A Smart Home Control using Brain Computer Interface

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Abstract— A brain-computer interface (BCI) is a new communication channel between the human brain and a digital computer. In this work, an attempt is made to design and develop a smart home control system using BCI. The signal generated by the brain is received by the brain sensor . These datas are transmitted to wireless medium and the data is converted into signal using MATLAB GUI platform. These instructions are sent to the home section to operate the different home appliances. With human brain assumption and the ON-OFF condition of home appliance extracted through mind wave sensor with eye blinking, controls home equipment /devices in a smart way.

Key words: Brain computer interface (BCI), MATLAB Graphical User Interface (GUI)

INTRODUCTION

A brain-computer interface (BCI) is a new communication channel between the human brain and a digital computer. The ambitious goal of BCI is finally the restoration of movements and environmental control for handicapped people. BCI is a system that captures the brain electrical activity in the form of EEG signals and translates those specific features of the signal that represents the intent of the user into computer readable commands. These commands can control and operate an electronic device. 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.

Different brain states are the result of different patterns of neural interaction. These patterns lead to waves characterized by different amplitudes and frequencies. The signal generated by brain was received by the brain sensor and it will be converted into raw data, data transmitted to wireless medium .The wave measuring unit will receive the brain wave raw data and it will convert into signal using MATLAB GUI platform. Then the instructions will be sent to the home section to operate the home appliance. The project operated with human brain assumption and the on off condition of home appliance is based on extraction of brain wave radiation through mind wave sensor with eye blinking.

METHODOLOGY

In this work, brain computer interface can be used for motion disabled people. However the mean classification rate achieved is above 90%. This means there is still 5-10% error rate. This error may result in loosing user control. Hence in this study we proposed a very simple and effective method for smart home control.

A. MIND WAVE SENSOR

For EEG signal acquisition the Mind wave Headset is used. It has Single channels (electrode) and the sampling frequency is 128 Hz (2048 Hz internal). It has a built in 5^{th} order low pass sinc filter of bandwidth 0.2 to 45 Hz, and is connected wirelessly to the PC through a 2.4 GHz band.

Location of the electrode: Mind Wave Sensor uses three built-in suites to determine the various types of signal inputs: i.e. Expressive Suite for analyzing users Eye Moments, Attention, the user's emotional state is interpreted by the Affective Suite while the Suite analyzes user's intent to control a movement. In addition the Eye Moment can be used as a mouse emulator. The aim of this project is to acquire and identify the EEG signal that is related with the user intention to operate a device in the smart home. Hence for event detection it is necessary to have a unique profile for each user to map the user's brain. A simple feature i.e. an eye blink to create an event is used. So whenever the user will blink the eye a mouse click will be activated.

Existing System

Recently, the concept of smart houses and small buildings that make use of IT technology to optimize energy

consumption within the home or building is gathering attention.

Smart homes relay on EMS to perform detailed control of lighting and air conditioning while monitoring power usage and environmental conditions such as temperature, humidity and lighting using sensors located throughout the home. This sensor network system for smart homes enables easy EMS construction.

Sensors and equipment in various locations can be connected using ZigBee , and monitored and controlled via the Internet. Wireless LAN (supports 11b/g/n) and Ethernet functions are provided for communication between tablet terminals and mobile terminals used as controllers and the Gateway equipment. The Android-based controller provides excellent operability

In above methods, it does not require remote control operation, depends on others to operate, no muscle contraction sensing, direct PC interaction

PROPOSED SYSTEM

To control home appliances by using human thought and eye blink. The signal generated by brain was received by the brain sensor, in brain sensor single electrode is used to analyse both human thought and eye blink .MATLAB GUI and VB softwares are used.

