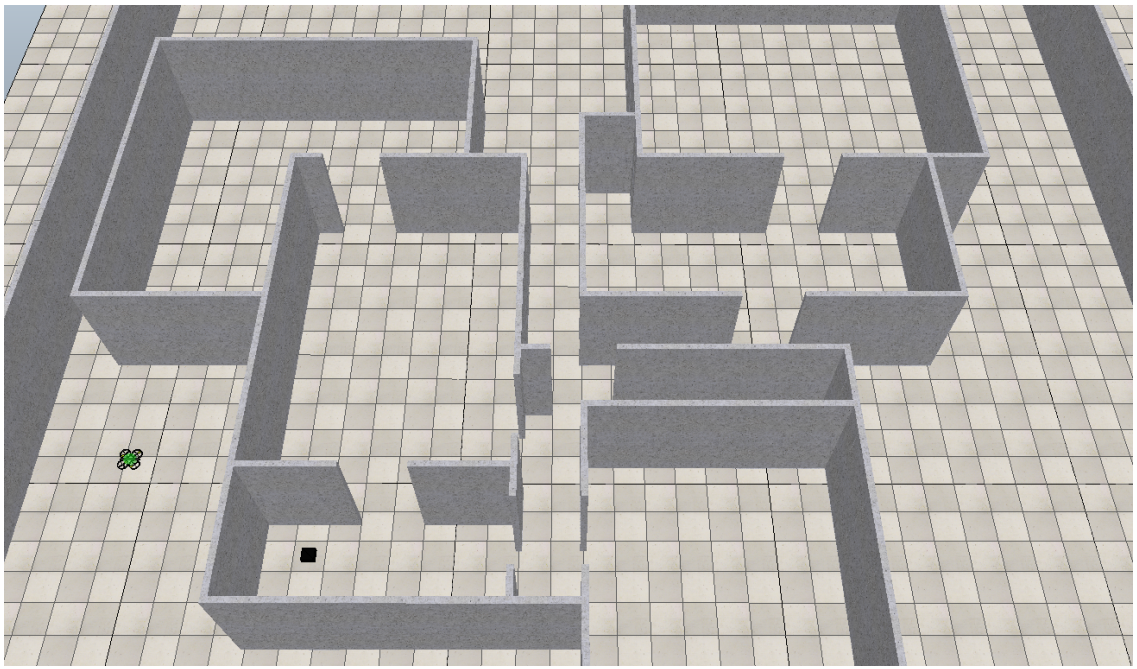
Maze Solver Quadrotor

Diogo Alexandre Martins



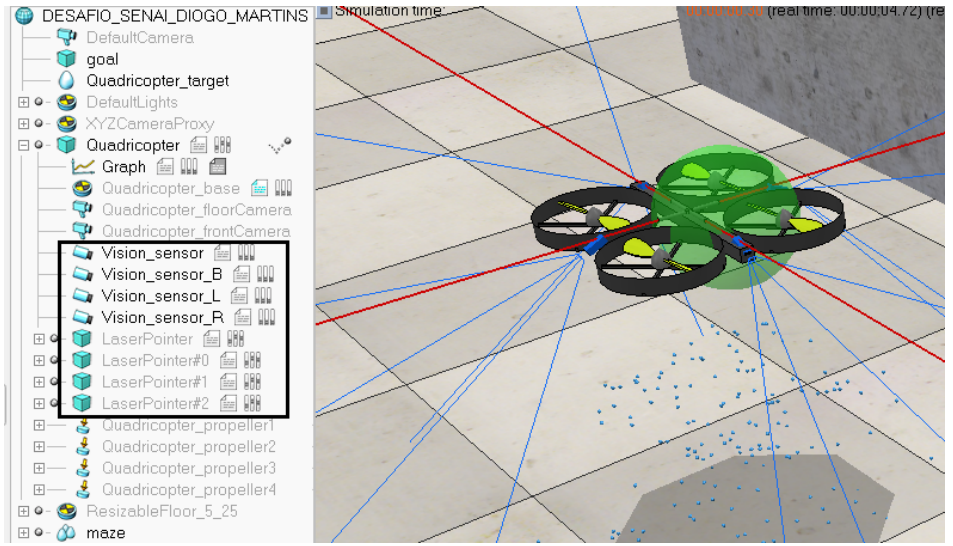
29 de outubro de 2019

Summary

Summary

Using Columns

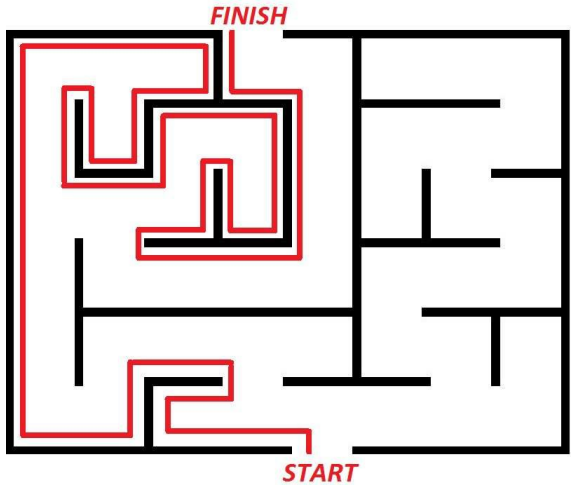
- Find a black box
- Avoid walls
- Laser sensor
- Vision sensor



Summary

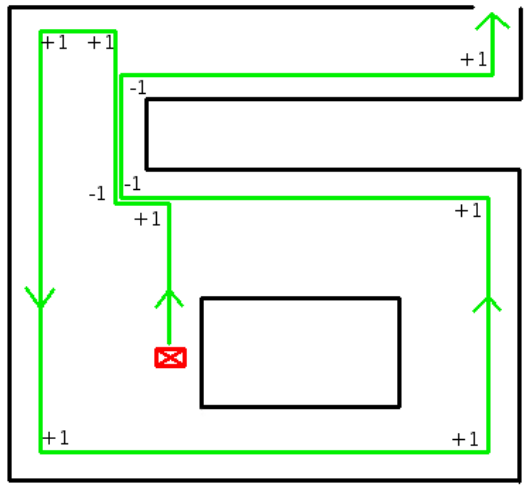
Maze Solving Algorithm: Wall Follower

- Left-hand rule or the right-hand rule
- Guaranteed solution for simply connected mazes



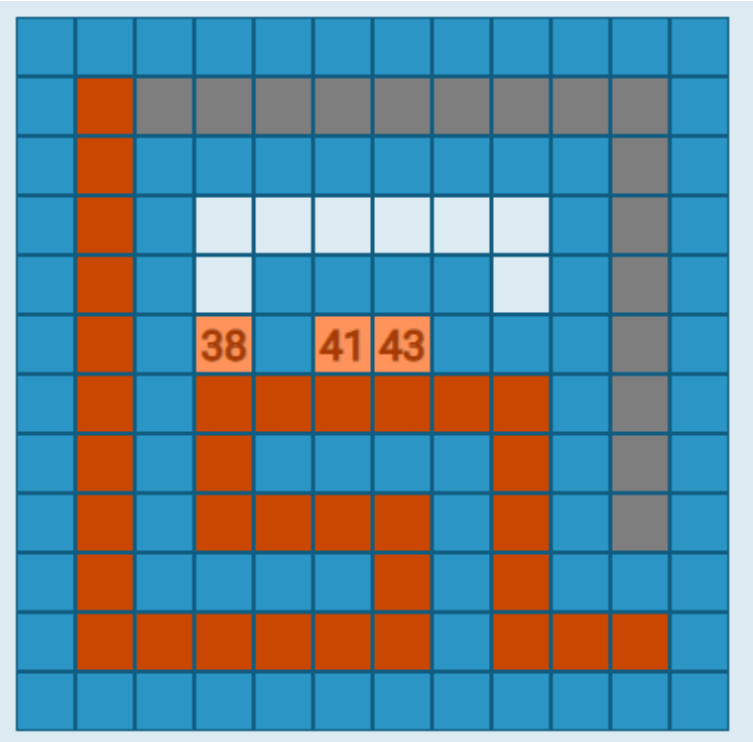
Maze Solving Algorithm: Pledge Algorithm

