Simultaneous EEG + fNIR + Multimodal Wearable Sensor Suite for Research in the Real and Virtual Worlds

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Abstract

This workshop will present a basic introduction to dry electrode EEG combined with fNIR and multimodal wearable sensors including ECG, EMG, EOG, GSR, Respiration, skin temperature, 3D accelerometers, IMU motion tracking, and eye-tracking. We will demonstrate how to use these sensors to collect high quality signals that are resistant to motion and environmental artifacts in the real and virtual worlds. We will also showcase some BCI and neuroergonomic applications.

Keywords

EEG, fNIRS, Brain-Computer Interfaces, Mobile Brain/Body Imaging, Gaze Tracking

Prerequisites

None.

Course Schedule (Tue 14 September 9AM-12PM **CET)**

Day 1 (Tuesday, Sep 14th)	
9:00AM	Intro to Dry Electrode EEG
9:15AM	Demo Dry Electrode EEG
9:30AM	Introduction to fNIRS
9:45AM	Demo Hybrid EEG+fNIR headset
10:00AM	Multimodal Physiological Sensors Demos
10:30AM	Eye-Tracking & EEG Demo
11:00AM	Cognitive Gauges for Neuroergonomics Demo
11:15AM	BCI Demo
11:30AM	Q&A: Exploring your applications
12:00PM	End

Maximum Intake

Unlimited

Anything else, if any

We encourage participants to share with us their specific research projects during the Q&A so we can explore how multimodal sensing might fit their needs.

Long Abstract

Over the past years, **Wearable Sensing** has developed high-fidelity dry electrophysiological sensors for recording the brain's electroencephalographic (EEG) signals from the scalp with comparable signal quality to that obtained with conventional medical grade electrodes, but without the hassles of skin preparation and sensitivity to artifacts. These sensors can also be used to record ECG, EMG and EOG, and have been embedded into headsets and systems that are practical to use outside the hospital or laboratory, in real-world environments. These practical yet high-fidelity systems are opening the door to innovative applications in commercial domains including neuroergonomics, augmented cognition, Brain-Computer-Interfaces (BCI), neuromarketing, peak-performance training, neuroeducation, etc.

This talk will introduce these sensors and some of the wearable systems they have been embedded into, as well as some a new system that incorporates these Dry Electrode EEG sensors with functional Near-InfraRed (fNIR) sensors into a single device. We will present some of the brain computer interface and neuroergonomics applications we have explored. In order to extract practical information from these non-intrusive sensors, we have implemented cognitive state monitoring algorithms. These real-time cognitive gauges will be described along with results from validations in several applications ranging from adaptive aiding to expertise assessment. This presentation will highlight this innovative Dry Sensor Interface (DSI) technology and showcase DSI headsets in action.