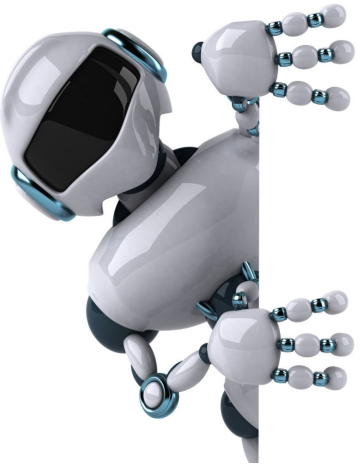
智能移动机器人

Navigation功能包



西安天之博特科技有限公司

公司简介

TIANBOT

天之博特
TIANBOT

天之博特成立于2016年，专注于智能移动机器人模块及整机的设计、研发、生产制造，将最前沿的人工智能与机器人技术应用到产品中，推动移动机器人在行业中落地。天之博特是国内智能移动机器人教育行业的先行者，为高校新工科和双一流建设提供人工智能和机器人专业的全套的解决方案。

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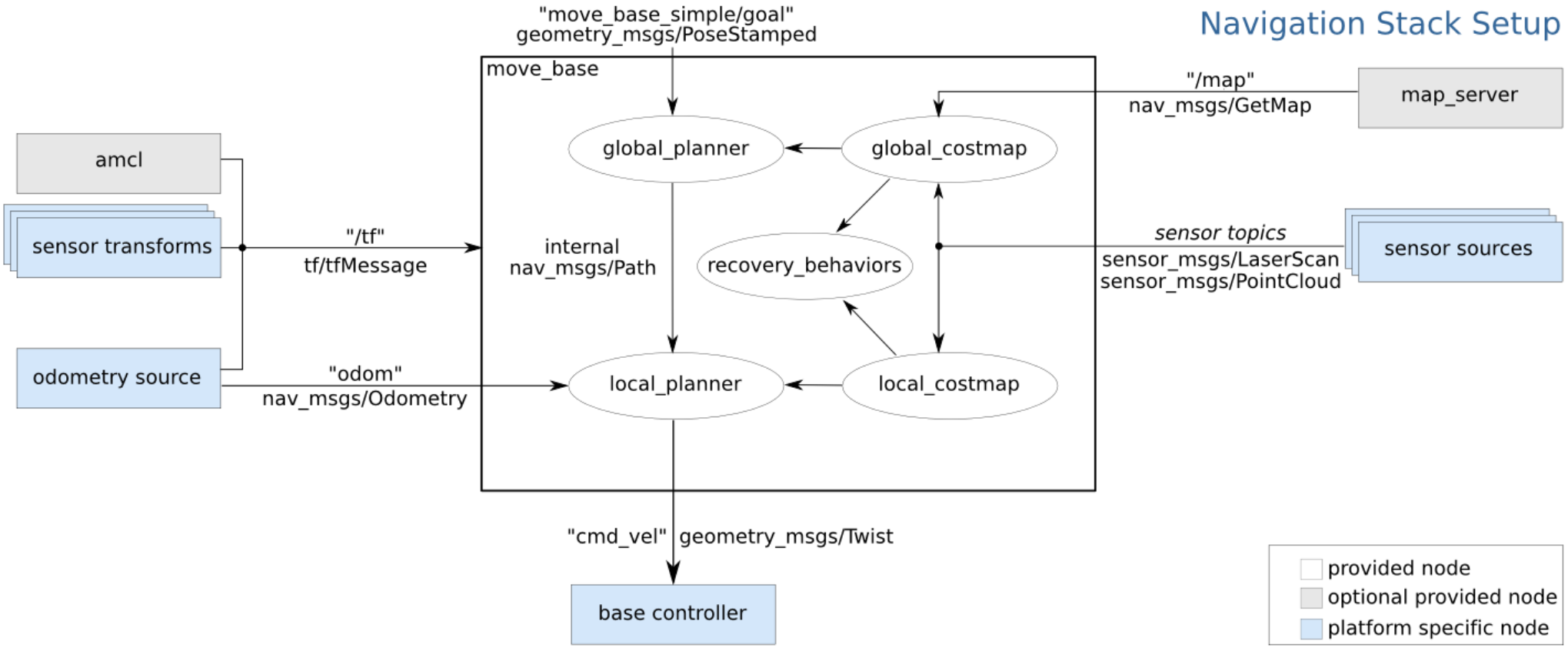
Navigation功能包浅浅介绍

