanadium pentoxide into the environment). The use of plasmatrons ensures scientific and technical progress in the further development of heat and power engineering and an improvement in the culture of workplaces at thermal power plants and boiler houses.

Object of implementation: plasma fuel systems.

Prospects for implementation: The prospects for the introduction of PFS technology to improve the environmental and economic indicators of TPPs and pulverized coal boilers are determined by the wide use of steam coal and heating oil in Kazakhstan.

Plasma technology has been tested in Russia, Kazakhstan, Ukraine, Korea, China, Slovakia, Serbia and Mongolia on 31 boilers with a steam capacity of 75 to 950 t / h. The payback period for plasma systems depends on the ratio of prices for coal and fuel oil and is within 1-3 years.

Consumers: The main consumers of plasma technology for the ignition of solid fuels are energy, metallurgy, construction and chemical industries. The use of plasma technology makes it possible to increase the environmental and economic efficiency of fuel use.

Competitiveness (Advantages of technology) and commercialization of the project: The advantage of the technology is the high level of temperatures in

the plasma reactor, which ensures almost complete conversion of the carbon contained in them into carbon monoxide and allows decomposition of any toxic substances.

Availability of documents of title:

– Patent of the Republic of Kazakhstan No. 12641 "Method for plasma ignition of pulverized coal and plasma pulverized coal burner (options)";

– Patent of the Republic of Kazakhstan No. 12023 "Method of ignition and / or stabilization of combustion of a pulverized coal flame in boilers";

– Patent of the Russian Federation No. 2054599 "Method for firing up a boiler unit";

– Patent of the Russian Federation No. 2210032 "Method for plasma ignition of pulverized coal (options) and plasma pulverized coal burner (options)";

– Patent of the Russian Federation No. 2230991 "Method of ignition and / or stabilization of combustion of a pulverized coal torch in boilers."

Availability of contracts, agreements with production and business:

In 2019, an agreement was completed on the topic "Feasibility study of the possibility of using plasma ignition of Aksu TPP boilers of JSC Eurasian Energy Corporation." The customer of the work LLP "Research Engineering Center ERG" is considering the possibility of implementing the project at the Aksu TPP. The possibility of developing a feasibility study for the project for the implementation of PTS at the boilers of TPPs in the western zone of the unified energy system of Kazakhstan (West Kazakhstan, Atyrau, Mangistau regions) is being considered.

Based on the results of EXPO-2017, a Memorandum was signed with Samruk-Energo JSC on long-term cooperation on the use of PFS for oil-free firing of boiler units, reduction of nitrogen oxide emissions and mechanical underburning of fuel.

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«ALFASAT» – CREATION OF SMALL ARTIFICIAL EARTH SATELLITES

Priority direction: Information, communication and space technologies.

Aim of the project: production and market launch of semi-natural simulation devices designed to teach schoolchildren and students the basics of development, design, assembly, testing and operation of a spacecraft with appropriate software and teaching materials.

Know-how: an innovative product, which is a set of components that visually gives the project participants a systematic understanding of the design, assembly, testing and operation of spacecraft.

Relevance and novelty:

Development. The proposed designer of a small spacecraft - nanosatellite is designed for the development of STEM technologies in educational institutions;

Skills. When working with a constructor, students develop not only Hard Skills, but also Soft Skills through studying the material in a team;

Knowledge. Working on this designer, the user gains in-depth knowledge of the design of a real spacecraft;

Feedback. The portal created within the framework of the project will support its clients in real time. It also provides for the creation of an offline center for user support;

Development of the Kazakh language. Availability of a methodological base (training material, textbook) in the Kazakh language;

Launch. Each student will be able to assemble his own nanosatellite and will be able to launch it into the stratosphere using a helium balloon.

Practical significance: When using this device, it is not required to develop separate systems of the spacecraft and delve into their detailed structure. The developed result allows us to focus on the system design of the spacecraft and quickly obtain the result – a working prototype. This approach is relevant for teaching schoolchildren and students with little or no experience in spacecraft development.

Expected results:

– production of innovative designers of small spacecraft;

– product approbation for the educational market;

– business scaling in the market of Kazakhstan and the CIS;

– the creation of a national scientific school for the development of small spacecraft starting from the school bench;

– mastering by schoolchildren and students of new space technologies.

Object of implementation: innovative designers of small spacecraft for educational institutions.

Prospects for implementation: the proposed designer of a small spacecraft - nanosatellite is intended for the development of STEM technologies in educational institutions. When working with a constructor, students develop not only Hard Skills, but also Soft Skills through learning the material in a team. Working on this designer, the user gains in-depth knowledge of the design of a real spacecraft.

Consumers:

– lyceums and gymnasiums with a physical and technical bias;

– private schools that carry out project activities;
– specialized higher educational institutions;
– Aerospace Committee of the Ministry of Digital Development, Innovations and Aerospace Industry of the Republic of Kazakhstan;
– children's technology parks and schoolchildren's palaces; children's camps and school scientific, technical and engineering Olympiads;
– summer schools for the development of nanosatellites.

Competitiveness (Advantages of technology) and commercialization of the project:

Basic set – Designer of small spacecraft (SC) AlfaSat-1 (designer, SC testing board, methodological manual in three languages).

Advanced set – Designer of a small spacecraft (SC) AlfaSat-X (designer, SC testing board, SC launching system, model of a Kazakhstani cosmonaut, ground receiving and transmitting station, methodological manual in three languages).

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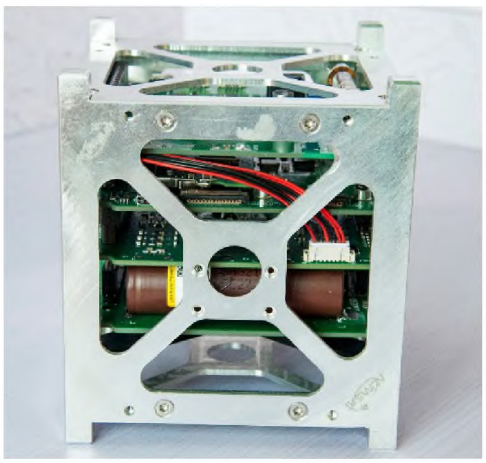

GEOINFORMATION SYSTEM BASED ON SPACE MONITORING

Priority direction: Information, communication and space technologies.

Aim of the project: creation of a unified geographic information system of railway lines of communication in the Republic of Kazakhstan.

Relevance and novelty: the results of the research within the framework of this Project will allow in the future to integrate the programs for calculating railway lines of communication into the functionality of the GIS interface at railway stations. Currently, there is no full-fledged vector digital map of railway communications.

Practical significance: the following will be developed: 1) An electronic map of railways, updated on the basis of Earth remote sensing data; 2) Attributive database of indicators of railway communications; 3) Interface for access via the Internet to the geospatial database of the state of the congestion of railway trains; 4) Models of analysis of the state of the RK railway communications congestion depending on the season, short-term changes and their software implementation in the geographic information system; 5) Interface for displaying the results of the functional analysis of the railway load.

Expected results: the technology of remote control over the movement of railway transport through the "cloud" Internet access will be developed.

Object of implementation: 1) Electronic map of railway lines, updated on the basis of Earth remote sensing data; 2) Attributive database of indicators of railway communications; 3) Interface for access via the Internet to the geospatial database of the state of railway lines; 4) Models of analysis of the state of the RK railway communications congestion depending on the season, short-term changes and their software implementation in the geographic information system; 5) The interface for displaying the results of the functional analysis of the railway load; 6) Longitudinal profiles of the railroad bed.

Prospects for implementation: a geographic information system of railway lines of communication of a given section will allow:

– introduction of energy-saving technologies during transportation;

– automation of collection, storage and access to data;

– provision of information on engine resources, condition of technical devices, last overhaul for making decisions on timely maintenance;

– creation of a reusable database;

– improved management of the rail transport system;

– increase profit from railway transportation by optimizing costs, long-term planning of transportation with regular customers, and reducing maintenance costs.

Consumers: Subsidiaries of NC "Kazakhstan Temirzholy". Enterprises for the design, repair and maintenance of railway tracks.

