VISA SensorTile Tutorial

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Introduction:

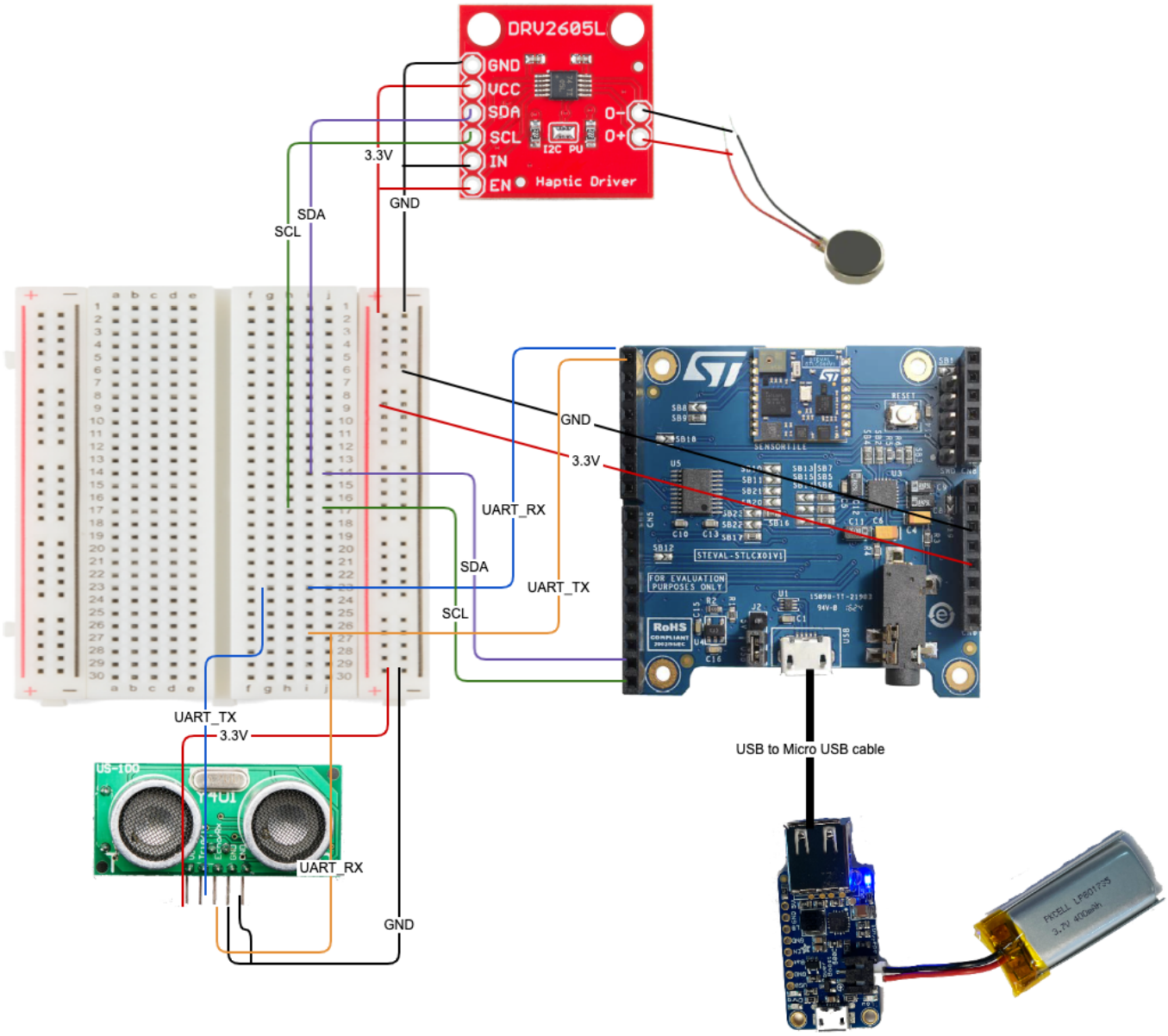
This tutorial guides you on setting up the VISA SensorTile project.

