

rqt_cam

User Manual

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Introduction

ROS is an open-source, meta-operating system (OS) for your robot. It provides the services you would expect from an OS, including hardware abstraction, low-level device control, implementation of commonly used functionality, message-passing between processes, and package management. It also provides tools and libraries for obtaining, building, writing, and running code across multiple computers. ROS is similar to robot frameworks, such as Player, YARP, Orocos, CARMEN, Orca, MOOS, and Microsoft Robotics Studio.

The ROS runtime graph is a peer-to-peer network of processes (potentially distributed across machines) that are loosely coupled using the ROS communication infrastructure. ROS implements several different styles of communication, including synchronous RPC-style communication over services, asynchronous streaming of data over topics, and storage of data on a Parameter Server.

ROS is not a real-time framework, though it is possible to integrate ROS with real-time code. The Willow Garage PR2 robot uses a system called `pr2_etherCAT`, which transports ROS messages in and out of a real-time process. ROS also has seamless integration with the Orocos Real-time Toolkit.

e-con Systems provides a sample video for Linux version 2 (V4L2) application, called `rqt_cam`, along with the publisher named `cam_v4l2_pub`. `rqt_cam` is a V4L2 video viewer and capture software to demonstrate some of the features of e-con Systems cameras.

This document describes about the usage of the `rqt_cam` application on Ubuntu [≥ 16.04 (LTS)] 64-bit Linux OS, and the special features of `rqt_cam` camera application.

Prerequisites

There is more than one ROS distribution supported at a time. Some are older releases with long term support, making them more stable, while others are newer with shorter support lifetimes, but with binaries for more recent platforms and more recent versions of the ROS packages that make them up. For more details, refer to the [Distribution](#) page. The recommended versions are as follows:

- For Wily (Ubuntu 15.10), Xenial (Ubuntu 16.04) and Jessie (Debian 8), refer to the [ROS Kinetic Kame](#) page.
- For Artful (Ubuntu 17.10), Bionic (Ubuntu 18.04) and Debian stretch, refer to the [ROS Melodic Morenia](#) page.

To build the `rqt_cam` application, please refer to the *[rqt_cam_Build_Manual.pdf](#)*.

Description

The `rqt_cam` application is a simple interface for capturing images and viewing video from the video devices.

Using `rqt_cam` application, you can perform the following:

- Enumerate and list all the video devices connected.
- Change color space/compression, resolution and frame rate for video stream, which are supported by the device.
- Capture the still images and set the path where still images will be saved.
- Configure V4l2 control, if supported by device.

All the above listed properties can be configured by attractive and easy to use Graphical User Interface (GUI). The application is tested in Ubuntu [>=16.04 (LTS)] 64-bit Linux Distributions.

Launching the Application

After connecting any e-con Systems camera to the Linux development system, you must perform the following steps from the catkin workspace folder using terminal:

1. Run the following commands to launch the publisher node.

```
$ roscd ecam_v4l2  
$ roslaunch launch/launch.launch
```

2. Open another terminal.
3. Run the following command to launch the `rqt_cam` application.

```
$ rqt_cam
```

When the application is launched, you can view the home screen as shown below.

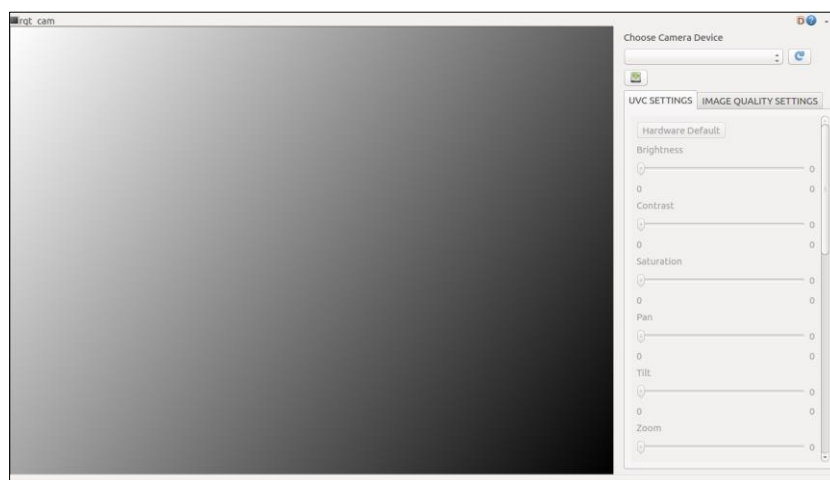


Figure 1: Home Screen

Application Features

This section describes the features that are supported in the current version of rqt_cam application. The features supported in rqt_cam application are as follows:

- [Enumeration and Selection of Camera Device](#)
- [Still Capture](#)
- [Camera Settings](#)

Enumeration and Selection of Camera Device

The application will enumerate only the e-con Systems devices connected to the system. You can select any one of the cameras, for example, See3CAM_130_1523C405, from the drop-down list box and the corresponding preview is displayed in the left-hand side of the side bar. The device name is displayed in the **Choose Camera Device** drop-down list box as shown below.

