EECS 388 Lab #4

Sensor Reading: TFmini Lidar

In this lab, we will attach a small Lidar sensor, which measures distance, to the HiFive1 board via UART and develop software to read the sensor data.

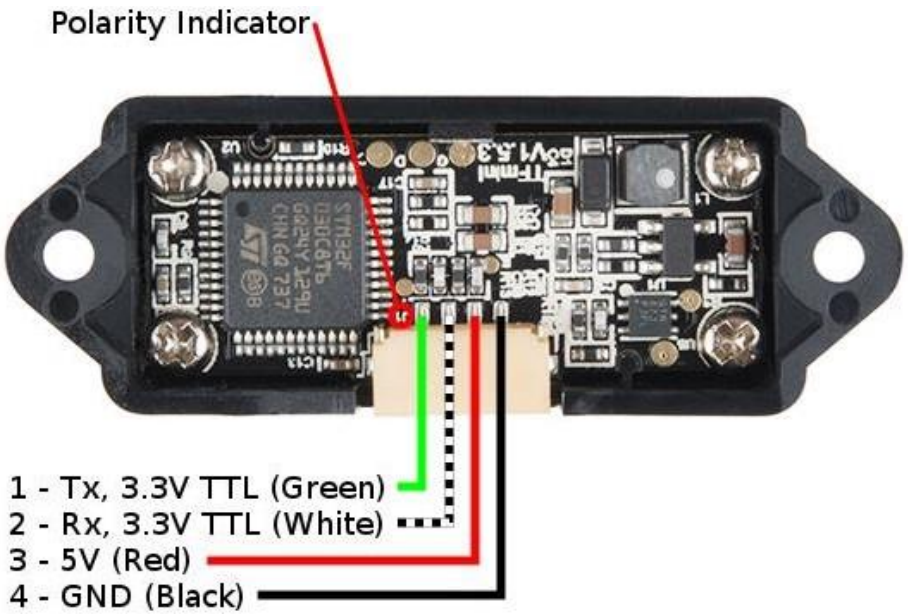
Part 0: Setup the project

Sign in to the Canvas account and go to the EEC 388 Embedded Systems section. Inside the "Files" section, go to the “Lab Materials” -> "Source Codes" folder. Click on the lab04.tar.gz file to download the source code for lab 4. Extract the file inside a folder on your PC.

After that, add this folder to the VS Code workspace (like the previous lab)

Part 1: TFmini Lidar

The TFmini sensor can be connected to the HiFive1 board via a UART connection.



You need to connect the TFmini's Tx (green) and Rx (white) to the HiFive1 board's UART 0 RX (pin 0 = gpio 16) and TX (pin 1 = gpio 17), respectively. The 5V (red) and GND (black) should be connected to HiFive's 5V and GND lines, respectively.

