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Содержание

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Marketing Distribution Techniques in Digital Medium

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In marketing, the Internet has opened such a thing as digital distribution channels or, in a different way, as it is typical to call it in Belarus, digital commodity distribution networks. It can be said that in general, digital marketing is engaged in the development of digital distribution, because it plays a bigger role and takes more specialist's time than traditional marketing.

However, despite the fact that digital marketing has become a separate discipline, it is important to understand that digital medium has influenced the traditional components of marketing. In particular, we will regard several examples of how familiar marketing concepts are being modified and adapted to digital medium.

Such a classic marketing concept as a sales funnel, according to B. Halligan, no longer meets the realities of the existing market. In his opinion, it's more accurate to talk about sales flywheel. Actually, Dr. Halligan is not only a theoretician working at Massachusetts Institute of Technology, but also a practitioner. He owns a large company that develops marketing and sales software, which tells us that actual technical needs require accurate scientific concepts.

Therefore, the sales funnel turns into a flywheel: «Using a flywheel to describe our business allows me to focus on how we capture, store and release our own energy, as measured in traffic and leads, free sign-ups, new customers, and the enthusiasm of existing customers. It's got a sense of leverage

and momentum. The metaphor also accounts for loss of energy, where lost users and customers work against our momentum and slow our growth» [1].

Another case is how T-Mobile company reinvents customer service. Using sociological techniques and modern technologies, they have built a system that allows a more nuanced attitude to customers' needs. This case is a great example for many Belarusian companies, for which work with a client is mostly a script conversation and an intrusive attempt to make sales at any price [2].

People working for T-Mobile company have chosen four questions to ask the customers in order to assess their satisfaction with service during a certain period of time. These questions are the following:

- Have the customers become happier?
- Are they staying with us longer?
- Are we deepening our relationship with them?
- Are we making their service experience low-effort?

A special team of experts was organized, which included cross-functional groups of 47 people who served a named set of customer accounts in a specific market. The team members were connected in spite of being hundreds of miles away from their clients. For instance, a team in Chattanooga was responsible for 120,000 customers in Detroit, and a team in Charleston served a similar number of customers in Philadelphia.

Thus, we can see that digital medium requires special approaches and flexibility when using familiar marketing methods. Traditional marketing is not a stale system, but a series of fundamental principles that require a suitable implementation in new media and situations of digital world.

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Inclinations Depending on Driving Behavior

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The human factor is one of the main criteria determining the safety of functioning technical means. A mistake in the work of people can lead to economic losses, and often to human losses. The purpose of this work is to analyze the impact of psycho-physiological factors on the safety of driving.

It is assumed that somatic, behavioral and emotional characteristics can have an impact on driving style, because these conditions of a driver could change any time a driver runs over a path. The analyzed drivers' conditions included such characteristics as tiredness, sleepiness, sickness, gloom, worry, nervousness, boredom, and anger. Driving style was defined by means of two kinds of indicators: firstly, this indicator was regarded as a subjective manner for defining driving style. Secondly, the kinematic parameters were recorded to define driving style; these data allowed to indicate the driving behavior that can be considered as an objective manner for defining driving style [1].

The correlation analysis of the characteristics obtained showed that the relationship between all parameters were positive; in certain cases a moderate correlation was shown, but in many cases the strength of relationship was weak (values lower than 0.3), and no strong correlation was highlighted (values higher than 0.7). The stronger relationships were shown between tiredness and sleepiness, gloom and worry, and finally between anger and gloom, worry and nervousness.

Standard Regression weight was estimated and showed that the behavioral-emotional latent construct weighed in average 30 % more than the somatic-emotional latent construct, and it positively affected driving style. On the contrary, somatic-emotional latent construct negatively affected driving style. This means that when a driver is tired, sleepy, sick or bored while driving, he inclines towards a more cautious driving style. On the other hand, if the individual when driving is gloomy, worried, nervous, or angry he inclines towards a more aggressive driving style. Such driver's conditions as tiredness, sleepiness, worry and anger mainly affected the way in which a driver runs over a path. Our interpretation of the emerging results is the following: if a driver feels bad because he is tired, sleepy, bored or with certain physical temporary problems, he has the perception that his driving style is cautious, probably because he has the tendency to drive more slowly. On the contrary, if a driver is gloomy, worried, nervous, or angry he has the tendency to perceive his driving style as aggressive because he drives speedily and with sudden changes of acceleration values.

We made the comparison of 2 groups of drivers. The aim of our research was to describe the personality and performance characteristics of risky drivers (those who had had their driving licenses suspended) and to compare them with safe drivers.

The group of risky drivers included:

- drivers whose driving licenses were suspended,
- drivers who were banned from driving because they had committed a serious traffic violation or a criminal offence (especially driving under the influence of alcohol or other drugs and speeding).

The group of non-risky drivers consisted of drivers who met the following criteria:

- they were professional drivers,

- in their previous driving career, they had not been fined for more than three traffic offences,
- they had committed no traffic violations in the past two years, and they had never had their driving licenses suspended.

A comparison of the results for the risky driver and safe driver groups was made by performance tests and personality testing methods. The following performance testing methods were used: the Bourdon Test, D2, Comp. ACT-Co, Comp. ACT-SR, the Determination Test, the test of decision making and attention, the Vienna Matrix Test (VMT), IST, and a test of general intelligence (the Memory subtest). The following areas of human cognition were examined: attention, concentration, memory, reaction time and correctness of response, resilience to monotony, and intelligence.

The following personality tests were used: NEO-PI-3, PSSI, and the Hand test. NEO-PI-3 (Revised NEO Personality Inventory) contained 5 factors: neuroticism, extraversion, openness, agreeableness, conscientiousness. PSSI was used to identify special skills. Hand test is mainly applied to diagnose aggressiveness among adults and children. In addition, the test allows to predict the propensity for open aggressive behavior.

In general, the vast majority of the performance testing methods found no differences between risky and non-risky drivers. Moreover, in some of the tests risky drivers achieved better scores than safe drivers (especially as far as the domain of memory, both verbal and non-verbal, is concerned). This can be explained by the well-known phenomenon, which implies that safe driving does not only involve performance personality characteristics, but also personal values, norms, beliefs, and other personality characteristics which determine the way in which we use our abilities. In addition, the higher scores recorded by risky drivers in performance tests can be explained by the theory of risk homeostasis and subjective perception of risk, which proposes that a person is prepared to take a certain

degree of risk, but if a given situation poses a risk that goes beyond that degree, a person seeks to eliminate it. If the level of risk is below this degree, drivers tend to increase the risk. In the context of driving, this instance of increasing the risk may take the form of speeding or engaging in secondary tasks such as telephoning [2].

As regards personality tests, statistically significant differences between risky and non-risky driver groups were shown. In general, it can be concluded that risky drivers tend to be less deliberate and cooperative, they are more likely to seek excitement, show less self-control and less respect for responsibilities and commitments, and are more likely to break rules and flout social norms. They are more preoccupied with their feelings and show a greater sense of their own incompetence and insecurity. They have a stronger inclination to manipulate others.

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Synthetic Aperture Orbital Telescope for Earth Remote Sensing Equipment

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One of the main requirements for modern orbiting telescopes is to ensure the maximum resolution of the optical system while maintaining a high level of image contrast. The spatial resolution determines the smallest size of objects that can be distinguished in the image and can be carried out both in panchromatic mode (more accurate) and in multispectral mode. Today, ultra-high-resolution images include images in which objects of 0.3-0.9 m in size are visible [1, 2, 3].

The actual task remains to increase the temporal resolution, which determines the frequency of obtaining images of a specific area on the Earth's surface. The increase in temporal resolution is possible in two directions. The first is the formation of a spacecraft group synchronized in a photograph when working on a specific part of the surface. The second is the increase of the height of the spacecraft orbit, which leads to the increase of its stay time over a specific part of the Earth's surface.

The disadvantages of telescopes located in the GSO (geostationary orbit, 35.786 km above sea level) include the total delay of the transmitted signal of about 2-4 s and the impossibility of observing parts of the Earth’s surface at high latitude (81-90) or significant signal shielding by ground objects already at latitude (from 75°) [4]. To form a high-resolution image with a telescope located in the GSO, the aperture of its main mirror should be about 30-40 m. Making

such a mirror and then placing it into the orbit is a difficult task. In classical spacecraft for remote sensing the aperture of the input window of the optical system is about 0.4-1.1 m. An increase in the aperture of the main mirror leads to additional difficulties associated with an increase in its mass, as well as the need to install additional mechanisms for balancing and adjusting. In addition, technological costs associated with the formation of a high-quality reflective surface increase.

Creating systems with a large aperture became possible by splitting the main mirror into segments [5]. According to the theory, in a synthesized aperture telescope, the final image is formed from separate fragments of several mirror modules and is equivalent in quality to a telescope with a solid mirror surface, provided that the images are geographically acceptable and phase synchronized. Today, from a practical point of view the problems of simulating synthetic aperture systems have been successfully solved only for ground-based observatories: the Very Large Telescope of the South European Observatory (VLT ESO); Hopkins multi-mirror telescope (MZT) and mainly for radar systems – Murchison Radio Astronomy Observatory (ASKAP). Orbital telescopes with segmented elements of the main mirror are implemented only in James Webb Space Telescope (JWST). Design options for orbital telescopes with synthetic aperture are currently lacking.

The purpose of the research was to develop a concept and determine possible options for building a high-resolution orbital telescope with a synthesized aperture of the main mirror for a remote sensing satellite located in a geostationary orbit.

The analysis of existing methods for the formation of the synthesized aperture was carried out, their accuracy, cost, and mass-dimensional characteristics were evaluated. A new version of the optical system of synthetic aperture mirror lens is presented and its optimization is performed in the Zemax software package. An estimate of the accuracy of the designed

system has been made; a design variant has been developed that includes a transformation mechanism when a telescope is put into near-earth orbit.

It has been established that the use of aperture synthesis technology allows to develop high resolution optical-electronic systems with lower production and operation costs compared with classical methods for forming the surface of the main mirror. In the course of the simulation, the instability of the values of the frequency-contrast characteristic with increasing angle of view was determined, which is important for a low near-earth orbit, and the requirement for positioning elements of the optical system was established.

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“Green economy” in the Republic of Belarus

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Green economy is the economy that increases people's well-being and reduces environmental risks, relying on resource-saving and environmentally friendly production. *The concept of green economy* is the model that leads to improved health and social justice, as well as reduced environmental impact. Thus, green economy can be a low-carbon, resource-saving and socially inclusive economic model.

Green energy comes from natural sources such as sunlight, wind, rain, tides, plants and geothermal heat. These energy resources are renewable. Renewable energy sources have also a much smaller impact on the environment than fossil fuels, which produce pollutants such as greenhouse gases as a by-product, contributing to climate change.

There is a potential of renewable energy sources in Belarus. All types of renewable energy technologies function in the Republic today. It is safe to say that the greatest prospect in the Republic is represented by hydro and wind power.

Priority environmental instruments of *green growth* are the following:

- sustainable consumption and production,
- *greening* of businesses and markets,
- sustainable infrastructure,
- *green* tax and fiscal reform,
- investing in natural capital,
- indicators of environmental effects.

Electric energy prime cost is influenced by:

• fuel prime cost ,

• depreciation charges,

• expenses for maintenance and operation of power equipment,

• cost of electricity losses,

• cost of compensation for uneven generation and consumption of electricity and so on.

In Belarus about 97 % of electricity is produced by burning natural gas. Only one Minsk thermal power plant burns about 250 thousand cubic meters of natural gas per hour and emits the same amount of carbon dioxide into the atmosphere.

The commissioning of a nuclear power plant will reduce natural gas imports by 5 billion cubic meters and thus reduce the generation of electricity from natural gas by 9 %, decommission and preserve some of the outdated facilities. According to many experts, the use of atomic energy, along with the energy generated from renewable sources, can reduce the cost of electricity.

Pros and cons of a nuclear power plant are the following:

pros – recyclable, emits nothing in environment except hot water; cons – running low, requires proper handling and geographical dispersion.

Belarus is planning to launch the first power unit of the Belarusian nuclear power plant in 2019. According to the energy security concept of the Republic of Belarus there going to be built a nuclear power plant with the capacity of about 2,4. Many researchers emphasize that the balanced combination of different types of power plants, for example wind, solar, thermal, hydroelectric power plants, will not require special reservation of electrical capacity, which significantly reduces the cost of electricity generated.

Belarus follows such principles of green economy as:

1) further development of environmental legislation and application of the most successful experience in air, water, soil and waste management;

2) expansion of the organic agriculture sector, introduction of a certificate for organic products in the country and an increase in the production of organic products;

3) promotion of eco-innovation solutions based on high research potential of the Republic of Belarus;

4) use of legal and economic tools to mitigate climate change and support adaptation measures;

5) introduction of energy efficiency measures in the cities of the Republic of Belarus;

6) attraction of foreign direct investment and creation of green jobs [1].

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Flying Cars

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Tokyo, Japan – Electric drones booked through smartphones pick people up from office rooftops, shortening travel time by hours, reducing the need for parking and clearing smog from the air. This vision of the future is driving the Japanese government's "flying car" project.

For now, nobody believes people are going to be zipping around in flying cars any time soon. Many hurdles remain, such as battery life, the need for regulations and of course safety concerns. But dozens such projects are popping up around the world.

A flying car is defined as aircraft that's electric, or hybrid electric, with driverless capabilities, that can land and takeoff vertically, according to Ebihara.

They are often called EVtol, which stands for "electric vertical takeoff and landing" aircraft. All the flying car concepts, which are like drones big enough to hold humans, promise to be better than helicopters, which are expensive to maintain, noisy to fly and require trained pilots, Ebihara and other proponents say [1].

Nissan Motor Co. and Honda Motor Co. said they had nothing to say about flying cars, but Toyota Motor Corp. recently invested $500 million in working with Uber on self-driving technology for the ride-hailing service. Toyota group companies have also invested 42.5 million yen ($375,000) in a Japanese startup, Cartivator, that is working on a flying car.

The hope is to fly up and light the torch at the 2020 Tokyo Olympics, but it's unclear it will meet that goal: at a demonstration last year the device crashed after it rose to slightly higher than eye level. A video of a more recent demonstration 0suggests it's now flying more stably, though it's being tested indoors, unmanned and chained so it won't fly away [2].

There are plenty of skeptics

Elon Musk, chief executive of electric car maker Tesla Inc., says even toy drones are noisy and blow a lot of air, which means anything that would be “1,000 times heavier” isn't practical.

“If you want a flying car, just put wheels on a helicopter," he said in a recent interview with podcast host and comedian Joe Rogan on YouTube. "Your neighbors are not going to be happy if you land a flying car in your backyard or on your rooftop”.

Unlike regular airplanes, with their aerodynamic design and two wings, Uber's “Elevate” structures look like small jets with several propellers on top. The company says it plans flight demonstrations as soon as 2020 and a commercial service by 2023.

Uber's vision calls for using heliports on rooftops, but new multi-floored construction similar to parking lots for cars will likely be needed to accommodate so many more EVtol aircraft, once the service takes off.

Unmanned drones are legal in Japan, the U.S. and other countries, but there are restrictions on where they can be flown and requirements for getting approval in advance. In Japan, drone flyers can be licensed if they take classes. There is no requirement like drivers licenses for cars.

Uber said at a recent presentation in Tokyo that it envisions a route between the city's two international airports, among others. Savings in time would add up, it said.

“This is not a rich person's toy. This is a mass market solution”, said Adam Warmoth, product manager at Uber Elevate [3].

Concepts for flying cars vary greatly. Some resemble vehicles with several propellers on top while others look more like a boat with a seat over the propellers.

Just as the automobile vanquished horse-drawn carriages, moving short-distance transport into the air could in theory bring a sea change in how people live, Ebihara said, pointing to the sky outside the ministry building to stress how empty it was compared to the streets below.

Flying also has the allure of a bird's eye view, the stuff of drone videos increasingly used in filmmaking, tourism promotion and journalism.

Atsushi Taguchi, a “drone grapher”, as specialists in drone video are called, expects test flights can be carried out even if flying cars won't become a reality for years since the basic technology for stable flying already exists with recent advances in sensors, robotics and digital cameras.

A growing labor shortage in deliveries in Japan is adding to the pressures to realize such technology, though there are risks, said Taguchi, who teaches at the Tokyo film school Digital Hollywood.

The propellers on commercially sold drones today are dangerous, and some of his students have lost fingers with improper flying. The bigger propellers needed for vertical flight would increase the hazards and might need to be covered.

The devices might need parachutes to soften crash landings, or might have to explode into small bits to ensure pieces hitting the ground would be smaller.

“I think one of the biggest hurdles is safety”, said Taguchi. “And anything that flies will by definition crash”.

Flying cars that can zoom over congested roads are closer to reality than many people think. Startups around the world are pursuing small aircraft, which until recently existed only in the realm of science fiction.

Japan wants to take a lead in writing the rules for the nascent industry because policymakers think the current aviation regulations are mostly set by [2].

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Google Projects

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Project Wing

Project Wing was a project of X that aims to rapidly deliver products across a city by using flying vehicles, similar to the Amazon Prime Air concept. At the time of the announcement on August 28, 2014, it had already been in development secretly at Google for about two years, with full-scale testing being carried out in Australia. The flying vehicles take off vertically, then rotate to a horizontal position for flying around. For delivery, it hovers and winches packages down to the ground. At the end of the tether is a small bundle of electronics which detects that the package has hit the ground, detaches from the delivery, and is pulled back up into the body of the vehicle. Dropping the cargo or landing were found to be unfeasible, as users compromised the safety [1].

In July 2018, the team graduated from X to become “Wing”, an independent Alphabet business. They are building a drone delivery system to improve the speed, cost and environmental impact of transporting goods, and an unmanned-traffic management platform to safely route drones through the skies. Wing will continue to collaborate closely with industry partners, regulators, and the broader aviation community to develop a common approach to safely and scalably managing drone traffic in the skies, so the potential of low-altitude airspace can be unlocked [2].

The team completed their first real-world deliveries in 2014 in rural Queensland, Australia where they successfully transported a first-aid kit, candy bars, dog treats, and water to farmers. Then in September 2016, the team delivered burritos to students at Virginia Tech in what was, at the time, the largest and longest drone delivery test on U.S. soil. Food is a great test case for drone delivery technology because it's fragile and temperature sensitive and therefore needs to be delivered quickly and carefully. The team is focused on refining how the delivery drones transport packages directly to suburban yards. Most recently, they've completed hundreds of deliveries to the yards of several homes in the Australian Capital Territory and Queanbeyan regions of Australia. The goal is to determine how to find the best route to a home and how to find a safe delivery spot in the yard. The Wing team is also learning how drone delivery might be useful in people's everyday lives by transporting meals, groceries, medicine, and even spare car parts in the event of a breakdown [3].

Project Loon

Billions of people around the world are still without internet access. Loon is a network of balloons traveling on the edge of space, delivering connectivity to people in unserved and underserved communities around the world. Delivering connectivity from balloons flying 20 km up in the stratosphere poses a unique set of engineering challenges. To expand connectivity to unserved and underserved areas around the world, Loon combines advancements in materials science, atmospheric modeling, machine learning, communications systems, and more. Loon has taken the most essential components of a cell tower and redesigned them to be light and durable enough to be carried by a balloon 20 km up, on the edge of space. Loon balloons are designed and manufactured to

endure the harsh conditions in the stratosphere, where winds can blow over 100 km/hr, and temperatures can drop as low as - 90° C. Loon is made from sheets of polyethylene, each tennis court-sized balloon is built to last for well over 100 days before landing back on Earth in a controlled descent. All the flight equipment is highly energy efficient and is powered by renewable energy. Solar panels power the system during the day while charging an onboard battery to allow for nighttime operations. Loon balloons travel approximately 20 km above the Earth's surface in the stratosphere, well above airplanes, wildlife, and weather events. Loon balloons can reach countries around the world from our launch sites. Predictive models of the winds and autonomous decision-making algorithms move each balloon up or down into a layer of wind blowing in the right direction, getting the balloon where it needs to go. The navigation system functions autonomously using our algorithms and software, with operators providing continuous human oversight. A group of Loon balloons creates a network that provides connectivity to people in a defined area in the same way a group of towers on the ground forms a terrestrial network. The difference is our "towers" are constantly moving with the winds. Our software is constantly learning to improve the choreography of the balloons, which improves the quality of the network. Entire network can function autonomously, efficiently routing connectivity across balloons and ground stations while taking into account balloon motion, obstructions, and weather events.

The balloon envelopes used in the project are made by Raven Aerostar, and are composed of polyethylene plastic about 0.076 mm (0.0030 in) thick. The balloons are superpressure balloons filled with helium, standing 15 m across and 12 m tall when fully inflated. They carry a custom air

pump system dubbed the "Croce" that pumps in or releases air to ballast the balloon and control its elevation. A small box weighing 10 kg containing each balloon's electronic equipment hangs underneath the inflated envelope. This box contains circuit boards that control the system, radio antennas and a Ubiquiti Networks 'Rocket M2' to communicate with other balloons and with Internet antennas on the ground, and batteries to store solar power so the balloons can operate during the night. Each balloon's electronics are powered by an array of solar panels that sit between the envelope and the hardware. In full sun, the panels produce 100 watts of power, which is sufficient to keep the unit running while also charging a battery for use at night. A parachute attached to the top of the envelope allows for a controlled descent and landing when a balloon is ready to be taken out of service. In the case of an unexpected failure, the parachute deploys automatically. When taken out of service, the balloon is guided to an easily reached location, and the helium is vented into the atmosphere [4].

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Sychova D., Akulich T.

Portraits by Deoxyribonucleic Acid (DNA)

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Heather Dewey-Hagborg, a graduate student and "information artist" from Brooklyn, creates three-dimensional portraits of strangers based on the DNA she finds in public places. Isolating nucleic acid from cigarette butts, pieces of hair, nails and gum, Heather tries using genetic analysis to restore the appearance of a person, and then prints the resulting portrait on a 3D printer.

Looking at these portrait sculptures, one may involuntarily think about how much information about ourselves we leave around. Every day DNA is more and more like a personal diary, which can be looked into not only by a doctor, but also by an absolute stranger.

The art project "images of strangers" began with a single hair stuck in a glass crack on the reproduction [1].

Thinking about how he got there and who he belonged to, Heather realized that this information is not lost and can be restored, because it is stored in the DNA of the hair.

Heather conducts the procedure for DNA isolation from the biomaterial in a homemade laboratory Genspace in Brooklyn. The artist amplifies nucleic acid fragments using polymerase chain reaction, choosing those areas that are involved in the formation of facial features [2].

Heather receives personal information about strangers in the form of single – nucleotide polymorphisms (SNP) – DNA sites that differ in different people by only one "letter". The

objective part of the work ends here, since the restoration based on SNP facial features is already a matter of interpretation [1].

Heather does not say that her sculptures directly correspond to the appearance of the owners of DNA [2].

These are rather generalized portraits of the relatives of those people, whose biological material came to hand to the artist [2].

According to Heather, there is correspondence of gender, race, skin color, eyes and hair, as well as the presence or absence of freckles, in her appearance portraits of DNA owners. In addition, the correct width of the nose, eye distance and "some other features" are observed to some extent [1].

If today there is a significant inaccuracy in such portraits, then year by year their similarity with the prototypes will only increase. So, just six months ago, in the course of a large-scale study, scientists discovered five genes, whose SNP indicates the proportions between different points of the face.

During the study, where more than 10 thousand volunteers took part, scientists analyzed how the proportions between the control points on the face correlate with the diversity of existing polymorphisms [2].

Within the work published in PLoS Genetics, scientists experimentally confirmed the generally accepted opinion that facial features are determined by the joint action of hundreds, if not thousands of different genes. The five genes found – PRDM16, PAX3, TP63, C5orf50 and COL17A1 – are simply the most important [1].

Creating portraits, Heather does not paint, but prints them colored at once. For this purpose the artist uses the Zcorp printer which works on sandlike coloured plastic and glue.

Heather puts the biomaterials from which DNA was isolated next to the resulting sculpture.

The proven technology of appearance restoration based on the analysis of the genome does not exist yet. The portraits

which Heather Dewey-Hagborg creates are just an artistic interpretation of the data of genetics, made, however, according to the latest science [2].

It is easy to see that in many ways the artistic effect of Heather's works is based on the fact that we cannot compare her portraits with the originals. There can be no doubt that if such a comparison was possible, the incompleteness of the existing data on the genetics of appearance would be too obvious [1].

