Coding Challenges Resource – Elective CPD

This resource was developed as part of the Applied Technology **"Problem-Solving through Coding, Applied Control and Mechatronics"** elective workshop which took place during the 2019/2020 school year. This elective workshop was designed to support the needs of teachers of Applied Technology and Engineering. All materials used during this workshop can be viewed in the Technologies section of www.jct.ie within the CPD Workshops tile.

Website Link:
https://www.jct.ie/technologies/cpd_supports_applied_technology_elective_workshops

The learning experiences below were showcased as part of this workshop and focused on how students could develop problem-solving and creative-thinking skills using Control Technology. The control software used during this activity was micro:bit, however these challenges can be accessed using any control software. This sample resource may assist you in planning and developing suitable challenges for your student's context.

What is included in this PDF?

1. Sample coding challenges and support material.

Included in this resource are sample coding challenges and support material for students' engagement. It is important to take note of the learning outcomes from Applied Technology and Engineering that are particularly relevant in this elective and contextualise the worksheet activities. These learning outcomes can be found on slide 5 of the Applied Technology elective workshop presentation.

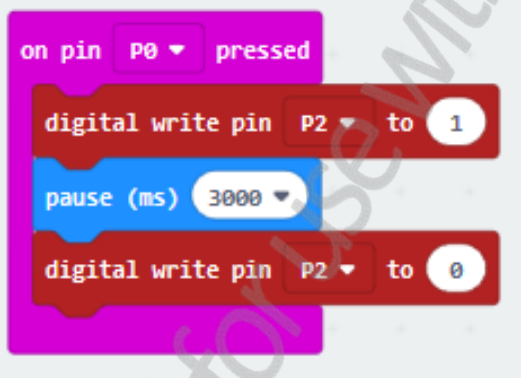
Link to Resource

Note: It is recommended that you view the CPD workshop materials in conjunction with using this resource to contextualise the resource and to develop a better understanding of how a unit of learning could be developed.

Developing creative thinking and problem-solving skills through coding.

micro:bit activity:

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

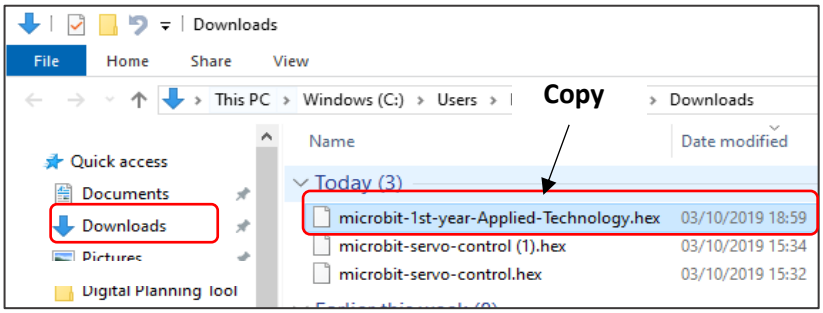


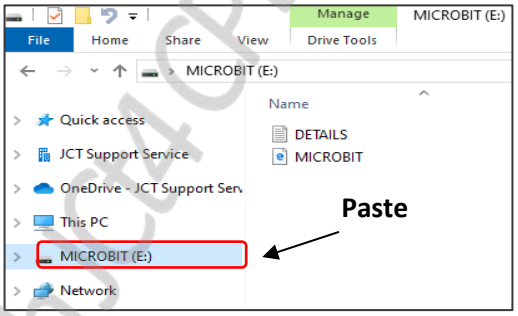
Steps

1. Place a on pin pressed block to run code when pin **0** (PTM switch) is pressed.
2. Place a digital write pin block inside on pin 0 pressed and set the pin to **P2** (the pin connected to the output component).
3. Set the connector value to **1 (high)** to activate the output (LED).
4. Place a pause block after the digital write pin block. Change the pause time as required.
5. Copy and paste the digital write pin block after the pause block.
6. Set the connector value to **0 (low)** to turn off the output (LED).
7. Use the simulator to ensure the code is effective.
8. With your micro:bit connected, click Download to transfer your code!

