Raspberry Pi Camera Installation on Raspberry Pi 5 /Ubuntu 24.04 Noble /ROS 2 Jazzy

Purpose

This document describes the installation, configuration and running of a **Raspberry Pi Camera Model 2 or 2.1** connected to a **Raspberry Pi 5/4GB** configured with **ROS2 Jazzy**. Future updates could enable the use of V3 (imx708) or 3rd party cameras, e.g. Waveshare IMX219 79.3 0r 120 FOV.

The principle installed package a ROS 2 “camera_ros” package that publishes the camera video of a ros topic.

Installation and configuration Steps

1.1 Install Ubuntu OS

1.2 Configure the following parameters on the Raspberry Pi 5 SD Card

/boot/firmware/config.sys

Configure Raspberry Pi /boot/firmware/config.sys file

```
# Camera Models
[all]
# Model 2
dtoverlay=imx219
#Model 3
dtoverlay= Imx708
[all]

[all]
# Autoload overlays for any recognized cameras or displays that are attached
# to the CSI/DSI ports. Please note this is for libcamera support, *not* for
# the legacy camera stack
# camera_auto_detect=0
# the legacy camera stack
# for legacy camera with v4l2 Package
camera_auto_detect=1
start_x=1
display_auto_detect=1
[all
```

1.3 Add User to vídeo group

```
$ sudo usermod -a -G vídeo ubuntu
```

1.4 Install ros-jazzy-desktop, build packages and configure workspace

https://docs.ros.org/en/jazzy/Installation/Ubuntu-Install-Debs.html

https://docs.ros.org/en/jazzy/Tutorials/Beginner-Client-Libraries/Colcon-Tutorial.html

1.5 Install Dependencies

v4l2 Utilities to manage a camera, a ROS 2 package that publishes camera output as a topic, Raspberry Pi configuration utility, and a ROS 2 package that used to subscribe to and publish images. It provides transparent support for transporting images in low-bandwidth compressed formats.

Install raspi-config, v4l-utils. ros-jazzy-image-transport-plugins,

```
$ sudo apt-get install raspi-config ros-jazzy-image-transport-plugins v4l-utils
```

- raspi-config: A tool for configuring camera device connection on Raspberry Pi.
- ros-jazzy-image-transport-plugins
- v4l-utils: A utility that assists with connection.

raspi-config
https://www.raspberrypi.com/documentation/computers/configuration.html
It helps you configure your Raspberry Pi. Changes to raspi-config will modify /boot/firmware/config.txt and other configuration files. This procedure describes directly editing the config.txt file rather than using this package.

v4l2 Utilities examples

Installation follows

Displays all available information for connected Camera Devices

```
:~$  v4l2 --all
```

Shows the device name of a connected Raspberry Pi Camera as device /dev/video0

```
:~$ v4l2-ctl –list devices
rp1-cfe (platform:1f00110000.csi):
        /dev/video0
```

image_transport : github: https://wiki.ros.org/image_transport

These plugin packages may be described in a future document revision.

Note:

ros-jazzy-v4l2-camera is a package that may be installed on the **Raspberry Pi** to publish camera output as a topic and should **NOT** be installed on the Raspberry Pi in this procedure

To verify its status: $ sudo apt purge ros-jazzy-v4l2-camera-package, should confirm this status.

1.6 Install Libcamera Package

GW PPA Repository for Raspberry Pi 5 Ubuntu 24.04 Noble arm64 libcamera Packages

https://launchpad.net/~marco-sonic/+archive/ubuntu/rasppios

Included Built Packages

- **gstreamer1.0-libcamera** complex camera support library (GStreamer plugin)
- **libcamera-dev** complex camera support library (development files)
- **libcamera-doc** complex camera support library (documentation)
- **libcamera-ipa** complex camera support library (IPA modules)
- **libcamera-tools** complex camera support library (tools)
- **libcamera-v4l2** complex camera support library (V4L2 module)
- **libcamera0.4** complex camera support library
- **python3-libcamera** complex camera support library (Python bindings)

Package Files

- gstreamer1.0-libcamera_0.4.0+rpt20250213-1ubuntu1~marco1_arm64.deb (58.0 KiB)
- libcamera-dev_0.4.0+rpt20250213-1ubuntu1~marco1_arm64.deb (33.2 KiB)
- libcamera-doc_0.4.0+rpt20250213-1ubuntu1~marco1_all.deb (16.3 MiB)
- libcamera-ipa_0.4.0+rpt20250213-1ubuntu1~marco1_arm64.deb (441.8 KiB)
- libcamera-tools_0.4.0+rpt20250213-1ubuntu1~marco1_arm64.deb (261.8 KiB)
- libcamera-v4l2_0.4.0+rpt20250213-1ubuntu1~marco1_arm64.deb (45.9 KiB)
- libcamera0.4_0.4.0+rpt20250213-1ubuntu1~marco1_arm64.deb (488.7 KiB)
- libcamera_0.4.0+rpt20250213-1ubuntu1~marco1.debian.tar.xz (19.5 KiB)
- libcamera_0.4.0+rpt20250213-1ubuntu1~marco1.dsc (2.9 KiB)
- libcamera_0.4.0+rpt20250213.orig.tar.xz (1.3 MiB)
- python3-libcamera_0.4.0+rpt20250213-1ubuntu1~marco1_arm64.deb (227.7 KiB)

