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Design of EEG based human-computer interface for real-time application

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ABSTRACT

Humans have fantasized about the ability to communicate and interact with machines through thought alone or to create devices that can peer into person's mind and thoughts. These ideas have captured the imagination of human kind in the form of ancient myths and modern science fiction stories. However, it is only recently that advances in cognitive neuroscience and brain imaging technologies have started to provide us with the ability to interface directly with the human brain. Primarily driven by growing societal recognition for the needs of people with physical disabilities, researchers have used these technologies to build brain-computer interfaces (BCIs), communication systems that do not depend on the Brain's normal output pathways of peripheral nerves, muscles. In these systems, users explicitly manipulate their brain activity instead of using motor movements to produce signals that can be used to control computers or communication devices. The impact of this work is extremely high, especially to those who suffer from devastating neuromuscular injuries and neurodegenerative diseases such as amyotrophic lateral sclerosis, which eventually strips individuals of voluntary muscular activity while leaving cognitive function intact.

Keywords: *Human, Thoughts, Brain-computer interface (BCI), Imagination.*

1. INTRODUCTION

Our goal is to build a brain-computer interface using an Arduino microcontroller. We decided that the least invasive way of measuring brain waves would be using electroencephalography (EEG) to record microvolt-range potential differences across locations on the user's scalp [1]. In order to accomplish this, we constructed a two-stage amplification and filtering circuit. Moreover, we used the built-in ADC functionality of the microcontroller to digitize the signal. Passive silver-plated electrodes soaked in a saline solution are placed on the user's head and connected to the amplifier board. The optoisolator UART sends the ADC digital values over USB to a PC connected to the microcontroller [3]. The PC runs software written in Arduino and C to perform FFT and run machine learning algorithms (SVM) on the resultant signal. From there, we were able to control our own OpenGL implementation of the robotic arm using our mind's brain waves. We also wrote software to record our sleep and store the EEG signal inside a data file. Concepts of intelligence IBM built the computer Deep Blue3 to compete against and eventually beat Garry Kasparov at chess, shaking the foundations of our concepts of intelligence [4].

2. SYSTEM DESCRIPTION

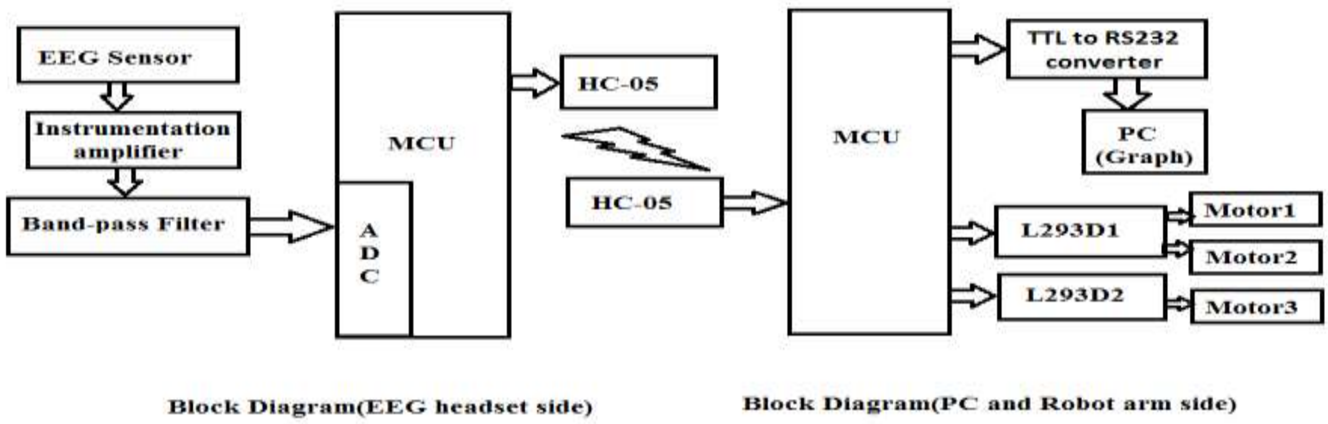

Figure1- Block Diagram

3. FUNCTION OF BLOCKS

EEG ELECTRODE: Electroencephalography (EEG) is the recording of electrical activity along the scalp. EEG measures voltage fluctuations resulting from ionic current flows within the neurons of the brain.[1] In clinical contexts, EEG refers to the recording of the brain's spontaneous electrical activity over a short period of time, usually, 20–40 minutes[citation needed], as recorded from multiple electrodes placed on the scalp. Diagnostic applications generally focus on the spectral content of EEG, that is, the type of neural oscillations that can be observed in EEG signals. EEG is most often used to diagnose epilepsy, which causes abnormalities in EEG readings.[2] It is also used to diagnose sleep disorders, coma, encephalopathy's, and brain death. EEG used to be a first-line method of diagnosis for tumors, stroke and other focal brain disorders,[3] but this use has decreased with the advent of high-resolution anatomical imaging techniques such as MRI and CT.

