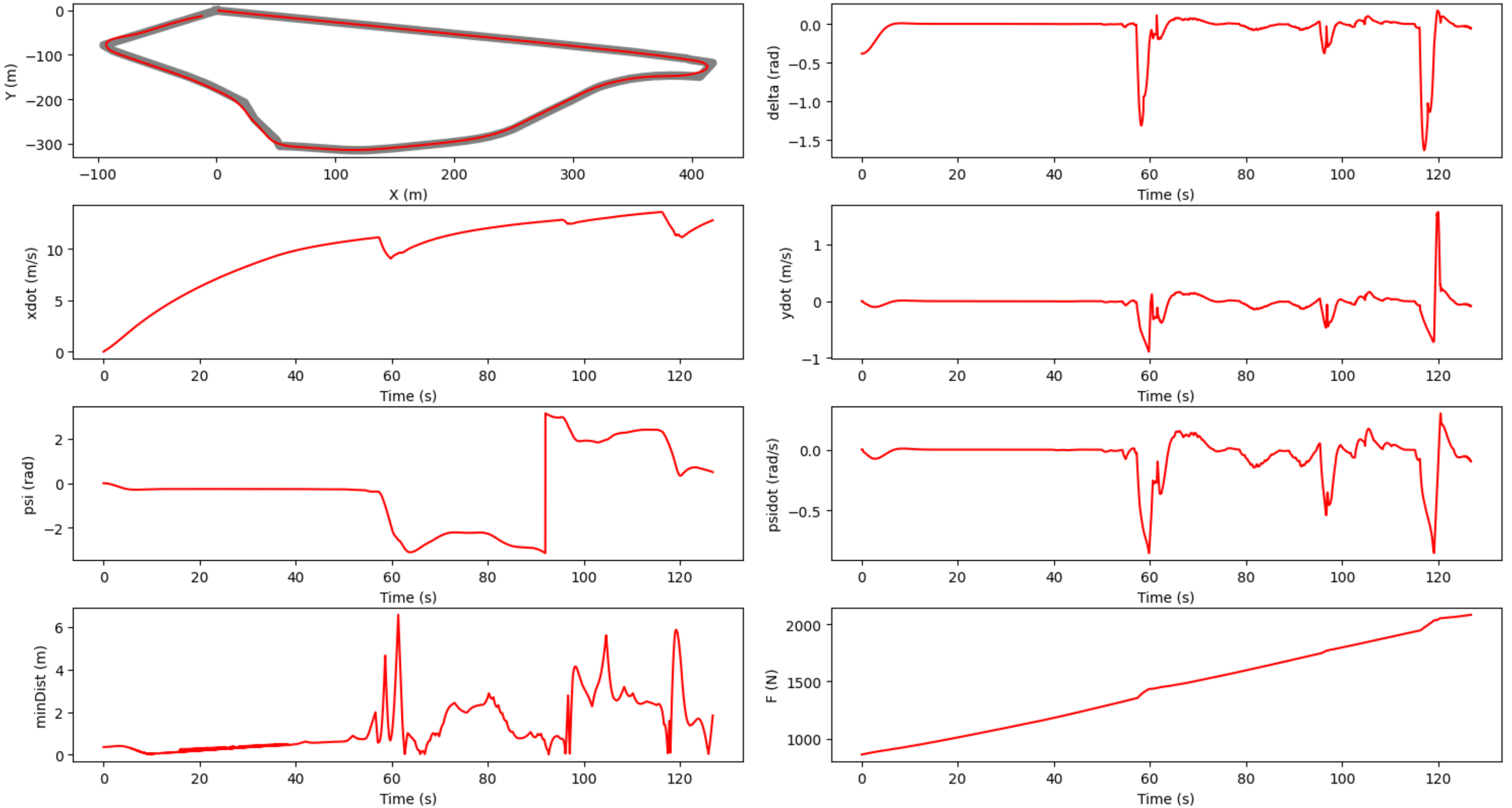

Y (m)
X (m)
delta (rad)
Time (s)
xdot (m/s)
Time (s)
ydot (m/s)
Time (s)
psi (rad)
Time (s)
psidot (rad/s)
Time (s)
minDist (m)
Time (s)
F (N)
Time (s)

\\wsl.localhost\Ubuntu\home\chubsloki\++CMU\SEM_1\24677-MCT\Proj\Proj_3\LQR\worlds\automotive_new.wbt (LQR) - Webots R2021b

