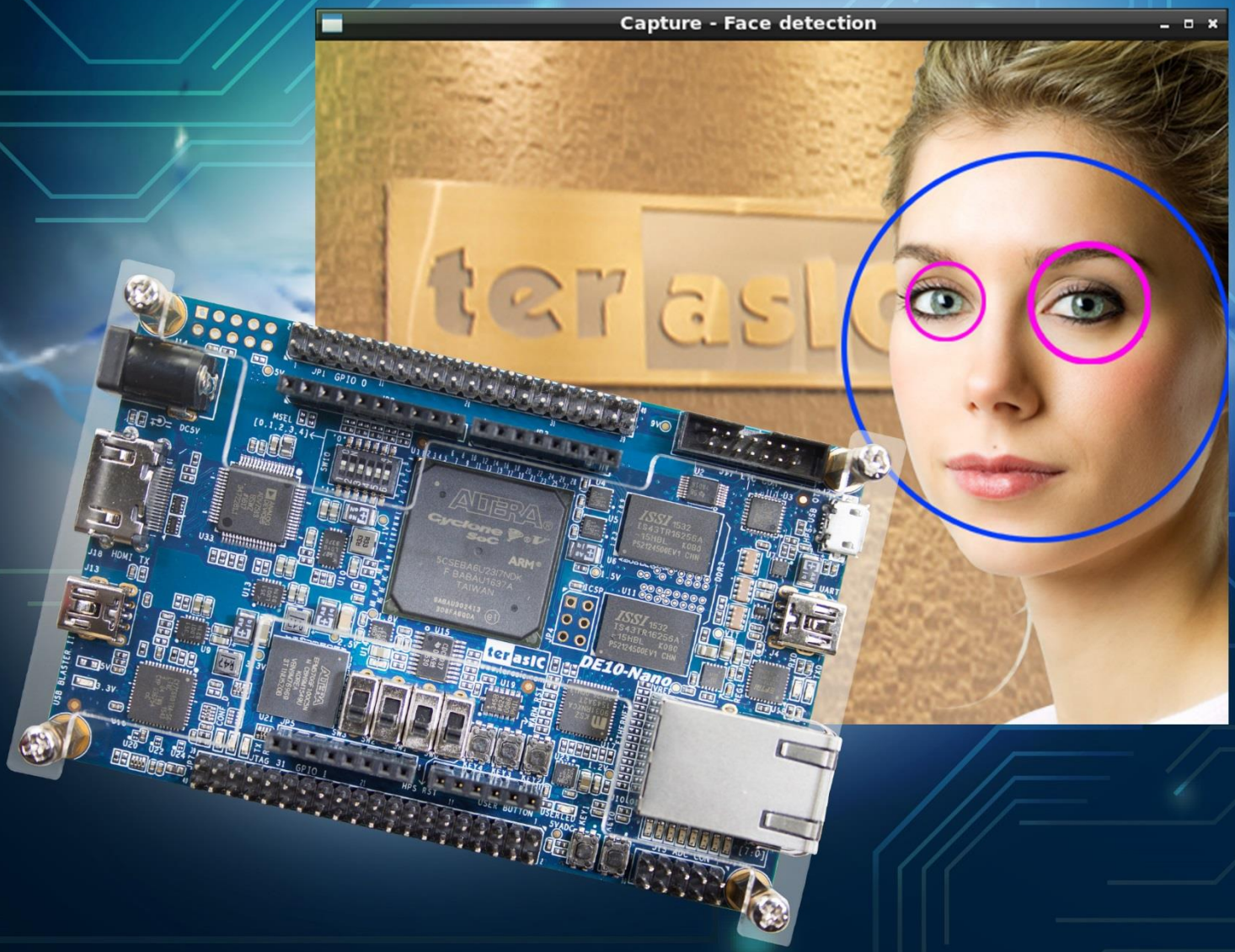
OpenCV

DE10-Nano

OpenCV User Manual



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Chapter 1

Introduction

OpenCV (Open Source Computer Vision) is a library of programming functions mainly used at real-time computer vision. The DE10-Nano LXDE Desktop BPS built-in the OpenCV library, so user can use the library to perform computer vision function. Also, the BPS includes the required toolchain for building OpenCV application, so developers can directly develop and execute their project on the LXDE Desktop. No cross-compile is required.

In these demonstration, all computation is performed by AMR processor. However, developers can improve the performance of critical computation by FPGA.

Software Development Flow

Figure 1-1 displays the software design flow block diagram. The development procedures are:

1. In LXDE Desktop, developers design their C-code software project with a generic text editor. Generally, .c and .h files are needed.
2. Create a "**Makefile**" for your software design project, so the compiler knows how to generate a final object/executable files for your project.
3. Use the build-in GNU toolchain to generate executable file
4. Execute the executable file generated in step 3.