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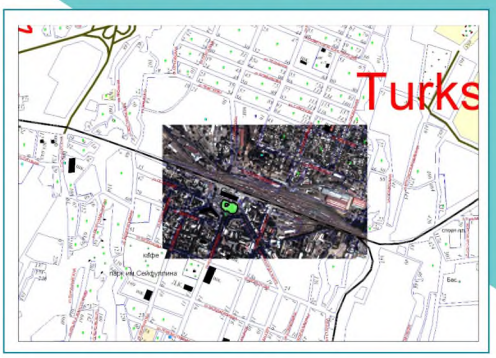
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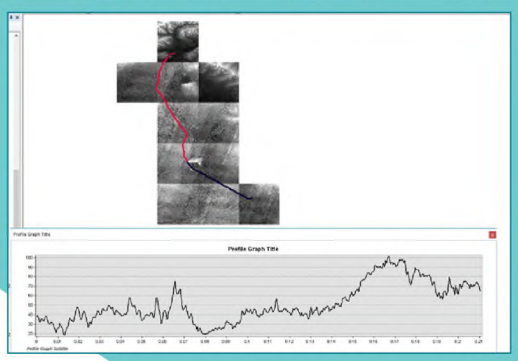

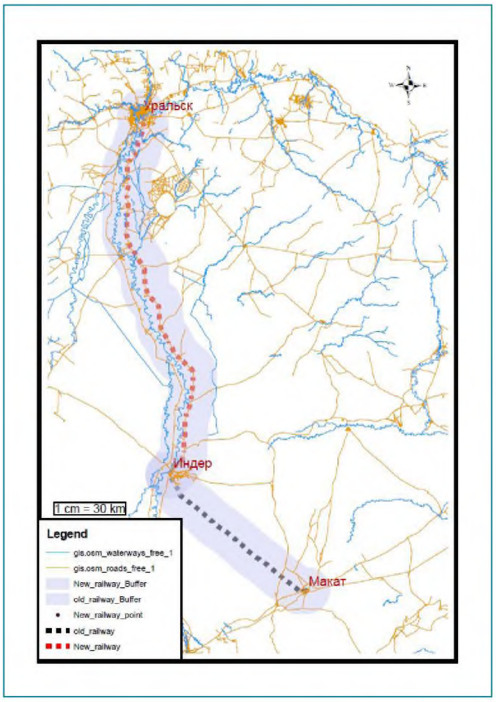
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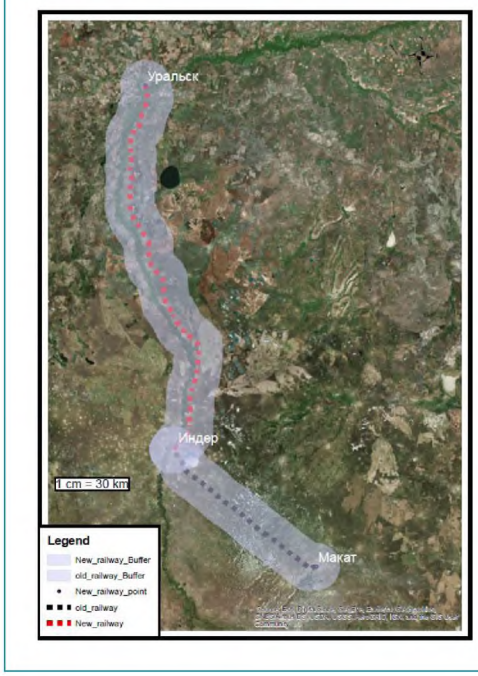
Уральск
Индер
Макат
1 cm = 30 km
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old_railway
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DEVELOPMENT OF METHODS FOR AUTOMATIC EXTRACTION OF GEOSPATIAL OBJECTS FROM HETEROGENEOUS SOURCES FOR INFORMATION SUPPLY OF GEOINFORMATION SYSTEMS

Priority direction: Information, communication and space technologies.

Aim of the project: development of methods for the automatic extraction of geospatial objects and associated nonspatial attributes from heterogeneous open data sources, namely from textual web tables.

Know-how: the essence-based approach to information extraction, which is dominant in modern research, has serious limitations, and an attribute-based approach to geospatial data extraction will be used for this project.

Relevance and novelty: while standardized data format and data access protocols such as Web Feature Service (WFS) may allow end users to access heterogeneous data stored in different formats from different sources, it is still time consuming and inefficient from -for lack of semantics. Therefore, for this project, one of the main tasks is also the implementation of the required parallel algorithms for processing unstructured data. It is planned to set up a cluster complex consisting of 10 or more computers for this task. The novelty of this project lies in the use of an attribute-based approach to the extraction of geospatial data.

Practical significance: the results of the project can be applied in the field of high-performance distributed computing, as well as intelligent decision support systems.

Expected results:

– development of intelligent methods for extracting data from textual tables;

– development of methods and technologies for automatic extraction of geospatial objects from heterogeneous sources for information support of geographic information systems;

– development of methods for semantic interpretation of geodata;

– development of web services for parsing and extracting geospatial information that will be available to potential users, the scientific community and the general public;

– development of technology for automatic extraction of geo-information from textual tables on the Web.

Object of implementation: prototyping a software product based on the developed technology and creating web services for parsing and extracting geospatial information from websites in the domains “Tourism”, “Emergencies”.

Prospects for implementation: web services for parsing and extracting geospatial information will be developed and made available to potential us-

ers, the scientific community and the general public. The target consumers of the obtained results are specialized research groups, information and analytical centers.

Consumers: companies whose work is related to the provision of travel services, marketing, processing of analytical information, government agencies, emergency departments, etc.

Competitiveness (Advantages of technology) and commercialization of the project: the results of the project will be patentable and commercializable. The obtained results are necessary for the work of specialized research groups, information and analytical centers, as well as possible demand from a company whose work is related to the provision of tourism services, marketing, processing analytical information, government agencies, emergency departments, etc.

Investment amount – 63,6 mln tenge.

Availability of contracts, agreements with production and business:

Agreement with the Organization Federal Research Center for Information and Computing Technologies of the Siberian Branch of the Russian Academy of Sciences (Novosibirsk) for the provision of third-party services under the project. Agreement on making a partnership contribution with NovoTek Group LLP.

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Sequence of stages of extracting data from tables

DEVELOPMENT OF THE ATLAS INFORMATION SYSTEM OF COMPREHENSIVE SPATIAL ANALYSIS OF THE QUALITY OF LIFE OF THE POPULATION OF THE REGIONS OF THE REPUBLIC OF KAZAKHSTAN WITHIN THE FRAMEWORK OF IMPLEMENTATION OF THE DIGITAL KAZAKHSTAN PROGRAM

Priority direction: Information, communication and space technologies.

Aim of the project: to develop and create atlas information system of the quality of life (AIS of Quality of Life) on the basis of an integrated spatial characterization of economic, social, demographic and natural-ecological indicators of human development in the Republic of Kazakhstan through GIS technologies.

Relevance and novelty: the geoinformation portal of the atlas information system of the quality of life of the regions of Kazakhstan will allow using the information, analytical spatial geographic base of economic, social, demographic and natural-ecological indicators, the knowledge base and the expert system of the created web application for monitoring, managing and developing forecasts of quality of life indicators.

Based on the methodology for a comprehensive spatial assessment of the quality of life of the population of Kazakhstan, for the first time, a geo-information portal AIS QoL of the regions of the Republic of Kazakhstan will be created on the GIS platform. The web application of the atlas information system will allow monitoring, analysis, management and forecasting of the main indicators of the quality of life of the population in the Republic.

Practical significance: being an important component of the information system, the AIS QoL web application will provide scientific, methodological and informational support: in the sectors of the economy: state national and municipal programs of socio-economic significance; in the field of science: promising scientific research and applied developments in the field of human development research, the development of electronic atlas mapping and an atlas information system of the quality of life, the formation of spatial, geographic databases and a knowledge base using GIS technologies of applied orientation.

Expected results: the analysis of the theoretical foundations of the geographical study of the quality of life of the population; the experience of creating AIS QoL has been studied, methods for assessing the QoL level have been identified and developed; a typology was carried out according to the QoL level of the regions of the republic on the basis of the calculated integral QoL indices for 4 blocks according to the author's CSAR methodology, a web application and a geoinformation platform AIS QoL of the regions of the Republic of Kazakhstan were created for the economic, social, demographic and natural-ecological blocks of the QoL indicators of the republic for 1999-2019.

Object of implementation: AIS QoL RK geoportal was introduced into the disciplines of educational programs: "6B05205 – Geography", "7M05203 – Geography", "8D05202 – Geography". Based on the project, dissertation research of master and PhD students is carried out.

Prospects for implementation: social demand for the results of the scientific project in the form of the developed AIS of Quality of Life will provide an opportunity to obtain a spatial geographical assessment of the existing territorial social and demographic, economic and natural and environmental imbalances of the regions. And also an atlas information system can be used by specialists to develop national, regional programs and offers for improving the quality of life.

Consumers: Ministries, state and local executive bodies, as well as research institutes and higher educational institutions. AIS QoL can serve as an analytical expert knowledge system for researchers of various branches of science and specialists in the field of socio-economic and environmental activities.

Investment amount – 48,0 mln tenge (109 324,8$).

Availability of documents of title:

– Copyright certificate No. 1605 dated February 5, 2019 "Social and demographic processes in the Republic of Kazakhstan: regional aspects";

– Copyright Certificate No. 8959 dated March 19, 2020 "Territorial differentiation of the quality of life of the population in RK regions";

– Copyright Certificate No. 9354 dated April 21, 2020 "Territorial differentiation of the quality of life of the population in RK regions";

– Copyright certificate No. 12873 dated October 28, 2020 "Quality of life of the RK population: approaches, assessments, prospects.".

