BT

British Science Week

Internet Of Things (IoT)
activity pack

EFFICIENCY 100%
STATUS Online
Improvement 78 percent
75%
83%

Internet Of Things (IoT)

Imagine a world where your everyday objects at home or school can talk to each other… making our lives easier, more connected, and a whole lot more exciting! Well, the Internet of Things, or IoT for short, is about connecting these objects to the internet to do just this.

Picture this… your fridge sending a message to your phone to let you know when you're running out of your favourite snack. Or your alarm clock not just waking you up, but also switching on the kettle or turning on the heating.

With our devices communicating and working together via IoT, our lives can become smarter, more convenient and even more efficient.

How does it work? Well, it's all about sensors, tiny computers and internet connections embedded in everyday objects or devices.

These can then collect and share information, take commands, and work together to make our surroundings smarter and more responsive.

Whether it's your smart home devices or wearable tech, they all become part of this interconnected web, making your life more fun and efficient.

IoT could help to make the world a better place. Imagine a smart city where traffic lights change based on live traffic data, reducing queuing and pollution. Or think about farmers working on a smart farm using sensors to take better care of their crops and animals.

There are so many possibilities, so what item would you like to be 'smart' and part of the Internet of Things? How would it help you in your life at home or school?

We'd love to see pictures of you all getting involved with the activities. Email these to us at **computerscience@bt.com** telling us which school you're from.

Or post it on social media and mention @adastralpark with the hashtag #BSW24.

Teacher Links

- STEM Learning - How can we live smarter? atadastral.co.uk/go/iott01
- Barefoot Computing - Programming input devices in Scratch atadastral.co.uk/go/iott02
- BBC micro:bit - Helping plants grow atadastral.co.uk/go/iott03
- BBC Micro:bit – Healthy Oceans atadastral.co.uk/go/iott04

Have A Go

- Introduction to micro:bit: sensors, buttons and lights! atadastral.co.uk/go/ioth01
- Raspberry Pi - Build your own weather station atadastral.co.uk/go/ioth02
- Micro:bit - turn your micro:bit into a meteorologist that can display the weather forecast atadastral.co.uk/go/ioth03
- Scratch - make an interactive water usage calculator atadastral.co.uk/go/ioth04

Find Out More

- Hello World – Download your free issue all about The Power of Data atadastral.co.uk/go/iotf01
- Microsoft - Learn Internet of Things (IoT) atadastral.co.uk/go/iotf02

Activity 1

Taking The Temperature

Just like a thermometer, your micro:bit can tell the temperature (how hot or cold it is).

It does this by checking how hot its processor (main computer chip) is on the back of the micro:bit. The micro:bit doesn't usually get very hot, so the temperature of the processor is normally close to the temperature of the environment.

It is measured as a number in degrees Celsius (often seen as °C). It can show this number on the LED display.

Kit List
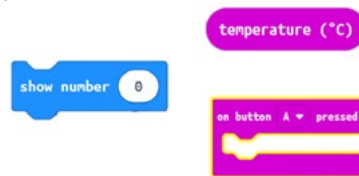
- **Computer with internet connectivity**
- **BBC micro:bit v2***
- **USB to micro USB cable**

Challenges

1 Display the temperature
a. On a web browser, go to MakeCode for micro:bit (https://makecode.microbit.org).
b. Start a 'New Project', give it a name and click 'Create'.
c. Can you arrange these three blocks of code below to get your micro:bit to show the temperature when you press Button B?

d. Test it out on the simulator on the left-hand side first.
e. Did it work as expected? If so, then download it to your micro:bit and try it out for real. If it didn't, try to troubleshoot it.

What is the temperature of the room you're in?

This block below is a Variable, meaning the value of it can change.

It stores the value of the temperature as a number, in degrees Celsius (°C). That number can go up if it gets hotter or down if it gets colder.

Every time the micro:bit runs this block of code, it asks the temperature sensor on the micro:bit "*what is your current temperature?*" and shows that.

2 Repeat Loop
What if you wanted to measure the temperature in a room more than once?

Rather than having to press the button on the micro:bit to show the temperature every time, there must be a better way…

Introducing a Repeat Loop means you can repeat commands as many times as you choose e.g. once, twice, ten times.
a. By adding these two blocks to your code from Challenge 1, can you modify your program to measure the temperature three times with a 5s gap in between each reading?

b. Remember to test it first and if it works, then download it to try it out for real.

