Enabling Python on the Sentrius BT510 Sensor

The Canvas Firmware has been ported to the Sentrius BT510 Sensor. This guide describes the steps required to program a Sentrius BT510 sensor with the python-capable Canvas Firmware for rapid application development.

BT510 Canvas Firmware

Canvas Firmware is required to run the BT510 Tilt demo. Canvas firmware can be found at https://github.com/Ezurio/canvas_python_firmware.

Programming the Canvas Firmware Image onto the BT510 Sensor

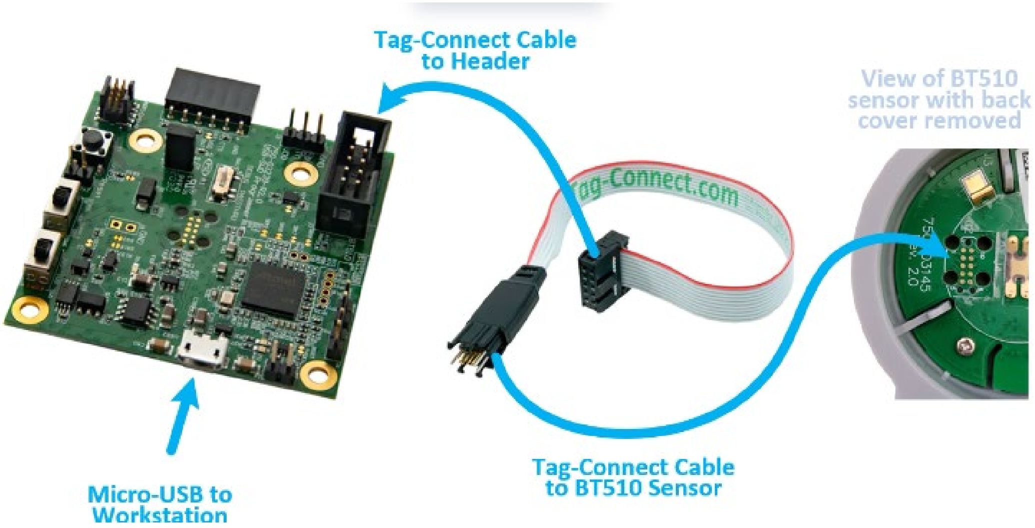
The BT510 sensor can be programmed and interacted with via UART using the Ezurio USB-SWD Programming Kit.

USB-SWD Programmer Kit
Laird
CONNECTIVITY
To get started with the USB-SWD programmer, visit:
www.lairdconnect.com/usb-swd-programmer
Laird
CONNECTIVITY

453-00062-K1 - USB-SWD Programming Kit

Here are the general steps required to program a firmware image .hex file on the BT510:

1. Install Python 3.11.6 (Newer versions of Python may not work with this demo)
2. Install or update pip if not installed (usually pip is automatically installed with Python)
3. Install **pyocd** (using pip)
4. Attach the Ezurio USB-SWD Kit to your workstation and attach the Tag-Connect cable to the back of the BT510 sensor.


Tag-Connect Cable to Header
View of BT510 sensor with back cover removed
Tag-Connect.com
Tag-Connect Cable to BT510 Sensor
Micro-USB to Workstation

5. **Make sure the SW5 switch is in the 3V3 position**
6. Ensure you are in the folder containing the firmware `.hex` file and open a command prompt in that folder. Use `pyocd` to program the .hex file of your choice onto the BT510. This example uses the version of firmware that keeps the UART enabled for development purposes.

   ```
   pyocd flash -t nrf52840 -e chip build.bt510_2.0.0.1739402471_merged.hex
   ```

7. Identify the serial/COM/UART/TTY port associated with your USB-SWD kit and open it in a serial terminal using **115200 baud, 8N1** for serial port settings.
8. Reset the BT510 by issuing the following command with pyocd

   ```
   pyocd reset -t nrf52840
   ```

9. If you see a prompt containing **>>>**, your BT510 sensor is now running python!
10. Follow the next sections to use the python REPL and/or install python scripts on to the BT510.

Using the Python REPL on the BT510 Sensor

Attaching the serial port of the BT510 to a serial terminal application on your workstation provides access to the python “Read-Eval-Print-Loop” or **REPL** interface console. This prompt is typically seen as three greater-than signs:

```
>>>
```

At this prompt, you can enter python code directly and it will be evaluated by the on-device python interpreter. For example, as a quick test, you can type the following to demonstrate printing to the console from within a python application:

```
>>> print('Hello, World!')
Hello, World!
>>>
```

From this interface, you can also perform filesystem operations and have access to many APIs for operating the underlying BT510 Sensor hardware.

Updating Python Scripts on the BT510 Sensor

Using the Xbit VS Code Extension

To program a python script (such as the **tiltad script** below) onto the attached BT510, drag and drop the python source code file onto the device in the **USB DEVICES** panel of the Xbit VS Code extension. After the file is transferred and shows up in the tree view, right click and select **Rename File** and name the file `main.py`.

At this point, the drag-and-dropped python script has been written to the attached BT510 Sensor device as a file in its filesystem named `main.py`. This is a special filename that the python engine is configured to automatically run after reset if it exists in the filesystem.

To start the BT510 Sensor running the newly downloaded python script, **reset** the device by its power supply or type **Ctrl+D** into the REPL console.

```
BT510 tilt sensor script 1.5.0
------------------------------
          BLE Name: BT510-99
Reporting Interval: 100ms
Press ctrl-c within 15 seconds to access the REPL and cancel low power mode
Entering low power mode, UART REPL will turn off in 20 seconds...
```

NOTE: You have 15 seconds to press CTRL+C on the REPL console to keep the UART awake for development or interacting with the BT510, otherwise the script will put the UART peripheral in sleep mode to reduce power consumption (better low power mode for use when powered by the coin cell battery) making the REPL unavailable.