- Similar to Wall Follower
- Angles turned are counted
- Guaranteed solution for disjoint mazes
- Does not work if the maze is surrounded by walls



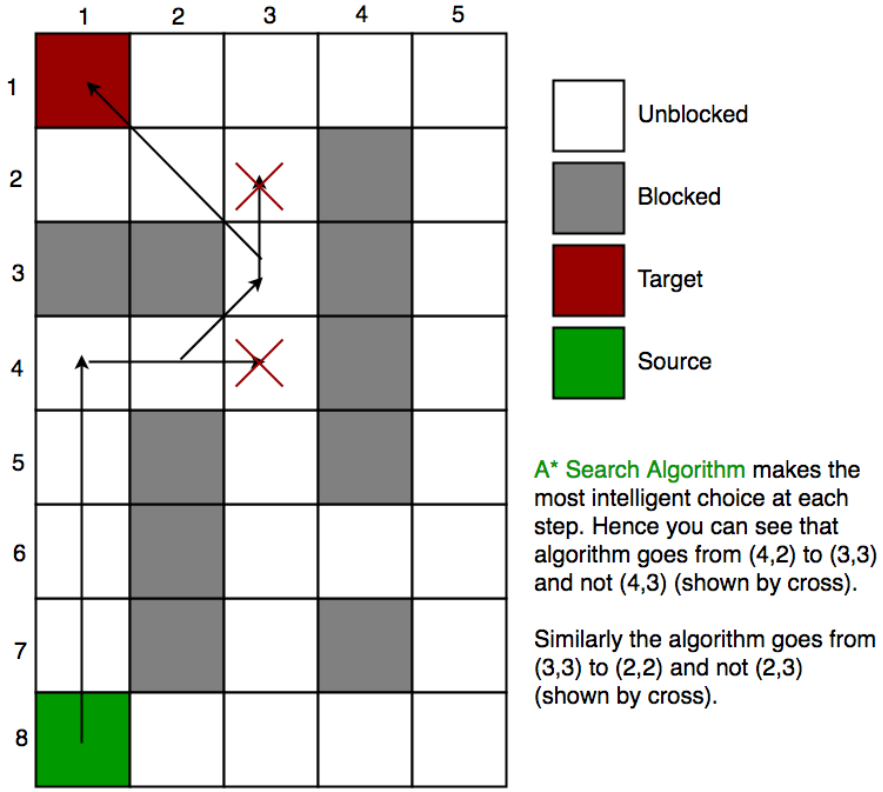
Maze Solving Algorithm: Depth-first Search

- Explores as far as possible along each direction
- Stores the explored path for backtracking
- Not optimal or guaranteed to find the best solution



Maze Solving Algorithm: A* Search Algorithm

- Popular technique used in path-finding
- Requires a destination
- Score = g + h
- g = movement cost to move from source to a given square
- h = estimated movement cost to move from that given square to the final destination (Manhattan Distance)



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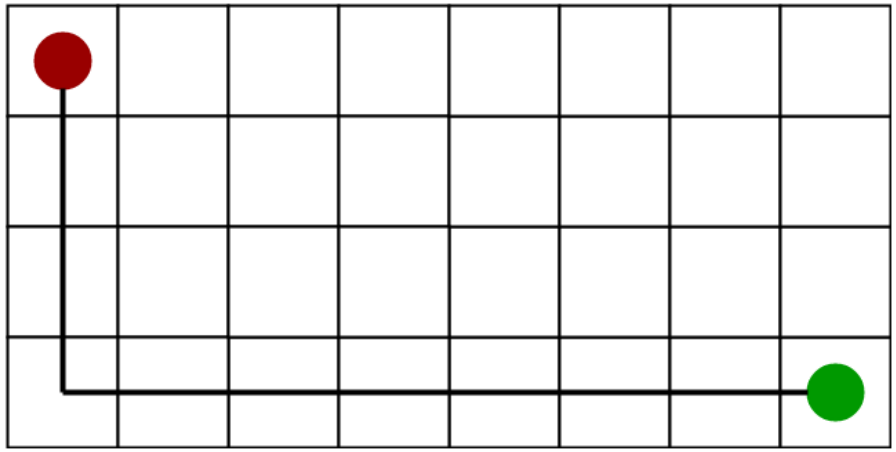
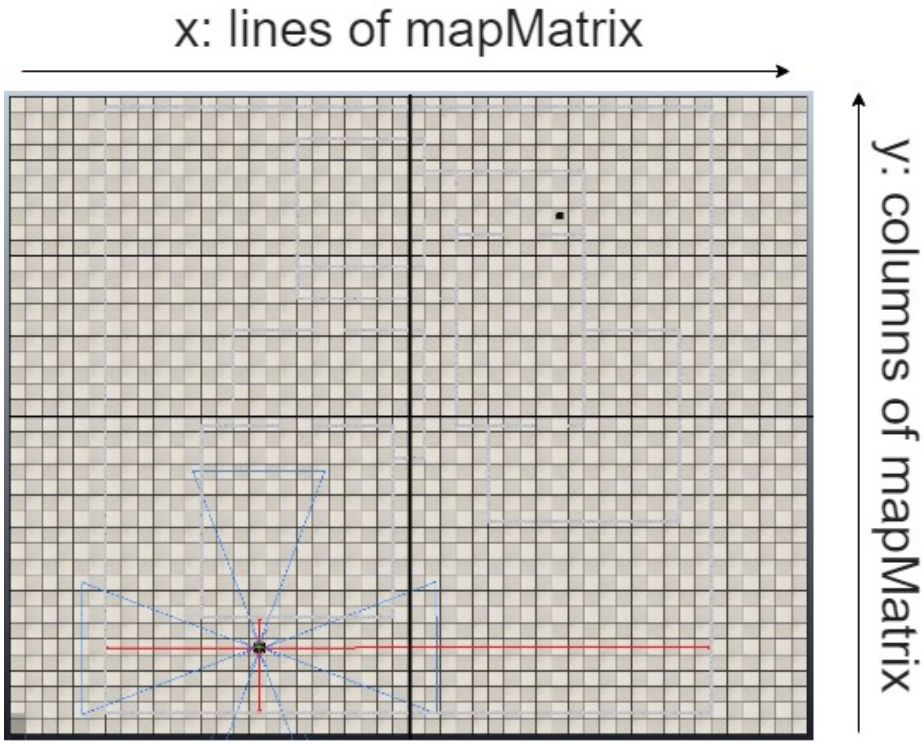


Summary

Mapping the Maze

- Discretize the maze
- Every region represents a matrix position
- Requirement for applying maze solving algorithms



