GUIDELINES

As far as the laboratory is concerned, the course is centered on the design and construction of an embedded system by each student, utilizing the PIC microcontroller, an MPLAB IDE, PIC24 (XC16) C compiler and Code Composer Studio. Students are required to demonstrate that their hardware works in the on-campus laboratory, and must demonstrate that they know how to use an oscilloscope to debug their systems. This includes the use of the MPLAB package, CCS package and the debug simulator and your ability to write well-documented C programs. For example you may asked to step through your program, set watches on variables, step into functions, set breakpoints etc. Programs are evaluated on the correctness of the code and the output, the readability & layout of the code, and the correct usage of the concepts discussed in the lectures. Appropriate and correct use of hardware features of the microprocessor system is also considered.

You are expected to read and prepare the material related to the lab before going to the laboratory sessions. In this way, you may take more advantage of the laboratory time. The sessions are intended for using CAD tools, asking questions, and demonstrating your practical assignment when it is complete.

ACADEMIC ETHICS: You are expected to complete your own assignments unless group work is involved. If cheating occurs, all parties involved will be denied any credit for that assignment and may be referred to course tutor for further action. You are expected to enter class with an attitude that will facilitate a higher level of learning, understanding, and comprehension.

Plagiarism will not be tolerated. Copying material from the web or from data sheets without giving credit is plagiarism. Figures may be borrowed from data sheets or application notes, provided that credit for each figure is clearly given in the report (e.g. "Fig.1 from ABC Company datasheet XYZ"). Borrowing a sentence or paragraph is reasonable (as long as credit is given), but do not borrow pages of material and include that in the body of your report. Students are expected to understand plagiarism and how to properly cite the work of others. Refer to http://en.wikipedia.org/wiki/Plagiarism.

Assignment 1: CCS/ MPLAB/PIKIT3

Hand in deadline: 15th July 2015

A demonstration MUST be given during your normal lab period of the week beginning 15th July 2015 to 22nd July 2015.

Introduction

Code Composer Studio™ (CCS)- Integrated Development Environment

Code Composer Studio is an integrated development environment (IDE) that supports TI's Microcontroller and Embedded Processors portfolio. Code Composer Studio comprises a suite of tools used to develop and debug embedded applications. It includes an optimizing C/C++ compiler, source code editor, project build environment, debugger, profiler, and many other features. The intuitive IDE provides a single user interface taking you through each step of the application development flow. Familiar tools and interfaces allow users to get started faster than ever before. Code Composer Studio combines the advantages of the Eclipse software framework with advanced embedded debug capabilities from TI resulting in a compelling feature-rich development environment for embedded developers.

Use CCS for free - By default when you install Code Composer Studio a free license will be enabled that supports working with development boards with an on-board debug interface, XDS1xx class debug probes, MSP430 with 16KB code size limit when using the TI compiler and 32KB code size limit with MSP432 and no limit when using GCC. A 90-day evaluation license is also available.

Components Required:

1. Stellaris Launch Pad
2. Oscilloscope
3. Probes
4. PCB
5. Pitkit3
6. CCS
7. MPLABX IDE or MPLAB IDE

TASK 1:

You should test the following questions using digital oscilloscope (In C code).

Q1.   By using the Timer **(Prefer ONE timer)** and interrupt, write a program to generate a single tone system wave as below in **ONE** single program.
- 50% duty cycle square wave
- 30% duty cycle square wave

Q2.   Write a program to generate a dual tone system as 400 Hz square waves for 500ms duration. Dual tone system wave usually use in DTMF generator and tone generator.

TASK 2:

Construct a PIC24FJ64GA002 based microcontroller system (or you may use the Sterllaris LaunchPad board) with the following requirements:
- There are two push buttons, SW1 and SW2.
- There are three LEDs, LED1, LED2, LED3.
- A variable voltage input at one of the analog input of the microcontroller.
  * You can create this voltage using a variable resistor of 10KOhm and connected to Vdd and Gnd (**Figure 1**).

- LED3 will always blink at the rate of 1Hz.
- When the system first starts, LED1 and LED2 are OFF

- For SW1 and LED1:
  * When SW1 is first pressed, LED1 will start to blink at a preset rate.
  * Thereafter, each time SW1 is pressed, LED1 will blink at twice the previous rate.
  * When SW1 is pressed for the 5th time, LED1 is OFF again and the cycle repeats (**Figure 2**)
  * If SW1 is pressed and hold, LED1 should continue to be OFF or blink, depends on the state it is in.

- For SW2 and LED2:
  * When SW2 is **pressed and hold**, LED2 will blink at the rate corresponds to the voltage level measure at the analog input
  * When SW2 is **released**, LED2 is OFF
- The operations of SW1 and SW2 are independent. As an example, when SW2 is pressed and hold, LED1 should operates as usual (OFF or blink)
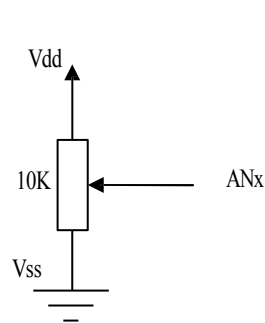

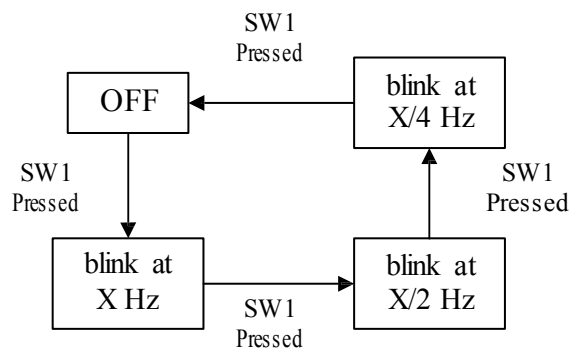**Figure 1**: Variable voltage level for the analog input

Figure 2: Operation of SW1 and LED1

Assignment Outcome

Upon completion of the project, the student should have achieved the following outcome:

(a) Ability to conduct R&D.

(b) Work as a team to achieve a common goal.

(c) Learn proper time management.

(d) Develop communication and soft skills in report writing.

Deliverables:

- Maximum 10 pages of hardcopy report: Circuits, source codes and explanations
- Software copy of report (email to me)
- A working system for demo

Due date for submission (**both soft and hard copies are needed**):

(i) Hardcopy: 2:00pm 15th July 2015 (Wednesday) – During demo session.

(ii) Softcopy: 11.59pm 22nd July 2015 (Wednesday) seeyc@utar.edu.my – Submission time will be based on the timestamp in my UTAR gmail account.