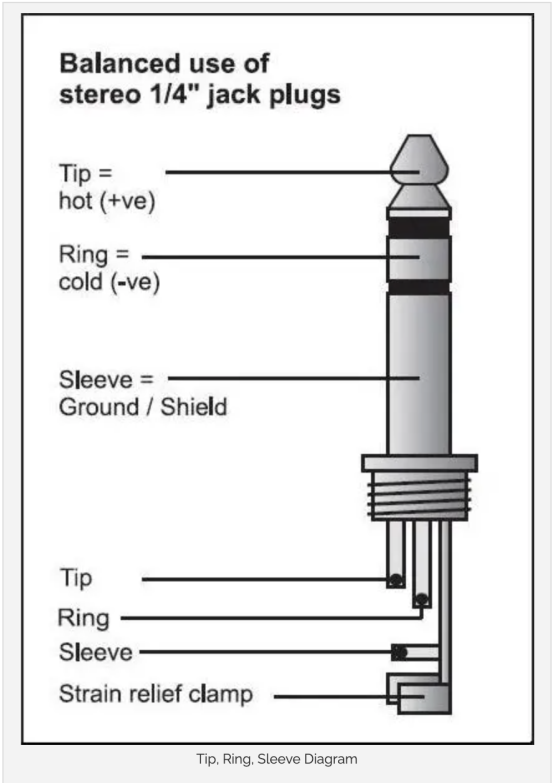
Mar 27, 2022

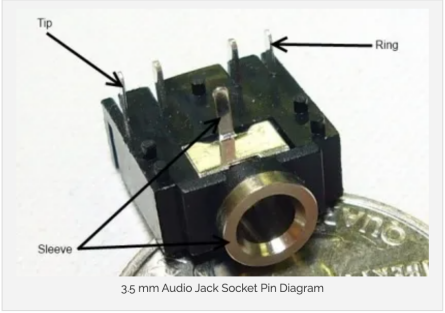
Today I tried out the eog sensor.
As shown in figure below, the pins of the jack correspond to the different regions of the plug.

Initially, I connected the pins directly to the analog discovery. However, no signal was obtained. I thought maybe it was simply too small, so I used the circuit from the last workshop(transistor) to create a simple amplifier, However, no signal was obtained either. Either I have not connected it correctly or the gain was not enough. From previous notes, the signal falls between 50uV to 3500 uV, so the gain needs to be around 500 to 1000 to get our operating voltage.

As a result, I think I'll return to this after I have studied more about the amplifiers. I should form a circuit that yields the desired gain first. I also wasn't able to find which pin corresponds to which eog cable too. I can only assume that the ring connects the red, tip the blue, and sleeve the ground.



