UNIVERSITÀ di VERONA

Dipartimento di INFORMATICA

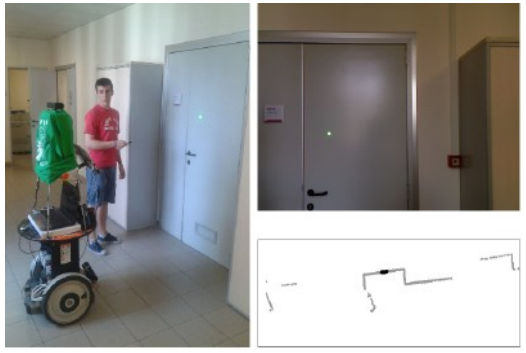
Corso di Laboratorio Ciberfisico

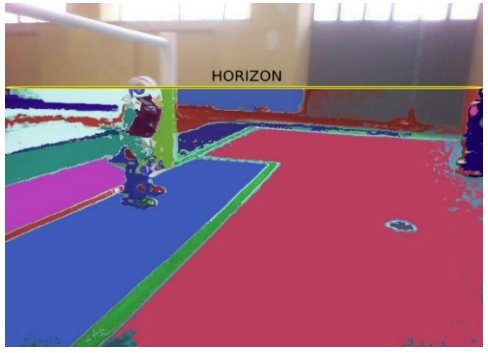
Modulo di Robot Programming with ROS

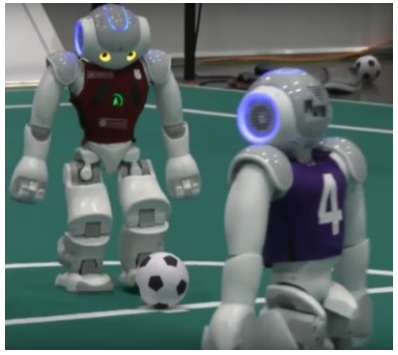
Turtlebot3

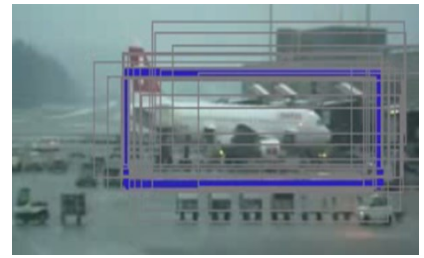
Docente:
Domenico Daniele Bloisi

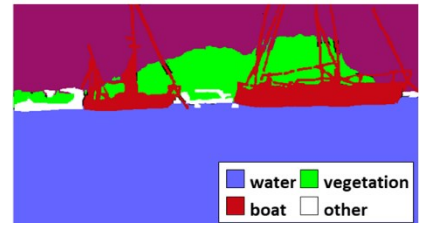
Maggio 2018



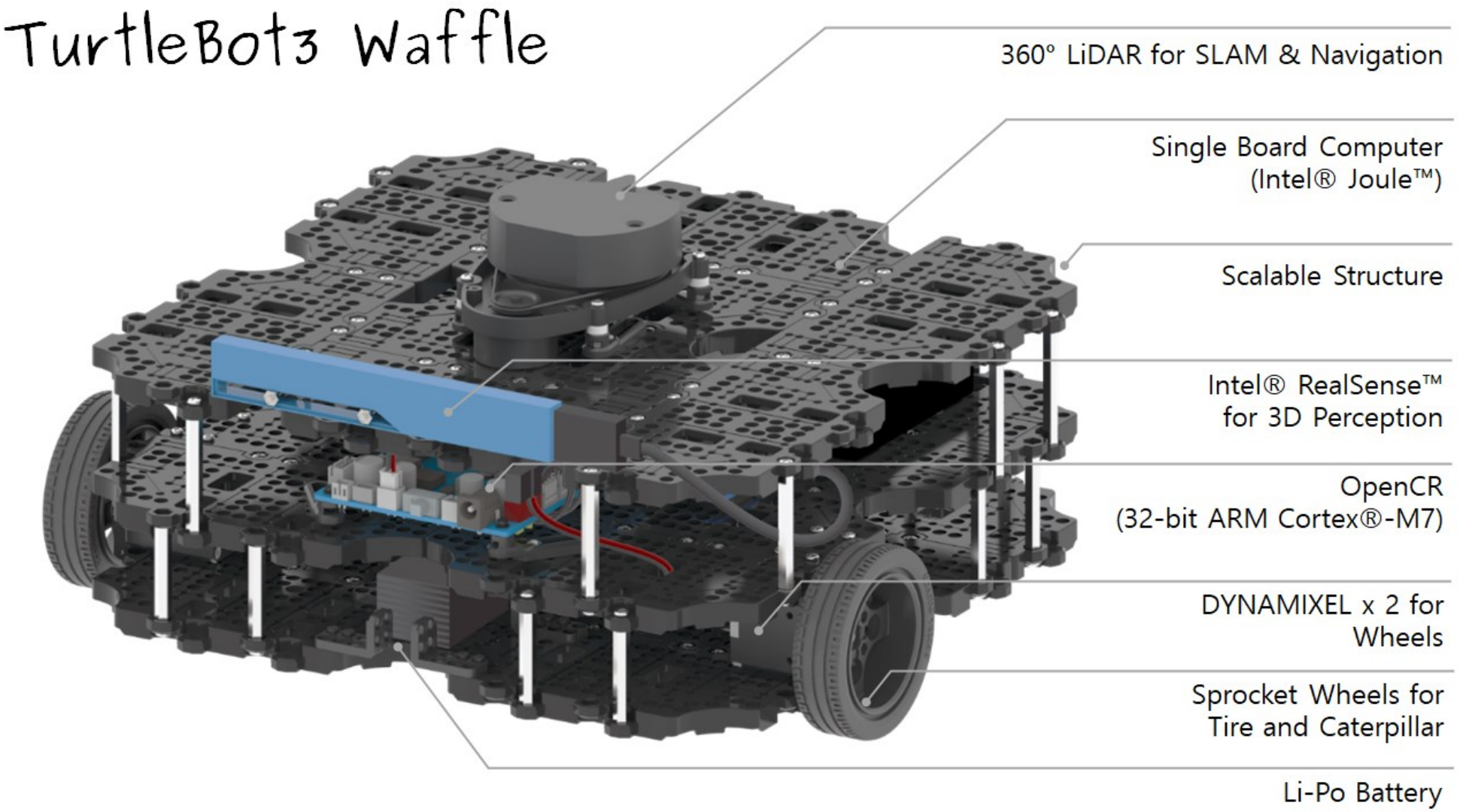








Turtlebot 3 Waffle



Turtlebot 3 – Architettura del sistema

Turtlebot 3 – Pc Software

Installare il software che girerà sul pc remoto seguendo la guida

http://emanual.robotis.com/docs/en/platform/turtlebot3/pc_setup/

Requisiti software per il pc remoto:

Remote PC

ubuntu

Ubuntu 16.04.3 LTS (Xenial Xerus)
http://releases.ubuntu.com/16.04

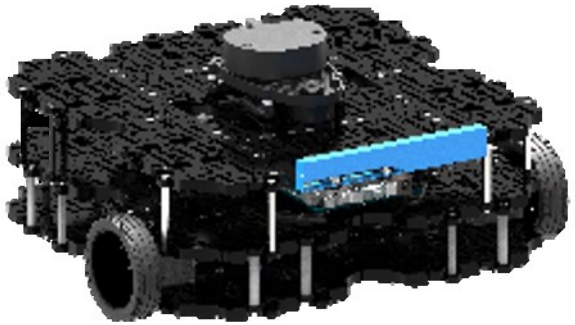
ROS

ROS Kinetic Kame
http://wiki.ros.org/kinetic

Turtlebot 3 – Intel Joule

https://github.com/ROBOTIS-GIT/emanual/blob/master/docs/en/platform/turtlebot3/joule_setup.md

Requisiti software per la Joule sul robot:



Ubuntu 16.04 for Intel® Joule™

ROS Kinetic Kame
http://wiki.ros.org/kinetic

dependent packages for TurtleBot3 control

Turtlebot3Waffle_Bringup

Il repository Git

https://github.com/labrobotica-bloisi/Turtlebot3Waffle_Bringup

contiene un insieme di utility per il Turtlebot3

Si tratta di un fork dal repository originale realizzato da Marco Panato

https://github.com/Marco9412/Turtlebot3Waffle_Bringup

Clone di Turtlebot3Waffle_Bringup

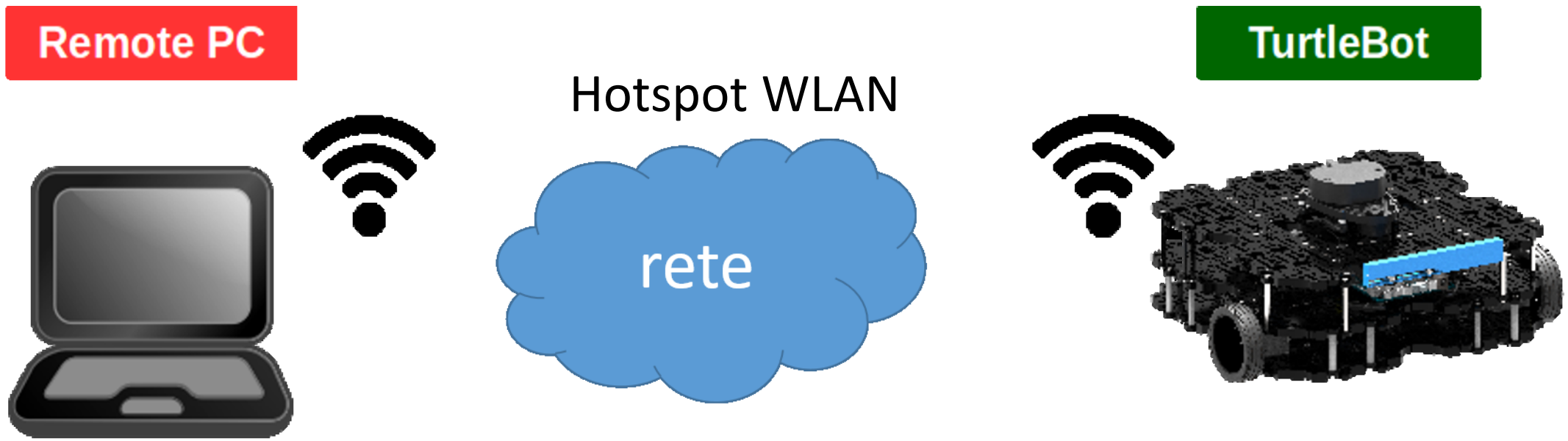
Cloniamo il repository in una cartella del nostro filesystem, per esempio, `~/workspace`

```
$ git clone https://github.com/labrobotica-bloisi/Turtlebot3Waffle_Bringup.git
```

Networking

Il PC remoto e la Joule devono essere collegati alla stessa rete e devono poter comunicare su di essa

Può essere una buona soluzione creare una WLAN utilizzando uno smartphone



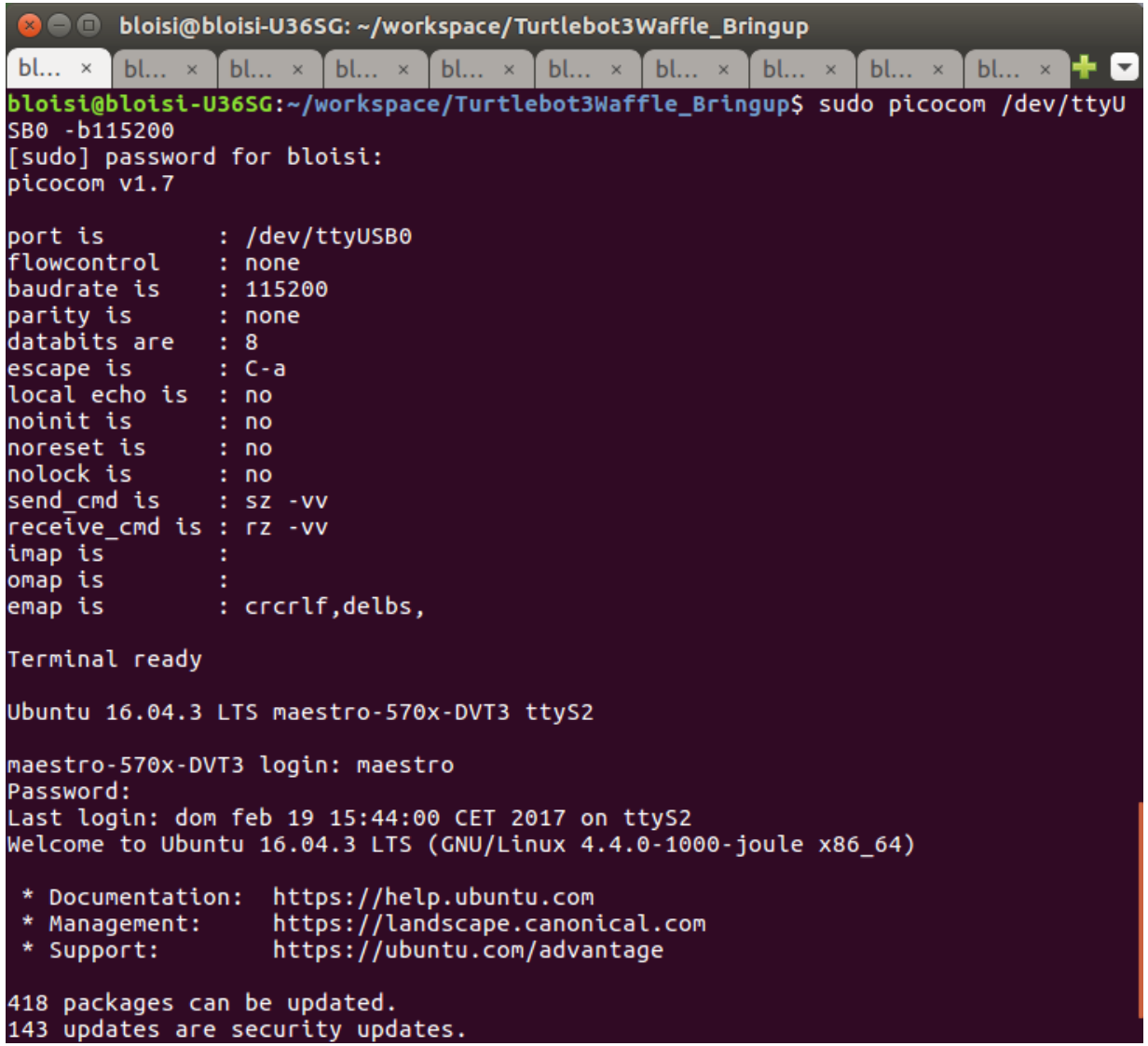
Accedere alla Joule via USB

1. With the joule board turned on, connect the remote pc to the board with a micro-usb cable

2. Use picocom to open the serial port and communicate to the joule with the command
   ```
   $ sudo picocom /dev/ttyUSB0 -b115200
   ```

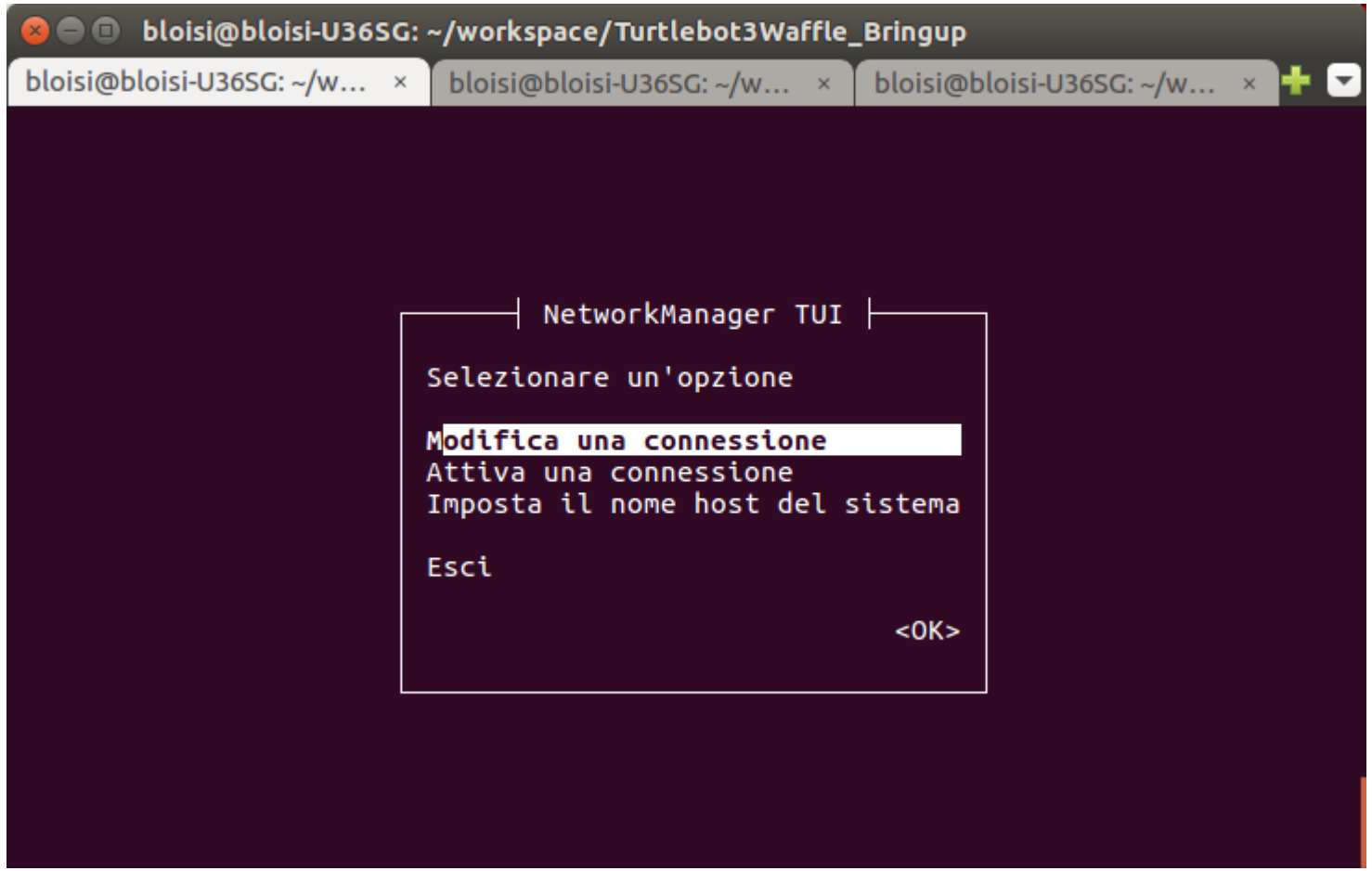
3. Log in to the joule from the serial, writing username and password

