DESIGN AND FABRICATION METHOD FOR USER-GENERIC IN-EAR EEG BRAIN-COMPUTER-INTERFATIGUE MONITOR

Tech ID: 33169 / UC Case 2023-137-0

BRIEF DESCRIPTION

Compromised cognitive states such as fatigue, lack of sleep, stress, and age-related cognitive decline can severely impact mental and physical performance, often contributing to accidents and significant health costs. To address this challenge, UC Berkeley researchers have developed an in-ear electro-mechanical device for monitoring brain activity. This innovative apparatus features a main body made of a compliant material with an internal electronics housing, a conical tip, and a plurality of dry electrodes. A key feature is the placement of the dry electrodes: some are formed on the surface of the conical tip, and others are on the surface of the main body's second end. The technology also includes methods for three-dimensional printing an electrode base sized for the ear, followed by forming successive layers of base, intermediate, and final metals. Furthermore, the invention encompasses a sophisticated methodology for training a machine learning model to predict a user's cognitive state based on these in-ear brain activity measurements. This is achieved by correlating in-ear brain activity measurements with objective and subjective cognitive state measurements taken during a known control task, identifying a "triggering event," and using that data to train the model to predict cognitive state for generic users.

SUGGESTED USES

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Continuous, non-invasive monitoring of short-term and long-term cognitive states (e.g., fatigue, lack of sleep, stress) in various settings.

»

Integrating into consumer or professional devices to provide real-time warnings of compromised cognitive states to mitigate risks in situations like driving, operating heavy machinery in construction or mining, or other high-risk activities.

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Assisting in the diagnosis and management of sleep disorders, which contribute to conditions like hypertension, diabetes, and heart attack.

»

Providing research tools for studies on cognitive function, including memory, attentiveness, and decision-making abilities.

»

Developing personalized cognitive state prediction models using machine learning trained on correlated objective, subjective, and in-ear brain activity measurements.

»

Creating highly customizable and form-fitting electrodes designed for the specific curvature of a user's ear using a three-dimensional printing process.

ADVANTAGES

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INVENTORS

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OTHER INFORMATION

CATEGORIZED AS

» **Biotechnology**
» Bioinformatics
» Other
» **Computer**
» Software
» **Materials & Chemicals**
» Other
» Polymers
» **Medical**
» Devices
» Diagnostics
» Other
» Software
» **Research Tools**
» Other
» Screening Assays
» **Sensors & Instrumentation**
» Biosensors
» Medical
» Other

The apparatus is positioned within an ear, offering a discrete and potentially more comfortable means of monitoring brain activity compared to traditional external devices.

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It utilizes dry electrodes, eliminating the need for messy conductive gels typically associated with electroencephalography (EEG).

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The device incorporates a main body made of a compliant material, which likely enhances user comfort and fit for prolonged wear.

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The methodology includes machine learning for training a model to predict the cognitive state of a generic user, moving beyond individual baseline tracking to broader applicability.

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The training process uses a multi-modal data correlation (brain activity, objective, and subjective cognitive measurements) for more robust and accurate cognitive state prediction.

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The electrode fabrication method uses 3D printing to create an electrode base sized and shaped to fit within or around the ear, which allows for personalized device fit and improved signal quality.

» **Engineering**

» Other

RELATED CASES

2023-137-0

RELATED MATERIALS

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