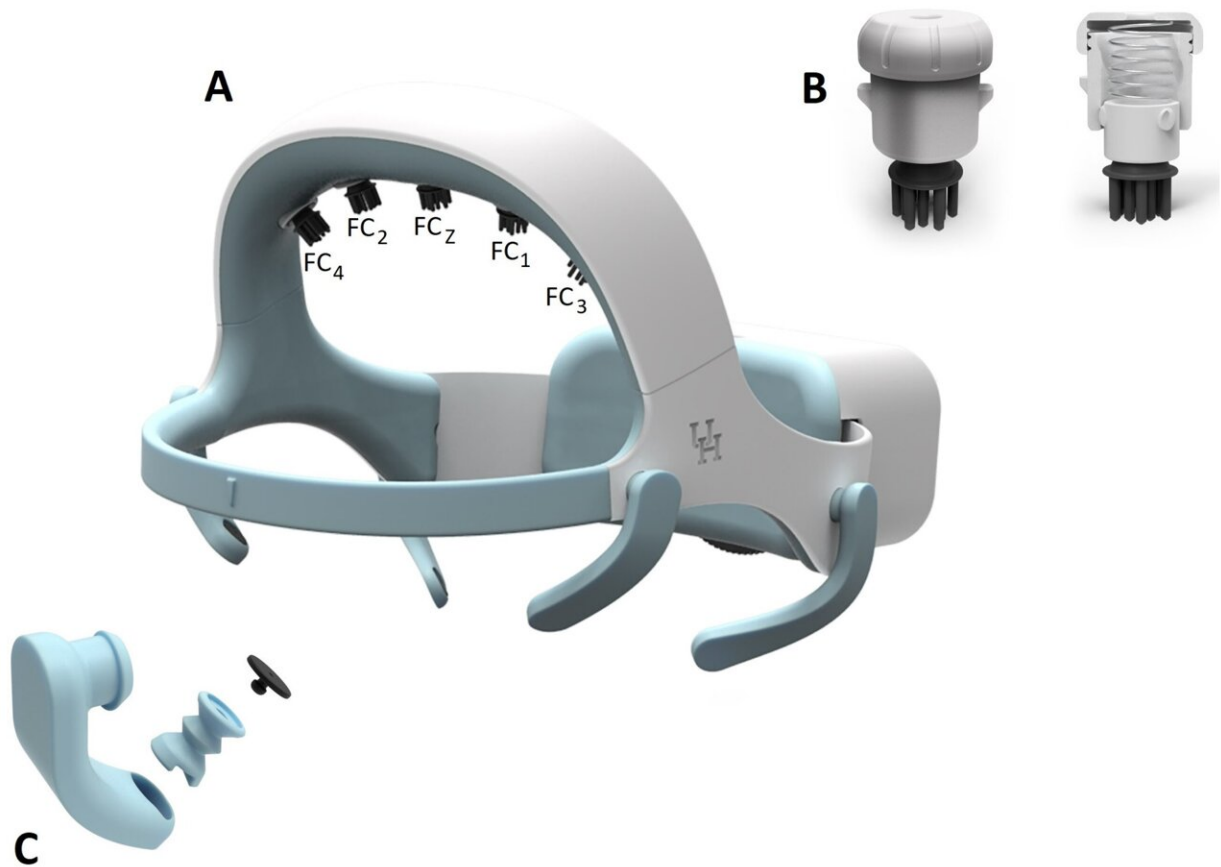


Stroke rehab at home is near: Researchers create portable EEG headset

August 8 2023, by Laurie Fickman



(A) Fully assembled one-size-fit-all (patent pending) headset design. (B) Dry-electrode bracket. (C) The skin sensor holder. This figure was adapted from US provisional patent #62857263. Credit: *Sensors* (2023). DOI: 10.3390/s23135930

The world of at-home stroke rehabilitation is growing near, incredible news for the 795,000 people in the United States who annually suffer a stroke. A new low cost, portable brain-computer interface that connects the brain of stroke patients to powered exoskeletons for rehabilitation purposes has been validated and tested at the University of Houston.

"We designed and validated a wireless, easy-to-use, mobile, dry-electrode headset for scalp electroencephalography (EEG) recordings for closed-loop brain-computer (BCI) [interface](#) and internet-of-things (IoT) applications," reports professor Jose Luis Contreras-Vidal, Hugh Roy and Lillie Cranz Cullen Distinguished Professor of electrical and computer engineering, in the journal *Sensors*. Contreras-Vidal is an international pioneer in noninvasive [brain-machine interfaces](#) and robotic device inventions.

An EEG-based brain-computer interface (BCI) is a system that provides a pathway between the brain and external devices by interpreting EEG. In other words, the device reads your mind, interpreting the brain's activity to initiate robotic movement. Brain-machine interfaces based on scalp EEG also have the potential to promote cortical plasticity following stroke, which has been shown to improve motor recovery outcomes.

The adjustable headset, designed from commercial off-the-shelf components, can accommodate 90% of the population. There is a patent-pending on both the BCI algorithm and the self-positioning dry electrode bracket allowed for vertical self-positioning while parting the user's hair to ensure contact of the electrode with the scalp.

"We used a multi-pronged approach that balanced interoperability, cost, portability, usability, form factor, reliability and closed-loop operation," said Contreras-Vidal.

In the current prototype, five EEG electrodes were incorporated in the

electrode bracket spanning the sensorimotor cortices and three skin sensors were included to measure eye movement and blinks. An inertial movement unit, measuring head motion, allows for a portable brain-body imaging system for BCI applications.

"Most commercial EEG-based BCI systems are tethered to immobile processing hardware or require complex programming or set-up, making them difficult to deploy outside of the clinic or laboratory without technical assistance or extensive training. A portable and wireless BCI system is highly preferred so it can be used outside lab in clinical and non-clinical mobile applications at home, work, or play," said Contreras-Vidal.

The invention solves an array of needs.

"Current commercial EEG amplifiers and BCI headsets are prohibitively expensive, lack interoperability, or fail to provide a high signal quality or closed-loop operation, which are vital for BCI applications," said Contreras-Vidal.

More information: Alexander Craik et al, Design and Validation of a Low-Cost Mobile EEG-Based Brain–Computer Interface, *Sensors* (2023). [DOI: 10.3390/s23135930](https://doi.org/10.3390/s23135930)

Provided by University of Houston

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