File Edit View Simulation Build Overlays Tools Wizards Help

Simulation View

1:16:34:624 - 264x

- WorldInfo
- Viewpoint
- TexturedBackground
- TexturedBackgroundLight
- DEF TESLA Robot
- Floor "floor"
- Road "road"
- Slide "slide"
- Swing "swing"
- Forest
- SimpleBuilding "building(2)"
- SimpleBuilding "Newell-Simon Hal

Selection: Forest (Transform)

Node

DEF:

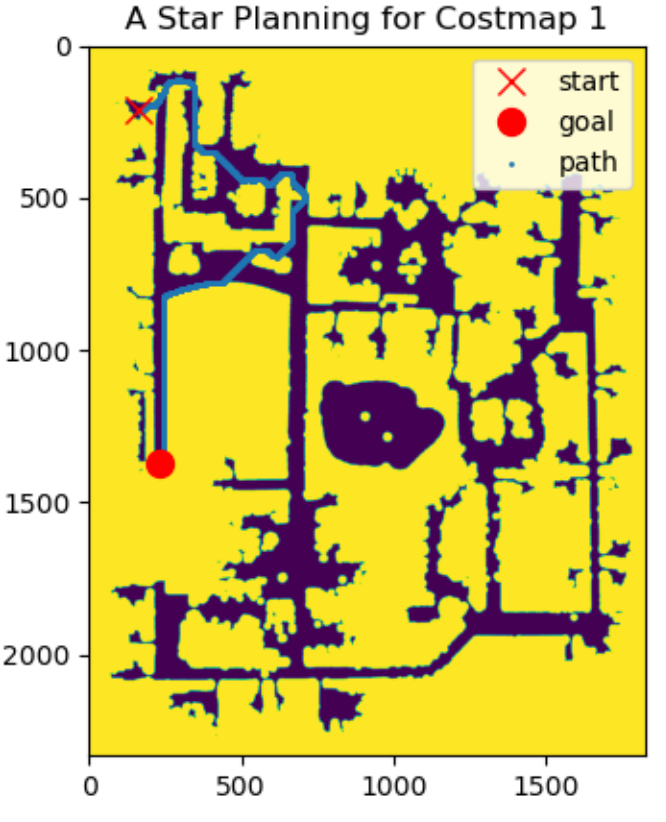
...SEM_1\24677-MCT\Proj\Proj_3\LQR\controllers\main\your_controller.py

