CSE 3442/5442: Embedded Systems Lab 1: Introduction to the QwikFlash Board

Objective:

The purpose of this lab assignment is to familiarize with:

- 1. QwikFlash board (which is a PIC18F452 microcontroller chip based board with various I/O devices.)
- 2. MPLAB X IDE used to create PIC microchip code programs and build *'.hex'* that will run in PIC chip.
- 3. XC8 is a C compiler for PIC chips.
- 4. The PICKit3 is the programmer used to upload your program to the PIC.

Part 1: MPLAB X IDE and XC8 Compiler This part will introduce MPLAB X IDE

1. Copy 'Lab1_example_1.c' program from the 'CSE3442 files' folder located in the embedded M: server to your Z: drive. Open MPLABX IDE.



2. Select Create New Project

×	New Project	
Steps 1. Choose Project 2	Choose Project Categories: Microchip Embedded Other Embedded Samples	Projects: Standalone Project Existing MPLAB IDE v8 Project Prebuilt (Hex, Loadable Image) Project User Makefile Project Library Project
	Description: Creates a new standalone application project project. < Back	t. It uses an IDE-generated makefile to build your Next > Finish Cancel Help

3. Choose *Microchip Embedded > Standalone Project*. Click *Next*.

4. Choose PIC18 family, PIC18F452 device. Click Next.

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6. Choose the XC8 Compiler. Click Next.

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- 7. Use Project_1 as your project name. Project location should be Z:\YourNetID (most likely is Z drive) Project folder should be Z:\YourNetID\Project_1.x Click Set as main project.

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4. 5.	Select Tool Select Plugin Board	Project Name		Project_1							
6. 7.	Select Compiler Select Project Name and	Project Locat	ion:	C:\Users\Nicholas\M		Browse					
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8. Copy the 'Lab1_example_1.c' file to your Project_1.x folder.



9. Right-click Source Files. Select Add Existing Item...

10. Select the .c file. Click Select.

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11. You can now double click the .c file to view/edit the code in the MPLABX IDE.

12. Select Run > Build Main Project



13. In the output console you should see BUILD SUCCESSFUL and Loading completed. The .hex file (which is the only file you upload to a PIC) has now been created, but we will not physically upload it to the PIC for this example. We will instead use the Simulator to mimic the PIC's capabilities completely within the desktop computer.



- **14.** Open up the following windows.
 - a. Watch (Window > Debugging > Watches)
 - b. Special function Registers (*Window > PIC Memory Views > SFRs*)
 - c. Logic Analyzer (*Window > Simulator > Analyzer*)
 - d. Stimulus (*Window > Simulator > Stimulus*)
- 15. You may now set various breakpoints within the C code, run the debugger simulation (*Debug > Debug Main Project*), and Step Into (F7) a line-by-line execution of the program.
- 16. Play around with the windows/watches opened up in Step 15 and see ports, registers, variables, etc. change values as you are stepping through the code. You may also use the Stimulus to imitate physical changes to the PIC's input pins on PORTB and PORTD.

If you have any questions/issues call the TA, if not you can move on to part 2.

Part 2: 'Hello, World!' program

The purpose of this part is to get familiar with running PIC programs using the QwikFlash board. The code will display a message on the LCD along with an incrementing number.

1. Copy 'Lab1_example_2.c' program from the 'CSE3442 files' folder located in the embedded M: server to your Z: drive. Open MPLABX IDE.



2. Select Create New Project

×	New Project	
Steps 1. Choose Project 2	Choose Project Categories: Microchip Embedded Other Embedded Samples	Projects: Standalone Project Existing MPLAB IDE v8 Project Prebuilt (Hex, Loadable Image) Project User Makefile Project Library Project
	Description: Creates a new standalone application project project. < Back	t. It uses an IDE-generated makefile to build your Next > Finish Cancel Help

3. Choose *Microchip Embedded > Standalone Project*. Click *Next*.

4. Choose PIC18 family, PIC18F452 device. Click Next.

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5. Choose the PICkin	t 3 (or serial # righ	t below) a	as your h	ardware	e tool. C	Click N	ext.
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1. Choose Project 2. Select Device 3	Hardware Tools O ICD 3 O PICkt2 O PICkt3 O PReal ICE O Simulator Microchip Starter O Other Tools O Other Tools O Licensed Debu	Kīts Jgger					
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6. Choose the XC8 Compiler. Click Next.

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- Use *Project_2* as your project name. Project location should be Z:\YourNetID (most likely is Z drive) Project folder should be Z:\YourNetID\Project_2.x Click **Set as main project**.

×	New Project				Ð		×
Steps	Select Project Name	and Folder					
Choose Project Select Device Select Header Select Tool Select Plunip Roard	Project Name:	Project_2					
6. Select Compiler 7 Select Project Name and	Project Location:	C:\Users\Nicholas\MPLABXProjects		Browse			
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- 8. Copy the 'Lab1_example_2.c' file to your Project_2.x folder.
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- 9. Right-click Source Files. Select Add Existing Item...

10. Select the .c file. Click Select.

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11. You can now double click the .c file to view/edit the code in the MPLABX IDE.

12. Select the button Make and Program Device Main Project.



13. In the output console you should see a success message indicating that your program was uploaded to the PIC.

There should now be a message and an incrementing number displayed on the QwikFlash Board's LCD Module.

IMPORTANT: Execute the "QwikFlash_Reset.bat" file in the shared M: drive. This code will overwrite the PIC so no student code is left behind. Do this at the end of every lab throughout the semester.

Assignment:

Write a lab report (using a word processor, submit as pdf) discussing the following:

- 1. What is the purpose of the function *void Initialize_PIC()*? How does this function relate specifically to the QwikFlash board?
- 2. Explain the process of printing characters to the LCD module in the function void Print_To_LCD(const char * tempPtr).

You can use reference materials for help on the two questions on the class webpage <u>http://omega.uta.edu/~nbb0130/CSE3442.html</u> (Chapter-7 of Embedded Design..., QwikFlash Board Schematic, etc.)

Submit your report via BlackBoard before the beginning of the next lab (one week).