SABIGLOBAL

TECHNOLOGY EVOLUTION

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SAFETY FIRST

System of Adaptive Biometric Identification (SABI)

2018

CONTENTS

SABI TECHNOLOGY EVOLUTION

Let's carry out a review of existing methods to have a better understanding of the identity authentication technology we offer. We will not consider fingerprint, iris, retinal, facial, etc. identification technologies. They have been used in everyday life for some time, and all advantages and disadvantages are already known. We will delve into the technologies and domains of science that were the prerequisites for our development.

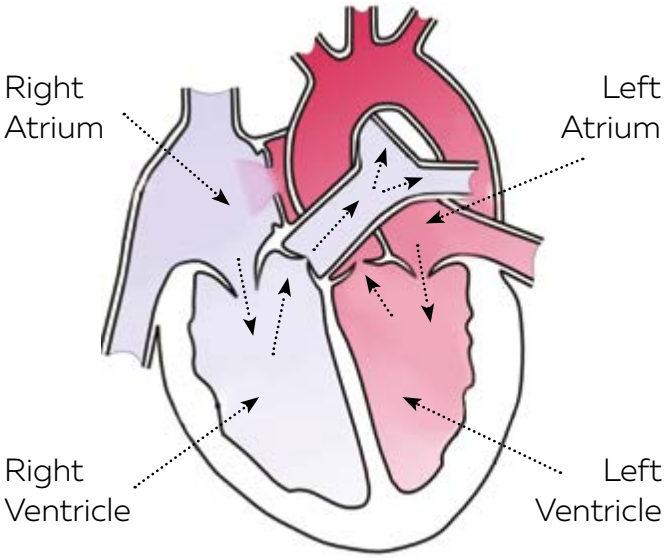
We mean biometric technologies that allow identifying a person by the parameters of human body functioning in the process of the person's life-sustaining activity. It is no secret that all technological innovations created by humankind are based on previous knowledge and experience. Thanks to this, even ideas that seem to be fantastic are translated into reality, and usual solutions are unusually implemented.

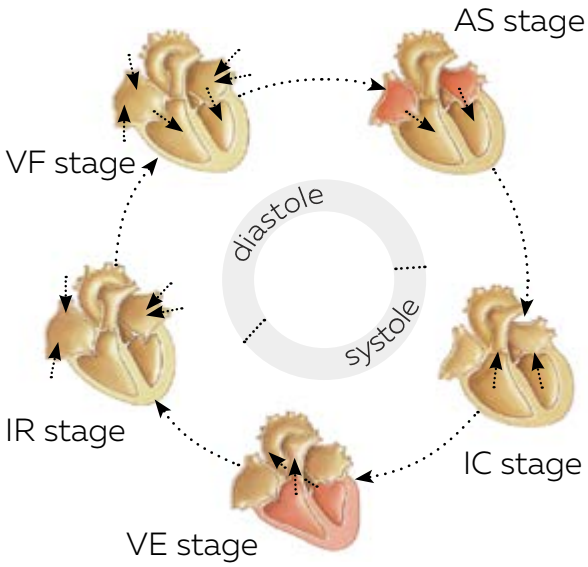
The most recent achievements in the field of biometric identification can be divided into several groups.

The first group of developments is related to the use of the heart rate as a unique personal identifier. There is a bundle of nerve cells and synapses stimulating heart function in the right atrium. A cardiac pacemaker is designed in a similar way - it generates electrical pulses that cause heart muscle contraction. These pulses, as well as the heart rhythm itself, can be measured by an electrocardiograph or ECG machine (it is used to perform electrocardiograms). If an electrocardiogram is quite accurate, it is possible to identify the person correctly. It is something like fingerprints that are unique, difficult to alter, and durable over the life.

Bionym company created a wearable device that performs an ECG of its owners. Bionym declares that the gadget reliably distinguishes one ECG from another, even when the heart beats faster or slower than usual. The device is called Nymi and is worn like a conventional wrist watch. It is equipped with two electrodes, one of which is placed on one side of the wrist, and the other one - on the opposite side of it. When the user touches the second electrode (without touching the first!), the circuit closes and the device begins to measure the heart rate or perform an ECG. Then this measurement is analyzed by the built-in application developed by the company.

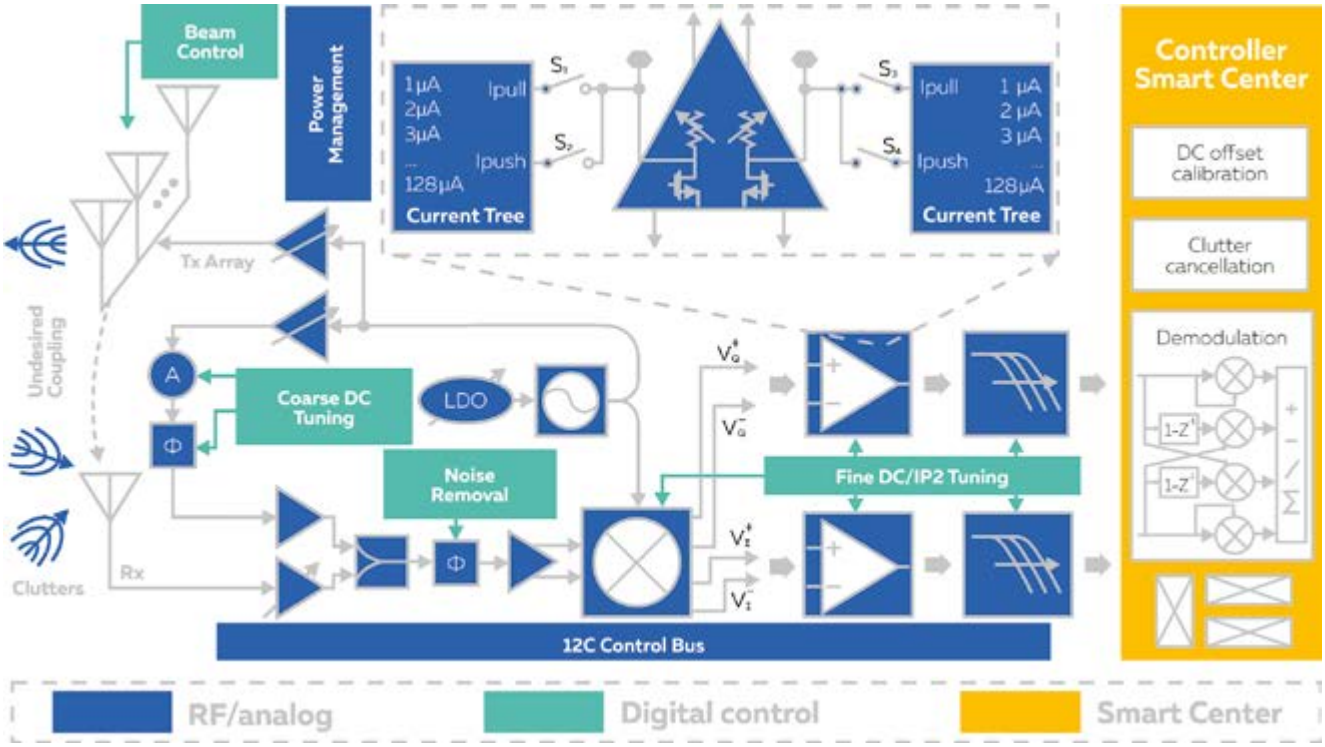
Specialists of the State University of New York at Buffalo (USA) went to even greater extremes. They developed a device that carris out non-contact authentication by the heart rhythm and geometry. They presented a scientific article at the 23rd Annual International Conference on Mobile Computing and Networking (MobiCom), which was held in Utah on October 16-20, 2017. Today this article is available in the public domain.



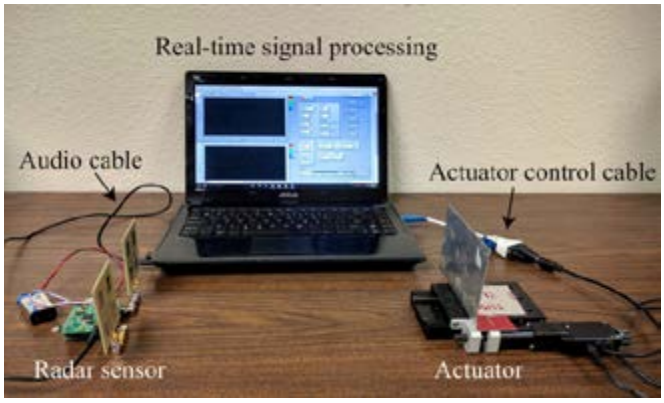


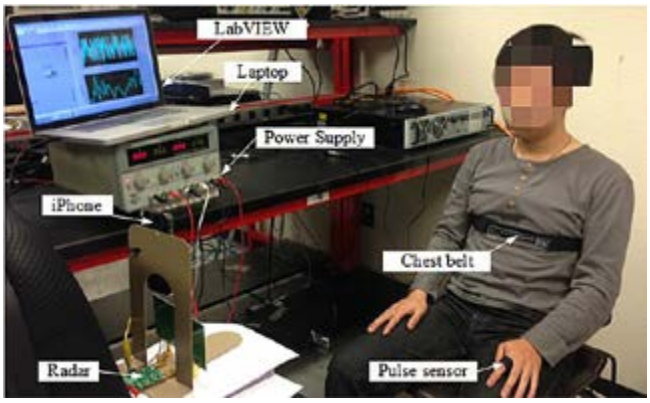
Some people are sceptical about the security of the system, which continuously irradiates the heart and reads the results of scanning. The developers say that there is nothing to be afraid of in the world of ubiquitous Wi-Fi radiation. The radiation power of the device under consideration is much lower - only 5 mW, i.e. less than 1% of radiation emited by smartphones.

