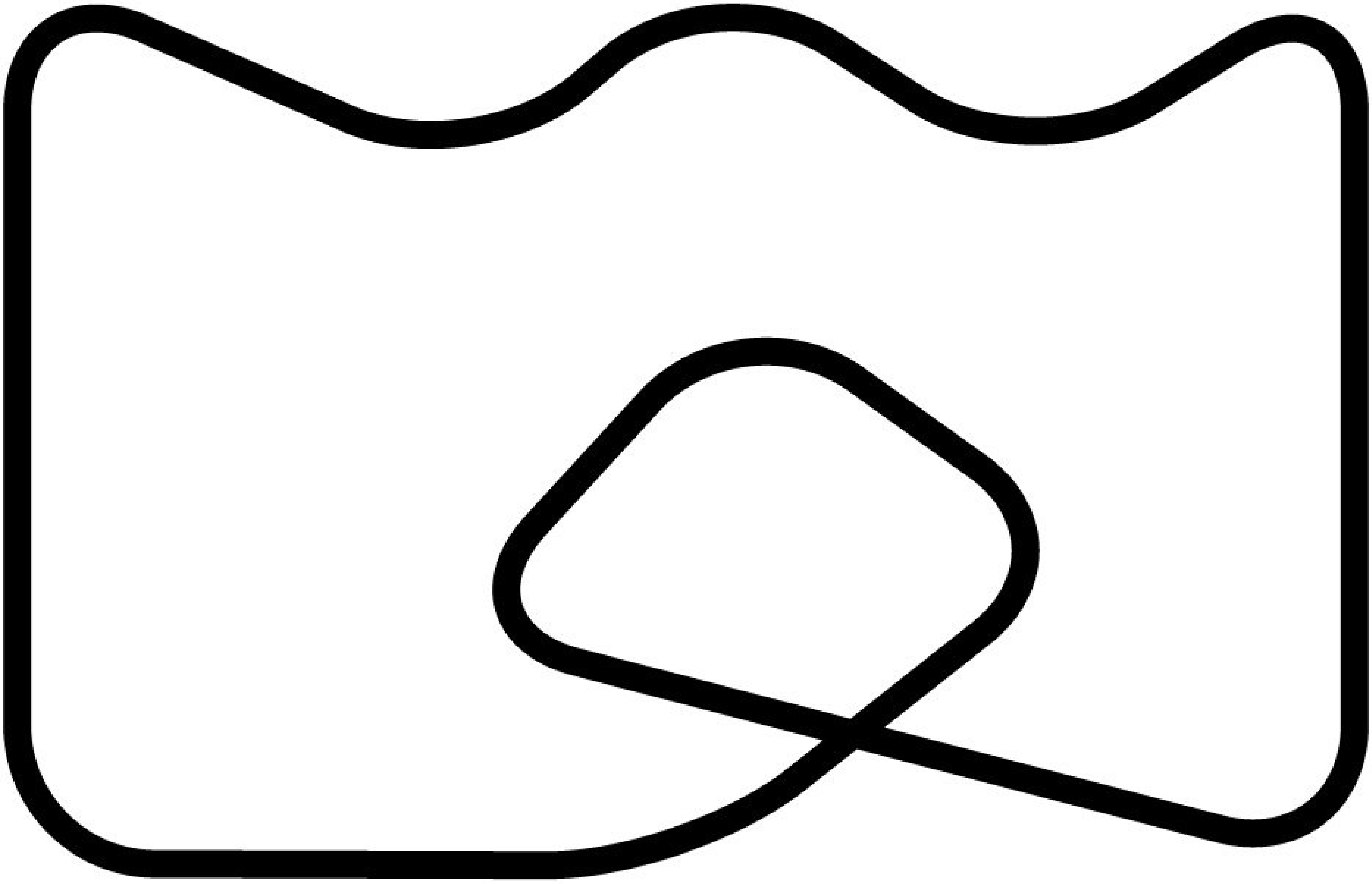
B - Follow the Path

1 line sensor is great, but we can't follow a complicated path - using two sensors however lets us do much more complex things!



