An LED game

Use an LED to help find the hedgehog

Step 1 You will make

Use a circuit to find the hidden hedgehog!

You will:

- Explore electronic circuits and what they are
- Connect an LED to your Raspberry Pi to make a circuit
- Use a `turn LED on` block to light and turn off an LED

In order to complete this project you will need:

Hardware

- A Raspberry Pi computer
- 3 x socket to socket jumper cables
- an LED
- a resistor (the lower resistance, the better!)

Software

- Scratch 3 Desktop - **This project can not be completed using the online Scratch 3 editor**, and must be completed using a Raspberry Pi with the desktop version installed.

Complete project

Step 2 Test your circuit

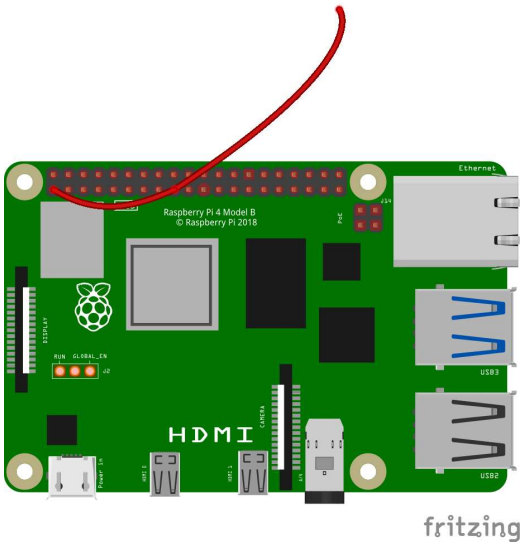
In this step, you will connect an LED and resistor to the Raspberry Pi's GPIO pins to test your circuit.

GPIO stands for **G**eneral **P**urpose **I**nput/**O**utput. GPIO pins allow you to create simple machines by sending a small electrical signal out of a pin, down a wire, through an output or input, and back into a ground pin on the Raspberry Pi to create a circuit. The circuits you make can be programmed and controlled by you, through programs written using Scratch!

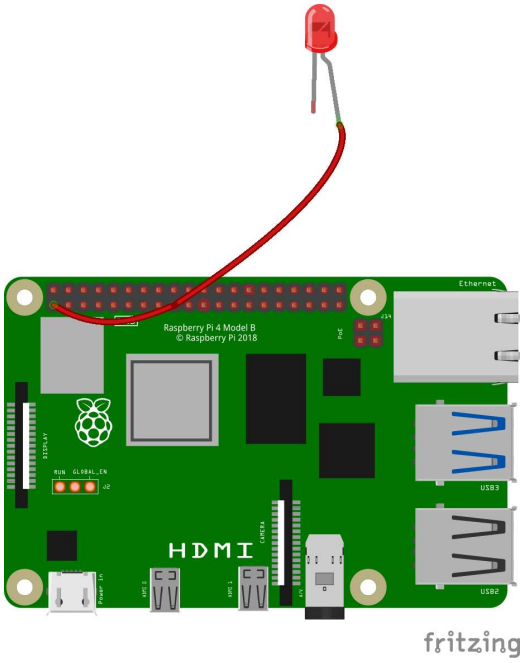
> The jumper cables we use for prototyping have what are called **dupont connectors** on the ends of them to make it easy to create circuits and connect components. These connectors come in two main types: **Pin** and **Socket**. **Pin** connectors are so called because they have a small metal pin sticking out, while **socket** connectors have a small port that accepts a pin to make a connection.

Your jumper wires should all have hollow socket ends that fit over the pins of your Raspberry Pi.

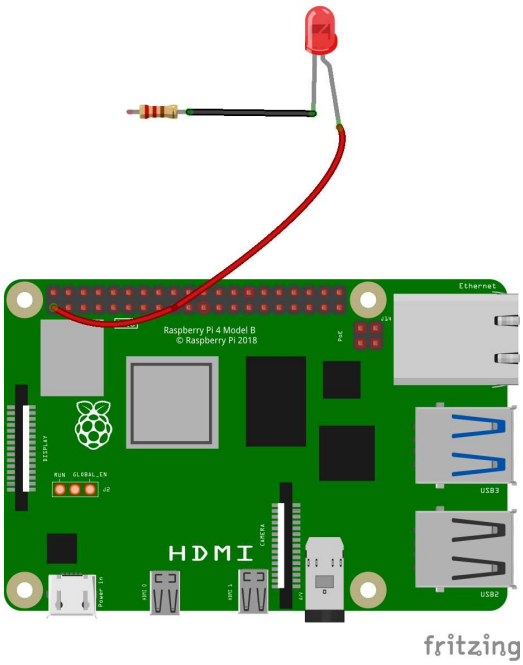
Connect a jumper wire to Pin 1. Pin 1 is always on and provides 3.3 volts to whatever you connect to it.