The device needs about 8 seconds to collect all the characteristics during the first scanning session. Further scanning is continuous. If another person is in front of the scanner, the device immediately reacts to the "heart change".



It took three years to develop the technology. In general, it is a rather complex technological device that analyzes the geometry of the heart (shape and size), as well as the dynamics of its work (heart rate). ECG pattern recognition is the method developed about ten years ago, but nobody has tumbled to an idea to use the shape and size of the heart for authentication. This is the first technology of this kind.





«You can never find two persons with the same heart» - said Wenyao Xu, the lead author of the study, a PhD and assistant professor of the Department of Computer Science and Engineering at the School of Engineering and Applied Sciences of the University of Buffalo. He draws attention to the fact that the shape of the heart of an adult person never changes, unless it is affected by some rare serious heart disease. Xu is currently working on miniaturizing the device so that the scanner can be installed in the corner of a computer keyboard or in a smartphone.

For ourselves we would like to add that in terms of safety such cardiometric systems are somewhat better than fingerprint reading methods, since you never leave a trace of your heart rate (although having such a device it is possible to listen in a person without his/her knowledge). However, this parameter is static and unchanged for each of us. It is unlikely that, if necessary, you can change this password.

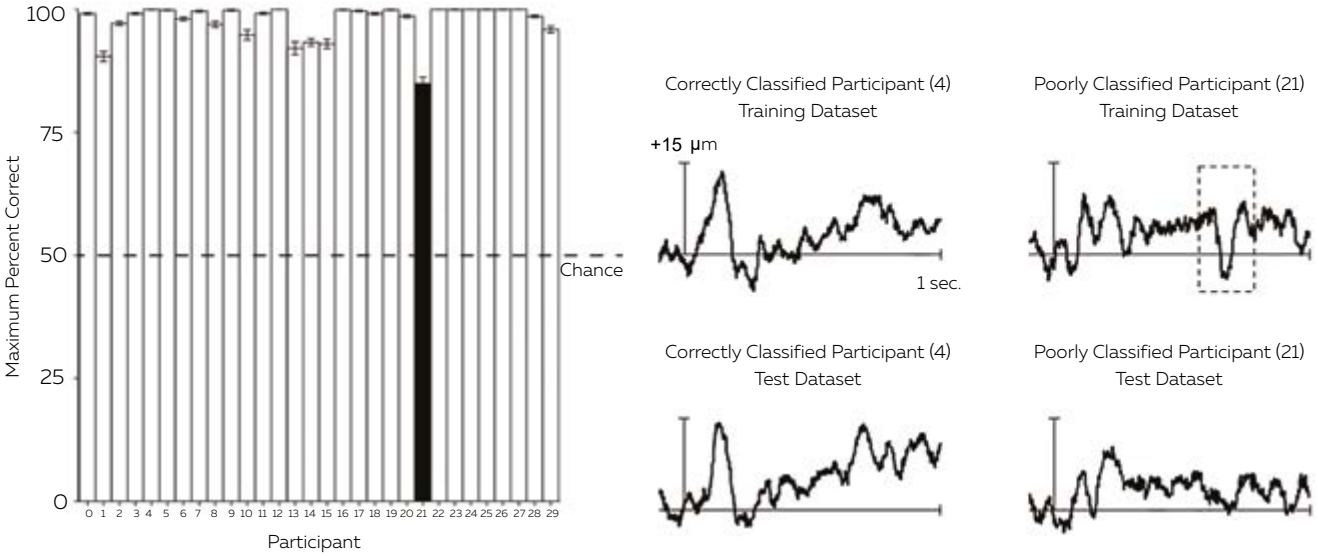
An electroencephalogram (EEG) is used as a biometric identifier in the second group of developments.

Each person perceives the world in his/her own way. The same food can excite disgust or stimulate appetite. Different memories, countries, colors, films, sounds, words, etc. The brain reacts differently to these objects and can give you away reflecting the unique imprint of brain waves in response to external stimuli.

HERE ARE SOME DEVELOPMENTS FROM THIS GROUP

Blair Armstrong of the Basque Center on Cognition, Brain, and Language in Spain and his team recorded the brain signals of 45 volunteers as they read a list of 75 acronyms – such as FBI or DVD – then used computer programs to spot differences between individuals. The participants' responses varied enough that the programs could identify the volunteers with about 94 per cent accuracy when the experiment was repeated.

https://www.newscientist.com/article/dn27555-your-brains-unique-response-to-words-can-reveal-your-identity/



Techniques for identifying people based on the electrical signals in their brain have been developed before, although at that time other methods were used. Armstrong explains that the objective was to reduce the measurement error. For this purpose three electrodes were directed to one specific brain region responsible for reading and recognizing words. There is a region in the brain - the so-called semantic memory region - where meanings of specific words are stored. A set of semantic associations and meanings can vary significantly in different people. And this is a fairly stable system. The semantic region cannot quickly change the state and associative series in relation to each word. This is its difference from episodic memory, which is responsible for the storage of memories. For example, memories of a mosquito bite undergo major changes over time, but the general concept of object "mosquito" does not change. In the future, the reliability of personal identification by a unique print of the person's semantic memory can increase as compared to identification by retina or fingerprints, since the brain cannot be cut off from the body or copied.

LET'S CONSIDER THE FOLLOWING EXAMPLE

American researchers of the abovementioned State University of New York at Buffalo under the leadership of Wenyao Xu found a way to use the evoked potential as passwords — waves that are emitted by different brain regions in response to pictures shown to a person are unique for each person. On the one hand, such passwords remain biometric, on the other hand, unlike fingerprints or irises, they can be quickly changed by changing the stimulus. The authors presented their research results at the 16th International Conference on Mobile Systems, Applications, and Services MobiSys 2018, which was held in Munich on June 10-15. Since the reaction is unconscious and does not depend on the will of a person, it cannot be faked. At the same time, if the database with pictures is stolen, it is easy to replace it. Accordingly, the reaction of the brain will change.

An electroencephalograph is used to measure brain activity. The authors of the method adapted a headset for this purpose. They removed most electrodes, only six electrodes were left: three electrodes - to determine the level of activity in different brain regions, two electrodes - for grounding and one electrode - as a reference electrode. The activity of three brain regions was measured using the headset: the intraparietal sulcus, which is associated with explicit memory (memory for events); the inferior parietal lobule associated with facial recognition; the temporoparietal junction, which is important for text understanding.

The researchers invited 179 volunteers to test the technology. 93 of them were men, 86

were women, the average age of the participants was 30 years. They put on the headset on the volunteers and showed them photos of animals (declarative memory began to work), photos of celebrities (face recognition) and short phrases (text understnading). Each image was diplayed during 200 milliseconds and intervals between displays lasted for 200 milliseconds. A single cycle took 1.2 seconds. It was repeated four times, and the researchers received the "brain password", which was uploaded to the database. The entire procedure lasted less than five seconds and was reproduced 20 times for each participant. Also, the researchers tested data resistance to hacking. Each participant was shown several sets of pictures and, accordingly, received several new "brain passwords".

HERE IS ANOTHER EXAMPLE

Scientists of the State University of New York at Binghamton created a method of biometric identification using the "image" of human brain waves. It turned out that every person, who, for example, is shown an apple, reacts to it in a strictly individual way. The report on this scientific work is published in "CEREBRE: A Novel Method for Very High Accuracy Event-Related Potential Biometric Identification" published in the IEEE Transactions on Information Forensics and Security. Brief information about the development is published on Science Daily portal.

Such "brainprints" in the experiments of the researchers ensured accurate personal identification in 100% of cases. The group, in which the experiment was conducted, consited of 50 persons. The scientists attached an encephalograph to each test person, which measured the electrical activity of the gray matter. People were shown a few hundreds of images, among which were photographs of a slice of pizza, a boat, faces of a famous actress, as well as cards with words (for example, conundrum - "puzzle"). After processing of the data obtained it turned out that each person reacted to all these pictures and words in a unique way. There were no identical "brainprints".

The next step in the development of the above technologies was combining of the heart and brain methods into a single concept.

It is known from open sources that Israeli company IDesia was engaged in combining these two technologies. It developed the method for determining biometric indicators based on reading dynamic electrophysiological characteristics of the brain, heart and lungs. A person must touch and hold BDS sensors (biodynamic signature sensors) with any two fingers for about eight seconds (the duration depends on the level of accuracy required) to make it

possible for the system to identify him/her.

The sensors represent two small metal plates. No other reading devices are required. Small size, possibility to produce them, their durability and minimum power consumption - all this creates prerequisites for using them in consumer electronics, peripherals, personal computers, mobile phones, PDAs, smart cards, and even identity cards. The company planned to sell BDS sensors to the manufacturers of biometric products. The first agreement was signed with Aladdin Knowledge Systems (Tel Aviv, Israel), which uses BDS sensors in identification devices eToken connected to the USB port. Aladdin Knowledge Systems was also an investor of IDesia. Then the company was acquired by Intel.

So, it is clear from the above brief review that world companies have been engaged in the development of this area. It would be logical to assume that the next step for these technologies to move up to a new level would be creation of devices that allow to completely remove the "brainprint" and "heartprint" and, perhaps, even any individual biometric parameter without touch.

«... This isn't real?"

"What is real? How do you define real?

If you're talking about what you can feel,

what you can smell, what you can taste and see,

then real is simply electrical signals interpreted by your brain..."

