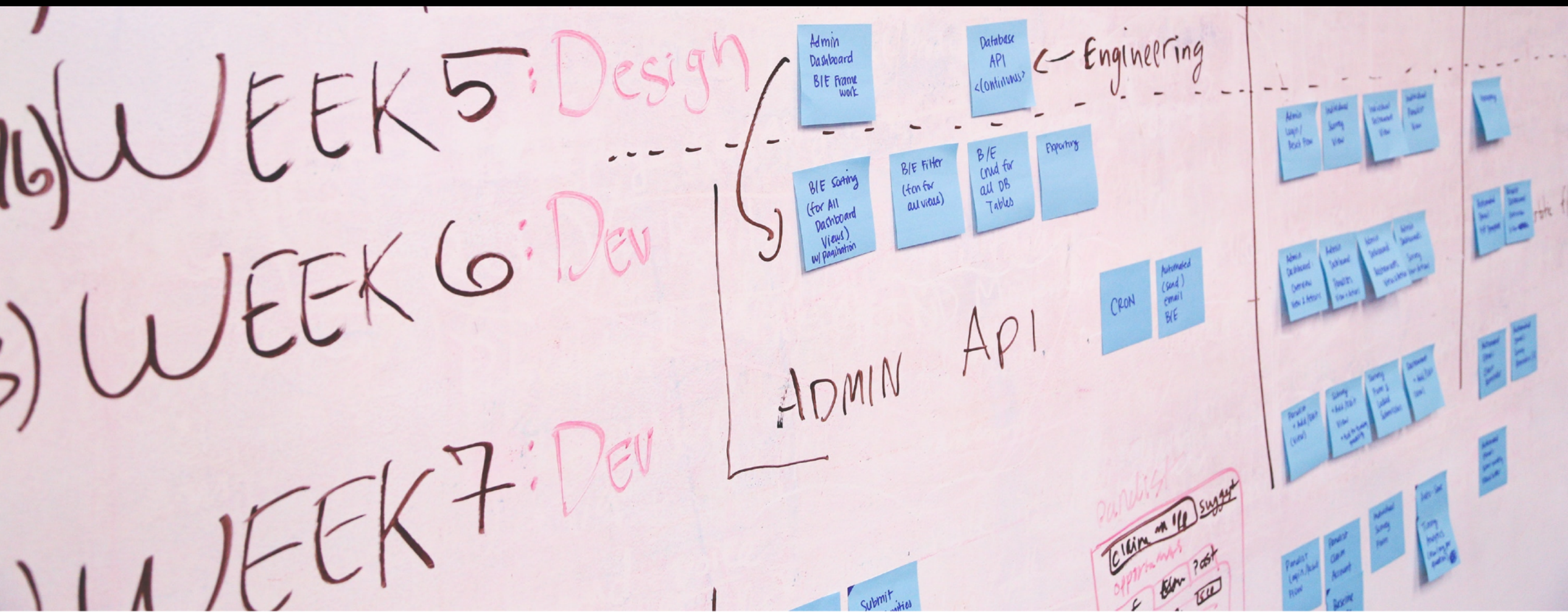


CUHK DATA HACK 2024:

IOT DATA SOURCING WITH MICRO:BIT

Bernard Suen
Center for Entrepreneurship
Chinese University of Hong Kong

Objectives

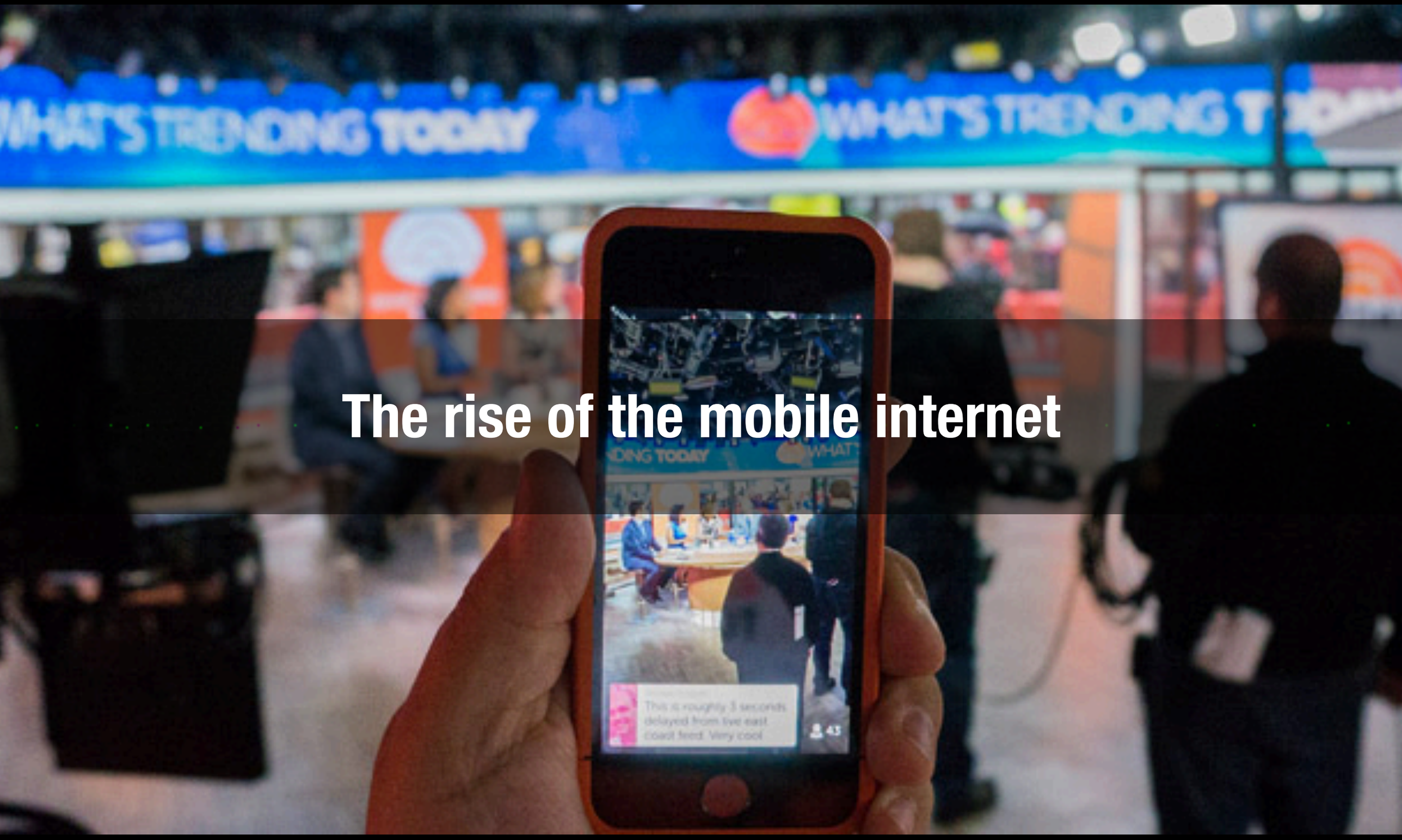
- Overview of the IoT trend —- the development of smart connected products, businesses, and platforms.

- Introduction to Micro:bit as a medium to learn about IoT.

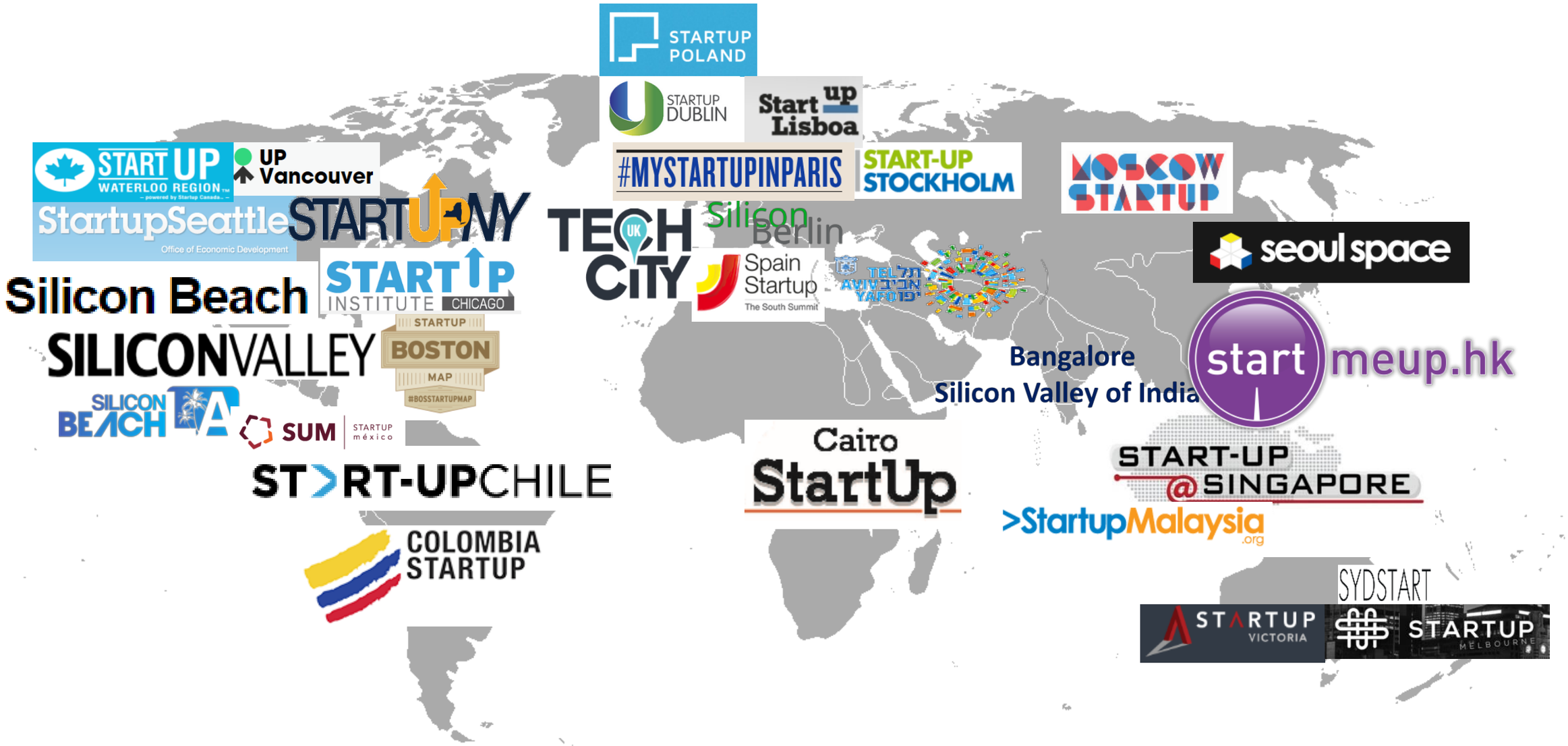
- Build a simple system with input (e.g. sensors, pins and buttons) and output (e.g. actuators and display) devices.

- Data communication with the Micro:bit (e.g. Radio, Serial Port, WIFI, and Bluetooth).

The rise of the mobile internet



Fuelled by the rise of the global startup movement.

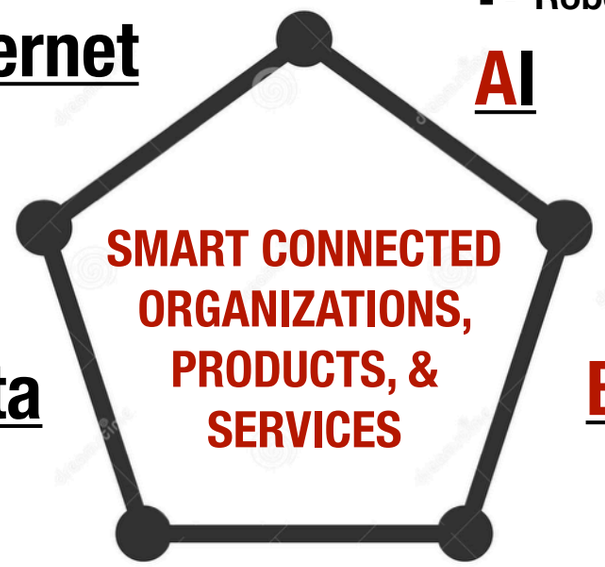


Embodied Internet

- Augment Reality
- Virtual Reality
- Mixed Reality
- Avartar Tech
- Embient & Experience Tech

AI

- Large Language Model (LLM) and Generative AI
- Recommend systems
- Clustering and association
- Classification and regression fitting
- Deep Learning applications in facial, sound/voice, image, and text recognition
- Robotics



Big Data

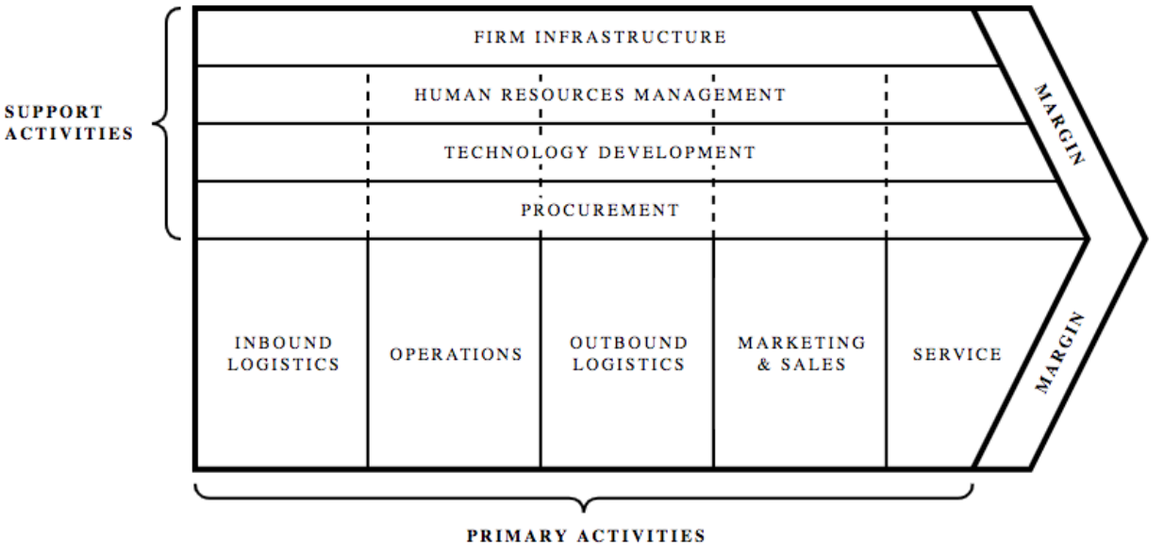
- Assemble structured & unstructured customer data for profiling trends
- Add smart devices & data to network
- Build enterprise data warehouse and data lake
- Enable streaming services

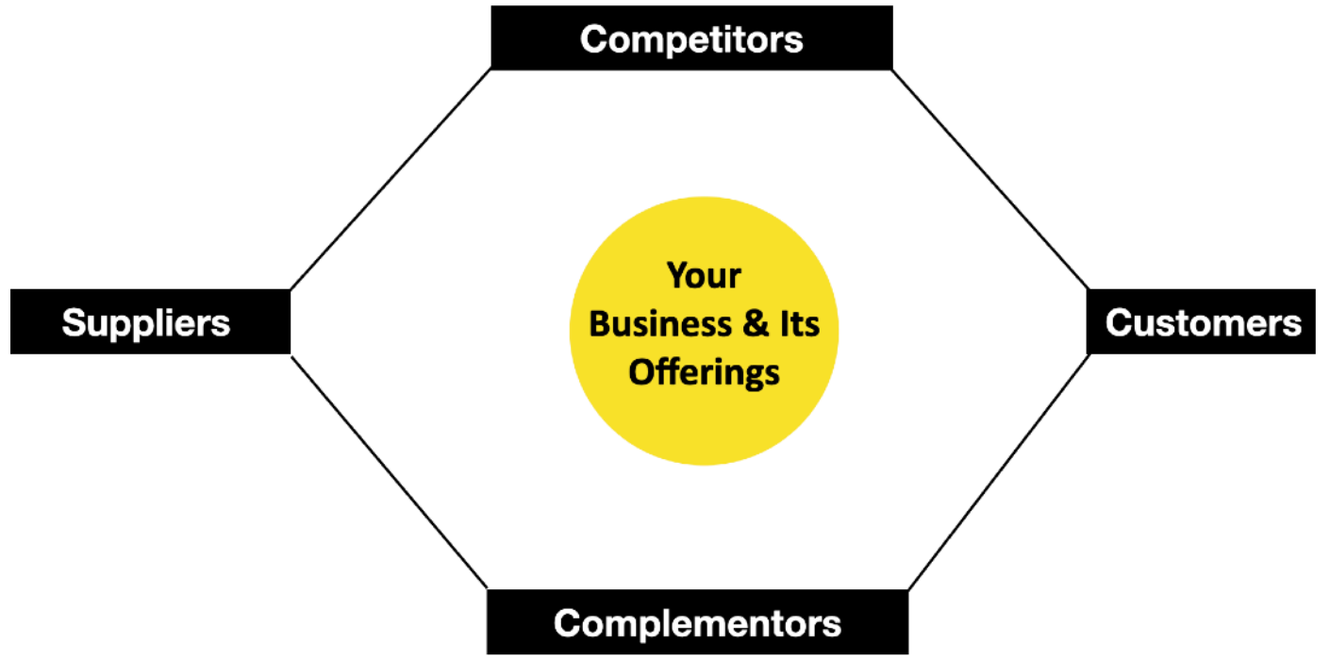
Blockchain

- Tokenize value exchange
- Disintermeded, decentralized, and distributed architecture
- Smart documents and contracts
- Crypto-currency
- NFT/Web 3.0

Cloud Computing

- Outsource data storage and computing
- Outsource hardware maintenance and upgrade
- Outsource big data and machine learning infrastructure
- Scale up flexibility
- Leverage container/serverless tech





Source：Michael Porter’s Value Chain

From Value Chain to Business Platform

Alibaba Group
阿里巴巴集团

Tencent 腾讯

Baidu 百度

HUAWEI

Microsoft

Alphabet

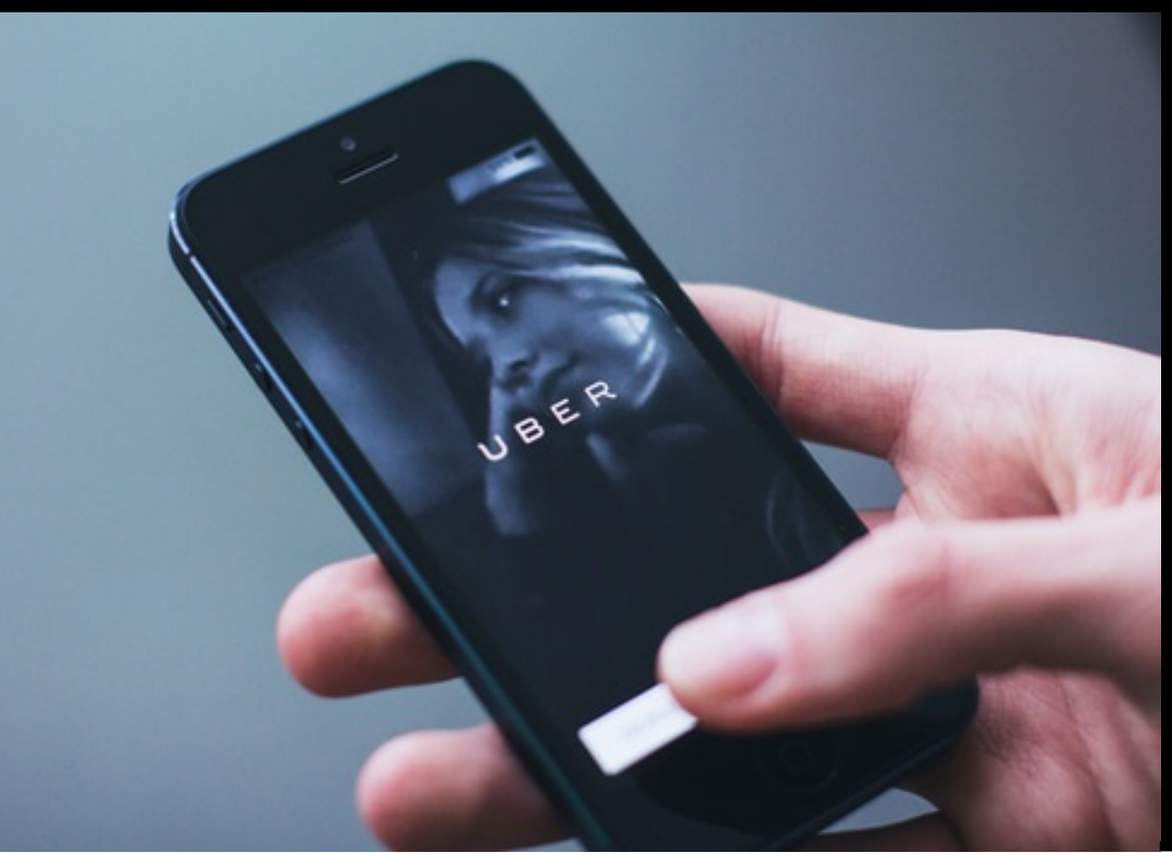
amazon

TESLA

BYD

OpenAI

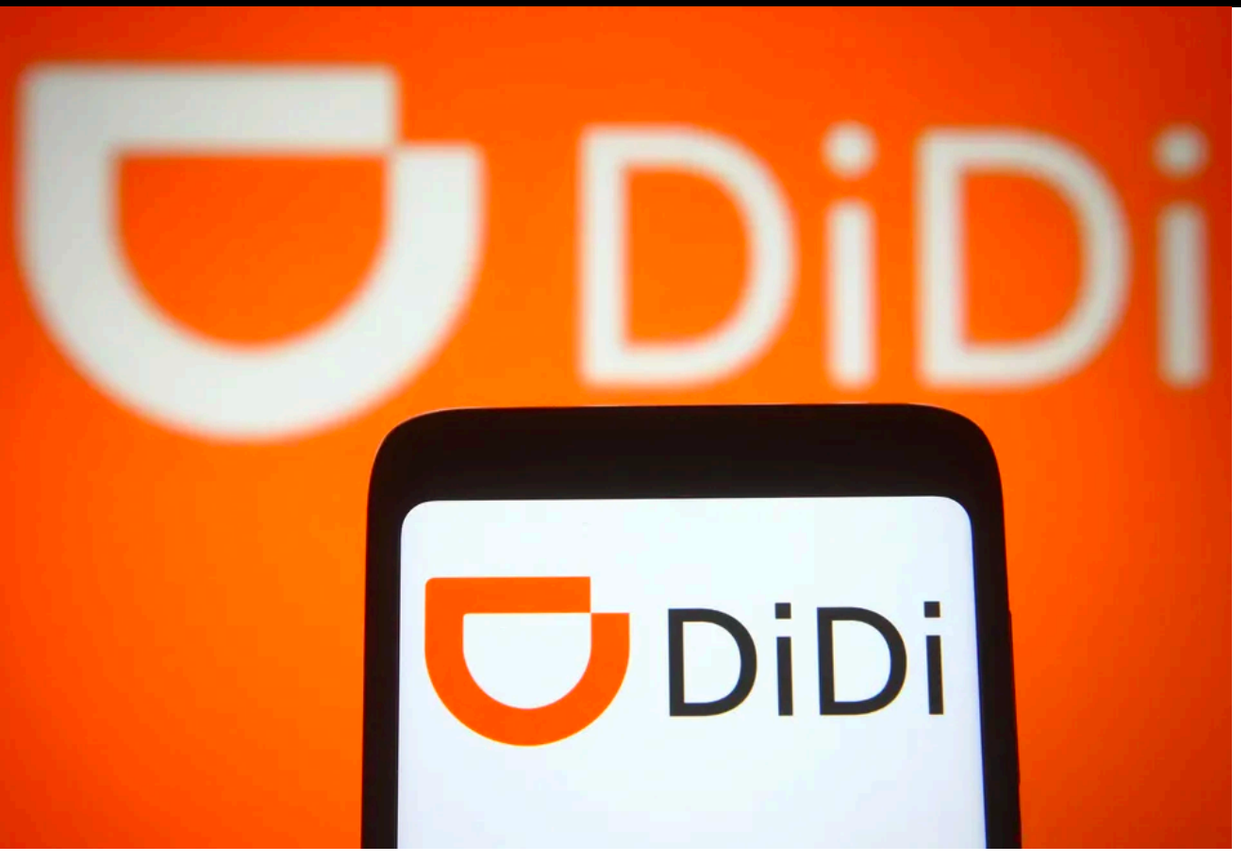
NVIDIA



NETFLIX

airbnb

Industry innovation and disruption comes from digital and technology platforms

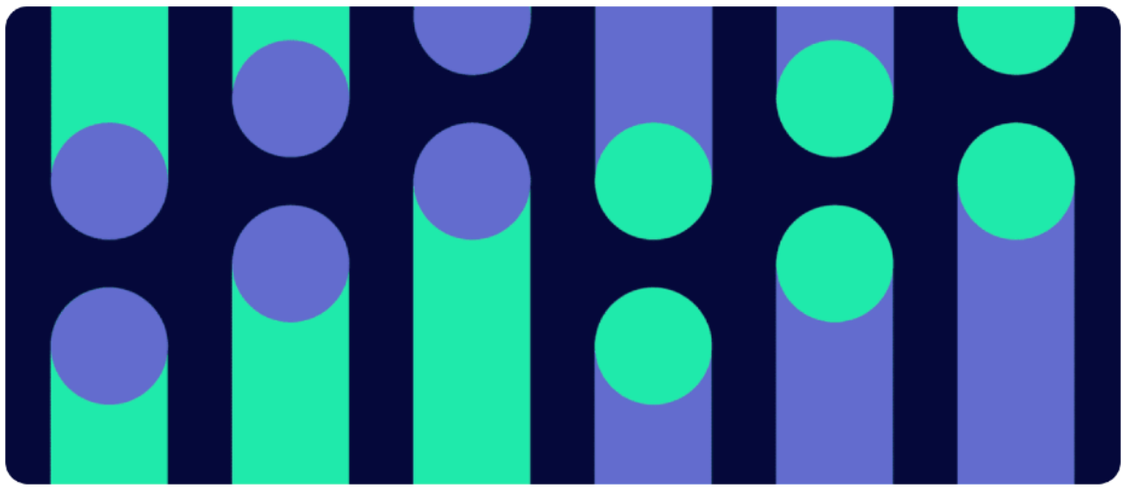


iQIY 爱奇艺

小猪 xiaozhu.com
有人情味的住宿

Industry innovation and disruption comes from digital and technology platforms.

The Power of API for Building Business Platform.



The role of APIs as a product in the API economy

or: How To Participate In The API Economy With Your Own API Marketplace

The API economy represents a pivotal strategy in digital transformation, where organizations unlock their internal capabilities and data to a broader ecosystem of developers, partners, and employees. This approach is key to creating innovative products and services, enabling companies to monetize their internal assets, spawn new revenue streams, and catalyze innovation.

Understanding the API Economy: A Gateway to New Value and Revenue

Source: Apinity

Welcome to the API Economy

June 09, 2016 Contributor: Christy Pettey

Enterprises need to create an industry vision for digital business.

As the Internet of Things (IoT) gets smarter, things using an application programming interface (API) to communicate, transact and even negotiate with one another will become the norm. You can remotely adjust the temperature of a room by using an app that calls the API controlling your thermostat, or when buying movie tickets online, an API is used to verify your credit card information.

> “ The API economy is an enabler for turning a business or organization into a platform.”

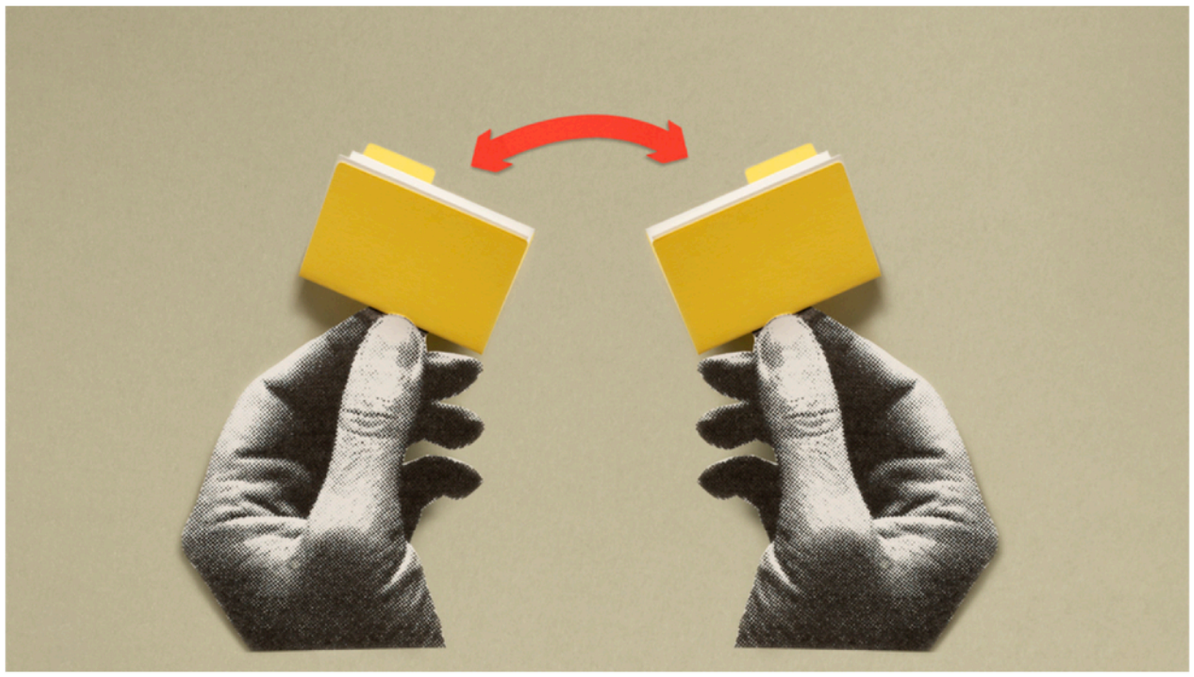
Source: Gartner

Innovation

APIs Aren't Just for Tech Companies

by Tiffany Xingyu Wang and Matt McLarty

April 13, 2021



Source: Harvard Business Review April 2021

Business partners requesting your services through API requests.

Partner A | Partner B | Partner C | Partner D

API Request

API Endpoints

"野餐乐" Picnic App

API Request

API Request

Micro-services provided by you

Micro-services formed the foundation for providing features needed by the application to serve the ultimate users/customers

Micro-services

API Gateway

- Ordering Service
- Payment Service
- Location-based Service
- Weather Service

deliveroo

WeChat Pay | Alipay | PayPal

OpenWeather

Data-driven Product:

Focus on 4 essential questions to ask in implementing platform strategy.

Two key Platform questions to ask:
Which platform should we leverage to offer our services and what platform should we build to create an eco-system of suppliers, customers, and partners to make our platform more sticky, scalable, and competitively more sustainable.

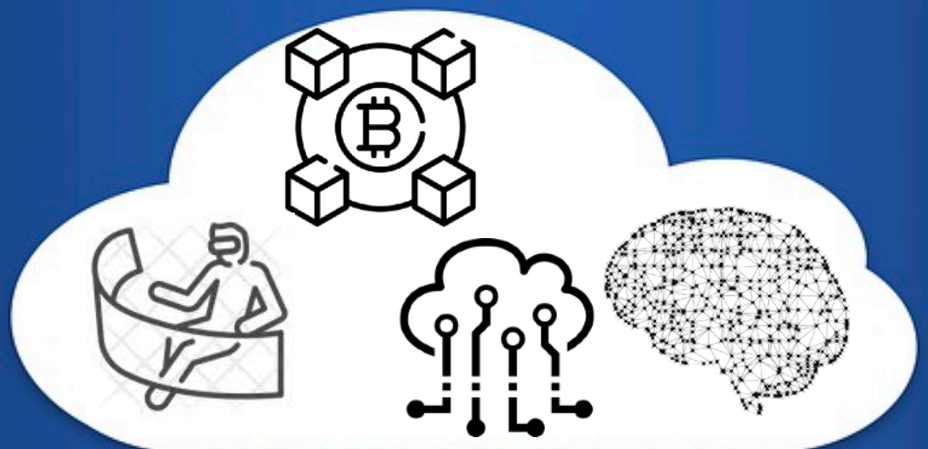
Two key API questions to ask:
Which external API services should we leverage and what internal API services should we develop and share to build network effects and to make our product smarter and more connected?

Case Study: Nike Plus

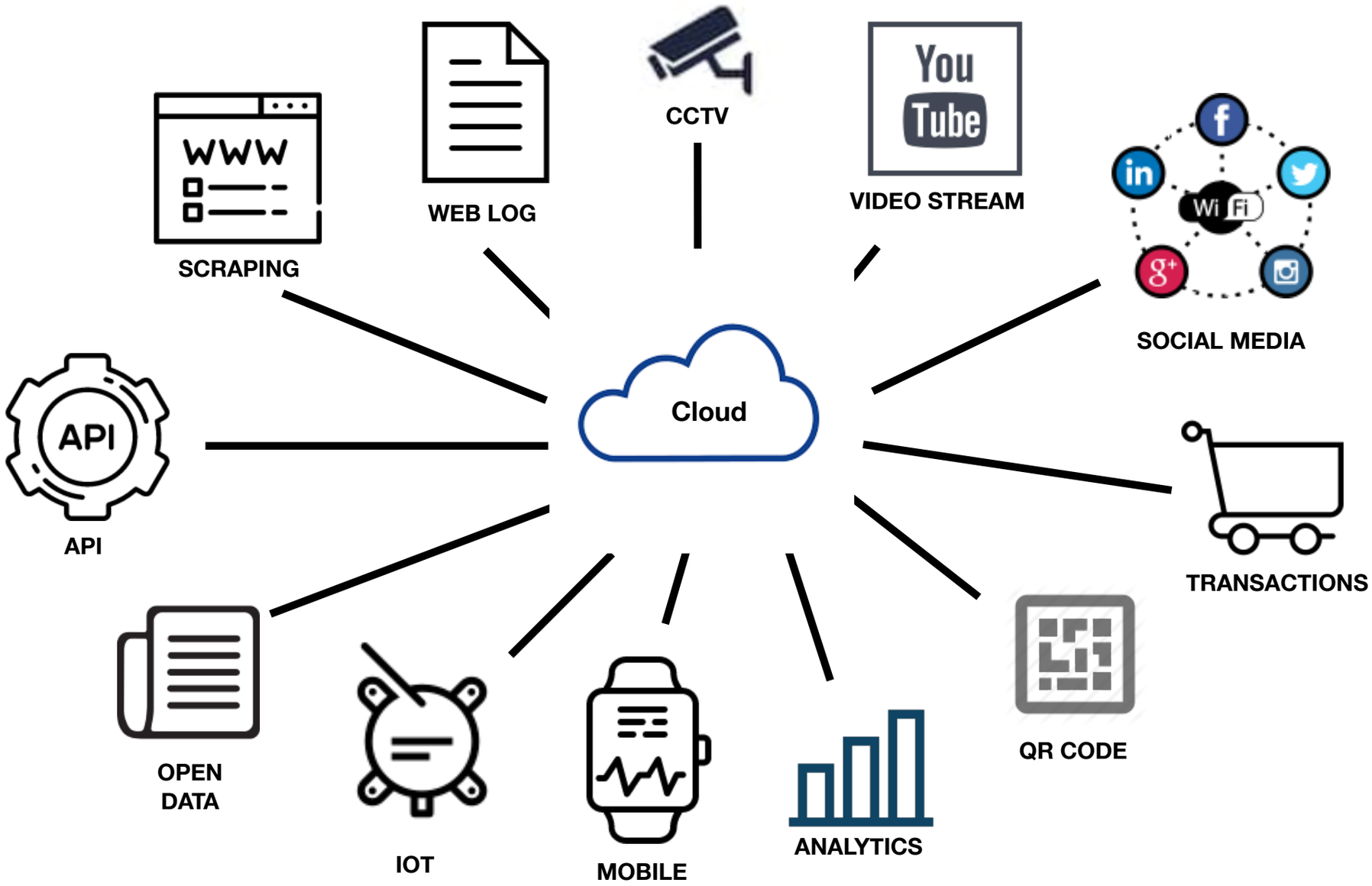
Source: Nike YouTube Promo

What makes NikePlus a data-driven product?

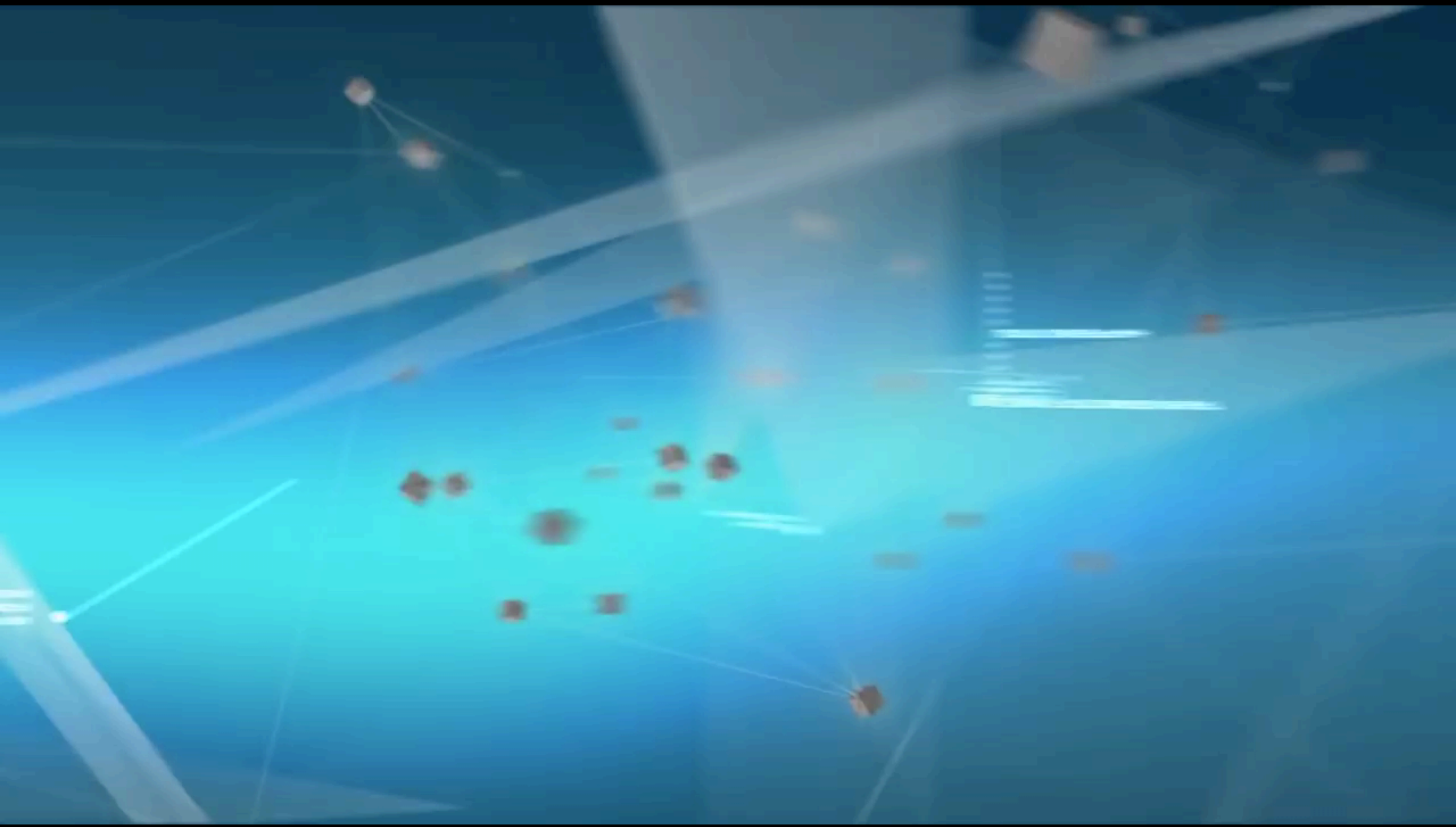
1. NikePlus is a platform for linking runners, music providers, and coaches together. Through the circulation of running profile data, NikePlus provides the glue to link everybody on the platform together to create values.
2. Being smarter allows NikePlus to improve the running and sharing experience through dashboard analytics and being more connected allows NikePlus to amplify the network effect by connecting more runners, music lovers, and coaches.
3. Deliver API based services to social networking apps to make sharing stretched beyond running to other sports lovers.

