CODERS Summer Workshop

CODERS CS Team

Summer 2024

Missouri State University

What is a Computer?


mouse


keyboard


monitor


ram


motherboard


hard-drive


central processing unit (CPU)

System software
macOS®, Microsoft Windows, Linux®, Android™

Application software
Microsoft Word, Google Maps™, Gmail™

Commodore 1351 mouse by Boffy, 2005. Apple keyboard by user Pollyanna1313 CC BY-SA 3.0
IBM PC Motherboard by Martinez CC BY-SA 4.0
(CPUs, from left) Intel C80186-6 (1982) adapted from Nguyen, 2016. Intel i7 by Gaba, 2018. Intel i9 by Cole. CC BY-SA 4.0

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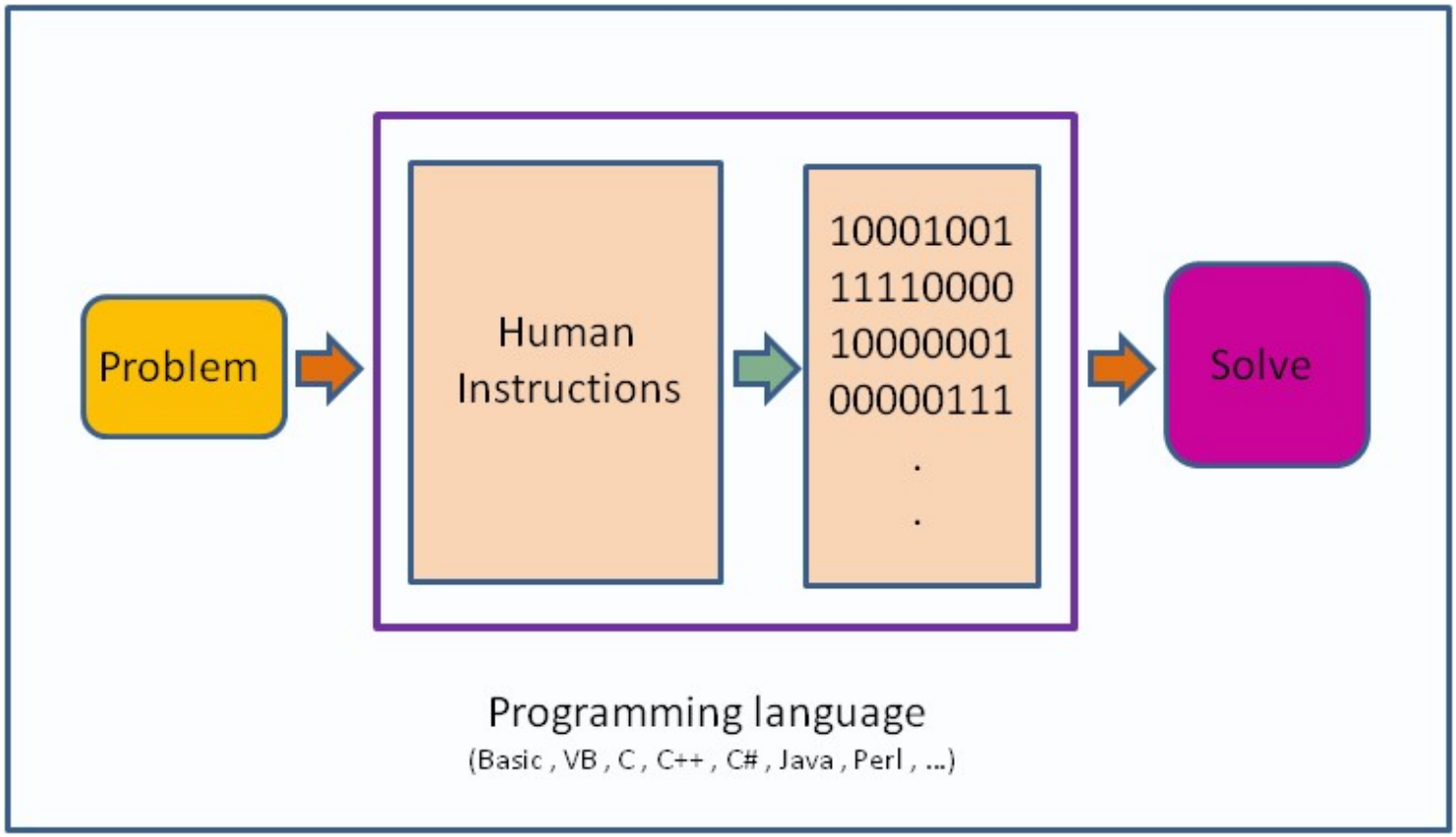
Programming a Computer



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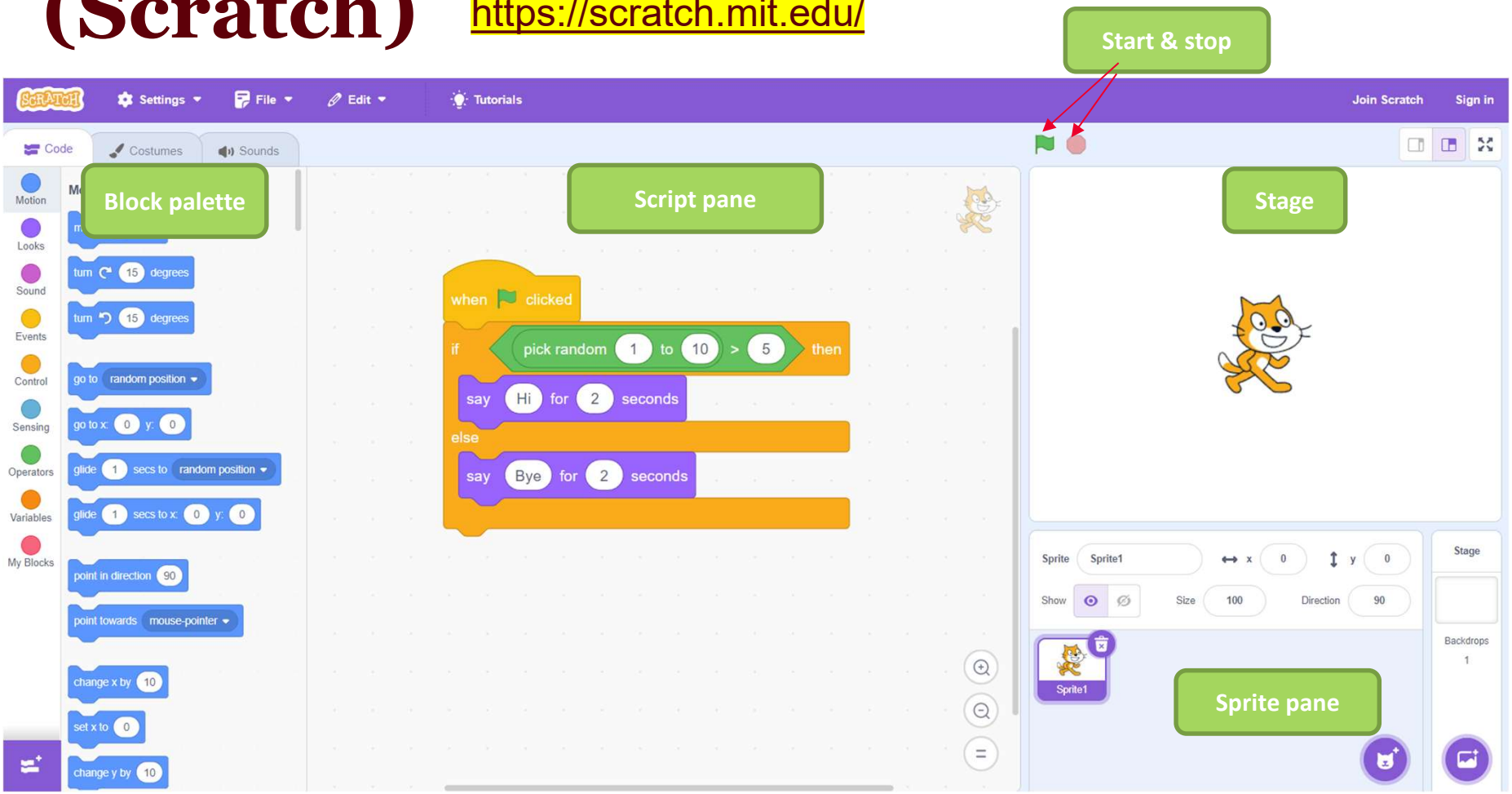
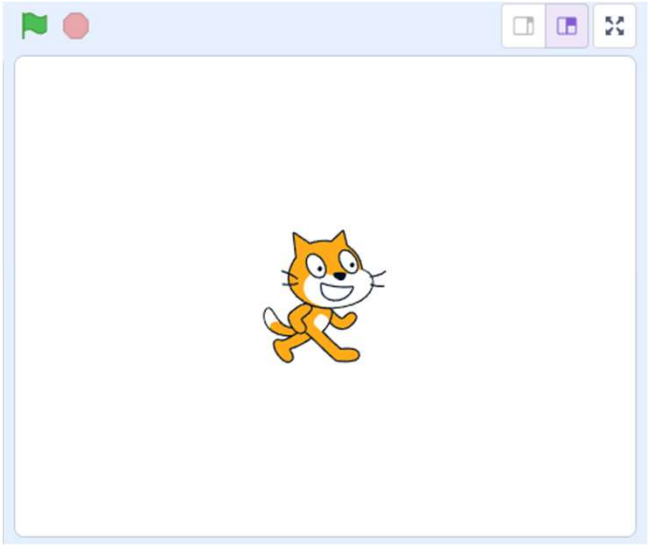
Introduction to Block Coding (Scratch)

https://scratch.mit.edu/



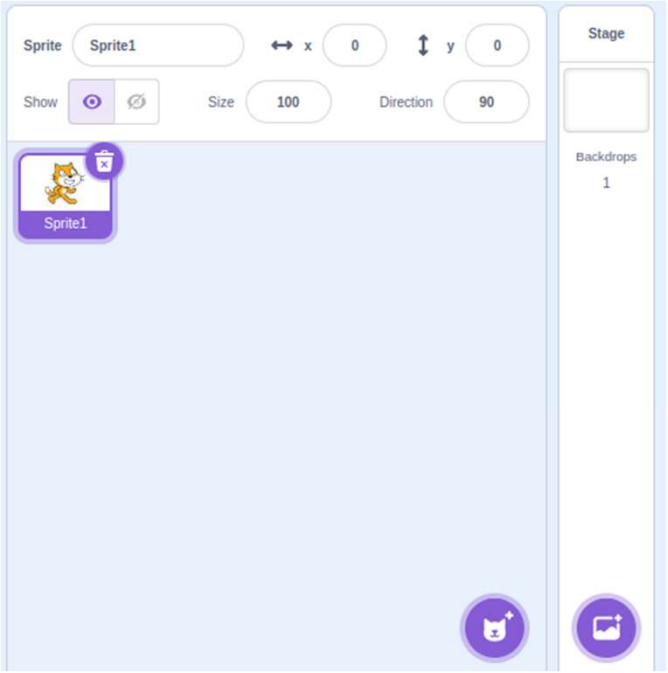
Stage and Sprite

Stage - The stage is the environment where sprites exist and interact.



Sprite - A sprite is an image that has its own code (script), costumes, and sounds independent from all other sprites in the Scratch project.

All sprites in your Scratch project can be accessed in the sprite pane.



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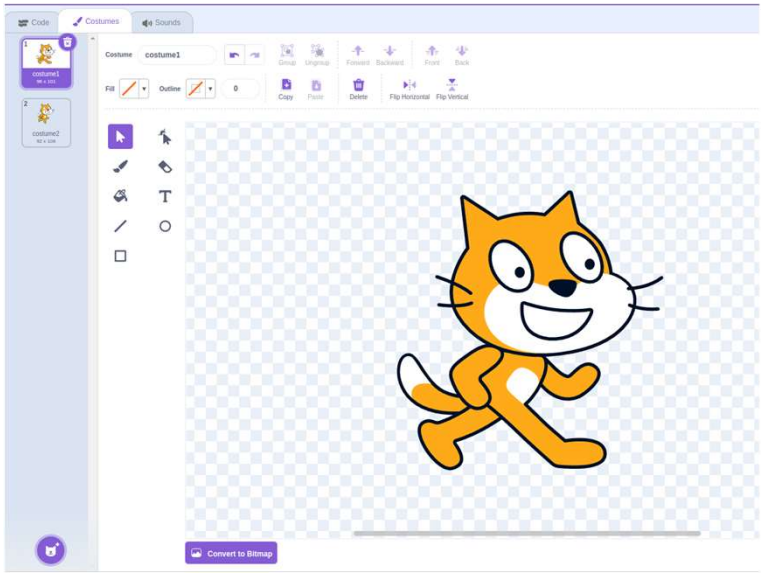
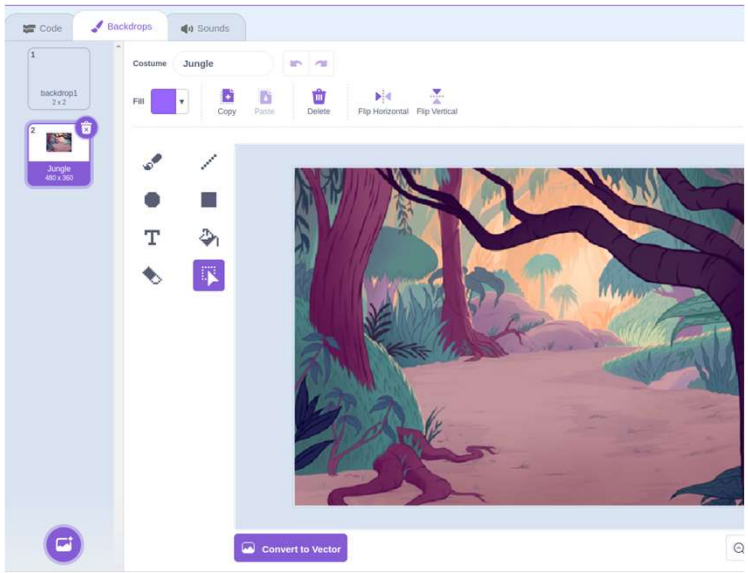
Costume and Backdrop

