Task 3 – Chaser Drone

Calibrating the Camera and Drone

Camera Calibration:

Output of USB cameras have a fish-eye effect. However, this is undesirable as it affects the Whycon coordinates. We need a flat image output from the USB camera and hence it is necessary to calibrate the USB camera. Notice the difference between Figure 1 and Figure 2. Figure 2 is the desirable image frame we need.

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 in checkerboard.pdf. 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 commands:

   rosdep install camera_calibration
   sudo apt-get install ros-indigo-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 in another terminal:

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

   Note: This is one command.

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

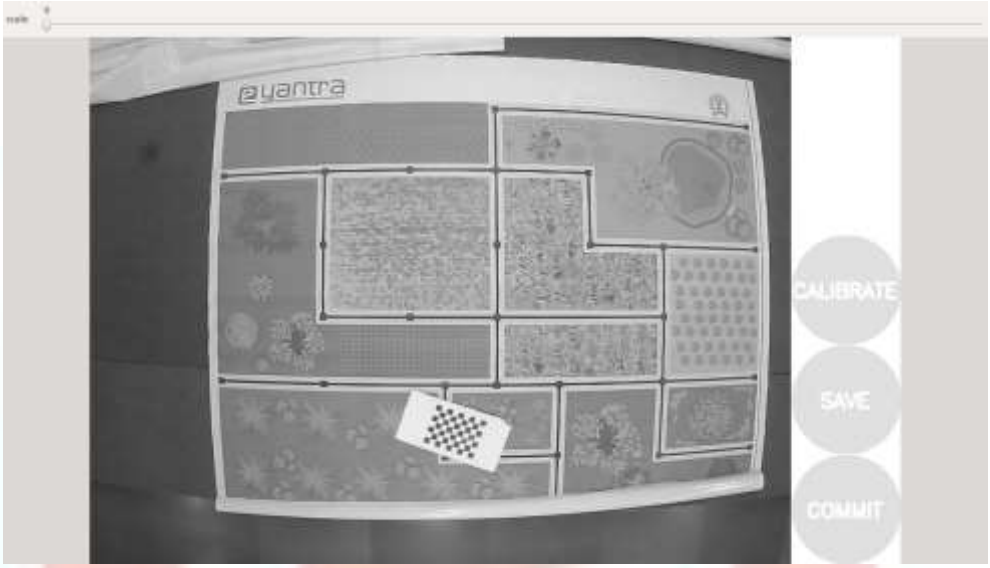

Figure 3: Camera Calibration Window

6. Hold up the checkerboard in front of the camera. A zig-zag line should be displayed on the checkerboard. You must now complete the following calibrations using 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

