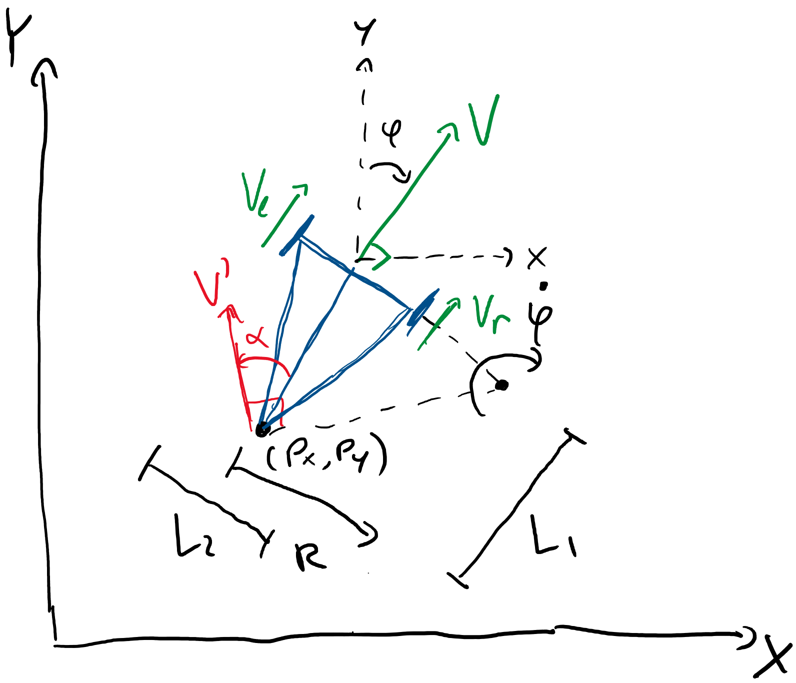
KALMAN FILTER

Sunday, August 7, 2022 8:57 AM



$$R = \frac{V}{\dot{\varphi}} = \frac{L_2}{2} \quad \frac{V_l + V_r}{V_l - V_r}$$

$$\dot{\varphi} = \frac{V_l - V_r}{L_2} \qquad V = \frac{V_l + V_r}{2}$$

$$V_l = \frac{2V + \dot{\varphi} L_2}{2} = \dot{\varphi}\left(R + \frac{L_2}{2}\right)$$

$$V_r = \frac{2V - \dot{\varphi} L_2}{2} = \dot{\varphi}\left(R + \frac{L_2}{2}\right)$$

INPUT CONTROL $: V, \dot{\varphi}$

$$\begin{bmatrix} P_x \\ P_y \\ \varphi \\ V \end{bmatrix}_k = \begin{bmatrix} P_{x_{k-1}} + \Delta t \, C_v V_{k-1} \sin(\varphi_{k-1} - \alpha) + \nu_{P_{x_k}} \\ P_{y_{k-1}} + \Delta t \, C_v V_{k-1} \cos(\varphi_{k-1} - \alpha) + \nu_{P_{y_k}} \\ \varphi_{k-1} + \Delta t \, \dot{\varphi} + \nu_{\varphi_k} \\ V_{k-1} + \Delta t \, \dot{V} + \nu_{V_k} \end{bmatrix}$$