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Die Casting

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Die casting is a metal casting process that is characterized by forcing molten metal under high pressure into a mold cavity. The mold cavity is created using two hardened tool steel dies which have been machined into shape and work similarly to an injection mold during the process. Most die castings are made from non-ferrous metals, specifically zinc, copper, aluminium, magnesium, lead, pewter, and tin-based alloys. Depending on the type of metal being cast, a hot- or cold-chamber machine is used. Die casting equipment was invented in 1838 for the purpose of producing movable type for the printing industry. The first die casting-related patent was granted in 1849 for a small hand-operated machine for the purpose of mechanized printing type production. In 1885 Otto Mergenthaler invented the Linotype machine, an automated type-casting device which became the prominent type of equipment in the publishing industry. The Soss die-casting machine, manufactured in Brooklyn, NY, was the first machine to be sold in the open market in North America [1].

Other applications grew rapidly, with die casting facilitating the growth of consumer goods and appliances by making affordable the production of intricate parts in high volumes. In 1966, General Motors released the Acurad process [2]. The main die casting alloys are: zinc, aluminium, magnesium, copper, lead, and tin; although uncommon, ferrous die casting is also possible [3]. The Aluminum Association (AA) standards: AA 380, AA 384, AA 386, AA 390; and

AZ91D magnesium [4]. The following is a summary of the advantages of each alloy [5].

Zinc: the easiest metal to cast; high ductility; high impact strength; easily plated; economical for small parts; promotes long die life. Aluminium: lightweight; high dimensional stability for complex shapes and thin walls; good corrosion resistance; good mechanical properties; high thermal and electrical conductivity; retains strength at high temperatures.

Magnesium: the easiest metal to machine; excellent strength-to-weight ratio; lightest alloy commonly die cast. Copper: high hardness; high corrosion resistance; highest mechanical properties of alloys die cast; excellent wear resistance; excellent dimensional stability; strength approaching that of steel parts. Silicon tombac: high-strength alloy made of copper, zinc and silicon. Often used as an alternative for investment cast steel parts. Lead and tin: high density; extremely close dimensional accuracy; used for special forms of corrosion resistance. Such alloys are not used in foodservice applications for public health reasons. Maximum weight limits for aluminium, brass, magnesium, and zinc castings are approximately 70 pounds (32 kg), 10 lb (4.5 kg), 44 lb (20 kg), and 75 lb (34 kg), respectively [6]. The material used defines the minimum section thickness and minimum draft required for a casting. The thickest section should be less than 13 mm (0.5 in), but can be greater [3]. There are a number of geometric features to be considered when creating a parametric model of a die casting: Draft is the amount of slope or taper given to cores or other parts of the die cavity to allow for easy ejection of the casting from the die. All die cast surfaces that are parallel to the opening direction of the die require draft for the proper ejection of the casting from the die. Die castings that feature proper draft are easier to remove from the die and result in high-quality surfaces and more precise finished product. Fillet is the curved juncture of two surfaces

that would have otherwise met at a sharp corner or edge. Simply, fillets can be added to a die casting to remove undesirable edges and corners. Parting line represents the point at which two different sides of a mold come together. The location of the parting line defines which side of the die is the cover and which is the ejector. Bosses are added to die castings to serve as stand-offs and mounting points for parts that will need to be mounted. For maximum integrity and strength of the die casting, bosses must have universal wall thickness. Ribs are added to a die casting to provide added support for designs that require maximum strength without increased wall thickness. Holes and windows require special consideration when die casting because the perimeters of these features will grip to the die steel during solidification. To counteract this effect, generous draft should be added to hole and window features.

There are two basic types of die casting machines: hot-chamber machines and cold-chamber machines [3]. These are rated by how much clamping force they can apply. Typical ratings are between 400 and 4,000 st (2,500 and 25,400 kg) [5].

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УДК 621.0

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Prospects for the Development of Machine-building Industry in Belarus

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The structure of the Belarusian industry comprises more than 300 enterprises of machine-building, metal-processing, metallurgic, machine-tool, tool, radio-technical, electronic, instrument-making, electrical, optical and mechanical industry. The above enterprises comprise production associations, republican unitary enterprises, joint-stock companies and educational establishments [1]. The subsector of the machine-building industry of the Republic of Belarus today includes 11 enterprises. The largest of them are Amkodor OJSC, Mogilevtransmash plant and Volkovysk machine-building plant.

The joint stock company "Amkodor" in Minsk produces loaders, airfield harvesting machines, snow plows, pavement cleaners, buses. It is considered to be one of the largest manufacturers of road-building, municipal, snow removal, forest, agricultural and other special equipment in the CIS and Europe. Amkodor JSC is a holding-type structure uniting 9 legal entities such as: Amkodor OJSC (Udarnik, Dormash and Dormashmet plants), Amkodor-Unikab JSC, Amkodor-Pinsk CJSC, and LLC Amkodor-Mozha, UE Amkodor-Torg, etc [2].

The plant Mogilevtransmash has advanced technology in the production of trailed and construction equipment and occupies one of the leading places in the industrial complex of the Republic of Belarus.

Volkovysk machine-building plant was created as a specialized enterprise for the production of construction, finishing and roofing equipment; the machines and units produced by it are well-known in the CIS countries.

Let's consider the dynamics of the production of certain types of construction and road machines of the Republic of Belarus over a number of years. Thus, the release of excavators after the transformational recession of the first half of the 90s began to grow steadily since 1995 and in 2007 amounted to 1,315 units. The volume of production of scrapers in Belarus in 1990 exceeded 1,800, which clearly exceeded the needs of the national economy in this type of equipment. Accordingly, after the collapse of the USSR, the output was reduced to 74 pieces in 1995 and 39 pieces in 2000. The fall stopped only in 2007, when the output increased to 45 pieces against 21 pieces in the previous year.

It should be noted that at present time the mechanical engineering industry in the Republic of Belarus is developing steadily. Modernization and comprehensive restructuring of the construction base, technology and construction production is taking place at many Belarusian enterprises. However, it is still necessary to solve the problem of updating construction equipment and providing technical support for manual processes by means of small-scale mechanization and creation of mobile units.

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Milling Machines

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A milling machine is a machine for machining metal and other parts with a mill as the workpiece moves progressively.

The production of machine tools is known from ancient times. Milling work today is one of the main types of processing of metal parts. Milling is a method of processing workpieces, the main movement of which is the rotation of the cutter. The feed movement in this case is the translational movement of the workpiece in the vertical, transverse or longitudinal direction. The milling cutter with which the workpieces are machined is a cutting tool equipped with several blades.

There are several types of milling machines.

Horizontal milling cantilever machines are characterized by the presence of the console and the horizontal spindle position when machining with cylindrical, angular and shaped mills of flat and shaped surfaces of blanks of various materials.

Universal milling machine has a horizontal spindle and is designed for milling a variety of surfaces on small and lightweight parts in a single and mass production.

Unlike a horizontal, vertical milling machine has a vertically positioned spindle, which in some models of machines allows for displacement along the axis and rotation around the horizontal axis, thereby expanding the technological capabilities of the machine.

Keyway milling machines are designed for milling mortise keyways gutter mills. There are two ways to cut

keyways. In the first method, the cutter first cuts to the full depth of the groove, then moves in the longitudinal direction. In the second method, the cutter reciprocates along the key groove, crashing after each stroke to a certain depth.

Milling and centering machines are designed for double-sided milling and centering of the ends of the rollers, which are then machined on a lathe.

Copy milling machines are made for milling surfaces of complex shape: dies, molds, turbine blades, molds, metal models, copiers, blanks of non-circular wheels.

Rotary milling machines are designed for surface treatment of various parts with end mills in conditions of mass, large-scale and individual production.

Universal dividing heads. These machines are used for periodic rotation of the workpiece around the axis and for its continuous rotation, consistent with the longitudinal feed of the table when cutting helical grooves.

One of the main conditions for high-performance cutting tools is the correct choice of tool material. For the manufacture of cutting elements of milling tools in the woodworking we may use tool steel (alloyed, high-speed), hard alloys, metal-ceramic materials. For the manufacture of tool cases we use structural quality steel, structural alloy steel, and special light alloys.

Mounted mills, depending on the design, are divided into integral and modular ones. Solid mounted mills, in turn, can be single and in the form of sets of mills (composite).

During operation, machine parts wear out, increased gaps appear in the mated pairs, which leads to the loss of machine strength and the appearance of vibration – a source of even more intensive wear of parts.

One of the crucial factors in milling machines operation is the lubrication of milling machines. Lubrication in the machine is necessary to reduce friction losses, reduce heating

and wear on working surfaces, and ensure reliable operation of the machine components.

To ensure reliable operation of the milling machine, organizational equipment is needed. Organizational equipment consists of devices for placing on the workplace of industrial equipment, blanks and machined parts, as well as lifting transport devices and local lighting, creating conditions for safe and productive work.

In conclusion, we would like to mention that no factory can do without milling machines. Obtaining parts by milling, with this type of production, seems to be the most economical method. By providing a high class of roughness at the milling stage it is possible to reduce the finishing time, which is the most time-consuming part of the process.

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History of Money

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The use of money is as old as the human civilization. Money is basically a method of exchange, and coins and notes are just items of exchange. But money was not always the same form as the money today, and it is still developing.

The basis of all early commerce was barter, in other words the direct exchange of one product for another, with the relative values a matter for negotiation. Subsequently both livestock, particularly cattle, and plant products such as grain, come to be used as money in many different societies at different periods. The earliest evidence of banking is found in Mesopotamia between 3000 and 2000 B.C. when temples were used to store grain and other valuables used in trade [1].

Various items have been used by different societies at different times. Aztecs used cacao beans. Norwegians once used butter. The early U.S. colonists used tobacco leaves and animal hides. The people of Paraguay used snails. Roman soldiers were paid a "salarium" of salt. On the island of Nauru, the islanders used rats. Human slaves have also been used as currency around the world. In the 16th century, the average exchange value of a slave was 8000 pounds of sugar.

Gradually, however, people began exchanging items that had no intrinsic value, but which had only agreed-upon or symbolic value. An example is the cowrie shell. Metal tool money, such as knife and spade monies, was also first used in China. These early metal monies developed into primitive versions of round coins at the end of the Stone Age. Chinese

coins were made out of copper, often containing holes so they could be put together like a chain. The Chinese invented paper money during the T'ang Dynasty.

Outside of China, the first coins developed out of lumps of silver. They soon took the familiar round form of today, and were stamped with various gods and emperors to mark their authenticity. These early coins first appeared in the Kingdom of Lydia (now in Turkey) in the 7th century B.C. Paper money was adopted in Europe much later than in Asia and the Arab world – primarily because Europe didn't have paper [1].

The First Coins

Between 600 and 700 BC, larger cities and civilizations began to use coins made from medal. Early coins were made of all sizes and shapes. Some coins had holes in the center so they could be carried on a string. Eventually, coins were minted by the local ruler or king. These coins were more precisely made and had a stamp on them saying that they were backed by the king. These coins allowed for easier commerce as they didn't have to be constantly weighed.

The First Paper Money

Paper money was first invented around 600 AD in China. However, it wasn't commonly used as money in China until around 1000 AD. It took a lot longer before paper money was first used in Europe. Banks began to issue banknotes in the 1600s in Europe. At first, a banknote was really just a promise that the bank would give the bearer a certain amount of coins. Eventually, the banknotes began to be used as history of money [2].

First U.S. Money

The first U.S. paper money was Continental Currency which was printed to help finance the Revolutionary War. After the war, the Continental became worthless and coins continued to be the main form of money. During the Civil War, coins became scarce and the government began to print paper

money again. This money was printed with green ink on one side and became known as greenbacks. At first, people still didn't like using paper money, but then the government said they would back the money with gold and paper money became more commonly used.

Credit Cards

Credit cards were first issued in the 1950s and 1960s. In 1958, Bank of America issued a card that would later become Visa. A number of other banks launched a rival card, MasterCard, in 1966. Credit cards have since become one of the most common forms of payment.

Conclusion

The origins of money are veiled in myths. Today, for most people, how money works is still shrouded in mystery. Most young people will want to understand it well enough to know how best to manage money for themselves and their families. Also, as citizens of their localities and countries and the world, many will want to understand how money could serve people's interests better than it does today. The history of money is a work in progress [3].

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History of Robotics

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Robotics is a science section that consists of electronic, mechanical and information engineering, computer science and other. Robotics deals with the design, construction, operation, and use of robots, as well as computer systems for their control, sensory feedback, and information processing.

Today, robots are developing very strongly and therefore they have been used almost every day. Now, as mentioned above, robots are used for military, industrial and medical purposes [1].

Military

Military robot is a machine that replaces a person in the military. It is used for reconnaissance, surveillance, demining and other military target. Military robots are used not only on earth but also in the underwater and sky.

Today, robots are the basis of any army because they do not risk human life, are several times more powerful than the creator and can be used anywhere in the world.

History of military robots

In 1910, a young American military engineer from Ohio, Charles Kettering proposed the use of aircraft without a person. According to his plan, the device controlled by the clock mechanism in a given place was supposed to drop its wings and fall like a bomb on the enemy. Having received funding from the US Army, he built, and with varying success, tested several devices.

In 1931, under the leadership of the USSR, the first tanks were built, which could be controlled by radio. These were the production tanks T-26 TT. In the early 1940s, the Red Army was armed with 61 radio-controlled tanks. These vehicles were used for the first time during the Soviet – Finnish war, where the tank "destroyer", also created on the basis of the T-26 tank, distinguished itself [2].

After these important inventions and the end of the war, the rapid development of robotics began. This development continues to this day and still does not get tired to surprise.

Industrial robots

An industrial robot is a robotic system that is used for production. Industrial robots are automated, programmable and can move in three or more axis.

In the year 2015, an estimated 1.64 million industrial robots were in operation worldwide according to International Federation of Robotics (IFR) [3].

History of Manufacture robots

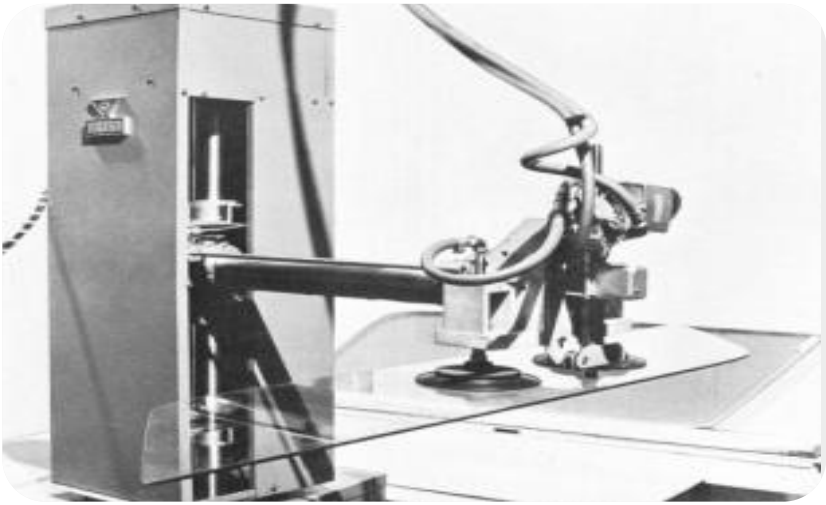
In 1947, in the USA, a group of employees of the Argonne National Laboratory, headed by R. Görz, developed the first automatic electromechanical manipulator with a copy control, repeating the movements of a human operator and intended to move radioactive materials.

The first industrial robots began to be invented and used in the mid-1950s in the USA. In 1954, American engineer J. Devol developed a method for controlling a loading and unloading manipulator using interchangeable punched cards .Together with J. Engelberg in 1956 he organized the world's first company for the production of industrial robots. Its name Unimage is an abbreviation of the term Universal Automation.

After these important inventions, automation of production began in the world – the first industrial robots, Unimeit and Versatran, were created. Their resemblance to humans was limited to the presence of a manipulator remotely

resembling a human hand. Some of them are still working, exceeding 100 thousand hours of working resource [3].

Unimate and Versatran-robots, thanks the beginning of the active development of robotics. Now industrial robots are used by such concerns as Volkswagen, Mitsubishi, Ford and others.



Versatran – one of the first industrial robots

Medicine

A medical robot is a robot used in the medical sciences. They include surgical robots. These are in most telemanipulators, which use the surgeon's actions on one side to control the "effector" on the other side.

We have obtained this category of robots by mixing the first and second categories of military and industrial robots. Medical robots use precision in the work of industrial robots and the ability to move from military robots. Medical robots can replace a doctor and can help people with disabilities.

Various types of medical robots are already performing a wide range of tasks today, but even in the future, when the machines become more advanced; they can hardly be completely trusted to make important decisions. It is thought that complex manipulations performed independently by robotic devices will also be controlled by humans.

So, in conclusion, I want to say that robots slowly replace us at work, at home, in everyday life and it seems that this will continue until robots completely replace us. But not everywhere robots will be able to replace us.

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Robot Learning

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Some of the jobs humans would like robots to perform, such as assisting having to stay in bed patients, or helping soldiers on the front lines, aren't possible because robots still don't recognize and easily handle objects [**Ошибка! Источник ссылки не найден.**]. The aim of the Robot Learning is to act as a focal point for wide distribution of technically results in the areas of interest around robot learning. Such areas of research interest include:

- researched models of robots, tasks or environments
- learning deep hierarchies of representations, from sensor and motor representations
- learning of plans and control policies by imitation and learning
- integrating learning with control architectures
- methods for probabilistic inference from multi-modal sensory information
- developmental robotics [0].

Pancake flipping using reinforcement learning

As Elon Musk said developing software to the home cleaning is an aim of his OpenAI robotics. This machine is going to be popular, but making it happen will be a remarkably difficult robotics challenge. Machines will need to analyze the types of messes in a house, formulate and execute a plan for rooms cleaning, and handle unexpected events.

To train robots OpenAI scientists use a technique called "learning by demonstration": Robots learn by repeating a researcher who shows a cleaning technique for the robot. At the end of the first year, scientists and students are running a robot through many trainings with colored material as "dirt test", using a variety of cleaning methods, from a broom to a feather duster. They want to get the robot to understand the cleaning motion from the human demonstration, and also identify the "state of dirt" before and after the cleaning action [**Ошибка! Источник ссылки не найден.**].

A researcher demonstrates a cleaning technique for the robot

Another perspective companies in this sphere:

BostonDynamics

American engineering and robotics design company founded in 1992 as a spin-off from the Massachusetts Institute of Technology.

Google.ai division of Google dedicated solely to artificial intelligence.

Hanson Robotics

Hong Kong-based engineering and robotics company founded by David Hanson, best known for its development of humanlike robots with artificial intelligence

The most famous of them is BostonDynamics. It is known by their 2 (3) robots:

Humanoid robot Atlas, latest in a line of advanced robots developed. It's possible to balance while doing tasks allows it to work with large objects having small footprint [0].

Four-legged robot Spot made for outdoor and indoor tasks. It's mobility shows it's unreal technology which allows it to get anywhere [5]. Spot has its mini version of it called SpotMini. It fits well in home or office. SpotMini is all-elecrtic and its battery charge allows it to work for 90 minutes.

Enthusiasts also can to try themselves in robot making without deep knowledge in programming or engineering because Europe have launched robot network where robot can get knowledges from another robots. It is called RoboBrain and absolutely free to use for any user. Also this network works like forum for robot makers where they can discuss various technical aspects and associated challenges such as modeling the correctness of knowledge, inferring latent information and formulating different robotic tasks as queries.

In conclusion it is required to say that robot learning is very perspective technology in the near future which is close to neural networks, which means that it is saving human resources. It can help humanity in different spheres of our life, like war, medicine and routine home work.

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Role of Media in Distance Education

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In a distance education system (DES), teachers and learners are physically separate and the instructional materials are delivered via telecommunication systems. The global application of the DES has proven to be an approach that is both successful and useful in education.

Based on technological, structural, and financial capabilities, a number of varieties of technologies are applied in higher education distance learning systems.

Radio and Television

Radio and television broadcasting has been used for educational purposes for many years. There are different types of broadcast: public, cable, and satellite. These technologies are convenient and cost-effective. These media can be used to present the views of experts, which would increase the credibility of and interest in the materials. Materials that cannot be communicated by print could be communicated this way. Video is a powerful medium in terms of capturing attention, and conveying a lot of information quickly [1].

Audio

Producing audio- or videotape helps keeping students in track, and get people in the community involved, and may recruit new learners to the institute. Broadcast may be provided

to learners through cable television network or satellite broadcast. Those channels can provide good quality broadcast and dedicated channels for educational purposes. An important disadvantage of television broadcast that this site lists is that broadcast delivery encourages passive viewing rather than active participation. Students lack control over the medium and are unable to stop the flow of information to ask questions and enhance understanding.

Teleconference

Teleconferencing involves the interaction of students and instructors via some form of telecommunications technology. Teleconferencing uses a variety of communication technologies such as satellite, microwave, and Instructional Television Fixed Service (ITFS). Services include producing, hosting, or broadcasting satellite downlinks, uplinks, or 2-way teleconferences to a number of locations. The studio classrooms have 3-camera production capability, an audio distribution system connecting remote locations and the studio on campus, and A-V equipment such as slide projectors, an overhead graphics camera and pad suitable for showing visual aids, 3/4" or SVHS videotape recorders, computers, etc. Computers can interface with the TV system for showing graphics or other visual aids and the Internet [2].

Audioconference

Audioconferencing most common and least expensive form of teleconferencing.

Audiographic teleconferencing systems involve the use of computer or facsimile technology to transmit visuals to support the audio. Some computer systems allow the transmission of graphics, programs, and data, where each site

sees anything on the instructor computer screen, besides hearing the audio. Audigraphic systems are good for classes that involve a lot of illustration, such as equations, or computer applications. Videoconferencing can be transmitted via satellite, cable, or standard telephone lines. It requires compressing the videos and several equipment. Videoconferencing allows learners and instructors to interact face-to-face. Computer Conferencing allows students and instructors to interact via a computer network. This interaction can be through e-mail messages, file transfer, chat rooms, real audio and video, and others. With the fast progress in computer technology, computer conferencing is taking its place in educational technology. Computer conferencing provides good quality, easy to use, and cost-efficient way of interaction.

Web-Based Instruction

With the fast growth of the Internet, and the fast progress of communication, the world wide web is a new promising medium for distance learning. With the enormous number of resources available online, and the increasing number of people who have access to the Internet, web-based instruction is considered one of the fastest media for teaching and learning. The world wide web provides a cost-effective, technology rich, and interactive medium.

There is a large number of technologies available for the delivery of distance education course. Selecting the medium is an important part of the efficiency of that course. Each medium has its own strengths and weaknesses, and these should be matched to the nature of the learning setting.

The medium selection process should be undertaken for each course and each program, since they all have different requirements depending on the objectives, learners, and learning environment [3].

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Electric Cars: Advantages and Disadvantages

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The electric car is a relatively new concept in the world of the automotive industry. Today, some companies have based their entire model of cars around being proactive and using electricity.

Actually more than 3 percent of new vehicle sales, electric vehicles sales could to grow to nearly 7 percent – or 6.6 million per year – worldwide by 2020, according to a report by Navigant Research. The demand for electric cars continue to climb as prices drop and consumers look for ways to save money at the pump [1].

Recently in the world more and more attention is paid to environmental protection, as well as to our own comfort. These are two of the main factors of high demand for electric cars. But despite all the advantages, it is not a magical device and has its disadvantages. Let's analyze both sides of this issue.

Advantages:

1. No Gas Required: Electric cars are entirely charged by the electricity you provide, meaning you don’t need to buy any gas ever again. Driving fuel based cars can burn a hole in your pocket as prices of fuel have gone all time high. With electric cars, this cost can be avoided as an average American spends $2000-$4000 on gas each year. Though electricity isn’t free, an electric car is far cheaper to run.

2. No Emissions: Electric cars are 100 percent eco-friendly as they run on electrically powered engines. It does not

emit toxic gases or smoke in the environment as it runs on clean energy source. You'll be contributing to a healthy and green climate.

3. Safe to Drive: Electric cars undergo same fitness and testing procedures test as other fuel powered cars. In case an accident occurs, one can expect airbags to open up and electricity supply to cut from battery. This can prevent you and other passengers in the car from serious injuries.

4. Cost Effective: Earlier, owing an electric car would cost a bomb. But with more technological advancements, both cost and maintenance have gone down. The mass production of batteries and available tax incentives have further brought down the cost, thus, making it much more cost effective.

5. Low Maintenance: Electric cars runs on electrically powered engines and hence there is no need to lubricate the engines. Other expensive engine work is a thing of past. Therefore, the maintenance cost of these cars has come down. You don't need to send it to service station often as you do a normal gasoline powered car [2].

6. Reduced Noise Pollution: Electric motors are capable of providing smooth drive with higher acceleration over longer distances.

