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«Sustainable Development Goals: Youth Policy and Innovative Technologies»

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Editors

H.A. Kadyrov

A.B. Muhammedov

S.M. Nokerov

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SERDAR BERDIMUHAMEDOW

TÜRKMENISTANYŇ DÖWLET TUGRASY

TÜRKMENISTANYŇ DÖWLET BAÝDAGY

TÜRKMENISTANYŇ
DÖWLET SENASY

Janym gurban saňa, erkana ýurdum,
Mert pederleň ruhy bardyr köňülde.
Bitarap, garaşsyz topragyň nurdur,
Baýdagyň belentdir dünýäň öňünde.

Gaýtalama:

Halkyň guran Baky beýik binasy,
Berkarar döwletim, jigerim-janym.
Başlaryň täji sen, diller senasy,
Dünýä dursun, sen dur, Türkmenistanym!

Gardaşdyr tireler, amandyr iller,
Owal-ahyr birdir biziň ganymyz.
Harasatlar almaz, syndyrmaz siller,
Nesiller döş gerip gorar şanymyz.

Gaýtalama:

Halkyň guran Baky beýik binasy,
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Başlaryň täji sen, diller senasy,
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Editors

Hydyrguly Atamyradovich Kadyrov

Aymyrat Babamyrat ogly Muhammedov

Suleyman Malikmyradovich Nokerov

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Preface

On the occasion of “Happy youth with Arkadag Serdar”, the Oguz Han Engineering and Technology University of Turkmenistan hosted an International scientific-practical conference on the topic “Sustainable Development Goals: Youth Policy and Innovative Technologies”. Famous scientists of the country, professors, students of higher educational institutions, as well as about 50 representatives of scientific institutions from 23 countries of the world took part in it. Among them are Georgia, Japan, Russia, USA, Romania, Germany, Azerbaijan, Nigeria, Kazakhstan, China, Thailand, Ethiopia, Korea, India and others. The agenda of the International scientific-practical conference included such issues as cooperation in priority areas of scientific research, the development of new technologies and their implementation, the importance of youth policy in the introduction of innovative technologies.

Within the framework of the International scientific-practical conference, an exhibition was organized, which presents the results of the research activities of researchers and students. At there were shown new developments of research and production centers of the Oguz Han Engineering and Technology University of Turkmenistan. Exhibition of research activities in such fields as artificial intelligence solutions based software, cybersecurity software, digital and smart technology, smart city system, chemical technology, materials science and new materials technology, nanomaterials, biotechnology, genetics and bioengineering, biomedical electronics, innovative economy, technology business, which are the latest achievements of modern science, made a great impression on the conference participants. It was especially noted that the fundamental changes being carried out in Turkmenistan gave a great impetus to the expansion of cooperation in important areas of advanced development of science and education. In the speeches of foreign scientists through the online digital network, comprehensive information was given on the future prospects for cooperation in the fields of science, education and innovative technologies of the country. An important place in the speeches was occupied by practical and methodological issues of the development of various sectors of the economy.

Participants of the International scientific-practical conference raised important issues aimed at the development of various fields of science and education, and provided information about their research works. The scientists also spoke about the importance of promising areas of international scientific and technical cooperation, the accumulated experience in creating high-tech industries, the use of digital technologies in life, the formation of a system of

services to solve scientific and technical problems at the regional and wider level, youth policy and innovative technologies in achieving the goals of Sustainable Development. Foreign scientists highly appreciated the research activities on the creation and implementation of innovative technologies at the Oguz Han Engineering and Technology University of Turkmenistan. It was noted that research activities carried out by scientists are of great importance in achieving sustainable development goals.

In general, the International scientific-practical conference, held at the Oguz Han Engineering and Technology University of Turkmenistan was very fruitful, the presentations were distinguished by scientific innovation, relevance and focus on achieving sustainable development goals.

We express our deep gratitude to the National Leader of the Turkmen people Scientist Arkadag and our esteemed President Arkadagly Serdar for the wide opportunities created and the successes achieved!

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Proceedings of International Scientific-Practical Conference «Sustainable Development Goals: Youth Policy and Innovative Technologies», February 15-16, 2023, Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan

FORMING ECOLOGICALLY CLEAN PRODUCTION MARKET IN TURKMENISTAN

Ayjeren Abdyrahmanova*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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Modern economic theory no longer studies two levels of the economic system - micro- and macroeconomics, as it was in the last century, but five main levels: nano- (the level of a human worker), micro-, macro-, mega- and metaeconomics. Without such an approach, provision of sustainable development is impossible, especially since it is recognized by the world community as the most important direction for further growth. Sustainable Development Goals submitted by the United Nations came into force in January, 2016. They were adopted by world leaders in September 2015 at the historic UN summit. Over the next 15 years to achieve these universal goals, countries must intensify their efforts to end poverty in all its forms, fight inequalities, and address climate and environmental challenges.

One of the directions of achieving sustainable development goals is forming and developing ecologically clean production market, or organic agriculture. According to FAO, "organic agriculture is a holistic production management system which promotes and enhances agri-ecosystem health, including biodiversity, biological cycles, and soil biological activities. It emphasizes the use of Good management practices in preference to the use of off-farm sources, taking into account that regional conditions require locally adapted systems. This is accomplished by using, where possible, agronomic, biological, and mechanical methods, as opposed to using synthetic materials, to fulfil any specific function within the system".

Organic agriculture is rapidly developing and is becoming increasingly important in the agricultural sector of countries around the world, regardless of their level of development.

Currently, organic agriculture is practiced in 190 countries, and almost 75 million hectares of agricultural land are managed organically by at least 3.3 million farmers. Organic farming is cultivated in 190 countries from the North to the South pole. According to FiBL, the global organic food market reached 120 billion euros in 2020. The countries with the largest organic markets were the United States (49.5 billion euros), Germany (15.0 billion euros) and France (12.7 billion euros). The US is the leading market (49.5 billion euros), followed by Germany (12.0 billion euros) and France (11.3 billion euros). Many major markets continue to show high growth rates.

Organic agriculture is a socio-economic and food component focused on the preservation of the environment, well-being of people and animals. Organic agriculture is considered as one of the components of the sustainable development of Turkmenistan. When defining the goals of the long-term development of the Turkmen economy in the Program "Revival of a new era of a sovereign state: the National program of socio-economic development of Turkmenistan for 2022-2052" the tasks are set to maintain a stable sustainability of development, forming and deýeloping the "green economy" while preserving natural capital. In this context the development of organic agriculture is especially important for Turkmenistan, as it can change the negative trends that have developed for decades and lay the foundations for sustainable development of rural areas.

Research have shown that the system of priority areas of the organizational and economic mechanism for the formation and sustainable development of organic farming in Turkmenistan includes: development and adoption of the regulatory framework necessary for the effective

functioning of the system of agricultural production and markets for environmentally friendly products; creation of a national system of certification, labeling and conditions for processing; organization of a centralized marketing service that ensures the promotion of products of domestic producers inside and outside the country; development of scientific support for this industry (biotechnology, ecological selection, etc.); providing consulting and information support, educational publications and programs to producers of organic products and the formation of an ecological culture of consumers; establishment of incentive measures and financial support for producers and processors.

Based on the conducted research and the study of existing experience, the following main stages for the transition of farms to organic production can be proposed.

First stage deals with monitoring and qualitative assessment of land and the natural environment to determine the possibility of conducting environmentally friendly management.

Second stage - training of heads and members of peasant (farm) enterprises on the issues of transition to a new type of production and the sale of environmentally friendly products.

Third stage deals with drawing up a business plan for the development of the economy with an economic analysis that will help to correlate costs and possible income, as well as in order to obtain state support.

Fourth stage is about certification procedure - certification of the quality management system for compliance of their products with international standards of organic agriculture and the right to use environmental labeling of goods.

In this context at the last stage, the conclusion of contracts with processing enterprises for the processing of organic raw materials and signing contracts for the sale of environmentally friendly products in the domestic and foreign markets.

Thus, in modern conditions and taking into account the current events, the transition of Turkmenistan to forming «green» economy is quite significant and relevant and can lead the country to a new round of development, occupy other economy`s niches. One of the main directions of this concept is organic production development in agriculture. Organic agriculture in Turkmenistan is just beginning its development, which in the future would allow the republic to join the dynamically developing market of organic products. Further improvement of a comprehensive legislation, provision of state support to producers, training of qualified specialists, reduction of prices to the level accessible to numerous segments of the population would significantly increase the share of organic production in the country's economy.

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ANALYSIS OF QUARTZ MINERAL IN QUARTZ BEDS OF KARAGUM USING ORGANIC SOLVENTS

Atamyrat Hojahmedovich Altyiev*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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Organic solvents with different densities are used to accurately determine the mineral content of the sand deposits of Karakum. When organic solvents of different densities are used, heavy minerals in sand samples are separated from the bottom and light minerals from the top [1]. Finally, the mineral composition of the separated heavy and light fractions is analyzed separately. It is difficult to determine the complete mineral composition without dividing it into heavy and light fractions, since many minerals are stored in the composition of the sand [2]. In this study, sand deposits (Baherden, Anau, Mane) were compared before and after dissolving in organic solvents in terms of the content of silicon element and the purity of quartz. To compare the purity of the sand samples before applying the organic solvent, each sample was first examined in an XRD diffraction analyzer and the data obtained were compared with the X-ray diffraction data of a standard pure quartz mineral. According to this XRD, it can be seen that the peaks detected by the standard quartz (SiO_2) and samples from Mane and Baherden deposits are similar. Thus, it was concluded that the purity level of quartz (SiO_2) stored in Mane and Baherden sand deposits is the same.

Before using the organic solvent, it was observed that the most amount of silicon in the sand samples was stored in the samples of Mane and Baherden deposits by comparing the peaks revealing only silicon element in the XRF spectra of the sand samples. These comparisons are a comparison of the composition of sand deposits (Mane, Baherden, Anau) before the use of organic solvents, and the samples of Mane and Baherden deposits showed the best results in terms of the purity of quartz and the retention of silicon element. In this study, the amount of elements other than silicon was also compared in the composition of the samples of sand deposits before the use of organic solvents . As can be seen from the survey, it was found that there are small amounts of iron and calcium aluminosilicates in the Anev sand deposit. Zirconium element and its compounds were observed to be higher in Baherden and Anew sand samples than in Mane sand deposits. According to the results of the research, there was no significant difference in the extraction of pure SiO_2 between Baherden sand deposit and Mane sand deposit . Investigations were continued on light fractions obtained using organic solvents of different concentrations (N,N-dimethylformamide and tetrabromoethane). By comparing the XRF spectra of the light fractions of the rock samples with only silicon-detecting peaks, it was observed that the Mane deposit sample contains large amounts of silicon. Although samples from Baherden and Mane deposits showed the same high silica retention results when compared before organic solvent application, but when comparing the light fractions obtained using organic solvent, it was observed that Mene sand retained more silicon element than Baherden sand deposit. Purity level of the light fraction of Mane sample has a higher SiO_2 purity level than the light fractions of other samples [3].

As a result, the sand samples of Mane and Baherden show the highest level of sand samples before using organic solvent, and after fractionation using organic solvents, it was

concluded that the light fraction of Mane sand sample is the most suitable for obtaining pure SiO_2.

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AMERICAN DREAM IN LITERARY WORKS

Ayna Annayeva*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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The American dream has an early root and a long history about three hundred years. Before Christopher Columbus who was funded by Spain explored this New Land, it was the land of native people. They were called Indians who had a different aspect of life. It was in 1585 when a wave of colonization started and the first colony was set up in Roanoke by British Empire. It followed the second wave of colonization which was set up in Jamestown. The common aim was to try to find somewhere that they manage to fulfill their dream [1].

From the beginning of sixteenth century a great impact of pilgrims who are also known as a Puritans immigrated to America. Plymouth was their first settlement. The invasion of puritans is one of the turning points in American history. Because they brought with them a new perspective and civilization. They were self-educated and high spirited people.

Many writers of this century like William Bradford give us magnificent scene of the events that they snapshotted from that era from his work *The history of Plymouth of Plantation*. Bradford tries to give us a glimpse of the society that challenged many difficulties Puritans faced. In addition to a fatigued voyage they faced the harshness of winter and no power to build a new nation. They expected life in America to be hard, but they did not realize how difficult it would be. The area they called New England was not very good for farming. Furthermore this the winter weather was much more fierce than weather in England or in Holland. We can understand this from the narrator's definition of winter as a sharp and violent. The second obstacle they faced was inhabitants of the land. They had many conflicts. By arriving to this land a new page was opened, a new life and initial acts of building a nation has started. Thus the common reason of leaving their sacred home was the dream [2].

We can't even consider the American Dream without Martin Luther King, Jr. He is not only the main figure of this dream but he is also the voice of this dream. His famous speech "I have a dream" at a national rally on August 28, 1963, at the Lincoln Memorial in Washington D.C. made him more noble.

America is essentially a dream, a dream as yet unfulfilled. It is a dream of a land where men of all races, of all nationalities and of all creeds can live together as brothers. The substance of the dream is expressed in this sublime word, words lifted to cosmic proportions: "We hold these truths to be self –evident, that all men are created equal, that they are endowed by their Creator with certain unalienable rights, that among these are life, liberty, and pursuit of happiness." This is the dream.

For ages America has been a self-sufficient in each field except wishes that people dreamed so many years. Many leaders performed great efforts on the great nation without problems. However, it is not so easy as mentioning. Some dreams was delayed and some come true and some disappeared like the poem of Langston Hughes's *Dream Deferred* [3]:

What happens to a dream deferred?

Does it dry up
like a raisin in the sun?
Or fester like a sore--

And then run?
Does it stink like rotten meat?
Or crust and sugar over--
like a syrupy sweet?

Maybe it just sags
like a heavy load.
Or does it explode?

Each great country has its own great history and a story to be told. Every literary piece of America contains story of a great deal of dreams. It is America which is also called a dreamland. For many ages, the people from different countries, races, religions and cultures gathered together in order to have a peaceful nation. They have had just one wish "American Dream" the pursuit of happiness. In order to gain this they struggle with many obstacles that should be overcomed, they fought in the bloody battlefield and they left their home. This is the story that should be both known and read.

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DEVELOPMENT OF SMART SYSTEM FOR REMOTE CONTROL OF FAN COIL DEVICES OF HEATING AND COOLING SYSTEMS

Azat Kakajanovich Babayev[1*], Suleyman Malikmyradovich Nokerov[2], Azat Nurnazarovich Jumanazarov[3]

[1,2,3]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*

[*]Corresponding author

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One of the key components of a smart city is the smart home system. The smart home system includes the functions of lighting, ventilation, heating and cooling, security and control systems, and etc. The uninterrupted performance of these tasks creates a comfortable living environment allowing you to save energy, ensure safety and protection [1, 2].

To develop a control system, it is required first to define its components. As a general rule, the power supply must be turned on or off from the circuit as needed to turn the equipment on or off. In usual systems, this is done by pressing a controller button on the device itself. The electric current in the circuit is controlled by the transmitted radio signal, using relays or semiconductor transistors, i.e. thyristors [3].

In the "smart" system for remote control of heating and cooling device developed at Oguz Han Engineering and Technology University of Turkmenistan, the BTA 600V thyristor was used due to its small dimensions, low power consumption, a fairly large electric current amplification factor and the ability to transmit a large amount of electricity [4-7]. An Optron MOC3063 [8] triac was used to prevent the branching of the electrical current. (Figure-1).

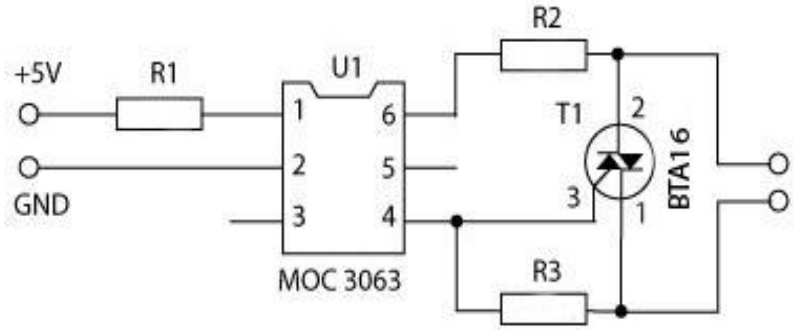
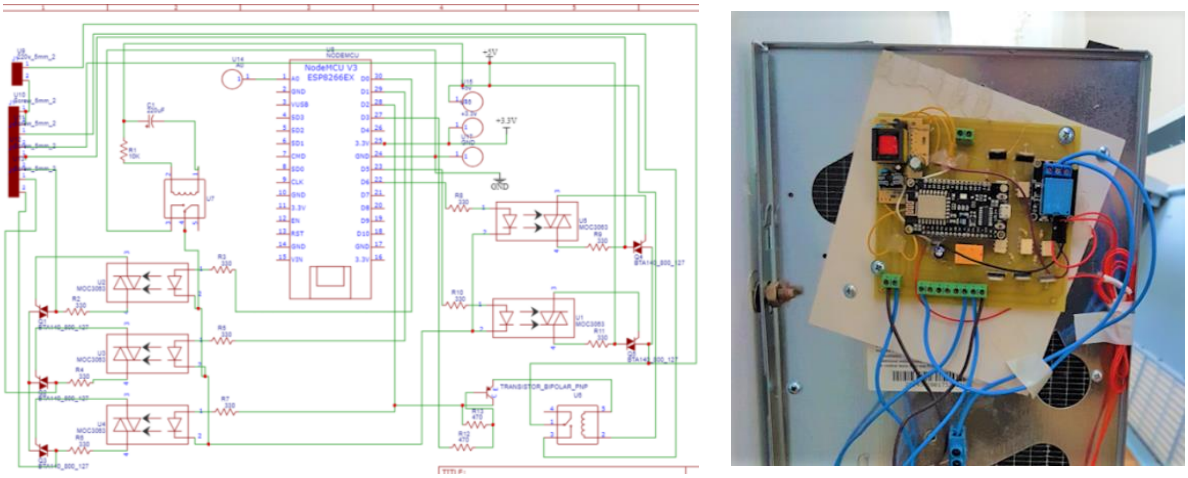


Figure 1. Connecting method of thyristor BTA 600V and triac MOC3063 to an electrical circuit

To assemble a "smart" remote control system for fan coils, an electrical circuit (figure 2 a)) was designed using the software EasyEda [9] and its PCB was developed with dimensions of $10 \times 11.5\ cm$. The developed intelligent control system for heating and cooling devices for use in smart homes is illustrated in figure 2 b).

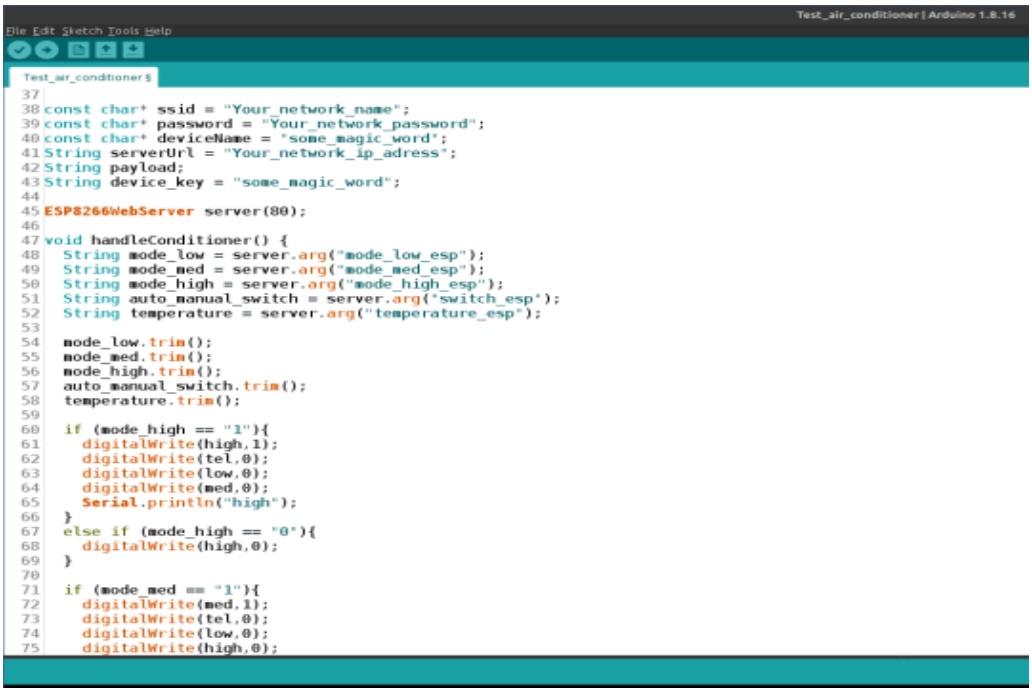
In the Arduino program (figure 3), there are two necessary functions which are called setup() and loop(). These functions need to be called or declared first; each function usually has a unique name that allows parts of the computer program to run specific commands. Similarly, we can declare variables before we get into the main part of the program. By giving the name of variables we want, the value is stored into the NodeMCU's memory to inspect some changes when the variable changes depending on our program instructions. For example, a variable with an int will hold an integer value or whole number without a decimal point. Every statement of

code usually ends with a semicolon (;). The setup function will run when the NodeMCU LoLin ESP8266 board is powered on followed by the loop function right after the setup function has been completed [10].



a) b)

Figure 2. a) – circuit diagram of the "smart" system for the fan coil controlling, b) – developed PCB board of the "smart" system for the fan coil controlling



```
const char* ssid = "Your_network_name";
const char* password = "Your_network_password";
const char* deviceName = "some_magic_word";
String serverUrl = "Your_network_ip_adress";
String payload;
String device_key = "some_magic_word";

ESP8266WebServer server(80);

void handleConditioner() {
  String mode_low = server.arg("mode_low_esp");
  String mode_med = server.arg("mode_med_esp");
  String mode_high = server.arg("mode_high_esp");
  String auto_manual_switch = server.arg("switch_esp");
  String temperature = server.arg("temperature_esp");

  mode_low.trim();
  mode_med.trim();
  mode_high.trim();
  auto_manual_switch.trim();
  temperature.trim();

  if (mode_high == "1"){
    digitalWrite(high,1);
    digitalWrite(tel,0);
    digitalWrite(low,0);
    digitalWrite(med,0);
    Serial.println("high");
  }
  else if (mode_high == "0"){
    digitalWrite(high,0);
  }

  if (mode_med == "1"){
    digitalWrite(med,1);
    digitalWrite(tel,0);
    digitalWrite(low,0);
    digitalWrite(high,0);
```

Figure 3. Setup function and pinMode function to declare the output pins in Arduino program for ESP8266

The main purpose of the proposed home automation system is to be able to read values from sensors in a smart home and send commands to adjust these values, adapting them to the specific needs of the end user. Thus, this system will help to improve the living conditions for the user and help the user to make his stay in his home more comfortable.

The developed intelligent control system for heating and cooling devices based on "smart" technologies, which is a main part of the digital economy, has been successfully tested in various conditions. The developed system can be used as a cheap alternative to smart home control systems.

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DEVELOPMENT AND IMPLEMENTATION OF ANDROID APPLICATION BASED CURTAIN CONTROL SYSTEM

Azat Kakajanovich Babayev*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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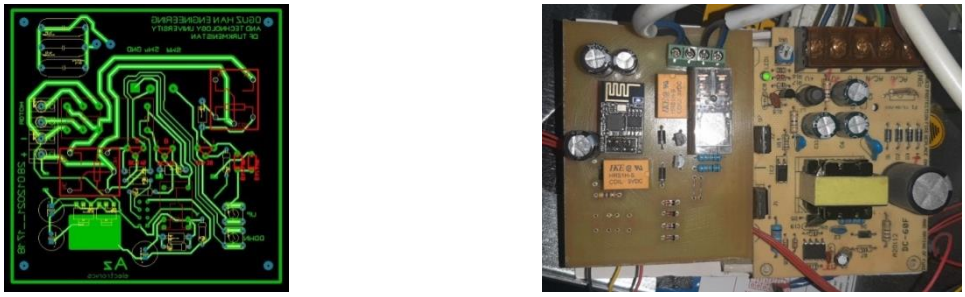
Recent days, digital and smart technologies, automated control devices are widely implemented in various fields of industry, manufacturing, agriculture and other important industries, as well as in residential buildings [1, 2]. The "Smart Home" system is aimed at improving the living conditions of residents by providing comfort and safety [3, 4]. Remote control of home electrical appliances with the help of mobile phones not only makes life convenient but also makes it easier for the elderly and disabled to control these appliances. Remote control of curtains in residential and office buildings is one of the main types of home automation [5, 6].

The first step in automating curtain management is to prepare the mechanism that will perform this task. Second, we need to develop an electronic circuit board to drive this mechanism (Figure – 1 a), 1 b)). Then we need to solve the problems of remote control of this electrical device and determine the sequence of its operation. Finally, we need to prepare controlling application to make this system work compatiblity with the smart home system.

A curtain control system is a device that supply the forward or reverse rotation of an electric motor that is connected to the curtain's drive mechanism. Electric curtain usually consist of a transmission, wheels, belt, electric motor and connecting components. Figures 2 a) and 2 b) show a simplified diagram of a curtain.

The movement of the curtain can be controlled based on the signal from the hall sensor. Based on the information provided by the magnetic sensors embedded in the belt, it will possible to determine the state of the curtain opening level. Also, the direction of rotation of the electric motor and the direction of movement of the curtain can be determined by the sequence of signals. Finally, the curtain is controlled according to the user's preferences.

In order to achieve the communication of the system components and the reliability of the transmission of signals, the system's components are transferred to a special printed circuit board. The selected schematic shape is drawn using the EasyEda software (Figure 1 (a)) and then transferred to the surface of the epoxide board (Figure 1 (b)).



a) b)

Figure 1. a) Electrical circuit of the smart curtain system, b) printed circuit board of a smart curtain system

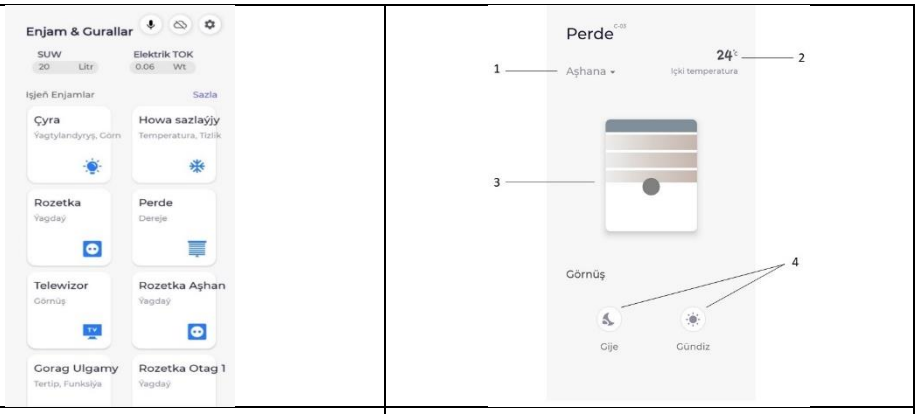
Opening or closing of the curtain is carried out by gearbox. Movement is transmitted on the curtain by means of special wheels and belts. A special wheel is attached to the end of the rotor of the actuator. The belt consists of a string of beads and rope which is also passed over the same wheel. The other end of the belt is attached to the second wheel, that is, the wheel of the curtain's axle. The wheels have special hollows like size of the beads, and the belt is firmly stretched between the wheels, the wheels can also rotate due movement of the belt.

a) b)

Figure 2. a) Interior and b) exterior view of transmission box

The main components of the curtain's movement transmission box: 12 V JGY370 electric motor; HI-LINK HLK-40M12 12 W, 3.3 A power supply; L298N electric motor control module [13,14]; ESP-01 Wi-Fi communication module.

Software of the system consists of two phases: a) The first step is to make the software for the ESP-01 microcontroller. it is carried out in Arduino IDE environment which is supplied connection between programmer and microcontroller. This environment runs in the C/C++ programming language. The ESP-01 microcontroller provides data transfer and processing between the system and the user's mobile application. b) The second stage is the prepare of a mobile application for system management. The ESP-01 allows us to make decisions based on the information coming from the microcontroller and issue the appropriate commands. This software is designed for Android and IOS operating systems (figures 3 a), b)). The main language of this application is turkmen language, and it is changeable the if necessary.



a) b)

Figure 3. a) The main windows of the mobile application, b) for managing the smart curtain system (1-place of curtain, 2- temperature, 3- opening level, 4- day mode)

In the center of the page is a curtain-shaped button, which is used to open and close the curtain. It works in real time and shows the current state of the screen. This button structure is also convenient for adjusting the curtain level (to fully or partially open and close). We can

use the "Night" and "Day" buttons at the bottom of the page to set the curtain opening and closing time. In this case, the curtain opens and closes automatically according to the schedule at the specified time.

The "smart" curtain system was developed and implemented in the Science and Production Center of the Oguz Han Innovation Complex of the Oguz han Engineering and Technologies university of Turkmenistan. The work consisted of several stages, and in each test, several important indicators were recorded, such as the consumption of electric energy, costs for the execution of the work, compliance with technical and safety regulations (table 1). As a result, the most suitable form was selected for the introduction of production.

Table 1. Some important parameters obtained from the test with the JGY370 electric motor

No	Monitored physcihal size	Result of Measurement
1	Curtain height	71 cm
2	Upward motion time	7 s
3	Downward motion time	7 s
4	Current	0.27 A
5	Work done by upward motion	47.2 kw*hour
6	Work done by downward motion	47 kw*hour

In this experiment, we have to place a "smart" curtain 2 m away from a central wireless controller located in a fixed position and analyze the quality level of the Wi-Fi connection there. The experiments were repeated several times by moving the microcontroller to a distance of 2 m in each experiment. The received signal quality level is used to indicate the ability of the system's transmitted signals to pass through obstacles such as walls and doors.

1. The "Smart" curtain system was installed in the classrooms and reading rooms of the Oguz han Engineering and Technology University of Turkmenistan.
2. The "Smart" curtain system was installed in residential buildings in the 16th stage of the development of Ashgabat city. Its components: The reliability of electrical equipment and their connecting parts is determined. Remote control and monitoring of the system via mobile phones has been established. Along with this, the security and insurance of the system was also checked.
3. At present, works are being carried out to install a "smart" curtain system in a number of residential houses and administrative buildings in the Arkadag administrative center of Ahal province, which is under construction.

Results.

1. In the prepare of the "Smart Curtain" system were used several types of the most reliable, economically viable components, which require less electrical energy.
2. A simplified system of the electrical circuit of the system has been developed.
3. Secure and convenient methods of remote system management and monitoring have been developed.
4. Insurance rules have been prepare for cases where remote control of the system is not possible. In case of need, the possibility of manual control of the system was also consider.

Conclusion. During the work, several experiments were conducted and results were obtained. Automated methods of controlling residential curtains have been developed. The discrepancies between theoretical and experimental results were also noted. Remote control of devices and remote data transfer (wireless) are performed with high precision. Along with this, the security and insurance of the system was also checked. For the first time, software for managing intelligent technologies and automated systems was prepared in the Turkmen

language. Considering the convenience and features of the smart curtain system, it can be used in residential and other office buildings.

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ANTHOCYANIN ISOLATION FROM BERBERIS TURCOMANICA FRUITS AND PREPARATION OF FOOD COLORANTS

Berdiyeva Akjagul[1*], Akmammedova Merjen[2]

[1]*Turkmen State Medical University named after Myrat Garryev, Asgabat, Turkmenistan*
[2]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*

[*]Corresponding author

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Introduction. In Turkmenistan, it is important to develop and use appropriate scientific methods of extracting eco-friendly natural food colorants from plants growing in Turkmenistan. There are more than 300 species of coloring plants in the flora of Turkmenistan. One of these plants is barberry (*Berberis turcomanica*). It contains anthocyanin pigments with powerful antioxidant property [1, 2]. Anthocyanin pigments can be mostly used in pharmaceuticals, food industry, cosmetic products etc. During the course of the work, anthocyanin pigments were extracted from barberry fruit in various ways. Useful method for high pigment yield was calculated by comparing the 219 nm standard peak using spectrophotometer. Obtained extract was dried by vacuum dryer and freeze dryer and brought to a ready state for use in food production [3, 4].

Importance. Nowadays it's significant to discover new scientific methods for isolation and effective application of environmentally friendly, natural food colorants from plants which are encountered in Turkmenistan. Moreover, this work hasn't done before in our country, also, food colorants, which are utilized in food industry of our country imported from overseas, furthermore, we have sufficient raw materials for production of food colorants [5].

Aims. To obtain pure and mixture form of natural coloring pigments by extraction method using different solvents and to get their liquid, powder, paste and gel forms for ready-to-use.

Materials and methods. The first step is gathering raw materials. As a raw material, mature berberis fruits were collected from mountain gorges of Magtymguly district in Balkan region. To avoid loss of color, berberis fruits were dried in an oven at 50^{o}C for 60 hours. Dried fruits were mechanically blended to obtain powdered form.

Powder was used for extraction. At each flask, 5 g of berberis fruit powder mixed with 20-40 ml of solvent. During experiment, four different extraction methods were examined. They are according to type of solvent (distilled water or ethanol (70%)), presence or absence of light, pH (3 or 1,5), temperature (25 or 50^{o}C). To reveal the effect of such factors to extraction efficiency 16 combinations were prepared. To achieve desired pH standard titer of nitric acid was used. Extraction time was 38 hours. Then extract was filtered through filter paper [6-10]. Excess was removed (figure 1).

Extract containing pigments was dried and powdered by two ways [11]. In first way it was dried in vacuum evaporator. In second way used freeze drier (figure 2).

Experimental part. Powdered extract analyzed by spectrophotometry. In this method 0,4 mg powder dissolved in 3,6 ml buffer. Buffer was prepared from sodium acetate and KCl. pH equaled to 1 and 3,5 by HCl. To analyze in which method amount of extracted pigments will be high, was evaluated by measuring 519 nm absorbance in spectrophotometer. By formulating of obtained data by given formula was determined the most effective extraction method (figure 3).

Quantity of anthocyanins: (*mg/ml*) = (A x MW x DF x 1000)/ε x *L*

Quantity of anthocyanins (*mg/ml*) = ((0,1708 x 433,2 *g/mol* x 10 x 1000)) / (31600 *L/cm* x 1 *cm*) = 739905,6/31600=23,4 *mg*

Here A (A519 (pH 1.0)-A519 (pH 3,5)), MW – molecular mass of anthocyanins (433,2 *g/mol*), DF – dilution factor (10), ε – disappearance coefficient (31600 *L*/*cm* -1 *mol*), L – length of cuvette (1 *cm*) [12,13].

Figure 1. Fresh and dried berberis (Berberis turcomanica) fruits and their grinding, sieving, extracting and filtering moments

Figure 2. Freeze drying and vacuum rotary evaporation of berberis extract

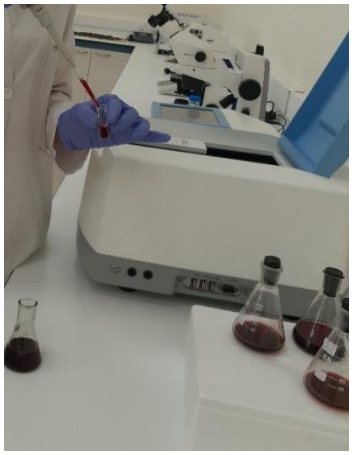

Figure 3. Spectrophotometry analysis of anthocyanin content

Result. As we can see from experiment results, high amount of anthocyanin pigments from berberis fruits was extracted when extraction carried on under the dark, at 25^{o}C and 3,5 pH value using 70% ethanol. Powdered pigments were used for spectrophotometric analysis. Quantity of anthocyanins in 70% ethanol extract was 23,4 mg/ml. Dried anthocyanin powder can be maintained in light impermeable containers for a long time and utilized for coloring food products.

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PECULIARITIES OF PREPARATION OF MEDICAL DIGITAL PLATFORM "MÄHREM ENE" FOR PREGNANT WOMEN'S UTILIZATION

Aygul Charyyeva*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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The medical field has always had an interest in the incorporation of technological advances into practice [1]. Many early adopters of mobile phones sought to evaluate their impact on clinical care as a medical reference. Throughout the early twenty-first century several studies evaluated the benefits of mobile devices as a way to increase communication, improve access to the medical literature, and streamline productivity and clinical workflow [2].

Pregnancy and delivery are considered to be one of the most important experience in women's lives, as well as an opportunity for screening their health and reinforcing healthy behaviors. As pregnant women go through various physical, psychological, and social changes, their need for information and seeking behavior often increase. While learning about healthy pregnancy, pregnant women learn that their health practices directly affect fetal health and pregnancy results [3].

Reliable source of getting this type of information definitely doctor advices. In addition, medical supervision is necessary during pregnancy and for the healthy growing up of the newborn baby.

Through using this platform, it is possible to keep track of the health of the mother and child using the potentials of the digital system.

In this software, it is possible:

– to monitor the accounts of all pregnant women and newborns registered in state, provincial, city, village policlinics;
– to track week by week pregnancy using pregnancy calendar;
– to manage medical checkups schedules and medical records;
– reminders medical checkups;
– take notes, keep diary about pregnancy symptoms, doctor visits;
– to chat online with doctor, get information and advices about healthy eating, collect and share data with doctor;
– to track calendar of newborn;
– to monitor baby's healthcare information.

In addition to the above-mentioned, this program includes a collection of children fairy tales, children songs and baby lullabies for them to go to sleep. In this platform has "Mahrem-Ene online shop" page, which will make a special contribution to the development of digital trade and digital economy, and the "Mahrem-Ene pharmacy" page, where the online pharmacy operates also includes.

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DESIGN OF A GPS BASED VEHICLE TRACKING SYSTEM

Ayjemal Jumamyradovna Ovetdiyeva*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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Currently almost of the public having an own transport, the safe of transport sector is very important for public transport. The development of satellite communication technology is easy to identify the vehicle locations. The place of the vehicle identified using Global Positioning system (GPS) and Global system mobile communication (GSM) [1]. The GPS/GSM based system is one of the most important systems, which integrate both GSM and GPS technologies. In this thesis its proposed to design an embedded system which is used for tracking and positioning of any vehicle by using GPS/GSM [2]. The current design is an embedded application, which will continuously monitor a moving vehicle and report the status of the vehicle on demand.

It is necessary to send the data received by the GSM and GPS modules connected to the Arduino to the user's phone via SMS. We need to create a program to display the coordinates from the Google map using the input data (figure-1).

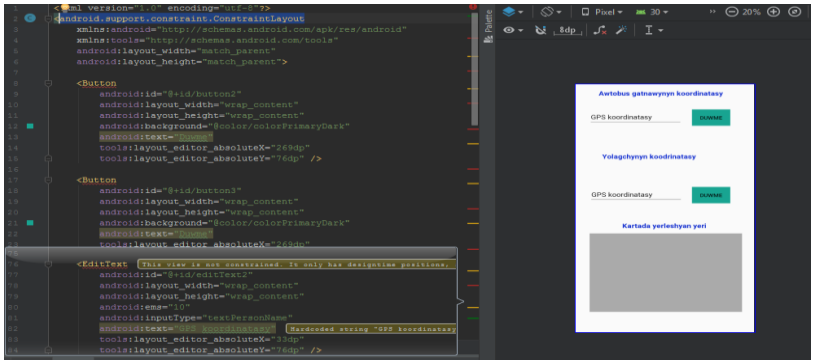

Figure 1. A window of an application developed in Android studio

Android studio platform used for it. Applications in Android studio written in Java. The user enters the phone application and clicks the button by entering the address of the vehicle route he need and his own coordinate and the distance between the vehicle and the passenger is displayed on the map [3]. The current design is an embedded application, which will continuously monitor a moving vehicle and report the status of the vehicle on demand. The proposed system operated efficiently and was cost effective. It is beneficial to vehicles that follow a specific travelling route on a daily basis. Also further enhancements like breakdown alert and over speeding alert can be made in to the system.

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DEVELOPING A PROGRAM FOR THE AUTOMATION OF TAILORING THE GARMENTS

Ayjemal Gurbanmyradovna Ussayeva[1*], Annageldi Meretmuhammedovich Orazov[2]

[1,2]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*

[*]Corresponding author

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Computer technology has a very functional structure. It currently includes the following sections: programming, system work and management, database, networking and internet, graphics and decorating, multimedia technologies, and etc.

Capabilities of computer graphics help to automate designing and drawing processes. Taking advantage of these opportunities, programs to automate the process of drawing out the original designs for garment sewing are used in large factories as well as in the shops serving for individual customers.

Before describing the functions of the program, let's look at the concepts of vector and raster graphics. In Raster graphics, images are pixels, that is, dots on the surface of a computer screen. Vector graphics, on the other hand, depict images in the form of sequences of points connected by straight or curved lines. These features determine the pros and cons of the two graphical methods. Raster images allow to capture high-quality images in a fixed size. When the screen or image is resized, the quality of the image decreases. When the Raster image is enlarged, the image appears to be clustered due to the magnification of the dots on the screen. When the image size is reduced, the image quality decreases with the loss of some pixels.

Raster images require more memory because they have to keep the color value of each pixel in memory. The graphic elements in the vector file are called objects. Each object is a unique unit of character, such as color, shape, line thickness, size, coordinates of the beginning and end points of the section. Therefore, the size of vector graphics files is significantly smaller than the size of raster files. When the dimensions of vector images are changed, their quality do not change, because the graphic objects are redrawn each time according to their properties and the new dimension [1]. It has been suggested that vector formatting for graphic images should be used in the tailoring program. The graphics in the program consist of dots and straight or curved lines that connect them.

In this article was developed a program for the automation of tailoring the garments using VisualBasic [2] programming language. In the program, the length of the lines in the shape of the tailoring, that is the distance between the two points can also be calculated by the formula. In this formula, the costume style (garment tailoring) can be automatically adjusted by entering the customer's measurements which means when the dimensions change, the shape of the tailoring also changes automatically. The postfix record of formulas was used in the program to calculate the value of the entered formula.

Computer technology, along with facilitating and accelerating work, allows to eliminate human errors (human factors) that occur at work. The main features of this program include: allows to accurately, quickly and easily enter the shape of the tailor into the computer; the entered tailoring can be customized quickly according to the dimensions of the other client; the shape of the finished tailoring can be easily transferred to the surface of the fabric through the projector; it is possible to maintain a database of tailoring shape of different models.

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A NOVEL APPROACH TO INTERFACE SENSOR AND ACTUATOR USING NI DAQ HARDWARE

Aravind Pitchai Venkataraman[1*], Khalid Ali Khan[2], Suleyman Malikmyradovich Nokerov[3], Subramanian Pitchai Venkataraman[4], Perman Ezizgulyyevich Hojagulyyev[5]

[1]*Saranathan College of Engineering, Thiruchirappalli, Tamil Nadu, India.*
[2]*Department of Electrical and Computer Engineering, Mattu University, Mettu, Ethiopia.*
[3,5]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*
[4]*M.A.M School of Engineering, Thiruchirappalli, Tamil Nadu, India.*

[*]Corresponding author
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Controller design for the interfacing of sensor and actuating element in closed loop is the most important part for process control researchers. For effective closed control system, the researchers were proposed various control algorithms and analyze the response in closed loop environment. In general, sensor output signal range is (4-20) mA and actuator input signal is (4-20) mA. In market data acquisition systems (DAQ) are available to acquire and generate signals in the range of (-10 to +10) V. It is highly need to convert the sensor output range of (4-20) mA to the range of (1-10) V to send signal to computer through DAQ and vice versa. For converting both input and output signal to the required range, the researchers have to design an appropriate electronic circuit with necessary components [1-7]. Many researchers are working directly on inbuilt real time interfaced process station. So, there is no need for them to design interfacing circuit. This lacks the researchers' knowledge in electronic circuit design for interfacing and some are interested in designing those circuit are facing problem due to availability of circuit components. This paper proposed a simple method to map the input and output signal using simple electronic circuit.

The proposed interface circuit is shown in figure 1. Illustrated circuit is not only quite simple and has the advantage of using simple laboratory level components like variable resistor (DRB), power supply, and a basic level DAQ interfacing system. For evaluating the proposed method, two cases (table 1) were considered and results were given in table 3, and table 4. Output voltage values were noted using multi-meter (DMM) or voltmeter before connecting to DAQ.