Get robot IP

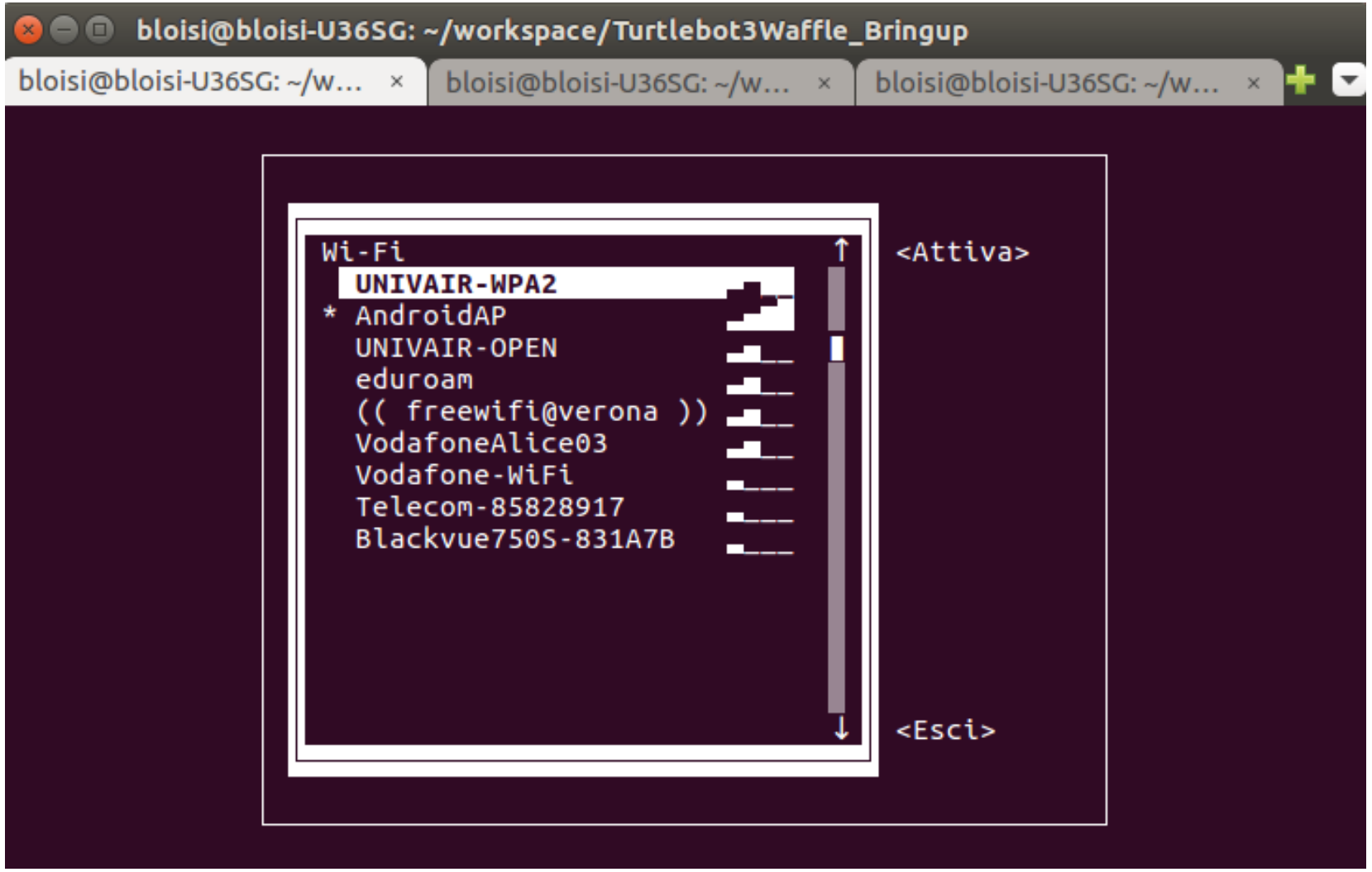

bloisi@bloisi-U36SG: ~/workspace/Turtlebot3Waffle_Bringup
bloisi@bloisi-U36SG:~/workspace/Turtlebot3Waffle_Bringup$ sudo picocom /dev/ttyUSB0 -b115200
[sudo] password for bloisi:
picocom v1.7
port is : /dev/ttyUSB0
flowcontrol : none
baudrate is : 115200
parity is : none
databits are : 8
escape is : C-a
local echo is : no
noinit is : no
noreset is : no
nolock is : no
send_cmd is : sz -vv
receive_cmd is : rz -vv
imap is :
omap is :
emap is : crcrlf,delbs,
Terminal ready
Ubuntu 16.04.3 LTS maestro-570x-DVT3 ttyS2
maestro-570x-DVT3 login: maestro
Password:
Last login: dom feb 19 15:44:00 CET 2017 on ttyS2
Welcome to Ubuntu 16.04.3 LTS (GNU/Linux 4.4.0-1000-joule x86_64)
* Documentation: https://help.ubuntu.com
* Management: https://landscape.canonical.com
* Support: https://ubuntu.com/advantage
418 packages can be updated.
143 updates are security updates.

Networking

4. Usare il comando `nmtui` per selezionare la rete desiderata



Networking


bloisi@bloisi-U36SG: ~/workspace/Turtlebot3Waffle_Bringup
bloisi@bloisi-U36SG: ~/w...
bloisi@bloisi-U36SG: ~/w...
bloisi@bloisi-U36SG: ~/w...
Wi-Fi
UNIVAIR-WPA2
* AndroidAP
UNIVAIR-OPEN
eduroam
((freewifi@verona))
VodafoneAlice03
Vodafone-WiFi
Telecom-85828917
Blackvue750S-831A7B
<Attiva>
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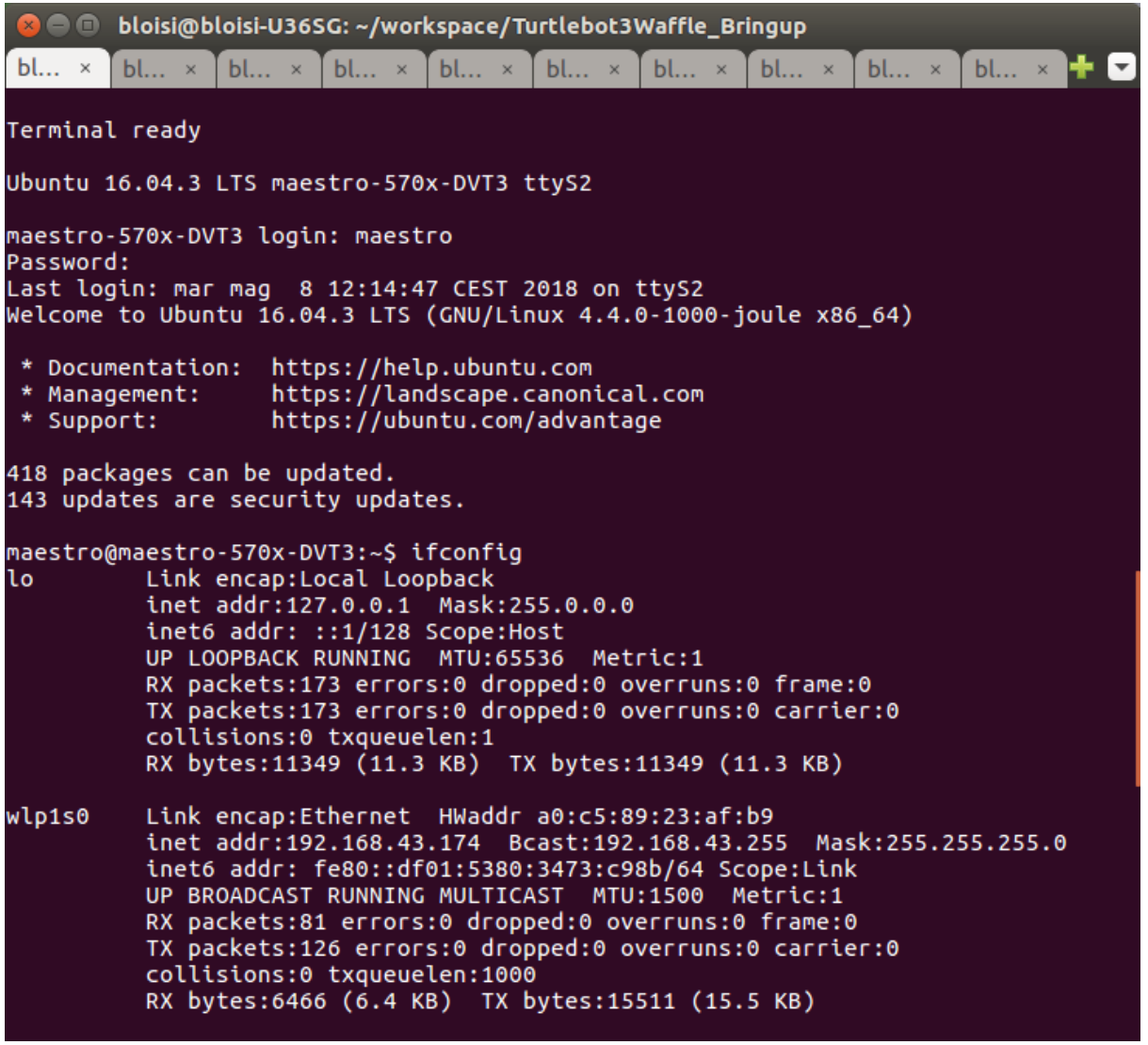
Get robot IP

