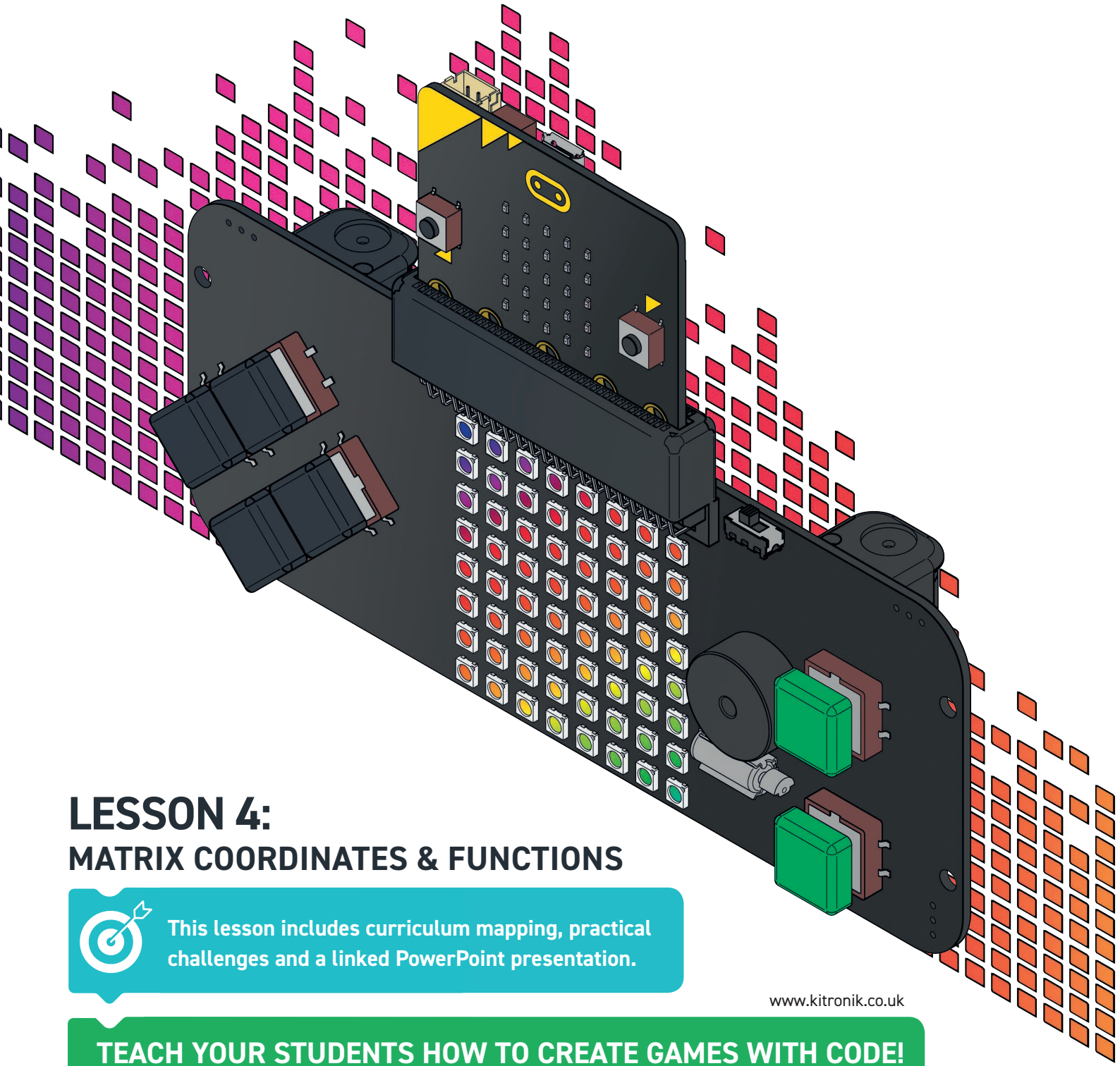
Kitronik

:GAME ZIP 64

THE TEACHERS LESSON GUIDE TO THE :GAME ZIP 64



LESSON 4:
MATRIX COORDINATES & FUNCTIONS

This lesson includes curriculum mapping, practical challenges and a linked PowerPoint presentation.

www.kitronik.co.uk

TEACH YOUR STUDENTS HOW TO CREATE GAMES WITH CODE!

LESSON 4

MATRIX COORDINATES & FUNCTIONS

This is the fourth lesson for students in Key Stage 3 to the KITRONIK :GAME ZIP64 controller. This lesson teaches the students to use x and y coordinates to control the lights on the grid. They will also learn what a function is, how to create one and how to call it. They will create and modify their own functions.
Recommended ratio of students to :GAME ZIP64 is 2:1.

Classroom setup

Students will work be working in pairs. They will need:

- A computer/laptop with a USB port and Internet access
- A :GAME ZIP64
- A BBC micro:bit
- 3 x AA batteries
- A micro USB cable

The teacher will be writing on the board as well as demonstrating code on a projected board (if available).

Timings

The lesson is expected to take 1 hour. It can be shortened or lengthened if needed. This lesson can easily be separated into 2 lessons as it contains a lot of content.

