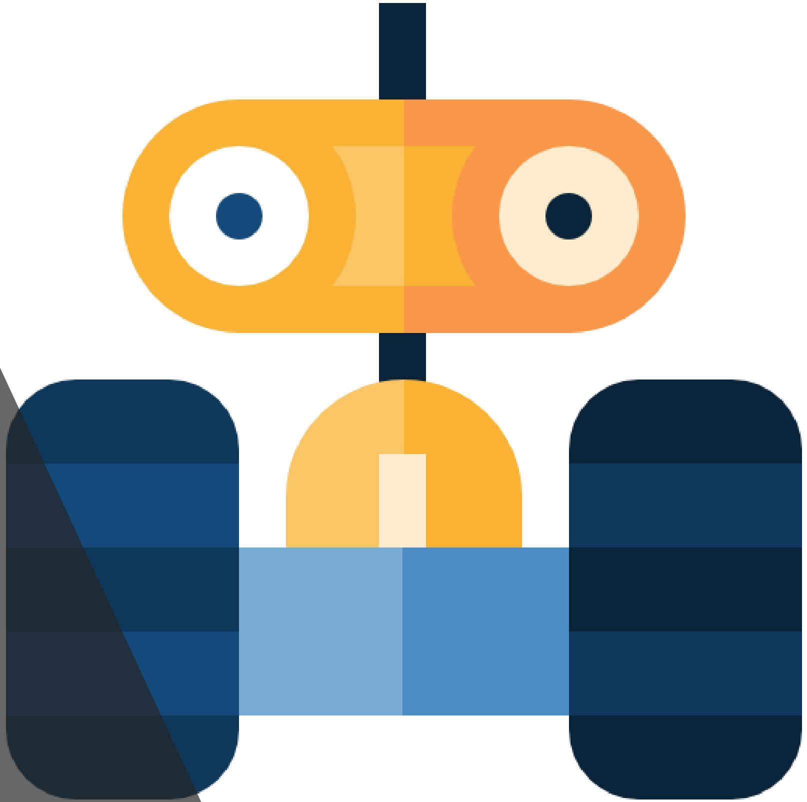
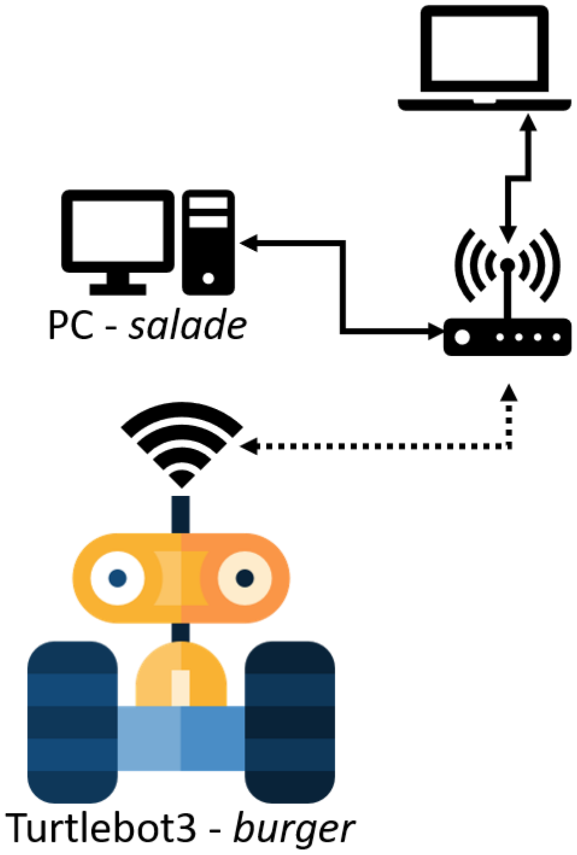
Amaury Camus & Grégoire Roussel

