IECE 553/453 Cyber-Physical Systems
Fall 2023

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Lab Assignment 4 - Due Oct 26
Total Points - 50

1. **(10 points) Calibration:** Write a program in C to calibrate the ADXL345 for all the three axis, keeping the sensor in required position for each axis. Your program should output an average of at least 100 samples per axis.
2. **(10 points) Measurement:** Write a program in C to communicate with the ADXL345 accelerometer using I2C (you may use the code provided in class). Do not perform calibration. Instead, use the output from the previous phase to write in the offset registers. Configure the accelerometer's *ADC bit resolution* and *range* to achieve the four possible options (refer to the data-sheet and register map to select the appropriate bit resolution and range) based on user input. The script should be able to continuously query the accelerometer for N seconds (user input) and write the output in a csv file with only three columns, each one representing acceleration in X, Y, Z directions.
   For example: `./accel 2g 10 accel_out_2g.csv` indicates that the chosen resolution is $\pm 2g$, data is accumulated for 10 seconds and output written in the `accel_out_2g.csv` file. The csv files should be generated for all the ranges and for the following motions: a) Single Tap, b) Tilt left, and c) Move right on X-Y plane.
3. **(10 points) Plot:** Write a program in C/MATLAB to read the csv files created in the previous step in each case and plot the acceleration in m/s^2 based on the range/resolution of the setting.
4. **(10points) Report:** Write a report on your findings, showing figures from calibration and measurement showing plots for the following motions: a) Single Tap, b) Tilt left, and c) Move right on X-Y plane. Try to recreate the same motion for all the range choices, but it is understood that there will be differences. Explain the plots with reasoning.

Submission Instructions:
Name your files using the following convention: `yourLastName_labN_problemM.extension`.
Submit a) program files (C or MATLAB) from parts 1 and 2, b) all csv files for different movements and ranges with proper naming convention, c) all plots in pdf with proper naming convention and d) the report in pdf. Upload a single tar or zip file in blackboard.

(10 points) Setup your code running in lab on Oct 27, and show it to get full credit.