Suggested shortening

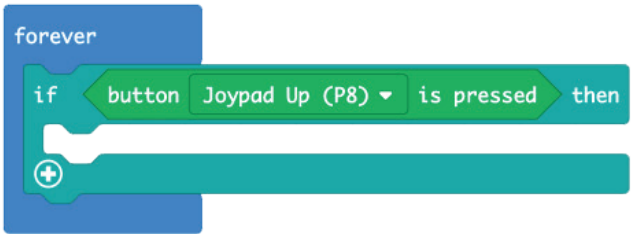
In the functions part of the lesson the students create a Buzz function. You could skip this and go straight to the changeX function. However I would complete the Buzz function and use the remainder of the lesson in the next lesson.

Suggested lengthening:

The game will not work now that we've changed everything into a matrix. The students could start looking at the old game algorithm and see what needs changing.

Differentiation

For younger or less able students there is differentiation in the lesson plan.
The controller can be controlled using the NeoPixel and digital read blocks described below. There are simpler custom blocks available to use. See **www.kitronik.co.uk/blog/game-zip-64-makecode-blocks/** for more details.



KEY

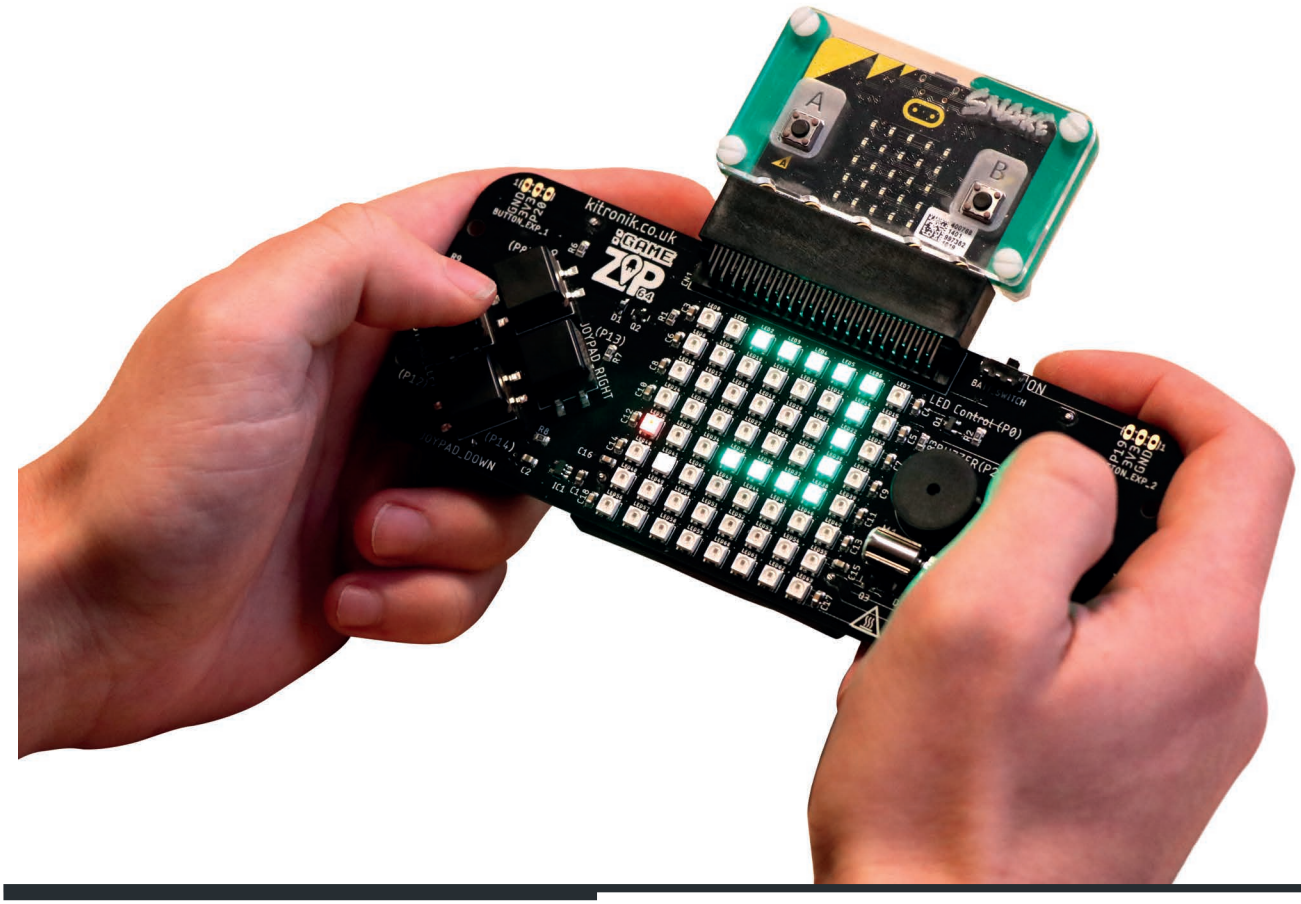
Teacher asks this question to the class and discusses the answers with them.

Where this content maps onto the curriculum.

Teacher writes the text in this box on the board.

Students take notes, either on paper on in their electronic workbooks.

