Co-thinking and Creation for STEAM diversity-gap reduction

2020-1-ES01-KA201-082601

Co-funded by the
Erasmus+ Programme
of the European Union

Educational Robotics with Micro:bit Training

CreaSTEAM CONSORTIUM

September 2021

Amendment History

Version	Revision	Date	Author	Modification
1	0	08/09/2021	Elena Jurado, Roger Olivella	Initial version

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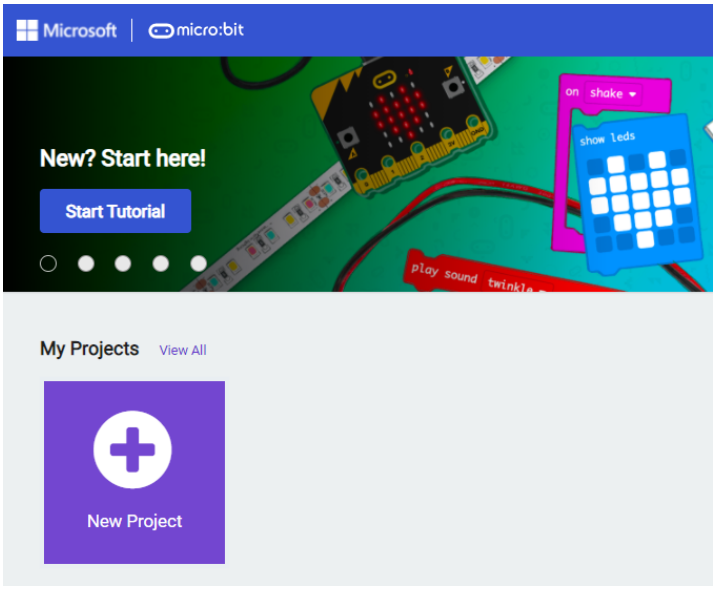
1. Micro:bit® - Connection guide

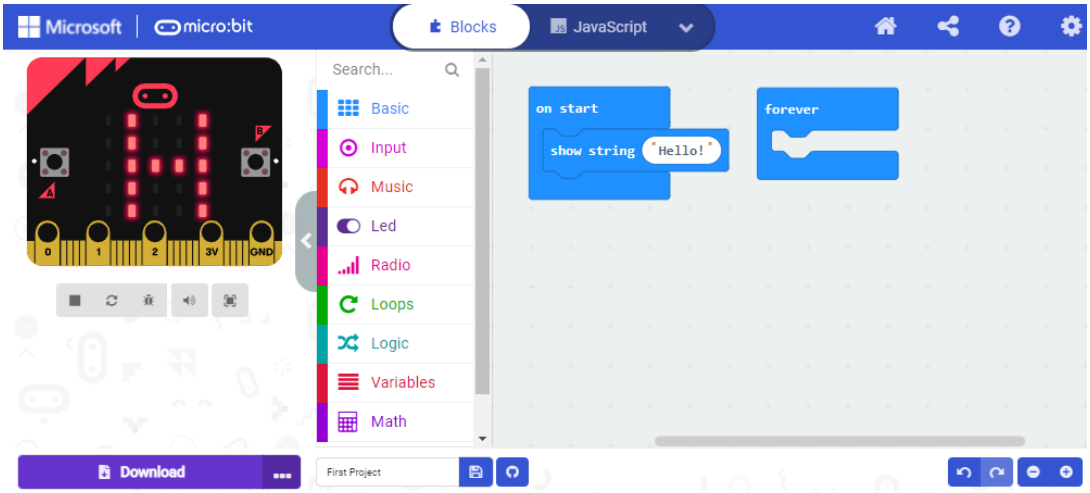
1.1. Program it!

Make a simple program. Go to https://makecode.microbit.org and try dragging and dropping some blocks with Microsoft MakeCode, a simple but powerful Scratch-like online coding environment.

- Create a New Project:



- And make a simple program like this one:



MakeCode includes a simulator so you can virtually see the result even without having the Micro:bit board with you.

You can change the language by going to the upper right corner > *Language*.

