ENGR 478

Lab 6: Edge-Triggered Interrupts

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Preparation

- Review Lectures 10, 11, and 12
- Understand the sample projects (iLearn->Labs->sample_projects)
    - switch_delay_interrupt/switch_delay_interrupt_TivaWare
    - switch_counter_interrupt/switch_counter_interrupt_TivaWare

References

- Getting Started with the Tiva TM4C123G LaunchPad Workshop Student Guide and Lab Manual (Chapter 4) (iLearn -> Reference Materials -> TM4C123G_LaunchPad_Workshop_Workbook.pdf)
- TivaWare Peripheral Driver Library User's Guide (iLearn-> Reference Materials -> SW-TM4C-DRL-UG-2.1.0.12573.pdf)
- Tiva TM4C123GH6PM Microcontroller Data Sheet (iLearn-> Reference Materials)

Purpose

The purpose of this lab is to learn how to implement edge-triggered interrupts on the TM4C microcontroller. Software skills you will learn include edge-triggered interrupt configurations, shared interrupt vector, interrupt handler implementation, and communication between two LaunchPads.

System Requirements

The system consists of two LaunchPads as shown in Figure 1. Device A and Device B are connected using two male-male wires (Figure 2). The output port PF2 on Device A is connected with the input port PA7 on Device B. The ground pins on both devices are also connected.

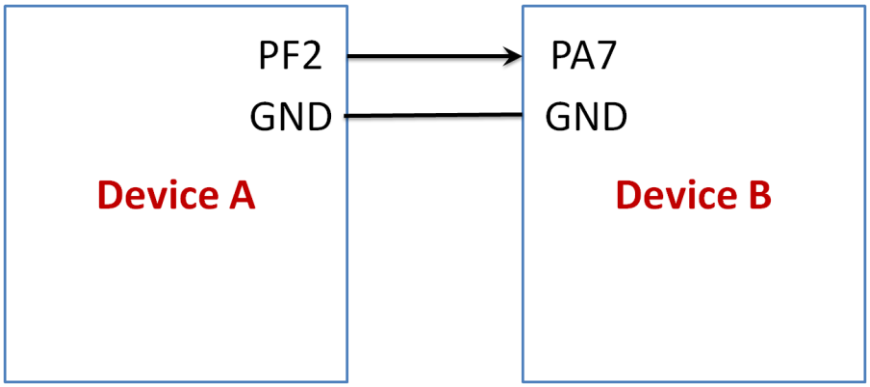

Figure 1

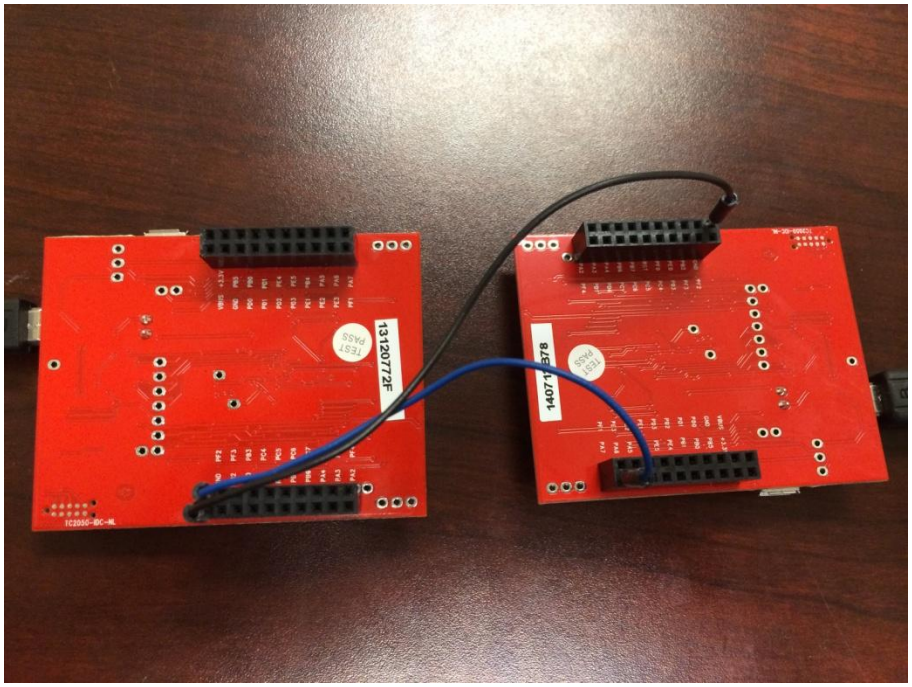

Figure 2

You need to develop two software projects in this lab, one for each device.

Software on Device A: The system implements a 2-bit rotary counter on Device A. The system has two input switches (SW1 (PF4) and SW2 (PF0)) and two output LEDs (red (PF1) and blue (PF2) LEDs). Overall functionality of this system is described in the following rules.

1) The red LED is used to display bit 0 of the counter; the blue LED is used to display bit 1.

2) The system starts with the counter equal to 0.

3) If SW1 is pressed, the counter is incremented by 1; If SW2 is pressed, the counter is decremented by 1. Both SW1 and SW2 generate edge-triggered interrupts to update the counter.

Software on Device B: The system has one input port (PA7) and one output port (PF3, green LED). Overall functionality of this system is described in the following rules.

1) The system starts with the green LED off.

2) The value change on PA7 generates edge-triggered interrupt to toggle PF3. When the value on PA7 changes from 1 to 0 or from 0 to 1 (the value of PA7 on Device B changes with the value of PF2 on Device A), the green LED will be toggled once.

After you download the software projects onto Devices A and B respectively, turn off the power of both boards. Carefully connect two boards using two male-male wires (**make sure the power is off when you connect the boards**). You can get the wires from Dr. Anwar. Make sure to return them after you finish the demonstration. You can then turn on the power on both boards and verify your system functionality. If the system

works correctly, you will see the LEDs on both boards turned on and off according to the actions on the switches on Device A.

Demonstration and Submission

You will have one week to complete the lab. You can discuss with your group members and complete the lab work together. Every group will need to write and submit a lab report to iLearn->Labs->Lab6 report submission. The lab report should include

- The students' names, emails and IDs
- System specifications (based on the system requirement, which ports do you need to configure, how to configure them, any special actions needed? How do you configure the edge-triggered interrupt?)
- The flow chart of your design
- The C program listing with **detailed comments for each line of code**. You are allowed to use PinMux and TivaWare library defined functions in your implementation.
- The execution results of your program (how did you evaluate your implementation and verify your system correctness? your observations, any supplemental images).
- Discussion and suggestions: Through your lab experiments, what have you learned? Do you have any suggestions for future labs, lectures or improvement on the learning experiences?

If you finish the lab experiments during the lab time, please demonstrate your results to the instructor. The instructor may ask questions regarding your program. After the demonstration, you can leave. **The latest demonstration time will be the beginning of next lab. The lab report is due at 6pm on the day of your next lab.**

Again, you can work with your group members on all the lab activities, but make sure you understand all the materials.

Note: Don't forget to edit startup_rvmdk.s to change the names of the interrupt handlers.