Intelligent Wireless Robotics

Lab on PID Control

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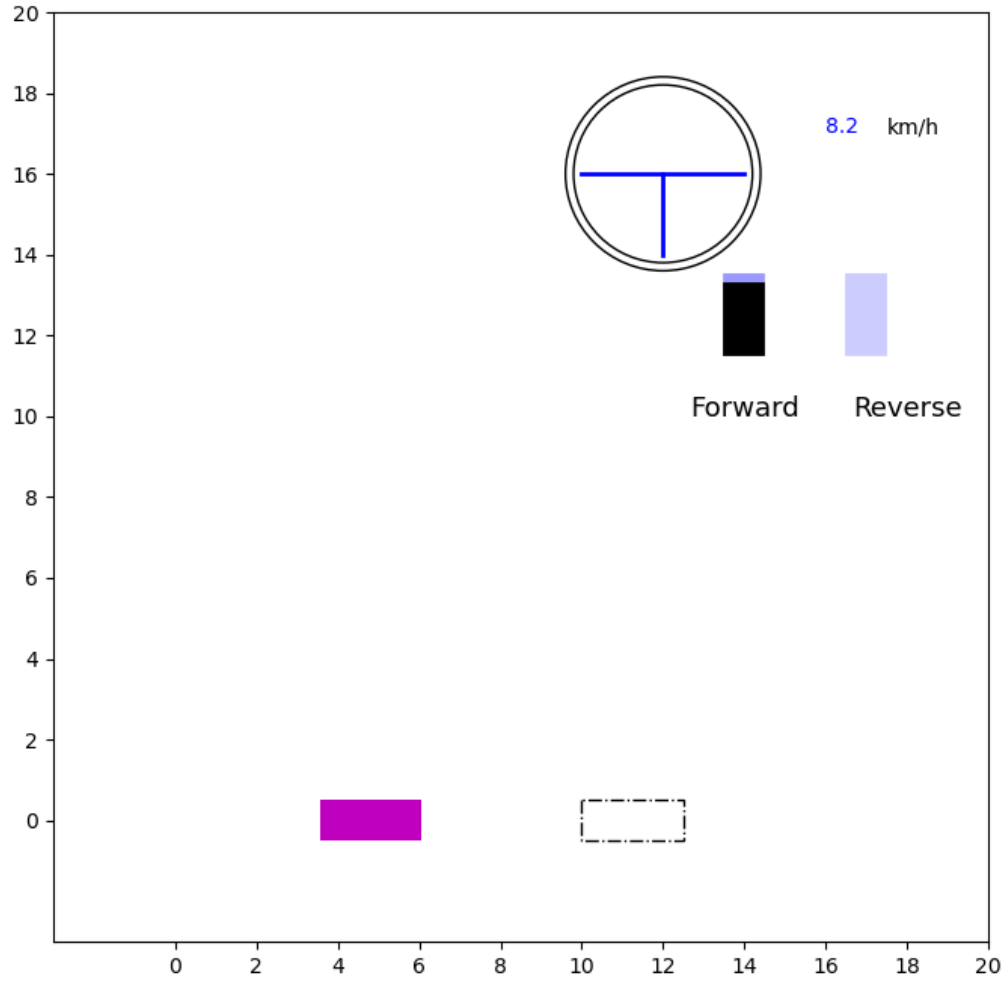
Toy Experiment – Parking at destination (1)

Imagine you are the controller, write some code to drive the car from starting position to the end position

toy_controller_st.py

1. Control inputs: pedal, steering
2. Fill in the control method *control (self, state)* to control the car to move from the startting position to the end position. Try to perfectly stop at the destination pose [x, y, θ]
   stop_pose = [x, y, θ] = [10, 0, 0]