This part of the lesson aligns to Slide 1 of the attached PowerPoint.



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MATRIX COORDINATES & FUNCTIONS

INTRODUCTION

This week we're going to look at editing the game from last week to work better.
You will continue to work in pairs (reminder of pairs if needed).

Let's look at the lights more closely.

0	1	2	3	4	5	6	7
8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23
24	25	26	27	28	29	30	31
32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47
48	49	50	51	52	53	54	55
56	57	58	59	60	61	62	63

? Last week when we were on light 7 and we pressed right what happened?
Answer: it went onto light 8.

This week we don't want that to happen. We want to create a proper grid that you can only go up, down, left and right. There is no winding around.

Using the grid as it is we would have to check when the light reaches: 7, 15, 21, 31, 39, 47, 55 when they press right and 8, 16, 22, 32, 40, 48, 56 when they press left. This is **not** obvious!

We need to use a new grid. We're going to use x and y coordinates.

Every light now has an X and Y coordinate.

0,0	1,0	2,0	3,0	4,0	5,0	6,0	7,0
0,1	1,1	2,1	3,1	4,1	5,1	6,1	7,1
0,2	1,2	2,2	3,2	4,2	5,2	6,2	7,2
0,3	1,3	2,3	3,3	4,3	5,3	6,3	7,3
0,4	1,4	2,4	3,4	4,4	5,4	6,4	7,4
0,5	1,5	2,5	3,5	4,5	5,5	6,5	7,5
0,6	1,6	2,6	3,6	4,6	5,6	6,6	7,6
0,7	1,7	2,7	3,7	4,7	5,7	6,7	7,7

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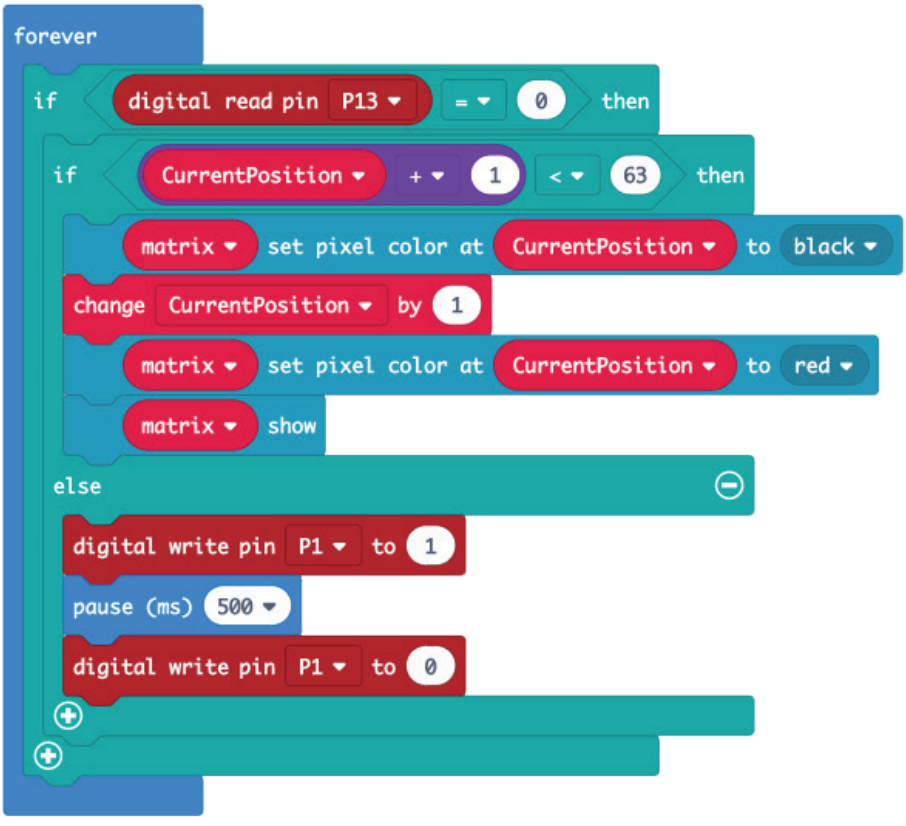
What are the X and Y coordinates of light number 34? 15? 55?

Let's look at the algorithm for moving the lights to the right from last week:

When the right button is pressed
IF CurrentPosition + 1 is less than 63 THEN
    Clear the CurrentPosition light
    Change the CurrentPosition by 1
    Set the CurrentPosition light red
    Show the lights
ELSE
    Turn the motor on
    Pause for half a second
    Turn the motor off
END IF



We need to change it to use x and y coordinates.