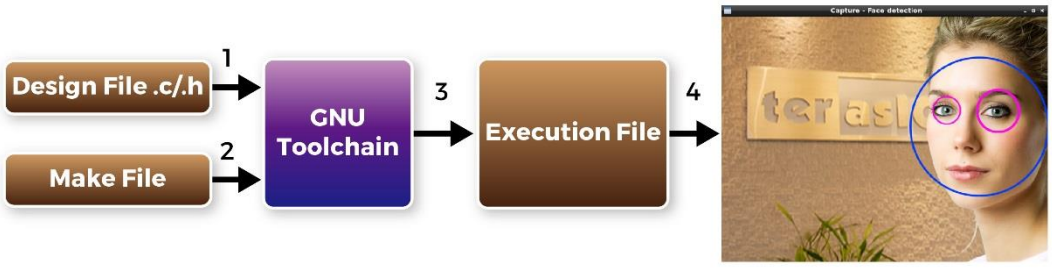

Figure 1-1 Design Flow

System Requirements

In addition to the DE10-Nano board, the following hardware are also required:

- microSD card contains LXDE Desktop Image
- HDMI Monitor
- USB Keybaord
- USB Mouse
- USB Camera (Optional)
- USB Hub

The LXDE Desktop Image is available at http://de10-nano.terasic.com/cd. Please download the image and create a LXDE to boot microSD. For details about how to create a booting micros SD card, please refer to the document **DE10-Nano_Getting_Started_Guide.pdf** in the DE10-Nano System CD.

The cameras which can be supported by the LXDE desktop are listed in the link: http://www.ideasonboard.org/uvc/#devices. However, not all of these cameras are fully compatible with the OpenCV software. The following cameras have been tested by Terasic and they all work well on the Open CV. If users need to use camera application, choose these camera of which we have approved.

- Logitech C310
- ET USB 2760 Camera
- Genius WideCam F100

Chapter 2

Execute OpenCV Demo

This chapter describes how to execute the demo included in the LXDE Desktop BSP. There are three OpenCV demonstrations in the BSP. The three demonstrations are houghlines, camine_in can face_detection. For the last two demonstrations, a USB Camera is required.

Hardware Setup

Below is the procedure to setup the demonstration as shown in **Figure 2-1**.

1. Make sure the MSEL[4:0] switch is set to 01010.
2. Insert the LXDE microSD card into microSD socket (J11) on DE10-Nano
3. Connect HDMI Monitor to HDMI output connector (J18) on DE10-Nano
4. Connect USB Hub to the USB OTG Port(J2) on DE10-Nano
5. Connect USB keyboard, mouse, and camera to the USB hub
6. Power on DE10-Nano
7. LXDE Desktop will appear on the HDMI monitor, as shown in **Figure 2-2**

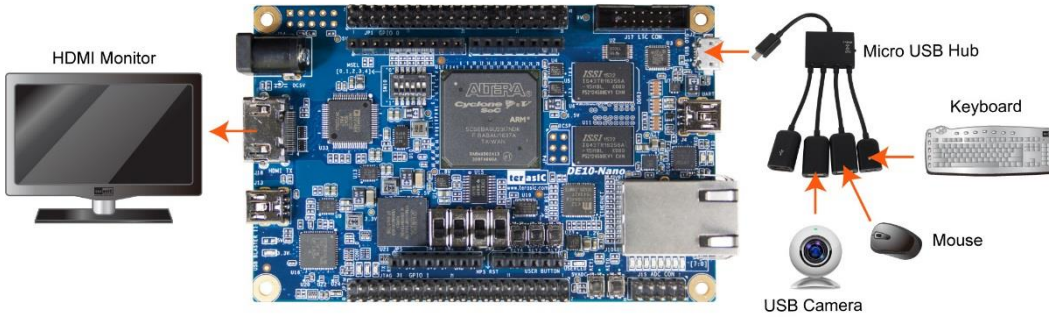

Figure 2-1 OpenCV Setup

Figure 2-2 LXDE Desktop

Execute Hough Lines Demo

This demonstration shows how to use OpenCV function to detect the lines in as image. In this demonstration, the detected image is given in pic1.png file. After LXDE Desktop is booted, please follow the procedure listed below to perform the hough line demonstration.

1. Open the **OpenCV** folder in the LXDE Desktop. Then, open **example** folder.
2. Dobule click the **hough lines** icon, as shown in **Figure 2-3**, to launch hough line demo.
3. When Execute File dialog appears, click "Execute" button as shown in **Figure 2-4**.
4. Two dialogs will appear as shown in **Figure 2-5** (If there is only one window appearing on the screen, another window may overlap below). The dialog on the left shows the original image, the processed image and the detected hough lines.