Disadvantages:

1. Recharge Points: Electric fueling stations are still in the development stages. Not a lot of places you go to on a daily basis will have electric fueling stations for your vehicle, meaning that if you're on a long trip and run out of a charge, you may be stuck where you are.

2. Electricity isn't Free: Electric cars can also be a hassle on your energy bill if you're not considering the options carefully. Sometimes electric cars require a huge charge in order to function properly – which may reflect poorly on your electricity bill each month.

3. Short Driving Range and Speed: Electric cars are limited by range and speed. Most of these cars have range about 50-100 miles and need to be recharged again. You just can't use them for long journeys as of now, although it is expected to improve in the future.

4. Longer Recharge Time: While it takes couple of minutes to fuel your gasoline powered car, an electric car takes about 4-6 hours to get fully charged. Therefore, you need dedicated power stations as the time taken to recharge them is quite long.

5. Normally 2 Seaters: Most of the electric cars available today are small and 2 seated only. They are not meant for entire family and a third person can make journey for other two passengers bit uncomfortable.

6. Battery Replacement: Depending on the type and usage of battery, batteries of almost all electric cars are required to be changed every 3-10 years [2].

7. Not Suitable for Cities Facing Shortage of Power: As electric cars need power to charge up, cities already facing acute power shortage are not suitable for electric cars. The consumption of more power would hamper their daily power needs.

8. Some base models of electric cars are still very expensive because of how new they are and the technology it took to develop them.

Thus, as in any reality, there are two sides. So far, this industry is only developing, especially in our country. There is still a shortage of opportunities for most people to have such a car. But technologies are developing rapidly, and we hope that in the very near future this technology will bring us much benefit.

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Electromotors

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Electric machines are widely used in power plants, industry, transport, aviation, automatic control and management systems, in everyday life.

Electrical machines convert mechanical energy into electrical energy, and vice versa. A machine that converts mechanical energy into electrical energy is called a generator. The conversion of electrical energy into mechanical energy is carried out by engines.

Any electric machine can be used both as a generator and as an electric motor. This property of an electric machine to change the direction of the energy it converts is called the reversibility of the machine. An electric machine can also be used to convert the electrical energy of one kind of current into the energy of another kind of current. These electrical machines are called *converters*.

Depending on the kind of current electrical installation in which the electric machine must operate, they are divided into DC and AC machines.

AC machines can be both single-phase and multi-phase. The most widely used three-phase *synchronous and asynchronous* machines and also categories AC machines that allow the economical speed control in a wide range.

Currently, asynchronous motors are the most common electrical machines. They consume about 50 % of the electricity produced by the country's power plants. Such widespread asynchronous electric motors received because of

the constructive simplicity, low cost, high operational reliability. They have a relatively high efficiency if the power is more than 1kW, efficiency = 0.7:0.95 and only in micro-motors, he is reduced to 0.2 to 0.65.

Along with the great advantages asynchronous motors have some disadvantages: the consumption of reactive current from the network, necessary to create a magnetic flux, resulting in asynchronous motors operate with cos = 1. In addition, the ability to adjust the speed they are inferior to DC motors.

The most common among electric motors was a three-phase asynchronous motor, first designed by the famous Russian electrician M.O. Dolivo-Dobrovolsky. The asynchronous motor is simple in design and easy to maintain. Like any AC machine, the induction motor consists of two main parts – the rotor and the stator. The stator is the stationary part of the machine, the rotor is its rotating part. The asynchronous machine has the property of reversibility, that is, it can be used both in the generator mode and in the engine mode. Due to a number of significant drawbacks, asynchronous generators are practically not used, whereas asynchronous motors are very widespread.

The multi-phase AC winding creates a rotating magnetic field whose rotational speed per minute is calculated by the formula:

$n1 = 60f1/p$, where:

n is the rotation frequency of the magnetic field of the stator;

f - frequency current in the network;

p - is the number of pairs of poles.

If the rotor rotates at a frequency equal to the frequency of rotation of the magnetic field of the stator, then this frequency is called synchronous.

If the rotor rotates at a frequency not equal to the frequency of the magnetic field of the stator, then this frequency is called asynchronous.

In an asynchronous motor, the working process can occur only at an asynchronous frequency, that is, at a rotor speed not equal to the frequency of rotation of the magnetic field.

The nominal speed of the induction motor depends on the speed of the magnetic field of the stator and cannot be chosen arbitrarily. At the standard frequency of industrial current f1 = 50Hz possible synchronous speed (magnetic field speed) n1 = 60f1/p = 3000/p.

In asynchronous motors, the permanent magnet is replaced by a rotating magnetic field created by a three-phase stator winding when it is connected to an alternating current network.

The rotating magnetic field of the stator crosses the conductors of the rotor winding and induces EMF in them, that is, the electromotive force. If the rotor winding is closed to any resistance or shorted, then a current passes through it under the action of the induced electromotive force. As a result of the interaction of the current in the rotor winding with the rotating magnetic field of the stator winding, a rotating moment is created, under the action of which the rotor begins to rotate in the direction of rotation of the magnetic field [1].

Asynchronous motors produce power from several tens of watts to 15000kw at voltages up to 6 kV stator winding.

Between the stator and the rotor there is an air gap, the value of which has a significant impact on the operating properties of the engine.

Along with the important positive qualities – simple design and maintenance, low cost – asynchronous motor has some disadvantages, of which the most significant is the relatively low power factor (cos). In an asynchronous motor, the cos at full load can reach a value of 0.85-0.9; when the

engine is underloaded, its cos decreases sharply and at idle is 0.2-0.3.

Special attention should be paid to *servomotors*:

These engines occupy a special place where precision changes in position and speed of movement are required. These are space technology, robotics, CNC machines, etc.

This engine is different types of transport because small diameter is light-weight. This speeds up the process, i.e. fast movements. These engines usually have a feedback sensor system that allows you to increase the accuracy of movement and implement complex algorithms for movement and interaction of various systems [2].

Synchronous servomotors – these classic three-phase synchronous motors, driven by several permanent magnets. Additionally, they have a built-in rotor position sensor.

The whole structure is very compact and reliable. The main advantage of such engines is the absence of inertia. They are accelerated and stopped in thousandths of a second, they are perfectly combined with various pulse machines and systems, and also due to their linearity they are perfectly controlled using computer programs [3].

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Biofuels

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One of the features of the development of the modern world is the increased attention of the world community to the problems of proper and efficient use of energy resources, the introduction of energy saving technologies and the search for renewable energy sources.

Today, the development of renewable energy in the world has taken an accelerated nature, which is associated with the growing multifactorial crisis phenomena of a global nature. On the one hand, there is limited geological reserves of the main types of fuel resources – oil and gas, which leads to an inevitable increase in prices [1]. On the other hand, there is an obvious increase in the negative impact of environmental factors caused by the consequences of human activity.

The main environmental damage associated with global climate change – the greenhouse effect – is caused mainly by the extraction, processing and combustion of fossil fuels-coal, oil and gas. The greenhouse effect accounts for up to 75 % of anthropogenic environmental damage. In this regard, meeting the growing needs of the world's population in fuel, electricity and heat, while ensuring environmental safety, necessitates the development of renewable energy, because oil is not the only raw material for producing high-octane organic matter for engines.

Biofuels occupy a special place in the structure of renewable energy sources. As one of the few alternative fuels in the transport sector, biofuels are seen as an important

resource for energy selection and energy security, agricultural and rural development, and climate change mitigation by reducing greenhouse gas emissions.

Conventionally, biomass, as a raw material for the production of biofuels, can be divided into three generations:

- edible oil and sugar-containing terrestrial plants;
- non-food and cellulose plants;
- non-food aquatic plants, i.e. algae.

Biofuels of the first generation are made from sugar, starch, vegetable oil and animal fat, using traditional technologies. The main sources of raw materials are seeds or grain. For example, vegetable oil is extracted from rapeseed, which can then be used in biodiesel. From wheat starch is obtained, after fermentation – bioethanol.

Deforestation, the negative impact on traditional agriculture, the imbalance in the use of agricultural land towards industrial crops and the threat to food security are some of the challenges facing humanity in the production of biofuels. The main problem in the production of biomass fuels is food security, as first-generation biofuels are produced from crops in the food chain of humans and animals (corn, soybeans, oil palm, rapeseeds, sugar cane, wheat, rye). The public has already realized that large areas where food was produced, commercially oriented farmers gave under the technical culture. As the world's population grows and more food is needed, the use of these areas for biofuel production reduces the amount of food available and increases their cost.

Second-generation biofuels are produced from non-food raw materials. The sources of raw materials are lignocellulosic compounds that remain after the parts of vegetable raw materials suitable for use in the food industry are removed. For this purpose, fast-growing trees and herbs (poplar, willow, miscanthus, jatropha and others) can also be used. They are otherwise called energy forests or plantations [1]. About 20

different species of plants – woody, shrubby and herbaceous-have been tested.

The advantage of this biofuel is that the plants from which it is derived do not compete with food crops for land. They can grow on slopes, hills, ravines, as well as on unproductive and degenerate lands, sometimes even with the prospect of restoring these lands. For their cultivation, you can use a minimum amount of water, fertilizers, pesticides and equipment. Every 4-7 years trees are cut, their annual harvest can reach up to 7 tons per hectare. In the aisles can be further planted crops. The collected biomass is used for the production of heat and electricity, and can also serve as a raw material for the production of liquid biofuels.

Unfortunately, economic, social and ethical aspects constrain the development of production of the first two generations of biofuels. The more acute these problems are, the greater the interest in the development of the third generation of biofuels. Algae is an effective renewable biomass that does not require arable land and fresh water.

These are simple organisms adapted to growth even in polluted or salt water. The determining factors for the accumulation of biomass by algae are: the intensity of solar radiation; water temperature; presence of nutrients; concentration of carbon dioxide.

Algae convert solar energy and carbon dioxide into cheap and highly productive raw materials for food, biofuels, animal feed and high-value, biologically active substances. That is, these organisms have an effective apparatus of bioconversion of solar energy and are its natural bioaccumulators. The productivity of microalgae in biomass exceeds the productivity of terrestrial plants. The maximum real values of algae biomass growth at solar radiation intensity of 5623-7349 MJ per m^2 per year (180-235 W/m^2) are 38-47 g of dry biomass per square meter per day [2].

Algae include many species of both unicellular and multicellular organisms. They consist of proteins, carbohydrates, fats and nucleic acids. The percentage of these substances depends on the type of algae. Some strains of algae are ideal for biofuel production due to their high oil content [2]. Microalgae on potential energy yield in 8-25 times greater than palm oil and 40-120 times-rapeseed, which allows us to refer them to the typical representatives of vegetable oilseeds. There are separate species of these plants containing up to 40 % fatty acids.

Summing up, we note that biomass can be converted into energy-intensive compounds that can be used for transport, for heating homes, for the chemical industry. Such use of biomass can play a significant role in energy security and environmental protection. All of this will require significant long-term interdisciplinary efforts. In order to achieve this, a number of bottlenecks in the integrated biofuel production chain must be eliminated: metabolic design and modelling of strains, accumulation of specific compounds, processing of biological substances, design and operation of photobioreactors and, finally, the use of logistics that integrates all these processes into a single whole and makes them cost-effective.

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Geneva Motorshow

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The International Geneva Motor Show is Europe's only Class A auto show, held annually. This exhibition is one of the main events of the automotive industry, with the largest automotive brands regularly participating in it. As it should be, every year the Geneva Motor Show opens its doors to hundreds of visitors and presents dozens of new models or concepts.

The International Motor Show in Geneva is younger than the Parisian, but older than Detroit – it was founded in 1905 and for many years takes place in the Palexpo exhibition center near the local airport. In addition to automobiles with internal combustion engines, steam engines were exhibited at the first car dealerships, and the Palais des Expositions exhibition complex itself was built in 1926 precisely in connection with the auto show and was expanded several times. At the first exhibition, 59 exhibits were shown, and over 17 thousand people visited the event. The second motor show was also held in Geneva in 1906, but the third exhibition was held a year later in Zurich.

In 1934, the Geneva International Motor Show became one of the main events of this kind in the world, and by 1939 two hundred companies participated in the exhibition. All the expositions were not placed in the exhibition complex, so some of them were placed in temporary halls. The first motor show after the Second World War opened its doors in 1947, but despite the difficult times, it was again successful – 305 exhibits were located on an area of 9602 sq. M. This was

followed by years of steady growth in the popularity of the event: in 1948, the exhibition gathered 200 thousand visitors, in 1960, 300 thousand visitors, and in 1967 over half a million viewers.

Geneva Palexpo, one of the largest and most modern exhibition complexes in Europe, was built in 1981 near the airport. The first event at the new exhibition complex was the International Trade Fair for Commercial Vehicles in January 1982, followed by the International Auto Show in March.

In 2000, over 700 thousand people visited the Geneva Motor Show for the first time in history, and the absolute record of 747,700 visitors was set in 2005. Switzerland does not belong to the world leaders in the automotive industry, so the Geneva Motorshow stands out against the background of car dealerships in Detroit, Frankfurt and Paris, with a more international character. The exhibition featured world premieres of such cars as the Mercedes 300 S Ponton, Ford Mondeo, Ford Granada, Audi 80, Audi 100, Audi A8, the first generation and many others. Opening of the 2019 Geneva Motor Show

In this year another exhibition took place. As a rule, the novelties of the Geneva Motor Show are presented 2 days before the official opening of the exhibition – within the framework of traditional press days. During this time, about 70 press conferences are held, in which representatives of exhibiting companies take part. The area of the covered complex is 108 thousand square meters. m, open-air exhibition area - 21 thousand square meters.

Also, a very characteristic feature of the Geneva Motor Show is its advertising posters – over the long decades of these graphic design works, a large book has been printed that was published for one of the past anniversaries.

In 2019, the 89th auto show will start on March 7 and will last until March 17. To figure out what to expect at the

Geneva Motor Show, consider the main models, the dates of their show, as well as characteristics. As already known, in the framework of the auto show, the leaders of the world production of cars will present more than 100 new models, concepts and prototypes, which will soon enter the market. All this action will be held at the well-known Palexpo Arena.

Despite the fact that the start of the show is only on March 7, for journalists at the 2019 auto show in Geneva, the doors will open from March 5th to the 7th of March, these days are also known as press and trade days. The organizers of the Geneva Motor Show in 2019 promised the most unexpected innovations and that in the coming days will appear in dealerships around the world. Among the concepts in Geneva, 30 models are expected to be shown, serial models will be about 100 copies (as an example, the new Skoda Kamiq crossover), although a sharp migration of concepts to serial models is not excluded.

As an example, the German manufacturer Audi has prepared several new concepts for the Geneva Auto Show, which had never been shown before. This is a pair of electric cars, a parquet version of the Q4 e-Tron, as well as a small five-door Audi E-Tron Hatchback concept. The recent French brand PSA has not lagged far, this time at the exhibition in Geneva, it will bring a modern electric car for a two-person city – the Citroen Ami One Concept and a slightly larger Citroen Centenary Concept.

From luxury and more bulky cars in Geneva, you can mark the new Aurus Senat. The British brand Bentley will present the fastest Bentley Bentayga Speed crossover, as well as a special version of the Bentley Continental GT in the Bentley Centenary Special configuration for the company's 100th anniversary.

Now consider the charged sports cars, which also show at the Geneva Motor Show. The French-German brand will

surprise the anniversary Bugatti Chiron Sport 110 ans Bugatti and the new Bugatti Hypercar whose price starts at $18 million. Lambo is not far behind, in the auto show we can expect a new Huracan EVO. McLaren continues the line of sports cars; it will bring the updated 600LT Spider MSO and 600LT Spider to the car dealership.

Going further on the list, at the Geneva Motor Show you can find another batch of cars from Volkswagen, but this time it is a hybrid specimen or with internal combustion engines. In particular, the new Golf GTI TCR, the eighth generation Golf and updated Passat in several versions, including the Alltrack and hybrid. Next on the list presented from Volkswagen listed Multivan and the new T6. Ford is not particularly diverse, while it is known about a pair of Mondeo and Focus ST models.

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Night Vision Technologies

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Night Vision Technology, as the name suggests, is the expertise that makes us capable to see in the night without using any external light source such as a torch or a lamp [1]. Highly advanced light sensitive cameras are used in this technology for producing clear visible images at night which can't be done by the naked eye. Low-light imaging, thermal imaging and near-infrared illuminations are the three most commonly used night vision technologies.

The most common method of low-light imaging is based on a device called an image intensifier to amplify available light. Available light is focused through the objective lens (the lens closest to the object being viewed) onto the photocathode of the image intensifier. Then the electrons released by the cathode and accelerated by an electric field enter holes in a microchannel plate and bounce off specially-coated internal walls thus creating a denser "cloud" of electrons representing an intensified version of the original image. The electrons next hit a phosphor screen, making the phosphor glow. And finally the light displays the desired view to the user or to an attached camera or video device [2]. Since the human eye is quite sensitive to green colour which falls in the middle of the spectrum, these cameras have green phosphor which gives the green colour to the night vision cameras.

Whenever a night vision device is used, some facts are to be kept in mind. Surface colours and patterns directly influence the produced image. A darker image will be formed for the

objects that are dull in texture and vice versa for bright textured objects. Presence of rain, fog, smog and various other forms of water precipitation can have an adverse effect on the performance of the device. This is because the devices are quite responsive to even a slight amount of light and presence of water can give rise to various light phenomena which may not give the exact output that one desires to get from a night vision device [1].

Thermal imaging is a method of improving visibility of objects in a dark environment by detecting the objects' infrared radiation and creating an image based on that information [2]. All objects emit infrared energy (heat) as a function of their temperature. In general, the hotter an object is, the more radiation is emitted. A thermal imager/camera is essentially a heat sensor capable of detecting even tiny temperature differences. The device collects the infrared radiation from objects in the scene and creates an electronic image based on information about the temperature differences. Because objects are rarely precisely the same temperature as other objects around them, a thermal camera can detect them and they will appear as distinct in a thermal image. Thermal images are normally grayscale in nature: black objects are cold, white objects are hot and the depth of gray indicates variations between the two. Some thermal cameras, however, add color to images to help users identify objects at different temperatures.

Near-infrared illumination is a method of night vision based on the employment of a device that is sensitive to invisible near infrared radiation in conjunction with an infrared illuminator. This popular and inexpensive method of night vision is used in a variety of applications including perimeter protection where it can be integrated with video motion detection and intelligent scene analysis devices for a reliable low-light video security system. Near-infrared illumination can also be used to perform high-speed video capture, such as

reading license plates of moving vehicles in an automatic license plate recognition system. Like thermal imaging, near-infrared illumination may provide visibility in fog, mist, rain and snow [2].

The original purpose of night vision technology was to locate enemy targets at night. It is still used extensively by the military for that purpose, as well as for navigation, surveillance and targeting. The police and security often use both thermal-imaging and low-light imaging technology, particularly for surveillance. Hunters and nature enthusiasts use night vision devices for maneuvering through the woods and for wildlife observing at night. A really amazing ability of thermal imaging is that it reveals whether an area has been disturbed – it can show that the ground has been dug up to bury something, even if there is no obvious sign to the naked eye. Law enforcement has used this to discover items that have been hidden by criminals, including money, drugs and bodies.

Many people are beginning to discover the unique world that can be found after darkness falls. If you're out camping or hunting a lot, chances that night-vision devices can be useful to you are very high – just be sure to choose the right type for your particular needs [3].

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Modern Programming Languages

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At the core of every technology there is a programming language. Thousands of programming languages exist, but there are some trusty ones that software developers turn to again and again. In this paper we are analyzing four popular programming languages, their advantages and disadvantages, and also comparing their relevance in the world and in Belarus. The rating is based on GitHub report of the top programming languages of 2018 and on the Belarussian web resources [1].

The first language is Python. Python was developed by the Netherlandish programmer Guido Van Rossum in 1991. Now Python is a high-level programming language and one of the world's fastest-growing language [2].

It is located on the 5th position in the Belarusian rating. Python has already been at the top of user growth for several years. Python is a multi-paradigm programming language. Python uses dynamic typing, and a combination of reference counting and a cycle-detecting garbage collector for memory management. The syntax of this language is very simple. However, the most important direction for Python is machine learning. Machine learning technologies are used in recommendatory services, for example, YouTube, Amazon and Netflix, in face and voice recognition systems. EPAM, IBA group and Belhard use this language in our country. Python has some advantages: a large user community, easy to code and read, free and open-source and etc. [2, 6].

The second programming language under analysis is C#. It was developed by Microsoft. Anders Hejlsberg created the language in 1999. If we consider the rating from GitHub, we will see that C# is located on the 8th place. It is a multiparadigm programming language encompassing strong typing, imperative, declarative, functional, generic, object-oriented, and component-oriented programming disciplines. C# is used to build enterprise applications and software used by corporate clients. C# is one of the most popular programming languages in many Belarussian IT companies, such as EPAM, Itransition, ISsoft, SaM Solutions. This language has some advantages: you don't need to write destructors in C#, the .net class library will allow rapid prototype development [3].

The third language in our research is Ruby. Ruby was created by the Japanese developer Yukihiro Matsumoto in 1995. Ruby takes the 7th position in the Belarusian rating of top programming languages. Ruby is a dynamic, open source platform that focuses on simplicity [6]. Ruby is object-oriented: every value is an object, including classes and instances of types. Ruby has been described as a multi-paradigm programming language with dynamic typing, and supports parametric polymorphism. Ruby was influenced by Perl, Smalltalk, Eiffel, Ada and Python. Ruby is used by NASA, NOAA (National Oceanic and Atmospheric Administration), Oxagile, EPAM, Itransition and other companies. This language also has some advantages: it has options for test automation, it is a full-stack framework that covers both front and back-end design [4].

The fourth programming language under discussion is PHP. It was created by Rasmus Lerdorf in 1994. PHP is located on the 5th position in GitHub rating and on the 4th position in the Belarusian rating of top programming languages. PHP is a server-side scripting language. Basically, PHP is used in web development. In particular, it is widely

used to make dynamic and interactive web pages. Large sites like Facebook and Yahoo are made using PHP. Such well-known IT companies of Belarus as IBA, Itransition, BelHard, Oxagile, SaM Solutions write programs with the help of PHP. PHP has some advantages for example: speed, open source, powerful library and ease of use [5, 6].

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Introduction to Machine Learning

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Machine Learning is an idea to learn from examples and experience, without being explicitly programmed. Instead of writing code, you feed data to the generic algorithm, and it builds logic based on the data given [1].

For example, one kind of algorithm is a classification algorithm. It can put data into different groups. The classification algorithm used to detect handwritten alphabets could also be used to classify emails into spam and not-spam.

As Tom M. Mitchell points out: “A computer program is said to learn from experience E with some class of tasks T and performance measure P if its performance at tasks in T, as measured by P, improves with experience E” [2].

Machine Learning is a field which is raised out of Artificial Intelligence (AI). Applying AI, we wanted to build better and intelligent machines. But except for few more tasks such as finding the shortest path between point A and B, we were unable to program more complex and constantly evolving challenges. There was a realization that the only way to be able to achieve this task was to let machine learn from itself. This sounds similar to a child learning from its self. So, machine learning was developed as a new capability for computers. And now machine learning is present in so many segments of technology, that we don’t even realize it while using it.

The techniques we use for data mining have been around for many years, but they were not effective as they did not have the competitive power to run the algorithms. If you run deep

learning with access to better data, the output we get will lead to dramatic breakthrough which is machine learning.

There are many examples of machine learning. Here are a few examples of classification problems where the goal is to categorize objects into a fixed set of categories.

Face detection is used to identify faces in images (or indicate if a face is present). Email filtering is applied to classify emails into spam and not-spam. The aim of medical diagnosis using machine learning is to diagnose a patient as a sufferer or non-sufferer of some disease. In weather prediction machine learning is useful to predict, for instance, whether or not it will rain tomorrow.

There are three kinds of Machine Learning Algorithms:

a. Supervised Learning

b. Unsupervised Learning

c. Reinforcement Learning

A majority of practical machine learning uses supervised learning. In supervised learning, the system tries to learn from the previous examples that are given. Supervised learning problems can be further divided into two parts, namely classification, and regression.

A classification problem is when the output variable is a category or a group, such as “black” or “white” or “spam” and “no spam”. A regression problem is when the output variable is a real value, such as “Rupees” or “height”.

In unsupervised learning, the algorithms are left to themselves to discover interesting structures in the data. This is called unsupervised learning because unlike supervised learning above, there are no given correct answers and the machine itself finds the answers.

Unsupervised learning problems can be further divided into association and clustering problems. An association rule learning problem is where you want to discover rules that

describe large portions of your data, such as “people that buy X also tend to buy Y”.

