Path Planning and Tracking for Autonomous Cars

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Introduction

- Autonomous vehicles have the potential to increase safety, efficiency, and reliability in transportation services.
- Given the starting position and orientation of the car, the objective is to navigate to a target position and orientation

Methods

Path Planning

- Utilize a Dubins path to find fastest route between a starting position & orientation and a target position and orientation shown in figure 1
- Dubins path contains a fixed turn radius and can consist of 3 segments

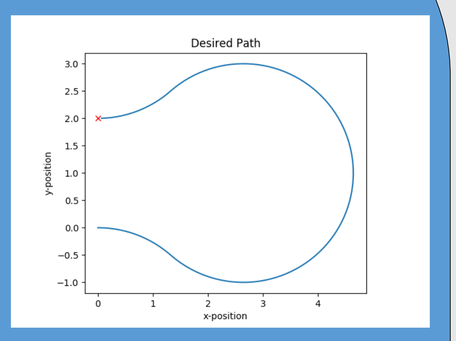

Figure 1

Path Tracking (Simulation)

- Run simulation where proportional controller is implemented to adjust the turn and follow the path as accurately as possible as shown in figures 2.1-2.3

Path Tracking (Real-World)

- Transfer values from simulation to hardware and try to mimic path trajectory

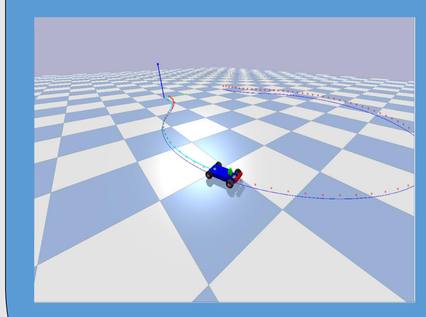

Figure 2.1

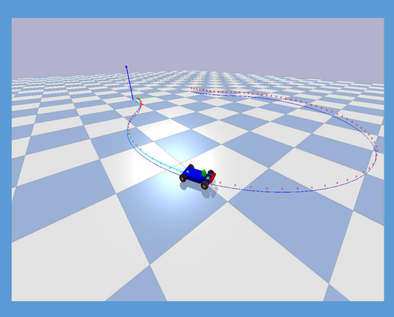

Figure 2.2

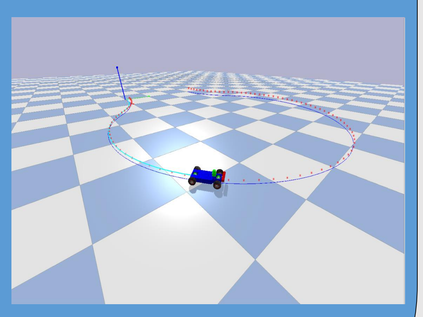

Figure 2.3

Hypothesis

- The car will not identically match the simulation since there exist external factors that can affect the trajectory of the car in the real-world.

Results

Simulation

- In Figure 3.1, the car's actual path was mapped versus its target trajectory
- Successful tracking since both paths are very similar

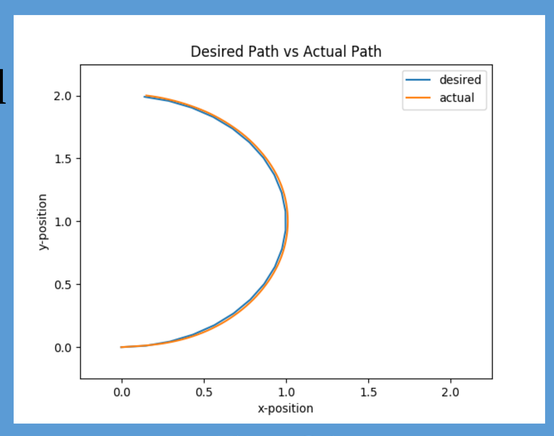

Figure 3.1

Real World

- In figure 3.2, desired and actual are minimally offset
- Expected some difference but not this little

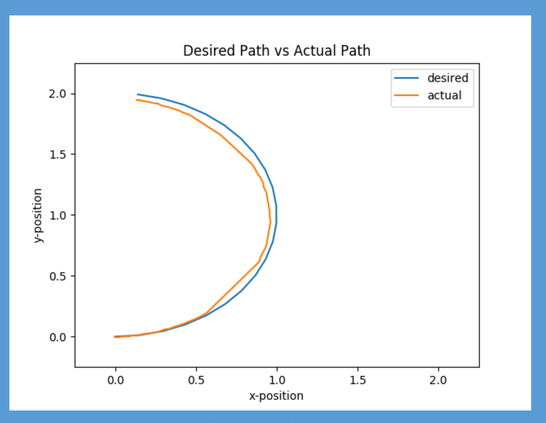

Figure 3.2

Future Research

- Use multiprocessing to live track the real car and make it more accurate
- Implementing LEDs to facilitate car tracking and sharpen precision

Acknowledgements

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