Collecting Data from Multiple Sensors
EECE-4710 IoT and Machine Learning
Cristinel Ababei
Electrical and Computer Engr., Marquette University

1. Objective

To do sensor fusion – by collecting data from two different sensors available on the Arduino Nano 33 BLE Sense sensors to build a heterogeneous dataset; this dataset will be used later to train an ML model.

2. Assignment

Part 1:
You must write an Arduino program to collect sensor data from the "barometric and temperature" and from "humidity and temperature" sensors. These data should be collected every 5 seconds. The four measurements every 5 seconds form a "packet" that should be transmitted via Serial from the Arduino board to your computer.

In writing your program, you can start from the source code from these tutorials:

Tutorial 1: Barometric and Temperature Sensor – LPS22HB

- https://docs.arduino.cc/tutorials/nano-33-ble-sense/barometric-sensor

Tutorial 2: Humidity and Temperature Sensor. You must do any of the following three options:

Option #1
If your Arduino Nano 33 BLE Sense board has the HTS221 built-in sensor, then, you are all set. This is the easiest option. Follow the tutorial below to work with the "Humidity and Temperature Sensor – HTS221":

- https://docs.arduino.cc/tutorials/nano-33-ble-sense/humidity-and-temperature-sensor

Option #2
Use DHT22 humidity + temperature sensor. You can find information about it for example here:

- https://www.adafruit.com/product/385
- https://learn.adafruit.com/dht
- https://cdn-shop.adafruit.com/datasheets/DHT22.pdf

You first need to install the following library in your Arduino IDE (in the library manager, search for "DHT sensor library" and Install it):

- https://www.arduino.cc/reference/en/libraries/dht-sensor-library/

Then, you must set-up the hardware to connect the DHT22 sensor to your board. Here, please use a breadboard to connect the DHT22 sensor. Do not connect jumper wires directly to the pins of DHT22

because they are very flimsy and break easily (ruining a $8 sensor!). Plug the DHT22 sensor in a breadboard and leave it there all the time. Connect with jumper wires from the breadboard to the Arduino board, as shown in the Figure 1 below.
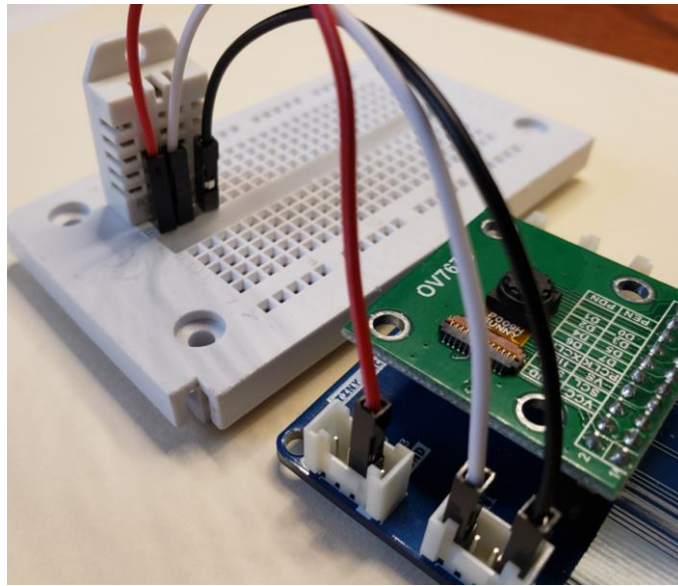

Figure 1: HW setup to connect DHT22 sensor to base board of Arduino Nano 33 BLE Sense board.