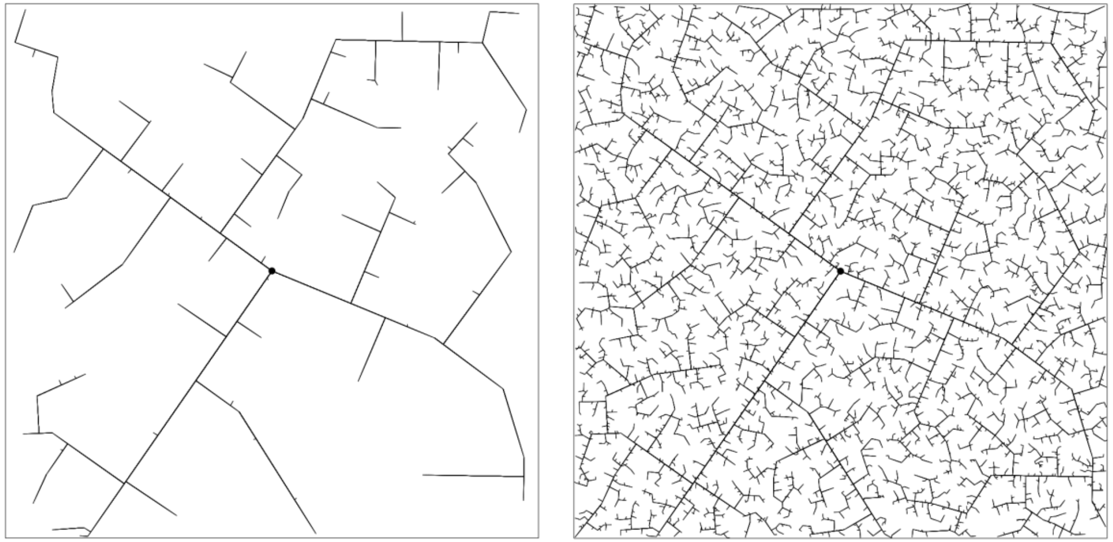
Implémentation d'algorithmes de path-planning garantis sur un TurtleBot3





