International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 08 | Aug 2020 www.irjet.net p-ISSN: 2395-0072
National Conference on Recent Advancements in Communication, Electronics and Signal Processing-RACES'20
Organised by: Department of ECE, Velammal Engineering College, Chennai-66

HANDS-FREE OPERATIONS ON HOME APPLIANCES USING BCI

Dr. M. Usha Rani[1]

[1]*Assistant professor, Department of Electronics and Communication Engineering, Velammal Engineering College, Surapet, Chennai, Tamil Nadu, India.*

R.Ishwarya[2], J.Janani[3], N.S.Swetha[4], V.Shanthini[5]

[2-5]*Student,Velammal Engineering College, Chennai, Tamilnadu, India.*

ABSTRACT: Internet of Things (IoT) has various applications in our daily life from a fully automated Smart Building, to a simple Smartphone application that records the users health information. IoT is the driving force for rapid development of human life transforming it to be more intelligent, productive and organized. It sheds the light on creative and different methods of transferring, combining and conversion of different types of knowledge as users interact and practice them, thus allowing developers and hobbyists to create novel applications. The aim of this paper is to introduce a novel approach to a system, which controls simple electrical appliances such as a water kettle or a coffee machine, depending on the user's attention values measured using NeuroSky/MindWave Mobile EEG sensor. This novel approach of controlling simple home appliances is not only a technological advancement in the area of IoT, it can be scaled to serve multiple purposes including the one proposed here to provide better assistant for disabled people, such that it breaks the barriers for the disabled people and allows them work their way around the house freely.

Keywords:

Brain Computer Interfaces, Brain signal acquisition, BCI applications, Mind commands, Brain monitoring, BCI challenges.

INTRODUCTION

Brain Computer Interface (BCI) is a process by which Humans can control the external devices using their brainwaves. These interfaces are made using sensors which can record brain data either by invasive plantation or noninvasive plantation. Our Human Brain is highly complex and is made up of 100 billion neurons]. There are many types of neurons in our brain such as motor neurons, sensory neurons. These neurons get fired up while generating a response for a particular stimulation and generate an electrical signal which is detected by the electrodes and can be used to control a number of devices. Home Automation is an area where BCI can be used and our entire house can be controlled simply by our brain. This technology would prove as a great boon for almost all people on the planet. Less energy would be wasted for performing menial tasks such as switching on the lights, ac's and other electrical appliances. This technology is breathtaking and has the potential to completely revolutionize and change our lives. As an application of BCI we have proposed to interface it with home appliances and automate ourhomes. Focus, and running modes used during the experiment. The developed system can be easily implemented in smart homes and has high potential to be used in smart automation and wireless biomedical applications.

TECHNOLOGIES USED:

IOT-Internet of things is a network of devices and sensor that are connected to the internet. Where this are interrelated computing devices, mechanical and digital machines which provides with unique identifiers(UIDs) and it has the ability to transfer data over a network without requiring human to human or human to computer interaction.

Figure 1 IOT

IOT is a computing concept that describes a future where everyday physical objects will be connected to the internet and be able to identify themselves to other devices. It significant because an

object that can represent itself digitally becomes something greater than the object by itself.

Where this aims to connect all devices to existing internet infrastructure. At present only mobile, computers, smart TV's are connected to internet. But by using IOT all devices can be connected like fan, lights..etc.

Figure 2 IOT applications

EXISTING SYSTEM:

The existing system is based on GSM module and bluetooth module. Where by using Matlab software may increase the complexity of the process.

Research into BCI's at the moment is at fairly basic level consisting of the problem.BCI are currently fairly inaccurate in terms of classifying neural activity. This BCI when placed outside of the skull have a limited ability to read brain signals. They can be placed under skull, but this requires pretty drastic surgery.

Reading people's inner thoughts comes with a massive amount of ethical.

PROPOSED SYSTEM:

Nowadays, air pollution is monitored by networks of static measurement stations operated by official authorities. However, the extensive cost of acquiring and operating those stations severely limits the number of installations and results in a limited spatial resolution of the published pollution maps. The proposed project is designed in such a way that the acquired data are made centralized so each and every citizen can able to know how much the air is polluted. It can be made possible by usingIoT.Thedataacquiredfromthehardwarecomponenta reupdatedtothecloud which can be made accessible to people by providing data through IFTTT application and also displayed in TFT LCD. As a result, everyone can access the pollution level and each can take some effort to reduce it.

