CA378-AOIS for Jetson TX2 Software Setup Guide

Version 1.0.2

Dated: 2017/12/26

Home Page *http://www.centuryarks.com/*

History

Date	Version	Comment
2017/12/15	v1.0.0	Initial Release
2017/12/18	v1.0.1	"How to build sample code" added wget command "--no-check-certificate" added
2017/12/26	v1.0.2	Support 2 to 5 connected multiple cameras

Contents

1. Environment configuration

★Before installing the CA 378-AOIS driver, please implement the following environment.

・Prerequisites
1. Installing Jetpack 3.0 (Linux for Tegra R27.1)
2. Setting sudo permissions

Step 1. Install Jetpack 3.0

(1) Register as user at NVIDIA DEVELOPER site.
https://developer.nvidia.com

(2) Download Jetpack 3.0
https://developer.nvidia.com/embedded/jetpack-3_0

(3) Install according to the procedure on page 10 below.
http://developer2.download.nvidia.com/embedded/L4T/r27_Release_v1.0/Docs/Jetson_X2_Developer_Kit_User_Guide.pdf?WZACmxm6jRHQtvToEuvEm4kspfaRaZJk8iX8mMEtn-YgwECKmEIn-GFEW5UPf9HIdkALsnxIZX4qZxO43CE3crogni16PuviWZO4bLF23I12fMhJ1jxyn4qq5OZHaMImZrchFQAhDNjQln9rSK6fw0lGAfzB12fu5WXOU717PVLQW6slDJIKTg

1. Environment configuration

Step 2. Setting sudo permissions

(1) Execute the following command.

```
$ sudo visudo
```

(2) Add the following red line.

```
# User privilege specification
root    ALL=(ALL:ALL) ALL
nvidia  ALL=(ALL:ALL) ALL

# Members of the admin group may gain root privileges
%admin ALL=(ALL) ALL

# Allow members of group sudo to execute any command
%sudo   ALL=(ALL:ALL) ALL
%nvidia ALL=(ALL:ALL) NOPASSWD: ALL
```

(3) Reboot Jetson TX2.

```
$ sudo reboot
```

2. Driver install

· Installation procedure

1. Download "CA378_2L_v1.0.2_L4T27.1.tar.gz" from the following site.

https://github.com/centuryarks/CA378-AOIS/releases

```
$ wget --no-check-certificate https://github.com/centuryarks/CA378-AOIS/releases/download/v1.0.2/CA378_2L_v1.0.2_L4T27.1.tar.gz
```

2. Extract "CA378_2L_v1.0.2_L4T27.1.tar.gz" file.

```
$ tar zxvf CA378_2L_v1.0.2_L4T27.1.tar.gz
```

3. Edit "/boot/extlinux/extlinux.conf" and add the following red line.

```
$ sudo vim /boot/extlinux/extlinux.conf
```

```
TIMEOUT 30
DEFAULT primary

MENU TITLE p2771-0000 eMMC boot options

LABEL primary
    MENU LABEL primary kernel
    LINUX /boot/Image
    FDT /boot/tegra186-quill-p3310-1000-c03-00-imx378.dtb
    APPEND fbcon=map:0 net.ifnames=0 console=tty0 OS=l4t console=ttyS0,115200n8 memtype=0 video=tegrafb
no_console_suspend=1 earlycon=uart8250,mmio32,0x03100000 gpt tegraid=18.1.2.0.0 tegra_keep_boot_clocks maxcpus=6
android.kerneltype=normal androidboot.serialno=0335115020673 vpr_resize root=/dev/mmcblk0p1 rw rootwait
```

2. Driver install

4. Configure the number of camera connections.
Execute the following command and enter the number of camera connections.

```
$ cd CA378_2L_v1.0.2_L4T27.1/
$ ./Install.sh
What is the number of camera connections? : 5
CN2 : CH1 Camera module installed
CN3 : CH2 Camera module installed
CN4 : CH3 Camera module installed
CN5 : CH4 Camera module installed
CN6 : CH5 Camera module installed
Cameras will be available after reboot.
```