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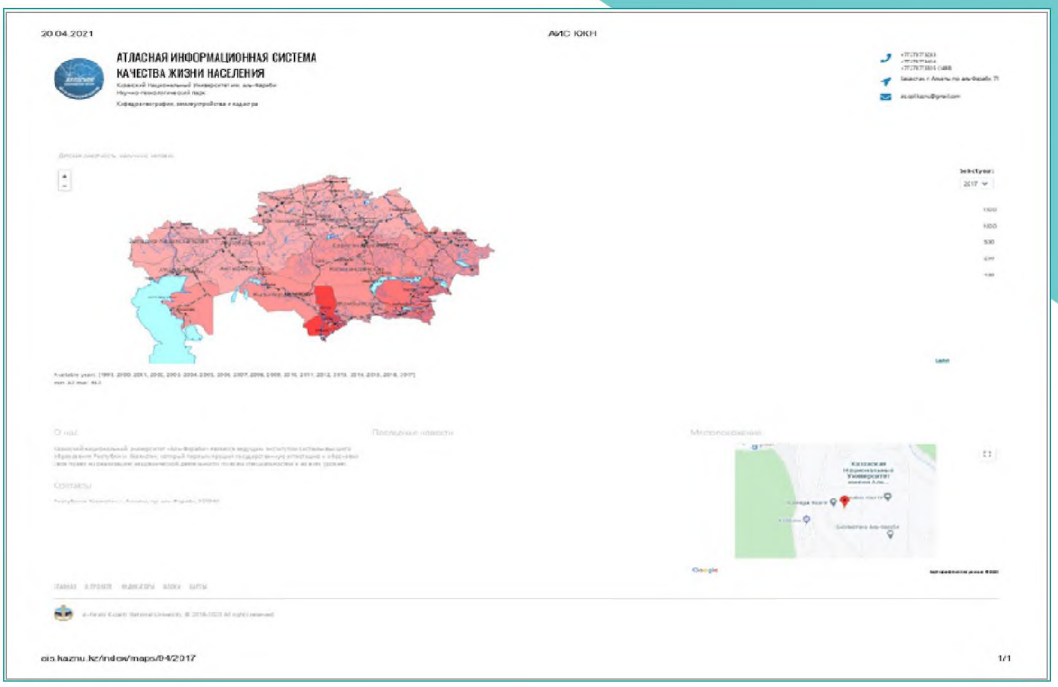

ASSESSMENT OF THE IMPACT OF NATURAL FACTORS AND ECONOMIC ACTIVITY ON THE STATE OF WATER BODIES OF URBANIZED TERRITORIES (ON THE EXAMPLE OF ALMATY CITY)

Priority direction: Rational use of water resources, flora and fauna, ecology.

Aim of the project: identification of regularities and taking into account the influence of urban and adjacent territories on the elements of hydrological processes that occur as a result of anthropogenic and natural in the hydrological cycle, using the example of the largest metropolitan city of Almaty.

Know-how: for the first time, comprehensive studies of the influence of urbanized territories on the hydrological characteristics of water bodies in the mountain-foothill zone with an amplitude of changes in the height of the terrain up to 800 meters and more were carried out.

Relevance and novelty: the prerequisite for the development of this project was the trend of an increase in the number of urban population and an increase in the area of urban area comparable to large river basins. In the future, the processes of changing surface runoff and elements of water balance under the influence of urbanization processes will intensify, so studying the influence of urbanization on hydrological processes becomes more complex and urgent.

On the basis of an assessment of the impact of urbanized areas on hydroecological processes for small rivers in Almaty, calculations of environmental risks were performed. Taking into account the revealed patterns of influence of urbanized territories on surface waters, a system of effective water protection measures for the city of Almaty has been developed and implemented.

Practical significance: the significance of the project on a national and international scale lies in the fact that for the first time an assessment of hydroecological risks arising on water bodies of urbanized territories will be carried out. On the basis of this, a program of measures to reduce the harmful impact of urbanized territories on surface waters will be developed and submitted to national and municipal authorities, which can be recommended for use at the international level, since there are works on the problem of the impact of urbanization on hydrological processes.

Expected results:

– generalization of existing methods for calculating the main hydrological characteristics of runoff and water balance in urbanized areas;

– refined descriptions and large-scale maps of the hydrographic network of Almaty by using GIS technology;

– determination of the zone of climatic influence of the city and associated changes in the hydrological cycle, regime of water bodies and water quality (table and graphs of the course of meteorological elements at meteorological stations in Almaty;

– results of the conducted field studies of the channel water balance of the main rivers of the city of Almaty.

Object of implementation: scientific support of management and planning of measures to reduce the harmful impact of urbanized areas on water bodies at the national level.

Prospects for implementation: scientific support for management and planning of measures to reduce the harmful impact of urbanized areas on water bodies at the international level.

Consumers: national and municipal authorities of Almaty and other urbanized territories of the Republic of Kazakhstan.

Investment amount – 18,1 mln tenge (41 224,56$).

Availability of documents of title:

– Patent for invention of the Republic of Kazakhstan No. 33643 «Method and deepening of the river bottom».

– Patent for invention of the Republic of Kazakhstan No. 33724 «Method of forming the bottom of a river by influencing the stream and a device for its implementation».

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MONITORING OF DEGRADATION AND DESERTIFICATION OF LANDS IN TALASS DISTRICT OF ZHAMBYL REGION USING GIS AND ERS DATA FOR SUSTAINABLE LAND USE

Priority direction: Sustainable development of agro-industrial complex and safety of agricultural products.

Aim of the project: identification of the conditions and factors of the process of degradation of irrigated lands in the desert and semi-desert zones, development of a geographic information system (GIS) for monitoring land degradation based on modern geoinformation technologies and remote sensing data for solving practical problems in land management.

Relevance and novelty: Due to the significant depletion of natural land, monitoring of the used land in the irrigated zone in natural deserts is the most important component in the development of technologies for the use of all available land resources in order to provide food for humanity.

Most of the territory of Kazakhstan is located in the arid zone and about 75% of the territory is subject to the processes of desertification and land degradation to varying degrees. Of the 273.5 million hectares of the republic's territory, about 191.1 million hectares are subject to desertification. More than 100 thousand hectares are subject to secondary salinization. Every year, due to land degradation, Kazakhstan loses almost 100 billion tenge. Most of the deflated land is located in the Almaty, Atyrau, Turkestan, Kyzylorda and Zhambyl regions. Thus, continuous monitoring of agricultural land in desert conditions is the most important component of the use of lands in the arid zone of Kazakhstan for agriculture.

Practical significance: the development of a system of constant monitoring of agricultural lands in order to prevent and improve the productivity of saline degraded agricultural landscapes will lead to the rational use of pastures and hayfields. In turn, this serves as the basis for an increase in the quality and quantity of rural products, and this is a resource and business from which everyone – consumers and producers – benefits. Also, the socio-economic effect of the agroindustry in the context of modern priorities for the development of rural areas is that it stimulates the development of peasant farms, activates the development of local infrastructure, promotes the sale of surplus agricultural products, increasing additional income of peasants and contributions to budgets; activates the local labor market, increases employment, reducing the need for overseas earnings; serves to protect rural resources.

Expected results: the end result of the project will be mechanisms and a set of measures for the development of a monitoring system for agricultural land in order to prevent and improve the productivity of saline degraded agri-

cultural landscapes for the rational use of pastures and hayfields in order to restore them in rural areas of the Republic of Kazakhstan with its subsequent approbation in peasant and / or farms of Zhambyl region, as well as for the entire Southern region.

Object of implementation: monitoring system.

Prospects for implementation: research results are commercializable, they can be implemented in the development of measures to prevent land degradation.

Consumers: farms/peasant farms; Ministry of Agriculture of the Republic of Kazakhstan, local authorities; scientific institutions.

Competitiveness (Advantages of technology) and commercialization of the project: research results can be used for scientifically based planning and targeted support for the restoration of degraded land in rural areas of both individual regions of the country and the country as a whole.

Investment amount – 53,05 mln tenge (120 826,68$).

Availability of contracts, agreements with production and business:

– Agreement on cooperation and co-financing with the farm "Shahantai".

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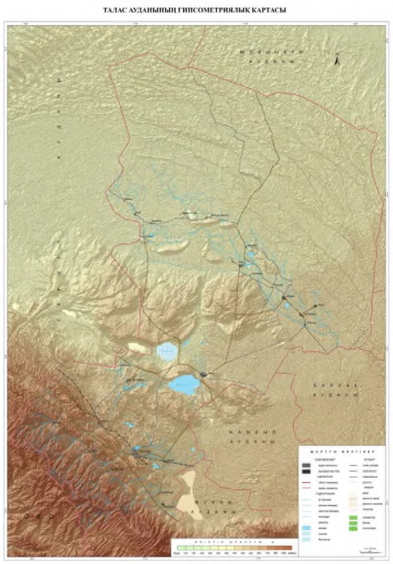

MODERNIZATION OF DIGITAL TOURISM CONTENT: MOBILE APPS, PANORAMIC 3D TOURS, INTERACTIVE MAPS AND QR CODES

Priority direction: Scientific foundations of "Mangilik El" (education of the XXI century, fundamental and applied research in the humanities).

Aim of the project: creation of integrated digital content in the form of a unified portal for registration and implementation of tourist services, operating through the official website, mobile applications and other information resources.

Know-how: development of a social service for users and a business tool for promoting the services of tour operators, travel agencies and other enterprises (suppliers) of the tourism industry, which will attract new customers, increase the loyalty of existing customers, optimize and automate business processes, increase profits thanks to monetization of a mobile application. This service will contribute to the development and expansion of tourism services, which will unite domestic tourism subagents and peasant farms that provide tourism services.

Relevance and novelty:

– a single portal for the provision of tourist services based on a search for specified parameters;

– the first mobile application with conditioned and reliable data on the tourist market of Kazakhstan;

– a service that provides a full range of services that are needed by tourists visiting Kazakhstan;

– clarity, availability of online service and a visual tourist map to help you design your trip;

– flexible search and / or search capabilities for inaccurate data.

Practical significance: project is aimed at creating a single tourist base and uniting subjects and objects of the tourist market of Kazakhstan, as well as disseminating information about tourism in Kazakhstan to increase its attendance, as well as to analyze statistics of the tourism industry.