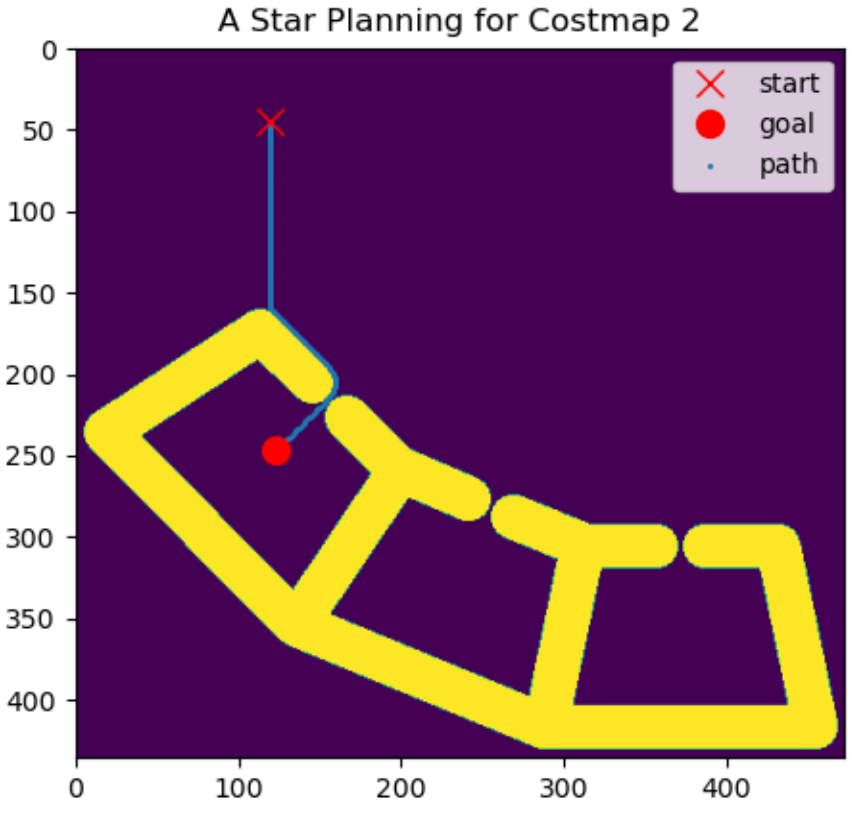
your_controller.py

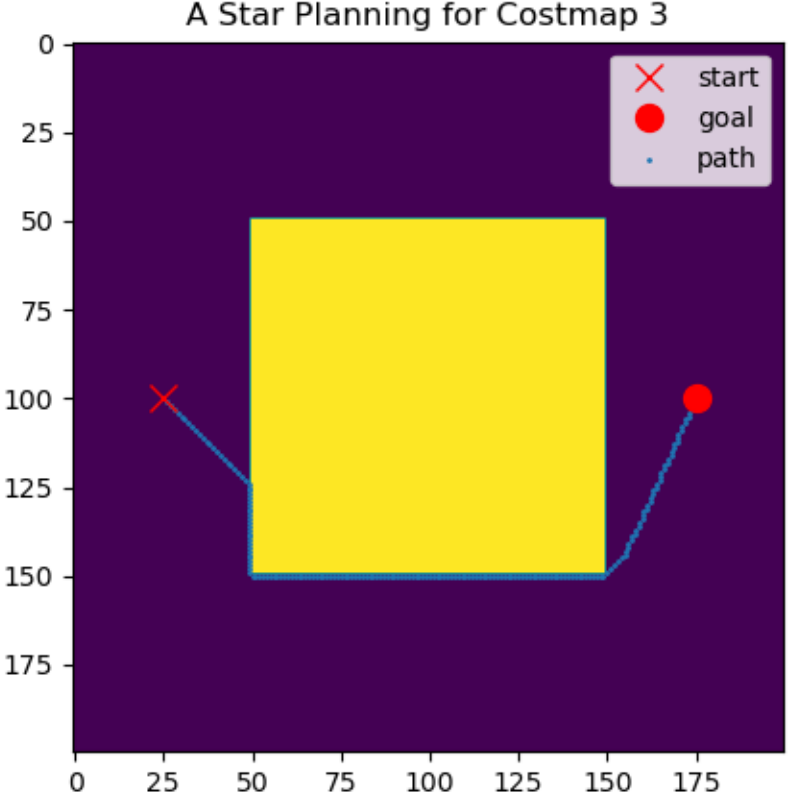
```
33          return output
34
35  class CustomController(BaseController):
36
37      def __init__(self, trajectory):
38
39          super().__init__(trajectory)
40
41          self.lr = 1.39
42          self.lf = 1.55
43          self.Ca = 20000
44          self.Iz = 25854
45          self.m = 1888.6
46          self.g = 9.81
47
48          self.delT = 0.032
49          self.longitudinal_pid = PID(Kp=24.58, Ki=0.482,
50          self.desired_speed = 35
51
52          e1_max = 0.5
53          e2_max = 8
54          e3_max = 0.1
55          e4_max = 1.4
56          del_max = 0.1
57
58          self.Q = np.diag([1/(e1_max**2), 1/(e2_max**2),
```

