Eyecloud OpenNCC

Software Development Kit (SDK) API

Specification

June 2021

Revision 3.0.1

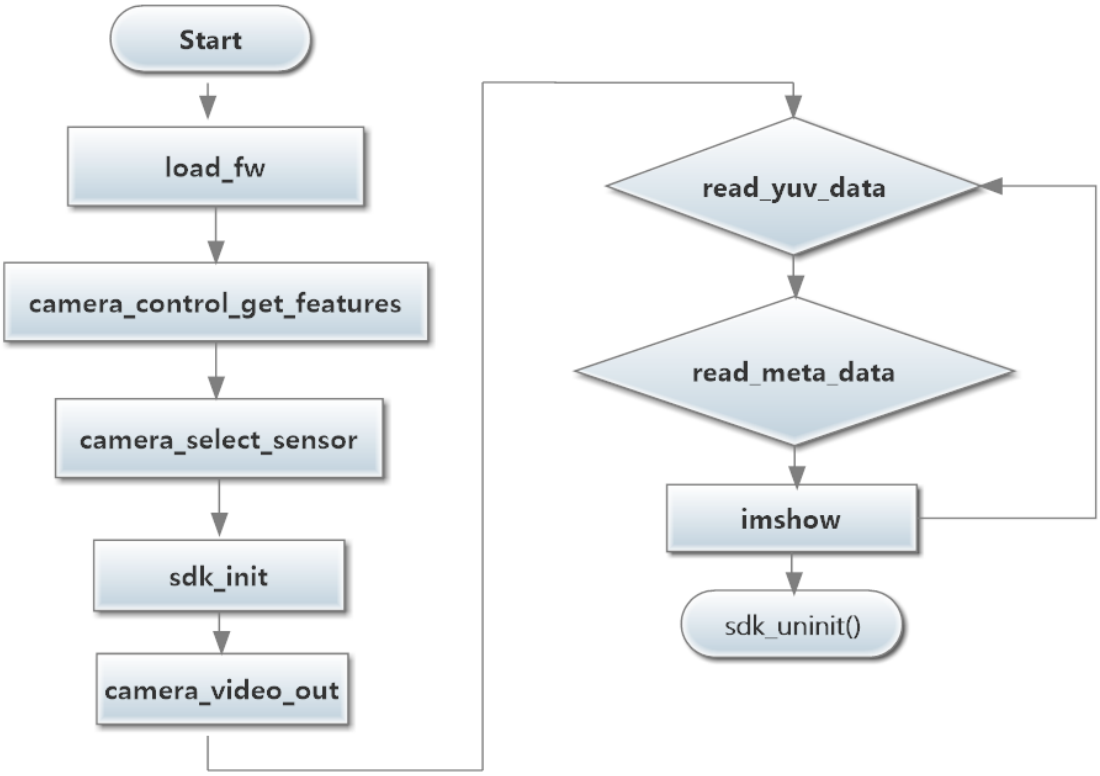
Revision

Version	Date	Editor	Description
1.0.0	2020/1/10	Joshua	Initial version
1.0.1	2020/3/16	Yang.W	Optimized version
2.0.0	2020/4/7	Duke	Add python interface
3.0.0	2020/10/14	Duke	1:Add interface suppored for dual model sdk_net2_init()and related structures. 2: Add 64 bytes in metadata 3:Remove interface of infrared and depth data .
3.0.1	2021/6/30	Zed	Optimize document structure

Directory

1 C/C++ SDK Interface Description

The interface files are primarily contained in 3 files: **sdk.h**, **cameraCtrl.h**, and **Fp16Convert**.



OpenNCC SDK Video Processing Flowchart

1.1 Device Initialization Related Interfaces

1.1.1 Load Device Firmware

Interface Name	Interface Parameters	Description
load_fw()	const char* bootExe	Path to USB boot program
	const char* firmware	Path to firmware file

Example:

- load_fw("./moviUsbBoot","./fw/flicRefApp.mvcmd");

Return:

0: Success; -1: Failure

Description:

Automatically loads device firmware, device boots, host (PC) opens USB device.

1.1.2 Get Connected USB Information

Interface Name	Interface Parameters	Description
get_usb_version()	void	N/A

Example:

- get_usb_version();

Return:30:usb3.0; 20:usb2.0

Description:

Returns USB Version Information (Port and USB Cable) connected to the device.

