Affordable, Wearable Multi-Modal Bio-Sensing Platform for Monitoring EEG, PPG, Eye-Gaze, and Limb Dynamics

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BACKGROUND

Electroencephalogram (EEG) systems have experienced a renewed interest by the research community for use in non-clinical studies. A major challenge is that the hardware and software typically used to make measurements limit their use to controlled environments. Additionally, the low spatial resolution of EEG itself limits the amount of usable information that can be extracted from noise in dynamic recording environments. Lastly, the absence of a method to automatically extract user-environment interactions for tagging with EEG data introduces an immense overhead to researchers - having to manually tag events or limit experimental design by requiring the subjects to provide information during the experiments. There are numerous sensors capable of measuring useful metrics for human behavior and interactions, however, limitations in the collection hardware and soft-ware hinder their use in experiments spanning multiple modalities.

TECHNOLOGY DESCRIPTION

Researchers from UC San Diego addressed the key limitations of existing systems and developed an affordable, wearable multi-modal bio-sensing platform that is capable of monitoring EEG, PPG, eye-gaze, and limb dynamics. Furthermore, this novel platform supports the addition of other biosensors including galvanic skin response (GSR) and lactate levels. Leveraging the capabilities of this system, a new breadth of applications can be explored that allow for better translations to impactful solutions.

APPLICATIONS

Applications include the use as a wireless, multi-modal bio-sensing system which is comfortable to wear, and can reliably monitor bio-signals such as electroencephalogram (EEG), electrocardiogram (ECG), electromyography sensing (EMG) and galvanic skin conductance (GSR) in real-time.

ADVANTAGES

By developing a low-cost, portable, multi-modal bio-sensing platform that is capable of interfacing with numerous different sensors, researchers are able to explore richer experimental questions that have previously been unable to be accessed due to the constrained nature of the measurement hardware

STATE OF DEVELOPMENT

The UC inventors are currently focusing on the application of this multi-modal system for emotion recognition studies in outdoor settings. Real-time processing of EEG is being done using ICA to extract true brain activity and measure valence and arousal. These bio-markers derived from the EEG can be used directly in an augmented reality (AR) based headset for interacting with environment and augmenting visual experience. For example, events such as when a person perceives another person's face can be automatically tagged using eye-gaze. The emotional response to real-world situations can also be visually displayed to the subject using augmented reality.

INTELLECTUAL PROPERTY INFO

CONTACT

University of California, San Diego
Office of Innovation and Commercialization
innovation@ucsd.edu
tel: 858.534.5815.

OTHER INFORMATION

KEYWORDS

Eye tracking-system, bio-sensing systems, real-time processing, emotion recognition

CATEGORIZED AS

- **Communications**
  - Wireless
- **Sensors & Instrumentation**
  - Biosensors
  - Medical

RELATED CASES

2016-303-0

This technology has a published patent and is available for licensing

RELATED MATERIALS

- Siddharth S, Tzyy-Ping Jung, Terrence J. Sejnowski. Multi-modal Approach for Affective Computing. Published in IEEE 40th International Engineering in Medicine and Biology Conference (EMBC) 2018 - 03/25/2018
- Siddharth S, Patel, A TP Jung, TP and Sejnowski, TJ. A Wearable Multi-modal Bio-sensing System. Submitted to IEEE Transactions on Neural Systems & Rehabilitation Engineering - 02/22/2018

PATENT STATUS

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United States Of America	Published Application	20190174039	06/06/2019	2016-303
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University of California, San Diego
Office of Innovation and Commercialization
9500 Gilman Drive, MC 0910, ,
La Jolla,CA 92093-0910

Tel: 858.534.5815
innovation@ucsd.edu
https://innovation.ucsd.edu
Fax: 858.534.7345