ROS 2 INTERFACE FOR A MOBILE ROBOT

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Abstract

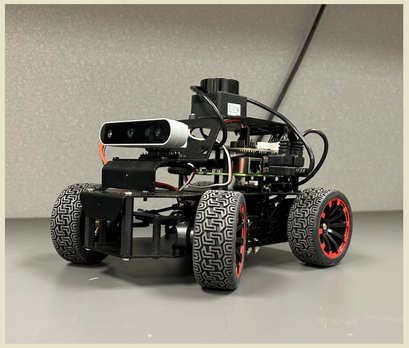
This project developed a simple Python interface for controlling a mobile robot with a basic PID controller. The interface allows users to start, stop, adjust speed, and manually move the robot. This interface serves as a stepping point and has the potential to work with advanced algorithms.

Introduction

- ROS 2 (Robot Operating System 2) is a versatile, open-source framework for creating robot software; it acts as a communicator between a computer and a robot.
- Gazebo Sim is a 3D robotics simulation environment that provides realistic physics simulation.
- This robot and interface are important because they simplify robot control, demonstrate feedback systems, and is vital to developing advanced processes.
- These systems can be applied to autonomous vehicles, manufacturing robots, delivery robots, and other machines that need precise and reliable movement.

HiWonder MentorPi

- Hiwonder MentorPi A1 is a Raspberry Pi–powered educational robot designed for ROS 2 projects.
  - It uses sensors including LiDAR and cameras for navigation, mapping, obstacle avoidance, computer vision, and Ackermann steering.
- The Dubins path is a technique for determining a quick route between an initial and final position.



HiWonder MentorPi A1 robot

System Workflow

Keyboard / GUI
↓
Python Interface
↓
ROS 2 Topics
↓
PID Controller
↓
MentorPi Robot
↓
Odometry Feedback

Scan to View the Ellipse Demonstration

MentorPi Control Panel

Status: Ready

Current Speed

0.000 m/s

Keyboard Controller

WASD or Arrow Keys

Drive: 0.00 m/s Turn: 0.00 rad/s

Enable Controller Mode

0.000 m/s

Drive Speed (m/s)

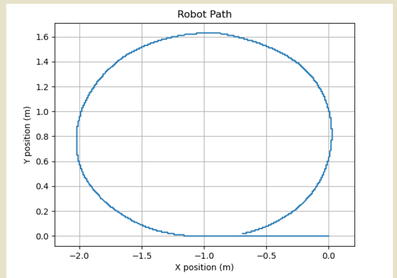
0.05

Start Ellipse

Stop Ellipse

EMERGENCY STOP

Python–based robot control panel

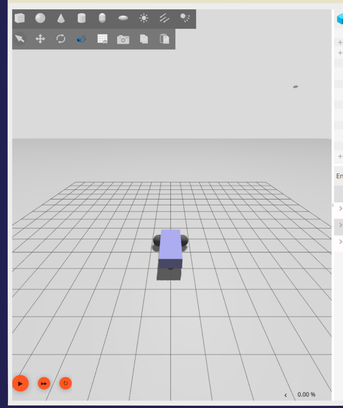


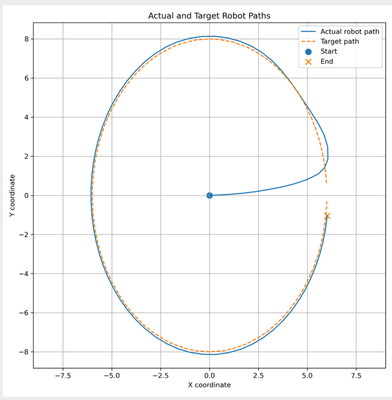
Recorded elliptical path using coordinates

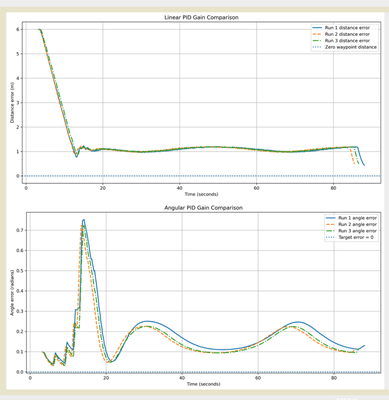
Future Work

- Establish a backup mechanism
- Add more autonomous movement options.
- Apply PID control to additional movements and autonomous tasks.

GAZEBO SIM AND PID







	Linear	Angular
Run 1	Kp = 0.7 Ki = 0.0 Kd = 0.08	Kp = 0.55 Ki = 0.0 Kd = 0.06
Run 2	Kp = 0.9 Ki = 0.01 Kd = 0.08	Kp = 0.65 Ki = 0.005 Kd = 0.08
Run 3	Kp = 0.08 Ki = 0.01 Kd = 0.08	Kp = 0.65 Ki = 0.005 Kd = 0.06

Result: The completed system successfully supports manual keyboard control and PID–controlled elliptical path following.

Aknowledgements

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