1.1.3 Initializing AI Camera Parameters

Interface Name	Interface Parameters	Description
sdk_init()	vscRecvCb cb	Callback
	void* param	Callback function parameters
	const char *blob_path	Path to AI Model (.blob)
	CameraInfo*cam	Camera Configuration Parameters (See below)
	int cam_Len	Camera Configuration Structure Length

There are two ways to get media and metadata.

1: Passively obtained through callback function.

2: Actively obtained through read_XXX_data() without setting the callback function and callback parameters.

```
typedef struct{
    int imageWidth;                //image width
    int imageHeight;               //image height
    int startX;                    //Ai calculation start X
    int startY;                    //Ai calculation start Y
    int endX;                      //Ai calculation end X
    int endY;                      //Ai calculation end Y
```

```
        int inputDimWidth;
  /* input width after resize,if <=0,get from xml automatically */
        int inputDimHeight;
/* input height after resize,if <=0,get from xml automatically */
        IMAGE_FORMAT inputFormat;
/*model input fomat,only support RGB/RGB_PLANAR/BGR/BGR_PLANAR */
        float meanValue[3];
/* Second pretreatment; If inputFormat is RGB:
                              R = (R-meanValue[0])/stdValue
                              G = (G-meanValue[0])/stdValue
                              B = (B-meanValue[0])/stdValue */
        float   stdValue;
        int     isOutputYUV;            //enable control 1 : open   0 :close
        int     isOutputH26X;           //enable control 1 : open   0 :close
        int     isOutputJPEG;           // enable control 1 : open   0 :close
        encodeMode mode;                /* H264/H265 */
} CameraInfo;
```

Example:

-
```
sdk_init(NULL,   NULL,
                (char*) "./blob/face-detection.blob",
                &cam_info,
                sizeof(cam_info));
```

Return:

0: Success; -1: Failure

Description:

Specifies the AI Vision model file and calculation parameters, initializes the device algorithm model, camera function switch selection, sets the video encoding parameters (if the function switch is turned on). Video output is controlled by camera_video_out()

Attention:This interface only supports one AI model with single-input.

1.1.4 Initializing AI Camera 2 modes Parameters

Interface Name	Interface Parameters	Description

sdk_net2_init()	vscRecvCb cb	Callback
	void* param	Callback function parameters
	const char *blob_path	AI Mode 1 file(blob)
	Network1Par* par1	Mode1 param
	int par1_Len	Param1 length
	const char *blob2_path	AI Mode 2 file(blob)
	Network2Par* par2	Mode2 param
	int par2_Len	Param2 length

There are two ways to get media and metadata.

1. Passively obtained through callback function.

2. Actively obtained through read_XXX_data() without setting the callback function and callback parameters.

```
/* first module process setting */
typedef struct{
        int imageWidth;
        int imageHeight;
        int startX;
        int startY;
        int endX;
        int endY;
        int inputDimWidth;
        int inputDimHeight;
        IMAGE_FORMAT inputFormat;
        /* input image mode,only RGB/RGB_PLANAR/BGR/BGR_PLANAR */
        float meanValue[3];             /* inputFormat RGB:
                                                  R = (R-meanValue[0])/stdValue
                                                   G = (G-meanValue[0])/stdValue
                                                   B = (B-meanValue[0])/stdValue */
        float stdValue;
        int     isOutputYUV;
        int     isOutputH26X;
        int     isOutputJPEG;
        encodeMode mode;                      /* H264/H265 */

    char extInputs[MAX_EXTINPUT_SIZE];            /* second model input */
    int     modelCascade;                         /* linked next model */
    int     inferenceACC;                        /*  Accelerating    inference  0:close
1:open */
} Network1Par;


/* second module param */
typedef struct{
        int startXAdj;
        int startYAdj;
        int endXAdj;
        int endYAdj;
        char    labelMask[MAX_LABEL_SIZE];
        /* mask label, bit equal to 1    will be useful */
        float minConf;                      /* conf value from first model */
        int inputDimWidth;
        int inputDimHeight;
        IMAGE_FORMAT inputFormat;
        /* input image mode,only RGB/RGB_PLANAR/BGR/BGR_PLANAR */
        float meanValue[3];
        /* inputFormat RGB:
              R = (R-meanValue[0])/stdValue
              G = (G-meanValue[0])/stdValue
              B = (B-meanValue[0])/stdValue */
        float stdValue;
        char extInputs[MAX_EXTINPUT_SIZE];      /* second model input    */
        int     modelCascade;           /*linked next model    for third model in future*/
} Network2Par;
```