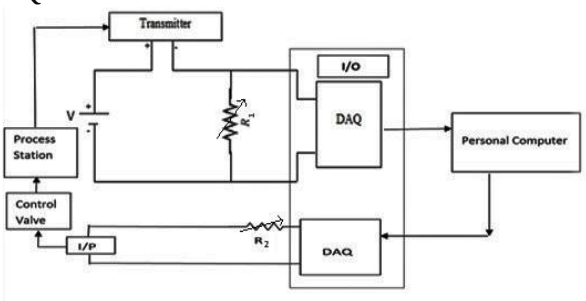

Figure 1. Interfacing of sensor and actuating element

Table 1. Values of operating parameters

Parameters	Case 1	Case 2
X_{ai}	1.28 V	1.28 V
X_{an}	5.41 V	5.41 V
X_{diff}	4.13 V	4.13 V
n	9	8
X_{div}	0.458889	0.51625
Output signal range	(1-9) V	(1-8) V

In figure 1, process variable level was measured from the process station using sensor (transmitter). Signal from computer was given to process station through current to pressure (I/P) converter and as pressure signal (3-15) was given to control valve as control signal. For

sensor needs a supply voltage of 24V, is supplied using power source (V). 'R' represents the variable resistor value.

In the case studies, National Instruments Engineering Laboratory Virtual Instrumentation Suite (NI-ELVIS) was used and it has four analog channels and two analog channels to acquire and generate electrical signals respectively. NI-ELVIS module is designed to operate in the range of (-10 to +10) V accommodating both positive and negative terminals to acquiring and generating analog signals. For the effective controller design, a researcher needs to map the input and output signal range. For this, the simple method was proposed and mapping formulas given in table 2.

Table 2. Conversion formula for real time interfacing

Iteration (i)	Step 1	Step 2	Step 3	Step 4
	$X_{a(i)}$	$X_{b(i)}$	$X_{c(i)}$	$X_{d(i)}$
1	X_{a1}	$X_{b1}=(X_{a1})-(X_{a1})$	$X_{c1}=((X_{an}-X_{ai})/n)$	$X_{d1}=(X_{c1})/(X_{c1})$
2	$X_{a2}= (X_{a1})+ X_{div}$	$X_{b2}=(X_{a2})-(X_{a1})$	$X_{c2}=((X_{c1})+(X_{an}-X_{ai})/n)$	$X_{d2}=(X_{c2})/(X_{c1})$
⋮	⋮	⋮	⋮	⋮
n	$X_{an}=(X_{a(n-1)})+ X_{div}$	$X_{bn}=(X_{an})-(X_{a1})$	$X_{cn}=((X_{c(n-1)})+(X_{an}-X_{ai})/n)$	$X_{dn}=(X_{cn})/(X_{c1})$

Where, Xa, Xb, Xc, and Xd are accordingly first, second, third and fourth step values with respect to iteration i (1, 2, 3, … n) it varies; n is the number of division we need to make for effective process, value decide based R2 value; Xa1 is initial value, (i=1); Xan is final value, (i=n); Xdiv is Xdiff divided by number of division n, (Xdiv= Xdiff/n); Xdiff is difference between initial and final values.

In this study, level sensor and control valve were considered, the full operating range was measured by supplying a water into the process tank of 1.28 V for 0 cm and 5.14 V for 90 cm liquid level. These values were obtained by varying the DRB (R1) to appropriate value, the value in the DRB is adjusted as per the requirement of the user, the objective is to convert the (4-20) mA current signal to (1-10) V. Simply by adjusting the DRB the user can get some random values. But the user must ensure the value should in the range of (1-10) V. For (0 to 100) % control valve i.e., (open to close) signal range was measured by adjusting the DRB resistance values to appropriate values and the respective voltage values were given in table 1. After obtaining the input and output signal range values, the user was framed four step formula in the LabVIEW and respective values were given in table 3, and table 4.

Table 3. Mapped values for case 1

Iteration (i)	Step 1	Step 2	Step 3	Step 4
	$X_{a(i)}$	$X_{b(i)}$	$X_{c(i)}$	$X_{d(i)}$
1	1,28	0	0,46	1
2	1,74	0,46	0,92	2
3	2,20	0,92	1,38	3
4	2,66	1,38	1,84	4
5	3,12	1,84	2,29	5
6	3,57	2,29	2,75	6
7	4,03	2,75	3,21	7
8	4,49	3,21	3,67	8
9	4,95	3,67	4,13	9
10	5,41	4,13		

Table 4. Mapped values for case 2

Iteration (i)	Step 1	Step 2	Step 3	Step 4
	$X_{a(i)}$	$X_{b(i)}$	$X_{c(i)}$	$X_{d(i)}$
1	1,28	0,00	0,52	1
2	1,80	0,52	1,03	2
3	2,31	1,03	1,55	3
4	2,83	1,55	2,07	4
5	3,35	2,07	2,58	5
6	3,86	2,58	3,10	6
7	4,38	3,10	3,61	7
8	4,89	3,61	4,13	8
9	5,41	4,13		

From the above cases 1 to 2, it can be seen that the sensor range (4-20) mA was initially converted to (1.28-5.41) V and by considering the output signal range as desired range values, the formula was framed for four different output ranges. It clearly shows that the mapping of input and output signal was done and gives a greater result in real time application. Once the formula given in table 2 was implemented, the controller design will be easy for the user to get proper closed loop results.

Based on case studies considered in this work, the proposed mapping formula is quite simple and allow the end user to design their own controllers and can be possible to check the performance of the controllers. The method can be easily adopted by many researchers and can be extended for on-line implementation for all the process.

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ANALYSIS OF CHLOROPHYLL IN PHYTOPLANKTON OF THE CASPIAN SEA

Bagul Annamyradova[1], Dovlet Annamuradov[2*]

[1,2]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*

[*]Corresponding author

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Nowadays under the leadership of our esteemed President, the study of the ecology of the Caspian Sea is one of the most important ecological tasks of Turkmenistan. It is obviously evidenced by the activities carried out at the international level on the ecology of the Caspian Sea.

The main attention in the ecological monitoring of waters is focused on phytoplankton, which have a major place in the food chain and influences the development and distribution of other organisms, and also synthesizes almost all of primary organic compounds. Phytoplankton is involved in the formation of aquatic communities, affecting the organoleptic properties of water and quality of water in general. It contains several pigments, the most important of which are considered to be chlorophyll. The period of intensive development of phytoplankton coincides with the high concentration of its pigments. This allows us to analyze phytoplankton production by chlorophyll concentration. In addition, phytoplankton have a bioindicator properties. These properties of phytoplankton make it possible to determine the quality of the aquatic ecological system.

Determination of chlorophyll concentration by spectrophotometry requires less time than determination of phytoplankton productivity than optical microscopy. Conducting a spectrophotometric analysis of phytoplankton pigments of the Caspian Sea and establishing the productivity of marine phytoplankton is considered the goal of the study.

The pigment composition of planktonic algae is very diverse. One of these pigments, chlorophyll a is the most important, and the total biomass and productivity of phytoplankton can be determined from concentration of chlorophyll a [1, 2].

The Turkmen part of the Caspian Sea shore is predominantly indented and composed of limestone. The climate of the Caspian Sea is variable, with the cold desert climate, cold semi-arid climate and humid continental climate being present in the northern portions of the Caspian Sea, while the Mediterranean climate and humid subtropical climate are present in the southern portions of the Caspian Sea.

The Caspian Sea is considered one of the lakes with high biological diversity. In the study has been studied the phytoplankton, which plays a pivotal role in the food chain of living organisms. Water samples for the study of phytoplankton were taken from 3 points in the northern part of the Turkmen coast of the Caspian Sea, more precisely from Avaza (39.97° N, 52.85° E), Soymonov Bay (40.01° N, 52.90° E) and Karshi (40.75° N, 52.85° E) points. These points were chosen to determine the impact of tourism on biodiversity in the Avaza National Tourist Zone and nearby areas.

Water samples for the study of phytoplankton were taken using sampling methods for the study of water (Ари Мякеля, Сари Антикайнен, Ирма Мякинен, Ярмо Кивинен & Туула Леппянен) and transported to the laboratory.

Chlorophyll concentration can be calculated using spectrophotometry. Currently, the concentration of photosynthetic pigments (Chlorophyll a – Chl a) is determined by the spectrophotometric method (N.M. Mineeva) is used as the value of phytoplankton biomass.

Analysis of chlorophyll requires immediate implementation. Because it is very sensitive to light, air oxygen and high temperatures. The concentration of chlorophyll is measured at the appropriate wavelengths using a spectrophotometer by preparing a liquid (extract) according to a special technique [3].

Calculation was conducted according to the equation of Jeffrey and Humphrey. When calculated according to this formula, the concentration of chlorophyll a (Chl a) does not differ from the concentration of phaeopigment a.

CE,a=11.85*(Abs 664-Abs 750)-1.54*(Abs 647-Abs 750)-0.08*(Abs 630-Abs 750)

CE,b=21.03*(Abs 647-Abs 750)-5.43*(Abs 664-Abs 750)-2.66*(Abs 630-Abs 750)

CE,c=24.52*(Abs 630-Abs 750)-7.6*(Abs 647-Abs 750)-1.67*(Abs 664-Abs 750)

Spectrophotometric analysis of phytoplankton were carried out in water samples taken in the spring in the Avaza National Tourist Zone, Soymonov Bay and Karshi points in the Caspian Sea (Figure 1).

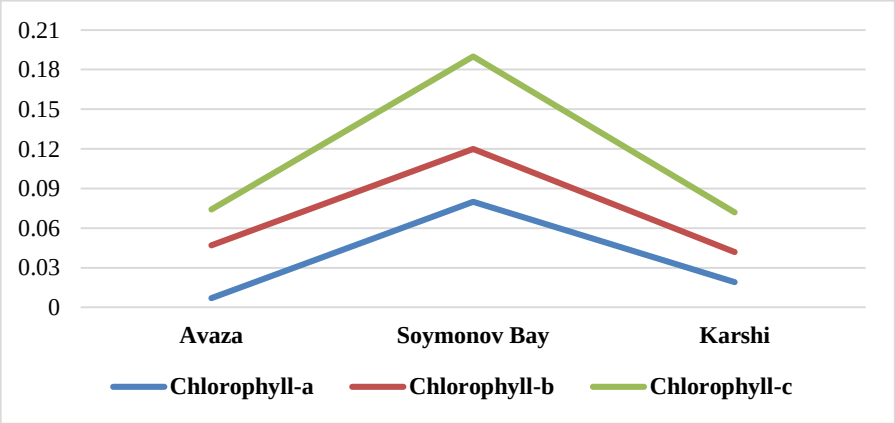

Figure 1. Spectrophotometric analysis of phytoplankton in water samples taken in spring

Spectrophotometric analysis of phytoplankton were carried out in water samples taken in autumn in the national tourist zone Avaza, Soimonov Bay and Karshi points in the Caspian Sea (Figure 2).

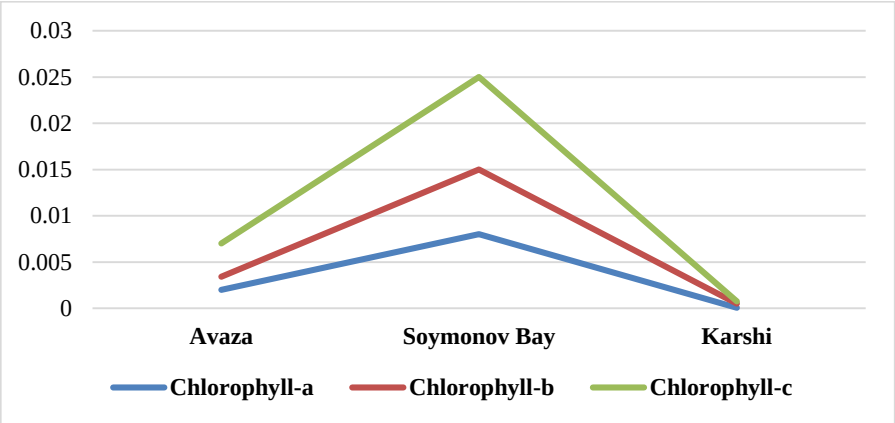

Figure 2. Spectrophotometric analysis of phytoplankton in water samples taken in autumn

Obtained data indicate the concentration of chlorophyll at a selected point in the water body. The spatial distribution of phytoplankton in the northern part of the Turkmen coast of the Caspian Sea was uneven and was determined by the quantitative change in chlorophyll a (Chl

a). Throughout the study, a significant influence of tourism on the amount of chlorophyll a was revealed. Due to increasing impact of tourism, the structural change of phytoplankton is accelerated, the aquatic ecosystem becomes eutrophic and the trophic status increases. As a consequence of anthropogenic eutrophication, phytoplankton biodiversity increases in the initial stages, but decreases at a high level of eutrophication.

The analysis of photosynthetic pigments of phytoplankton of the Caspian Sea was carried out in spring and autumn. Studies have shown that levels of chlorophyll concentration are high in the Avaza National Tourist Zone, in the Soymonov Bay in autumn and at the Karshi point in spring. It was determined that the productivity of phytoplankton increases in the Avaza National Tourist Zone, in the Soymonov Bay - in autumn and spring at the point of Karshi [5].

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THE FUTURE OF INFORMATION SCIENCE

Bagul Atabayeva*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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The future of information science is a rapidly evolving field that is shaping how individuals, organizations, and society as a whole interact with and use information. The growing amount of data being generated and the integration of cutting-edge technologies such as artificial intelligence and the Internet of Things (IoT) are driving the need for new and innovative solutions for data management and analysis.

Advancements in data generation are providing new opportunities for organizations to collect, store, and process larger and more complex data sets. This growth in data volume presents both opportunities and challenges for information science, as the need for more sophisticated and efficient systems for data management and analysis becomes increasingly important.

One of key areas of focus the future of information science will be the integration of artificial intelligence (AI) and machine learning technologies. The use of these technologies will enable organizations to gain deeper insights into the data they collect, leading to more accurate predictions and decision-making. In addition, the development of sophisticated algorithms will enable organizations to process and analyse larger and more complex data sets with greater efficiency. AI and machine learning technologies will also play a crucial role in the development of new and innovative solutions for data management and analysis.

Improved data management and analysis will be a key area of focus for the future of information science. The integration of artificial intelligence and machine learning technologies will enable organizations to gain deeper insights into the data they collect, leading to more accurate predictions and decision-making. In addition, the development of sophisticated algorithms will enable organizations to process and analyse larger and more complex data sets with greater efficiency.

Another important aspect of the future of information science will be a focus on privacy and security. With the growing amount of sensitive information being generated and stored, it is increasingly important to ensure that this information is handled and stored securely. Information science will play a critical role in developing new technologies and methods for protecting privacy and ensuring the secure handling of sensitive information.

The integration of new technologies, such as the Internet of Things (IoT), will bring new opportunities for innovation and growth in the field of information science. IoT involves the integration of sensors, devices, and systems to create a network of connected “smart” objects, which will generate vast amounts of data from a wide range of courses. This integration will require new and innovative solutions for data management and analysis, as well as increased attention to privacy and security concerns. To support this demand, information science will play a critical role in the development of new data analytics tools and methodologies.

In conclusion, the future of information science is an exciting and dynamic field that is poised to bring significant advancements in the way information is generated, processed, stored, and analysed. With new technologies and solutions for data management and analysis, as well as a focus on privacy and security, the future of information science is poised to play a critical role in shaping the technological landscape and supporting the needs of individuals, organizations, and society as a whole.

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TECHNOLOGY OF MARBLE PRODUCTION WITH POLYESTER-REINFORCED IN TURKMENISTAN

Batyr Atdayev[1*], Ikram Intizarov[2], Mezil Mezilov[3]

[1,2]Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.
[3]Turkmen State Architecture and Construction Institute, Ashgabat, Turkmenistan.

[*]Corresponding author

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Artificial marble is also known as cultured, composite, synthetic, or engineered marble. Cultured or synthetic marble is a cheaper alternative for real marble. It is composite of resins like polyester and synthetic fillers or mineral mixture. Quartz, limestone, dolomite, silica, granite in the form of gravel or sand are used as fillers. Artificial marble is mainly used as tiles, interior construction and small scale architecture and design products. The desirable properties in an artificial marble are high mechanical strength, excellent weather resistance, flexural strength, improved surface hardness, heat resistance, stain resistance and an excellent processability.

As we know, our capital Ashgabat was entered into the Guinness Book of World Records on May 25, 2013 as the city with the largest concentration of white marble buildings. Today, natural marble stones are widely used in construction in our country. Marble stones, which have decorative features, are always considered a valuable material in construction. The value of the material and the limited resources of natural marble make it one of the most important problems to develop an economically viable method of using it for interior and exterior decoration. The main goal of the scientific work is to establish the production of artificial marble that can replace imported products using local raw materials. Artificial marble is a material similar to natural marble obtained by mixing cement, plaster, or resin-based polymer materials with fillers (marble, calcite, gravel, travertine, quartz, etc.). A lot of scientific work on the production of artificial marble is currently being conducted in Turkmenistan. In the preparation of artificial marble, two components binders and fillers are used. Seven samples of artificial marbles with different fillers were prepared in the scientific research work. Prepared samples are divided into TDS-9479-2011 “Rock blocks for the manufacture of roofing, architectural construction, monuments and other products. Technical specifications", TDS-9480-2012 "Coating tiles from natural stones. Physical and mechanical tests were carried out in accordance with the requirements of "Technical conditions". Currently, this scientific work is being patented and a literature review is being conducted on other types of artificial marble.

A number of scientific works are studied at the "Green Chemistry" scientific production center operating within the framework of the Oguz Han University of Engineering and Technology of Turkmenistan and aims to implement the learned scientific works. A clear example of this is the technology of obtaining polyester-reinforced artificial marble in Turkmenistan, which is one of the scientific activities carried out in the scientific production center . The main goal of this scientific work is to establish artificial marble production that can replace imported products using local raw materials.

Scientific work is carried out within the framework of the Sustainable Development Goals Industrialization, Innovation and Infrastructure (Goal 9) and Sustainable Cities and Settlements (Goal 11). The National Program of Social and Economic Development of Turkmenistan until 2030 and the National Program of Social and Economic Development of the President of

Turkmenistan in 2019-2025 are aimed at achieving sustainable development and set the consistent implementation of Sustainable Development Goals as the main priority.

Based on the experiments, samples were prepared and tests were carried out to determine their physical and mechanical properties. The mechanical and physical properties of artificial marble depend on the resin and filler content.

Establishing artificial marble production using local raw materials and replacing imported products will be of great importance in the sustainable economic development of the country.

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MODELING THE CONVERSION PROCESS OF SYNGAS TO METHANOL PRODUCTION

Begench Charyyevich Garahanov*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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Nowadays, when digital technologies are actively developing, the use of computer developments in existing industrial enterprises and production facilities is becoming more and more important. As a result, the relevance of research in the field of creating "Digital twins of industrial production processes" is increasing, which began in the first decade of the 21st century.

The relevance of this work can be justified by its scientific and practical interest. Scientific interest is supported by the fact that, despite the innovation and development of technology in the field of digital twins, the topic of using simulators that can help familiarize students with this direction to the methods of their practical work, remains understudied. As little-studied digital twins themselves, which appeared relatively recently - in the early 2000s [1].

The practical importance of the work lies in the fact that computer simulators created on the basis of digital twins, allow you to simulate a variety of situations that may occur in production. Location of equipment, movement of workers, conducting repair operations, the reaction of devices to changes in various indicators, emergencies - all this can be considered with the help of digital twins [2].

The work aims to develop a virtual space for a digital twin chemical methanol production. Especially, to create a static and dynamic model of this production, the development of its master plan, and building a unified technological line in the virtual space. It is supposed that the structure, according to which the modules will be built, will be universal and can be applied in the future to other digital twins.

In this work, we will investigate the simulation technology of synthesis gas and methanol production processes, as well as methods and means of modeling various chemical-technological apparatuses.

During the research, the intuitive process modeling program Honeywell's UniSim® Design Suite will be used, which helps engineers to create models for plant design, using which the model of synthesis gas production processes in static and dynamic modes will be built and an automated control system of this process will be developed.

In conclusion, with the help of such virtual simulators based on digital twins of real production facilities, employees can fully master the essence of all running processes, get acquainted with the technology, as well as acquire the appropriate qualification, without any threat to the serviceability of equipment and health of employees. Also, the detailed study of such digital twins allows us to work out the qualitative and quantitative characteristics of production, its efficiency, and costs. The creation of digital twins contributes to adequate management of production processes and solving typical problems of enterprises.

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ANALYSIS OF ELECTROMAGNETIC COMPATIBILITY GEOSTATIONARY COMMUNICATIONS SATELLITES TURKMENALEM 52.E AND BELINTERSAT-1

Chary Seyitnepesov[1], Guvanch Allamuradov[2*]

[1]*Institute of Telecommunications and Informatics of Turkmenistan, Ashgabat, Turkmenistan.*
[2]*Space Administration of "Turkmenaragatnashyk" Agency, Ashgabat, Turkmenistan.*

[*]Corresponding author
DoI: https://doi.org/10.5281/zenodo.7776869

The satellite orbit (GSO) is unique in that a satellite located on it will appear fixed with respect to the rotating Earth. At this altitude a single satellite is able to provide communication services over a very wide area, with approximately 40% of the Earth's surface visible. The line of this orbit in the sky is called the GSO arc, and positions or slots, defined by the longitude of the GSO satellite, are in great demand. If satellites are located too close together, they can cause harmful interference. For this reason the GSO arc is considered a limited resource, and there are specific requirements in international regulations to ensure it is used in an efficient and equitable manner. A GSO system comprises two paths, an uplink and a downlink [1]. Where there are two GSO systems, there can be four potential interference paths as identified in Figure 1.

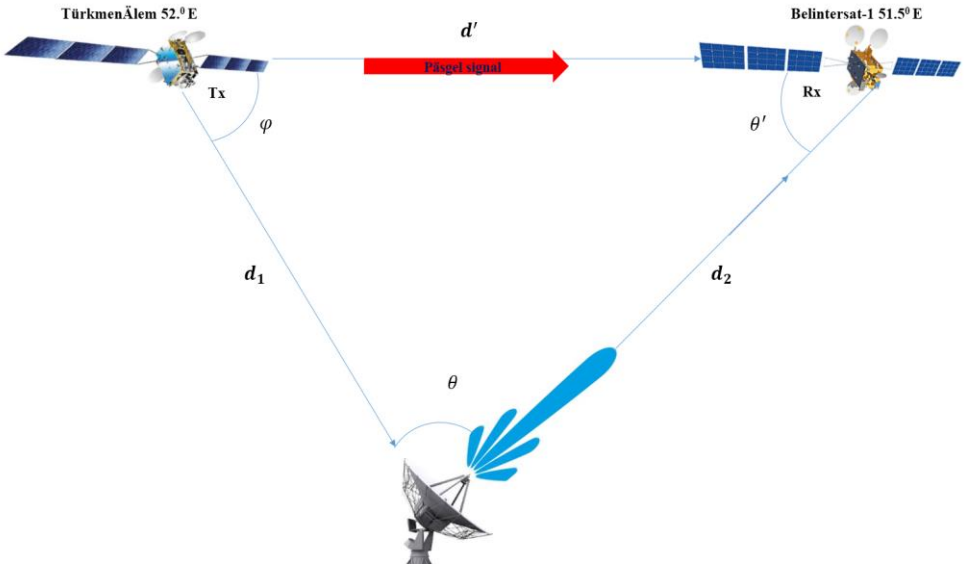

Figure 1. Potential interference paths to consider between GSO satellite systems

The standard GSO satellite coordination process involves the first of these cases and has two stages: 1. The coordination trigger, by which it is identified where further analysis is required, involves checking if there is frequency overlap (hence non-co-frequency analysis is typically not required) and one of: a. Difference in GSO longitude between two systems is less than the coordination arc defined for the bands involved. b. T(DT/T) > 6%. 2. Detailed coordination.

The coordination arc is defined in the RR Appendix 5 and varies between ±70 and ±160 depending upon frequency band. In some bands the coordination arc is the default method

unless an administration requests it be included in the coordination process based upon a DT/T calculation [2].

In the work, the electromagnetic compatibility analysis of "TurkmenElem 520 E" and "Belintersat-1" geostationary communication satellites located at 52 and 51.50 degrees, as well as communication satellites operating in the same Ku radio frequency band in different directions, was conducted. TurkmenElem 52 E uses the radio frequency for transmission (TX) and Belintersat-1 uses the same radio frequency for reception (RX). The power of the interfering signal of the "TurkmenElem 52 E" satellite to the "Belintersat-1" satellite is determined based on the following expression, dBWt,

$$I' = P'_{st} + G'(\phi)_{st} + G(\theta')_{sr} - L'_t$$

As a criterion of the permissible interference signal, the ratio of the signal of the receiving radio system to the power of the interference signal at the input is taken, dB. The loss signal power N can be written as dBWt.

$$N = k + 10(lgT_s + lgB_{wup})$$

During the study, an analysis of the electromagnetic compatibility of communication satellites “TurkmenAlem 52 E” and “Belintersat-1” operating in different directions in the same radio frequency range Ku was carried out. According to the results of the study, the level of interference caused by the Turkmenel 52 E satellite to the Belintersat-1 satellite is “71.5 %”. This shows that the electromagnetic compatibility between the systems exceeds the “6%” standard of the limit values set by the International Telecommunication Organization [3]. The results convincingly indicate the need for technical measures to ensure the electromagnetic compatibility of communication satellites. An increase in the ratio of interference signals to noise signals leads to a deterioration in the behavior of the useful signal in the receiver. This can lead to increased errors, reduced image quality or distortion of audio data, and in some cases communication may be completely lost [4].

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MODERN METHODS OF STUDYING ELECTRIC AND MAGNETIC FIELD PROPERTIES OF LIQUID CRYSTAL ALLOY COMPOUNDS

Cristina Cirtoaje[1*], Saparov Bagtyyar[2]

[1]*University Politehnica of Bucharest, Bucharest, Romania.*
[2]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*

[*]Corresponding author

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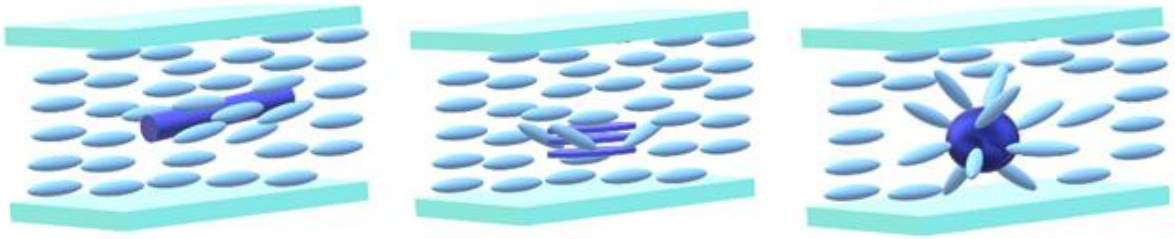
New composite materials obtained by mixing liquid crystals with various microparticles and nanoparticles have become one of the important materials in biomedicine and modern display technologies, including the chemical industry. The use of liquid crystals mixed with dyes, ferromagnetic and ferroelectric particles, carbon-based nanoparticles, etc. on the screens of televisions, computers, and mobile phones helps to capture high-resolution images in a short time [1].

Depending on the size and concentration of the mixture of liquid crystals and nanoparticles, the mechanical (elasticity), electro-optical, and magneto-optical properties of the mixture change under the influence of external electric and magnetic fields and laser rays [2].

When a mixture of liquid crystals is exposed to an external field, the molecules change the direction of their axes in a direction parallel to the field's lines of force. This transition is called the Fréedericksz transition [3]. These transition conditions were determined depending on the intensity of the laser beam applied to the sample and the variation of the external electric or magnetic field. Experiments are also carried out in mixing liquid crystals with various microparticles and nanoparticles.

Due to their soft nature and relatively weak anchoring forces between molecules, the liquid crystal composites can be hardly investigated by any microscopy techniques such as atomic force microscopy (AFM). Thus we can only obtain most part of the information from indirect measurements such as optical transmission, nonlinear optical effects induced by external fields or temperature gradients, Freedericksz transitions or dynamic behavior under any external stimuli.

Figure 1 indicates the orientation of liquid crystals on different nanoparticle's surface.



a) b) c)

Figure 1. LC molecules alignment on nanoparticle's surface: a) carbon nanotube, b) graphene, c) quantum dot

Mixtures of liquid crystals with single-walled carbon nanotubes are used in liquid crystal media. The dependence of the Fréedericksz transition conditions and relaxation times of this

mixture on the variation of the external impact area, particle size, and concentration was studied [1].

Also, the physical properties of multi-walled carbon nanotubes [3], ferroelectric nanoparticles [4], $CoFe_2O_4$ ferromagnetic nanoparticles [5] or nanodiamonds [6], etc. were studied. Experiments were carried out with different sizes and concentrations of these particles.

Currently, in addition to the use of liquid crystals and silver nanoparticles in bio-imaging and quantum computing [7], considering their future use in various fields, the possibilities of studying the properties of liquid crystals through research are great.

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METHODS FOR MAKING ECOLOGICAL SAND-POLYMER PLATES

Dovlet Annamuradov*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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Rational use of natural resources, and prevention of environmental pollution, especially waste processing are one of the main issues in ensuring environmental well-being in the period of the Revival of the Powerful state.

Nowadays the high demand for polymer products in the world causes the production of polymer products at a higher level. Mass production of these products leads to an increase in the amount of polymer waste. The biodegradation of polymer products continues for a million years. Therefore, the development of new, environmentally friendly materials and products using polymer waste is important for ensuring the well-being of the environment.

The purpose of scientific research is to study the physicochemical properties of polymer products, obtain economically and environmentally friendly products from their waste and prepare important suggestions for the national economy.

The physicochemical properties of polymer products make it possible to obtain economical and environmentally friendly sand-polymer products from their waste. Sand-polymer products are a mixture of solid polymer waste and sand. Sand polymer products are permanent and chemically stable compared to conventional concrete plates. Because the polymers within sand polymer products give them strength, flexibility, durability, and high aesthetic properties. Sand polymer products can be used in the construction industry for the production of roofing material (tiles), plates, well materials, as well cover used in the regulation and management of sewage networks. In consequence, establishing the production of sand polymer products in Turkmenistan will provide a great opportunity to ensure environmental well-being. Sand fractions less than 3 mm, single or secondary processing, crushed polymers (plastics), inorganic dyes, and stabilizers are necessary for the production of sand-polymer plates. Chromium can be used to make sand-polymer plates green, titanium to white, and iron oxides to coral, orange, or brown. For the manufacture of sand-polymer plates, the sand is first cleaned, then mixed with crushed polymers, and processed on special equipment. To perform this process, a press, an extruder, and a concrete mixer are also used. After heating and compression of this material, its moisture resistance increases, and friction decreases [1, 2].

The research was carried out at three different concentrations in the Ecological Biotechnology research center of the Oguz Han Engineering and the Technology University of Turkmenistan according to the methodology and was obtained from sand polymer plates.

The weight of sand polymer plates depends on their dimensions, composition, and manufacturing technology. Based on experiments, the weight of sand-polymer plates is 0.9-0.95 kg. Their thickness was 60-65 mm, and the diameter was 90 mm.

Based on the experiments, the obtained products were tested for resistance to compression and water permeability. According to the results of the experiments, it was found that the best results were obtained by sand-polymer plates obtained from a 1:3 mixture of polyethylene and crushed particles of plastic waste and sand.

The study was carried out in laboratory conditions and the following results were obtained:

– sand-polymer plates are competitive in the world market, and considers a demanded building product with high economic benefits and low material costs;

– the importance of using polymer waste as a filler not only with sand but also with other building materials has been studied;

– based on the conducted research, it was found that sand-polymer plates produced without cement and water with a ratio of 1:3, are comfortable and durable, meet all requirements, and are an environmentally friendly, cost-effective product;

– sand-polymer plates can be installed on bases consisting of sand, sand-gravel mortar, and concrete;

– sand-polymer products, which are also beautiful in decoration, can be used in house building too.

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THE ROLE OF ANDRAGOGICAL APPROACH TO TEACHING ENGLISH TO ENGINEERS AND TECHNICIANS

Dunya Hydyrova*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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In the Era of Revival of the New Epoch of the Powerful State under the visionary and effective leadership of our Esteemed President, education, science, innovation and production systems are being developed and their connection is constantly being strengthened in a coordinated manner with the participation of young generation. Declaring 2023 as the year of "Happy Youth with Arkadag Serdar" is also a clear evidence of the great attention paid to the young generation in our country. For this reason training of high-level young specialists, by using their intellectual level, talent, skills, knowledge, science, culture and other abilities properly and fully is one of the primary tasks of instructors and teachers in higher educational institutions.

In accordance with the language policy, the National Programs and Concepts that have been adopted recently in our country, English is one of the main foreign languages to be studied at all educational institutions. Therefore, improving the proficiency of English has become the major requirement for high quality education [1]. It is especially true for Oguz han Engineering and Technology University of Turkmenistan since English is medium of instructions as well as an essential tool for communication at university. The students of this higher educational institution are expected to become competent specialists, who are able to raise their qualification using materials in foreign language and communicating with their colleagues from abroad.

In this perspective, to promote English language teaching the instructor has to choose proper methods and approaches so he/she can address to the educational needs of the engineering students. Traditionally, there are two types of teaching approaches. These are andragogy and pedagogy approaches. The word andragogy stems from the Greek word andragogos which means "teaching adults." Andragogy is defined as the art and science of helping adults to learn by Knowles [2], while pedagogy is used for young learners. Seen from their age, students at university are categorized into adult learners. Therefore, this paper aims to share experience in the implementation of andragogical approach to teaching ESP at Oguz han Engineering and Technology University of Turkmenistan.

Although the early concepts on adult education go back to the early 1800s, the concept and name "andragogy" was popularized by Malcom Knowles to distinguish adult education from pedagogy or child education. Knowles [2] initially based his andragogical model on four pillars: (a) student's self-directed learning; (b) students' accumulated and growing experience for learning; (c) students' readiness to learn; (d) shift from subject-centered to performance-centered.

The concept of self-directed learning is a form of study in which students have a primary responsibility for planning, carrying out and conducting their own learning activities. By taking control of their own learning activities students are able to develop self-esteem and self-confidence. In this approach the teacher acts as the facilitator who considers learners as capable of self-direction and self-development [3]. Students are also able to assess their needs and focus on relevant skills which they have to improve.

With regard to the concept of students' accumulated and growing experience for learning in which they are treated as someone who already has prior knowledge, will help them to use their knowledge and experience in context with the real-world problems that they will have to solve. This assumption relies on the idea that adults have more experiences than children to apply information or draw from it. Thus, effective learning will draw upon these experiences. It also focuses on motivation of students to become lifelong learners.

Based on the assumption of readiness to learn, students improve their language skills through a field that is already known and relevant to them. This means that they can use what they learn in the ESP classes right away in their work and studies [4]. It also enables them to use the language they know to learn even more, since their interest in their field or major will motivate them to interact with various scopes of learning materials.

While subject-centered ESP class focuses on the content of the curriculum, performance-centered approach focuses on the students' participation. They are able to design, manage, and lead their own learning styles based on personal needs and interests. This approach also enhances problem-solving skill and critical thinking in students which can be result in boosting student engagement, accelerating learning and improving content retention.

Taking into consideration above mentioned, it can be concluded that andragogical approach builds interactive learning atmosphere for the adult learner, especially in teaching ESP. When ESP classes are conducted in this approach they must provide practical exercises, project works, role-plays, case studies, addressing specific real-world problems. Effective use of group discussions and group work is essential. Technical vocabulary can be taught and revised using crosswords, word searches and puzzles, and communication activities can take the form of games. In adult learning situations, teaching can focus more on training. Training activities can be less formal, and the role of andragogical approach is to move away from the theoretical knowledge and into a practical application of the knowledge.

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INNOVATIVE METHODS OF SELF-STUDYING FOREIGN LANGUAGES THROUGH A MULTILINGUAL VISUAL DICTIONARY

Lachyn Yusupovna Gurdova[1*], Dilnoza Mamutniyazova[2]

[1,2]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*

[*]Corresponding author

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Language is the most direct connection to other cultures. Being able to communicate in another language exposes us to and fosters an appreciation for the traditions, arts, history of the people associated with that language. The many cognitive benefits of learning languages are undeniable. People who speak more than one language have improved memory, problem-solving and critical-thinking skills, enhanced concentration, ability to multitask, and better listening skills. Nowadays, Multilingualism has become more than just “important”. Knowing a foreign language has evolved to be extremely beneficial. On the other hand, learning a foreign language is tough and involves a lot of mental exercise. On the individual level, it improves personality and increases your sense of self-worth. Vocabulary is the foundation of language. It's the raw building blocks that we can use to express our thoughts and ideas, share information, understand others and grow personal relationships. As a result, we have the opportunity to understand the world from the respective of another culture and gain a greater appreciation of human society in all its diversity. Therefore, the importance of second language learning is gain reinforced [1].

The importance of Visual dictionary. A visual dictionary is a dictionary that primarily uses pictures to illustrate the meaning of words. Visual dictionaries are often organized by themes, instead of being an alphabetical list of words. For each theme, an image is labeled with the correct word to identify each component of the item in question. Visual dictionaries can be monolingual or multilingual, providing the names of items in several languages. An index of all defined words is usually included to assist finding the correct illustration that defines the word. The Visual Dictionary is designed to help you find the right word at a glance. When you know what something looks like but not what it's called, or when you know the word but can't picture the object, The Visual Dictionary has the answer. In a quick look, you can match the word to the image [2].

Multilingual visual dictionary presents a large range of useful current vocabulary. The dictionary is divided thematically, includes 650 pages, 3 big chapters, 4 languages and covers most aspects of the everyday world in detail. You will also find additional words and phrases for conversational use and for extending your vocabulary. The Visual Dictionary is more than a reliable resource of meticulously labeled images-it innovates by combining dictionary-scale definitions with exceptional illustrations, making it the most complete dictionary. The Visual Dictionary is an indispensable visual reference that goes beyond object identification to answer questions about function, significance and purpose. Ideal for teachers, parents, writers, translators and students of all skill levels, it helps the user understand a phenomenon and quickly grasp the meaning of a term, the characteristics of an object or simply learn something new [3].

Multilingual visual dictionary mobile application for language learners is a versatile specialized application that makes learning foreign languages easy, designed with high quality and developed with modern innovative technologies. This smartphone application aims to encourage the student to learn to speak as soon as possible. Knowing the vocabulary, set

phrases, and grammar helps to keep a conversation going in no time. The program is mainly intended for learners of all ages and will help to memorize words in different languages permanently or in the long term. The process of learning a new word through the program is carried out by looking at a picture of the word, listening, reading the spelling of the word (transcription), giving an example of the word in a sentence, and testing it in writing and in a test. A word successfully tested at three different times and in three different places is considered learned or mastered by the learner [4].

This guidebook is created for everyone that explore ideas and nurture curiosity about the world we live in. Multilingual Visual Dictionary has been designed to give you easy access to the vocabulary you need. It is a valuable vocabulary building resource and language teaching tool that is perfect for work, school, university, self-study, travel or simply browsing. There is a Visual Dictionary for every age… for every need… for everyone. You can find words organized themes or individual objects. You can see thousands of highly realistic illustrations and detailed diagrams. You can discover a visual world of information of immense scope and depth, around major subject fields. This Visual Dictionary contains a rich, detailed vocabulary, carefully developed from systematic and comparative terminology research. Extreme care is taken to ensure the accuracy of every word. The perfect tool to carry around when learning a new language.

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TISSUE CULTURE STUDIES ON VALUABLE PLANTS

Dovletmyrat Porrykov[1*], Mamedov Didar[2]

[1,2]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*

[*]Corresponding author

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With teachers and student groups at the scientific-manufacturing center of Biotechnology and genetics scientific works are performed on micropropagation of plants. Our purpose is micropropagation of rarely encountered medicinal herbs in Turkmenistan (*Glycyrrhiza glabra*, *Mandragora turcomanica*), agriculturally valuable, high yielding plant breeds (tomato, potato, cucumber), decorative plants (*Paulownia sp.*), rarely encountered plants (*Pistachio badhyziensis*) by obtaining their callus or cell biomass [1].

Recent years one of the main methods of agricultural biotechnology, tissue culture took the main role to grow plants in agriculture. Plant tissue culture is a cultivation of plant fragments obtained from any parts of plant in vitro pure medium, for economical or scientific purposes. Thus, by realization of new plant regeneration, whole, complete plant can be obtained [2, 3].

Nowadays, in many countries of the world, to solve the problems such as development of agricultural field, eradication of nutrient deficiency, protection of plants from diseases, prevention of loss of high-yield quality, obtaining pure plant biomass for pharmaceutical industry, maintaining plant types which are rarely encountered and under extinct depend on usage of in vitro plant growth method, that is plant tissue culture [4, 5].

Projects consist of several stages and each stage has been repeated many times: preparation of culture medium; preparation of required equipment; obtaining of samples and purification; planting explants on the culture media; growth controlling.

Based to the experiments have done during research have been developed general protocol and optimal ratio of growth stimulants for each plant species (*Figure 1-3*).

For tomato plant it constitutes taking explants from apical buds and stem nodes, sterilizing them sequentially by hypochlorite (1 *min*), ethanol (30 *sec*) and peroxide (4 *min*), then cultivating into MS growth medium by adding growth stimulants (16/8 light/dark regime, 25^0C, 60-65% humidity). Obtained calluses stimulated by phytohormones for taking seedlings (*figure 4-6*). Phytohormone ratio was 1,664 *mg/L* IBA and 3,68 *mg/L* kinetine respectively [6] (*Table 1*).

Figure 1. The callus of *Glycyrrhiza glabra*

Figure 2. Seedling of Pavlovnia grown from callus

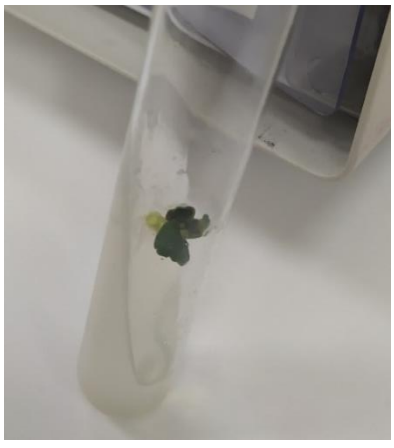

Figure 3. *In vitro* grown seedling of raddish

Figure 4. The callus of *Lycopersicon esculentum*

Figure 5. Root growth from tomato callus

Figure 6. *In vitro* grown seedling of tomato from callus

Table 1. Auxin/Cytokinine ratio for tomato explant cultivated in MS medium

Kinetin conc. (*mg/L*) \ IBA concentration (*mg/L*)	0	1	1,664	2,0
0	no growth	root formation	root formation	root formation
1	shoot formation	medium callus formation	highly callus formation	highly callus formation
3,68	shoot formation	shoot formation	highly callus formation	highly callus formation
4,344	shoot formation	shoot formation	medium callus formation	medium callus formation

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MAIN RESULTS OF COTTON GROWING USING DRIP IRRIGATION

Dovlet Taganov[1*], Mekan Allyev[2], Amangeldi Ybadullayev[3]

[1,2]Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.
[3]Yagshygeldi Kakayev International Oil and Gas University, Ashgabat, Turkmenistan.

[*]Corresponding author

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Drip irrigation is currently the most efficient way to irrigate crops. With the traditional method of irrigation, the number of irrigations, that is, necessary to ensure normal moisture during irrigation, ranges from 700-800 m^3/ha to 1000-1200 m^3/ha, unlike the drip method, water is used to moisten the area of the root system of the plant, and its the amount is from 50 to 200 m^3/ha. This situation creates a favorrable water-climatic regime in the area where the root system of the plant is located, and there are no cases of waterlogging or lack of moisture, which often occur in areas irrigated by conventional irrigation. As a result, the establishment of the necessary nutrition regime with the drip irrigation method creates conditions for obtaining the highest possible crop yield [1-3].

In 2018-2021, scientific research was carried out at the experimental site of the Turkmensuvylymtaslama Institute, located in the Gokdepe etrap of the Akhal velayat, to study the effect of water-saving irrigation methods on cotton cultivation.

The experiment was carried out with three repetitions of two types of irrigation, drip and sprinkler irrigation, and the effect on cotton yield was studied. The options are based on the percentage of soil moisture before watering, in the first option the moisture content was 70-75%, in the second 80-85%.