Expected results:

– placement of tourist products/services on the website http://tourismkaz.kz/;

– placement of tourist products/services on the TOURISMKAZ mobile application;

– development of panoramic 3D tours;

– generation of QR codes;

– placement of tourist facilities on an interactive map of tourist infrastructure.

Object of implementation: tourism services and content in the digital space.

Prospects for implementation: creation of a flexible mobile application with elements of monetization and an interactive portal to meet the needs of domestic and foreign tourists in Kazakhstan.

Consumers: enterprises of the tourism industry, individuals, accommodation companies, catering establishments, travel agencies, air carriers, tourists and their associations, railway companies, bus companies, taxi companies, government agencies.

Competitiveness (Advantages of technology) and commercialization of the project:

– creation of a service that allows the sale of tourist products and individual tourist services according to the specified parameters, through this portal the entire tourist route will be bought, which includes all the main expenses of the tourist (food, accommodation, excursions and other services);

– mobile application “TOURISMKAZ”;

– an interactive tourist map, using which a tourist will be able to make panoramic 3D tours across the regions of the country;

– generation of QR codes that provide information needed by tourists;

– organization of scientific tourism.

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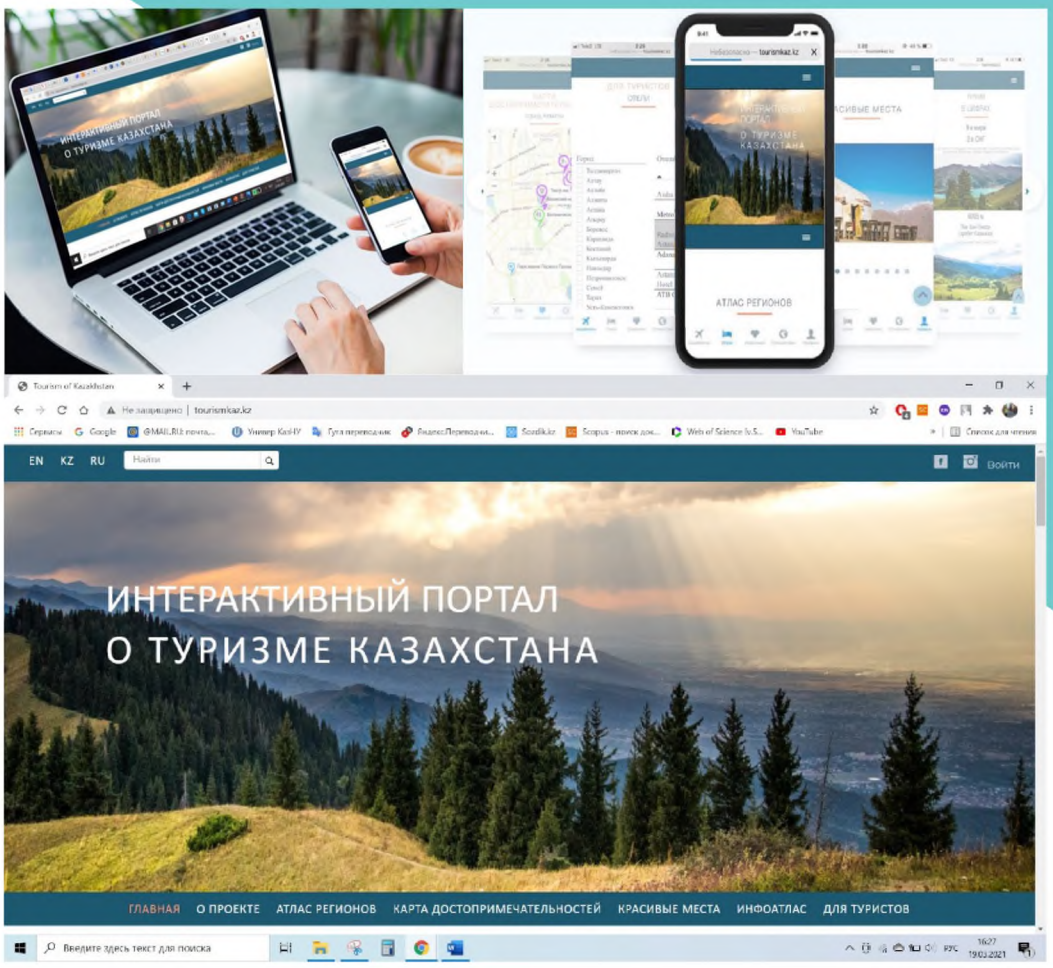

ENSURING SUSTAINABLE DEVELOPMENT OF KAZAKHSTAN'S NATIONAL PARKS THROUGH THE TERRITORIAL ORGANIZATION OF ECOLOGICAL TOURISM

Priority direction: Scientific research in the field of natural sciences.

Aim of the project: ensuring sustainable development and territorial organization of ecological tourism in state national natural parks of Kazakhstan (on the example of national parks in Almaty and East Kazakhstan regions) based on a scientifically grounded assessment of tourist and recreational capacity and permissible environmental load on geosystems, taking into account the multiplicative effect of recreational activities and using GIS technologies.

Know-how: development of a methodology for assessing tourist and recreational capacity and permissible environmental load on the national park's geosystems, taking into account correlation coefficients and multiplicative effect of recreational activities using GIS technologies.

Relevance and novelty: relevance of the project lies in ensuring the sustainable development of national natural parks through rational planning of ecotourism activities, taking into account the norms of maximum permissible recreational loads on the geosystems of protected natural areas, regulating tourists flow, optimizing the infrastructure and logistics of routes, as well as implementing innovative approaches to environmental education of the population based on digital technologies.

The novelty of the project lies in the consistency and complexity of the planned research, including the analysis of existing approaches to solving the problem, monitoring of ongoing activities and scientific substantiation of the innovations proposed in the framework of ensuring sustainable development of ecological tourism in Kazakhstan, taking into account the government policy of cluster development and the territorial organization of domestic tourism.

Practical significance: ecotourism opens up opportunities for obtaining additional legal income for rural communities; development of alternative (environmentally friendly) types of economic activity helps to reduce poaching; educational activity raises ecological culture, creates preconditions for nature protection through tourism, and, as a consequence, sustainable development of territories.

Expected results: recommendations will be developed for the systemic development of ecotourism in Kazakhstan, taking into account innovative approaches and solutions, optimization of the territorial organization of ecotourism based on a scientifically grounded assessment of the tourist resource potential and ensuring the principles of safety and sustainable development.

Object of implementation: state national natural parks of Almaty and East Kazakhstan regions.

Prospects for implementation: after approbation, it is planned to replicate positive experience in the territories of other national parks of Kazakhstan in order to popularize ecotourism that meets the criteria for sustainable development.

Consumers: national parks of the Republic of Kazakhstan; Committee of Forestry and Wildlife of the Ministry of Ecology, Geology and Natural Resources of the Republic of Kazakhstan; Tourism Industry Committee of the Ministry of Culture and Sports of the Republic of Kazakhstan; JSC «National Company "Kazakh Tourism"»; Kazakhstan Tourism Association (KTA); Tourism Department of Almaty and East Kazakhstan regions; tourists, local population, local communities, NGOs, tourism industry (travel agencies, tour operators), rural entrepreneurs, etc.

Competitiveness (Advantages of technology) and commercialization of the project: the results of the study are applicable to other national parks in Kazakhstan. Research results are commercializable (for example: the development of effective actions for local communities and a scenario for the development of tourism in protected areas; assessment/economic planning materials for the effective production of tourist products in protected areas and regions; technological foundations for managing the development of tourist flows and the production of tourist products, geographic information maps, balanced a set of actions, decision support models for the development of tourism and related areas in protected areas; sustainable development of tourist and recreational activities in national parks of the Republic of Kazakhstan; introduction and dissemination of methods for assessing anthropogenic load on tourist routes and training of employees of national parks).

Investment amount – 47,42 mln tenge (108 003,79$).

Availability of documents of title:

– Copyright Certificate No. 13053 dated November 5, 2020. "Map of the Turgen branch of the Ile-Alatau State National Nature Park".

Availability of contracts, agreements with production and business:

– cooperation agreements with the national parks of the Almaty region and the East Kazakhstan region are in the process of signing.

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NEW ANTIBACTERIAL DRUGS FOR THE TREATMENT OF DISEASES OF STURGEONS

Priority direction: Life and Health Science.

Aim of the project: research of the therapeutic potential of parental and engineered chimeric endolysins with increased lytic activity against Gram-negative bacteria *P. fluorescens, P. putida, A. hydrophila, A. salmonicida* and *A. sobria*.

Know-how: the presented project is aimed at developing new effective chimeric endolysins with increased lytic activity against gram-negative and antibiotic-resistant bacteria, which are the main cause of sturgeons diseases in aquaculture.

Relevance and novelty: the production of sturgeons in aquaculture has increased significantly in recent years due to the high demand for caviar on the world market. However, due to the widespread and often uncontrolled use of antibiotics, the number of antibiotic-resistant bacteria has increased dramatically and is the main cause of morbidity and mortality. Bacterial species, most commonly *Aeromonas* and *Pseudomonas*, have been reported as the main pathogens.

For this reason, new strategies to combat these drug-resistant pathogens are urgently needed. Endolysins are possible alternatives to antibiotics.

Most endolysins of gram-positive bacteria phages have a modular structure consisting of N-terminal catalytically active domains (CAD) and a C-terminal cell wall binding domain (CBD) separated by a short linker.

