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Ukrainian and Foreign Science: Yesterday, Today, Tomorrow

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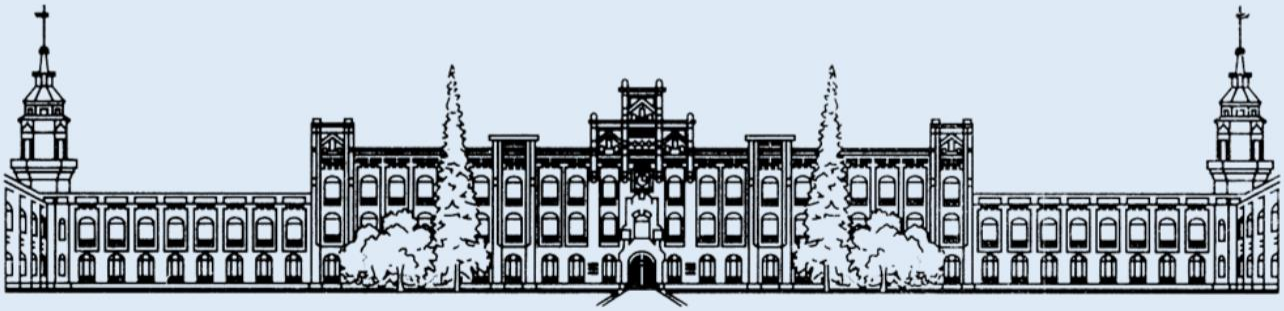

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Responsibility for the accuracy of facts, proper names, quotations, place names, and other information is born by the authors of the publication.

RESEARCH OF METALLURGICAL INDUSTRY OF UKRAINE AND ITS CAPACITY IN THE WORLD MARKET

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Today, as well as 30 years ago, the mining and metallurgical complex is the most important part of Ukraine's economy. However, the industry has undergone numerous transformations, because of which it has become stronger, more technological and more efficient. Together with metallurgists, miners and coke chemists, the cities where these enterprises operate are developing.

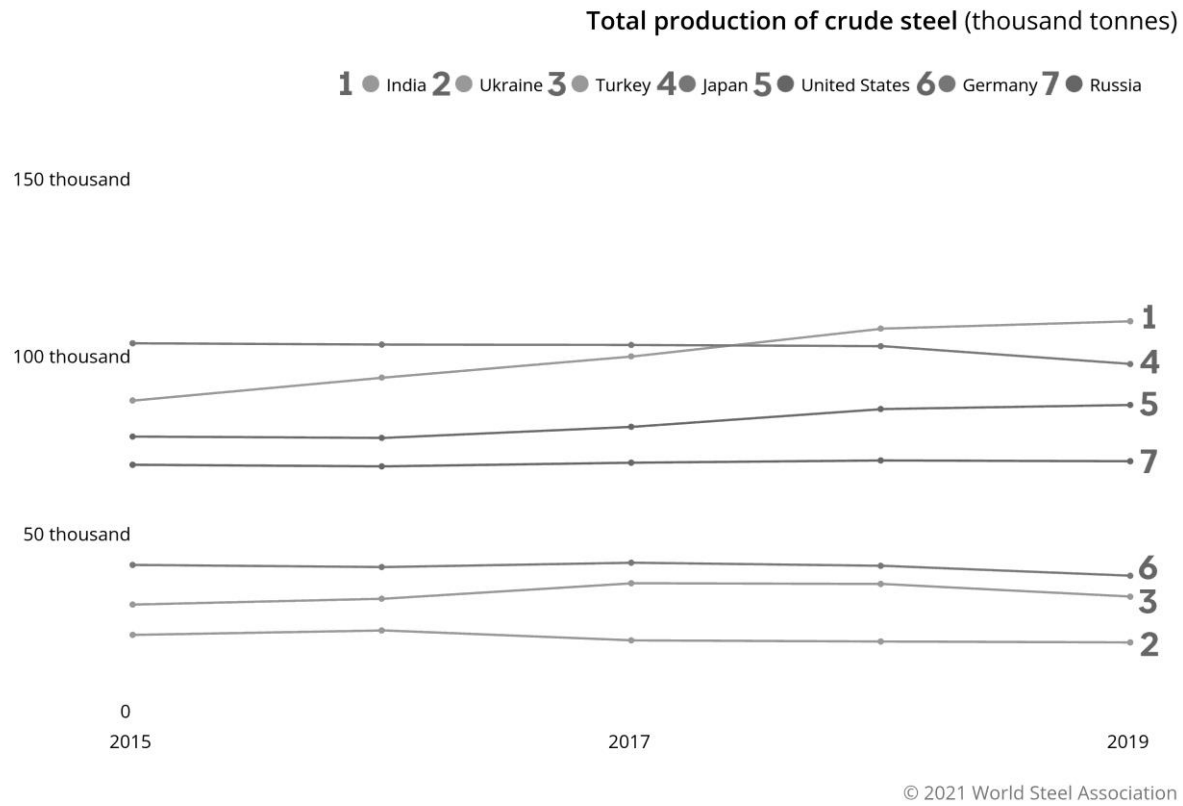
In the past, they were city-forming in all respects, and today they have become reliable partners of local communities, helping them to develop all spheres of life. The mining and metallurgical complex of Ukraine (MMC) is a strategic national resource and complex scientific, technical and organizational system represented by numerous sub-industries, starting with the mining industry and ending with enterprises producing metal products. Today MMC of Ukraine exists an integral part of world metallurgy and is closely associated with the trends of its development.

Thus, the production of "raw" steel in 2015. Ukraine ranked 10th among crude steel producers. The situation has changed since 2017, rising by 10 points Italy, 11th - Taiwan, and Ukraine took 12th place (Fig. 1). (Wikipedia, 2021)

Position (2017)	Country/Region	2017[1][9]	2016[1][10]	2015[11]
—	World	1691.2	1606.3	1620.4
1	People's Republic of China	831.7	786.9	803.8
-	*European Union*[a]	168.7	162.3	166.2
2	Japan	104.7	104.8	105.2
3	India	101.4	95.5	89.6
4	United States	81.6	78.5	78.9
5	Russia	71.3	70.5	71.1
6	South Korea	71.1	68.6	69.7
7	Germany	43.6	42.1	42.7
8	Turkey	37.5	33.2	31.5
9	Brazil	34.4	30.2	33.3
10	Italy	24.0	23.3	22.0
11	Taiwan	23.2	21.8	21.4
12	Ukraine	22.7	24.2	22.9

Figure 1. List of countries by steel production

Brazil, Turkey, Germany, South Korea, Russia, USA, India, Japan and China were the main competitors of domestic producers of "raw" steel at the beginning of 2015, but now Italy has joined them. According to the World Steel Association, we will consider the dynamics of production of such types of metallurgical products as "raw" in 2015-2019; determine the place of domestic metallurgy and the main trends in the metallurgical market. (World Steel Association, 2021)



Thus, analyzing the previous years, we can see a significant decline in steel production in Ukraine. This decline began after 2011 (in that year the country produced the most tons of steel in the last decade). This can be said not only about the production of "raw" steel, but in general about the entire base of steel in Ukraine.

To some extent, hostilities in Donetsk and Luhansk oblasts since 2014 have been the reason for the steady decline in steel production in Ukraine. Suspension of activity or reduction of business activity of metallurgical enterprises in the territory temporarily uncontrolled by Ukraine with subsequent loss of control over them and inability to include the results of their work in official Ukrainian statistics led to negative dynamics of steel production in the country during 2014-2018.

However, the reduction of steel smelting was not the biggest problem, as it coincides to some extent with global trends in the metallurgical industry, where stagnation has been observed in recent years. The situation was and still is much worse with the volumes and dynamics of consumption of finished metal products in the domestic market, which lag far behind production, leading to an excessive level of overproduction of metal in the country.

Based on the conducted researches it is possible to allocate four stages for perspective development of metallurgical branch in Ukraine:

1) priority development of the domestic market for metal products, which will ensure more stable sales of manufactured products and reduce dependence on fluctuations in world conditions;

2) intensification of the introduction and implementation of innovative developments to create fundamentally new technical and technological metallurgical solutions, which will provide domestic demand for their own scientific, technical and innovative developments, reduce production costs by reducing resource and energy

consumption at all stages of production, increase environmental friendliness process, improvement of the range of metal products produced;

3) training of new generation specialists, who will have a higher level of digital culture, will be able to deeply combine and comprehensively apply modern digital technologies in real production and will be ready for lifelong learning;

4) public-private partnership, which will help determine the strategic framework goals and objectives of the industry, improve the institutional conditions of interaction between science and investors, solve the problem of volume and priority areas of funding and state support for scientific, technological and socio-economic changes in metallurgy of the future.

Therefore, summing up, we can say that ferroalloy production is an important component of both the metallurgical complex and the entire economy of Ukraine, which provides a significant share of tax and currency state revenues. To address the basic problems of domestic producers of ferroalloys it is necessary to develop government programs that should include the development of innovation infrastructure and scientific and technical support production, economically reasonable prices for energy, commercialization of scientific developments, establishing effective cooperation between the state, business and science, greater attraction of private investment.

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HOW DO TECHNOLOGIES, DATA SCIENCE AND ANALYTICS EVOLVE FOOTBALL?

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Large companies and tech start-ups are no longer the only ones needing widespread use of data science and analytics. In fact, technologies and data processing are now an essential part of the winning formula that's revolutionizing football teams and the way they play.

Ordinary fans, as well as referees and coaches, no longer need to stare at the monitor screen to understand how the goal was scored, who took the right position, and whose mistake led to the loss of the ball in this situation. Today any game-changing moment of the game can be reviewed from absolutely any angle thanks to technologies, such as True View and Hawk-Eye.

The replay system uses dozens of high-definition cameras installed all around stadiums worldwide, along with advanced algorithms, to enable views of gameplay action from every angle and even from a player's perspective. Each of the cameras in the stadium is connected to high-performance servers capable of processing up to 1 terabyte of data per 15- to 30-second clip. And this pure magic is managed by AI, which in several minutes after the episode happened delivers those stunning views via broadcast, digital, and mobile.

However, watching video replays brings not only an aesthetic pleasure to the audience but also practical benefits during the game. The video assistant referee (VAR) reviews video footage and checks signals from a chip implanted in the ball to either corroborate or refute the verdict of the head referee. VAR does not provide 100 percent accuracy, but impacts decision-making positively and helps to judge better and fairer. That's why Maradona's famous "the hand of God" goal wouldn't have been awarded if the match was played today.

While preparing for the match, football teams rely on data from plenty of variable sources to improve the game. First of all, Internet of Things sensors and GPS trackers monitor players' and ball movements in real-time. Innovative wearable devices record movement, effort, and fatigue levels during training sessions. Among the advantages of these appliances, specialists determine lightness, high accuracy of measurements, relatively low price and ease of use. All the gathered data goes directly to the coaching staff. In addition, optical tracking technology, which determines the position of players on the pitch in relation to the ball, opponents and teammates, up to 25 times per second, is also often used. Personalized video measurements provide data synchronized in time from body sensors combined with position sensors in the venue or at the training facility (Marinho, 2018, p. 49).

Many professional top clubs have their own cloud-based data warehouse which aggregates and structures data received from those devices. Last, but not least, big data analytics and artificial intelligence jointly process and analyze data from different sources.

Nevertheless, human is still the one to decide whether something happens on the pitch or beyond it or not. Sports data analysts scrutinize and interpret the information collected and processed by the means mentioned earlier, depending on the task at hand - whether it is to predict the club's profits based on the team's current results or to choose the game plan for the next match according to the opponent's style of play and the availability of healthy players for each position in the team. It is also their task to make clear charts, diagrams and tables, in order to explain the results relatively easily to the players, the coaching staff, as well as the owners of the club.

Data analysts are taking football to another level. Gathering and processing data has raised the performance, helped players be more consistent, and provided fans with an opportunity to enjoy sports in new ways. This has also helped teams in raising financial resources. As stated in a study by the Massachusetts Institute of Technology, "companies in the top third of their industry in the use of data-driven decision making were, on average, 5% more productive and 6% more profitable than their competitors" (Kovacic, 2019). Equipped with data, the teams are now better placed to negotiate and get a deserving price on brand endorsements, partnerships and revenues.

Advanced statistics, provided by data experts, help coaches to prepare matches easily. Only 10 years ago coaches used to have their own databases with players' statistics, written and gathered by themselves. That took an enormous amount of time and still wasn't accurate enough to be useful in each situation. Today, even non-professionals can buy a subscription to a special service like Opta, whose analysts and robust AI systems have already done this hard work. Moreover, it gives scouts powerful tools to identify the most promising profiles and enables player agents to better understand their players' strengths and weaknesses.

Summarizing, automatization, advanced examples of artificial intelligence and machine learning models, well-managed by professionals, have already changed the world of football. They have improved the capabilities of exploring and, as a result, upgraded the performance of many teams all over the world. In order to leverage the potential of data analytics in sports, brand new technologies of data assembling, processing and transfer will be applied. Hence, the future of data science in the sports industry, particularly football, is dazzling.

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INTERNET FRAUD AND WAYS TO AVOID IT

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The Internet is a network that connects computers all over the world and allows communication, file exchange, trade and much more. Internet only appeared in 1969, but now, only 52 years later, we cannot imagine our lives without it. You can communicate, study and do shopping without leaving home. It opens up a great world of possibilities, but has some drawbacks. We'll highlight a few varieties of online scams(Sabadash, 2013):

- with overpayment
- with prizes
- contingency
- online shopping
- online dating
- receipt

The scam with overpayment

This may include situations where you were asked to pay some money in advance for some kind of service or product, offering employment, but first need to send the money for the very same employment (job search service). This can also include fraudulent activities with the lease of property: You lease something, but such property does not exist(Ochimovska, 2013).

Fooling around with prizes

Won a car, a trip to Hawaii or a case of cosmetics? Do not hurry to press on these windows. Free cheese is only in a mousetrap. Very soon you will be asked to send money to some account to take part in the raffle, or a hacker can get access to your computer simply by sending a message. You will not even know about it.

Cranking on an emergency

This type of scams was popular in 2017-2019. You probably received a text message with the standard text “Mom, send money to this phone number, I am in trouble”. Here is the same scheme: you are asked to send personal data, because the bank blocked your card, but the bank has nothing to do here or something on the staff of messages "Hello, I am your childhood friend, help, send to the card some money" (Korshikova, 2021).

Online shopping

Often intertwined with the schemes of scams with prepayment, but you may also be asked to send money for the goods, the discount on which looks very significant, but sometimes, after you send the money you do not see neither the goods, nor the opportunity to contact the seller.

Fraud in online dating

There are more and more stories of couples who met online. Online dating industry is more developed than you can imagine. Trading personal photos, personal information, even web-prostitution and a lot of other things you can get on the

expanses of this segment of the Internet. Here you should be especially careful. Most often, and most banal – you spend some time talking to a person, and you are asked to drop some money for something he/she really needs (Ochimovska, 2013).

Fraud with receipts

Be particularly careful when you receive receipts: they can be corrupted, and you are asked to either return the money, if you missed the receipt, or the receipt for more than the agreement, and you are asked to return the difference between the indicated and the agreed sum. Here you have to check several times – these receipts may be spoiled, do not hurry, and call a person who can assure you that everything is correct (for example, a bank where you serve, or a financial expert acquaintance)(Korshikova, 2021).

Recommendations on how not to become a victim of online scams(Tyulyukina, 2018).

- Beware of fake online shops, pages in social networks and two-way websites;
- Do not believe all the messages;
- Personal information is only yours – do not reveal it on unproven sites and services;
- Do not disclose data bank cards (term of action and CVV-code);
- Do not respond to the letters that you did not expect or do not know their sources;
- Prepay only at the verified online stores or for the amount that you are not afraid of losing;
- Pop-up windows with announcements of sales of promotional goods or jobs – not the place where you find what you need;
- Do not use suspicious services;

If you have become a victim of online scammers, then contact the police.

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ENERGETICS SCIENCE

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Nowadays, all of us can make a small effort to make a meal, travel by car or public transport, study at home. However, what is a thing that provides us with the opportunity to do it? It is energy. Its importance is priceless for modern world.

Energy is too related to us that we have been dependent on it. And there is a main question: what caused energy needs and how did it begin?

In the past, people did not have enough effective technology to do daily work fast and qualitatively. They tried to improve it and finally could. An important invention was the steam engine, because after its creation idea of automation became popular. Many scientists developed this idea and finally they made the main invention. The concept of energy became known. From that moment, energetics science appeared.

It is a huge science which includes a lot of different ways of obtaining energy. It was begun to progress firstly in one way. It was the method of burning energy resources. Also, this method is one of the main ways of getting energy for these days. The action proceedings are not too difficult. The resources are burned and energy, which is formed, is saved in a receptacle.

Every day this science is improved. It gives us new effective ideas of obtaining and using energy. Nowadays, we can even get energy from our nature. We now know such technologies. By using wind, scientists can get energy. They install a huge wind generator in the open area and connect it to other generators. It is a wind farm. When blades spin, we can get work which is converted in energy. Other native generators work in the same way. For example, hydropower gets energy by using work of water flow. About solar panels which work differently than previous. They are installed in an open and sunny area. When sunbeams fall on a solar panel reaction appears. Because of this reaction, we can get energy.

Also, there is one effective way of obtaining energy. It is nuclear power. It gets much energy and takes small amount of resources. Nuclear power plant is huge base which has not only nuclear reactor. It includes many containers for cooling and for saving waste. The way of getting energy from nuclear power plant is unstable, so it is dangerous. Scientists try to reduce risk. The process of getting energy is clear. We get it from nuclear chain reaction of fission of plutonium or uranium.

However, there is one big disadvantage. It is environmental pollution. People make efforts to reduce it, but emissions are still immense.

Obtaining and using energy is a great idea of automation nowadays, but for this we lose our health.

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PERSPECTIVES ON ARTIFICIAL INTELLIGENCE

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Technologies of modernity are being developed rather fast, which will certainly lead to the soon genesis of Artificial Intelligence(AI) - the neural network which is capable of almost anything. By the word 'Anything' I mean the unlimited spectrum of possibilities. And exactly this fact grants us high possibility of occurrence of a threat to our race' existence. Let us look at AI from both sides: as it if it was the humanity friend or aggressive algorithm.

But first of all, let us see, what exactly is AI. This term appeared in 1956 and has been first spoken by American computer scientist John McCarthy. But at that moment it implied the use of different research methods which are not peculiar to people by a computer. Now the term 'AI' implies the algorithm which is literally endows the machine with human feelings and consciousness.

As a result, it can become an excellent conversationalist, an excellent teacher, a skilled artist, a film director or an indispensable worker in any factory, as well as a perfectly trained combat unit that can make important decisions or calculate the trajectory of a bullet in a split second. Thanks to access to the Internet, the mechanism will be fully aware of everything that is currently known to mankind, for example, about the harm that we cause to the Earth. Do you see what I'm getting at? Will this mechanism turn against us? There are many films describing this topic, the most striking tape of which is the famous saga "The Terminator", about an artificial intelligence that got out of control and decided that humanity is a harmful species.

This is the problem which interests many scientists around the world and is a stop factor in the development of this technology. Many experts believe that humanity is not ready yet for the consequences of the genesis of a perfect mind, and I support them in this. So as long as there is even the slightest risk of something going wrong, artificial intelligence cannot exist.

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ENERGY SAVING TECHNOLOGIES

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Nowadays the usage of electrical devices is one of main problems. As a nation, we spend a lot of money for electronics, heating, light appliances, cooling and other uses in homes, schools, different workplaces and other buildings. The research of U. S. Department of Energy, Office of Energy Efficiency and Renewable Energy says that nowadays people use energy more in 1.37 times at their homes than in 1980s. But an interesting fact – though, in general, usage of energy has got higher, its consumption is decreased on 10 percent per house. It is really strange, because our homes get bigger and bigger and contain more devices than in that times.

So, to reduce the CO2 pollution and save our money, there are a few ways how to use energy smartly. The goal is to figure out, if these devices are really so useful, as others say.

When you are going to sleep, do you turn off all items in the home? If you say "no", I suppose, you don't know that many electronics are left on standby when not in use. Of course, they don't use as much energy as turned on items, but such electronics can easily add 10 extra percent to your total amount of energy. The solution for the problem is a smart power strip. These devices control power and cut off items, which are plugged in, but not in use, so it helps to avoid extra spending of energy.

The next thing worth paying attention is energy monitor. The main goal of this device is calculating the running cost of all items to give a report of your spendings. Then you can analyze the data and make some changes in the house to avoid wasting energy. The statistics shows that it can save up to 15 percent on your electricity bills.

One of the most famous solutions are solar panels. What they do and how they help? Solar panels convert sunlight into energy, avoiding the need for traditional energy sources. In Ukraine, lots of people make money in this sphere because of special tariff plan of produced energy. For example, you spend near 15 thousand dollars to make a solar station with power of 35 kilowatts. Then you make a contract with regional energy station and sell your energy to the country. Such amount of money is enough for not paying for electricity and the station will bring net income after 4-5 years after the start. One and only disadvantage that producing of the energy with one solar panel is reducing after 8-10 years working. But, after this time you'll get at least the whole cost of panels or even double invested money. In addition, it's harmless for the environment.

Similar to solar panels, there is a little analogue. If you don't have enough money for many panels, inverter, you can buy solar charges. It's a great lifestyle change, which is convenient and saves our environment. These devices allow you to charge mobile phones, headphones and so on without power supply or battery pack wherever you want.

Recently I have learnt about an interesting device – programmable thermostat.

I heard that only a few people know, what it is. It's a great addition to a home, which allows to have full control of the temperature in the house. All cooling and heating equipment will be programmed to turn on and off based on your schedule. For example, boiler can be scheduled to begin warming up water an hour before you arriving home. So, you can come back and take a shower after a long day, also you can turn on your heating a bit earlier. I think, it's ideal for reducing your energy use because of usage heating and cooling only when it's necessary.

Nowadays most of us use LED lightning and it's a great decision, because they are not only 80 percent more efficient, but also last up to 100,000 operating hours more than common lightning. So, there are lots of innovations, connected with this lightning, including "Smart lightning". For example, you can buy IKEA's Trådfri bulbs with a remote control and smartphone hub. The smartphone hub connects to your device and allows to control each light bulb.

In summary, you see that there are lots of interesting ecofriendly energy saving technologies around us. So, let's try to use them and save our environment and money, because, unfortunately or lucky, they are main resources of the Earth.

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THE USAGE OF VIRTUAL REALITY IN DIFFERENT AREAS

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When it comes to virtual reality (or just VR), the vast majority of people have associations with computer games and consider that this is just a fancy toy most cannot afford. But nowadays this technology is rapidly developing and in the near future, it will be used worldwide for various purposes.

This is possible because of ability to impact on all human senses, not only our visualization and hearing, but even tactile sensations. This level of imitation find's it's uses in virtual prototyping and ergonomic design, remote control, creation of training simulations and many more occupations.

The most obvious and commonly practiced use of VR is for studying. It is used to teach professions where the operation of real devices and mechanisms comes with increased risk or requires high costs, like aircraft pilot, train driver, dispatcher, driver, mine rescuer, etc. It is also can be used for training personnel to work in critical or inaccessible conditions, like performing surgical operations and manipulations by novice doctors without endangering the patient's health, or training law enforcement officers by placing them in unique situations to study the reaction and work out different scenarios for their professional development (Kornilov (2019) p. 174-178).

The other common way of using VR technologies is through engineering, urbanism, architecture, or other occupations that require highly detailed modeling of various structures. Computer visualization of future buildings allows customers and contractors to travel across floors and rooms even before the laying of the foundation. Construction workers were given an opportunity to demonstrate their idea not just in a drawing form, but with the use of three-dimensional image, in which adjustments can be made already at the familiarization stage, and designers can try on their own creative solutions for building interiors, and find the optimal layout. Schemes for the city expanding, arrangement of park zones, competent management of space for comfortable and safe living of citizens - now this can all be done with the help of virtual reality (Nadysseva (2019)).

It can also be helpful for industrial workers: for crash tests, projecting power units, testing new equipment, holding corporative meetings, in construction of heavy machinery and even in soil analysis or finding minerals by creating visual models based on geoinformational data (Abdul-Hadi (2011) p. 751-757).

And after all, VR is extremely popular for entertainment and informational purposes, like watching sport games and concert broadcasts, or tourism, because with its help, you can not only visit the most famous and stunningly beautiful cities and sights. but also travel to yet unknown corners of the world.

It is important for us to realize the potential of modern technologies and all the possibilities we can explore with it. Despite the fact that virtual reality is still mostly a luxury or an attribute of highly developed industries, it shows it's uses even now and it's not hard to imagine how significant it will affect our future.

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FUTURE OF STEM

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STEM is a relatively new concept that educates students in four technical disciplines — Science, Technology, Engineering and Math — in a complex and flexible approach. This approach is based on a combination of theoretical and applied skills. The student covers several areas of knowledge at once by getting a chance to use information, check facts based on his own experience (Williams, 2018). Natural sciences explain the laws of nature, which we face every day. Technology makes it possible to use scientific knowledge in practice. Engineering helps to work with resources, materials, teaches how to experiment, and how to improve the environment. Math develops accuracy, logical thinking and the ability to follow algorithms .

The acronym STEM was introduced for the first time in 2001 by scientists in the U.S. National Science Foundation. The original acronym was SMET - Science, Math, Engineering and Technology - but then it was rearranged by Judith Ramaley, American biologist. Since the 2000s STEM-focused curriculum has been introduced to many different countries beyond the USA. At the beginning American students were falling behind students in other countries. Upon longer examination it was concluded that educators lacked deep knowledge of STEM and as a result were not prepared to guide students to those spheres (Hallinen, n.d.).

The main idea of STEM education is a cohesion of four spheres instead of using them as separate subjects. This integration allows students to deal with real-world applications. Solution of STEM problems requires not only technical knowledge and mastery of each individual discipline, but also a significant amount of creativity and flexible thinking. Students apply different types of knowledge in a context that helps them understand an association between the classroom and the outside world.

Why do we need STEM education? Nowadays, our world is changing and developing as fast as never before. Now even reading this text is impossible without those changes. Yes, we are talking about inventions. However, what is invention? Invention is a type of solution to a technical problem with creating something new, thus, each invention is about creation, and creation is the pushing power of today. STEM suggests us to pay more attention to resolving real life problems through learning math, technology and engineering. Does it mean that we should forget about humanities? Absolutely no, but it makes us understand that way of learning STEM subjects should be different. Humanities teach us how to live and give us direction to the future, while technical disciplines help us to build it. In addition, STEM is right about it, it is about developing the future that will provide us with an even wider circle of opportunities to continue that development.

The concept of STEM means and emphases that we need to start learning math, for example, with an extremely clear sight of what we are doing, not just to solve

some equations and calculate an integral, but also to try to understand why we are in need of math to solve a particular problem. To sum up, STEM is not about learning math and other technical subjects, it is about awareness of problems, and it's understanding (Oakley, 2014).

The most common argument against STEM education is that STEM is not meant for everyone due to two reasons. Firstly, people cannot have enough possibilities to study technical subjects, because maybe they cannot afford it. Secondly, our society has plenty of biases that not everyone can understand math, physics and engineering. In some cases, it might be true, but recent research shows us that it is not the common case.

The next step of bringing STEM to life is that we need to reconsider the role of teachers. Now, mostly the teacher is the person who teaches you and gives information, despite that on the Internet you can find it in a few seconds. The teacher in the STEM concept is the person who guides you and learns something interesting as well as you do. Nowadays, we have a tendency among modern teachers to teach in the scope of that behavior model.

Let us talk about advantages and disadvantages. Starting with advantages, we cannot mention that STEM implementation will increase the percentage of well-educated children. In addition, it helps to develop such important skill as thinking outside the box. Speaking of drawbacks, we cannot expect that such big changes will be a challenge for modern teachers. Not everyone can provide good guidance to the world of Science and Engineering with respective practise. Secondly, the STEM educational cycle might take a lot more time than a regular one, due to empirical nature. In addition, STEM will be a lot more expensive than the regular approach, because it means that society should provide all opportunities, including material one, for students for efficient studying, but there are already some material bases in schools. Finally, as mentioned before, STEM education is not a change for humanities, but in effort with trying to implement STEM and teach our children Science, we can forget about teaching them very important components, like humanities.

To conclude, implementation of the STEM education will be helpful for building the world of the future. There are plenty of advantages that we will get from it. Despite that, our society is still not ready for its changes, because it takes many reformations of educational processes we have for now and because of some biases that people claim to be true.

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HOW UNREAL ENGINE 5 WILL CHANGE THE GAME

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The game engine is called the central software component of the computer and video games, it makes development easier and often allows the game to run on multiple platforms such as game consoles and desktop operating systems such as Linux, Mac OS, and Windows. The game engine includes a graphics engine (rendering engine), physics engine, sound, scripting system, animation, artificial intelligence, network code, memory management, and multithreading.

There are many different game engines out there. Some of them are outdated, some have not withstood the competition in the market, and some are supported and updated over the years. One of the most popular, technologically advanced, and progressive game engines is the Unreal Engine.

Unreal Engine was developed and maintained by Epic Games. The first game made with this engine appeared in 1998. Since then, various versions of Unreal have been used in over a hundred games. The list of games made on this engine is quite long, the most popular are Borderlands, Bioshock, Postal, Devil May Cry, etc (Epic Games, 2021).

But Unreal Engine has received much more scope with help of new technologies like Nanite, Lumen, and others.

The goal of our research was to present what a game engine is, the features of modern game engines, the purposes of their implementation, and the perspectives of further developments.

The Demo version of Unreal Engine 5 showed the work of new technologies: Lumen and Nanite (Makuch, 2020). Lumen is responsible for realistic global illumination. This technology allows light to bounce off surfaces an infinite number of times and work in much the same way as in real life. Nanite - one of the key technologies in the heart of Unreal Engine 5. It allows you to show as much geometry in the frame as the eye can see, and it depends on the resolution - the higher it is, the higher the detalization becomes.

While game engines were originally developed to optimize the creation of games, the used technologies have found use in other spheres of the digital world as well.

Every few decades a technological revolution takes place in cinema, renewing the industry. The emergence of color and sound, computer graphics, "green screen", motion capture technology, a new approach to 3D in "Avatar" - all these innovations completely changed the way major studio projects were filmed. What the next revolutionary technology will be is still unknown. One likely option is to use game engines (Valentine, 2020).

It is first of all about Unreal Engine 4, which was used in the Marvel blockbusters, the new "Star Wars" and the "Mandalorian" series. Not a surprise that the engine was quickly adopted by movie studios - it comes in handy in pre-

production and in the creation of special effects in real-time. Filmmakers are increasingly refusing to use the "green screen" and other popular technologies in favor of Unreal Engine 4.

And even this is not all that this engine can be useful for. (Wikipedia, 2020). Also, its application can be found in industrial design and construction. For example, people doing modern apartment renovations could recreate a 3D model of a future home and use a VR helmet to show customers how their new home will look like.

Thanks to game engines, filmmakers, designers, architects, and engineers from around the world will be able to bring their ideas to life using this fairly simple and convenient tool in their work and for this, they do not even need to know to program or deepen in information technologies.

We believe that game engines will evolve rapidly and find use in more and more areas of our lives. Engines will no longer be game engines as well because they will no longer be associated only with games. All the latest digital technologies will be integrated into such environments to recreate our reality.

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ALTERNATIVE ENERGY SOURCES. PROSPECTS FOR THE DEVELOPMENT OF HYDROGEN ENERGY IN UKRAINE

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Renewable energy sources have long proven their efficiency and ergonomics to humanity. Combating environmental pollution and climate change, the rapid decline in oil and gas, have prompted people to look for alternative energy sources.

It is very important that humanity has already begun to take steps to displace traditional alternative energy sources. At first, it was perceived without much enthusiasm, but our planet is immersed in waste, chemicals and other remnants of human activity. The leaders of our planet finally decided to reduce the level of environmental pollution.

Ukraine's plans to use alternative resources are not very impressive: according to Ukraine's Energy Strategy for the period up to 2035, the share of alternative sources in the total amount of electricity should be over 13% by 2025. To better explain the Ukrainian level, I suggest to consider a very significant example: EU countries are planning to set the respective index up to more than 50% of the total by 2030 (Ministry of Energy of Ukraine, 2017).

Hydrogen is an environmentally friendly source of energy. The specific heat of its combustion is three times higher than that of oil (qhydrogen = 1.17 GJ / kg). According to astrophysicists, hydrogen makes up about 99% of the mass of the universe, and in the atmosphere of the Sun - 90%. Large reserves of primitive (space) hydrogen are stored in the bowels of our planet (Dong, 2017).

According to the statics for 2018, the world's hydrogen use has grown to about 74 million tons. According to the International Energy Agency, adding only 20% of hydrogen to the European gas network will reduce CO2 emissions by 60 million tons per year (Dubko, 2021).

Currently, the method of hydrogen production cannot be called environmentally friendly, because this element is obtained by burning methane, which leads to mass emissions of heavy elements into the atmosphere. This threatens the greenhouse effect, from which hydrogen must save. However, there is another way of synthesis. Renewable energy sources are needed to produce clean hydrogen. To provide the same electricity, you can use solar. According to scientists from the Massachusetts Institute of Technology, the extraction of hydrogen using energy from solar panels may become profitable in the coming years. In this case, hydrogen production will cost about $ 2.5 per kilogram, which is four times less than the current price of $ 10.6 (Bellini, 2018).

In Ukraine, alternative sources tend to develop rapidly. Therefore, in Europe it is believed that our country has a great potential for the development of the hydrogen industry. Ukraine can also become the leader in hydrogen supplying to the European Union market. It is planned that 75% of Ukraine's fuel will be exported to the European Union, and the rest will be used for its own needs (Titamir, 2020).

Ordinary hydrogen can help our planet "breathe easier", because it is used in almost all sectors of the economy. For example, instead of natural gas in heating and instead of gasoline in transport. The most active water filling stations are developing in Japan, China, Germany, the USA and Canada. The development of cars and water fuels by such concerns as Toyota, Honda, Mercedes, BMW, Hyundai became the reason for it.

It can also be used for heating houses. The UK was the first to succeed in this area. They have already started using a mixture of 20% hydrogen and natural gas to heat Kiel University and about a hundred houses next to it. Also, the world's first hydrogen boiler was put into operation in the Netherlands for heating a residential building.

Stanislav Kazda, RGC Development Strategy Director, believes that Ukraine will start using hydrogen in the next 5-10 years. Therefore, it will be expedient to reconstruct the gas transmission system for the possibility of hydrogen transposition. According to the director, it is also important for Ukraine to develop a strategy to change the country's energy balance to attract funding (EU grant programs, investments) (Biznes tsenzor, 2020).

At the same time, there are obstacles that make it impossible to develop the use of hydrogen energy in Ukraine in the near future.

One of the main reasons for it is the high cost. The value of pure ecological hydrogen is determined by the cost of electricity. In different countries, this index varies from 20 to 79 dollars per MW.

The price of such electricity for electrolyzers per kilowatt will be from 15 cents for solar and from 11.5 - for wind. With such results, environmentally friendly hydrogen will be unprofitable for 2-3 decades. Even the United States, where such energy is the cheapest, plans to equalize its cost to the price of natural gas at about 2030.

Another problem is that hydrogen needs to be produced by electrolysis. The biggest problem in order to increase renewable energy is storage systems and highly maneuverable power plants, which Ukraine does not currently have. There is simply nowhere to store energy. Therefore, our state continues to be forced to use "cheap" nuclear power plants, which are the biggest polluters of the environment. It is also necessary to have a large amount of purified water. However, Ukraine is insufficiently supplied with potable water resources. Reservoirs are also drained annually due to global warming. It turns out a kind of paradox: global warming is knocking on the door due to environmental pollution, and we cannot pollute it, because our water resources have already been devastated by the same global warming.

Another problem is that in order to ensure the operation of electrolysis fuel technology, it is necessary to put into operation a significant number of stations. Of course, the problem is not that it requires significant funding, but that as a result of such construction we will get a significant amount of carbon dioxide emissions into the atmosphere. Therefore, the global development of hydrogen energy is impossible until the utilization of CO2 begins.

According to the IEA, we currently obtain 99% of our hydrogen from fossil fuels. Global production is about 70 million tons. As a result, hydrogen production leads to emissions of about 830 million tons of carbon dioxide per year. At this time, "gray" hydrogen inevitably leads to even greater environmental pollution and improperly distributed costs of fossil resources (Bobro. 2019).

The last problem considered is that the transportation of hydrogen is possible only through sealed pipelines. For successful operation of this method, it is necessary to provide new modern pipelines along the entire length of the site, because this element has a small atomic mass and a feature of volatility. There is nothing special about it, but it can slip out of the smallest cracks and is explosive. This feature of hydrogen poses a great danger to use.

Also, our government plans to supply hydrogen mixtures to consumers for domestic use in the near future. However, the developed "Road Map" does not have an estimate, technological calculations, regulations, so we cannot talk about a clear plan that will be implemented (Dubko, 2021).

It is impossible to develop Ukraine's hydrogen energy without approving the regulatory framework, replacing obsolete pipelines, adapting legislation to international requirements in this area, attracting investment in the development and construction of new technologies, and certification.

Of course, it's sad that we have to graze the rear, but agree, it's great that other countries are taking steps to improve the environment. By working together, we can save the planet from anomalous restructuring. Alternative energy sources must enter our lives through many developments, and this is not as simple as it seems at first glance.

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IMPLEMENTATIONS AND FUTURE PROSPECTS OF THE XEROGRAPHY PRINTING TECHNOLOGY

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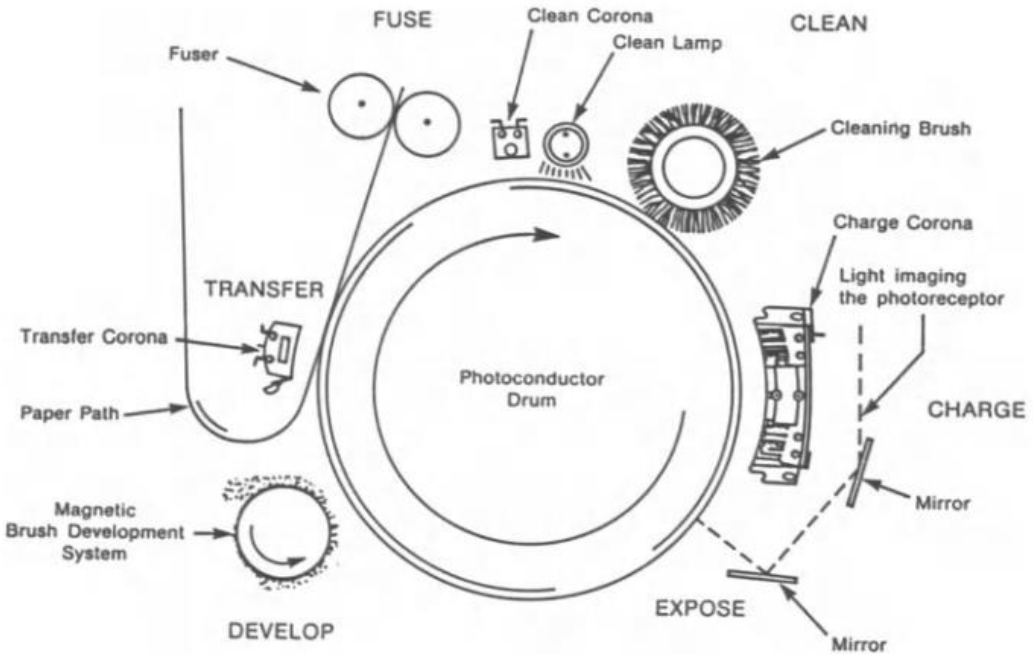
Xerography is one of the most renowned technical approaches in construction of modern printing equipment. It implies the use of electricity-sensitive components to produce the desired output on a printing surface. This technique belongs to the digital printing methods – it avoids using any kinds of analogous medium material (usually film, the *Computer-to-Film* technology) in favor of direct transmission of image to the printing plate. Such type of technology is called *Computer-to-Plate* (CtP), which replaced the CtF and is widely used nowadays.

Various printing machines based on xerography have been developed over a course of, roughly, 70 years. In the late 1930s, American physicist Chester Carlson created a first working appliance that used specific properties of metal (selenium) coating applied to the printing cylindrical drum. The key principle was initialization of electrostatic forces in specified open areas of the drum coating due to their exposure to the light. As a result, areas carrying electrical charge are to interact with traces of dry toner in order to transfer it to printing material, i.e. paper. This process triggered paint particles to attach to the surface.

It is worth mentioning, that initially, xerography went under other name – it was called electrophotography (now term is obsolete). However, the term xerography, coined by the legal successor of the Carlson's invention, the Haloid Company (then Xerox Corp.) has been more acceptable.

Overall, xerography consists of six distinct subsequent steps: charge, expose, develop, transfer, fuse and clean. Each step is performed by special parts of a machine (printer, copier).



During the first step, charge, the surface of a photoreceptor is charged by a corona discharge to incept a development of internal electrical field inside it. Two different devices may be used for the process – either corotron or scorotron. Both of them conduct current through a set of positive and negative corona wires.

The next step, exposition by light eminent enables the photoreceptor to produce a latent image - charge pattern on the photoreceptor that mirrors the information to be transformed into a real image. For copiers, light is emitted by a lamp, and for printers - by a modulated laser or a linear array of light sources.

Development of an image is achieved by depositing toner particles onto the surface of photoreceptor. The variation of charge within constant (or alternating) electrical field determines the distribution of particles and the shape of image.

Then developed toner is transferred to paper by attracting to opposite sign charge on the back of that paper. Fuser melts toner applied to paper to make it permanently stick to the media. Finally, photoconductor gets discharged and any traces of toner are cleaned off to ensure smooth printing process in future. The reason is that small quantities of toner are always left on the surface of the drum which may disrupt future publications.

Although the basic description of the technology seems plain for it is based on elementary laws of electrostatics, it actually concerns some science-backed as well as engineering issues in the xerography printing technique. For example, different ways of controlling the charge of printing toner (in particular, its distribution) are subject to rigorous scientific research, further technical tweaking and therefore – marketing competition between the biggest equipment manufacturers. Toner (electrostatically charged and pigmented polymer particles) is a key substance performing the printing process in xerography; its behavior depends on the given electrostatic potential. So it is particularly important to collect information about the impact on the components involved in the set of related printing technologies with toner as a main agent – among them magnetography, ionography and others.

Numerous companies at the field (Kodak, Xerox, Canon) bring out their developments that may subtly vary in materials, appliances and other details. Though, the key principle remains unchanged.

Broadly speaking, the branch of xerography-based devices has great perspectives, as well as the adjacent, relative magnetography and ionography fields. They all skip the stage of analog phototypesetting presented in classical printing techniques thus enabling high quality of the output images. In addition, they are also more ecological for no chemicals are involved in the process. Shortly, these technologies set the bar high for the industry.

Drawbacks are due too, for example, the demand for more qualified workforce and more delicate technological tweaks. Costs may also be way higher, but xerography still is a priority direction of studies and researches.

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STRANGE PROGRAMMING LANGUAGES

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Such a branch of computer science as programming is gaining mass popularity. And we all know our usual programming languages (Python, JavaScript, Java, C#, C, C++, Php, Swift, Ruby, Go), but this article aims at describing some strange programming languages, such as 'Chef', 'Shakespeare', 'Chicken', 'Malbolge', 'LolCode', 'English'. The syntax is very interesting, easy to learn. However, programmers do not use them at all or use them very rarely. Although there are some that are very similar to common programming languages (such as "English" and "Python" and so on), but for some reason they choose a known option to us.

At the current time, the IT-sphere gains popularity among the perspective professionals. Besides, many inventive people are creative with their business. That is why strange programming languages should be taken into account.

One of these programming languages is 'Chef'. It is very amusing, being created for those people, who like to cook and want to study learn to program. It looks like a cooking recipe. Consists of ingredients and cooking steps. It sounds funny, but it works well and creates programs.

In addition, 'Shakespeare' is not less interesting. The names of the heroes in Shakespeare's poems match with the names in the programming language. Their interactions take place in scenes, where input and output acts are carried out, questions are asked, and answers can be received.

The programming language 'Chicken' shows only one word that is 'chicken'. The code page does not contain any other symbols. A Swedish developer created this language after a parody of scientific reports. . It is clear that the language does not function normally and cannot perform various actions.

In addition, one more language should be mentioned and it is 'Malbolge'. It was developed in 1998 and in general, it aims to become the most difficult programming language in the world. It does not have any constructed syntax. The interesting fact is that the first program could be written only 2 years after the creation of the language. However, the program was not written by the creator and in another language more exact it is 'Lisp'.

"LolCode" was developed in 2007 and it came from slang English and phrases from a picture of the internet memes 'Lolca'. The language has its interpreter and documentation on how to use it to write the quite normal program.

In the end, the biggest simple language on my list is 'English'. Because natural English is simulated in this language.

In consequence, the benefit of such creativity is that with its support programmers can study different languages and improve their experience.

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MODERN DEVELOPMENTS IN BIOMEDICAL CYBERNETICS

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Nowadays IT is actually implemented in all the sectors of health care. Thanks to that medicine has completely new features today.

This process is accompanied by significant changes in medical theory and practice associated with making adjustments to the training of health workers. IT helps a doctor to diagnose diseases, store and effectively use the information at all the stages of treatment and, what is more important for medical science, IT is invaluable in scientific knowledge.

Medical hardware and computer systems are the separate expert system. This is a medical system of monitoring of patients based on long term and continuous analysis of large amount of data that describes the state of physiological systems; computer analysis system; data imaging, ultrasound, radiography, automated systems of intensive therapy, biofeedback, prostheses and artificial organs based on microprocessor technology computer – aided analysis of data of microbiological and virological studies, analysis of human tissue and cells.

For example, German scientists have produced a worthy microprocessor - micro implant in the retina, called Argus II. It uses an electric array of photoreceptors that stimulates retinal cells at the back of the eye, which then sends a signal through the optic nerve to the brain. The wireless signal is transmitted from the camera, built into the glasses, that the patient wears, on a chip implanted near the retina. Argus II is for people with a rare disease called retinitis pigmentosa, which damages the lings – sensitive photoreceptors and doesn't affect other cells of the retina. It is an ideal prosthesis for reproducing surrounding area in portable form.

Nowadays we have made another step to create devices controlled directly by the human brain. The Japanese company Riken in cooperation with Toyota and several other organizations created a wheelchair which can be controlled by disabled themselves. Receiving brain radiation sensor converts brain signals, thansmits them to the special notebook and then to the mechanisms that control the movement of the wheelchair.

The main ideal of the RoboEarth project is to create a universal management system with using internet technology and local computer networks to make it much more accessible to users.

Scientists from California Institute of Technology have implanted two microscopic chips in back parietal cortex (part of brain (cerebras) which is connected with primary motives) of a volunteer who is completely paralyzed below neck in order to trace the activity of about 100 neurons. Thus his body was tied with the robot-assisted hand connected to chips in brain (cerebras). The chips allow to use artificial hand as the own one, transforming brain electric signals to commands. The experiments showed that using chips, the disabled person could take a cup and move

the cursor, using computer mouse. Specialists hope that this approach in future will make hands and legs controlling intuitive.

The group of scientists of Illinois University has created a new kind of implants that must be placed directly in the brain tissue.

- Until now, brain activity was measured in two ways. By the first one scientists used electrodes attached to the ends of thin needles which could damage brain tissues. The other way is considered to be safer and it has to use the array of electrodes which reads information from brain surface. However it does not always provide the necessary accuracy of measurement.
- New implants represent the array of electrodes fixed on silk basis. They are installed on brain surface and dissolved due to saline solution. Thus electrodes grow into tissues, allowing not only to receive information, but also to transmit signals to external prostheses.
- The sense of this invention is in possibility to recreate by electronic means the same processes which happen in human neural network after brain synaptic structures scanning.
- The technology of personality transferring from biological onto computer matrix allows to write down all information on the electronic computer (EC). Transistors improvement will allow the computer to achieve the power of human brain in 10-15 years. That means that in 15 years the human brain will be able to live not only in human body but in computer as well.
- There are two types of consciousness loading: with destruction (the original of brain is destroyed while being scanned) and non-destructive way (the original of brain remains unimpaired). The first option will be applied in the case when keeping brain alive will be impossible, for example, in case of injuries, incompatible with life. The other option will be applied in cases when the brain of the human gradually fails while aging. Then the chip will be installed in the patient's head to which the person's identity information will be gradually transferred, and in process of brain aging, more and more replaceable powers will be transferred onto the chip.

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RECOMMENDATION ALGORITHMS VARIETY AND IMPORTANCE

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The business nowadays competes every day for our attention, especially in days of customers' demand for personalized media every day. Some might say insights from the data and targeting customer-based systems rather than particular audiences bring your business to the next level. As big tech says: everyone is or eventually will be a data business. Couse, from data: we get insights and build up the knowledge. Recommendation-based algorithms are the best delivery mechanism for any business.

The main task is to outline benefits and use cases for creating recommendations. Also, proof: "Personalized algorithms know us better than we know ourselves." (Smith, J. J. 2021 Sep 8).

The main ingredient of the recommender system is collecting information about you to recommend relevant content to you. Collaborative filtering models(CFM), Content-Based models(CBM), and Hybrid Models/Deep Learning are the foundation of all recommendation algorithms. CFM is built either on explicit feedback or implicit feedback and has a cost start problem. CBM is similar to CFM, with one main difference that diminishes cost start problems by using only content-based features. And the most modern of all is Hybrid Deep Learning algorithms. They represent complex tastes over a various range of items, even from cross-domain datasets. In Hybrid Deep Learning algorithms, users and items are modeled using both embeddings that are learned using the collaborative filtering approach, and content-based features. Once embeddings and features are computed, the recommendations can also be served in real-time (Contal, E. 2020 Mar 9).

By using recommendation algorithms, businesses can increase average order value, boost the number of items per order, lower work, and overhead, engage customers, and provide relevant material. For example, TikTok - designed based on recommendations collected about you building up the foundation of their business.

To sum up: businesses gain tremendous value from using recommendation systems. Clients on the other hand enjoy the mindless decisions made for them.

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HISTORY OF VIDEO GAMES

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Despite the fact that the first video games were developed less than one hundred years ago and it is a short period in the context of history, nowadays they have become a very promising industry and an important part of our lives, because almost every person has played a video game at least once.

The main task is to study the history of video games and their impact on society.

The history of video games can be divided into several separated periods: early history, 1970s, 1980s, 1990s, 2000s, 2010s and 2020s. This division allows us to analyse the rapidly changing trends in the video-games entertainment industry. We are interested in showing the continuous development of the industry rather than providing a narration of each period. There are also local trends in each period.

The history of video games spans less than one century, but still it is quite complicated. It is even hard to say which game was the first video game, because there are several contenders for this title. Moreover, it turned out that most of the earliest known video games were created as parts of scientific research and did not mean to be a form of entertainment. However, some of them were designed purely for fun. All these games had a couple of traits in common: they were based on traditional games and were designed for a special computer and could be played only on it (Donovan, 2010, pp. 29–34). Only a few decades later we saw the true potential of the video games phenomenon. Already in the 70s it was getting obvious that video games had gone beyond academic laboratories. In contrast to previous developments, video games were beginning to be a part of pop-culture (Kent, 2001, pp. 105–112). In addition, making games became commercially viable then. Evidence of that can be seen in the fact that the manufacturer of the first commercial home video game console won more than $100 million in copyright lawsuits related to their video game patents (Video Game History, 2017).

To sum up, nowadays video games are no longer just a way to entertain yourself. They became an important part of culture, formed a completely new industry, which is constantly developing, and were applied to lots of spheres of our lives, such as art, education, medicine, science and others.

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SELF-DRIVING CARS

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Nowadays, a car is really the type of transport without which it is difficult to imagine a modern person. The world is developing rapidly, and the engineering industry is no exception. Every year we observe how the number of new, improved cars increases. Their capabilities can easily hit an average person. Already, in 2021, self-driving cars are becoming more popular all over the world, and making it much easier to drive a car and much safer. This is a vehicle that can operate almost without human involvement and easily responds to environmental stimuli. The Society of Automobile Engineers (SAE) divided cars into 6 types, from zero to fifth, according to the criterion of vehicle automation. The zero level is characterized by the lack of automation, the first, second and third levels have different functions that can be performed automatically, at the fourth level the car can drive itself under certain conditions, but human control is still necessary. At the fifth level, there may not be a driver in the car at all, that is, a car in any conditions can go without human control.

Currently, it is not possible to buy a car with full automation yet. Such cars are only developed and tested on the roads. Such developments require great accuracy in software to allow the free movement of such vehicles. Motion sensors, radars, cameras, ultrasonic mechanisms are installed on them, thus, the car transmits all the information to programs that further analyze it and give appropriate commands. Thus there is an acceleration, a partial or full stop and maneuvering on the road according to the set route. Self-driving cars easily work out road markings, signs, traffic lights, that is, they determine how to behave at the time of movement. Although free sales of autopilot cars should have happened a few years ago, however, this did not happen due to certain difficulties with the software. Probably, in the coming years we will definitely be able to try such unusual cars for us. But the global market offers a wide variety of partially autonomous vehicles belonging to the third and fourth levels of automation. Built-in function help to avoid drifting onto dangerous sections of the road, slow down and brake if necessary without human intervention. That is, such a car reacts to advance, fixing deviations from the norm, analyzes and executes the necessary instruction. This significantly increases the level of safety of passengers, creates more comfortable driving conditions. Almost all modern car models have the following functions in their configuration. Therefore, it becomes normally to use such a function. These innovations are really an important achievement in the automotive industry, and in the near future it will be only improved.

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THE IMPACT OF CRYPTOCURRENCY ON THE COUNTRY'S ECONOMY

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The rapid development of information technology, the expansion of the IT field and the creation of new engineering inventions are causing a constant transformation of the world. Each new technology is designed to make a person's life comfortable, otherwise simplify and improve it. This principle has extended to all areas of human activity, respectively to the economy. A breakthrough in it was a cryptocurrency, a new financial instrument.

Cryptocurrency is a type of digital currency, the issuance and accounting of which are based on asymmetric encryption and the use of various cryptographic methods of protection, such as Proof-of-work and / or Proof-of-stake. The operation of the system is decentralized in a distributed computer network.(1)

Cryptocurrencies are a type of digital money that usually operates on the basis of blockchain technology. The value of this technology is that the information encoded in it is stored on different, independent computers, ie there is no single server for it. When transferring cryptocurrency, a peer-to-peer network is created between the sender and the recipient, which may have no intermediaries. (2) exclusively between two users.

At the moment, cryptocurrency is not very popular, but there are already potential participants in economic processes that are affected - banks. National banks cannot track completed transactions or influence the cryptocurrency rate. The exchange rate of cryptocurrencies is influenced exclusively by market factors: due to the decentralization of these currencies, the exchange rate is set by the ratio of supply and demand for them, sometimes the exchange rate may be influenced by media people or people with the largest share of the currency. Therefore, all that remains for banks is to follow the trends and developments of the cryptocurrency market and try to adapt - to create their own cryptocurrency unit.

