IN THE FOCUS

OpenViBE driver dedicated to the actiCHamp device

by Yann Renard, CTO at Mensia Technologies

Brain computer interfaces are a revolutionary new way of interacting with any system through cerebral activity. This has consequences for disabled patients as well as healthy individuals: the former can now spell text or control a wheelchair through thoughts[1], while the latter can monitor their mental state in a critical situation, play video games that adapt to their mental feedback[2], improve the functioning of their brain through neurofeedback, etc..

Of course, this requires a device through which the computer can acquire the signals coming from the brain. Among the many different ways of acquiring brain signals such as magnetoencephalography (MEG) or functional magnetic resonance imaging (fMRI), the most widely used is electroencephalography (EEG). Less expensive and non-invasive, EEG is well suited for BCI and for real-time applications as it delivers brain activity measurements with a high temporal resolution. With a large range of high-quality EEG acquisition devices, Brain Products offers BCI researchers excellent solutions for EEG-based experiments and analysis. What was missing until recently was a software framework that would enable clinicians, neurologists, computer scientists and signal processing researchers to design, create and test new BCI concepts and applications.

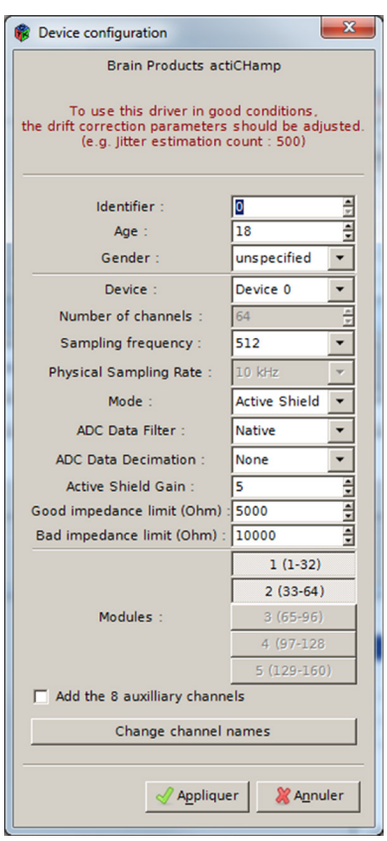

Fig. 1: The actiCHamp configuration dialog allows OpenViBE users to configure the device behavior at will. For instance, the use can chose the sampling frequency, configure the active shield feature for power-line noise reduction, set the impedance thresholds of the actiCAP, or chose which acquisition modules should be active during acquisition

This is exactly the vision that led to the creation of OpenViBE[3] within Inria, the French national institute for research in computer science, back in 2004. OpenViBE, a free and open-source software for real-time neurosciences, was first released in 2009[4] and has now become the leading framework to acquire, filter, process and classify brain signals to produce BCI commands. Portability, modularity, comprehensiveness of the toolset, both for programmers and non-programmers, and superior code performances are some of OpenViBE's qualities.

As a team, we are firm believers in the power of BCIs and therefore, leveraging the research work embodied in OpenViBE, we launched Mensia Technologies[5], a start-up focused on developing OpenViBE-based, innovative BCI solutions for research as well as wellness markets.

One of the first calls we got after setting up Mensia was from Brain Products. While the V-Amp / FirstAmp devices (up to 16 channels / 2kHz sampling rate) and the whole BrainAmp series (BrainAmp Standard, BrainAmp DC, BrainAmp MR and BrainAmp MR plus EEG devices - capable of reaching up to 128 channels by piling up 4 amplifiers of 32 channels each with a 5kHz sampling rate) were fully compatible with OpenViBE and used daily in many laboratories in conjunction with OpenViBE, their new actiCHamp devices were not.

