ArduCAM USB Camera Python SDK

User Guide

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1 Introduction

This user guide describes the detail software operation of ArduCAM USB camera shield based on Python SDK library. The latest SDK library and examples can be downloaded from the https://github.com/arducam.

2 USB SDK Library

The ArdCAM USB Python SDK library is designed for both ArduCAM USB2.0 and USB3.0 camera boards. It is binary from library which composed by *.lib and *.dll or *.so files. The x86 is compiled for 32bit system and the x64 is compiled for 64bit system.

3 Demo Code

The demo code is provided in source code form to help user to understand the operation the ArduCAM USB camera and Python SDK library. The demo code located in Python folder which supports both Python2 and Python3.

4 ArduCAM APIs

There are a set of API functions that access to the ArduCAM USB camera hardware.

4.1 Data Structures

There is important data structures used by the SDK library for the camera configuration.

4.1.1 ArduCamCfg Data Structure Members

u32CameraType:	unsigned long, reserved for future use.
u32Height:	unsigned long, the height of the video stream
u32Width:	unsigned long, the width of the video stream
u8PixelBytes:	unsigned char, the number of bytes of one pixel
u8PixelBits:	unsigned char, the bits depth per pixel
emI2cMode:	enum type i2c_mode, I2C protocol for the sensor
u32I2cAddr:	unsigned long, I2C slave address for the sensor
u16Vid:	unsigned short, the vendor code of the camera
usbType:	unsigned char, USB camera version
emImageFmtMode:	enum type format_mode,Image format
u32Size:	unsigned long, The size of the received data, mainly used for JPG data

Example:

```
cfg = {"u32CameraType":0x4D091031,
          "u32Width":1280,"u32Height":964,
          "usbType":0,
          "u8PixelBytes":1,
          "u16Vid":0,
          "u32Size":0,
          "u8PixelBits":8,
          "u32I2cAddr": "0x20",
          "emI2cMode":3,
          "emImageFmtMode":0,
"u32TransLvl":64 }
```

The SDK library support 4 different I2C modes. For example I2C_MODE_8_8 is for 8bits register and 8bits register value, I2C_MODE_8_16 is for 8bits register and 16bits register value.

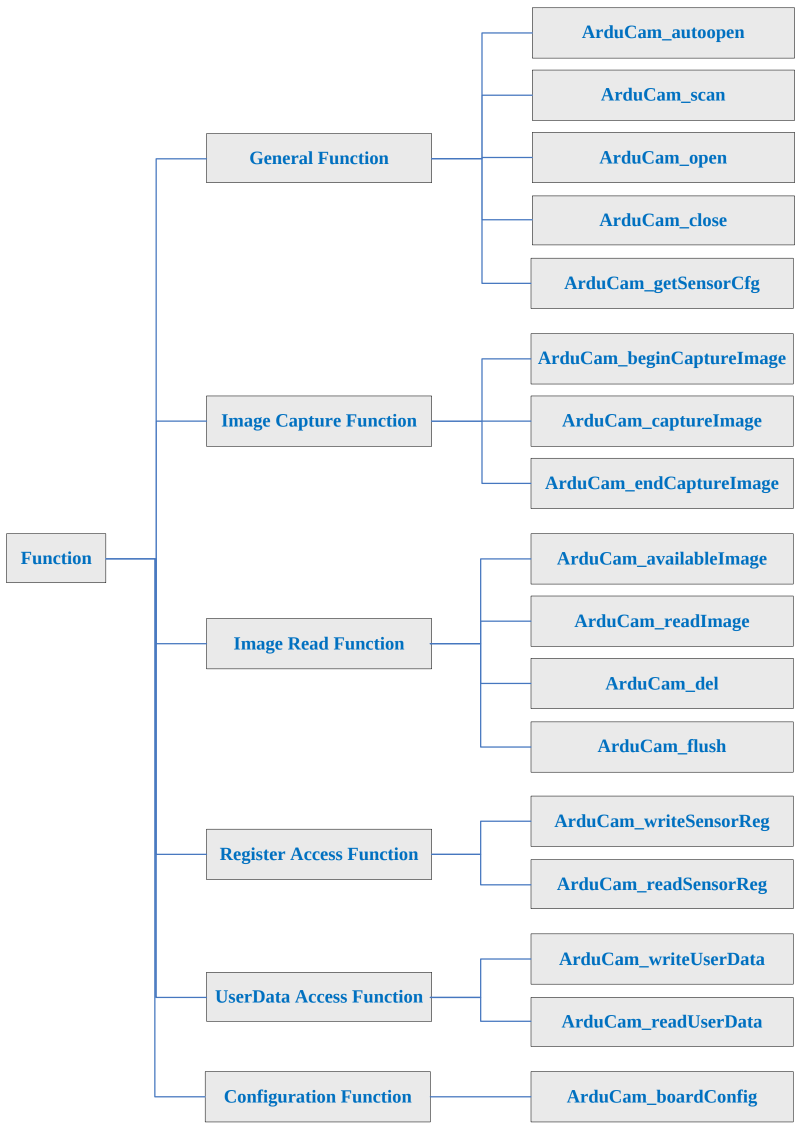
```
ArducamSDK.I2C_MODE_8_8      = 0
ArducamSDK.I2C_MODE_8_16     = 1
ArducamSDK.I2C_MODE_16_8     = 2
ArducamSDK.I2C_MODE_16_16    = 3
```

The SDK library support 7 different Image format modes.

```
ArducamSDK.FORMAT_MODE_RAW     = 0
ArducamSDK.FORMAT_MODE_RGB     = 1
ArducamSDK.FORMAT_MODE_YUV     = 2
ArducamSDK.FORMAT_MODE_JPG     = 3
ArducamSDK.FORMAT_MODE_MON     = 4
ArducamSDK.FORMAT_MODE_RAW_D = 5
ArducamSDK.FORMAT_MODE_MON_D = 6
```

4.2 Function

Function diagram:



4.2.1 General Function

4.2.1.1 Py_ArduCam_autoopen(cfg)

This function is used auto open the supported cameras when it find the first camera on the USB bus, which matched the vendor code of the camera in ArduCamCfg structure.

Param 1: ArduCamCfg structure instance

Return vale: error code, handle,cfg

4.2.1.2 Py_ArduCam_scan()

Scan how many supported cameras available on the USB bus, and return the camera index and camera serial number.

Return vale: number of supported cameras,indexs,serials

4.2.1.3 Py_ArduCam_open(cfg,index)

It is commonly used with scan method and open the camera with the camera index.

Param 1: ArduCamCfg structure instance

Param 2: index of the camera, handle,cfg

Return vale: error code

4.2.1.4 Py_ArduCam_close(handle)

Close the current camera by the camera handle.

Param 1: handle to the USB camera instance

Return vale: error code

4.2.1.5 Py_ArduCam_getSensorCfg(handle)

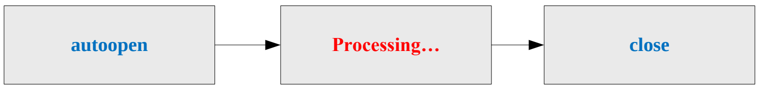
Get the configuration parameter of the USB camera instance.

Param1: handle to the USB camera instance

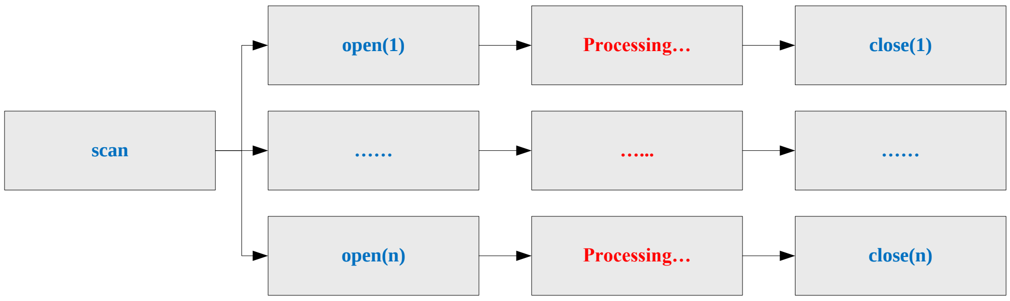
Return value: error code,cfg

4.2.1.6 Recommend Operation Procedure

Single Camera：



Multiple Cameras：



4.2.2 Image Capture Function

4.2.2.1 Py_ArduCam_beginCaptureImage(handle)

Create and prepare the image capture task list.

Param 1: handle to the USB camera instance

Return value: error code

4.2.2.2 Py_ArduCam_captureImage(handle)

Launch an image capture task.

Param 1: handle to the USB camera instance

Return value: error code

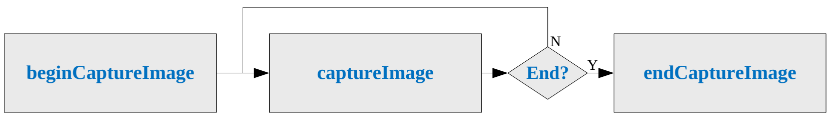
4.2.2.3 Py_ArduCam_endCaptureImage(handle)

Destroy the image capture task list.