The area of each experiment is 2800 m^2. Different types of irrigated cotton applied organic and mineral fertilizers in the appropriate norms. All agrotechnical activities were carried out according to the rules adopted in the economy. For drip irrigation of one hectare of a cotton field in 90 cm interrow, 6160 m of drip hoses were installed.

Studies have shown that with drip irrigation there is no row tillage of cotton. Thus, cotton receives less water, which gives us a chance to increase the number of irrigations. The value of each irrigation water was determined based on the moisture deficit on the roots, determined by the depth of the spread of the roots in different vegetative phases.

In the first variant of the experiment, the cotton field was watered 47 times on average. The amount of water supplied each time from the initial growing phase until the moment of harvesting varied from 70-80 m^3 to 220 m^3 per hectare. In the second variant of the experiment, the cotton field was watered 54 times on average. The amount of water supplied each time from the initial growing phase to the time of harvest varied from 60-70 m^3 to 145 m^3 per hectare.

In the experiment, based on the study of the effect of cotton on the growth and yield of the Yoloten-7 variety, the following results were obtained:

With drip irrigation, according to the first variant, irrigation was applied at the rate of 6479 m^3/ha per hectare during the entire growing season, and according to the second variant, at the rate of 6596 m^3/ha. The average yield of cotton under drip irrigation was 59.5 c/ha. Compared to conventional surface irrigation, the yield with the drip method increased by 2.5 times. At the same time, the amount of water used per ton of crop with the drip method was 1005 m^3/t, which decreased by 3 times compared to the corresponding indicator of the irrigation method with conventional containers.

Regular watering with a small amount of water, without row tillage, helps the cotton grow well and produce a large crop. When irrigating crops with water-saving methods, mineral fertilizers are not washed out and are not absorbed to the depth of the soil, water flows to all parts of the crop evenly, a balanced distribution of mineral fertilizers improves the water-fertilization regime, which provides conditions for the growth, development and productivity of cotton throughout the cultivated area.

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THE COMPARATIVE ANALYSIS OF WEIBULL AND RAYLEIGH DISTRIBUTIONS UNDER STOCHASTIC APPROACH IN 4G AND 3G CELLULAR NETWORK

Emanuel Tefera[1], Muluken Tesfaye[2], Khalid Ali Khan[3*]

[1,2,3]*Department of Electrical and Computer Engineering, Mattu University, Mettu, Ethiopia.*

[*]Corresponding author

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The aim of this paper is to investigate and compare the stochastic parameters of the received signal in a cellular network between UMTS (3G) and LTE(4G). Drive test measurements are conducted on a street having the high rise building on both sides wherein the line of sight from the cell tower to mobile devices is not clear. Therefore, the street (120 meters long) between block-7 and block-8 (Lat: 8.3162452/8.3162767; Long: 35.559375/35.5597058) in the Mattu University (Ethiopia) has been chosen for this. Insinix hot.9 smartphones with an "Android 7+" operating system and "cell info" software were used during the observations and measurements in Ethio-telecom coverage. Collected received signal strength is used to plot the Weibull [1] and Rayleigh [2] distribution with help of Easy Fit software. Consequently, the statistical data of the random variable (received signal strength) in a stochastic behaviour like mean, variance standard deviation, coefficient of variation, and skewness will be calculated and compared.

Received signal strength indicator (RSSI) [3] in dBm reveals that the average value of RSSI in 4G and 3G are approximately around -100 dBm and -85 dBm respectively. However, the table-1 shows the actual RSSI as measured repeatedly at the place of observation.

Table-1. RSSI value measured at fading location

RSSI/4G (dBm)	-99	-100	-98	-100	-97	-99	-103	-104
RSSI/3G (dBm)	-93	-89	-86	-85	-90	-87	-85	-85

Statistical calculations for 4G and 3G networks are shown in table-2 and table-3.

Table-2. Statistical calculation for 4G

PDF	Variance	Standard deviation	Coefficient of variance	Skewness
Weibull	75.97	8.71	-0.093	1.129
Rayleigh	61.32	7.83	-0.084	0.631

Table-3. Statistical calculation for 3G

PDF	Variance	Standard deviation	Coefficient of variance	Skewness
Weibull	86.13	9.27	-0.116	-0.05
Rayleigh	116.69	10.8	-0.134	0.63

As per the available random variable, the Probability Density Function (PDF) plot for Weibull and Rayleigh distribution in the 4G network are shown in figure 1 and figure 2 respectively. Similarly, figure 3 and figure 4 reflect the PDF plot for Weibull and the Rayleigh distribution in the 3G network.

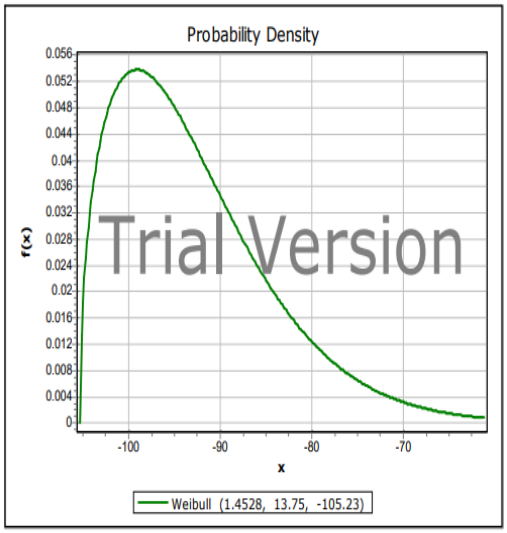

Figure 1. Weibull Distribution (4G)

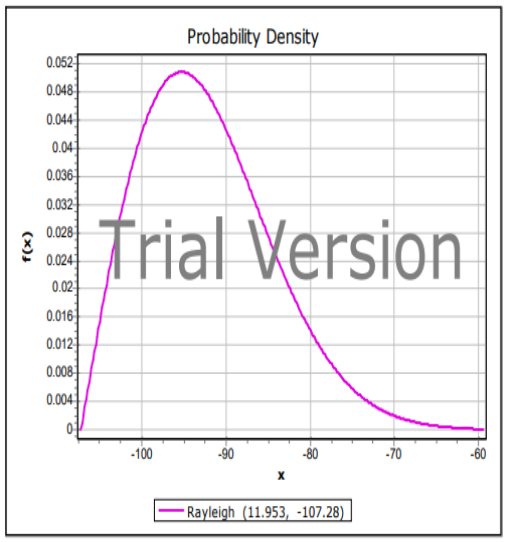

Figure 2. Rayleigh Distribution (4G)

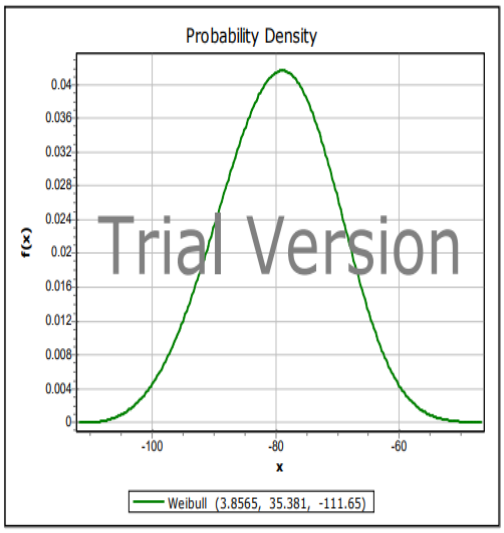

Figure 3. Weibull Distribution (3G)

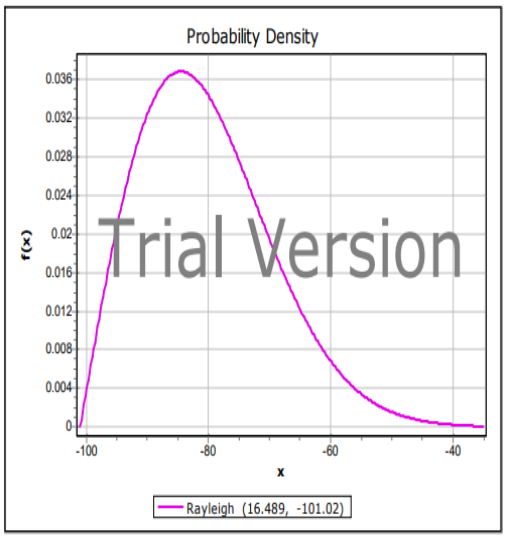

Figure 4. Rayleigh Distribution (3G)

By refereeing the CDF plots and table-2 for 4G, it can be concluded that the Rayleigh approximation is a better choice to study the stochastic behaviour of the 4G network at this location. But table-3 and plotted CDF strongly recommend that the Weibull approximation is a better choice to study the stochastic behaviour of the 3G network at this location.

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PROGRESS IN THE DIAGNOSIS AND TREATMENT OF KAWASAKI DISEASE AND OTHER MULTI-SYSTEM INFLAMMATORY SYNDROMES BY ARTIFICIAL INTELLIGENCE

Fuyong Jiao[1*], Hongping Zhong[2], Xin lv[3], Xiaoya Sun[4]

[1]*Children's Hospital of Shaanxi Provincial People's Hospital, Xi'an, Shaanxi, China.*
[2,3,4]*Department of Paediatrics, Yan'an University Affiliated Hospital, Yan'an Shaanxi, China*

[*]Corresponding author

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Purpose. To explore the role of artificial intelligence in distinguishing Kawasaki disease from other multi-system inflammatory syndromes. **Method.** We refer to the existing relevant articles at home and abroad for analysis. **Results**. The clinical application of artificial intelligence has played a time-saving and labour-saving role in the differentiation of Kawasaki disease and other multi-system inflammatory syndromes, suggesting that the application of big data in clinical practice can bring new development opportunities for medical treatment. **Conclusion**. Kawasaki disease and other multi-system inflammatory syndromes are similar and overlapping in clinical practice, which is difficult to distinguish and easy to misdiagnose and missdiagnose. Artificial intelligence is applied to analyze the above disease data, to achieve the effect of accurate differentiation, timely diagnosis, symptomatic treatment and reduction of complications.

Introducation. In December 2019, the first case of the novel coronavirus (COVID-19) was first reported in Wuhan, China. Later, large outbreaks spread globally, and a new syndrome, multisystemic inflammatory syndrome (MIS), with fever and cytokine release after infection with SARS-COV2, was initially considered to be an atypical form of Kawasaki disease (KD), as most of its clinical symptoms are similar to Kawasaki disease and may also lead to cardiac complications. The difference is that left ventricular insufficiency and cardiovascular shock, coagulopathy and gastrointestinal involvement are more serious in this novel syndrome than in Kawasaki disease. Kawasaki disease (KD), previously known as cutaneous mucosal lymph node syndrome, was first reported by Tamisaku Kawasaki in 1974. The disease is a systemic inflammatory disease with medium-sized vasculitis and is mainly seen in children under 5 years of age. Artificial intelligence (AI) is a technology that integrates advanced brain cognition, big data, cloud computing and machine learning based on modern medical and biomedical theories. Corresponding studies have shown that the multi-system inflammatory syndrome associated with the SARS-CoV-2 pandemic partially overlaps with Kawasaki disease (KD). For example, they all present with fever, rash, mucous involvement, conjunctivitis, erythema/edema of hands and feet, and swollen lymph nodes in the neck. The difference is that the associated lymphocytopenia observed in patients with MIS-C has been compared to the significant neutrophilism and thrombocytosis observed in KD. Other studies have found that the number of related lymphocytes observed in patients with MIS-C is decreased, while the number of neutrophils and platelets observed in KD is significantly increased. With our current knowledge reserve and medical level, KD and MIS-C cannot be judged quickly and accurately, which may make patients in emergency environment or emergency department unable to receive timely and effective symptomatic treatment.We boldly hypothesized whether some modern technologies, such as artificial intelligence, could be used to distinguish these two diseases

quickly and effectively. Therefore, the author consulted the literature on this aspect and found that there were very few literatures on the use of artificial intelligence to distinguish and study KD and MIS-C.The study is prospective, and it's worth debating whether using AI to distinguish between diseases can be accurate. It will be a cause for celebration for paediatricians if the research proves to be feasible enough to be applied to the clinic.

Content. Collecting, integrating data, defining the host immune response, using an AI-guided approach help to uncover shared host immune responses in Kawasaki disease and pediatric multisystem inflammatory syndrome, and filling in the gaps in previous studies step by step by developing and validating a computational approach with human intelligence to distinguish KD, MIS-C, and other similar febrile diseases. However, based on current studies, we still cannot accurately distinguish KD from other multi-system inflammatory syndromes effectively. Although there are many methods to distinguish MIS-C from Kawasaki disease at home and abroad, most of them are based on the clinical characteristics of the disease and laboratory test results. There are few clinical studies using artificial intelligence to distinguish MIS-C and KD. After reading and thinking about relevant literature, the problem that has been solved so far is that we can temporarily use some technologies to distinguish Kawasaki disease, MIS-C and other febrile diseases, but whether this technology is mature enough and when it can be applied in clinic remains to be investigated.

Conclusion. In conclusion, Kawasaki disease (KD) and pediatric multisystem inflammatory syndrome (MISC) are both autoimmune hyperinflammatory method in the diagnosis of these diseases.

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ADVANCES IN THE CO-HOST IMMUNE RESPONSE TO MULTISYSTEM INFLAMMATORY SYNDROME AND KAWASAKI DISEASE IN CHILDREN WITH AI-GUIDED FEATURES

Fuyong Jiao[1*], Hongping Zhong[2], Xiaoya Sun[3], Xin lv[4]

[1]*Children's Hospital of Shaanxi Provincial People's Hospital, Xi'an, Shaanxi, China.*
[2,3,4]*Department of Paediatrics, Yan'an University Affiliated Hospital, Yan'an Shaanxi, China*

[*]Corresponding author

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Objective. To explore the role of artificial intelligence in the immune response mechanism of children with multi-system inflammatory syndrome and Kawasaki disease. **Method.** To search the domestic and foreign literatures about the immune response mechanism of these two diseases, and analyze the literatures according to the characteristics of artificial intelligence. **Result.** AI analysis showed that the two kinds of children's syndrome were concentrated in the cytokine storm centered on il-15/IL15RA, which confirmed that the two diseases had the same initial immune pathway, but the differences in immune phenotype, cytokine, cell count and other aspects suggested that KD and MIS-C were two different diseases. Conclusion.It shows the applicability of AI in this research direction, and points out the limitations of the current research scope and samples. The difference between the results of KD and MIS-C research guides the direction of future research. Accurate and comprehensive laboratory indicators and parameters can be applied to artificial intelligence and provide basis for diagnosis and treatment of diseases. As the number of infected people increases, the problem of sample limitation in the current work can also be improved.

Background. In April 2020, children with symptoms similar to incomplete Kawasaki disease (KD) or toxic shock syndrome were reported in the UK. The disease was later defined as coronavirus-associated multisystem inflammatory syn-drome in children (MIS-C), which can be fatal in severe cases. Children's multisystem inflammatory syndrome (MIS-C) and Kawasaki disease are highly inflammatory diseases related to infectious diseases, but are they different syndromes or continuous?

Content. The SARS - CoV - 2 pandemic has inspired many research groups to analyse more than 45000 pandemic transcriptome datasets ,166 gene signatures were extracted with ACE2 as the "seed" gene, and ViP and severe ViP features were named. AI analysis showed that the two kinds of children's syndrome were concentrated in the cytokine storm centered on il-15/IL15RA, which confirmed that the two diseases had the same initial immune pathway. Prolonged and excessive IL-15 stimulation can lead to significant depletion and reduction of NK cells in severe COVID-19 infection cases, and this reduction occurs as early as 6 days after symptoms appear. We conclude that fatal COVID-19 is characterized by a contradictory immune response, that is, inhibiting the function of epithelial cells and NK cells in the context of cytokine storm (excessive immune response) (immunosuppression). The results showed that: (1) compared with KD, the level of cytokine in patients with misc was higher, the decrease of whole blood cells was more serious, and the host immune response of MISC was significantly higher than that of KD; (2) Misc has the key distinguishing characteristics of thrombocytopenia and low eosinophil count, and both of these characteristics are negatively correlated with serum

il-15 and VIP levels. Eosinophilia seems to be a significant common feature between misc and COVID-19, but not KD. These findings are consistent with the fact that KD is known to exhibit higher (rather than lower) eosinophil counts. Thrombocytopenia has been shown to be significantly associated with mortality. Like thrombocytopenia, persistent eosinophilia after admission is associated with the severity and low recovery rate of COVID-19. (3) Misc had impaired cardiac contractility, but KD did not. These two kinds of pediatric syndromes focus on the cytokine storm centered on il-15/il15ra, suggesting that there is a common proximal pathway for immune pathogenesis. However, they differ in other laboratory parameters (platelets, eosinophils) and cardiac phenotype (cardiac function decline, coronary artery dilation). These relevant clinical/laboratory parameters (low PLT and AEC) may be useful indicators of disease severity and prognosis, and can be used to guide hospital treatment and nursing decisions.The above studies confirmed that MIS-C and KD have a common initial immune pathway, but in cytokines (IL-17A increased in Kawasaki disease and significantly decreased in misc patients), T cell subsets (CD4 and CD8 counts in Kawasaki disease were higher than misc,), immunophenotypes (CD57 markers were higher in misc), antibodies (the overexpression of EDIL3 autoantibodies in Kawasaki disease was the most obvious, and CSNK and MAP2K2 family proteins were highly expressed in MIS-C) There are differences in blood coagulation status (fibrinogen increase, d - dimer increase and platelet decrease in acute phase of Misc, not in Kawasaki disease), cell count (neutrophil and platelet increase in KD, and eosinophil count decrease in misc), etc. which suggested that KD and MIS-C were two different diseases.

Conclusion. In the future, we hope to find more extensive and accurate gene features in existing studies (related to cytokines, cellular immunophenotypes, antibodies, gene susceptibility, etc.), use artificial intelligence algorithms to define and layer diseases from clinical or laboratory parameters, and identify the phenotypes and complications of disease spectrum, including cardiogenic shock (such as MIS-C shock and Kawasaki disease shock syndrome), MAS (cytopenia and coagulation dysfunction related to cytokine storm caused by infection), Kawasaki disease (typical and complete Kawasaki disease phenotype, caused by SARS - CoV-2 or other infectious factors), and provide evidence for the formulation of treatment strategies. The amount of research data should be further expanded in clinical practice, and the special method of artificial intelligence should be used to diagnose, differential diagnosis and treatment of the above diseases to serve the clinical.

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THE SIGNIFICANCE OF CURRENT SECURITIES IN THE CONDITIONS OF THE DIGITAL ECONOMY

Govshut Guvanchmyradovich Akmyradov[1*], Suleyman Malikmyradovich Nokerov[2]

[1,2]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*

[*]Corresponding author

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The globalization of the digital economy in the world has led to the acquisition of a modern and innovative character of securities operating in the economic space of the relevant organizations of any country. One of the main conditions for the development of modern financial instruments is economic innovation technologies. The digitization of the economy has led to the creation of new types of securities and the emergence of hybrid financial instruments that contain several financial instruments and have opened a wide avenue for their diffusion. This work analyzes the impact of modern innovation technologies on securities in the era of globalization of the digital economy. These innovative technologies have created more convenient and secure conditions for trading in the stock market and stock exchanges. This branch of the economy has also given rise to new professions such as internet trading and internet brokerage. With the development of economic circulation through the Internet, it became possible to monitor, purchase and sell classified securities, such as shares, bonds, futures, and promissory notes online through special Internet platforms. Today, securities, which are financial instruments issued by private joint-stock companies and joint-stock commercial banks, have become an integral part of the national economy. It has become possible to monitor bills online through special Internet platforms, to carry out operations such as buying and selling them [1]. "Ashgabat Stock Exchange" CJSC 2022 of stock held 2021 of 336130.6 (%) percent increase in comparisonclearly testifies to this. And this is itshows that the emission and circulation of securities in our country is increasing [2].

SANLY_PAY.tm auxiliary web software (figure 1) was developed to analyze and monitor data on stocks, promissory notes, bonds, which are valuable securities of banks, joint-stock companies, industrial enterprises, economic organizations, based on modern innovative technologies.

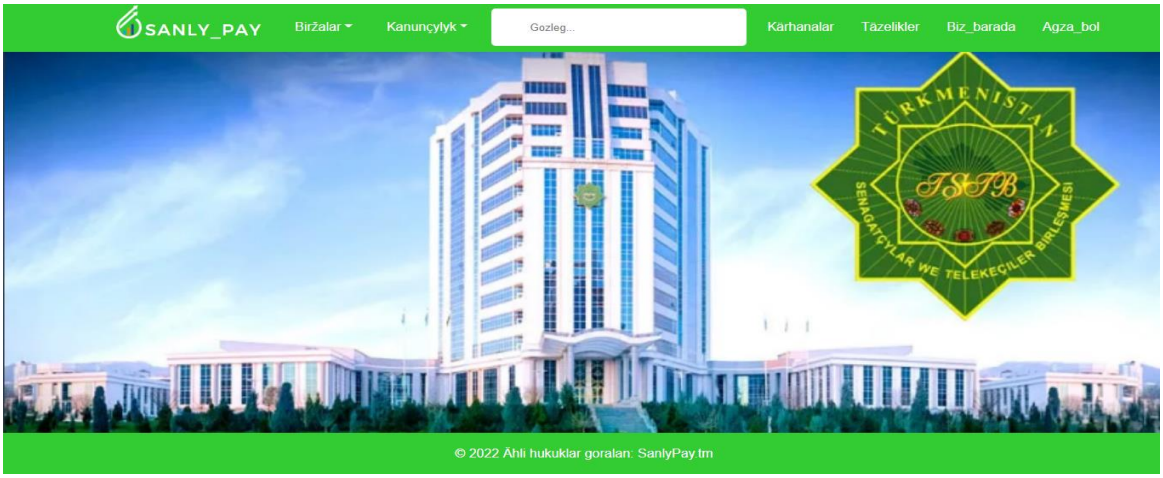

Figure 1. The main window of the SANLY_PAY.tm web application

In this web application, the shares of "closed" and "open" types of joint stock companies are analyzed through the graphical method on different types of charts. Using a 2D coordinate system (figure 2), time t is represented on the horizontal axis, and the value G of the stock at a given time is represented by the coefficient on the vertical axis. The time function includes minute, hour, day, week, month, and year calendars.

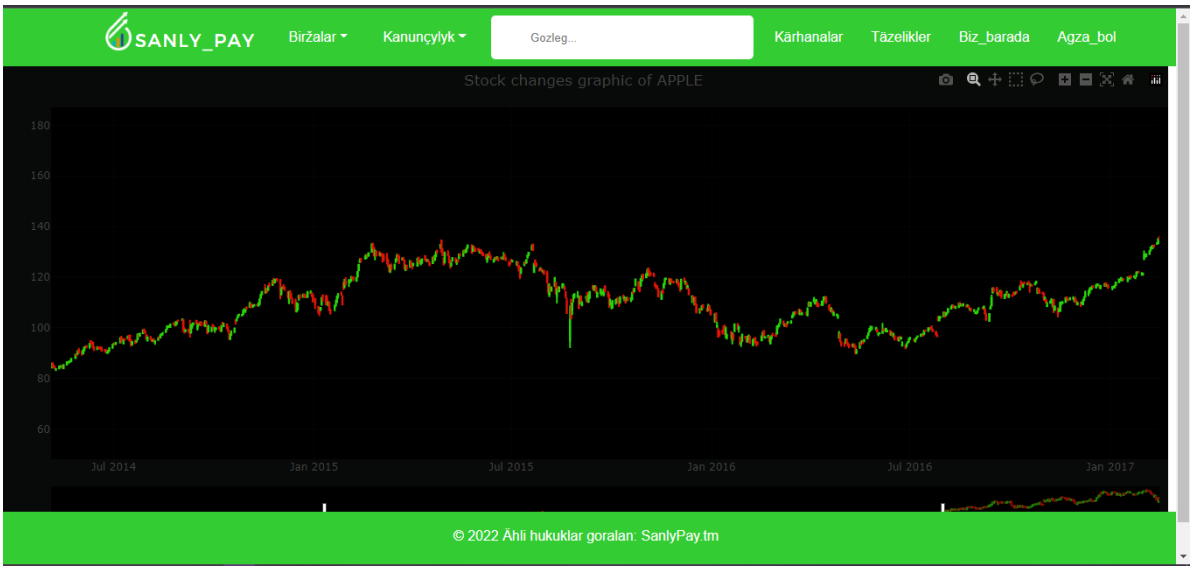

Figure 2. SANLY_PAY.tm web application window

The main feature of the web program is that operations are carried out in the Turkmen language, and it is possible to determine the max, min and trend values of the function of securities belonging to one joint-stock company in real time and compare those values with shares of other joint-stock companies at the same time. In addition, geometric and dispersion functions are built into the web application indicator for thorough stock analysis. As a result of the investigations, a clear decision is made about the relevant stock, and the operation of selling or buying a valuable paper is carried out.

The development of modern innovative programs for smooth, functional and fast functioning of the securities market and their compatibility with other web programs and portals has become one of the most important issues of today.

As a result, one of the main conditions for solving the problem of continuous development of securities circulation and sustainable improvement of financial instruments in the conditions of the digital economy is the use of modern economic innovation technologies.

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USE OF WEB-QUEST TECHNOLOGY IN THE PROCESS OF TEACHING ENGLISH

Gyzylgul Charyyarovna Ekeyeva*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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In accordance with the language police of our country, English is priority foreign language to be studied at all educational institutions. Therefore, in Prosperous Epoch of "Happy Youth with Arkadag Serdar", fluent of English has become the major requirement for high quality education. It's especially true for our university since English is medium of instruction over here.

One of the challenges of modern education is to enhance the variety of types and forms pedagogical educational system, such activities allow significantly increase educational opportunities, to make a choice and implementation of individual trajectories of open educational space. XXI century requires new approaches to education.

Information Technology helps to create a new educational surrounding in which students are involved and able to accept more responsibility for their own training and designing them own knowledge. Certain experience on the use of Internet resources have already been accumulated by teachers in the self-organization of students. Firstly this is the usage of Internet at implementation of individual or group research work. It's the way to integrate the Internet into foreign language teaching named – web quest. A web-quest in pedagogy means a problematic task with elements of a role – playing game, for fulfilment which is used for informational resources. Web-quest is difficult to students as well as to teachers. Web quest is directed to develop the analytical and creative thinking of learners. Teacher who is creating the web quest must have high level of methodical and into communication competence. Features of web quests is that some of the information or all of it for individual or group students, can be found in different sites. Web quests can cover both a single problem, a subject, a topic or can be interdisciplinary. B.Dodge highlights 3 web quest classification principles [1]:

1. By duration of fulfilment: long-term, short- ter.
2. Subject-wise content: mono projects and interdisciplinary web quests.
3. By the type of tasks performed by students: retelling tasks, complication tasks, riddles, journalistic tasks, design tasks, creative product, consensus building tasks, persuasive tasks, self- knowledge, analytical, evaluation, scientific tasks.

Web quest must have the following structure [1]:

1. Introduction (wording topics, description, major roles participants, scenario quest, an overview of the entire quest).
2. Central task (questions to which students must find the answer in framework, independent research, final result is to be achieved).
3. List of informational resources (the funds that can be used at implementation assignments.
4. Description of the main stages of work, management to actions.

Conclusion (results of research, questions for further development of the topic). In language learning can be used web quests such as [2]:

- Various educational discipline created for native speakers.
- For students of foreign languages.

Using web quest and other resource-based tasks on Internet requires from students language skills for authentic resources. In connection with this effective integration you can learn languages through web quest when:

– It's creative task completing the study of a topic.

– Accompanied training and lexical grammar based on exercises web quest's authentic resources. Such exercises can either precede work on the quest or be carried out in parallel with it. Topics for web quests can be the most diverse, problematic tasks can vary in degree of difficulty.

Results of complete web quests, independent from the studied material, can be presented in the form of an oral presentation, computer presentation essay, web page etc.

Advantages [2]:

1. Web quests give a teacher a clear model of how to conduct project work.
2. Model of working. Quests use a lot with web teachers in various countries, so you can find many interesting developments.
3. Online available templates that can be very useful for teachers to create their own web quests, a lot of methodological advice for teachers.
4. Teachers provide a list of sites which students use when completing a project.
5. One of the important reasons why should we use web technology is that many students will work to improve level of proficiency.

Difficulties and problems. In reality, of course, the picture isn't so rosy and there are many difficulties [3]:

1. To complete the project students must have access to Net.
2. Web-quest technology from children and adults require a level of computer literacy certain slow Internet may limit the type of uploaded sources (video materials).

Web-quests are being used a long time ago and have a clear structure. However it is not something that may be frozen and used only as a base which can be changed. The quest is divided into 4 main sections: introduction, assignment, execution, evaluation. Technology web quest has a universal character and can be used for purposes such as development competence in the field of independent cognitive activities based on the assimilation of methods of acquiring knowledge shells. Technology can stimulate the cognitive activity of students, as it's new, and allows not only to students but teachers also to express creative personality which is essential in modern educational process.

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GLOBAL, ECOLOGICAL POTENTIAL OF THE PLANET

Giorgi Ivanovich Kvesitadze*

President of the Georgian National Academy of Sciences, Tbilisi, Georgia.

*Corresponding author

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Uncontrolled, unpredictable population growth is changing the reality of the planet; natural ecosystems are being displaced by megalopolises, transport, agricultural, energy, other industrial facilities; oil extraction and refining are causing especially great harm to the environment. All of them lead to colossal pollution of the environment, loss of biological diversity, reduction of agricultural plantations, deterioration of living conditions of the population of the whole planet. Environmental pollution has an extremely negative impact on the health of its inhabitants. Every year, more than 1.8 million people die, as a result of non-infectious lung diseases; 9 out of 10 inhabitants of the planet breathe polluted air; more than 70% of deaths from stroke, widespread lung cancer and respiratory diseases are caused by high levels of air pollution. It seems, that in the XXI century, the most important international problem concerns the field of ecology – namely, keeping the acceptable environmental balance in conditions of extremely increased and still increasing worldwide population and highly developed industry.

Already at the beginning of the XXI century, humanity faced unprecedented environmental problems: in addition to the unpredictably growing population of the planet, global climate change, the melting of large masses of ice, a huge increase in the volume of industry and transport, the formation of a large number of megalopolises, worldwide spreading of unknown earlier infectious illness, and many others. On the basis of intensive agriculture, soils are becoming increasingly depleted in terms of their content of organic carbon and nitrogen and degraded as a result of the action of great amount of techno-genic stable compounds. In this amazingly fast-changing world, achieving a sustainable ecological balance and providing food resources to the world's population has never been such a difficult and important task.

More than 800 millions of tons of chemicals are produced annually in the world. In different ways, huge amounts of these hazardous substances or toxic intermediate products of their incomplete transformations are accumulated in the biosphere, significantly affecting ecological balance. Nevertheless, members of the plant kingdom (microorganisms and plants) could assimilate environmental contaminants, and remove toxic compounds from the environment, providing long-term protection against their environmental dispersal in ever increasing doses. Lately, many ecological technologies have been elaborated, targeted to minimize the flow of toxic compounds to the biosphere or to control their level or state. Despite the definite positive effect from the realization of these technologies, the intensive flow of toxic compounds to the biosphere is still increasing.

Taking into account all the above mentioned, the group of scientists under the leadership of the author, proposed a biological concept, developing over 30 years, as a permanent acting ecological biotechnology, designed to restore eroded soil, monitor and improve ecological imbalance by degrading toxic (foreign) compounds, intensifying the metabolic processes of the soil, by using the detoxification potential of rhizosphere microorganisms and the root system of plants. In fact, the proposed concept represents a significant intensification of the natural biological process based on the synergistic action of microorganisms and plants to jointly degrade in natural conditions anthropogenic stable contaminants. A significant increase in the

efficiency of the technology is achieved through the selection of both plants and microorganisms that actively assimilate contaminants in the soil. According to the authors' calculations, the effectiveness of joint detoxification potential of microorganisms and plants occurring in nature, as a result of their joint co-existence, does not exceed 5-7% of their maximum capacity. This potential can be increased to at least up to 40-50% by introduction in soil selectively chosen active consortia of microorganisms and plants acting by root systems, thereby only strengthening the immune system of the soil, and using them in the form of environmentally friendly technology under unlimited global conditions.

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YOUTH POLICY AND THE PLACE OF INNOVATIVE TECHNOLOGIES IN TURKMENISTAN

Gozel Gurbanmyradovna Muhammedova*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

DoI: https://doi.org/10.5281/zenodo.7779160

Under the leadership of our Esteemed President, great work is being carried out in our independent, permanently neutral state of Turkmenistan during the revival of a new era of a powerful state. The adoption of the Law of Turkmenistan "On state policy towards youth" in the "Year of the Epoch of the people with Arkadag" and the decision of the Mejlis of Turkmenistan to declare 2023 the "Year of youth with Arkadagly Serdar" are clear evidence of the concern for young people in the country at the state level. This law is of great historical and social significance. In our country, ample opportunities and conditions have been created for young people to be able to get an education and master a profession.

The adoption of the Law of Turkmenistan "On state policy towards youth" in order to introduce the best international and world experience in the field of youth policy in the country also paved the way for the implementation of large-scale measures to develop cooperation with foreign countries, as well as with the United Nations Permanent Coordinating Bureau in Turkmenistan, the United Nations Children's Fund (UNICEF), the United Nations Development Program and the United Nations Population Fund. Our independent, permanently neutral state of Turkmenistan is expanding multifaceted relations and developing cooperation with many countries of the world. The domestic and foreign policy of our country is adopted by the countries of the world at an exemplary level. We can proudly note that young people make a worthy contribution to the comprehensive development of our country.

Domestic and foreign policy of our country is adopted by world countries at a standard level. Our Esteemed President Serdar Berdimuhamedov said: "With our initiative, the following resolutions were adopted at the 76th session of the General Assembly "Integrating public cycling for sustainable development", "Central Asia is a zone of peace, trust and cooperation", and at the 77th session, "Year 2023 as an international year of dialogue as a guarantee of peace". The awarding of an international certificate to the city of Ashgabat for its contribution to the United Nations Economic Commission for Europe's "Gardens in the City" initiative is a recognition of the country's achievements in environmental and environmental protection", marking it as a recognition of the high reputation of the Motherland at the international level. It is a matter of pride to note that the youth have a worthy contribution in the all-round development of our country. The active participation of youth and students in the bicycle rally on June 3 – the World Bicycle Day is a testimony of the indomitable enthusiasm of youth for the sake of the development of the Motherland. Students also actively participate in the annual autumn and spring gardening events in the country. This shows that the state of Turkmenistan pays great attention to the issue of protecting nature, preserving and increasing its resources, introducing "green" technologies into the economy. It should be noted that the Law of Turkmenistan "On State youth policy" has an important role for the active participation of young people in these issues of international importance, for them to show their abilities in this field.

It is noted **in paragraph 8** of the National program of social and economic development of Turkmenistan in 2022-2052 **entitled "Main directions of industrial and innovative development of economic sectors"**: "The development strategy of Turkmenistan for the future period is to introduce new innovative technologies, including digital technologies and leading international practices in various sectors of the national economy, to move to electronic document circulation and electronic identity card system, to create an innovative, high-tech, competitive digital economy and a well-functioning electronic industry". Young people also have a rightful place in the work to be done to develop the national innovation system of the country, to establish innovative works, and to introduce new innovative technologies into production. Giving a great place to innovative technologies in the future development of the country requires the training of qualified young people in this field. Formation of a generation of specialists and scientists who can use innovative technologies in higher educational institutions of our country is of great importance for the successful implementation of the tasks ahead in this field.

Under the wise leadership of the President of Turkmenistan, successfully implemented in the "Program of social and economic development of the country of the President of Turkmenistan in 2019-2025", "Concept of development of digital economy in Turkmenistan in 2019-2025", as well as in the "State program for the development of the digital economy in Turkmenistan for 2021-2025", the main principles of the development of the digital economy for the medium and long-term future in the country by diversifying our national economy, increasing its competitiveness and continuously moving towards the industrial-innovation direction of development, and methods are defined. In this field, the work of young people is also important.

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SOFTWARE DEVELOPMENT FOR DATA CYBER SECURITY

Gulshat Orazdurdyyeva[1*], Yuldashbay Kurambayev[2]

[1,2]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*

[*]Corresponding author

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Objective of paper. The essential issue of data, digital, intellectual and computer technologies is the data cybersecurity. An integrated approach to ensuring data cyber security is key importance. It requires the legal, organizational, software provider and integrated system of technical measures. As it is known, information technologies have become a global inexhaustible resource for humanity, which has stepped into the era of development up-to-date data civilization. Therefore, the main objective of the paper is to create software intended for ensuring cyber security of information and to develop a new model capable of ensuring cyber security of information using already existing technologies to use in local conditions.

Materials and methods. General scientific, mathematical modeling, mathematical statistics, calculations, comparative analysis, unified knowledge of the state of cyber security of information systems, integrated cyber security strategies, SSL/TLS, IPSec, SSH, DNSSEC, OpenID, SAML, Pfsense, suricate technologies. [1-3].

Research findings. To install the software in order to ensure data cybersecurity was selected the Linux operating system, pfsense and suricate technologies. Based on selected technologies, Pfsense blocks a set of IP addresses added to the system's drop table. Simultaneous flow backing up and analysis features have been designed and implemented so that the flow over the developed technology does not affect the timing of requests. Installation of Pfsense-based firewall, installation of Suricata IDS/IPS module layers, Pfsense + nginx reverse proxy + Suricata IDS/IPS hardware preparation technology and its installation are performed [4, 5]. pfSense is a firewall based on the FreeBSD operating system. It works with different routers, devices, and you can create your own if you need additional settings. PfSense offers routers under the Netgear name, but they also offer their own routers called Netgate with the added options and flexibility that pfSense offers.

Suricata consists of several modules (capture, collection, encoding, detection and extraction), by default, the captured traffic before decoding passes in one stream, which is optimal from the point of view of detection, but it loads the system more. After the settings in the Suricata configuration were fully implemented, one was used to split the streams, and the other was to determine how the streams would be distributed among the processors. This provides extensive opportunities to optimize traffic processing on individual devices in a given network.

Conclusion. In the first stage of software designed to ensure cyber security of information, a firewall was created to block an IP address after several consecutive calls, and an algorithm for the firewall was developed. Software designed to ensure cyber security of information has been proven in practice to ensure cyber security of servers in any system.

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EXPANDING VOCABULARY THROUGH READING

Guljemal Saryyeva*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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Nowadays teaching English has become a very important aspect of Turkmen educational system. Large-scale reforms are implemented in the systems of national science and education. Esteemed President of the country has signed a number of important resolutions and documents connected with the improvement of the work of the educational and scientific institutions of the country. Activities in this field are successfully carried out. The development of new academic curricula and the publication of new textbooks continue in high pace. Classes in all higher schools of the country are conducted according to the updated curricula meeting the spirit of new reforms in the educational system. All these are done to stimulate our youth to conduct research works and help them to get good education in the chosen specialization.

In all of these developments, teaching English plays a very important role. However, it is still difficult for students of all levels to work with vocabulary of the English language. For this reason, exploring the theory and practice of teaching vocabulary is very important for any English teacher.

"No matter how well the student learns grammar, no matter how successfully the sounds of a foreign language are mastered, without words to express a wide range of meanings, communication in a foreign language just cannot happen in any meaningful way." [1].

In other words, regardless of one's knowledge of grammar and phonetics, it is impossible to express oneself properly without good knowledge of vocabulary. As mentioned previously, vocabulary updates itself and new words and expressions (slangs, jargons) are constantly augmented into the "word pool". Therefore, the importance of vocabulary in expressing oneself and achieving understandable, clear communication cannot be overstated.

There have been periods when insufficient attention was paid to vocabulary learning. What was more, vocabulary has been changed or even deleted from many textbooks and curricula. Nowadays, however, many linguists have changed their opinion on teaching and learning vocabulary and they have realized that the knowledge of vocabulary is as important as the knowledge of grammar. Vocabulary is the most important component in learning a foreign language. Therefore, recently, more attention has been paid to teaching, learning, acquiring, storing, memorizing and recalling lexis.

Vocabulary is "the basic need" of an ESL learner. Vocabulary knowledge enables language use and thus communication. Therefore, the more vocabulary one knows, the better one can express himself in a foreign language. Moreover, vocabulary acquisition is not only a matter of foreign language; native speakers can always find something to learn from the lexicon of their language.

Another point worth mentioning here is that lexis is important at every level. What is more, at higher levels the learners are supposed to learn vocabulary for more subtle purposes, such as greater precision, to convey and evoke emotions, to suggest attitudes, to invoke interest or to appeal to the aesthetic sense.

Candlin stated that "… *the study of vocabulary is at the heart of language teaching in terms of organization of syllabuses, the evaluation of learner performance, and the provision of learning resources….*" while McCarthy claims that '*No matter how well the student learns*

grammar, no matter how successfully the sounds of L2 (second language learner) are mastered, without words to express a wider range of meanings, communication in L2 just cannot happen in any meaningful way." [1]

The importance of vocabulary in second language acquisition has been stressed over and over. Unlike native speakers, second language learners (L2) go through a more conscious and demanding process of vocabulary acquisition. They experience lexical gaps, the words they read which they simply do not understand or concepts that they cannot express as clearly as they could in their first language (L1). Many learners see second language learning as essentially a matter of learning vocabulary, so they devote a great deal of time to memorizing lists of L2 words.

Vocabulary acquisition is the largest and most important task facing the language learner. Actually, when students travel, they don't carry grammar books, they carry dictionaries. In fact, Widdowsen goes as far as suggesting, *"The more one considers the matter, the more reasonable it seems to suppose that lexis is where we need to start from, the syntax needs to be put to the service of words and not the other way round."* [2].

Briefly stated, vocabulary is too important to ignore and constitutes the basis on which language lies. It is the concretization of language, the frame to which other language elements adhere. Additionally, vocabulary is not only a list of individual words of a language but also includes the grammar and grammatical forms of the language as well as the discourse created out of the combination of the individual words or phrases. Besides, vocabulary is the most sizeable and unmanageable component in the learning of any language.

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THE VALUE OF EXTRACURRICULAR ACTIVITIES IN TEACHING TECHNICAL DISCIPLINES TO STUDENTS

Hydyrguly Atamyradovich Kadyrov*

Vice-rector, Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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The article focuses on the importance of extracurricular activities in the assimilation of knowledge gained in English classes for students of technical universities. Extracurricular activities play an important role in the development of the intellectual activity of young people.

In addition to compulsory classes, there are also voluntary forms of teaching a foreign language. Activities aimed at satisfying the creativity and curiosity of students are called "Extracurricular Activities". Extracurricular activities are carried out in different ways depending on the goal. The goal of reforms in the education system in Turkmenistan is to improve the quality of education of young people and develop their creative abilities. Extracurricular activities are a form of student activity that includes upbringing, education and personal development [1].

Purposefully planned extracurricular activities contribute to the inclusion of young people in life, their passion for learning and science, personal development, independence of action and correct behavior in society. Extra-curricular activities are divided into three categories, such as education, entertainment and recreation, and health improvement.

1. Extracurricular activities related to education are aimed at activating the curiosity of students, expanding the range of interests, deepening their knowledge, and forming a civic position of the individual.

2. Recreational extracurricular activities are aimed at developing new skills and competencies that students need in society. Various games and spending time together make student life interesting and strengthen it.

3. Extracurricular activities related to health and physical education ensure the physical development and health of young people. In addition, extra-curricular activities promote healthy competition and foster personal dignity, team cohesion, and respect for the opponent.

Consolidation of technical knowledge of students through extracurricular activities is carried out on the basis of an approved plan. We offer innovative methods of extracurricular activities related to the knowledge gained in the English language classes from students of a technical university, the main area of training, an engineer with a degree in Mechanical Engineering, Mechatronics and Robotics.

According to the plan, the development of special software for solving the problem of designing the design of mechanical modules, control systems and data processing was entrusted to students and the deadlines were set: a) preparation of a presentation of modules in English; b) building an algorithm for modules; (c) organization data management; d) data processing algorithm; e) presentation of sections of the program; f) development of custom software; g) use of a single application.

As we can see, the development of special software is carried out on the basis of a specially developed and approved plan for "Extracurricular activities" with students majoring in "Mechatronics and Robotics".

