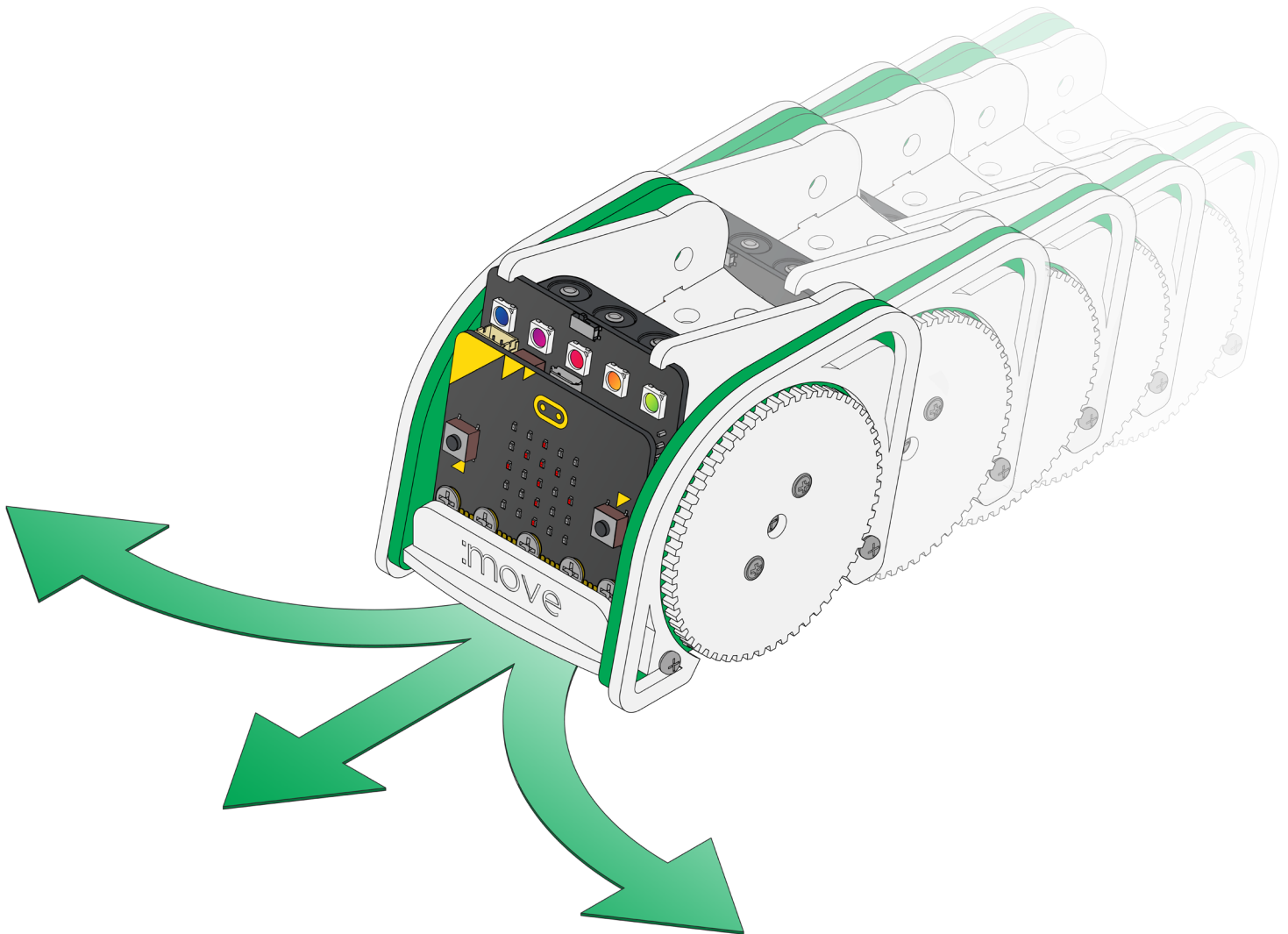


THE TEACHERS LESSON GUIDE TO THE :MOVE MINI



LESSON 4: RADIO CONTROL



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

www.kitronik.co.uk

TEACH YOUR STUDENTS HOW TO CONTROL A ROBOT WITH CODE!