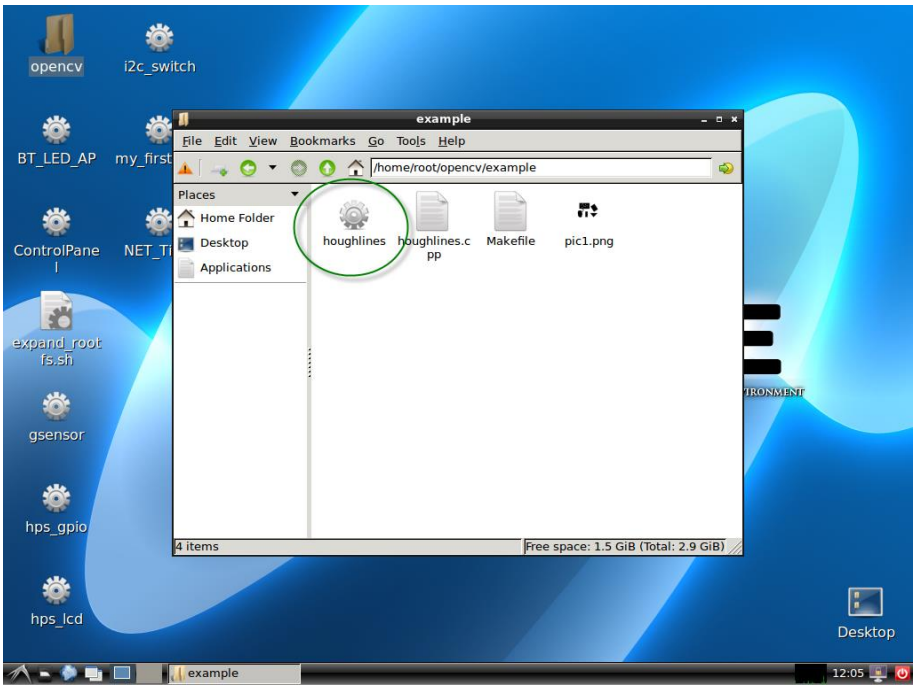

Figure 2-3 Double click houghlines icon

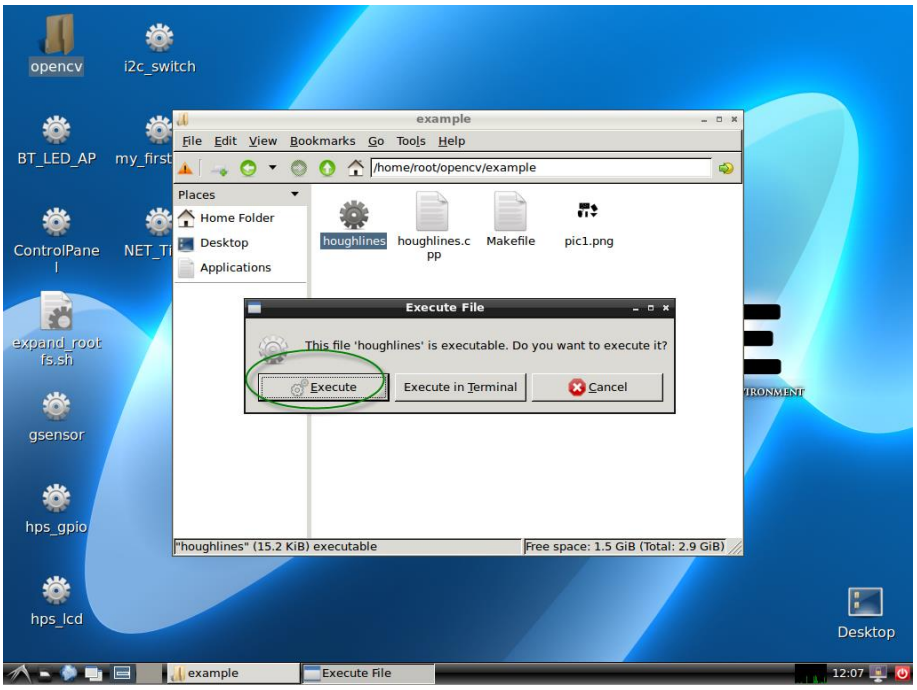

Figure 2-4 Click the "Execute" button

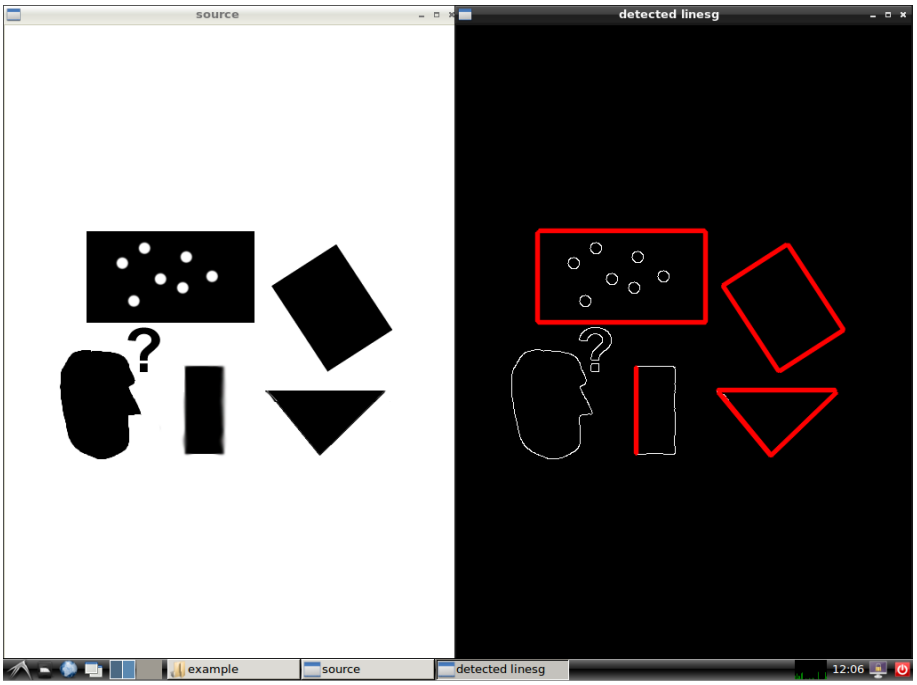

Figure 2-5 Screenshot of Hough Line demo

Execute Camera In Demo

This demonstration shows how to use OpenCV fuction to real time display the image captured by an USB camera. Note, this demonstration requires an USB camera plug-in to the DE10-Nano. After LXDE Desktop is booted, please follow the below procedure to perform the camera in demonstration.

1. Open the **OpenCV** folder in the LXDE Desktop. Then, open **camera_in** folder.
2. Dobule click the **camera_in** icon, as shown in **Figure 2-6**, to launch camera in demo.
3. When Execute File dialog appears, click “Execute” button.
4. A dialog will appear as shown in **Figure 2-7**. The dialog will real time display the camera captured image. The frame rate is approximately 19.
5. Click **ESC** key on the USB keyboard to close the dialog.