Mapping the Maze

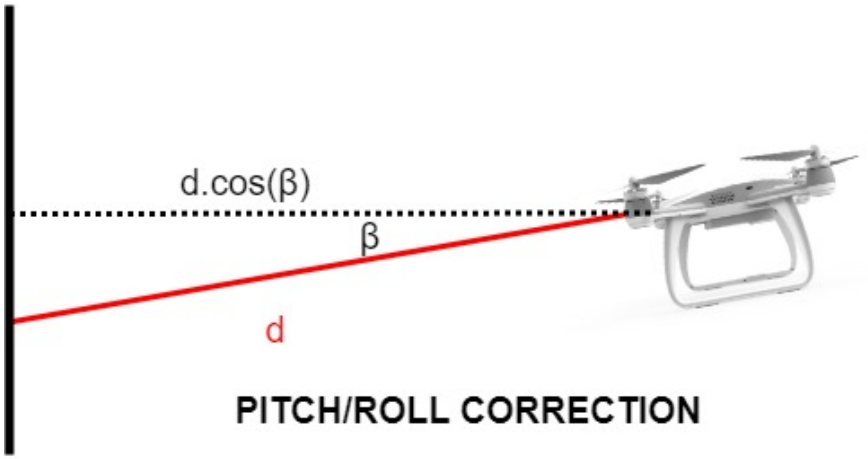
Region status

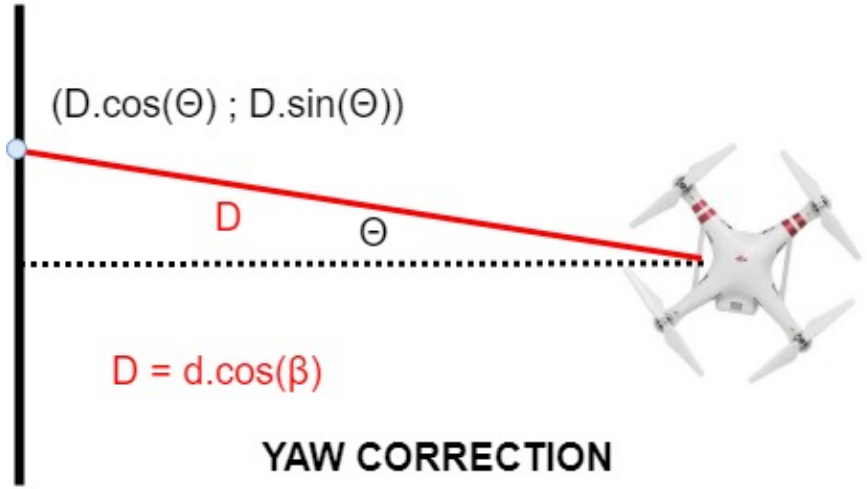
- Unknown: 9
- Visited: 2
- Visiting: 1
- Obstacle: 3

mapMatrix

9	9	9	0	0	9
3	9	9	0	0	9
3	3	0	1	0	0
3	3	0	2	0	0
3	3	0	2	2	0
3	9	9	3	2	0

Mapping the Maze





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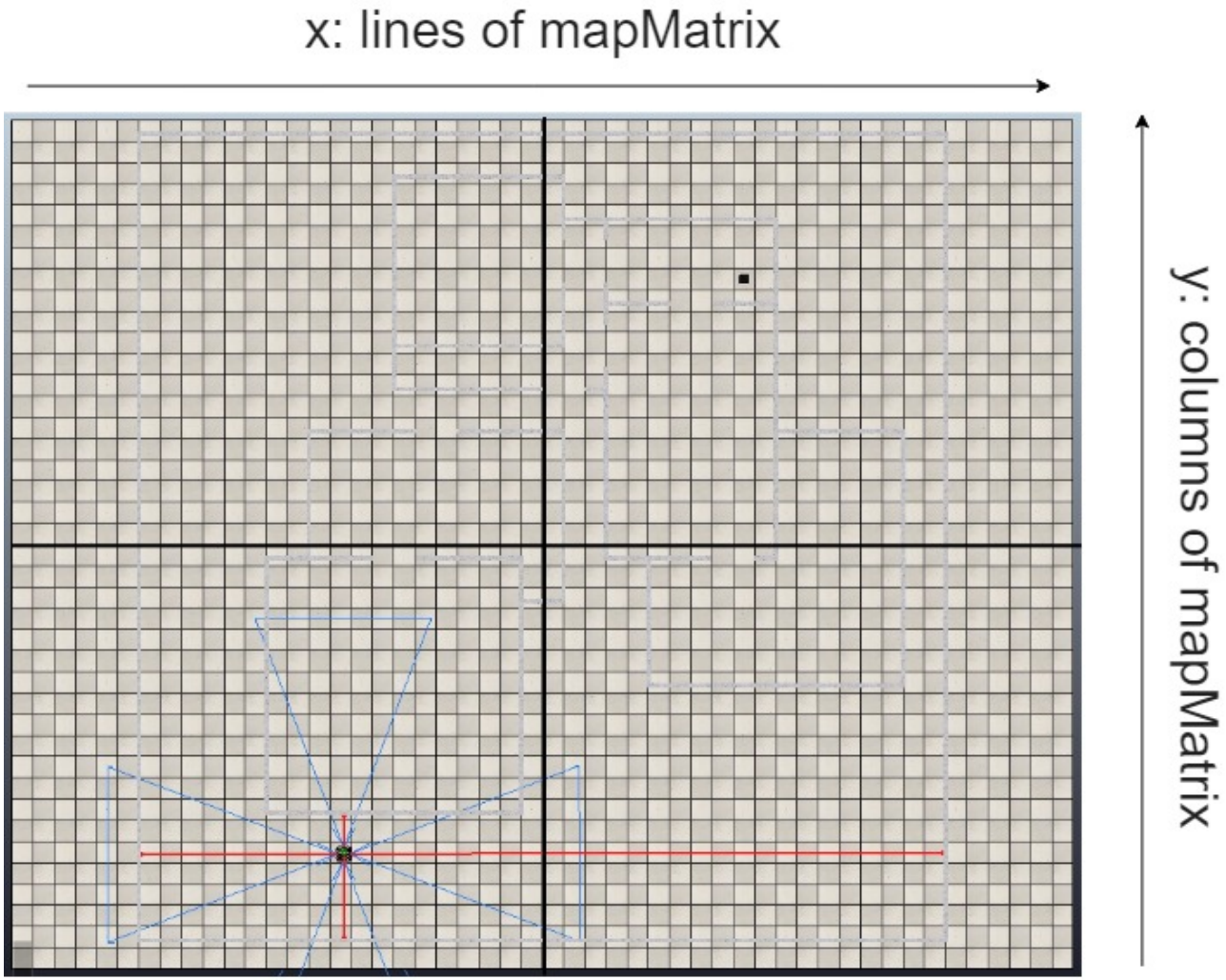

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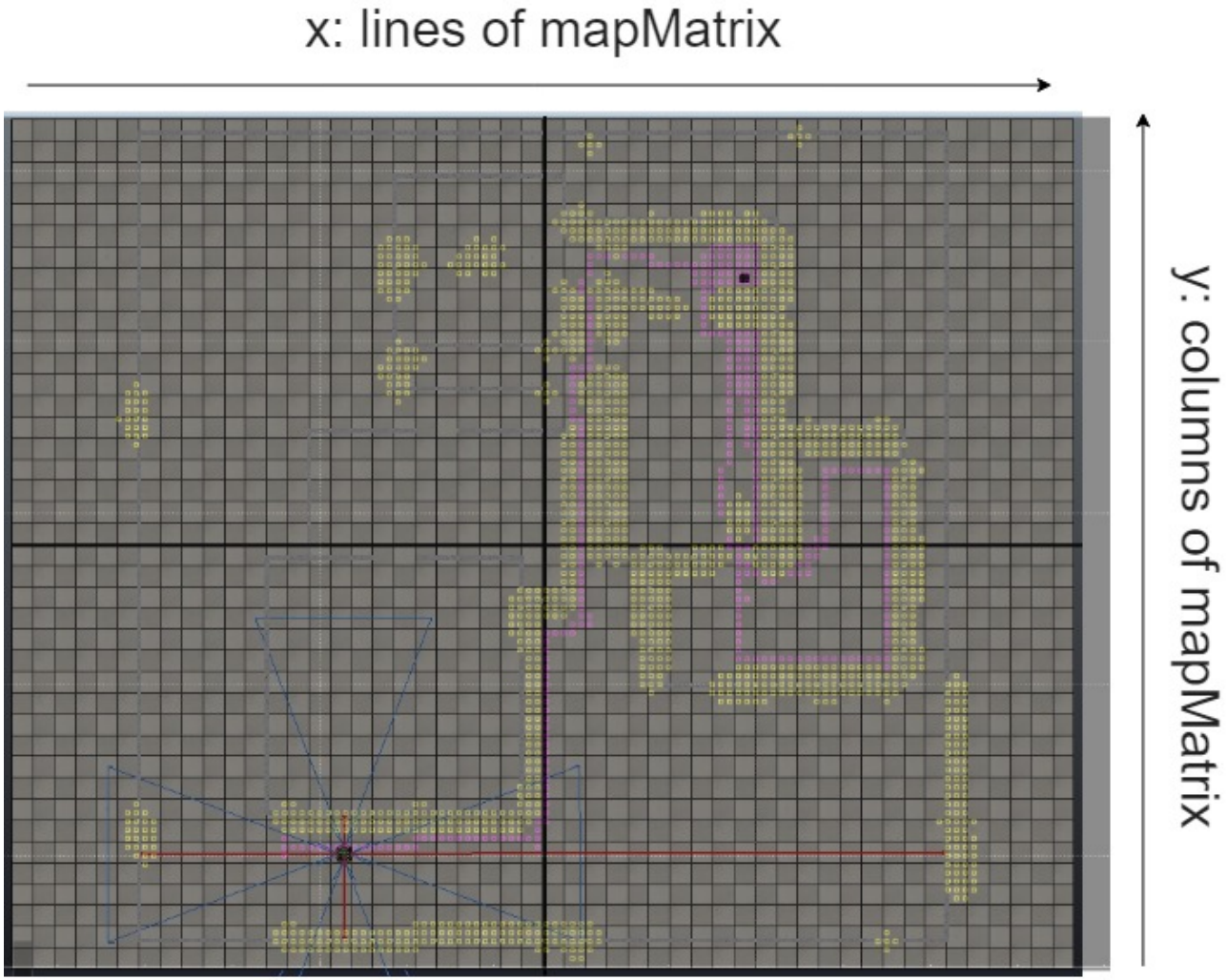