LESSON 4

RADIO CONTROL



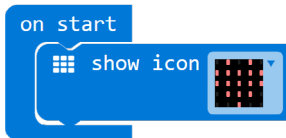
This lesson is the fourth lesson on robots for students in key stage 3. You will discuss radio control with the students and they will send each other radio messages. You will discuss privacy, ethics and security. Students will then send radio messages to the robots to make them move remotely. Recommended ratio of students to robot is 6:1

Classroom setup

Students will be writing algorithms individually and coding in pairs. They will need

- Pen & Paper (Each)
- A computer/laptop with a USB port and Internet access (shared between 2)
- As well as the miro:bits in the robots the students will need 1 micro:bit per pair
- 6 robots
- 6 separate micro:bits for controlling

Position the assembled robots in the centre of each group of 6 students. Make sure there is no code on the micro:bits. A sample piece of code you could have:



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 and lengthened if needed.

Suggested shortening:

Remove Advanced challenges

Suggested lengthening:

Include advanced challenges – move the robot through tilting the micro:bit. Making the robot turn left when tilting will turn it too far left – they will need to tweak this code several times before getting it right.

Differentiation

For younger or less able students there is differentiation in the lesson plan.

The robot can be controlled using servo commands like "Servo write P1 to 120" OR it can be controlled using simple blocks like "Turn left 90 degrees". See www.kitronik.co.uk/blog/kitronik-custom-makecode-editor-servo-blocks for more details. All students will understand how robots move through the algorithm but only the most able/older students will code the servos directly.

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.



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



RADIO CONTROL

INTRODUCTION



Teacher: So our robots have followed a pre-programmed set pattern and a line drawn on the ground.



What other ways can we control robots? And why?



Class discussion on radio control: What is it? How does it work? Have you seen real world examples? What do you think of it? Advantages and disadvantages of radio control. Examples of radio control: drones, toys, robot surgery. We use radio control when we still want some human interaction with robots without using wires to connect the two.



Curriculum mapping

Design, use and evaluate computational abstractions that model the state and behaviour of real world problems and physical systems.

Main Lesson

Challenge 1: Say Hello



Teacher: We're going to send a message to the other robots in the room. To send and receive a message each group needs to be on the same radio group. Assign radio group numbers to 2 groups. Group number can be between 0 and 255.

e.g. a pair of students on table 1 and a pair of students on table 2 will be on radio group 7. They will send and receive each other messages. (Edit this slide to assign groups).



What is our algorithm for sending a message?

Write the best algorithm on the board



Send message

When I press button A:
Send a message to group 1



RADIO CONTROL

PART 1



What is our algorithm for receiving a message?



NOTE: We always have to be listening for a message. We can't put this on a button press.



Receive message

Forever
Receive a message
Display the message



Write up who is sending who a message
e.g. Table 1 group A and Table 2 group A are sending messages to each other. They are radio group 7

Let's get coding

1. Open <http://makecode.com>
2. Select the micro:bit



Curriculum mapping

Use two or more programming languages, at least one of which is textual, to solve a variety of computational problems.

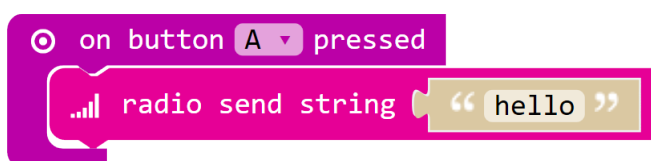
Show the students where all the blocks they need are and ask them to get coding. They should use the algorithms in their notes to guide them in creating the code.

Setup each group:



Answers

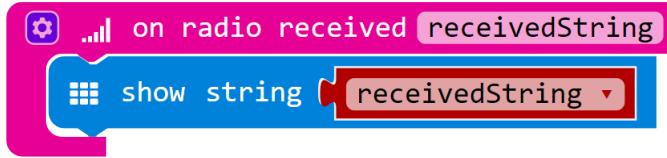
Send a message



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RADIO CONTROL

Receive and display a message



After the first few messages have been sent send a message to one of the groups from your micro:bit. Something like "Ha ha ha, I can see you"

Stop the class and discuss what has happened. Someone has hacked into that radio group and sent a message. What are the implications of this? Discuss security of robots/drones/remote controlled robots. How can we make them secure? Discuss encryption.