Costumes – You can edit a sprite



Backdrops – You can change the scene appearance



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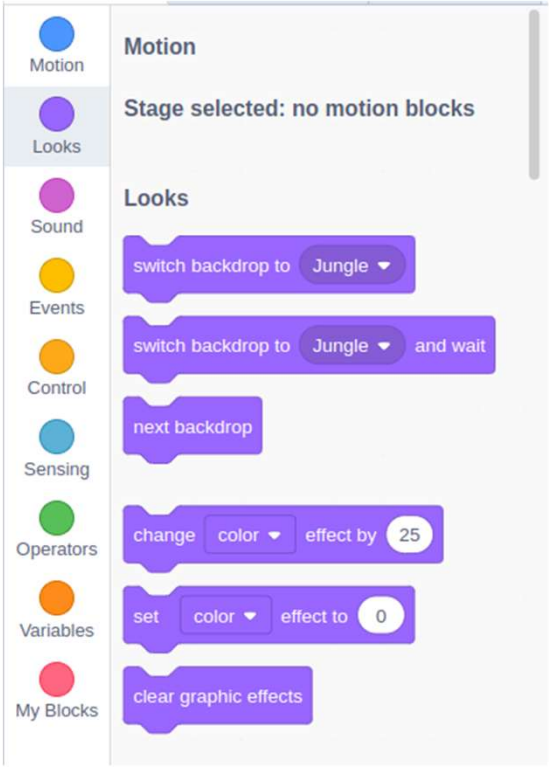
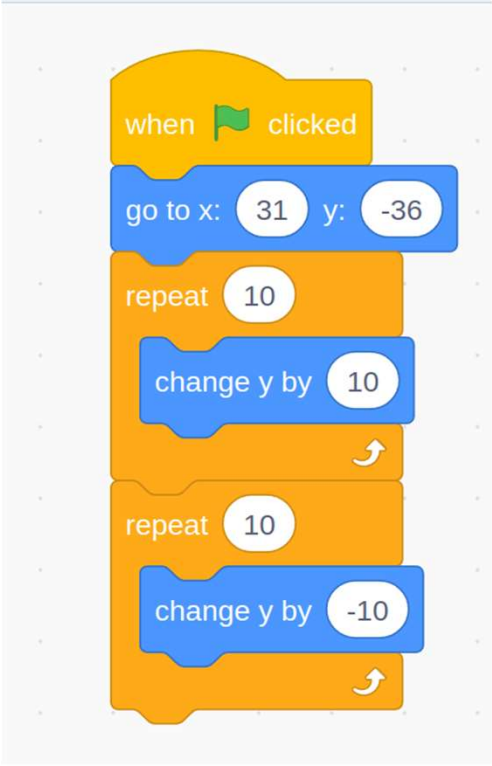
Blocks and Scripts

Blocks are for choosing different actions

Scripts are associated with each sprite (and backdrop)





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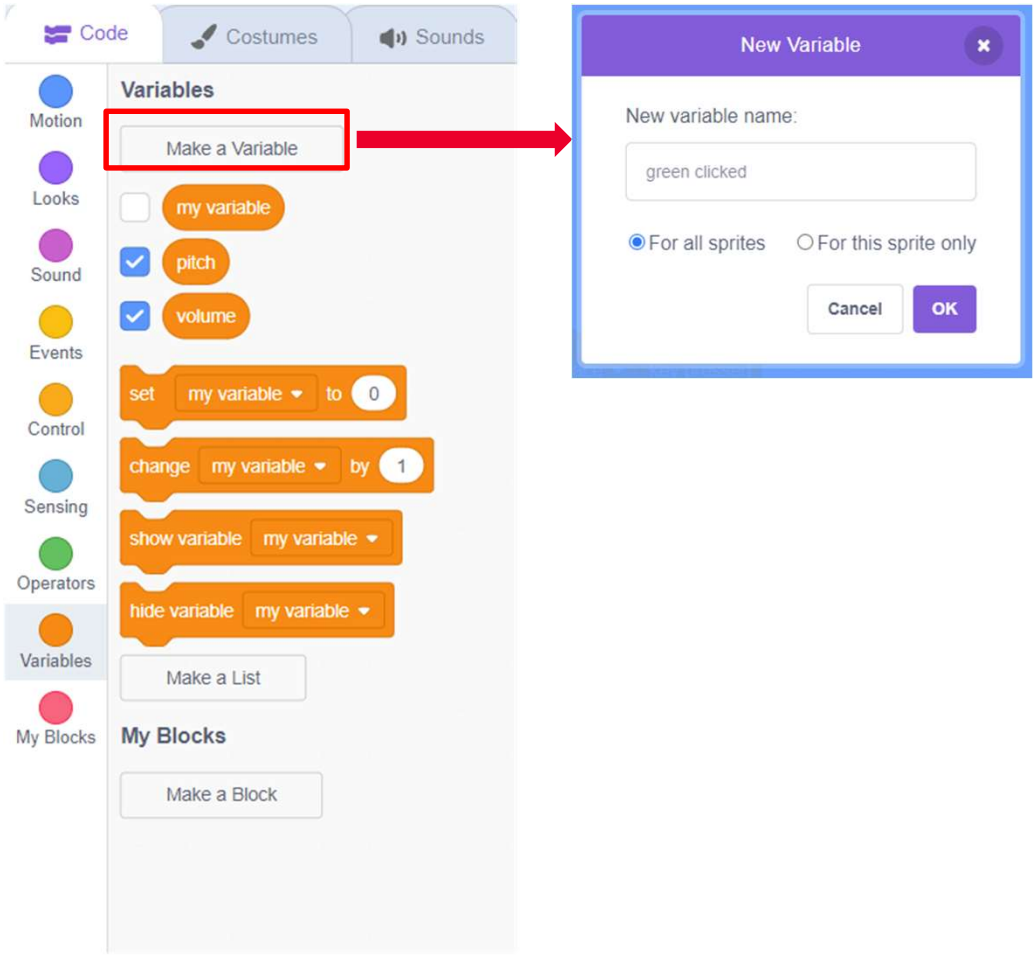
Variables

- A variable is a placeholder to store and reuse the value.
- The value can change, depending on conditions or information passed to the program.



Example:

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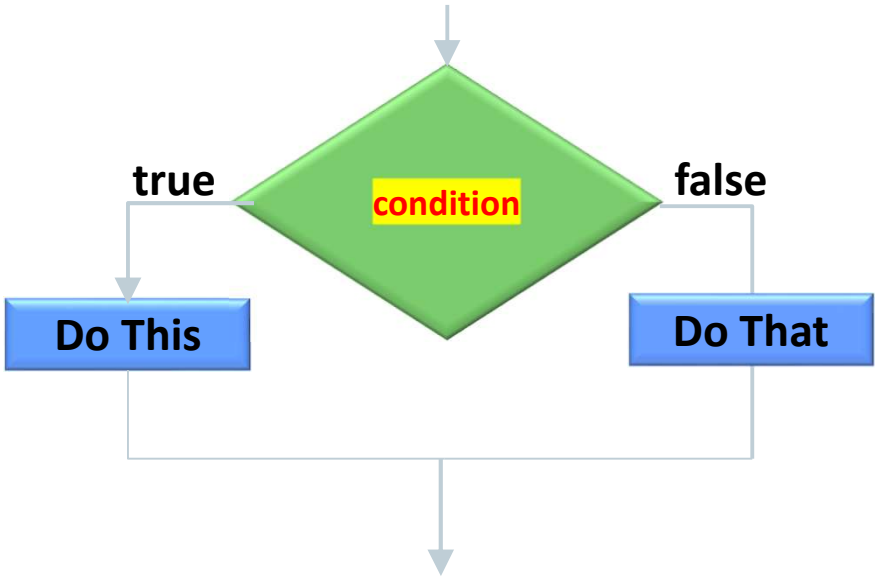
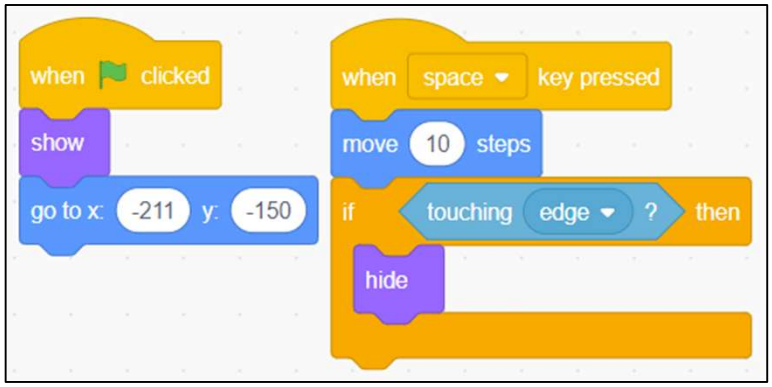
III Branching

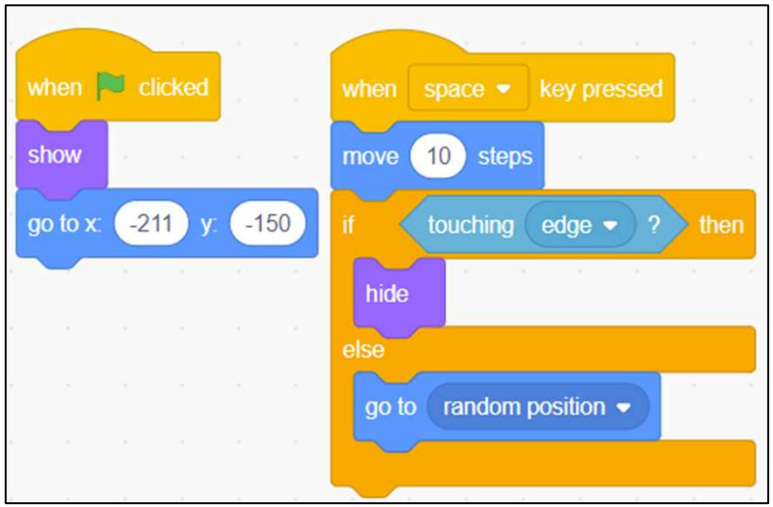
- Make the program do something when a condition is True or False.



Examples:



IF Block



IF-ELSE Block

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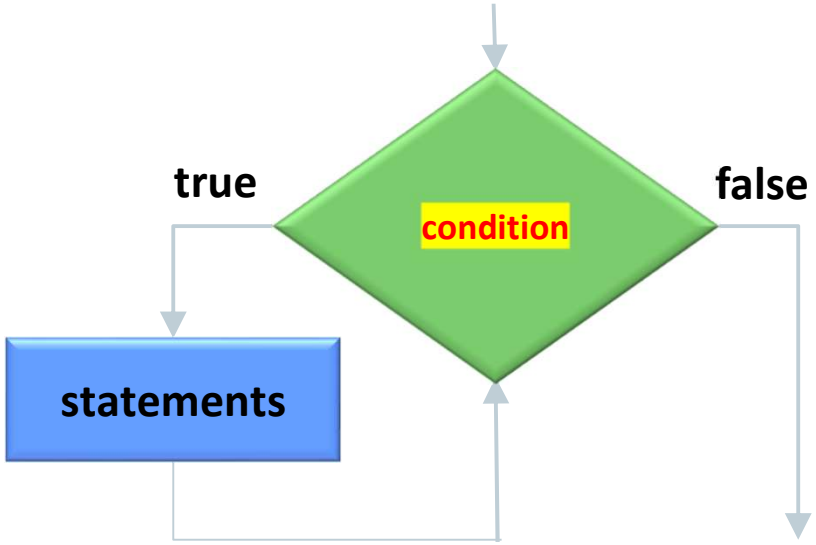
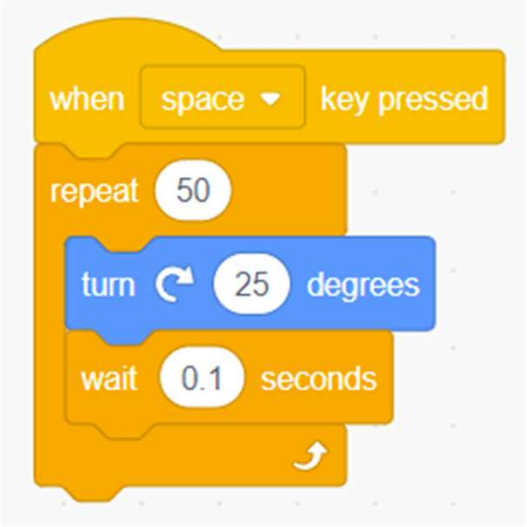
Loop

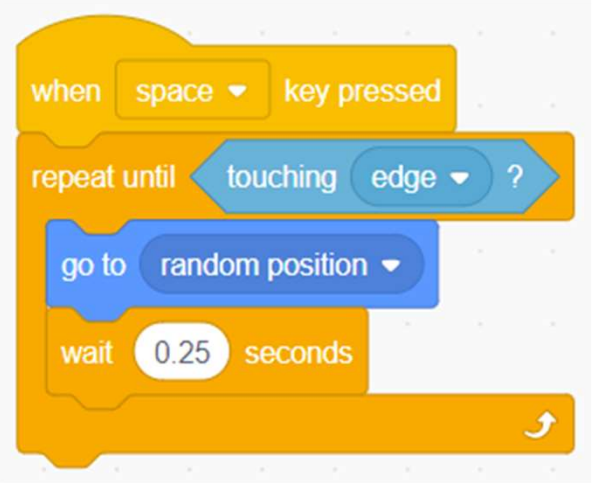
- A **loop** allows repeated execution of a set of statements until a condition is met.



