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See3CAM_12CUNIR

Application User Manual

Revision 1.2
08-October-2014



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See3CAM_12CUNIR

1 Revision History

Rev No	Date	Major Changes	Author
Initial Draft	09-09-2014	Initial Draft	Bhanu
1.1	03-10-2014	Added changes	Bhanu
1.2	08-10-2014	Changed project Name	Bhanu



2 Introduction

The See3CAM_12CUNIR is a 1.3 Megapixel, UVC Compliant, USB3.0 Super Speed camera from e-con Systems, a leading embedded Product Design Services Company which specializes in the advanced camera solutions. The See3CAM is a new family of USB3.0 Super Speed camera products launched by e-con and See3CAM_12CUNIR is the first member of this family.

The See3CAM_12CUNIR is an electronic rolling shutter, 1.3 Megapixel Monochrome Camera that is based on the Aptina AR0130 CMOS image sensor. This See3CAM_12CUNIR is a UVC-compliant USB3.0 Super Speed Camera that is also backward compatible with USB2.0 host ports and does not require any special camera drivers. The See3CAM_12CUNIR is capable of supporting 720p60 (HD) , 1280x960 resolution at 45 fps and 640x480 binned at 45 fps with the pixel depth of 12-bit monochrome data when interfaced to a USB3.0 host port. The AR0130 CMOS image sensor used in this See3CAM_12CUNIR is an Electronic Rolling Shutter, 1/3" optical form-factor, CMOS Image sensor from Aptina and the See3CAM_12CUNIR is supported with CS-mount lens holder for enabling the users to choose the lens as per their requirements.

E-con provides a sample DirectShow application, called e-CAMView, along with the See3CAM_12CUNIR camera. The e-CAMView is a typical DirectShow camera application, but customized to demonstrate some of the features of See3CAM_12CUNIR.

3 Scope

E-con provides a sample DirectShow application, called e-CAM View, along with the See3CAM_12CUNIR. The e-CAM View is a typical DirectShow camera application, but customized to demonstrate the features of See3CAM_12CUNIR. This document describes these features of this sample camera application when it is used with See3CAM_12CUNIR.

4 Description

The See3CAM_12CUNIR is a USB 3.0 camera capable of streaming camera frames 1280x 720 @ 60 fps, 1280x960 @ 45 fps and 640x480 binned from 1280x960 @ 45 fps. It is an Electronic Rolling shutter camera and the camera can synchronize the exposure of all the pixels on receiving an external trigger. It also supports all the features with a USB 2.0 fallback. In USB 2.0, See3CAM_12CUNIR can stream in 1280 x 720 resolution @ 12 fps and in 1280 x 960 resolution @ 9 fps and 640 x 480 resolution binned from 1280 x 960 @ 30fps.

The See3CAM_12CUNIR has two major camera controls namely,

- Brightness
- Exposure (both manual and automatic)

The sample application e-CAMView for See3CAM_12CUNIR can demonstrate the controls supported, switching between preview resolutions, capturing still images and operating modes.

The next section starts with the preliminary steps involved in installation of the e-CAMView software and launching the application.



5 Pre-Requisites

This section describes the high level instructions to install the See3CAM_12CUNIR on a PC. Please refer the Getting Started manual for more detailed installation steps and pictures of the same.

5.1 Installation of the See3CAM_12CUNIR and Drivers

Follow the following steps to initialize the device with the host computer

- Connect the one end of the USB 3.0 cable to the USB 3.0 connector provided at the side of See3CAM_12CUNIR and connect the other end to the USB 3.0 host controller on the computer.
- Move the power switch to on position,
- Once Switched ON, the LED light on the device will glow indicating that See3CAM_12CUNIR is powered up and ready to use.
- As See3CAM_12CUNIR is a generic USB Video Class device windows will automatically detect all the drivers and will be installed. This happens for the first time and from the second time device will be detected immediately by the host PC and will be ready for use.
- To see the preview the e-CAM View application designed for See3CAM_12CUNIR has to be installed. The installation steps are given in the **section 5. Installation of e-CAM View** of the **e-CAM View Installation Manual for See3CAM_12CUNIR _1_1** document.



6 Using e-CAM View

To launch the video streaming and capture application e-CAM View click on the **Start -> All Programs -> e-con Systems -> e-CAM View**.

This version of e-CAM View comes with a set of features that can be used to attain the full functionality of See3CAM_12CUNIR. The Menu bar at the top contains few menu items and the lower status bar shows some information. When the application is running, the current preview resolution and the frame rate are displayed in the lower status bar. The following sections describe each of the menu items in detail.

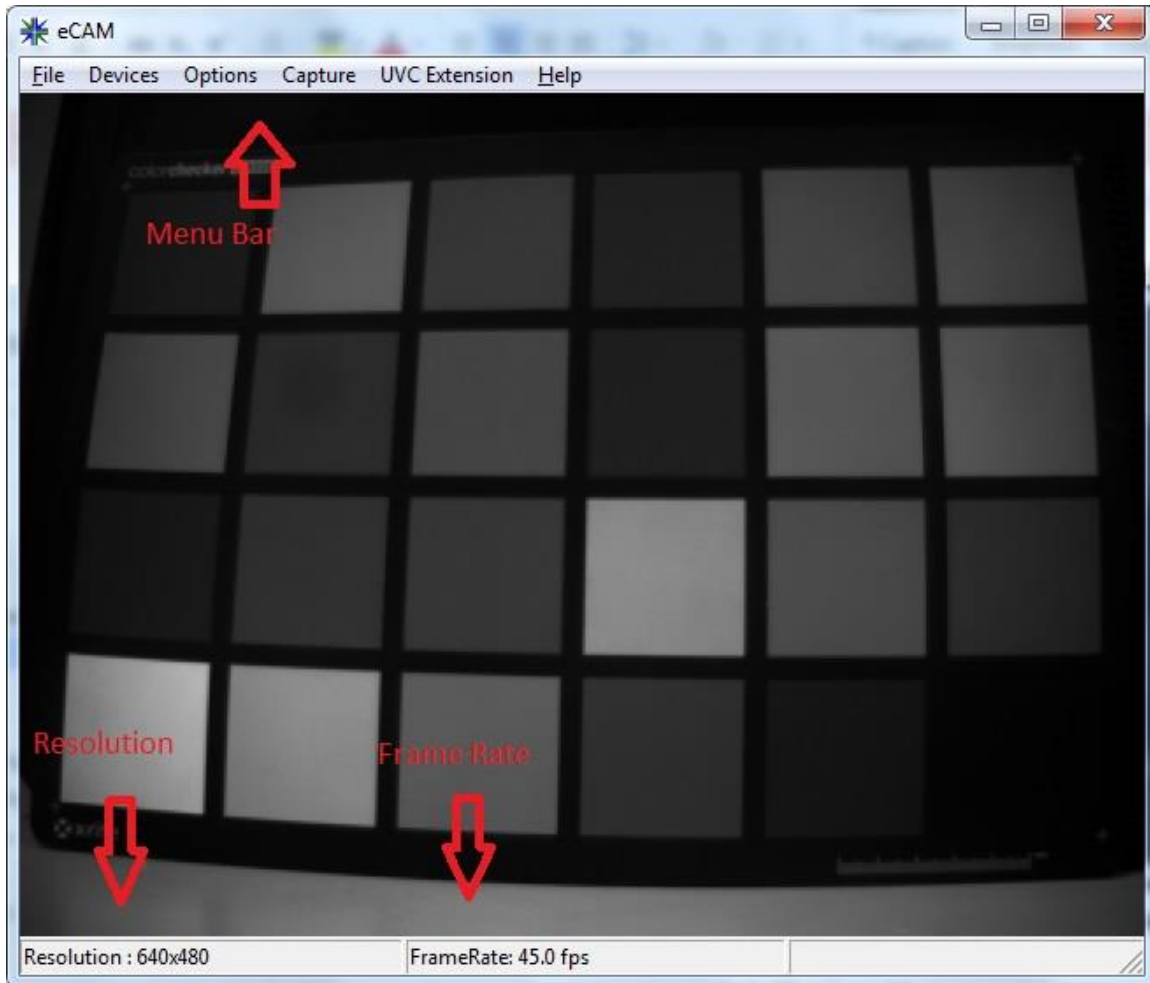


Figure 1: Application launch appearance



6.1 Devices Menu

Devices menu will show the currently connected video devices to host PC and the user can select any video devices attached to the computer. A check mark is placed before the device indicating the video device which is currently streaming. By default See3CAM_12CUNIR will be indicated by the name See3CAM_12CUNIR. In case any other video device is connected such as on-board webcam etc., the e-CAM View shall list down those video capture devices as well and the user can switch between the available video capture devices, by selecting the respective device.

