

# Robot Design Pre-Season Navigation Challenges

## CARGO CONNECT

Reliable navigation is very important in FIRST LEGO League Challenge. We have four challenges for you using an empty CARGO CONNECT mat. You do not need to have any build instructions to complete these challenges. You can work on these challenges before the season launch on August 17. If you have not registered and do not have a CARGO CONNECT Challenge Mat, just create some lines using black electric tape on a white poster or use a previous year's mat.

### **Skills you will need to learn in the process:**

Line Following

Squaring on a Line

Moving Until a Color/Intersection

Aligning on a Wall

### **Where can you learn these skills?**

Follow the guides in this document.

## Robot Design Pre-Season Navigation Challenges

### CARGO CONNECT

## CHALLENGE 1: Line follow until the end of the line



## CHALLENGE 2: Go straight until the black line, square up on the line





# Robot Design Pre-Season Navigation Challenges

## CARGO CONNECT

**CHALLENGE 3: Follow the line, turn, straighten out on the wall**

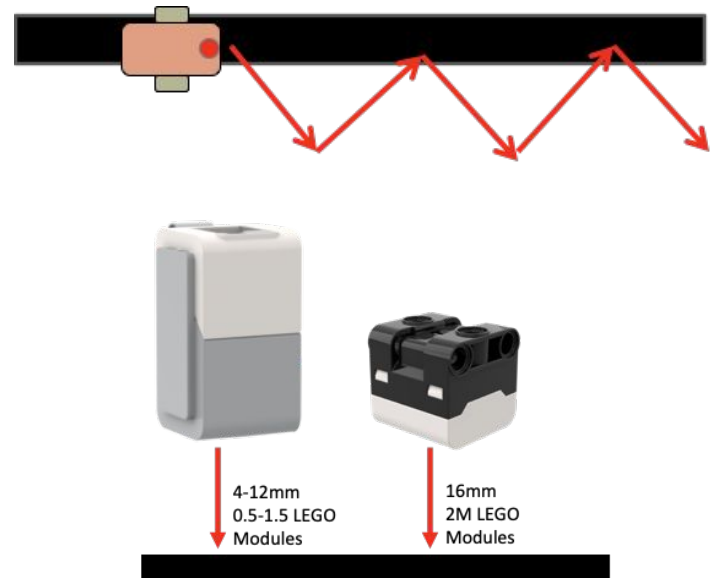


**CHALLENGE 4: Line follow as fast as you can, turn around and line follow back to launch**



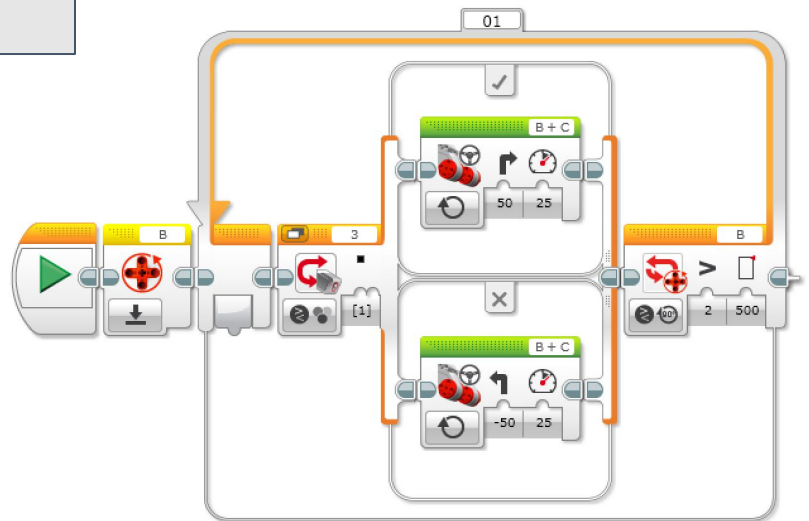
# Line Follow for Distance

- **Objective:** Program your robot to follow a line for a specified distance (500 degrees).
- Note that robot line followers follow the edge of the line (not the middle).
- Make sure you check the height of your color sensor before you begin
- Make sure your color sensor starts on the correct side of the line to match your code (the examples below follow the right side).
- If you want to create a faster line follower, try using two color-sensors or learn proportional control.



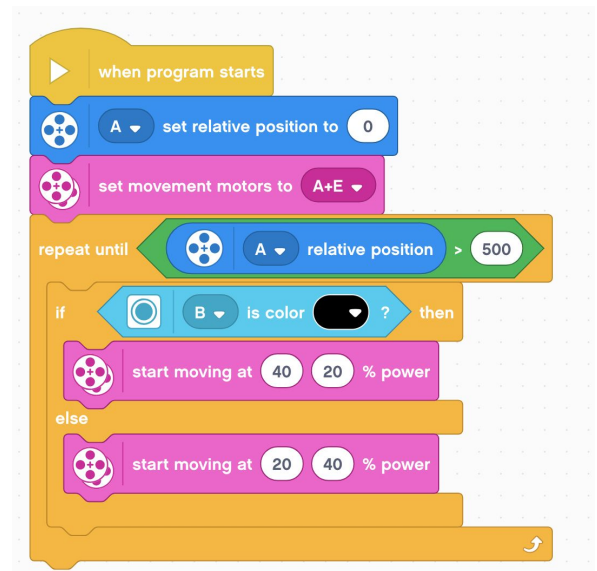
## EV3-Lab

- Reset movement motor (B)
- Turn Right if color sensor sees black
- Turn Left if it does not see Black
- Repeat until motor (B) is greater than 500 degrees



