Towards Open and affordable Real-world Brain-computer Interface: The BASIL Project

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Abstract

Background: Independent and open brain-computer interfaces (BCIs) working outside the laboratory environment are still rare. Their most limiting factors include low classification accuracy, information transfer bit-rate, low variability of used approaches, and closeness of the hardware and software components of the system. The presented BASIL project has focused on the design, development and testing of an open and affordable BCI system that is built on low-cost hardware and open-source software components. It provides people with motor impairments with an opportunity to control their basic home environment.

Methods: The concept of the BASIL prototype follows the best practices that are known within the construction of BCI systems, adds the concept of the cloud for remote BCI computations, relies on testing and customization of the whole system to the needs of individuals, and focuses on the open solution affordable for ordinary users. The core components of the BASIL project solution include hardware components for signal acquisition and software components for local execution of online BCIs.

Results: The BASIL system was tested on ten participants in laboratory conditions. We failed to evoke a reliable P300 component with eight-trial averages. Eyes blinks, alpha activity, and steady-state visually evoked potentials were clearly observable. Dry electrodes with long pins were preferred by most users. Out of ten participants, six were able to control the system online, achieving more than 70 % accuracy.

Conclusions: The results show that a successful BCI system can be built on low-cost hardware for EEG signal acquisition and amplification. The current solution, the prototype of the open and affordable BASIL BCI system, is prepared for further community development and testing.

Full Text

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