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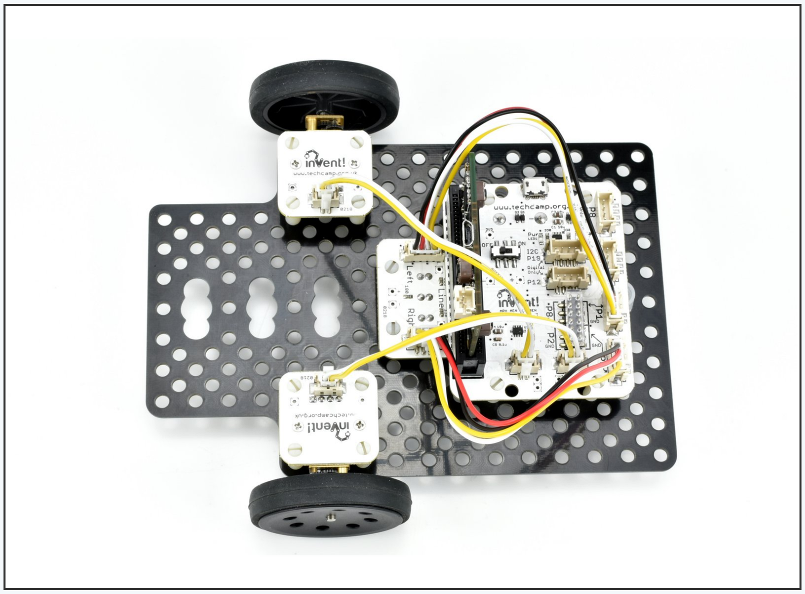
INTRODUCTION

1 line sensor is great, but we can't follow a complicated path - using two sensors however lets us do much more complex things!

Step 1

Two Line Sensors

- Assemble your robot like the last section.
- Plug the left sensor in **P1**, and the right into **P0**.



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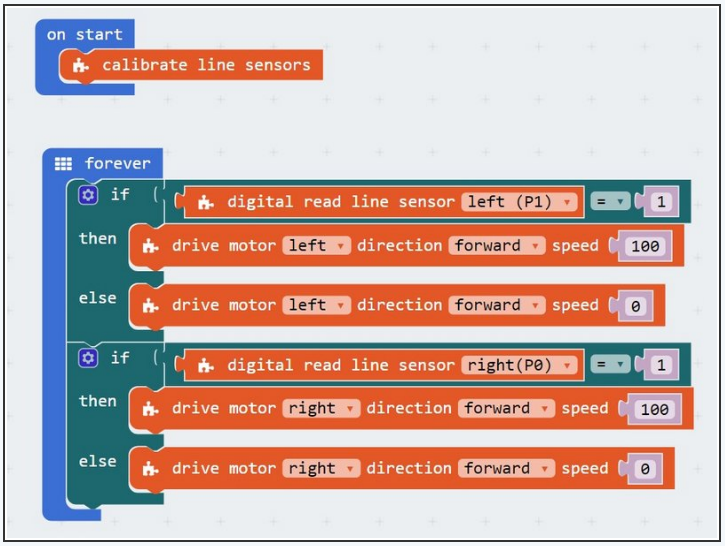
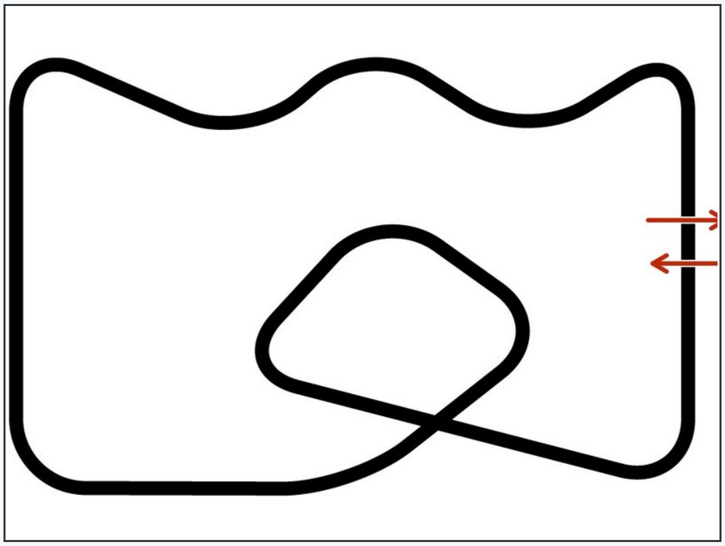
Step 2

