1、Gemini2 camera calibration

Due to some reasons inside and outside the camera, the image will be greatly distorted, mainly radial deformation and tangential deformation, resulting in bending of the straight line. The farther the pixel is from the center of the image, the more serious the distortion will be.In order to avoid the error caused by the data source, it is necessary to calibrate the parameters of the camera. Calibration essentially uses a known and definite spatial relationship (calibration board) to reversely deduce the inherent and real parameters of the camera (internal reference) by analyzing the pixels of the photographed picture.

Disadvantages of Infrared Depth Camera Ranging : :

（1）It is impossible to accurately measure the distance of the black object, because the black substance can absorb infrared rays, and the infrared rays cannot return, so the distance cannot be measured.

（2）It is impossible to accurately measure the distance of the specular object, because only when the depth camera is on the vertical line of the specular object, the receiver can receive the reflected infrared light, and it will cause overexposure.

（3）It is not possible to accurately measure the distance of transparent objects, because infrared rays can pass through transparent objects.

（4）It is not possible to accurately measure distances for objects that are too close.

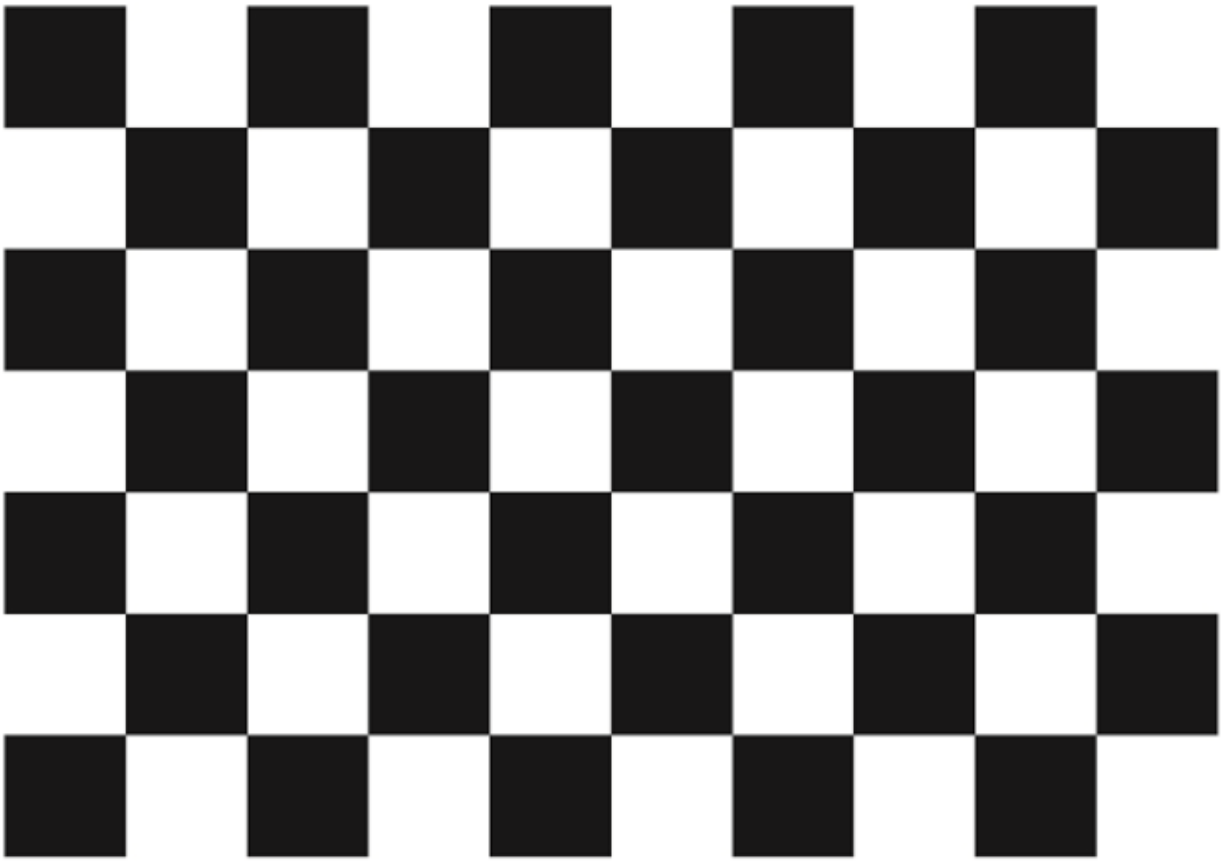
1.1、Preparation before calibration

- A large **[checkerboard]** of known dimensions (http://wiki.ros.org/camera_calibration/Tutorials/MonocularCalibration?action=AttachFile&do=view&target=check-108.pdf). This tutorial uses a 9x6 checkerboard and 20mm squares, flattened when scaled.