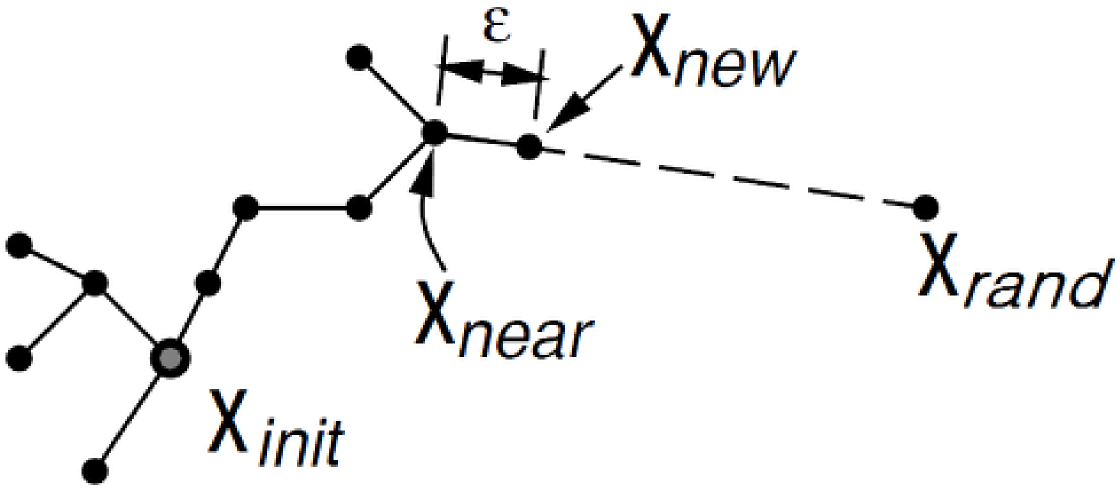
PC - *salade*

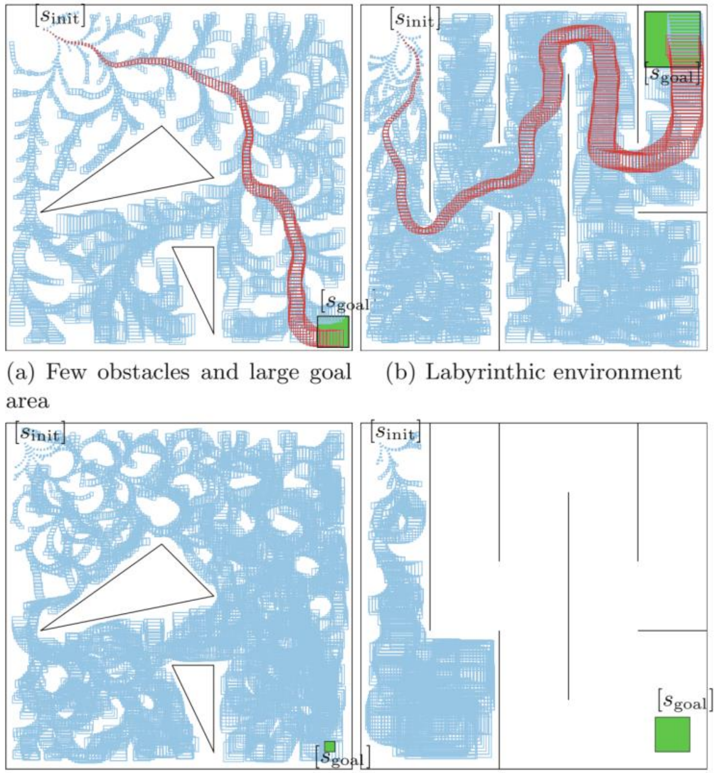
Turtlebot3 - *burger*



45 iterations

2345 iterations



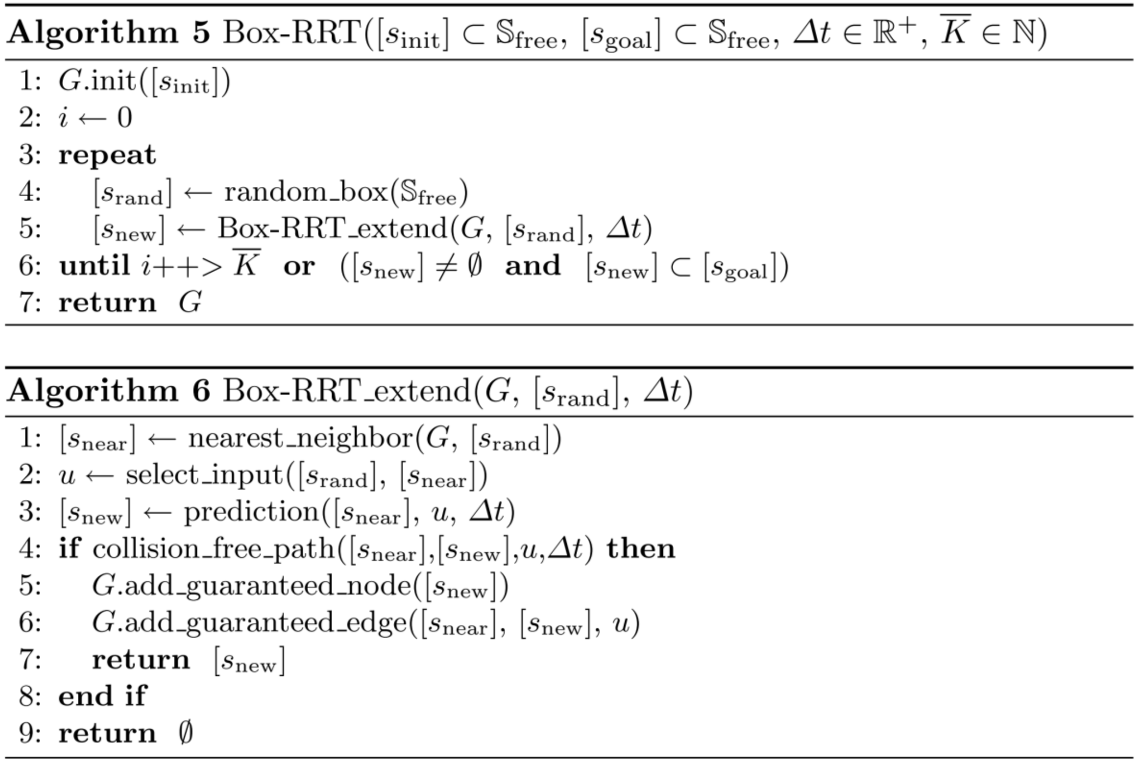


(a) Few obstacles and large goal area

(b) Labyrinthic environment

(c) Box-RRT fails to find a path (the goal area is too small)

(d) Box-RRT fails to find a path (skidding errors are too large)

