ADVANCED EV3 PROGRAMMING LESSON

Gyro Turns

By Droids Robotics

Lesson Objectives

1. Learn what Gyro Lag is
2. Learn two ways to correct for this lag
3. Understand why it is important to explore alternative solutions to a problem

- Pre-requisites: My Blocks with Inputs and Outputs, Data wires, Math Blocks, Loops, Proportional Control

Gyro Problem 2: Lag

- What is lag?
  - The gyro sensor readings lag behind the true value sometimes
- When the turn starts, it takes time for the gyro to begin changing
- This lesson presents two ways to deal with lag in a turn
  1. Reduce the amount of angle that you turn to compensate for lag (slides 4-9)
  2. Use proportional control to continue performing your turn for a requested duration (slides 10-12)

Stage 1: Simple Gyro Turn

GOAL OF THE PROGRAM: Simple turn degrees using the gyro

To run these programs, you will need a gyro sensor on your robot connected to port 2. Connect motor B to the left wheel and motor C to the right wheel.

Install tips: The gyro can be anywhere on your robot (even hidden or upside down is okay).

This program turns one motor on and waits for the gyro to read 90 degrees. This will make the robot turn 90 degrees to the right.

STEP 1: YOU NEED TO RESET THE GYRO: We have these two blocks here because the gyro sensor reading somtimes continues to go up even though the robot is still. By reading the rate of the gryo then the angle the gyro sensor gets recalibrated. Make sure to run these blocks when the robot is still.

This is a wait block. We wait 0.1 seconds because it takes time for the gyro sensor to reset to zero.

Turns on left motor.

Stops right motor.

This block waits until the gyro sensor reads 90.

This stops the motor so it does not keep moving after you reach 90 deg.

Stage 2: Dealing with Lag

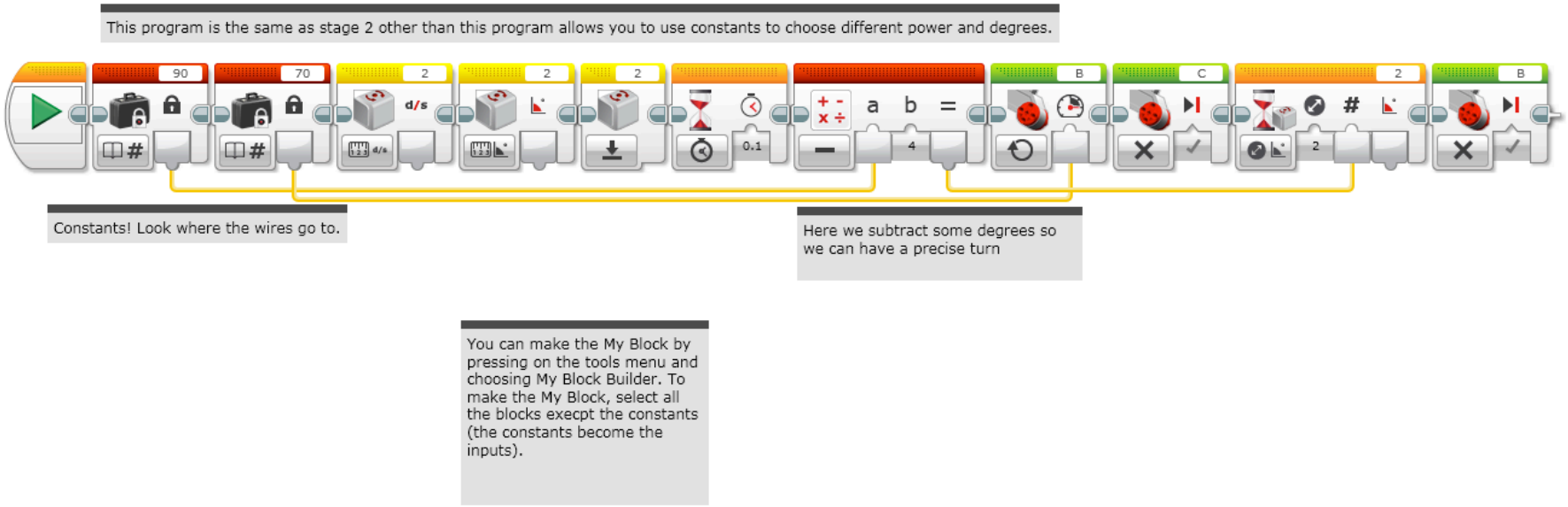
Problem with the Stage 1: You will find that the gyro does not go the degrees you want it to. If you set it to turn 90 degrees, sometimes it overshoots to 93. You need to make adjustments for this.

