EAVI EMG board

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1. DEMO

Electromyography (EMG) has been widely adopted to build new interfaces for musical expression by the community [10, 4]. Muscular activity is inherently noisy, making EMG signals potentially difficult to map to audio parameters, and work with when designing interactions with audiovisual systems. For decades, musicians and technologists have explored different solutions – from costly medical devices to do-it-yourself (DIY) packages – to find reliable hardware for capturing the best EMG signal in order to facilitate the music and instrument making process.

In 2014 Thalmic Labs released the Myo, a wireless 8-channel EMG armband with a built-in inertial measurement unit (IMU) designed specifically for multimodal human-computer interactions. This device, together with custom software developed by the community [3, 2, 6, 7], has allowed the NIME community to easily take advantage of EMG technology in a variety of applications involving interactive audiovisual control [8, 5, 1, 9]. Unfortunately, the Myo armband was discontinued in October 2018 and is no longer available on the market. Thus, the community is once again facing the problem of generating its own EMG solutions. For this reason, we decided to build the EAVI EMG board (Figure 1).

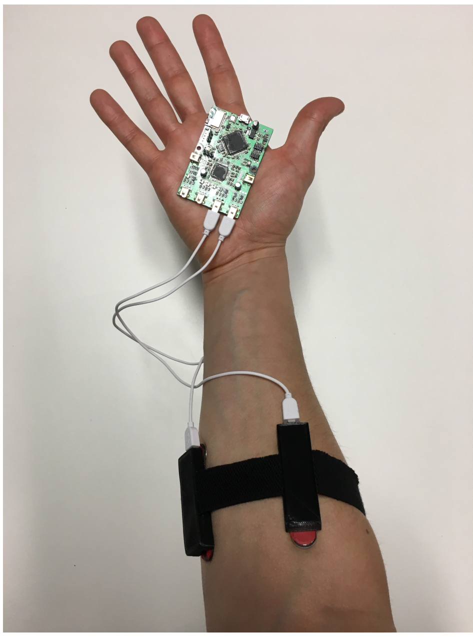

Figure 1: Board prototype worn on right forearm.

The EAVI EMG board features six EMG channels and a 3-axis accelerometer. Dry electrodes are attached to a Plux Snap-Bit Trio[1] with an EMG sensor[2] seated on top of it (Figure 2) and housed in a custom case. Each sensor is connected the board via micro-USB. In contrast to the Myo armband, which could be worn on the forearm only, our solution enables the positioning of the electrodes on any part of the body through our custom electrode case (Figure 3) which supports the use of bands of any length and material. The accelerometer is on the main circuit board.

Figure 2: Plux's Snap Bit Trio with soldered EMG module.

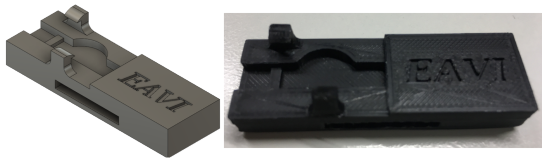

Figure 3: Snap Bit Custom Case.

The EAVI EMG board captures gestural data at a sample rate of 16 kHz and a resolution of 20 bits, and streams to a computer via USB and Bluetooth Low-Energy (BLE).

As it is possible to observe in Figure 4, at the current stage, the board suffer from a high signal-noise ratio. However, the board is currently under constant development, thus we aim to present to the NIME community the latest improvements made on this work.

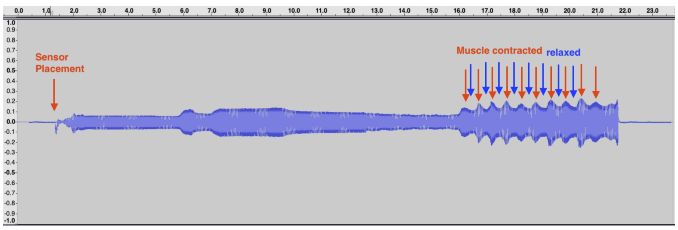

Figure 4: EMG signal.

We will demonstrate the potential of the EAVI EMG board for NIME applications by using it to control parameters of a bespoke software synthesizer. We will invite the public try the board and welcome discussions related to potential applications in music, dance, building new bio musical instruments and related themes.

This technology represents an alternative solution for researchers and musicians interested in implementing EMG technology in their work. Because this board supports flexible placement of electrodes on muscles other than the forearm, it opens

[1] https://store.plux.info/breakout-boards/220-snapbit-trio.html
[2] https://store.plux.info/bitalino-sensors/8-electromyography-emg-sensor.html

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up a new range of possibilities for performers (e.g. dancers) when compared to previous EMG implementations.

Source code and more technical details about the board will be released through an open repository, thus facilitating the customisation and implementation of the board in different contexts by the community.

2. TECHNICAL AND SPACE REQUIREMENTS

- Table
- Multi-plug (3 plugs min)
- Computer monitor (optional)

3. BIOGRAPHIES

3.1 Balandino Di Donato

Balandino is a Research Assistant at Goldsmiths, University of London, where he is currently involved in BioMusic ERC-POC funded project. BioMusic focuses on the creation of BioMusical instruments using EMG based techonlogies. His undergraduates works have been focused on the realisation of the Tangible User Interface (TUI) 'Metis', and in contemporary music composition. He worked at Centro Ricerche Musicali di Roma (CRM) as artistic and research assistant, and for national and international musical productions as sound engineer. In 2013, he was involved in the development of Integra Live at the Royal Birmingham Conservatoire, where he later realised his PhD with a thesis regarding the embodied control of audiovisual feedback during musical performance using IMU and EMG technology.

3.2 Atau Tanaka

Atau Tanaka conducts research in embodied musical interaction. This work takes place at the intersection of Human Computer Interaction and gestural computer music performance. He studies our encounters with sound, be they in music or in the everyday, as a form of phenomenological experience. This includes the use of physiological sensing technologies, notably muscle tension in the electromyogram signal, and machine learning analysis of this complex, organic data. He is Professor of Media Computing in the Embodied Audiovisual Interaction unit (EAVI) at Goldsmiths.

3.3 Michael Zbyszyński

Michael Zbyszyński is a lecturer at Goldsmiths, University of London, where he is co-leader of the Electronic Music, Computing and Technology program. His research involves application of interactive machine learning to musical instrument design and performance. As a musician, his work spans from brass bands to symphony orchestras, including composition and improvisation with woodwinds and electronics. He has been a software developer at Avid, SoundHound, Cycling '74, and Keith McMillen Instruments, and was Assistant Director of Pedagogy at UC Berkeley's Center for New Music and Audio Technologies (CNMAT). He holds a PhD from UC Berkeley and studied at the Academy of Music in Kraków on a Fulbright Grant. His work has been included in Make Magazine, the Rhizome Artbase, and on the ARTSHIP recording label.

3.4 Martin Klang

Martin Klang is a software developer, electronics designer, start-up entrepreneur and improvising musician. Having studied at University of Gothenburg, Chalmers University of Technology and Université Paris-Sorbonne, he spent 10 years as a software engineer and systems architect before setting up his own consultancy. His work for large and small clients has specialised in developing state-of-the-art compilers and designing bespoke programming languages. Martin has always been committed to Free and Open Source, and is a founding member of the London Music Hackspace. He now runs Rebel Technology, a London-based manufacturer of innovative and unique music electronics.

4. ACKNOWLEDGEMENT

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