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Brain computer interface with home appliences

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Abstract

Main aim of this paper is to help paralysed and physically disabled people to control the home appliances using Electroencephalogram (EEG) signals, so they become independent in their daily life. Electroencephalographic measurements are commonly used in medical and research areas. This project discussed about a brain computer interface (BCI) is a new communication channel between the human brain and a digital computer. The Neuro Sky brainwave sensor is used to sense the attention values of the brain signals and the eye blinks. The ARM7 processor is used as main interfacing device. It offers an alternative to natural communication and control. It is an artificial system that bypasses the body's normal efficient pathways, which are the neuromuscular output channels.

Keywords: *EEG, home control, Brain-Computer Interface (BCI), NeuroSky Brainwave sensor,*

I. Introduction:

Smart Homes, also known as automated homes, intelligent buildings, integrated home systems or domestics, are a recent design development. Different brain states are the result of different patterns of neural interaction. These patterns lead to waves characterized by different amplitudes and frequencies.

Electroencephalography is a medical imaging technique that reads scalp electrical activity generated by brain structures. The electroencephalogram (EEG) is defined as electrical activity of an alternating type recorded from the scalp surface after being picked up by metal electrodes and conductive media[1]. Every interaction between neurons creates a minuscule electrical discharge. This project dealing with the signals from brain. Different brain states are the result of different patterns of neural interaction. The electrical activity in neurons is generated primarily by two sources. One source is the action potential, which is the result of a change in membrane permiability. An action potential is generated when a nerve cell receives an impulse from a neighboring cell. When brain cells (neurons) are activated, local current flows are produced. EEG measures mostly the currents that flow during synaptic excitations of the dendrites of many pyramidal neurons in the cerebral cortex. Whenever there is a muscular activity or some sort of thoughts provoked by a person, the neurons in the cerebrum gets activated [2]. Differences of electrical potentials are caused by summed postsynaptic graded potentials from pyramidal cells that create electrical dipoles between soma (body of neuron) and apical dendrites (neural branches). Pores in the membrane of that cell open and allow

large sodium ions to flow from outside to inside the axon of the cell, This flow of positively charged sodium ions causes a change in the voltage across the cell membrane and the membrane becomes depolarized. Only large populations of active neurons can generate electrical activity recordable on the head surface. Between electrode and neuronal layers current penetrates through skin, skull and several other layers. Weak electrical signals detected by the scalp electrodes are massively amplified, and then displayed on paper or stored to computer memory [3].

II. METHODOLOGY:

In this project, collect the raw brain wave signal by using brain computer interface system. The Brain computer interface is to establish a novel communication system that translates human intensions reflected by suitable brain signals into control signal for an brain wave sensor. Brain wave sensor, which consist of EEG signal processing unit and electrode unit.EEG signal processing including data acquisition. And from the sensor unit using library function we are getting directly attention of driver. Sensor unit is connected to PC by using Bluetooth module. Transfer the processing data to PC. In PC by using MATLAB programming and library functions extract the data and analyze the level of the signal with the threshold level. Send the information to hardware through RS 232(Serial transmission Unit). Hardware get fixed in home. we will control that by using attention and eye blink . Use of think gear connector to receive brain wave signal.Pairing brain wave sensor to PC using Bluetooth.Loading of EEG signal in MATLAB.Implement the MATLAB program for analyze the level of the signal with the threshold level and graphical representation of attention & eye blink.Design and implementation of hardware section by using ARM LPC2148Use the Keil compiler software implement the program for hardware.Finally we will try to control devices using brain waves .proposed system architecture which is composed of four main modules described as Sensor input module—receives data from sources:—BMI device which provides EEG data that can be translated into brain states (Alpha-sleepy, Beta-awake, etc.). Graphic user interface (GUI)—provides a visualization of the available electronic appliances and their corresponding functionalities. This module is only enabled during training mode. Data collection module—constructs a dataset of sensor information and user actions to be used as training set.

Control output module—sends commands to appliances in a simulation environment as well as to the physical devices. Brain waves have been categorized into four basic groups (Figure 1)

III. DESIGN AND IMPLEMENTATION:

Brain patterns form wave shapes that are commonly sinusoidal. Usually, they are measured from peak to peak and normally range from 0.5 to 100 μV in amplitude, which is about 100 times lower than ECG signals. A BCI records brain signals and processes this signals to produce device commands. This signal processing has two stages: The first stage is feature extraction, (calculation of the values of specific features of the signals). The feature extraction stage must focus on features that encode the user' s intent, and extract those features as accurately as possible. The second stage is the translation algorithm: features are translated into device commands.

