Initial data:

$$\mu_t = \begin{bmatrix} x \\ y \\ \theta \end{bmatrix} = \begin{bmatrix} \mathrm{x}_{t-1} + \delta_{trans} \cdot \cos(\theta + \delta_{rot1}) \\ \mathrm{y}_{t-1} + \delta_{trans} \cdot \sin(\theta + \delta_{rot1}) \\ \theta_{t-1} + \delta_{rot1} + \delta_{rot2} \end{bmatrix}$$

$$\mu_1 = \begin{bmatrix} x \\ y \\ \theta \end{bmatrix} = \begin{bmatrix} 180 \\ 50 \\ 0 \end{bmatrix}$$

$$z = \begin{bmatrix} \varphi \\ s \end{bmatrix}$$

$$u = \begin{bmatrix} \delta_{rot1} \\ \delta_{trans} \\ \delta_{rot2} \end{bmatrix} = \begin{bmatrix} atan2(y_t - y_{t-1}, x_t - x_{t-1}) \\ \sqrt{(x_t - x_{t-1})^2 + (y_t - y_{t-1})^2} \\ \theta_t - \theta_{t-1} - \delta_{rot1} \end{bmatrix}$$

The noise added to the observation function:

$$\eta_t = \begin{bmatrix} \eta_\varphi \\ \eta_s \end{bmatrix} = N(0, Q) = N(0, \begin{bmatrix} 20^\circ & 0 \\ 0 & 0 \end{bmatrix}$$

The noise added to the transition function:

$$\varepsilon_t = \begin{bmatrix} \varepsilon_{\delta_{rot1}} \\ \varepsilon_{\delta_{trans}} \\ \varepsilon_{\delta_{rot2}} \end{bmatrix} = \mathrm{N}([\alpha_1 \quad \alpha_2 \quad \alpha_3 \quad \alpha_4],$$

$$\begin{bmatrix} \alpha_1 \cdot \delta_{rot1}^2 + \alpha_2 \cdot \delta_{trans}^2 & 0 & 0 \\ 0 & \alpha_3 \cdot \delta_{trans}^2 + \alpha_4 \cdot (\delta_{rot1}^2 + \delta_{rot2}^2) & 0 \\ 0 & 0 & \alpha_1 \cdot \delta_{rot2}^2 + \alpha_2 \cdot \delta_{trans}^2 \end{bmatrix})$$

$$\mu_\varepsilon = [0.05 \quad 0.001 \quad 0.05 \quad 0.01],$$

$$R_t = \begin{bmatrix} \alpha_1 \cdot \delta_{rot1}^2 + \alpha_2 \cdot \delta_{trans}^2 & 0 & 0 \\ 0 & \alpha_3 \cdot \delta_{trans}^2 + \alpha_4 \cdot (\delta_{rot1}^2 + \delta_{rot2}^2) & 0 \\ 0 & 0 & \alpha_1 \cdot \delta_{rot2}^2 + \alpha_2 \cdot \delta_{trans}^2 \end{bmatrix}$$

For u=[δ_{rot1}, δ_{trans}, δ_{rot2}]=[0,10,0]:

$$R = \begin{bmatrix} 0.1 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & 0.1 \end{bmatrix}$$

$$G_t = \left.\frac{\partial g(x_{t-1}, \mu_t)}{\partial x_{t-1}}\right|_{\mu_{t-1}} = \begin{bmatrix} 1 & 0 & -\delta_{trans} \cdot \sin(\theta + \delta_{rot1}) \\ 0 & 1 & \delta_{trans} \cdot \cos(\theta + \delta_{rot1}) \\ 0 & 0 & 1 \end{bmatrix}$$

$$G_0 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 180 \\ 0 & 0 & 1 \end{bmatrix}$$

$$V_t = \left.\frac{\partial g(x_{t-1}, \mu_t)}{\partial u_t}\right|_{\mu_{t-1}} = \begin{bmatrix} -\delta_{trans} \cdot \sin(\theta + \delta_{rot1}) & \cos(\theta + \delta_{rot1}) & 0 \\ \delta_{trans} \cdot \cos(\theta + \delta_{rot1}) & \sin(\theta + \delta_{rot1}) & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$V_0 = \begin{bmatrix} 0 & 1 & 0 \\ 180 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$h_t = \begin{bmatrix} \varphi_t^j \\ s_t^j \end{bmatrix} = \begin{bmatrix} atan2\left(m_{j,y} - y, m_{j,x} - x\right) - \theta \\ s_j \end{bmatrix}$$

$$H_t = \frac{\partial h}{\partial x_t}\bigg|_{\mu_t} = \begin{bmatrix} -\frac{m_{j,y} - y}{(m_{j,y} - y)^2 + (m_{j,x} - x)^2} & \frac{m_{j,x} - x}{(m_{j,y} - y)^2 + (m_{j,x} - x)^2} & -1 \\ 0 & 0 & 0 \end{bmatrix}$$

$$H_0(m_1) = \begin{bmatrix} -0.0018 & 0.0057 & -1 \\ 0 & 0 & 0 \end{bmatrix}$$

$$H_0(m_2) = \begin{bmatrix} -0.0079 & -0.0098 & -1 \\ 0 & 0 & 0 \end{bmatrix}$$

$$H_0(m_3) = \begin{bmatrix} -6.0541 & -3.4266 & -1 \\ 0 & 0 & 0 \end{bmatrix}$$

$$H_0(m_4) = \begin{bmatrix} 0.0018 & -0.0020 & -1 \\ 0 & 0 & 0 \end{bmatrix}$$

$$H_0(m_5) = \begin{bmatrix} 3.8777 & -9.9346 & -1 \\ 0 & 0 & 0 \end{bmatrix}$$

$$H_0(m_6) = \begin{bmatrix} 0.0029 & 0.0019 & -1 \\ 0 & 0 & 0 \end{bmatrix}$$