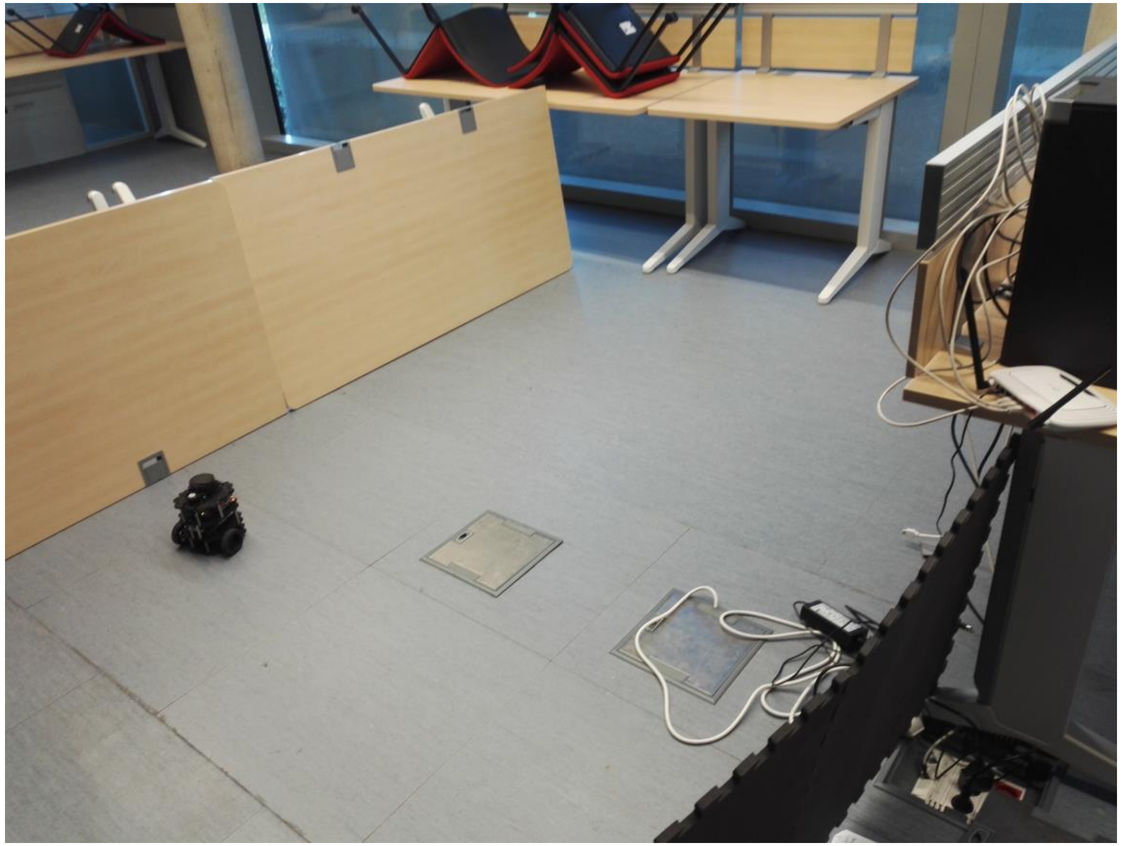


Algorithm 5 Box-RRT($[s_{\text{init}}] \subset \mathbb{S}_{\text{free}}$, $[s_{\text{goal}}] \subset \mathbb{S}_{\text{free}}$, $\Delta t \in \mathbb{R}^+$, $\overline{K} \in \mathbb{N}$)

```
G.init($[s_{\text{init}}]$)
$i \leftarrow 0$
repeat
    $[s_{\text{rand}}] \leftarrow$ random_box($\mathbb{S}_{\text{free}}$)
    $[s_{\text{new}}] \leftarrow$ Box-RRT_extend($G$, $[s_{\text{rand}}]$, $\Delta t$)
until $i{+}{+} > \overline{K}$ or $([s_{\text{new}}] \neq \emptyset$ and $[s_{\text{new}}] \subset [s_{\text{goal}}])$
return $G$
```