An extract from the dialogue of Neo and Morpheus ("The Matrix")

In the period from 2006 to 2017, in the course of studying the impact of weak electomagnetic fields on human body resources increasing, our company's specialists discovered a few electromagnetic radiation (EMR) frequency ranges that produce an unusual but well-repeated effect during complex exposure. The essence of the effect is in the combined radiation of frequencies in the SHF and EHF ranges that can penetrate into the tissues of the human body.

This discovery made it possible to create deeply penetrating probing signals and, based on the analysis of the echo reflected from the body, get a unique electromagnetic profile of a

biological object bearing the imprint of electrophysiological, cell and molecular processes occurring in living tissues. An article about it was published in journal "Biomedical electronics" No. 10, 2017 and was titled **"Development of a new generation of diagnostic biomedical equipment based on microwave electromagnetic radar sounding of biological objects by micropower non-contact exposure and analysis of the reflected signal".**

The paper reports on some results of many-years' studies conducted by Research and Production Company BIOMEDIS that are related to the development of the methodology and equipment for electromagnetic diagnostics of the body functional state. The methods proposed by BIOMEDIS are based on microwave radar sounding of biological objects by a non-contact, non-invasive method using own technology of reflected signal processing. Based on the developed methods a new class of diagnostic equipment samples sold in more than 20 countries of the world is mass-produced.

Studies of electromagnetic oscillations generated by bio-objects in various ranges are widely known and well developed. These include methods and instruments designed to evaluate the surface distribution of biopotentials on the skin and mucous membranes in the form of an ECG, EEG, ECoG, induced potential, EOG, coronarography, etc. However, these are passive methods, which with all their undeniable advantages have a number of significant drawbacks. The main one is low noise immunity due to using amplitude measurements of ultra-small potentials. Active methods and electromagnetic diagnostic instruments, such as NMR, PET, and X-ray technology are also known. Their disadvantages are high complexity, bulkiness, high power consumption and high power of generated signals, unhealthy radiation associated with it to some extent, and the need to use harmful, including radioisotope, medicines in a number of methods. Also, these methods, unlike the passive ones, do not allow to register fast wave processes in real time, which is the most important diagnostic factor.

As a result of the research conducted by Research and Production Company BIOMEDIS a new class of diagnostic equipment was developed that uses active methods of radio-frequency probing in the centimeter and millimeter ranges of low-intensity radio waves. The measurement method is based on the radiation of a micropower radio signal directed to the skin of a bio-object and receipt of an echo signal, which is modulated by the bio-object signal by amplitude and phase (Fig. 1).

According to the results of our analysis of literary sources and patent search, radar methods are known and widely used, including for medical monitoring, but usually only to register mechanical movements at the macroscale (for example, chest movement during respiratory cycles and macroscopic movements of the heart).

Thanks to the selection of frequencies, close location of the sensor to the bio-object and

the algorithms of reflected signals processing, the information content of the radar method was significantly improved. This makes it possible to obtain a wider range of information about rhythmic processes of the body and covers micromechanics of vascular circulation, as well as electrophysiological processes occurring in the tissues.

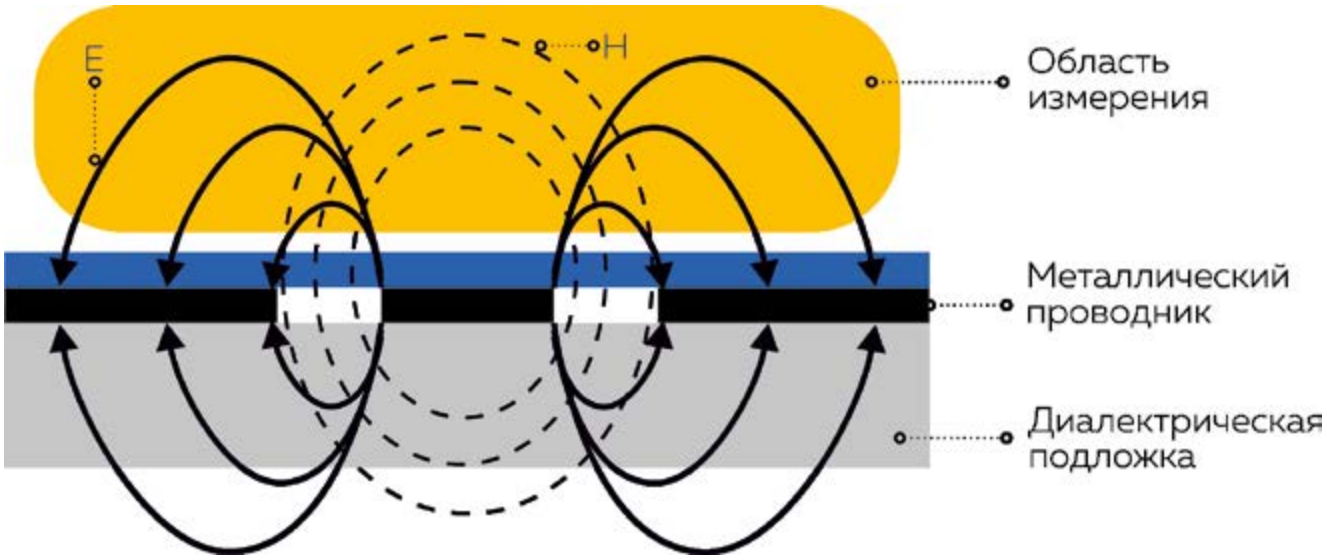


Fig.1. Scheme of electromagnetic radiation interaction with a bio-object according to the proposed method. **E –** vectors of electric component intensity. **H —** vector of magnetic field intensity.

As a result of processing the signal reflected from the bio-object and its comparison with the radiated signal it was found that the signal reflected from the bio-object contains a significant information component about rhythmic electrophysiological processes occurring in the bio-object. These include the following: the cardiac signal, an electroencephalogram, the blood flow rhythm, a pulsogram, an electromyogram, and a spirogram. They can be distinguished using digital filtering.

Fig. 2. Exterior and the electronic circuit board of active micropower electromagnetic and wave diagnostics device ENDOGEN.

The interaction of microwave electromagnetic radiation generated by the device towards the bio-object with the complicated structure of an electrolyte complex of cell biomembranes, intracellular and extracellular space is in the basis of the model of amplitude and phase modulation of the reflected signal. Electrophysiological processes in them are modulated, in turn, by powerful rhythmic signals of the body associated with electrophysiology, blood flow, microcirculation, respiration cycles and muscle activity. The device complies with all safety requirements. It was certified based on the results of the tests performed.

The power of the emitted signal is 1 mW, which makes the device completely safe. The range of frequencies used is 1-60 GHz.

The proposed method and a number of modifications of diagnostic devices have advantages of both passive and active methods of measurement of basic rhythmic processes of the body. At the same time they do not have their main disadvantages. This is due to rather large amplitudes of measured signals, which ensures high noise immunity and measurement stability in contrast to passive methods. As compared to familiar active methods of electromagnetic diagnostics, the temporal resolution of the proposed equipment allows to measure high-speed electrophysiological processes, but it is distinguished by compactness, simplicity, low energy consumption and low radiated power.

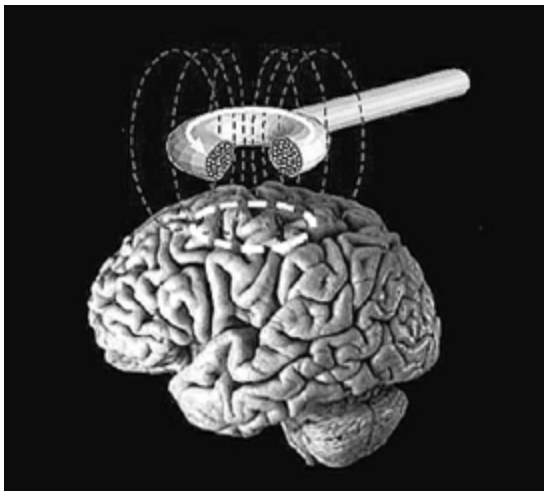
So, the first step towards creating new biometric system **SABI** was made.

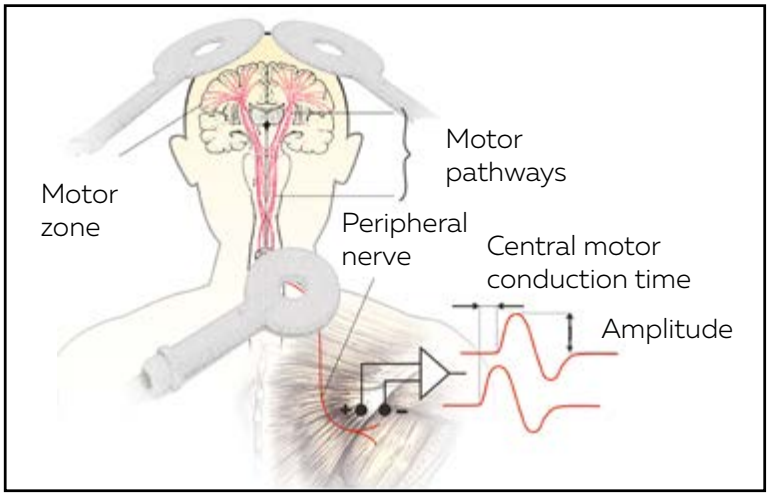
The second component of SABI evolution was development of the **method of transcranial electromagnetic stimulation of the brain,** which was reported in article **"Fundamentals of the innovative method of transcranial electromagnetic stimulation of the brain"** published in journal "Neurocomputers: Development, Application" No. 5, 2017.