Example-1:



Example-2:



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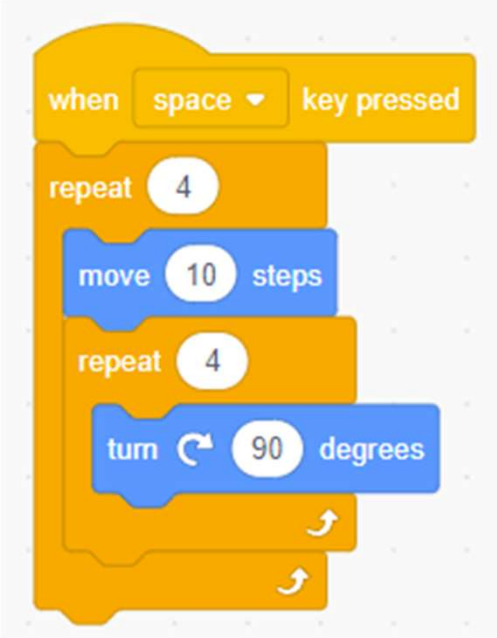
Nested Loop

- A loop can be inside another loop (and so on)

Example:



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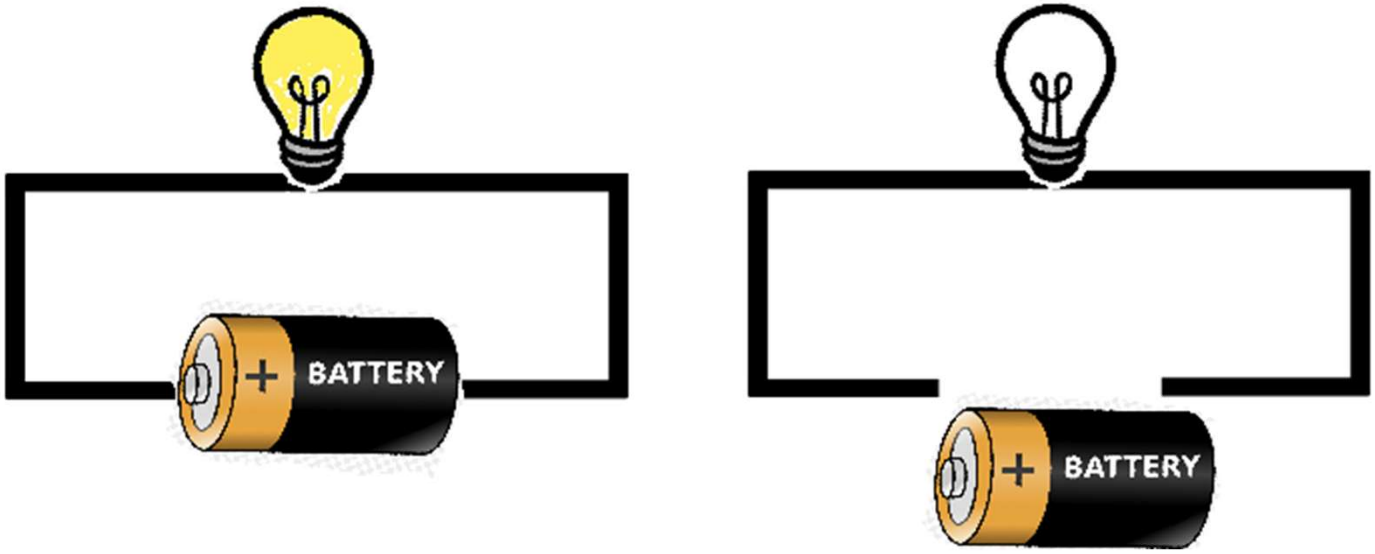
Activity-1: Light the Bulb!

Goal: Simulate a simple circuit in scratch using wires, a bulb, and a battery. The bulb will light up when the circuit is complete.



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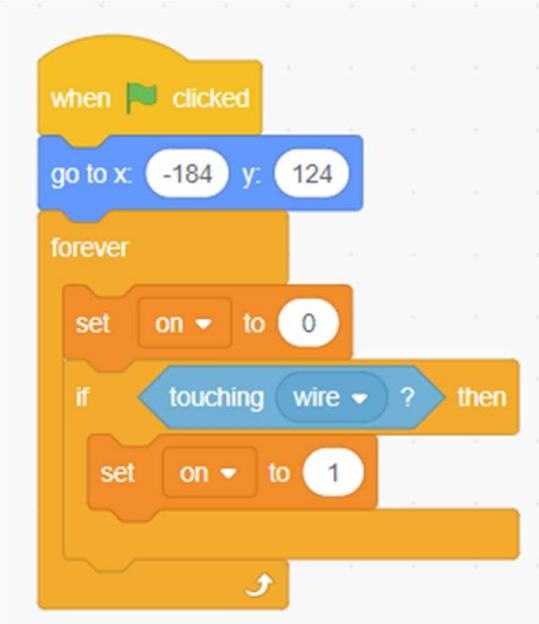
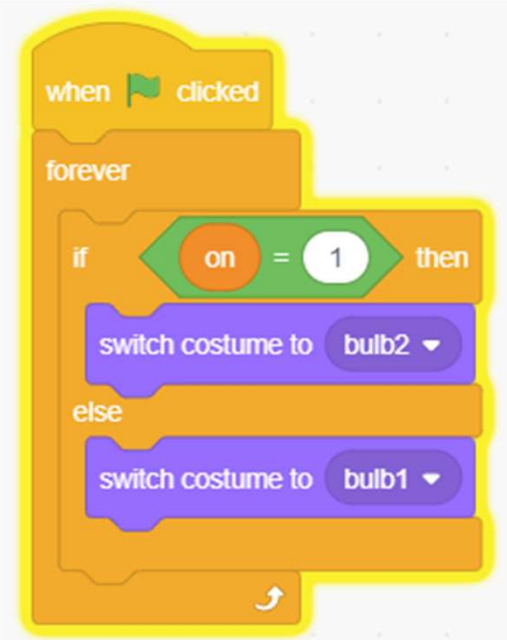
Activity: Sample Code

- Code for the battery



- Code for the bulb



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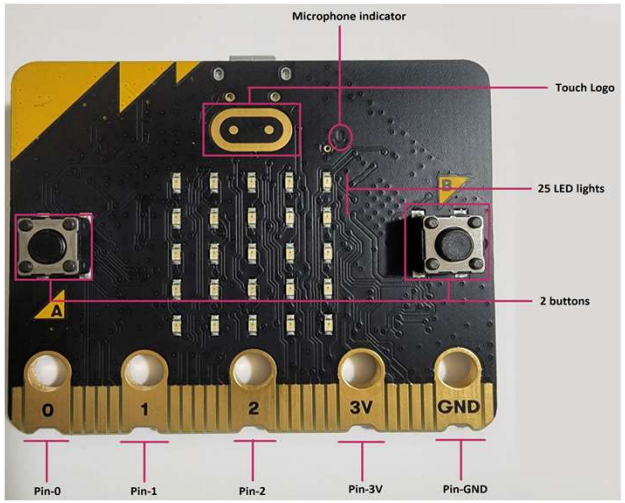
Introduction to Micro:bit

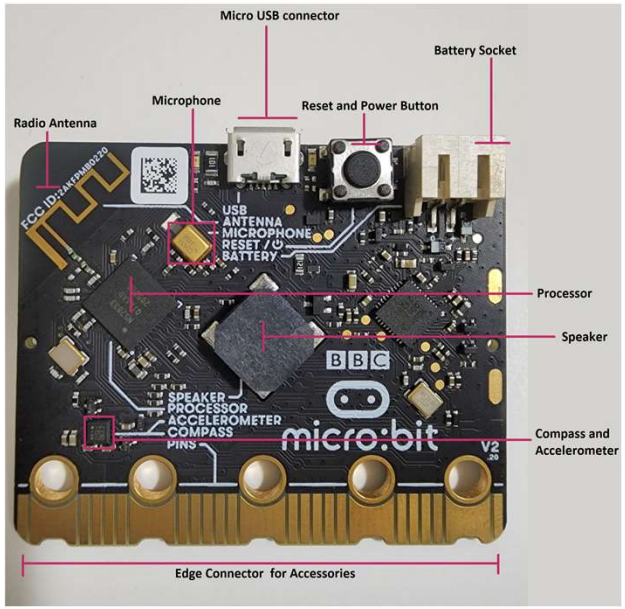
https://microbit.org/

Unpacking the Micro:bit

Micro:bit Components and Capabilities

- LED Display
- Speaker
- Buttons
- Microphone
- Accelerometer
- Compass
- Temperature Sensor
- Light Sensor
- Touch Sensor
- Radio





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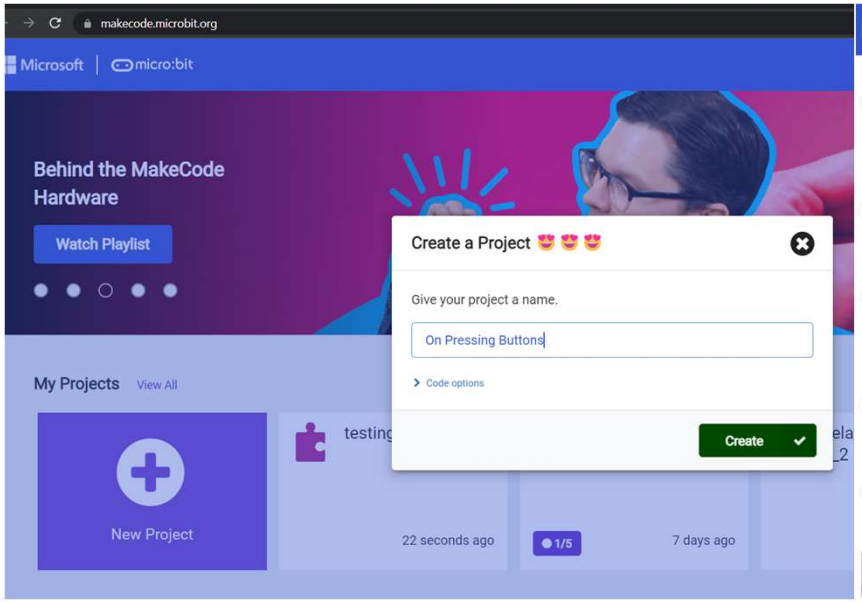
Connecting to the Micro:bit

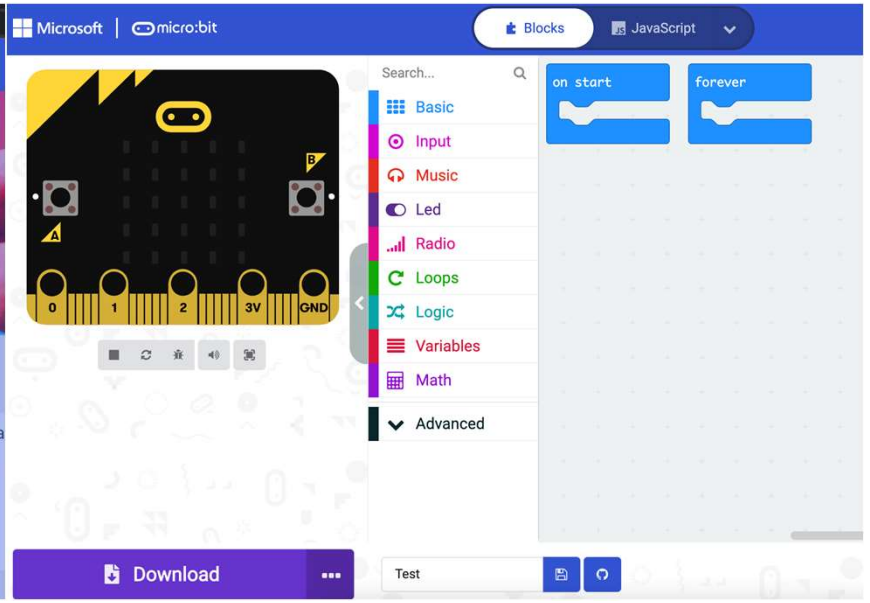
Connect micro:bit to a computer directly using a USB-A to micro-USB cable.

1. Plug small connector of micro-USB cable into the micro:bit USB connector.
2. Plug USB type A connector into an open USB port on the computer.

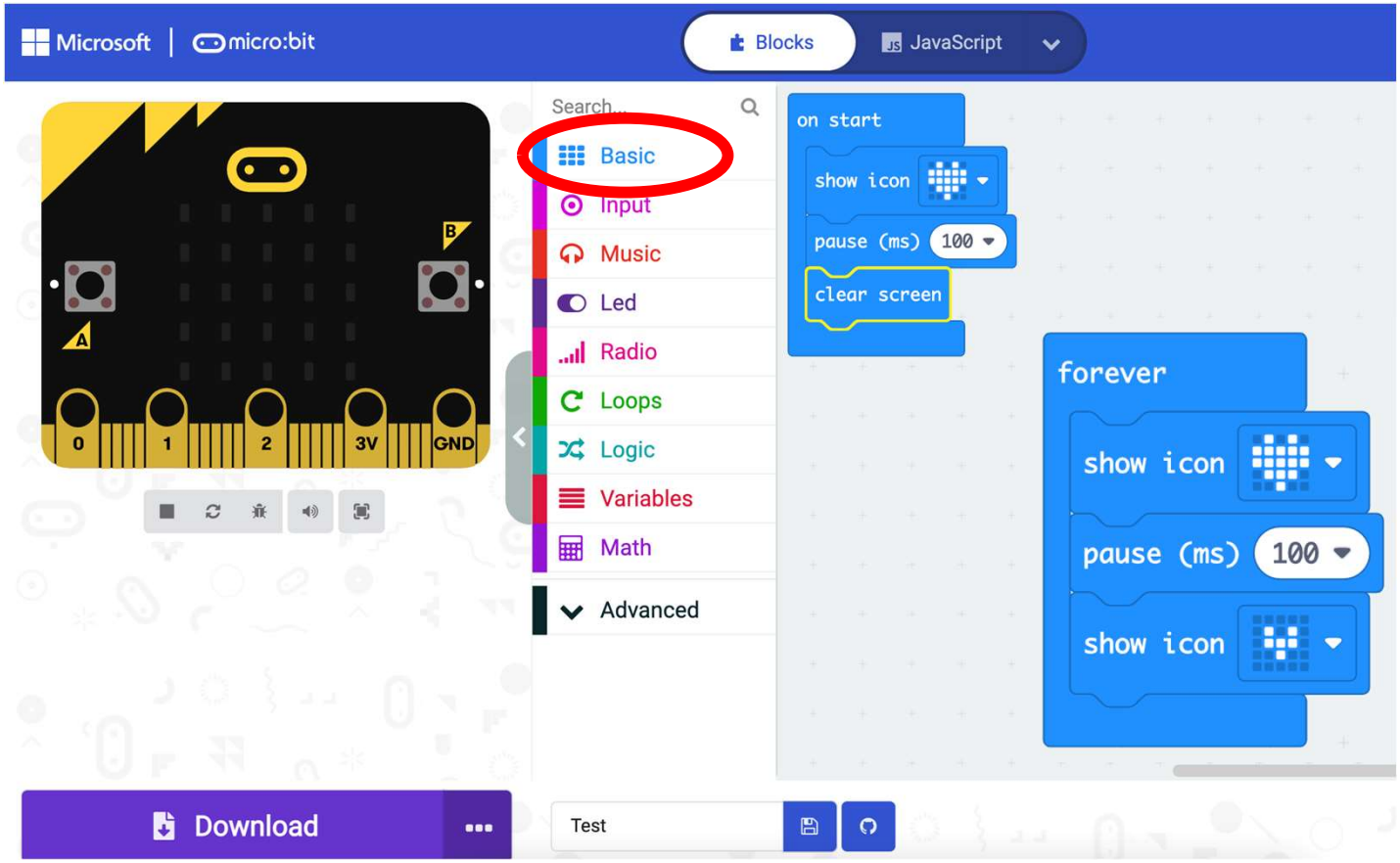
Let us code!