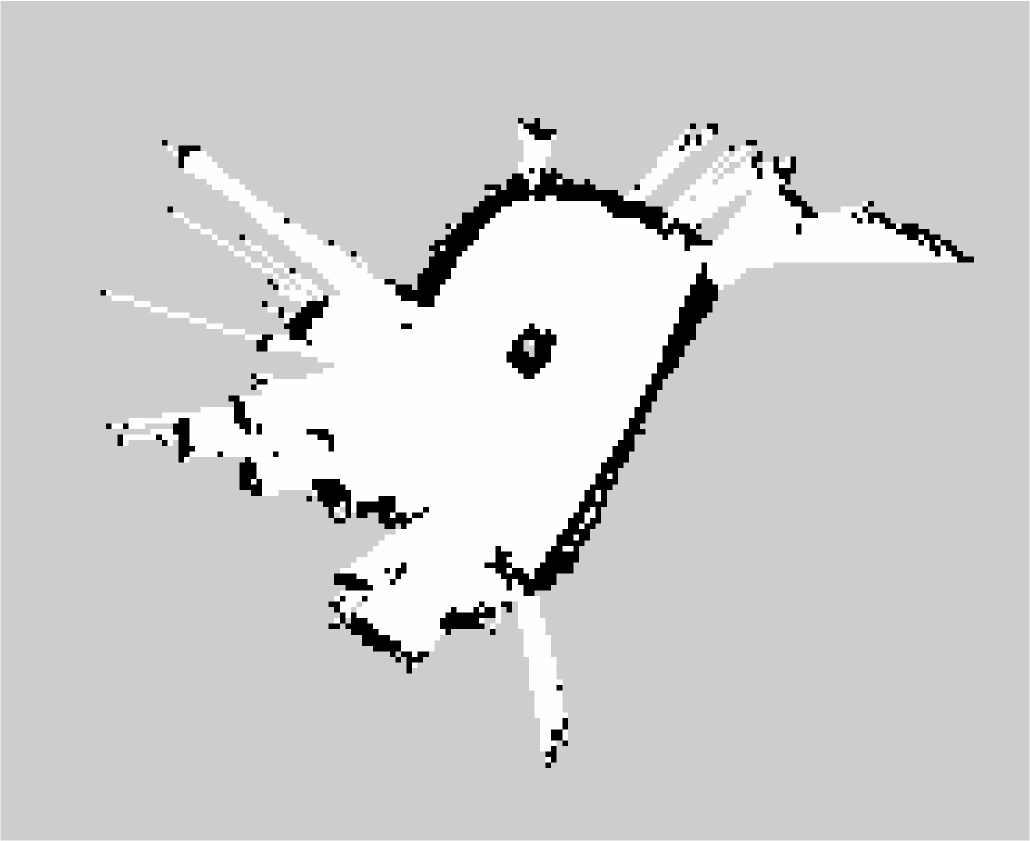
Algorithm 6 Box-RRT_extend(G, $[s_{\text{rand}}]$, Δt)

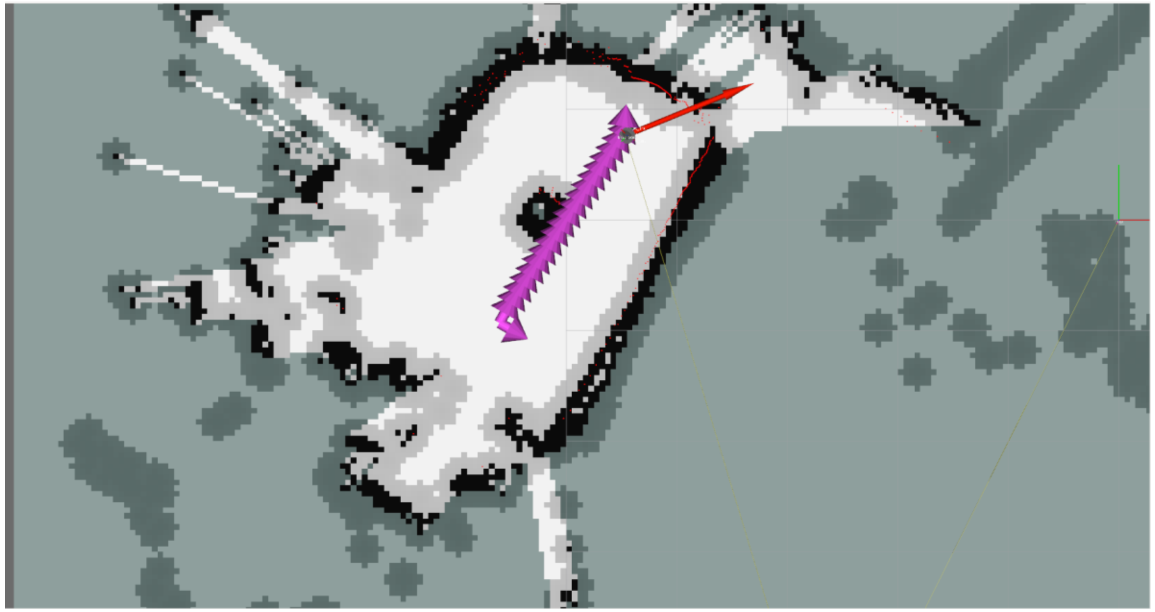
```
$[s_{\text{near}}] \leftarrow$ nearest_neighbor($G$, $[s_{\text{rand}}]$)
$u \leftarrow$ select_input($[s_{\text{rand}}]$, $[s_{\text{near}}]$)
$[s_{\text{new}}] \leftarrow$ prediction($[s_{\text{near}}]$, $u$, $\Delta t$)
if collision_free_path($[s_{\text{near}}]$,$[s_{\text{new}}]$,$u$,$\Delta t$) then
    $G$.add_guaranteed_node($[s_{\text{new}}]$)
    $G$.add_guaranteed_edge($[s_{\text{near}}]$, $[s_{\text{new}}]$, $u$)
    return $[s_{\text{new}}]$
end if
return $\emptyset$
```