A clustering problem is where you want to discover the inherent groupings in the data, such as grouping customers by purchasing behavior.

A computer program will interact with a dynamic environment in which it must perform a particular goal (such as playing a game with an opponent or driving a car). The program is provided feedback in terms of rewards and punishments as it navigates its problem space.

Using this algorithm, the machine is trained to make specific decisions. It works this way: the machine is exposed to an environment where it continuously trains itself using trial and error method.

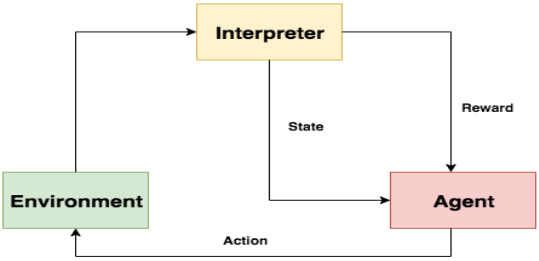

Fig.1 Reinforcement learning process

Machine Learning theory is a field that meets statistical, probabilistic, computer science and algorithmic aspects arising from learning iteratively from data which can be used to build intelligent applications.

The foremost question when trying to understand a field such as Machine Learning is the amount of mathematics necessary and the complexity of mathematics required to understand these systems [3].

The answer to this question is multidimensional and depends on the level and interest of the individual. Here is the minimum level of mathematics that is needed for Machine Learning Engineers / Data Scientists.

1. Linear Algebra
2. Probability Theory and Statistics
3. Calculus
4. Algorithms and Complex Optimizations

According to the statistics the importance of mathematic topics needed for Machine Learning accounts for 35% of Linear Algebra, 25% of Probability Theory and Statistics, 15% of Algorithms and Complexity, and also 15% of Calculus.

In conclusion, finding patterns in data is possible only for human brains so far. The data is becoming very massive, the time taken to compute it increases, and this is where Machine Learning comes into action, to help people with large data in minimum time.

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Sensor Systems

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The era of automation has begun already. Most of the things that we use now can be automated. To design automated devices first we need to know about the sensors, these are the modules/devices which are helpful in making things done without human intervention [9]. The sensor can be defined as a device which can be used to sense/detect the physical quantity like force, pressure, strain, light etc. and then convert it into desired output. The output is generally a signal that is converted to human-readable display at the sensor location or transmitted electronically over a network for reading or further processing [1]. We use sensors in our everyday life. For examples: sensors in our smartphone (it contains accelerometer, Gyroscope, GPS, Proximity Sensor and so on), at home and in all large enterprises we use a security system that is based on motion sensors, in medicine often used thermal imagers which use temperature sensors. We use sensors everywhere on work, at home and when we travel abroad. By combining a set of sensors and a communication network, devices share information with one another and are improving their effectiveness and functionality. This helps sensors becoming "smarter" every day and takes the sensor evolution to a completely different level. Irrespective of types of IoT sensors, any end point is where the IoT begins. Sensors generate primary signals that reflect one or another property of objects where sensors are installed. No sensors – no data. The wider variety of sensors appears, the more flexible IoT development

is provided. We greatly appreciate our natural sensors – eyes, ears, fingers etc. being afraid of losing any of our sensory capabilities. The industrial IoT sensors described above constitute just a tiny part of all available data-generating devices. Nevertheless, a deep expertise even in a given brief list of sensors enables any IoT solution provider to create powerful systems for a broad range of applications [8]. There are some examples of sensors:

1. Temperature sensor

Followed are some sub-categories of temp sensors:

- Thermocouple
- Resistor temperature detector (RTD)
- Thermistor
- IC (Semiconductor)
- Infrared sensor

2. Proximity sensor

Following are some sub-categories of proximity sensors:

- Inductive sensor
- Capacitive sensor
- Photoelectric sensor
- Ultrasonic sensor

3. Water quality sensor

Following is a list of the most common kinds of water sensors:

- Chlorine residual sensor
- Total organic carbon sensor
- Turbidity sensor
- Conductivity sensor
- pH sensor
- Oxygen-Reduction potential sensor [5].

On the example of a motion sensor (one of the most popular sensor used in our life), we consider how a sensor works and advantages and disadvantages of this sensor. This type is usually used in security systems. The device has the ability to quantify motion and alert the individual about any

movement, within a stipulated range, in the surroundings. Basically there are two types of sensors: active and passive.

Active sensors a.k.a. radar-based motion detectors: these sensors use ultrasonic sound waves to track any movement in the specified range. Once activated, an active sensor sends out pulses of energy and times the echoes those pulses create when the energy reflects off of nearby objects. If someone walks into the scanned area, the echo time will change, indicating that someone is moving through the area.

Passive sensors a.k.a. pyroelectric detectors: these sensors read changes in infrared energy levels in the surroundings in order to detect the presence of any individual. Passive infra-red sensors are the most widely used motion in home security systems. All living things give off heat, and these sensors can detect that heat. Passive sensors are programmed to detect sudden changes in the temperature of surroundings. Changes in energy levels are detected by a photo detector, which converts the wavelengths to electric current and transfers it to a small computer unit present in the device. When a human or animal enters an area covered by passive infrared sensors, the increase in infrared energy tells the sensor that someone or something is moving through the area. Normally the detector is programmed to detect emissions in the range of 8 to 12 micrometers. The detector triggers the alarm as soon as the photo detector 'senses' large variations in infrared energy levels in the surroundings. [2, 7].

Advantages: it can be used in very harsh environment having irregular heat cycles, has more lifespan which is about 100000 hours, detects motion both day and night, helps in providing security, easy to install. Disadvantages: radio frequency at high power is harmful for humans and in microwave range do not penetrate metal objects (active type), passive motion sensors do not operate above temperature of 350° C, passive infrared (PIR) sensor can detect human being

within 10 meters range, any kind of moving object can trigger the sensor [6]. Various forces underpinning the changing role of sensors in electronics systems include the following:

• The extreme miniaturization of components of many sensor systems. In optical applications, for example, aims pioneered the fabrication of on-wafer interferometric light filters for multi-channel spectral sensors, and micro-optic lens arrays for miniature light sources and light detectors.

• The availability of advanced computing resources in non-computer devices – a capability that enables products such as smartphones to process and intelligently use vast amounts of sensor data.

• The expansion of the Internet of Things (IoT), which gives rise to a new class of connected, autonomous devices that need the ability to see, hear, feel and smell, and to report their "perceptions" to cloud-based monitoring and control systems.

• Climate change, which gives urgent impetus to OEMs' energy-saving innovations, many of which depend on capturing more precise and relevant information about the real-world phenomena experienced or produced by electronics devices, such as heat, noise and vibration [3].

In the conclusion I want to say that creating of sensor made great influence on our life, because it made possible the creation of multi-functional devices. Sensors make our life easier. The future of sensors is complex, sophisticated, application-focused and often supplied as a modular solution. Enough real-world examples already exist for the electronics industry to clearly see where the future is headed.

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Press Brake: Types and Operating Principles

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Bending is a manufacturing process that produces a V-shape, U-shape, or channel shape along a straight axis in ductile materials, most commonly sheet metal. A press brake or a bending press is a device designed for metal bending and metal strips and sheets forming. It allows producing metal sections of given sizes and there is no need to carry out preliminary thermal treatment of the material. The production of details of the required parameters is performed by the method of cold deformation [1].

The operating principle of the bending press is to provide the necessary force and the working stroke of a traverse – a steel rigid beam that the necessary tooling is installed on, depending on the intended manufactured product and the bending mode. The beam stroke is controlled by linear motion sensors, usually two of them, controlling the left and right sides of the traverse to ensure uniform motion and synchronization. The back stop is used as an additional piece of equipment installed on the bending presses. Its position can be programmed based on the required size of the bent edge [2].

The most important part of the brake press is its safety system which serves primarily to protect a human operative from injury. Its auxiliary function is to limit the working stroke in case of certain technological operation perturbations. The safety system is a combination of hardware and software that processes signals from various devices controlling a particular technological process, a laser control device determining a

foreign object presence (for example, an operator's hand) being the most important one. Laser beams form a plane under the upper tool at a distance of about 3-5 mm below it. If during the transverse movement the operator's hands get into the working area, the laser beams will cross and thus the control system will direct a command to stop the movement immediately.

The press brake has got two main hydraulic cylinders providing a fast approach and power stroke of the traverse. Each cylinder is equipped with a position sensor that reports the position of each cylinder piston to the electronic control system. Besides these two main hydraulic cylinders, the press brake can also be provided with extra hydraulic cylinders: matrix moving cylinders, cylinders for adjusting the position of the back stops for the workpiece, cylinders for hydraulic support and compensation of the deflection of the matrix (crowing), cylinders for upper and lower tool clamps. All these cylinders have a feedback position system or end position switches (sensors) [3].

The sequence of actions, the operation speeds, the developed force and the component under pressure holding time in the bending press are monitored by the electronic press control system. It is connected by control wires to the solenoid coils of proportional valves. Depending on the value of the electrical signal, these valves provide pressure adjustment (hydraulic cylinder force) or the value of the oil flow (cylinders speed). Each proportional valve is equipped with an electronic position sensor of the valve main spool – electrical position feedback. This sensor continuously informs the control system about the position of valve main spool at the right moment. Besides these valves hydraulic system of the brake press is equipped with pressure sensors and pressure switches of the working liquid of the hydraulic system [2].

According to the applied force press brakes are described as mechanical, pneumatic, hydraulic, and servo-electric. In a

mechanical press, energy is added to a flywheel with an electric motor. A clutch engages the flywheel to power a crank mechanism that moves the ram vertically. Accuracy and speed are two advantages of the mechanical press. Hydraulic presses operate by means of two synchronized hydraulic cylinders on the C-frames moving the upper beam. Servo-electric brakes use a servo-motor to drive a ballscrew or belt drive to exert tonnage on the ram. Pneumatic presses utilize air pressure to develop tonnage on the ram. Hydraulic brakes produce accurate high quality products, are reliable, use little energy and are safer because the motion of the ram can be easily stopped at any time in response to a safety device [1].

Modern press brakes often include a multi-axis computer-controlled back gauge, a device that can be used to accurately position a piece of metal so that the brake puts the bend in the correct place. Optical sensors allow operators to make adjustments during the bending process. These sensors send real-time data about the bending angle in the bend cycle to machine controls that adjust process parameters [1].

The press brakes find wide application in the mechanical engineering, instrument making, construction, metal production for bending metal products of different assignment according to the prescribed form and specified dimensions.

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English Phraseological Units and Idioms

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A word comes to be a powerful means of communication but it can also be a cause of a great misunderstanding if it is not clearly understood by one of the speakers. This is the case with a special layer of language – phraseology – a set of stable expressions with independent meaning. In English and American linguistics no special branch for this exists, and the term “phraseology” has a stylistic meaning. The aim of this paper is to define and classify English idioms, to highlight their origin, and to focus on peculiarities and main problems of translation of phraseological units and idioms

A phraseological unit or an idiom is a phrase or expression, the total meaning of which differs from the meaning of the individual words. For example, *to blow one's top (get angry*) and *behind the eight ball (in trouble)* are examples of English idioms and it is obvious they cannot be translated literally (word by word). An idiom is a common word or phrase with a culturally presupposed meaning that differs from what its composite words' denotations would suggest. For example, an English speaker would understand the phrase *to kick the bucket* to mean *to die* – as well as to actually *kick a bucket.* Furthermore, they would understand when each meaning is being used in context. Idioms, like slang and swear words, are among the hardest parts of a language because you must be precise and correct, otherwise you might use an idiom that is not adequate for the situation, and sounds rather

awkward or that means something different to your intended use [1].

There exist a considerable number of different classification systems devised by different scholars and based on different principles. The traditional and oldest principle for classifying phraseological units is based on their original content and might be alluded to as "thematic". This approach is widely used in numerous English and American guides to idiom and phrase books. Idioms are classified according to their sources of origin that is to the particular sphere of human activity, life, nature, natural phenomena, etc. We can find groups of idioms associated with domestic and wild animals and birds, agriculture and cooking.

There are also numerous idioms drawn from sports, arts, and other types of activity. This principle of classification is sometimes called "etymological". For example, word–groups associated with the sea and the lives of seamen are especially numerous in English vocabulary. Most of them have long since developed metaphorical meanings which have no longer any association with the sea or sailors. Here are just some of them: *to be all at sea* – to be unable to understand; *to sink or swim* – to fail or succeed; *in deep water* – in trouble or danger; *in low water, on the rocks* – in strained financial circumstances; *to be in the same boat with somebody* – to be in a situation in which people share the same difficulties and dangers; *to sail under false colours* – to pretend to be what one is not; *half seas over* – drunk.

According to the degree of idiomatic meaning of various groups of phraseological units, they can be classified as follows:

1) phraseological fusions – units the meaning of which cannot be deduced from the meanings of their component parts: *to come a cropper* – to come to disaster; *neck and crop* –

entirely, altogether; a*t sixes and sevens* – in confusion or in disagreement;

2) *phraseological unities* – expressions the meaning of which can be deduced from the meaning of their components: *to show one's teeth* – to be unfriendly; *to sit on the fence* – in discussion, politics, etc. refrain from committing oneself to either side; *to lose one's head* – to be at a loss what to do; *to lose one's heart to smb*. – to fall in love; *a big bug* – a person of importance;

3) *phraseological collocations* (*combinations*) – traditional word–groups: *meet the demand, meet the necessity, to be good at something, to be a good hand at something, to have a bite, to take something for granted, to stick to one's word, gospel truth, bosom friends, to break news* [2].

Secondary ways of forming phraseological units are on the basis of another phraseological unit:

- *changing the grammar form*, e.g. *Make hay while the sun shines* is transferred into a verbal phrase – to make hay while the sun shines;
- *analogy*, e.g. *Curiosity killed the cat* was transferred into *Care killed the cat*;
- *contrast , thin cat – «a poor person»* was formed by contrasting it *with fat cat*;
- *shortening of proverbs or sayings*, e.g. the phraseological unit *to make a sow's ear* with the meaning « ошибаться » was formed from the proverb *You can't make a silk purse out of a sow's ear by means of clipping the middle of it*;
- *borrowing* phraseological units from other languages, either as translation loans, e.g. *living space (German), to take the bull by the horns (Latin)*, or by means of phonetic borrowings, e.g. *meche blanche* (French), *corpse d'elite* (French).

We can see how phraseological units are formed. For example, the class of phraseological units describing human appearance can be divided into several subclasses, according to the object which is described.

- Facial features, beauty: *face like thunder*– somebody looks very angry; *face like a wet week–end*– they look sad and miserable; *face only a mother could love*– someone is ugly or unattractive; *face that would stop a clock* – has a shockingly unattractive face; *poker face* – an expressionless face that shows no emotion or reaction at all.
- Eyes: *eyes like saucers* – eyes opened widely as in amazement; *eyes flash fire* – somebody looks at someone angrily
- Nose: *nose to light candles at* – red nose.

Sometimes, idioms can be created by individuals, generally, famous people, and, then, they gain worldwide popularity: Benjamin Franklin – *Time is money;* Washington Irving – *the almighty dollar;* Fennimore Cupper – *go on the warpath;* Jack London – *the call of the wild.*

One can also single out the following two groups of phraseological units:

1) primordial English phraseological units: on top of the world; in seventh heaven; old hand; all ears;

2) phraseological units adopted from foreign languages or American English: *nest egg, buzzing*.

Idioms are integral part of any language; they make our speech more colourful and authentic. Without phraseological expressions our speech would be considered poor. So, if we want to improve our speech we need to know and understand phraseological units [3].

In this paper we have discussed how idioms can be used in English. We have focused on different types of phraseological units according to various classifications, and provided a number of examples. Thus, being based on practical

and theoretical research we have come to the conclusion that idioms are figurative expressions which do not mean what they literally state.

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The History of the Flag «Union Jack»

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The study of the history of the flag «Union Jack» helps us to understand deeper the historical features of the development of the country, to know the names of the people who took part in the creation of the national flag. It is very important to learn more about the country and develop the interest to study foreign languages.

The United Kingdom of Great Britain and Northern Ireland consists of four countries including England, Scotland, Wales, and Northern Ireland. The UK flag is one of the symbols of the United Kingdom of Great Britain and Northern Ireland. It is a blue rectangular cloth with red slanting crosses [1]. For years, this flag flew high in many locations across the world, symbolizing the British colonial rule in countries across the world.

Why «Union Jack»? Many people know that the English flag is called so. It is known that the son of Mary Stuart James during his reign was nicknamed Jacques. Probably, the flag was named in his honor. However, there is another version, according to which «Union Jack» was to be installed as a bow flag of the ship on warships, thereby emphasizing the unity and pointing to the country [2].

So, the Union Flag is sometimes known as the Union Jack after its creator, James of England, James VI of Scots. When James VI took over the reign in the Kingdoms of English and Ireland in 1603 and united the crowns, he asked for the establishment of a new flag as the representation for the

regal union. On April 12, 1606 a new flag was established with the flag of Kingdom of England, and of Scotland put together to create the flag of the UK and the first ever union flag. The royal flag was meant for civil and military ships of both kingdoms on sea only while the land forces were to continue using their respective flags.

However, the flag gained regular use in the Kingdom of Britain after the Acts of Union in 1707. The flag was finally adopted by the armies operating on land although the shade of blue used on the field resembled that of the flag of Scotland. The current flag has a dark navy blue which traces its origin from the Royal Navy's Blue Squadron. The thin white stripe separating the red crosses from the blue fields is in line with the requirements where some colors like red and blue must be separate from each other. Wales was not recognized in the flag because it had been part of England since 1282. The Kingdom of Ireland was also not represented in the original version of the flag with the flag of the Protectorate between 1658 and 1660 decorated with the Ireland's arms.

Another alternative is that the name may be derived from a proclamation by Charles II that the Union Flag should be flown only by ships of the Royal Navy as a jack, a small flag at the bowsprit; the term 'jack' once meant small. It is so called because it combines the crosses of the three countries united under one Sovereign - the kingdoms of England and Wales, of Scotland and of Ireland (although since 1921 only Northern Ireland has been part of the United Kingdom.

The fact is that the UK consists of three historical areas of the United Kingdom: England, Scotland and Northern Ireland. Each of them has its own flag, the elements of which are "stacked" in the common flag of Great Britain.

1.4 The Flag of England

The first element of the flag of Great Britain (England) is the image of the red straight cross on a white background (St. George's cross). This element of the flag of Great Britain appeared much earlier than the official approval of the modern flag of this country, and has its roots in the middle Ages. There is a version that St. George began to protect the freedom-loving British nation during the Crusades, in which the knights of England for the first time showed their exceptional courage and skill, which later played a significant role in the formation of a huge colonial Empire.

1.5 The Flag of Scotland

The patron Saint of Scotland is Saint Andrew and this part of the flag of England has a blue background and a white diagonal cross. This background supposedly appeared as a tribute to King James I, who started the unification of England and Scotland. In Russia, this flag is known as "St. Andrew's" (in honor of St. Andrew) and it is the official flag of Russian fleet.

1.6 The Flag of Ireland

The red diagonal cross on a white background symbolizes St. Patrick, another defender of Great Britain. St. Patrick is the patron Saint of the Irish and it is clear that this thin diagonal cross on the flag of England is slightly offset. Some people who study the flags of different countries believe that it is this displacement of the cross of St. Patrick gives the flag of England the very originality and uniqueness for which it is valued by the British themselves. Historians believe that such a decision was invented by the British in order not to confuse the sense of national pride of the Scots [3].

1.7 The flag of Wales

Wales is not represented on the Union Flag because by the time the first version of the flag appeared, Wales was already united with England Wales.

So, the cross of St. George, patron saint of England since the 1270's, is a red cross on a white ground. After James I succeeded to the throne, it was combined with the cross of St Andrew in 1606.The cross of St Andrew, patron saint of Scotland, is a diagonal white cross on a blue ground. The cross of St. Patrick, patron saint of Ireland, is a diagonal red cross on a white ground. A Red Dragon is a symbol of Welsh Flag. This was combined with the previous Union Flag of St. George and St. Andrew, after the Act of Union of Ireland with England (and Wales) and Scotland on 1 January 1801, to create the Union Flag that has been flown ever since. The Welsh dragon does not appear on the Union Flag. This is because when the first Union Flag was created in 1606.

So, the Union Flag was originally a Royal flag. When the present design was made official in 1801, it was ordered to be flown on all the King's forts and castles, but not elsewhere. The modern British flag is a blue rectangular cloth with the image of a red straight cross in a white edging, superimposed on top of white and red oblique crosses. Officially, the ratio of the width and length of the flag is not established, but usually public authorities use flags with a ratio of width to length of 1:2 [4].

The Union Jack should be flown at half-mast from public buildings in the following situations: on the day of the death of the monarch, on the day of the funeral of members of The British Royal family, during the funeral of the former British Prime Minister.

The Union Flag is flown on Government buildings on days marking the birthdays of members of the Royal Family, Commonwealth Day, Coronation Day, The Queen's official birthday, Remembrance Day and on the days of the State Opening and sessions of Parliament.

Today the Union Jack is not only the flag but also a popular symbol that regularly appears on clothes, bags,

souvenirs and even cars. Its colours attract people so that it has become a fashionable emblem all over the world [5].

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Red Brick Universities

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The UK has several types of universities. The first type is ancient universities. They were founded before the 17th century. This type includes universities such as Oxford, Cambridge and so on. The process of admission to these universities is so hard.

The second type of Universities is red-brick ones. They are located in Manchester, Birmingham and Leeds. As you could guess, they are built of red bricks.

Red Brick Universities is the name for the union of six prestigious British universities located in large industrial cities. The peculiarity of the new educational institutions was that they accepted students without regard to their origin, social status. In addition, they focused on applied science and technology, that is, they sought to inculcate skills necessary for real life to students, preferring practical knowledge rather than theoretical knowledge.

Now Red Brick Universities are also included in the prestigious Russell Group – the union of the 20 best English universities.

Who are the red brick universities? There has been a list of official orders before the First World War. These institutions are all evolved from specialized industrial cities. The six are:
1) University of Birmingham; 2) University of Bristol; 3) University of Leeds; 4) University of Liverpool; 5) University of Manchester; 6) University of Sheffield [1].

Origins of the term and use

The term ‘red brick’ or ‘redbrick’ was first coined by Edgar Allison Peers, a professor of Spanish at the University of Liverpool, to describe the civic universities, while using the pseudonym "Bruce Truscot" in his 1943 book "Redbrick University". Although Peers used red brick in the title of the original book, he used redbrick adjectivally in the text and in the title of the 1945 sequel. He is said to have later regretted his use of red brick in the title.

While the University of Liverpool was an inspiration for the "red brick" university alluded to in Peers' book, receiving university status in 1903, the University of Birmingham was the first of the civic universities to gain independent university status in 1900 and the University has stated that the popularity of the term "red brick" owes to its own Chancellor's Court, constructed from Accrington red brick. The University of Birmingham grew from the Mason Science College (opened two years before University College Liverpool in 1880), an elaborate red brick and terracotta building in central Birmingham which was demolished in 1962.

Civic university movement

These universities were distinguished by being non-collegiate institutions that admitted men without reference to religion or background and concentrated on imparting to their students "real-world" skills, often linked to engineering and medicine. In this sense they owed their structural heritage to the Humboldt University of Berlin, which emphasized practical knowledge over the academic sort. This focus on the practical also distinguished the red brick universities from the ancient English universities of Oxford and Cambridge and from the newer University of Durham, collegiate institutions which concentrated on divinity and the liberal arts, and imposed religious tests on staff and students. Scotland's ancient

universities were founded on a different basis between 1400 and 1600.

The first wave of large civic red brick universities all gained official university status before the First World War, all of these institutions have origins dating back to older medical or engineering colleges. These universities developed out of various 19th-century private research and education institutes in industrial cities. The 1824 Manchester Mechanics' Institute formed the basis of the Manchester Institute of Science and Technology (UMIST), and thus led towards the current University of Manchester formed in 2004. The University of Birmingham has origins dating back to the 1825 Birmingham Medical School.

Red brick universities history

In the 19th Century, Britain was undergoing enormous changes as a result of the Industrial Revolution. In the large industrial cities, there was an urgent need for a workforce with technical and scientific skills to meet the demands of the new economy.

This led to the creation of specialised schools and private education institutes, often dedicated to fields such as medicine or engineering. For example, the Manchester Mechanics Institute was established in 1924, and Birmingham Medical School in 1925.

These institutions were incredibly successful, and became centres of knowledge and research during the Victorian era. Eventually, some were granted independent university status.