1. The correct organization of extracurricular activities related to learning activates the student's curiosity, deepens his interest and increases enthusiasm. The student gets the opportunity to apply their theoretical knowledge in practice. The academic competence of a student, which is part of the competences of a future specialist, includes the ability to apply the knowledge and skills acquired in the learning process in practice. The requirements for the academic qualification of students require the ability to work independently and the ability to generate new ideas. The student must know such requirements as possession of analysis skills, an integrated approach to solving problems, knowledge of the latest in scientific and technological development and the ability to implement them in industry [2].

Extracurricular activities serve as a means of facilitating the student's successful fulfillment of the above requirements. To master the theoretical foundations and practical skills of the invention and production of high-tech products, extracurricular activities of students are organized in technoparks, technology centers, and factories.

Extracurricular activities organized in technology centers, factories and technology parks contribute to the complete mastery of production and technological, organizational and managerial, experimental research, research and design activities of students to create high-tech products and equipment. Various extra-curricular activities are organized to teach them how to use their theoretical and practical knowledge in production.

2. Recreational extracurricular activities are aimed at developing new skills and competencies that students need in society. Various games and spending time together make student life interesting and strengthen it. Requirements for the social and personal rights of students, the availability of interpersonal communication skills lead to the adaptation and socialization of students [3].

At the Oguz Han Engineering and Technology University of Turkmenistan, a grant on knowledge of a foreign language called “Language is the key to reason” was announced from February 9 to March 9, 2022. During this month, competitions were held among all teachers and students of the university to determine the level of knowledge of the English language and various events aimed at learning foreign languages.

The competition was aimed at using innovative teaching methods at the university, conducting active, effective and interesting extracurricular activities, improving the speech and thinking skills of students in foreign languages. In order to further improve the level of English language proficiency at a technical university, a number of methodological materials have been prepared within the walls of the university and in educational buildings. Daily news, excerpts from English and Japanese literature were read on the university's radio network. Since our university is specialized in Japanese and English, subjects are taught in these languages.

3. Extra-curricular activities related to health and physical culture are carried out in the form of sports competitions, competitions, excursions and processions that ensure the physical development and health of students. In addition, extra-curricular activities promote healthy competition and foster personal dignity, team cohesion, and respect for the opponent. The student must know the requirements for social and personal competencies, such as the ability to think self-critically, take care of their health, and the ability to work in a team.

The general requirements for obtaining a bachelor's degree state that "a bachelor must be able to constantly and continuously improve his theoretical knowledge and practical skills, properly use in his work the experience and scientific information collected in his field, and organize his activities, work on a scientific basis " [4].

To fulfill this requirement, extra-curricular activities are offered depending on the student's field of study:

– calculation and preparation of projects of individual blocks and structures of mechatronic and robotic complexes that control information-sensor and executive systems according to technical instructions;

– development of special software for solving the problem of designing mechanical and mechatronic modules, control systems and data processing;

– development of a mathematical model for mechatronic and robotic systems, their individual parts, including information, electromechanical, hydraulic, electrohydraulic, electronic structures and computer technology;

– organizes students in technoparks, technology centers, factories to master the theoretical foundations and practical skills in designing and manufacturing high-tech products;

Extracurricular activities are organized in individual, group and collective forms, depending on the number of participants. An individual type of extracurricular work allows us to work with an individual student. The group type of extracurricular work is carried out in groups in accordance with the needs and interests of students. These are events, creative evenings, project competitions, etc.

The content of the collective form of extracurricular activities includes competitive (games, competitions, competitions) events, information and mass events (paintings, exhibitions), cultural events (holiday evenings, excursions) and political events (meetings with people of various professions, creative workers) .

The joint use of individual, group and collective forms of communication contributes to the development of intellectual activity of students.

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KEY TECHNOLOGIES ON RENEWABLE MATERIALS AND ENERGY RESOURCES FOR PEACE AND SURVIVAL DIPLOMACY OF MANKIND ON THE EARTH

Hideomi Koinuma[1*], Kenji Itaka[2], Masatomo Sumiya[3], Sataro Yamaguchi[4]

[1]*Tokyo Institute of Technology / SCT. Inc., Tokyo, Japan.*
[2]*Hirosaki University, Hirosaki-shi, Japan.*
[3]*Nat. Inst. Mats. Sci. & Tech., Tsukuba, Japan.*
[4]*Chubu University, Kasugai, Japan.*

[*]Corresponding author

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Depending primarily on the energy resource and technology, the human civilization is classified into several generations: G1 (Hunting), G2 (Agricultural), G3 (Coal/Industrial: 18-19C), G4 (Electric/Electronic: 20C-), and G5~ (Quantum/Metaverse: IoT/AI, 21C). Recent progress in science and technology is so fast that it is providing us with not only future dreams but also fatal risks for our world by the dictators and autonomous domination of IoT/AI.

Here, we pick up 3 topics from our research carriers as long as 5 decades since 1970.

1. CO_2 copolymerization to produce bio-degradable plastics for contribution to SDGs.

2. Convert the deserts to PV energy mines with food supplying green fields.

3. Asia-Pacific to Atlantic trans-continental Super highway of PV and gas energies.

The topic-1 is based on Koinuma's Ph.D. research at Tokyo University. [1], while topics-2 and 3 are on the Sahara Solar Breeder (SSB) plan which was acknowledged by Sci. Council of Japan (SCJ) to propose to G8+5 Academies Conference in Rome (2009). SSB had been supported by JST-JICA as a global project to collaborate with Algeria (2010-2015) [2]. These topics, especially 2 and 3, appear to be Don-Quixotic [2, 3] but had favors by MENA and Turkmenistan academia for developing technologies of new solar Si and High-Tc superconducting dc-power transmission (SCDC) to inspire the engineers' spirit and technology of young students. Some details of the topics are summarized below.

1. CO_2 copolymerization to produce bio-degradable solid polymer/plastics.

Carbon dioxide is assigned a main criminal of global warming and is targeted to be reduced. A variety of policies, like carbon neutral and CCS (Carbon Capture and Storage), have been proposed, but their execution is severely restricted due to the narrowing of the natural gas supply from Russia accompanied by its invasion of Ukraine. Technologically the simplest CCS would be the direct fixation into solid and regeneration of CO_2 at appropriate time intervals. The alternating copolymerization of CO_2 with epoxides is a typical case and it was discovered in 1969 by H. Koinuma during his Ph.D. research at Tokyo University, published and patented in Japan and abroad [1]. The alternating polycarbonate sequence was verified by NMR and IR spectroscopies indicating that $ZnEt_2$-H_2O and other catalysts initiated the opening of the strained epoxide ring in combination with the C=O $\pi \rightarrow$C-O σ bond in CO_2 to form the carbonate bond spontaneously (figure 1).

Most of the copolymers with different substituents on epoxide could be purified by reprecipitation into a white soft solid with Mw as high as 400,000. which exhibited melting and degrading temperatures as low as 40℃ and about 200℃, respectively. They also had bio-

degradability as well. Thus, these CO_2 copolymers may be useful as CO_2 capture and storage: CCS material without forming micro-plastic pollution. For large-scale industrial production, although a few test plants were reported to exist in US and China, we need to improve the catalyst efficiency significantly and find good applications and markets. Since CO_2 and CS_2 copolymer work as electrolytes, they could be used for solid polymer batteries of EV. Other candidates for application include composites with inorganic solids (e.g. $CaCO_3$), polymer alloys, and plastics without forming micropollutants in the sea.

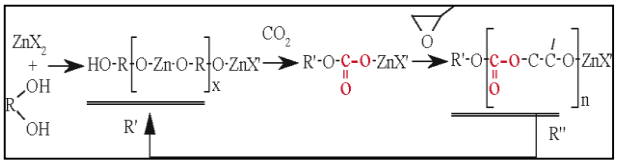


Figure 1. Alternating copolymerization of CO2/CS2 and epoxides to form Biodegradable/Electrolytic aliphatic polycarbonates and poly xanthates

2. Convert the deserts to PV energy mines with food supplying green fields.

The Sahara Solar Breeder: SSB project was a technical cooperation plan between Japanese and Algerian Universities for 5 years from 2010 in a framework of SATREPS (Sci. & Tech. Res. Partnership for Sustainable Development) supported by Japanese funding agencies: JST and JICA [2]. The main purpose and motivation of the SSB project were the following:

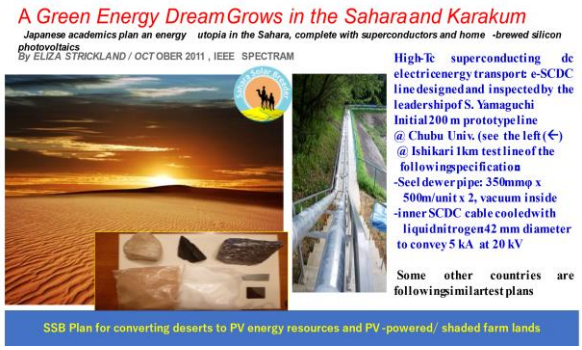
1. New Si technology for purifying and reducing desert sands to SOG-Si of 6+ nines purity as inexpensive mass production material of solar cells and PV panels to make shadows and GW-TW class power plants in the desert.
2. PV electricity is designed to be beneficial for local people to pump up water to make oases and agricultural lands, and amplify PV plants by the breeding mode using the extra electric power converted from the sunlight as infinitely-fed free fuel.
3. In parallel with the construction of solar breeder plants, SCDC transmission R & D should start to supply surplus energy to surrounding areas and globally in the future.

Shortly after the Rome conference, we got an invitation from the Turkmenistan Academy of Sciences (TAS) to the June 12 Science Day International Conference and Exhibition to deliver a talk on the SSB project. Apparently, TAS was interested in the SSB because of the Karakum desert, as big as the whole area of Japan, and the possibility of its change to rich energy resources. Later, we established JTSTC: Japanese-Turkmen Assoc. for Science and Technology Cooperation to start academic collaboration by signing the contract for fostering young Turkmen engineers and challenging together to advance research for the future. Natural gas, the origin of the richness of the permanent neutral country Turkmenistan, is not permanent but drying up in 50-100 years by using it as a fuel, even if its CO_2 emission is relatively lower than other fossil fuels. In order to stabilize this economically and politically fluctuating world as well as to bring peace to the world, the best solution is presumed to be a sufficient and fair energy supply to human beings. The spaceship earth is cruising in a steady state of energy flow from the sun that is a nuclear fusion reactor bringing solar energy 10,000 times as much as we are consuming, free of charge. Assuming the placement of solar panels with 10 % solar to electricity conversion efficiency, 1 km^2 and 100x100 km^2 desert can respectively be 100 MW and 1 TW power stations.

Technology tasks of SSB include:

1. The purification of desert sand and its energy-saving reduction to solar-grade silicon.
2. Innovative electric energy transmission by high-Tc superconducting cable.

Preliminary R & D have been proposed and tested in view of a variety of technological progress and international circumstances for spreading out the clean energy policy. Rather than



the technology, the diplomatic/economic factors coming from the incentive to avoid the nuclear and global environmental risks could trigger the paradigm shift. Japanese dominance in the solar cell industry until the early 21 century decayed and was taken over by clever Chinese business sense. SSB concept can be traced back to the virtual GENESIS proposal by Kuwano soon after the discovery of HTSC. It also can be compared with the current going Dii Energy consortium to transfer energy from the African desert to Europe using conventional HVDC technology. Based on our experience in energy science and technology since the 1980s, we hope to bring a renaissance of solar Si technology and innovation in energy transmission as well.

3. Asia-Pacific to Atlantic trans-continental SCDC highway of PV and gas energies.

The human population is supposed to have increased from less than one to eight billion during the past 200 years due mainly to Haber-Bosch's NH_3 synthesis from N_2 in the air and H_2. N is one of the 3 key elements, together with P and K, of fertilizer to produce the foods as raw materials to constitute organic living things including human beings, plants, seaweeds, bacteria, and viruses. Photosynthesis is another typical case of chemical conversion of inorganic, non-living to organic living things with the assistance of solar light. Our and every living thing's life is filled with many chemical reactions by the catalysis of enzymes and driven by the exchange of various types of energy. The key technology in our life exists not only in energy resources but also in their supply chains. Natural gas resources in Turkmenistan are mainly exported to China and Russia via gas pipelines. From the viewpoint of low loss and high security, we propose the SCDC scheme of SSB. As a result of Ishikari's 1km SCDC project, the leading status of Japanese technology in this respect was recognized [3]. The fierce race toward SCDC-type power transmission is prospected to start internationally. Preliminary SSB research with Algeria can be extended to cooperation with Turkmenistan and MENA countries to stabilize and balance the energy needs in the world. SCDC's future technology could present a possibility for Turkmenistan to possess the third and the safer efficient way of natural gas energy transport by replacing it with the current gas pipeline (and LNG tanker). Some more details will be reported elsewhere.

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APPLICATION OF CLOUD TECHNOLOGIES IN EDUCATION

Isgender Tagangylyjov[1*], Oguljan Gawirova[2]

[1,2]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*

[*]Corresponding author

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Today, the Internet is available everywhere. This has a great impact on the uninterrupted use of the Internet in the educational process as well. Therefore, it is more important to study the use of the Internet in the educational process in this field [1].

First, cloud computing is becoming more popular these days due to its ease of use. Students, teachers, and students can access content from any phone, computer, or iPad. This internet accessibility not only allows students, learners and teachers to be able to access the system from anywhere, but also extends the learning of students or students beyond the confines of the traditional four walls of the classroom. “With today's technology, student learning is no longer in the classroom. "The learning environment can be improved so that students can access learning resources anywhere, anytime," he said. Easy access to classroom content allows students to learn at their own pace, helping them think critically about information and gain deeper understanding. they can conduct and design lessons that allow the student to engage in extracurricular activities of the student's interest.

Second, cloud computing can improve collaboration among students as well as between students and teachers. “Google Docs and the entire G Suite system for English classrooms are changing the way we interact with each other. "This collaboration helps kids make real connections with text and information." Using apps like Google Docs and Google Slides can help students get real-time feedback from teachers on their work. As Barkley points out, " Collaborative learning is a pedagogy that emphasizes that when students and teachers work together to create knowledge, people create meaning together and the process is enriched and developed.

Third, using applications such as Google Classroom, cloud computing can help students and teachers organize and facilitate classroom communication. Google Classroom is an online learning management system that can host all of your classroom content. An online education system reduces the paperwork that teachers are used to. Teachers no longer have to carry paper assignments home because they can access information from any device. Also, students don't have to worry about not being on form or on assignments. Google Classroom is versatile, easy to use from both staff and student perspectives, and allows for easy collaboration . Using Google Classroom makes teachers and students better organized because it allows students and teachers to organize course content in Google Classroom. It also allows students and teachers to communicate with each other in an easy way [2].

Availability of data in the cloud is another advantage. Because students and faculty can instantly store and retrieve materials on remote servers, they can work from anywhere with an Internet connection and collaborate with classmates and peers without being in the same room.

Cloud technologies provide a secure Internet connection, which allows teachers to adopt online platforms for assigning and tracking homework assignments. By using all resources in the cloud, teachers can also focus on virtual learning. This flexibility has made cloud computing a major advancement in education, allowing all schools and colleges to better serve their students.

Cloud computing makes education more efficient and accessible. As education technology continues to change, many businesses struggle to ease the transition. Therefore, accelerating the adoption of cloud technologies in the education sector is an important issue.

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THE IMPORTANCE OF COMPUTATIONAL LINGUISTICS IN DIGITIZING OUR COUNTRY

Jasurbek Ashyrbayev*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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Turkmenistan is rapidly advancing its digital transformation initiatives, working towards the implementation of the Conception of Digital Economy Development in Turkmenistan (2019-2025) and the State Programme of Digital Economy Development in Turkmenistan (2021-2025). Under the guidance of President Serdar Berdimuhamedov, the country is making significant strides in incorporating digital technologies into all aspects of daily life, aimed at making it more efficient and user-friendly.

The government of Turkmenistan has launched several initiatives aimed at digitizing key sectors of the economy, such as healthcare, education, and transportation. These initiatives are aimed at improving the delivery of services, reducing costs, and enhancing the overall competitiveness of the country. For example, the government has launched a program to digitize the healthcare sector, aimed at improving the delivery of healthcare services and reducing the costs associated with healthcare.

Computational linguistics is a branch of computer science and linguistics that deals with the development of computational models for the analysis and generation of human language. It leverages artificial intelligence, natural language processing (NLP), and machine learning to process, analyze, and understand human language, making it a powerful tool in the digitalization of country.

In the implementation of the Conception and the State Programme of the Development of Digital Economy, computational linguistics is being utilized to enhance various sectors of the national economy. For example, in the digital government sector, computational linguistics is used to analyze large amounts of text-based data such as public opinion and policy documents, to help decision-makers make informed decisions. Chatbots are being employed to provide citizens with information about government services and procedures and assist them in completing online forms and applications [1]. In the digital economy, computational linguistics is utilized to analyze large amounts of customer feedback, product reviews, and market trends, to help businesses understand their customers and make data-driven decisions. Sentimental analysis can measure the sentiment of customer feedback, allowing businesses to understand how their customers feel about their offerings [2].

In the healthcare sector, computational linguistics is making a significant impact by analyzing patient data, medical records, and research papers to help providers make informed decisions. NLP techniques can process large amounts of medical data and extract insights to improve patient outcomes, while speech-to-text and text-to-speech systems can assist patients and healthcare providers in communication [3].

Computational linguistics is also shaping the future of the smart city sector, by analyzing data generated by IoT devices to help city managers make informed decisions [4]. NLP techniques can process this data and extract insights that can be used to improve city services, such as traffic management and waste management.

The robotics sector is also benefiting from computational linguistics, by developing robots that can interact with humans in natural language. NLP techniques enable robots to understand human speech and respond in a human-like manner.

One of the key applications of computational linguistics in digitization is machine translation. Machine translation systems use algorithms and models to translate text or speech from one language to another. This has several benefits, including reducing the cost and time required for translation, making it possible to translate large volumes of text quickly and accurately, and enabling communication between people who speak different languages [5].

Finally, computational linguistics is playing an increasingly important role in education by enabling the development of personalized learning tools and virtual tutors. These tools can analyze students' language and learning patterns, and provide individualized support, leading to better learning outcomes [6].

In conclusion, computational linguistics is an important field of study that is playing a critical role in the digitization of Turkmenistan. The technology and algorithms developed by computational linguists are making it possible to improve communication, accessibility, and decision-making, and support the growth of key sectors of the economy. As digitization continues to advance, it is likely that the importance of computational linguistics will continue to grow, making it an increasingly important field for researchers, practitioners, and policymakers.

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FORESIGHT AS A TOOL FOR "SMART" REGIONAL SPECIALIZATION

Jemal Kulyyeva*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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Currently, one of the main indicators that determine the competitiveness of a region is not concerned with its size, but with its ability to create inventions and innovations taking into consideration its unique features and economics date of a region. Therefore, the systematic base of innovation economy in a country should be based on innovation policy concerned with the distinctive features and advantages of one region from another. Under the conditions of international global competition, developing regions follow the "powerful development" of socio-economically developed regions and try to directly repeat and copy the "model" of creating and introducing innovations. By directly repeating "growth models" regions carry out unsuccessful and counterproductive work because they do not take into account the region's strengths and weaknesses, opportunities and threats.

With this on mind, the "smart" program of specialization for regions was created to solve the problem of "not repeating others". "Smart specialization" is a program to develop the region based on its natural and raw material resources, ecological and climatic features, human capital, and all the advantages that distinguish it from other regions, based on innovative technologies in those areas.

Foresight research is an effective tool to protect and avoid obstacles and limitations, implementing the regions' raw materials, climate characteristics, development potential, level of human capital supply, entrepreneurship, innovative and investment capacity, regional infrastructure to the fullest.

Foresight being a technology to build the future is a set of studies used systematically to build an everlasting future, taking into account possible reforms in all spheres of life: science and education, economy, social relations and culture, with the participation of all experts and stakeholders.

Representatives of various industries participate in Foresight studies. They are representatives of scientific and technological organizations, entrepreneurship, government and societal entities.

An average of 6-10 inspection methods are used per Foresight. The choice of audit methods depends on the project, organization, circumstance, budget, availability of experts, or intended purpose. Looking at the international experience, for example Japan, the Delphi method was used to make a technological forecast for the next 30 years, in Great Britain and Germany, a wide range of methods and their mix were used, and in the United States and France, it was widely used to make a list of technologies of great importance.

Methods for conducting foresight research require specific conditions, information, technologies, or expertise. In this paper, the opportunities of using the methods of Foresight research set under the conditions of Turkmenistan were analyzed.

As a result, methods such as bibliometrics, patents and literature analysis are currently not fully utilized due to the scarcity of data, on the other hand benchmarking, extrapolation of trends, brainstorming, citizen and expert panels, STEP and SWOT analysis, implementation of Delphi and a list of important technologies methods is possible and could be carried out under the beneficial conditions.

Some of the most effective methods include Delphi, technology priority lists, scenario building, technological roadmaps, and expert panels.

There is no specific sequence or set interrelations of methods used in foresight studies, and each region chooses it based on its own goals and capabilities.

The cost of conducting foresight inspections depends on the area being inspected, the size of the inspection, the time and methods used.

Basic costs are made up of:

- funding of the project management team;
- holding meetings and events expenses;
- advertising expenses;
- additional expenses.

In conclusion, the foresight research is the most effective method implemented to develop the region by bringing together experts from different business types, authorities and citizens' opinions.

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GAUSSIAN PROCESS WITH HYPERPARAMETERS OPTIMIZATION USING LBFGS ALGORITHM: A CASE STUDY WITH 5G NEW RADIO THROUGHPUT DATA

Joseph Isabona[1*], Okiemute Roberts Omasheye[2]

[1]*Department of Physics, Federal University Lokoja, Lokoja, Kogi State, Nigeria.*
[2]*Department of Physics, Delta State College of Education, Mosogar 331101, Nigeria.*

[*]Corresponding author

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Gaussian Process Regression (GPR) is a fast and powerful non-parametric regression method for data mining and machine learning. The Bayesian optimization method, which has remained one of the standard methods of optimizing the GPR, usually leads to poor parameter tuning and code start problems. In this paper, we proposed and leveraged the accurate and robust gradient-based limited-memory Broyden–Fletcher–Goldfarb–Shanno (LBFGS) algorithm to surmount the aforementioned Bayesian optimization tuning method. We have applied the proposed GPR-LBFS tuning algorithm to mine and predict a set of throughput data that were acquired over 5G New radio networks. We show by engaging the Root Mean Square Error (RMSE) and Correlation coefficient (R) statistics, that the proposed GPR-LBFS tuning algorithm provides the best hyperparameter tuning results, and also attains the best throughput data prediction accuracies at different measurements points and spatial domains.

Introduction and Problem Statement. For effective model selection and application of any machine learning method during data mining processes, its hyperparameters tuning algorithm plays a decisive role [1]. Particularly, tuning the hyperparameters of Gaussian Process Regression (GPR) based machine learning and predictive modelling method can be exhaustive and cumbersome if the data is relatively large [2-4]. The Bayesian optimization method, which has remained one of the standard methods of optimizing the GPR, usually leads to poor parameter tuning and code start problems [2].

In this paper, we proposed and leveraged the accurate and robust gradient-based limited-memory Broyden–Fletcher–Goldfarb–Shanno (LBFGS) algorithm to surmount the aforementioned Bayesian optimization tuning method. We have applied the proposed GPR-LBFS tuning algorithm to mine and predict five different sets of throughput data that were acquired over 5G New radio networks. We show by engaging the Root Mean Square Error (RMSE) and Correlation coefficient Indicators, that the proposed GPR-LBFS tuning algorithm provides the best hyperparameter tuning results, and also attains the best throughput data prediction accuracies at different spatial domains.

Methodology. A novel stepwise framework is engaged in this paper to tune the GPR model hyperparameters for effective throughput data predictive mining. The first step concentrates on real-time throughput data acquisition. The second step focuses on GPR model description and its hypermeter identification. The next step is GPR-based hyperparameter tuning with the LBFGS algorithm and application to mining and predicting the acquired throughput data.

The LBFGS Algorithm. The LBFGS algorithm [2, 5], is a strong and resourceful gradient-based optimization algorithm that has the capacity to solve diverse large-scale data mining problems, mostly within the sphere of artificial network applications. The LBFGS is an

improved version of the BFGS method and its memory requirements are about (12+2m) N where N and m indicate the model space size and BFGS updates number. LBFGS achieves its adaptive optimization by employing inverse Hessian matrix approximation via iterative processes to pilot its line search over variable space.

Results. The graphs in Figures 1 and 2 display the extrapolative learning and prediction accuracies using the proposed GPR–LBFGS in comparison with the standard BOP method. We can infer from the figures the proposed GPR–LBFGS technique achieved 0.38 RMSE accuracy in throughput data prediction. In contrast, the standard GPR-BOP and GPR with hyperparameter tuning achieved 90.20 and 288.42 RMSE accuracies.

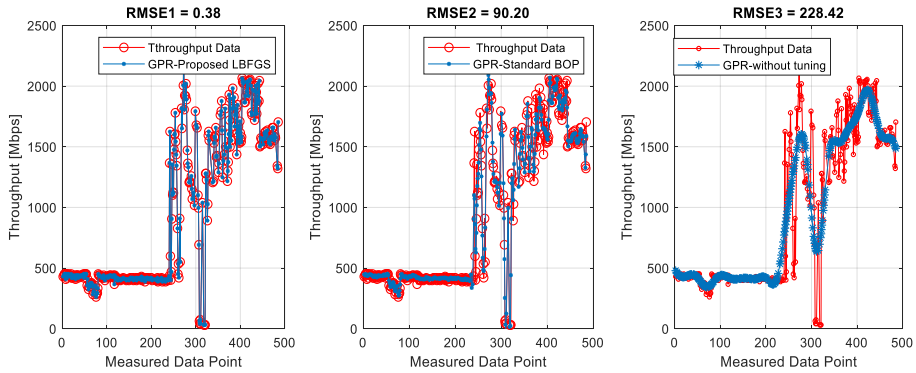

Figure 1. Measured Throughput Data and RMSE prediction performance with Proposed LBFGS and BOP

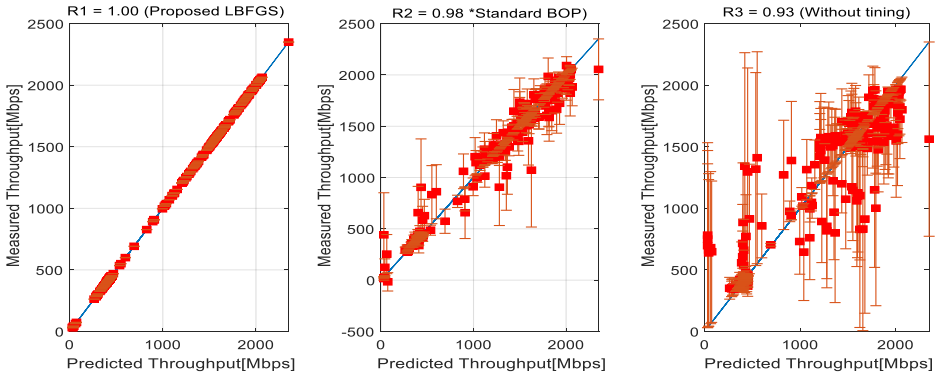

Figure 2. Measured Throughput Data and correlation coefficient prediction performance with Proposed LBFGS and BOP

Conclusions. The LBFGS algorithm has been successfully proposed and applied with the GPR to analysis and predict real-time throughput data sets. The datasets were collected from 5G-New Radio networks. Moreover, we show by means of the RMSE and Correlation coefficient, R Indicators, that the proposed GPR-LBFS tuning algorithm provides the best hyperparameter tuning results, and also attains the best throughput data prediction accuracies at different spatial domains.

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EEG DATA PROCESSING FOR BRAIN COMPUTER INTERFACE

Vladislav Goncharenko[1*], Kerven Durdymyradov[2], Isaac Parrondo[3]

[1,3]Department of Machine Learning, Moscow Institute of Physics and Technology, Moscow, Russia.
[2]Computer, Electrical and Mathematical Sciences & Engineering Division, King Abdullah University of Science and Technology, Thuwal, Kingdom of Saudi Arabia.

[*]Corresponding author

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BCI - Brain-computer interfaces make it possible to communicate between a computer and the brain using neural activities. Generally, electroencephalogram(EEG) signals are used for this communication.

In this work, we worked in two ways. In the first way, we used Riemannian geometry and in the second we used Neural Networks - as baseline architecture we used EEGNet, a compact convolutional neural network for EEG-based BCIs. Riemannian geometry is the branch of differential geometry that studies Riemannian manifolds. We used it for feature extraction. Because we are converting the EEG signals to covariance matrices, during these estimations, we used several covariance estimations like ERPCovariances and XdawnCovariances. So, by using Riemannian geometry, we are writing these matrices in the vector. At last, we can use any classification to classify these vectors. In the deep learning part, We use EEGNet which is used depthwise and separable convolutions to construct the model which encapsulates well-known EEG feature extraction concepts for BCI.

We make several tests for parameters of EEGNet (table 1), PyRimannian library (table 2), and parameters during the pre-processing of datasets like decimation, filtering and scaling. Brain-computer interfaces (BCI) make it possible to communicate between a computer and the brain using neural activities [1]. Traditionally, BCIs are used for medical applications. The studies have opened the chance for brand-spanking new BCIs targeting enhancing the performance of the users, with noninvasive approaches grounded on EEG. Generally, a BCI consists of five main processing stages [2] the information collection, sign processing stage, feature extraction stage, and feedback step. While these stages are largely identical across BCI paradigms, each paradigm relies on nonautomatic specification of signal processing, feature extraction, and classification methods [3, 4].

The filtering algorithm is often seen as a data-driven dimension reduction method that aims at promoting variance differences between two conditions. during this fashion, covariance matrices are handled within the metric space inconsiderately of the curvature of the space of Symmetric Positive Definite (SPD) matrices to which they belong. This paper provides a straightforward thanks to take under consideration the non-Euclidean geometry for EEG signal classification. Furthermore, a replacement kernel springs by establishing a reference to the elliptic geometry of SPD matrices. Similar approaches are applied, resulting in the definition of various kernels looking at the Riemannian metric considered. [5, 6].

Neural networks have largely soothed the necessity for feature extraction, achieving state-of-the-art performance in fields just like computer vision. Specifically, the utilization of CNNs has grown due partly to their success in numerous image classification problems [7], surpassing styles relying on hand-crafted features. During this work, we used EEGNet, a compact CNN for the classification and interpretation of EEG- grounded BCIs. during this EEGNet structure, it's used Depthwise and Separable convolutions, preliminarily utilized in computer vision [8], to construct an EEG-specific network that encapsulates several well-known EEG feature

extraction conceptions, like optimal spatial filtering and filter-bank construction, while contemporaneously reducing the number of trainable parameters to suit in comparison to being approaches [9].

Table 1. Results from EEGNet

Classifier	accuracy	f1	precision	recall	roc-auc
EEGNet	0.864653	0.506274	0.764358	0.377845	0.661713

Table 2. Results from PyRiemann libraries

Classifier	accuracy	f1	precision	recall	roc-auc
ERPCov TS LR	0.953653	0.856285	0.885698	0.829846	0.981511
Xdawn LDA	0.950128	0.848273	0.884239	0.819141	0.977125
SVM	0.947137	0.829210	0.893059	0.775881	0.974534
LDA	0.944750	0.828423	0.868455	0.799009	0.967462
LR	0.941905	0.815382	0.868115	0.775330	0.970644

Riemannian approaches are successfully applied to EEG signals for brain-computer interfaces. Acting on covariance matrices in Riemannian spaces offers a good choice of distances, embedding desirable invariances: it's thus possible to avoid the computation of user-specific spatial filters which are sensitive to artifacts and outliers. Nonetheless, the estimation of the Riemannian mean incorporates a strong impact on the classifier accuracy. This study investigates the performance of several distances and divergences on a true EEG dataset within the context of the BCI-supported paradigm. That's if you are working with not only EEG signals, for all time series - Riemannian geometry is one of the first choices. On the other hand, by using neural networks, like EEGNet you can create a strong model with big datasets.

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SCIENTIFIC BASES OF TECHNOLOGY OF MANUFACTURE OF HIGH-TEMPERATURE STABLE MAGNESIUM BRICKS USING LOCAL RAW MATERIALS OF TURKMENISTAN (DOLOMITE, BISCHOFITE)

Kerim Nepesovich Ryzayev[1*], Gulnar Ovezdurdyeva[2]

[1,2]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*

[*]Corresponding author

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The fact that the country has huge reserves of various underground and surface resources leads to an increasing number of industries that find, develop and process raw materials. In particular, the number of modern enterprises in the oil and gas, chemical, energy, transport and communication, mining, construction, agricultural, textile and food industry sectors is increasing. Thus, the demand for important industrial products and resources is met at the expense of our own local resources and exported to the foreign market. The development of these industries, in turn, is directly related to the need for the purification and efficient use of water resources, including wastewater. This is especially important in our humid, hot and dry climate.

Currently, the production of various types of construction materials based on local raw materials and their export to the world is the main demand of the time. This scientific The research work consists of buying imported high temperature resistant magnesia bricks based on local raw materials available in Turkmenistan. These bricks are widely used in the Turkmendemirunumleri state enterprise belonging to the Ministry of Industry and Construction Production, as well as in the cement factory of the country. The main ingredient of magnesia bricks is magnesium oxide (MgO), which is mainly found in Turkmenistan in the form of dolomite ($MgCO_3 \cdot CaCO_3$) and bischofite mineral ($MgCl_2 \cdot 6H_2O$).

Several methods are known for obtaining high temperature stable magnesia bricks based on synthesized magnesium oxide. In this research work, pure magnesium oxide synthesized according to methods V and VI "A" was ground to 0.25 mm in a ZM 200 mill, a product of the German company RETSCH. It was then moistened to 5-6%. It was then molded into a cylindrical shape with a diameter of 60 mm and compressed at 150 bar. The obtained tablet was dried at a temperature of 100 oC for 4 hours and then stored at a temperature of 1700 oC for 3 hours in a P310 muffle furnace, a product of the German company Nabertherm. To adjust the temperature program of the muffle page, the magnesium oxide sample was monitored for mass loss at every 100 oC temperature up to 1000 oC on a DIL402 PC dilatometer, a product of Nietzsche, Germany, and the temperature program of the muffle page was adjusted accordingly.

The purpose of the work to study the possibilities of obtaining magnesium oxide on the basis of local raw materials of Turkmenistan (dolomite, bischofite). Analysis of the scientific basis of production of high-temperature-resistant magnesia bricks based on obtained magnesium oxide . Today, several methods of obtaining magnesium oxide used for construction purposes are known on earth. The strong magnesium-oxygen bond in the crystal pore of magnesium oxide (MgO) increases its high temperature stability. Therefore, the main feature of building materials made of magnesium oxide is its stability to high temperatures. This scientific research work, as it is known by its name, consists of buying imported high-temperature

resistant magnesia bricks for the “Türkmendemirönümleri” State Enterprise of the Ministry of Industry and Construction and for the Cement Factory of the country.

Novelty of the work. The efficient methods of thermal and chemical extraction of magnesium oxide from dolomite will be analyzed. A convenient method of obtaining magnesium oxide from bischofite will be studied. Based on the obtained magnesium oxide, the scientific basis of making magnesia bricks resistant to high temperature will be analyzed. A technological scheme for obtaining magnesium oxide from dolomite and bischofite and obtaining magnesia bricks stable at high temperatures will be developed.

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IMPACT OF TURKMEN LAKE "ALTYN ASYR" ON PASTURE PRODUCTIVITY

Kaka Soyunmyradov[1*], Aybek Tajiyev[2]

[1]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*
[2]*Turkmen Agricultural Institute, Dashoguz, Turkmenistan.*

[*]Corresponding author

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The President of Turkmenistan is making tireless efforts to turn our motherland and vast desert into a wonderland by effectively using the country's water reserves. "Altyn Asyr" Turkmen Lake, created in the Garashor Basin, located in the northwest of Turkmenistan, is a clear evidence of the ongoing reforms in Turkmenistan.

The artificial lake being created in the Karashor basin is an innovative project. This is a clear example of Turkmenistan's continuous contribution to solving important problems related to the preservation of the world's water resources.

"Altyn Asyr" Turkmen Lake is 103 km long, 18.6 km wide, and 132 km3 in volume. Salt water is brought to the lake through two large aqueducts - the main saline aqueduct and the Dashoguz aqueduct. The total length of the main saline aqueduct is 720 km, and the length of the Dashoguz aqueduct is 381 km [2]. The construction of Turkmen Lake is being carried out in 3 stages. The construction of its first phase began in 2000 and was completed in 2009.

Thus, as a result of the natural purification of drainage water and the use of modern technologies in purification, a reserve fund of water is created that can be used for the needs of the agricultural industry - for the development of new lands, irrigation of pastures, as well as for irrigation of forest zones, technical needs.

As stated in the "Social and Economic Development Program of the President of Turkmenistan in 2019-2025", the construction of the "Altyn Asyr" Turkmen Lake made it possible to improve the ecological condition of the desert, as well as the melioration of irrigated lands [1]. In the future, the treatment of the water that collects here allows it to be reused.

As a result of the connection of the Main water aqueduct and the Dashoguz aqueduct, the improvement of the agricultural land will be improved, and the level of problems in the irrigated areas will be significantly reduced. Improvements in irrigated land reclamation through water balance adjustments will also allow for reductions in the need to impound washwater. This will significantly reduce irrigation water productivity losses and ultimately groundwater levels. As a result, it will contribute to the rapid reduction of irrigation water and increase the yield of agricultural crops, prevent the flooding of pasture areas, and improve the ecological and meliorational condition of the land. In recent years, large-scale work has been carried out in Turkmenistan to turn vacant land into a forest, and to maintain forest zones [4]. In the case of afforestation of Karakum desert, the importance of the lake's salt water streams is relatively large.

The new water facility is of great importance for the fauna of Turkmenistan, primarily for migratory birds. In Lake Turkmen, in the Central and Eastern Karakum areas, where the aqaba system passes, a favorable ecology and forage base for birds is created. In the future, these areas will be a breeding ground for wetland birds. New places for nesting and wintering will be created here. In particular, it will allow to increase the area and number of valuable bird species.

Thus, irrigation of the central part of the Karakum will contribute to the conservation of biological diversity. This will have a positive effect on the breeding status of the rare ungulates

included in the Red Book of Turkmenistan - mountain goats, gulans, gerenas. The number of aquatic fauna living on the shores of reservoirs will also increase.

The construction of "Altyn Asyr" Turkmen lake in the middle of the Karakum desert, the drawing of many water pipes from the agricultural lands to the lake, not only affects the flora and fauna of the Karakum, but also affects the condition of the pastures, the water supply of the fields, the method of use, cattle breeding and camel breeding. it also has a positive effect on their methods. Currently, the amount of pastures in the desert has reached 8 million 640 thousand hectares. This makes it possible to keep 4.6 million head of cattle and 60 thousand camels here, to grow sorghum, water grass, barley, wheat and other forage crops [5].

"Altyn Asyr" Turkmen Lake has great importance in increasing the economic potential of the country, in developing the agricultural and livestock sectors, in increasing the production of food products and in ensuring the stable food security of the state, in improving the social and economic conditions of the people, and in creating thousands of new jobs [3]. New towns and villages will be built on its shores in the near future.

As we mentioned above, the creation of an artificial water reservoir in the Karakum desert is intended for the collection of rainwater , which does not take into account the extraction of water from Amyderia and other irrigation sources. Thus, the construction of Lake Turkmen is carried out together with a set of nature protection measures. The water collected in "Altyn Asyr" Turkmen Lake will be a source for secondary use in the future after special purification and desalination.

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PHASE AND GROUP VELOCITIES OF WATER WAVES - DESCRIPTION OF WAVE DEFORMATION USING FRACTIONAL DERIVATIVES

Kazuo Matsuuchi*

University of Tsukuba, Tsukuba, Japan.

*Corresponding author

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Since 1980's it has been known that there exists a speed higher than that of light in a vacuum ($2.9979 \times 10^8\ m/s$). It is also known that a duck swims at about 0.7 m per second whose distance is only twice as large as the body, while a whirligig beetle, which is a small insect living on a water surface, can swim longer than several ten times of its size in a second. What is the difference between the speeds of two kinds of creatures? To know the above two interesting matters correctly, it is necessary to get a deep understanding of traveling waves of an arbitrary shape.

Some specific behaviors of wave propagation depend on the dispersion relation between the frequency and wavenumber of the wave. Most of the discussions on wave propagation have almost been made on monochromatic waves, i.e., on those of one wavenumber or one frequency. Waves of an arbitrary shape are expressed by the superposition over many waves of different wavenumbers.

We consider a superposition of many water waves with various *k*. The surface elevation $\eta(x,t)$ is written as

$$\eta(x,t) = \int A(k)\mathrm{e}^{i(kx-\omega t)}\mathrm{d}k \qquad (1)$$

where $\omega/k\ (=c)$ is called the *phase velocity*. The frequency ω depends on the wavenumber k. For gravity and capillary waves the dependence is in the dimensionless form as $\omega^2 = k\tanh k$ for gravity waves and $\omega^3 = k^3\tanh k$ for capillary waves, respectively. It should be noted that $\tanh kh \approx 1$ for deep water waves. On the other hand, another kind of velocity called the *group velocity* c_g defined as $\mathrm{d}\omega = \mathrm{d}k$ plays an important part in the investigation of the energy transport due to wave motion. It is important to notice the difference between the two. We first derive the equation governing the gravity wave. From eq.(1) the equation describing the wave development is written as

$$\frac{\partial \eta}{\partial t} + \frac{1}{\sqrt{2}}\left(I^{-\frac{1}{2}} - K^{-\frac{1}{2}}\right)\eta = 0 \qquad (2)$$

Two operators $I^{-\frac{1}{2}}$ and $K^{-\frac{1}{2}}$ are called the fractional derivatives of order $1/2$. The operators are written in general as

$$I^{-\lambda}f(x) = \int_{-\infty}^{\infty} \hat{f}(k)|k|^{\lambda}\,\mathrm{e}^{\frac{\pi}{2}\mathrm{i}\lambda\,\mathrm{sgn}k}\mathrm{e}^{\mathrm{i}kx}\mathrm{d}k$$

$$K^{-\lambda}f(x) = \int_{-\infty}^{\infty} \hat{f}(k)|k|^{\lambda}\,\mathrm{e}^{-\frac{\pi}{2}\mathrm{i}\lambda\,\mathrm{sgn}k}\mathrm{e}^{\mathrm{i}kx}\mathrm{d}k$$

where $I^{-\lambda}$ and $K^{-\lambda}$ are the Riemann-Liouville and Weyl derivatives of order λ, respectively, and sgn stands for the sign function.

We consider the temporal development of waves under the boundary condition at $x = 0$,

$$\eta(0,t) = \mathrm{e}^{\mathrm{i}\Omega t} \tag{3}$$

By applying the Laplace transform to (2), the formal solution for $t \geq 0$ is written as

$$\eta(x,t) = \frac{1}{2\pi \mathrm{i}} \int_L \mathrm{e}^{h(s)x} \frac{\mathrm{d}s}{s - i\Omega} \tag{4}$$

where

$$h(s) = \frac{s}{m} + \mathrm{i}s^2(1 - 2\mathrm{i}u_0 s - 5u_0^2 s^2) \text{ and } m = x/t \tag{5}$$

The line L is a vertical line lying to the right of all singularities and the integration is from $-\mathrm{i}\infty$ to $\mathrm{i}\infty$. By carrying out the integration we could obtain the final solution. The result is shown in figure 1.

