

Notes and Resources for Localization Project

Setting up the Virtual Environment

These are the setup steps I used for running the Test_KF.ipynb notebook.

Creating venv: <https://www.geeksforgeeks.org/creating-python-virtual-environment-windows-linux/>

```
virtualenv -p3.8.6 HIRO_env
```

Activate Virtual Environment

```
Scripts\activate.bat
```

Installing stuff:

```
pip install jupyterlab
```

```
pip install -r requirements.txt
```

```
pip install matplotlib
```

```
pip install torch==1.7.0+cpu torchvision==0.8.1+cpu torchaudio===0.7.0 -f  
https://download.pytorch.org/whl/torch_stable.html
```

Had to change NumPy version to 1.19.3 for it to work on my machine

PyTorch doesn't like Python 3.6.1 or 3.9.1

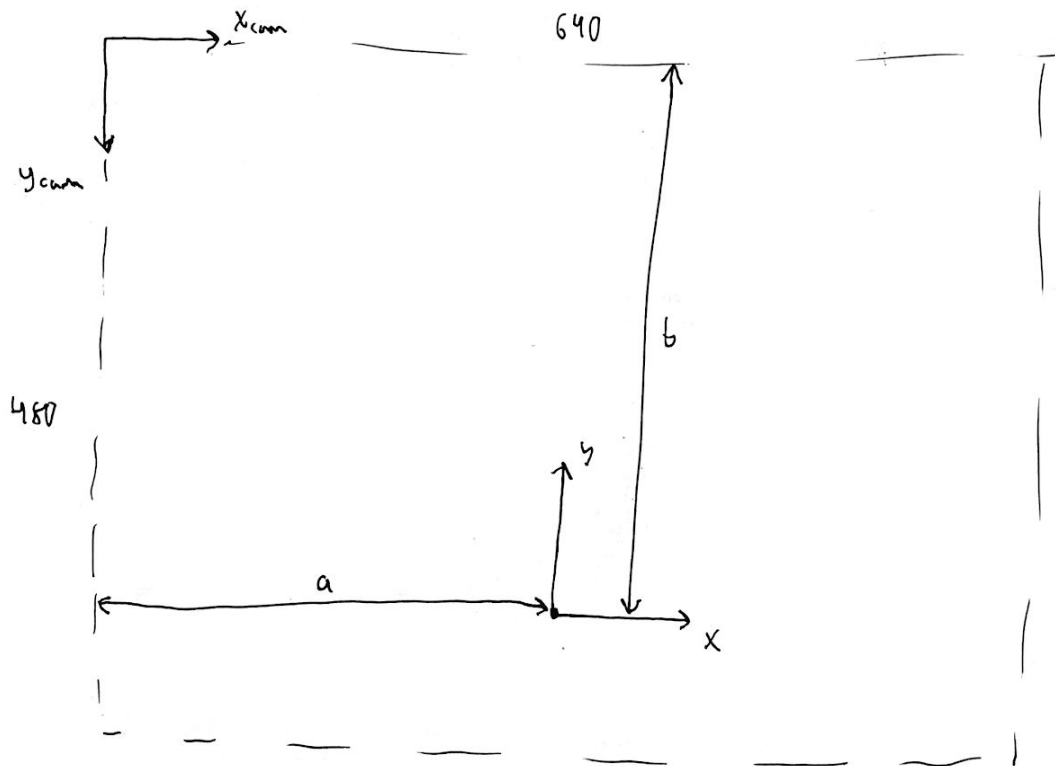
Converting overhead image to x-y location

Take pixel measurements of pictures: <https://www.rapidtables.com/web/tools/pixel-ruler.html>

Some data I collected for the origin location:

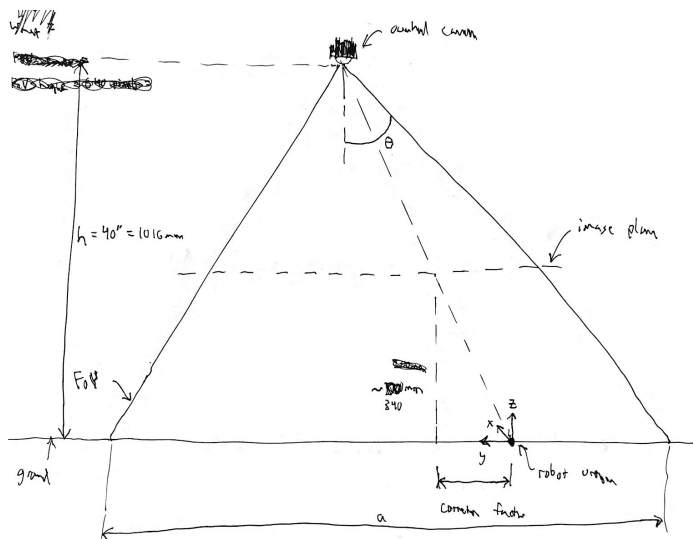
<https://docs.google.com/spreadsheets/d/1oSCYQ1A4CoGlm3wyLa1OCmo6ObQbBwvY5aRJDihNCxE/edit?usp=sharing>

Math for finding origin:



$$(x_{cam}, y_{cam}) \rightarrow (x_{cam} - a, b - y_{cam}) * \text{pix } 2\text{mm}$$

Y-origin correction factor:



$$a = 480 \text{ pixels} = 941.99 \text{ mm}$$

mat dims:

$$\begin{aligned} R &= 452 \text{ pixels} = 889 \text{ mm} \\ W &= 227 \text{ pixels} = 444.5 \text{ mm} \end{aligned} \left. \begin{array}{l} \\ \end{array} \right\} 1.962 \text{ mm/pixel} \text{ on floor}$$

similar triangles:

$$\frac{a/2}{h} = \frac{CF}{340} \rightarrow \frac{471}{1016} = \frac{CF}{340}$$

$$CF = 157.6 \text{ mm} = 80.33 \text{ pixels}$$

I ended up just using the data to approximate correction factors and correct the offsets, but this math is still important

Cameras

Taking multiple pictures at the same time:

<https://stackoverflow.com/questions/21450262/taking-multiple-snapshots-at-the-same-time-in-python-on-rpi>
(didn't use)

Picam

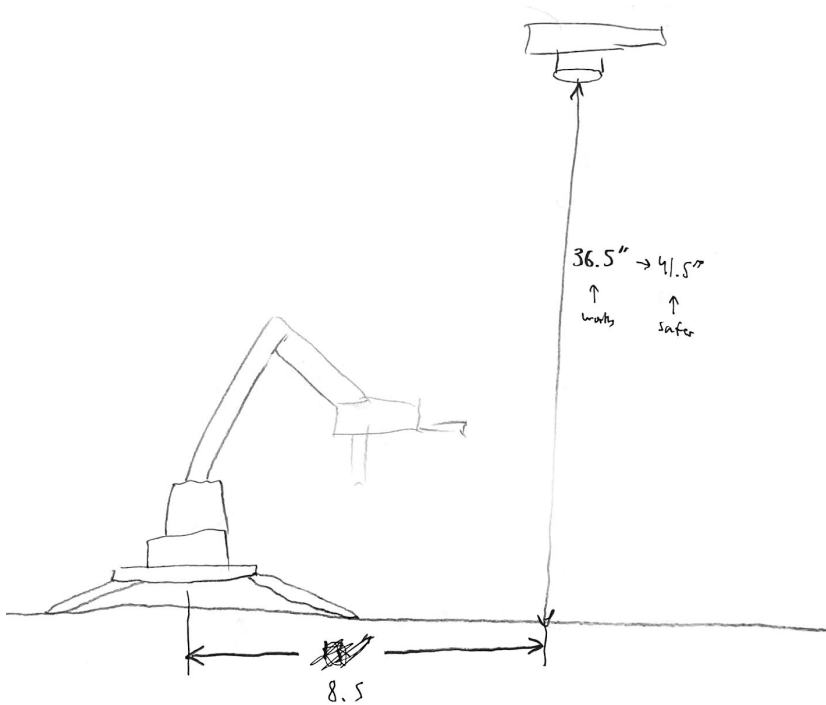
<https://projects.raspberrypi.org/en/projects/getting-started-with-picamera/3>

Pi NOIR is pink: <https://github.com/raspberrypi/firmware/issues/1167> (I set the flag in /boot/config.txt at <https://github.com/raspberrypi/firmware/issues/1167#issuecomment-647499669>)

Webcam (Overhead cam)

<https://www.raspberrypi.org/documentation/usage/webcams/> (doesn't show python code and just pulled from the picam)