Six of the world's largest banks - Barclays (UK), CreditSuisse (Switzerland), Canadian Imperial Bank of Commerce, HSBC, MUFG (Japan) and StateStreet (USA) - have stepped up efforts to launch a new form of currency: distributed registry technology will be used for instant payments and clearing of securities transactions, writes FinancialTimes. The Swiss bank UBS together with Clearmatics Technologies created a new cryptocurrency, which they called utility settlement coin (USC - practical currency for settlements). BNY Mellon, DeutscheBank and Santander then joined the project to increase the efficiency of financial transactions (3).

The influence of cryptocurrencies on traditional currencies and settlement methods is inextricably linked to political debates about their status in the modern economy. Restrictions and bans on their use have been introduced in some countries to avoid market destabilization and financial fraud. Governments and central banks are usually negative about not being able to fully control, making it extremely difficult for states to use cryptocurrency for their own purposes. As a result,

governments either do not respond to the development of the cryptocurrency market or restrict its activities and investments in it. (4) India, Nepal, Bolivia, and Thailand have exemplified the use of such an ineffective approach. Yes, as the number of interested users to buy or invest in cryptocurrency increases. Accordingly, the growing demand for cryptocurrency may trigger the process of replacing the fiat currency, thereby reducing its turnover and affect the country's economic processes.

Thus, the development of cryptocurrencies, popularization and increasing demand for it increase its impact on the economy in the future. How positive or negative the impact will be depends on the country's suitability, namely their legislation. Outlining the clear legal status of cryptocurrencies and optimizing the regulatory activities of government agencies will eliminate possible shortcomings.

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ENERGY SAVING

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Nowadays, humanity has made significant progress in technological development, which has become an integral part of modern society. However, industrialization has presented the need for a new resource - energy. Mass reckless use of various devices by the people creates a problem of an energy shortage, which can lead to both serious climate problems and an increase in the ratio of energy used to energy produced.

As always, no one wants to destroy their planet or throw away devices that will not work without energy, or even pay big bills. Therefore, everyone should start saving energy on their own in different ways: there is no need to completely renounce the use of energy, it is enough to just monitor how it is used and not waste it in vain. There are so many tips that everyone can find something useful for themselves and think about why he/she has not used it before and how much it was possible to save both energy and money.

So, it is time to start using some of them. For instance, the most popular habit is the irrational use of light in the house: you want to go to the store or do something else in another room without turning off the TV and lights. Let it happen once or twice due to inattention, but when it becomes a habit, you need to change it. The more light consumed, the more money you have to pay. Another great example is that if you live with your family, you need to make sure that each of you turns off the lights or devices, load the freezer and washing machine more than 60% each time it is used, and install energy-saving appliances (light bulbs, sockets, etc.). Switch to new, energy-efficient light bulbs and you could cut your lighting bill by up to 90% a year (Topping, 2021).

Furthermore, it is necessary to understand that you should save not only light in the house but also other types of energy (gas, fuel) outside. If you go somewhere, think about whether you need to use a car or you can go ride a bike or just go walk. This helps not only to save energy and resources but also to improve health and prevent the growth of the climate problem. Everyone should also understand that you need to use energy rationally both at home and at work or at someone's party. No one wants to pay more because you didn't turn off a light bulb or a TV.

In addition, if you are tired of paying your bills and you have some extra money, think about investing in solar panels. This will not only save you from constantly paying bills, but also allow you to earn money by selling energy. Moreover, this energy is completely environmentally friendly and can have an impact on climate change in a better way.

In some cases, energy loss occurs not only from human inattention but also from malfunctioning generators, transmitters, and various devices. Very often this loss is because the devices are old but continue to be used. Therefore, it is necessary to replace poorly functioning and old appliances to save a lot of energy.

These examples are the most popular of the wasted energy in large with its solution. Others can be talked about for a long time, but everyone must conclude how he spends energy and how it can be saved. Governments of different countries understand the problem of energy saving, so they encourage people to save in all possible ways. The Energy Efficiency Office of the Department of Energy in London coordinates government activity relating to the efficient use of energy and encourages conservation through leaflets, publications, films, seminars, events, and various schemes. (Smith, Collett, 1988).

In conclusion, it is necessary to start following the various tips for energy conservation as various global energy problems are already beginning to rise fast and they may reach irreparable limits soon.

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IMPLEMENTATION OF SUSTAINABLE AI SYSTEMS

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Nowadays, some advanced algorithms are capable of producing pictures, composing poems, and classifying photographs. Robots are able to move around independently and some even know how to make sensible decisions. With the technology progress, computers perform plenty of tasks without human intervention. All this is possible thanks to machine learning that was developed to adapt to new data and produce recommendations based on complex calculations and analysis.

Nevertheless, new issues occur as a result of advancing technology. The AI lifecycle involves lots of intensive computations such as long-running training or hyperparameter searches. Besides, they demand huge datasets that may be transmitted over the Internet. All of these activities need a lot of power, which releases carbon dioxide into the atmosphere. Additional energy consumption, including hardware and data center cooling, also contributes to carbon emissions.

Recently, scientists have found out that the computing expenses of high-performance AI systems double every three months, and research centers are receiving significant funding to build more efficient algorithms. This will result in severe environmental issues over time, particularly in places where data centers are located. That is why developers should think about the influence on ecology. For instance, the training of an advanced NLP model is already comparable to the emissions produced by five cars during their operation.

Even though it is still impossible to find a solution to all problems, sustainable AI offers several techniques to reduce the negative ecological influence of AI systems in the stages of designing, developing, and deploying.

Firstly, we could introduce alternative deployment strategies. A positive effect may be accomplished by preventing power consumption through using special equipment or optimizing the use of existing hardware like general-purpose CPUs. It also matters where we choose to train our AI systems and where they will be deployed. It can be controlled by the load balancing services supplied by cloud providers.

Secondly, a great number of research projects aim at looking into how to train models faster and more efficiently by reducing the model size and restricting compute cycles. Therefore, we can reduce the financial and environmental costs of developing and implementing AI systems.

This is one of the issues TinyML may help with. This subject has been exposed to scientific scrutiny as a result of the expansion of IoT devices, which have limited memory and processing capabilities.

TinyML is the combination of traditional machine learning and energy-efficient IoT devices. Historically, these areas have not interacted and worked almost separately. Nevertheless, they have been integrated to form a new engineering field

that will change a variety of areas. Edge and energy-efficient computing are the primary areas where this approach could be applied successfully.

Opposing cloud solutions, edge computing is a distributed paradigm in which calculation is performed close to the data source. The purpose of edge computing is to keep data away from CPU resources as much as possible. Data sets are is analyzed and processed closer to the point of origin.

TinyML algorithms work similarly to traditional machine learning techniques. The only difference is that «tiny» models are compressed after training. Shrinking a model implies reducing the size of bigger pre-trained models without sacrificing accuracy. It is necessary because of the lack of microcontrollers' RAM.

A few methods can be implemented to compress a model.

The first approach is pruning. It is the procedure of eliminating neurons that have minimal impact on prediction error. The new architecture does not reduce the precision of the output since the neurons that have a dramatic impact are preserved.

Deep compression is the second approach. It includes processes of quantization and Huffman encoding. Quantization is a method of neural network approximation by converting floating-point data to low bit-width numbers. The purpose is to reduce the memory consumption and amount of calculation. Huffman encoding is the algorithm used to compress data. It ensures more efficient data storage, which further reduces the size of the model.

Thus, we investigated the environmental impact of sophisticated neural networks and discovered what sustainable AI is and how it works. Considering all the arguments, environmental sustainability should become the main subject of our researches if we are to continue enhancing the standard of living for future generations. In addition to sustainability, we can conclude that it opens up plenty of prospects for innovation across a great number of areas. This method has the advantages of cutting device costs, minimizing ping, and boosting data security.

To sum up, I would like to point out the fact that it is a debatable issue. Nevertheless, we can not simply ignore the problem. AI consumes a lot of energy, and most technology companies have no idea how to assess their ecological consequences. And the first step toward solving this problem is to start an open conversation about AI's environmental impact and how to measure it.

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ADVANTAGES AND DISADVANTAGES OF ARTIFICIAL INTELLIGENCE

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Nowadays, Artificial Intelligence (AI) has widely spread in our lives. Artificial intelligence is a computer program, which has some learning abilities. It is known that AI involves a method doing some work or running an experiment which we would consider to depend on the human intelligence.

The main task is to analyze the advantages and disadvantages of Artificial Intelligence and realize the impact on the society that not only can be considerably beneficial for us but also unexpected. Nowadays technologies are all the range that can affect all fields of jobs.

Exploring the Artificial intelligence seems to be a debatable topic. There are a lot of notable advantages of Artificial intelligence applications. AI Robots can be used in such situations where researching can be harmful for our health, they even do not need any breaks, in contrast to humans. If we want to build system that has well behavior, we have a need to decide what good behavior means in each application domain (Russell, S., Dewey, D., & Tegmark, M., 2015). These robots can physically interact with environment that makes them possible to assist even with patient care in residential care homes (Virginia, E., & Jenny. D. 2014). There is a dark side to every bright. The improvement of innovative technologies can be a double-edge sword. That means that scientists predict that in the next 20 years, a lot of jobs will be completely lost because of machine automation, getting rid of the need for physical labor.

To sum up, there are some positive and negative effects of existence some Artificial intelligence in our life. Thanks to AI, we can broaden our horizons. The appearance of some nowadays obstacles certainly calls for the need of innovative technologies. Some people consider that methods of using Artificial intelligence can lead to damaging problems in the way it comes to be held by the wrong person, such as invention of the nuclear weapons. Although, none of the AI robots have caused irreversible damage yet. It has only made benefits of such technology, which is available to a wide range of people.

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BIG DATA IN AGRICULTURE

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In today's world, big data is assisting in the improvement and transformation of a wide range of industries, including agriculture. It is the foundation of any nation's and the world's economies. The majority of rural populations in some countries, such as Africa and India, rely on agriculture for their livelihood. Agriculture is responsible for providing us with food, energy, and medicine (Meisner, 2015).

Climate change, rising population, land and water limits, increasing urbanization, environmental degradation, coping with new technologies, achieving more with less, and other issues confront the agriculture sector today.

Agriculture has changed over the years to become more high-tech. Agriculture specialists are now promoting data-driven agriculture as a solution to the global concerns of climate change and rising food demand.

Agriculture has experienced multiple revolutions, including the industrial, green, biotechnology, and big data revolutions. It is going through a digital transformation. Traditional skill-based agriculture is rapidly evolving into digital and data-driven agriculture, with big data playing an increasingly important role in increasing production.

Big data (BD) is a newer technology that can be used to support smart city services. Machines, people, and businesses are the three main sources of big data. In farming, big data technologies are critical: machines are outfitted with sensors that collect data from their surroundings.

Agriculture is embracing big data in a big manner, resulting in agricultural "big data," necessitating massive expenditures in data storage and processing infrastructure. Agricultural big data refers to the large amount of data generated naturally during the agricultural process, from seeding through harvesting. Agreements on data availability, data quality, data access, security, responsibility, liability, data ownership, privacy, and cost distribution are all important arrangements for big data management. One of the most essential aspects of big data is that it necessitates the use of analytical tools to extract value from it, hence increasing farmer and agricultural professional output. Big data can be costly, time-consuming, and ineffective if it is not analyzed properly. Traditional and non-traditional players' roles are predicted to evolve dramatically as a result of big data. It will alter the way farms are run and maintained, as well as real-time forecasts and physical item tracking. Big data can implement the interventions required to reverse alarming food insecurity trends, enhance food production, and implement long-term solutions. The agriculture business may benefit the most from big data and analytics in terms of efficiency gains and improvements. It could be the most effective strategy to transform the agriculture industry (Agboola, 2018; Nichols, 2018).

Agriculture is confronted with numerous issues, particularly in developing countries. Big data's key challenge in agriculture, despite its many benefits, is its

adoption and how to make the data produced relevant and usable for farmers. Understanding how to make the greatest use of large volumes of data remains a key difficulty. As big data analytics becomes more widely used, some skeptics may wonder if it may someday replace humans in a variety of roles. When building predictive algorithms that largely rely on data, data bias and variation are significant hurdles to overcome.

Although the benefits of big data in agriculture have surpassed the risks, the problems must be solved for big data applications in farming or agriculture to gain traction.

To conclude, big data and smart farming are two notions that are still in their infancy. In agriculture, big data is unavoidable. Industry and scholars all across the world are interested in its potential to "revolutionize" the agricultural industry (Fleming, 2018).

Currently, big data applications are primarily discussed in Europe and North America. Other nations, such as China and India, are projected to see a rapid increase in applications. It is easier to meet the requirements of citizens in countries that encourage the use of data-driven agriculture. Although the whole impact of big data on agriculture is unknown, it will have a huge impact on many parts of the industry.

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WHAT IS VIRTUAL REALITY AND WHICH POSSIBILITIES DOES IT PROVIDE

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Since the dawn of time, people have been passing information to each other in multiple ways. It was either a warning about how dangerous a foe is, or whether fruit is edible or not. Throughout the ages, these ways have improved, and by a lot. We even got a tendency to enjoy the information, that is given to us in a more virtuous way than we are used to getting. That is why artists, writers, musicians, and now designers, film directors, etc. are popular, depending on the quality of the information they provide. The outcome of all of this is the moment virtual reality was created.

To start with, it would be better to determine what virtual reality (hereinafter – VR) is. VR is a newly created technology, which is used to bestow a realistic immersion in a veracious-looking digital world. But how exactly does it work? Usually, the immersion is provided by a "helmet" with two lenses and a pair of screens. The distance between those parts depends on the size of the screens and is specifically calculated to grant a clear vision of what is shown on the screen. Movement in VR is carried out by remote controllers, and so is interaction with objects. There are different types of those: joysticks, VR-oriented gloves, and many others depending on what the user needs to do. Some programs even require you to wear special sensors, so that your whole body is tracked and movements are transferred to the virtual world.

Omitting the fact that VR is mostly used in games, it has found its uses in various branches of human activities. For example, people can use it for work and studying. Whether it is a business conference for many people, an architecture project that requires high accuracy, an estate agent needs to take a tour around the house for customers, or a medical student learns to operate, it doesn`t matter much. What matters, is that the possibilities are infinite. You can do whatever you want in VR. For this reason, people often use it as a way to spend time.

These days, things like virtual tours are a real thing. Some people would rather stay at home and enjoy the wilderness with comfort, than travel for hours to the destination, just to put themselves in danger. Virtual museum tours are hugely common too, as they let people spend as much time as they want, or even extend the tour by a few days. This does not only apply to such tours, virtual cinemas are gaining visitors too. Things like sports and many other IRL (in real life) activities continuously get their virtual interpretations (Lowood, 2020).

Nevertheless, everything has its pros and cons, so does VR. Because of how demanding this technology is, it takes more time to embody things, which takes less time when realized with the old-style ways. People, who work with virtual reality-related content have to dot all the i`s and cross the t`s if they aim to create a stable and excellently working immersion. And to not let aside the price: VR sets are not that cheap, not to mention that a powerful PC is required to run it.

To sum up, virtual reality is a technology with a wide specter of possible usages, and we come up with new ones every day. It has changed the way people think about some things and gave even more people some capabilities they could not imagine having.

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INFLUENCE OF ARTIFICIAL INTELLIGENCE ON MODERN WORLD

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Throughout human history, scientific and technological progress played a pivotal role in shaping our life: sometimes for better and sometimes not. It allowed us to cure once incurable diseases, communicate with each other despite great distances, and help us to solve our daily tasks, at the same time exposing humanity to the threat of a nuclear apocalypse. In modern society conception of science, to some extent, is starting to take the place of a higher idea, which was previously taken by things like religion. And much like those ancient greek gods, it has its offsprings, one of the most prominent of them being artificial intelligence. It influences our lives in many fields, whether we realize it or not, and this influence carries quite a dualistic nature.

Artificial intelligence is getting emerging roles in the secondary sector of economics. It is getting heavily used in a huge range of industries. One great piece of evidence of this could be increasing investments into AI by leading companies. For instance, Foxconn, one of the main manufacturers of Apple's products, increased expenses on AI research and development by astounding 342 million dollars over a period of 5 years. And high-precision manufacturing is not the only example. Another one is nuclear power plants. In 2020 International Atomic Energy Agency encouraged the integration of machine learning technologies, which specifically provided with the ability to estimate power pin peaking factor, wall temperature at critical heat flux, detect anomalies, and notify of equipment malfunction. And furthermore, the report by KMPG states that 93% of respondents of the survey implemented AI in their processes, main of which are: defects monitoring, predictive and preventive maintenance. And, obviously or not, all of these cases lead to cost optimization. Defect monitoring allows to identify flaws and correct them on the spot, which would save money for unnecessary transporting and avoid the dissatisfaction of consumer in case of refund; and application of AI, recommended by IAEA, would replace people, which previously were responsible for what is covered by its functionality, so the expenses would be much lower.

Specific parts of the third sector of economics, particularly healthcare and finances, also didn't remain unchanged. Effects of AI implementation in these spheres could be described as productivity increasement, either by excluding human factor or solving manual tasks, which usually take excessive amounts of time. For instance, in 2018 J.P. Morgan Chase released world's first A.I. Powered Virtual Assistant for corporate payments. Rather than manually searching through online options, the assistant helps the user to navigate their online cash management portals. And, as the client uses the application, it slowly unveils the capabilities it holds by learning how to respond better to certain queries and analyzing preferences and behaviors of the user, leading to better and better effectiveness. This project turned out to be so successful, that it already handles 5 trillion dollars daily, bringing annual

revenue of 7.6 billion dollars. And while that may sound great enough on its own, but it turns out to be pretty minor, compared to advancements of AI in healthcare. Recently, a company Babylon made an AI chatbot startup. After testing its abilities and comparing its score to ones of actual general practitioners at an event held at the Royal College of Physicians, the result showed that AI hit 81% of accuracy, while GPs got only 72% on average. Even though currently AI can't make an accurate diagnosis, as "there are many factors to take into account, a great deal of risk to manage, and the emotional impact a diagnosis might have on a patient to consider", it still can be used as an indicator of whether you should seriously consider going to doctor. In fact, Rwanda, which suffered a genocide in 1994, that took away 800 thousand lives, shows actual interest in this technology and has two million Rwandans registered there. If developed well enough, Healthcare AI could be a perspective way of providing growing population with high-quality medical management at a reasonable price.

Well, all of the listed above sounds good: lower costs of products, less trouble with manual labor, and higher quality of what is being produced. But it only views how AI would change our life from a materialistic point of view. And what about the influence of AI on our inner selves? To some extent, the final goal of AI development- the creation of some entity, that could solve any given task- could be called pathologically wrong aim. True capabilities of AI lay far beyond of mind of human being, so we can't even be sure, that we can reach our aim. But even if we do, what would it bring us? Because in reality, it may turn out, that AI may simply rob its master, humanity, of the most precious thing it has- a purpose. Human won't be able to become an artist, as AI could copy and reproduce any style imaginable. Human won't be able to bear the light of knowledge, as AI would know infinitely more and would find a way to reach to anyone. Human won't be able to make a crucial breakthrough, as our mind can't compete with immeasurable capacities of great intelligence with no evolutionary limitations. Human would be left aside with no goal to strive for. And furthermore, won't artificial intelligence depreciate the great feats of our predecessors? Because eminent people of the past sacrificed a lot in order to achieve greater goods, very often dedicating their whole lives. And it generously paid off with marvelous discoveries, that amazed scientific society for centuries. We honor them. We praise and get inspired by them. But what would happen if an inexhaustible self-teaching mind, that inviolately strives for goals set before him, starts making discoveries of a whole new level every month, while equals of those of the past would blend in with other information noise? Wouldn't it destroy the measure of a great deed and won't human forget the price of a true feat? All of these values may be put under threat with total implementation of AI…

So all-in-all, artificial intelligence is a powerful phenomenon of scientific and technological progress, that nowadays plays an enormous role in different spheres, allowing us to optimize costs, which would ease the financial burden of vulnerable segments of the population, and increasing our productivity. But it also may carry a menace for humanity, for it could deprive us of something that makes us, humans, valuable.

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BIG DATA - THE IT-STUDENT ROADMAP

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The training of bachelors in any field of study is determined by the requirements of the relevant standards of higher education. These requirements are outlined in the form of a list of competencies and learning outcomes that a student must demonstrate during the public defense of a qualification paper. The type of qualification is described in the form of an integral competence (characteristic) of the student who applies for a Bachelor's degree in the specialty. The specialty qualification is formulated based on the content of its four components: knowledge; tools; materials; types of services (goods) provided.

The term "information technology" (IT) denotes a set of modern methods (ways) of processing information using computers and computer networks. Since the 1990s. XX century modern information technology is usually associated with the concept of the Internet, but in the last decade, a new trend has been added - Big Data. It is caused by the necessity to process huge data arrays (Geron, 2018).

The modern IT specialist in the field of Big Data requires appropriate skills to work with the information that we usually get from things like the Internet of Things, social networks. He must be knowledgeable in techniques such as Data Mining, Machine Learning, Text Mining, Process Mining, Visual Mining, be able to work with MapReduce, SQL/NoSQL database, Hadoop. But knowledge of methodology alone is not enough to work with the Big Data sphere because the task of these specialists is not just to write a program, but to write a program that works in the conditions of a large influx of information and that can run for a sufficient amount of time without interruptions. To implement robot algorithms, you will need knowledge in such areas of mathematics as k-nearest neighbors, linear regression, logistic regression, Support Vector Machine, decision tree, random forest, neural network, k-means, Hierarchical Cluster Analysis, expectation-maximization, Principal Component Analysis, Local-Linear Embedding, t-distributed Stochastic Neighbor Embedding. (Bengfort, 2019). The implementation of algorithms also requires knowledge in programming languages such as Python, namely knowledge of working with some of its modules, namely NumPy, Pandas, Matplolib, Scikit-Learn, TensorFlow. These modules provide a good toolkit for creating Big Data.

The above list of items to study constitute the minimum required skills for the future IT specialist in the field of Big Data. The need for such specialists is enormous, the results of the algorithms can be used in almost all areas of human activity, including trade and medicine. For example, processing data on shopping in different shops makes it possible to simplify the task of allocating certain types of goods to certain shops, or studying data on citizens' travels can predict the epidemical situation in some regions. And studying customer choices for their purchases in shops allows marketers to draw attention to the goods that people need or what things should be promoted or what improvements should be made to existing products.

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SMALL MODULAR NUCLEAR REACTOR ACP-100

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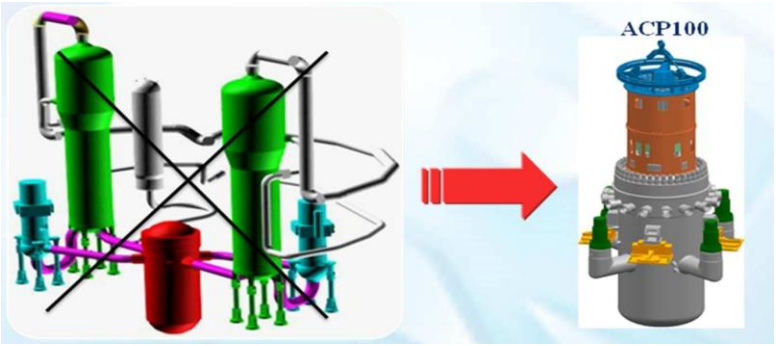
The ACP100 (Access control point-100) is an integrated PWR design to produce an electric power of 100-125 MW. The ACP100 use PWR technology adapting verified passive safety systems to cope with the effects of accident events; in case of transients and postulated design basis accidents the natural convection cools down the reactor.

ACP 100 can generate electricity, heat buildings, seawater desalination and do all it in places without cool industrial infrastructure.

Specific design features:

a) Integral reactor module

The reactor coolant system has been integrated reactor module, which is illustrated in Figure. The reactor module is consisted of reactor vessel (corpus), once-through steam generators, canned motor pumps (for regulation of pressure), reactor internals and integrated reactor head package.



b) System function and composition: 4 main pumps

16 OTSG

1 pressurizer;

c) System description: operation pressure 15.0MPa

core exit temperature 325℃

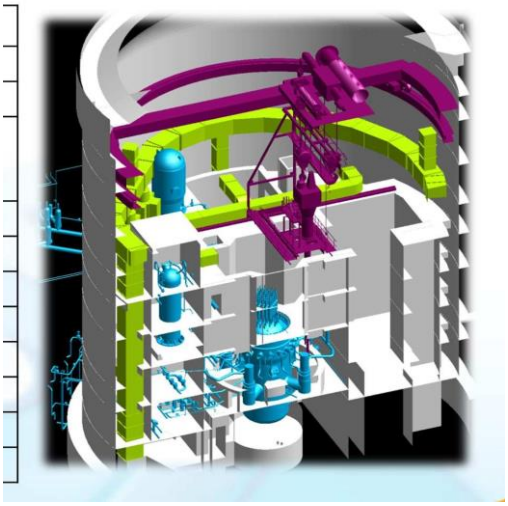
The reactivity is ruled by means of control rods, solid burnable poison and soluble boron dissolved in the primary coolant. There are 21 control rods, with a magnetic force type control rod driving mechanism (CRDM).

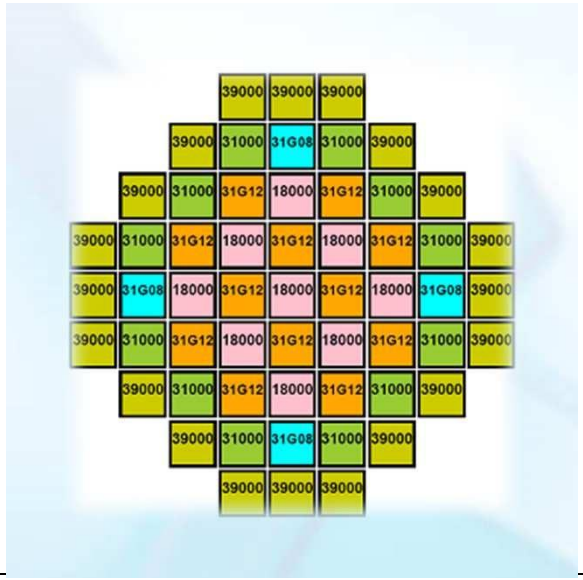
d)Reactor Core

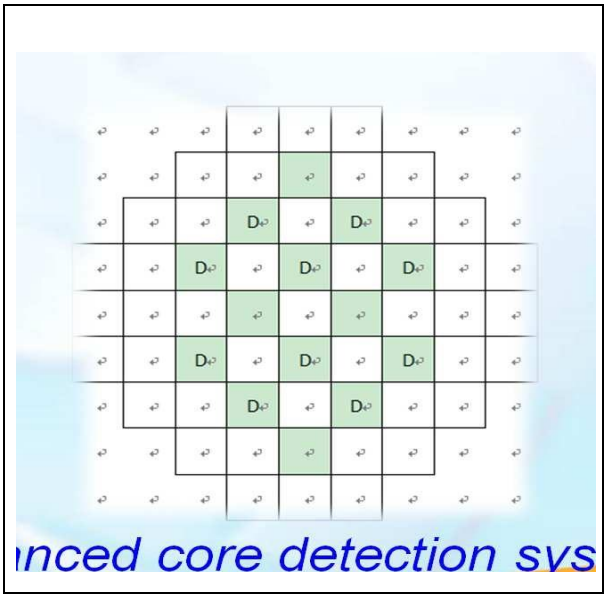
57 CF3S fuel assembly with Gd2O3 solid burnable poison;

total length of 2.15 m core have a squared 17x17 configuration. The fuel ^{235}U improvement is about 1.9–4.95%. The reactor will be able to operate 24 months at balance fuel cycle.

f)Pressurizer:







The pressurizer of ACP100 is located outside of the reactor vessel. The pressurizer is a vertical, cylindrical vessel with hemispherical top and bottom heads.

Safety feathers (PAS) (passive containment air) and reactor automatic depressurization system (RDP). Engineered Safety System Approach and Configuration Water in pool with the spent fuel can protect it 7 days if accident will happen. Accident prevention and their minimization are achieved by passive flooding of reactor, that stop RPV melting. Passive pressure relief system and RPV off-gas system to remove non-condensable gas gathered at RPV head after accidents.

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ELECTRONIC SYSTEM FOR CONTROL OF SAFETY OF CITY RESIDENTS

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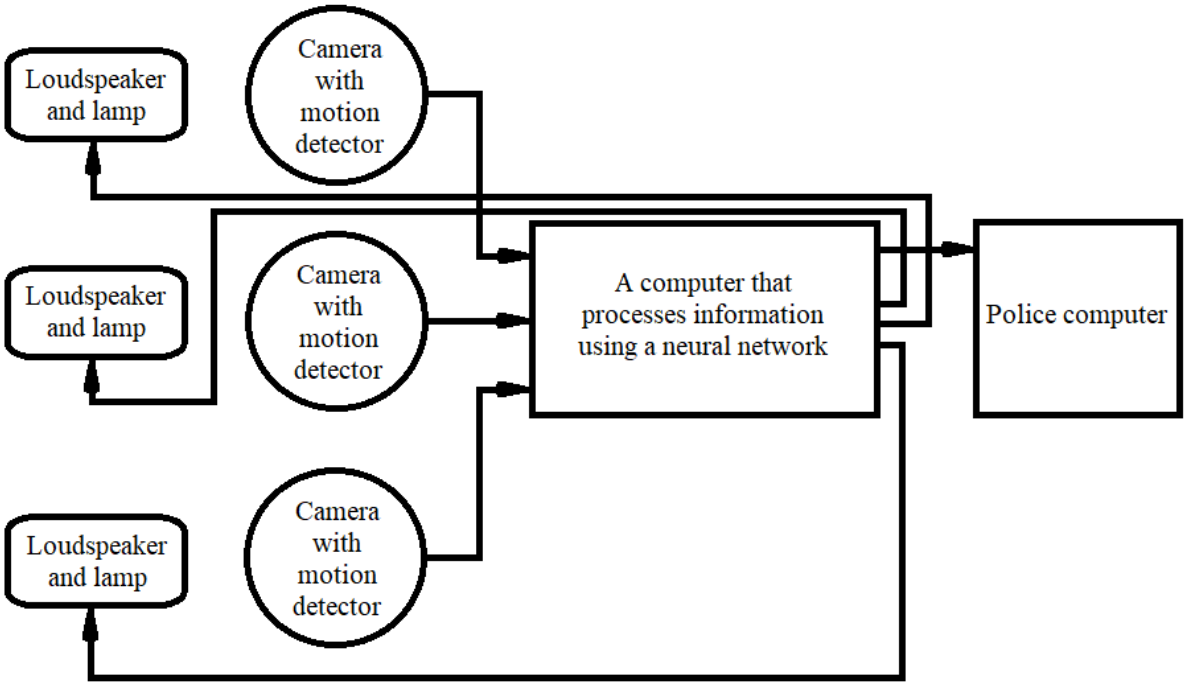
In today's world, people face a lot of everyday problems, such as not being late for work in the morning, having time to complete all their planned tasks, cope with anxiety so that it does not interfere with a successful speech at a conference or meeting, but we - modern people are less likely to think about our own safety or the safety of our children, such as when we return home late at night or even at night, or when we let a child walk outside. I believe that this issue cannot be left on the periphery, but rational ways must be sought to minimize the likelihood of getting into an unpleasant situation, such as an attack or robbery. According to the report of the National Police of Ukraine on the results of work in 2020, during 2019-2020 in Ukraine there were 2754 premeditated murders, 3175 robberies, 18492 cases of robberies. Most of these events could have been avoided if the police had received a timely alert.

In my opinion, a promising solution to improve the safety of people in the city could be a special electronic system that would monitor everything that happens on the streets of the city and when an event with signs of offenses that threaten human safety, would automatically send a signal to the police and recorded all persons who are participants in this event. Also, such a system should predict possible offenses and give a sound and light signal. At the same time, such a system should not violate the confidentiality of individuals, if there is no security threat.

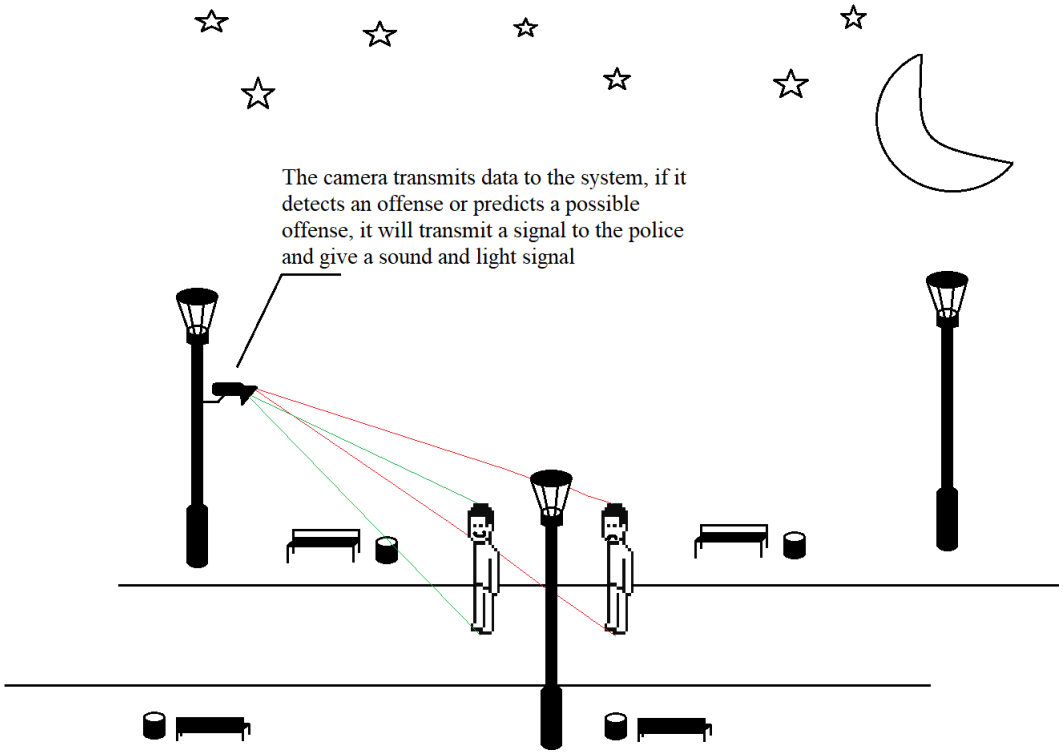
Such a system can be implemented using a neural network. The advantage of a neural network is that a system based on it can "learn" and not just execute certain prescribed commands, because to solve this problem requires such an approach, the system must be able to prevent certain security threats or quickly recognize it and do it automatically. It is not possible to describe all possible events by conventional algorithms, because each such event is unique and without a neural network must take into account a huge number of different factors, which is not rational. The ability to "learn" the system and the high speed of analysis of events that occur in real time is one of the main keys in solving the problem of improving the security of city residents.

In general, the proposed system can be described as follows: the system consists of cameras that operate when motion is recorded in a certain area, such as on the track to which the camera is directed. The choice of the area in which the motion is recorded is to avoid the malfunction of the motion detector, for example, on the movement of trees from the wind. The signal from the cameras goes to a computer, which uses a neural network to analyze the information and, when a certain event occurs or when there is a high probability of such an event, sends a signal to the police and gives a light and sound signal.

The block diagram of such a system can be represented as follows:



You can partially visualize the system as follows:



Thus, using such a system can increase the safety of residents of any city.

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NEW FIELD IN CRYPTOCURRENCY OR WHAT DO WE KNOW ABOUT NFT

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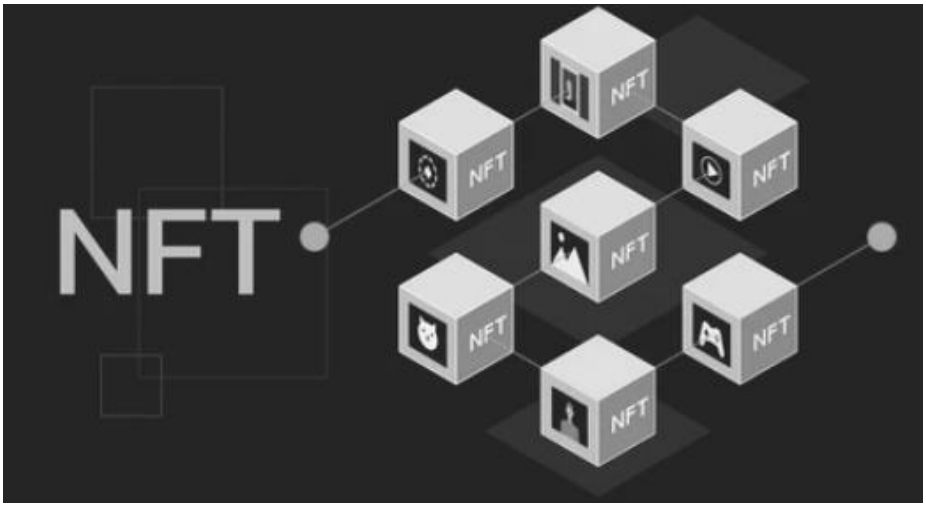

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Everyone has already heard about cryptocurrency such as Bitcoin, maybe even about Ethereum. If not, then very briefly, a cryptocurrency is a currency that is not assigned to any country. And all information about its movement is stored as a record in the blockchain.
Cryptocurrency appeared a long time ago in 2009. And everyone, who wanted to, has already managed to figure it out.

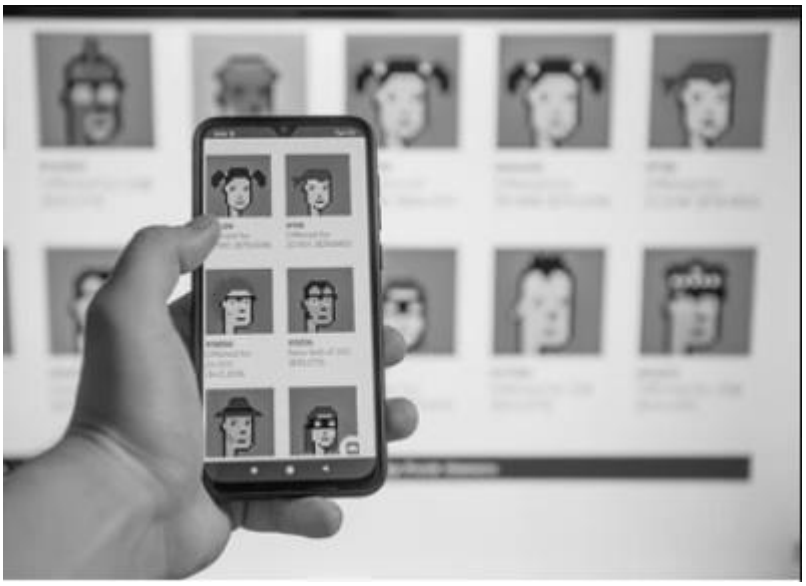
But we'll talk about a relatively new area in cryptocurrency like NTF. “NFT technology was developed in 2017 based on Ethereum smart contracts. The first piece of art to be converted into an NFT token was a black and white work by artist Banksy - 2007 stencil titled Morons (White). Blockchain company Injective Protocol bought it, burned it and created an NFT token - a virtual asset tied to a "digital image of an art object" (Karpova, 2021).

YouTube, Burnt Finance, Authentic Banksy Art Burning Ceremony.

So what is NFT? NFT is a Non Fungible Token. What does it mean and what is the difference between NFT and cryptocurrency?

“Each record on the blockchain is called a token. However, in an open blockchain, all tokens are equivalent and are replaceable. This

means that one token can be replaced with another of the same token and nothing will change. But Non Fungible Token (NFT) technology works variously.



© 2003-2021 Shutterstock, Inc. Rokas Tenys, A non-fungible token(NFT).

Each non-fungible token is unique and cannot be tampered with, split, or subtly replaced. This system is ideal for securing your rights to any unique object, be it a work of art in a single copy, an item in a computer game, or even real estate". (Korneyev, 2021). What is NFT?)

You need to understand that NFT is called the main trend of 2021 in the blockchain. The community of NFT holders rapidly increases. So we understood that NFT is something that is unique and can be transferred over blockchain, but what usage serves? Because of its uniqueness, it's become to be used in Art and P2E games.

First of all, let's talk about Art. All collectors want to have unique and not fake art and this technology comes in hand with it, also trading your NFT is much easier than selling real pictures or something else. Because all operations occur on the internet, you can sell your art within a second. For example, look at one of the most popular NFT collections. Its Cryptopunks, one of the earlies NFT collection.

OpenSea, CryptoPunks

When you see this collection for the first time, the first that comes to mind is who will buy these pixel heads that you could make in Paint. But you will be very surprised if I tell you that the most recent punk was sold today for $460,000. You can see it right here at the link (Solsea, 2021.). And collections like this appear every day.

The second place where NFT is used is its games. P2E games or play-to-earn games. It's hard to because this sphere is immense and complicated, but this kind of game will be very popular in the future.

In these games, NFT is used to show that the user owns something like if you have a car in the game you have a car NFT that can be sold to someone

for some price.

To sum up. NFT is a new and promising sphere in cryptography. It's been on hype nowadays. Because of NFT exclusiveness and non-fungible technology in the future, we will have many things using it. For example, it was said that even

papers of owning an apartment can be saved as NFT. It`s a stunning idea because purchasing and selling products will be much easier and all action with your product is stored in blockchain. So, you will be able to see who owned it before you.

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SMART GLASSES: LOOK TO THE FUTURE

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For a long time, the main goal of glasses was to improve vision. Now, in the era of technology, eyewear manufacturers and developers are joining forces to make glasses even smarter. In fact, glasses are very useful thing in the modern world, when gadgets (phones, laptops, tablets etc.) have gained incredible popularity, which in turn lead to vision problems in an increasing percentage of the world's population.

In fact, smart glasses can ease our lives: they can show important notifications from a smartphone or callers' phone numbers, display roads, maps, "speak" text, even with real-time translation. With the help of the device, you can capture images, and the software can turn any inscriptions on the pictures into text for subsequent translation.

The first well-known company that announced the development of a "completely new device" was Xiaomi. The device runs on Android and can function separately from your phone.

The glasses have a microphone and a camera that can be used for quickly translating of texts and messages from foreign languages. Unlike similar products from Google, Snapchat and Lenovo, Xiaomi glasses do not include immersion in the world of virtual reality in their goals. Such glasses weight as usual - only 51 grams (Karpus, 2021).

The MicroLED technology played a big role in the development of smart glasses, which helped to reduce the space required by the structural design of the glasses. In addition, this technology has a higher pixel density, longer life, simple structure and higher brightness than OLED. The internal chip size of the display is 2.4x2.02mm. Therefore, the display chip was able to fit into the frame of the glasses. The display was chosen to be monochrome, with a maximum brightness of 2 million nits, so that content can be seen even in direct sunlight. Smart glasses Xiaomi Smart Glasses are equipped with two microphones, a speaker, a 5 MP camera and a 4-core ARM chip. There is also a built-in battery, touch panel, Wi-Fi and Bluetooth module inside.

Obviously, there is no competition in new developments anywhere. Xiaomi's main competitor is Facebook, which offers glasses created in collaboration with Ray Ban. Their glasses have cameras of 5 MP, a built-in microphone and speakers.

Competitive glasses can also work completely autonomously, take photos and videos. To do this, they have a memory for about 500 photos or 30 clips of 30 seconds each. As we can see, there is still more memory in such glasses.

Despite all the advantages of such invention, there are many disadvantages, here are some of them:

Owner safety: Pop-up windows on the screen right in front of your eyes can distract the user, which is dangerous for him and others. This is especially true when you wear glasses while driving.

Confidentiality of personal data and freedoms: glasses take images or video of people around in real time without their consent; this can be appealed as an offense. In addition, it is not a fact that personal data will not leak from the glasses.

Main goal: Let us not forget that glasses were created primarily for vision correction. Therefore, we cannot claim that all modern technologies, such as video recording or voiceover of messages, can be properly combined with the original goal of improving vision.

As well, many questions still remain open. For instance, what could be the capacity and placement of the battery that powers this entire system? Besides, in the modern world, the gadget should not be only unique in functionality, but also fashionable (MacDonald, 2021).

Smart glasses are not just a vision correction device; they are a navigator, a teleprompter and even a translator. It is impossible to say unequivocally that such glasses have more advantages or disadvantages. Therefore, an accurate answer to this question can be obtained in the future - when the development of smart glasses reaches a new level and becomes close to perfection.

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ARTIFICIAL SLOWDOWN OF GADGETS

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Mobile devices have really strong impact at people's lives, it is impossible to imagine the modern world without them. According to the rule of the Moors, the power of technology doubles every 18 years. The lifespan of most mobile devices is from one to two years, then their use becomes surprisingly difficult, the phone starts to work slowly, there is not enough RAM to work with urgent applications, mechanical damage makes itself felt, newer models have more interesting features and functions. Transnational corporations are already able to provide a level of technology that will keep gadgets relevant for 5-7 years, but is it beneficial for the companies themselves? Not at all. It is much more profitable to sell a low-quality gadget every 2 years than a high-quality thing that will last for many years. In the first case of artificial slowdown of technologies, Apple was caught, whose super-popular phone, the Iphone 4 worked perfectly on the version of iOS 6, but with the installation of iOS 7 turned into a slow piece of glass and plastic. In December 2017, Apple was first accused of artificially slowing down smartphones. The story is called "Batterygate". The company did not argue, but admitted that as the battery in the iPhone wears out, the processor starts to run slower. "Apple is slowing down the iPhone, which motivates users to switch to new devices" - such a decision was made by a court in the United States, France and other countries.

Users and agencies are winning lawsuits over this. In March 2020, the company agreed to pay $ 500 million to owners of the iPhone 6 and 7 series in the United States as compensation for a lost class action lawsuit.

As a result, we can say that modern companies are clearly not interested in the development of technology, because it is not profitable for them.

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THE PROGRESS IN ROBOTIC ENGINEERING

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Nowadays, we live in an age where technology and engineering progress skyrockets towards the future that was described in fantasy books. Back in 1897 H.G. Wells writes a science-fiction book "War of The Worlds", where he describes the use of the "heat ray" by the Martians (Wells, 1897), and half a century later, in 1960, Theodore H. Maiman creates the first working laser (Maiman, 1961). In the present day, we observe an identical situation: Isaac Asimov wrote a collection of sci-fi stories "I, Robot" that was published in 1950 (Asimov, 1950), and in the present day we can see Atlas. Atlas is a humanoid robot developed by Boston Dynamics, an American company that is funded by Hyundai Motor Company. This robot is designed for a variety of tasks such as search and rescue. Up to the present moment it can jump, squat, do backflips and handstands, in addition to walking and running.

Boston Dynamics engineers were tasked with the difficult task of making the robot maneuver through complicated parkour courses, a task that proved challenging for the company that spent many years of engineering robots for purely operational purposes. They could walk, navigate in rough terrain, pick things up, and detect things based on the sensors attached. (Boston Dynamics, 2021)

Due to it being a difficult task getting the robot to pass the obstacle course, engineers at Boston Dynamics had to modify the robot to be stable and with enough power to do the entire performance without halting. Consequently, improvements were beneficial to the design. Atlas' advanced version uses an extensive range of sensors to execute its moves and a gyroscope to maintain balance. The robot has twenty-eight actuators that assume the role of muscles (they convert electronic signals into physical movement), and three quad-core built-in computers, one is used to process perception data, and the other two for controlling movements. Also, the improvement was made so that the Atlas robot became able to sense and react to its environment. A robot's control system is driven by perception and additionally is embedded with artificial intelligence making it capable of self-learning, has to make lots of critical adjustments on the move to maintain balance and posture. While it might appear to be a narrow and specific activity, parkour is a whole-body activity that requires the Atlas robot to keep its balance in various situations while switching between behaviors imperceptibly. Visualization is used to adapt the robot's behavior and abilities according to the surroundings it percepts. Hence, it is not necessary for the engineers to pre-program jumping motions for every possible obstacle the robot might encounter. Instead, the control team creates a minor quantity of algorithms of template behaviors that can be matched to the environment and improved on the move. (Ngowi, 2021)

The team produced a video of results a bit over a minute in length after nearly one and a half years of choreography surveying, programming, simulation process, and upgrades. What was demonstrated is a product of continuous, hard work driven

by passion and determination to create a robot capable of completing such a futuristic, seemingly impossible routine. (Hennic, 2021)

To summarize, it can be said that American company Boston Dynamics is slowly but surely driving the world forward to an age of robots, a world where a go-anywhere, do-anything robots are nothing extraordinary. Robots' ability to perform the same forms of movement and physical tasks as human beings will bring practically limitless possibilities for applications.

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WHICH WAYS OF OPTIMIZING THE USE OF ELECTRIC ENERGY

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Recently, the topic of energy saving technologies has been considered at the level of international and state policy. Issues of limited natural resources, changes in climate and other problems are discussed daily. The constant rise in prices and tariffs for energy resources is directly reflected in the production process of any enterprise. The solution to this problem is seen in one thing - the need to save energy and carry out activities that contribute to this.

Energy saving involves the implementation of various measures to bring renewable energy sources back into the production process. All measures aimed at energy conservation are of an organizational, legal, scientific, economic and technical nature. Speaking of energy saving, we also mean the preservation of natural resources, which today is more than an urgent problem.

Today, energy conservation is the main driver in the development of the economy of markets for consumer services and materials.

The use of alternative energy sources is becoming more and more popular in energy-saving technologies. Solar panels in combination with the use of solar collectors can be used both as an additional and as the main source of energy, thus protecting the end user from the necessary dependence in centralized energy networks. This reduces the consumption of solid fuels and energy.

Along with the rapid development of scientific and technological progress in the field of energy saving technologies, one can often encounter the notorious human factor caused by the use of technologies that are so effective today. Knowledge-intensive industries offer us a variety of uses and applications for energy efficient technologies, a rich variety of energy conservation tools and methods, and their applications for any energy-consuming industry.

An example is a banal everyday situation. A certain citizen, inspired by the ideas of energy saving, purchased energy efficient light sources for his home. Having studied the technical characteristics of these devices in advance, he began to use them for a longer time without shutting down, well, they are energy efficient. And what a surprise it will ultimately be when, over the reporting period, he will not receive a purely economic effect from the use of these lighting devices. This is false energy saving.

In the given example, only one factor is presented that directly affects energy efficiency, but when it comes to monitoring the energy saving of industrial enterprises, there are many factors that both directly and indirectly affect the energy efficiency of the enterprise as a whole. To improve energy efficiency, a systematic approach is required, including well-planned and well-defined specific goals of practical implementation, and in the subsequent development of a major energy saving program

The material benefit between the subjects of economic relations deserves no less attention. Today there are a huge number of ready-made energy-saving solutions, metering devices, sensors, and directly effective energy-consuming devices. In such conditions, there is an excellent opportunity to choose energy efficiency products based on their qualities and cost.

Important indicator of energy efficiency is the quality of the electrical or thermal energy itself. Undoubtedly, the efficiency of any technological process, and in the final goal and the quality of products will depend on the quality indicators of consumed energy. There is no point in talking about energy efficiency of production if the supplied energy does not meet generally accepted standards and may harm a separate technological complex and the enterprise as a whole. In this matter, two important components of any production should be noted:

1)production of electrical energy of proper quality;

2)uninterrupted transmission and reliable distribution networks.

In matters of energy conservation, it should be understood that a ready-made solution does not exist and cannot exist. The constant increase in the energy intensity of production, as well as the rise in energy prices, make us look for individual solutions for a specific production, with subsequent monitoring of energy efficiency. This is the only way to bring energy saving to a different level of quality.

With the development of power grids, the growth of interconnection, there is a need to present more and more requirements for the reliability, security and quality of power supply and the power grids themselves.

The issue of personnel potential of the energy industry deserves special attention in matters of energy saving and quality of electric energy.

These problems are forcing employers to raise the upper age bracket for applicants. The solution to the problems can be found in the creation of specialized training centers for the training of highly qualified specialists, as well as the establishment of close cooperation between energy companies and universities that train relevant specialists. Some energy companies have taken this path, and successfully cooperate with higher education institutions, providing them with an extensive production base for technological and undergraduate internships.

This has a number of significant advantages, such as the selection of future applicants for jobs, the ability to track the entire learning process, make the necessary adjustments to the educational program, and it will become more approximate for a specific field of activity of a future specialist. Immediate forecasts show that the shortage of young specialists in the energy sector will only worsen, and this is caused by a simple aging of the staff. Energy companies, with the support of the state, should make every effort to create a single bank of specialists in the energy industry, and raise the prestige of the energy industry. Future specialists must be sure that they will be in demand in the modern labor market. And they can rely on the appropriate material support and subsequent career growth in their chosen industry.

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THE ROLE OF DIGITAL COMMUNICATIONS AND 5G IN COMBATING CLIMATE CHANGE: REDUCING CO2 EMISSIONS

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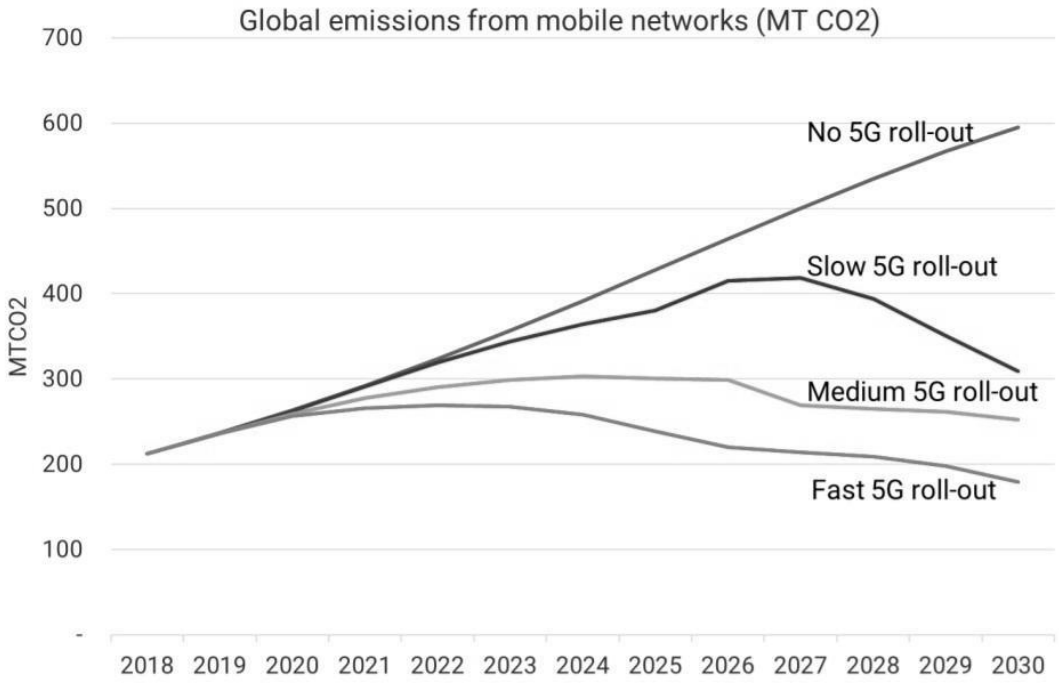
In the future, humanity will face the problem of climate change and this inevitably awaits us. In this regard, options for adaptation to already existing changes in the climate system are already being developed. For example, the rollout of 5G technology in the future will help reduce carbon dioxide emissions. 5G technologies open up new possibilities. A stable connection with minimal latency and high data protection is the bare minimum that a new generation of 5G mobile broadband can provide. According to experts, by 2030 the massive spread of 5G will help reduce carbon emissions in the EU by about 550 million tons per year. 5G transmits data more efficiently than previous communication standards, so the amount of carbon emissions will be reduced. If 5G is implemented in the four sectors that produce the most CO_2 - electricity, transport, production and construction - the emissions in the European region will be reduced by 55-170 million tons. Now only 15% of the world's inhabitants are provided with 5G communications. If the rate of adoption of the standard continues to be slow, then we will miss the opportunity to combat climate change (Ericsson, 2021, p.7).

Furthermore, digitalization can help provide emissions savings in the coming years, which will allow us to hit our intermediate emission's reduction goals, in advance of developing the hard to abate sectors in the future. Many of these benefits are already here today, including remote work, reduced travel, IoT, sensors efficiency and smart buildings' automation. Other changes rely on innovation, which can be accelerated by better connectivity, for example the required expansion in the market adoption of low-carbon electric vehicles.

5G and connectivity are decisive to solutions, representing opportunity to reductions of 20% of the EU's total emissions. A 20 percent emissions' reduction represent an enormous potential. To put this statistic in context, that's equivalent to the total annual emissions of Spain and Italy composite, and greater than the yearly EU emissions resulting from agriculture and international aviation combined

A fast rollout would see the highest and quickest realization of the benefits of 5G to energy efficiency. It would see 5G launch between 2022 and 2023, and the highest percentage of the access network run on 5G networks (up to 99% in 2030 for progressive economies). Therefore, we have assumptive the highest energy potency levels by 2030 as 2/3/4G networks are decommissioned.

We can see from the figure that Faster 5G roll-out would have a material impact on greenhouse emissions - projected CO_2 emissions from mobile networks under 4 scenarios (Laidler, 2019, p.13).



For instance, preparations are already underway in Switzerland for the widespread launch of a new high-speed mobile communication technology of the 5G generation. Nevertheless, in some regions of the country, primarily in the French-speaking cantons, there is public resistance to these plans. As well, About 70 French left-wing and Green politicians (including the mayors of Marseille, Bordeaux and Lyon) have called for a moratorium on the deployment of 5G in France.

All the same, in the short term, there are no proven negative effects of 5G "below the recommended exposure limits" (WCED, 2020, p.31).

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DISCOURSIVE DEFENSE THEORY AS A COGNITIVE PROPERTY OF INTERNET MATERIALS

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The Internet as a means of mass communication has many internal features, the main of which is cognitiveness (Gorina, 2013, p. 155-161). Cognitiveness, first of all, reveals the lifelikeness of the Web. On the Internet, the user encounters everything that surrounds him in real life, and the technical capabilities of the virtual platform often make it possible to convey information most realistically. Thanks to the combination of text, video, and audio information transfer formats, a person can perceive the information as fully as possible. Lifelikeness leads to a variety of information on the Web, a variant presentation, a huge emotional palette of presenting the same things. All of this is attractive to the Internet user. However, at the same time, the diversity of information becomes an obstacle in the process of searching, choosing a source of information, questions of trust in the author of messages on the Web, and frequent misinformation of the audience are raised. As a result, the satiation of information, the breadth of choice of information lead to the fact that each message on the Web turns into a project, the purpose of which is to attract the reader. Of course, the user can choose a reputable publication or a reputable author, but most of the messages are focused on hunting the user. Messages, which are often duplicated in terms of content, are forced to focus on design, external presentation of material, additional functions - everything that can intrigue users and keep their attention. Let's give a general description of the compositional speech means of discourse defense.

Segmentation of information - submission of significant parts of the message by independent blocks, segments (headings, announcements, headings, texts). Segmentation facilitates the visual perception of information on a page on the Web, provides a clearer understanding of the content. Thanks to the segmented parts, the reader is guided in the construction of the entire Internet page, sees the main and secondary elements, illustrations, interrelated and self-sufficient thematic blocks on the forum, website, online media, etc.

Integration is the unification of self-sufficient blocks into a single work (a composite text of an Internet media, forum, site, etc.). Integration leads to an understanding of the diversity of information, helps the user to understand the essence of the information source (media, advertising, guestbook, chat, forum, website, etc.), evaluate its content, understand its concept, structure, see the proposed options for information, many different authors. Integration leads to the interaction of different sub-discourses represented in the global discourse of the Internet. For example, on one page of the information portal 4mama.ua there are subdiscourses at the same time: "health", "sports", "rest", "children", "cooking", "woman's world", "news", "sale announcements" and others (Edimedia Ukraine, 2021). All

subdiscourses interact, forming a complex space of the Internet, emphasizing its lifelikeness (Skvortsov, 2009, p.177).

Reference - reference elements (hyperlinks) lead to the fact that the user is accustomed to reference reading, which is comparable to the headline reading of the media. A superficial reading of hyperlinks leads to a reduction in the amount of text to the level of the heading or announcement, as a result of which the heading itself changes, genres are transformed (in the Internet media). The originality of the composition, the expressiveness, and the imagery of the text is replaced by maximum accuracy, laconism with high informative saturation. A person receives most of the news by reading headlines or announcements on information portals or in the news feed of search programs, news agencies, and Internet publications.

As you can see, the text on the Internet acquires new features not only because it finds itself on a new, technically more advanced platform, but also largely due to the means of discursive defense. The message on the web is becoming much shorter, but at the same time endless. The brevity of the message boils down to the fact that more and more often the headline or lead (announcement) becomes the unit of reading. The reading becomes superficial, and the headline moves from expressiveness and originality to more informativeness and accuracy.

Thus, a message on the Internet is a project thought out from start to finish, both in terms of content and design. And the better it is thought out, the more attentively the author reacted to the use of means of discursive defense, the more advantageous his message looks against the background of similar materials, the more successfully it is sold on the Internet, the more popular it is.

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THE IMPORTANCE OF LEARNING PROGRAMMING

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Everything is getting digitalized and this fact can not be denied. We face it on daily basis and use modern technologies sometimes not even realizing how much effort it took to make something like a smartphone or even a simple Bluetooth speaker and it is not even mentioning the programming part of any of these devices. Nonetheless, you should not be scared of it just because you do not understand some basics. As an example for people who want to become good at programming but do not know where to start, first of all, you should think about what actually you want to get from it. If the answer is only financial benefits then you will probably fail sooner or later due to a lack of motivation. However, if you are actually interested in learning to program for any reason except the money that probably indicates your real interest in it. For instance, I have started learning programming from the moment when I was trading game items and at some point, I have decided that I want to make it easier by creating a bot that will notify me and show full info about the incoming transaction whenever I get any trade offer.

Besides trading, I also liked computer games so the answer was simple. Why do not I make my own game? This was not a very easy task for me as I was at the beginning stages I had to start everything from scratch. It took me all summer but the result was worth it. I have ended up with several simple but fully functional games which I have completely designed and programmed by myself.

One of my projects

Currently, I have switched from trading and game development to studying desktop app development and microcontroller programming considering it to be a part of my future career but it all would not be possible if I have not found my

interest in coding in the first place. Accordingly, why is computer programming important? As you can tell from my experience it does not matter how you begin your programmer path. Today I could not imagine my life without programming not only because it plays a huge role in my specialization but also for making me think in a different way. Coding teaches you to be persistent. If to be clear you become determined to find a way to obtain a solution using every source of information that may lead you to the right answer and as you know there is no better way to learn something except examine that something on your own. Essentially, by studying programming, you develop problem-solving skills and those are very highly demanded among IT companies. Besides it, you probably will not even notice when you start implementing these problem-solving skills in your life and not only while coding. Speaking about the other advantage of programming and programmer jobs in general. Since the job only requires a computer with an internet connection it is obvious that you can work remotely for any company without dependence on your location. This means that you will save some extra time by not going anywhere and as a result, will spend more time with your family for example. Also, I should mention that programmers can easily try to open their own business or start a startup company. Becoming self-employed has several benefits than working for someone. Firstly you can choose whatever you want to do it can be anything like an online shop, making indie games, creating websites or giving online coding courses and tutoring people online, and many more. The only thing that can limit you is your imagination. The most exciting part of it is that the competition is not very high and your idea will definitely find its client.

And secondly, you are always in charge of your workflow and it is up to you how the process will be managed.

In conclusion, I want to make the point that programming does not necessarily require any special abilities just enthusiasm, dedication, willingness to improve your skills, and your free time.

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UKRAINIAN AND FOREIGN SCIENCE: YESTERDAY, TODAY, TOMORROW

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Today, a modern person cannot imagine his life without a TV, radio, cell phone, and most importantly, without a computer. In the current world, the personal computer takes a major role in all spheres of activity, in all countries of the Earth. Of course, a few decades ago, no one used a PC and at the same time did not have any conveniences, but the world does not stand still and it is necessary to keep pace with the times.

For the majority of people, the PC is an object that in one form or another is central in everyone's life. After all, with the help of a computer, we can play video games, watch films, TV series, listen to music, learn useful information, news, meet, communicate with people who are in another part of the earth, and much more. And all this can be done using a computer. Recently, computer technology has been understood as information technology, namely the use of computers and software for storing, processing, protecting the transmission, and receipt of information.

The beginning of the 21st century is identified with the emergence of the information society. The computer in the information society is a constituent part.

Information community is a theoretical concept of a post-industrial society, the historical phase of the possible development of different civilizations, in which information and knowledge become the main supplies of production. Unique features: increasing the role of information, knowledge, and information technology in the life of society, an increase in the number of people employed in information technology, communications, and the production of information products and services the growing information industry of society using telephony, radio, television, the Internet, as well as traditional and electronic media; creation of a global information space that provides effective information interaction of people, meeting their needs for information products and services and access to all world information resources.

Nowadays, technical specialties are in great demand against the background of today's robotics and computer science progress. Over the past 15 years, IT technologies have become the center of human progress and development. The IT technology we already know and are accustomed to has paved the way for us to innovate the world further, and this list of current and future technologies certainly has the potential to change our lives even more. It depends only on whether the motivating person who is interested in the field of IT technologies will be able to improve and enrich their knowledge in this important and popular field.

Currently, almost all organizations need information services, processing a large amount of information. One of the main technical means for transmission, perception, processing of information is a computer. The role of the computer is an effort of the intellectual capabilities of a person and society as a whole, serving for

communication and transmission of information. The concept of new information technology also includes communication technologies that ensure the transfer of information in various ways, namely, telephone, radio, telegraphs, and telecommunications.

So in conclusion, it can be noted the formation and improvement of information technology is one of the main factors in society. The spread of IT transforms people's lives, makes work easier, gives more free time, and brings development in the economic, cultural, educational, and other spheres. Modern society is filled and permeated with streams of information that need to be processed. Therefore, it cannot function normally without information technology, as well as without energy, transport, and chemical technologies.

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3-D MODELING IN MEDICINE. PROSPECTS FOR THE DEVELOPMENT OF PROTHESES AND IMPLANTS

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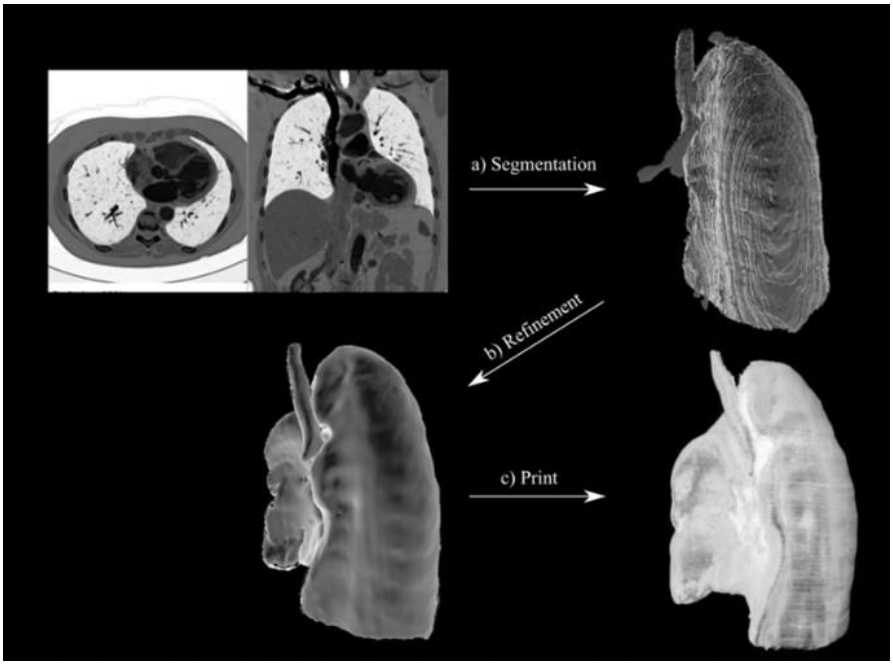
3-D modeling is an industry of computer technology that has made a breakthrough in medicine over the last century. It is used in various fields, such as industrial production, film and video game creation, design and advertising, research and engineering, etc. 3-D modeling has a wide range of possibilities, such as:

1) Organ scanning and fabrication.
2) Creation of implants, axial creation of a patient model
3) Creation of artificial bones, tissues, blood vessels, veins and even organs of the patient.

Creating a model is becoming cheaper and better. The probability of error is minimal. Simulations help in the operations themselves too. It is much easier for doctors to perform surgery on a pre-examined organ. It is important for the surgeon to know the contours, shape, features of the tumor in three dimensions. Components of the operation using the model:

1) Scanning
2) Plastic model
3) Analysis of
the method of treatment
4) The treatment itself



Many successful operations have been performed:

In Connecticut, a successful operation was performed to replace part of the patient's skull. This element was created in the program and printed on a 3-D printer.

The implant is perfect for the patient. It took only 2 weeks to create everything for the operation.

Princeton University has developed and printed a bionic ear that contains a radio-sensitive antenna and living cells.

One American company created small artificial liver fragments using 3D printing.

In dentistry, temporary crowns are made using 3D printers.

The time will soon come when the production of prostheses and implants on the printer will be put on the assembly line, and this will be a real breakthrough in the fight against disability.

A group of scientists from the Higher Technical School of Zurich Switzerland in 2017 made the world's first heart

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ANALYSIS OF DATA SORTING ALGORITHMS

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At present, information is extremely valuable. Every second a large amount of data is generated, and it needs to be processed in some way – stored, analyzed and sorted. That is why the problem of data sorting is of great importance.

Here are some of the most important uses of sorting:

1) solving grouping problems, when it is necessary to collect all the elements with the same values of a feature;

2) search for common elements in two or more arrays;

3) search for information on the values of keys.

Sorting methods are an excellent illustration of the basic concepts of algorithm analysis – quality assessment of algorithms, which, in turn, allows us to reasonably choose one method among the seemingly equivalent ones. After all, each sorting algorithm has its own characteristics, which is reflected in the execution time (Knut, 2020).

To determine the efficiency of the algorithm, the concept of computational complexity is used, which denotes the dependancy function of the volume of work performed by some algorithm on the size of the input data (Stephens, 2019). Workload is usually measured by the amount of time and space it takes up in memory. Time is determined by the number of elementary steps that are required to solve the problem. With Big O Notation, we can mathematically describe what behavior an algorithm will take in a worst-case scenario for data sets of different volumes.

For comparison, arrays of numbers in the range from 1 to 100 of 10, 100, 1000 and 10000 elements are taken. Five classical sorting algorithms of different principles of operation and computational complexity are implemented. For example, the known bubble sort has a computational complexity of O (n^2) (see Table 1) in the average case, in contrast to Shell sort, where the result depends on the choice of step (Cormen et al., 2019).

Table 1

Sort name	**Program execution time, s**				**Computational complexity**
	10 el.	100 el.	1000 el.	10000 el.	
Bubble sort	0.179	0.245	0.774	5.895	O(n^2)
Shell sort	0.18	0.238	0.723	5.794	Depends on the choice step
Merge sort	0.184	0.247	0.811	5.617	O(n*log(n))
Quick	0.1	0.2	0.76	5.782	O(n*log(n))

sort	87	28	7		
Tree sort	0.181	0.308	0.742	4.935	O(n*log(n))

However, there are more efficient sorting algorithms, for example, merge sorting based on the principle of "divide and conquer", which offers the division of the problem into several simpler subtasks, recursive solution of which leads to the solution of the initial problem.

The fast sorting algorithm is also based on the "divide and conquer" paradigm and, like merge sort, has the computational complexity O (n*log (n)) (Table 1): if the sequence needs to be placed in ascending order, then in the left part all the elements whose values are less than the reference element will be placed, and in the right – the elements whose values are greater than or equal to the reference. Then the recursive execution of the above part of the algorithm for each of the subarrays is performed. In addition, a binary tree sort algorithm is effective, which consists in constructing a binary search tree by array keys with the subsequent formation of the resulting array of ordered elements by directly traversing the tree.

Thus, according to the results of the studies (Cormen et al., 2019; Knut, 2020; Stephens, 2019), we can conclude that the most effective sorting algorithms among the mentioned above are the algorithms that use binary search tree, merge sort and fast sort, in contrast to, for example, the bubble sort algorithm, which is the most resource-intensive.

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METAVERSE: IS IT WORTH OR A GLOBAL CURSE?

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2021 – April

World experts notify that more than 500 million Facebook users' data were leaked online.

2021 – October 4 15:40 UTC

Facebook, Instagram, WhatsApp are down. The work of the services was stopped for more than 7 hours.

2021 - October 28

Mark Zuckerberg announced the new corporate name for Facebook – Meta and disclosed plans to build a "metaverse".

Looking at such chronicles, you inadvertently wonder what can be expected from such a near future, while in the present things are not so rosy.

Take, for example, statistics on the amount of time people spend online. Due to last research and statistics, on average, a person spends 145 minutes a day on social media. It's almost 2,5 hours a day – not little, but things don't seem to be so critical. But what if we look at the numbers on a different scale. Find, that we spend up to 7 years in a lifetime using social media. (Average time spent daily on social media (latest 2020 data), 2020) After such statements, the current state of affairs becomes frightening.

But quantity is only one side of the coin of spending time this way. Unfortunately, things are even worse with its quality. What awaits the average platform user from the moment he enters the network? Manipulation, propaganda, incessant notifications, reminders, unwanted video autoplay, data collection and advertising, advertising and advertising again. And what's the worst, people cease to belong to themselves. They get hooked on the needle and their addiction is a source of income for corporations.

Let's look at the facts. Remember the October 4 mentioned earlier? Then during the seven-hour "stagnation", consider that Facebook (already Meta) lost almost all its users for a while, or in other words, about 6 billion dollars. But it is worth paying attention to other indicators: the number of people who have "defected" to other platforms (e.g., Signal, Twitter, Telegram) in this short period of time. "The daily growth rate of Telegram exceeded the norm by an order of magnitude, and we welcomed over 70 million refugees from other platforms in one day," Pavel Durov wrote on his Telegram channel (Sauer, 2021).

This data does not just tell us, it screams to us, that the population is dependent on something that does not even exist in the physical world. And what happens if we take the virtual world out of the electronic device and integrate it into our space?

This is what the metaverse is all about. The more 'academic' definition is this 'metaverse is a shared virtual environment that people access via the internet. It combines aspects of social media, online gaming, augmented reality (AR), virtual

reality (VR), and cryptocurrencies (Folger, 2021). By the way, AR and VR are already quite popular in the game and movie sphere.

It would be foolish to argue that this organization of functionality is very effective: almost instant access to the necessary platforms, saving physical effort and space, simplifying and schematizing the execution of tasks.

The metaverse is where the physical and digital worlds come together. It is a space where digital representations of people – avatars – interact at work and play, meeting in their office, going to concerts, and even trying on clothes (Milmo, 2021). But now it begs the question: don't they want to take too much of our real lives?

As it stands today, with access to every component of the potential metaverse separately, we are still fish who could be caught on the company's hook. If the idea of a meta-universe is realized as envisioned, wouldn't each of us become a controlled puppet for the very people who chase our attention every day and try to anticipate our actions?

In total, in terms of technology and engineering, the metaverse is a serious stage in its evolution. But in terms of humanity? Should we replace real communication with chat rooms or online meetings, real clothes with skins bought in the virtual world, ourselves with avatars? I think not.

Until users on one side of the screen learn to manage their own lives, and employees on the other side learn not to put finances above moral principles, we will not expect anything exceptionally positive from technological innovations.

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OXIDATION METHOD FOR TREATMENT OF WASTEWATER FROM DYES (ON THE EXAMPLE OF THE "SUNSET YELLOW" - E110)

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Contamination of surface and groundwater sources with anthropogenic substances, which include insufficiently treated wastewater containing surfactants, dyes, and other compounds, is currently a very painful environmental problem for society. Therefore, water purification from dyes is relevant today and, in my opinion, in the near future.

The presence of anthropogenic organic matter in water poses is a serious threat to human health.

Water purification from organic pollutants is usually carried out by two methods:

- oxidation (destruction) - chlorine, ozone, oxygen are used as oxidants;
- sorption (absorption).

Among the methods used to treat wastewater from organic pollutants, preference should be given to methods of advanced oxidative processes, namely:

- ozonation;
- ozonation together with the use of ultraviolet radiation.

This method (H_2O_2 together with the use of ultraviolet radiation) was chosen by us for research. The method of spectrophotometry was chosen to assess the quality of the purification.

The experiments were performed in the laboratory using the installation (Figure 1) to determine the effect of UV and H_2O_2 on the processes of destruction of the dye E-110 at its various mass fractions.

1- Magnetic stirrer
2-Chemical beaker with dye
3-UV lamp
4-Ultraviolet light reflector
5-Power supply
6-Box

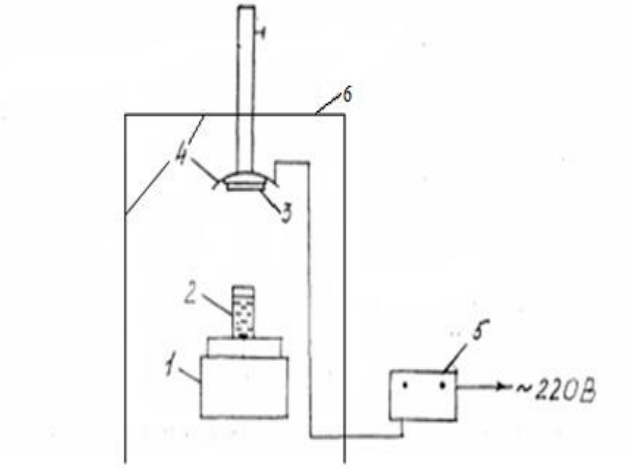
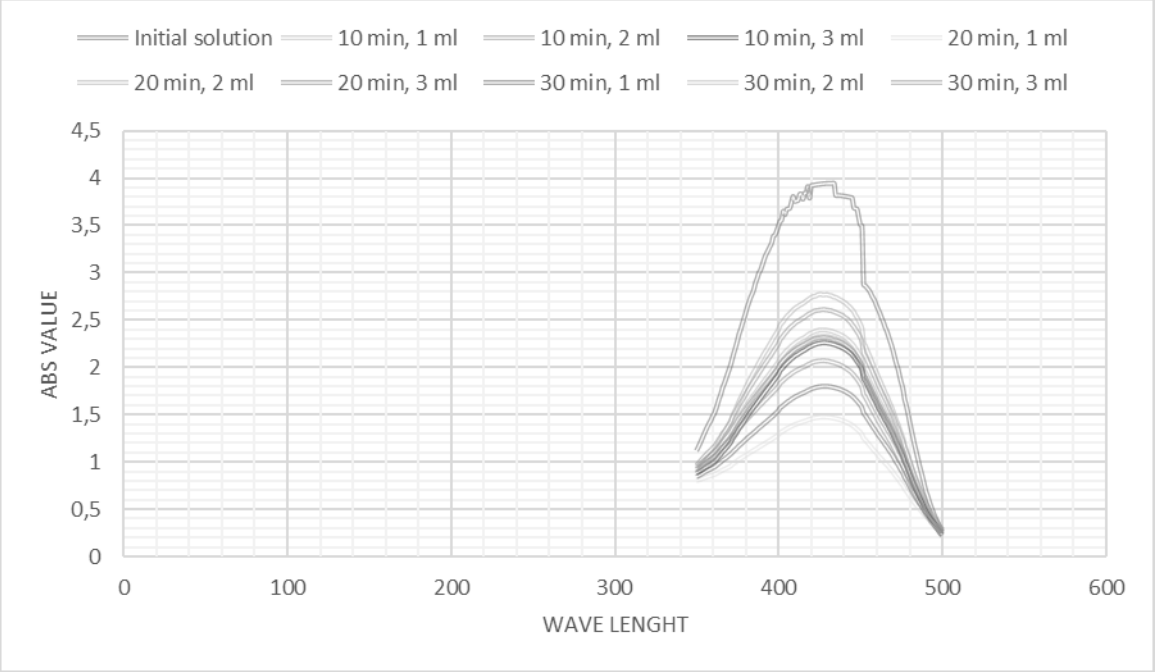


Figure 1

To confirm the effectiveness of removing the E-110 dye from the solution, a series of experiments were performed using a model solution with an E-110 dye concentration of 25 mg / dm^3 and 50 mg / dm^3. The experiment was performed at different values of H_2O_2 content (1, 2, 3 ml of 30% solution) with additional irradiation of water with ultraviolet light.

The following graph presents results of spectrophotometry measurements (the lower the abs value, the cleaner the water) after the total effect on the selected dye E-110 of different amounts of the substance H_2O_2 (1, 2, 3 ml of 30% solution) for 10,

20, 30 minutes and at the same time ultraviolet radiation, in comparison with the initial solution with a concentration of 50 mg/dm^3.



This graph clearly shows that with the combined action of ultraviolet radiation and hydrogen peroxide, the value of Abs decreases more than twice, what means that water become cleaner. There is also an obvious relationship between the operating time, the amount of H_2O_2, and the quality of water purification

- The chosen research method was analyzed, namely - oxidative method of wastewater treatment from organic pollutants;
- Among the known methods, the method of spectrophotometry was chosen to qualitatively assess the purification of the aqueous solution from the dye E-110;
- The combined use of H2O2 and ultraviolet light proved to be the most effective method.

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EQUIFAX AND CREDIT REPORTING COMPANY. CASE STUDY

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In 2017 Equifax reported a data breach in which the records of 147 million people had been exposed, mostly of people in the US, but 693,665 people in the UK also had their data exposed. Equifax UK later wrote letters to each of these people explaining the situation (Your credit. Your identity).

The exposed data contained millions of names and dates of birth, Social Security numbers, physical addresses, and other personal information that could lead to identity theft and fraud. Equifax had a system to monitor network traffic, but it wasn't working for the previous 19 months because a security certificate hadn't been renewed.

Equifax stored its data in a database called ACIS and was alerted in 2017 to a critical security vulnerability in an Apache Struts web server that provided access to this database. A patch had been issued but Equifax failed to ensure that the patch was installed. Hackers exploited this vulnerability until the missing certificate was installed at the end of July 2017 (ACIS Database).

So how do the principles of CIA apply to the Equifax case? Quite obviously, confidentiality was violated: unauthorised people could read the data. However, authorised users still had full access to the data, so it remained available; and the data was not changed, so its integrity was preserved.

Time for another definition. When talking about valuable data we use the term 'information assets'. In the Equifax case the information assets were the data about people and their financial records, collected by Equifax. When we consider security of online communications and services, we also need two additional concepts: 'authentication' and 'non-repudiation'.

When we receive a message, we want to be confident that it really came from the person we think it came from. Similarly, before an online service allows a user to access their data, it is necessary to verify the identity of the user. This is known as authentication. Non-repudiation is about ensuring that users cannot deny knowledge of sending a message or performing some online activity at some later point in time. For example, in an online banking system the user cannot be allowed to claim that they didn't send a payment to a recipient after the bank has transferred the funds to the recipient's account.

Finally, there are a number of terms associated with software that attempts to harm computers in different ways. Collectively these are known as 'malware' (a contraction of malicious software). Depending on what the malware does, different terms are used in relation to it.

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THE METALLURGICAL INDUSTRY IN UKRAINE

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The metallurgical industry brings together companies that consistently perform the extraction, enrichment, metallurgical processing of ferrous and non-ferrous metals and non-metallic raw materials (called fluxes and refractory materials), the production of pig iron, steel, non-ferrous and precious metals, alloys, rolling production, processing of scrap metal.

The main consumers of metallurgical products are mechanical engineering, construction and transport.

The metallurgical industry includes both ferrous and non-ferrous metallurgy.

Ferrous metallurgy is one of the most developed industries in Ukraine, accounting for more than a quarter of all industrial products. Produces cast iron, steel, rolled products, ferroalloys, pipes, etc. It is a material-intensive industry: around 3 tons of iron ore, 1.1 tons of coke, 20 tons of water, as well as manganese ores, limestones, fluxes, etc. are needed to melt 1 ton of cast iron. Therefore, ferrous metallurgy companies are located near or between sources of raw materials or fuels.

Ukraine has large reserves of iron and manganese ores, coking coal, fluxes and refractories for industrial development, their deposits are very well combined - mainly in the Dnipro and Donbass.

In terms of the production of ferrous metallurgy, Ukraine has long been one of the leading countries in Europe and the world. So, in the 80s of the XX century. Each year, from 120 to 125 million tons of iron and 7 million tons of manganese were mined there, and 55 million tons of steel were smelted.

Currently, these figures are much more modest - about 55 million tons of iron ore, less than 3 million tons of manganese ore, 32 million tons of steel (2000). However, Ukraine still ranks seventh among the world's largest steel producers. In recent years, the production of rolled products, ferroalloys, steel tubes has been constantly increasing. These goods are exported in large quantities out of Ukraine; In general, the products of ferrous metallurgy give the country the most foreign exchange earnings from exports.

Ferrous metals are traditionally smelted in full cycle plants, which cover all the final stages of metallurgical production, as well as the production of coke (metallurgical fuel from special grades of coal) and agglomeration (lumps of ore from iron fired from limestone and coke). Each of the industries has waste and by-products which are raw materials for other industries - chemicals, building materials, metalworking.(1)

Companies in these industries, as well as heavy mechanical construction plants, have an advantage in locating near metallurgical plants. Thus, ferrous metallurgy has an important value of complex formation, on its basis multidisciplinary units are formed.

The largest metallurgical factories in Ukraine are:

Kryvorizhstal,

Azovstal (Mariupol),
Zaporizhstal,
Dniprovsky (Dniprodzerzhynsk),
Alchevsk,
Makéevski.

Large metallurgical plants that do not have a complete metallurgical cycle - Donetsk, Yenakiyevo, two Dnepropetrovsk and others. The production of ferroalloys (alloys of iron with other metals to obtain high-quality steel grades) is concentrated in Zaporizhzhia, Nikopol, Stakhanov and pipes - in Nikopol, Novomoskovsk, Dnipropetrovsk, Mariupol, Makiivka, Khartsyzsk (1).

Ferrous metallurgy enterprises are located in three metallurgical districts - Prydniprovsky, Donetsk and Pryazovsky.

The Prydniprovskyi district was formed on the basis of the extraction of iron ore from the Kryvyi Rih, Kremenchug and Belozersky basins, manganese ores from the Nikopol, Velykotokmatsky deposits, flows from the Dnipropetrovsk region, imported coke and refractories (from Donbass). The metallurgical divisions of Dnipropetrovsk (Dnipropetrovsk, Dniprodzerzhynsk, Novomoskovsk), Zaporizhia, Kryvyi Rih, Nikopol (Nikopol, Marganets) and Kremenchug were formed here.

Donetsk region was born near coking coal deposits on the basis of processing ores from the Dnieper region ("pendulum" principle - cars with coke go to Dnieper factories and return with iron ore and manganese). Metallurgical subdivisions were formed - Donetsk-Makeyevka, Alchevsk-Almaznyansky, Yenakiyevo and separate metallurgical centers - Kramatorsk, Khartsyzsk, Kostiantynivka.

Priazovsky district used poor iron ores from the Kerch basins and rich Kryvyi Rih and Belozersky, manganese ores from Nikopol, coke, fondants and refractories from Donbass. However, iron ore companies on the Kerch Peninsula have suspended their activities. So, the district now includes two metallurgical enterprises in Mariupol (one of them - the "Azovstal" plant - the largest rolling mill in Ukraine).

Important problems of Ukrainian ferrous metallurgy are the need for technical and technological re-equipment of production, improvement of the quality of ferrous metals, production of new types of steel and rolled products. So far invaluable, environmentally friendly methods of producing ferrous metals, in particular electrometallurgy (the largest plant - Zaporizhzhia) and powder metallurgy (the only plant operates in Brovary near Kiev)

Non-ferrous metallurgy, unlike ferrous metallurgy in Ukraine, is relatively undeveloped. It has several characteristics: a) the ores contain a small amount of metal, which necessitates the establishment of numerous non-ferrous metallurgy companies close to the sources of raw materials; b) non-ferrous metal ores contain many different metals, which requires the integrated use of raw materials; c) industry requires a lot of energy and water, and also has a negative effect on the environment. Thus, its location and development are influenced by energy and environmental factors.(2)

In the structure of non-ferrous metallurgy of Ukraine, the first place is occupied by the aluminum industry. It works on imported raw materials (bauxite

from Hungary, Africa, Russia), its companies are located near ports and in places of electricity production. The branch is represented by the large Nikolaev alumina plant, the output of which (alumina - a semi-finished product for receiving metal) is used in Ukraine; it is sent to Russia. There is an aluminum plant in Zaporizhia and an aluminum alloy plant in Sverdlovsk (Luhansk region).

Other branches of non-ferrous metallurgy include the production of magnesium (Kalush), titanium and magnesium (Zaporizhzhya), mercury (Horlivka), ferronickel (Pobuzhye, Kirovohrad region) and gold (Muzhievo, region of Zakarpattia). These industries work on their raw materials, the safest of which are the titanium (ore deposits of the Zhytomyr and Dnipropetrovsk regions) and mercury (Donbass) industries. In Kostiantynivka, a zinc industry was created on imported raw materials (2).

There are two districts of metallurgy of non-ferrous metals in Ukraine - Donetsk and Prydniprovsky. The Carpathian district is promising.

Among the problems associated with the development of non-ferrous metallurgy, the most important are air pollution, the accumulation of a large number of rocks, the incomplete use of raw materials.

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HOW TO USE FRACTALS IN GAMEDEV

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A fractal is an infinite self-similar structure made up of parts that are similar to the whole object. In simpler terms, it is an infinite division into parts.[i]

Fractals are very common in nature. A striking example is the snowflake. It is formed by condensation and crystallization. Due to the structure of the water molecule, angles of only 60 or 120 degrees are possible between the rays of the crystals. In this way, the crystal has the shape of a regular hexagon, with other crystals appearing on it and on each ray, new crystals on new rays and so on until a certain moment. This phenomenon is called bifurcation. The bifurcation can be biological (circulatory system), geographical (division of the river into smaller and smaller streams), physical (Brownian motion) etc.

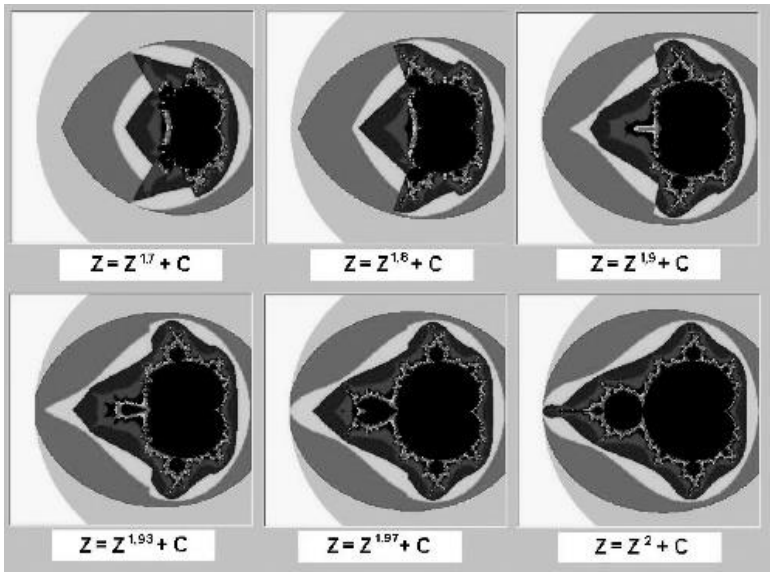

Fig. 1 Mandelbrot- Julia set (Labut, 2008)

Let's leave the terminology and get down to business. So, how can we use a fractal in a gamedev? There are many elements that you have to draw yourself, but it is not necessary. These are elements of the environment, such as: bushes, trees, clouds, mold, mountainous terrain, ocean surface It is possible to simplify the work of game designers and just write all these little things down with formulas, for example: $f(z) = z^n + C$ (Julia set: $f:C \to C$, $J(f) = \partial \{ z: f(n)(z) \to \infty, n \to \infty \}$, but of course it is not the only one, because there are many other ways to present a fractal). This is done using complex numbers: $C = x + iy$, where x and y are real numbers, and i is an imaginary unit ($i = \sqrt{-1}$) (Raba, 2007, p. 31).

These formulas apply to the plane, but it is not necessary to build fractals only on it. This can be done in three-dimensional space thanks to the Mandelbrot set. Complex numbers are not used here, but quaternions are used, which are hypercomplex numbers : $H: = (a_1 + a_2 i + a_3 j + a_4 k \mid an \in R)$, in which $i^2 = j^2 = k^2 = ijk = -1$ (Raba, 2007, p. 27).

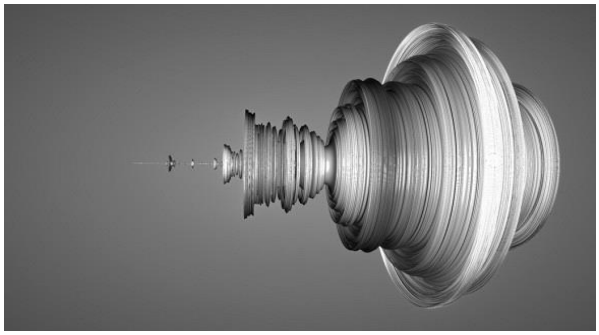
Fig. 2 Mandelbrot's quaternion (Shakhov, 2014)

For practical use, this way you can build fern leaves (Barnsley's fern).

In addition to gamedev, such technologies can be used in graphic

design and book illustration as a decorative element. In general, there are many areas where you can combine fine arts and mathematics from fashion to bioart.

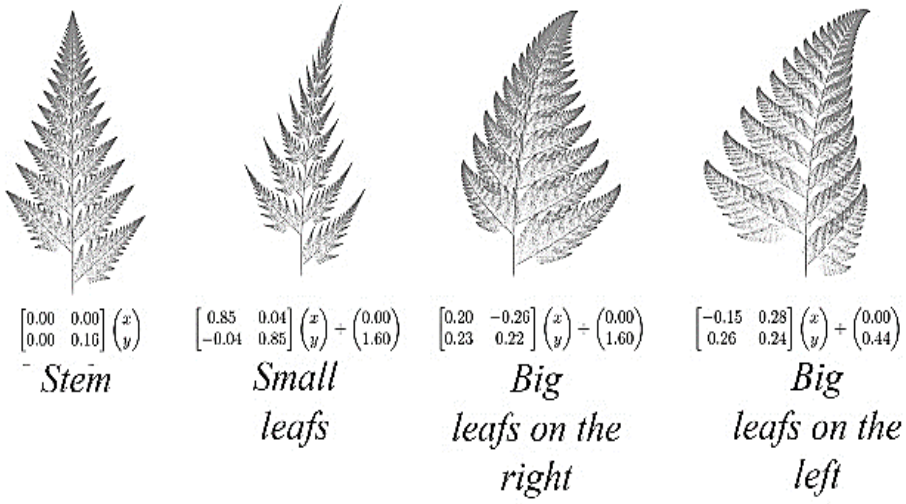

Fig. 3 Barnsley's fern (Vectozavr, 2020)

Fractal graphics is a very promising area, with it you can not only create fractal game engines, that will increase the productivity of the gamedev industry many times over, but also explore chaotic biological structures such as our brains (Wai Tsang, 2016, p. 426). It has certain advantages: it does not take up large amounts of data, allows for detail and is easy to modify images. It also will help us understand the structure of the universe better, because fractals exist almost everywhere and, perhaps, they are the answer to our questions.

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FACE ID

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In 2017 iPhone presented the 10th generation of their product line and introduced a new function, which provided the users with the ability to keep the phone safe.

Nowadays it is important to keep information on our devices private. Different companies try to find out the latest security technologies, so that their devices could be sold faster than others and make a profit for the corporation. As a result, engineers from Cupertino have developed one of the most secure and innovative user identification systems in the field of consumer electronics.

How does Face ID work?

First of all, it does not depend on the camera, as the majority of users think. The phone is equipped with a special three-dimensional scanner of the human face, so that the module of cameras and sensors recognizes not just a flat portrait of a person, but his three-dimensional model. For each pixel received, the sensor detects the distance to it forming the depth of the image. The distance to each point is calculated by fixing the beam flight time. Thus, it is not significant if a user wears makeup or beard, as it does not change the distance between your face features or all the 3D structure.

Moreover, the Face ID technology is self-learning, the neural networks in the iPhone processor memorize the user's face more accurately with time and begin to work better in more complex conditions.

Can it be considered as a reliable technology?

- To avoid inadvertent authentication, the system requires scanning the face with eyes open looking towards the camera. This means that it is impossible to unlock the phone by scanning while sleeping.
- Furthermore, the scanner needs a 3D model, so the device will not be unlocked with a flat image.

Nevertheless, researchers suggest that it has a disadvantage. Facial recognition responds to the twins and in most cases consider them as the phone’s owner.

Face ID gives a possibility not to enter a password every time you have to do some actions with your phone. It is just possible to look at the zone where the camera is located and confirm your personality. In this way financial transactions can be reaffirmed and the user is capable of having access to all the information, which is stored on the phone.

Taking everything into account, this new technology is secure enough and could be a reliable replacement for passwords and other ways of device protection in future.

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HOW DOES AN ELECTRIC GUITAR WORK

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Today it is hard to imagine the music culture without electric guitars. Since they were first created in the 1930s, they have been widely used by dozens of musicians all around the world. Electric guitar became a symbol of protest in world culture. But how does an electric guitar actually work?

The main difference between electric and acoustic guitars is the way they use to represent the sound. In case with the acoustic guitar it is clear that the sound comes from the sound hole and it is already loud enough. By describing the sound system of an electric guitar we will need to focus on the electronics and some basic laws from the electromagnetic field.

The component that is located under the strings is called “Guitar Pickup”. Guitar Pickup is the most important part of every electric guitar. It is just a long wire that reeled up around the magnets. The amount of magnets is usually equal to the amount of strings. Such system in physics is called an inductor.

Now let's move from the “hardware section” to the software. As it was said before, there is one string above every magnet of the inductor. Magnet is able to magnetize the string in the region above the magnet. When the string vibrates, the flux of the magnetic field vector through the inductor changes. It causes the appearance of the Electromotive force in the inductor. This basic law of electromagnetism was discovered independently by Michael Faraday in 1831 and Joseph Henry in 1832 and today is known as Faraday's law of induction.

The Electromotive force in the inductor now causes a current which transfers to the guitar preamplifier. In the preamplifier the signals are processed and amplified. From there the strong enough signals transfer to the amplifier where they become strong enough for being represented out of dynamics.

Also, before pre-amplifying the signal, it can be deformed in the effects unit. It will give a more specific sound. The effects unit is able to change the input signal. It is able to change the frequency, to reduce the volume of loud sounds or to amplifie quiet sounds, to delay the signal and even to change the separate parts of frequency response. By the way, today it is rare to hear songs with a clear guitar sound.

Now it is clear that electric guitar doesn’t replicate the quiet sound of strings and emit it from the dynamic. The concept is to convert the mechanical vibrations of the strings into electrical signals. The output signal can be easily changed in any way in order to receive the desired sound. Throughout almost one hundred years the technologies of electric guitars have been discovering not only by musicians but by engineers as well. Numerous experiments with changing the properties of signals helped in formatting the full picture of how the electric signals can be represented as music. Also dozens of experiments were made with shapes and properties of pickups. Such concept would not be possible without electrodynamics laws which were discovered in the 19th century.

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ASSEMBLY LANGUAGE IN MODERN PROGRAMMING

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Assembly is one of the first programming languages made to ease the process of human-computer communication. Before its invention in 1947, the main ways of transferring information to the IBM was manually written in machine code commands, which is literally a set of zeros and ones, or inserting a special card with premade holes that represented each bite directly. It could hardly limit the max program size, as well as the speed of information insertion and receiving and programming itself, because humans are not designed to understand that type of info. Therefore, Assembly was born. It greatly simplified the process of writing computer instructions by making them look much more word-like, automated assembling and translation of the code, and first presented the feature that, years after that became the basis of all high-level programming: operators of nonlinear program compilation/execution. Firstly, they were used for making loops and “forks” in a program, that shorten an average code size a lot, and now all the modern “high-level” things such as classes, functions and so on are written using them, so it is not an exaggeration to say that it was a revolution.

It is important to note that despite the usage of the expression "assembly language" in our article, it would be more correct to say that this is a group of languages similar in type, functionality and application areas, but sometimes differing in syntax and some details. Each manufacturer of processors, controllers, or other machines that need low-level code creates their own separate language corresponding to the machine instructions that the product supports. However, large corporations such as Intel and AMD, in order to maintain backward compatibility of their programs (when a program written for an early version of the processor is guaranteed to work on a later version), over the years, they maintain and update the same "language", which is usually meant by, for example, learning the assembly language.

In the modern world, despite the emergence of more and more high-level languages, knowledge of assembler is again becoming prestigious and well-paid. A programmer who knows assembler as a "second language" can write a much better code than a programmer with similar qualifications who does not know this language. Moreover, such an employer is able to write a much more optimized code for solving a specific task and coping with a program debugging and reverse engineering, if necessary, which is, among other things, a great advantage when hiring. In addition, all that is due to a deep understanding of the work of the processor itself, ways of implementing individual functions, commands and directives of higher-level languages. This is literally a consequence of the specific structure of the language itself.

Specialized on low level coding, Assembly remains one of the hardest languages to master. It is important to understand that low level programming languages communicate to the computer directly, and are used when memory and speed of the program are our main concern, when high level languages are made in a way to be easily understood by a person reading the lines of code, and in the end it does not require much time spent on writing. So to say, a program written on Assembly works times faster than an analogical program written on any high level

language. However, in the same example when a high-level code can take a page, the same code on a low-level language takes up to 10-20 pages.

Although in many cases when a low-level language has to be used Assembly was replaced with C, there are still some instances where it is irreplaceable. For example, it is still used in:

1) drivers
2) programming of microcontrollers and embedded processors;
3) pieces of operating systems where it is important to ensure the speed of work;
4) antiviruses (and viruses).

Memory aspect. As written above, Assembly programs are incredibly effective in terms of memory. That is why drivers are written in this language, which is embedded directly into devices, or control programs that occupy several kilobytes. Such a program is written for a specific processor and uses its capabilities on its full potential.

Speed aspect. Assembler allows you to work with the processor and memory directly - and to do it very quickly. The fact is that in Assembler, almost no processor time is wasted. If the processor is clocked at 3 gigahertz - which is about 3 billion processor instructions per second - then a very good Assembler code will execute about 2.5 billion instructions per second. For comparison, JavaScript or Python will execute a thousand times fewer commands in the same time.

So, now it is obvious that if a person determines to connect their life with informational technologies it would be quite useful to understand the way operations go inside the CPU of the machine, where all operations are performed using mainly the exchanges between registers. While in Python, for example, you do not have to write the lines to do such operations directly, in Assembly you have to do this directly through code.

In addition, in a more abstract example, a person does not have to understand how a certain machine is constructed in order to use it. However, if you know this, you can easily diagnose a problem, understand how to solve it. It is the same with Assembly: to understand how a program works, how to debug it, diagnose it, understand what does not work - that is what Assembly is needed for.

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APPLICATION OF ELECTRONIC SENSOR EVALUATION SYSTEM IN MARTIAL ARTS (TAEKWONDO)

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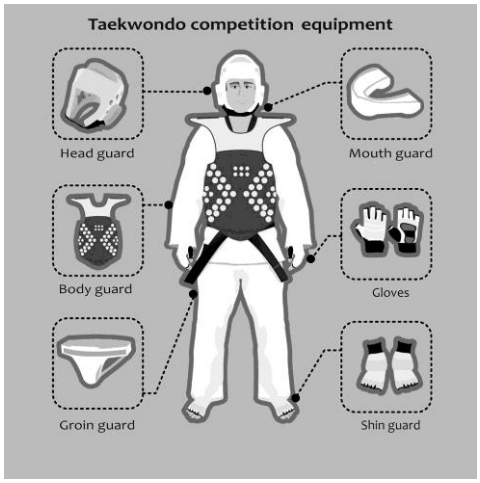
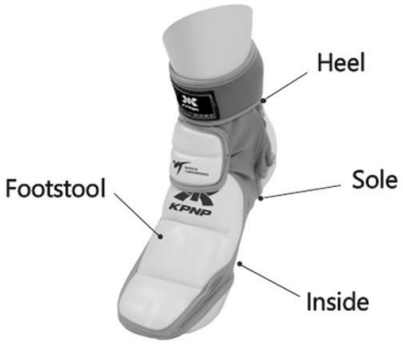
The 21st century is the age of information technology. Thanks to technological advances, many processes that were previously performed manually by humans have been automated. Sports are no exception. In sports management and refereeing, technology incredibly simplifies the work of not only referees, but also athletes and their coaches. This ensures a fair assessment of the performance and guarantees the athletes a fair victory. Taekwondo is a prime example of the introduction of technology into sports.



Taekwondo is a Korean form of martial arts that is characterized by punches and kicks with an emphasis on high kicks, spin jumping, and swift kicks. Physical training in taekwondo is focused and strengthens the fortitude with the help of psychological weapons. Under World Taekwondo and Olympic rules, sparring is a full-contact event, employing a continuous scoring system where the fighters are allowed to continue after scoring each technique, taking place between two competitors in either an area measuring 8 meters square or an octagon of similar size.



Before the fight, the athlete must wear a uniform, protection for arms and legs, electronic equipment (special socks, a protector (vest) and a helmet with electronic sensors). When touching the sensors in the socks with the protector or helmet of the enemy, the electronic system calculates the force of the impact. If there is enough strength, the athlete earns points depending on the difficulty of the blow.

The control of the course of the fight is carried out using a special electronic scoring system. There are software from various brands such as Adidas, Daedo and Armor Hardware.

A computer with software, joysticks, a helmet, a vest (protector), socks with sensors are the main electronic equipment for fighting.

Socks with electronic sensors:

- Provide protection for the athlete's foot.
- In contact with the protector or helmet of the enemy, it transfers the level of force of the blow to the computer for setting points.

Joysticks:

- Wireless triggers make it easy to set up competitions.
- Judges can move more freely without wires.

Vest:

- Not affected by sweat or water.

- Very durable proximity and impact sensors.
- Double touch system for improved accuracy.
- Sensors over valid scoring areas.

Details:

- The impact sensor measures the impact level depending on the strength and speed of the impact.
- Proximity sensor - recognizes contact with the correct part of the body for assessment to avoid mistakes.
- Transmitter - receives information from sensors and sends information to the scoreboard.

Helmet. Product feature:

- Additional element for an automatic 3-point course.
- Automatic scoring.

Details:

- Sensors built around protective gear.
- The transmitter is connected to an electronic headgear.

In conclusion, I would like to say that the development of electronics also directly affects the development of sports. I believe that over time, technology will be able to fully control and evaluate the course of any sporting event.

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METHOD OF RESEARCH OF HEAT-INSULATING PROPERTIES OF MATERIALS USING ARDUINO NANO

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The preservation of non-renewable resources in the modern world is a very important issue. Thermal insulation materials help in this. They reduce heat loss in

the room, thereby saving resources that would be spent on maintaining a stable temperature. The estimation of the thermal insulation properties of materials can be carried out using a theoretically substantiated and experimentally tested in our work installation for determining the thermal conductivity coefficient.

The developed algorithm according to the author's methodology allows conducting research on popular insulators and, on the basis of the results obtained, draw conclusions about the thermal insulation qualities of insulators and assess their compliance with the standards declared by the manufacturer. The invention is devoted to the creation of modern technologies for studying the heat-insulating properties of materials and the development of methods for measuring the thermal conductivity of heat-insulating materials.

The existing methods of studying the heat-insulating properties of materials are analyzed, which make it possible to measure the coefficient of thermal conductivity of heat-insulating materials. An own technique for studying the heat-insulating properties of materials has been created, which allows measuring their thermal conductivity coefficient, assessing the compliance of the actual characteristics of the main working properties with those characteristics that were declared by the manufacturer. To simplify the mathematical apparatus, we investigate the stationary thermal regime, when the temperature of the test sample does not depend on time.

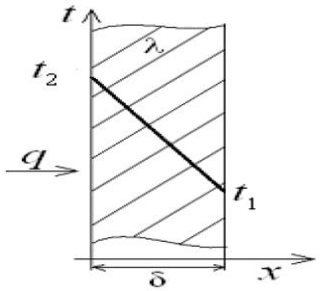

Fig. 1.1- Flat homogeneous sample in a stationary heat flow *(source: author's development)*

Consider a flat homogeneous sample (Fig. 1.1) with a thickness δ with a constant thermal conductivity λ. Temperatures t1 and t2 are maintained on the outer surfaces of the sample. Thus, a stationary heat flow passes through the sample. Heat flux is the amount of heat transferred per unit time over an arbitrary surface. Heat flux density *q* is the heat flux per unit area. This is a vector that coincides with the direction of heat distribution, i.e. directed in the direction of decreasing temperature and perpendicular to the parts with the same average temperature (Kalinchak V.V., 2012, p. 4).

Based on theoretical calculations and analysis of existing methods of measuring thermal conductivity, a working model of the installation was built, which uses common materials and available measuring instruments. The thermal chamber model of installation was made of PSB-35 foam State standards of Ukraine B 13163: 2012, 50 mm thick. The source of electric amperage was a laboratory power supply DHF-1502DD with smooth regulation and stable values of amperage and voltage. Necessary for calculating the electric power of the heater values of amperage *I* and voltage *U* in the stationary mode of installation were determined using an electrical

measuring instrument C4317 and checked with a digital multimeter DT-830B. Consecutively, every 10 minutes, the temperature sensors of the front faces of the sample located on the installation were taken (Fig. 1.2).