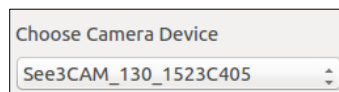


Figure 2: Enumeration and Selection of Camera Device

Note:

- Preview will not be displayed for the device if the camera is busy, that is, the camera is opened by other applications such as v4l2ctl, and so on.
- The preview will not be displayed in the second instance of the rqt_cam application, if two instances of rqt_cam application is selecting the same camera.

Still Capture

To capture the still image, you can click the save image icon available on the side bar. The **rqt_cam** dialog box displaying **The image is saved in the workspace folder** message will appear as shown below.

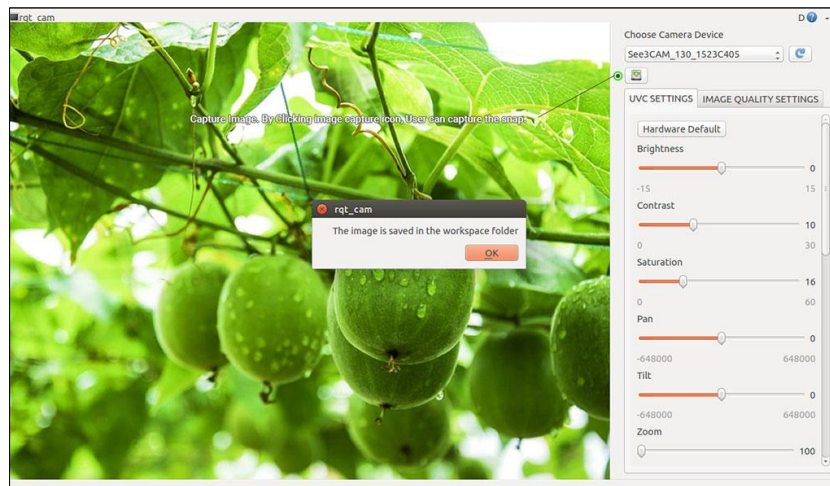


Figure 3: Still Capture

The image will be saved in the catkin workspace path. The supported image formats are as follows:

- .bmp
- .jpg
- .png
- .raw

The file name for captured image file will be

CameraName_SerialNo_format_width_height dd_mm_yy_hh_mm_ss-x, with the selected image extension format. If the extension format is jpg, the file name will be **CameraName_SerialNo_format_width_height dd_mm_yy_hh_mm_ss-x.jpg**.

Where YY-Year, MM-Month, dd-day, hh-hour, mm-min, ss-x denotes image number updated when multiple images are captured.

Camera Settings

The features supported in Camera Settings are as follows:

- [UVC Settings](#)
- [Image Quality Settings](#)

UVC Settings

On selecting the UVC Settings, a **Control** menu will display the camera control settings. You can adjust the video preview settings in the Menu tab. The sliders whose labels are not greyed can only be configured.

You can move the slider and configure the preview settings according to your needs. The value being set will be displayed based on the position of the slider.

Note: The preview property will not change while dragging the slider.

The controls available in UVC Settings are as follows:

- Brightness
- Contrast
- Saturation
- Pan
- Tilt
- Zoom
- Hue
- White Balance
- Gamma
- Gain
- Sharpness
- Exposure
- Focus (Absolute)
- Backlight Compensation
- Focus
- Hardware Default

Note:

- In this document, the selected camera is See3CAM_130_1523C405 which does not support hue, backlight compensation and focus controls.
- The supported controls and values change according to the selected camera.

Brightness

The brightness control increases the low light performance. You can change the brightness values from a minimum value to maximum value (which is mentioned on the sides of the slider) by moving the slider, and the exact changes will be reflected immediately in the preview as shown below.