<https://medium.com/propelland/raspberry-pi-tutorial-on-using-a-usb-camera-to-display-and-record-videos-with-python-a41c6938f89f>



Height of 41.5" above ground results in a FoV of about 49"x36"

For data collection we used a height of 40"

Installing OpenCV

<https://pimylifeup.com/raspberry-pi-opencv/>

Workspace Mat

Ideas:

- Something artsy:
<https://medium.com/@mishaheesackers/process-ing-generative-irregular-grid-8f0d712dfaa4>
- Irregular grid
- Grid of AprilTags: https://april.eecs.umich.edu/wiki/Camera_suite
- Should be about 32x16
- Where's Waldo

The discrete gradient we used was 17.5"x35"

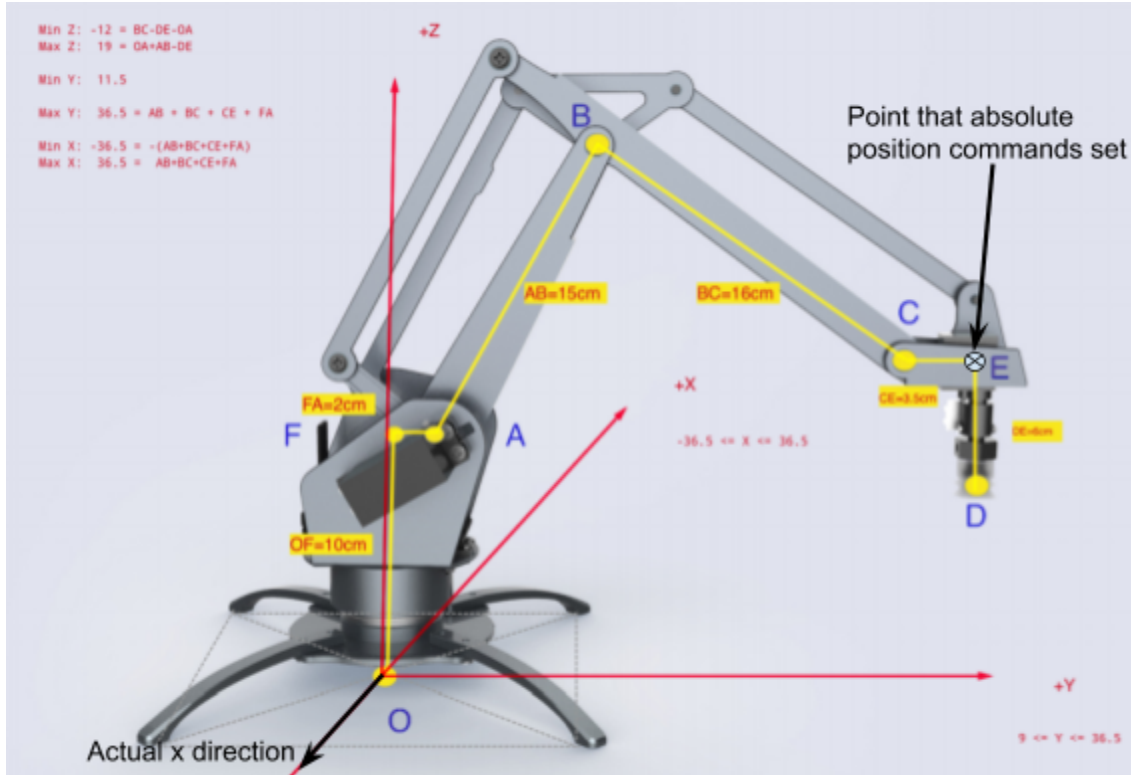
Fiducials

Family of 16h5 resulted in too many false positives so 36h11 was used

I just grabbed image from here: https://berndpfrommer.github.io/tag slam_web/making_tags/

Working with uArm Metal

Frame:



Reset Position: (0, 150, 150)

Pyuarm repo: <https://github.com/uArm-Developer/pyuarm>

Pyuarm Documentation: <https://pyuarm.readthedocs.io/en/dev/index.html>

uArm Metal Documentation: <https://buildmedia.readthedocs.org/media/pdf/uarmdocs/latest/uarmdocs.pdf>

Original firmware: <https://github.com/mgreia/uarm-quickstart>

Mirrors for stuff that's gone: <https://pop.fsck.pl/hardware/uarm.html>