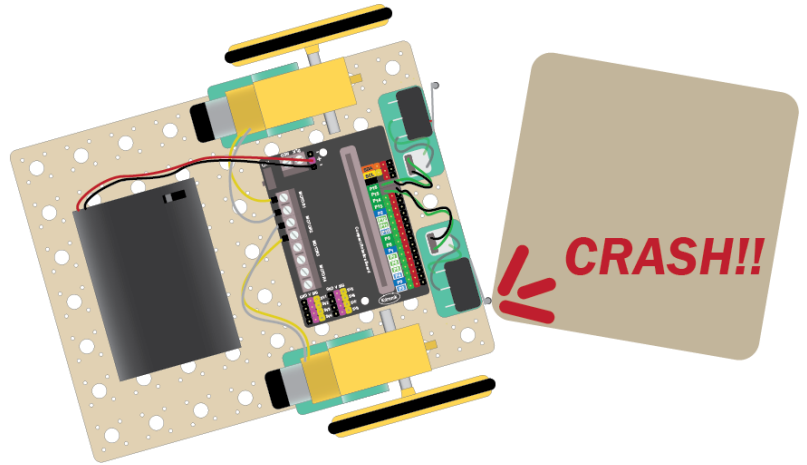


1.03 Add Crash Sensors to your Robot

In this workshop you will add some crash sensors to your robot. These will detect when the robot has crashed into a wall or another robot. You can use these to take evasive action, such as turning around or making a noise.

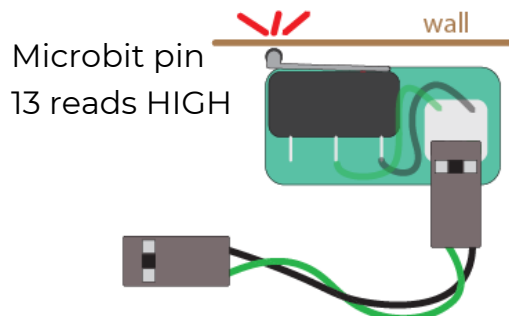
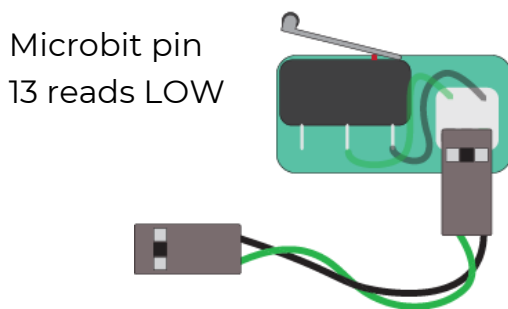


How it Works

The crash sensors are a type of switch called a microswitch. We will use a digital input to detect when the switch is hit, which closes the switch.

Each switch will be connected to a pin on the Microbit. When the switch is open, the pin will read HIGH, corresponding to a value of 1. When the switch is closed, the pin will be set LOW, corresponding to a value of 0. We can use code to read to 0 and 1 values and respond accordingly.

The crash sensors need to be connected to the Microbit using GS cables, which have 2 wires. G is ground, which is the black wire. S is signal, which is the green wire and connects to the pin on the Microbit.



