Development of a Low Cost EEG for at home applications

Overview
Students were tasked with beginning the development of a low cost EEG system with several potential applications but beginning with ADHD applications. An at home device for biofeedback is desired as it is useful for some therapies to connect brainwave frequency with the user’s state of awareness. A proof of concept prototype was developed which uses a LabVIEW virtual instrument.

Objectives
The main goals associated with this project included acquiring a high quality signal, assessing the minimum number of scalp electrodes, and developing a signal processing virtual instrument.

Approach
- Customer needs were gathered from students within the team. We justified this approach by agreeing that we would all like to improve our attention span in lectures, homework, and studying.
- Five concepts for hardware signal processing and amplification were generated.
- A patent search revealed no at home EEG devices, and clinical sessions may run over $1000.
- The sponsor collaborated with the team on a weekly basis to provide practical guidance.
- Alternative concepts were primarily evaluated based on cost and ease of manufacturing.
- CAD models for the circuit schematics included gain calculations based on op amp datasheets.
- Testing was primarily performed on a solderless breadboard model of the device.
- A prototype was fabricated by soldering electrical components onto a printed circuit board and attaching it to unshielded head electrodes, a grounding electrode, and the LabVIEW DAQ.
- The device was validated through testing at different gains and comparing voltage values.
- By dividing the voltage by the gain, our waveforms fell reasonably well within accepted EEG values.

Outcomes
- The sponsor has a potential ADHD treatment ready for clinical verification.
- Users with ADHD may save hundreds of dollars over conventional biofeedback treatment within a home environment.
- EEG cap with installed electrodes which interfaces via USB simplifies and reduces set up time for end user.
- Design uses minimal hardware and transfers post processing to a PC.
- Ideally, through repeated use, the user can learn to recognize the theta and beta states on their own.

![Diagram of EEG setup](image)