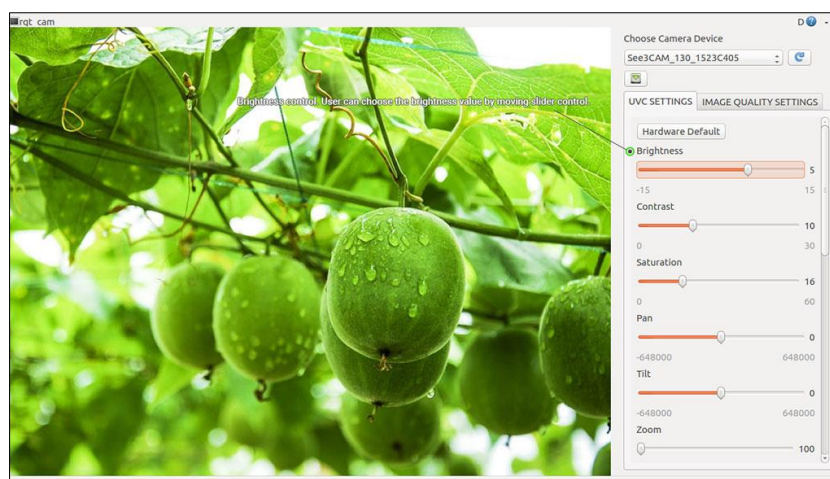


Figure 4: Brightness Control

Contrast

Increasing the value of contrast control increases the luminance. You can change the contrast values from a minimum value to maximum value (which is mentioned on the sides of the slider) by moving the slider, and the exact changes will be reflected immediately in the preview as shown below.



Figure 5: Contrast Control

Saturation

Increasing the value of saturation control increases the intensity of color. You can change the saturation values from a minimum value to maximum value (which is mentioned on the sides of the slider) by moving the slider, and the exact changes will be reflected immediately in the preview as shown below.

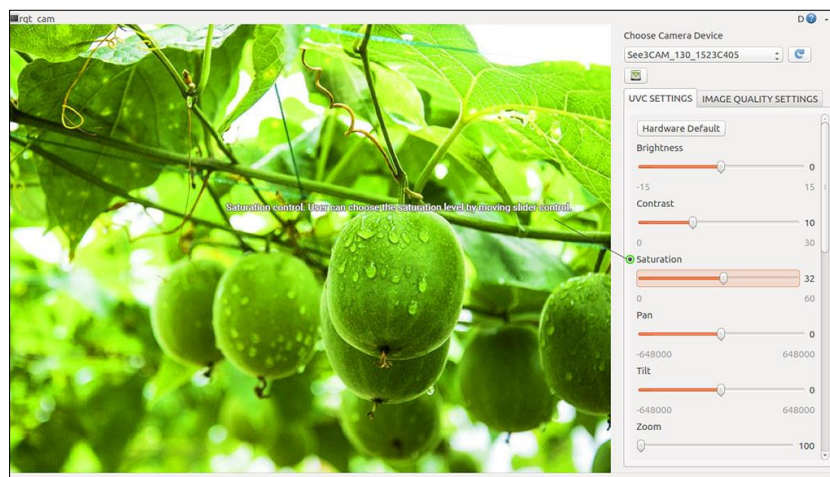


Figure 5: Saturation Control

Pan

You can change the pan values from a minimum value to maximum value (which is mentioned on the sides of the slider) by moving the slider, and the exact changes will be reflected immediately in the preview as shown below.



Figure 6: Pan Control

Tilt

You can change the tilt values from a minimum value to maximum value (which is mentioned on the sides of the slider) by moving the slider, and the exact changes will be reflected immediately in the preview as shown below.

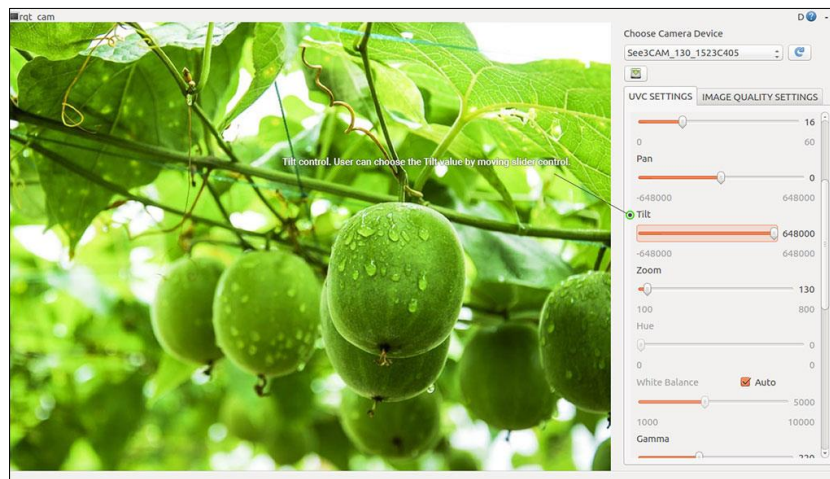


Figure 7: Tilt Control

Zoom

You can change the zoom values from a minimum value to maximum value (which is mentioned on the sides of the slider) by moving the slider, and the exact changes will be reflected immediately in the preview as shown below.