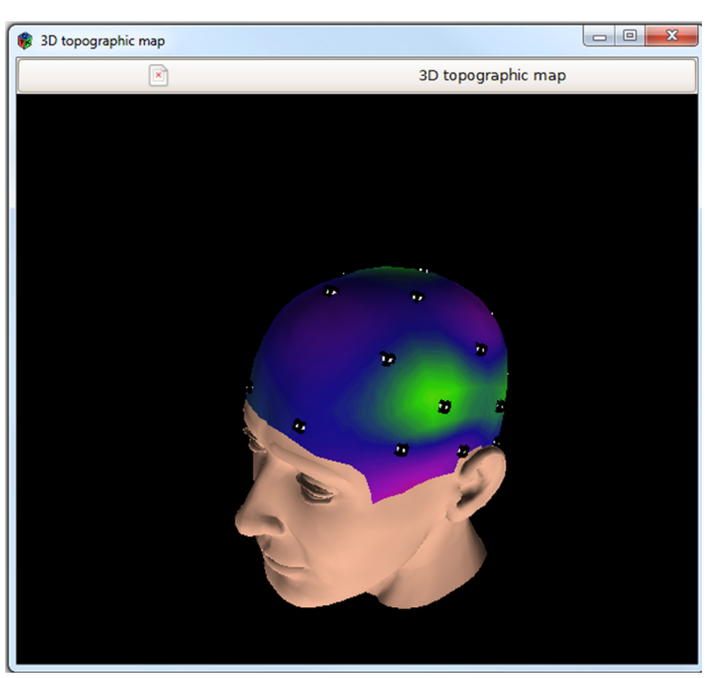

Fig. 2: TThe signals acquired by the actiCHamp can be visualized in realtime and in 3D with OpenViBE. This picture shows the beta-band power for 32 channels of the actiCHamp

The actiCHamp is a complete system to acquire signals from electro-physiological sensors. Thanks to its neat EEG modular system, it can acquire between 32 and 160 EEG channels at 5kHz to 100kHz sampling rate, using easy-to-install 32-channel card modules. Eight additional auxiliary channels can be used for EOG, EMG, GSR or other electrophysiological sensors. We immediately saw the potential of those devices and were happy to collaborate with Brain Products to develop the necessary software.

This collaboration has now reached fruition, and we are excited to announce a newcomer in the OpenViBE driver family, dedicated to the Brain Products actiCHamp device! All the actiCHamp features, including input triggers, impedance check or built-in data filters are exposed in the OpenViBE driver. Also, as the actiCHamp amplifier is designed to be used with the Brain Products active electrode set, the OpenViBE acquisition server now also includes configuration files to automatically obtain the 10-20 electrode names corresponding to the actiCHamp electrode placement.

Along with OpenViBE, the actiCHamp amplifier can give BCI researchers a very good opportunity to design, implement and experiment with state-of-the-art BCI applications, on top of, or re-using the ready-to-use scenarios already available in OpenViBE such as event-related potential (ERP) detection e.g. in the P300 speller, Motor Imagery BCI based on event-related (de)synchronization (ERS/ERD) or BCI game prototype based on steady-state visual evoked potential (SSVEP), etc.

We would be pleased to hear from researchers using the combination of actiCHamp and OpenViBE in the future! http://openvibe.inria.fr/downloads/ ●

References

[1] *J. Wolpaw, , Birbaumer, N., McFarland, D., Pfurtscheller, G., Vaughan, T. (2002). "Brain-computer interfaces for communication and control". Clinical Neurophysiology, 113(6), 767-791.*

[2] *L. George, A. Lécuyer (2010). „An overview of research on "passive" brain-computer interfaces for implicit human-computer interaction". In International Conference on Applied Bionics and Biomechanics ICABB 2010 - Workshop W1 "Brain-Computer Interfacing and Virtual Reality".*

[3] *Y. Renard, F. Lotte, G. Gibert, M. Congedo, E. Maby, V. Delannoy, O. Bertrand, A. Lécuyer. (2010) "OpenViBE: An Open-Source Software Platform to Design, Test and Use Brain-Computer Interfaces in Real and Virtual Environments", Presence : teleoperators and virtual environments, vol. 19, no 1.*

[4] *OpenViBE software: openvibe.inria.fr*

[5] *Mensia Technologies: www.mensiatech.com*