

INFORMATIKAI TEREK

Honfi Vid Sebestyén-Király Zoltán-Nagy Bálint (Szerk.)

ZSOLT CSABA HORVÁTH-GYÖRGY ÁGOSTON

Possibilities in improving transport safety and security through technology transfers among certain subsections

LAJOS KISGYÖRGY-ÁDÁM UNGVÁRI

Design Patterns In Transport Design: The New Way Of Powerful Designing

BARANYAI DÁVID-ANDREJSZKI TAMÁS-TÖRÖK ÁDÁM

Statisztikai előrebecslés és visszafejtés a közlekedésben közlekedésinformatikai eszközök segítségével

HAMZA ZSOLT-TÖRÖK ÁRPÁD

A közúti infrastruktúra biztonsági vizsgálata: alkalmas rendszer bemutatása

FERDE ÖRSÖLYA-PAPP DÁVID-KÖVÁRI ATTILA

Arduino vezérelt mozgásérzékelős galambriasztó fejlesztése

HADARICS KÁLMÁN

Nyílt forráskódú szoftverek sebezhetőségének vizsgálata

KATONA JÓZSEF

A rövidtávú memória (RTM) és a nyelvi szűrepe az emberi tanulásban és emlékezésben

UJBÁNYI TIBOR

A Windows 10 újdonságai

JÓZSEF KATONA

The Comparison of the non-invasive mobile EEG registration and the signal processing devices

OROSZI ESZTER DIÁNA

Kártekonny-programok terjedése social engineer szemmel

SZAKONYI LAJOS

Hőtechnikai modellezés és identifikáció a lakótérben

ROSTÁS ISTVÁN-KÖVÁRI ATTILA

Vakok tájékozódását segítő rendszerek összehasonlítása, továbbfejlesztési lehetőségei

KATONA JÓZSEF

Aszteroida becsapódások hatásának összehasonlító elemzése szimulációs szoftver segítségével

HONFI VID SEBESTYÉN-KIRÁLY ZOLTÁN

Modern technológiák, innovatív megoldások vállalati informatikában

GELENCSÉR SANDOR-KUTSCHI ZOETÁN-

DOSZKOCS NORBERT-KÖVÁRI ATTILA

Olcsó távvezérelt riasztó kialakítása

HORVÁTH PÉTER-BOGNÁR LÁSZLÓ

A hallgatói preferenciák a felsőoktatásban a hagyományos és az online kurzusok közötti választásnál

KIRCHNER ISTVÁN

Az integráció konvergenciájának gyorsítása lineáris egyenletrendszerek megoldásakor

FANCSIKAI HAMAR ÉVA-TÓTH GYULA

Függőleges gravitációs gradiens számításával kapcsolatos integrál csonkítási együtthatóinak meghatározása

VÖRÖS TÜNDE

Az intézményi struktúra és a gazdasági fejlettség kapcsolatának vizsgálata matematikai-statisztikai eszközökkel

BARTALOS NORBERT-UJBÁNYI TIBOR-

KÖVÁRI ATTILA-NAGY BÁLINT

A Chua-rendszer vizsgálata az Octave alkalmazásával



Dunakavics
KÖNYVEK 5.

D U F PRESS

Honfi Vid Sebestyén–Király Zoltán–Nagy Bálint (Szerk.)

INFORMATIKAI

TEREK

© Honfi Vid Sebestyén–Király Zoltán–Nagy Bálint editors 2015

© Ágoston György, Andrejszki Tamás, Baranyai Dávid, Bartalos Norbert, Bognár László, Doszkocs Norbert, Fánicsikné Hamar Éva, Ferde Orsolya, Gelencsér Sándor, Hadarics Kálmán, Hamza Zsolt, Honfi Vid Sebestyén, Horváth Zsolt Csaba, Horváth Péter, Katona József, Király Zoltán, Kirchner István, Kisgyörgy Lajos, Kővári Attila, Kutschi Zoltán, Nagy Bálint, Oroszi Eszter Diána, Papp Dávid, Rostás István, Szakonyi Lajos, Tóth Gyula, Török Ádám, Török Árpád, Ujbányi Tibor, Ungvárai Ádám, Vörös Tünde, 2015

Lektorálta

Bognár László, Csete Mária, Csiszár Csaba, Fi István, Jenei Árpád, Joós Antal, Katona József, Kővári Attila, Kuspér Gábor, Leitold Ferenc, Mohsen Ghaemi, Polyák József, Szendrő Gábor,

DUNAÚJVÁROSI FŐISKOLA
www.duf.hu

D•U•F PRESS

Kiadóvezető Németh István

Felelős kiadó András István
Felelős szerkesztő Nemeskéry Artúr

Tördelés Duma Attila
Készült a HTSART nyomdában
Felelős vezető Halász Iván

ISBN 978 963 9915 63 3

INFORMATIKAI TEREK

Honfi Vid Sebestyén-Király Zoltán-Nagy Bálint (Szerk.)



Dunaújvárosi
KÖNYVEK 5.

D·U·F PRESS

Dunaújváros, 2015

Tartalom

Előszó	7
<u>ZSOLT CSABA HORVÁTH–GYÖRGY ÁGOSTON</u> Possibilities in improving transport safety and security through technology transfers among certain subsectors	9
<u>LAIOS KISGYÖRGY–ÁDÁM UNGVÁRAI</u> Design Patterns In Transport Design: The New Way Of Powerful Designing	23
<u>BARANYAI DÁVID–ANDREISZKI TAMÁS–TÖRÖK ÁDÁM</u> Statisztikai előrebecslés és visszafejtés a közlekedésben közlekedésinformatikai eszközök segítségével.	34
<u>HAMZA ZSOLT–TÖRÖK ÁRPÁD</u> A közúti infrastruktúra biztonsági vizsgálatára alkalmas rendszer bemutatása	39
<u>FERDE ORSOLYA–PAPP DÁVID–KÖVÁRI ATTILA</u> Arduino vezérelt mozgásérzékelős galambriasztó fejlesztése	52
<u>HADARICS KÁLMÁN</u> Nyílt forráskódú szoftverek sebezhetőségeinek vizsgálata	62
<u>KATONA JÓZSEF</u> A rövidtávú memória (RTM) és a figyelem szerepe az emberi tanulásban és emlékezésben	74
<u>UIBÁNYI TIBOR</u> A Windows 10 újdonságai	85
<u>JÓZSEF KATONA</u> The Comparison of the non-invasive mobile EEG registration and the signal processing devices	97

<u>OROSZI ESZTER DIÁNA</u>	
Kártékony programok terjedése social engineer szemmel	111
<u>SZAKONYI LAJOS</u>	
Hőtechnikai modellezés és identifikáció a lakótérben	121
<u>ROSTÁS ISTVÁN-KÖVÁRI ATTILA</u>	
Vakok tájékozódását segítő rendszerek összehasonlítása, továbbfejlesztési lehetőségei	134
<u>KATONA JÓZSEF</u>	
Aszteroida becsapódások hatásának összehasonlító elemzése szimulációs szoftver segítségével	145
<u>HONFI VID SEBESTYÉN-KIRÁLY ZOLTÁN</u>	
Modern technológiák, innovatív megoldások a vállalati informatikában	157
<u>GELENCSÉR SÁNDOR-KUTSCHI ZOLTÁN-DOSZKOCS NORBERT-KÖVÁRI ATTILA</u>	
Olcsó távvezérelt riasztó kialakítása	167
<u>HORVÁTH PÉTER-BOGNÁR LÁSZLÓ</u>	
A hallgatói preferenciák a felsőoktatásban a hagyományos és az online kurzusok közötti választásnál	175
<u>KIRCHNER ISTVÁN</u>	
Az iteráció konvergenciájának gyorsítása lineáris egyenletrendszerek megoldásakor	199
<u>FÁNCSIKNÉ HAMAR ÉVA-TÓTH GYULA</u>	
Függőleges gravitációs gradiens számításával kapcsolatos integrál csonkítási együtthatóinak meghatározása	210
<u>VÖRÖS TÜNDE</u>	
Az intézményi struktúra és a gazdasági fejlettség kapcsolatának vizsgálata matematikai-statisztikai eszközökkel	216
<u>BARTALOS NORBERT-UIBÁNYI TIBOR-KÖVÁRI ATTILA-NAGY BÁLINT</u>	
A Chua-rendszer vizsgálata az Octave alkalmazásával	233

The Comparison of the non-invasive mobile EEG registration and the signal processing devices

Abstract: In recent years, the measurement and processing of EEG signals have been improved very significantly, which enables the application of these devices in more and more areas. This article describes and compares some EEG devices.