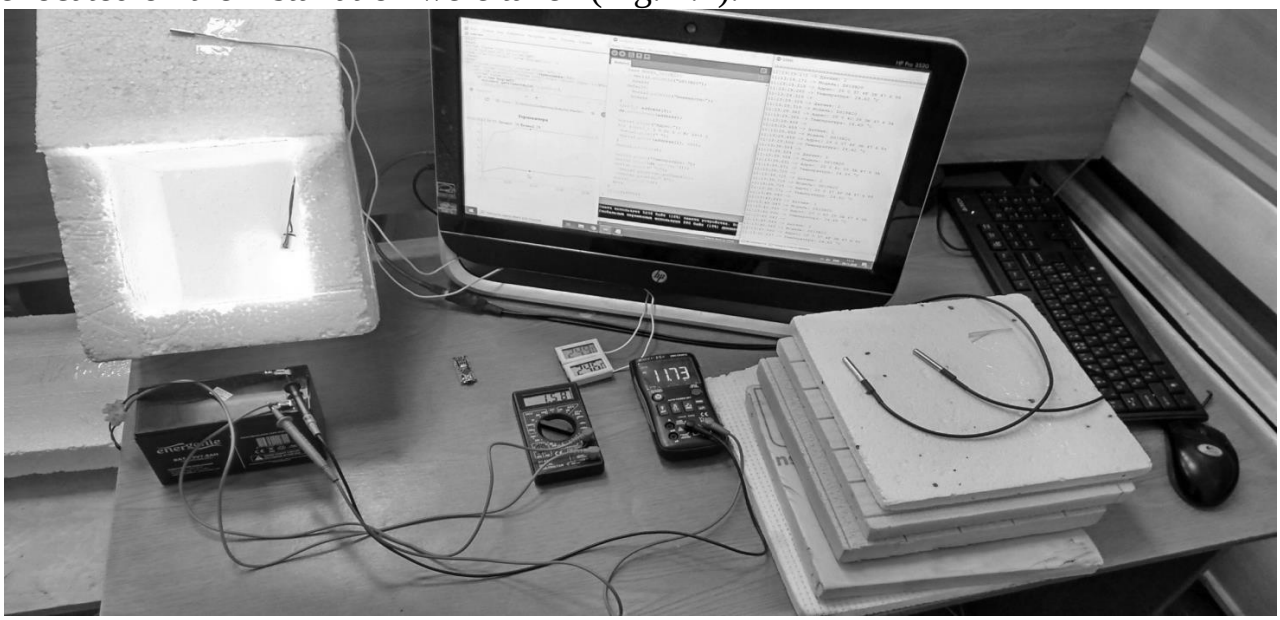

Fig. 1.2 - Photo of the installation *(source: author's development)*

Arduino Nano is used to obtain and analyze temperature parameters. The special program was written by Arduino language for its work. Temperature readings are recorded by two DS18B20 temperature sensors inside and outside the unit, displayed on an indicator and saved on a computer for further analysis by the unit operator. The output of temperature data can be configured at a given frequency using a program in the Arduino language and saved in text format.

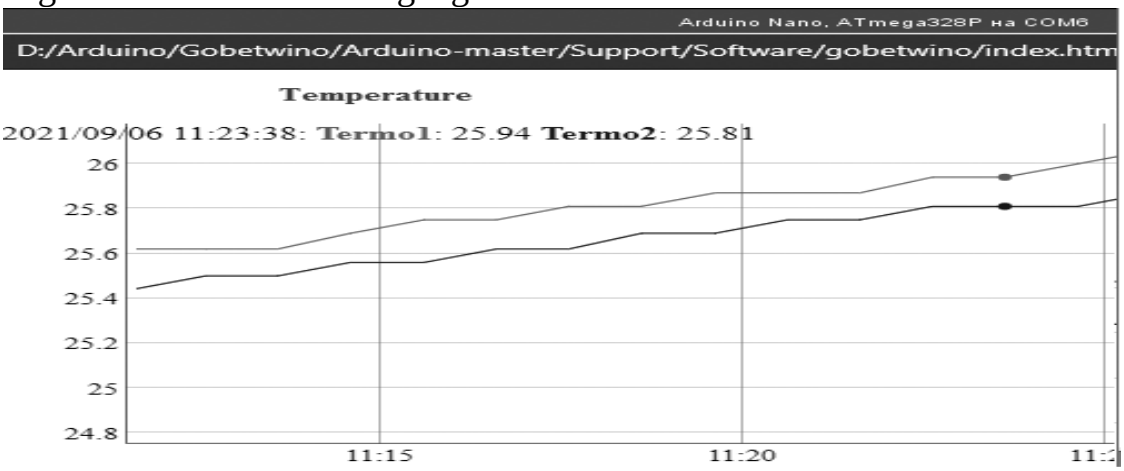

Fig. 1.3 - The output of temperature data using a program by Arduino language *(source: author's development)*

The temperature difference of the front faces of the sample Δt was 10–50 ° C, which provided a constant coefficient of thermal conductivity during the test. The heat flux through the test sample was considered stationary when the value of the temperature difference of the front faces of the sample Δt in three consecutive measurements of temperature sensor signals did not increase or decrease monotonically. As a result, the possibility of using the experimental dependence to

determine the thermal conductivity of unknown materials at this installation was confirmed.

The results of scientific work devoted to the development of research methods thermal insulation properties of materials became the basis for the following conclusions:

1. The analysis of existing methods is researched heat-insulating properties of materials, in particular such that allow measuring the coefficient of thermal conductivity of heat-insulating materials using Arduino Nano. Among the disadvantages of existing methods is the relatively high cost of methods, long test time, as well as a rather complex mathematical analysis of experimental data.

2. The technique of research of heat-insulating properties of materials which allows to measure their coefficient of thermal conductivity, to estimate conformity of actual characteristics of the basic working properties to that were declared by the manufacturer is created.

3. An experimental sample of a measuring device is created thermal conductivity coefficient and the results of experimental studies of thermal insulation materials. This installation was introduced into the educational process in physics at the Zaporizhzhya Multidisciplinary Lyceum №99 and Zaporizhzhya National University of Ukraine as part of the training of students of the subject specialty "Secondary Education (Physics)".

4. In the future, the results of my research can be used in the educational process in Computer Science as a practical illustration of the possibilities of using the Arduino Nano tools when conducting experiments in physics.

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PYTHON DICTIONARIES

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This article aims to give base knowledge concerning such types of objects in Python as dict. Python is now one of the rapidly developing programming languages, and of course the most popular one (Bansal, 2021). In other programming languages,

types, which let you realize such functions as dictionaries in Python do, are more complicated and are not built-in (Sturtz, 2021).

As Python is a programming language with dynamic typing, you should not use a keyword to create a dictionary, like in other ones (Campbell, 2021). I think everybody agrees that this opportunity makes code more comfortable to read. To declare a dictionary you just have to use the next construction:

<name> = { key1:value1, key2:value2, …, keyn:valuen}

where <name> is identification, the key is a specific object, which we use to get the value that is located after the key. Do not forget, that the identification should not begin with a number, or contain any other symbols except for English letters or the symbol "_". Also, you cannot use keywords to name your variables. By the way, there are some restrictions as for keys. They should have an immutable type, for instance: int, float, complex, str or tuple. Here you can see an example of declaration a dictionary:

```
d = {1:'a', 'text':4, (3,4):'numbers'}
```

Of course, there are more opportunities to create your dictionary. One of which is with the help of built-in function dict(). It has several different signatures. The first one is the following:

dict key1= value1, key2= value2, …, keyn:valuen)

Here, dict() returns a dictionary, which contains n elements. Let's have an example

```
>>> d = dict(a = 1, b = 2, c = 3)
>>> d
{'a': 1, 'b': 2, 'c': 3}
```

The second signature you can see below:

dict(list)

The list, which we set as a parameter has to contain only lists or tuples with two elements, the first one is a key, and the second - a value. For instance:

```
>>> arr = [[ord(a),a] for a in "abcde"]
>>> arr
[[97, 'a'], [98, 'b'], [99, 'c'], [100, 'd'], [101, 'e']]
>>> d = dict(arr)
>>> d
{97: 'a', 98: 'b', 99: 'c', 100: 'd', 101: 'e'}
```

Here we declare a list with a name arr with the help of a list-generator, it contains lists of two elements, the first of which is an ASCII code of the second element. Then we use dict() to get a dictionary from this list.

Besides, there is a way, how to create a dictionary without using the function dict(). You can use a method fromkeys() insted. Let's see its signature:

dict.fromkeys(list or tuple, value)

It returns a dictionary, every element of the first parameter is used as a key for a new dictionary. But in this case, all keys will have the same value - the second parameter. For example:

```
>>> arr = ['key1', 'key2', 'key3']
>>> d = dict.fromkeys(arr, 'value')
>>> d
{'key1': 'value', 'key2': 'value', 'key3': 'value'}
```

We have learnt how to create our dictionaries, but how to get their values? So, there are two ways how to do it. The first one is to use a key. Let's see an example below:

```
>>> d = {"var1":'a', "var2":1, "var3":(1,2)}
>>> d["var3"]
(1, 2)
```

The second one is more flexible but more complex. You can use method get(), which has the next signature:

dict.get(key, default value)

If our dict does not contain an element with such a key, then it will return the second parameter - default value. But if it does, then it will return the appropriate value. Let's see an example:

```
>>> d = {"var1":'a', "var2":1, "var3":(1,2)}
>>> d.get("var4", "no key")
'no key'
```

We have an opportunity to add elements to our dictionary. Method update() can be used for this purpose. It has the following signature

dict.update(dict)

For example, if we want to add an element to our dictionary we use the next construction:

```
>>> d = { 'a':1, 'b':2, 'c':3}
>>> d1 = { 'a':1, 'b':2, 'c':3}
>>> d2 = { 'd':4, 'e':5}
>>> d1.update(d2)
>>> d1
{'a': 1, 'b': 2, 'c': 3, 'd': 4, 'e': 5}
```

Also, we can remove elements from a dictionary. Simple, but useful operator, which gives us this opportunity is <<del>>. For instance, if we want to remove one of the dictionary elements, then we can use the next construction:

del d[key]

```
>>> d = {1:'a', 2:'b'}
>>> del d[1]
>>> d
{2: 'b'}
```

But what if we need to remove the last dictionary element and get it before it will be deleted? In this case method popitems() can help you. It removes the last dictionary element and returns it.

```
>>> d = {1:'a', 2:'b', 3:'c'}
>>> d.popitem()
(3, 'c')
```

To sum up, type dict is powerful and flexible. It lets you process data easily. Last but not least, is that all operations with dictionaries in Python are more simple then with similar types in any other popular programming language.

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VIDEO RECOGNITION TECHNOLOGY

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Video recognition technology is growing extremely fast today. Big corporations collect video footage and use them for peculiar purposes. AI-powered video surveillance may increase the effectiveness of security, labor or quality control,

marketing or management processes, or just extracting important information from the records.

For example, retail companies may track the customer traffic in shops, which helps them to improve the effectiveness of business strategy or analyze the behavior of clients. Other examples are automatic cash registers in the store or replenishment of goods on shelves, taken by customers.

Other interesting examples are watching the growing process of agricultural plants, like crops, and distinguishing them from weeds, or inspecting the level of water in dikes and predicting its strength for a purpose of avoiding accidents. Without AI these and even more features would be impossible or too challenging to develop. So, what is video recognition actually, and how it works?

Video recognition is a complicated task, which requires a lot of labeled data and consists of 5 main subtasks: object detection, object recognition, target recognition, real-time video analysis triggering, real-time alarm.

Object detection is a part of Computer Vision. The idea is to find and highlight objects in photos or videos. It can use the location method to find and count the objects.

To perform video recognition different tools are used: from python libraries, like OpenCV to frameworks like Tensorflow. AutoML Video Intelligence is also a good tool to train the model. In this journey, it is mandatory to prepare a dataset of videos. Training videos should be as similar as possible to videos you would test the final project on. The perfect amount of recordings in the dataset is a thousand per label, but the more the better. After gathering the data, it should be divided into three parts: test, train, and valid. The training dataset will be used in the learning process of the model by searching patterns with multiple algorithms. The validation dataset is meant to test the results of the previous stage. And finally, the test dataset is used to evaluate the accuracy and error rate of the model.

There are different metrics that exist to evaluate how well the model works. Particularly, AuPRC (Area under Precision) indicates the accuracy of the model with numbers from 0,5 to 1. The bigger number is the higher its accuracy. In order to improve the quality, it is essential to add more videos to the dataset or check the labeling part of the job.

In a conclusion, the main pros of using AI are: saving time and people efforts in video surveillance work, increasing the quality, the ability to process large pieces of information quickly and with less finance required.

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JAVASCRIPT USAGE IN CREW DRAGON CAPSULE FOR ITS FIRST CREWED SPACEFLIGHTS

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Millions of people worldwide faced the historic launch into space on 30th of May, 2020. It was the first time astronauts were sent to space from the United States since 2011 and yet the first crewed test flight of the Crew Dragon shuttle was made by SpaceX. Later this year, the space company surpassed its success with First Operational Commercial Crew flight, launched in space on the 16th of November. Those glorious occasions meant that a new era of space travelling and entertainment had already arrived.

There are several reasons why the Demo-2 mission is considered significant: it was the first launch ever controlled by a commercial provider, the first stage of the rocket landed itself after separation for the first time in a crewed mission and last but not least, the Dragon capsule interior has greatly changed. In comparison with the past, it has become much more futuristic. Nowadays, inside the cabin there are high-tech touch-screens, which make the inner design look really as if it came from the far future.

SpaceX software developers shared some details about programming languages which were used in Crew Dragon. Hardly did anyone expect to hear that JavaScript (JS) was used in Crew Dragon for its first crewed space flights. Having announced this surprising piece of news, the rumor that the software that was written in JS quickly spread in the IT community. Consequently, that caused some members to doubt the flight's safety.

However, Sofian Hnaide, who worked on the display's software, quickly dispelled that myth on Reddit interview. He claimed that Chromium engine, JavaScript and other web-related tools were used for user interface only. As a software design team lead Josh Sulkin said, that all vehicle control systems were written mostly in C++ and running in the Linux environment. “We take reliability and performance very seriously, we test extensively under different conditions to understand all failure modes” (Sofian H., 2020). SpaceX is able to meet all NASA requirements for reliability and touch feedback about displays. And even if something goes wrong and touch-screens are completely gone, there are few physical buttons and a joystick which provide a full spacecraft's control.

Since JavaScript is a really popular programming language today, there are a lot of competent specialists therefore that, as predicted, led to faster vehicle development. SpaceX also intends to use the same display technology stack for Starship ground software.

Thanks to SpaceX engineers, today we can see modern touch-screens instead of dozens of hardware buttons, which have highly impressed ordinary people. Surprisingly for all programmers, they are powered by web technologies. JavaScript has crossed a new frontier and found its place in space industry. This brave decision will crucially influence the spacecraft's development in the nearest future.

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BLOCKCHAIN TECHNOLOGY IN MEDICINE

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Nowadays, there is no proper mechanism for exchanging medical information in today`s healthcare infrastructure. In most cases, the patient is forced to bring their past medical records to a new medical institution. In addition to the obvious inconvenience, the lack of a patient`s history can lead to improper treatment. However, there is a solution to the problem and it's called blockchain technology.

A blockchain is a database that is built as a continuous chain of blocks. Each block contains information from the previous block and new information that was embedded in the newly created block. The main feature of the blockchain is the absence of a third party, which means complete confidentiality, security, reliability and complete reduction of the risk of leakage and falsification of information. However, is it relevant to apply this feature in the field of medicine?

In terms of patient data, this is the best technology today. It allows you to distribute and manage patient data, for example by creating a single register of electronic medical records based on the blockchain. As already mentioned, the system is built on the principle of a chain of blocks, where each block contains information from the previous one. Therefore, this is an ideal place to store medical records of patients, because with this system you can unwind the history of a particular patient until the beginning of the creation of an electronic card. In addition, the data cannot be replaced, which means that the information cannot be compromised, and even if it is changed, it will be indicated in the future history of all blocks. It also helps to quickly and easily view reliable information on medications that have been prescribed or taken by the patient.

The next advantage is the fight against counterfeit products. For example, in the blockchain system, namely the block, bring in information about the manufacturer of the drug, its unique number and, for example, the packaging number. With this data, pharmaceutical companies, drug manufacturers and consumers will be able to verify the authenticity of the data. This method allows to provide inexpensive quality control of drugs, as well as tracking of counterfeits at all stages of the chain of blocks. In this case, all parties are interested in this possibility, because it allows at any time to detect counterfeit or the possibility of counterfeiting the unit.

The main problems of the blockchain in the field of medicine include the issue of scaling. Not all medical institutions are ready to share existing data, moreover, not all patients want to take responsibility and manage their own data. Some participants in the medical field directly point out the lack of the necessary competence and add that the technology is too new. In general, in addition to the fear of the new due to the small use of technology in practice, this technology has no disadvantages (ZdravExpert, 2019).

In conclusion, blockchain is the technology of the future. The principle of its operation is difficult at first glance, but very practical, because it provides transparency and accessibility of information to all, has reliable protection and prevents the loss of information. In the medical field, this technology is extremely convenient for entering and storing information about the patient. It saves a lot of time. Also, its mass introduction involves the complete destruction of counterfeit products. Of course, there are problems. The main one is the problem of scaling. Both

the state and medical institutions are not aware of this technology and do not want to develop it. In addition, some institutions are reluctant to share existing information. However, the technology is extremely promising. It provides unrealistic possibilities. In 5-10 years, blockchain technology will become as popular as the payment system as Master Card or PayPal.

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QUANTUM COMPUTING

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From the second half of the twentieth century, the rapid development of computer technology began. Scientific advances that are racing forward to this day have allowed humanity to move from clumsy boxes that barely added numbers to devices that fit in the palm of your hand and can process an incredible amount of information in a matter of seconds. However, the mechanical part of any computing machine rests on the laws of physics, and today it is difficult to find a way to improve the components of a computer. The scale on which modern technology is being assembled is on the verge between classical physics and the realm of quantum mechanics. Roughly speaking, quantum physics is concerned with the study of the behavior of very small (comparable to an atom), very cold (near absolute zero) or very isolated (in a vacuum) particles. Obviously, modern technology is approaching the first of the above categories.

So, what are the physical limitations on the computer hardware? Consider the procedure of processing information. The computer operates with information through a system of modules – for storage, processing and management. Each of these modules, however, has to go from electricity to zeros and ones somehow, and it took a long way from relays and lamps to transistors. It is convenient to think of them as simple switches that can either pass current or not, which corresponds to a logical "yes" or "no". But at the level of nanometers, the behavior of the current is reduced to the behavior of the electron, and here the phenomenon of quantum tunneling comes into play. Because of it, the physical barrier in the form of a transistor loses its meaning, and information processing becomes impossible. Therefore, scientists have made the transition to quantum computers.

If in an ordinary computer information processing is performed through charge carriers, or bits, then in a quantum computer this happens through superposition carriers, or quantum bits (qubits). Thus, the work of quantum computers is reduced to the creation of qubits and the means to control their state. The physical implementation of the qubit can be any particle whose behavior before measurement is any proportion of two possible states at once: spin or charge of an electron, polarization of a photon, charge of a semiconductor crystal, etc. To manipulate the state of the qubit on quantum level, microwave signals, or so-called precision lasers, are used. In addition to superposition, to find a correct solution the phenomena of entanglement (correlation between behavior of two particles) and interference (interaction of opposites) are used. The very process of computing becomes more like simulating transformations of real-world objects carefully encoded as input data and decoding the result, than guessing a sequence of complex formulas one by one, as it was in the ordinary computer. All in all, quantum computing creates new ways to approach problems that classical computers have difficulty solving.

Perhaps the biggest advantage of quantum computers is their processing power. Consider the following: one ordinary bit "stores" one of the two values – 0 or 1, that is, at a given moment in time it is in one state. A qubit, due to its quantum nature, is in two states at the same time, that is, it "stores" twice more information than its ordinary progenitor. Hence, quantum supremacy – incredibly complex problems that ordinary computers could spend thousands of years solving, quantum computers get

right in seconds. They don't represent a step-by-step linear problem-solving structure, but rather a whole plain of possible solutions at once, the best of which are selected using quantum algorithms. To better show the computational advantage of qubits, refer to the table.

Combination length	States	Quantum bits	Quantity	Ordinary bits	Quantity
1	T, F		1	1, 0	2
2	TT, TF, FT, FF		2	11, 10, 01, 00	4
3	TTT, TTF, TFT, FTT, FFT, FTF, TFF, FFF		3	111, 110, 101, 011, 001, 010, 100, 000	8
n	2^n	…	n	…	2^n

What's counterintuitive is that with a help of qubits, a machine can process all combinations, or states of a system, simultaneously, while ordinary bits allow you to test every possible combination, just only one at a time. Note that 2^n states can be described just by n qubits, as opposed to 2^n regular bits.

The seemingly amazing work of quantum computers has been described above, but creating and maintaining them involves significant challenges that have been omitted before this section. Firstly, quantum phenomena work flawlessly in highly isolated environments and low temperatures. Therefore, the first step in creating a computer – creating a qubit (using technologies available today) – requires high-precision equipment and a reliable cooling system. Secondly, imperfect parts that tend to fall apart cannot fit together into a perfect machine. That is to say, the individual sensitivity of qubits to external influences will only grow with their number. This increased instability of the system, called decoherence, imposes a limit not only on the time during which the information in the computer remains intact, but also on the number of consecutive operations, because the state of superposition is hard to maintain. Thirdly, the very process of coding input data is very far from working with the programming languages we are used to. It's more like building quantum configurations by hand to match real things. Then tossing these configurations around until something plausible can be extracted using quantum algorithms, such as Shor's or Grover Algorithm. All the inconvenience in work is due to the fact that quantum computers operate on an analog, probabilistic principle. The result of the operation of a given algorithm on a given initial state – a set of the probability distribution of the outcomes plus possible errors. The digital, rigidly deterministic principle, on the other hand, gives the same result if the algorithm and inputs remain the same. This is the reason why regular algorithms are not applicable, and scientists need to develop new abstraction systems on which to build a programming language.

In point of fact quantum computing is the behavior of complex systems with many variables, so why not use them to model something similarly multidimensional,

such as the interaction of protein structures or the properties of complex substances. These predictions could be, and already are, a breakthrough in medicine, chemistry, physics etc. Machine Learning and Big Data processing, using quantum computers, are able to reach a whole new level of productivity and speed. And where Big Data is, there is Cryptography. Sure, quantum computing only pays off for incredibly complex systems, and the creation of the corresponding computers is not the easiest. But some highly specialized problems that were previously impossible to solve on any computer, with the help of quantum computers are solved quickly and efficiently.

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PERSPECTIVES AND USE CASES OF BLOCKCHAIN TECHNOLOGY

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Blockchain is a ground-breaking technology, the interest in which has grown along with the popularity of cryptocurrencies. Today it is widely discussed not only in the world of finance. They are already trying to use blockchain for storing and processing personal data and identification, in marketing and computer games. Blockchain is a non-mutable database. Blockchain is a non-mutable decentralized database that is simultaneously stored on multiple computers connected to each other on the Internet. To change the state of the database, most of the computer nodes must reach a consensus.

Let's take a look at one of the examples of using blockchain technology for e-governance. This will be a voting system. In the beginning, a public key is generated for each person. This is the address of the wallet in the blockchain database. When voting, exactly one token is sent to the address of each wallet. The token can be spent only once by sending it to the voting address. Each candidate in the voting lists has its own address. After sending a token to this address, the vote is counted for its candidate. The entire system is integrated into a De-Fi application that interacts with a smart contract deployed to a blockchain network. The application is decentralized, which guarantees its independence from the server infrastructure, which in turn guarantees its trouble-free operation even in a global catastrophe. Thanks to the technology, the system is faultless, immutable, and completely transparent.

For the user, everything under the hood remains hidden. The user just opens the application, where appears a list for voting. The user puts a tick next to the selected candidate label and presses the "vote" button. The voter does not need to make sure that his vote is counted correctly. This is guaranteed. But, if he still wants, he can open the blockchain explorer and check his transaction there. Data interception, manipulation, and substitution of votes become simply impossible due to the nature of blockchain. And this is just one of the uses of the blockchain.

NFTs (non-fungible tokens) are the latest cryptocurrency phenomenon to become mainstream. NFT transforms collectibles into unique, verifiable assets that are easy to trade on a blockchain. “Non-fungible” means that it’s unique and can’t be replaced with something else. Linking real assets to NFT can digitize the way we prove ownership. NFT can help confirm legal ownership when selling a valuable item. For example, an authentic diamond usually comes with a certificate of authenticity. This certificate is also the way to confirm you are the owner. Anyone trying to resell a product without a certificate cannot verify its authenticity and may have trouble convincing buyers that they are the real owner.

Having an NFT related to an item can make NFT ownership as important as owning an asset. When we see the development of the Internet of Things, we are likely to see more NFT being used to represent real assets.

Blockchain technology can also be useful in logistics. The reliability and safety of the system guarantee the safety and authenticity of the information in the supply chain. The main feature of NFTs is that they represent unique items. They can be used to track goods - view information about their origin, route, and location.

Let’s have a look at the following example: A country produces high-quality goods of an elite brand with NFT assigned to each item, which can be scanned on the

package. With the NFT public key, the buyer can check where and when each good was created. As the parcel is moved to the delivery point, the NFT is scanned to add new information about its status, including the location and the time of arrival or departure.

As a result, the buyer will have access to detailed information about the delivery and authentication of such goods. There are many ways to implement NFT in the delivery process, but for each of them, it is necessary to use the same system at all stages of the supply chain.

Blockchain has an incredible number of uses due to its benefits. We are now only at the beginning of the development of this truly revolutionary technology. We are already seeing how this technology is changing the financial sector, making cryptocurrencies the most profitable investment tool in the last 10 years, helping ordinary people to make fortunes. Now we see the active development of decentralized applications, games, and entire metauniverses. It's difficult to imagine how this will change the world in the future.

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IMPLEMENTATIONS OF ARTIFICIAL INTELLIGENCE INTO OUR LIFE

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Some people are afraid of everything connected with AI as they think it will break down and the apocalypse will start. In fact it is not true. It is used in your smartphones, in your smart TVs. Even the world-popular platform YouTube is also based on AI. A lot of services are made over self-learned platforms.

The main purpose of my speech is to tell the audience about different implementations of artificial intelligence in the modern world. So, I want to show people that there are a lot of uses of AI around them and they do not even know about the existence of those things. It is not evil as it is described in the «Terminator» series. It helps us to make our life easier and it can not even do something except for the task it is created for. AI just optimizes itself to work more efficiently so you should not be afraid of its deviation (Reynolds, 2018).

Artificial intelligence is used mostly everywhere. To begin with, if you are interested in the car industry, you know that suspension in modern cars is usually adaptive to make it more comfortable. You may be surprised, but it works due to AI. Different data are captured by sensors and processed with special algorithms. Also, AI is used in modern greenhouses in Europe. They are constructed especially, so all plants are grown vertically. In this way, they cover less area and have higher productivity. Above each plant is placed a camera. It takes a photo of the plant once in a period of time and AI analyzes it. If AI decided that plant is grown, a manipulator harvest is. Nothing evil, or not? The next example is controlled prostheses for people. There are ones that can be moved by nerve impulses. That information is captured from muscles. When a part of an arm or leg was amputated, all doctors connect muscles and these actions allow to save nerve impulses. So, those signals are proceeded by AI and then the prothesis can move. After a month, for example, the person can control this artificial body part as fluently as the natural one because it has learned how they usually move (Greenhouse Grower, 2020). A lot of musicians continue playing different instruments after the imputation of a hand due to this technology (The Medical Futurist, 2020).

To sum up, AI is used in different parts of our life. Even if you think that something can not include this technology, it can have one. But you should not worry about it, AI just helps gadgets to work fine and even better. It can not improve itself so much that it will kill humanity or something like this. The main purpose of artificial intelligence is to learn the most popular scenarios of using the gadget and as a result to make it work more effective

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POWER ENGINEERING

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I want to discuss two problems and a single solution for both. The ecological situation on the planet is getting more complicated every year. This is due to the constant growth of production and population. All this leads to significant pollution of the environment and a reduction in human life expectancy. Here are some facts. Ukraine has 10,000 hectares of landfills. This is 6% of the territory. And 11 million tons of garbage is produced annually.

The second problem is the shortage of energy resources. The scarcity increases the price.

- Gas - 1200 $ / m3. Caloric content - 8000 kcal / kg
- Coal - $ 200 / ton. Caloric content - 4000-5500 kcal / kg.
- Wood pellets - $ 200 / ton. Caloric content - 4000 kcal / kg

While working at LLC “Vol`ten”, I and our team developed a solution. Solid household waste should be divided into two types: "dry" and "wet". All waste is transported for sorting. Of these: 25-30% - recyclable materials, up to 10% - estimates and construction waste, up to 20% - wet waste, from 40 to 50% - mixed residues that are used to make RDF (Refuse Derived Fuel).

RDF (Refuse Derived Fuel) - Is a fuel obtained by crushing and dehydrating municipal solid waste (MSW) using conversion technology.

Benefits of switching to burning RDF fuel:

- Price: $ 20 per gigacalories
- Saving natural resources
- New workplaces
- Elimination of garbage in the country

We will highlight this decision as a potential for growth not only in the energy sector in Ukraine, but also in the economy as a whole. In addition, it is much easier for environmental projects to attract funds from foreign investors.

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VR AND AR TECHNOLOGIES

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The striving for constant development is characteristic of modern man. It should be noted that the modern education system is built in such a way that theoretical knowledge prevails over practical knowledge in the learning process. At the same time, it is known that knowledge gained practically is assimilated by students better and is preserved for a longer period, in contrast to knowledge obtained only theoretically. Thus, the situation in the field of education regarding practical training determines the relevance of the use of new information technologies in the field of education. One promising direction for the development of innovative educational technologies is the use of augmented reality in the learning process. The direction of research in this area is indicated by a clear well-established term — Augmented Reality. (Devyatykh, 2019, p. 4)

At the present stage of its development, augmented reality computer technologies are beginning to influence learning technologies, enriching their means and methods, expanding didactic and cognitive capabilities. Placing virtual objects in a specific environment, in which they are initially absent, makes it possible to simulate unusual educational practices. Learning to use augmented reality technologies increases engagement, makes education interactive and contextual. With the help of AR, students can visually study the topic and examine in detail full-fledged three-dimensional models of objects that are very difficult or impossible to get in life. It can be a three-dimensional model of a black hole, various chemical reactions, visualization of the process of movement of tectonic plates. Such material is better for children to learn than traditional text or 2D images.

Currently, VR / AR technologies have received the most serious development in the entertainment and markets, but this is not the limit, but only the first stage of their implementation. The most promising in terms of economic effect are products based on VR / AR technologies in industrial production, education, healthcare, and consumer services. Supporting companies that create products with virtual and augmented reality technologies will help create world-class products in the industry, achieve technological and economic advantages in critical market segments, as well as take a significant share of the global market. (cdto.wiki, 2020, p. 1)

Virtual reality technology (VR) is a complex technology that allows you to immerse a person in an immersive virtual world using specialized devices (virtual reality helmets). Virtual reality provides complete immersion in the computer environment that surrounds the user and responds to his actions in a natural way. Virtual reality constructs a new artificial world transmitted to a person through his sensations: sight, hearing, touch and others. A person can interact with a three-dimensional, computerized environment, as well as manipulate objects or perform specific tasks. In its simplest form, virtual reality includes 360-degree images or videos. Achieving the effect of full immersion in virtual reality to a level where the user cannot distinguish between visualization and real environment is the task of technology development.

Augmented reality (AR) technology is a technology that allows information to be integrated with objects of the real world in the form of text, computer graphics, audio and other representations in real time. Information is presented to the user

using a heads-up display, augmented reality glasses or helmets (HMD), or another form of human graphic projection (such as a smartphone or projection video mapping). Augmented reality technology enhances user interaction with the environment.

The introduction of VR / AR in the educational segment will provide accessible tools for users and supplement training programs with interactive visual VR / AR content in the amount of up to 30% of all educational materials (with a priority on subject areas that are not reproducible in traditional formats). This can lead to the following effects: increasing the effectiveness of online learning; provision of continuing professional education; ensuring the availability of quality education in the regions.

In the corporate sphere, the use of VR / AR technologies can ensure the creation of an effective corporate training system. (Dmitry Makeev, 2019, p.6)

Thus, VR / AR technologies are useful and necessary for society, so we need to study these technologies in more detail and expand their capabilities.

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INTERNET TECHNOLOGIES IN BUSINESS

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Internet technologies in business - explores the work with information that surrounds the management of the business entity, with the introduction of the probabilities of modernity - the Internet. The relevance of such research is due to the information development of the community, the development of machinery and technology and the need to use modern methods of information processing and expanding the probabilities of the Internet by using its resources in the actual work of people (Shchedrina, 2012)

The main IT trends in the development of various sectors of the economy and business are artificial intelligence, voice and visual product search, chatbots, big data, self-driving machines and devices, augmented analytics, digital duplicates, biometric data, 5G technology, intelligent border technologies, immersive technologies , intellectual space, digital ethics and privacy, quantum computing, blockchain (Shevchuk., 2020).

Internet technologies are considered a mandatory part of information technology, but in the absence of repeated updates, information systems are worn out, ie something becomes inaccessible, or simply fails, which leads to their functional unsuitability and, consequently, losses for a particular enterprise. To maintain the appropriate state of information technology, it is appropriate to use modern Internet technologies. The use of a global network of companies allows you to increase the competitiveness of goods, expand markets, find new suppliers, intermediaries and buyers, which is essential for business. This corresponds to the business processes of attracting the client, studying his needs, the very act of making a transaction and service, namely the system should cover all business processes of the company's interaction with potential customers. It is this system of operation that can ensure the use of Internet technology, which is relevant to doing business and becomes an integral part of the operation of any enterprise in the modern world. After all, Internet technologies are evolving rapidly, and the need to use such technologies is simply a necessary condition for a profitable business (Manko, 2019).

The IT sphere in Ukraine is now becoming one of the key resources of national and regional development. The use of information technology simplifies and accelerates production and business processes, accelerates the establishment of links in areas of activity, not only in business, intensifies cooperation between regions and countries, creates and develops new industries in economics, science and technology. They are the basis for increasing the efficiency of enterprises and ensuring competitiveness in domestic and foreign markets. All this certainly increases the opportunities for regional development and economic recovery blockchain (Shevchuk., 2020).

Also in the use of Internet technology in business, you can come across major intolerances, namely I mean threats, namely such as viruses, etc .. In order for actions when using Internet technologies for business to be safe, you need follow the basic rules of information security. Modern threats include computer worms, Trojans, adware, spyware, jokes, rootkits, spam, hacker attacks, and internet fraud. The protection system includes the following actions: constant updating of the operating system, use of an effective file system, correct use of

passwords, use of anti-virus programs, use of attack detection systems, backup data archiving, etc.. (Manko, 2019)

Information technology creates opportunities for unlimited business expansion and allows you to optimize management processes as a whole. However, they must be used thoughtfully and carefully. A positive effect is achieved only if there is a clear idea of how to develop their application to support the successful implementation of business strategy. Otherwise, this expensive and difficult-to-use tool will not benefit business, and investment in information technology will be ineffective blockchain (Shevchuk., 2020).

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MODERN APPROACHES TO CREATING POWERFUL WEB APPLICATIONS

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The modern world is unceasingly developing and new business problems and their solutions emerge every day. Not difficult to notice that there are more and more popular applications that move to the web. Usually, there are three same apps created for different platforms: browser, desktop, and mobile. Web applications' popularity is fully justified: it is really convenient that one app (browser) provides us an opportunity to search, watch media, download, and use powerful apps online. In the past, web applications were slow, not secure, they looked awful and required a good Internet connection and a lot of space. Nowadays, there are many powerful technologies and ready-to-go solutions for most modern problems. Today, web applications look great, they are smart, and they also strive to use as little storage as possible. What is more, they use modern principles, patterns and approaches to increase productivity, accessibility and reactivity.

Development principles that applied in the past no longer make sense, while new ones have sprung up. The main task is to research modern approaches to creating web applications and find out how they solve past problems and present business problems (mrc-productivity, 2019).

By and large, we can see that modern user, as a rule, prefers using multimedia information to text. That is why it is essential for our service to have a voice search technology. Some users will not use it at all, but many of them consider a voice search to be necessary. What is more, 84% of users believe that the design of the app is important, so here comes a modern library for the design called "Motion UI". Using it we can create amazing animations, backgrounds, loaders etc. We can speed up our app and boost our web app rankings in search results (codica.com, 5). It is also important that the user has an opportunity to comfortably use our app on different platforms, especially on the smartphone. Here comes the principle called "mobile-first".

According to Flexera report, 98% of all companies at least once used cloud services to run servers. It is called serverless architecture. It is the way of developing the back-end part of our app without thinking about the servers itself. Actually, our logic systems are still run on server, but they are supported by cloud providers like Google (firebase), Amazon (AWS) etc. (Flexera report, 2020).

One more approach is called "SPA – Single Page Application". It is a kind of application that is based on Javascript and its feature is that it does not load the whole HTML page, but markup and dynamically changed data. In this way users feel like they are always on the same page, and the speed of the app is keenly increased. (Codica, 2020)

As we can see technologies are developed every year, so we do not want to use old ones, because it becomes difficult to maintain our app. So, one of the approaches is based on using a modern and powerful stack of technologies. For example, MERN – which includes MongoDB as a database, Express.js for holding our server, React.js for creating powerful user interfaces and Node.js – for everything else we need.

What if we have to create a server that needs to maintain a variety of different clients like desktop browsers, mobile browsers, native mobile applications, and also it

should work with 3-rd party APIs and include some integrations with other systems like banks. What should we do not to make our server a trash bin? The answers are obvious: to use a microservices architecture. We can create a small service for every separate task we need. Every service has its own database. All microservices communicate using HTTP/REST. And data between services is maintained using Saga pattern, which describes just a simple sequence of local transactions that trigger and evoke the next (microservices.io, 2019).

There are many smaller principles, for example: "module separation" requires the developer to create a specific folder structure, when he is creating a package to decrease the amount of memory of the imported library. If we have 1000 similar things to show on the screen – use virtualization. Show only the first 20-50 and only than show others but only when the user scrolls down to them. This will secure our app from terrible lags. Also, try to minimize the number of HTTP requests. Use local storage, cookies, cache – anything we want, just to do this. It will increase the speed of our app in many times.

I believe that the goal was achieved successfully because it was researched and described many modern and really useful approaches and principles of creating powerful web applications. To verify whether named principles are really useful — we should check, how big modern IT companies create their products. And, make no doubt, all of them use at least 5 of them, because today they are really essential.

I am confident about the future of web development. Most of these approaches will be improved and replaced by those, we cannot even imagine now. But at the moment, we should use what we have to find out new problems and solutions for them because it is the only way the progress can be.

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POSSIBILITIES OF DEVICES FOR REMOTE MONITORING OF ARTERIAL PRESSURE

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Blood pressure (BP) is one of the main indicators of central hemodynamics, which reflects the blood supply to vital organs. Determination and control of this indicator are now considered the main tools that prevent the risk of occurrence and development of cardiovascular disease and help to avoid fatal consequences of these diseases (Stergiou & Bliziotis, 2009). For example, arterial hypertension leads to the formation of renal failure, contributes to the damage of arteries, retinal vessels, the development of pathology in pregnant women and newborns. At the same time, there is unsatisfactory public awareness of the disease, a low percentage of patients receive treatment, insufficient effect of antihypertensive therapy. Emergencies during illness (cardiogenic shock, coma, syncope, hypertensive crisis, eclampsia of pregnant women), hemodynamic monitoring during anesthesia and resuscitation, functional tests require accurate assessment of blood pressure and thus make invasive measurement impossible. Thus, the determination of blood pressure should be strictly regulated, which imposes certain requirements, both on the conditions of its measurement and the recording devices themselves.

In the course of the work, an analytical review of the literature was conducted, which classifies the methods of measuring blood pressure and focuses on indirect methods as the most comfortable for continuous use. Such, in the course of acquaintance, became non-invasive occlusive methods (Spelde & Monahan, 2016). These methods determine the corresponding measuring device. The analysis of medical and technical literature gave an understanding of the features of these devices, which allowed to form a comparative description of the advantages and disadvantages for each.

There are direct (invasive) and indirect (non-invasive) methods of measuring blood pressure. A direct one is carried out through a catheter or cannula, which is inserted into the lumen of the artery. It is impossible to use this method at home and for constant monitoring of blood pressure, so it is not smoothed in the future. The most common indirect methods include occlusal methods (auscultatory and oscillometric), ultrasound examination of vascular wall movement, and Doppler measurement of blood flow velocity (Sikors'kij, 2015).

The principle of operation of modern tonometers is based on two main methods of measuring blood pressure: Korotkov's method (mechanical tonometer) and oscillometric method (electronic tonometer).

The first one is based on the complete compression of the brachial artery by the cuff and the subjective assessment of the auditory sounds that occur when the air is slowly released from the cuff. In addition to subjectivity, the disadvantages of this method include its dependence on the individual characteristics of the person performing the measurement (sensitivity of hearing and vision, speed of reaction), sensitivity to the presence of others, you need to ensure direct contact with the skin of the shoulder. The results of blood pressure measurement by tonometers by this method may be generally inaccurate due to the phenomena of infinite Korotkov pulse or auscultatory failure. However, this method is a reference, because the accuracy of

measurements is maintained during hand movements and the method is resistant to cardiac arrhythmias(Sikors'kij, 2015, p.24).

The oscillometric method is to record the pulsations of air pressure that occur when blood passes through a compressed area of the artery. The amplitude of the mentioned pulsations is rather insignificant, therefore to tonometers by this method there are high requirements of the accuracy of measurement, reliability of algorithms of processing of the measured signal (its filtering, decoding, detection of peaks, etc.). The advantage of these devices is the ability to automate their work; reducing the impact of the human factor; greater accuracy of measurements of systolic and diastolic pressure, than at Korotkov's method; resistance to external noise. This method has its drawbacks: low resistance to hand movements; inaccurate results in people with defects of the cardiovascular system; is not a benchmark.

A review of the modern market of devices in this segment for the complex decision of problems of measurement of BP was also conducted. The latest solution for measuring blood pressure with a built-in electronic tonometer - smartwatch Omron Heartguide. It looks like an ordinary smartwatch, due to which it has additional functions: counting steps, calories, assessing the quality of sleep, notifications from a smartphone. At the base of the watch is a cuff 25 mm wide, which is inflated when measuring blood pressure using the oscillometric method (Omron, n.d., para.3).

The basis of the considered methods of blood pressure measurement is overpressure of the cuff of the artery. Auscultatory and oscillometric methods can be used in practice. Usually the disadvantages of one method overlap with the advantages of another, and vice versa.

Modern devices offer comprehensive blood pressure measurements. In everyday life, the use of such watches is the most comfortable among the considered methods, while maintaining the accuracy of measurements.

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NEURAL NETWORKS THE BASIS OF MODERN LIFE OF HUMANITY

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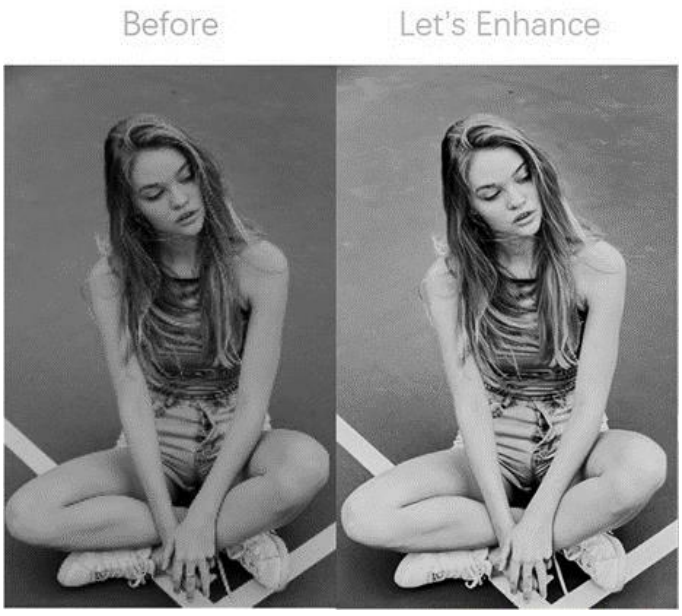
A neural network is a software simulation of the neural structures of the human brain. The first artificial neural network was created in 1943, so this branch of science can hardly be called new. But it has developed globally, during its existence, and has not yet reached the peak of its development.

An important feature of neural networks, indicating their great potential and wide application capabilities is the parallel processing of information by a large number of neurons. This achieves a significant acceleration of information processing. Another important feature of neural networks is the ability to learn and summarize information. In this way, some resemblance to the work of the human brain is achieved.

Today, neural networks are used in almost all spheres of human activity: medicine, economics, communications, information processing, programming, editing, design, automation and so on.

Ukrainian scientists have also contributed and continue to contribute to the development of neuroscience. Among modern domestic scientists it is necessary to allocate Akulova PV and Stanislav Osovsky. So, in particular, in the sphere of activity of Akulov PV includes issues of solving problems using neural networks. Stanislav Osovsky is engaged in research of neural networks in the field of information processing.

In 2017, Ukrainians Oleksandr Savsunenko and Vladyslav Pranskevychus created and launched the online service Let's Enhance for processing and touching photos. With the use of neural networks, you can increase the photo expansion four times, minimizing quality loss. Less than a month later, Let's Enhance became the product of the day on ProductHunt. Alexander Savsunenko considers the key advantages to be "a good algorithm, a balance of speed and quality prepared for production, implemented in a normal visual service."



https://c2.vanceai.com/posts/16281486673622178-VanceAIVSLetsEnhance.jpg

Modern services for photo autocorrection greatly facilitate and simplify the retouching process for all users. AI-powered photo editors do everything a retoucher would do manually in Photoshop, while giving us full control over the process. Automatic retouching helps:

✓ give pictures taken on a simple camera a professional look and improve the quality of the image;

✓ save time by allowing the program to do all the work instead of manual editing;

✓ print and publishing companies to improve the process of image correction for magazines, marketing campaigns and more.

Intelligent systems based on artificial neural networks can successfully solve the problems of pattern recognition, prediction, optimization, associative memory and control.

Let's continue the theme of photo processing with the help of neural networks, the capabilities of which are impressive. Neural networks are used in FaceAdd facial recognition. Today, recognition is used in smartphones, credit and insurance companies.

Neural networks are used in video analytics. Video analytics systems are programs that allow you to analyze a video stream or an image and draw the following conclusions: counting objects in the image, the parameters of objects, their behavior (trajectory, nature of movement, etc.)

https://evergreens.com.ua/assets/images/articles/videoanalytics/object_count.gif

Over time, household appliances should appear that adapt to their owner, the harbinger of which can be considered a neural network unit for adaptive control in the new vacuum cleaner from Samsung. Security systems will recognize their owners by their voice, appearance and a number of other unique characteristics. The life support systems of "smart" electronic houses will also be developed, which will become even more adaptive and learnable. In production and in various industrial systems, intelligent neural network controllers will be able to recognize potentially dangerous situations, notify people about them and take adequate and, most importantly, timely measures. Data streams in computer networks and cellular networks will also be optimized using neurotechnologies.

Another area of application of neural networks is their use in specialized software agents in robots designed for information process, and not for physical work. Intelligent assistants should make it easier for users to work with information and communicate with a computer. Their distinctive feature will be the desire to understand as best as possible what is required of them by observing and analyzing the behavior of their owner, trying to detect some patterns in this behavior and promptly offer their services to perform certain operations, for example, to filter news messages, with advice on to resolve a problem or to back up documents that the user

is working on. That is why neural networks that can generalize data and find patterns in them are a natural component of such software agents.

But all this is a matter for future. Today, neural networks are used to work in relatively narrow areas, and it is not known whether they will ever be trusted to solve problems that require an understanding of the social context. Meanwhile, neural networks continue to confidently penetrate into our lives, and there are many examples of this.

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RESOURCE-SAVING BATHROOM DEVICE

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The purpose of the study. To develop computer system software based on a microcontroller that monitors the temperature and water level in the bath.

Formulation of the problem. Most couples who give birth to a baby experience some discomfort while bathing their baby. There are a number of devices that can be used, but they all perform only one specific function. When analyzing the range of items of Smart Home, it was found that there is currently no device that would combine all the necessary functions. That is, it was multifunctional (MimiSystems, 2021). Therefore, it was decided to create a device with a wide range of functionality that would make taking a bath by a child comfortable.

Consider the cases that demonstrate the existing problems in the bath:

1) taking a bath with a comfortable temperature is much better than waiting for it to cool, or vice versa, to heat it if it is not hot enough;

2) bathing a child should be treated more carefully. Due to the parents' habit to check the temperature with elbows or thermometers, there is a need for quick information about the state of water;

3) untimely blocked tap can develop into a flood, which will lead to large losses;

4) excessive overflow with water. When we take a bath, excess water flows into the drain, but do not return the energy resources spent for its heating

5) existing of a problem of resource conservation, because 2.5% of the total volume of the planet's water accounts for fresh water, which people massively and irrationally use in their needs.

Analysis of recent research. As the previous analysis showed, existing bathroom appliances have certain disadvantages, such as: design fragility, slow reaction, lack of accurate measurement, limited temperature, influence of external factors (water can lead to short circuit), lack of all desired functions (Gsm Signalka, 2020). Based on the analysis of these and other shortcomings, a model of the device of the new design was developed. The main advantage is to get the current results of measurement in real time on the smartphone - this increases the speed and accuracy of work.

Since existing devices have disadvantages, as well as their separate use is not so productive and deliberate, it was decided to create a new device. The presented device combines everything you need to control all the water parameters in the bath. The device model has advantages because of its multifunctionality and moreover it can be a part of the Smart Home.

Main part. Fig. 1 shows a block diagram of the prototype.

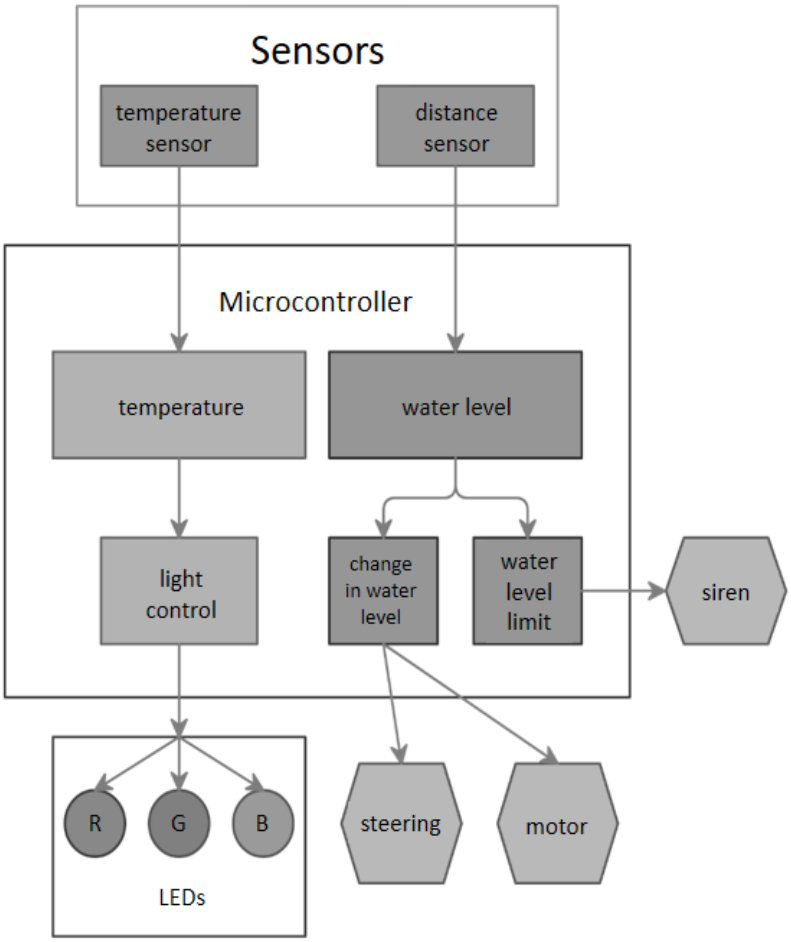

Fig. 1. - Block diagram of the device

The device includes temperature and distance sensors (Kashkanov, 2015).

Measurement of the distance from the device to the surface of the bath is provided by an infrared distance sensor. After that, it transmits the signal to the microcontroller through the analog input and analyzes it. It depends on the work of the steering wheel, sirens and motor. Analyzing the current depth value, the microcontroller decides whether to continue working, or turn on the siren at the end of water extraction in the bath. If the level has not reached its maximum value, the motor and the steering wheel continue their work. Consider the algorithm of the steering wheel: if the device reaches the edge of the bath, it records the decrease in water level due to the distinctive bath shape, then it turns to the random side (right or left) and returns until the level begins to increase. When it records the increase - straightens the steering wheel and drifts in the opposite direction.

The analogue of the device is the nozzle on the tap, which illuminates the water depending on the temperature, but it can not illuminate the water in the already filled out bath. Therefore, we added to the device a temperature sensor that works in tandem with LEDs. In the mobile application, the user indicates a comfortable temperature for him, and the LEDs change their color depending on the current and specified temperature. For example, if the temperature is in the range of plus-minus 5 degrees from a comfortable value, then a green LED burns, if less - blue, if more - red. This allows to check the temperature change, and the application displays the current temperature value.

Quick access to configuration settings is via a Bluetooth module connecting the device to the smartphone (Asmakov, 2013). A mobile application was created that has a convenient interface, it transmits the established indicators of a comfortable value of water temperature and the maximum value of water level, the excess of which is accompanied by a siren on the phone and on the device itself.

The internal interface of the program is shown in Fig. 3.

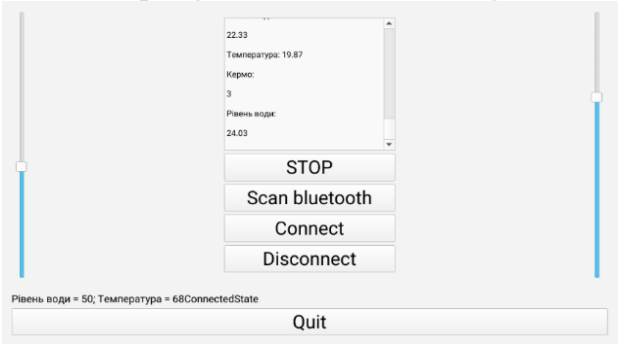

Figure 3. – View of the program interface for the device

The interface contains 5 buttons and 2 sliders. The left slider is responsible for regulating the temperature, and the right - the water level. Buttons: STOP - stops the program, Scan Bluetooth - searches for possible devices, Connect - connect to the device, Disconnect - disconnect, Quit - closes the program. It has the following capabilities: connect to the device; set the maximum value of depth in the bath, the excess of which is accompanied by a siren; set the average temperature, which differs from the minimum and maximum within five degrees Celsius; show current temperature and depth values.