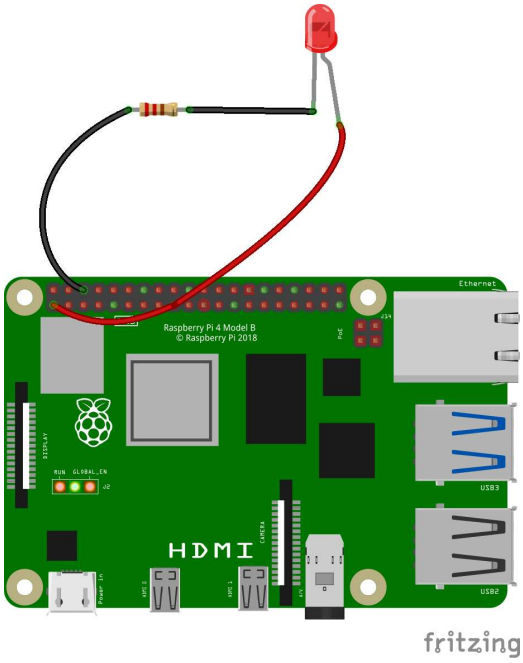
Insert the **long leg** of your LED into the other end of this jumper wire. Take a second socket to socket jumper wire and attach it to the **short leg** of your LED.



Take a resistor and insert one of its legs into the free end of the second jumper wire. Insert the other leg into another socket to socket jumper wire. Adding the resistor to your circuit reduces the **electrical current** passing through the circuit; this will protect the LED from burning out.



Now, connect your circuit back to Pin 6 using the loose end of the socket to socket jumper wire. As soon as you close the circuit by connecting it back to your ground pin, your LED should light up!



Help – My LED isn't working!

If your LED isn't lighting up, make sure you have the **long leg** connected to the output pin (Pin 1) and the **short leg** connected to the ground pin (Pin 6). LEDs only work one way round!

If your LED **still** isn't lighting up, check all your connections are secure and fit properly, then swap your LED for another one if it still won't work (this one might be broken).

In the next step, you will swap your working circuit to a numbered control pin so that you can drive it using code!

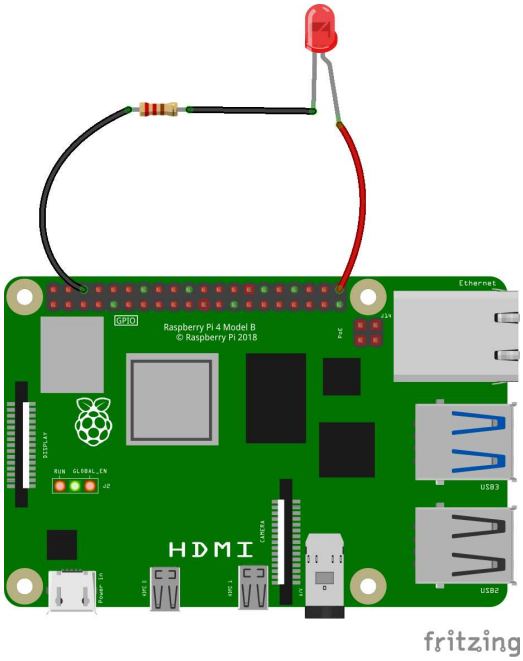
Step 3 Code your circuit

In this step, you will connect your completed circuit to an output pin on the Raspberry Pi and control it using the `Simple Electronics` extension.

Currently, your circuit is tested and working, and your LED is on; but you want it to light up when something happens in your Scratch program.

To do that, you need to connect your LED circuit to an output pin on the Raspberry Pi.

Take the jumper wire off of Pin 1 and attach it to any other numbered pin. In this example, I've used Pin 21 (because it's easy to get to) but you can use any numbered general purpose (GP) pin on your Raspberry Pi.



If you use a pin other than Pin 21, make sure that you change the number **everywhere** it appears in your code.

Download and open the starter project **available here (https://rpf.io/p/en/scratch-led-game-get)**.

Opening a downloaded Scratch 3 Desktop project

Once you have downloaded the zip file from the link above, open your file manager and navigate to the **Downloads** folder.

Find the file you just downloaded. It will end in `.zip`.

Right click on the file and choose 'Extract files'. Extract them to your downloads folder.

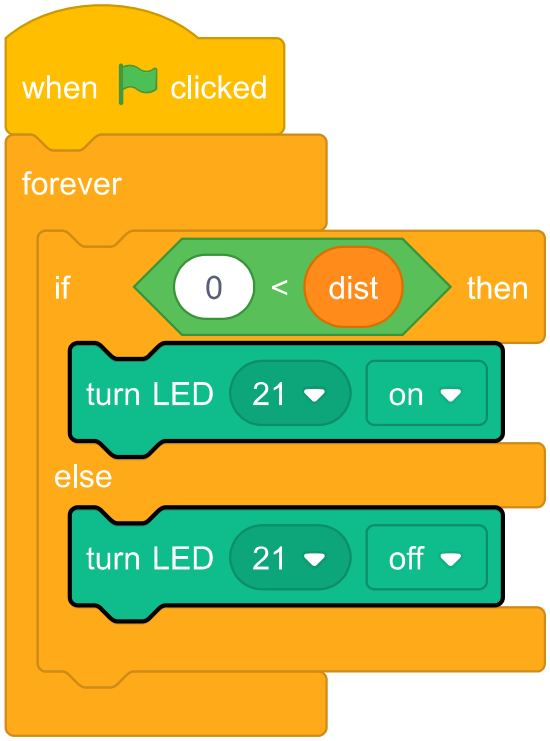
In Scratch 3 Desktop, click the `File` menu and choose `Load from your computer`.

