

Session 4 Lab 5: Accelerometer data collection from embedded target

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1 Installation for the RF Things board

1.1 Arduino IDE

Download and install Arduino IDE 1.8.13 from <https://www.arduino.cc/en/software>.

Install the support package for the Lacuna LS-200 board with an STM32L4 microcontroller:

- Open the *Preferences* panel from the *File* menu.
- Add the following URL to the *Additional Boards Manager URLs*:
https://github.com/piernov/arduino-STM32L4/releases/download/0.0.28-lacuna-9p1/package_STM32L4_Lacuna_boards_index.json
- Open the *Board Manager* from the *Tools* → *Board:* menu.
- Search for *STM32L4*.
- Select and install *STM32L4 Boards (Lacuna)* (version 0.0.28-lacuna-9p1).

1.1.1 Linux only

Place the udev rules file `stm32dfu.udev.rules` (from Moodle) in `/etc/udev/rules.d`, then reload udev rules:

```
sudo mv ~/Downloads/stm32dfu.udev.rules /etc/udev/rules.d/  
sudo udevadm control --reload  
sudo udevadm trigger
```

1.1.2 Windows only

- Download Zadig at <https://zadig.akeo.ie/> and execute it.
- Put the board in bootloader mode (see Appendix A).
- Select STM32 BOOTLOADER in the list.
- Make sure WinUSB driver is selected.
- Click Install Driver.
- Wait for it to finish.

1.2 MicroAI GUI

Ubuntu: install the package `microai-gui_0.1.1-1_amd64.deb` (from Moodle).

Windows: extract the package `microai-gui_0.1.1_win32.zip` (from Moodle).

1.3 Serial bridge

The serial bridge `serial_client.py` (from Moodle) requires Python 3 (3.6 or newer) and the `pyserial` library.

Ubuntu: install the `python3-serial` package.

Windows: install Python 3.9 from <https://www.python.org/downloads/> and type `python -m pip install pyserial` in a PowerShell prompt.

2 Deploy the Arduino sketch onto the board

- Open the *S5Lab1* sketch from the *S5Lab1* directory (from Moodle) with the Arduino IDE.
- In the *Tools* → *Boards* menu, select the *STM32L4 (Lacuna)* → *Lacuna-LS200* board.
- In the *Tools* → *Port* menu, select the serial port corresponding to the *Lacuna-LS200* board.
- Click on the right arrow in the toolbar to compile and deploy the sketch.
- After deployment, open the *Serial Monitor* from the *Tools* menu to confirm that the board is communicating.
- If some data is being received, close the *Serial Monitor*.

3 Collect and label data inside MicroAI GUI

- Open MicroAI GUI from the application menu under Ubuntu or by running the executable on Windows.
- Open a Terminal and run the `serial_client.py` script. You can pass the appropriate serial port as a parameter, such as `COM4` on Windows (check in Device Manager).
- Click on *Start* at the bottom of the MicroAI GUI window. The accelerometer graph should start displaying realtime acceleration data.
- Capture some data and click on *Stop* once done.
- Hold the *Shift* key and drag with middle click (or hold *Ctrl+Shift* and drag with right click) across the accelerometer graph to select a range of data.
- Click on *Label* and select *Positive* to mark positively labeled data. Every unlabelled data is assumed to be negative.
- Once all positive data has been labeled, click *Save* and enter a filename.
- Data will be exported as `x_<filename>.csv` and `y_<filename>.csv` in the directory it is executed from or the home directory.

Warning: the current revision of the board has a hardware issue that will cause the communication to crash very often. The serial bridge should recover automatically, but you will see a lot of incorrect data. Please do your best to capture the data and label positively appropriately.

A Bootloader/DFU mode

Bootloader or DFU mode is a special mode of the USB controller inside the STM32 microcontroller that allows reflashing a firmware (even if the current firmware is corrupt).

To put the board into bootloader mode:

- Unplug the USB cable.
- Press and hold the *BOOT* button next to the microUSB port.
- Plug the USB cable in.
- The board should now be recognized as *STM Device in DFU Mode* or *STM32 BOOTLOADER*

B Common issues

B.1 Cannot open DFU device 0483:df11 (Windows)

See Section 1.1.2

B.2 dfu-util: File not found (Linux)

Install the 32-bit glibc to run 32-bit binary. The package is called `libc6-i386` on Ubuntu.

B.3 Board goes into bootloader mode but the countdown goes all the way up to 10 and fails. (Linux)

Run:

```
~/ .arduino15/packages/lacunaspace/hardware/stm32l4/0.0.28-lacuna-9/tools/linux/dfu-util -l
```

If there is a permission error, see Section 1.1.1.

B.4 Permission denied while trying to open `/dev/ttyACM0` (Linux)

Add your user to the `dialout` (or `uucp` on some distributions) group to obtain permissions for the serial port:

```
sudo usermod -G dialout -a $(whoami)
```

You need to log out and log back in after joining a group.

B.5 Input/output error, Port not found, `acm_port_activate - usb_submit_urb(ctrl irq)` failed (Linux)

If deployment fails with an error such as `Error opening serial port '/dev/ttyACM0'. (Port not found)`, opening a terminal to the port fails with `Input/output error` and the kernel log (`dmesg`) shows an error similar to `cdc_acm 1-5.3:1.0: acm_port_activate - usb_submit_urb(ctrl irq) failed`, you may be hit by a bug introduced in recent kernel releases (from April 7, 2021 to April 27, 2021). Please upgrade to the latest release (from April 28, 2021 onwards).

B.6 Deployment fails for another reason

You can try to put the board in bootloader mode (see Appendix A) and deploy again.