**🧭 Student Activity: “Tuning for the Perfect Escape”**

**How does the code work?**

1) The code reads the presence of black tape under multiple sensors using the ***border\_threshold*** parameter.

2) To prevent false positives, the code uses the ***strong\_black\_threshold*** parameter to confirm that at least one sensor has a good view of the black tape.

3) The code uses the ***confirm\_required*** parameter to get a second reading of the tape after a short amount of time to ensure a shadow or other factors don’t effect an actual reading.

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| --- | --- | --- |
| **Variable** | **Used for...** | **Benefit** |
| *border\_threshold* | Early black detection | Reacts faster to approaching lines |
| *strong\_border\_threshold* | Confident detection | Prevents reacting to noise or shadows |
| *confirm\_required* | Requires sustained detection | More reliable decisions |

**🎯 Objective**

Students will adjust line detection and avoidance parameters to improve how reliably the robot stays inside a black tape boundary without overcorrecting or missing lines.

**🧰 Setup**

* Place the robot inside a **square or circular black-tape boundary**.
* Load the boundary-avoidance script (7\_boundary\_contain) with these parameters exposed at the top of the file.

**📝 Instructions**

1. **Calibrate** the sensors by pressing Button A.
2. Observe robot behavior with default settings.
3. Tune **one parameter at a time**, rerun the robot, and **record the results** in a table.
4. Repeat for all five parameters.

**🧩 Parameters to Adjust**

|  |  |  |
| --- | --- | --- |
| **Param** | **Try Values** | **Observe** |
| border\_threshold | 800, 880, 940, 980 | When does the robot detect the line? Too early? Too late? |
| strong\_black\_threshold | 880, 940, 970, 990 | How often does it false-trigger vs. miss a real line? |
| confirm\_required | 0, 1, 3 | Does it wobble near the line or act decisively? |
| drive\_speed | 1200, 2000, 3000 | Does speed affect accuracy or responsiveness? |
| turn\_duration\_ms | 300, 550, 700 | Does the robot oversteer or not turn enough? |

**🧩 Custom Boundary Activity**

Use the black tape to create a custom boundary and test if the robot is able to stay inside of it as effectively as in the rectangle.