Navigate to your downloads folder again and select the file `scratch-physcomp1.sb3`.

Click `OK` or press `Enter`.

Make sure you have the Stage selected and you can see the following scripts:

Using the `Simple Electronics` extension, add the following blocks into the `if` block so that if `distance` is less than `10`, the LED comes on — `else` it turns off.



Now click on the green flag, and see if you can hunt the hedgehog!

Save your project

Upgrade your project

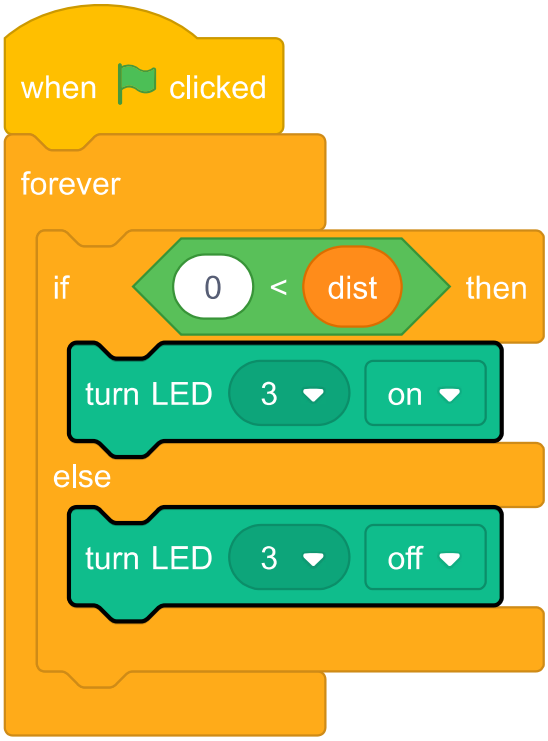
Now, you can add another LED to show when you are moving in the wrong direction. You will need to connect another LED bulb to your Raspberry Pi using a different numbered pin and another ground pin.

Tip: Make sure you remember which numbered GPIO pin you connect the long leg of your LED to - you'll need to use it in your code!

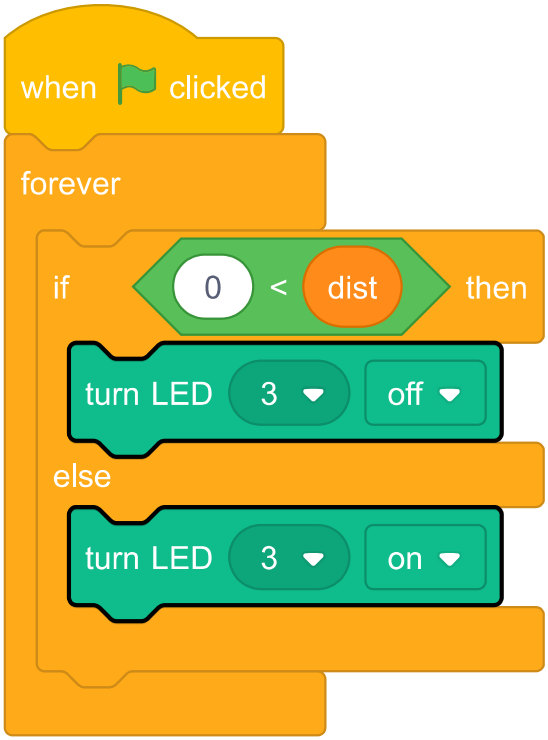
Once you have connected the LED to your Raspberry Pi, right-click the script on the Player sprite which calculates the distance to the hedgehog, and duplicate it so there are two in your workspace.

In the new script, change the number in the `turn LED (21 v) [on v]` and `turn LED (21 v) [off v]` blocks to the new number for your second LED.

In this example I have used pin 3:



The script works out how far away from the hedgehog the player currently is, and checks that against the last distance it calculated. If the distance is smaller, it turns the LED on. Swap over the two `on` and `off` settings in your second script so it looks like this:



And one light will come on when you get further from your goal.

Completed project

You can view the **completed project here** (https://scratch.mit.edu/projects/486719199/).

You can also 'remix' the project to make any changes you like. You could add sound effects to the game or other sprites or backdrops, or set the colour effect and costumes of the player character. Maybe add another hidden sprite that activates another LED?

Save your project

What next?

If you are following the Scratch Physical Computing pathway, you could try the **Raspberry Pi and Scratch stress buster** (https://projects.raspberrypi.org/en/projects/rpi-stress-buster-with-scratch) project in which you will learn how to use electronic inputs with Scratch!

If you want to have more fun exploring Scratch, then you could try out any of **these projects** (https://projects.raspberrypi.org/en/projects?software%5B%5D=scratch&curriculum%5B%5D=%201).
