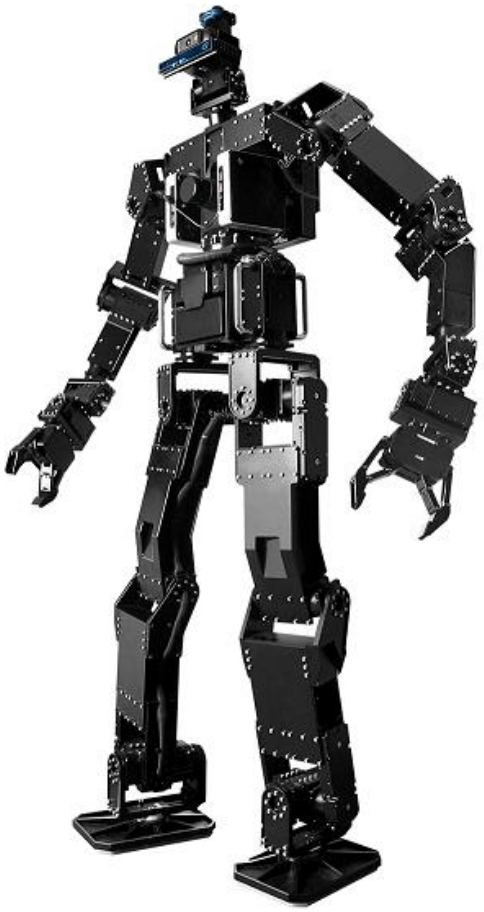

THORMANG3

THORMANG3 Tutorial

Sensor

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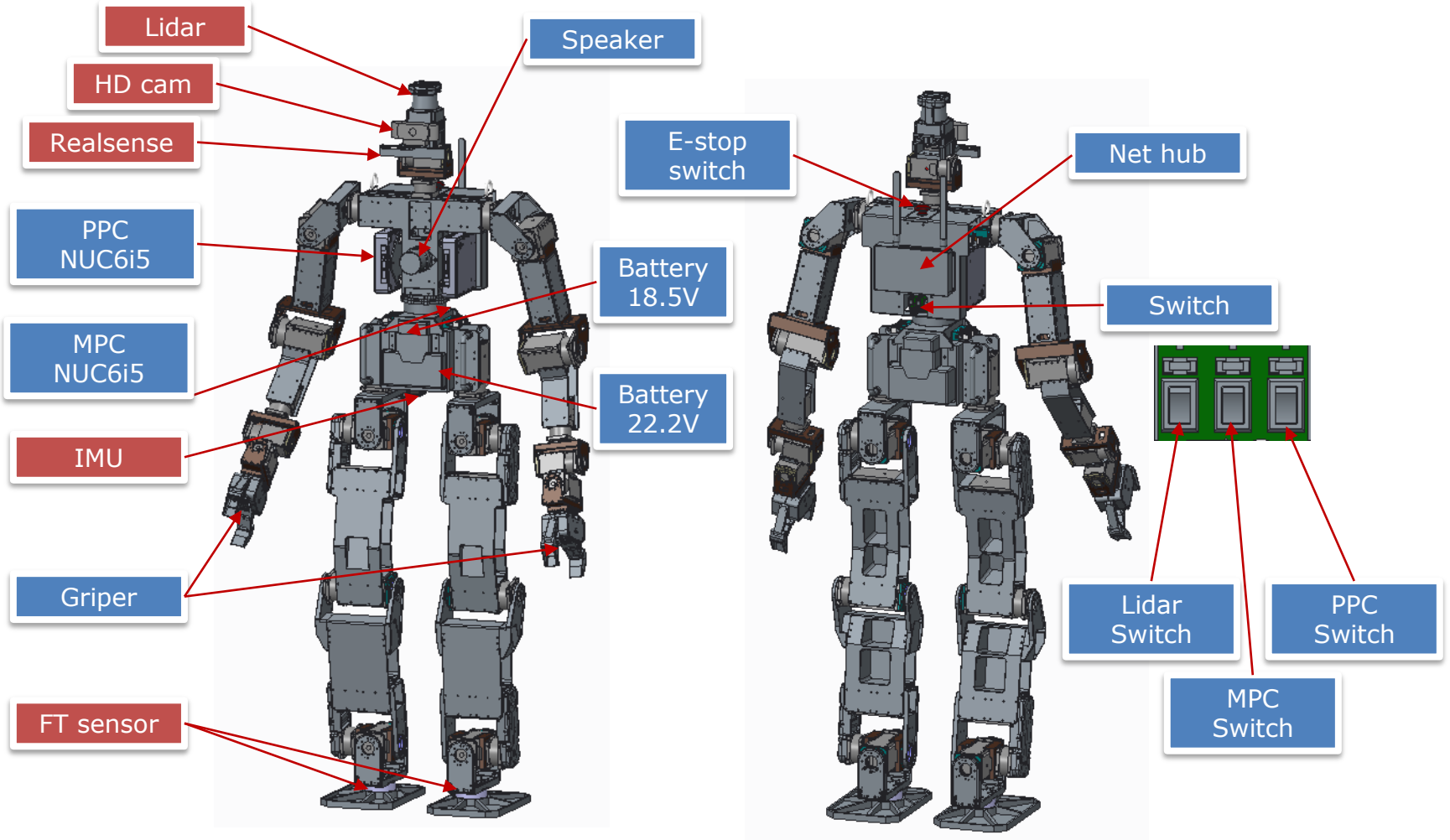
1. Introduction