The article is concerned with the results of research conducted by Research and Production Company BIOMEDIS related to the development of theoretical and experimental models of electromagnetic effects on nervous tissues. In contrast to well-known methods of transcranial magnetic stimulation, modeling and determination of their possible electromagnetic-dependent ultrastructural peculiarities was carried out followed by geometry determination and clarification of their role in electromagnetic interactions. Consideration of this allows to reduce the power of exposure significantly preserving or increasing its efficiency.

The objective of the paper is to report on the results of the development of the new method of transcranial electromagnetic stimulation of the human brain in the millimeter radio range based on modeling of the physics of exposure taking into account the ultrastructure of nervous tissues.

Methods of transcranial magnetic stimulation (TMS) of the human brain and corresponding equipment are well known. Usually TMS presupposes non-invasive short high-power magnetic pulses up to 4 T by means of induction coils placement on the patient's head (Fig. 1) or near axon nerve tracks (Fig. 2), and the field from such pulses penetrates to a depth of 2 cm and induces ring currents in the tissues of the cerebral cortex or directly in the peripheral nerves, which allows diffuse or focal stimulation of the rhythmic activity of certain neurons of the corresponding areas of the neocortex and neuromuscular junctions.





Their disadvantages are as follows: low penetration, which does not allow to stimulate the subcortical structures, as well as physical and physiological inconsistency of the effects with the morphological peculiarities of nervous tissues. As a result, in order to achieve an acceptable effectiveness of exposure, it is necessary to apply very high power, which, in turn, greatly increases negative side effects of known effects and, in addition, forces to use bulky equipment distinguished by high power consumption.

We proposed a new, more physiological method of transcranial electromagnetic stimulation, which allows to achieve a positive effect from exposure to even a micropower stimulating signal. A number of models of nervous tissues were built and electrically active components in them were determined, the targeted impact on which could significantly increase the effect and allow to refuse from high powers involving many harmful side effects. The models were based on the specific ultrastructural structure of the myelin sheaths of axons and the reasons for such their structure associated with their electromagnetic dependence. The electromagnetic dependence of such an ultrastructural morphology is due to the electrolyte composition of the cytoplasm, the extracellular environment, and the special spatial organization of the membranes and myelin sheaths (Fig. 1). In addition, according to some data, Lantermann notches of nodes of Ranvier can act as "induction coils" that generate oscillating microcircuits about 1 x 5 μm.

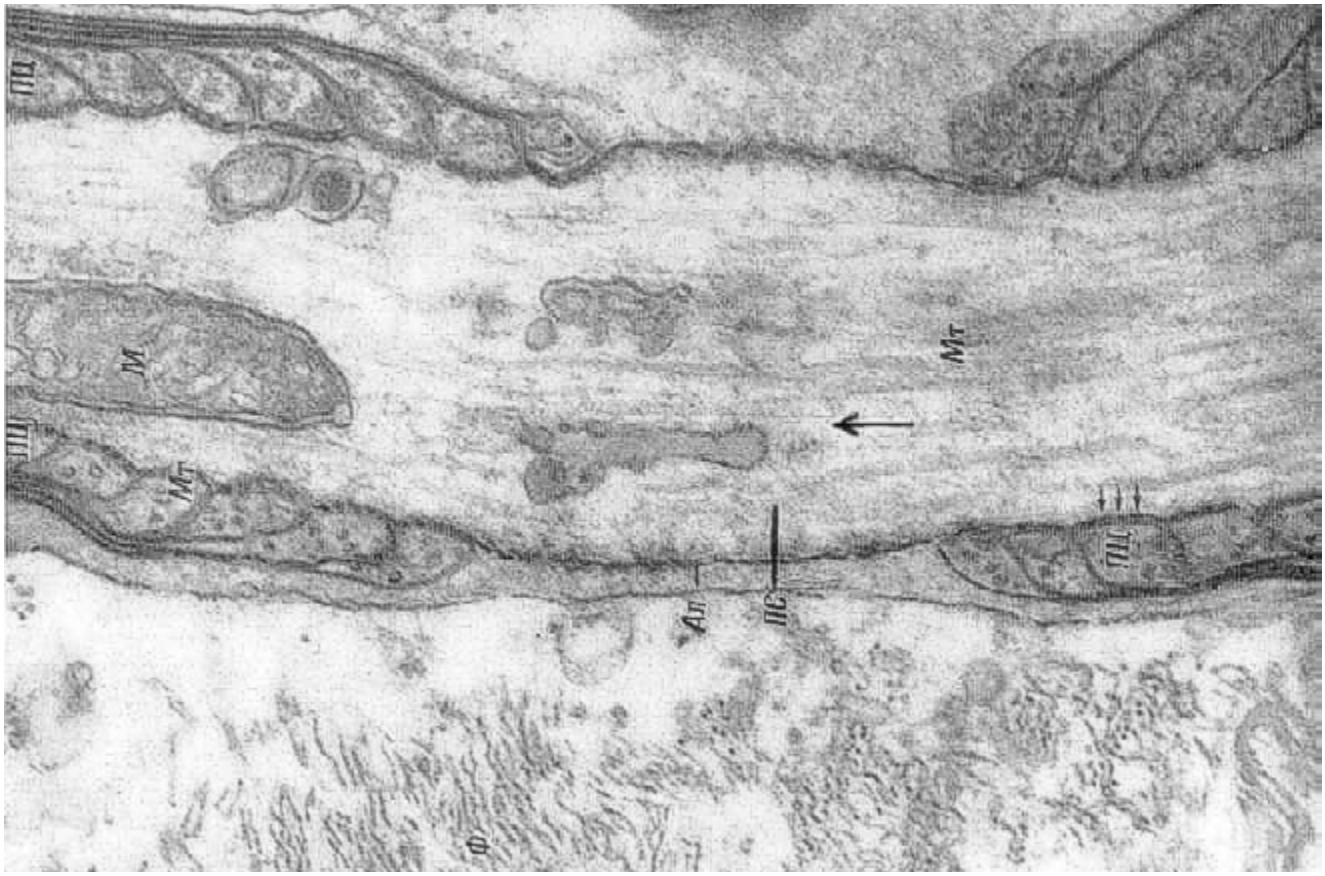


Fig. 3. Longitudinal section of an axon in the area of a node of Ranvier; Lantermann notches and the structure of the initial parts of the myelin sheaths can be seen.

The electrical dependence of processes in axons and dendrites of neurons was modeled in a number of neuromodels reflecting the effects associated with the fine architectonics of nervous tissues. Data of neurophysiological studies obtained using microelectrode equipment and with the help of electron microscopy of sections of brain tissues of animals and humans, as well as methods of optical microscopy of cell cultures of the intravital state were used for modeling.

So, the frequency of exposure was based on the geometrical dimensions of the electromagnetic-dependent elements of the ultrastructural morphology of nervous tissues, which leads to an increase in the efficiency of exposure. Due to the specific relatedness of electromagnetic dependence to myelination, an appropriate set of stimulating parameters can influence them, which can be important not only for depressive states deprivation and performance increasing, but also for the prevention of neurodegenerative diseases, in particular Alzheimer's and Parkinson's diseases.

A brief description of the equipment within the framework of the new method of transcranial electromagnetic stimulation was presented in article **"Instrumental increasing of opportunities of transcranial electromagnetic stimulation of the brain"** in journal

"Biomedical Radioelectronics" No. 10, 2017.

The article describes the results of research, experimental works and design and production activities carried out over a number of years by Research and Production Company BIOMEDIS in the area of micropower effects of electromagnetic radiation of the centimeter and millimeter wave bands on the nervous tissue, mainly on the human brain. Based on the developed methods a new generation of transcranial electromagnetic simulators is being mass-produced.

The objective of the paper is to report on a series of advanced biomedical electronic equipment for transcranial electromagnetic stimulation (TEMS) of the human brain in centimeter and millimeter radio frequency ranges developed by Research and Production Company BIOMEDIS designed to normalize the functional state of the human body.

Today mass-produced domestic and foreign equipment exist and is well-known (Fig. 1) for transcranial magnetic stimulation (TMS). Since generated magnetic pulses for TMS are distinguished by high power, equipment is usually quite cumbersome and consumes a lot of energy (2 kW or more). However, the depth of such exposure does not exceed 2 cm, which does not allow stimulating the subcortical structures of the brain. Recently even more powerful instruments with an increased (up to 5-6 cm) depth of impact have been developed (Fig. 2). All this creates numerous contraindications due to multiple harmful side effects up to brain overheating.

Fig. 1. TMS equipment with the inductor cooled by liquid (above). More powerful equipment with the inductor in the form of a helmet by Israeli company Brainsway.

Fig. 2. Assembled TMS equipment by Brainsway.

Based on the theoretically developed provisions on the components of the morphological ultrastructure of nervous tissues, possible mechanisms of action of electromagnetic fields were modeled and frequencies of effects geometrically consistent with them were determined. SHF and EHF radio signals of the centimeter and millimeter frequency ranges were used for exposure. To increase the depth of the targeted action, frequencies of three generators were used, which directed radiation from the waveguides intersected and created beats of the desired frequency at the required depth of the brain. This creates a kind of "binaural beats" directly between areas of the brain. All generators are independently modulated using a built-in microprocessor, synchronized by modulation time parameters and radiation frequency (Fig. 3).