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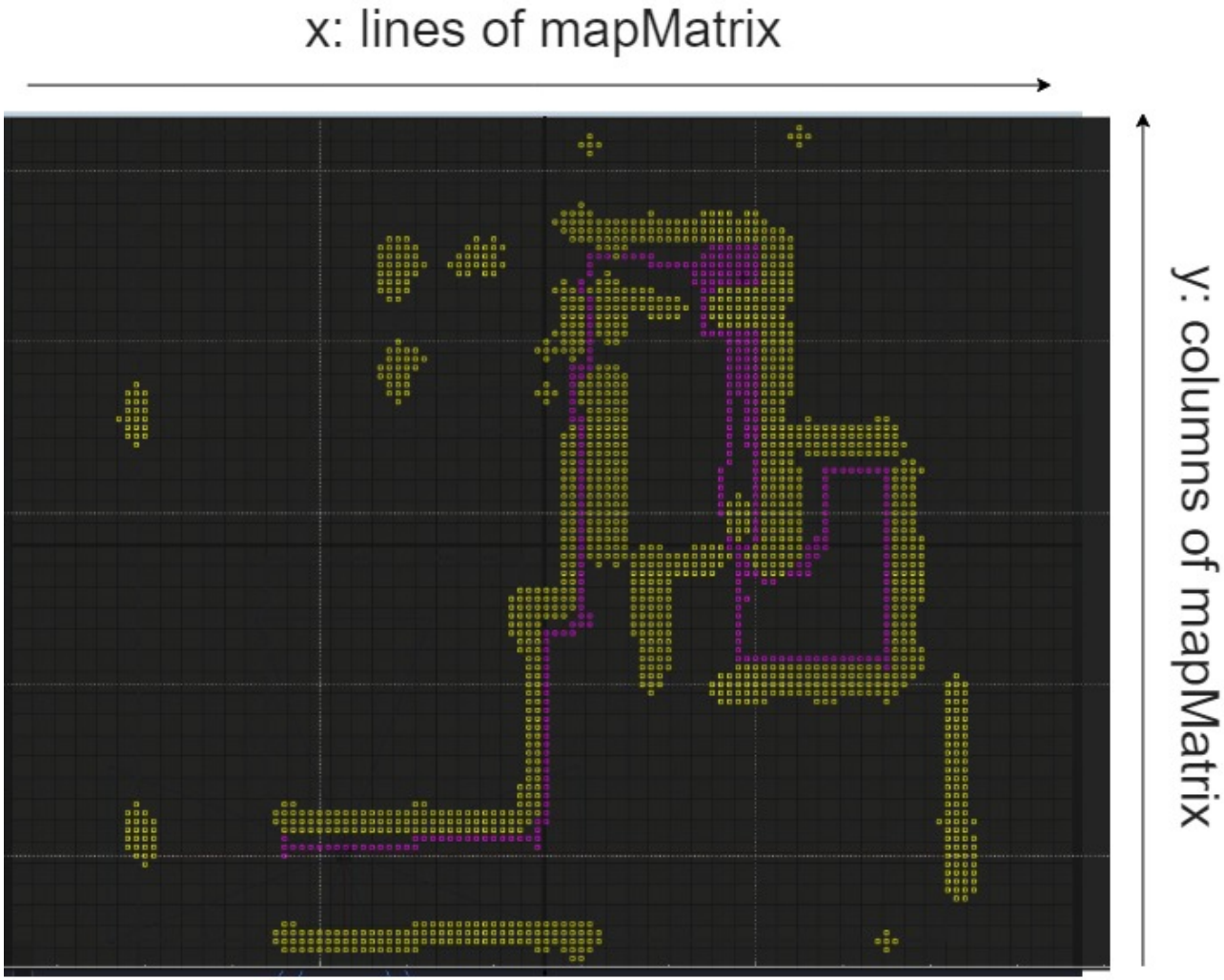
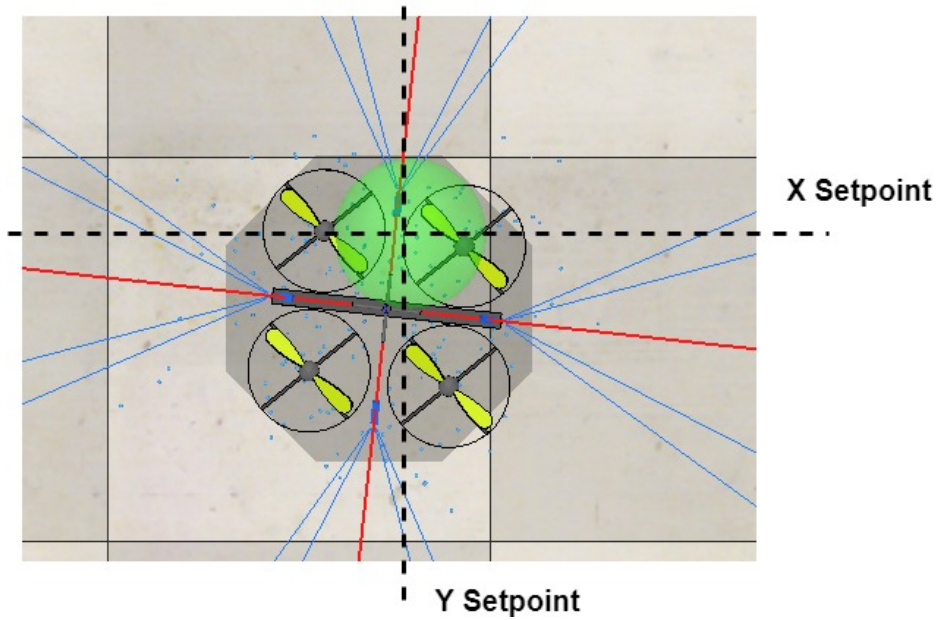


Summary

Control Tuning and Movement Restriction

Horizontal Control and Yaw Control

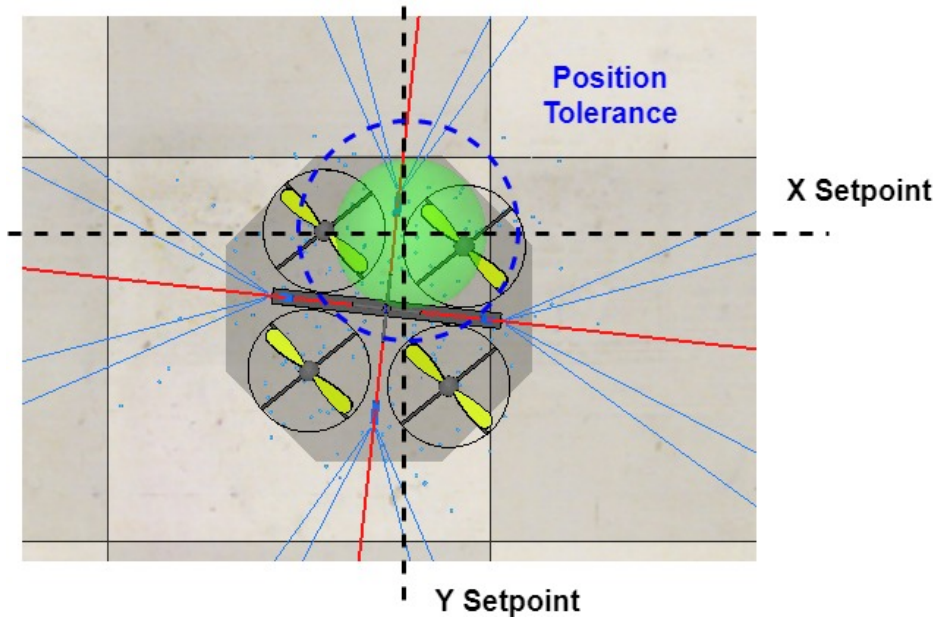
- Added integral action to eliminate offset
- Increased derivative action to reduce overshoot



