

Project 4

$$\begin{aligned}
 1. \quad x_{t+1} &= x_t + \delta t (\dot{x}_t \cos \psi_t - \dot{y}_t \sin \psi_t) + w_t^x \\
 y_{t+1} &= y_t + \delta t (\dot{x}_t \sin \psi_t + \dot{y}_t \cos \psi_t) + w_t^y \\
 \psi_{t+1} &= \psi_t + \delta t \dot{\psi}_t + w_t^\psi
 \end{aligned}$$

$$x_t = f(x_{t-1}, u_t) + w_t$$

$$\begin{bmatrix} x_t \\ y_t \\ \psi_t \\ m_x' \\ m_y' \\ \vdots \\ m_x'' \\ m_y'' \end{bmatrix} = \begin{bmatrix} x_t + \delta t (\dot{x}_t \cos \psi_t - \dot{y}_t \sin \psi_t) \\ y_t + \delta t (\dot{x}_t \sin \psi_t + \dot{y}_t \cos \psi_t) \\ \psi_t + \delta t \dot{\psi}_t \\ m_x' \\ m_y' \\ \vdots \\ m_x'' \\ m_y'' \end{bmatrix} + \begin{bmatrix} w_t^x \\ w_t^y \\ w_t^\psi \\ 0 \\ 0 \\ \vdots \\ 0 \\ 0 \end{bmatrix}$$

$$F = \left. \frac{\partial f}{\partial x} \right|_{\hat{x}_{t-1|t-1}, u_t}$$

$$F = \begin{bmatrix} 1 & 0 & \delta t (-\dot{x}_t \sin \psi_t - \dot{y}_t \cos \psi_t) & 0 & 0 & \dots & 0 \\ 0 & 1 & \delta t (\dot{x}_t \cos \psi_t - \dot{y}_t \sin \psi_t) & 0 & 0 & \dots & 0 \\ 0 & 0 & 1 & 0 & 0 & \dots & 0 \\ 0 & 0 & 0 & 1 & 0 & \dots & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 & 0 & \dots & 0 & 1 \end{bmatrix}$$

