International Journal For Technological Research In Engineering
Volume 2, Issue 1, September-2014 *ISSN (Online): 2347 - 4718*

BCI (BRAIN COMPUTER INTERFACE) TO PLAY VIDEO GAME USING EEG (ELECTROENCEPHALOGRAPHY) SIGNAL

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Abstract- BCI (Brain computer interface) using to Brain EEG (electroencephalography) video game we can use maximum 80% human ability to play video game.[4] The obtained using a specially designed electrode cap and equipment, and sent to a PC that processes it in real time.[2] The signal was then mapped onto two control signals and sent through gaming device. Brain signals taken from brain using EEG cap made of silver plated electrodes.[3] After it, Amplifier (where common-mode noise is measured using a right-leg driver attached to the patient's mastoid or ear lobe), along with an operational amplifier and some filters (to The overall structure of the project consists of an amplifier pipeline consisting of a differential instrumentation remove DC offsets, 60 Hz power-line noise, and other artifacts). From there, the signal passes to the microcontroller, where it is digitized via an ADC. Next, it is send over an isolated US B UART connection to a PC via an FTDI chip.[4] The PC then performs signal processing and is able to output the results to the user, creating a neuron feedback loop which allows the user to control the PC using their brain waves.

I. INTRODUCTION

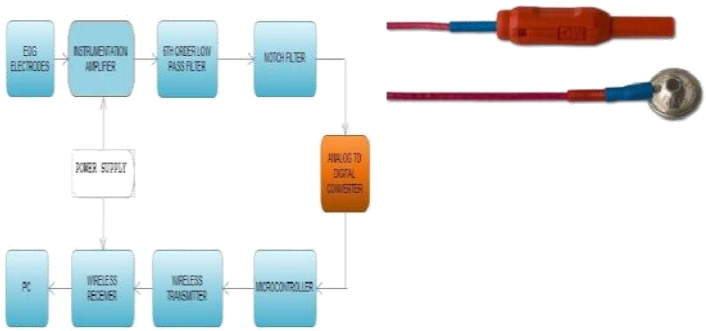
Brain–computer interfaces (BCI's) give their users communication and control channels that do not depend on the brain's normal output channels of peripheral nerves and muscles. Current interest in BCI option for those with severe motor disabilities—disabilities that prevent them from using conventional augmentative technologies, all of which require some voluntary muscle control. They range from descriptions of variety of functioning EEG-based or single-unit based BCI's, to analyses of the correlations between EEG or single-unit activity and the brain's conventional motor outputs, to investigations of issues important for BCI applications, to BCI software development. Together they constitute a comprehensive review of the present state of BCI research[3] The following two days were devoted to six discussion sessions each led by a panel of five to seven people; and each addressing set of questions focused on a single important aspect of BCI research and development.[4] Evenings were occupied with demonstrations of BCI technology and by poster presentations. The discussion sessions were designed to cover the full range of crucial issues, from the essential features of any BCI, to the brain activity it uses, to the algorithms that translate that activity into control signals, to user–system interactions, to research methods and standards, to practical applications in rehabilitation settings.[3]

A. Main Control System

In this control system there are main five parts

- EEG electrode
- Instrumentation amplifier
- Filtering
- Analog to Digital convertor
- Microcontroller
- Wireless module

BLOCK DAIGRAM



II. EEG

The human brain generates electrical signals called EEG signals which are related to body functions, and this paper is about their acquiring. These signals are roughly less than 100 V and 100 Hz and can be measured with electrodes placed on the scalp, noninvasively. Because of their low amplitude due to the skull's composition, the measurement of EEG is more difficult than the other noninvasive bio signal measurements such as the electrocardiogram, electromyogram, electrooculogram, and so forth. [8]Having expensive bio-signal recording systems cannot guarantee acquiring proper signals. In that sense, some factors to acquire good EEG signals should be considered in new designs and during recording sessions. These major considerations are discussed and some suggestions are presented in this paper.[3] In bio-signal recordings, electrodes are the initial elements which are used for converting biopotential signals due to biopotential sources into electrical signals. Figure 1 shows the simplified biopotential measurement. [3]EEG electrodes are usually made of metal and are produced as cup -shaped, disc, needle, or microelectrode to measure intra-cortex potentials. Silver chloride (AgCl) is preferred for common neurophysiologic applications. Because A g is a slightly soluble salt, AgCl