Description of the Sensors

- **Layout of the Sensors**



2. Sensors

Sensor – HD Web Cam

1. Overview

1. HW : Logitech C920 HD
2. SW : uvc_camera (ROS package)
   - Wiki site : http://wiki.ros.org/uvc_camera
   - Installation (If user use ros-indigo version)

```
$ sudo apt-get install ros-indigo-uvc-camera
```

   - Source : https://github.com/ktossell/camera_umd
   - Note
     - **HD Web Camera is connected to the PPC(Perception PC). All commands should be typed in PPC.**

2. Topic List

	Name	Description
Topic	/robotis/sensor/camera/image_raw	A stream of images from the camera
	/robotis/sensor/camera/camera_info	Camera intrinsics for images

Sensor – HD Web Cam

3. How to run individual

```
$ roslaunch thormang3_sensors thormang3_web_cam.launch
```

- thormang3_web_cam.launch

```
<?xml version="1.0"?>

<launch>
   <!-- center camera -->
   <node pkg="uvc_camera" type="uvc_camera_node" name="uvc_camera_center_node"  >
      <param name="frame_id" type="string" value="cam_link" />
      <param name="device" type="string" value="/dev/WebCam" />
      <param name="width" type="int" value="640" />
      <param name="height" type="int" value="480" />
      <param name="fps" type="int" value="10" />
      <param name="auto_focus" type="bool" value="False" />
      <param name="focus_absolute" type="int" value="0" />
      <param name="auto_white_balance" value="0" />
      <param name="auto_exposure" value="0" />
      <param name="brightness" value="120" />
      <remap from="/image_raw" to="/robotis/sensor/camera/image_raw"/>
      <remap from="/camera_info" to="/robotis/sensor/camera/camera_info"/>
   </node>

   <!-- other camera -->
   <!-- <node pkg="uvc_camera" type="uvc_camera_node" name="uvc_camera_second_node" >
      <param name="frame_id" type="string" value="head_right_camera_link" />
      <param name="device" type="string" value="/dev/video2" />
      <remap from="/image_raw" to="/ppc/camera_right/image_raw"/>
      <remap from="/camera_info" to="/ppc/camera_right/camera_info"/>
   </node> -->

</launch>
```

Sensor – Depth camera (1)

1. Overview

1. HW : Intel Realsense R200
2. SW : RealSense_R200 (ROS package)
   - Wiki site : http://wiki.ros.org/RealSense
   - Installation : Go to the Wiki
   - Note
     - **Depth Camera is connected to the PPC(Perception PC). All commands should be typed in PPC.**