Use the Arduino sketch provided, i.e., **sketch_dht22**, to test the sensor and receive via serial humidity and temperature data. During the execution of the above sketch, you should receive data as shown in Figure 2 below.
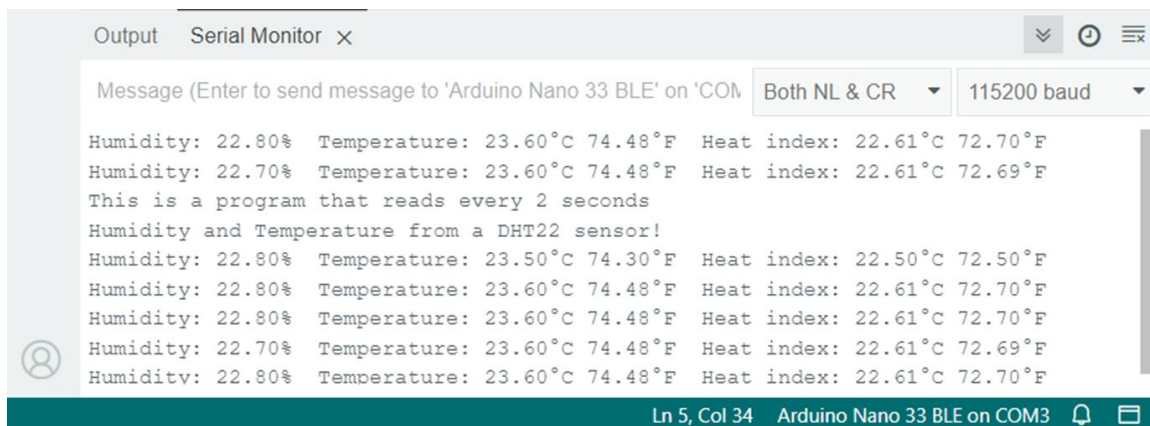

Figure 2: Serial monitor of Arduino IDE showing humidity and temperature data received from DHT22 sensor.

Option #3

Use an AM2320 + temperature sensor (easier to work with because it talks I2C). You can find information about it for example here:

- https://www.adafruit.com/product/3721
- https://learn.adafruit.com/adafruit-am2320-temperature-humidity-i2c-sensor/overview
- https://cdn-shop.adafruit.com/product-files/3721/AM2320.pdf

You first need to install Adafruit_Sensor in your Arduino IDE. So, in the library manager, search for "Adafruit Unified Sensor" to locate the Unified Sensor library and install it, if it is not already installed.

You also need to install the library Adafruit_AM2320. So, search for "Adafruit AM2320 sensor library" and Install it if not already installed!

Then, you must set-up the hardware to connect the AM2320 sensor to your board. Here, please use a breadboard to connect the AM2320 sensor. Do not connect jumper wires directly to the pins of AM2320 because they are very flimsy and break easily. Plug the AM2320 sensor in a breadboard and leave it there all the time. **You must also use 2 pull-up resistors (4K7 Ohm or a value between 2K2 to 10K)**. Connect with the provided jumper wires + Grove 4 Pin Conversion Cable to the Arduino board, as shown in the Figure 3 below.
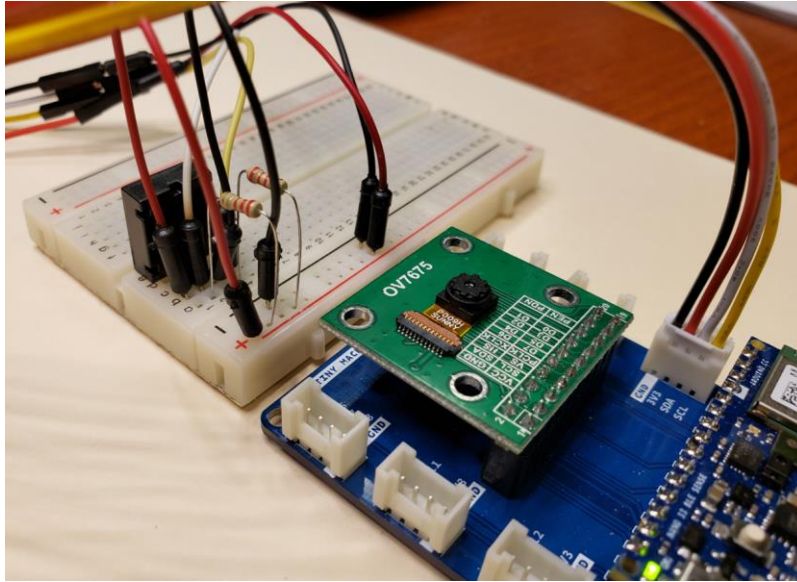

