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Annexes

Introduction

In this section, you will read some useful concepts related with this ebook.

1. Getting Started with LeJOS on Linux

Getting started with leJOS on Linux

Introduction

This section is a prerrequisite for any project which you use LeJOS APIs for NXT Brick, your computer or your mobile phone with J2ME or Android. In previous releases of this ebook, this material was included in some chapter, but with the time, I have thought that this material is better if it is included in the annexes.

To begin any project using LeJOS it is necessay to do the following tasks before starting.

1. Install Ubuntu
2. Install Java
3. Install LeJOS
4. Install LeJOS firmaware in your NXT brick
5. Install Eclipse
6. Install some plugins for Eclipse
    1. Install LeJOS plugin for Eclipse
    2. Install a SVN plugin for eclipse
    3. Install some code analyzers plugins
        1. Install FindBug plugin
        2. Install PMD plugin
        3. Install Checkstyle plugin

In the following pages, you will learn to install all software required to develop a robust project at

home, high school, university or research lab.

Install Ubuntu

Ubuntu is a very stable and easy to use Linux distro and we recommend to use in your projects with LeJOS. Modern computers has the feature to install Operating Systems using Pendrives.

How to install Ubuntu from a pendrive?

The way to install in your computer Ubuntu using this method is really easy. Download the ISO for Ubuntu 10.04 in Ubuntu's website. Once you have stored that file (ubuntu-10.04-desktop-i386.iso) Download from Unetbootin's website latest release of the software to install ubuntu from a website. Using a pendrive, execute Unetbootin to convert a pendrive into a installer of ubuntu. Unetbootin is able to run run in Linux systems and Windows so you can begin the experince with Ubuntu and LeJOS from both Operating Systems.

Once you have the Ubuntu installer in your pendrive, check BIOS settins in your computer to configure Boot settings to configure that you need to boot from a USB drive. Save BIOS settings and reset your computer to begin boot process from your pendrive. In this moment, you will install Ubuntu in a normal way.

Links of interest

http://www.ubuntu.com/

http://ubuntu-manual.org/?lang=en_GB

http://unetbootin.sourceforge.net/

Install Java

LeJOS project is a project based on Java Technology so it is necessary to have installed in your computer latest JDK release. If you use a Debian Distro, I suppose that you have experience with APT manager.

To install latest JDK, open a shell window an type:

```
sudo apt-get update
sudo apt-get install sun-java6-jre sun-java6-jdk sun-java6-plugin
```

Testing your Java JDK

Once you have installed in your system a Java JDK, it is necessary to test it. To test any Java JDK installation, it is necessary to check the following commands:

1. **javac:** This command is used to compile Java programs.

2. **java:** This command is used to execute any Java program compiled into bytecodes.

Use the following example to check it:

```
public class Test {
    public static void main(String[] arg) {
        System.out.print("My Java installation runs nice!\n");
    }
}
```

Compile and test:

```
jabrena@system1:~/Desktop/> javac Test.java
jabrena@system1:~/Desktop/> java Test
My Java installation runs nice!
```

Install LeJOS project

In this section, you will learn how to install leJOS project in a Ubuntu System. This section is a complement for the file README included in any leJOS release.

The process

The process to install leJOS on your Unbutu system is the following:

1. Step 1: Download and move LeJOS to the right place

2. Step 2: Install some required libraries/utilities to build leJOS in your system

   1. gcc

   2. Libusb

   3. Ant

   4. Bluez

3. Step 3: Configure some files on Ubuntu

4. Step 4: Test your LeJOS's installation

Step 1: Download and move LeJOS to the right place

Download latest LeJOS release from the following URL:

http://lejos.sourceforge.net/

Extract the file and rename the folder **lejos_nxj** into **lejos** and paste the folder in the path: /user/local/ using root privilegies:

```
jabrena@system1: sudo su
root@system1:/usr/local# tar xvf lejos_NXJ_0_9_0beta.tar.gz
```

when you have the folder lejos in that path, update the permissions for the folder bin:

```
root@system1/usr/local/lejos> chmod +x bin/*
```