Tip, Ring, Sleeve Diagram



3.5 mm Audio Jack Socket Pin Diagram

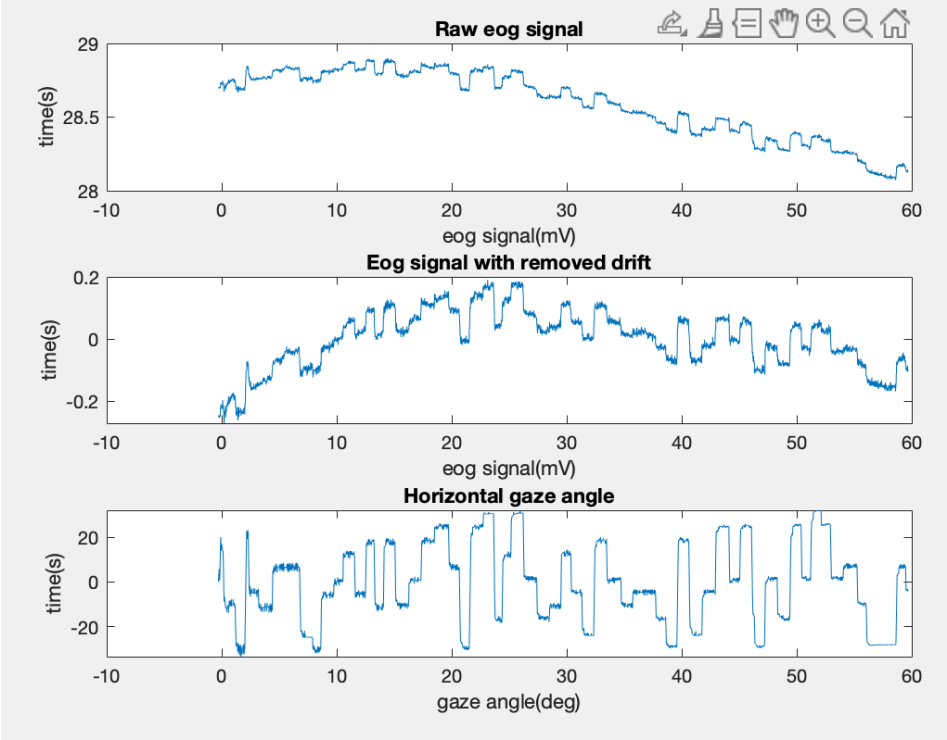
Figure

May 10, 2022

In case where I cannot get the sensor working, we will switch to using eog dataset as an alternative.
The eog data provided, though having the sampling frequency, does not indicate what the measuring units are, and no gaze angle was provided. Instead, I will use other datasets found from the internet, since I will have a larger sample size for validation, and the measurement units and equipment are known.

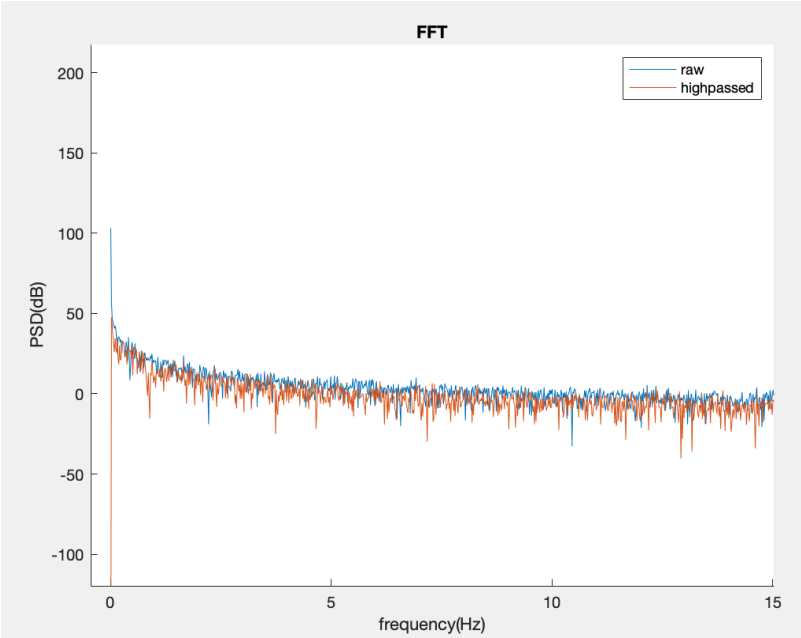
Measurements:
EOG : eog signal(mV) measured by conductive ear moulds
Since it is using a different equipment, the magnitude will not correspond to what we will get in our circuit
GAZE_INTERPOLATED : horizontal gaze angle(degrees)
TIME : time stamp(s)
Sampling frequency: 83.34 Hz.

An example of the data



From the fft results, we also need to reconsider what signal we put in to validate each block. Using sine waves may not be sufficient to capture the characteristics of the signal, since they do not contain any prominent spikes at any given frequency, but a mixture of low frequency signals.

Powerline noise is not removed in the measurement, however, we do not see it in the psd. Since the sampling frequency is around 80Hz, a 50Hz noise will be aliased, which may be present at frequency around 10Hz, but we do not observe that. Maybe the magnitude of powerline noise is negligible in this measurement, we should be wary about its potential presence in our circuit.