1. Open Google Chrome web-browser
2. Navigate to https://makecode.microbit.org/
3. Select "New Project" and type in a name for your project, e.g. “My First”.





Micro:bit - Let us code!



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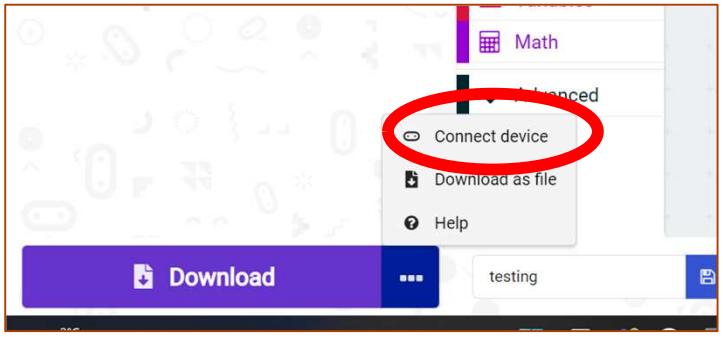
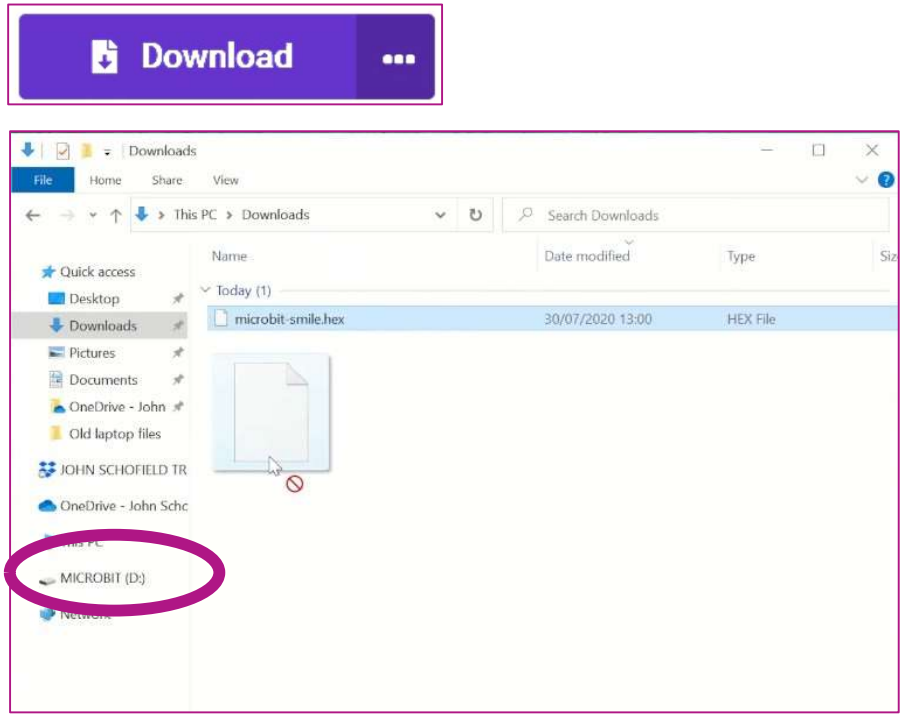
Flashing Program: Direct Flashing

1. From your project window, click on the three dots next to Download and select "Connect Device".
2. Click "next" twice and select your micro:bit.
3. Once connected, click the "Download" button.
4. Your code will be sent to the micro:bit and the amber light on the back of the micro:bit will be flashing while the download is in progress.



Flashing Program: Drag and Drop

1. Click "Download" and save your code as a .hex file in your computer.
2. Drag and drop the .hex file to the micro:bit drive shown in your file explorer.



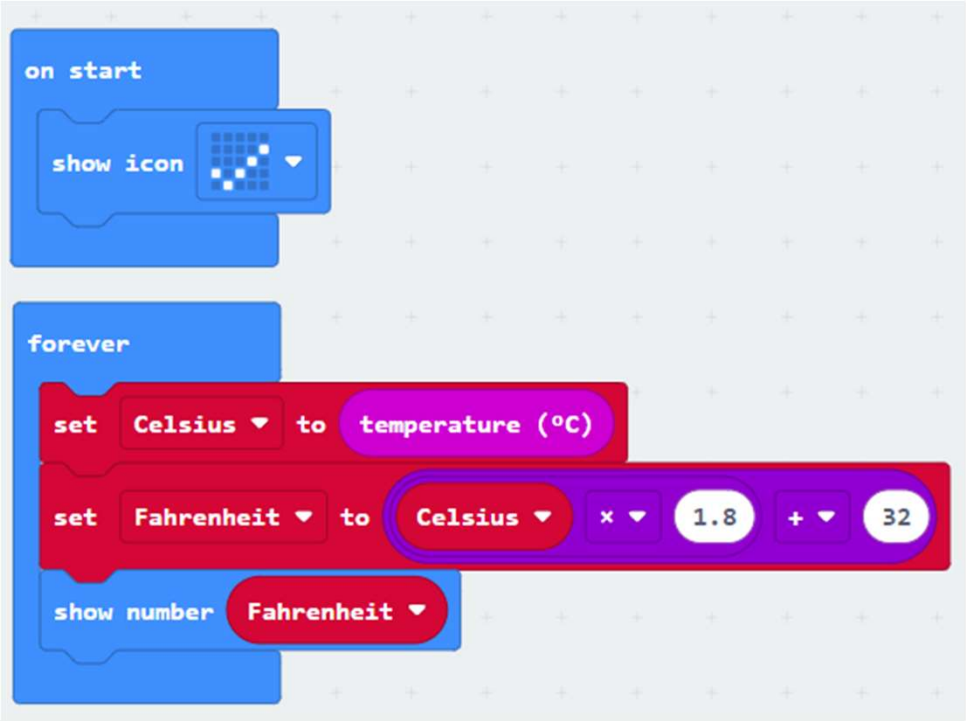
Activity-1: Temperature Monitor

Code the micro:bit to display temperature (in Fahrenheit).

Input:
Temperature sensor.

Output:
Display current temperature (in Fahrenheit) on the micro:bit

Fahrenheit = (Celsius * 1.8) + 32



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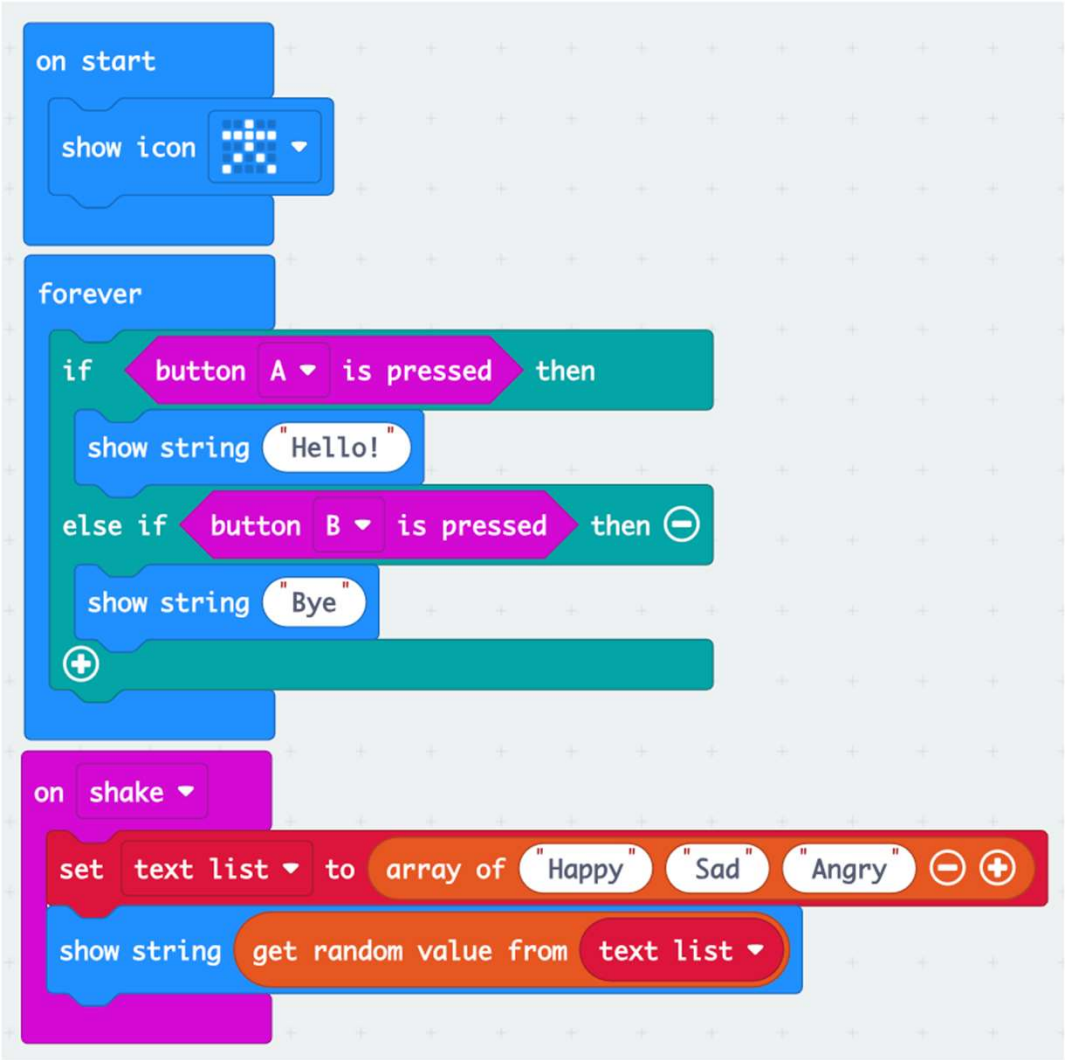
Activity-2: Exploring Various Inputs



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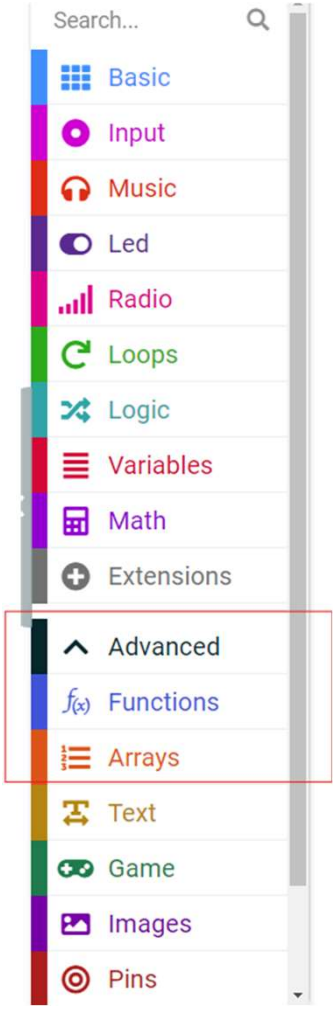
Activity-3: Fortune Teller!

