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D - Change the Speed

What if we want to change the speed our robot is following the line, without stopping it and reprogramming? Let's use variables and switches to do this.

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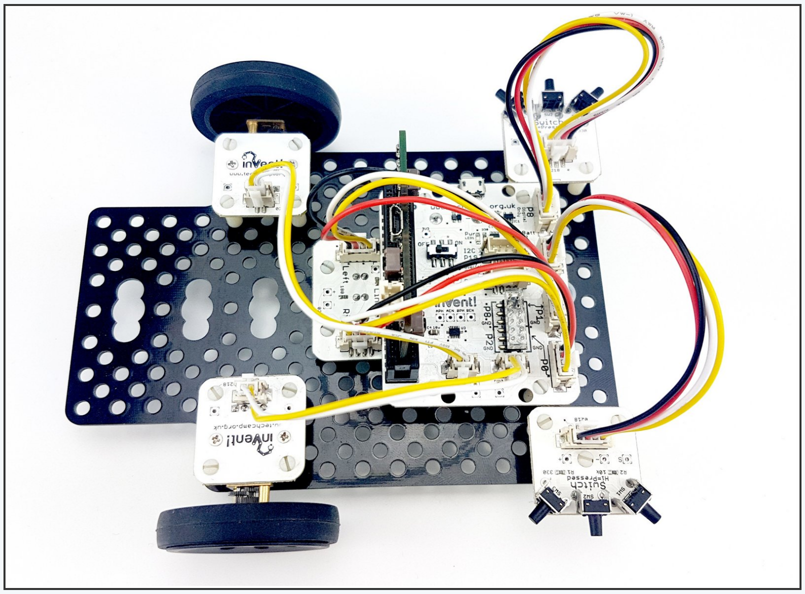
INTRODUCTION

What if we want to change the speed our robot is following the line, without stopping it and reprogramming? Let's use variables and switches to do this.

Step 1

Add the Switches

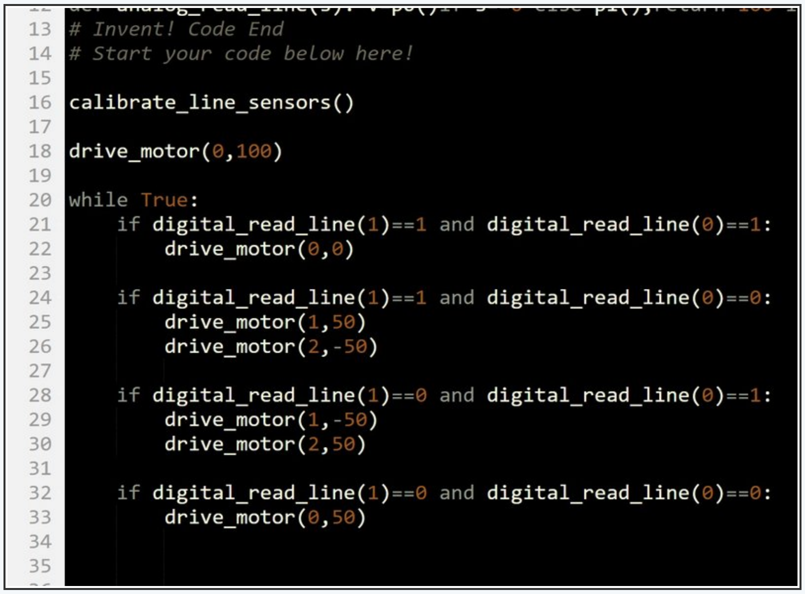
- We're going to need **two** switches - one to **increase** the speed, and one to **decrease** the speed.
- Add the **two switch modules** to your robot, and plug them into **P2** and **P8.**
- You can remove the Sparkles for now - **setup the robot just like the picture**



Step 2

Two Sensor Follower Program

- **Load** your two sensor line follower program from the last lesson.
- **Remove** all the Sparkle code for now - we don't have the sparkles anymore.
- Your program should look like the **picture** - your speeds might be **different**, depending on what works best for you.



```
# Invent! Code End
# Start your code below here!

calibrate_line_sensors()

drive_motor(0,100)

while True:
    if digital_read_line(1)==1 and digital_read_line(0)==1:
        drive_motor(0,0)

    if digital_read_line(1)==1 and digital_read_line(0)==0:
        drive_motor(1,50)
        drive_motor(2,-50)

    if digital_read_line(1)==0 and digital_read_line(0)==1:
        drive_motor(1,-50)
        drive_motor(2,50)

    if digital_read_line(1)==0 and digital_read_line(0)==0:
        drive_motor(0,50)
```