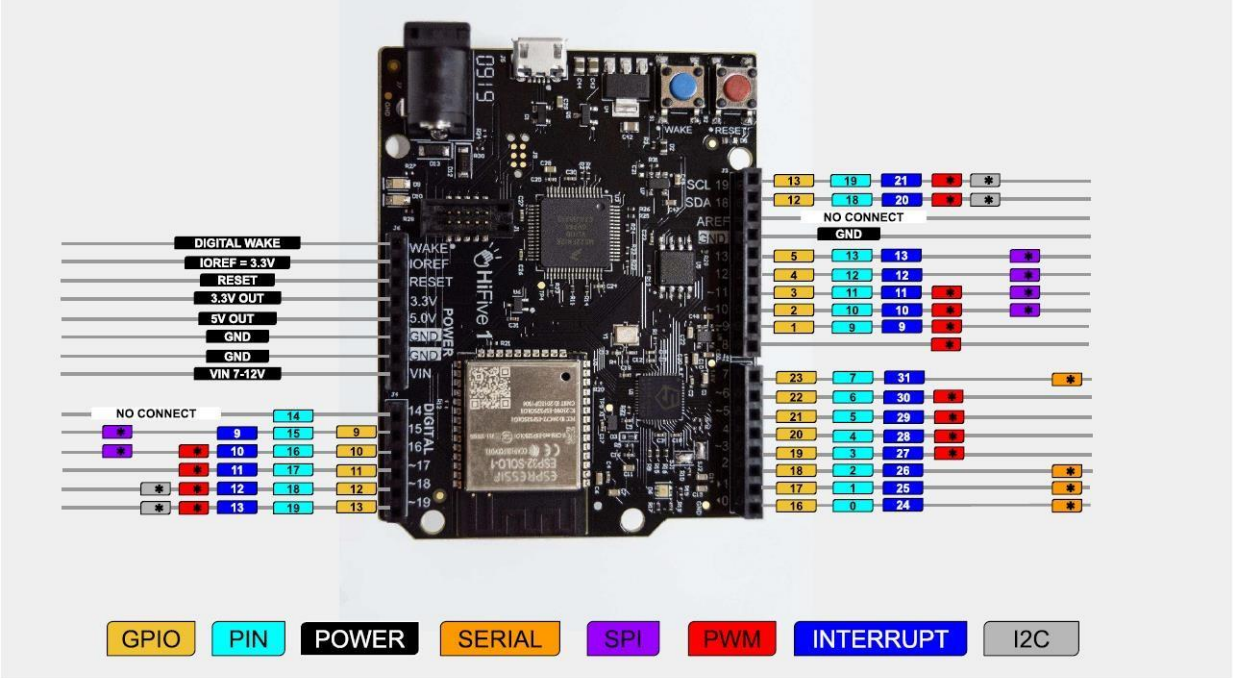
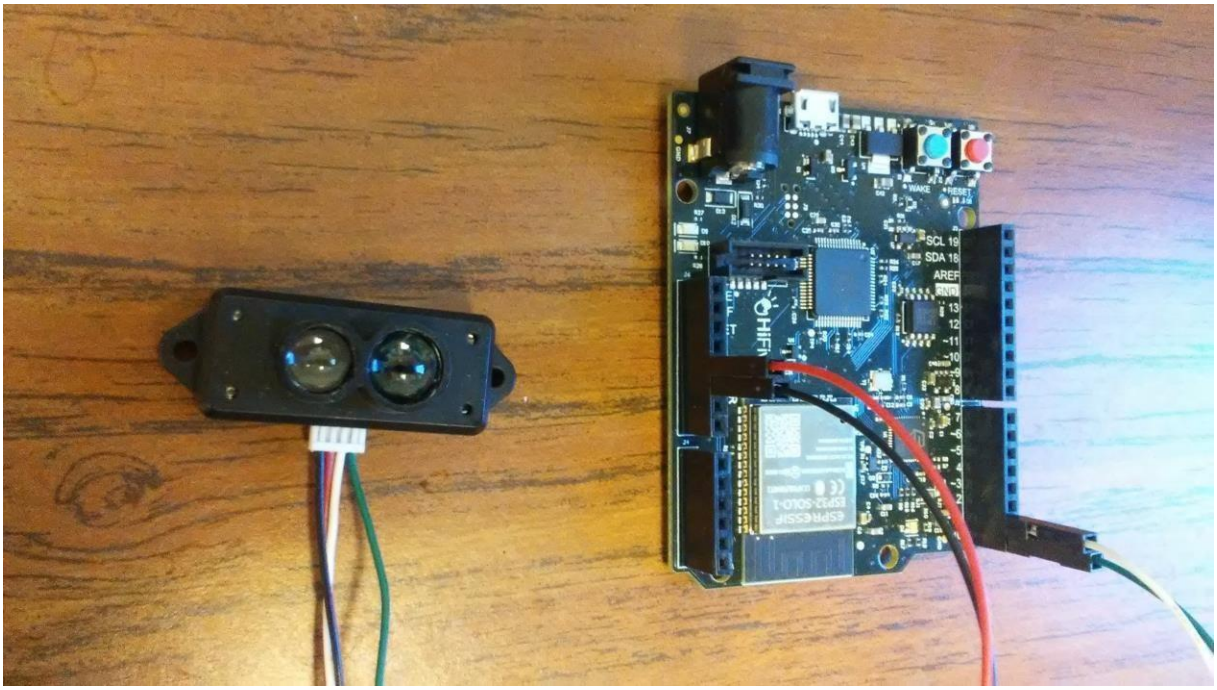


Figure 5: HiFive1 Rev B Pinout

The figure below shows the final connections.



Now, let's open the datasheet of the TFmini lidar (***docs/benewake-tfmini-datasheet.pdf***) in order to find out how to retrieve data from the sensor. The data exchange format of the sensor is described in Section 6.1 "Standard Data Format of Serial Port" of the datasheet. The simplified version of Table 6 of Section 6.1 is shown below.

Byte 1	2	3	4	5	6	7	8	9
0x59	0x59	Dist_L	Dist_H	...	...	...	...	Chksum

In this sensor, each measured data is encoded in a 9 byte data frame. The first two bytes are frame headers (0x59 = 'Y' in ASCII). The next two bytes encode the actual distance data (in cm). Note that the byte 3 (Dist_L) is the low 8 bits and byte 4 (Dist_H) is the high 8 bits of the measured distance data (16 bit). The rest of the bytes of a data frame are not used in this lab.

Note that the sensor operates at 100 Hz, generating one data frame (distance measurement) at every 10 ms.

Part 2: TFmini sensor reader programming

You will re-use the ser_read() function you implemented in Lab 2 here (or use the provided ser_read() function in the source code you downloaded). You only need to modify **`eecs388_tfmini.c`** to complete the lab.

Task 2.1. Implement TFmini data frame reader – 80 points

The first task is to interact with the TFmini sensor via UART0 to parse the sensor's distance data. Note that the distance data is stored in bytes 3 and 4 of the sensor's data frame. So, you need to do a bit of data manipulation to obtain the distance value. Note that the variable **`dist`** should contain the obtained distance value. You will then print the value to the console (i.e. the serial monitor), by using either **`printf`** or **`sprintf`** and **`ser_printline`** combination.

Task 2.2. Control LED based on distance - 20 points

The next task is to control the red and green LEDs based on the observed distance. If the distance between the sensor and the object is less than 50 cm, turn on the red LED. Otherwise, turn on the green LED.

Submission

Go to the "Assignments" section of the Canvas and submit your modified **`eecs388_tfmini.c`** file to the correct submission link based on your lab class time. Also make sure that you have shown your completed work to your respective GTA for demo.

Screenshots/PDF/Text files will NOT be allowed/graded as submission. You need to submit a modified `eecs388_tfmini.c` file only.