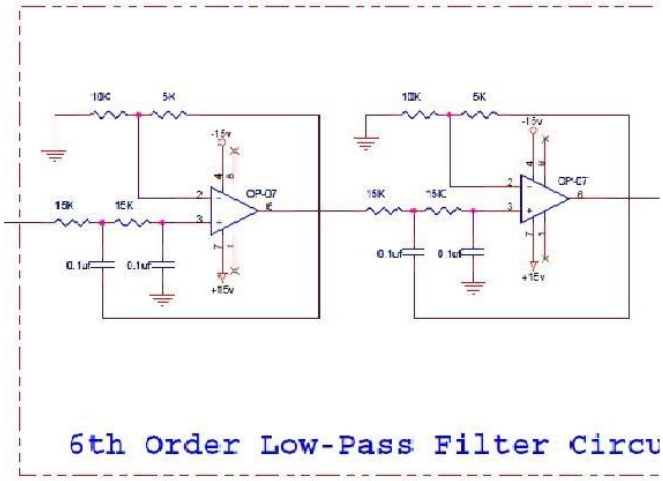
quickly saturates and comes to equilibrium. Therefore, A g is a good metal for metallic skin-surface electrodes. Choosing the correct electrode as well as preparation of the skin before recording affects the accuracy of the measurements,

III. INSTRUMENTATION AMPLIFIER

An instrumentation amplifier is a type of differential amplifier that has been out fitted with input buffer amplifiers, which eliminate the need for input impedance matching and thus make the amplifier particularly suitable for use in measurement and test equipment. Additional characteristics include very low DC offset, low drift, low noise, very high open-loop gain, very high common-mode rejection ratio, and very high input impedances. Instrumentation amplifiers are used where great accuracy and stability of the circuit both short and long-term are required. [10]

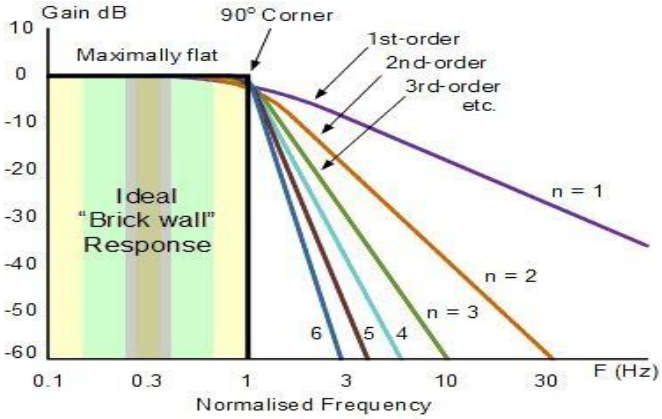
IV. FILTERING

1. 6th ORDER BUTTERWROTH LO W PASS FILTER

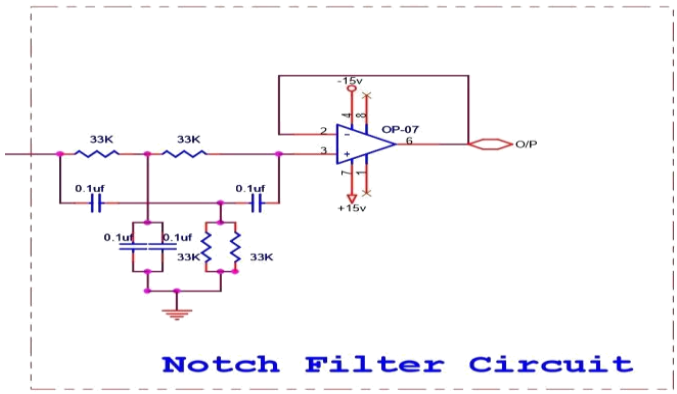


Butterworth filters are termed maximally - flat-magnitude-response filters, optimized for gain flatness in the pass-band. The attenuation is –3 dB at the cutoff frequency . Above the cutoff frequency the attenuation is –20 dB/decade/order. The transient response of a Butterworth filter to a pulse input shows moderate overshoot and ringing.[10]

FREQUENCIES RES PONS E

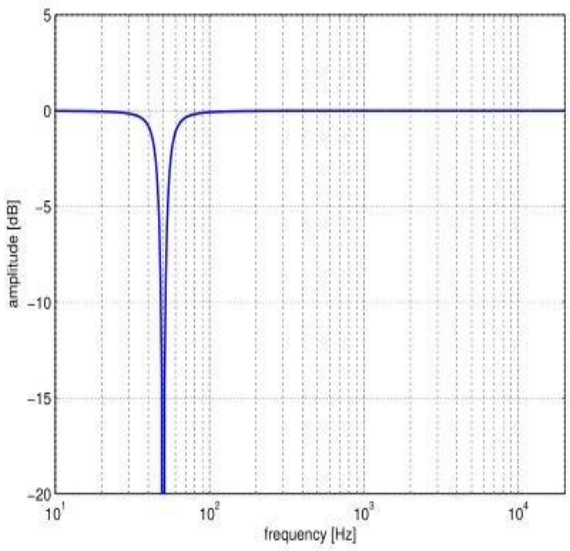


V. NORTH FILTER



A band reject (band stop) filter is a filter passes the most part of frequencies unchanged but attenuates other frequencies to very low levels in a certain range. [4] A notch filter actually can also be perceived as a band stop filter with a high Q factor, i.e. it often wants to filter out the undesired signal in the specific frequency (e.g. noise) only . However, the conventional band stop filter usually has a relatively wide stop band [2]