  Calibration uses the interior vertices of the checkerboard, so a "10x7" checkerboard uses interior vertex parameters of "9x6", as in the example below.

  Any specification of the calibration board is fine, just change the parameters.
- An open area without obstacles and calibration board patterns
- Publishing images via ROS

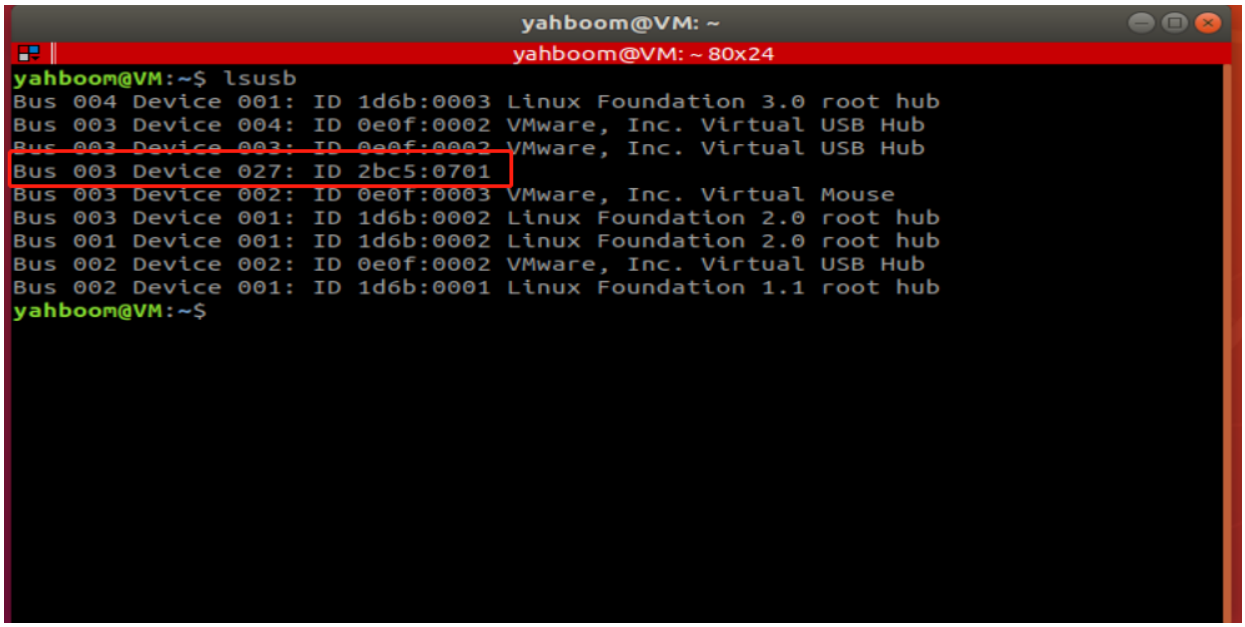
Checkerboard (calibration board)



