ISSN 2395-1621

Multimodal Human-Machine Interface Based on A Brain Computer Interface For Disable People Controlling Home Appliances

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ABSTRACT

This paper presents a brain controlled home appliance based on Brain–computer interface (BCI). Today even though technology is helping some of the handicapped people to perform their tasks, but some of them are completely paralysed while their brain is still working. This paper presents a brain control interface technology that helps physically disable people but mentally active people to operate the device externally, by using their brain power and their eye blinking mechanism. BCIs are systems in which the information is transfered from brain to computer by interfacing it through muscles and brain waves movement by the electrodes placed on scalp of brain. These waves are intercepted by dry electrodes in brain wave sensor. For analysis of brain waves alpha and beta waves of EEG output are used to control the home appliances operation through PIC controller by transferring serial data from brain waves through serial communication.

Keywords: PIC, EEG, BCI, Serial Communication

ARTICLE INFO

Article History

Received: 18th July 2016

Received in revised form :

18th July 2016

Accepted: 20th July 2016

Published online :

21st July 2016

I. INTRODUCTION

Between 40 to 50 million people in the world report some kind of disability. In this project people can send information simply by thinking. There are two main BCI approaches: the invasive one that is based on ElectroCorticoGraphic (ECoG) data or single neuron recording and the non-invasive one that is based on EEG data. BCI is a system in which we captures the brain waves in the form of EEG signals; and translates this signal to the user and allows them to operate devices.

This technology is developing very rapidly, as it has innumerable uses. The most important of which is improving the quality of life of Human beings in general and elderly and disabled people in particular. In invasive type, an IC is implanted in the brain by surgery. Therefore people prefer non invasive BCI which involves only headset or cap equipped with an active electrode system.

II. METHODOLOGY

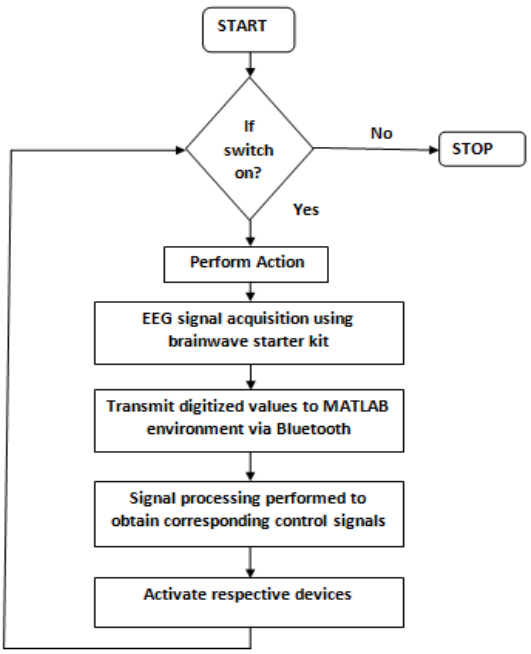

Figure 1: Design Flow

III.PROPOSED SYSTEM

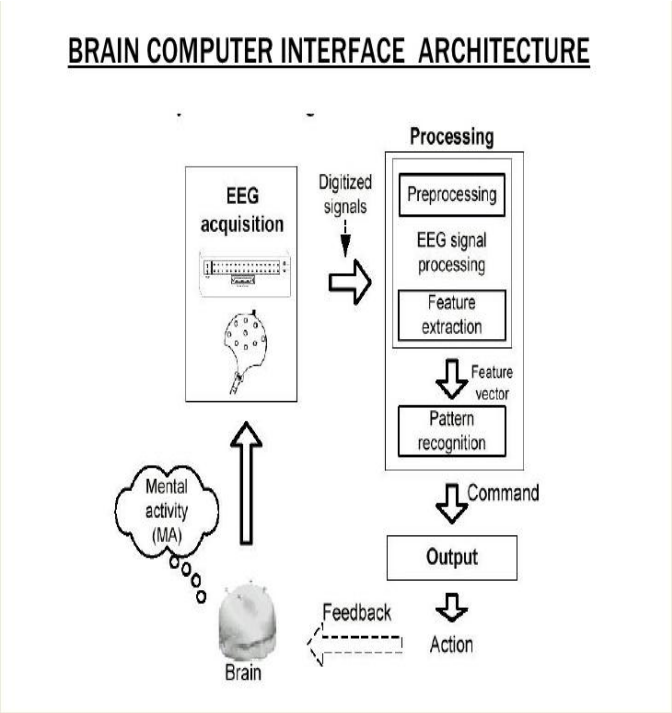

Figure 2 : Brain computer Interface Architecture

Brain-computer interface technology allows users who are impaired or paralyzed to control the devices such as controlling home appliance in which they can switch on/off fan, lights, television, changing television channels, etc. The disabled individuals can therefore convey their intentions or operations to these interfaces. The basic idea of BCI is to translate user produced patterns in EEG. To operate home lighting systems manually using switches may be difficult to be performed by some paralyzed people. Even though using a remote control may also be a difficult task. Nowadays, a lot of improvement has been made in the development of lighting system. It is also believed that eye blink is one of the mechanisms to help disable people in their everyday routines. So without using many gestures the eye blinking activity can be detected from EEG (electroencephalography) signal through a brain computer Interface and this will make people to communicate with other devices. There have been several studies using the signals of brain activity to control machines. For example, these systems were constructed to control home appliances.