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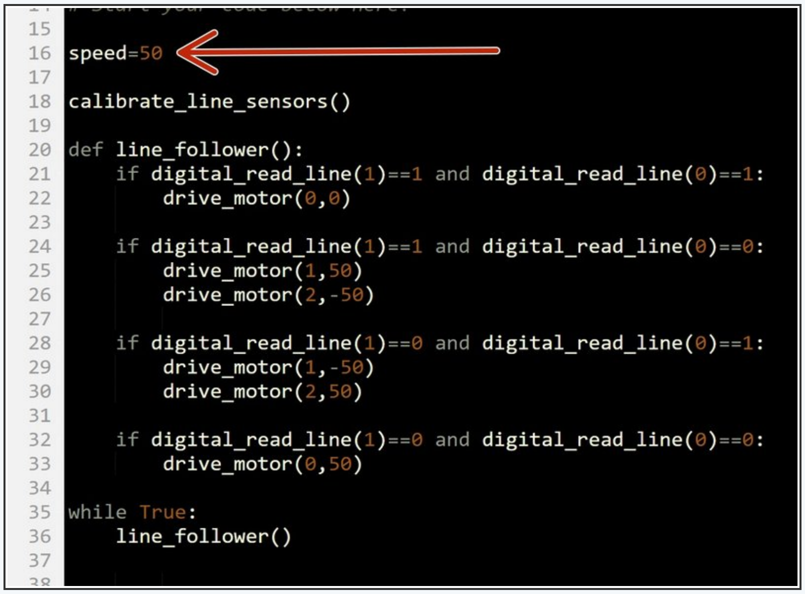
Step 3

Add a Variable

- Remember variables? Here's a quick **reminder** of what we can do with them:
  - **Call** them anything we like (variable **name**)
  - **Store** any number we like inside them (variable **contents**)
  - **Change** the contents at any time (add, subtract, multiply, divide and so on)
  - **Access** the contents at any time, so long as we know the **name** of the variable.
  - **Add** a new variable called **speed** at the start of the program, which is equal to 50

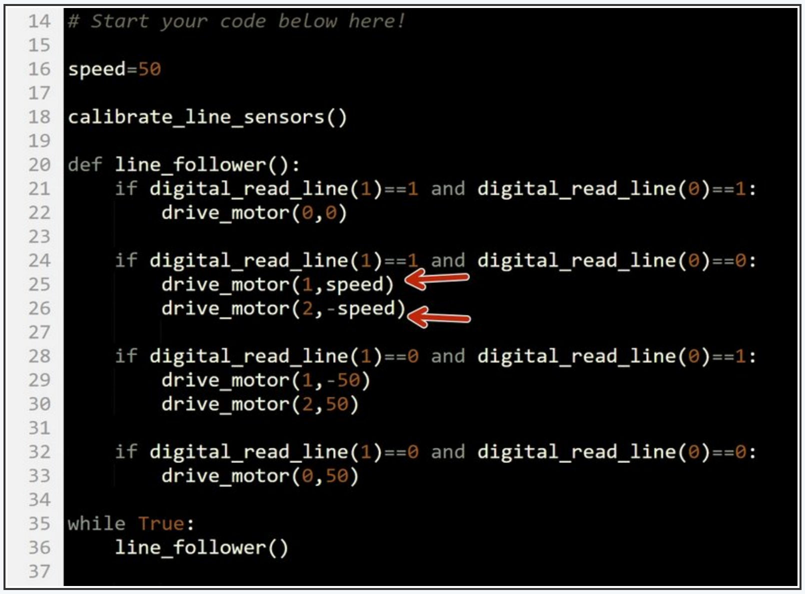


```
# Start your code below here!

speed=50

calibrate_line_sensors()

def line_follower():
    if digital_read_line(1)==1 and digital_read_line(0)==1:
        drive_motor(0,0)

    if digital_read_line(1)==1 and digital_read_line(0)==0:
        drive_motor(1,50)
        drive_motor(2,-50)

    if digital_read_line(1)==0 and digital_read_line(0)==1:
        drive_motor(1,-50)
        drive_motor(2,50)

    if digital_read_line(1)==0 and digital_read_line(0)==0:
        drive_motor(0,50)

while True:
    line_follower()
```