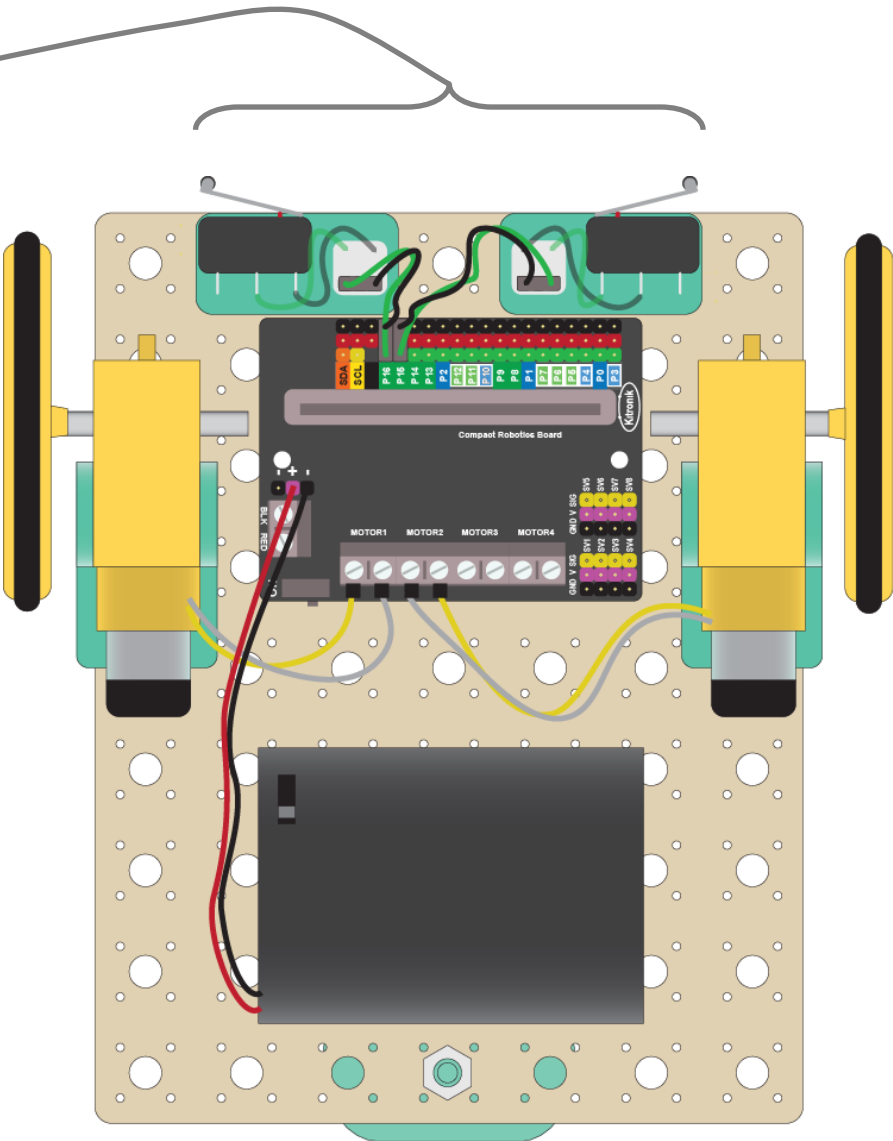
What to do

- If you haven't already done so, build and code the robot by referring to the previous worksheets
- Then follow this worksheet to add two crash sensors and make your robot stop when it crashes
- Finally, attempt the challenges to make your robot respond to a crash in different ways

Add the Crash Sensors

Connect Two Crash Sensors

1 Add two crash sensors to your robot.



These connections on the Microbit are called **pins**

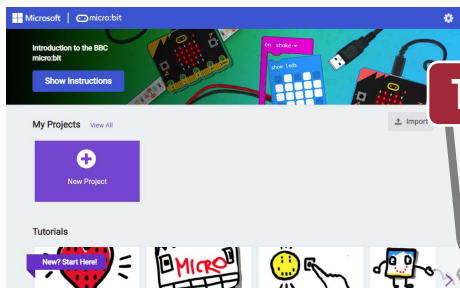
2 Wire up the crash sensors as follows using GS cables

Component	Microbit Connections
Right crash sensor	P15
Left crash sensor	P16

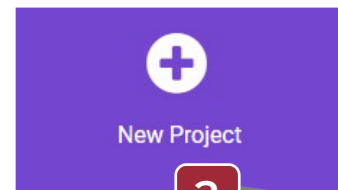
Code the Crash Sensors 1

Create a Project for the Robot

<https://makecode.microbit.org/>



1 Go to the Makecode website



2 Click on New Project

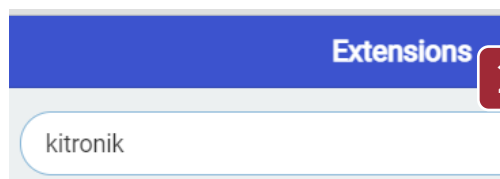
A 'Create a Project' dialog box with a title bar containing three smiley face emojis and a close button. The main text says 'Give your project a name.' Below this is a text input field containing 'bumper robot'. There is a 'Code options' link with a right-pointing arrow. At the bottom right is a green 'Create' button with a checkmark icon.