1

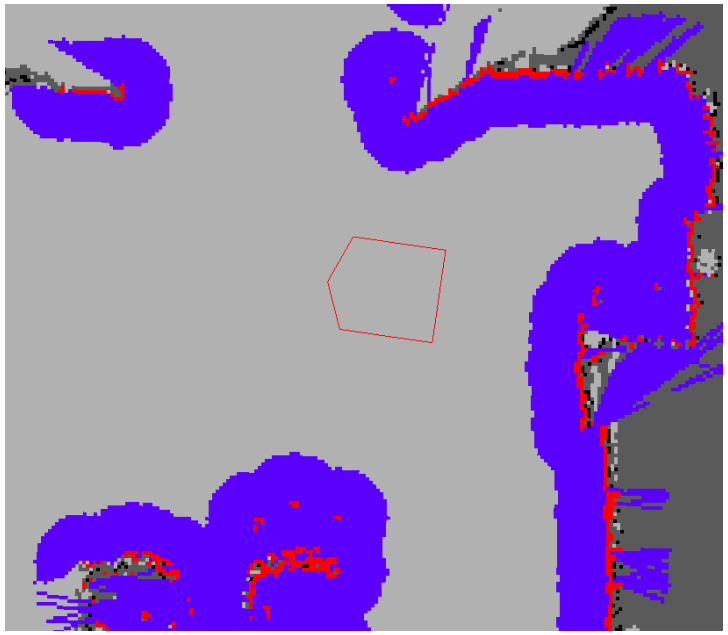
定位导航技术概述：move_base



代价地图Costmap

2

Costmap代价地图

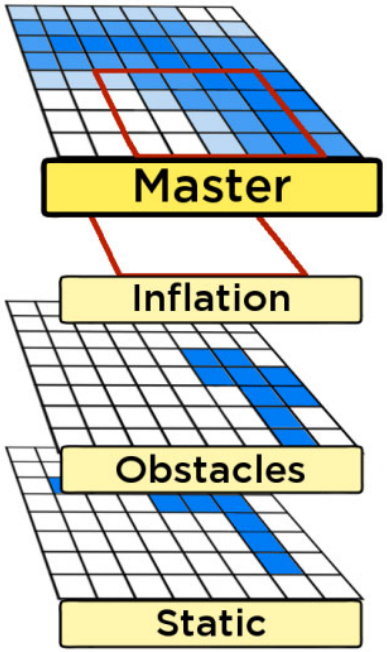


costmap_2d::LETHAL_OBSTACLE;
costmap_2d::NO_INFORMATION;
costmap_2d::FREE_SPACE;
costmap_2d::INSCRIBED_INFLATED_OBSTACLE

Costmap代价地图图层

- 静态地图层
  - 静态地图层代表代价地图中大部分不变的部分，与SLAM生成的地图类似。
- 障碍物地图层
  - 障碍地图曾记录了由传感器数据读取的障碍物。ObstacleCostmapPlugin在两个维度上标记并光线追踪障碍物, VoxelCostmapPlugin则在三个维度上进行标记并追踪。
- 膨胀层
  - 膨胀层是一种优化，它在障碍物周围增加新数值 (即膨胀障碍物) 以使得代价地图代表了机器人的空间设置。
- 其他层
  - Social Costmap Layer（）
  - Range Sensor Layer（范围传感器层）

Costmap地图层图示



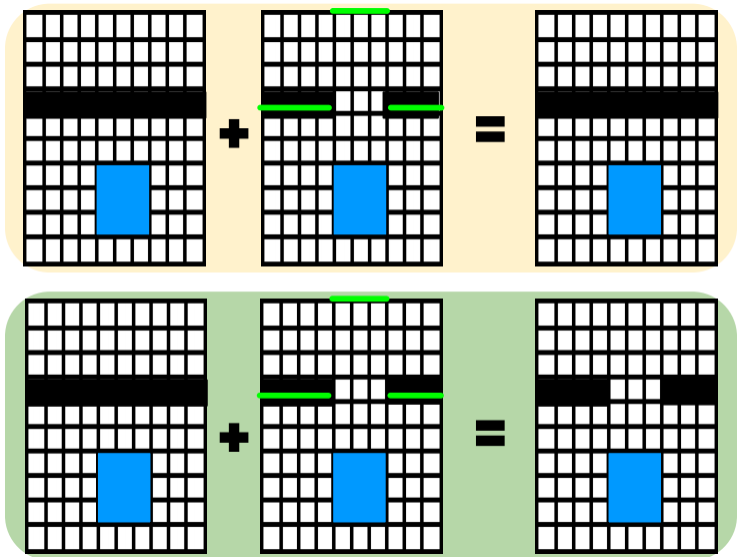


figure source: http://roscon.ros.org/2014/wp-content/uploads/2014/07/ROSCON2014_DLu.pdf