2. Topic List

	Name	Description
Topic	`/realsense/rgb/image_raw`	A stream of color images from the camera
	`/realsense/rgb/camrea_info`	Camera intrinsics for images

Sensor – Depth camera (2)

2. Topic List (cont.)

	Name	Description
Topic	/realsense/depth/image_raw	A stream of depth images from the camera
	/realsense/depth/camera_info	Camera intrinsics for images
	/realsense/depth_registered/points	Registered XYZRGB point cloud

3. How to run individual

```
$ roslaunch thormang3_sensors thormang3_realsense.launch
```

Sensor – Lidar(option)

1. Overview

1. HW : Hokuyo UTM-30LX-EW
2. SW : urg_node (ROS package)
   - Wiki site : http://wiki.ros.org/urg_node
   - Installation (If user use ros-kinetic version)

```
$ sudo apt-get install ros-kinetic-urg-node
```

   - Note
     - **We assume that you're using ros kinetic.**
     - **Lidar is connected to the MPC(Motion PC). All commands should be typed in MPC.**
     - **Lidar's IP address is 10.17.3.31**

2. Topic List

	Name	Description
Topic	/robotis/sensor/scan	single return output

3. How to run individual

```
$ roslaunch thormang3_description thor_laserscan.launch
```

Sensor – FT sensor

1. Overview

1. HW : ATI Mini58
2. SW : thormang3_manager
   - thormang3 manager publishes the ft sensors output on the feet

2. Topic List

	Name	Description
Topic	`/robotis/sensor/ft_right_foot/raw`	raw out put from ft sensor on right foot
	`/robotis/sensor/ft_right_foot/scaled`	scaled out put from ft sensor on right foot
	`/robotis/sensor/ft_left_foot/raw`	raw out put from ft sensor on left foot
	`/robotis/sensor/ft_left_foot/scaled`	scaled out put from ft sensor on left foot

Sensor – IMU

1. Overview

1. HW : MicroStrain 3DM-GX4-25
2. SW : imu_3dm_gx4
   - Wiki site : http://wiki.ros.org/imu_3dm_gx4
   - Git : https://github.com/KumarRobotics/imu_3dm_gx4
   - Installation : Please refer to above links.
   - Note
     - This pacakge should be located on MPC

2. Topic List

	Name	Description
Topic	/robotis/sensor/imu/imu	Gyro and Acceleration
	/robotis/sensor/imu/filter	Orientation and Gyro Bias

3. How to run individual

```
$  roslaunch thormang3_imu_3dm_gx4 imu.launch
```

3. Check the Sensors

Check in terminal

- **The Sensors in MPC (IMU, FT, Lidar)**
  - **IMU** : type below ros command and check the messages

```
$ rostopic echo /robotis/sensor/imu/imu
```

```
robotis@mpc:~$ rostopic echo /robotis/sensor/imu/imu
header:
  seq: 218798
  stamp:
    secs: 1456227058
    nsecs: 657393447
  frame_id: imu
orientation:
  x: 0.551555931568
  y: 0.831686019897
  z: -0.0350182652473
  w: 0.0534624755383
orientation_covariance: [-1.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]
angular_velocity:
  x: 0.00529906712472
  y: 0.0256397109479
  z: 0.108881101012
angular_velocity_covariance: [0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]
linear_acceleration:
  x: 1.40463167375
  y: 0.0995190255708
  z: 9.7412729802
linear_acceleration_covariance: [0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0]
```

