Serial Port IO Control and System Integration

PURPOSE

In this three-week lab, you will interface an LCD and a Bluetooth modem to the UNO. You will design and implement an embedded system based on components you implemented in previous labs. Interrupt will be used.

PRELAB (30%): Complete the prelab assignments as teams. Remove any syntax error before you turn in prelab codes.

(1) (Week 1: 10%) For Experiment (1), study LCD_SPI.ino and identify the results after running the code. For Experiment (2), specify the hardware connection, including the Uno board pins used, and write a code.

(2) (Week 2: 20%) Draw a diagram to illustrate the hardware connection, including the Uno board pins used. Then draw a corresponding "rough" flow chart. Specify in the flowchart the function name that will be used for each system feature. Also specify any library packages (or header files) that need to be included in the Arduino code. In addition, identify in the flowchart whether polling or interrupt would be used for each system feature such as keypad scanning, ADC reading, and so on.

EXPERIMENT (70%)

(1) (10%) Study the Arduino sketch LCD_SPI.ino available on the course pilot website under labs\LCD. Connect an LCD display (NHD-0216K3Z-FL-GBW-V3) to some UNO digital pins. Open the sketch, upload the code, and record its execution results.√

(2) (10%) Connect a Bluetooth modem to the UNO board. Create a project that would allow the LCD to display a message, e.g., "Hello World", sent from a Termite program running on the host PC. The Termite program sends out Bluetooth signals to the Bluetooth modem. The LCD should be cleared initially.√√
Hint: Refer to https://learn.sparkfun.com/tutorials/using-the-bluesmirf (which uses UNO digital pins other than pins 0 and 1) or study materials provided on the course pilot website under labs\Bluetooth (which uses digital pins 0 and 1). Note that the IDE uses digital pins 0 and 1 to communicate with the UNO board.

(3) (50%) Develop the following UNO-based system by integrating components you have developed.

The system has a keypad, a push-button, a speaker, a force-sensitive resistor, an LCD, a Bluetooth modem, and an LED that serves as an "optical metronome". It also takes a square wave input from a signal generator with $\mathbf{F_{in}}$ as its frequency. The system functions as follows:

- The system plays a default song segment when it starts up. The playing of the default (or new) song stops when either the keypad or the Bluetooth modem receives some user actions.

- As in Lab 1, the keypad is used for users to input a new song segment. At any time, only two of the most recent song segments are kept in the system.

- The keypad input is displayed on the LCD and is also sent to the PC-based Termite program through the Bluetooth modem. The keypad should be allowed to clear the LCD display.

- Users select which one of the two most recent song segments to play by using the Termite program through the Bluetooth modem.

- As in Lab 2, the brightness of the LED is controlled by the temperature sensor and its flashing frequency is equal to $\mathbf{F_{in}}/1{,}000$.

- Identify one key that stops or re-starts the LED flashing depending on the LED status. Initially the system starts without the LED flashing. In that case, that key starts the flashing. Note that once the LED starts flashing, the tempo of the music should be consistent with the LED flashing.

Some teams may get extra credits (therefore more than 70%) if their systems are much better than other teams' systems. (Note that the system is not fully specified, especially in terms of user friendliness and error handling.) Such grading will be based on the lab instructor's subjective evaluations.