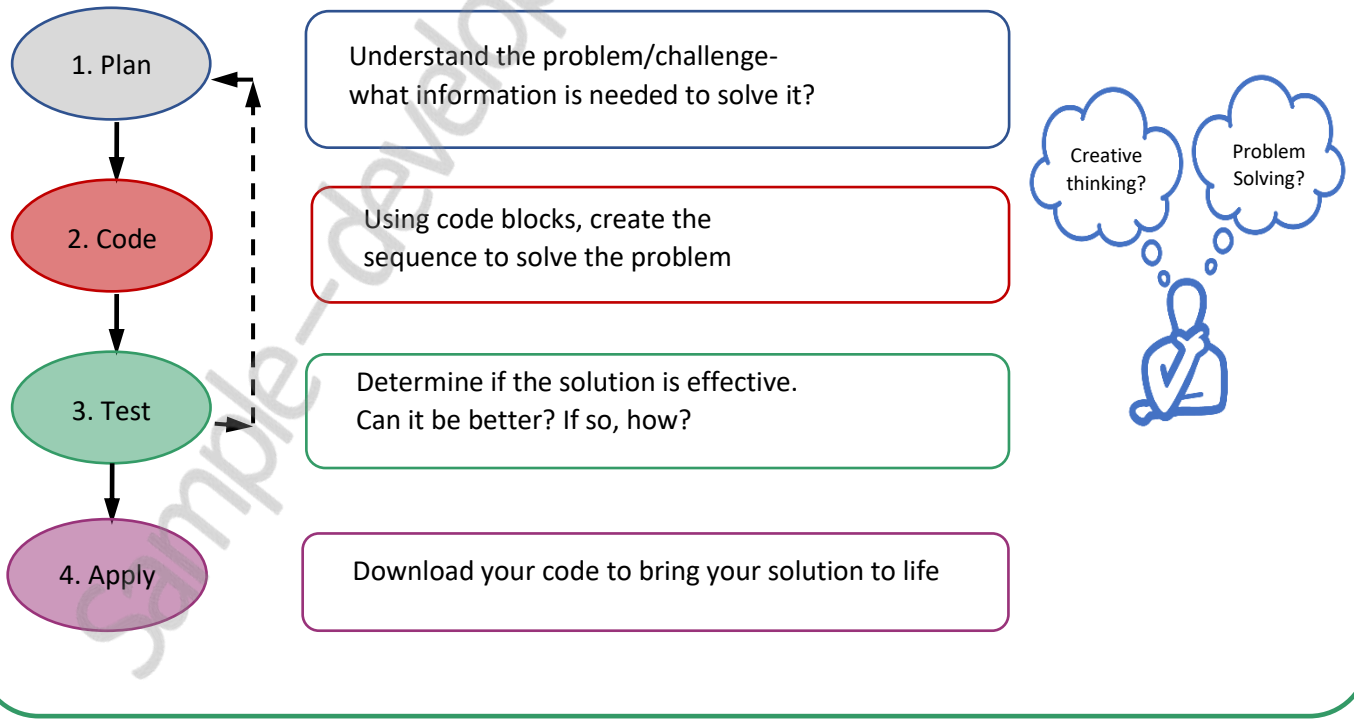
To transfer the HEX file to the micro:bit.

Once the file is downloaded, 'copy' the file from the Downloads folder and 'paste' it into the micro:bit drive.





Planning for coding skills development



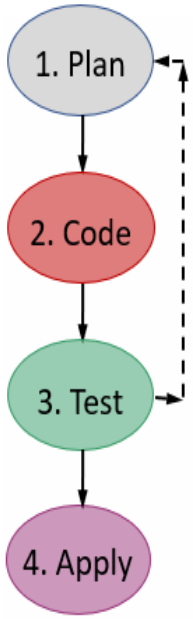
A context for code challenges

'More than 1 billion animals estimated dead in Australia wildfires' (ABC News, Jan 2020)

Notes:

Coding Challenge 1:

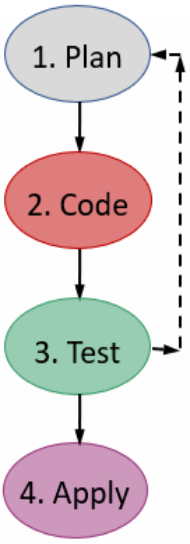
Planning Process



A student has decided to make a model on a 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.*

