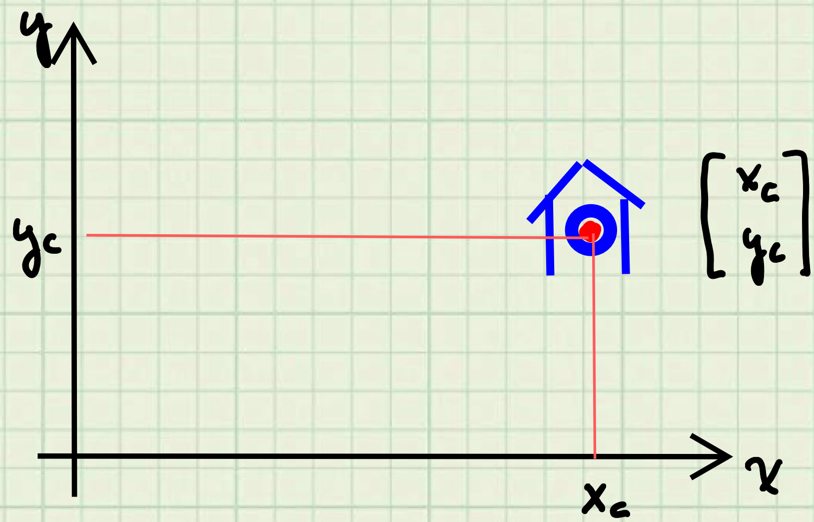
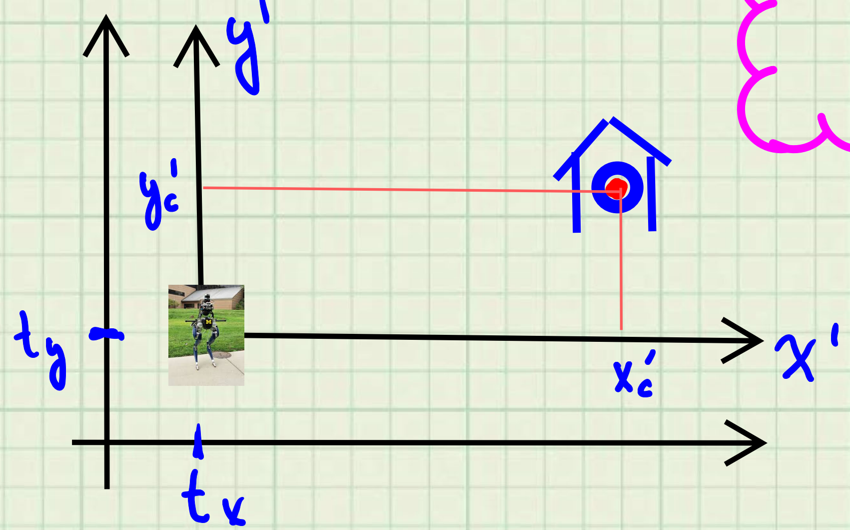
Project #1



Translation

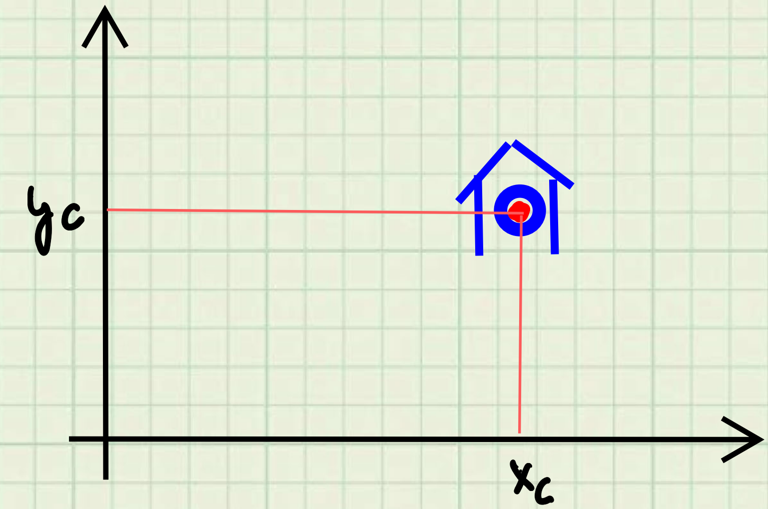


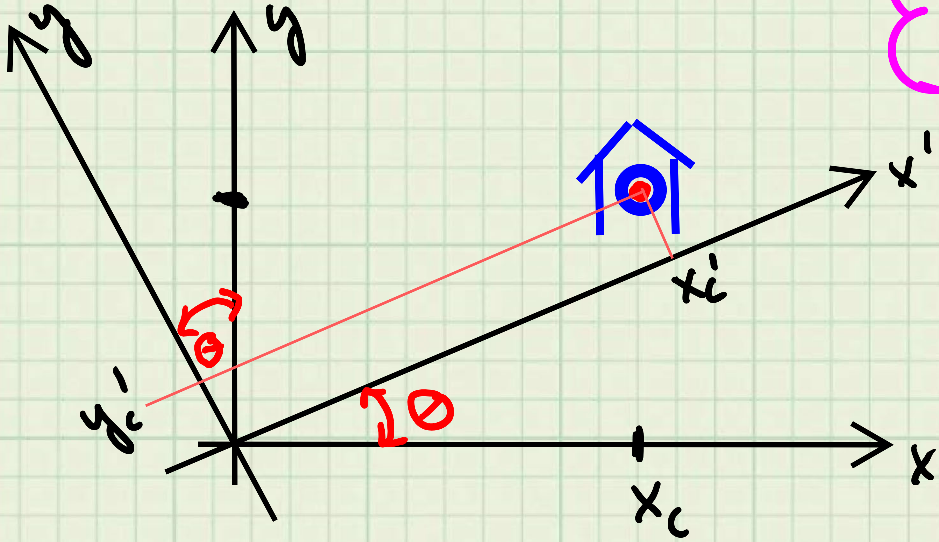
Cassie measures the object at $\begin{bmatrix} x_c' \\ y_c' \end{bmatrix}$, but the object is "really" at $\begin{bmatrix} x_c \\ y_c \end{bmatrix}$. We know Cassie is at $\begin{bmatrix} t_x \\ t_y \end{bmatrix}$.

What is the true position of the object?

$$\begin{bmatrix} x_c \\ y_c \end{bmatrix} = \begin{bmatrix} x_c' \\ y_c' \end{bmatrix} + \begin{bmatrix} t_x \\ t_y \end{bmatrix}.$$

Rotation





Cassie has turned by an angle of θ, and now "sees" the object at $\begin{bmatrix} x_c' \\ y_c' \end{bmatrix}$.

Where is the object in the "world frame"?

$$\begin{bmatrix} x_c \\ y_c \end{bmatrix} = \begin{bmatrix} \cos(\theta) & -\sin(\theta) \\ \sin(\theta) & \cos(\theta) \end{bmatrix} \begin{bmatrix} x_c' \\ y_c' \end{bmatrix}$$

$$\begin{bmatrix} \cos(\theta) & -\sin(\theta) \\ \sin(\theta) & \cos(\theta) \end{bmatrix}$$

called a rotation matrix

The sensor [Inertial Measurement Unit or IMU] and algorithm [Invariant Kalman Filter] are amazing in their own right. They are treated in ROB 501 & ROB 530. Robotics faculty would like to offer undergrad versions of that material.