There is no audio capture source available with the See3CAM_12CUNIR. The following menu shows only our camera being listed in the Devices menu.

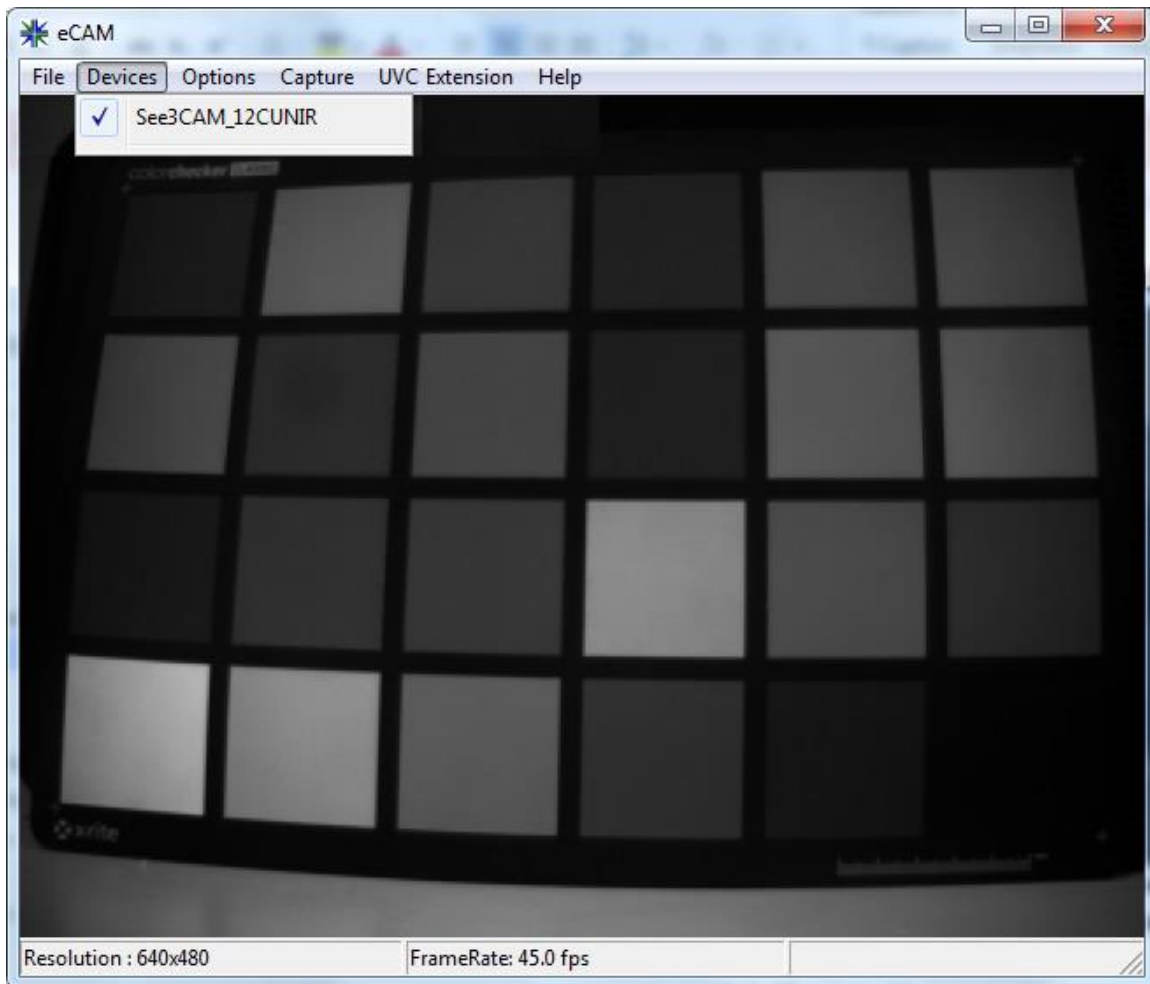


Figure 2: Enumerated Devices list



6.2 Options Menu

The options menu can be used to select the various preview and image resolutions and the controls that are supported by See3CAM_12CUNIR. When clicked the options menu will appear as shown in the snapshot below.

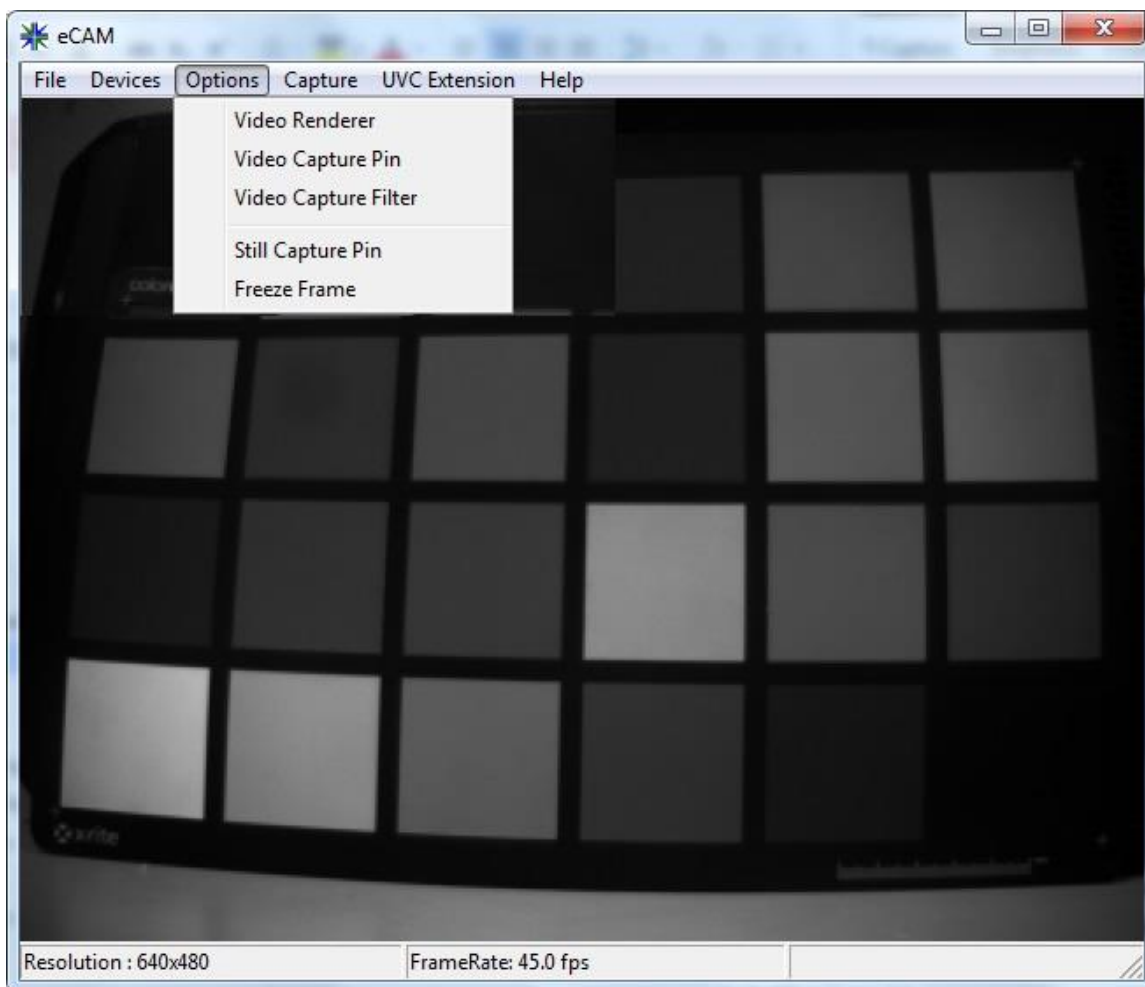


Figure 3: Options Menu

From this Options menu the following options can be selected

- **Video Capture Filter** – to change brightness, Manuel Exposure and Auto Exposure.
- **Video Capture Pin** – to select various video preview resolutions supported by the device.
- **Still Capture Pin** – to select various still image resolutions supported by the device.