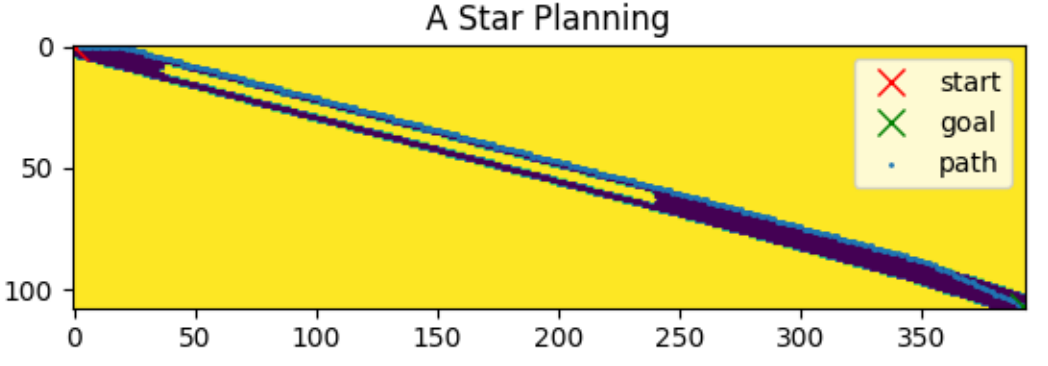
Console - All

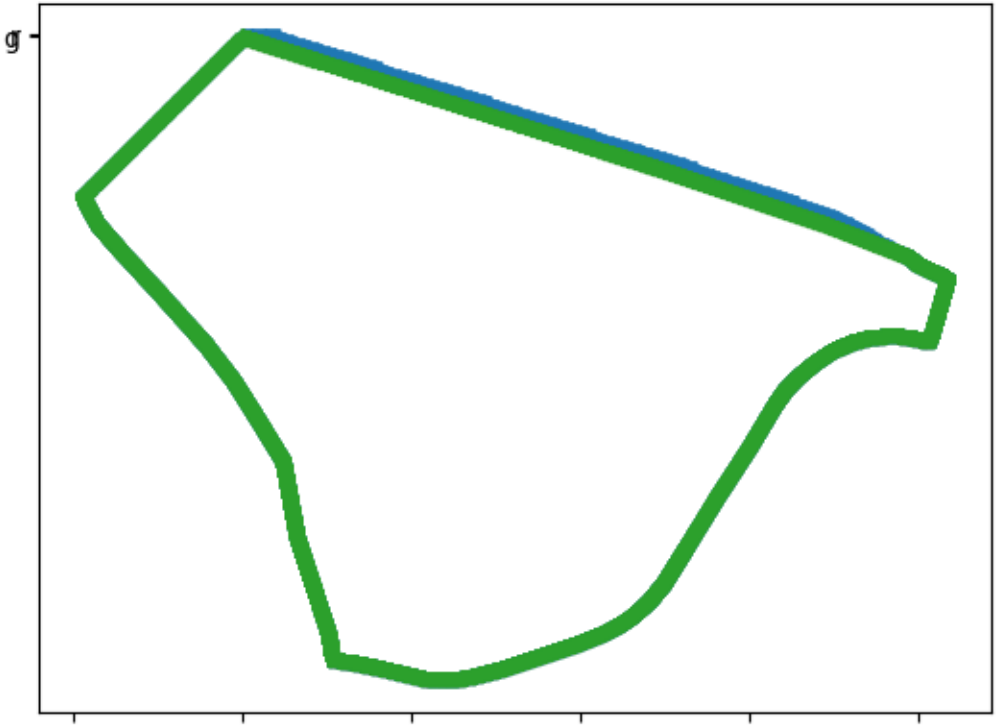
```
INFO: main: Starting controller: python.exe -u main.py
DEPRECATION: Robot.getDisplay is deprecated, please use Robot.getDevice instead.
DEPRECATION: Robot.getDisplay is deprecated, please use Robot.getDevice instead.
Evaluating...
Score for completing the loop: 30.0/30.0
Score for average distance: 30.0/30.0
Score for maximum distance: 30.0/30.0
Your time is  126.848
Your total score is : 100.0/100.0
total steps:  126848
maxMinDist:  6.568396546362561
avgMinDist:  1.2745822285290542
INFO: 'main' controller exited successfully.
```

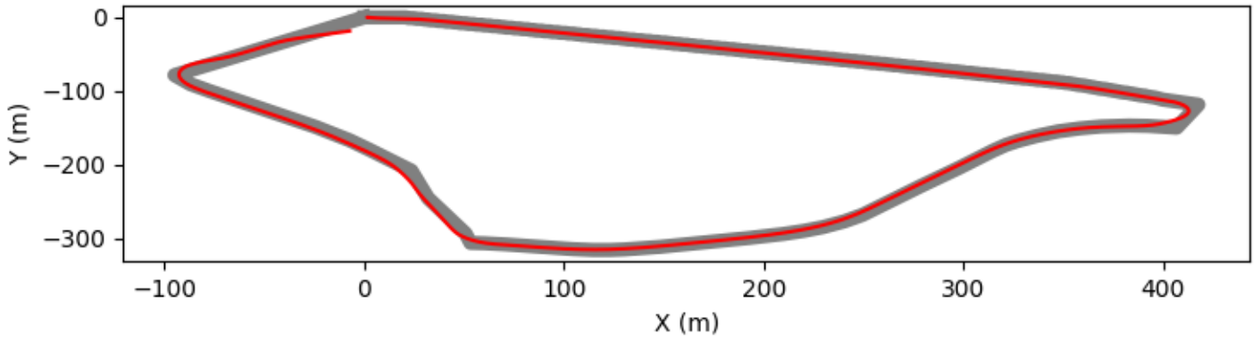

A Star Planning for Costmap 1
start
goal
path
0
500
1000
1500
2000
0
500
1000
1500

