

Project 5 by Tianhua Zhao

Gitlab: <https://gitlab.com/tzhaojustdoit/student1819009>

Motion primitives:

- Developed offline in c++
- Bezier curve:
 - Quintic bezier curve: (0, 0) (20, 0) (40, 0) (60, 3.7) (80, 3.7) (100, 3.7)
 - By observation, these control points result in a smooth curve
- 3 motion primitives:
 - Straight: displacement (10, 0) cost 10
 - Left turn: displacement (100, 3.7) cost 200
 - Right turn: displacement (100, -3.7) cost 200

Graph configuration:

- Discretization : $10\text{m} * 3.7\text{m} * 0.2\text{s} * 3\text{intents}$; about $200 * 3 * 400 * 3 = 720000$ nodes
- First cell's center is at (0,0) in map frame
- Edges represent valid actions. If an action is in collision, no edge is made.
- Flashing headlight is only valid if vehicle is in valid range(30-50m)

Value iteration:

- V is initialized to 10000 for all states except goal states
- Stops when runs out of time: 1 second
- Stops when bellman errors are all less than delta: 1
- In practice, there are about 800 states to value iterate over. It took only 3 iterations to stop(bellman errors are 0)

Collision checking:

- Inner outer circle check, then bounding box check
- Compute cell coverages for obstacles and motion primitives, and do collision with their lower-resolution representations
- Guarantees no collision

Initial delay: 6 seconds. Start ego vehicle 6 seconds later for obstacles to load

Time estimate:

Observation callback: 2 hours

State generation: 5 hours

VI - 2 hours

Update obstacle routine: 3 hours

Building data structure for states, successors for VI: 3 hours

Debugging: 4 hours