Example:

- `char *blob    = "./blob/vehicle-license-plate-detection-barrier-0106/vehicle-license-plate-detection-barrier-0106.blob";`
- `char *blob2 = "./blob/license-plate-recognition-barrier-0001/license-plate-recognition-barrier-0001.blob";`

-
  ```
  ret = sdk_net2_init(0,0,\
                  blob,    &cnn1PrmSet, sizeof(cnn1PrmSet), \
                  blob2,    &cnn2PrmSet, sizeof(cnn2PrmSet));
  ```

Return:

0: Success; -1: Failure

Description:

Specifies the 2 AI Vision model files and calculation parameters, initializes the device algorithm model, camera function switch selection, sets the video encoding parameters (if the function switch is turned on). Video output is controlled by camera_video_out().

1.1.5 Get Metadata Size

Interface Name	Interface Parameters	Description
get_meta_size()	void	N/A

Example: Omitted.

Return: Size of the CNN calculation result’s metadata

Description:

Turn off the camera, reload the model, and call before changing the model.it only support one AI mode net now.

1.1.6 Uninitialize SDK

Interface Name	Interface Parameters	Description
sdk_uninit()	void	N/A

Example:

- sdk_uninit();

Return: N/A

Description:

Turn off the camera, reload the model, and call before changing the model.

1.1.7 Get SDK Version Information

Interface Name	Interface Parameters	Description
get_sdk_version()	char* version	Version Information

Example:

- char version[100];

- get_sdk_version(version);

Return:void

Description:

Gets SDK version information.

1.2 Video Streaming Related Interfaces

1.2.1 Get YUV Data

Interface Name	Interface Parameters	Description
read_yuv_data()	char* pbuf	Receive Buffer
	int * size	Input and output parameters. Input is the size of the input buffer , output is the size of the returned video data.
	int blocked	0: If there is no data, return immediately.

Example:

- read_yuv_data(data_yuv, &size,1)

Return:

0: Success; -1: Failure

Description:

Gets a YUV data stream from the device.

Content: struct frameSpecOut + YUV(NV12)

1.2.2 Get H.264 or H.265 Data

Interface Name	Interface Parameters	Description
read_26x_data()	char* pbuf	Receive Buffer
	int * size	Input and output parameters. Input is the size of the input buffer , output is the size of the returned video data.
	int blocked	0: If there is no data, return immediately.

Example:

- read_26x_data(data_26x, &size,1)

Return:

0: Success; -1: Failure

Description:

Gets a H.264 or H.265 data stream from the device.

Content: struct frameSpecOut + H26X data.

1.2.3 Get JPEG data

Interface Name	Interface Parameters	Description
read_jpg_data()	char* pbuf	Receive Buffer
	int * size	Input and output parameters. Input is the size of the input buffer area, output is the size of the returned video data.
	int blocked	0: If there is no data, return immediately.

Example:

- read_jpg_data(yuv420p, &size,1)

Return:

0: Success; -1: Failure

Description:

Gets a JPEG data stream from the device.

Content: struct frameSpecOut + MJPEG data.

1.2.4 Get the output of the AI Network algorithm

Interface Name	Interface Parameters	Description
read_meta_data()	char* pbuf	Receive Buffer
	int * size	Input and output parameters. Input is the size of the input buffer area, output is the size of the returned video data.
	int blocked	0: If there is no data, return immediately.

Example:

- read_meta_data(data_mate,&size,1)

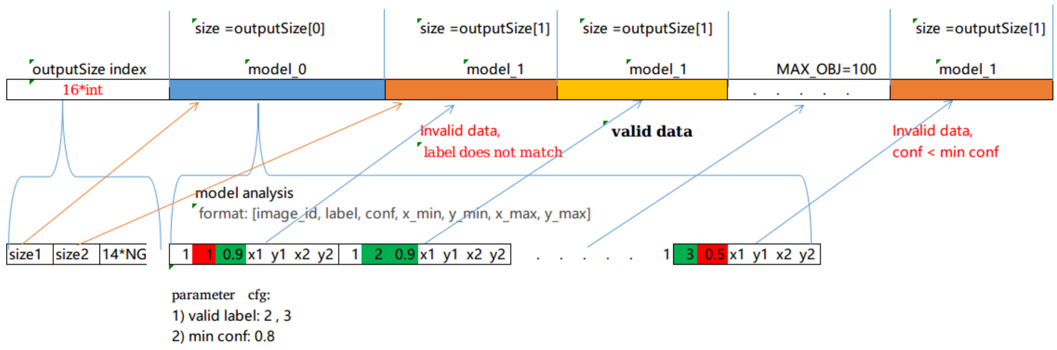
Return:

0:Success; -1: Failure

Description:

Get the number of operations from the device’s AI Network

.Content: struct frameSpecOut + AI data. and AI data format is below::



1.3 Camera Control Related Interfaces

1.3.1 Obtain Camera Module Information

Interface Name	Interface Parameters	Description
camera_control_get_features()	SensorModesConfig *	Device information structure pointer

Example:

- SensorModesConfig cameraCfg;
- camera_control_get_features(&cameraCfg);

Return:

0: Success; -1: Failure

cameraCfg.moduleName

cameraCfg.camWidth //image width

cameraCfg.camHeight //image height

cameraCfg.camFps //frame rate

cameraCfg.AFmode //focus mode

cameraCfg.maxEXP // maximum time of exposure,unit: us

cameraCfg.minGain //minimum gain

cameraCfg.maxGain //maximum gain

Description:

Obtain information about the mode of the camera. Some cameras will support multiple video modes, which can be selected through camera_select_sensor().

1.3.2 Select Module’s Working Mode

Interface Name	Interface Parameters	Description
camera_select_sensor()	int sensorid	camera_control_get_features() obtains the array of information of supported camera modes. sensorid is the serial number of the array

Example:

- camera_select_sensor(0);

Return:

0: Success; -1: Failure

Description:

Sets the working mode of the camera’s visible light module.

1.3.3 Control Camera’s Video Output

Interface Name	Interface Parameters	Description
camera_video_out()	int video_type	YUV Data output mode
	camera_ctrl_VIDEO_out mode	Disabled, Single (For photos), Continuous

```
typedef enum
{
      VIDEO_OUT_DISABLE,            /* Output   Disabled */
      VIDEO_OUT_SINGLE,             /* Single Output */
      VIDEO_OUT_CONTINUOUS,     /* Continuous Output */
}camera_ctrl_video_out;
```

Example:

- camera_video_out(YUV420p, VIDEO_OUT_CONTINUOUS);

Return:

0: Success; -1:Failure

Description:

Sets the device to output video data. This works for YUV420p, H26X, JPEG. H26X does not support single output..

1.3.4 Set Camera's Focus Mode

Interface Name	Interface Parameters	Description
camera_control_af_mode()	camera_ctrl_af_mode af_mode	CAMERA_CONTROL__AF_MODE_OFF : Manual Focus CAMERA_CONTROL__AF_MODE_AUTO :Automatic Focus

Example:

- camera_control_af_mode(CAMERA_CONTROL__AF_MODE_OFF);

Return:

0: Success; - 1: Failure

Description:

Sets the camera to manual focus. Using camera_control_get_features() one can check if the camera supports manual focusing (cameraCfg.AFmode). If not supported, the setting is invalid and the camera defaults to automatic.

1.3.5 Set Camera's Lens Distance

Interface Name	Interface Parameters	Description
camera_control_lens_move()	uint32_t lens_position	Range of distances(1-100)

Example:

- camera_control_lens_move(10);

Return:

0: Success; -1: Failure

Description:

Used when focusing manually, greater value is a greater distance.

1.3.6 Trigger Single Focus

Interface Name	Interface Parameters	Description
camera_control_focus_trigger()	N/A	

Example:

- camera_control_focus_trigger();

Return:

0 :Success; -1: Failure

Description:

Single focus

1.3.7 Set Camera's Exposure Mode

Interface Name	Interface Parameters	Description
camera_control_ae_mode()	camera_ctrl_ae_mode flash_mode	Manual or Automatic

Example:

- camera_control_ae_mode(CAMERA_CONTROL__AE_AUTO__FLASH_MODE__AUTO);

Return:

0: Success; -1: Failure

Description:

Sets exposure mode.

1.3.8 Set Exposure Time

Interface Name	Interface Parameters	Description
camera_control_ae_set_exp()	uint32_t exp_compensation	Exposure duration in microsecond (µs) range (1-1 / fps)

Example:

- camera_control_ae_set_exp(20000);

Return:

0: Success; -1: Failure

Description:

Sets the exposure time for the manual exposure mode.