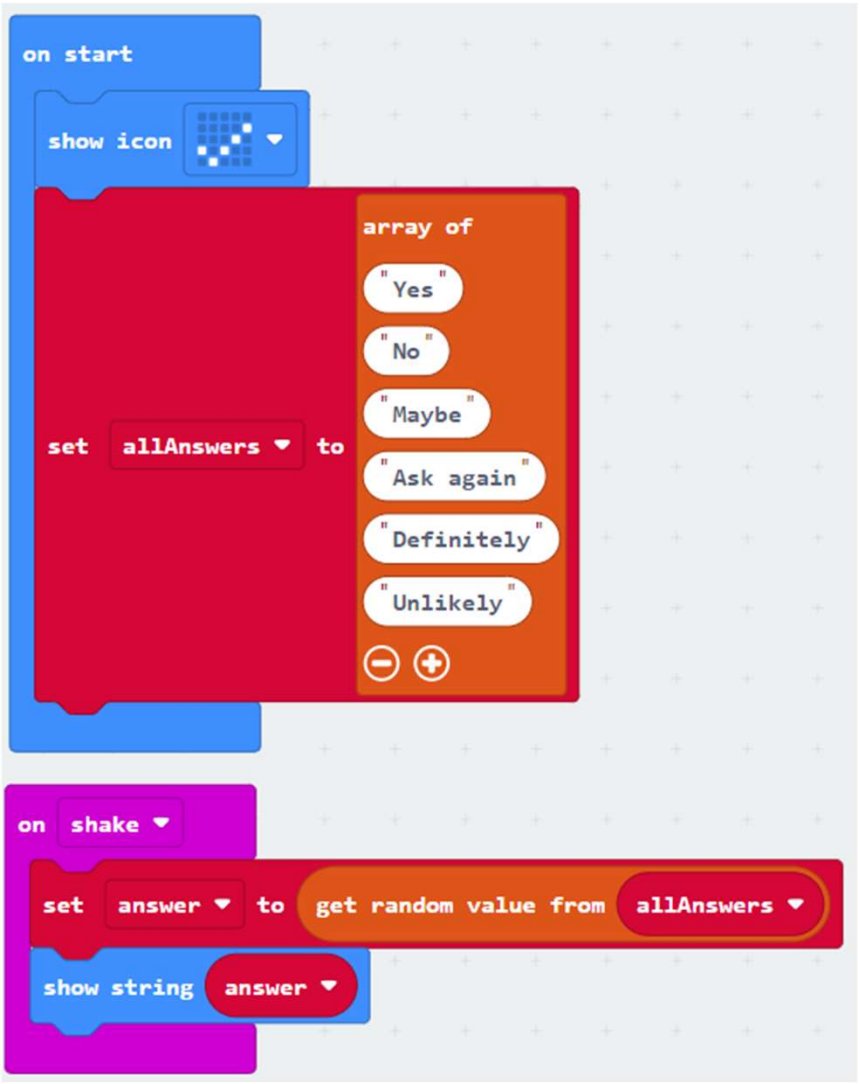
Goal of this exercise is to create a fortune teller game like magic 8 ball!

1. From the “Advanced” section create an array of answers.
2. On shake pick a random answer from the array.
3. Display the answer.

Note: Arrays are kind of variable that are used to store multiple values.
Example,
allAnswers = ["Yes", "No", "Maybe", "Ask Again", "Definitely", "Unlikely"]

Activity-3: Code





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Activity-4: Classroom Noise Monitor!

https://www.mdhearingaid.com/blog/decibel-chart/

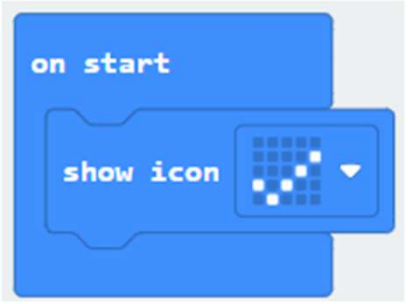
Goal of this exercise is to create a noise monitor

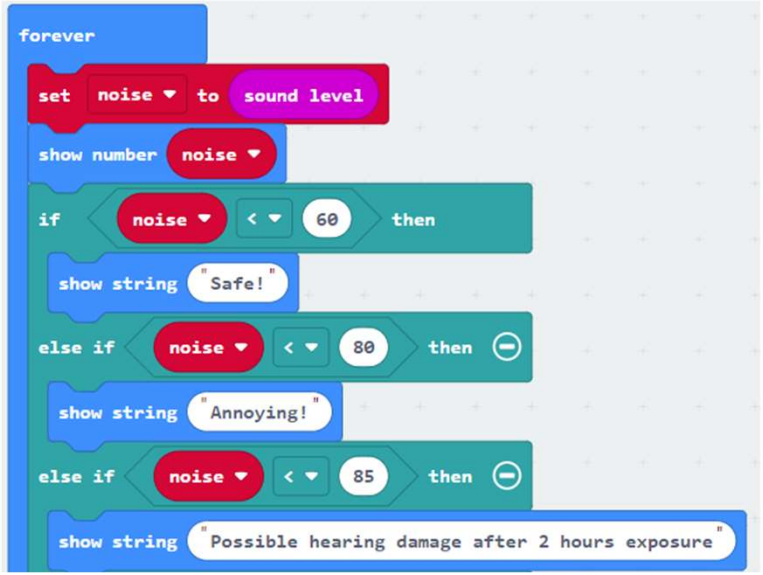
1. Sense the sound level using micro:bit sensor.
2. Display message based on the noise level.

Noise Level	Possible Damage
<60	Safe
60-80	Annoying
80-85	Possible hearing damage after 2 hours of exposure
85-95	Possible hearing damage after 50 minutes exposure
95-100	Possible hearing damage after 15 minutes exposure
100-110	Possible hearing damage after 5 minutes exposure
110-150	Possible hearing damage within 1 minute
150+	Damage immediately

Activity-4: Classroom Noise Monitor!

https://www.mdhearingaid.com/blog/decibel-chart/





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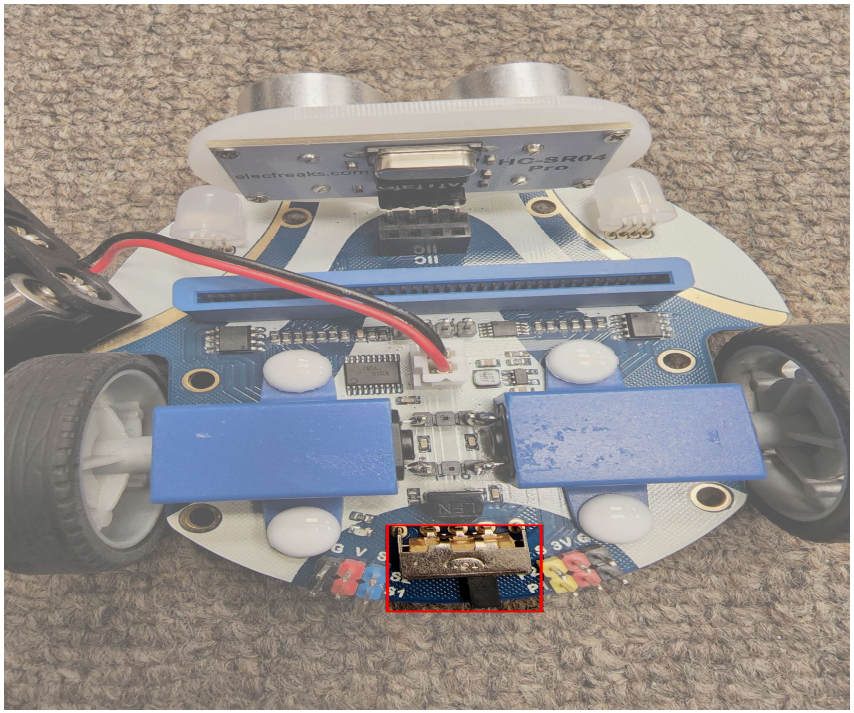
Introduction to Cutebot

https://www.elecfreaks.com/learn-en/microbitKit/smart_cutebot/cutebot_car.html

ON/OFF Switch

- There is a **black** ON/OFF switch and a status LED.



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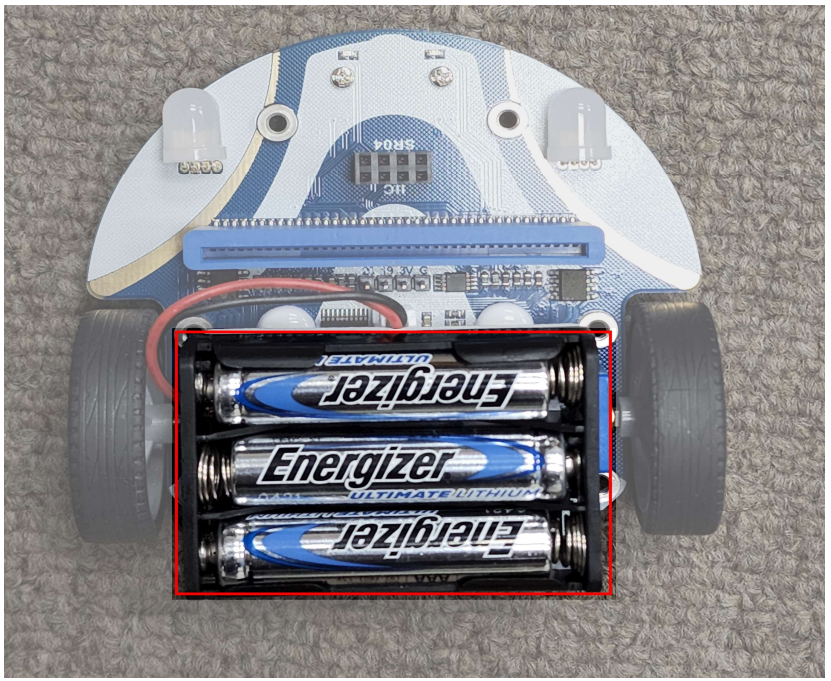
Battery Placement

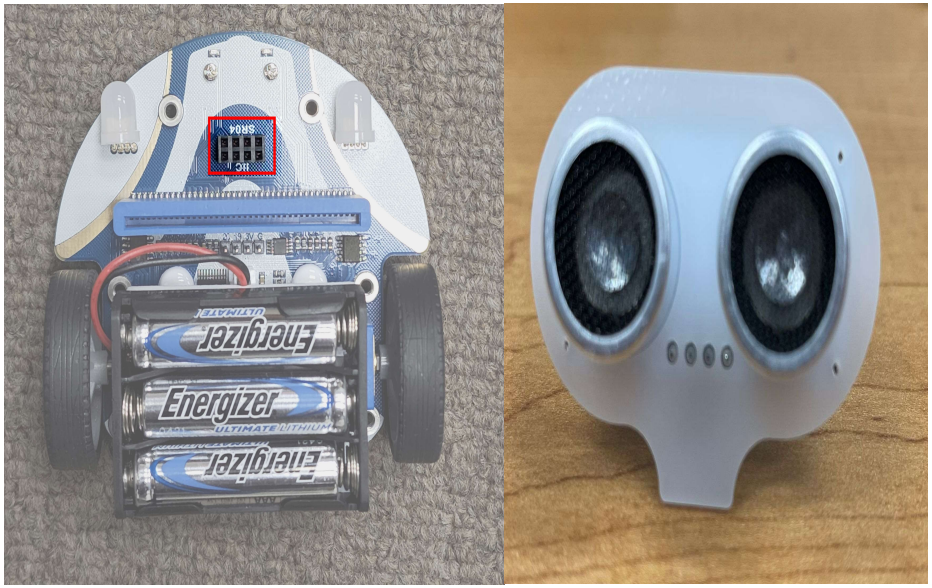
- An expansion board for **3xAAA** batteries is placed on the top of the Cutebot (and behind the micro:bit slot).



Ultrasonic Sensor

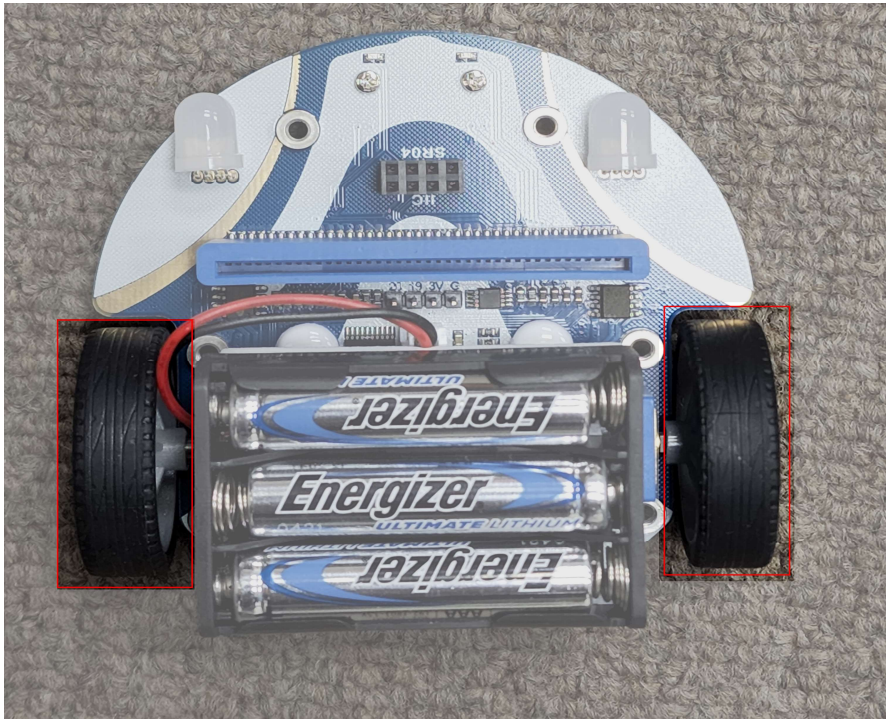
- The red highlighted part of the Cutebot has an **ultrasonic sensor** connection SR04 in the front top part of the Cutebot to connect ultrasonic sensor.

- The ultrasonic sensor helps the Cutebot to sense object in-front of it and measure the distance of the Cutebot from the object.



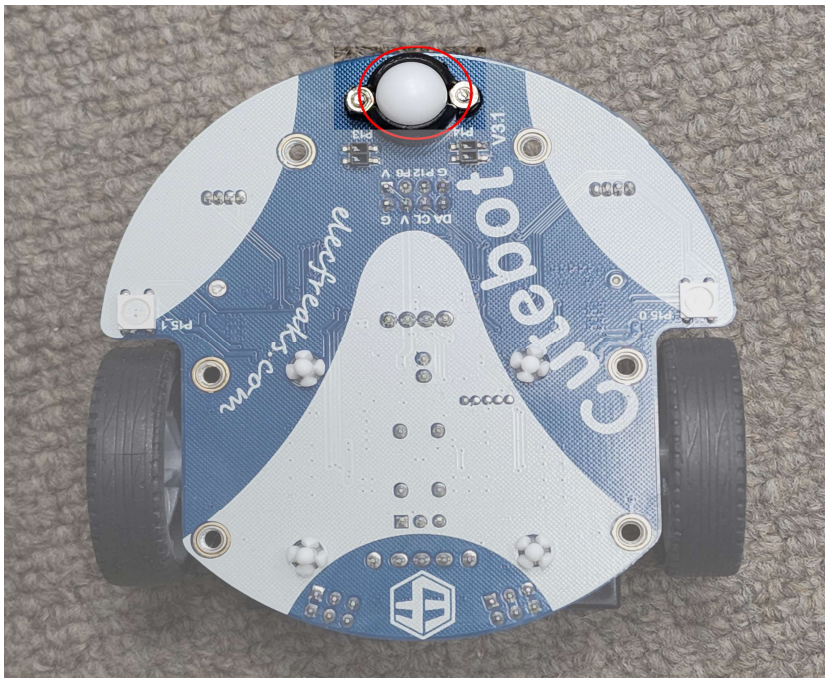
Wheels

- Two wheels on the sides are driven by DC motors (maximum 300 RPM).
- The wheels are responsible for moving the Cutebot forward or backward.



