

Brain Controlled Home Automation

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ABSTRACT: Today people become physically disabled by traumatic accidents and by severe other harmful diseases. Due to this people get paralyzed and it is unable for them to operate home appliances. Brain Computer Interface (BCI) are the systems, which monitors the different states of the brain along the scalp through EEG. Different brain states results in different patterns of brain waves of different amplitudes and frequencies. The brain sensor senses the signals generated by the brain. The analog signals are converted into digital signals and they are transmitted through wireless medium(Bluetooth) in the form of packets to the receiving Bluetooth module. The received data is converted into signals by using MATLAB. Then the instructions will be sent to Arduinouno to operate the modules (bulb, fan). Hence, this project is operated with human brain waves and the appliances can be controlled by changing the muscle movement by blinking the eyes.

KEYWORDS: Brain controlled interface, EEG, Bluetooth, MATLAB, Arduino.

I.INTRODUCTION

A BCI is simply a computer-based system that reads brain signals, analyses them, and transforms them into commands. It measures the signals produced by the central nervous system. The scalp-recorded EEG signals have advantages of being easy, safe, and inexpensive. In scalp recorded signals, major information gets lost, as the electrical signals intensity decreases significantly when passed through skull. Now let's see the types of BCI systems.

A.TYPES OF BCI SYSTEMS:

Invasive BCI system:

In invasive BCI systems, the electrodes are attached directly on the brain tissue. Gradually, brain gets adapts to the signals sensed by the electrodes.

Non-invasive BCI system:

Non- invasive BCI systems are worn on the scalp. The type of systems consists of multiple channels based on the number of electrodes. The electrodes placed on the scalp senses brain waves.

II.OBJECTIVES

The aim of the Brain Computer Interface system is to establish a connection between the brain of a user and a computer. Appliances can be controlled automatically using mind waves without any physical control.

III.RELATED WORK

In this paper [1] author BCIs are systems which will bypass conventional channels of communication (i.e., muscles and thoughts) which give an immediate communication and control between the human brain and physical devices that translate the various patterns of brain activity into commands in real time. With these

commands a mobile robot are often controlled. The author has intention is to develop a robot that can assist the disabled people in their daily life to do some work independent on others .Here a single robot is employed for multiple purposes thereby reducing cost for designing multiple robots.

This paper [2] author covered the Mind Controlled Robot is predicated on Brain Computer Interface (BCI) which will use brain waves. Using these commands a mobile robot are often controlled. The intention is to develop a mechanism for disable person they'll assist in lifestyle to undertake to to some work freelance on others. Human, the brain signals that are widely wont to develop EEG-based BCIs using embrace P300 potentials that are a positive potential deflection on to the continuing brain activity.

In this paper [3] author explained the number of people is handicapped. Using this technique they use different technologies for controlling the robot move around. In this paper author designed robot or wheelchair is fully automatic and controlled using Beta wave and sensor sense Mind wave which is detected from brain signal.

IV.METHODOLOGY

A.SIGNAL ACQUISITION

The Mind wave sensor is used to sense the brainwaves using headset which uses electrodes to sense the signals and transmit them to PC to use with computer development platforms. The mind wave sensor determines the EEG signals such as alpha and beta waves. It senses eye blinks. Mind wave has a single electrode which is mounted on the users' forehead. The device has an ear clip and headband. It uses a single AAA battery to power up. This Mind wave sensor has the ability to sample the raw data into data packets which are sent to the computer via Bluetooth.

Brain wave sensor is showed in Fig 1.



Fig 1 BRAIN WAVE SENSOR

B. Relay

It is used to control high voltage or low power signal. It can be interfaced with arduino to turn ON/OFF the appliances.Relay is showed in Fig 2.



Fig 2 RELAY

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C. Arduino UNO

It is a popularly used microcontroller which is based on ATmega328p microcontroller. It consists of set of analog and digital pins that can be interfaced with various circuits. Arduino UNO is showed in Fig 3.

