ECEN 3360
Digital Design Lab #4
UART / BLE Communications
Spring 2019

Objective: This assignment is broken into two deliverables. The first part, 4a, is focusing on getting the Pearl Gecko LEUART communication with the UART BLE network co-processor. The second part, 4b, is focusing on transmitting the temperature read from the Si7021 to a phone or other Bluetooth Low Energy device. As in Lab 3, the project will continue to use Load Power Management.

Note: This assignment will begin with the completed Lab 3b, I2C Load Power Management

Lab 4a Due: Sunday, March 3rd, 2019
Lab 4b Due: Sunday, March 10th, 2019

Lab 4a Instructions:

1. Make any changes required to Lab 3b, I2C Load Power Management, lab. Please work with the Instructing Team to get your code working to Lab 3b.

2. To better match the energy measurements from your project to the expect results, all projects must enable HFXO to wake up and run after coming out of sleep energy modes. The following line of code should be added in your cmu.c function after all the calls to initialize the HFXO oscillator.
    a. **CMU_HFXOAutostartEnable**(true, true, true);

3. LETIMER0 should be set to the following conditions at startup / reset.
    a. Si7021 temperature read period = 5.0 seconds
    b. No LED heart beat requirement

4. Initialize/program the Pearl Gecko LEUART to work down into EM2 energy mode
    a. Determine the LEUART0 baud rate, stop bits, etc from the Bluetooth Low Energy co-processor data sheet
    b. Establish the LEUART0 clock tree
    c. Initialize your LEUART0 peripheral

5. Download your Bluetooth co-processor, or similar, application to your phone and install it. You will be using this application to interface to your Pearl Gecko + Bluetooth dev kits.

6. When you connect your BLE module, there are two power pins on the Pearl Gecko dev kit expansion port, 3.3 and VMCU. You must connect to 3.3v to prevent the current consumption of the Bluetooth module from showing up on the Energy Profiler readings.

7. Determine the command to change the name advertised by your Bluetooth Low Energy, Smart, co-processor.
    a. The communication to and from the DSD-TECH is AT commands and the characters are sent in ASCI-II format
    b. For the DSD-TECH HM-10, the command is:
        i. AT+NAMEffll
        ii. ffll is the custom name that you will program into your co-processor module
        iii. This assignment you will set the DSD TECH name to the following:
            1. ff = your first two letters of your first name
            2. ll = your last two letters of your last name

8. The routine to send a string of characters to the LEUART must be interrupt driven and not polled.
    a. Example: After a character has been sent to the LEUART, the CPU should go to sleep in its lowest energy mode that will allow the LEUART to continue to operate until the LEUART can accept the next character.

9. For you to see the name displayed by your phone application, you will most likely need to close out your phone program and re-open it. Also, if it has bonded to your phone, you may need to have your phone forget the bonding.

10. Submit your project code to Canvas Lab 4a assignment.
    a. No flow chart required for submission, but advisable to plan your code and functions before you begin coding.

11. No Canvas 4a Worksheet quiz.

Lab 4a approximate rubric: (Base grade is 20 pts)

1. I2C software project		10 pts
	a. Total	10 pts
2. Deductions:		
a. Magic numbers		- 3 pts
b. Not unique files per peripheral		- 3 pts
c. No acknowledgement of IP		- 2 pts
3. Late Submission:		
a. 0 - 24hours late		- 3 pts
b. 24+ to 48 hours late		- 6 pts
c. 48+ hours late		-10pts

4. If code does not work, corresponding Quiz questions will be marked as 0 if answered correctly.

Lab 4b Instructions:

1. Make any changes required to Lab 4a, UART / BLE Communications. Please work with the Instructing Team to get your code working to Lab 4a.

2. Create a routine to publish the temperature to your Bluetooth phone application after each temperature reading of the Si7021. This temperature should be displayed in the following format:
    a. + or –
    b. 3 digits to the left of the decimal point, leading 0s are translated to spaces
    c. Decimal point
    d. One digit to the right of the decimal point
    e. Note, the temperature should be converted as a real number
    f. Examples:
        i. +105.6C
        ii. + 21.3C
        iii. - 8.2C

3. The instructing staff will have cans of "cold spray" to enable you to test your code for temperatures below 0.

4. Submit your exported project code in Canvas 4b project assignment.
    a. No flow chart required for submission, but advisable to plan your code and functions before you begin coding.

5. Complete the Canvas 4b worksheet quiz.

Lab 4b approximate rubric: (Base grade is 20 pts)

5. I2C software project 15 pts
    a. Total 15 pts
6. Deductions:
    a. Magic numbers - 3 pts
    b. Not unique files per peripheral - 3 pts
    c. No acknowledgement of IP - 2 pts
7. Late Submission:
    a. 0 - 24hours late - 4 pts
    b. 24+ to 48 hours late - 8 pts
    c. 48+ hours late -15pts

8. If code does not work, corresponding Quiz questions will be marked as 0 if answered correctly.