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RESEARCH ARTICLE

STUDY AND APPLICATION OF BRAIN WAVES (ALPHA, BETA) FOR USER AMBIENT ENVIRONMENT CONTROL

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Abstract: Brain-computer interface (BCI) is a fast growing technology, in which a brain accepts & controls a mechanical device as a natural part of its representation of the body. BCI extracts electro-physical signals from suitable components of the brain and process them to generate control signals for computers, robotic machines (or) communication devices.The major goal of BCI research is to develop a system that allows disabled people to communicate with other persons and helps to interact with the external environments. In this paper the total work is carried through EEG signals, measurement of the electrical activity produced by brain as recorded from electrode and analyzed through Fast Fourier Transform (FFT) analysis. This activity is called an electroencephalogram or EEG.

Index Terms: BCI, EEG, FFT, electro-physical signals, Computer

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I. INTRODUCTION

In this present world many people are coming across many problems, one of those problems is physically handicapped and aged people depending on others to complete their tasks. Technology can be used to reduce this problem to maximum extant using BCI (Brain-computer interface)[1]

The number of existing neurons in human brain cortex which being activated in synchronize patterns are resulting in certain rhythmic behavior. The potential stimulation produced in brain cortex is recordable with the recommended electrodes position on the skull. The potential patterns occur due to electrical rhythms and transient discharge represents in electroencephalogram (EEG)[2]. EEG signals can be classified based on skull positions, frequency ranges, amplitudes, signal waveforms, periods and signal- induced actions. Basically, the EEGs signals are synchronize when the external stimulated has been measured. The EEG signal passes through Dura,

cerebrospinal fluid and skull to scalp will produces peak-to-peak amplitude is only about 1 ~ 100μV with frequency range 0.5 ~ 100 Hz. In addition, the electrode material, contact tightness and electrode paste may even affect the recordings due to some unpredictable noise which interferewith EEG detection.Brain waves are measured in cycles per second or Hertz (Hz) also known as frequency of brain wave activity

Brain-computer interface is nothing but the interaction between the human neural system and machines, it is a control system which enables the people to communicate [5] and control a device by mere thinking. This is done through three steps 1st step is to get the signal acquisition from the (user's) human brain and sends the digital signal to the signal processing unit which contains two blocks namely i)feature extraction, ii)translation, here the signal is processed and sends the commands to BCI application and the application acts accordingly.

II. METHODOLOGY

In the experiment, the brain wave sensor is placed on the positions of frontal and potential ground to ear as shown in Figure. It has 3 electrodes 2 are kept in frontal and 1 for ground ear. These positions had been chosen since thepresences of hair on the scalp make it difficult to place electrode[3] on the proper region. The isolation concept was incorporated in circuit designing to avoid electrical shock caused by power supply or measuring instrument leakage.

Fig-1: Electrode Placement

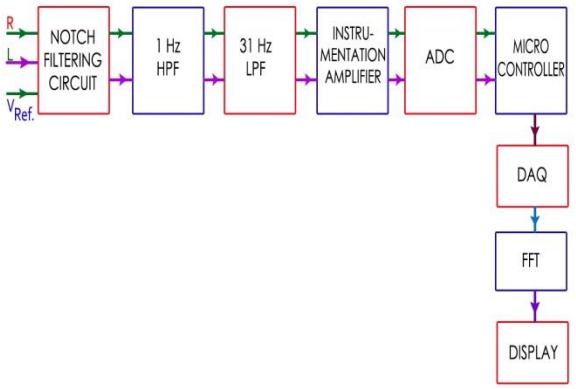

Fig-2: System Block Diagram.

The Notch Filtering Circuit [6] consists three terminals from which the signals from the brain are taken. First terminal is used to take the information from right hemisphere of the brain and second terminal is used to take the signals from the left hemisphere [4] of the user's brain which is in inside the head band and the third terminal is used as ground. This Notch filtering circuit is used to eliminate the unwanted noise from human body.Here the range of the filter is 1Hz and above. The HPF will allow those signals which has the frequency of 1Hz and more than 1Hz, thus it is used to eliminate the lower frequency signals (i.e. < 1Hz). Also the range of the frequency should be below 31Hz.So LPF is used to eliminate the higher frequency signals which has more frequency than 31Hz. And the signals coming from the brain will have the low voltage i.e. in micro volts which cannot be use full to identify, so these are needed to be amplified, so to amplify the low voltage signals from brain here Instrumentation Amplifier [7] is used.