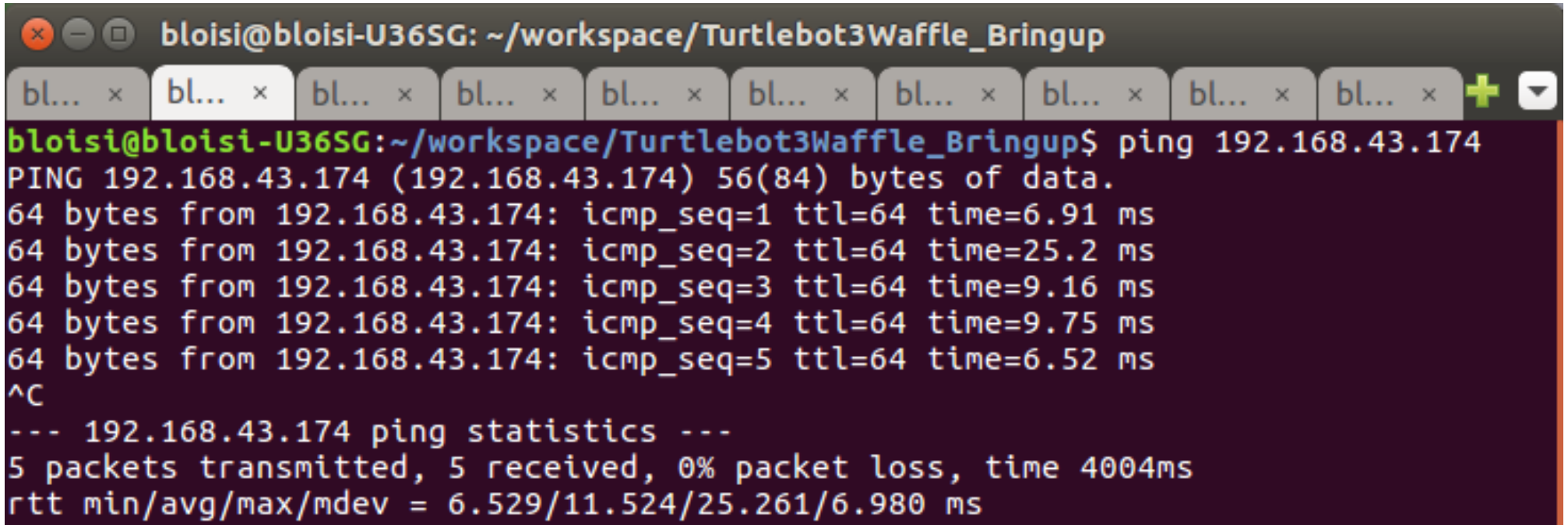
5. use `ifconfig` command to get the joule IP address

