# AAE2004 Introduction to Aviation Systems
# AAE
# Design of Path Planning Algorithm for Aircraft Operation

## Week 6: 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

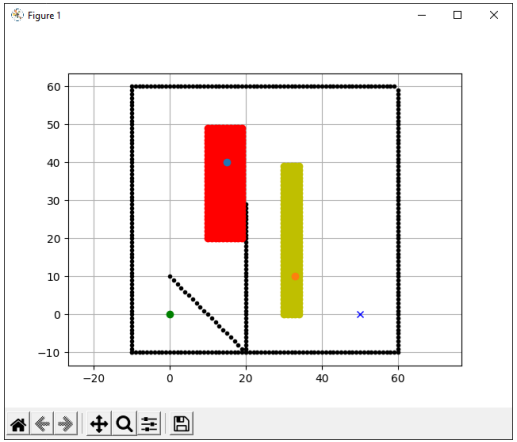
# Adding a Checkpoint (Waypoint)

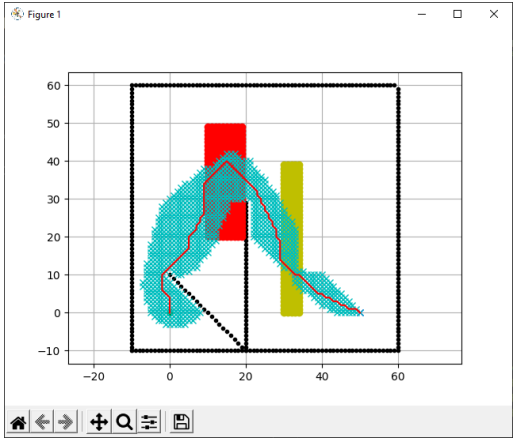
- Assume the Aircraft is a supply craft that must reach 2 drop-off points to drop supplies before heading back to base

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

# Adding a Checkpoint

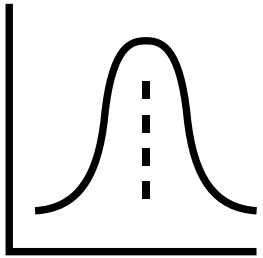
- Requirements:
  1. This is an add-on for the code you are currently working on
  2. Checkpoints should be generated inside the heavy consumption areas
  3. Print the checkpoints, planning and the final path correctly **with different appearance**



# Changing Environment

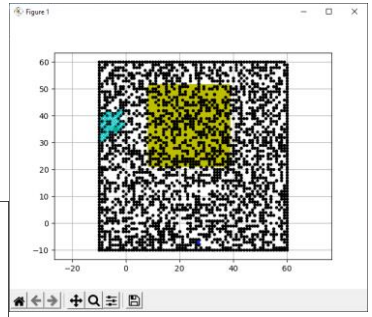
- ***Continue this task using the previous task's code**
- We have been working on the same set of obstacles
- However, Path Planning should be able to work with different obstacle sets
- A **new scenario** per execution

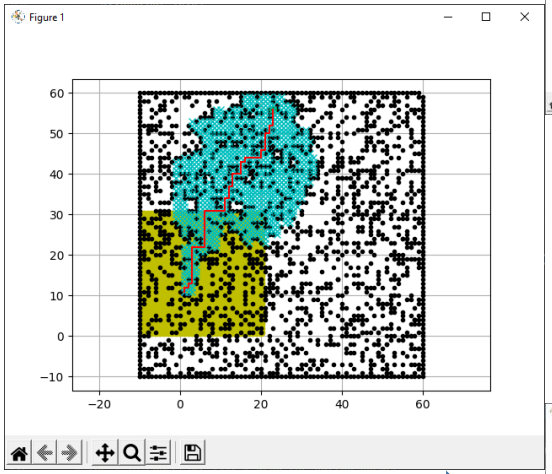


# Changing Environment

- 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

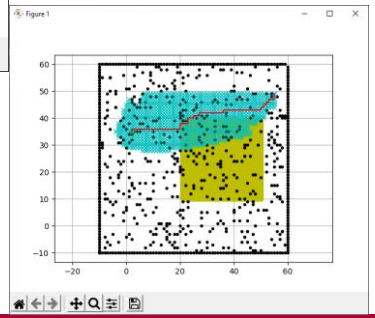
Density too high






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

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|---|---|---|
| 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 oscillations (#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