Thus, endolysins are able to effectively and quickly cause the death of a bacterium, regardless of its physiological state or antibiotic resistance.

Practical significance: The practical significance of the research project is to develop new effective chimeric endolysins with increased lytic activity against gram-negative and antibiotic-resistant bacteria, which are the main cause of diseases in sturgeon aquaculture.

Expected results:

– bacterial pathogens *(A. hydrophila, A. salmonicida, A. caviae, A. sobria, P. putida* and *P. fluorescens)* of sturgeon will be isolated and identified and their sensitivity to antibiotics *in vitro* will be tested;

– chimeric endolysins will be constructed, as well as the genes of three parent and 7 chimeric endolysins will be cloned and their expression in *E. coli* will be optimized;

– the antibacterial activity of endolysins will be determined, and methods of treatment of infected sturgeons will be developed.

Object of implementation: antibacterial drugs used to treat diseases of sturgeons caused by bacterial pathogens.

Prospects for implementation: Currently, endolysin therapy is considered a very promising alternative to the treatment of complex infections. Endolysins are phage-encoded enzymes that have peptidoglycan hydrolase activity and are therefore capable of destroying the bacterial cell wall, allowing the phage to leave the host cell after replication.

In contrast antibiotics and bacteriophages, bacterial strains do not develop resistance to endolysins, which contributes to the widespread use of antibacterial drugs.

Consumers: the main consumers are fishery enterprises, including industrial aquaculture complexes and fish hatcheries, as well as fish farmers.

Competitiveness (Advantages of technology) and commercialization of the project: in general, the use of anti-bacterial drugs based on lysing proteins - endolysins is not limited to the use only in the treatment of fish diseases, there is also the possibility of use as a prevention of bacterial diseases and farm animals, which makes the proposed drugs universal, thereby significantly increasing competitiveness.

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Figure 1. Hemorrhagic septicemia of sturgeons

"GOLDEN FLY" FODDER

Priority direction: Sustainable development of the agro-industrial complex and safety of agricultural products.

Aim of the project: deep processing of food waste to obtain a valuable nutritious product for birds, fish and animals (Golden Fly), as well as organic fertilizer (Golden Soil); and solving environmental problems through deep processing of all types of organic waste. Introduction of a new bioecotechnology for the disposal of organic waste on the scale of Kazakhstan.

Know-how: use in the process of disposal of organic waste (including food waste) larvae of Black Lion flies.

Relevance and novelty: Today the problem of waste in our country is as acute as in the whole world. Annually in Kazakhstan 4.5-5 million tons of municipal solid waste (hereinafter - MSW) are generated. Now MSW is partially sorted and processed at factories, while organic waste (food waste, gardening waste, etc.), which makes up 20 to 55 percent of all solid household waste, is not yet processed in our country. When organic wastes enter the landfill, they emit landfill gas, including combustible methane, which leads to fires and explosions at landfills, as well as its greenhouse effect 24 times higher than carbon dioxide.

Today, there are various technologies for the disposal and processing of organic waste, including the use of the Black Lion's larvae to obtain valuable nutrients for animals and birds. This promising direction began its rapid development since 2000. There are over 10 large companies on the world market that recycle millions of tons of food waste every day using this technology, and also attract multimillion-dollar investments from large venture capital funds (French startup Ynsect raised $ 224 million from the Footprint Coalition Foundation of the famous actor Robert Downey Jr., and AgriProtein was invested $ 10 million by Bill Gates) and government agencies. According to research by Arcluster, the global insect market will surpass $ 4.1 billion over the next five years, up from $ 473.4 million in 2020.

Practical significance: a great contribution to the sustainable food system of the country, as the project solves a number of the most pressing issues:

– Recycling of organic waste;
– Obtaining protein feed for animals (birds, fish, livestock);
– Getting high quality organic fertilizer – zoohumus;
– Obtaining chitin and chitosan for medical purposes.

Expected results: a workshop for processing 1000 kg of food waste per day will be built on the basis of the Technopark greenhouse. The results will be scaled to the entire territory of the country.

Object of implementation: mixed fodder.

Prospects for implementation: Today our startup company Golden Fly recycles 100 kg of food waste per day. We plan to bring this figure to 1000 kg in

the next few months. Scaling the project at the country level. Implementation of the project for the construction of the first organic waste processing plant in Kazakhstan.

Consumers: fish farms, poultry farms, greenhouses, agricultural entities, pet shops, the private sector.

Competitiveness (Advantages of technology) and commercialization of the project: the advantage of the technology lies in the fact that the processing process is much faster compared to other types of technology (composting, the use of California worms), and is also waste-free. At the moment, negotiations are underway with fish farms.

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METHOD FOR PRODUCING HYDROPHOBIC SOOT WITH MAGNETIC PROPERTIES

Priority direction: Geology, mining and processing of mineral and hydrocarbon raw materials, new materials, technologies, safe products and structures.

Aim of the project: synthesis of soot containing iron nanoparticles, which has hydrophobic and magnetic properties, for cleaning spilled oil from the water surface.

Know-how: the resulting soot not only absorbs oil, but is also easily removed due to its magnetic properties.

Relevance and novelty: with the development of nanotechnology in recent years, research on the synthesis of soot with specified special properties has intensified.

The production of superhydrophobic soot by pyrolysis and combustion of hydrocarbons has a number of advantages over traditional methods, since the process is a continuous, easily scalable, technologically advanced and controlled method for the production of low-cost products, while the special properties of the resulting product allow it to be applied to a wide range.

This study relates to the chemical industry, in particular to the production of hydrophobic adsorbent materials that are used in environmental protection, namely to clean the water surface from oil and oil products in the form of gasoline and motor oil, which have a lower density than water and spread over surfaces through the use of a magnetic field.

Practical significance: with the positive implementation of the project, the Republic of Kazakhstan will enter the world high-tech market in the field of innovative technologies for the synthesis of nanomaterials with superhydrophobic properties. The implementation of the project will create the preconditions for increasing the competitiveness of the economy of the Republic of Kazakhstan through the use of its own scientific personnel and natural and material and technical resources.

Expected results:

– a method for obtaining a material with magnetic, hydrophobic and sorption properties will be developed;

– soot will be obtained with hydrophobic and magnetic properties, as well as sorption properties for cleaning spilled oil from the water surface;

– the sorption properties of the obtained hydrophobic and magnetic soot will be investigated.

Object of implementation: hydrophobic and metallic soot.

Prospects for implementation: the introduction of science-intensive technology will help improve the level of knowledge and the training of highly qualified specialists. The ecological effect of this project is the creation of superhydrophobic nanomaterials and the use of this soot for cleaning the water

surface from oil waste. This will contribute to the scientific, technical and socio-economic development of the Republic of Kazakhstan. Hydrophobization is carried out due to the hydrophobic effect of the soot itself, and no hydrophobizing agents are used to impart hydrophobic properties to the composition.

The proposed method for the production of superhydrophobic soot has a number of advantages over traditional methods, since the process is continuous, easily scalable, technologically advanced and controlled for the production of products at low cost.

Consumers: companies specializing in the creation of hydrophobic materials with the best characteristics.

Competitiveness (Advantages of technology) and commercialization of the project: the implementation of the project will create the preconditions for increasing the competitiveness of the economies of the Republic of Kazakhstan through the use of their own scientific personnel and natural and material and technical resources.

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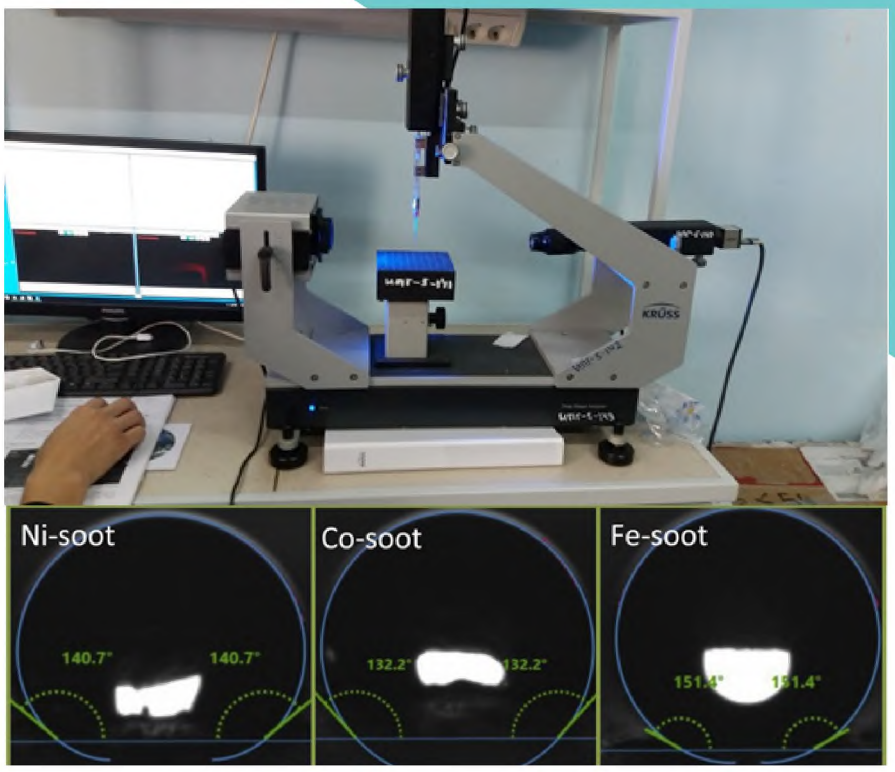

PSYCHOPHYSIOLOGICAL MARKERS OF DEPRESSION

Priority direction: Life and Health Science.