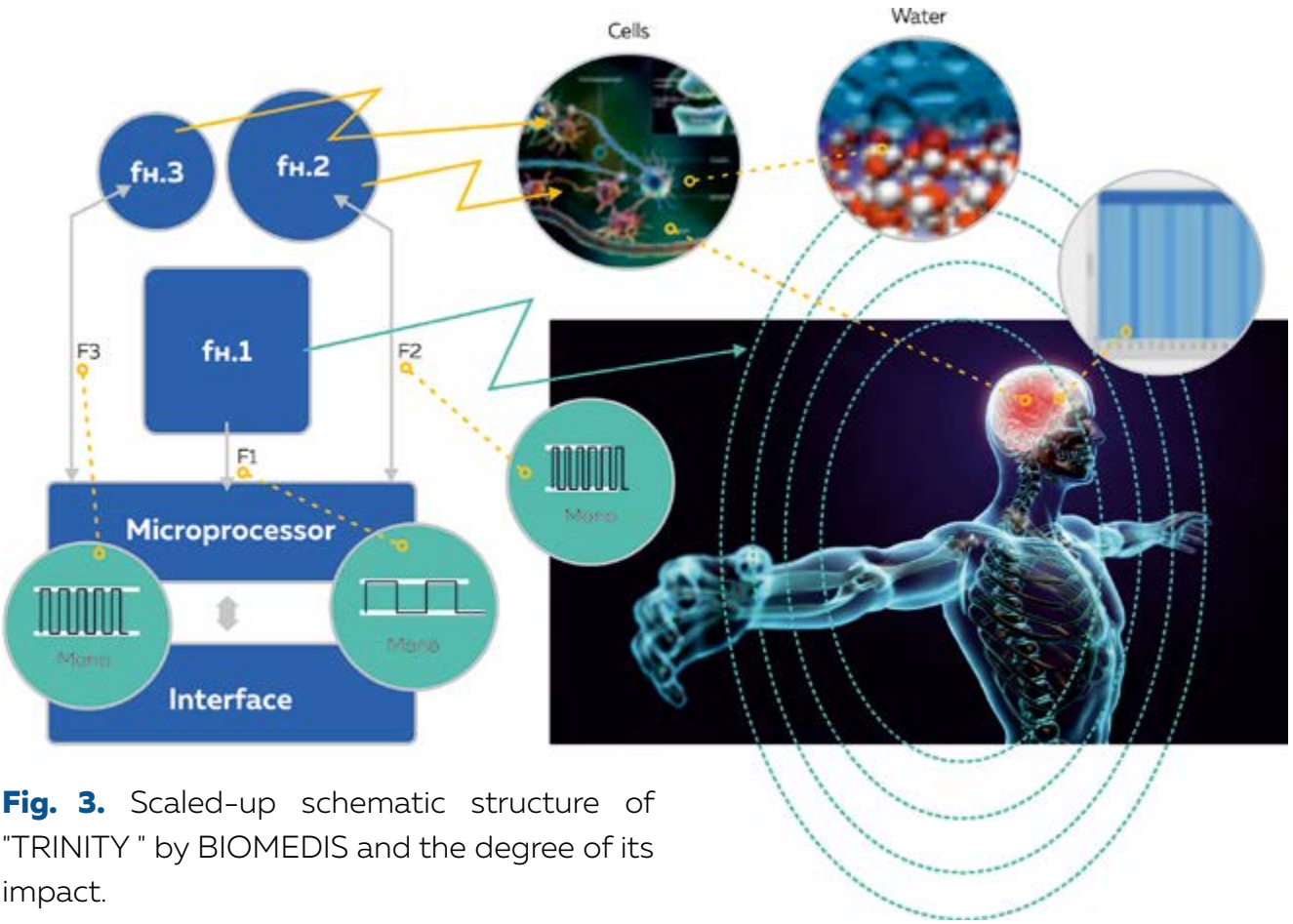


Fig. 3. Scaled-up schematic structure of "TRINITY " by BIOMEDIS and the degree of its impact.

As a result, the deepest, most ancient structures of the human brain, which are responsible for managing the reserve and hidden capabilities of the body, are stimulated easily and with guaranteed reliability.

The series of devices developed by Research and Production company BIOMEDIS is equipped with not just generators, but with generators, which work simultaneously as signal receivers that are generated by the human body, brain structures. The principle of operation of generators as receivers is known and widely used in the so-called autodyne contactless firing mechanisms of air-launched missiles, microwave motion sensors, etc.

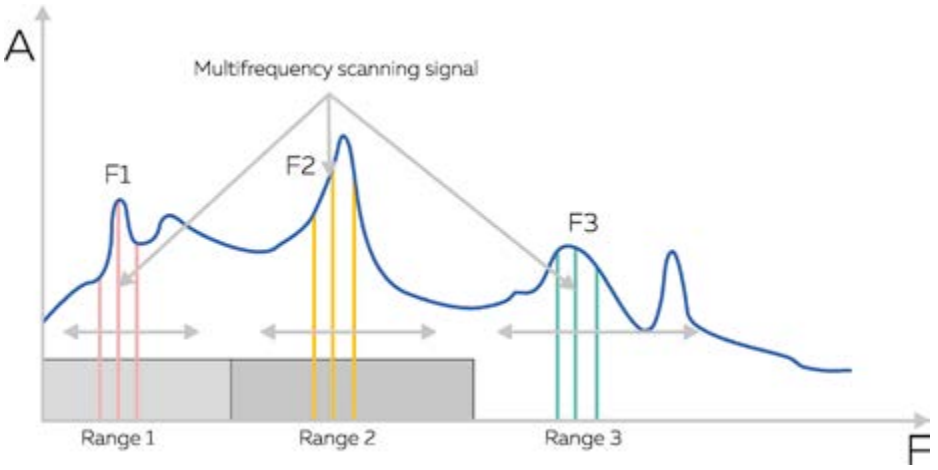


Fig. 4. The ratio of frequency bands generated by " TRINITY" by BIOMEDIS.

However, the principle of operation of such generators/receivers fundamentally differs from the known ones by the fact that generators do not create mutual interference and spurious signals. It was possible to implement an unconventional system of biological feedback of devices and humans by means of the original information processing system combined with digital filters and using relevant mathematics.

So, in contrast to the well-known TMS equipment, proposed devices "TRINITY" by BIOMEDIS have almost no side effects because of low powers used to stimulate effects, which was confirmed by the research results.

The result of one of these studies can be found in article "Study of the effects of equipment for transcranial electromagnetic stimulation of the brain on the improvement of the mental capacity of a person" published in journal "Neurocomputers: Development, Application" No. 5, 2017.

The article reports on the results of electrophysiological studies conducted by Scientific and Production Company BIOMEDIS aimed at obtaining objective indicators of effects of electromagnetic radiation of transcranial electromagnetic stimulators of " TRINITY" series by BIOMEDIS developed and manufactured by BIOMEDIS. Stable correlates of changes in the functional state of the test persons expressed in a steady increase in the alpha rhythm were found.

The objective of the paper is to study the effect of transcranial electromagnetic stimulation (TEMS) carried out using TRINITY devices developed by Research and Production Company BIOMEDIS on EEG objective indicators for the purposes of assesing normalization of the functional state of the body and intellectual performance of a person.

It is known that EEG dynamics in various frequency ranges is associated with higher cognitive functions of a human. Desynchronization in the lower and middle alpha range usually correlates with impaired attention, waiting for action, changes in the upper range of EEG alpha rhythm correlate with short-term and semantic memory, as well as intellectual activity. The integrated spectral power of the alpha range is related to the efficiency of actions determined by the visual-spatial orientation (Fig. 1).