Dataset Publication

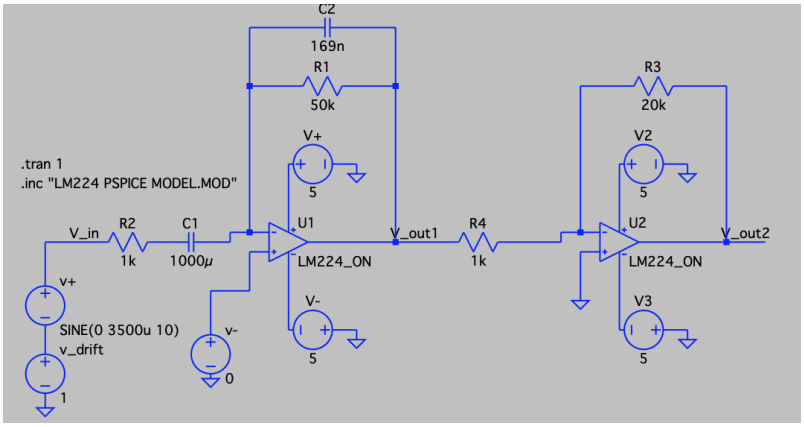
Reference

Hládek, Ľ., Porr, B., Brimijoin, W. O. (2018). Real-time estimation of horizontal gaze angle by saccade integration using in-ear electrooculography. PLOS ONE, 13(1), e0190420. doi:10.1371/journal.pone.01904

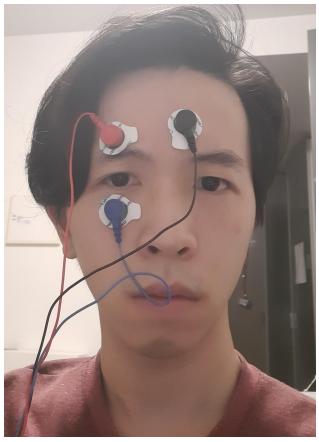
Test with difference amplifier

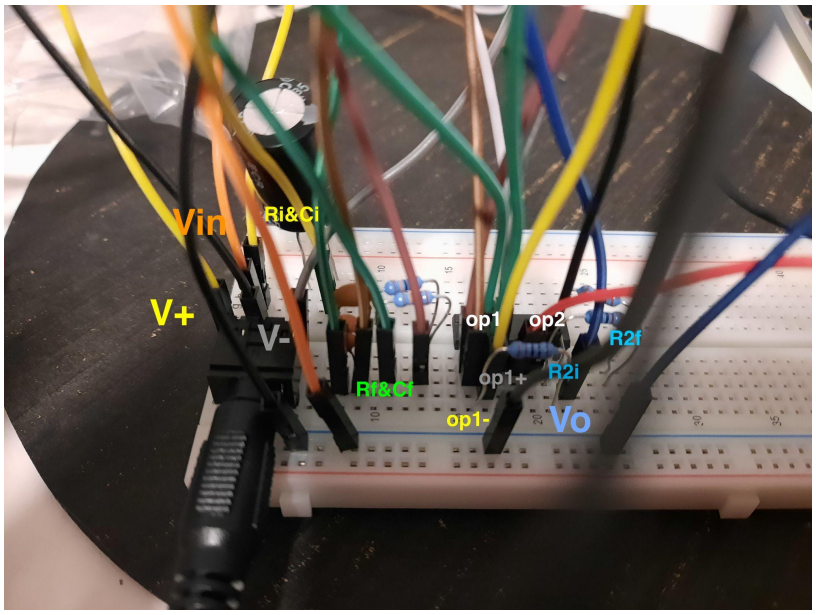
With the audio jack, I connected the middle pin(sleeve/ ground) to the ground, right most pin(tip/V+) to V_in, and left most pin (ring/ V-) to the + end of the first opamp.

The resulting circuit is as follows:



The result shows that there are no differences between Vi and the gaze angle. I may have not connected the audio jack correctly, or I may have not considered certain noises generated by the jack.





Gazing up

Gazing down

Gazing middle