Control Tuning and Movement Restriction

Movement Restriction

- Position tolerance
- Velocity tolerance
- Reset integral action within the tolerance region

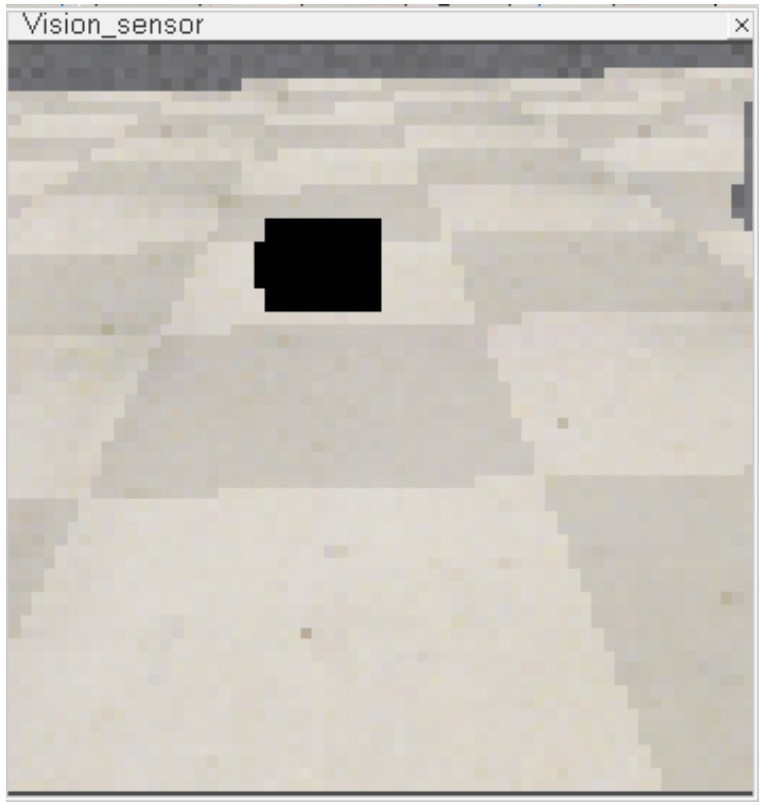


Summary

Image Recognition

Used filters

- "Binary work image and trigger"
- "Edge detection on work image"
- "Blob detection on work image"



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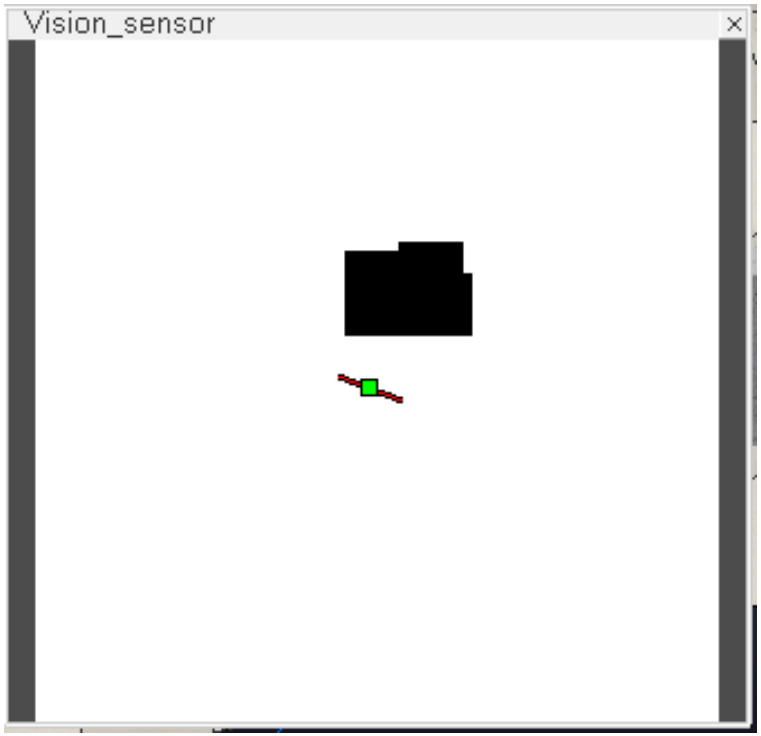

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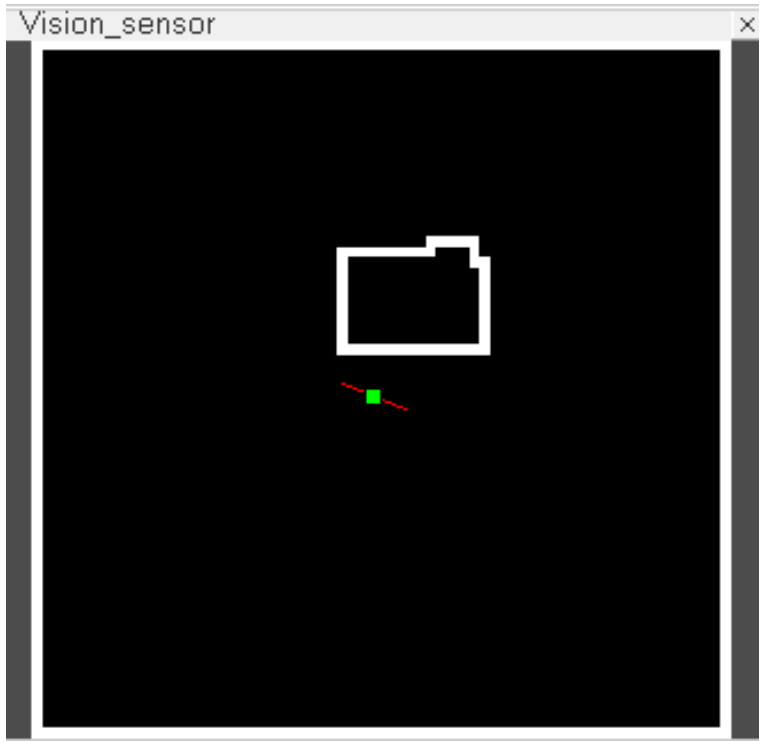