Program goal: A more precise gyro turn

This program turns the robot a bit less than 90 degrees to reach exactly 90 degrees. This value will have to be changed for your robot. The reason the robot does not turn exactly 90 deg. when you type in 90 is because the gyro readings lag behind the robot's actual position.

The only change made from the previous stage is that I am now waiting till the Gyro reaches 86 degrees rather than 90 in this block.

Stage 3: Making a My Block



Stage 4: Using the My Block

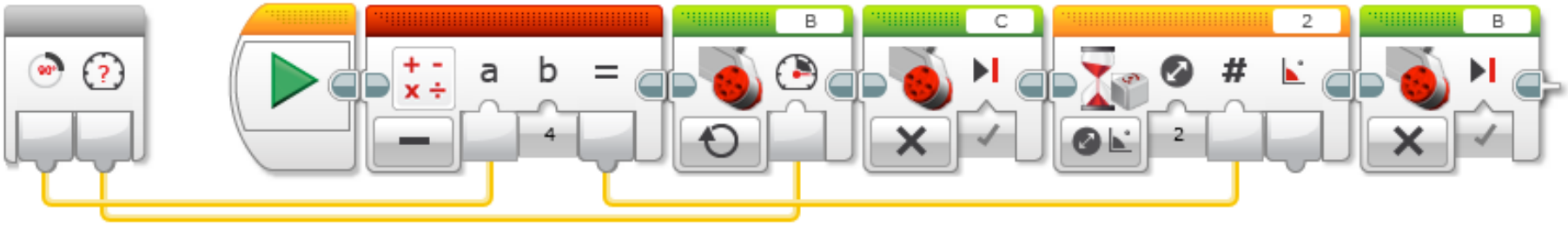
Here is our final stage, it is the same as stage 3, but converted into a my block. It has two changable inputs, degrees and power. Double click on the my block to see inside.

Here two different my blocks that have been made turn left and right.

You can make the My Block by pressing on the tools menu and choosing My Block Builder. To make the My Block, select all the blocks execpt the constanst (the constants become the inputs). Double click on the My Blocks to see inside.

Inside the My Block: Turn Degrees Right

This program is the same as stage 3 other than it is a my block. The two constants turned into the grey block with two outputs.