Test Both Sensors



```
on start
    calibrate line sensors

forever
    if ( digital read line sensor left (P1) = 1 )
    then
        drive motor left direction forward speed 100
    else
        drive motor left direction forward speed 0
    if ( digital read line sensor right(P0) = 1 )
    then
        drive motor right direction forward speed 100
    else
        drive motor right direction forward speed 0
```



- Let's **test** both sensors so we know how they work.

- **Build** the test program in the picture - can you **guess** what it will do?

- **Program** the robot, and place the line sensor over the line on the **other side of the activity mat**, so it can complete the **calibration sequence** like before.

⚠ Don't forget, you need to use this **calibration block** every time you use the line sensor, and place the robot **on the black line** when you first turn it on.

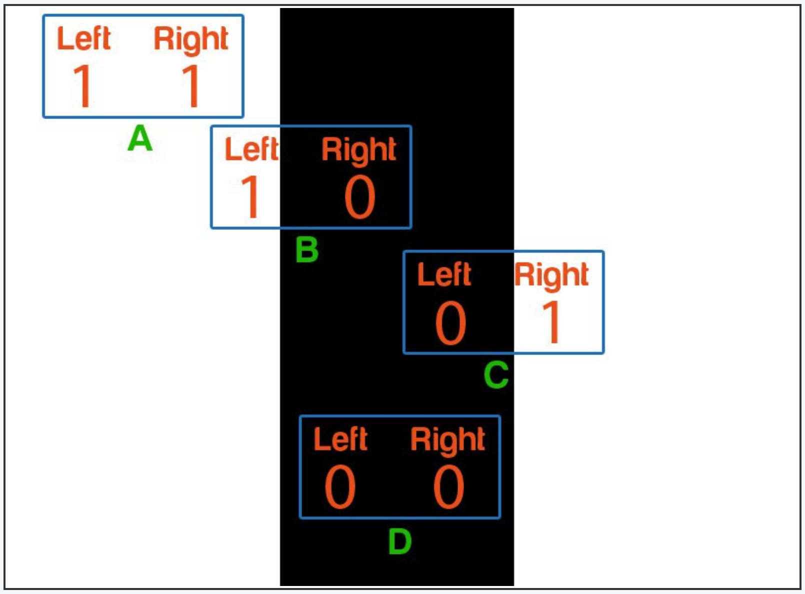
- **Slowly** move the line sensor **side to side** across one of the lines.

- **What happens** to the motors? Does it do what you expected?

