EEE212 - Microprocessors
Project Assignment 2

Due on 22 December 2020, 23.55

Important Reminders

Normally, we have two more project assignments left in this class. For convenience, we have decided to give you a single assignment, which will have a greater contribution to your total grade (**13**/100). You will have more time to complete this assignment than you would normally have for a project assignment. This is the last project assignment you will get in this class, and you need to use the equipments in the laboratory. It would be in your best interest to start doing the lab. Further announcements will follow based on the university senate decision ($e.g.$ letter grades, whether you are allowed to do the lab later in the Spring semester etc.) Also, note that this is a **hard deadline**, that is, the deadline will not be extended under any circumstance.

Part A (20 Pts.)

In this part, you will apply a DC signal to the ADC and continuously measure the voltage. The voltage values should be in $[0V, 3V]$. Display the measurement on the LCD (*i.e.* 2.69V). Choose an update interval larger than $0.33s$. You should select an appropriate ADC configuration that produces the best precision possible, and your readings should be consistent with the corresponding step size.

Part B (30 Pts.)

In this part, you will identify the *waveform* applied by the signal generator. The input signal has the following properties:

- **Amplitude** (peak-to-peak): 3V
- **Off-set**: 1.5V
- **Frequency**: 400 Hz
- **Waveform**: Square, Sine, Triangle

Design and implement an algorithm that identifies the *waveform* using samples from the ADC. Display your estimate on the LCD (*i.e.* Triangle). Your algorithm should continuously check the waveform and update its estimates every second.

Hint. Calculating the derivatives of the samples can help differentiating waveforms. Also, pay attention to sampling period of the ADC. You might find it useful to draw waveforms and mark sample points while designing your algorithm.

Partial grading.

- Sine Identification: 10 pts.
- Triangle Identification: 10 pts.
- Square Identification: 10 pts.

Part C (30 Pts.)

In this part, you will measure various parameters of a square wave. The input signal will not have a fixed amplitude and off-set.

- The amplitude (peak-to-peak) can be in $[0.5V, 3V]$.
- Off-set of the signal will also be variable such that the minimum and maximum voltage values stay in between $[0V, 3V]$.
- Frequency will be in between $[100Hz, 1000Hz]$, and the duty cycle will be in between 10% - 90%.

Continuously measure the peak-to-peak amplitude and the off-set of the input signal. Additionally, estimate the duty cycle using sample points you have observed. Display your measurements on the LCD (*i.e.* $A = 1.80V$ $O = 1.00V$ $D = 40\%$). Choose an update interval such that the number of samples collected is enough to calculate the off-set and the duty cycle.

Part D (20 Pts.)

In this part, you will generate a signal with following properties:

- **Amplitude** (peak-to-peak): 2V
- **Off-set**: $[1V, 4V]$
- **Frequency**: 200Hz
- **Waveform**: Sine

For this part, the off-set will be changing between 1V and 4V. Design and implement an algorithm that measures the off-set voltage continuously, and show the estimate on the LCD.

Notes

- You are going to have 10-minute demos to show your results. We will ask you to download and run the code you have submitted to the Moodle. Therefore, make sure that the code you have uploaded works properly.
- Proteus demos and previously coded chips will not be accepted. However, you can use Proteus to check whether you have a hardware or software-related issue.
- Demo schedule will be announced later. You can lose points if you arrive late to the demo, so do not be late.
- If you have any valid excuse to not to attend the demo, please let us know beforehand so that we can rearrange your demo time.
- Do not miss the deadline since there will not be any extensions.