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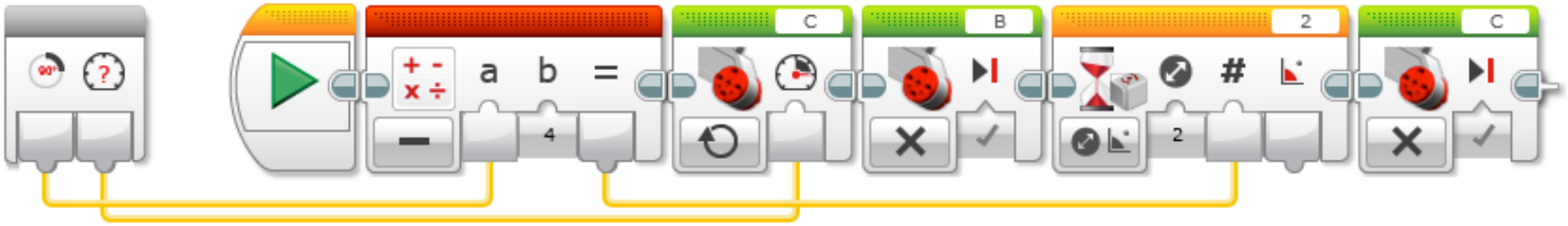
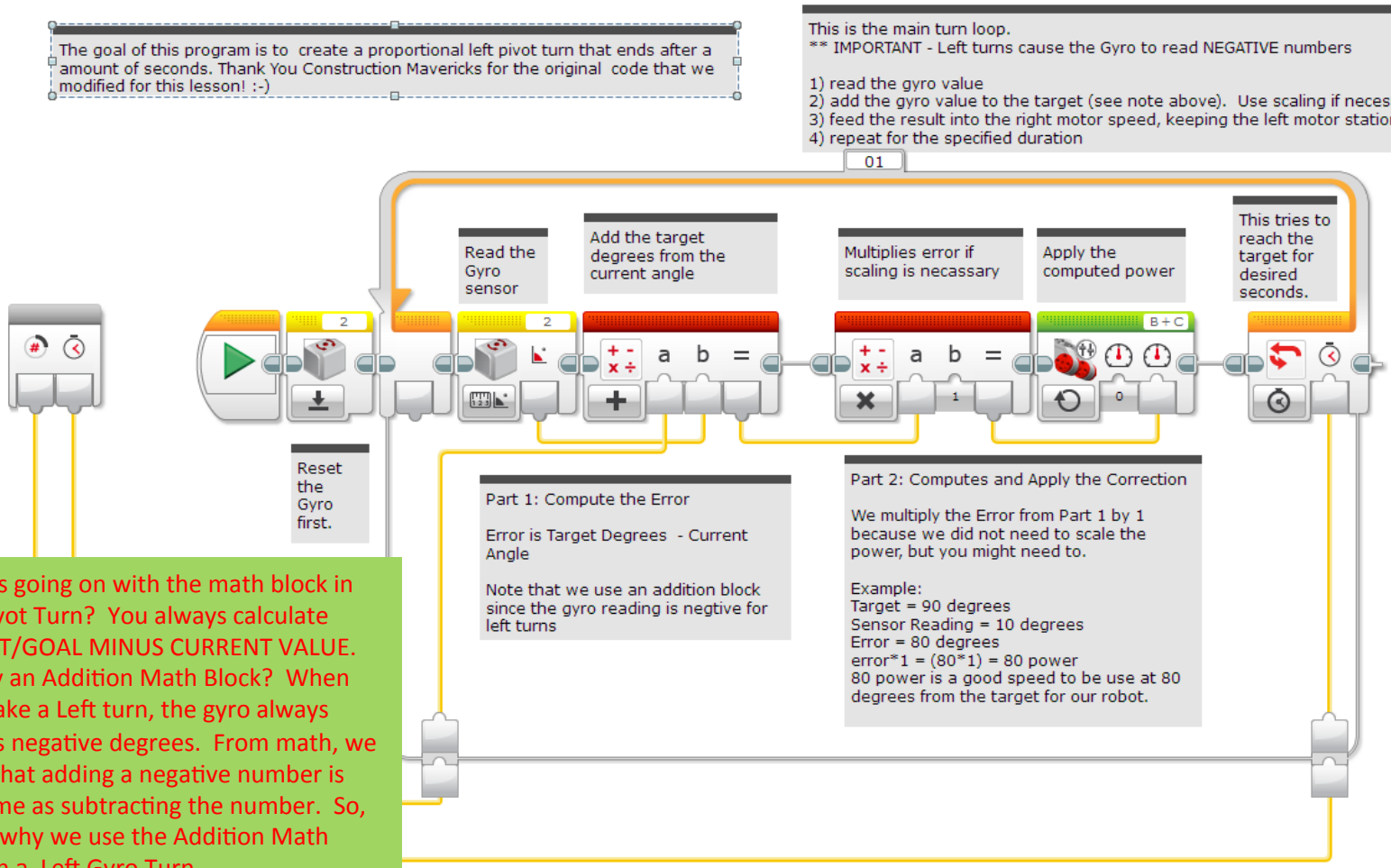


Proportional Gyro Turns
by The Construction Mavericks

- This method improves over the simple overshoot correction mechanism from earlier by using proportional control
  - If you are unfamiliar with proportional control, please see the advanced lesson on proportional control before continuing.
  - The basic idea is to use the current gyro position and where it wants to point to determine how to set the motor power.
- Note from Construction Mavericks: It's not perfect, but we have had much better success with these blocks than the overshoot-corrected ones.
- Tip from Construction Mavericks: Try to set the outer loop to an infinite loop. Once the robot settles into place, pick it up and rotate it and watch it try to get back to where it wants to be.

