FLIR Lepton 3.5

We use the FLIR Lepton 3.5 with GroupGets PureThermal 2 FLIR Lepton Smart I/O Module that provides a USB 2 interface for the FLIR Lepton product series.

FLIR Lepton 3.5 resources:

- FLIR Lepton 3.5
- FLIR Lepton Datasheet
- FLIR Lepton Google Group

GroupGets PureThermal 2 resources:

- PureThermal 2
- PureThermal 2 Datasheet
- PureThermal 1/2/mini Firmware
- PureThermal 2 libuvc
- libuvc Documentation
- PureThermal 2 UVC Capture Examples
- GetThermal

Script

Run FLIR Lepton installation script
sw/NVIDIA_Jetson_Xavier_NX/Scripts$ bash **install-5-FLIR_Lepton_3.5.sh**

Dockerfile

FLIR Lepton Dockerfile
sw/NVIDIA_Jetson_Xavier_NX/Docker/**Dockerfile-5-FLIR_Lepton_3.5**

PureThermal 2 Firmware v1.3.0 (USB via DFU-Mode)

GroupGets provides the source code and binaries of the firmware on GitHub.

Download binaries of the firmware v1.3.0
Firefox: https://github.com/groupgets/purethermal1-firmware/releases
> Click pt1-v1.3.0.tar.gz
$: tar -xf pt1-v1.3.0.tar.gz
An already downloaded copy can be found here:
sw/NVIDIA_Jetson_Xavier_NX/FLIR_Lepton_3.5/**pt1-v1.3.0**

Enter bootloader DFU-Mode
> Press and hold the BOOT button while plugging the USB cable from PureThermal 2 into the host computer
> Press and release the RST button
> Release the BOOT button
LED stops blinking and dim to half brightness

Flash
$: sudo apt-get install **dfu-util**
$: dfu-util --list
Found DFU: [0483:df11]
$: cd sw/NVIDIA_Jetson_Xavier_NX/FLIR_Lepton_3.5/pt1-v1.3.0
.../pt1-v1.3.0$: dfu-util -a 0 -d 0483:df11 -D pt1-v1.3.0.bin -s 0x08000000

v4l-utils

v4l-utils provides linux utilities and libraries to handle video devices.

List all video devices
$: v4l2-ctl --list-devices
vi-output, imx219 9-0010 (platform:15c10000.vi:0):
/dev/video0
vi-output, imx219 10-0010 (platform:15c10000.vi:2):
/dev/video1
PureThermal (fw:v1.3.0) (usb-3610000.xhci-2.1):
/dev/video5
Intel® RealSense(TM) Depth Ca (usb-3610000.xhci-3.2):
/dev/video2
/dev/video3
/dev/video4

Query a video device's information
$: v4l2-ctl -d5 -D
Driver Info (not using libv4l2):
Driver name : uvcvideo
Card type : PureThermal (fw:v1.3.0)
Bus info : usb-3610000.xhci-2.1
Driver version: 4.9.201
Capabilities : 0x84200001
Video Capture
Streaming
Extended Pix Format
Device Capabilities
Device Caps : 0x04200001
Video Capture
Streaming
Extended Pix Format

gstreamer

The FLIR Lepton 3.5 with the GroupGets PureThermal 2 works out-of-the-box with gstreamer.

View Imagery
$: gst-launch-1.0 v4l2src **device=/dev/video5** ! videoconvert ! xvimagesink

When running the realsense-viewer for the Intel RealSense D435i, the video device /dev/video5 of the thermal camera disappears and can no longer be accessed directly. uvc-radiometry.py and GetThermal still work. Reboot and the video devices reappear.

USB video class (UVC)

GroupGets provides a modified version of the libuvc for the PureThermal 2 on GitHub.