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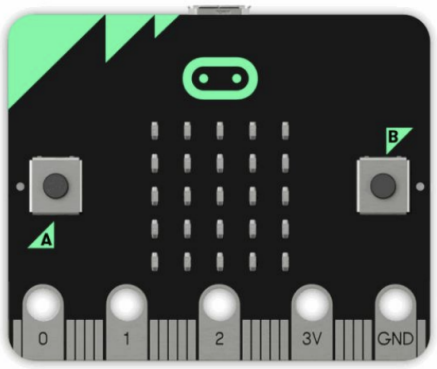
1.2. Connect it!

Connect the Micro:bit board to your computer using a micro USB cable. You'll see a new drive disk in your computer called "MICROBIT".



Micro:bit is compatible with Mac, PC, Chromebooks and Linux (including Raspberry Pi).

1.3. Download it to your Micro:bit!

Download the program you created with the editor and transfer it to the Micro:bit board. You'll see a '.HEX' file, the specific compiled program for Micro:bit.

- Copy and paste (or drag and drop) the '.HEX' file to the "MICROBIT" drive on your computer.

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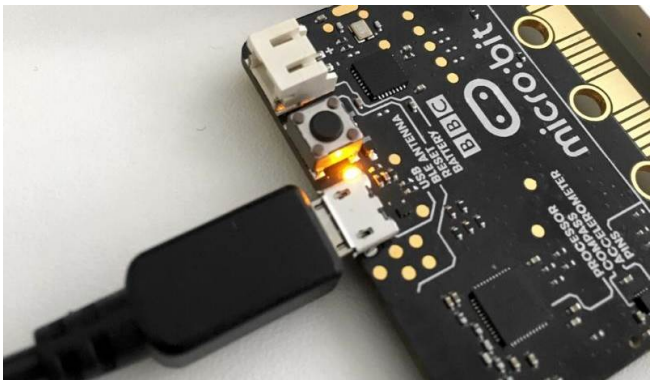
1.4. Play it and enjoy it!

The Micro:bit yellow LED on the back will start blinking and then the code will start running.



Every time you load a new program, the older program will be deleted.

1.5. Alternative ways of connecting your Micro:bit

There are other ways of connecting with Micro:bit board. You can explore them here:

- Computer direct flashing: https://microbit.org/get-started/first-steps/set-up/#direct-flashing
- Mobile / Tablet. You can use the app and bluetooth. https://microbit.org/get-started/first-steps/set-up/#transfer-from-mobile-app
- Computer MakeCode Offline App: https://makecode.microbit.org/offline-app

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2. Micro:bit® - First challenges

The best way to learn is “learning by doing”, so let’s start to code with these first proposed challenges. You can solve them using only MakeCode virtual simulator, but, if possible, we recommend that once you solve them, you download them to the Micro:bit board. In this way you will check that the solution is working correctly in a real environment.

2.1. Beginner challenges

Let’s start doing some simple challenges.

Challenge 1 - ShowYourName

- Goal:
  - Show your name in the LEDs screen, wait 1 second and show it again. Repeat it forever.
- Proposed pseudocode:

```
forever
      show string “your name here”
      wait 1000 milliseconds
```

- Check the solution at the end of this document.

Challenge 2 - LEDs ON_OFF

- Goal:
  - When you press Button A, all LEDs on the screen will turn on. When you press Button B, the screen will turn off.
- Proposed pseudocode:

```
forever
      if button A pressed
            turn on all LEDs of the screen
      if button B pressed
            turn off all LEDs of the screen
```

- Check the solution at the end of this document.

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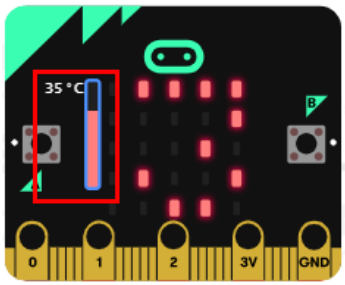
Challenge 3 - Temperature

- Goal:
  - Write the temperature constantly (in celsius degrees) on the LEDs screen.
- Proposed pseudocode:

```
forever
      show number 'temperature'
```

- Hint:
  - You can simulate the temperature using the virtual simulator:



- Check the solution at the end of this document.

2.2. Intermediate challenges

Let's continue with some more difficult challenges.

Challenge 4 - Is it hot or cold?

