# Homework 3

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1. Collision Detection
   For the potential new node, check whether it is reachable through the node that expand it.

2. Parameter Tuning
   The RRT planner with initial parameter setting tends to stuck in the corner places. Increasing the number of sampled points, steering angle limit and path integration time enable the planner explore more the new space, thus enhancing the possibility of jumping out of corner cases.
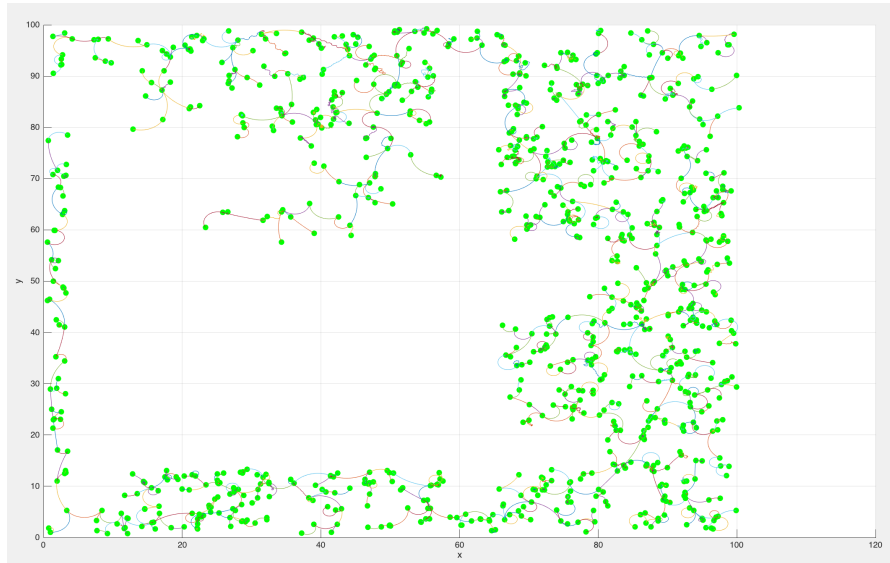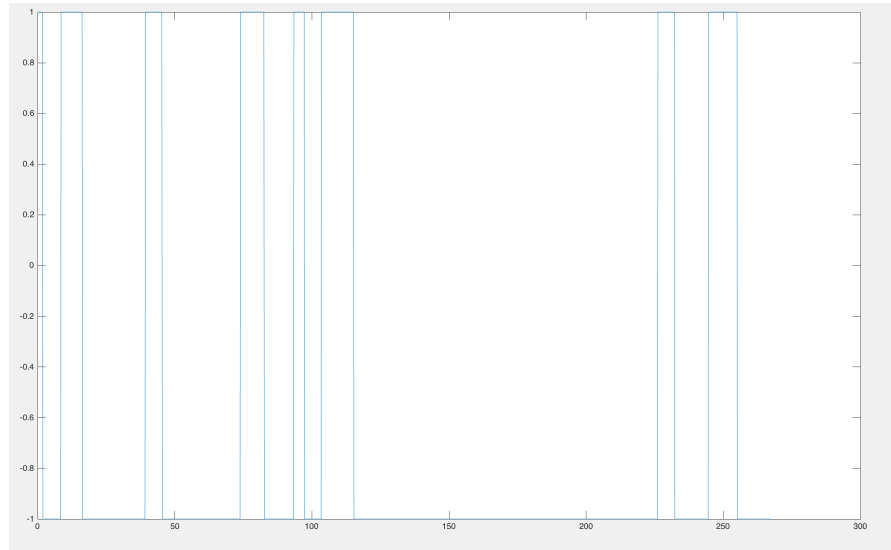
Figure 1: Results of RRT Planning
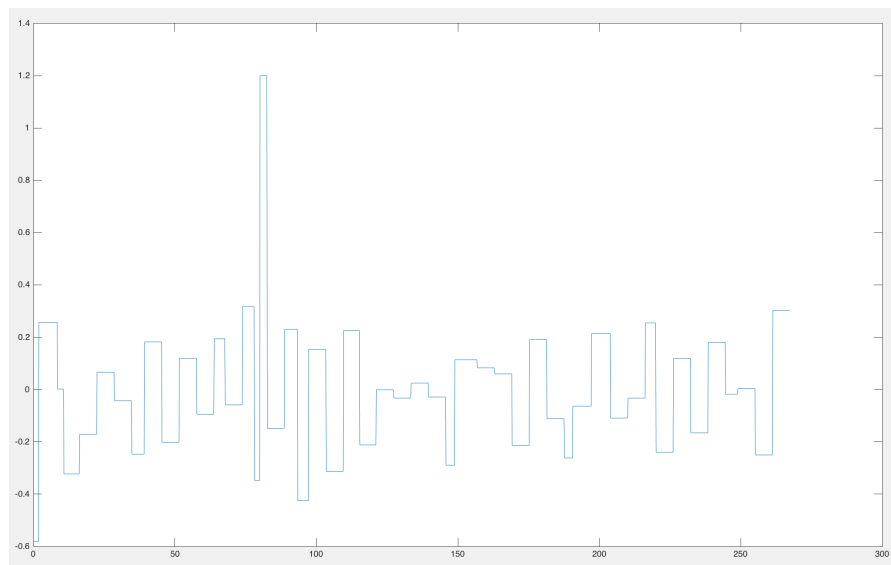npoints:500, tmax;5, steermax:2.4
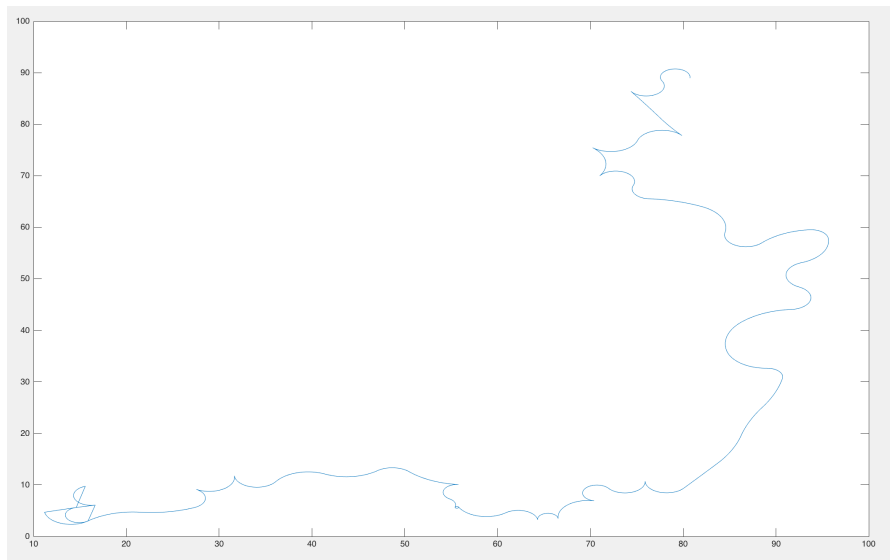
Figure 2: Plot of Path from RRT