Step 2: Install some required libraries/utilities to build leJOS in your system

To build your LeJOS release located in /usr/local/lejos/ it is necessary to install sobre required libraries. The libraries to install are:

1. C Compiler, gcc
2. Ant
3. Bluez Library
4. Libusb

The commands to install the libraries are:

```
sudo apt-get install blueman
sudo apt-get install ant
sudo apt-get install build-essential
sudo apt-get install libbluetooth-dev
sudo apt-get install libusb-dev
```

Once you have installed that libraries, the following steps are:

1. Build LeJOS project with Ant
2. Stablish some variables in your system

3. Test your compilation
4. Give IO permissions to manage a NXT brick
5. Test leJOS

Build LeJOS project with Ant

Once you have installed gcc,lisbusb,bluez and Ant, you could build the project with Ant:

```
jabrena:/usr/local/lejos/build # ant
Buildfile: build.xml

clean:
     [echo] saving existing files to .bak files

libnxt:

clean:

jlibnxt:
       [cc] 1 total files to be compiled.
       [cc] Starting link

make:

jbluez:

clean:

jbluez:
       [cc] 1 total files to be compiled.
       [cc] /usr/local/lejos/src/jbluez/jbluez.c: In function
'Java_lejos_pc_comm_NXTCommBluez_search':
       [cc] /usr/local/lejos/src/jbluez/jbluez.c:61: warning: 'name_str' may be
used uninitialized in this function
       [cc] Starting link
```

```
make:


copy.binaries:
     [copy] Copying 1 file to /usr/local/lejos/bin
     [copy] Copying 1 file to /usr/local/lejos/bin


clear:


build:
     [echo] Done.


BUILD SUCCESSFUL
Total time: 1 second
jabrena:/usr/local/lejos/build #
```

Configurating some variables in the system.

To use the system, it is necessary to edit some files to use leJOS in any Linux session. You have to paste the following commands in the files: .profile y /etc/profile

```
export NXJ_HOME=/usr/local/lejos
PATH=$PATH:$NXJ_HOME/bin
export LD_LIBRARY_PATH=$NXJ_HOME/bin
```

USB Permissions

A NXT brick is a USB device and it is necessary to give permissions to read and write data. If you use the command **lsusb** you will see all usb connected to your system:

```
jabrena:/usr/local# lsusb
Bus 005 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 003 Device 001: ID 1d6b:0001 Linux Foundation 1.1 root hub
Bus 002 Device 003: ID 046d:c016 Logitech, Inc. M-UV69a/HP M-UV96 Optical Wheel
Mouse
Bus 002 Device 001: ID 1d6b:0001 Linux Foundation 1.1 root hub
Bus 001 Device 002: ID 0694:0002 Lego Group
Bus 001 Device 001: ID 1d6b:0001 Linux Foundation 1.1 root hub
Bus 004 Device 001: ID 1d6b:0001 Linux Foundation 1.1 root hub
```

```
jabrena:/usr/local # ls -la /dev/bus/usb/
```

If you observe the previous list, you will see a Lego device connected to a Ubuntu's system:

```
Bus 001 Device 002: ID 0694:0002 Lego Group
```

A partial solution to give permissions to that device is:

```
sudo chmod a+w /dev/bus/usb/001/002
```

But this alternative will have to be done every time when your connect and disconnect your NXT brick because values change:

```
system1:/dev/bus/usb/001 # ls
001
system1:/dev/bus/usb/001 # ls
001  003
system1:/dev/bus/usb/001 # ls
001
system1:/dev/bus/usb/001 # ls
001  004
system1:/dev/bus/usb/001 #
```