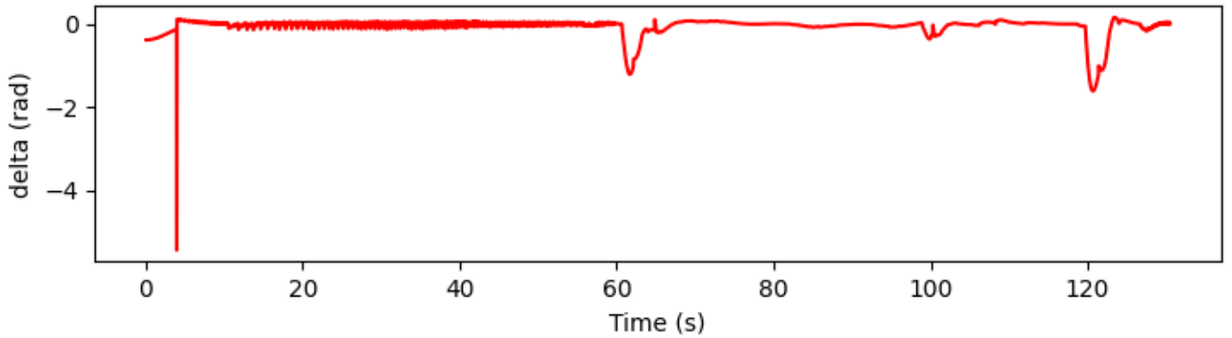

A Star Planning for Costmap 2
start
goal
path
0
50
100
150
200
250
300
350
400
0
100
200
300
400

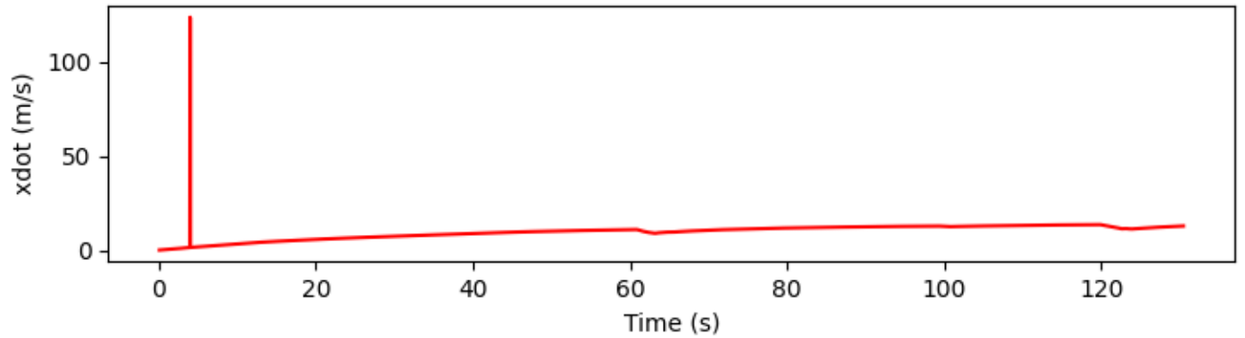

A Star Planning for Costmap 3
start
goal
path
0
25
50
75
100
125
150
175
0
25
50
75
100
125
150
175