Step 4

Use the Variable

- Let's use the variable we have just created to **set the motor speeds!**
- **Replace** all the motor speeds in the motor blocks with the **speed variable.** We've done the first one for you!
- **Program** your robot and **test** to make sure it still works correctly.



```
# Start your code below here!

speed=50

calibrate_line_sensors()

def line_follower():
    if digital_read_line(1)==1 and digital_read_line(0)==1:
        drive_motor(0,0)

    if digital_read_line(1)==1 and digital_read_line(0)==0:
        drive_motor(1,speed)
        drive_motor(2,-speed)

    if digital_read_line(1)==0 and digital_read_line(0)==1:
        drive_motor(1,-50)
        drive_motor(2,50)

    if digital_read_line(1)==0 and digital_read_line(0)==0:
        drive_motor(0,50)

while True:
    line_follower()
```

Step 5

Increase the speed

- Let's use the **first switch** connected to **P2** to **increase** the speed.

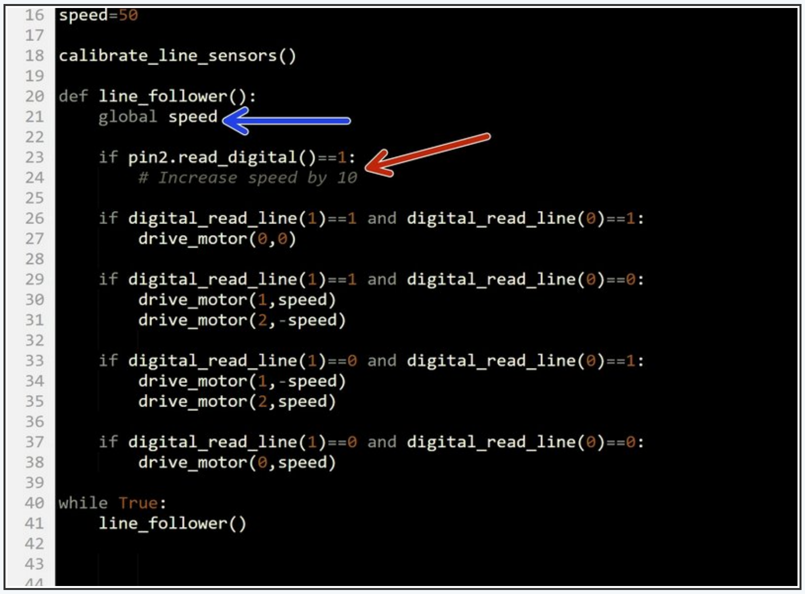
- Add an **IF statement** right at the top of the loop to **check** the switch.

- We also need to add the line **global speed** at the top of the function. Speed is a variable that is created **outside** of the function - we can access it without this line, but to **change** it we need to tell the robot it is **global**, which just means it has already been created outside of the function.

- If the switch is pressed, **increase speed by 10.**

- There is a **hint** if you need it!

- **Test** out the program - can you work out **what is wrong?**



```
speed=50

calibrate_line_sensors()

def line_follower():
    global speed

    if pin2.read_digital()==1:
        # Increase speed by 10

    if digital_read_line(1)==1 and digital_read_line(0)==1:
        drive_motor(0,0)

    if digital_read_line(1)==1 and digital_read_line(0)==0:
        drive_motor(1,speed)
        drive_motor(2,-speed)

    if digital_read_line(1)==0 and digital_read_line(0)==1:
        drive_motor(1,-speed)
        drive_motor(2,speed)

    if digital_read_line(1)==0 and digital_read_line(0)==0:
        drive_motor(0,speed)

while True:
    line_follower()
```

Step 6

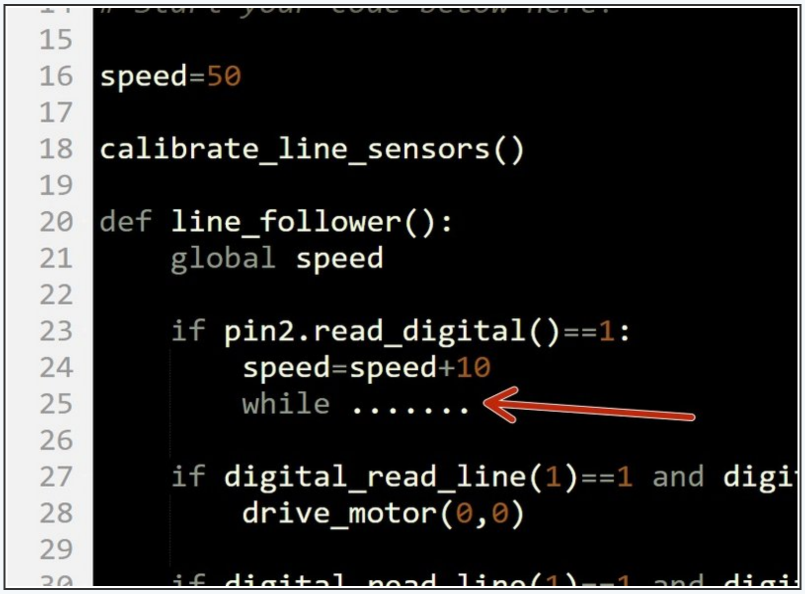
Wait for Release

- Remember last time we used a switch to change something? We had to add something else so it didn't change **too fast!**

