MOBILE ROBOT APPLICATION FOR OBJECT FOLLOWER

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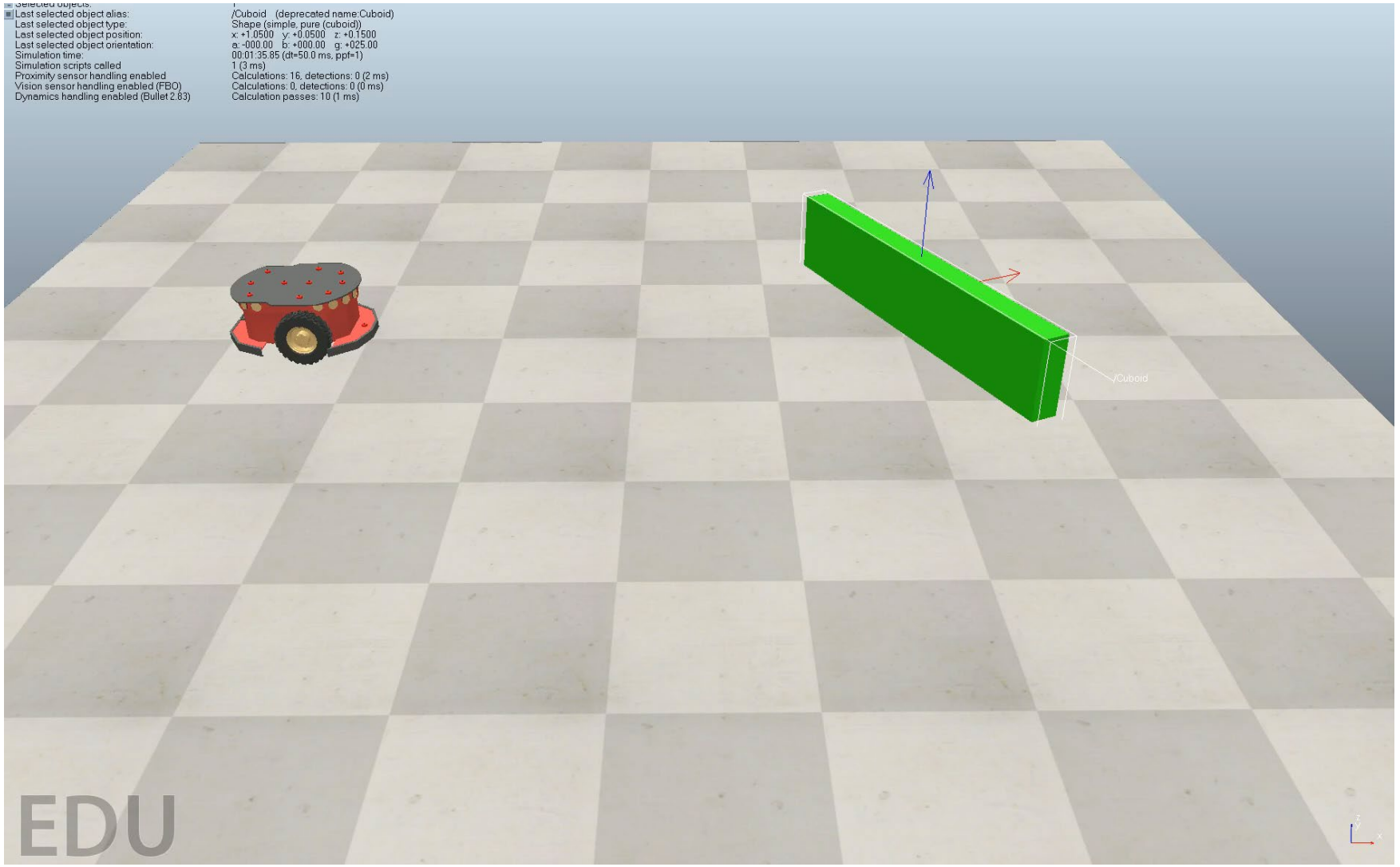
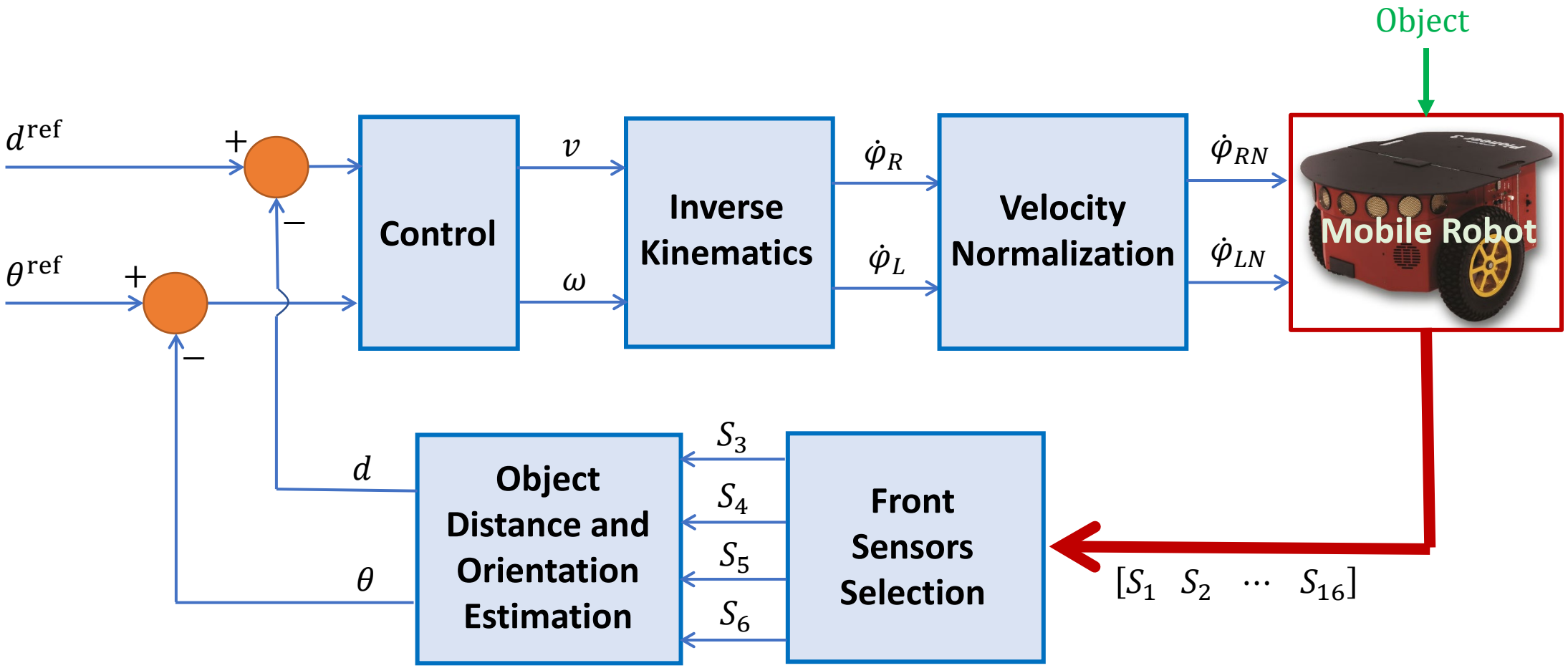
INTRODUCTION