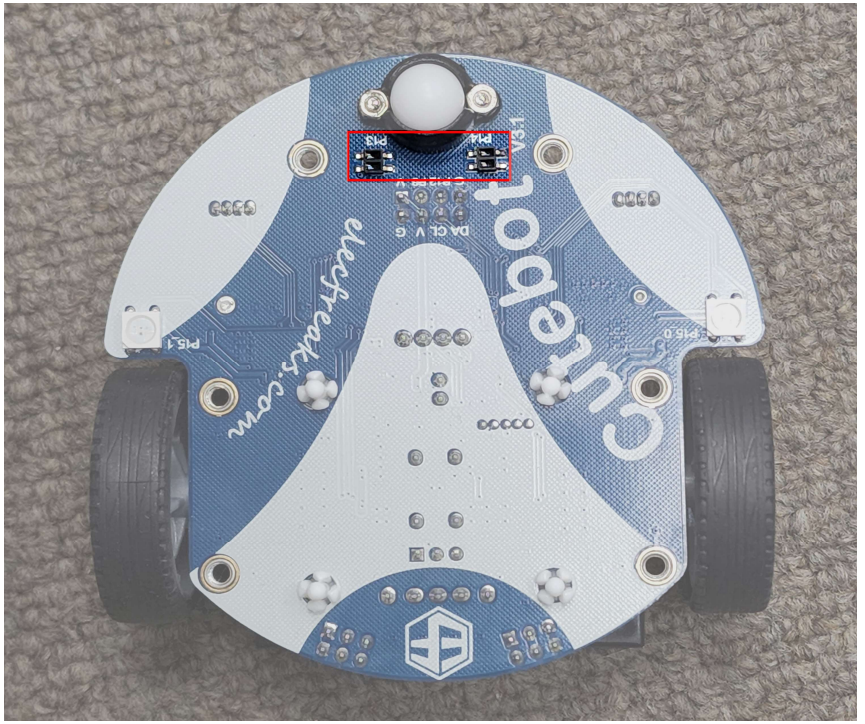
Universal Wheel

- A white universal wheel is placed in the front bottom of the Cutebot.
- The purpose of this feature is to steer the Cutebot in all directions.



Line Tracking Sensors

- The highlighted part shows 2-line tracking sensors.
- The purpose of line tracking sensors is to detect broad lines and their edges.



Coding the Cutebot

In a Chrome browser, go to: https://makecode.microbit.org

1. Create a **new** project and give it a unique name
2. Click "Extensions" from the side drawer.
3. Search for "cutebot".
4. Select Cutebot to add it to your project.

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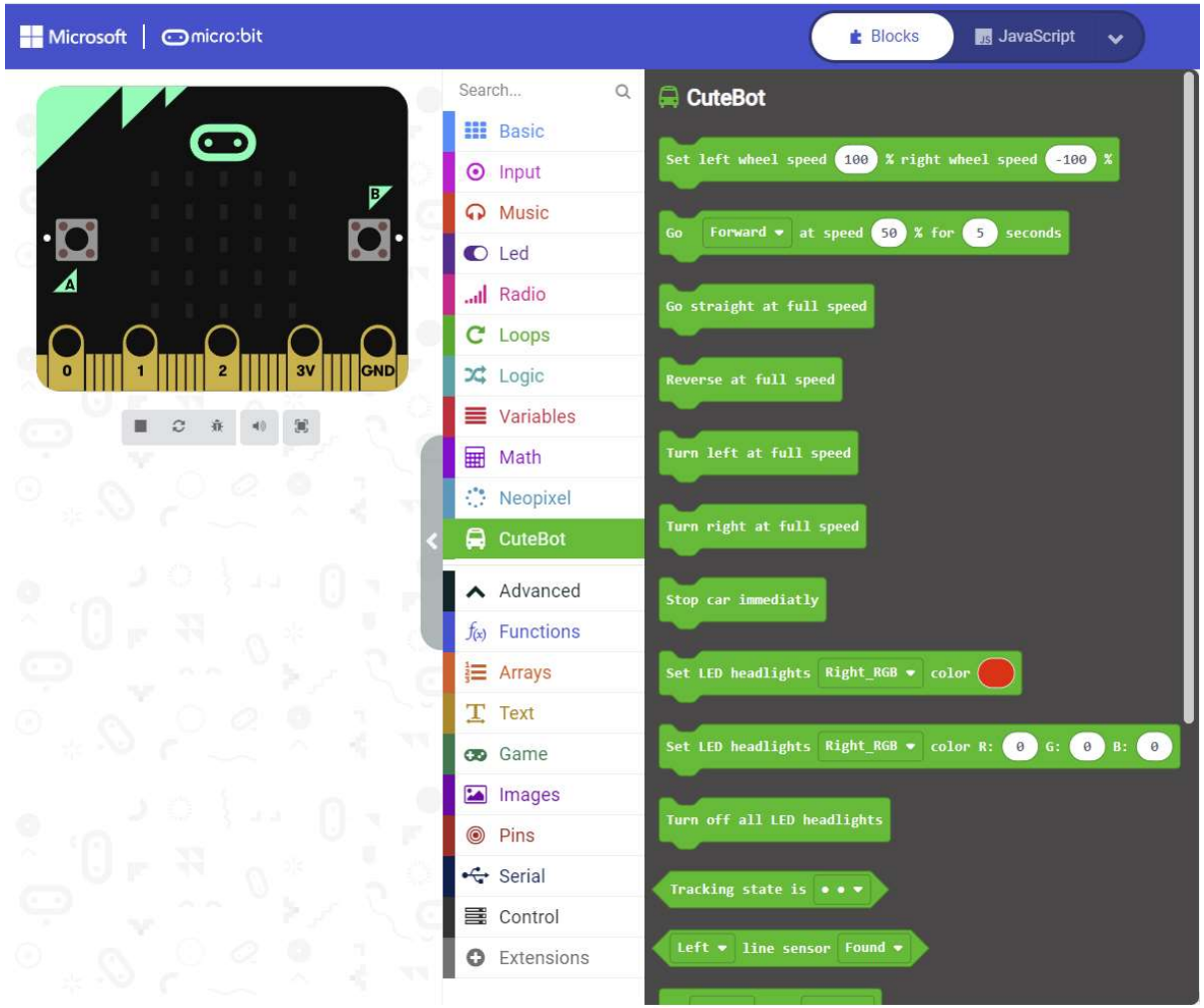
Coding the Cutebot



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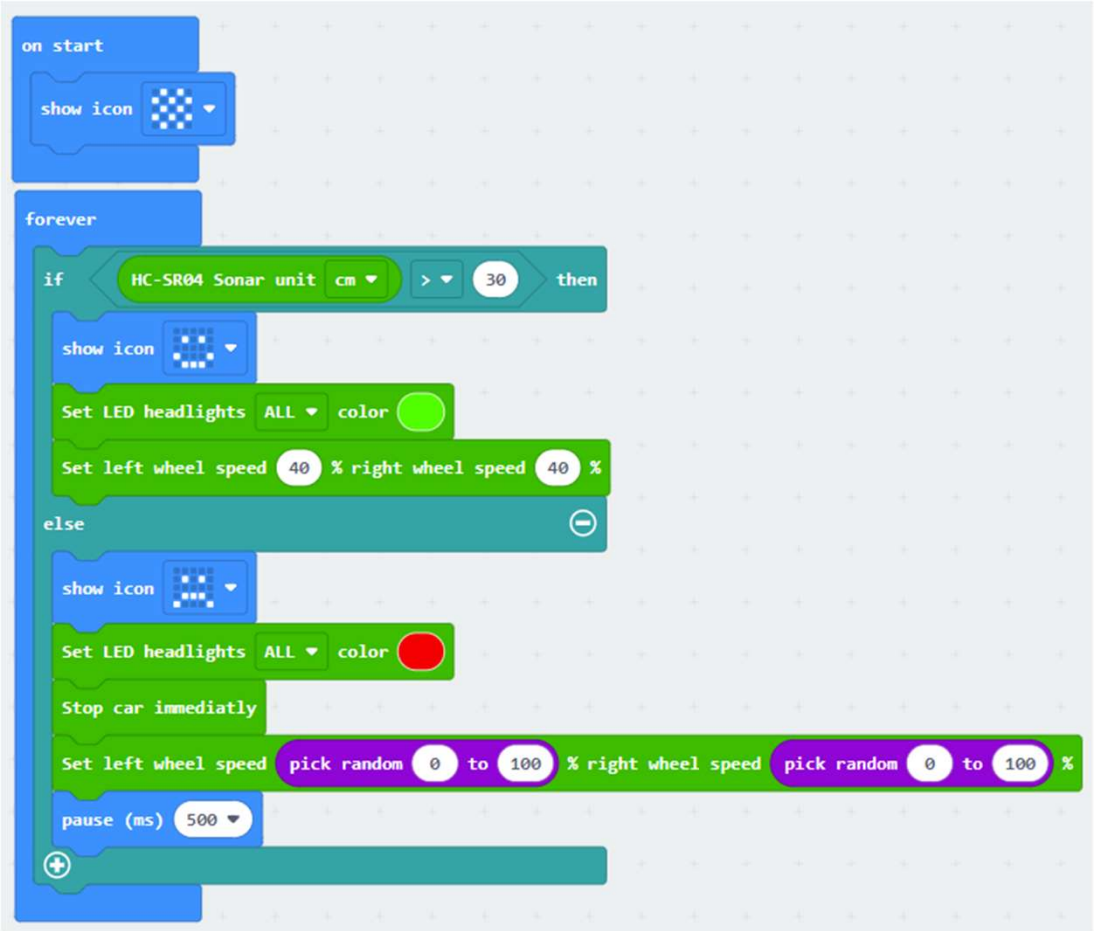
Activity-1: Don’t Crash

Goal: The cutebot will move around freely with the headlights on, avoiding the obstacles in front of it.

1. If no obstacle, go forward with green headlights.

2. Else, turn the headlights to red, stop the car, and try to go in a different direction to avoid obstacles.



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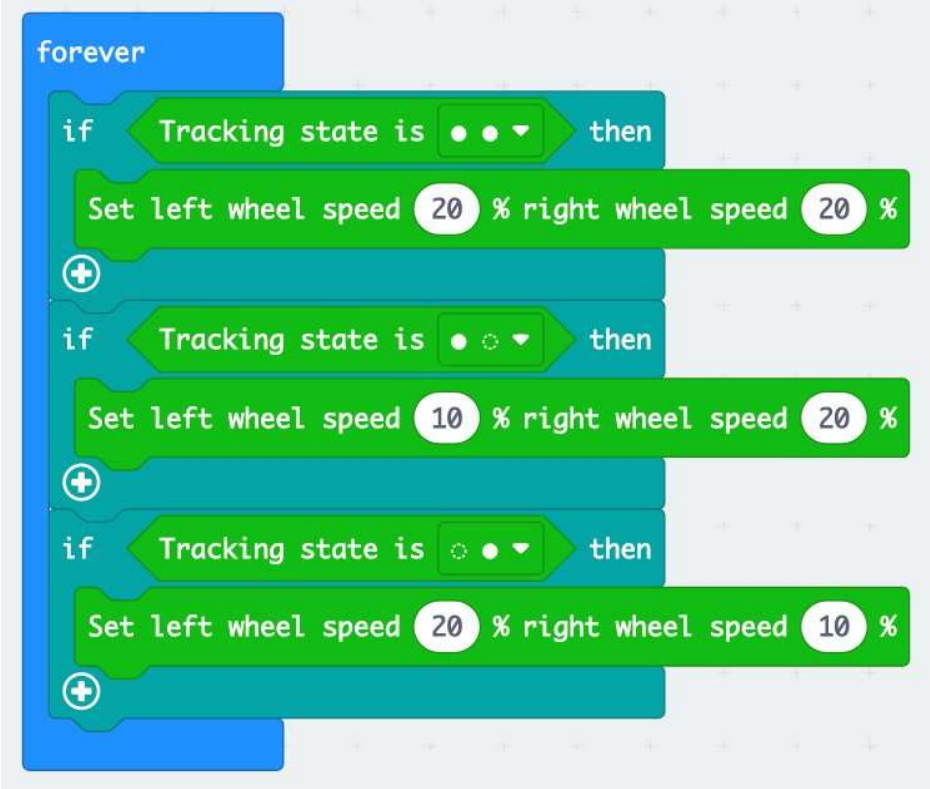
Activity-2: Line Following

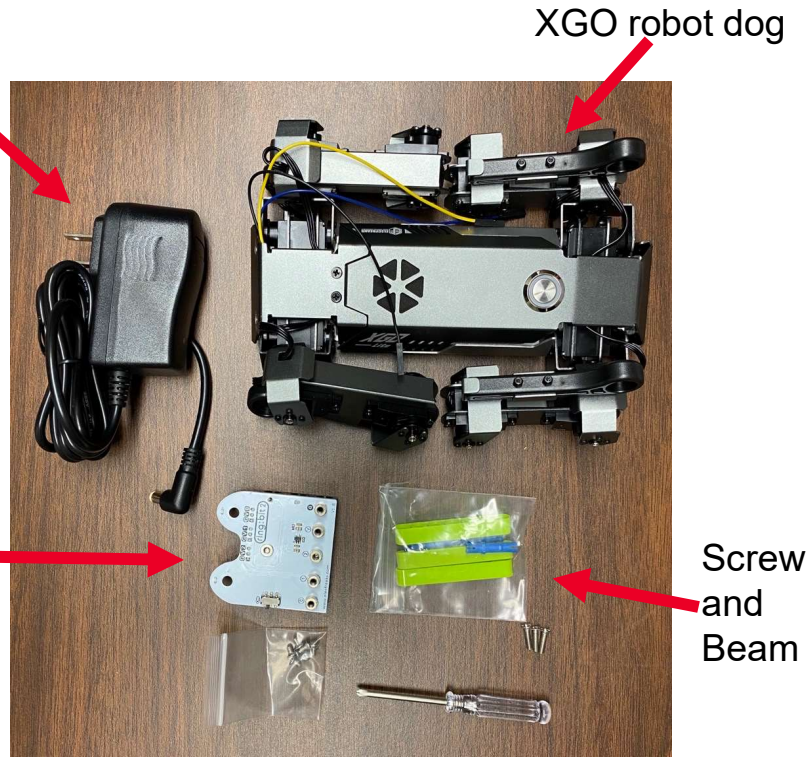
Goal: The cutebot will drive along the black line and will adjust to going back to the black line if any deviation happens.



