

# CORTICAL ACTIVITY INDEX

BrainU

THE DEPTH OF ANESTHESIA MONITORING



# BrainU

## Keep Your Brain in Shape

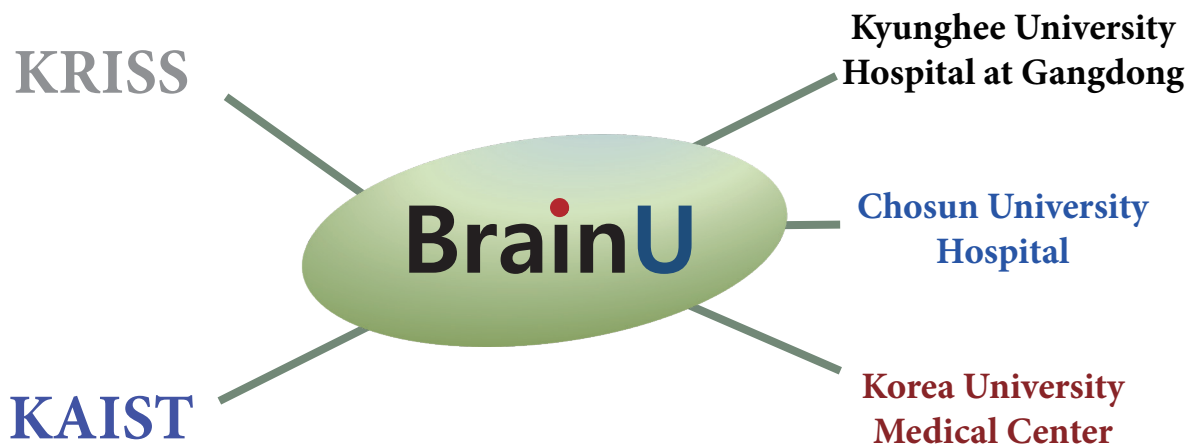
BrainU is a company that develops medical devices related to brain waves and bio-signal.

Based on the signal and data processing technology, BrainU has strengths in 4th industry related technology (artificial intelligence and big data).

With these expertise, we are developing medical devices that require precision such as EEG analysis.

We developed the depth of anesthesia monitoring system(called 'CAI') to measure the anesthetic state of the patient during the operation and received approval from the Korean Ministry of Food and Drug Safety.(MFDS)

Currently, we are also developing healthcare products based on bio signal analysis such as sleeping and concentration.



## PRODUCT DESCRIPTIONS



### CAIs Sensor

- Collecting frontal lobe EEG waves
- 4 electrodes hydrogel - attached sensor
- Low skin irritation
- Compact sized design for patient comfort



### CAIx AMPLIFIER

- Compact & Light-weight
- Easy to mount
- Bluetooth 3.0 supported
- Built-in Battery (over 24H)



### CAIv MONITOR & APPLICATION

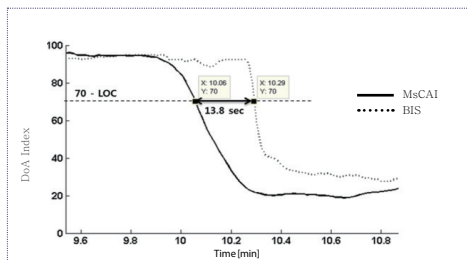
- Alarm, warning and error messages
- Easy to move & mount
- User - configurable displays
- Easy to manage Patients' data

CAI displays the following information on the screen

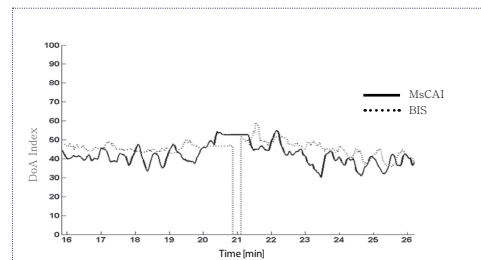
- CAI index value
- SQI Signal Quality Index
- EMG Electromyography
- EEG Electroencephalogram wave form display
- BSR Burst Suppression ratio
- Warning and Alarm Messages

# ADVANCED

The system quickly processes the brain's electrical activity based on original signal processing technology. Newly adopted Bluetooth wireless module guarantees high quality of signals. You can safely monitor the live depth of anesthesia anywhere and anytime in an operation room.



FAST RESPONSE vs BIS™



IMPROVED STABILITY vs BIS™

## ALGORITHM FEATURES

- Analysis of frontal lobe brain activity
- Approx. 14 secs faster signal processing vs BIS™
- Real Time Cortical Activity Index and Electro-myography Index
- Burst Suppression Ratio & Raw EEG Data

# EXTENDED

User-friendly designed UI/UX displays important patient information in a concise way. Touch actions control the main functions of the app during monitoring of the patients. Simple design of the system focuses the essential function and provides the environments for the user friendly. Wireless system to improve space efficiency in the operation room. Configuration and display of user customized EEG information.