Parts:

- Sparkfun Haptic Motor Driver – DRV2605L (https://www.sparkfun.com/products/14538)
- Vibration Motor – B1034.FL45-00-015 (https://www.sparkfun.com/products/8449)
- STM SensorTile with SensorTile Cradle Expansion Board - STEVAL_STLKT01V1 (https://www.st.com/en/evaluation-tools/steval-stlkt01v1.html)
- US-100 Ultrasonic Distance Sensor (https://www.adafruit.com/product/4019)
- Adafruit PowerBoost 500 + Charger (https://www.adafruit.com/product/1944)

Setting up the circuit:

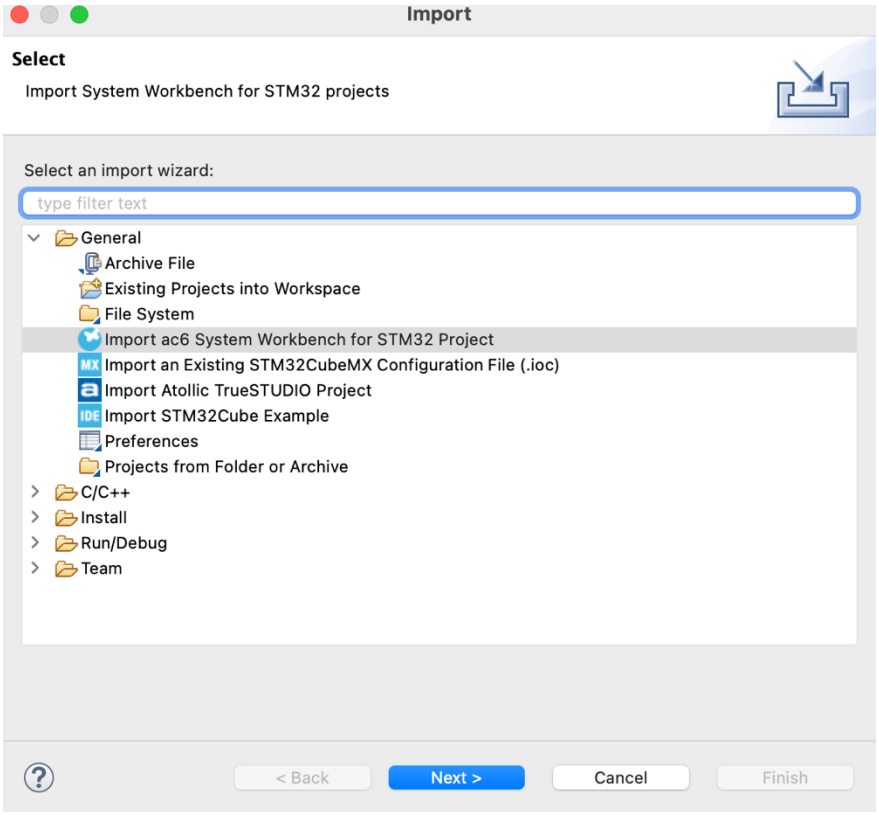
Utilize the following diagram and schematic to help setup the circuit.



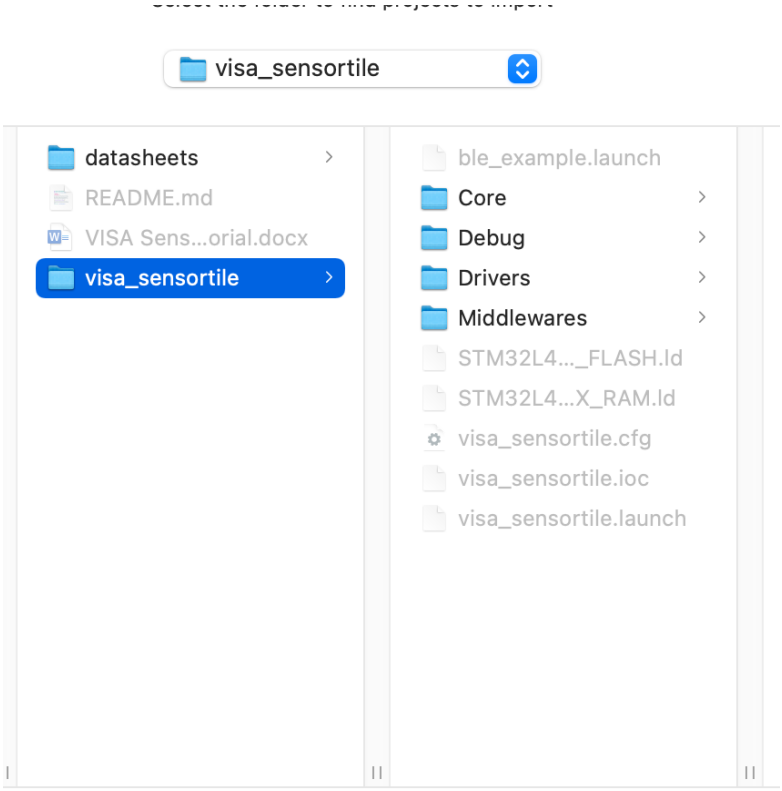
Importing the VISA SensorTile project:

1. Download the VISA SensorTile Source code

2. Inside STM32CubeIDE Go to File → Import → import ac6 System Workbench for STM32 Project then click “next.”



3. In the next screen you will select the visa_sensortile project folder from your download.



4. Click the “Finish” button. Your visa_sensortile project is now imported and ready to be build and run.

Running the VISA SensorTile project:

For this portion I am using a Raspberry Pi 4 to interact with the VISA SensorTile over BLE.

1. Run the VISA SensorTile code.
2. On your BLE device start bluetoothctl and then use “scan on” to list all available BLE devices for pairing.

```
[pi@raspberrypi:~ $ bluetoothctl
Agent registered
```

```
[[bluetooth]# scan on
Discovery started
[CHG] Controller DC:A6:32:BD:79:D5 Discovering: yes
[NEW] Device 6B:03:1B:A4:12:E3 6B-03-1B-A4-12-E3
[NEW] Device 12:B4:A4:E2:05:F4 12-B4-A4-E2-05-F4
[NEW] Device C0:CC:BB:AA:AA:AA STLB250
```

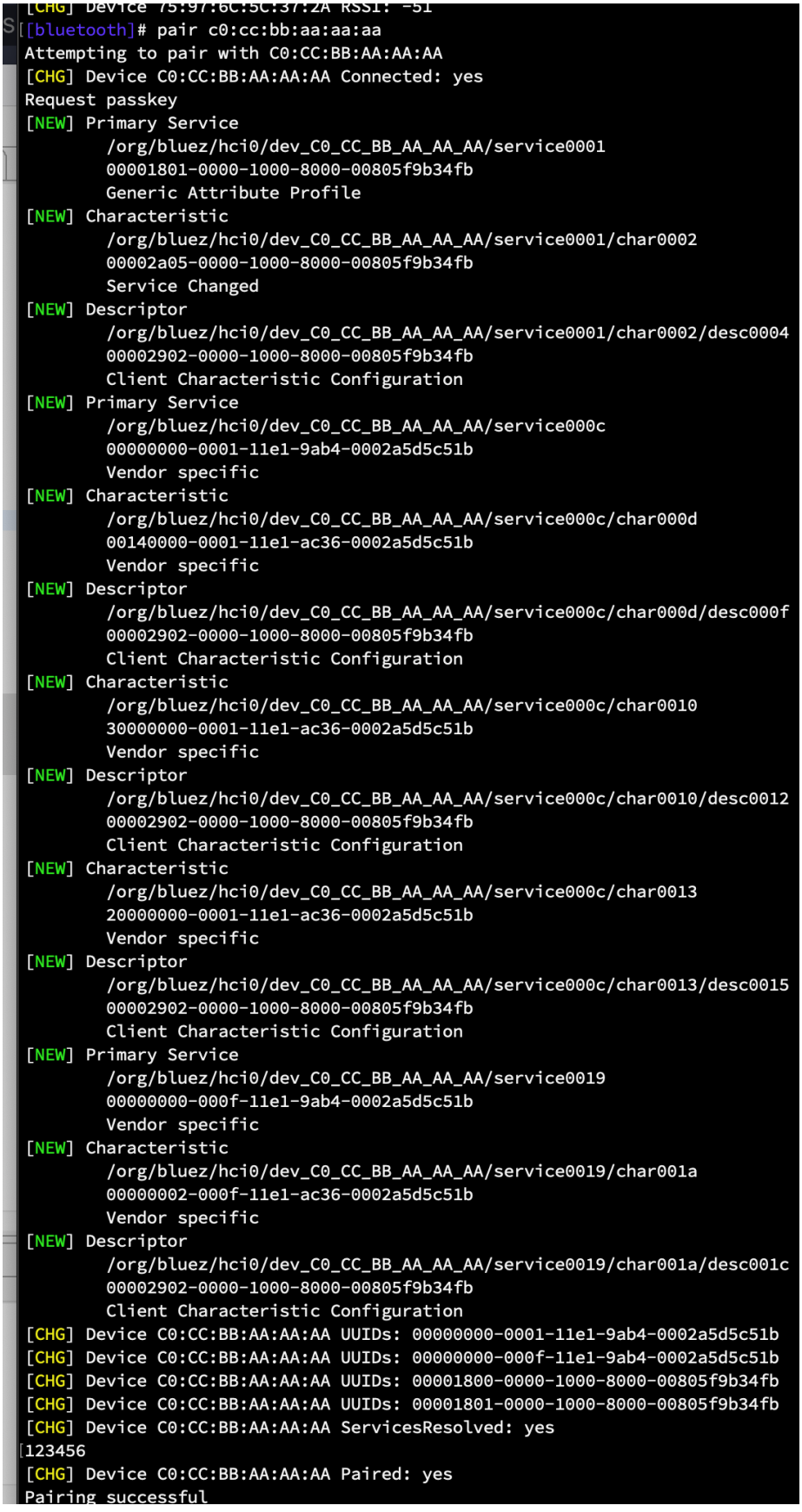
3. Next type “info c0:cc:bb:aa:aa:aa” to get BLE related information about the SensorTile. Here we can see that the SensorTile, named STLB250, is neither paired nor connected.

```
[[bluetooth]# info c0:cc:bb:aa:aa:aa
Device C0:CC:BB:AA:AA:AA (random)
        Name: STLB250
        Alias: STLB250
        Paired: no
        Trusted: no
        Blocked: no
        Connected: no
        LegacyPairing: no
        ManufacturerData Key: 0x0201
        ManufacturerData Value:
  20 f4 00 00 c0 cc bb aa aa aa
        RSSI: -63
        TxPower: 0
```