- Goal:
  - Show on the screen the word "hot" if the temperature is higher than 22 celsius degrees, and "cold" if it is lower.
- Proposed pseudocode:

```
forever
     if temperature > 22
           show string "hot"
     else
           show string "cold"
```

- Hint:
  - You can simulate the temperature changing using the virtual simulator:

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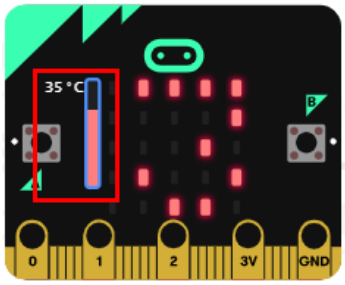


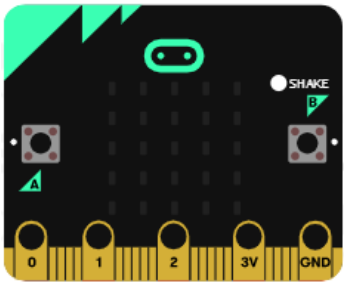
- Check the solution at the end of this document.

Challenge 5 - Rock, paper & scissors!

- Goal:
  - Get a random draw (rock, paper or scissors) is displayed on the screen every time Micro:bit vibrates (on shake).
- Proposed pseudocode:

```
on shake
     variable = random number from 1 to 3
     if variable = 1
            show rock icon
     if variable = 2
            show paper icon
     if variable = 3
            show scissors icon
```

- Hint:
  - You can simulate the vibration by pressing the white button called “shake”.



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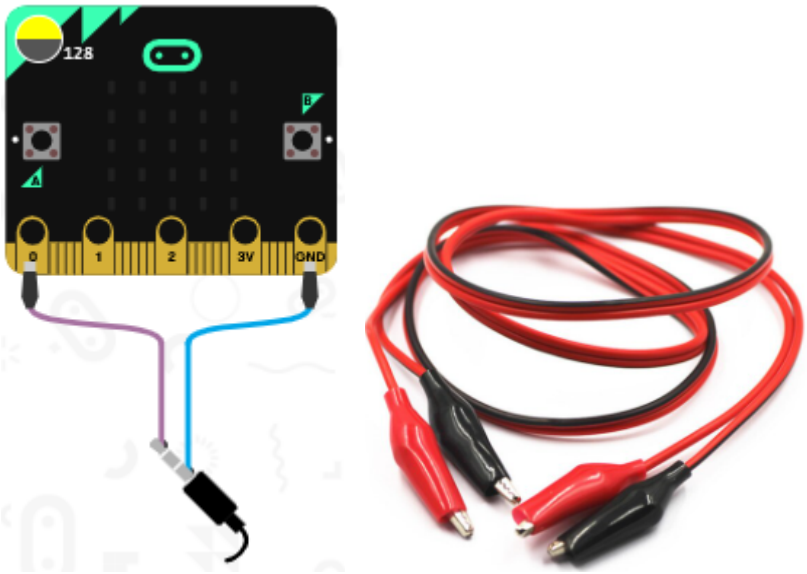
Challenge 6 - Let's wake up with music!

- Goal:
  - Turn on the speakers and program Micro:bit to play a joyful melody when it receives a lot of light and to play a quiet song when it receives less light.
- Proposed pseudocode:

```
forever
     if light level > 200
              play joyful melody
     if light level < 50
              play quiet melody
     else
              (don't do anything)
```

- Hint:
  - Simulate the level of light by clicking on the yellow circle on the simulator.
  - Turn on the speakers to hear the melody on the computer simulator.
  - If you have Micro:bit V2, the melody is going to be played through the built-in speaker.
  - If you have Micro:bit V1, you have to connect headphones to pins 0 and GND with crocodile clips, as shown in the image.



