

Part 1 Depth Camera Configuration

1. Network Configuration

- 1) Open virtual machine
- 2) Right click the imported virtual machine "Ubuntu" and select "Settings".
- 3) Click on "Network Adaptor". If your computer adopts wired connection, select NAT mode. If your computer adopts wireless connection, select bridge mode.

After the mode is confirmed, click on 'OK'.

- 4) Select the imported virtual machine, then click on 'Power on this virtual machine'.
- 5) Open terminal.
- 6) Enter command "ping www.baidu.com" to check whether the network connection is successful.

2. Change Source of Ubuntu System

3. Install ROS System

4. Install Dependency

- 1) Input command "**sudo apt update**" to update apt library.

After update, the following messages will occur.

- 2) Input command "**sudo apt install ros-\$ROS_DISTRO-rgb-d-launch**" to install dependency library.
- 3) Input command "**sudo apt install ros-\$ROS_DISTRO-libuvc**" to install dependency library.
- 4) Input command "**sudo apt install ros-\$ROS_DISTRO-libuvc-camera**" to install dependency library
- 5) Input command "**sudo apt install ros-\$ROS_DISTRO-libuvc-ros**" to install dependency library.

5. Build Work Space

- 1) Input command "**mkdir -p ~/astra_ws/src && cd ~/astra_ws**" to build work space.
- 2) Input command "**catkin_make**" to compile new work space.
- 3) Input command "**source ~/astra_ws/devel/setup.bash**" to set new work space.
- 4) Input command "**echo "source \$HOME/astra_ws/devel/setup.bash" >> ~/.bashrc**" to set the work space as environment variable.

Part 2 Depth Camera Installation

- 1) Copy "**ros_astra_camera.zip**" in "**8. Depth Camera/ Part 2 Depth Camera Installation**" to the virtual machine.

- 2) Input command **"cd Desktop"** to enter the desktop.
Input command **"unzip ros_astra_camera.zip"** to extract the file.
- 3) Double click the folder in the green frame, and right click **"ros_astra_camera"** folder and select **"copy"**.
- 4) Move to the directory as shown in the green frame, and paste **"ros_astra_camera"** folder to it.
- 5) Input command **"cd ~/astra_ws/src/ros_astra_camera"** to enter the work space.
- 6) Input command **"chmod a+x ./scripts/create_udev_rules"** to add permission.
- 7) Input command **"./scripts/create_udev_rules"** to restart udev.
- 8) Input command **"cd ~/astra_ws/"** to enter the work space.
- 9) Input command **"catkin_make --pkg astra_camera"** to recompile the work space.

Part 3 Usage of Depth Camera

1. Enable Camera Service

- 1) Input command **"roslaunch astra_camera astrapro.launch"** to enable the camera service.

2. View on rqt_image_viewer

- 1) Input command **"roslaunch rqt_image_view rqt_image_view"** to open **rqt_image_viewer**.

3. View on rviz

- 1) Input command **"roslaunch rviz rviz"** to open **rviz**

Part 4 Camera Calibration

Part 5 Data Type and Point Cloud

1. Point Cloud Description

Human possess 3D vision, however computer only has 2D vision that is it only obtains 2D information from the pictures. To enable computer to display 3D objects, it is required to empower computer with 3D vision. And point cloud is a specific example of 3D vision.

2. Data Type of Point Cloud

Point cloud data is a set of vectors in 3D coordinate system, which are generally represented by X, Y, Z of 3D coordinate system. Usually, it is used to indicate the outer shape of an object, and also RGB color, gray value, depth, etc.

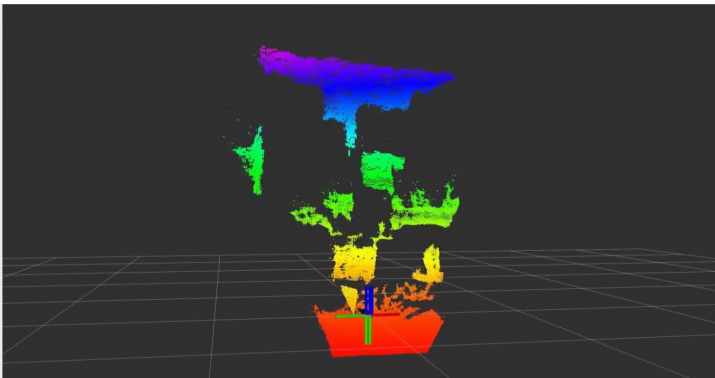
JetAuto's point cloud data is obtained by Lidar and depth camera which can be used for measurement.

Point cloud data is commonly **stored in the format of pts, asc, dat, stl, imw, xyz, txt, csv**, etc. Working like attribute list, **it records the position of X, Y and Z axes of the corresponding point, as well as various attributes.**

3. JetAuto Point Cloud

3.1 Depth Camera Point Cloud

- 1) Start JetAuto, and connect to ubuntu desktop through NoMachine.
- 2) Open command line terminal.
- 3) Input command “**sudo systemctl stop start_app_node.service**” to stop APP service
- 4) Input command “**roslaunch jetauto_peripherals astrapro.launch**” to enable camera service.
- 5) Open a new terminal, and input command “**roslaunch jetauto_example astrapro_point_cloud_view.launch**” to view the point cloud obtained by the depth camera.
- 6) When the following interface pops up, you can view the point cloud. The colored parts are the point cloud data of the depth camera which are obtained by the infrared sensor on the depth camera.



3.2 Configure the Point Cloud of the Depth Camera

- 1) Close the point cloud, and input command “**roslaunch rviz rviz**” to open rviz which is configured by default.
- 2) Click “**Add**”, and select “**By topic ->camera->depth->points->PointCloud2**” in sequence, then click “**OK**” to add the point cloud to rviz.
- 3) Next, complete the following settings in the red frame.

