Sheet 3
Robot Control

Group 4
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Exercise 1

a) Specify the control law of a PID controller

$$u(t) = K_P\ e(t) + K_D\ \dot{e}(t) + K_I \int_{-\infty}^{t} e(t)\, dt.$$

b) Define how the error integral can be computed in the discrete case

$$\begin{aligned} e_{I,t} &= e_{I,t-1} + e_t. \\ e_{I,0} &= 0. \end{aligned}$$

c) Define a formula for the discrete error derivative

$$e_{D,t} = e_t - e_{t-1}$$

d) Specify the discrete PID control law

$$u_t = K_P\ e_t + K_D\ e_{D,t} + K_I\ e_{I,t}$$

f) Specify how the error signals for each of these controllers can be computed from the current pose and the goal pose

$$\vec{e} = \begin{pmatrix} x_e \\ y_e \\ \psi_e \end{pmatrix}, \vec{x} = \begin{pmatrix} x_x \\ y_x \\ \psi_x \end{pmatrix}, \vec{g} = \begin{pmatrix} x_g \\ y_g \\ \psi_g \end{pmatrix}$$

$$\vec{e} = \vec{g} - \vec{x}$$

$$\begin{pmatrix} x_e \\ y_e \\ \psi_e \end{pmatrix} = \begin{pmatrix} x_g - x_x \\ y_g - y_x \\ \psi_g - \psi_x \end{pmatrix}$$

h) Screenshol of RVIZ

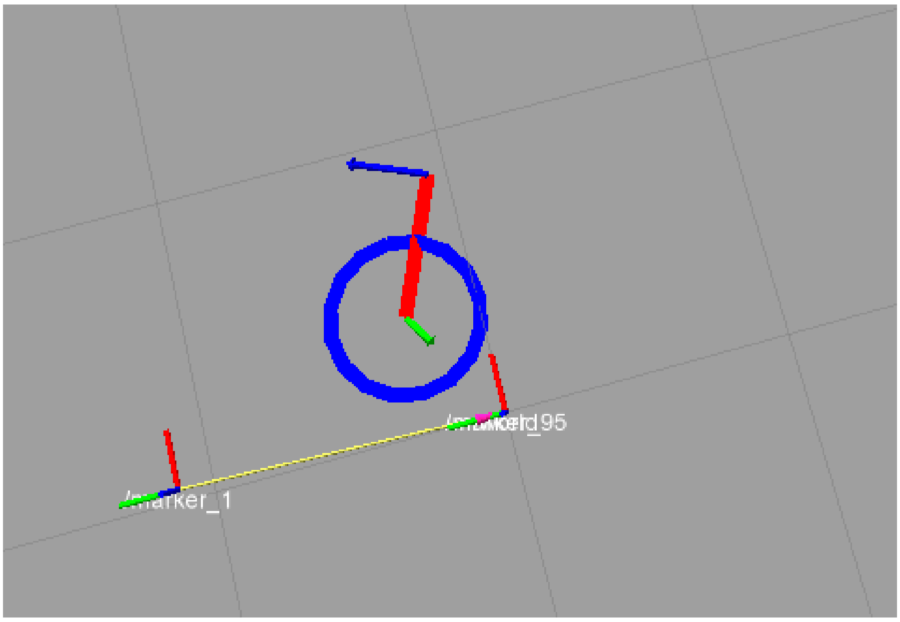

Figure 1: screenshot from RVIZ to indicate the x,y,yaw control command