A Novel Method for Analysis of EEG Signals Using Brain Wave Data Analyzer

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Abstract: ***The present day research allow us to develop a new class of bioengineering control devices and robots to provide daily life assistance to handicapped and elderly people. This proposed method describes how the brain activity is measured using mind wave EEG signal data transmission device. The brain electric signal are measured by EEG (Electroencephalograph) which shows a demand for better accuracy and stability and facilitates the graphical illustration of spatial features of electric brain activity. It provides a very promising technology for physically disabled people who are unable to access their hands and in this paper we will discuss briefly how the data acquisition can be done by using biosensor.***

Index Terms -: EEG, Mind wave, Biosensor.

I. INTRODUCTION

The human brain is made up of billions of interconnected neurons; the patterns of interaction between these neurons are represented as thoughts and emotional states. Every interaction between neurons creates a minuscule electrical discharge; alone these charges are impossible to measure from outside the skull. However, the activity created by hundreds of thousands concurrent discharges aggregates into waves which can be measured.

In the proposed paper [1]. The brain activity is measured using the Neurosky MindFlex EEG Headset. In this paper, the so-called Brain Computer Interface unit will be presented that was developed for further brain wave analysis and ensures the detection of brain waves. Moreover, an application for visualization and procession of the measured and signals is described. The application can be used for EEG data acquisition, processing and visualization which could be the base of several further researches.

In the Proposed paper [2] A brain computer interface-based smart living environmental auto-adjustment control system (BSLEACS) is proposed. Based on the advantage of brain computer interface (BCI), BCI technique with universal plug and play (UPnP) home networking for smart house applications. BSLEACS mainly consists of a wireless physiological signal acquisition module, an embedded signal processing module. Here, the physiological signal acquisition module and embedded signal processing module were designed for long-term electroencephalogram (EEG) monitoring and backend analysis, respectively. The advantages of low power consumption and small volume of the above modules are suitable for smart house applications in daily life.

Manuscript Received on May 2015.

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BSLEACS has been verified in a practical demo room, and the environmental adjustment can be automatically controlled by the change of the user's cognitive state also can be simply extended and integrated with the UPnP home networking for other applications.

In the proposed paper [3] Drowtion, the drowsiness detection software is proposed. A Significant numbers of road accidents are caused by drowsy driver. This factor can be reduced if the drowsy condition of the driver can be identified and alarmed. This research is conducted by using Electroencephalography approach to detect drowsy state of the driver using Mindwave. Mindwave will sense the value changes of the driver's awareness caused by changes in concentration value. The changes between conscious and drowsiness state are mapped and used as threshold values for triggering the alarm. Accuracy of DrowTion application in normal condition is about 68,11%.

Different brain states are the result of different patterns of neural interaction. These patterns lead to waves characterized by different amplitudes and frequencies; for example waves between 12 and 30 hertz, Beta Waves, are associated with concentration while waves between 8 and 12 hertz, Alpha Waves, are associated with relaxation and a state of mental calm. (The contraction of muscles is also associated with unique wave patterns, isolating these patterns is how some NeuroSky devices detect blinks.)

All electrical activity produces these waves (even light bulbs), thus all electrical devices create some level of ambient noise this noise interferes with the waves emanating from the brain, this is why most EEG devices will pick up readings even if they are not on a person's head. Measuring mental activity through these waves is like trying to eavesdrop on a conversation at a loud concert. In the past, EEG devices circumvented this problem by measuring these signals in environments where electrical activity is strictly controlled and increasing the signal strength of the data coming from the brain through the application of a conductive solution. With this application we can easily find out the necessary action should be performed by the user automatically with the help of mind wave sensor and we can give input or command to the particular application or devices to do specific task.

II. IMPLEMENTATION

To detect the EEG signals the non-invasive Brain-Computer Interface technique[4] is used in which medical scanning devices or sensors are mounted on the scalp to read brain signals. The read brain signals from many points in the brain could help identify a wider range of brain activity. The measure of the brain signals and their transmission is implemented with the help of sensors mounted in the

mindwave EEG signal data transmission device.

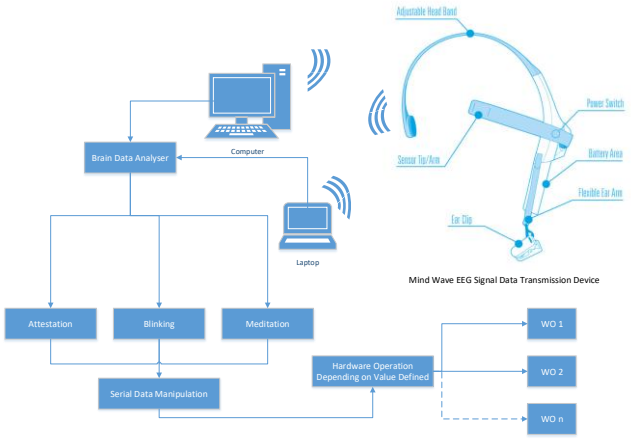

Figure 1: Schematic of Brain Wave data analyzer.