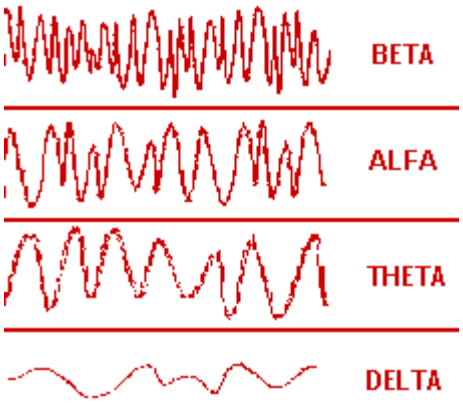

Fig1. Brain wave samples with dominant frequencies belonging to beta, alpha, theta, and delta band.

The scalp-itself acts as a spatial verager of electrical activity. depicts the block diagram of data transmission in the system(Figure 2).The EEG records only those waves which are common to and synchronous over a relatively large area of the cortex.

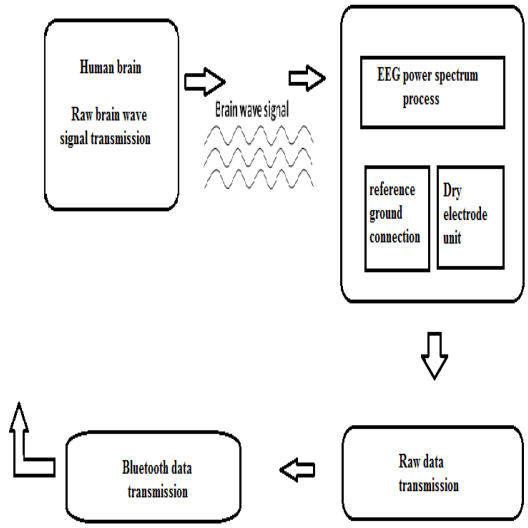

Fig 2. Brain computer interface system

A NeuroSky brainwave sensor is used to analyse the EEG signals.The BCI is a direct communication pathway between the human brain and an external device. According to the human thoughts, In this project a brain computer interface system is used which will do the key role in the entire operation. For the BCI system, we are using the MATLAB and for brain wave sensor and Processor communication neurosky is used. The patterns and frequencies of the brain electrical signals can be measured by placing a sensor on the scalp. The mind tools line of headset products contain NeuroSky ThinkGear technology [4], which measures the analog electrical signals, commonly referred to as brainwaves, and processes them into digital signals. Brain attention values the physical devices are operated. Once the blinking levels will calculated it will be send to MATLAB. Whenever MATLAB reads an blinking values it will convert into digital values because for microprocessor understanding purpose the values should be in digital format (Figure 3).

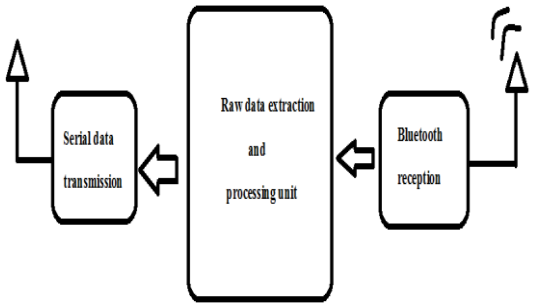

Fig 3. Level analysis platform

The controller section, the serial data is received and is transmitted to the ARM7 processor, through which the physical devices are connected via UART (Figure 4).

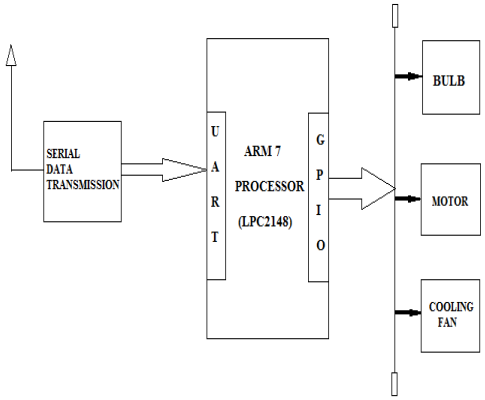

Fig 4. Home appliance controller

In the data processing unit, for processing the data we use DSP processing i.e., MATLAB. The Visual Basic software is used along with the MATLAB because, 179 bytes of huge data will be receiving from the brain sensor and sending these data to the MATLAB and meanwhile these data i.e. the attention and the values should be sent to the hardware part. So the data transmission rate in visual basic is comparatively greater than that of the MATLAB. The form is created in the visual basic with two captions FAN and BULB and MOTOR.

IV.CONCLUSION:

The non-invasive BCI is an emerging technique which is still under research. This paper presents the design and implementation of non-invasive type of Brain-Computer Interface technique to control the home appliances using EEG based brain signals. It includes NeuroSky

Brainwave Sensor with a dry electrode and a reference ear clip so that usage of gel is not necessary as it is used in wet electrode for connecting the sensor electrode to the scalp. This paper works on the brain signals for controlling the physical devices, so the paralysed and the physically disabled people can independently do their work like switching on and off the lights and fans by their own .Whereas, in existing techniques remotes are used for controlling purpose. In the future, this technique can be used to replace the whole manual control system in industries and in risk environments with the human mind control

V. REFERENCES:

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