Figure 3: HW setup to connect AM2320 sensor to base board of Arduino Nano 33 BLE Sense board.

Use the Arduino sketch provided, i.e., **sketch_am2320**, to test the sensor and receive via serial humidity and temperature data. During the execution of the above sketch, you should receive data as shown in Figure 4 below.
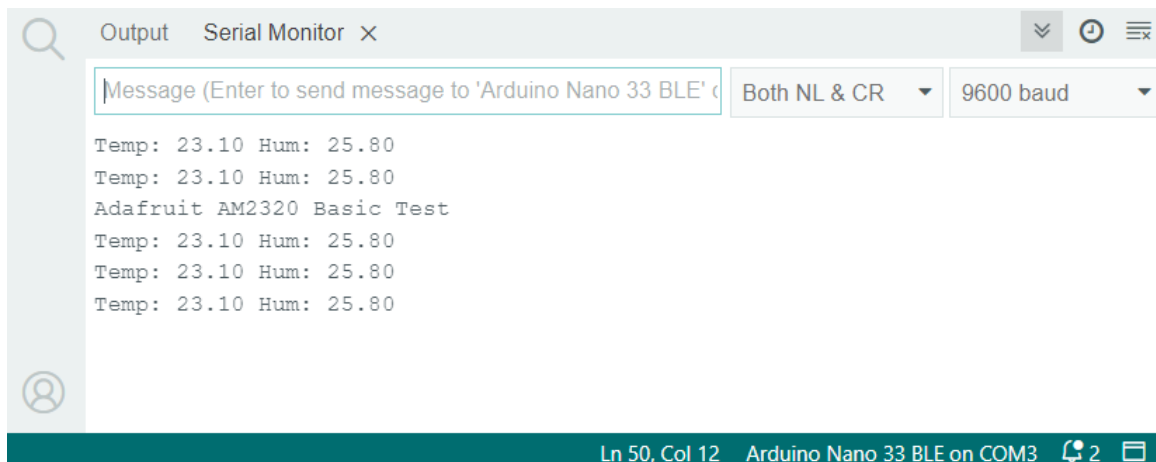

Figure 4: Serial monitor of Arduino IDE showing humidity and temperature data received from AM2320 sensor.

Part 2:

You must write a Python program, which will run on your laptop. This program should listen to the Serial and receive the data transmitted by the Arduino board. These data should be written into a local .csv file, called `dataset.csv`. Each new received "packet" must be written into the file on a

new row. On each row, you should also add the floor number where the measurements are taken. The file should have also written a first row with the names of the 5 columns. In other words, the file must look like this:

```
Pressure,Temp1,Humidity,Temp2,FloorNumber
Val1,Val2,Val3,Val4,Val5
Val6,Val7,Val8,Val9,Val10
…
```

Part 3:

You must use the system created with the above two programs to collect data in the Engineering Building on four different floors of the building, for 10 minutes on each floor.

3. Deliverables

You must upload on D2L a .zip archive, named **LastName_hw7.zip**, with the following files:
- Your `dataset.csv`
- The 2 programs you wrote: the Arduino program which does sensor fusion and the computer program which runs on your computer to receive the sensor data sent from the Arduino board.
- A short, typed report as a PDF file. The report should be named "**LastName_hw7.pdf**". The report should include: 1) your name and course info; 2) summarize what you did; 3) issues you encountered and how you solved them; and 4) lessons learned.