HighSeek

Neuro-Interface for control a smartphone by brain

White Paper

Table of contents

What is a neurointerface?

Neurointerface (BCI or brain-computer interface) is, in a broad sense, a device for exchanging information between the brain and an external device (computer, exoskeleton, artificial senses, household devices or a wheelchair). The state-of-the-art technology allows the use of unidirectional interfaces in which external devices can either receive or send signals to the brain. Bi-directional multifunctional neurointerfaces interacting with the brain is still a matter of the future.

Neurointerfaces combine the technologies of many fields, including computer science, electrical engineering, neurosurgery and biomedical engineering, and differ in type: invasive (with the implantation of electrodes in the brain), partially invasive (with the location of electrodes on the surface of the brain) and non-invasive brain external devices).

Neurointerfaces are also distinguished by their application (management or restoration of brain function) and areas of use (medicine, military industry, manufacturing, games and entertainment).

The history and scope of Neurointerfaces

The history of the brain-computer interfaces has more than a hundred years. In 1875, Richard Caton discovered electrical signals on the surface of the animal's brain, and in 1929 Hans Berger published the results of experiments with the EEG and established the ability of the brain for electrical signaling.

The first neurointerface is Stimoceiver, an electrode device that can be controlled wirelessly via FM radio. In the 1950s, Jose Delgado, a neurosurgeon at Yale University, tested him in the brain of a bull, and for the first time changed the direction of the animal's movement with the help of the NCI (neurocomputer interface - ed.).

Now, neuro-interfaces occupy niches in many applications. And the first area is medicine. Neurointerfaces are used in neurological diagnostics. In addition, there are already devices NKI-neurofeedback, which contribute to the restoration of brain functions - the patient learns to manage his state on the basis of such feedback.

Another promising direction is neuroprosthetics. When it is impossible to "repair" the damaged conductive nerves, for example, in a paralyzed limb, they can be replaced by

electrodes that serve to carry signals to the muscles. Now, in addition to cochlear implants, there are already neuronal retina implants that help restore vision. In the future, such systems can be used to manipulate robots "avatars."

Games and devices of virtual reality - the second after the medical field of application of NCI. And here virtual robots, "avatars", managed by NCI, exist now. The principle of the neural interface (that is, in fact, the management of objects by the "power of thought") looks extremely attractive to the consumer. Indeed, who, for example, refuses to "materialize the imagination", using the NCI and the 3D printer, to create objects or art objects presented to him-pictures, virtual sculptures or neuro-video art.

Market of Neurointerfaces

According to forecasts of Markets and Markets (October 2017), the market of neurointerfaces will begin to grow after studies of disorders and brain injuries, as well as violations of its work. In addition, the demand for biocompatible materials will further stimulate market growth.

Among the factors limiting the growth of this market, Markets-and-markets mentions first of all the shortage of qualified technical specialists for the creation and maintenance of complex neurointerfaces.

And, nevertheless, according to the forecasts of Alliedmarketresearch (2016), the volume of the market for neurointerfaces will increase by 12% between 2015 and 2020 and by 2020 will become one of the most high-tech technologies in the following areas (in decreasing order of market share) : medicine, games and entertainment, communications and telecommunications, "smart" houses.

It is interesting that the share of semi-invasive and invasive neurointerfaces on the market will be even more than the share of non-invasive neurointerfaces. "We are all practically cyborgs," said the most famous modern innovator and inventor Elon Mask in an interview.

According to Alliedmarketresearch, the growth of the market for neurointerfaces depends on the development of medicine for brain disorders affecting the movement of parts of the body, improving the health infrastructure in dynamically developing countries such as India and China, as well as using sensory technologies and neurotechnologies in the field of games and entertainment.

Among the major players working in the market of neurointerfaces are, first of all, American Mind Technologies, as well as the Irish Covidien, Australian Compumedics, American

Natus Medical, Japanese Nihon Kohden, American Integra Life Sciences, CAS Medical Systems and Advanced Brain Monitoring.

The Future of NeuroInterfaces

And nevertheless, neural interfaces are, perhaps, one of the most fantastic technologies, the development of which brings us closer to a new, unlike today, world of the future.

NCIs potentially allow, for example, to read and write down thoughts. Now we are separated from the possibility of determining what the other person is thinking about, by the problem of the lack of sufficiently reliable algorithms for processing registered information. However, to determine, for example, whether a person thinks about the movement, whether the conversation has occurred earlier or represents a certain visual image, it is possible today.