7×10 | Size: 20mm

Device view

```
lsusb
```

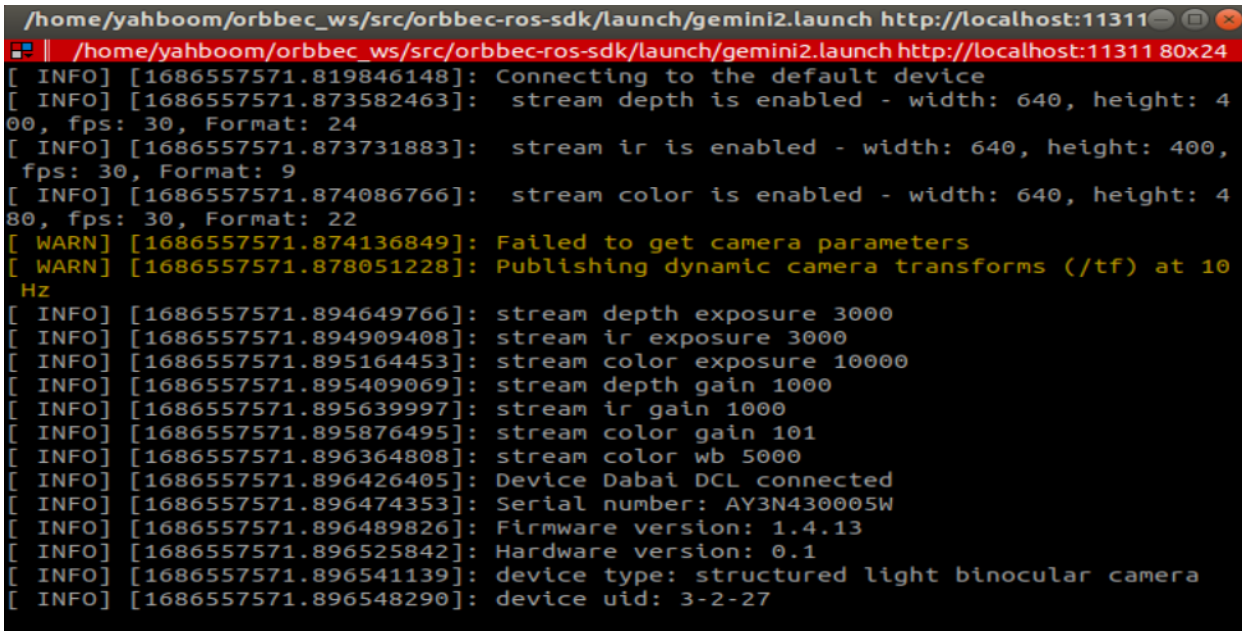


If this ID appears, the device is connected.

1.2、calibration

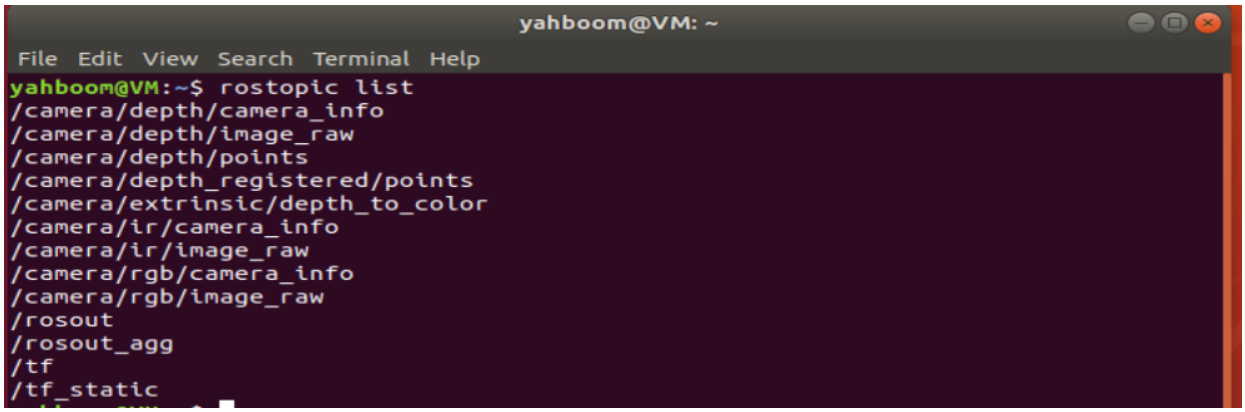
Start the Gemini2 camera

```
roslaunch orbbec_camera gemini2.launch
```