6. disconnect the micro USB cable from the joule



Check robot IP

Ping from the remote PC



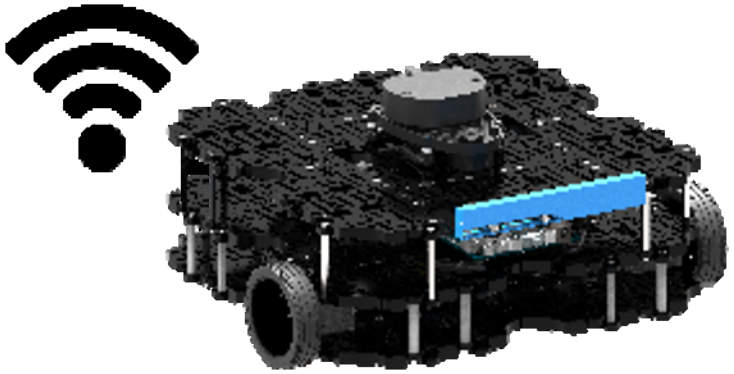
IP addresses

Remote PC

192.168.43.93

Hotspot WLAN

TurtleBot

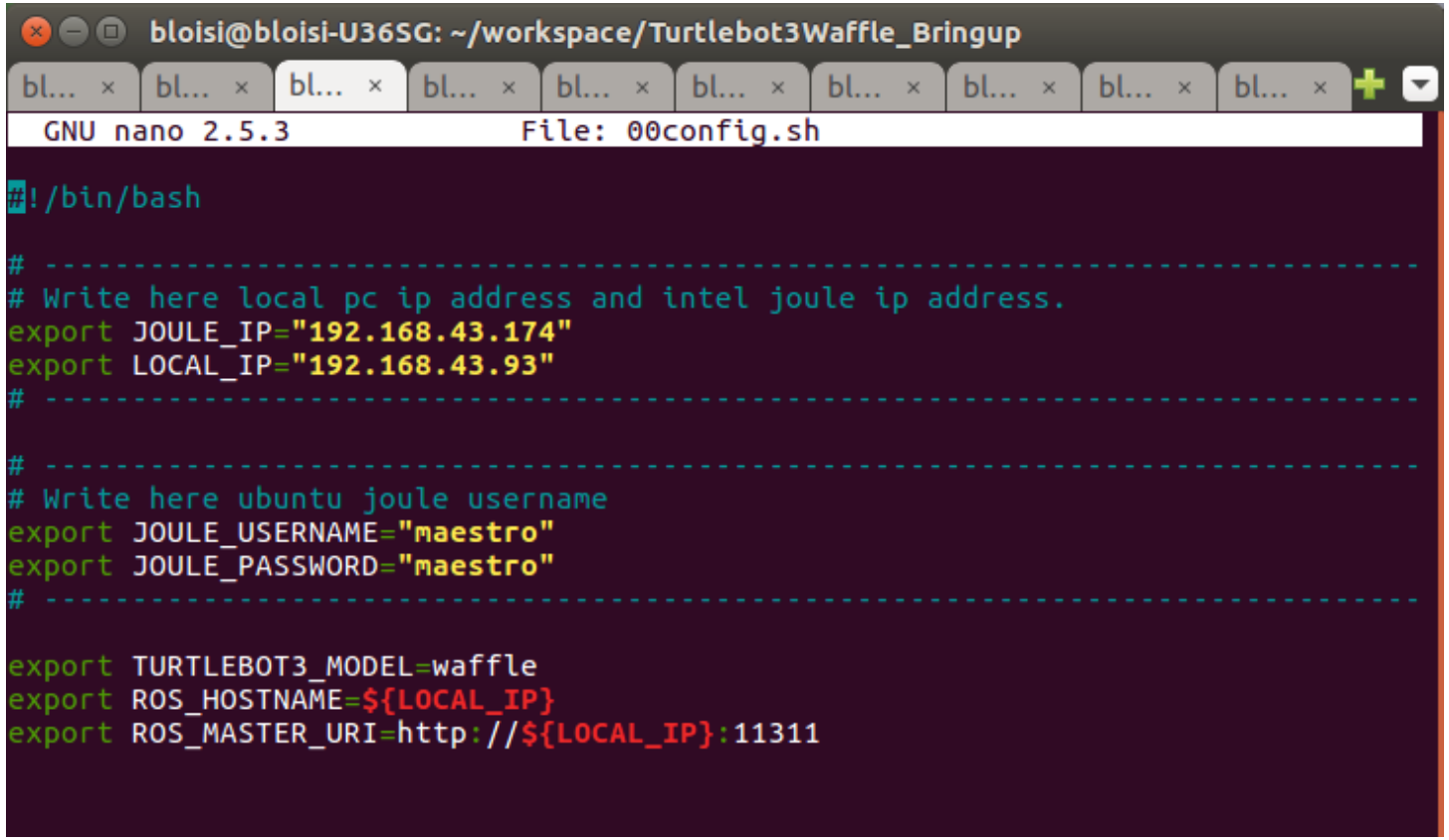


192.168.43.174

00config.sh

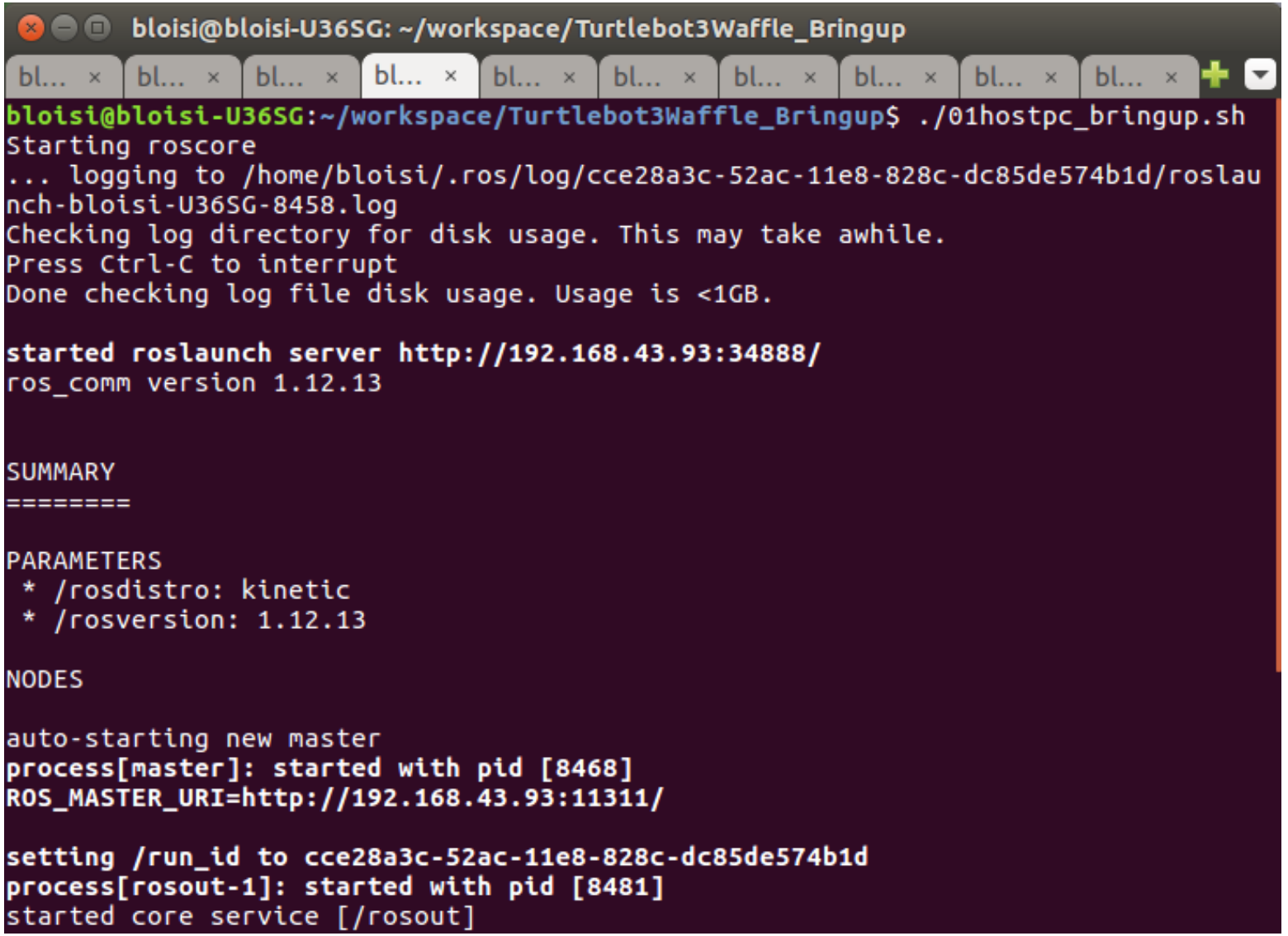
Settiamo I valori degli indirizzi di rete per il Remote PC (campo LOCAL_IP) e per la Joule (campo JOULE_IP)