Conclusion. The article describes the developed model of the device for a bath that allows to carry out a complex of analyzes of a condition of water in a bath in real time. A mobile application has been created to control the device. The results of the analysis are transferred to a smartphone, which creates additional convenience for using the device. Prototypes of existing models, their areas of use are analyzed and the main differences are indicated. The device can be a perfect addition to the Smart Home system. Its functionality and capabilities are shown, which ensure the rational use of water and energy resources, save time and make human life easier. The technical description of the device is given.

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CONTENTS

RESEARCH OF METALLURGICAL INDUSTRY OF UKRAINE AND ITS CAPACITY IN THE WORLD MARKET

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Today, as well as 30 years ago, the mining and metallurgical complex is the most important part of Ukraine's economy. However, the industry has undergone numerous transformations, because of which it has become stronger, more technological and more efficient. Together with metallurgists, miners and coke chemists, the cities where these enterprises operate are developing.

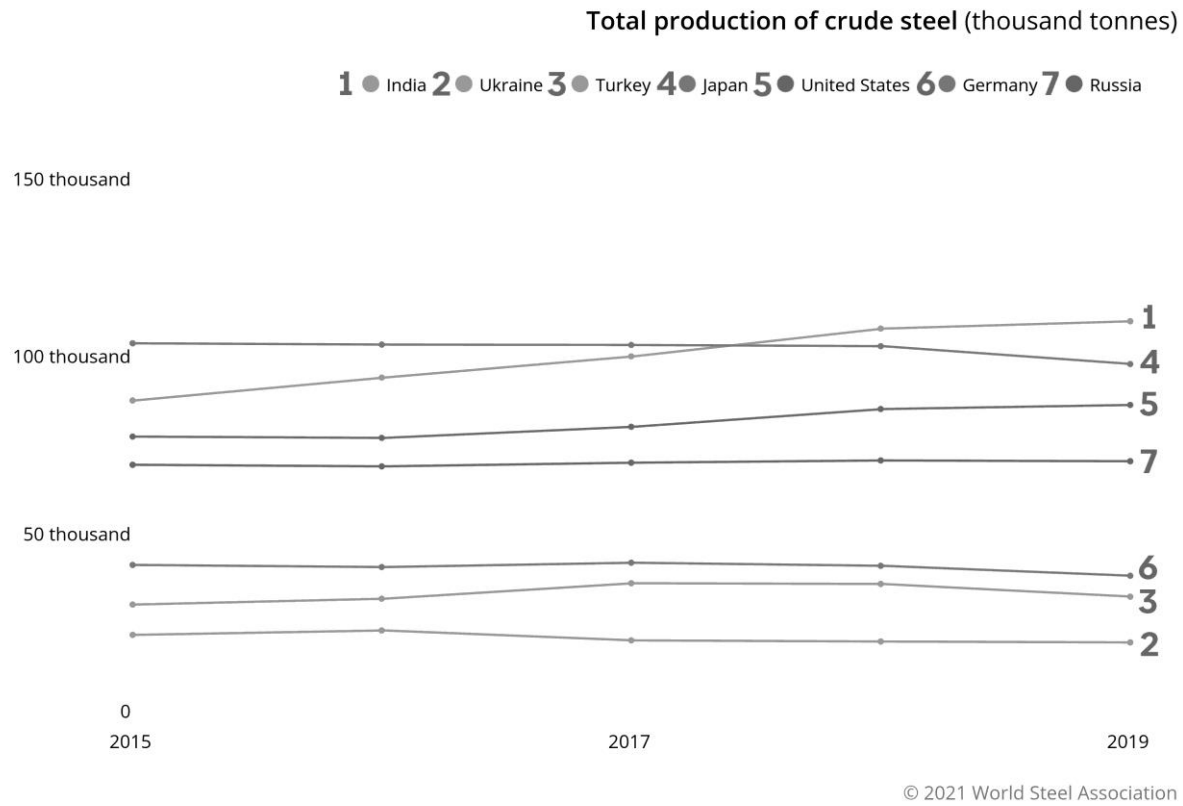
In the past, they were city-forming in all respects, and today they have become reliable partners of local communities, helping them to develop all spheres of life. The mining and metallurgical complex of Ukraine (MMC) is a strategic national resource and complex scientific, technical and organizational system represented by numerous sub-industries, starting with the mining industry and ending with enterprises producing metal products. Today MMC of Ukraine exists an integral part of world metallurgy and is closely associated with the trends of its development.

Thus, the production of "raw" steel in 2015. Ukraine ranked 10th among crude steel producers. The situation has changed since 2017, rising by 10 points Italy, 11th - Taiwan, and Ukraine took 12th place (Fig. 1). (Wikipedia, 2021)

Position (2017)	Country/Region	2017[1][9]	2016[1][10]	2015[11]
—	World	1691.2	1606.3	1620.4
1	People's Republic of China	831.7	786.9	803.8
-	*European Union*[a]	168.7	162.3	166.2
2	Japan	104.7	104.8	105.2
3	India	101.4	95.5	89.6
4	United States	81.6	78.5	78.9
5	Russia	71.3	70.5	71.1
6	South Korea	71.1	68.6	69.7
7	Germany	43.6	42.1	42.7
8	Turkey	37.5	33.2	31.5
9	Brazil	34.4	30.2	33.3
10	Italy	24.0	23.3	22.0
11	Taiwan	23.2	21.8	21.4
12	Ukraine	22.7	24.2	22.9

Figure 1. List of countries by steel production

Brazil, Turkey, Germany, South Korea, Russia, USA, India, Japan and China were the main competitors of domestic producers of "raw" steel at the beginning of 2015, but now Italy has joined them. According to the World Steel Association, we will consider the dynamics of production of such types of metallurgical products as "raw" in 2015-2019; determine the place of domestic metallurgy and the main trends in the metallurgical market. (World Steel Association, 2021)



Thus, analyzing the previous years, we can see a significant decline in steel production in Ukraine. This decline began after 2011 (in that year the country produced the most tons of steel in the last decade). This can be said not only about the production of "raw" steel, but in general about the entire base of steel in Ukraine.

To some extent, hostilities in Donetsk and Luhansk oblasts since 2014 have been the reason for the steady decline in steel production in Ukraine. Suspension of activity or reduction of business activity of metallurgical enterprises in the territory temporarily uncontrolled by Ukraine with subsequent loss of control over them and inability to include the results of their work in official Ukrainian statistics led to negative dynamics of steel production in the country during 2014-2018.

However, the reduction of steel smelting was not the biggest problem, as it coincides to some extent with global trends in the metallurgical industry, where stagnation has been observed in recent years. The situation was and still is much worse with the volumes and dynamics of consumption of finished metal products in the domestic market, which lag far behind production, leading to an excessive level of overproduction of metal in the country.

Based on the conducted researches it is possible to allocate four stages for perspective development of metallurgical branch in Ukraine:

1) priority development of the domestic market for metal products, which will ensure more stable sales of manufactured products and reduce dependence on fluctuations in world conditions;

2) intensification of the introduction and implementation of innovative developments to create fundamentally new technical and technological metallurgical solutions, which will provide domestic demand for their own scientific, technical and innovative developments, reduce production costs by reducing resource and energy

consumption at all stages of production, increase environmental friendliness process, improvement of the range of metal products produced;

3) training of new generation specialists, who will have a higher level of digital culture, will be able to deeply combine and comprehensively apply modern digital technologies in real production and will be ready for lifelong learning;

4) public-private partnership, which will help determine the strategic framework goals and objectives of the industry, improve the institutional conditions of interaction between science and investors, solve the problem of volume and priority areas of funding and state support for scientific, technological and socio-economic changes in metallurgy of the future.

Therefore, summing up, we can say that ferroalloy production is an important component of both the metallurgical complex and the entire economy of Ukraine, which provides a significant share of tax and currency state revenues. To address the basic problems of domestic producers of ferroalloys it is necessary to develop government programs that should include the development of innovation infrastructure and scientific and technical support production, economically reasonable prices for energy, commercialization of scientific developments, establishing effective cooperation between the state, business and science, greater attraction of private investment.

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HOW DO TECHNOLOGIES, DATA SCIENCE AND ANALYTICS EVOLVE FOOTBALL?

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Large companies and tech start-ups are no longer the only ones needing widespread use of data science and analytics. In fact, technologies and data processing are now an essential part of the winning formula that's revolutionizing football teams and the way they play.

Ordinary fans, as well as referees and coaches, no longer need to stare at the monitor screen to understand how the goal was scored, who took the right position, and whose mistake led to the loss of the ball in this situation. Today any game-changing moment of the game can be reviewed from absolutely any angle thanks to technologies, such as True View and Hawk-Eye.

The replay system uses dozens of high-definition cameras installed all around stadiums worldwide, along with advanced algorithms, to enable views of gameplay action from every angle and even from a player's perspective. Each of the cameras in the stadium is connected to high-performance servers capable of processing up to 1 terabyte of data per 15- to 30-second clip. And this pure magic is managed by AI, which in several minutes after the episode happened delivers those stunning views via broadcast, digital, and mobile.

However, watching video replays brings not only an aesthetic pleasure to the audience but also practical benefits during the game. The video assistant referee (VAR) reviews video footage and checks signals from a chip implanted in the ball to either corroborate or refute the verdict of the head referee. VAR does not provide 100 percent accuracy, but impacts decision-making positively and helps to judge better and fairer. That's why Maradona's famous "the hand of God" goal wouldn't have been awarded if the match was played today.

While preparing for the match, football teams rely on data from plenty of variable sources to improve the game. First of all, Internet of Things sensors and GPS trackers monitor players' and ball movements in real-time. Innovative wearable devices record movement, effort, and fatigue levels during training sessions. Among the advantages of these appliances, specialists determine lightness, high accuracy of measurements, relatively low price and ease of use. All the gathered data goes directly to the coaching staff. In addition, optical tracking technology, which determines the position of players on the pitch in relation to the ball, opponents and teammates, up to 25 times per second, is also often used. Personalized video measurements provide data synchronized in time from body sensors combined with position sensors in the venue or at the training facility (Marinho, 2018, p. 49).

Many professional top clubs have their own cloud-based data warehouse which aggregates and structures data received from those devices. Last, but not least, big data analytics and artificial intelligence jointly process and analyze data from different sources.

Nevertheless, human is still the one to decide whether something happens on the pitch or beyond it or not. Sports data analysts scrutinize and interpret the information collected and processed by the means mentioned earlier, depending on the task at hand - whether it is to predict the club's profits based on the team's current results or to choose the game plan for the next match according to the opponent's style of play and the availability of healthy players for each position in the team. It is also their task to make clear charts, diagrams and tables, in order to explain the results relatively easily to the players, the coaching staff, as well as the owners of the club.

Data analysts are taking football to another level. Gathering and processing data has raised the performance, helped players be more consistent, and provided fans with an opportunity to enjoy sports in new ways. This has also helped teams in raising financial resources. As stated in a study by the Massachusetts Institute of Technology, "companies in the top third of their industry in the use of data-driven decision making were, on average, 5% more productive and 6% more profitable than their competitors" (Kovacic, 2019). Equipped with data, the teams are now better placed to negotiate and get a deserving price on brand endorsements, partnerships and revenues.

Advanced statistics, provided by data experts, help coaches to prepare matches easily. Only 10 years ago coaches used to have their own databases with players' statistics, written and gathered by themselves. That took an enormous amount of time and still wasn't accurate enough to be useful in each situation. Today, even non-professionals can buy a subscription to a special service like Opta, whose analysts and robust AI systems have already done this hard work. Moreover, it gives scouts powerful tools to identify the most promising profiles and enables player agents to better understand their players' strengths and weaknesses.

Summarizing, automatization, advanced examples of artificial intelligence and machine learning models, well-managed by professionals, have already changed the world of football. They have improved the capabilities of exploring and, as a result, upgraded the performance of many teams all over the world. In order to leverage the potential of data analytics in sports, brand new technologies of data assembling, processing and transfer will be applied. Hence, the future of data science in the sports industry, particularly football, is dazzling.

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INTERNET FRAUD AND WAYS TO AVOID IT

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The Internet is a network that connects computers all over the world and allows communication, file exchange, trade and much more. Internet only appeared in 1969, but now, only 52 years later, we cannot imagine our lives without it. You can communicate, study and do shopping without leaving home. It opens up a great world of possibilities, but has some drawbacks. We'll highlight a few varieties of online scams(Sabadash, 2013):

- with overpayment
- with prizes
- contingency
- online shopping
- online dating
- receipt

The scam with overpayment

This may include situations where you were asked to pay some money in advance for some kind of service or product, offering employment, but first need to send the money for the very same employment (job search service). This can also include fraudulent activities with the lease of property: You lease something, but such property does not exist(Ochimovska, 2013).

Fooling around with prizes

Won a car, a trip to Hawaii or a case of cosmetics? Do not hurry to press on these windows. Free cheese is only in a mousetrap. Very soon you will be asked to send money to some account to take part in the raffle, or a hacker can get access to your computer simply by sending a message. You will not even know about it.

Cranking on an emergency

This type of scams was popular in 2017-2019. You probably received a text message with the standard text “Mom, send money to this phone number, I am in trouble”. Here is the same scheme: you are asked to send personal data, because the bank blocked your card, but the bank has nothing to do here or something on the staff of messages "Hello, I am your childhood friend, help, send to the card some money" (Korshikova, 2021).

Online shopping

Often intertwined with the schemes of scams with prepayment, but you may also be asked to send money for the goods, the discount on which looks very significant, but sometimes, after you send the money you do not see neither the goods, nor the opportunity to contact the seller.

Fraud in online dating

There are more and more stories of couples who met online. Online dating industry is more developed than you can imagine. Trading personal photos, personal information, even web-prostitution and a lot of other things you can get on the

expanses of this segment of the Internet. Here you should be especially careful. Most often, and most banal – you spend some time talking to a person, and you are asked to drop some money for something he/she really needs (Ochimovska, 2013).

Fraud with receipts

Be particularly careful when you receive receipts: they can be corrupted, and you are asked to either return the money, if you missed the receipt, or the receipt for more than the agreement, and you are asked to return the difference between the indicated and the agreed sum. Here you have to check several times – these receipts may be spoiled, do not hurry, and call a person who can assure you that everything is correct (for example, a bank where you serve, or a financial expert acquaintance)(Korshikova, 2021).

Recommendations on how not to become a victim of online scams(Tyulyukina, 2018).

- Beware of fake online shops, pages in social networks and two-way websites;
- Do not believe all the messages;
- Personal information is only yours – do not reveal it on unproven sites and services;
- Do not disclose data bank cards (term of action and CVV-code);
- Do not respond to the letters that you did not expect or do not know their sources;
- Prepay only at the verified online stores or for the amount that you are not afraid of losing;
- Pop-up windows with announcements of sales of promotional goods or jobs – not the place where you find what you need;
- Do not use suspicious services;

If you have become a victim of online scammers, then contact the police.

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ENERGETICS SCIENCE

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Nowadays, all of us can make a small effort to make a meal, travel by car or public transport, study at home. However, what is a thing that provides us with the opportunity to do it? It is energy. Its importance is priceless for modern world.

Energy is too related to us that we have been dependent on it. And there is a main question: what caused energy needs and how did it begin?

In the past, people did not have enough effective technology to do daily work fast and qualitatively. They tried to improve it and finally could. An important invention was the steam engine, because after its creation idea of automation became popular. Many scientists developed this idea and finally they made the main invention. The concept of energy became known. From that moment, energetics science appeared.

It is a huge science which includes a lot of different ways of obtaining energy. It was begun to progress firstly in one way. It was the method of burning energy resources. Also, this method is one of the main ways of getting energy for these days. The action proceedings are not too difficult. The resources are burned and energy, which is formed, is saved in a receptacle.

Every day this science is improved. It gives us new effective ideas of obtaining and using energy. Nowadays, we can even get energy from our nature. We now know such technologies. By using wind, scientists can get energy. They install a huge wind generator in the open area and connect it to other generators. It is a wind farm. When blades spin, we can get work which is converted in energy. Other native generators work in the same way. For example, hydropower gets energy by using work of water flow. About solar panels which work differently than previous. They are installed in an open and sunny area. When sunbeams fall on a solar panel reaction appears. Because of this reaction, we can get energy.

Also, there is one effective way of obtaining energy. It is nuclear power. It gets much energy and takes small amount of resources. Nuclear power plant is huge base which has not only nuclear reactor. It includes many containers for cooling and for saving waste. The way of getting energy from nuclear power plant is unstable, so it is dangerous. Scientists try to reduce risk. The process of getting energy is clear. We get it from nuclear chain reaction of fission of plutonium or uranium.

However, there is one big disadvantage. It is environmental pollution. People make efforts to reduce it, but emissions are still immense.

Obtaining and using energy is a great idea of automation nowadays, but for this we lose our health.

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PERSPECTIVES ON ARTIFICIAL INTELLIGENCE

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Technologies of modernity are being developed rather fast, which will certainly lead to the soon genesis of Artificial Intelligence(AI) - the neural network which is capable of almost anything. By the word 'Anything' I mean the unlimited spectrum of possibilities. And exactly this fact grants us high possibility of occurrence of a threat to our race' existence. Let us look at AI from both sides: as it if it was the humanity friend or aggressive algorithm.

But first of all, let us see, what exactly is AI. This term appeared in 1956 and has been first spoken by American computer scientist John McCarthy. But at that moment it implied the use of different research methods which are not peculiar to people by a computer. Now the term 'AI' implies the algorithm which is literally endows the machine with human feelings and consciousness.

As a result, it can become an excellent conversationalist, an excellent teacher, a skilled artist, a film director or an indispensable worker in any factory, as well as a perfectly trained combat unit that can make important decisions or calculate the trajectory of a bullet in a split second. Thanks to access to the Internet, the mechanism will be fully aware of everything that is currently known to mankind, for example, about the harm that we cause to the Earth. Do you see what I'm getting at? Will this mechanism turn against us? There are many films describing this topic, the most striking tape of which is the famous saga "The Terminator", about an artificial intelligence that got out of control and decided that humanity is a harmful species.

This is the problem which interests many scientists around the world and is a stop factor in the development of this technology. Many experts believe that humanity is not ready yet for the consequences of the genesis of a perfect mind, and I support them in this. So as long as there is even the slightest risk of something going wrong, artificial intelligence cannot exist.

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ENERGY SAVING TECHNOLOGIES

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Nowadays the usage of electrical devices is one of main problems. As a nation, we spend a lot of money for electronics, heating, light appliances, cooling and other uses in homes, schools, different workplaces and other buildings. The research of U. S. Department of Energy, Office of Energy Efficiency and Renewable Energy says that nowadays people use energy more in 1.37 times at their homes than in 1980s. But an interesting fact – though, in general, usage of energy has got higher, its consumption is decreased on 10 percent per house. It is really strange, because our homes get bigger and bigger and contain more devices than in that times.

So, to reduce the CO2 pollution and save our money, there are a few ways how to use energy smartly. The goal is to figure out, if these devices are really so useful, as others say.

When you are going to sleep, do you turn off all items in the home? If you say "no", I suppose, you don't know that many electronics are left on standby when not in use. Of course, they don't use as much energy as turned on items, but such electronics can easily add 10 extra percent to your total amount of energy. The solution for the problem is a smart power strip. These devices control power and cut off items, which are plugged in, but not in use, so it helps to avoid extra spending of energy.

The next thing worth paying attention is energy monitor. The main goal of this device is calculating the running cost of all items to give a report of your spendings. Then you can analyze the data and make some changes in the house to avoid wasting energy. The statistics shows that it can save up to 15 percent on your electricity bills.

One of the most famous solutions are solar panels. What they do and how they help? Solar panels convert sunlight into energy, avoiding the need for traditional energy sources. In Ukraine, lots of people make money in this sphere because of special tariff plan of produced energy. For example, you spend near 15 thousand dollars to make a solar station with power of 35 kilowatts. Then you make a contract with regional energy station and sell your energy to the country. Such amount of money is enough for not paying for electricity and the station will bring net income after 4-5 years after the start. One and only disadvantage that producing of the energy with one solar panel is reducing after 8-10 years working. But, after this time you'll get at least the whole cost of panels or even double invested money. In addition, it's harmless for the environment.

Similar to solar panels, there is a little analogue. If you don't have enough money for many panels, inverter, you can buy solar charges. It's a great lifestyle change, which is convenient and saves our environment. These devices allow you to charge mobile phones, headphones and so on without power supply or battery pack wherever you want.

Recently I have learnt about an interesting device – programmable thermostat.

I heard that only a few people know, what it is. It's a great addition to a home, which allows to have full control of the temperature in the house. All cooling and heating equipment will be programmed to turn on and off based on your schedule. For example, boiler can be scheduled to begin warming up water an hour before you arriving home. So, you can come back and take a shower after a long day, also you can turn on your heating a bit earlier. I think, it's ideal for reducing your energy use because of usage heating and cooling only when it's necessary.

Nowadays most of us use LED lightning and it's a great decision, because they are not only 80 percent more efficient, but also last up to 100,000 operating hours more than common lightning. So, there are lots of innovations, connected with this lightning, including "Smart lightning". For example, you can buy IKEA's Trådfri bulbs with a remote control and smartphone hub. The smartphone hub connects to your device and allows to control each light bulb.

In summary, you see that there are lots of interesting ecofriendly energy saving technologies around us. So, let's try to use them and save our environment and money, because, unfortunately or lucky, they are main resources of the Earth.

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THE USAGE OF VIRTUAL REALITY IN DIFFERENT AREAS

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When it comes to virtual reality (or just VR), the vast majority of people have associations with computer games and consider that this is just a fancy toy most cannot afford. But nowadays this technology is rapidly developing and in the near future, it will be used worldwide for various purposes.

This is possible because of ability to impact on all human senses, not only our visualization and hearing, but even tactile sensations. This level of imitation find's it's uses in virtual prototyping and ergonomic design, remote control, creation of training simulations and many more occupations.

The most obvious and commonly practiced use of VR is for studying. It is used to teach professions where the operation of real devices and mechanisms comes with increased risk or requires high costs, like aircraft pilot, train driver, dispatcher, driver, mine rescuer, etc. It is also can be used for training personnel to work in critical or inaccessible conditions, like performing surgical operations and manipulations by novice doctors without endangering the patient's health, or training law enforcement officers by placing them in unique situations to study the reaction and work out different scenarios for their professional development (Kornilov (2019) p. 174-178).

The other common way of using VR technologies is through engineering, urbanism, architecture, or other occupations that require highly detailed modeling of various structures. Computer visualization of future buildings allows customers and contractors to travel across floors and rooms even before the laying of the foundation. Construction workers were given an opportunity to demonstrate their idea not just in a drawing form, but with the use of three-dimensional image, in which adjustments can be made already at the familiarization stage, and designers can try on their own creative solutions for building interiors, and find the optimal layout. Schemes for the city expanding, arrangement of park zones, competent management of space for comfortable and safe living of citizens - now this can all be done with the help of virtual reality (Nadysseva (2019)).

It can also be helpful for industrial workers: for crash tests, projecting power units, testing new equipment, holding corporative meetings, in construction of heavy machinery and even in soil analysis or finding minerals by creating visual models based on geoinformational data (Abdul-Hadi (2011) p. 751-757).

And after all, VR is extremely popular for entertainment and informational purposes, like watching sport games and concert broadcasts, or tourism, because with its help, you can not only visit the most famous and stunningly beautiful cities and sights. but also travel to yet unknown corners of the world.

It is important for us to realize the potential of modern technologies and all the possibilities we can explore with it. Despite the fact that virtual reality is still mostly a luxury or an attribute of highly developed industries, it shows it's uses even now and it's not hard to imagine how significant it will affect our future.

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FUTURE OF STEM

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STEM is a relatively new concept that educates students in four technical disciplines — Science, Technology, Engineering and Math — in a complex and flexible approach. This approach is based on a combination of theoretical and applied skills. The student covers several areas of knowledge at once by getting a chance to use information, check facts based on his own experience (Williams, 2018). Natural sciences explain the laws of nature, which we face every day. Technology makes it possible to use scientific knowledge in practice. Engineering helps to work with resources, materials, teaches how to experiment, and how to improve the environment. Math develops accuracy, logical thinking and the ability to follow algorithms .

The acronym STEM was introduced for the first time in 2001 by scientists in the U.S. National Science Foundation. The original acronym was SMET - Science, Math, Engineering and Technology - but then it was rearranged by Judith Ramaley, American biologist. Since the 2000s STEM-focused curriculum has been introduced to many different countries beyond the USA. At the beginning American students were falling behind students in other countries. Upon longer examination it was concluded that educators lacked deep knowledge of STEM and as a result were not prepared to guide students to those spheres (Hallinen, n.d.).

The main idea of STEM education is a cohesion of four spheres instead of using them as separate subjects. This integration allows students to deal with real-world applications. Solution of STEM problems requires not only technical knowledge and mastery of each individual discipline, but also a significant amount of creativity and flexible thinking. Students apply different types of knowledge in a context that helps them understand an association between the classroom and the outside world.

Why do we need STEM education? Nowadays, our world is changing and developing as fast as never before. Now even reading this text is impossible without those changes. Yes, we are talking about inventions. However, what is invention? Invention is a type of solution to a technical problem with creating something new, thus, each invention is about creation, and creation is the pushing power of today. STEM suggests us to pay more attention to resolving real life problems through learning math, technology and engineering. Does it mean that we should forget about humanities? Absolutely no, but it makes us understand that way of learning STEM subjects should be different. Humanities teach us how to live and give us direction to the future, while technical disciplines help us to build it. In addition, STEM is right about it, it is about developing the future that will provide us with an even wider circle of opportunities to continue that development.

The concept of STEM means and emphases that we need to start learning math, for example, with an extremely clear sight of what we are doing, not just to solve

some equations and calculate an integral, but also to try to understand why we are in need of math to solve a particular problem. To sum up, STEM is not about learning math and other technical subjects, it is about awareness of problems, and it's understanding (Oakley, 2014).

The most common argument against STEM education is that STEM is not meant for everyone due to two reasons. Firstly, people cannot have enough possibilities to study technical subjects, because maybe they cannot afford it. Secondly, our society has plenty of biases that not everyone can understand math, physics and engineering. In some cases, it might be true, but recent research shows us that it is not the common case.

The next step of bringing STEM to life is that we need to reconsider the role of teachers. Now, mostly the teacher is the person who teaches you and gives information, despite that on the Internet you can find it in a few seconds. The teacher in the STEM concept is the person who guides you and learns something interesting as well as you do. Nowadays, we have a tendency among modern teachers to teach in the scope of that behavior model.

Let us talk about advantages and disadvantages. Starting with advantages, we cannot mention that STEM implementation will increase the percentage of well-educated children. In addition, it helps to develop such important skill as thinking outside the box. Speaking of drawbacks, we cannot expect that such big changes will be a challenge for modern teachers. Not everyone can provide good guidance to the world of Science and Engineering with respective practise. Secondly, the STEM educational cycle might take a lot more time than a regular one, due to empirical nature. In addition, STEM will be a lot more expensive than the regular approach, because it means that society should provide all opportunities, including material one, for students for efficient studying, but there are already some material bases in schools. Finally, as mentioned before, STEM education is not a change for humanities, but in effort with trying to implement STEM and teach our children Science, we can forget about teaching them very important components, like humanities.

To conclude, implementation of the STEM education will be helpful for building the world of the future. There are plenty of advantages that we will get from it. Despite that, our society is still not ready for its changes, because it takes many reformations of educational processes we have for now and because of some biases that people claim to be true.

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HOW UNREAL ENGINE 5 WILL CHANGE THE GAME

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The game engine is called the central software component of the computer and video games, it makes development easier and often allows the game to run on multiple platforms such as game consoles and desktop operating systems such as Linux, Mac OS, and Windows. The game engine includes a graphics engine (rendering engine), physics engine, sound, scripting system, animation, artificial intelligence, network code, memory management, and multithreading.

There are many different game engines out there. Some of them are outdated, some have not withstood the competition in the market, and some are supported and updated over the years. One of the most popular, technologically advanced, and progressive game engines is the Unreal Engine.

Unreal Engine was developed and maintained by Epic Games. The first game made with this engine appeared in 1998. Since then, various versions of Unreal have been used in over a hundred games. The list of games made on this engine is quite long, the most popular are Borderlands, Bioshock, Postal, Devil May Cry, etc (Epic Games, 2021).

But Unreal Engine has received much more scope with help of new technologies like Nanite, Lumen, and others.

The goal of our research was to present what a game engine is, the features of modern game engines, the purposes of their implementation, and the perspectives of further developments.

The Demo version of Unreal Engine 5 showed the work of new technologies: Lumen and Nanite (Makuch, 2020). Lumen is responsible for realistic global illumination. This technology allows light to bounce off surfaces an infinite number of times and work in much the same way as in real life. Nanite - one of the key technologies in the heart of Unreal Engine 5. It allows you to show as much geometry in the frame as the eye can see, and it depends on the resolution - the higher it is, the higher the detalization becomes.

While game engines were originally developed to optimize the creation of games, the used technologies have found use in other spheres of the digital world as well.

Every few decades a technological revolution takes place in cinema, renewing the industry. The emergence of color and sound, computer graphics, "green screen", motion capture technology, a new approach to 3D in "Avatar" - all these innovations completely changed the way major studio projects were filmed. What the next revolutionary technology will be is still unknown. One likely option is to use game engines (Valentine, 2020).

It is first of all about Unreal Engine 4, which was used in the Marvel blockbusters, the new "Star Wars" and the "Mandalorian" series. Not a surprise that the engine was quickly adopted by movie studios - it comes in handy in pre-

production and in the creation of special effects in real-time. Filmmakers are increasingly refusing to use the "green screen" and other popular technologies in favor of Unreal Engine 4.

And even this is not all that this engine can be useful for. (Wikipedia, 2020). Also, its application can be found in industrial design and construction. For example, people doing modern apartment renovations could recreate a 3D model of a future home and use a VR helmet to show customers how their new home will look like.

Thanks to game engines, filmmakers, designers, architects, and engineers from around the world will be able to bring their ideas to life using this fairly simple and convenient tool in their work and for this, they do not even need to know to program or deepen in information technologies.

We believe that game engines will evolve rapidly and find use in more and more areas of our lives. Engines will no longer be game engines as well because they will no longer be associated only with games. All the latest digital technologies will be integrated into such environments to recreate our reality.

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ALTERNATIVE ENERGY SOURCES. PROSPECTS FOR THE DEVELOPMENT OF HYDROGEN ENERGY IN UKRAINE

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Renewable energy sources have long proven their efficiency and ergonomics to humanity. Combating environmental pollution and climate change, the rapid decline in oil and gas, have prompted people to look for alternative energy sources.

It is very important that humanity has already begun to take steps to displace traditional alternative energy sources. At first, it was perceived without much enthusiasm, but our planet is immersed in waste, chemicals and other remnants of human activity. The leaders of our planet finally decided to reduce the level of environmental pollution.

Ukraine's plans to use alternative resources are not very impressive: according to Ukraine's Energy Strategy for the period up to 2035, the share of alternative sources in the total amount of electricity should be over 13% by 2025. To better explain the Ukrainian level, I suggest to consider a very significant example: EU countries are planning to set the respective index up to more than 50% of the total by 2030 (Ministry of Energy of Ukraine, 2017).

Hydrogen is an environmentally friendly source of energy. The specific heat of its combustion is three times higher than that of oil (qhydrogen = 1.17 GJ / kg). According to astrophysicists, hydrogen makes up about 99% of the mass of the universe, and in the atmosphere of the Sun - 90%. Large reserves of primitive (space) hydrogen are stored in the bowels of our planet (Dong, 2017).

According to the statics for 2018, the world's hydrogen use has grown to about 74 million tons. According to the International Energy Agency, adding only 20% of hydrogen to the European gas network will reduce CO2 emissions by 60 million tons per year (Dubko, 2021).

Currently, the method of hydrogen production cannot be called environmentally friendly, because this element is obtained by burning methane, which leads to mass emissions of heavy elements into the atmosphere. This threatens the greenhouse effect, from which hydrogen must save. However, there is another way of synthesis. Renewable energy sources are needed to produce clean hydrogen. To provide the same electricity, you can use solar. According to scientists from the Massachusetts Institute of Technology, the extraction of hydrogen using energy from solar panels may become profitable in the coming years. In this case, hydrogen production will cost about $ 2.5 per kilogram, which is four times less than the current price of $ 10.6 (Bellini, 2018).

In Ukraine, alternative sources tend to develop rapidly. Therefore, in Europe it is believed that our country has a great potential for the development of the hydrogen industry. Ukraine can also become the leader in hydrogen supplying to the European Union market. It is planned that 75% of Ukraine's fuel will be exported to the European Union, and the rest will be used for its own needs (Titamir, 2020).

Ordinary hydrogen can help our planet "breathe easier", because it is used in almost all sectors of the economy. For example, instead of natural gas in heating and instead of gasoline in transport. The most active water filling stations are developing in Japan, China, Germany, the USA and Canada. The development of cars and water fuels by such concerns as Toyota, Honda, Mercedes, BMW, Hyundai became the reason for it.

It can also be used for heating houses. The UK was the first to succeed in this area. They have already started using a mixture of 20% hydrogen and natural gas to heat Kiel University and about a hundred houses next to it. Also, the world's first hydrogen boiler was put into operation in the Netherlands for heating a residential building.

Stanislav Kazda, RGC Development Strategy Director, believes that Ukraine will start using hydrogen in the next 5-10 years. Therefore, it will be expedient to reconstruct the gas transmission system for the possibility of hydrogen transposition. According to the director, it is also important for Ukraine to develop a strategy to change the country's energy balance to attract funding (EU grant programs, investments) (Biznes tsenzor, 2020).

At the same time, there are obstacles that make it impossible to develop the use of hydrogen energy in Ukraine in the near future.

One of the main reasons for it is the high cost. The value of pure ecological hydrogen is determined by the cost of electricity. In different countries, this index varies from 20 to 79 dollars per MW.

The price of such electricity for electrolyzers per kilowatt will be from 15 cents for solar and from 11.5 - for wind. With such results, environmentally friendly hydrogen will be unprofitable for 2-3 decades. Even the United States, where such energy is the cheapest, plans to equalize its cost to the price of natural gas at about 2030.

Another problem is that hydrogen needs to be produced by electrolysis. The biggest problem in order to increase renewable energy is storage systems and highly maneuverable power plants, which Ukraine does not currently have. There is simply nowhere to store energy. Therefore, our state continues to be forced to use "cheap" nuclear power plants, which are the biggest polluters of the environment. It is also necessary to have a large amount of purified water. However, Ukraine is insufficiently supplied with potable water resources. Reservoirs are also drained annually due to global warming. It turns out a kind of paradox: global warming is knocking on the door due to environmental pollution, and we cannot pollute it, because our water resources have already been devastated by the same global warming.

Another problem is that in order to ensure the operation of electrolysis fuel technology, it is necessary to put into operation a significant number of stations. Of course, the problem is not that it requires significant funding, but that as a result of such construction we will get a significant amount of carbon dioxide emissions into the atmosphere. Therefore, the global development of hydrogen energy is impossible until the utilization of CO2 begins.

According to the IEA, we currently obtain 99% of our hydrogen from fossil fuels. Global production is about 70 million tons. As a result, hydrogen production leads to emissions of about 830 million tons of carbon dioxide per year. At this time, "gray" hydrogen inevitably leads to even greater environmental pollution and improperly distributed costs of fossil resources (Bobro. 2019).

The last problem considered is that the transportation of hydrogen is possible only through sealed pipelines. For successful operation of this method, it is necessary to provide new modern pipelines along the entire length of the site, because this element has a small atomic mass and a feature of volatility. There is nothing special about it, but it can slip out of the smallest cracks and is explosive. This feature of hydrogen poses a great danger to use.

Also, our government plans to supply hydrogen mixtures to consumers for domestic use in the near future. However, the developed "Road Map" does not have an estimate, technological calculations, regulations, so we cannot talk about a clear plan that will be implemented (Dubko, 2021).

It is impossible to develop Ukraine's hydrogen energy without approving the regulatory framework, replacing obsolete pipelines, adapting legislation to international requirements in this area, attracting investment in the development and construction of new technologies, and certification.

Of course, it's sad that we have to graze the rear, but agree, it's great that other countries are taking steps to improve the environment. By working together, we can save the planet from anomalous restructuring. Alternative energy sources must enter our lives through many developments, and this is not as simple as it seems at first glance.

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IMPLEMENTATIONS AND FUTURE PROSPECTS OF THE XEROGRAPHY PRINTING TECHNOLOGY

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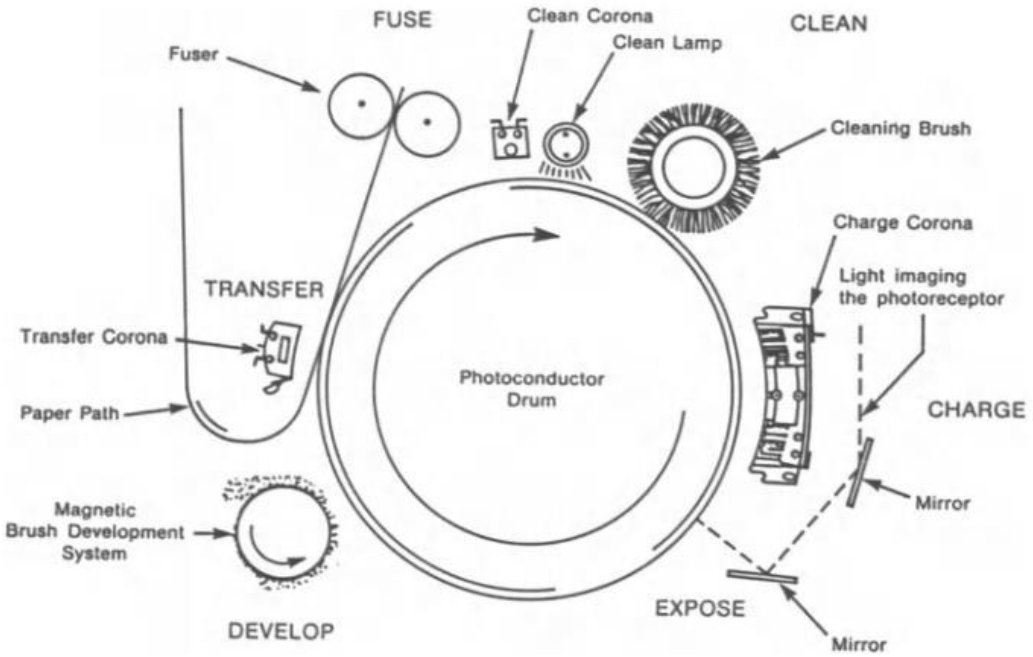
Xerography is one of the most renowned technical approaches in construction of modern printing equipment. It implies the use of electricity-sensitive components to produce the desired output on a printing surface. This technique belongs to the digital printing methods – it avoids using any kinds of analogous medium material (usually film, the *Computer-to-Film* technology) in favor of direct transmission of image to the printing plate. Such type of technology is called *Computer-to-Plate* (CtP), which replaced the CtF and is widely used nowadays.

Various printing machines based on xerography have been developed over a course of, roughly, 70 years. In the late 1930s, American physicist Chester Carlson created a first working appliance that used specific properties of metal (selenium) coating applied to the printing cylindrical drum. The key principle was initialization of electrostatic forces in specified open areas of the drum coating due to their exposure to the light. As a result, areas carrying electrical charge are to interact with traces of dry toner in order to transfer it to printing material, i.e. paper. This process triggered paint particles to attach to the surface.

It is worth mentioning, that initially, xerography went under other name – it was called electrophotography (now term is obsolete). However, the term xerography, coined by the legal successor of the Carlson's invention, the Haloid Company (then Xerox Corp.) has been more acceptable.

Overall, xerography consists of six distinct subsequent steps: charge, expose, develop, transfer, fuse and clean. Each step is performed by special parts of a machine (printer, copier).



During the first step, charge, the surface of a photoreceptor is charged by a corona discharge to incept a development of internal electrical field inside it. Two different devices may be used for the process – either corotron or scorotron. Both of them conduct current through a set of positive and negative corona wires.

The next step, exposition by light eminent enables the photoreceptor to produce a latent image - charge pattern on the photoreceptor that mirrors the information to be transformed into a real image. For copiers, light is emitted by a lamp, and for printers - by a modulated laser or a linear array of light sources.

Development of an image is achieved by depositing toner particles onto the surface of photoreceptor. The variation of charge within constant (or alternating) electrical field determines the distribution of particles and the shape of image.

Then developed toner is transferred to paper by attracting to opposite sign charge on the back of that paper. Fuser melts toner applied to paper to make it permanently stick to the media. Finally, photoconductor gets discharged and any traces of toner are cleaned off to ensure smooth printing process in future. The reason is that small quantities of toner are always left on the surface of the drum which may disrupt future publications.

Although the basic description of the technology seems plain for it is based on elementary laws of electrostatics, it actually concerns some science-backed as well as engineering issues in the xerography printing technique. For example, different ways of controlling the charge of printing toner (in particular, its distribution) are subject to rigorous scientific research, further technical tweaking and therefore – marketing competition between the biggest equipment manufacturers. Toner (electrostatically charged and pigmented polymer particles) is a key substance performing the printing process in xerography; its behavior depends on the given electrostatic potential. So it is particularly important to collect information about the impact on the components involved in the set of related printing technologies with toner as a main agent – among them magnetography, ionography and others.

Numerous companies at the field (Kodak, Xerox, Canon) bring out their developments that may subtly vary in materials, appliances and other details. Though, the key principle remains unchanged.

Broadly speaking, the branch of xerography-based devices has great perspectives, as well as the adjacent, relative magnetography and ionography fields. They all skip the stage of analog phototypesetting presented in classical printing techniques thus enabling high quality of the output images. In addition, they are also more ecological for no chemicals are involved in the process. Shortly, these technologies set the bar high for the industry.

Drawbacks are due too, for example, the demand for more qualified workforce and more delicate technological tweaks. Costs may also be way higher, but xerography still is a priority direction of studies and researches.

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STRANGE PROGRAMMING LANGUAGES

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Such a branch of computer science as programming is gaining mass popularity. And we all know our usual programming languages (Python, JavaScript, Java, C#, C, C++, Php, Swift, Ruby, Go), but this article aims at describing some strange programming languages, such as 'Chef', 'Shakespeare', 'Chicken', 'Malbolge', 'LolCode', 'English'.

The syntax is very interesting, easy to learn. However, programmers do not use them at all or use them very rarely. Although there are some that are very similar to common programming languages (such as "English" and "Python" and so on), but for some reason they choose a known option to us.

At the current time, the IT-sphere gains popularity among the perspective professionals. Besides, many inventive people are creative with their business. That is why strange programming languages should be taken into account.

One of these programming languages is 'Chef'. It is very amusing, being created for those people, who like to cook and want to study learn to program. It looks like a cooking recipe.

Consists of ingredients and cooking steps. It sounds funny, but it works well and creates programs.

In addition, 'Shakespeare' is not less interesting. The names of the heroes in Shakespeare's poems match with the names in the programming language. Their interactions take place in scenes, where input and output acts are carried out, questions are asked, and answers can be received.

The programming language 'Chicken' shows only one word that is 'chicken'. The code page does not contain any other symbols. A Swedish developer created this language after a parody of scientific reports. . It is clear that the language does not function normally and cannot perform various actions.

In addition, one more language should be mentioned and it is 'Malbolge'. It was developed in 1998 and in general, it aims to become the most difficult programming language in the world.

It does not have any constructed syntax. The interesting fact is that the first program could be written only 2 years after the creation of the language. However, the program was not written by the creator and in another language more exact it is 'Lisp'.

"LolCode" was developed in 2007 and it came from slang English and phrases from a picture of the internet memes 'Lolca'.

The language has its interpreter and documentation on how to use it to write the quite normal program.

In the end, the biggest simple language on my list is 'English'. Because natural English is simulated in this language.

In consequence, the benefit of such creativity is that with its support programmers can study different languages and improve their experience.

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MODERN DEVELOPMENTS IN BIOMEDICAL CYBERNETICS

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Nowadays IT is actually implemented in all the sectors of health care. Thanks to that medicine has completely new features today.

This process is accompanied by significant changes in medical theory and practice associated with making adjustments to the training of health workers. IT helps a doctor to diagnose diseases, store and effectively use the information at all the stages of treatment and, what is more important for medical science, IT is invaluable in scientific knowledge.

Medical hardware and computer systems are the separate expert system. This is a medical system of monitoring of patients based on long term and continuous analysis of large amount of data that describes the state of physiological systems; computer analysis system; data imaging, ultrasound, radiography, automated systems of intensive therapy, biofeedback, prostheses and artificial organs based on microprocessor technology computer – aided analysis of data of microbiological and virological studies, analysis of human tissue and cells.

For example, German scientists have produced a worthy microprocessor - micro implant in the retina, called Argus II. It uses an electric array of photoreceptors that stimulates retinal cells at the back of the eye, which then sends a signal through the optic nerve to the brain. The wireless signal is transmitted from the camera, built into the glasses, that the patient wears, on a chip implanted near the retina. Argus II is for people with a rare disease called retinitis pigmentosa, which damages the lings – sensitive photoreceptors and doesn't affect other cells of the retina. It is an ideal prosthesis for reproducing surrounding area in portable form.

Nowadays we have made another step to create devices controlled directly by the human brain. The Japanese company Riken in cooperation with Toyota and several other organizations created a wheelchair which can be controlled by disabled themselves. Receiving brain radiation sensor converts brain signals, thansmits them to the special notebook and then to the mechanisms that control the movement of the wheelchair.

The main ideal of the RoboEarth project is to create a universal management system with using internet technology and local computer networks to make it much more accessible to users.

Scientists from California Institute of Technology have implanted two microscopic chips in back parietal cortex (part of brain (cerebras) which is connected with primary motives) of a volunteer who is completely paralyzed below neck in order to trace the activity of about 100 neurons. Thus his body was tied with the robot-assisted hand connected to chips in brain (cerebras). The chips allow to use artificial hand as the own one, transforming brain electric signals to commands. The experiments showed that using chips, the disabled person could take a cup and move

the cursor, using computer mouse. Specialists hope that this approach in future will make hands and legs controlling intuitive.

The group of scientists of Illinois University has created a new kind of implants that must be placed directly in the brain tissue.

- Until now, brain activity was measured in two ways. By the first one scientists used electrodes attached to the ends of thin needles which could damage brain tissues. The other way is considered to be safer and it has to use the array of electrodes which reads information from brain surface. However it does not always provide the necessary accuracy of measurement.
- New implants represent the array of electrodes fixed on silk basis. They are installed on brain surface and dissolved due to saline solution. Thus electrodes grow into tissues, allowing not only to receive information, but also to transmit signals to external prostheses.
- The sense of this invention is in possibility to recreate by electronic means the same processes which happen in human neural network after brain synaptic structures scanning.
- The technology of personality transferring from biological onto computer matrix allows to write down all information on the electronic computer (EC). Transistors improvement will allow the computer to achieve the power of human brain in 10-15 years. That means that in 15 years the human brain will be able to live not only in human body but in computer as well.
- There are two types of consciousness loading: with destruction (the original of brain is destroyed while being scanned) and non-destructive way (the original of brain remains unimpaired). The first option will be applied in the case when keeping brain alive will be impossible, for example, in case of injuries, incompatible with life. The other option will be applied in cases when the brain of the human gradually fails while aging. Then the chip will be installed in the patient's head to which the person's identity information will be gradually transferred, and in process of brain aging, more and more replaceable powers will be transferred onto the chip.

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RECOMMENDATION ALGORITHMS VARIETY AND IMPORTANCE

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The business nowadays competes every day for our attention, especially in days of customers' demand for personalized media every day. Some might say insights from the data and targeting customer-based systems rather than particular audiences bring your business to the next level. As big tech says: everyone is or eventually will be a data business. Couse, from data: we get insights and build up the knowledge. Recommendation-based algorithms are the best delivery mechanism for any business.

The main task is to outline benefits and use cases for creating recommendations. Also, proof: "Personalized algorithms know us better than we know ourselves." (Smith, J. J. 2021 Sep 8).

The main ingredient of the recommender system is collecting information about you to recommend relevant content to you. Collaborative filtering models(CFM), Content-Based models(CBM), and Hybrid Models/Deep Learning are the foundation of all recommendation algorithms. CFM is built either on explicit feedback or implicit feedback and has a cost start problem. CBM is similar to CFM, with one main difference that diminishes cost start problems by using only content-based features. And the most modern of all is Hybrid Deep Learning algorithms. They represent complex tastes over a various range of items, even from cross-domain datasets. In Hybrid Deep Learning algorithms, users and items are modeled using both embeddings that are learned using the collaborative filtering approach, and content-based features. Once embeddings and features are computed, the recommendations can also be served in real-time (Contal, E. 2020 Mar 9).

By using recommendation algorithms, businesses can increase average order value, boost the number of items per order, lower work, and overhead, engage customers, and provide relevant material. For example, TikTok - designed based on recommendations collected about you building up the foundation of their business.

To sum up: businesses gain tremendous value from using recommendation systems. Clients on the other hand enjoy the mindless decisions made for them.

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HISTORY OF VIDEO GAMES

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Despite the fact that the first video games were developed less than one hundred years ago and it is a short period in the context of history, nowadays they have become a very promising industry and an important part of our lives, because almost every person has played a video game at least once.

The main task is to study the history of video games and their impact on society.

The history of video games can be divided into several separated periods: early history, 1970s, 1980s, 1990s, 2000s, 2010s and 2020s. This division allows us to analyse the rapidly changing trends in the video-games entertainment industry. We are interested in showing the continuous development of the industry rather than providing a narration of each period. There are also local trends in each period.

The history of video games spans less than one century, but still it is quite complicated. It is even hard to say which game was the first video game, because there are several contenders for this title. Moreover, it turned out that most of the earliest known video games were created as parts of scientific research and did not mean to be a form of entertainment. However, some of them were designed purely for fun. All these games had a couple of traits in common: they were based on traditional games and were designed for a special computer and could be played only on it (Donovan, 2010, pp. 29–34). Only a few decades later we saw the true potential of the video games phenomenon. Already in the 70s it was getting obvious that video games had gone beyond academic laboratories. In contrast to previous developments, video games were beginning to be a part of pop-culture (Kent, 2001, pp. 105–112). In addition, making games became commercially viable then. Evidence of that can be seen in the fact that the manufacturer of the first commercial home video game console won more than $100 million in copyright lawsuits related to their video game patents (Video Game History, 2017).

To sum up, nowadays video games are no longer just a way to entertain yourself. They became an important part of culture, formed a completely new industry, which is constantly developing, and were applied to lots of spheres of our lives, such as art, education, medicine, science and others.

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SELF-DRIVING CARS

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Nowadays, a car is really the type of transport without which it is difficult to imagine a modern person. The world is developing rapidly, and the engineering industry is no exception. Every year we observe how the number of new, improved cars increases. Their capabilities can easily hit an average person. Already, in 2021, self-driving cars are becoming more popular all over the world, and making it much easier to drive a car and much safer. This is a vehicle that can operate almost without human involvement and easily responds to environmental stimuli. The Society of Automobile Engineers (SAE) divided cars into 6 types, from zero to fifth, according to the criterion of vehicle automation. The zero level is characterized by the lack of automation, the first, second and third levels have different functions that can be performed automatically, at the fourth level the car can drive itself under certain conditions, but human control is still necessary. At the fifth level, there may not be a driver in the car at all, that is, a car in any conditions can go without human control.

Currently, it is not possible to buy a car with full automation yet. Such cars are only developed and tested on the roads. Such developments require great accuracy in software to allow the free movement of such vehicles. Motion sensors, radars, cameras, ultrasonic mechanisms are installed on them, thus, the car transmits all the information to programs that further analyze it and give appropriate commands. Thus there is an acceleration, a partial or full stop and maneuvering on the road according to the set route. Self-driving cars easily work out road markings, signs, traffic lights, that is, they determine how to behave at the time of movement. Although free sales of autopilot cars should have happened a few years ago, however, this did not happen due to certain difficulties with the software. Probably, in the coming years we will definitely be able to try such unusual cars for us. But the global market offers a wide variety of partially autonomous vehicles belonging to the third and fourth levels of automation. Built-in function help to avoid drifting onto dangerous sections of the road, slow down and brake if necessary without human intervention. That is, such a car reacts to advance, fixing deviations from the norm, analyzes and executes the necessary instruction. This significantly increases the level of safety of passengers, creates more comfortable driving conditions. Almost all modern car models have the following functions in their configuration. Therefore, it becomes normally to use such a function. These innovations are really an important achievement in the automotive industry, and in the near future it will be only improved.

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THE IMPACT OF CRYPTOCURRENCY ON THE COUNTRY'S ECONOMY

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The rapid development of information technology, the expansion of the IT field and the creation of new engineering inventions are causing a constant transformation of the world. Each new technology is designed to make a person's life comfortable, otherwise simplify and improve it. This principle has extended to all areas of human activity, respectively to the economy. A breakthrough in it was a cryptocurrency, a new financial instrument.

Cryptocurrency is a type of digital currency, the issuance and accounting of which are based on asymmetric encryption and the use of various cryptographic methods of protection, such as Proof-of-work and / or Proof-of-stake. The operation of the system is decentralized in a distributed computer network.(1)

Cryptocurrencies are a type of digital money that usually operates on the basis of blockchain technology. The value of this technology is that the information encoded in it is stored on different, independent computers, ie there is no single server for it. When transferring cryptocurrency, a peer-to-peer network is created between the sender and the recipient, which may have no intermediaries. (2) exclusively between two users.

At the moment, cryptocurrency is not very popular, but there are already potential participants in economic processes that are affected - banks. National banks cannot track completed transactions or influence the cryptocurrency rate. The exchange rate of cryptocurrencies is influenced exclusively by market factors: due to the decentralization of these currencies, the exchange rate is set by the ratio of supply and demand for them, sometimes the exchange rate may be influenced by media people or people with the largest share of the currency. Therefore, all that remains for banks is to follow the trends and developments of the cryptocurrency market and try to adapt - to create their own cryptocurrency unit.

Six of the world's largest banks - Barclays (UK), CreditSuisse (Switzerland), Canadian Imperial Bank of Commerce, HSBC, MUFG (Japan) and StateStreet (USA) - have stepped up efforts to launch a new form of currency: distributed registry technology will be used for instant payments and clearing of securities transactions, writes FinancialTimes. The Swiss bank UBS together with Clearmatics Technologies created a new cryptocurrency, which they called utility settlement coin (USC - practical currency for settlements). BNY Mellon, DeutscheBank and Santander then joined the project to increase the efficiency of financial transactions (3).

