UMBC Energy Efficient High Performance Computing Lab

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*The following guide is a detail regarding the main general guide of “Getting started with the lighthouse system”:
https://www.bitcraze.io/documentation/tutorials/getting-started-with-lighthouse/

Hardware Dependencies:

Device(s)	Link(s)
Crazyflie 2.1	https://store.bitcraze.io/collections/kits/products/crazyflie-2-1
Lighthouse Positioning Deck	https://store.bitcraze.io/products/lighthouse-positioning-deck
Crazyradio PA 2.4 GHz USB Dongle	https://store.bitcraze.io/collections/kits/products/crazyradio-pa
Lighthouse V2 base stations	https://store.bitcraze.io/collections/accessories/products/lighthouse-v2-base-station

Software Dependencies:

Name(s)	Instruction(s)
bitcraze/crazyflie-lib-python	https://github.com/bitcraze/crazyflie-lib-python/blob/master/docs/installation/install.md
bitcraze/crazyflie-clients-python	https://github.com/bitcraze/crazyflie-clients-python/blob/master/docs/installation/install.md

python3	https://phoenixnap.com/kb/how-to-install-python-3-ubuntu
pip3	https://www.educative.io/edpresso/installing-pip3-in-ubuntu

Setup:

Ubuntu 21.04 / 20.04.3 LTS

As of writing this manual, the most recent version of Ubuntu is 21.04. It is recommended to use the latest version of Ubuntu while working with the Crazyflie Lighthouse system. There is also the option of a Bitcraze virtual machine with a given installation guide. However, linux works faster and is more reliable compared to the VM.

Python3 & Pip3

Install the most recent version of python using the link provided above. I have worked with python3 and pip3 for most of my package installations and they are more recent compared to python and pip. However, it is not required to install the most recent version of either python or pip using the given links.

Crazyflie Python Library

The demos available for the lighthouse deck are within the python library of crazyflie which can be used to fly the drones in any desired pattern. The library needs to be cloned and installed using the given link above. It is recommended to use the python library examples for the *first time* users of the lighthouse deck. The main example codes that are using the lighthouse are the swarm sequences provided by default.

Crazyflie Clients Python

The installation of this repository is a **must** in order to access the lighthouse tab under the Crazyflie PC Client also known as “cfclient”. When everything is cloned and installed using the link provided (which also prompts you to upgrade python and pip), a terminal would need to be opened from the installation location which then accepts the command “cfclient” for accessing the detailed Crazyflie PC client. Note: crazyradio driver installation is not necessary for linux

systems but the instructions from the crazyflie-python-lib are needed for getting USB permission to work with the **crazyradio PA**.

V2/V1 Base Stations

The base stations are the crucial part of working with the lighthouse decks. The Bitcraze tutorial website explains in detail how to set up the base stations. For V1, the "Set BS Channel" under system management of cf client's Lighthouse Positioning tab is not used. That specific window is only for **V2 base stations**! As mentioned on the website, each V2 BS needs to be connected once to a computer for getting set to appropriate channels and then disconnected. This process does not need to happen every time the V2 BS is turned on. For V1 BS, there is a button on the back which helps to set the channels based on the cables available with the purchased station. Make sure to mount the base stations (V2/V1) on camera stands or walls with the mentioned height and tilt for detection and accuracy. The lights on top of each BS should turn green once they are able to detect each other. Note: There is a distance advantage when using V2 BS in comparison to V1 BS for any trial.

Preparing the Crazyflie

Using the installed cfclient and crazyradio PA, connect to the drone with the lighthouse deck installed on top. The radio needs to be in 2Mbit mode. Using the radio connection, go to the "Connect" and click on "Bootloader" and a new window will open. While connected to the radio, choose the most recent package to flash on the "From release" tab. Then click on "Program" and wait for the drone to be updated along with the lighthouse deck. Now, it is ready for calibration. Go back to the Lighthouse Positioning tab and choose the BS type from "Change system type". If the base stations are ready and set, the drone should start to **receive** sweeping angles from the stations automatically and **calibrate** its location. If both of those have finished and turned green, click on "Manage geometry" and select "Estimate Geometry". Make sure the new BS locations make sense and proceed by choosing "Write to Crazyflie". The 3D view on your current tab should now show the drone as a blue dot in center and base stations as 1 and 2 on either side of the drone. Both **geometry** and **estimator** should now be green. Check the positioning of the drone by moving it around while looking over the 3D view. The drone is now ready to fly! In order to fly the drone, disconnect from the cfclient and on a terminal type the following:

python3 name_of_the_example_program.py

Note: The geometry will need to be set again if the crazyflies have been reset. Also, the code can be run in **Visual Studio** by opening the code and pressing the green arrow on top right of the window.

Probable hardware/software issues:

Base Stations

If the crazyflie detects the base stations at a very close proximity to itself, do **NOT** fly the drone. Make sure the base stations are located at a good distance away from it and keep resetting the geometry until the 3D view shows a good distance from them and the drone. Otherwise, there is a high chance that the drone will crash.

Lighthouse Deck

At some point during the trials, there may be an issue with detecting the sweeping angles. The drone tends to keep resetting by itself when in range of two base stations and M1 LED will blink at a fast pace. There is a manual fix for this issue discussed in the Bitcraze forum. First, turn on the V2/V1 BS and set them to appropriate channels. Then, hide the drone from the base stations and press “change system type” on the lighthouse positioning tab on cfclient. Change the system to V2/V1 and back to V1/V2. This resets the previous geometry calibrations of the Crazyflie and thus there will be no more refreshing when the two base stations are detected! Now, connect to the crazyflie and, if on appropriate BS channels, they will automatically receive and calibrate. All that needs to be done now is setting the geometry to new values and testing the drones.

Additional Information

If additional issues are preventing the drone from flying (lighthouse questions included), please visit the following FAQ for detailed answers:
https://docs.google.com/document/d/19whW8Vf5ssbnM-swZKMQ7Yxf4S9kWOW-Az9zb7Fkilo/edit?usp=sharing