3. Plot of Control Input
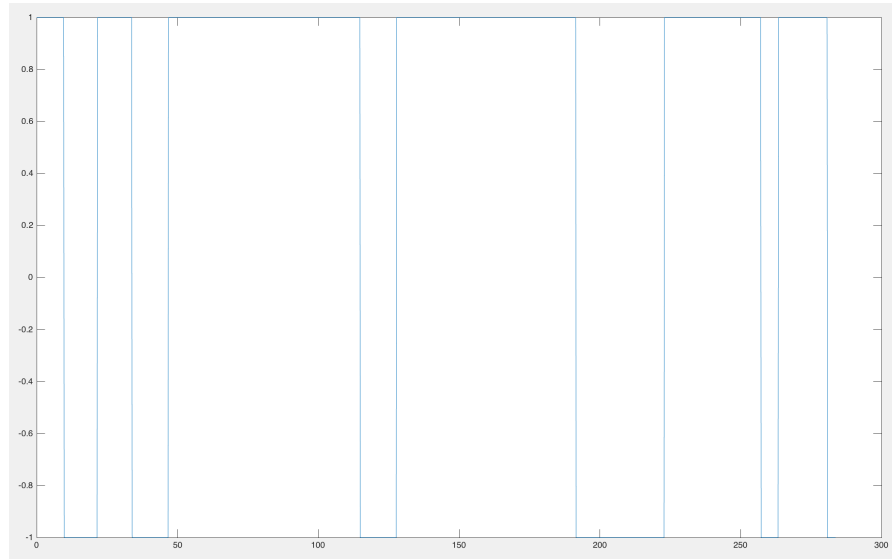   Steering angles are sampled from uniform distribution.