Keywords: Brain-waves, electroencephalogram (EEG), non-invasive, EEG headset.

Összefoglalás: Az elmúlt években az EEG-jelek mérését és feldolgozását végző eszközök igen nagy fejlődésen mentek keresztül, melynek köszönhetően az alkalmazási lehetőségeik egyre több területre terjednek ki. E cikk ismerteti és összehasonlítja néhány ilyen EEG-eszközt.

Kulcsszavak: Agyhullámok, elektroencefalogram (EEG), non-invazív, EEG headset.

Introduction

The traditional EEG sign fixing and its analysis was made for the graphic illustration of the temporal and spatial features of the electric brain function for a long time. During the evaluation the characteristics determined only by the records was used for a long time, then in the second half of the XX. Century with the beginning of the digital era the evaluation and the process of the signals changed very much. The development of the digital technology made the complex real-time mathematical analysis of the EEG signals possible. Before the presence of the digital signal processing the treatment and the evaluation of the graphical printed records was very elaborate. With the appearance of the digital signal processing processors and with the de-

* Dunaiújvárosi Főiskola,
Informatikai Intézet
E-mail: katonaj@mail.duf.hu

[1] Snyder, S. M.–Hall, J. R. (2006): A meta-analysis of quantitative EEG power associated with attention-deficit hyperactivity disorder. *J. Clin. Neurophysiol.* Pp. 440–455.

[2] Saeid Sanei, S.–Chambers, J. A. (2007): *EEG Signal Processing*. Cardiff: Cardiff University Press–Wiley.

velopment of the signal processing algorithms for the evaluation of the brain signals entirely new evaluation methods that differ from the earlier applied ones were used with the help of the new algorithms and they have given new and more exact results. One of the most common applied algorithm is the so called quantitative EEG and to the existence of the studies based on this contributed the computerized signal processing widely. [1]

During the QEEG the digitized EEG signals are evaluated with the help of Fou-rier- transformation and with the use of this transformation the components of the sign frequency or rather the spectrum of the frequency can be determined in exact way. The development of the technology made the creation of such mobile measuring and processing devices possible which offer new research possibilities in several other areas besides the medical science. In our days grain bigger and bigger ground the EEG devices that require no operative interference and apply non-invasive method.

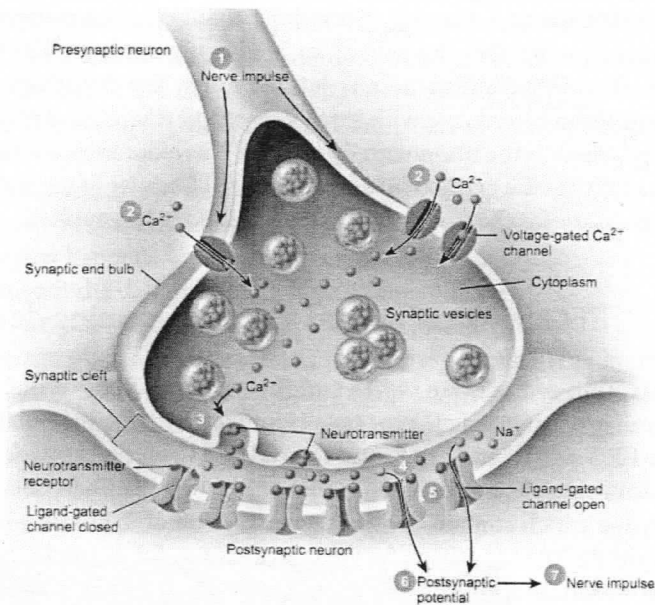
The EEG devices can ensure for the users besides the perception of the electric signals of the brain and its process other functions like a mobile phone headset which can make more universal the use of these devices.