Many of these new civic universities featured buildings built in the Gothic style with red bricks – a popular trend in the Victorian times. This led to institutions of this type being nick-named 'red brick' universities.

However, after the end of the First World War, a number of other institutions from the Victorian era began to be made fully fledged universities.

Despite differences in architecture styles, these universities are all considered 'red brick' [2].

Red brick universities today

Red brick institutions were actually mocked at first by Britain's existing universities. The university establishment, particularly 'ancient' universities such as Oxford and Glasgow, saw them as inferior. This led to the term 'red brick' being used in a derogatory way.

However, this quickly changed. Today, England's red brick universities are among the most highly ranked in the world. Out of the 6 original red brick universities, 5 are in the global top 100. Nearly all of the red brick universities are members of the prestigious Russell Group (which includes Cambridge, Oxford, Glasgow and Imperial), and many employers request graduates with a red brick degree [3].

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Logistics in Everyday Life

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If we think for a moment of our favorite restaurant or supermarket, perhaps the concept of logistics does not come to mind at first. However, if we consider how that particular restaurant or supermarket gets all necessary products and materials, the importance of logistics in our life seems to be great.

Therefore, logistics management is the process that plans, implements, and controls the efficient flow and storage of goods, services between the point of origin and the point of consumption.

Anything that can be found in a supermarket was once loaded in a truck and transported from one location to another.

Now we will describe some problems in transportation of special goods. There are certain products that are more time sensitive than others. Like fresh products and frozen food. And first of all, it concerns ice-cream.

Ice cream supply chain

Ice cream companies have to ensure products maintain their quality as they travel from the manufacturing plant to the distribution center, then to the retailer, and finally into the consumer's shopping cart and home.

The cold chain's enemy is heat shock; ice cream that warms up and refreezes tends to become icy and grainy. That is why it is important for the temperature of frozen foodstuff not to exceed – 18 degrees Celsius at all times in the transport.

Trucks are to be cooled down before loading which ensures the ice cream to have the right temperature during transportation.

After that, the boxes are stored in distribution warehouses for frozen goods at temperatures between - 21 and - 24 degrees Celsius. And finally ice-cream is delivered to consumers.

The refrigerated vehicle is cooled down before loading. Due to the fact that the ice cream has already been stored between - 21 and - 24 degrees Celsius, a temperature reserve is created. During the transport, professional drivers always keep an eye on the temperature.

Unloading trucks as quickly as possible is important so that the ice cream can be stored in the deep-freeze room immediately. Then the ice cream is stocked in the freezer cabinets at the retailers to be available to the consumers [1].

After such a long and difficult process, our ice cream appears in supermarkets and when we buy it, we don't think what way ice-cream has travelled.

Disney queuing system

We have studied information about queue management system and how it is applied to manage and analyze the flow of visitors and to prevent the formation of queues. It can be used in a retail store, hospital, etc. Let us take the example of Disneyland. There are numerous rides, museums, parks and long queues there. So how do they manage it? Disney queuing theory knows the magic words to make people forget that they are stuck in a queue.

First of all, Disney queue management has turned what is typically viewed as a stagnant experience – waiting idly around – into an extension of its amusement park. What do we mean?

As clients wait in line for rides, Disney characters parade the line, shaking hands, and snapping pictures with those in queue. These are interactive queue lines.

So that, waiting in line becomes an experience of its own. Disney knows to take visitors' minds off the queue and put it on to something else. When we are entertained, time flies.

Secondly, they took advantage of mobile phones. Nearly half of the world's population has a phone. Why not make use of them in combination with digital signage?

On some lines for rides, the Disney queuing system asks clients to text jokes to a specified number. If their joke is selected, it will be read aloud in the live show that's to follow. It's a means of engaging customers.

Moreover, they made change in 2014 by introducing a smart phone app and magic band bracelets with chips that guests use to schedule ride times, character meet-and-greets, parade viewing.

In addition, by using Fastpass+ from home, guests can adjust their schedules 60 days before they arrive [2].

Fastpass+

Logistics in the organization of sports events

Generally, large events have a logistics team with various individuals monitoring various components of the event logistics. A national or international event may require liaising with various municipal or city councils, departments and

organizations, preparation of documentation required for traffic control, parking, security, and multi-modal transportation by road, rail and air; storage and control of materials and equipment; preparation of documentation required for import of the necessary equipment.

A great deal of athletes from many countries and a number of media members arrive in a host country. These people need equipment and goods to do their job, and the process of getting that material through customs and into the host country poses a logistical challenge. Specialized sporting equipment must be in perfect condition for competition, which means that it should be treated properly during transportation, unloading, and storage. To cut labor costs organizers rely on huge armies of volunteers.

In conclusion, it should be mentioned that logistics is not an industry that we talk about often, but it is an industry that affects our lives daily – even if we do not realize it.

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Brakes That Help You Steer

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Speed is known to be a critical factor in all road crashes. Driving is unpredictable and if something unexpected happens on the road ahead it is a driver's speed that will determine whether they can stop in time and, if they can't stop, how hard they will hit. That's why, reducing and managing traffic speeds is crucial to road safety.

In case of emergency braking, it is possible to lock one or several wheels of a car. So, the entire reserve on the wheel adherence is steered in the lateral direction. A locked wheel stops to perceive the lateral forces that hold the car on a given trajectory and slides over the road. The car loses handling and the small lateral force causes its drifting.

The anti-lock braking system (ABS) has a rather simple structure, it includes several basic elements such as rotation rate sensors, an electronic control unit and hydraulic ABS modulators.

Rotation rate sensors. These sensors determine the angular velocity of the wheel rotation and having received the information the electronic control unit decides to turn on the ABS. Today the principle of operation of the most common sensors is based on the Hall effect and for this reason simple induction sensors have become popular.

Electronic control unit. It is a computer, the "brain" of the entire system, it processes information from sensors and when a critical situation occurs, it activates actuators. Today a

single electronic unit is often used to control ABS, Automatic Slip Regulation (ASR) and other active safety systems.

Hydraulic ABS block. Usually the ABS includes a hydraulic unit that combines various components — valves, a pump, pressure accumulators, etc. Often this unit is called a hydraulic modulator because it creates a variable pressure in the system with a frequency of 15-20 times per second.

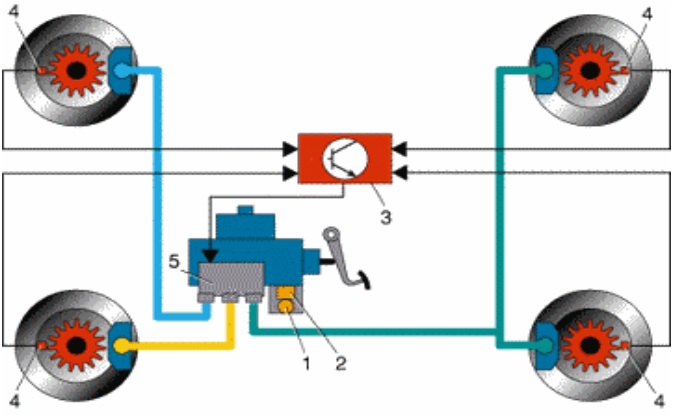

Fig.1 Anti-lock braking system

1) hydraulic pump; 2) pressure accumulator; 3) electronic control unit; 4) rotation rate sensors; 5) electromagnetic valve block

Principle of working. The work of the anti-lock system can be divided into three stages:

- The occurrence of a critical situation (the risk of wheel blocking) – the electronic unit makes a decision to turn on the hydraulic unit;

- The operation of the hydraulic unit - periodic increase and decrease in pressure in the brake system;

- The system turns off when the wheels are unlocked.

The ABS work principle is based on the measurement of speed and angular acceleration of the wheels, they are "one step ahead", i.e. a driver presses an accelerator pedal abruptly

and the system already "knows" that at the current speed brakes are likely to be locked and the system starts working. Nowadays, the development of modern anti-lock systems is aimed at improving the efficiency of its operation at all speeds.

How does the ABS work? In the event of a critical situation (the angular speed of the wheel is sharply reduced), an electronic unit turns on a hydraulic modulator, which first stabilizes the pressure in the wheel brake cylinder and then ensures the intake of pressure brake fluid. When the pressure drops (the exhaust valve opens, the brake fluid flows into the pressure accumulator) the wheel stops locking and turns at a certain angle, as the pressure raises the wheel slows down [1].

In conclusion, we can summarize that ABS is a system that prevents a vehicle from locking while braking. The main purpose of the system is to reduce the braking distance and ensure the controllability of the vehicle during the forced braking and to eliminate the possibility of its uncontrolled slip.

In most cases, the presence of ABS allows you to get a significantly shorter stopping distance than in its absence. In addition, the ABS allows the driver to maintain a vehicle control during the forced braking, i.e., it remains possible to perform quite sharp maneuvers during the braking process. The combination of these two factors makes the ABS a very significant advantage in ensuring the active safety of vehicles.

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Inception Project

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In the 21st century, people are used to face with 3D technologies in different spheres. However, this is not the limit of virtual reality development.

The project called Inception is going to improve 3D laser survey, data reception and processing. The slogan is “Forever. For everybody. From everywhere”.

The word *Inception* means ‘beginning, emergence’. This is connected to the project’s historical value. Scientists and IT-specialists want to create 3D models of European cultural heritage like buildings, artefacts and other sites. All the models will be placed on platform called Heritage Building Information Model (HBIM) (‘forever’) [1].

Because of developing visualization and analysis technologies for 3D modelling, the platform will be accessible for engineers, scientists and common people on every hardware (‘for everybody’).

New software and technologies will be tested at different cultural heritage sites. In the future, the technology will be applicable across Europe (‘from everywhere’).

The main aim of the project is to replace the models into augmented reality, which will become accessible for every device.

The project was created in University of Ferrara, Italy and has quickly found sponsorship. It has full support from Stakeholder Panel that represents interests of UNESCO, different public institutions. NGOs in field of culture.

Inception has three main objectives:

1) To make historical heritage understandable for everybody by collaborations across variable sectors, disciplines and tools. Accessing, Understanding, and Strengthening European identity through its rich cultural heritage. In the nearest future AR and VR will be easily read on mobile devices. European cultural identity will be opened for scientific and common-users research. It may help to make our history more popular and open education and business opportunities.

2) To optimize and develop cost-effective hardware and software for rapid capturing and processing of data. Nowadays 3D technologies are still not enough portable, affordable and perfect. In the aim of project is to make this processes more automated: smart handling of nonconventional characteristics, location and geometries.

3) To create an open-standard Semantic Web platform for easy sharing, accessing and work with digital models. It includes making high quality and interoperable 3D models made of results from 3D survey; implementation of new APLs (Application Programming Interfaces) without compromising quality and functionality. So the project establishes 3D digital model-based documentation of cultural heritage that will be disseminated online as well as through on-site and off-site demonstrations by educational, cultural and governmental institutions, which are directly engaged in the inception Stakeholder Panel [2].

The project has been developing for 4 years. The project consists of eight inter-dependent work packages (WP). They are numerated and work with different sides of Inception:

WP1 – Data about user requirements on cultural heritage knowledge.

WP2 – 3D data acquisition and hardware enhancement. Second package has information about technology development/capturing and acquisition.

WP3 – BIM semantic modelling and software applications for Heritage usability.

WP4 – INCEPTION platform for sharing Heritage BIM models.

WP5 – Includes use cases and demonstrations.

WP6 – Works with deployment of 3D models in user applications.

WP7 – Education, knowledge dissemination and exploitation.

WP8 – Project and scientific management.

Inception has an ambition to strongly support the development of a pan-European approach to data usage; to popularize and promote European culture and values; to make their research available for common users and specialists; to improve 3D technologies so that augmented reality will be accessible on each device [3].

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УДК 636.04

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The Influence of Animals on People

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During the last decade it has become more widely accepted that pet ownership and animal assistance in therapy and education may have a multitude of positive effects on humans. Among the well-documented effects of human-animal interactions (HAI) in humans of different ages, with and without special medical, or mental health conditions are benefits for: social attention, social behavior, interpersonal interactions and mood; stress-related parameters such as cortisol, heart rate, and blood pressure; self-reported fear and anxiety; mental and physical health, especially cardiovascular diseases.

At present, animal assistance in therapy, education, and care has greatly increased. Today, the value of animal-assisted interventions (AAI), including animal-assisted therapy (AAT) is widely acknowledged. In the light of the rapid development of the practice of AAI, research evaluating the effects of AAIs seem to lag behind. Still, there is already quite a body of scientific literature on this topic. Further an overview of studies assessing effects of AAI as well as pet ownership which meet certain scientific criteria will be provided [1].

Effects of Human-Animal Interaction:

1) *Effects on social interaction.* Interacting with animals influences social interaction between humans and related factors important in this respect, such as trust, empathy, aggression, and a positive mood.

2) *Increased positive social attention from others and stimulation of social behavior.* A relatively large body of research investigated the effect of a friendly animal on the perception of the human in its company and on the stimulation of social behavior. Interaction with an animal is a form of social behavior. For example, children with pervasive developmental disorders (including autism) were more playful in interaction with a live dog compared to toys, and also more aware of their social environment in the presence of the dog.

In 2009 Kramer investigated visits by a person alone, in the company of a dog, and in the company of a robotic dog (AIBO) in female nursing home residents with dementia. The visit of a person with a live dog as well as a robotic dog led to more social interaction than the person alone.

3) *Increased trust and trustworthiness.* Schneider and Harley (2006) asked college students to rate the trustworthiness of two different psychotherapists, each of them depicted once with a dog present and once without the dog in a video. When the dog was present, participants, reported more general satisfaction with the therapist as well as more willingness to disclose personal information.

4) *Reduction of aggression.* Only few results point to the potential of the presence of a friendly animal to reduce aggression in humans. In two studies, effects of the presence of friendly dogs on aggressive behavior in a classroom. In the presence of the dog, in comparison to its absence, aggressive behavior was decreased.

5) *Reduction of depression and promotion of a positive mood.* In their meta-analysis Souter and Miller (2007) conclude that animal-assisted interventions (AAT) have the potential to significantly reduce depressive symptoms.

Elderly residents of an institution experienced a reduction in depression and improvement in quality of life when caring for a canary for a period of 3 months. A companion bird also

reduced depression in elderly adults after admission to a skilled rehabilitation. Also in children and adults with physical or mental health problems animal contact can improve mood. Nathans-Barel (2005) found that a 10-week AAT-program for patients with chronic schizophrenia improved the mood in comparison with a group without AAT.

6) *Effects on blood pressure, heart rate, and heart rate variability.* In 1983 Friedmann investigated the effect of the presence of a dog on children while they were reading or resting. Blood pressure was lower when the dog was present during the entire time than when the animal was just introduced during the second half of the observation time.

Overall, most of the studies show that the presence of friendly animals, both familiar or unfamiliar, can effectively reduce heart rate and blood pressure or buffer increases in these parameters in anticipation of a stressor. These effects may even be stronger with one's own pet.

7) *Effects on anxiety and pain, reduction of fear and anxiety and promotion of calmness.* Several studies investigated whether animal contact can reduce fear and anxiety elicited by a stressor. In 2003 Shiloh first showed participants a live tarantula spider and indicated that they might be asked to hold it later on. Participants were randomly assigned to five groups, and instructed to pet either a live rabbit, a live turtle, a toy rabbit, a toy turtle, or to just rest. Only petting a live animal, but not a toy animal reduced self-reported anxiety.

8) *Effects on learning.* Little research addresses animals' positive effects on learning in children. In a series of studies, Gee and colleagues investigated the effect of the presence of a dog on children performing different tasks. A group of developmentally delayed and a group of normally developed children performed faster in a motor skill task with the same accuracy when a dog was present than when no dog was

present. According to the authors, one explanation could be that the dog served as an effective motivator, another that the presence of the dog led to increased relaxation and a reduction of stress during execution of the task thus increasing speed of performance.

9) *Effects on human health and restoration.* Already in the 1980s researchers tested the idea that pet ownership is good for the owner's mental and physical health.

In 1999 Headey and his colleagues found that dog and cat owners paid fewer annual doctor visits and were less likely to take medication for sleeping problems than non-pet owners. It was also found that pet-owning couples showed better mental and physical health than those not owning a pet.

Many of these studies generally suggest that companion animal owners have better health than non-animal owners, as indicated by medical markers such as cholesterol levels, or indirectly, via the frequency of doctor visits. However, these correlative studies do not allow making a causal connection between pet ownership and health [2].

It needs to be mentioned here that obviously the reported studies worked with an optimal setting. Stress-reducing and calming effects of dogs cannot be expected in people with a dog phobia. This self-selection limits the generalization to the entire population.

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Energy from Water

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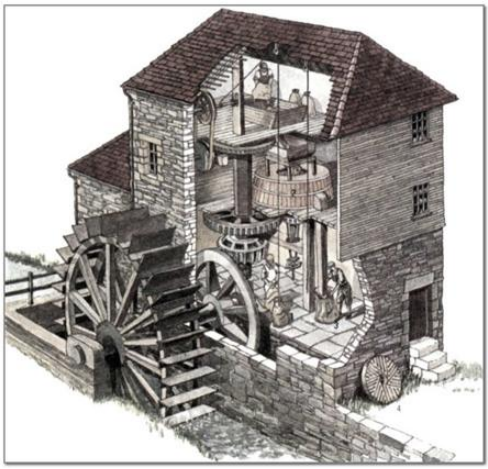
Rivers often start as small trickles of rain water or melting snow high in the mountains. Responding to the pull of gravity, the trickles flow downhill. They merge into larger and larger channels. High in the mountains, a river has a great store of potential energy. As it flows downhill, this potential energy changes into kinetic one. A bladed wheel mounted over a river or stream can be used to harness the water's energy. During the 1800s such water wheels were employed to run machines. Today water turns the turbines of electric generators that produce electricity. Electricity produced by flowing water is called hydroelectricity.



Water Wheel

Hydroelectricity has two main advantages. It produces very little pollution. And water in nature is never really used up. Liquid water does evaporate. But water vapor rises into the air, condenses into clouds, and returns to the earth as rain or snow. However, hydroelectricity can sometimes cause a problem. In certain areas, dams have killed species of water animals and plants by interrupting the natural flow of water. This interruption can sometimes interfere with the reproductive cycles of these living organisms (for example, salmon). The problem can be prevented by careful study of river life before a dam is constructed. For instance, a lot of dams are now being built with the help of fish ladders. These structures provide a way for fish to swim around a dam. Thus, the dam does not interfere with the activities of the fish.

Another way that can be used to produce electricity is a geyser. The latter shoots out jets of steam from water that boils naturally underground. Underground water in a geyser is boiled by geothermal energy. Geothermal energy is heat inside the earth. Heat is energy transferred between materials that have different temperatures. Energy is transferred from rocks to water trapped below the surface. The water heats up and can change into steam. When steam forms, pressure builds up until it is released as a geyser. Geothermal energy can be tapped by locating underground areas where steam or very hot water is trapped. The steam or hot water, once located, can be pumped out and used to turn turbines.

The ocean becomes another important source of electricity. Sea water can provide vast amounts of a fuel, such as hydrogen. Water is made of hydrogen and oxygen. The process by which hydrogen is separated from the oxygen in water is electrolysis.

Hydrogen can be used in place of fossil fuels to heat water and produce the steam for turning turbines. Unlike fossil fuels, hydrogen produces no pollution when it burns. Burning

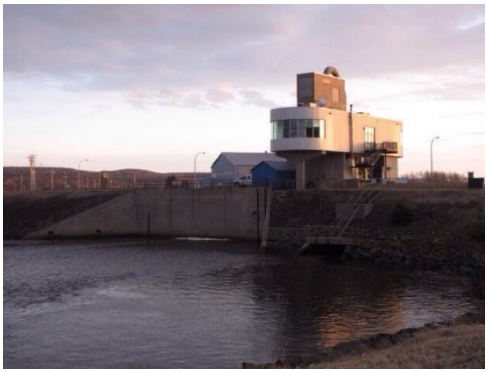
hydrogen produces ordinary water. However, hydrogen can burn explosively unless it is carefully controlled. A problem with using hydrogen from the ocean as a fuel is that electrolysis requires energy. It takes electricity to separate hydrogen from water. If applied to a large amount of ocean water, electrolysis would require a great deal of electricity. As yet, no effective means of providing electricity for this process has been perfected. In many cases, it would take more electricity to get the hydrogen than the hydrogen could provide when it is burned. However, research is continuing.

The tides are still another source of electricity. The incoming and outgoing flow of water can be used to spin the blades of turbines. The spinning turbines and alternators then generate electricity.

The tidal power plant built across the estuary of the La Rance River in Brittany, France has an installed capacity of 240 MW distributed between 24 bulb-type turbine generators, each with the capacity of 10 MW. In a world first for this resource of renewable energy, it produces around 500 GWh/year [1].

La Rance Power Plant, France

Another such hydroelectric power plant is located on the Annapolis River in Nova Scotia, Canada. North America's only salt water generating station can make as much as 20 MW of electricity and has a daily output of roughly 80-100 MWh, depending on the tides. It is also a tourist center that lets you witness the incredible power of the Bay of Fundy's world-renowned tides [2].



Annapolis Tidal Power Plant, Canada

There are a lot of advantages of using tides to generate electricity: tides are a perfectly predicable phenomenon, they are inexhaustible and carbon-free, and they have low environmental impact.

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УДК 620.95=111

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Biomass Energy

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Solar collectors, solar panels and solar cells are known to trap the sun's energy. Green plants do much the same thing. They trap the solar energy in a process called photosynthesis. It is the chemical reaction by which plants make food from carbon dioxide and water in the presence of light. In the action, solar energy is changed into stored chemical energy in the food. This energy is passed on to animals when the plants are eaten.

Biomass includes plants, animal wastes, and all other organic matter that can be used as a source of energy.

The amount of garbage produced all over the world is staggering. The average person produces more than 1,500 grams each day. This garbage is actually a treasure chest of energy. It contains much animal waste and other forms of biomass. The solid wastes of large cities are said to contain enough energy to light homes and businesses across the country for an entire year. The problem is how to get the energy from solid waste.

One way to release energy from solid wastes is to burn them. Before solid wastes can be burned, however, they must be processed and dried. In some countries, farmers have been processing such wastes for use as fuel for centuries. They simply dry solid animal wastes in sunlight.

In a modern waste treatment plant, solid wastes are processed so that they can be burned. Then the energy from the wastes is used to produce steam for an electric generator. The

process releases waste gases that pollute the air. However, the plant helps dispose of the wastes by scrubbing. The latter is a way of cleaning waste smoke by using water. Water is sprayed into the smoke, dissolving some of the polluting gases.

Much solid waste material is dumped into landfills. Here bacteria take in and digest the waste. The bacteria then give off natural gas, which is made largely of methane.

Methane is a greenhouse gas. Some farmers collect methane gas from animal waste. The methane can be pumped into the mains gas system, where it goes to houses for cooking and heating. Scientists are looking for ways to obtain more methane from landfills and dump sites. Doing so would also help solve a waste-disposal problem.

The People's Republic of China has experienced an energy shortage for many years. People there have found a way to combat the shortage. They put organic wastes into hole called a "biopit." There, bacteria change the biomass into methane. The methane is collected and used as fuel [1].

Alcohol is a clean fuel that burns with a bright, hot flame. The source or alcohol is biomass.

Ethanol (ethyl alcohol) is an alcohol being tested for use in fuel for cars. It is produced by fermentation. It is a process by which living yeast cells change sugar into alcohol and carbon dioxide. The sugars in corn and other grains are used in the process. They give ethanol its common name, "grain alcohol" [2].

Ethanol is mixed with gasoline in a fuel called gasohol. It has been used in gasoline engines to help conserve fossil fuel. However, the alcohol used must be very pure. Purifying the alcohol takes energy. As a result, gasohol is expensive.

Farming is becoming an important step in energy production. For example, if you visit Brazil, you may see its "fuel farms", fields of sugar cane with fermentation plants and storage tanks. Brazil has only a small oil supply. Cars in that

country run on gasohol. The ethanol used in the gasohol comes from the fermentation of sugar cane on the fuel farms.

Water crops are becoming important as energy sources. For example, scientists are considering harvesting kelp for energy. Kelp is a fast-growing water plant. Kelp plants grow well in the ocean. Under good conditions, a giant kelp can grow 60 to 90 cm in one day. Kelp plants are sources of biomass. The action of bacteria on the remains of these plants yields methane gas. A research test farm with giant kelp is in operation off the coast of southern California. Scientists are trying to learn more about the effects of kelp farming on the environment [3].

The water hyacinth is another fast-growing water plant that is being studied as a source of biofuel. These plants are especially interesting to scientists because of their unique diet. Water hyacinths feed on raw sewage. As they feed, they clean up the water around them. So these plants are valuable on two accounts. They may be sources of fuel. And they are agents in the fight against pollution.