Aim of the project: determination of electroencephalographic biomarkers of depressive conditions for objective diagnosis in order to reduce the burden of a socially significant disease.

Know-how: The uniqueness of this work is the determination of new EEG biomarkers that reliably determine the depressive state during cognitive loads. The value of the study for theoretical science lies in the determination of specific EEG patterns reflecting the depressive states of the local population, and for applied science - in the computerization of biomarkers of depression, which will contribute to the timely and objective diagnosis of depressive conditions and the prevention of behavioral disorders and suicide. For the first time, valid EEG biomarkers have been identified based on an original cognitive task in the population of Kazakhstan.

Relevance and novelty: the WHO estimates that the economic losses due to depression amount to approximately one trillion dollars annually. Depression, accompanied by impaired cognitive functions, leads to the choice of the tactics of absenteeism or presentism (imitation of activities at work) and reduces the population's ability to work. Untreated disease leads to a high risk of suicide, reduced quality of life and is potentially a social threat to society. The lack of objective methods for diagnosing depressive conditions, along with stigma, complicates the situation. All this determined the urgent need for the development of new objective methods for diagnosing depressive conditions.

The obtained results revealed the most informative indicators of spontaneous brain activity during rest and characteristics of the evoked potential during the performance of cognitive tasks for executive control and decision-making. Psychometric methods were promptly introduced into the psychotherapeutic practice, which was carried out free of charge during the pandemic due to the increase in the number of depression (in cooperation with UNISEF, UNESCO) by our psychotherapists. EEG biomarkers ready for technical development of equipment for EEG diagnostics of depression.

Practical significance: The results of this study confirm that it is precisely well-developed cognitive and emotional loads that can make it possible to identify patterns in the changes in brain signals characteristic of a depressive state. The selected cognitive tasks for our research are executive. On the whole, our results showed that the deterioration of executive control in subjects with depression, which is a central regulatory link in cognitive processes, is associated with decreased brain activity in response to specific stimuli. EEG indicators during the execution of the task of the adapted version allowed us to determine a lower level of functioning of neural networks of cognitive control in a depressive state. The second cognitive decision-making task revealed a deficit in brain activation for perception and feedback.

Expected results: the main results of the research can be implemented in the form of creating a computer program or a device of domestic production for the

diagnosis of emotional-depressive states. Implementation in practice will make it possible to diagnose and treat the disease in a timely manner at early stages, avoid severe consequences and suicide, create a domestically produced device for diagnosing emotional-depressive states and subsequent commercialization of the results in the future.

For the first time, a computer program will be created on the basis of a scientifically grounded experimental complex of psychometric, cognitive tasks and psychophysiological methods for the study of diagnostic criteria for depressive states, already adapted and validated in the local population.

EEG biomarkers indicating the presence of a deficit in brain activity and a decrease in brain lability in depression will be laid down as the main criteria in the diagnosis of depression. This device can be widely used in clinical practice to prevent depression and suicide.

Object of implementation: computer program or device that diagnoses emotional states.

Prospects for implementation: the results can be implemented in psychotherapeutic practice, security services, human resources services, medical services, research and educational institutions.

Consumers: the data can then be widely used in national and international practice: the intended consumers will be psychological and psychiatric services, security services, human resources services, medical services, research and educational institutions.

Competitiveness (Advantages of technology) and commercialization of the project: the offered product is highly competitive. At the moment, there is no analogue of the proposed technology in the domestic market.

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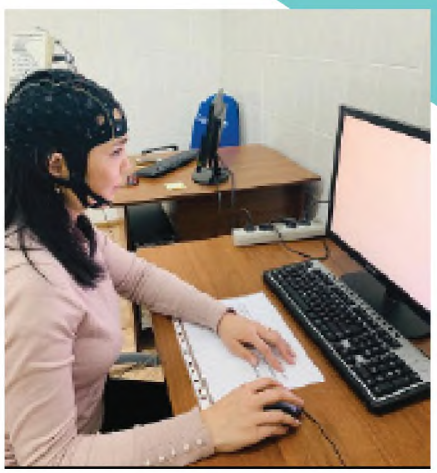
Preparing for EEG research



During the experiment

NEW IMPLANTATION METHODS FOR CARDIOVASCULAR DISEASES

Priority direction: Life and Health Science.

Aim of the project: development of new methods of implantation of a composite valve-containing conduit for ascending aortic aneurysm.

Know-how: This method has shown a high efficacy of the prophylaxis of a bleeding from the aortic root forming a high leakproofness in fixation of prosthesis, formation of thrombi, pannus and periprosthetic fistulas.

Relevance and novelty: There are diverse methods and modifications of a composite conduit implantation used to reduce and prevent the bleeding, thrombi and fistula formation. Despite numerous modifications of a composite conduit implantation method, the bleeding remains one of the severe complications of a procedure.

Well-known techniques of an implantation have shown efficacy, but they require the additional manipulation, formation and using artificial tissues, additional sutures and synthetic materials that elongates the procedure duration, and as a result, elongation of myocardial ischemia time, therefore there is a high risk of myocardial infarction, meanwhile it poorly prevents the bleeding along the suture line.

Therefore the author team has worked out its own new Kazakhstani method of an implantation of the composite valve-containing conduit in ascending aortic aneurysm by mean of supraannular prosthetic repair using interrupted mattress pledged sutures, for effective prophylaxis of bleedings, thrombi and fistulas formation.

Practical significance: The proposed method consists in supraannular prosthetic repair using interrupted mattress pledged sutures, but it differs in that threads taken outside from the conduit cuff are done to the external surface of ascending aorta and fixated using pledges in such a way that after tying the knots the cuff of a composite conduit becomes wrapped like «a sandwich» in remnant part of ascending aorta, and the periprosthetic space is closed, while a proximal suture line enhances the fixation. Thus, we can provide an effective prophylaxis of bleeding owing to complete hermeticity. Thrombi formation does not develop due to complete isolation of conduit cuff due to the fact that the cuff of a prosthetic conduit remains in the fold between the fibrous ring and the remnant of aortic wall. The absence of fixating sutures in the aortic lumen prevents fistula formation.

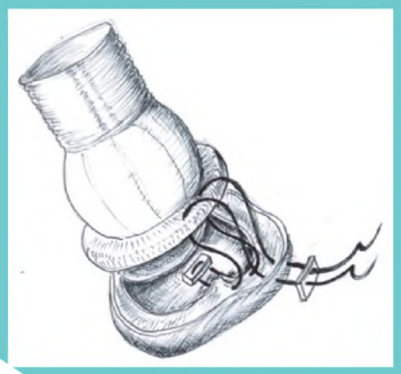


Figure 1. «Interrupted» mattress pledged sutures were placed under the fibrous ring of the aortic valve and taken outside to the external wall of an ascending aorta

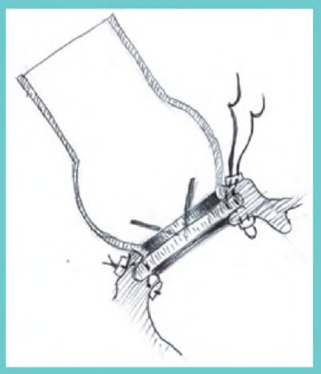
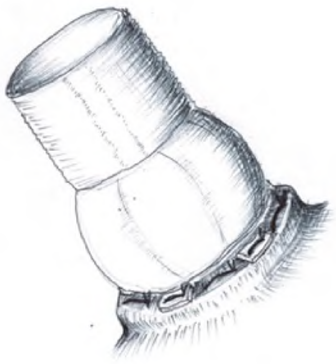


Figure 2. The view in cross-section. The «sandwich» prosthetic cuff is covered below with fibrous ring and thin strip of remnants of the aortic valve cusp, above remnants of the ascending aorta

The new method will result in more qualitative prophylaxis of the bleeding, thrombus and fistula formation.

The final view after conduit implantation into aortic position is illustrated in figure 3.



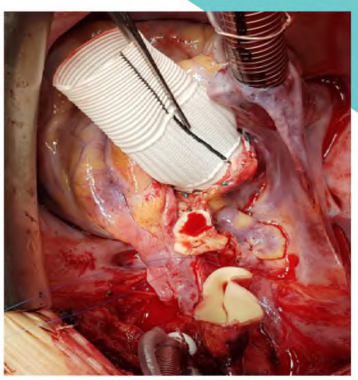


Figure 1. The view following the completion step of tying suture knots. Under this method you can avoid the «leakages» (perisutural bleedings). The blood loss dramatically decreases, prosthetic valve fistula and thrombi (pannus) do not develop

Object of implementation: a method of implantation of a composite valve-containing conduit for ascending aortic aneurysm.

Consumers: patients.

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DEVELOPMENT AND CREATION DOMESTIC VENDING APPARATUS FOR BUSINESS

Priority direction: Information, communication and space technologies.

Aim of the project: development and creation of a vending machine with a complex software for remote orders of goods (food) and their delivery to customers through the cells of the device.

Know-how: sales automation based on inexpensive control boards.