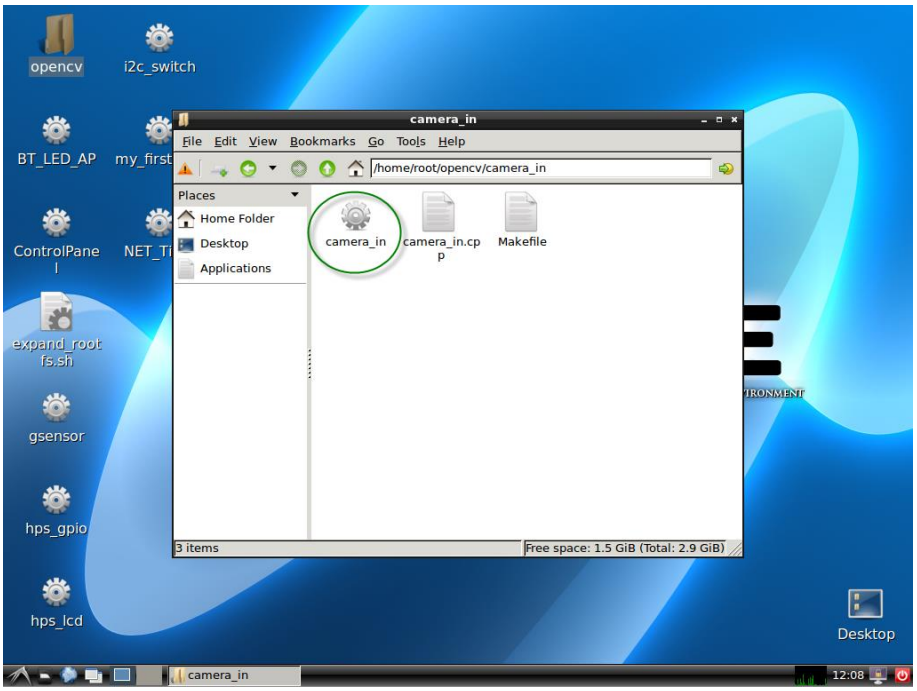

Figure 2-6 Double click houghlines icon

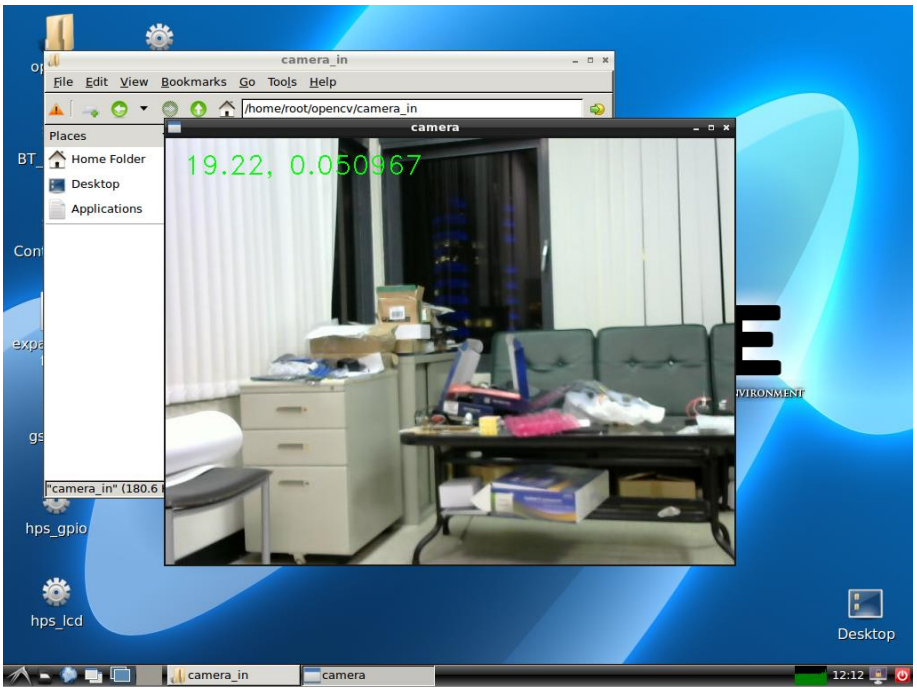

Figure 2-7 Screenshot of camera in demo

Execute Face Detection Demo

This demonstration shows how to use OpenCV fuction to perform face detection with an USB camera.

Note, this demosration required an USB camera plug-in to the DE10-Nano. After LXDE Desktop is booted, please follow the below procedure to perform the camera in demonstration.

1. Open the **OpenCV** folder in the LXDE Desktop. Then, open **face_detection** folder.
2. Dobule click the **objectDetection2** icon, as shown in **Figure 2-7**, to launch the face detection demo.
3. When Execute File dialog appears, click “Execute” button.
4. A dialog will appear as shown in **Figure 2-8**. The dialog will real time display the camera captured image and show the detected face. When face is detected, the frame rate is about 3. Mutiple face detection is supported in this demonstration.
5. Click **ESC** key on the USB keyboard to close the dialog.

