POLITECNICO DI MILANO

AUTONOMOUS VEHICLES

S. Arrigoni

Methods of examination

recap

Methods of examination

The exam consists into 2 parts:

- Discussion on **reports** of at least **3 of 5** assignments proposed during the course;
- Discussion on the **final project** (code and report are required)

Methods of examination

- Can I do the assignments / final project in a small group?
  *Yes, small groups of max 3 are allowed, but the discussion of the results is **individual***

- Can I do more assignments / final projects?
  *Yes, you can do more then 3 assignments and more than 1 project. By the way **quality** will be preferred to **quantity***

- Are all assignment/final projects evaluated the same?
  No, they have a different degree of complexity (estimated) but it also depends on the implementation presented

Methods of examination

Assignments

- Assignment_1 = ●○○○○ Assignment_1+ = ●●○○○
- Assignment_2 = ●○○○○ Assignment_2+ = ●●○○○
- Assignment_3 = ●○○○○
- Assignment_4 = ●●○○○
- Assignment_5 = ●○○○○

Final projects

- Final project_1 = ●●●●○○
- Final project_2 = ●●●●○○ Final project_2+ = ●●●●●●
- Final project_3 = ●●○○○○
- Final project_4 = ●●●○○○ Final project_4+ = ●●●●○○

Final Projects

overview

Final Project: Project_1

What we expect from you

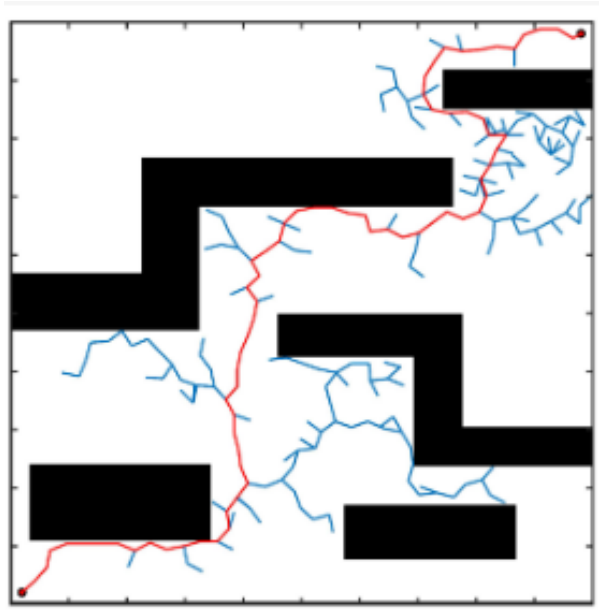
- Implement an RRT planner
- then apply it on the same maps provided for assignment_4
- compare results with A*

Final Project: Project_1

HINT: if you do also assignment_4…

…some suggestions

- https://en.wikipedia.org/wiki/Rapidly-exploring_random_tree
- https://ieeexplore.ieee.org/document/844730



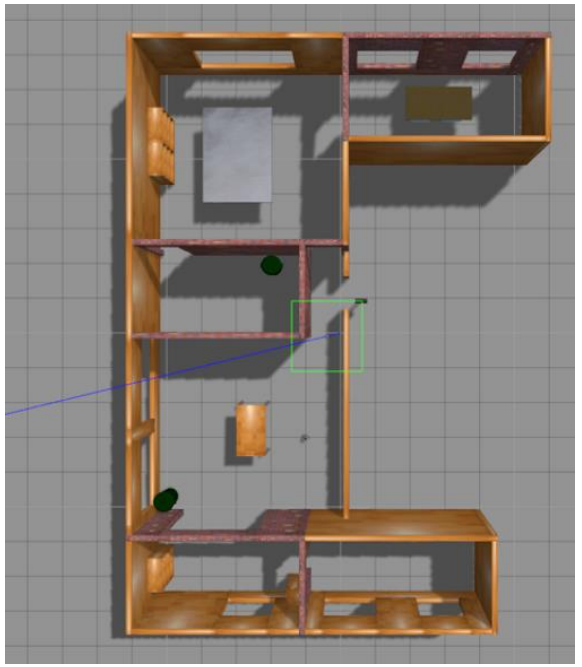
Final Project: Project_2

What we expect from you

- Using ***teleop_node,*** map the environment of ***turtlebot3_house.launch*** (using gmapping);
- Implement a new A* algorithm capable of dealing with big maps (300x300 at least);
- Apply it for 4 different Start- End points (you choose)