The details of each of these options are described below:



6.2.1 Video Capture Filter

The Video Capture Filter submenu of the Options Menu can be used to configure some of the camera parameters of See3CAM_12CUNIR. Currently the See3CAM_12CUNIR supports brightness, Manuel Exposure and Auto Exposure control. The user can choose the values of these controls of the See3CAM_12CUNIR.

The various controls that are supported by See3CAM_12CUNIR are

- Brightness Control
- Exposure Control (Auto & Manual)

The brightness control is available in the **Video Proc Amp**.

The **Default** button in the tab is used to select the default inbuilt values of all the controls for the See3CAM_12CUNIR.

Note: Controls other than brightness, contrast, hue, saturation, sharpness, white balance, focus are not supported and hence cannot be used.

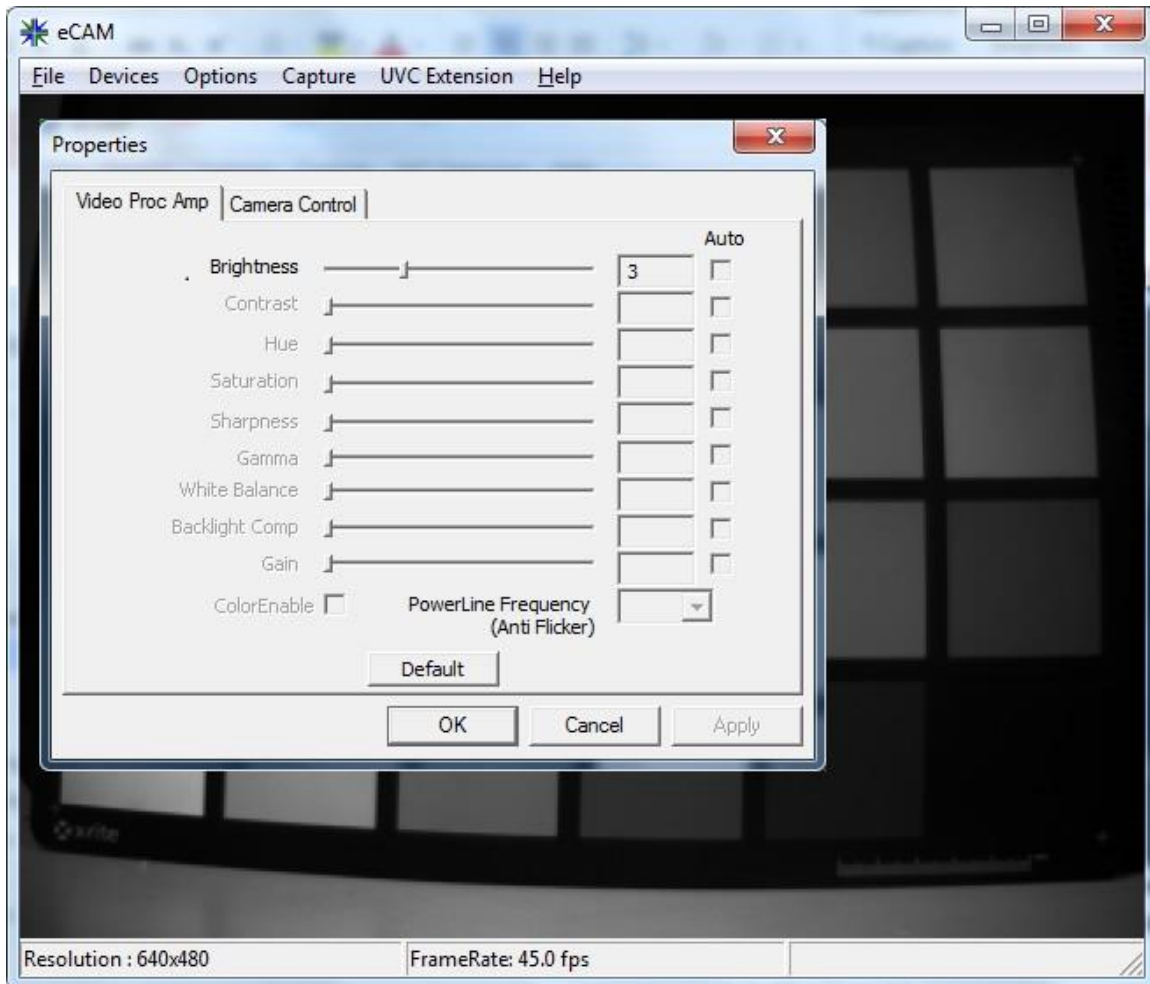


Figure 4: Video Proc Amp properties



6.2.1.1 Brightness Control

The Brightness values can be changed from a minimum value of 1 to 8 by moving the slider, and the exact changes will be reflected immediately in the preview. This brightness control increases the brightness of See3CAM_12CUNIR. The Default value is 1. Adjusting this control in turn will increase the Gain of the sensor. So increasing the value of this control will result in noise in the image because of the Gain increase of the Sensor.

6.2.1.2 Exposure Control (Manuel and Auto)

The See3CAM_12CUNIR supports manual Exposure and Auto Exposure control which can be controlled using the Camera Control tab of the Video Capture Filter submenu. The Manual Exposure can be selected by uncheck the check box near the Exposure control. The Manual Exposure values can be changed from a minimum value of -11 to +2 by moving the slider, and the exact changes will be reflected immediately in the preview. This Manual Exposure control changes the preview Exposure time which results in decrease of Frame Rate of See3CAM_12CUNIR. The Default value is -4.

