Plant model and Jacobian

- the (noise free) plant model is given by:

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

  where x_t is the position of the robot at time t, x_{t-1} is the position of the robot at time $t-1$, and u_t is the change in position of the robot at time t
- this is the equation you should use on Line 3 of the EKF algorithm

Plant model and Jacobian

- the compute the Jacobian of the plant model, you need to express how the robot computes its control:

$$u_t = \frac{L - x_{t-1}}{\|L - x_{t-1}\|} = \frac{\begin{bmatrix}(15 - x_{t-1})\\(-2 - y_{t-1})\end{bmatrix}}{\sqrt{(15 - x_{t-1})^2 + (-2 - y_{t-1})^2}}$$

$$x_t = \begin{bmatrix}g_1\\g_2\end{bmatrix} = \begin{bmatrix}x_{t-1} + (15 - x_{t-1})/\sqrt{(15 - x_{t-1})^2 + (-2 - y_{t-1})^2}\\y_{t-1} + (-2 - y_{t-1})/\sqrt{(15 - x_{t-1})^2 + (-2 - y_{t-1})^2}\end{bmatrix}$$

$$G = \begin{bmatrix}\frac{\partial g_1}{\partial x_{t-1}} & \frac{\partial g_1}{\partial y_{t-1}}\\\frac{\partial g_2}{\partial x_{t-1}} & \frac{\partial g_2}{\partial y_{t-1}}\end{bmatrix}$$

Measurement model and Jacobian

- the measurement model is given by:

$$z_t = \begin{bmatrix} h_1 \\ h_2 \end{bmatrix} = \begin{bmatrix} \sqrt{(5 - x_t)^2 + (0 - y_t)^2} \\ \sqrt{(10 - x_t)^2 + (0 - y_t)^2} \end{bmatrix} = h(\mu_t)$$

where $\mu_t = \begin{bmatrix} x_t \\ y_t \end{bmatrix}$ is the predicted location of the robot at time t

- the Jacobian of the measurement model is:

$$H = \begin{bmatrix} \frac{\partial h_1}{\partial x_t} & \frac{\partial h_1}{\partial y_t} \\ \frac{\partial h_2}{\partial x_t} & \frac{\partial h_2}{\partial y_t} \end{bmatrix}$$