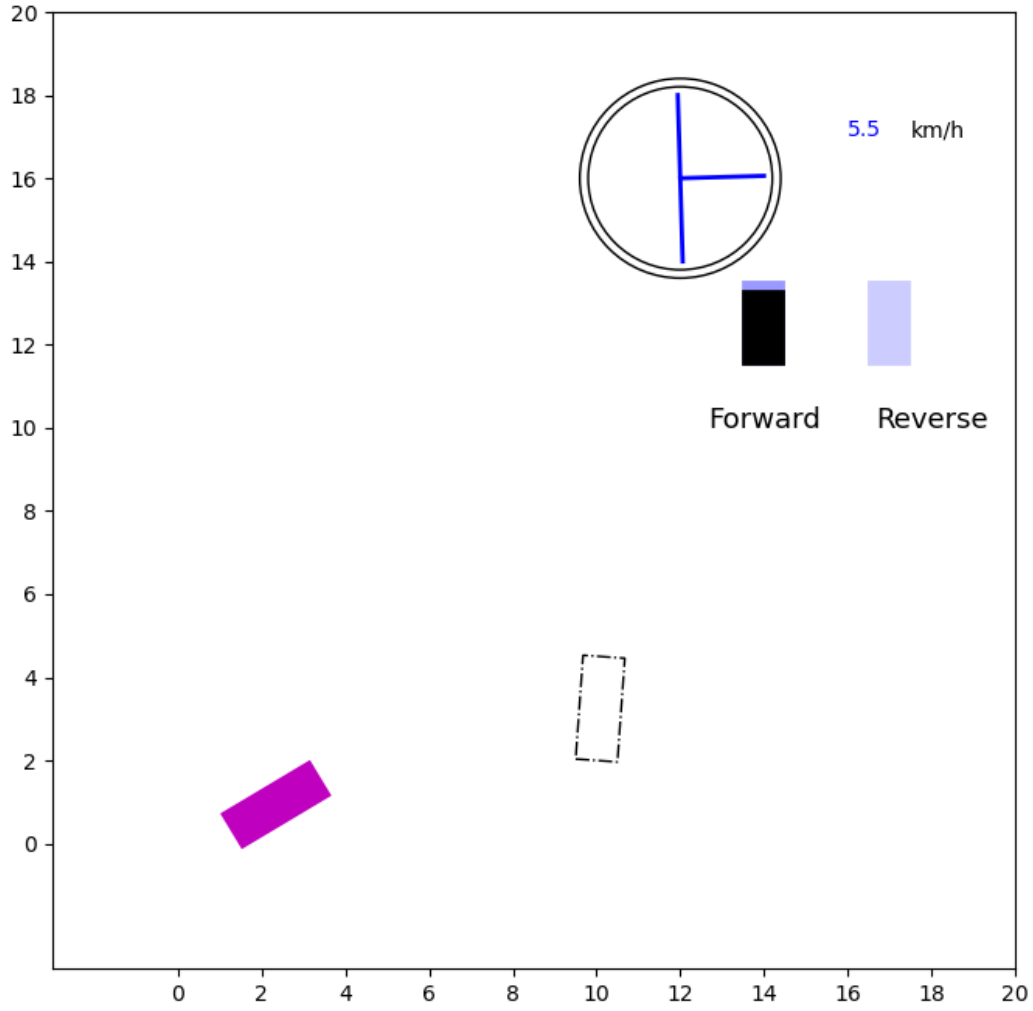


Toy Experiment – Parking at destination (2)

Imagine you are the controller, write some code to drive the car from starting position to the end position

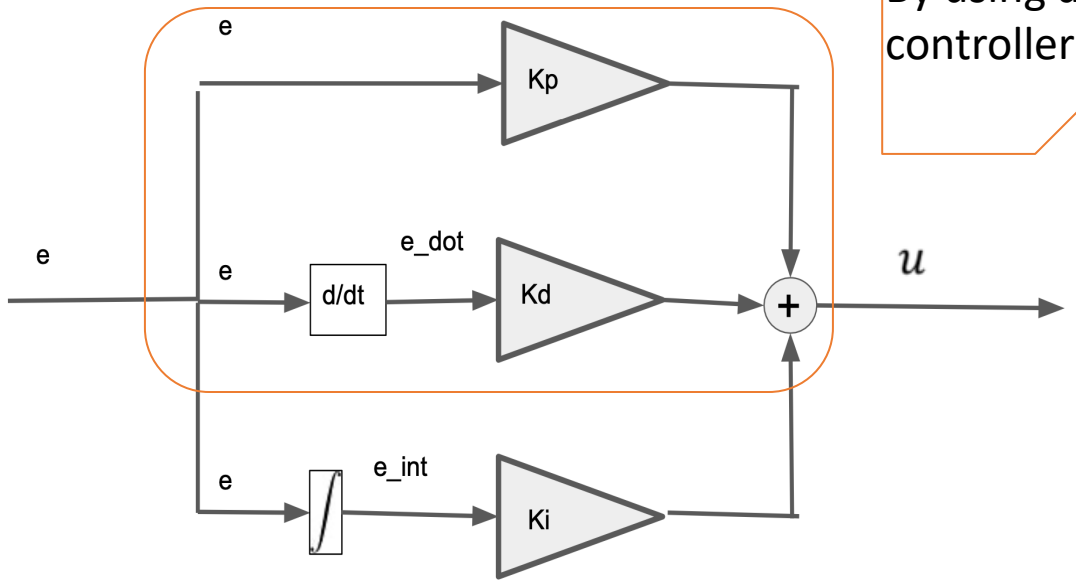
toy_controller_st.py

1. Control inputs: pedal, steering
2. Fill in the control method *control (self, state)* to control the car to move from the startting position to the end position. Try to perfectly stop at the destination pose [x, y, θ]
   stop_pose = [x, y, θ] = [10, 2, 3.14/2]