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2.3. Advanced challenges

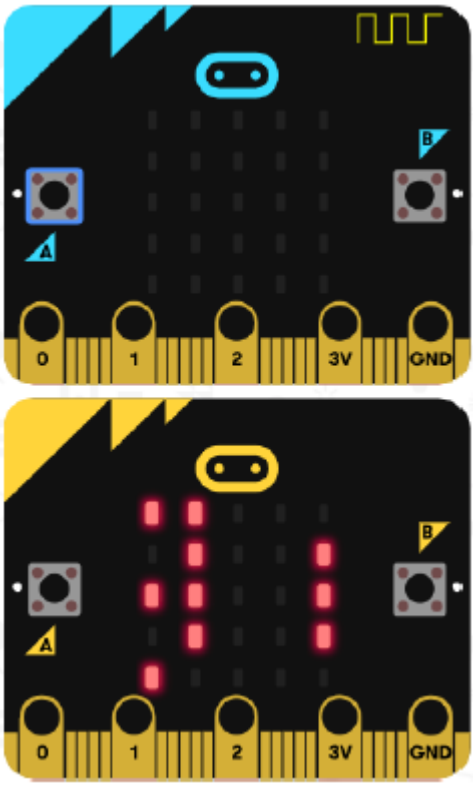
Challenge 7 - Is there anyone on Earth?

- Goal:
  - Send a text message by radio when button A is pressed.
  - In addition, if you receive a text message by radio, display it on the screen.
- Proposed pseudocode:

```
when button A is pressed
     radio send string "your message here"

when radio message is received (receivedString)
     show string "(receivedString)"
```

- Hint:
  - When you simulate your code, you'll see two Micro:bits (the sender and the receiver).



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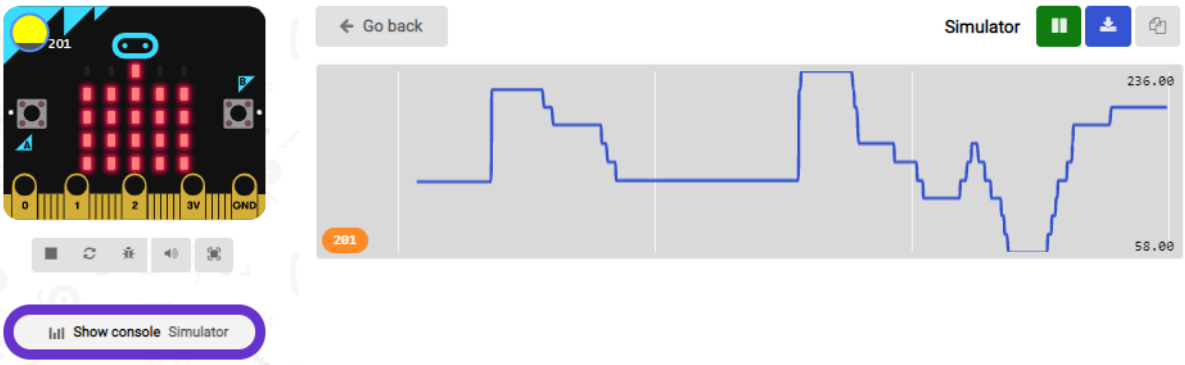
Challenge 8 - Weather station

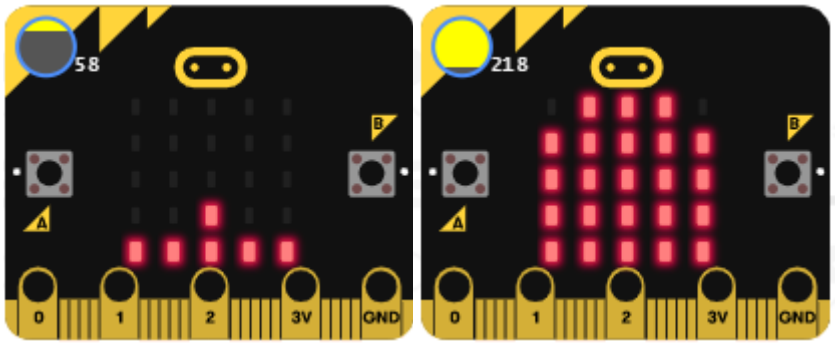
- Goal:
  - Plot a bar graph on the Micro:bit screen that shows the light level.
  - Then, if you click on the “Show console” button, you’ll see a graph as a function of time.