The formation of the EEG signals

The earliest model that was created for the modelling of the formation of the EEG signals is the Hodgkin and Hukley's which has got the Nobel Prize and was published in 1952. One of the biggest structure of our body is the nervous system which is a group of neuron networks. This relationship system interlaces our whole body. The neurons are able to communicate with each other so it makes the transmission of the stimulus arriving from the brain possible. [2]

That linking place where the stimulus spread from one cell to another is called synapse. One protoplasm of the neurons (axon) creates the synapse in bigger part with the nerve ending of the other neuron (dendrite). The neuron that brings stimulus is called presynaptic and the other one that takes it on is called postsynaptic. (*Figure 1.*)

1. Figure. Synapse, the moment of stimulus transmission.



Source: <http://antranik.org/synaptic-transmission-by-somatic-motorneurons/>

The complex of the neuron's electric potential is called electrophysiological activity. When a neurotransmitter starts firing with the mediation of the chemical stimulus transmitting materials the positive ions that stream in depolarize the neurons. This depolarization is called postsynaptic potential (PSP). The formation of the synapsis happens when one neuron's axon gets in touch with another neuron's dendrite. The section between the two transmitter is called synaptic section. The human brain includes nearly 100 milliard neurons. When out of this neurons more thousands start aligned firing in certain area of the brain results measurable voltage. [3] These can be measured on the human scalp. We are able to measure low (5–100...) electric potential with placing appropriately the EEG electrodes on the human scalp directly. Furthermore the alternating electric voltages and due to the current fluctuation aroused by them magnetic field strength change is also measurable which is demonstrable on the human scalp too.

[3] Luck, S. (2005): *An Introduction to the Event-Related Potential Technique*. Cambridge: MIT Press.

[4] Jerbi, K. et al. (2011): Inferring hand movement kinematics from MEG, EEG and intracranial EEG: From brain-machine interfaces to motor rehabilitation. *IRBM*. Vol. 32. No. 1. Pp. 8–18.

[5] Sawan, M. et al. (2013): Wireless Recording Systems: From Noninvasive EEG-NIRS to Invasive EEG Devices. *Biomedical Circuits and Systems*. IEEE Transactions. Volume 7. Issue 2. Pp. 186–195.

[6] TOBI: Tools for Brain-Computer Interaction: www.tobi-project.org/ (2012. június 12.)

The electrophysiological activity can be measured in two methods. The first measuring method is the so called invasive and the other is the non-invasive opportunity. During the non-invasive method the changes of the magnetic field and voltages are also fixable with the help of an EEG equipment. [4] The biggest drawback of this method is that the measured data are noisy. The disturbance signals aroused by the noises can be reduced with invasive method where the EEG electrodes are directly implanted to the brain with operation. Therefore increase the measuring and the punctuality of the extractive information. [5] Because of the risk of the operation that is necessary for the implantation this method is less applied.

EEG registration and signal processing devices

The perception of the brain waves and their transmission to the signal processing unit – perhaps its immediate process – is fulfilled with the help of the perceptive that measure EEG signals and can be put to head and these perceptive's signal processing and transmitting electric unit. In recent years such EEG headsets became available for everyone which contain besides the perception of the brain waves the perceived brain wave digitiser (perhaps further processing, for example: the one that fulfils the determination of FFT) and a communication unit that is able to transmit these signals on some kind of digital communication channel.

In order to be these devices possibly more mobile used therefore they have power-supply from an own element or battery. In the followings some non-invasive headset will be reviewed which are able for the accomplishment of uniquely developed brain computer interfaces (BCI).

NEURO FOCUS

The Neuro Focus is the first wireless EEG device which applies more perceptive that has dry type. (*Figure 2.*) The developers has already started besides laboratory adoption the development of the device which was intended for commercial trade. The TOBI (The European Tools for Brain-Computer Interaction consortium) consortium will use the NeuroFocus for researches as an EEG register for developments that have medical application purposes. [6]

The EEG sensors of the NeuroFocus measures the brain function 2000 times per second then it is able to transmit the data through Bluetooth connection. This wireless method means a great leap forward compared to the traditional EEG devices which can be used only in hospital surroundings, making possible the use of this devices in other surroundings. [7]

The device is able to supply the processed information besides the raw, measured data.

The more significant features of the device:

- the multi-channel device that expand for the whole brain field
- the measuring that happens in standard measuring points [8]
- it is able to transmit the data through wireless transmission
- it applies dry electrodes so the sensors are easily replaceable

The disadvantage of the EEG headset is in one respect that it is multi-channel shaped where the perceptive touch the scalp on the upper part of the head therefore its placing is more circumstantial because of the assurance of the appropriate signal perception.

2. Figure. NeuroFocus EEG headset.



[7] Nielsen (2013): What People Watch: www.nielsen.com/us/en/nielsen-solutions/nielsen-measurement/consumer-neuroscience.html (2013. január 24.).

