Interdisciplinary Division of
Aeronautical and Aviation Engineering
航空工程跨領域學部

THE HONG KONG
POLYTECHNIC UNIVERSITY
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AAE2004 Introduction to Aviation Systems
AAE
Design of Path Planning Algorithm for Aircraft Operation

Project Goals (design & learning)
Additional Tasks

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Additional Tasks

Additional Tasks

- Start working on the following Tasks after you finish the previous ones (Create separate .py files so these tasks don't affect each other)

- Additional Tasks:
    - Adding Checkpoints
    - Changing Environment
    - Compare Different Algorithms

Adding a Checkpoint (Waypoint)

- Assume the Aircraft is a supply craft that must reach 2 drop-off points to drop supplies before heading back to base

1. Add 2 checkpoints:
   - One per each heavy consumption area
2. Reach all checkpoints before arriving at the destination

Adding a Checkpoint

- Requirements:
  1. This is an add-on for the code you are currently working on
  2. Checkpoints should be generated inside the heavy consumption areas
  3. Print the checkpoints, planning and the final path correctly **with different appearance**
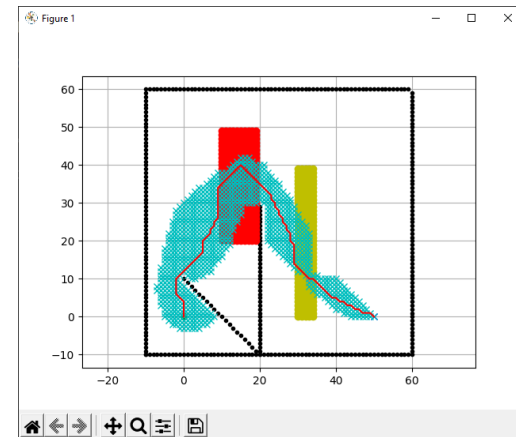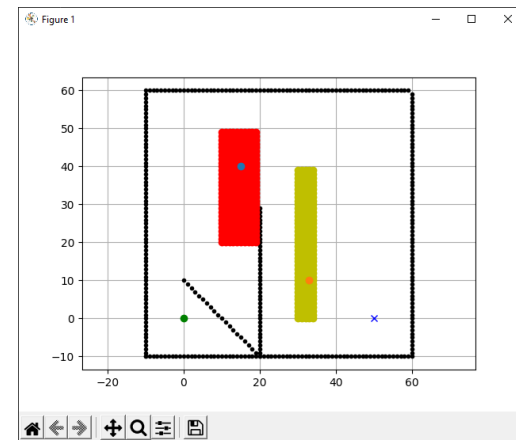
Changing Environment

- *__Continue this task using the previous task's code__

- We have been working on the same set of obstacles

- However, Path Planning should be able to work with different obstacle sets

- A **new scenario** per execution
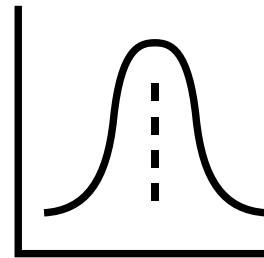
Changing Environment

- Modify the code so that:
    1. Only the fuel-consuming area remains and generate it randomly **with a fixed area (30x30)**
    2. Diagonal movement is **disabled**, change parameter(s) so that the object could travel **within one grid size**
    3. Obstacles are generated randomly with **reasonable density**
    4. Destination and starting points are generated randomly with **at least a 50-unit distance in-between**
    5. Diagonal movements are **disabled**
    6. Plotting of the fuel-consuming area would not cover the obstacles, and obstacles **should not generate** at/near the start and end point
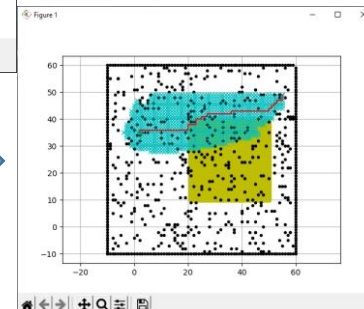
Density too high
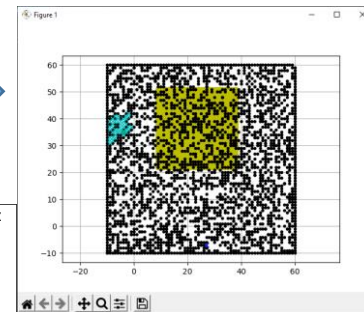
Reasonable
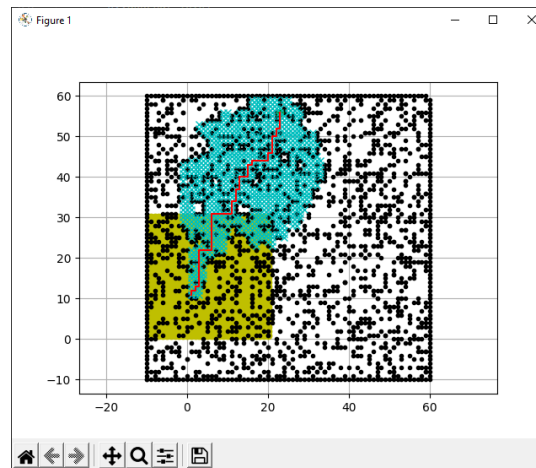
Density too low