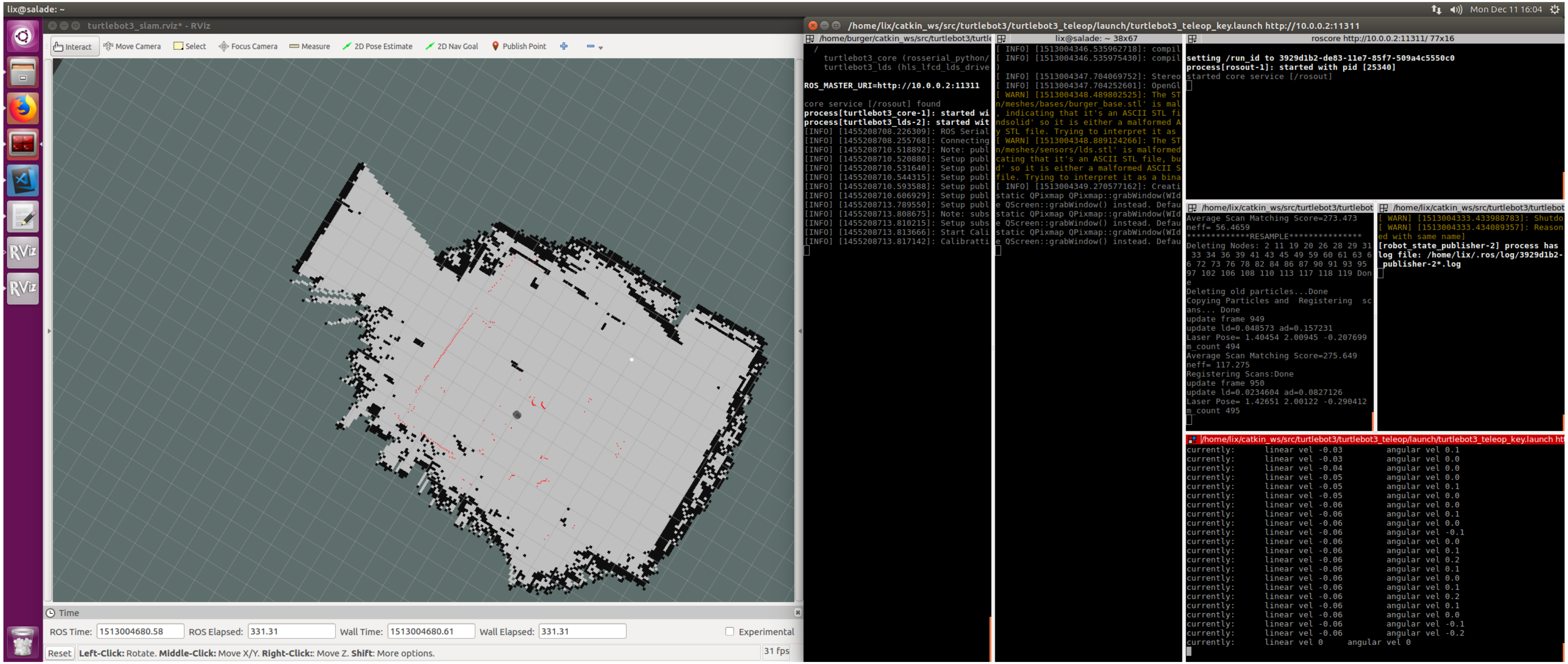
Un robot-taupe…

- Distance max du LIDAR
- Trop de régularité déstabilise le SLAM





SLAM & Navigation



ROS Time: 1513004680.58 ROS Elapsed: 331.31 Wall Time: 1513004680.61 Wall Elapsed: 331.31

Left-Click: Rotate. **Middle-Click:** Move X/Y. **Right-Click:**: Move Z. **Shift**: More options.