Clone libuvc repository from GitHub
sw/NVIDIA_Jetson_Xavier_NX/FLIR_Lepton_3.5$: git clone https://github.com/groupgets/libuvc

Un-comment the following lines in the CMakeLists.txt:
```
find_package(jpeg QUIET)
if(NOT JPEG_FOUND)
  find_path(JPEG_INCLUDE_DIR jpeglib.h)
  if(JPEG_INCLUDE_DIR)
    set(JPEG_FOUND ON)
    set(JPEG_LIBRARIES -ljpeg)
  endif()
endif()
```

$: lsusb
Bus 003 Device 006: ID **1e4e**:**0100** Cubeternet WebCam

Add a 99-pt2.rules file with the following content:
SUBSYSTEMS=="usb", ATTRS{idVendor}=="**1e4e**", ATTRS{idProduct}=="**0100**", SYMLINK+="pt2", GROUP="usb", MODE="0666"

An already downloaded and modified copy can be found here:
sw/NVIDIA_Jetson_Xavier_NX/FLIR_Lepton_3.5/**libuvc**

The libuvc is put under **/opt/FLIR_Lepton_3.5/libuvc** and is installed under ***usr/*local**.

GroupGets UVC capture examples

GroupGets provides UVC capture examples on GitHub.

Clone UVC capture examples repository from GitHub
sw/NVIDIA_Jetson_Xavier_NX/FLIR_Lepton_3.5$: git clone
https://github.com/groupgets/purethermal1-uvc-capture.git

Modify python/uvc-radiometry.py to change from Kelvin to Celsius
```
def display_temperature(img, val_k, loc, color):
  val = kto**c**(val_k)
  cv2.putText(img,"{0:.1f} deg**C**".format(val), loc, cv2.FONT_HERSHEY_SIMPLEX, 0.75, color, 2)
```

An already downloaded and modified copy can be found here:
sw/NVIDIA_Jetson_Xavier_NX/FLIR_Lepton_3.5/**purethermal1-uvc-capture**

The UVC capture examples are put under **/opt/FLIR_Lepton_3.5/purethermal1-uvc-capture.**

Print the Lepton's software and hardware version information
$: /opt/FLIR_Lepton_3.5/purethermal1-uvc-capture/python/**uvc-deviceinfo.py**
Version gpp: 3.3.26 dsp: 3.3.26
FLIR part #: 500-0771-01
FLIR serial #: '\xe037\x01\x00\x00\x00\x00'

Run OpenCV example
$: /opt/FLIR_Lepton_3.5/purethermal1-uvc-capture/python/**opencv-capture.py**
If Camera not found!, unplug and reconnect USB cable.
It searches from video index 9 down to 0, so when multiple cameras are connected, it only connects to the last one, which might not be the thermal camera.

Run min/max temperature example
$: /opt/FLIR_Lepton_3.5/purethermal1-uvc-capture/python/**uvc-radiometry.py**
Version gpp: 3.3.26 dsp: 3.3.26
FLIR part #: 500-0771-01
FLIR serial #: '\xe037\x01\x00\x00\x00\x00'
format: UYVY
frame 160x120 @ 9fps
format: Y16
frame 160x120 @ 9fps
frame 160x122 @ 9fps
format: Y8
frame 160x120 @ 9fps
format: RGBP
frame 160x120 @ 9fps
format: }6
frame 160x120 @ 9fps
Estimated / selected altsetting bandwith : 18 / 642.

GetThermal

GroupGets provides an open-source example application GetThermal on GitHub.

Clone GetThermal repository from GitHub
sw/NVIDIA_Jetson_Xavier_NX/FLIR_Lepton_3.5$: git clone https://github.com/groupgets/GetThermal.git
sw/NVIDIA_Jetson_Xavier_NX/FLIR_Lepton_3.5/GetThermal$: git submodule init
sw/NVIDIA_Jetson_Xavier_NX/FLIR_Lepton_3.5/GetThermal$: git submodule update
An already downloaded copy can be found here:
sw/NVIDIA_Jetson_Xavier_NX/FLIR_Lepton_3.5/**GetThermal**

GetThermal is put under **/opt/FLIR_Lepton_3.5/GetThermal**.

Run GetThermal
$: /opt/FLIR_Lepton_3.5/GetThermal/build/release/**GetThermal**