

Robot Perception Course Project

Violet Navigators

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Description of the Problem and References (4pt)

- In this project, we need to navigate the robot to find two targets, from the visual informations provided through the two different single-goal mazes.
- In this problem, for the initial stage we need to perform the exploration, from the provided exploration data for each maze separately.
- After the exploration, the final stage i.e. the navigation stage starts, when we need to navigate the robot to the target image, in the maze, and achieve the goal in the fastest, and shortest way.

References:

- [The Revisiting Problem in Simultaneous Localization and Mapping: A Survey on Visual Loop Closure Detection.](#)
- [ORB-SLAM: a Versatile and Accurate Monocular SLAM System](#)
- [g2o: A General Framework for Graph Optimization](#)
- <https://www.thinkautonomous.ai/blog/loop-closure/>
- <https://ieeexplore.ieee.org/document/7827292>

Maze Mapping Phase

Method 1

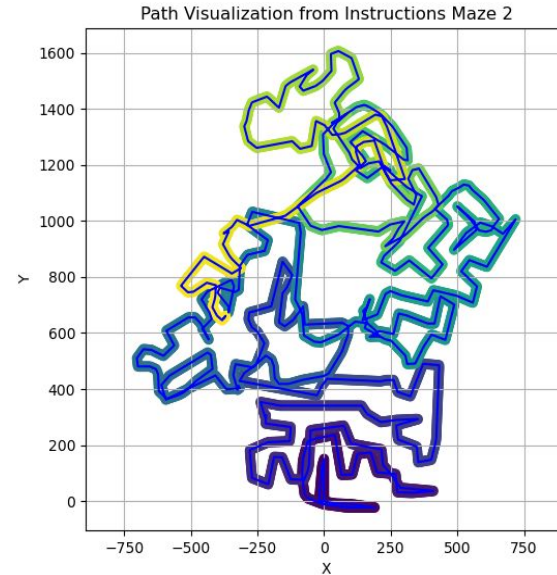
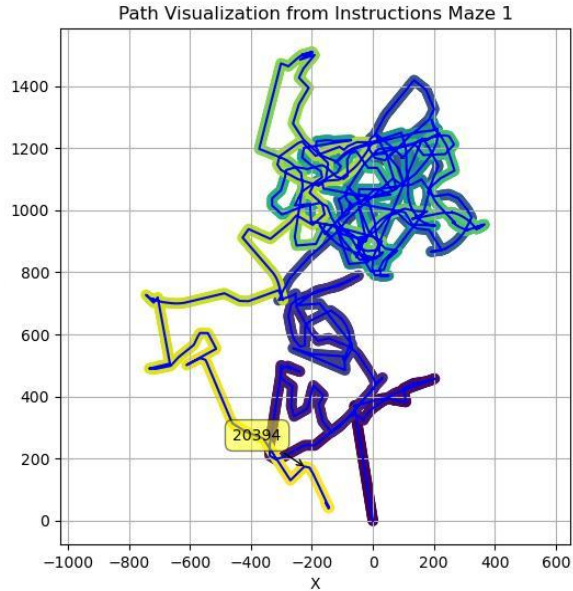
- We created a maze using the raw instructions
- Used ORB descriptors and BFMatcher to perform Pose Estimation
- Used the pose estimation to get an accurate representation of maze

Method 2

- Utilized maze images and instructions from the exploration data.
- Mapped the maze using ORB and BFMatcher along with the exploration instructions to generate the path of each maze.
- Treated poses as vertices and constraints as edges to map the entire maze using G2O, a graph optimization technique.
- Set constraints based on instructions, pose estimation, and loop closure.
- Assigned higher weightage to loop closure to enhance the map's accuracy.

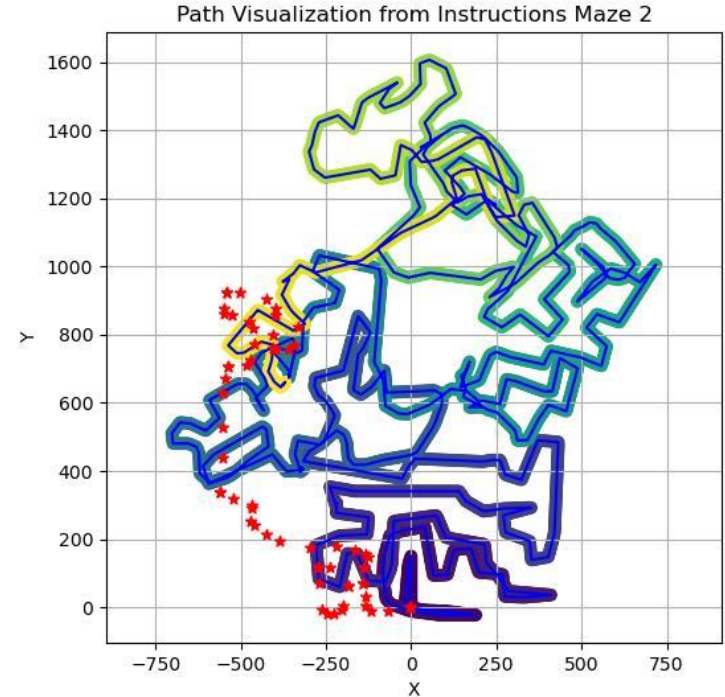
Maze Mapping Phase

We compared and chose the first method since it gave better results



Navigation Phase:

1. Records the path that the robot is following in the maze while exploration
2. We can automate the traversal of the robot in the navigation phase after the initial exploration
3. The robot can traverse the final maze autonomously, and the path can be seen (red markers)



Video Submission:

