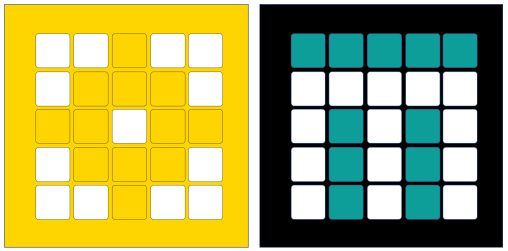
PRIME LESSONS

By the Makers of EV3Lessons



TURNING WITH THE GYRO

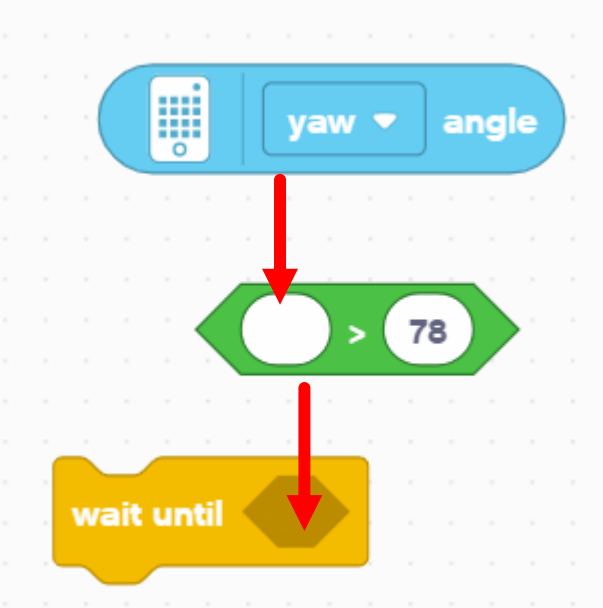
BY SANJAY AND ARVIND SESHAN

LESSON OBJECTIVES

- Learn how to turn using the built-in gyro sensor
- Learn how to use the Wait Until Block with sensors
- Note: Although images in this lessons may show a SPIKE Prime, the code blocks are the same for Robot Inventor

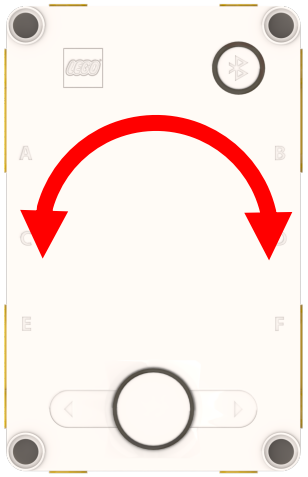
BLOCKS YOU NEED IN THIS LESSON

- Reporter blocks (Float/String) – numbers and text can be placed inside oval slots. They can read sensor values or the retrieve the value stored in a variable.
- Boolean Blocks – carry a true or false value and can be placed inside hexagonal slots such as the Wait Block on the right
- Wait Until Block – Like the Wait for Seconds block, this block makes the program pause execution for some time. In this case, the program waits until the condition in the Boolean block is true

