

Analysis of EEG Using 10:20 Electrode System

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ABSTRACT: This biomedical paper is about 10:20 Electrode System is used to achieve the electroencephalograph (EEG). In neurology, the main diagnostic application of EEG is in the case of epilepsy, as epileptic activity can create clear abnormalities on a standard EEG study. A secondary clinical use of EEG is in the diagnosis of coma, encephalopathy, and brain death. A third clinical use of EEG is for studies of sleep and sleep disorders where recordings are typically done for one full night. This is a technical review paper about the different devices/equipment using 10:20 electrode system method to achieve accurate analysis of EEG with ease.

KEYWORDS: EEG, 10:20 electrode system, electrodes, Brain.

I. INTRODUCTION

Electroencephalography (EEG) is the recording of electrical activity along the scalp. EEG measures voltage fluctuations resulting from ionic current flows within the neurons of the brain. In clinical contexts, EEG refers to the recording of the brain's spontaneous electrical activity over a short period of time, usually 20–40 minutes, as recorded from multiple electrodes placed on the scalp. Diagnostic applications generally focus on the spectral content of EEG, that is, the type of neural oscillations that can be observed in EEG signals. In neurology, the main diagnostic application of EEG is in the case of epilepsy, as epileptic activity can create clear abnormalities on a standard EEG study.

II. 10:20 ELECTRODE SYSTEM

The 10-20 system or International 10-20 system is an internationally recognized method to describe and apply the location of scalp electrodes in the context of an EEG test or experiment. This method was developed to ensure standardized reproducibility so that a subject's studies could be compared over time and subjects could be compared to each other. This system is based on the relationship between the location of an electrode and the underlying area of cerebral cortex. In figure.1 "10" and "20" refer to the fact that the actual distances between adjacent electrodes are either 10% or 20% of the total front-back or right-left distance of the skull.

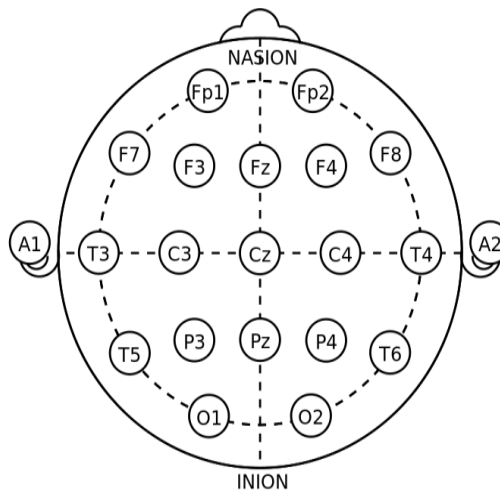


Figure.1. Arrangement Of 10:20 Electrode System

III.DIFFERENT PRODUCTS

A. Electro Cap System III For QEEG:

FEATURE:

Electro-Caps are an EEG electrode application technique. They are made of an elastic spandex-type fabric with recessed, pure tin electrodes attached to the fabric. The electrodes on the standard caps are positioned to the International 10-20 method of electrode placement as shown in figure 2.

SPECIFICATIONS:

1. For NeuroPulse, Lexicor, Mitsar and other 19, 21 and 24 channel EEG systems.
2. Extra Small Cap.
3. Small Cap.
4. Medium Cap.
5. Large Cap.

COST:

\$1,314.00



Figure.2 (Electro Cap System III)

B. Infa-Cap III:

FEATURES:

Electro-Cap International Infa-Cap III (34-38 cm) (Brown) (Modified System). These caps have an abbreviated electrode placements consisting of F1, F2, C3, C4, O1, O2, T3, T4, Cz and ground. Infa-Caps are similar to the regular Electro-Caps. These caps will fit newborn infants to babies about the age of 9 to 12 months as shown in the figure.3. Infa-Cap III can be used for recording premature babies by using E6 Disposable Sponge Disks on all of the electrodes.