View Image Topics

```
rostopic list
```



Start the calibration node

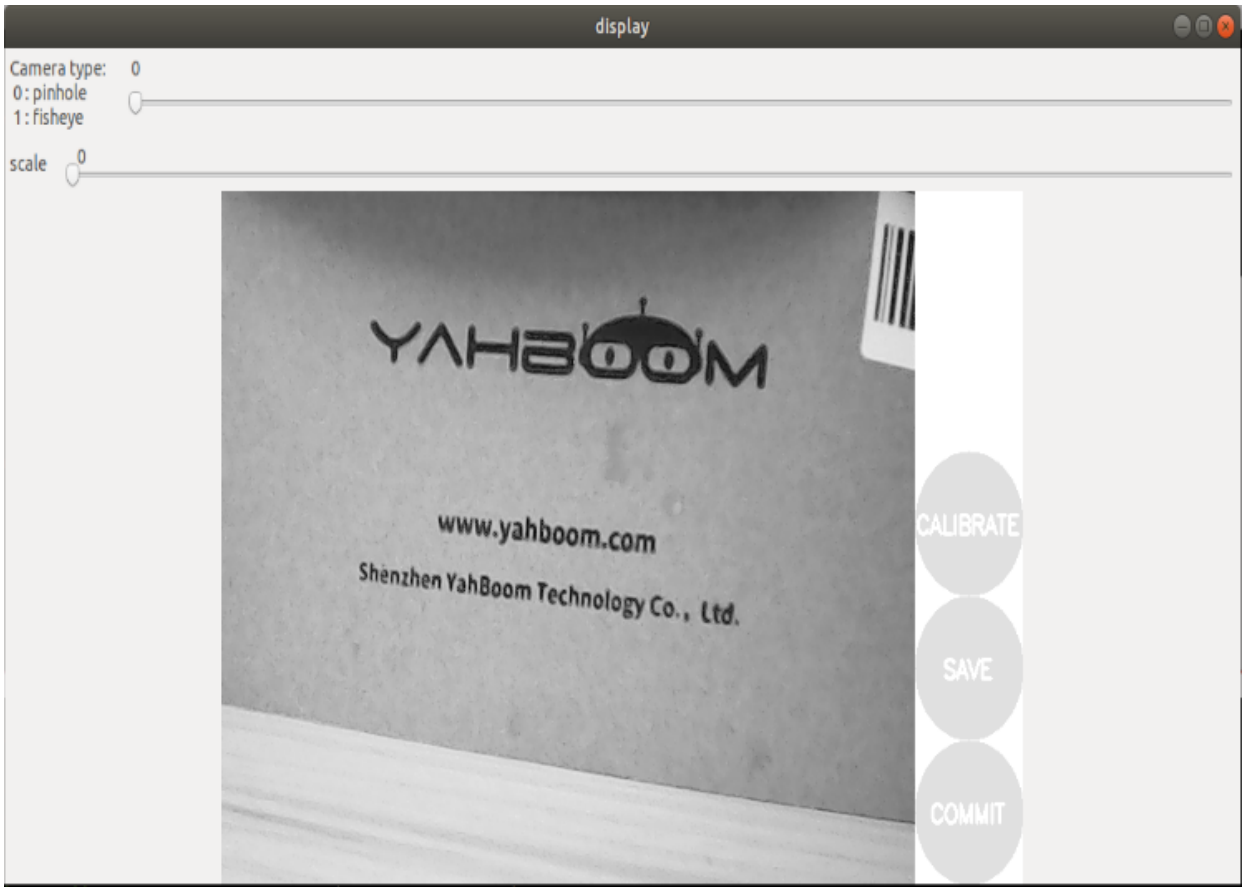
```
# color picture
rosrun camera_calibration cameracalibrator.py image:=/camera/rgb/image_raw
camera:=/camera --no-service-check  --size 9x6 --square 0.02
```

size：The number of internal corners of the calibrated checkerboard, such as 9X6, the corners have six rows and nine columns.

square： The side length of the checkerboard, in meters.

image和camera：Set the topic of the image released by the camera.