Comparing Algorithms

- AStar is only one of the many Pathplanning Algorithms
- Different Algorithms
  - Different theories
  - Different performance
  - Difference limitations and strengths

AStar	fix unittest animation bugs (#429)	10 months ago
BSplinePath	mypy fix test	2 years ago
BatchInformedRRTStar	fix scanning error (#339)	15 months ago
BezierPath	Replaced sqrt(x**2+y**2) with hypot in PathPlanning/BezierPath/bezier...	2 years ago
BidirectionalAStar	fix scanning error (#339)	15 months ago
BidirectionalBreadthFirstSearch	fix scanning error (#339)	15 months ago
BreadthFirstSearch	Update breadth_first_search.py (#374)	13 months ago
BugPlanning	fix docstring error	12 months ago
ClosedLoopRRTStar	Fix No module error in GridBasedSweepCPP and ClosedLoopRRTStart (#516)	3 months ago
CubicSpline	improve test coverage (#352)	14 months ago
DStar	change DStar animation	4 months ago
DStarLite	Add D* Lite. (#511)	3 months ago
DepthFirstSearch	Update breadth_first_search.py (#374)	13 months ago
Dijkstra	Update breadth_first_search.py (#374)	13 months ago
DubinsPath	fix dubins path length bug and clean up codes. (#527)	2 months ago
DynamicWindowApproach	dwa pr (#390)	12 months ago
Eta3SplinePath	use pytest for test runner (#452)	8 months ago
Eta3SplineTrajectory	use pytest for test runner (#452)	8 months ago
FlowField	fix unittest animation bugs (#429)	10 months ago
FrenetOptimalTrajectory	mypy fix test	2 years ago
GreedyBestFirstSearch	Update greedy_best_first_search - calc_final_path method (#477)	7 months ago
GridBasedSweepCPP	Fix No module error in GridBasedSweepCPP and ClosedLoopRRTStart (#516)	3 months ago
HybridAStar	Test code clean up (#456)	8 months ago
InformedRRTStar	Using scipy.spatial.rotation matrix (#335)	15 months ago
LQRPlanner	add comment for stopping the simulation	2 years ago
LQRRRTStar	add comment for stopping the simulation	2 years ago
ModelPredictiveTrajectoryGenerator	Merge pull request #222 from zhkmxx9302013/master	2 years ago
PotentialFieldPlanning	Potential field - potential range and ocillations (#345)	14 months ago
ProbabilisticRoadMap	use scipy kd-tree directly (#337)	15 months ago
QuinticPolynomialsPlanner	Using scipy.spatial.rotation matrix (#335)	15 months ago
RRT	Sobol sampler implemented (#413)	8 months ago
RRTDubins	fix dubins path length bug and clean up codes. (#527)	2 months ago
RRTStar	Bug RRT* fix, issues #382 and #383 (#401)	11 months ago
RRTStarDubins	fix dubins path length bug and clean up codes. (#527)	2 months ago
RRTStarReedsShepp	add comment for stopping the simulation	2 years ago
ReedsSheppPath	Fix reeds shepp path issue (#529)	2 months ago
SpiralSpanningTreeCPP	fix deprecation warning for latest numpy (#480)	7 months ago
StateLatticePlanner	fix state_lattice_planner.py coordinate conversion (#495)	5 months ago
VisibilityRoadMap	fixed CI	2 years ago
VoronoiRoadMap	fix dijkstra hypot check bug (#522)	2 months ago
WavefrontCPP	fix deprecation warning for latest numpy (#480)	7 months ago

Comparing Algorithms

1. Choose 2 more algorithms from the AStar GitHub repository

2. Modify the code so all 3 algorithms are working with the **same obstacle set**

3. Try and compare the algorithms and produce a conclusion