SPECIFICATIONS:

1. Electro-Caps are an EEG electrode application technique.
2. They are made of an elastic spandex-type fabric with recessed, pure tin electrodes attached to the fabric.
3. The electrodes on the standard caps are positioned to the International 10-20 method of electrode placement.
4. Sizes in age are approximate; the patient should always be measured to determine proper cap size.

Cost:

275\$



Figure.3 (Infa-Cap III)

IV.COMPUTERIZED ANALYSIS OF EEG SYSTEMS

A. *B-Alert X4 – Wireless EEG Headset System:*

FEATURES:

One channels of medical-grade EEG, plus 1 auxiliary channel for ECG, EMG, or EOG (4 Channels @ 256Hz).Real-time delivery of the validated B-Alert Cognitive State Metrics for engagement, distraction, drowsiness, and stress.On-board 2GB SD card for data storage.Comfortable and non-intrusive; sets up in less than 5 minutes(refer figure.4).Automated wireless impedance checks.Bluetooth wireless signal transmission up to 10 meters. 6 hrs rechargeable battery life in wireless mode; 16 hrs in SD card mode.On-board accelerometer for head movement & position.Data quality monitoring and feedback. Real-time access to Raw Data, Decontaminated Data, and Cognitive State Metrics.SDK fully compatible with MatLab, EEGLab and BCI2000.

SPECIFICATIONS:

- 1.Channels3 EEG with fixed gain, 1 auxiliary differential channel.
- 2.Sampling rate256 samples/second.
- 3.Dynamic rangeFixed gain $\pm 1,000 \mu V$
- 4.Resolution 16 bit, CMRR 105 dB.
- 5.Bandpass characteristics0.1Hz HPF, 100Hz 5th order LPF.

Cost:

1550\$



Figure.4(B-Alert X4 – Wireless EEG Headset System)

4. Mitsar 202 24 Channel:

FEATURES:

The Mitsar 202 is a 24 channel QEEG system. This 24 Channel quantitative (refer figure.5) EEG system is intended for EEG monitoring, recording, and providing spectral analysis of the electroencephalogram (EEG) signals as well as recording of evoked (event related) potentials. The Mitsar 24 Channel QEEG system also has the ability to record video in conjunction with the QEEG recording. Special return conditions apply to this custom item.

SPECIFICATIONS:

1. 24 EEG + 8 active/reference pairs.
2. Optical Signal Isolation.
3. Automatic built-in Electrode impedance (Input Impedance: Greater than 200 MOhm).
4. Noise: Typically less than 1.5uV peak to peak from 0.16-30 Hz.
5. Input range of 300 mV - DC modification
6. 100 mV - AC modification.
7. 24 Bit Analog to digital conversion.

COST:
 10500 \$



Figure.5(Mitsar 202 24 Channel)

TABLE I
 Comparison Between Different Products

Product Name	Specifications	Features	Cost
1. Electro Cap System III For QEEG	1.Extra Small Cap 2.Small Cap 3.Medium Cap 4.Large Cap 5.Electrode Board Adapter	Made of an elastic spandex-type fabric with recessed	\$1,314.00
2. 10/20 Brainet Placement Caps	1.Extra Small - 45.5 - 49cm 2.Small - 49 - 54cm 3.Medium - 54.5 - 57cm 4.Large - 57.5 - 62cm 5.Lead wires not included.	Color-coded template with 21 scalp electrode placement locations.	35\$
3.Infa-Cap III	1.Electro-Cap International Infa-Cap III (34-38 cm) (Brown) (Modified System). 2.These caps have an abbreviated electrode placements consisting of F1, F2, C3, C4, 01,02, T3, T4, Cz and ground.	Infa-Caps are similar to the regular Electro-Caps. These caps will fit newborn infants to babies about the age of 9 to 12 months.	275\$
4. Standard Electro-Cap - All sizes	1. Deymed caps are custom . 2. Call for size and reference location (FCZ, CPZ, or POZ.). 3. Takes 10-14 days for delivery.	They are made of an elastic spandex-type fabric with recessed, pure tin electrodes attached to the fabric.	\$295