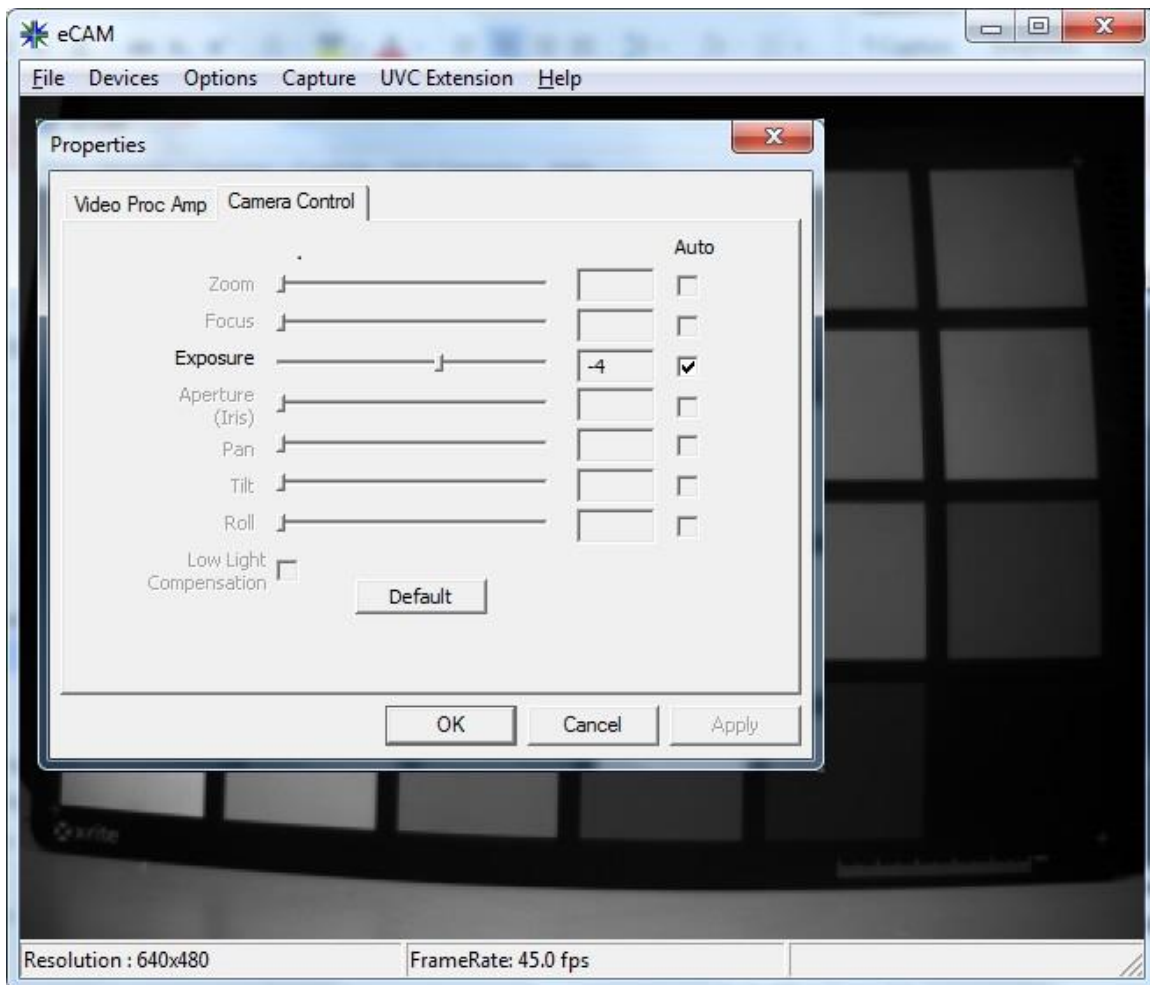


Figure 5: Camera Control –Exposure Bar



6.2.2 Video Capture Pin

The Video Capture Pin is the submenu of the Options Menu and it is used to select the various supported resolutions by See3CAM_12CUNIR.

- To change the resolution the user can select any one of the resolutions from the **Output Size** list box.
- To change the color format of the preview the user can select one of the color formats from the **Color Space / Compression** list box. The See3CAM_12CUNIR supports Y16 format.

The frame rate supported by the current resolution will appear in the **Frame Rate** text box.

Currently See3CAM_12CUNIR supports **Y16** format and in this format three resolutions are supported in USB3.0 and USB2.0;

Y16:

- 640 x 480 at 45 fps in USB 3.0 and 30 fps in USB 2.0.
- 1280 x 720 at 60 fps in USB 3.0 and 12 fps in USB 2.0.
- 1280 x 960 at 45fps in USB 3.0 and 9 fps in USB 2.0.

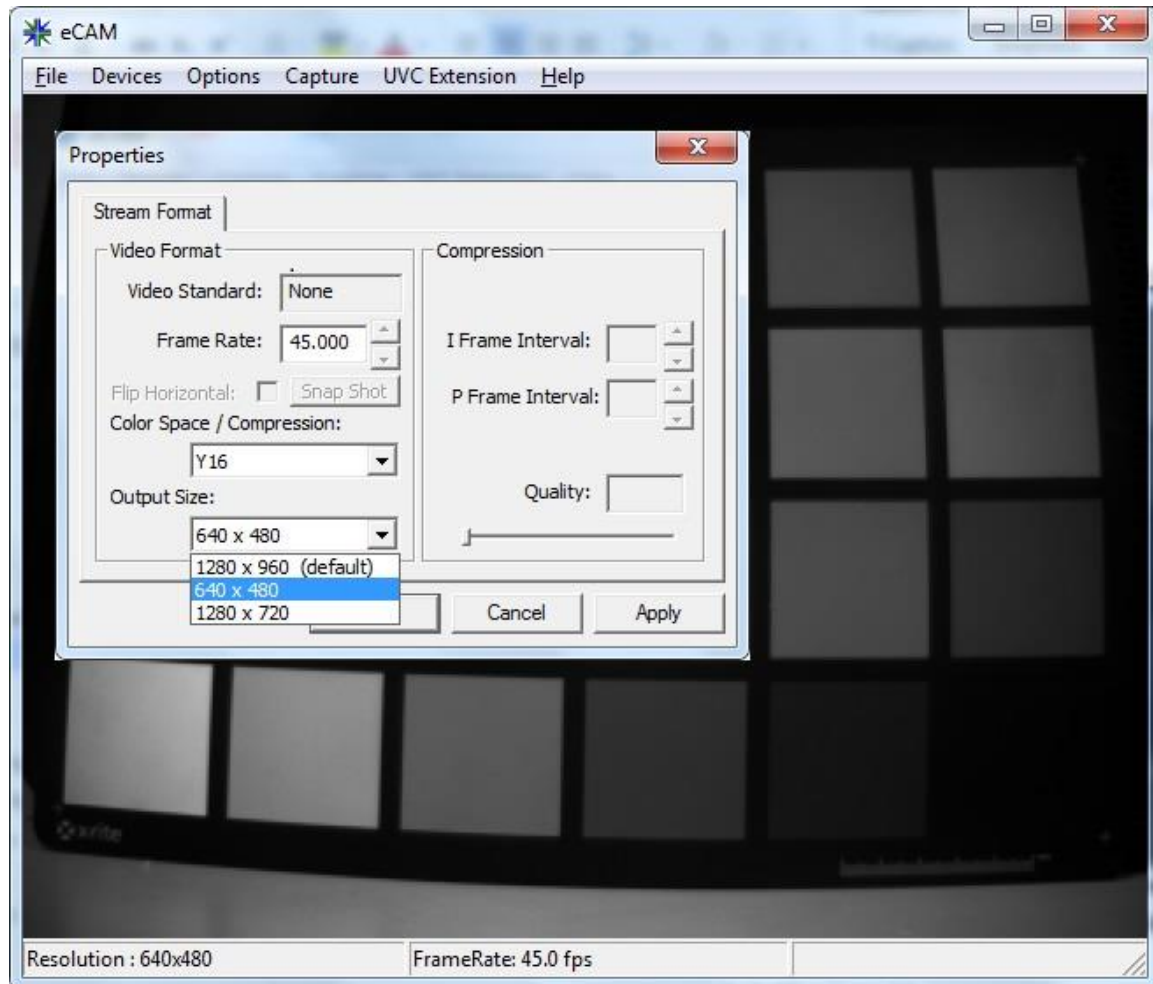


Figure 6: Video Capture Pin



Note1: While changing the preview resolution, the preview will be stopped and resume once again when the resolution is selected and the **OK** button is pressed.

6.2.3 Still Capture Pin

The Still Capture Pin submenu of the Options Menu is used to select the various resolutions supported by See3CAM_12CUNIR for taking still images. One of the important features of See3CAM_12CUNIR is that a still image of any resolution can be taken from any preview resolution. The e-CAM View application will save the images in **RAW (.raw)** format in the user specified location.

- To change the resolution the user can select any one of the resolutions from the **Output Size** list box.
- To change the color format of the preview the user can select one of the color formats from the **Color Space / Compression** list box.

The See3CAM_12CUNIR supports only Y16 color format and in this format three resolution is supported.

- 640 X 480.
- 1280 X 720.
- 1280 X 960.

Note1: While changing the still image resolution, the preview will be stopped and resume once again when the resolution is selected and the **OK** button is pressed.