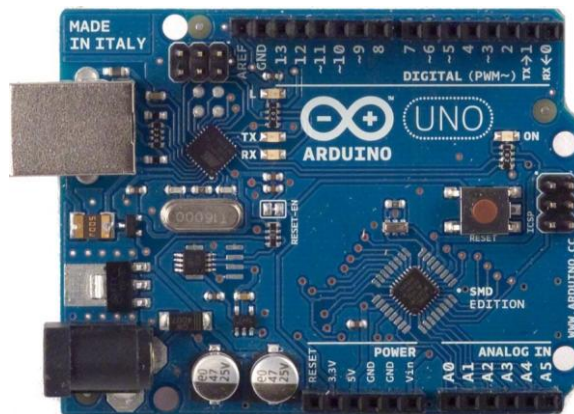


Fig 3 Arduino UNO

D. Bluetooth module (HC-05)

It is easy to use Bluetooth SPP (serial port protocol), designed for transparent wireless connection setup. Bluetooth module (HC-05) is showed in Fig 4.



Fig.4 Bluetooth module (HC-05)

E. THINKGEAR MODULE

TGAM module offers e-Sense technology Outputs Attention, Meditation and Physical eye blinks from raw EEG data 2.79cm x 1.52cm x 0.25cm, weighs 130mg, communicates through UART interface at baudrate 1200, 9600 or 57600. Think gear module is showed in Fig 5.



Fig 5. Thinkgear module

F.PERSONAL COMPUTER

It is used as medium to connection brain sense, HC-05 Bluetooth module. It is also used to receive the signal packets and process it by MATLAB software.

G.SOFTWARE REQUIRED

Matlab simulation software
Arduino IDE

H.HARDWARE SETUP

Open Arduino IDE Application Upload the “Home_automation_relay.ino” file to the Arduino Give the Power supply either by placing Batteries or External supply (9 v) to to the Arduino connect the Arduino Board and the Bluetooth Module Connect the wires from port in relay to the respective pins in the Arduino board observe the LED in Bluetooth Module which turns ON. Now Relay is ready to get commands.

I.MINDWAVE SENSOR SETUP

Switch on the Mind wave Mobile Now turn on the Bluetooth in the Laptop or Pc Pair both the Mind wave mobile (Default key: 0000) and Bluetooth Module HC-05 (Default key: 1234) Open the code “Home_automation.m” file using Matlab. Before Running the program it is essential to change the com port number in the program. After connecting the Mindwave mobile to the laptop Go for Bluetooth Settings -> More Bluetooth option -> COM port tab and observe the com port number which has Direction on “OUTGOING”. It’s the port number which has to be changed in the Program.

V.WORKING

The automation system consists of Mind wave sensor, Bluetooth module (HC-05), Arduino UNO, Relay module, PC MATLAB Simulation software and a setup of home appliances. The mind wave sensor is a single channel sensor which is worn on the scalp. It consists of one electrode and the ground pin. The electrode is placed above the left eye and the ground is pinned to right ear. Then the mind wave sensor is turned ON which consists of think gear module and a Bluetooth module. BCI (Brain Computer Interface) monitors EEG waves from the brain. An electroencephalography (EEG) wave provides different brain waves from which the electrical property of the brain can be determined. Arduino is programmed with set of commands. It is interfaced with Relay and Bluetooth module (HC-05). Both Brain sense (Mind wave mobile) and HC-05 gets paired to the laptop or pc.

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Matlab helps to read Raw EEG from our Brain via Brain sense and to detect blink and sends command to relay to operate the appliances.

When the eye is blinked, EEG signal rises to its peak. The Bluetooth module transmits the detected peak signal in the form of packets to the HC-05 Bluetooth module which is connected to Arduino. The HC-05 module receives packets and establishes the connection with brain sensor. MATLAB reads the brain waves, processes it and sends the command to the arduino to trigger the relay and further activate the home appliances.

