

## Week 7 - Overview

This week, students will use a proportional line tracking algorithm. They will find that line tracking with a proportional controller is much more effective than a two-level controller.

Students will also combine line tracking programming with multiple sensor outputs to improve the performance of the robot. In addition, they will tune the controller to work under various geometries.

### Computer Science Skills

- Proportional controllers
  - Setpoint
  - Gain
  - Tuning a controller
  - Using variables
  - Optimizing code
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### CoderZ Techniques

- Using switches
- Using loops

## Implementation Thoughts

The trickiest part will be tuning the controller and determining how to optimize the code for the robot to drive along lines of different curvature. If the students use one code for both straight and curved lines, there will be a point where the code is not optimal for either line. They may be able to anticipate these curves and switch between the types of codes.

### Lesson 1: The Proportional Line Tracker

Students will:

- Develop a proportional line tracker.
  - Calculate the desired setpoint for tracking a line based on the HUD.
  - Add gain to their controllers.
  - Employ variables in their code.
  - Tune the controller.
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## **Lesson 2: What is the Setpoint?**

Students will:

- Determine the setpoint autonomously.
  - Combine the ultrasonic sensor with the color sensor in the same program.
  - Use the ultrasonic sensor to signal a transition from one part of a program to the next.
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## **Lesson 3: Balloon Challenge**

Students will:

- Repeat the balloon challenge using a proportional line tracker.
  - Optimize their code for time.
  - Tune the gain and power parameters in their code.
  - Program the robot to dynamically vary the tuning parameters depending on the location in the course.
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## **Lesson 4: Obstacles on the Track**

Students will:

- Apply the proportional controller to the Electrical Tape racetrack.
  - Program the robot to interrupt line tracking when there are obstacles on the line.
  - Regain the line after avoiding obstacles.
  - Vary the tuning depending on the nature of the course.
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## **Lesson 5: A-mazing Line Tracking**

Students will:

- Use proportional line tracking to track a line through a maze.
  - Track around 90 degree corners in the maze.
  - Use other sensors to aid maze navigation.
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