So this kind of solution is not good. To solve the problem it is necessary to create a file in the path: **/etc/udev/rules.d/**

```
system1:/etc/udev/rules.d # ls
10-board.rules              56-sane-backends-autoconfig.rules
10-vboxdrv.rules            60-pcmcia.rules
40-alsa.rules               65-wacom.rules
40-bluetooth.rules          70-kpartx.rules
41-soundfont.rules          70-persistent-cd.rules
51-lirc.rules               70-persistent-net.rules
51-packagekit-firmware.rules  71-multipath.rules
```

```
52-irda.rules                77-network.rules
55-hpmud.rules               79-yast2-drivers.rules
55-libsane.rules             99-pcsc_lite.rules
56-idedma.rules
```

Create a file named **70-lego.rules** with the following content:

```
# Lego NXT
BUS=="usb", SYSFS{idVendor}=="03eb", GROUP="lego", MODE="0660"
BUS=="usb", SYSFS{idVendor}=="0694", GROUP="lego", MODE="0660"
BUS=="usb", SYSFS{idVendor}=="0694", GROUP="lego", MODE="0660"
```

Besides, create a group named lego

```
groupadd lego
```

and <u>add all linux users who will use NXT brick in the group lego</u>.

Note:

In my case I added the user jabrena to the group lego

Reboot

Once you have done previous tasks, reboot your system to test your LeJOS's installation

Testing your configuration

If you have done previous tasks, now you can generate nxj files for you NXT brick and send programs to your NXT brick using leJOS technology.

To know if your LeJOS's installation will run nice every time and you have installed and configurated all software dependencies, it is necessary to check your instllation in 3 ways:

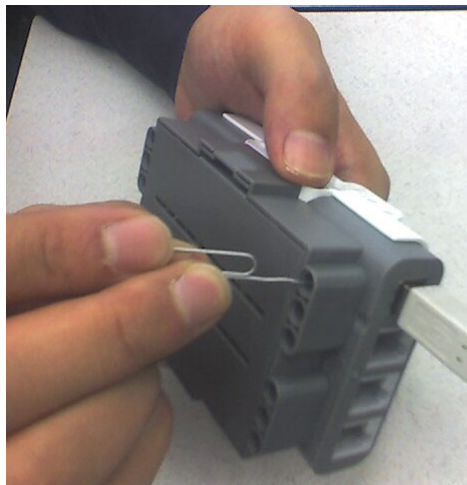1. USB permissions's tests
2. Bluetooth tests

3. Command tests

USB permissions's test

When you finish your installation, it is necessary to change your firmware on your NXT brick. This action is neccesary to do every time that you reinstall LeJOS with a newer release. So, the first action once you have installed LeJOS, is the action to install latest firmware on your NXT brick. To install LeJOS's firmware, type in a shell nxjflash.

```
nxjflash
```

Note:

To install every firmware developed for Lego Mindstorm NXT it is neceesary to put your NXT brick in boot mode. To update the mode in your NXT brick then you have to push reset button. To find that button see at the back of the NXT, upper left corner and push it for more than 5 seconds then you will hear an audibly sound.

If you execute the command nxjflash and you update the firmware on your NXT brick then you have USB permissions ok. In some Ubuntu systems, it is possible that you receive the following exception:

```
"cannot load comm driver"
"an error occurred: Failed to open device in SAM-BA mode."
```

The solution is:

```
sudo rmmod cdc_acm
sudo -s
echo "" >> /etc/modprobe.d/blacklist.conf
echo "blacklist cdc_adm" >> /etc/modprobe.d/blacklist.conf
```

If you installed the firmware then your NXT brick is ready to execute LeJOS programs.