[8] H. H. Jasper (1958): The twenty electrode system of the International Federation. *Electroencephalogr. Clin. Neurophysiol.* 10. Pp. 371–375.

Source: <http://www.fastcompany.com/1741403/thinking-cap-mynd-first-dry-phone-compatible-portable-brain-scanner>

[8] H. H. Jasper (1958): The ten-twenty electrode system of the International Federation. *Electroencephalogr. Clin. Neuro-physiol.* 10. Pp. 371–375.

[9] Imec: Imec and Holst Centre bring brain wave monitoring to your home: http://www2.imec.be/be_en/press/imec-news/imeceegMDM-West.html (2011. február 8.)

[10] Imec: Imec, Holst Centre and Panasonic Present Wireless Low-power Active-Electrode EEG Headset: http://www2.imec.be/be_en/press/imec-news/imeceeg2012.html (2012. november 4.)

EEG HEADSET DEVELOPED BY IMEC AND HOLST CENTRE

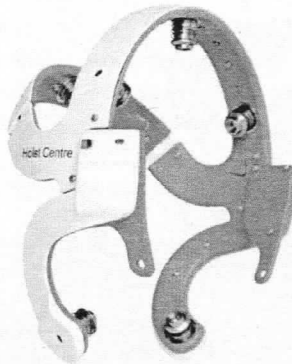
The Holst Centre and the IMEC introduced their first EEG headset prototype in 2009 and with the help of this they developed an easily useable EEG measuring tool. Altogether 10 electrodes were put to the headset according to the international 10–20 standard. [8] Reusable and provided with Ag/AgCl cover electrodes were used in the commercial EL120 headset which is specially planned ensuring with this the appropriate contact through the hair and the nap. The electrodes are fixed in special points which ensure the proper motive freedom and the appropriate signal transmission. The technology is already under development and its aim is the fixing of the EEG data during walk. To the achievement of this we have to solve the compensation of the motion and other physiological troubles, the development of the dry electrodes and the circuit belonging to them and the development of the ultra-low consuming processor that is able to process EEG data. [9]

The EEG is a system constructed for an ultra-low consuming ASIC (.) circuit that is able to measure EEG data which can be described with big noise oppression and low noise level. The integrated EEG measuring system includes a low consuming micro-controller and a unit that fulfils the wireless transmission, making the local data processing and the wireless communication possible. [9]

The upgrade version of the headset was presented in 2011 which was integrated to an EEG headset prototype (*Figure 3.*). The prototype can be easily put to the head of the user and a sprung hanging improves the stability as well as a magnetic hinged mechanism gives an opportunity for the refined setting of the unit. The magnetic fixing of the electrodes makes the exchange fast and simple. In certain cases it is possible to use jelly. This system also uses Ag/AgCl electrodes. The prototype can transmit the EEG signals towards the unit that is 10m far. [10]

New further development of the device was published in 2012 collectively with the Panasonic company. They improved the quality of the EEG signal's registration measured by the EEG signals. Thanks to the low consuming (750 μ W) signal processing unit it is able to fix signals of 8 perceptive quite like during 22 hours and to transmit via wireless connection.

3. Figure. EEG headset developed by IMEC and Holst Centre.



Source: <http://www.koenenco.nl/en/project/headset/>

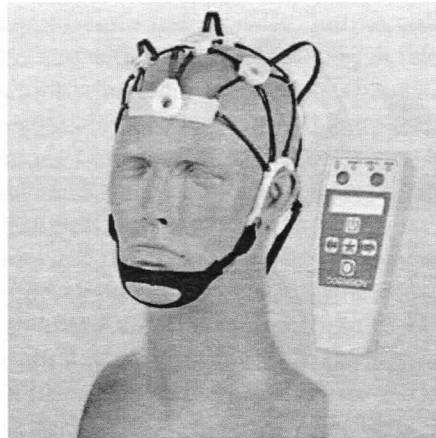
HYDRODOT EEG SYSTEM

The Hydrodot EEG system consists of a frame that can be put to the head and 12–20 EEG perceptives that are placed according to the standard. (Figure 4.) The devices apply disposable sensors. With the help of the frame that can be put to the head the sensors are precisely positioned. The system applies Ag/AgCl sensors that have jelly type. The measured electric signal can be processed by whatever standard EEG devices through a cable. The device was developed in the first place for hospital urgency and intensive supply. The drawback of the device is that it can be used only once and the placing and wear of it is less convenient. [11]

[11] Hydrodot: The hydrodot EEG system: <http://www.hydrodot.net/> (2010. december 3.)