1.2.1、Color icon set



Calibration interface

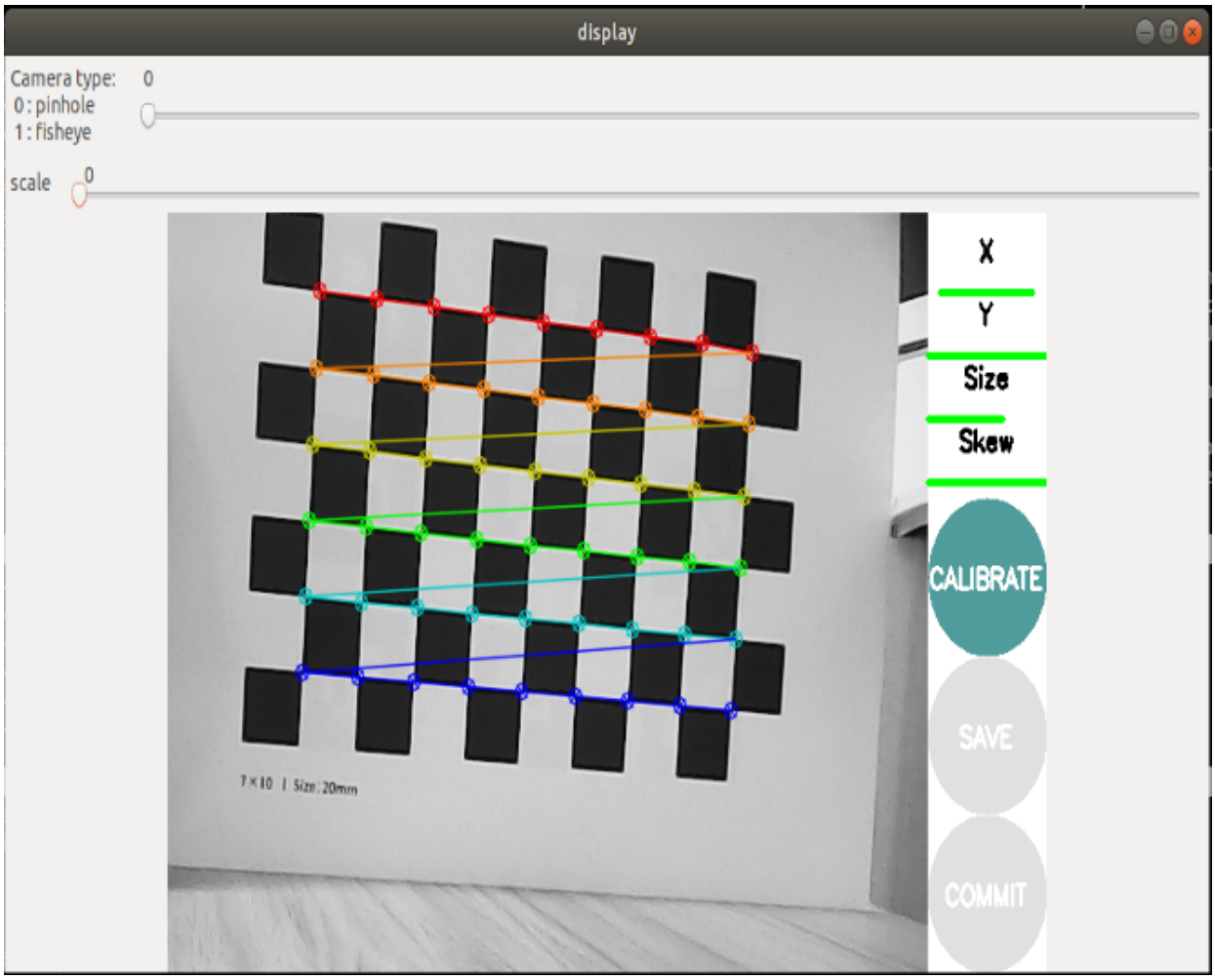
X：The left and right movement of the checkerboard in the camera field of view