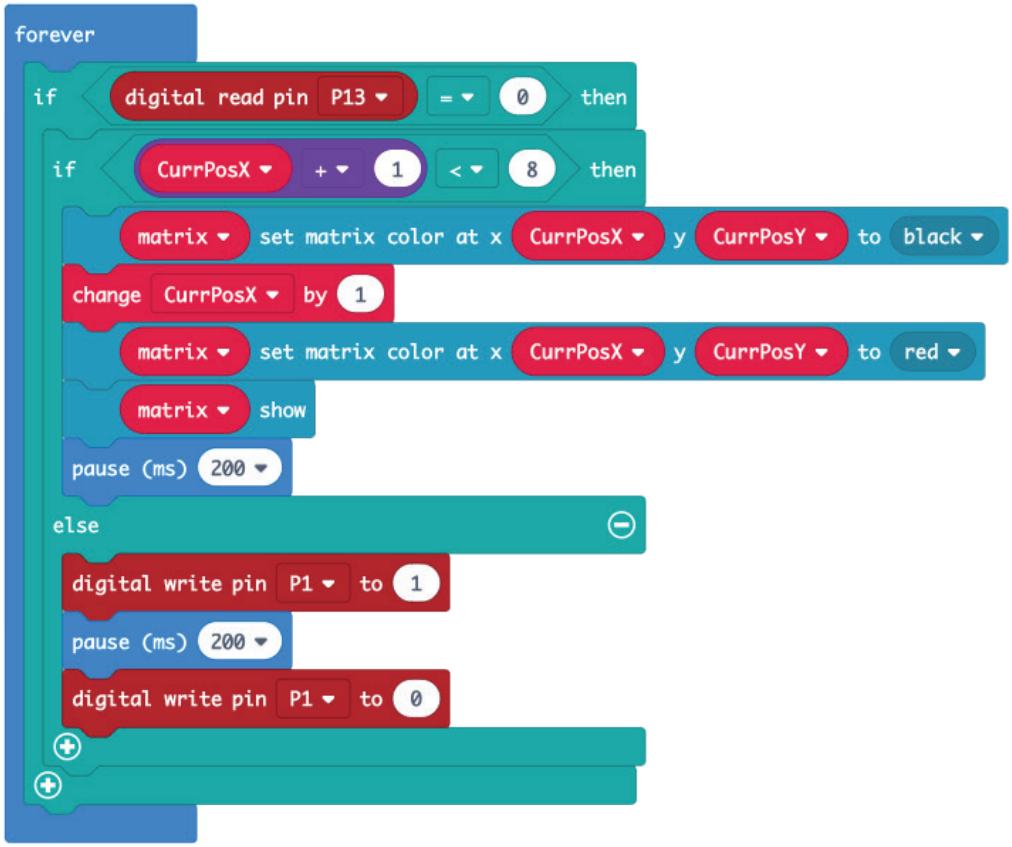
Encourage the students to help you build the new algorithm.

Moving the light to the right only deals with the x axis.

MATRIX COORDINATES & FUNCTIONS

You need 2 new variables: CurrentPositionX and CurrentPositionY.

When the right button is pressed
IF CurrentPositionX + 1 is less than 8 THEN
    Clear the CurrentPositionX CurrentPositionY light
    Change the CurrentPositionX by 1
    Set the CurrentPositionX CurrentPositionY light to red
    Show the lights
ELSE
    Turn the motor on
    Pause for half a second
    Turn the motor off
END IF



(The 200 pause in the code above slows down the light – it's a handy block to have).

Students should change their algorithm from last week to match this week's algorithm using the x and y coordinates. The more they see the old algorithm changing into the new one, the easier it is to realise the changes.

Ask the students to change the other direction buttons: left, up and down. Encourage every student to have a try at changing the code.

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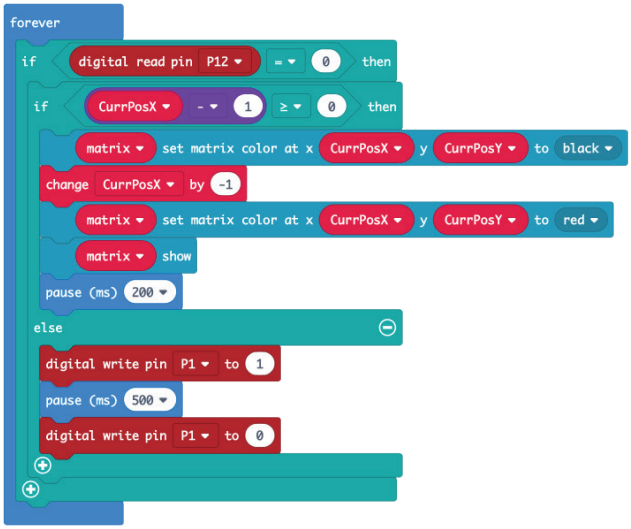
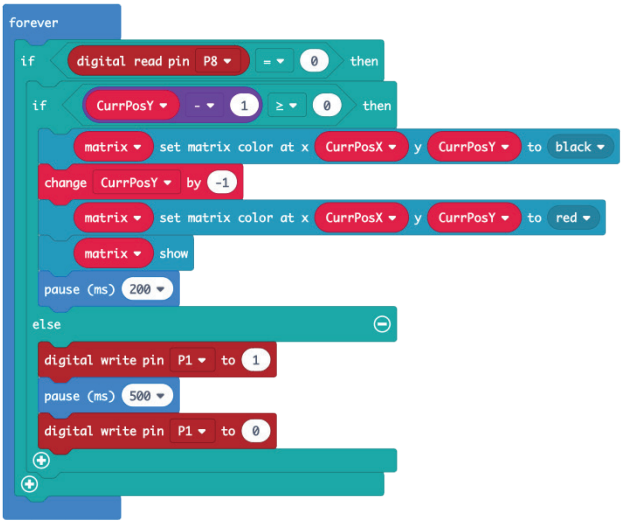
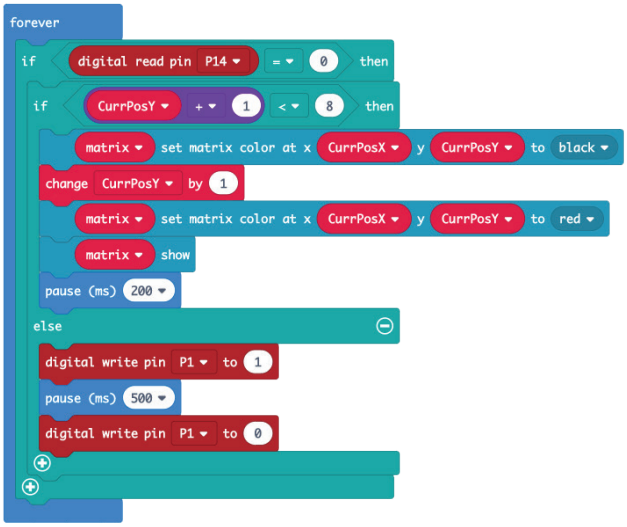
Answers:







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MATRIX COORDINATES & FUNCTIONS

Main Lesson

Functions

Curriculum mapping
Use two or more programming languages, at least one of which is textual, to solve a variety of computational problems... design and develop modular programs that use procedures or functions.

Look at the code for left and right.

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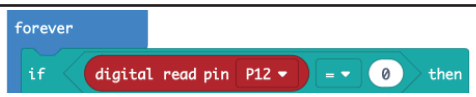
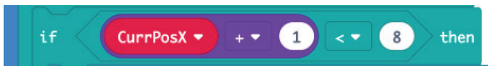
They are exactly the same except for 3 things – spot the difference!

1. Reading a different pin
    a. For left you're reading Pin12
    b. For right you're reading Pin13
2. Checking the CurrPosX
    a. For left you're checking that the new position minus 1 is greater or equal to 0
    b. For left you're checking that the new position plus 1 is less than 8
3. Changing the CurrPosX
    a. For left you're changing it by -1
    b. For right you're changing it to +1

#	LEFT	RIGHT
1		
2		
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We're recreating this code 4 times for the 4 different button presses. It's boring! And inefficient. We can create one piece of code and call it 4 times. This is called a function. It saves time, helps you debug easier and is how real programmers code.

We're going to learn about functions – creating them and calling them. Let's start with a simple function called Buzz. This will set the buzzer off if they hit the edge of the matrix.

Demonstrate how to create a function:
1. Select Advanced > Function > Make a Function.
2. Call it Buzz.
3. It will appear on the screen.
4. Drag out the blocks into the function.

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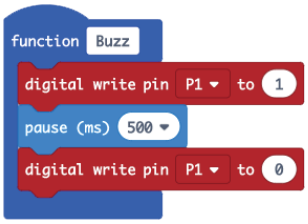
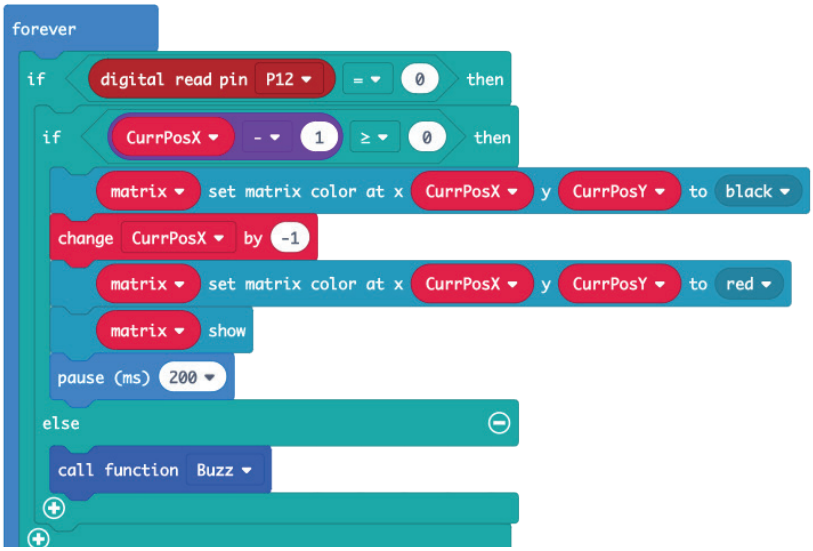


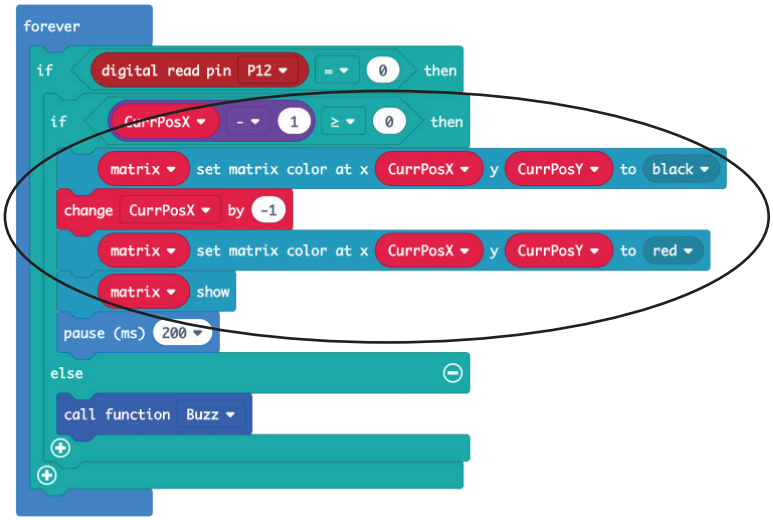
Now from Advanced > Function drag out the block “call function” and put it in its place.



