# 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 [ ]:
```python
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 [ ]:
```python
# 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.

In [ ]:
```
# Your code here:
# for _ in range(2):
#     node.move_in_direction(?, ?, ?)
#     node.rotate_right(?, ?)
```

## 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.

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

## 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**.

In [ ]:
```
# Example - Spiral Start
for i in range(1, 6):
    node.move_in_direction(0, 0.5, i)
    node.rotate_right(30, 1)
```

**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()
```