Group #8

Hydrogel-Electrode Modular EEG

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Abstract

Many electroencephalography (EEG) devices are classified as “wet,” “semi-dry,” or “dry” based on their conductive media (i.e., gel, saline, dry metal, respectively); however, each category comes with its own pitfalls, either sacrificing comfort and setup time for input impedance or vice versa. This project aims to bridge the gaps between these by utilizing a solid hydrogel to reach similar input impedances to a “wet” EEG system while maintaining the form factor and ease of use of a “dry” EEG system. This solution utilizes a solid hydrogel electrode with comb-electrode morphology, a custom electrode amplifier printed circuit board (PCB), and a 3D-printable headset with compliant parts made of thermoplastic polyurethane (TPU). The electrode reached a 30 kΩ effective impedance (> 10x lower than commercial dry EEG signals), the PCB was successful in its delivery of active-shielded unitary gain signals, and the mechanical headset implements a 2-DOF electrode housing to allow for electrode adjustments and enlarge the skin-electrode interface. This demonstrates viability for a full-system integration that outperforms current dry EEG systems in impedance and wet EEG systems in setup time.