Y：The checkerboard moves up and down in the camera's field of view

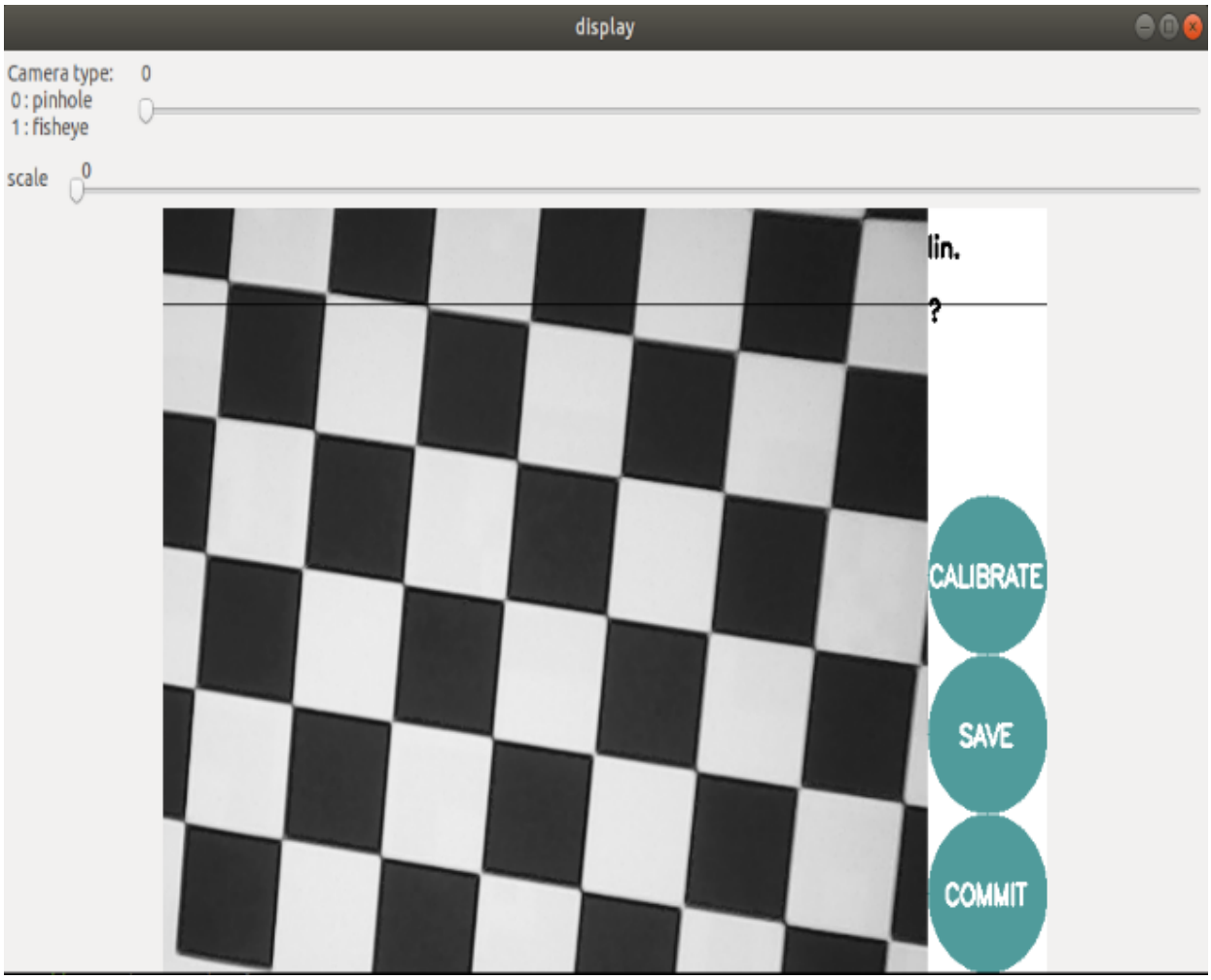
Size ： the back and forth movement of the checkerboard in the camera's field of view