Comparison Between Different Products

B-Alert X4 – Wireless EEG Headset System	Procomp2 - 2 Channel EEG System With V5.1 Infiniti Software	I-330-C2 Plus Clinical System	MITSAR 202 24 CHANNEL
<p>FEATURES: One channel of medical-grade EEG, plus 1 auxiliary channel for ECG, EMG, or EOG (4 Channels @ 256Hz).Real-time delivery of the validated B-Alert Cognitive State Metrics for engagement, distraction, drowsiness, and stress. On-board 2GB SD card for data storage. Comfortable and non-intrusive; sets up in less than 5 minutes. Data quality monitoring and feedback.SDK fully compatible with MatLab, EEGLab and BCI2000.</p>	<p>FEATURES: Full 13 bit resolution with fibre-optic cable for low noise and flexibility. Easily worn on headband or shirt collar. Works with all current Thought Technology sensors: EEG, EMG, EKG, SC, Temp, BVP, Respiration and Voltage. Enhanced 3D graphic displays.</p>	<p>FEATURES: The I-330 C2 monitors and records up to 12 channels of physiological activity - 4 available for EMG/EEG or ECG.</p>	<p>FEATURES: The Mitsar 202 is a 24 channel QEEG system. This 24 Channel quantitative EEG system is intended for EEG monitoring, recording, and providing spectral analysis of the electroencephalogram (EEG) signals as well as recoding of evoked (event related) potentials.</p>

<p>SPECIFICATIONS: 1.Channels 3 EEG with fixed gain, 1 auxiliary differential channel 2.Sampling rate 256 samples/second 3.Dynamic range Fixed gain $\pm 1,000 \mu V$ 4.Resolution 16 bit, CMRR 105 dB 5.Bandpass characteristics 0.1Hz HPF, 100Hz 5th order LPF</p>	<p>SPECIFICATIONS: 1.15 Foot long Fibre Optic Cable to USB(ITT-USB interface) or COM port(Pro-SB) 2.Impedance check(with EEG-Z Sensor Head): Channel B only 3.Self-calibration: No 4.Fast Channels: 1 channel, 256 samples/sec DC-45Hz 5.Slow channels: 2 channels 32 samples/sec DC-8Hz (shared with fast channels)</p>	<p>SPECIFICATIONS: 1.Spec Input Channels: (4) sEMG,ECG,EEG and (8) Skin Resistance, Heart Rate, Temperature, Respiration. 2.Input Ranges: 100 V, 500 V, 2000 V 3.Input Impedance: 10 Gohm, 4.Notch Filter: 50/60 Hz 5.Maximum Band pass: 1 to 400 Hz 6.Static Discharge Protection: +15,000V</p>	<p>SPECIFICATIONS: 1.24 EEG + 8 active/reference pairs 2.Optical Signal Isolation 3.Automatic built-in Electrode impedance (Input Impedance: Greater than 200 MOhm) 4.Noise: Typically less than 1.5uV peak to peak from 0.16-30 Hz 5.Input range of 300 mV - DC modification</p>
<p>Cost: 1550\$</p>	<p>COST: 1850 \$</p>	<p>COST: 3170\$</p>	<p>COST: 10500\$</p>

VI. CONCLUSION

Acquiring faithful, accurate frequency and amplitude of electroencephalogram is very essential for rapid interpretation of any distinct changes in normalized human brain behavior. Therefore usage of modern machines as mentioned above can be very utile and effective in curing and treating patients suffering from neurological illness as well as problems associated with trauma. Therefore we conclude that 10:20 electrode system is an internationally accepted powerful and useful solution for the analysis of EEG.

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