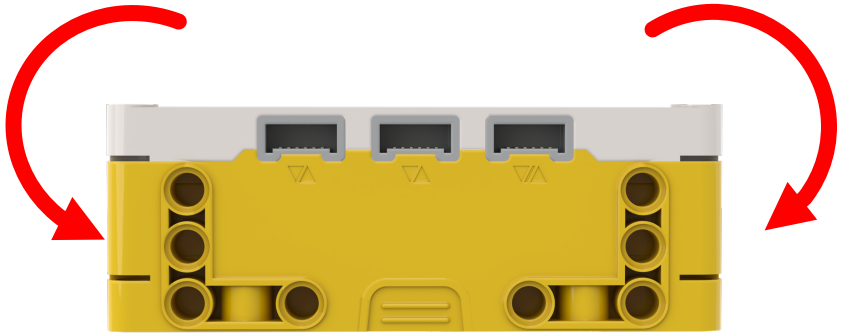


ROBOT ORIENTATION: YAW, PITCH AND ROLL

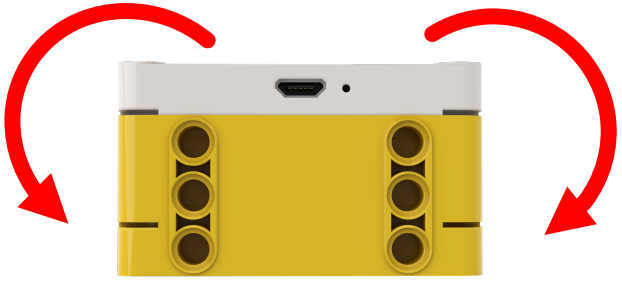
Yaw is turning the Hub to right or left



Pitch is turning the Hub up and down

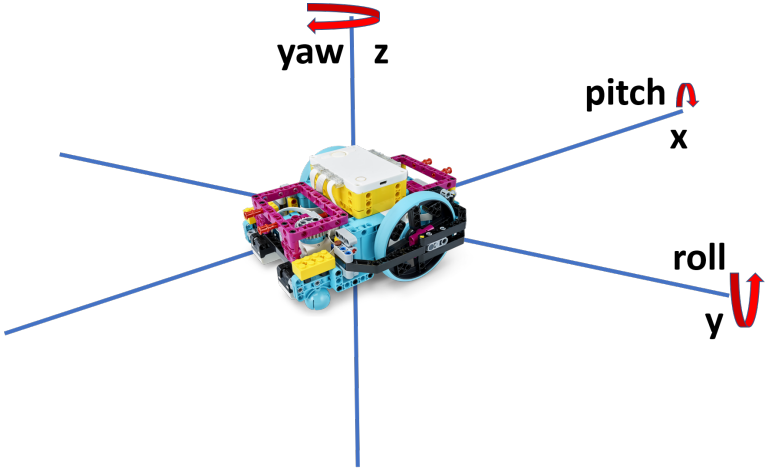


Roll is turning the Hub to side-to-side



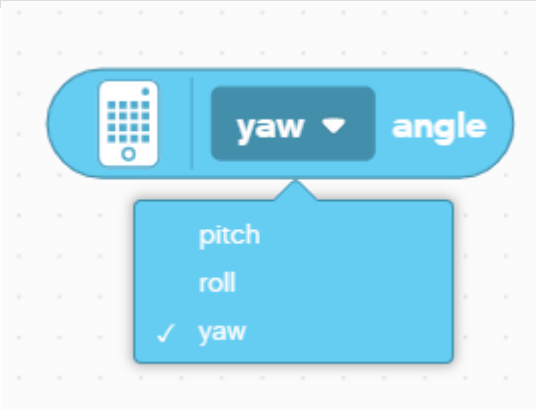
Just like x, y and z coordinates are used to describe a robot's position, yaw, pitch and roll are terms used to describe a robot's orientation. Yaw is rotation around the z-axis. Pitch is rotation around y-axis. Roll is rotation around the x-axis.

The built-in Gyro Sensor can measure the robot's orientation



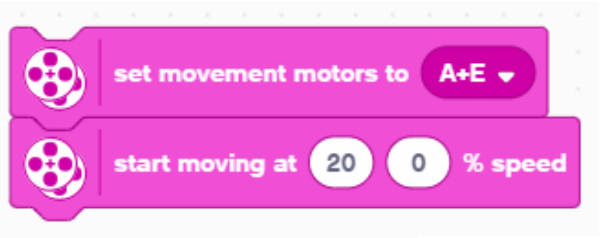
USING THE GYRO SENSOR TO TURN

- The gyro sensor can be programmed to measure the hub's yaw, pitch and roll
- These values can be used to sense if the robot has turned around x, y, or z axes
- In this lesson, we will focus on yaw which can be used to determine if a robot has turned left or right
- For pitch and roll, the robot uses gravity to determine what is a zero reading. Flat on the ground is 0 pitch and 0 roll.
- For yaw, the robot doesn't have a compass to tell it what is north or south. Therefore, you need to tell the robot what it should consider zero. This is done with the "set yaw angle to 0" block.
  - Note that clockwise is positive in yaw measurement