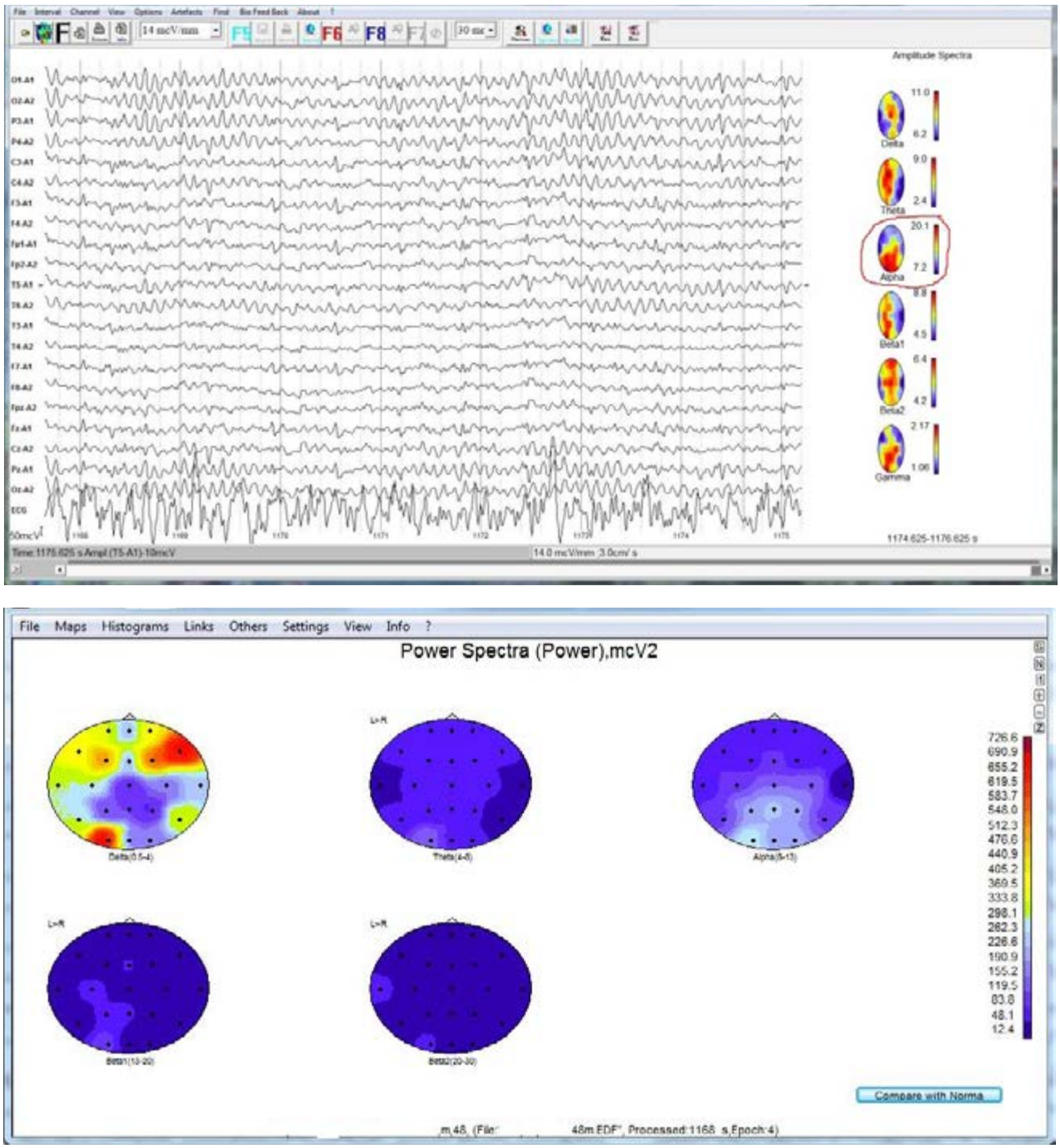


Fig. 1. Normal EEG and EEG spectral power distribution map of the test person before exposure to " TRINITY" by BIOMEDIS.

TEMS sessions were conducted using "TRINITY" devices by TEMS developed and mass-produced by Research and Production Company BIOMEDIS.

70 test persons of various professional and age categories from 18 to 52 years old took part in the studies. Professions of the test persons were selected taking into account the share of intellectual work and were mainly associated with professional employment

constantly using information technology. EEG was recorded in standard 10–20 leads using an encephalographic apparatus "Neuron-Spectr" in a monopolar mode.

SHF and EHF radio waves of the centimeter and millimeter frequency ranges generated by "TRINITY" devices by BIOMEDIS were used for exposure. A session represented a transcranial effect on the patient for 12 minutes from a distance of 0.5 meters from the back of the device.

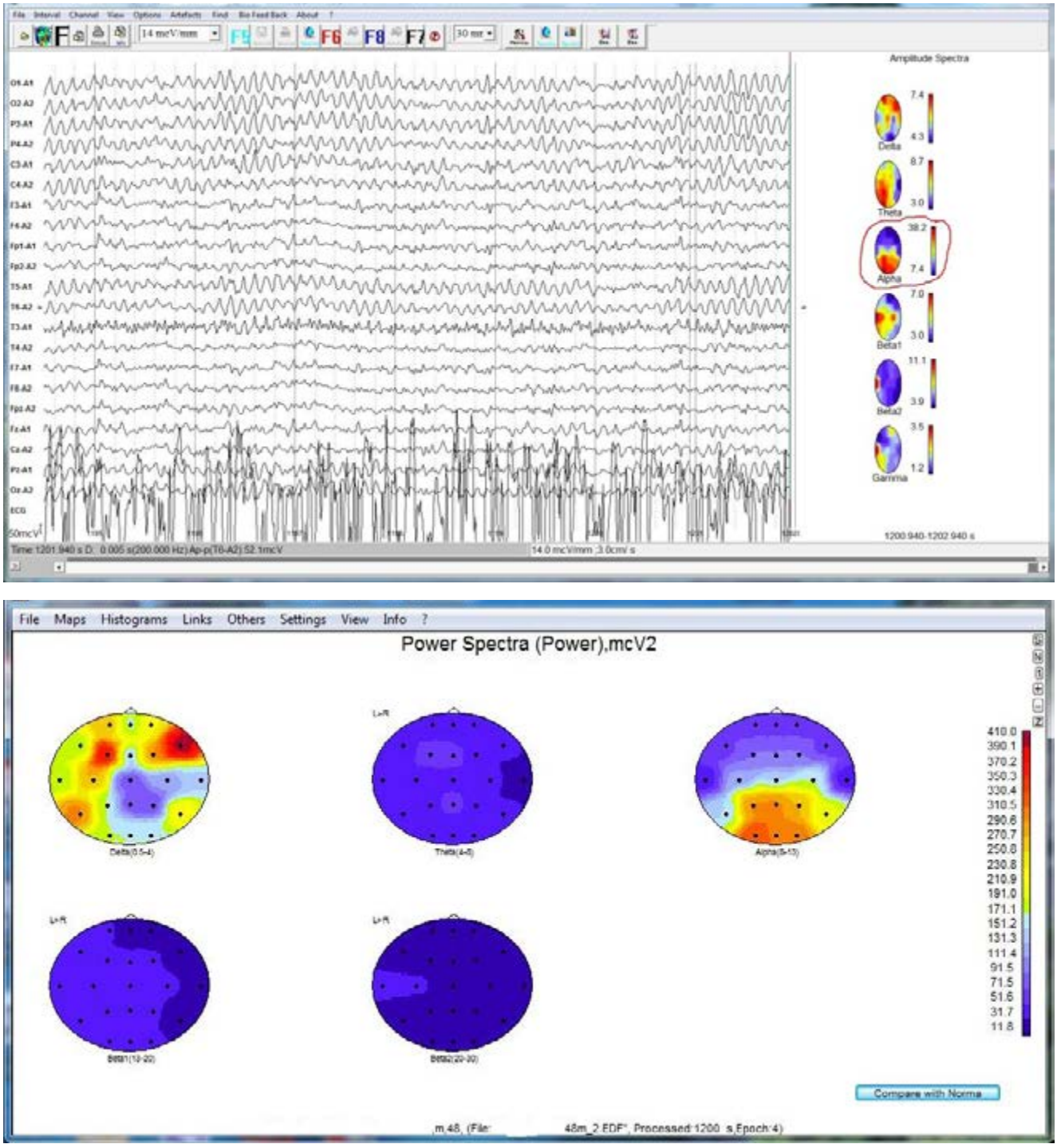


Fig. 2. Normal EEG and EEG spectral power distribution map of the test person after exposure.

A comparative analysis showed a significant increase in the amplitude of the alpha rhythm of the test persons. A typical example is shown in Fig. 2. You can also see the corresponding changes in the power spectrum, namely activation of the occipital regions of the brain suggesting improvement of attention and short-term memory, the ability to perform spatial and orienteering tasks, which, in turn, contributes to an increase in intellectual performance.

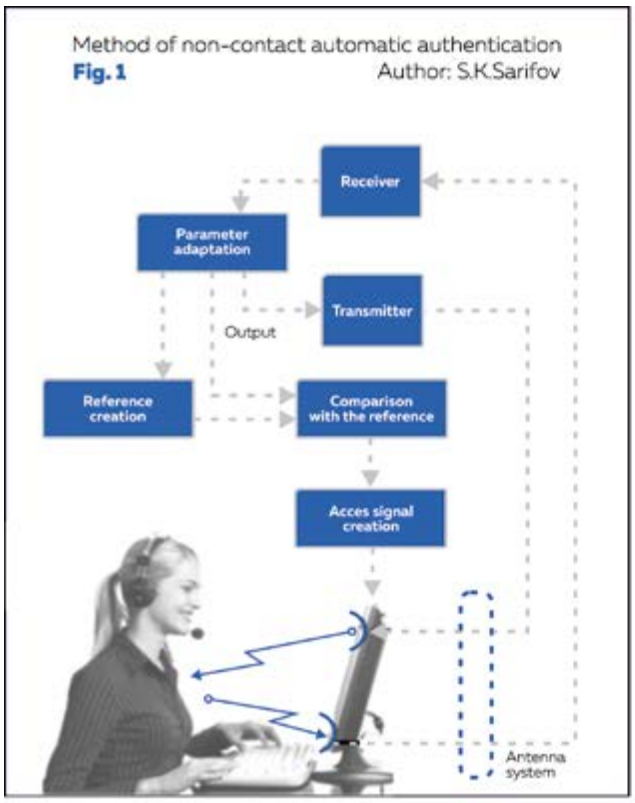
We already had two working technologies, one of which allowed us to measure electrophysiological parameters of the body in a non-contact way, and the other one allowed to give stimuli to the body in a completely non-contact way. We combined these developments and created SABI technology. So, we were able to record the reaction of the whole body to the stimuli in a completely non-contact way (distantly) and bypass its sensory systems (vision, hearing, touch, taste and smell) and consciousness.

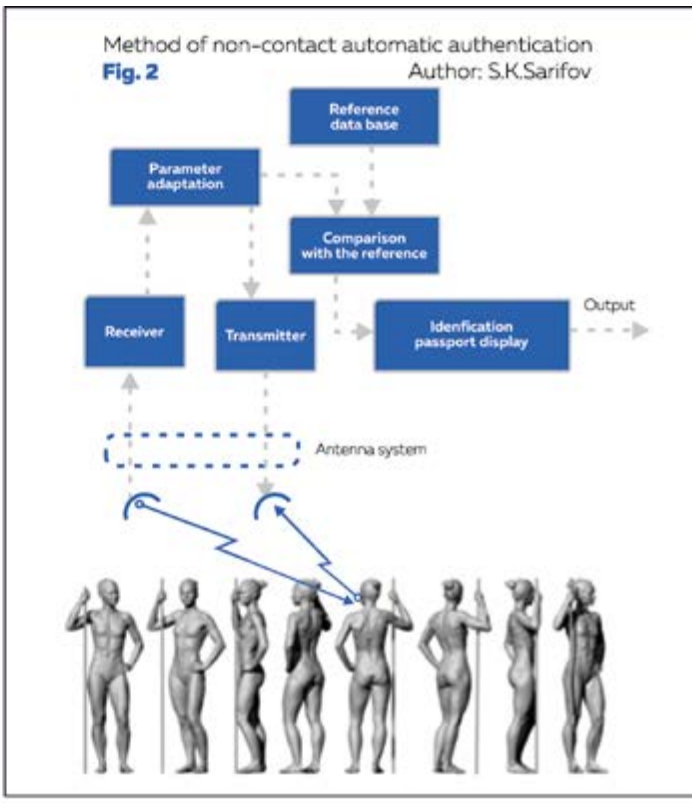
The technologies we created allowed us to scan the body in a certain frequency range of electromagnetic waves and, based on the analysis of the echo reflected from the body, obtain a unique electromagnetic profile of a biological object bearing the imprint of electrophysiological, cell and molecular processes occurring in living tissues. When the scanning device interacts with a bio-object, the parameters of the probing signal are adapted to the physiological processes of a particular body to achieve the highest informational value of the reflected signal.