5. Shutdown Jetson TX2 and turn off the power.

2. Driver install

6. Connect the Jetson TX2 conversion board as shown in the picture below.

C C C C C C
N N N N N N
7 6 5 4 3 2
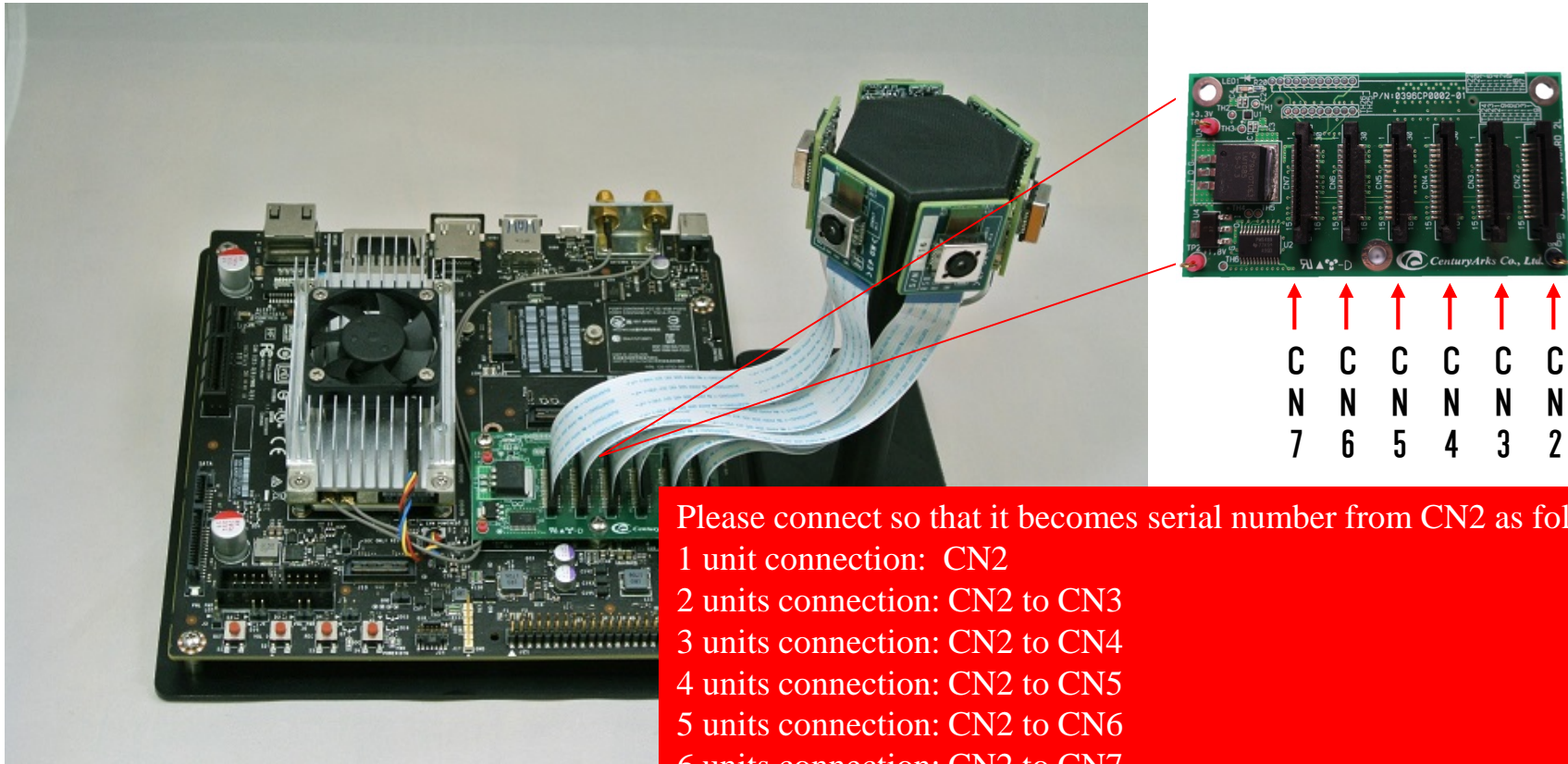
Please connect so that it becomes serial number from CN2 as follows.
1 unit connection: CN2
2 units connection: CN2 to CN3
3 units connection: CN2 to CN4
4 units connection: CN2 to CN5
5 units connection: CN2 to CN6
6 units connection: CN2 to CN7

7. Turn on the power and start up Jetson TX2.

* If you want to change the number of camera connections, repeat steps 4 to 7.

3. Software install

Please install by the following procedure.

· Installation procedure
1. Download " demo_v1.0.0_tx2.tar.gz " from the following site.
https://github.com/centuryarks/Sample/releases

```
$ wget --no-check-certificate https://github.com/centuryarks/Sample/releases/download/v1.0/demo_v1.0.0_tx2.tar.gz
```

