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# Omni-Wheel Robot - Advanced Motion Challenges

This notebook will help you complete advanced movement challenges using the **omni-wheel robot**. Follow the tasks, experiment with commands, and refine your scripts!

#### Learning Objectives

- Write and test scripts for **precise movement patterns**.
- Adjust speed, duration, and direction for smoother control.
- Analyze how different parameters affect movement.

```
In []: import time
    import random
    import sys
    import os

# Add parent directory to the Python path
    sys.path.insert(0, os.path.abspath('..'))
    import rclpy
    from controllers.omni_robot_controller import OmniWheelControlNode # Import

# Initialize ROS2 node
    rclpy.init()
    node = OmniWheelControlNode()
```

### Challenge 1: Triangle Pattern

**Goal:** Move the robot in a triangle shape.

- Move forward for a set distance.
- Rotate 120° to the right.
- Repeat the pattern three times to complete the triangle.

#### **Example Start:**

```
In [ ]: # Example - First step of the triangle
    node.move_in_direction(0, 0.5, 2)
    node.rotate_right(120, 1)
```

**Your Challenge:** Complete the full triangle by adding two more movement steps.

#### Challenge 2: Zig-Zag Movement

**Goal:** Make the robot move in a **zig-zag pattern**.

- Move diagonally to the right.
- Move diagonally to the left.
- Repeat the pattern **multiple times**.

```
In [ ]: # Example - One Zig-Zag movement
   node.move_in_direction(45, 0.5, 2)
   node.move_in_direction(135, 0.5, 2)
```

Your Challenge: Extend the pattern for multiple repetitions.

## Challenge 3: Spiral Path

**Goal:** Create a **spiral motion** by gradually increasing movement duration.

- Move forward a small amount.
- Rotate slightly.
- Increase movement duration step by step.

**Your Challenge:** Experiment with different speeds and angles for a smoother spiral.

```
In [ ]: # Your code here:
    # for i in range(?):
    #    node.move_in_direction(?, ?, ?)
    #    node.rotate_right(?, ?)
```

#### Challenge 4: Obstacle Avoidance Simulation

**Goal:** Simulate reacting to obstacles by stopping after each movement.

- Move forward and **stop immediately**.
- Move in another direction and stop again.
- Experiment with different stopping points.

```
In [ ]: # Example - Move and stop
   node.move_in_direction(0, 0.5, 2)
   node.stop_all_motors()
```

**Your Challenge:** Add multiple movement directions with stops in between.

```
In [ ]: # Your code here:
    # node.move_in_direction(?, ?, ?)
    # node.stop_all_motors()
    # node.move_in_direction(?, ?, ?)
    # node.stop_all_motors()
```

#### Shutting Down the Node

Once you're done, **shutdown the node** properly.

```
In [ ]: node.destroy_node()
    rclpy.shutdown()
```