Frequency Response for Notch Filter

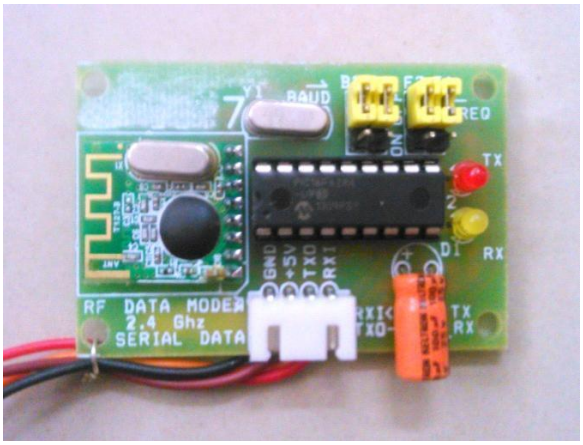


VI. MICROCHIP MCP3201 INTERFACING WITH 8051

8051 microcontroller used in analog to digital converter TheM CP3201isafast100kHz 12-bitA/DConverte featuring low power consumption and power saving standby modes. Here in this circuit we have drawn the output of the amplifier and filters are given to the IN+of the M CP3201 circuit. This input voltage is converted into digital and that digital output is given to the Microcontroller for the comparison of the level of the output. So the output from Doutis given to the P1.1 pin of Microcontroller. Data compared in the microcontroller and output is given to the Wireless transmitter [10].

VII. WIRELESS MODULE CC2500

CC2500 RF M odule is a wireless transceiver module which provides easy to use RF communication at 2.4 GHz. It can be used to transmit and receive data at multiple baud rates from any standard CM OS/TTL source. This module is a direct line in replacement for your serial communication it requires no extra hardware and no extra coding to turn your wired communication into wireless one. It works in Half Duplex mode i.e. it provides communication in both directions, but only one direction at same time (not simultaneously). This switching from receiver to transmitter mode is done automatically. [10]



- Supports Multiple Baud rates (4800/9600/19200/38400).
- Works on ISM band (2.4 GHz) which is reserved internationally so no need to apply for license.
- Supports multiple frequencies within the same band rate thus avoiding data collision.
- No complex wireless connection software or intimate knowledge of RF is required to connect your serial devices.
- Designed to be as easy to use as cables.
- No external Antenna required.
- Plug and play device.
- Works on 5-9v DC supply.

VIII. ACKNOWLEDGEMENT

We would thank our guide, Prof. Naresh Patel for the valuable guidance and advice. he inspired us greatly to work in this project. His willingness to motivate us contributed tremendously to our project. We would also thank the authority of our institute for providing us necessary facilities to complete the project. In addition, we are thankful to the University for offering innovative subjects.

IX. CONCLUSION

We get signal using EEG electrodes. Then amplify it using instrumentation amplifier and remove noise using 6th order low pass filter and pass the signal which has frequency below 100hz.We then pass it through notch filter which removes the 50Hz frequency . After it we will give it to the ADC to convert it to in digital signal and by using microcontroller we decide the threshold level. After it we transmit signal through the wireless transmitter and catch it through the wireless receiver, which is connected to the PC and we can play game without hand movement.

X. APPLICATION OF BCI

Ageing and dependence are two terms that are increasingly interrelated. Increased life expectancy in Western countries is leading to a gradual increase in the number of people dependent on others. An ageing soci ety calls for new solutions to assist elderly people who find their ability to perform everyday tasks limited and need help to carry them out. BCI systems could turn out to be extremely useful in this respect, as they offer a new way of interacting with the various different devices present in the everyday envir-onment. This would allow certain basic communication, comfort, leisure and mobility needs to be met. These systems could therefore contribute to improving the ability of people who are dependent on others for their care to live more autonomously, improving their quality of life and social integration.

- Television: turn on/off, turn the volume up/down, mute, change channels, access the set -up menu, etc.
- DVD player: turn on/off, exp lore the DVD contents, play, pause or stop a film, etc.
- Stereo: turn on/off, turn the volume up/down, mute, change the radio or CD function, select a track or station, etc.
- M ultimedia disk drive: turn on/off, explore the hard drive's contents, play, pause or stop a film, etc.
- Telephone: hang up, pick up the phone, dial a number, access the address book, consult the list of missed calls, calls made or received, etc.
- Lights: turn on/off, change colour, increase or decrease the light intensity.
- Heating: turn on/off, raise or lower the temperature, switch the timer on/off, etc.
- Fan: turn on/off, raise or lower the power, switch the timer on/off, etc.[9]

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