Step 3

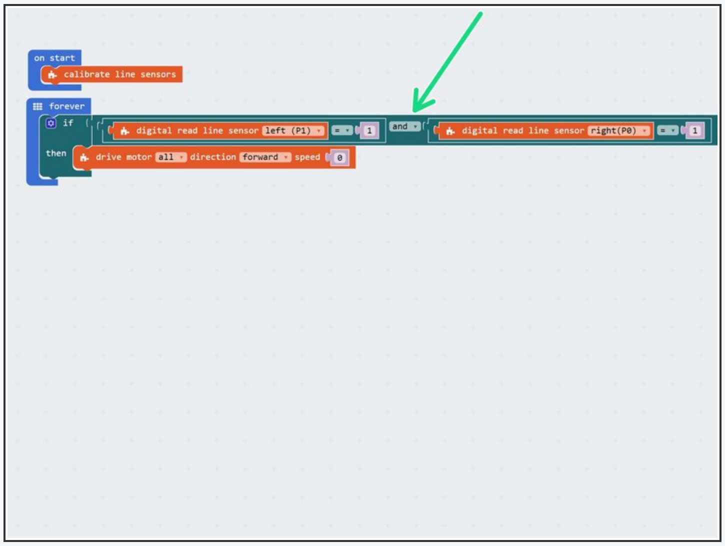
Using Both Sensors

- We need to write a program using the two sensors that follows the **black track.**
- Let's consider **each of the possibilities** in turn, as shown in the diagram:
    - **A** - Off the track completely - **both sensors read 1**
    - **B** - Slightly off to the left of the track - left sensor reads **1**, right sensor reads **0**
    - **C** - Slightly off to the right of the track - left sensor reads **0**, right sensor reads **1**
    - **D** - on the track, both sensors read **0**

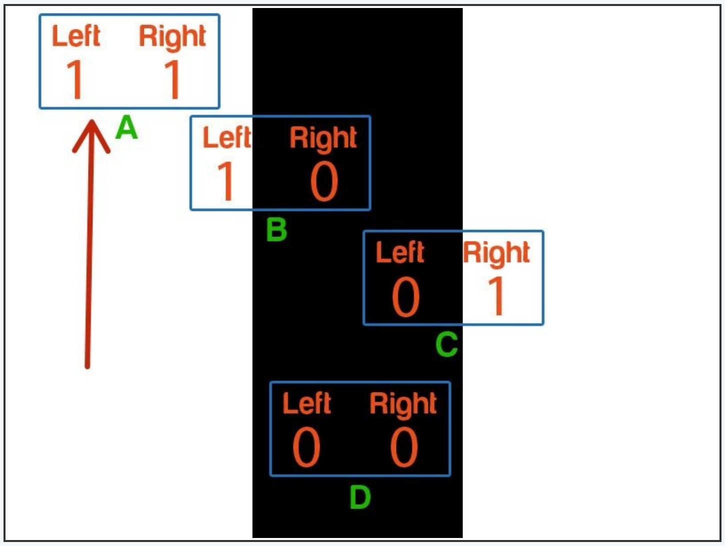


Step 4

Off the Track



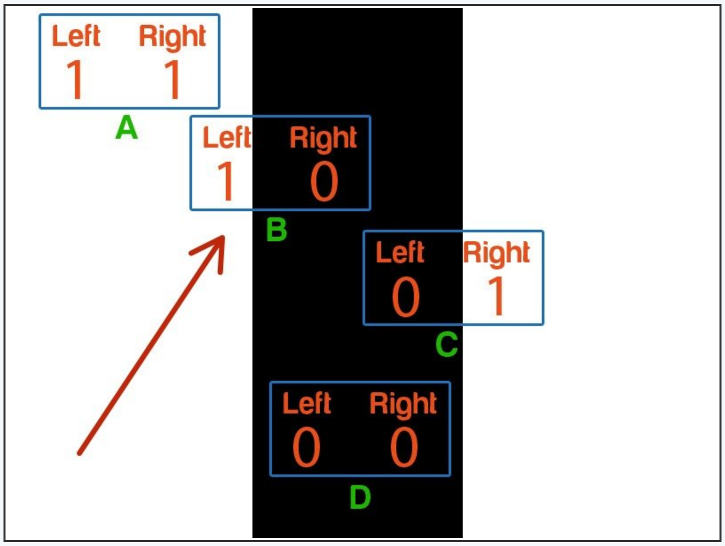
```
on start
    calibrate line sensors
forever
    if ( digital read line sensor left (P1) = 1 and digital read line sensor right(P0) = 1
    then
        drive motor all direction forward speed 0
```