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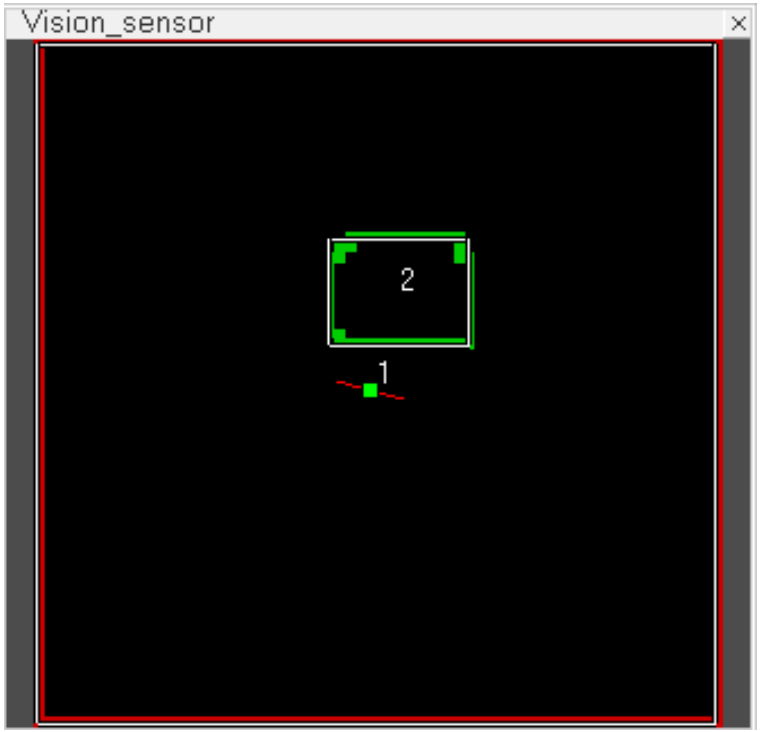
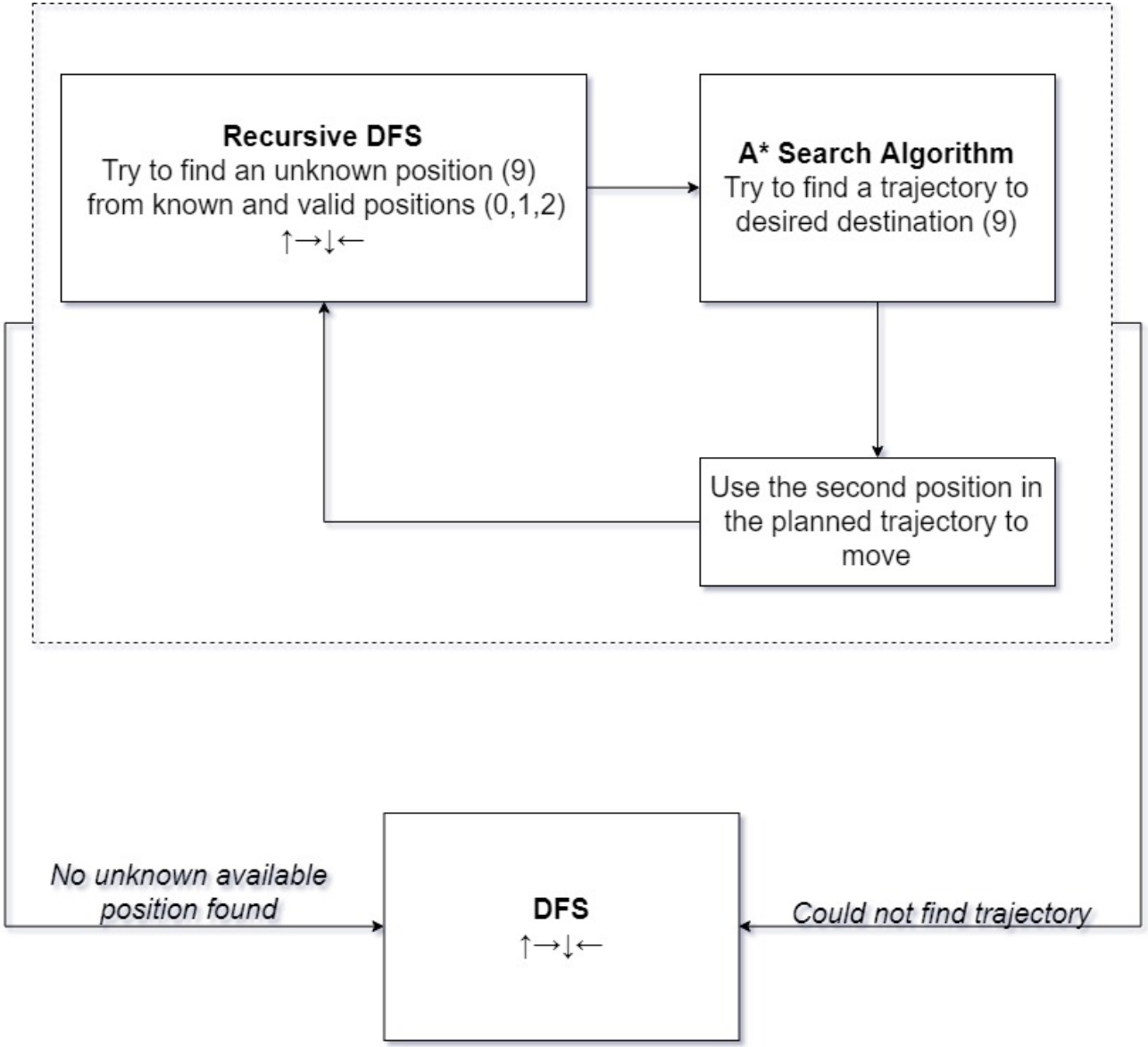