2. Unzip "demo_v1.0.0_tx2.tar.gz" file.

```
$ tar zxvf demo_v1.0.0_tx2.tar.gz
```

3. Execute "Install.sh" in the extracted folder.

```
$ cd demo
$ ./Install.sh
```

4. A shortcut is created on the desktop.
 DEMO

4. Demonstration functions

4.1. Focus & OIS
4.2. 4K3K-resolution(12Mpixel) still image capturing
4.3. Multi cameras control

4.1. Focus & OIS

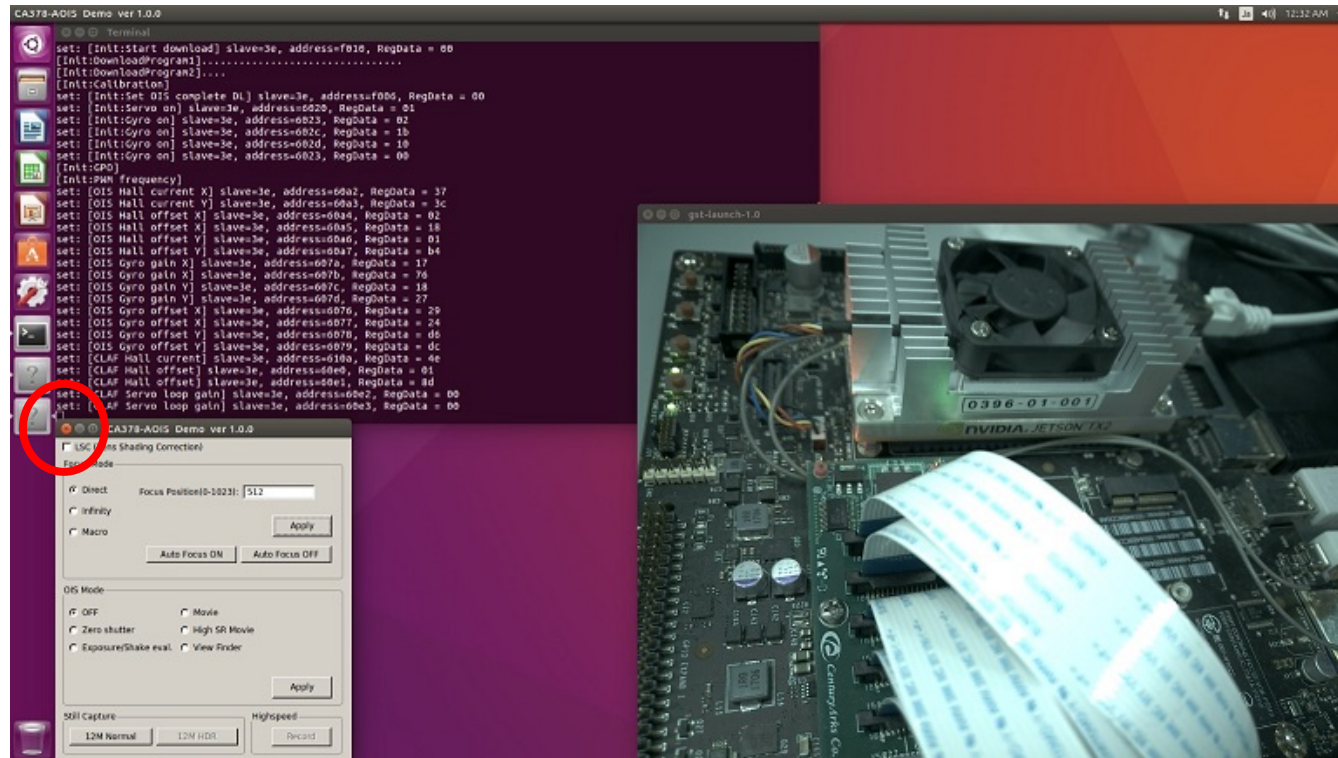Procedure of starting Focus & OIS:
1. Click "DEMO" on the desktop.
2. After a while the GUI screen will be displayed.
3. Please change the distance of the object, or move the camera, confirm the function.
   * For details of functions, refer to page 12-13.
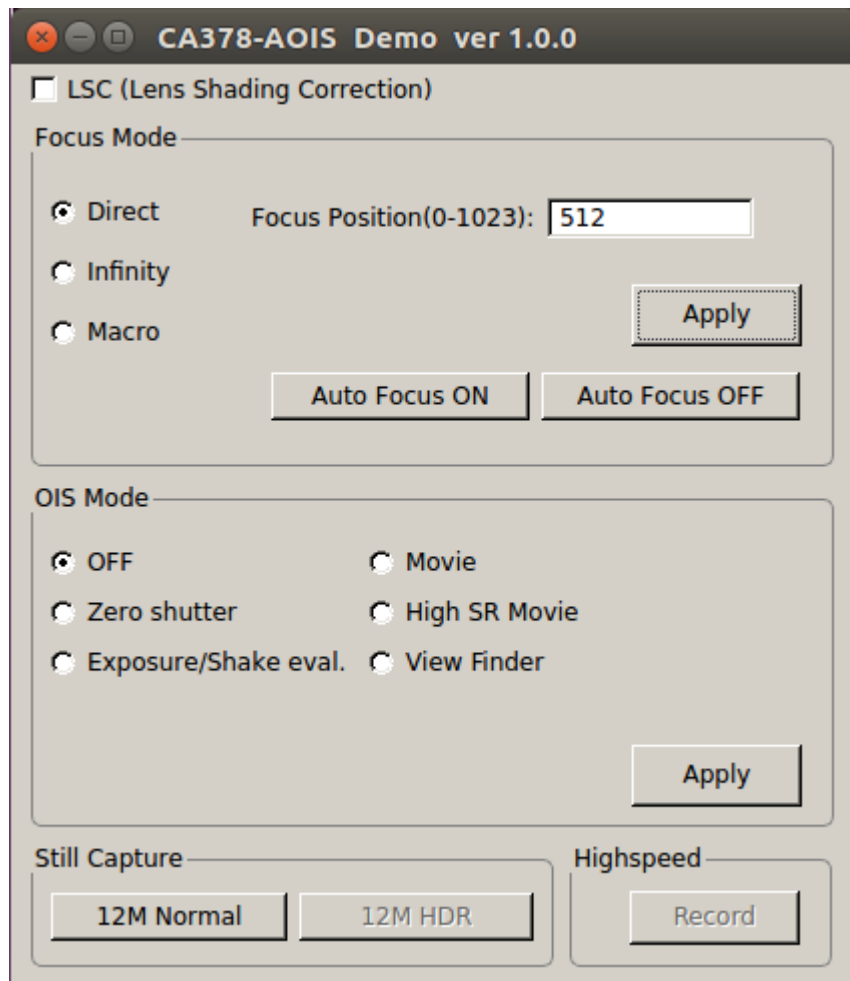
CenturyArks Co., Ltd.

Procedure of finishing Focus & OIS:
1. Click the [x]

4.1. Focus & OIS

The following section describes each function of Focus & OIS.

Function	Description
LSC	Check to enable shading correction. ※ Theoretical values have been set.
Focus Mode	Direct: Directly specify the focus position. Infinity: Set the focus position to infinity. Macro: Set the focus position to the short distance. Focus Position: Focus position. Apply: Apply the settings. Auto Focus ON: Enable auto focus. Auto Focus OFF: Disable auto focus. * Current debug control is for demo.
OIS Mode	OFF: Disable OIS. It corresponds to each OIS mode. Zero Shutter Exposure / Shake eval. Movie High SR Movie View Finder Apply: Apply the settings.
Still Capture	12M Normal: Capture 12Mpixel normal still image.

Description of the script file:
It describes about the "script/demo.sh".

```
#!/bin/sh
cd /home/nvidia/demo
sudo ./bin/DemoGUI -id 0 -w 4056 -h 3040 -fps 30
```

| Function	Description
-id	Specify 0 to 5 when 6 camera modules are connected.
-w	Specify the width.
-h	Specify the height.
-fps	Specify the frame rate.
	The combination of resolution and frame rate is as follows. 4056 x 3040 @ 30 fps 3840 x 2160 @ 30 fps 1920 x 1080 @ 30 fps 1920 x 1080 @ 60 fps 1920 x 1080 @ 120 fps To add a mode, edit "script / preview.sh".