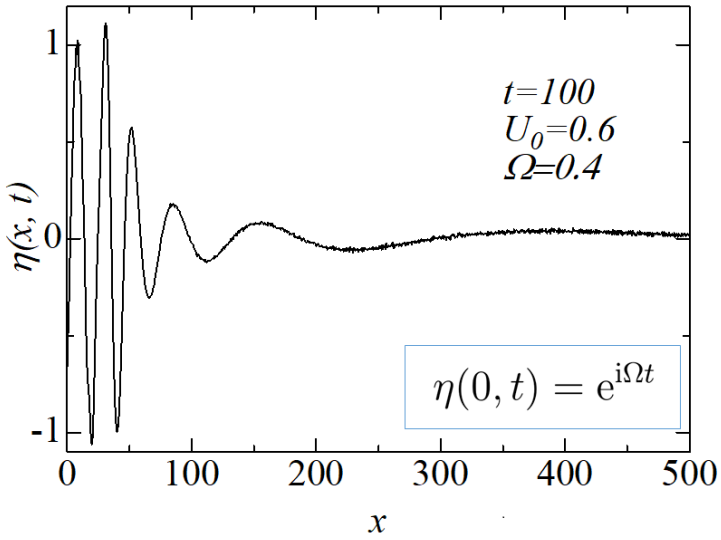

Figure 1. The development of gravity wave under the boundary condition, $\eta(0,t) = \mathrm{e}^{\mathrm{i}\Omega t}$

Next, we consider the development of capillary waves generated by small insects. By carrying out the procedure in a way similar to that for the gravity wave, we can get the characteristics of waves. The equation governing the motion can be obtained by rewriting the second term on the left-hand side of eq. (2) as $1/\sqrt{2}\left(I^{-1/2} - K^{-1/2}\right)\partial\eta/\partial t$. As a simpler case, we solve an initial- value problem to the equation. As an initial value at $x = 0$, we choose $\eta(x,0) = \sqrt{a/\pi}\,\mathrm{e}^{-ax^2}$. The development at $t = 75$ is shown in figure 2 for $a = 1$. This wave propagates far upstream containing high energy, i.e., with higher frequency but low amplitude. The charateristic is contrary to the case of gravity waves in which the wave energy is restricted near the origin of the wave disturbance.

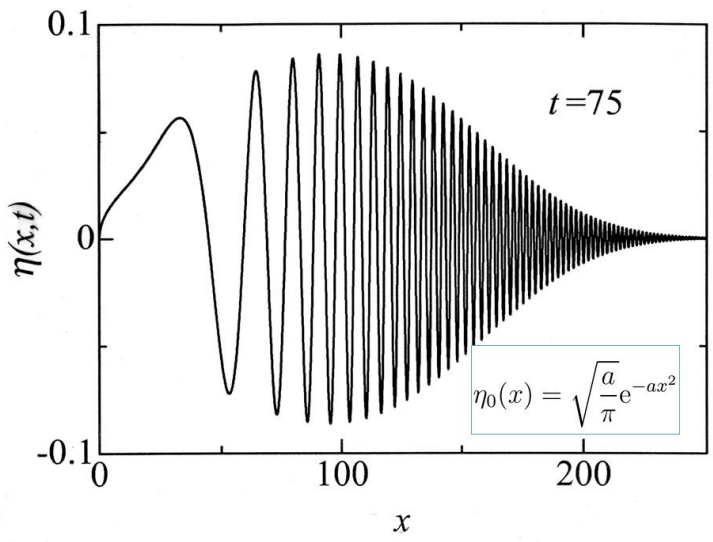

Figure 2. Asymptotic wave form for capillary wave at $t = 75$

It is known that whirligig beetles become active at night. For this reason their eyes are not useful in their night action. Our result suggests that they have a strategy that they use the wave as a signal for detecting their food. In constrast with the gravity wave, capillary ones generated by small insects have remarkable properties. It should be noted that the difference between the two kinds of waves comes from that between the phase and group velocities.

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MULTI-BAND CDR SMART ANTENNA FOR 5G APPLICATION: MID-BAND (7 GHZ) EXTENSION AND VISION 2030

Khalid Ali Khan[1*], Suleyman Malikmyradovich Nokerov[2], Aravind Pitchai Venkataraman[3], Junaid Ahmed Uqaili[4]

[1]*Department of Electrical and Computer Engineering, Mattu University, Mettu, Ethiopia.*
[2]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*
[3]*Saranathan College of Engineering, Thiruchirappalli, Tamil Nadu, India.*
[4]*Beijing University of Posts and Telecommunications, Beijing, China.*

[*]Corresponding author

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Recently, a new analysis of the spectrum needs of 5G networks across low-, mid-, and high-bands has been released by Global System for Mobile Communication Association (GSMA) [1]. Actually, GSMA's recommendation is concerned with the extension of the existing spectrum or search for a new and adequate band for the business and consumer services demand, which is part of vision 2030. Mid bands for 5G applications are found in the range of 1 GHz to 7 GHz in which lower mid-bands and the upper mid-bands are in use for rural areas or deep-indoor coverage in cities. However, an extension of another 7 GHz of the 5G spectrum is needed, so that telecom operators can provide enhanced mobile broadband (eMBB) in a dense urban environment [2].

Nowadays, cylindrical di-electrical resonator antenna (CDRA) is becoming a reveling antenna at higher microwave frequencies [3, 4] due to its several features like high gain, low loss, compactness, and supportive feasibility with different radiating modes [5].

This paper investigates a multiband CDRA that supports the IOT based telecom environment more efficiently in 7 GHz to 8 GHz. It meets the all standard requirement as the GSMA suggested for the vision of the 5G spectrum for 2030. Figure-1 shows the geometry of the proposed antenna which is mounted over the FR-4 (ϵ_r=4.3; tanδ=0.025) substrate plate (60 mm × 6 mm × 2 mm).

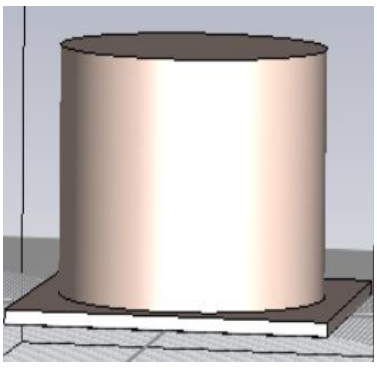

Figure 1. Proposed CDRA

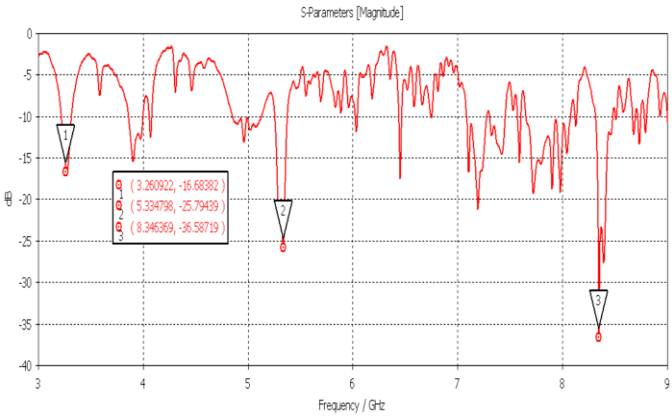

Figure 2. Return loss (S11) plot for proposed CDRA

An annealed copper based square patch (14 mm × 15 mm × 0.035 mm) is used to excite the CDRA which is sandwiched coaxially in between the substrate and CDRA. A microstrip line (23 mm × 2 mm × 0.035 mm) of 50 ohms has been etched on FR-4 to connect the exiting port to the square patch. Conventional ground plain is also made up of annealed copper. A cylindrical dielectric resonator (height=35 mm; radius=25 mm) of material Alumina (99.5%) having

ϵ_r=9.9; tanδ=0.0001 is coaxially fixed on the top layer of the substrate by using an adhesive material.

Plotted graph of return loss (S11) as figure 2, reveals that the proposed antenna has multiband characteristics and can be supportive in traditional 5G (3.7 GHz to 4.2 GHz) services, high speed Wi-Fi (5 GHz band) too. But as a whole, it covers the entire range of 7.09 GHz to 8.08 GHz under the -10 dB return loss.

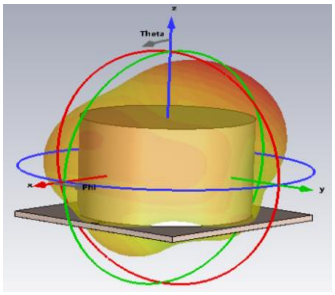

Figure 3(a). Far field pattern (3D) at 3.8 GHz

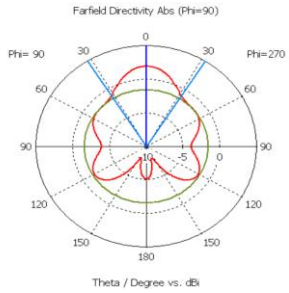

Figure 3(b). Far field pattern (2D) at 3.8 GHz

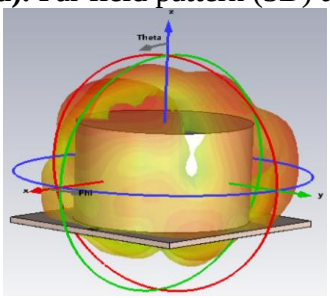

Figure 4(a). Far field pattern (3D) at 7.5 GHz

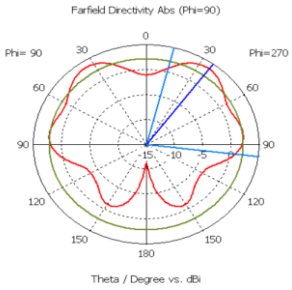

Figure 4(b). Far field pattern (2D) at 7.5 GHz

Simulated result for far field at 3.8 GHz and at 7.5 GHz has been depicted in figure-3 (a, b) and figure-4 (a, b) respectively shows a gain of 7.51dBi and 6.17dBi at both frequencies and above the antenna plane. Theoretically, antenna performance is highly acceptable if its far-field radiation pattern gives a high gain (practically it should be greater than 6 dBi) [6]. Rather than its gain, directivity and radiation efficiency within the 7 GHz extended spectrum is also well satisfied. Additionally, this antenna radiation in between 3.7 GHz to 4.2 GHz also meets the better presentation for LTE and CBRS [7] based mobile band.

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OPPORTUNITIES FOR THE PRODUCTION OF POTASSIUM SULFATE IN TURKMENISTAN

Khatsrinov Alexey[1*], Suleimanova Alsu[2], Khatsrinova Yulia[3]

[1,2]*Department of Technology of Inorganic Substances and Materials, FGBOU VO Kazan National Research Technological University, Kazan, Russia.*
[3]*Complex Laboratory "NanoAnalytics", FGBOU VO Kazan National Research Technological University, Kazan, Russia.*

[*]Corresponding author

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Potassium sulfate is one of the most promising potash fertilizers today. It can be obtained by processing chennit or polyhalite. However, unique conditions have been created in Turkmenistan for the production of potassium sulfate from mirabilite and potassium chloride. Huge reserves of mirabilite are contained in the Kara-Bogaz-Gol Bay. In addition, there are large reserves of sylvinite and plants for the production of potassium chloride. Using halurgical methods, potassium sulfate can be obtained from these substances.

Figure 1 shows the phase diagram of the KCl-NaCl-K_2SO_4-Na_2SO_4 system at 25°C. This diagram shows that the K_2SO_4 crystallization region is in the lower part and the KCl-Na_2SO_4 diagonal intersects it in a small area. Therefore, it is unprofitable to immediately obtain K_2SO_4 in the precipitate due to the low yield of the product and the large amount of waste. At the same time, the region of glaserite crystallization is intersected by the KCl-Na_2SO_4 diagonal in a large area. Therefore, the process of obtaining potassium sulfate must be divided into two stages. First, glaserite (Na_2SO_4 $3K_2SO_4$) is obtained. This process can be organized cyclically by mixing mother liquors obtained at 25^{0}C and 100°C. As a result, the process will be waste-free. In the course of calculations, it was found that to obtain 1 ton of glaserite, 1940 kg of mirabilite and 675 kg of potassium chloride should be taken. In addition, the products will contain 530 kg of sodium chloride, which can be used in the production of soda.

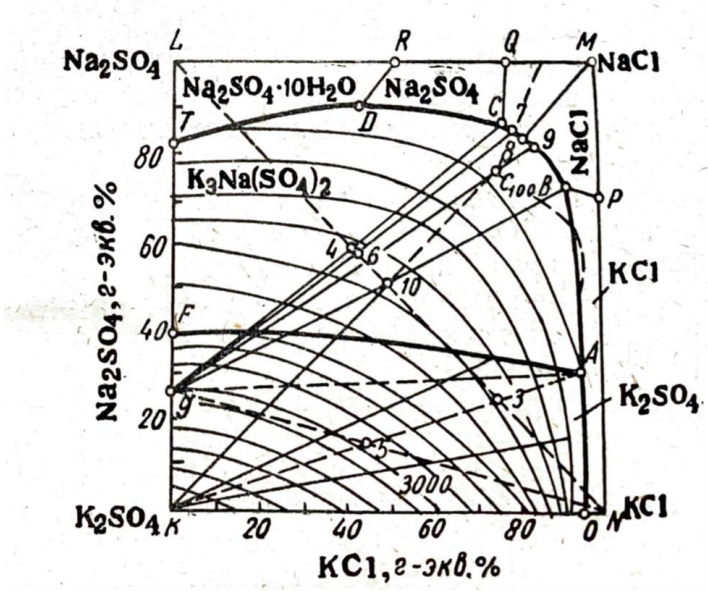

Figure 1. Phase diagram of the KCl-NaCl-K_2SO_4-Na_2SO_4 system at 25°C

At the second stage, potassium sulfate is obtained from glaserite at 75^{0}C (figure 2). The remaining mother liquor can, when mixed with mirabilite, be used to obtain additional amounts

of glaserite. One ton of glaserite produces 1.27 tons of K_2SO_4. If glaserite is added to the remaining mother liquor, then another 0.6 t of K_2SO_4 can be obtained.

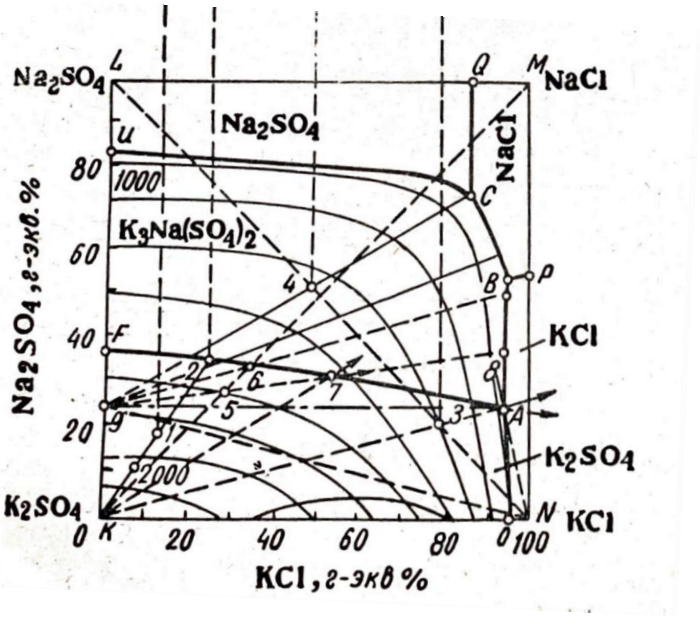

Figure 2. Phase diagram of the KCl-NaCl-K_2SO_4-Na_2SO_4 system at 75˚C

Thus, efficient, waste-free production of potassium sulfate can be organized in Turkmenistan.

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WEB SERVER TECHNOLOGY TO PROVIDE CYBER SECURITY

Yuldashbay Kurambayev*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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Honorable President of Turkmenistan determined the digitization of the country's industry institutions as a priority for solving systemic tasks. In the era of the Revival of a new epoch of a powerful state, the "State Program for Ensuring Cyber Security of Turkmenistan for 2022-2025" approved by the decree of the deeply respected Turkmen President Serdar Berdimuhamedov, is oriented to develop the efficiency of the sectors of the national economy and the social system through the widely usage of reliable communication and information technologies.

The objective of paper: To create a modern new technology of data cyber security and to develop a new device model based on existing models for use in local conditions. Various technologies exist that help to build a strong basis for website security. For example, web application firewalls are one of the technologies that help protect data secure. SSL (Secure Sockets Layer) certificates are a technology that provides privacy and security by encrypting all data sent between the server and the user.

Currently, CDNs (Content Delivery Networks) have become an essential constituent of the website's architecture. CDNs operate by caching data content at multiple points distributed around the world. CDNs help ensure website security and improve web infrastructure reliability. CDNs are mainly used to provide security for servers hosting content [1, 2].

Web application security is a branch of information security that provides protection for Web sites and Web applications. Web software security differs from other areas of information security in that it focuses on vulnerabilities in software code discovered by users in real time on the Internet. Most attacks on web servers are made through firewalls and HTTP (80) or HTTPS (443) ports. Some of the most common hacking techniques include denial of service, exfiltration, site scripting, SQL injection, and data disclosure. In addition to traditional firewalls, various solutions are used at the application level to ensure the security of web applications. This includes external tools such as web application scanners (WAS) and firewalls (WAF) [3-5].

The paper analyses the advantages of three-layered technology in providing and protecting the cyberattacks in web servers and the architecture of protection device that was developed on the basis of that technology. Above mentioned CDN technology and its anti-attack capabilities are applied on developed technology. Web server data cyber security technology is deployed in front of the main web server in a CDN.

The developed firewall has been proven to protect against attacks from levels 1-6 of the OSI (Open Systems Interconnection) model by pre-blocking all open ports of the server, except ports 80 and 443, which are sufficient for the operation of web sites. The developed technology has been designed and implemented to simultaneously back up and analyze the flow so that the flow does not affect the request response time.

The findings of paper present the developed security hardware designed to ensure data security is not intended just for only CDN network system but in any system.

The new technology that has been developed, i.e., the protection device developed for the purpose of ensuring the information cyber security of the geographically dispersed (distributed)

network infrastructure capable of delivering the data of web-based services to the clients in a fast manner, can be proposed to be used as a firewall to protect any web server from cyber threats.

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THE PECULIARITIES OF POLITENESS IN THE LINGUISTIC CULTURE OF THE TURKMEN AND JAPANESE PEOPLES

Lachyn Yusupovna Gurdova*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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To understand people from different cultures, it is not enough to study their psychology. The main thing is to understand how they perceive the outside world. A prime example of this is the fact that there are several levels of Japanese proficiency. Politeness is a form of communication between people. In a polite conversation, appropriate words are used depending on the level, such as “commanding - lower”, “senior - junior”, “friends - strangers” [1]. For example, just look at the words used to express gratitude in Japanese. The words in Turkmen language like as: "sag boluň" and "minnetdar", used in the usual sense for all, are expressed differently in Japanese depending on the position of the interlocutor in society, the service rendered to them and the attention rendered. The word arigato is often used to express gratitude when a person refers to his or her family and children.

In general, there are dozens of expressions of gratitude in Japanese. This means that in the Japanese picture of the world, politeness manifests itself in different ways depending on the position of person, place in society, age kinship. Politeness is taught from childhood. The Japanese phrase "reigi tadashii" does not have a Russian translation. In a large Russian-Japanese dictionary [2], this phrase is translated as "любезный", but the words in Japanese and Russian differ in semantics and meaning. The meaning of this word can be understood by dividing it into two parts. The word "reigi" means "etiquette", "rules of conduct". The word "tadashii" means "correct", "lawful" [3]. Based on these words, the phrase "reigi tadashii" fully corresponds to the meaning of the word "edep" in the Turkmen language. Thus, to be polite, to behave correctly in society are characteristics of the Turkmen and Japanese peoples. These characteristics reveal the similarity of cultural values of both nations.

In Japan, it is considered impolite to express your emotions such as happiness, sadness, or fear in the presence of strangers. In the Japanese mentality, it is considered wrong to agree or disagree. They are obvious in Japanese. For example, the sentence 気にしてありませんから (“ki ni shite arimasenkara”) means “I can`t accept it”. This can be translated into Turkmen as "Men göwnämok" or "Men garşy". There is no definite "no" in Japanese. This word is used only in the family or among close relatives and friends. The Japanese avoid saying "no" when talking to strangers. The word いいえ means "no" and is rarely used [4]. Although the Japanese people know that the interlocutor feels that they do not agree with them, without saying a clear "no", they leave the interlocutor with hope and scope for working together in the future. This shows the main national character of the Japanese politeness.

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AUTOMATION OF THE ACCESS SYSTEM FOR CARS

Meryem Amanovna Gurbanberdiyeva*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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Special attention is paid to the development of the digital economy in the country. This is evidenced by the approval of the relevant Resolution of the President of the Republic of Turkmenistan "The State Program for the Development of the Digital Economy in Turkmenistan for 2021-2025" and the Action Plan for the implementation of this program.

Nowadays, Radio Frequency (RF) was one of the main technologies in the world. This technique applied with tags was very famous and useful methods to do security control, access control or tracking system. Radio-frequency identification (RFID) is the wireless non-contact use of Radio Frequency Electromagnetic Fields to transfer data. It is basically used for the purposes of automatically identifying and tracking tags attached to objects. RFID technology uses RFID tags, RFID reader and RFID antenna. The application can be used for managing and controlling various reports and operations of parking system. By using this software, the check-ins and check-outs will be in control of the RFID tags, readers and barriers. With this software and technology, the check-ins and check-outs can be done in a fast manner by avoiding the traffic jam problem near the gates of parking lots. Drivers will not have to wait for the identification of their vehicles as it will be done automatically by the tags that are provided to them. This will also ensure security as only the registered tags (users) are allowed to enter.

The RFID parking management system is actual and control the vehicles. This vehicle parking system power consumption can be reduced. It enables user to operate an unattended parking barrier with control parking access. This system is ideal for apartments and condos, gated communities, business parking lots and garages, university parking area. It offers almost efficiency, convenience, safety and the reliability. It is good solution for today's car parking and reduction of traffic problem.

Advantages:

1. No need for physical contact between data career and communication device.
2. Tags can be used repeatedly.
3. Low maintenance cost.
4. Switch is used in place of RFID reader

Applications:

1. Autonomous sensors military and aerospace embedded software applications.
2. Communication application.
3. Industrial automation and process control software.
4. Mastering the complexity of applications.
5. Reduction of product design time.
6. Real time processing of ever increasing amounts of data.

The 21st century is a century of technology. This century is marked by the rapid growth of innovations – the invention of new perfect form. It is worth noting that the limitations of the innovative technologies created by the rapid development of scientific and technological progress. Therefore, in the age of modern innovation "Automation of the access system for cars" is the one of the aspects of our lives are being technological.

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MATHEMATICAL MODELING OF LIQUID FLOW BY THE FINITE ELEMENT METHOD

Halmuhammet Ovezov[1], Maral Bekiyeva[2*]

[1,2]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*

[*]Corresponding author

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Liquids are one of the most important natural phenomena that humanity faces and human life depends on. Watching the movement of water in a river, lake or ocean, we are amazed at the beauty and naturalness of moving water, its mobility and flexibility. After all, it seems that there is nothing simpler than water, which is used and without which there is no life.

Paradoxical, but true. We know next to nothing about how water behaves. The resulting mathematical models were difficult to solve, and the results of the analysis were surprising. In the end, this leads us to believe that we may have missed something underlying the movement of the fluid along this path.

The equations of a viscous incompressible fluid with density ρ and viscosity v on the plane $u(x,t) = (u,v,w)$ and pressure p have the form below (Navier-Stokes equation):

$$\frac{\partial u}{\partial t} + (u\nabla)u = -\frac{1}{\rho}\nabla p + v\Delta u - F, \quad (1)$$

$$\nabla \cdot u = 0. \quad (2)$$

Here x is the Euler coordinates, t is the time, F is the body force. According to the type of determination of the boundary conditions at the boundary of the wave Ω occupied by the liquid, two main installations are distinguished: a) with a velocity vector specified in Γ; b) a stream of written problems; for example, the pressure and contact velocity components are shown on the Γ_1 (inlet) and Γ_2 (outlet) boundaries, and the velocity vector is shown on the rest of the boundary. A 2D plot is plotted with wall equation $u = 0$, inlet equation $u = -U_0 n$, outlet equation

$$\begin{cases} [-pl + K]n = -\widehat{p_0}n \\ \widehat{p_0} \le p_0 \end{cases},$$

and pressure $p_0 = 0\ Pa$.

For (1)-(2), obtaining analytical solutions to boundary value problems is impossible due to non-linearity. The study of the properties of solutions is usually carried out by solving a series of simplified mathematical equations. The use of the finite element method provides a detailed and accurate representation of the physical processes occurring in these systems. Figure 1 shows that the flow velocity on the walls, obtained at a flow rate of 0.001 m/s, is greater than that of water flowing at a speed of 0.01 m/s, shown in figure 2. The flow of water can be seen with horizontal lines.

The finite element method involves dividing the physical space into small interconnected elements, each of which is represented by a set of nodes (figure 3 and figure 4). In these nodes, the values of physical properties such as flow rate and pressure are calculated. The values at the nodes are then used to generate a global solution for the entire system [1]. The mesh has 6381 triangles, 582 quads and a total of 6963 elements and 3939 nodes.

One of the main advantages of using the finite element method when modeling groundwater systems is the ability to work with complex geometries. This method can be applied to both simple and complex systems such as multilayer soil and rock layers, and can

also be used to model systems with highly variable properties such as permeability and porosity [2].

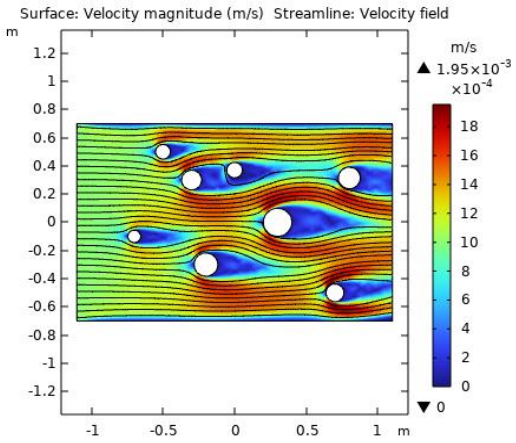

Figure 1. 2D plot with horizontal lines with flow velocity U_0=0.001 m/s

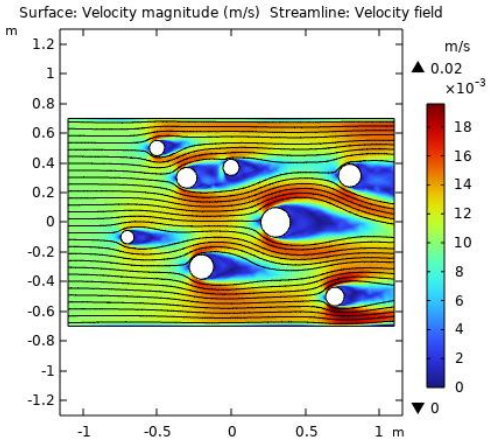

Figure 2. 2D plot with horizontal lines with flow velocity U_0=0.01 m/s

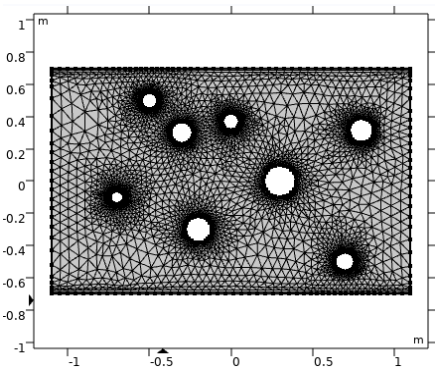

Figure 3. Mesh distribution of water flow

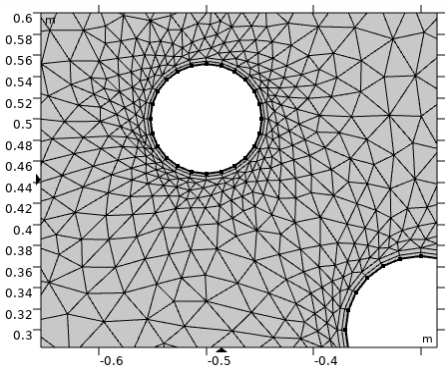

Figure 4. Enlarged section of the mesh distribution of water flow

In addition, the finite element method makes it possible to take into account various boundary conditions, such as the presence of wells or rivers, which play an important role in the behavior of groundwater systems. This method also allows the simulation of time-dependent processes such as groundwater recharge and depletion.

However, the finite element method also has some limitations. One of them is the high computational cost associated with solving large systems of equations, which can be a major problem when dealing with large and complex systems. In addition, the accuracy of the solution can be affected by the quality of the grid used to divide the area into elements. Therefore, it is important to select the appropriate mesh size and element type to obtain accurate results.

Therefore, the finite element method is a powerful tool for the mathematical modeling of groundwater systems. Decomposing a system into small interconnected elements provides a detailed and accurate representation of the physical processes occurring in the system. But this is computationally intensive and it is important to choose the appropriate mesh size and element type to get accurate results.

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FUNCTIONALIZATION OF GRAPHENE AND ITS IMPACT TO SENSOR ABILITIES

Mukam Charyyarovich Ekayev*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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Due to their high sensitivity and stability, solid state ceramic materials have been widely used as gas sensors [1-2]. Carbon nanotubes and graphene are a new generation of gas sensor materials that are free from metal oxides. Almost all the interfaces of carbon nanotubes, graphene oxides, and graphene are exposed, and thus these materials exhibit high sensitivity to their surroundings [3]. Inherent defects, boundaries, and the introduction of structural defects are necessary to endow graphene with p- or n-type semiconducting properties.

We demonstrate the distinction of piezoresistive and chemiresistive graphene-based gas sensors and extremely high piezoresistive properties of polycrystalline graphene. Graphene materials with different numbers of layers were first intentionally prepared in this study, referred to as graphene-based sensors (GBSs), from two-layer graphene to multilayer graphene. These GBSs were then used to demonstrate the gas sensing of H_2, CO_2, NH_3, and He associated with piezoresistance and chemiresistive properties. The distinction of resistance changes by physical adsorption, chemisorption, and piezoresistance, as well as chemical structure changes of graphene before and after NH_3 gas injection were exhibited to gain a fundamental understanding of relationship between graphene structure changes and gas sensing with various gas insertion [4].

The GBSs synthesized by 80% and 100% CH_4 have piezoresistive properties evaluated using He gas. The GBSs synthesized by 80% and 100% CH_4 here had 100 and more than 300 graphene layers, respectively. The resistance responses by piezoresistance were 3–6% at ambient pressures, which were considerably higher than the preceding reports. Considerable changes in the sheet resistance with hysteresis by NH_3 injection were observed for the GBS synthesized by 40% CH_4 (trilayer and p-type semiconductor), whereas the GBS synthesized by 80% CH_4 (100 graphene layers and n-type semiconductor) exhibited relatively small and negative sheet resistance changes without any hysteresis. The hysteresis of the sheet resistance on GBS of 40% CH_4 is a result of NH_3 chemisorption, although the chemisorbed NH_3 was perfectly released by evacuation at 360 K. In this work demonstrated hetero atom doping by a dry method using plasma irradiation and evaluate its functionalization with structure and electrical resistance changes by plasma irradiation in O_2, H_2, Ar, N_2 gases. In addition, NH_3 gas sensing on functionalized graphene was evaluated using four-probe electrical measurements at 273 K, 300 K and 327 K. The initial graphene was high-quality bilayer graphene. The findings on the changes in sheet resistance of graphene by physical adsorption, chemisorption, and piezoresistance shed light on opportunities for the further development of gas sensors using graphene and its related materials.

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RECYCLING OF SEWAGE

Mitsunori Yamazumi*

Tohkemy Corporation, Yodogawa-ku, Osaka, Japan.

*Corresponding author

DoI: https://doi.org/10.5281/zenodo.7782393

Tohkemy Corporation – Japanese water treatment company with over 50 years of experience in Japan.

1. Background: increase of water stress.
   - The water on earth: 97% is seawater, only 3% is freshwater, only 0.8% of freshwater is actually usable.
   - The world's population: 7.35 billion in 2015→7.88 billion in 2021→9.73 billion in 2050=32% increase from 2015.
   - Global economic development and urbanization will continue.
   - All result increase water demand and water stress.
   - We need new water resources.
2. Where are the new water resources?
   - Seawater is one of them. 97% of the water on earth is seawater. Seawater desalination is one of the solutions. But it has high energy and environmental costs.
   - Sewage and waste water are other new resources. In addition, these will increase with economic development and urbanization. Treatment cost is also cheaper than seawater desalination.
   - Thus recycling system is very important.
3. Conventional sewage treatment process (figure 1):
   - Primary treatment: coagulation and sedimentation.
   - Secondary treatment: bacteria for biological treatment. This is called secondary treatment. In some cases, MBR (Membrane Bioreactor), which combines this with membrane treatment, is used. In this case, the electricity costs for aeration are high because the bacteria need to be supplied with oxygen 24 hours a day. Sludge disposal is also required.
   - Secondary treated sewage is often discharged into the environment.
4. Sewage recycling system (figure 2a): we propose to tertiary treat secondary treated sewage and use it as industrial water (figure 2b). Our experiences show 2 options:
   - Option 1 is a case that secondary treatment is properly made. In this case we use submerged membranes and nano filters to provide industrial water quality. The energy cost for aeration is mainly for membrane washing only and lower than option 2.
   - Option 2 is a case that secondary treatment is not properly made. In this case we have to use MBR and RO to achieve industrial water quality. The energy cost for aeration is much higher for supplying oxygen to bacteria.
5. This proposal achieves:
   - Recycling society.
   - Reallocation of conventional clean water to residents.
   - Reduction of secondary treated sewage release to environment.

Since clean water, which was conventionally supplied as industrial water, is covered by this recycled sewage, conventional clean water is provided to other users such as residents.

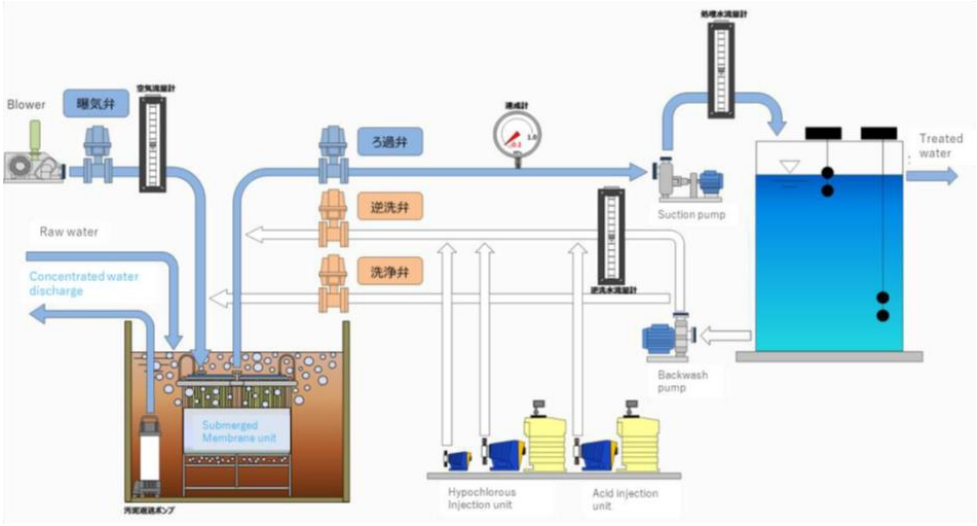

Figure 1. Sewage treatment process

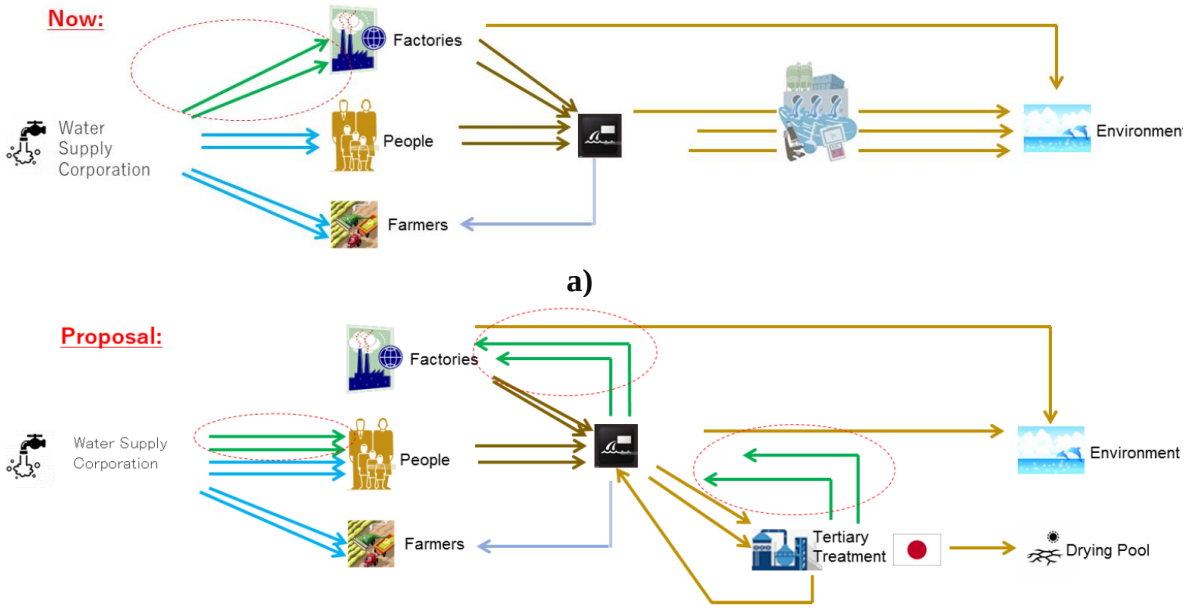

Figure 2. Sewage recycling system. a) Now available system; b) Proposed system

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RESEARCH ON SMART REFRIGERATOR USING RASPBERRY-PI

Saparov Mekan[1*], Ryuichiro Ohyama[2]

[1,2]*Tokai University, Hiratsuka, Japan.*

[*]Corresponding author

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Background and purpose of development. A smart home is a house or apartment equipped with advanced technology to improve quality of life and comfort. The technology includes smart devices, automated procedures, and remote controls, all of which can be managed through a central control unit. The goal is to make these homes accessible to everyone, with a focus on user-friendly technology. I want to develop new technologies and create a low-budget smart refrigerator to solve small daily problems such as meal planning and grocery shopping.

Development goals. I intend to develop a smart refrigerator that can be easily integrated with various devices such as mobile phones, PC, or tablets. With this, people can easily access information about the availability of products in their refrigerator and quickly check what they need to restock without having to physically open the fridge. When the quantity of a product drops below a certain level, a notification will be sent to the owner to remind them to restock.

Additionally, the mobile application will have a custom shopping list feature, where necessary items will be automatically added. The project will also make use of barcodes to make the process more efficient and convenient. Another key feature of the project is the ability to suggest recipes based on the ingredients available in the refrigerator, this will help save time and make daily life more comfortable.

Development stages. The development of this project is divided into three stages: the backend, the Raspberry Pi setup, and the mobile interface. One of the first steps was deciding on a framework for the backend. After looking at options like Laravel, Django, and NodeJS, we decided that Laravel would be the best choice for this project. One of the main reasons for this decision is that Laravel's Eloquent ORM is easy to use and allows for seamless interaction with databases using an object-oriented approach. Additionally, Laravel's Blade templating engine makes it easy to separate logic and presentation, making it a great option for developers with limited experience in creating templates [1]. It's important to note that these reasons are specific to Laravel and may not apply to Django or Node.js. However, we took the specific needs of this project into account when making our decision and determined that Laravel would be the best fit for the backend of this project.

Setting up the Raspberry Pi component of the project was relatively easy. I wrote a Python script that allows us to read the barcodes of products and send that information to the backend for further processing.

The last step of the project was to build a mobile app for users to view the contents of their fridge. Initially, I thought of creating a hybrid app that would work on both iOS and Android. But after further thought, I decided to create a native iOS app as it has a larger user base than Android. To make the development process simpler, I chose to use SwiftUI over UIKit as it gives a more straightforward approach.

Working principles. The system (figure 1) allows users to track the contents of their refrigerator using a mobile app. Users add products to the fridge by inputting info into the app, which is then sent to a database for easy access from a smartphone. When product used,

a Raspberry Pi scans barcodes on products as they're used to update the database and inform the user of changes.

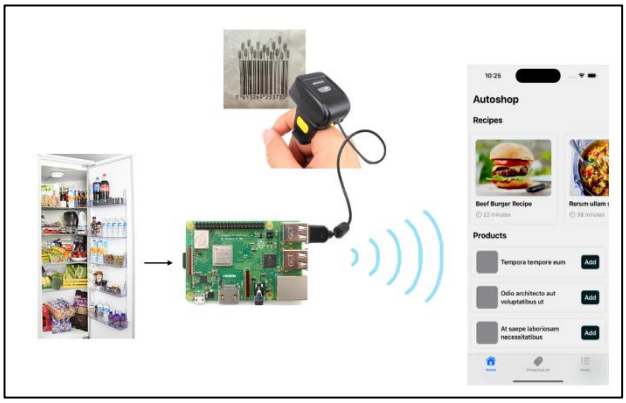

Figure 1. Working principle of the developed smart refrigerator

This information is also sent to a web server for access from any device with internet access. The app also provides recipe suggestions based on the products in the fridge, helping users make use of their food inventory. The system aims to make it easier for users to track their refrigerator contents.

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MICROCONTROLLER-BASED EMBEDDED SYSTEM DESIGN AND IMPLEMENTATION TOWARDS SUSTAINABLE DEVELOPMENT GOALS

Muhibul Haque Bhuyan*

Department of Electrical and Electronic Engineering, American International University - Bangladesh (AIUB), Dhaka, Bangladesh.

*Corresponding author

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The United Nations approved the 17 Agenda of the Sustainable Development Goals (SDG) to implement a sustainable world by 2030 [1]. It was accepted that poverty and other problems in this world must be resolved jointly in the areas of poverty, health, energy, education, gender inequality, economic growth, environment and climate changes, social issues, collection and preservation of natural resources above and below this earth, etc. [1] The 17 SDGs encompass 169 sub-targets to be attained by 2030 [1]. For this purpose, we need a coordinated and concerted efforts by all signatory countries. Engineering design research, innovations, development, and commercialization can support us in the venture.

In this talk, emphasis would be given to the recent research and innovative product development to the microcontroller-based embedded system design to realize the 17 SDGs within the stipulated time frame, and as such, we will be able to attain both societal and economic impacts for viable progress.

The word "embed" means "To fix (an object) firmly and deeply in a surrounding mass." It means that the system is portion of a bigger device or system. Embedded would also mean connected with something for some purpose and with limited resources. An embedded system serves a specific purpose and the functionality of that purpose is executed and controlled by a miniature controller, which is embedded within the system. For example, a microcontroller can be a heart of an embedded system. We may use Arduino Uno. Arduino Mega, Raspberry Pi, or STM microcontrollers to design embedded system based on our system requirements and specifications [2-4].

An embedded system has a set of following characteristics, such as:

- An embedded system is a kind of mini computer;
- It forms part of a bigger system, device, or machine;
- It can control multiple devices through its I/O ports;
- It may receive signals from multiple sources through various sensors connected to its I/O ports;
- It can allow its users to interact with it through its I/O ports;
- It has one, or a limited number of tasks that it should accomplish.

An embedded system is preferred due to its several advantages, such as:

- Perform only very specific and restricted number of functions;
- Comparatively cheaper to design and implement;
- Necessitate less power to control;
- Systems may run by using batteries;
- Does not require much processing speed;
- Possible to build it using cheaper, less powerful processors to minimize the costs.

Here, I shall also concentrate on a few goals to demonstrate how the microcontroller-based embedded system design and development can help us in this regard. These areas are good health and well-being, quality education, clean water and sanitation, affordable and clean energy, sustainable cities and communities, life below water, and life on land [1]. We started our research works on microcontroller-based embedded system design by designing and implementing biomedical devices, like IoT-based pulse oximeter device, designing a device to measure the activity level of the body, especially in measuring the amount and quality of sleep by a person in his house and thus to improve his home's heat consumption or temperature, blood pressure measurement, glucose level measurement, microcontroller-based ECG machine design, etc. to attain the goal of good health and well being [3-6]. We also started our works on IoT-based student database preparation for calculating students' outcomes for courses and programs of study by implementing outcome-based education (OBE) system to attain the goals for quality education using both online and on-campus mode of education [7-9]. We also worked on designing, simulating, implementing, and testing of a solar power and an IoT-based pisciculture management system to attain the goal on life below water [10]. We are also working on an IoT based eco-friendly efficient cattle management system, an IoT based smart robot car for hazardous areas with live streaming option, an IoT-based bio latrine system design and implementation for achieving the goal of life on land [11].

Finally, we are confident that the microcontroller-based embedded system design is very chip and so, electronic engineers find it easy to resolve complex engineering problems to achieve specific SDGs, and hence to realize a sustainable world for humanity.

