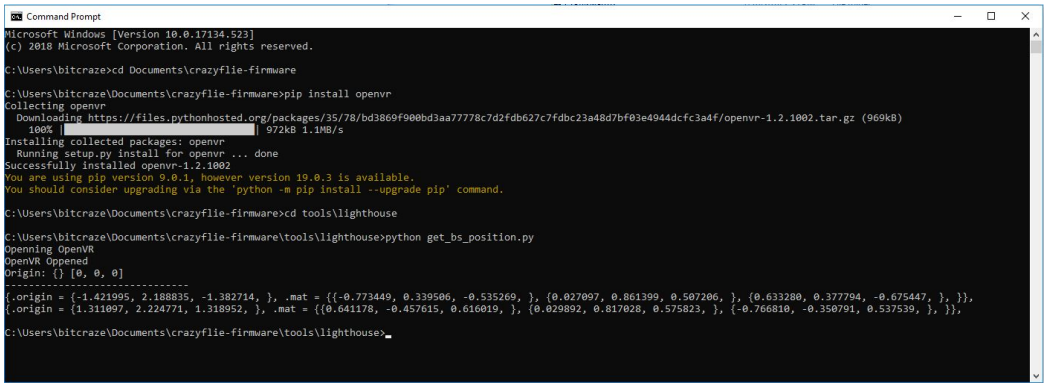
Setup

Bitcraze explanation: https://wiki.bitcraze.io/doc:lighthouse:setup

- Mount base stations in opposite corners of the flight space, angled ~30-40 degrees down at least 2 meters apart.
    - Set one base station to mode *b* and one to *c* by clicking the button on the back. Both stations should display a solid green light when working.
- Connect USB, power and video to computer and HMD through the Vive link box
    - Mini-HDMI-adapter for the Lenovo is found on the HDMI cable in the Vive box
- Launch SteamVR and make sure both base stations and HMD are solid green and tracking. The HMD must be set up as an extended display in Windows display settings.
- Position the HMD at the desired origin of the space. The X-axis of the space will be facing forward out of the HMD, and the origin will be ~40 cm above the HMD. Raise the display ~1.5-2 cm to align the Z-axis correctly.

- Open SteamVR settings -> developer
    - Hit quick calibrate to set the coordinate system.
    - Ensure the system is working correctly by opening Room Overview and moving the headset/controllers about.
    - Keep SteamVR running for the upcoming script
- Open directory *C:\drones*
- Short version of compiling:
    - Open cygwin with the shortcut (or navigate to */cygdrive/c/drones* manually)
    - Run *bash setup.sh* (with SteamVR running)
    - As soon as *"make: Går till…"* has been printed, close SteamVR to speed up compilation
- Long version of compiling:
    - Clone crazyflie-firmware from bitcraze's github https://github.com/bitcraze/crazyflie-firmware

        - Ensure the required submodules are installed by running clone recursively or
            - *git submodule init*
            - *git submodule update*
    - Navigate to *crazyflie-firmware/tools/lighthouse*
    - Run the following python script (requires SteamVR running):
        - `python3 get_bs_position.py`
    - The python script will give you the position of the base stations. Copy the two lines of coordinates starting with {.origin = …. , see figure below



    - Close SteamVR
    - Open the file *crazyflie-firmware/src/deck/drivers/src/lighthouse.c*
        - Paste the new coordinates and rotations in place of the old ones
        - Comment the line #define DISABLE_LIGHTHOUSE_DRIVER if that is not already done. See picture below

> **Note**: If you have a setup without HMD and you want to set the origin of the space on the floor, you can open the get_bs_position.py script and modify the top of it to set "CENTER_AROUND_CONTROLLER = True". Be aware that this will put the SteamVR and your space out of sync, so none of the example using the SteamVR coordinate will work correctly.

Copy the last two lines and, on the computer or virtual machine you use for Crazyflie development, past them in the file 'src/deck/drivers/src/lighthouse.c'. It should replace the content of *baseStationsGeometry[]* and the line "#define DISABLE_LIGHTHOUSE_DRIVER" should be commented to enable the driver:

```
55  // #define DISABLE_LIGHTHOUSE_DRIVER
56
57  baseStationGeometry_t baseStationsGeometry[] = {
58  {.origin = {-1.421995, 2.188835, -1.382714, }, .mat = {{-0.773449, 0.339506, -0.535269, }, {0.027097, 0.861399, 0.507206, }, {0.633280, 0.377794, -0.675447, }, }},
59  {.origin = {1.311097, 2.224771, 1.318952, }, .mat = {{0.641178, -0.457615, 0.616019, }, {0.029892, 0.817028, 0.575823, }, {-0.766810, -0.350791, 0.537539, }, }},
60  };
```

```
// #ifndef DISABLE_LIGHTHOUSE_DRIVER
//   #define DISABLE_LIGHTHOUSE_DRIVER 1
// #endif

baseStationGeometry_t baseStationsGeometry[] = {
{.origin = {-1.421995, 2.188835, -1.382714, }, .mat = {{-0.773449, 0.339506, -0.535269, }, {0.027097, 0.861399,
{.origin = {1.311097, 2.224771, 1.318952, }, .mat = {{0.641178, -0.457615, 0.616019, }, {0.029892, 0.817028, 0.
};
```

    - Save the file and compile the new firmware by running *make*
        - Full compilation can be done through the bitcraze VM or by following the instructions on https://github.com/bitcraze/crazyflie-firmware
        - This requires that python2 and python3 are available as commands pointing to their respective versions of python.
- Plug in the CrazyRadio (you can unplug the VR kit)
- Launch the Crazyflie Windows Client and upload the compiled file *crazyflie-firmware/cf2.bin* to all drones

    - Start the Crazyflie in bootloader mode by holding the on-switch until the blue light starts to flash (about 1,5 seconds).
    - Enter the current Crazyflie uri (0xE7E7E7E70n for drone n)
    - Through the Crazyflie Client, click Connect -> Bootloader
    - Initiate bootloader cold boot
    - Load the *cf2.bin* and hit program (if this somehow fails, just rerun)
    - Restart in firmware mode once the binary has been uploaded
    - Restart drone again for good measure...
- Test coordinate system using Crazyflie client
    - Align the drone coordinate system to the global one when restarting
    - Connect to drone
    - Go into plotter (enable tab through View-Tabs-LOG/Plotter)
    - Select “Lighthouse” from the drop-down
    - Positions from stateEstimate X Y Z should correspond to global X Y Z.

To start the control software, open PyCharm and run the *GUI* configuration as debug

First time setup

- Install Steam
    - Install SteamVR
- Install python 3.7.X x86 (32 bit)
    - Make a copy of python.exe and name it python3.exe
    - Crazyradio will not work using python 64 bit, make sure environment path points to 32 bit version
    - “which python” should return this directory
- Install python 2.7
    - Add to environment path
    - Make a copy of python.exe and name it python2.exe
- Install cygwin with packages git and make (make sure python does not install)
- Install PIP for python3 installation using get-pip.py
- Install packages through pip:
    - cflib
    - numpy
    - scipy
    - openvr
- Install Zadig from https://zadig.akeo.ie/
- Install radio driver using Zadig
    - Options -> List all devices
    - Choose Crazyradio PA USB Dongle
    - *libusbK* should work, otherwise try *libusb-win32*