4.2. 12Mpixel still image capturing

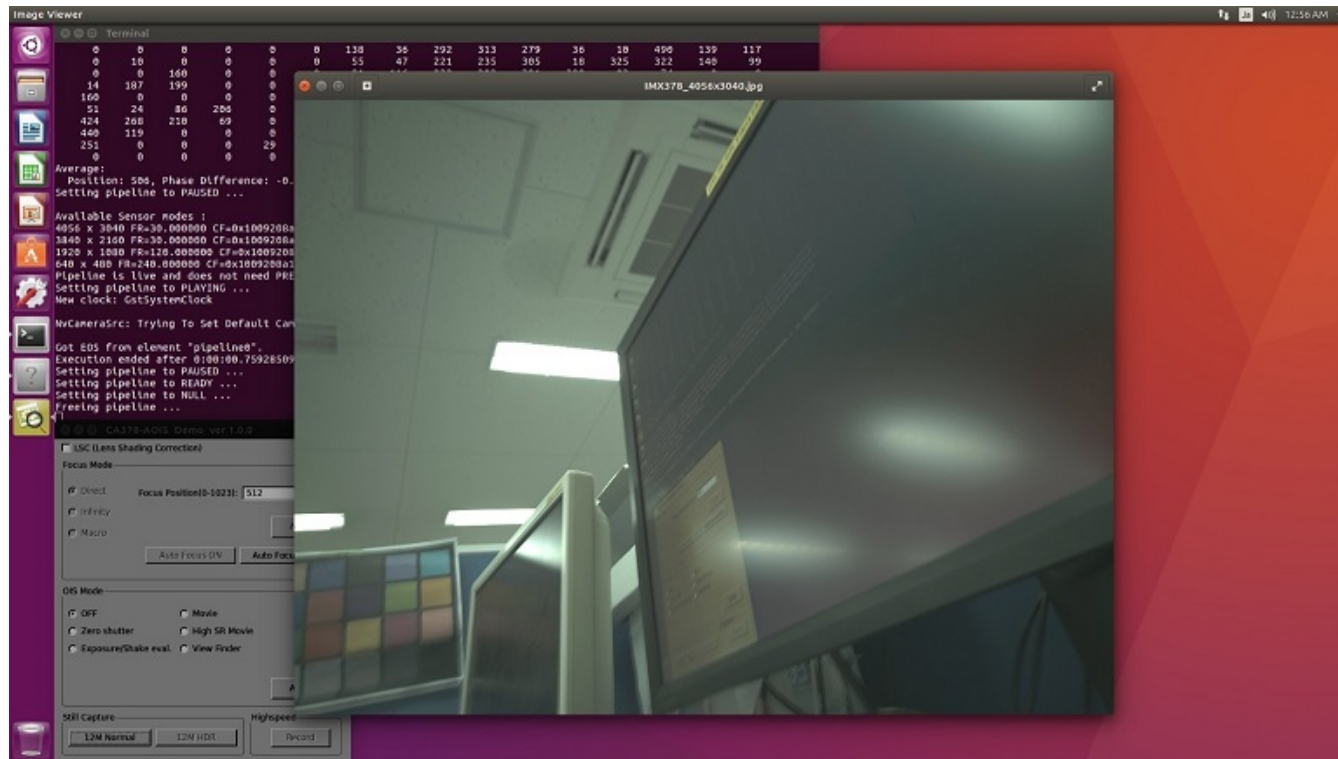Procedure of capturing 12Mpixel still image:
1. Adjust the focus.
   (It is useful to turn on Auto Focus and turn Auto Focus OFF when focus is on)
2. Click the [12M Normal] button
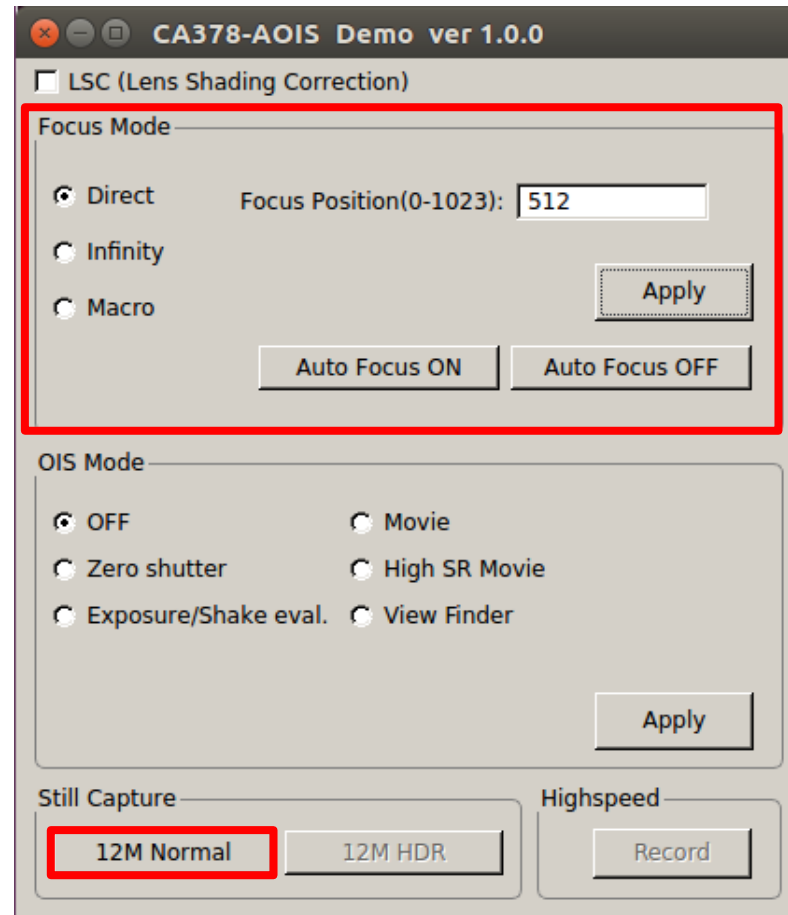
4.2. 12Mpixel still image capturing