[12] Emotiv:
EEG System
– Electroen-
cephalogra-
phy: [www.
emotive.com](http://www.emotive.com)
(2012. január
27.)

4. Figure. Hydrodot EEG system.



Source: <http://www.medgadget.com/2015/02/neuronetrix-brain-scanner-fda-approved-for-in-office-qeegerp-brainwave-analysis.html>

EMOTIVE EPOC EEG HEADSET

The Emotive System has developed the Emotive EPOC EEG headset. It can be connected to the computer though not standard wireless connection (*Figure 5.*) the key combinations can be ordered to the commands with the help of EmoKey software so the device can be suitable for control of a computer.

The EPOC includes 14 electrodes (compared to the hospital systems that usually apply 19 electrodes). The rotation of the head is also measurable thanks to the built-in two-shafted acceleration measurer. Several application remedial packages are available to the device. [12]

The device supplies the following information:

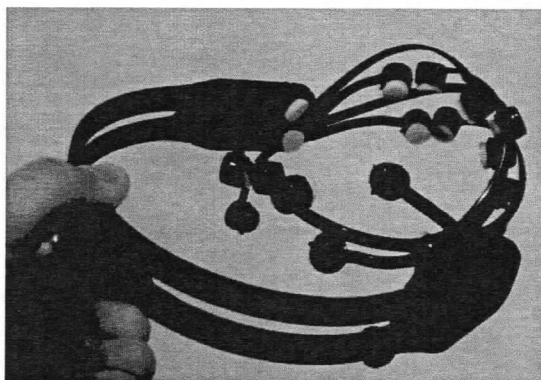
- Cognitive: Imaginative movement (left, right, up, down, forward and turn, rotation)
- Facial expressions: One by one eyelid and eyebrow position, eye position (smile, laugh) can be identified. The device identifies the facial expressions based on the signals of the

muscles that are on the face perceived by the EEG sensors and not based on the process of the brain waves.

- Rotation of the head: it is measurable by built-in acceleration measurer which is independent from the EEG process.
- Other: excitement, attention and its contrary

The headset is the choice that seems to be the most appropriate based on its features for the completion of general guiding and other controlling tasks.

5. Figure. Emotive Epoc EEG headset.



NeuroSky EEG headsets

During the development of the EEG devices of NeuroSky several universities was contributed like the Stanford, Carnegie Mellon, University of Washington, University of Wollongong and the Trinity College. Dry EEG sensor that was made from rustproof alloy is applied in the device for the perception of the brain signals.

The ThinkGear signal processing unit fulfils the filtering, the evaluation of the brain signals and the determination of the brain wave information. The EEG devices are simpler well-constructed, their wearing are more convenient and they are relatively cheap. [13]

[13] NeuroSky: Brain Wave Sensors for Every Body: www.neurosky.com (2013. október 31.)

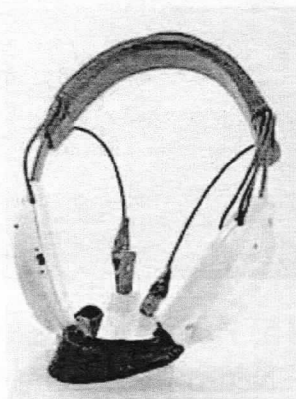
[13] NeuroSky: Brain Wave Sensors for Every Body: www.neurosky.com (2013. október 31.)

MINDFLEX

The MindFlex is also a device based on the technology developed by NeuroSky (*Figure 6.*). The device consists of a guided unit and a wireless EEG headset. The device applies one perceptive and two reference points from which the perceptive settles in the frontal lobe part and the other two reference points are fixed to the lower part of the ear.

