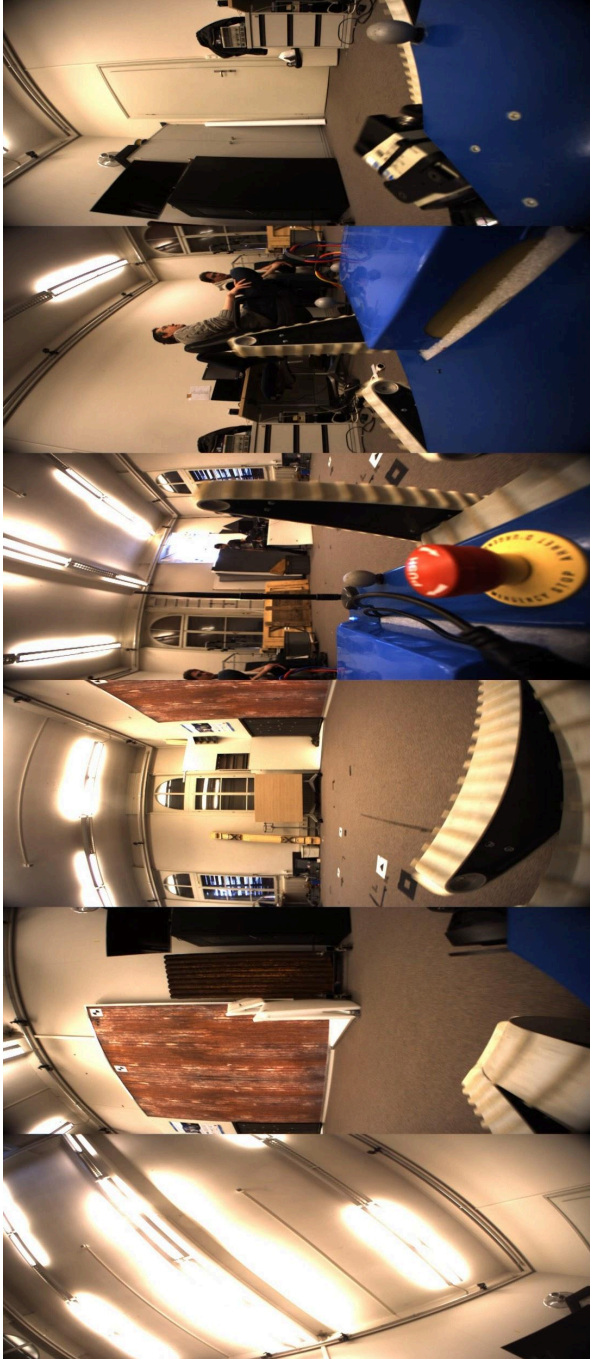


Omni-Directional Camera *Ladybug 3*

Internal/External Camera Parameters

The topic `/viz/omnicam/image` stored in the ROS bags contains images like this one:



Each row of pixels of the 6-in-1 image is a result of decimation of two original rows. It is necessary to restore the original number by cloning each row of the image.

To obtain images of a single camera, it is necessary to split it into 6 parts and rotate each one. Camera indices start from 0, which relates to the top image (therefore, the bottom one is “camera_5”).

In the following text, we describe internal and external parameters of each camera. The external parameters express transformation from the given camera frame to the common “omnicam” frame - see the Ladybug 3 online documentation for reference. The transformation from this common “omnicam” frame to the robot centre is

omnicam -> base_link

- Translation: $[0.014, -0.097, -0.271]$

- Rotation: in Quaternion $[0.000, 0.000, 0.454, 0.891]$

in RPY $[0.000, -0.000, 0.942]$

IMPORTANT:

In each ROS bag file we provide, there is the “/tf” topic storing all the transformations, including the external parameters of the omnicamera frames. Those are not the same as those we publish in this document; we have performed better calibration after recording the bag files, the values below are more precise.

Camera 0

Internal

frame_id: /camera_0
height: 1616
width: 1232
distortion_model: plumb_bob
D: [0.2167526484, -0.020813087, -1.9139e-06, -2.937e-07, 0.001387802, 0.482394129, -0.0253976677, 0.0017855095]
K: [745.839, 0.0, 619.355, 0.0, 745.528, 792.543, 0.0, 0.0, 1.0]
R: [1.0, 0.0, 0.0, 0.0, 1.0, 0.0, 0.0, 0.0, 1.0]
P: [745.839, 0.0, 619.355, 0.0, 0.0, 745.528, 792.543, 0.0, 0.0, 0.0, 1.0, 0.0]
binning_x: 0
binning_y: 0
roi:
 x_offset: 0
 y_offset: 0
 height: 0
 width: 0
 do_rectify: False

External

/camera_0 -> /omnicam
- Translation: [-0.002, -0.000, -0.042]
- Rotation: in Quaternion [0.501, -0.500, 0.500, 0.499]
 in RPY [-3.140, -1.569, -1.569]