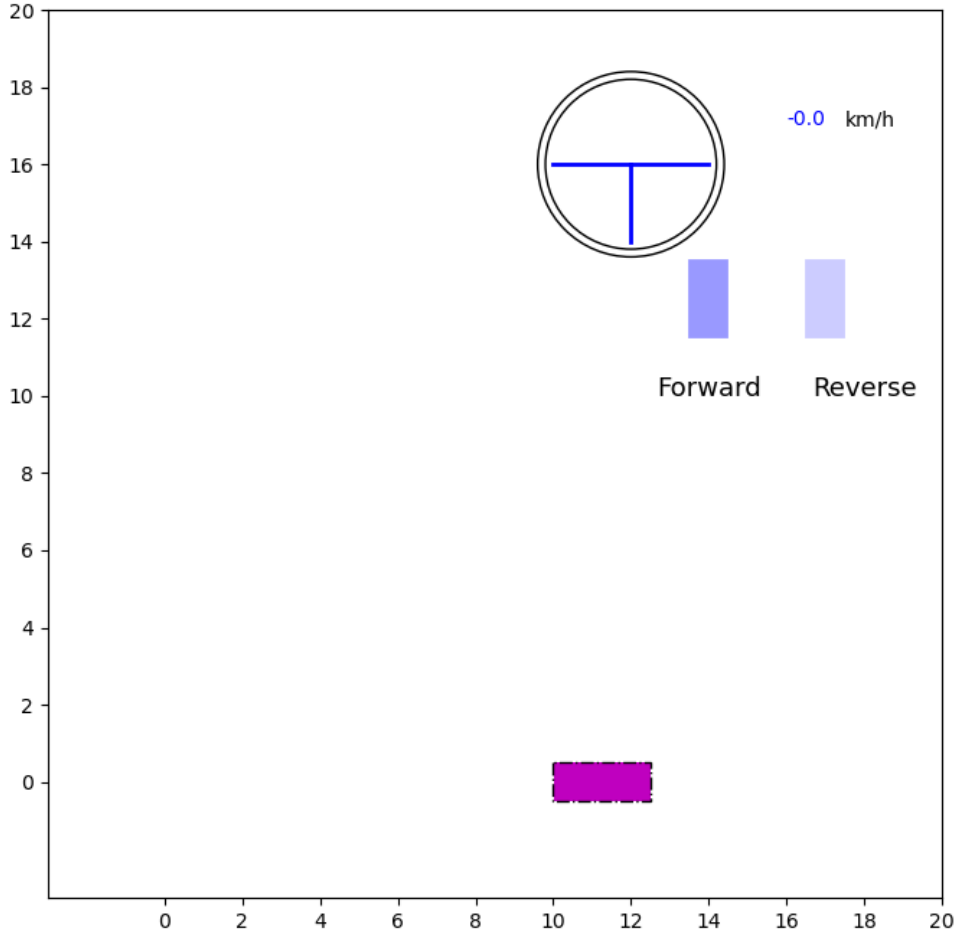


PID for a self-driving car on 1D trajectory

PID controller



By using a PD controller



PID for a self-driving car on 1D trajectory

- Apply PID controller to 1D self-driving car
  - Drive the car from starting position [0, 0, 0] to end position ref = [10, 0, 0]
  - **Control Inputs**: u = [pedal, steering], where pedal is in the range [-1, 1] = [full brake, full throttle]
  - *Starter code: car_controller_pid_st.py*
  - Think about what's the difference if the car moves with the following two motion model?

Motion Model 1:

$$x_{t+1} = x_t + \dot{x}\,dt \qquad \dot{x} = v_t$$
$$v_{t+1} = v_t + \dot{v}\,dt \qquad \dot{v} = pedal_t * 5$$

Motion Model 2:

$$x_{t+1} = x_t + \dot{x}\,dt \qquad \dot{x} = v_t$$
$$v_{t+1} = v_t + \dot{v}\,dt - v_t/25 \qquad \dot{v} = pedal_t * 5$$

Motion Model 3:

$$x_{t+1} = x_t + \dot{x}\,dt \qquad \dot{x} = v_t$$
$$v_{t+1} = v_t + \dot{v}\,dt - v_t/25 \qquad \dot{v} = pedal_t * 5 - 0.5$$

Assume a constant resistive force