Installing Linux on a Pandaboard for Use With ASUS Xtion and OpenNI

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This document will detail how to set up a Pandaboard microcontroller for use with an ASUS Xtion. After following these steps the combination of the Pandaboard and Xtion will be able to do skeleton tracking on human persons. Using the features of Linux and the Pandaboard make this extremely versatile as it can be portable and send information via WIFI, Ethernet, etc.
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Introduction

Microcontrollers are important pieces of equipment that have uses in many everyday technologies. Their size and portability make them very functional for doing simple functions. In this paper the Pandaboard is the microcontroller of focus. The Pandaboard features a powerful processor, the Arm A9. This makes it possible for the Pandaboard to be able to keep up with a complex camera that features both infrared and RGB lenses. It is also possible for the Pandaboard to be able to boot Linux, which makes programming easier. A framework has been developed by PrimeSense called OpenNI. OpenNI is designed to be a framework for the cameras such as, the Microsoft Kinect and ASUS Xtion. These technologies all can come together and we will be described in further detail. I will go over how set up a Pandaboard with Linux, OpenNI framework, NITE middleware and the ASUS Xtion to bring it all together.

Installing Linux on the Pandaboard

The Pandaboard boots operating systems off of an SD card. It is important to get a fast SD card, or the operating system may not run properly. We chose a powerful SanDisk with a high read/write speed. Size does not matter as much, but should be at least 4 GB.

Flashing the SD card with Ubuntu

For the purposes of making sure the Pandaboard will work properly with the ASUS Xtion it is important to make sure the correct version of Linux Ubuntu is downloaded to a host machine. This will be pre-installed desktop image 11.10. At the time of this writing this is not the most current edition, but the most stable
for our application. Currently this version can be found at the following web address
http://cdimage.ubuntu.com/releases/11.10/release/ although other sources may be available.

The next steps to complete flashing the SD card will assume the host machine is running some Linux distribution; however, it should be easy to find how to do an OMAP desktop installation for Arm devices with different host machines. The following steps will help make sure the SD card is flashed:

1. After inserting SD card in computer make sure the card not mounted.
2. Make sure the name of the device is noted i.e. /dev/sde.
3. Next fun the following command:

   zcat ./ubuntu-12.04-preinstalled-desktop-armhf+omap4.img.gz |sudo dd bs=4M of=/dev/sde ; sudo sync

Alternatively, these commands could also be run:

1. gunzip ubuntu-12.04-preinstalled-desktop-armhf+omap4.img.gz
2. sudo dd bs=4M if=ubuntu-12.04-preinstalled-desktop-armhf+omap4.img of=/dev/sde
3. sudo sync

Potential bugs during installation/configuration

The one bug found during installation was an infinite restart loop after installation. During installation the computer will need to restart, however, it has been noticed that this can result in a loop. To prevent this from happening TODO during the first reboot press and hold “ctrl”+”alt”+F1. This will bring up a command prompt where the following command should be issued:

   /$ sudo oem-config-remove && sudo reboot

This should stop the infinite loop and complete installation.
**Downloading and installing libraries**

The following sections will go over how to install the libraries used to take advantage of the features of the ASUS Xtion. The first is the API or framework OpenNI. OpenNI is developed by PrimeSense and is used for applications that utilize real world interactions. We will install the NITE middleware, which is also a PrimeSense project. NITE is used for skeleton tracking features. This is important for our motion tracking uses. Finally, the sensor binaries are the driver to make interfacing with the operating system and other previously mentioned APIs.

**Downloading libraries needed**

The libraries can be accessed at Noritsuna Imamura’s GitHub page at the following URL: https://github.com/OESF/TreasureHuntingRobot where it is provided under the Apache license. To be specific, the important libraries for this application are titled openni-bin-dev-linux-arm-v1.5.2.4.tar.bz2, sensor-bin-linux-arm-v5.1.0.22.tar.bz2, and nite-bin-linux-arm-v1.5.0.1.tar.bz2.

**Installing OpenNI**

The first step is to turn on the Pandaboard and run Ubuntu. Using the command line, two directories need to be made (one is actually for installing the NITE middleware, but is best taken care of now to insure the directories are put in a location that can be remembered). The following commands will create the needed directories:

```
mkdir /usr/etc/primesense
mkdir /var/lib/ni
```

After these directories are created Ubuntu is ready to install OpenNI. Issue the following commands via the command line to install OpenNI:

```
tar -jxvf openni-bin-dev-linux-arm-v1.5.2.4.tar.bz2
cd OpenNI-Bin-Dev-Linux-Arm-v1.5.2.4
sh install.sh
```
When the installation completes the OpenNI API should be properly installed.

**Installing NITE**

This will follow a very similar process as installing OpenNI. The directories created in installing OpenNI step do not need to be created again. For the NITE installation to be successful similar commands need to be issued at the command line:

```
cd ..
tar -jxvf nite-bin-linux-arm-v1.5.0.1.tar.bz2
sh install.sh
```

Notice the first command assumes that the installation of OpenNI has just completed. This command will not be needed if the terminal is already opened to the directory containing the nite-bin-linux-arm-v1.5.0.1.tar.bz2 file. After these commands have run the NITE middleware will be installed on the Pandaboard.

**Installing sensor binaries**

The sensor binaries that have been downloaded via Noritsuna Imamura’s GitHub page use similar commands for installation as NITE and OpenNI, however, there is one minor detail to pay attention to here. The first commands to be issued should be:

```
tar -jxvf sensor-bin-linux-arm-v5.1.0.22.tar.bz2
cd Sensor-Bin-Linux-Arm-v5.1.0.22
```

Before issuing the final command to complete installation, open the file Config/GlobalDefaultsKinect.ini and change a line from:

```
UsbInterface=2
```

to

```
UsbInterface=1
```

Without this change it is likely that installing the sensor binaries will fail. Finally, issue the following command inside the directory Sensor-Bin-Linux_Arm-v5.1.0.22:

```
sh install.sh
```
This should successfully complete installing the sensor binaries and all the libraries needed to use the ASUS Xtion on the Pandaboard.

**Conclusion**

This method will provide an effective way to use and ASUS Xtion camera in a portable way that does not require the use of a personal computer or laptop. Open source frameworks such as OpenNI are used to effectively take full advantage of the Xtion’s capabilities. The Linux operating system is also cost effective and a highly capable to run complex tasks efficiently.

**References**

https://wiki.ubuntu.com/ARM/OmapDesktopInstall

http://www.openni.org/

https://github.com/OESF/TreasureHuntingRobot