Check in terminal

- **The Sensors in MPC (IMU, FT, Lidar)**
  - **FT sensor** : type below ros command and check the messages

```
$ rostopic echo /robotis/sensor/ft_right_foot/raw
$ rostopic echo /robotis/sensor/ft_left_foot/raw
```

```
robotis@mpc:~$ rostopic echo /robotis/sensor/ft_right_foot/raw
header:
  seq: 110484
  stamp:
    secs: 1456227469
    nsecs: 577939051
  frame_id: r_leg_foot_link
wrench:
  force:
    x: 5175.13464253
    y: 12796.9383106
    z: 9230.67538064
  torque:
    x: -134.298186423
    y: -234.033554692
    z: -267.399062596
```

```
robotis@mpc:~$ rostopic echo /robotis/sensor/ft_left_foot/raw
header:
  seq: 113669
  stamp:
    secs: 1456227506
    nsecs: 383800602
  frame_id: l_leg_foot_link
wrench:
  force:
    x: 9699.47838375
    y: 5305.99705173
    z: 10538.1527615
  torque:
    x: -243.133327243
    y: -325.658292323
    z: -202.514837491
```

Check in terminal

- **The Sensors in MPC (IMU, FT, Lidar)**
  - **LIDAR** : type below ros command and check the messages

```
$ rostopic echo /robotis/sensor/scan --noarr
```

  - *--noarr : no array option*

```
robotis@mpc:~$ rostopic echo /robotis/sensor/scan --noarr
header:
  seq: 403902
  stamp:
    secs: 1456227605
    nsecs: 320116247
  frame_id: lidar_link
angle_min: -2.35619449615
angle_max: 2.35619449615
angle_increment: 0.00436332309619
time_increment: 1.73611151695e-05
scan_time: 0.0250000003725
range_min: 0.0230000000447
range_max: 60.0
---
header:
  seq: 403903
  stamp:
    secs: 1456227605
    nsecs: 350245326
  frame_id: lidar_link
angle_min: -2.35619449615
angle_max: 2.35619449615
angle_increment: 0.00436332309619
time_increment: 1.73611151695e-05
scan_time: 0.0250000003725
range_min: 0.0230000000447
range_max: 60.0
```

Check in terminal

- **The Sensors in PPC (HD Web Cam, Depth camera)**
  - **HD Web Cam** : type below ros command and check the messages

```
$ rostopic echo /robotis/sensor/camera/image_raw --noarr
```

  - *--noarr : no array option*

```
robotis@DDC:~$ rostopic echo /robotis/sensor/camera/image_raw --noarr
header:
  seq: 23
  stamp:
    secs: 1456228631
    nsecs: 803098057
  frame_id: head_p_link
height: 480
width: 640
encoding: rgb8
is_bigendian: 0
step: 1920
---
header:
  seq: 24
  stamp:
    secs: 1456228631
    nsecs: 903091604
  frame_id: head_p_link
height: 480
width: 640
encoding: rgb8
is_bigendian: 0
step: 1920
```

Check in terminal

- **The Sensors in PPC (HD Web Cam, Depth camera)**
  - **Depth Camera** : type below ros command and check the messages

```
$ rostopic echo /realsense/depth_registered/points --noarr
```