## SPIKE Prime

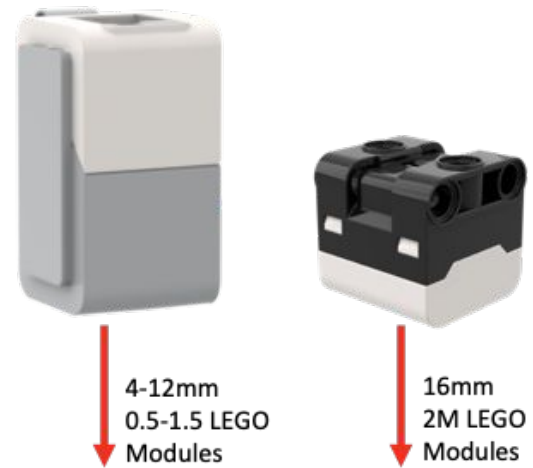
- Reset movement motor to "0" (A)
- Set movement motors (A+E)
- Turn Right if color sensor sees Black
- Turn Left if it does not see Black
- Repeat until relative position of the motor (A) is greater than 500





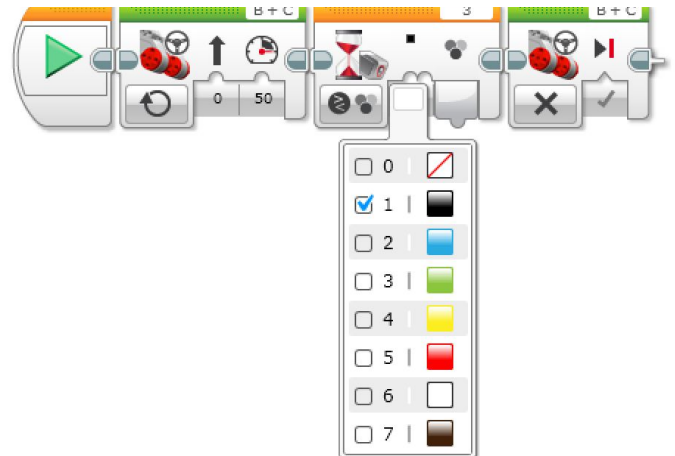
# Move Until Black

- **Objective:** Program your robot to move straight until a color sensor sees black
- Make sure you check the height of your color sensor before you begin
- Line up your robot as far away from the black line as you want and see if you can make it stop on the line.
- What if you want to line follow first until a black intersection? Try using two color sensors - one to line follow and the other to find the black intersection.



## EV3-Lab

- Start motors
- Use the Wait For block in color mode to detect when the color sensor sees black
- Stop Motors



## SPIKE Prime

- Set the movement motors for your robot
- Start moving straight at % speed
- Use the wait until block to detect when the color sensor sees black
- Stop moving



# Aligning to or Squaring on a Line

- **Objective:** Program your robot to straighten out on a line
- Make sure your color sensors are at the correct height and as far apart as possible on your robot
- The code below is a simple program. The robot may not be perfectly straight at the end. Brainstorm how you can improve the code.



## EV3-Lab

- Use parallel beams
- Start both motors
- Stop both motors when the sensor on the corresponding side sees the line (black)



## SPIKE Prime

- Use events - the second event should be initiated when message1 is broadcasted
- Start both motors
- Stop the motors when the sensor on the corresponding side sees black



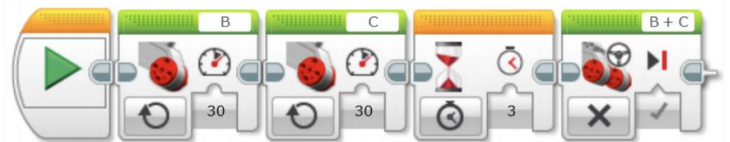
# Aligning on a Wall

- **Objective:** Program your robot to straighten out on a wall
- Make sure that your robot has some kind of flat bumper on it to use in alignment.



## EV3-Lab

- To align on the wall or a fixed mission model, you will use Move Seconds
- Two separate motor blocks (one for the left motor and one for the right motor) will be needed.
- The robot will wait for seconds and then turn off the motors.



- Note that we do not use Move Steering block, motors are synchronized so when one wheel hits the wall and stops, the other wheel will stop as well even if it hasn't touched the wall yet. Therefore, the robot will not be straight.

## SPIKE Prime

- As with EV3 Lab, run each more of your robot drive base separately
- Wait for 3 seconds
- Stop both motors

