Université Paul Sabatier

Master Intelligence Artificielle et
Reconnaissance des Formes
Master Robotique : Décision et Commande

User Manual - Ball Search

Mobile Robot Navigation

Authors:
Thibaut Aghnatios
Marine Bouchet
Bruno Dato
Tristan Klempka
Thibault Lagoute

Tutors:
Frédéric Lerasle
Michaël Lauer
Michel Taix

10 January 2017s

Document tracking

Name	Major Version	Minor Version	Creation Date	Last version
User Manual - Ball Search	A	3	10/01/2017	30/03/2017

Document authors

Redaction	Integration	Review	Validation
Bruno Dato	Bruno Dato	??	??

Document validation

Validation	Name	Date	Visa

Broadcast list

User Manual - Ball Search is distributed to all clients and external stakeholders.

Review history

Version	Additions or modifications	Author	Date
A.0	Document creation	Bruno Dato	10/01/2017
A.1	Section 1 and 2	Bruno Dato	11/01/2017
A.2	Section 2	Bruno Dato	12/01/2017
A.3	Minor updates	Bruno Dato	30/03/2017

Contents

1 Prerequisites

1.1 Equipment

- TurtleBot 2
- Red balls[1] (diameter $\sim$ 10.5 cm)

1.2 Software

To be able to use any TurtleBot 2 with all the basic features, you need to complete the following tutorials :

- Turtlebot Installation
- PC Installation
- Network Configuration

You also need the following software :

- GIT [Installation]

1.3 Buid workspace

You need a ROS workspace (catkin workspace) to build our project before executing it. If you are running the ball search on the TurtleBot PC you have to create the workspace on the TurtleBot PC. In the case your are running it on a remote PC, you have to create the workspace on this PC.

Place you where you want to build the workspace and execute the following commands :

```
> mkdir -p /catkin_ws/src
> cd /catkin_ws/src
> catkin_init_workspace
> cd ..
> catkin_make
```

Then, in .bashrc, add the following lines (it's normal if some of them are already there) :

```
#Initialisation Turtlebot kinect
export TURTLEBOT_3D_SENSOR=kinect
#ROS Version
source /opt/ros/indigo/setup.bash
source <YOUR_PATH>/catkin_ws/devel/setup.bash
#Select corresponding TurtleBot on your network
export ROS_MASTER_URI=http://<IP_OF_TURTLEBOT>:11311
```

[1] The color can be changed in the code in ballSearch_node.cpp line 53

1.4 Download package

Now, you need to download the package containing the source code. Place you in your workspace (catkin_ws), and execute the following commands :

```
> cd src
```

```
> git clone https://github.com/Projet-Navigation-UPS/TurtleBot-pkgs
```

1.5 Build executables

Now that you have downloaded the source code, you just need to compile to build the executables files. Place you in your workspace (catkin_ws) and run the command :

```
> catkin_make
```

Three red lines must appear in the compilation description, meaning that the three executables we need have been created.

2 Run Ball Search

First, you need to turn on the TurtleBot (there is a switch button on the side of the robot base). Then, turn on the TurtleBot PC. We will now launch all the ROS nodes that we need to run our application.

2.1 On the TurtleBot PC

2.1.1 Basic features

If you are using the TurtleBot PC, open two terminals and chronologically execute the following commands to activate the minimal features and the vision features, one on each terminal :

```
> roslaunch turtlebot_bringup minimal.launch
```

```
> roslaunch turtlebot_bringup 3dsensor.launch
```

2.1.2 Ball search

Ounce you have place the robot in an environment with no obstacles and no red objects except the ball which should be at maximum distance of 1.80 m. On a third terminal, you can now launch the research of the ball executing the following command :

```
> roslaunch turtlebot_proj_nav ballSearch.launch
```

2.2 On a remote PC

2.2.1 Basic features

To execute the ball search from a remote PC, fist you have to ssh to the TurtleBot PC to launch the minimal and vision features. Open a fist terminal and write the following commands :

```
> ssh turtlebot@<TURTLEBOTP_IP>
```

```
> roslaunch turtlebot_bringup minimal.launch
```

Then, in a second terminal :

```
> ssh turtlebot@<TURTLEBOTP_IP>
```

```
> roslaunch turtlebot_bringup 3dsensor.launch
```

2.2.2 Ball search

Like previously, ounce you have place the robot in an environment with no obstacles and no red objects except the ball which should be at maximum distance of 1.80 m. On a third terminal, you can now launch the research of the ball executing the following command without having to ssh the TurtleBot PC:

```
> roslaunch turtlebot_proj_launch ballSearch.launch
```

2.3 Behaviour of the search

Ounce ballSearch is launched, you can see on your screen the video stream of the RGB TurtleBot's camera and the treatment on that stream that allows to detect the ball. If there is no ball in front of the robot, it will scan the environment to find one. If it hasn't find anything after the scan, it will abandon the search. If it finds a ball, it will get closer to to ball by first sniping to focus on the ball if it has to, and them moving towards the ball. Ounce a ball is found, the robot is done.