Relevance and novelty: existing foreign options for vending devices for the most part on the market are aimed at selling coffee, bottled drinks and other everyday goods. In today's realities with the advent of the COVID-19 pandemic and with it strict restrictive measures on movement (quarantine) demand for all kinds of food delivery solutions, medicines and many other vital goods for everyday human life in a non-contact way.

Practical significance: creation of the planned vending machine will allow you to solve the problem of delivery and transfer of the necessary categories food on time and of proper quality without the risk of infection.

Expected results: cheaper consumer goods and food, reducing the risk of contracting COVID-19.

Object of implementation: vending machine.

Prospects for implementation: creation of a domestic vending machine with these functions and software will have a significant social and economic effect for the population and entrepreneurship. It will unite in the field of business suppliers, logistics companies, lessors of trading floors (shopping and entertainment centers, residential complexes) and directly customer. A contactless way to get the food you need or any other types of goods will reduce the number of contacts among people. At the end of the project, in the course of its implementation, the necessary experience and proven developments for the implementation of new types of domestic vending machines.

Investment amount – 30,0 mln tenge (68 328$).

Availability of documents of title:

– documentation (drawings, software software) for the developed prototype (vending machine) is the property of developer and are at the stage of copyright registration.

Availability of contracts, agreements with production and business:

– available agreements with industrial enterprises of the city of Almaty for the creation new prototypes of the vending machines.

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DEVELOPMENT AND CREATION OF PROTOTYPE OF A NEW TYPE OF URBAN ELECTRIC TRANSPORT – ELECTRIC TRICYCLE

Priority direction: Energy and mechanical engineering.

Aim of the project: development and creation of a prototype of an electric tricycle with an integrated intelligent safe control system and an autonomous on-board charging station.

Know-how: a new type of urban electric transport and an intelligent safe management system.

Relevance and novelty: an electric tricycle is a new, more mobile vehicle in comparison with existing traditional ones. In many cities around the world, dedicated lanes for this type of transport are increasingly appearing on the main lanes of urban transport. This type of transport is environmentally friendly, there are no CO^2 emissions, fluids and oils are not used in the transmission. The electric tricycle is less energy-consuming in its production and economical in operation: the distance of the route on one charge is 80-120 km, while the cost of charging will be no more than 80 tenge.

Practical significance: environmentally friendly, economical, comfortable and safe individual mode of transport.

Expected results: creation of a domestic individual electric vehicle.

Object of implementation: vehicle.

Prospects for implementation: the experience of creating such a vehicle will give an impetus to the development of the domestic auto industry.

Consumers: population. At the same time, there is a very great need for this type of transport in delivery services, city utilities, parks and other areas of business.

Competitiveness (Advantages of technology) and commercialization of the project: there are no existing and imported analogs on the market yet. This design is competitive with existing electric scooters, bicycles and scooters with internal combustion engines.

Investment amount – 20,0 mln tenge (45 552$).

Availability of documents of title:

– Copyright Certificate No. 13053 dated November 5, 2020. "Map of the Turgen branch of the Ile-Alatau State National Nature Park".

Availability of contracts, agreements with production and business:

– Agreements with manufacturing enterprises of the city of Almaty for the creation new prototype of the electric tricycle.

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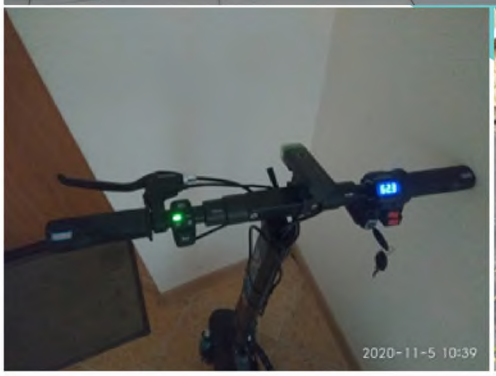
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EXA


Speed meter
PAS
Motor
H-brake
L-brake
Alarm
Cruising
Reverse
Hall sensor
Self learn
Throttle
Battery
3 Speed


Li-ion 16S 60V BMS
30A
79*58*11mm

PREVALENCE AND PREDICTORS OF PROFESSIONAL BURNOUT AMONG EMPLOYEES OF THE FIRE SERVICE IN ALMATY

Priority direction: Public Health.

Aim of the project: to assess the indicators of professional burnout among fire service workers, their predictors and ways of correction.

Know-how: for the first time in the post-Soviet space, the phenomenon of burnout among fire service workers was studied taking into account the position held, work experience, indicators of fatigue, lifestyle factors and quality of life.

Relevance and novelty: for the first time in the post-Soviet space, the phenomenon of burnout among fire service workers was studied taking into account the position held, work experience, indicators of fatigue, lifestyle factors and quality of life. Recommendations have been developed for the prevention of professional burnout in firefighters, which can also be applied to other professional groups.

Practical significance: the prevalence and predisposing factors of burnout have been identified, which will help to contribute to labor protection of the fire service of the Republic of Kazakhstan. The obtained scientific data can be used as a basis for improving the system of state planning in relation to the health of employees of law enforcement agencies, as well as standards, rules regarding labor legislation in the Republic of Kazakhstan, as well as in the CIS countries, near and far abroad. Developed preventive measures to prevent burnout among fire service workers can be applied to other professions and industries, which can be of great importance for public health.

Expected results: an in-depth understanding of the mechanism of the occurrence of professional burnout and its analysis will help to identify predictors and early manifestations of fatigue (exhaustion) syndrome, significantly improve productivity in general and the psychophysical state of each employee individually. Preventing burnout of workers in various services will increase the efficiency of providing assistance to the population, reduce injuries, disability and other negative consequences for the health of workers.

Object of implementation: the results of the study were implemented into practical activities in one of the fire departments of Almaty city.

Prospects for implementation: the results obtained can be implemented into the educational process of medical universities.

Consumers: security forces.

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Figure 1. Participants in the burnout project

Figure 2. Work with firemen

BUILDING CAPACITY FOR THE STUDY OF COGNITION AND RISK FACTORS IN KAZAKHSTAN

Priority direction: Life and Health Science. Innovative research in medicine.

Aim of the project: Development of research potential for the study of cognitive impairments (hereinafter referred to as CI) and associated risk factors in the Republic of Kazakhstan (hereinafter referred to as RK).

Know-how: Methods for the application of neuropsychological tests, assessment of coronary artery calcification (CAA), assessment of pulse wave velocity of the arteries (PWV), and assessment of aggregate air pollution indicators have been harmonized with the methods currently used in the United States through a hybrid teaching method.

Relevance and novelty: An increase in the population and proportion of elderly people, as well as a high prevalence of cardiovascular diseases and air pollution, will affect the growth of cognitive impairment and dementia in the Republic of Kazakhstan. Building research capacity in this area will assess the magnitude of the problem and lay the foundation for the development of preventive measures. The need to build a strong research base in Central Asia for an objective assessment of IP and associated risk factors, as well as through the use of epidemiological research tools used in the United States. Replenishment of data on CI and associated risk factors in the Republic of Kazakhstan using objective methods can provide new knowledge in the development of cognitive impairments, and the development of preventive measures, diagnostics based on evidence-based medicine in state programs for the development of healthcare in the Republic of Kazakhstan.

Practical significance:

– assessment of the role of the impact of environmental pollution on IP among the elderly in the Republic of Kazakhstan;

– the introduction of neuropsychological tests and the definition of normative indicators of cognitive functions for the study and assessment of the burden of CI in medical practice in the Republic of Kazakhstan;

– attracting investment, international research specialists and strengthening international partnership between the Republic of Kazakhstan and the United States.

Expected results:

– to determine the normative indicators of cognitive functions using neuropsychological tests in the Republic of Kazakhstan;

– to build up scientific potential in conducting research in the field of brain function, assessing air pollution and pre-symptomatic diagnosis of CVD in the territory of the Republic of Kazakhstan;

– to build technical potential in the application of artificial intelligence in the diagnosis of brain dysfunctions;

– to attract investment, international research professionals and the pharmaceutical industry.

Object of implementation: Transfer of technologies, namely, methods for the use of neuropsychological tests, assessment of coronary artery calcification

(CAA), assessment of arterial pulse wave velocity (PWV), and assessment of aggregate indicators of air pollution in medicine.

Implementation of hybrid training of specialists in new diagnostic methods.

Prospects for implementation: Application of artificial intelligence technologies, new biomarkers in medicine for solving the problems of diagnostic and prevention of CD and dementia.

Establishment of the Center for Best Practices in the Diagnosis, Treatment and Prevention of CI and Dementia in Central Asia.

Consumers: politicians, central and local offices of the Ministry of Health of the Republic of Kazakhstan, the Ministry of Education and Science of the Republic of Kazakhstan, the Ministry of National Economy of the Republic of Kazakhstan, pharmaceutical companies, clinicians, health managers, society.

Competitiveness (Advantages of technology) and commercialization of the project: The most cited scientist in Central Asia with a team of Bolashakers (Hirsch Index – 30);

Expertise in the use of AI, new biomarkers of CVD development factors at the level of pre-symptomatology in medicine.

Investment amount – $ 118.1.

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THE PROSPECTIVE URBAN RURAL EPIDEMIOLOGICAL (PURE) STUDY

Priority direction: Life and Health Science. Innovative research in medicine.

Aim of the project: to study the impact of urbanization on the development of primary risk factors (changes in physical activity and nutrition), main risk factors (obesity, hypertension, dysglycemia and dyslipidemia, smoking) and cardiovascular diseases.

