ECE 153B LAB 2

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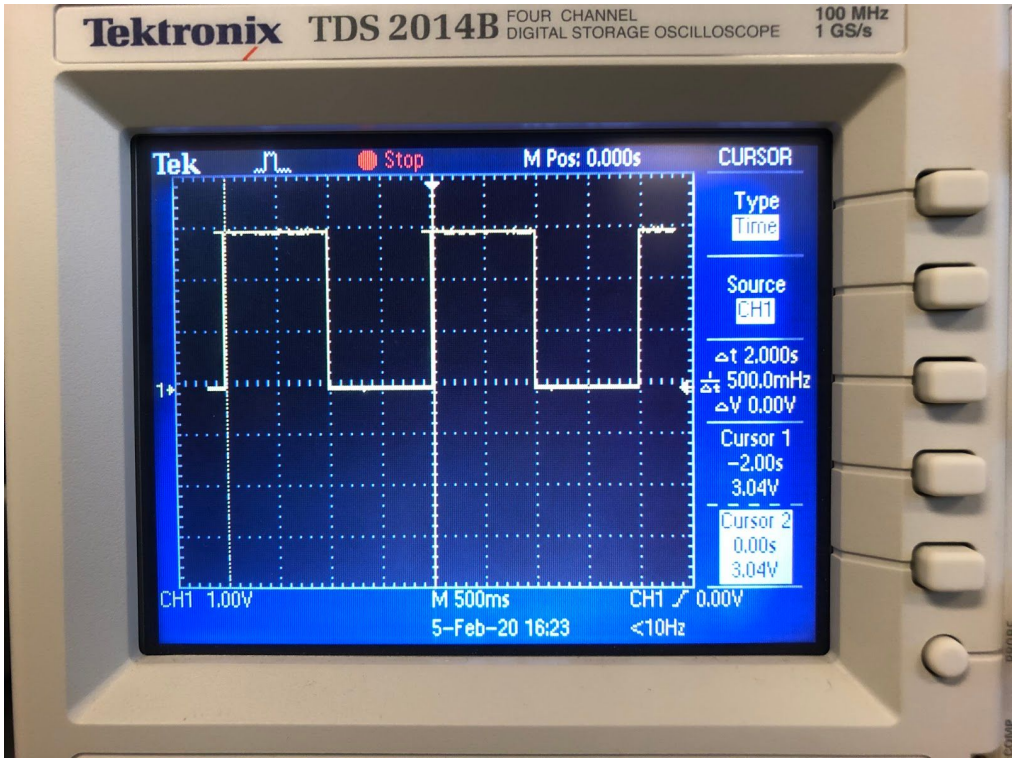
Part B

1. External clocks are preferred over internal ones because they are more accurate. Internal clocks are stopped when the system is powered down, but external clocks are not affected by the state of the internal processor. As a result, if there is a battery plugged into our STM32L476 boardm the RTC clock will continue to run even when the board is off due to its low current drain.

2. We had a period of 2 seconds, which means our light was on for 1 second then off for 1 second, so it is 100% accurate.



3. Yes, it runs independently from the processor core. In the case of our board, if there is a battery in the back, the RTC clock will run even if the rest of the board is off. (Lecture 5 Slide 28)

4. A better approach to updating the LCD display is to move the display function into the RTC interrupt instead of polling it in the main function.

Part C (Part 1)

1. To record the period in milliseconds, we used a prescaler value of 15 (which gives a counter period of 1 μs) and then divided the timeInterval value by 1000. You can also use a prescaler value of 15999 to get a time interval value in ms directly.

2. Assuming a prescaler value of 15, the difference of CCR values between the two interrupts should be 500,000.

$$f_{counter} = \frac{16\,MHz}{1+15} = 1\,MHz$$
$$T_{counter} = \frac{1}{1\,MHz} = 1\,\mu s$$
$$D_{CCR} = \frac{0.5\,sec}{10^{-6}sec} = 5 * 10^{5}$$

3. The counter / timer will reset when it reaches the maximum value of $2^{16} = 65536$. Assuming a prescaler value of 15, the time between two consecutive timer resets is:

$$T_{reset} = \frac{10^{-6}sec}{counter} * 65536\ counters = 65.536\ ms$$

Part C (Part 2)

1. If the prescaler is 15, then the minimum time unit is 1 μs.

2. The range of CCR values between two consecutive interrupts is:

$$150\ \mu s\ *\ \frac{1\ counter}{1\ \mu s}\ <\ x\ <38\ ms\ *\ \frac{1\ counter}{1\ \mu s}$$
$$Range:\ 150 <\ x\ <38000$$

3. The time between two consecutive timer rests is 65,536 ms. This is the same as that of the input capture.

4. We measured the sensor at the three distances listed below:
   - 36 inches = 91.44 cm - Actual Distance
     90 cm - Measured Distance

$$\%\ Error\ =\ \frac{|91.44-90|}{91.44}\ =\ 1.57\%$$

   - 18 inches = 45.72 cm - Actual Distance
     45 cm - Measured Distance

$$\%\ Error\ =\ \frac{|45.72-45|}{45.72}\ =\ 1.57\%$$

   - 9 inches = 22.86 cm - Actual Distance
     22 cm - Measured Distance

$$\%\ Error\ =\ \frac{|22.86-22|}{22.86}\ =\ 3.76\%$$