Ask the students to create the function Buzz and replace it in all the direction buttons. Give the students the time to create this. It shouldn't take long once they create the function. They don't have to create a new function every time as they're calling the same function called Buzz.

Task 2

Let's create a function called ChangeX that changes the direction of X.
We're going to put this code into the function:



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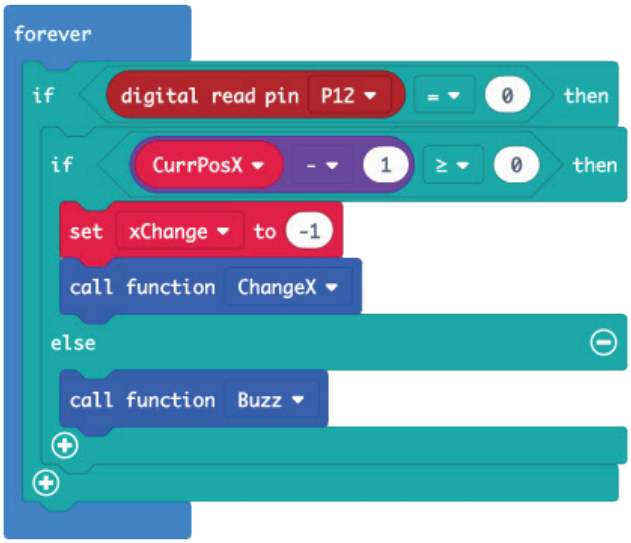
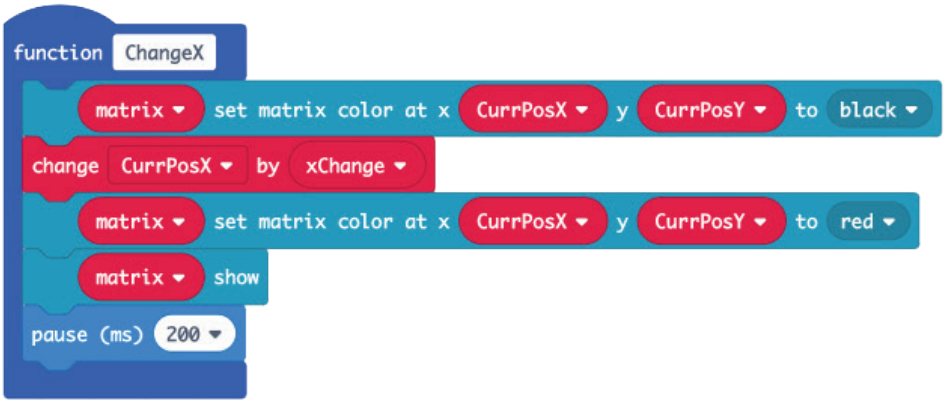
We just need to change the -1 to a variable that we can set depending on which button was pressed.
Create a new variable “xChange”.
Set it on the button press:

E,g. for left xChange changes by -1:



Add it to the function:



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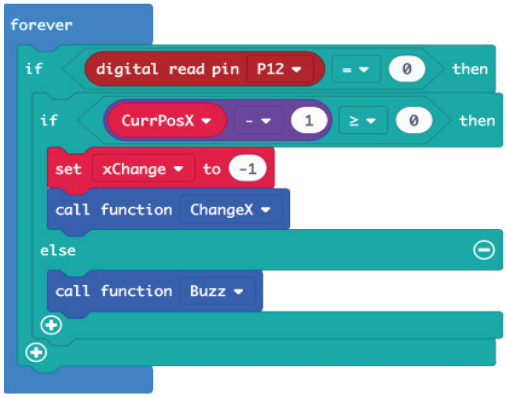
Ask the students to create the function ChangeX and change left and right buttons use it.
Ask the students to create the function ChangeY and change up and down buttons use it.

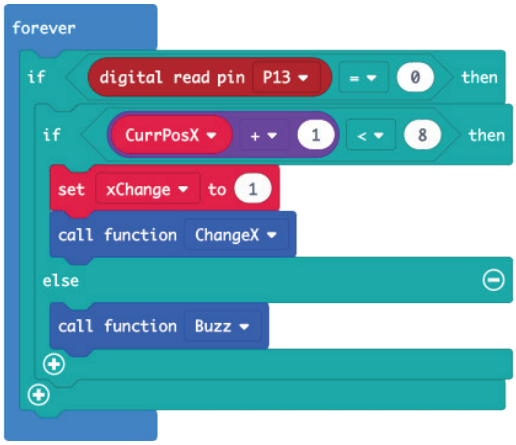
The students should download the code and test it works on their controller. The controller will now buzz if you hit any edge of the matrix.