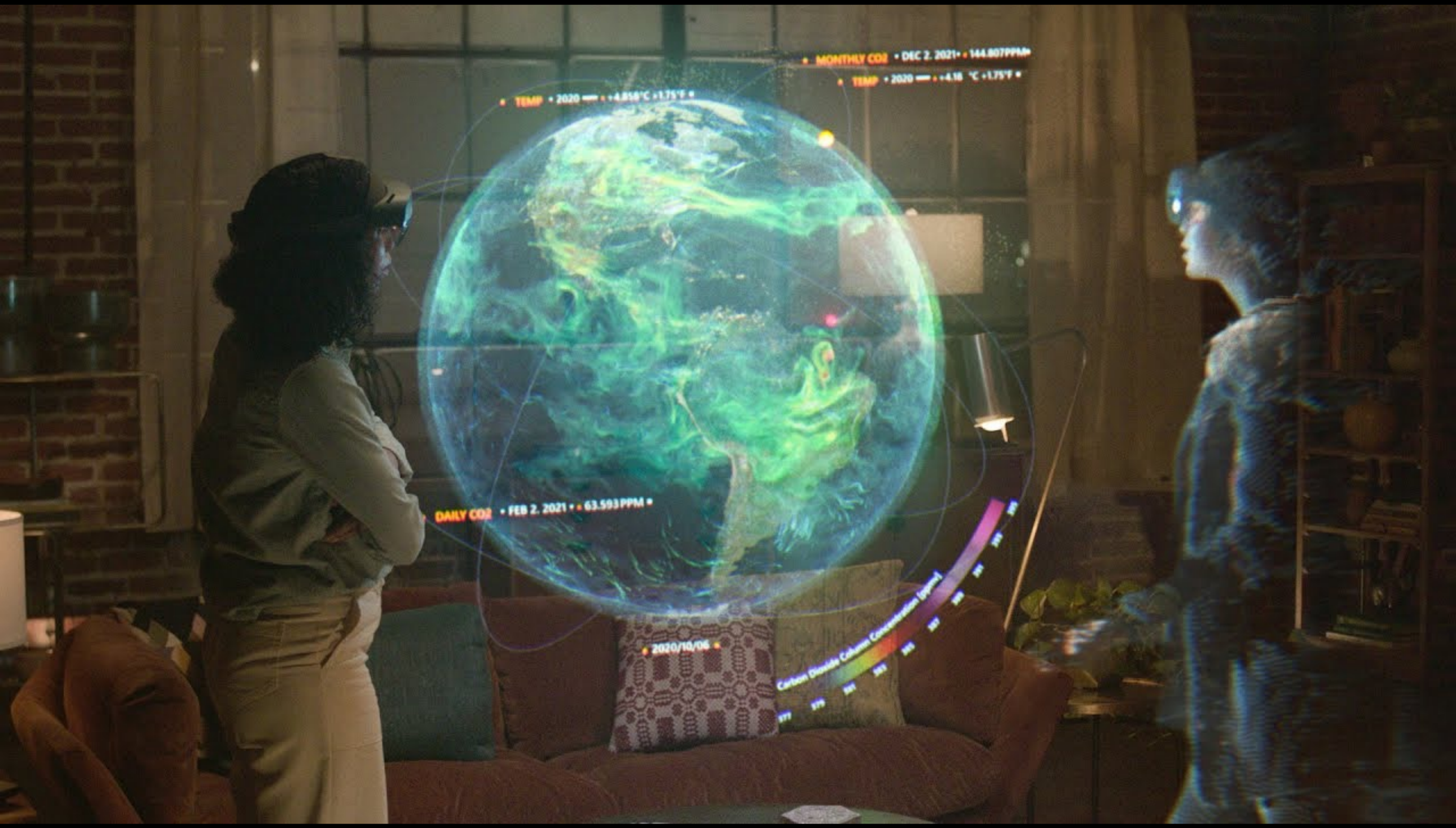


Structured and Un-structured Data Sources



Future of UI/UX Development of Data-driven Products



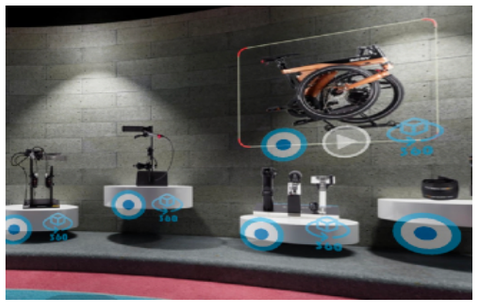

MONTHLY CO2 • DEC 2. 2021 • • 144.807PPM •
TEMP • 2020 • • +4.18 °C +1.75°F •
TEMP • 2020 • • +4.858°C +1.75°F •
DAILY CO2 • FEB 2. 2021 • • 63.593PPM •
2020/10/06
Carbon Dioxide Column Concentration (ppm)

Dashboard

Digital
Twin

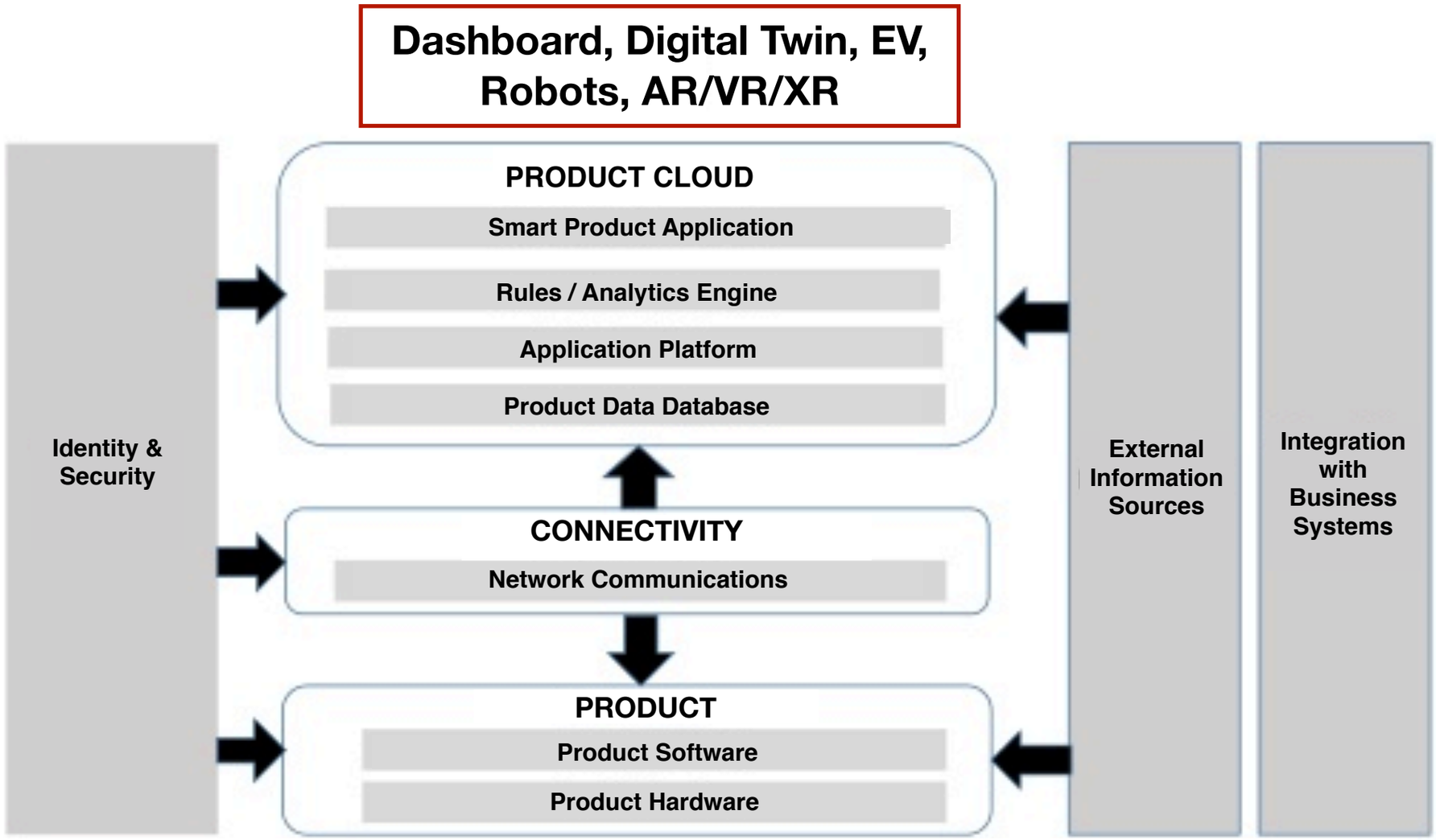
Augment
Reality

Mixed
Reality




Mobile ALOHA
Robot Cooking!

AIoT Cloud Stack

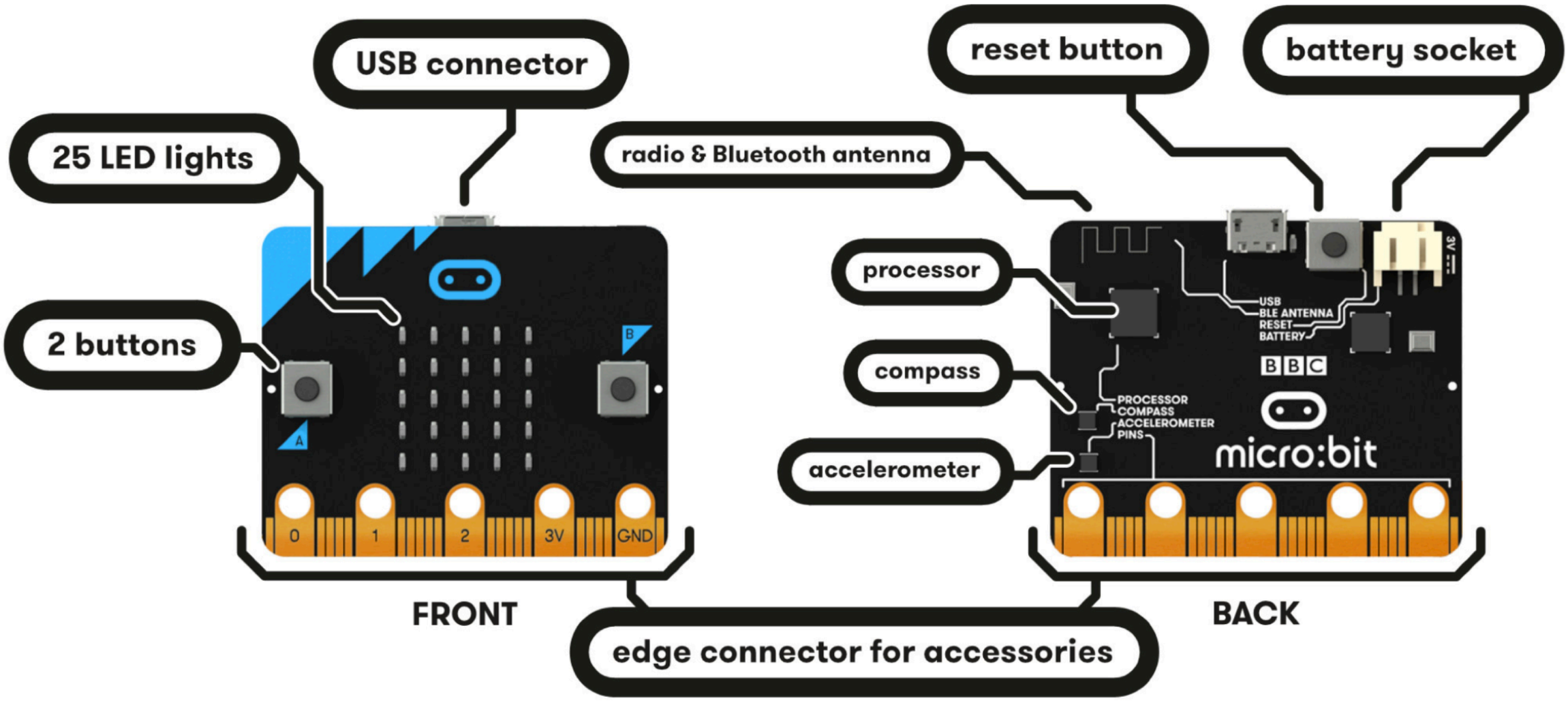


Connected Product Transform Business by Michael E. Porter & James E. Heppelmann. Harvard Business Review

Summary of the IoT Trends.

1. Data acquisition will become an integral part of smart and connected (IoT based) product and service design.
2. Digital twin, dashboard, and VR/AR/XR, technologies will be used to enrich the UX while collecting the data.
3. The data will be aggregated on the cloud and big data and AI/Robotics technologies will be used to monitor, predict, and enhance performances of AIoT products.
4. Blockchain technology can be used for tokenisation and security of AIoT based activities between businesses and individuals.
5. Build and disseminate API to foster platform development and create network effect.

Introduction to IoT Using Microbit



source: https://microbit.org/guide/features

Basic Structure & Components

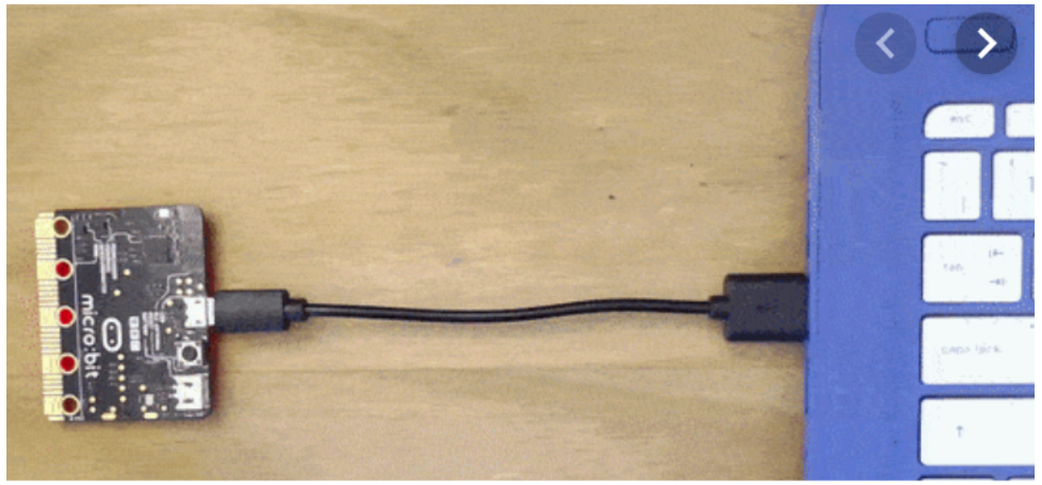
The Basic Package

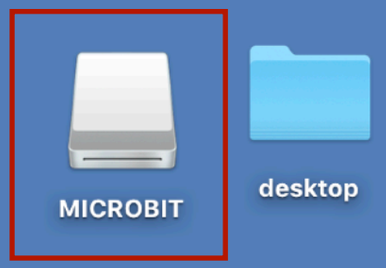
source: https://geekworm.com

Connecting a Micro:bit to the Computer via USB

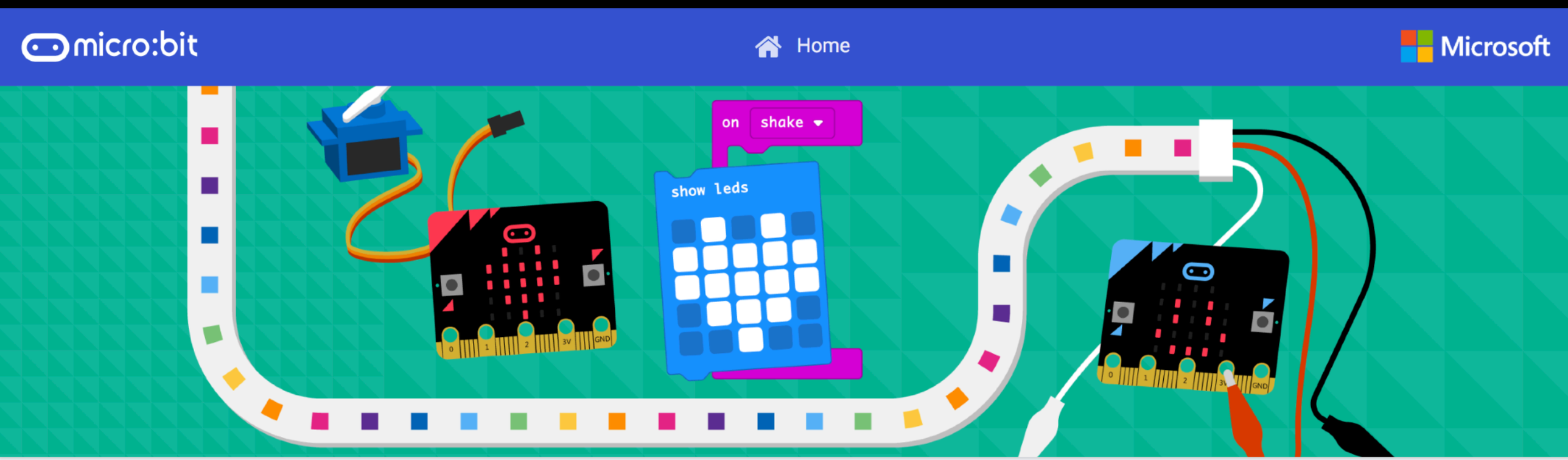
For the newer Macintosh laptop, we need a USB-C connector.

source: https://support.microbit.org




MICROBIT
desktop

The User Interface for Operating a Micro:bit



My Projects >

Import

New Project

https://makecode.microbit.org

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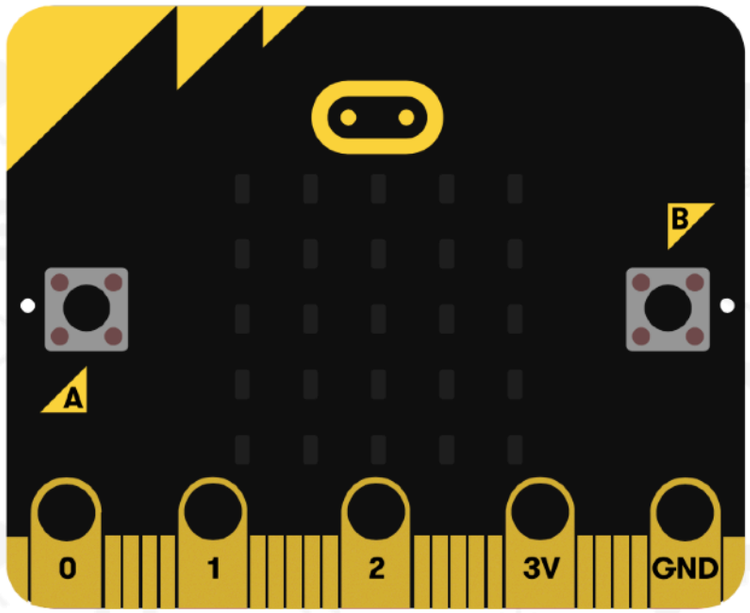

Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced

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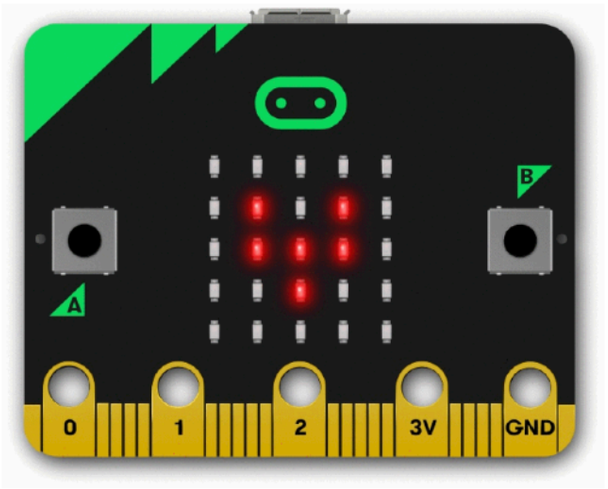
Key Features and Examples

LEDs

The micro:bit has 25 individually-programmable LEDs (Light Emitting Diode), allowing it to display text, numbers, and patterns.



Exercises on LEDs

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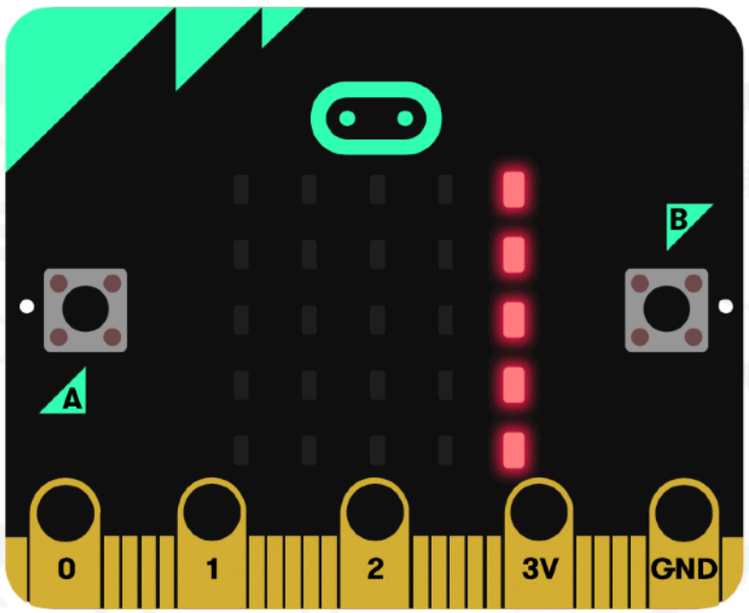

Search...

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- Led
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- Logic
- Variables
- Math
- Advanced

```
forever
    show string "Hello world!"
```

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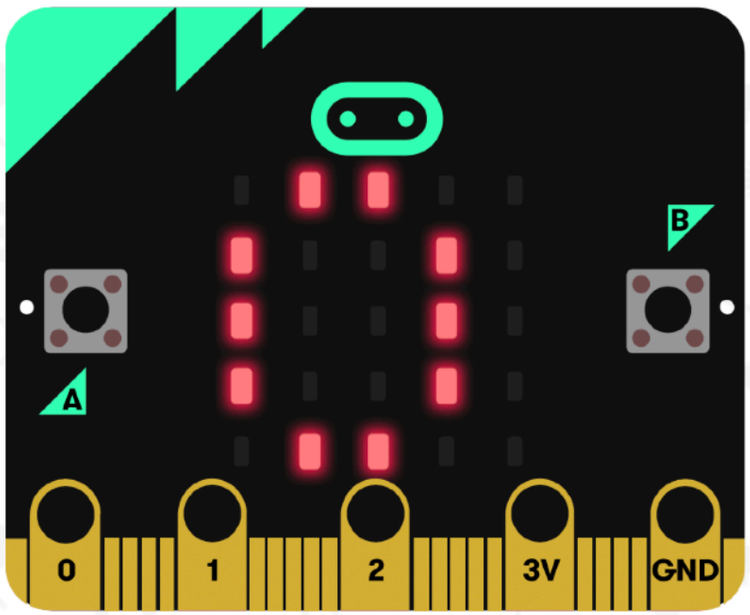

Search...

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- Led
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- Advanced

```
forever
    show number 0
    pause (ms) 100
    show number 1
```

Download

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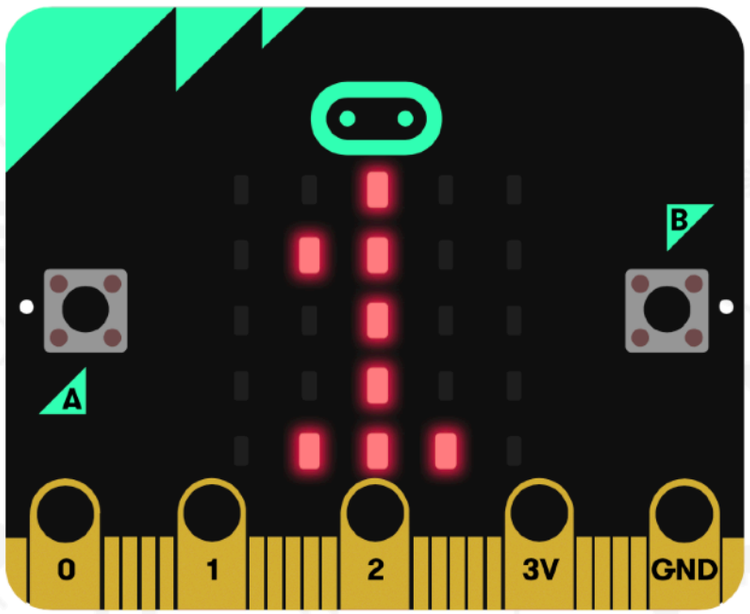

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```
forever
    show number 0
    pause (ms) 100
    show number 1
```

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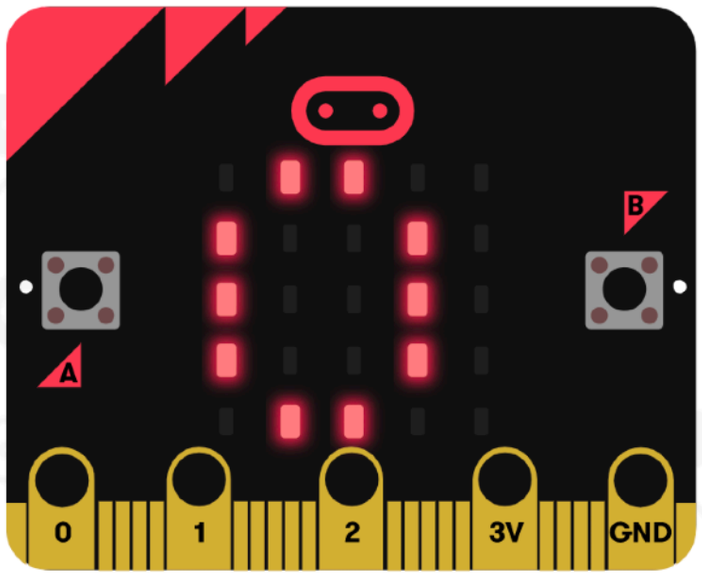


Search...

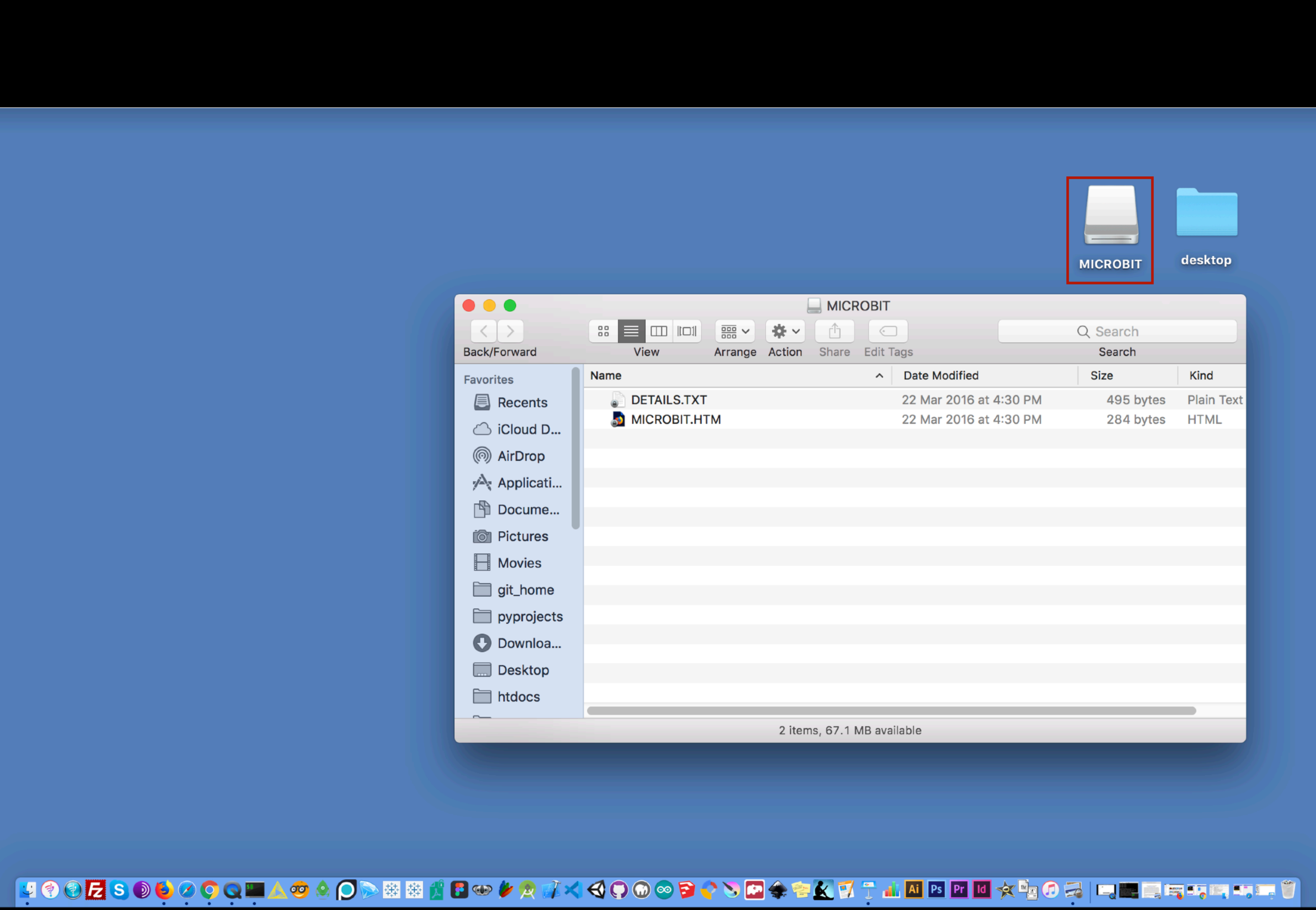
- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math