EASY UI / UX

## DEVICE FEATURES

- User friendly designed UI/UX
- Concise patient information display
- Wireless communication (Bluetooth 3.0)
- Alarm / Warning / Error Message
- Low skin irritation sensor design

## PAPER

33rd Annual  
International Conference  
of the IEEE EMBS

Boston, Massachusetts USA,  
August 30 - September 3,  
2011

### Monitoring the Depth of Anesthesia from Rat EEG using Modified Shannon Entropy Analysis

Young-Gyu Yoon, Tae-Ho Kim, Dae-Woong Jeong, and Sang-Hyun Park

**Abstract**—In this paper, an entropy based method for quantifying the depth of anesthesia from rat EEG is presented. The proposed index for the depth of anesthesia called modified Shannon entropy (MShEn) is based on Shannon entropy (ShEn) and spectral entropy (SpEn) which are widely used for analyzing non-stationary signals. Discrimination power (DP), as a performance indicator for indexes, is defined and used to derive the final index for the depth of anesthesia. For experiment, EEG from anesthetized rats are measured and analyzed by using MShEn. MShEn shows both high stability and high correlation with other indexes for depth of anesthesia.

35th Annual  
International Conference  
of the IEEE EMBS

Osaka, Japan, 3 - 7 July, 2013

### A Cepstral Analysis based Method for Quantifying the Depth of Anesthesia from Human EEG

Tae-Ho Kim, Young-Gyu Yoon, Jinu Uhm, Dae-Woong Jeong, Seung Zhoo Yoon and Sang-Hyun Park

**Abstract**— In this paper, a cepstral analysis based approach to measuring the depth of anesthesia (DoA) is presented. Cepstral analysis is a signal processing technique widely used especially for speech recognition in order to extract speech information regardless of vocal cord characteristics. The resulting index for the DoA is called index based on cepstral analysis (ICep). The Fisher criterion is engaged to evaluate the performance of indices. All analyses are based on a single-channel electroencephalogram (EEG) of 10 human subjects. To validate the proposed technique, ICep is compared with bispectral index (BIS), which is the most commonly used method to estimate the level of consciousness via EEG during general anesthesia. The results show that ICep has high correlation with BIS, and is outstanding in terms of the Fisher criterion and offers faster tracking than BIS in the transition from consciousness to unconsciousness.

2014  
International Conference  
on Information and Com-  
munication  
Technology Convergence  
(ICTC)

### Implementation of Real-time Depth of Anesthesia Monitoring System Using Wireless Data Transfer

Jihoon Park<sup>1</sup>, Junbeom Kim<sup>2</sup>, Seung-Kyun Hong<sup>3</sup>, Kwang Moo Kim<sup>3</sup>, Ho-Jong Chang<sup>2\*</sup>

School of Electrical and Electronic Engineering, Yonsei University, Seoul, Republic of Korea<sup>1</sup> / Biomedical Team, IT Convergence, Korea Advanced Institute of Science and Technology, Daejeon, Republic of Korea<sup>2</sup> / Charm Engineering Co., Ltd. Gyeong-gi, Republic of Korea<sup>3</sup>  
polypark@yonsei.ac.kr<sup>1</sup>, hojongc@itc.kaist.ac.kr<sup>\*</sup>

**Abstract**— In this paper, wireless communication system for Depth of Anesthesia (DoA) monitor system, which is used as auxiliary device for operation, has been implemented. Conventional systems use wired data transfer for communication between sensor and the main system. Thus, the existing systems have constrained distance of data transfer. The proposed system resolves this problem to obtain convenience and portability. With clinical trials, high quality signal wireless transmission is verified.

# PRODUCT SPECIFICATION

	PARAMETER	SPECIFICATIONS
Sensor (CAIs®)	Dimensions / Weight	260 mm x 24 mm x 1.3 mm / App. 5 g
	Dimensions / Weight	111 mm x 60 mm x 57 mm / App. 160 g
Amplifier (CAIx®)	No. of Channel	2 (EEG) + 1 (EMG)
	Sensed Bio-Signal	EEG / EMG
	Battery	Max 40 hr / Rechargeble
	Cummunication	Wireless (BT 3.0)
	Dimensions / Weight	211 mm x 124 mm x 8.2 mm / App. 316 g
Monitor & S/W (CAIv®)	Battery	Max 4 hr / Rechargeble



## Certification & Permission

### CAI MONITORING SYSTEM

Classification : Electroencephalograph  
Product License No. 16-4323

### CAIs SENSOR

Classification : Electrode, electroencephalograph, scalp  
Product License No. 15-586

Manufacturer(Registered No.) : 5203

Certificate of GMP : KTL-ADB-3266



Address : SangSaeng Plaza #702, 253-1, Jukjeon-ro, Suji-gu, Yongin-si, Gyeonggi-do, 16876, KOREA

Tel : + 82-31-889-1788 e-Mail : [support@brainu.co.kr](mailto:support@brainu.co.kr)