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ABSTRACT:

Control of an Assistive Mobility Device via EEG Artifact Mapping and ADB-Based Actuation: A Case Study from the 1st INAOE Biomedical Application Contest

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Assistive mobility represents a critical field for patients with motor impairments. This study presents a BCI-based control architecture for an AIRWheel H3PS electric wheelchair, developed and awarded 3rd place in the 1st Student Contest for Biomedical Applications at INAOE (Instituto Nacional de Astrofísica, Óptica y Electrónica). The system focuses on the real-time translation of neurophysiological signals into mechanical navigation commands.

The architecture utilizes an EMOTIV EPOC wireless headset to capture data via the Lab Streaming Layer (LSL) protocol [1]. Given the environmental noise in mobile assistance, the software was engineered to identify physiological artifacts, specifically ocular and facial muscular activity, as robust control triggers [2]. The processing core employs a windowed average where a threshold of $V_{th} \geq 4200$ units triggers the state machine.

Navigation is facilitated by a sequential menu with auditory biofeedback (2000-5000 Hz), allowing direction selection (forward, right, left, backward) without visual overhead. The interface is achieved through Android Debug Bridge (ADB), translating classified artifacts into input tap commands on the wheelchair's native control application [3]. Experimental trials on a designated circuit demonstrated that the system significantly improves trajectory stability and reduces cognitive load compared to standard BCI paradigms [4].

Keywords: BCI, EEG, Assistive Technology, INAOE, ADB Shell, AIRWheel H3PS.

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