International Journal of Research in Engineering, Science and Management
Volume-2, Issue-3, March-2019
www.ijresm.com | ISSN (Online): 2581-5792

Brain Signal Analysis and Automation using Neurosky

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***Abstract*: This article presents a motion control system to help severely disabled people to operate an auxiliary appliance using eye-blink bioelectric signal measured by a single channel dry electrode on the forehead. Using the data recorded from the brain the Brain Computer Interface (BCI) processes it and performs the pre-assigned task. LabView serves as the brain computer interface and the raw data accumulation is done by Mindwave Mobile 2. By using this proposed scheme it is possible to build an effective interface between human brain and machine by cutting the cost amount by significant margin.**

***Keywords*: Bioelectrical, BCI, LabVIEW, Mindwave Mobile2**

1. Introduction

A brain-computer interface, sometimes called a direct neural interface or a brain machine interface, is a direct communication pathway between a human or animal brain and an external device. In one BCIs, computers either accept commands from the brain or send signals to it but not both. Two way BCIs will allow brains and external devices to exchange information in both directions. The electrical activity (fields) generated by the neurons is measured, this measuring technique is known as EEG (Electroencephalography). An EEG-based BCI system measures specific features of the EEG-activity and uses these as control signals. The concept of thinking is perhaps too broad a concept and can actually better be replaced by generating brain patterns. The general picture of a BCI thus becomes that the subject is actively involved with a task which can be measured and recognized by the BCI. This task consists of the following: evoked attention, spontaneous mental performance or mental imagination. The BCI then converts the 'command' into input control for a device. This is the basic idea. With the continuously increasing knowledge of the brain and advances in BCI over time. The fundamental idea of this project is to analyse, record and measure the signal generated by the Brain using BioEEG sensor which is placed on the left side of the forehead above the left eye that is FP1 location through non-invasis type of brain computer interface and demodulate ad isolate suitable data from which control output can be mapped for control of an embedded applications.

2. Literature review

- Towards a versatile Brain-Machine interface Neural decoding of multiple behavioural variables and delivering sensory feedback versatile brain machine interface in 2018 6th International Conference on Brain Computer Interface (BCI) by Mikhail A Lebedev. This journal discuss about the brain-machine interfaces (BMIs). BMIs strive to provide neural prosthetic solutions to people with sensory, motor and cognitive disabilities, they have been typically tested in strictly controlled laboratory settings. Making BMIs versatile and applicable to real life situations is a significant challenge. For example, in real life we can flexibly and independently control multiple behavioural variables, such as programming motor goals, orienting attention in space, fixating objects with the eyes, and remembering relevant information.
- Developement of an open source platform for brain computer interface in Open BMI IEEE Feb 2013 by Min-Ho Lee, Siamac Fazli, Keun-Tae Kim, Seong-Whan Lee. This paper intend to present some important theoretical and practical knowledge about Brain Machine Interface (BMI) toolbox for Neuroscience research. A BMI system provides a communication tool for people with severe motor disabilities that can be used to control external devices. OpenBMI offers various BMI paradigms, signal processing tools, data analysis techniques as well as real-time feedback module.
- Design of a robotic wheelchair with motor imagery based Brain Computer Interface in 2013 International winter workshop on Brain Computer Interface in IEEE by Keun-Tae Kim, Tom Carlson, Seong-Whan Lee. This paper presents a prototype for an electro-encephalogram (EEG) based brain-actuated wheelchair system using motor imagery. To overcome some of the limitations of other previous works, such as gaze dependence and unnecessary stops, five commands (left, left-diagonal, right, right-diagonal, and forward) were decoded based on the motor imagery correlates in EEG signals. Also, the system was modularized into three components: BCI control, and network. On the basis of the conclusions, we can expect a robust brain-actuated wheelchair system, which can allow the user's intention to control the wheelchair in multi-directional movements, thereby increasing the user's authority compared with many of the alternative approaches

- A comparison of recording modalities of P300 Event Related Potentials (ERP) for Brain-Computer Interface(BCI) paradigm in Clinical Neurophysiology, vol. 43, no. 4, pp. 217-227, 2013 by L. Mayaud, M. Congedo, A. van Laghenhove. This paper of brain-computer interface aims at restoring communication and control in severely disabled people by identification and classification of EEG features such as event-related potentials (ERPs). The aim of this study is to compare different modalities of EEG recording for extraction of ERPs. The first comparison evaluates the performance of six disc electrodes with that of the EMOTIV headset, while the second evaluates three different electrode types (disc, needle, and large squared electrode).
- EEG signal analysis for bci interface: a review in International Journal of Scientific & Engineering Research Volume 4 January 2013 by Swati Vaid, Preeti Singh, Chamandeep Kaur. This journal discuss about the devices which are [proposed to help the disabled people who are incapable of of making motor response to communicate with computer using brain signal. The aim of BCI is to interpret brain activity into digital form which acts as acommand for a computer. One key challenge in current BCI research is how to extract features of random time varying nEEG signal and its classification as accurately as possible. This paper also includes a review on the conventional methods that are used for features extraction of the signals.
- Brain computer interface and its types - a study in International Journal of Advances in Engineering & Technology, May 2012 by Anupama. H. S, N. K. Cauvery, Lingaraju. G. M. This Paper provides an insight into the aspects of BCI, its applications, recent developments and open problems in this area of research. Brain computer Interface(BCI) provides a communication path between human brain and the computer system. With the advancement in the areas of information technology and neurosciences, there has been a surge of interest in turning fiction into reality. The major goal of BCI research is to develop a system that allows disabled people to communicate with other persons and helps to interact with the external environments. This area includes components like, comparison of invasive and non-invasive technologies to measure brain activity, evaluation of control signals development of algorithms for translation of brain signals into computer commands, and the development of new BCI applications.

2. Conclusion

The technology of Brain Computer Interface is more demanding to the modern science. The possibility of BCI open the advanced channel of interaction in the field of medicine, psychology, military and media. BCI opens a new channel of communication for the disabled or medical disorder or aged people who gradually lose their control on their own body and reach to state where they have no potential to communicate with the external environment. Hence BCI creates an innovative platform for all these group of people to interact with external environment in the similar fashion as the normal human being to some extent. Hence the control of home appliance such as light bulb switching on/off with eye blink of a human eye with a single blink using Neurosky Mindwave Mobile Headset (BCI technology) is concluded.

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