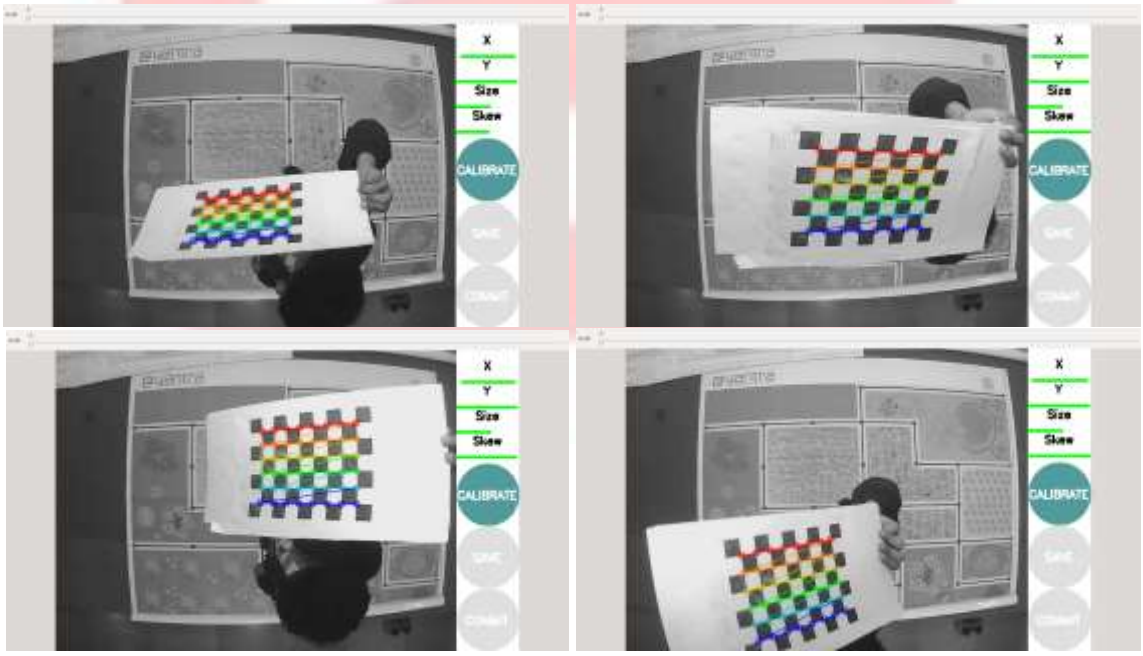

Figure 7: Skew calibration

7. You must perform all these steps until you get all green for X, Y, Size and Skew at the right side as shown in Figure 8.

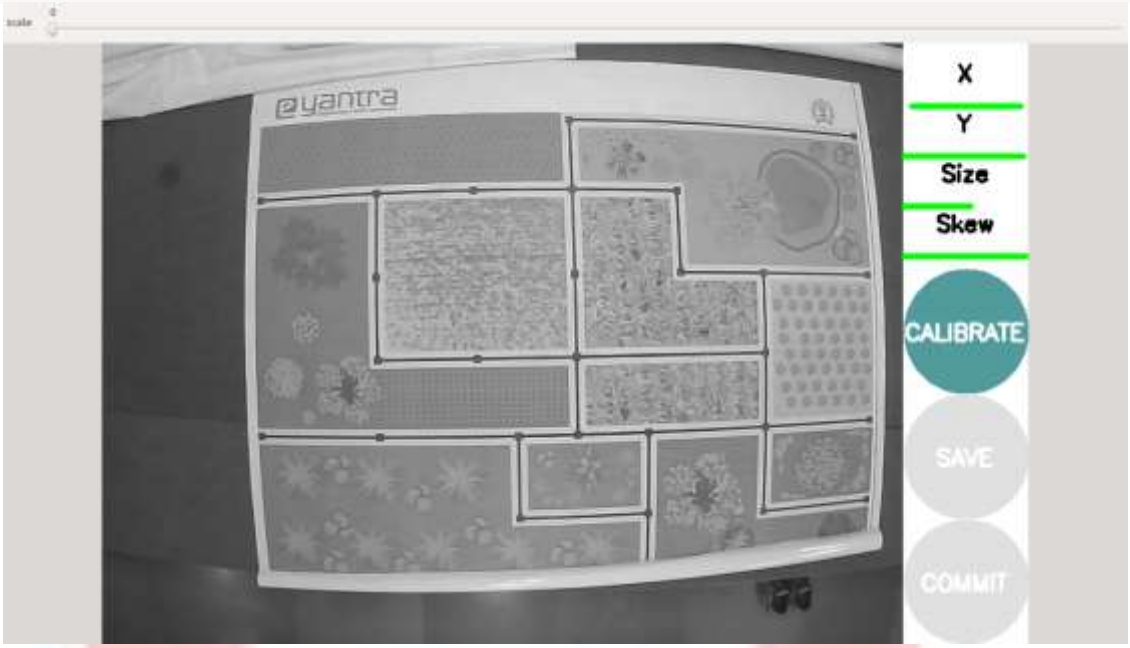

Figure 8: Calibration Complete

8. Perform the above process till 'CALIBRATE' button is highlighted. Once 'CALIBRATE' button is highlighted, click the button in order to calibrate the camera. Note: This calibration process takes time, it might appear your computer is stuck, but that is not the case, have patience.
9. Once calibration is complete, 'SAVE' and 'COMMIT' buttons get highlighted. Click 'SAVE' and then 'COMMIT'.
10. Place the 'task_3.launch' file provided by us, in launch folder under new Task_3 project of 'src' folder in catkin workspace.
11. Open a terminal and run the task_3.launch. You should get a flat image output.

Note: You must ensure the image_proc package is installed. If not, run the following command: ***sudo apt-get install ros-distro-image-proc*** where distro is the ROS distro you are using.

Drone Calibration:

To compensate the error in drone due to battery attachment and other hardware changes, we need to calibrate the Drone accelerometer and magnetometer.

In order to calibrate the Pluto drone download the "pluto controller" app in android play store and follow the steps mentioned in this video.