  - You can choose another input value, like: temperature, acceleration, rotation, magnetic force, etc.
- Proposed pseudocode:

```
forever
     plot bar graph of (light level)
     up to (255)
```

- Hint:
  - You can find this block inside the “Led” type. The “up to” value indicates the top value of the graph and it should be adjusted to the maximum value of the sensor. In case of light level, it goes from 0 (minimum) to 255 (maximum).
  - If you use the magnetic force sensor, it can not be simulated with MakeCode virtual simulator. You’’l need to download to the Micro:bit and you’ll need to calibrate it as shown in this video: https://www.youtube.com/watch?v=IL5grHtz_MU



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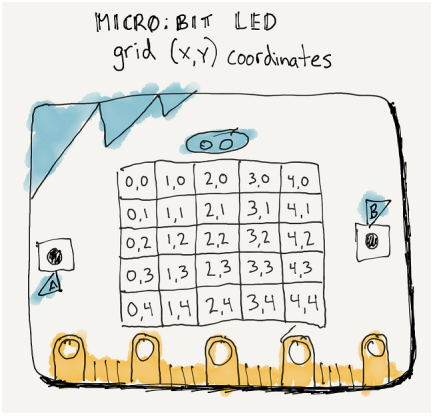
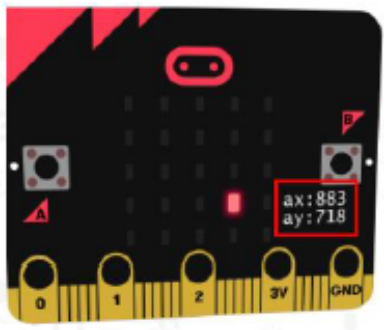
Challenge 9 - Move the drop over the screen

- Goal:
  - Simulate the movement of a drop through the screen of LEDs. Turn on only one LED that will move up-down or left-right by tilting the Micro:bit board.
- Proposed pseudocode:

```
on start
     variable set x = 2
     variable set y = 2
forever
     turn on the LED on position 'x' , 'y'
     wait 100 milliseconds
     turn off the LED on position 'x' , 'y'
     if (x > 0) and (X axis acceleration <= 150)
            set x = x - 1  //decrease x
     if (x < 4) and (X axis acceleration > 150)
            set x = x + 1  //increase x
     if (y > 0) and (Y axis acceleration <= 150)
            set y = y - 1  //decrease y
     if (y < 4) and (Y axis acceleration > 150)
            set y = y + 1  //increase y
```

- Hint:
  - The position of the LEDs on the screen starts at 0,0 position on the upper-left corner and ends at 4,4 position on the lower-right corner.
  - You can simulate the tilt of the Micro:bit by moving the mouse over the simulator.





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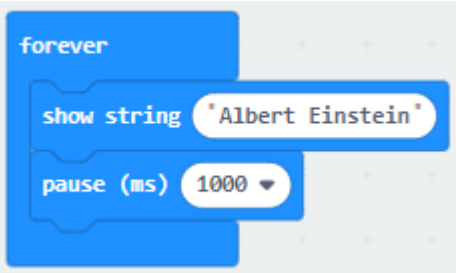
2.4. Solutions to the challenges

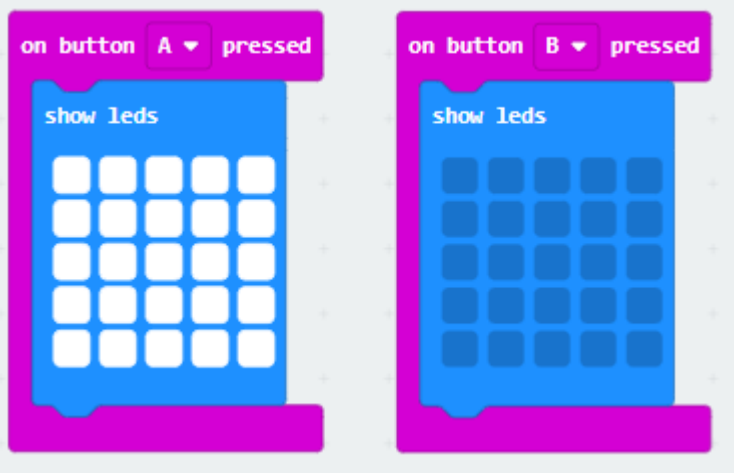
Next, you will find the code of the solution of all the challenges. These are not the only solutions, as, when we code, there's always as many solutions like people in the world! It is very interesting to see each other's solutions to learn different ways to solve the challenges!