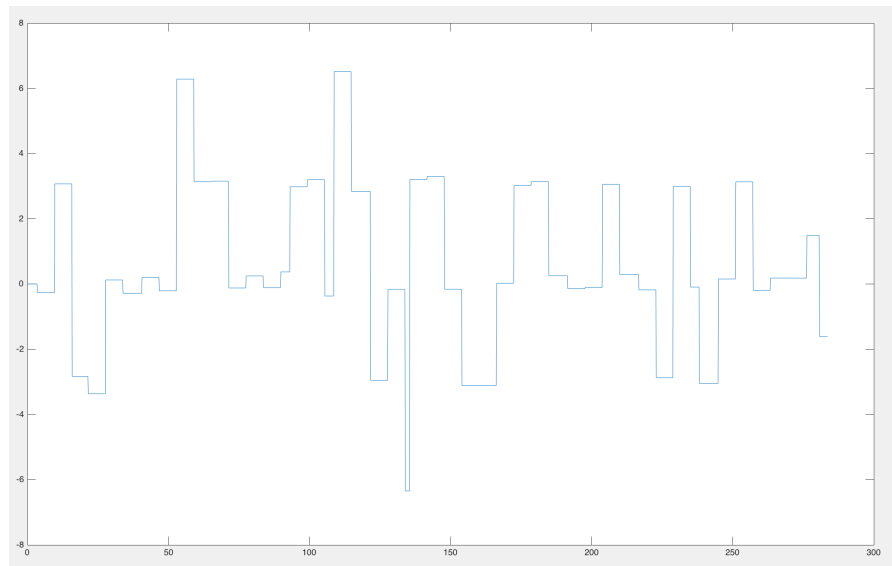**Figure 3:** Plot of Velocity
npoints:500, tmax;5, steermax:2.4

Figure 4: Plot of Steering Angle
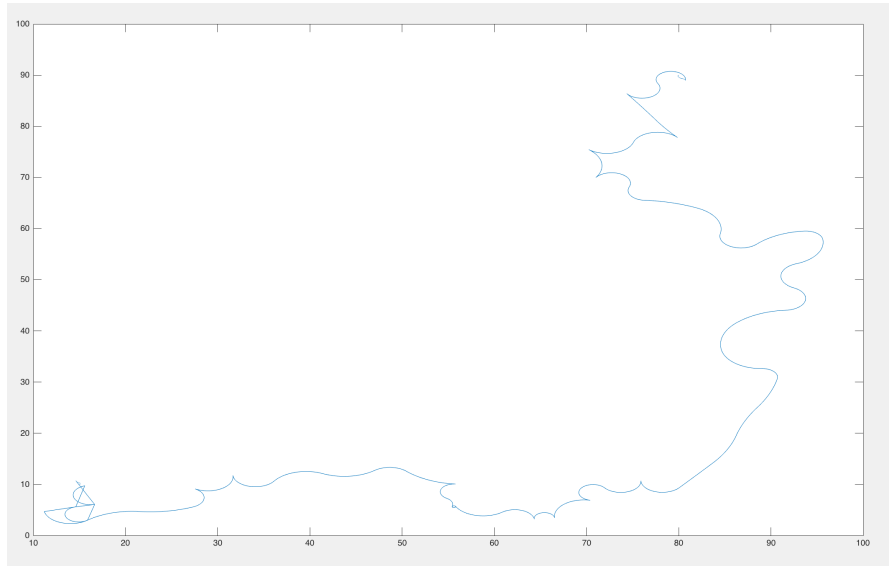npoints:500, tmax;5, steermax:2.4