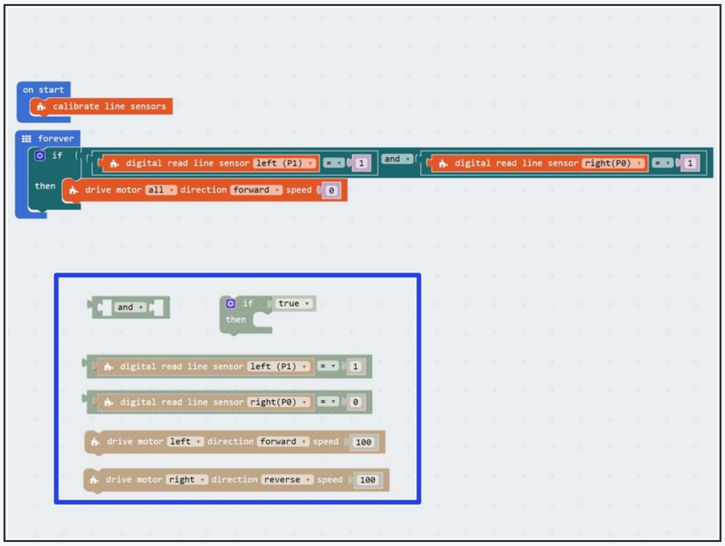


- For case **A**, if the robot goes off the track we need to make it **stop** so it doesn't drive off forever!
- Start your line following program by building the program in the picture.
- We need to check if the left sensor is 1 **AND** if the right sensor is 1 at the same time - we can do this with an **AND block,** which you can find in the **Logic** menu.

Step 5

Left of the Track





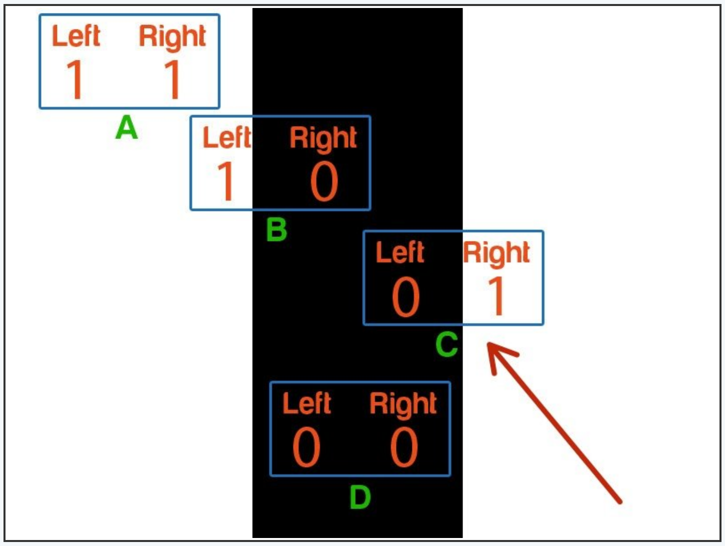
```
on start
    calibrate line sensors
forever
    if ( digital read line sensor left (P1) = 1 and digital read line sensor right(P0) = 1 )
    then
        drive motor all direction forward speed 0
```

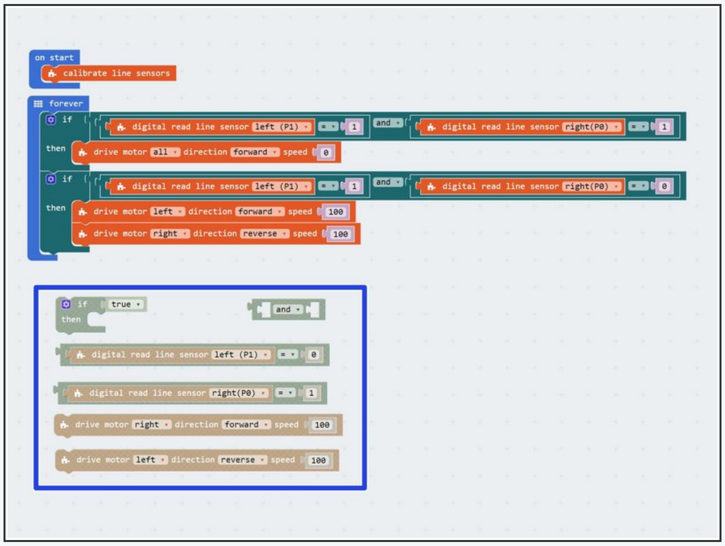
```
and
if true
then
digital read line sensor left (P1) = 1
digital read line sensor right(P0) = 0
drive motor left direction forward speed 100
drive motor right direction reverse speed 100
```