Already, there are studies that can "see" images on their images in the visual cortex of the brain. The first image of sleep has already been received. While the corresponding resolution does not exceed a few pixels - because of the problem of inaccuracy of the electrode contact.

What is HighSeek?

HighSeek is a neuro-headset-controller. Our main task is to simplify the use of smartphone applications and do it without hands, with the help of mind.

Prototype

The neuro-headset on dry electrodes, allowing to register pulses without a conductive gel.

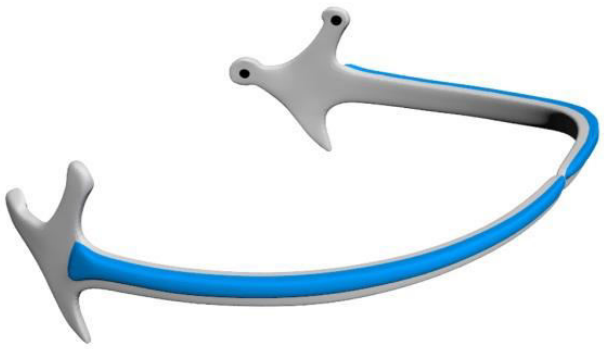
- Number of electrodes: 8 and 2 neutral;
- The sampling frequency of the ADC: 50-400 Hz;
- The recorded range of the amplitude of the input EEG signal in the max band: - + 0.5 .... 300.0 mkVp-p;
- International arrangement of electrodes: "10-20";
- Built-in gyroscope and accelerometer;

- The Bluetooh interface on the arduino board for interfacing with external devices.
- Registration module: analogue microcontroller tgam1_r2.8, extended to 12 channels,

The neural interface allowed us to identify the key points for obtaining high-quality signals for certain mental teams, so that their registration was as clear and explicit as possible. Just to get four commands. Two of which are the result of the mental command. and the rest are two extreme states - meditative mental relaxation and concentration.

End-product

The headset - the BCI (Brain-Computer-Interface) neurointerface is based on the EEG principles, and is a rim, on which there are 6 sensors for recording electrical impulses (5 electrodes and one neutral). One is located on the frontal lobe, four - in pairs above the ears, and one is attached with a clips for the lobe of the ear.



Principle of operation

The neural unit registers up to 4 teams, two of which are instantaneous, and two are cumulative.

• Sensors located above the ear could register impulses with a mental sharp movement of the hand. With the intention to make a move with the left hand, a negative potential arises in the region of the right hemisphere, and before the movement with the right hand it occurs in the region of the left hemisphere.

• The sensor on the forehead, together with the sensor on the ear (the point of complete absence of electrical signals) allows you to fix the state of concentration or mental relaxation.

The microcontroller registers the pulses, converting it into a digital signal. The Bluetooth module sends signals to the phone, after which api manages the selected application

In order for the signal recognition system to improve itself, we introduce the concept of cloud technology of the project (all devices - headsets - are united into a single network, in fact - a new segment of the IoT - Internet of things) and the capabilities of the Neural Network (patterning occurs several times faster, patterns are characterized by a high degree compatibility).

This will give us the speed and accuracy of the commands, bringing them closer to instantaneous.

Using the headset

• A new look at mobile games. If yesterday you play the game with your fingers, today you can do it with the help of the power of thought. Instant commands allow you to adjust the movement of the character, or perform instant actions. Cumulative commands - accumulation of impact force, adjustment of flight altitude, speed, etc.

- The use of applications comes to a new level. With the help of the power of thought, now much is possible, for example switching tracks in the player or scrolling pages on the Internet.

Training

Learning to work with the headset takes place individually. Here the headset is trained, and a person should only show her how he is going to manage it.

During training, the user 10-20 times logs each team to receive BOS (Bio Feedback). In fact, he sees the result of interaction with the headset. Training is necessary only in the first acquaintance with the headset, further use occurs without additional settings.

HighSeek neural network.

The neural network in the model of the interaction between a headset and a smartphone is introduced to speed up the recognition of the patterns of a particular command, as well as to clear out noise and interference. The neural network will reduce the response time of nano seconds.