The signal processing unit that can be found in the headset is able to determine the value of the concentration/attention with the help of ThinkGear technology developed by NeuroSky. [13]

6. *Figure. MindFlex.*

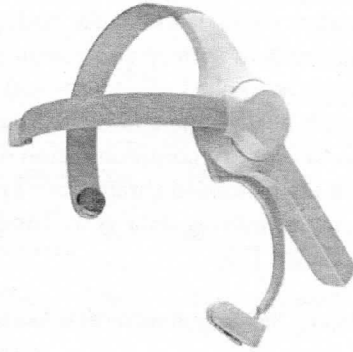


Source: <http://www.medgadget.com/2015/02/neuronetrix-brain-scanner-fda-approved-for-in-office-qeegerp-brainwave-analysis.html>

MINDWAVE

The MindWave EEG headset is similar to the MindFlex it is its upgrade version which is suitable for the rectification of blinking. The device is able for wireless connection (*Figure 7.*). [13]

7. Figure. NeuroSky MindWave EEG headset.



Source: <http://www.neurosky.com/>

BRAIN ATHLETE

This EEG cap was developed in the first place for athletes (baseball players, tennis players, golf players) who can be informed about their occurring mental state during sports. The device includes a built-in battery and it is able for Bluetooth communication. [14]

8. Figure. Neurosky Brain Athlete EEG headset.



Source: <http://www.neurosky.com/>

[14] BrainAthlete: Mental Sports Training using Brain Wave: <http://brain-athletesports.com/> (2012. március 23.)

[13] NeuroSky: Brain Wave Sensors for Every Body: www.neurosky.com (2013. október 31.)

MINDSET

The MindSet is an EEG headset which is usable for both general and research purposes. The headset includes built-in battery and communicates through standard Bluetooth connection and can be applied as a traditional telephone headset, what's more as a standard Blue-tooth headphone and other functions are available with a separate guiding button too in case of a communication happening with PC.

The device supplies both the processed (brain wave information in the 3–50 Hz frequency range) and the raw measuring data as well as determines attention/concentration and meditation values. [13]

9. Figure. Neurosky MindSet EEG headset.



Source: <http://www.neurosky.com/>

The comparison of EEG headset

Some parameter can be seen to sum in the following chart about the previously reviewed EEG headsets:

Table 1.

	Feeding of the battery	The number of the perceptive	Type of the perceptive	Wireless data transmission	Type of the information
<i>NeuroFocus</i>	Yes	18	Dry	Yes(Bluetooth)	Processed
<i>IMEC és Holst Centre</i>	Yes	10	Dry/Jellied	Yes (other)	Processed
<i>Hydrodot</i>	No	20	Jellied	No (wired)	Raw data
<i>Emotive EPOC EEG</i>	Yes	14	Dry	Yes (other)	Processed
<i>MindFlex</i>	Yes	1	Dry	Yes (other)	Processed
<i>Mindwave</i>	Yes	1	Dry	Yes (other)	Processed /Raw data
<i>Brain Athlete</i>	Yes	1	Dry	Yes (Bluetooth)	Processed
<i>MindSet</i>	Yes	1	Dry	Yes (Bluetooth)	Processed/ Raw data

It is visible from the comparison that most of the studied EEG devices have wireless connection and they are feed by battery. It makes the wearing of the devices more convenient and less disturb-ing. Thanks to the built in low consuming data processing unit they are able directly even for the supply of processed data which makes their use easier and their fitting to other devices.

The EEG devices of Emotive and Neurosky are available in commercial trade in the first place, they are the cheapest and most convenient and the devices that can be most simply put on as they are headsets produced by NeuroSky. Based on the information on the web page of the maker the Midwave produced by NeuroSky costs \$100 while the Emotive headset which is usable for improvement purposes and supplies raw data too costs \$750.

It can be seen based on the chart that while the Neuro-Sky applies only one perceptive the other devices collect information about the brain function. Of course with the use of more perceptive put on different parts of the head more information can be extracted like for example the imaginative motion.

Summary

The reviewed EEG data processing devices went through a huge development compared to the traditional EEG equipment and thanks to this their application possibilities has expanded. The article gives an overall picture about the features of the processing and measuring data collecting EEG devices that apply non-invasive EEG based process. It is provable based on the summary that today more EEG measuring data collecting and processing devices are available which require no special application knowledge, their use become simpler. As a consequence of this their use can emerge not only in medical use but can be expanded with other areas like the reduction of the reaction time, the observation of the watchful state and control based on the rectification of the imaginative motion. The EEG recording and signal processing devices that was developed for commercial and research purposes and available for everyone are continuously developing so in the future a device could come to light that will be widen with several new, further functions.