BCI FOR THE HOME AUTOMATION OF APPLIANCES BY USING RASPBERRY PI

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Abstract

The basic principle in this project is that the change in the EEG signal caused due to various reasons like fluctuations in the state of mind, muscle contractions, physical movement etc can be used for controlling the different kind of the appliances. The system unwinds in three stages that are raw signal acquisition, signal transmission and lastly system control. The appliances are chosen by having different order of priority for the appliances. In this system the priority and the order for the appliances is Light, Fan and TV. Different appliances can be used by further giving different order of priorities. The raspberry pi microprocessor is used as operating system in this device. This project is specifically designed to help the elderly, paralyzed and disabled people have an independent lifestyle.

Keywords-- *BCI, RaspberryPi,, EEG*

I. INTRODUCTION

The Brain-Computer Interface (BCI) is the external channel which is used to make an interaction between the neurons in the brain cells and a external device. BCI monitors EEG waves from the Brain. EEG monitors an Electrical property of the Brain along with the Scalp (Non-invasive). The BCI provides external pathway between brain and external devices. The Raspberry Pi is a cheap, small sized computer which can be plugged into a monitor or TV and has a keyboard and mouse. It is a System on a Chip, a method for placing all electronics for running a device on a single chip. Raspberry Pi needs an Operating system to start. For cost reduction, the Raspberry Pi ignores onboard non-volatile memory which is used to store the boot loaders, Linux and file systems.

II. EXISTING SYSTEM

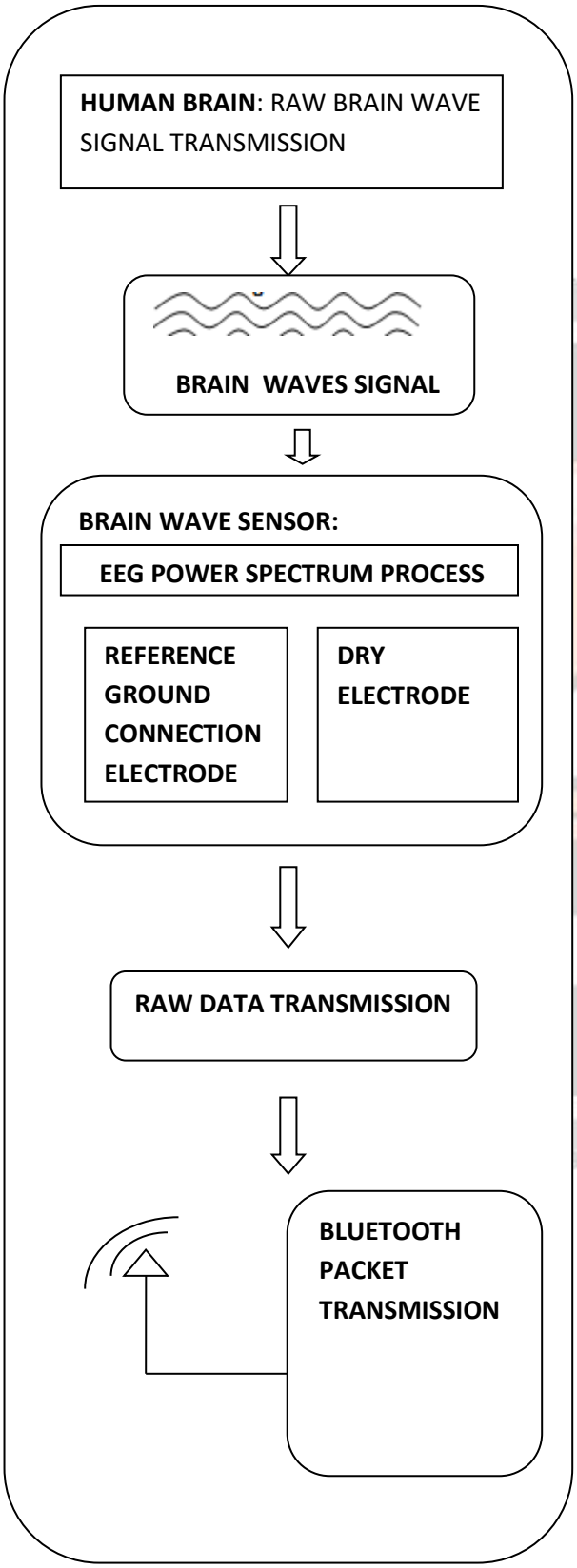
In the existing system, every application is developed by using MATLAB; it requires a computer for processing signal and processing application through MATLAB. The existing system uses an arduino which also requires Bluetooth connection. The programming which is done on the arduino is complex and requires the user to either have a prior knowledge or learn to program on arduino. This makes it less user-friendly.