Challenge 1 - ShowYourName



Challenge 2 - LEDs ON_OFF

- Alternative solution a)



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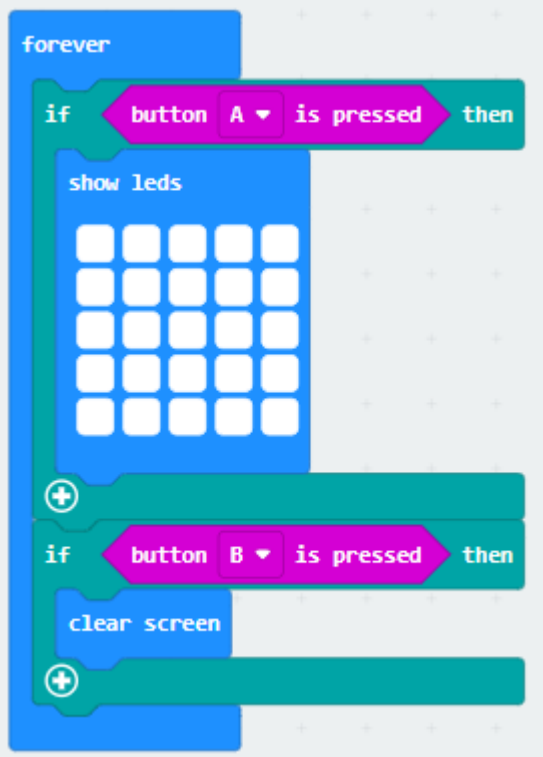
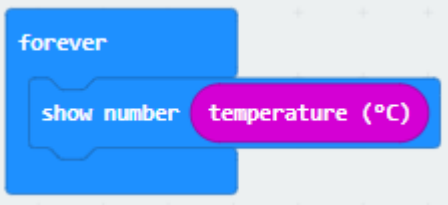
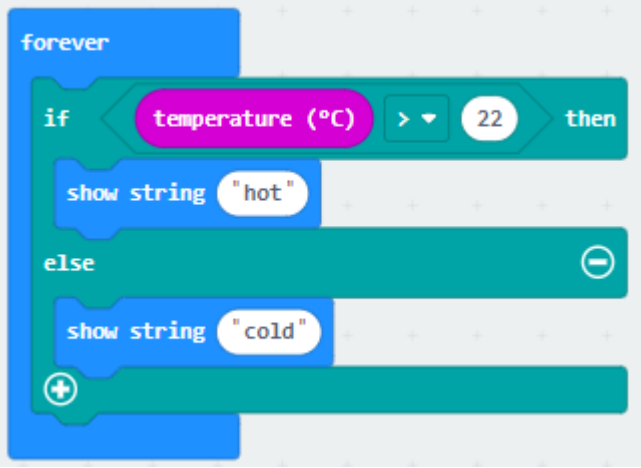
- Alternative solution b)



Challenge 3 - Temperature



Challenge 4 - Is it hot or cold?