Param 1: handle to the USB camera instance

Return value: error code

4.2.2.4 Recommend Operation Procedure



4.2.3 Image Read Function

4.2.3.1 Py_ArduCam_availableImage(handle)

Check if the image is available for reading in image FIFO.

Param 1: handle to the USB camera instance

Return value: Number of available images

4.2.3.2 Py_ArduCam_readImage(handle)

Read one image data from image FIFO.

Param 1: handle to the USB camera instance

Return value: error code, data,cfg

4.2.3.3 Py_ArduCam_del(handle)

Delete the image data from image FIFO.

Param1: handle to the USB camera instance

Return value: error code

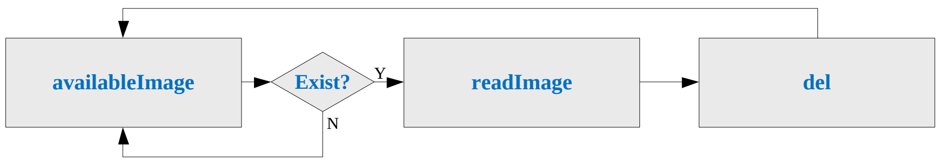
4.2.3.4 Py_ArduCam_flush(ArduCamHandle useHandle)

Clear all the image data from image FIFO.

Param1: handle to the USB camera instance

Return value: error code

4.2.3.5 Recommend Operation Procedure



4.2.4 Sensor Register Access Function

4.2.4.1 Py_ArduCam_writeSensorReg(handle, regAddr, val)

Write the sensor register.

Param 1: handle to the USB camera instance

Param 2: the register address to be written

Param 3: value to be written

Return value: error code

4.2.4.2 Py_ArduCam_readSensorReg(handle, regAddr)

Read the sensor register.

Param 1: handle to the USB camera instance

Param 2: the register address to be read

Return value: error code, regValue

4.2.5 User Data Access Function

There are 1024 bytes flash memory for storing user defined data.

4.2.5.1 Py_ArduCam_writeUserData(handle,u16Addr, u8Len,data)

Write data to user region.

Param 1: handle to the USB camera instance

Param 2: user region address to be written, range from 0 ~1023.

Param 3: data length to be written (length≤32， address+length≤1024)

Param 4: data to be written

Return value: error code

4.2.5.2 Py_ArduCam_readUserData(handle, u16Addr, u8Len)

Write data from user region.

Param 1: handle to the USB camera instance

Param 2: user region address to be read, range from 0 ~1023.

Param 3: data length to be read (length≤32，address+length≤1024)

Return value: error code,data

4.2.6 Camera Board Configuration

The board configuration function is used to set correct register or firmware values to hardware for different working mode. See section 5 for detail.

4.2.6.1 Py_ArduCam_setboardConfig(handle, u8Command, u16Value, u16Index, u32BufSize, data)

Write board configuration data.

Param 1: handle to the USB camera instance

Param 2: vendor command code

Param 3: vendor command value

Param 4: vendor command index

Param 5: data buffer size

Param 6: data

Return value: error code

4.2.7 External Trigger

The external trigger mode requires latest hardware and firmware support. If the firmware version does not support external triggering, the following function will return: USB_BOARD_FW_VERSION_NOT_SUPPORT_ERROR

4.2.7.1 Py_ArduCam_setMode(handle,mode)

This function is used to set the working mode between external trigger mode and continuous mode.

Param 1: handle to the USB camera instance

Param 2: mode EXTERNAL_TRIGGER_MODE or CONTINUOUS_MODE

Return value: error code

4.2.7.2 Py_ArduCam_isFrameReady(handle)

This function checks if there is a frame ready to read.

Param 1: handle to the USB camera instance

Return value: 1 is ready or 0 is not ready

4.2.7.3 Py_ArduCam_softTrigger(handle)

This function is used to trigger the camera to take image by software rather than from the external trigger input.

Param 1: handle to the USB camera instance

Return value: error code

4.2.7.4 Py_ArduCam_getSingleFrame(handle,time_out=1500)

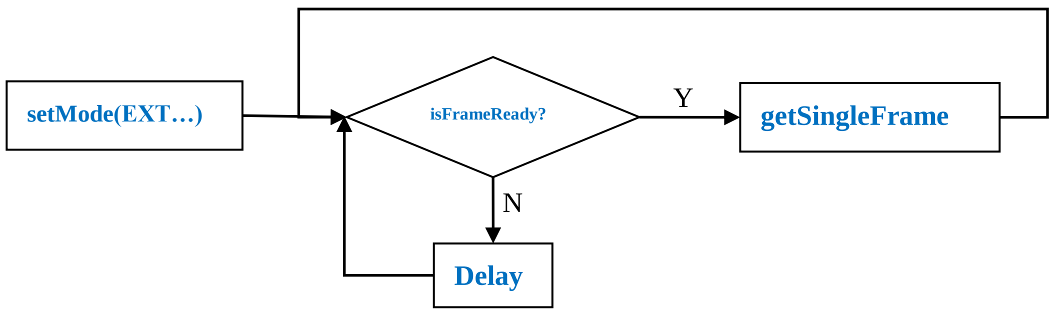
This method can be used to read a single frame with software or external trigger mode.

