



Recording of EEG, ECG, EMG Signal

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Abstract- Ionic voltages produced as a result of electrochemical activity of special type of cells are called bioelectric potential. Bioelectric potentials are generated to nerve conduction, heart activity, heartbeat, muscle activity etc , The bioelectric signal produced in patient body are coordinated activity of large group of cells. Electroencephalography (EEG), Electrocardiography (ECG), and electromyography (EMG) systems measure brain, heart, Muscle activity. Measuring electric potentials on surface of active tissue. Nervous stimuli & muscle contractions can be identified by measuring the ionic current flow in body. This is consummate using a biopotential electrode. Frequency range of bioelectric signal is ECG amplitude is $50\mu V-5\mu V$, EEG amplitude is $2\mu V-100\mu V$, EMG amplitude is $20\mu V-5\mu V$.

Keywords: EEG, ECG, EMG, CMRR

I. INTRODUCTION

EEG, These are bio potential generate neural activity of the brain known as electroencephalogram. EEG signal repeated application of stimulus, awake, sleep is evoked response. EEG signal is classified in five band for analyze paper.[10]

Band of EEG signal	Frequency
Delta	0.5Hz - 4Hz
Theta	4Hz - 8Hz
Beta	13Hz -22Hz
Gamma	22Hz - 30Hz

History of EEG-Early 1300s started Its continuous process i.e. brought daily, development of clinical experimental ,discovery, recognition, diagnosis & treatment of neurological & physiological abnormalities of the brain , EEGs are fully computerized system. EEG machine are equipped with many tools ,accurate electrode & memory for very long term recording of some hours. EEG machines may be integrated with neuroimaging systems such as FMRI (functional magnetic resonance imaging). Very elusive needle like electrodes can be used for recording the EEG over the cortex & avoid the nonlinearity effects induced by the mind.

Neural Activity- The entire cortex , just not area responsible for certain function. Its activated when a given mission is initiated. Activity occurs in a pattern waves of activity from one side to another side of brain.

The generation of an inhibitory postsynaptic potential (IPSP), There is overflow of cation from the nerve cell.This flow ultimately reasons a change in potential along the nerve cell membrane. Transmembranous primary currents generate inonal secondary current along the membrane cell in the extracellular & intracellular space. Current flow through the extracellular space directly responsible for generation of potentials field. Field potential less than 100 Hz frequency , called EEGs i.e. no changes in the signal average & DC if slow drifts in average signals, mask the actual EEG signals. Combination of EEG & DC potentials is often observed some abnormalities in brain i.e. induced by penthylenetetrazol, asphyxia, hypercania.

Action Potential- Action potentials are produced when dissimilar ions irritated the neuron skin. A stimulus main causes sodium channels open. Because there are more Na ions on outside, & inside of neuron is negative to the outside, Na (sodium) ions rush into the neuron., sodium has a +ve charge, so neuron becomes additional positive & becomes depolarized.Longer for open channel potassium. When open, potassium flashes out the cell, backing the depolarization at this time, sodium channels start to close. This reasons the action potential go back toward -70 mV.The action potential actually go past -70 mV because the potassium channels break open too long. Regularly, the ion concentrations drive back to resting level& the cell return to -70 mV.

EEG Recording- EEG recording is obtained by assigning electrodes on the scalp. A conductive gel or paste, after preparing the scalp part by light abrasion to decrease impedance due to gone skin cells. Many organisms use electrodes, which is attached to a separate wire. Some organisms use nets into electrodes are embedded; when high-density arrays of electrodes are needed.

Conventional Electrode Positioning- Electroencephalography represent recommended the conventional electrode in below fig. The earlobe electrodes called A1 & A2 connected to left & right earlobes, used as reference electrodes. 10-20 system avoid eyeball placement & consider constant distance by specific anatomic landmarks from the measurement made & uses 10% or 20% of specified distance as electrode interval.

The even electrodes are on the right & odd on the left.[2] Adult human EEG signal is about $10\mu\text{V}$ to $100\mu\text{V}$ in amplitude when measured from the scalp and is about 10 to 20mV when measured from electrodes. An EEG voltage signal represents a variance between voltages at two electrodes, display of the EEG for the reading encephalographer may be set awake in one of several ways. The demonstration of the EEG channels is raised to as a montage.

Sequential montage-Waveform represents the alteration between two adjacent electrodes. The sequential montage consists of a sequence of channels

Referential montage-Each Waveform represents the alteration between a certain electrode & designated reference electrode. There is no typical position for this location; However, a different location of the recording electrodes. Another popular position is linked ears, which is a mathematical normal of electrodes devoted to both mastoids.

Average reference montage-The productions of all of the amplifiers are averaged, and averaged signal is used the mutual position for channel.

Laplacian montage-Each channel denotes the difference among an electrode & weighted average of surrounding electrodes. Digital EEG & Analog EEG, signals are classically digitized and deposited in a specific montage. Any montage can be constructed mathematically other, EEG can be watched by electroencephalographer in any display montage is desired.[4]

II. APPLICATION OF EEG

Sleep Disorder, Epileptical Seizure, Alzheimer's disease.