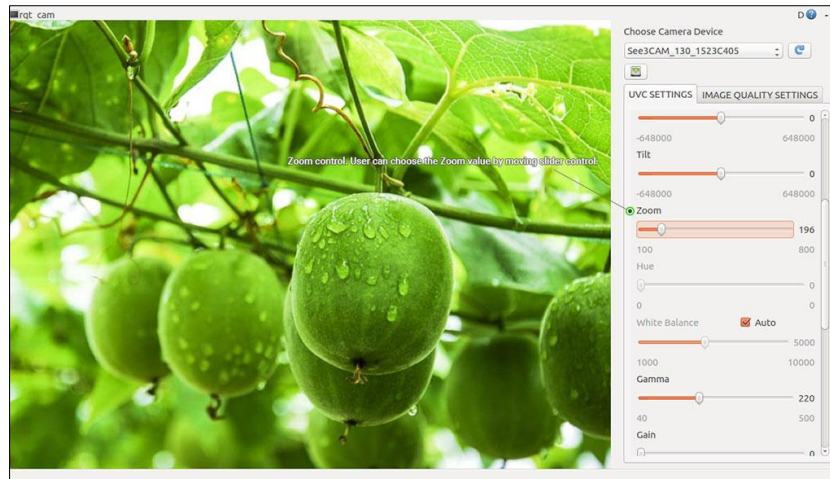


Figure 8: Zoom Control

White Balance

The white balance value decides the colour temperature. You can change the white balance values from a minimum value to maximum value (which is mentioned on the sides of the slider) by moving the slider, and the exact changes will be reflected immediately in the preview.

The manual white balance (if available in the camera) can be selected by deselecting the **Auto** check box near the White Balance control as shown below.

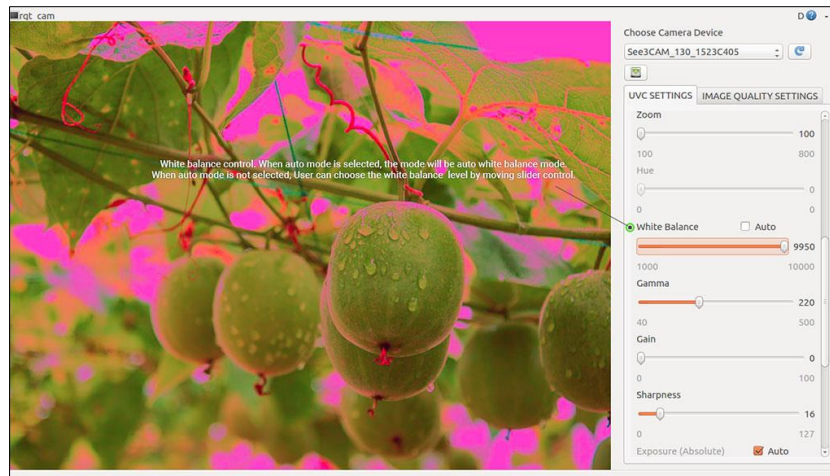


Figure 9: White Balance Control

Gamma

You can change the gamma values from a minimum value to maximum value (which is mentioned on the sides of the slider) by moving the slider, and the exact changes will be reflected immediately in the preview as shown below.