BT510 Sensor Python Scripts

The “tiltad” Application Script

The tiltad python script can be found in the Canvas Python Samples repository:

https://github.com/Ezurio/canvas_python_samples

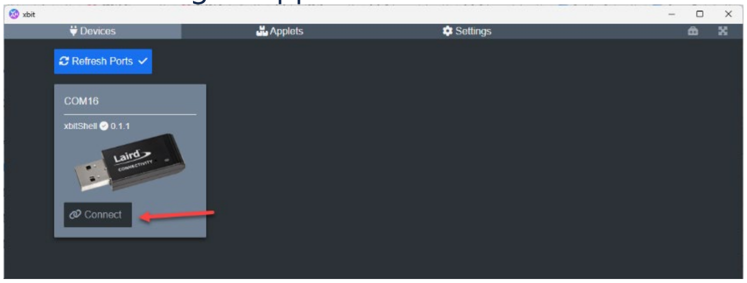
The `tiltad.py` script provides a simple periodic read of accelerometer axis data and reporting in standard Bluetooth Low Energy advertisement packets. When programmed as the `main.py` on a BT510 sensor, this script loops infinitely, waking up every 100ms to read accelerometer axis data and update the data in the BLE advertisement.

Viewing the BT510 Tilt Sensor Data

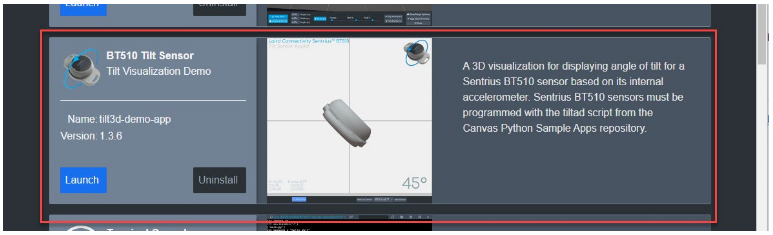
The Canvas Xbit Desktop tool includes a BT510 Tilt Sensor Applet designed to display the tilt of a BT510 provided by the BLE advertisements from the **tiltad** python script running on a BT510.

NOTE: These instructions assume you have already programmed a BL654 USB adapter (**Part #: 451-00004) with the Canvas Firmware image running the xbit_usb python script.

Open the serial port associated with your BL654 USB Adapter from within the Xbit Desktop tool. If the FW and `xbit_usb` script were properly loaded it will appear as shown below in the Xbit for Desktop app. Be sure to **click** “**Connect**” to select the device before moving to Applets screen.



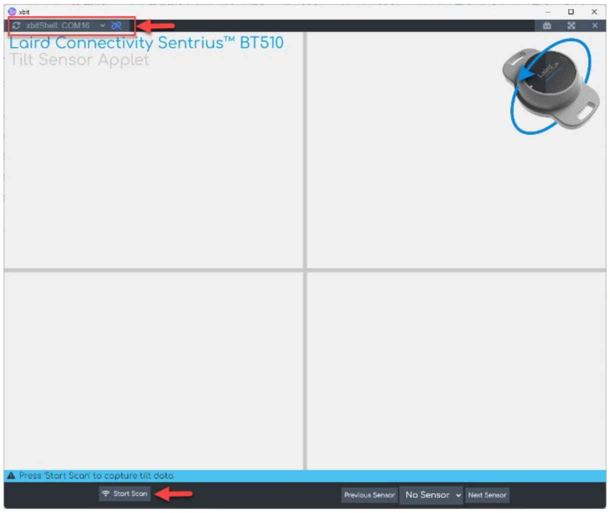
Next, start the BT510 Tilt Sensor Applet. Navigate to the **Applets** tab. Click the **Install** button on the Applet named **BT510 Tilt Sensor**, then **Launch** to launch it.



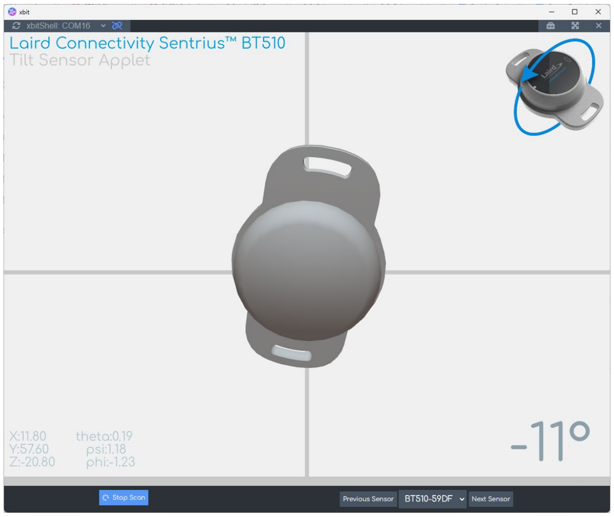
Name: tilt3d-demo-app
Version: 1.3.6

A 3D visualization for displaying angle of tilt for a Sentrius BT510 sensor based on its internal accelerometer. Sentrius BT510 sensors must be programmed with the tiltad script from the Canvas Python Sample Apps repository.

In the Applet, click the **Start Scan** button to begin updating the 3D model of the BT510 based on received BLE advertisement data. As the BT510 sensor orientation changes, the 3D model in the Applet will update to match based on the data from its internal accelerometer.



Press 'Start Scan' to capture tilt data



X:11.80
Y:57.60
Z:-20.80

theta:0.19
psi:1.18
phi:-1.23