**Aaron Wong**

Wongx654

**Yahya Alhinai**

Alhin010

LAB REPORT 6

**Deliverables for Part 1:**

2. Your lab report should include an analysis of your code. The analysis should clearly state how long each of the two tasks outlined in the previous section take to execute.

* **For Part 1 with the potentiometer, we had the ADC interrupt every 100ms to read and print out the voltage value on the lcd. In Part 2, we used the FSR which is noisy so we sampled multiple values and averaged them in our Timer 2 interrupt which was set to low priority. The T2 Interrupt also found the standard deviation. Timer 2 was set to interrupt every 1 second and in main, the average and standard deviation values were printed on the lcd.**

3. State the maximum sampling rate that a PIC24 chip with Fcy=16MHz can handle, assuming we do not need output anything on the LCD display? In other words, for the maximum value that K can take, what is 1/K?

* **Minimum sampling time = (12 + 1 )\* 125 ns = 1.625 \* 10^-6 second**
* **Maximum sampling rate = 1/(1.625 \* 10^-6) = 615384.6154 samples per second.**

4. State the maximum display refresh rate assuming we only want to convert 10-bit digital values to the string format “x.xxxx V” and show the 8-character strings on the LCD display? Ignore A/D times here, i.e., assume the data is already in the buffer. In other words, how far can we push the 100ms refresh rate?

* **It takes around 69\*10^-6 to save the value in the form of “xxx.x V”**
* **To write on the LCD it takes around 10^-5 second for each command. And since we have 5 commands without the sending data, it takes 5 \* (10^-5)**
* **Adding to the time the number of characters (8 characters) in the string. Thus, it takes 10^-5 \* 8 second to send one character.**
* **Adding all above the above with give us the minimum time to write on the LCD**

**69\*10^-6 + 5 \* (10^-5) + 8 \* 10^-5 = 200 us**

5. Assuming the A/D sampling rate described in Item 3, and the fastest LCD display update calculated in Item 4, how many samples do we have to drop and not show on the LCD display?

* **Samples rate = 615384.6154 \* 200 us = 123 samples**
* **The sampling rate drop from 615384 to 123 samples per second**

**Deliverables for Part 2 :**

2. Generate a table that shows at least ten observed voltages when you have 1 penny, 2 pennies, 3 pennies, 1 quarter, 1 quarter and a penny. In all cases you have the offset weight of ~30g. For each observation wait at least ten seconds to make sure the voltage stabilizes. The table should also list the variance across the ten observations for each weight.

* **We waited until the standard deviation decreased to about 0.02mV before recording the value of the average.**
* **We had 3 pennies, 1 nickel, 1 quarter, and one dime. So we tested trials at 1 penny, 2 pennies, 3 pennies, added a nickel, then added a quarter and dime.**
* **Spreadsheet Attached to zip file**

3. Can we use this digital scale to tell how many coins and of what types we have?

* **Yes but somewhat, each coin should have a set voltage associated with its weight. But since we didn’t have the same coins to work with we weighed the quarter and dime together. We don’t know the associated voltage values with each coin.**

4.Suppose we want to sample voltages at the fastest rate possible in PIC24 with Fcy=16MHz (without any considerations for calculating the running average or displaying the values). Also suppose we want to calculate the running average for N=512 points. How many A/D samples have to go without a corresponding running average calculation? (I don’t even know what it means!)

* **615384 is the maximum sampling**
* **615384 - 512 = 614872**
* **So 614872 samples are not corresponding running average calculation**