ECE 5255 Biomedical System Design Fall 2013

Due: 12/12/13

Project-Lab 5 Electrooculogram

Objective: Adapt the previously developed ECG sensor system to produce an EOG sensor system. You will use the system to capture, develop feature extraction, and classification for both horizontal and vertical eye movements.

Procedure/Submission:

1. Design, simulation, and breadboard of an EOG amplifier:

Consider the EOG signals to be between 10-100 µV and with a usable bandwidth between DC-10 Hz, adapt the ECG amplifier such that the low frequency cutoff is less than 1 Hz but not DC, the high frequency cutoff is about 10 Hz, and the gain is sufficient to produce an output of 1 V for a 100 µV input. Note that excluding DC implies that the system can only capture the movement and not static direction. **Complete the below table and also submit the hand calculations, hardcopies of LTSpice schematic and ac simulation results, and the schematic of the breadboard implementation with pinout annotations.**

Specification	Hand Design	SPICE Simulation	Measurement
Maximum Gain			
Low 3-dB f (Hz)			
High 3-db f (Hz)			

2. Biosignal capture on myDAQ:

Attach the electrodes to capture horizontal eye movements. Use the myDAQ built-in oscilloscope and save the waveform for the eyeballs moving to the left and right positions. Repeat for the vertical eye movements. Draw a subject's face and indicate the locations of the electrodes. Complete the table below for the peak voltages for each directional movement and submit hardcopy plots of the waveforms from the myDAQ oscilloscope. You will need to repeat this step (left and right then up and down) for both your EOG amplifier and the FRI physiological amplifier with the gain settings adjusted appropriately for EOG signals.

Draw DIAGRAM of electrode placements (+,-, ground) for corresponding channels here.

Your EOG Amplifier Design:	Max Peak Value (V)
Left	
Right	
Top	
Bottom	
FRI Physiological Amplifier:	
Left	
Right	
Top	
Bottom	

3. Construct LabVIEW VI that would (1) read in the real-time EOG signals using the myDAQ module and (2) determine the moving eyeball direction for left, right, up, and down. You will also need to develop a GUI to indicate the directions of movements. Consider the recommendations provided in the lab talk in terms of thresholds and "logic" design.

    a. Test and verify one channel at a time for each pair of directions, left with right and up with down. The unused channel input should have a non-time varying reference voltage supplied to its terminals. For example, if you are testing the horizontal channel, you should tie the inputs of the vertical channel such that the input voltage will not exceed the threshold value for detecting the direction of movement.

        i. **Sign-off for demo of 1 channel (L-R)_____**

        ii. **Sign-off for demo of 1 channel (U-D)_____**

    b. Test and verify 2 channels, use your EOG amplifier design for one channel input and the FRI physiological amplifier for the other channel input.

        i. Sign-off for demo of 2 channels (L-R and U-D)_____

        ii. **Name this VI EOG_2CH_lastname1_lastname2.vi and submit the completed VI on the course Blackboard website.**