The influence of cryptocurrencies on traditional currencies and settlement methods is inextricably linked to political debates about their status in the modern economy. Restrictions and bans on their use have been introduced in some countries to avoid market destabilization and financial fraud. Governments and central banks are usually negative about not being able to fully control, making it extremely difficult for states to use cryptocurrency for their own purposes. As a result,

governments either do not respond to the development of the cryptocurrency market or restrict its activities and investments in it. (4) India, Nepal, Bolivia, and Thailand have exemplified the use of such an ineffective approach. Yes, as the number of interested users to buy or invest in cryptocurrency increases. Accordingly, the growing demand for cryptocurrency may trigger the process of replacing the fiat currency, thereby reducing its turnover and affect the country's economic processes.

Thus, the development of cryptocurrencies, popularization and increasing demand for it increase its impact on the economy in the future. How positive or negative the impact will be depends on the country's suitability, namely their legislation. Outlining the clear legal status of cryptocurrencies and optimizing the regulatory activities of government agencies will eliminate possible shortcomings.

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ENERGY SAVING

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Nowadays, humanity has made significant progress in technological development, which has become an integral part of modern society. However, industrialization has presented the need for a new resource - energy. Mass reckless use of various devices by the people creates a problem of an energy shortage, which can lead to both serious climate problems and an increase in the ratio of energy used to energy produced.

As always, no one wants to destroy their planet or throw away devices that will not work without energy, or even pay big bills. Therefore, everyone should start saving energy on their own in different ways: there is no need to completely renounce the use of energy, it is enough to just monitor how it is used and not waste it in vain. There are so many tips that everyone can find something useful for themselves and think about why he/she has not used it before and how much it was possible to save both energy and money.

So, it is time to start using some of them. For instance, the most popular habit is the irrational use of light in the house: you want to go to the store or do something else in another room without turning off the TV and lights. Let it happen once or twice due to inattention, but when it becomes a habit, you need to change it. The more light consumed, the more money you have to pay. Another great example is that if you live with your family, you need to make sure that each of you turns off the lights or devices, load the freezer and washing machine more than 60% each time it is used, and install energy-saving appliances (light bulbs, sockets, etc.). Switch to new, energy-efficient light bulbs and you could cut your lighting bill by up to 90% a year (Topping, 2021).

Furthermore, it is necessary to understand that you should save not only light in the house but also other types of energy (gas, fuel) outside. If you go somewhere, think about whether you need to use a car or you can go ride a bike or just go walk. This helps not only to save energy and resources but also to improve health and prevent the growth of the climate problem. Everyone should also understand that you need to use energy rationally both at home and at work or at someone's party. No one wants to pay more because you didn't turn off a light bulb or a TV.

In addition, if you are tired of paying your bills and you have some extra money, think about investing in solar panels. This will not only save you from constantly paying bills, but also allow you to earn money by selling energy. Moreover, this energy is completely environmentally friendly and can have an impact on climate change in a better way.

In some cases, energy loss occurs not only from human inattention but also from malfunctioning generators, transmitters, and various devices. Very often this loss is because the devices are old but continue to be used. Therefore, it is necessary to replace poorly functioning and old appliances to save a lot of energy.

These examples are the most popular of the wasted energy in large with its solution. Others can be talked about for a long time, but everyone must conclude how he spends energy and how it can be saved. Governments of different countries understand the problem of energy saving, so they encourage people to save in all possible ways. The Energy Efficiency Office of the Department of Energy in London coordinates government activity relating to the efficient use of energy and encourages conservation through leaflets, publications, films, seminars, events, and various schemes. (Smith, Collett, 1988).

In conclusion, it is necessary to start following the various tips for energy conservation as various global energy problems are already beginning to rise fast and they may reach irreparable limits soon.

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IMPLEMENTATION OF SUSTAINABLE AI SYSTEMS

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Nowadays, some advanced algorithms are capable of producing pictures, composing poems, and classifying photographs. Robots are able to move around independently and some even know how to make sensible decisions. With the technology progress, computers perform plenty of tasks without human intervention. All this is possible thanks to machine learning that was developed to adapt to new data and produce recommendations based on complex calculations and analysis.

Nevertheless, new issues occur as a result of advancing technology. The AI lifecycle involves lots of intensive computations such as long-running training or hyperparameter searches. Besides, they demand huge datasets that may be transmitted over the Internet. All of these activities need a lot of power, which releases carbon dioxide into the atmosphere. Additional energy consumption, including hardware and data center cooling, also contributes to carbon emissions.

Recently, scientists have found out that the computing expenses of high-performance AI systems double every three months, and research centers are receiving significant funding to build more efficient algorithms. This will result in severe environmental issues over time, particularly in places where data centers are located. That is why developers should think about the influence on ecology. For instance, the training of an advanced NLP model is already comparable to the emissions produced by five cars during their operation.

Even though it is still impossible to find a solution to all problems, sustainable AI offers several techniques to reduce the negative ecological influence of AI systems in the stages of designing, developing, and deploying.

Firstly, we could introduce alternative deployment strategies. A positive effect may be accomplished by preventing power consumption through using special equipment or optimizing the use of existing hardware like general-purpose CPUs. It also matters where we choose to train our AI systems and where they will be deployed. It can be controlled by the load balancing services supplied by cloud providers.

Secondly, a great number of research projects aim at looking into how to train models faster and more efficiently by reducing the model size and restricting compute cycles. Therefore, we can reduce the financial and environmental costs of developing and implementing AI systems.

This is one of the issues TinyML may help with. This subject has been exposed to scientific scrutiny as a result of the expansion of IoT devices, which have limited memory and processing capabilities.

TinyML is the combination of traditional machine learning and energy-efficient IoT devices. Historically, these areas have not interacted and worked almost separately. Nevertheless, they have been integrated to form a new engineering field

that will change a variety of areas. Edge and energy-efficient computing are the primary areas where this approach could be applied successfully.

Opposing cloud solutions, edge computing is a distributed paradigm in which calculation is performed close to the data source. The purpose of edge computing is to keep data away from CPU resources as much as possible. Data sets are is analyzed and processed closer to the point of origin.

TinyML algorithms work similarly to traditional machine learning techniques. The only difference is that «tiny» models are compressed after training. Shrinking a model implies reducing the size of bigger pre-trained models without sacrificing accuracy. It is necessary because of the lack of microcontrollers' RAM.

A few methods can be implemented to compress a model.

The first approach is pruning. It is the procedure of eliminating neurons that have minimal impact on prediction error. The new architecture does not reduce the precision of the output since the neurons that have a dramatic impact are preserved.

Deep compression is the second approach. It includes processes of quantization and Huffman encoding. Quantization is a method of neural network approximation by converting floating-point data to low bit-width numbers. The purpose is to reduce the memory consumption and amount of calculation. Huffman encoding is the algorithm used to compress data. It ensures more efficient data storage, which further reduces the size of the model.

Thus, we investigated the environmental impact of sophisticated neural networks and discovered what sustainable AI is and how it works. Considering all the arguments, environmental sustainability should become the main subject of our researches if we are to continue enhancing the standard of living for future generations. In addition to sustainability, we can conclude that it opens up plenty of prospects for innovation across a great number of areas. This method has the advantages of cutting device costs, minimizing ping, and boosting data security.

To sum up, I would like to point out the fact that it is a debatable issue. Nevertheless, we can not simply ignore the problem. AI consumes a lot of energy, and most technology companies have no idea how to assess their ecological consequences. And the first step toward solving this problem is to start an open conversation about AI's environmental impact and how to measure it.

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ADVANTAGES AND DISADVANTAGES OF ARTIFICIAL INTELLIGENCE

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Nowadays, Artificial Intelligence (AI) has widely spread in our lives. Artificial intelligence is a computer program, which has some learning abilities. It is known that AI involves a method doing some work or running an experiment which we would consider to depend on the human intelligence.

The main task is to analyze the advantages and disadvantages of Artificial Intelligence and realize the impact on the society that not only can be considerably beneficial for us but also unexpected. Nowadays technologies are all the range that can affect all fields of jobs.

Exploring the Artificial intelligence seems to be a debatable topic. There are a lot of notable advantages of Artificial intelligence applications. AI Robots can be used in such situations where researching can be harmful for our health, they even do not need any breaks, in contrast to humans. If we want to build system that has well behavior, we have a need to decide what good behavior means in each application domain (Russell, S., Dewey, D., & Tegmark, M., 2015). These robots can physically interact with environment that makes them possible to assist even with patient care in residential care homes (Virginia, E., & Jenny. D. 2014). There is a dark side to every bright. The improvement of innovative technologies can be a double-edge sword. That means that scientists predict that in the next 20 years, a lot of jobs will be completely lost because of machine automation, getting rid of the need for physical labor.

To sum up, there are some positive and negative effects of existence some Artificial intelligence in our life. Thanks to AI, we can broaden our horizons. The appearance of some nowadays obstacles certainly calls for the need of innovative technologies. Some people consider that methods of using Artificial intelligence can lead to damaging problems in the way it comes to be held by the wrong person, such as invention of the nuclear weapons. Although, none of the AI robots have caused irreversible damage yet. It has only made benefits of such technology, which is available to a wide range of people.

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BIG DATA IN AGRICULTURE

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In today's world, big data is assisting in the improvement and transformation of a wide range of industries, including agriculture. It is the foundation of any nation's and the world's economies. The majority of rural populations in some countries, such as Africa and India, rely on agriculture for their livelihood. Agriculture is responsible for providing us with food, energy, and medicine (Meisner, 2015).

Climate change, rising population, land and water limits, increasing urbanization, environmental degradation, coping with new technologies, achieving more with less, and other issues confront the agriculture sector today.

Agriculture has changed over the years to become more high-tech. Agriculture specialists are now promoting data-driven agriculture as a solution to the global concerns of climate change and rising food demand.

Agriculture has experienced multiple revolutions, including the industrial, green, biotechnology, and big data revolutions. It is going through a digital transformation. Traditional skill-based agriculture is rapidly evolving into digital and data-driven agriculture, with big data playing an increasingly important role in increasing production.

Big data (BD) is a newer technology that can be used to support smart city services. Machines, people, and businesses are the three main sources of big data. In farming, big data technologies are critical: machines are outfitted with sensors that collect data from their surroundings.

Agriculture is embracing big data in a big manner, resulting in agricultural "big data," necessitating massive expenditures in data storage and processing infrastructure. Agricultural big data refers to the large amount of data generated naturally during the agricultural process, from seeding through harvesting. Agreements on data availability, data quality, data access, security, responsibility, liability, data ownership, privacy, and cost distribution are all important arrangements for big data management. One of the most essential aspects of big data is that it necessitates the use of analytical tools to extract value from it, hence increasing farmer and agricultural professional output. Big data can be costly, time-consuming, and ineffective if it is not analyzed properly. Traditional and non-traditional players' roles are predicted to evolve dramatically as a result of big data. It will alter the way farms are run and maintained, as well as real-time forecasts and physical item tracking. Big data can implement the interventions required to reverse alarming food insecurity trends, enhance food production, and implement long-term solutions. The agriculture business may benefit the most from big data and analytics in terms of efficiency gains and improvements. It could be the most effective strategy to transform the agriculture industry (Agboola, 2018; Nichols, 2018).

Agriculture is confronted with numerous issues, particularly in developing countries. Big data's key challenge in agriculture, despite its many benefits, is its

adoption and how to make the data produced relevant and usable for farmers. Understanding how to make the greatest use of large volumes of data remains a key difficulty. As big data analytics becomes more widely used, some skeptics may wonder if it may someday replace humans in a variety of roles. When building predictive algorithms that largely rely on data, data bias and variation are significant hurdles to overcome.

Although the benefits of big data in agriculture have surpassed the risks, the problems must be solved for big data applications in farming or agriculture to gain traction.

To conclude, big data and smart farming are two notions that are still in their infancy. In agriculture, big data is unavoidable. Industry and scholars all across the world are interested in its potential to "revolutionize" the agricultural industry (Fleming, 2018).

Currently, big data applications are primarily discussed in Europe and North America. Other nations, such as China and India, are projected to see a rapid increase in applications. It is easier to meet the requirements of citizens in countries that encourage the use of data-driven agriculture. Although the whole impact of big data on agriculture is unknown, it will have a huge impact on many parts of the industry.

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WHAT IS VIRTUAL REALITY AND WHICH POSSIBILITIES DOES IT PROVIDE

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Since the dawn of time, people have been passing information to each other in multiple ways. It was either a warning about how dangerous a foe is, or whether fruit is edible or not. Throughout the ages, these ways have improved, and by a lot. We even got a tendency to enjoy the information, that is given to us in a more virtuous way than we are used to getting. That is why artists, writers, musicians, and now designers, film directors, etc. are popular, depending on the quality of the information they provide. The outcome of all of this is the moment virtual reality was created.

To start with, it would be better to determine what virtual reality (hereinafter – VR) is. VR is a newly created technology, which is used to bestow a realistic immersion in a veracious-looking digital world. But how exactly does it work? Usually, the immersion is provided by a "helmet" with two lenses and a pair of screens. The distance between those parts depends on the size of the screens and is specifically calculated to grant a clear vision of what is shown on the screen. Movement in VR is carried out by remote controllers, and so is interaction with objects. There are different types of those: joysticks, VR-oriented gloves, and many others depending on what the user needs to do. Some programs even require you to wear special sensors, so that your whole body is tracked and movements are transferred to the virtual world.

Omitting the fact that VR is mostly used in games, it has found its uses in various branches of human activities. For example, people can use it for work and studying. Whether it is a business conference for many people, an architecture project that requires high accuracy, an estate agent needs to take a tour around the house for customers, or a medical student learns to operate, it doesn`t matter much. What matters, is that the possibilities are infinite. You can do whatever you want in VR. For this reason, people often use it as a way to spend time.

These days, things like virtual tours are a real thing. Some people would rather stay at home and enjoy the wilderness with comfort, than travel for hours to the destination, just to put themselves in danger. Virtual museum tours are hugely common too, as they let people spend as much time as they want, or even extend the tour by a few days. This does not only apply to such tours, virtual cinemas are gaining visitors too. Things like sports and many other IRL (in real life) activities continuously get their virtual interpretations (Lowood, 2020).

Nevertheless, everything has its pros and cons, so does VR. Because of how demanding this technology is, it takes more time to embody things, which takes less time when realized with the old-style ways. People, who work with virtual reality-related content have to dot all the i`s and cross the t`s if they aim to create a stable and excellently working immersion. And to not let aside the price: VR sets are not that cheap, not to mention that a powerful PC is required to run it.

To sum up, virtual reality is a technology with a wide specter of possible usages, and we come up with new ones every day. It has changed the way people think about some things and gave even more people some capabilities they could not imagine having.

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INFLUENCE OF ARTIFICIAL INTELLIGENCE ON MODERN WORLD

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Throughout human history, scientific and technological progress played a pivotal role in shaping our life: sometimes for better and sometimes not. It allowed us to cure once incurable diseases, communicate with each other despite great distances, and help us to solve our daily tasks, at the same time exposing humanity to the threat of a nuclear apocalypse. In modern society conception of science, to some extent, is starting to take the place of a higher idea, which was previously taken by things like religion. And much like those ancient greek gods, it has its offsprings, one of the most prominent of them being artificial intelligence. It influences our lives in many fields, whether we realize it or not, and this influence carries quite a dualistic nature.

Artificial intelligence is getting emerging roles in the secondary sector of economics. It is getting heavily used in a huge range of industries. One great piece of evidence of this could be increasing investments into AI by leading companies. For instance, Foxconn, one of the main manufacturers of Apple's products, increased expenses on AI research and development by astounding 342 million dollars over a period of 5 years. And high-precision manufacturing is not the only example. Another one is nuclear power plants. In 2020 International Atomic Energy Agency encouraged the integration of machine learning technologies, which specifically provided with the ability to estimate power pin peaking factor, wall temperature at critical heat flux, detect anomalies, and notify of equipment malfunction. And furthermore, the report by KMPG states that 93% of respondents of the survey implemented AI in their processes, main of which are: defects monitoring, predictive and preventive maintenance. And, obviously or not, all of these cases lead to cost optimization. Defect monitoring allows to identify flaws and correct them on the spot, which would save money for unnecessary transporting and avoid the dissatisfaction of consumer in case of refund; and application of AI, recommended by IAEA, would replace people, which previously were responsible for what is covered by its functionality, so the expenses would be much lower.

Specific parts of the third sector of economics, particularly healthcare and finances, also didn't remain unchanged. Effects of AI implementation in these spheres could be described as productivity increasement, either by excluding human factor or solving manual tasks, which usually take excessive amounts of time. For instance, in 2018 J.P. Morgan Chase released world's first A.I. Powered Virtual Assistant for corporate payments. Rather than manually searching through online options, the assistant helps the user to navigate their online cash management portals. And, as the client uses the application, it slowly unveils the capabilities it holds by learning how to respond better to certain queries and analyzing preferences and behaviors of the user, leading to better and better effectiveness. This project turned out to be so successful, that it already handles 5 trillion dollars daily, bringing annual

revenue of 7.6 billion dollars. And while that may sound great enough on its own, but it turns out to be pretty minor, compared to advancements of AI in healthcare. Recently, a company Babylon made an AI chatbot startup. After testing its abilities and comparing its score to ones of actual general practitioners at an event held at the Royal College of Physicians, the result showed that AI hit 81% of accuracy, while GPs got only 72% on average. Even though currently AI can't make an accurate diagnosis, as "there are many factors to take into account, a great deal of risk to manage, and the emotional impact a diagnosis might have on a patient to consider", it still can be used as an indicator of whether you should seriously consider going to doctor. In fact, Rwanda, which suffered a genocide in 1994, that took away 800 thousand lives, shows actual interest in this technology and has two million Rwandans registered there. If developed well enough, Healthcare AI could be a perspective way of providing growing population with high-quality medical management at a reasonable price.

Well, all of the listed above sounds good: lower costs of products, less trouble with manual labor, and higher quality of what is being produced. But it only views how AI would change our life from a materialistic point of view. And what about the influence of AI on our inner selves? To some extent, the final goal of AI development- the creation of some entity, that could solve any given task- could be called pathologically wrong aim.

True capabilities of AI lay far beyond of mind of human being, so we can't even be sure, that we can reach our aim. But even if we do, what would it bring us? Because in reality, it may turn out, that AI may simply rob its master, humanity, of the most precious thing it has- a purpose. Human won't be able to become an artist, as AI could copy and reproduce any style imaginable. Human won't be able to bear the light of knowledge, as AI would know infinitely more and would find a way to reach to anyone. Human won't be able to make a crucial breakthrough, as our mind can't compete with immeasurable capacities of great intelligence with no evolutionary limitations. Human would be left aside with no goal to strive for.

And furthermore, won't artificial intelligence depreciate the great feats of our predecessors? Because eminent people of the past sacrificed a lot in order to achieve greater goods, very often dedicating their whole lives. And it generously paid off with marvelous discoveries, that amazed scientific society for centuries. We honor them. We praise and get inspired by them. But what would happen if an inexhaustible self-teaching mind, that inviolately strives for goals set before him, starts making discoveries of a whole new level every month, while equals of those of the past would blend in with other information noise? Wouldn't it destroy the measure of a great deed and won't human forget the price of a true feat? All of these values may be put under threat with total implementation of AI…

So all-in-all, artificial intelligence is a powerful phenomenon of scientific and technological progress, that nowadays plays an enormous role in different spheres, allowing us to optimize costs, which would ease the financial burden of vulnerable segments of the population, and increasing our productivity. But it also may carry a

menace for humanity, for it could deprive us of something that makes us, humans, valuable.

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BIG DATA - THE IT-STUDENT ROADMAP

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The training of bachelors in any field of study is determined by the requirements of the relevant standards of higher education. These requirements are outlined in the form of a list of competencies and learning outcomes that a student must demonstrate during the public defense of a qualification paper.

The type of qualification is described in the form of an integral competence (characteristic) of the student who applies for a Bachelor's degree in the specialty. The specialty qualification is formulated based on the content of its four components: knowledge; tools; materials; types of services (goods) provided.

The term "information technology" (IT) denotes a set of modern methods (ways) of processing information using computers and computer networks. Since the 1990s. XX century modern information technology is usually associated with the concept of the Internet, but in the last decade, a new trend has been added - Big Data. It is caused by the necessity to process huge data arrays (Geron, 2018).

The modern IT specialist in the field of Big Data requires appropriate skills to work with the information that we usually get from things like the Internet of Things, social networks. He must be knowledgeable in techniques such as Data Mining, Machine Learning, Text Mining, Process Mining, Visual Mining, be able to work with MapReduce, SQL/NoSQL database, Hadoop.

But knowledge of methodology alone is not enough to work with the Big Data sphere because the task of these specialists is not just to write a program, but to write a program that works in the conditions of a large influx of information and that can run for a sufficient amount of time without interruptions. To implement robot algorithms, you will need knowledge in such areas of mathematics as k-nearest neighbors, linear regression, logistic regression, Support Vector Machine, decision tree, random forest, neural network, k-means, Hierarchical Cluster Analysis, expectation-maximization, Principal Component Analysis, Local-Linear Embedding, t-distributed Stochastic Neighbor Embedding. (Bengfort, 2019).

The implementation of algorithms also requires knowledge in programming languages such as Python, namely knowledge of working with some of its modules, namely NumPy, Pandas, Matplolib, Scikit-Learn, TensorFlow. These modules provide a good toolkit for creating Big Data.

The above list of items to study constitute the minimum required skills for the future IT specialist in the field of Big Data. The need for such specialists is enormous, the results of the algorithms can be used in almost all areas of human activity, including trade and medicine. For example, processing data on shopping in different shops makes it possible to simplify the task of allocating certain types of goods to certain shops, or studying data on citizens' travels can predict the epidemical situation in some regions. And studying customer choices for their purchases in shops

allows marketers to draw attention to the goods that people need or what things should be promoted or what improvements should be made to existing products.

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SMALL MODULAR NUCLEAR REACTOR ACP-100

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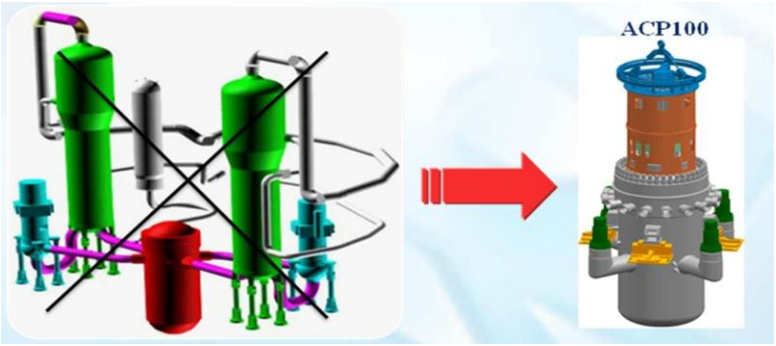
The ACP100 (Access control point-100) is an integrated PWR design to produce an electric power of 100-125 MW. The ACP100 use PWR technology adapting verified passive safety systems to cope with the effects of accident events; in case of transients and postulated design basis accidents the natural convection cools down the reactor.

ACP 100 can generate electricity, heat buildings, seawater desalination and do all it in places without cool industrial infrastructure.

Specific design features:

a) Integral reactor module

The reactor coolant system has been integrated reactor module, which is illustrated in Figure. The reactor module is consisted of reactor vessel (corpus), once-through steam generators, canned motor pumps (for regulation of pressure), reactor internals and integrated reactor head package.



b) System function and composition: 4 main pumps

16 OTSG

1 pressurizer;

c) System description: operation pressure 15.0MPa

core exit temperature 325℃

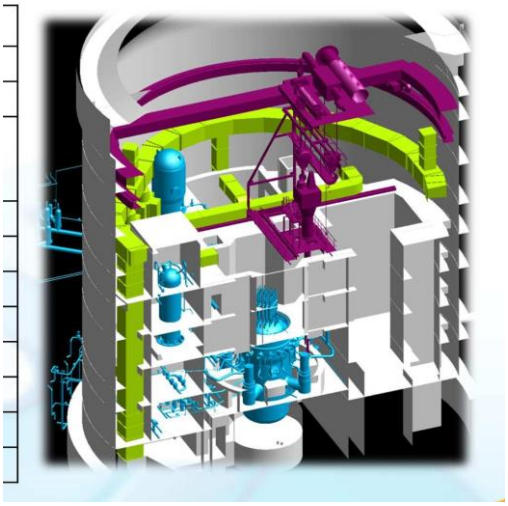
The reactivity is ruled by means of control rods, solid burnable poison and soluble boron dissolved in the primary coolant. There are 21 control rods, with a magnetic force type control rod driving mechanism (CRDM).

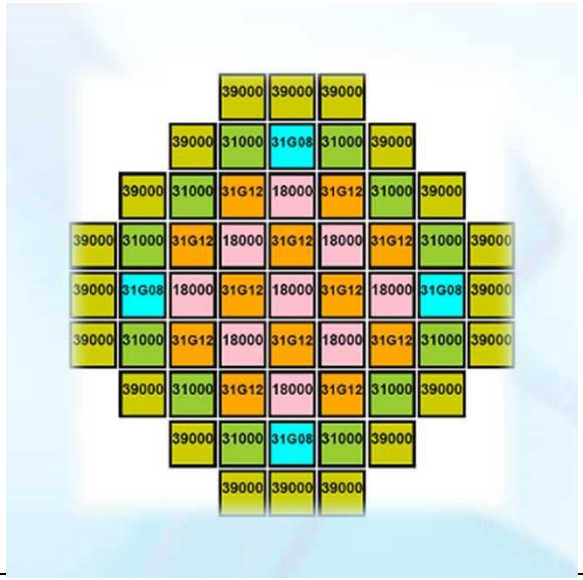
d)Reactor Core

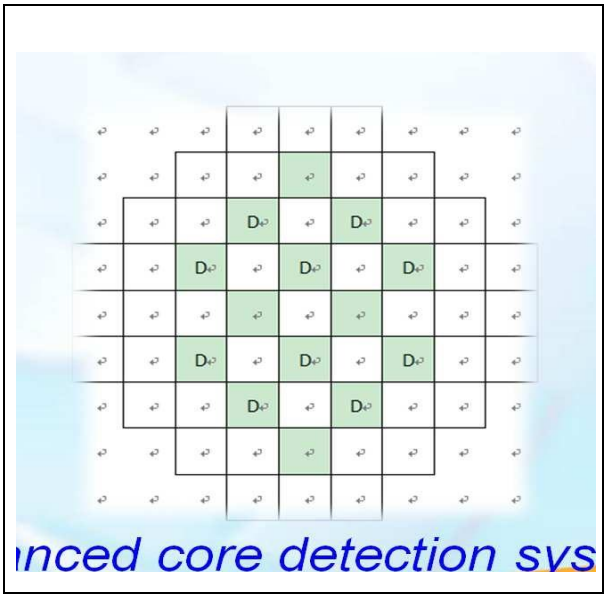
57 CF3S fuel assembly with Gd2O3 solid burnable poison;

total length of 2.15 m core have a squared 17x17 configuration. The fuel ^{235}U improvement is about 1.9–4.95%. The reactor will be able to operate 24 months at balance fuel cycle.

f)Pressurizer:







The pressurizer of ACP100 is located outside of the reactor vessel. The pressurizer is a vertical, cylindrical vessel with hemispherical top and bottom heads.

Safety feathers (PAS) (passive containment air) and reactor automatic depressurization system (RDP). Engineered Safety System Approach and Configuration Water in pool with the spent fuel can protect it 7 days if accident will happen. Accident prevention and their minimization are achieved by passive flooding of reactor, that stop RPV melting. Passive pressure relief system and RPV off-gas system to remove non-condensable gas gathered at RPV head after accidents.

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ELECTRONIC SYSTEM FOR CONTROL OF SAFETY OF CITY RESIDENTS

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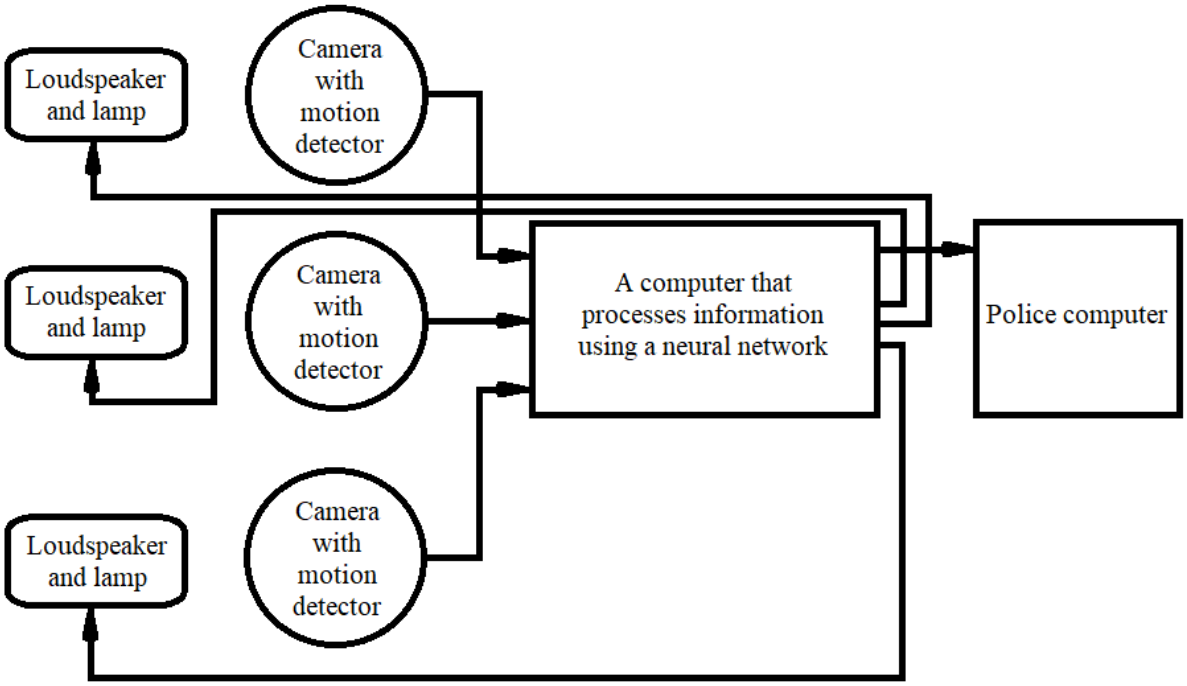
In today's world, people face a lot of everyday problems, such as not being late for work in the morning, having time to complete all their planned tasks, cope with anxiety so that it does not interfere with a successful speech at a conference or meeting, but we - modern people are less likely to think about our own safety or the safety of our children, such as when we return home late at night or even at night, or when we let a child walk outside. I believe that this issue cannot be left on the periphery, but rational ways must be sought to minimize the likelihood of getting into an unpleasant situation, such as an attack or robbery. According to the report of the National Police of Ukraine on the results of work in 2020, during 2019-2020 in Ukraine there were 2754 premeditated murders, 3175 robberies, 18492 cases of robberies. Most of these events could have been avoided if the police had received a timely alert.

In my opinion, a promising solution to improve the safety of people in the city could be a special electronic system that would monitor everything that happens on the streets of the city and when an event with signs of offenses that threaten human safety, would automatically send a signal to the police and recorded all persons who are participants in this event. Also, such a system should predict possible offenses and give a sound and light signal. At the same time, such a system should not violate the confidentiality of individuals, if there is no security threat.

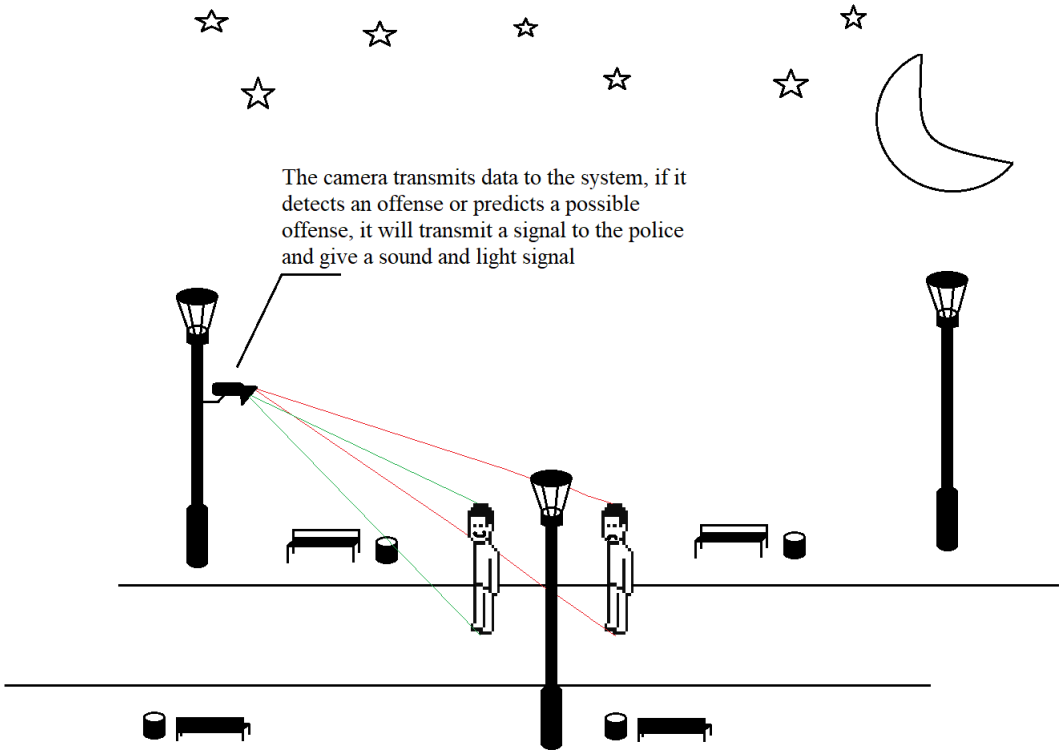
Such a system can be implemented using a neural network. The advantage of a neural network is that a system based on it can "learn" and not just execute certain prescribed commands, because to solve this problem requires such an approach, the system must be able to prevent certain security threats or quickly recognize it and do it automatically. It is not possible to describe all possible events by conventional algorithms, because each such event is unique and without a neural network must take into account a huge number of different factors, which is not rational. The ability to "learn" the system and the high speed of analysis of events that occur in real time is one of the main keys in solving the problem of improving the security of city residents.

In general, the proposed system can be described as follows: the system consists of cameras that operate when motion is recorded in a certain area, such as on the track to which the camera is directed. The choice of the area in which the motion is recorded is to avoid the malfunction of the motion detector, for example, on the movement of trees from the wind. The signal from the cameras goes to a computer, which uses a neural network to analyze the information and, when a certain event occurs or when there is a high probability of such an event, sends a signal to the police and gives a light and sound signal.

The block diagram of such a system can be represented as follows:



You can partially visualize the system as follows:



Thus, using such a system can increase the safety of residents of any city.

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NEW FIELD IN CRYPTOCURRENCY OR WHAT DO WE KNOW ABOUT NFT

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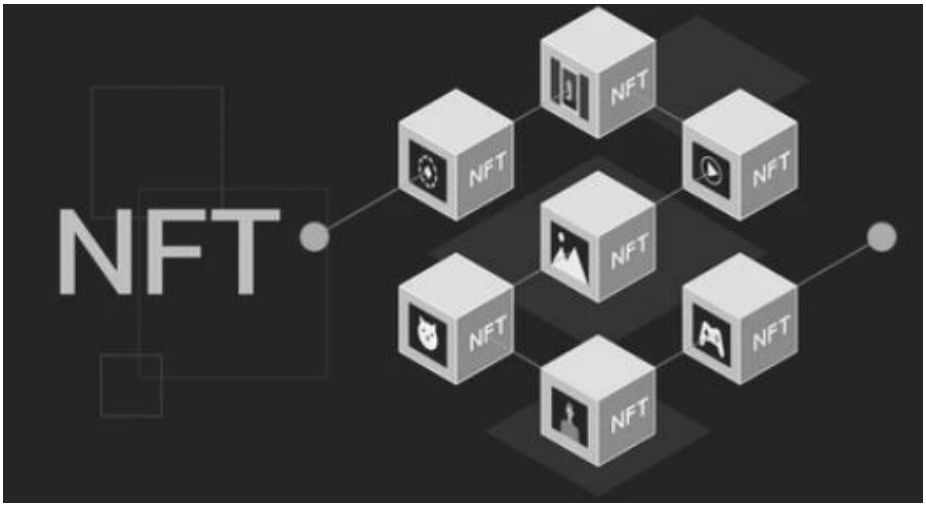

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Everyone has already heard about cryptocurrency such as Bitcoin, maybe even about Ethereum. If not, then very briefly, a cryptocurrency is a currency that is not assigned to any country. And all information about its movement is stored as a record in the blockchain.
Cryptocurrency appeared a long time ago in 2009. And everyone, who wanted to, has already managed to figure it out.

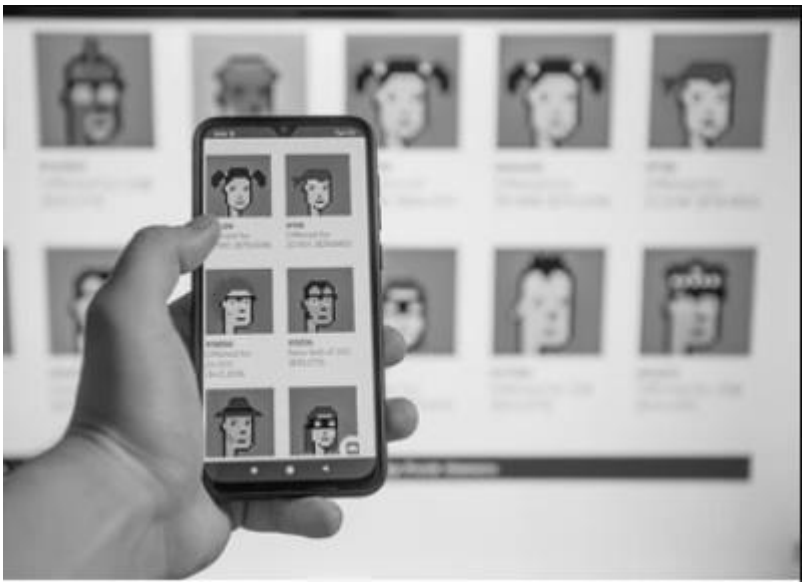
But we'll talk about a relatively new area in cryptocurrency like NTF. “NFT technology was developed in 2017 based on Ethereum smart contracts. The first piece of art to be converted into an NFT token was a black and white work by artist Banksy - 2007 stencil titled Morons (White). Blockchain company Injective Protocol bought it, burned it and created an NFT token - a virtual asset tied to a "digital image of an art object" (Karpova, 2021).

YouTube, Burnt Finance, Authentic Banksy Art Burning Ceremony.

So what is NFT? NFT is a Non Fungible Token. What does it mean and what is the difference between NFT and cryptocurrency?

“Each record on the blockchain is called a token. However, in an open blockchain, all tokens are equivalent and are replaceable. This

means that one token can be replaced with another of the same token and nothing will change. But Non Fungible Token (NFT) technology works variously.



© 2003-2021 Shutterstock, Inc. Rokas Tenys, A non-fungible token(NFT).

Each non-fungible token is unique and cannot be tampered with, split, or subtly replaced. This system is ideal for securing your rights to any unique object, be it a work of art in a single copy, an item in a computer game, or even real estate". (Korneyev, 2021). What is NFT?)

You need to understand that NFT is called the main trend of 2021 in the blockchain. The community of NFT holders rapidly increases. So we understood that NFT is something that is unique and can be transferred over blockchain, but what usage serves? Because of its uniqueness, it's become to be used in Art and P2E games.

First of all, let's talk about Art. All collectors want to have unique and not fake art and this technology comes in hand with it, also trading your NFT is much easier than selling real pictures or something else. Because all operations occur on the internet, you can sell your art within a second. For example, look at one of the most popular NFT collections. Its Cryptopunks, one of the earlies NFT collection.

OpenSea, CryptoPunks

When you see this collection for the first time, the first that comes to mind is who will buy these pixel heads that you could make in Paint. But you will be very surprised if I tell you that the most recent punk was sold today for $460,000. You can see it right here at the link (Solsea, 2021.). And collections like this appear every day.

The second place where NFT is used is its games. P2E games or play-to-earn games. It's hard to because this sphere is immense and complicated, but this kind of game will be very popular in the future.

In these games, NFT is used to show that the user owns something like if you have a car in the game you have a car NFT that can be sold to someone

for some price.

To sum up. NFT is a new and promising sphere in cryptography. It's been on hype nowadays. Because of NFT exclusiveness and non-fungible technology in the future, we will have many things using it. For example, it was said that even

papers of owning an apartment can be saved as NFT. It`s a stunning idea because purchasing and selling products will be much easier and all action with your product is stored in blockchain. So, you will be able to see who owned it before you.

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SMART GLASSES: LOOK TO THE FUTURE

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For a long time, the main goal of glasses was to improve vision. Now, in the era of technology, eyewear manufacturers and developers are joining forces to make glasses even smarter. In fact, glasses are very useful thing in the modern world, when gadgets (phones, laptops, tablets etc.) have gained incredible popularity, which in turn lead to vision problems in an increasing percentage of the world's population.

In fact, smart glasses can ease our lives: they can show important notifications from a smartphone or callers' phone numbers, display roads, maps, "speak" text, even with real-time translation. With the help of the device, you can capture images, and the software can turn any inscriptions on the pictures into text for subsequent translation.

The first well-known company that announced the development of a "completely new device" was Xiaomi. The device runs on Android and can function separately from your phone.

The glasses have a microphone and a camera that can be used for quickly translating of texts and messages from foreign languages. Unlike similar products from Google, Snapchat and Lenovo, Xiaomi glasses do not include immersion in the world of virtual reality in their goals. Such glasses weight as usual - only 51 grams (Karpus, 2021).

The MicroLED technology played a big role in the development of smart glasses, which helped to reduce the space required by the structural design of the glasses. In addition, this technology has a higher pixel density, longer life, simple structure and higher brightness than OLED. The internal chip size of the display is 2.4x2.02mm. Therefore, the display chip was able to fit into the frame of the glasses. The display was chosen to be monochrome, with a maximum brightness of 2 million nits, so that content can be seen even in direct sunlight. Smart glasses Xiaomi Smart Glasses are equipped with two microphones, a speaker, a 5 MP camera and a 4-core ARM chip. There is also a built-in battery, touch panel, Wi-Fi and Bluetooth module inside.

Obviously, there is no competition in new developments anywhere. Xiaomi's main competitor is Facebook, which offers glasses created in collaboration with Ray Ban. Their glasses have cameras of 5 MP, a built-in microphone and speakers.

Competitive glasses can also work completely autonomously, take photos and videos. To do this, they have a memory for about 500 photos or 30 clips of 30 seconds each. As we can see, there is still more memory in such glasses.

Despite all the advantages of such invention, there are many disadvantages, here are some of them:

Owner safety: Pop-up windows on the screen right in front of your eyes can distract the user, which is dangerous for him and others. This is especially true when you wear glasses while driving.

Confidentiality of personal data and freedoms: glasses take images or video of people around in real time without their consent; this can be appealed as an offense. In addition, it is not a fact that personal data will not leak from the glasses.

Main goal: Let us not forget that glasses were created primarily for vision correction. Therefore, we cannot claim that all modern technologies, such as video recording or voiceover of messages, can be properly combined with the original goal of improving vision.

As well, many questions still remain open. For instance, what could be the capacity and placement of the battery that powers this entire system? Besides, in the modern world, the gadget should not be only unique in functionality, but also fashionable (MacDonald, 2021).

Smart glasses are not just a vision correction device; they are a navigator, a teleprompter and even a translator. It is impossible to say unequivocally that such glasses have more advantages or disadvantages. Therefore, an accurate answer to this question can be obtained in the future - when the development of smart glasses reaches a new level and becomes close to perfection.

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ARTIFICIAL SLOWDOWN OF GADGETS

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Mobile devices have really strong impact at people's lives, it is impossible to imagine the modern world without them. According to the rule of the Moors, the power of technology doubles every 18 years. The lifespan of most mobile devices is from one to two years, then their use becomes surprisingly difficult, the phone starts to work slowly, there is not enough RAM to work with urgent applications, mechanical damage makes itself felt, newer models have more interesting features and functions. Transnational corporations are already able to provide a level of technology that will keep gadgets relevant for 5-7 years, but is it beneficial for the companies themselves? Not at all. It is much more profitable to sell a low-quality gadget every 2 years than a high-quality thing that will last for many years. In the first case of artificial slowdown of technologies, Apple was caught, whose super-popular phone, the Iphone 4 worked perfectly on the version of iOS 6, but with the installation of iOS 7 turned into a slow piece of glass and plastic. In December 2017, Apple was first accused of artificially slowing down smartphones. The story is called "Batterygate". The company did not argue, but admitted that as the battery in the iPhone wears out, the processor starts to run slower. "Apple is slowing down the iPhone, which motivates users to switch to new devices" - such a decision was made by a court in the United States, France and other countries.

Users and agencies are winning lawsuits over this. In March 2020, the company agreed to pay $ 500 million to owners of the iPhone 6 and 7 series in the United States as compensation for a lost class action lawsuit.

As a result, we can say that modern companies are clearly not interested in the development of technology, because it is not profitable for them.

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THE PROGRESS IN ROBOTIC ENGINEERING

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Nowadays, we live in an age where technology and engineering progress skyrockets towards the future that was described in fantasy books. Back in 1897 H.G. Wells writes a science-fiction book "War of The Worlds", where he describes the use of the "heat ray" by the Martians (Wells, 1897), and half a century later, in 1960, Theodore H. Maiman creates the first working laser (Maiman, 1961). In the present day, we observe an identical situation: Isaac Asimov wrote a collection of sci-fi stories "I, Robot" that was published in 1950 (Asimov, 1950), and in the present day we can see Atlas. Atlas is a humanoid robot developed by Boston Dynamics, an American company that is funded by Hyundai Motor Company. This robot is designed for a variety of tasks such as search and rescue. Up to the present moment it can jump, squat, do backflips and handstands, in addition to walking and running.

Boston Dynamics engineers were tasked with the difficult task of making the robot maneuver through complicated parkour courses, a task that proved challenging for the company that spent many years of engineering robots for purely operational purposes. They could walk, navigate in rough terrain, pick things up, and detect things based on the sensors attached. (Boston Dynamics, 2021)

Due to it being a difficult task getting the robot to pass the obstacle course, engineers at Boston Dynamics had to modify the robot to be stable and with enough power to do the entire performance without halting. Consequently, improvements were beneficial to the design. Atlas' advanced version uses an extensive range of sensors to execute its moves and a gyroscope to maintain balance. The robot has twenty-eight actuators that assume the role of muscles (they convert electronic signals into physical movement), and three quad-core built-in computers, one is used to process perception data, and the other two for controlling movements. Also, the improvement was made so that the Atlas robot became able to sense and react to its environment. A robot's control system is driven by perception and additionally is embedded with artificial intelligence making it capable of self-learning, has to make lots of critical adjustments on the move to maintain balance and posture. While it might appear to be a narrow and specific activity, parkour is a whole-body activity that requires the Atlas robot to keep its balance in various situations while switching between behaviors imperceptibly. Visualization is used to adapt the robot's behavior and abilities according to the surroundings it percepts. Hence, it is not necessary for the engineers to pre-program jumping motions for every possible obstacle the robot might encounter. Instead, the control team creates a minor quantity of algorithms of template behaviors that can be matched to the environment and improved on the move. (Ngowi, 2021)

The team produced a video of results a bit over a minute in length after nearly one and a half years of choreography surveying, programming, simulation process, and upgrades. What was demonstrated is a product of continuous, hard work driven

by passion and determination to create a robot capable of completing such a futuristic, seemingly impossible routine. (Hennic, 2021)

To summarize, it can be said that American company Boston Dynamics is slowly but surely driving the world forward to an age of robots, a world where a go-anywhere, do-anything robots are nothing extraordinary. Robots' ability to perform the same forms of movement and physical tasks as human beings will bring practically limitless possibilities for applications.

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WHICH WAYS OF OPTIMIZING THE USE OF ELECTRIC ENERGY

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Recently, the topic of energy saving technologies has been considered at the level of international and state policy. Issues of limited natural resources, changes in climate and other problems are discussed daily. The constant rise in prices and tariffs for energy resources is directly reflected in the production process of any enterprise. The solution to this problem is seen in one thing - the need to save energy and carry out activities that contribute to this.

Energy saving involves the implementation of various measures to bring renewable energy sources back into the production process. All measures aimed at energy conservation are of an organizational, legal, scientific, economic and technical nature. Speaking of energy saving, we also mean the preservation of natural resources, which today is more than an urgent problem.

Today, energy conservation is the main driver in the development of the economy of markets for consumer services and materials.

The use of alternative energy sources is becoming more and more popular in energy-saving technologies. Solar panels in combination with the use of solar collectors can be used both as an additional and as the main source of energy, thus protecting the end user from the necessary dependence in centralized energy networks. This reduces the consumption of solid fuels and energy.

Along with the rapid development of scientific and technological progress in the field of energy saving technologies, one can often encounter the notorious human factor caused by the use of technologies that are so effective today. Knowledge-intensive industries offer us a variety of uses and applications for energy efficient technologies, a rich variety of energy conservation tools and methods, and their applications for any energy-consuming industry.

An example is a banal everyday situation. A certain citizen, inspired by the ideas of energy saving, purchased energy efficient light sources for his home. Having studied the technical characteristics of these devices in advance, he began to use them for a longer time without shutting down, well, they are energy efficient. And what a surprise it will ultimately be when, over the reporting period, he will not receive a purely economic effect from the use of these lighting devices. This is false energy saving.

In the given example, only one factor is presented that directly affects energy efficiency, but when it comes to monitoring the energy saving of industrial enterprises, there are many factors that both directly and indirectly affect the energy efficiency of the enterprise as a whole. To improve energy efficiency, a systematic approach is required, including well-planned and well-defined specific goals of practical implementation, and in the subsequent development of a major energy saving program

The material benefit between the subjects of economic relations deserves no less attention. Today there are a huge number of ready-made energy-saving solutions, metering devices, sensors, and directly effective energy-consuming devices. In such conditions, there is an excellent opportunity to choose energy efficiency products based on their qualities and cost.

Important indicator of energy efficiency is the quality of the electrical or thermal energy itself. Undoubtedly, the efficiency of any technological process, and in the final goal and the quality of products will depend on the quality indicators of consumed energy. There is no point in talking about energy efficiency of production if the supplied energy does not meet generally accepted standards and may harm a separate technological complex and the enterprise as a whole. In this matter, two important components of any production should be noted:

1)production of electrical energy of proper quality;

2)uninterrupted transmission and reliable distribution networks.

In matters of energy conservation, it should be understood that a ready-made solution does not exist and cannot exist. The constant increase in the energy intensity of production, as well as the rise in energy prices, make us look for individual solutions for a specific production, with subsequent monitoring of energy efficiency. This is the only way to bring energy saving to a different level of quality.

With the development of power grids, the growth of interconnection, there is a need to present more and more requirements for the reliability, security and quality of power supply and the power grids themselves.

The issue of personnel potential of the energy industry deserves special attention in matters of energy saving and quality of electric energy.

These problems are forcing employers to raise the upper age bracket for applicants. The solution to the problems can be found in the creation of specialized training centers for the training of highly qualified specialists, as well as the establishment of close cooperation between energy companies and universities that train relevant specialists. Some energy companies have taken this path, and successfully cooperate with higher education institutions, providing them with an extensive production base for technological and undergraduate internships.

This has a number of significant advantages, such as the selection of future applicants for jobs, the ability to track the entire learning process, make the necessary adjustments to the educational program, and it will become more approximate for a specific field of activity of a future specialist. Immediate forecasts show that the shortage of young specialists in the energy sector will only worsen, and this is caused by a simple aging of the staff. Energy companies, with the support of the state, should make every effort to create a single bank of specialists in the energy industry, and raise the prestige of the energy industry. Future specialists must be sure that they will be in demand in the modern labor market. And they can rely on the appropriate material support and subsequent career growth in their chosen industry.

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THE ROLE OF DIGITAL COMMUNICATIONS AND 5G IN COMBATING CLIMATE CHANGE: REDUCING CO2 EMISSIONS

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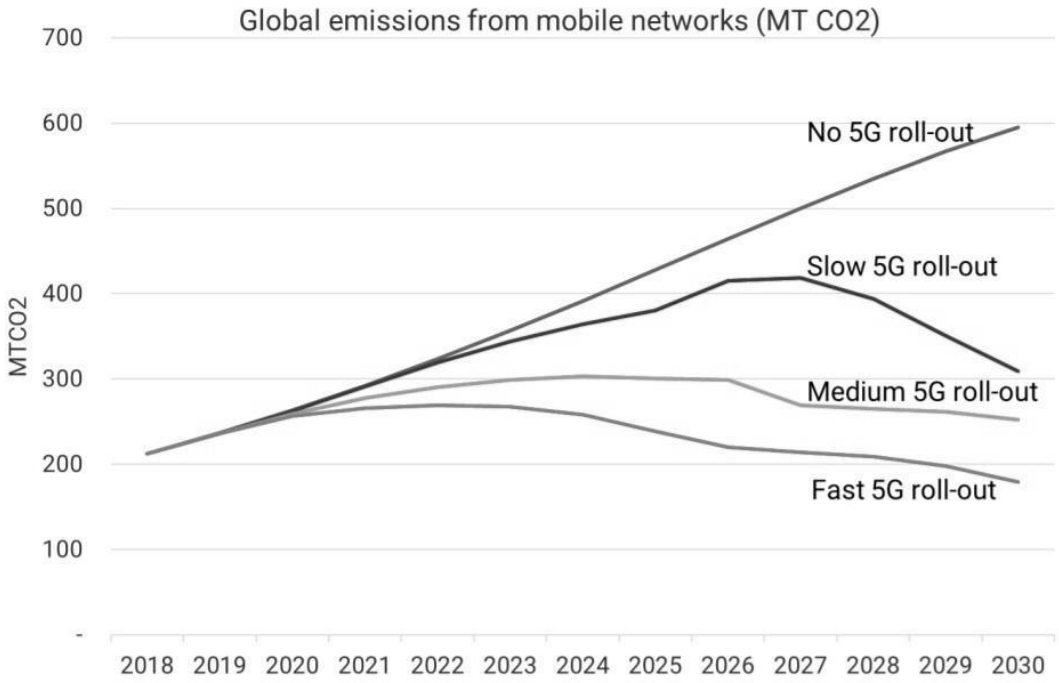
In the future, humanity will face the problem of climate change and this inevitably awaits us. In this regard, options for adaptation to already existing changes in the climate system are already being developed. For example, the rollout of 5G technology in the future will help reduce carbon dioxide emissions. 5G technologies open up new possibilities. A stable connection with minimal latency and high data protection is the bare minimum that a new generation of 5G mobile broadband can provide. According to experts, by 2030 the massive spread of 5G will help reduce carbon emissions in the EU by about 550 million tons per year. 5G transmits data more efficiently than previous communication standards, so the amount of carbon emissions will be reduced. If 5G is implemented in the four sectors that produce the most CO_2 - electricity, transport, production and construction - the emissions in the European region will be reduced by 55-170 million tons. Now only 15% of the world's inhabitants are provided with 5G communications. If the rate of adoption of the standard continues to be slow, then we will miss the opportunity to combat climate change (Ericsson, 2021, p.7).