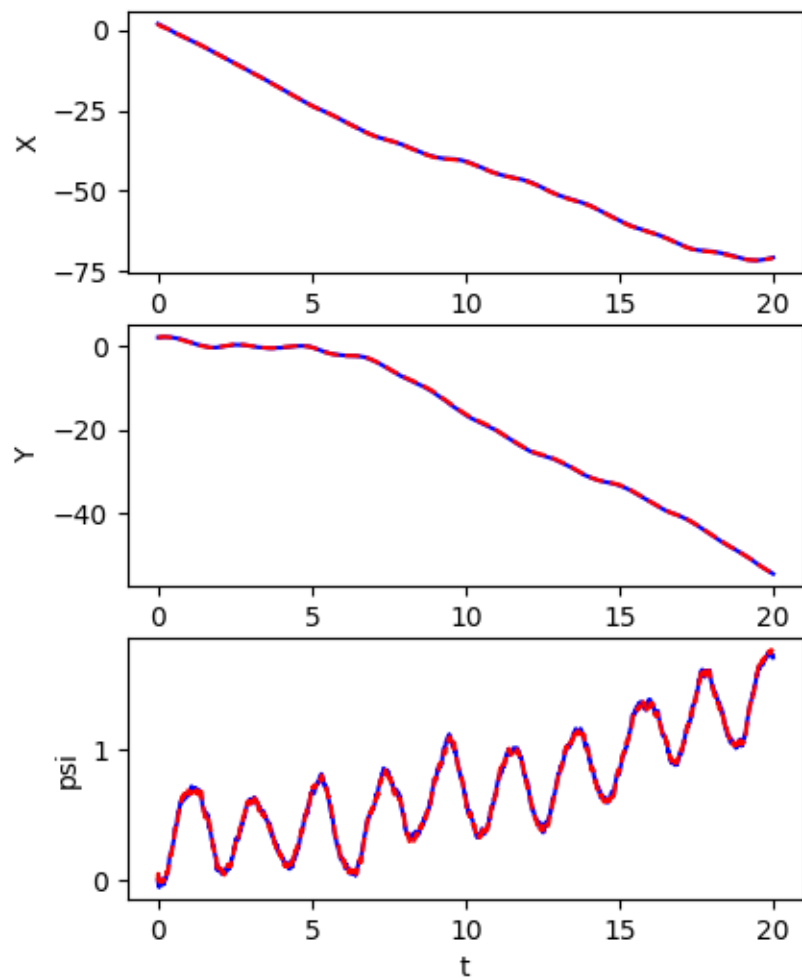
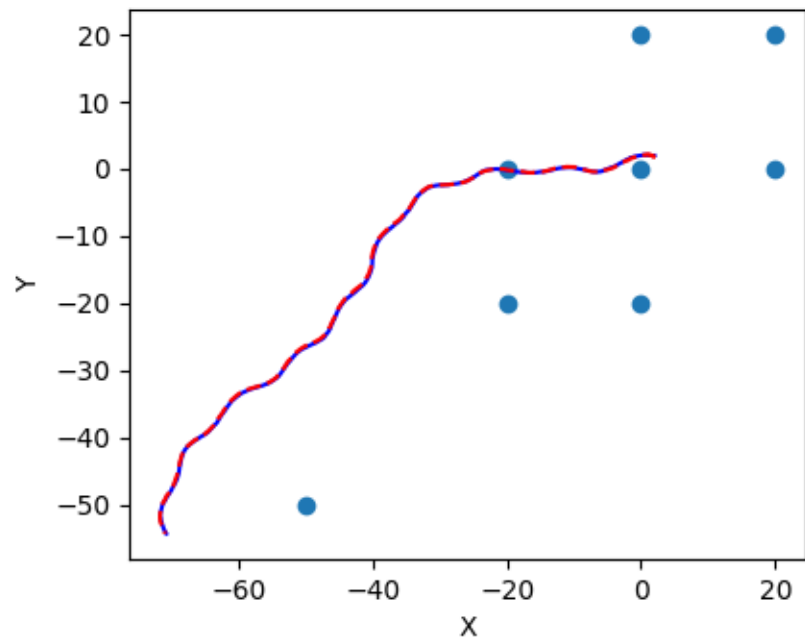
$$Y_t = h(x_t) + v_t$$