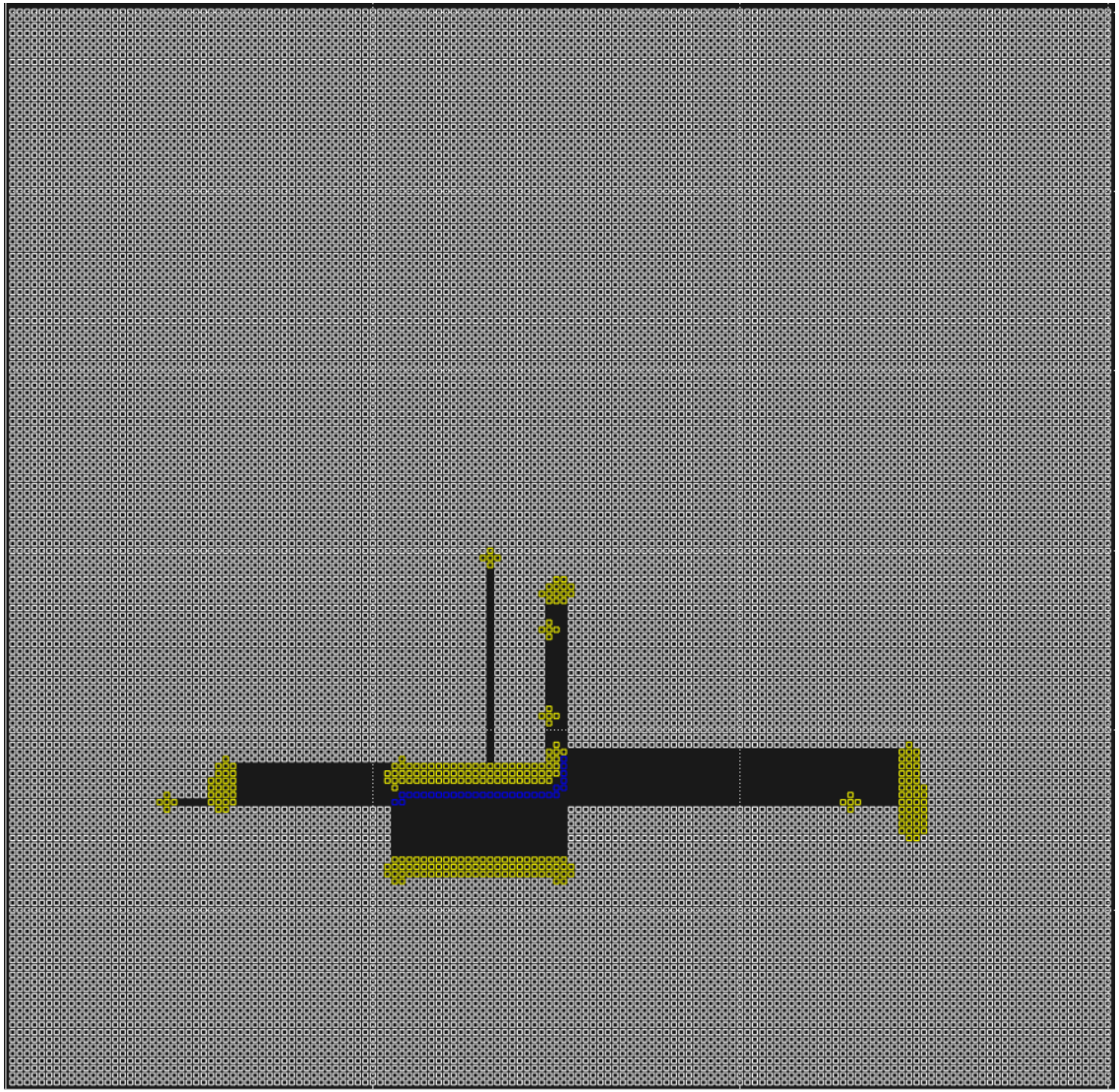
Summary

Final Strategy



Summary

Results



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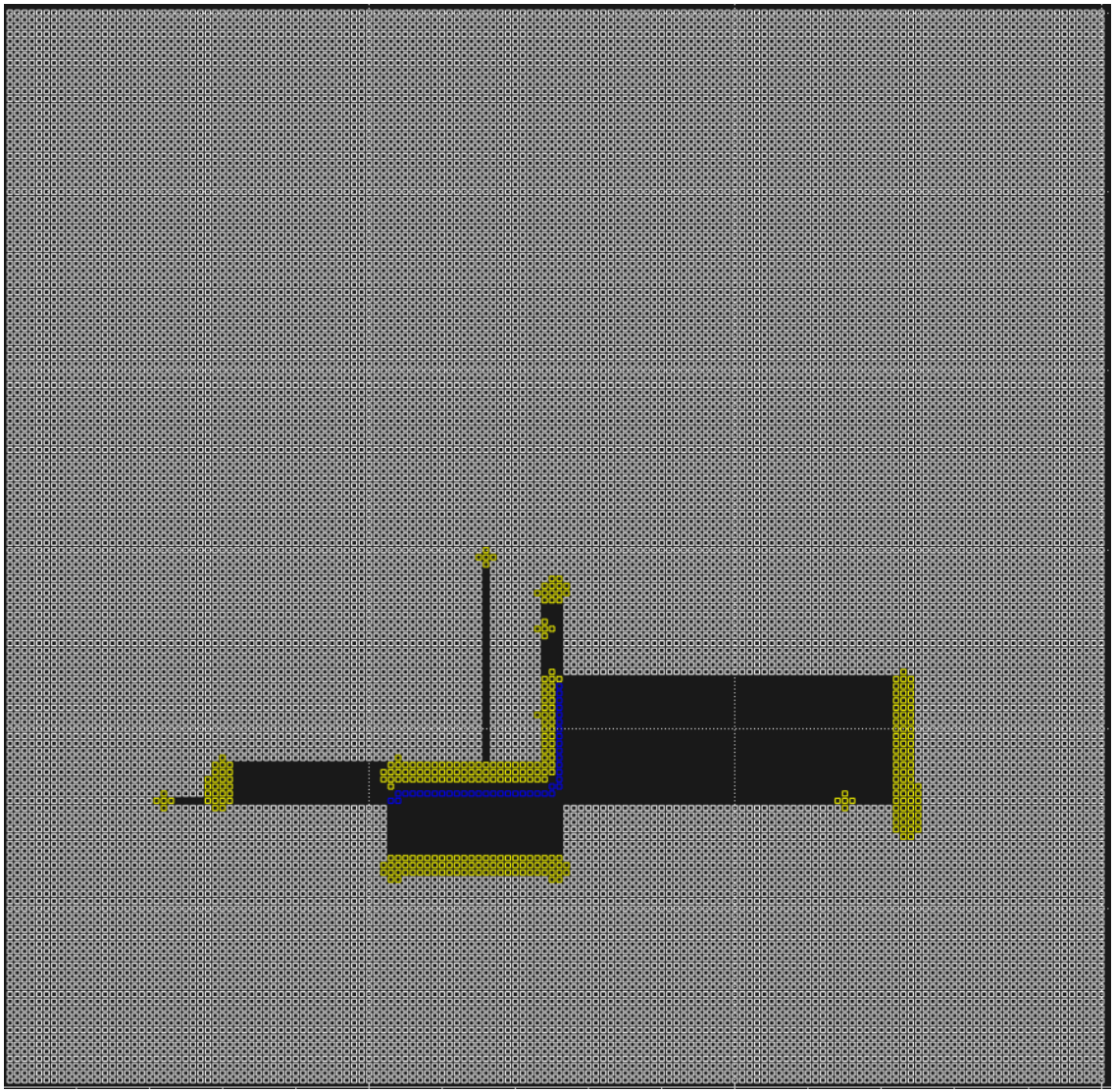

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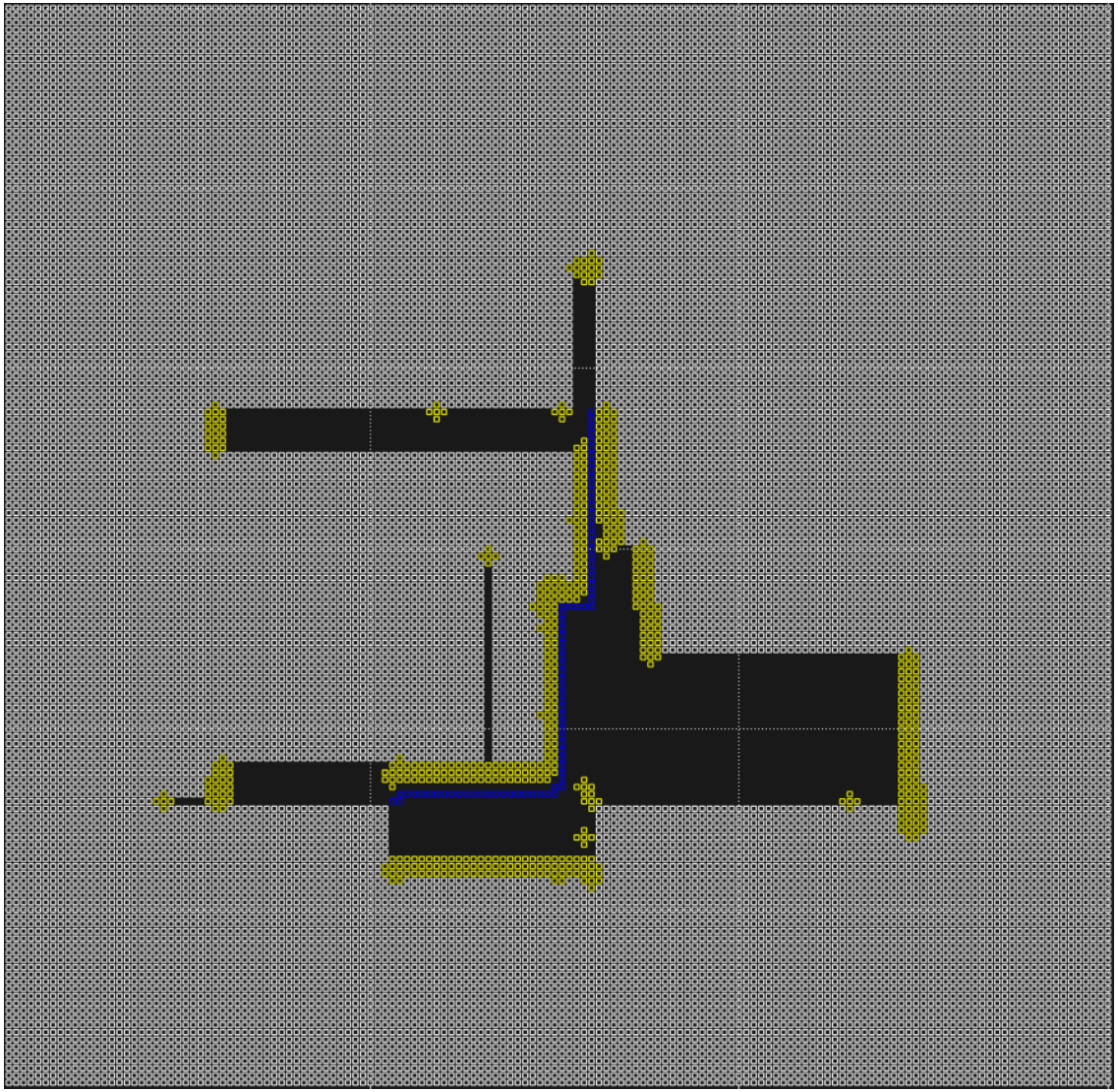