3 Forever Loop
Repeat loops are great, but they stop after the set number of repeats. What if you wanted to monitor the temperature constantly?

This is where a Forever Loop comes in.
a. Can you modify your code with this block below, to measure the temperature constantly with a 1s gap in between each reading?
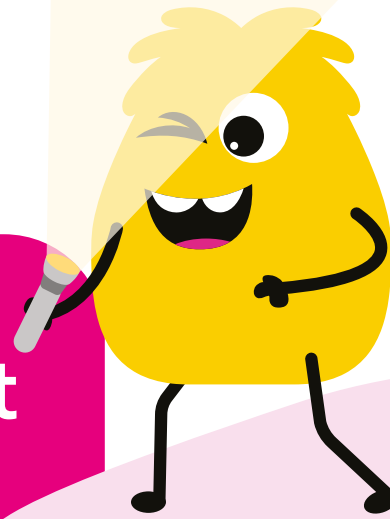
b. Test it and download it.

4 Bring the heat!
Now that we can constantly measure the temperature, let's see if we can watch the temperature change.
a. Gently put your finger on the processor on the back of the micro:bit and hold it there. The processor is also called the CPU (Central Processing Unit).
b. What's happening to the temperature now?

Activity 2

Show Me The Light

A sensor is an input device which detects or measures something and responds to it.

A light sensor measures light levels and responds to them. For example, streetlights often have a light sensor to save electricity:
- If they detect enough light, they keep the streetlights off.
- If they do not detect enough light, they turn the streetlights on.

The micro:bit can act as a light sensor; it uses the LEDs to sense the levels of light on them.

Kit List

Computer with internet connectivity

BBC micro:bit v2*

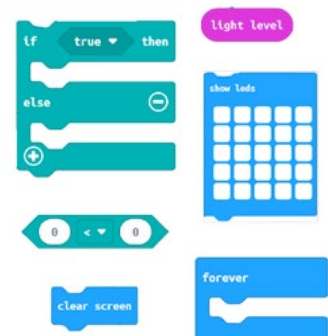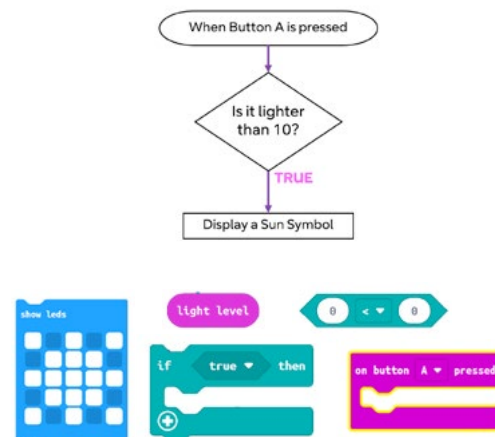| |
|---|
| USB to micro USB cable |

Challenges

1 If, Then…
To configure our micro:bits as a light sensor, we need to help it to make some decisions – so it can tell whether something is TRUE or not.

These are called Conditions (selecting what to do depending on the answer to the question).

a. On a web browser, go to MakeCode for micro:bit (https://makecode.microbit.org).
b. Start a 'New Project', give it a name and click 'Create'.
c. Use these 5 blocks of code below to create a program for this algorithm:

d. Test it out on the simulator on the left-hand side first.
e. Did it work as expected? If so, then download it to your micro:bit. If it didn't, try to troubleshoot it.

2 If, Then, Else…
Decisions with only one outcome are quite limiting though. Sometimes we want to do something whether the answer is TRUE OR FALSE.

We can do this by adding an ELSE clause to the IF statement.

It can then have two results, like our streetlight example from before:

Is it light outside?
IF this is true, then keep the lights off
ELSE turn the lights on

You're going to use this example above to make your own night light.

Night lights come on when the light sensor detects there is a low amount of light.
a. Use these blocks below to make your micro:bit into a night light. It should only come on when the light level is less than 1.
b. Remember to test it first and if it works, then download it to try it out for real.

Activity 3

Count My Steps

You can also use your micro:bit to create your own step-counter, also known as a pedometer. The micro:bit has a motion sensor (also known as an accelerometer) which allows it to work out when you are taking a step.

See, they're clever little things these micro:bits!

Kit List

Computer with internet connectivity

BBC micro:bit v2*

USB to micro USB cable

BBC micro:bit battery pack

Instructions

1. a. On a web browser, go to MakeCode for micro:bit (https://makecode.microbit.org).
   b. Start a 'New Project', give it a name and click 'Create'.