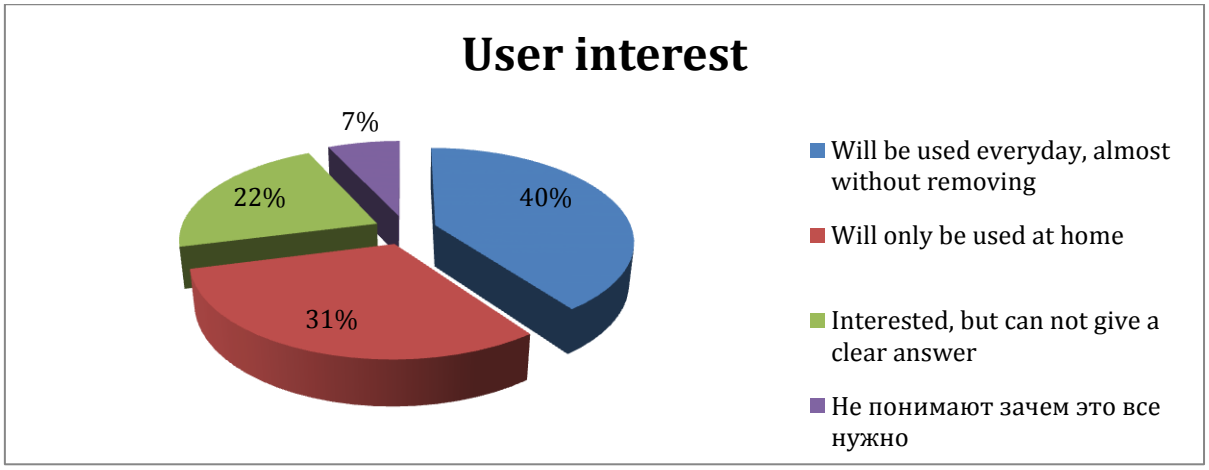
Convenience and benefit

- Controlling the smartphone with the power of thought frees hands, for example, while driving or doing fitness;
- A completely new approach to mobile games. The process of the game becomes much more interesting.
- The process of working with a headset develops thinking, ability **to** concentrate and mental relaxation, normalizes the blood circulation of the brain, improves memory.

We offer a product - a tool for interacting with any applications and any smartphones. We are expanding the boundaries.

Plans and forecast

A social survey was conducted, about the need, interest in the product, duration of use, cost, design, etc.



From this, the following goals were set:

1. Product patent;

2. Minimize the size of the headset from the rim to an inconspicuous device behind the ear;

3. Popularization of the headset;

4. Partnership with large Asian chain stores;

5. Different design and different color solutions;

6. Attraction of stars to advertising of a product;

The goal is to ensure that everyone in the house has a headset and is used every day, like the smartphone itself.

Investments

To attract investment, for certain reasons, the ICO (Initial-Coin-Offering) model was chosen. In other words, we are releasing a digital asset - the HISK token, which is a share of the project. Thus, the investor will be able to earn even on the difference in the price of the token between rounds of their sales.

We plan to conduct 3 rounds of selling tokens:

	Pre-sale	pre-ICO	ICO
Date	March 2018	April 2018	May 2018
Token price	1 HISK = 0,05 $	1 HISK = 0,2 $	1 HISK = 1 $
Token Emission amount	500 000 HISK	1 500 000 HISK	6 000 000 HISK
Amount to collection	25 000 $	300 000$	6 000 000 $

Distribution of investments

Pre-sale

Object of expenditure	Amount, $
Project management	5 000
PR, marketing	11 000
Administrative expenses	5 000
Finishing the product in 5 neuro-headsets	4 000
Total	25 000

Pre-ICO

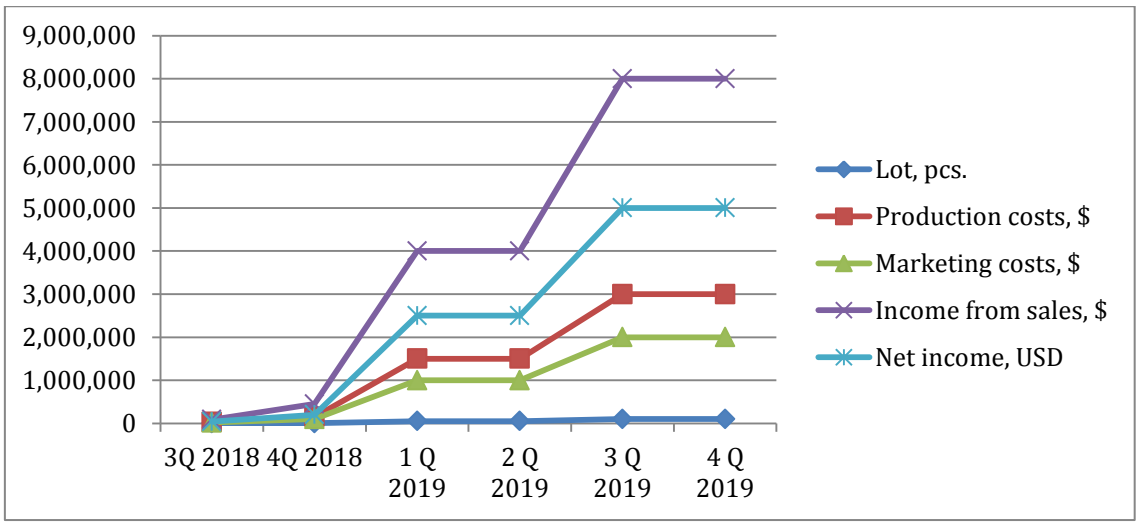
Object of expenditure	Amount, $
Project management	22 000
PR, marketing	190 000
Administrative expenses	31 000
Frontend/backend dev	32 000
Neuroscientists	25 000
Total	300 000