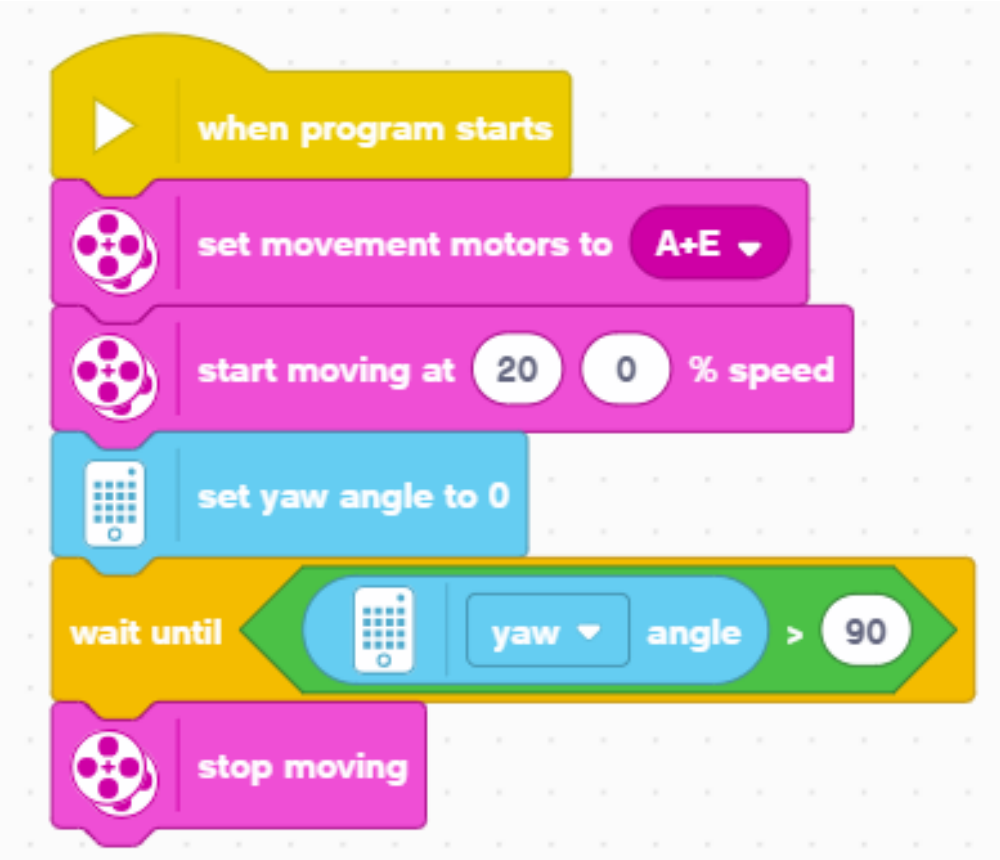


CHALLENGE 1

- Write a program that turns 90 degrees to the right
- Basic Steps:
  - Make your robot start slowly turning right by just turning on the left wheel motor
    - Use low speeds here to improve keep the turn accurate
  - reset the gyro sensor angle to 0
  - Wait until the gyro yaw angle has reached the degrees you want
  - Stop moving