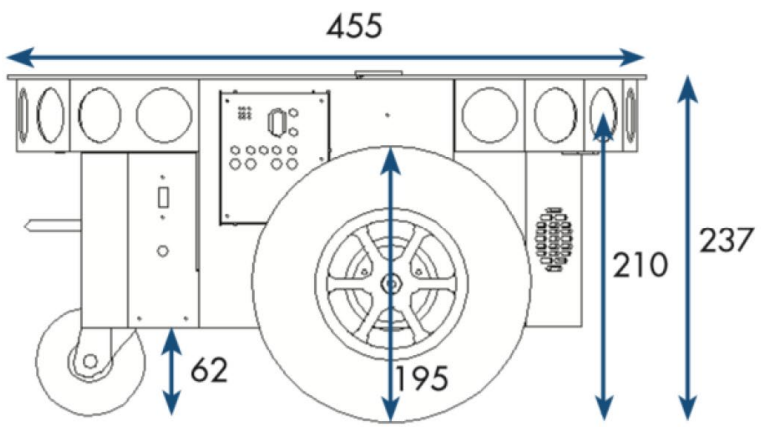


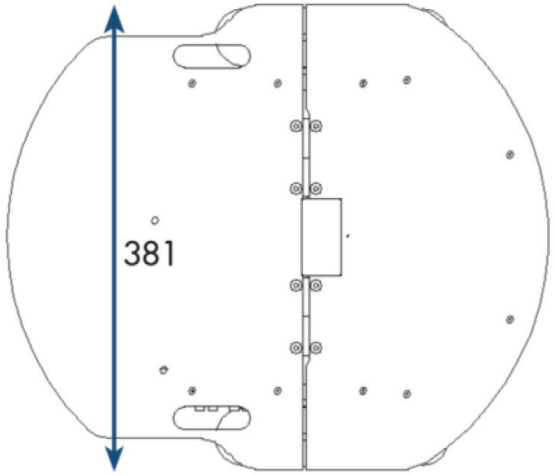
OBJECT FOLLOWER ROBOT



Pioneer P3DX and Its Dimension

Dimension (in mm)





Follower System Formulation

Object Distance and Orientation Estimation

$$d = \min(S_4, S_5)$$

$$\theta = S_6 - S_3$$

Control

$$v = K_1\left(d^{\text{ref}} - d\right)$$

$$\omega = K_2\left(\theta^{\text{ref}} - \theta\right)$$

Inverse Kinematics

$$\begin{bmatrix}\dot{\varphi}_R \\ \dot{\varphi}_L\end{bmatrix} = \begin{bmatrix}\frac{R}{2} & \frac{R}{2} \\ \frac{R}{2L} & -\frac{R}{2L}\end{bmatrix}^{-1} \begin{bmatrix}v \\ \omega\end{bmatrix}$$

Velocity Normalization

$$\dot{\varphi}_{\max} = \max(\dot{\varphi}_R, \dot{\varphi}_L)$$

$$\dot{\varphi}_{RN} = \begin{cases} \frac{\dot{\varphi}_{\text{norm}}}{\dot{\varphi}_{\max}}\dot{\varphi}_R & \dot{\varphi}_{\max} > \dot{\varphi}_{\text{norm}} \\ \dot{\varphi}_R & \text{otherwise} \end{cases}$$

$$\dot{\varphi}_{LN} = \begin{cases} \frac{\dot{\varphi}_{\text{norm}}}{\dot{\varphi}_{\max}}\dot{\varphi}_L & \dot{\varphi}_{\max} > \dot{\varphi}_{\text{norm}} \\ \dot{\varphi}_L & \text{otherwise} \end{cases}$$

ASSIGNMENT 3

1. Open CoppeliaSim, place the Pioneer P3DX mobile robot in the scene, and position a cuboid object in front of the robot.
2. Create a Python program to control the robot's motion for an automatic object-following task. Refer to the system described on pages 2-5 to implement the simulation. At the end of the simulation, display plots of distance and orientation over time.

THANK YOU