Skew：The tilt and rotation of the checkerboard in the camera field of view

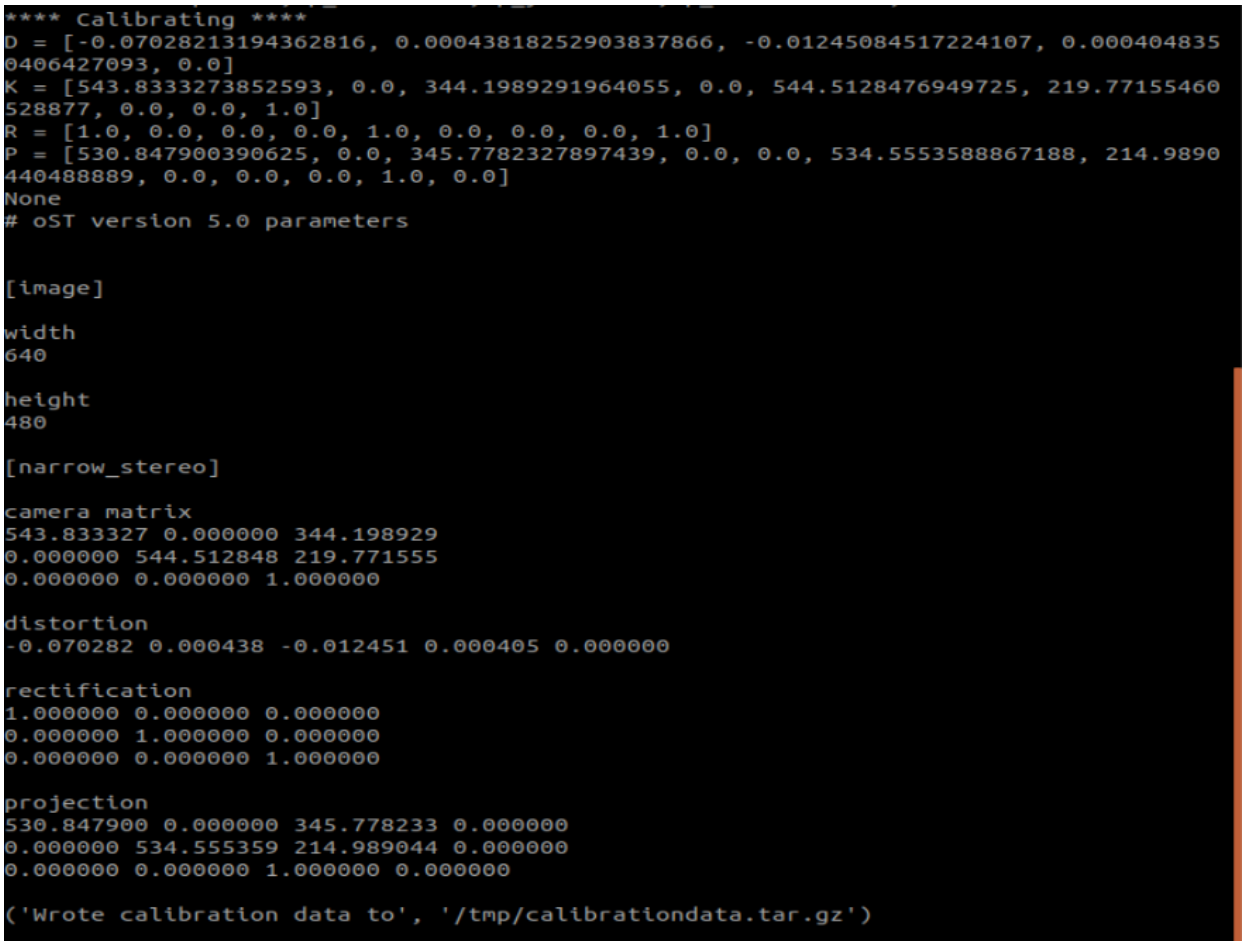
After the startup is successful, put the checkerboard into the center of the screen and change different poses. The system will recognize it autonomously. In the best case, the lines under **[X], [Y], [Size],** and **[Skew]** will first change from red to yellow and then to green as the data is collected, filling them as much as possible.



Click **[CALIBRATE]** to calculate the camera internal parameters, the more pictures, the longer the time, just wait.



Click **[SAVE]** to save the calibration results.



After the calibration, the calibration result is stored in [/tmp/calibrationdata.tar.gz], you can move it out to see the content

```
sudo mv /tmp/calibrationdata.tar.gz ~
```

After decompression, there are the pictures just calibrated, an ost.txt file and an ost.yaml file. **The yaml file is the internal reference of the calibrated camera. Since the camera is started to load the built-in calibrated parameters, the calibration result is not used, and it is only for function demonstration**.