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DEVELOPMENT OF ROBOTICS IN ELEMENTARY SCHOOL

Mukhasheva Meruyert*

[1]*Doctoral student of the specialty "Pedagogy and Methodology of Primary education" Zhetysu University named after I.Zhansugurov, Republic of Kazakhstan.*

*Corresponding author

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Many researchers and teachers agree that the inclusion of Science, Technology, Engineering, and Math in early education provides a strong motivation and a great improvement in learning speed. Most curricula in primary schools include a number of concepts that cover science and math, but less effort is applied in teaching problem solving, computer science, technology and robotics. The use of robotic systems and the introduction of Robotics as a curricula subject can bring the possibility of transmit to children the basics of technology and to give them other kind of human and organizational values. The subject of Robotics becomes part of the Primary school curricula. The program has allowed the teachers training and a complete way through which children have demonstrated great learning abilities, not only in mere technology but also in collaboration and teamwork [1].

Many researchers have studied the possibility of using robots to support education. Research has shown that robots can help students develop problem-solving abilities and master computer programming, mathematics and natural sciences. The educational approach, based mainly on the development of logic and creativity in new generations from the first stage of education, is very promising. To achieve these goals, the use of robotic systems becomes fundamental if it is applied from an earlier stage of education. In primary schools, robot programming is fun and therefore an excellent tool both for familiarizing with ICT and for promoting the development of logical and linguistic abilities of children. Moreover, teaching robot programming also becomes an opportunity for elementary school students to develop their linguistic and logical skills, always paying special attention to pedagogical rather than technological issues. This article presents an innovative program designed to teach the basics of robotics in elementary school as an academic subject. The same tools are used as interdisciplinary validation and motivation for other subjects (languages, mathematics, natural sciences, etc.).

LEGO Education WeDo is an easy-to-use robotics platform that introduces young students to hands-on learning using LEGO constructors and the simplest form of graphical programming that National Instruments can offer. It's a fun and easy way to introduce younger students to basic engineering concepts at an early age. Using LEGO Education WeDo provides a hands-on learning experience that actively engages children's creative thinking, teamwork and problem solving skills. LEGO Education WeDo is a practical platform that elementary school students can use to create simple robotic applications controlled by a personal computer with a simplified version of LabVIEW. Combining the intuitive and interactive interface of the LEGO Education WeDo software with the physical experience of building models from LEGO bricks, students can connect the physical and virtual worlds to provide the most practical and intelligent learning ([LabVIEW Graphics System Design]). This system is being applied in other countries, offering their use in primary schools and exploring possible benefits for children's education. For example, in [2] the author analyzes the situation of the first contact, in which students of the 3rd grade of elementary school for the first time encounter LEGO WeDo. The article describes a pilot study of robotics in

elementary schools, as well as the motivation for choosing LEGO WeDo for classes with children: a low learning curve of the programming language (visual programming, not writing code) and the educational content provided by them [3].

In recent years, there has been a development of cooperation between National Instruments, the Polytechnic University of Marche and primary schools in order to improve the use of new technologies starting from the first grade of school [4].

Both the scientific and educational communities recognize the role of ICT companies' investments in improving science and engineering education, introducing students to technology and providing teachers with resources that will help them teach fundamental engineering concepts in an exciting and practical way. In particular, National Instruments and Lego provide interactive learning experiences in the real world; inexpensive and free learning opportunities; a powerful global mentoring program; technology and funding [5].

Initiatives such as K12Lab.com for primary and secondary school teachers and the NI courseware portal for university teachers contain effective content that teachers can use directly or adapt to their learning environment [6]. K12Lab is a website where teachers can view and share lesson plans, get inspired by what others are achieving with technology, and get tools and support to help their students connect theory to reality faster.

The improvements registered by teachers are very relevant and have demonstrated the tremendous value of using a robotic system in every aspect of learning. Students have always been curious about certain aspects of learning, from the pure design of robots and programming to the importance of working together in a group, achieving new skills and solving new problems. There are also some students who are directly involved in practical activities, in particular in visual programming and mechanical design of robots.

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TECHNOLOGY OF TEACHING FOREIGN LANGUAGES TO THE STUDENTS OF EXACT AND NATURAL SCIENCES IN HIGHER EDUCATIONAL INSTITUTIONS OF TURKMENISTAN

Nasiba Ikramovna Kurambayeva*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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Under the leadership of our leader the Epoch of happiness Turkmen people moves forward with great strength. Highly esteemed Hero Arkadag several times noted that socio-economical development should be the care of the society. In the Revival Era of a Powerful State, every day of the year, held under the motto "The Epoch of the People with Arkadag", which will be inscribed in golden letters in the history of the Motherland, marked by important events and labor achievements to maintain the development of our country in various spheres of life: "The development of socio-humanitarian aspects of science for 2018-2023 state program", "To transfer the science into the digital system program for the 2020-2025 years", "The concept of the promotion digital system in Turkmenistan", "The concept of improving the methods of teaching foreign languages in Turkmenistan." For that reasons our President follows the above policy to introduce the world experience into the process of education. There are several higher educational establishments where students gain knowledge in the following disciplines: Math, Informatics, natural and exact sciences, humanitarian sciences and foreign languages.

At Oguz han Engineering and Technology University of Turkmenistan there are all opportunities to implement all concept for fruitful studies. In the book "Source of wisdom" written by Hero Arkad ag there are many lines devoted to the learning languages. We teach students not only English but also Japanese too. As teachers, we pay great attention to the extra curriculum activities, such as: round tables, contests, "brain rings", discussions and debates. The Russian professor G. A. Kitaygorodskaya mentioned that each student is certainly an individual and we can not teach them all according to the same method or technology, but a master pedagogue-teacher will be able to determine the end. There is a language barrier in students learning foreign languages, and in order to overcome it, the role of the teacher to make the young generation perfect individuals is also great. Learning a foreign language does not mean mastering the system of that language, but rather learning the history, origin, and culture of the language you are learning. Thus, a foreign language teacher uses various pedagogical technologies to master the material. Today, there are several types of pedagogical technologies, which are complex systems consisting of images that combine teaching technology, conceptually related educational goals, various types of resources, methods of organizing learning and educational processes. Another thing that should be noted is pedagogical technologies in the direction of personal structures, which are divided into the following types: informational (the formation of basic knowledge and skills), practical (the technology that ensures the formation of mental actions) and self-development).

At the university, students, studying at the language learning department cover scientific materials and texts, and also, they do some exercises related to their profession in English.

During the course, students also learn special terms and words. After all, students studying technical and scientific courses are not only familiar with the vocabulary of standard English, but also with technical and academic terms related to their major. In English lessons, taking into account the students' psychological abilities, they are given guiding an introductory questions related to the topic to avoid problems before starting a new topic. Also, difficulties are eliminated through new innovative strategies called know, want to know, learned, and students learn new words and information during the lesson through Total physical response. In order to develop the language skills of students who study in a natural and exact science to revise the topics which were covered, all kinds of discussion, brainstorming, action games to check their fluency, and spelling tests using cards are used during the lesson. Also, producing videos related to their majors in English and Japanese at the university lab is also great way to develop a foreign language among the students.

Content and language integrated learning, Bloom's taxonomy, Critical thinking, Case technology, game and problem-solving technology are used as technologies to teach students not only by foreign language teachers at the university, but also by natural and exact sciences: physics, chemistry, biology, informatics, philology, mathematics and ecology. The technologies, methods and strategies operating in the 20th century are different from the present century, that is students are taught through group, two-to-one, and one-to-one methods to improve life skills in students. It will improve their way of thinking, language skills and worldview.

The topic of the condition provides a chance for any student to express his own judgment and also to assist in the development of a general resolution, which will be thrown out for consideration. With such a role, modern technologies of teaching foreign languages allow us to come to the conclusion that at present there are two main ways to intensify the learning process: one - by maximizing the use of technical means, the other – by activating the reserves of the personality of each student. It was found out that at Oguz han Engineering and Technology University of Turkmenistan these methods show high results for students and it will also be improved in the nearest future.

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THE ROLE OF STANDARDIZATION IN MODERN PRODUCTION

Nargyz Orazgeldiyeva[1*], Gulshat Durdyyeva[2]

[1,2]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*

[*]Corresponding author

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In today's world, the importance of standards is constantly growing. The main reason for this is the changes in the economy and social life associated with the globalization of the world market, the erasure of boundaries in the way of the movement of capital, goods, ideas and information. Scientific and technological progress, the rapid development of information technologies and their active implementation - all this also contributed to the intensification of the process of development and implementation of international standards in all areas of human activity, including in document management.

The International Organization for Standardization (ISO) is a worldwide association of national standardization bodies (ISO member organizations). The preparation of International Standards is usually carried out in the relevant ISO technical committees. Each ISO member organization has the right to be represented on those technical committees, the topics of which correspond to its interests. International organizations, both governmental and non-governmental, also take part in this work.

Due to the successful use of ISO quality standards, as well as in connection with the global trend of tightening regulatory requirements to the conduct of financial and economic activities, there is a growing need throughout the world to develop a unified approach to solving the most common issues that are important for any of the existing office systems.

ISO has defined its objectives for the end of the century, and at the beginning of the new millennium, highlighting the most relevant strategic areas of work:

– establishing closer links between the organization's activities and the market, which should primarily be reflected in the choice of priority developments;

– reduction of general and time costs as a result of increasing the efficiency of the administrative apparatus, better use of human resources, optimization of the work process, development of information technologies and telecommunications;

– providing effective assistance to the World Trade Organization through the implementation of a program focused on the gradual processing of technical conditions for the supply of goods into ISO standards;

– stimulating "self-supporting" elements of the above program: encouraging the creation of new standards for industry, developing relations with the WTO on the terms of providing the necessary technical assistance. In particular, it is intended to contribute in every possible way to the inclusion of requirements for products supplied by states in international ISO standards, which should have a positive impact on the recognition of conformity assessment;

– concern for improving the quality of national standardization activities in developing countries, where the main attention is paid to leveling the levels of standardization.

Thanks to the successful use of ISO quality standards, as well as in connection with the global trend of tightening legal and regulatory requirements for conducting financial and economic activities, there is a growing need throughout the world to develop a unified approach to solving the most common issues that are important for any of the existing office work systems.

Organizations are required to develop rules for working with documents, including issues of protection, search, determination of retention periods and controlled destruction of documents with expired retention periods. To comply with the requirements of the standard, it is necessary to prepare a large number of internal regulatory documents and regularly make changes and improvements to them.

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UNLOCKING THE POTENTIAL OF BIO-ELECTRONIC DEVICES WITH DNA THIN SOLID FILMS DEVELOPED VIA LASER MOLECULAR BEAM DEPOSITION

Tomohiro Murata[1], Kosuke Minami[2], Tomohiko Yamazaki[3], Tomomasa Sato[4], Hideomi Koinuma[5], Katsuhiko Ariga[6], Nobuyuki Matsuki[7*]

[1,6]*The University of Tokyo, Tokyo, Japan.*
[1,2,3,6]*National Institute for Materials Science (NIMS), Tsukuba, Japan.*
[4,7]*Kanagawa University, Yokohama, Japan.*
[5]*Smart Combinatorial Technology (SCT) Inc., Tokyo, Japan.*

[*]Corresponding author

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Deoxyribonucleic acid (DNA) is one of the most important biomolecules that govern the genetic information of life, and recently it has attracted attention as a functional material for electronic device applications such as sensors [1]. In the application of DNA to electronic devices, it is necessary to form a flat thin film at the nanometer (nm) level for heterogeneous film stacking and patterning. We have been developing nm flat DNA thin films by laser molecular beam deposition (LMBD) method, and also fabricated a quartz crystal microbalance sensor (QCM) for volatile organic compound (VOC) detection and evaluated its VOC detection characteristics to explore the possibility of sensor applications of the DNA solid-state thin films [2].

A synthetic quartz and a non-doped Si substrates that had been organically cleaned were introduced into a high-vacuum LMBD apparatus, and then an infrared laser (wavelength: 808 nm, power: 1.8-2.5 W) was used to irradiate purified dry powder DNA material derived from salmon sperm at a position opposite the substrate to generate DNA molecular beams, which were used for film formation on the substrate. Using the same method, an LMBD-QCM sensor was fabricated, and for comparison, also a QCM sensor was prepared by the spin-coating (SC) method (SC-QCM), and the detection characteristics of both sensors were evaluated by using a VOC measurement system.

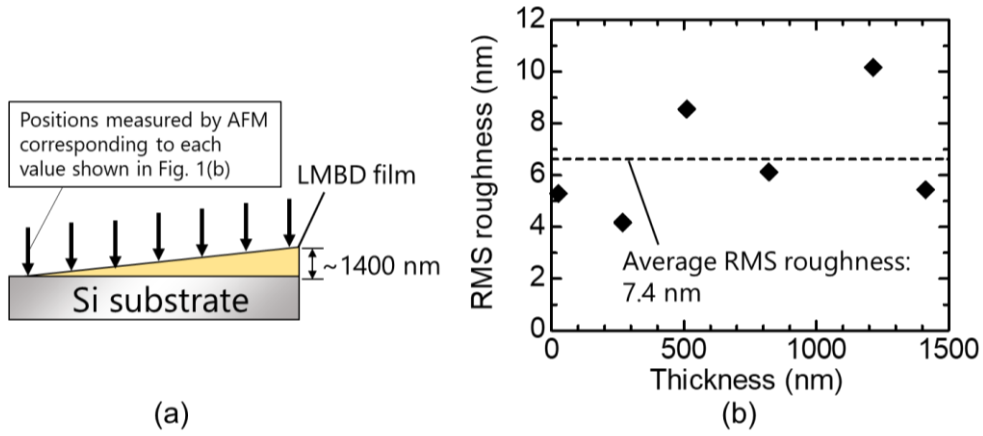

Figure 1. (a) A DNA thin solid film having a wide range of gradient thicknesses fabricated by LMBD. (b) Root-mean-square roughness of LMBD thin film measured by AFM.

A DNA thin solid film having a wide range of gradient thicknesses from approximately 30 nm to 1400 nm was formed on a single Si substrate by applying a continuously moving mask mechanism to the LMBD (figure 1(a)). Using atomic force microscopy, the root-mean square (RMS) roughness of the surface was evaluated, and its average value was 7.4 nm (figure 1(b)).

Figure 2 shows a graph obtained by normalizing the results of various VOC detection measurements using the SC-QC and LMBD-QCM by the resonance frequency change $|\Delta f|$ in methanol, taking into account the difference in DNA film thickness (100 nm and 300 nm, respectively) of the two sensors. This demonstrates that LMBD is a superior preparation method for forming flat DNA solid thin films at the nanometer level, which is suitable for electronic device applications.

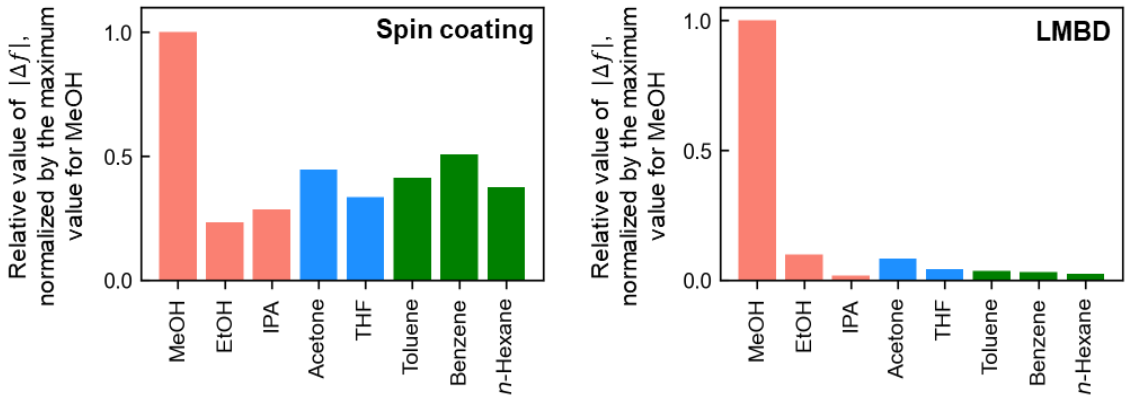

Figure 2. Relative values of change in resonance frequency of QCMs with DNA films prepared by spin coating (left) and LMBD (right) after exposure to VOCs: normalized by values for methanol

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A NUMERICAL ALGORITHM FOR THE TELEGRAPH INVOLUTORY PROBLEM WITH NEUMANN CONDITIONS

Ogulbabek Batyrova*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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Introduction. Delay differential equations are universal phenomena applied their models in engineering systems to behave like a real process [1-5].

In general, for the solutions of delay differential equations, we need to give the values of unknown functions on some segments. Initial conditions in one point are not enough to get the solution of delay differential equations. For the first time, in an experiment measuring the population growth of a species of water fleas, Nisbet [7] tried to use delay differential equations with reversal time. He reversed time to get the solution of functional differential equations with a given value of the unknown function on one point. Such types of functional differential equations are called involutory differential equations. The time reversal problem is a special case of involutory problems.

We obtained an equivalent initial value problem for the fourth-order ordinary differential equations to the initial value problem for second-order linear differential equations with damping term and involution.

The theorem on stability estimates for the solution of the initial value problem for the second-order ordinary linear differential equation with damping term and involution was proved. Theorem on the existence and uniqueness of the bounded solution of initial value problem for second-order ordinary nonlinear differential equation with damping term and involution was established.

Involutory telegraph partial differential equations are not investigated before. The present paper is devoted to studying involutory telegraph equations. Fourier series, Laplace, and Fourier transforms can be applied to the solutions of involutory telegraph problems. When coefficients of the space operator are dependent on time and space variables, these methods are not applicable. In the present paper, the first and second-order accuracy difference schemes for the numerical solution of the initial boundary value problem for one-dimensional telegraph equations are constructed. Some numerical results are explained.

Numerical algorithm for the solution of the telegraph involutory partial differential equation. We present the algorithm for the numerical solution of the initial boundary value problem

$$\begin{cases} \dfrac{\partial^2 u(t,x)}{\partial t^2} + \dfrac{\partial u(t,x)}{\partial t} - u_{xx}(t,x) - b u_{xx}(-t,x) \\ = (\cos(t) - b\sin(t))\cos(x), x \in (0,\pi), -\pi < t < \pi, \\ u(0,x) = 0, u_t(0,x) = \cos(x), x \in [0,\pi], \\ u_x(t,0) = u_x(t,\pi) = 0, t \in [-\pi,\pi] \end{cases} \quad (1)$$

for the one-dimensional telegraph type involutory partial differential equation with the Neumann condition. The exact solution problem (1) is $u(t,x) = \sin(t)\cos(x)$, in $0 \le x \le \pi, -\pi \le t \le \pi$. For the approximate solutions of the problem (1), using the set of grid points

$$[-\pi,\pi]_\tau \times [0,\pi]_h = \{(t_k,x_n): t_k = k\tau, -N \le k \le N, N\tau = \pi, x_n = nh, 0 \le n \le M, Mh = \pi\},$$

we get the first order of accuracy in t difference scheme

$$\begin{cases} \dfrac{u_n^{k+1}-2u_n^k+u_n^{k-1}}{\tau^2}+\dfrac{u_n^{k+1}-u_n^k}{\tau} \\ -\dfrac{u_{n+1}^{k+1}-2u_n^{k+1}+u_{n-1}^{k-1}}{h^2}-b\dfrac{u_{n+1}^{-k+1}-2u_n^{-k-1}+u_{n-1}^{-k-1}}{h^2} \\ = (\cos(t_{k+t})-b\sin(t_{k+1}))\cos(x_n), \\ -N+1 \le k \le N-1, 1 \le n \le M-1, \\ u_n^0 = 0, \dfrac{u_n^1-u_n^0}{\tau} = \cos(x_n), 0 \le n \le M, \\ u_1^k = u_0^k = 0, u_M^k = u_{M-1}^k = 0, -N \le k \le N \end{cases} \quad (2)$$

and second order of accuracy in t difference scheme

$$\begin{cases} \dfrac{u_n^{k+1}-2u_n^k+u_n^{k-1}}{\tau^2}+\dfrac{u_n^{k+1}-u_n^k}{2\tau} \\ -\dfrac{u_{n+1}^k-2u_n^k+u_{n-1}^k}{2h^2}-\dfrac{u_{n+1}^{k+1}-2u_n^{k+1}+u_{n-1}^{k+1}}{4h^2} \\ -\dfrac{u_{n+1}^{k-1}-2u_n^{k-1}+u_{n-1}^{k-1}}{4h^2}-b\dfrac{u_{n+1}^{-k}-2u_n^{-k}+u_{n-1}^{-k}}{2h^2} \\ -b\dfrac{u_{n+1}^{-k+1}-2u_n^{-k+1}+u_{n-1}^{-k+1}}{4h^2}-b\dfrac{u_{n+1}^{-k-1}-2u_n^{-k-1}+u_{n-1}^{-k-1}}{4h^2} \\ = (\cos(t_k)-b\sin(t_k))\cos(x_n), \\ -N+1 \le k \le N-1, 1 \le n \le M-1, \\ u_n^0 = 0, \dfrac{-u_n^2+4u_n^1-3u_n^0}{2\tau} = \cos(x_n), 0 \le n \le M, \\ -u_2^k+4u_1^k-3u_0^k = 0, -3u_M^k+4u_{M-1}^k-u_{M-2}^k = 0, -N \le k \le N. \end{cases} \quad (3)$$

They are systems of algebraic equations and they can be written in the matrix form

$$\begin{gathered} u_{n-1}+Bu_n+Cu_{n+1} = D\varphi_n, 1 \le n \le M-1, \\ 3u_0 = 4u_1-u_2, 3u_M = 4u_{M-1}-u_{M-2}, \end{gathered} \quad (4)$$

where A, B, C are (2N + 1) × (2N + 1) matrices and $D = I_{2N+1}$ is the identity matrix, φ_n and u_s are (2N + 1) × 1 column vectors. For the approximate solutions of the problem (1). We will apply the modified Gauss elimination method to solve the matrix equation by following the form

$$u_n = \alpha_{n+1}u_{n+1}+\beta_{n+1}, n = M-1,\dots,1, \quad (5)$$

where $u_M = (I-\alpha_M)^{-1}\beta_M, \alpha_j\ (j = 1,\dots,M-1)$ are $(2N+1)\times(2N+1)$ square matrices, $\beta_j\ (j = 1,\dots,M-1)$ are $(2N+1)\times 1$ column matrices, $\alpha_1 = I$, $\beta_1$is zero matrices and

$$\begin{cases} \alpha_{n+1} = -(B+C\alpha_n)^{-1}A, \\ \beta_{n+1} = (B+C\alpha_n)^{-1}(D\varphi_n+C\beta_n), n = 1,\dots,M-1. \end{cases}$$

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Numerical analysis. The numerical solutions are recorded for different values of N and M, and u_n^krepresents the numerical solution of this difference scheme $u(t_k, x_n)$. Table 1 is constructed for $N = M = 40; 80; 160$ respectively and the errors are computed by

$$E_M^N = \max_{-N \le k \le N, 1 \le n \le M-1} |u(t_k, x_n) - u_n^k|.$$

If N and M are doubled, the values of the errors are decreasing by a factor of approximately $1/2$ for the first order difference scheme (2) and $1/4$ for the second order of accuracy scheme (3). The errors presented in the table 1 indicates the accuracy of difference scheme. We conclude that, the accuracy increases with the second order approximation.

Table 1. Error analysis E_M^N

Difference schemes/N=M	40	80	160
(2)	0.1013	0.0496	0.0200
(3)	0.0080	0.0020	5.0452e-04

Conclusion. In the present paper, telegraph-type involutory partial differential equations are studied. The first and second-order accuracy difference schemes for the numerical solution of the initial boundary value problem for one-dimensional telegraph type involutory partial differential equations are constructed. Numerical analysis and discussions are presented.

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NECESSITY OF ELECTRONIC PASSPORT IN THE DIGITAL SYSTEM

Dadebayeva Ogulmengli Halmyradovna*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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"The concept of the development of the digital economy of Turkmenistan for 2019-2025" attaches particular importance to the widespread integration of the digital system in the country. In this regard, the tasks defined in the "Program of socio-economic development of the country of the President of Turkmenistan for 2019-2025", developed on the basis of the initiatives of Turkmen leader, are key importance. With the transition to the digital system, documents have been kept electronically in the country. State regulation should also be noted when using digital electronic documents. When electronic documents are used, state regulatory work is carried out by the Cabinet of Ministers of Turkmenistan and other state institutions in accordance with their powers [1].

State regulatory work to implement a unified state policy when electronic documents are used; to ensure the rights and legal interests of users of electronic documents; to legally ensure the technology of creating, processing, storing, issuing and receiving electronic documents; and develop a safe and secure payment system using electronic documents; is aimed at ensuring the security and protection of data when it is created, developed, stored, transmitted and received [2].

There are more than 140 States and non-state entities (e.g. United Nations, European Union) currently issuing e-Passports, and over 1 billion e-Passports in circulation. E-Passports add a layer of security to traditional non electronic passports by embedding an electronic chip in the passport booklet that stores the biographical information visible on page 2 of the passport, as well as a digital security feature. This digital security feature is a country specific "digital signature." These digital signatures are unique and can be verified using their respective certificates [3].

The e-passport is also the cornerstone of the digital system. An electronic passport (identity card of a citizen) is an electronic document proving the identity of a citizen. This is an electronic medium containing personal information necessary for identification. It is a plastic card containing a chip with the size of a bank card. Moreover, except the standard passport information, fingerprints and other biometric authentication information, driver's license, migration card and electronic signature can be recorded. The integration of an electronic passport provides with the creation of a single electronic database of documents, including cloud storage and access, as well as addressing security issues. Cryptographic protection of SIM cards when using the software on mobile devices. Crypto protection and issuing secure national SIM cards should be addressed. Transactions with an electronic passport will also be possible through the "My Passport" mobile phone application. It is to provide online access to personal data, in particular, with the help of an e-passport in the form of a mobile application. This document, in particular, creates a legal basis for creating a digital profile of citizens and legal entities, an electronic identity document that creates conditions for the development and entry into the field of electronic services, commerce and other transactions conducted in electronic form [4].

Currently, tests are being carried out on the preparation of the digital passport system project, its main parts - electronic reading and placement of its electronic data, electronic signature and biometric image, and ensuring the protection of personal information.

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ROLE OF "HUMAN CAPITAL" IN NANOECONOMICS

Oguljeren Kulyyeva*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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In the modern economy the need for education is becoming highly important. It is asseverated as a separate economic intangible asset, a central element of competitiveness and a driving force of a long-term economic growth in a modern economy. Knowledge based economic theory is directly related to position alteration of factors of production in the economy where information and knowledge occupy higher placing.

A new type of economic concept "knowledge-based economy" is proposed, and the importance of innovation and innovative business in the development of modern society is emphasized. State regulation implements economic tools that promote the creation, adaptation and duration of innovations: improvement of market relations, pricing that stimulate the development of innovations and tax policy, creation of favorable conditions for taxation, for economic entities that promote innovation, providing work efficiency in the sphere of innovations and encouragement towards innovative entrepreneurship.

As is well known, innovative economic business is characterized by high risk and uncertainty. In this regard most people from the high – risk group have begun to master the strategy of human actions and behavior in the modern knowledge-based economy through additional study and training in the relevant business literature. But in order to attract people to innovative business and increase employment in this environment special economic conditions are needed.

In order to create those conditions, "Human capital" is of a particular importance as the priority of innovative growth tools. Human capital having an ability to create added value, encompasses real and strong intellectual capabilities, health, education and talent acquired through experience [1].

Human capital is set of capabilities of individuals and separate social groups acquired during his entire life in order to create new ideas or goods and services under the market conditions using their own intangible asset such as educational skills, creativity, self-actualization, and standard skills for solving non-standard problems.

A person who has increased the competitiveness of developed countries in the world market can evaluate their own skills, determine the value of human capital and offer it on the labour market at the market price. Therefore, with the aim of provision of successful economico-innovative business occurs a necessity in comprehension of motivating force for highly educated individual towards his behavior under economic conditions. In order to achieve the general economic goals of society its important to fully activate the intellectual capabilities of each person at a higher level of economic analysis than the microeconomic level [2].

In order to analyze the position of a person in the economy, the concept of nanoeconomics, a new level of economic analysis was introduced. The concept of nanoeconomics in determining the number of individuals in the economy was first revealed by K. Arrow and improved in the scientific works of a Russian scientist G.B. Kleiner in 2004, in the publication of an article by the Russian scientist G.B. Kleiner: "Nanoeconomics" in the 12th edition of the scientific journal "Вопросы Экономики (Questions of economy)" which

gave a great impetus to the study of this area. In his article the scientist examines the basics of economic research and their disciplinary subject hierarchy, mega and nanoeconomics as the "boundaries" of economic research that is, at the hierarchical level he calls mega economics "the top" of this boundary, while nanoeconomics is the "bottom holder" of the economic system [3]. The main task of nanoeconomics is to explain and predict human economic behavior, it consists of determining the internal and external causes of human behavior in various economic situations, as well as rational and irrational view of it.

Thus, the main goal of creating human capital and its disclosure is to create new opportunities in the field of economics, to study the economic process at the nanoscale, improve the quality of economic stages and achieved results, take risks, think outside the box, rediscover the purpose and meaning of work, that is carried out and enhance human emotional skills.

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SOME WAYS OF ENGLISH SCIENTIFIC-TECHNICAL TERMS TRANSLATION

Oguljennet Movlamova Hudayberdiyevna*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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Abstract. Science and technology are developing continuously because of scientific and technological revolution in cutting-edge epoch. The fields of science are growing constantly, new branches of technology are appearing and as a result of globalization. Globalization has imposed the rapid flow of scientific and technological terms [1]. The elements of vocabulary related to science, technology and production -the terminology of science and technology is active and relevant to constant updating layer of current lexis. Extra-linguistic development of terminology (development related to science and technology), profound stimulus of science and technology on human life set linguists, philologists' crucial tasks. In order to accomplish this intricate task, linguists should acquire not only general linguistic awareness of terminology, but also specific skills of terminology translation. The article considers the structural and semantic features of terminologies used scientific-technical texts and ways of translation.

Introduction. Terminology vocabulary is rising extremely quickly. Terms in any branch of science, technology and production form their own systems that have conceptual connections with professional knowledge and express these connections by means of the language. If in a common language (beyond the terminology) a word can be multivalent, then, getting into a certain terminology, it acquires unambiguity [2]. To overcome the unambiguity translators, seek the solution of the problems via modern Internet resources. They are searching for matching pairs of terms with corresponding notion in different languages. They recognize the meaning of the term through images found in many search bases. Such translation methods don't always provide desired result. There is no doubt that terminology translation plays an extremely important role so further research should be made in order to enhance the translation quality of this typology.

Literature Review. The theme under consideration deals with the proliferation of scientific and technical knowledge, which is going with new notions development, resulting in naming and coining the so-called term. Term deals with names and process of naming. Technical terms fall in two categories: general scientific and general technical terms derived from general words or terms that can be used in many fields with different meanings 2) specific (nomenclature) terms. The former one denotes general concepts of science and technology, while the latter is used in one specific field. As explained by scholars, terminology depicting a set of terms is an autonomous part of any national language that is closely related to professional activity. For example, many large companies also have their own preferred terminology, which they insist be used in all of their often-corporate documents.

In lexicological studies, terminological development issues and terminology users for communication are key importance. According to Auger there were four basic periods in the development of modern terminology. It started to originate in 1930's until 1960. From 1960-1975 the field was structured. The booming period was between 1975-1985 years. Since then the field continues expanding. Two main groups of people use terminology as a communicative tool: direct users, and intermediaries who use terminology to facilitate communication for other users. The initial one is specialists in each subject field, while the

latter is translators, interpreters and technical writers [3]. The most important problem in achieving translation equivalence of scientific and technical terminologies due to variation in the terminological difference in source and target languages. So, there is need to study the term systems and find ways to render the meaning partially or complete.

Methods. It is often difficult to find the exact equivalent in the recipient language during the translation process, so terminologies are often simply left with foreign origin in the language. So, translators have to apply the direct translation method. Direct translation involves relatively straightforward strategies which require less intervention by the translator and less deviation from the ST [4]. Leaving the terminology without translation, it should undergo certain modifications to fit into system of recipient language. The process is called adaptation of loan terminologies through interlanguage term harmonization process. It includes the following methods: The transcription/ orthographic adaptation is a formal phoneme by phoneme imitation of an original lexical unit with the help of the target language phonemes. The pronunciation of source and target languages can be the same but in writing different. Some letters in English (c,q,v,x) can be missing in target language. Such letters should conform to national alphabetic system rules. For example, office-ofis, joystick-joýstik, chip-çip, notebook-noutbuk, cartridge-kartrij etc.

Transliteration is a formal letter by letter reproduction of the original lexical unit with the help of the target language alphabet, a letter imitation of an original form of a word [3]. Transliterated words are often naturalized to assimilate the structure of the target language. Naturalization of loanwords refers to the addition of some affixes to the foreign words without changing their roots.

Calquing/ loan translation is a word (morphemes) or a phrase (lexemes) borrowed from another language by literal word-for-word or root-for-root translation. For example, *high voltage -ýokary woltly*, ultraviolet-ultramelewşe, telegram-telegramma etc. *Semantic calques* (also known as semantic loans): additional meanings of the source word are transferred to the word with the same primary meaning in the target language. As described below, the "computer mouse" was named in English for its resemblance to the animal; many other languages have extended their own native word for "mouse" to include the computer mouse [5].

Descriptive translation and translation comments. The descriptive translation, as a rule, is used in parallel with the transcription and is applied when translating terms, culturonims, unique objects, etc., having no lexical equivalents in the target language. The word meaning is presented with more or less common explanation. If the description as a translation method usually accompanies the word, presented in a simple form, or even is used instead of the word, the translator's comments are given beyond the text, being mentioned either in the footnotes at the same page or into the endnotes of the text. It mainly concerns various acronyms, abbreviations, and terms, *"phishing – illegal act over the internet"* etc.

Taking above-mentioned things into consideration, there are some issues in the field of scientific technical terminology and translation field. Specific requirements for the scientific and technical translation are the ability to suggest accurate terminology equivalents, which is a requirement for adequate translation. In this developing age, there is great demand to technical and scientific terms. So, today linguists/technical philologists should work in this field more than past, because it is age of technology.

Results and Discussion. In some cases, translating terms in lexical way leads some difficulties, as it demands from a translator both perceiving the original term meaning and knowledge of its possible opponents in target language. The terms can be polysemic, synonymous and homonymous. Polysemic term has more one meaning. It is widely used in

reterminologization (when a term adopts a new meaning [6]. Identifying polysemy may be challenging without sufficient technical knowledge, for example in financial terminologies, "*own shares*", "*debtors*" and provisions are the British equivalents for American terms "*treasury stock*", "*accounts receivable*" and "*allowances* [7]. A synonym is an alternate word that has the same or similar meaning of any particular word. For example, *disease/disorder*, *toxic: containing or being poisonous material especially when capable of causing death or serious debilitation: toxic waste a toxic radioactive gas*. One should mind, that one and the same word form can have different meanings in several branches of one and the same scientific or technological sphere. It is often encountered in homonymy. Homonymy refers to two unrelated words that look or sound the same. Two or more words become homonyms if they either sound the same (homophones), have the same spelling (homographs), or if they both homophones and homographs, but do not have related meanings. Given below are some examples of homonyms: For example: *"feed" in biology -to give food to; supply with nourishment but in physics to furnish for consumption*. Therefore, in scientific-technical terms translation, a translator should stick to the topic of the text to avoid the wrong versions of rendering the homonymous term. Summarizing the available research data, we have identified the following properties inherent to the terms: monosemy, specific meaning; belonging to a certain terminological system; lack of expression.

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METABOLIC SYNDROME AND ITS RISK FACTORS

M. Elyasov[1*], O. Soltanova[2]

[1]*Academy of Sciences of Turkmenistan, Ashgabat, Turkmenistan.*
[2]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*

[*]Corresponding author

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There are several definitions which are suggested to explain how metabolic syndrome is appeared. According to modern scientific information G. Reaven was one of the first who tried to explain the term of "syndrome X" or "metabolic syndrome" in 1988. He found out such symptoms as hyperinsulinemia, tissue-induced insulin resistance (IR), impaired glucose tolerance, high density of lipoprotein, hypertriglyceridemia that lowers cholesterol (HDL cholesterol) and arterial hypertension (AG) were composition of metabolic syndrome. However, considering the metabolic syndrome it started from earlier times. In 1966 J. Camus revealed that Hyperlipidemia, 2nd ed mutual cause of type diabetes and gout diseases had an interrelation. He called this type of metabolic disorder as "metabolic trisyndrome" (trisyndrome metabolique). In 1968, N. Mehnert and N. Kuhlmann explained that in hypertension and diabetes mellitus the factors and causes of metabolic disorders are related and discovered new syndrome "abundance syndrome". In 1988 M. Hanefeld and W. Leonard suggested to call different metabolic disorders similarities as " Metabolic syndrome ". After that in 1989 N.M. Kaplan described Metabolic syndrome concept as abdominal obesity and clinical metabolic disorders and lead the theories that destruction of impaired glucose tolerance, arterial hypertension, obesity and delayed dyslipidemia, called it a "deadly quartet". Consideration of The main pathogenetic mechanism of this syndrome, usually the term "insulin resistance syndrome" is also used as a synonym [1, 2].

Metabolic syndrome makes combination - pathological conditions such as abdominal obesity, dyslipidemia, arterial hypertension, insulin resistance, and in starvation there is a rise of glucose degree in the blood. The metabolic syndrome is the dangerous factor of 2nd type diabetes and formation of cardiovascular disease. In some cases, insulin resistance (insulin resistance) is cause of other symptoms, unlike other conditions, obesity is the main reason insulin resistance. A result of recently conducted studies chronic flu is the main reason formation of metabolic syndrome and last pathophysiology [1, 3].

In the 21st century atherosclerosis (arterial hypertension, myocardial infarction, stroke) took the first place among reasons of diseases related to cardiovascular disease, mortality and disability. It is one of the leading causes of cardiovascular disease. Cardiovascular mortality and morbidity Hypertension (AG) should be associated with elevated risk factors as a result of exposure. There are more than 200 kinds, the most dangerous one among them are arterial hypertension, dyslipidemia, obesity, diabetes mellitus and hyperinsulinemia. During recent decades many patients are suffering with metabolic syndrome so the syndrome has known as the "epidemic of developed countries". 15-25% of the world's population who is over 30 years old suffer from metabolic syndrome, 74% of patients with arterial hypertension are suffering from it in the Russian Federation, It occurs in 90% of patients with impaired tolerance and diabetes mellitus [4].

Insulin resistance's purpose makes appearing and developing of metabolic syndrome's mechanism. The basis of insulin resistance disorders mutation of the gene encoding (pre-receptor mechanism) causes autoimmunity (production of antibodies to insulin and insulin

receptors (for this purpose), changing of insulin molecule, the movement of the insulin molecule from the number of insulin receptors are also can be hormonal and molecular factors. Insulin is an anabolic hormone whose function is to control glucose utilization and consists of synthesizing glycogen. However, regulating metabolism its function goes beyond regulating blood glucose levels [4].

Among the population in the last decades of the 20th century and the beginning of the 21st century atherosclerosis, hypertension, 2nd type of diabetes, obesity Pathologies were been found. The above-mentioned pathologies are metabolic and consequences of insulin resistance syndromes. One of the clinical signs of this is visceral obesity, as well as research from leading clinics It is one of the main causes of the symptoms and excessive sweating of these two syndromes are chronic diseases. The prevalence of these syndromes in the population is high As a result, they have been labeled an "epidemic of missing diseases." According to the BSGG's report, there are approximately 1.7 billion people worldwide who suffers from body weight obesity. According to this index, the USA, Germany and Canada takes top places. 34% of adult people suffer from extra body weight and 27% suffer from obesity. In the last 10 years obesity has increased by an average of 75% all around the world. There is a possibility that 40% of men and 50% of women can suffer from obesity by 2025 [5].

According to modern researches rising of Metabolic syndrome in the general population, will lead to an increased risk, especially of kidney stone diseases, cardiovascular diseases, with sclerosis and their nephrolithiasis. According to the results, the population of the USA suffers from this systemic disease and it can be reason of pathological atherosclerosis, especially in people with kidney stones, it is noted that the risk of cardiovascular diseases is increased. Last years has proven there are many incidences of kidney disease among youth generation and it is associated with subclinical atherosclerosis [6].

In the result we consider said above then patients with metabolic syndrome are at risk of developing functional disorders of internal organs and this will lead to increased risks. In this situation we should find out patients with metabolic syndrome and their treatment would become one of our main duty.

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ON THE SYNTACTIC AND SEMANTIC FUNCTIONS OF INTERJECTORY PARTICLES “-da, -de/-da, -dä” IN TURKMEN AND “-yo” IN JAPANESE

Onur Taşören*

Marmara University, Institute of Turkic Studies, Istanbul, Turkey.

*Corresponding author

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As they are considered as Altaic languages, both Turkmen and Japanese are languages in SOV (subject-object-verb) order. Most of the sentence members in both languages have a position in a sentence, even though Turkmen is more available for scrambling. However, interjectory particles in both Turkmen and Japanese come to the end of the sentence after predicate. Interjectory particles (Turkmen: ownuk bölegi [1] [2], Japanese: kantō-joshi [間投助詞]) in Turkmen and Japanese don’t change the main meaning of sentence; however, they add nuance which makes the expression stronger. Thus, we can say that speaker wants to express himself or herself strongly, or he or she thinks that receiver is not aware of the shared information by speaker.

In Turkmen grammar book [3], interjectory particle -da (-de, -dä) is described by seven functions: 1. Being added to nouns or verbs in present and future tenses, it makes question in speaking language. 2. It makes the expression stronger in the sentence and speaker wants to confirm. 3. Adding to commands, it repeats the request. 4. After an unknown future suffix added to predicate, it strengthens the meaning of disbelief on a future act. 5. It adds indecision or regret feelings to the sentence. 6. It adds surprised feelings to the sentence. 7. It strengthen the meaning of believing in the sentence. In summary, interjectory particle in Turkmen is added to nouns or verbs which are predicates, and it adds strong impression or doubt to the sentence.

In Japanese grammar book [4], interjectory particle -yo can be added to nouns, adjectives and verbs which are predicates at the end of the sentence. -yo can also be used as vocative case suffix in any other position of the sentence or after other particles; however, we will approach only the one which is used after predicates. -yo which comes after predicate strengthens command, prohibition, or any other predicates as in Turkmen. In this article, seven examples in Turkmen will be given for these functions described in Turkmen grammar book, then their Japanese translations will be compared below.

(1) Tm: “Onda goýna eýe bolmaga çykan oglan sen-**dä**?” («Görogly»)
SO SHEEP +DAT. OWNER BE+TO GO OUT+WHO SON YOU(SIN.)+IP.
Jp: “それで羊の主人になりに出かけた息子はあんたかよ？”
Sorede hitsujino şujinni narini dekaketa musukowa antakayo?
SO SHEEP +GEN. OWNER+DAT. BE(N)+DAT. GO OUT+PAST.T. SON+BP YOU(SIN.)+QM+IP?
Meaning: So the boy who went out to be owner of the sheep is you, right?

As it is seen, “-da, -de/-da, -dä” in Turkmen and “-yo” in Japanese can make questions; however, it is necessary to add question particle -ka in Japanese to sentence.

(2) Tm: “Munuň geňeşini özüň bilýärsiň-**dä**, Görogly!” («Görogly»)
THIS+GEN. ADVICE+3rd.SIN+ACC. SELF+2ND.SIN KNOW+PRS.T.+IP, GÖROGLY!
Jp: これのアドバイスを自分は知っているよ、ゴルオグリさん！

Koreno adobaisuo jibunwa şitteiruyo, Goruoguri-san!
THIS+GEN. ADVICE+ACC. SELF+BP KNOW+PRES.T+IP, GÖROGLY!
Meaning: You know its advice yourself, Görogly!

(3) Tm: “Siz maňa ýol harjy tapyp beriň-**dä**.” (A. Durdyýew)
YOU I+DAT. WAY EXPENCE+3rd.SIN.PA FIND+ADV. GIVE+2nd.PLU.COM+IP.
Jp: あなたたちは私に旅費を見つけてくれてよ。
Anatataçiwa wataşini ryohio mitsukete kureteyo.
YOU(PLU)+BP I+DAT. TRAVEL EXPENCES+ACC. FIND+ADV. GIVE+COM+IP.
Meaning: You just find me the travel expences!

In (2) and (3), interjectory particles in both languages don’t change meaning but strengthen expression.