1.3.9 Set Camera Gain

Interface Name	Interface Parameters	Description
camera_control_ae_set_gain()	uint32_t iso_val	Gain value

Example:

- camera_control_lens_move(100);

Return:

0: Success; -1: Failure

Description:

Sets the gain in manual exposure mode. Min/max gain values can be retrieved through camera_control_get_features() and set manually.

1.3.10 Set Camera White Balance Mode

Interface Name	Interface Parameters	Description
camera_control_awb_mode()	camera_ctrl_awb_mode awb_mode	Manual or Auto

Example:

- camera_control_awb_mode(CAMERA_CONTROL__AWB_MODE__AUTO);

Return:

0 :Success; -1: Failure

Description:

Sets camera to automatic white balance mode.

1.3.11 Float Conversion

Interface Name	Interface Parameters	Description
f16Tof32()	unsigned int x	16-bit Data

Example:

- Float f=f16Tof32(100);

Return: float

Description:

Converts 16-bit short data to a floating point number. Used for metadata calculations and analysis.

2 Python SDK Interface Documentation

Starting from version 2.0.X onwards, the API will support Python. The SDK Interface can be found in the openncc.py file. To use the module, import it using: import openncc as ncc.

2.1. Device Initialization Related Interfaces

2.1.1 Get SDK Version

Interface Name	Interface Parameters	Description
get_sdk_version()	void	N/A

Example:

- print("get usb %d sdk versin %s" % (ncc.get_usb_version() ,ncc.get_sdk_version()))

Return:SDK Version

Description:

Gets the SDK version.

2.1.2 Get Version of Connected USB Device

Interface Name	Interface Parameters	Description
get_usb_version()	void	N/A

Return: 30 :usb3.0; 20: usb2.0

Example:

- print("get usb %d sdk versin %s" % (ncc.get_usb_version() ,ncc.get_sdk_version()))

Description:

Returns USB Version Information (Port and USB Cable) connected to the device

2.1.3 Load Device Firmware

Interface Name	Interface Parameters	Description
load_fw()	bootExe	Path to USB boot program
	firmware	Path to firmware file

Return:

0: Success; -1: Failure

Example:

- res = ncc.load_fw("./moviUsbBoot","fw/flicRefApp.mvcmd")
  if res<0:

```
        printf('load firmware error!')
        sys.exit(1)
```

Description:

Automatically loads device firmware, device boots, host (PC) opens USB device..

2.1.4 Initializing Camera Parameters

Interface Name	Interface Parameters	Description
sdk_init()	vscRecvCb cb	Callback
	param	Callback function parameters
	Blob1_path	Path to AI Model (.blob)
	cam	Camera Configuration Parameters (See below)
	Cam_len	Camera configuration structure length

There are two ways to get Media and Metadata. 1: Passively obtained through callback function, 2: Actively obtained through read_XXX_data() without setting the callback function and callback parameters..

Example:

```
cam_info=ncc.CameraInfo()
cam_info.inputFormat=ncc.IMG_FORMAT_BGR_PLANAR
cam_info.stdValue=1

cam_info.isOutputYUV=1
cam_info.isOutputH26X=1
cam_info.isOutputJPEG=1

cam_info.imageWidth    = cameraCfg.camWidth
cam_info.imageHeight = cameraCfg.camHeight
cam_info.startX          = 0
cam_info.startY          = 0
cam_info.endX              = cameraCfg.camWidth
cam_info.endY              = cameraCfg.camHeight
cam_info.inputDimWidth =0
cam_info.inputDimHeight =0
```

```
ncc.SetMeanValue(cam_info,0.0,0.0,0.0)
```

-
  ```
  ret = ncc.sdk_init(None, None, "./blob/face-detection-retail-0004-fp16.blob",cam_info, struct.calcsize("13I4f"))
  ```

-
  ```
  print("xlink_init ret=%d " % ret)
  if (ret<0):
      return
  ```

Description:

Specifies the AI Vision model file and calculation parameters, initializes the device algorithm model, camera function switch selection, sets the video encoding parameters (if the function switch is turned on). Video output is controlled by camera_video_out().

