Depth camera ranging

This lesson uses the Raspberry Pi as an example. For Raspberry Pi and Jetson-Nano boards, you need to open a terminal on the host computer and enter the command to enter the Docker container. Once inside the Docker container, enter the commands mentioned in this lesson in the terminal. For instructions on entering the Docker container from the host computer, refer to **[01. Robot Configuration and Operation Guide] -- [4.Enter Docker (For JETSON Nano and RPi 5)]**. For RDKX5 and Orin boards, simply open a terminal and enter the commands mentioned in this lesson.

1. Program Functionality

> After starting the program, click a point in the pseudo-color image with your mouse. Within the depth camera's valid data range, the screen displays the distance between that point and the depth camera.

2. Program Code Reference Path

```
~/yahboomcar_ros2_ws/yahboomcar_ws/src/yahboomcar_depth/yahboomcar_depth/Basic/get_center_dis.py
```

- get_center_dis.py

The main program uses the center coordinates of the mouse click to obtain the distance of the changed coordinates and display it on the screen.

3. Program Startup

For Raspberry Pi and Jetson-Nano boards, you need to enter the Docker container first. For RDKX5 and Orin controllers, this is not necessary.

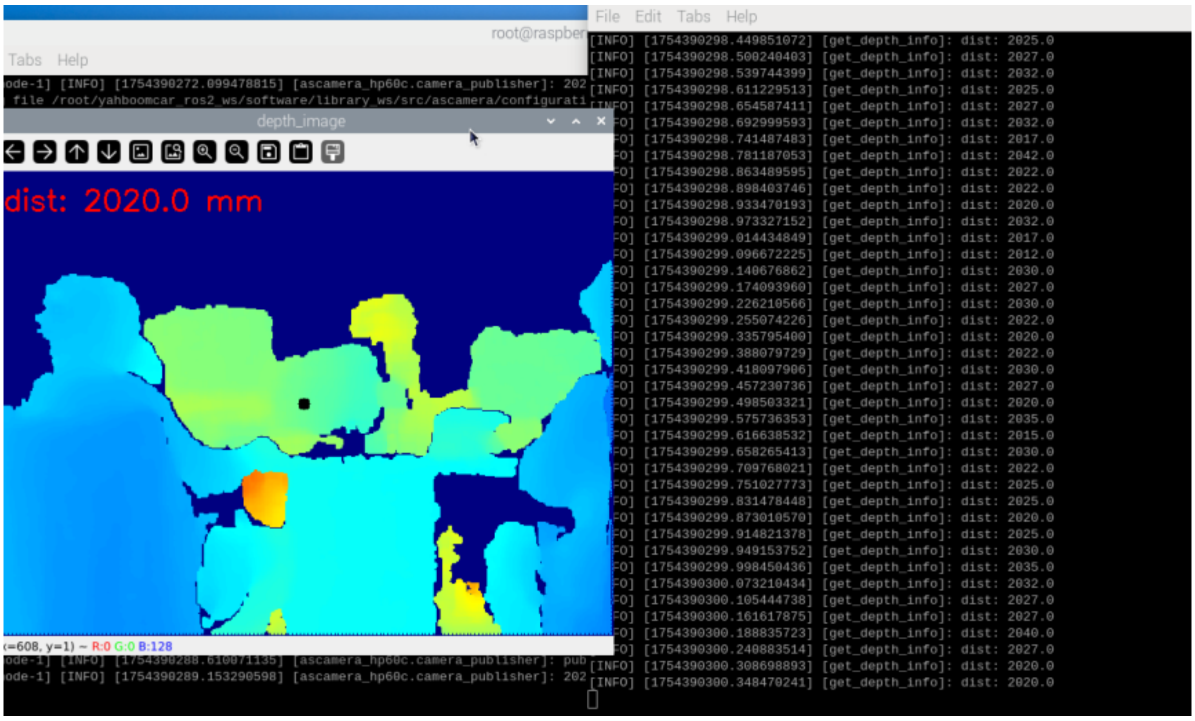
Enter the Docker container (see [Docker course] --- [4. Docker Startup Script] for steps).