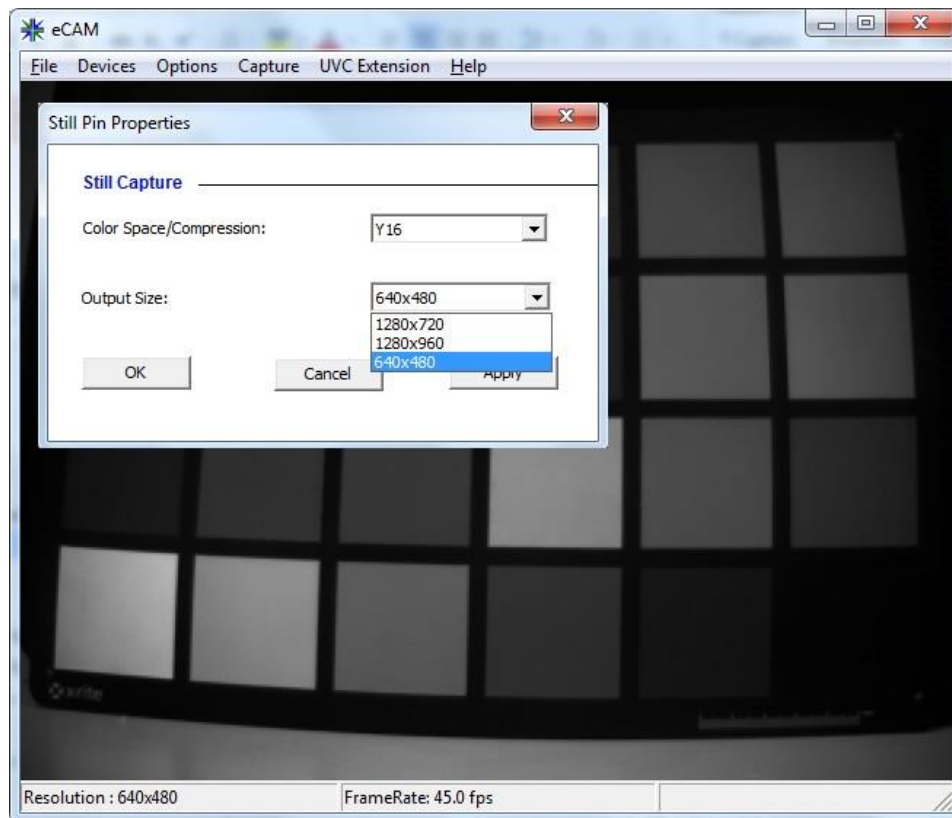


Figure 7: Still capture pin



6.3 Capture Menu

The Capture Menu is used to capture the image by using the e-CAM View application. It can also be used to select the Still image capture path where the images will be saved. By default the e-CAM View will set the Desktop as the image storage path for easy access, but the user can change to any location by using the still path option.

To take an image the user can either click the **Get Still** option or press the **Enter** key of the keyboard with the e-CAM View application being in focus. The image will be captured and stored in the location specified by the user. The image resolution and format shall be as per the selection made by the user during the Still Pin configuration page.

