

Spline Motion with Pololu 3 π + 2040

Robotics – CS549AH1

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Purpose

The purpose of Lab Project 4 is to develop microPython code to execute a continuous trajectory generated by a Hermite spline.

Summary

The Pololu 3pi+ 2040 Robot is a versatile platform for various robotic applications. The objective is to make the robot follow a continuous trajectory generated by a Hermite spline.

The code utilizes MicroPython and the Pololu 3pi+ 2040 Robot library. The `spline_points()` function calculates the coordinates of points along the spline trajectory using cubic Hermite interpolation. Motion parameters such as length and direction are computed using the `motion_param()` function. The primary function `move_along_spline()` iterates over the generated spline points. The robot calculates the angle difference at each point to orient itself towards the next point. The `rotate_robot()` function adjusts the robot's orientation by turning it left or right based on the angle difference. The robot moves forward towards the next point using the `forward()` function.

Motor control is achieved by adjusting the motor speeds. The `forward()` function moves the robot forward by a specified distance based on encoder counts. Left and right turns are executed using the `left()` and `right()` functions by rotating the robot to the desired angle using encoder counts.

The code initializes the robot's position, generates spline points, and moves the robot along the spline trajectory. The robot's movement is synchronized with the spline points, ensuring accurate trajectory following. Proper sleep durations are incorporated to manage robot movement and orientation adjustments.

Conclusion:

The implemented code successfully enables the Pololu 3pi+ 2040 Robot to follow a spline trajectory using Hermite interpolation. Correct movement and orientation adjustments are achieved by leveraging motor control and encoder feedback. This project demonstrates the capability of the Pololu 3pi+ 2040 Robot for autonomous navigation tasks using spline trajectory following algorithms in MicroPython.

References:

1. Popenbrinck, N. (1998) Hermite Curve Interpolation, Hermite curve interpolation. Available at: <https://www.cubic.org/docs/hermite.htm> (Accessed: 05 March 2024).
2. demofox2 (2015) Cubic hermite interpolation, The blog at the bottom of the sea. Available at: <https://blog.demofox.org/2015/08/08/cubic-hermite-interpolation/> (Accessed: 05 March 2024).