



(x, y, θ) = state

turning angle β

a = steering angle

$$\beta = \frac{d}{L} * \tan(a)$$

θ = orientation

turning radius R

L = vehicle length

$$R = \frac{d}{\beta}$$

$$cx = x - \sin(\theta) * R$$

$$cy = y + \cos(\theta) * R$$

$$x' = cx + \sin(\theta + \beta) * R$$

$$y' = cy - \cos(\theta + \beta) * R$$

$$\theta' = (\theta + \beta) \bmod 2\pi$$

if $|\beta| < 0.001$ (approximated to straight motion)

$$x' = x + d * \cos \theta$$

$$y' = y + d * \sin \theta$$

$$\theta' = (\theta + \beta) \bmod 2\pi$$