Differential Drive Robot Simulation and Control in MuJoCo

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1.Project Description

The goal of this project is to design, implement, and simulate a differential drive robot in the MuJoCo physics engine. The robot should be capable of following a predefined path using differential drive kinematics and a closed-loop control algorithm

2. Technical Approach

Model a differential drive robot in MuJoCo using XML configuration.

Implement wheel actuation and sensor feedback.

Develop a path-following controller in Python (using mujoco or mujoco-py).

Test and evaluate the robot's tracking performance on various trajectories (straight line, circular, or S-shaped paths).

3.Expected Results

Working MuJoCo simulation of a differential drive robot.

Implementation of a control law capable of accurate path tracking.

Performance evaluation (position error plots, speed profile, etc.).

Final report and short demonstration video.

4.Timeline（To 03.11）

1)Week1: Build and verify MuJoCo robot model, Configure actuators &

sensors, Implement differential drive forward kinematics

2)Week2: Implement PD/PID control for path following, Run tests on different paths, Collect

results and finalize report

5. Team Members and Task Distribution

Member1(Xiangzhang): System Modeling

Main tasks: Create base MuJoCo XML model of the differential drive robot, define joints,

actuators, and sensors.

Member2(Zyad Al-Shuja): Control Algorithm Developer

Main tasks: Implement PD/PID control for wheel velocities, tune parameters for stable path

tracking.

Menber3(Mohammed Almaswary): Simulation & Analysis

Main tasks: Set up path trajectories, run experiments, collect and analyze results, prepare

visualizations and video demo.