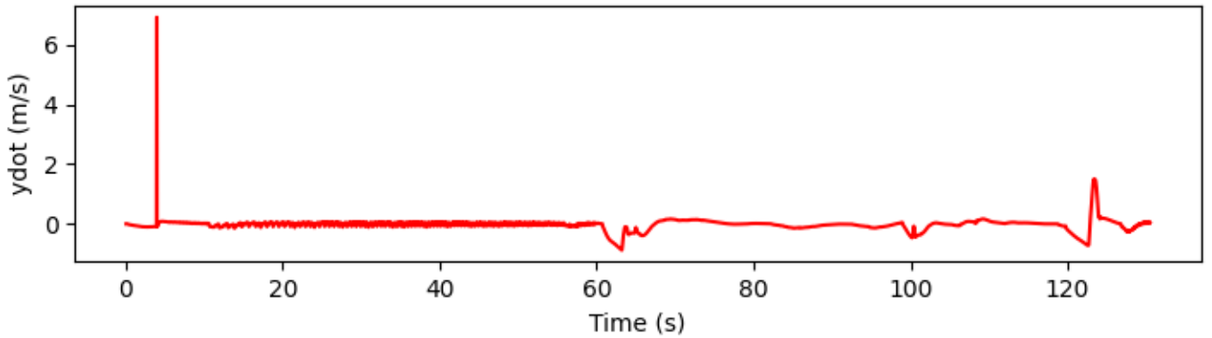

A Star Planning
start
goal
path
0
50
100
0
50
100
150
200
250
300
350

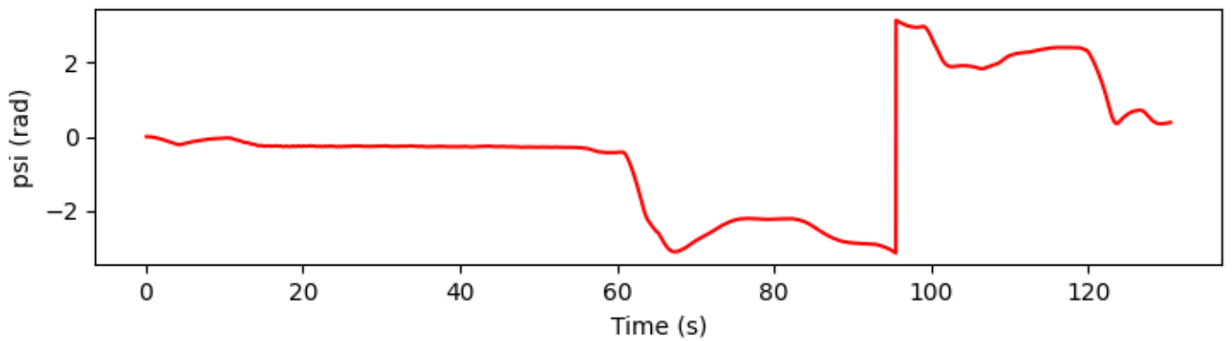

−100
0
100
200
300
400

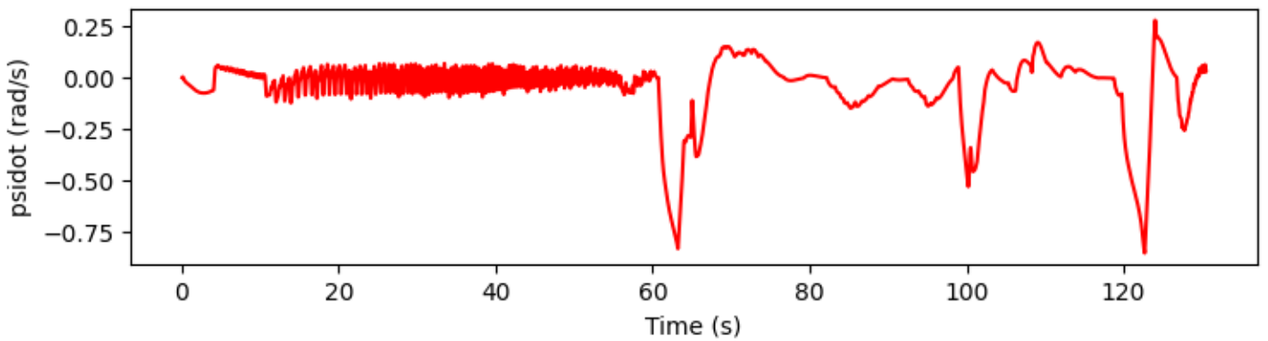

Y (m)
X (m)

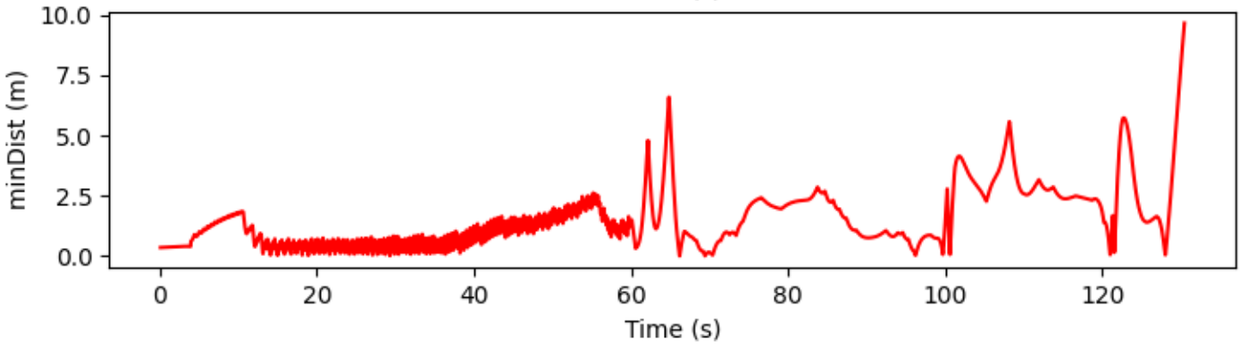

delta (rad)
Time (s)