IV.BCI SYSTEM DESIGN

Following figures shows complete block diagram of our proposed system.

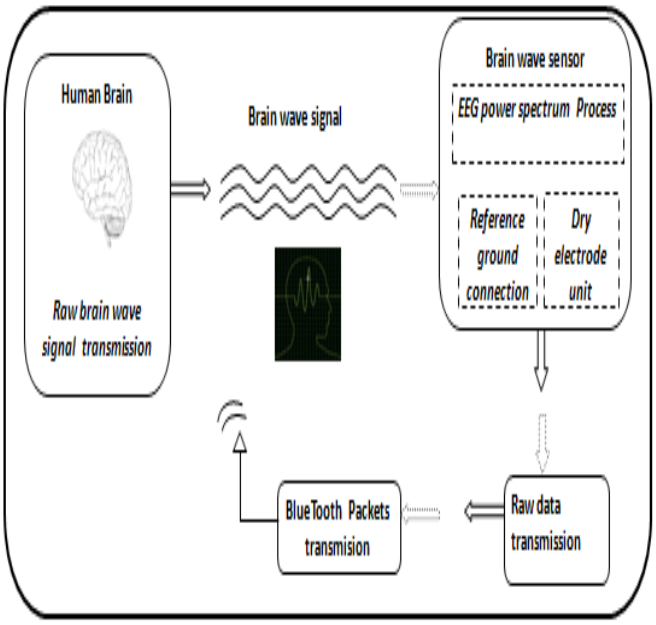

Figure 3: Brain Computer Interface Section

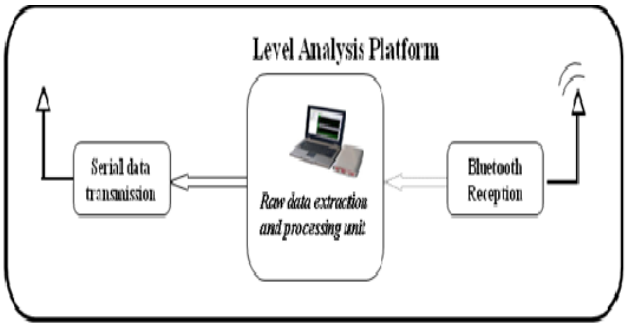

Figure 4: Data Processing Unit

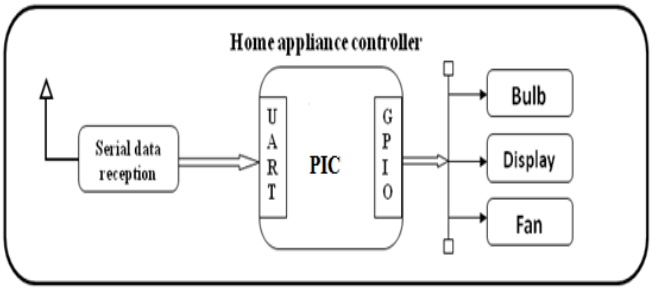

Figure 5: Home section

The proposed work is to develop a system can assist by the disabled people in their daily life to do some work independent on others and to bring this technique into the equipments which are used by the elders at homes. The proposed system analyze the brain wave signals, and uses only single electrode headset based on EEG sensors which will monitor the EYE BLINKS, ATTENTION MODE, and MEDITATION MODE, and not going to monitor all the rays coming from the scalp, by analysing the frequencies ranges of the certain level, every human being will have different thoughts and emotions so it's enough

monitor waves from forehead frontal point (FP1)alone, this mind wave headset sensor uses the Electromyography (EMG) Technique which will detect the muscle contractions that occurs while blinking the eye(i.e. rising the eyebrows or blinking)and this contraction will generate a unique electrical signal. The brain wave sensor will sense the electrical waves and it will convert the data into packets and it will transmit it to the wireless medium. The brain wave raw data will be received by the Level analyzer unit (LAU) and it will extract and process the signal using MATLAB software. With this it's possible to control devices, according to the human thoughts both at attention and meditation modes, by only keeping single electrode on the forehead it is possible to do, since it's a portable headset device it can be easily operated by the elders.