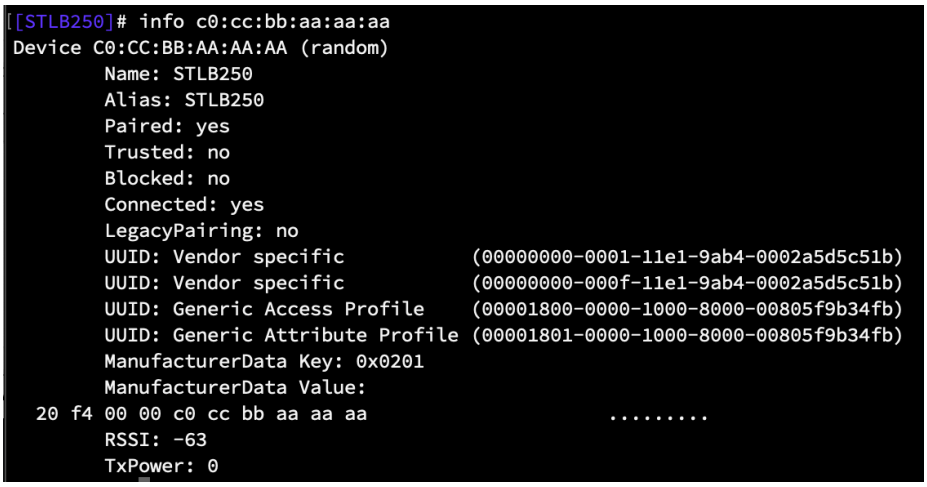
4. Next in order to pair the SensorTile with your Linux device type “pair c0:cc:bb:aa:aa:aa”

```
[[bluetooth]# pair c0:cc:bb:aa:aa:aa
Attempting to pair with C0:CC:BB:AA:AA:AA
[CHG] Device C0:CC:BB:AA:AA:AA Connected: yes
Request passkey
```

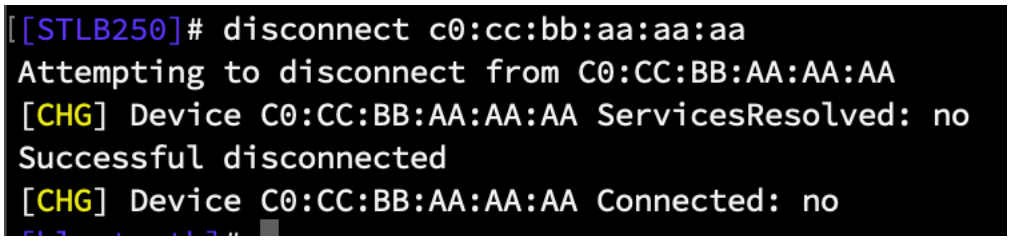
5. You will be prompted for a password. Please enter the password “123456”. Upon successful pairing you will the BLE device’s services, descriptors and characteristics listed along with the confirmation “pairing successful.”