All the following commands must be executed within the same Docker container **(see [Docker course] --- [3. Docker Submission and Multi-Terminal Access] for steps).**

Enter the terminal:

```
ros2 launch ascamera hp60c.launch.py
ros2 run yahboomcar_depth get_center_dis
```

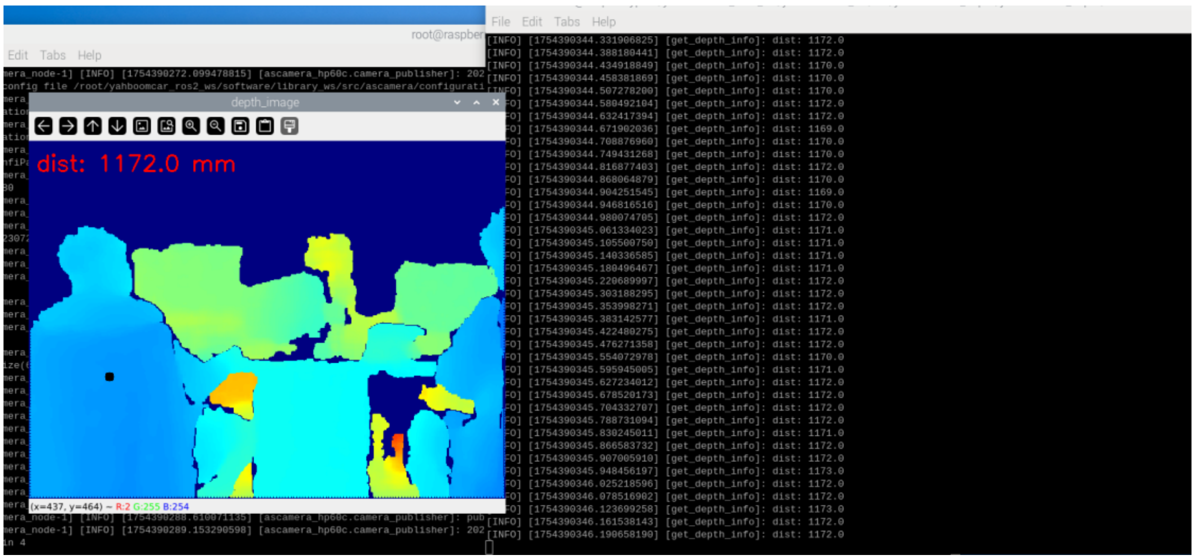
Upon startup, the program retrieves the distance to the image center by default. If the distance is outside the depth camera's range, an error may occur. A normal startup is shown below.



```
ode-1] [INFO] [1754390272.099478815] [ascamera_hp60c.camera_publisher]: 202
 file /root/yahboomcar_ros2_ws/software/library_ws/src/ascamera/configurati
ode-1] [INFO] [1754390288.610071135] [ascamera_hp60c.camera_publisher]: pub
ode-1] [INFO] [1754390289.153290598] [ascamera_hp60c.camera_publisher]: 202
```

```
[INFO] [1754390298.449851072] [get_depth_info]: dist: 2025.0
[INFO] [1754390298.500240403] [get_depth_info]: dist: 2027.0
[INFO] [1754390298.539744399] [get_depth_info]: dist: 2032.0
[INFO] [1754390298.611229513] [get_depth_info]: dist: 2025.0
[INFO] [1754390298.654587411] [get_depth_info]: dist: 2027.0
FO] [1754390298.692999593] [get_depth_info]: dist: 2032.0
FO] [1754390298.741487483] [get_depth_info]: dist: 2017.0
FO] [1754390298.781187053] [get_depth_info]: dist: 2042.0
FO] [1754390298.863489595] [get_depth_info]: dist: 2022.0
FO] [1754390298.898403746] [get_depth_info]: dist: 2022.0
FO] [1754390298.933470193] [get_depth_info]: dist: 2020.0
FO] [1754390298.973327152] [get_depth_info]: dist: 2032.0
FO] [1754390299.014434849] [get_depth_info]: dist: 2017.0
FO] [1754390299.096672225] [get_depth_info]: dist: 2012.0
FO] [1754390299.140676862] [get_depth_info]: dist: 2030.0
FO] [1754390299.174093960] [get_depth_info]: dist: 2027.0
FO] [1754390299.226210566] [get_depth_info]: dist: 2030.0
FO] [1754390299.255074226] [get_depth_info]: dist: 2022.0
FO] [1754390299.335795400] [get_depth_info]: dist: 2020.0
FO] [1754390299.388079729] [get_depth_info]: dist: 2022.0
FO] [1754390299.418097906] [get_depth_info]: dist: 2030.0
FO] [1754390299.457230736] [get_depth_info]: dist: 2027.0
FO] [1754390299.498503321] [get_depth_info]: dist: 2020.0
FO] [1754390299.575736353] [get_depth_info]: dist: 2035.0
FO] [1754390299.616638532] [get_depth_info]: dist: 2015.0
FO] [1754390299.658265413] [get_depth_info]: dist: 2030.0
FO] [1754390299.709768021] [get_depth_info]: dist: 2022.0
FO] [1754390299.751027773] [get_depth_info]: dist: 2025.0
FO] [1754390299.831478448] [get_depth_info]: dist: 2025.0
FO] [1754390299.873010570] [get_depth_info]: dist: 2020.0
FO] [1754390299.914821378] [get_depth_info]: dist: 2025.0
FO] [1754390299.949153752] [get_depth_info]: dist: 2030.0
FO] [1754390299.998450436] [get_depth_info]: dist: 2035.0
FO] [1754390300.073210434] [get_depth_info]: dist: 2032.0
FO] [1754390300.105444738] [get_depth_info]: dist: 2027.0
FO] [1754390300.161617875] [get_depth_info]: dist: 2027.0
FO] [1754390300.188835723] [get_depth_info]: dist: 2040.0
FO] [1754390300.240883514] [get_depth_info]: dist: 2027.0
[INFO] [1754390300.308698893] [get_depth_info]: dist: 2020.0
[INFO] [1754390300.348470241] [get_depth_info]: dist: 2020.0
```