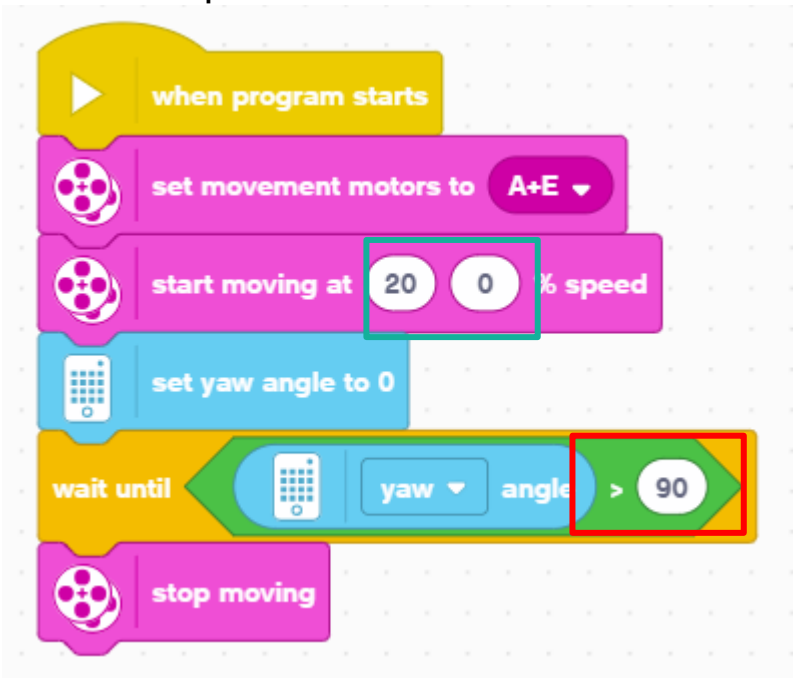


CHALLENGE 1 SOLUTION

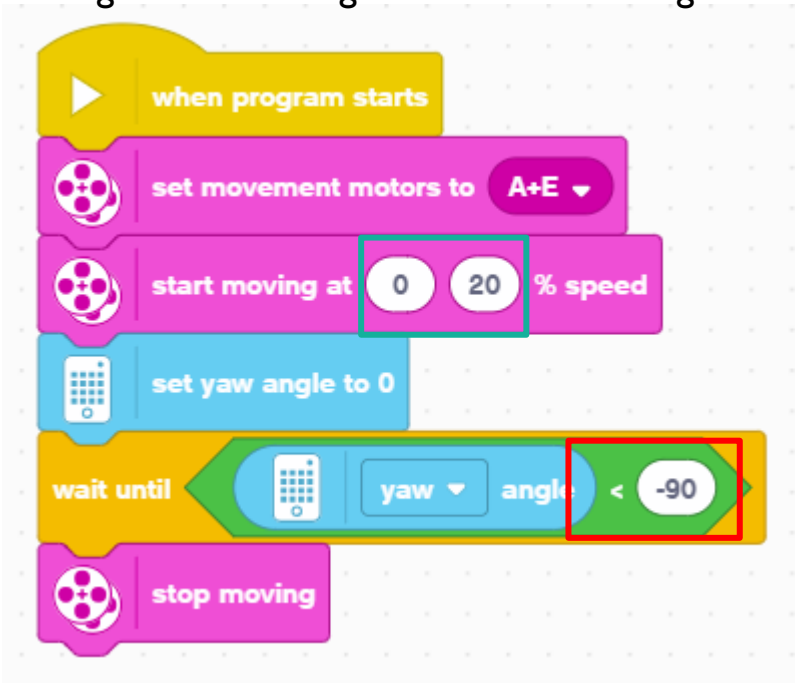


TURNING RIGHT VS. TURNING LEFT

- To change the direction of the turn, you have to:
  1. Change which wheel should turn
  2. The final angle should be -90 degrees instead of 90 degrees
  3. The comparison should be "<" instead of ">" since the angle is decreasing instead of increasing



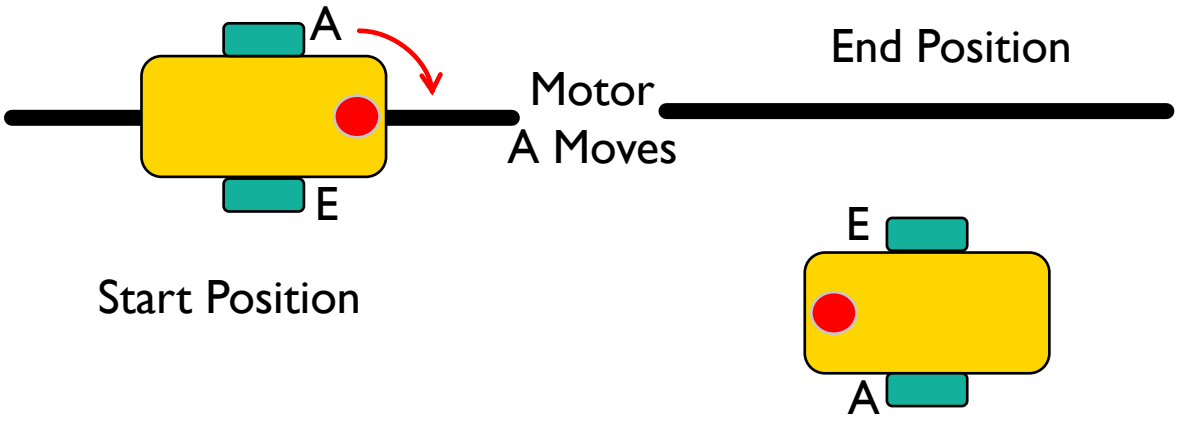
Right Turn



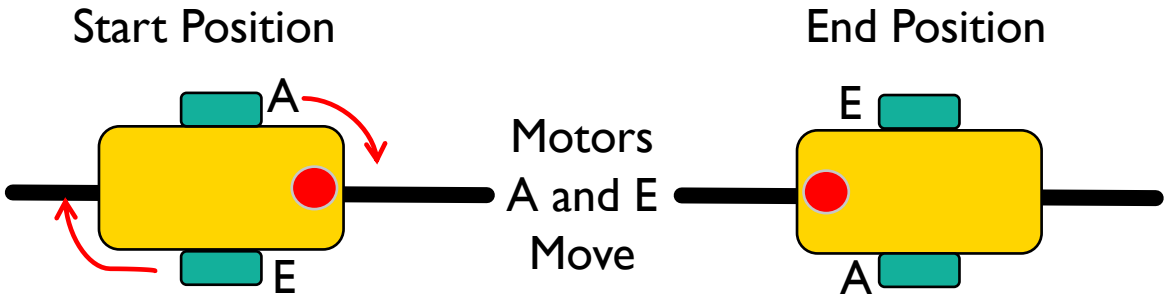
Left Turn

THERE ARE TWO TYPES OF TURNS YOU CAN DO

180 Degree Pivot Turn



180 Degree Spin Turn



Notice where the robot ends in both pictures after a 180 degree turn.