Curriculum mapping

Understand a range of ways to use technology safely, respectfully, responsibly and securely, including protecting their online identity and privacy; recognise inappropriate content, contact and conduct, and know how to report concerns.

Challenge 2: Control the Robot



We can only send text or numbers to the robot. How can we control it from the radio?

Discuss ways of controlling the robot by just sending messages. What's the most efficient way? What do computers operate in? Numbers! Let's start assigning numbers to activities that we want the robot to do.

What will the remote do to send these numbers?



Button A sends a 1 – this means turn left
 Button B send a 2 – this means turn right
 Button A&B sends a 3 – this means go
 Shake sends a 4 – this means stop



RADIO CONTROL

There are now 8 tasks! Try and split the groups into tasks, e.g.
In a room of 5 tables, there are 6 students on each table. Working in threes:



1. Code the robot micro:bit to receive all the commands
2. Code the remote micro:bit to send all the commands

Break the algorithms down further.

Radio micro:bit

On button A Press:

Send number 1

On button B Press:

Send number 2

On button A&B Press:

Send number 3

On shake:

Send number 4

Robot micro:bit

On radio receive:

If number = 1

Turn Left

If number = 2

Turn Right

If number = 3

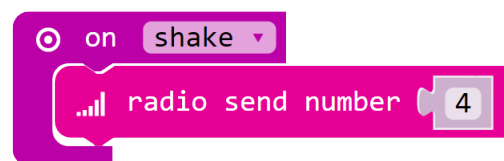
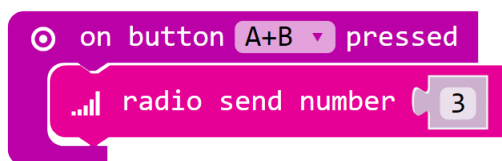
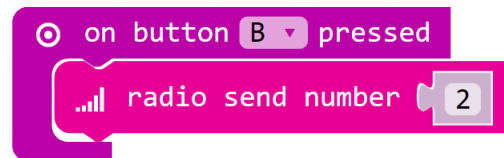
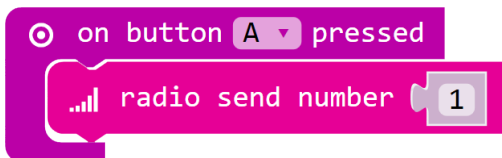
Go forwards

If number = 4

Stop

Answers

Radio controller



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RADIO CONTROL

Answers



Robot micro:bit

```

on radio received receivedNumber
  if (receivedNumber = 1)
    then turn left
  if (receivedNumber = 2)
    then turn right
  if (receivedNumber = 3)
    then drive forward
  if (receivedNumber = 4)
    then drive backward
  
```

Advanced

A better way of doing multiple if statements is to select the blue cog on the first statement and add if else and build it up like so.

```

on radio received receivedNumber
  if (receivedNumber = 1)
    then turn left
  else if (receivedNumber = 2)
    then turn right
  else if (receivedNumber = 3)
    then drive forward
  else if (receivedNumber = 4)
    then drive backward
  
```

In the first example if the number was 1 it would turn left but then it would check if it was 2, 3 and 4 – this is inefficient. The second example checks it's 1, if it is 1 it stops checking.

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RADIO CONTROL

PART 1

Advanced 2



Instead of using the buttons the student could use the tilt sensor on the micro:bit to control the robot car, e.g.



These can be found under the drop down for on shake.



Evidence

In this lesson the students will each have written down algorithms in their notes. With one robot students will be waiting between each task. As each group finishes a task ask them to take a screenshot of their code and paste it into a document. Ask them to comment the code with labels. Every student needs a copy of the code in their own notes.

Summary



Students modelled automation in a robot, sent, received and displayed radio messages to/from another micro:bit. They learned about possibly security issues with remote controlled robots and discussed ways of securing their devices. They coded a remote for the robot car and coded the robot car to respond to the remote.



