Lab 4: Data communication: UART and I2C

In this lab, the main goals are

1. To get familiar with the UART operation
2. To get familiar with the I2C operation

Important Knowledge

SoftwareSerial Library: https://www.arduino.cc/en/Reference/SoftwareSerial

SoftwareSerial Example: https://www.arduino.cc/en/Tutorial/SoftwareSerialExample

How to determine which board it is in your code:
http://tonygaitatzis.tumblr.com/post/134967126657/determine-arduino-board-model-and-version

Sensor board information: https://www.adafruit.com/products/1120

Wire (I2C) Library: https://www.arduino.cc/en/Reference/Wire

What to submit for this lab

1. You need to submit the sketch files you write or modify, and do not copy the code to the lab report this time.
2. Zip the files for each exercise as one folder and submit it – you need to submit at least two zip files in total. If you can finish exercise 3, then you need to submit three zip files.
3. Your lab report without code copied in.

Please make sure you create one sketch for each exercise and copy the code to the report! Do not submit your code directly, the submission only allows doc, docx or pdf.

Exercises

1. **Difficult (60 min):** Implement the wired communication between two Arduino devices. **NOTICE: You ONLY NEED ONE PROGRAM for Arduino Mega and Arduino Micro. You just need to select the correct board, CPU, and port when compiling and downloading the program.**
   a. You need to first connect the Arduino Mega and Micro devices.
   b. Following the SoftwareSerial example to pick two ports on each Arduino device as the UART port.
   c. Connect the keypad you used in Lab 3 into the Mega device
   d. Connect both Mega and Micro to the PC via USB
   e. Press the key on the keypad that is connected the Mega device, and let the Mega sends the captured key value to the Micro (you may add extra information besides the key value), then the Micro should send (forward) the information received form Mega to PC so as to be printed in SerialMonitor.

f. Once you have implemented the previous step, as an acknowledgement method to the Micro device: after the Micro sends data to PC, it should also send back an ACK to the Mega, so that Mega actually knows that the message is received by the Micro. The Mega device should also print out the received ACK to the host PC. After this step, you should see information about the pressed key, and the ACK information in two separated SerialMonitor windows.
NOTICE: how to open two SerialMonitor?
   i. Open two Arduino IDEs from the start menu. It's not opening two sketches, but two IDEs.
   ii. Open one Arduino IDE, and open one serial terminal (e.g., Putty)

2. **Ninja (90min):** Connect the sensor board to the Arduino Micro device over I2C interface.
   a. Sensor board information: https://www.adafruit.com/products/1120. You can also find example code there.
   b. You may download the code provided by Adafruit, but you need to change it by splitting the read function to two functions: one is to read accelerometer only, and the other one is to read magnetometer only.
   c. Changing the code that you have wrote in the first exercise. Once key "1" is pressed on the Mega device, the accelerometer information should be collected on the Micro device and sent to PC. The Micro also ACKs the Mega device for the received command information. Once key "2" is pressed, the magnetometer information should be collected on the Micro device and sent to PC. The Micro also ACKs the Mega device for the received command information. Once key "3" is pressed, information about both accelerometer and magnetometer information should be collected on the Micro device and sent to PC, and the Micro should ACK the command. You need to show the data printed at two SerialMonitor windows.

3. **Ninja Sensei (unlimited time until due)**
   a. Change the UART connection between the Mega and Micro devices, using I2C instead.
   b. All other functions should be the same as in exercise 2.
   c. This basically means: 1) The Mega device will communicate with the Micro device via I2C back and forth; 2) The Micro device will communicate with the Mega device via I2C back and forth, plus, the Micro device will also need to collect sensor data from another I2C interface.

What to submit
1. Your lab report, please use the template in canvas, and submit in word or pdf.
2. 2. Please do follow the lab report template and don't miss any required content.
3. 3. Please be sure to copy all your code to the report and follow the requirement.