```
forever
    show number 0
    pause (ms) 100
    show number 1
```

Download

Show Number

Download for Mac


MICROBIT
desktop
MICROBIT
Back/Forward
View
Arrange
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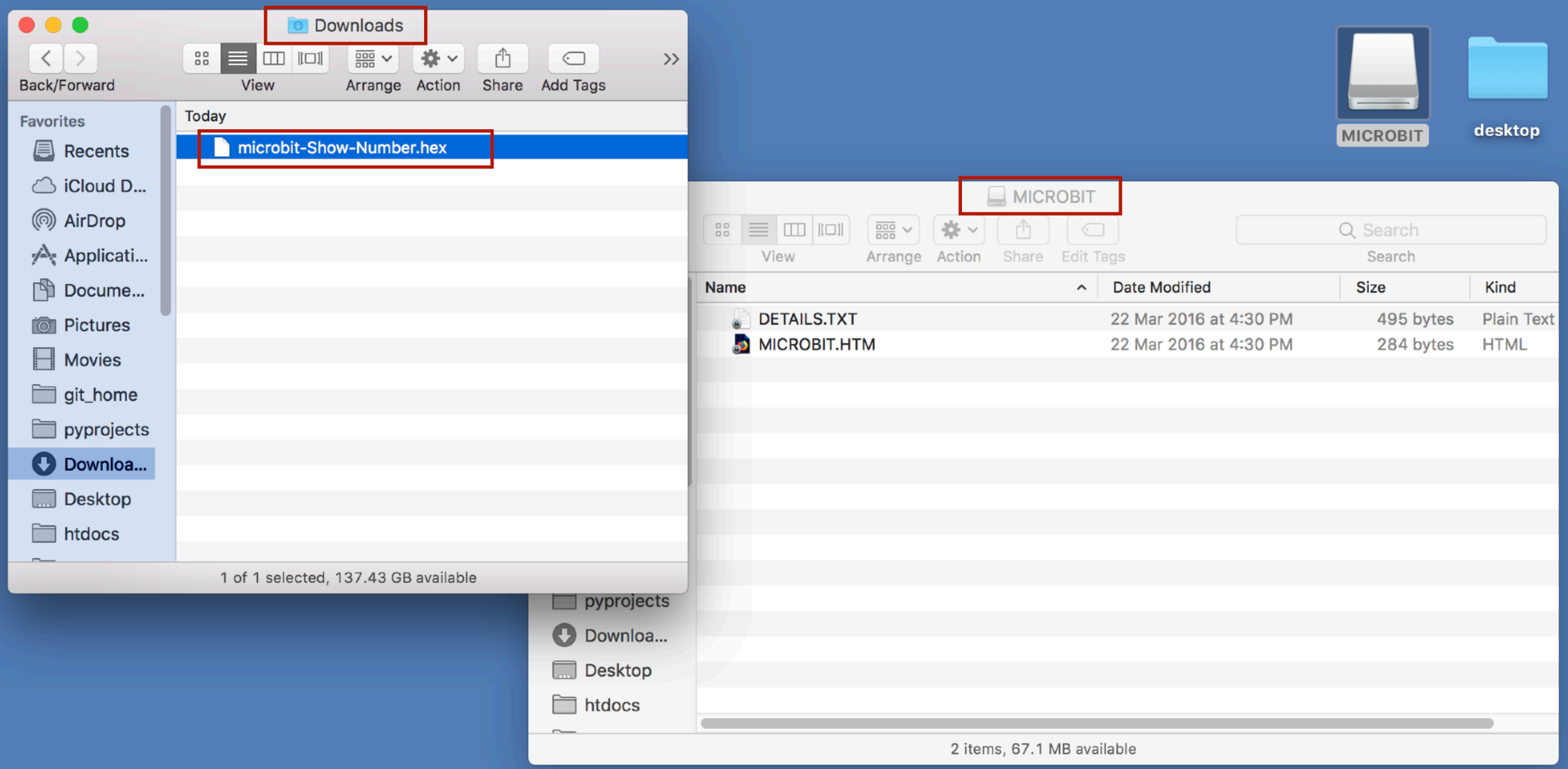
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pyprojects
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1 of 1 selected, 137.43 GB available
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View
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Action
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Edit Tags
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Size
Kind
DETAILS.TXT
22 Mar 2016 at 4:30 PM
495 bytes
Plain Text
MICROBIT.HTM
22 Mar 2016 at 4:30 PM
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Downloa...
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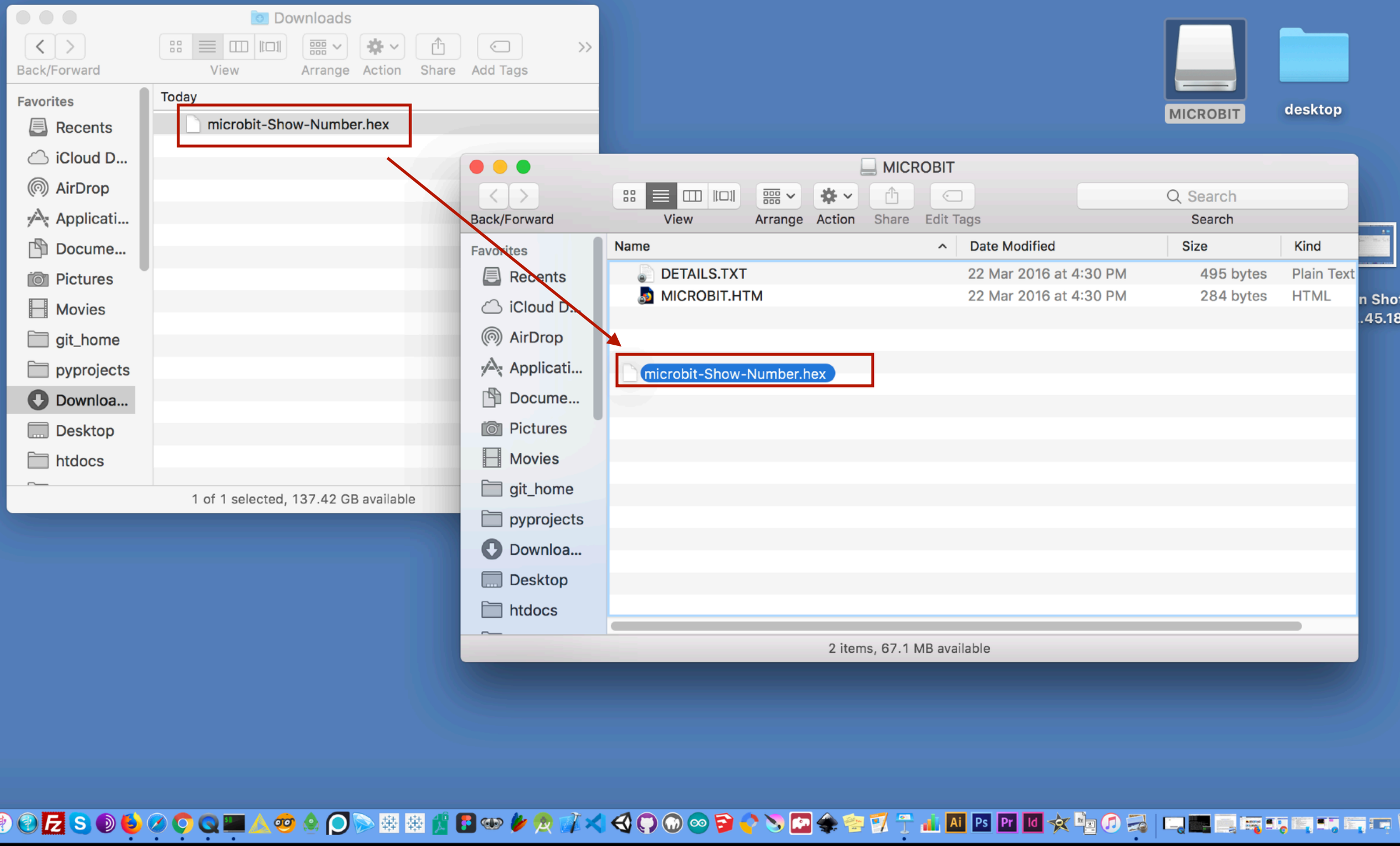
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1 of 1 selected, 137.42 GB available
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Action
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Edit Tags
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Recents
iCloud D...
AirDrop
Applicati...
Docume...
Pictures
Movies
git_home
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DETAILS.TXT
22 Mar 2016 at 4:30 PM
495 bytes
Plain Text
MICROBIT.HTM
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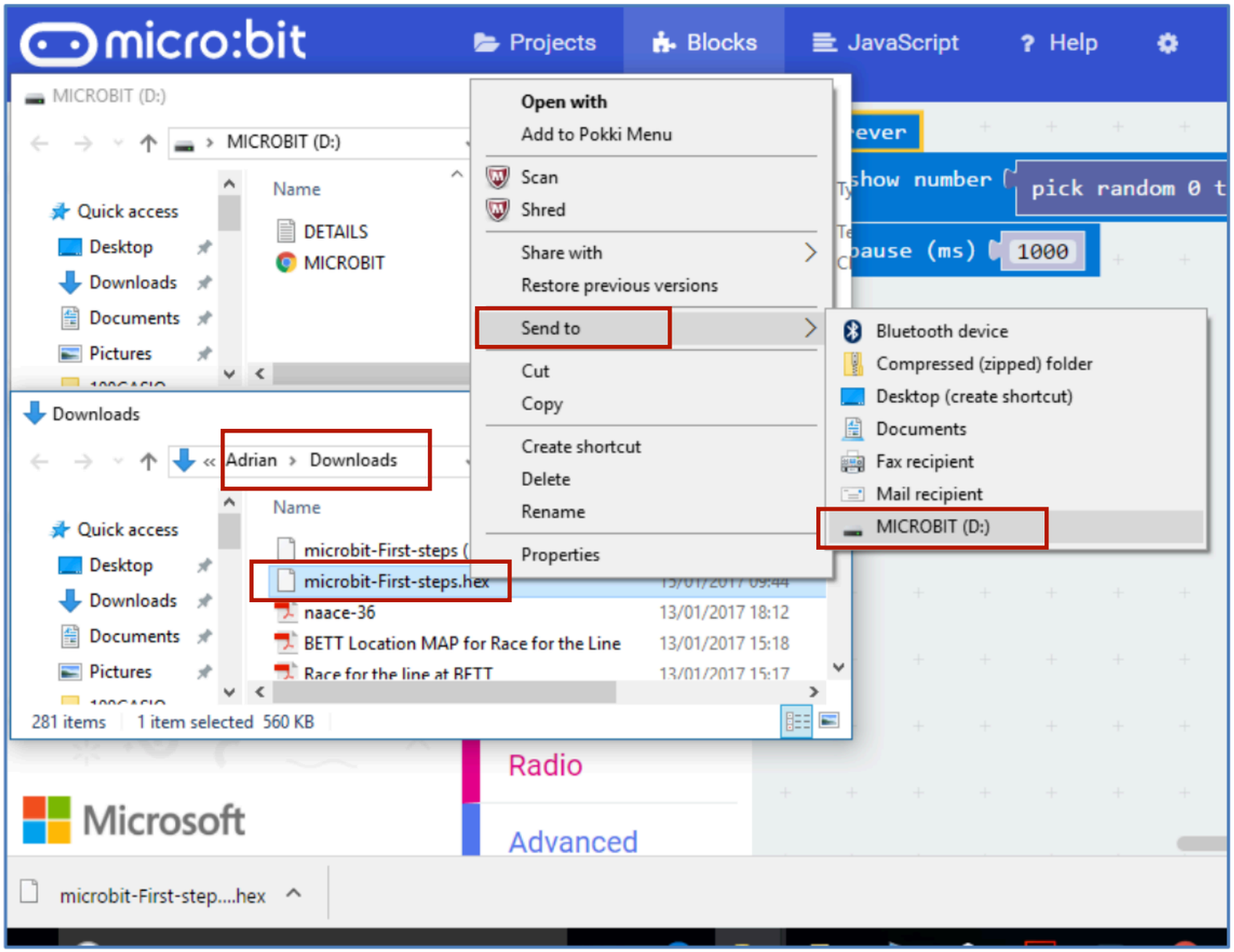
micro:bit
Projects
Blocks
JavaScript
Help
MICROBIT (D:)
Quick access
Desktop
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Documents
Pictures
Name
DETAILS
MICROBIT
Open with
Add to Pokki Menu
Scan
Shred
Share with
Restore previous versions
Send to
Cut
Copy
Create shortcut
Delete
Rename
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Bluetooth device
Compressed (zipped) folder
Desktop (create shortcut)
Documents
Fax recipient
Mail recipient
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281 items
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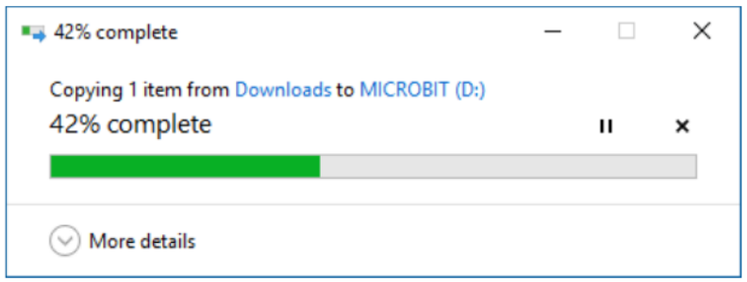
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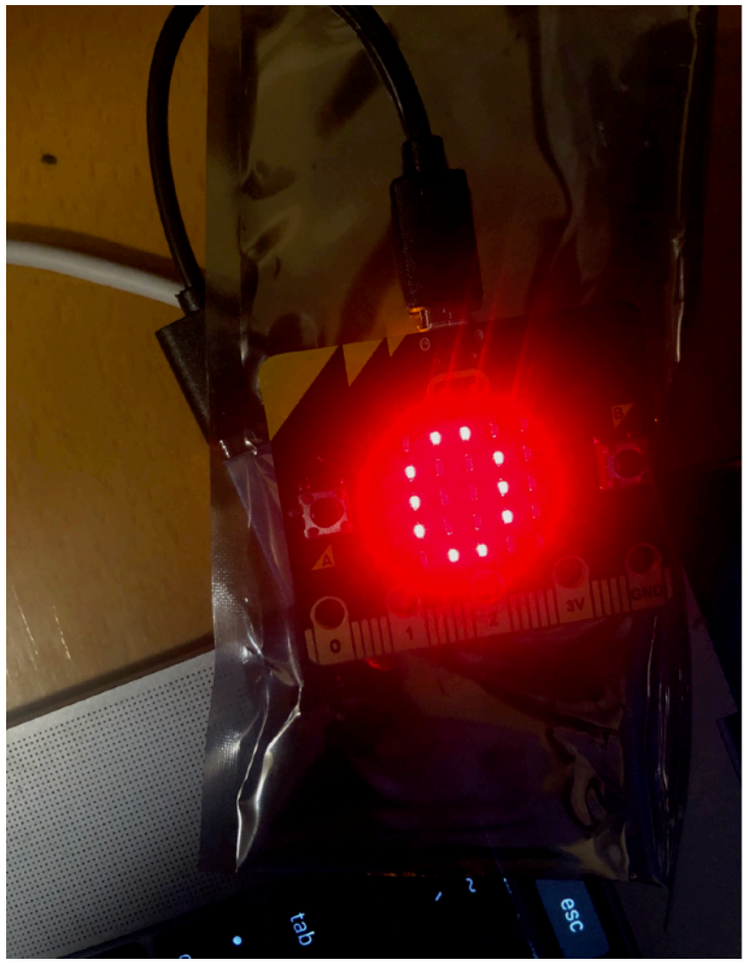
Copying 1 item from Downloads to MICROBIT (D:)
42% complete
More details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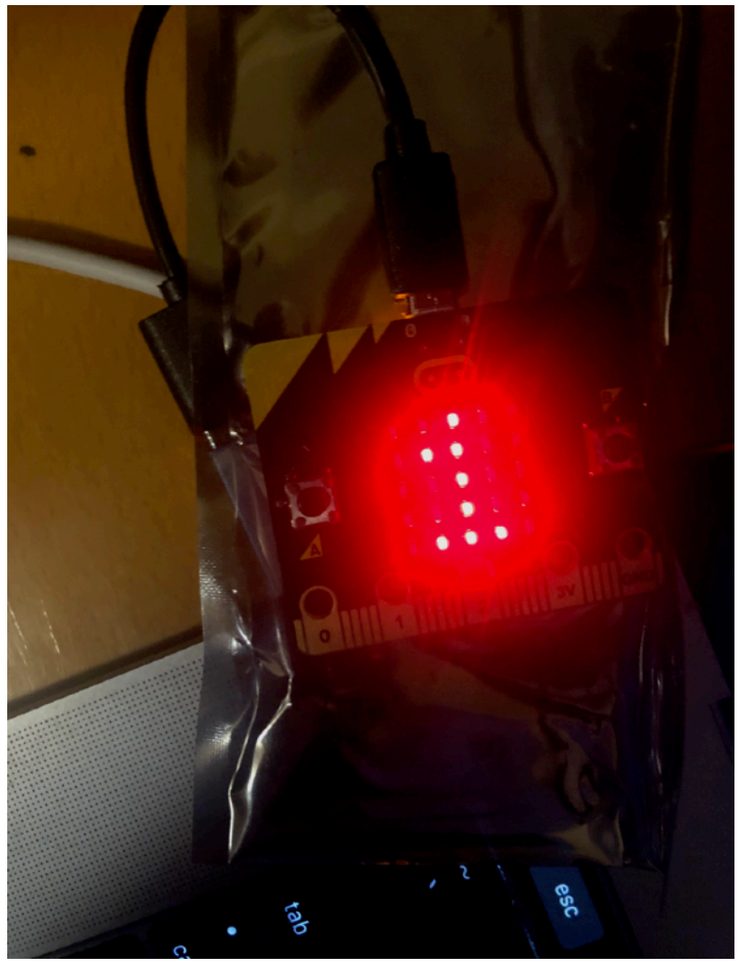
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More Exercises on LEDs

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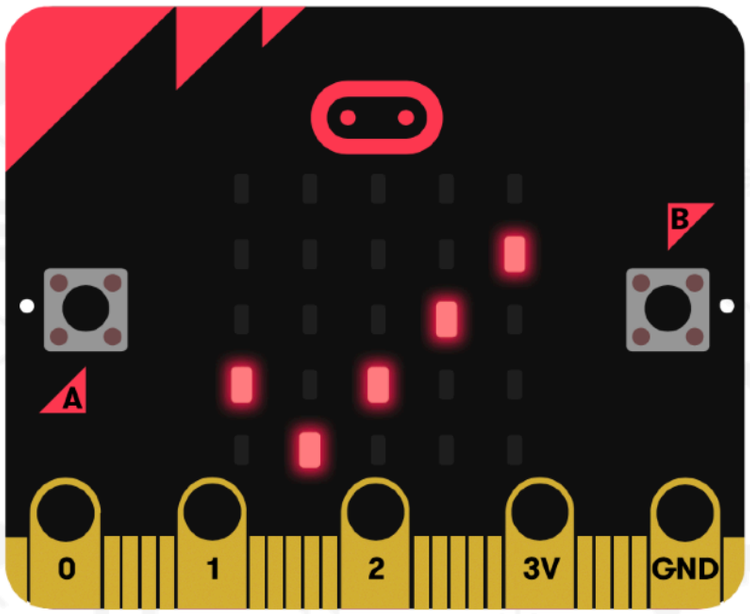

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- Variables
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- Advanced

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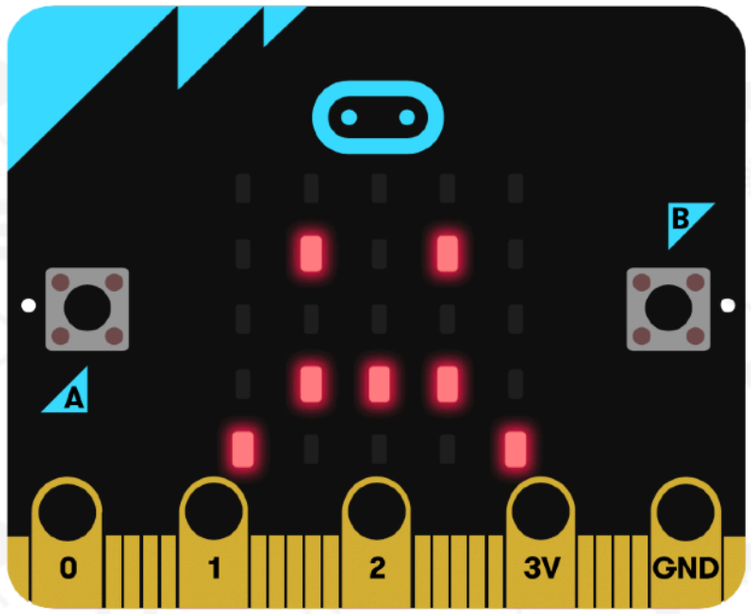

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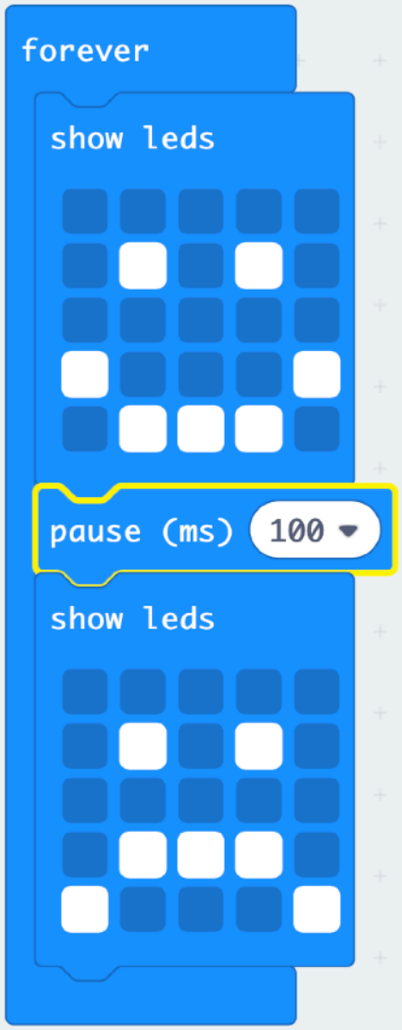

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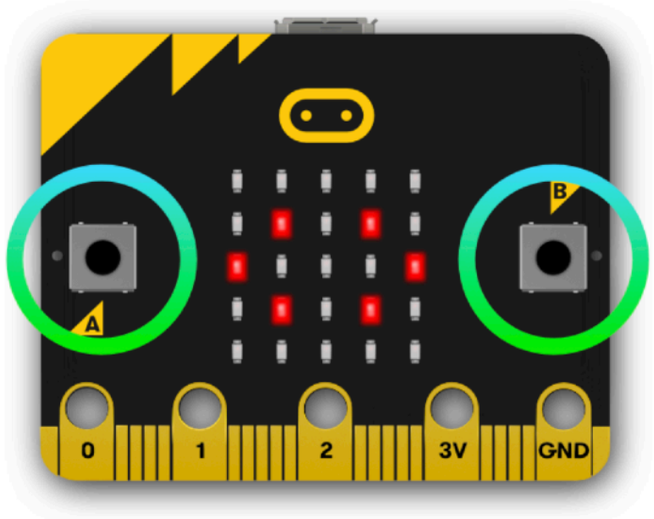
Buttons

There are two buttons on the front of the micro:bit. These buttons can be detected when pressed.



Exercise on buttons.

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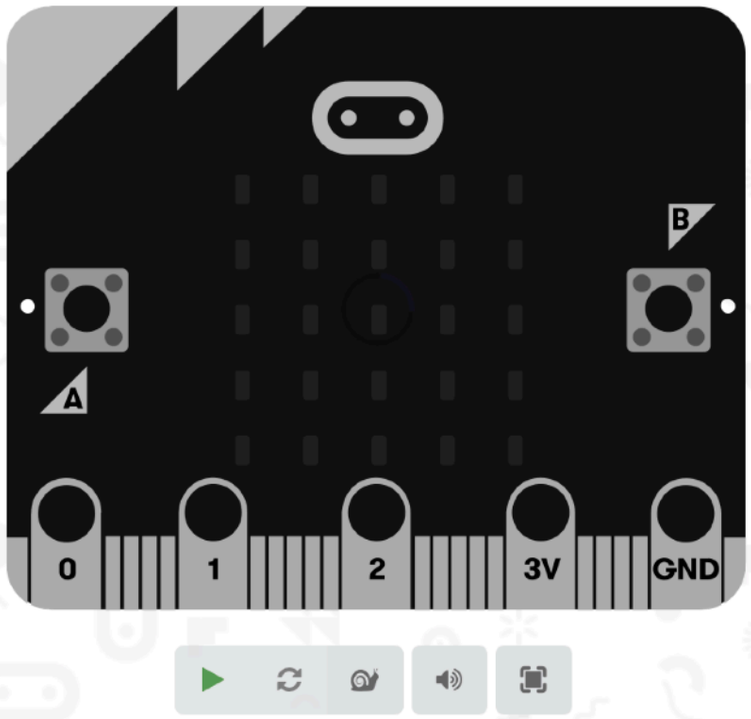
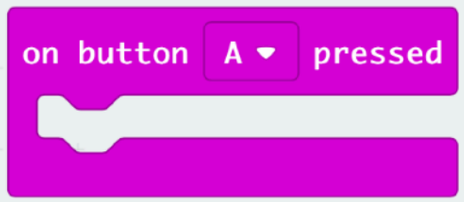


Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced



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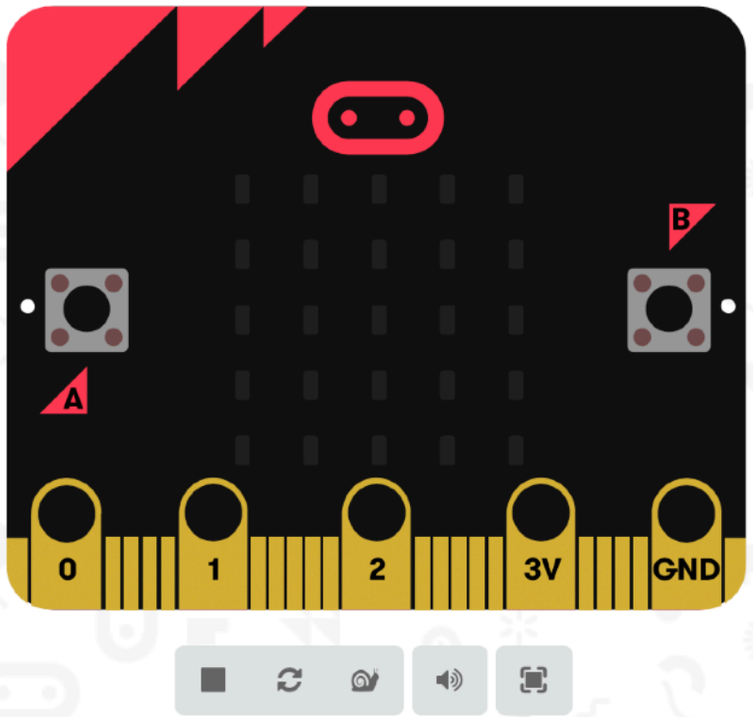

Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced

Variables

Make a Variable...

ssed

forever

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Search...

Basic

Input

Music

Variables

Make a Variable...

forever

New variable name:

count

Ok

Cancel

Advanced

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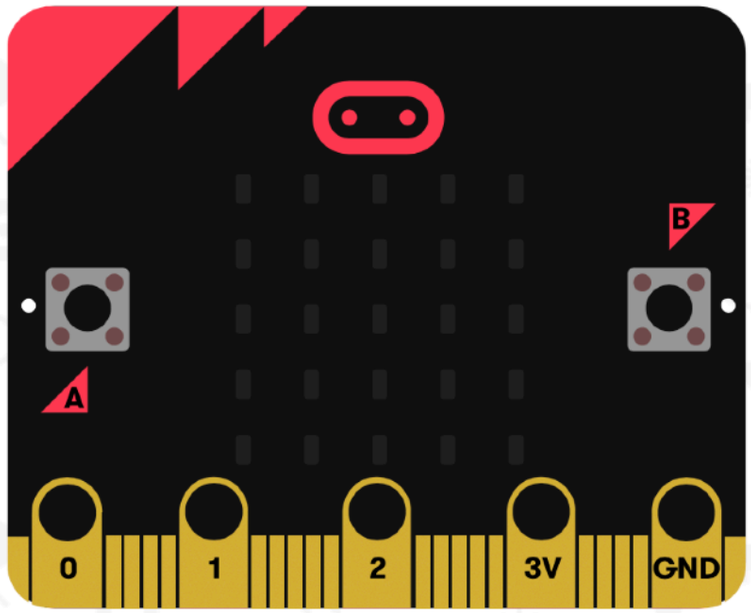

Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced

Variables

Make a Variable...

count

set count to 0

change count by 1

forever

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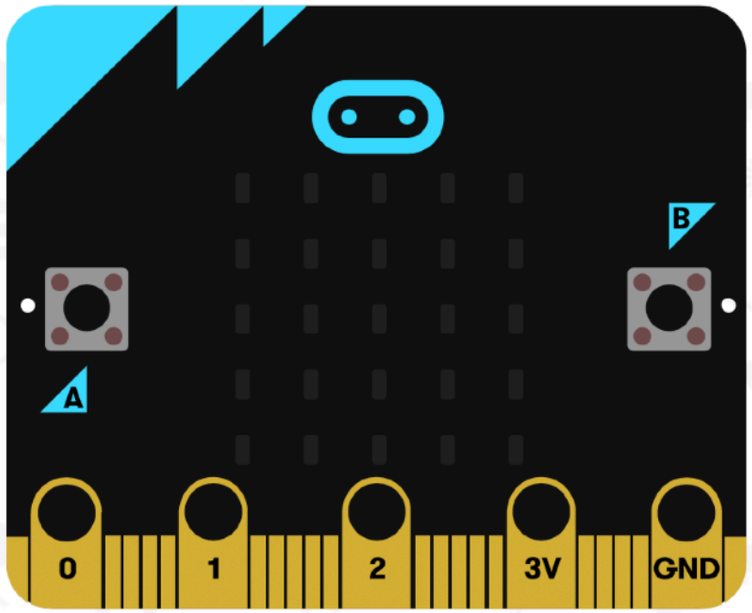
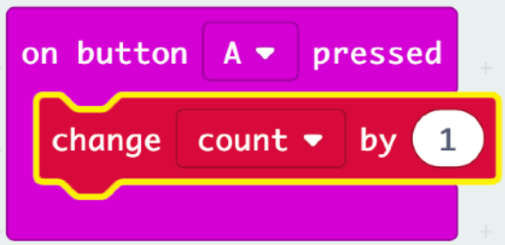


Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced



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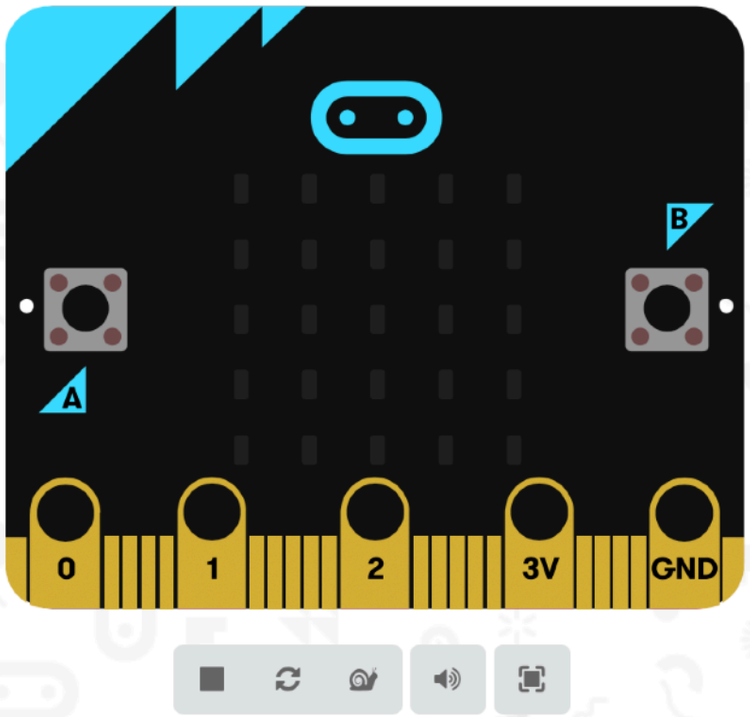

Search...

- Basic
- more
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced

Basic

show number 0

show leds

show icon

show string "Hello!"

forever

ed

1

forever

Download

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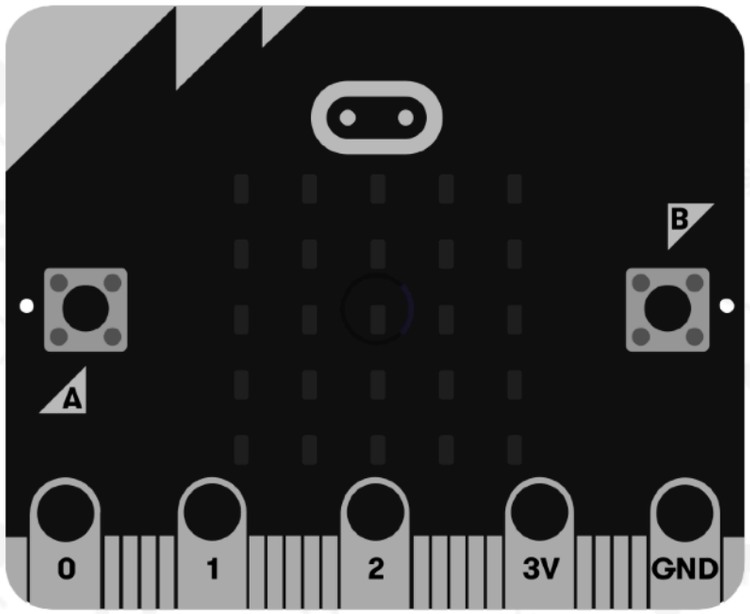

Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced

```
on button A pressed
    change count by 1
    show number 0
forever
```

Download

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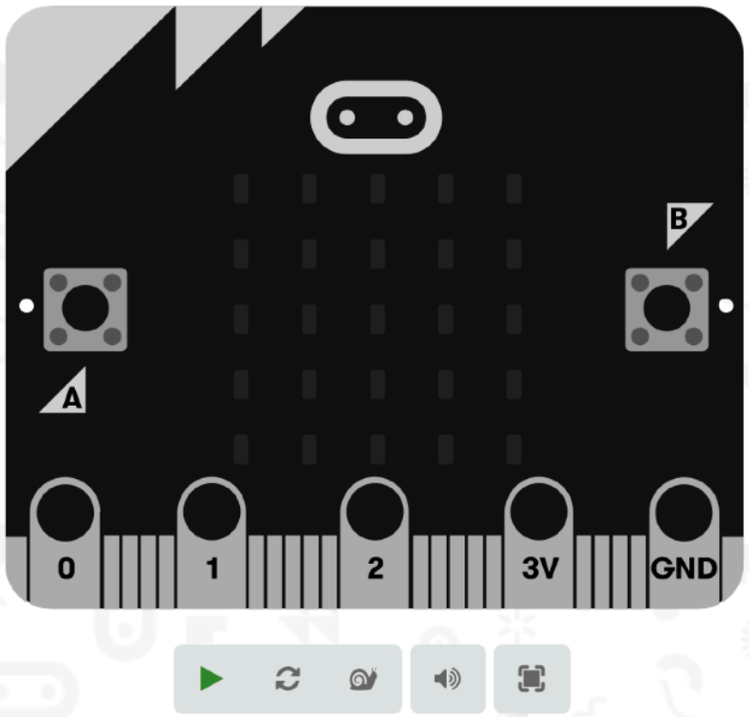
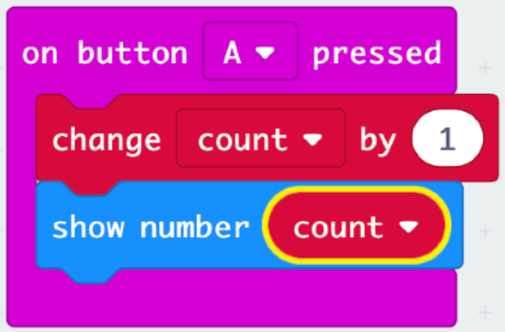


Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced



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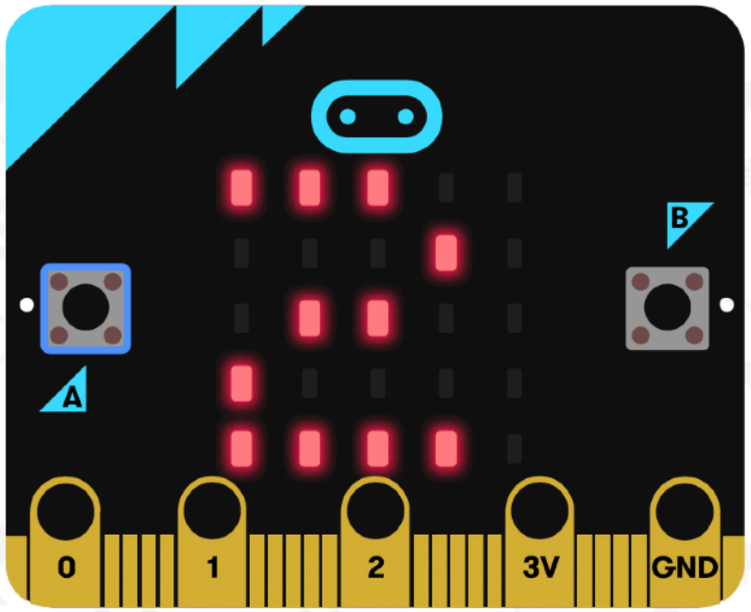
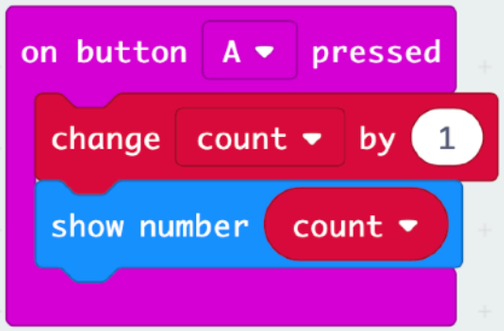
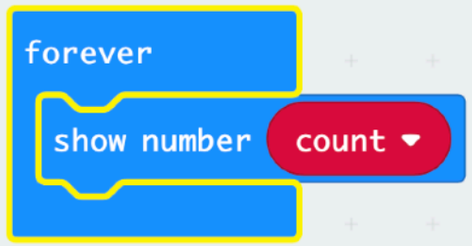


Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced





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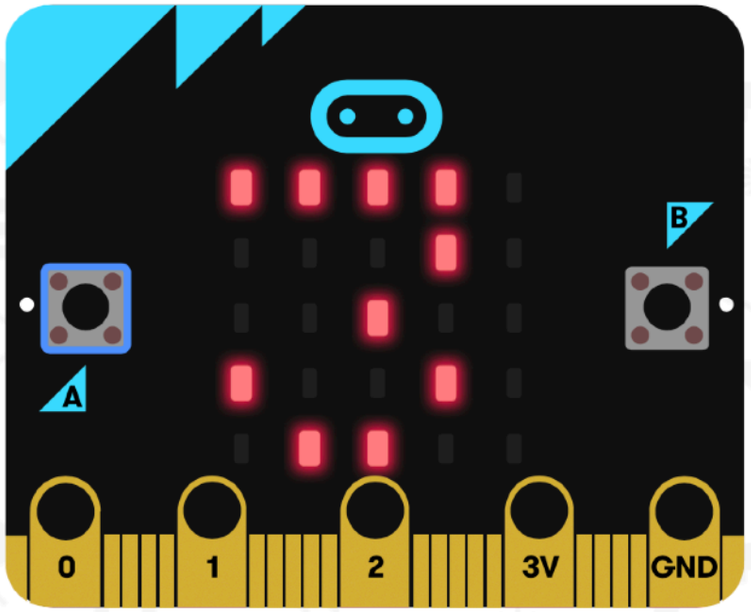

Search...

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- Input
- Music
- Led
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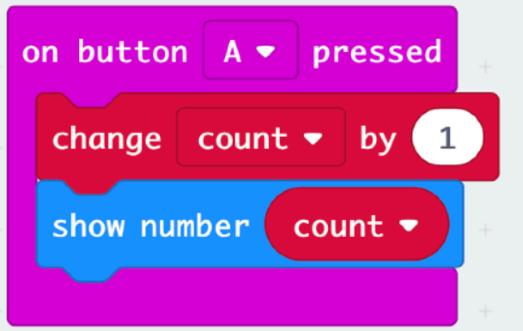
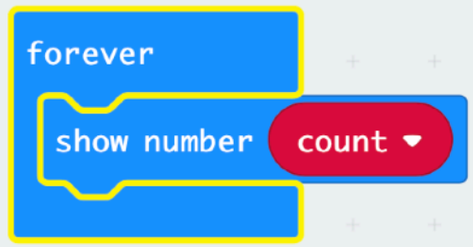
- Loops
- Logic
- Variables
- Math
- Advanced





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Exercise on random number.

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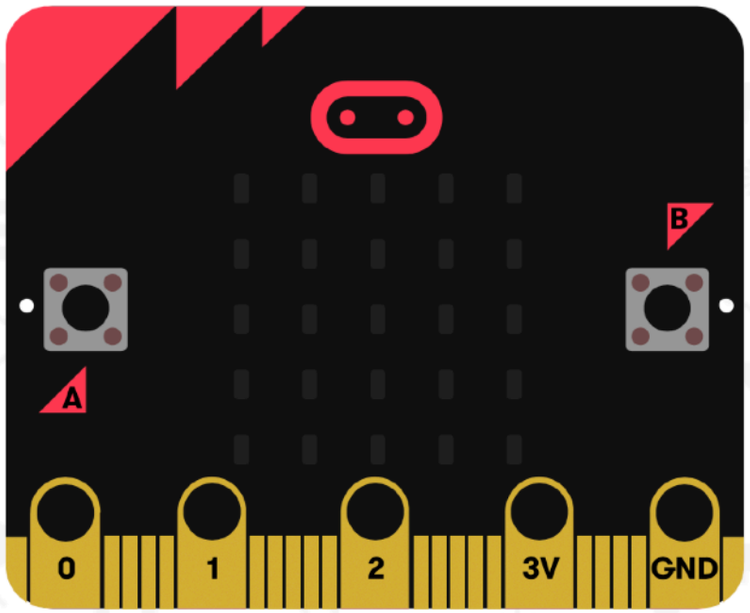

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- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced

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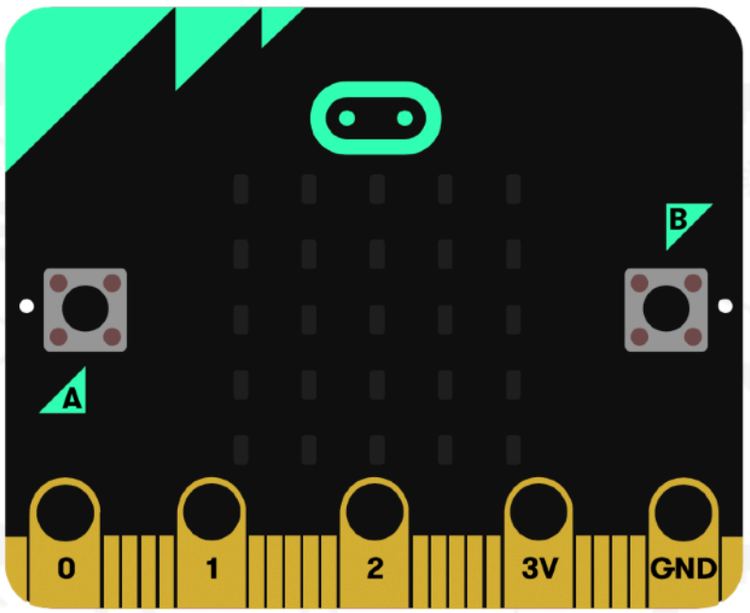

Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced

Variables

Make a Variable...

dice

set dice to 0

change dice by 1

ressed

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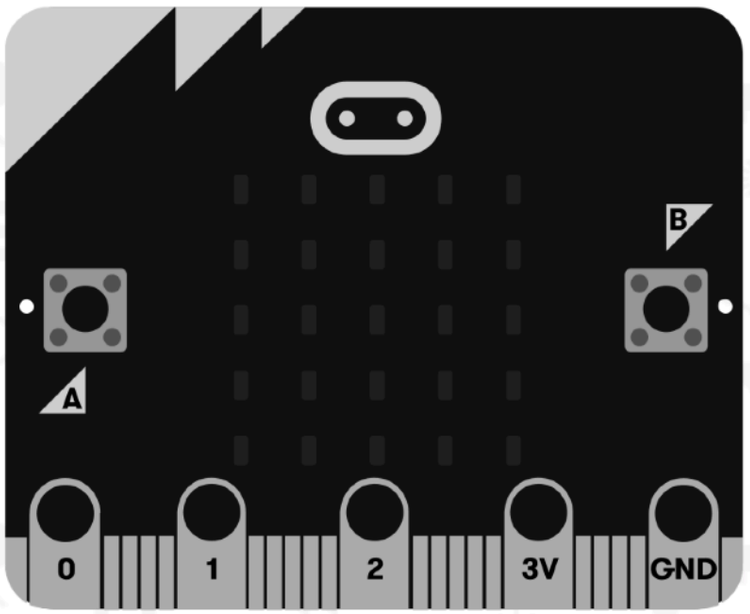

Search...

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- Input
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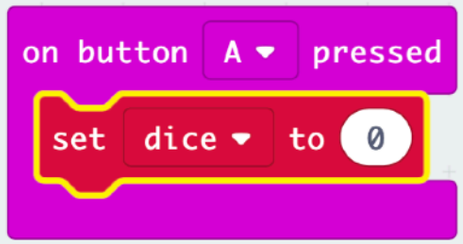
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced



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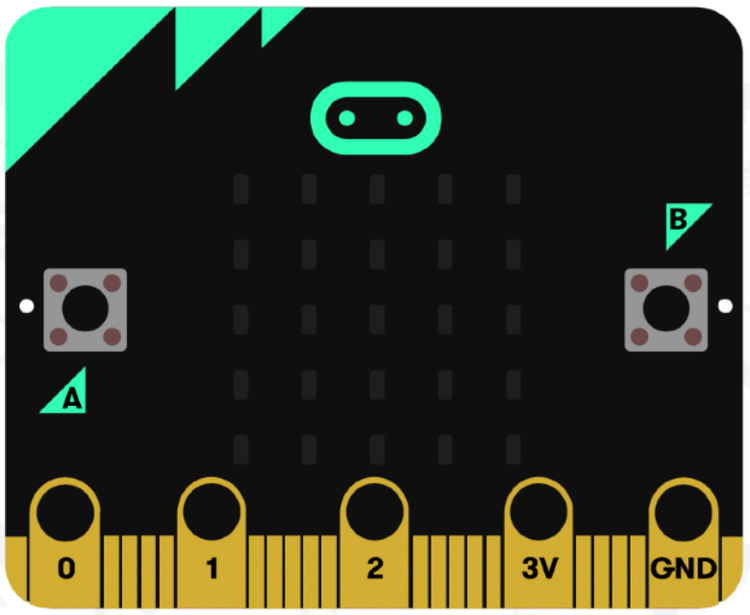

Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced

0

remainder of 0 ÷ 1

min of 0 and 0

max of 0 and 0

absolute of 0

square root 0

round 0

pick random 0 to 10

constrain 0 between 0 and 0

map 0 from low 0 high 1023 to low 0 high 4

pick random true or false

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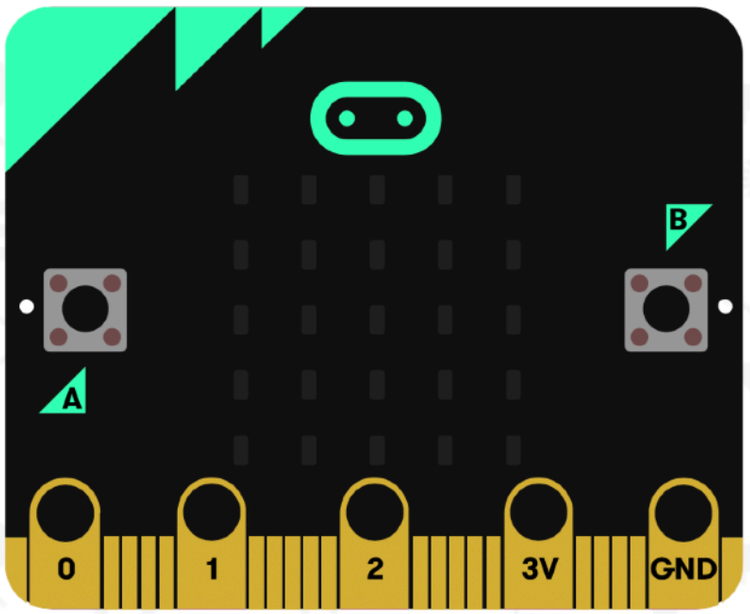

Search...

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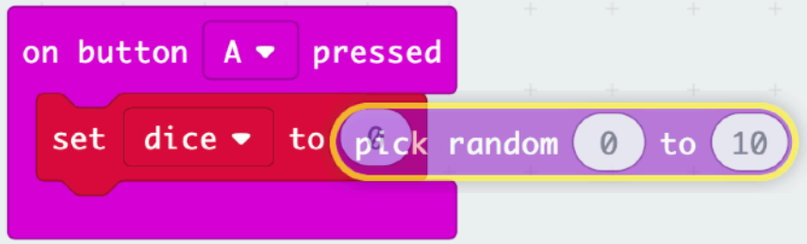
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced



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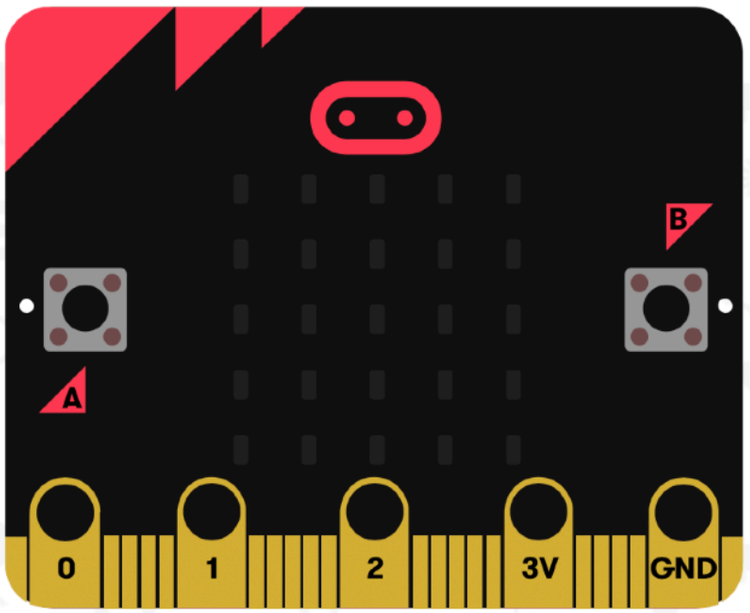

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- Led
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- Loops
- Logic
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- Math
- Advanced

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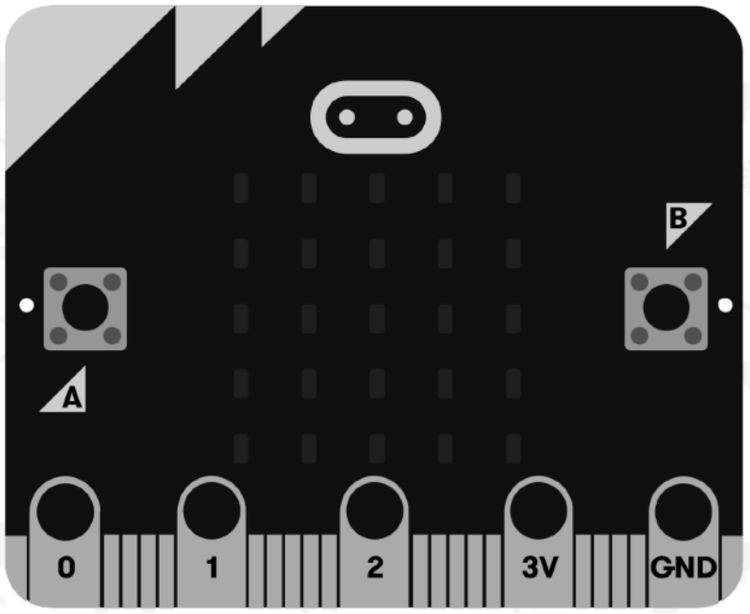

Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced

```
on button A pressed
    set dice to pick random 1 to 6
    show number dice
```

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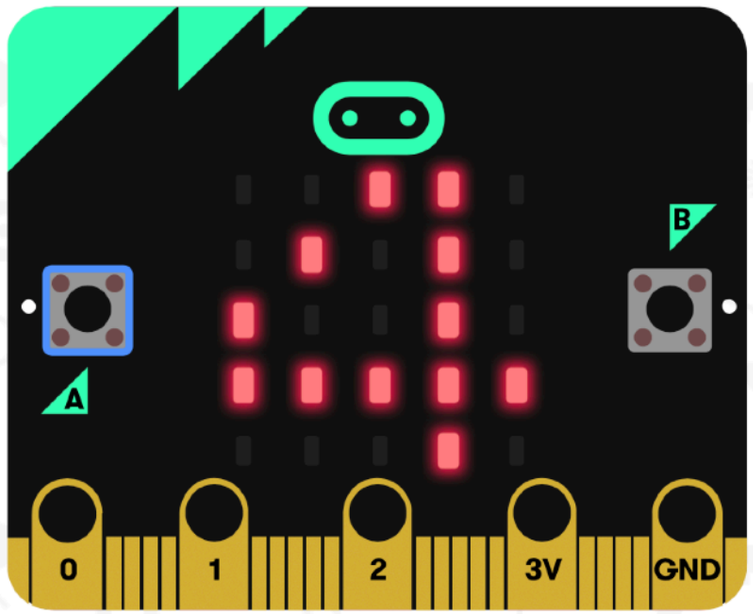

Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced

```
on button A pressed
    set dice to pick random 1 to 6
    show number dice
```

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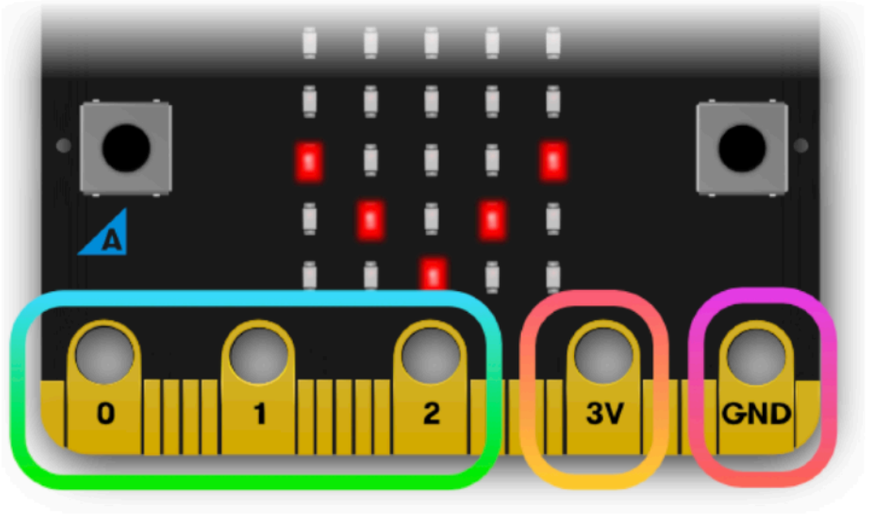
Pins

There are 25 external connectors on the edge connector of the micro:bit referred as 'pins'. Other electrical components can be connected to the Micro:bit through these pins.



Exercise on pins.

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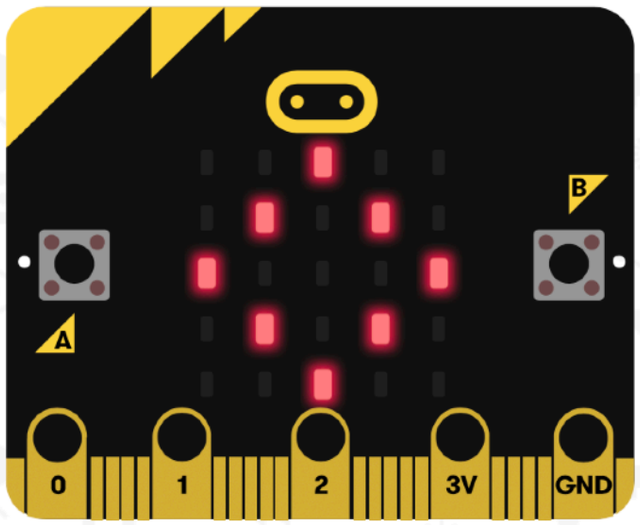

Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced
- Functions
- Arrays
- Text
- Game
- Images
- Pins

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pin testing

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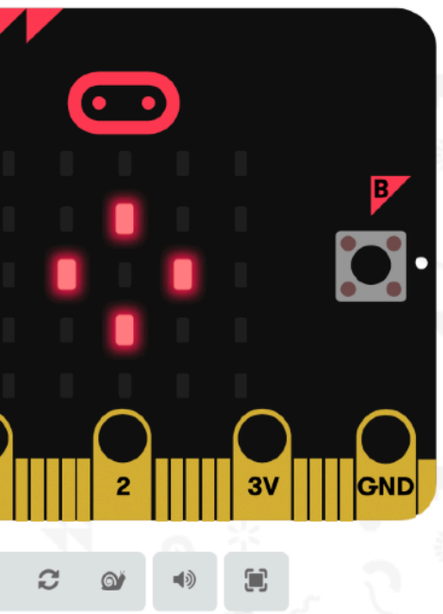
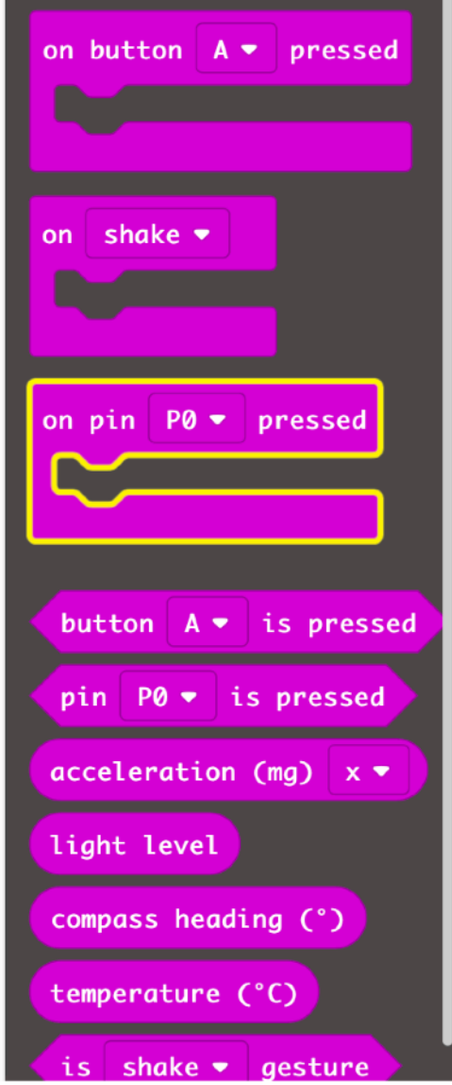


Search...

- Basic
- Input
- more
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced
- Functions
- Arrays
- Text
- Game
- Images

Input



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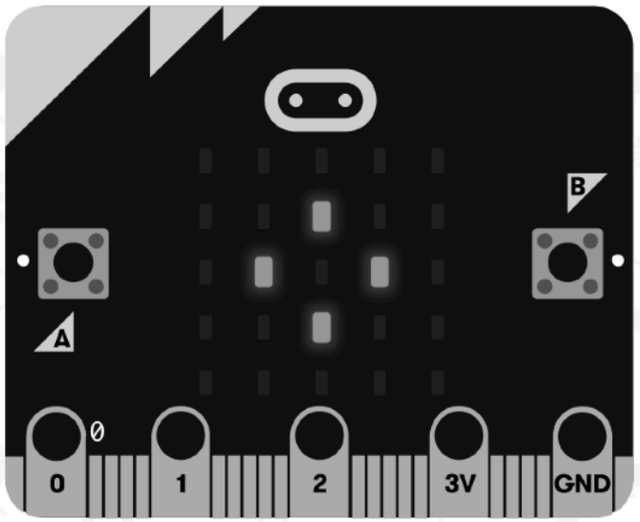
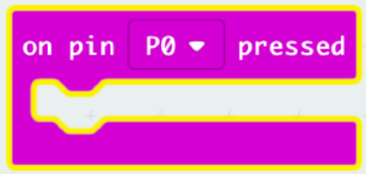


Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced
- Functions
- Arrays
- Text
- Game
- Images
- Pins



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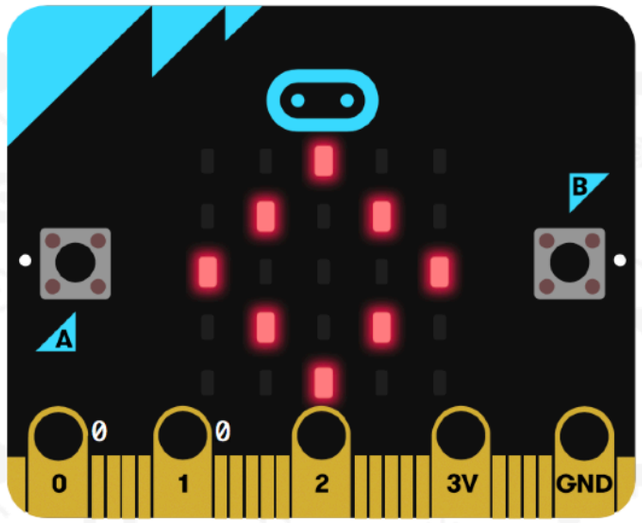

Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced
- Functions
- Arrays
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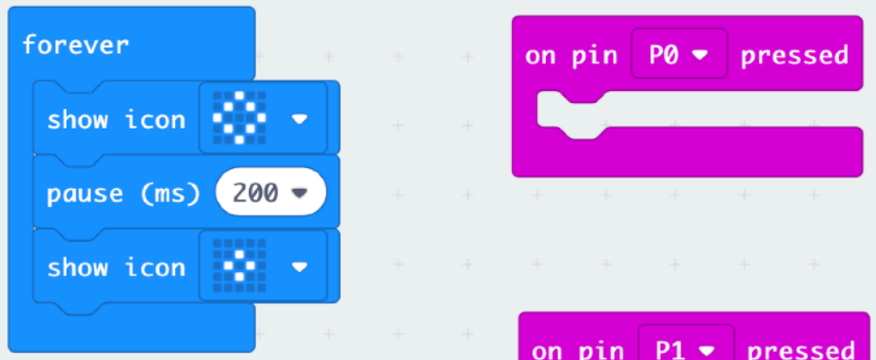
- Game
- Images
- Pins



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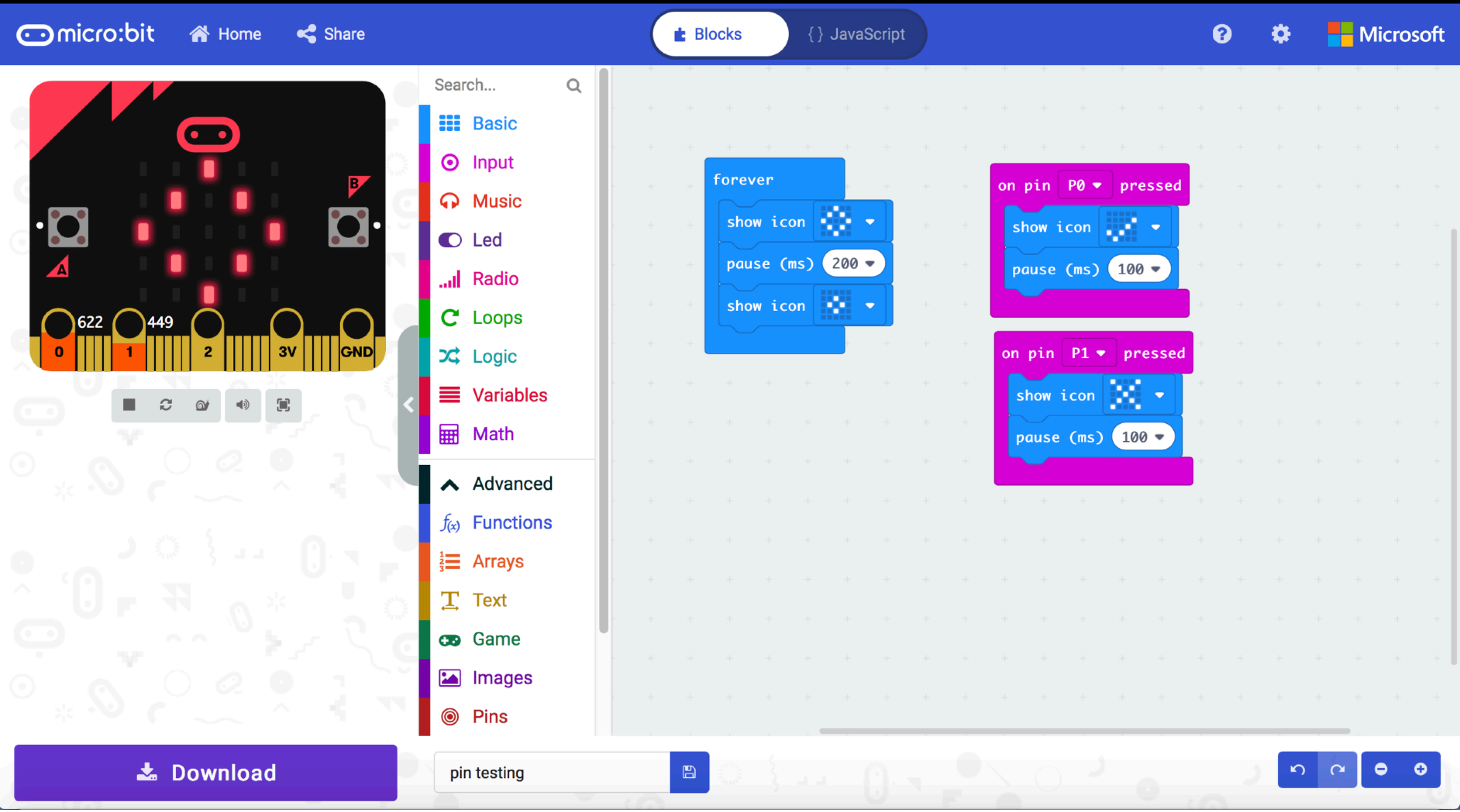
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622
449
0
1
2
3V
GND
A
B
Search...
Basic
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forever
show icon
pause (ms) 200
show icon
on pin P0 pressed
show icon
pause (ms) 100
on pin P1 pressed
show icon
pause (ms) 100
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Controlling a Servo.

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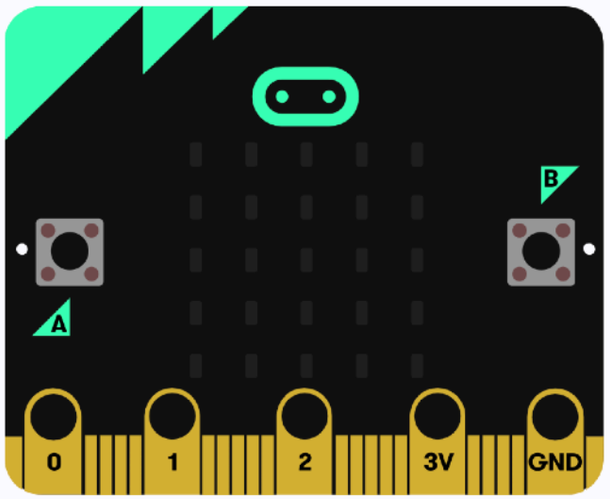
Sign In



Show data Simulator

Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Extensions
- Advanced
- Functions
- Arrays
- Text
- Game
- Images
- Pins

on start

forever

Pick an extension

- Project Settings
- Extensions
- Connect Device
- Print...
- Delete Project
- Language
- High Contrast On
- Green Screen On
- Report Abuse...
- Reset
- About...

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Servo 2

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Extensions

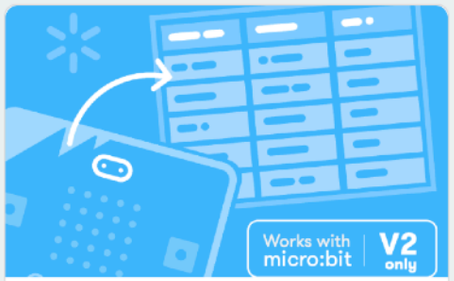
Search or enter project URL...

Lights and Display | Software | Science | Robotics | Gaming | Networking

Pick servo.

Recommended

Import File



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Data logging to flash memory. micro:bit (V2) only.

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radio-broadcast

Adds new blocks for message communication in the radio category

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servo

A micro-servo library

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Record sound clips. micro:bit (V2) only

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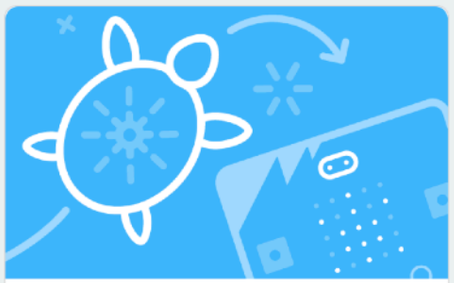
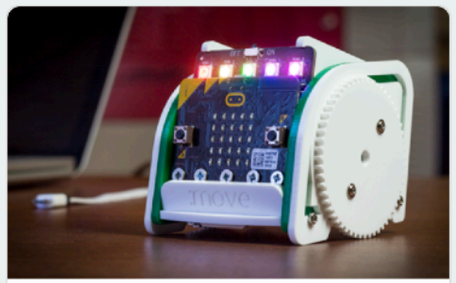


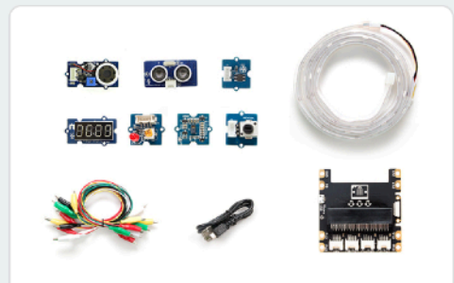
microturtle

sonar



kitronik-servo-lite

kitronik-motor-driver



Grove

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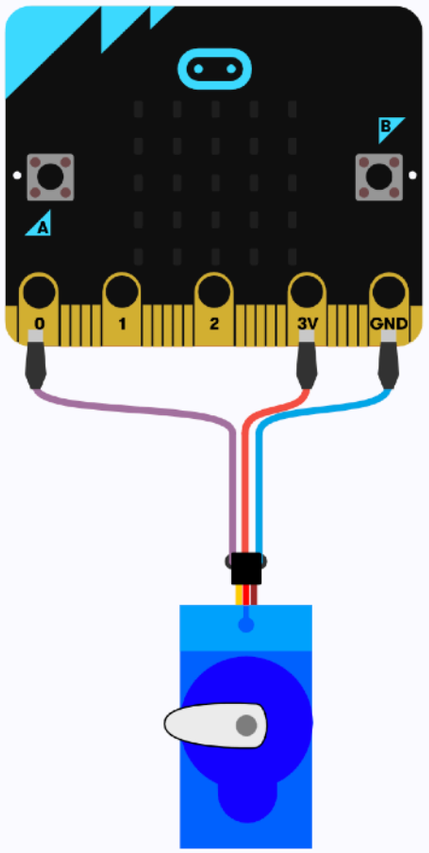


Search...

- Basic
- Input
- Music
- Led
- Radio
- Servos
- Loops
- Logic
- Variables
- Math
- Extensions
- Advanced
- Functions
- Arrays
- Text
- Game
- Images

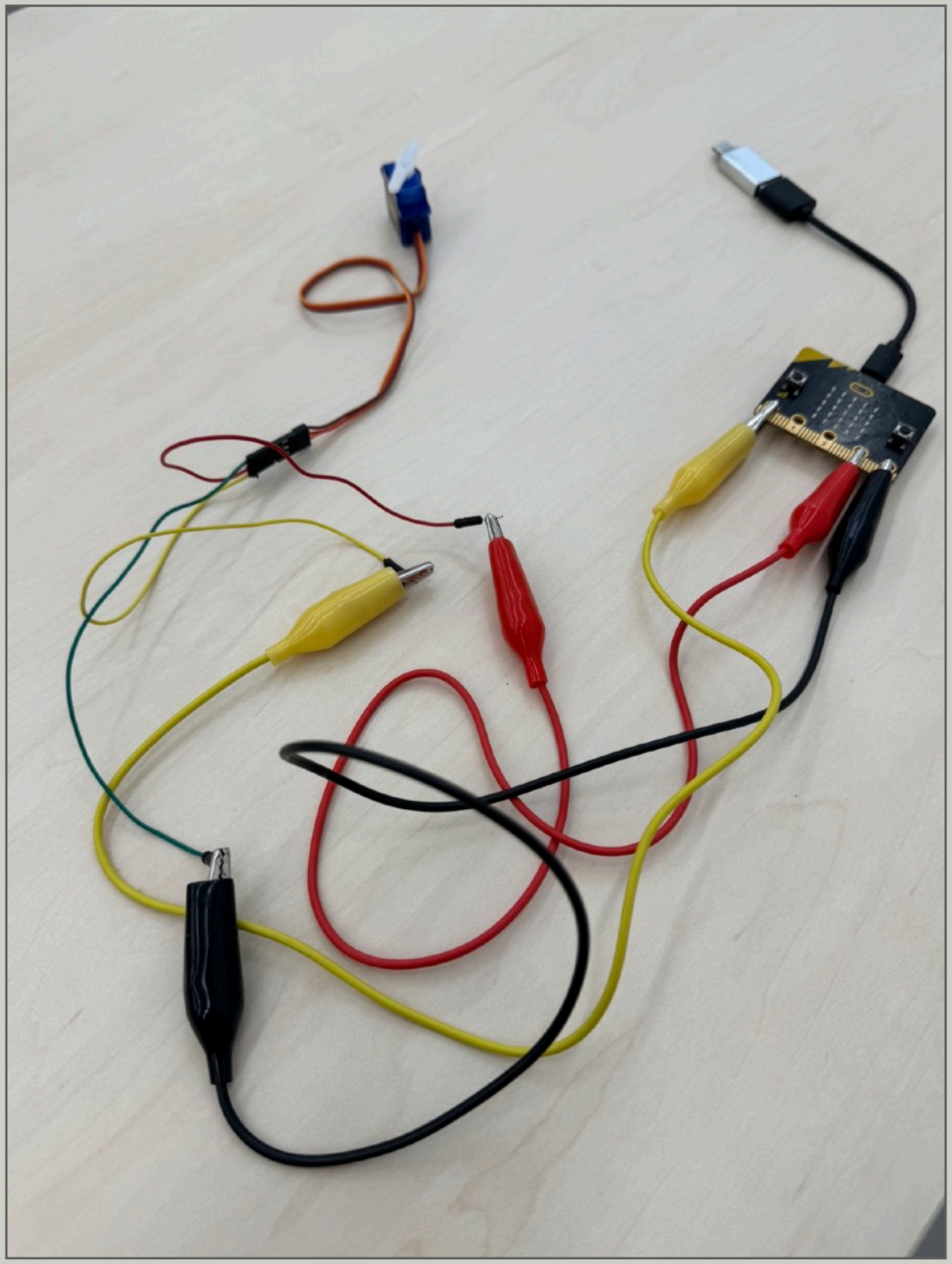
```
on button A pressed
    set servo P0 angle to 30 °
```

```
on button B pressed
    set servo P0 angle to 180 °
```

Show data Simulator

Download

Servo Test



Another way of doing it.

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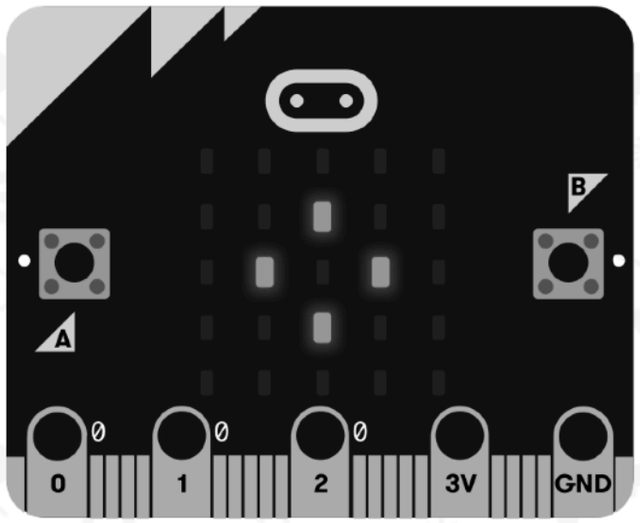


Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced
- Functions
- Arrays
- Text
- Game
- Images
- Pins

```
forever
    show icon
    pause (ms) 200
    show icon
```

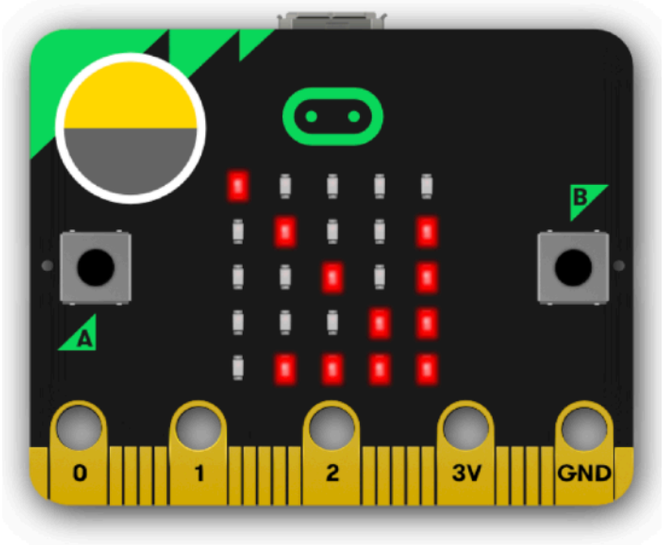
```
forever
    if pin P0 is pressed then
        show icon
        pause (ms) 100
    else if pin P1 is pressed then
        show icon
        pause (ms) 100
    else if pin P2 is pressed then
        show icon
        pause (ms) 100
```

Download

pin testing

Light Sensor

The LEDs of the screen, working as light sensors, can become input units, allowing detection of ambient light.



Exercise on light sensor.

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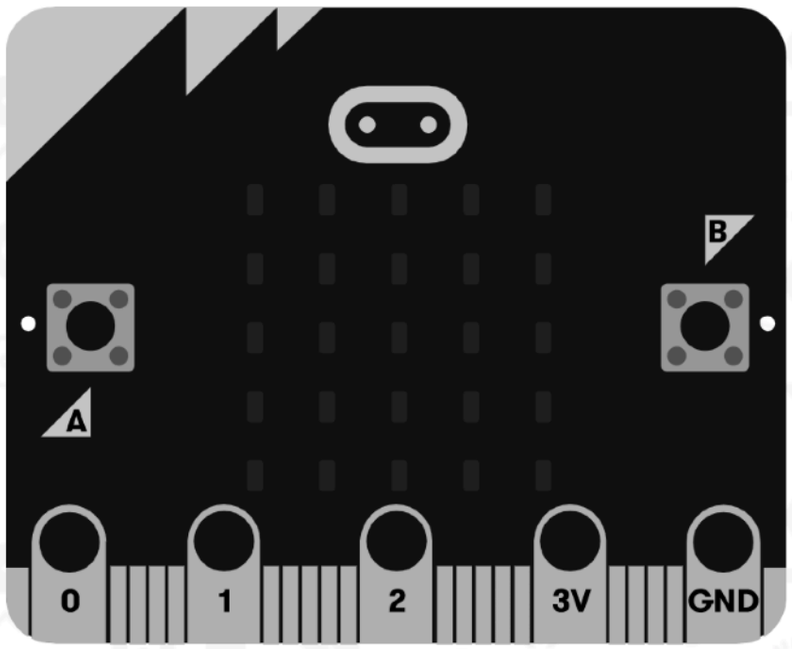

Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced
- Functions

forever

Download

Light Level Meter

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Search...

Basic

Input

Variables

Make a Variable...

New variable name:

reading

Ok

Cancel

Math

Advanced

Functions

Download

Light Level Meter

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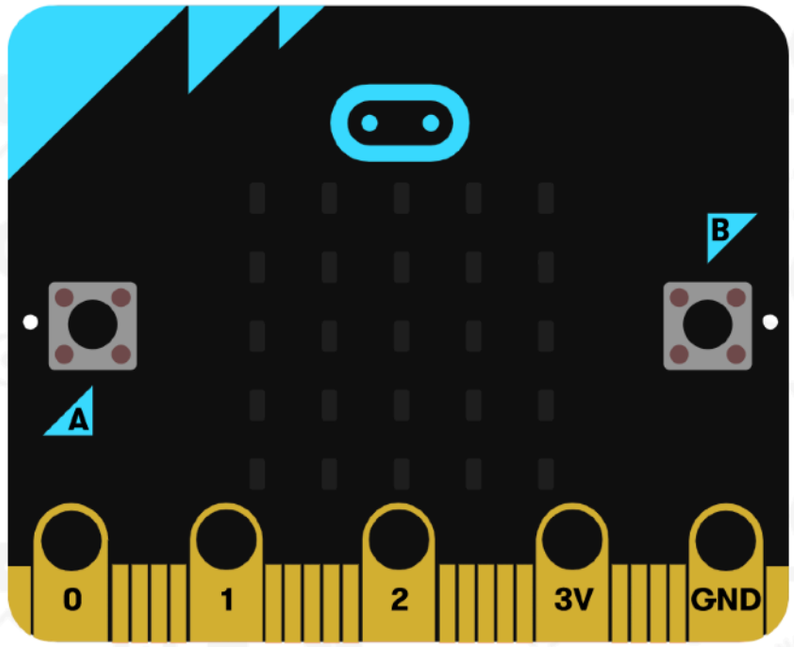

Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced
- Functions

Variables

Make a Variable...

reading

set reading to 0

change reading by 1

Download

Light Level Meter

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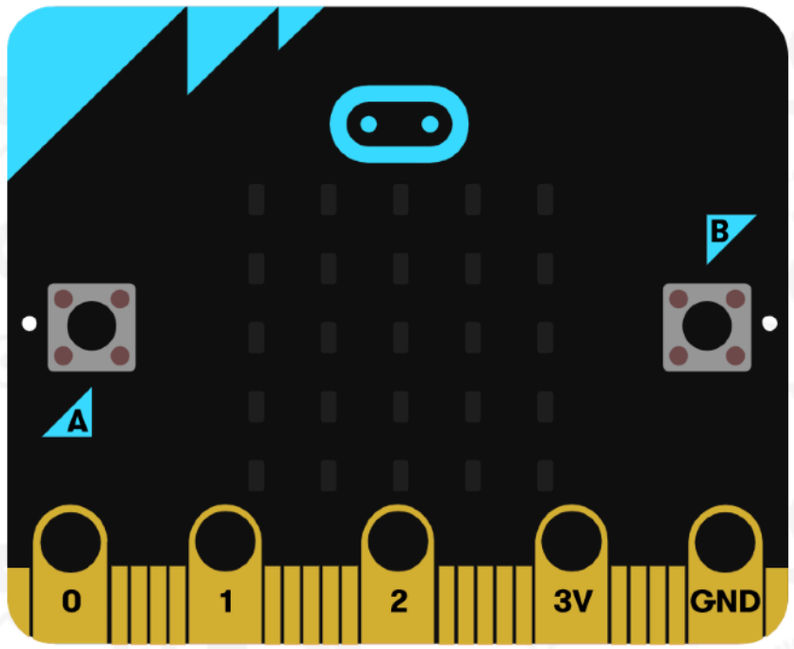
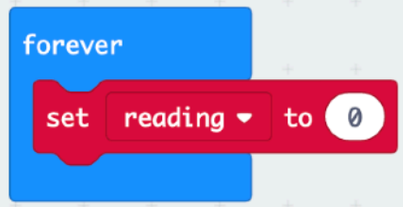


X#

- Search
- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced



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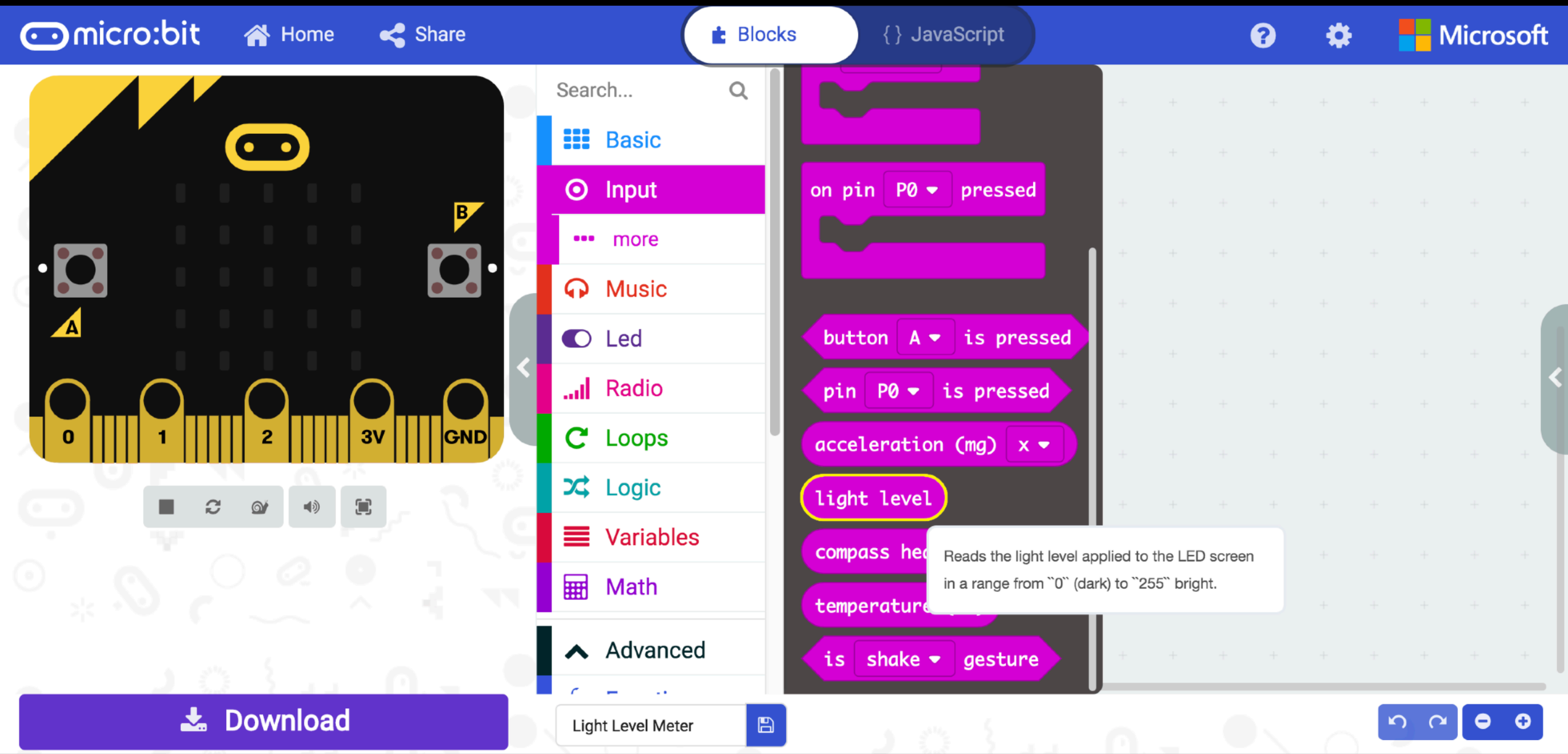
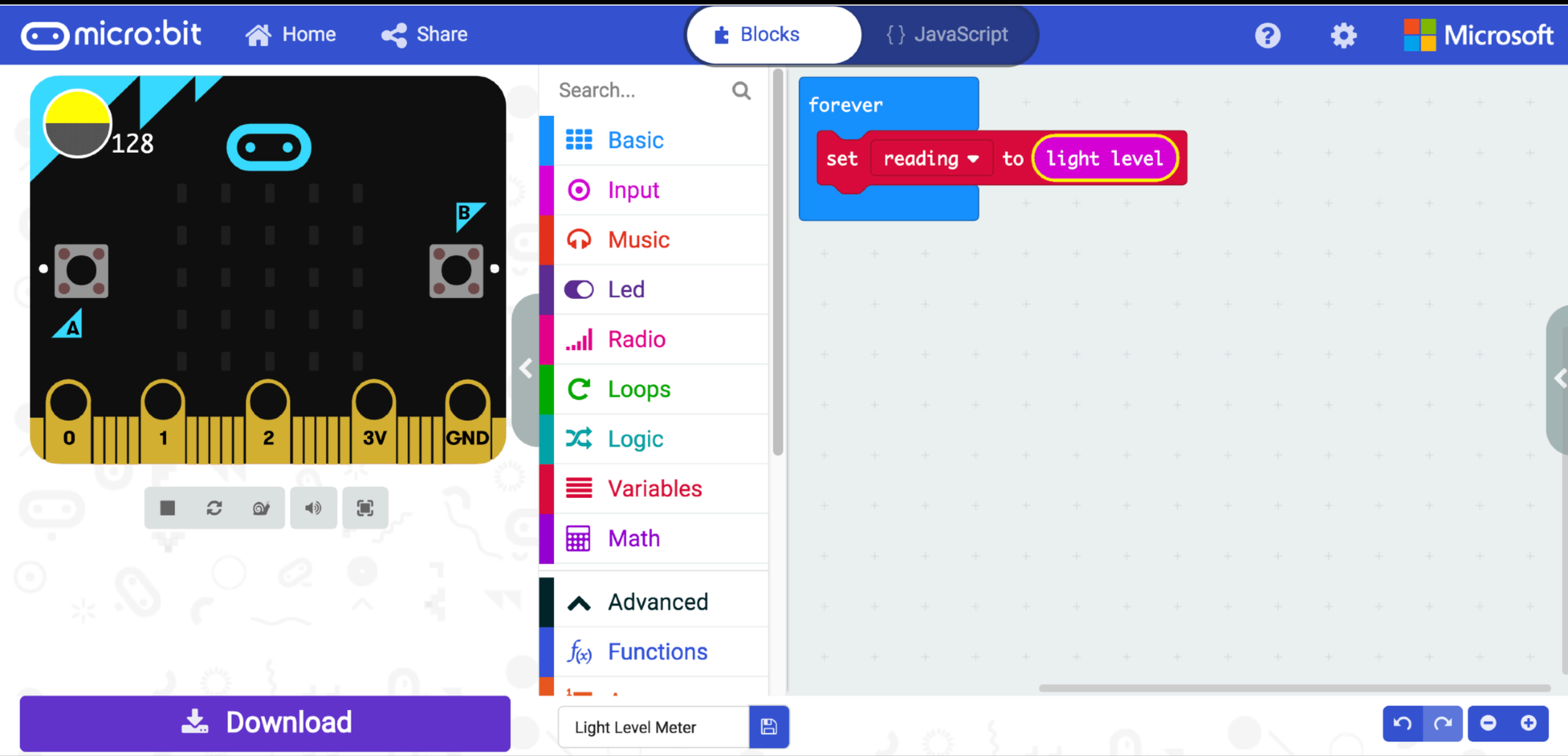
Light Level Meter


micro:bit
Home
Share
Blocks
{ } JavaScript
Microsoft
B
A
0
1
2
3V
GND
Search...
Basic
Input
more
Music
Led
Radio
Loops
Logic
Variables
Math
Advanced
on pin P0 pressed
button A is pressed
pin P0 is pressed
acceleration (mg) x
light level
compass he
temperature
is shake gesture
Reads the light level applied to the LED screen
in a range from `0` (dark) to `255` bright.
Download
Light Level Meter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Microsoft
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Loops
Logic
Variables
Math
Advanced
Functions
forever
set reading to light level
Download
Light Level Meter

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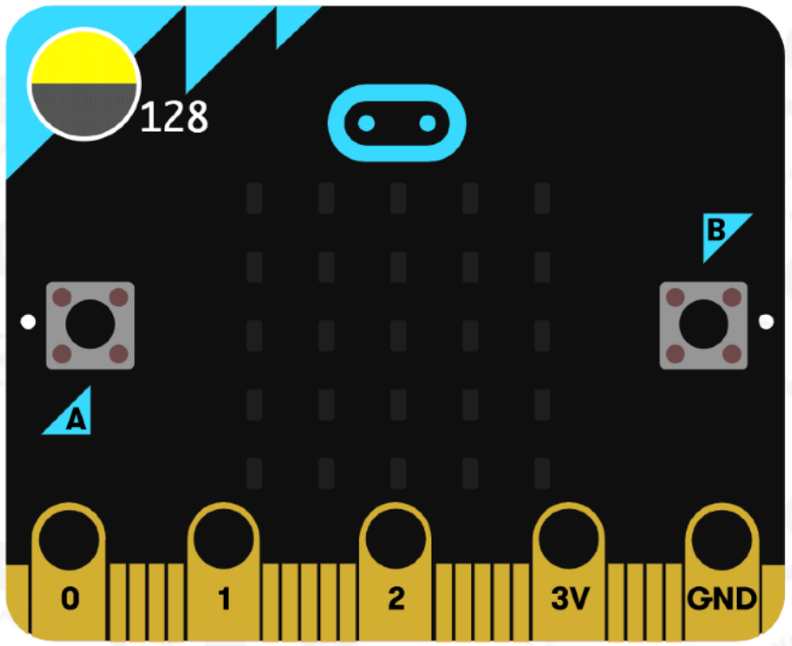

X#

- Search
- Basic
- Input
- Music
- Led
- more
- Radio
- Loops
- Logic
- Variables
- Math

Led

plot x 0 y 0

unplot x 0 y 0

toggle x 0 y 0

point x 0 y 0

plot bar graph of 0 up to 0

to light level

Download

Light Level Meter

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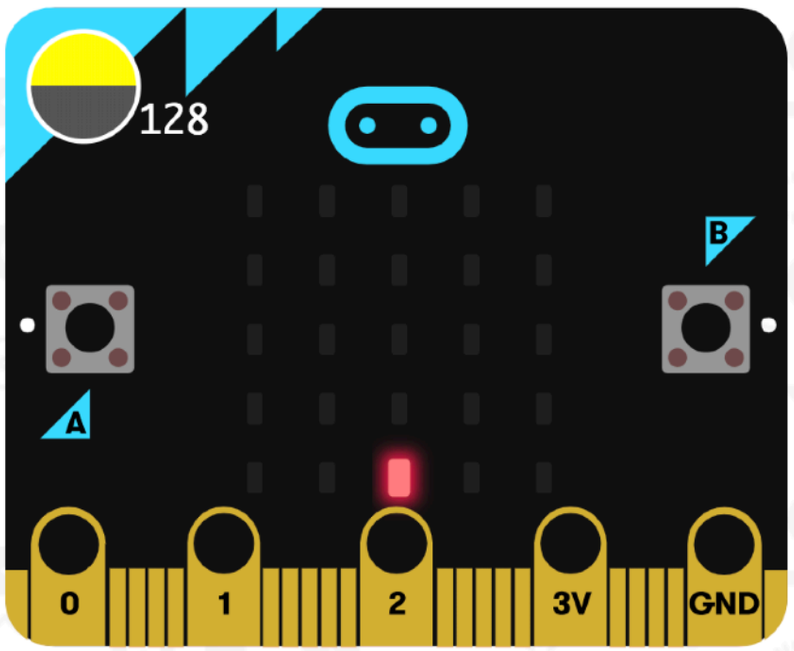

Show console Simulator

Download

X#

- Search
- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced

```
forever
    set reading to light level
    plot bar graph of 0
    up to 0
```

Light Level Meter

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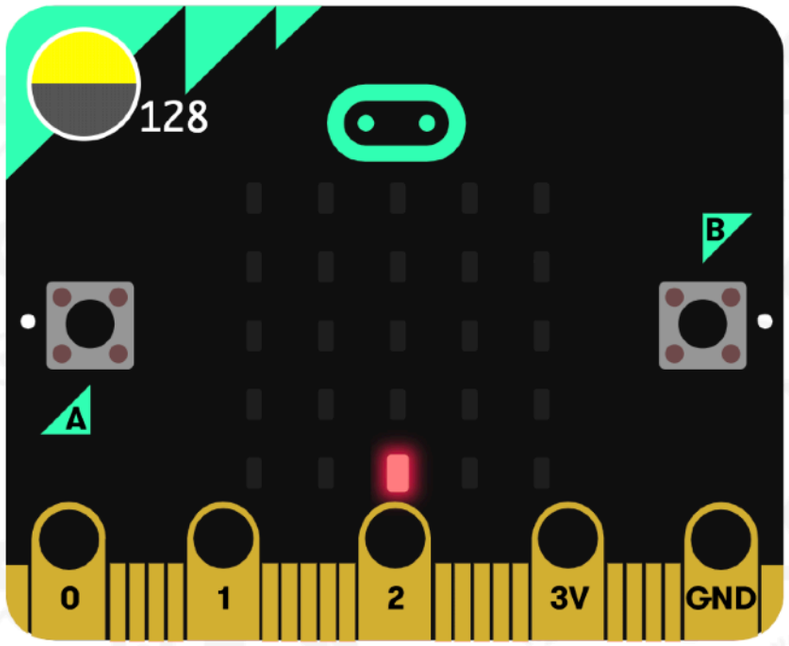

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Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced

Variables

Make a Variable...

reading

set reading to 0

change reading by 1

to light level

f 0

Light Level Meter

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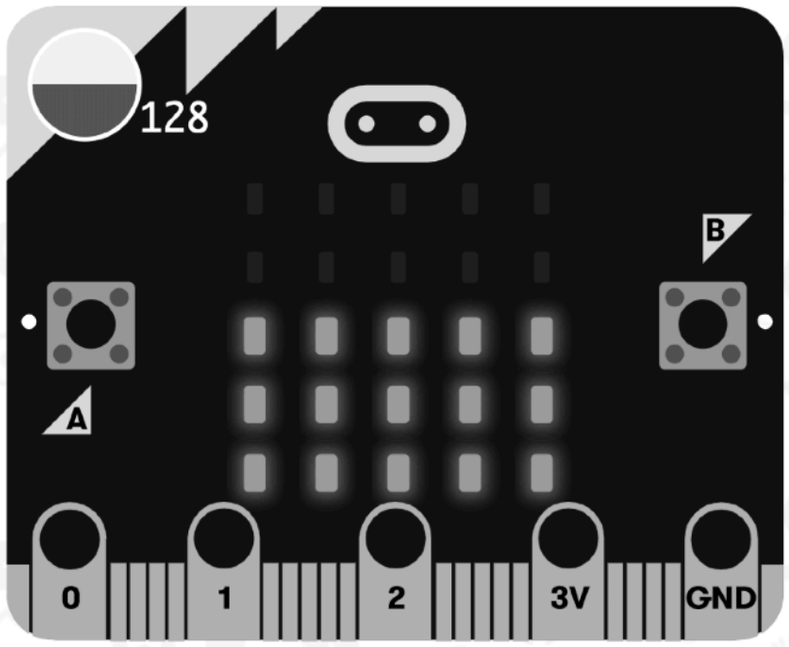

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Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced

```
forever
    set reading to light level
    plot bar graph of 0
    up to 255
```

Light Level Meter

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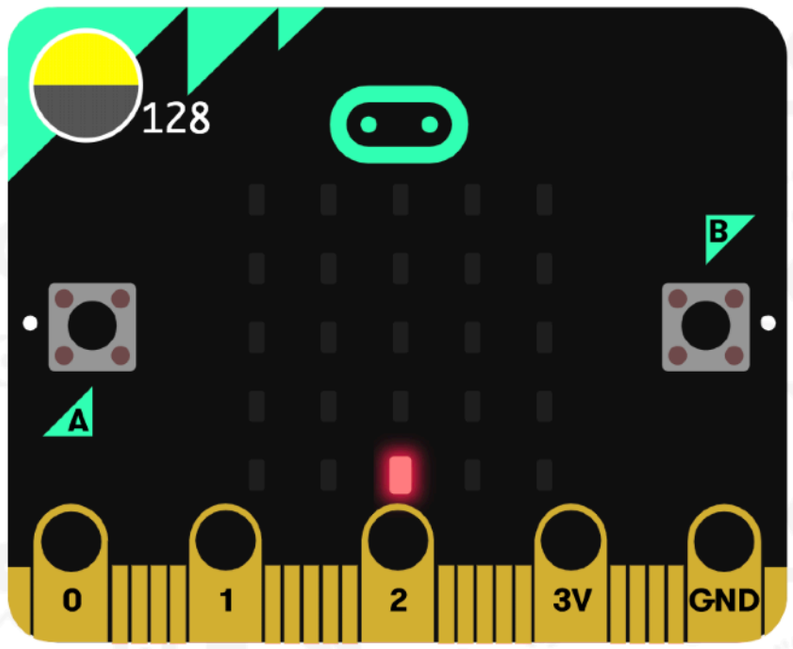

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- Input
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- Loops
- Logic
- Variables
- Math
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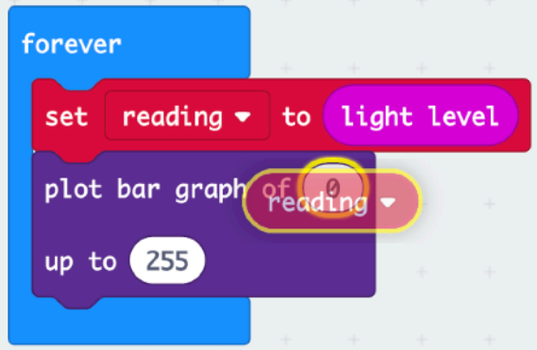

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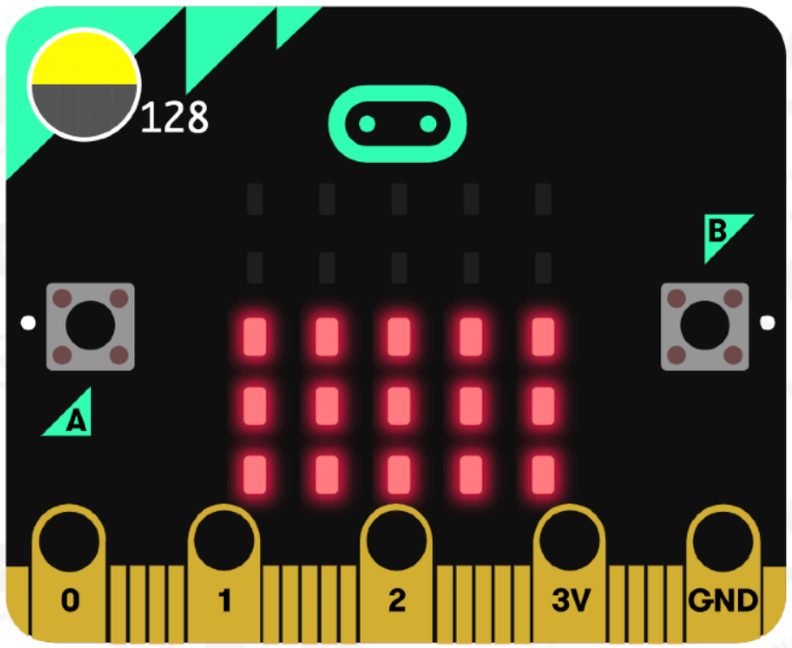

Search...

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- Input
- Music
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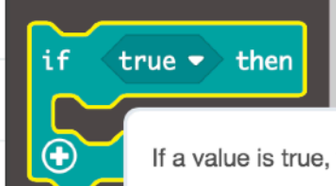
- Logic
- Variables
- Math
- Advanced

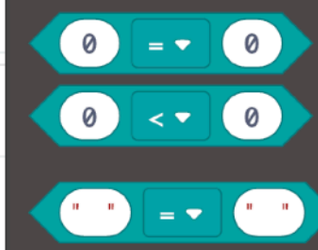
Logic

Conditionals



If a value is true, then do some statements.

Comparison



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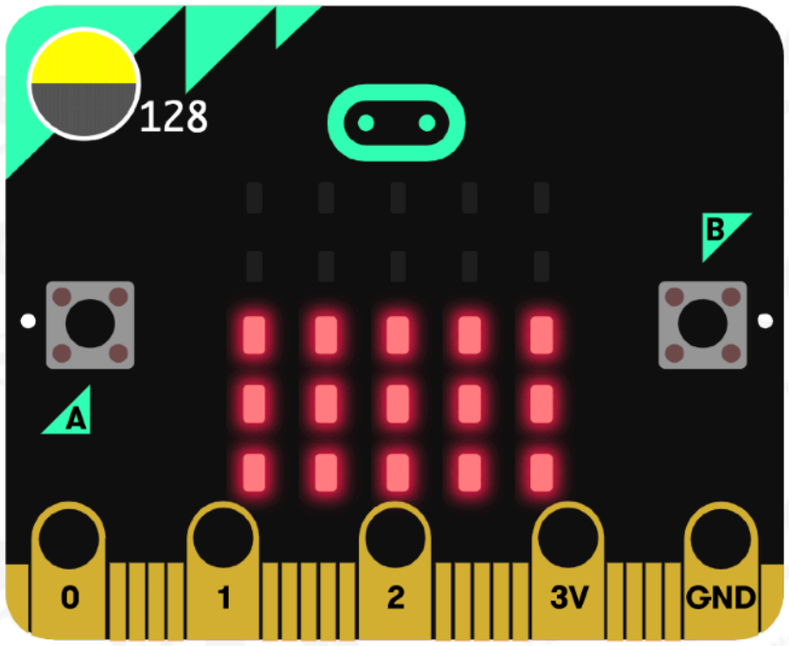

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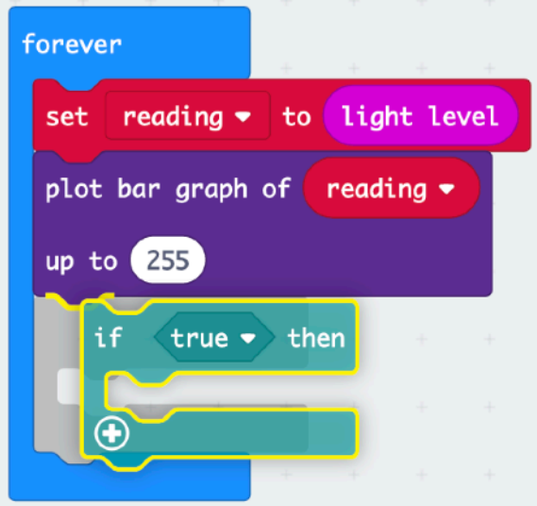
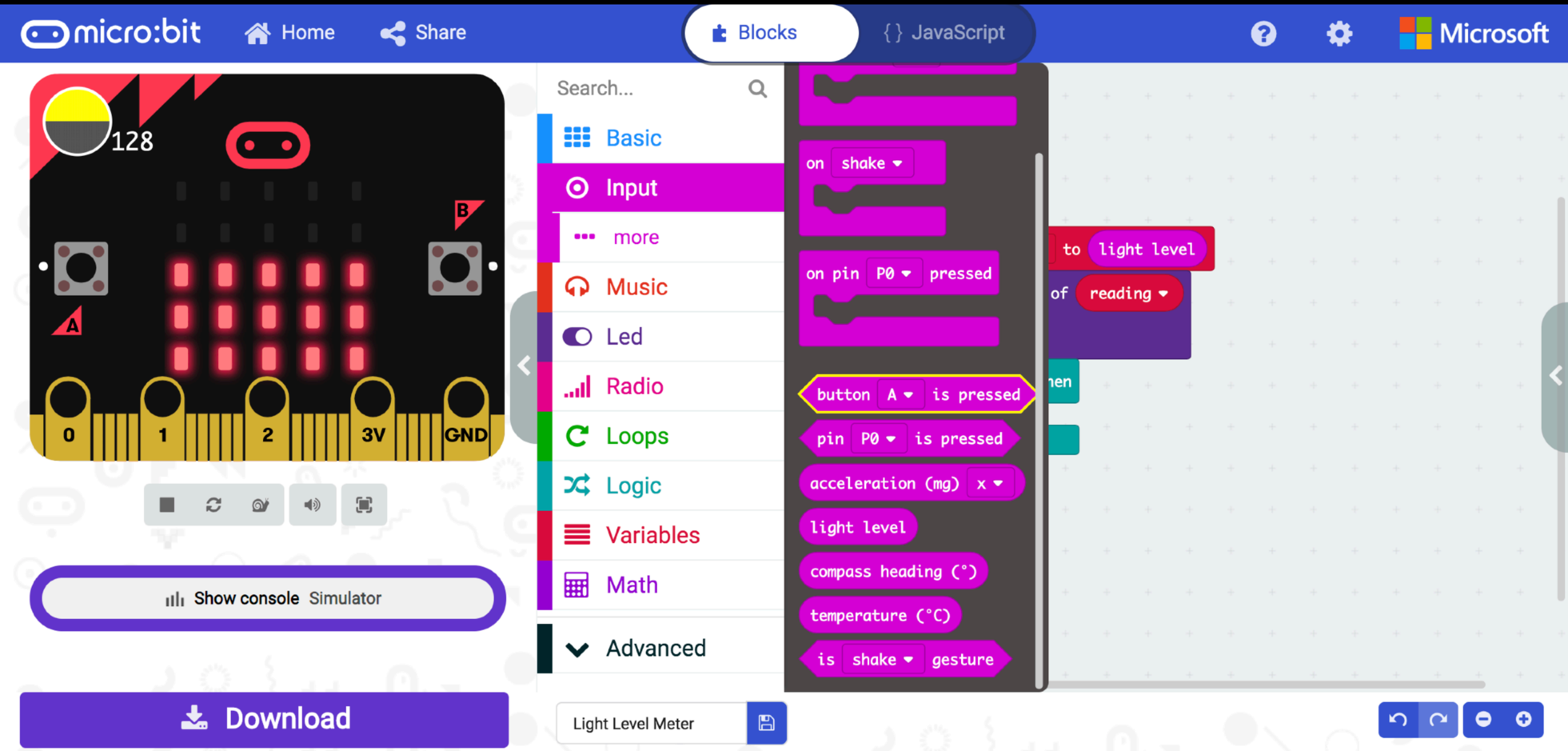


Light Level Meter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Basic
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more
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Advanced
on shake
on pin P0 pressed
button A is pressed
pin P0 is pressed
acceleration (mg) x
light level
compass heading (°)
temperature (°C)
is shake gesture
to light level
of reading
Light Level Meter

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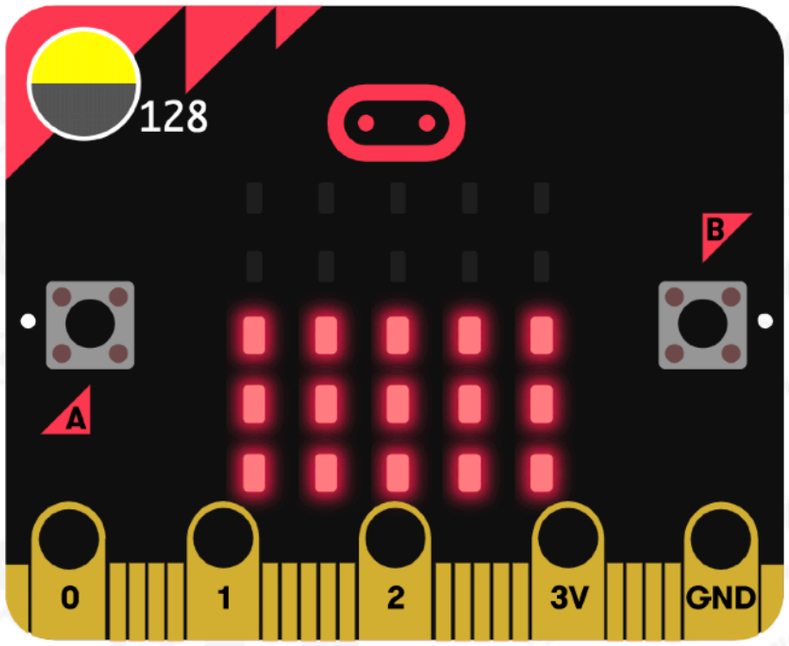

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Search...

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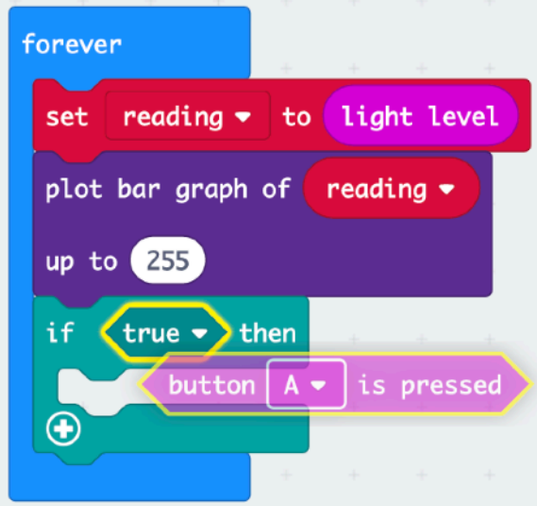
- Advanced



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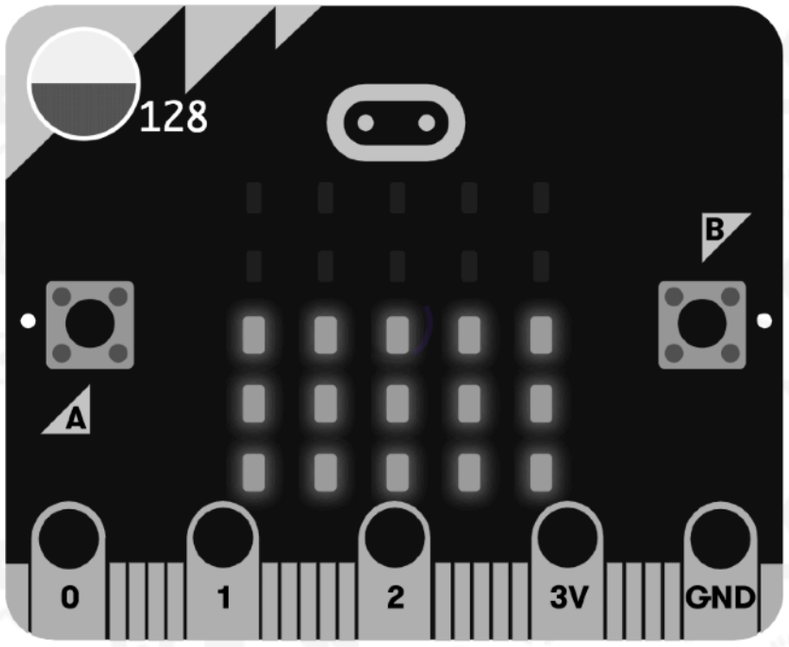

Search...

- Basic
- Input
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- Radio
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- Variables
- Math
- Advanced

```
forever
  set reading to light level
  plot bar graph of reading
  up to 255
  if button A is pressed then
```

Show console Simulator

Download

Light Level Meter

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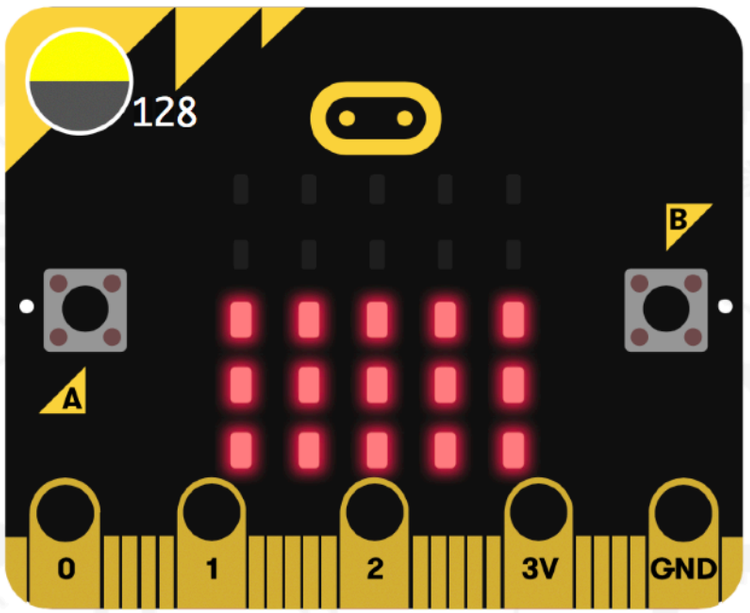


Show console Simulator

Basic
more
Input
Music
Led
Radio
Loops
Logic
Variables
Math
Advanced
Functions
Arrays
Text

Basic

show number 0

show led

Scroll a number on the screen. If the number fits on the screen (i.e. is a single digit), do not scroll.

show icon

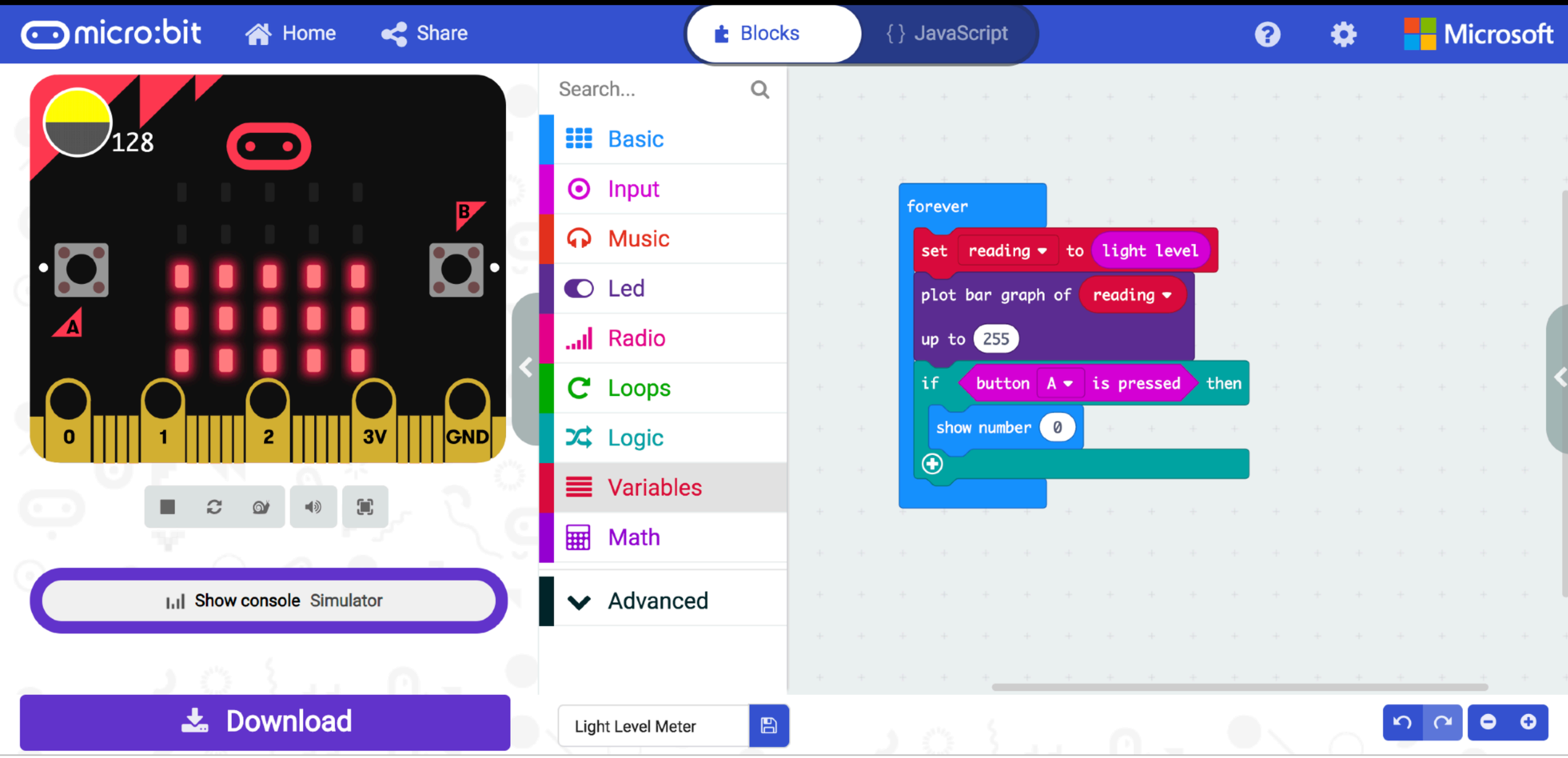
show string "Hello!"

forever

ed then

Download

Untitled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Search...
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Variables
Math
Advanced
forever
set reading to light level
plot bar graph of reading
up to 255
if button A is pressed then
show number 0
Show console
Simulator
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Light Level Meter

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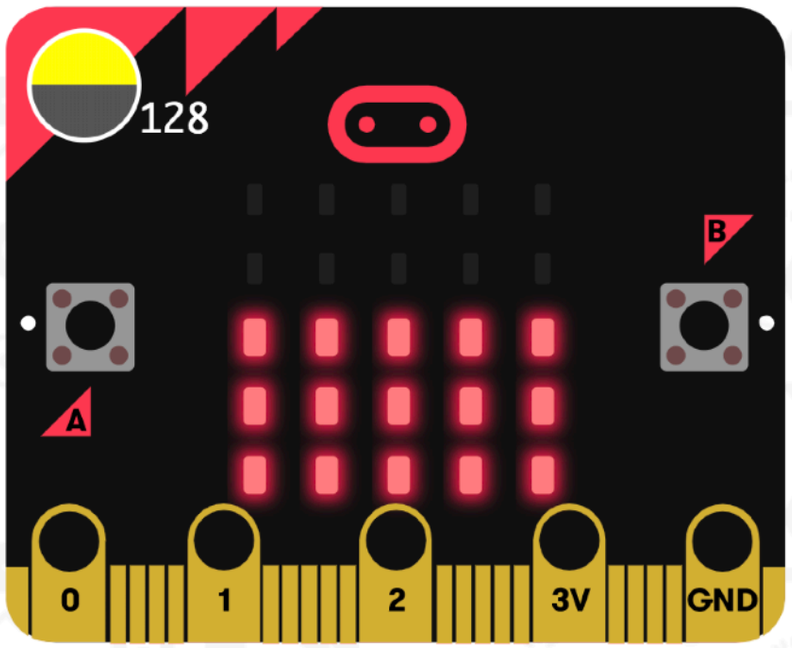

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Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced

Variables

Make a Variable...

reading

set reading to 0

change reading by 1

to light level

f reading

is pressed then

Light Level Meter

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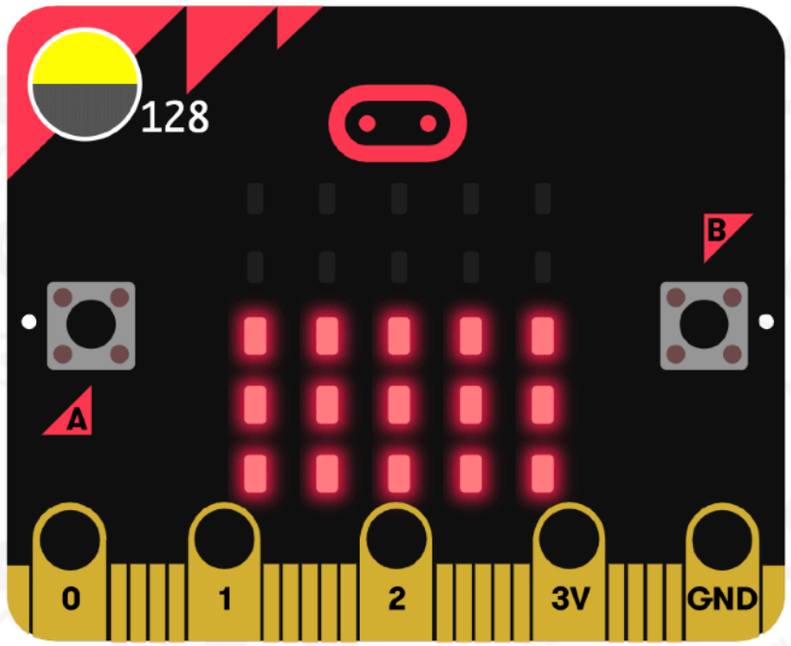

Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced

```
forever
  set reading to light level
  plot bar graph of reading up to 255
  if button A is pressed then
    show number reading
```

Show console Simulator

Download

Light Level Meter

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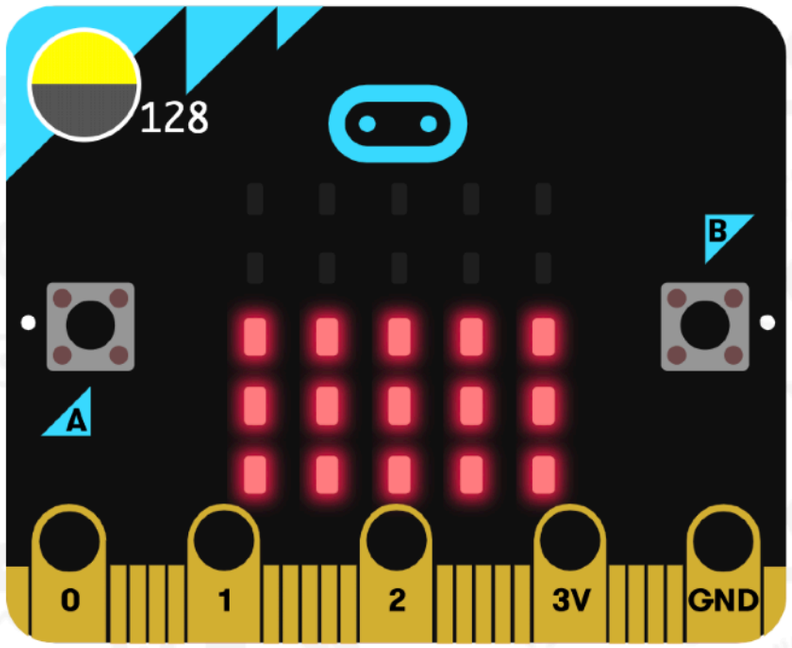


Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced

```
forever
  set reading to light level
  plot bar graph of reading
  up to 255
  if button A is pressed then
    show number reading
```

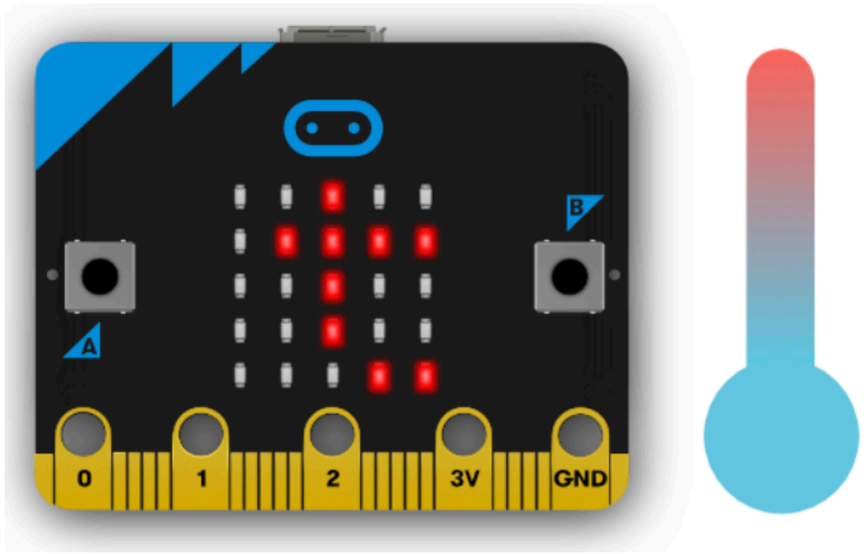
Show console Simulator

Download

Light Level Meter

Temperature Sensor

The temperature sensor can be used to detect the current temperature of the device in degrees and Celsius.



Exercise on temperature sensor.

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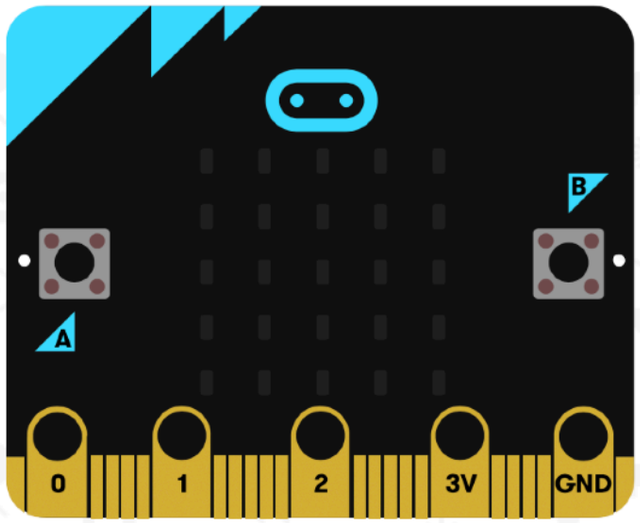

Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced
- Functions
- Arrays
- Text
- Game
- Images
- Pins

Variables

Make a Variable...

rever

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Search...

Basic

Input

Music

Variables

Make a Variable...

forever

B

A

0 1 2 3V

New variable name:

temperature

Ok

Cancel

Advanced

Functions

Arrays

Text

Download

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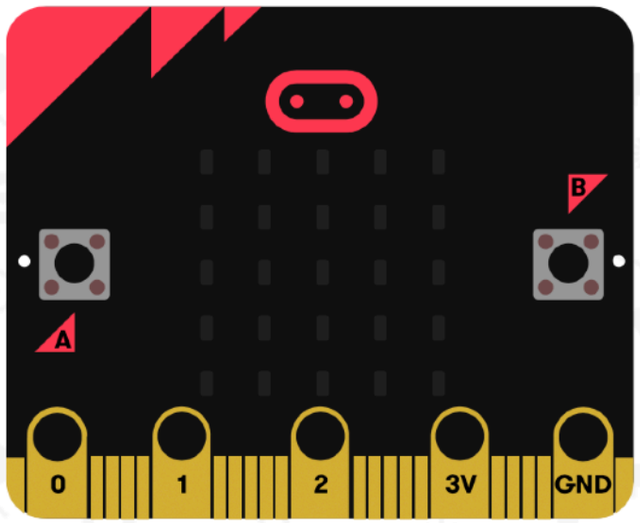

Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced
- Functions
- Arrays
- Text
- Game
- Images
- Pins

Variables

Make a Variable...

temperature

set temperature to 0

change temperature by 1

Download

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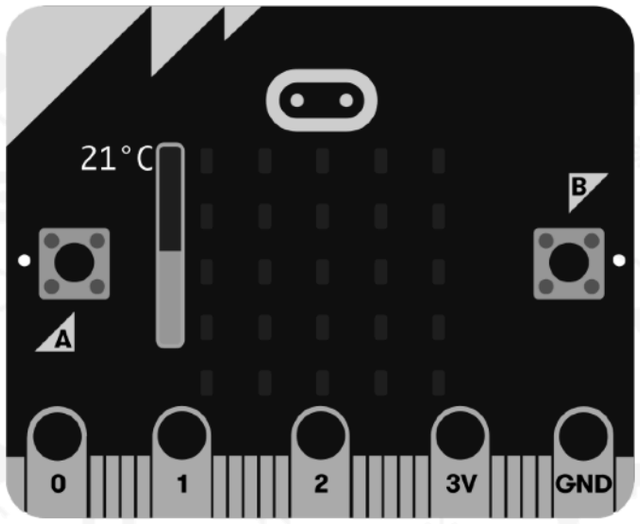
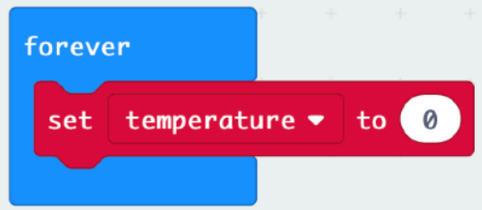


- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced
- Functions
- Arrays
- Text
- Game
- Images
- Pins
- Serial
- Control
- Extensions



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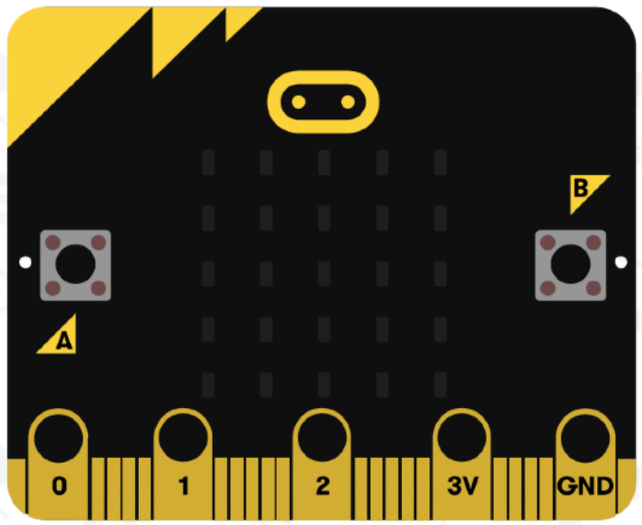
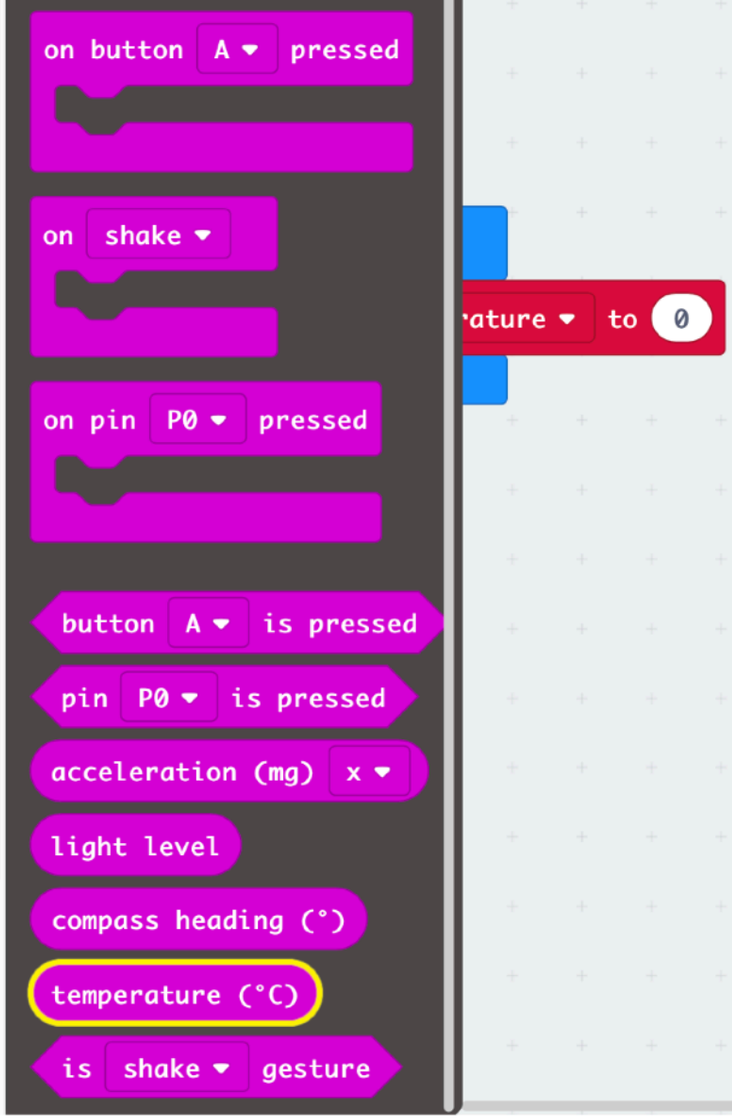


Search...

- Basic
- Input
- more
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced
- Functions
- Arrays
- Text
- Game
- Images

Input



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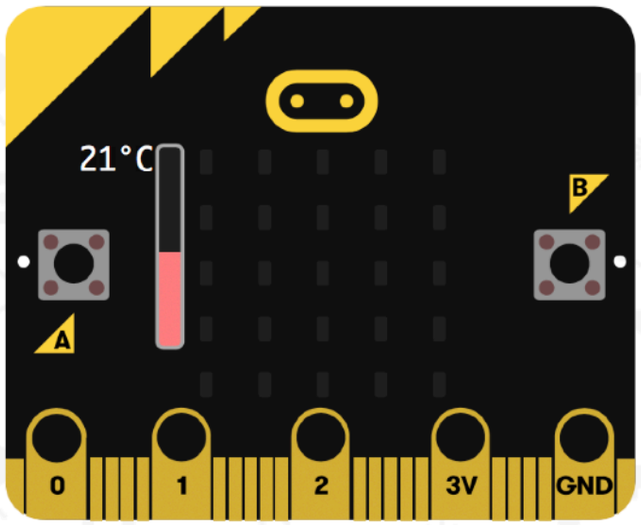

Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
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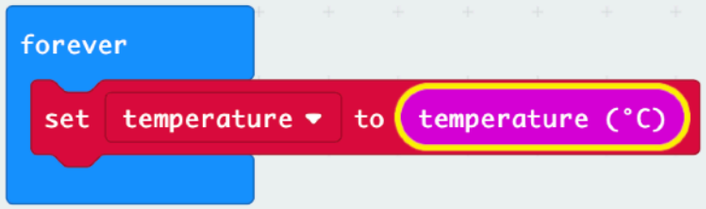
- Game
- Images
- Pins



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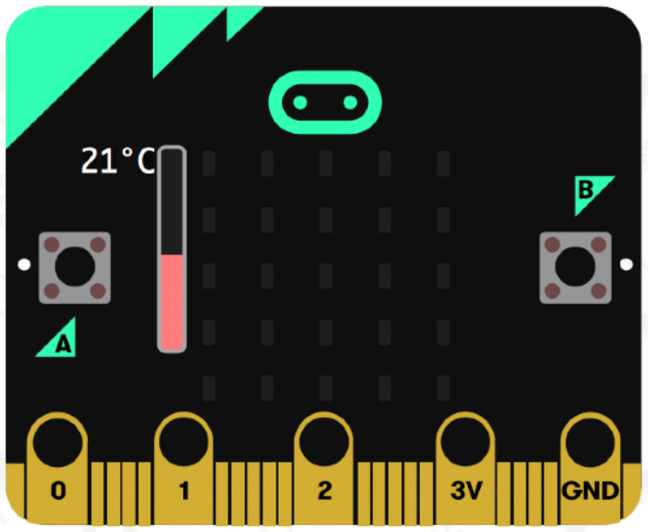

Search...

- Basic
- more
- Input
- Music
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- Radio
- Loops
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- Images

Basic

show number 0

show leds

show icon

show string "Hello!"

forever

pause (ms) 100

on start

temperature (°C)

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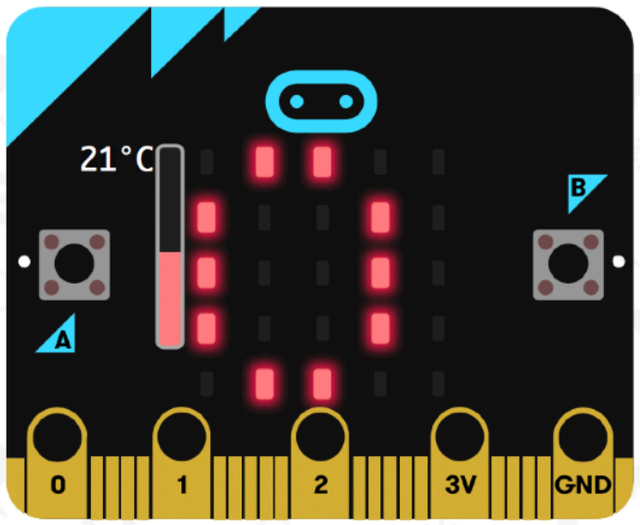

- Music
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- Logic
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- Text
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- Serial
- Control
- Extensions

```
forever
    set temperature to temperature (°C)
    show number 0
```

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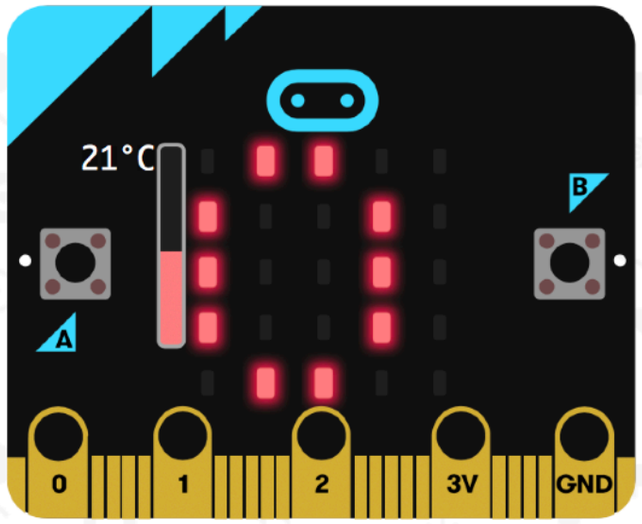

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- Logic
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- Arrays
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Variables

Make a Variable...

temperature

set temperature to 0

change temperature by 1

to temperature (°C)

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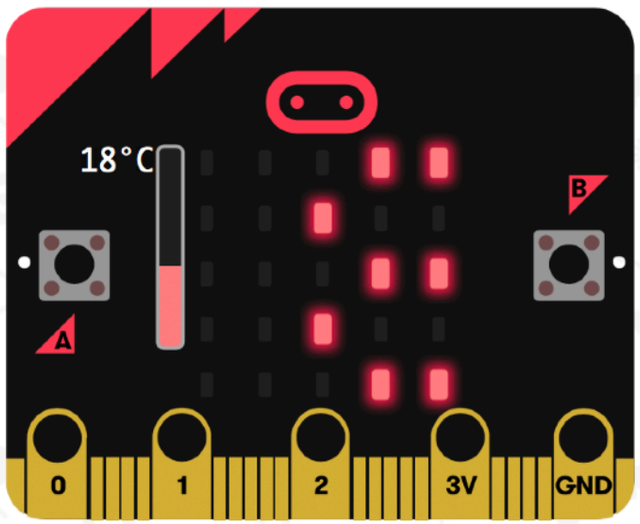

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```
forever
    set temperature to temperature (°C)
    show number temperature
```

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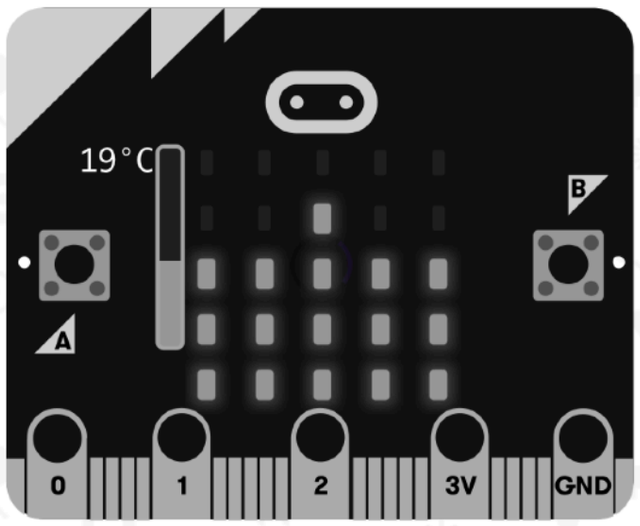
Another way of showing the temperature.



Show console Simulator

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```
forever
    set temperature to temperature (°C)
    plot bar graph of temperature
    up to 32
```

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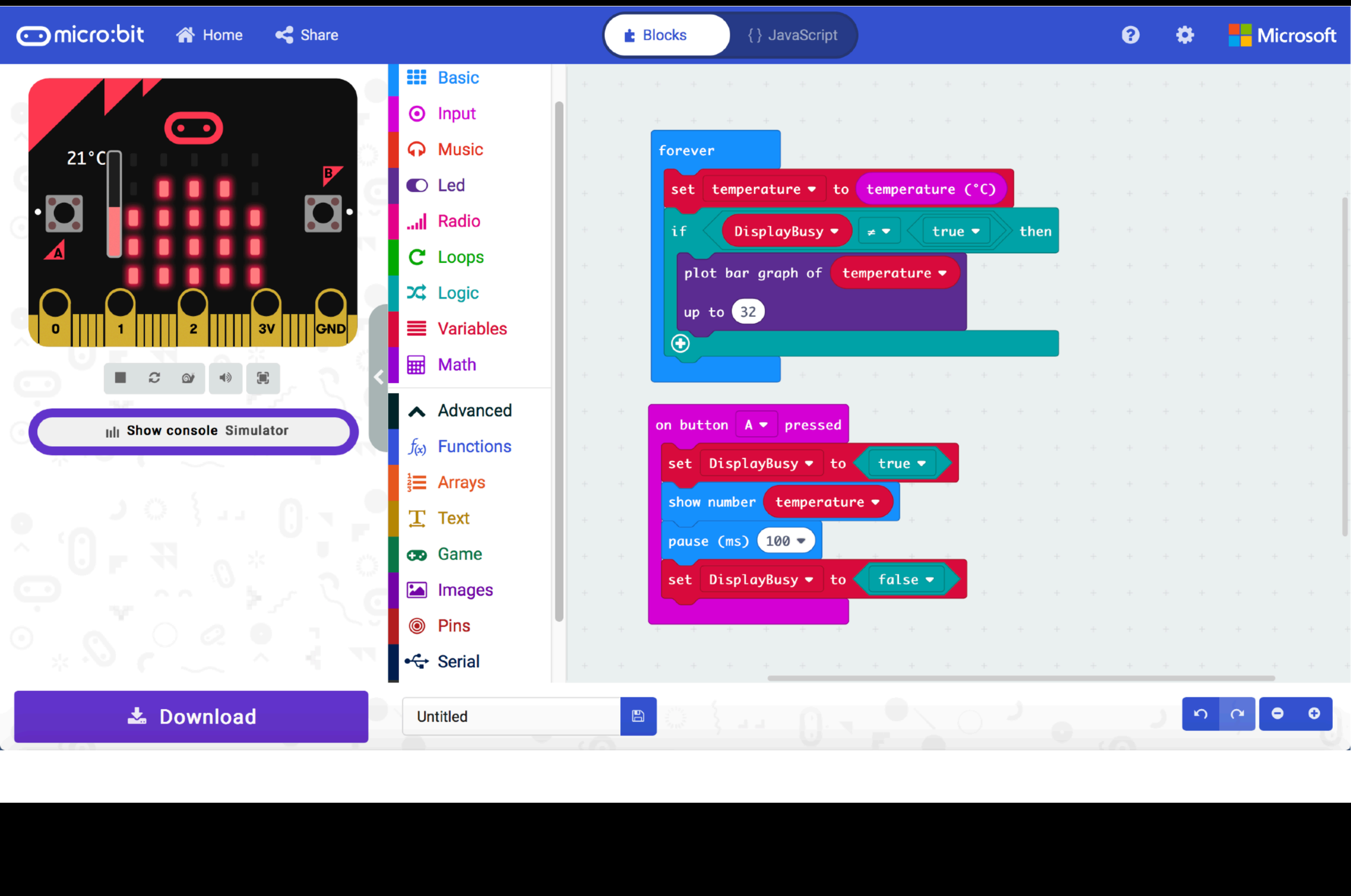
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Show console Simulator
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forever
set temperature to temperature (°C)
if DisplayBusy ≠ true then
plot bar graph of temperature
up to 32
on button A pressed
set DisplayBusy to true
show number temperature
pause (ms) 100
set DisplayBusy to false
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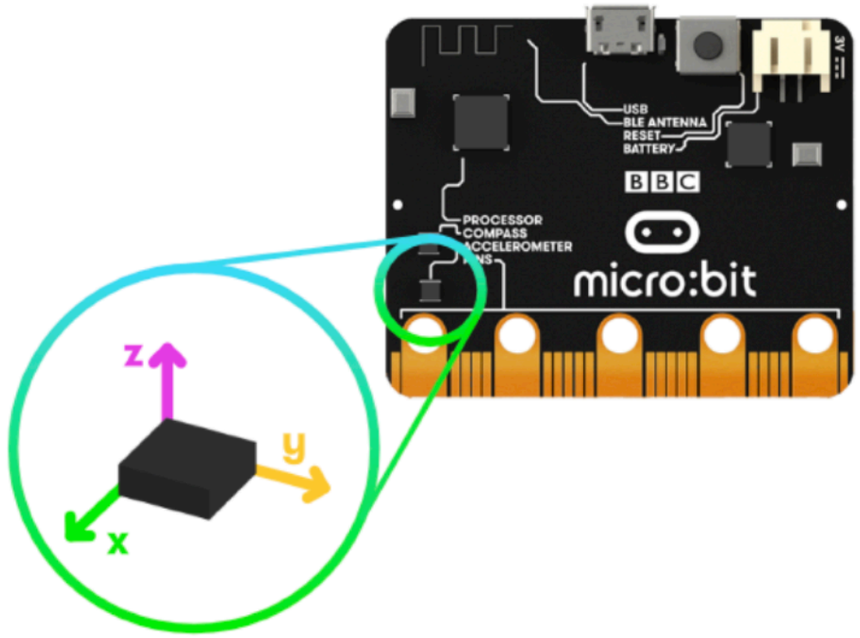
Accelerometer

This feature measures the acceleration of the micro:bit when it is moved, shaked, tilted, and dropped.



Exercise on accelerometer.

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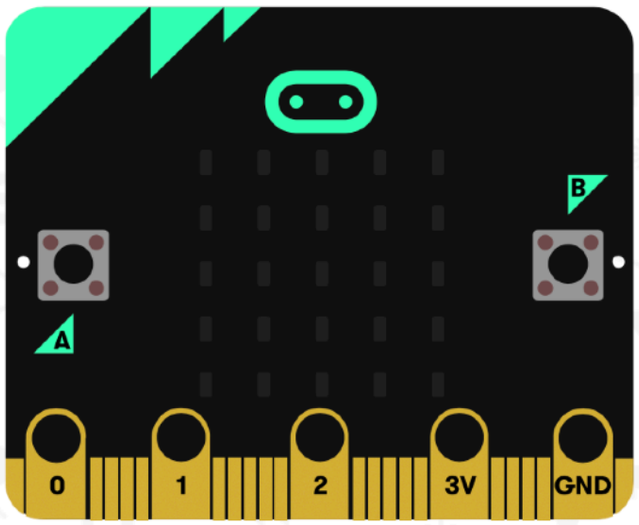

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Variables

Make a Variable...

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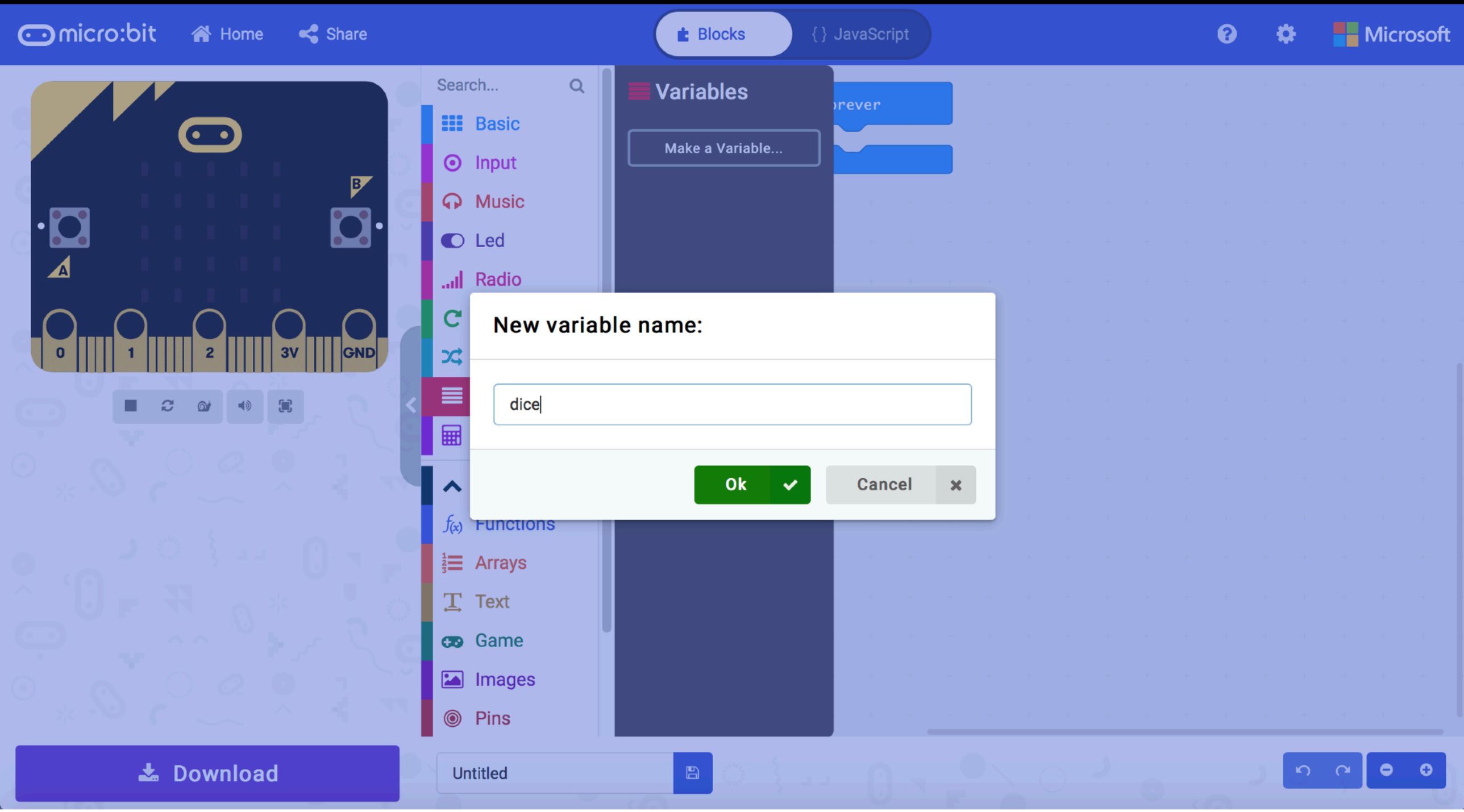
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forever
New variable name:
dice
Ok
Cancel
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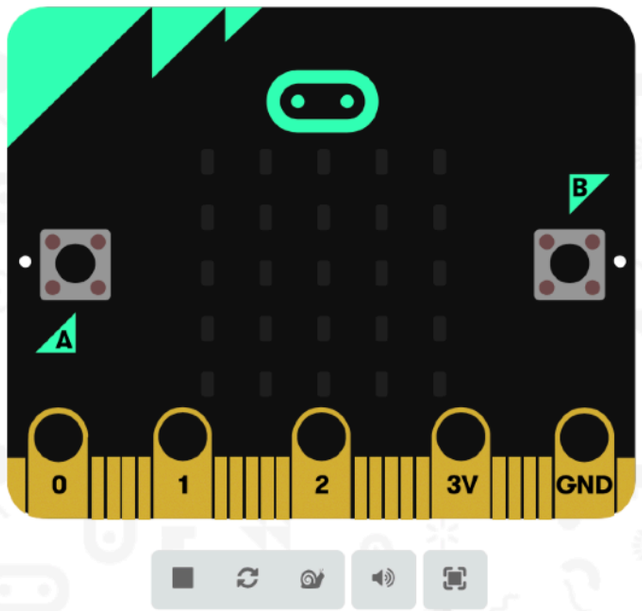

Search...

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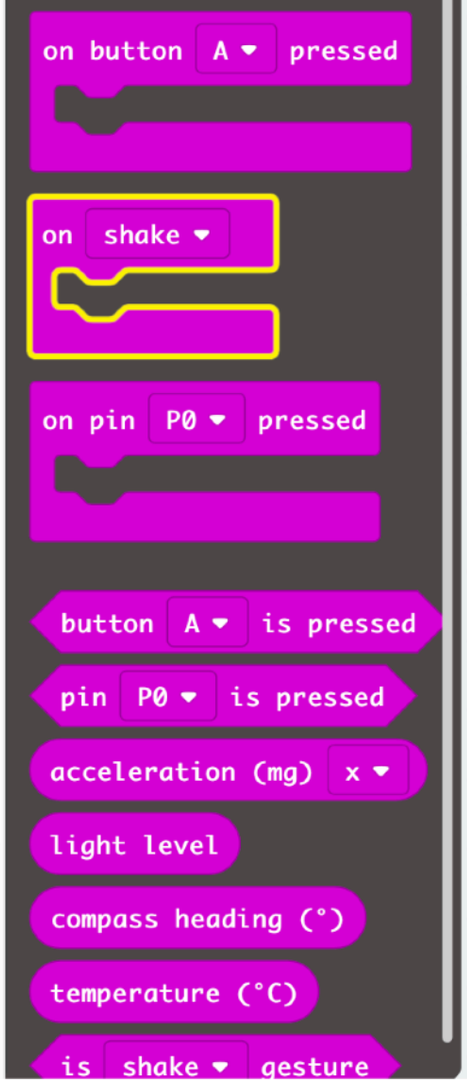
Input



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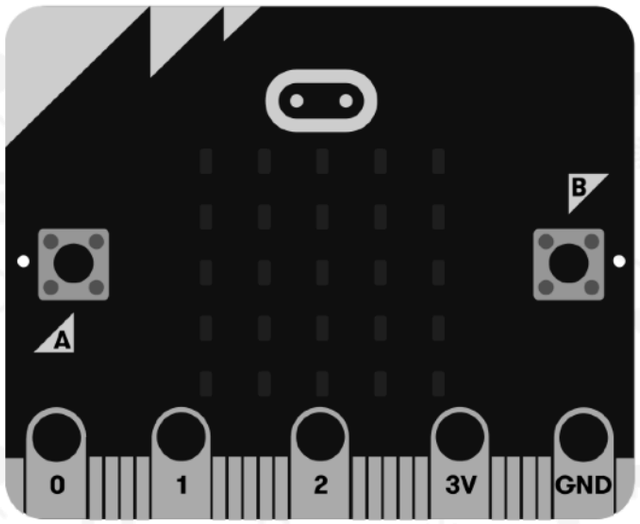

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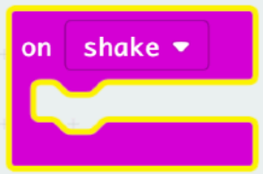

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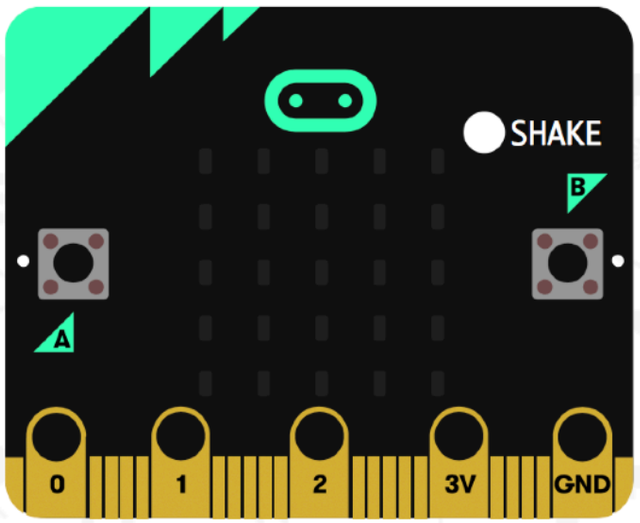

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Variables

Make a Variable...

dice

set dice to 0

change dice by 1

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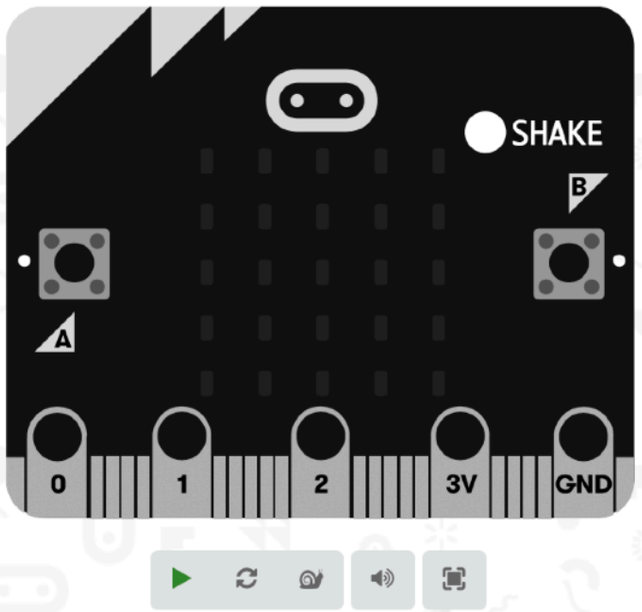

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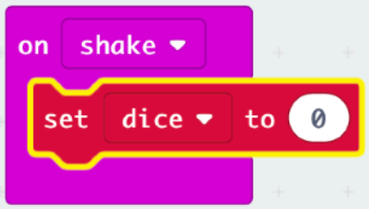

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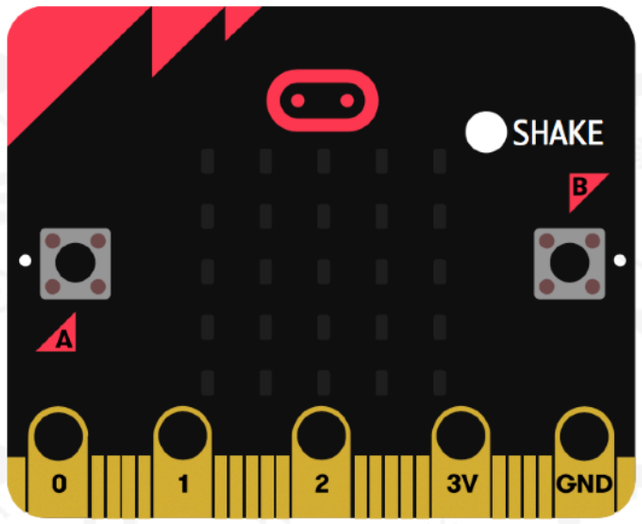

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0 - 0
0 × 0
0 ÷ 0
0
remainder of 0 ÷ 1
min of 0 and 0
max of 0 and 0
absolute of 0
square root 0
round 0
pick random 0 to 10

Returns a pseudorandom number between min and max included. If both numbers are integral, the result is integral.

map low 0 high 4
pick random true or false

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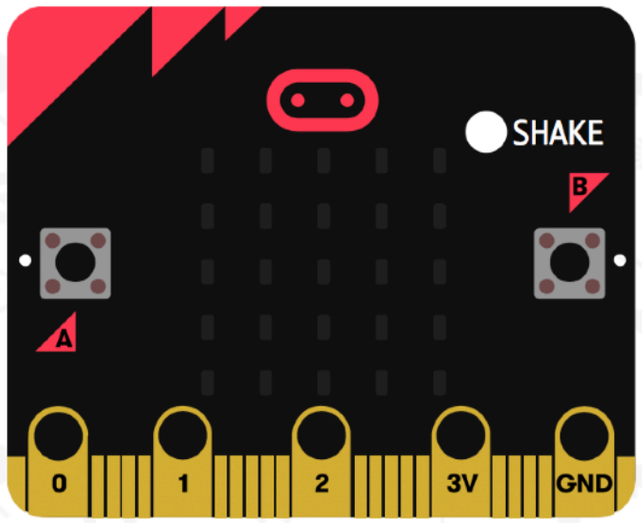

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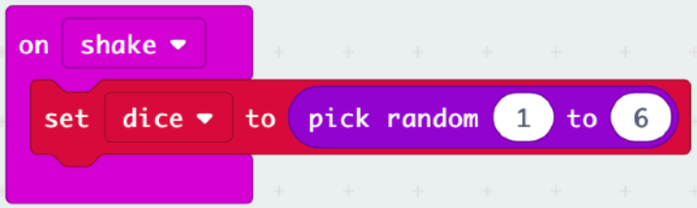

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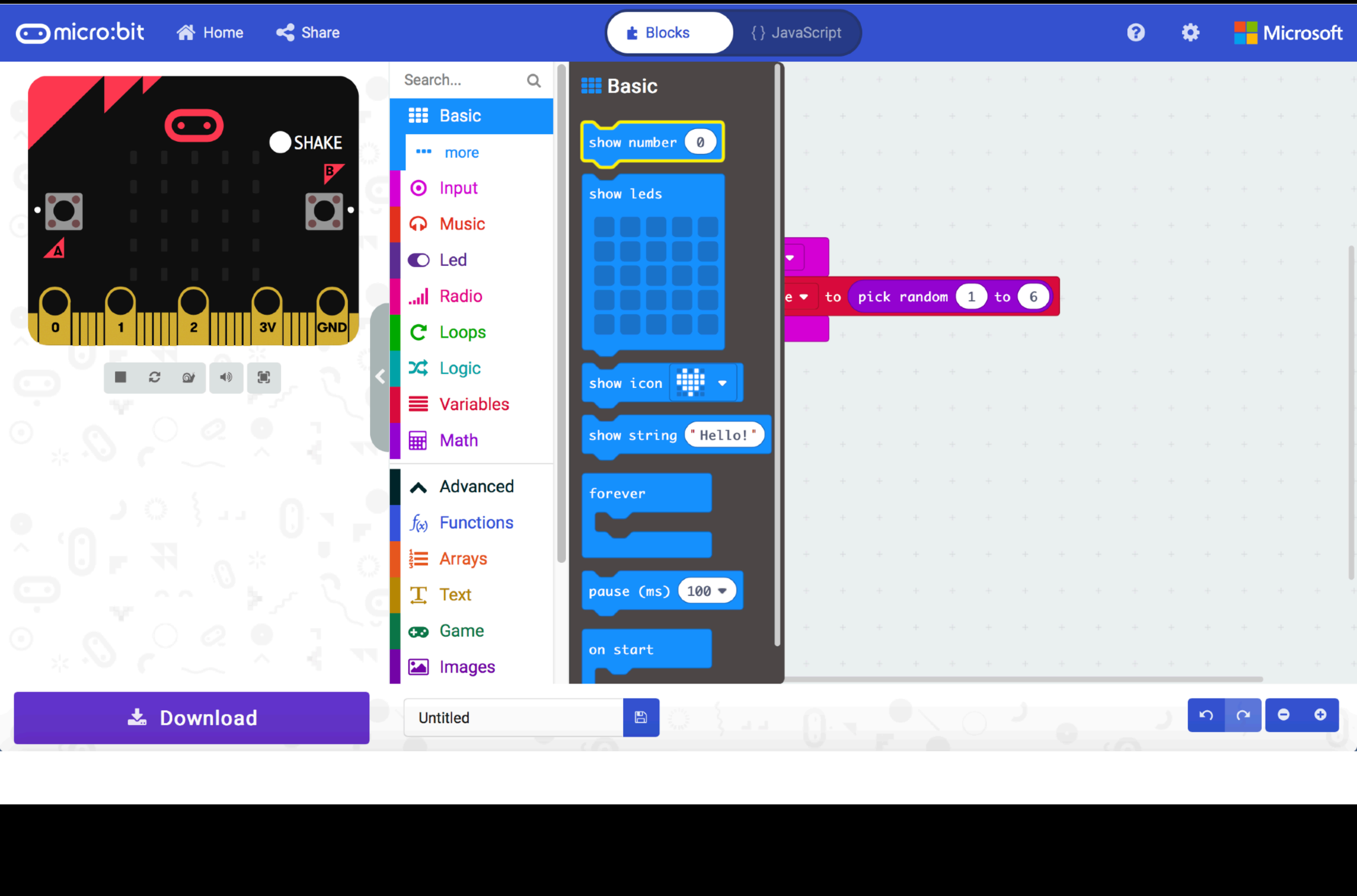
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Basic
show number 0
show leds
show icon
show string "Hello!"
forever
pause (ms) 100
on start
e to pick random 1 to 6
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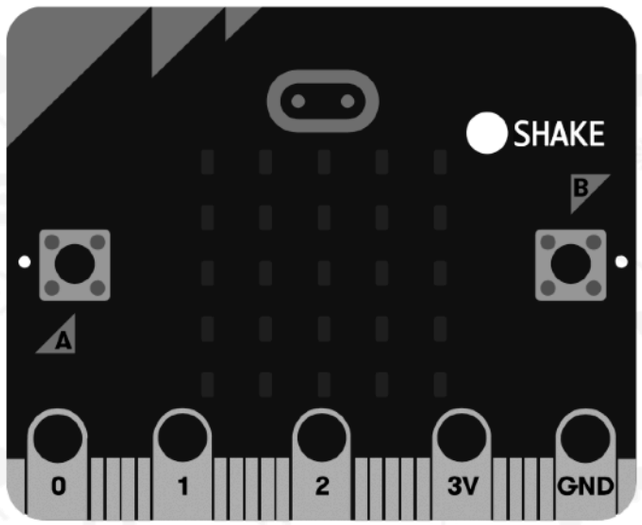

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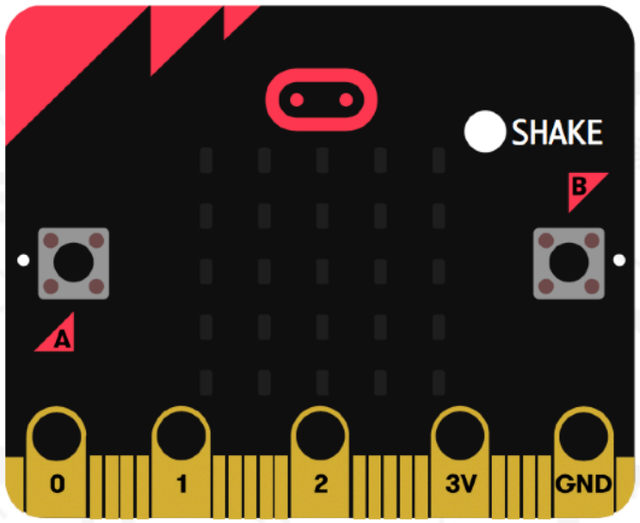

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- Math
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Variables

Make a Variable...

dice

set dice to 0

change dice by 1

pick random 1 to 6

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Dice

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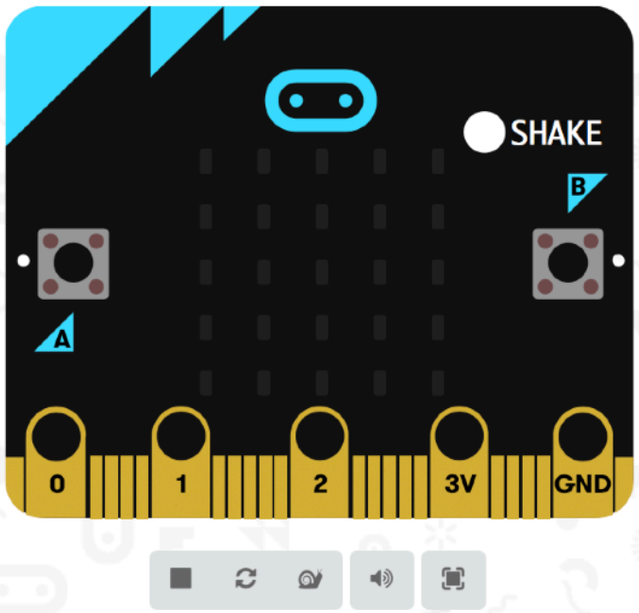

Search...

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Dice

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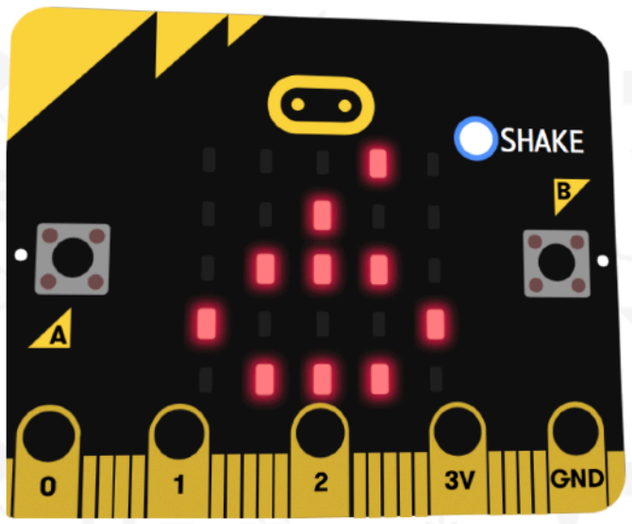

Search...

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- Led
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```
on shake
    set dice to pick random 1 to 6
    show number dice
```

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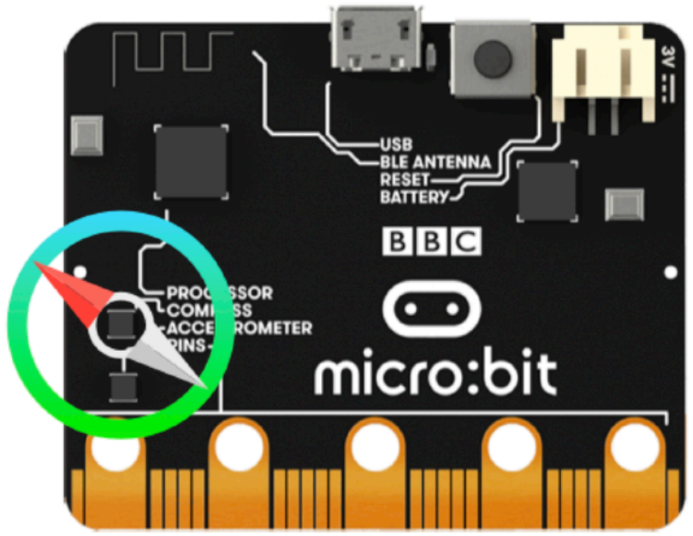
Dice

Compass

The compass has to be calibrated before it can be used to detect the earth's magnetic field, pointing out which direction the micro:bit is facing.