Settiamo inoltre username e password per la Joule



01hostpc_bringup.sh

Lanciamo ROS sul Remote PC



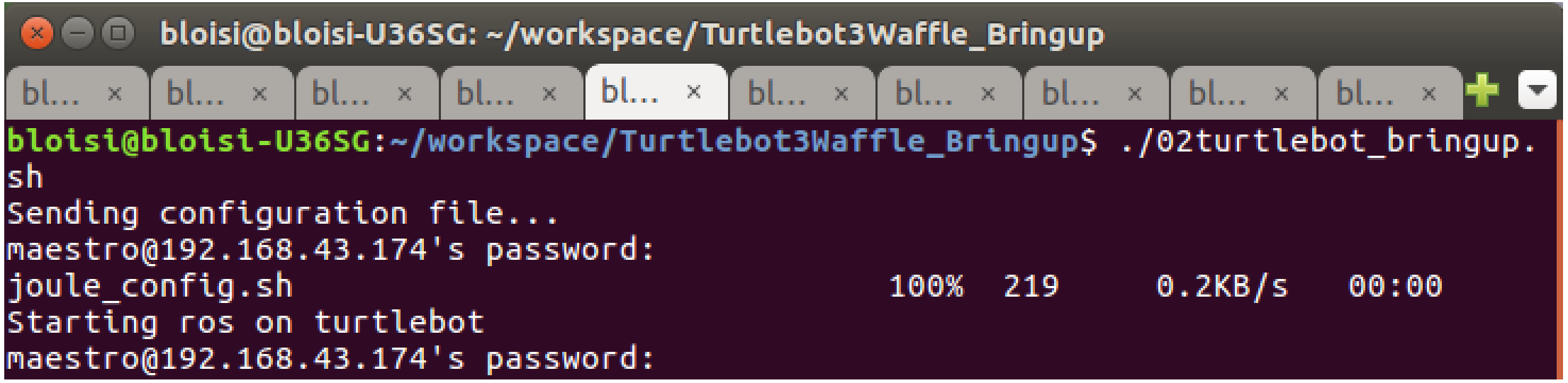
02turtlebot_bringup.sh

Lanciamo ROS

dal Remote PC

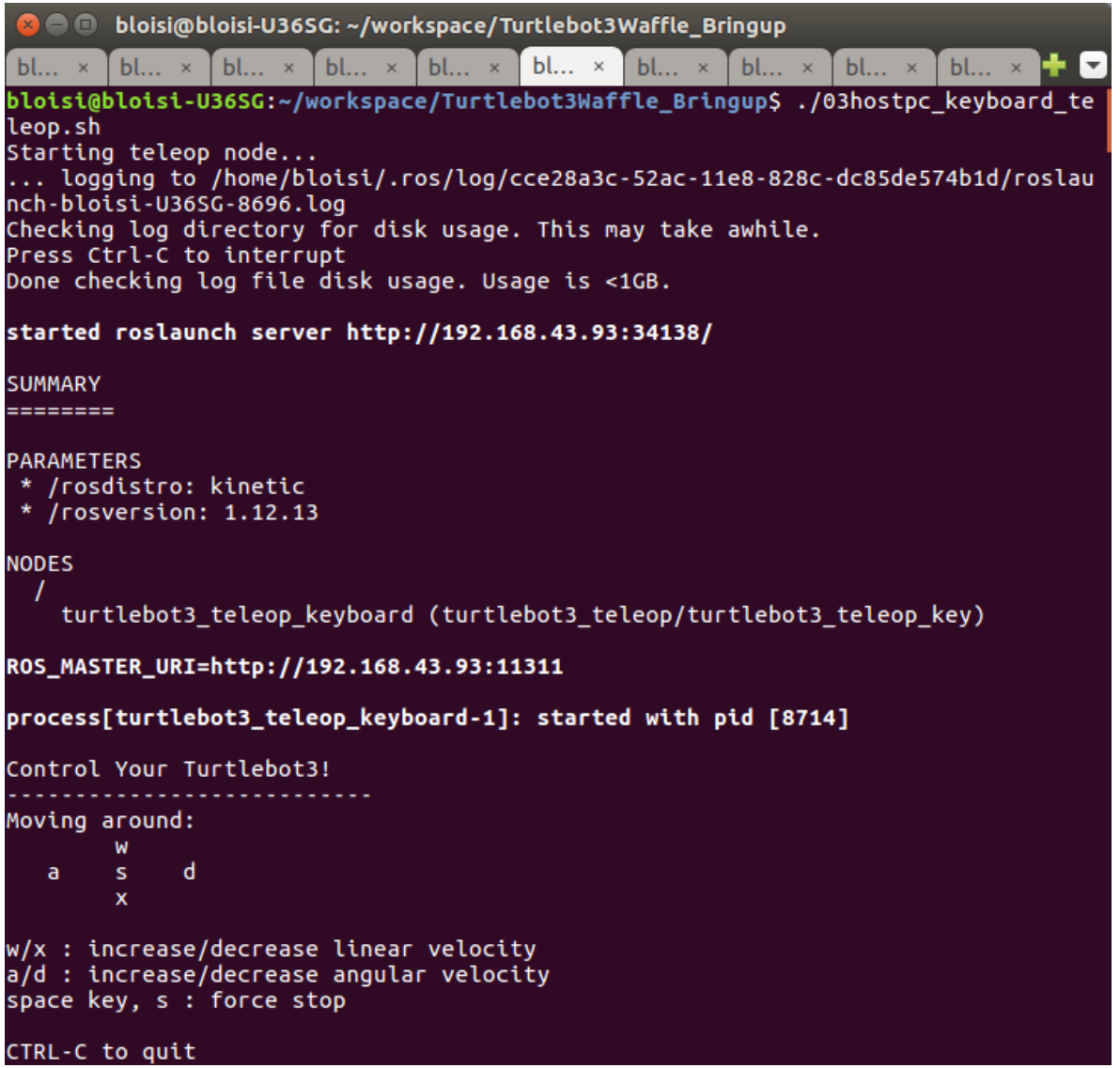
sulla Joule

sfruttando una connessione ssh

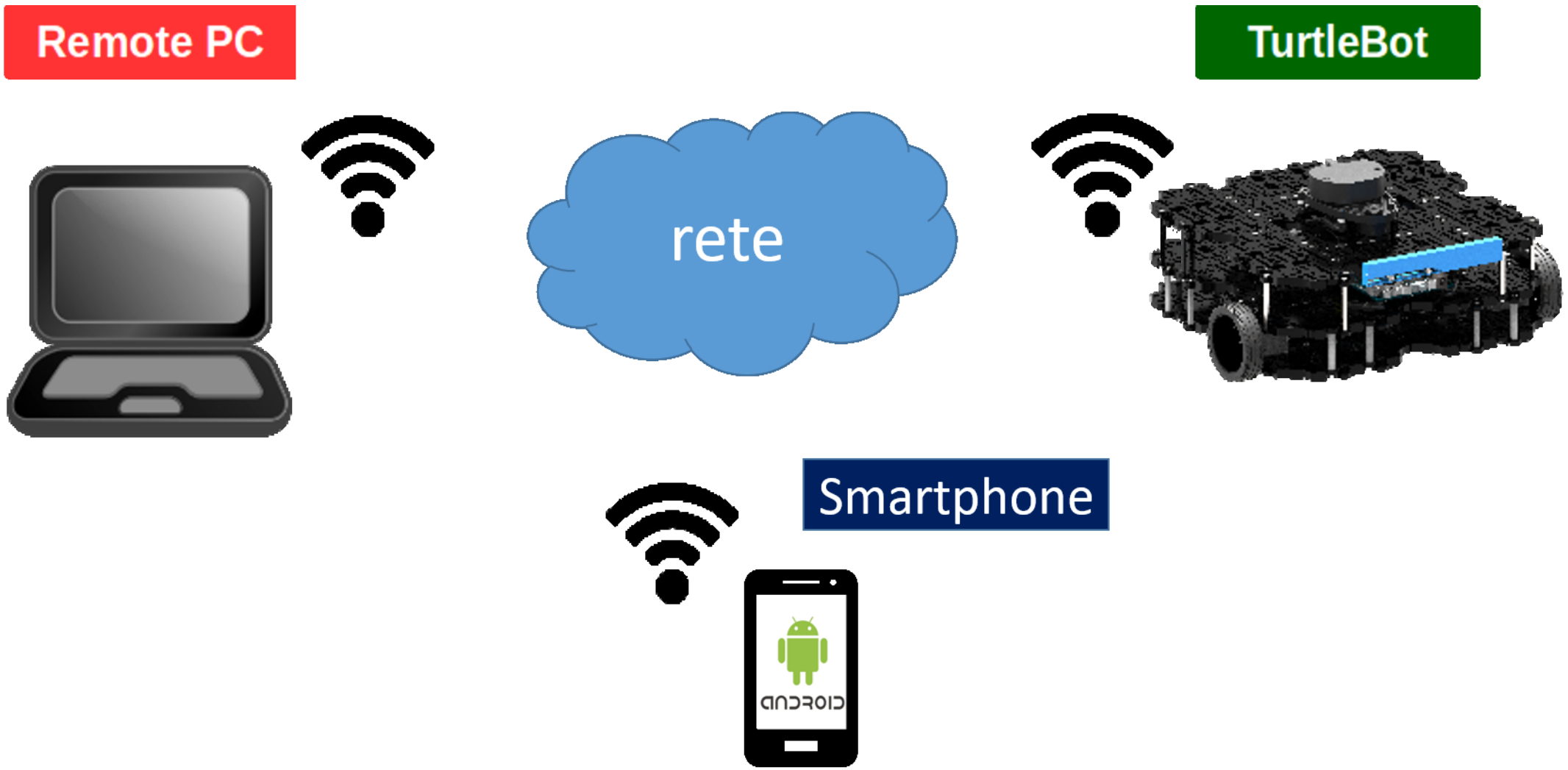


03hostpc_keyboard_teleop.sh

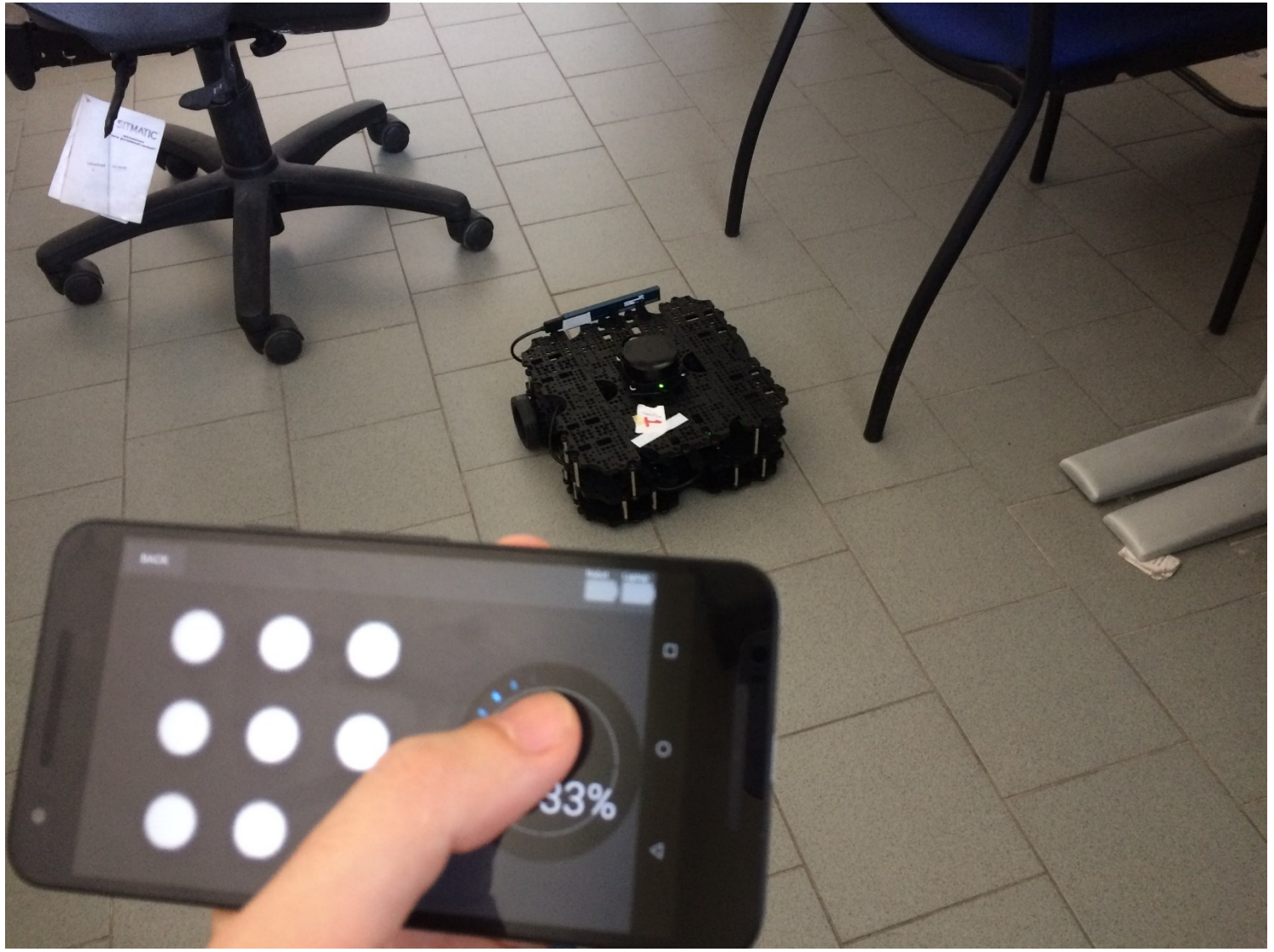
Lanciamo il nodo di teleoperazione dal Remote PC sulla Joule sfruttando una connessione ssh