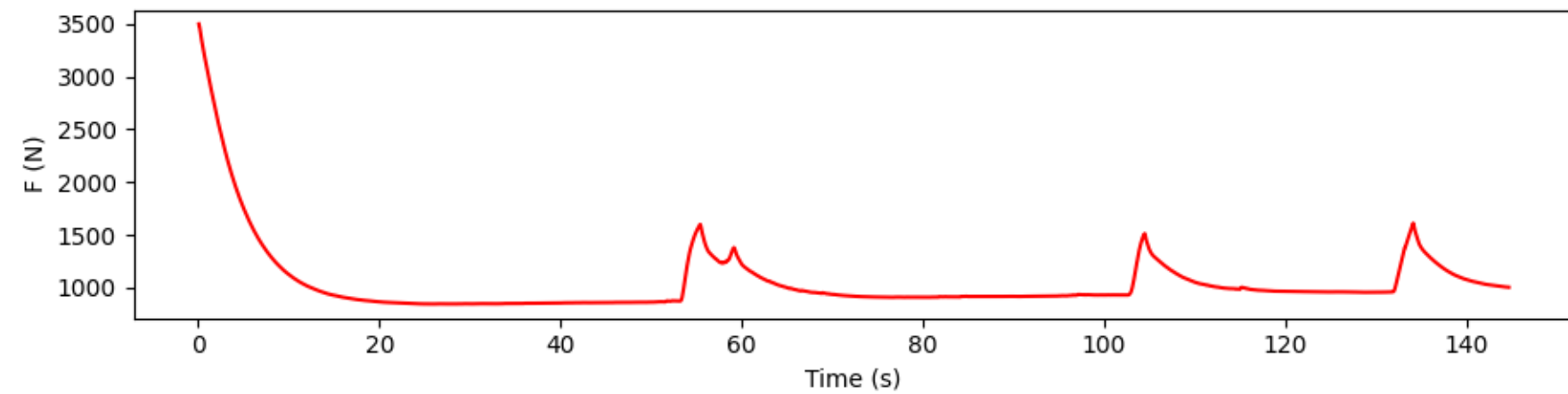
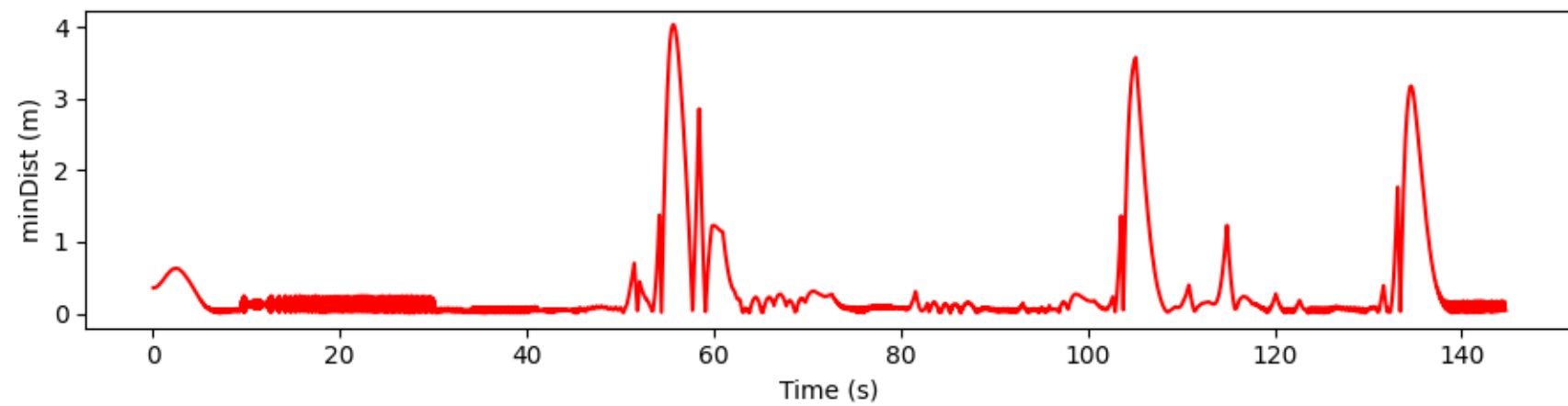
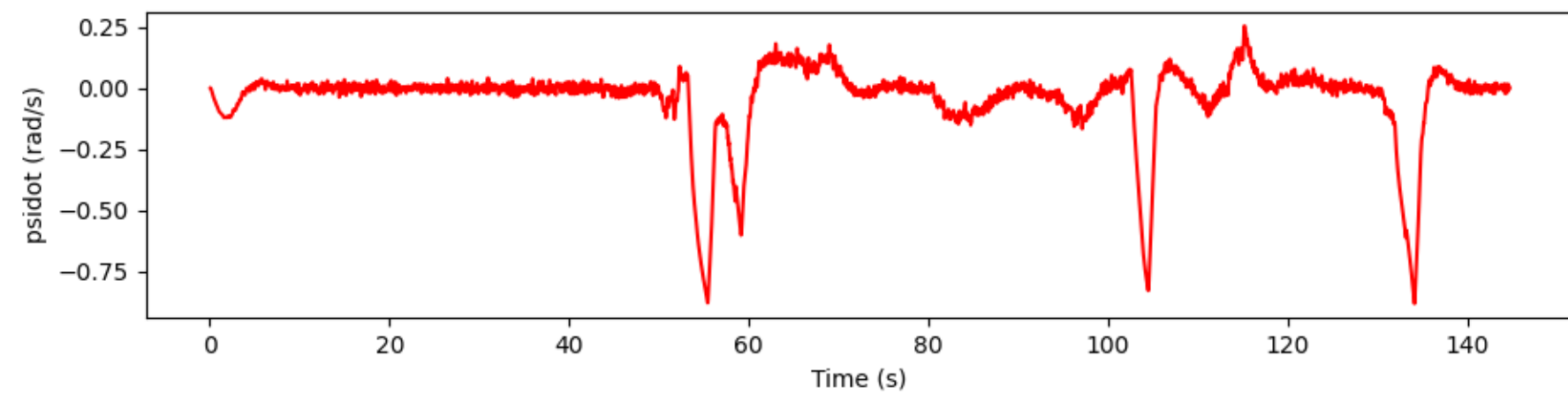
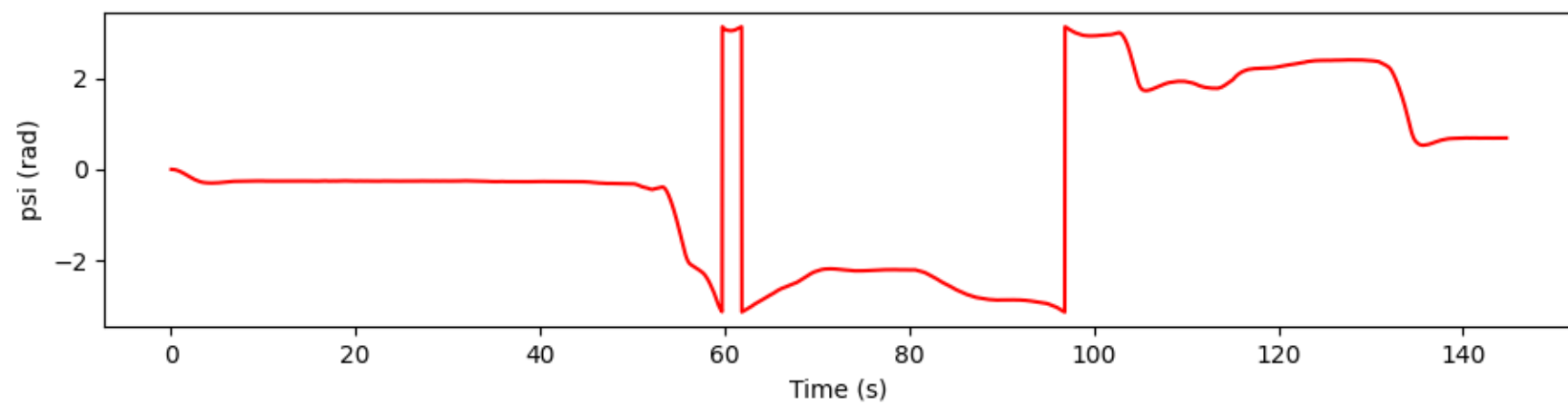
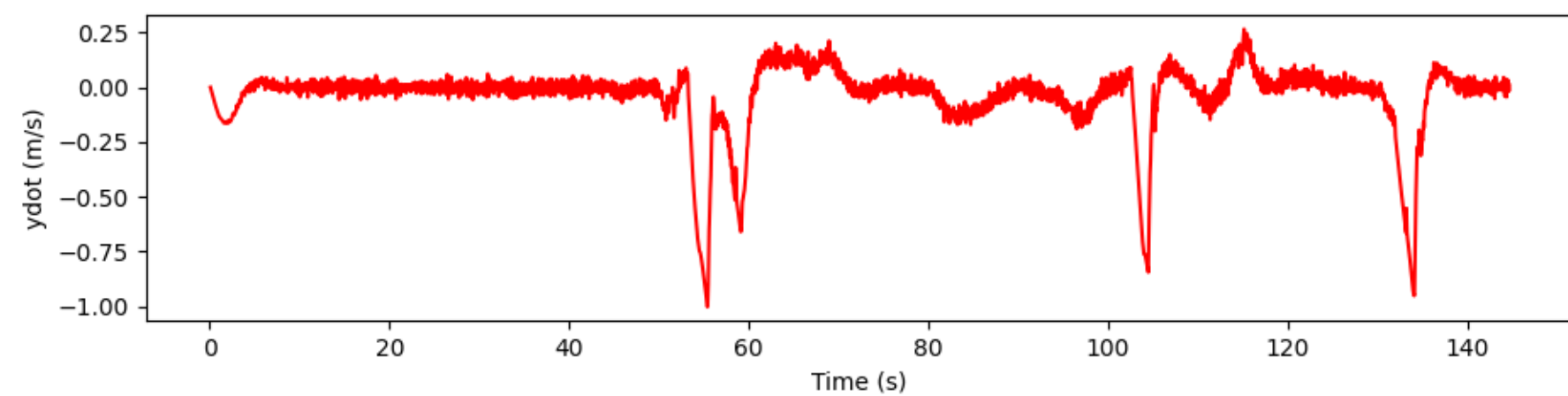