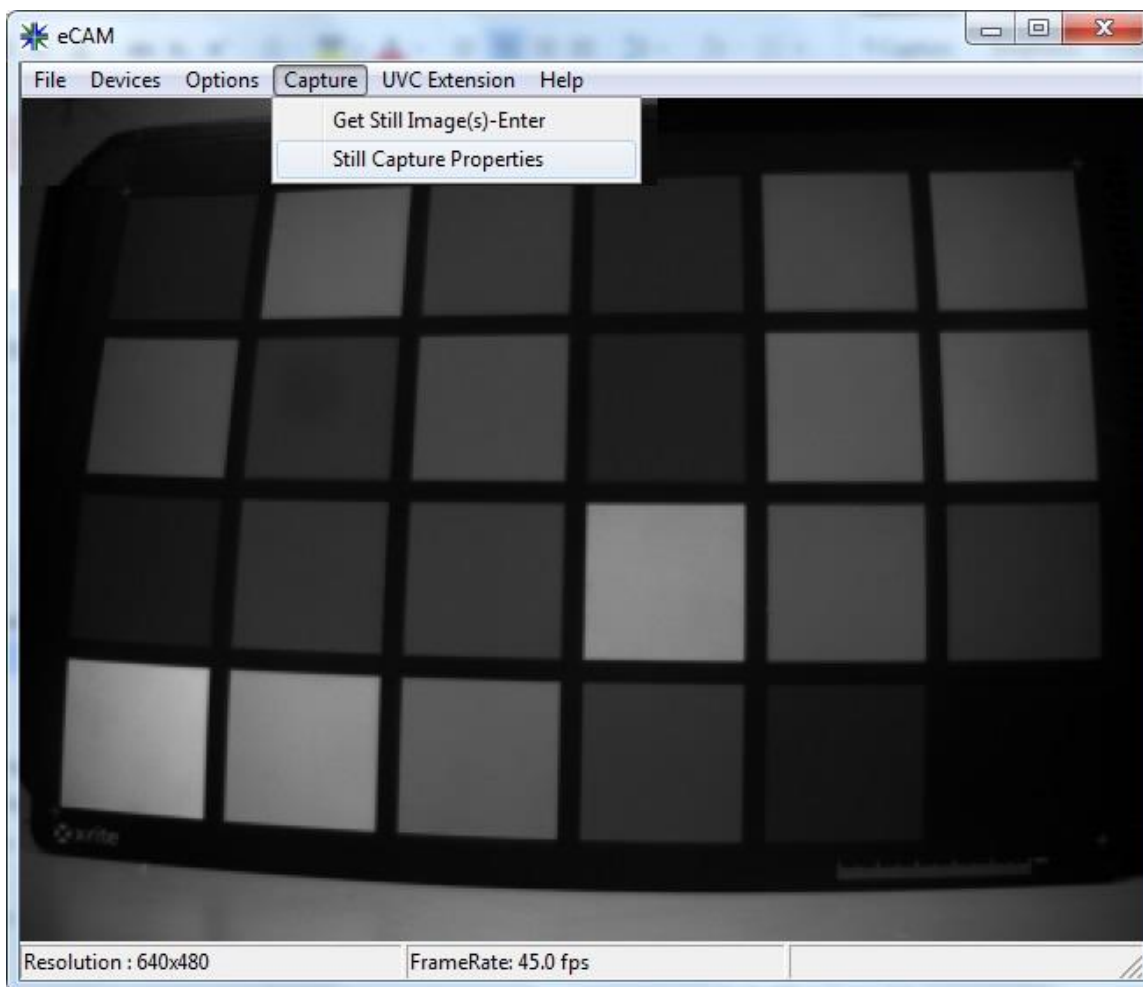


Figure 8: Capture menu



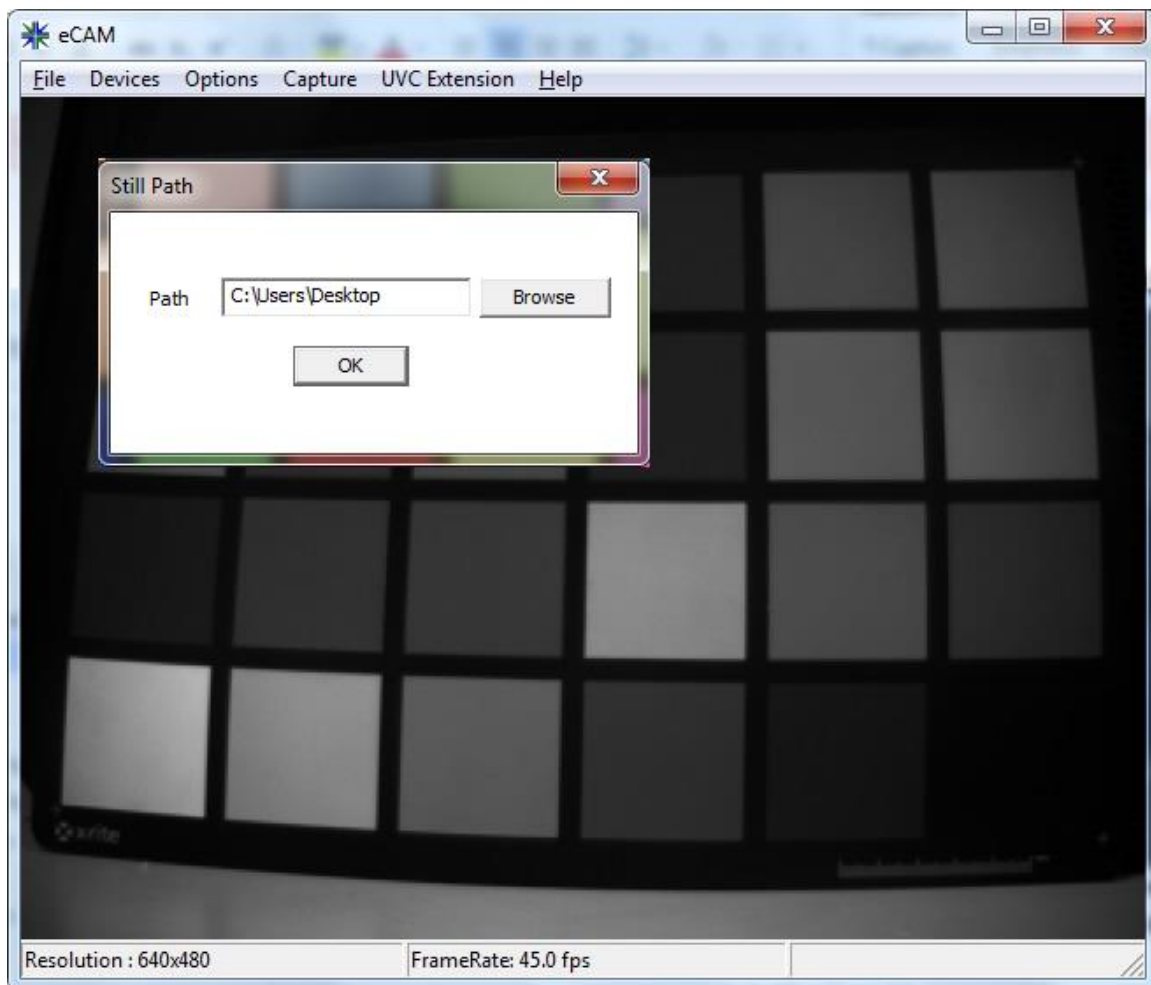


Figure 9: Capture Path

6.4 Opening RAW Image

The See3CAM_12CUNIR Monochrome camera stores the images in a RAW (.raw) format. To view these images the user can use the following steps;

6.4.1 Installing IrfanView

To open the RAW format image, the user can use any raw image viewer application. The following section describes the method of viewing RAW images using a third party application "Irfanview".

The application can be downloaded from http://www.irfanview.com/main_download_engl.htm and the user should install it to proceed to the next step.



6.4.2 Selecting Image Properties

Once the application is installed the user can open the image by double clicking it. Irfanview will show a property page indicating the properties to be selected. In this the following fields need to be changed according to the image.

1. **Image width** – This is to be set still width for See3CAM_12CUNIR.
2. **Image height** – This is to be set still Height for See3CAM_12CUNIR.
3. **Bits Per Pixel (BPP)** – Select 12 BPP.
4. **Bayer pattern used** – Select the checkbox and select BG pattern.
5. Check on **don't show this dialog again** if multiple images of same resolution are to be viewed.
6. Once selected, click OK to view the image.

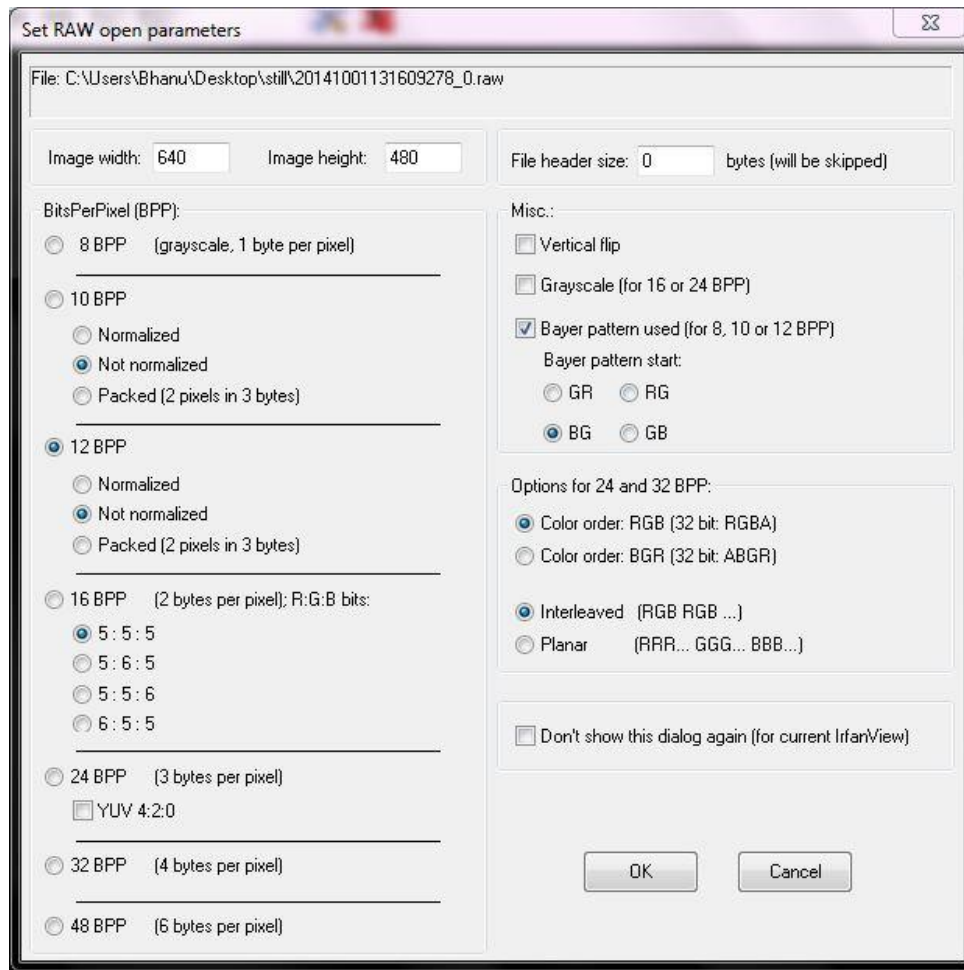


Figure 10: Irfanview properties



6.5 Extension Unit Menu

The See3CAM_12CUNIR camera has some additional controls and features and these not quite common controls and hence they are not included in the standard UVC controls, but listed as UVC Extension controls. The Extension Unit Menu is used to select these extended UVC controls of See3CAM_12CUNIR. It can be used to switch between Master and Trigger mode of operation. This can be done by clicking the appropriate button of the Extension Menu. It can be used to Set Flash On or Off and set the Gpio level to On or Off. This can be done by clicking the appropriate button of the Extension Menu. The **Firmware Version** button can be used to see the current firmware version.

