Michigan Technological University

MEEM 4707: Autonomous system

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Lab - 7

By

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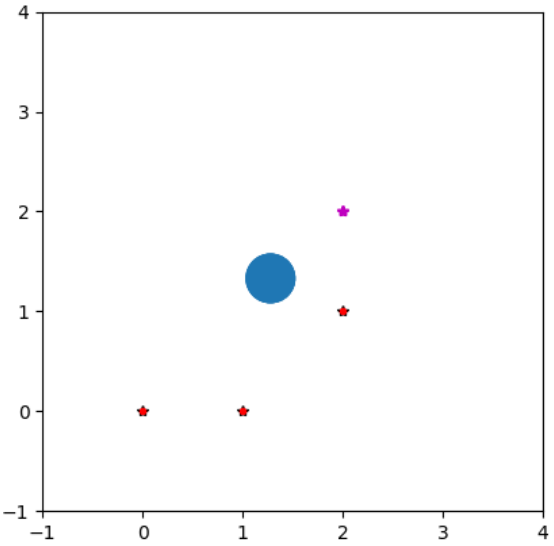
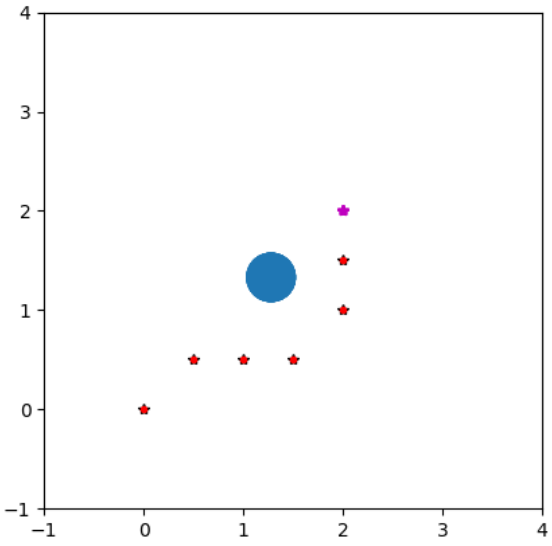
Problem 1

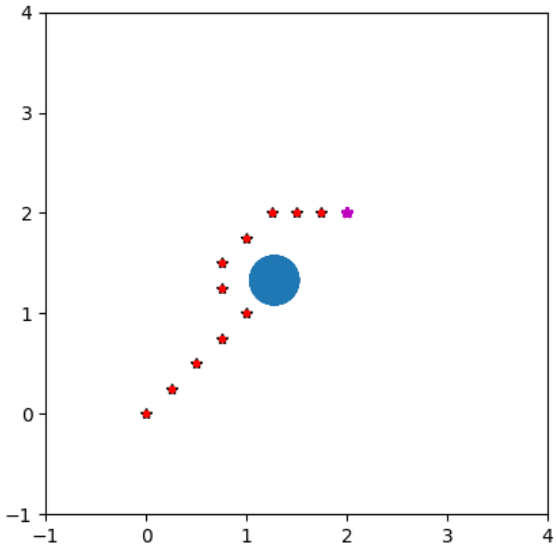
Start: (0,0)
Obstacle/Radius: (1.28, 1.33) / 0.25m
goal:(2,2)

Plan paths using the potential field method from the initial location to the goal position using the three grid sizes below. Submit the figures of generated paths for all three cases. Summarize your observation about each path. Explain how the resolutions cause differences.
Note: Please use Spyder to write this Python script.

(1) Make the grid size as 1m
(2) Make the grid size as 0.5m
(3) Make the grid size as 0.1m







While there was a somewhat obvious granularity to the paths with lower resolutions, the net result was that the path was able to get closer to the object without intersecting it as the resolution increased. Interestingly, however, the path length did actually increase at 0.25 m grid size, while the 0.5 and 1.0 paths were the same length. This was the result of getting closer to the object (introducing the need for the path to move away from the goal), however this is not optimal for a robot compared to the first two paths.

To resolve this in the future, an additional optimization goal should be added minimizing the overall path length. If the controller is only ever going to be used for this one condition however, then it would make sense to tune the zeta/eta gains so that the algorithm naturally finds the most optimal paths for that exact setup. If there are any modifications to the path, though, this will no longer have the same path-shortening effect; in this case, the path-length optimization would be needed.