- We want to use a **while loop** to wait until the switch is not pressed anymore, so we only increase the speed **once** each time the switch is pressed.

- Add a while loop **after** you increase the speed by 10 to fix this.

- **Test it out** - make sure it works properly now!

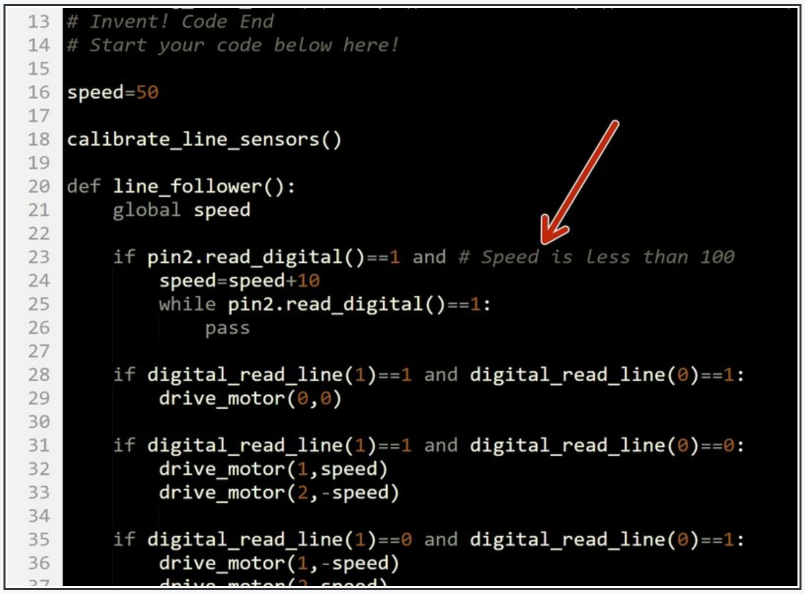


```
# Start your code below here!

speed=50

calibrate_line_sensors()

def line_follower():
    global speed

    if pin2.read_digital()==1:
        speed=speed+10
        while .......

    if digital_read_line(1)==1 and digi
        drive_motor(0,0)

    if digital_read_line(1)==1 and digi
```

Step 7

Limit the Speed

- The motor blocks **cannot have a speed of over 100**, so we need to make sure **speed is never more than 100!**
- To do this, let's edit the IF statement that checks the switch.
- Change the condition so that it checks if P2 is 1, **AND** speed is less than **(<)** 100.
- Test it out!



```
# Invent! Code End
# Start your code below here!

speed=50

calibrate_line_sensors()

def line_follower():
    global speed

    if pin2.read_digital()==1 and # Speed is less than 100
        speed=speed+10
        while pin2.read_digital()==1:
            pass

    if digital_read_line(1)==1 and digital_read_line(0)==1:
        drive_motor(0,0)

    if digital_read_line(1)==1 and digital_read_line(0)==0:
        drive_motor(1,speed)
        drive_motor(2,-speed)

    if digital_read_line(1)==0 and digital_read_line(0)==1:
        drive_motor(1,-speed)
```

Step 8

Decrease the Speed

- Now its **up to you!**
- Add some more code to check the **other switch**, and **decrease** the speed by 10 each time it is pressed.
- This time, you will need to make sure that speed is only **decreased** if it is **more than 0.**

Step 9

One switch only!

- This is a **hard** extension challenge, so don't worry if you find it difficult!
- Can you change the code so only **one switch** is needed?
- The speed should **increase** with a **short** press, and **decrease** with a **long** press.

Step 10

Speed change with sparkles

- If you're feeling really clever, **add the Sparkle code back in** once you've got rid of one switch!
- For super advanced coders only - can you change the **brightness** of the Sparkles depending on the **speed of the robot?** For example, at **maximum speed (100)** they should be as **bright as possible**, and at **0** speed they should be **off**.