3. Images can be captured in JPEG and YUV format. (RAW format will be available soon.)
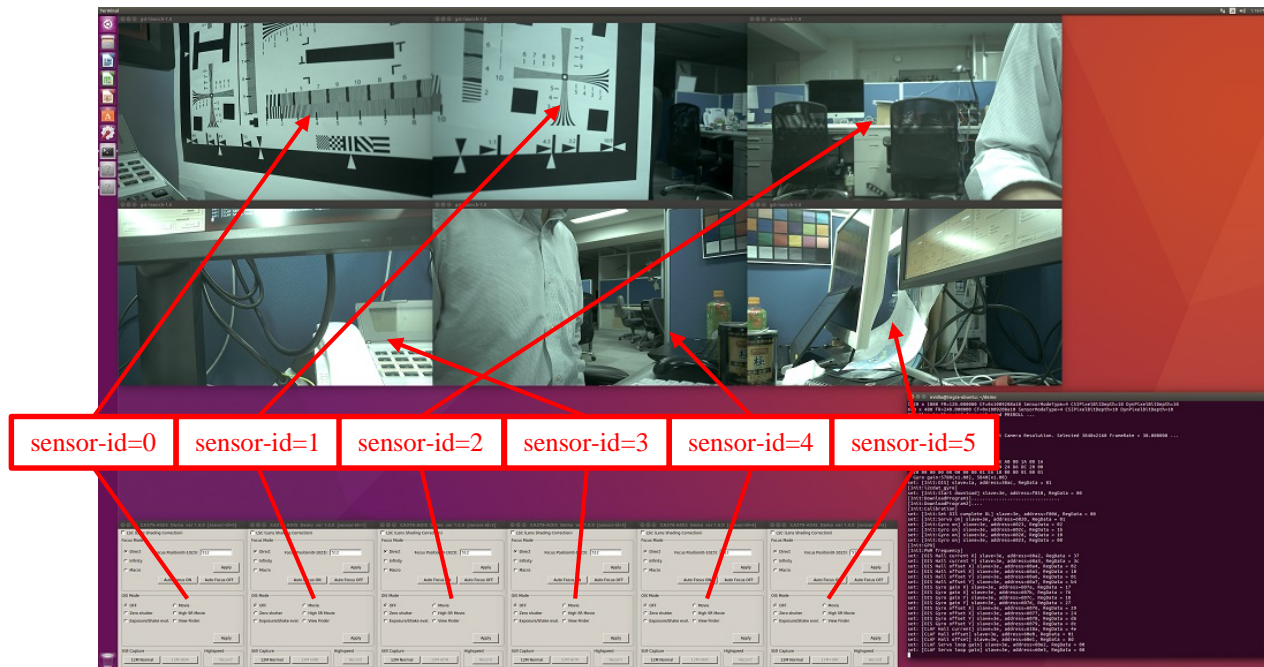
4.3. Multi cameras control

Please start one at a time the following command although it will take some time.

```
$ cd demo
$ ./script/demo.sh 0 &
$ ./script/demo.sh 1 &
$ ./script/demo.sh 2 &
$ ./script/demo.sh 3 &
$ ./script/demo.sh 4 &
$ ./script/demo.sh 5 &
```


sensor-id=0　sensor-id=1　sensor-id=2　sensor-id=3　sensor-id=4　sensor-id=5

For it exceeds the processing of Jetson TX2 (1.4G pixel/sec),
Depending on Jetson's environment and conditions, it may not be possible to display 6 cameras.

5. Sample Script

1. Camera display
The camera can be displayed on the screen with the following command.

```
$ gst-launch-1.0 nvcamerasrc ! 'video/x-raw(memory:NVMM),width=4056,height=3040,framerate=(fraction)30/1' ! nvvidconv ! nvoverlaysink -e
$ gst-launch-1.0 nvcamerasrc ! 'video/x-raw(memory:NVMM),width=3840,height=2160,framerate=(fraction)30/1' ! nvvidconv ! nvoverlaysink -e
$ gst-launch-1.0 nvcamerasrc ! 'video/x-raw(memory:NVMM),width=1920,height=1080,framerate=(fraction)120/1' ! nvvidconv ! nvoverlaysink -e
```

2. JPEG still image capturing
JPEG still image can be captured with the following command.

```
$ gst-launch-1.0 nvcamerasrc num-buffers=1 ! 'video/x-raw(memory:NVMM),width=3840,height=2160,format=I420,framerate=30/1' ¥
    ! nvvidconv ! nvjpegenc ! filesink location=test.jpg -e
```

3. H.264 video recording
H.264 video can be recorded with the following command. (Maximum 60 fps)

```
$ gst-launch-1.0 nvcamerasrc num-buffers=100 ! 'video/x-raw(memory:NVMM),width=1920,height=1080,format=I420,framerate=60/1' ¥
    ! nvvidconv ! omxh264enc ! qtmux ! filesink location=test.mp4 -e
```