Turtlebot 3 – teleoperation con smartphone



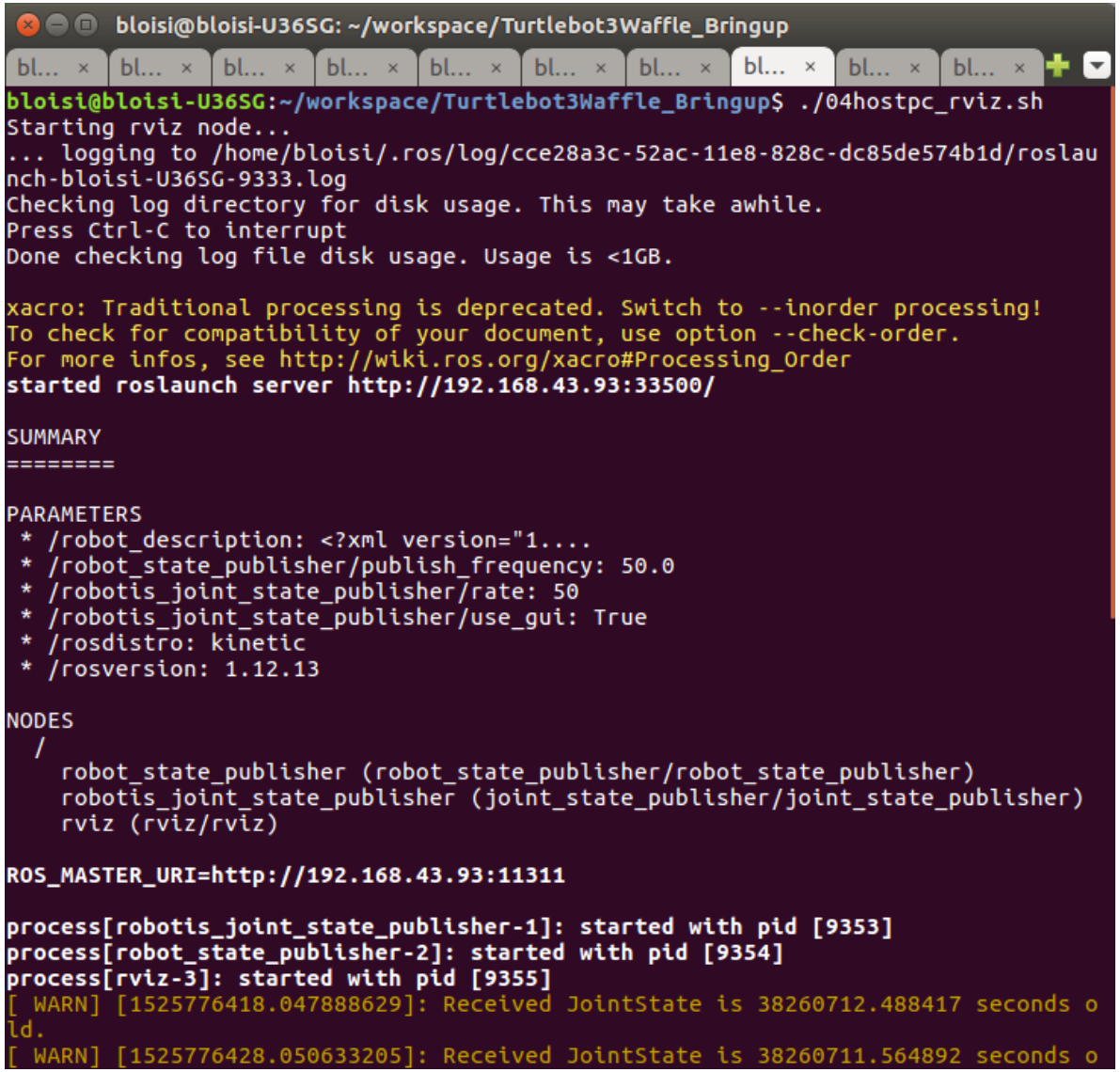
Turtlebot 3 – teleoperation con smartphone



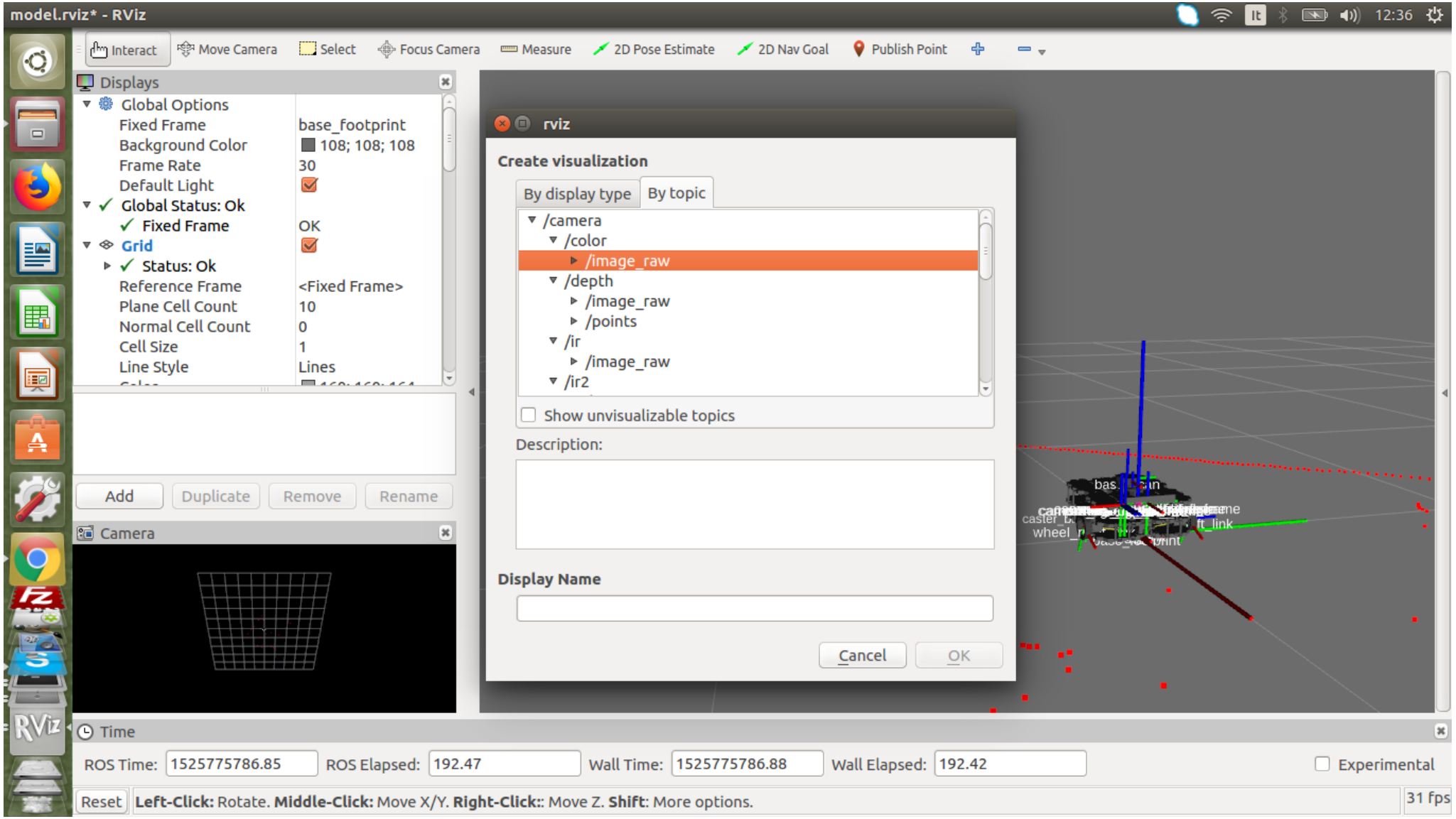
Turtlebot 3 – camera

```
bloisi@bloisi-U36SG:~/workspace/Turtlebot3Waffle_Bringup$ ./07turtlebot_realsens
e.sh
Sending configuration file...
maestro@192.168.43.174's password:
joule_config.sh                               100%  219     0.2KB/s   00:00
maestro@192.168.43.174's password:
[ERROR] [1487515690.036686893]: Skipped loading plugin with error: XML Document
'/opt/ros/kinetic/share/gmapping/nodelet_plugins.xml' has no Root Element. This
likely means the XML is malformed or missing..
Connection to 192.168.43.174 closed by remote host.
```