SYSTEM DESIGN

WORKING:

The System Design consists of two main stages the transmitter stage and the receiver stage. The transmitter circuit consists of the following stages:

- **Electrodes**

We will be using dry non-invasive scalp sensors to measure the electrical activity of our brain. Specific electrodes would be placed at the motor cortex area and the rest would be placed in many specific areas of the brain to measure brain activity.

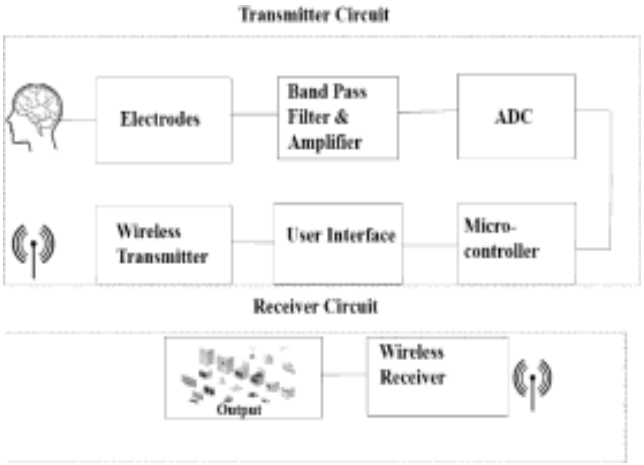

Figure 3 Block Diagram

- **Amplitude and filter circuit**

These signals along the scalp are very weak i.e, in micro volts and contain noise. Thus, we need to amplify and filter out the frequencies not useful to us, we can use an instrumentation amplifier to amplify the signals we get from electrodes.

- **Amplifier**

One such instrumentation amplifier is AD620, in which we can vary the gain by varying the value or resistor. A High pass filter is designed having cut off frequency 7 Hz and a low pass filter is designed which will have a cut-off frequency at 31 Hz. Hence it will allow only frequencies from 8-31 Hz to pass. The basic noise in all the systems is at 60HZ which is due to power line interference. For, suppression or attenuation of this frequency we can design a notch filter, that will severe reduce gain of this frequency. Also an Analog to Digital converter will be required to feed the data to micro controller

- **Micro-controller**

After the amplification and the filtering process the micro controller will process the signals and give the output according to the specific algorithm. The micro-controller will do the following operations:

1. Will take the digital signal data from the ADC and process it according to the working specified.
2. The microcontroller will be directly connected to the user interface which will display the data selected, and details such as concentration level.
3. The microcontroller will send the processed data to the wireless transmitter which will transmit it wireless.

MODULE DESCRIPTION

Our project is based upon two modules: EEG and ECG module. The first module is based on capturing EEG signals or brain signals using brain signals using brain sensor and operate electronic appliances like bulb, fan etc.

EEG MODULE:

Figure 4

Figure 5 Brain sensor

In EEG module the hardware consists of a node MCU, relay driver circuit and a brain sensor. After capturing brain signal, it is programmed using Arduino programming language. The brain signals are captured in the form of beta waves and the data is displayed in serial monitor. Based on the value that has arrived, we can control the electronic appliances in its ON-OFF mode.

The value is a fixed value and for every count of the value, the bulb switches its mode. Thus an electronic appliance is controlled using brain sensor.

ECG MODULE:

This module controls home appliances using heart beats that has been recorded.it consists of ECG electrodes, an electrode gel and a micro tape. The electrodes are placed on the human body using electrode gel and micro tape. The placement of electrodes is shown in figure.

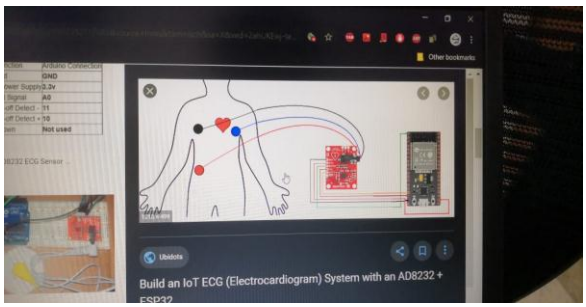

Figure 5 Placement of electrodes

After placing the electrodes, the heart beat is measured and a graph is obtained in the cloud(every minute). The graph obtained is beats per minute(BPM) along y-axis and time along x-axis.the measurement is recorded every minute.

