# COMPUTER ORGANIZATION (ELE408) LAB 3

***Interrupt Processing of the*** TWR-K70F120M

## 1. Pre-lab Report

- Read Chapters 45 (PIT), Chapter 48 (RTC) and Chapter 61 (TSI) of the TWR-K70F120M Reference Manual.
- Read this lab handout carefully. Take notes and prepare the programs required in this handout.
- Review the class notes regarding exception processing and interrupt operations.

## 2. Objectives of this Lab

The purpose of this lab is to learn and gain first hand experiences on interrupt processing of the ARM Cortex M4 processor. You will apply your knowledge and basic concepts of exception processing and interrupt handling that you have learnt in the lectures to the lab experiments.

Specifically, you will learn and exercise the basics of

2.1. Exception priorities, vector tables, and handler routines;

2.2. How to configure and program the interrupt controller to process various interrupt events and functions;

2.3. How to generate periodic events triggering interrupts

2.4. How to use interrupt to save power consumptions.

## 3. Basics

As discussed in the classes, interrupt is one of the most important mechanisms used in a computer system to handle various unexpected events such as address errors, undefined instructions, access errors, and so forth. It is also the most important interfacing technique to allow smooth communication between high speed devices such as CPU and RAM and low speed devices such as disks, displays, serial ports, printers etc. To design a microprocessor based system for any application, interrupt is one of the key mechanisms an engineer should master.

The ARM Cortex M4 processor has a hardware interrupt controller. In this lab, you will configure and program the controller to implement at least two interrupt handlers

## 4. Experiment Requirements and Procedures

In this lab, you are required to handle two interrupts: Real Time Clock interrupt and Touch sense input interrupt exceptional events.

**Main Functions To Be Implemented:** Implement two interrupt handlers to process two exceptional events.

Design a real time clock with alarm function using RTC. You can use the RTC interrupt request periodically to display current time in digital clock format. And use the TSI interrupt as the function of the alarm.

**In the Lab:**

- Set workspace as "C:\Freescale\ELE408_lab", Import and run example project k70-rtc:

1. What's the result of the example project. Change the setting of interval and compensation value, record your result in your lab report

- Import and run example project k70-TSI_demo_lowpower

2. Test the project by touching and releasing the led touch sensor on the board.

- Combine these two project together to design a digital clock with follow alarm function:

3. LED1 control the start and stop of the digital clock
4. LED2 clear the digital clock
5. Set a time for your alarm, when the time arrive, flash other two LEDs 5 times to indication the alarm

Hint: to preserve the hierarchy and file reference of the project, you can do your modification in one project, just add file from another project.

## 5. Lab Report Requirements

In your lab report, you should discuss your designs, trade-offs. Explanation and interpretation of your results are very important. The lab report will be graded based on your report and discussions. Total mark for the report is 100 points.

- Prelab report: 20 points
- Successful experiment: 50 points
- Results analysis, interpretation, and discussions on your design and engineering constraints: 30 points

In the following items, numbers inside each bracket "[]" indicates the point you will earn on a satisfactory report and discussions.

In your discussion and explanations of your results, you should consider the following:

**A.** What knowledge of mathematics, science and engineering have you applied in this lab? [5]

**B.** How did you design the lab (including architecture, flowchart, programs, etc.)? How did you conduct the experiment? What is your interpretation and conclusion on the experiments? [5]

**C.** Who is your team partner? How did you collaborate with each other and what roles did each of the team members play in the lab? [5]

**D.** What specific modern engineering tools have you used in your experiments. What specific techniques and skills have you learnt from the lab? [5]

Did your design consider the following constraints? If yes, how did you make your design decisions?

- Economic Constraint (performance/cost ratios) [3]
- Manufacturability, Modularity and Expandability Constraints [3]
- Environmental Constraint (power consumption) [2]
- Sustainability: Is your design and implementation sustainable? [2]

Hand in the debugged source code with comments; the machine code is not necessary. Note that both hardcopy and a file with programs are required for the report. Be very specific with your comments that explain what you are doing and why you are doing it.