(4) Tm: “Şolar biziň gapymyzdan garamazlar-**da**.” (H. Deryaýew)
THAT+PLU WE+GEN. DOOR+1st.PLU.PA+ABL. LOOK+NEG.IND.FTR.T.+PLU+IP.
Jp: そいつらは私たちのドアをさえ見ないよ。
Soitsurawa wataşitaçino doao sae minaiyo.
THAT+PLU+BP WE+GEN. DOOR+ACC.+BP SEE/LOOK+NEG.PRE.T.+IP.
Meaning: These will not even look at our door.

In (4), if interjectory particle adds doubt meaning, Japanese needs “sae” binding particle.

(5) Tm: “Wah, Görogly, men ony birinden nesýe alypdym-**da**!” («Görogly»)
EXP., GÖROGLY, I IT+ACC. SOMEONE+ABL. ON CREDIT TAKE/BUY+PAST.T.+IP.
Jp: ゴルオグリよ、私はあれを誰かに掛け売りで買ったんだよ！
Goruoguri-yo, wataşiwa areo darekani kakeuride kattandayo!
GÖROGLY+VOC., I+BP IT+ACC. SOMEONE+ABL. ON CREDIT+INS. BUY+PAST.T.+COP.+IP.
Meaning: Ah, Görogly, I bought it on credit from someone!

(6) Tm: “Waý-eý, jan dogan, tüýs Selim-**dä**.” (T. Gurbanow)
EXP., DEAR BROTHER, REALLY SELIM+IP.
Jp: ほらほら、兄弟よ、さすがセリムさんだよ。
Hora hora, kyōdai-yo, sasuga Serimu-san dayo.
EXP., BROTHER+VOC., AS EXPECTED SELIM+MR+COP.+IP.
Meaning: Hey, dear brother, as expected, It’s Selim!

(7) Tm: “Şony almak meniň bilen-**dä**.” (A. Durdyýew)
THAT+ACC. TAKE/BUY+NOUN I+GEN. TOGETHER+IP.
Jp: それを買うのは私次第なんだよ。
Soreo kaunowa wataşi şidai nandayo.
THAT+ACC. BUY+PRE.T.+NOUN+BP I+DEPEND ON+COP+IP.
Meaning: Buying that depends on me.

As in (5), (6), and (7), interjectory particles in both languages strengthen regret, admiration and/or belief expresions in sentence.

Seeing that interjectory suffixes in both Turkmen and Japanese are added to predicates, we can say both languages are not only same for SOV order, but also similar with their interjectory particle systems. In addition, -da (-de/-dä) and -yo interjectory particles in both languages have semantic similarity that strengthens the expression but doesn’t change the main meaning.

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DESIGN OF THE AUTOMATIC GREENHOUSE CONTROLLER USING A PIC18F4550 MICROCONTROLLER

Perman Ezizgulyyevich Hojagulyyev[1*], Suleyman Malikmyradovich Nokerov[2], Arslan Tirkeshovich Tirkeshov[3], Aravind Pitchai Venkataraman[4]

[1,2,3]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*
[4]*Department of Electrical and Computer Engineering, Mattu University, Mettu, Ethiopia.*

[*]Corresponding author

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In order to facilitate human labor in the agricultural sector in our country, agricultural machinery is automated on the equipment of leading world technologies. Given the importance of greenhouses for the development of agriculture, research, and design work were carried out to create a greenhouse control system. PIC microcontrollers are now widely used to develop high-performance and low-cost greenhouse control systems. In this context, the PIC18F4550 microcontroller was selected to develop the greenhouse automation control system considering the advantage of its introduction into production [1] and its high operating speed and efficiency [2]. In smart greenhouses, various subsystems (heating, lighting, photovoltaic, etc.) are controlled and managed. Smart greenhouses are designed to increase production and ensure environmental sustainability [3].

A number of research works have been studied on the greenhouse control system. The electrical circuit (figure 1) of the system was designed using the Proteus EDA software and its functionality was verified by circuit simulation.

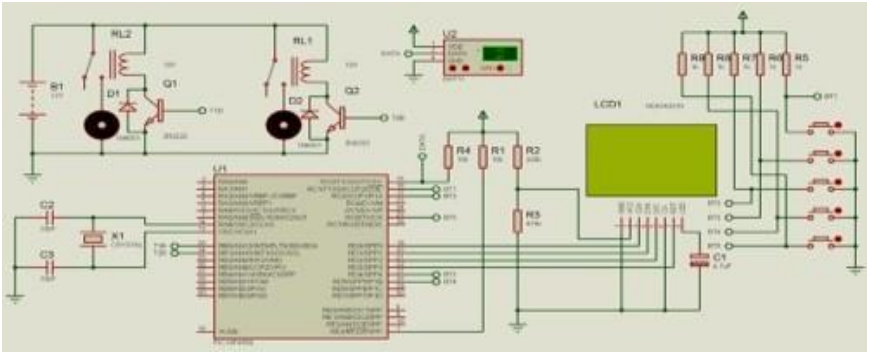

Figure 1. Electric circuit of greenhouse control system in Proteus program

Our selection of microcontrollers has 40 I/O systems, allowing us to increase the number of sensors and actuators that can be connected to the control system. Its memory is larger than other models, which allows it to accommodate complex program code that includes multiple functions. The Nokia 3310 display was used for the display of commands. The 4 relays act as a bridge between the microcontroller to ensure that the commands to the actuators work properly. A DHT 11 temperature and humidity sensor were connected to a device for measuring temperature and humidity in a greenhouse. There are 5 buttons for user control and control settings. Then using this program was the designed printed circuit board. According to the PCB in the program, a printed circuit board was made and the components necessary for the circuit board were placed on it. A control program was loaded into the microcontroller

to make the board fully functional, using the Pickit 3 programmer. The main program of the system, the display library for the correct display of text and images on the display, and the library for the DHT 11 sensor are written in C language, and for addressing the ports of the microcontroller the program code is written in Assembly language. The developed control system has opportunities for implementation in automated greenhouses.

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INNOVATIVE TECHNOLOGY FOR SMART CAR PARKING SYSTEM

Perman Ezizgulyyevich Hojagulyyev[1*], Suleyman Malikmyradovich Nokerov[2], Yagshygeldi Annagurdovich Annagurdov[3], Khalid Ali Khan[4]

[1,2,3]Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.
[4]Department of Electrical and Computer Engineering, Mattu University, Mettu, Ethiopia.

[*]Corresponding author

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One of the major problems people face in big cities is the lack of proper traffic and car parking management systems. In the smart city, which will be built in the coming years, it is planned to build multi-storey car parks for residents' cars, office employees cars, service systems cars and other specialized vehicles. When cars are not in use for a short or long time, parking lots are needed to park them. For optimal placement of a large number of cars for various purposes in parking lots, of course, automated smart parking spaces are needed, which means that it is advisable that the parking lots of the smart city should also be “smart”. One of the key components of smart cities being built today is smart parking systems [1-4].

Conventional car parking systems that are not properly managed can't fully meet the needs of smart cities. The smart parking solution allows drivers to easily and quickly identify available parking lots [3]. Cars play an important role in the life of a smart city. That is, the ecology of the city, motion of transports in cities, traffic jams, the time required to do certain tasks in cities and other phenomena are one of the main indicators of urban traffic, and urban life is closely related to them. From this point of view, since the large role of parking in city management is felt, part of the research work in the field of "smart cities" falls on smart parking [4].

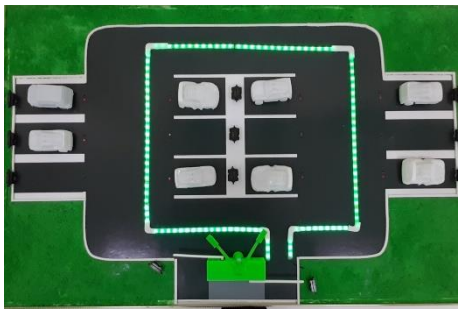
In view of the above, an automated smart parking technology based on innovative technologies was developed, and its prototype is shown in Figure 1. As shown in the figure, the smart parking prototype consists of 2 parts. These are the left and right parts. Each part consists of 6 individual parking lots for a total of 12 parking spaces. This prototype consists of 1 entry and 1 exit.

In order to implement a prototype of an innovative smart parking system were used 2 Arduino platforms (1 Arduino MEGA and 1 Arduino UNO), 14 SHARP GP2Y0A21YK0F infrared sensors, 1 HC-SR505 PIR sensor, 2 MG996R servo motors, 12 red, 12 green and 2 white LEDs and also 2 peaces of RGB LED strips.

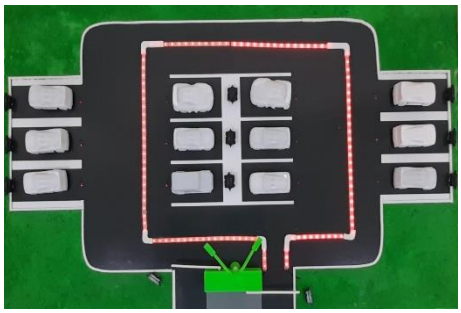
When the individual parking lot is empty, the IR sensor detects that it is empty and informs the central control unit about it. And the central control unit will activate a green LED to indicate that the space is empty. When the driver parks his car in any free parking lot, the IR sensor detects the occupied space and informs the central control unit about it. The central control unit, in turn, activates a red LED there to signal that the parking lot location is not empty, i.e. busy.

RGB LED strips serve as an additional accessory for informing drivers in advance about the availability of a free space in a smart parking lot. On both right and left parts of the car parking system, 1 RGB LED strip is installed. Figure 1, a, c and d shows the moments illustrating the presence of at least 1 free parking lot in the left and right parts, respectively, and vice versa. If all spaces in the right or left lane are occupied, these LED strips turn red to alert drivers that there is no parking space in the parking lot (figure 1 b).

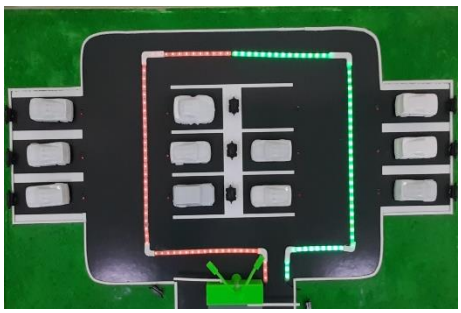
As a result, a smart, energy-saving, understandable and user-friendly innovative technology of car parking system has been developed and implemented. Using this smart parking system will make optimal and efficient use of existing parking spaces, thus avoiding the costly construction of new "redundant" car parking lots.



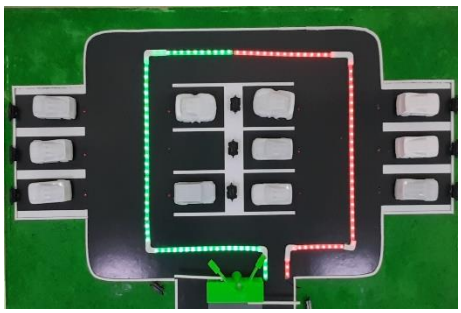
a) There are free parking lots in both parts of the car park (the LEDs in both parts are green)



b) There are not free parking lots in both parts of the car park (the LEDs in both parts are red)



c) There are not free parking lots on the left side of the car park, but there are on the right side (LEDs on the left side are red, on the right side are green)



d) There are not free parking lots on the right side of the car park, but there are on the left side (LEDs on the left side are green, on the right side are red)

Figure 1. The working state of the LED strips for indicating free and occupied parking lots in the developed smart parking system

The use of computer softwares and mobile phone applications to manage and use various services in smart cities is becoming more and more popular these days. Therefore, future scope of this project consists of creating computer software and mobile application for parking management in order to further improve the innovative smart car parking system.

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STEPS OF BUILDING AN ARTIFICAL NEURAL NETWORK

Resul Mametsaliyev*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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The rapid introduction and targeted use of the achievements of science and technology are becoming the key to the future development of our society. In this regard, in the education system, there is a need of introducing new teaching methods into the educational process along with traditional teaching methods. In accordance with modern requirements, the priority of activity and quality indicators of training in harmony with the description of the theoretical and practical foundations of knowledge in the course have a special characteristic property.

When building an Artifical Neural Networking (ANN) model, it is necessary to accurately determine the tasks that will be solved with its help. Currently, neural network technologies are successfully used for forecasting, recognition and generalization.

The first step in building a neural network model is a careful selection of input data that affects the expected result. From the source information, it is necessary to exclude all information that is not related to the problem under study. At the same time, you should have a sufficient number of examples for ANN training. There is the empirical rule that establishes a recommended ratio X between the number of training examples containing inputs and correct answers and the number of connections in the neural network: $X < 10$ [1].

For the factors that are included in the training sample, it is advisable to preliminarily assess their significance by conducting a correlation and regression analysis and analyze the ranges of their possible changes [2].

At the second step, the transformation of the initial data is carried out, taking into account the nature and type of the problem displayed by the neural network model, and the ways of presenting information are selected. The efficiency of the neural network model increases if the ranges of input and output values are reduced to a certain standard, level for example, [0.1] or [-1.1].

The third step is to design the ANN, i.e. in designing its architecture (the number of layers and the number of neurons in each layer). The structure of the ANN is formed before the start of training, so the successful solution of this problem is largely determined by the experience and skill of the analyst conducting the study.

The fourth step is associated with network training, which can be carried out on the basis of a constructive or destructive approach. In accordance with the first approach, ANN training starts on a small network, which is gradually increased until the required accuracy is achieved according to the test results. The destructive approach is based on the principle of “tree thinning”, according to which “extra” neurons and connections adjacent to them are gradually removed from a network with a deliberately excessive volume. This approach makes it possible to investigate the influence of remote links on the accuracy of the network. The learning process of a neural network is a refinement of the values of weight coefficients for individual nodes based on a gradual increase in the volume of input and output information [1]. The beginning of training should be preceded by a procedure for choosing the activation function of neurons, taking into account the nature of the problem being solved. In particular, in three-layer perceptrons on the neurons of the hidden layer, in most cases, the logistic function is used, and the type of the transfer function of the neurons of the output layer is determined

based on the analysis of the results of computational experiments on the network. A histogram of the values of interneuronal connections can serve as an indicator of ANN learning ability.

At the fifth step, the obtained ANN model is tested on an independent sample of examples.

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INVESTIGATIONS ON PHYTOCHEMICAL ANALYSIS OF LICORICE EXTRACT

Serdar Gedayev Rejepbayevich[1*], Rozyyeva Ogulnur Charyyevna[2]

[1,2]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*

[*]Corresponding author

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Licorice belongs to the genus Glycyrrhiza, and it is one of the most widely used medicinal plants in turkmen folk medicine. The underground stems (stolons) and roots of this plant have been used by mankind for 4 thousand years and are considered the "father of medicinal herbs" [1, 2].

The purpose of the scientific study was to analyze the phytochemical composition of the root. For this purpose, the split roots were placed in a drying oven at 40oC for 3 days to dry. It was then crushed in a mechanical grinder and ground into a powder. 30 grams of the obtained powder was placed in a solution of 320 ml of methanol (50%) for 72 hours. 150 ml of the methanol extract was taken and placed in a rotary evaporator at a temperature of 55-60°C. After evaporation of methanol, the final volume of the solution was 50 ml and the extract was used for phytochemical studies.

Phytochemical analysis revealed the presence of flavonoids, terpenes, tannins and glycosides in the extract. The obtained results are shown in figure 1 and table 1.

Table 1. Preliminary phytochemical analysis of water-methanol extract of Glycyrrhiza glabra roots ((+) substance presence; (-) lack of substance; * in small quantities)

No	Phytochemical compounds	Investigations	Results
1	Carbohydrates	Benedict test	(-)*
2	Proteins	Ninhydrin test	(-)
3	Flavonoids	NaOH solution test	(+)
4	Terpenoids	Salkowski test	(+)
5	Saponins	Buble test	(+)
6	Tannins	Ferric Chloride	(+)
7	Glycosids	Keller-Killany test	(+)
8	Phenolic compounds	Ferrous sulfate test	(-)

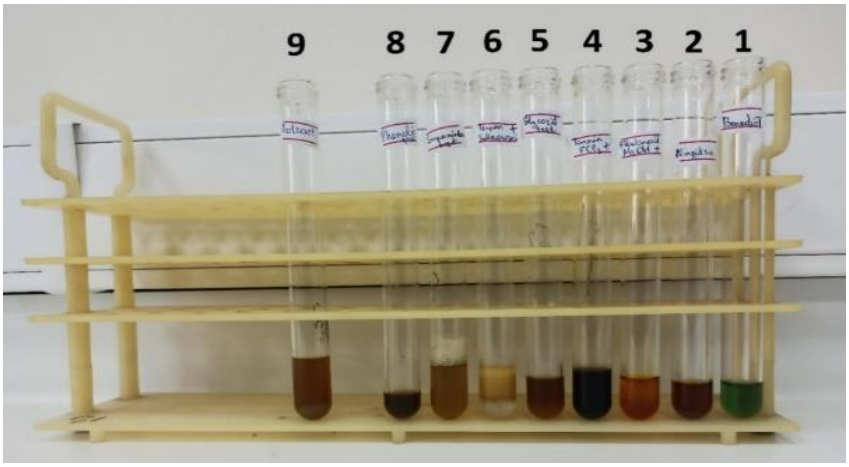

Figure 1. Phytochemical analysis results

Glycyrrhizic acid prepared from Glycyrrhiza glabra extract based on literature data was obtained for UV spectral analysis. A solution of glycyrrhizic acid with a concentration of 100 µg/ml was prepared and the wavelength of the UV spectrophotometer was scanned between 200 and 800 nm. A 70% alcohol solution was taken as standard.

Spectral analysis (figure 2) was performed using an SP-UV 500 DM spectrophotometer (Spectrum Instruments). The highest peak was at a wavelength of 234 nm. In literature sources, the standard wavelength of glycyrrhizic acid is 254 nm, which means that the obtained glycyrrhizic acid is closer to the standard [3].

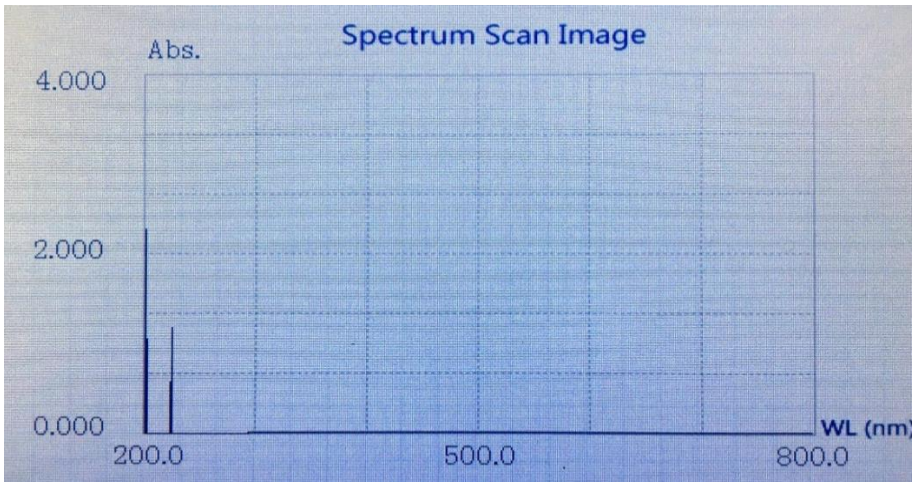

Figure 2. UV spectrum of the root extract. Glycyrrhizic acid gives a peak at 234 nm

A check solution, a standard solution and a reference solution were prepared for TLC analysis. To prepare the test solution, the extract was mixed with alcohol and water (7:3). The stirred solution was heated for 5 min and cooled. After cooling, it was filtered.

To prepare the standard solution, 50 mg of glycyrrhizic acid was mixed with a 7:3 solution of 1 mL of alcohol and water.

The lead solution was prepared by mixing butyl alcohol, water and acetic acid in a ratio of 7:2:1. TLC plates were prepared using a silica gel solution. Plates were stored in a running solution system (Camag TLC chamber) and visualized under UV light (UV lamb Camag) at 254 nm. Figure 3 shows the path of glycyrrhizin and the extracts prepared in different solutions.

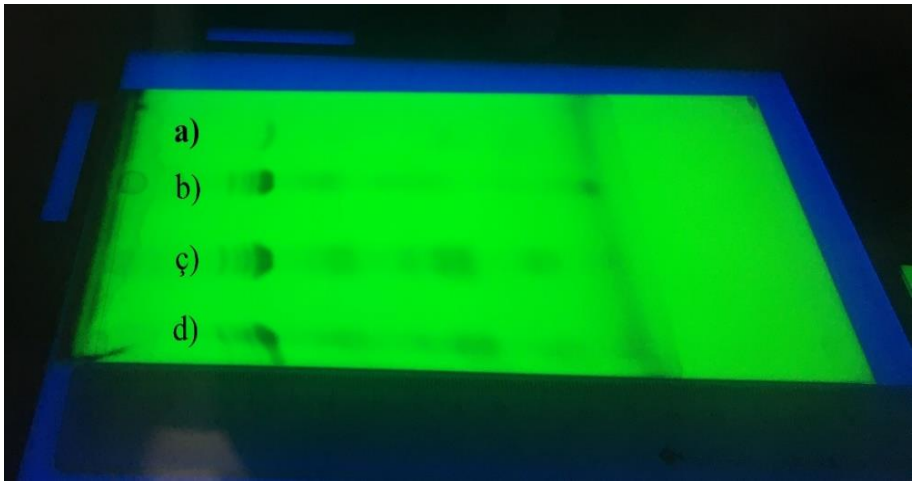

Figure 3. Thin layer chromatograms of the extract obtained in different solutions compared with standard glycyrrhizin: a) Standard glycyrrhizin; (b) Aqueous extract of rhizome; c) Extract of the root in methanol; (d) Ethanol extract of burdock root

As we can see in the figure 3, glycyrrhizin forms a band, which indicates its purity. The presence of several bands in the extracts prepared in different solutions means that they contain many phytochemical compounds [3, 4].

The RF value (retention factor) is calculated by dividing the passage of the test solvent in the TLC analysis by the passage of the solution. The RF value was also calculated for glycyrrhizin and was equal to 0.42 cm.

RF= solvent flux/solvent
RF= 5cm/12cm = 0.42cm

As a result, a phytochemical analysis of the plant (*Glycyrrhiza glabra*) growing in the country was carried out and the groups of biologically active substances found in its composition were determined.

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OPPORTUNITIES FOR SYNTHESIZING QUATERNARY AMINES IN TURKMENISTAN

Saparmyrat Annameredovich Ovezsahedov*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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"The State Program for Integrated Development of Chemical Science and Technologies in Turkmenistan for 2021-2025" is an integral part of the "Social and Economic Development Program of the President of Turkmenistan for 2019-2025". The State Program of our Hero Arkadag set before us the tasks of modernizing the chemical industry, increasing the role of chemical science and technology in the development of our economy based on advanced technologies, innovations and scientific achievements, and increasing the speed of introducing the results of scientific research into production [1].

Turkmenistan is rich in various mineral resources. These resources are mainly concentrated in the Garabogazkol Bay, the Caspian Sea, the underground iodine-bromine waters of Balkanabad, and the Govurdak-Koytendag mineral deposits. One of the priority directions of the economy is to develop the chemical and technological system by diversifying the country's natural raw materials and increasing the level of processing [2].

Currently 1,2-halohydrins with at least 6 carbon atoms, which are used as reagents in green chemistry production centers, are easily obtained by the reaction between, for example, 1,2-epoxyalkanes with at least 6 carbon atoms and hydrogen halide . The reaction is preferably carried out in a 1:1 molar ratio with the above reagents. The corresponding halohydrin is obtained in quantitative yield with a shorter reaction time than the 1,2-epoxyalkane. Hydrogen halide can be used as concentrated aqueous solution of 37% HCl; 48% or 63% HBr; or 57% or 67% HI. The reaction temperature ranges from about 30°C to about 100°C. Such temperatures are usually obtained without external heating due to the heat of reaction. The reaction mixture is two-step when aqueous hydrogen halide solutions are used, and the reaction is completed within one hour. If liquid hydrogen halide solutions are used in dilute concentrations, the reaction will take longer. Halohydrins can also be obtained when using gaseous or dry hydrogen halide instead of using aqueous solutions. The halohydrin reaction product obtained from the process described above is usually heterogeneous, ie the reaction mixture consists of a mixture of 1-halo-2-hydroxyalkane and 1-hydroxy-2-haloalkane isomers. It is not necessary to separate these isomers for use in the invention. The hydride can also be obtained when using gaseous or dry hydrogen halide. [3]

Object of the invention - the quaternary ammonia compounds of the invention can be added to detergent formulations containing at least one detergent active compound to have a softening effect on laundry. Such detergent formulations are usually based on formulations containing non-ionic surfactants. In addition, the products of the invention can be applied to textile surfaces as a collapse aid. The activities in this field are aimed at the systematic and efficient use of our natural resources.

The novelty of the work is to increase the role of science within the framework of the reforms taking place in all sectors of the country's economy, including the development of innovative and digital technologies for the production of environmentally friendly, energy-saving, imported and competitive products through chemical science and new chemical technologies.

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THE INFLUENCE OF ULTRASOUND ON THE HUMAN BODY

Kulliyeva Shirin*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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It is impossible to imagine modern medicine without powerful diagnostic equipment, which directly determines the diagnosis of the pathological process, the choice of treatment tactics, and further prevention. Such equipment based on the use of high technologies of radiation diagnostics, which allow visualizing normal and pathological tissues of the human body with the help of various physical agents.

One of the important links of instrumental diagnostics is ultrasound diagnostics. Ultrasound is a mechanical vibration of an elastic medium occupying an area above 16000 HZ. Ultrasound with a frequency from 800 to 3000 kHz used in medicine. The important parameters of ultrasound are frequency, amplitude, speed and intensity. All these parameters give an idea of the propagation of the sound wave in the medium. Also very important in ultrasound diagnostics is the idea of how the ultrasonic wave propagates in biological tissues and media. Since organs and liquid media have their own density, the propagation of the sound wave will vary depending on the medium. It is also important to take into account that when a sound wave propagates in the medium, a number of other effects manifest themselves: mechanical, thermal and physico-chemical [1].

In addition to ultrasound diagnostics, the use of ultrasound for the treatment of various pathologies is relevant in modern practice. Among the improved methods of treatment, focused ultrasound of high intensity is widespread, wide possibilities of using this method in such areas of medicine as surgery, hyperthermia of tumors, neurosurgery, treatment of prostate tumors, destruction of stones, stopping bleeding, liposuction, activation of peripheral nerve structures, as well as in otolaryngology, ophthalmology, cardiology, etc. are shown. In modern medicine, also used methods of using ultrasound as a modifier of radiotherapy [2].

The study of all these methods and their intended use is important for improving the instrumental diagnosis and treatment of diseases.

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HOW TO FOSTER INNOVATION

Steven C. Michael*

Lubar School of Business, University of Wisconsin-Milwaukee, and Gies College of Business, Univerity of Illinois at Urbana-Champaign, USA.

*Corresponding author

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The UN sustainable development goals are hard. All will require change…in our practices, techniques, infrastructure, and education. All will require innovation! Indeed, the ninth goal explicitly seeks to foster innovation. But all the goals will require it. Achieving better industry will require innovation. Making clean water available everywhere will require innovation. Clean and affordable energy including natural gas will require innovation. So the most important resource we have is people!

If the most important resource we have is people, then the most important technology we need is tools to make people into innovators. This is a special responsibility for us as educators of young people. Let me offer some basic tools supported by research that can help us to build innovators.

First, we must develop creativity in people, individually and in groups. A creative person has a store of raw information AND the ability to combine it in novel and useful ways. So we need to encourage diverse experiences. Narrow disciplinary specialization can be complemented by a larger education in teamwork. Not everyone has the same information, expertise, approach, or perspective! Diversity of thought drives innovation. Imagination is not the monopoly of a particular age group, profession, or nationality.

Innovators must understand user needs from observation and experience, not just analysis at a distance. Rather than viewing the problem of water supply from a distance, visit the site, know the people and their problems, observe carefully. Then cooperate though "ideation" or idea generation. Encourage contributions from all areas and levels of experience. Formal techniques exist like brainwriting and brainstorming that complement informal sessions.

Perhaps the most important rule in this process is to separate creating from judging. Sometimes in our classrooms or corporate offices we are too quick to judge. An important principle is to generate many ideas, then choose the best ones. Let creativity reign using the right side of our brains, individually and collectively, then critique those ideas with the left side of our brains.

Teamwork requires trust and spirit. Time spent building these is time well spent. Whether it is pizza or shashliks, shared meals and fellowship, coffee and conversation, all these can build the trust necessary for people to feel comfortable sharing ideas. This is money well spent. Innovation is a team sport!

Reaching these goals with specific innovations will require social experiments. Like any experiment, social experiments take time and effort, and they are rarely done right the first time. What meets the needs, what works, what can be done quickly, safely, and economically has to be discovered. Take feedback from stakeholders—customers, policymakers, suppliers and companies. Feedback from users is essential to insure that the innovation is truly meeting the needs for which it is intended.

A few examples from history can illustrate. "Fail fast and break things" was the motto of Facebook in its early days. Thomas Edison said: "The light bulb did not have 1000 failures but it did take 1000 steps to produce." And the first Nike waffle soled shoe took 33 iterations. Fail fast, fail cheaply, and learn!

Reward risk taking and tolerate failure. This is in many ways the hardest, because our inclination as individuals and organizations is different. Organizations exist to replicate products, processes, and services efficiently with a minimum of resources. Leadership sets direction, monitors tasks and performance. Deviation is "wrong."

But innovation requires deviation—we only learn from differences. Ideas come from anywhere and anyone. Resources are used IN-efficiently. Social experiments are costly in terms of money but they are essential, even a bargain when treated as a purchase of information – information that cannot be obtained in any other way.

Taking risks requires special rewards for people. Too often we require an unbroken series of successes for an individual's career. We need to be more tolerant of honest failure, and judge by lessons learned rather than achievement alone. In Silicon Valley almost everyone has had a failure of some kind, and yet it is viewed as a chance to learn rather than a permanent setback. The only failure is the failure to learn, and the failure to share that learning!

Projects might fail but people are not failures when learning occurs.

These techniques are counter intuitive; they struggle against our biases in favor of the individual, in favor of the present, in favor of what currently is done. BUT these principles work! They have been used in corporations and entrepreneurial ventures, they are entering universities, governments, and charitable organizations, where they can be equally successful. Everyone can learn to be an innovator, AND

The future belongs to the innovators!

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METHODS OF TEACHING PROGRAMMING

Tachjemal Gurbanova*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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The current stage of the development of society is characterized by the integration of information technologies in all spheres of human activity, so we must not only be able to use them for their intended purpose, but also understand how they are created and possibly even create more practical, more useful and, most importantly, safe for human health.

Computer science, despite the fact that it is the youngest of all sciences, is rapidly developing and popular today. And one of the areas of this science is programming, respectively, in a developing society, the question arises about its study and teaching methods [1].

And if we talk about learning, questions arise at “What age you need to start learning?”, “Where to start?” and “Whether you need to study programming at all, if in future you do not choose a profession related to programming, and indeed to computer engineering?”.

As for the issue of teaching methods, computer science is a very young science, unlike other sciences, so there are not so many scientific works on the topic of teaching methods. But based on them, as well as on my small teaching experience, I would like to note that the methodology should be compiled based on the age, knowledge base and individual abilities of the student [2].

And if you follow the line "Algorithms and executors", which is a necessary basis for the assimilation of students, both the basics of programming and the technological components of computer science, then the programming methodology consists of:

1. Focus on practice as much as possible, but we must not forget about theory, because in order to find something, you need to know what to look for. And if the developer does not know the theory, then most often he does not even suspect the existence of the knowledge necessary to effectively solve a non-trivial problem. Programming is not only the ability to write code, but also the ability to choose the best one for given specific conditions from dozens of different algorithms for solving a problem. And the theory is needed in order to:

• Learn to see diversity algorithms to solve problem.

• Learn to evaluate the optimality of each of these algorithms under given conditions.

Excluding the theory, you get regular coders mindlessly copying parts of the code and not able to evaluate the effectiveness of the decisions made [3].

2. In order for the lessons to be visual, the practice should be compiled on the basis of real problems that programmers constantly face.

3. Students should share their solutions to the problem and discuss them. Students learn theory from different sources - this leads to the fact that the solutions to problems are different for everyone. Project defense is part of the learning process and is based on checking each other's tasks. Thus, students understand the difference between different solutions. They don’t just copy what was shown at the lecture, but they see the difference by comparing it with their own solution. This much faster leads to the realization that there is no one correct solution for the problem, but there are a lot of them, they are different and each is correct in its own way.

4. Another effective way to teach is to write code in front of students, since the teacher's question is “what, if?” and predicting the student's response will lead to the correct mastering of the material.

5. The mentor should divide the students into groups (2-5 people). Partners can not only help each other during practical exercises, but also explain the proposed solutions [4].

In conclusion, if you want to teach someone how to code, you can't just talk and let them get the feeling that they can't succeed (if they didn't start at a young age) or that any skill they have (whether when and how it was acquired) is useless. Let your students feel they can be programmers, and they may be very well.

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MICROBIAL DEGRADATION OF POLYSTYRENE BY MEALWORM ISOLATED BACTERIA

Behzad Matyakubov[1*], Dinara Ramanova[2], Lee Tae-Jin[3]

[1,2,3]*Seoul National University of Science and Technology, Department of Environmental Energy Engineering, Seoul, Korea.*

[*]Corresponding author

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The proliferation of plastic waste has become a significant environmental issue in the 21st century, and finding effective ways to biodegrade plastic has become a critical strategy to tackle this problem. While microbial degradation experiments on non-hydrolysable or vinyl plastics have a low rate of plastic degradation, hydrolysable plastics, on the other hand, have a much higher rate of plastic degradation. However, the limited bioavailability of plastics to microorganisms poses a fundamental challenge to microbial biodegradation.

A recent study investigated whether the egg, larva, pupa, and adult stage of the brown mealworm, known as honeymoon, can biodegrade plastic. The study found that the biodegradation and mineralization of polystyrene (PS) occurred in the intestine of the mealworm for 15 to 20 hours. The researchers also examined the amount of plastic decomposition in honeymoon at different levels of humidity and temperature and identified the microorganisms in the intestines of mealworms using PCR and DGGE techniques.

In the experiment, the mealworms were supplied with bran for two days before being used. The researchers analyzed the microbial community in the intestine of the mealworms using DNA extracted and 16S rDNA variable part-in-law V3 region amplification using nested PCR. They also analyzed a range of major functional groups using FTIR and nuclear magnetic resonance, with triplicate analyses performed for each sample.

Statistical analysis of the amount of consumed PS decomposition showed that mealworms consumed 12.22 grams and 15.72 grams of PS when cultured at 25°C and 30°C, respectively, under 70% and 80% humidity conditions. The study found that the higher the temperature, the lower the PS loss, and the consumption rate of PS by mealworms was relatively slow, with a range of 0.15 mg PS/d/mealworm in the experiment. The researchers found that maintaining a relative humidity of 80% was more effective in maintaining maximum consumption.

When bran and PS were supplied as sole nutrients, the growth pattern of mealworms was measured by measuring the length of the wheatgrass body. The study observed that the growth of mealworms was slower when PS was supplied, and the maximum growth was slower than the general growth cycle of 3 months.

The study identified the microbial community in the intestines of mealworms as *Acinetobacter, Citrobacter, Klebsiella, and Exiguobacterium, with Citrobacter, Enterococcus, Klebsiella, Lactococcus,* and *Serratia* being the dominant species contributing to the degradation of PS in mealworms. However, the distribution of intestinal microorganisms contributing to decomposition of PS appears to be different depending on the region or experimental environment.

The study found that mealworms degrade PS by secreting it into their secretions. The FTIR and 13C solid-state NMR spectra showed that the degradation process involved the pulverization and oxidation of the PS ring structure. The 13C NMR spectrum of the secretion

of PS-fed mealworms showed distinct new peaks, which were attributed to chitin and a phenyl derivative. These new aromatic resonance signals were generated during the depolymerization or oxidation of PS.

The study concludes that the consumption rate of PS by domestic Mealworm larvae is most active at 30°C and 80% humidity, and the growth pattern of mealworms due to PS supply lasts longer than the ecological cycle of normal nutrient supply. Additionally, the research suggests that different kinds of microbes in the human gut, including Bacillus, Citrobacter, Enterococcus, Klebsiella, Lactococcus, and Serratia, may play a role in the degradation of plastics.

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TOXIC IMPACT OF HEAVY METALS AND MICROBIAL COMMUNITY VARIETY DURING ANAEROBIC FERMENTATIVE HYDROGEN PRODUCTION

Tae-Jin Lee[1*], Behzad Matyakubov[2], Yuhoon Hwang[3]

[1,2,3]*Seoul National University of Science and Technology, Department of Environmental Energy Engineering, Seoul, Korea.*

[*]Corresponding author

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Organic industrial and municipal waste is contaminated with various heavy metals. The studied samples of compost, solid and liquid digestate contain heavy metals such as Cd (0.16 mg/kg), Co (3.98 mg/kg), Cr (17.7 mg/kg), Cu (76.2 mg/kg), Ni (14.48 mg/kg), Pb (39 mg/kg), Zn (159.2 mg/kg). Attempts to produce hydrogen gas from contaminated organic waste have revealed that some heavy metals, such as Zn in low concentrations, can stimulate hydrogen gas production. However, the toxicity of heavy metals to fermentative hydrogen production has been thoroughly investigated. This study investigated the effect of heavy metals alone or in combination on biological hydrogen production. The results can be used as reference data for a comprehensive analysis of the effects of various heavy metal types at different concentrations. The microflora for seeding was collected from a sewage treatment plant and inoculated with synthetic medium.

The variable region of the 16S rDNA gene was amplified by PCR using the extracted DNA as a template. A clip 341f GC was added to the forward primer and the second step of the PCR procedure was repeated.

A semi-4-parameter logistic model was used to determine the chemical impact on the biological process and to indicate the concentration of heavy metals needed to inhibit hydrogen production by half.

The correlation between two heavy metals can be evaluated based on the value of the additive toxicity Index (AI). If the calculated AI value is greater than 0, it is a synergistic heavy metals interaction.

The modified Gompertz equation was used to estimate the production potential, maximum production rate, and lag time of hydrogen gas in the presence of single heavy metals. The results were similar to those of another study under the same conditions. The concentration of Zn had a significant influence on the hydrogen gas yield. The yield declined as the Zn concentration was increased to over 1.0 ppm. The results showed that Zn had a positive effect on the hydrogen yield in the relevant concentration range, but higher Zn concentrations inhibited the metabolism of hydrogen production. In addition, higher Zn concentrations had a negative effect on nitrogenase activity.

The Cd concentration at 0e20 ppm showed an inhibitory effect on the accumulation of hydrogen production. At a concentration above 1.0 ppm, the hydrogen gas production decreased to 597.82 mL/L. Cd is a biological inhibitor that can block the expression of genes related to iron and copper homeostasis, and can inhibit the methanogenetic process. However, at very small concentrations, Cd has a stimulating effect on the fermentative hydrogen production in mixed culture.

At all concentrations, the addition of Cu to the experimental batches showed an inhibitory effect on hydrogen production. The highest hydrogen gas yield was 952.55 mL/L at 0.5 mg/L Cd and the lowest hydrogen gas yield was 178.58 mL/L at 20 ppm Cd.

The Pb supplementation inhibited hydrogen production in the present study. The inhibition ranged from 41% to 85% for Pb concentrations from 0.50 to 20.0 mg/L, and the hydrogen yield increased by 3.5% at a low concentration of Pb (0.5 mg/L). This study investigated the effects of two heavy metals together on fermentative hydrogen production. The concentration of each heavy metal was the same as the concentration used in the single heavy metal experiment.

The present study found that the presence of more than 5.0 mg/L of Zn cd mixture had a stimulating effect on hydrogen production during sucrose fermentation, but the presence of 0.5 or 1.0 mg/L of Zn cd mixture had an inhibition effect on hydrogen production compared with the control experiment (sucrose only).

A 4-parameter logistic model was used to estimate the IC50 for hydrogen production in the presence of heavy metals. The lowest IC50 value indicated the highest inhibitory effect, and the relationship between the average cumulative hydrogen production and the IC50 value contributed to the predictive behavior of bio-hydrogen production. The hydrogen gas yield was stimulated at low concentrations by Pb, Cu, Cd, and Zn, but decreased at higher concentrations.

The additive index was calculated to understand how the two heavy metals interacted when mixed. The Zn cd interaction showed a less inhibitory effect by being antagonistic, and the cumulative hydrogen production was higher than that with a single Zn or Cd application. In this study, the ratio of n-butyrate/acetate (HBu/HAc) was used to indicate the performance of the hydrogen fermenter. The HBu/HAc ratio ranged from 0.2 to 2.9 depending on the heavy metal concentrations.

Using the 16S rDNA gene-directed PCR-DGGE method, 213 bands were identified in 16 different positions (or 16 species). Most of the bacterial taxa were related to the phylum Bacteria. Bordetella sp., Lactococcus raffinolactis, and non-cultured bacteria are not clearly recognized as hydrogen-producing strains, but a Bordetella avium strain can generate hydrogen and polyhydroxybutyrate.

The Shannon-Weaver index (H') was used to measure the diversity of the microbial community in the batch reactor. The highest index values were detected for Cu Cd at 20.0 mg/L and Cu Pb at 5.0 mg/L.

The Pielou index was used to indicate the richness of hydrogen-producing bacteria in microbial communities. A higher Pielou index indicated a relatively higher production of hydrogen. This study demonstrated that heavy metals have an effect on the rate of fermentative hydrogen production. The amount of hydrogen produced per HBu/HAc ratio differs between single heavy metals and mixed heavy metals, and the richness of the hydrogen-producing co-culture is an important factor in hydrogen production.

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TECHNICAL INNOVATIONS IN STROKE REHABILITATION - AN INTERDISCIPLINARY APPROACH TO THE ADVANCEMENT OF BRAIN-COMPUTER INTERFACES (BCI) IN CONJUNCTION WITH FUNCTIONAL ELECTRICAL STIMULATION (FES)

Tom Schaal[1*], Tim Tischendorf[2], Julia Winterlich[3], Stefanie Liebl[4]

[1,2,4]*Faculty of Health and Healthcare Sciences, West Saxon University of Applied Sciences Zwickau, Germany.*
[3]*University of Applied Science Mittweida, Germany.*

[*]Corresponding author

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Introduction: Stroke is one of the most common causes of death in Germany and in industrialized countries. An estimated 24,300-26,000 people suffer a stroke in Germany every year. Affected people often suffer particularly from functional motor impairments of the upper extremities. Newer approaches such as BCI-FES systems aim to establish a communication channel between the brain and external devices without neuromuscular interventions. Brain electrical activity is measured, processed, translated into control signals, and an external electrical impulse is triggered painlessly.

Methods: Three main work packages were implemented across three faculties at the University of Applied Sciences Zwickau. The faculty of physical engineering/computer science was responsible for the conceptual design of the software application for a self-learning BCI. The faculty of electrical engineering developed the stimulation generator for the electronic impulses. The faculty of health and healthcare sciences was responsible for usability and health services research. In a mixed-methods design (explorative design), first eight guided expert interviews were conducted in a hospital with a supra-regional stroke unit, which served to explore necessary requirements for a BCI-FES system from the users' point of view. Subsequently, the explored requirements were tested for their generalizability in a quantitative survey. The results of the qualitative sub-study were incorporated into the hypothesis generation and questionnaire construction of the quantitative sub-study. An invitation to the quantitative online survey was sent by e-mail to 95 chief and senior physicians from the field of neuromedicine in rehabilitation facilities nationwide. Data were analyzed descriptively.

Results: Physicians were largely receptive to the new technical rehabilitation systems. They considered it not only important that the system works. They also want to understand how the system works as well as how it makes sense, and in doing so, they are willing to invest their time to try out the new features of the technical rehabilitation systems. The system should be motivating for the patient, easy to use, quick to apply, evidence-based, and provide meaningful movement. Concerns were expressed that patients in the acute phase after a stroke, on the one hand, do not understand the system's procedures and, on the other hand, have too high expectations of the system. Stroke patients in rehabilitation phase C and all patients who are able to understand the language requirements were considered the most appropriate patient group.