Click any point within the pseudo-color image frame with your mouse. A black dot will appear, indicating the current location. The distance to the selected point will be displayed in the image and on the terminal simultaneously.



```
[INFO] [1754390344.331906825] [get_depth_info]: dist: 1172.0
[INFO] [1754390344.388180441] [get_depth_info]: dist: 1172.0
[INFO] [1754390344.434918849] [get_depth_info]: dist: 1170.0
[INFO] [1754390344.458381869] [get_depth_info]: dist: 1170.0
[INFO] [1754390344.507278200] [get_depth_info]: dist: 1170.0
FO] [1754390344.580492104] [get_depth_info]: dist: 1172.0
FO] [1754390344.632417394] [get_depth_info]: dist: 1172.0
FO] [1754390344.671902036] [get_depth_info]: dist: 1169.0
FO] [1754390344.708876960] [get_depth_info]: dist: 1170.0
FO] [1754390344.749431268] [get_depth_info]: dist: 1170.0
FO] [1754390344.816877403] [get_depth_info]: dist: 1172.0
FO] [1754390344.868064879] [get_depth_info]: dist: 1170.0
FO] [1754390344.904251545] [get_depth_info]: dist: 1169.0
FO] [1754390344.946816516] [get_depth_info]: dist: 1170.0
FO] [1754390344.980074705] [get_depth_info]: dist: 1172.0
FO] [1754390345.061334023] [get_depth_info]: dist: 1171.0
FO] [1754390345.105500750] [get_depth_info]: dist: 1171.0
FO] [1754390345.140336585] [get_depth_info]: dist: 1171.0
FO] [1754390345.180496467] [get_depth_info]: dist: 1171.0
FO] [1754390345.220689997] [get_depth_info]: dist: 1172.0
FO] [1754390345.303188295] [get_depth_info]: dist: 1172.0
FO] [1754390345.353998271] [get_depth_info]: dist: 1172.0
FO] [1754390345.383142577] [get_depth_info]: dist: 1171.0
FO] [1754390345.422480275] [get_depth_info]: dist: 1172.0
FO] [1754390345.476271358] [get_depth_info]: dist: 1172.0
FO] [1754390345.554072978] [get_depth_info]: dist: 1170.0
FO] [1754390345.595945005] [get_depth_info]: dist: 1171.0
FO] [1754390345.627234012] [get_depth_info]: dist: 1172.0
FO] [1754390345.678520173] [get_depth_info]: dist: 1172.0
FO] [1754390345.704332707] [get_depth_info]: dist: 1172.0
FO] [1754390345.788731094] [get_depth_info]: dist: 1172.0
FO] [1754390345.830245011] [get_depth_info]: dist: 1171.0
FO] [1754390345.866583732] [get_depth_info]: dist: 1172.0
FO] [1754390345.907005910] [get_depth_info]: dist: 1172.0
FO] [1754390345.948456197] [get_depth_info]: dist: 1173.0
FO] [1754390346.025218596] [get_depth_info]: dist: 1172.0
FO] [1754390346.078516902] [get_depth_info]: dist: 1172.0
FO] [1754390346.123699258] [get_depth_info]: dist: 1173.0
[INFO] [1754390346.161538143] [get_depth_info]: dist: 1172.0
[INFO] [1754390346.190658190] [get_depth_info]: dist: 1172.0
```