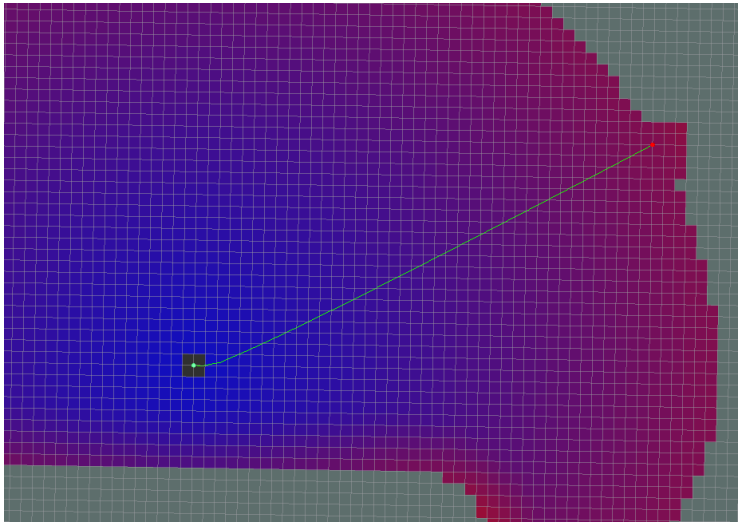
全局规划器

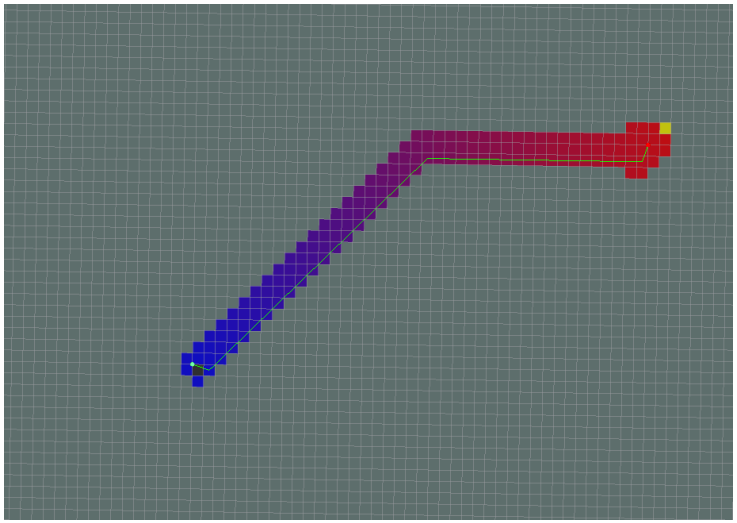
3

Dijkstra和A*

A*的搜索计算量更少，但是不能保证每次能够搜索到同样的路径。

Note that a lot less of the potential has been calculated (indicated by the colored areas). This is indeed faster than using Dijkstra's, but has the effect of not necessarily producing the same paths. Another thing to note is that in this implementation of A*, the potentials are computed using 4-connected grid squares, while the path found by tracing the potential gradient from the goal back to the start uses the same grid in an 8-connected fashion. Thus, the actual path found may not be fully optimal in an 8-connected sense. (Also, no visited-state set is tracked while computing potentials, as in a more typical A* implementation, because such is unnecessary for 4-connected grids).





局部规划器

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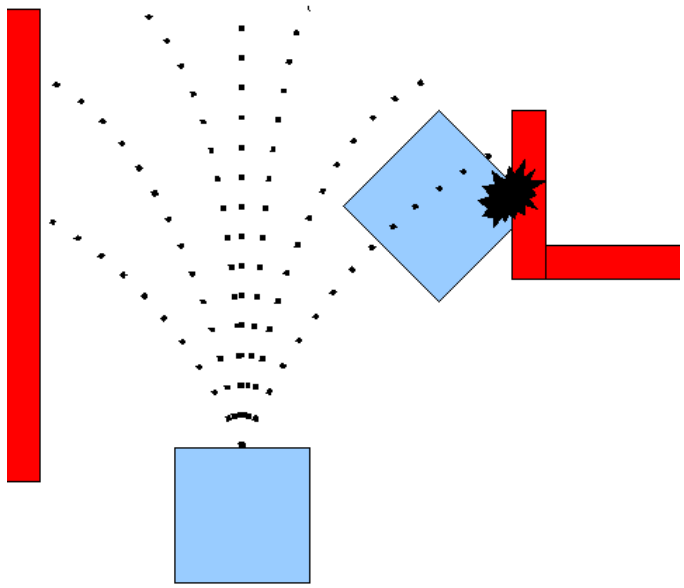
局部规划器

- ROS中的常用局部规划器
  - Base Local Planner
    - base_local_planner::TrajectoryPlanner
  - DWA（Dynamic Window Approach）
    - dwa_local_planner::DWAPlannerROS
  - Teb （Time Elastic Band）
    - teb_local_planner/TebLocalPlannerROS
  - Eband
    - eband_local_planner/EBandPlannerROS



动态调参与多点导航测试

5

rqt进行导航参数的动态调整

Teb规划器的调试

竞速可以参考古月居公众号的一篇文章
智能车竞赛——TEB轨迹规划算法的参数调试

参考Teb Local Planner的教程，同时注意cmd_vel到ackermann_cmd的转换

```
rosrun teb_local_planner_tutorials cmd_vel_to_ackermann_drive.py
```

完整的调参需要参考作者论文

```
C. Rösmann, F. Hoffmann and T. Bertram: Kinodynamic Trajectory
Optimization and Control for Car-Like Robots, IEEE/RSJ International
Conference on Intelligent Robots and Systems (IROS), Vancouver, BC,
Canada, Sept. 2017.
```

利用Action Client进行多点导航

多点导航

```
roslaunch tianracer_navigation multi_goal.launch
```

谢谢观看

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