So, taking into account the fact that the body also changes its response to time-varying electromagnetic stimuli, which are probing signals, the scanning process turns into a process of mutual adaptation of the external device and the body. A self-learning neural network determines the uniqueness in the parameters of such a mutual adaptation process.

Next we will consider SABI in more detail according to the filed international patent application for invention No. PCT/IB2018/001074 as of September 14, 2018.

According to all the options, the inventions ensure continuous uninterrupted or pulse single or periodically repeated irradiation of a bio-object with low-intensity (P<10μW/cm^2) complex modulated signals with possible multichanneling of the SHF/EHF ranges in the frequency range from 1 to 300 GHz using a radio transmitter with an antenna system.

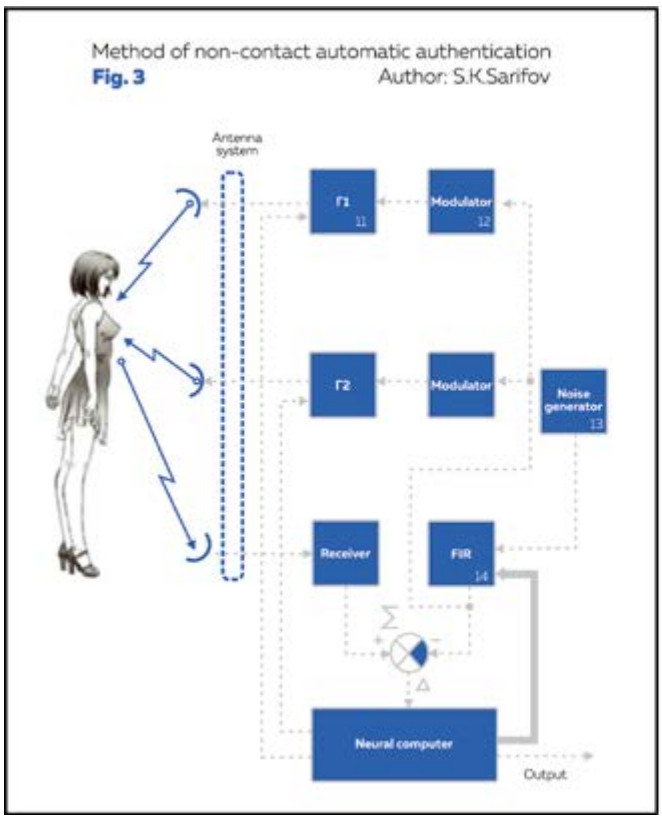


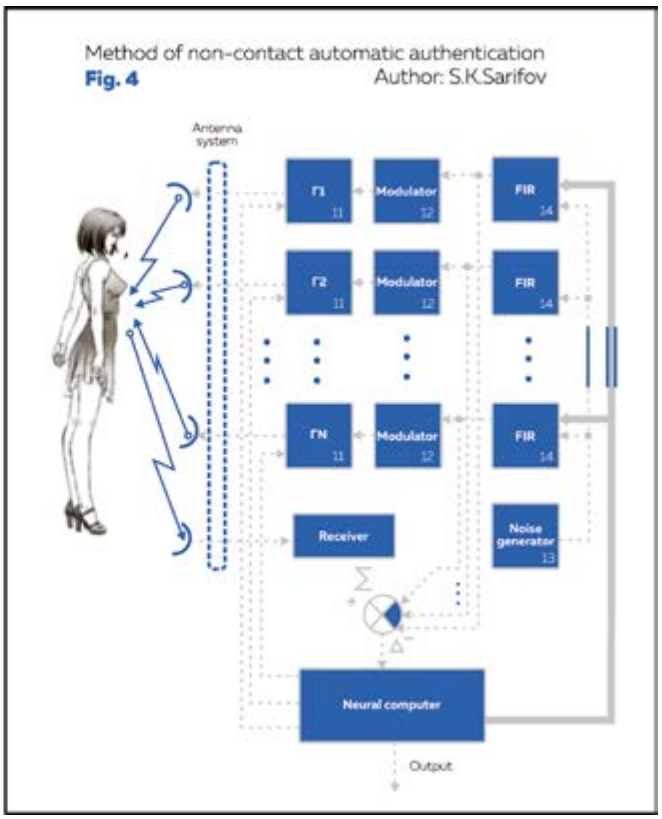


In real time they continuously receve the signal reflected from the bio-object (user), decrypt it, and get an individual electromagnetic user profile with adaptive adjustment of the parameters of the transmitted signal according to the reflected one. If the reflected signal coincides with the profile memorized in the current time when compared, i.e. there are no deviations, then an access signal is continuously generated (Fig. 1). As soon as the received reflected signal (its spectrum) begins to contain side components that do not coincide with the profile determined before, the signal of access stop is generated. It is also possible to compare the individual electromagnetic profile with the library of profiles stored in the database (Fig. 2) and issue an access signal or display identification parameters (identification passport) based on it.

The essence of the invention is in the new method of obtaining a stable, time invariant profile of any bio-object, including a human, proposed by the authors.

It is carried out in the following manner: Fig. 3 shows a scheme of method carrying out according to the option of invention realization in the case of dual-channel probing.





A probing signal is created. Two generators are used to create signals of two frequencies f1, f2 in the SHF/EHF ranges (from 1 to 300 GHz) (Fig. 3). The signals from the generators (11) are modulated by modulators (12) across the width of the radio pulses using a white noise generator (13) (Fig. 3). This is due to the fact that the signals from the generators (11) are modulated by pulse binary sequence with random pulses (pulses correspond to "1s" and pauses - to "0s") with clocked normalized time of pulse and pause (Fig. 6).