4. YUV video recording
YUV video can be recorded with the following command.

```
$ gst-launch-1.0 nvcamerasrc num-buffers=200 ! 'video/x-raw(memory:NVMM),width=1920,height=1080,format=I420,framerate=120/1' ¥
    ! nvvidconv ! 'video/x-raw,width=1920,height=1080,format=I420,framerate=120/1' ! filesink location=test.yuv -e
```

5. Sample Script

5. Multiple cameras display

Multiple cameras can be displayed on the screen with the following command.

```
$ gst-launch-1.0 nvcamerasrc sensor-id=0 ! 'video/x-raw(memory:NVMM), width=(int)3840, height=(int)2160, framerate=(fraction)30/1' !¥
    nvvidconv flip-method=2 ! 'video/x-raw, width=(int)640, height=(int)360, framerate=(fraction)30/1' ! queue ! xvimagesink ¥
    nvcamerasrc sensor-id=1 ! 'video/x-raw(memory:NVMM), width=(int)3840, height=(int)2160, framerate=(fraction)30/1' ! ¥
    nvvidconv flip-method=2 ! 'video/x-raw, width=(int)640, height=(int)360, framerate=(fraction)30/1' ! queue ! xvimagesink ¥
    nvcamerasrc sensor-id=2 ! 'video/x-raw(memory:NVMM), width=(int)3840, height=(int)2160, framerate=(fraction)30/1' ! ¥
    nvvidconv flip-method=2 ! 'video/x-raw, width=(int)640, height=(int)360, framerate=(fraction)30/1' ! queue ! xvimagesink ¥
    nvcamerasrc sensor-id=3 ! 'video/x-raw(memory:NVMM), width=(int)3840, height=(int)2160, framerate=(fraction)30/1' ! ¥
    nvvidconv flip-method=2 ! 'video/x-raw, width=(int)640, height=(int)360, framerate=(fraction)30/1' ! queue ! xvimagesink ¥
    nvcamerasrc sensor-id=4 ! 'video/x-raw(memory:NVMM), width=(int)3840, height=(int)2160, framerate=(fraction)30/1' ! ¥
    nvvidconv flip-method=2 ! 'video/x-raw, width=(int)640, height=(int)360, framerate=(fraction)30/1' ! queue ! xvimagesink ¥
    nvcamerasrc sensor-id=5 ! 'video/x-raw(memory:NVMM), width=(int)3840, height=(int)2160, framerate=(fraction)30/1' ! ¥
    nvvidconv flip-method=2 ! 'video/x-raw, width=(int)640, height=(int)360, framerate=(fraction)30/1' ! queue ! xvimagesink
```
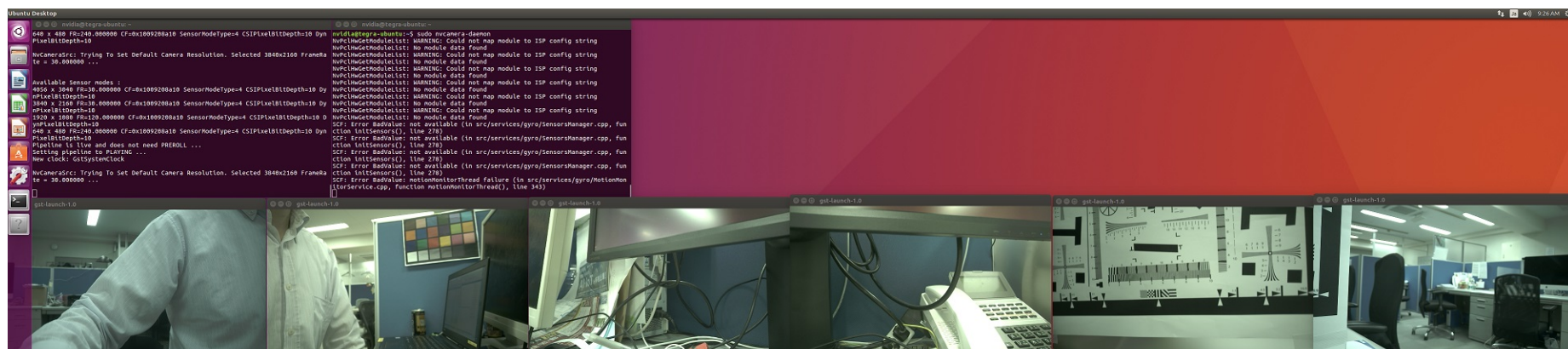