Bluetooth tests

LeJOS offer some utilities to communicate with your NXT brick using a Bluetooth link. The most easier way to test if your Bluetooth capabilities runs nice is using the utility: nxjcontrol. Type nxjcontrol in a Shell to run that utility and try to discover NXT brick with Bluetooth features enabled.

```
nxjcontrol
```

If you don't see any exception in your shell and nxjcontrol detects your NXT brick with LeJOS firmware

Command tests

The final set of tests is required to verify if normal commands runs ok in your system, so the main test is based on the creation or a simple program to compile and link in your NXT Brick. Create a simple example in a notepad and save the file as HelloWorld.java

```java
import lejos.nxt.*;

public class HelloWorld {

    /**
     * @param args
     */
    public static void main(String[] args) {
        System.out.println("Hello World");
        Button.waitForPress();
    }
}
```

Once you have saved the file, execute the following commands:

```
jabrena@system1:~/projects/lejos/examples/HelloWorld> nxjc HelloWorld.java
jabrena@system1:~/projects/lejos/examples/HelloWorld> nxj -r HelloWorld
leJOS NXJ> Linking...
leJOS NXJ> Uploading...
leJOS NXJ> Linking...
leJOS NXJ> Uploading...
Found NXT: GPSNXT 0016530050A6
leJOS NXJ> Connected to GPSNXT
leJOS NXJ> Upload successful in 744 milliseconds
```

If you execute with success all test then your LeJOS installation is ok.

Install Eclipse

Develop any Java program in general is easy, but it is more confortable if you use a development tool. In the java market, many developers in the world use Eclipse IDE or Netbeans. In this section I will explain how to develop with Eclipse and the plugin for eclipse.

Eclipse is an extensible, open source IDE (integrated development environment). The project was originally launched in November 2001, when IBM donated $40 million worth of source code from Websphere Studio Workbench and formed the Eclipse Consortium to manage the continued development of the tool.

The stated goals of Eclipse are "to develop a robust, full-featured, commercial-quality industry platform for the development of highly integrated tools." To that end, the Eclipse Consortium has been focused on three major projects:

1. The Eclipse Project is responsible for developing the Eclipse IDE workbench (the "platform" for hosting Eclipse tools), the Java Development Tools (JDT), and the Plug-In Development Environment (PDE) used to extend the platform.

2. The Eclipse Tools Project is focused on creating best-of-breed tools for the Eclipse platform. Current subprojects include a Cobol IDE, a C/C++ IDE, and an EMF modeling tool.

3. The Eclipse Technology Project focuses on technology research, incubation, and education using the Eclipse platform.

Download Eclipse Europa 3.3 Classic from eclipse's website. Use the following URL:
http://www.eclipse.org/downloads/

Install Eclipse plugins

Once you have the basic elements installed in your system (Java, LeJOS & Eclipse), you could some features to your Eclipse environment to be more confortable when you develop your projects.

The plugins reviewed are:

1. LeJOS plugin
2. SVN plugin
3. FindBugs plugin
4. PMD plugin
5. CheckStyle plugin

Eclipse plugin for leJOS

When you execute Eclipse and you want to install any Eclipse plug-in, in this case NXJ Plug-in, you have to go to help > software updates > find and install:
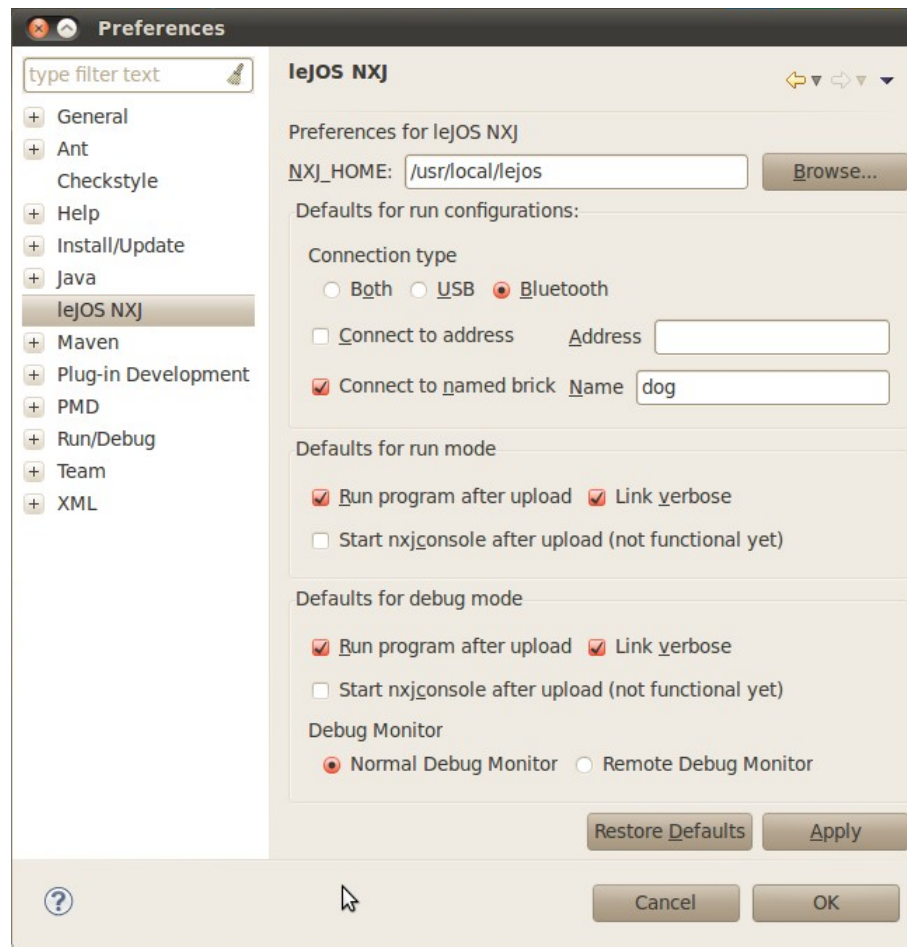
The parameters to write in the next window are:

Name: leJOS NXJ

URL: http://lejos.sourceforge.net/tools/eclipse/plugin/nxj/

Configuring Eclipse plugin for leJOS

Once you have installed NXJ Plug-in, you have to set NXJ_HOME variable in preference area in Eclipse.

NXJ Plugin Features

NXJ Plug-in allow to NXJ developers to do the following actions:

1. Upload latest firmware into NXT Brick
2. Upload NXJ programs into your NXT Brick
3. Convert any Java project into NXJ project

Besides, NXJ Plugin includes a excellent documentation.

SVN Plugin for Eclipse

LeJOS project is a live project and continously is improving so we recommend to install a SVN client to update your local copy of the project. One benefit to have this software appear when LeJOS

Developer Team launch an internal release for developers to tests new concepts.

Eclipse IDE has a SVN plugin, subversive. I recommend to use this plugin to manage the code and use RapidSVN to manage other files which they are not Java code.

Rapid SVN.

```
sudo apt-get install rapidsvn
```

Subversive

```
sudo apt-get install subversion
```

```
sudo apt-get install libsvn-java
```

http://subclipse.tigris.org/

Subclipse - http://subclipse.tigris.org/update

Note:

Test RapidSVN to make a checkout from LeJOS project:

https://lejos.svn.sourceforge.net/svnroot/lejos/trunk

http://rapidsvn.tigris.org/

http://www.eclipse.org/subversive/

Maven plugin for eclipse

Apache Maven is a software project management and comprehension tool. Based on the concept of a project object model (POM), Maven can manage a project's build, reporting and documentation from a central piece of information.

http://maven.apache.org/

http://marketplace.eclipse.org/content/maven-integration-eclipse

http://www.sonatype.com/books/mvnref-book/reference/

Findbug plugin for eclipse

FindBugs is a program to find bugs in Java programs. It looks for instances of "bug patterns" --- code instances that are likely to be errors.