6. Now if you type “info c0:cc:bb:aa:aa:aa” you will see that the device is both paired and connected.



7. Now we must disconnect from the device so that we connect to it via gatttool. Type “disconnect c0:cc:bb:aa:aa:aa” and you should receive a confirmation that you’ve disconnected.



8. Next exit bluetoothctl by typing “exit”.

9. On your BLE client device connect to the SensorTile’s mac address which is **c0:cc:bb:aa:aa:aa**.

10. To read data from the distance sensor you can issue the following command: **char-read-hnd 000e**. The last two bytes returned will be the distance in little endian order. So, for example, in the below screenshot you have a distance of 0x0102 which is 258 millimeters when converted to decimal.

11. To stream distance sensor data over BLE you will need to modify the characteristic value of handle 0x000f as seen below. You can write 0100 to turn the stream on and 000 to turn it off.

```
[[aa:aa:aa:dd:ee:ff][LE]> char-write-req 000f 0100
Characteristic value was written successfully
Notification handle = 0x000e value: 77 d3 4c 90 01 00 02 01
Notification handle = 0x000e value: 84 d3 4b 90 01 00 02 01
Notification handle = 0x000e value: 91 d3 52 90 01 00 02 01
Notification handle = 0x000e value: 9e d3 46 90 01 00 02 01
Notification handle = 0x000e value: ab d3 43 90 01 00 02 01
Notification handle = 0x000e value: b8 d3 48 90 01 00 02 01
Notification handle = 0x000e value: c5 d3 49 90 01 00 02 01
Notification handle = 0x000e value: d2 d3 4e 90 01 00 02 01
Notification handle = 0x000e value: df d3 4a 90 01 00 02 01
Notification handle = 0x000e value: ec d3 4c 90 01 00 02 01
Notification handle = 0x000e value: f9 d3 4a 90 01 00 02 01
Notification handle = 0x000e value: 06 d4 48 90 01 00 02 01
Notification handle = 0x000e value: 13 d4 49 90 01 00 02 01
Notification handle = 0x000e value: 20 d4 4b 90 01 00 02 01
Notification handle = 0x000e value: 2d d4 43 90 01 00 02 01
Notification handle = 0x000e value: 3a d4 4a 90 01 00 02 01
Notification handle = 0x000e value: 47 d4 49 90 01 00 02 01
Notification handle = 0x000e value: 54 d4 4a 90 01 00 02 01
Notification handle = 0x000e value: 61 d4 47 90 01 00 02 01
Notification handle = 0x000e value: 6e d4 45 90 01 00 02 01
[[aa:aa:aa:dd:ee:ff][LE]> char-write-req 000f 0000
Notification handle = 0x000e value: 7b d4 46 90 01 00 02 01
Characteristic value was written successfully
[aa:aa:aa:dd:ee:ff][LE]>
```

12. The haptic feedback can be controlled by modifying the characteristic value of handle 0x0012. This can take one of the following values. When you change the characteristic value, the haptic motor will give a vibration pattern unique to each hand movement.

Characteristic Value	Hand Movement
0000	Turn off haptic feedback
0100	Move hand right
0200	Move hand left
0300	Move hand up
0400	Move hand down
0500	Move hand forward
0600	Move hand backward

```
[[aa:aa:aa:dd:ee:ff][LE]> char-write-req 0012 0100
Characteristic value was written successfully
[[aa:aa:aa:dd:ee:ff][LE]> char-write-req 0012 0400
Characteristic value was written successfully
[[aa:aa:aa:dd:ee:ff][LE]> char-write-req 0012 0000
Characteristic value was written successfully
[aa:aa:aa:dd:ee:ff][LE]>
```

13. If you want to see what the current characteristic value is for the haptic feedback handle you can issue the following command: **char-read-hnd 0012**. You will receive the current characteristic value returned in little endian format.

```
[[aa:aa:aa:dd:ee:ff][LE]> char-write-req 0012 0100
Characteristic value was written successfully
[[aa:aa:aa:dd:ee:ff][LE]> char-read-hnd 0012
Characteristic value/descriptor: 01 00
```