3 Give the project a name (whatever name you want!)

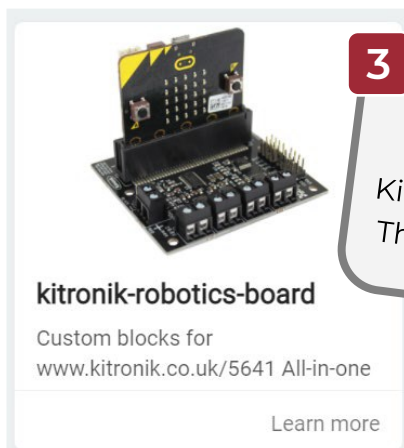
Add the Motor Driver Extension

1 Select this block

+ Extensions

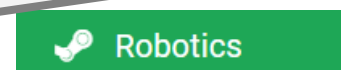


2 Search for Kitronik



3 Make sure you select the right Kitronik extension. There are a few of

4 If all goes well you will see this new

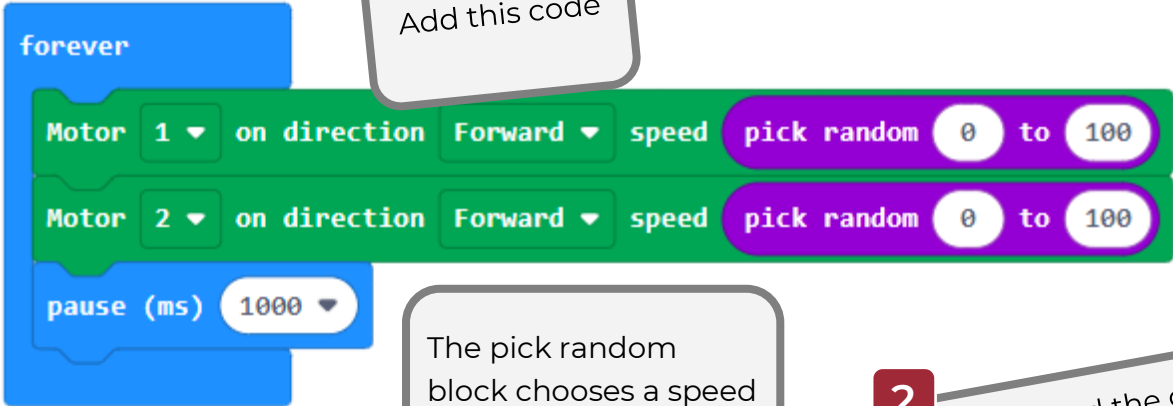


Code the Crash Sensors 2

Code a Random Robot

First we will code a robot that moves at random speeds.

1 Add this code



The image shows a Scratch code editor with a blue 'forever' loop block. Inside the loop, there are two green 'Motor' blocks. The first block is for Motor 1, set to 'on direction' 'Forward' and 'speed' 'pick random 0 to 100'. The second block is for Motor 2, also set to 'on direction' 'Forward' and 'speed' 'pick random 0 to 100'. Below these is a blue 'pause (ms)' block set to '1000'. A callout box points to the 'pick random' blocks with the text: 'The pick random block chooses a speed between 0 and 100'. Another callout box with a red '2' points to a 'Download' button with the text: 'Download the code to the Microbit, place your robot on the floor and watch it move around'.

2 Download the code to the Microbit, place your robot on the floor and watch it move around

Download

Set up the Crash Sensors

Now we will start to code the crash sensors. First we need to tell the Microbit that the pins should be set to HIGH when the switches are not pressed.

1 Add this code



The image shows a Scratch code editor with a blue 'on start' block. Inside the block, there are two red 'set pull pin' blocks. The first block is for pin P15, set to 'to up'. The second block is for pin P16, also set to 'to up'. A callout box with a red '1' points to the code with the text: 'Add this code'.