Plugin Name: FindBugs

URL: http://findbugs.cs.umd.edu/eclipse

http://findbugs.sourceforge.net/

http://findbugs.sourceforge.net/manual/index.html

http://marketplace.eclipse.org/content/findbugs-eclipse-plugin

PMD plugin for eclipse

PMD scans Java source code and looks for potential problems like:

- Possible bugs - empty try/catch/finally/switch statements

- Dead code - unused local variables, parameters and private methods

- Suboptimal code - wasteful String/StringBuffer usage

- Overcomplicated expressions - unnecessary if statements, for loops that could be while loops

- Duplicate code - copied/pasted code means copied/pasted bugs

Plugin Name: PMD

URL: http://pmd.sf.net/eclipse

http://pmd.sourceforge.net/

http://marketplace.eclipse.org/content/pmd-eclipse

Checkstyle plugin for Eclipse

Checkstyle is a development tool to help programmers write Java code that adheres to a coding standard. It automates the process of checking Java code to spare humans of this boring (but important) task. This makes it ideal for projects that want to enforce a coding standard.

Checkstyle is highly configurable and can be made to support almost any coding standard. An example configuration file is supplied supporting the Sun Code Conventions. As well, other sample

configuration files are supplied for other well known conventions.

Plugin Name: Checkstyle

URL: http://eclipse-cs.sf.net/update/

http://checkstyle.sourceforge.net/

http://marketplace.eclipse.org/content/checkstyle-plug

Install latest Developer LeJOS firmware

LeJOS is a open source project which launch new releases every year 2 times more less. Meanwhile LeJOS developer team releases continuosly internal releases for developers to test new features, concepts and refactors.

The way to use latest firmware for internal purposes is:

1. Make a backup of your folder /bin/ and /lib/

2. Download a copy of LeJOS repository

3. Find the folder snapshot and copy the folder /bin/ and /lib/ into your leJOS's installation

    1. Remove .bat files from bin folder

4. Test the operation with some LeJOS utility

    1. nxjcontrol

5. Update firmware with the command nxjflash or nxjflashg

Summary

In this chapter you should be learnt how to Install leJOS in your Linux system. With the time the process should last lest than 1 hour in the process. In my personal opinion, now I prefer to use Linux System than windows system. Linux is more robust and stable than Windows XP. When you have done some instalations, the process last 15 minutes.

How to reinstall Lego Firmware

Introduction

LeJOS is an excellent platform to develop software for NXT Lego Mindstorm but it is not the unique

solutions. If you read the section NXT Programming Software written by Steve Hassenplug in http://www.teamhassenplug.org/NXT/NXTSoftware.html then you will notice that exist several options to develop software in the NXT brick. If you have installed LeJOS firmware and you decided to reinstall Lego firmware, read this section to know how to do.

Download latest Lego firmware

To reinstall Lego Firmware is necessary to have latest firmware in your computer. Visit http://mindstorms.lego.com/support/updates/ to download the firmware.

Set your NXT brick in update mode

Once you have stored latest firmware, it is necessary to set your NXT brick in Update mode. To update the mode in your NXT brick then you have to push reset button. To find that button see at the back of the NXT, upper left corner and push it for more than 5 seconds then you will hear an audibly sound.

If you want to be sure, check your Lego Devices connected with your computer then you will see:

Reinstall Lego firmware

Use Lego Software that you received with your NXT Kit to download Lego Firmware.

Execute the software and search the option Update NXT Firmware in Tools tab.

When you click in that option then you will see an assistant to download the firmware. Select the firmware that you downloaded and click in download button:

When the process finish then you will see all steps with green color and your NXT brick will have Lego Firmware.

How to be a new LeJOS Developer

Request a user

In previous section, we see that if you create new code, it is necessary to authenticate then you need a LeJOS user. Write us to get your LeJOS user to collaborate with us.

How to use beta software from leJOS SVN?

If you are an active user then you know that leJOS project releases software every 4-6 months more or less. But in this period, the project suffers many changes and If you want to use latest works into your NXT projects, I recommend you that use the following technique.