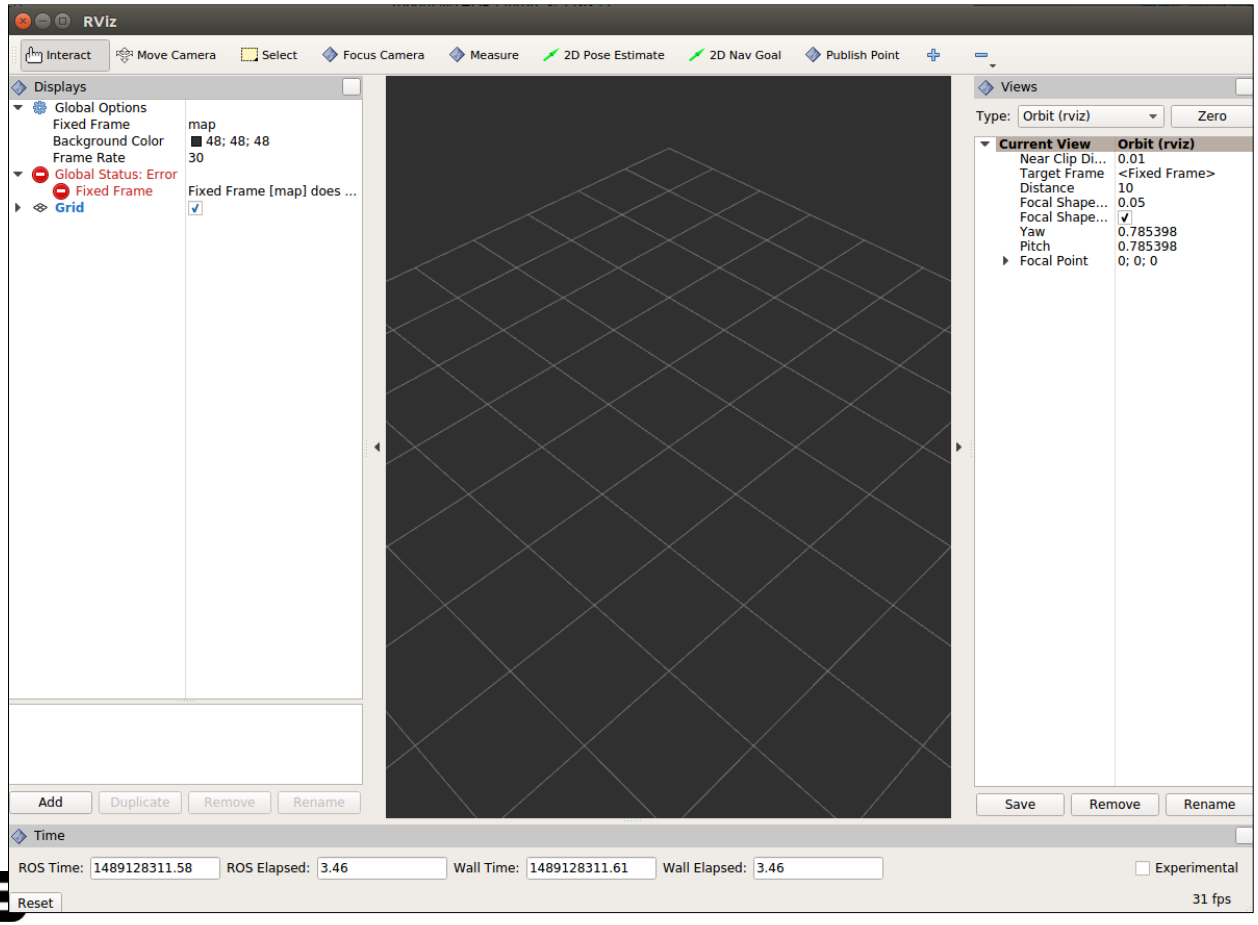
  - *--noarr : no array option*

```
robotis@ppc:~$ rostopic echo /realsense/depth_registered/points --noarr
header:
  seq: 321
  stamp:
    secs: 1489128097
    nsecs: 394884544
  frame_id: realsense_rgb_optical_frame
height: 480
width: 640
is_bigendian: False
point_step: 32
row_step: 20480
is_dense: False
---
header:
  seq: 322
  stamp:
    secs: 1489128097
    nsecs: 428217877
  frame_id: realsense_rgb_optical_frame
height: 480
width: 640
is_bigendian: False
point_step: 32
row_step: 20480
is_dense: False
```

Check in visualization tool(Rviz)