Basically the signals will have analogue formwhich a micro controller cannot understand; the signals should be convertedto digital form which can be easily understood by the micro controller. So to convert analogue signals to digital signals ADC is used.Micro controller controls the total blocks and processes the data and sends it to the DAQ.Data Acquisition system (DAQ)[5] stores the processed data from micro controller. Also **t**he signals generally will be in time domain which is difficult for mapping or to display as there may be many signals with many frequencies at particular time interval and it is easy to

map the signals in frequency domain so to convert time domain signals to frequency domain a transformation is needed to be done to the signals from DAQ. So an FFT is used to convert the time domain signals to frequency domain and will be displayed on a display.

III. FLOW CHART

Firstly initializing the required peripherals like SERIAL PORT, Analogue[7] to Digital Converter and Serial Peripheral Interface should be done, after that a conversion rate(level) is set to convert the analogue values to digital value. After setting the conversion rate, a slave address of EEG sensor is set to the micro controller, after setting the conversion rate and slave address EEG signals from the brain which has the analogue values are converted to digital values and then driven to a micro controller and then the micro-controller reads the values of EEG signals and converts into ASCII code. Finally the information will be send to PC server and there the respective graphs of the EEG signals from the brain are drawn through those graphs (of EEG signals) the information from the user's brain can be known.

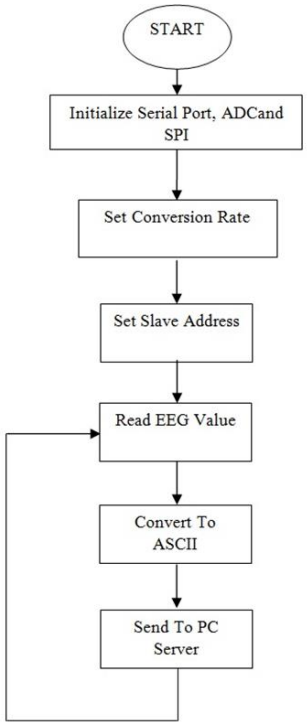

Fig-3: Work Flow of the System

IV. RESULTS

It is observed that the developed circuit study and application of brain waves (alpha, beta) for user ambient environment control is working as the brain computer interface has proved to be boon the disabled persons by providing them independent environment through controlling the appliances by their mere thinking

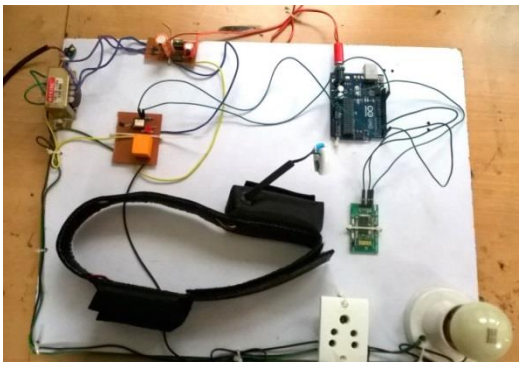

Fig-4: EEG Sensor with Electrodes

V. CONCLUSION&FUTURE SCOPE

The Brain Computer Interface has proved to be boon to the disabled persons by providing them independent environment not by manual control but by mere "thinking".. This type of BCI system is cost effective, extendable and more accurate.. Through this the paralyzed people can communicate to the other persons. In this paper BCI used to switch on and off the devices through thinking.As BCI technology further advances, brain tissue may one day give way to implanted silicon chips there by creating a completely computerized simulation of the human brain that can be augmented at will. Light reactive imaging which involve implanting a laser inside the skull. Futurists predict that from there, super human artificial intelligence be far behind.

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