



An tSraith Shóisearach do Mhúinteoirí

Junior **CYCLE**
for teachers

Problem solving through Coding, Applied Control and Mechatronics



An Roinn Oideachais
agus Scileanna
Department of
Education and Skills



Accessing supports to date

- Webinar
- CPD Workshops
- To keep up-to-date:
Join our mailing List

The image shows a screenshot of a website interface. On the left is a sign-up form for a mailing list. The form has a purple header bar with the word 'Technologies' partially visible. Below the header, the text reads 'Technologies Teachers - Mailing List (2019)' and 'GDPR compliant subscription form.' There is a red asterisk and the word 'Required' next to the 'First Name' field. Below that is a green banner with the JuniorCYCLE logo and the text 'An tSraith Shóisearach do Mhúinteoirí JuniorCYCLE for teachers'. The form includes a 'Mailing List' section with a paragraph of text about GDPR. There are two input fields: 'First Name *' and 'Surname *', both with 'Your answer' placeholder text. On the right side of the screenshot, there is a navigation menu with icons and labels: 'Events' (with a red icon), 'Ment' (with a purple icon), 'CPD Workshops' (with a green icon and a yellow border), and 'Resources' (with a blue icon). At the bottom right, there is a purple button with a yellow border that says 'Join the Mailing List' and a purple button with a white border that says 'Twitter' with a Twitter icon.

Technologies Teachers - Mailing List
(2019)

GDPR compliant subscription form.

* Required

JCT

An tSraith Shóisearach do Mhúinteoirí
JuniorCYCLE
for teachers

Mailing List

Under the EU General Data Protection Regulation (GDPR), new rules on Data Protection will come into law in May 2018. Because of these new regulations, JCT is required to ensure that all data is fairly obtained and processed. If you wish to receive regular email updates, please fill in the required fields and click submit. By submitting this form, you agree to be part of Junior Cycle for Teachers Technologies mailing list.

First Name *

Your answer

Surname *

Your answer

Events

Ment

CPD Workshops

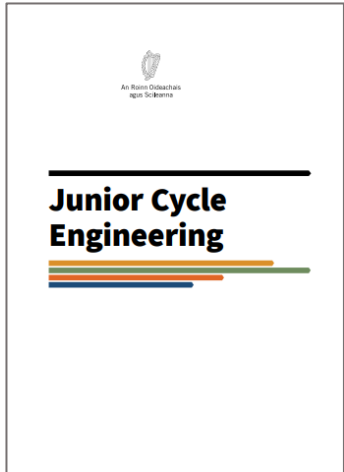
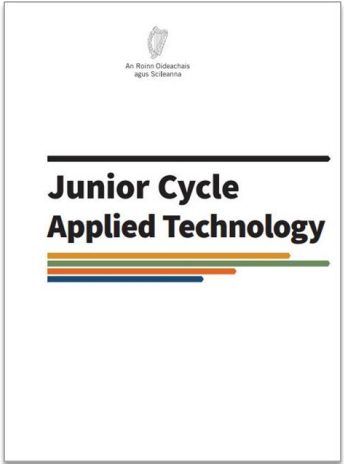
Resources

Join the Mailing List

Twitter

This evening we will...

- Appreciate how emerging technology can support student learning
- Consider an approach taken to problem solving coding tasks
- Code a micro:bit to perform simple tasks using inputs and outputs



How confident am I in using control technology for this purpose?

How can we develop problem solving and creative thinking through **Control Technology**?



Problem solving

Creative thinking

Curiosity

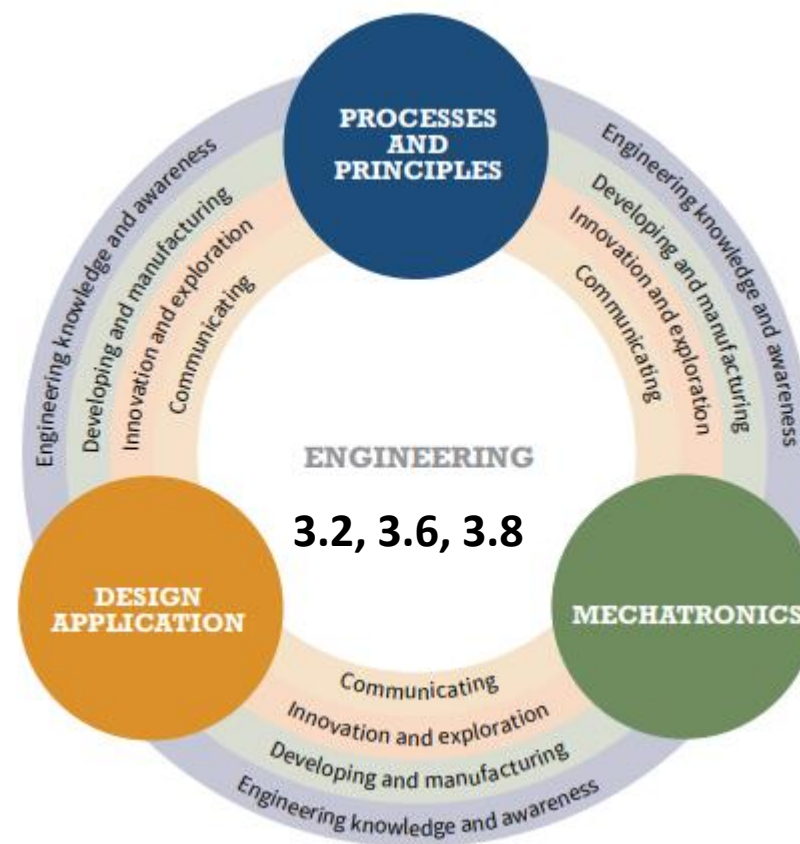
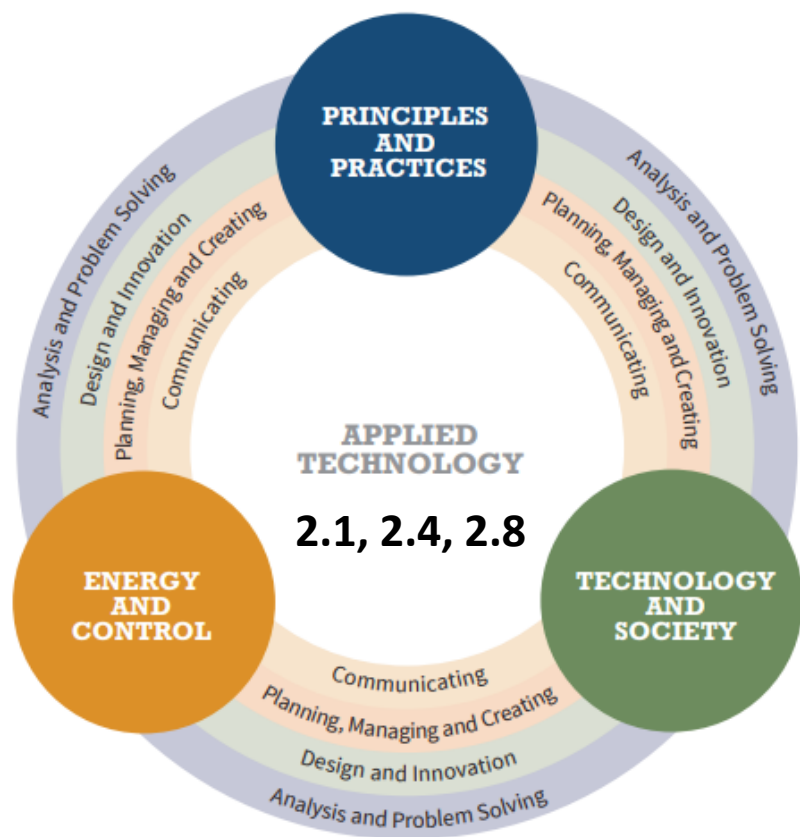
Systematic approach

Engage with existing and emerging technologies

Safe failure environment

Voice and ownership

Learning outcomes that are particularly relevant in this elective



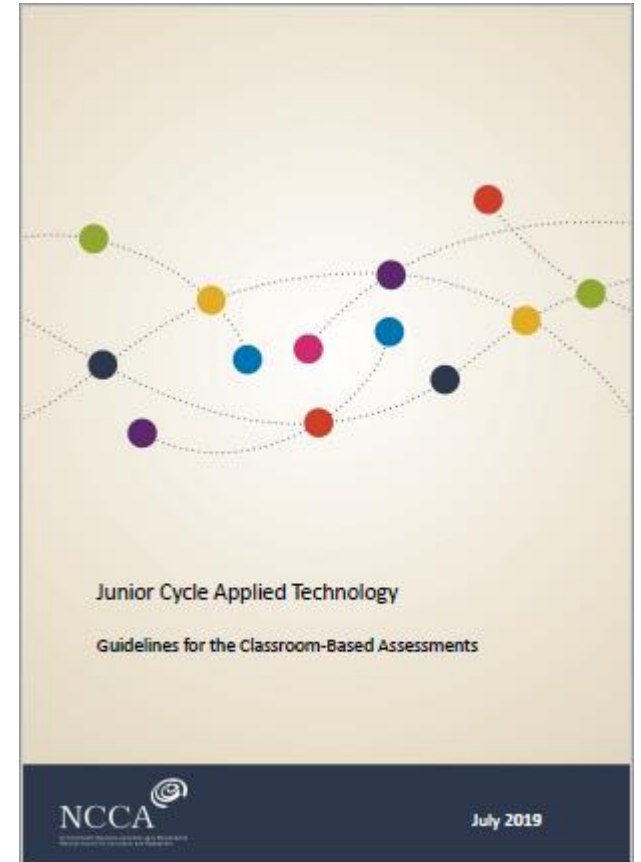
Other learning outcomes may also be supported

What is Control Technology?

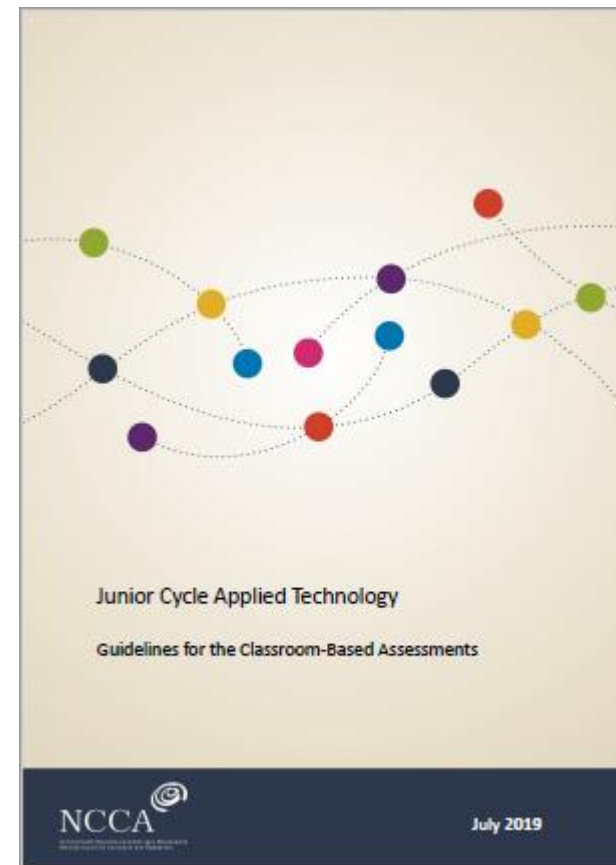
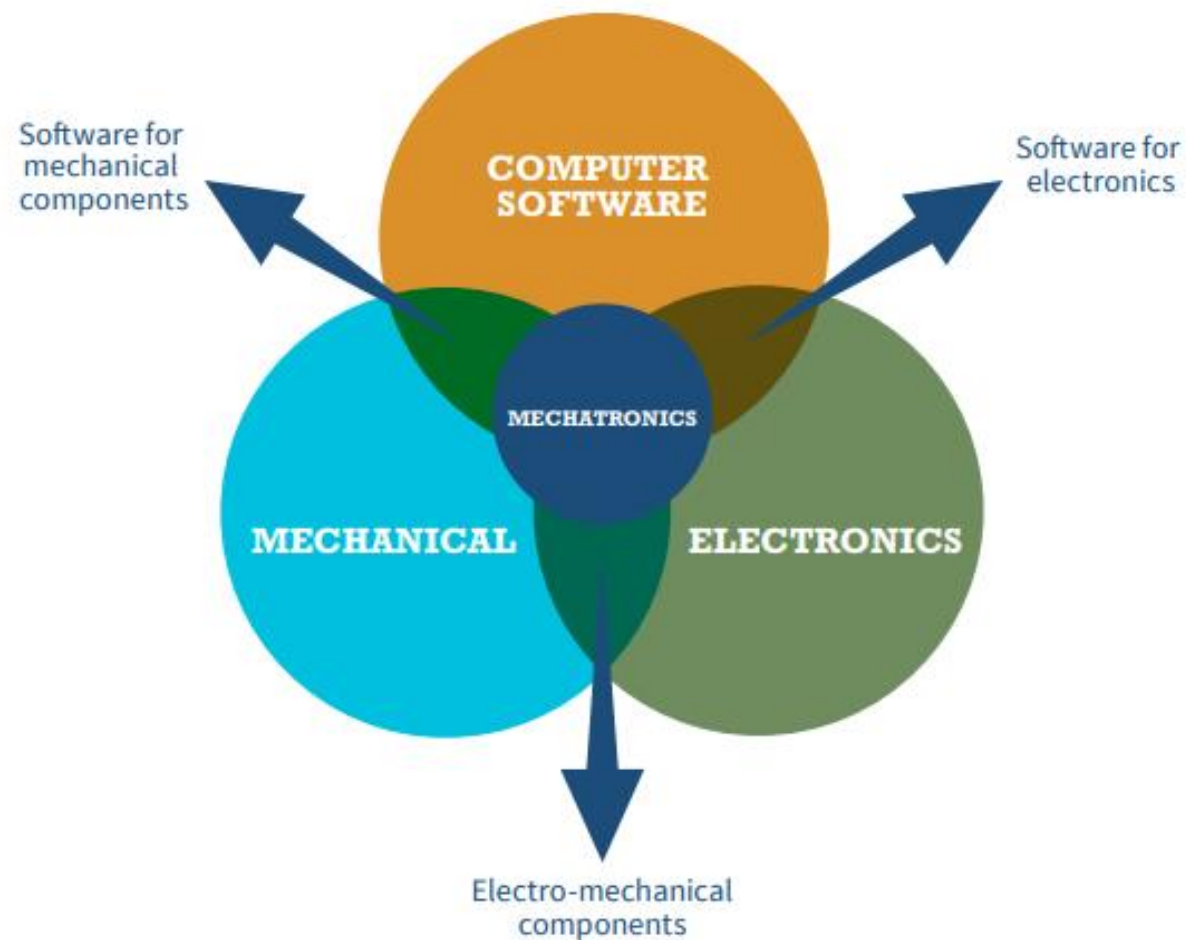
Controlled system definition:

A controlled system is where components are used to modify the behaviour of a system so it behaves in a specific way

(Applied Technology- Assessment Guidelines, page 9)

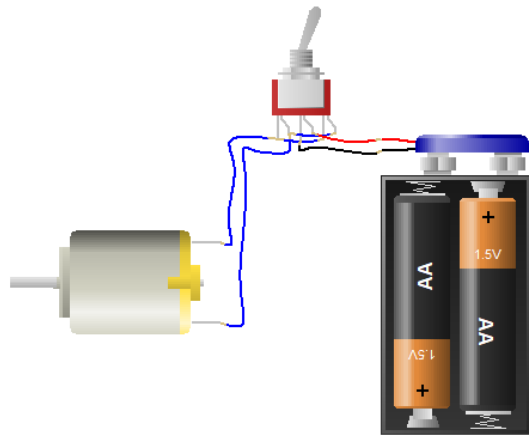


What is Control Technology?

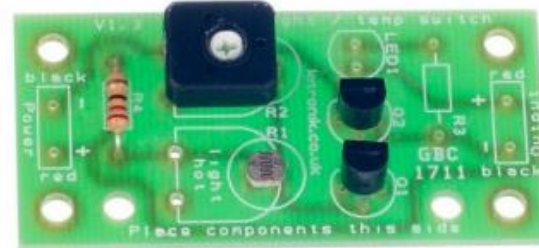


(Engineering Specification- appendix D, page 27)

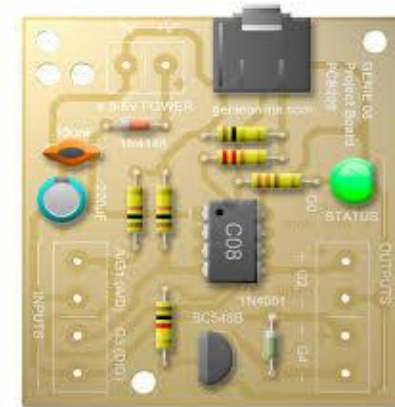
Using Control Technology to solve problems



Simple circuit



Easy build PCB kits



Microcontroller board

Explore the use of an emerging technology



Micro:bit microcontroller
board

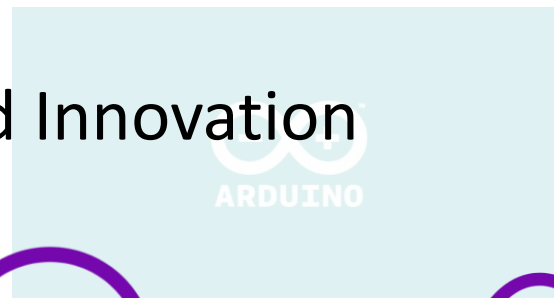
What is it?

- Stimulus to drive learning
- It is a pocket-sized computer
- Pre-populated and pre-soldered
- Multiple inputs/outputs
- Options for break-out boards and additional soldering
- Free coding software
- Many students will have prior knowledge

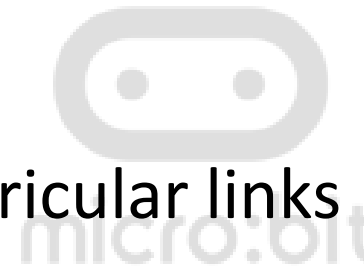
Learning experiences through coding



Creativity and Innovation



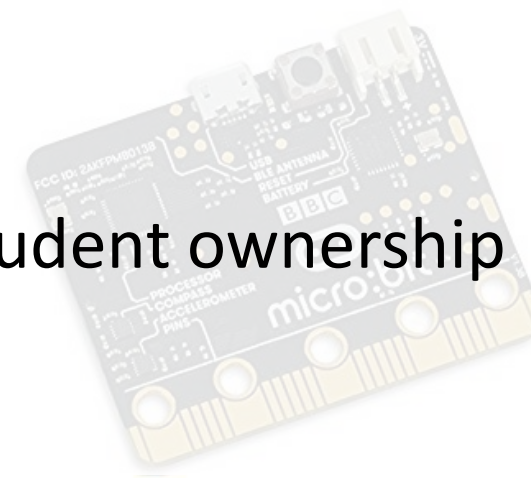
Cross-curricular links



Problem Solving



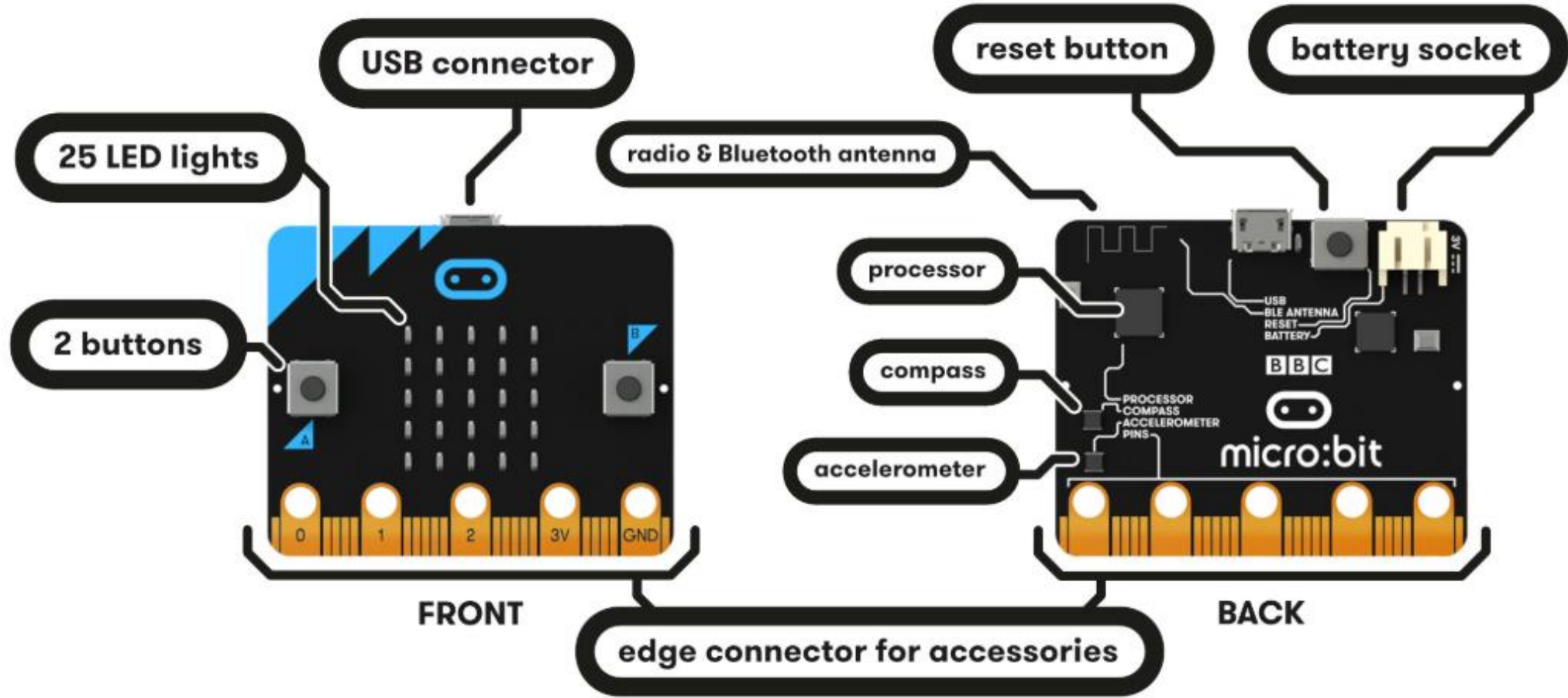
Student ownership



Safe failure environment

Enjoyable

Exploring the micro:bit

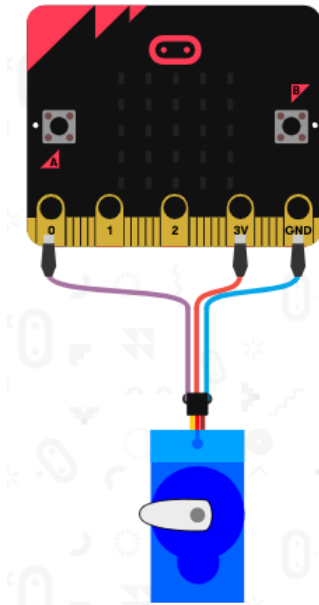


Using Breakout boards with a micro:bit

Why?

- Ability to do more using a micro:bit
(access to all processing pins for additional functionality)
- Limited power supply for output components attached directly to a micro:bit.
- Micro:bit can be reused in different breakout boards

Applied Technology 2019/2020 CPD

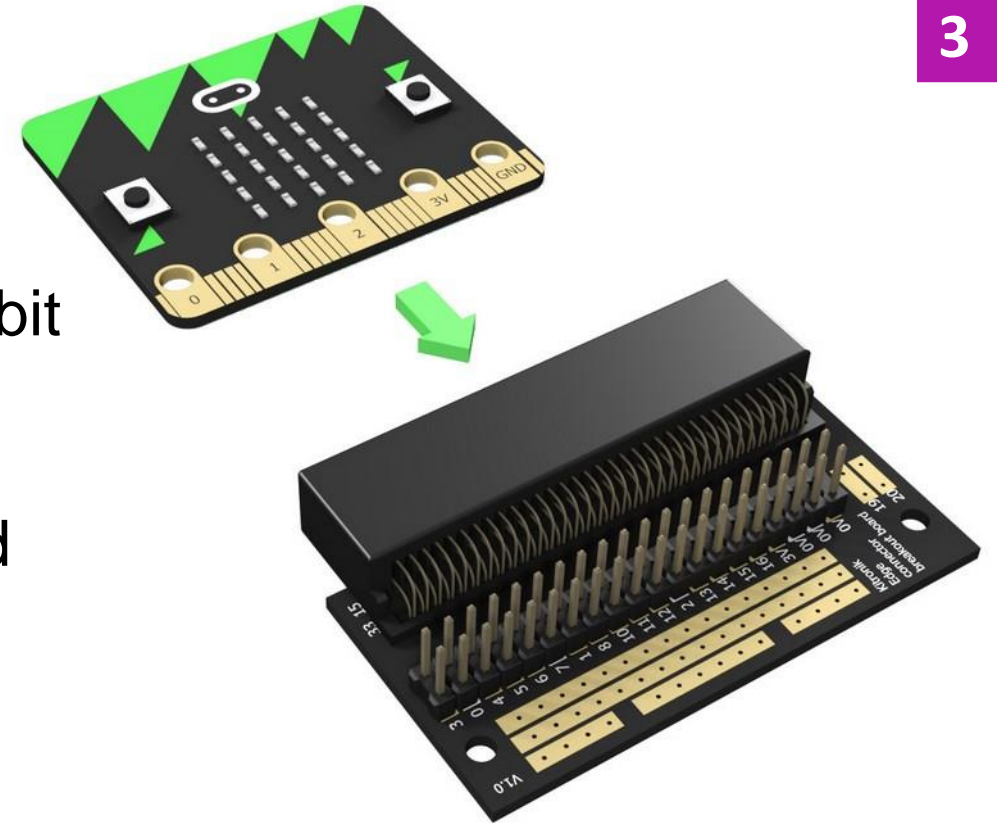


Code Challenge:

Open and close a barrier using a servo motor

Micro:bit edge connector breakout board

- 21 pins available from the edge of the micro:bit
- External inputs/outputs can be soldered or connected using jumper wires.
- Additional expansion boards can be attached
- Relatively low cost



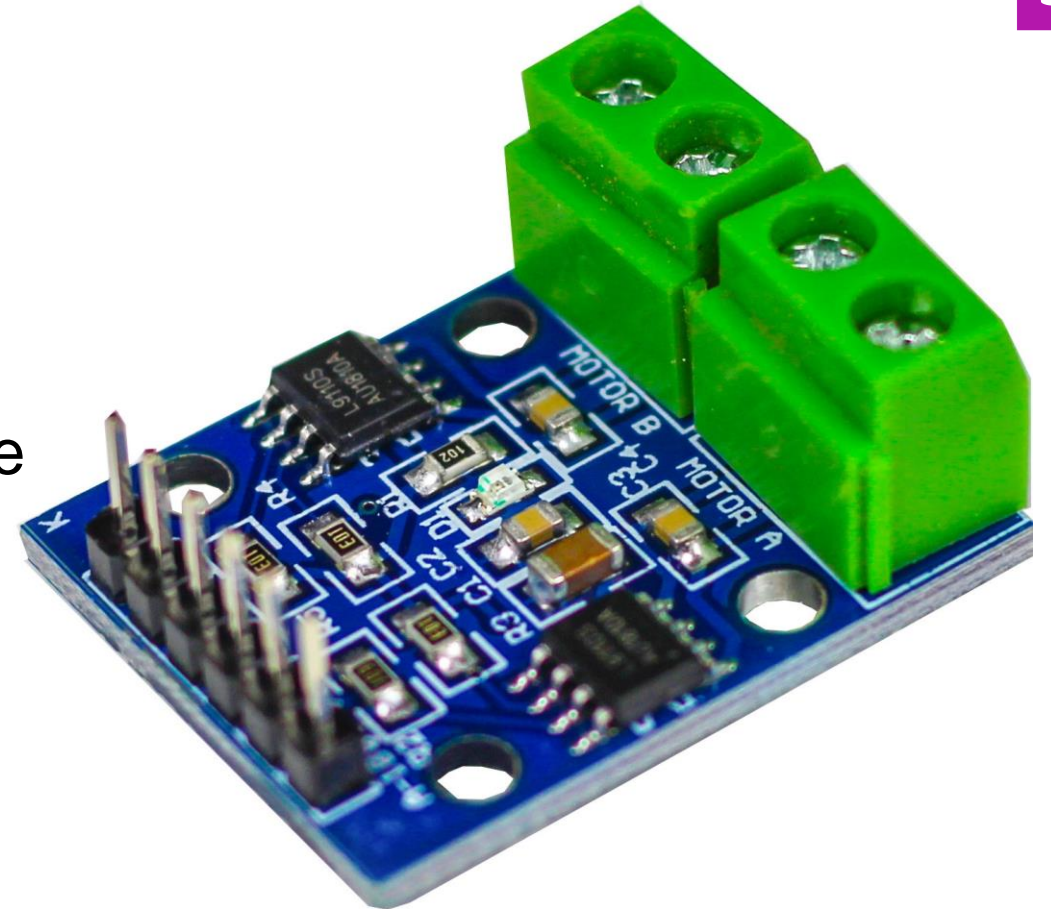
<https://youtu.be/bzm4zepbGAc>

Two Channel Motor Driver Board L9110S

3

- Low cost motor driver board
- 2.5V to 12V DC supply
- drive either two DC motors or one 4 wire 2 phase stepper motor
- Motors controlled using program code
- Relatively low cost

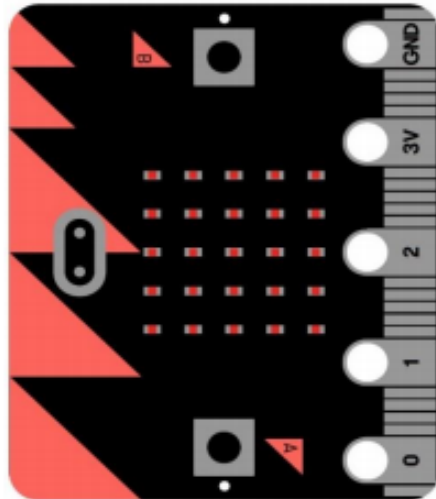
<https://youtu.be/atKICzdzkA>



Edge connector pin description

Edge Connector Pinout

Note: A number of these pins may not be accessible in all editors.

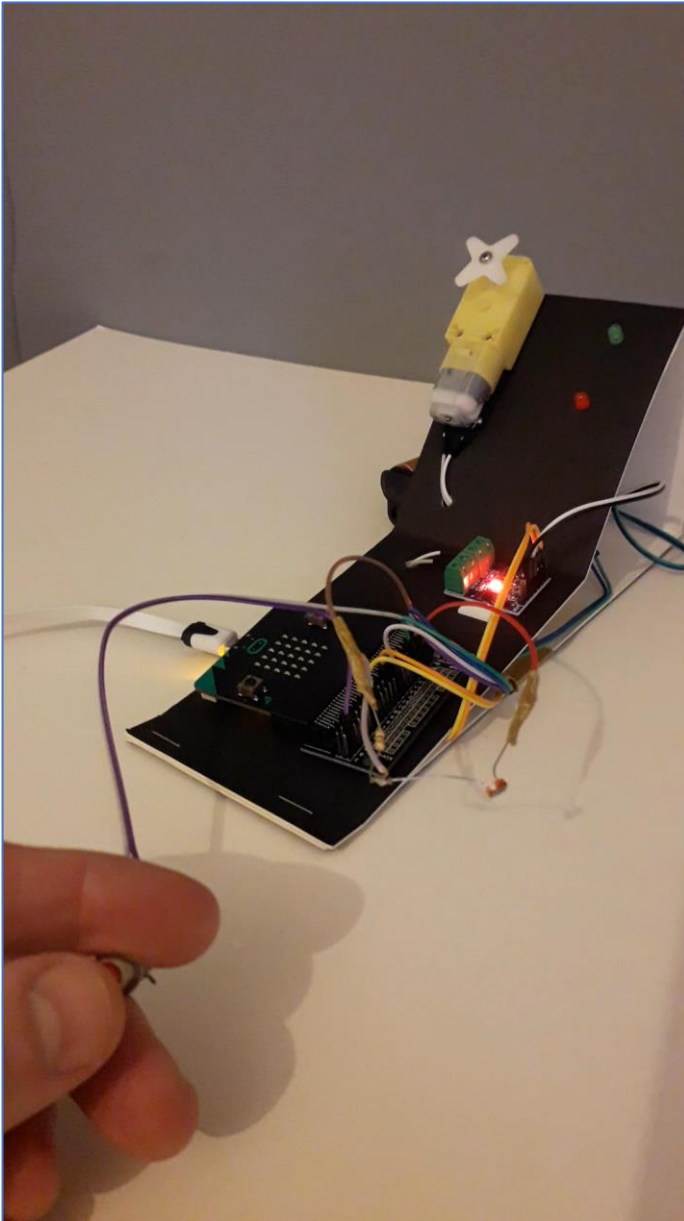


- 0V
- Special function pin
- 3V
- Digital input / output
- Analogue input / digital IO
- Digital input (shared with a button)
- Digital output (shared with LED matrix)

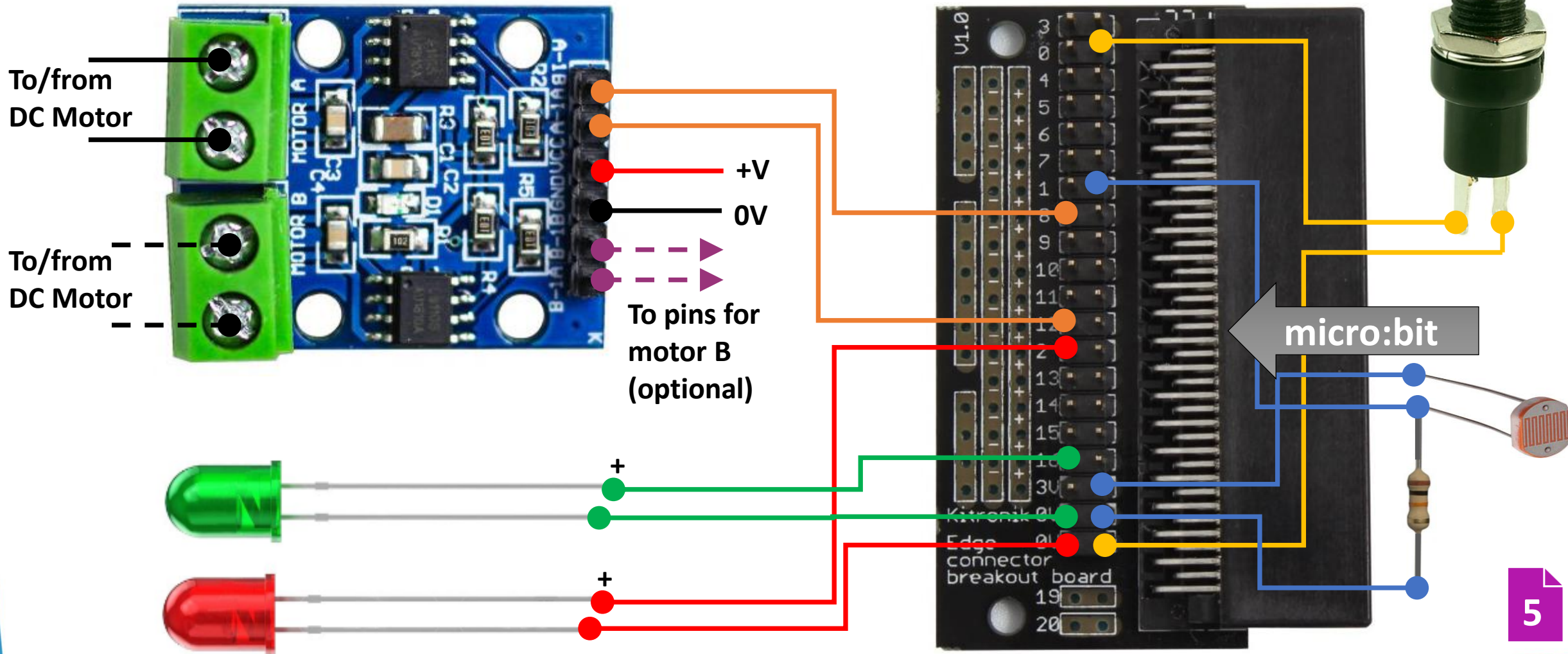
Breakout PCB Ref (if applicable)

Breakout PCB Ref (if applicable)	Name	Description
22	0V	0V / ground
0V	0V	0V / ground
21	0V	0V / ground
20	SDA	Serial data pin connected to the magnetometer & accelerometer
19	SCL	Serial clock pin connected to the magnetometer & accelerometer
18	3V	3V / positive supply
3V	3V	3V / positive supply
17	3V	3V / positive supply
16	DIO	General purpose digital IO (P16 in editors)
15	MOSI	Serial connection - Master Output / Slave Input
14	MISO	Serial connection - Master Input / Slave Output
13	SCK	Serial connection - Clock
2	PAD2	General purpose digital / analogue IO (P2 in editors)
12	DIO	General purpose digital IO (P12 in editors)
11	BTN_B	Button B – Normally high, going low on press (Button B in editors)
10	COL3	Column 3 on the LED matrix
9	COL7	Column 7 on the LED matrix
8	DIO	General purpose digital IO (P8 in in editors)
1	PAD1	General purpose digital / analogue IO (P1 in editors)
7	COL8	Column 8 on the LED matrix
6	COL9	Column 9 on the LED matrix
5	BTN_A	Button A – Normally high, going low on press (Button A in editors)
4	COL2	Column 2 on the LED matrix
0	PAD0	General purpose digital / analogue IO (P0 in editors)
3	COL1	Column 1 on the LED matrix

Using a Two Channel Motor Driver Board L9110S with a micro:bit



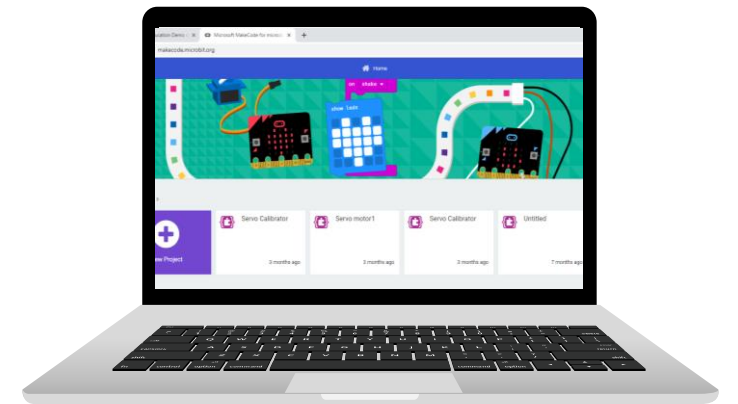
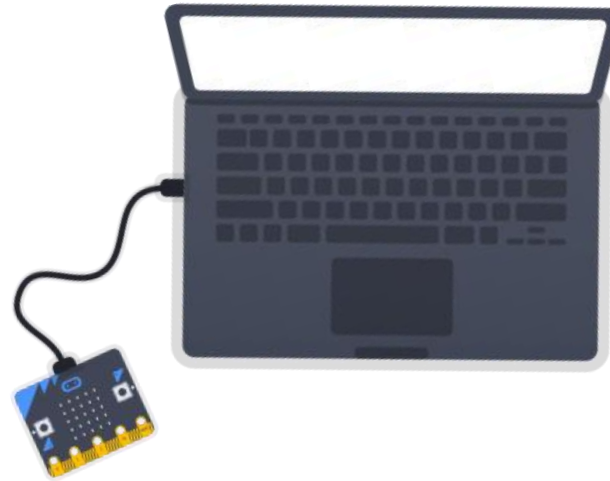
Connecting the motor driver board to the edge connector board (one solution)