III. PROPOSED SYSTEM

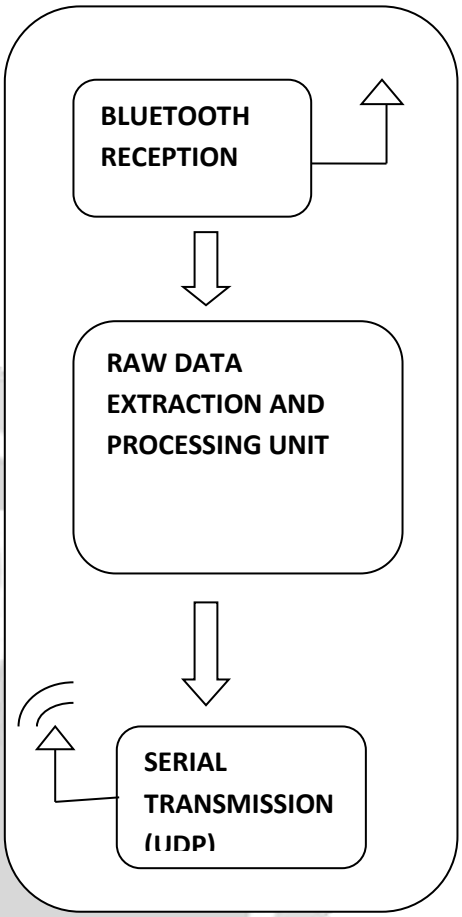
The proposed system uses Raspberry Pi and does require MATLAB for processing the signal. Raspberry Pi has in-built Bluetooth and hence any home appliance can be operated by connecting the relay through the Raspberry Pi. The MATLAB can process the signal and it is able to classify different EEG waves which can be done by using python programming. The proposed system uses python programming which is user-friendly and can be learnt easily. The electrodes are placed by the non invasive technique and hence there are no implantations inside the brain.

IV.BLOCK DIAGRAM

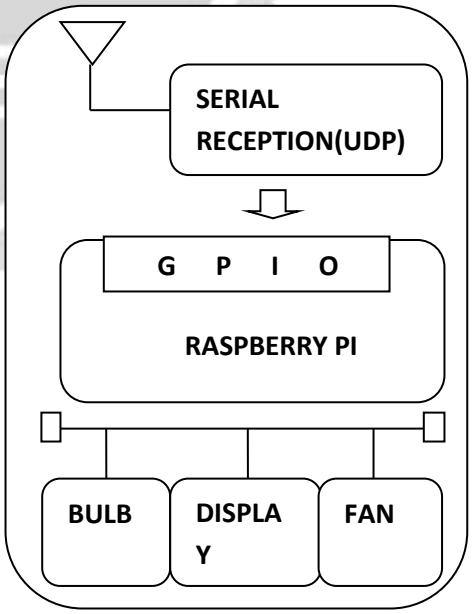
A. BRAIN COMPUTER INTERFACE SYSTEM



B. LEVEL ANALYSIS PLATFORM



C.HOME APPLIANCES CONTROLLER



BCI Based system comprise of electrode headset connected to computer via wire or wireless connection. The Brain wave headset records and transmits the brain signal to computer. The brain signals are processed in computer.