V. EXPERIMENTAL SIMULATION

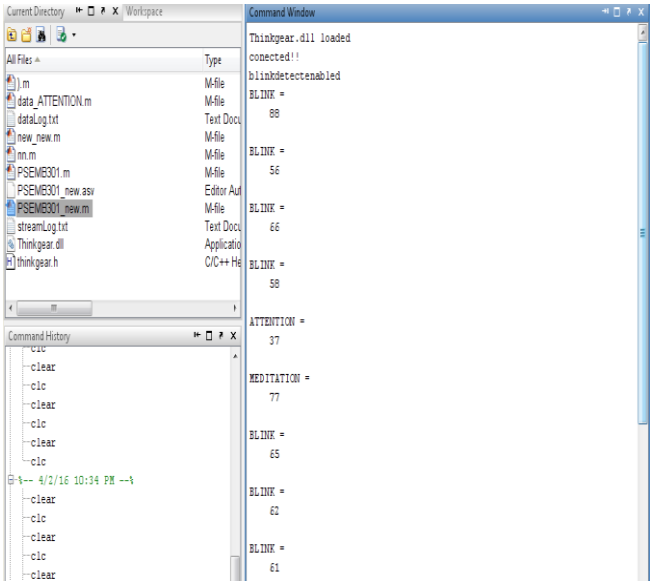

Figure 6: Screenshot of Attention level and Blink level

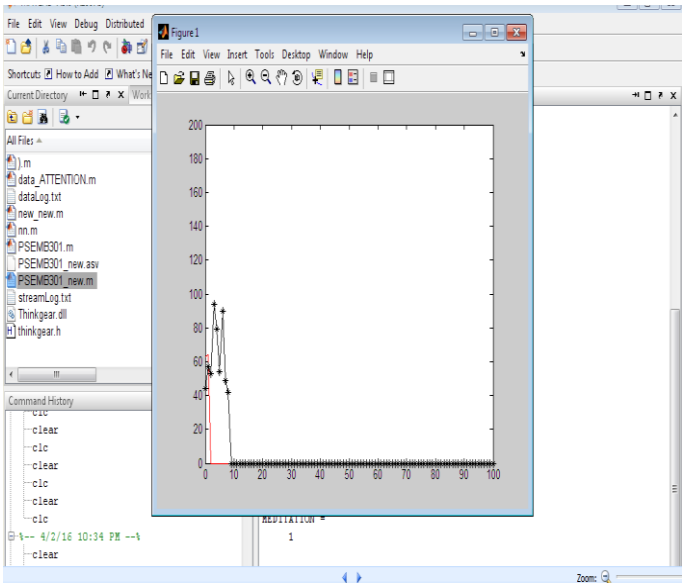

Figure 7: Screenshot of Graph (Black: Blink level, Red: Attention Level)

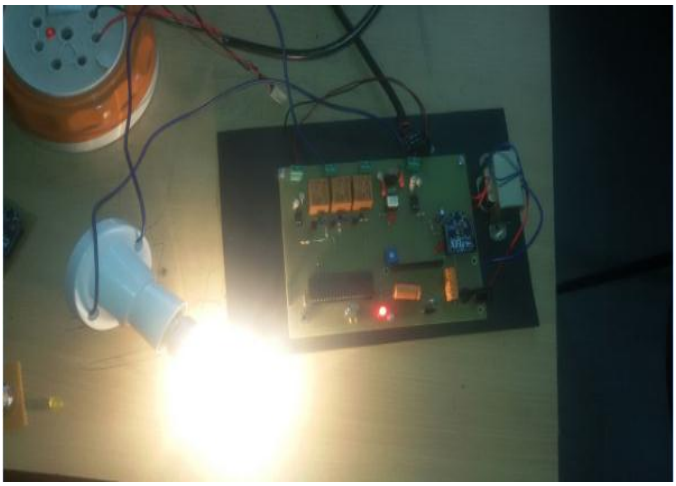

Figure 8: BCI based home appliance controller

VI. CONCLUSION

In this paper Brain computer interfaces intended to translate ''thought into action'' with brain activity only. In the present study, the proposed system is an EEG based BCI system with EEG sensors for sensing brain signals and a microcontroller for Processing. EEG signal and to control the devices .In addition to demonstrate its use by an EEG-based home appliance control system. By decoding the brain wave signal, prototype model of "HOME APPLIANCE CONTROLLER" will work according to the coded signal. It is an achievement to the disabled person.

VII. ACKNOWLEDGMENTS

I put on record and warmly acknowledge the constant encouragement, invaluable supervision, timely suggestions and inspired guidance offered by my guide and Head of Department of Electronics and Telecommunication Engineering, JSPM'S Bhivarabai Sawant Institute of Technology and Research, Dr. Yogesh Angal, this report to a successful Completion.

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