For it exceeds the processing of Jetson TX2 (1.4G pixel/sec),
Depending on Jetson's environment and conditions, it may not be possible to display 6 cameras.
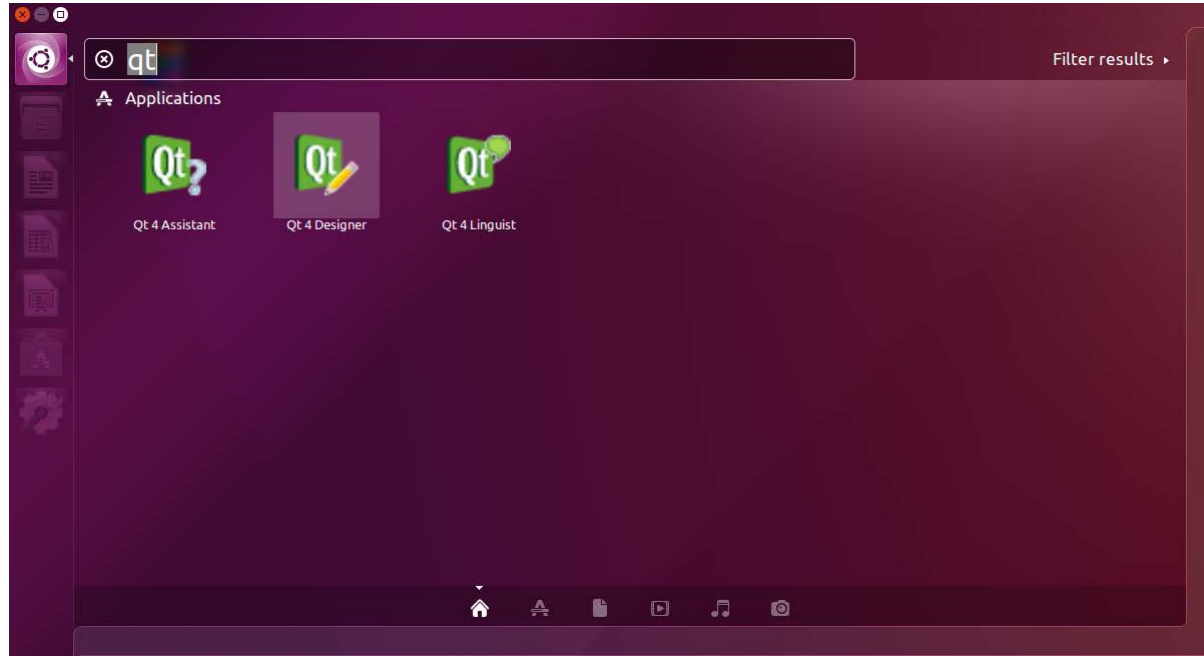
6. How to build sample code

1. Install build environment
Install the build environment with the following command.
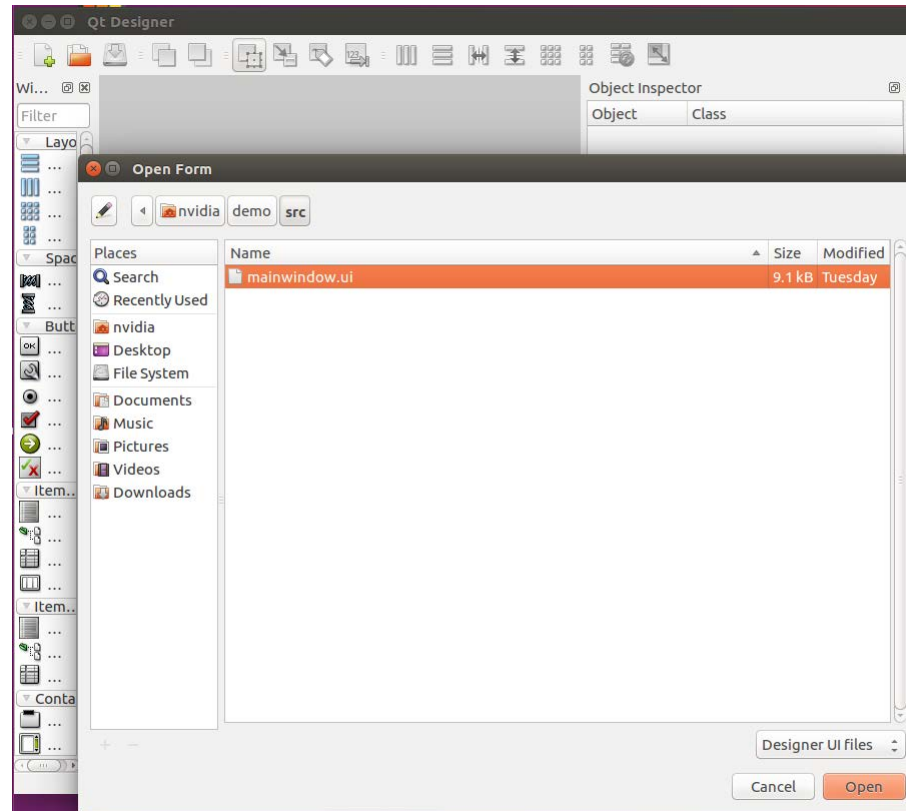
```
$ sudo apt-get install qt4-dev-tools
```
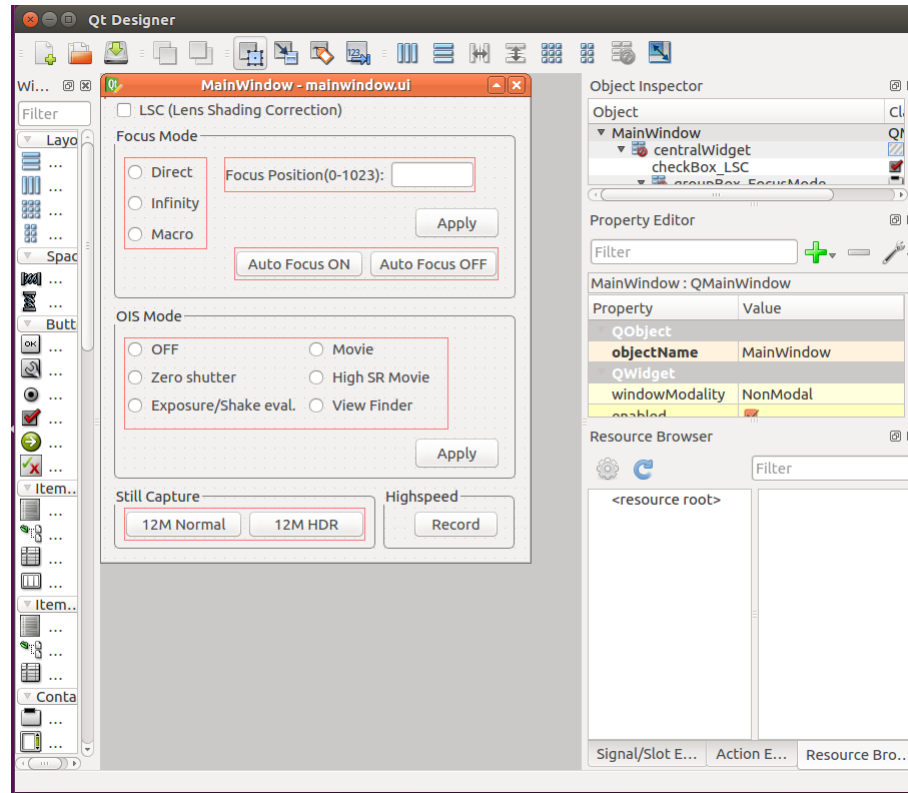
2. GUI design
(1) Search "qt" and select "Qt 4 Designer"