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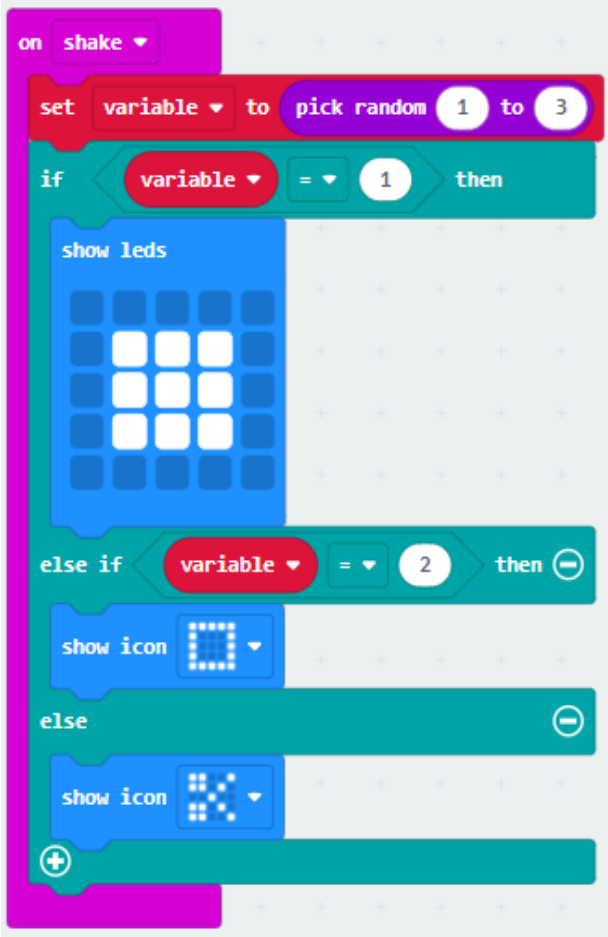
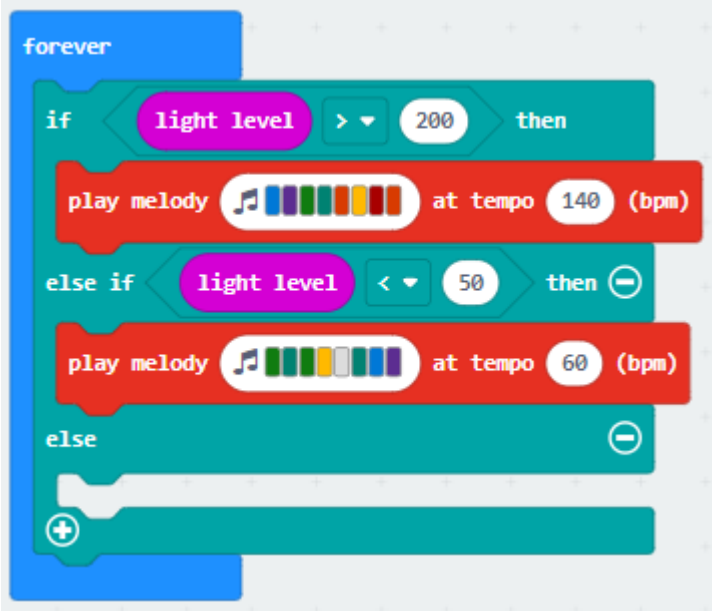
Challenge 5 - Rock, paper & scissors!



Challenge 6 - Let's wake up with music!



- Example of joyful melody: "Rising" at tempo 140 bpm
- Example of quiet melody: "Parius" at tempo 60 bpm

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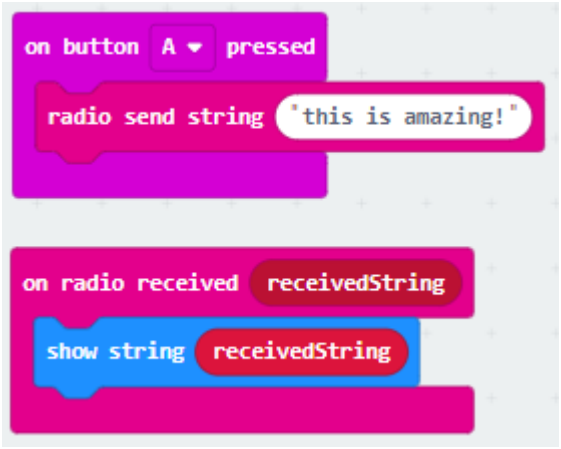
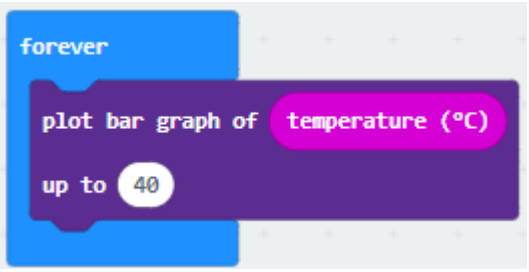
Challenge 7 - Is there anyone on Earth?