Answers:

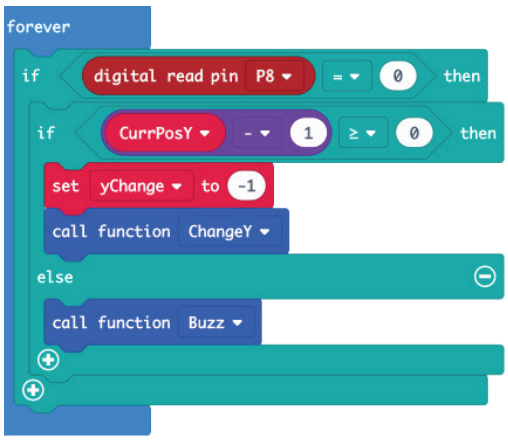
Left:



Right:



Up:



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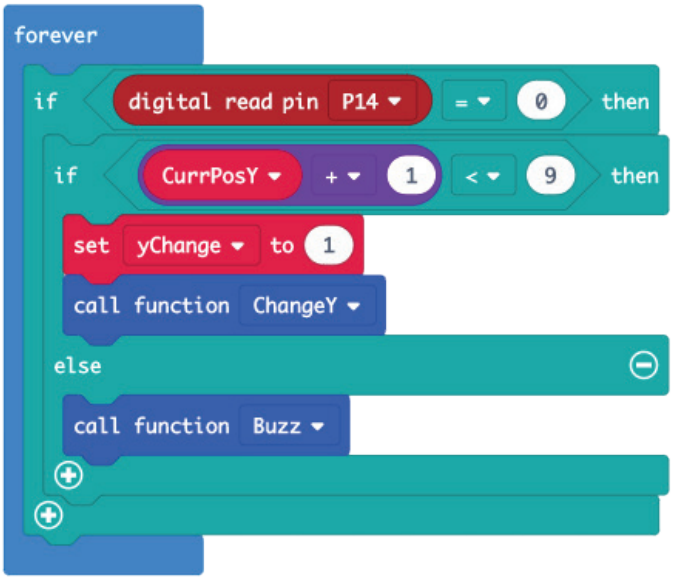
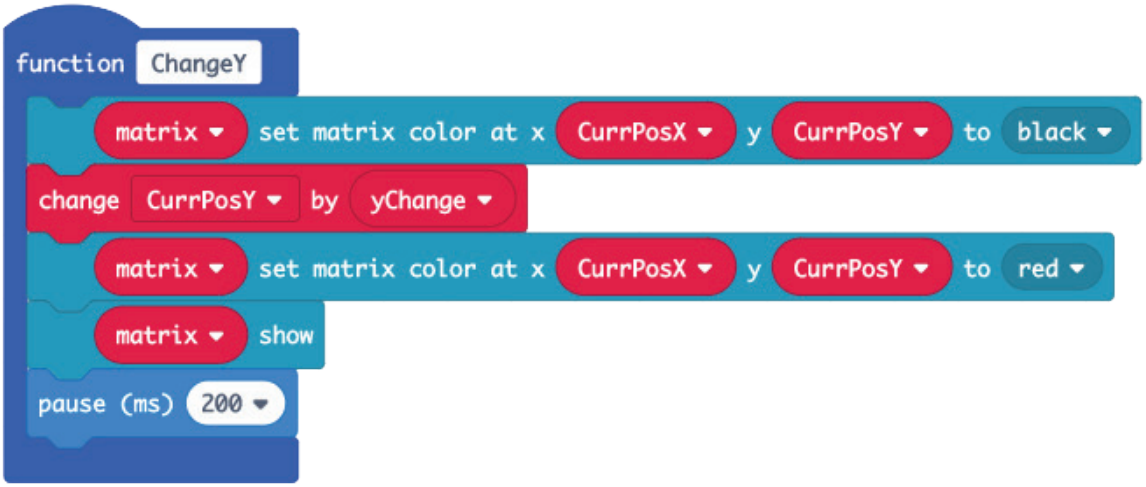
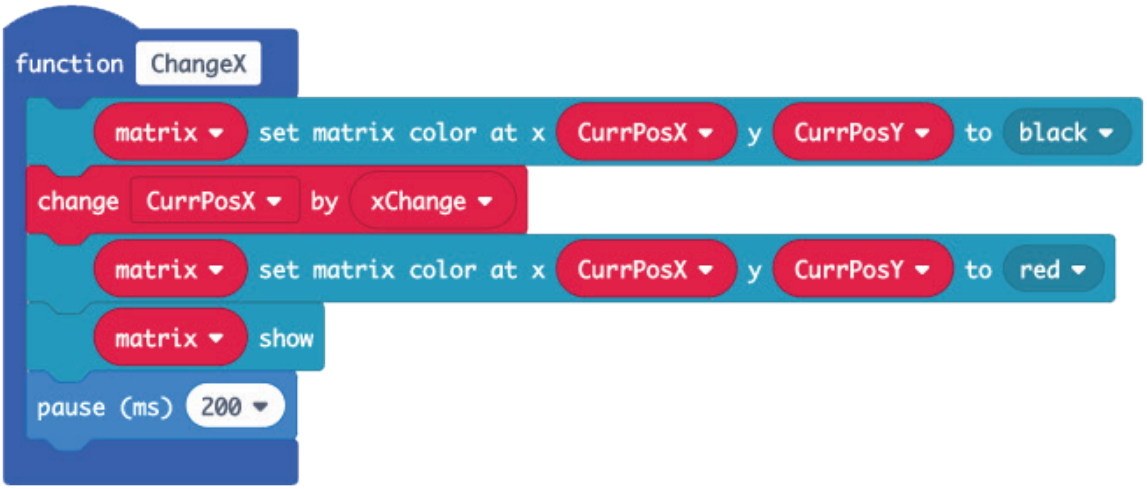
Down:



Function ChangeY:



Function ChangeX:



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Before the end of the lesson:

Ask the students to take notes.
They will need a copy of the algorithms and their code for each challenge they've completed today.
Take screenshots of their code and explain it.

Summary

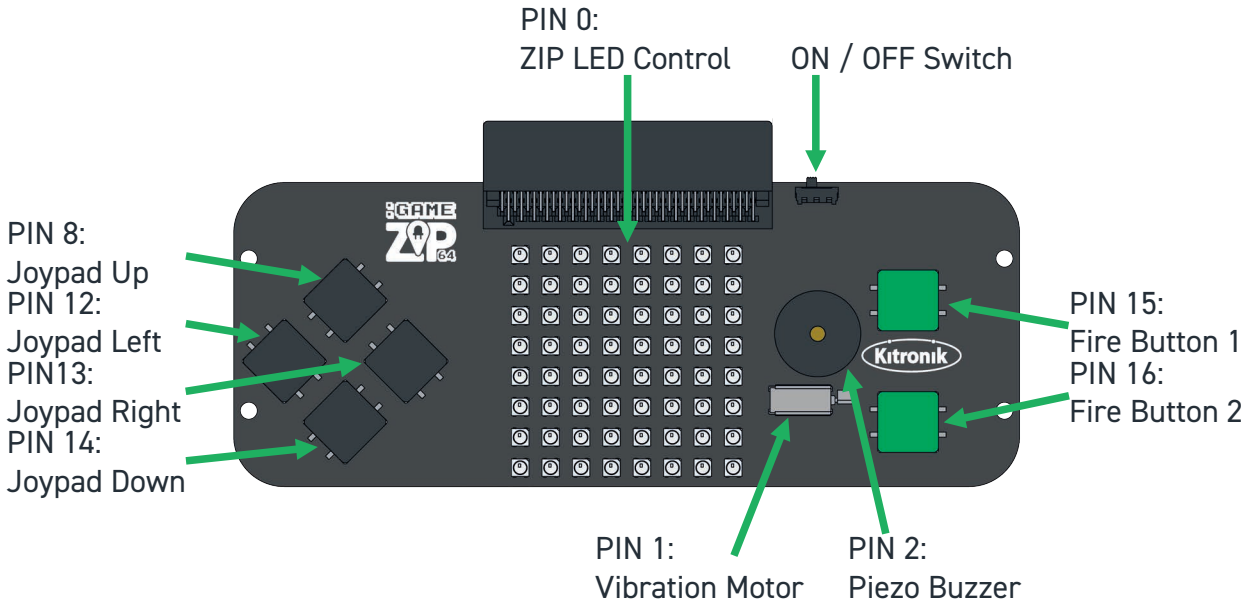
This lesson students combined the skills learnt in previous lessons to move lights around the controller using the buttons on the controller and a matrix of coordinates x and y. The students learnt what functions were and created and called their own functions.
After changing the game to use x and y the students may notice the game doesn't work anywhere! This will be solved in the final lesson.
Next lesson they will amend their game to use the matrix.

This is the fourth lesson for students in **Key Stage 3** for the **Kitronik :GAME ZIP64** controller for **BBC micro:bit**. This lesson teaches the students to use x and y coordinates to control the lights on the grid. They will also learn what a function is, how to create one and how to call it. They will create and modify their own functions. The recommended ratio of students to :GAME ZIP 64 is 2:1. Please find additional lesson plans, accompanying **PowerPoint** presentations and more at **www.kitronik.co.uk/5626.**

The Kitronik :GAME ZIP 64 is the ultimate retro gaming accessory for the BBC micro:bit. This all in one hand held gaming platform includes a built in 64 (8x8) individually addressable full colour ZIP LED screen.
It features on-board sound, 4 directional buttons, 2 fire buttons, and haptic feedback. All features are fully programmable. Breakout points are also included allowing for shoulder buttons or I2C devices to be added, as well as the use of additional LEDs.
All the BBC micro:bit features are still available when plugged in to the :GAME ZIP 64, so your games can still make use of the LED matrix, accelerometer etc.

LESSON REQUIRES:

- Pen & Paper including coloured pens (grid paper)
- A computer/laptop with a USB port and Internet access
- A :GAME ZIP64
- A BBC micro:bit
- 3 x AA batteries
- A micro USB cable



WARNING : Contents may inspire creativity

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