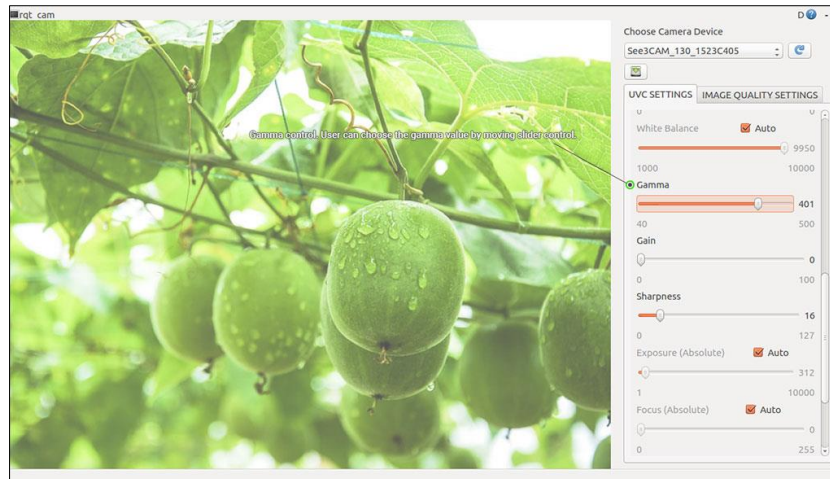


Figure 10: Gamma Control

Gain

You can change the gain values from a minimum value to maximum value (which is mentioned on the sides of the slider) by moving the slider, and the exact changes will be reflected immediately in the preview as shown below.

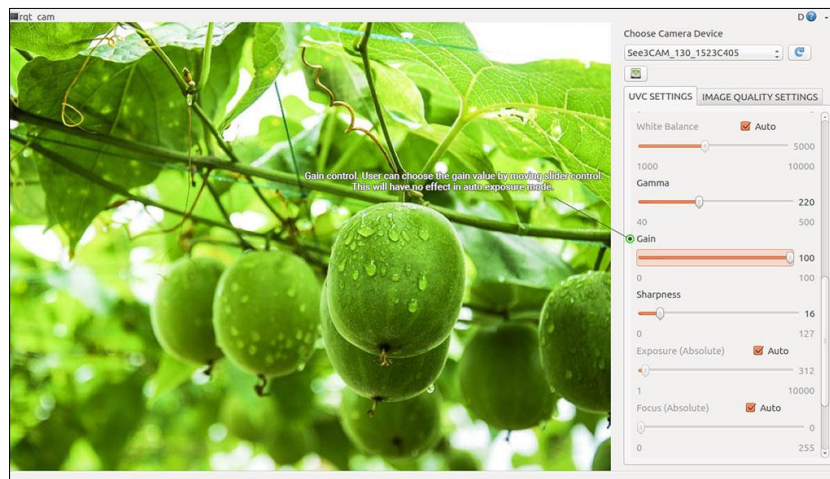


Figure 11: Gain Control

Note: The slider of gain control will not have any effect in auto exposure mode.

Sharpness

The sharpness control increases clarity. You can change the sharpness values from a minimum value to maximum value (which is mentioned on the sides of the slider) by moving the slider, and the exact changes will be reflected immediately in the preview as shown below.

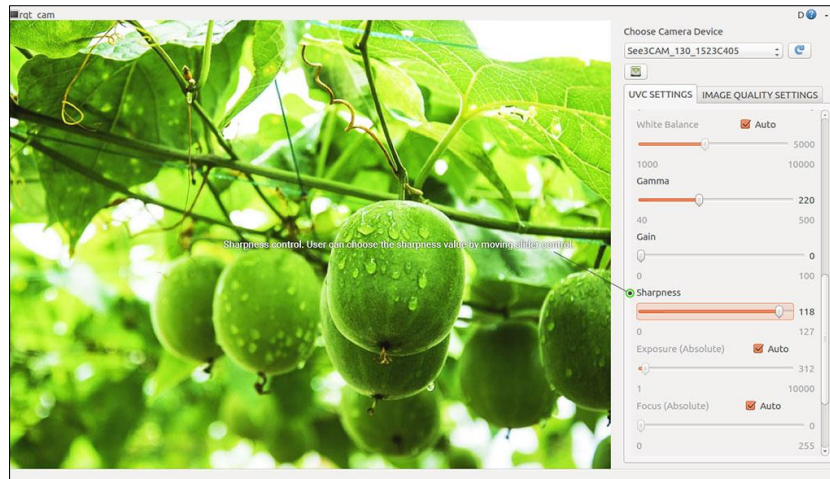


Figure 12: Sharpness Control

Exposure

You can change the exposure values from a minimum value to maximum value (which is mentioned on the sides of the slider) by moving the slider, and the exact changes will be reflected immediately in the preview.

The manual exposure (if available in the camera) can be selected by deselecting the **Auto** check box near the Exposure (Absolute) control as shown below.