Challenge 8 - Weather station



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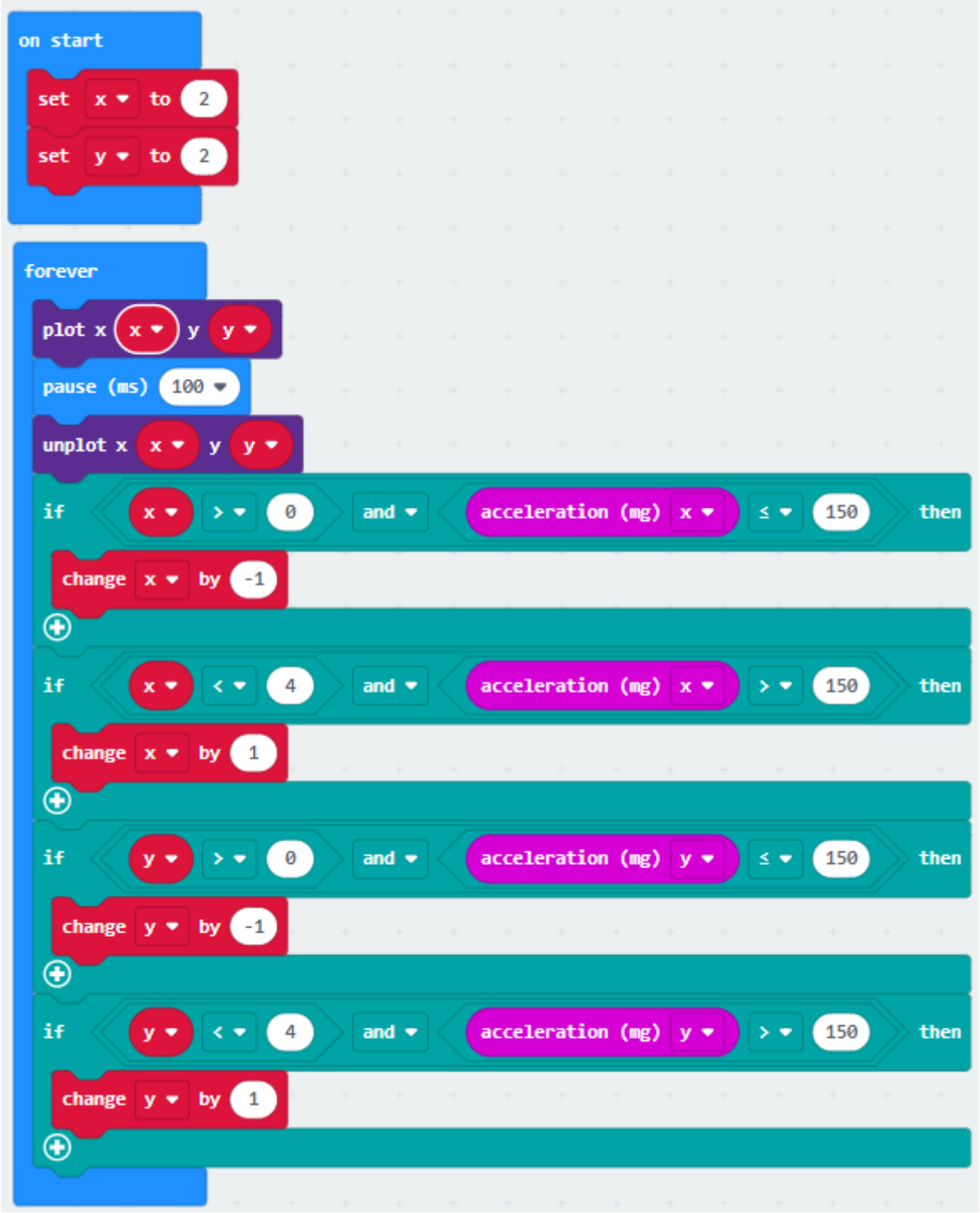
Challenge 9 - Move the drop over the screen



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3. Micro:bit® - Additional resources

Basic resources

- Get started: https://www.microbit.org/get-started/first-steps/introduction
- Videos introducing each component of the Micro:bit board: https://www.youtube.com/watch?v=u2u7UJSRuko&list=PLEo0hMrjdofusveMscRFN9FeqKzDBzuXr
- Videos "Behind the MakeCode hardware": https://www.youtube.com/watch?v=qqBmvHD5bCw&list=PLMMBk9hE-SeqDYtw9pGNPsQ10V_EGMyGe
- Example projects: https://www.microbit.org/projects
- Example lessons: https://www.microbit.org/lessons

Resources to go further

- Python editor: https://www.microbit.org/code/#python
- Micro:bit with Scratch: https://www.microbit.org/code/#scratch

** The images of this document are from https://www.microbit.org*

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