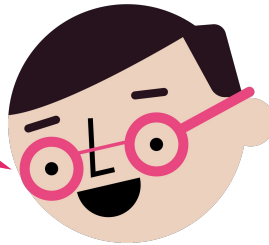
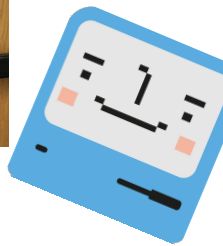
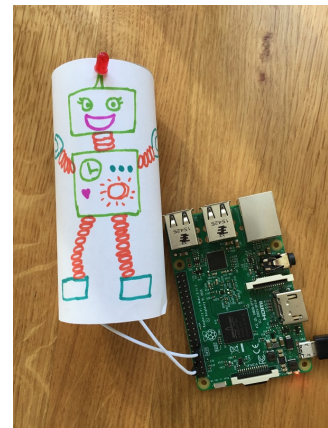


SCRATCH ROBOT ANTENNA



What you will make

This resource is taken from the Raspberry Pi Projects site here: <https://projects.raspberrypi.org/en/projects/robot-antenna/> In this resource you will build a cardboard robot with a real flashing LED antenna, and use Scratch 2 to create a robot twin that beeps. Here is an example of the kind of robot you could make:



What you will need

- * A Raspberry Pi and associated peripherals
- * 1 x LED
- * 1 x 330 ohms resistor
- * 3 x female to female jumper leads
- * A mini speaker or headphone
- * Scratch 2 with GPIO support (available by default with the latest version of Raspbian)
- * One sheet of A4 cardboard
- * Sharp pencil
- * Pens, crayons etc.
- * Small blob of modelling clay
- * Scissors

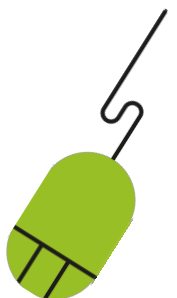
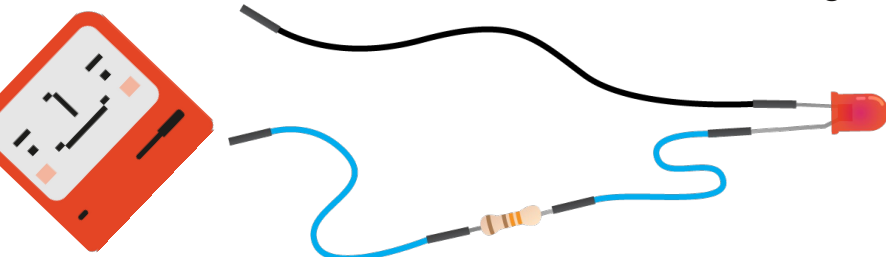


Make an antenna

First, look at your LED. It has a short leg and a long leg.

- * Slot a jumper wire onto the end of the long leg.
- * Slot the resistor into the other end of the same jumper wire. It doesn't matter which way round it goes.
- * Add another jumper wire to the other end of the resistor.
- * Take another jumper wire and slot one end onto the short leg of the LED.

You should end up with something that looks like this:

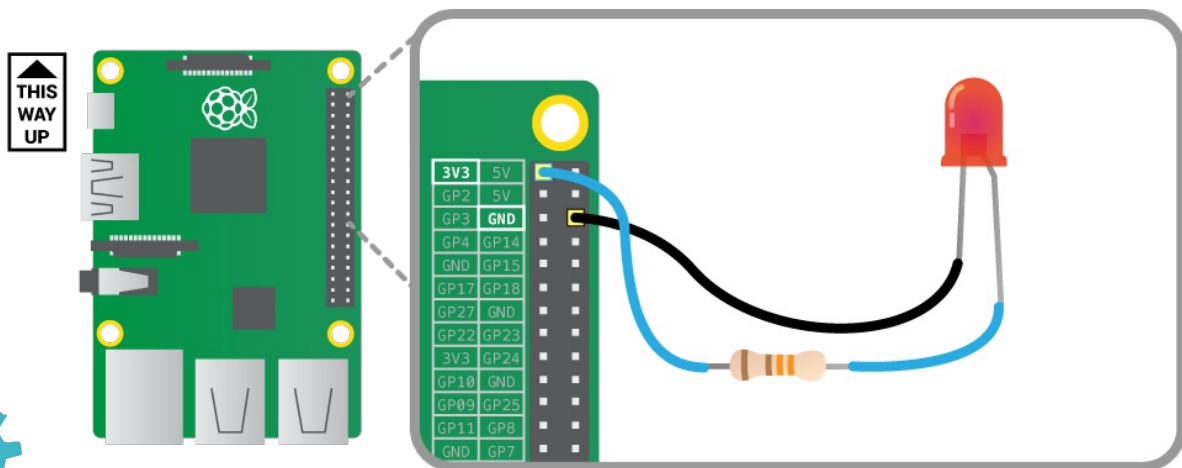




Test your antenna

Now let's connect the antenna to the Raspberry Pi to make a circuit.

