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How to be a maker 2 **Week 3**

No more thirsty plants

With **Hannah Joshua**'s device, you can go on holiday safe in the knowledge that your plant will get all the water it needs

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New stuff you need

3V submersible water pump
Plastic tubing to fit your pump
2n7000 transistor
Breadboard
Crocodile clip jumper wires

For next week

Old smartphone
Phone stand

Next in the series

1 Moisture-sensing plant
2 Moisture and temperature-sensing plant
3 Plant auto-waterer
4 **Tweeting wildlife cam**
A motion-controlled animal spotter
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10 Remote controlled pest-proof bird feeder part 2

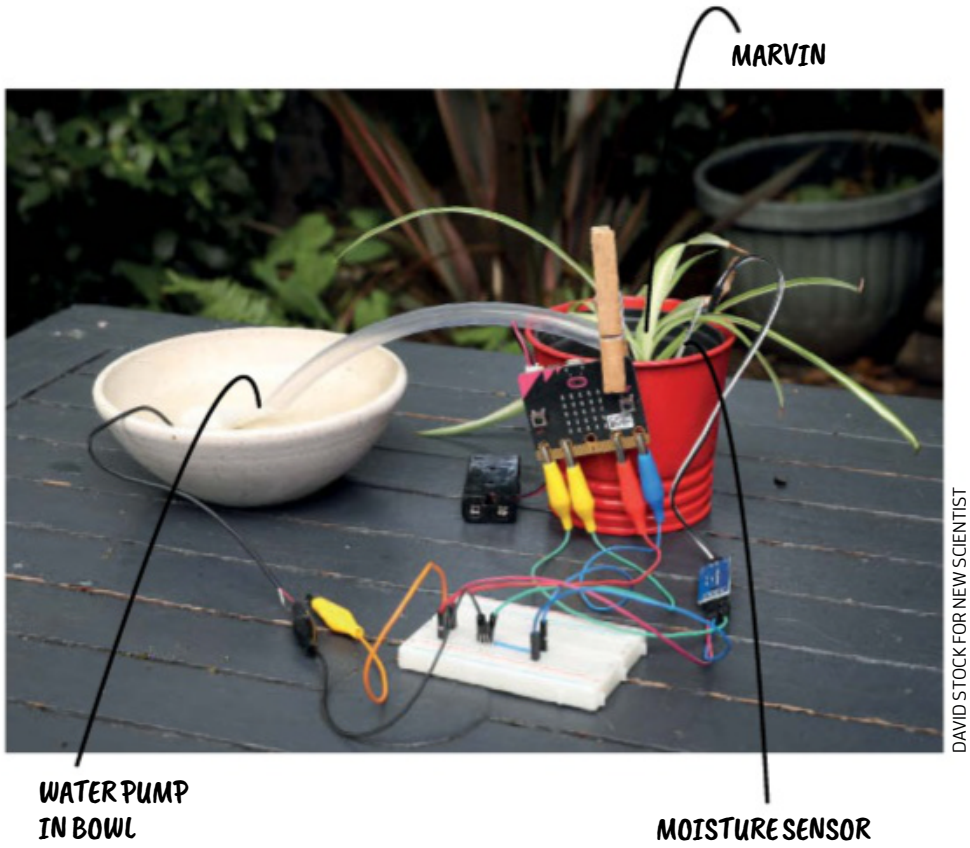
YOU have gone seven days with a moody plant after we left it complaining last week. Now we can give it both the means and a reason to be happy.

First, tweak your code to show a smiley face when the plant's conditions are good. Open your code in the editor – now the variables we created last week will come in handy. Take another "if" block with no "else" part, and snap it under the first two. Then slot in a "<> and <>" block from the "Logic" menu, and two "0 = 0" comparisons. Slot the "0 = 0" blocks either side of "and".

Next, take your variables, DRY and WRONG TEMP, as well as two "false" blocks from the "Logic" menu and make a line that says "if DRY = false and WRONG TEMP = false". Nestle a "show icon" from "Basic" inside the "if" block and select the smiling face.

Now it is time to build an automatic waterer to stop your plant drying out. For this we need a transistor. A transistor can act like an electronic switch. It has three legs, two of which are connected or not depending on the current going into the third.

Grab your breadboard (for a refresher, see "How to be a maker", 25 May), and place the transistor so its legs each sit in different rows. Connect the middle leg, called the "gate", to pin 1 on the micro:bit. On my transistor, when the flat side is facing me, the right leg is the "drain" and the left is the "source". Yours will probably be the same, but check the packet to be sure. Connect the drain to the pump's ground wire, which should be white, and the source to micro:bit's ground. Connect the pump's red power wire to micro:bit's 3v pin.



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Now, when the micro:bit sends a 1 to the transistor's middle leg, it will complete the circuit, while a 0 will break it. This lets us switch the pump on and off.

Let's add to our code to do this. From the "Pins" menu, grab a "digital write pin" and select P1 from the drop-down. Leave the 0 at the end and clip the block into "on start". This will make sure that the pump is off to begin with.

Next, under the block that says "set DRY to true", add another "digital write pin p1", but this time change the 0 to a 1. Underneath that, slot in a "pause" from "Basic" and select 2 seconds from the drop-down. Add another "digital write pin p1" underneath, leaving the 0 in the box. This will switch on the pump for 2 seconds then off again when the soil is dry. Add one final "pause" below, typing in 10,000. This makes the system wait 10 seconds for the water to percolate. Once again, if you get stuck, check my code online.

Finally, put the pump in a bowl of water and attach a length of tube between it and the plant pot. And you're done! Now you can go on holiday and return to a happy houseplant. ▮