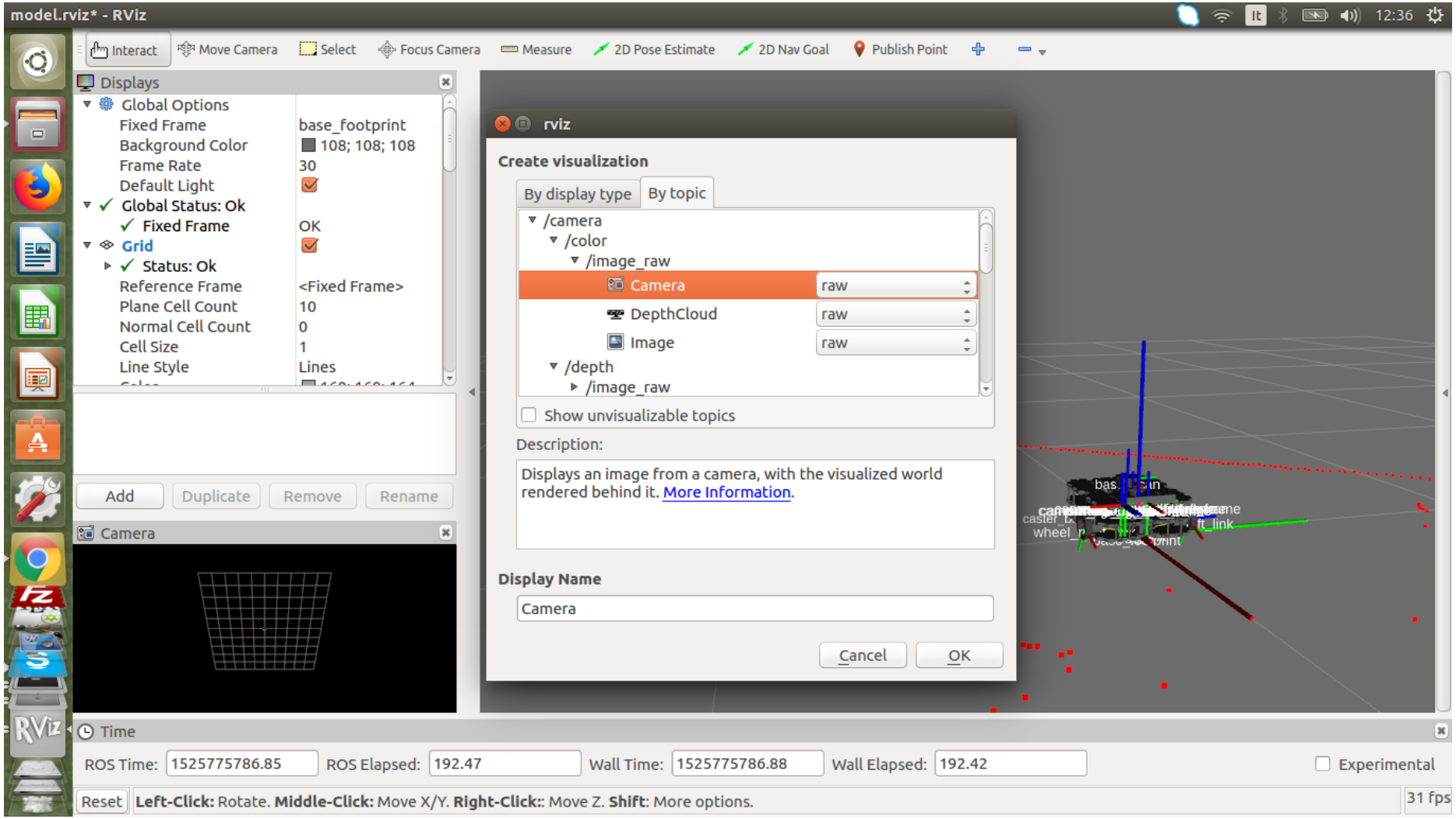
Turtlebot 3 – RViz



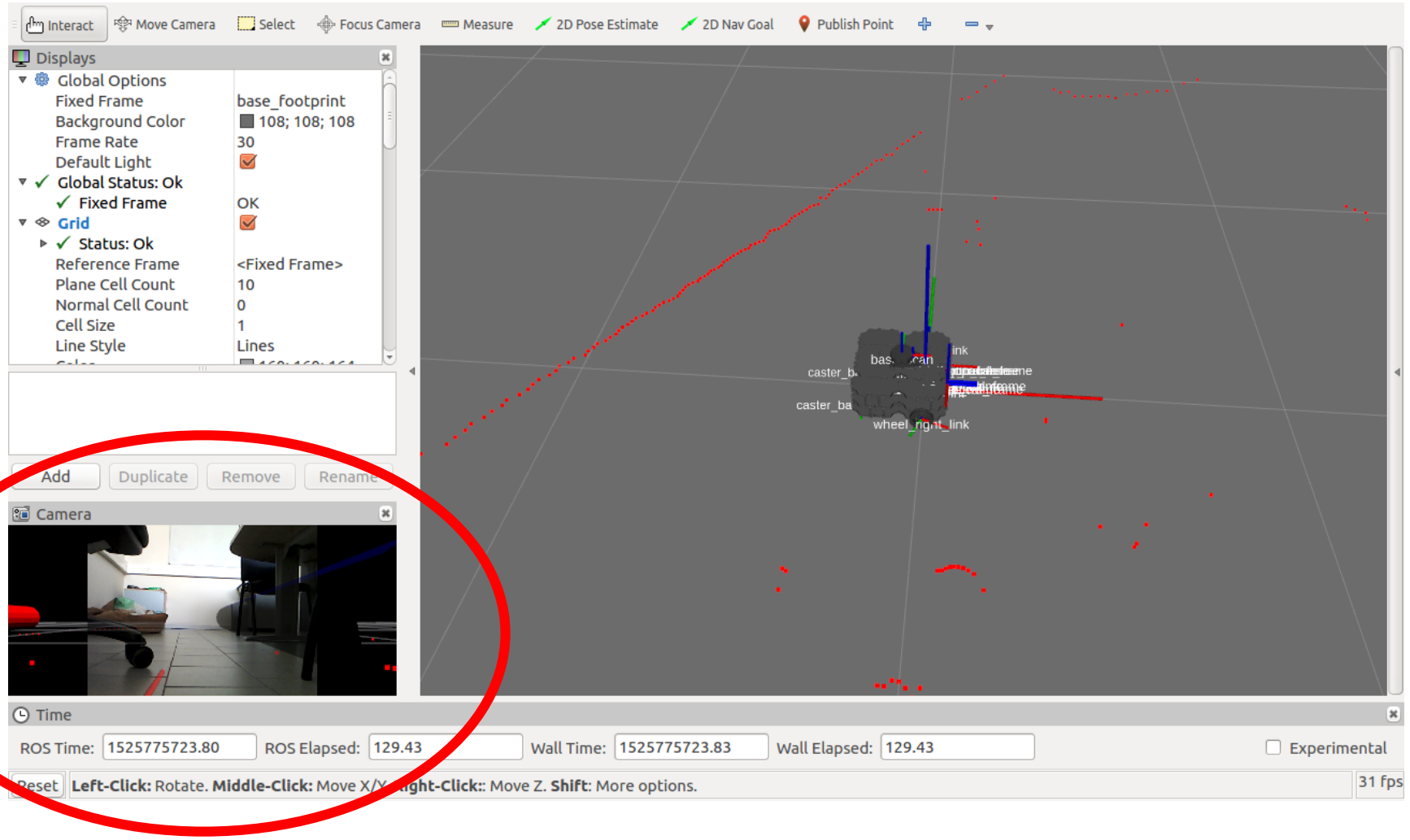
Turtlebot 3 – camera topic



Turtlebot 3 – camera topic

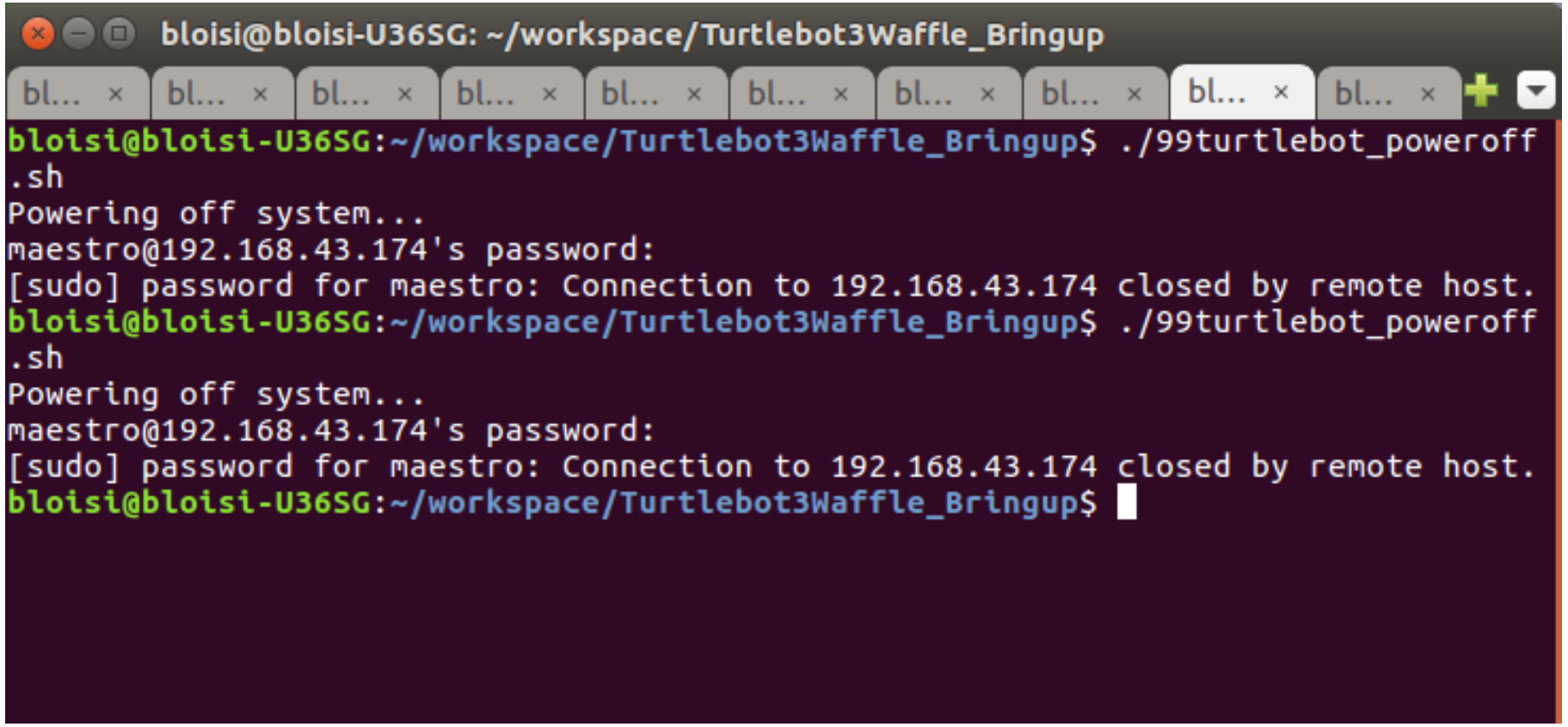


Turtlebot 3 – camera topic



99turtlebot_poweroff.sh

Terminiamo le operazioni



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