Coding with micro:bit

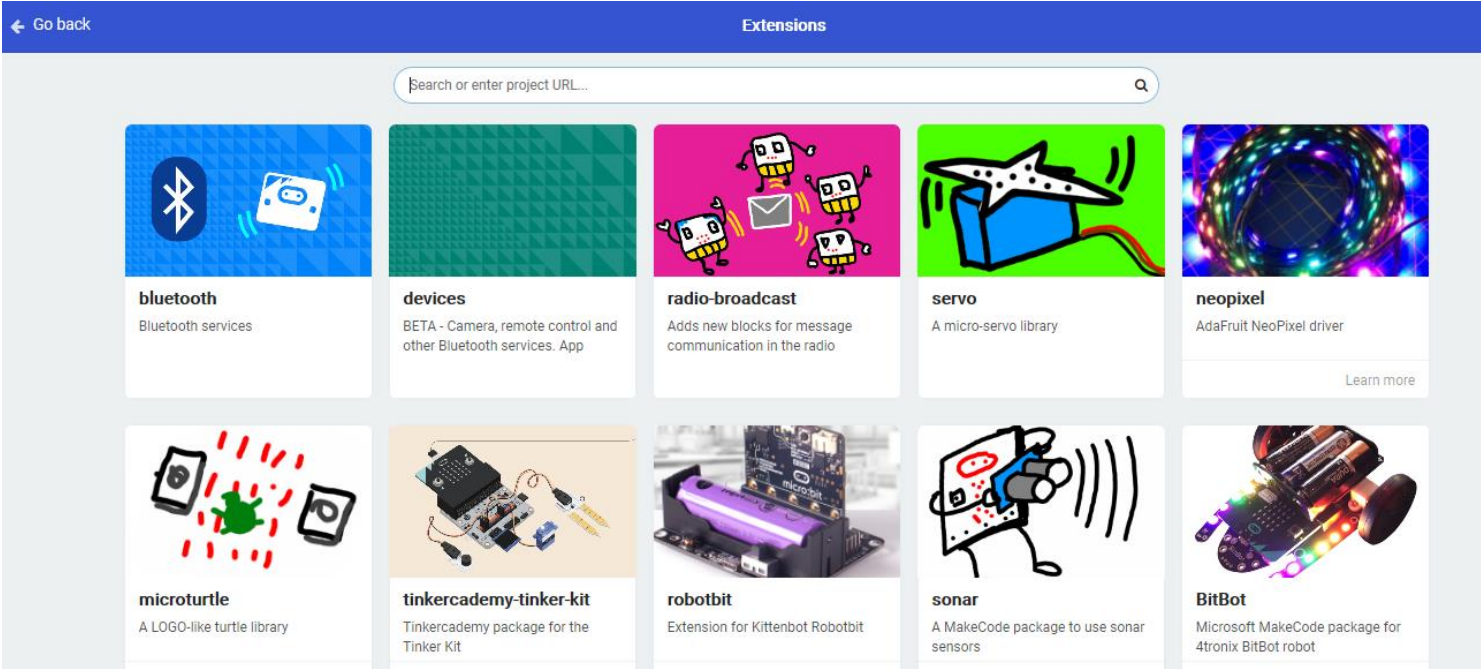
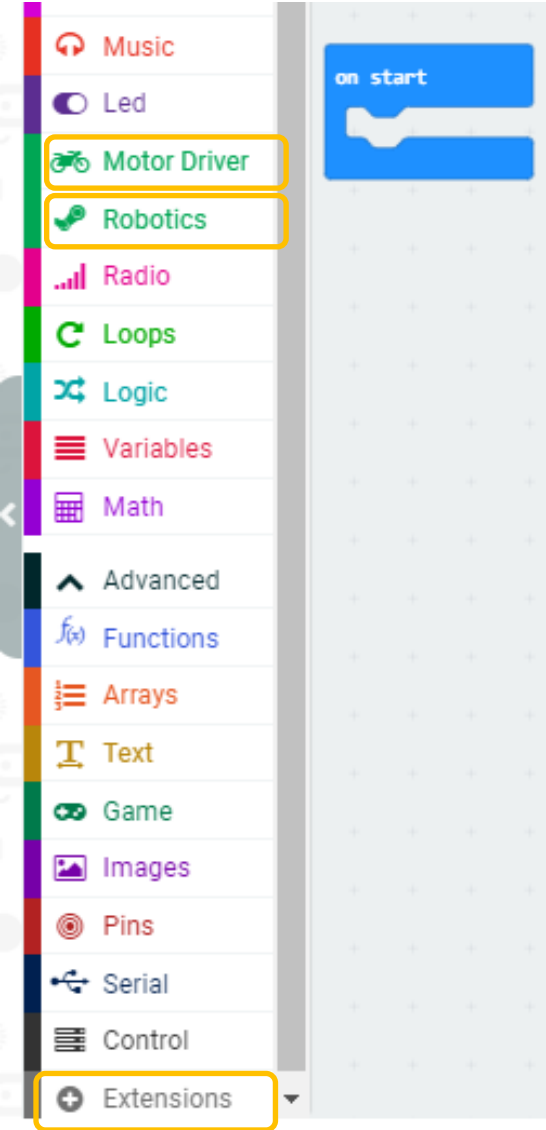
Pair Task:

- Slot the micro:bit into the edge connector board
- Connect the motor driver board to the edge connector board
- Connect the micro:bit to your laptop

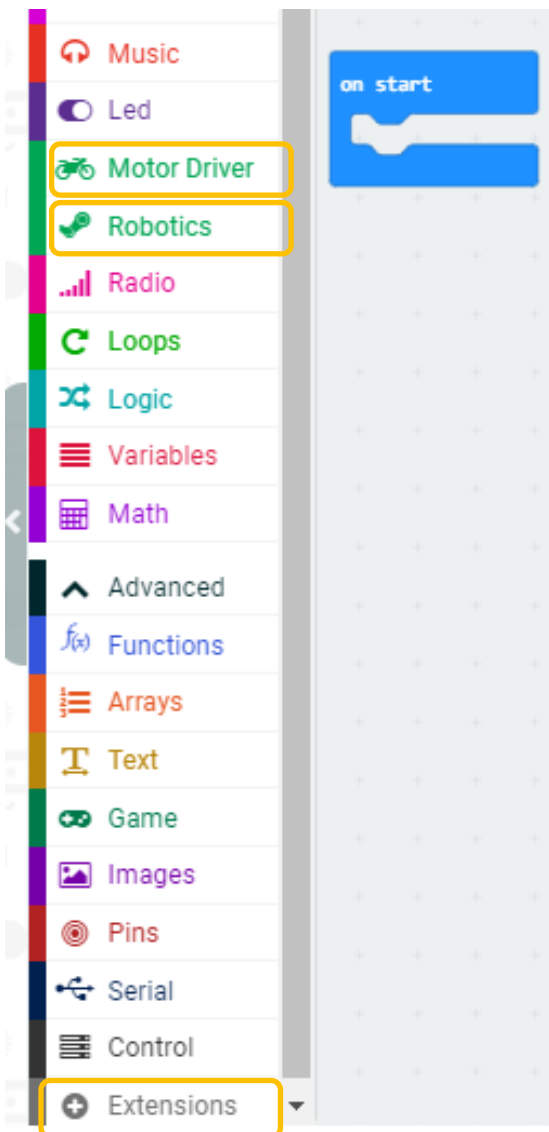


Let's code - <https://makecode.microbit.org/#>

Adding Extensions



Adding Extensions



kitronik-motor-driver

Blocks for driving the Kitronik micro:bit motor driver board

[Learn more](#)

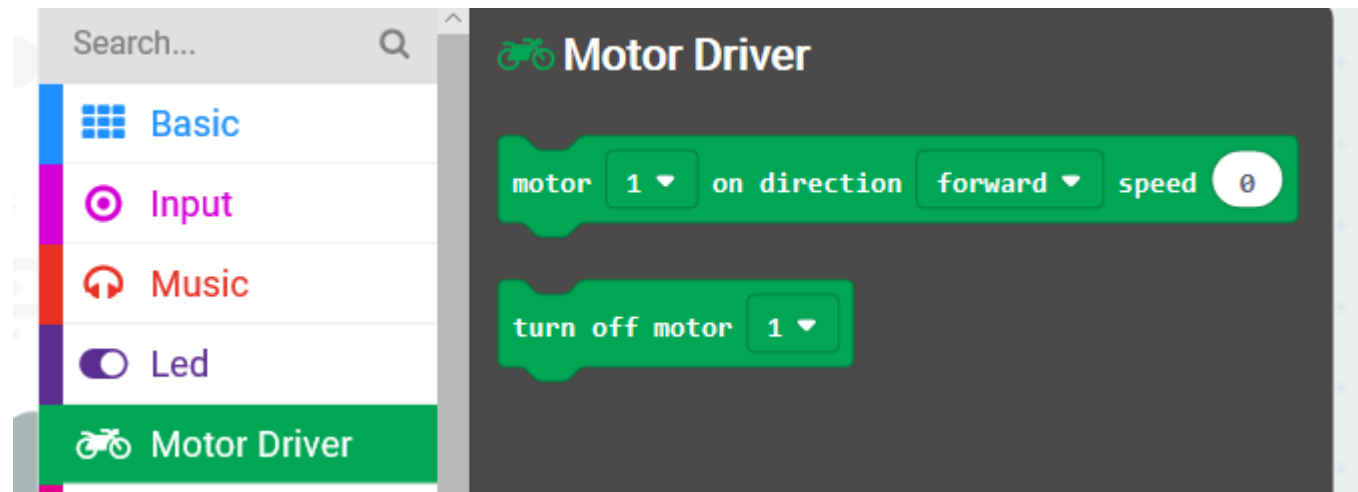
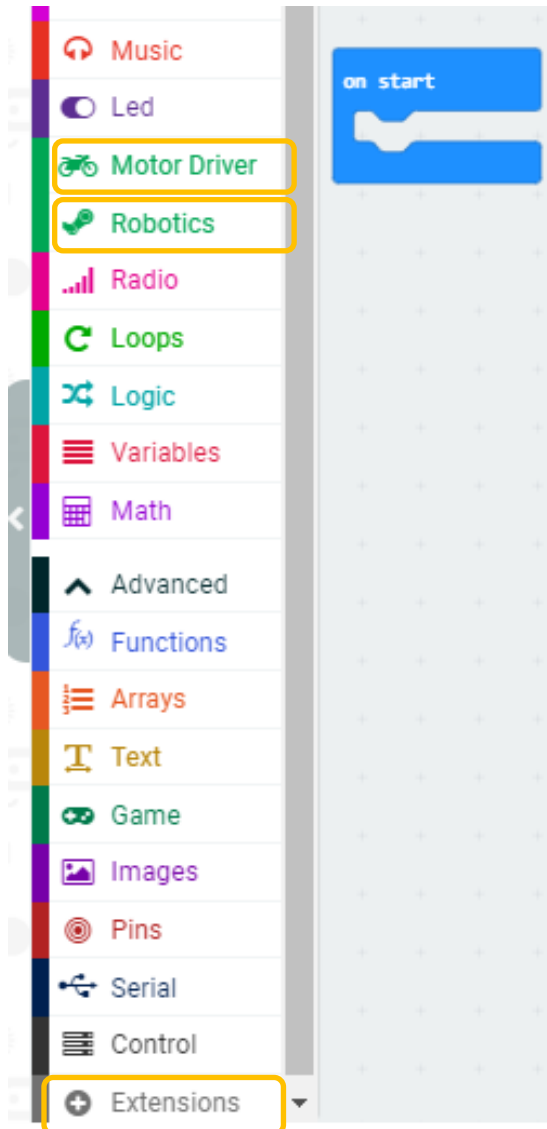


kitronik-robotics-board

Custom blocks for www.kitronik.co.uk/5641 All-in-one

[Learn more](#)