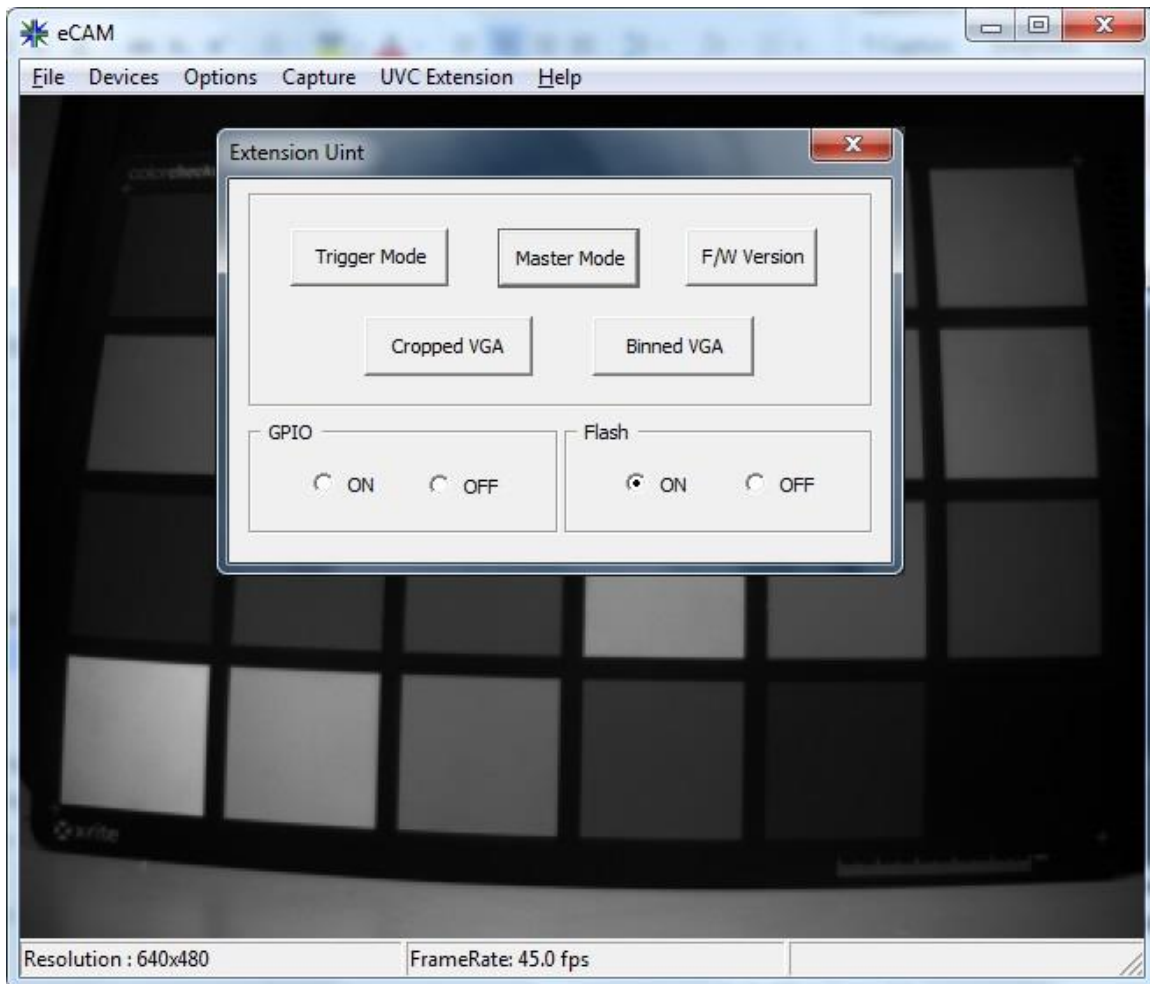


Figure 11: Extension Unit Menu

Flash can set to either On or Off.

Currently the user can set the level of Gpio's to ON or OFF.



To set the **Flash** to **ON** state Click the ON Radio button under the Flash group box. In this mode the Flash LED will be in Off position and it will give a flash when a still is captured.

To set the **Flash** to **OFF** state Click the OFF Radio button under the flash group box.

To set the level of the **GPIO**, Select the corresponding ON or OFF radio button.

The Gpio's mapped to the hardware signals are listed in the table below.

CN5 Pin Number	Signal Name	Pin Type
1	VCC	-
2	GPIO	Output
3	CLK_I2C_SCL	-
4	I2C_SDA	-
5	STROBE	Output
6	EXT_TRIGGER	Input
7	GND	
8	GND	

To select the Master mode, click on the **MASTER MODE** button and click OK. Similarly to select the Trigger mode, click on the **TRIGGER MODE** button and click OK. For more information on operating conditions of Master and Trigger modes, please refer to the sections below.

Note1: The preview will be stopped when See3CAM_12CUNIR goes into trigger mode and it will resume when it comes back to Master mode.

The See3CAM_12CUNIR supports two types of VGA resolution modes.

- Cropped VGA mode
- Binned VGA mode

The Cropped VGA mode is selected by cropping the 640x480 at the center from the 1280x960 total preview area of the AR0130 sensor. Because of this See3CAM_12CUNIR is able to stream at 60 fps in this resolution. This mode can be used by clicking on the **VGA 60 fps (CROPPED)** button in the Extension Unit Menu.

The Binned VGA mode is selected by binning or averaging the 1280x960 total preview area of the AR0130 sensor. In binned VGA mode the See3CAM_12CUNIR is able to stream at 30 fps. This mode can be used by clicking on the **VGA 45 fps (BINNED)** button in the Extension Unit Menu.

Note: In Binned VGA mode, the entire FOV (Field Of View) is conserved so the frame rate is only 45 fps, whereas in the Cropped VGA mode only the center area of the entire FOV is made visible, other areas are cropped out. So it is able to achieve the 60 fps frame rate.

It supports GPIO Output Pin and Flash Control. GPIO Button is used to Turn On and Off the LED, and Flash Button is used to Turn On and Off the Flash for while taking still.



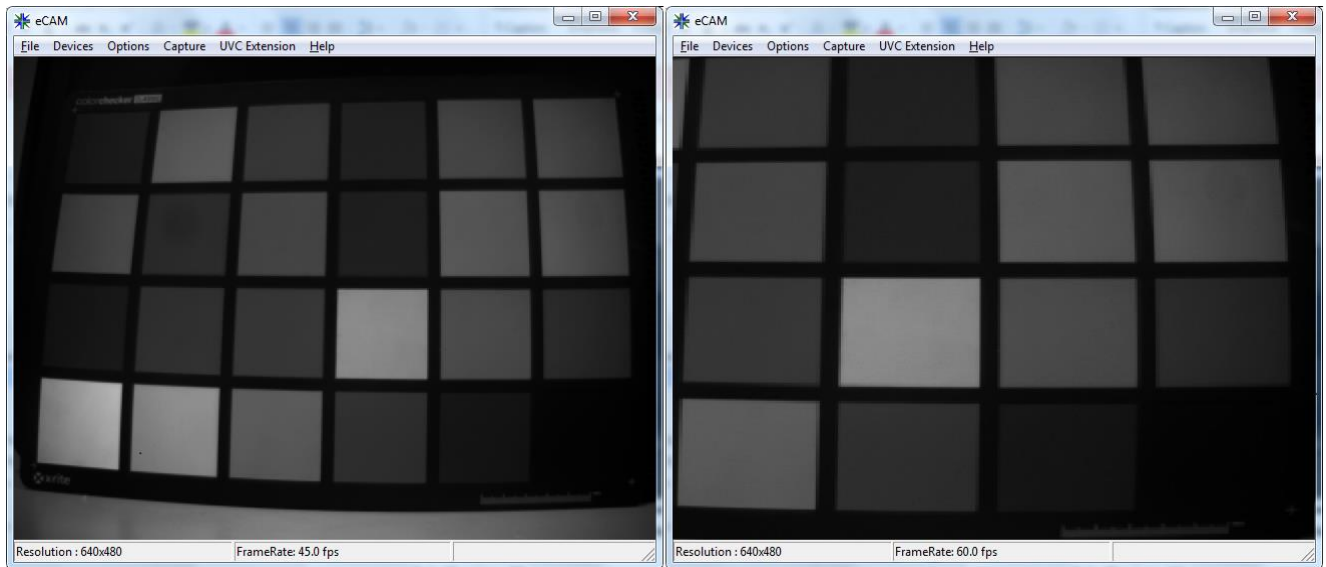


Figure 12: Comparison between Cropped and Binned VGA

6.5.1 Master Mode

The Master Mode of operation can be considered as a free-running mode of the camera. The camera is configured for a preview resolution and still resolution. The application is started and the Master mode is chosen and the application starts streaming the video. This is a simple mode of operation for the camera without any external trigger capability.