Robot control system based upon human thoughts controlled by themselves and operating facility communicated via bluetooth

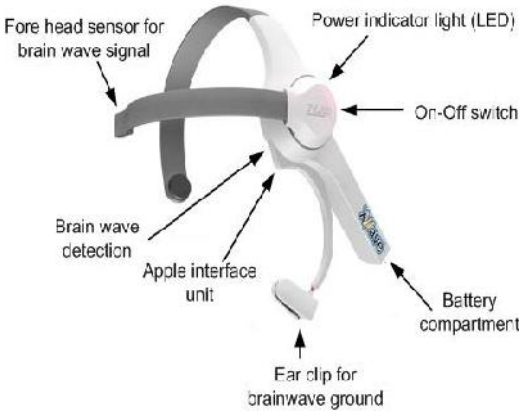

Fig.1.Brain wave sensor device

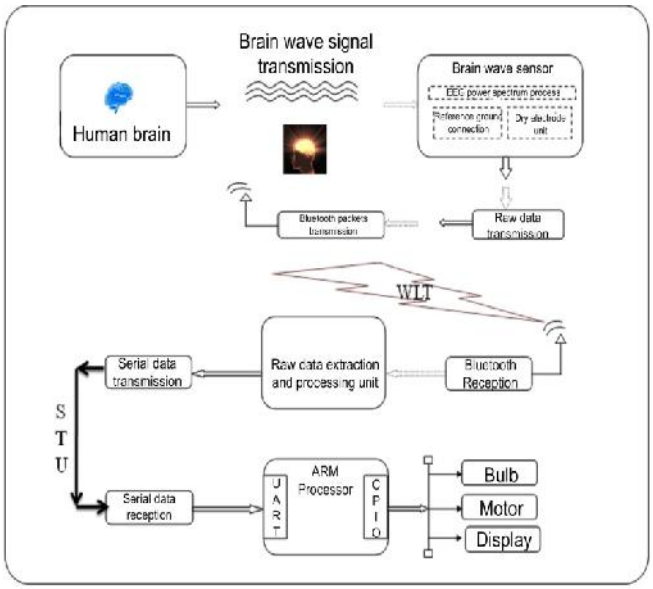

Fig.2.Block diagram for smart home control using BC

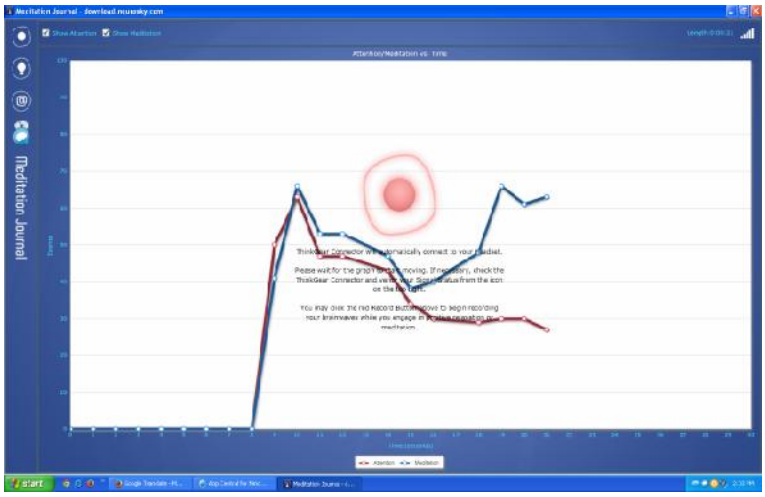

Fig .3.Graphical Representation of Mind Wave Sensor

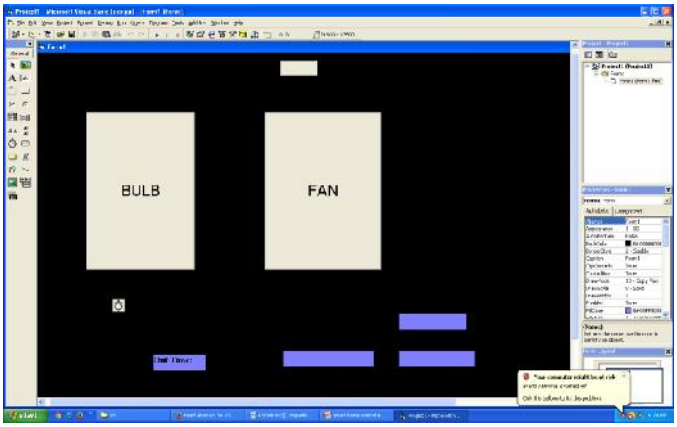

Fig.4. Screen shot of VB application for BCI

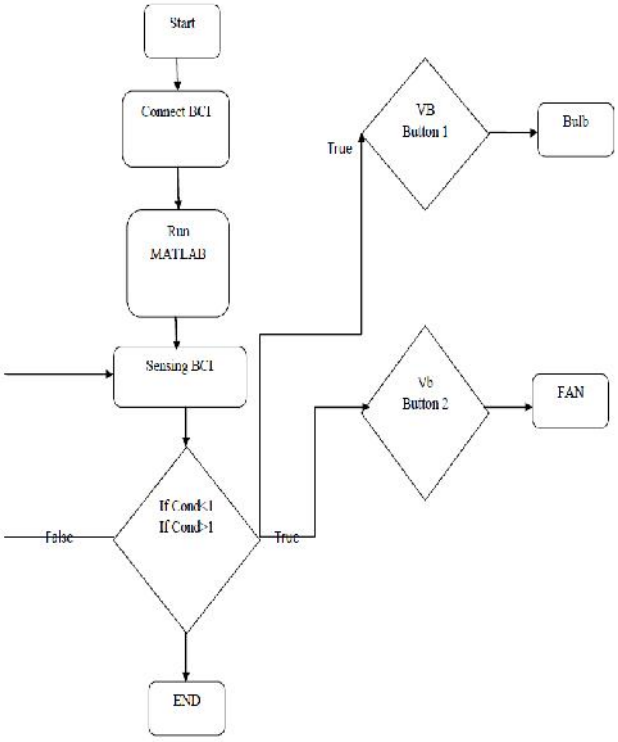

Fig.5. Flow Chart

CONCLUSION

The proposed method has over come to develop and implement a brain controlled smart home system. In this system, the brain EEG signals are acquired using the headset. The only feature i.e. blinking an eye along with the human thought is used to control the virtual home environment using a graphical user interface. Each click on the desired home icon by using a eye blink signal will activate the control of that home item, like turn on or turn off the home appliances. The preliminary result shows a thought controlled smart home system can become a reality in the near future. It will result in a drastic change in the type of quality of the life of disabled and elderly people. In addition it will result in demand of consumer electronics devices that can be easily interfaced with BCI systems.

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REFERENCE

[1] R Corralejo, R. Horneroand D. Alvare using Brain-Computer Interface (BCI)part I, pp. 345-352, 2011.

[2] A. Vourvopoulos, and F. Liarokapis,Tele-operating a robot through "Brain-controlled NXT Robot: Tele-operating a robot through brain electrical activity ", third International Conference on Games Applications, Coventry University Cove

[3] Humaira Nisar, Vooi Voon Yap,"Analysis of Electroencephalogram movements", Australasian Physical Medicine, Accepted, December, 2012.

[4] H. Nisar, H.C. Balasubramaniam, W.TYeap, "Analysis of real-time brain animated 3D cube," Journal of Neurology

[5] J. J. Szafir, "Non-Invasive BCI through Utilization of Electroencephalography Computer Interfaces," Boston College.

[6] Emotiv.com (2013). EPOC Features [online] retrieved from: http://www.emotiv.com/epoc/ [Accessed: 5 march 2013]

[7] Hyun-sang Cho et.al, "The Virtual RSystem for Ubiquitous Home Control," LNAI 4304,pp. 992-996, 2010