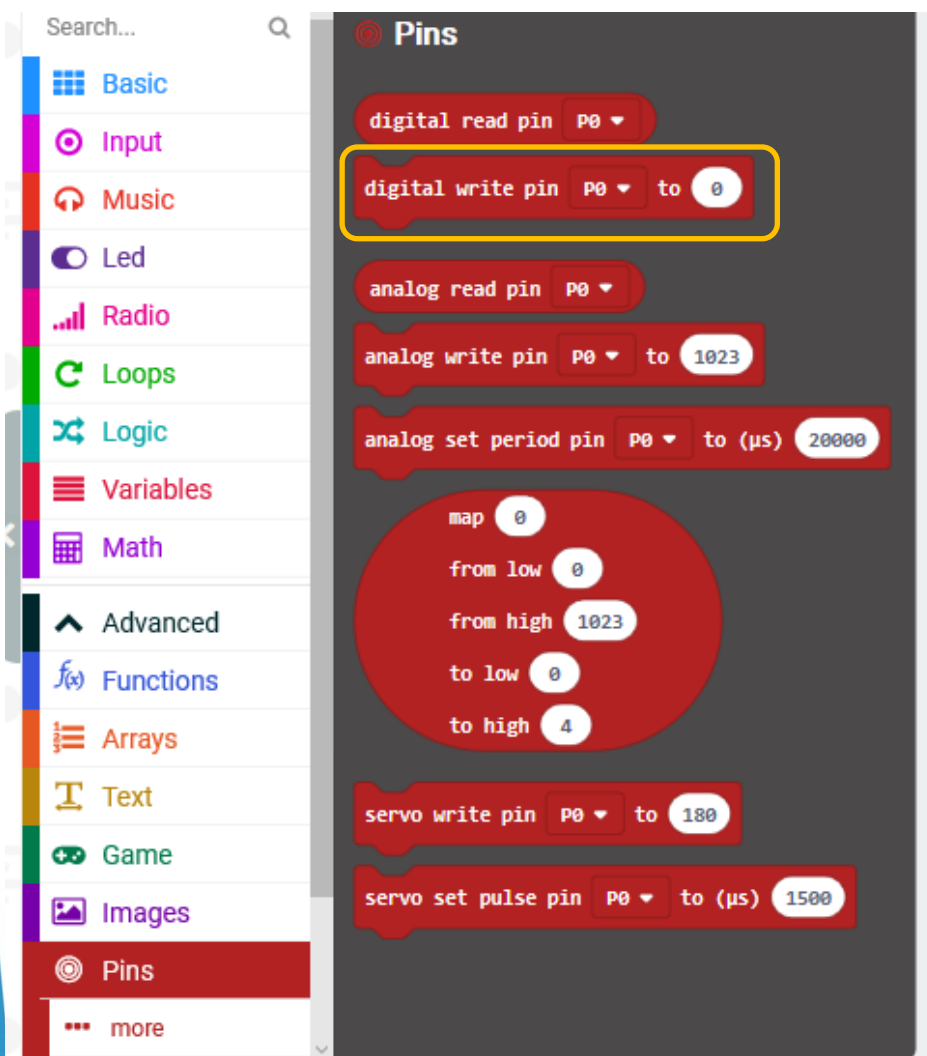
Adding Extensions



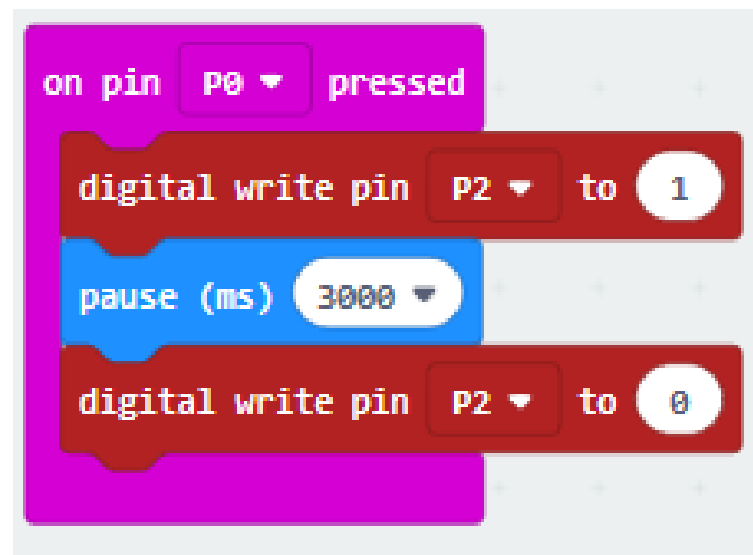
Coding with Micro:bit

Introduction activity: Use pins to turn an LED on/off

7

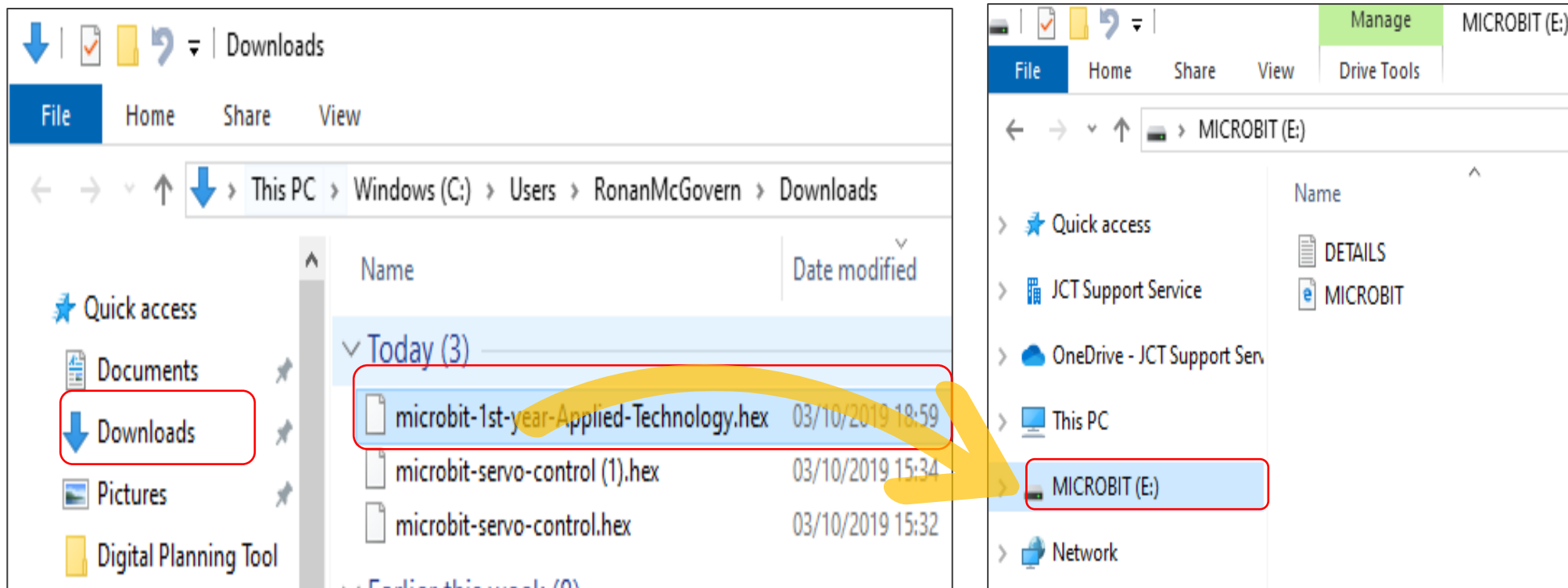


High output = 1
Low output = 0



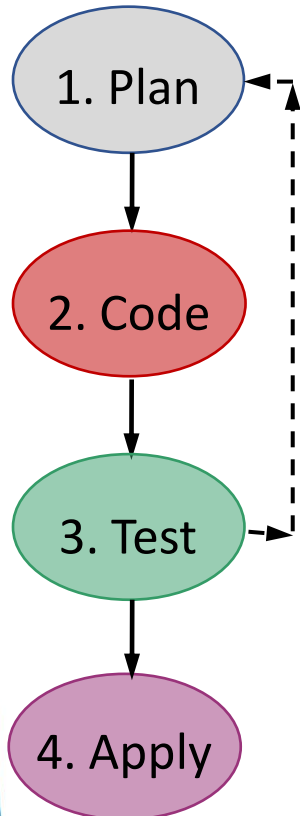
Transferring your HEX file to your micro:bit

8



Copy file from your download folder
Paste file into micro:bit drive.

Planning for coding skills development

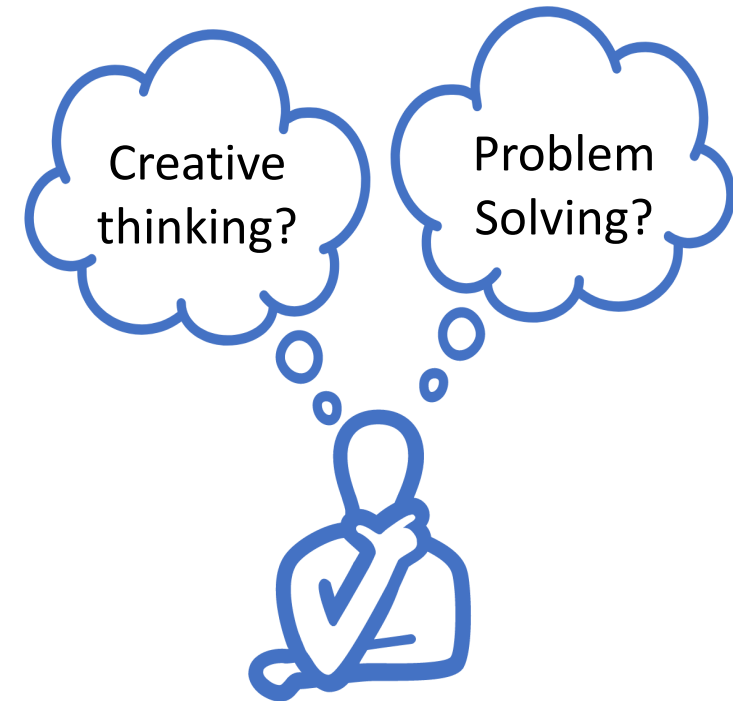


Understand the problem/challenge-
what information is needed to solve it?

Using code blocks, create the
sequence to solve the problem

Determine if the solution is effective.
Can it be better? If so, how?

Download your code to bring your solution to life



A context for code challenges

9



‘More than 1 billion animals estimated dead in Australia wildfires’

(ABC News, Jan 2020)

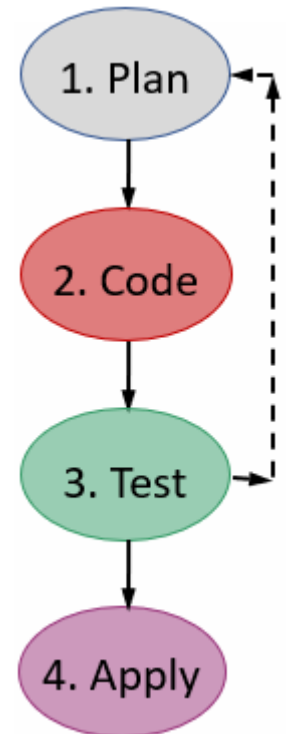
Coding Challenge 1:

*A student has decided to make a model on an circulating fan to comfort people during extreme heat conditions. Design code to turn on the fan (motor) for **five** seconds and then turn off the fan.*

10



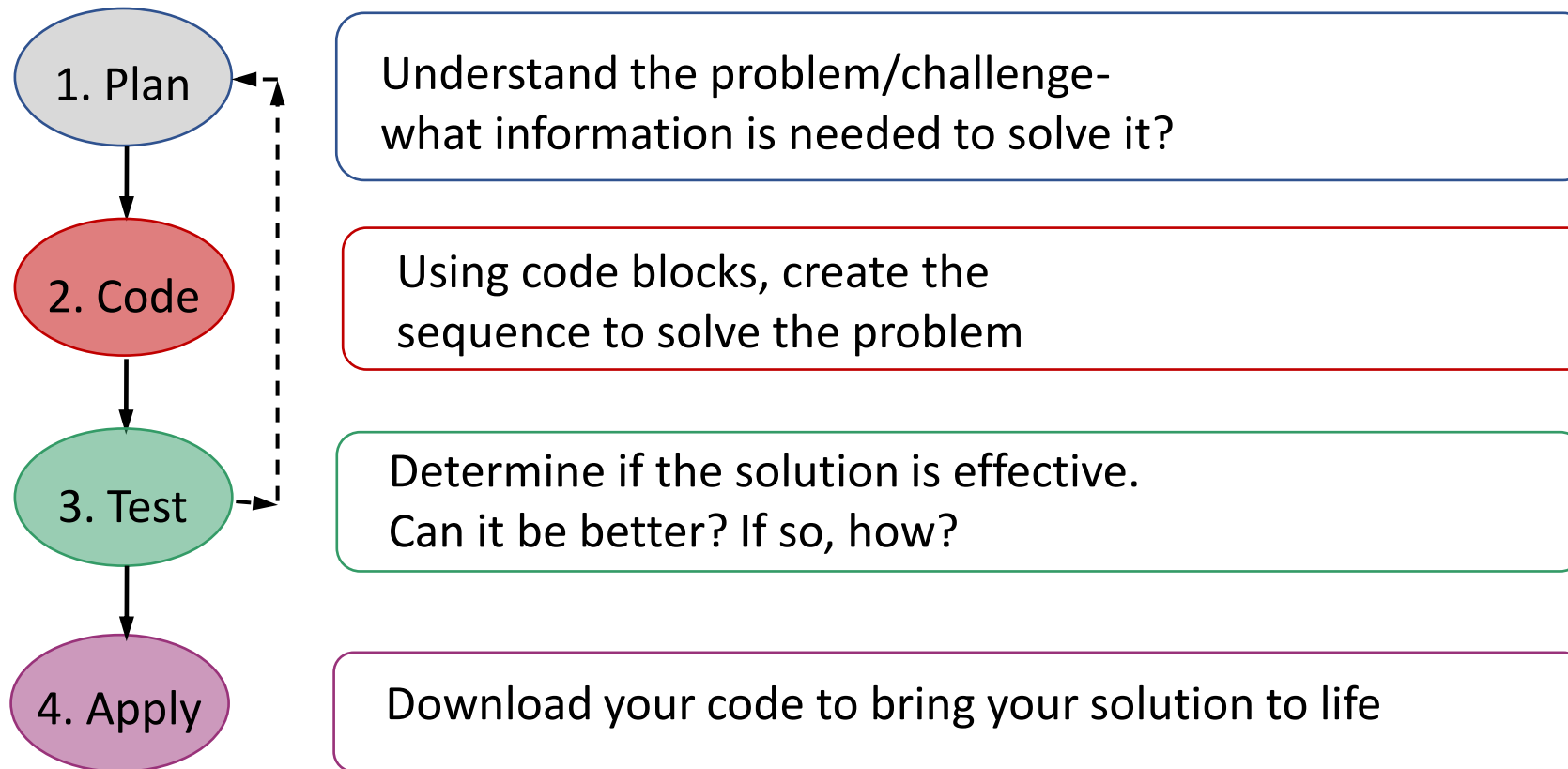
A planning process



Coding Challenge 1:

