Calibrating the Camera

Please note Images in this file are for representation purposes only.

General image views of USB cameras have a fish-eye view output. However, this is undesirable as it affects the WhyCon coordinates. We need a flat image output from our camera and hence it is necessary to calibrate our USB camera. Notice the difference between Figure 1 and Figure 2. Figure 2 is the desirable image frame we need. (Ignore the RGB to Black and White change. That is not important)

Figure 1. Fish-eye image

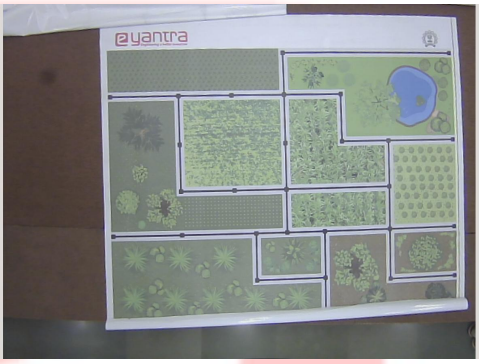

Figure 2. Calibrated image

Camera Calibration Process:

1. You will need a checkerboard board in order to calibrate your camera. Print out the image given on this link. This tutorial uses an 8x6 checkerboard with 108mm squares.
2. You must install the camera calibration package in ROS. Open a terminal and type the following command:

```
>> rosdep install camera_calibration

>> sudo apt-get install ros-kinetic-image-proc
```

3. Once completed, run the following two commands on separate terminals:

```
>> roslaunch usb_cam usb_cam-test.launch

>> rostopic list
```

You should see '/usb_cam/image_raw' and '/usb_cam/camera_info'. If you face any difficulties, refer Camera_testing.pdf of Hardware Testing.

4. Next, run the following command:

```
>> rosrun camera_calibration cameracalibrator.py --size 8x6 --square 0.108
image:=/usb_cam/image_raw camera:=/usb_camostopic list
```

Note: This is one command.

5. You should now see a new window as shown in Figure 3.

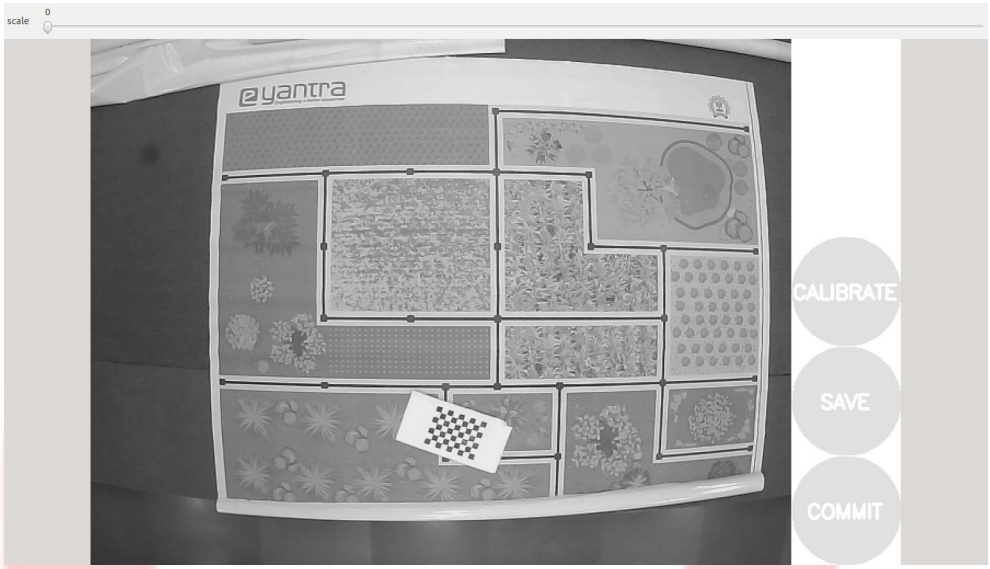

Figure 3. Camera Calibration Window

6. Hold up the checkerboard in front of the camera. A zig-zag line should be displayed on the checkerboard. You must now perform the complete the following calibrations by the completing the given steps:
    - **a.** X axis – Move the checkerboard left to right and right to left.
    - **b.** Y axis – Move the checkerboard top to bottom and bottom to top.
    - **c.** Size – Move the checkerboard close to away and away to close from the camera.
    - **d.** Skew – Tilt the checkerboard in all directions.

The following figures elaborate on this:

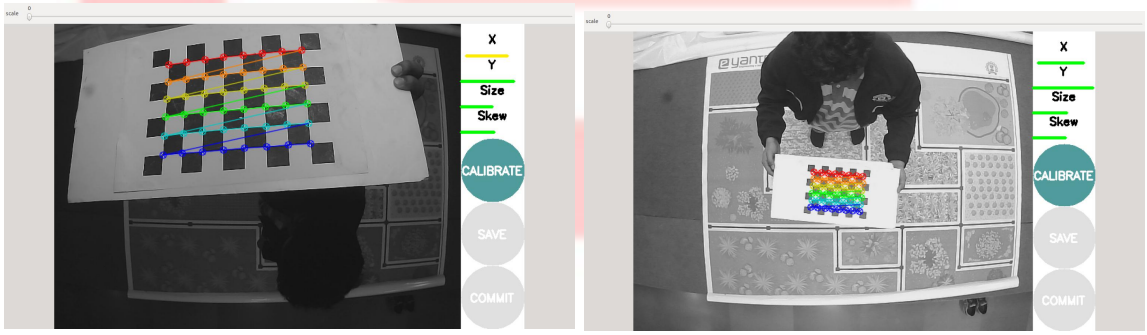

Figure 4. Size Calibration

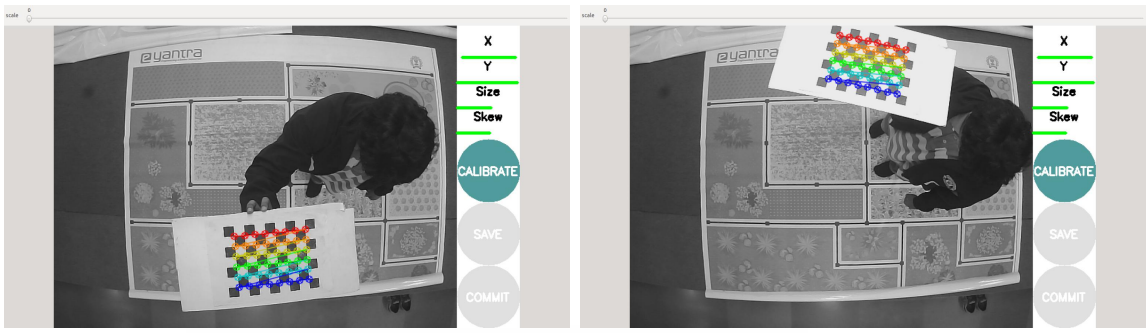

Figure 5. Y axis calibration.

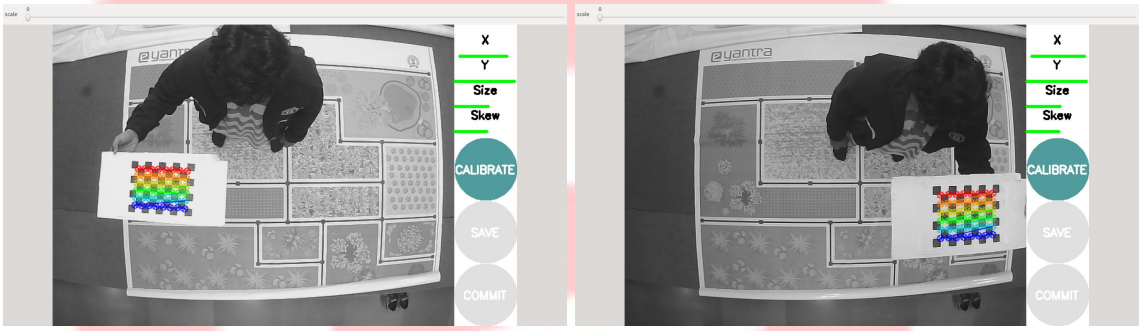

Figure 6. X axis calibration

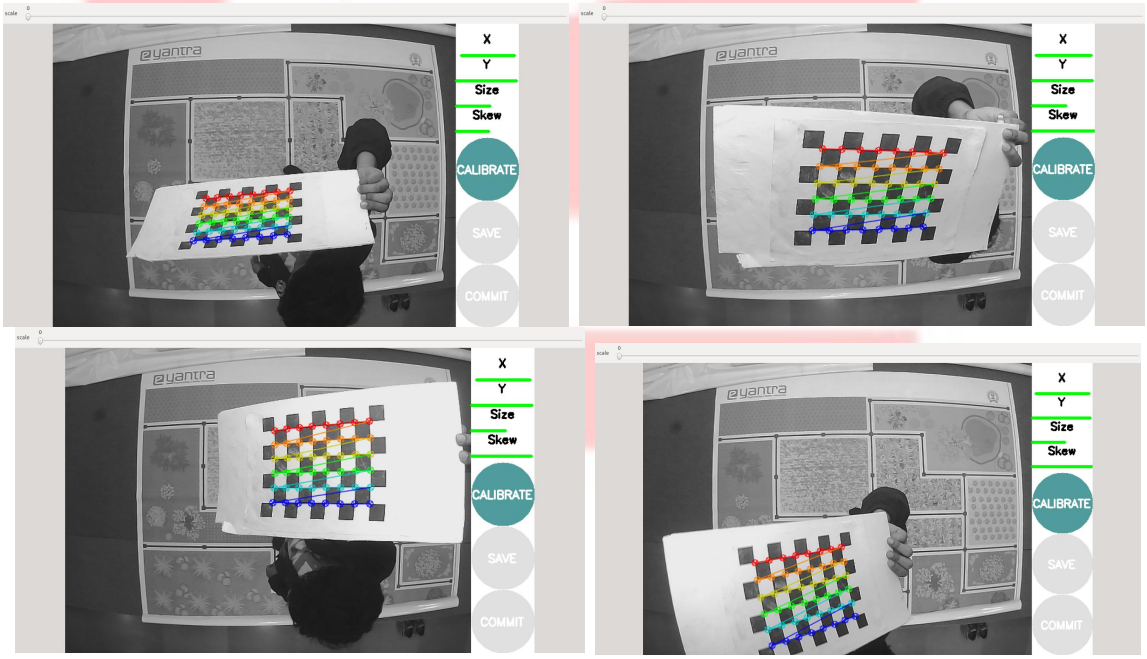

Figure 7. Skew calibration

7. You must perform all these steps until you get all green for X, Y, Size and Skew at the right side. When complete your final progress should look like Figure 8.

Figure 8. Complete calibration

8. When you get green progress for X, Y, Size and Skew, your '**CALIBRATE**' button will be highlighted. Click that button in order to generate the calibration matrix. This might take some time so please wait while it generates the matrix. It might appear your computer has hung, but that is not the case.
9. Once the calibration matrix is generated, the '**SAVE**' and '**COMMIT**' button are highlighted. Hit '**SAVE**' and then '**COMMIT**'. This saves your matrix.

Note: You must ensure the image_proc package is installed. If not, run the following command:

>> `sudo apt install ros-distro-image-proc`

where *distro* is the ROS distribution you are using. Which is `kinetic` in our case.