BONUS

- Feedback control of robot to reach the goals from initial position



Final Project: Project_2

…some suggestions

- Consider to use sparse matrixes in Matlab
- In order to map you need gmapping (next lesson)
- How to locate on the new map? (see documentation..)
- An easy feedback control from previous assignments…
- Apply RRT just at beginning or each time-step? (You choose)

Final Project: Project_3

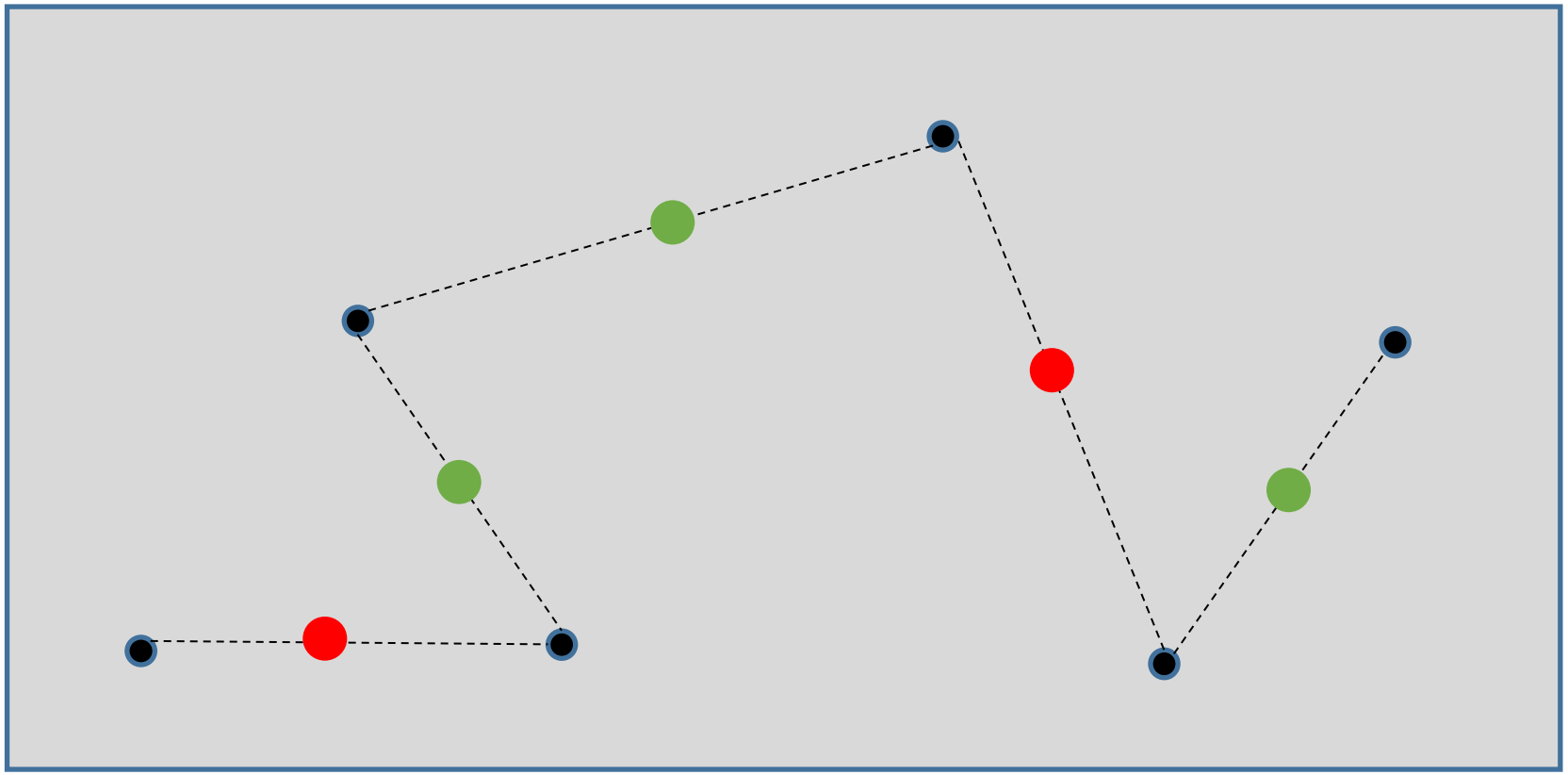
What we expect from you

- Define a path (waypoints): at least 6;
- In between of them, generate spheres (red or green) in Gazebo;
- Define a control feedback capable of:
  - Pass from all waypoints
  - Capable of stopping at the last waypoint
  - Capable of obstacle avoidance:
    - If the detected sphere is red (overtake on the left)
    - Otherwise overtake on the right

Final Project: Project_3

…some suggestions

- Example:



Final Project: Project_4

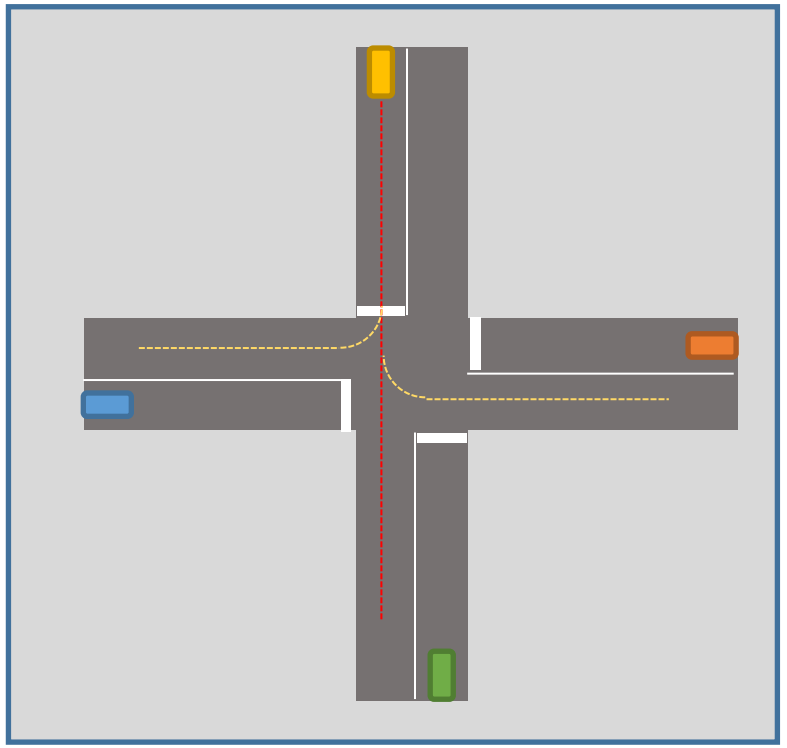
What we expect from you

- Define a 4-way intersection scenario where:
  - Vehicles can randomly appear on the lanes (at same time) and decide the travelling direction (straight, left, right);
    - ***Standard*** 2 vehicles only at the same time
    - ***BONUS*** 1 to 4 vehicles at the same time
- Implement an overall system to take care of:
  - the rules of the road for each of the vehicle;
  - Acceleration / deceleration functions for the vehicles (according to limits)
- Analyze several simulations and:
  - Prepare a report
  - Show overall system time evolution from a top-view moving plot

Final Project: Project_4

…some suggestions

- Vehicle physical limits:
  - Max acc/dec = |2| m/sec^2
  - Const deceleration profiles
  - Max speed = 30 km/h
  - Initial distance from stopping line = 20 m
- Make motion simple!
  (consider it as a fixed set of trajectories)



That’s it for today…

See you next time!

S. Arrigoni