Manual for using ROS on Khepera III with KoreBot II

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1 Section 1: Quick start

1.1 Installing

- Download Player driver as following: (current version of Player at this time is 3.0.2)
  `http://playerstage.sourceforge.net/`
  Click on the "Download" button on left bar under the Sourceforge part.
  This library is important to link between ROS and Khepere through Player driver server running on Khepera

- Install Player driver as following: (this guide follows the "In-source Build" written in INSTALL file by Player creators).
  - Uncompress the Player downloaded file to Home folder in your Ubuntu machine and keep the name of the new uncompressed folder, for example "player-3.0.2" or you have to change the name of related path to Player driver in CMakeList.txt file of "playerros" package!!!
  - Open new Terminal and type:
    $ cd player-3.0.2
    $ cmake .
    $ make install
  - If errors occur during the build process, perform a verbose make:
    $ VERBOSE=1 make
  - If it still has problem, you should contact with Player project members, it is out of this Manual. But it works well with Ubuntu 12.04 both in pure installation and Virtual machine.

- Download and install ROS as following: (if you are using Ubuntu) `http://wiki.ros.org/hydro/Installation/Ubuntu`

- Configuring ROS Environment `http://wiki.ros.org/ROS/Tutorials/InstallingandConfiguringROSE`

- Download a zip file from the following link and unzip to your /catkin_ws/src/ (if it is your source folder of ROS workspace)
  `https://drive.google.com/file/d/0B5uzFFH3HdnocGdxUkpubGh4MGs/edit?usp=sharing`
  There are 3 packages inside this zip file: playerros - communicating ROS with Khepera through Player driver (via Wifi), playerros_teleop - control robot with keyboard and randomwalk - simple controller for robot to walk randomly and avoid obstacles.

Now you are ready to run ROS with Khepera.

1.2 Running

This part is a guide to connect with Khepera through Wifi. Khepera will connect to a host spot named Taurus without password and has IP address: 192.168.1.150. Check the Section Wifi Connection Install guide for detail if you want to change this!

- Insert the Wifi card to Khepera. Make sure that you insert it before turn Khepera on. If NOT, you have to turn it off and repeat this step!

- Turn on the Khepera with battery or power cord.

- Wait for the blue and yellow LED light in Wifi card stop blinking, Khepera has finished connection to Wifi!

- Connect to Khepera through Wifi: open a terminal in your PC and type:
  $ ssh root@192.168.1.150 (or your new IP Address)
  then press Enter key for password (NO password)

- Make sure that Player was installed in Khepera. (Following part A (step 1 to 4) of Section of Player for Khepera III with KoreBot II Instructions 2)

- After installing Player in Khepera, continue:
  $ cd Setup
  $ ./laser.sh on
  $ player KheperaIII_urglaser_usb.cfg
  Now Khepera is waiting for command from PC

- Running ROS on your PC: open new terminal and go to launch folder in "randomwalk" package:
  $ cd /catkin_ws/src/randomwalk/launch
  $ roslaunch playerros.launch
  - If there is not Khepera at IP address (now is 192.168.1.150) set in "args" argument of launch file, there will be a red error in terminal. If there is Khepera at that IP address, robot will start to run.
  - There are 5 packages used in launch file:
    * playerros: publish laser scan as /base_scan topic, odometry as /odom topic, subscribe velocity command as /cmd_vel topic
    * playerros_teleop: publish /cmd_vel topic
    * randomwalk: publish /cmd_vel topic, subscribe /base_scan topic
    * gmapping to draw environment map (already installed with ROS)
    * rviz to show map, odometry , laser scan information (already installed with ROS)

2 Section 2: Player for Khepera III with KoreBot II

This section is part A of Instruction from K-team (can find in Khepera III CD-ROM).

2.1 Required:

- computer with linux 2.6 and Wifi access
- player 2.1.1 installed on the computer (`http://playerstage.sourceforge.net/`)
- Khepera 3 with Korebot II and Wifi (KoreWifi), Kernel 2.6
- from the binaries directory: (`http://ftp.k-team.com/KheperaIII/player_stage/korebotII/binaries`
  - Khepera 3 player driver: KheperaIII.so
  - Khepera 3 player driver configuration file:
    KheperaIII.cfg: to work without Hokuyo Laser Range Finder
    KheperaIII_urglaser_usb.cfg: to work with Hokuyo Laser Range Finder
  - Player needed libraries:
    libltdl3_1.5.10-r3_armv5te.ipk
    libstdc++6_4.1.2-r10_armv5te.ipk
  - laser.sh script

2.2 Establish a network connection with the Khepera 3/Korebot 2 see Korebot 2 user manual, chapter "5.2.2 Using a Wireless compact flash card":

`http://ftp.k-team.com/KorebotII/UserManual/`

2.3 Copy and install the 3 following packages on the korebot:

- command for copying:
  $ scp PACKAGE_NAME root@KHEPERA_IP_ADDRESS:/home/root
- installation procedure :
  $ ipkg install PACKAGE_NAME

- packages:
  - c++ standard library: libstdc++6_4.1.2-r10_armv5te.ipk
  - libtool: libltdl3_1.5.10-r3_armv5te.ipk
  - player server: player_2.1.1-r0_armv5te.ipk
- If there is not enough free space, delete each package after installation.