2.1.5 Initializing Camera with 2 AI Parameters

Interface Name	Interface Parameters	Description
sdk_net2_init()	vscRecvCb cb	Callback
	param	Callback function parameters
	blob1_path	AI Mode 1 file(blob)
	par1	Mode1 param
	par1_Len	Param1 length
	blob2_path	AI Mode 2 file(blob)
	par2	Mode2 param
	par2_Len	Param2 length

There are two ways to get Media and Metadata. 1: Passively obtained through callback function, 2: Actively obtained through read_XXX_data() without setting the callback function and callback parameters..

Description:

Specifies the AI Vision model file and calculation parameters, initializes the device algorithm model, camera function switch selection, sets the video encoding parameters (if the function switch is turned on). Video output is controlled by camera_video_out().

2.1.6 Uninitialize SDK

Interface Name	Interface Parameters	Description
sdk_uninit()	N/A	N/A

Example:

- sdk_uninit();

Return:N/A

Description:

Turn off the camera, reload the model, and call before changing the model.

2.2 Video Streaming Related Interfaces

2.2.1 Get YUV Data

Interface Name	Interface Parameters	Description
GetYuvData()	yuvbuf	Bytearray receive buffer

Example:

- metasize=ncc.get_meta_size()
  offset=struct.calcsize(media_head)
  yuvsize=cameraCfg.camWidth*cameraCfg.camHeight*2
  yuvbuf = bytearray(yuvsize+offset)
  metabuf = bytearray(metasize+offset)
- size = ncc.GetYuvData(yuvbuf)

Return:Size of the YUV data.

Description:

Gets a YUV data stream from the device.

Content: struct frameSpecOut + YUV(NV12) data.

2.2.2 Get H.264 or H.265 Data

Interface Name	Interface Parameters	Description
GetH26xData()	databuf	Bytearray receive buffer

Example:

Same as 2.2.1

Description:

Gets a H.264 or H.265 data stream from the device.

Content: struct frameSpecOut + H26X data..

2.2.3 Get JPEG data

Interface Name	Interface Parameters	Description
GetJpegData()	databuf	Bytearray receive buffer

Example:

Same as 2.2.1

Description:

Gets a JPEG data stream from the device.

Content: struct frameSpecOut + MJPEG data.

2.2.4 Get the results of the AI Network inference

Interface Name	Interface Parameters	Description
GetMetaData()	databuf	Bytearray receive buffer

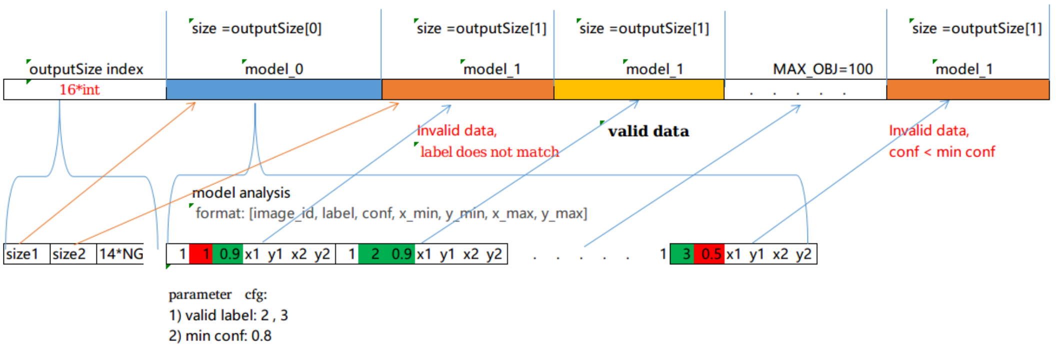
Example:

Same as 2.2.1

Description:

Get the number of operations from the device's AI Network.

Content: struct frameSpecOu t+ AI data and AI data format is below:



2.3 Camera Control Related Interfaces

2.3.1 Obtain Camera Module Information

Interface Name	Interface Parameters	Description
CameraSensor class	GetFirstSensor(),GetNextSensor()	

Example:

- sensors=ncc.CameraSensor()
- sensor1 = ncc.SensorModesConfig()
- if sensors.GetFirstSensor(sensor1)==0:

print("camera: %s, %dX%d@%dfps, AFmode:%d, maxEXP:%dus,gain[%d, %d]\n" % (
sensor1.moduleName, sensor1.camWidth, sensor1.camHeight, sensor1.camFps,
sensor1.AFmode, sensor1.maxEXP, sensor1.minGain, sensor1.maxGain))

- sensor2 = ncc.SensorModesConfig()
- while sensors.GetNextSensor(sensor2)==0:

print("camera: %s, %dX%d@%dfps, AFmode:%d, maxEXP:%dus,gain[%d, %d]\n" % (
sensor2.moduleName, sensor2.camWidth, sensor2.camHeight, sensor2.camFps,
sensor2.AFmode, sensor2.maxEXP,sensor2.minGain, sensor2.maxGain))

Description:

Obtains information about the mode of the camera. Some cameras will support multiple video modes, which can be selected through camera_select_sensor().