2. We now need to create a Variable which will record the number of steps taken.

   Remember from Activity 1 that a variable is something that stores a value that is likely to change.

   For example, we saw 'Temperature' as a variable before because the temperature goes up and down all of the time. If I were to ask you what the temperature is, you wouldn't say 15 degrees Celsius because that is what it was the last time you looked. Now it could be 10 degrees Celsius, 30 degrees Celsius or anything else!

   a. Click on Variables > Make a Variable to create a name for your new variable before clicking Ok. We've called our variable Steps as it makes it nice and easy to understand how we're going to use it throughout our code.

3. Use these four blocks on the left to make a program that:
   a. Sets your step counter to start at 0.
   b. Shows that number on the micro:bit's LED screen.
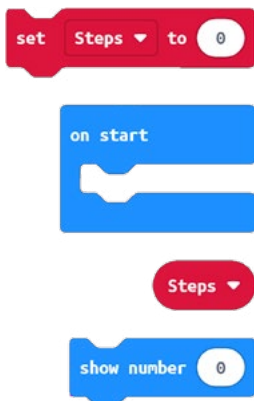
The micro:bit will be attached to your foot, so that every time you take a step, the micro:bit will be shaken. Therefore, we want the micro:bit to record a step every time it shakes.

4. Add these blocks of code below to your program from Step 3 to increase your variable by 1 every time the micro:bit gets shaken.

Counting the steps is great, but we want to be able to see how many steps we've taken.

5. Modify your code, using these blocks below, to display the number of steps taken on the micro:bit's LED screen.
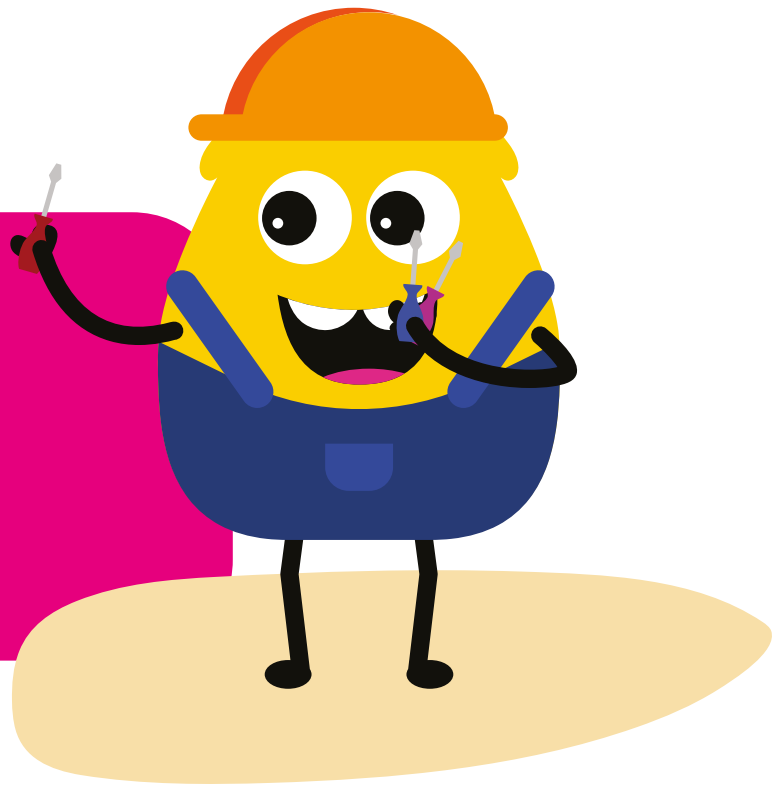
6. Test your code out on the simulator.