Install these arm64 packages from this PPA

1.6.1 sudo add-apt-repository ppa: https://launchpad.net/~marco-sonic/+archive/ubuntu/rasppios/+sourcepub/17057732/+listing-archive-extra

1.6.2 sudo apt-get update && upgrade

1.6.3 sudo apt-get install <**>

```
sudo apt-get install gstreamer1.0-libcamera
sudo apt-get install libcamera-dev
sudo apt-get install libcamera-doc
sudo apt-get install libcamera-ipa
sudo apt-get install libcamera-tools
sudo apt-get install libcamera-v4l2
sudo apt-get install libcamera0.4
sudo apt-get install python3-libcamera
```

After doing this, check the installation with the **dpkg** command

```
$ sudo dpkg -l |grep libcamera
```

A possible future release is" rpicam-apps"

1.7 Install "camera_ros" package from Source, that publishes camera output as a topic

A helpful background reference for a similar camera package installation is: https://emanual.robotis.com/docs/en/platform/turtlebot3/sbc_setup/#sbc-setup

Developed and maintained by:
https://github.com/christianrauch/camera_ros

```
$ mkdir -p camera_ws/src
$ cd camera_ws
$ git clone git clone https://github.com/christianrauch/camera_ros.git
$ # resolve binary dependencies and build workspace
$ source /opt/ros/$ROS_DISTRO/setup.bash
$ cd ~/camera_ws/
$ rosdep install -y --from-paths src --ignore-src --rosdistro $ROS_DISTRO --skip-keys=libcamera
```

```
colcon build --event-handlers=console_direct+
$ . install/setup.bash
```

OR to permanently configure this package to run from anywhere
With $ nano edit .bashrc, and add the line:
source /home/ubuntu/camera_ws/install/setup.bash
Now, any Terminal that opens will source this package.

In a Terminal,

```
$ ros2 run camera_ros camera_node -–ros-args -p camera:=0 -p role:=viewfinder
```

In a 2nd Terminal,

```
$ ros2 run rqt_image_view rqt_image_view /camera/image_raw
```

Node, topic and param list are as follows:

```
ubuntu@rp5-ub24j-mb:~$ ros2 node list
/camera
ubuntu@rp5-ub24j-mb:~$ ros2 topic list
/camera/camera_info
/camera/image_raw
/camera/image_raw/compressed
/parameter_events
/rosout
ubuntu@rp5-ub24j-mb:~$ ros2 param dump /camera
/camera:
  ros__parameters:
    camera: 0
    format: ''
    height: 0
    jpeg_quality: 95
    qos_overrides:
      /parameter_events:
        publisher:
          depth: 1000
          durability: volatile
          history: keep_last
          reliability: reliable
    role: raw
    start_type_description_service: true
    use_sim_time: false
```

If Camera Calibration is not done, on running “camera_node, an error message may be displayed:

The error message Unable to open camera calibration file [/home/ubuntu/.ros/camera_info/imx219__base_soc_i2c0mux_i2c_1_imx219_10_640x480 .yaml]appears because the calibration file is missing. After performing the calibration, place the corresponding info file in the specified folder.

The camera_name should be set as imx219__base_soc_i2c0mux_i2c_1_imx219_10_640x480

A sample yaml file

```
mage_width: 640
image_height: 480
camera_name: imx219__base_soc_i2c0mux_i2c_1_imx219_10_640x480
frame_id: camera
camera_matrix:
  rows: 3
  cols: 3
  data: [322.0704122808738, 0, 199.2680620421962, 0, 320.8673986158544,
155.2533082600705, 0, 0, 1]
distortion_model: plumb_bob
distortion_coefficients:
  rows: 1
  cols: 5
  data: [0.1639958233797625, -0.271840030972792, 0.001055841660100477, -
0.00166555973740089, 0]
rectification_matrix:
  rows: 3
  cols: 3
  data: [1, 0, 0, 0, 1, 0, 0, 0, 1]
projection_matrix:
  rows: 3
  cols: 4
  data: [329.2483825683594, 0, 198.4101510452074, 0, 0, 329.1044006347656,
155.5057121208347, 0, 0, 0, 1, 0]
```

Camera Calibration

https://docs.ros.org/en/rolling/p/camera_calibration/

Full description in a future document revision