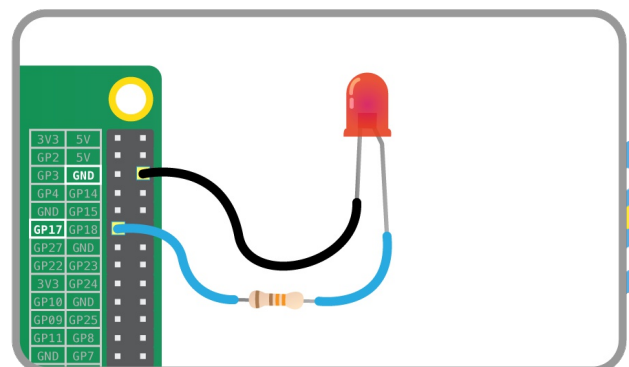
- * Make sure your Raspberry Pi is switched off.
- * Take the jumper wire that is connected to the resistor and plug it onto the pin labelled 3V3 on the diagram below. This pin provides power to the LED, so it's rather like connecting the LED to the positive side of a battery.
- * Take the jumper wire that is connected to the short leg of the LED and plug it onto the pin labelled GND on the diagram. This pin provides grounding to the LED, like connecting it to the negative side of a battery would do.
- * Power on your Raspberry Pi, and your LED should switch on. If it is not, make sure that you have plugged the jumper wires into the correct pins by checking the diagram below.



Make your antenna flash

Now you have an antenna that lights up, let's write a program to tell the LED when to turn on and off.

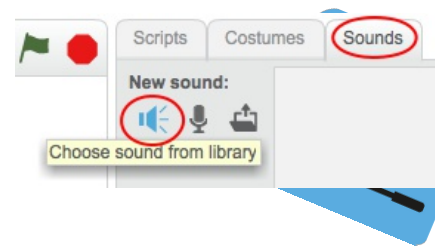
- * Shut your Raspberry Pi down and remove the power cable.
- * Move the jumper wire that is connected to the resistor from the 3V3 pin to the pin which is labelled 17 in the diagram below:
- * Power on your Raspberry Pi and wait for it to boot.





Make your antenna flash continued

- * Open Scratch 2 by clicking on the menu and then Programming, followed by Scratch 2.
- * Right-click on the Scratch cat and choose delete from the menu.
- * Click on the button for a new sprite and choose a robot from the fantasy folder, or, if you prefer, you can draw your own robot.
- * Click on Events. Drag the when space key pressed block into the Scripts area.
- * Click on Sound, drag the play sound block into the Scripts area and connect it to the previous block.
- * Add a sound for your robot. We chose the computer beeps from the electronic section.
 - * Select the sprite you want to add the sound to.
 - * Click the Sounds tab, and click Choose sound from library:
 - * Sounds are organised by category, and you can click the Play button to hear a sound. Choose a suitable sound and click OK.
 - * You should then see that your sprite has your chosen sound.
- * Go back to the Scripts tab. Click on the drop-down box in your play sound block and select the sound you just added.
- * Test that your program is working so far by pressing the space key. In response, your robot should beep!
- * Save your work by clicking File, then Save project, and call it robot.sb2.



Enable the Pi GPIO Extension

The Pi GPIO extension in Scratch 2 on the Raspberry Pi is needed to control and read input and output components connected to the GPIO pins.

- * With Scratch 2 open, click on More Blocks in the Scripts menu.
- * Next click on the Add an Extension button.
- * You can then double-click on the Pi GPIO extension to add it.
- * You should now see the Pi GPIO blocks in the More Blocks section.



Pi GPIO



Program the LED to flash

* Select More blocks and then drag this block to the bottom of your script:
This block allows you to specify a GPIO pin, and whether it is on [output high] or off [output low].

set gpio to output high

* Type 17 into the circle to specify pin 17, and leave the drop-down on high. This block will turn your LED on.

* Add a block to wait 1 secs from the control tab.

* Now add another set gpio block, but this time ask it to set GPIO pin 17 to low.

Here is how your code should look:

Test your program by pressing the space bar. You should see the LED turn on for a second and then turn off, and your robot should beep.

```
when space key pressed
  play sound computer beeps
  set gpio 17 to output high
  wait 1 secs
  set gpio 17 to output low
```



Make a cardboard robot

Let's make a cardboard robot to display the antenna you've made.

* Fold the bottom quarter on a sheet of A4 card so that it can stand up

* Now draw your own robot design. It doesn't have to be a person robot - maybe it could be a car or an animal! Just make sure it has an antenna.

* Colour in the robot picture

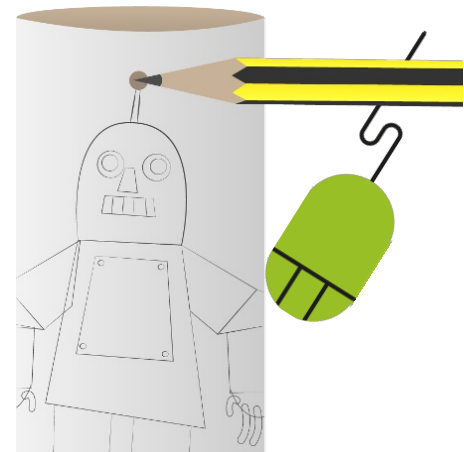
* Stick some modelling clay behind the robot's antenna

* Push a pencil into the antenna to make a hole through the card

* Remove the modelling clay

* Push your LED through the hole in the card to make the robot's antenna.

* Give your robot a name and welcome it to the world!



Challenge: beeps and flashes

* Make the LED antenna stay on for longer.

* Make the LED flash more than once.

* Record your own sound for the robot to make – get creative!