Furthermore, digitalization can help provide emissions savings in the coming years, which will allow us to hit our intermediate emission's reduction goals, in advance of developing the hard to abate sectors in the future. Many of these benefits are already here today, including remote work, reduced travel, IoT, sensors efficiency and smart buildings' automation. Other changes rely on innovation, which can be accelerated by better connectivity, for example the required expansion in the market adoption of low-carbon electric vehicles.

5G and connectivity are decisive to solutions, representing opportunity to reductions of 20% of the EU's total emissions. A 20 percent emissions' reduction represent an enormous potential. To put this statistic in context, that's equivalent to the total annual emissions of Spain and Italy composite, and greater than the yearly EU emissions resulting from agriculture and international aviation combined

A fast rollout would see the highest and quickest realization of the benefits of 5G to energy efficiency. It would see 5G launch between 2022 and 2023, and the highest percentage of the access network run on 5G networks (up to 99% in 2030 for progressive economies). Therefore, we have assumptive the highest energy potency levels by 2030 as 2/3/4G networks are decommissioned.

We can see from the figure that Faster 5G roll-out would have a material impact on greenhouse emissions - projected CO_2 emissions from mobile networks under 4 scenarios (Laidler, 2019, p.13).



For instance, preparations are already underway in Switzerland for the widespread launch of a new high-speed mobile communication technology of the 5G generation. Nevertheless, in some regions of the country, primarily in the French-speaking cantons, there is public resistance to these plans. As well, About 70 French left-wing and Green politicians (including the mayors of Marseille, Bordeaux and Lyon) have called for a moratorium on the deployment of 5G in France.

All the same, in the short term, there are no proven negative effects of 5G "below the recommended exposure limits" (WCED, 2020, p.31).

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DISCOURSIVE DEFENSE THEORY AS A COGNITIVE PROPERTY OF INTERNET MATERIALS

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The Internet as a means of mass communication has many internal features, the main of which is cognitiveness (Gorina, 2013, p. 155-161). Cognitiveness, first of all, reveals the lifelikeness of the Web. On the Internet, the user encounters everything that surrounds him in real life, and the technical capabilities of the virtual platform often make it possible to convey information most realistically. Thanks to the combination of text, video, and audio information transfer formats, a person can perceive the information as fully as possible. Lifelikeness leads to a variety of information on the Web, a variant presentation, a huge emotional palette of presenting the same things. All of this is attractive to the Internet user. However, at the same time, the diversity of information becomes an obstacle in the process of searching, choosing a source of information, questions of trust in the author of messages on the Web, and frequent misinformation of the audience are raised. As a result, the satiation of information, the breadth of choice of information lead to the fact that each message on the Web turns into a project, the purpose of which is to attract the reader. Of course, the user can choose a reputable publication or a reputable author, but most of the messages are focused on hunting the user. Messages, which are often duplicated in terms of content, are forced to focus on design, external presentation of material, additional functions - everything that can intrigue users and keep their attention. Let's give a general description of the compositional speech means of discourse defense.

Segmentation of information - submission of significant parts of the message by independent blocks, segments (headings, announcements, headings, texts). Segmentation facilitates the visual perception of information on a page on the Web, provides a clearer understanding of the content. Thanks to the segmented parts, the reader is guided in the construction of the entire Internet page, sees the main and secondary elements, illustrations, interrelated and self-sufficient thematic blocks on the forum, website, online media, etc.

Integration is the unification of self-sufficient blocks into a single work (a composite text of an Internet media, forum, site, etc.). Integration leads to an understanding of the diversity of information, helps the user to understand the essence of the information source (media, advertising, guestbook, chat, forum, website, etc.), evaluate its content, understand its concept, structure, see the proposed options for information, many different authors. Integration leads to the interaction of different sub-discourses represented in the global discourse of the Internet. For example, on one page of the information portal 4mama.ua there are subdiscourses at the same time: "health", "sports", "rest", "children", "cooking", "woman's world", "news", "sale announcements" and others (Edimedia Ukraine, 2021). All

subdiscourses interact, forming a complex space of the Internet, emphasizing its lifelikeness (Skvortsov, 2009, p.177).

Reference - reference elements (hyperlinks) lead to the fact that the user is accustomed to reference reading, which is comparable to the headline reading of the media. A superficial reading of hyperlinks leads to a reduction in the amount of text to the level of the heading or announcement, as a result of which the heading itself changes, genres are transformed (in the Internet media). The originality of the composition, the expressiveness, and the imagery of the text is replaced by maximum accuracy, laconism with high informative saturation. A person receives most of the news by reading headlines or announcements on information portals or in the news feed of search programs, news agencies, and Internet publications.

As you can see, the text on the Internet acquires new features not only because it finds itself on a new, technically more advanced platform, but also largely due to the means of discursive defense. The message on the web is becoming much shorter, but at the same time endless. The brevity of the message boils down to the fact that more and more often the headline or lead (announcement) becomes the unit of reading. The reading becomes superficial, and the headline moves from expressiveness and originality to more informativeness and accuracy.

Thus, a message on the Internet is a project thought out from start to finish, both in terms of content and design. And the better it is thought out, the more attentively the author reacted to the use of means of discursive defense, the more advantageous his message looks against the background of similar materials, the more successfully it is sold on the Internet, the more popular it is.

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THE IMPORTANCE OF LEARNING PROGRAMMING

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Everything is getting digitalized and this fact can not be denied. We face it on daily basis and use modern technologies sometimes not even realizing how much effort it took to make something like a smartphone or even a simple Bluetooth speaker and it is not even mentioning the programming part of any of these devices. Nonetheless, you should not be scared of it just because you do not understand some basics. As an example for people who want to become good at programming but do not know where to start, first of all, you should think about what actually you want to get from it. If the answer is only financial benefits then you will probably fail sooner or later due to a lack of motivation. However, if you are actually interested in learning to program for any reason except the money that probably indicates your real interest in it. For instance, I have started learning programming from the moment when I was trading game items and at some point, I have decided that I want to make it easier by creating a bot that will notify me and show full info about the incoming transaction whenever I get any trade offer.

Besides trading, I also liked computer games so the answer was simple. Why do not I make my own game? This was not a very easy task for me as I was at the beginning stages I had to start everything from scratch. It took me all summer but the result was worth it. I have ended up with several simple but fully functional games which I have completely designed and programmed by myself.

One of my projects

Currently, I have switched from trading and game development to studying desktop app development and microcontroller programming considering it to be a part of my future career but it all would not be possible if I have not found my

interest in coding in the first place. Accordingly, why is computer programming important? As you can tell from my experience it does not matter how you begin your programmer path. Today I could not imagine my life without programming not only because it plays a huge role in my specialization but also for making me think in a different way. Coding teaches you to be persistent. If to be clear you become determined to find a way to obtain a solution using every source of information that may lead you to the right answer and as you know there is no better way to learn something except examine that something on your own. Essentially, by studying programming, you develop problem-solving skills and those are very highly demanded among IT companies. Besides it, you probably will not even notice when you start implementing these problem-solving skills in your life and not only while coding. Speaking about the other advantage of programming and programmer jobs in general. Since the job only requires a computer with an internet connection it is obvious that you can work remotely for any company without dependence on your location. This means that you will save some extra time by not going anywhere and as a result, will spend more time with your family for example. Also, I should mention that programmers can easily try to open their own business or start a startup company. Becoming self-employed has several benefits than working for someone. Firstly you can choose whatever you want to do it can be anything like an online shop, making indie games, creating websites or giving online coding courses and tutoring people online, and many more. The only thing that can limit you is your imagination. The most exciting part of it is that the competition is not very high and your idea will definitely find its client.

And secondly, you are always in charge of your workflow and it is up to you how the process will be managed.

In conclusion, I want to make the point that programming does not necessarily require any special abilities just enthusiasm, dedication, willingness to improve your skills, and your free time.

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UKRAINIAN AND FOREIGN SCIENCE: YESTERDAY, TODAY, TOMORROW

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Today, a modern person cannot imagine his life without a TV, radio, cell phone, and most importantly, without a computer. In the current world, the personal computer takes a major role in all spheres of activity, in all countries of the Earth. Of course, a few decades ago, no one used a PC and at the same time did not have any conveniences, but the world does not stand still and it is necessary to keep pace with the times.

For the majority of people, the PC is an object that in one form or another is central in everyone's life. After all, with the help of a computer, we can play video games, watch films, TV series, listen to music, learn useful information, news, meet, communicate with people who are in another part of the earth, and much more. And all this can be done using a computer. Recently, computer technology has been understood as information technology, namely the use of computers and software for storing, processing, protecting the transmission, and receipt of information.

The beginning of the 21st century is identified with the emergence of the information society. The computer in the information society is a constituent part.

Information community is a theoretical concept of a post-industrial society, the historical phase of the possible development of different civilizations, in which information and knowledge become the main supplies of production. Unique features: increasing the role of information, knowledge, and information technology in the life of society, an increase in the number of people employed in information technology, communications, and the production of information products and services the growing information industry of society using telephony, radio, television, the Internet, as well as traditional and electronic media; creation of a global information space that provides effective information interaction of people, meeting their needs for information products and services and access to all world information resources.

Nowadays, technical specialties are in great demand against the background of today's robotics and computer science progress. Over the past 15 years, IT technologies have become the center of human progress and development. The IT technology we already know and are accustomed to has paved the way for us to innovate the world further, and this list of current and future technologies certainly has the potential to change our lives even more. It depends only on whether the motivating person who is interested in the field of IT technologies will be able to improve and enrich their knowledge in this important and popular field.

Currently, almost all organizations need information services, processing a large amount of information. One of the main technical means for transmission, perception, processing of information is a computer. The role of the computer is an effort of the intellectual capabilities of a person and society as a whole, serving for

communication and transmission of information. The concept of new information technology also includes communication technologies that ensure the transfer of information in various ways, namely, telephone, radio, telegraphs, and telecommunications.

So in conclusion, it can be noted the formation and improvement of information technology is one of the main factors in society. The spread of IT transforms people's lives, makes work easier, gives more free time, and brings development in the economic, cultural, educational, and other spheres. Modern society is filled and permeated with streams of information that need to be processed. Therefore, it cannot function normally without information technology, as well as without energy, transport, and chemical technologies.

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3-D MODELING IN MEDICINE. PROSPECTS FOR THE DEVELOPMENT OF PROTHESES AND IMPLANTS

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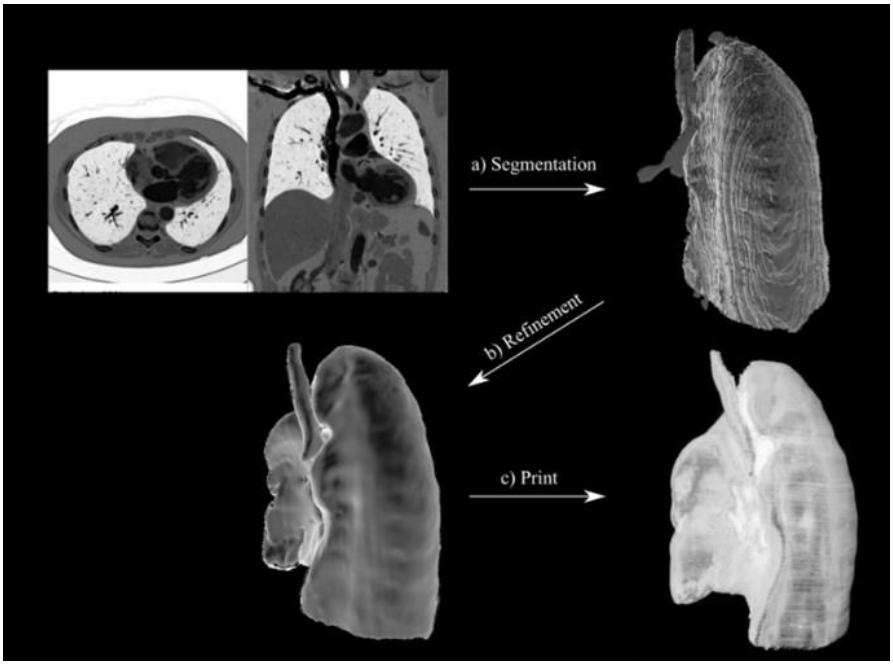
3-D modeling is an industry of computer technology that has made a breakthrough in medicine over the last century. It is used in various fields, such as industrial production, film and video game creation, design and advertising, research and engineering, etc. 3-D modeling has a wide range of possibilities, such as:

1) Organ scanning and fabrication.
2) Creation of implants, axial creation of a patient model
3) Creation of artificial bones, tissues, blood vessels, veins and even organs of the patient.

Creating a model is becoming cheaper and better. The probability of error is minimal. Simulations help in the operations themselves too. It is much easier for doctors to perform surgery on a pre-examined organ. It is important for the surgeon to know the contours, shape, features of the tumor in three dimensions. Components of the operation using the model:

1) Scanning
2) Plastic model
3) Analysis of
the method of treatment
4) The treatment itself



Many successful operations have been performed:

In Connecticut, a successful operation was performed to replace part of the patient's skull. This element was created in the program and printed on a 3-D printer.

The implant is perfect for the patient. It took only 2 weeks to create everything for the operation.

Princeton University has developed and printed a bionic ear that contains a radio-sensitive antenna and living cells.

One American company created small artificial liver fragments using 3D printing.

In dentistry, temporary crowns are made using 3D printers.

The time will soon come when the production of prostheses and implants on the printer will be put on the assembly line, and this will be a real breakthrough in the fight against disability.

A group of scientists from the Higher Technical School of Zurich Switzerland in 2017 made the world's first heart

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ANALYSIS OF DATA SORTING ALGORITHMS

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At present, information is extremely valuable. Every second a large amount of data is generated, and it needs to be processed in some way – stored, analyzed and sorted. That is why the problem of data sorting is of great importance.

Here are some of the most important uses of sorting:

1) solving grouping problems, when it is necessary to collect all the elements with the same values of a feature;

2) search for common elements in two or more arrays;

3) search for information on the values of keys.

Sorting methods are an excellent illustration of the basic concepts of algorithm analysis – quality assessment of algorithms, which, in turn, allows us to reasonably choose one method among the seemingly equivalent ones. After all, each sorting algorithm has its own characteristics, which is reflected in the execution time (Knut, 2020).

To determine the efficiency of the algorithm, the concept of computational complexity is used, which denotes the dependancy function of the volume of work performed by some algorithm on the size of the input data (Stephens, 2019). Workload is usually measured by the amount of time and space it takes up in memory. Time is determined by the number of elementary steps that are required to solve the problem. With Big O Notation, we can mathematically describe what behavior an algorithm will take in a worst-case scenario for data sets of different volumes.

For comparison, arrays of numbers in the range from 1 to 100 of 10, 100, 1000 and 10000 elements are taken. Five classical sorting algorithms of different principles of operation and computational complexity are implemented. For example, the known bubble sort has a computational complexity of O (n^2) (see Table 1) in the average case, in contrast to Shell sort, where the result depends on the choice of step (Cormen et al., 2019).

Table 1

Sort name	**Program execution time, s**				**Computational complexity**
	10 el.	100 el.	1000 el.	10000 el.	
Bubble sort	0.179	0.245	0.774	5.895	O(n^2)
Shell sort	0.18	0.238	0.723	5.794	Depends on the choice step
Merge sort	0.184	0.247	0.811	5.617	O(n*log(n))
Quick	0.1	0.2	0.76	5.782	O(n*log(n))

sort	87	28	7		
Tree sort	0.181	0.308	0.742	4.935	O(n*log(n))

However, there are more efficient sorting algorithms, for example, merge sorting based on the principle of "divide and conquer", which offers the division of the problem into several simpler subtasks, recursive solution of which leads to the solution of the initial problem.

The fast sorting algorithm is also based on the "divide and conquer" paradigm and, like merge sort, has the computational complexity O (n*log (n)) (Table 1): if the sequence needs to be placed in ascending order, then in the left part all the elements whose values are less than the reference element will be placed, and in the right – the elements whose values are greater than or equal to the reference. Then the recursive execution of the above part of the algorithm for each of the subarrays is performed. In addition, a binary tree sort algorithm is effective, which consists in constructing a binary search tree by array keys with the subsequent formation of the resulting array of ordered elements by directly traversing the tree.

Thus, according to the results of the studies (Cormen et al., 2019; Knut, 2020; Stephens, 2019), we can conclude that the most effective sorting algorithms among the mentioned above are the algorithms that use binary search tree, merge sort and fast sort, in contrast to, for example, the bubble sort algorithm, which is the most resource-intensive.

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METAVERSE: IS IT WORTH OR A GLOBAL CURSE?

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2021 – April

World experts notify that more than 500 million Facebook users' data were leaked online.

2021 – October 4 15:40 UTC

Facebook, Instagram, WhatsApp are down. The work of the services was stopped for more than 7 hours.

2021 - October 28

Mark Zuckerberg announced the new corporate name for Facebook – Meta and disclosed plans to build a "metaverse".

Looking at such chronicles, you inadvertently wonder what can be expected from such a near future, while in the present things are not so rosy.

Take, for example, statistics on the amount of time people spend online. Due to last research and statistics, on average, a person spends 145 minutes a day on social media. It's almost 2,5 hours a day – not little, but things don't seem to be so critical. But what if we look at the numbers on a different scale. Find, that we spend up to 7 years in a lifetime using social media. (Average time spent daily on social media (latest 2020 data), 2020) After such statements, the current state of affairs becomes frightening.

But quantity is only one side of the coin of spending time this way. Unfortunately, things are even worse with its quality. What awaits the average platform user from the moment he enters the network? Manipulation, propaganda, incessant notifications, reminders, unwanted video autoplay, data collection and advertising, advertising and advertising again. And what's the worst, people cease to belong to themselves. They get hooked on the needle and their addiction is a source of income for corporations.

Let's look at the facts. Remember the October 4 mentioned earlier? Then during the seven-hour "stagnation", consider that Facebook (already Meta) lost almost all its users for a while, or in other words, about 6 billion dollars. But it is worth paying attention to other indicators: the number of people who have "defected" to other platforms (e.g., Signal, Twitter, Telegram) in this short period of time. "The daily growth rate of Telegram exceeded the norm by an order of magnitude, and we welcomed over 70 million refugees from other platforms in one day," Pavel Durov wrote on his Telegram channel (Sauer, 2021).

This data does not just tell us, it screams to us, that the population is dependent on something that does not even exist in the physical world. And what happens if we take the virtual world out of the electronic device and integrate it into our space?

This is what the metaverse is all about. The more 'academic' definition is this 'metaverse is a shared virtual environment that people access via the internet. It combines aspects of social media, online gaming, augmented reality (AR), virtual reality (VR), and cryptocurrencies (Folger, 2021). By the way, AR and VR are already quite popular in the game and movie sphere.

It would be foolish to argue that this organization of functionality is very effective: almost instant access to the necessary platforms, saving physical effort and space, simplifying and schematizing the execution of tasks.

The metaverse is where the physical and digital worlds come together. It is a space where digital representations of people – avatars – interact at work and play, meeting in their office, going to concerts, and even trying on clothes (Milmo, 2021). But now it begs the question: don't they want to take too much of our real lives?

As it stands today, with access to every component of the potential metaverse separately, we are still fish who could be caught on the company's hook. If the idea of a meta-universe is realized as envisioned, wouldn't each of us become a controlled puppet for the very people who chase our attention every day and try to anticipate our actions?

In total, in terms of technology and engineering, the metaverse is a serious stage in its evolution. But in terms of humanity? Should we replace real communication with chat rooms or online meetings, real clothes with skins bought in the virtual world, ourselves with avatars? I think not.

Until users on one side of the screen learn to manage their own lives, and employees on the other side learn not to put finances above moral principles, we will not expect anything exceptionally positive from technological innovations.

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OXIDATION METHOD FOR TREATMENT OF WASTEWATER FROM DYES (ON THE EXAMPLE OF THE "SUNSET YELLOW" - E110)

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Contamination of surface and groundwater sources with anthropogenic substances, which include insufficiently treated wastewater containing surfactants, dyes, and other compounds, is currently a very painful environmental problem for society. Therefore, water purification from dyes is relevant today and, in my opinion, in the near future.

The presence of anthropogenic organic matter in water poses is a serious threat to human health.

Water purification from organic pollutants is usually carried out by two methods:

- oxidation (destruction) - chlorine, ozone, oxygen are used as oxidants;
- sorption (absorption).

Among the methods used to treat wastewater from organic pollutants, preference should be given to methods of advanced oxidative processes, namely:

- ozonation;
- ozonation together with the use of ultraviolet radiation.

This method (H_2O_2 together with the use of ultraviolet radiation) was chosen by us for research. The method of spectrophotometry was chosen to assess the quality of the purification.

The experiments were performed in the laboratory using the installation (Figure 1) to determine the effect of UV and H_2O_2 on the processes of destruction of the dye E-110 at its various mass fractions.

1- Magnetic stirrer
2-Chemical beaker with dye
3-UV lamp
4-Ultraviolet light reflector
5-Power supply
6-Box

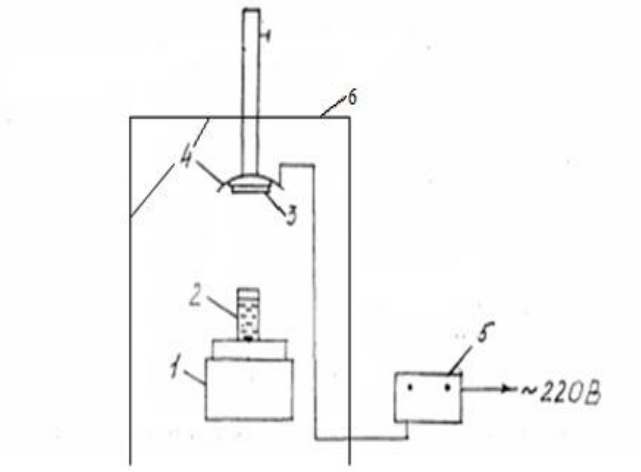
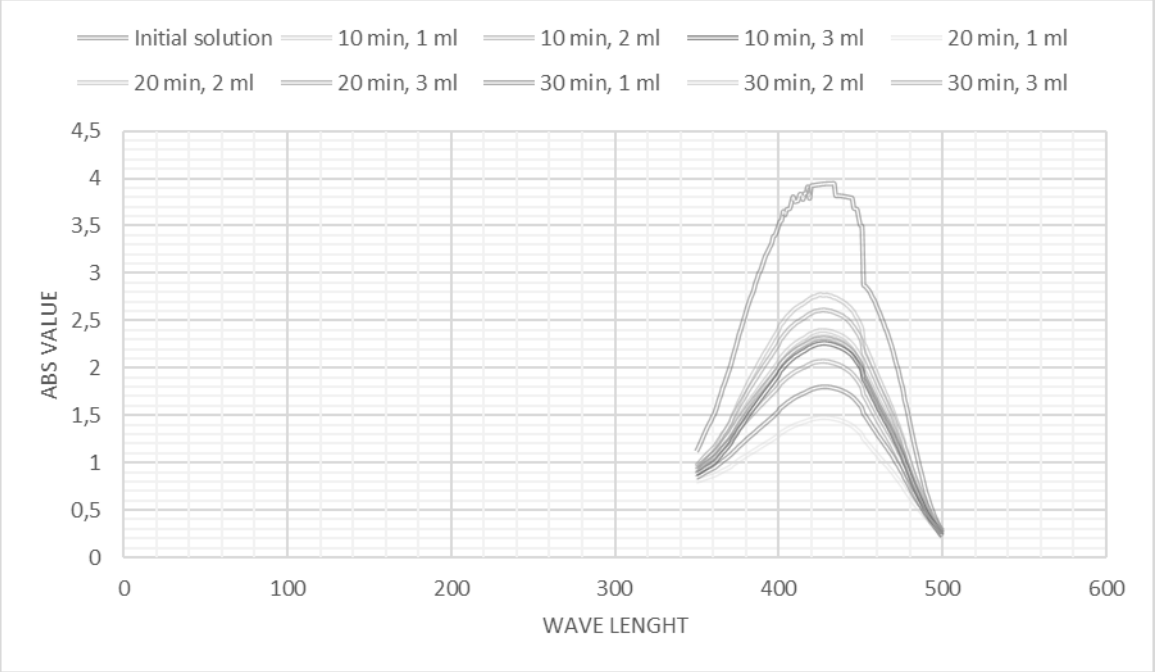


Figure 1

To confirm the effectiveness of removing the E-110 dye from the solution, a series of experiments were performed using a model solution with an E-110 dye concentration of 25 mg / dm^3 and 50 mg / dm^3. The experiment was performed at different values of H_2O_2 content (1, 2, 3 ml of 30% solution) with additional irradiation of water with ultraviolet light.

The following graph presents results of spectrophotometry measurements (the lower the abs value, the cleaner the water) after the total effect on the selected dye E-110 of different amounts of the substance H_2O_2 (1, 2, 3 ml of 30% solution) for 10, 20, 30 minutes and at the same time ultraviolet radiation, in comparison with the initial solution with a concentration of 50 mg/dm^3.



This graph clearly shows that with the combined action of ultraviolet radiation and hydrogen peroxide, the value of Abs decreases more than twice, what means that water become cleaner. There is also an obvious relationship between the operating time, the amount of H_2O_2, and the quality of water purification

- The chosen research method was analyzed, namely - oxidative method of wastewater treatment from organic pollutants;
- Among the known methods, the method of spectrophotometry was chosen to qualitatively assess the purification of the aqueous solution from the dye E-110;
- The combined use of H2O2 and ultraviolet light proved to be the most effective method.

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EQUIFAX AND CREDIT REPORTING COMPANY. CASE STUDY

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In 2017 Equifax reported a data breach in which the records of 147 million people had been exposed, mostly of people in the US, but 693,665 people in the UK also had their data exposed. Equifax UK later wrote letters to each of these people explaining the situation (Your credit. Your identity).

The exposed data contained millions of names and dates of birth, Social Security numbers, physical addresses, and other personal information that could lead to identity theft and fraud. Equifax had a system to monitor network traffic, but it wasn't working for the previous 19 months because a security certificate hadn't been renewed.

Equifax stored its data in a database called ACIS and was alerted in 2017 to a critical security vulnerability in an Apache Struts web server that provided access to this database. A patch had been issued but Equifax failed to ensure that the patch was installed. Hackers exploited this vulnerability until the missing certificate was installed at the end of July 2017 (ACIS Database).

So how do the principles of CIA apply to the Equifax case? Quite obviously, confidentiality was violated: unauthorised people could read the data. However, authorised users still had full access to the data, so it remained available; and the data was not changed, so its integrity was preserved.

Time for another definition. When talking about valuable data we use the term 'information assets'. In the Equifax case the information assets were the data about people and their financial records, collected by Equifax. When we consider security of online communications and services, we also need two additional concepts: 'authentication' and 'non-repudiation'.

When we receive a message, we want to be confident that it really came from the person we think it came from. Similarly, before an online service allows a user to access their data, it is necessary to verify the identity of the user. This is known as authentication. Non-repudiation is about ensuring that users cannot deny knowledge of sending a message or performing some online activity at some later point in time. For example, in an online banking system the user cannot be allowed to claim that they didn't send a payment to a recipient after the bank has transferred the funds to the recipient's account.

Finally, there are a number of terms associated with software that attempts to harm computers in different ways. Collectively these are known as 'malware' (a contraction of malicious software). Depending on what the malware does, different terms are used in relation to it.

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THE METALLURGICAL INDUSTRY IN UKRAINE

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The metallurgical industry brings together companies that consistently perform the extraction, enrichment, metallurgical processing of ferrous and non-ferrous metals and non-metallic raw materials (called fluxes and refractory materials), the production of pig iron, steel, non-ferrous and precious metals, alloys, rolling production, processing of scrap metal.

The main consumers of metallurgical products are mechanical engineering, construction and transport.

The metallurgical industry includes both ferrous and non-ferrous metallurgy.

Ferrous metallurgy is one of the most developed industries in Ukraine, accounting for more than a quarter of all industrial products. Produces cast iron, steel, rolled products, ferroalloys, pipes, etc. It is a material-intensive industry: around 3 tons of iron ore, 1.1 tons of coke, 20 tons of water, as well as manganese ores, limestones, fluxes, etc. are needed to melt 1 ton of cast iron. Therefore, ferrous metallurgy companies are located near or between sources of raw materials or fuels.

Ukraine has large reserves of iron and manganese ores, coking coal, fluxes and refractories for industrial development, their deposits are very well combined - mainly in the Dnipro and Donbass.

In terms of the production of ferrous metallurgy, Ukraine has long been one of the leading countries in Europe and the world. So, in the 80s of the XX century. Each year, from 120 to 125 million tons of iron and 7 million tons of manganese were mined there, and 55 million tons of steel were smelted.

Currently, these figures are much more modest - about 55 million tons of iron ore, less than 3 million tons of manganese ore, 32 million tons of steel (2000). However, Ukraine still ranks seventh among the world's largest steel producers. In recent years, the production of rolled products, ferroalloys, steel tubes has been constantly increasing. These goods are exported in large quantities out of Ukraine; In general, the products of ferrous metallurgy give the country the most foreign exchange earnings from exports.

Ferrous metals are traditionally smelted in full cycle plants, which cover all the final stages of metallurgical production, as well as the production of coke (metallurgical fuel from special grades of coal) and agglomeration (lumps of ore from iron fired from limestone and coke). Each of the industries has waste and by-products which are raw materials for other industries - chemicals, building materials, metalworking.(1)

Companies in these industries, as well as heavy mechanical construction plants, have an advantage in locating near metallurgical plants. Thus, ferrous metallurgy has an important value of complex formation, on its basis multidisciplinary units are formed.

The largest metallurgical factories in Ukraine are:

Kryvorizhstal,
Azovstal (Mariupol),
Zaporizhstal,
Dniprovsky (Dniprodzerzhynsk),
Alchevsk,
Makéevski.

Large metallurgical plants that do not have a complete metallurgical cycle - Donetsk, Yenakiyevo, two Dnepropetrovsk and others. The production of ferroalloys (alloys of iron with other metals to obtain high-quality steel grades) is concentrated in Zaporizhzhia, Nikopol, Stakhanov and pipes - in Nikopol, Novomoskovsk, Dnipropetrovsk, Mariupol, Makiivka, Khartsyzsk (1).

Ferrous metallurgy enterprises are located in three metallurgical districts - Prydniprovsky, Donetsk and Pryazovsky.

The Prydniprovskyi district was formed on the basis of the extraction of iron ore from the Kryvyi Rih, Kremenchug and Belozersky basins, manganese ores from the Nikopol, Velykotokmatsky deposits, flows from the Dnipropetrovsk region, imported coke and refractories (from Donbass). The metallurgical divisions of Dnipropetrovsk (Dnipropetrovsk, Dniprodzerzhynsk, Novomoskovsk), Zaporizhia, Kryvyi Rih, Nikopol (Nikopol, Marganets) and Kremenchug were formed here.

Donetsk region was born near coking coal deposits on the basis of processing ores from the Dnieper region ("pendulum" principle - cars with coke go to Dnieper factories and return with iron ore and manganese). Metallurgical subdivisions were formed - Donetsk-Makeyevka, Alchevsk-Almaznyansky, Yenakiyevo and separate metallurgical centers - Kramatorsk, Khartsyzsk, Kostiantynivka.

Priazovsky district used poor iron ores from the Kerch basins and rich Kryvyi Rih and Belozersky, manganese ores from Nikopol, coke, fondants and refractories from Donbass. However, iron ore companies on the Kerch Peninsula have suspended their activities. So, the district now includes two metallurgical enterprises in Mariupol (one of them - the "Azovstal" plant - the largest rolling mill in Ukraine).

Important problems of Ukrainian ferrous metallurgy are the need for technical and technological re-equipment of production, improvement of the quality of ferrous metals, production of new types of steel and rolled products. So far invaluable, environmentally friendly methods of producing ferrous metals, in particular electrometallurgy (the largest plant - Zaporizhzhia) and powder metallurgy (the only plant operates in Brovary near Kiev)

Non-ferrous metallurgy, unlike ferrous metallurgy in Ukraine, is relatively undeveloped. It has several characteristics: a) the ores contain a small amount of metal, which necessitates the establishment of numerous non-ferrous metallurgy companies close to the sources of raw materials; b) non-ferrous metal ores contain many different metals, which requires the integrated use of raw materials; c) industry requires a lot of energy and water, and also has a negative effect on the environment. Thus, its location and development are influenced by energy and environmental factors.(2)

In the structure of non-ferrous metallurgy of Ukraine, the first place is occupied by the aluminum industry. It works on imported raw materials (bauxite from Hungary, Africa, Russia), its companies are located near ports and in places of electricity production. The branch is represented by the large Nikolaev alumina plant, the output of which (alumina - a semi-finished product for receiving metal) is used in Ukraine; it is sent to Russia. There is an aluminum plant in Zaporizhia and an aluminum alloy plant in Sverdlovsk (Luhansk region).

Other branches of non-ferrous metallurgy include the production of magnesium (Kalush), titanium and magnesium (Zaporizhzhya), mercury (Horlivka), ferronickel (Pobuzhye, Kirovohrad region) and gold (Muzhievo, region of Zakarpattia). These industries work on their raw materials, the safest of which are the titanium (ore deposits of the Zhytomyr and Dnipropetrovsk regions) and mercury (Donbass) industries. In Kostiantynivka, a zinc industry was created on imported raw materials (2).

There are two districts of metallurgy of non-ferrous metals in Ukraine - Donetsk and Prydniprovsky. The Carpathian district is promising.

Among the problems associated with the development of non-ferrous metallurgy, the most important are air pollution, the accumulation of a large number of rocks, the incomplete use of raw materials.

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HOW TO USE FRACTALS IN GAMEDEV

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A fractal is an infinite self-similar structure made up of parts that are similar to the whole object. In simpler terms, it is an infinite division into parts.[i]

Fractals are very common in nature. A striking example is the snowflake. It is formed by condensation and crystallization. Due to the structure of the water molecule, angles of only 60 or 120 degrees are possible between the rays of the crystals. In this way, the crystal has the shape of a regular hexagon, with other crystals appearing on it and on each ray, new crystals on new rays and so on until a certain moment. This phenomenon is called bifurcation. The bifurcation can be biological (circulatory system), geographical (division of the river into smaller and smaller streams), physical (Brownian motion) etc.

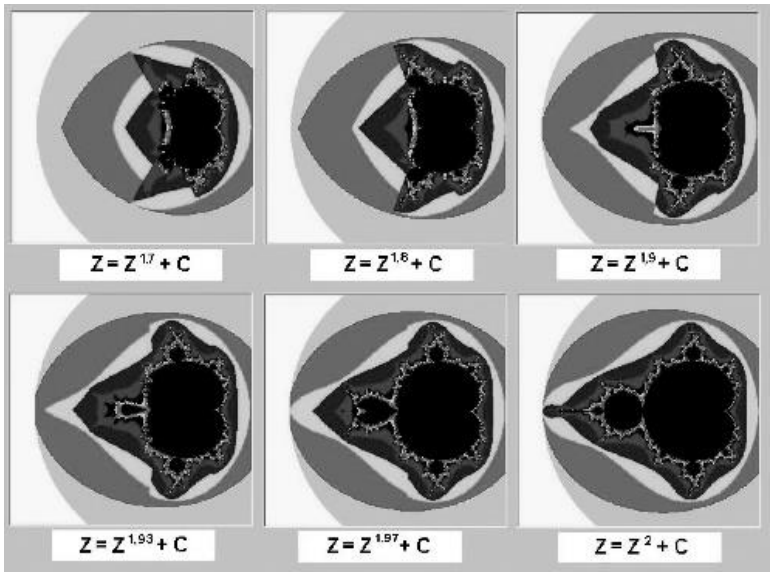

Fig. 1 Mandelbrot- Julia set (Labut, 2008)

Let's leave the terminology and get down to business. So, how can we use a fractal in a gamedev? There are many elements that you have to draw yourself, but it is not necessary. These are elements of the environment, such as: bushes, trees, clouds, mold, mountainous terrain, ocean surface It is possible to simplify the work of game designers and just write all these little things down with formulas, for example: f (z) = z^n + C (Julia set: f:C→C , J(f)= ∂ { z: f(n)(z) → ∞, n → ∞}, but of course it is not the only one, because there are many other ways to present a fractal). This is done using complex numbers: C = x + iy, where x and y are real numbers, and i is an imaginary unit (i = √-1) (Raba, 2007, p. 31).

These formulas apply to the plane, but it is not necessary to build fractals only on it. This can be done in three-dimensional space thanks to the Mandelbrot set. Complex numbers are not used here, but quaternions are used, which are hypercomplex numbers : H: = (a_1 + a_2i + a_3j + a_4k | an ϵ R), in which i^2 = j^2 = k^2 = ijk = -1 (Raba, 2007, p. 27).

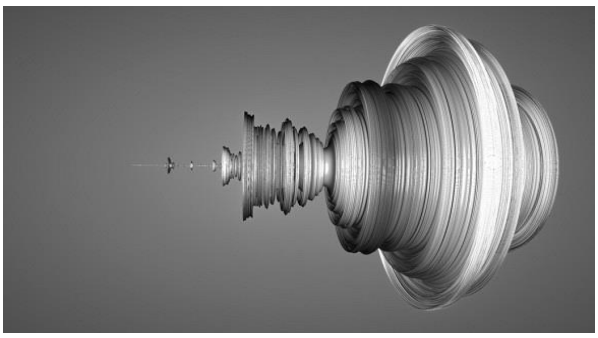

Fig. 2 Mandelbrot's quaternion (Shakhov, 2014)

For practical use, this way you can build fern leaves (Barnsley's fern).

In addition to gamedev, such technologies can be used in graphic design and book illustration as a decorative element. In general, there are many areas where you can combine fine arts and mathematics from fashion to bioart.

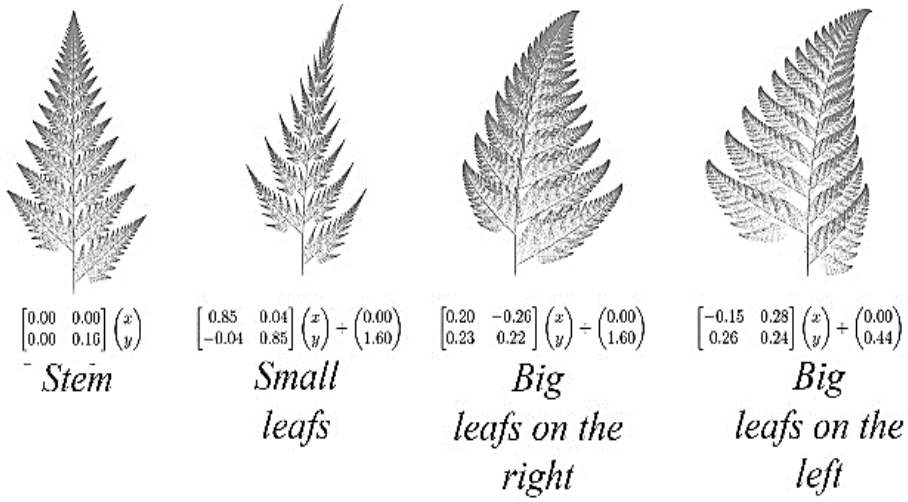

Fig. 3 Barnsley's fern (Vectozavr, 2020)

Fractal graphics is a very promising area, with it you can not only create fractal game engines, that will increase the productivity of the gamedev industry many times over, but also explore chaotic biological structures such as our brains (Wai Tsang, 2016, p. 426). It has certain advantages: it does not take up large amounts of data, allows for detail and is easy to modify images. It also will help us understand the structure of the universe better, because fractals exist almost everywhere and, perhaps, they are the answer to our questions.

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FACE ID

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In 2017 iPhone presented the 10th generation of their product line and introduced a new function, which provided the users with the ability to keep the phone safe.

Nowadays it is important to keep information on our devices private. Different companies try to find out the latest security technologies, so that their devices could be sold faster than others and make a profit for the corporation. As a result, engineers from Cupertino have developed one of the most secure and innovative user identification systems in the field of consumer electronics.

How does Face ID work?

First of all, it does not depend on the camera, as the majority of users think. The phone is equipped with a special three-dimensional scanner of the human face, so that the module of cameras and sensors recognizes not just a flat portrait of a person, but his three-dimensional model. For each pixel received, the sensor detects the distance to it forming the depth of the image. The distance to each point is calculated by fixing the beam flight time. Thus, it is not significant if a user wears makeup or beard, as it does not change the distance between your face features or all the 3D structure.

Moreover, the Face ID technology is self-learning, the neural networks in the iPhone processor memorize the user's face more accurately with time and begin to work better in more complex conditions.

Can it be considered as a reliable technology?

- To avoid inadvertent authentication, the system requires scanning the face with eyes open looking towards the camera. This means that it is impossible to unlock the phone by scanning while sleeping.
- Furthermore, the scanner needs a 3D model, so the device will not be unlocked with a flat image.

Nevertheless, researchers suggest that it has a disadvantage. Facial recognition responds to the twins and in most cases consider them as the phone's owner.

Face ID gives a possibility not to enter a password every time you have to do some actions with your phone. It is just possible to look at the zone where the camera is located and confirm your personality. In this way financial transactions can be reaffirmed and the user is capable of having access to all the information, which is stored on the phone.

Taking everything into account, this new technology is secure enough and could be a reliable replacement for passwords and other ways of device protection in future.

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HOW DOES AN ELECTRIC GUITAR WORK

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Today it is hard to imagine the music culture without electric guitars. Since they were first created in the 1930s, they have been widely used by dozens of musicians all around the world. Electric guitar became a symbol of protest in world culture. But how does an electric guitar actually work?

The main difference between electric and acoustic guitars is the way they use to represent the sound. In case with the acoustic guitar it is clear that the sound comes from the sound hole and it is already loud enough. By describing the sound system of an electric guitar we will need to focus on the electronics and some basic laws from the electromagnetic field.

The component that is located under the strings is called "Guitar Pickup". Guitar Pickup is the most important part of every electric guitar. It is just a long wire that reeled up around the magnets. The amount of magnets is usually equal to the amount of strings. Such system in physics is called an inductor.

Now let's move from the "hardware section" to the software. As it was said before, there is one string above every magnet of the inductor. Magnet is able to magnetize the string in the region above the magnet. When the string vibrates, the flux of the magnetic field vector through the inductor changes. It causes the appearance of the Electromotive force in the inductor.

This basic law of electromagnetism was discovered independently by Michael Faraday in 1831 and Joseph Henry in 1832 and today is known as Faraday's law of induction.

The Electromotive force in the inductor now causes a current which transfers to the guitar preamplifier. In the preamplifier the signals are processed and amplified. From there the strong enough signals transfer to the amplifier where they become strong enough for being represented out of dynamics.

Also, before pre-amplifying the signal, it can be deformed in the effects unit. It will give a more specific sound. The effects unit is able to change the input signal. It is able to change the frequency, to reduce the volume of loud sounds or to amplifie quiet sounds, to delay the signal and even to change the separate parts of frequency response. By the way, today it is rare to hear songs with a clear guitar sound.

Now it is clear that electric guitar doesn't replicate the quiet sound of strings and emit it from the dynamic. The concept is to convert the mechanical vibrations of the strings into electrical signals. The output signal can be easily changed in any way in order to receive the desired sound.

Throughout almost one hundred years the technologies of electric guitars have been discovering not only by musicians but by engineers as well. Numerous experiments with changing the properties of signals helped in formatting the full picture of how the electric signals can be represented as music. Also dozens of experiments were made with shapes and properties of pickups. Such concept would

not be possible without electrodynamics laws which were discovered in the 19th century.

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ASSEMBLY LANGUAGE IN MODERN PROGRAMMING

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Assembly is one of the first programming languages made to ease the process of human-computer communication. Before its invention in 1947, the main ways of transferring information to the IBM was manually written in machine code commands, which is literally a set of zeros and ones, or inserting a special card with premade holes that represented each bite directly. It could hardly limit the max program size, as well as the speed of information insertion and receiving and programming itself, because humans are not designed to understand that type of info. Therefore, Assembly was born. It greatly simplified the process of writing computer instructions by making them look much more word-like, automated assembling and translation of the code, and first presented the feature that, years after that became the basis of all high-level programming: operators of nonlinear program compilation/execution. Firstly, they were used for making loops and "forks" in a program, that shorten an average code size a lot, and now all the modern "high-level" things such as classes, functions and so on are written using them, so it is not an exaggeration to say that it was a revolution.

It is important to note that despite the usage of the expression "assembly language" in our article, it would be more correct to say that this is a group of languages similar in type, functionality and application areas, but sometimes differing in syntax and some details. Each manufacturer of processors, controllers, or other machines that need low-level code creates their own separate language corresponding to the machine instructions that the product supports. However, large corporations such as Intel and AMD, in order to maintain backward compatibility of their programs (when a program written for an early version of the processor is guaranteed to work on a later version), over the years, they maintain and update the same "language", which is usually meant by, for example, learning the assembly language.

In the modern world, despite the emergence of more and more high-level languages, knowledge of assembler is again becoming prestigious and well-paid. A programmer who knows assembler as a "second language" can write a much better code than a programmer with similar qualifications who does not know this language. Moreover, such an employer is able to write a much more optimized code for solving a specific task and coping with a program debugging and reverse engineering, if necessary, which is, among other things, a great advantage when hiring. In addition, all that is due to a deep understanding of the work of the processor itself, ways of implementing individual functions, commands and directives of higher-level languages. This is literally a consequence of the specific structure of the language itself.

Specialized on low level coding, Assembly remains one of the hardest languages to master. It is important to understand that low level programming languages communicate to the computer directly, and are used when memory and

speed of the program are our main concern, when high level languages are made in a way to be easily understood by a person reading the lines of code, and in the end it does not require much time spent on writing. So to say, a program written on Assembly works times faster than an analogical program written on any high level language. However, in the same example when a high-level code can take a page, the same code on a low-level language takes up to 10-20 pages.

Although in many cases when a low-level language has to be used Assembly was replaced with C, there are still some instances where it is irreplaceable. For example, it is still used in:

1) drivers
2) programming of microcontrollers and embedded processors;
3) pieces of operating systems where it is important to ensure the speed of work;
4) antiviruses (and viruses).

Memory aspect. As written above, Assembly programs are incredibly effective in terms of memory. That is why drivers are written in this language, which is embedded directly into devices, or control programs that occupy several kilobytes. Such a program is written for a specific processor and uses its capabilities on its full potential.

Speed aspect. Assembler allows you to work with the processor and memory directly - and to do it very quickly. The fact is that in Assembler, almost no processor time is wasted. If the processor is clocked at 3 gigahertz - which is about 3 billion processor instructions per second - then a very good Assembler code will execute about 2.5 billion instructions per second. For comparison, JavaScript or Python will execute a thousand times fewer commands in the same time.

So, now it is obvious that if a person determines to connect their life with informational technologies it would be quite useful to understand the way operations go inside the CPU of the machine, where all operations are performed using mainly the exchanges between registers. While in Python, for example, you do not have to write the lines to do such operations directly, in Assembly you have to do this directly through code.

In addition, in a more abstract example, a person does not have to understand how a certain machine is constructed in order to use it. However, if you know this, you can easily diagnose a problem, understand how to solve it. It is the same with Assembly: to understand how a program works, how to debug it, diagnose it, understand what does not work - that is what Assembly is needed for.

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APPLICATION OF ELECTRONIC SENSOR EVALUATION SYSTEM IN MARTIAL ARTS (TAEKWONDO)

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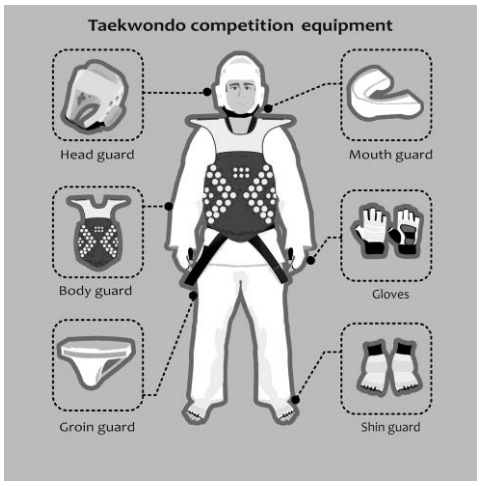
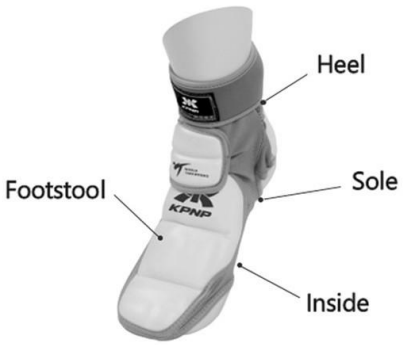
The 21st century is the age of information technology. Thanks to technological advances, many processes that were previously performed manually by humans have been automated. Sports are no exception. In sports management and refereeing, technology incredibly simplifies the work of not only referees, but also athletes and their coaches. This ensures a fair assessment of the performance and guarantees the athletes a fair victory. Taekwondo is a prime example of the introduction of technology into sports.



Taekwondo is a Korean form of martial arts that is characterized by punches and kicks with an emphasis on high kicks, spin jumping, and swift kicks. Physical training in taekwondo is focused and strengthens the fortitude with the help of psychological weapons. Under World Taekwondo and Olympic rules, sparring is a full-contact event, employing a continuous scoring system where the fighters are allowed to continue after scoring each technique, taking place between two competitors in either an area measuring 8 meters square or an octagon of similar size.



Before the fight, the athlete must wear a uniform, protection for arms and legs, electronic equipment (special socks, a protector (vest) and a helmet with electronic sensors). When touching the sensors in the socks with the protector or helmet of the enemy, the electronic system calculates the force of the impact. If there is enough strength, the athlete earns points depending on the difficulty of the blow.

The control of the course of the fight is carried out using a special electronic scoring system. There are software from various brands such as Adidas, Daedo and Armor Hardware.

A computer with software, joysticks, a helmet, a vest (protector), socks with sensors are the main electronic equipment for fighting.

Socks with electronic sensors:

- Provide protection for the athlete's foot.
- In contact with the protector or helmet of the enemy, it transfers the level of force of the blow to the computer for setting points.

Joysticks:

- Wireless triggers make it easy to set up competitions.
- Judges can move more freely without wires.

Vest:

- Not affected by sweat or water.
- Very durable proximity and impact sensors.
- Double touch system for improved accuracy.
- Sensors over valid scoring areas.

Details:

- The impact sensor measures the impact level depending on the strength and speed of the impact.
- Proximity sensor - recognizes contact with the correct part of the body for assessment to avoid mistakes.
- Transmitter - receives information from sensors and sends information to the scoreboard.

Helmet. Product feature:

- Additional element for an automatic 3-point course.
- Automatic scoring.

Details:

- Sensors built around protective gear.
- The transmitter is connected to an electronic headgear.

In conclusion, I would like to say that the development of electronics also directly affects the development of sports. I believe that over time, technology will be able to fully control and evaluate the course of any sporting event.

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METHOD OF RESEARCH OF HEAT-INSULATING PROPERTIES OF MATERIALS USING ARDUINO NANO

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The preservation of non-renewable resources in the modern world is a very important issue. Thermal insulation materials help in this. They reduce heat loss in the room, thereby saving resources that would be spent on maintaining a stable temperature. The estimation of the thermal insulation properties of materials can be carried out using a theoretically substantiated and experimentally tested in our work installation for determining the thermal conductivity coefficient.

The developed algorithm according to the author's methodology allows conducting research on popular insulators and, on the basis of the results obtained, draw conclusions about the thermal insulation qualities of insulators and assess their compliance with the standards declared by the manufacturer. The invention is devoted to the creation of modern technologies for studying the heat-insulating properties of materials and the development of methods for measuring the thermal conductivity of heat-insulating materials.

The existing methods of studying the heat-insulating properties of materials are analyzed, which make it possible to measure the coefficient of thermal conductivity of heat-insulating materials. An own technique for studying the heat-insulating properties of materials has been created, which allows measuring their thermal conductivity coefficient, assessing the compliance of the actual characteristics of the main working properties with those characteristics that were declared by the manufacturer. To simplify the mathematical apparatus, we investigate the stationary thermal regime, when the temperature of the test sample does not depend on time.

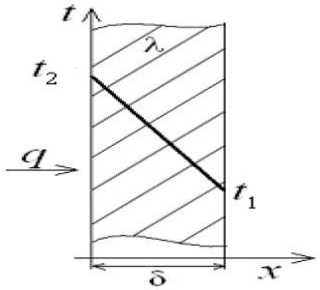

Fig. 1.1- Flat homogeneous sample in a stationary heat flow *(source: author's development)*

Consider a flat homogeneous sample (Fig. 1.1) with a thickness δ with a constant thermal conductivity λ. Temperatures t1 and t2 are maintained on the outer surfaces of the sample. Thus, a stationary heat flow passes through the sample. Heat flux is the amount of heat transferred per unit time over an arbitrary surface. Heat flux density *q* is the heat flux per unit area. This is a vector that coincides with the direction of heat distribution, i.e. directed in the direction of decreasing temperature and perpendicular to the parts with the same average temperature (Kalinchak V.V., 2012, p. 4).

Based on theoretical calculations and analysis of existing methods of measuring thermal conductivity, a working model of the installation was built, which uses common materials and available measuring instruments. The thermal chamber model of installation was made of PSB-35 foam State standards of Ukraine B 13163: 2012, 50 mm thick. The source of electric amperage was a laboratory power supply DHF-1502DD with smooth regulation and stable values of amperage and voltage. Necessary for calculating the electric power of the heater values of amperage *I* and voltage *U* in the stationary mode of installation were determined using an electrical measuring instrument C4317 and checked with a digital multimeter DT-830B. Consecutively, every 10 minutes, the temperature sensors of the front faces of the sample located on the installation were taken (Fig. 1.2).