In the Master mode, the camera is configured for the specific preview resolution and frame rate. The exposure mode can be set to Manual Exposure or Auto exposure. When the sensor is configured for Auto exposure mode, and if the ambient light is good enough to achieve the necessary exposure time to meet the read-out time, then the camera streams at the required frame rate. Otherwise, the camera tries to internally decide a right frame rate that provides the necessary exposure/integration time for the sensor and the frame rate is adjusted according to the ambient light. In this case of Auto exposure, the sensor tries to capture the images well-exposed at the cost of the frame rate.

The still image pin can be configured for the required still capture resolution. The still image capture can be done in two methods as described below:

- Software Still Capture
- Hardware Still Capture

When the user initiates the still capture operation, the still image is captured and stored. In the Software Still Capture operation, the user is initiating the still capture operation from the e-CAMView application. More description about this Software Still Capture operation is described in the sections below.

In the Hardware Still Capture mode, the user can send a hardware trigger pulse to the TRIGGER pin of the camera's DIN connector. This trigger pulse could have been generated by pressing a hardware switch connected to this TRIGGER pin. The camera controller recognizes this TRIGGER command and then instructs the camera sensor to capture a still and this still image is sent to the PC. This Hardware Still Capture operation can be more like a hardware switch that initiates a Capture operation when pressed by the user.



In Master Mode still image can be taken by using any of the methods, and also in both the resolutions using any exposure or brightness value.

In both the cases, the Auto exposure value is set in the still image capture. However, when the camera is in Manual exposure mode for the video preview, the same manual exposure value is used during the still image capture as well.

6.5.2 Trigger Mode

In Trigger mode, See3CAM_12CUNIR camera is capable of synchronizing the exposure (or integration) of the pixels of the camera to an external trigger pulse that can be given through the DIN connector of the camera. Since this is an Electronic Rolling Shutter camera, all the pixels start and stop integrating at the same time, avoiding rolling skew during the capture of fast moving scenes. In addition to this, the start of integration of pixels can be synchronized to an external event in Trigger mode.

In Trigger mode of See3CAM_12CUNIR, the preview will not be available and the camera will be kept in standby waiting for a trigger pulse to start the integration of pixels and provide an Electronic Rolling Shutter image.

The user can configure the camera settings such as focus, exposure, still image resolution, still image storage location etc., in Manual mode and then enter the Trigger mode. In the Trigger mode, the camera settings will be retained, but preview will not be available. The camera shall be waiting for an external event on the DIN connector and the camera will start exposing on the trigger signal. The external trigger pulse on the DIN connector must be of certain duration in order for the camera to recognize this event. The requirements for this external Trigger signal are given in the later sections of this document.

In Trigger mode, only external Trigger event is supported and no software still image capture is possible.

In trigger mode still image capture is supported for 640 x 480, 1280 x 720 and 1280 x 960 and resolutions in both USB 3.0 and USB 2.0.

All the images taken will be stored in the default location i.e. the desktop or can be stored in any user specified path, in the **.RAW** format.

6.5.3 Getting the Unique ID of the camera:

To get the Unique ID that has been assigned to the See3CAM range of cameras, the user has to press the F/W Version button available in the Extension Unit dialog. The camera serial number will be displayed along with the F/W version as shown below.

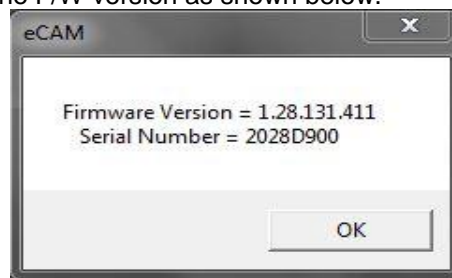


Figure 13: Camera serial number



6.6 Help Menu

The Help Menu can be used to obtain the version information of e-CAM View application installed in the computer.

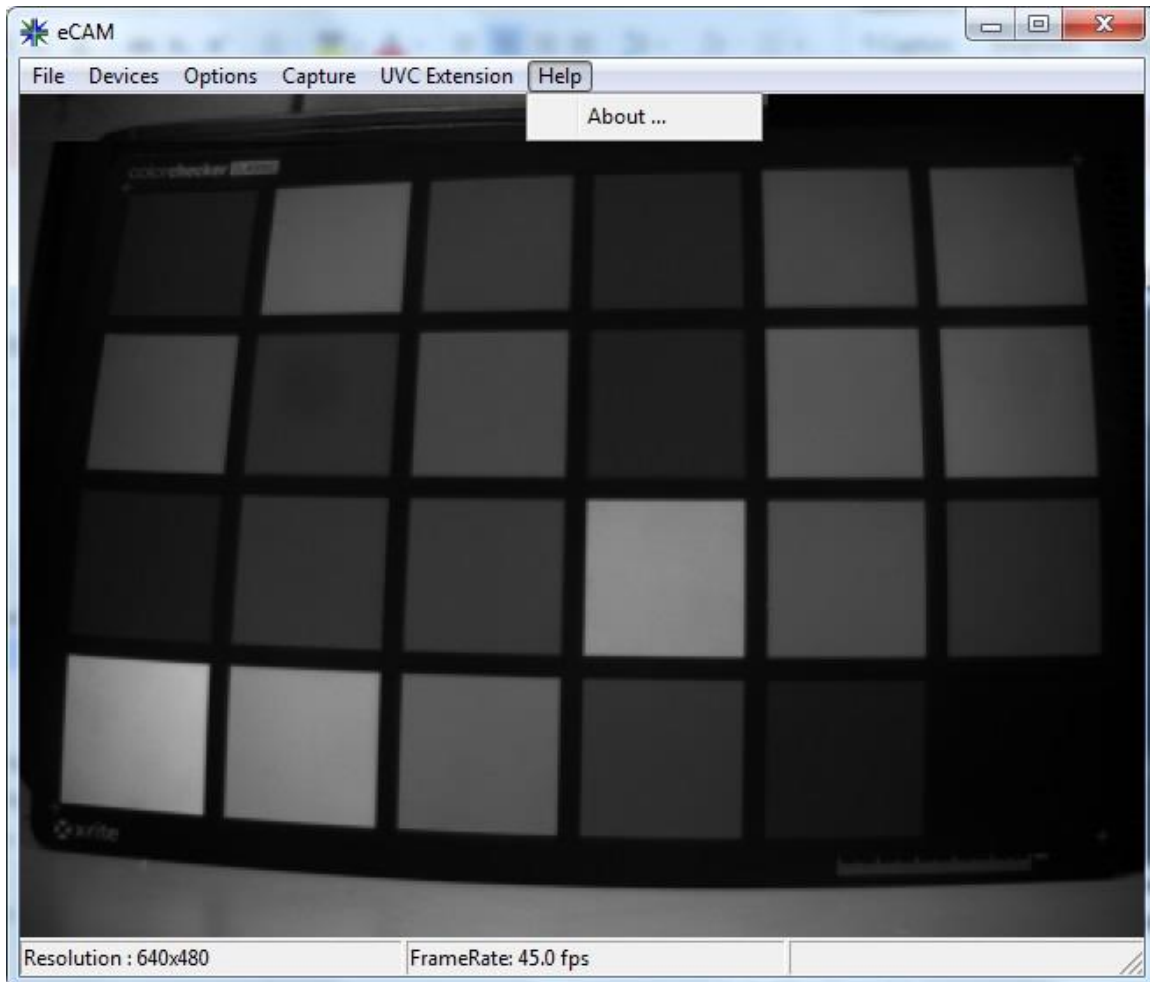


Figure 14: Help menu

7 Conclusion

This document provides the basic steps involved in using the e-CAM View application and See3CAM_12CUNIR in the appropriate modes. For additional information on the usage of See3CAM_12CUNIR refer the specific documents provided.

