e-Yantra Robotics Competition (eYRC 2019-20)

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. We need to remove this fish-eye effect to effectively detect beacons (refer the Rulebook) in further tasks. 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 for image processing. (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 in order to calibrate your camera. Print out the image given on this link (This will either download the pdf or view it)..
2. You must install the camera calibration package in ROS. Open a terminal and type the following command (Type the commands):

```
>> rosdep install camera_calibration

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

3. Copy the *usb_cam_SR.launch* file provided to you in the same folder as this document to the *~/catkin_ws/src/survey_and_rescue/launch* directory and then source the .bashrc file by typing following command in a terminal

```
>> source ~/.bashrc
```

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

```
>> roslaunch survey_and_rescue usb_cam_SR.launch


>> rostopic list
```

You should see '/usb_cam/image_raw' and '/usb_cam/camera_info'.

5. Next, run the following command:

```
>> rosrun camera_calibration cameracalibrator.py --size 8x6 --square
0.0245 image:=/camera/image_raw camera:=/camera
```

Note: This is one command.

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

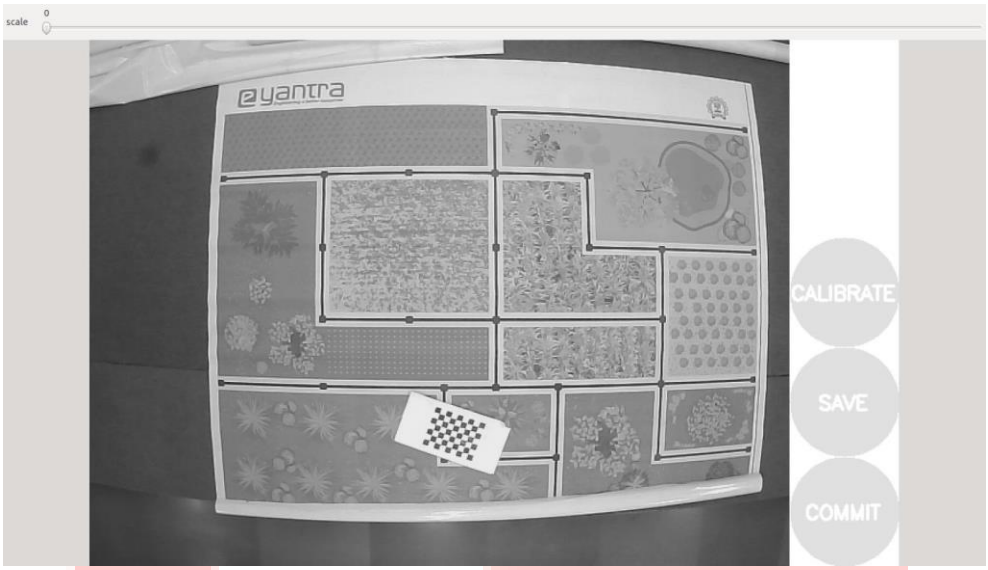
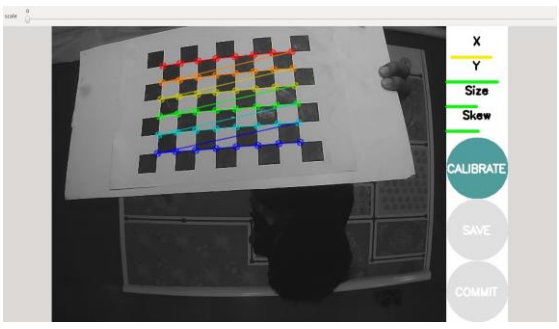


Figure 3. Camera Calibration Window

7. Hold up the checkerboard in front of the camera. A zig-zag line should be displayed on the checkerboard. You must now perform 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

Note: The more sample you take, the better is the output.

The following figures elaborate on this:



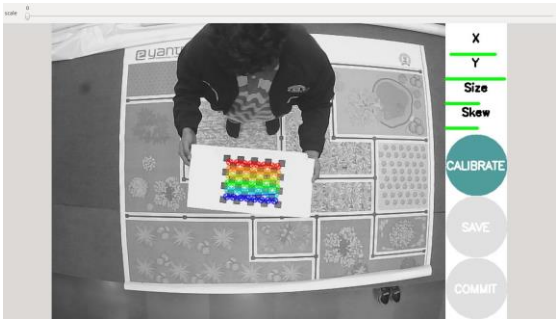


Figure 4. Size Calibration

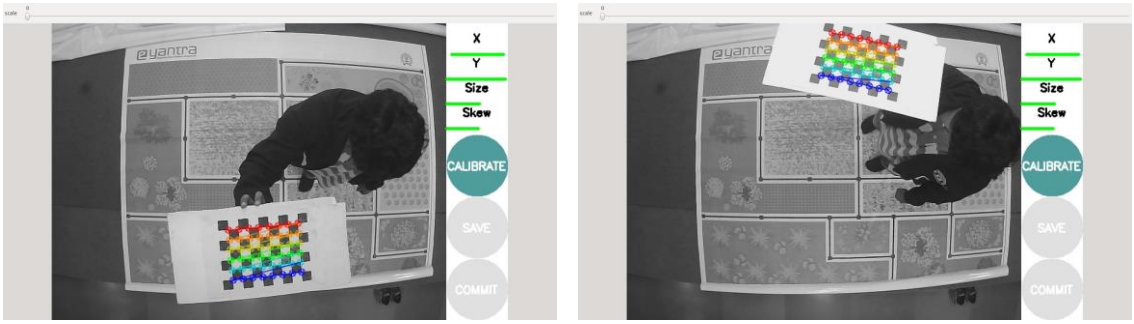


Figure 5. Y axis calibration.

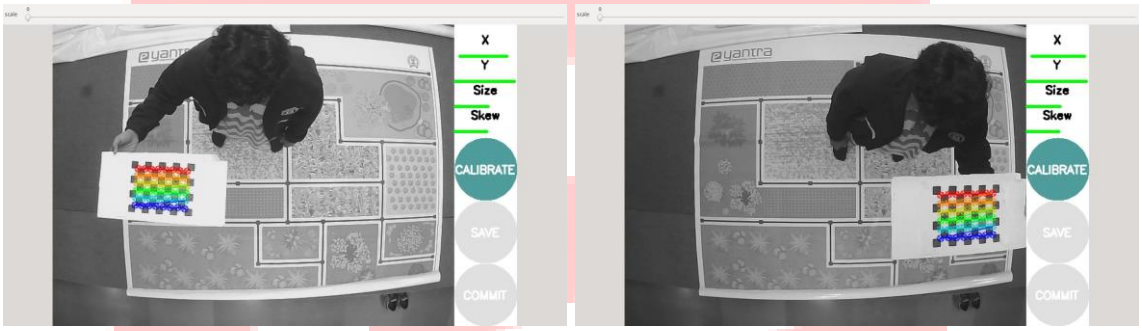


Figure 6. X axis calibration

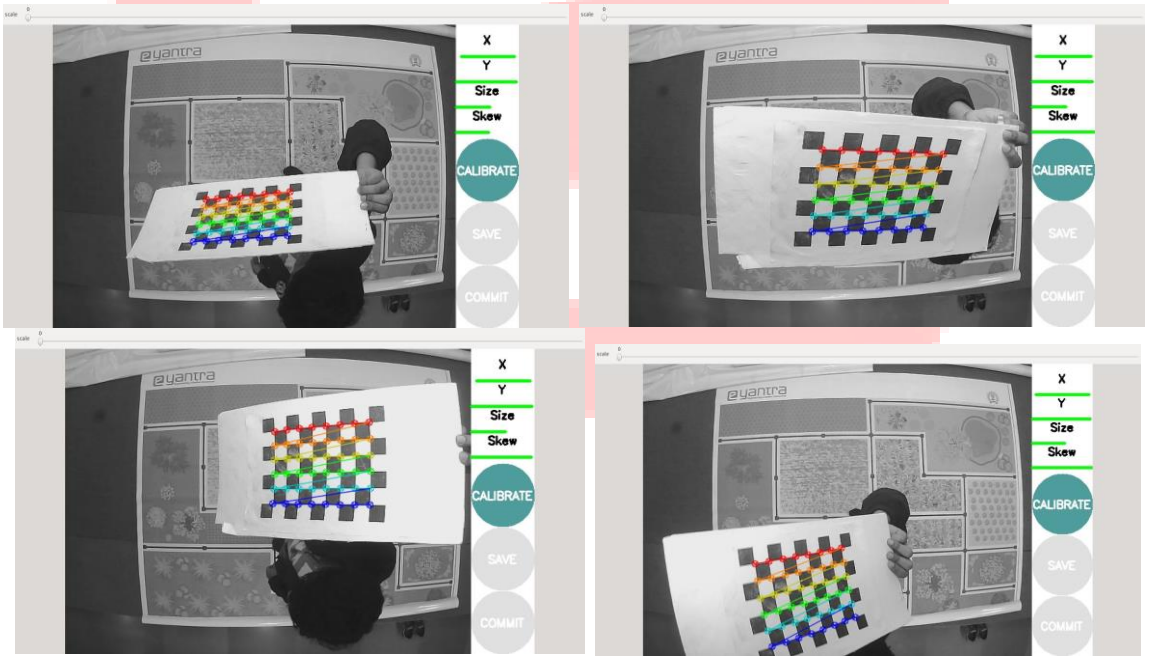


Figure 7. Skew Calibration

8. You must perform all these steps until you get maximum green for X, Y, Size and Skew in both directions on the panel on the right-hand side. When complete, your final progress should look like Figure 8.

Figure 8. Complete Calibration

9. 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.
10. Once the calibration matrix is generated, the '**SAVE**' and '**COMMIT**' button are highlighted. Hit '**SAVE**' and then '**COMMIT**'. This saves your matrix.