report for interview2

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September 2020

1 Answers of rule quiz

1. content
2. Egress is considered complete when the driver stands next to the car both feet on the ground.
3. Yes
4. None of the above
5. Teams must install the standardised data logger piece of hardware provided by the officials on their vehicle.
6. Only one-way-telemetry for information retrieval is allowed.

2 Exercise 1

1. sensor: detect the cones' and the car's location, velocity of the car, steer angles, memory for all cones
2. For now, the first lap is pure-pursuit algorithm. It's easy to be implemented. And for the 2-10 laps, maybe try some optimal method to reduce the total time with global minimum
3. Improvement:
(1) dynamics of the car system
(2) constrains to be added
4. Risk:
(1) Since the cones isn't continuous, there is risk that the car may tough the boundary.
(2) Not sure if the function of total time is convex.
5.Further Research
(1) Connect path planning with dynamics model
(2) Constrains about car and path
(3) Convexity of cost function

3 Exercise 2

3.1 Task 1

$$\dot{x} = vcos\theta \tag{1}$$

$$\dot{y} = vsin\theta \tag{2}$$

$$\dot{\theta} = \frac{v}{L}tan\delta \tag{3}$$

1. The states are x,y and θ.
2. The inputs are v and δ (or tanδ).
3. Assume the working point is with state (x_1,y_1,θ_1), and input (v_1, δ_1) Let A be the Jacobian matrix with respect to the states

$$A = \begin{bmatrix} 0 & 0 & -vsin\theta_1 \\ 0 & 0 & vcos\theta_1 \\ 0 & 0 & 0 \end{bmatrix} \tag{4}$$

Let B be the Jacobian matrix with respect to the inputs

$$B = \begin{bmatrix} cos\theta_1 & 0 \\ sin\theta_1 & 0 \\ \frac{tan\delta_1}{L} & \frac{1}{cos\delta_1^2} \end{bmatrix} \tag{5}$$

$$\begin{bmatrix} \dot{x} \\ \dot{y} \\ \dot{\theta} \end{bmatrix} = A \begin{bmatrix} x \\ y \\ \theta \end{bmatrix} + B \begin{bmatrix} v \\ \delta \end{bmatrix} \tag{6}$$