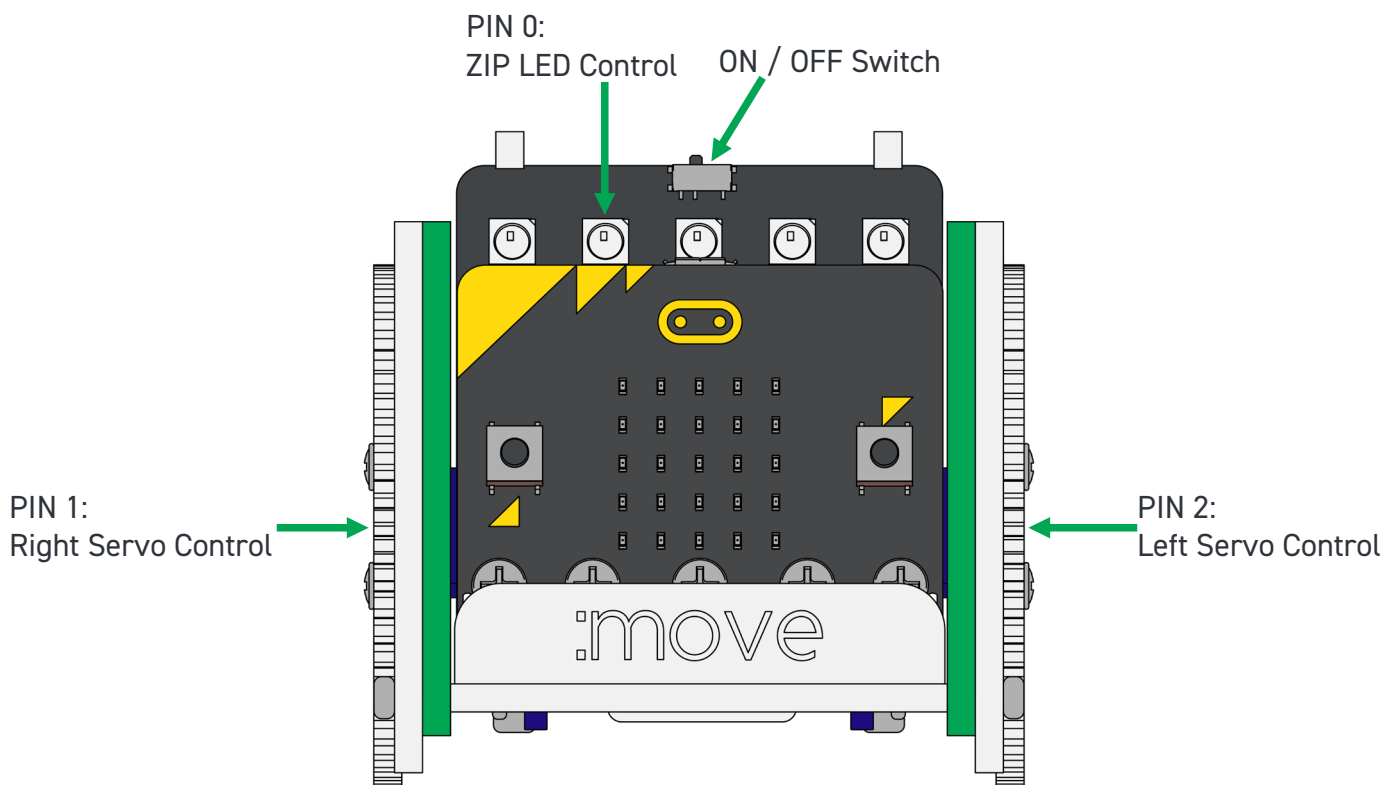
This is the fourth and final lesson on robots for students in Key Stage 3 for robotics with the **Kitronik :MOVE mini** for **BBC micro:bit**. You will discuss radio control with the students and they will send each other radio messages. You will discuss privacy, ethics and security. Students will then send radio messages to the robots to make them move remotely. The recommended ratio of students to robot is 6:1. Please find additional lesson plans, accompanying **PowerPoint** presentations and more at www.kitronik.co.uk/5624.

The Kitronik :MOVE mini buggy kit for the BBC micro:bit provides a fun introduction to the world of robotics. The :MOVE mini is a 2 wheeled robot that is suitable for autonomous operation, remote control projects and more. Once built it can be coded for a variety of activities. A range of add on boards can expand the capabilities to include more advanced functionality.



LESSON REQUIRES:

- Pen & Paper
- A computer/laptop with a USB port and Internet access
- A :MOVE mini
- A BBC micro:bit
- 3 x AAA batteries (included with :MOVE mini)
- A micro USB cable



WARNING : Contents may inspire creativity

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