Lab 7:
Advanced Racing I

Team 2 • 14.06.2022

Outline

- Path Planning
- Tuning and Optimisation
- Performance on Hardware
- Goals for lab 8

Progress - Path Planning

Gradient-based planner

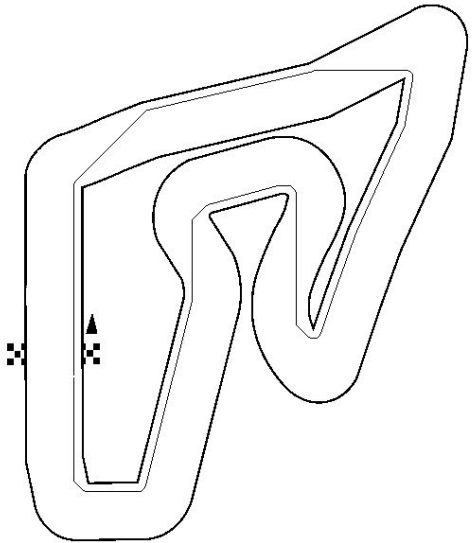
- Instead of considering neighboring pixels follow gradient of distance
- Overall shorter paths possible (as not only multiples of 45°)
- Inherent smoothing by pure pursuit lookahead

Improvements

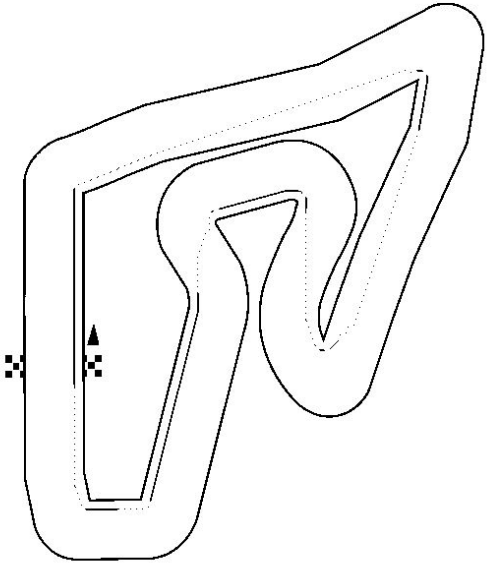
- Smoothening by considering previous & next gradient
- Add wall distance to field → drive far from the wall when it is only a small detour
- Logical next step: consider curve radius

Progress - Path Planning

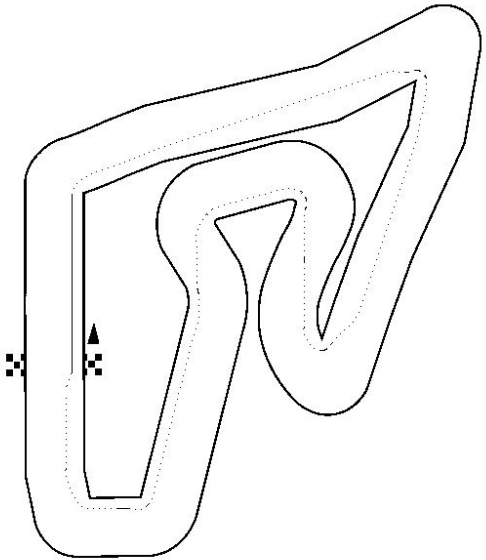
A*



Gradient (shortest path)



Gradient (smoother)



Progress - Tuning and Optimisation

- Speed based on the distance in front of the car
- Minimum and Maximum speed
- Velocity and steering gain

Disparity Extender

This approach worked pretty well

Pure Pursuit

Sharper turns → drifting

Overshooting: Car faces the wall while correcting → slows down

Measured Lap Times

Map	Disparity Extender	Pure Pursuit
f1_aut_wide		
f1_gbr		
f1_esp		
Infhs (SLAM)		

Pure Pursuit is way harder to tune and does not bring notable gains

Measured Lap Times

Map	Disparity Extender	Pure Pursuit
f1_aut_wide	17.75s	18.04s
f1_gbr	43.30s	43.59s
f1_esp	47.71s	48.92s
Infhs (SLAM)	11.32s	9.81s

Pure Pursuit is way harder to tune and does not bring notable gains

Performance on Hardware

Problems with Path Planning

- Outdated dependencies
- Inconsistent SLAM maps
- Bug in path planning on newly slammed maps

Problems with Self-Localization

- Getting the Self-Localization to run on the hardware
- AMCL seems to work poorly with Ackermann drive and faster speeds

Goals for lab 8

1. Try out the MIT particle filter
2. Improve Disparity Extender
3. Smarter velocity calculation