4. Motion Smoothing
   Steering angles are sampled from Gaussian distribution. The smoothed path has fewer velocity switches and more "gentle" curve.
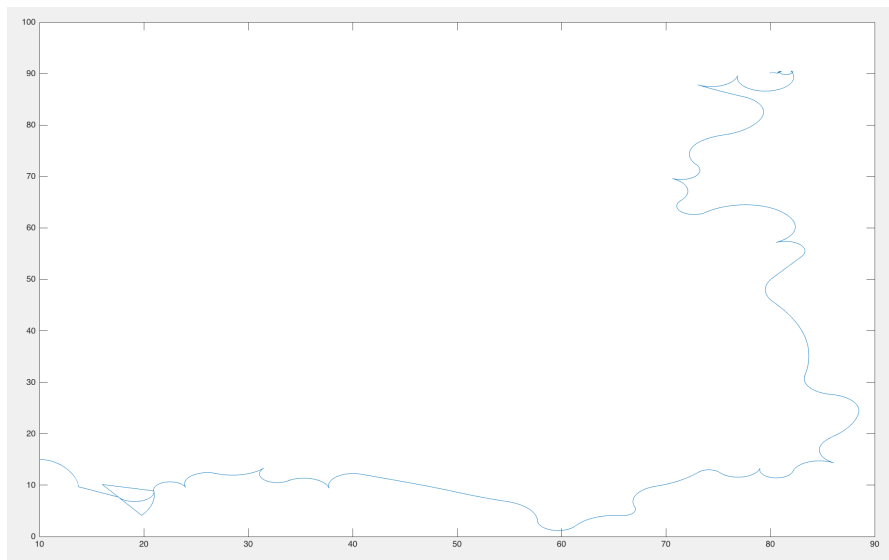
Figure 5: Plot of Velocity "Gaussian"
npoints:500, tmax;5, steermax:2.4

Figure 6: Plot of Steering Angle "Gaussian"
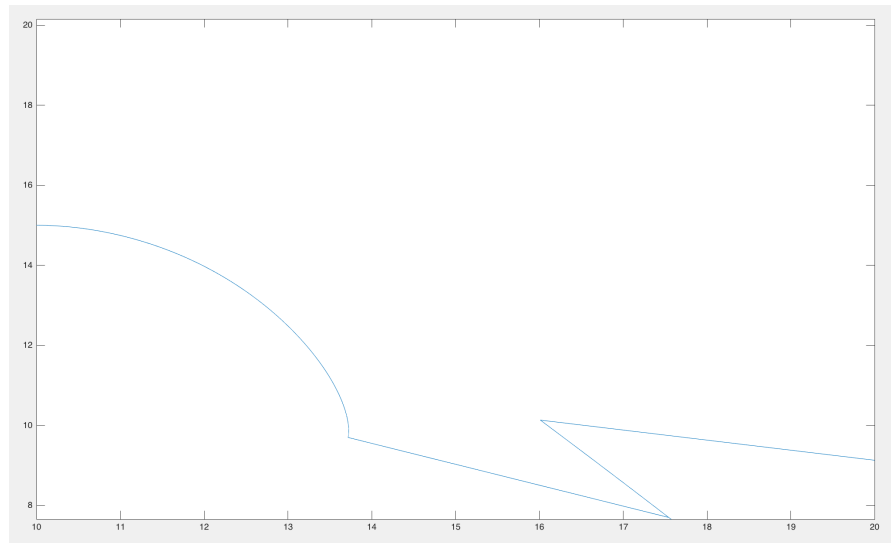npoints:500, tmax;5, steermax:2.4

Figure 7: Uniform distribution
npoints:500, tmax;5, steermax:2.4

Figure 8: Gaussian distribution
npoints:500, tmax;5, σ:3.6

5. Complete Path
   Add feedback control based local planner before the RRT planner to drive the robot from initial state to the closest vertex, so the path is complete.

Figure 9: Feedback control based local planner