Meet the dog!

https://www.elecfreaks.com/learn-en/microbitKit/microbit-xgo-robot-kit/microbit-xgo-robot-kit-Introduction.html

- Aluminum alloy shell (NW 500g)
- Built-in battery (120min in one charge)
- Each foot has three servos to allow a flexible and smooth movement
- Built-in actions, e.g., sit down, look for food, etc.



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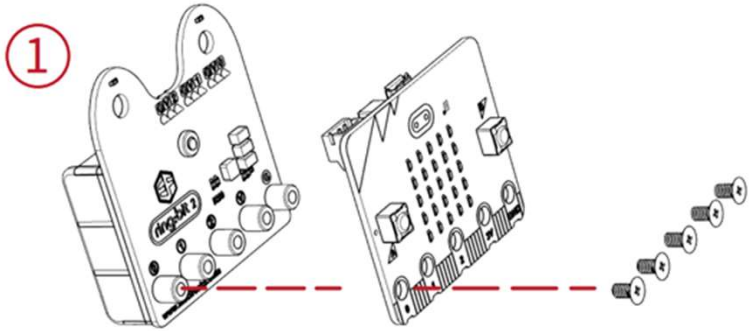
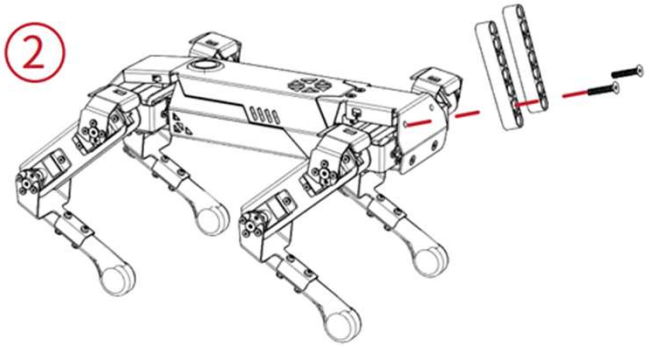
Assembling

- **Step-1:** Attach the micro:bit to the ring:bit expansion board using the short flat head screws

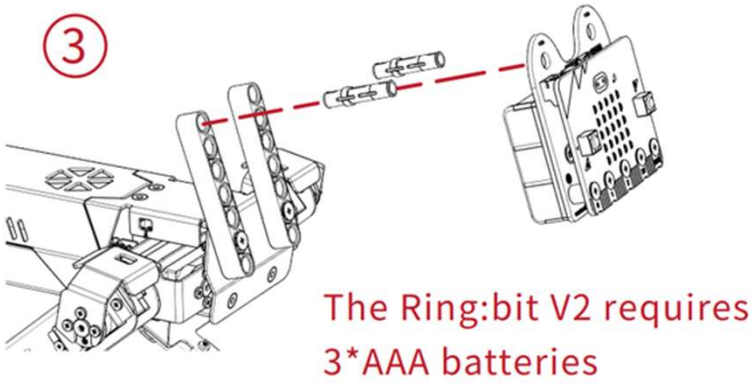


- **Step-2:** Use the longer flat head screws to fasten the seven-hole beam to the corresponding screw holes on the XGO

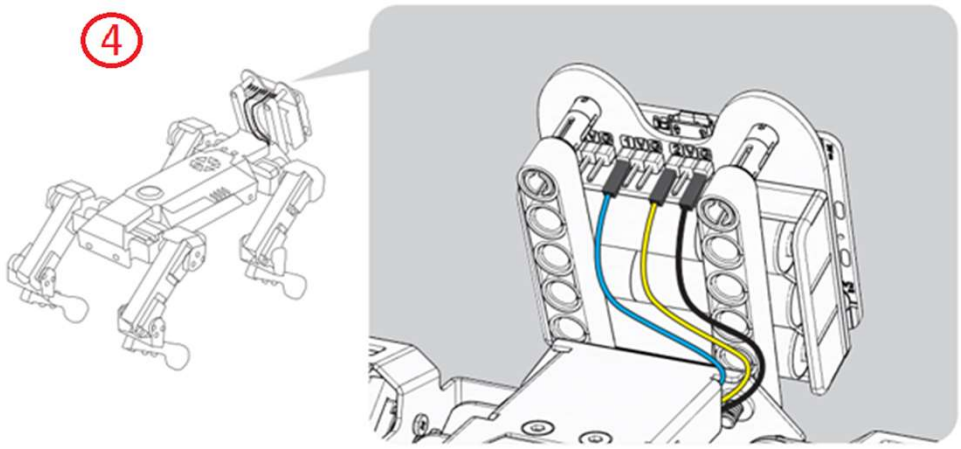


Assembling Contd.

- **Step-3:** Add 3xAAA batteries and mount the ring:bit expansion board with the micro:bit installed to the seven-hole beam using the long pins



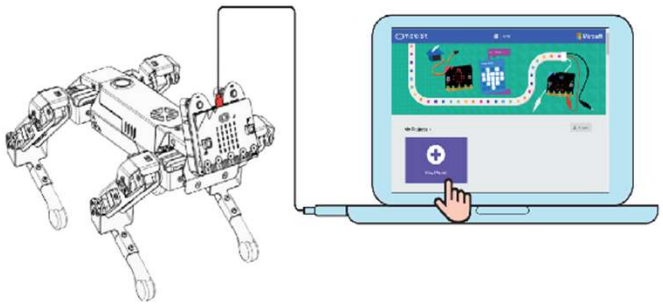
- **Step-4:** Connect the DuPont cables (Yellow, Black, and Blue) from the XGO to the corresponding ports of the ring:bit
- Blue DuPont cable is connected to port 1, yellow DuPont cable is connected to port 2, and black DuPont cable is connected to port G

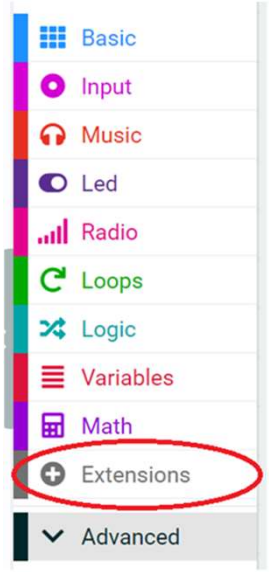


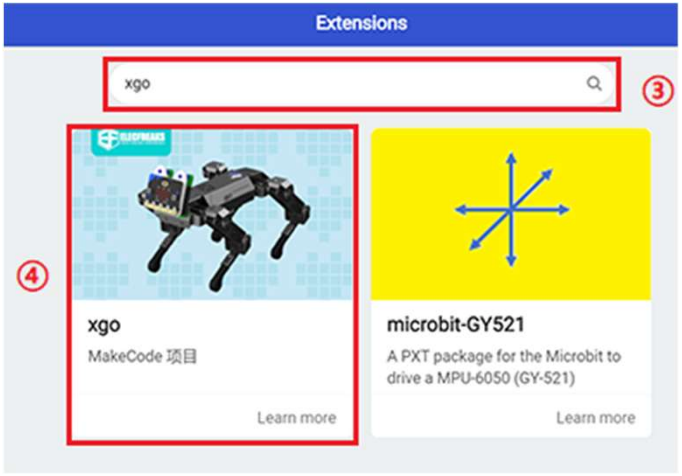
MakeCode-Project Setup

https://makecode.microbit.org/

1. Connect your XGO micro:bit to the computer using USB cable
2. Goto the makecode website from Chrome web browser
3. Create a new project, and give it a unique name
4. Click on Extensions
5. Search for XGO
6. Add XGO to your project







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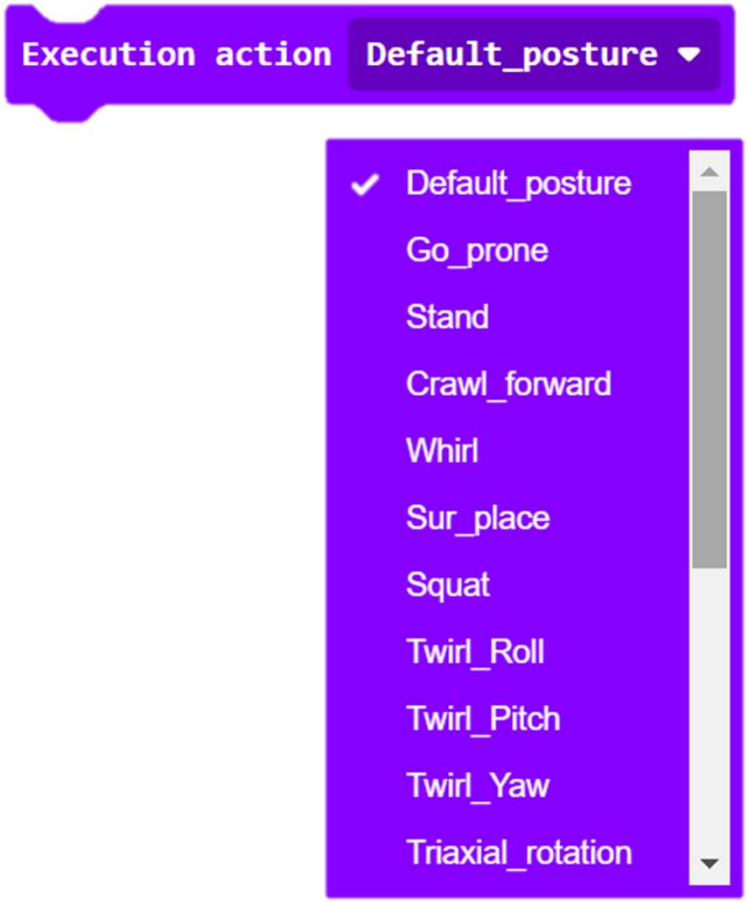
Programming XGO - Initialization

- Initialize the XGO on start

- Choose a default XGO action from the following list



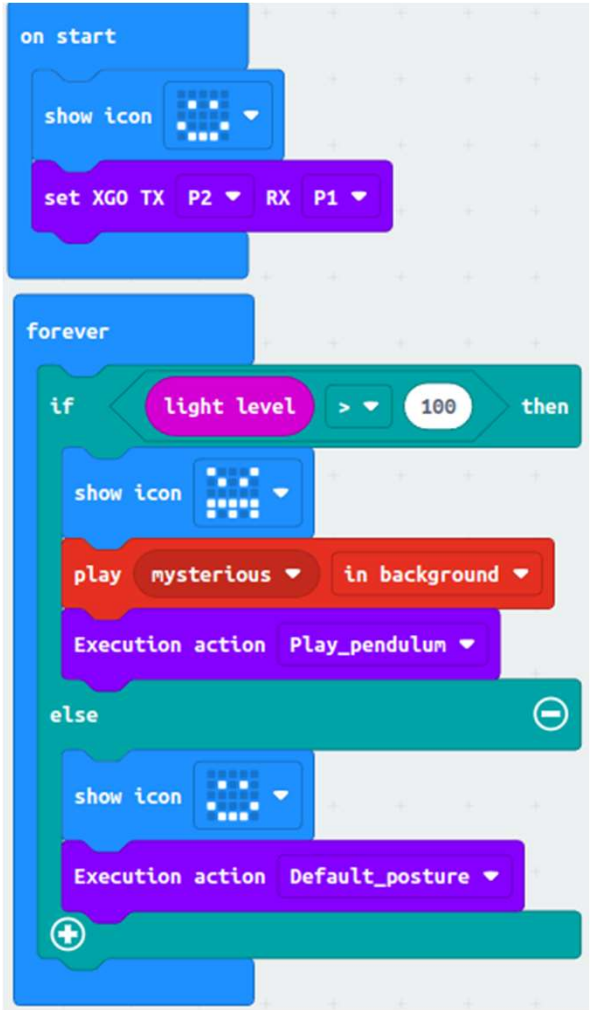
Activity-1: Beware of Dog!

Goal: The dog starts scaring as soon as the light turns on to indicate that someone has entered the room.