7. It's now time to download your code and try it out for real.

8. Connect the micro:bit battery pack to the micro:bit.

9. Secure the micro:bit safely to your shoe.

10. Press Button A on the micro:bit and start walking – how many steps does it take to get from one side of your classroom to another?
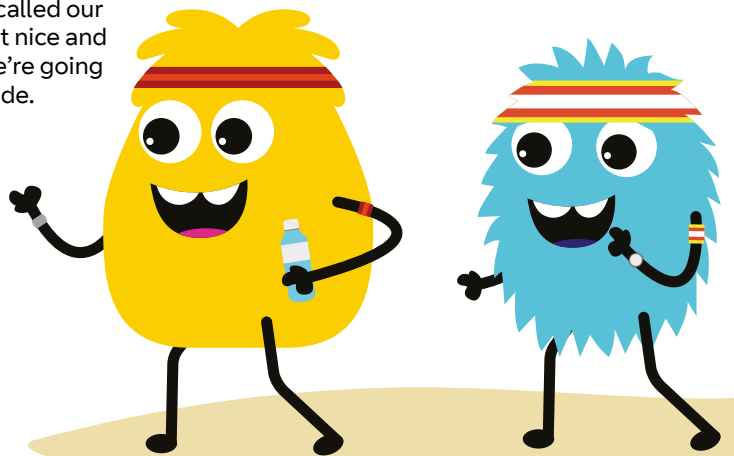
Activity 4

DIY IoT

Now it's time to get creative and design your own IoT device!

Here's what you've got to do:

Kit List

Print out Template on Page 7

Pens or Pencils

Colouring Pens or Pencils

Materials that can be used to make a physical model of the IoT device e.g.

↘ Scissors

↘ Glue

↘ Sellotape

↘ Cardboard

↘ String

↘ Straws

Instructions

1 Define the problem
What happens in your life now that you think an IoT device could help you with?

It might make your life better by speeding up a process. It might stop you from having to do something manually. Alternatively, it might just be a plain cool idea.

Have a think about how a device that collects data and is connected to a network could improve your life.

Write the problem down in a few sentences in box 1 of the DIY IoT Template from page 7.

2 Design it
Draw what your IoT device will look like in box 2 of the DIY IoT Template from page 7.

Make sure it's really detailed. Label all the key features to describe what they are and what they do.

3 Make it
Have a go at making your IoT device using the creative materials available to you.

Remember to make it look like what you have drawn and labelled in step 2.

Take a picture of your new IoT device. Print it out and stick it into box 3 of the DIY IoT Template from page 7.

4 Send it to us
We'd love to see your completed DIY IoT templates as well as pictures of your new IoT device. Email these to us at computerscience@ bt.com telling us which school you're from. Or post it on social media and mention @adastralpark with the hashtag #BSW24.
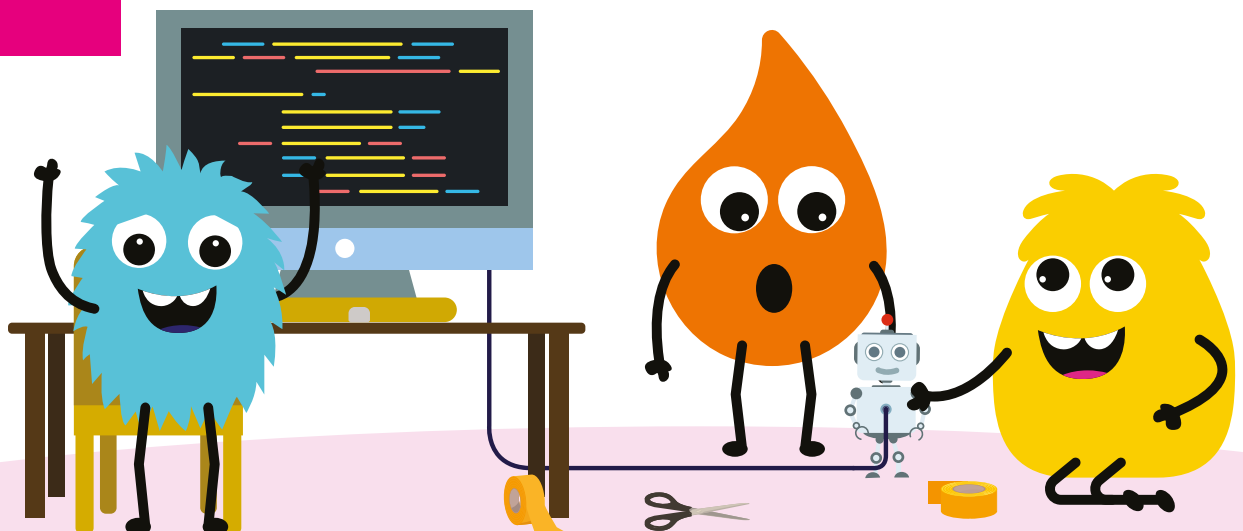
DIY IoT
Template

1. **Define the problem (explain what problem you're trying to solve by creating your IoT device)**

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2. **Design it (draw an image of what your IoT device will look like)**

3. **Make it (include a picture of the IoT device you've now made)**