Camera 1

Internal

frame_id: /camera_1
height: 1616
width: 1232
distortion_model: plumb_bob
D: [0.2275557965, -0.0222333074, 1.093e-07, -1.0494e-06, 0.0015335338, 0.4942185879, -0.0259299297, 0.0018871631]
K: [748.912, 0.0, 608.208, 0.0, 748.563, 807.726, 0.0, 0.0, 1.0]
R: [1.0, 0.0, 0.0, 0.0, 1.0, 0.0, 0.0, 0.0, 1.0]
P: [748.912, 0.0, 608.208, 0.0, 0.0, 748.563, 807.726, 0.0, 0.0, 0.0, 1.0, 0.0]
binning_x: 0
binning_y: 0
roi:
 x_offset: 0
 y_offset: 0
 height: 0
 width: 0
 do_rectify: False

External

/camera_1 -> /omnicam
- Translation: [-0.002, -0.000, -0.042]
- Rotation: in Quaternion [-0.110, 0.698, -0.698, -0.113]
 in RPY [-1.571, -0.317, 3.137]

Camera 2

Internal

frame_id: /camera_2
height: 1616
width: 1232
distortion_model: plumb_bob
D: [0.2124365121, -0.0199869424, -4.886e-07, 2.211e-07, 0.0013283446, 0.4770828485, -0.0251796767, 0.001804265]
K: [747.056, 0.0, 642.906, 0.0, 746.754, 785.916, 0.0, 0.0, 1.0]
R: [1.0, 0.0, 0.0, 0.0, 1.0, 0.0, 0.0, 0.0, 1.0]
P: [747.056, 0.0, 642.906, 0.0, 0.0, 746.754, 785.916, 0.0, 0.0, 0.0, 1.0, 0.0]
binning_x: 0
binning_y: 0
roi:
 x_offset: 0
 y_offset: 0
 height: 0
 width: 0
 do_rectify: False

External

/camera_2 -> /omnicam
- Translation: [-0.002, 0.001, -0.042]
- Rotation: in Quaternion [-0.325, -0.630, 0.630, -0.318]
 in RPY [-1.577, 0.943, 3.127]

Camera 3

Internal

```
frame_id: /camera_3
height: 1616
width: 1232
distortion_model: plumb_bob
D: [0.2292103618, -0.0225696284, 7.153e-07, 1.0262e-06, 0.0015954117, 0.4955890775,
-0.0260845665, 0.0019365017]
K: [750.844, 0.0, 622.19, 0.0, 750.645, 807.008, 0.0, 0.0, 1.0]
R: [1.0, 0.0, 0.0, 0.0, 1.0, 0.0, 0.0, 0.0, 1.0]
P: [750.844, 0.0, 622.19, 0.0, 0.0, 750.645, 807.008, 0.0, 0.0, 0.0, 1.0, 0.0]
binning_x: 0
binning_y: 0
roi:
  x_offset: 0
  y_offset: 0
  height: 0
  width: 0
  do_rectify: False
---
```

External

```
/camera_3 -> /omnicam
- Translation: [-0.002, 0.000, -0.042]
- Rotation: in Quaternion [0.632, 0.320, -0.322, 0.629]
           in RPY [1.575, 0.942, -0.002]
```

Camera 4

Internal

```
frame_id: /camera_4
height: 1616
width: 1232
distortion_model: plumb_bob
D: [0.2212992013, -0.0214319061, -8.886e-07, 1.7041e-06, 0.0014578628, 0.4875985086,
-0.0258332267, 0.0018632873]
K: [748.17, 0.0, 632.069, 0.0, 747.84, 801.361, 0.0, 0.0, 1.0]
R: [1.0, 0.0, 0.0, 0.0, 1.0, 0.0, 0.0, 0.0, 1.0]
P: [748.17, 0.0, 632.069, 0.0, 0.0, 747.84, 801.361, 0.0, 0.0, 0.0, 1.0, 0.0]
binning_x: 0
binning_y: 0
roi:
  x_offset: 0
  y_offset: 0
  height: 0
  width: 0
  do_rectify: False
---
```

External

```
/camera_4 -> /omnicam
- Translation: [-0.002, 0.000, -0.042]
- Rotation: in Quaternion [0.702, -0.111, 0.110, 0.695]
           in RPY [1.581, -0.313, -0.003]
```

Camera 5

Internal

frame_id: /camera_5
height: 1616
width: 1232
distortion_model: plumb_bob
D: [0.2242452055, -0.0216800068, -2.0851e-06, -1.48e-08, 0.0015142466, 0.4904972911, -0.0259709451, 0.0019623348]
K: [750.482, 0.0, 617.463, 0.0, 750.084, 790.652, 0.0, 0.0, 1.0]
R: [1.0, 0.0, 0.0, 0.0, 1.0, 0.0, 0.0, 0.0, 1.0]
P: [750.482, 0.0, 617.463, 0.0, 0.0, 750.084, 790.652, 0.0, 0.0, 0.0, 1.0, 0.0]
binning_x: 0
binning_y: 0
roi:
 x_offset: 0
 y_offset: 0
 height: 0
 width: 0
 do_rectify: False

External

/camera_5 -> /omnicam
- Translation: [-0.001, -0.001, -0.062]
- Rotation: in Quaternion [0.000, -0.000, 0.705, 0.710]
 in RPY [-0.000, -0.000, 1.564]