6. How to build sample code

(2) Click "Open...", select and open "demo/src/mainwindow.ui"

6. How to build sample code

(3) Change design and save

3. Build

Build with the following command.

```
$ qmake
$ make
```

Appendix

A.1. About the directory structure

The following section describes the directory structure of the software.

```
demo
├──Install.sh
│
├──bin
│     demo.ini
│     DemoGUI
│
├──script
│     demo.sh
│     preview.sh
│     stillCapture12M_Normal.sh
│
└──src
      af_control.c
      af_control.h
      communication.h
      communication_jetson.c
      debug_util.h
      DemoGUI.pro
      DemoGUI.pro.user
      demo_control.c
      demo_control.h
      lsc_control.c
      lsc_control.h
      main.cpp
      mainwindow.cpp
      mainwindow.h
      mainwindow.ui
      Makefile
      ois_control.c
      ois_control.h
      slave_address.h
      types_util.h
```

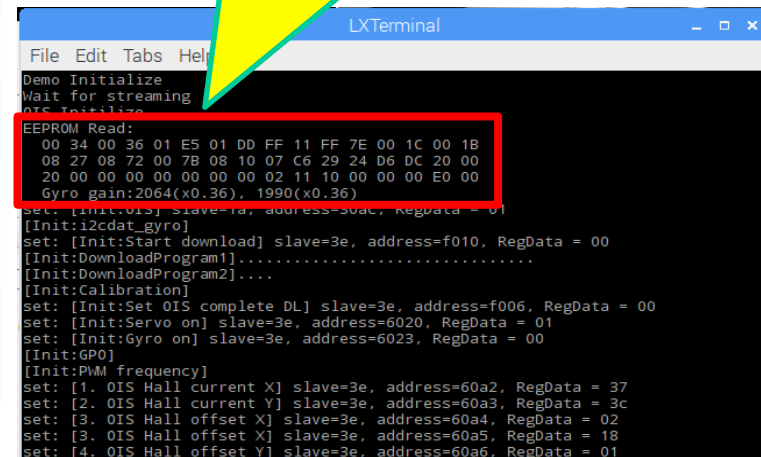| Function	Description
bin	DemoGUI: Demonstration software Demo.ini: Demonstration software setting file
script	Script files are described. It can be customized according to specifications. demo.sh preview.sh stillCapture12M_Normal.sh
src	It is a set of demo software source code.

A.2. About the setting file

The following section describes the "demo.ini" of the setting file.

```
# DEMO Setting
preview = /home/pi/demo/script/preview.sh
stillCapture12M_Normal = /home/pi/demo/script/stillCapture12M_Normal.sh
gyroGainRateX=1.00
gyroGainRateY=1.00
autoFocusGain=2.0
autoFocusConfidenceThreshold=10
autoFocusMoveLimit=100
AutoFocusAverageNum=1
```

Function	Description
preview	Script path for preview
stillCapture12M_Normal	Script path for capturing 12M normal still images
gyroGainRateX gyroGainRateY	It is valid only when OIS calibration result is written in EEPROM.
autoFocusGain	Adjust the autofocus gain.
autoFocusConfidenceThreshold	Specify the threshold value of the confidence level of Phase Difference.
autoFocusMoveLimit	Limit the amount of focus movement at one time.
AutoFocusAverageNum	Adjust the average amount of autofocus.

If OIS calibration is already done,
The following log is output to Terminal.

LXTerminal

```
File  Edit  Tabs  Help
Demo Initialize
Wait for streaming
OIS Initialize
EEPROM Read:
  00 34 00 36 01 E5 01 DD FF 11 FF 7E 00 1C 00 1B
  08 27 08 72 00 7B 08 10 07 C6 29 24 D6 DC 20 00
  20 00 00 00 00 00 00 00 02 11 10 00 00 00 E0 00
  Gyro gain:2064(x0.36), 1990(x0.36)
set: [Init:OIS] slave=1a, address=30ac, RegData = 01
[Init:i2cdat_gyro]
set: [Init:Start download] slave=3e, address=f010, RegData = 00
[Init:DownloadProgram1]...............................
[Init:DownloadProgram2]....
[Init:Calibration]
set: [Init:Set OIS complete DL] slave=3e, address=f006, RegData = 00
set: [Init:Servo on] slave=3e, address=6020, RegData = 01
set: [Init:Gyro on] slave=3e, address=6023, RegData = 00
[Init:GPO]
[Init:PWM frequency]
set: [1. OIS Hall current X] slave=3e, address=60a2, RegData = 37
set: [2. OIS Hall current Y] slave=3e, address=60a3, RegData = 3c
set: [3. OIS Hall offset X] slave=3e, address=60a4, RegData = 02
set: [3. OIS Hall offset X] slave=3e, address=60a5, RegData = 18
set: [4. OIS Hall offset Y] slave=3e, address=60a6, RegData = 01
```