if $V_\ell = V_r$

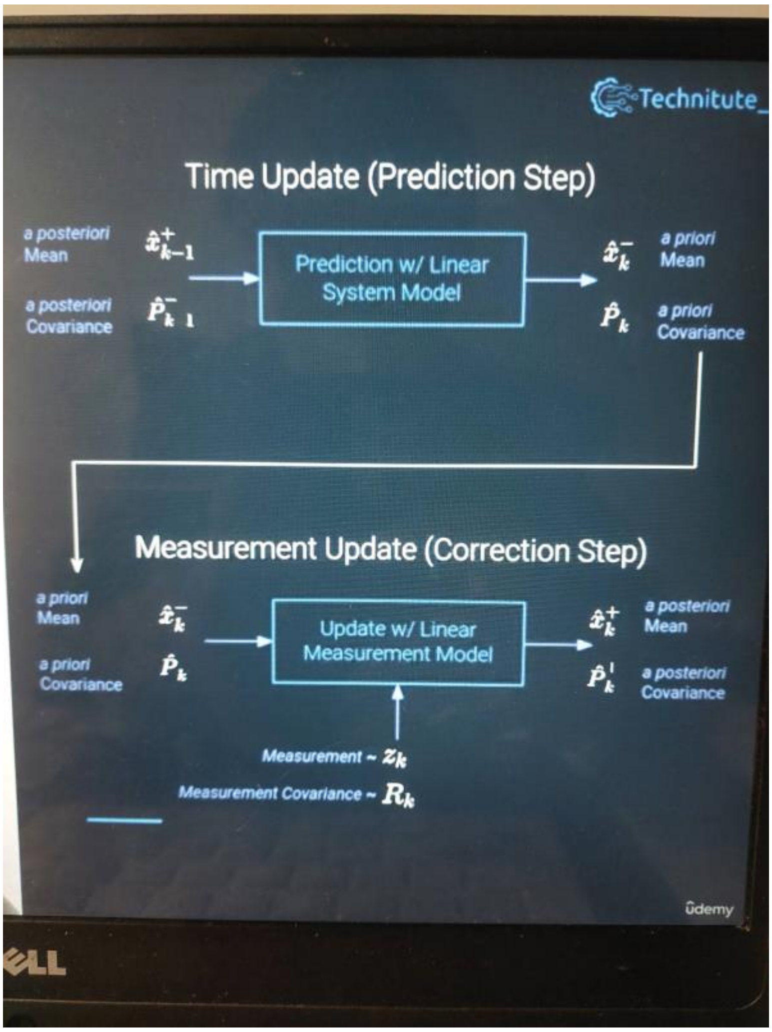
$C_v = 1 \qquad \alpha = 0$

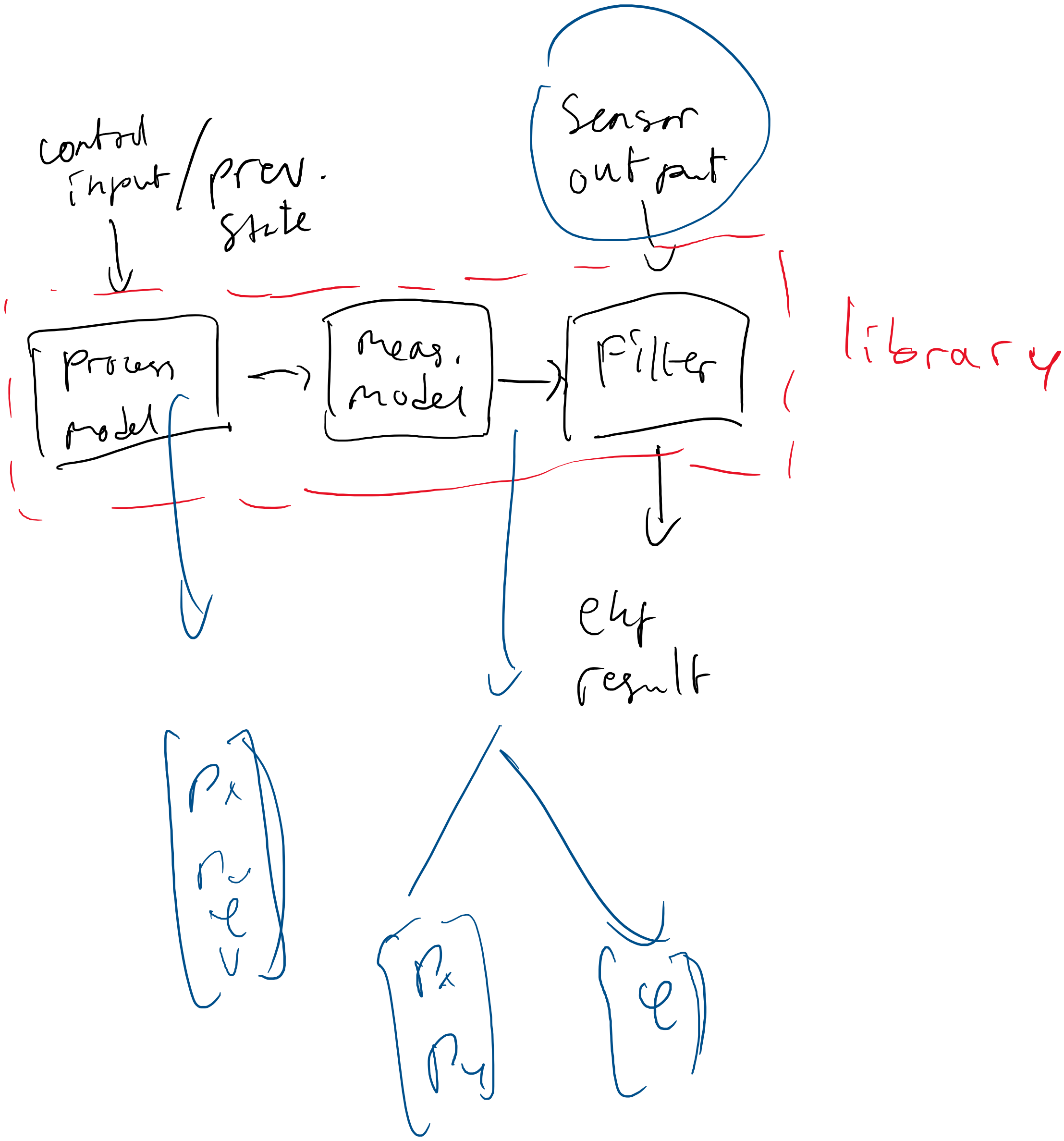
else if $V_\ell = -V_r$

$C_v = L_1 \qquad \alpha = \frac{\pi}{2} \rightarrow V_\ell < V_r \qquad \alpha = -\frac{\pi}{2} \rightarrow V_\ell > V_r$

else

$$C_v = \frac{\sqrt{L_1^2 + R^2}}{R} \qquad \alpha = \arctan\left(\frac{L_1}{R}\right)$$




control input / prev. state
Sensor output
Process model
meas. model
Filter
library
ekf result
p_x
p_y
φ
v
p_x
p_y
φ