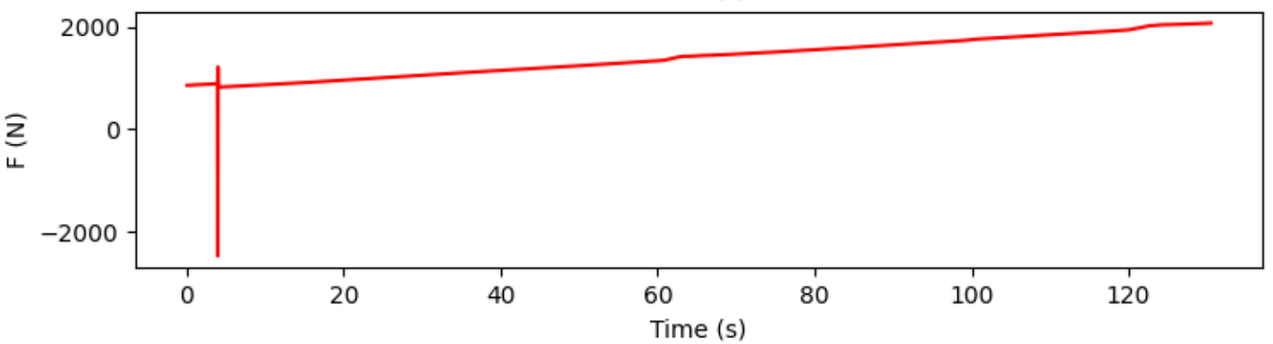

xdot (m/s)
Time (s)


ydot (m/s)
Time (s)


psi (rad)
Time (s)


psidot (rad/s)
Time (s)


minDist (m)
Time (s)


F (N)
Time (s)

\\wsl.localhost\Ubuntu\home\chubsloki\++CMU\SEM_1\24677-MCT\Proj\Proj_3\AStar\worlds\Project3.wbt (AStar) - Webots R2021b

File Edit View Simulation Build Overlays Tools Wizards Help

Simulation View

0:02:10:528 - 0.00x

- WorldInfo
- Viewpoint
- TexturedBackground
- TexturedBackgroundLight
- DEF TESLA Robot
- DEF OBSTACLE Robot
- Floor "floor"
- Road "road"
- Slide "slide"
- Swing "swing"
- Forest
- SimpleBuilding "building(2)"

Selection: Forest (Transform)

Node

DEF:

...77-MCT\Proj\Proj_3\AStar\controllers\main\your_controller_lqr_astar.py

your_controller_lqr_astar.py

```
40          # Define constants
41          # These can be ignored in P1
42          self.lr = 1.39
43          self.lf = 1.55
44          self.Ca = 20000
45          self.Iz = 25854
46          self.m = 1888.6
47          self.g = 9.81
48
49          self.delT = 0.032
50          self.longitudinal_pid = PID(Kp=24.58, Ki=0.482,
51          self.desired_speed = 35
52
53          e1_max = 0.5
54          e2_max = 8
55          e3_max = 0.1
56          e4_max = 1.4
57          del_max = 0.1
58
59          self.Q = np.diag([1/(e1_max**2), 1/(e2_max**2),
60          self.R = np.array([[1/(del_max**2)]])
61
62
63      def design_lateral_controller_LQR(self,v_design):
64          """Calculates the state-feedback gain vector K
65
```

Console - All

```
DEPRECATION: Robot.getDisplay is deprecated, please use Robot.getDevice instead.
DEPRECATION: Robot.getDisplay is deprecated, please use Robot.getDevice instead.
DEPRECATION: Robot.getDisplay is deprecated, please use Robot.getDevice instead.
[[0 0 0 ... 1 1 1]
 [0 0 0 ... 1 1 1]
 [0 0 0 ... 1 1 1]
 ...
 [1 1 1 ... 0 0 0]
 [1 1 1 ... 0 0 0]
 [1 1 1 ... 0 0 0]]
map size (108, 393)
reach goal
path length 393
```

\\wsl.localhost\Ubuntu\home\chubsloki\++CMU\SEM_1\24677-MCT\Proj\Proj_3\AStar\worlds\Project3.wbt (AStar) - Webots R2021b