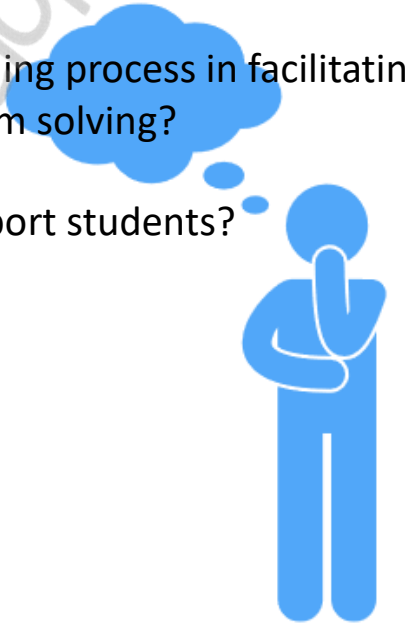
Pause and reflect

Planning Process



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

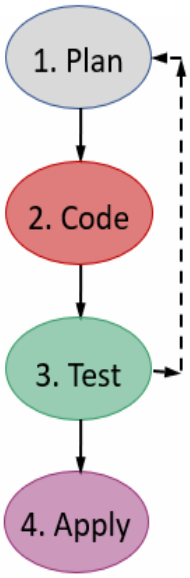
How might this process support students?



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.

Planning Process



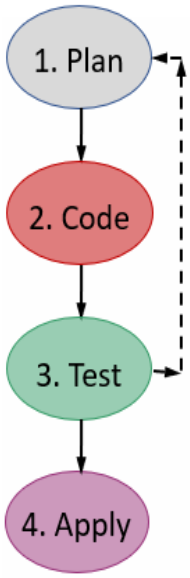
Pause and Reflect

Planning Process

Future extension challenge:

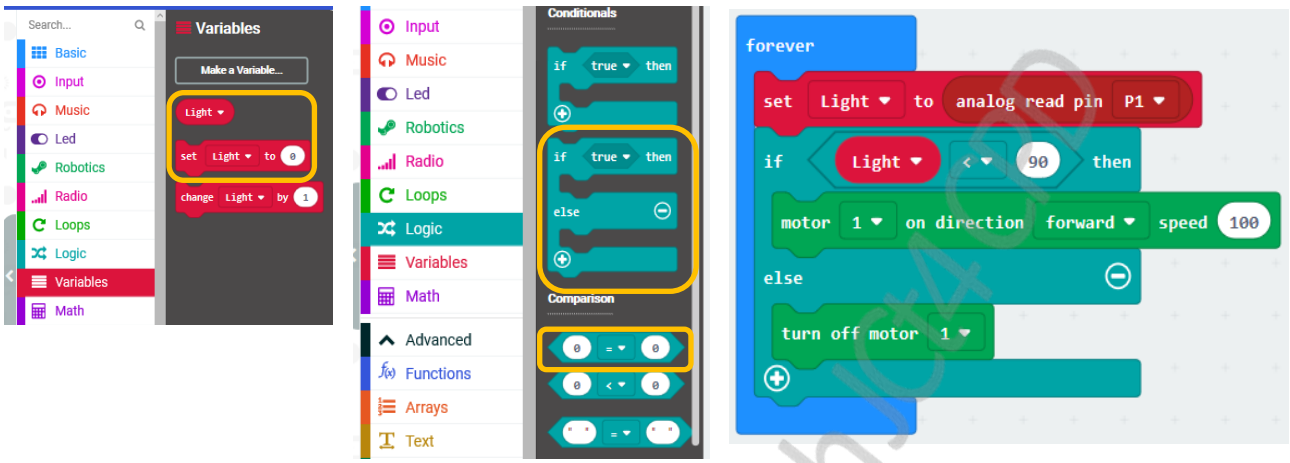
Limit switches are to be incorporated to stop the motor (door) when it is open and closed.

What code solution would you propose?



Micro:bit activity:

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



Steps

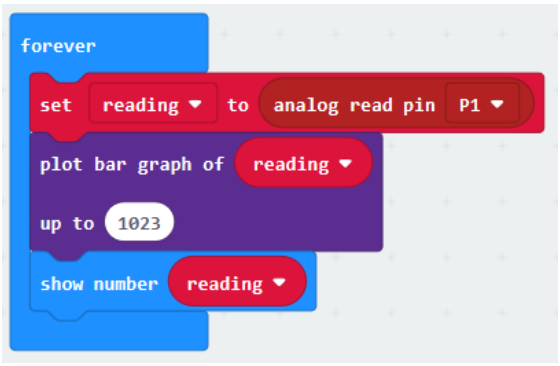
1. Make a new variable and call it **light**.
2. Place a set light to 0 block inside the forever block.
3. Place an analog read pin P1 block inside set light to 0 block. This code allows the micro:bit to read the digital light value associated with **P1** (using LDR/10k resistor).
4. Place an if, else logic block inside the forever block and after the set light to 0 block.
5. Insert a comparison block into the if, else logic block and set it to compare '**>**'.
6. Inside the comparison block, insert a light variable block on the left side of the equation.
   Set a digital light level of **90** on the right side of the equation. This code will compare the real LDR value against a threshold value of 90. The threshold value can be adjusted accordingly.
7. Place a motor block into the 'if' section of the if,else block. Set the motor block as follows; motor **1**, **forward** in direction and at full speed **100**.
8. Place a turn off motor block into the 'else' section of the if,else block. If the value is true, then the motor block will activate rotating the motor at full speed. If the value is false, then the turn off motor block will activate bringing the motor to a stop.
9. If you have a micro:bit connected, click Download to transfer your code!