Know-how: a database of 500,000 people from over 1,000 urban and rural communities in 27 high, middle and low income countries, compiled in a prospective study of more than 225,000 people that examines the interactions between social, household, individual and genetic determinants of disease and influence on the prevention of cardiovascular diseases worldwide. The project is also one of the largest dietary studies in the world that could influence global dietary guidelines.

Relevance and novelty: this study will provide important and new information about the underlying health burdens of obesity, diabetes and cardiovascular disease around the world. Its scale (both social and individual influence) and the inclusion of people from different groups of countries allows it to recognize truly universal risk factors and, importantly, their contextual variations and contingencies, as well as their impact on cardiovascular disease, and this allows avoid the limitations inherent in studying more homogeneous groups.

Practical significance:

– to use the knowledge gained about social changes affecting individual lifestyles and biological markers for the development of state programs for the development of healthcare in the Republic of Kazakhstan, as well as interventions at the community level that will mitigate the adverse health effects of rapid social changes;

– implementation of digital solutions (digital platforms, gadgets, wearable devices) in medical practice;

– attraction of international funds and pharmaceutical companies to conduct clinical trials in the Republic of Kazakhstan.

Expected results:

– to determine social, household, individual and genetic determinants of diseases in order to develop effective strategies for the prevention of cardiovascular diseases in the Republic of Kazakhstan;

– to build up scientific potential in conducting clinical trials in the territory of the Republic of Kazakhstan;

– to build technical capacity in the application of digital solutions in medicine;

– to attract investments from international organizations and the pharmaceutical industry.

Object of implementation: Transfer of technologies, namely digital solutions (digital platforms, gadgets, wearable devices) in medicine.

Nutritional research that could provide new insights into global dietary recommendations.

Prospects for implementation:

– the use of artificial intelligence technologies in medicine to solve diagnostic, treatment and prevention issues;

– application of knowledge and experience in conducting clinical trials in humans.

Consumers: politicians, central and local offices of the MH RK, MES RK, MOT RK, MST RK, pharmaceutical companies, clinicians, health managers, social workers, teachers, faculty, representatives of the fitness and sports industry, food, restaurant and health resort businesses.

Competitiveness (Advantages of technology) and commercialization of the project:

– the most cited scientist in Central Asia with a team of Bolashakers (Hirsch Index - 30);

– rights to use digital solutions (digital platforms, gadgets, wearable devices, AI) in medicine;

– scientifically grounded social project carried out in accordance with international standards.

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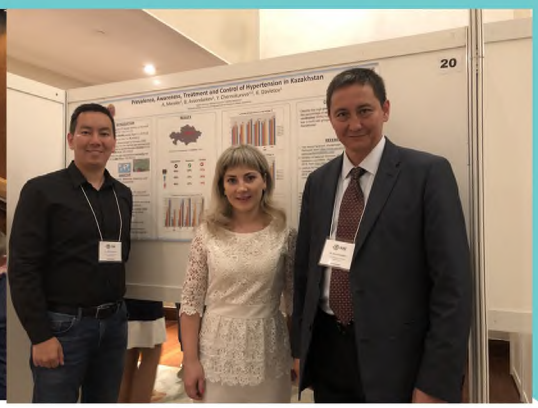

PROJECTS ON THE GLOBAL AND EUROPEAN BURDEN OF DISEASES AND NON-COMMUNICABLE DISEASES

Priority direction: Life and Health Science.

Aim of the project: Quantifying health losses from all diseases, injuries and risk factors to improve the health care system and eliminate health disparities.

Know-how: GBD methods can be used globally, nationally and locally to assess the burden of all diseases, injuries, risk factors and understand health trends to monitor a country's economic activity.

Relevance and novelty: Decision-makers need to understand the true nature of problems and their tendencies among the population. This means more than just estimating the prevalence of a disease, such as the number of people with depression or diabetes in a population. GBD methods take into account the prevalence of the disease and its risk factors, as well as the relative harm, which are collectively visualized in graphs and diagrams. As a result, it allows decision-makers to compare the effects of different diseases and use the information to make evidence-based decisions.

Practical significance:

– to use GBD methods to assess the burden of disease, risk factors and injuries at the national and local levels for making better decisions, as well as using it in the development of state programs for the development of healthcare in the Republic of Kazakhstan, assessing medical interventions;

– implementation of complex statistical methods, Big Data, machine learning in medical practice;

– involvement of international funds and pharmaceutical companies to assess the effectiveness of medical interventions in the Republic of Kazakhstan.

Expected results:

– to assess the burden of all diseases, injuries, risk factors and their course in order to develop effective strategies for diagnosis, treatment and prevention in the Republic of Kazakhstan;

– to build up scientific potential in conducting clinical trials in the territory of the Republic of Kazakhstan;

– to create technical potential in the application of Big Data, machine learning in medicine;

– to attract investments from international organizations and the pharmaceutical industry for conducting clinical trials on the territory of the Republic of Kazakhstan.

Object of implementation: transfer of technologies, namely, complex statistical methods, Big Data, machine learning in medicine and healthcare of the Republic of Kazakhstan.

Prospects for implementation:

– Application of complex statistical methods, Big Data, machine learning in medicine to solve diagnostic, treatment and prevention issues in the Republic of Kazakhstan;

– Creation of a Hub Center for best practices in analytics and digital technologies used in medicine in Central Asia.

Consumers: politicians, central and local offices of the MOH RK, MES RK, MT RK, MST RK, pharmaceutical companies, clinicians, health managers, social workers, society.

Competitiveness (Advantages of technology) and commercialization of the project:

– the most cited scientist in Central Asia with a team of Bolashakers (Hirsch Index - 30);

– expertise in the application of complex statistical methods, Big Data, machine learning in medicine;

– scientifically grounded social project carried out in accordance with international standards.

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EPIDEMIOLOGY AND ASSESSMENT OF THE RISK FACTORS FOR THE DEVELOPMENT OF CEREBRAL PALSY IN THE REPUBLIC OF KAZAKHSTAN

Priority direction: Life and Health Science.

Aim of the project: to substantiate and develop recommendations for improving a comprehensive program for the prevention of cerebral palsy in children in the prenatal and intranatal period based on an in-depth study of risk factors for the development of cerebral palsy in children.

Know-how: for the first time in Kazakhstan (within Almaty city) frequency and structure of cerebral palsy was studied for 10 years from 2006 to 2015.

We developed data model-register for the information system for storage and processing of information about patients with cerebral palsy.

We developed a set of measures for the prevention of cerebral palsy considering the genetic and intranatal factors of disease development.

Relevance and novelty: one of the most important indicators of the nation's economic, intellectual, cultural and reproductive potential is the health of children and adolescents.

In his message "Strategy" Kazakhstan-2050 "- a new political course of the established state", the President of the Republic of Kazakhstan outlined the new principles of social policy, noting that one of the priorities of state development in the coming years is the protection of children. The issue of the family was also highlighted in the Address of the President Kassym-Zhomart Tokayev to the people of Kazakhstan on September 2, 2019, "... there are children with disabilities in their care. According to official statistics more than 80,000 children with cerebral palsy are registered as disabled. The government should develop measures to increase medical and social support for children with cerebral palsy ...".

To date, more than 400 factors contributing to the development of cerebral palsy have been described, but in general, the etiology of this disease is still unknown.

The main factor in the successful fight against the disease is prevention, timely detection, early rehabilitation. It combines coordinated data on children with cerebral palsy and identifies important risk factors for the development of the disease in the prenatal, intranatal and postnatal stages of child development, trends in indicators, the relationship of different risk factors for cerebral palsy, differences in clinical practice and access to health care. It also requires the study of target groups of the population, creating a register that will allow to develop a system of preventive measures to prevent the occurrence of this pathology.

Practical significance: The developed register of patients with cerebral palsy allows to conduct epidemiological monitoring of the development of cerebral palsy, risk factors, to improve the planning and implementation of measures aimed at reducing its incidence and proper organization of care for patients. The register is of a supervisory nature and is aimed at studying the situation in specific clinical practice.

Socio-economic efficiency is the introduction of resource-saving methods of organizing medical and social care for children with cerebral palsy and reducing the cost of specialized care. The data were incorporated into practical health care to provide medical and social care to children with cerebral palsy.

Expected results:

– the structure and frequency of occurrence of various types of cerebral palsy among children in Almaty for 10 years (from 2006 to 2015).

– in Kazakhstan (within Almaty city) the most statistically important risk factors for the development of cerebral palsy in children were identified.

– an information database ((register)) of patients with cerebral palsy in the Republic of Kazakhstan (within Almaty city) was created.

– developed practical recommendations for the prevention of cerebral palsy in the prenatal and intranatal period.

Consumers: healthcare sector of the Republic of Kazakhstan.

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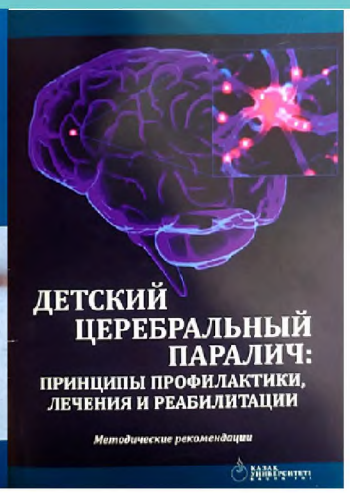

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