2.4 Copy KheperaIII.so and KheperaIII.cfg to the korebot

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2.5 copy the laser.sh script to the korebot

Make it executable and run it with the commands:

```
$ chmod +x laser.sh
$ ./laser.sh on
```

2.6 On the KoreBot, launch the server:

```
$ player KheperaIII.cfg
```

2.7 On the computer in a terminal, export the library path and launch the viewer

(player 2.1.1 must be installed on the computer):

```
$ export LD_LIBRARY_PATH=/usr/local/lib:$LD_LIBRARY_PATH
$ playerv -h IP_ADDRESS_OF_THE_ROBOT –ir:0 –position2d:0 –sonar:0 –power:0
```

2.8 drive the robot:

- either with the playerv interface :
  - Go to "Devices/Position2d" and select "Command"
  - A red cross appears on the robot.
  - You can move it to drive the robot.
- or with "playerjoy":
  - the keyboard:
    ```
    $ playerjoy IP_ADDRESS_OF_THE_ROBOT
    ```
  - a standard joystick connected:
    ```
    $ playerjoy -speed 1.0 -turnspeed 90 -dev /dev/input/js0 IP_ADDRESS_OF_THE_ROBOT
    ```

3 Serial Connection with Khepera III

3.1 Using minicom

- Install minicom
  ```
  $ sudo app-get install minicom
  ```
- Setup minicom
  ```
  $ minicom -s
  ```
- Change the serial port which connect to Khepera
- Using administration to setup minicom for the first time and save configuration for next uses
  ```
  $ sudo minicom -s
  ```
- Get access permission to serial ports if meet "permission denied error" when try to connect to Khepera

  - check connection
    $ ls -l /dev/ttyUSB*
  - verify if the user belongs to the dialout group
    $ id -Gn <username>
  - add user to the "dialout" supplementary group
    $ sudo usermod -a -G dialout <username>

- Log out and log in before changes take effect. Test again by:
  $ id - Gn <username>
- Turn on Khepera and wait for booting.

3.2 Using Khepera

Note: open 1 terminal and connect with robot through minicom; open another terminal to compile program

- First step
  - Note: Connect with minicom: configuration (pages 9, KoreBot Manual)
    * 115200 Bps
    * 8 data bits
    * No parity
    * 2 stop bits (not 1)
  - Follow 4.2 (KoreBot Manual), 4.3
  - Install Light toolchain (4.4)
- Build your program
  - Go to folder of program
  - Using command: (page 37, Khepera II manual) to build your program
    $ source ../../env.sh (numbers of ../ depends on path of program folder
    $ arm-angstrom-linux-gnueabi-gcc <filename.c> -o <output> -I $LIBKOREBOT_ROOT/build-korebot-2.6/include -L $LIBKOREBOT_ROOT/build-korebot-2.6/lib -lkorebot
- Copy to Khepera/KoreBot (page 45, KoreBot Manual)
  Note: Using minicom
  - In the Minicom console, hold the keys "Ctrl + a" and press "s" and select "Z-Modem".
  - Select the file you would like to upload to the Korebot (navigate with the arrows keys, 2x "spacebar" to change directory and "spacebar" to select the file).
  - Select [Okay] to send it.

*** Can test with kh3test.c in /development_k2_v1.0/libkorebot-1.19-kb1/src

4 Wifi Connection for Khepera III with KoreBot II

Follow the Section 5.2.2 of KoreBot II Manual

4.1 Set the wifi host spot without password

- Insert a Wireless compact flash card in the Korebot before it is turned on
- Load the module by typing:
  $ modprobe pxa2xx_cs
  You may load the Wifi module automatically by adding pxa2xx_cs in the file
  $ /etc/modules
  You can use the following command echo to add the module name to the file:
  $ echo pxa2xx_cs »/etc/modules

- Configure the wireless network:
  Without any encryption for security:
  Modify the file /etc/network/interfaces with your wireless network settings with vi editor
  (see chapter 5.2.7 "Using vi text file editor"=> Note for vi text editor):

```
/***************** /etc/network/interfaces **********/
# The loopback interface
#
auto lo
iface lo inet loopback
#
# Wireless interfaces
#
auto eth0
#iface eth0 inet dhcp
iface eth0 inet static
wireless\_mode managed
wireless\_essid YOUR\_SSID\_OF\_NETWORK (name of the Wifi host spot)
address YOUR\_IP\_ADDRESS (IP Address of Robot used to control it later)
netmask YOUR\_NETMASK (can be 255.255.255.0)
gateway YOUR\_GATEWAY\_IP (can be the same as IP address)
/*****************************************/
```

4.2 Using:

Restart robot

$ reboot

Connect to robot through wifi

$ ssh root@ROBOT_IP_ADDRESS (set above)

Tried with WEP_TKIT but not succeed yet!!!

```
+++Note for "vi text editor":++++++++++++++++++++++++++++++
        Arrow key for moving cursor
        i               insert function
        a               append function
        ESC             stop insert/append function
        ZZ              save and quit
        :q!             quit without saving
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```