ECG-Electrocardiography (ECG) is the process of displaying the electrical activity of the heart over a period of time using electrodes placed on a human body. These electrodes detect the electrical changes on the membrane that arise from heart muscle depolarizing during heartbeat.[5]

Recording of ECG-The normal cardiac cycle spontaneous depolarisation of sinus node, an area of specialized tissue situated in high right atrium (RA). A wave of electrical depolarization then spreads through RA and across the inter-atrial septum into LA. The atria are detached from the ventricles by electrically inert fibrous ring, i.e. normal heart only route of transmission of electrical depolarisation from atria to ventricles through atrioventricular (AV) node. The atrioventricular node stays the electrical signal for small time, and the wave of depolarisation spreads down the IVS (interventricular) septum, via right and left bundle divisions, into the RV and LV ventricles. Hence normal conduction into the two ventricles contract simultaneously, which important in maximizing cardiac efficiency. After complete depolarisation of the heart, myocardium must then *repolarize*, before can be ready to depolarize again the next cardiac cycle.

The preamplifier is followed by a power amplifier that's provide power to pen motor record ECG trace. ECG recorder used to the output of other device i.e. EMG that's record Achilles reflex. Position control the pen amplifier makes possible to center the pen on the recording paper. ECG are recorded paper speed of 25mm/s, but faster of 50mm/s. Better resolution of QRS band complex at very high heart rate. The CMRR of the overall system reduces interference i.e. reducing effect of current flow in right leg electrode.

Digitization of ECG record- ECG has existed for century year, and digital ECG has existed than two decade. A cardiac patient history of heart disorders will always have to transfer & maintain a bulk of such ECG reports visiting a physician for consultation. printed ECG reports includes some characters as well as annotations, while taking an image of such ECG strips it is desirable to remove printed characters. Efficient removal noise & image enhancing algorithms are required.

A) Scanning -ECG paper recordings to be scanned. Scanning resolution can be 600/200 dpi (dots per inch). Algorithm for the image compression is JPEG. The image can also be acquired from a digital camera used in cell phones.

B) De-Skewing- Skew is a common occurrence can appear in a scanned image. Skewing rotates the image angle, resulting in a rotated image. Skew angle is designed using the background grid outlines of scanned ECG image.

C) Image Enhancement- This step enhances ECG image by manufacture the signal lines. Laplacian filtering is applied for making related noise lighter than main ECG signal. Threshold value is selected by comparing between noise pixels and representing real ECG signal. The resulting image will contain separate ECG signal in the image.

D) Color Based Segmentation-Remove the background network of an ECG. Background grid is usually of daintier shade of color than actual signal waveform. ECG image is processed column by column. The darkest pixels are extracted in each column and are replaced by pure black pixel as pure white. Produces a binary image. However this may lead to extraction of undesired printed.

E) Region Based Segmentation-The isolated pixels do not represent printed characters. This step comprises of the following steps

Step 1-Eradicate the frame of the picture that's border of the input picture.

Step 2- Scan the feedback ECG image column by column.

Step 3- Repeat for each column

F) Signal Representation-Each column is governed by a only pixel so the signal is denoted by the corresponding column pixel table. The signal is saved as a txt file

G) Median Filtration- Actual ECG signal verified by an ECG machine can be tarnished due to presence of noise. Sources of clatter can be - Item Power Line Interface, low frequency noise, Muscle noise [8]

EMG-Electromyography is an electro diagnostic medicine technique for estimating and footage the electrical activity produced by skeletal muscles. Electromyography is performed using an instrument called an electromyograph, produce record called as electromyogram.

Principle of Electromyography-Metallic electrodes placed on skin over muscle, a complex series of electrical potentials is discovered. This type of electrical recording is called as EMG. It is same as ECG.

Recording of EMG-

Set up of EMG-Recording instrument should be strongly prepared on a heavy table equipped with three grounded AC outlets. Plug in audio monitor if its an AC powered division. Plug in the oscilloscope. All power cords are positioned well away from human sinks.

Electrode Placement- Place a pea size glob of electrode cream in the midpoint of one circle on the calf. Position one of the two copy electrode disks directly on the glob. Hold the electrode in place by pressing on the red network backing behind the electrode. Repeat procedure for other recording electrode.

Recording of EMG activity-

- The patient should be seated in relaxed position.
- Red, white, & blue banana plugs on end of the cable attached to amplifier. Attachment these three plugs into the red, white, and blue sockets on amplifier power supply.
- Red, black, & green banana plugs on the close of the electrode cable assemble i.e.already attached to the patient.
- ON/OFF power switch on the audio monitor is in OFF position
- Audio monitor volume to the lowest setting 0, & move the monitor ON/OFF switch to ON position.
- Patient makes slow and measured movements in various directions at ankle joint.
- Patient stand upright together feet on floor and alternately rise up on her tiptoes, & then stand on his heels.
- Control activity of a single motor unit. Patient should again be seated on the top with legs fully relaxed

III. CONCLUSION

Transducer are used to measurement of bioelectric potentials. Transducer converts current & ionic potential into electric potentials. Transducer consists of two electrode. Bioelectric potential waveforms are named on the application i.e. EEG, ECG & EMG. Recording of ECG signal is done by analog & digital form. The Electrocardiogram (ECG) digitized recording is based on Algorithm of MAT Lab programming. The EEG (electro encephalogram) signal recording is based on 10/20system. EMG signal recording is done in step wise setup. The above recording is very important role in human treatment. EEG, ECG & EMG recording is cover the all human treatment.

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