The read brain signals are transmitted to the controlled unit which includes laptop or desktop wirelessly. There are two versions of Neurosky mindwave, the normal one uses the RF to transfer the data and the mobile version uses the Bluetooth connection to transfer data. Here we are using Bluetooth network of version 3.0. The measured brain activity shows the state of the person, whether he is in attention, blinking or meditation.

A. WIRELESS SIGNAL ACQUISITION

The MindFlex EEG headset is used to measure the EEG signals. The electrodes are placed on hairy scalp; the detected brain signals are passed to Neurosky chip to examine the type of brain wave. The Signal processing unit is developed by the Thinkgear technology of Neurosky can determine the value of concentration or attention.

Figure 2: Wireless Signal Acquisition Module

The basic blocks of signal processing unit consist of preprocessing, feature extraction and classification.1) Preprocessing**:** To remove noise and artifacts (mostly related to ocular, muscular, and cardiac activities) to enhance the SNR. 2) Feature extraction**:** Performs feature extraction and selection to detect the specific target patterns in brain activity that encode the user's mental tasks, detect an event-related response, or reflect the subject's motor intentions.3) Classification**:** Translating or associating these specific features into useful control (command) signals to be sent to an external device. The Neurosky MindFlex EEG headset transmits the processed signal to the controlled unit through a wireless network. Examining the internal construction of the EEG electrical unit, the power adapter providing 3,3 V supply voltage and a pin with a Tx label could be noticed. Having examined this Tx signal, a serial line information could be retrieved. The internal construction of the EEG headset is shown in Figure 2.

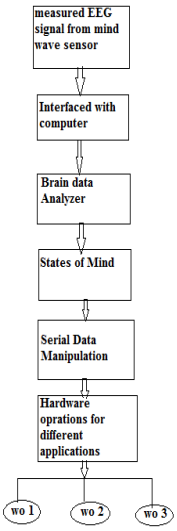

Figure 3: Flow chart for Brain Data Analyzer system.

III. HARDWARE AND SOFTWARE

A. NEUROSKY MINDWAVE SENSOR

The Neurosky mind flex EEG head set [1] is cheapest biosensor available in the market. Neurosky is a Silicon Valley company located at California produces innovative biosensors in hundred of wearable products for body and mind health. These solutions capture, quantify and reveal unique health and wellness insights, so that people can monitor and improve the performance of body and mind. Thinkgear technology is used to initialize connection and data transfer between the mind wave and the computer.

B. MICROSOFT VISUAL STUDIO 2012

The Microsoft visual studio 2012 is used to implement the program, which supports modern object oriented programming and it can be used in windows operating systems. The BCI program can run on a PC and has been written in C#. the program can be divided into two main parts namely: the dta processing and the visualization parts. The data processing parts reads the data from the brain and process the received data and converts into the form read by the computer and the visualization part display the given signals by column and time plot.

IV. EXPECTED RESULTS AND DISCUSSION

This system is implemented to help for the better understanding, how the human brain works in terms of reorganization, learning, memory, attention, thinking, social interaction motivation etc. The module is mainly developed to help the elderly people and the paralyzed patients who can't able to use their hands. The measured data values from the head set is compared with the data base present in the computer, the hardware system is programmed in such a way that, the database values are assigned with some particular task such as moving a cursor or turning on light or fan, depending

on the value measured the respective task will be performed. The Robotic arm is used to pick and place the objects.

V. CONCLUSION

This paper deals with design and implementation of the invasive method of the BCI technique**.** It includes how the brain data is measured using the mindflex EEG headset and data collection and data processing. On the basis of the result obtained, the brain activity and the present state of the person is determined. The novelty of the development of this module is to help the people who are unable to use their hands. To run this BCI program on PC, the system is coded using C# program. The electric impulse alterations that generated during the operation of neurons can be measured by the EEG device. The data collected is processed and analyzed using brain data analyzer and transmitted wirelessly to hardware unit using zigbee device.

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Mrs. Prathibha Kiran was awarded with M.Tech in Biomedical Signal Processing and Instrumentation during 2011 from Dayanand Sagar College, which is affiliated to VTU, Belgaum. Presently working as Assistant Professor in AMC Engineering College, Bangalore in the department of Electronics & Communication Engineering. She secured 2'nd rank in M.Tech in the stream of Biomedical Signal Processing and Instrumentation from Visvesvaraya Technological University. It is to her credit that she has already contributed papers at National conference, International conference and International Journals: Her Area of research interest includes Signal processing, Wavelets, Advanced digital image processing, Neural Network and Fuzzy logic, Bio-medical Instrumentation and Wireless Communication.

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