1. If light level > 100, it means an intruder has entered the house.

2. To scare the intruder, show a scary face and play a mysterious sound in the background while moving like a pendulum.

3. Else, show a happy icon and stand in the default position.



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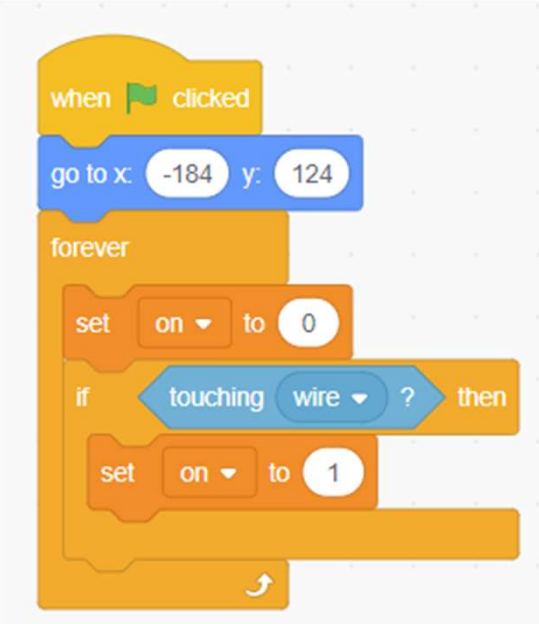
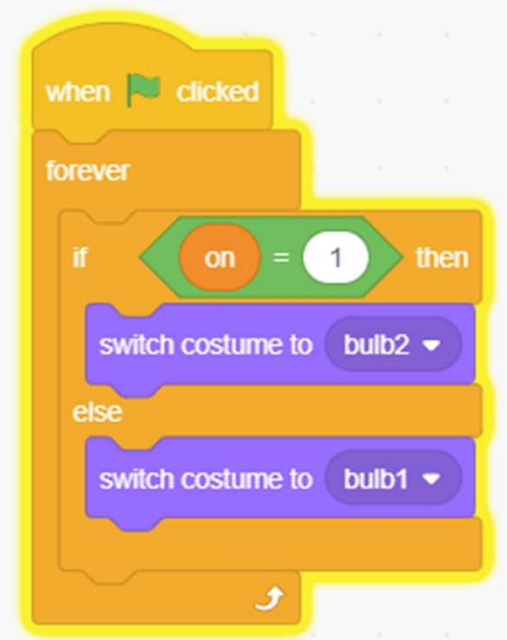
Bulbs and Battery Activity: Sample Code

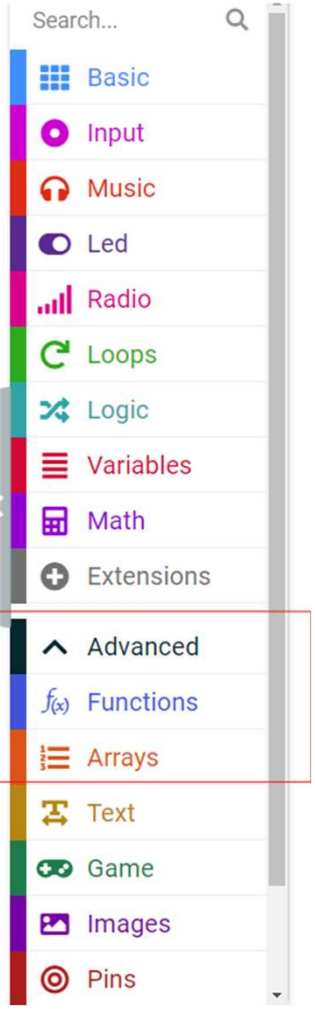
- Code for the battery

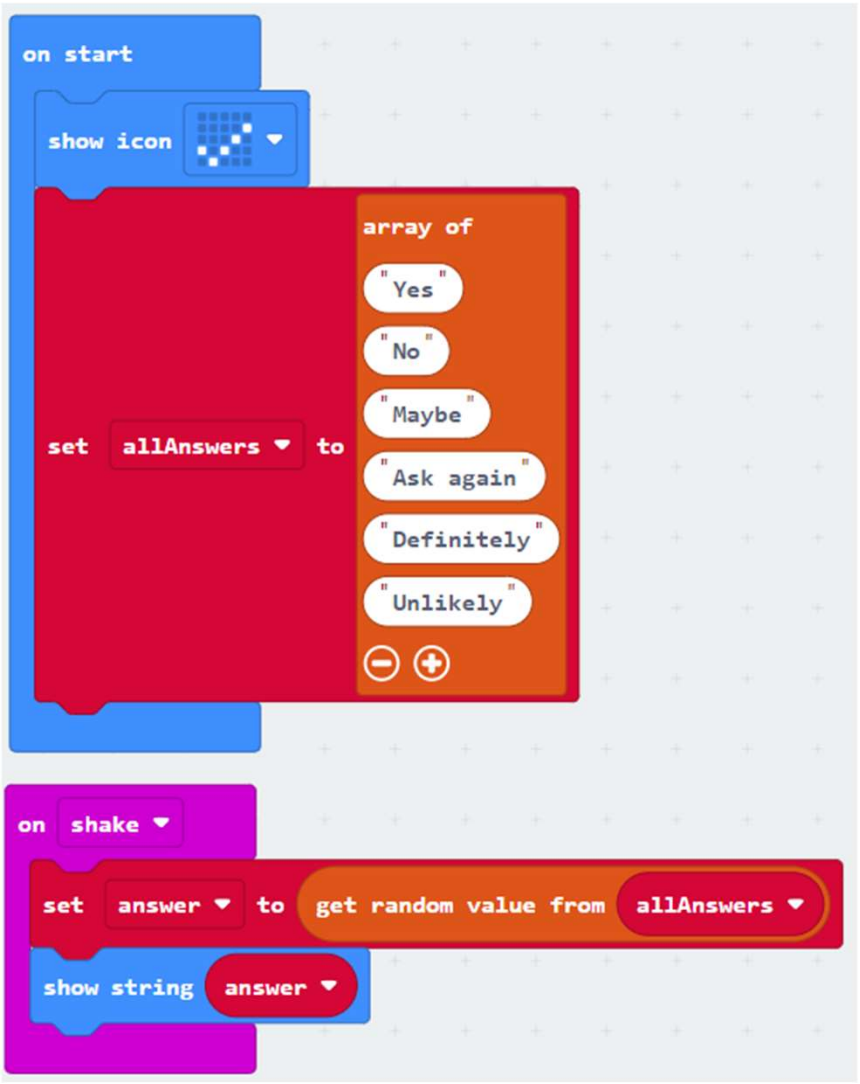


- Code for the bulb



Fortune Teller: Sample Code





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Activity-2: BINGO Bot

Goal: The cutebot will generate random numbers while following a black line to complete the bingo.

Expected functionalities:

1. Create a fixed length array that store some numbers and play the role of bingo card.
2. Generate random number and match with the values of the array.
3. If the generated random number matches with any value of the array, remove that value from the array.
4. Keep repeating the process of point 2 and 3 until the array is empty.
5. While doing above mentioned processes, the cutebot will parallelly keep following a black line.
6. When the array becomes empty it will show “BINGO!” on the microbit and the cute cutebot will spin in one place and play a happy music.

Activity 2: Shake my hand

Goal: The dog starts shaking hand when you give your hand forward while holding a micro:bit.

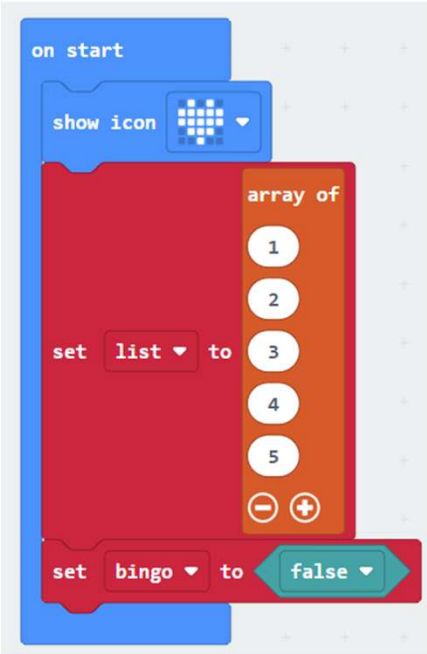
Expected functionalities:

1. The person will carry a micro:bit in his or her hand which will send a radio signal to the robot.
2. The robot dog will receive the signal.
3. Based on the strength of the received signal, the robot dog will understand if the person has forwarded his/her hand for handshake or not.
4. If the signal strength is strong, the dog will shake hand, else it will stand in the default posture.

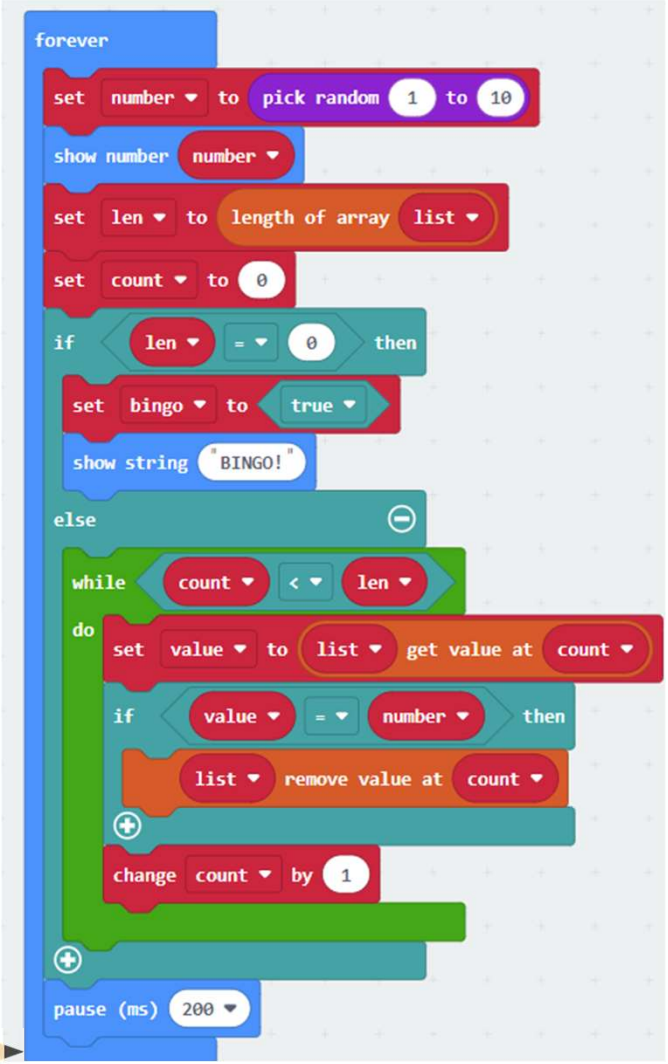
Note: The range of micro:bit radio signal is from –128 to –28, where -128 means the signal is weak and –28 means the signal is strong.

Activity-2: BINGO Bot Sample Code

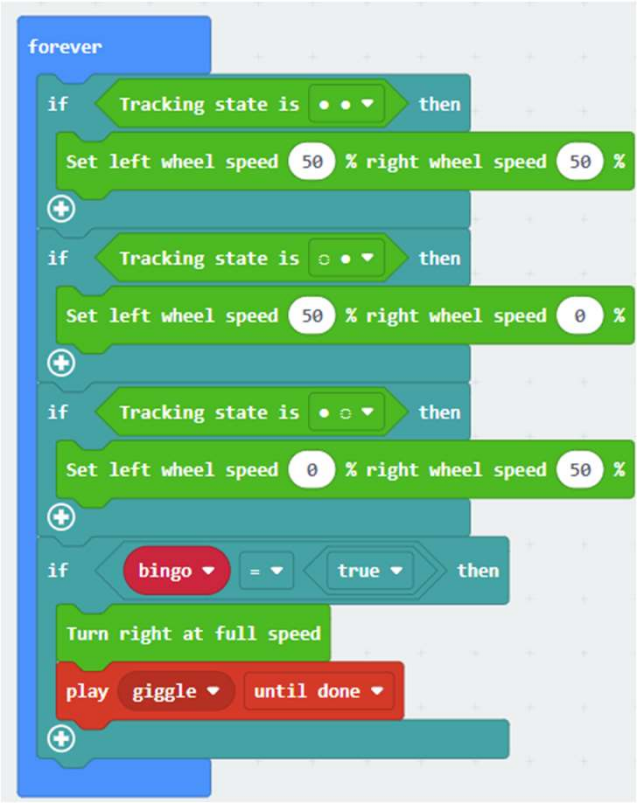
Code for initializing array



Code for making the bingo game



Code for following black line



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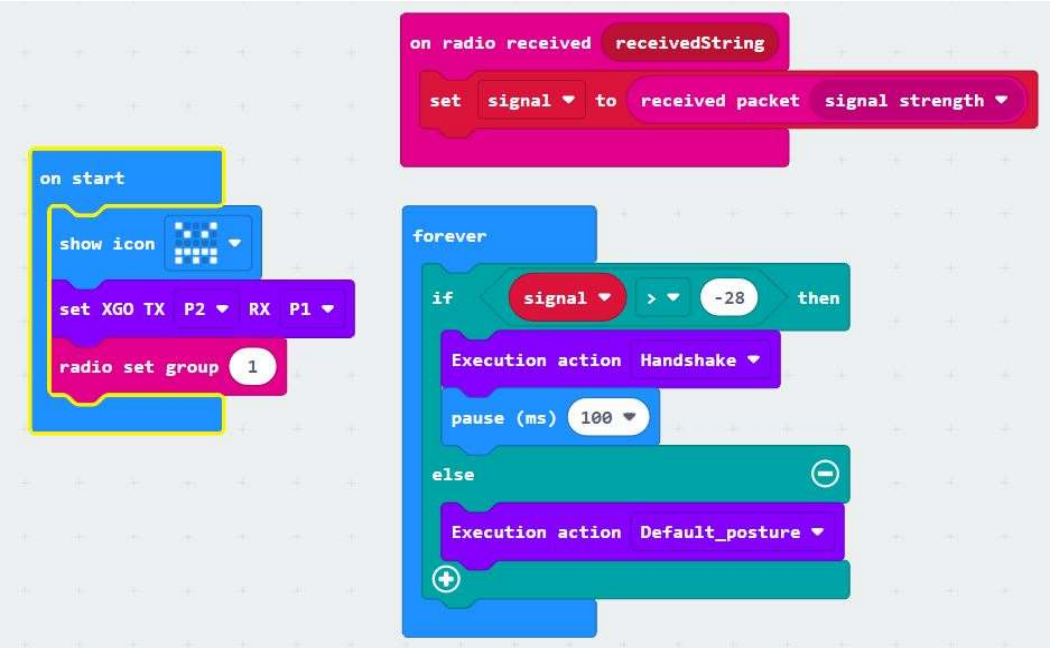
Activity 2: Shake my hand sample code

Code for the micro:bit in a person's hand



Code for the robot dog to shake its' hand based on the received signal

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Thank You

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