2.3.2 Select Module’s Working Mode

Interface Name	Interface Parameters	Description
camera_select_sensor()	sensorid	camera_control_get_features() obtains the array of information of supported camera modes. sensorid is the serial number of the array.

Example:

- ncc.camera_select_sensor(0)

Return:

0: Success; -1:Failure

Description:

Sets the working mode of the camera’s visible light module.

2.3.3 Control the Camera’s Video Output

Interface Name	Interface Parameters	Description
camera_video_out()	video_type	Video data type
	out mode	Disabled, Single (For photos), or Continuous

Example:

- ncc.camera_video_out(ncc.YUV420p,ncc.VIDEO_OUT_CONTINUOUS)

Return:

0: Success ;-1: Failure

Description:

Sets the device to output video data. This works for YUV420p, H26X, JPEG. H26X does not support single output.

2.3.4 Set Camera’s Focus Mode

Interface Name	Interface Parameters	Description
camera_control_af_mode()	camera_ctrl_af_mode af_mode	CAMERA_CONTROL__AF_MODE_OFF: Manual Focus CAMERA_CONTROL__AF_MODE_AUTO :Automatic Focus

Example:

- ncc.camera_control_af_mode(ncc.CAMERA_CONTROL__AF_MODE_AUTO);

Return:

0: Success; -1: Failure

Description:

Sets the camera to manual focus. Using camera_control_get_features() one can check if the camera supports manual focusing (cameraCfg.AFmode). If not supported, the setting is invalid and the camera defaults to automatic focusing.

2.3.5 Set the Camera’s Lens Distance

Interface Name	Interface Parameters	Description
camera_control_lens_move()	lens_position	Range of distances(1-100)

Example:

- ncc.camera_control_lens_move(10);

Return:

0: Success; -1:Failure

Description:

Used when focusing manually, greater value is a greater distance.

2.3.6 Trigger Single Focus

Interface Name	Interface Parameters	Description
camera_control_focus_trigger()	void	N/A

Example:

- camera_control_focus_trigger();

Return:

0: Success; -1: Failure

Description:

Focuses the camera once.

2.3.7 Set Camera's Exposure Mode

Interface Name	Interface Parameters	Description
camera_control_ae_mode()	camera_ctrl_ae_mode flash_mode	Manual or Automatic

Example:

- ncc.camera_control_ae_mode(ncc.CAMERA_CONTROL__AE_AUTO__FLASH_MODE__AUTO);

Return:

0 :Success; -1: Failure

Description:

Sets exposure mode.

2.3.8 Set Exposure Time

Interface Name	Interface Parameters	Description
camera_control_ae_set_exp()	exp_compensation	Exposure duration in microsecond (μs) range (1-1 / fps)

Example:

- ncc.camera_control_ae_set_exp(20000);

Return:

0: Success; -1: Failure

Description:

Sets the exposure time for the manual exposure mode.

2.3.9 Set Camera Gain

Interface Name	Interface Parameters	Description
camera_control_ae_set_gain()	iso_val	Gain value

Example:

- ncc.camera_control_lens_move(100);

Return:

0: Success; -1: Failure

Description:

Sets the gain in manual exposure mode. Min/max gain values can be retrieved through camera_control_get_features() and set manually..

2.3.10 Set Camera White Balance Mode

Interface Name	Interface Parameters	Description
camera_control_awb_mode()	camera_ctrl_awb_mode awb_mode	Manual or Automatic

Example:

- ncc.camera_control_awb_mode(ncc.CAMERA_CONTROL__AWB_MODE__AUTO);

Return:

0: Success; -1: Failure

Description:

Sets camera to automatic white balance mode..

2.3.11 Float Conversion

Interface Name	Interface Parameters	Description
f16Tof32()	x	16-bit Data

Example:

- f=f16Tof32(100);

Return: Float

Description:

Converts 16-bit short data to a floating point number. Used for metadata calculations and analysis.