.Matlab GUI also shows the Graphical representation of our Brain waves Onscreen keyboard keys highlights are occurring repeatedly as loop, when it is supposed to detect the blink, the text gets selected (Observe the sound occurred while blinking, to indicate that key is selected).If the eye is not blinked for a particular key, it remains in OFF state. This transmission is takes place via Bluetooth communication.

VI.EXPERIMENTAL RESULTS

After extracting the raw EEG waves from the brain, signal processing takes place in MATLAB to identify the blink waves. Normally, blink wave is in the form of sinusoidal wave from among the EEG waves. It is identified by measuring both onset and offset voltages. The amplitude of the blink wave is based on the blink strength (Strong blink will have a high amplitude). Normal eye blink is differentiated from voluntary eye blink by using its intensity of blink. Paralyzed people can able to control the homeappliance such as light, fan, tv by using this application, from the wheel chairitself by using eye blink. By observing the current state of “Blink to switch image” in Home automation control panel, then each application can be selected using eye blink at certain appliance.

Experimental setup is showed in Fig 6. Experimental outputs showed in Fig 7 and Fig 8.



Fig 6. Experimental setup

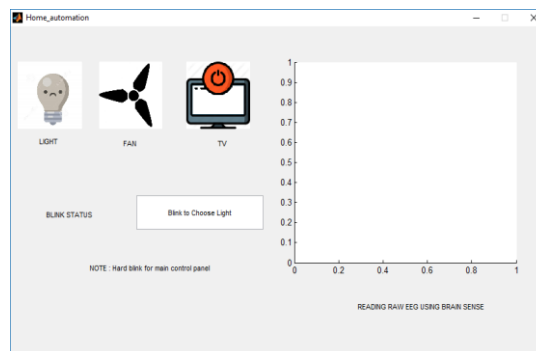


Fig 7 Experimental output 1

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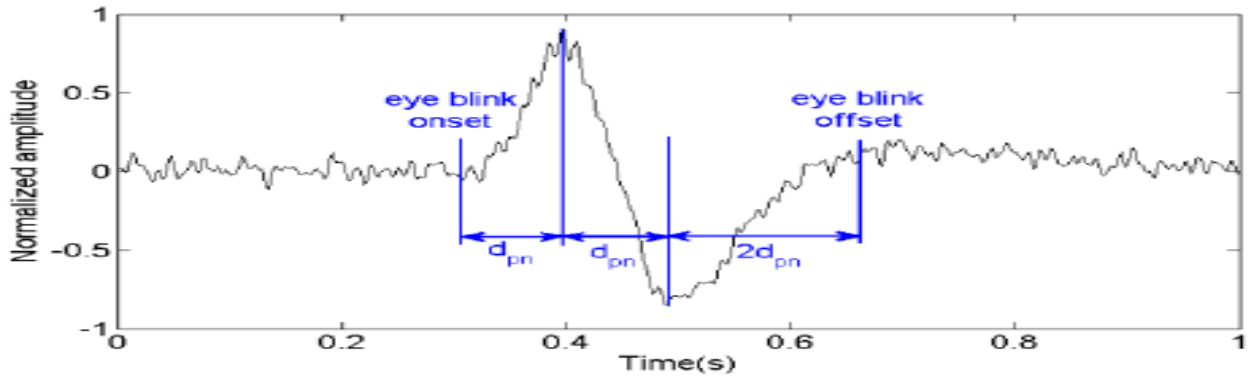


Fig 8 Experimental output 2

VII.CONCLUSION

Thus the paper concludes that, by using Brain Computer Interface technology, brain actuated application can be used for controlling Home appliances with the help of brain waves. The BCI technology can be mainly for the paralyzed people and bed-ridden who cannot move physically.

VIII.FUTURE ADVANCEMENTS

Further this system can be developed by adding features like controlling speed of Fan and changing intensity of light using human attention level. Also television channels can be selected by using human attention level.

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