Discussion: BCI-FES systems have the potential to be used in the future as an adjunct to existing approaches in the rehabilitation of stroke patients. The reduction of the currently still high preparation time of the prototype in relation to therapy times as well as an improved definition of correct electrode placement will contribute significantly to make the system successively more practical. Thus, a user-friendly and -defined therapy can be ensured by BCI-FES systems.

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IMPLEMENTATION OF CDIO AT THE EAST-KAZKAHSTAN TECHNICAL UNIVERSITY

Assiya Mashekenova[1], Anatoli Vakhguelt[2*], Oxana Denissova[3]

[1,3]*Administration of Academic Affairs, D.Serikbayev East-Kazakhstan Technical University, Kazakhstan.*
[2]*School of Mechanical Engineering, D.Serikbayev East-Kazakhstan Technical University, Kazakhstan.*

[*]Corresponding author

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The international initiative CDIO (Conceive-Design-Implement-Operate) is the main principle of an innovative educational environment for training a new generation of engineers.

The development of the CDIO concept began in the late 1990s in the United States as a response to employers' dissatisfaction with the fact that university engineering education was too far removed from practice. Officially, the CDIO community came into existence in 2000 through a collaboration between the Massachusetts Institute of Technology, Chalmers University of Technology, Linköping University, and the Royal Swedish Institute of Technology [1].

In accordance with the CDIO concept, educational programs and technologies for their implementation should be aimed at training engineers who are able to provide support for complex engineering products, processes and systems in a modern environment throughout the entire life cycle and be aware of the responsibility for the economic, environmental and technological consequences of their actions. In fact, the concept of CDIO is a comprehensive integrative approach to the organization of the educational process and the formation of an appropriate university environment to train a new generation of engineering elite.

To date, CDIO has covered more than 150 universities in 30 countries.

Members of the largest international project CDIO develop and implement a progressive and modern concept for improving engineering education at the undergraduate level in the universities participating in the project. This is an international project aimed at eliminating contradictions between theory and practice in engineering education. The new approach involves strengthening the practical orientation of training, as well as the introduction of a system of problem-based and project-based learning.

The general task of a modern engineering university is to prepare graduates who are able to plan, design, produce and apply complex engineering objects, processes and value-added systems in modern conditions with a team work. We see that this educational approach really promises good results and will help us educate a new generation of engineering personnel. Not a single university of Kazakhstan is represented in the CDIO initiative, EKTU named after D. Serikbaev became the first university.

The implementation of the CDIO approach in the training of engineering personnel at EKTU is an integral part of the large-scale modernization of the educational activities of the university, aimed at creating a student-oriented educational environment, developing educational programs of a new generation, developing academic independence and responsibility of students, and improving the skills of teachers and scientific and pedagogical staff. The main goal of joining the EKTU to the "Worldwide CDIO initiative" is to improve

the quality and effectiveness of engineering educational programs, bringing them into line with the requirements of modern production.

Over the past three years, at our university it has been implemented a number of initiatives:

1. In recent years, the University has carried out serious work on the development and implementation of the Practice-Oriented Learning Model. This system is implemented on the principles of continuity and accumulation of learning outcomes at the stages of "pre-university - university - post-university" Practice-oriented training is implemented in 14 industry-specific Competence and Technology Transfer Centers (CTTC) and in the Center of Excellence in the field of metallurgy and materials science.

2. In the 2021-2022 academic year, 21 best accepted to the university students have participated in the "Leaders of Engineering Education" (LEE) project. 5 of them, second-year students, of this LEE project were approved for the scholarship program from the enterprises of Kazzinc LLP. An agreement was signed with the condition of passing industrial practice with this subsequent employment.

3. To obtain initial skills and abilities in the future profession, 21 programs for the formation of basic engineering qualifications (BIQ) were developed as part of the educational programs (EP) through the implementation of the 1st year course "Introduction to engineering education" at our CTTCs.

4. In February 2022, the EKTU team visited two universities – Tomsk Polytechnic University and Tomsk State University of Control Systems and Padioelectronics, which are members of the Worldwide CDIO Initiative. We learned their experience of the CDIO standards introduction into the educational process in order to systematize and deeper implement project-oriented education. The problems of ensuring the quality of higher education, the modernization of engineering education based on Worldwide CDIO standards were discussed. Experience of implementation of the CDIO initiative at the universities were discussed.

5. We are using our project "Managing the effectiveness of educational programs" which was implemented in 2020 to for analyzing the quality and effectiveness of EPs and assessing their impact on the innovative development of the industry and the region. E-Monitoring was developed, which allows us to monitor the dynamics of the criteria base and the integral indicator of the effectiveness of the EP in real time.

6. The implementation of the student-centered approach and the relationship between the objectives of the EP, expected results and assessment methods are prescribed in the working curricula (syllabuses). Teaching staff presents types of assessment tools that allow to check effectively the availability of planned results and assess the level of mastering the discipline.

7. Specialized accreditation of 12 EPs of the university corresponding to 12 CDIO standards was carried out in the International Accreditation Agency - ASIIN.

As part of the additional program (Minor), a pool "Project design" was developed for all EPs at 2,3,4 years of study. Profile disciplines developed jointly with the leading enterprises of the region and the country. An obligatory part of the educational process are personal and group projects of students. At the end of the academic period, students present their work at the student conferences to staff, fellow students and employers.

Employers are actively involved in the educational process as teaching staff, EP developers, and leaders of final year projects. All our students participate in industrial practice at the enterprises at the end of each year of study.

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MONITORING TOOL FOR AIR AND WATER QUALITY PARAMETERS BASED ON IOT

Vladimir Tanasiev*

Head of Smart Buildings Laboratory, University POLITEHNICA of Bucharest, Bucharest, Romania.

*Corresponding author

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Since 2015 Sustainable Development Goals report tracks the advances of 17 interlinked objectives to monitor peace and prosperity for the people and the planet, now and into the future, calling for action of the countries in a global partnership [1].

Goals 13, 14, and 15, namely "Take urgent action to combat climate change and its impacts. Conserve and sustainably use the oceans, seas and marine resources. Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss" are calling for concrete actions in preserving the Danube Delta biosphere.

The Danube Delta, which is a UNESCO World Heritage, is one of the most diverse reserves. The Delta biosphere has more than 5500 species, out of which 1839 are plants. To monitor such a difficult and large area is a real challenge [2].

To overcome this challenge, our approach is based on the advancement made in sensing solutions and digital technologies. The solution consists of an electric boat equipped with sensors which monitor air and water quality parameters. The proposed sensing solution is based on the IoT (Internet of Things) concept, a network of devices that uses internet communication to exchange data between devices. The figure below, figure 1., shows the data paths from sensors air quality and water sensors to the local cloud computing platform.

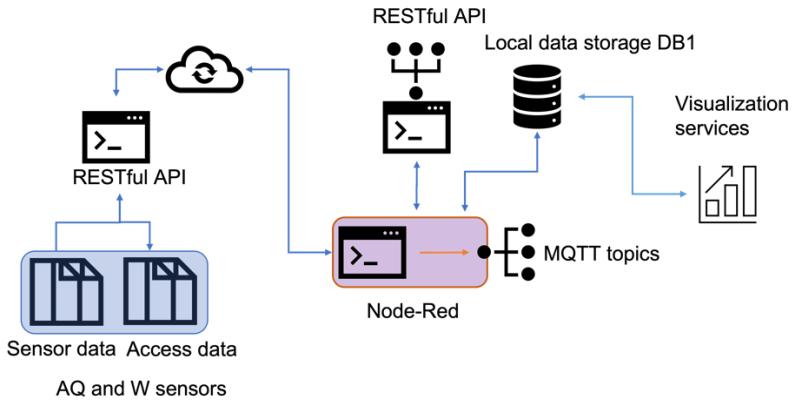

Figure 1. Water and Air quality sensor data flow diagram

The concept of data transfer is based primarily on two communication protocols, namely HTTP (RESTful API) and MQTT. The water and air quality sensors send the data based on RESTful API requests (PUT, GET, POST, and DELETE). The data is encapsulated using JSON format. The second protocol, MQTT, together with RESTful API, are used to transfer data to third-party applications, the proposed solution includes an open-source interactive analytics and visualization tool. Moreover, in order to predict the evolution of monitored parameters, the solution uses Long Sort-Term Memory (LSTM) algorithm, an artificial neural network.

In conclusion, the proposed solution for monitoring of water and air quality parameters is based on the IoT concept. The solution transfers, processes, stores and uses a web-based visualization tool. The solution was tested in real conditions, and it has proven to be reliable and efficient. As future research, the approach will include extending the network of sensors and developing the stationary system.

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DEVELOPMENT OF A MOBILE ROBOT CONTROLLED BY VIRTUAL REALITY TECHNOLOGY

Yagshygeldi Annagurdov[1], Bossan Atayeva[2], Perman Ezizgulyyevich Hojagulyyev[3*]

[1,2,3]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*

[*]Corresponding author

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Today, robotic technology is evolving and became a most important technologies that used in industries and daily life [1, 2]. Among the emerging technologies, virtual reality is becoming more and more popular. Virtual reality technology places the user in an imaginary 3-dimensional world. It can be an island, a city, a cartoon world, a virtual world that exists in reality or does not exist in real life. Virtual reality technology is used not only in the creation of games, but also in the creation of cyber-physical systems, allowing the transfer of reality into virtual reality. The main component of virtual reality is the VR goggles [3].

In this project was made Mobile VR robot that performs real-life tasks using virtual reality technology. The user can control the robot using his own virtual reality goggles by downloading special software on his mobile phone.

Main components of the mobile robot:

- Arduino Uno;
- NodeMcu esp8266;
- Mi Router 4c;
- Hikvision IP camera;
- 2 Servo motors;
- 4 DC motors;
- L298N motor driver;
- Mi powerbank 10000 mAh;
- 2 Li-ion batteries that power the motors.

Since the designed robot is mobile, all components and equipment are housed inside the robot. All data exchanges are carried out through using the 4-pronged Mi Router 4C in the robot. Electronic scheme of a VR mobile robot is illustrated in figure 1.

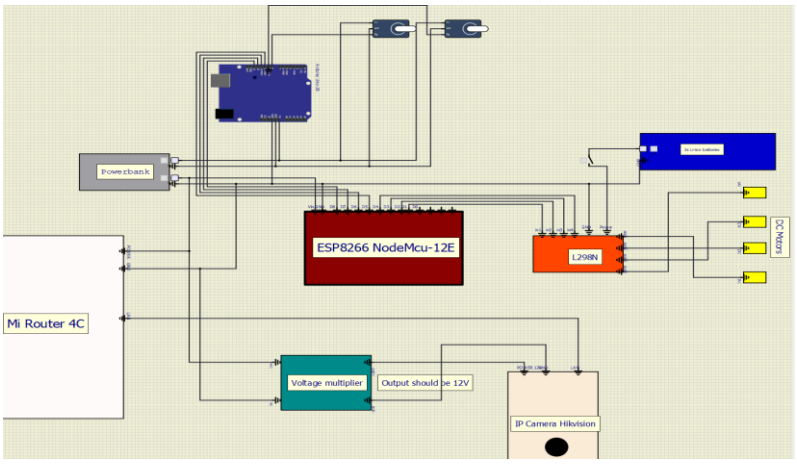

Figure 1. Electronic scheme of a VR mobile robot

As shown in figure 1, this router is connected to a Hikvision IP camera via LAN. The reason we chose this IP camera is that it is resistant to dust and rain, which increases the uptime of the robot. Since the Powerbank supplies 5 volts and the IP camera runs on 12 volts, we installed a Voltage Multiplier circuit and adjusted it to return 12 volts. For stable operation of a robot 2 Li-ion batteries are connected externally to the motors.

The camera rotates according to the head movement of the person wearing the virtual glasses. This project has many uses. This robot is easy to control from a distance. Therefore, the VR mobile robot can be used in these places, whatever work needs to be done at a distance. For example, inspecting pipes underground, in low-oxygen areas, entering and monitoring thin and narrow places, working in dangerous places [4], etc. The developed VR mobile robot is depicted in figure 2.

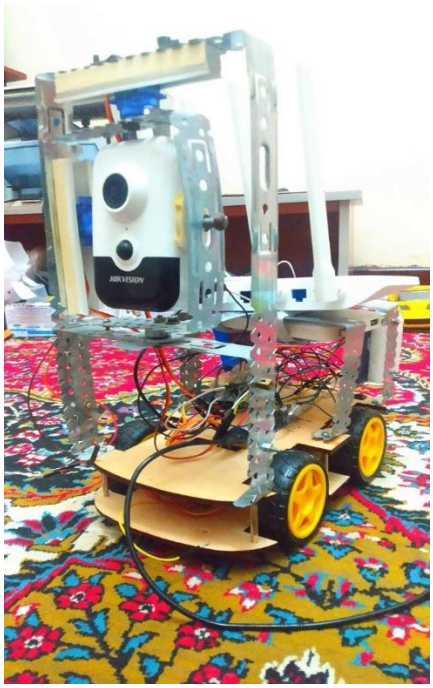

Figure 2. External view of VR mobile robot

In the future, it is planned to develop the mobile application for controlling the robot and to add the function of object recognition with the help of the camera.

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TAU PROTEIN DETECTION BY USING DEVELOPED MICROTUBULE-KINESIN SYSTEM

Yslam Kyyasovich Orazov*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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Lack of intraneuronal transport is a common hallmark of many neurodegenerative diseases including Alzheimer's disease (AD) [1, 2]. This often involves dysfunction of microtubule associated proteins such as tau, which normally protect microtubule stability and regulate molecular transport along the microtubules. Tauopathies, a large group of age-related neurodegenerative diseases including AD, is characterized by abnormal accumulation of tau protein [3-5]. A reliable and sensitive in vitro assay for rapid analysis of the components and conditions affecting intraneuronal microtubule-based transport would be crucial.

Conventional bead assay uses microtubules immobilized on a solid surface [6]. However, the issue of whether full attachment negatively affects kinesin motion was not previously investigated. In this work, an alternative bead assay design employing microtubules immobilized between two parallel walls (suspended microtubules) to prevent substrate interferences was described and the performance of the "suspended" bead assay in comparison to a conventional bead assay using microtubules immobilized on a glass surface (attached microtubules) was examined.

Experiments were conducted in flow cells to optimize the detection system. Two different immobilization configurations were compared: attached and suspended microtubule cases. Microtubules were immobilized on a poly-l-lysine (PLL) coated surface in the attached microtubule configuration. For the suspended microtubule case, microtubules were bridged in between high parallel walls. After immobilization of microtubules, kinesin-coated beads were inserted in the flow cells. By adding ATP solution, the kinesin motion was activated.

Motion of the kinesin-coated bead was investigated along both attached and suspended microtubules. The average kinesin-coated bead velocity for the attached microtubules was 37% slower ($p<0.0001$) than that for the suspended microtubules. Next, the sensitivity of the assays for the tau binding experiments was investigated. The suspended microtubules demonstrated higher significance ($p=0.014$) than the attached microtubules ($p=0.065$) and the significant difference ($p<0.05$) was achieved only along the suspended microtubules indicating higher sensitivity of the "suspended" assay.

In this work proposed "suspended microtubules" configuration with the commonly used "attached microtubules" configuration has been compared and the proposed suspended system shows higher sensitivity in the microtubule-tau attachment experiments has been demonstrated. As the kinesin-microtubule system is an essential component of the intraneuronal transport, development of the reliable and robust in vitro system permitting functional analysis of its components is of paramount importance for the development of novel diagnostic and therapeutic approaches selecting tau born neurodegenerative diseases including AD.

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DIGITAL TRANSFORMATION A ROOT IN THE MODERN ERA FOR ONLINE EDUCATIONAL WORKSHOP: A SUSTAINABLE APPROACH

Yhing Sawheny[1*], Ashutosh Mishra[2]

[1]*Deputy Director of International Affairs, Siam University, Bangkok, Thailand.*
[2]*International Affairs officer & Coordinator (President Office), Siam University, Bangkok, Thailand.*

[*]Corresponding author

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The COVID-19 pandemic led to widespread lockdowns in early 2020, causing many universities to shift to remote learning. This called for Digital revolution, with new strategic plans and values must be redesigned. In digital transformation, many public and private higher education are obstructed: How can they maximize the full potential of digital technology in education? And how can they increase admission rate of the University? This hesitancy place restraint on the transformational power of digital technology and means of private and public institution fall well behind other digital pioneers. This required professional development of faculty members and lecturers to enhance technical knowledge with sharing good practice among all. While some other parts of the world, faculty failed to optimize the use of digital technology and delayed in addressing issues such as online pedagogical shift, online exams, conducting practical labs, online internships and till today they are still exploring solutions to these areas. Online workshops and camps have been organized to sustain in this disruptive technology era to encourage both faculty members and students to join and participate actively.

The crucial goal of universities is to prepare students for successful careers and great citizens, helping to make the sustainable world for brighter future. In the meantime, Institutions should also support faculty by fostering a learning community, providing learning resources and professional development opportunities, and offering required guidance and support. Institutions should encourage academic freedom among students and encourage them to evaluate and access the class and suggest the exceptional work among faculty members. This had contributed to continuous improvement of faculty members as facilitator and create a positive impact on students' learning experience. Faculty members plays a vital role in higher education, regardless of the mode of delivery (online or in person). The value of faculty lies not just in sharing knowledge but their ability to facilitate the growth and progress of their students, as well as generate and co-create new knowledge and solutions that benefit society.

During 2021, Siam University designed the virtual (online) camp by hearing from youth their desire and goals to achieve SDGs. This virtual camp was organized for 3 days using zoom platform under student leadership program: the theme "The New Leadership for Our Sustainable Future" (Figure 1). It was well attended by 40 students; the programme was built around a framework in which students were guided to tackle a challenge related to a Sustainable Development Goal by applying the 4 C's core skills: Collaboration; Communication skill; Critical thinking; and Creativity. This was in partnership with Tokai University in Japan by bringing together students and faculty from eight Asian countries, namely, Bangladesh; P.R. China; Japan; Thailand; Nepal; India; Cambodia; Myanmar to develop the next generation of leaders in tackling sustainability.

Figure 1. Virtual (online) camp

Any Camp despite virtual or onsite it is great platform of listening to youth and learning their skills of disruptive technologies. Technologies is empowering student to make their own decisions through social media, many have become great influencers and youtubers. Higher education institution needs to catch up from theoretical and rote memorization knowledge to experiential learning and problem-solving skills with analytical skills. We have used paperless camp, workshop, conferences, and learning material all available on google platform to utilize with open access anywhere and anytime.

This camp was incredible with enhancing student learning experiences and outcomes where students had to develop self-awareness; with fostering a positive mindset with exemplary lessons from speakers about Corporate Social Responsibility as well as SDGs to be achieved by 2030. This was done by placing learning in a real-world context by creating small groups of five members each with mentors and assigning each Sustainable development goals such as SDG 11 Sustainable cities and communities; or SDG 16: Peace, Justice and Strong institutions and engage them to solve real world problems with solution with encouragement to deeper understand the complexities and possibilities of applying the knowledge that they gain from listening to top-notch speakers during the virtual camp.

The conclusion was driven that SDGs are all interconnected, interrelated and it is not possible to achieve one SDG without the help and partnership of all goals. Sustainability must be adaptable and constantly evolve to ensure always more equity. It is essential that higher education institutions should sustain to fully contribute to sustainable communities and democratic societies. Through this virtual leadership camp till today all are connected through social media and have been in good networking to build and achieve a more sustainable future.

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THE ROLE OF DRAINAGE SYSTEM PLANTS IN DRAINAGE PURIFICATION

Bahadir Yuldashov[1*], Jemshit Beghanov[2]

[1,2]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*

[*]Corresponding author

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Turkmenistan is located in the center of the Eurasian continent, far from the world ocean, in the desert and semi-desert zones of the temperate zone. The main part of its territory (80%) is occupied by the Karakum desert. As such, the majority of the country's population lives in oases, i.e. river valleys and foothills with underground streams. However, today the role of the Karakum desert in the development of various sectors of the national economy of Turkmenistan is indispensable. Its subsoil is rich in hydrocarbon raw materials, and the fuel and energy sector occupies an important place in the country's economy. The Karakum desert is rich in flora and fauna compared to other deserts in the world. This is of great importance in the development of animal husbandry in the desert. Also, the area of land suitable for cultivation in the Karakum desert exceeds 15 million hectares.

The President of Turkmenistan is making tireless efforts to turn our motherland and vast desert into a wonderland by effectively using the country's water reserves. "Altyn Asyr" Turkmen Lake, created in the Garashor Basin, located in the northwest of Turkmenistan, is a clear evidence of the ongoing reforms in Turkmenistan. As stated in the "Social and Economic Development Program of the President of Turkmenistan in 2019-2025", the construction of the "Altyn Asyr" Turkmen Lake made it possible to improve the ecological condition of the desert, as well as the melioration of irrigated lands [1] .

"Altyn Asyr" Turkmen Lake is 103 km long, 18.6 km wide, and 132 km^3 in volume. Drainage wateris brought to the lake through two large aqueducts - the main saline aqueduct and the Dashoguz aqueduct. The total length of the main saline aqueduct is 720 km, and the length of the Dashoguz aqueduct is 381 km [2]. The construction of Turkmen Lake is being carried out in 3 stages. The construction of its first phase began in 2000 and was completed in 2009.

Lake Turkmen is created on the basis of the natural Karashor depression located in the northwest of the country to collect the drainage water of Turkmenistan and partly Uzbekistan. Thus, as a result of the natural purification of drainage water and the use of modern technologies in purification, a reserve fund of water is created that can be used for the needs of the agricultural industry - development of new lands, irrigation of pastures, as well as irrigation of forest zones, technical needs.

At present, scientific research and experimental work on the water purification of the Turkmen lake "Altyn Asyr" and its drainage water reservoirs is being carried out at the "Ecological Biotechnology" scientific production center of the Oguz Han Engineering and Technology University of Turkmenistan. Mainly, it is used to treat drainage water and polluted water it is intended to use biological methods of cleaning. These include absorbing organic matter from water, removing solid particles, pesticides, etc. Of greater interest is the use of aquatic plants capable of retaining water. Thus, the possibilities of using natural bioplato in drainage wateraquifers for drainage water treatment in the conditions of Turkmenistan were studied.

A drain passing through the north of Ashgabat was chosen for the experiment. Reed (Phragmites communis) dominates the wetland. Small amounts of cattail (Typha L.), silver

plume (Erianthus) and other macrophytes are found. The density of plants is on average 50 plants per 1 m^2. The flow rate in the river is about 0.01 m/h. In order to investigate how well the natural bioplato in the drain cleans the drainage water, water samples were taken at 2 points of the drain at the same time, the distance between the 2 points is 100 meters. Thus, the possibility of purification was evaluated when the drainage water was passed through a bioplato with a length of 100 meters.

As a result, it can be seen that after passing through the bioplato containing the mentioned plants, the amount of chlorine ions decreases in the drainage water is almost 2 times, the amount of bicarbonate ions decreases to 25 mg/l, and the pH level decreases. The amount of calcium and magnesium ions in the water remained unchanged (Table 1).

Table 1. Drainage water test results

Tested indicators of the content of drainage water	Water content from point 1, mg/l	Water content from point 2, mg/l
HCO_3^-	518.5	494.1
Cl^-	1198.99	725.71
Ca^{2+}	180.36	180.36
Mg^{2+}	103.3	103.3
pH	8.5	8.1
Hardness	17.5	17.5

In recent years, large-scale works have been carried out in Turkmenistan to transform vacant lands into forests and create forest zones [3, 4]. In the afforestation of the Karakum desert, the place of the lake's drainage water reservoirs is important [5].

The results of the conducted research show that by purifying the water of drainage waterreservoirs in the Karakum desert through natural bioplato, they can be reused in some sectors of agriculture. In particular, it allows the cultivation of forage plants and the development of agriculture. Also, purified water is of great importance in creating forest zones in Karakum.

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TECHNOLOGY OF PRODUCING TECHNICAL SALT (NaCl) FROM WASTE OF GARLYK POTASSIUM MINING AND PROCESSING PLANT

Bahadir Saburovich Yuldashov[1*], Sover Serdarov[2]

[1,2]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*

[*]Corresponding author

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Establishing waste-free industries in Turkmenistan, as well as waste processing, is considered one of the main areas in ensuring environmental safety [1]. According to the "State Program for Integrated Development of Chemical Science and Technology in Turkmenistan for 2021 - 2025", the products of chemical science and new chemical technologies in the country are ecologically clean, energy-saving, substitute goods imported from abroad and competitive in the world market. it is planned to carry out continuous work on the development of innovative production technologies [2].

Potassium chloride is one of the main products of the Garlyk potassium mining and processing plant, which is one of the main enterprises of the chemical industry in the country. For the production of chlorinated lime, sylvinite ore serves as a raw material, which is mined by the mining method. The annual capacity of the underground complex of the enterprise is 7.8 million tons of sylvinite ore. The main mineral composition of the ore is sylvinite, halite, water-insoluble and slightly soluble minerals [3]. The mined raw materials are processed and enriched in the beneficiation unit. After passing the technological systems, ready potassium fertilizers are accumulated in the storage of the complex.

Table 1. Annual production capacity of Garlyk potassium mining and processing plant

№	Name of manufacturing facility	The name of the product	Volume of the produced product (thousand tons/year)
1.	Base set	Sylvinite	7800
2.	Sylvinite Mining Factory	Granular potassium chloride	600
		Particulate potassium chloride	800

A large amount of waste remains during the production process in the Garlyk potassium mining and processing plant [4]. The remaining waste is stored above ground near the plant in a specially designed salt collection facility (figure 1).

The amount of waste here is increasing year by year. As a result, in the future, ecological problems such as air, soil, surface and underground water pollution, reduction of biological diversity, disturbance of the balance of ecological systems will appear in the region [5].

Therefore, scientific research and experimental works are being conducted at the Oguz Han Engineering and Technologies University of Turkmenistan on the processing of halite waste and obtaining new products from it. Halite waste processing is very important not only in Turkmenistan, but also in the region to ensure ecological security.

On the basis of the experiments, the technology of extracting sodium chloride (technical salt) from halite waste was developed. The technology is low step, where no additional

reagents are used. For the production process, waste from Garlyk potassium mining and processing plant, distilled water and muffle furnace are used. As we mentioned above, the residue of the Garlyk potassium mining and processing plant is the residue from the potash fertilizer production of that complex. It contains a large amount of sodium chloride.

Figure 1. Industrial waste from the Garlyk potassium mining and processing plant

Wastes from the Garlyk potassium mining and processing plant is weighed on an analytical balance and dissolved in distilled water in a magnetic stirrer at a temperature of 100^{o} C for 30 minutes. The solution is then filtered 4 times. The filtered melt was heated in a muffle furnace at 150°C for 2 hours. After heating in muffle furnace, water is evaporated to obtain 84.5% technical salt. The amount of technical salt obtained exceeds 80% of the residual waste (figure 2).

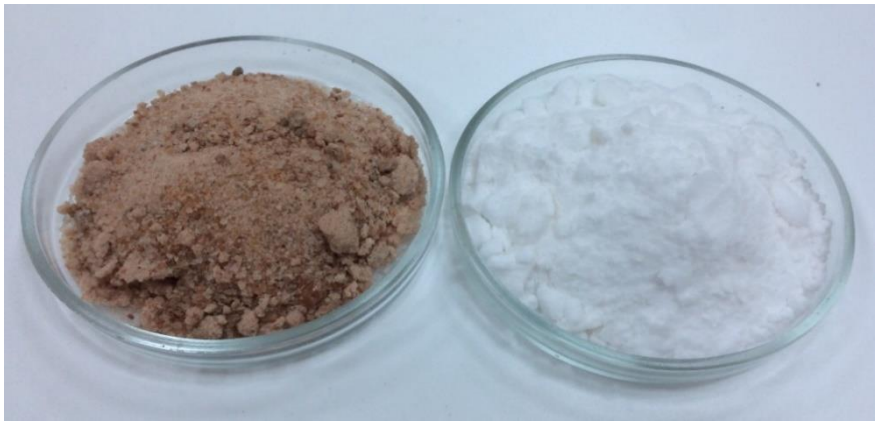

Figure 2. The industrial waste of the Garlyk potassium mining and processing plant

The obtained technical salt can be used in various sectors of the economy: in paint production, baking soda production, chlorine-alkali production, paper production, melting of snow on roads in winter, and in agriculture.

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TECHNOLOGY FOR PREPARING LIQUID ORGANIC FERTILIZER FROM LICORICE ROOT WASTE

Bahadir Yuldashov[1*], Yazpolat Keriev[2], Sover Serdarov[3], Sona Avisheva[4]

[1,3,4]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*
[2]*Director of the Central Council of the Magtymguly Youth Organization of Turkmenistan.*

[*]Corresponding author

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The President of Turkmenistan is tirelessly concerned about ensuring the environmental well-being of the Motherland. Large-scale work in this field gives its positive results [1]. Ecological problems, protection of the environment from adverse technical effects has become one of the most important problems in the world today. It is impossible to imagine the development of any society without waste. Therefore, in recent years, several ecological problems related to waste have emerged [2] .

As in all countries of the world, in Turkmenistan, various types of waste are thrown into the environment in various sectors of the economy. One of such enterprises is "Buyan" agro-industrial complex of Turkmenabad. A dry and dark liquid extract is obtained by re-cultivating the root in the complex. An average dry weight of 7,000 tons of root is collected annually in the group. On average, about 3 thousand tons of cut and crushed betel root are prepared, and 1 thousand 300 tons of thick and dry extract of the root are obtained from it [3]. Organic waste from the production process is stored on land. As a result of the processing of the generated organic waste, it will be possible to obtain valuable liquid organic fertilizer (biocompost), which is necessary for agricultural crops. The importance of processing the mentioned industrial waste in improving the ecological condition of Turkmenabat city is very great [4] (figure 1).

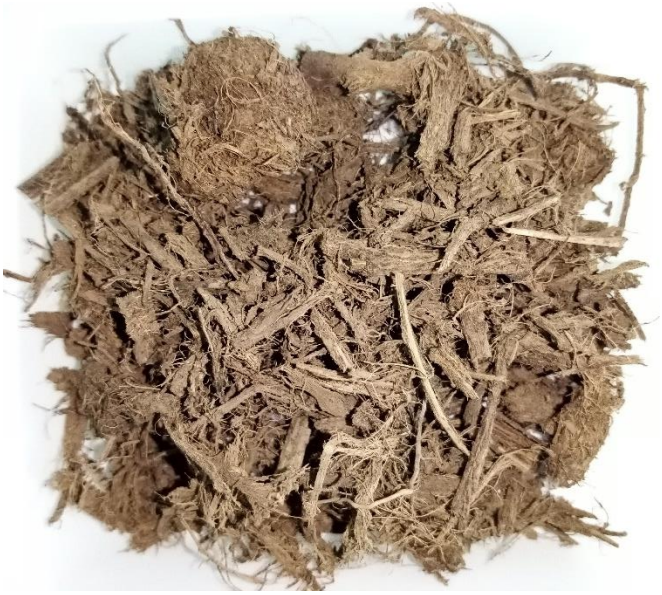

Figure 1. Wastes of "Buyan" agro-industrial complex of Turkmenabad

One of the activities carried out in the laboratory of the "Ecological Biotechnology" Scientific Production Center of the Oguz Han Engineering and Technology University of

Turkmenistan on the processing of various types of economic and industrial waste and the production of new products from them is the technology of preparing liquid organic fertilizer (biocompost) from the waste of the root [5].

Preparation of liquid organic fertilizer (biocompost) from the waste of the production waste and using it to increase the productivity of agricultural fields and the growth of crops is of great importance in solving one of the important problems of today [6, 7].

The world-wide technologies for the preparation of liquid organic fertilizers were studied, and as a raw material in Turkmenistan, the waste of the local industrial waste was used. If the transition stage of the production process is small, the technological process of the obtained product is economically favorable.

On the basis of the experiments, the composition of the preparation of bio-compost from the waste of the root was developed. To prepare liquid biocompost, 500 ml of 1% sodium hydroxide (NaOH) solution (1:10 ratio) was added to 50 g of sludge, heated at 150 °C for 3 hours, and 200 ml (used sodium hydroxide) was added to the resulting solution. (40% of a 1% solution of NaOH) is added to distilled water. Then the solution is heated at a temperature of 200 °C until the density of the solution reaches 1.12 g/l. As a result, liquid organic fertilizer (biocompost) is formed (figure 2).

Figure 2. Liquid organic fertilizer from root wastes

Liquid organic fertilizer contains 8-10% humic substances. The proposed technology is economically viable. Liquid organic manure (biocompost) can be widely used to increase the productivity of agricultural fields and the growth of crops.

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HETEROGENEITY AND STRENGTH OF POLYMER MATERIALS UNDER THE INFLUENCE OF ZEOLITE PARTICLES

Olmaxon Pulatovna Gadoeva[1], Zarina Nayimovna Fayzullaeva[2*]

[1,2]*Bukhara Institute of Engineering and Technology. Bukhara, Uzbekistan.*

[*]Corresponding author

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The paper investigates the strength properties of polyolefins (LDPE and HDPE) filled with highly dispersed zeolite particles. It is established that an increase in the filler content leads to an increase in the tensile stress at rupture. Heterogeneity manifests itself in the destruction of all standard injection molding samples without exception during stretching in the part of the working area that is as far away from the gate as possible. The reasons for the rupture, the decrease in strength and the unequal strength along the length of the injection samples during stretching are explained.

The results obtained show (Figure 1) that the farther away from the gate, the lower the strength of the sample. A similar pattern was established when studying the deformation properties of dispersed-filled polymer composite materials. It has been experimentally established that, regardless of the nature of the polymer and the highly dispersed filler, the destructive tensile stresses of the samples near the gate are significantly higher than at the point as far away from it as possible.

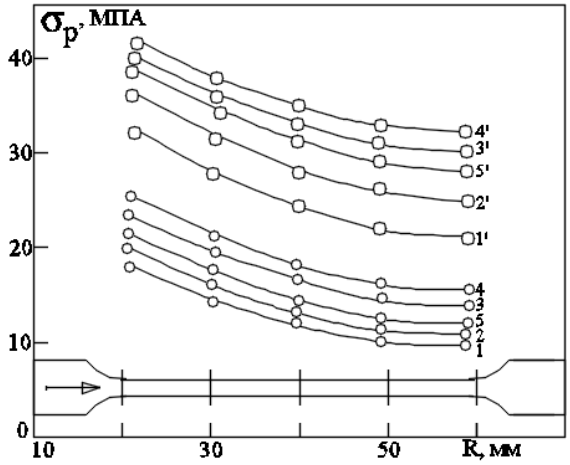

Figure 1. The dependence of the destructive tensile stress of filled injection molding samples of LDPE (1-5) and HDPE (1′-5′) on the distance to the gate. Zeolite content in polymer (wt.%): 1,1′ – 0, 2,2′-5, 3,3′-20, 4,4′-35, 5,5′-50%. The arrow shows the direction of casting

Significant structural macro-heterogeneity of injection molded products from components can be detected not only by standard mechanical tests, but also by the method of swelling of micro samples in physically active liquid media [1].

It has been established that almost all standard injection molding samples tested for strength under uniaxial tension are destroyed in the part of the working area that is as far away from the gate channel as possible [2, 3]. The observed phenomenon is explained by the fact that the maximum degree of orientation is achieved in the injection zone of the material into the mold, and at the opposite wall of the mold it is minimal [4]. In addition, the orientation of

macromolecules, which occurs, as a rule, during injection molding, is mainly across the direction of movement of the polymer melt flow [5]. The longitudinal orientation of macromolecules occurs only when the melt flows in very narrow channels with a cross section of less than 1 mm^2. Only in the first section of the product, located directly after the gate channel, macromolecules are located along the flow axis and this leads to an increase in the strength of the composition. In addition, crystal lamellae are regularly arranged in injection molding products mainly perpendicular to the direction of casting [6]. Intensive shear effects on the polymer melt activate transformations leading to changes in its molecular mass characteristics [7]. The resulting change in these indicators is determined by the ratio of the reaction of breaks of macromolecules and the addition of macroradicals during the molding of the product. A consequence of the specific conditions of injection molding is the difference in the levels of change in the molecular weight characteristics of the polymer in the volume of the mold cavity. The heterogeneity of these polymer characteristics in the section of the product perpendicular to the direction of melt injection is considered in [4, 5, 7-10]. According to IR spectroscopy and gel chromatography, it was found that the low-molecular fraction of the polymer is located near the surface of the injection sample. For unfilled HDPE [7], as well as components [11], it was found that the presence of the material in the plasticization node, its passage through the gate system leads to the dominance of the destruction process. At the same time, at distances of 20 and 60 mm from the gate channel, the value of M_ω is $201 \bullet 103$ and $140 \bullet 103$, respectively.

Thus, it is established that with the help of highly dispersed zeolite as a modifying additive, it is possible to regulate the technological and physico-mechanical characteristics of structural polymer materials. The packing density of macromolecules, structural defects, the degree of crystallinity and strength characteristics of injection molded products made of polymer composite materials are closely related to the heterogeneity of the molecular mass characteristics of the polymer matrix and the uneven distribution of filler particles in the morphological zones of the product and can be explained by the difference in the conditions of forming the material in the cross section of the mold.

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INFINITE ARTISTIC SPIRITUAL VALUE

Amanmyrat Baymyradov[1], Seyyara Saparova[2*]

[1]*Turkmen National Institute of World Languages named after Dovletmamed Azadi, Ashgabat, Turkmenistan.*
[2]*Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.*

[*]Corresponding author

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In the history of Turkmen literature, Magtymguly created a unique national way of seeing and feeling the world, man, and expressing his problems artistically in opening the way to the soul of humanity, creating a river of emotions from the artistic word. The development of patriotism, heroism, bravery, high morals, philanthropy in Dana Magtymguly's creations to the level of fine word art went down in history as a national artistic revival of Turkmen literature. According to this fact, Wise Magtymguly's poetic world, which is rooted in the history, today and tomorrow, spiritual development of the people is complex and has a thousand colors.

The literary treasure of the great master of words, his way of view point of the world is wide, original, at the same time delicate and elegant, fresh and beautiful. The poet's poetic identity is also the same: his era, time scale is unlimited, and his field of action is wide. As far as human imagination and dreams can reach, the thinking of the poet reaches there and reveals to us its mysterious artistic reality. There, he forms his complex thought and moral world, driven to deep wisdom. In Magtymguly's creativity, the field of such formation includes the events of the throne, the throne, the earth, the events of fantasy (mythical), legend, fairy tales, and philosophies about them. This kind of literary breadth, the elegance of the art of words, various behaviors, artistic means, traditions, meaning, which are used to admonish the people, morals, actions, wisdom form the artistic and spiritual world of Magtymguly. In order to create such a world, the poet focuses on the unified meaning of each work, the unified thought that it promotes. As a result, its depth, breadth and depth are revealed in the aforementioned artistic field. It is impossible to limit that area, to control it, to bring it to a policy of its own accord. Accordingly, Magtymguly's multi-colored imagination, poetic world, in most cases, depends not only on his personal life, but also on his artistic spiritual world. The poetic personality in Magtymguly's works was also formed in such a context, his poetic thought and appeal often appeared in the artistic and spiritual world of the master of words.

The Turkmen people paid special attention to the individuals who completed the advantageous jobs in the country and created delightful stories about them. Folktales have been passed down from language to language and have become an indelible asset in the history of folklore and literature. As our father Magtymguly said: "If a sign from person is left in the world, his name will be immortalized, and that is the foundation". The poet recited these lines with care. A great symbol of his pride remained, an indelible name remained.

Folk works about Magtymguly are artistic products of views of the great son of the Turkmen people, it is a set of complete works of art, perfected on the basis of a harmonious combination of historicity and artistry, nationalism and commonality, moral philosophy and life conflict. The root of its perfection rested on the forces that made the development of life, public morals, science, culture and speech art of the Turkmen people. The persistence of that power, the deep establishment of a new direction in the history of the people and the world of artistic society is directly connected with the name of Magtymguly and the service of his graduates. Accordingly, we call the character of Magtymguly artistic people's a hero who has

changed from simplicity to a complex character. The public interest also demanded it. The way people understood Magtymguly, if they heard his heart sounds, the people also understood their eldest son in the same way: they looked at him as a pure example of humanity, humanity, morals and conscience. Over the years, this attitude has grown, settled in hearts, and turned into holiness. This led to the creation of an artistic character that grew out of public interest over time. The stories of Magtymguly's life, works, and period of his life have enriched the people to the point where the name of the city has become famous.

The depiction of Magtymguly is a hero, whose artistic image in stories has unique characters and characteristics in Turkmen folklore and fiction. Its place in poetry and narrative, its characteristics and generalities are as follows.

The character of Magtymguly's artistic depiction traces its origin from certainty, the reality of life. Art, imagination, and generality based on metaphors are based on concreteness and draw from the wellspring of concreteness and truth. The artistic character of the poet's depiction also moves in concrete or real life events. In his character, actions, moral and life views, noble qualities characteristic of Magtymguly: patriotism, bravery, humanitarianism, whose values are artistically reflected.

The people created vivid artistic characters of the great poet Magtymguly Pyragy and his well-intentioned comrades of that time. Magtymguly's artistic character in the stories fully meets the rules of creating an artistic character of folk art. Accordingly, all the signs, including the artistic image, were reflected in the event of a specific character.

Magtymguly, like a sentimental poetic hero in the stories, is adorned with good ideas and attitudes, a hero who is able to distinguish between kindness and cruelty, wisdom and ignorance, and similar contradictions and stand on the side of good things.

The poetic personality of the great master of words that befriends and fraternizes the people, the artistic image of the people in the stories is an inflexible artistic spiritual value that cleans, enriches and educates the spiritual world of the people during the Revival of the new age of stable state.

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SPORTS VOCABULARY OF THE TURKMEN LANGUAGE LEXICO-THEMATIC GROUPS

Ahmet Begchiev*

Oguz Han Engineering and Technology University of Turkmenistan, Ashgabat, Turkmenistan.

*Corresponding author

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At the inauguration ceremony of the President of Turkmenistan on March 19, 2022, the Honorable President Serdar Gurbangulyevich Berdimuhamedov said: "The main place belongs to the development of mass sports and youth policy in our independent country" [1]. Today, sports, which have become an integral part of people's healthy life, are the focus of attention of scientists working in various fields, and at the same time, the language of sports is of great interest to linguists. While studying the words that make up the sports lexicon of the Turkmen language in every way, it is important to analyze their semantic relationship with each other.

The lexical system of any language forms a complex structure, in which lexical units have different meaning relations. Therefore, one of the main tasks of lexicology is to systematize those lexical units by dividing them into thematic groups. It is considered the most convenient way to study (declare) large-scale and diverse lexical material by thematic groups [2].

The sports lexicon of the Turkmen language is divided into seven lexical-thematic groups. They are: names of sports, names of participants in sports competitions and games, names of sports equipment, training tools, names of sports clothing and protective equipment, names of sports facilities and fields, names of acts and actions, names of sports levels, symbols, awards.

One of the largest lexical-thematic groups of our analyzed lexicon is the names of sports. More than a hundred words belonging to this group have been registered. We have divided the names of sports into the following thematic groups according to their characteristics, condition, goal to be achieved, similarity of rules, venue, sports equipment used, active mobility, logic of passive thinking (summarization, correct and quick calculation of opportunities): 1) equestrian sports; 2) athletics; 3) technical sports; 4) gymnastics; 5) head-to-head martial arts; 6) racket sports; 7) team sports games; 8) water sports; 9) skiing and snowboarding sports; 10) bicycle sports; 11) sports related to hitting, throwing; 12) multi-type competitions; 13) logical thinking (concentrating, calculating possibilities correctly and quickly).

The words belonging to the lexical-thematic group named names of participants in sports competitions and games consist of common and special names. Special names differ according to the position of athletes on the field of play, their affiliation to a certain sports competition, their role in the competition, the sports vehicle they drive or the sports equipment they use. Words belonging to this lexical-thematic group are more numerous than the ones mentioned above. Words belonging to the lexical-thematic group named names of sports equipment and training tools are distinguished by their diversity. The sports lexicon of the Turkmen language includes words related to lexical-thematic groups such as the names of sports clothes and defense equipment, the names of sports facilities and fields, the names of actions and actions, the names of sports levels, symbols and awards, but they are significant in terms of meaning.

As can be seen from the analysis, it is possible to divide the units related to the sports lexicon of the Turkmen language into lexical-thematic groups according to their meaning. Dividing these lexical units into thematic groups helps to visualize the structure of the language of sports and to reliably understand their meaning.

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