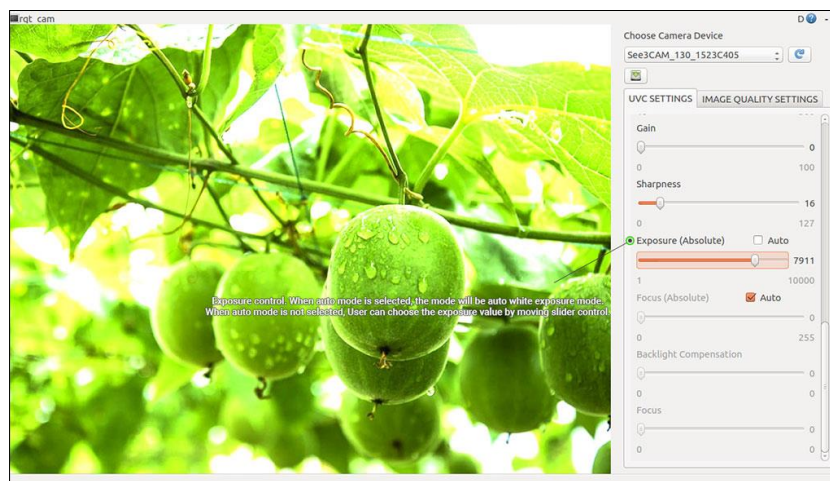


Figure 13: Exposure Control

Note:

- When the exposure time period is more than the time period of camera frame, the frame rate will drop.
- Controls are global across all resolutions and formats, and hence changing the control values will reflect the changes in both the formats and resolutions.

Hardware Default

The **Hardware Default** button is used to reset the UVC Settings values to the hardware default state. Once you click the **Hardware Default** button, all the control

values and preview are set to the default mode. You can view the screen similar to the screen shown below.

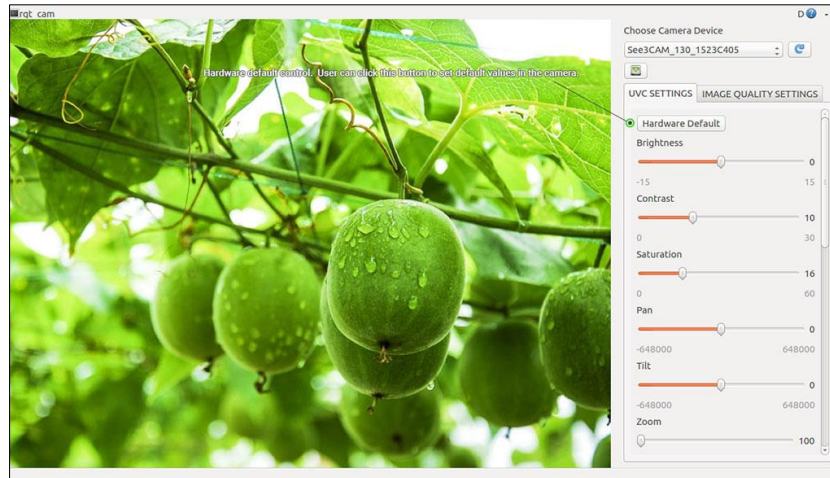


Figure 14: Hardware Default

Image Quality Settings

On selecting the Image Quality Settings, you can select the color space/format, image resolution, frame rate and image save format type.

The controls available in Image Quality Settings are as follows:

- Format
- Resolution
- Frame Rate
- Image Format

Format

When you click the **FORMAT** drop-down list box, you can view the color space compression / format as shown below.

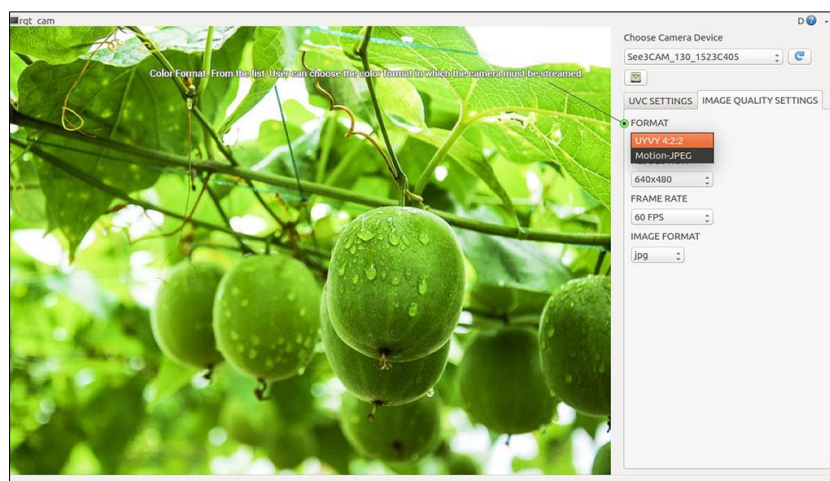


Figure 15: Color Space Format

The color space formats which are supported by the rqt_cam application are as follows:

- MJPG
- UYVY
- YUYV
- Y8
- Y12
- Y16

By default (while camera is selected), the preview color space/format will be selected, but you can change this any time.