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Extraordinary Power Lines

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In the context of energy, supply is the process of bringing energy from the point of creation, such as a power plant, all the way to the point of consumption at a home or business.

The process of energy creation starts by collecting the source, whether it be a traditional fossil fuel or a renewable source, such as wind or solar. Energy can be harnessed from these sources in a number of ways. For example, a power plant can use a furnace to burn fossil fuels to release energy. Or turbines can be used to turn renewable energy like wind into energy that can be used to power our homes [1].

After the energy is created, it is distributed to consumers. Power lines span thousands of kilometers, carrying electric energy from generators to cities. Some of the electric energy travelling in the lines is changed into heat due to the wire's resistance. This heat is wasted.

One way to prevent such waste is to send low currents through power lines. In order to transmit useful amounts of electric power using low currents, thousands of volts are required. However, most generators produce much lower voltages. Such voltages result in wasted energy.

However, electric energy from a generator is usually conducted to a transformer. The latter is a device that changes voltage. A transformer near a generating station increases voltage. At the same time, the current is lowered so that waste is avoided. The high-voltage electricity is then sent through power lines to our homes.

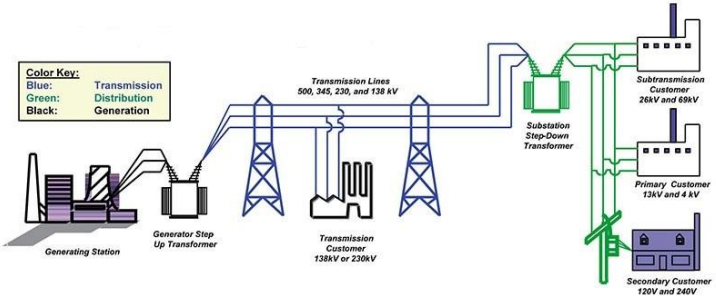
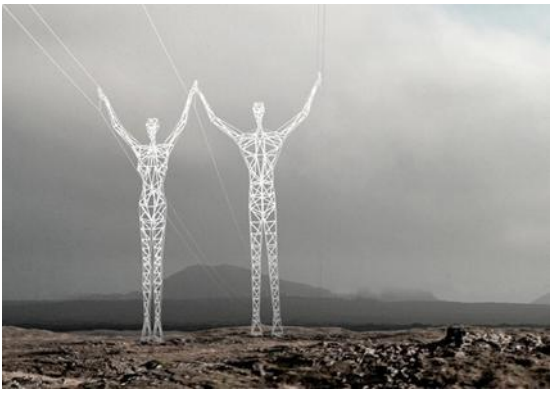


Figure 1: Basic Structure of the Electric System

High voltages, however, are dangerous. As a safety precaution, high-voltage power lines are held high above the ground on steel wires. Before the electricity reaches your home, it first reaches a power distribution station. Here the electricity flows through another kind of transformer. The latter lowers the voltage to safer levels. From the power station the electricity is sent to consumers. Before entering our homes, the electricity passes through one more transformer. This transformer lowers the voltage to 220 volts. This level is safe for household circuits.

Overhead lines run above the ground and are installed on pylons of various shapes. The selection of the pylon form depends on the necessary number of systems and the features of the environment where the pylon will stand [2].

The architects from Choi+Shine turned boring electricity pylons into majestic human-shaped statues in Iceland. They created the original project the Land of Giants and proved that even a simple industrial object can be turned into an example of art design. The idea came to the designers from their long car journey from Boston to Montreal. It was about five or six hours of driving and they got bored seeing only monochromatic landscape. The car was fast-moving and they couldn’t perceive all the objects from the eyes of travellers.



The Land of Giants, Iceland

Transmission towers reminded them of living gigantic insects or some mythical creatures. So, they decided to transform transmission towers into open structures and they gave more legible and figurative form to power lines that are now very familiar with the form of human beings. The architects wanted to share their thoughts, ideas and feelings with other people and they managed to do it. One of the Italian newspaper called their invention "a poem to the eyes". Undoubtedly, the goal of these constructions is to attract more tourists to Iceland from all over the world [3].

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УДК 620.97=111

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Inexhaustible Resource: Solar Power

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The main source of energy that powers the earth is the sun. On a clear day, about 150 J of direct light energy hit one square meter of earth each second [1].

Solar energy is changed into heat energy when sunlight hits the molecules in a material. The light energy is changed into the increased kinetic energy of the molecules in the material. The sun's energy also heats the atmosphere. It causes large movements of warm air masses. The sun's energy is part of a complex system in the atmosphere that creates winds and weather. The sun's light energy can evaporate large amounts of water from the oceans. This evaporated water eventually falls back to earth as rain. The rain collects in lakes high above sea level. The solar energy ends up as the stored potential energy in the lake's water. As the water flows back down, electric energy can be generated in a hydroelectric power station. Sunlight can also be changed directly into electric energy with a solar cell.

The energy on the earth comes from the sun. Energy is not created or destroyed. It just changes from one kind into another. Energy is always conserved! Sometimes the sun's energy is stored for millions of years before it is released. Gasoline, natural gas, oil and coal are called fossil fuels. Fossil fuels are plants that have been compressed for millions of years. Ancient light energy is stored in fossil fuels. The stored energy is changed into heat energy as the fuels are burned in a car engine or home furnace.

Energy consumption has increased immensely in the last decades. We have been burning up our supply of fossil fuels at an alarming rate. Industries and new technologies have grown rapidly. As they grow and expand, so does the demand for energy to run them.

There is a problem with large amounts of energy we use. The energy that is used does not disappear. It ends up as useless heat energy. Thermal pollution is a new problem on the earth. As our atmosphere, lakes, and rivers become hotter, changes in weather patterns will occur. Because of these changes, our way of life will also change.

Other sources of energy are being developed to replace the dwindling fossil-fuel supply. The sun is a huge and largely untapped source of energy. Science and technology are working together to find new and better ways to use energy from the sun. Solar energy is being used for heating and cooling homes. Use of solar energy can conserve fossil fuels and reduce air pollution.

The solar-heated house absorbs heat from the sun by using collector panels. These panels have black energy-absorbing surfaces covered with glass or clear plastic. They are attached to pipes that circulate air or water throughout the house. The dark surfaces of the panels absorb solar energy and heat the air or water in the pipes. The heated materials transfer energy throughout the building. Solar energy must be stored for use at times when it cannot be collected. Tanks of water and beds of large pebbles are two common methods of storage [2].

Energy is required to run air conditioners. Most air conditioners get this energy from electricity. The energy runs the refrigeration generator. The latter cools air by evaporating and then condensing a circulating liquid refrigerant.

A solar cell converts solar energy directly into electricity. The conversation of sunlight into electricity is called the photovoltaic effect.

A major advantage of using solar energy is that it is clean. Solar energy produces little or no waste material. So it does not cause air pollution or waste disposal problem. Another advantage: energy from the sun is not going to run out for many years to come.

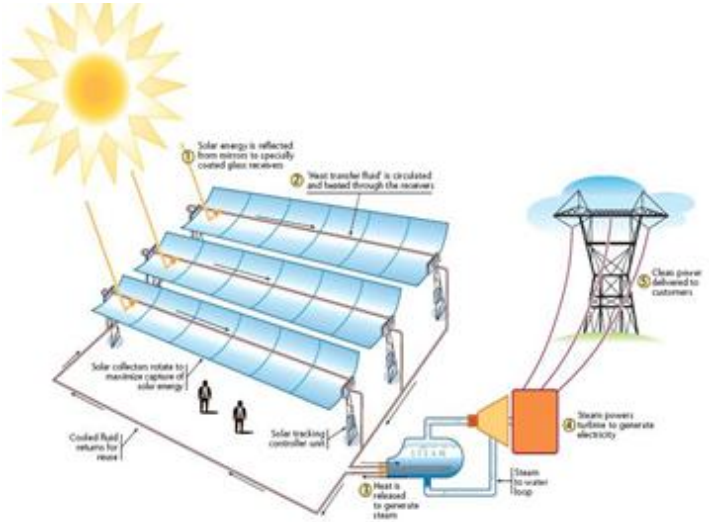

Figure 1: Solar Thermal Parabolic Technology

The solar energy plant uses a giant curved mirror to focus the sun's rays. The focused rays are used to heat water in a boiler. The energy produces steam. The steam, in turn, drives a turbine in a generator. The spinning turbine enables the generator to produce electricity.

A solar cell is two layers made largely from the element silicon. When the sun shines on the cell, electrons are released from the lower layer. These electrons are collected by one surface of the cell. The electrons can then travel through a path, a circuit, made of metal grids. This flow of electrons through a circuit is an electric circuit. By connecting many solar cells,

one can increase the amount of current produced. Groups of solar cells have been used for communication and transportation [2].

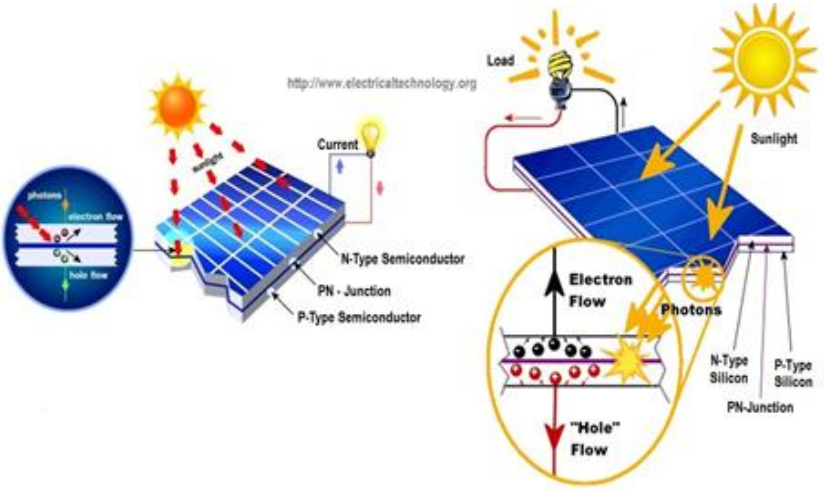

Figure 2: Basic Operating Principle of a Solar Cell

However, using solar energy does have some disadvantages. It can be collected only when the sun is shining. The cost of installing solar heating and cooling systems is high. But once the systems are in operation, they save on fuel. Solar cells are also expensive at present. Scientists are searching for less expensive ways to produce solar cells.

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УДК 62-83

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Overview of Electric Drive Systems of Domestic Woodworking Machines

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Domestic woodworking machines are an important part of home workshops. Domestic machines are distinguished by industrial several important features: 1) domestic machines usually have low power; 2) these machines usually require lower regulation of mechanical quantities; 3) at home workshops there are usually no three-phase 400 V grids, which means that the machines are designed to be powered from a 230 V single-phase grids.

All of these features led to the use of those electric drive systems that are currently used in domestic woodworking machines. The most common currently unregulated electric drive is based on single-phase capacitor asynchronous motors. In machines, where speed control is not required, the transmission of torque from the electric motor to the working body is carried out through mechanical transmission with a constant gear ratio (gear, chain and belt drives). There are also direct drive circuits.

In the case when, under the conditions of the technological process, it is necessary to regulate the speed of the working mechanism, transmission mechanisms with variable gear ratio (gear boxes, belt drives with a set of pulleys, belt variators) are used. The main disadvantage of such drive circuits is the inability to control smoothly the speed of the actuator, as well as the impossibility of using an automatic control system (ACS). The advantages of these schemes are

ease of implementation, reliability, low cost and maintainability [1].

In the case when the machine requires the regulation of the speed of the main movement, an adjustable electric drive is used based on the "frequency converter - asynchronous motor" system [2]. These systems are the most common on machine tools with computer numerical control (CNC). In such systems, a gear unit with a constant gear ratio is used, and the speed is controlled by varying the frequency of the supply voltage in the frequency converter. Using a frequency converter allows to adjust smoothly the speed of an electric motor (usually, the frequency change step is no more than 0.1 Hz, which corresponds to adjusting the speed of the electric motor in increments of 6 rpm or less, depending on the number of motor poles). The main disadvantage of this scheme is the high cost of the electric drive system due to the presence of a frequency converter.

Another promising type of an engine for using in domestic machines can be called motors with excitation from permanent magnets. Electric drives based on such engines include, in addition to the engine itself, also a semiconductor energy converter and a rotor position sensor. They are divided into the permanent magnet synchronous motor drive system (PMSM), where the position of the resulting vector of the magnetizing armature force F_a relative to the rotor position is controlled continuously, and the system brushless DC motor (BLDC), where the position of the F_a is discretely controlled [3]. At present, such motors are excited by magnets based on neodymium – iron – boron alloys (Nd – Fe – B) and ferrites. In woodworking machines, the most advantageous is the use of the BLDC system, since scalar control is used to control the electrical variables in the BLDC. The main advantages of such a system are the absence of losses in the rotor and a greater

allowable torque of the electric motor. The main disadvantage is the high cost.

Precision woodworking machines also find limited use of the feed drive based on stepper motors. Stepper motors are a good solution in systems with high positioning accuracy requirements. A stepper motor is a brushless DC electric motor which position can be set to move and hold at one of these steps without any position sensor for feedback. The stepper motor is known by its property to convert a train of input pulses (typically square wave pulses) into a precisely defined increment in the shaft position. Each pulse moves the shaft through a fixed angle.

Stepper motors have multiple "toothed" electromagnets arranged around a central gear-shaped piece of iron [1]. To make the motor shaft turn, first, one electromagnet is given power, which magnetically attracts the gear's teeth. When the gear's teeth are aligned to the first electromagnet, they are slightly offset from the next electromagnet. This means that when the next electromagnet is turned on and the first is turned off, the gear rotates slightly to align with the next one. From there the process is repeated. Each of those rotations is called a "step". In that way, the motor can be turned by a precise angle. Advantages of stepper motor are precise positioning, low cost for control achieved, high torque at startup and low speeds, simplicity of construction, low maintenance etc. The main disadvantages are susceptibility to resonance, difficulty of working at high speeds, low power density.

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Renewable Solar Energy: Hydroelectricity, Wind and Solar Power

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Renewable sources account for rapidly growing shares of power generation in most parts of the world. Globally, running water is still the dominant renewable source of electricity in terms of generation, but the sum of solar PV and wind power could, according to some projections, grow already in the late 2020s or early 2030s. Global hydro power generation increased by an average of 2.4 % per year between 1990 and 2015 [1]. Growth was highly uneven across countries and regions. Whereas Chinese generation increased by more than 9 % per year, OECD area generation was up by a mere 0.6 % per year [2].

Hydro has the advantage of being dispatchable, i.e., adjustable to accommodate fluctuations in demand. In a global warming conscious world, hydro should therefore have a bright future. However, hydro generation has levelled out, and is expected to play only a supporting role in reducing greenhouse gas emissions, for three main reasons; the best resources close to demand centres have in many cases already been developed, hydro generation costs have not declined along with other renewable generation costs, and finally, large-scale hydro power projects have become increasingly controversial due to their social and environmental impact.

In cost terms, large-scale hydro compares well. But whereas the costs of solar PV and wind have declined in recent years, those of hydro have gone up. This development is likely

to continue. Learning curve analysis suggests that solar PV and offshore wind have significant remaining potential for cost reductions. Hydro is a mature technology with little potential left. On the contrary, as hydro developers are forced towards lower quality resources further away from demand centres, unit costs may increase further.

Wind and solar photovoltaic power have been the renewable energy growth stories "par excellence" in recent years. About two thirds of total capacity is utility scale, along with that made up of factory, office and residential rooftop panels. Global onshore wind capacity increased from 116 GW to 416 GW for 11 years, implying an average growth of 18 % per year [3]. Global offshore wind is still at 19.3 GW or 4 % of total wind capacity, a small sibling in the family of renewable power technologies, but a growth of 33% per year between 2008 and 2017 suggests a potential for significant market capture. Solar photovoltaic and wind generation capacity account for 5.1 % and 8.5 %, respectively in global total generation capacity as of 2017 [1].

The reasons for the rapid growth in wind and solar photovoltaic generation since 2010 are government support and falling costs. They are highly interconnected in that the support has stimulated technology development, allowed for economies of scale, attracted more actors to the playing field and boosted competition. Now governments are reassessing, modifying and in some cases winding down support arrangements. The feed-in tariffs, tax breaks and other incentives that are available have become fiscally burdensome, and in some cases created electricity supply-demand imbalances, calling for power system optimisation and better regulation, rather than continued propped-up growth in zero marginal cost electricity supply. The consequences for wind and solar photovoltaic remain to be seen, but few observers envisage long-term set-

backs for either technology, rather a natural moderation of growth rates.

The standard metric for comparing power generation costs is the socalled levelized cost of electricity (LCOE), which means the sum of investment costs, operating and maintenance costs, fuel and carbon costs (if relevant) and financial costs over the lifetime of a power plant, divided by anticipated output and discounted to present day values. Competitiveness in LCOE terms is not the only variable relevant for investment decisions – there are cost items that are not captured by the LCOE, and some technologies have more flexibility to generate when prices are favourable than others. Relative LCOE developments are nevertheless key signposts to the future shape of the power sector.

The wind and solar photovoltaic LCOE reductions over the last decade or so, and expectations of more of the same, have turned outlooks for power sector decarbonisation even in the most fossil fuel reliant regions, which used to be outlier scenarios, into baseline forecasts.

LCOE estimates vary significantly, depending on underlying assumptions, and are typically presented as ranges to account for differences in national and site-specific cost drivers, but most recent overviews show well-located onshore wind power plants as the cheapest of all options, and utility-scale solar photovoltaic plants to be competitive with most new coal and gas plants. And whereas the capital and operational costs of fossil fuels are flat, and those of nuclear and large-scale hydro plants are up, those of new renewable electricity are still pointing down. The pace of cost declines has abated, but the learning curve rule of thumb, saying that costs drop by 20 % for every doubling of capacity, suggests possibilities of additional declines in double digit territory, especially for solar photovoltaic.

Recent power auction prices convey the same message. Bid rounds have been won at prices below recent published average LCOE estimates, suggesting expectations of favourable electricity price, carbon price and/or cost developments between now and the time of commissioning, and probably that bidders consider they have exit options if these expectations are not met. Renewable power players' growing preparedness to take on "merchant" risk has been visible in recent offshore wind bid rounds. Offshore wind typically enjoys more stable wind conditions allowing for higher capacity factors, and represents an answer to the growing "Not in My Backyard" reservations against onshore wind.

The electricity price impacts of increasing shares of electricity available at zero marginal costs, in total supply, have prompted calls for regulatory reform and new power sector business models. There are fears of increased price volatility around depressed levels disincentivising investments in services that are crucial for uninterrupted supply. Unless the current mis-match between price signals, power plant dispatching principles and system long-term needs are handled, it could conceivably derail or at least slow the ongoing de-carbonization of electricity supply.

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Computers

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Computer is an electronic device that can receive a set of instructions called program and then carry them out. The modern world of high technology could not be possible without computers. Different types and sizes of computers find uses throughout our society. They are used for the storage and handling of data, secret governmental files, information about banking transaction sand so on [1].

Computers have opened up a new era in manufacturing and they have enhanced modern communication systems. They are essential tools in almost every field of research, from constructing models of the universe to producing tomorrow's weather reports. Using of different databases and computer networks make available a great variety of information sources [2].

The first computers were developed during the Second World War to break the codes or send secret information. They were also used to do calculations for the first atom bomb. Generally, all that computes do is calculate. They turn numbers into pictures, words and sounds. The Japanese have already created the device which responds to human language.

Computers have opened a new era in many spheres of life, especially in manufacturing and communication systems. The word “computer” was first used in 1613 in a book, written by English writer. It referred to a person, who carried out calculations. Soon the first mechanical calculator was invented by Blaise Pascal. However, the actual father of the first

recognizable computer was Charles Babbage. In the first half of the 19th century he created a fully programmable mechanical device. The sophisticated analog computers appeared in the 20th century. First functional computer was called Z1 and was created by Konrad Zuse [3].

Unlike the analog computer, which operates on continuous variables, the digital computer works with data in discrete form – i.e. expressed directly as the digits of the binary code. It counts, lists, compares, and rearranges these binary digits, or bits, of data in accordance with very detailed program instructions stored within its memory. The results of these arithmetic and logic operations are translated into characters, numbers, and symbols that can be easily understood by the human operator or into signals intelligible to a machine controlled by the computer.

Digital computers can be programmed to perform a host of varied tasks. The hybrid computer combines the characteristics and advantages of analog and digital systems; it offers greater precision than the former and more control capability than the latter. Equipped with special conversion devices, it utilizes both analog and discrete representation of data.

Computer memory is a physical device that is used to store such information as data or programs (sequences of instructions) on a temporary or permanent basis for use in an electronic digital computer. The memory of a typical, digital computer retains information of this sort in the form of digit 0 and 1 of the binary code. It contains numerous individual storage cells, each of which is capable of holding one such binary digit (or "bit") when placed in either of two stable electronic, magnetic, or physical states corresponding to 0 and 1 [4].

Most digital computer systems have two levels of memory – the main memory and one or more auxiliary storage

units. Besides the main memory, other units of the computer (e.g., the control unit, arithmetic- logic unit (ALU), and input / output units) also use transistor circuits to store electronic signals. The flow of electric current through the transistors in memory units is controlled by semiconductor materials.

Semiconductor memories utilizing very-large-scale integration (VSLI) circuitry are extensively used in all digital computers because of their low cost and compactness. Composed of one or more silicon chips only about a quarter of an inch in size, they contain several million microelectronic circuits, each of which stores a binary digit. Semiconductor memories provide great storage capacity but are volatile, i.e. they lose their contents if the power supply is cut off [5].

A computer must be given instructions in a "language" that it understands – that is, a particular pattern of binary digital information. On the earliest computers, programming was a difficult, laborious task, because vacuum-tube ON-OFF switches had to be set by hand. Teams of programmers often took days to program simple tasks such as sorting a list of names. Since that time a number of computer languages have been devised, some with particular kinds of functioning in mind and others aimed more at ease of use – the "user-friendly" approach. Unfortunately, the computers own binary-based language, or machine language, is difficult for humans to use. The programmer must input every command and all data in binary form, and a basic operation such as comparing the contents of a register to the data in a memory-chip location might look like this: 1100101000010111 11110101 00101011. Machine-language programming is such a tedious, time-consuming task that the time saved in running the program rarely justifies the days or weeks needed to write the program [6].

Computers are very useful and necessary in our lives. I think that a computer is the very important machine.

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Social Networks and Their Influence on People

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About 40 % of the population in the world use social networks. On average we spend on them about 2 hours a day. If social networks play such a big role in our life it is important to understand how they affect us.

There are some advantages and disadvantages of using of social networks. I will start with disadvantages.

Stress. Social networks are the place where people express their negative. Moreover women are more likely to be stressed by social networks, because they constantly remind them of unpleasant moments in lives of other people. Among men this effect was not observed [1].

Low self-esteem. People in social networks are rarely honest with others. There are a lot of happy photos of weddings, holidays, career achievements. People compare their lives with happy photos of other people and begin to envy them. Interesting, that viewing your own account increase your self-esteem.

Procrastination. If you do not know how to control yourself, you can't make do yourself things which you have to do right now. For example Facebook users experience chronic sleep deprivation and this badly affects mental abilities.

Advantages. Life's satisfaction. People who use social networks primarily for communication are more satisfied with themselves and with life in general. Communication in social networks helps you to quickly get used to new teams, keep contact with old friends and relatives. As the 2010's studies

show, photo sharing and messaging improve relationships in families. Having friends increases your social capital, which gives you the realization of your own need and importance.

Finding a job. Social networks can be useful for careers. A correct Facebook page can be a big plus to your CV. The profiles help HR's of Russian and European companies help to make conclusion about the culture, interests and sociability of potential workers. Also as researches show that employees who communicate a lot with their colleges are more satisfied with job, because communication create a friendly and productive atmosphere [2].

Memory. Scientists from Beijing University explained positive impact of social networks on human's memory. According to the head of the experiments, people many years ago used diaries in which they described experience, memories and thoughts. Nowadays with the development of IT technologies social services replaced all paper records. Social Networks as Facebook, Twitter and Instagram helps to keep in memory the most important events [3].

To sum up I would like to tell you some tips which can help you to decrease bad influence of social networks:

1. You should determine how much time you spend on SN.
2. Make a special time when you will check SN. One half an hour in the evening or in the morning would be enough.
3. Don't check SN if you are bored. You should better read a book or speak with somebody.
4. Check the pages of only those people who are really important for you [4].