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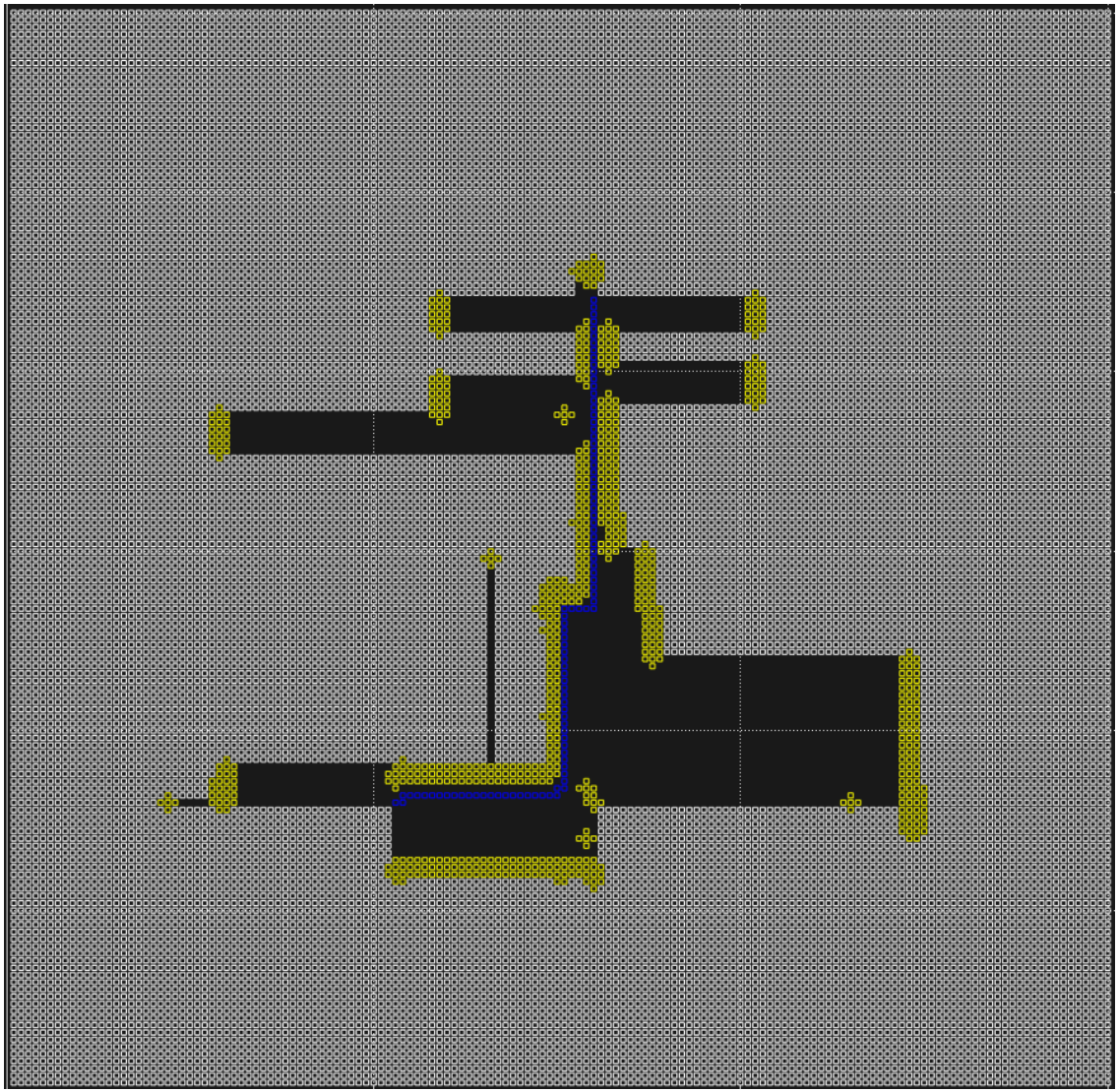

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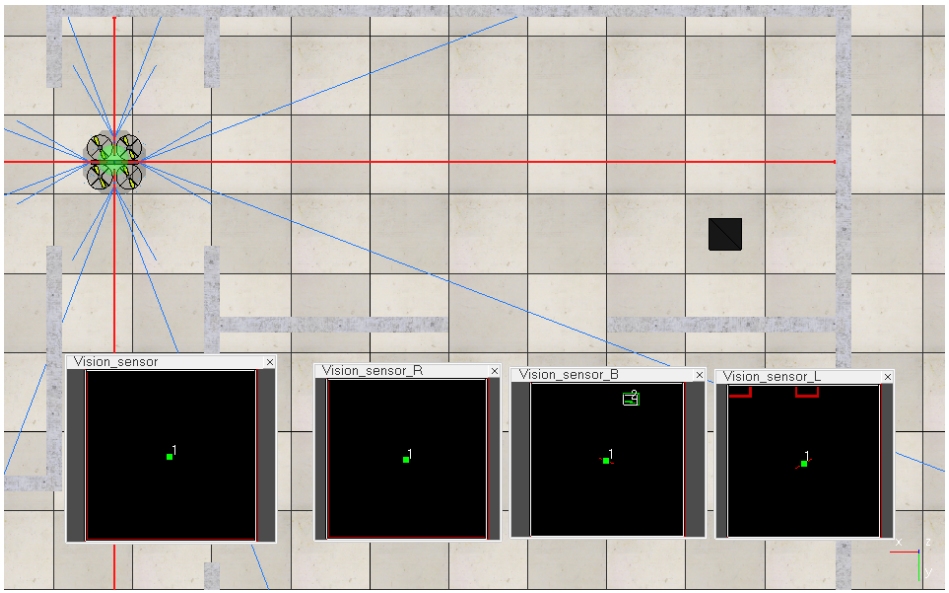


```
Back sensor: Goal on sight

Back sensor: Goal on sight
Step 1 >> 80, 109
Step 2 >> 81, 109
Step 3 >> 81, 110

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Maze Solver Quadrotor

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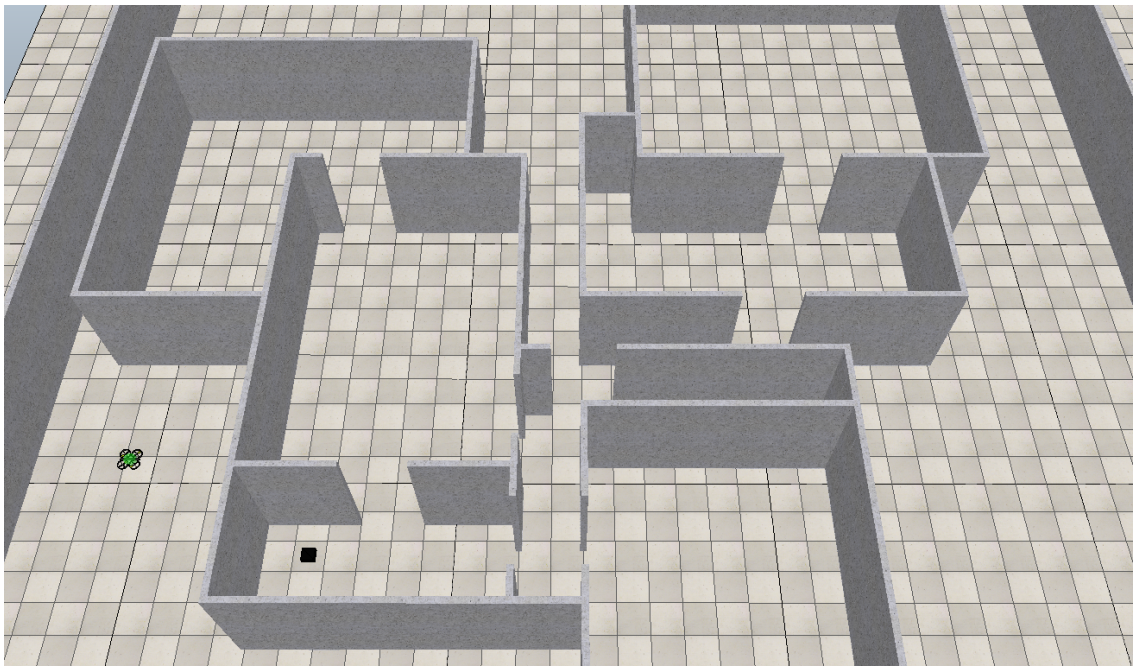

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