Exercise on compass.

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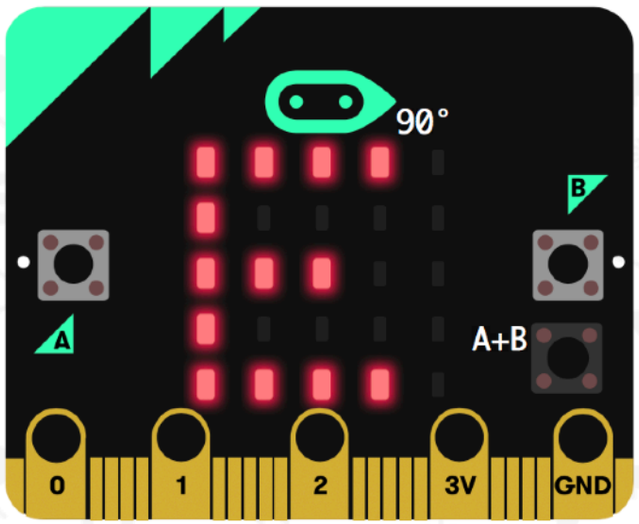

Search...

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```
forever
    set degrees to compass heading (°)
    if degrees < 45 then
        show string "N"
    else if degrees < 135 then
        show string "E"
    else if degrees < 225 then
        show string "S"
    else if degrees < 315 then
        show string "W"
    else
        show string "N"

on button A+B pressed
    calibrate compass
```

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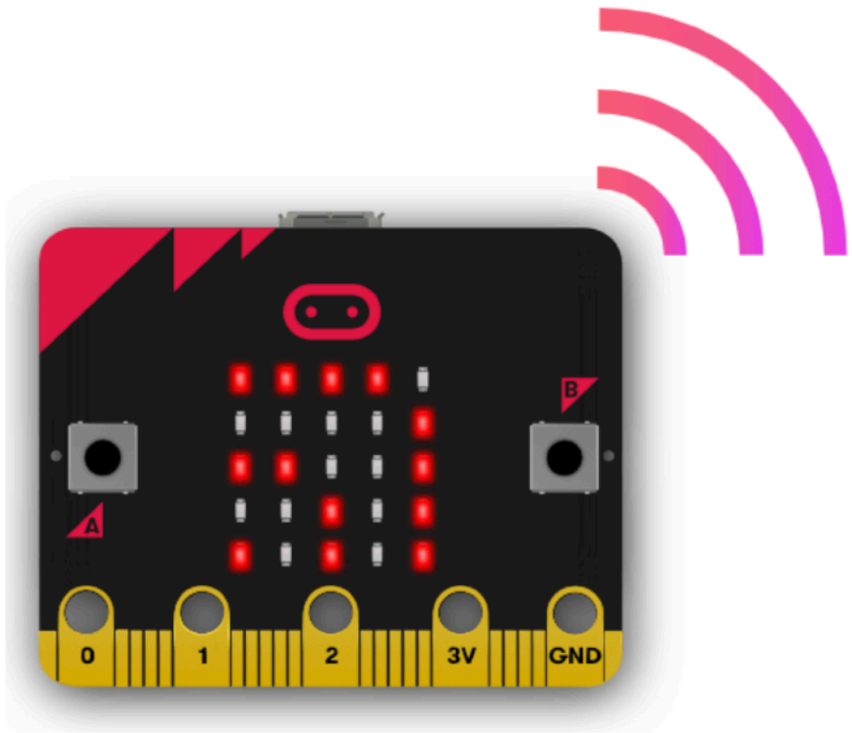
Radio

The radio feature enables different micro:bits to communicate wirelessly among each other.



Exercise on radio.

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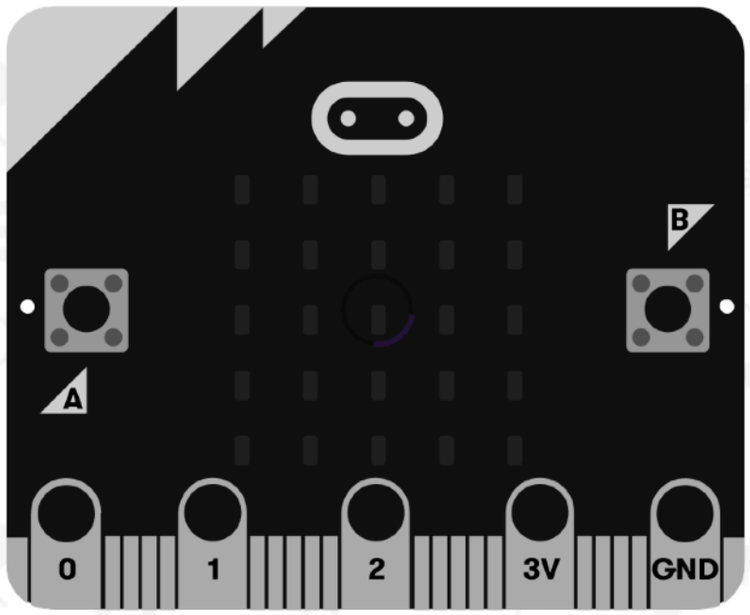

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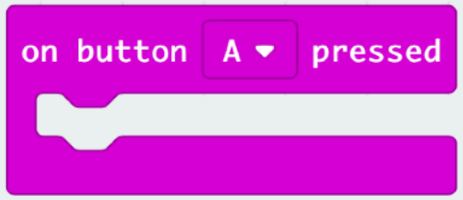

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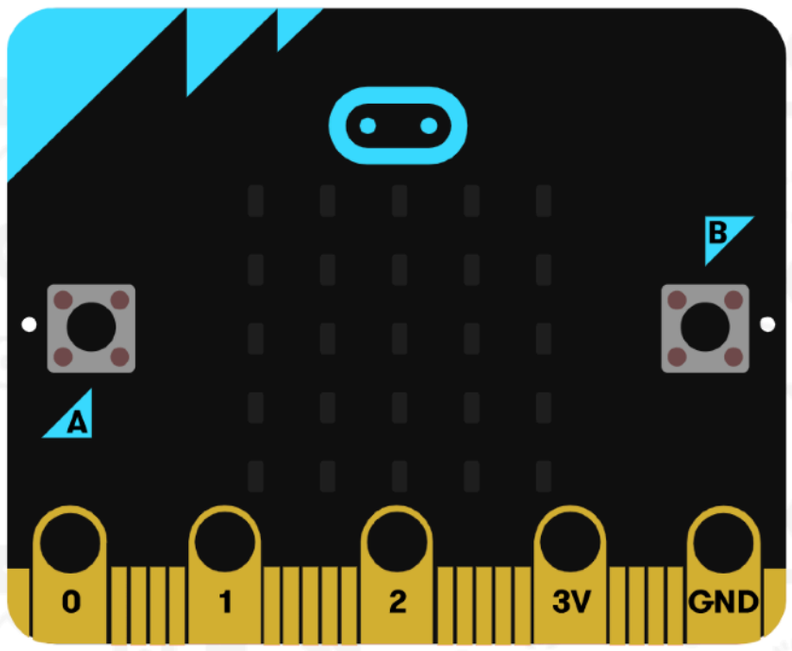

Search...

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Radio

radio set group 1

radio send number 0

radio send value "name" = 0

radio send string " "

Broadcasts a string along with the device serial number and running time to any connected micro:bit in the group.

on radio received name value

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Micro Chat

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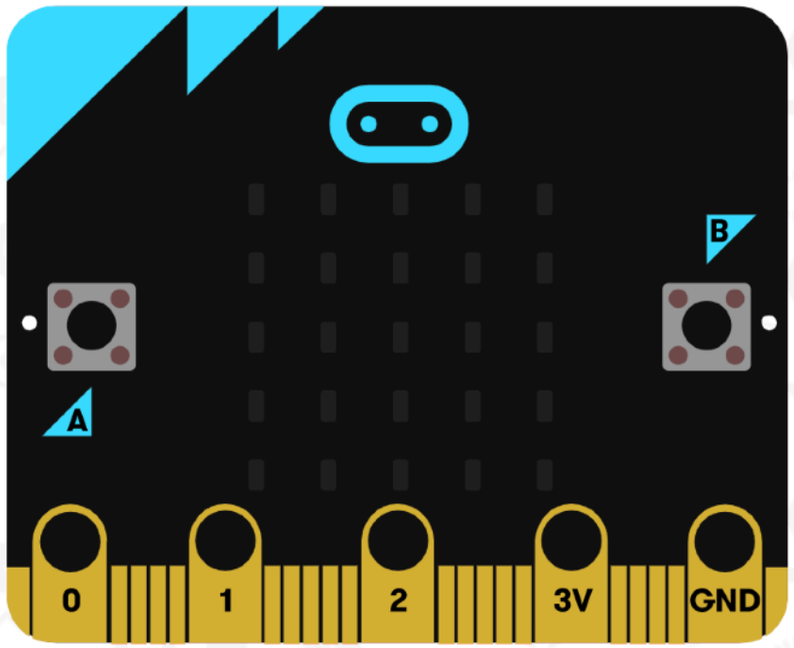

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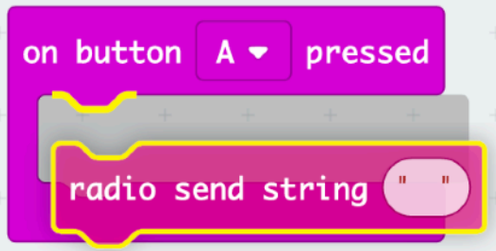

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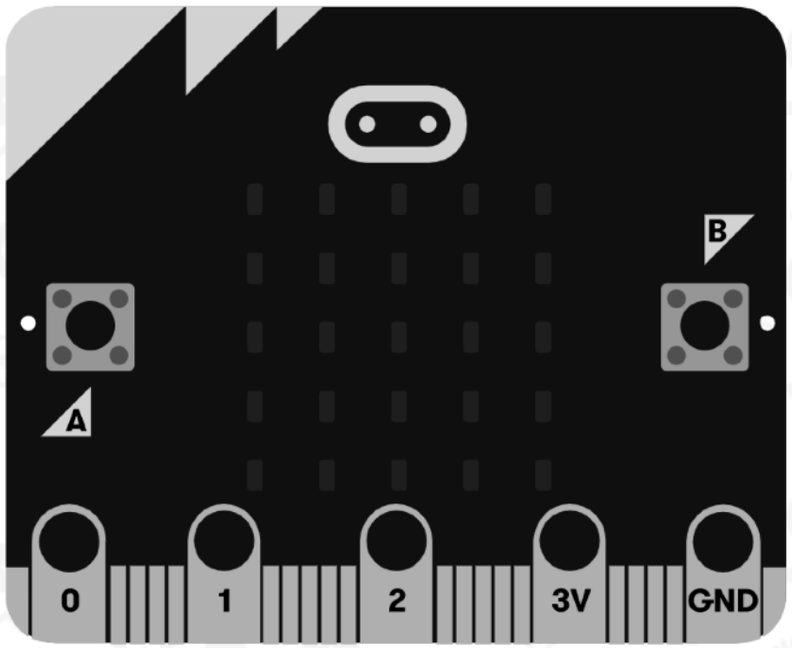

Search...

- Basic
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```
on button A pressed
    radio send string "Good morning!"
```

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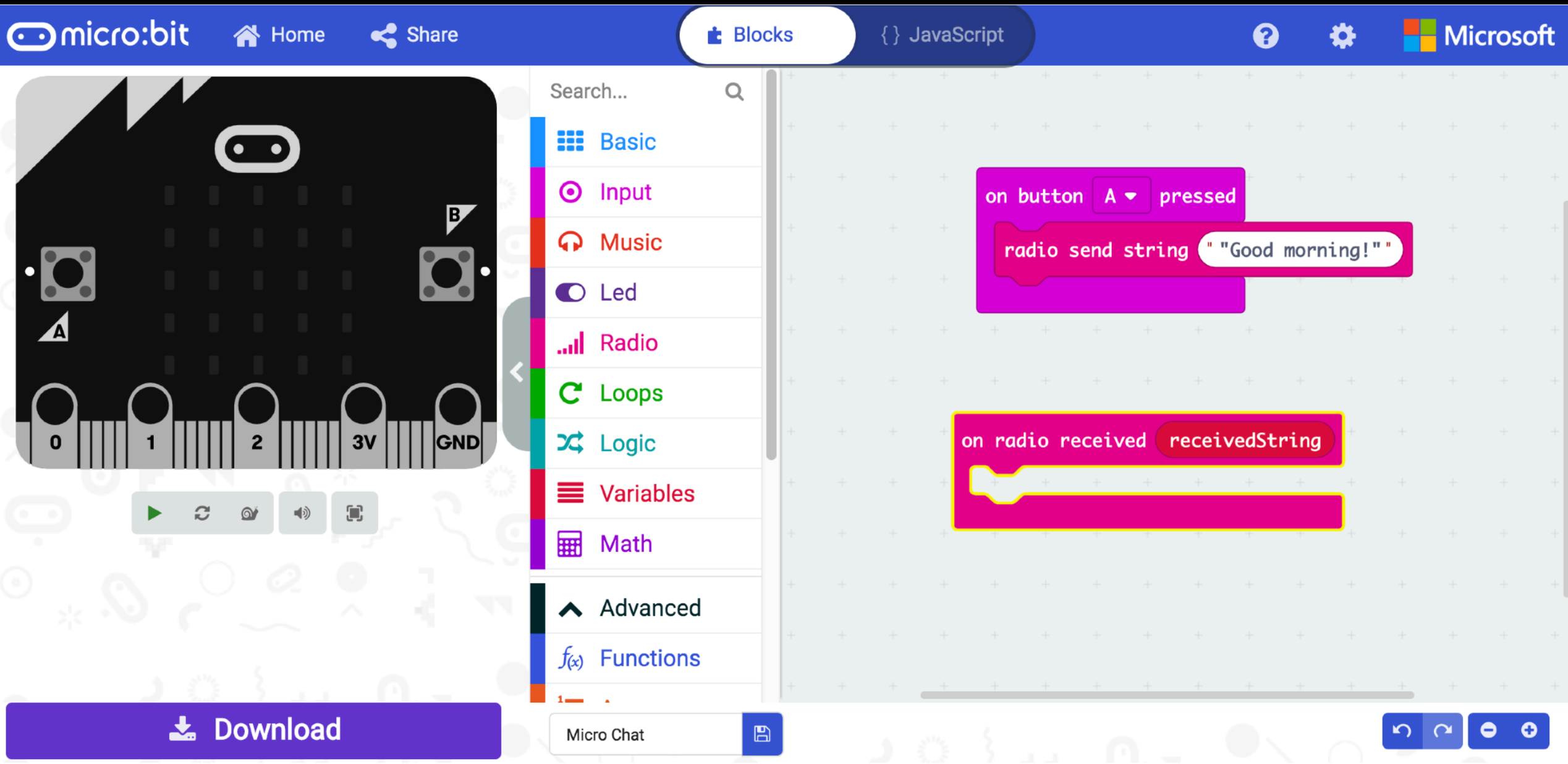
Micro Chat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on button A pressed
radio send string "Good morning!"
on radio received receivedString
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Micro Chat

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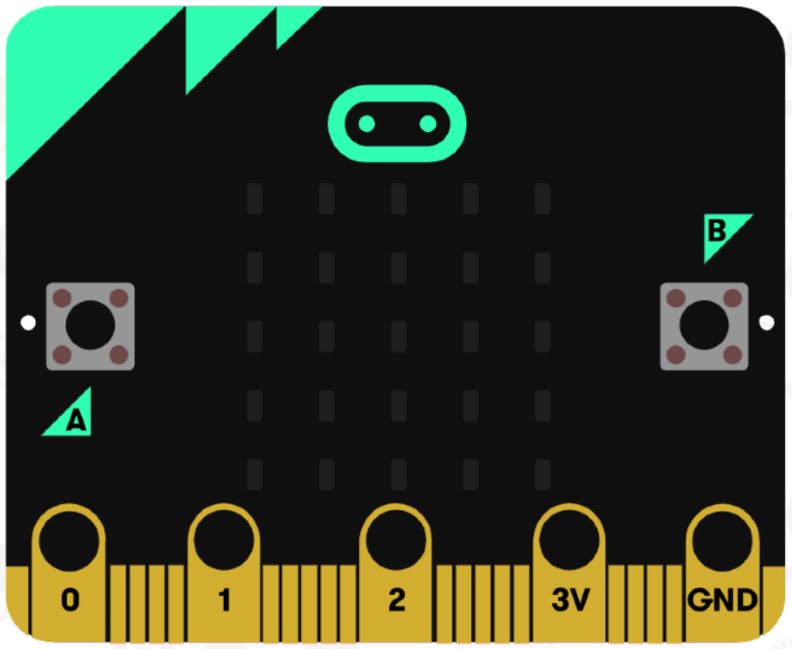

Search...

- Basic
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- Math
- Advanced

radio send value "name" = 0

radio send string " "

on radio received receivedNumber

on radio received name value

on radio received receivedString

received packet signal strength

sed

"Good morning!"

Registers code to run when the radio receives a string.

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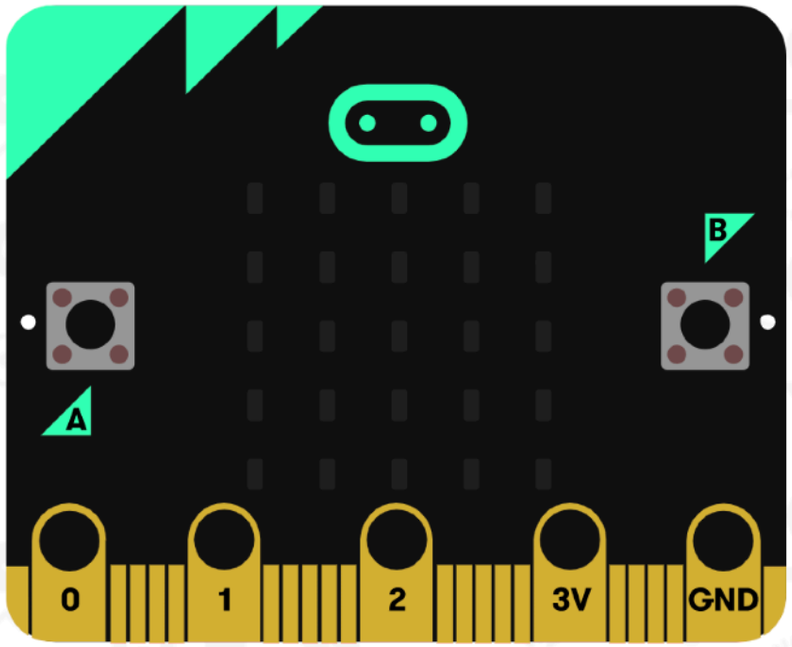

Search...

- Basic
- more
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- Radio
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- Advanced

Basic

show number 0

Scroll a number on the screen. If the number fits on the screen (i.e. is a single digit), do not scroll.

show leds

show icon

show string "Hello!"

forever

on A pressed

morning!""

received receivedString

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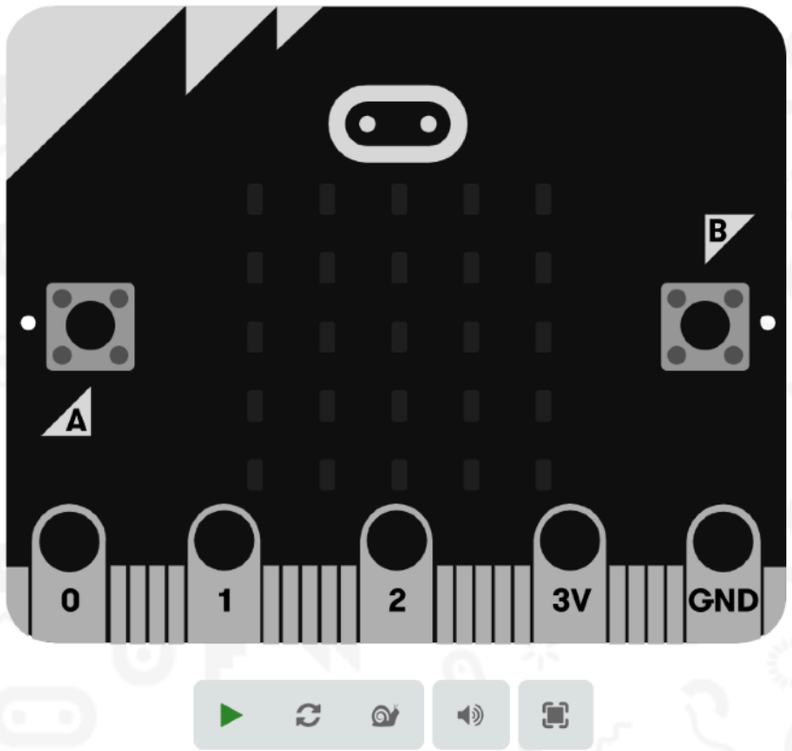

Search...

- Basic
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- Functions

```
on button A pressed
    radio send string "Good morning!"

on radio received receivedString
    show string receivedString
```

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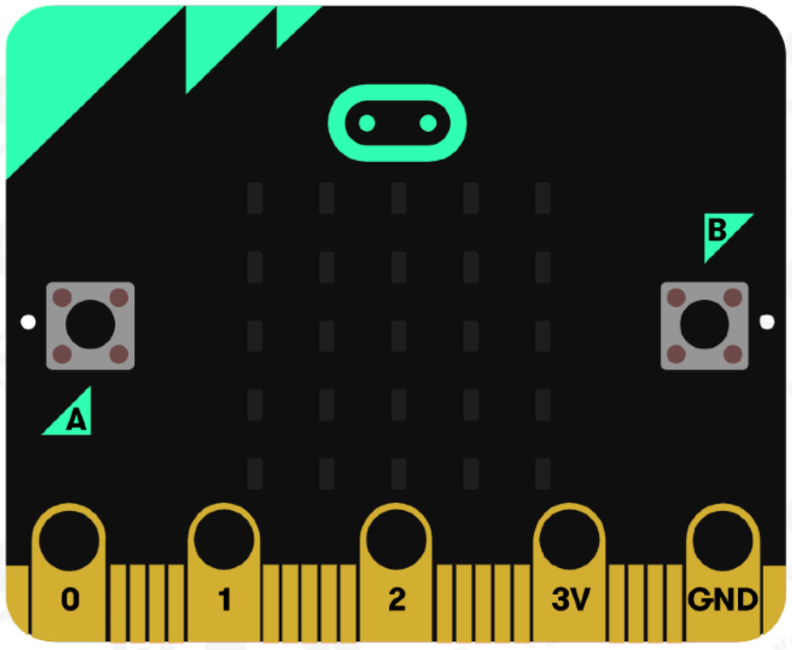

Search...

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- Radio
- Loops
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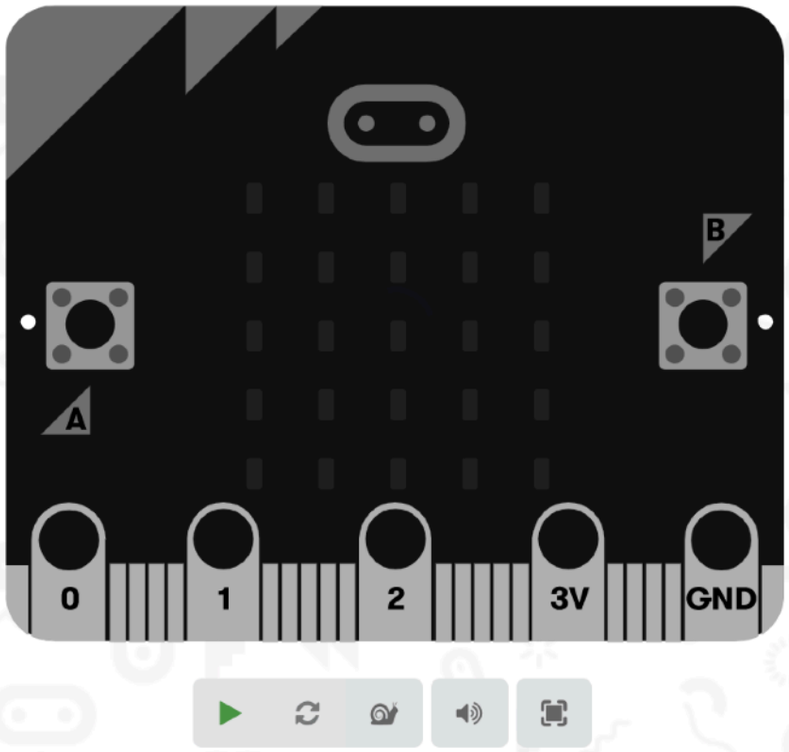
```
on button A pressed
    radio send string "Good morning!"

on radio received receivedString
    show string "Hello!"
```

Download

Micro Chat

micro:bit Home Share Blocks { } JavaScript Microsoft



Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced
- Functions

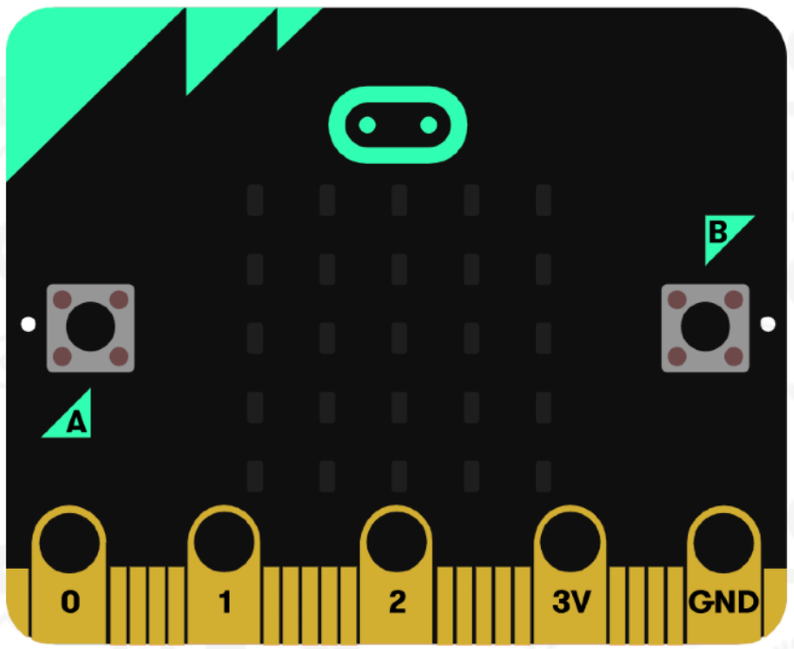
```
on button A pressed
    radio send string "Good morning!"

on radio received receivedString
    show string receivedString
```

Download

Micro Chat

micro:bit Home Share Blocks { } JavaScript Microsoft



Search...

- Basic
- Input
- Music
- Led
- Radio
- more
- Loops
- Logic
- Variables
- Math
- Advanced

Radio

```
radio set group 1
radio send
radio send value "name" = 0
radio send string ""
on radio received receivedNumber
on radio received name value
```

Sets the group id for radio communications. A micro:bit can only listen to one group ID at any time.

```
on start
```

Download

Micro Chat

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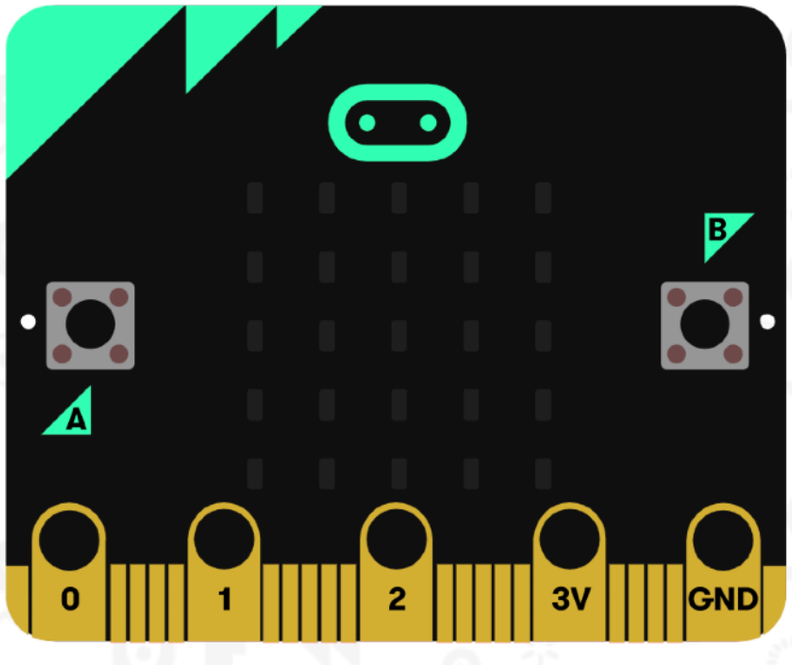


Search...

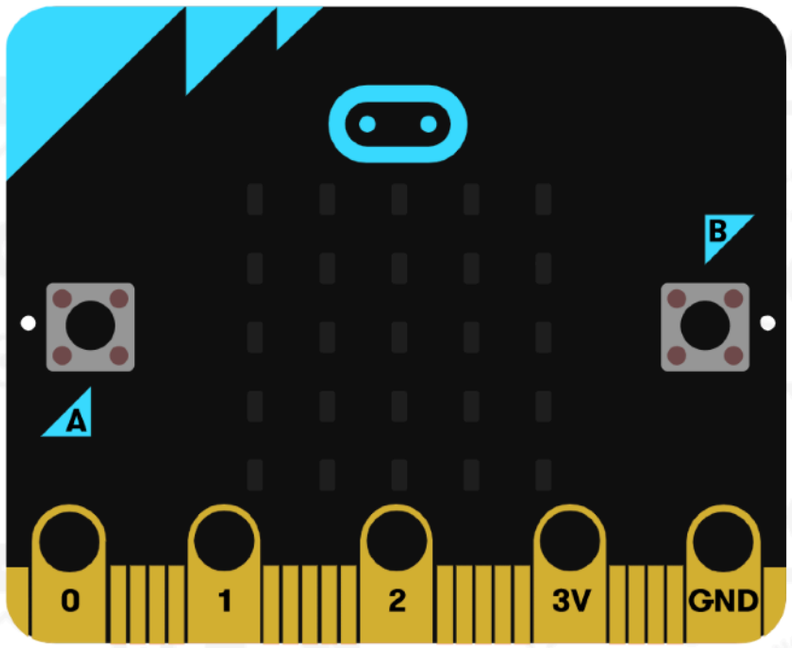
- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced
- Functions

```
on button A pressed
    radio send string "Good morning!"

on start
    radio set group 1

on radio received receivedString
    show string receivedString
```

Download

Micro Chat

micro:bit Home Share Blocks { } JavaScript Microsoft



Search...

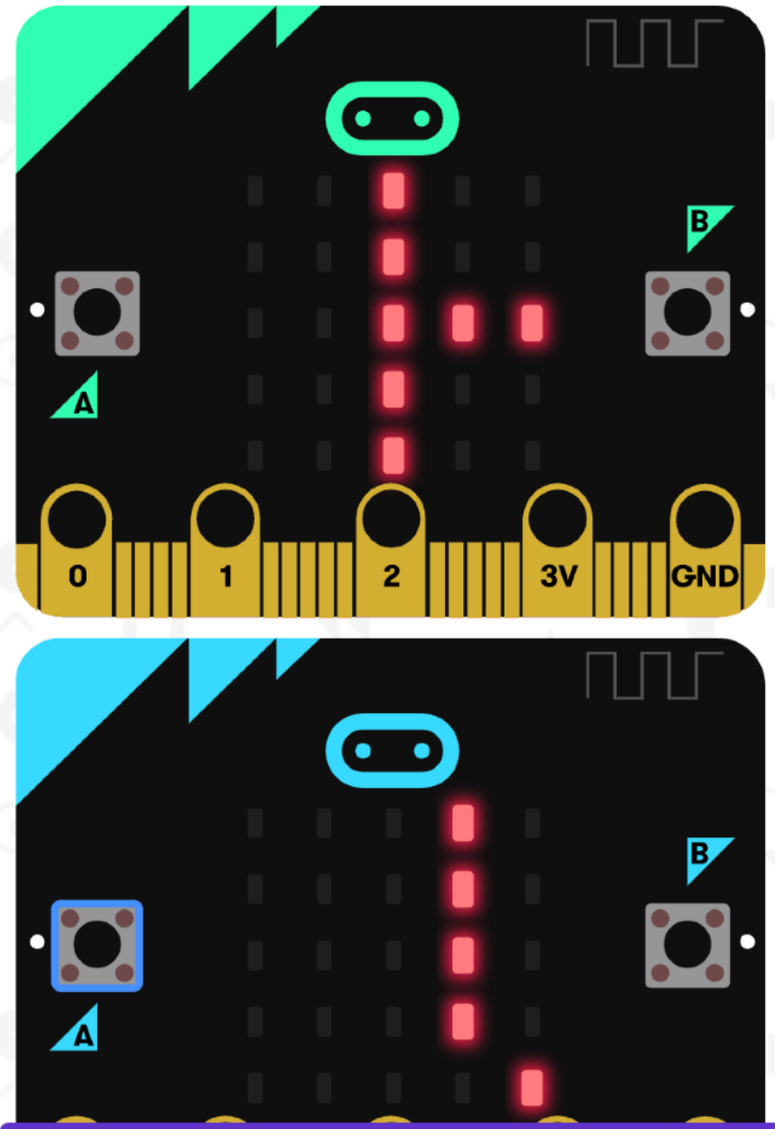
- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced
- Functions

```
on button A pressed
    radio send string "Good morning!"

on start
    radio set group 1

on radio received receivedString
    show string receivedString
```

Download

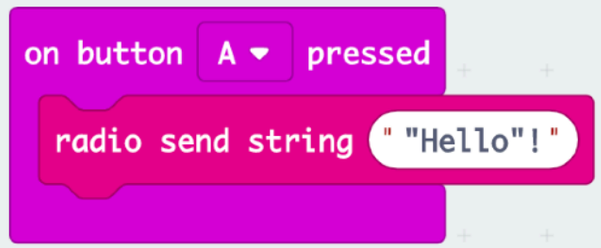
Micro Chat

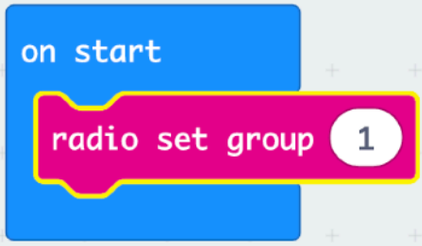
micro:bit Home Share Blocks { } JavaScript Microsoft

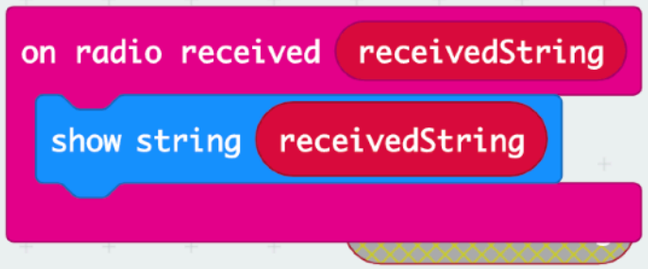


Search...