In this demonstration, the distance to the adjacent chair is 117.2 cm, or 1172 mm.

4. Core Code

get_center_dis.py

This program has the following main functions:

- When the user clicks the left mouse button in the depth image window, it returns the distance to the current point.
- It updates the coordinates (x, y) of the current detection point.
- It returns the depth distance, and the window displays the detailed information.

Some of the core code is as follows.

```
def topic_callback(self, msg):
    # 1. ROS图像转OpenCV格式 1. Convert ROS images to OpenCV format
    depth_image = self.depth_bridge.imgmsg_to_cv2(msg, encoding[1])
    # 2. 图像预处理 2. Image Preprocessing
    frame = cv.resize(depth_image, (640, 480))
    depth_image_info = frame.astype(np.float32)

    # 3. 获取当前点的深度值 Get the depth value of the current point
    dist = depth_image_info[self.y, self.x]

    # 4. 创建彩色深度图像 Creating a color depth image
    depth_image_colored = cv.applyColorMap(
        cv.convertScaleAbs(depth_image, alpha=0.06),
        cv.COLORMAP_JET
    )

    # 5. 深度值处理和记录 Depth value processing and recording
    self.get_logger().info(f'dist: {dist}')
    dist = round(dist, 3)
    dist_text = f'dist: {dist} mm'

    # 6. 在图像上添加文本 6. Add text to the image
    cv.putText(depth_image_colored,
               dist_text,
               (10, 40),
               cv.FONT_HERSHEY_SIMPLEX,
               1.0,
               (0, 0, 255),
               2)

    # 7. 标记当前检测点 7. Mark the current detection point
    cv.circle(depth_image_colored,
              (self.x, self.y),
              1,
              (0, 0, 0),
              10)

    # 8. 显示图像并设置鼠标回调 8. Display the image and set the mouse callback
    cv.imshow(self.window_name, depth_image_colored)
    cv.setMouseCallback(self.window_name, self.click_callback)  # 关联鼠标事件 #
Associate mouse events
    cv.waitKey(1)
```