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УДК 316.3

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Six Degrees of Separation Theory

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In 1929 a Hungarian author Frigyes Karinthy wrote a short story called “Chains”. And in it, one character challenges the others to find another person on earth, that he cannot connect himself fewer than five intermediaries. This is the origin of six degrees of separation, which is also well known as a problem of small world. And if the theory is correct, we can be connected with Queen Elizabeth the second, Donald Trump, Johnny Depp and some man in Namibia Desert [1].

As the theory is widely accepted by more and more people, it is also considered as the motivation of online Social Network Services (SNS). Many Web 2.0 websites are based on the idea that the users would greatly increase their social capital simply because they would be able to know almost everyone on this planet within six steps of hops.

To begin with, a 'degree of separation' is a measure of social distance between people. You are one degree away from everyone you know, two degrees away from everyone they know, and so on.

What the theory really means is that we can pick two random people from different places on earth and they will be connected with six steps in average. And it was just an idea until 1960s when Harvard psychologist named Stanley Milgram attempted to test it. He called his attempt the small world experiment. What he did was he sent out 300 packages to people both in Boston and Nebraska. He wanted them to resend the package to a particular man in Boston, and they

weren't allowed to send it directly. They were allowed to send this package to a person, who, to his mind, has more chance to know the person. Most of packages lost their way, but 64 did it to the target in average 5.2 steps. On the one hand it's the evidence. Let's take a closer look: 100 people were living in the same city, other hundred had the same profession, and finally last hundred had nothing in common. Out of this hundred only 18 were delivered. So we think that 18 packages of 300 is all the evidence there was for six degrees of separation.

There were tries to build mathematical properties on this theory. For example, famous Hungarian mathematician named Paul Erdos tried to build a theory of networks like these. But he didn't have any information on structure of real social networks, so he decided to work on networks, where connections between nodes are all completely random. So, we could call it a small world network, but it doesn't represent real life well, since we have something like "I know my friend, and he knows his friend", so all notes must be connected one another, but also we have mutual acquaintances, so small number of connections can be wired randomly. And this network is called small world network [2].

So, many people tried to work with this theory from the scientific point of view.

In 2001, Duncan Watts, a professor at Columbia University, repeated Milgram's experiment on the Internet, using an e-mail message with 48,000 senders and 19 targets. It was found that the average number of intermediaries was around six.

In 2011 the most popular social network named Facebook also decided to test the theory. Joint experiment of Facebook and Milan University found that average number of degrees is even less than six, and equally about 4.74 [3].

Some people criticize this experiment because they think that not all people from list of friends in social network are our acquaintances.

Another cause of criticism is that during all experiments chain of people was broken many times, at different stages. But as experimenters states, the most often cause of chain breaks was that people refuse to continue chain [4].

After all these experiments even Microsoft became interested. Company analyzed more than 30 billion emails among 180 million people all over the world. The database covered all the Microsoft Messenger instant-messaging network in June 2006, equivalent to roughly half the world's instant-messaging traffic at that time. They considered two people to be acquaintances if they had sent each other a message. The Researchers looked at minimum chain length it would take to connect 180 million different people. The result was pretty shocking: 78 % of users can be connected in seven or fewer steps, but there were ones, who were separated even by 29 steps.

According to the last data this experiment was conducted 2 years ago. The point was to find a man with the help of social networks in 12 hours.

It became famous thanks to Alex Reserford from Masdar Institute of Science and technology in Abu Dhabi and social game “Tag Challenge”, which was held in 2012.

The goal was to find 5 men in 5 different cities of USA and Europe. The only information about every man was city, where he was located, his photo and that he was wearing a t-shirt with “Tag Challenge” logo. Alex Reserford and his team won this challenge by finding 3 of 5 men in just 12 hours [5].

The team of Alex Rutherford went their way, addressing personally those who can help in the search, based on geographical data and other information available on social

networks. According to the team leader, it is likely that with the right approach, finding the right person can be faster.

With the help of this work we tried to show main points and interesting facts about the theory. The idea of the theory becomes widespread and is used for experiments, plots of films, games, articles and issues, modeling social structures in various industries, including IT. And it's just exciting to know how we are all connected to each other, isn't it?

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Solid Perfume

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Until the beginning of the 20th century all perfume was natural without exception. Even Cleopatra-the greatest beauty of all women-had also become famous as a skillful creator of handmade perfume.

But rapid development of the chemical science and industry had adjusted the perfume sector and as a result the synthetic production had appeared. Apparently, synthesized aromatics had immediately allowed reducing the cost of product though its exclusiveness had been lost. The thing is that even if perfume made from the same flowers but they were gathered at different time they will obviously smell different, when at the same time the synthetic perfume of a particular brand will have a fixed aroma [1].

Solid perfume is very practical perfume option. Such a perfume has a creamy consistency, so it makes it easy to travel with. Unfortunately, it's not the easiest thing to find them in the store and even if you've succeeded the range is very poor. In this case it's easier to make them at home and using only natural products- bees wax, vegetable and essential oils.

The healing properties of natural scents have known for a long time. So that is why the handmade perfume not will only please you with its entrancing scent but they are capable to improve your health and mood. The process of making solid perfume gives you a freedom choice of natural essential oils [2].

The relevance of this topic lies in the fact that solid perfume is safe for your health and easy-to-use. The theory: let's say that making solid perfume is economically beneficial
The aim of our work is to study the method of making solid perfume from natural ingredients by yourself.

The Making process. First, you should make a foundation. For this measure the required amount of wax (paraffin) and base oil. In our case – one tablespoon of each ingredient. Put the wax into the heat-resistant tank. Then put the tank in water bath, in this way the ingredients will be melting. When the wax becomes fluid add the base oil-jojoba oil. Wait until all the ingredients become fluid, stir it carefully. Put off the fire. Add chosen essential oils-one or more. Stir again, put off the fire and while the mixture is fluid pour it into the container. In half an hour or so the mixture will become solid and ready to use. To get the perfume with an unusual scent you can mix different essential oils. The comparative characteristic of prices of ingredients and solid perfume.

Due to the analysis of online shops and internet websites was found that this type of perfume is not in great demand among producers. That is why there are only a few companies which produce them in small amounts and for this reason the price is rather high.

The price of essential oils varies from 2.5 rub per 10 ml to 11.5 rub.

Name	Weight(grams)	Price (bel.rub)
Paraffin (bees wax)	300	From 2 bel. rub.
Essential oil (bergamot)	25	3.5 bel. rub
Essential oil (grapefruit)	25	4 bel.rub
Essential oil (lemon)	25	4 bel.rub
Jojoba oil	25	2 bel.rub
Bottles	-	free
	total	15.5

We have made the perfume about 10 grams per can, 40 items in total. As shown in the table, it's more economically beneficial to make the solid perfume by yourself than buy the finished one. It must be noted that the scents will be simpler than made by producing company bought ones, but it will be your own scents [3].

To make your own solid perfume at home is quiet easy and affordable. The scents will probably be simpler than made by producing firms bought ones, but if you'll follow the technological mode you can create various interesting scents. The study helped to confirm the theory that making solid perfume at home is possible and has a financial benefit.

This perfume, made for your own self, has a persistent scent. This solid perfume don't have a trail of a scent, for this purpose you'd better use an alcohol based ones.

Solid perfume is practical and easy to use perfume variety which you can always take with you [4].

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The Value of Idioms

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Have you ever met such expressions as couch potato, fat cat and rolling stone? Would you like to understand them and use in your speech or you don’t even see the sense in it? Well, I’m here to open the tiny universe of one of the most interesting part of language – idioms.

In fact, idioms are a feature of each language. They represent a very interesting category of stable verbal combinations that often have semantic meanings that are completely different from the meanings of the words they consist of. Sometimes we can guess an idea of an idiom, nevertheless some idioms will remain a mystery unless their meaning is explored. Actually, translations of idioms as translations of proverbs, sayings from one language to another, often represent finding just expressions that are close in meaning. An important fact which must be mentioned is that idioms are not only colloquial expressions, as many people believe. They can appear in formal style and in slang. They can appear in poetry or in the language of Shakespeare and the Bible. Idioms seem often strange and inexplicable, but if you find out a little about their origin, then everything falls into place. For example, well known to everyone idiom “to break the ice”. It means “to initiate social interchanges and conversation”. Previously, when road transport wasn’t developed, the only way to transport goods over long distances was ships. During the winter, they were constantly stuck on the way, because in some places the water was covered with an ice

crust. In order to solve this problem, small vessels were sent from the recipient country, which broke the ice so that the ship with the goods could sail to the destination without obstacles. This gesture demonstrated the establishment of good relations and mutual understanding between the two territories.

The next one is also a popular idiom "rain cats and dogs". There are many assumptions about the occurrence of this idiom. In the 16th century, when modern architecture was far away, the roofs of houses were covered with straw, which made them attractive for cats and dogs (this material retained heat better). During heavy rains, the animals slipped and fell down, and the British began to associate heavy rain with falling cats and dogs.

If you hear two Englishmen talk about the weather, don't be so sure that they are talking about it. Thus, next idioms are the confirmation of this: face like thunder – to be in a bad mood; storm in a teacup – much ado about nothing; lightning-fast – very fast; to have one's head in the clouds – to dream; to be under the weather – to be sick [1].

As in any other language, the meaning of idioms in English is often not clear at first glance and lies somewhere under the surface of a web of interlacing cultures and centuries (and sometimes thousands of years) of the formation of a language. You must carefully and individually examine the meaning of each expression. It seems that this is a difficult and long process, but diving into a world of steadily obscure meanings is fun. Especially when the native statements are connected to the case and the comparison begins.

Knowledge of idioms expands vocabulary and makes speech more diverse and lively. Idioms are actively used in everyday speech and relevant in various styles. However, studying idioms is not only useful for expanding vocabulary. They reflect the nature of the language, retain the information about the mentality. It is a source of knowledge about culture

and traditions, and possession of idioms helps to think like a native speaker.

The English have a lot of time-related idioms, so I couldn't ignore this fact and gathered the most common ones: once in a blue moon – rarely; the big time – the big success; around the clock – all day and all night; run out of time – to have less and less time; in the blink of an eye – in an instant; like clockwork – without interruption; to give someone a hard time – to criticize someone; to catch unawares – surprise somebody [2].

Idioms are created in order to diversify our speech, to make it "tasty", more emotional and, as it seems to me, to add more humor to the routine. Both in fairy tales and fables, human character traits are attributed to animals, so it is not surprising that there are many idioms with animals that most often reflect people of a certain behavior, character, class. In order to have an application in life, idioms must relate to those things and situations that a person meets almost every day. For example: monkey business – killing the time; smell a rat – suspect that something is wrong; cash cow – a business or investment that generates a large or consistent profit; eager beaver – someone who is very enthusiastic; elephant in the room – an obvious truth or fact; when pigs fly – never, it won't happen; like a cat on a hot tin roof – to be anxious and unable to sit still or relax; to let a cat out of the bag – to share information that was previously concealed; to eat like a horse – to eat large quantities of food [3].

To continue the theme of food, let's find out the origin of the idiom "to be full of beans". This idiom has appeared in the world of British entertainment, horse racing. Earlier beans were the most expensive and difficult-to-get feed for horses, which at the same time gave a large amount of energy, so the horse on such a diet was more likely to win the race. Therefore, this idiom means to be very energetic.

The English often do not take thoughts about food literally. These idioms will tell you more about it: egghead – an intellectual person; bad apple – one bad person who has a bad effect on others in a group; hard nut to crack – difficult problem or person to deal with; as cool as a cucumber – very calm, untroubled by stress; to sell like hot cakes – be sold quickly and in large quantities; to take something with a pinch of salt – not believe everything somebody says; to bite off more than one can chew – to take more than one can deal with; to cry over spilt milk – complain about a loss from the past [4].

To draw the conclusion, learning to use common idioms and expressions will make your English sound more native, so it's a good idea to master some of these expressions. Idioms in fact, evolve the language; they are the building blocks of a language and civilization. Idioms bring a spectacular illustration to everyday speech. They provide interesting insights into the use of words, languages and the thought processes of their speakers. They have a sense of mystery and fun about them. Moreover, mastering common idioms will add your speech naturalness and beauty. Significant incentive to spend time and effort, isn't it?

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The Past and Present of Surgical Instruments

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Surgical instruments are specially designed tools or devices for performing specific actions during a surgery or operation. Some surgical instruments are designed for general use in surgery, while others are designed for a specific, particular procedure. Surgical instruments are divided into: graspers, such as forceps; clamps and occluders for blood vessels and other organs; needle drivers; retractors used to spread open skin, ribs and other tissue; distractors, positioners and stereotactic devices; mechanical cutters (scalpels, lancets, drill bits, rasps, trocars, Ligasure, harmonic scalpel, surgical scissors, rongeurs etc.; dilators and specula, for access to narrow passages or incisions; suction tips and tubes, for removal of bodily fluids; sealing devices, such as surgical staplers; irrigation and injection needles, tips and tubes, for introducing fluid; powered devices, such as drills, cranial drills and dermatomes; scopes and probes, including fiber optic endoscopes and tactile probes; carriers and appliers for optical, electronic and mechanical devices; ultrasound tissue disruptors, cryotomes and cutting laser guides; measurement devices, such as rulers and calipers.

In the past, medical equipment has not always looked as beautiful as now. Medical engineers have not had the technology yet to design and manufacture instruments to work with. And no one was particularly worried about the appearance of the instruments. Before the advent of modern surgical laser instruments, a surgical saw was used to amputate

limbs and viscera. The saw consisted of a rounded, ergonomic handle, as well as a curved, serrated blade to facilitate manipulation with the surgeon's device. The Tonsil Guillotine was invented in 1828. This was an updated model of a uvula-removing device, and was the standard for tonsillectomies for over 80 years after that. The doctor would reach into the patient's throat, skewer the tonsil with the device's fork, and cut the tissue away with the guillotine's blade. By the late 19th century a mild anesthetic of cocaine solution was injected before use [1].

The current level of development of surgical equipment is significantly different from surgical instruments in the past. In modern conditions, tools that provide high quality of various surgical operations are more widespread. For example one can emphasize the features of the manufacture of surgical instruments using diamond particles. The use of such modern approaches is possible even in the manufacture of conventional scalpels and injection needles by depositing diamond particles or special treatment on them, which allows us to increase the wear resistance and durability [2].

Future surgical equipment is collaboration between conventional equipment and computer technology that improves the accuracy and efficiency of operations that we have never seen before. Three years ago, Nasa teamed up with American medical company Virtual Incision to develop a robot that can be placed inside a patient’s body and then controlled remotely by a surgeon. Augmented reality (AR) differs from virtual reality in that the users of AR do not lose touch with reality, while AR puts information into eyesight as fast as possible. With these distinctive features, it has a huge potential in helping surgeons become more efficient at surgeries. Whether they are conducting a minimally invasive procedure or locating a tumor in liver, AR healthcare apps can help save lives and treat patients seamlessly.

Surgical robots are the opening in surgery. The most commonly known surgical robot is the da Vinci Surgical System. It features a magnified 3D high-definition vision system and tiny wristed instruments that bend and rotate far greater than the human hand. With the da Vinci Surgical System, surgeons operate through just a few small incisions. The surgeon is 100% in control of the robotic system at all times; and they are able to carry out more precise operations than previously thought possible.

Recently, Google has announced that it started working with the pharmacompany Johnson&Johnson in creating a new surgical robot system. With their AXSIS robot, Cambridge Consultants aim to overcome the limitations of the da Vinci, such as its large size and inability to work with highly detailed and fragile tissues. Their robot relies on flexible components and tiny, worm-like arms. The developers believe it can be used later in ophthalmology, e.g. in cataract surgery.

Minimally invasive surgery can be performed with a magnetic surgical system. This is a technological platform that uses gallbladder magnetic retraction during laparoscopic surgery.

The intelligent surgical knife (iKnife) was developed by Zoltan Takats of Imperial College London. This knife works by using an old technology where an electrical current heats tissue to make incisions with minimal blood loss. With the iKnife, a mass spectrometer analyzes the vaporized smoke to detect the chemicals in the biological sample. This means it can identify whether the tissue is malignant in real-time. The technology is especially useful in detecting cancer in its early stages and thus shifting cancer treatment towards prevention [3].

The development of medical equipment, especially in recent years, has been responsible for an increased level of medical service, which has led to a decrease in mortality during and after surgical intervention. Improvement of modern

medical equipment has touched upon all areas of medicine. Every year there are new highly specialized devices that enable diseases to be more accurately diagnosed and detected at an early stage. It results in timely and successful surgical treatment of many conditions which used to be untreatable. The future of public health largely depends on the new scientific equipment developments that will be successfully introduced into medical practice.

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The Issues of Brexit

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Brexit is a word that is used as a shorthand way of saying the UK leaving the EU - merging the words ‘Britain’ and ‘exit’ to get Brexit. A referendum was held on Thursday 23 June, 2016, to decide whether the UK should leave or remain in the European Union. Leave won by 51.9 % to 48.1 %. The referendum turnout was 71.8 %, with more than 30 million people voting.

Britain was (and still remains) a part of the European Union. The European Union – often known as the EU – is an economic and political partnership involving 28 European countries. It began after World War Two to foster economic cooperation, with the idea that countries which trade together were more likely to avoid going to war with each other. It has since grown to become a "single market" allowing goods and people to move around, basically as if the member states were one country. It has its own currency, the euro, which is used by 19 of the member countries, its own parliament and it now sets rules in a wide range of areas.

If to speak about certain dates, the UK had been due to leave the EU on 29 March 2019, two years after it started the exit process by invoking Article 50 of the EU's Lisbon Treaty. But the withdrawal agreement reached between the EU and UK has been rejected three times by UK MPs (Members of Parliament). As things stand now, the UK is due to leave the European Union at 23:00 GMT on 31 October 2019. If the UK

and EU ratify the withdrawal agreement before then, the UK will leave on the first day of the following month.

But as every process Brexit can be cancelled. Stopping Brexit would require a change in the law in the UK, something neither the government nor the main UK opposition parties want to do at this point. The European Court of Justice ruled on 10 December 2018 that the UK could cancel the Article 50 Brexit process without the permission of the other 27 EU members, and remain a member of the EU on its existing terms, provided the decision followed a "democratic process", in other words, if Parliament voted for it.

Brexit can also be delayed. Theresa May has said she wants the UK to leave the EU as soon as possible, if possible by 22 May, so the UK will not have to take part in the European Parliament elections taking place across Europe that month. The EU has said the Brexit process should not be extended again beyond 31 October 2019, but legally speaking another extension could happen if all EU countries, including the UK, agree to it.

As Brexit is the first precedent in the history of the country's withdrawal from the EU, there remain many issues of concern to ordinary Britons, for example:

"Would trade with the EU continue?"

Yes. But without an agreement on trade, the UK would trade with the EU under World Trade Organization rules.

"Will Britons need visa to travel to the EU?"

No. Under the Brexit deal, EU citizens and UK nationals will continue to be able to travel freely with a passport or identity card until the end of the transition period in December 2020. After this period ends, the European Commission has offered visa-free travel for UK nationals coming to the EU for a short stay, as long as the UK offers the same in return. British citizens will, however, have to pay €7 (£6.30) every three years

to travel to EU countries, because of a new security system for countries in the passport-free Schengen zone.

"Will the UK be able to rejoin the EU in the future?"

The UK would have to start from scratch with no rebate, and enter accession talks with the EU. Every member state would have to agree to the UK re-joining. But with elections looming elsewhere in Europe, other leaders might not be generous towards any UK demands. New members are required to adopt the euro as their currency, once they meet the relevant criteria.

"How much has Brexit cost so far?"

The £39bn "divorce bill" will cover things like pension payments to EU officials, the cost of relocating London-based EU agencies and outstanding EU budget commitments. But the calculation of an exact UK share will depend on exchange rates, on interest rates, on the number of financial commitments that never turn into payments, and more.

"Will the EU still use English?"

Yes. There will still be 27 other EU states in the bloc, and others wanting to join in the future, and the common language tends to be English.

"And what happens now?"

The UK could leave earlier if a withdrawal agreement has been ratified by MPs. The country must now take part in European elections on 23 May – if it did not the UK would have to leave the EU on 1 June without a deal. The UK was originally due to leave on 29 March. The first extension shifted that date to 12 April. But now the UK now has just over six months to decide what it wants to do. Government ministers are continuing talks with Labour leaders to try to find a compromise deal. If they can agree, MPs will be given a chance to vote on the deal. If not, a range of alternative options will be put to them instead.

Meanwhile, European Council President Donald Tusk said there was a 20 to 30 % chance Brexit would not happen. Mr.Verhofstadt, who is the European Parliament's Brexit coordinator said the Brexit process so far "had done more damage than has ever been predicted" and that "people can change their opinion".

"What do 'SOFT' and 'HARD' Brexit mean?"

These terms are used during debate on the terms of the UK's departure from the EU. There is no strict definition, but they are used to refer to the closeness of the UK's relationship with the EU post-Brexit. So, "hard" Brexit could involve the UK refusing to compromise on issues like the free movement of people or having to give up hopes of free trade arrangements. A "soft" Brexit means Britain remains a member of the single market and has to accept the free movement of people as a result of that.

Besides setting a precedent for being the first member to officially leave the European Union, the reason why Brexit is such a big deal is that we just don't know how it will turn out yet. It's a big, dramatic move that will take years to complete; years of shifts that will impact the pound and European markets. It will certainly make the UK countries seem less hospitable to new immigrants. One thing to note is that Britain's economy is strong enough that no one needs to expect a sudden collapse.

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Animals in War

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Throughout human history there have been great changes to human cultures and civilizations because of animals. Animals impact our lives daily like the cows that give us milk, dogs that are friends and protect us, mosquitoes, rodents and many others. All these animals are part of a complex web of systems that influences our lives for the better or for the worse. Some we may respect and understand their importance in our lives but others impact us in less obvious ways. Animals have appeared in our art, our stories, our food and our homes for thousands of years.

Military animals are trained animals that are used in warfare and other combat related activities. As working animals, different military animals serve different functions. Horses, elephants, camels, and other animals have been used for both transportation and mounted attack. Pigeons were used for communication and photographic espionage. Many other animals have been reportedly used in various specialized military functions, including rats and pigs. Dogs have long been employed in a wide variety of military purposes, more recently focusing on guarding and bomb detection, and along with dolphins and sea lions are in active use today.

The horse was the most widely used animal throughout the recorded history of warfare. Early mounts could pull a chariot or carry lightly armored skirmishing forces. With the appearance of heavier mounts and the invention of the stirrup, the horse-mounted cavalry became the most prestigious combat

arm in Europe for several centuries. A knight's warhorse was trained to bite and kick. The combination of the horse-mounted warrior armed with a bow made the steppe people's armies the most powerful military force in Asian history [1].

While elephants are not considered domesticable, they can be trained to serve as mounts, or for moving heavy loads. Sanskrit hymns record their use for military purposes as early as 1,100 B.C. A group of elephants was employed by Hannibal during the Second Punic War. They were employed as recently as World War II by both the Japanese and Allies. Elephants could perform the work of machines in locations where vehicles could not penetrate, so they found use in the Burma Campaign.

Both Sweden and, later, the Soviet Union, attempted to utilize moose as deep-snow cavalry. Moose were discovered to be unsuitable for warfare, as they easily contracted livestock diseases, were difficult to feed, and fled the battleground. The Soviets later trained moose not to be gun-shy, but were unable to make use of their cavalry because of the Soviet-Finnish War and World War II [2].

Anti-tank dogs were dogs taught to carry explosives to tanks, armored vehicles and other military targets. They were intensively trained by the Soviet and Russian military forces between 1930 and 1996 and used in 1941-1942 against German tanks in World War II. Although the original dog training routine was to leave the bomb and retreat so that the bomb would be detonated by the timer, this routine failed and was replaced by an impact detonation procedure which killed the dog in the process. The USA military trained anti-tank dogs in 1943 for using against fortifications, but never deployed them. Dogs were trained by being kept hungry and their food was placed under tanks. The tanks were at first left standing still, then they had their engines running, which was further combined with sporadic blank-shot gunfire and other battle-

related distractions. This routine aimed to teach the dogs to run under the tanks in battlefield situations. Each dog was fitted with a 10-12 kilogram (22-26 lb) mine. The bomb was fastened on the dog and detonated upon contact with the target, killing the animal. The tanks were at first left standing still, then they had their engines running, which was further combined with sporadic blank-shot gunfire and other battle-related distractions. This routine aimed to teach the dogs to run under the tanks in battlefield situations [1].