/home/lix/catkin_ws/src/turtlebot3/turtlebot3_teleop/launch/turtlebot3_teleop_key.launch http://10.0.0.2:11311

/home/burger/catkin_ws/src/turtlebot3/turtle

```
  /
    turtlebot3_core (rosserial_python/
    turtlebot3_lds (hls_lfcd_lds_drive

ROS_MASTER_URI=http://10.0.0.2:11311

core service [/rosout] found
process[turtlebot3_core-1]: started wi
process[turtlebot3_lds-2]: started wit
[INFO] [1455208708.226309]: ROS Serial
[INFO] [1455208708.255768]: Connecting
[INFO] [1455208710.518892]: Note: publ
[INFO] [1455208710.520880]: Setup publ
[INFO] [1455208710.531640]: Setup publ
[INFO] [1455208710.544315]: Setup publ
[INFO] [1455208710.593588]: Setup publ
[INFO] [1455208710.606929]: Setup publ
[INFO] [1455208713.789550]: Setup publ
[INFO] [1455208713.808675]: Note: subs
[INFO] [1455208713.810215]: Setup subs
[INFO] [1455208713.813666]: Start Cali
[INFO] [1455208713.817142]: Calibratti
```

lix@salade: ~ 38x67

```
[ INFO] [1513004346.535962718]: compil
[ INFO] [1513004346.535975430]: compil
)
[ INFO] [1513004347.704069752]: Stereo
[ INFO] [1513004347.704252601]: OpenGl
[ WARN] [1513004348.489802525]: The ST
n/meshes/bases/burger_base.stl' is mal
, indicating that it's an ASCII STL fi
ndsolid' so it is either a malformed A
y STL file. Trying to interpret it as
[ WARN] [1513004348.889124266]: The ST
n/meshes/sensors/lds.stl' is malformed
cating that it's an ASCII STL file, bu
d' so it is either a malformed ASCII S
file. Trying to interpret it as a bina
[ INFO] [1513004349.270577162]: Creati
static QPixmap QPixmap::grabWindow(WId
e QScreen::grabWindow() instead. Defau
static QPixmap QPixmap::grabWindow(WId
e QScreen::grabWindow() instead. Defau
static QPixmap QPixmap::grabWindow(WId
e QScreen::grabWindow() instead. Defau
```

roscore http://10.0.0.2:11311/ 77x16

```

setting /run_id to 3929d1b2-de83-11e7-85f7-509a4c5550c0
process[rosout-1]: started with pid [25340]
started core service [/rosout]
```