Param 1: handle to the USB camera instance

Param 2: Timeout millisecond default is 1500ms

Return value: error code

4.2.7.5 Recommend Operation Procedure


setMode(EXT…)
isFrameReady?
Y
getSingleFrame
N
Delay

5 Vendor Command Code

The vendor command code is used to configure the hardware or firmware registers. The USB2.0 and USB3.0 vendor command code lists as below:

5.1 USB2.0 Vendor Command Code

VRCMD Code	Value	Index	Size	Buffer Value	Comment
0xD7	0x4600	0x0100	1	0x00	Reset the camera
0xD7	0x4600	0x0100	1	0x15	Enable IR-Cut
0xD7	0x4600	0x0100	1	0x25	Invert the Pixel Clock
0xD7	0x4600	0x0100	1	0x45	Enable JPEG mode
0xD7	0x4600	0x0100	1	0x85	16bit camera bus
0xF6	0x0000	0x0000	3	0x03,0x04,0x0C	Sync 8bit bus mode
0xF6	0x0000	0x0000	3	0xCB,0x00,0x0C	Async 8bit bus mode
0xF6	0x0000	0x0000	3	0x03, 0x04, 0x09	Sync 16bit bus mode

5.2 USB3.0 Vendor Command Code

VRCMD Code	Value	Index	Size	Buffer Value	Comment
0xA3	0x0000	0x0000	0	NULL	Reset the camera
0xA3	0x8000	0x0000	0	NULL	Disable IR-Cut
0xA3	0x8001	0x0000	0	NULL	Enable IR-Cut
0xF3	0x0000	0x0000	0	NULL	Enable I2C bus
0xF9	0x0000	0x0000	0	NULL	8bit camera bus
0xF9	0x0001	0x0000	0	NULL	16bit camera bus

6 Error Code

The error code of the SDK library is defined in the following table.

ArducamSDK.USB_CAMERA_NO_ERROR	= 0x0000
ArducamSDK.USB_CAMERA_USB_CREATE_ERROR	= 0xFF01
ArducamSDK.USB_CAMERA_USB_SET_CONTEXT_ERROR	= 0xFF02
ArducamSDK.USB_CAMERA_VR_COMMAND_ERROR	= 0xFF03
ArducamSDK.USB_CAMERA_USB_VERSION_ERROR	= 0xFF04
ArducamSDK.USB_CAMERA_BUFFER_ERROR	= 0xFF05
ArducamSDK.USB_CAMERA_NOT_FOUND_DEVICE_ERROR	= 0xFF06
ArducamSDK.USB_CAMERA_I2C_BIT_ERROR	= 0xFF0B
ArducamSDK.USB_CAMERA_I2C_NACK_ERROR	= 0xFF0C
ArducamSDK.USB_CAMERA_I2C_TIMEOUT	= 0xFF0D
ArducamSDK.USB_CAMERA_USB_TASK_ERROR	= 0xFF20
ArducamSDK.USB_CAMERA_DATA_OVERFLOW_ERROR	= 0xFF21
ArducamSDK.USB_CAMERA_DATA_LACK_ERROR	= 0xFF22
ArducamSDK.USB_CAMERA_FIFO_FULL_ERROR	= 0xFF23
ArducamSDK.USB_CAMERA_DATA_LEN_ERROR	= 0xFF24
ArducamSDK.USB_CAMERA_FRAME_INDEX_ERROR	= 0xFF25
ArducamSDK.USB_CAMERA_USB_TIMEOUT_ERROR	= 0xFF26
ArducamSDK.USB_CAMERA_READ_EMPTY_ERROR	= 0xFF30
ArducamSDK.USB_CAMERA_DEL_EMPTY_ERROR	= 0xFF31
ArducamSDK.USB_CAMERA_SIZE_EXCEED_ERROR	= 0xFF51
ArducamSDK.USB_USERDATA_ADDR_ERROR	= 0xFF61
ArducamSDK.USB_USERDATA_LEN_ERROR	= 0xFF62
ArducamSDK.USB_BOARD_FW_VERSION_NOT_SUPPORT_ERROR	= 0xFF71