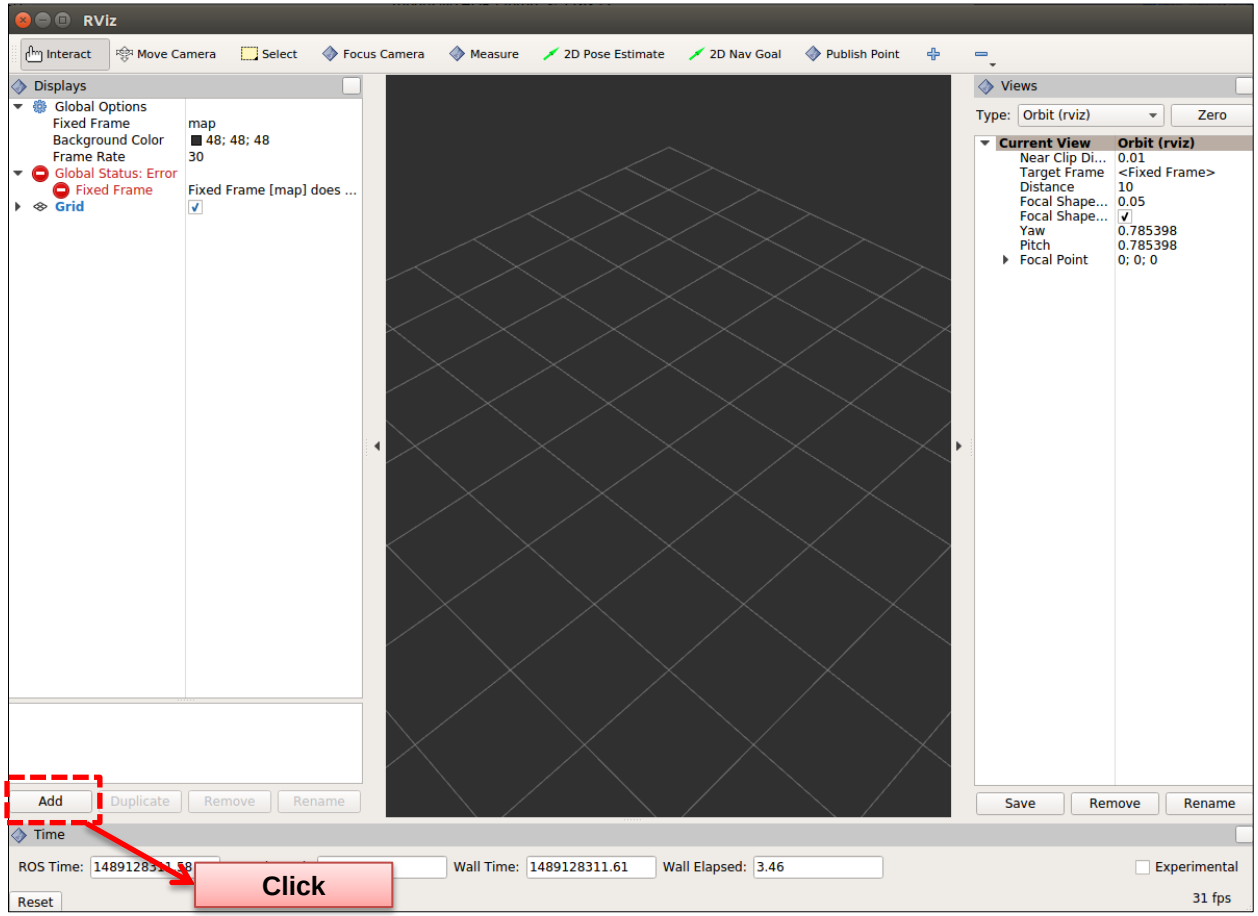
- **Open visualization tool in OPC**
  - Run rviz : type below command

```
$ rviz
```