/home/lix/catkin_ws/src/turtlebot3/turtlebot

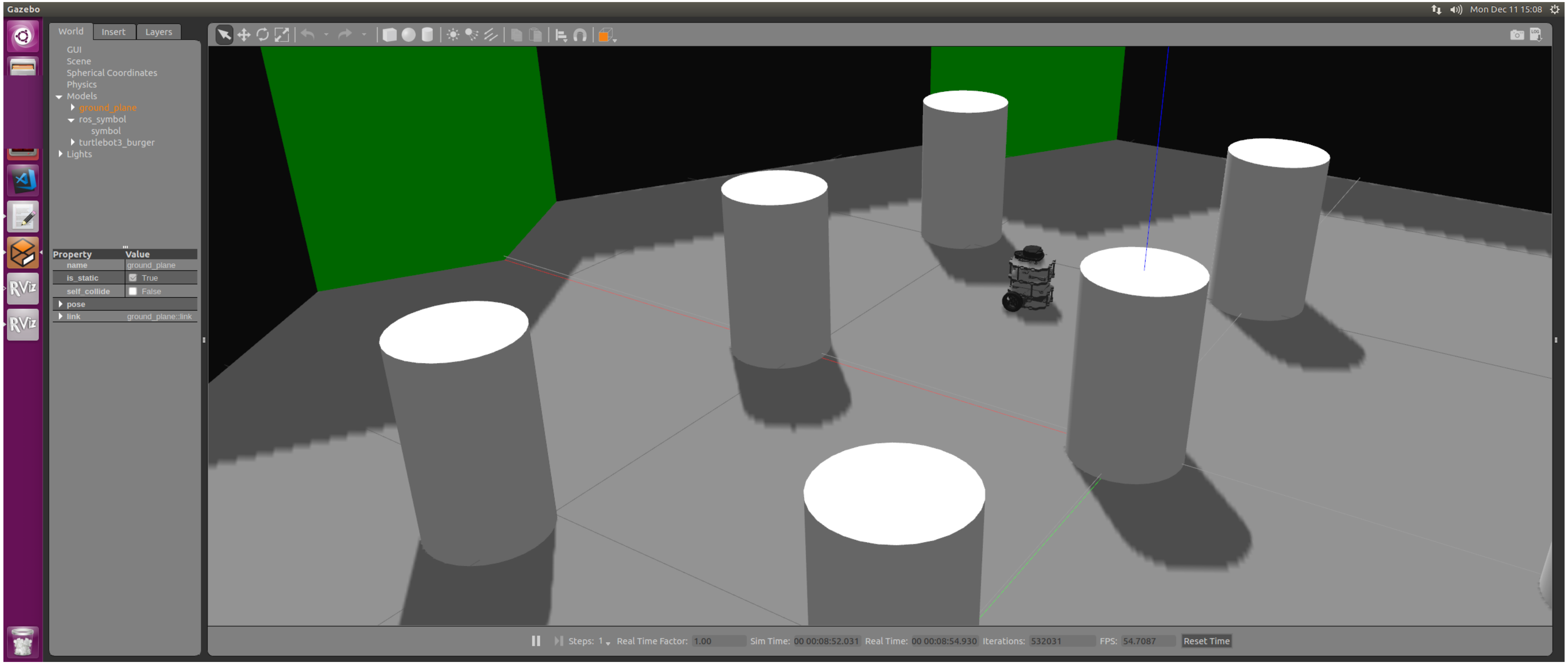
```
Average Scan Matching Score=273.473
neff= 56.4659
*************RESAMPLE***************
Deleting Nodes: 2 11 19 20 26 28 29 31
 33 34 36 39 41 43 45 49 59 60 61 63 6
6 72 73 76 78 82 84 86 87 90 91 93 95
97 102 106 108 110 113 117 118 119 Don
e
Deleting old particles...Done
Copying Particles and  Registering  sc
ans... Done
update frame 949
update ld=0.048573 ad=0.157231
Laser Pose= 1.40454 2.00945 -0.207699
m_count 494
Average Scan Matching Score=275.649
neff= 117.275
Registering Scans:Done
update frame 950
update ld=0.0234604 ad=0.0827126
Laser Pose= 1.42651 2.00122 -0.290412
m_count 495
```

/home/lix/catkin_ws/src/turtlebot3/turtlebot

```
[ WARN] [1513004333.433988783]: Shutdo
[ WARN] [1513004333.434089357]: Reason
ed with same name]
[robot_state_publisher-2] process has
log file: /home/lix/.ros/log/3929d1b2-
_publisher-2*.log
```

/home/lix/catkin_ws/src/turtlebot3/turtlebot3_teleop/launch/turtlebot3_teleop_key.launch ht

```
currently:      linear vel -0.03         angular vel 0.1
currently:      linear vel -0.03         angular vel 0.0
currently:      linear vel -0.04         angular vel 0.0
currently:      linear vel -0.05         angular vel 0.0
currently:      linear vel -0.05         angular vel 0.1
currently:      linear vel -0.05         angular vel 0.0
currently:      linear vel -0.06         angular vel 0.0
currently:      linear vel -0.06         angular vel 0.1
currently:      linear vel -0.06         angular vel 0.0
currently:      linear vel -0.06         angular vel -0.1
currently:      linear vel -0.06         angular vel 0.0
currently:      linear vel -0.06         angular vel 0.1
currently:      linear vel -0.06         angular vel 0.2
currently:      linear vel -0.06         angular vel 0.1
currently:      linear vel -0.06         angular vel 0.0
currently:      linear vel -0.06         angular vel 0.1
currently:      linear vel -0.06         angular vel 0.2
currently:      linear vel -0.06         angular vel 0.1
currently:      linear vel -0.06         angular vel 0.0
currently:      linear vel -0.06         angular vel -0.1
currently:      linear vel -0.06         angular vel -0.2
currently:      linear vel 0     angular vel 0
```



Property	Value
name	ground_plane
is_static	☑ True
self_collide	□ False
pose	
link	ground_plane::link

Steps: 1 Real Time Factor: 1.00 Sim Time: 00 00:08:52.031 Real Time: 00 00:08:54.930 Iterations: 532031 FPS: 54.7087