- For case **B,** we are slightly too far left, so we need to **turn right** to get back on the line.
- **Add** some more blocks to check the sensors, and **turn right** if we are slightly to the left of the track.
- There are some **hint blocks** if you need them!

Step 6

Right of the track





```
on start
    calibrate line sensors
forever
    if ( digital read line sensor left (P1) = 1 ) and ( digital read line sensor right(P0) = 1 )
    then
        drive motor all direction forward speed 0
    if ( digital read line sensor left (P1) = 1 ) and ( digital read line sensor right(P0) = 0 )
    then
        drive motor left direction forward speed 100
        drive motor right direction reverse speed 100

if true
then
and
digital read line sensor left (P1) = 0
digital read line sensor right(P0) = 1
drive motor right direction forward speed 100
drive motor left direction reverse speed 100
```

- For case **C**, we are too far right, so need to **turn left** to get back on the track.
- **Add** some more blocks to your program to **check the sensors** and **turn left** if we need to!
- There are some more **hint blocks** if you need them.

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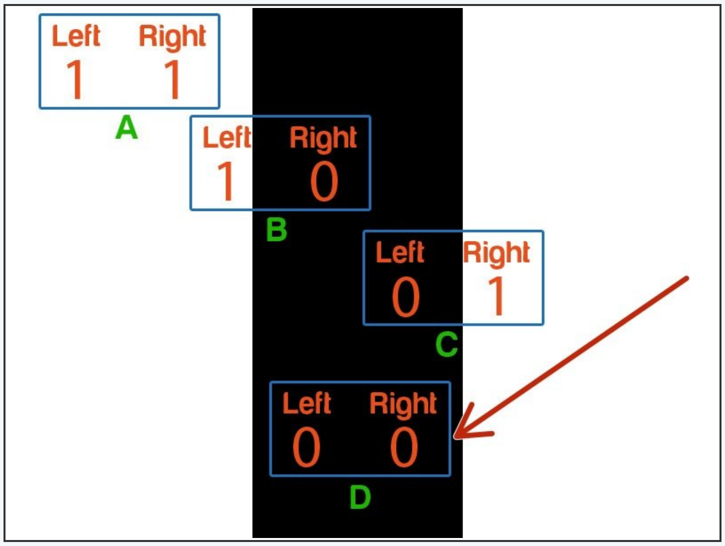
Step 7

The completed line follower



- Finally, we need to check for case **D** - both sensors are **0** so we are **on the track,** and just need to go **forwards.**
- **And some more blocks** to your program to complete it, and **test** your robot on the track.
- It should be able to make it **all the way around on its own!**

⚠ If you're robot keeps coming off the track, try **slowing it down**.

Step 8

Find the Path

- Currently, if the robot goes **off the path completely** (or the path ends) it just **stops.**
- It would be more useful if the robot tried to **find the path again!**
- **Change** your program so that instead of stopping, the robot drives so that it might **find** the path again. You can make this **as complex as you like!**
- Some ideas:
  - **Reverse** in a straight line
  - Drive **forwards** whilst sweeping **left and right**
  - Drive in increasing size squares **(hard)**
  - Drive in an increasing size spiral **(v. hard!)**