Circuit for Extracting (γ)-band EEG signal

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Introduction & Motivation

This project aims to develop a cost-effective EEG signal (Gamma Band) extraction model to contribute to the creation of a brain-computer interface for timely detection and resolution of motor disabilities. Motivated by the substantial global prevalence of disabilities, particularly in Bangladesh, where 10% of the population faces motor challenges, the project addresses the need for improved health facilities. Objectives include implementing and analyzing circuit blocks, calculating compatible values, and visualizing EEG signals on an oscilloscope. Success in this endeavor not only advances neuroscience and medical technology but also provides a pathway for innovative solutions, potentially transforming the lives of the 1.3 billion people globally with significant disabilities.

Objectives:

The main objective regarding this project is to develop a gamma (γ)-band EEG signal extraction circuit and analyze particular circuit blocks based on the model to obtain certain comparative results.

The specific objectives can be summarized as follows:

- To ensure proper detection EEG signal
- To implement individual circuit blocks in NI Multisim
- To analyze voltage gain referred to the source voltage
- To calculate compatible resistance and capacitance values
- To implement the circuit in the beadboard
- To visualize the ultimate EEG signal in the oscilloscope

Methodology

Fig: Block Diagram of gamma band EEG signal extraction

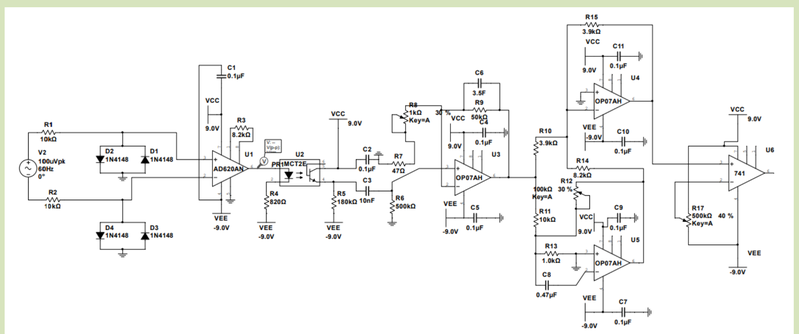
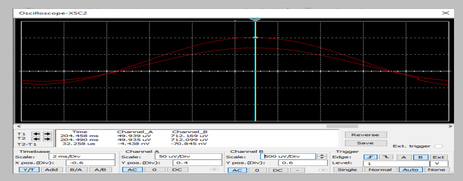
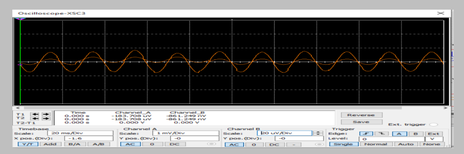


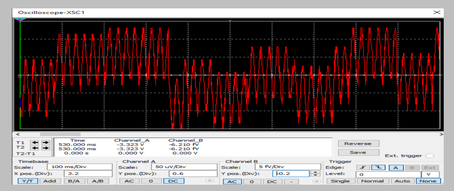
Fig: Circuit Diagram of gamma band EEG signal extraction

Results & Analysis

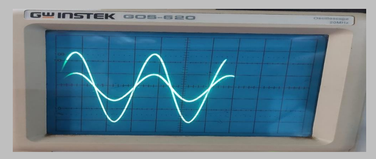
Simulation waveform

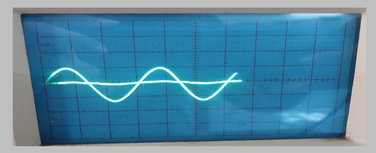




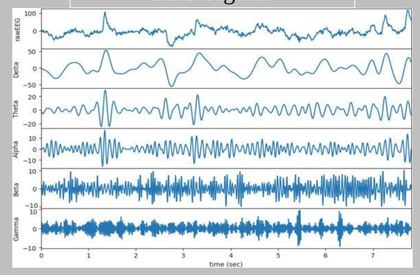


Practical waveform





EEG Signals



From the simulation the signals are clearly found at the instrumentation amplifier, opto-coupler and finally comparator end.

While practical observation, signals are found at instrumentation amplifier point, optocoupler point and bandpass filter end . But in the next three segment the signals are not clearly visible.

Conclusion

- We have implemented individual circuit blocks in NI Multisim and analyzed certain parameters.
- The circuit is designed at a very low cost and is a compact circuit.
- It can be a demo circuit and needs further improvement based on proper research.
- Accuracy level is comparatively low in practical implementation.

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