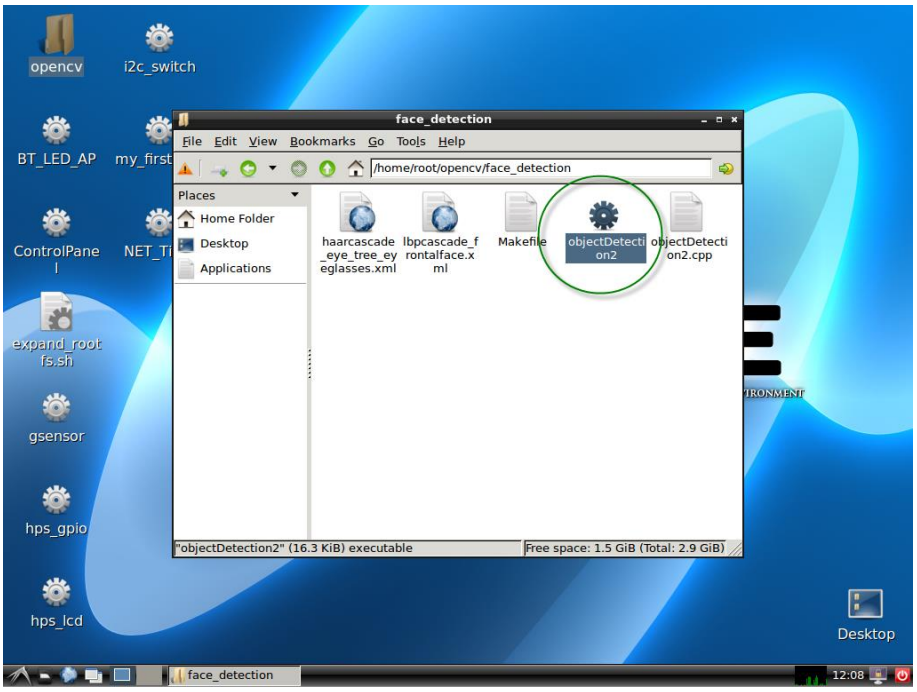

Figure 2-8 Double click objectDetection2 icon

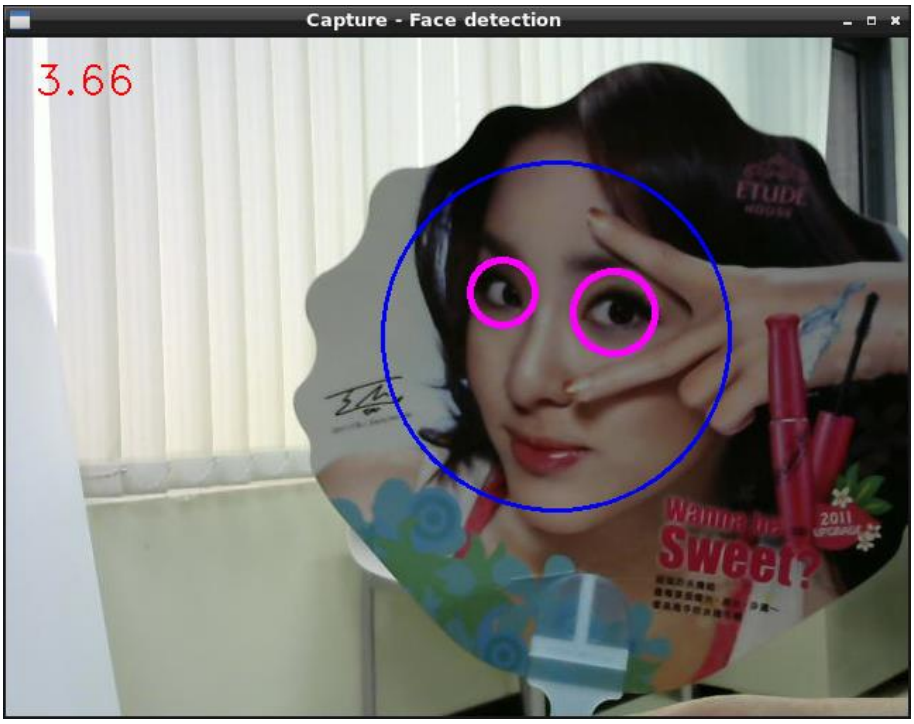

Figure 2-9 Screenshot of face detection demo

Chapter 3

Compile OpenCV Project

This chapter describes how to compile the three demonstration projects on LXDE. The required GNU toolchain had been preinstalled on the LXDE BSP. In addition, the source code of these demonstrations are also incuded in the LXDE BSP. For hardware setup, please refer to Section **0 Hardware Setup**.

Compile Rough Line Project

After LXDE Desktop is booted, please follow the below procedure to compile the rough line project.

1. Open the O**penCV** folder in the LXDE Desktop. Then, open **example** folder.
2. Click the menu item **Tools→Open Current Folder in Terminal** to open terminal, as shown in **Figure 3-1**.
3. In terminal, type "ls" to show file list, type "make clean" to cleanse temporal and target file, and type "make" to build the project as shown in **Figure 3-2**.
4. When make is completed, binary file **houghlines** will be generated.