*A student has decided to make a model on an circulating fan to comfort people during extreme heat conditions . Design code to turn on the fan (motor) for **five** seconds and then turn off the fan.*

10



Coding Challenge 1:

*A student has decided to make a model on an circulating fan to comfort people during extreme heat conditions . Design code to turn on the fan (motor) for **five** seconds and then turn off the fan.*

10



```
on pin P0 pressed
  motor 1 on direction forward speed 100
  pause (ms) 5000
  turn off motor 1
```

The image shows a Scratch code block for a fan challenge. It starts with an 'on pin P0 pressed' event block. This is followed by three action blocks: 'motor 1 on direction forward speed 100', 'pause (ms) 5000', and 'turn off motor 1'.

Possible solution to the task.

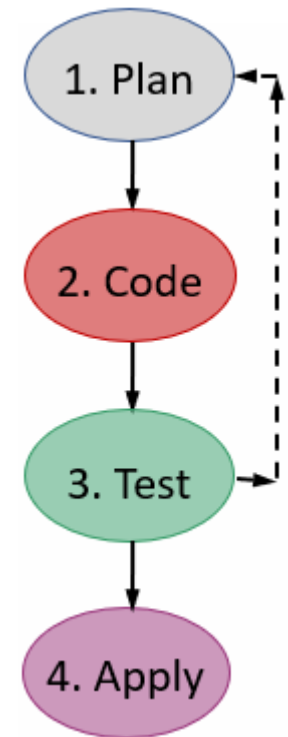
Did you consider an alternative solution?

Pause and Reflect

How effective was this planning process in facilitating creative thinking and problem solving?

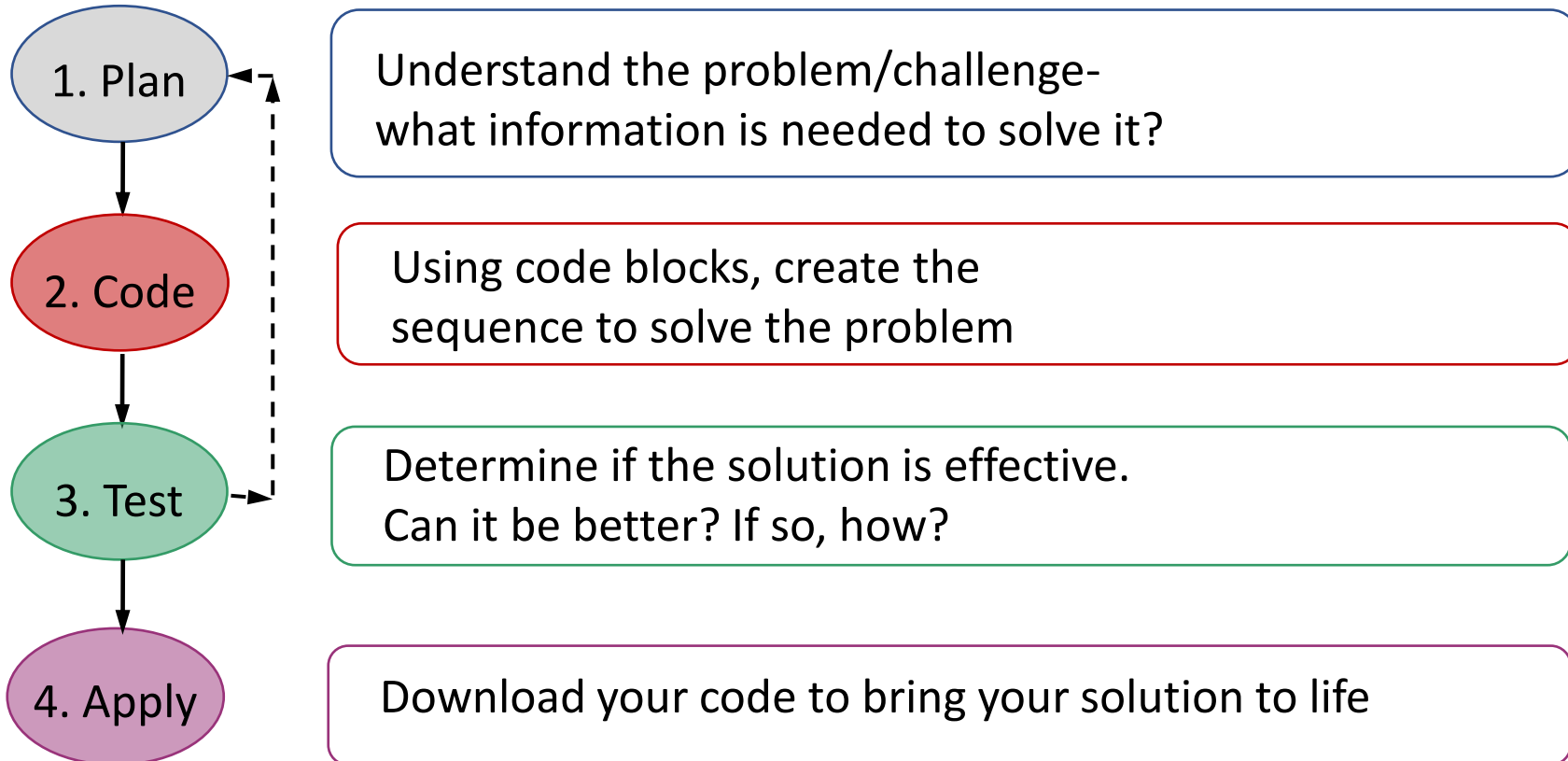
How might this process support students?

A planning process



Coding Challenge 2:

An enclosure is to be used to care for wild animals affected by the wildfires. Design code to open and close the enclosure door using the motor with display LEDs.



Coding Challenge 2:

An enclosure is to be used to care for wild animals affected by the wildfires. Design code to open and close the enclosure door using the motor with display LEDs.

11

```
on pin P0 pressed
  digital write pin P2 to 1
  motor 1 on direction reverse speed 40
  pause (ms) 3000
  digital write pin P2 to 0
  turn off motor 1
  pause (ms) 2000
  digital write pin P16 to 1
  motor 1 on direction forward speed 100
  pause (ms) 3000
  turn off motor 1
  digital write pin P16 to 0
```

Possible solution to the task.

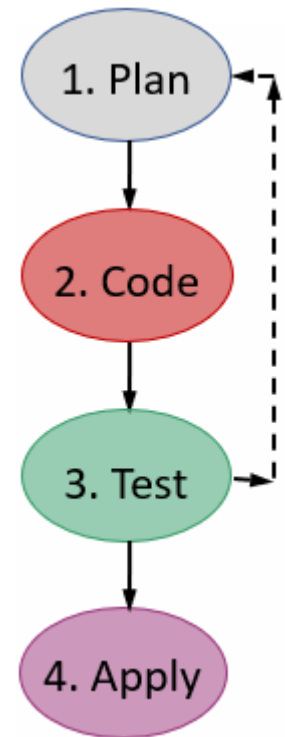
Did you consider an alternative solution?

Pause and Reflect

Future extension challenge:

Limit switches are to be incorporated to stop the motor (door) when it is open and closed.

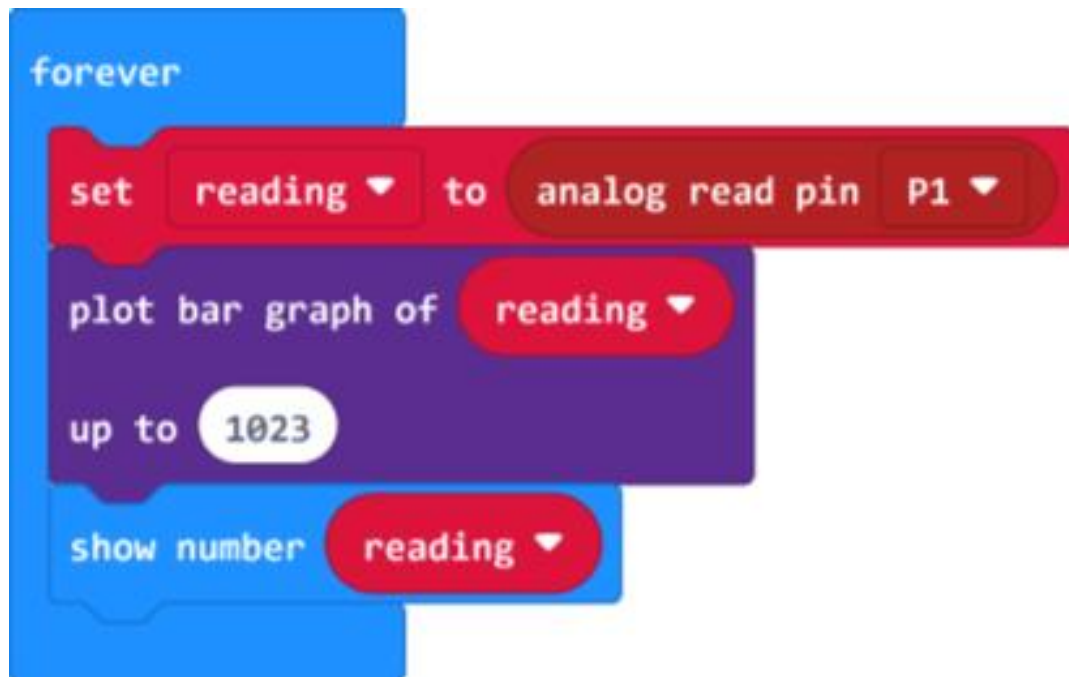
What code solution would you propose?



Calibrating a sensor:

Introduction activity: Reading and digitally displaying the analogue value of a sensor.

12



```
forever
  set reading to analog read pin P1
  plot bar graph of reading
  up to 1023
  show number reading
```

The image shows a Scratch script within a blue 'forever' loop. The first block is a red 'set' block with 'reading' as the variable and 'analog read pin P1' as the value. The second block is a purple 'plot bar graph of' block with 'reading' as the variable. The third block is a white 'up to' block with the value '1023'. The fourth block is a blue 'show number' block with 'reading' as the variable.