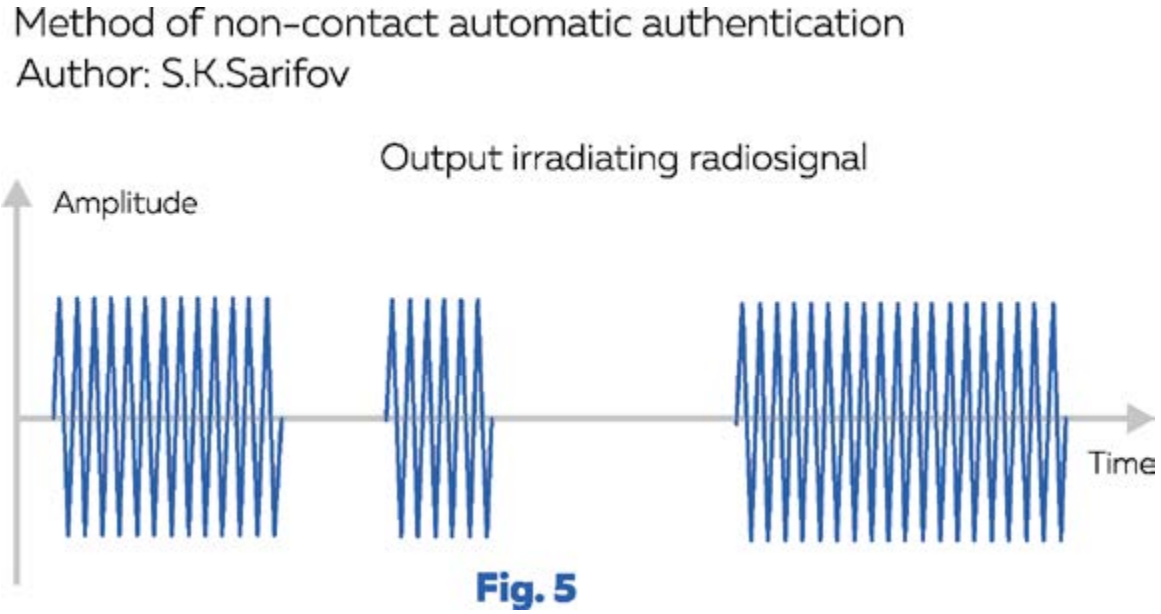


Fig. 5

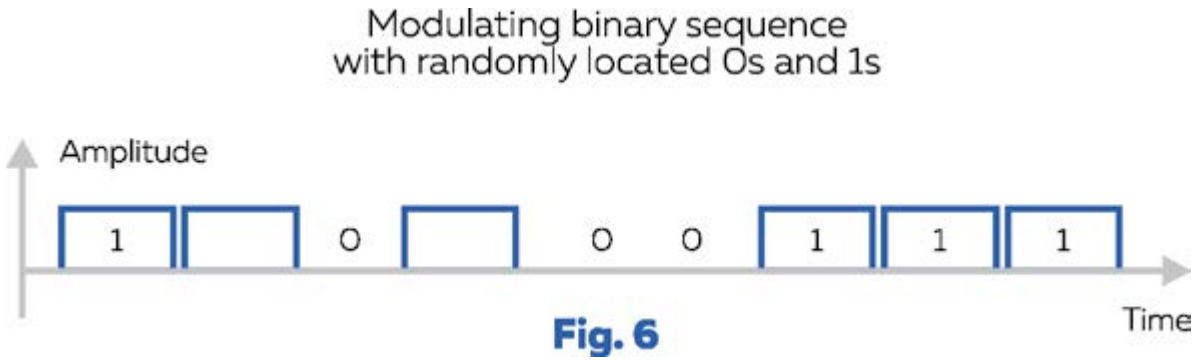


Fig. 6

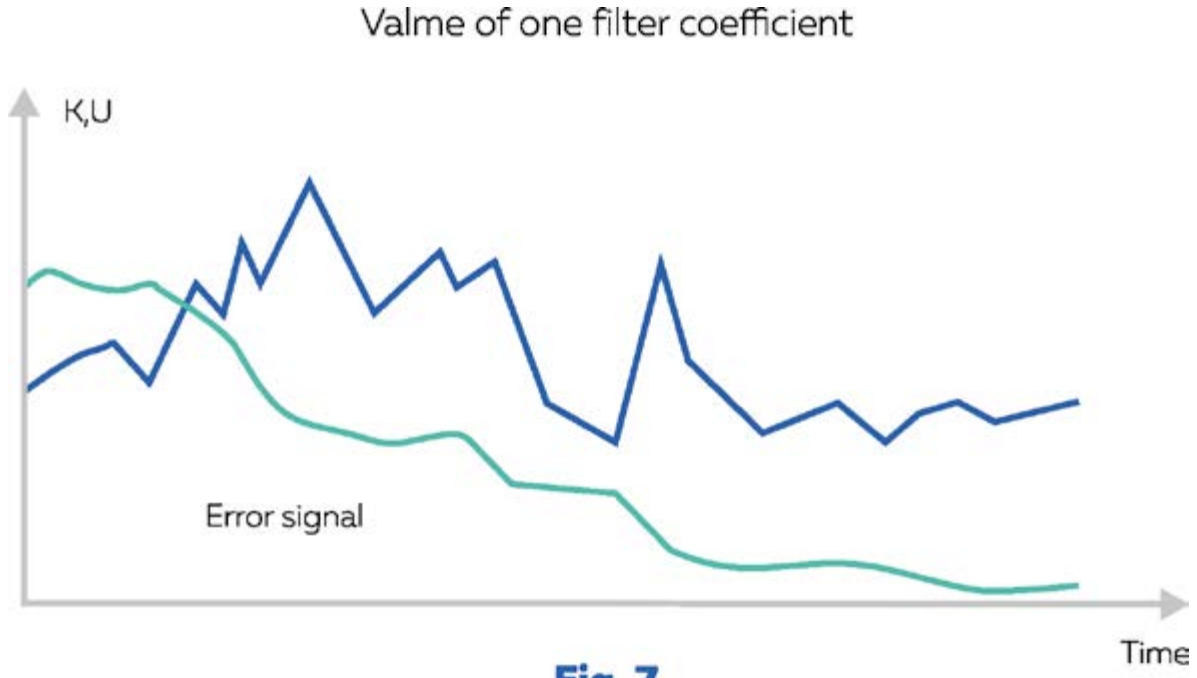
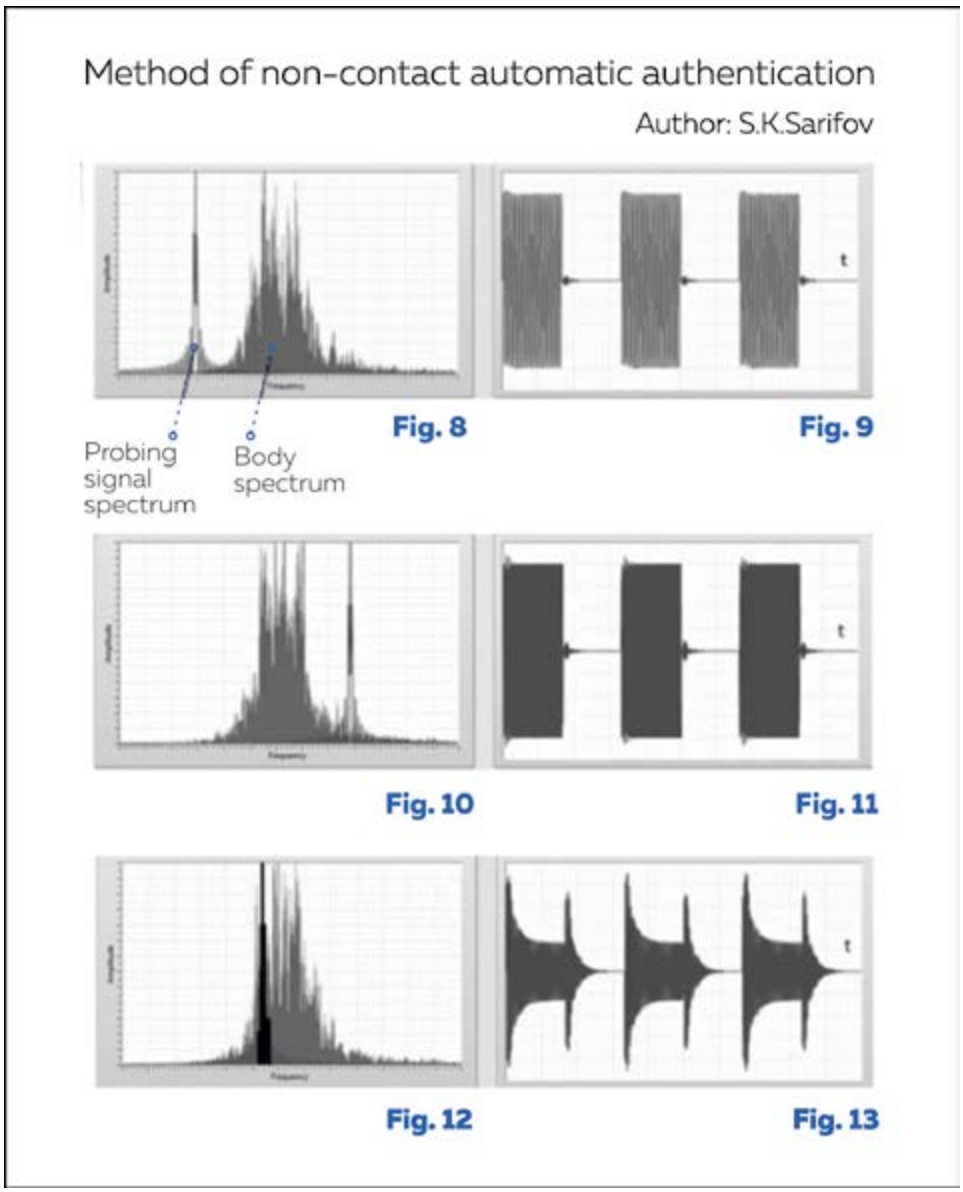


Fig. 7

For this purpose white noise (digital (Fig. 6) or analog) from the output of the generator (13) is passed through a digital filter (14) with a finite-pulse characteristic and tunable coefficients. The output signal is sent to the modulators (12). So, modulated signals of the generators (11) represent packs of random duration with pauses of randoma duration (Fig. 5). After that these signals are emitted by the system 3 using an antenna in the direction of a bio-object (1), which results in their imposition and non-linear transformation in the bio-object's tissues contributing to a better alignment of the transmitting signal spectrum with the body spectrum by means of adjustment of the frequency of generator carrier signals (11) (Fig. 8 -13).



The emitted signal conforms to cellular and nuclear biomembranes of the body in terms of the frequency. As a result it is modulated by their acoustoelectric oscillations, which are stable for each body, but have rather distinct individual characteristics. The reflected signal containing the abovementioned components is received by the system (3) remotely using an antenna and is sent to the receiver (4). The signal from the output of the receiver (4) is compared with the modulating signal from the output of the digital filter (14). The difference signal from the output of the difference element (15), which is an error signal, is sent to the information input of the neurocomputer (16). The neurocomputer containing an adaptive hardware or virtual artificial neural network generates control signals sent to the control inputs of the digital filter (14) and thereby sets the values of filter coefficients (14).

So, the feedback by the reflected signal is closed to the probing one due to adaptive adjustment of the modulating signal spectrum based on the reflected signal. The dynamics of changes in the filter coefficients (14) is shown by means of an example of one coefficient

in Fig. 7 and is aimed at minimization of the error of modulating signal deviation from the demodulated received signal from the output of the receiver (4). The initial spectrum of the total signal of generators, which stands out on non-linearities of the bio-object, i.e. the absorption signal, has a complex structure and is shown in Fig. 14. At the same time Fig. 15 shows deviation of adaptive filter (14) coefficients from coefficients of the model of an unknown identifiable system (bio-object 1). The feedback action is expressed in adjustment of adaptive filter (14) coefficients, so that their values approaches the values of coefficients of the model of the unknown system. The dynamics of this approximation (the time law) is strictly individual for each body, practically does not change over time during adulthood, and therefore can serve as an identification passport, based on which, among other things, information and other systems can be accessed. It is facilitated by the selected frequency of generator carrier signals (11) determined by the authors, so that the spectrum of the mixed signal of the generators (11), which stands out on non-linearities of the tissues of bio-object 1, overlaps the spectrum of the body's own frequencies (Fig. 8-13). In this case the reflected signal is the most informative.

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