ISSN 2347 - 3983
Volume 4, No.3 March 2016
International Journal of Emerging Trends in Engineering Research
Available Online at http://www.warse.org/IJETER/static/pdf/file/ijeter01432016.pdf

EEG Signal Processing To Detect The Human State Using LabVIEW

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ABSTRACT: The paper presents the detection of the state the human being is in by analyzing the EEG signals of the brain. Different states of human being are waking state,dreaming state and deep sleep state.as these states change the frequency of the brain waves which are represented by EEG signal changes. The EEG is generally divided into four different types of waveforms with respect to their frequencies Delta (0 to5-3) Hz, Theta (4 to-7)Hz, Alpha(8 to-13)Hz and Beta(14 to 30)Hz. These four waveforms are basic waveforms of EEG.The EEG signals are recorded by placing electrodes on brain and can extract by using the LABVIEW.with the help of DAQ board the EEG signals can be analysed by using LABVIEW software.

Keywords: EEG,LabVIEW, DAQ card

I.INTRODUCTION

Now a days it is gaining significance to analyze Electro Encephalo gram (EEG) Signals to estimate the behavior and state of the subject.Today it is of much interest to analyze the EEG for many biomedical applications such as medical imaging, analyzing patient condition,curing mental disorders etc.in this paper.In general the EEG signals can be extracted by placing electodes on a scalp using 10-20 system.The EEG will be of much less amplitudes. The EEG is generally divided into four different types of waveforms with respect to their frequencies Delta (0 to5-3) Hz, Theta (4 to-7)Hz, Alpha(8 to-13)Hz and Beta(14 to 30)Hz[1]. These four waveforms are basic waveforms of EEG. These waveforms shows different states of the person and by analyzing these waveforms we can analyze the persons mental disorder and working of the brain.these waves can be influenced under certain stimuli.

2. EEG PROCESSING

For the implimentaion of single channel EEG analysis.The EEG data has to be acquired form the person by placing electrode on the scalp and the EEG signal first amplified by a suitable low noise instrumentation amplifier.these signals then passed through a filter of bandwidth normally between 0.5Hz to 100Hz since the range of EEG lies within this band of frequencies. We used an NI PCI-6220 DAQ board and NI LabVIEW to develop a system that acquires and analyzes EEG signals. We connected the signals from an existing preamplifier to the DAQ board inputs. The board processes and analyzes the recorded signals. We can extract parts of the signal (epochs) to filter it and perform spectral

analysis by calculating average fast Fourier transform

Because an EEG signal is not a steady signal, we must use analysis methods that offer information about the signal in the time-scale domain. Therefore, we applied short time FFT and continuous, discrete wavelet transformation. For this analysis, we used prebuilt LabVIEW functions. A rich library of prebuilt signal processing and analysis functions is one advantage of LabVIEW, compared to other programming languages. You can generate reports and export signals in JPEG and MS Excel formats.

For signal calibration, the user must select a calibration option from the main menu and set the duration and number of channels. The calibration data remains in the system's memory until it performs the next calibration. After the user chooses to acquire new signals,

3. Lab VIEW Interfacing

LabVIEW (Laboratory Virtual Instrument Engineering Workbench) is a development environment based on graphical programming. It uses terminology, icons and ideas familiar to technician, scientists, and engineers and relies on graphical symbols rather than textual language to describe programming actions. It is graphical programming that uses icons instead of lines of text to create applications. In contrast to text based programming language, where instructions determine program execution, LabVIEW dataflow programming, where data determine execution. Complex Filter using LabVIEW graphical programming were designed having four frequencies ranges from 0.5 to 3 Hz, 4 to (FFT) and time FFT.

7 Hz, 8 to 13 Hz and 13 to 30 Hz[1]. for separating out EEG wave forms into Delta, Theta, Alpha and Beta waveforms[1]. Visual output is a waveform of graph as well as chart graph as shown in fig.1. The EEG data acquisition is done by the device called data acquisition card (DAQ) which is shown in fig.2