Code the Crash Sensors 3

Responding to a Crash

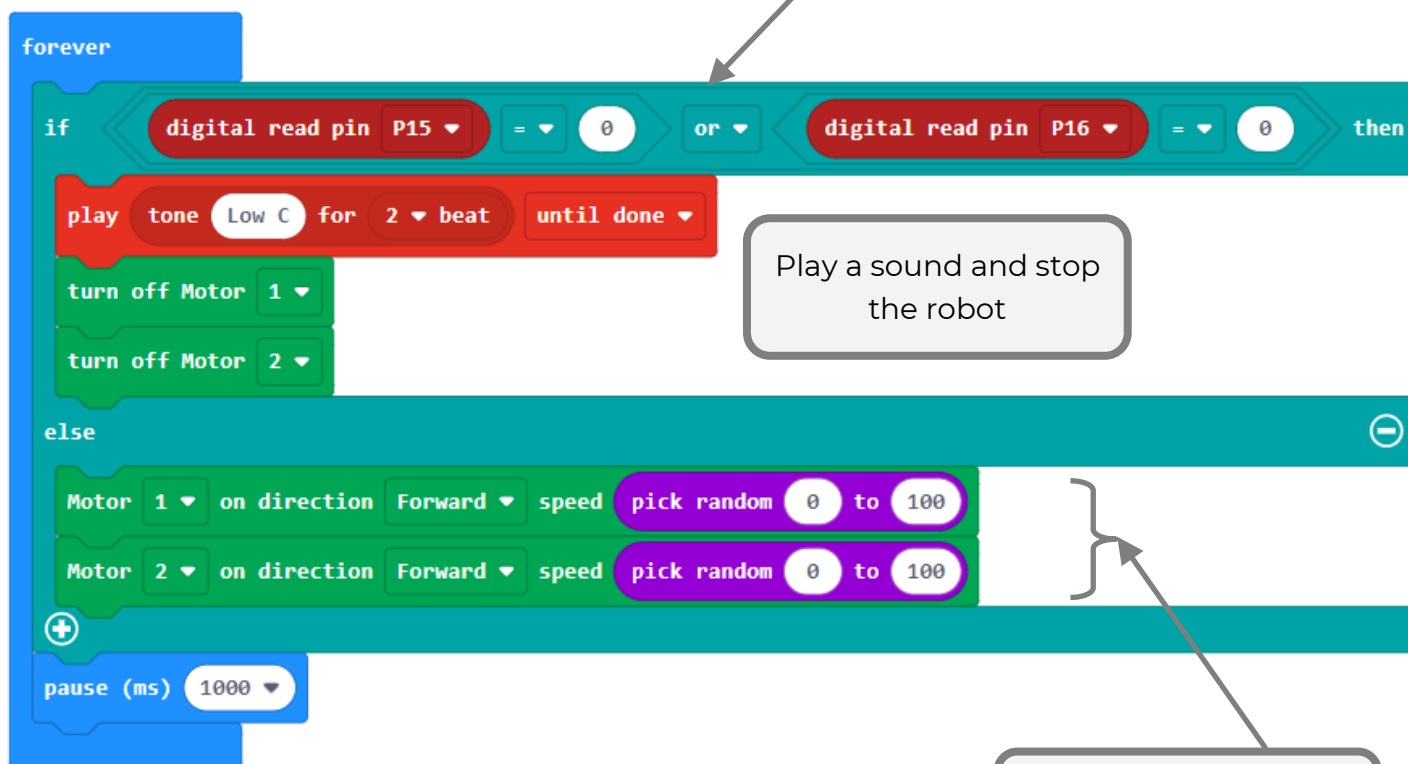
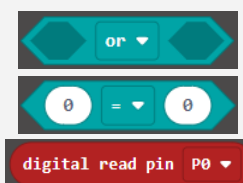
Now we will get the robot to stop and play a sound when the robot hits something.

1

Change the forever block so it looks like this

Detect if either crash sensor is hit. We check if pin 15 is LOW or pin 16 is LOW. So only one sensor needs to be hit for a crash to be detected. This code block is a little tricky! There are several parts:

First add an OR block
then add the = blocks
and then add the pin blocks



Play a sound and stop the robot

Move forwards randomly

3

Download the code to the Microbit, place your robot on the floor and check that it stops when it hits something

Download

Challenges

Your challenge!

Try these challenges:

- Instead of just stopping, can you get your robot to turn around when it hits a wall?
- Get the robot to flash its lights when it crashes (if you haven't added lights go back to the worksheet **Adding Lights to your Robot**).

Solutions 1

Turning Around

This is one way to get your robot to turn around when it hits something. You may come up with a different way.

The script is a Scratch-style block-based program for a robot. It starts with a 'forever' loop. Inside the loop, there is an 'if' condition: 'if digital read pin P15 = 0 or digital read pin P16 = 0 then'. If the condition is true, the following blocks execute: a red 'play tone Low C for 2 beat until done' block, followed by two green 'Motor' blocks for Motor 1 and Motor 2, both set to 'on direction Reverse' and 'speed 50'. This is followed by a blue 'pause (ms) 500' block. Then, two more green 'Motor' blocks for Motor 1 and Motor 2, both set to 'on direction Reverse' and 'speed pick random 0 to 100'. This is followed by a blue 'pause (ms) 1000' block and a red 'stop all sounds' block. If the 'if' condition is false (the 'else' branch), the following blocks execute: two green 'Motor' blocks for Motor 1 and Motor 2, both set to 'on direction Forward' and 'speed pick random 0 to 100'. This is followed by a blue 'pause (ms) 1000' block. The script ends with a plus sign icon in the loop block.

```
forever
  if digital read pin P15 = 0 or digital read pin P16 = 0 then
    play tone Low C for 2 beat until done
    Motor 1 on direction Reverse speed 50
    Motor 2 on direction Reverse speed 50
    pause (ms) 500
    Motor 1 on direction Reverse speed pick random 0 to 100
    Motor 2 on direction Reverse speed pick random 0 to 100
    pause (ms) 1000
    stop all sounds
  else
    Motor 1 on direction Forward speed pick random 0 to 100
    Motor 2 on direction Forward speed pick random 0 to 100
    pause (ms) 1000
```

Reverse straight

Reverse randomly

Forward randomly

Solutions 2

Lights

This code will flash this lights while the robot is crashed.