Resolution

When you click the **RESOLUTION** drop-down list box, you can view the supported resolution list based on still color space/format selection as shown below.

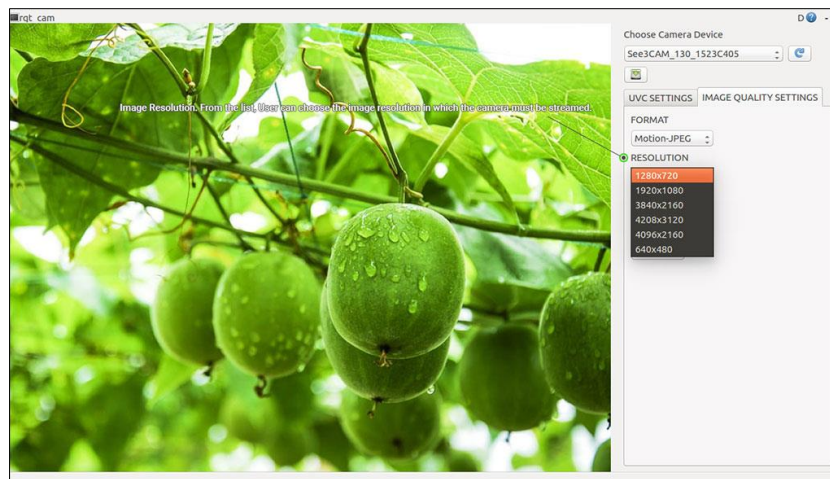


Figure 16: Still Image Resolution

The resolution will be varied based on USB 3.0/USB 2.0 and color space formats. By default (while camera is selected), the preview output size will be selected, but you can change this any time.

Frame Rate

The frame rate displayed is the maximum expected fps for the current resolution (output size). When you click the **FRAME RATE** drop-down list box, you can view the supported frame rate list as shown below.

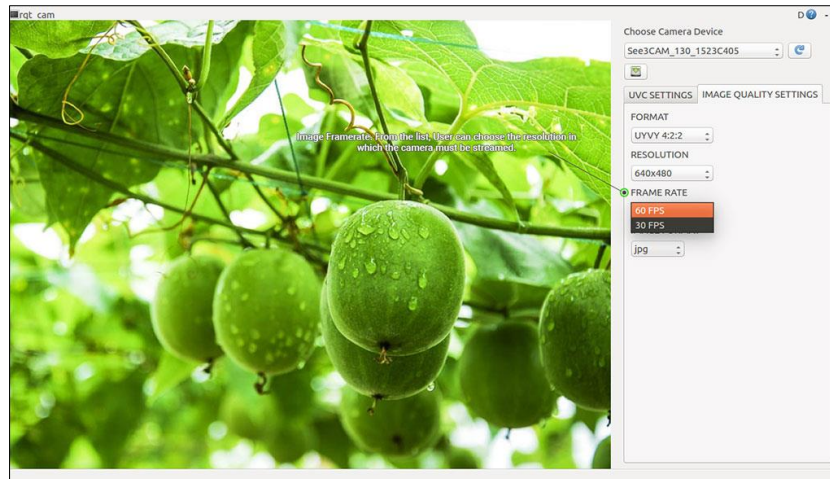


Figure 17: Frame Rate

Image Format

When you click the **IMAGE FORMAT** drop-down list box, you can view the supported image format list as shown below.

