An Implantable Electrocorticogram (ECoG)-Brain-Computer Interface System for Restoring Lower Extremity Movement and Sensation

Tech ID: 29193 / UC Case 2016-344-0

BRIEF DESCRIPTION

A fully implantable brain-computer interface (BCI) with onboard processing to control a robotic gait exoskeleton as a walking aid for individuals with chronic spinal cord injury (SCI). This technology would alleviate SCI patient's dependence on wheel chairs, reducing the risk of secondary medical complications that account for an estimated $50 billion/year in healthcare costs.

FULL DESCRIPTION

Patients with spinal cord injury suffer the inability to control their lower extremities, most importantly, the ability to walk on their own. To manage an independent lifestyle, patients can utilize a wheel chair for mobility. Unfortunately, prolonged wheel chair usage can cause pressure ulcers, blood clots and affect patient metabolism. Cap-based electroencephalogram, a minimally invasive cap device worn over the skull that measures brain electrical activity to control a prosthesis, has been suggested as an alternative to wheel chairs. Despite their utility, minimally invasive brain control prosthesis system hold many limitations. Cap-based electroenecephalograms have a limited ability to map specific brain signals to prosthesis motion, are cumbersome to put on, and are not aesthetically pleasing. Therefore, there exists a need for a precise and socially acceptable form of brain-controlled prosthetic interface to alleviate spinal cord injury patients from the social and secondary health problems associated with prolonged wheel chair usage.

UCI researchers have developed a battery powered electrocorticogram brain computer interface, a fully implantable device that sits underneath a patient's skull to directly measure the electrical activity of the brain to control a prosthesis. Since the device detection circuitry sits closer to the brain. It can precisely map brain activity to controlled movements of a prosthesis, resolving one of the drawbacks of current systems. This device does not require mounting and dismounting, and is hidden away out of plane sight. It has also been shown that the device measures and produces five years of reproducible control signal that is within FDA implantable compliance.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,278,226	03/22/2022	2016-344
Patent Cooperation Treaty	Published Application	WO 2018/068013	04/12/2018	2016-344

STATE OF DEVELOPMENT

Experimental stage

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OTHER INFORMATION

CATEGORIZED AS

- **Biotechnology**
  - Health
- **Communications**
  - Wireless
- **Computer**
  - Hardware
  - Software
- **Materials & Chemicals**
  - Electronics Packaging
  - Thin Films
- **Medical**
  - Devices
  - Rehabilitation
- **Engineering**

» A 64-channel CMOS ultra-low power amplifier array and serializer have been designed and tested.

» Electrophysiological validation of amplifier was completed using EMG and EEG tests to observes the system's ability to amplify low amplitude bioelectric signals.

» ECoG implantable electrodes provide a robust walking aid solution for SCI patients.

» Reduce the occurrence of medical complications associated with prolonged periods of sitting in wheel chairs.

» Minimal implantable ECoG BCIs provide a normal independent lifestyle for those previously dependent on a wheel chair for motility.

» Wireless data transfer shifted away from the brain to minimize radiation exposure to sensitive tissues.

» Minimal surgical intervention needed to repair subcutaneous hardware.

» On-board processing and low power management.

RELATED MATERIALS

» A Low-Cost, Fully Programmable, Battery Powered Direct Cortical Electrical Stimulator1 Po T. Wang, Alireza Karimi-Bidhendi, Charles Y. Liu, Zoran Nenadic, Payam Heydari and An H. DoJ. Med. Devices 10(3), 030901 (Aug 01, 2016) (3 pages - 08/01/2016

» Mahajan, A; et. al. A 64-Channel Ultra-Low Power Bioelectric Signal Acquisition System for Brain-Computer Interface. Biomedical Circuits and Systems Conference(BioCAS). 2015 - 10/22/2015

» Robotics and Automation

RELATED CASES

2016-344-0

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