Instrumentation Amplifier [AD624] :

The AD624 is a high precision, low noise, instrumentation amplifier designed primarily for use with low-level transducers, including load cells, strain gauges, and pressure transducers.

- Low Noise: 0.2 mV p-p 0.1 Hz to 10 Hz
- Low Gain TC:5 ppm max (G = 1)
- Low Nonlinearity: 0.001% max (G = 1 to 200)
- High CMRR: 130 dB min (G = 500 to 1000)
- Low Input Offset Voltage: 25 mV max
- Low Input Offset Voltage Drift: 0.25 mV/8C max
- Gain Bandwidth Product: 25 MHz

Band pass Filter:

The Active Band Pass Filter is slightly different in that it is a frequency selective filter circuit used in electronic systems to separate a signal at one particular frequency, or a range of signals that lie within a certain "band" of frequencies from signals at all other frequencies. This band or range of frequencies is set between two cut-off or corner frequency points labeled the "lower frequency" ($ƒL$) and the "higher frequency" ($ƒH$) while attenuating any signals outside of these two points. Simple Active Band Pass Filter can be easily made by cascading together a single Low Pass Filter with a single High Pass Filter.

ARDUINO UNO MICROCONTROLLER:

- Microcontroller ATmega328 Operating Voltage: 5V
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- Flash Memory: 32 KB (ATmega328) of which 0.5 KB used by bootloader SRAM 2 KB (ATmega328) EEPROM 1 KB (ATmega328)
- Clock Speed: 16 MHz

Motor or Device Control:

Motor control devices are the building blocks of an efficient automation strategy, optimizing production and reducing costs. We offer a wide range of flexible, robust products such as overload relays, contactors and starters and higher power control products such as low and medium voltage variable speed drives and motor control centers. Many of our motor control devices easily plug and play into our Integrated Architecture system.

Bluetooth Module HC-05:

- Bluetooth protocol: Bluetooth Specification v2.0+EDR
- Frequency: 2.4GHz ISM band
- Modulation: GFSK(Gaussian Frequency Shift Keying)
- Emission power: ≤4dBm, Class 2
- Sensitivity: ≤-84dBm at 0.1% BER
- Speed: Asynchronous: 2.1Mbps(Max) / 160 kbps, Synchronous: 1Mbps/1Mb

4. CONCLUSION

The results of BCI are spectacular and almost unbelievable. BCI's will definitely have the ability to change the way a person looks at the world by giving people back their vision and hearing. BCI research is an interdisciplinary endeavor involving neuroscience, engineering, signal processing, and rehabilitation and lies at the intersection of several emerging technologies such as machine learning and artificial intelligence among other. BCI is considered as a be frontier in science technology.

5. REFERENCES

[1] Sravanth Kumar, Vivek Kumar, " Feature extraction from EEG signal through one electrode device for medical application", IEEE conference on 4-5 Sept 2015.

[2] anupamah.s, n.k.cauvery, lingarajugm, "Real-time EEG based recognition system using brain-computer interface", IEEE 2014 international conference on contemporary computing &information, Bangalore.

[3] Neethurobinson, a.p.vinod ,cuntai guan, "modified wavelet common spatial pattern method for decoding hand movement direction in brain-computer interfaces", WCCI2012 IEEE world congress on computational intelligence June 10,2012 Australia.

[4] feiwang,kijunkim, shiguang wen, "EEG based automatic left-right hand movement classification", 978-1-4577-2074-1/12/$26.00c 2012 IEEE.

[5] S.Nasrin Banu ,S. Syed Rafiammal, "CONTROLLING OF PROSTHETIC ARMS BY EEG SIGNALS USING WAVELET CSP ALGORITHM" , national conferences on research advances in communication, computation, electrical science & structure (NCRACCESS-2015) ISSN :2348-8549.