ICO

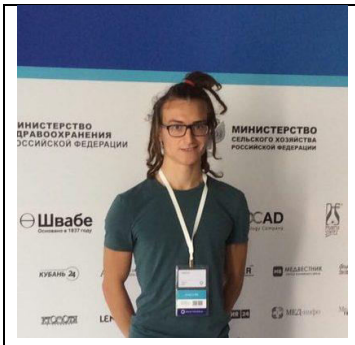
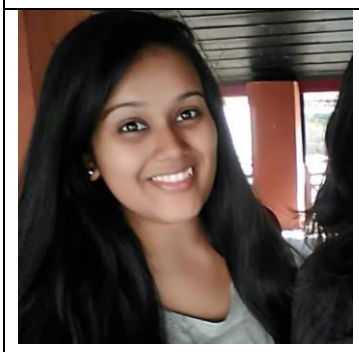
Object of expenditure	Amount hard cap, $
Project management	856 000
PR, marketing	830 000
Administrative expenses	644 000
Hardware dev	450 000
Software dev	460 000
Frontend/backend dev	460 000
Neuroscientists	680 000
Equipment + headset production	1 620 000
Total	6 000 000

Financial calculations for 2018-2019

Date	3Q 2018	4Q 2018	1 Q 2019	2 Q 2019	3 Q 2019	4 Q 2019
Lot, pcs.	1 000	5 000	50 000	50 000	100 000	100 000
Production costs, $	30 000	150 000	1 500 000	1 500 000	3 000 000	3 000 000
Marketing costs, $	20 000	100 000	1 000 000	1 000 000	2 000 000	2 000 000
Income from sales, $	90 000	450 000	4 000 000	4 000 000	8 000 000	8 000 000
Net income, USD	40 000	200 000	2 500 000	2 500 000	5 000 000	5 000 000



HighSeek team

	**Sagunov Egor** CRO-co-founder, project ideologist
	**Sunidhi Chaudhary** **Languages:** C, C++, Java, ML, Neural Networks, Matlab , Assembly, SQL, Python. **Web Development:** HTML, CSS, JavaScript, PHP. **Applications:** Vi/Vim, Eclipse, Git, VMWare, MySQL. **Operating Systems:** Unix, Linux, Windows, Android. **Github ID-**https://github.com/sunidhichaudhary **Linkedin ID -** https://www.linkedin.com/in/sunidhi-chaudhary-4bb70811a/
	**Andrés López Guerrero** Electronic Engineer/ Software-web developer. Electronic engineer - Full-Stack developer. JS(Angular), Python (Django), Dbs, Node, elastic search, AWS, microservices, GIT, eventstore. Worked in biomedics.
	**Gaidukov Sergey.** Leading engineer of the Institute of Electronic Control Machines. Brook, RosTech.

Advisors

Ilya Zenin.

Vice-President of the Foundation for Support and Development of Children's Creativity "The Planet of Talents". A consultant on the SMD approach and the design of activity systems.

Zamir Akimov.

Vice President of RACIB. CEO Runeiro, NeuroDAO.

Dmitry Yakovlev.

Lequid.ru, Moscow, Russia. CEO-co-founder.

Road Map

Development of a prototype of the neuro-headset on dry electrodes.	April 2017
Research work on the prototype.	May 2017
Marketing analysis of the market.	September - October 2017
Collection of information and data for the HighSeek project.	November 2017 - February 2018
Emission of the token. + Start pre-Sale	15 February - 30 March 2018
Pre-ICO.	30 March-30 April 2018
ICO	30 April - 30 May 2018
Mass production of the neuro-headset.	June 2018
Development of API. Neural network test	July 2018
Start of sales of devices	September2018
Entering the markets of Europe	February 2019
Entering the markets of Asia	March 2019