ECEN 5053

Lab 7 (11-9-17): Capacitive Sensing

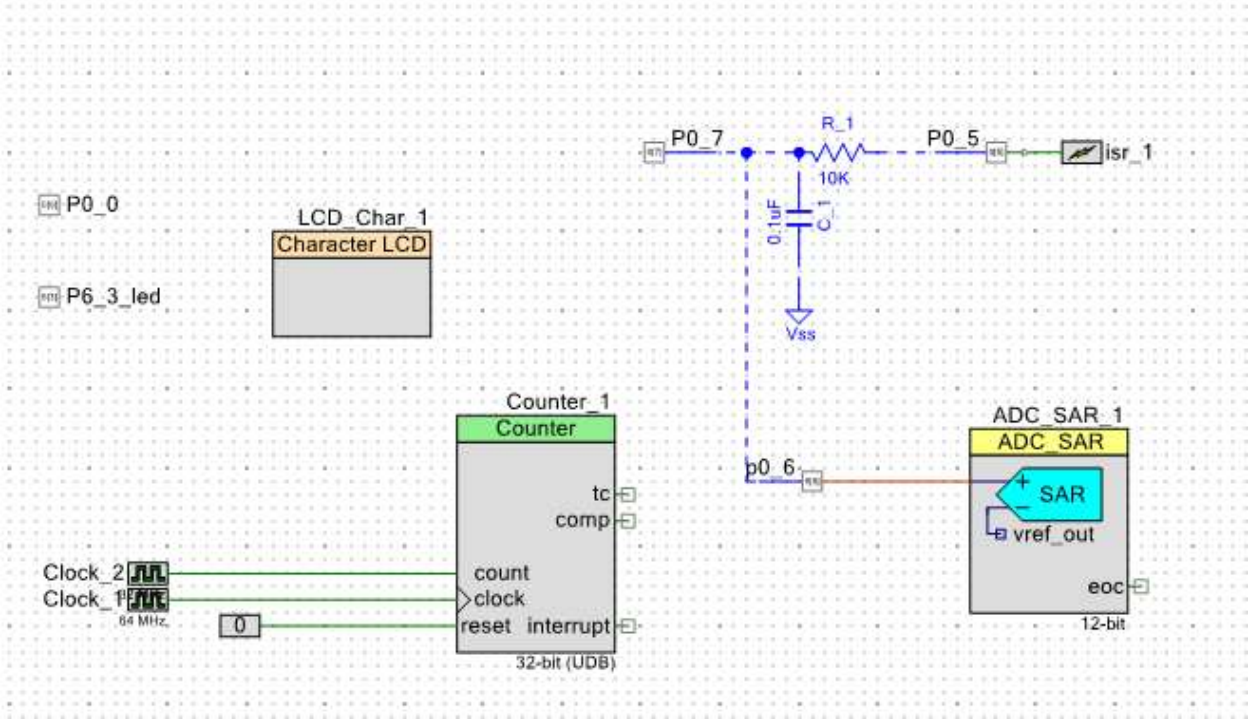
Questions shown in red must be answered in your lab report.

Ben & Monish

Goal: Learn basic methods of capacitive sensing using hardware and software.

Background: Capacitive sensing is a pervasive technology with many advantages (cheap, durable, completely solid state) but it can be tricky to set up because the changes in capacitance with a finger touch can be very small (like 0.1 pF) compared to the nominal value of a sensor (typically 40- 40 pF). If not done well, noise and contamination can cause both false touches and missed touches.

Equipment and Parts Required: Cypress PSoC CY8CKIT-050B development board, power supply, digital oscilloscope, copper metal foil, wire, cardboard, other discrete parts of your choice.



Reading: Cypress app note AN64846 - Getting Started with CapSense

Procedure:

1- Test the PSoC dev kits own built-in cap sense slider and buttons by downloading the Cypress demonstration project from D2L. Test changes to the tuning parameters by reconfiguring the "CSD" component in that project and observe the effect.

Required Demo 1: Demo the project working, Slider and Button

2- Use the PSoC board to build a system that measures capacitance *by whatever method you choose.* When an unknown capacitor is inserted into the circuit, the capacitance should be display, with appropriate units on the LCD. This feature will be tested using 3 different values of capacitor (none too small).

Hint: Capacitance affects charging rate in an RC circuit.

Required Demo 2: Test 3 capacitor values at 3 different values, 2-orders of magnitude away (1uF, 100uF, 100nF, 1nF, 100pF) (supplied by TA or instructor or look in the ITLL) Display value and correct units on LCD.

Time	Capacitance (pF)
2306000	22000000
913557	10000000
101600	1000000
46922	470000
9528	100000
1013	10000
522	4700
353	3300
120	1000

**** Extra Credit #1 (0.5 point per order of mag. (10x) Upto 2 points) ****:** Get more than three capacitor values correct to within 20%.

**** Extra Credit #2 (2 points) ****:** If a resistor is substituted for a test capacitor, automatically recognize this, measure the resistance and display it on the LCD.

3- Build a capacitive button using copper metal foil, cardboard and wire of at least 10" length and demonstrate that you can detect a touch to this button by writing to an LED and/or displaying "touch detected" on the LCD.

Required Demo 3: Demo the button working.

Question #1: What is the minimum capacitance your circuit can read? What limits this minimum value?

Answer: 100pF. Value of resistance limits this value. If we increase the value of resistance then we can find smaller values but then the delay time for sensing larger capacitances will be high.

Question #2: What is the maximum capacitance your circuit can read? What limits this maximum value?

Answer: 1000uF. It is limited by the maximum count of the counter.

Question #3: Estimate the value of the make-shift capacitive sensor.

Answer: The value of the makeshift capacitance was near 200pf.

Hint: Start with the simplest design you think might work.

###################### End of Lab ########################