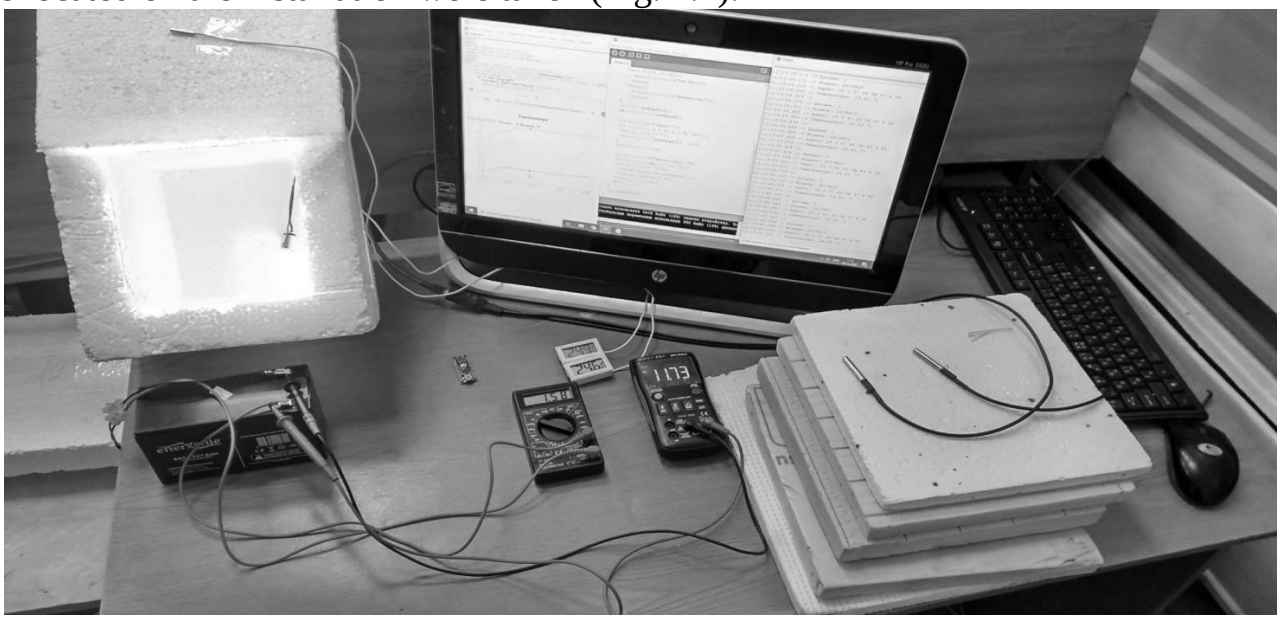

Fig. 1.2 - Photo of the installation *(source: author's development)*

Arduino Nano is used to obtain and analyze temperature parameters. The special program was written by Arduino language for its work. Temperature readings are recorded by two DS18B20 temperature sensors inside and outside the unit, displayed on an indicator and saved on a computer for further analysis by the unit operator. The output of temperature data can be configured at a given frequency using a program in the Arduino language and saved in text format.

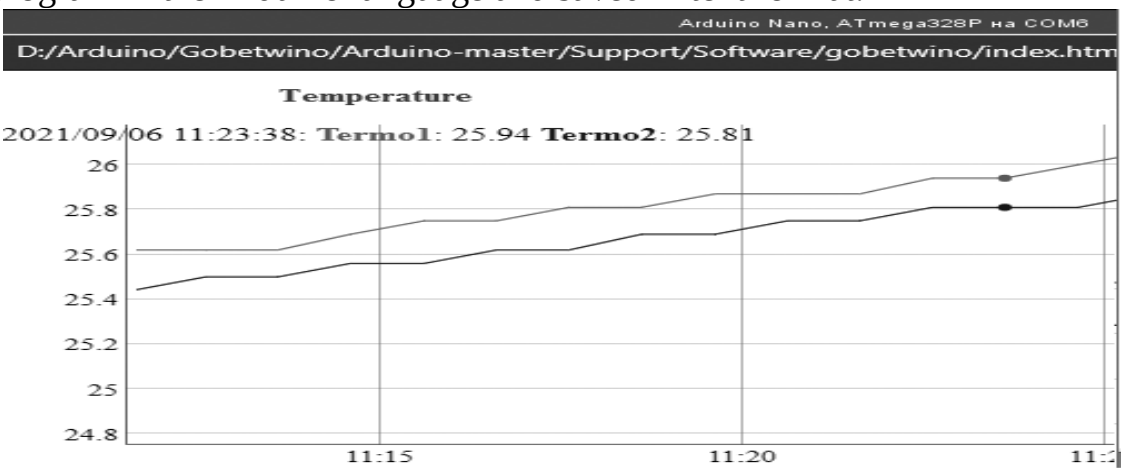

Fig. 1.3 - The output of temperature data using a program by Arduino language *(source: author's development)*

The temperature difference of the front faces of the sample Δt was 10–50 ° C, which provided a constant coefficient of thermal conductivity during the test. The heat flux through the test sample was considered stationary when the value of the temperature difference of the front faces of the sample Δt in three consecutive measurements of temperature sensor signals did not increase or decrease monotonically. As a result, the possibility of using the experimental dependence to determine the thermal conductivity of unknown materials at this installation was confirmed.

The results of scientific work devoted to the development of research methods thermal insulation properties of materials became the basis for the following conclusions:

1. The analysis of existing methods is researched heat-insulating properties of materials, in particular such that allow measuring the coefficient of thermal conductivity of heat-insulating materials using Arduino Nano. Among the disadvantages of existing methods is the relatively high cost of methods, long test time, as well as a rather complex mathematical analysis of experimental data.

2. The technique of research of heat-insulating properties of materials which allows to measure their coefficient of thermal conductivity, to estimate conformity of actual characteristics of the basic working properties to that were declared by the manufacturer is created.

3. An experimental sample of a measuring device is created thermal conductivity coefficient and the results of experimental studies of thermal insulation materials. This installation was introduced into the educational process in physics at the Zaporizhzhya Multidisciplinary Lyceum №99 and Zaporizhzhya National University of Ukraine as part of the training of students of the subject specialty "Secondary Education (Physics)".

4. In the future, the results of my research can be used in the educational process in Computer Science as a practical illustration of the possibilities of using the Arduino Nano tools when conducting experiments in physics.

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PYTHON DICTIONARIES

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This article aims to give base knowledge concerning such types of objects in Python as dict. Python is now one of the rapidly developing programming languages, and of course the most popular one (Bansal, 2021). In other programming languages, types, which let you realize such functions as dictionaries in Python do, are more complicated and are not built-in (Sturtz, 2021).

As Python is a programming language with dynamic typing, you should not use a keyword to create a dictionary, like in other ones (Campbell, 2021). I think everybody agrees that this opportunity makes code more comfortable to read. To declare a dictionary you just have to use the next construction:

<name> = { key1:value1, key2:value2, …, keyn:valuen}

where <name> is identification, the key is a specific object, which we use to get the value that is located after the key. Do not forget, that the identification should not begin with a number, or contain any other symbols except for English letters or the symbol "_". Also, you cannot use keywords to name your variables. By the way, there are some restrictions as for keys. They should have an immutable type, for instance: int, float, complex, str or tuple. Here you can see an example of declaration a dictionary:

```
d = {1:'a', 'text':4, (3,4):'numbers'}
```

Of course, there are more opportunities to create your dictionary. One of which is with the help of built-in function dict(). It has several different signatures. The first one is the following:

dict key1= value1, key2= value2, …, keyn:valuen)

Here, dict() returns a dictionary, which contains n elements. Let's have an example

```
>>> d = dict(a = 1, b = 2, c = 3)
>>> d
{'a': 1, 'b': 2, 'c': 3}
```

The second signature you can see below:

dict(list)

The list, which we set as a parameter has to contain only lists or tuples with two elements, the first one is a key, and the second - a value. For instance:

```
>>> arr = [[ord(a),a] for a in "abcde"]
>>> arr
[[97, 'a'], [98, 'b'], [99, 'c'], [100, 'd'], [101, 'e']]
>>> d = dict(arr)
>>> d
{97: 'a', 98: 'b', 99: 'c', 100: 'd', 101: 'e'}
```

Here we declare a list with a name arr with the help of a list-generator, it contains lists of two elements, the first of which is an ASCII code of the second element. Then we use dict() to get a dictionary from this list.

Besides, there is a way, how to create a dictionary without using the function dict(). You can use a method fromkeys() insted. Let's see its signature:

dict.fromkeys(list or tuple, value)

It returns a dictionary, every element of the first parameter is used as a key for a new dictionary. But in this case, all keys will have the same value - the second parameter. For example:

```
>>> arr = ['key1', 'key2', 'key3']
>>> d = dict.fromkeys(arr, 'value')
>>> d
{'key1': 'value', 'key2': 'value', 'key3': 'value'}
```

We have learnt how to create our dictionaries, but how to get their values? So, there are two ways how to do it. The first one is to use a key. Let's see an example below:

```
>>> d = {"var1":'a', "var2":1, "var3":(1,2)}
>>> d["var3"]
(1, 2)
```

The second one is more flexible but more complex. You can use method get(), which has the next signature:

dict.get(key, default value)

If our dict does not contain an element with such a key, then it will return the second parameter - default value. But if it does, then it will return the appropriate value. Let's see an example:

```
>>> d = {"var1":'a', "var2":1, "var3":(1,2)}
>>> d.get("var4", "no key")
'no key'
```

We have an opportunity to add elements to our dictionary. Method update() can be used for this purpose. It has the following signature

dict.update(dict)

For example, if we want to add an element to our dictionary we use the next construction:

```
>>> d = { 'a':1, 'b':2, 'c':3}
>>> d1 = { 'a':1, 'b':2, 'c':3}
>>> d2 = { 'd':4, 'e':5}
>>> d1.update(d2)
>>> d1
{'a': 1, 'b': 2, 'c': 3, 'd': 4, 'e': 5}
```

Also, we can remove elements from a dictionary. Simple, but useful operator, which gives us this opportunity is <<del>>. For instance, if we want to remove one of the dictionary elements, then we can use the next construction:

del d[key]

```
>>> d = {1:'a', 2:'b'}
>>> del d[1]
>>> d
{2: 'b'}
```

But what if we need to remove the last dictionary element and get it before it will be deleted? In this case method popitems() can help you. It removes the last dictionary element and returns it.

```
>>> d = {1:'a', 2:'b', 3:'c'}
>>> d.popitem()
(3, 'c')
```

To sum up, type dict is powerful and flexible. It lets you process data easily. Last but not least, is that all operations with dictionaries in Python are more simple then with similar types in any other popular programming language.

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VIDEO RECOGNITION TECHNOLOGY

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Video recognition technology is growing extremely fast today. Big corporations collect video footage and use them for peculiar purposes. AI-powered video surveillance may increase the effectiveness of security, labor or quality control, marketing or management processes, or just extracting important information from the records.

For example, retail companies may track the customer traffic in shops, which helps them to improve the effectiveness of business strategy or analyze the behavior of clients. Other examples are automatic cash registers in the store or replenishment of goods on shelves, taken by customers.

Other interesting examples are watching the growing process of agricultural plants, like crops, and distinguishing them from weeds, or inspecting the level of water in dikes and predicting its strength for a purpose of avoiding accidents. Without AI these and even more features would be impossible or too challenging to develop. So, what is video recognition actually, and how it works?

Video recognition is a complicated task, which requires a lot of labeled data and consists of 5 main subtasks: object detection, object recognition, target recognition, real-time video analysis triggering, real-time alarm.

Object detection is a part of Computer Vision. The idea is to find and highlight objects in photos or videos. It can use the location method to find and count the objects.

To perform video recognition different tools are used: from python libraries, like OpenCV to frameworks like Tensorflow. AutoML Video Intelligence is also a good tool to train the model.

In this journey, it is mandatory to prepare a dataset of videos. Training videos should be as similar as possible to videos you would test the final project on. The perfect amount of recordings in the dataset is a thousand per label, but the more the better.

After gathering the data, it should be divided into three parts: test, train, and valid. The training dataset will be used in the learning process of the model by searching patterns with multiple algorithms. The validation dataset is meant to test the results of the previous stage. And finally, the test dataset is used to evaluate the accuracy and error rate of the model.

There are different metrics that exist to evaluate how well the model works. Particularly, AuPRC (Area under Precision) indicates the accuracy of the model with numbers from 0,5 to 1. The bigger number is the higher its accuracy. In order to improve the quality, it is essential to add more videos to the dataset or check the labeling part of the job.

In a conclusion, the main pros of using AI are: saving time and people efforts in video surveillance work, increasing the quality, the ability to process large pieces of information quickly and with less finance required.

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JAVASCRIPT USAGE IN CREW DRAGON CAPSULE FOR ITS FIRST CREWED SPACEFLIGHTS

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Millions of people worldwide faced the historic launch into space on 30th of May, 2020. It was the first time astronauts were sent to space from the United States since 2011 and yet the first crewed test flight of the Crew Dragon shuttle was made by SpaceX. Later this year, the space company surpassed its success with First Operational Commercial Crew flight, launched in space on the 16th of November. Those glorious occasions meant that a new era of space travelling and entertainment had already arrived.

There are several reasons why the Demo-2 mission is considered significant: it was the first launch ever controlled by a commercial provider, the first stage of the rocket landed itself after separation for the first time in a crewed mission and last but not least, the Dragon capsule interior has greatly changed. In comparison with the past, it has become much more futuristic. Nowadays, inside the cabin there are high-tech touch-screens, which make the inner design look really as if it came from the far future.

SpaceX software developers shared some details about programming languages which were used in Crew Dragon. Hardly did anyone expect to hear that JavaScript (JS) was used in Crew Dragon for its first crewed space flights. Having announced this surprising piece of news, the rumor that the software that was written in JS quickly spread in the IT community. Consequently, that caused some members to doubt the flight's safety.

However, Sofian Hnaide, who worked on the display's software, quickly dispelled that myth on Reddit interview. He claimed that Chromium engine, JavaScript and other web-related tools were used for user interface only. As a software design team lead Josh Sulkin said, that all vehicle control systems were written mostly in C++ and running in the Linux environment. "We take reliability and performance very seriously, we test extensively under different conditions to understand all failure modes" (Sofian H., 2020). SpaceX is able to meet all NASA requirements for reliability and touch feedback about displays. And even if something goes wrong and touch-screens are completely gone, there are few physical buttons and a joystick which provide a full spacecraft's control.

Since JavaScript is a really popular programming language today, there are a lot of competent specialists therefore that, as predicted, led to faster vehicle development. SpaceX also intends to use the same display technology stack for Starship ground software.

Thanks to SpaceX engineers, today we can see modern touch-screens instead of dozens of hardware buttons, which have highly impressed ordinary people. Surprisingly for all programmers, they are powered by web technologies. JavaScript

has crossed a new frontier and found its place in space industry. This brave decision will crucially influence the spacecraft's development in the nearest future.

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BLOCKCHAIN TECHNOLOGY IN MEDICINE

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Nowadays, there is no proper mechanism for exchanging medical information in today`s healthcare infrastructure. In most cases, the patient is forced to bring their past medical records to a new medical institution. In addition to the obvious inconvenience, the lack of a patient`s history can lead to improper treatment. However, there is a solution to the problem and it's called blockchain technology.

A blockchain is a database that is built as a continuous chain of blocks. Each block contains information from the previous block and new information that was embedded in the newly created block. The main feature of the blockchain is the absence of a third party, which means complete confidentiality, security, reliability and complete reduction of the risk of leakage and falsification of information. However, is it relevant to apply this feature in the field of medicine?

In terms of patient data, this is the best technology today. It allows you to distribute and manage patient data, for example by creating a single register of electronic medical records based on the blockchain. As already mentioned, the system is built on the principle of a chain of blocks, where each block contains information from the previous one. Therefore, this is an ideal place to store medical records of patients, because with this system you can unwind the history of a particular patient until the beginning of the creation of an electronic card. In addition, the data cannot be replaced, which means that the information cannot be compromised, and even if it is changed, it will be indicated in the future history of all blocks. It also helps to quickly and easily view reliable information on medications that have been prescribed or taken by the patient.

The next advantage is the fight against counterfeit products. For example, in the blockchain system, namely the block, bring in information about the manufacturer of the drug, its unique number and, for example, the packaging number. With this data, pharmaceutical companies, drug manufacturers and consumers will be able to verify the authenticity of the data. This method allows to provide inexpensive quality control of drugs, as well as tracking of counterfeits at all stages of the chain of blocks. In this case, all parties are interested in this possibility, because it allows at any time to detect counterfeit or the possibility of counterfeiting the unit.

The main problems of the blockchain in the field of medicine include the issue of scaling. Not all medical institutions are ready to share existing data, moreover, not all patients want to take responsibility and manage their own data. Some participants in the medical field directly point out the lack of the necessary competence and add that the technology is too new. In general, in addition to the fear of the new due to the small use of technology in practice, this technology has no disadvantages (ZdravExpert, 2019).

In conclusion, blockchain is the technology of the future. The principle of its operation is difficult at first glance, but very practical, because it provides

transparency and accessibility of information to all, has reliable protection and prevents the loss of information. In the medical field, this technology is extremely convenient for entering and storing information about the patient. It saves a lot of time. Also, its mass introduction involves the complete destruction of counterfeit products. Of course, there are problems. The main one is the problem of scaling. Both the state and medical institutions are not aware of this technology and do not want to develop it. In addition, some institutions are reluctant to share existing information. However, the technology is extremely promising. It provides unrealistic possibilities. In 5-10 years, blockchain technology will become as popular as the payment system as Master Card or PayPal.

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QUANTUM COMPUTING

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From the second half of the twentieth century, the rapid development of computer technology began. Scientific advances that are racing forward to this day have allowed humanity to move from clumsy boxes that barely added numbers to devices that fit in the palm of your hand and can process an incredible amount of information in a matter of seconds. However, the mechanical part of any computing machine rests on the laws of physics, and today it is difficult to find a way to improve the components of a computer. The scale on which modern technology is being assembled is on the verge between classical physics and the realm of quantum mechanics. Roughly speaking, quantum physics is concerned with the study of the behavior of very small (comparable to an atom), very cold (near absolute zero) or very isolated (in a vacuum) particles. Obviously, modern technology is approaching the first of the above categories.

So, what are the physical limitations on the computer hardware? Consider the procedure of processing information. The computer operates with information through a system of modules – for storage, processing and management. Each of these modules, however, has to go from electricity to zeros and ones somehow, and it took a long way from relays and lamps to transistors. It is convenient to think of them as simple switches that can either pass current or not, which corresponds to a logical "yes" or "no". But at the level of nanometers, the behavior of the current is reduced to the behavior of the electron, and here the phenomenon of quantum tunneling comes into play. Because of it, the physical barrier in the form of a transistor loses its meaning, and information processing becomes impossible. Therefore, scientists have made the transition to quantum computers.

If in an ordinary computer information processing is performed through charge carriers, or bits, then in a quantum computer this happens through superposition carriers, or quantum bits (qubits). Thus, the work of quantum computers is reduced to the creation of qubits and the means to control their state. The physical implementation of the qubit can be any particle whose behavior before measurement is any proportion of two possible states at once: spin or charge of an electron, polarization of a photon, charge of a semiconductor crystal, etc. To manipulate the state of the qubit on quantum level, microwave signals, or so-called precision lasers, are used. In addition to superposition, to find a correct solution the phenomena of entanglement (correlation between behavior of two particles) and interference (interaction of opposites) are used. The very process of computing becomes more like simulating transformations of real-world objects carefully encoded as input data and decoding the result, than guessing a sequence of complex formulas one by one, as it was in the ordinary computer. All in all, quantum computing creates new ways to approach problems that classical computers have difficulty solving.

Perhaps the biggest advantage of quantum computers is their processing power. Consider the following: one ordinary bit "stores" one of the two values – 0 or 1, that is, at a given moment in time it is in one state. A qubit, due to its quantum nature, is in two states at the same time, that is, it "stores" twice more information than its ordinary progenitor. Hence, quantum supremacy – incredibly complex problems that ordinary computers could spend thousands of years solving, quantum computers get right in seconds. They don't represent a step-by-step linear problem-solving structure, but rather a whole plain of possible solutions at once, the best of which are selected using quantum algorithms. To better show the computational advantage of qubits, refer to the table.

Combination length	States	Quantum bits	Quantity	Ordinary bits	Quantity
1	T, F	𝛹	1	1, 0	2
2	TT, TF, FT, FF	𝛹𝛹	2	11, 10, 01, 00	4
3	TTT, TTF, TFT, FTT, FFT, FTF, TFF, FFF	𝛹𝛹𝛹	3	111, 110, 101, 011, 001, 010, 100, 000	8
n	2^n	…	n	…	2^n

What's counterintuitive is that with a help of qubits, a machine can process all combinations, or states of a system, simultaneously, while ordinary bits allow you to test every possible combination, just only one at a time. Note that 2^n states can be described just by n qubits, as opposed to 2^n regular bits.

The seemingly amazing work of quantum computers has been described above, but creating and maintaining them involves significant challenges that have been omitted before this section. Firstly, quantum phenomena work flawlessly in highly isolated environments and low temperatures. Therefore, the first step in creating a computer – creating a qubit (using technologies available today) – requires high-precision equipment and a reliable cooling system. Secondly, imperfect parts that tend to fall apart cannot fit together into a perfect machine. That is to say, the individual sensitivity of qubits to external influences will only grow with their number. This increased instability of the system, called decoherence, imposes a limit not only on the time during which the information in the computer remains intact, but also on the number of consecutive operations, because the state of superposition is hard to maintain. Thirdly, the very process of coding input data is very far from working with the programming languages we are used to. It's more like building quantum configurations by hand to match real things. Then tossing these configurations around until something plausible can be extracted using quantum algorithms, such as Shor's or Grover Algorithm. All the inconvenience in work is due to the fact that quantum computers operate on an analog, probabilistic principle. The result of the operation of a given algorithm on a given initial state – a set of the probability distribution of the outcomes plus possible errors. The digital, rigidly

deterministic principle, on the other hand, gives the same result if the algorithm and inputs remain the same. This is the reason why regular algorithms are not applicable, and scientists need to develop new abstraction systems on which to build a programming language.

In point of fact quantum computing is the behavior of complex systems with many variables, so why not use them to model something similarly multidimensional, such as the interaction of protein structures or the properties of complex substances. These predictions could be, and already are, a breakthrough in medicine, chemistry, physics etc. Machine Learning and Big Data processing, using quantum computers, are able to reach a whole new level of productivity and speed. And where Big Data is, there is Cryptography. Sure, quantum computing only pays off for incredibly complex systems, and the creation of the corresponding computers is not the easiest. But some highly specialized problems that were previously impossible to solve on any computer, with the help of quantum computers are solved quickly and efficiently.

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PERSPECTIVES AND USE CASES OF BLOCKCHAIN TECHNOLOGY

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Blockchain is a ground-breaking technology, the interest in which has grown along with the popularity of cryptocurrencies. Today it is widely discussed not only in the world of finance. They are already trying to use blockchain for storing and processing personal data and identification, in marketing and computer games. Blockchain is a non-mutable database. Blockchain is a non-mutable decentralized database that is simultaneously stored on multiple computers connected to each other on the Internet. To change the state of the database, most of the computer nodes must reach a consensus.

Let's take a look at one of the examples of using blockchain technology for e-governance. This will be a voting system. In the beginning, a public key is generated for each person. This is the address of the wallet in the blockchain database. When voting, exactly one token is sent to the address of each wallet. The token can be spent only once by sending it to the voting address. Each candidate in the voting lists has its own address. After sending a token to this address, the vote is counted for its candidate. The entire system is integrated into a De-Fi application that interacts with a smart contract deployed to a blockchain network. The application is decentralized, which guarantees its independence from the server infrastructure, which in turn guarantees its trouble-free operation even in a global catastrophe. Thanks to the technology, the system is faultless, immutable, and completely transparent.

For the user, everything under the hood remains hidden. The user just opens the application, where appears a list for voting. The user puts a tick next to the selected candidate label and presses the "vote" button. The voter does not need to make sure that his vote is counted correctly. This is guaranteed. But, if he still wants, he can open the blockchain explorer and check his transaction there. Data interception, manipulation, and substitution of votes become simply impossible due to the nature of blockchain. And this is just one of the uses of the blockchain.

NFTs (non-fungible tokens) are the latest cryptocurrency phenomenon to become mainstream. NFT transforms collectibles into unique, verifiable assets that are easy to trade on a blockchain. "Non-fungible" means that it's unique and can't be replaced with something else. Linking real assets to NFT can digitize the way we prove ownership. NFT can help confirm legal ownership when selling a valuable item. For example, an authentic diamond usually comes with a certificate of authenticity. This certificate is also the way to confirm you are the owner. Anyone trying to resell a product without a certificate cannot verify its authenticity and may have trouble convincing buyers that they are the real owner.

Having an NFT related to an item can make NFT ownership as important as owning an asset. When we see the development of the Internet of Things, we are likely to see more NFT being used to represent real assets.

Blockchain technology can also be useful in logistics. The reliability and safety of the system guarantee the safety and authenticity of the information in the supply chain. The main feature of NFTs is that they represent unique items. They can be used to track goods - view information about their origin, route, and location.

Let's have a look at the following example: A country produces high-quality goods of an elite brand with NFT assigned to each item, which can be scanned on the package. With the NFT public key, the buyer can check where and when each good was created. As the parcel is moved to the delivery point, the NFT is scanned to add new information about its status, including the location and the time of arrival or departure.

As a result, the buyer will have access to detailed information about the delivery and authentication of such goods. There are many ways to implement NFT in the delivery process, but for each of them, it is necessary to use the same system at all stages of the supply chain.

Blockchain has an incredible number of uses due to its benefits. We are now only at the beginning of the development of this truly revolutionary technology. We are already seeing how this technology is changing the financial sector, making cryptocurrencies the most profitable investment tool in the last 10 years, helping ordinary people to make fortunes. Now we see the active development of decentralized applications, games, and entire metauniverses. It's difficult to imagine how this will change the world in the future.

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IMPLEMENTATIONS OF ARTIFICIAL INTELLIGENCE INTO OUR LIFE

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Some people are afraid of everything connected with AI as they think it will break down and the apocalypse will start. In fact it is not true. It is used in your smartphones, in your smart TVs. Even the world-popular platform YouTube is also based on AI. A lot of services are made over self-learned platforms.

The main purpose of my speech is to tell the audience about different implementations of artificial intelligence in the modern world. So, I want to show people that there are a lot of uses of AI around them and they do not even know about the existence of those things. It is not evil as it is described in the «Terminator» series. It helps us to make our life easier and it can not even do something except for the task it is created for. AI just optimizes itself to work more efficiently so you should not be afraid of its deviation (Reynolds, 2018).

Artificial intelligence is used mostly everywhere. To begin with, if you are interested in the car industry, you know that suspension in modern cars is usually adaptive to make it more comfortable. You may be surprised, but it works due to AI. Different data are captured by sensors and processed with special algorithms. Also, AI is used in modern greenhouses in Europe. They are constructed especially, so all plants are grown vertically. In this way, they cover less area and have higher productivity. Above each plant is placed a camera. It takes a photo of the plant once in a period of time and AI analyzes it. If AI decided that plant is grown, a manipulator harvest is. Nothing evil, or not? The next example is controlled prostheses for people. There are ones that can be moved by nerve impulses. That information is captured from muscles. When a part of an arm or leg was amputated, all doctors connect muscles and these actions allow to save nerve impulses. So, those signals are proceeded by AI and then the prothesis can move. After a month, for example, the person can control this artificial body part as fluently as the natural one because it has learned how they usually move (Greenhouse Grower, 2020). A lot of musicians continue playing different instruments after the imputation of a hand due to this technology (The Medical Futurist, 2020).

To sum up, AI is used in different parts of our life. Even if you think that something can not include this technology, it can have one. But you should not worry about it, AI just helps gadgets to work fine and even better. It can not improve itself so much that it will kill humanity or something like this. The main purpose of artificial intelligence is to learn the most popular scenarios of using the gadget and as a result to make it work more effective

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POWER ENGINEERING

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I want to discuss two problems and a single solution for both. The ecological situation on the planet is getting more complicated every year. This is due to the constant growth of production and population. All this leads to significant pollution of the environment and a reduction in human life expectancy. Here are some facts. Ukraine has 10,000 hectares of landfills. This is 6% of the territory. And 11 million tons of garbage is produced annually.

The second problem is the shortage of energy resources. The scarcity increases the price.

- Gas - 1200 $ / m3. Caloric content - 8000 kcal / kg
- Coal - $ 200 / ton. Caloric content - 4000-5500 kcal / kg.
- Wood pellets - $ 200 / ton. Caloric content - 4000 kcal / kg

While working at LLC "Vol`ten", I and our team developed a solution. Solid household waste should be divided into two types: "dry" and "wet". All waste is transported for sorting. Of these: 25-30% - recyclable materials, up to 10% - estimates and construction waste, up to 20% - wet waste, from 40 to 50% - mixed residues that are used to make RDF (Refuse Derived Fuel).

RDF (Refuse Derived Fuel) - Is a fuel obtained by crushing and dehydrating municipal solid waste (MSW) using conversion technology.

Benefits of switching to burning RDF fuel:

- Price: $ 20 per gigacalories
- Saving natural resources
- New workplaces
- Elimination of garbage in the country

We will highlight this decision as a potential for growth not only in the energy sector in Ukraine, but also in the economy as a whole. In addition, it is much easier for environmental projects to attract funds from foreign investors.

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VR AND AR TECHNOLOGIES

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The striving for constant development is characteristic of modern man. It should be noted that the modern education system is built in such a way that theoretical knowledge prevails over practical knowledge in the learning process. At the same time, it is known that knowledge gained practically is assimilated by students better and is preserved for a longer period, in contrast to knowledge obtained only theoretically. Thus, the situation in the field of education regarding practical training determines the relevance of the use of new information technologies in the field of education. One promising direction for the development of innovative educational technologies is the use of augmented reality in the learning process. The direction of research in this area is indicated by a clear well-established term — Augmented Reality. (Devyatykh, 2019, p. 4)

At the present stage of its development, augmented reality computer technologies are beginning to influence learning technologies, enriching their means and methods, expanding didactic and cognitive capabilities. Placing virtual objects in a specific environment, in which they are initially absent, makes it possible to simulate unusual educational practices. Learning to use augmented reality technologies increases engagement, makes education interactive and contextual. With the help of AR, students can visually study the topic and examine in detail full-fledged three-dimensional models of objects that are very difficult or impossible to get in life. It can be a three-dimensional model of a black hole, various chemical reactions, visualization of the process of movement of tectonic plates. Such material is better for children to learn than traditional text or 2D images.

Currently, VR / AR technologies have received the most serious development in the entertainment and markets, but this is not the limit, but only the first stage of their implementation. The most promising in terms of economic effect are products based on VR / AR technologies in industrial production, education, healthcare, and consumer services. Supporting companies that create products with virtual and augmented reality technologies will help create world-class products in the industry, achieve technological and economic advantages in critical market segments, as well as take a significant share of the global market. (cdto.wiki, 2020, p. 1)

Virtual reality technology (VR) is a complex technology that allows you to immerse a person in an immersive virtual world using specialized devices (virtual reality helmets). Virtual reality provides complete immersion in the computer environment that surrounds the user and responds to his actions in a natural way. Virtual reality constructs a new artificial world transmitted to a person through his sensations: sight, hearing, touch and others. A person can interact with a three-dimensional, computerized environment, as well as manipulate objects or perform specific tasks. In its simplest form, virtual reality includes 360-degree images or

videos. Achieving the effect of full immersion in virtual reality to a level where the user cannot distinguish between visualization and real environment is the task of technology development.

Augmented reality (AR) technology is a technology that allows information to be integrated with objects of the real world in the form of text, computer graphics, audio and other representations in real time. Information is presented to the user using a heads-up display, augmented reality glasses or helmets (HMD), or another form of human graphic projection (such as a smartphone or projection video mapping). Augmented reality technology enhances user interaction with the environment.

The introduction of VR / AR in the educational segment will provide accessible tools for users and supplement training programs with interactive visual VR / AR content in the amount of up to 30% of all educational materials (with a priority on subject areas that are not reproducible in traditional formats). This can lead to the following effects: increasing the effectiveness of online learning; provision of continuing professional education; ensuring the availability of quality education in the regions.

In the corporate sphere, the use of VR / AR technologies can ensure the creation of an effective corporate training system. (Dmitry Makeev, 2019, p.6)

Thus, VR / AR technologies are useful and necessary for society, so we need to study these technologies in more detail and expand their capabilities.

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INTERNET TECHNOLOGIES IN BUSINESS

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Internet technologies in business - explores the work with information that surrounds the management of the business entity, with the introduction of the probabilities of modernity - the Internet. The relevance of such research is due to the information development of the community, the development of machinery and technology and the need to use modern methods of information processing and expanding the probabilities of the Internet by using its resources in the actual work of people (Shchedrina, 2012)

The main IT trends in the development of various sectors of the economy and business are artificial intelligence, voice and visual product search, chatbots, big data, self-driving machines and devices, augmented analytics, digital duplicates, biometric data, 5G technology, intelligent border technologies, immersive technologies , intellectual space, digital ethics and privacy, quantum computing, blockchain (Shevchuk., 2020).

Internet technologies are considered a mandatory part of information technology, but in the absence of repeated updates, information systems are worn out, ie something becomes inaccessible, or simply fails, which leads to their functional unsuitability and, consequently, losses for a particular enterprise. To maintain the appropriate state of information technology, it is appropriate to use modern Internet technologies. The use of a global network of companies allows you to increase the competitiveness of goods, expand markets, find new suppliers, intermediaries and buyers, which is essential for business. This corresponds to the business processes of attracting the client, studying his needs, the very act of making a transaction and service, namely the system should cover all business processes of the company's interaction with potential customers. It is this system of operation that can ensure the use of Internet technology, which is relevant to doing business and becomes an integral part of the operation of any enterprise in the modern world. After all, Internet technologies are evolving rapidly, and the need to use such technologies is simply a necessary condition for a profitable business (Manko, 2019).

The IT sphere in Ukraine is now becoming one of the key resources of national and regional development. The use of information technology simplifies and accelerates production and business processes, accelerates the establishment of links in areas of activity, not only in business, intensifies cooperation between regions and countries, creates and develops new industries in economics, science and technology. They are the basis for increasing the efficiency of enterprises and ensuring competitiveness in domestic and foreign markets. All this certainly increases the opportunities for regional development and economic recovery blockchain (Shevchuk., 2020).

Also in the use of Internet technology in business, you can come across major intolerances, namely I mean threats, namely such as viruses, etc .. In order

for actions when using Internet technologies for business to be safe, you need follow the basic rules of information security. Modern threats include computer worms, Trojans, adware, spyware, jokes, rootkits, spam, hacker attacks, and internet fraud. The protection system includes the following actions: constant updating of the operating system, use of an effective file system, correct use of passwords, use of anti-virus programs, use of attack detection systems, backup data archiving, etc.. (Manko, 2019)

Information technology creates opportunities for unlimited business expansion and allows you to optimize management processes as a whole. However, they must be used thoughtfully and carefully. A positive effect is achieved only if there is a clear idea of how to develop their application to support the successful implementation of business strategy. Otherwise, this expensive and difficult-to-use tool will not benefit business, and investment in information technology will be ineffective blockchain (Shevchuk., 2020).

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MODERN APPROACHES TO CREATING POWERFUL WEB APPLICATIONS

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The modern world is unceasingly developing and new business problems and their solutions emerge every day. Not difficult to notice that there are more and more popular applications that move to the web. Usually, there are three same apps created for different platforms: browser, desktop, and mobile. Web applications' popularity is fully justified: it is really convenient that one app (browser) provides us an opportunity to search, watch media, download, and use powerful apps online. In the past, web applications were slow, not secure, they looked awful and required a good Internet connection and a lot of space. Nowadays, there are many powerful technologies and ready-to-go solutions for most modern problems. Today, web applications look great, they are smart, and they also strive to use as little storage as possible. What is more, they use modern principles, patterns and approaches to increase productivity, accessibility and reactivity.

Development principles that applied in the past no longer make sense, while new ones have sprung up. The main task is to research modern approaches to creating web applications and find out how they solve past problems and present business problems (mrc-productivity, 2019).

By and large, we can see that modern user, as a rule, prefers using multimedia information to text. That is why it is essential for our service to have a voice search technology. Some users will not use it at all, but many of them consider a voice search to be necessary. What is more, 84% of users believe that the design of the app is important, so here comes a modern library for the design called "Motion UI". Using it we can create amazing animations, backgrounds, loaders etc. We can speed up our app and boost our web app rankings in search results (codica.com, 5). It is also important that the user has an opportunity to comfortably use our app on different platforms, especially on the smartphone. Here comes the principle called "mobile-first".

According to Flexera report, 98% of all companies at least once used cloud services to run servers. It is called serverless architecture. It is the way of developing the back-end part of our app without thinking about the servers itself. Actually, our logic systems are still run on server, but they are supported by cloud providers like Google (firebase), Amazon (AWS) etc. (Flexera report, 2020).

One more approach is called "SPA – Single Page Application". It is a kind of application that is based on Javascript and its feature is that it does not load the whole HTML page, but markup and dynamically changed data. In this way users feel like they are always on the same page, and the speed of the app is keenly increased. (Codica, 2020)

As we can see technologies are developed every year, so we do not want to use old ones, because it becomes difficult to maintain our app. So, one of the approaches

is based on using a modern and powerful stack of technologies. For example, MERN – which includes MongoDB as a database, Express.js for holding our server, React.js for creating powerful user interfaces and Node.js – for everything else we need.

What if we have to create a server that needs to maintain a variety of different clients like desktop browsers, mobile browsers, native mobile applications, and also it should work with 3-rd party APIs and include some integrations with other systems like banks. What should we do not to make our server a trash bin? The answers are obvious: to use a microservices architecture. We can create a small service for every separate task we need. Every service has its own database. All microservices communicate using HTTP/REST. And data between services is maintained using Saga pattern, which describes just a simple sequence of local transactions that trigger and evoke the next (microservices.io, 2019).

There are many smaller principles, for example: “module separation” requires the developer to create a specific folder structure, when he is creating a package to decrease the amount of memory of the imported library. If we have 1000 similar things to show on the screen – use virtualization. Show only the first 20-50 and only than show others but only when the user scrolls down to them. This will secure our app from terrible lags. Also, try to minimize the number of HTTP requests. Use local storage, cookies, cache – anything we want, just to do this. It will increase the speed of our app in many times.

I believe that the goal was achieved successfully because it was researched and described many modern and really useful approaches and principles of creating powerful web applications. To verify whether named principles are really useful — we should check, how big modern IT companies create their products. And, make no doubt, all of them use at least 5 of them, because today they are really essential.

I am confident about the future of web development. Most of these approaches will be improved and replaced by those, we cannot even imagine now. But at the moment, we should use what we have to find out new problems and solutions for them because it is the only way the progress can be.

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POSSIBILITIES OF DEVICES FOR REMOTE MONITORING OF ARTERIAL PRESSURE

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Blood pressure (BP) is one of the main indicators of central hemodynamics, which reflects the blood supply to vital organs. Determination and control of this indicator are now considered the main tools that prevent the risk of occurrence and development of cardiovascular disease and help to avoid fatal consequences of these diseases (Stergiou & Bliziotis, 2009). For example, arterial hypertension leads to the formation of renal failure, contributes to the damage of arteries, retinal vessels, the development of pathology in pregnant women and newborns. At the same time, there is unsatisfactory public awareness of the disease, a low percentage of patients receive treatment, insufficient effect of antihypertensive therapy. Emergencies during illness (cardiogenic shock, coma, syncope, hypertensive crisis, eclampsia of pregnant women), hemodynamic monitoring during anesthesia and resuscitation, functional tests require accurate assessment of blood pressure and thus make invasive measurement impossible. Thus, the determination of blood pressure should be strictly regulated, which imposes certain requirements, both on the conditions of its measurement and the recording devices themselves.

In the course of the work, an analytical review of the literature was conducted, which classifies the methods of measuring blood pressure and focuses on indirect methods as the most comfortable for continuous use. Such, in the course of acquaintance, became non-invasive occlusive methods (Spelde & Monahan, 2016). These methods determine the corresponding measuring device. The analysis of medical and technical literature gave an understanding of the features of these devices, which allowed to form a comparative description of the advantages and disadvantages for each.

There are direct (invasive) and indirect (non-invasive) methods of measuring blood pressure. A direct one is carried out through a catheter or cannula, which is inserted into the lumen of the artery. It is impossible to use this method at home and for constant monitoring of blood pressure, so it is not smoothed in the future. The most common indirect methods include occlusal methods (auscultatory and oscillometric), ultrasound examination of vascular wall movement, and Doppler measurement of blood flow velocity (Sikors'kij, 2015).

The principle of operation of modern tonometers is based on two main methods of measuring blood pressure: Korotkov's method (mechanical tonometer) and oscillometric method (electronic tonometer).

The first one is based on the complete compression of the brachial artery by the cuff and the subjective assessment of the auditory sounds that occur when the air is slowly released from the cuff. In addition to subjectivity, the disadvantages of this method include its dependence on the individual characteristics of the person performing the measurement (sensitivity of hearing and vision, speed of reaction),

sensitivity to the presence of others, you need to ensure direct contact with the skin of the shoulder. The results of blood pressure measurement by tonometers by this method may be generally inaccurate due to the phenomena of infinite Korotkov pulse or auscultatory failure. However, this method is a reference, because the accuracy of measurements is maintained during hand movements and the method is resistant to cardiac arrhythmias(Sikors'kij, 2015, p.24).

The oscillometric method is to record the pulsations of air pressure that occur when blood passes through a compressed area of the artery. The amplitude of the mentioned pulsations is rather insignificant, therefore to tonometers by this method there are high requirements of the accuracy of measurement, reliability of algorithms of processing of the measured signal (its filtering, decoding, detection of peaks, etc.). The advantage of these devices is the ability to automate their work; reducing the impact of the human factor; greater accuracy of measurements of systolic and diastolic pressure, than at Korotkov's method; resistance to external noise. This method has its drawbacks: low resistance to hand movements; inaccurate results in people with defects of the cardiovascular system; is not a benchmark.

A review of the modern market of devices in this segment for the complex decision of problems of measurement of BP was also conducted. The latest solution for measuring blood pressure with a built-in electronic tonometer - smartwatch Omron Heartguide. It looks like an ordinary smartwatch, due to which it has additional functions: counting steps, calories, assessing the quality of sleep, notifications from a smartphone. At the base of the watch is a cuff 25 mm wide, which is inflated when measuring blood pressure using the oscillometric method (Omron, n.d., para.3).

The basis of the considered methods of blood pressure measurement is overpressure of the cuff of the artery. Auscultatory and oscillometric methods can be used in practice. Usually the disadvantages of one method overlap with the advantages of another, and vice versa.

Modern devices offer comprehensive blood pressure measurements. In everyday life, the use of such watches is the most comfortable among the considered methods, while maintaining the accuracy of measurements.

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NEURAL NETWORKS THE BASIS OF MODERN LIFE OF HUMANITY

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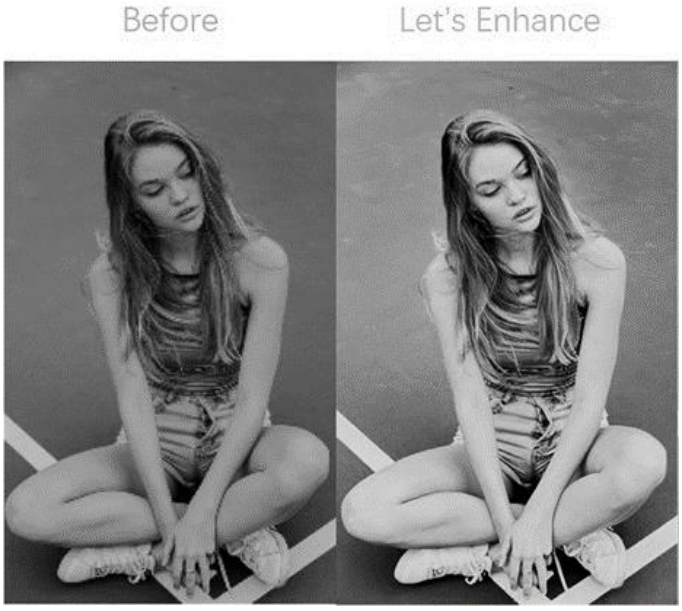
A neural network is a software simulation of the neural structures of the human brain. The first artificial neural network was created in 1943, so this branch of science can hardly be called new. But it has developed globally, during its existence, and has not yet reached the peak of its development.

An important feature of neural networks, indicating their great potential and wide application capabilities is the parallel processing of information by a large number of neurons. This achieves a significant acceleration of information processing. Another important feature of neural networks is the ability to learn and summarize information. In this way, some resemblance to the work of the human brain is achieved.

Today, neural networks are used in almost all spheres of human activity: medicine, economics, communications, information processing, programming, editing, design, automation and so on.

Ukrainian scientists have also contributed and continue to contribute to the development of neuroscience. Among modern domestic scientists it is necessary to allocate Akulova PV and Stanislav Osovsky. So, in particular, in the sphere of activity of Akulov PV includes issues of solving problems using neural networks. Stanislav Osovsky is engaged in research of neural networks in the field of information processing.

In 2017, Ukrainians Oleksandr Savsunenko and Vladyslav Pranskevychus created and launched the online service Let's Enhance for processing and touching photos. With the use of neural networks, you can increase the photo expansion four times, minimizing quality loss. Less than a month later, Let's Enhance became the product of the day on ProductHunt. Alexander Savsunenko considers the key advantages to be "a good algorithm, a balance of speed and quality prepared for production, implemented in a normal visual service."



https://c2.vanceai.com/posts/16281486673622178-VanceAIVSLetsEnhance.jpg

Modern services for photo autocorrection greatly facilitate and simplify the retouching process for all users. AI-powered photo editors do

everything a retoucher would do manually in Photoshop, while giving us full control over the process. Automatic retouching helps:

- ✓ give pictures taken on a simple camera a professional look and improve the quality of the image;
- ✓ save time by allowing the program to do all the work instead of manual editing;
- ✓ print and publishing companies to improve the process of image correction for magazines, marketing campaigns and more.

Intelligent systems based on artificial neural networks can successfully solve the problems of pattern recognition, prediction, optimization, associative memory and control.

Let's continue the theme of photo processing with the help of neural networks, the capabilities of which are impressive. Neural networks are used in FaceAdd facial recognition. Today, recognition is used in smartphones, credit and insurance companies.

Neural networks are used in video analytics. Video analytics systems are programs that allow you to analyze a video stream or an image and draw the following conclusions: counting objects in the image, the parameters of objects, their behavior (trajectory, nature of movement, etc.)

https://evergreens.com.ua/assets/images/articles/videoanalytics/object_count.gif

Over time, household appliances should appear that adapt to their owner, the harbinger of which can be considered a neural network unit for adaptive control in the new vacuum cleaner from Samsung. Security systems will recognize their owners by their voice, appearance and a number of other unique characteristics. The life support systems of "smart" electronic houses will also be developed, which will become even more adaptive and learnable. In production and in various industrial systems, intelligent neural network controllers will be able to recognize potentially dangerous situations, notify people about them and take adequate and, most importantly, timely measures. Data streams in computer networks and cellular networks will also be optimized using neurotechnologies.

Another area of application of neural networks is their use in specialized software agents in robots designed for information process, and not for physical work. Intelligent assistants should make it easier for users to work with information and communicate with a computer. Their distinctive feature will be the desire to understand as best as possible what is required of them by observing and analyzing the behavior of their owner, trying to detect some patterns in this behavior and

promptly offer their services to perform certain operations, for example, to filter news messages, with advice on to resolve a problem or to back up documents that the user is working on. That is why neural networks that can generalize data and find patterns in them are a natural component of such software agents.

But all this is a matter for future. Today, neural networks are used to work in relatively narrow areas, and it is not known whether they will ever be trusted to solve problems that require an understanding of the social context. Meanwhile, neural networks continue to confidently penetrate into our lives, and there are many examples of this.

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RESOURCE-SAVING BATHROOM DEVICE

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The purpose of the study. To develop computer system software based on a microcontroller that monitors the temperature and water level in the bath.

Formulation of the problem. Most couples who give birth to a baby experience some discomfort while bathing their baby. There are a number of devices that can be used, but they all perform only one specific function. When analyzing the range of items of Smart Home, it was found that there is currently no device that would combine all the necessary functions. That is, it was multifunctional (MimiSystems, 2021). Therefore, it was decided to create a device with a wide range of functionality that would make taking a bath by a child comfortable.

Consider the cases that demonstrate the existing problems in the bath:

1) taking a bath with a comfortable temperature is much better than waiting for it to cool, or vice versa, to heat it if it is not hot enough;

2) bathing a child should be treated more carefully. Due to the parents' habit to check the temperature with elbows or thermometers, there is a need for quick information about the state of water;

3) untimely blocked tap can develop into a flood, which will lead to large losses;

4) excessive overflow with water. When we take a bath, excess water flows into the drain, but do not return the energy resources spent for its heating

5) existing of a problem of resource conservation, because 2.5% of the total volume of the planet's water accounts for fresh water, which people massively and irrationally use in their needs.

Analysis of recent research. As the previous analysis showed, existing bathroom appliances have certain disadvantages, such as: design fragility, slow reaction, lack of accurate measurement, limited temperature, influence of external factors (water can lead to short circuit), lack of all desired functions (Gsm Signalka, 2020). Based on the analysis of these and other shortcomings, a model of the device of the new design was developed. The main advantage is to get the current results of measurement in real time on the smartphone - this increases the speed and accuracy of work.

Since existing devices have disadvantages, as well as their separate use is not so productive and deliberate, it was decided to create a new device. The presented device combines everything you need to control all the water parameters in the bath. The device model has advantages because of its multifunctionality and moreover it can be a part of the Smart Home.

Main part. Fig. 1 shows a block diagram of the prototype.

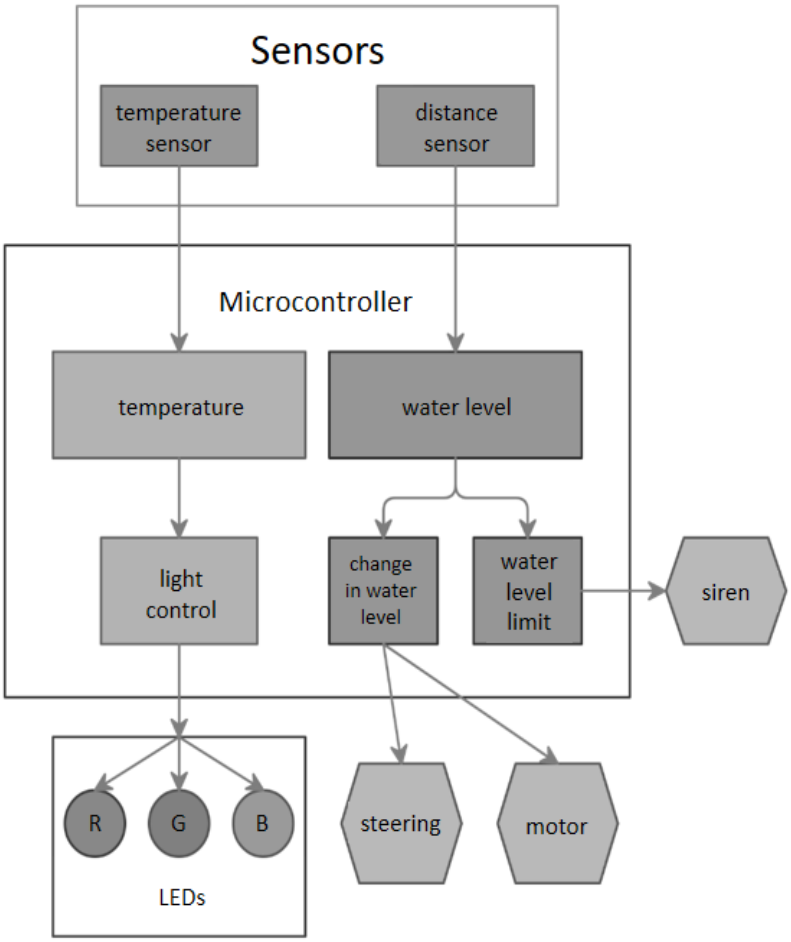

Fig. 1. - Block diagram of the device

The device includes temperature and distance sensors (Kashkanov, 2015).

Measurement of the distance from the device to the surface of the bath is provided by an infrared distance sensor. After that, it transmits the signal to the microcontroller through the analog input and analyzes it. It depends on the work of the steering wheel, sirens and motor. Analyzing the current depth value, the microcontroller decides whether to continue working, or turn on the siren at the end of water extraction in the bath. If the level has not reached its maximum value, the motor and the steering wheel continue their work. Consider the algorithm of the steering wheel: if the device reaches the edge of the bath, it records the decrease in water level due to the distinctive bath shape, then it turns to the random side (right or left) and returns until the level begins to increase. When it records the increase - straightens the steering wheel and drifts in the opposite direction.

The analogue of the device is the nozzle on the tap, which illuminates the water depending on the temperature, but it can not illuminate the water in the already filled out bath. Therefore, we added to the device a temperature sensor that works in tandem with LEDs. In the mobile application, the user indicates a comfortable temperature for him, and the LEDs change their color depending on the current and specified temperature. For example, if the temperature is in the range of plus-minus 5 degrees from a comfortable value, then a green LED burns, if less - blue, if more - red. This allows to check the temperature change, and the application displays the current temperature value.

Quick access to configuration settings is via a Bluetooth module connecting the device to the smartphone (Asmakov, 2013). A mobile application was created that has a convenient interface, it transmits the established indicators of a comfortable value of water temperature and the maximum value of water level, the excess of which is accompanied by a siren on the phone and on the device itself.

The internal interface of the program is shown in Fig. 3.

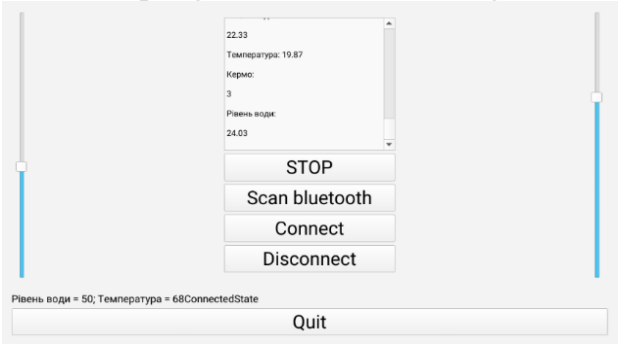

Figure 3. – View of the program interface for the device

The interface contains 5 buttons and 2 sliders. The left slider is responsible for regulating the temperature, and the right - the water level. Buttons: STOP - stops the program, Scan Bluetooth - searches for possible devices, Connect - connect to the device, Disconnect - disconnect, Quit - closes the program. It has the following capabilities: connect to the device; set the maximum value of depth in the bath, the excess of which is accompanied by a siren; set the average temperature, which differs from the minimum and maximum within five degrees Celsius; show current temperature and depth values.

Conclusion. The article describes the developed model of the device for a bath that allows to carry out a complex of analyzes of a condition of water in a bath in real time. A mobile application has been created to control the device. The results of the analysis are transferred to a smartphone, which creates additional convenience for using the device. Prototypes of existing models, their areas of use are analyzed and the main differences are indicated. The device can be a perfect addition to the Smart Home system. Its functionality and capabilities are shown, which ensure the rational use of water and energy resources, save time and make human life easier. The technical description of the device is given.

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