CMPG-185

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H.W#1.

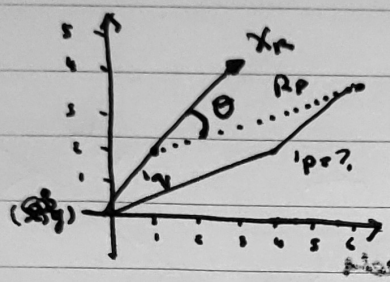
1.a. 2D range sensor

$x = 1.0m$

$y = 2.0m$

Obstacle at $\alpha = -\frac{\pi}{6}$ and $b = 1.0m$

$\theta = \frac{\pi}{4}$. a. What is the position of obstacle?



$^1p = R_2^1 R_p + {}^1q$

$R_p = R^{-1}(^1p - {}^1q)$

$R = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$

$= \begin{bmatrix} x \\ y \end{bmatrix} = (R_1^B)^{-1} \begin{bmatrix} x_B \\ y_B \end{bmatrix} + \begin{bmatrix} x_1 \\ y_1 \end{bmatrix}$

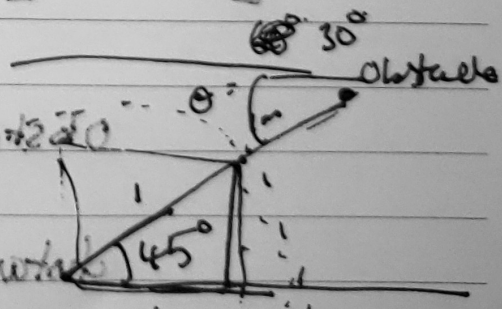
$= \begin{bmatrix} 1/\sqrt{2} & -1/\sqrt{2} \\ 1/\sqrt{2} & 1/\sqrt{2} \end{bmatrix} + \begin{bmatrix} 2 \\ 1 \end{bmatrix}$

$\begin{bmatrix} \frac{1}{\sqrt{2}} & -1/\sqrt{2} \\ \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \end{bmatrix} \cdot \begin{bmatrix} x_0 \\ y_0 \end{bmatrix} + \begin{bmatrix} 2 \\ 1 \end{bmatrix}$

Obstacle

$\begin{bmatrix} c\theta & s\theta \\ -s\theta & c\theta \end{bmatrix} \alpha = -\frac{\pi}{6}$

$= \begin{bmatrix} \frac{\sqrt{3}}{2} & 1/2 \\ -1/2 & \frac{\sqrt{3}}{2} \end{bmatrix} \cdot \begin{bmatrix} 1 \\ 1 \end{bmatrix} \begin{bmatrix} -0.366 \\ -0.366 \end{bmatrix}$



180-65

$\begin{bmatrix} 1/\sqrt{2} & -1/\sqrt{2} \\ 1/\sqrt{2} & 1/\sqrt{2} \end{bmatrix} \cdot \begin{bmatrix} -0.366 \\ -0.366 \end{bmatrix} + \begin{bmatrix} 2 \\ 1 \end{bmatrix}$

Distance

$= \begin{bmatrix} 0 \\ -0.517 \end{bmatrix} + \begin{bmatrix} 2 \\ 1 \end{bmatrix} = \begin{bmatrix} 2 \\ 0.483 \end{bmatrix}$

$\frac{2}{1}$ 47.5.

b. Wheel radius = 0.3m Circumference = $2\pi r$ = 3.77m.

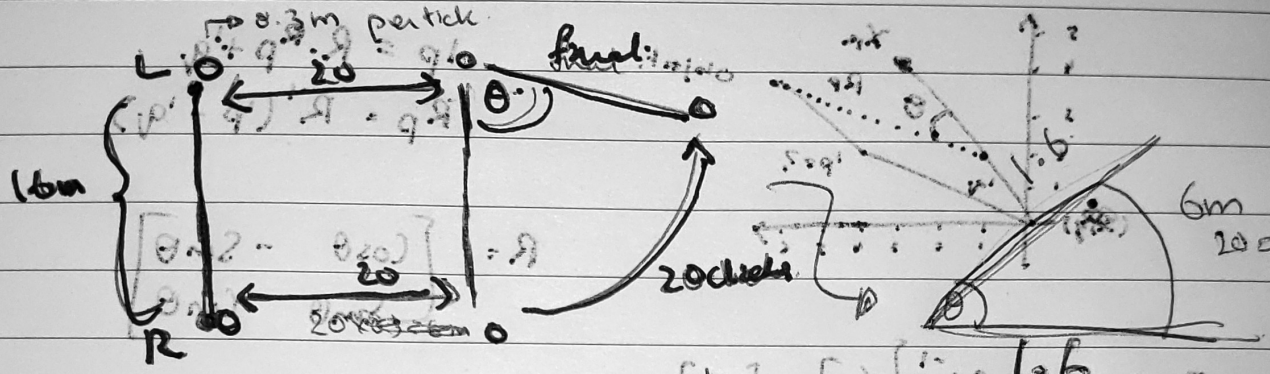
length of axles = 1.6m

total ticks per revolution = 50.

movement per tick = $\frac{3.77}{50}$ = 7.54cm.

left = 20 right = 40

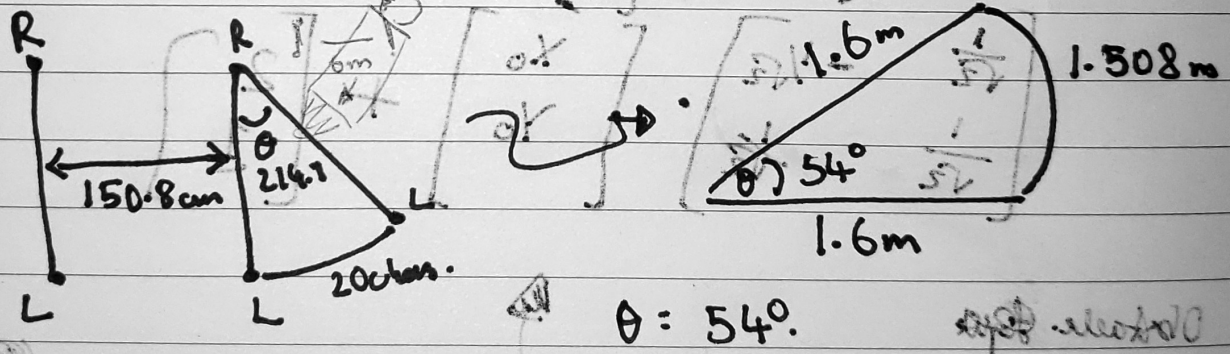
Can collide w obstacle?



20 ticks.

20 × 7.54 = 150.8 cm

θ = 214.9 degrees



θ = 54°.

Obstacle at $\begin{bmatrix} 2 \\ 0.483 \end{bmatrix}$.

distance travelled at = 1.6m at 54°

= 2 − 1.6 = 0.4 at 54°

0.483

* The car will collide with the object