IV.2. MEASUREMENT OF EEG SIGNAL

EEG signal can be measured by using electrodes that are placed on the user's head at respective positions. The Brain wave headset fits comfortably on user's head. It consists of non – invasive type of electrodes, in which one is placed above the left eyebrow and another is attached to the left ear lobe that works as a reference. It records the raw signals from the brain wave and is transmitted to the computer via Bluetooth which is also an inbuilt feature of raspberry pi. The dry sensor of the headset extracts 12 bit raw brain waves in the range of 3-100 Hz with a sampling rate of 512 Hz.

IV.3. PRE PROCESSING OF RAW DATA

The data sent by the Brain wave is processed in MATLAB program. The Bluetooth connection is opened through com port 4 in MATLAB

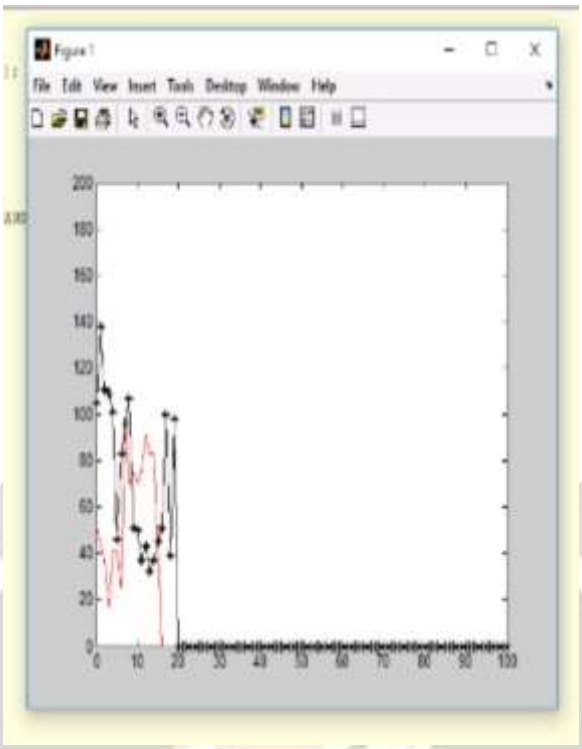
Pre processing is the process of sending raw data into a form that can be easily analyzed and interpreted by the anyone. It also enhances the quality of signal by removing unnecessary noises from the data.

IV.4.FEATURE EXTRACTION

The process of extracting the signal belonging to a specific frequency range, as per need is called feature extraction. Each frequency contains information related to a different aspect of human thinking. For example, the beta rhythms ranging from 12Hz to 30 Hz are related to Mo- Echo feature contains information about a certain aspect of human thinking . The transmission of processed signal from MATLAB to the Raspberry Pi processor is performed through UDP protocol which is performed by accessing the IP address hence makes it easy for accessing appliances from anywhere. In the receiver end for enabling the transmission of signals from MATLAB python coding platform is used and is uploaded to Raspberry Pi. Thus the appliances connected to the raspberry pi works when it crosses the threshold voltage.

EXPERIMENTAL RESULT

Brain wave headset is the best choice for EEG brain waves. The headset measures the signal from brain and wirelessly sent EEG information to computer. This uses Bluetooth technology. EEG signal in computer varies from 3-100 Hz. A suitable attention, meditation and relaxation should be set by the programmer. If the acquired signal exceeds the threshold value, it will activate household appliances like TV, fan and light.



VI.CONCLUSION

This project is dealing with the signals from brain. The various brain states are produced due to the result of different patterns of neural interaction. These pattern leads to wave formation as a result of different amplitude and frequencies. The signal generated by brain was received by the brain sensor and transmitted to wireless medium (Bluetooth). The wave measuring unit will receive the brain wave raw data and it will convert into signal using python coding platform.

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