Map Based Localisation

A non-holonomic robot navigates in a partial unknown environment.

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$\boldsymbol{\mu}_0 = \begin{bmatrix} s_{x,0} \\ s_{y,0} \\ s_{\theta,0} \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$ robot initial position $\boldsymbol{\Sigma}_0 = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ initial covariance matrix $\boldsymbol{m} = \begin{bmatrix} m_x \\ m_y \end{bmatrix} = \begin{bmatrix} 3 \\ 4 \end{bmatrix}$ landmark position Assume the following conditions remain constant $\forall\, k$ $\boldsymbol{Q_k} = \begin{bmatrix} 0.5 & 0.01 & 0.01 \\ 0.01 & 0.5 & 0.01 \\ 0.01 & 0.01 & 0.2 \end{bmatrix}$ motion model covariance matrix $\boldsymbol{R_k} = \begin{bmatrix} 0.1 & 0 \\ 0 & 0.02 \end{bmatrix}$ observation model covariance matrix $V_k = 1m/s$ mobile robot linear velocity $\omega_k = 1rad/s$ mobile robot angular velocity $\Delta t = 0.1s$ sampling time Assumed measurements at each step k using the LiDAR $\boldsymbol{z}_{1,1} = [4.87 \;\; 0.8]^T$ $\boldsymbol{z}_{1,2} = [4.72 \;\; 0.72]^T$ $\boldsymbol{z}_{1,3} = [4.69 \;\; 0.65]^T$	Using Kalman filter estimate the position of the robot for three time steps, i.e., μ_1, μ_2, μ_3 and Σ_1, Σ_2, Σ_3.

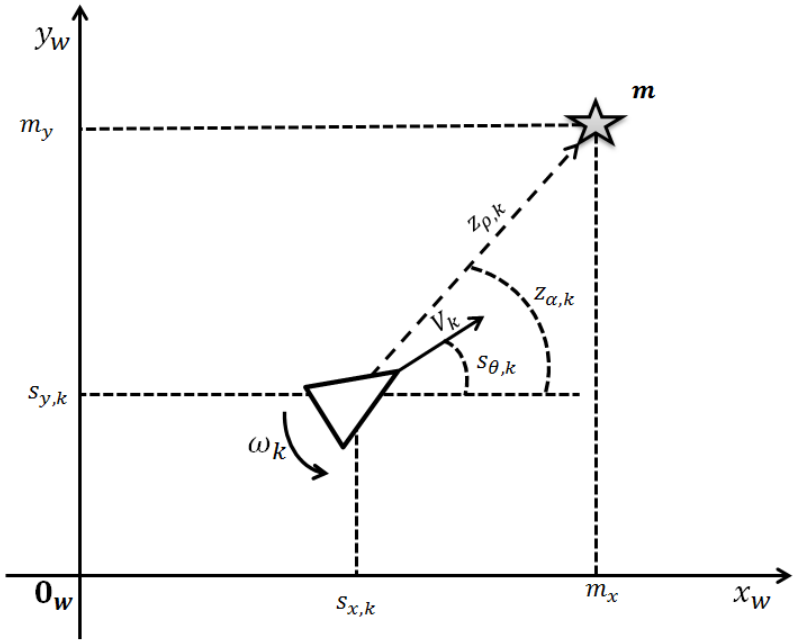

Figure 1 A non-holonomic robot moving in a 2D environment