Embedded and Realtime Systems

Laboratory Project (with Realtime feature)

Name:_____

INSTRUCTIONS

Read this document carefully. Be sure to include your name on all your work submitted.

This laboratory project should be completed by the end of the project period, Thursday 17th December, 5pm. You are required to demonstrate your project to one of the demonstrators.

You will have three 3 hour supervised laboratory sessions but you may work on the project outside these lab times. Your project should be submitted to Moodle as a single file. If you have multiple files, archive them together e.g. zip them into one file, before submitting. Be sure to include your names on all your work.

This laboratory project should incorporate all topics covered in the labs to date, i.e. Basic I/O, ADC, LCD, UART, I^2C, Interrupts, and Timers.

DETAILS

Your embedded project should be a **realtime** system which could be used in a real world application. The system should be based on the PIC-DIP40 development platform and plug-in daughter board.

Here are just some examples. Please feel free to come up with your own idea;

Environmental Monitoring System.
A Medical Device.
An Alarm System.
A Game.
A Toy.
A Battery Charger.
Home Automation Device.
Etc…

Remember, when selecting/designing your system you must be able to demonstrate a realtime aspect to your system.

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It is important that your system design incorporates all of the following peripherals found on the PIC16F877A;

Basic I/O	**:**	***LEDs, Speakers, Switches, etc.**
ADC	**:**	**Any analog input.**
LCD	**:**	**LCD module provided in kit. Display something.**
UART	**:**	**Asynchronous communication between PIC-DIP40 and PC**
I^2C	**:**	**I^2C EEPROM. Store and read data.**
Interrupts	**:**	**Incorporate at least 1 Interrupt**
Timer	**:**	**Incorporate at least 1 Timer**

***Note: Onboard LEDs and the LCD cannot be used together, as both use PORTD. If you want to incorporate a LED and the LCD, do so by using one of the LEDs on the daughter board.**

DESCRIPTION OF ASSIGNMENT

PART 1

With the aid of a block diagram describe your system design and its application. Explain what each PIC16F877A peripheral does in your design. **(15 Marks)**

PART 2

Explain the realtime aspect of you system. **(15 Marks)**

PART 3

Write the software for your system design. Pay particular attention to configuring the Special Function Registers. Make sure one configuration does not overwrite another, e.g. I2C_Init. Comment your code fully. **(70 Marks)**

- A lab demonstrator should verify the operation of your system code.

Useful Notes:

1. **All the peripherals above have been covered in the lab sessions.**
2. **If you are having difficulties implementing all the peripherals above in one system, try implement as many as you can in a system that you can demonstrate working.**
3. **Code your programs in stages by getting one peripheral to work before coding for the next. This will make debugging easier. Don't attempt to code your entire program in one go.**

4. **You can use the potentiometer for your analog input. This should however be representing some analog source for your system, e.g. a voltage level, sensor output, etc.**

5. **Your project does not necessarily have to perform the task it is designed for. As an example, if we take a battery charger. You could use two LEDs to indicate charging and fully charged, and use the potentiometer as a representation of the battery voltage. The system does not have to actually charge a battery.**

6. **Don't over complicate things, keep it simple. The important thing is that you can demonstrate that you can configure and use the on-board peripherals listed above. Also, that you understand and implement a realtime aspect to your system.**