EE 444/645

Lab #4: MSP430–UART communication and interrupt mechanism

Report due: 3/09/2017 by 2:00 pm

Introduction

The goal of this laboratory is to use USCI in the UART mode, ADC12, and TimerA modules concurrently to communicate the information to a PC through its serial port. This lab assignment should also strengthen your understanding of the interrupt mechanism.

Equipment:

CrossStudio for MSP430
TI MSP-EXP430F5438 Experimenter Board
Oscilloscope
Frequency counter (optional for EE444 students)

Procedure:

1. Write a program that receives characters from a terminal program (for example, TeraTerm) and echoes them back to the terminal.
2. When a PC user hits a RETURN key, the MSP430 program should send to the terminal the number of characters entered by the user so far.
3. If the user enters the word "TEMP" the program should start the following process, and repeat it until the user enters the word "STOP":
    *   Sample the internal temperature **two times per second**
    *   Send to the PC: the temperature (in C or F) and the time in minutes and seconds since the word "TEMP" was detected. Format the message so that it's displayed nicely on the screen.

NOTE: *For a full credit your program should:*
*   Use the SMCLK of **17** MHz to source the USCI
*   Communicate at a baud rate of 460800 bps
*   Use <u>oversampling method</u> to set up the baud rate
*   *Receive and send characters only in the interrupt service routine(s)*
*   Exit from all interrupt service routines as soon as possible (for example, prepare the message and then let the UART interrupt service routines take care of transmission)
*   Spend the remaining time in the lowest possible low power mode.
*   The originality, effectiveness, and power consumption awareness of the solution will affect your grade for this assignment. Extensive use of interrupt mechanisms and low-power modes is strongly recommended.

Lab Assignments:
*   Capture the signal generated by the microcontroller when it is sending a character through its serial port. Measure precisely the bit length and determine the exact baud rate.
*   Capture the similar signal generated by the PC, as it is being sent to the microcontroller by TI TUSB transceiver. What is the baud rate now?
*   Annotate your printouts to show start/stop bits, parity (if used), and the least significant and most significant bits of the character.

- Give the ASCII code of a character being sent and show that the signal you captured corresponds to this character.

  optional for EE444 students, mandatory for EE645 students:

- Use the frequency counter to measure precisely the frequency of the clock used for BRCLK.
- Based on your measurements of actual baud rates and the frequency of your clock, make changes in your program to set the baud rate as close to the one used by the PC. You can slightly change the frequency of the clock if you need to.

Report requirements:
   Use the lab report template provided on Blackboard.
1. The report should include all the programming files you wrote.
2. The report should include all the measurements.
3. The report should include the detailed description of the program and the procedures used in completing this task.
4. The code should be reasonably commented.

Be extra careful when handling the board and connecting the oscilloscope.