*Digital value **0** = total darkness*

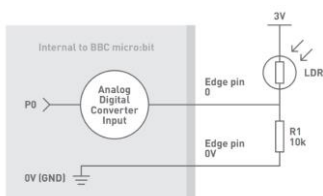
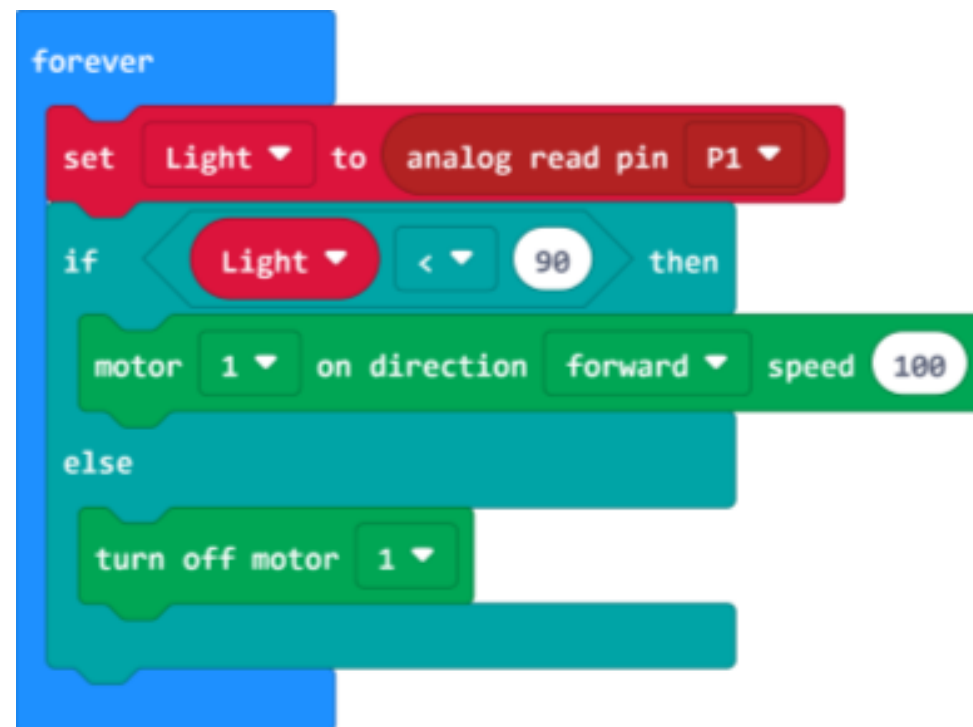
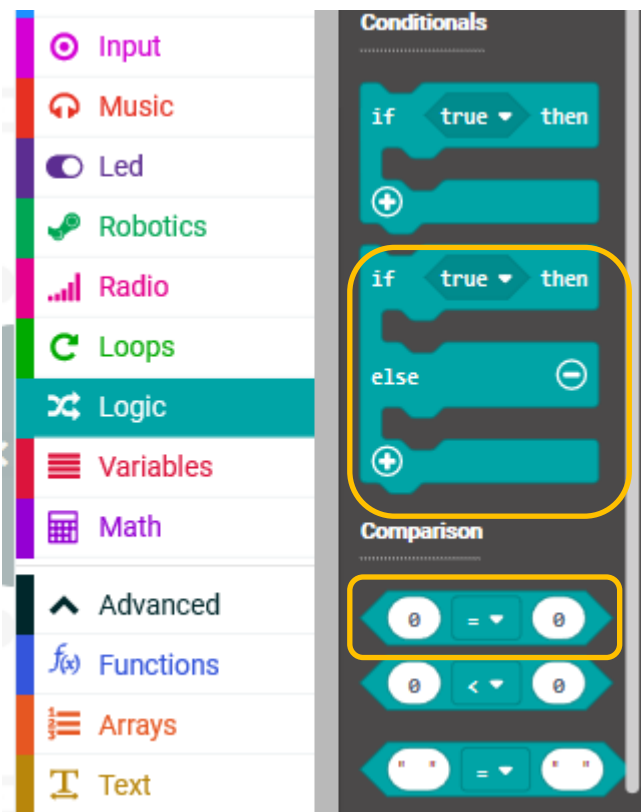
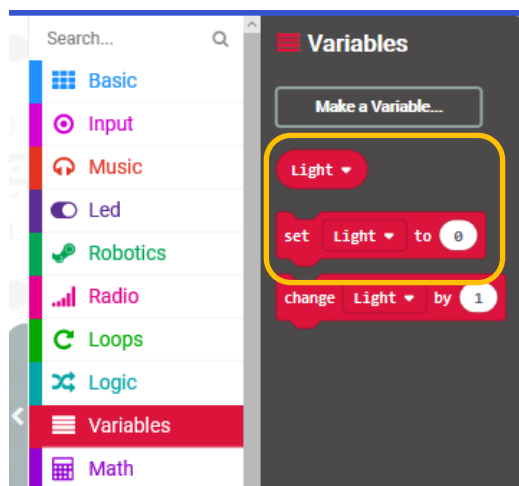
*Digital value **1023** = total brightness*

Why is it important to know this value?

Using a sensor with a breakout board:

Introduction activity: Using a light sensor to activate an output.

12



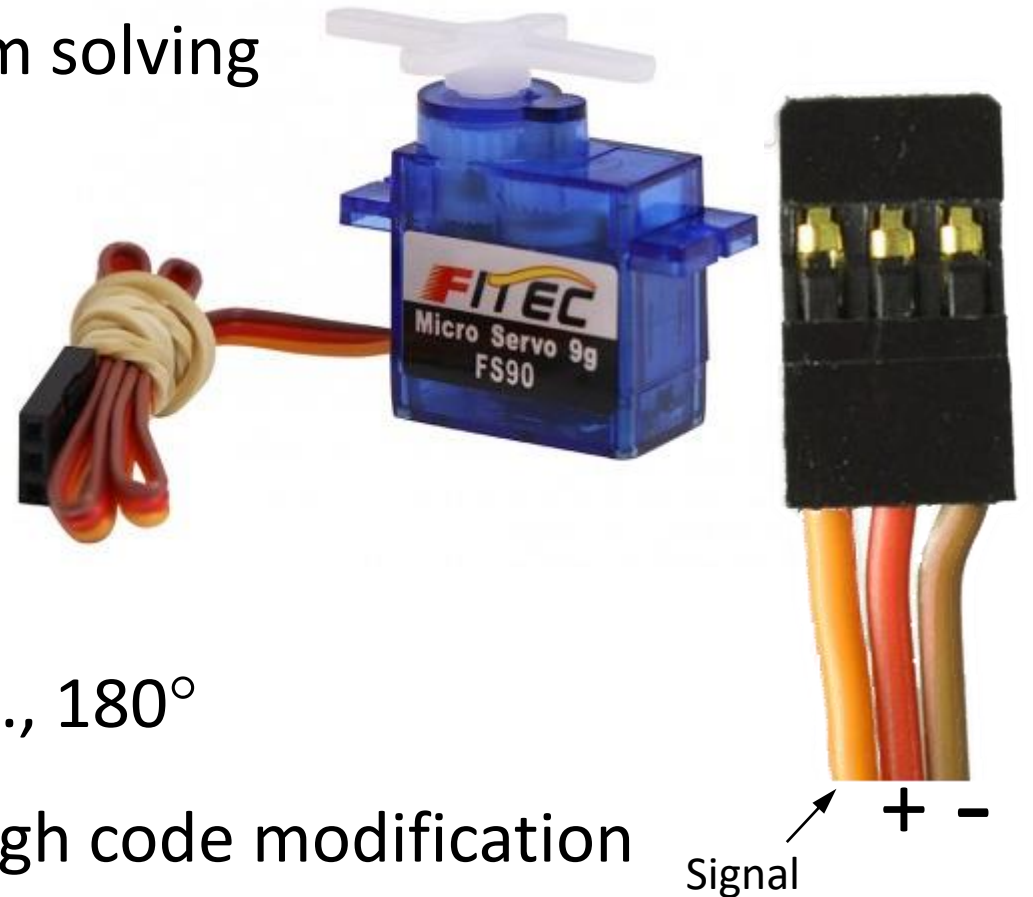
Using a servo motor

Why?

- Encourages creative thinking and problem solving
- Safe failure experience for students

How?

- Offering a high level of control
- Continuous rotation or limited range- e.g., 180°
- Servo speed/angle can be changed through code modification



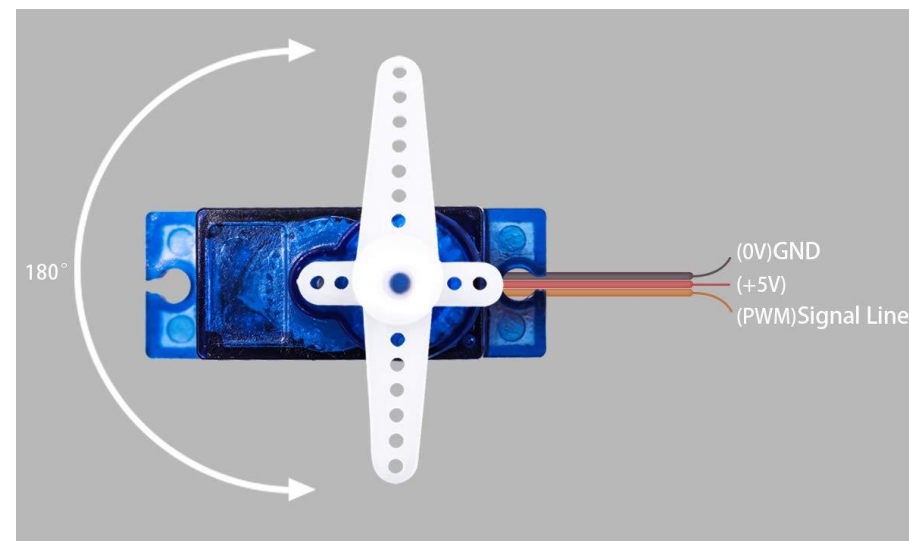
Servos- Angular and Continuous

Angular Servo:

Set range, e.g. 0° to 180°

Continuous Servo:

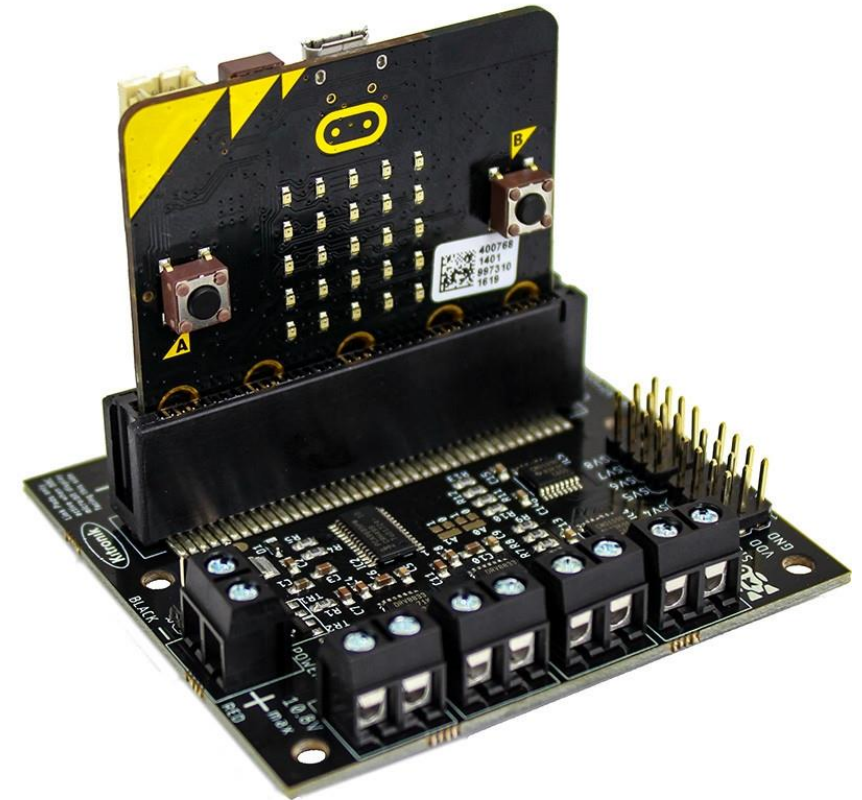
variable speed in both directions



All-in-one Robotics Board

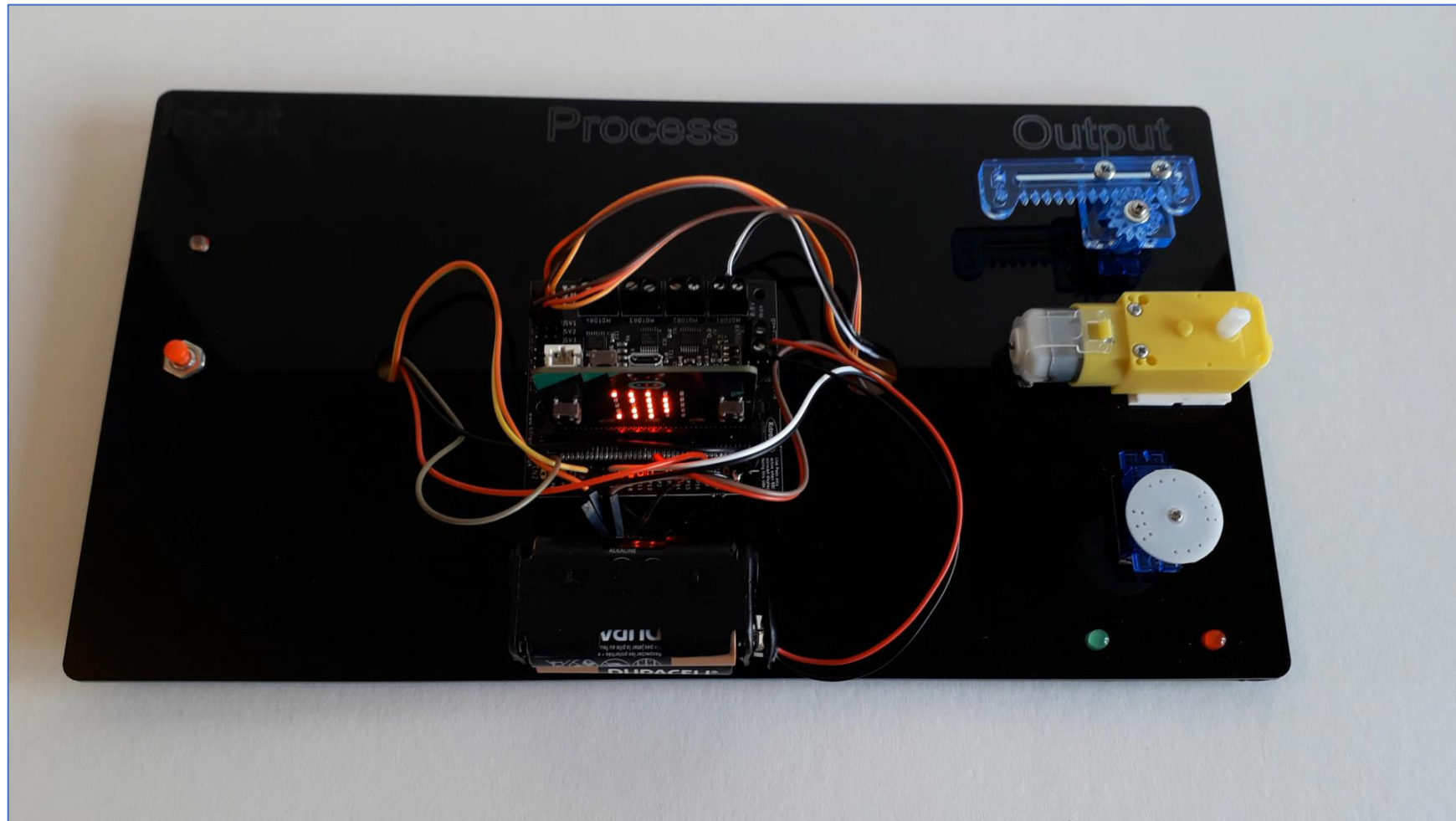
14

- It can drive 4 motors (or 2 stepper motors) and 8 servos.
- All the usable pins of the micro:bit are broken out to a 2.54mm link header.
- The 17 available I/O pins allow other input devices, such as sensors, or output devices, such as ZIP LEDs, to be added to the board.
- Power is provided via either a terminal block or servo-style connector



<https://youtu.be/EVowN8RN8nU>

Using an all-in-one robotics board with a micro:bit



Coding Challenge 3:

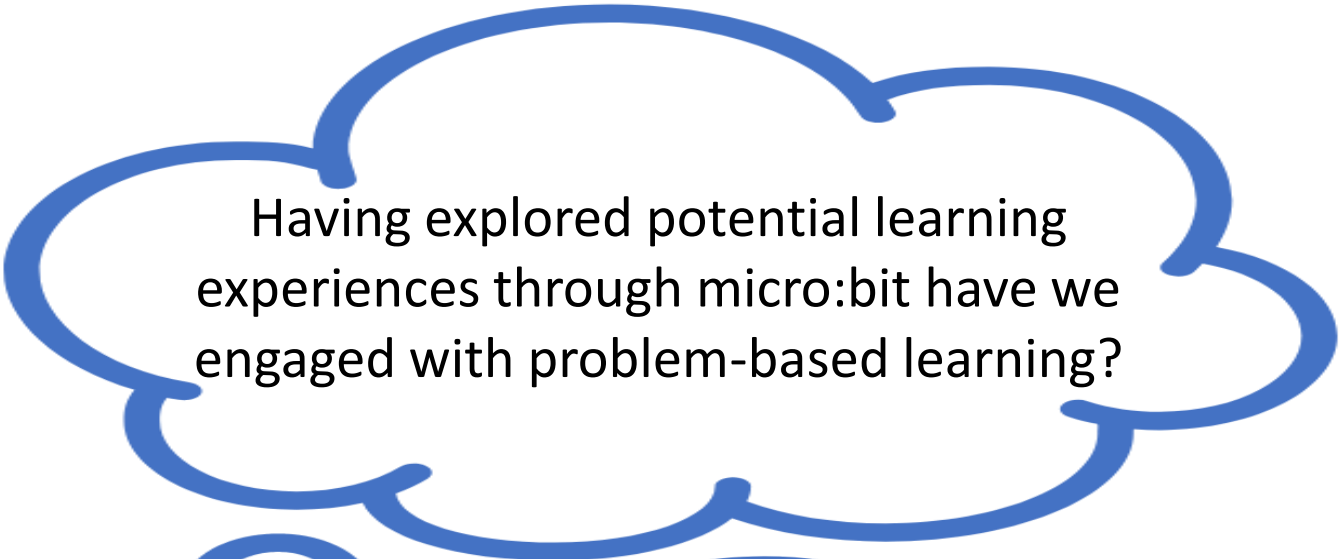


Group Task:

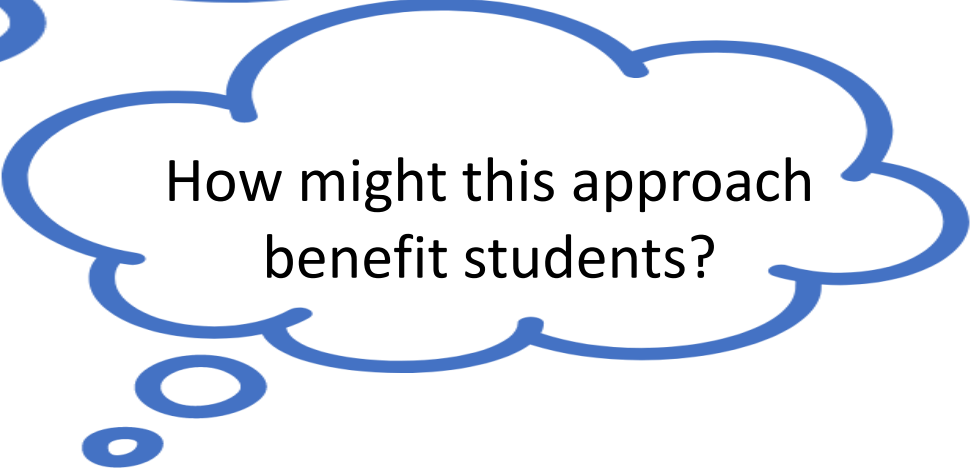
In the context of the Australian wildfires, design a code solution that maximises the potential use of the robotics board.

Consider:

- Your focus; e.g., water distribution system, alert/alarm system?
- Which inputs and outputs to use?



Having explored potential learning experiences through micro:bit have we engaged with problem-based learning?



How might this approach benefit students?



Problem based learning

Setting Problems

Co-Design Learning Tasks

Discovery Learning

Valuing Questions

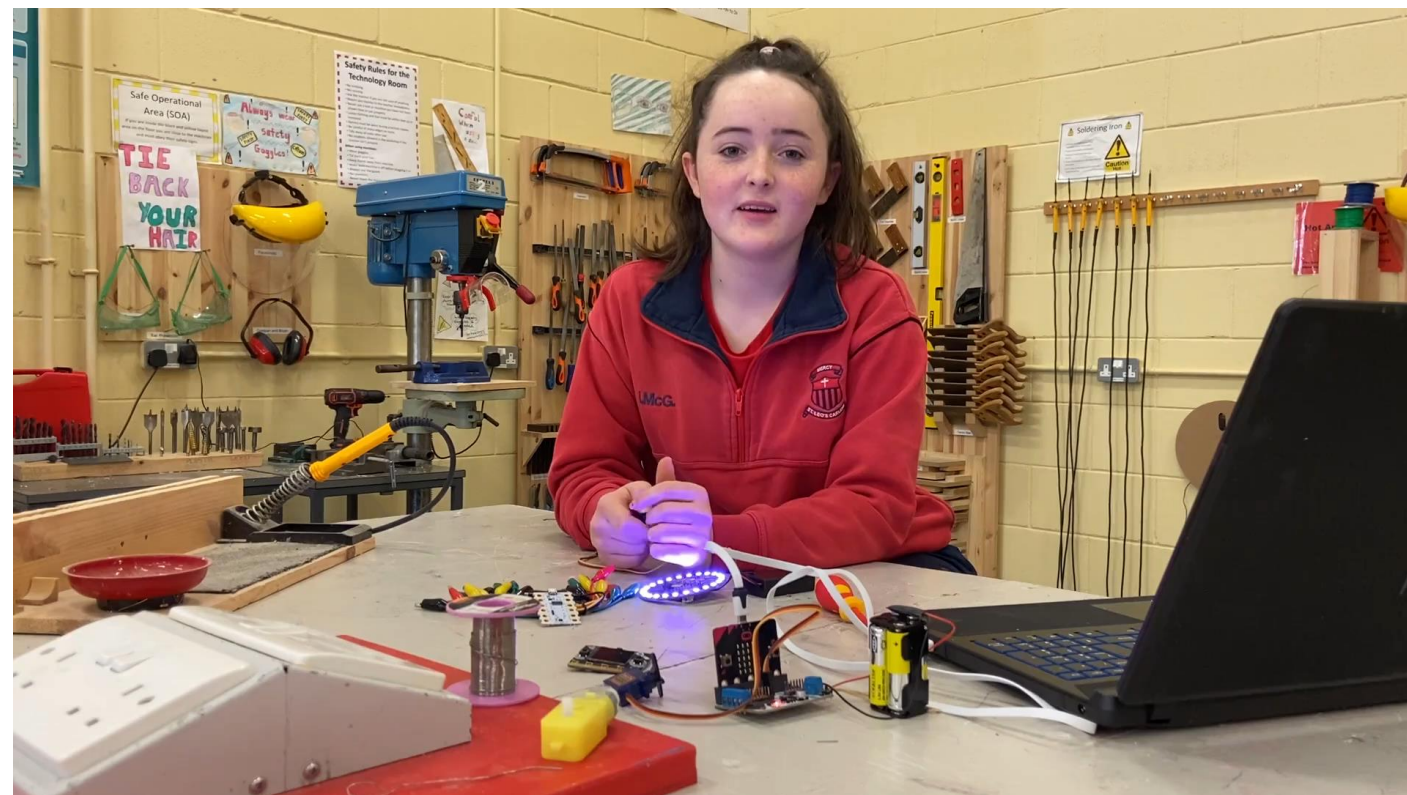
Transferring Knowledge & Skills

Ref: Bill Lucas, Teaching Creative Thinking

What do students think?



Our thanks to...
Isabelle from
St. Leo's College, Carlow



Future Learning in Control Technology

– Project realisation, expansion board opportunities

For further support visit:
Senior Cycle micro:bit tutorials



curaclam ar line
curriculum online

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EARLY CHILDHOOD PRIMARY JUNIOR CYCLE SENIOR CYCLE

2. ALT Resources

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ALT3 Support
ALT4 Support
CSinP ALT
3. The Evolution of Computers in Society

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ALT4 Support

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Video lessons and html resources to develop skills and scaffolding classes around the use of embedded systems. The lessons

[Read more](#)

Click on the Vimeo symbol to watch in full screen.

Strand 3 ALT4 : Embedded Systems scaffolding videos

01-Introduction to the micro:bit

02-Internal Inputs and Sensors

03-disco_task

04-Introduction to variables

05-fitbit_task

06-radio_communication and outdoor temperature sensor

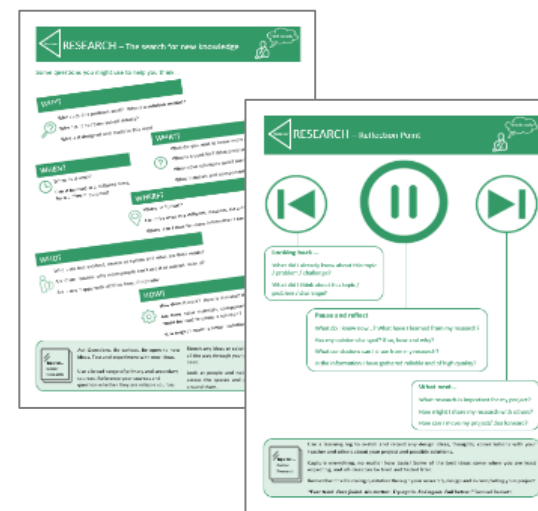
Opportunities for Future Learning

Using a micro:bit (or a similar stimulus) and with a focus on enhancing research skills:

Consider **where the learning could go next** for your students?

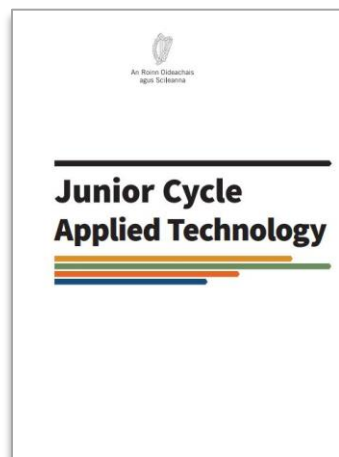


Microcontroller board

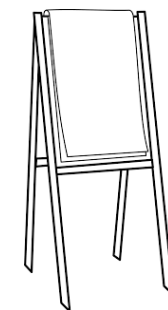


Next Steps

Back to school



- What I must do...
- What I could do...
- What new strategies could I use in my classroom?



Feedback form

<http://jctregistration.ie/Feedback>

