

## Integration of EEG and Motion Tracking Sensors for Objective Measure of Attention-Deficit Hyperactivity Disorder in Pre-Schoolers

**Authors :** Neha Bhattacharyya, Soumendra Singh, Amrita Banerjee, Ria Ghosh, Oindrila Sinha, Nairit Das, Rajkumar Gayen, Somya Subhra Pal, Sahely Ganguly, Tanmoy Dasgupta, Tanusree Dasgupta, Pulak Mondal, Aniruddha Adhikari, Sharmila Sarkar, Debasish Bhattacharyya, Asim Kumar Mallick, Om Prakash Singh, Samir Kumar Pal

**Abstract :** Background: We aim to develop an integrated device comprised of single-probe EEG and CCD-based motion sensors for a more objective measure of Attention-deficit Hyperactivity Disorder (ADHD). While the integrated device (MAHD) relies on the EEG signal (spectral density of beta wave) for the assessment of attention during a given structured task (painting three segments of a circle using three different colors, namely red, green and blue), the CCD sensor depicts movement pattern of the subjects engaged in a continuous performance task (CPT). A statistical analysis of the attention and movement patterns was performed, and the accuracy of the completed tasks was analysed using indigenously developed software. The device with the embedded software, called MAHD, is intended to improve certainty with criterion E (i.e. whether symptoms are better explained by another condition). Methods: We have used the EEG signal from a single-channel dry sensor placed on the frontal lobe of the head of the subjects (3-5 years old pre-schoolers). During the painting of three segments of a circle using three distinct colors (red, green, and blue), absolute power for delta and beta EEG waves from the subjects are found to be correlated with relaxation and attention/cognitive load conditions. While the relaxation condition of the subject hints at hyperactivity, a more direct CCD-based motion sensor is used to track the physical movement of the subject engaged in a continuous performance task (CPT) i.e., separation of the various colored balls from one table to another. We have used our indigenously developed software for the statistical analysis to derive a scale for the objective assessment of ADHD. We have also compared our scale with clinical ADHD evaluation. Results: In a limited clinical trial with preliminary statistical analysis, we have found a significant correlation between the objective assessment of the ADHD subjects with that of the clinician's conventional evaluation. Conclusion: MAHD, the integrated device, is supposed to be an auxiliary tool to improve the accuracy of ADHD diagnosis by supporting greater criterion E certainty.

**Keywords :** ADHD, CPT, EEG signal, motion sensor, psychometric test

**Conference Title :** ICEBEA 2023 : International Conference on Electronics, Biomedical Engineering and Applications

**Conference Location :** Montreal, Canada

**Conference Dates :** May 15-16, 2023