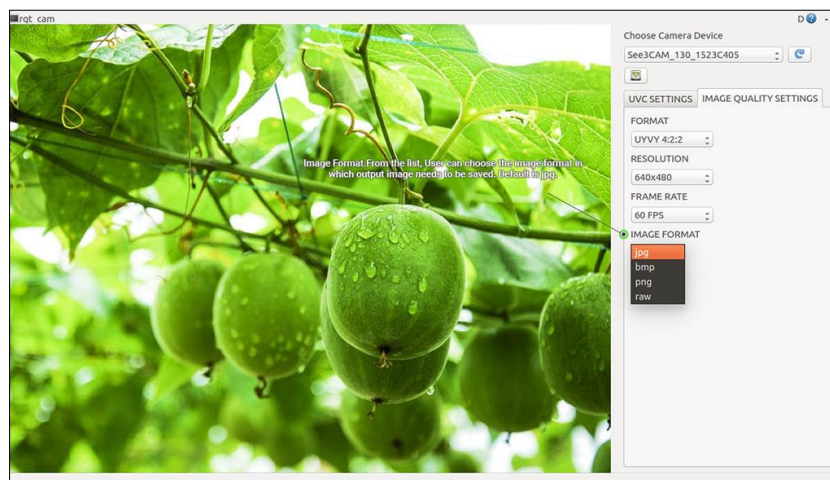


Figure 18: Still Image Format

The image format which are supported by the rqt_cam application are as follows:

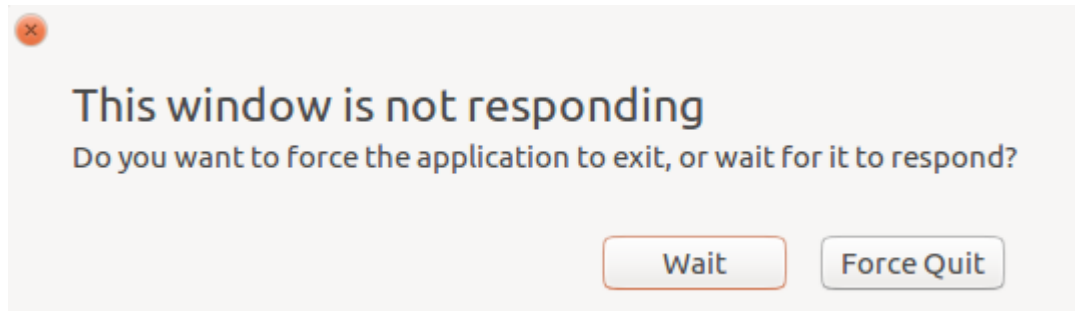
- jpg
- bmp
- raw
- png

The captured images are saved as per the selected image format. The default format is jpg.

Troubleshooting

In this section, you can view the list of commonly occurring issues and their troubleshooting steps.

This window is not responding error in rqt_cam application.



This error will occur if the publisher node is shutdown, so make sure that the publisher node is running and try again.

This camera is already streaming error when selecting camera device.

This error will occur when you try to select the camera which is already streaming in another instance of rqt_cam application.

In this version, multiple subscriber is not supported to same camera.

This is a known limitation. e-con Systems have planned to give support in future.

The camera needs to be connected before running the application.

This is a known limitation. e-con Systems have planned to give support in future.

1. Can I stream multiple cameras at the same time?

Yes, you can stream multiple cameras at the same time by creating instances of rqt_cam application and selecting different cameras in each instance. But consider the bandwidth limitation.

2. I can view frame corruption while streaming. Can this be avoided?

Yes, this is due to bandwidth limitation in USB host. This may occur when multiple cameras are connected to single USB host or in USB host of less powerful embedded boards. Visit this <https://www.e-consystems.com/blog/camera/usb-3-0-maximum-bandwidth-utilization-for-see3cams-using-pcie-expansion-cards/> blog for more information on USB practical bandwidths.

3. What are the supported ROS distributions?

e-con Systems supports both ROS kinetic and ROS melodic.

What's Next?

After understanding the usage of `rqt_cam` application, you can refer to the *rqt_cam Build Manual* to know how to build `rqt_cam` application.

Glossary

API: Application Programming Interface.

GUI: Graphical User Interface.

ROS: Robot Operating System.

RPC: Remote Procedure Call.

UVC: USB Video Class.

V4L2: Video for Linux version 2 is a collection of device drivers and API for supporting real-time video capture on Linux systems.

Support

Contact Us

If you need any support on rqt_cam application, please contact us using the Live Chat option available on our website - <https://www.e-consystems.com/>

Creating a Ticket

If you need to create a ticket for any type of issue, please visit the ticketing page on our website - <https://www.e-consystems.com/create-ticket.asp>

RMA

To know about our Return Material Authorization (RMA) policy, please visit the RMA Policy page on our website - <https://www.e-consystems.com/RMA-Policy.asp>

General Product Warranty Terms

To know about our General Product Warranty Terms, please visit the General Warranty Terms page on our website - <https://www.e-consystems.com/warranty.asp>

Revision History

Rev	Date	Major Changes	Edited By	Reviewed By
1.0	20-January-2020	Initial Draft	Ramson Jehu	Ram Prasath