

A Controller for Assistive Devices using Eye Movement and Electroencephalography

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Assistive technology is adapted or specially designed technology for improving the functioning of people with disabilities. However, access to assistive technology is limited in Sri Lanka. The high cost of assistive technology development has put them out of reach of most of the disabled Sri Lankans. Therefore, low-cost equipment to read signals from patients with limited abilities will lead this technology development to next level. This research presents the development of a low-cost system which acquires and process brainwaves and eye movements of individuals. These signals are processed for controlling few assistive devices. Further, the research explores methods for using the system in aids with the brain's ability to undergo plastic changes for the recovery of function and to ensure patient's safety. Experiments in this project revealed different ways of brainwave processing and meaningful brainwave output frequencies to identify more emotions and motives of human brain like levels of concentration and drowsiness. The tests were performed on different subjects and revealed many new useful results such as suitable positions to place the electrode, variations in results when the subject gets familiar with the system. Hough transformation based eye tracking system is developed to detect iris position. Initially, it is implemented in MATLAB to detect three iris positions, left, right and center within 4-5 seconds. Later, the system is implemented on Raspberry-Pi using Open CV and Python with less than 3 seconds detection time. Finally, this research concludes that incorporating eye iris movement tracking with brainwave can be used as a novel low-cost approach. This combination allows developing a simple real time assistive device controller. This system can be used as a solution for connecting physically disabled individuals in developing countries to smart assistive devices.

Keywords: Brainwaves, Eye movements, Hough transformation, Assistive technology, Electroencephalography