1.2.2、Depth image calibration

Start the calibration node

```
rosrun camera_calibration cameracalibrator.py image:=/camera/ir/image_raw
camera:=/camera --no-service-check --size 9x6 --square 0.02
```

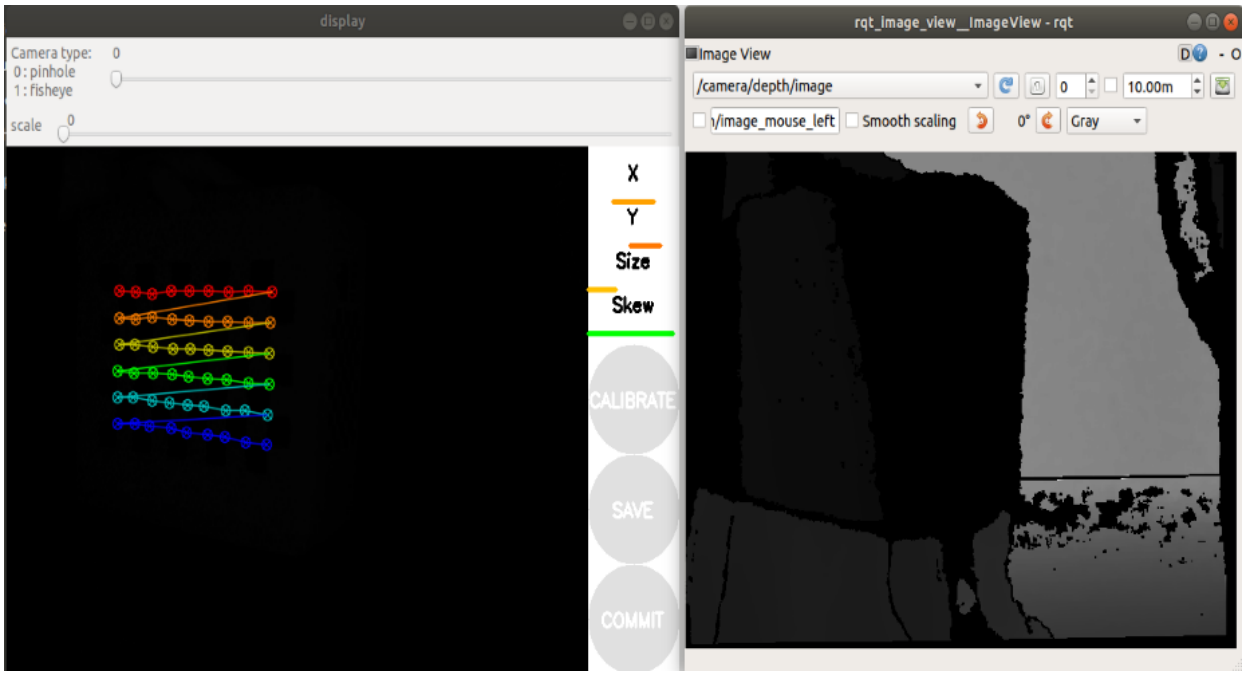
size：he number of internal corners of the calibrated checkerboard, such as 9X6, the corners have six rows and nine columns.

square：The side length of the checkerboard, in meters.

image和camera：Set the topic of the image released by the camera.

The calibration process is similar to the color camera calibration, but the depth camera calibration visualization is not so intuitive; it only displays the calibration results when it is recognized, and it is dark when it is not recognized. It is difficult to calibrate. We can start the depth image again to check the screen content, if it is not clear, then open a color image.

```
rqt_image_view
```



The following operations are similar to color camera calibration, changing different poses. The system will recognize it independently. The best situation is that the lines under **[X], [Y], [Size],** and **[Skew]** will first change from red to yellow and then green as the data is collected, and fill them up as much as possible. Click **[CALIBRATE]** to calculate the internal parameters of the camera, the more pictures, the longer the time, just wait. (Sixty or seventy sheets are enough, too many are easy to get stuck) Click **[SAVE]** to save the result. After the calibration is finished, the calibration result will be stored in **[/tmp/calibrationdata.tar.gz]**, you can move it out to see the content

```
sudo mv /tmp/calibrationdata.tar.gz ~
```

After decompression, there are the pictures just calibrated, an ost.txt file and an ost.yaml file. The yaml file is the internal reference of the calibrated camera. **Since the camera is started to load the built-in calibrated parameters, the calibration result will not be used, and only the function demonstration will be used**.