ADVANCED EV3 PROGRAMMING LESSON

EV3 Classroom:
Introduction to Gyro Sensor and Drift

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EV3 CLASSROOM LESSON
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Lesson Objectives

1. Learn what the Gyro Sensor does

2. Learn about 2 common problems with using the gyro sensor (drift and lag)

3. Learn what "drift" means

4. Learn how to correct for drift with a gyro "calibration" technique

Prerequisites: Loops, Operators, Wait Blocks

What is the Gyro Sensor?

↗ Gyro sensor detects rotational motion

↗ The sensor measures the rate of rotation in degrees per second (rate)

↗ It also keeps track of the total rotational angle and therefore lets you measure how far your robot has turned (angle)

↗ The accuracy of the sensor is ±3 degrees for 90 degree turn

Gyro Sensor Problems

↗ There are 2 common Gyro issues – drift and lag

  ↗ Drift – readings keep changing even when the robot is still
  ↗ Lag – readings are delayed

↗ In this lesson, we focus on the first problem: drift.

  ↗ We will cover lag in the Gyro Turn lesson

↗ Solution to drift: gyro calibration

  ↗ The source of the drift problem is that the gyro must "learn" what is still.
  ↗ For a color sensor, you have to "teach" the robot what is black and white
  ↗ For your gyro, you need to calibrate the sensor to understand what is "still"

Gyro Calibration to Solve Drift

- The gyro auto-calibrates when the robot is turned on or the gyro wire is connected. If the robot is moving during calibration, the gyro "learns" the wrong value for "still" – this causes drift!

- Unfortunately, there is no gyro calibration block. However, there is a way to force a calibration of the sensor.

Terms to Know

↗ Reset: Current value of the gyro sensor angle is set to "0". This is what the gyro block with mode set to "reset" does.

↗ Calibration: The gyro calibrates what it considers to be "still". This sets both the current gyro sensor rate and angle to "0". This typically occurs when the gyro is connected.

↗ Some people refer to calibration as a "hard reset". We will call this calibrate through this lesson to reduce the amount of confusion.

IMPORTANT NOTES

- <u>Keep the robot still</u> when you calibrate the gyro

- You <u>should not not run this every time</u> you need to read the gyro

- You should <u>calibrate in a separate program</u> and run it once before you run your code

Solutions For Fixing Drift

Hardware Solution

↗ Unplug and re-plug your gyro sensor while making sure your robot is still

↗ This technique requires access to the EV3 ports and is prone to failure since you may shake the robot as you re-plug the wire.

Software Solution

↗ If you read the port the gyro is connected to as an infrared sensor and then read it again as a gyro sensor, it seems to force a recalibration of the gyro.

↗ See the next slide for recalibration code that can be used with all generations of gyro sensors.

↗ Note: Did not work reading the sensor as color, ultrasonic, or touch

Recalibration Code
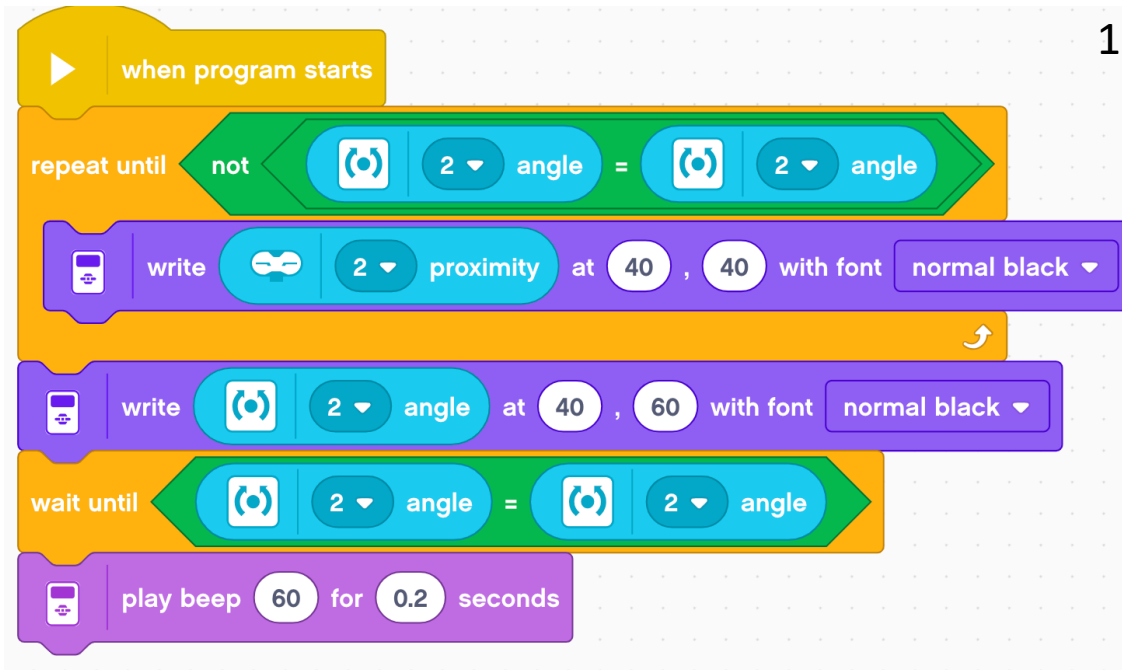
1. Read the port of the gyro as an infrared sensor. Unfortunately, in the EV3 Classroom software, the infrared does not force the gyro sensor communication to timeout properly every time when reading it on the gyro port. To ensure that it works, a loop keeps reading the infrared on port 2 until the gyro angle is not equal to itself. When the gyro disconnects, it reads as NAN, and NAN is not equal to NAN. Therefore, it will repeat until the gyro is successfully disconnected.

2. Read port 2 back as a gyro sensor.
3. Wait until the angle is equal to itself, or the gyro has been reconnected.
4. Play a beep so that the user knows that the recalibration has been completed

NAN: Not a Number

Discussion Guide

1. **What are 2 common problems when programming with the gyro?**

   Ans. Gryo drift and Gyro lag

2. **What does Gyro drift mean?**

   Ans. The Gyro readings keep changing even when the robot is still

3. **Can you move your robot when you calibrate your gyro?**

   Ans. No. Keep the robot still.

4. **Do you need to calibrate your gryo before every move?**

   Ans. No. Once before you run your entire program

Credits

- ↗ This tutorial was written by Sanjay Seshan and Arvind Seshan

- ↗ More lessons at www.ev3lessons.com