The hardware part is configured with ECG sensor and it is programmed using arduino. When this is interfaced with any electronic appliance i.e fan, it operates with respect to the heart beats recorded per minute. Thus we can also control home appliances using ECG module.

RESULTS AND DISCUSSIONS

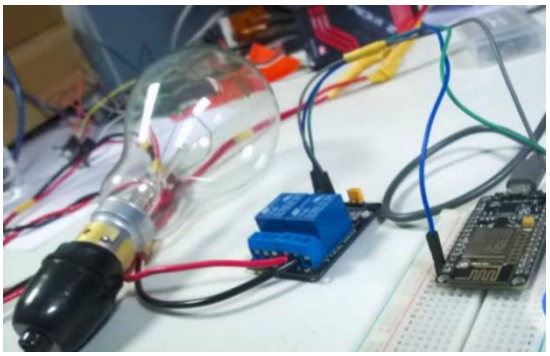

Figure 6 Working model

This project aims to establish BCI systems as assistive technologies for disabled people, thereby helping them interact with there living environment and facilitating social interaction. These efforts rely on properly interfacing the BCI with supporting systems, devices, services and tools. It makes it possible to adapt BCI to the user's needs while providing standardized interface for using BCI as control and interaction devices with a large and constantly growing number of applications, assistive services and devices

CONCLUSION & FUTURE WORK

Controlling a simple home appliance such as a water kettle or a coffee machine using an EEG sensor is the first step towards a novel approach for assisting the living of people with disabilities. Using simple electronic components such as Arduino board, BlueSMirf Bluetooth modem and a relay, proves that the idea can be implemented in further scalable applications in order to further assist disabled people. This humble idea can turn out to be an IoT based home automation application by making it meet the standard and requirements for a true IoT application that would assist people and especially those who are disabled for a better living conditions and make them feel free and less dependent on others. Future applications could incorporate the four main types of brainwaves, for hopefully in the future, to reach a fully brainwave interface.

REFERENCES

[1] M. Jiang, T. N. Gia, A. Anzanpour, A. M. Rahmani, T. Westerlund, S. Salanter, P. Liljeberg, and H. Tenhunen, "IoT-based remote facial expression monitoring system with sEMG signal," in 2016 IEEE Sensors Applications Symposium (SAS), pp. 1–6, April 2016.

[2] A. Dix, J. Finlay, G. Abowd, and R. Beale, Human-computer interaction. Upper Saddle River, NJ, USA: Prentice-Hall, Inc., 1997.

[3] L. Bi, X.-A. Fan, and Y. Liu, "EEG-based brain-controlled mobile robots: A survey," vol. 43, pp. 161–176, 03 2013.

[4] P. R. Wolpe, K. R. Foster, and D. D. Langleben, "Emerging neurotechnologies for lie-detection: promises and perils.," The American journal of bioethics : AJOB, vol. 5 2, pp. 39–49, 2005.

[5] T. C. Major and J. M. Conrad, "A survey of brain computer interfaces and their applications," in IEEE SOUTHEASTCON 2014, pp. 1–8, March 2014.

[6] F. B. Taher, N. B. Amor, and M. Jallouli, "EEG control of an electric wheelchair for disabled persons," in 2013 International Conference on Individual and Collective Behaviors in Robotics (ICBR), pp. 27–32, Dec 2013.

[7] P. S. Kanagasabai, R. Gautam, and G. N. Rathna, "Brain-Computer Interface Learning System for Quadriplegics," in 2016 IEEE 4th International Conference on MOOCs, Innovation and Technology in Education (MITE), pp. 258–262, Dec 2016.

[8] L. R. Squire, F. E. Bloom, N. C. Spitzer, S. du Lac, A. Ghosh, and D. Berg, Fundamental neuroscience. ELSEVIER Inc., 3ed., 2008

[9] NeuroSky. http://download.neurosky.com/support pagefiles/MindWaveMobile/docs/mindwave mobile user guide.pdf, Last accessed 27 November 2017.

[10]W.E.Specialist. http://www.wecl.com.hk/distribution/catalogs/ 058-31-0328.pdf, Last accessed 27 November 2017.

[11]SparkFun. https://learn.sparkfun.com/tutorials/using-the-bluesmirf/all.pdf, Last accessed 27 November 2017.