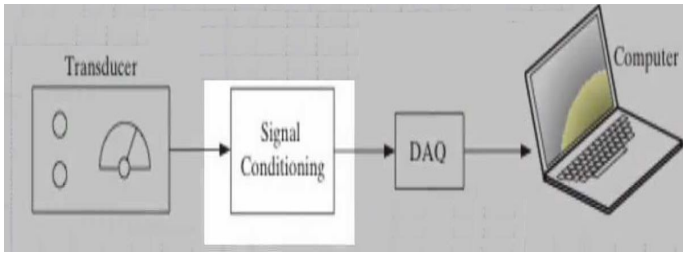

Figure 1: Model of implementation

Figure 2: DAQ card

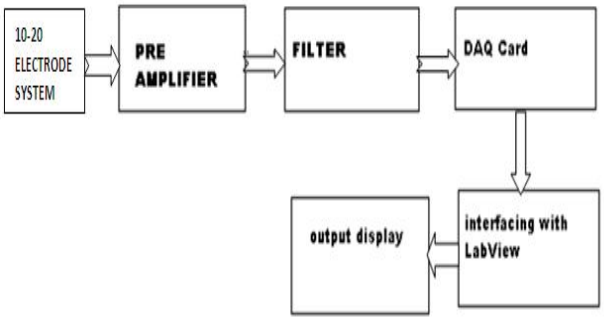

Figure 3: Block diagram of single channel EEG

4. IMPLEMENTATION

10-20 electrode placement system as shown in fig.4.standardizes physical placement and designation of electrodes on the scalp the head divided in to proprtional distance from prominent skull landmark (nasion, preauricular points and inions)[3].To provide adequate coverage of all regions of the brain. Label 10-20 designate proportional distance in present between ears and nose where points of electrodes are chosen. Electrode placement are labeled according to adjusant brain area: F(frontal), C(central), T(temporal), P(posterior), O(Occipital)[3]. Odd numbers at the left side of the head and even numbers right side.

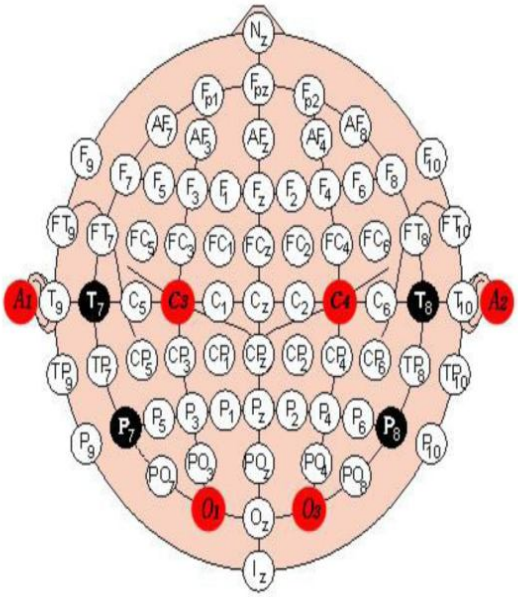

Figure 4:10-20 electrode system

5. RESULTS

By placing electrodes on the scalp (10-20 system) a record is obtained of the EEG of cerebrum.and the EEG signal waveforms are shown in the fig.5 is extracted[2]. In the normal condition when keeps his eyes closed the usual pattern of EEG is of frequency range 8-12Hz(Alpha).On opening the eyes the Alpha waves gets irregular oscillations. The maximum number of alpha waves present in the occipital and parieto-occipital areas and are reduced by mental and visual activity. The waves which are of low amplitude of 10 microvolts.Delta waves dominate in deep sleep. From wakeful state to deep sleep the EEG frequency changes from fast Beta waves(above 14 cycles per second) to theta waves(0-4 cycles per second)

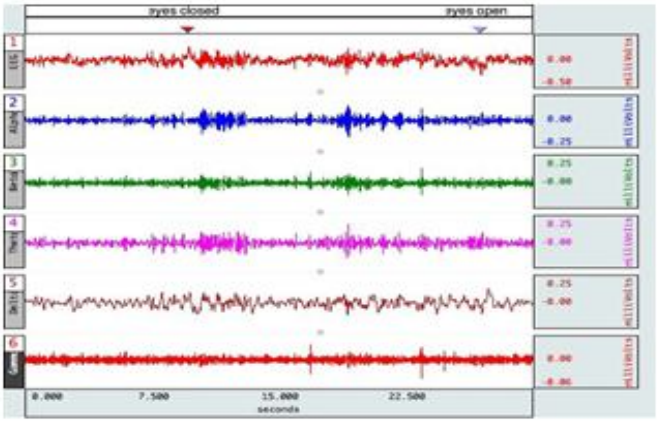

Figure 5: EEG signal waveforms

6. CONCLUSION

The states wakeful state ,dream state and deep sleep states of the human are defined with respect to the EEG Signal processing have been reviewed in this paper. Result shows clear relations among the frequency of EEG waves and the state of the person.

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