$$x_{t+1} = x_t + v * cos(\psi_t) * dt$$

$$y_{t+1} = y_t + v * sin(\psi_t) * dt$$

$$\psi_{t+1} = \psi_t + \frac{v_t}{L_f} * \delta_t * dt$$

$$v_{t+1} = v_t + a_t * dt$$

$$cte_{t+1} = y_t - f(x_t) + (v_t * sin(e_{\psi_t}) * dt)$$

$$e_{\psi_{t+1}} = \psi_t - \arctan\left(f'(x_t)\right) + (\frac{v_t}{L_f} * \delta_t * dt)$$

$$cost_t = \sqrt{(X_{dst} - X_t)^2 + (Y_{dst} - Y_t)^2}$$

$$cost_t = (v_t - v_{reference})^2$$

$$cost_t = \delta_t^2$$

$$cost_t = (\delta_{t+1} - \delta_t)^2 + (a_{t+1} - a_t)^2$$

$$J = \sum_{t=1}^{N} cte_t^2 + e_{\psi_t}^2 + \delta^2 + [(\delta_t - \delta_{t-1})^2 + (a_t - a_{t-1})^2] + (v_t - v_{reference})^2)$$

$$\begin{aligned} \underset{a,\delta}{\text{minimize}} \quad & cost_{x_1,y_1,v_1,\psi_1,cte_1,e_{\psi_1},f}(a,\delta) \\ \text{subject to} \quad & \delta \in \mathbb{R}^{N-1} \\ & a \in \mathbb{R}^{N-1} \\ & -25^\circ \preceq \delta \preceq 25^\circ \\ & -1 \preceq a \preceq 1 \end{aligned}$$