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Noninvasive Brain-Machine Interface to Control Both Mecha TE Robotic Hands Using Emotiv EEG Neuroheadset

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Abstract : Electroencephalogram (EEG) is a noninvasive technique that registers signals originating from the firing of neurons in the brain. The Emotiv EEG Neuroheadset is a consumer product comprised of 14 EEG channels and was used to record the reactions of the neurons within the brain to two forms of stimuli in 10 participants. These stimuli consisted of auditory and visual formats that provided directions of 'right' or 'left.' Participants were instructed to raise their right or left arm in accordance with the instruction given. A scenario in OpenViBE was generated to both stimulate the participants while recording their data. In OpenViBE, the Graz Motor BCI Stimulator algorithm was configured to govern the duration and number of visual stimuli. Utilizing EEGLAB under the cross platform MATLAB®, the electrodes most stimulated during the study were defined. Data outputs from EEGLAB were analyzed using IBM SPSS Statistics® Version 20. This aided in determining the electrodes to use in the development of a brain-machine interface (BMI) using real-time EEG signals from the Emotiv EEG Neuroheadset. Signal processing and feature extraction were accomplished via the Simulink® signal processing toolbox. An Arduino™ Duemilanove microcontroller was used to link the Emotiv EEG Neuroheadset and the right and left Mecha TE™ Hands.

Keywords : brain-machine interface, EEGLAB, emotiv EEG neuroheadset, OpenViBE, simulink
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