

Brain Signal Analysis and Automation using Neurosky

Saurabh G. Gaiky¹ Saksham J. Kantharia² Saurabh R. Barve³ Dr. Rahul A. Burange⁴

^{1,2,3,4}Department of Electronics Engineering

^{1,2,3,4}K.D.K College of Engineering, Nagpur, India

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: BCI, EEG, NeuroSky

I. 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.

A. Brain Computer Interface

What is a Brain Computer Interface? As mentioned in the preface a BCI represents a direct interface between the brain and a computer or any other system. BCI is a broad concept and comprehends any communication between the brain and a machine in both directions: effectively opening a completely new communication channel without the use of any peripheral nervous system or muscles.

BCI is mainly focusing on communication from the brain to the computer. To communicate in the other direction, inputting information in to the brain, more thorough knowledge is required concerning the functioning of the brain. Certain systems like implantable hearing-devices that convert sound waves to electrical signal which in turn directly stimulate the hearing organ already exist today. These are the first steps. The brain on the other hand is on a whole other complexity level compared to the workings of the inner ear.

From here on the focus is on communication directly from the brain to the computer. Most commonly 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.

Over the past 15 years the field of BCI has seen a rapidly increasing development rate and obtained the interest of many research groups all over the world. Currently in BCI-research the main focus is on people with severe motor disabilities.

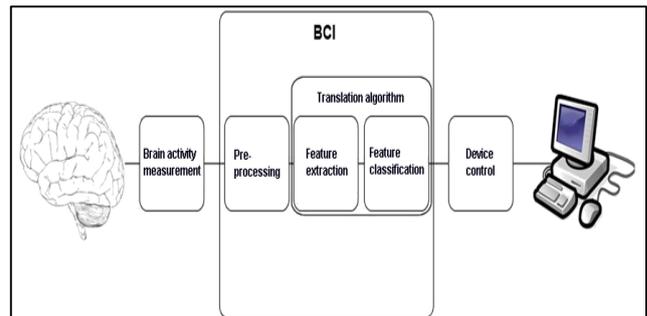
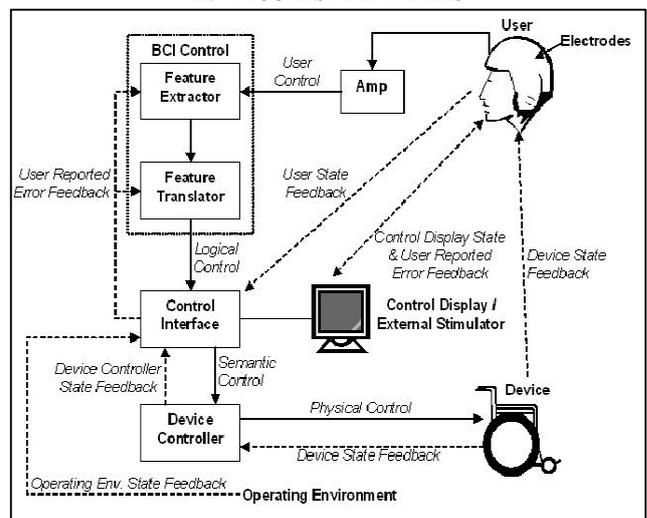


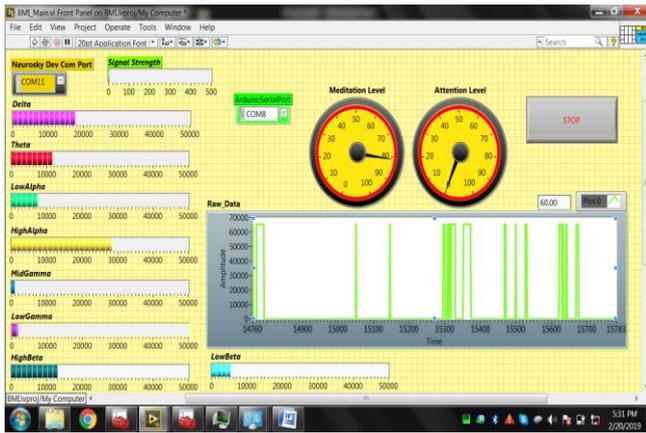
Fig. 1: Basic BCI layout.

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, perhaps BCI will be able to extract actual intentions and thoughts. This however does not appear to be on the cards for the very near future.

II. FIGURES AND TABLES





III. BIOSENSOR

The NeuroSky platform provides a powerful foundation for developing applications that promote improved focus, concentration, working memory, and mind acuity. Other uses include meditation, relaxation monitoring, and improved educational processes.

A. Features

- Direct connect to dry electrode
- One EEG channel + Reference + Ground
- Extremely low-level signal detection
- Advanced filter with high noise immunity
- RAW EEG at 512Hz

B. Data Outputs

- RAW EEG Signal
- Attention
- Meditation
- Delta, Theta, low alpha, high alpha, low beta, high beta and gamma waves

C. Dimensions

- Module: 27.9 x 15.2 x 2.5mm
- Chip: 9 x 9 x 1.6mm
- Weight (Max) 130

D. Specifications

- 512Hz sampling rate at 12 bits
- 3-100Hz frequency range
- ESD Protection: 4kV Contact Discharge; 8kV Air
- Max Power Consumption: 15mA @ 3.3V
- Operating voltage 2.97 ~3.63V

E. UART (Serial)

- 1200, 9600, 57600 baud
- 8-bits
- No parity
- 1 stop bit

IV. BCI APPLICATIONS

After we go through the various techniques of direct neural interface the first question that comes to our mind is, what does BCI do to us and what are its applications. So BCI in today's time turns useful to us in many ways. Whether it is in any medical field or in a field leading to enhancement of

human environment. Some of the BCI applications are discussed below.

- 1) Adaptive BCI for Augmented Cognition and Action
- 2) BCI offers paralyzed patients improved quality of life
- 3) The Mental Typewriter

A. The LabVIEW Software

LabVIEW Offers a graphical programming approach that helps you visualize every aspect of your applications, including hardware configuration, measurement data, and debugging. This visualization makes it simple to integrate measurement hardware from any vendor, represent complex logic on the diagram, develop data analysis algorithms, and design custom engineering user interface.

B. Work of Software

The LabVIEW software allows us to

- Do simple Biofeedback. You can display raw EEG channels, narrow band frequency amplitudes and classes.
- Simulate trials.
- Record trials for a number of choices of different classes.
- Train the interface.

V. CONCLUSION

The utilization of Brain-Computer Interface communication based on voluntary neural activity generated by the brain will help in the study of brain signals to higher extent. The neural activity used in BCI can be easily recorded using noninvasive techniques. This techniques emerging with infinite possibilities in the automation industry. We can say as detection techniques and experimental designs improve, the BCI will improve as well and would provide wealth alternatives for individuals to Interact with their environment.

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