Monkeys were used in the beginning of the Southern Song Dynasty, in a battle between rebels of the Yanzhou province and the Chinese Imperial Army, led by Zhao Yu. The monkeys were used as live incendiary devices. The animals were clothed with straw, dipped in oil and set on fire. They were set loose into the enemy's camp, thereby setting the tents on fire, and driving the whole camp into chaos [3].

In 1267, the sheriff of Essex was accused of plotting to release flying cockerels carrying bombs over London.

Animal-borne bombs have been used by modern terrorists and insurgents in the Middle East, who have affixed explosives to animals, sometimes left wandering alone, and other times ridden by suicide bombers, in modern insurgent attacks in the Middle East.

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New Era in the Automotive Industry

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Today a new era in the automobile industry begins. Combustion engines become obsolete. This is caused by a large number of disadvantages, such as: low efficiency, high wear parts, high cost of fuel, the need for frequent oil changes, high emissions [1].

But now carmakers around the world are investing huge sums of money in the development and creation of motor vehicles with electric motors, because they cover most disadvantages of internal combustion engines.

History of electrical engines

The history of electrical engines begins much earlier than the history of internal combustion engines. It starts in 1821, when British scientist Michael Faraday demonstrated the principle of converting electrical energy into mechanical energy [2].

History of electrical cars

The first electric car prototype was invented in 1828 by Hungarian inventor Anjos Dzhedlik. It was looked like a cart more like a skateboard than a car with electrical engine. The first electric car was created in 1841. The main disadvantage in early electric cars was hard system of charging. The first electric car used the lead battery of the Bari system, which had 36 cans (volt columns). It demanded recharge every 60 versts (~ 64 kilometers). The total power of the car was 4 horsepower. There were no advanced AC-to-DC converters, charging was

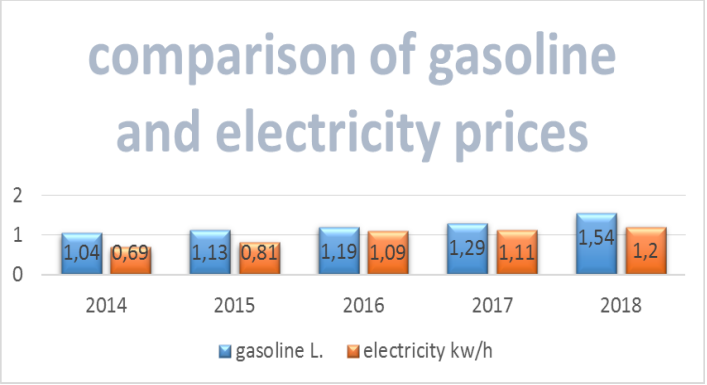
done in an extremely complicated way. An electric motor that operated from AC was used for recharging. In 1906 a relatively easy-to-use rectifier was invented. The revival of interest in electric vehicles occurred in the 1960s due to environmental problems of vehicles, and in the 1970s due to a sharp increase in the cost of fuel as a result of energy crisis. However, after 1982, interest in electric vehicles was asleep again. This was caused by a sharp change in the situation on the oil market [3].

Advantages of electric cars

In recent years, due to the continuous increase in the price of oil, electric vehicles have begun to gain popularity again. The main advantages are: cost reduction, pollution abatement, noise reduction, higher level of safety, cost price.

Cost reduction

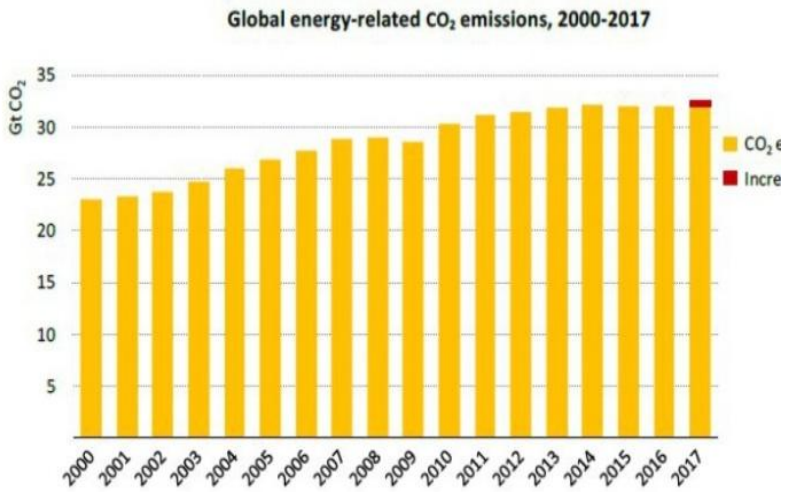
An electric car is a great way to save on fuel. The cost of gasoline is gradually increasing.



Pollution reduction

A running engine does not emit any harmful gases or other substances, so that it itself does not pollute the

environment. Of course, here we must also take into account the way in which electricity is produced. Ideally, to minimize



the environmental impact, it should be produced from clean, renewable energy sources. These include: sunlight, wave energy, wind, water flows, and geothermal heat [4].

Noise reduction

Electric motors are capable of providing quiet and smooth acceleration. Higher level of safety

Road safety is a top priority for any sensible driver. Electric cars are quite safe on the road. Thus, in the event of a collision, the airbags will work; the collision sensors will disconnect the batteries, so the car will stop. This reduces the likelihood of serious injury in the event of a car accident, not only for the driver and passengers of the electric vehicle, but for the passengers of the vehicle with which the collision occurred.

Cost price

Gone are the days when buying an electric car meant spending a fortune. A modern electric car has a lower maintenance cost. The electric motor does not require lubrication, and with it there is no need to visit maintenance stations as often as with an internal combustion engine.

Disadvantages of electric cars

Despite the high development of electric cars, disadvantages still remain.

Recharging stations

Electric recharging stations appeared in Europe in 2015 but so far the infrastructure is in its infancy. This is really what creates a serious problem in the operation of an electric car. Electricity is not free.

It is necessary to carefully select the electric vehicle, since different models require different charges for normal functioning. So choosing the wrong model can lead to significant electricity bills.

Short run and limited speed

Due to the lack of technical progress in the field of batteries, most electric vehicles can travel from about 160 to 240 km without recharging. Therefore, it is difficult to consider them as suitable for long trips, especially given the lack of charging stations, although some models promise to go up to 480 km without recharging.

Recharge time

It takes usually about 8-10 hours to charge an electric car fully. Consequently, a special recharging station may be required, at which the electric vehicle can stay during this time. What to do all this time? [5].

We have been looking for the best way to transport things and other people for centuries. Maybe somebody will come up with a new form of transport. But today electrical

transport is the most efficient type of transportation. A few years ago, people did not even think about using electric motors as the most effective means of transportation. But even today we can say that the future is now.

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Wind Power

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The limited global reserves of fuel and energy, deterioration of the ecological situation raise the question of renewable energy resources application. The active use of environmentally friendly energy sources is welcomed by both the world community and the governments of the developed countries.

Wind is one of the most common and available energy sources. Devices which convert wind energy into useful mechanical, electrical or thermal forms of energy are called wind power plants. Wind turbines are classified according to two main features: the geometry of the wind wheel and its position relative to the direction of the wind. If the axis of rotation of the wind wheel is parallel to the air flow, the installation is called horizontal, if it is perpendicular then it is vertical. The exploitation of wind turbines does not require fuel and water, they can be fully automated. That is why wind power is rapidly developing and becoming the main branch of power engineering [1].

Wind power develops the theoretical foundations, methods and means of using wind energy to generate mechanical, electrical and thermal energy. Wind power energy consists of 2 main parts: wind engineering, which develops theoretical foundations and practical techniques for designing technical equipment, and wind use, including theoretical and practical problems of optimal consumption of wind energy, rational operation. The results of wind research in different

places are registered in the energy cadastre. And wind generators are built based on this energy cadastre.

The advantages of wind energy are accessibility, renewability and availability. Moreover the energy source does not need to be mined and transported to the place of consumption. This feature of the wind is very important for remote areas that are located at a long distance from sources of centralized energy supply [2].

The main disadvantage of wind energy is changeability of wind in different places. The wind doesn't have only long-term and seasonal variability, but also changes its activity during the day. Wind generator produces electrical power at special speed (2-15 m/s). But if the wind speed is above the established value the wind generator will stop to generate electrical power [3].

Electricity is an important part of human life, and the need in it is constantly increasing. Our planet is facing an energy crisis because of the limited global reserves of fuel and energy. Therefore, the use of alternative energy sources is gaining popularity now.

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Wireless Transfer of Electricity

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Each of us lives in an apartment, where there are a lot of electrical devices, which require a socket located nearby. Therefore, in almost every room there are at least 3-5 outlets. But this is not the worst thing. The wires stretch all over the room. Firstly, it does not look attractive, and secondly, we can knock against them, fall and be injured. Fortunately, this problem may be solved soon thanks to wireless transmission of electricity. This article is about how to implement such a solution.

Today, the magnetic resonance system (Coupled Magnetic Resonance System, CMRS) developed at the Massachusetts Institute of Technology in 2007 is considered the most promising energy transfer technology [1]. With its help it is possible to transmit electricity at a distance of 2 meters. For 12 years, nothing radically new has been invented in this field. The system had a lot of flaws, because of which it did not go into mass production: a complex device of coils, rather large sizes, high transmission frequency and high sensitivity to interference.

Scientists from South Korea were able to solve some of the problems. They created a resonating system of dipole coils (Dipole Coil Resonance System, DCRS). This system is able to transmit electricity at a distance of 5 meters. It is devoid of such a disadvantage as a large size: since the coils that are used have dimensions of 10x20x300 cm. Such coils can be embedded in one of the walls of the apartment.

The configuration of this device is shown in Figure 1.

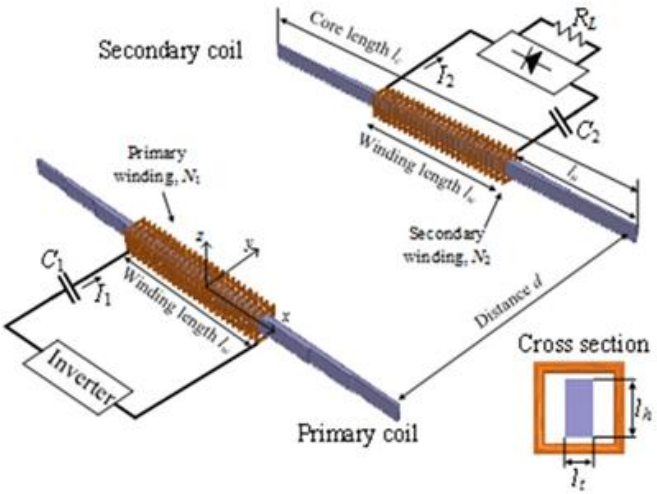

Fig. 1 – Configuration DCRS

A similar technology, but on a smaller scale, is used to charge batteries of portable devices such as laptops and cell phones, medical implants and electric vehicles [2].

In conclusion, it is necessary to say that the effectiveness of such an installation is rather small. But even with low efficiency, the technology can still be useful as it is quite convenient.

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УДК 811.111:619

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Technology in Veterinary Medicine

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Technologies used in human medicine are also used in the veterinary medicine for therapeutic purposes and diagnostic to better understand the health of animals. The last trends in veterinary technology have moved towards the integration of devices to monitor pets and interact with veterinarians. From inspection to treatment, these tools, devices and technologies allow vets to provide correct and effective medical care to pet-patients.

A general tool list for a veterinary clinic includes: thermometers; stethoscopes; laryngoscopes; a centrifuge; an autoclave; glucometers; anesthesia machines; IV pumps; cages and crates.

An electronic thermometer is most commonly used in veterinary practice for both large and small animals. Typically temperatures are taken rectally. Stethoscopes are standard tools that, thanks to their specially designed acoustic cups, enable vets to bypass fur, animal muscles, and actually hear the heart and lung sounds of any animal. Laryngoscopes are typically used in veterinary practices during the process of intubation prior to surgery. A centrifuge is commonly used in veterinary practices in order to prepare blood samples for analysis. Components of the blood are separated using high velocities and centrifugal force. Vets must ensure proper sterilization of their medical tools. Autoclave steam sterilization helps ensure that vet tools are satisfactorily disinfected and sterilized, for optimal pet-patient outcomes. Autoclaves come in various

sizes. The most expensive autoclave is an automatic or digital autoclave, which enables faster turn-around than its manual version. A glucometer is a tool used to approximate blood glucose levels, often in order to manage type 1 and type 2 diabetes mellitus. Anesthesia machines are used to make pets stay still during scans, invasive exams and procedures, from the pain of their injuries, surgeries or other treatment protocols. Anesthetic equipment at a veterinary practice ensure animals receive adequate oxygen, ventilation and breathing while under anesthesia and mix the anesthetics properly according to predetermined concentrations, through a mostly automated process that minimizes risk to the patient. Almost all veterinary clinics use IV pumps to administer fluids, drugs and other supplements during surgeries and other treatments. IV pumps are the preferred method for controlling the delivery of a constant rate infusion (CRI) of the substance to be provided to the patient, for a consistent or time-dependent effect [1].

Common diagnostic technologies include: x-ray; ultrasound; ecg; bp monitor; biochemistry analyzer; pulse oximeter; refractometer; veterenary laser; microscopes; incubatores; defibrillators; CT scanners; veterinary monitors.

Digital radiology (X-Ray) technology enables veterinarians to quickly and accurately obtain clear images of animals muscles, bones, internal organs, without requiring the use of film, chemicals of darkroom processing. The images obtained can be saved to a digital database. The most advantages of this are that animals can spend less time under anesthesia and on the examining table and more time at home for resting and recovering from their particular condition. Vets need diagnostic equipment, such as veterinary ultrasounds, which use sound waves to scan and present internal images of an animal’s body, around at all times. New, innovative, real-time ultrasound equipment with external cameras significantly reduces exam time while producing deeper and wider crisp

images of vascular, abdominal, vascular, musculoskeletal and other systems. If they need, these images can be shared live via telemedicine with a sonographer, for richer real-time guidance, with far less diagnostic guesswork involved. Refractometers. used for measuring the refractive indices of gases can be of four main types: traditional handheld refractometers, digital handheld refractometers, laboratory or Abbe refractometers and inline process refractometers. There are also the Rayleigh Refractometer CT scanners which are needed for accurate imaging and diagnosis. Defibrillation is a treatment for life-threatening cardiac dysrhythmias, specifically ventricular fibrillation and non-perfusing ventricular tachycardia incubators. Laser therapy is a treatment modality that has been utilized for decades, but is finally finding its place in mainstream veterinary medicine. Therapeutic laser has been incorporated into treatments that address diverse conditions including: skin wounds; tendon and ligament injuries; trigger points; edema; lick granulomas; muscle injuries; nervous system injury and neurologic conditions; osteoarthritis; post-operative incisions and tissues; pain [2].

In addition, there is more specific equipment which is often used in veterinary medicine, for example Hartmann alligator forceps, Elizabethan collar, orthotics devices. The Hartmann alligator forceps (Hartmann foreign body forceps) are medical forceps for removing foreign bodies. You can even grasp objects in small tubes and position them precisely. In veterinary medicine the Hartmann, ear polypus forceps are used to remove awns or epilate hairs of dog's ears. The design reduces the natural tremor. An Elizabethan collar (E-Collar, Buster colla) is a protective medical device worn by an animal, usually a cat or dog. Shaped like a truncated cone, its purpose is to prevent the animal from biting or licking at its body or scratching at its head or neck while wounds or injuries heal [3].

Orthotics is an allied health care field concerned with the design, development, fitting and manufacture of orthoses which are devices that support or correct musculoskeletal deformities and/or abnormalities of the body. Animals that might benefit from the use of an orthosis commonly have an injury to a lower limb or paw, such as a fracture, torn meniscus, ruptured Achilles tendon, or injured cruciate ligament. They may also have an orthopedic condition due to arthritis, spinal cord injury, or a congenital abnormality. Orthoses can decrease pain and increase stability in an unstable joint, as well as prevent potential progression or development of a deformity or contracture [2].

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Artificial Intelligence Problem

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Artificial intelligence emerged as an independent scientific discipline in the second half of the 20th century. Its goal is to use the computing power of computers to solve problems that were considered exclusively subject to humans.

The main problem is that this kind of tasks can't be solved by methods used by artificial intelligence earlier. Rigid algorithms or fixed systems based on rigid rules do not work well with such things as image recognition or handwriting comprehension.

To solve such problems it was not enough to imitate human behavior, it was necessary to imitate the process of educating people. This is the essence of machine learning ideas, to give the algorithm a large amount of data and allow it to draw conclusions. In the process of improving these algorithms, many problems became solvable [1].

However, even this did not help to solve a whole layer of problems that is easily amenable to man. These include speech recognition, handwriting.

To solve problems of this kind, it was decided to go ahead and try to imitate the human brain. In practice, the implementation of this idea resulted in neural networks.

However, machine learning was still limited to simple tasks. Simple neural networks with hundreds or even thousands of neurons connected in a relatively simple way could not reproduce the capabilities of the human brain. This is not at all

surprising: there are about 86 billion neurons in the human brain and very complex interrelationships take place.

Deep learning is the use of neural networks with a large number of neurons and interconnections between them. Humanity is still far from imitating the human brain in all its complexity, but we are moving in this direction [1].

Deep learning is a specialized form of machine learning. A machine learning workflow starts with relevant features being manually extracted from images. The features are then used to create a model that categorizes the objects in the image. With a deep learning workflow, relevant features are automatically extracted from images. In addition, deep learning performs "end-to-end learning" – where a network is given raw data and a task to perform, such as classification, and it learns how to do this automatically [2].

There are many different artificial intelligence training methods, but one of the subsets of this larger list, machine learning, allows algorithms to learn from data sets. Finally, deep learning is a subset of machine learning that uses multilayered neural networks to solve the most complex tasks for computers.

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Artificial Intelligence around Us

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In 1956, American computer scientist John McCarthy organized the Dartmouth Conference, at which the term ‘Artificial Intelligence’ was first adopted. Research centers appeared across the United States to explore the potential of AI. Researchers Allen Newell and Herbert Simon were instrumental in promoting AI as a field of computer science that could transform the world. However, despite this well-funded global effort over several decades, computer scientists found it incredibly difficult to create intelligence in machines.

Nowadays machine learning continued its rising, largely thanks to improvements in computer hardware. Corporations and governments successfully used machine-learning methods in narrow domains. In the past 15 years, Amazon, Google, Baidu, and others leveraged machine learning to their huge commercial advantage [1].

The concept of self-programming computers was closer to science fiction than reality just ten years ago. Today, we feel comfortable conversing with smart personal assistant like Siri and keep wondering just how Spotify guessed what we like [2].

It’s not just the mobile apps that are becoming more “intelligent”. Marketing & advertising industry is among those sectors who have utilized AI technology in creating better business opportunities. In digital advertising using data to make a decision isn’t a new concept. The online advertising industry has been familiar with AI and has used the technology for creating better decisions to inspire innovation [3].

One area where AI excels, and its capabilities are undoubtedly unquestionable, is programmatic advertising: a world where billions of impressions are auctioned off in a split second off the back of compelling data [4].

Thanks to robust analytical capabilities, ML-algorithms can create the perfect recipe for your ad, displaying it at the right time to the right people. Google has already been experimenting with various optimizations for mobile search ads. The results so far are rather promising [2].

The best part is that AI-powered advertising is no longer cost-prohibitive for smaller companies. With new solutions entering the market, it would be interesting to observe how the face of mobile advertising will change in 2019 and onward [2].

Due to the ever-expanding applications of AI, it will not only change our workplace but will also change the way we live in our homes. The availability of smart electronic devices is on the rise, which can be controlled by apps through smartphones and tablets.

Gadgets like Amazon's Echo and Google home connects different devices to each other through the Internet of things (IOT) by voice command [5].

Similarly, through a facial recognition algorithm, an AI-powered system builds a catalog of known individuals through your social media connections and home visits, which helps it to understand between family members, guests, and visitors.

One of the beauties behind automation is machine learning. Smart home devices available now not only react to people's movements and commands, but they learn and adopt. With consumers buying more Wi-Fi enabled devices, outlets are filling up fast in homes and the smart meter is tallying energy used accurately in real time. An example of this would be leaving the heater on and instead of smacking your head when you get to work, you can use your mobile device to turn off the heater and not rack up the added expense of heating an

empty house. The time spent on small tasks like turning on the TV, changing the thermostat setting and turning off a light switch are seconds in reality, but added up multiple times a day over the course of a week, month or year are significant. Home automation devices are changing all those tasks so they are automatic [6].

While most of the attention has been on advanced driver assistance systems (ADAS) and autonomous driving, AI will penetrate far deeper into the car.

Inward-facing AI cameras can be used to prevent accidents before they occur. These are currently widely deployed in commercial vehicles and trucks to monitor drivers to detect inebriation, distraction, drowsiness and fatigue to alert the driver. AI also can help reduce crash severity in the event of an accident. Computer vision and sensor fusion will detect whether seat belts are fastened and estimate body size to calibrate airbag deployment. Beyond safety, AI also will improve the user experience. Vehicles as a consumer product have lagged far behind laptops, tablets, TVs and mobile phones. AI also can be used to help diagnose and even predict maintenance events. Currently, vehicle sensors produce a huge amount of data, but only spit out simple codes that a mechanic can use for diagnosis. AI can be used to create high-definition maps that can be used for vehicle localization, identifying road locations and facades of addresses to supplement in-dash navigation systems, monitoring traffic and pedestrian movements and monitoring crime, as well as a variety of new emerging use cases [7].

Artificial Intelligence is a technology where machines show intelligence, but not at the par of human beings, but their evolution will surprise you on how strikingly similar they can be to humans. Some robots mimic human emotions with fair accuracy [8]. Once it arrives, general AI will begin taking jobs away from people. In one possible scenario, it will free us to

pursue our dreams unburdened by the need to earn a living. In another, it will create staggering wealth inequalities of different countries across for the globe. But the revolution will go much further.

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Classification of Programming Languages

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A programming language is the medium of communication between a user and a computer system. There are basically three types of programming languages, they are Machine level language (MLL), Assembly level language (ALL) and High-level language (HLL) [1].

Machine level language is the lowest level and is named as the first generation of programming languages. Machine level language consists only of two conditions i.e. either true (1) or false (0); this type of language is known as a binary language. A computer system can understand only a binary language.

The advantages of machine level language include the following: machine level languages are directly interacting with a computer system; there is no requirement of software of conversion like a compiler or interpreter; it takes very less time to execute a program, because there is no conversion. However, a machine language has a number of disadvantages: it's a machine dependent language i.e. individual program is required for each machine; it's rather time-consuming to develop a new program on a machine language; the debugging process is very hard.

Assembly level language is a middle level language and is named as the second-generation programming language. It contains the same instruction as machine level language, but the instructions and the variables have a specific name. They are called commands instead of being just binary numbers.

As for the advantages of Assembly language, they are: it is easily understood by the humans because this language uses statements instead of binary digits; it takes less time to develop a program; debugging and troubleshooting is not hard due to the ease of finding errors. There are several disadvantages of Assembly language: it's a machine dependent language due to that program design for one machine is not suitable for another machine; sometimes it's hard to understand the statement or a command use [1].

High level language is the upper level language and is also known as the third-generation programming language. It is considered as high level because any language that comes under this category is close to human languages. There are many examples of high-level languages such as, Fortran, Pascal, C, C++, Java, Ada, Cobol, LISP, Prolog etc.

The strong points of a high-level language comprise the following: the instructions and commands are much easier to be remembered by a programmer; the logic and structure a high-level language are much easier to understand; debugging is easier compared to other languages; it's less time-consuming to write new programs. The weak points of high-level languages include: HLL programming language takes more space compared to MLL (machine level language) and/or ALL (Assembly level language); the execution of this type of programming language is slow.

Next, programing languages are classified as static / dynamic typed. Static typed programming languages are those in which variables don't need to be defined before they're used. This implies that static typing has to do with the explicit declaration (or initialization) of variables before they're employed. Java is an example of a static typed language; C and C++ are also static typed languages. Note that in C (and C++ also), variables can be cast into other types, but they don't get

converted; you just read them assuming they are of another type.

Dynamic typed programming languages are those languages in which variables must be defined before they are used. This implies that dynamic typed languages do not require the explicit declaration of the variables before they're used. Python is an example of a dynamic typed programming language, and so is PHP [2].

Further, programming languages are categorized as compiled or interpreted. With a compiled language, the code you enter is reduced to a set of machine-specific instructions before being saved as an executable file. For example, C, C++ are compiled languages. With interpreted languages, the code is saved in the same format that you entered. For instance, Python is an interpreted language. Compiled programs generally run faster than interpreted ones because interpreted programs must be reduced to machine instructions at runtime. However, with an interpreted language you can do the things that cannot be done in a compiled language.

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