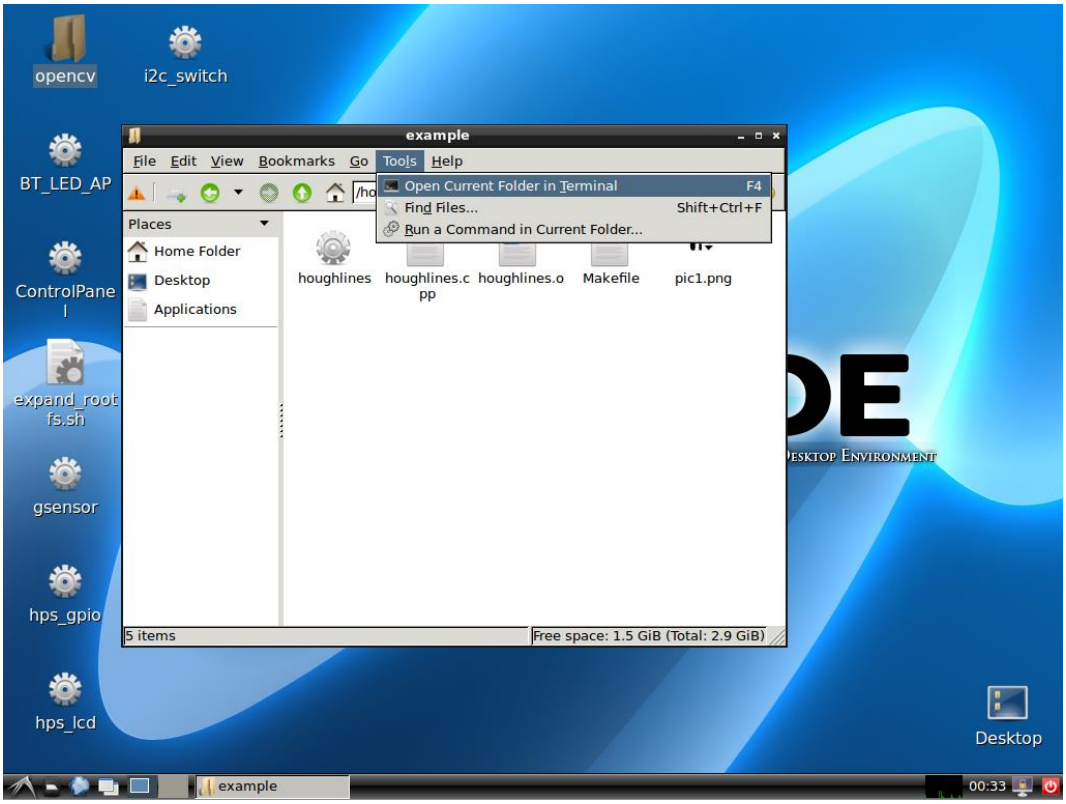

Figure 3-1 Open Current Folder in Terminal

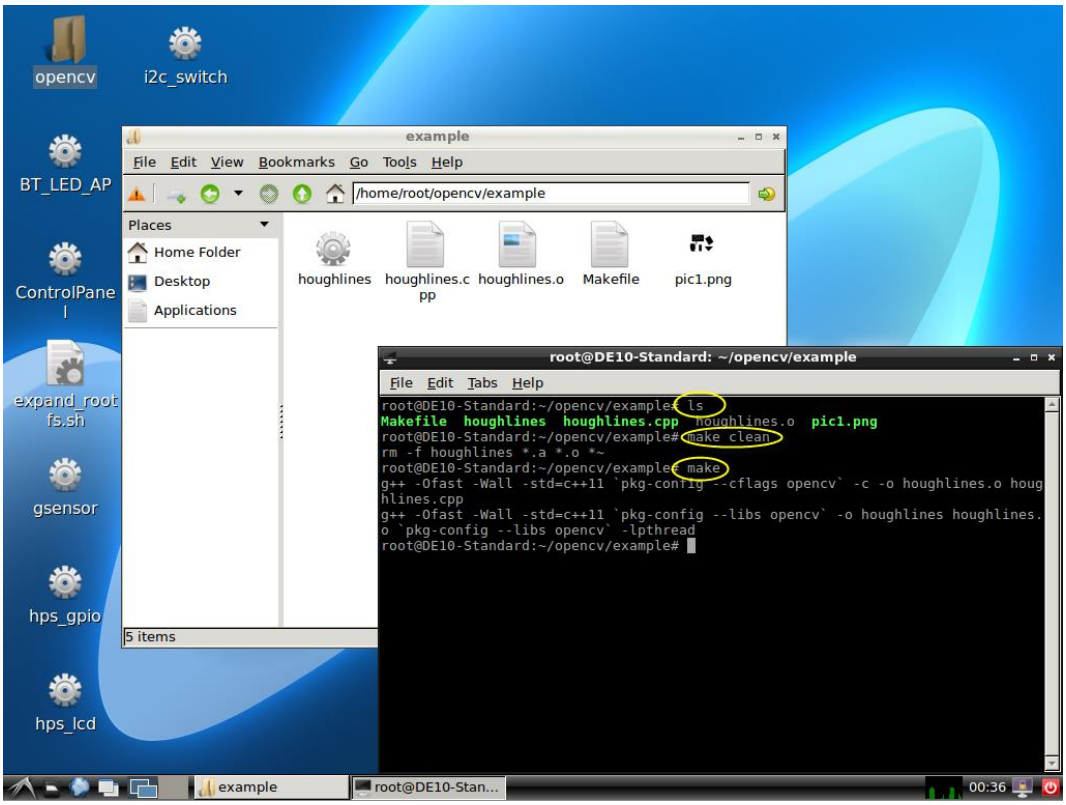

Figure 3-2 Make for hough line project

Compile Camera in Project

After LXDE Desktop is booted, please follow the below procedure to compile the camera_in project.

1. Open the O**penCV** folder in the LXDE Desktop. Then, open **camera_in** folder.
2. Click the menu item **Tools→Open Current Folder in Terminal** to open terminal.
3. In terminal, type "ls" to show file list, type "make clean" to cleanse temporal and target file, and type "make" to build the project as shown in **Figure 3-3**.
4. When make is completed, binary file **camera_in** will be generated.