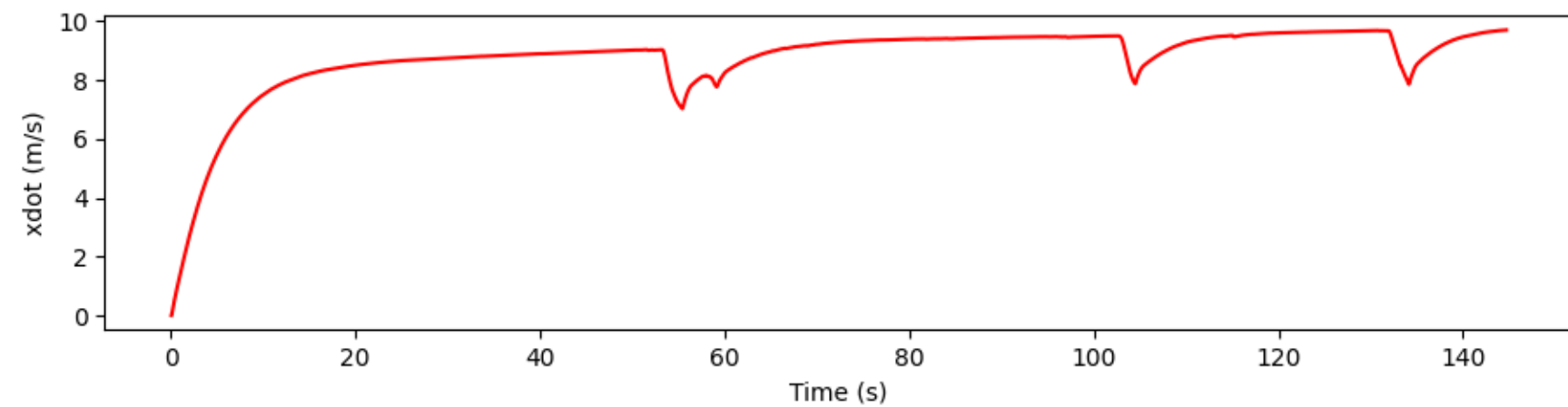
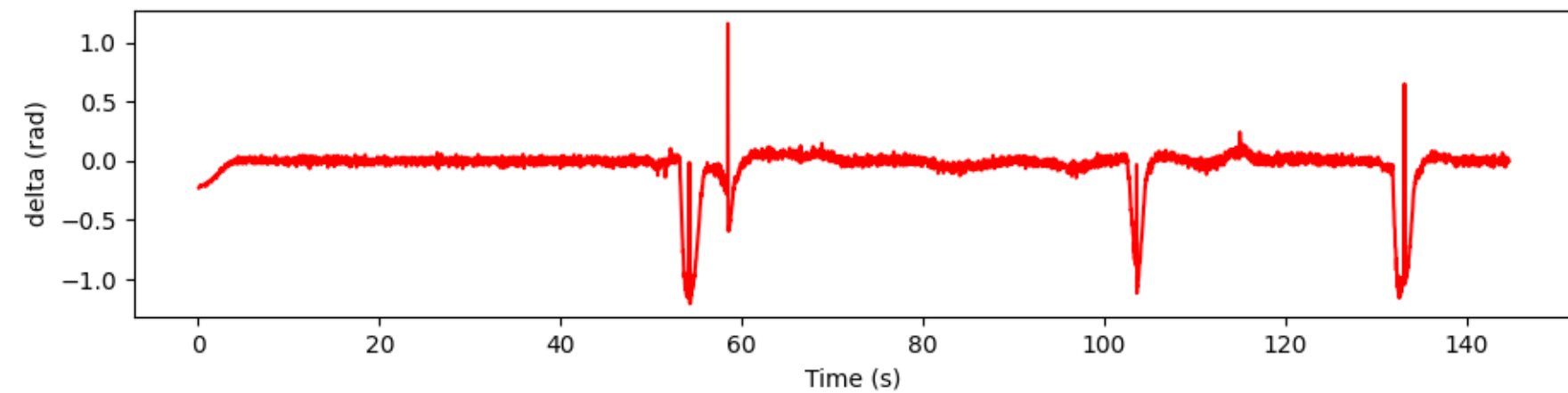
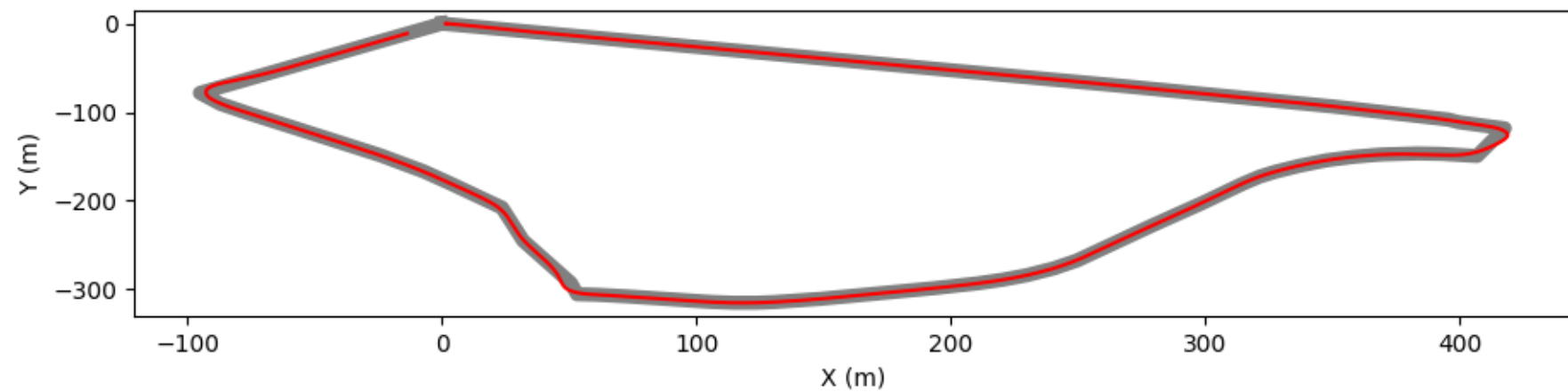
$$Y_t = \begin{bmatrix} \|m^1 - p_t\| \\ \vdots \\ \|m^n - p_t\| \\ a \tan 2(m_y^1 - Y_t, m_x^1 - X_t) - \psi_t \\ \vdots \\ a \tan 2(m_y^n - Y_t, m_x^n - X_t) - \psi_t \end{bmatrix} + \begin{bmatrix} v_{t,dist}^1 \\ \vdots \\ v_{t,dist}^n \\ v_{t,bear}^1 \\ \vdots \\ v_{t,bear}^n \end{bmatrix}$$