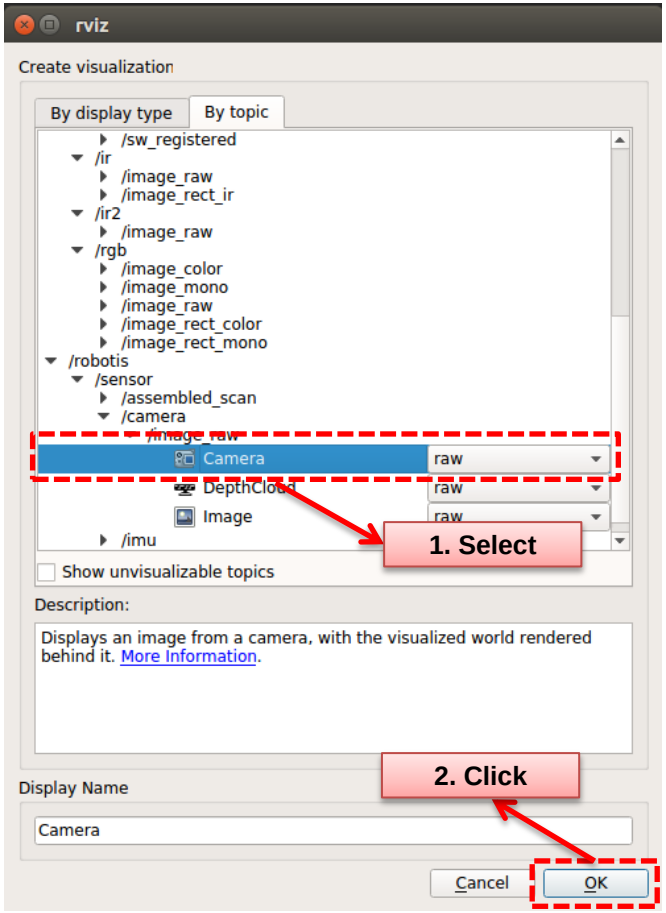
Check in visualization tool(Rviz)

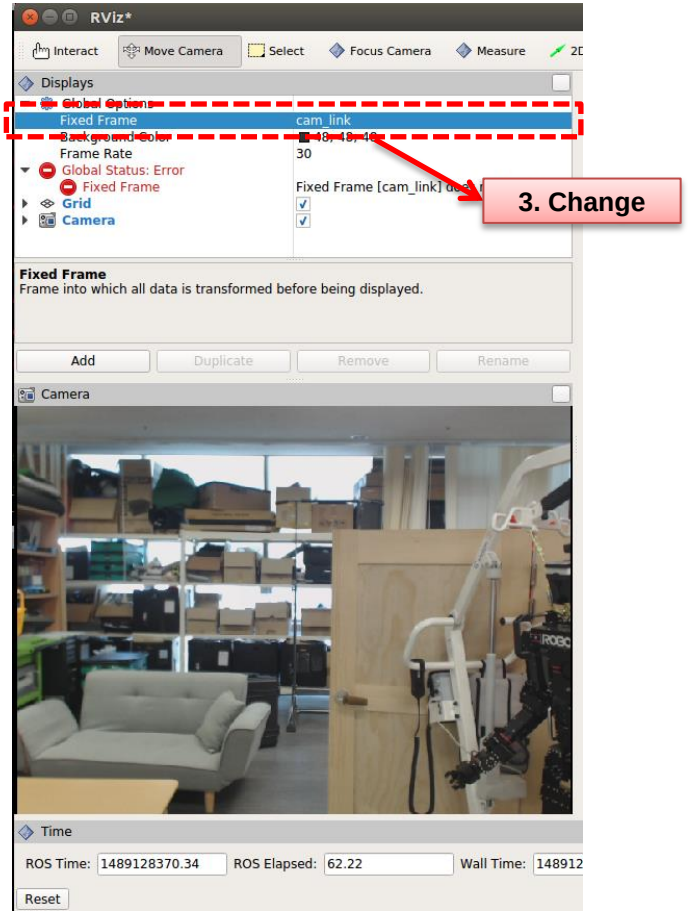
- **Open visualization tool in OPC**
  - Add sensor topic and change 'Fixed Frame' to name of sensor frame



Check in visualization tool(Rviz)

- **Open visualization tool in OPC**
  - Add sensor topic and change 'Fixed Frame' to name of sensor frame





Check in visualization tool(Rviz)

- **Open visualization tool in OPC**
  - Topic name and frame id(for Fixed Frame)

Sensor	Topic name	Frame ID
HD Web Cam	/robotis/sensor/camera/image_raw	cam_link
Depth Camera	/realsense/depth_registered/points	realsense_rgb_optical_frame
LIDAR	/robotis/sensor/scan	lidar_link
FT Sensor	/robotis/sensor/ft_right_foot/raw	r_foot_ft_link
IMU	/robotis/sensor/imu/imu	imu_link

Check in visualization tool(Rviz)

- Open visualization tool in OPC