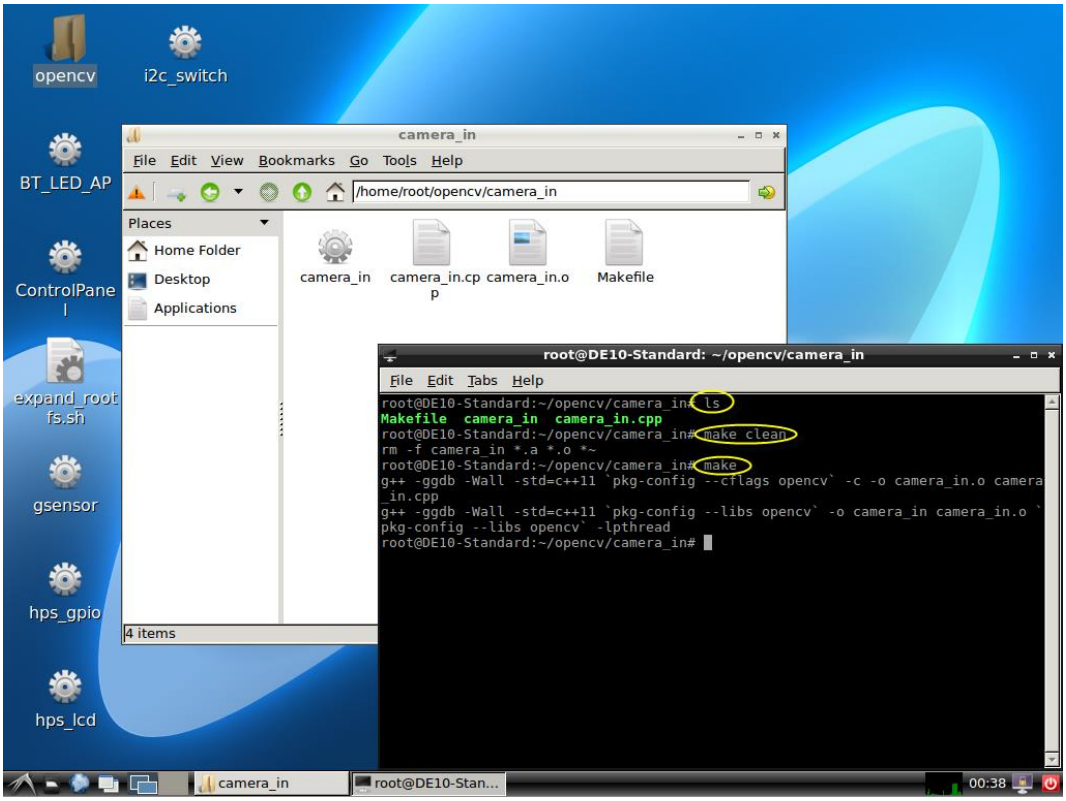

Figure 3-3 Make for camera_in project

Compile Face Detection Project

After LXDE Desktop is booted, please follow the below procedure to compile the face detection project.

1. Open the **OpenCV** folder in the LXDE Desktop. Then, open **face_detection** folder.
2. Click the menu item **Tools→Open Current Folder in Terminal** to open terminal.
3. In terminal, type "ls" to show file list, type "make clean" to cleanse temporal and target file, and type "make" to build the project as shown in **Figure 3-4**.
4. When make is completed, binary file **objectDetection2** will be generated.

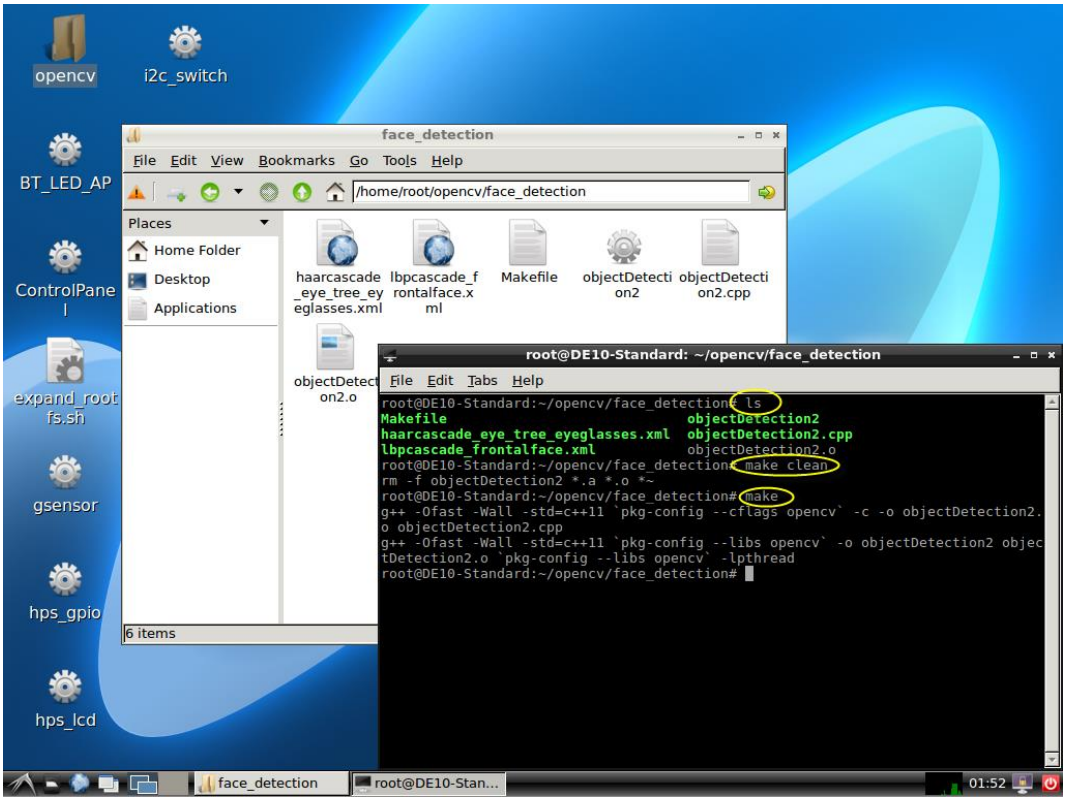

Figure 3-4 Make for Face Detection project

Chapter 4

Appendix

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