$$h = \begin{bmatrix} \sqrt{(m_x^1 - X_t)^2 + (m_y^1 - Y_t)^2} \\ \vdots \\ \sqrt{(m_x^n - X_t)^2 + (m_y^n - Y_t)^2} \\ a \tan 2(m_y^1 - Y_t, m_x^1 - X_t) - \psi_t \\ \vdots \\ a \tan 2(m_y^n - Y_t, m_x^n - X_t) - \psi_t \end{bmatrix}$$

$$H = \frac{\partial h}{\partial x} \bigg|_{\hat{x}_{t|t-1}}$$

$$H = \begin{bmatrix} \sigma_8 & \sigma_6 & 0 & -\sigma_8 & -\sigma_6 & 0 & \dots & 0 & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ \sigma_7 & \sigma_5 & 0 & 0 & 0 & 0 & \dots & -\sigma_7 & -\sigma_5 \\ -\sigma_2 & \sigma_4 & -1 & \sigma_2 & -\sigma_4 & 0 & \dots & 0 & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ -\sigma_1 & \sigma_3 & -1 & 0 & 0 & 0 & \dots & \sigma_1 & -\sigma_3 \end{bmatrix}$$





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 144.704

Your total score is : 100.0/100.0

total steps: 144704

maxMinDist: 4.030576739264646

avgMinDist: 0.31415418553392377