File Edit View Simulation Build Overlays Tools Wizards Help

Simulation View

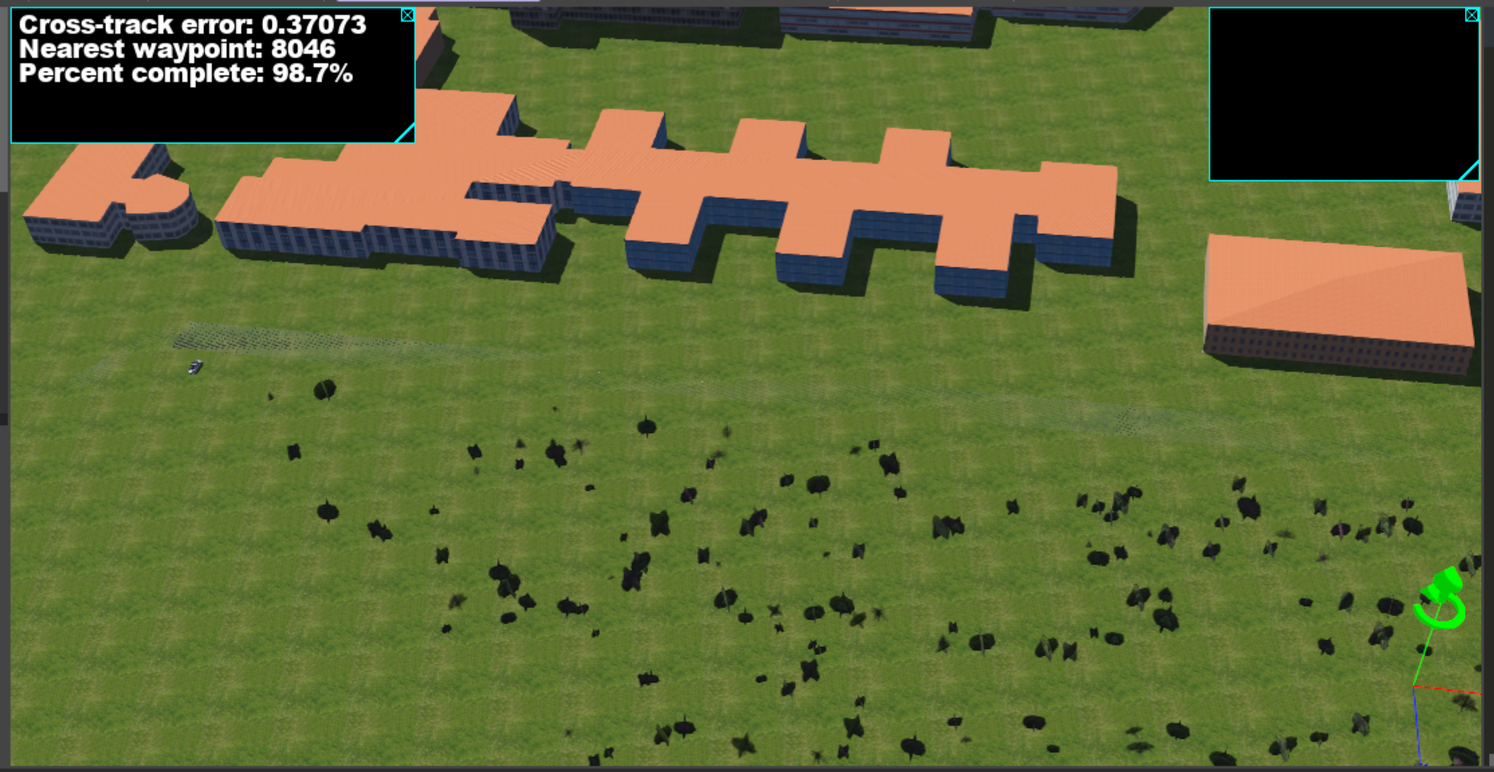
0:03:36:192 - 0.00x

- WorldInfo
- Viewpoint
- TexturedBackground
- TexturedBackgroundLight
- DEF TESLA Robot
- DEF OBSTACLE Robot
- Floor "floor"
- Road "road"
- Slide "slide"
- Swing "swing"
- Forest
- SimpleBuilding "building(2)"

Selection: Forest (Transform)

Node

DEF:



...77-MCT\Proj\Proj_3\AStar\controllers\main\your_controller_lqr_astar.py

your_controller_lqr_astar.py

```
40          # Define constants
41          # These can be ignored in P1
42          self.lr = 1.39
43          self.lf = 1.55
44          self.Ca = 20000
45          self.Iz = 25854
46          self.m = 1888.6
47          self.g = 9.81
48
49          self.delT = 0.032
50          self.longitudinal_pid = PID(Kp=24.58, Ki=0.482,
51          self.desired_speed = 35
52
53          e1_max = 0.5
54          e2_max = 8
55          e3_max = 0.1
56          e4_max = 1.4
57          del_max = 0.1
58
59          self.Q = np.diag([1/(e1_max**2), 1/(e2_max**2),
60          self.R = np.array([[1/(del_max**2)]])
61
62
63      def design_lateral_controller_LQR(self,v_design):
64          """Calculates the state-feedback gain vector K
65
```

Console - All

```
 [0 0 0 ... 1 1 1]
 [0 0 0 ... 1 1 1]
 ...
 [1 1 1 ... 0 0 0]
 [1 1 1 ... 0 0 0]
 [1 1 1 ... 0 0 0]]
map size (108, 393)
reach goal
path length 393
total steps:  130496
maxMinDist:  9.661183548780691
avgMinDist:  1.5512230423419093
INFO: 'main' controller exited successfully.
```