Calibrating a Sensor

Use this code to measure and digitally display on your micro:bit the actual analogue reading of your sensor!

Knowing this value will allow you to plan for effective code solutions accordingly**.**

*Digital value **0** = **total darkness***
*Digital value **1023** = **total brightness***

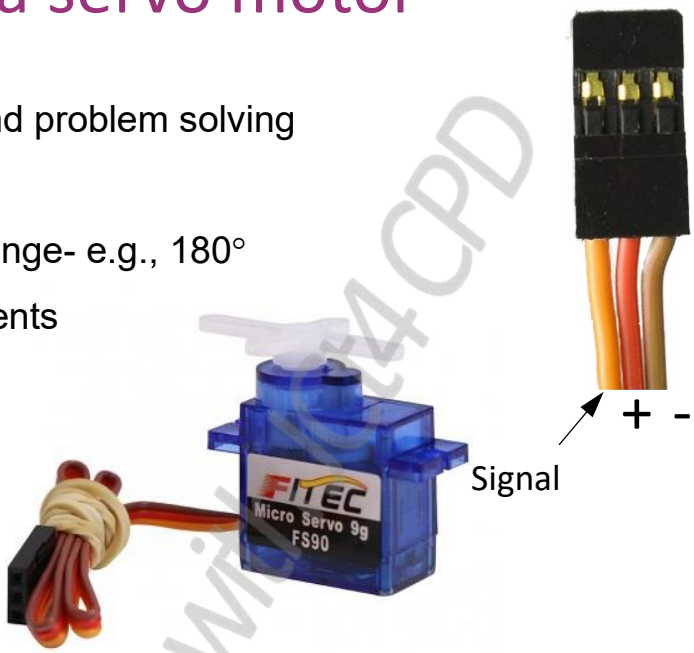


This resource was created to support a Professional Development workshop facilitated by JCt4 during the 2019-2020 school year and sits within the context of the discussions that took place during this workshop.

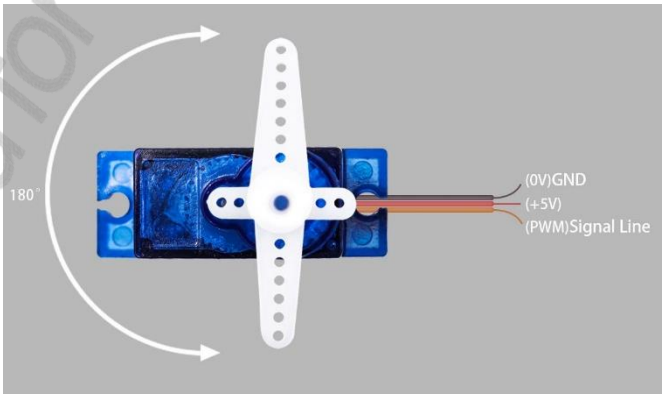
Using a servo motor

Why?

- Encourages creative thinking and problem solving
- High level of control
- Continuous rotation or limited range- e.g., 180°
- Safe failure experience for students



Angular Servo:
Set range, e.g. 0° to 180°



Continuous Servo:
variable speed in both directions

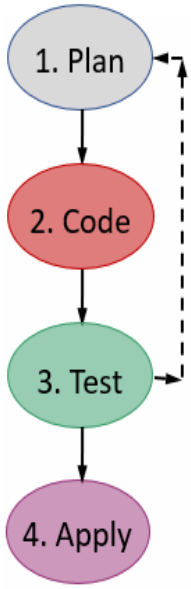
All for One Robotics Board

- 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.

Video: https://youtu.be/EVowN8RN8nU

Coding Challenge 3:

Planning Process



Group Task:

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

Consider:

Your context, e.g., water distribution system, alert/alarm system?

Which inputs and outputs to use?

For further tutorials:

https://makecode.microbit.org/#

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?

- Explore learning outcomes and key learning
- Consider assessment
- Develop experiences for students to engage in.

Microcontroller board

Research skills