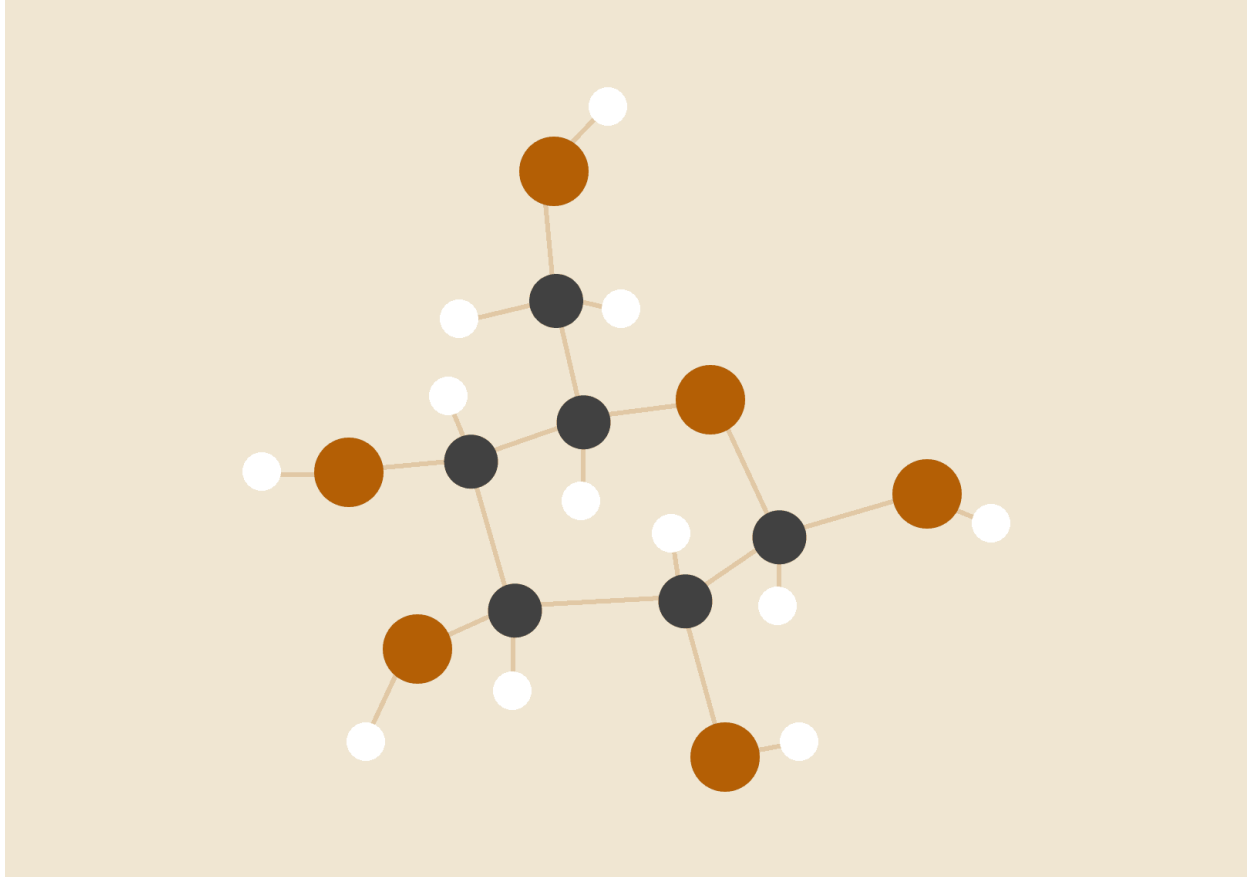


Narrative

EEG - Responsive LEDs



Connell Webb

26/06/2024

ID620 Embedded Systems

DESIGN, AND HARDWARE CHOICES

When I was deciding on how I would go about the design of my project, I did some looking at both medical, and homebrew type EEGs to determine what should be doable for me in the time given. I also did a lot of reading on how the brain would end up interfacing with electronics so that I wouldn't get hurt, or burn out any components when I assembled the EEG.

I very quickly discovered that I would not be able to create an EEG safely, without extreme amounts of current and voltage dampening components, capacitors, resistors, and a potentiometer would provide this effect.

I also discovered that I would also need to produce a lot of amplification to get any measurement to be able to use with the Arduino Uno. This is due to the brain, and the human body as a whole, functioning off of electrical signals, however they are extremely weak, usually in the 50 - 150 millivolts (0.05 - 0.15 volts), and the baseline is approximately 70 millivolts. I then looked at the Chipstein EEG Tutorial, which the circuit is strongly based on. Which led me to choose the op amps, and the instrumental amp I selected (3130 and AD620 respectively).

To keep it interesting I also decided to create my own electrodes, of which there are three. One neutral, one positive, and one negative. This is far less than the usual for a medical grade EEG, although seeming I am looking for ANY brain activity for the purpose of this project, a more limited number should have been no problem.

ISSUES, SCOPE, ARROGANCE.

For a long time now, I have been aware of my family history of degenerative brain diseases such as MS, and Parkinsons. It is also becoming more and more likely that people globally will be afflicted by these debilitating diseases. I was inspired by the opportunity given to me by this project to look into potential solutions to this. I am also becoming more and more interested in the field of neuroscience, of which I am still extremely new to. This lead me to the initial idea of using brain waves given by the left lobe of the brain, more specifically the Broca's area of the brain, which is responsible for speech recognition, language and comprehension (as far as my reading is able to tell) to dictate the thoughts of the user, to type on the computer without the use of your hands.

This already created some issues, with me being extremely limited in the development of hardware, and AI. I thought it would be best if I removed my ego from the situation and narrowed the scope to a more achievable goal. I then discussed with Vaughn whether it would be a good idea to build the EEG, but then use it to turn on LEDs rather than use language to dictate typing.

I ran into many issues with my project overall. One that I could not manage to overcome within the time of the project was the electro-magnetic interference that occurred when using the machine. Usually EEGs and machines like them will have a 'shield' around them to nullify this however I was not able to isolate enough in order to remove the noise. This made the data that I got from the EEG itself extremely difficult, and temperamental, and thus made it so difficult to record hence why my prototype is lacking in performance.

DISCUSSION

I managed to run into discoveries later on when building the overall project. As discussed in my design section, having to change my vision in order to try and complete something I could produce for the presentation. In the actual build, I also had to consider the ever changing brainwaves, so creating baselines for the data input became very difficult, and as the interference made it very difficult to read, even after all the considerations I made in the design phase, it has been the main reason that some of the data is incredibly useful when the device is on, and other times the data sits around 10Mhz constantly and does not shift from approximately that range.