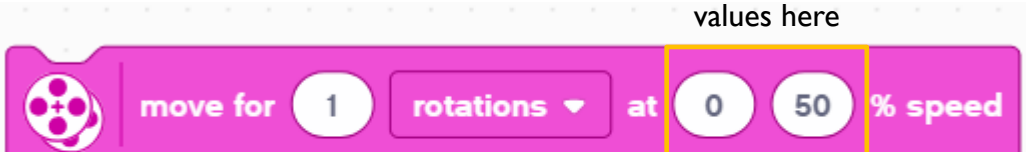
In the Spin Turn, the robot moves a lot less and that makes Spin Turns are great for tight positions. Spin turns tend to be a bit faster but also a little less accurate.

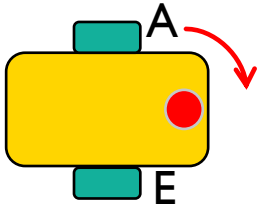
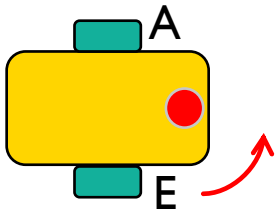
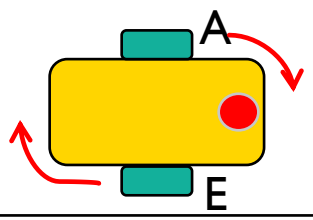
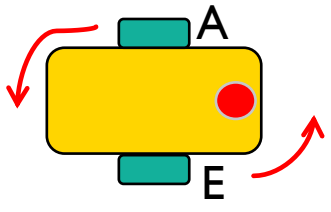
So when you need to make turns, you should decide which turn is best for you!

HOW TO MAKE PIVOT AND SPIN TURNS

Move Tank Block

Change % Speed values here

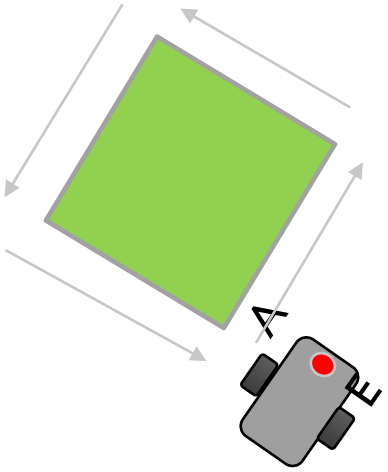


Move Tank Values			
Speed, 0	0, Speed	Speed, -Speed	-Speed, Speed
			
Pivot Turn Right	Pivot Turn Left	Spin Turn Right	Spin Turn Left

TURNING CHALLENGES

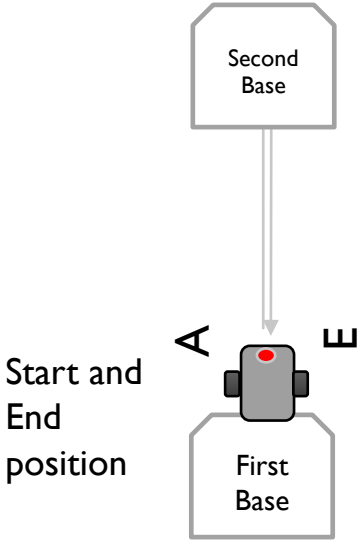
Challenge 1

- Your robot is a baseball player who has to run to all the bases and go back to home plate.
- Can you program your robot to move forward and then turn left?
- Use a square box or tape



Challenge 2

- Your robot baseball player must run to second base, turn around and come back to first.
- Go straight. Turn 180 degrees and return to the same spot.



CHALLENGE SOLUTIONS

Challenge 1

You probably used a combination of move steering to go straight and do **pivot turns** to go around the box.

Challenge 2

You probably used a spin turn because it is better for tighter turns and gets you closer to the starting point!

CREDITS

- This lesson was created by Sanjay Seshan and Arvind Seshan for SPIKE Prime Lessons
- More lessons are available at www.primelessons.org