Proportional Left Turn

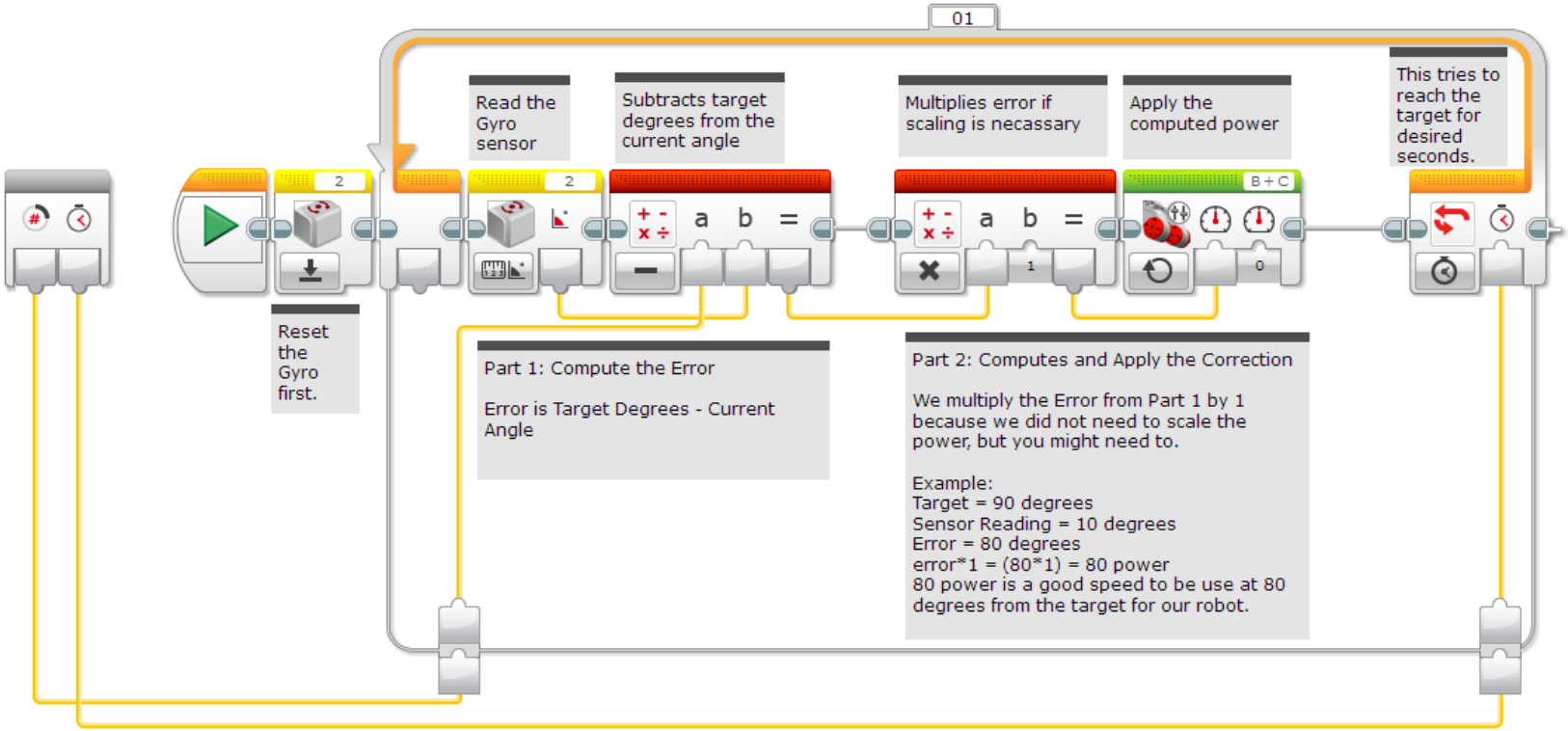


What is going on with the math block in Left Pivot Turn? You always calculate TARGET/GOAL MINUS CURRENT VALUE. So why an Addition Math Block? When you make a Left turn, the gyro always returns negative degrees. From math, we know that adding a negative number is the same as subtracting the number. So, that is why we use the Addition Math block in a Left Gyro Turn.

Proportional Right Turn

The goal of this program is to create a proportional right pivot turn that ends after a amount of seconds. Thank You Construction Mavericks for the original code that we modified! :-)

This is the main turn loop.
1) read the gyro value
2) subract the gyro value from our target. Use scaling if necessary.
3) feed the result into the left motor speed, keeping the right motor stationary
4) repeat for the specified duration



Discussion

1. What is gyro lag?
   Ans. The gyro sensor's reading lags behind the true reading

2. What is the difference between the two solutions presented in this lesson?
   Ans. The first way was to reduce the amount of angle that you turn to compensate for lag. The second way was to use proportional control to continue performing your turn for a requested duration

Credits

- This tutorial was written by Sanjay Seshan and Arvind Seshan from Droids Robotics using code shared by The Construction Mavericks (http://fllmavericks.wix.com/fllmavericks)
- More lessons at www.ev3lessons.com