- Basic
- Input
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced
- Functions
- Arrays
- Text





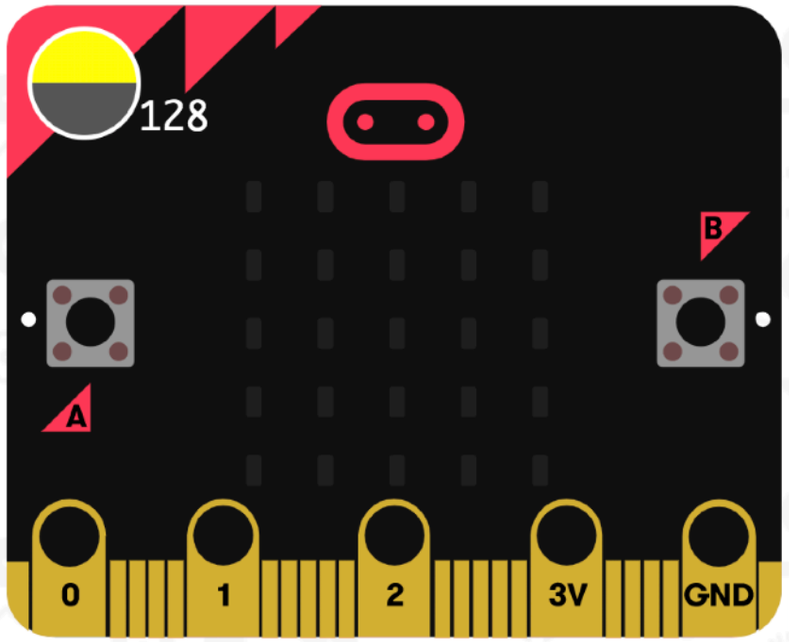


Download

Micro Chat

Writing data to serial port.

micro:bit Home Share Blocks JavaScript Microsoft



Show console Simulator

Search...

- Basic
- Input
- more
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- Advanced

```
forever
    serial write number [light level]
    serial write line [" "]
    show number [light level]
    pause (ms) [5000]
on start
    serial
    redirect to
    TX [USB_TX]
    RX [USB_RX]
    at baud rate [115200]
    serial redirect to USB
```

Download ...

Microbit_to_Serial_USB

Reading from serial port in Python.

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3

Run Code

In [*]:

```
# !pip3 install pyserial
# Obtain serial/usb port information by issuing the "ls /dev/*" command
import serial, time
port = "/dev/tty.usbmodem1462"
baud = 115200
s = serial.Serial(port)
s.baudrate = baud

while True:
    data = s.readline()
    data = int(data[0:4])
    print(data)
    time.sleep(1)
```

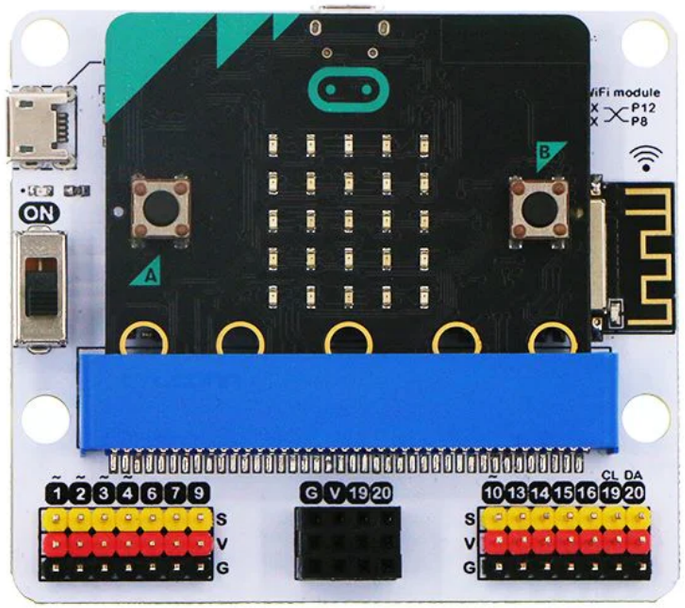
```
39
41
37
35
42
37
43
41
42
43
42
42
6
6
5
3
7
5
```

Light Level : 15

Thanks to Soumil Nitin Shah and Peter Kazarinoff for inspiring me to create this Python Flask data logger.

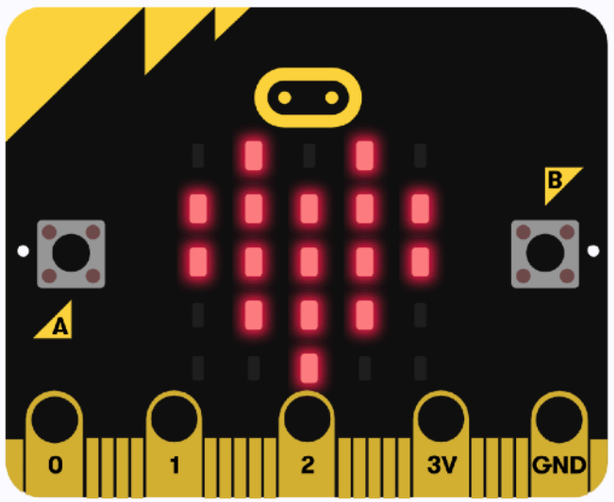
WiFi

The WiFi feature requires a ESP8266 expansion module (e.g. Elecfreaks IOT:bit for micro:bit) to provide communication link between Micro:bit and a WiFi network.



Microsoft | micro:bit

Blocks | JavaScript



Show data Simulator

Search...

- Basic
- Input
- more
- Music
- Led
- Radio
- Loops
- Logic
- Variables
- Math
- ESP8266_IoT
- OLED
- RTC1307
- Octopus
- Extensions
- Advanced
- Functions
- Arrays

```
on start
    show icon
    set ESP8266 RX P8 TX P12 Baud rate 115200
    connect Wifi SSID = "network" KEY = "password"
    pause (ms) 5000

forever
    set Temperature to temperature (°C)
    connect thingspeak
    set data to send ThingSpeak
        Write API key = "7G45PR2XBS057N4N"
        Field 1 = Temperature
    Upload data to ThingSpeak
    pause (ms) 5000
```

Download ...

IoT_Feb17_2024

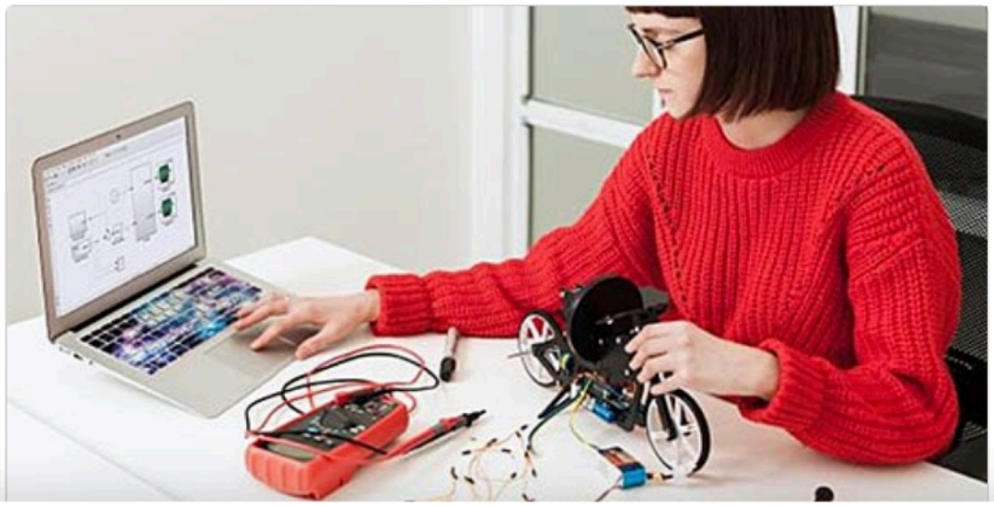
saved!

ThingSpeak for IoT Projects

Data collection in the cloud with advanced data analysis using MATLAB

Get Started For Free

Learn More



Channel Settings

Percentage Complete	50%
Channel ID	2391327
Name	suenlab IoT
Description	Experiment with Micro:bit IoT capabilities.
Field 1	Temperature ☑
Field 2	☐
Field 3	☐
Field 4	☐
Field 5	☐
Field 6	☐
Field 7	☐
Field 8	☐
Metadata	

Help

Channels store all the data that a ThingSpeak application collects. Each channel includes eight fields that can hold any type of data, plus three fields for location data and one for status data. Once you collect data in a channel, you can use ThingSpeak apps to analyze and visualize it.

Channel Settings

- Percentage complete: Calculated based on data entered into the various fields of a channel. Enter the name, description, location, URL, video, and tags to complete your channel.
- Channel Name: Enter a unique name for the ThingSpeak channel.
- Description: Enter a description of the ThingSpeak channel.
- Field#: Check the box to enable the field, and enter a field name. Each ThingSpeak channel can have up to 8 fields.
- Metadata: Enter information about channel data, including JSON, XML, or CSV data.
- Tags: Enter keywords that identify the channel. Separate tags with commas.
- Link to External Site: If you have a website that contains information about your ThingSpeak channel, specify the URL.
- Show Channel Location:
  - Latitude: Specify the latitude position in decimal degrees. For example, the latitude of the city of London is 51.5072.
  - Longitude: Specify the longitude position in decimal degrees. For example, the longitude of the city of London is -0.1275.
  - Elevation: Specify the elevation position meters. For example, the elevation of the city of London is 35.052.
- Video URL: If you have a YouTube™ or Vimeo® video that displays your channel information, specify the full path of the video URL.
- Link to GitHub: If you store your ThingSpeak code on GitHub®, specify the GitHub repository URL.

ThingSpeak™ Channels Apps Devices Support Commercial Use How to Buy YS

suenlab IoT

Channel ID: 2391327
Author: mwa0000032527514
Access: Public

Experiment with Micro:bit IoT capabilities.

Private View | Public View | Channel Settings | Sharing | API Keys | Data Import / Export

Write API Key

Key: 7G45PR2XBS057N4N

Generate New Write API Key

Read API Keys

Key: XBCRV57D4TI7H5XX

Note:

Save Note | Delete API Key

Add New Read API Key

Help

API keys enable you to write data to a channel or read data from a private channel. API keys are auto-generated when you create a new channel.

API Keys Settings

- Write API Key: Use this key to write data to a channel. If you feel your key has been compromised, click Generate New Write API Key.
- Read API Keys: Use this key to allow other people to view your private channel feeds and charts. Click Generate New Read API Key to generate an additional read key for the channel.
- Note: Use this field to enter information about channel read keys. For example, add notes to keep track of users with access to your channel.

API Requests

Write a Channel Feed

```
GET https://api.thingspeak.com/update?api_key=7G45PR2XBS057N4N&field1=0
```

Read a Channel Feed

```
GET https://api.thingspeak.com/channels/2391327/feeds.json?results=2
```

Read a Channel Field

```
GET https://api.thingspeak.com/channels/2391327/fields/1.json?results=2
```

Read Channel Status Updates

ThingSpeak™ Channels Apps Devices Support Commercial Use How to Buy YS

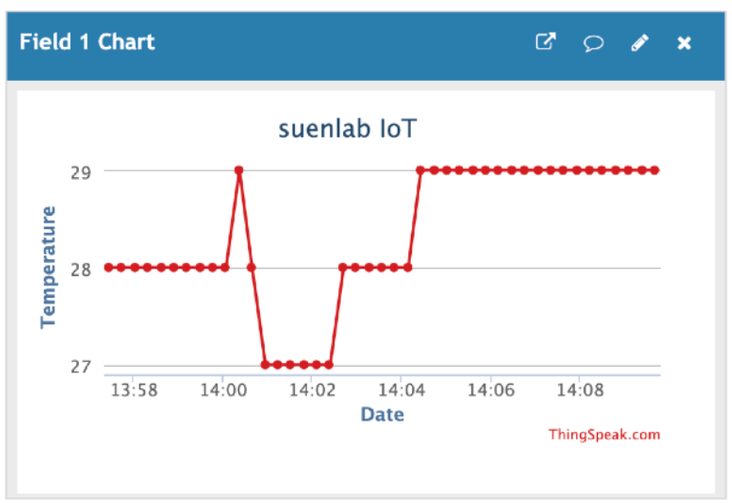
Use Private View to test out visual display result.

Private View | Public View | Channel Settings | Sharing | API Keys | Data Import / Export

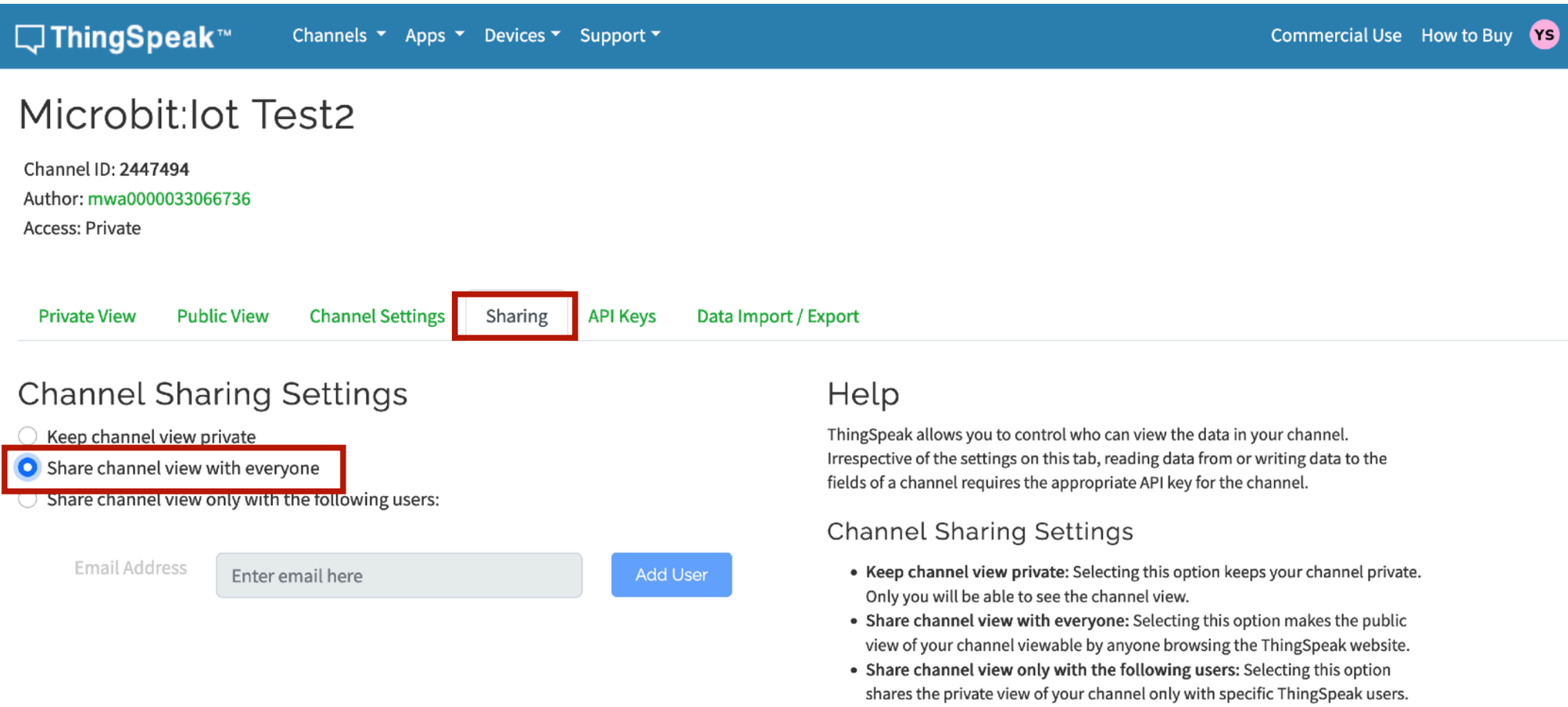
Add Visualizations | Add Widgets | Export recent data | MATLAB Analysis | MATLAB Visualization

Channel Stats

Created: about a month ago
Last entry: 45 minutes ago
Entries: 43



Use Private View to test out visual display result.



Press Sharing to publish result to “Share channel with everyone”.

ThingSpeak™ Channels Apps Devices Support Commercial Use How to Buy YS

Microbit:Iot Test2

Channel ID: **2447494**
Author: mwa0000033066736
Access: Public

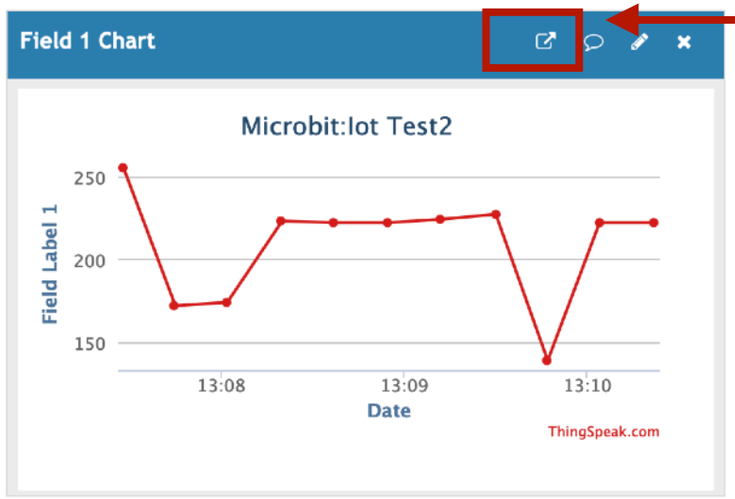
Private View | Public View | Channel Settings | Sharing | API Keys | Data Import / Export

Add Visualizations | Add Widgets | Export recent data | MATLAB Analysis | MATLAB Visualization

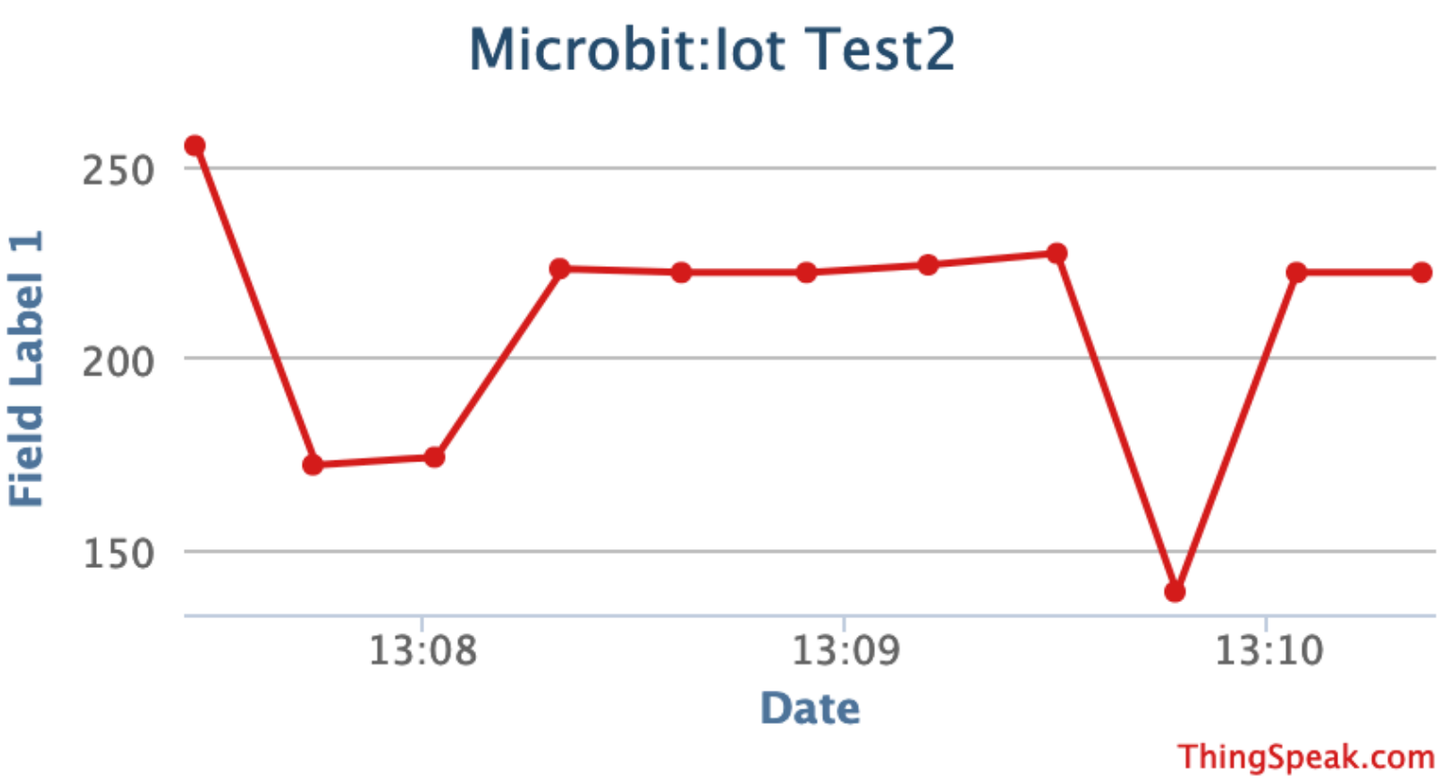
Use Public View to share result with others.

Channel Stats

Created: about an hour ago
Last entry: 9 minutes ago
Entries: 11



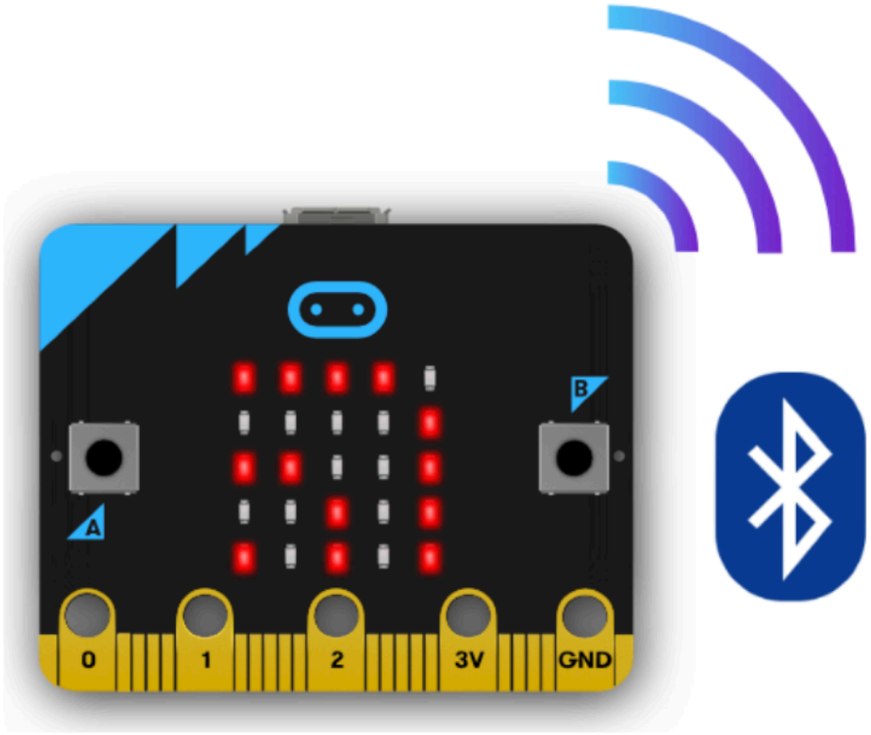
Press the Popup button to view the plain chart. This chart can be embedded in another independent web page.

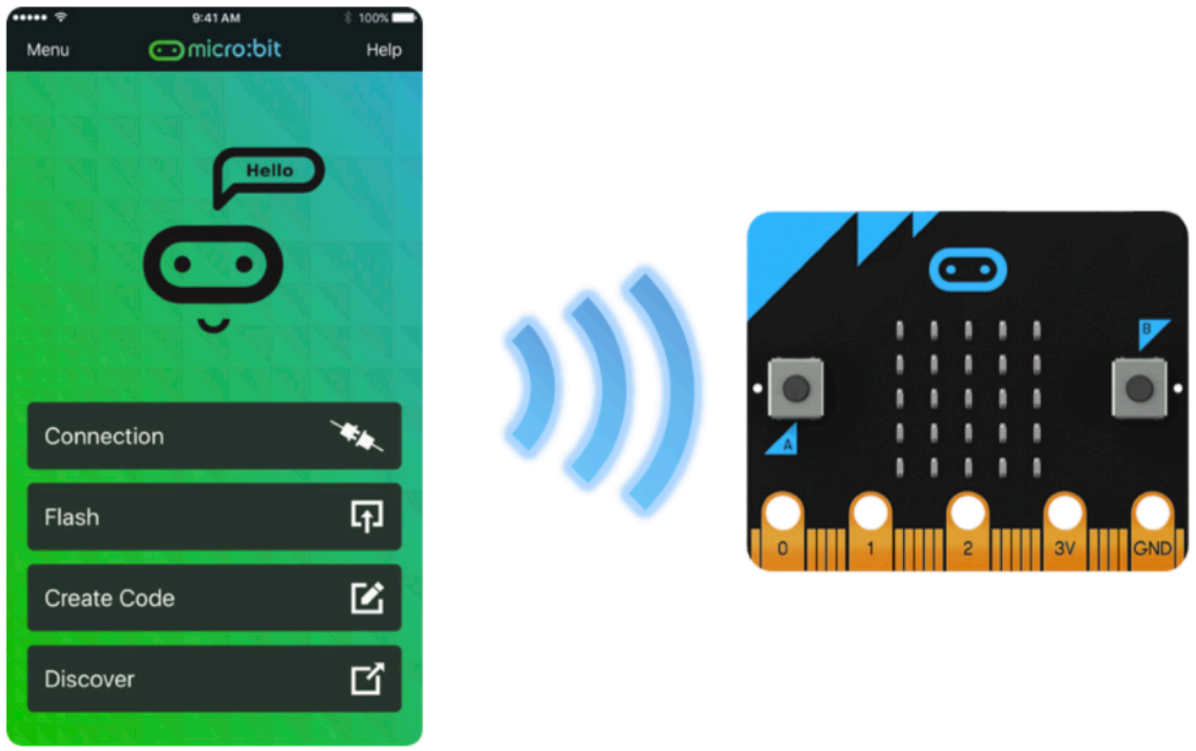


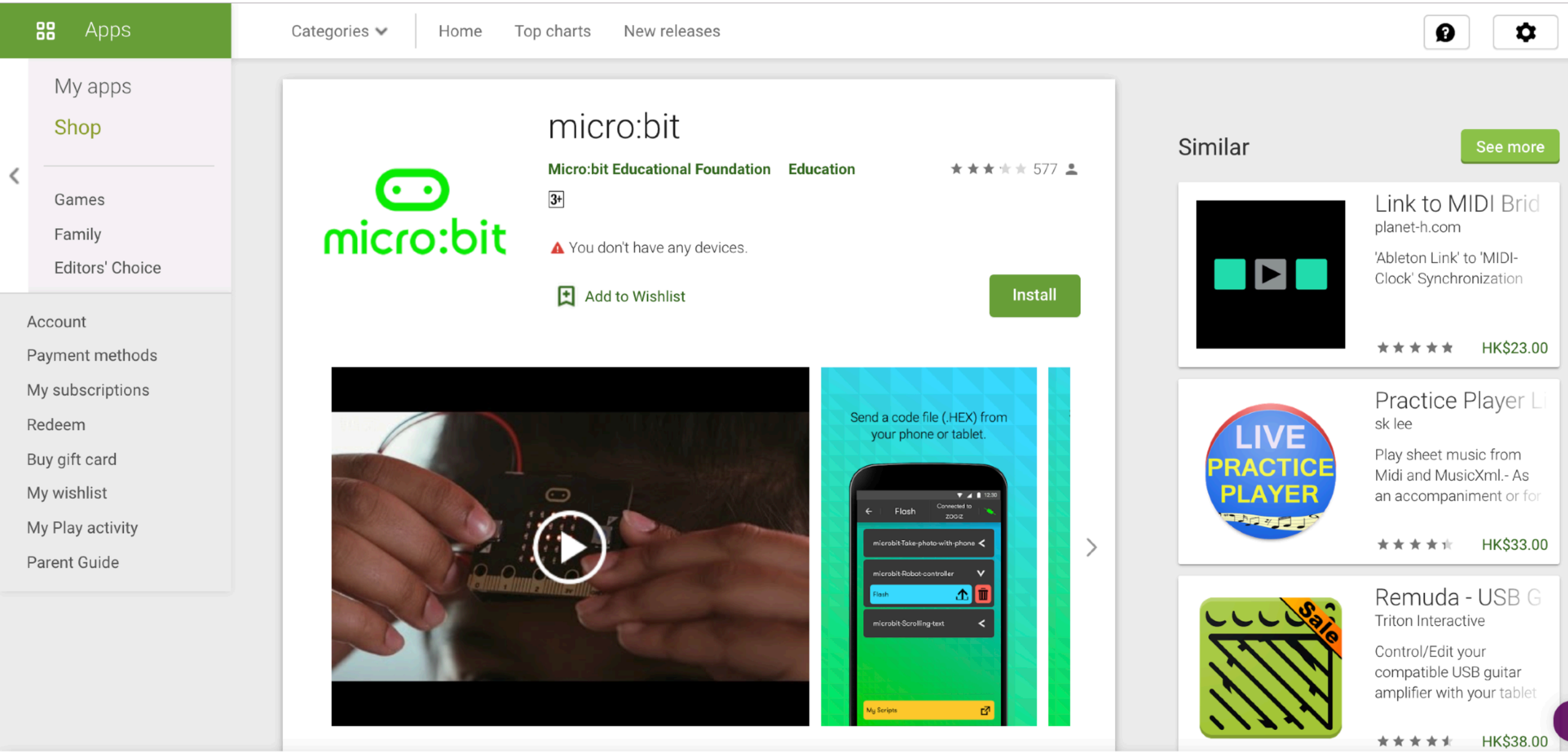
Embed data visualisation result inside another web page.

Bluetooth

The BLE (Bluetooth Low Energy) feature allows the micro:bit to control mobile devices over Bluetooth. Conversely, these devices can also send code and messages to the micro:bit wirelessly.

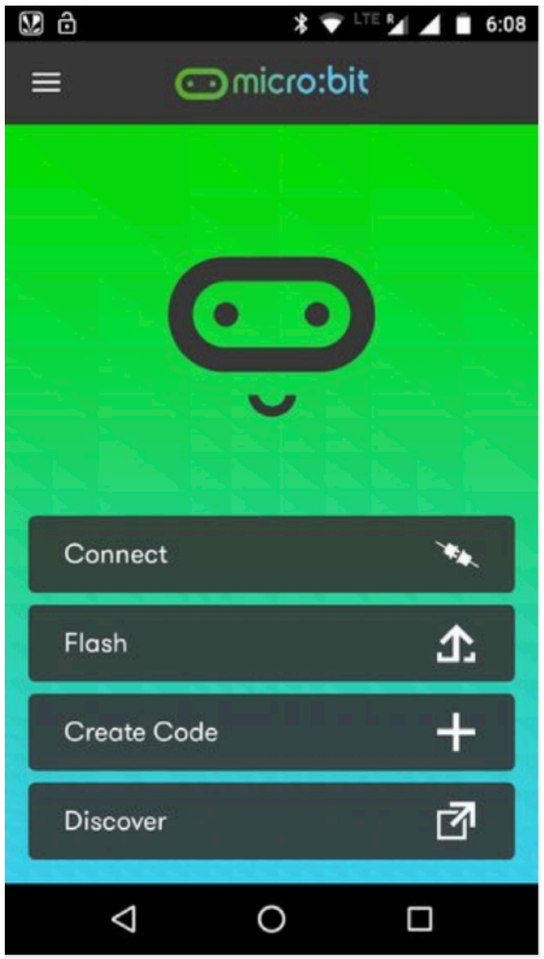



9:41 AM
100%
Menu
micro:bit
Help
Hello
Connection
Flash
Create Code
Discover
A
B
0
1
2
3V
GND

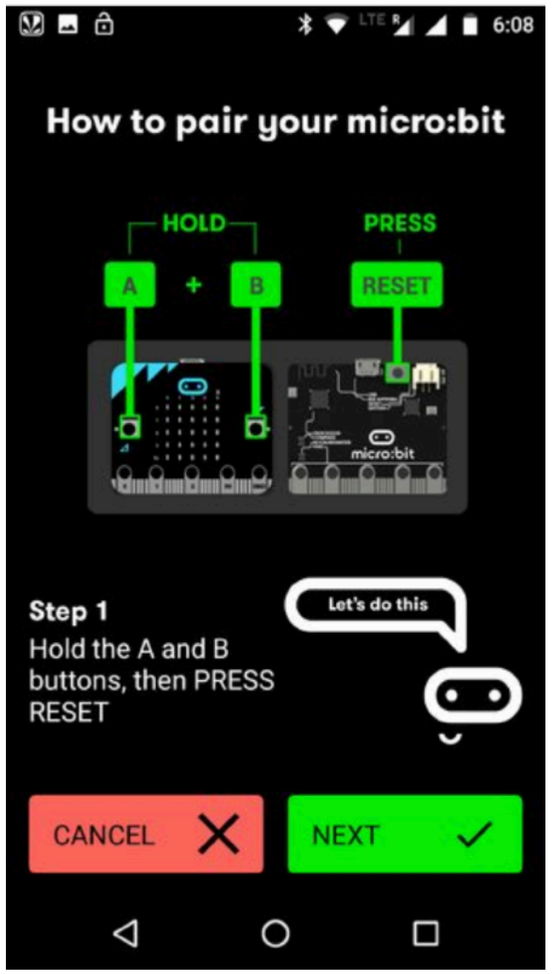


Step1: Download the App.

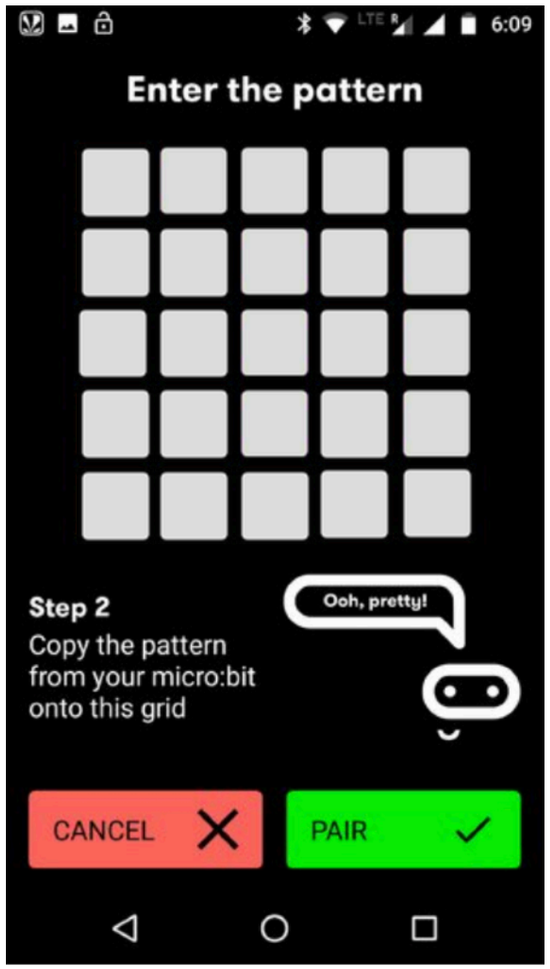
Pair up Microbit and mobile phone in Bluetooth.



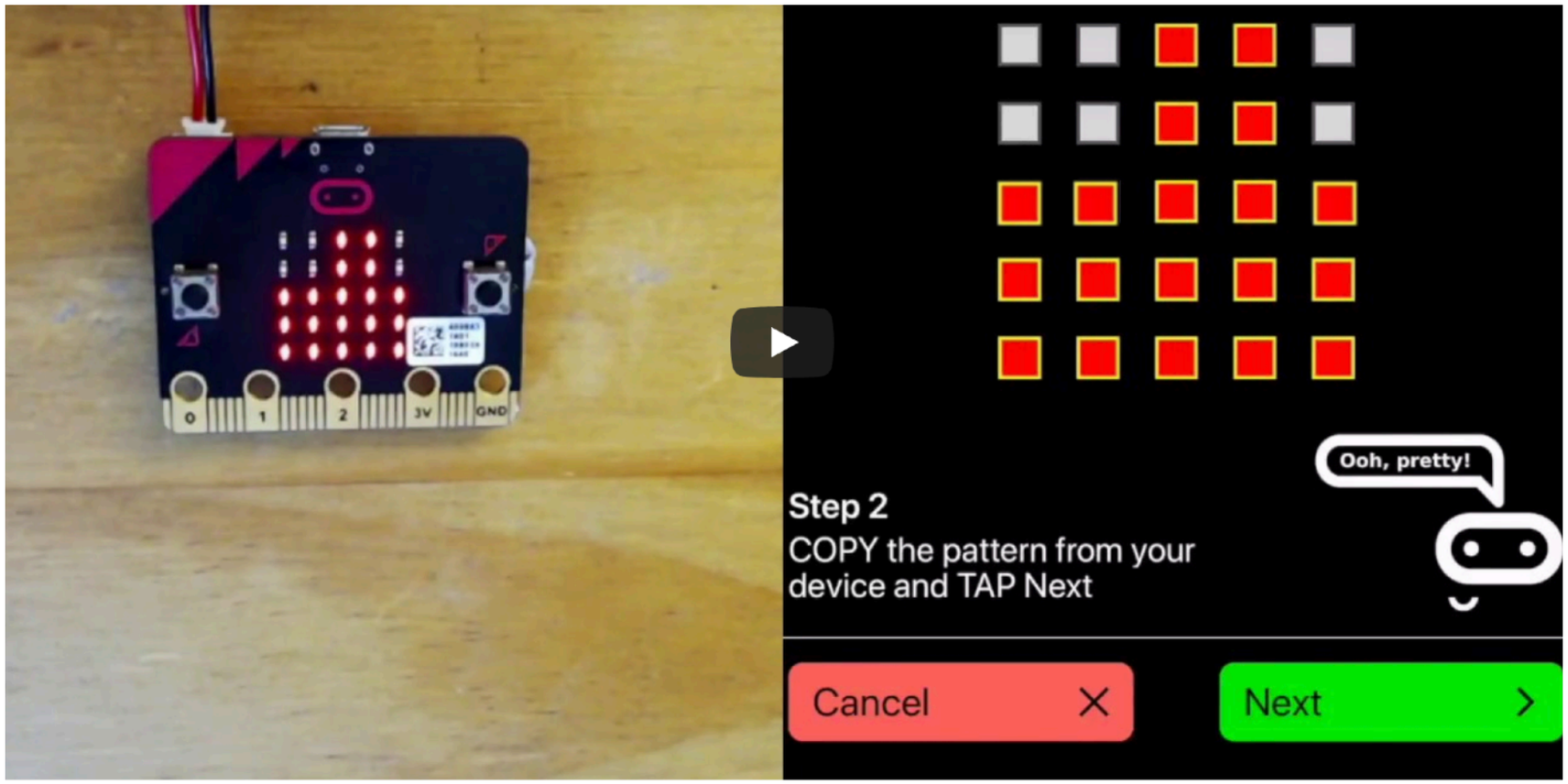
Step 1: Pair up the Micro:bit with the smart phone through Bluetooth.



Step 2: Press A, B and RESET buttons simultaneously. Release the RESET button in one second and hold on to the A and B buttons until a pattern show up on the Micro:bit LEDs.



Step 3: Copy the pattern on the Micro:bit and enter it into the grid space displayed on the app. Once the two patterns become identical, press “PAIR”.



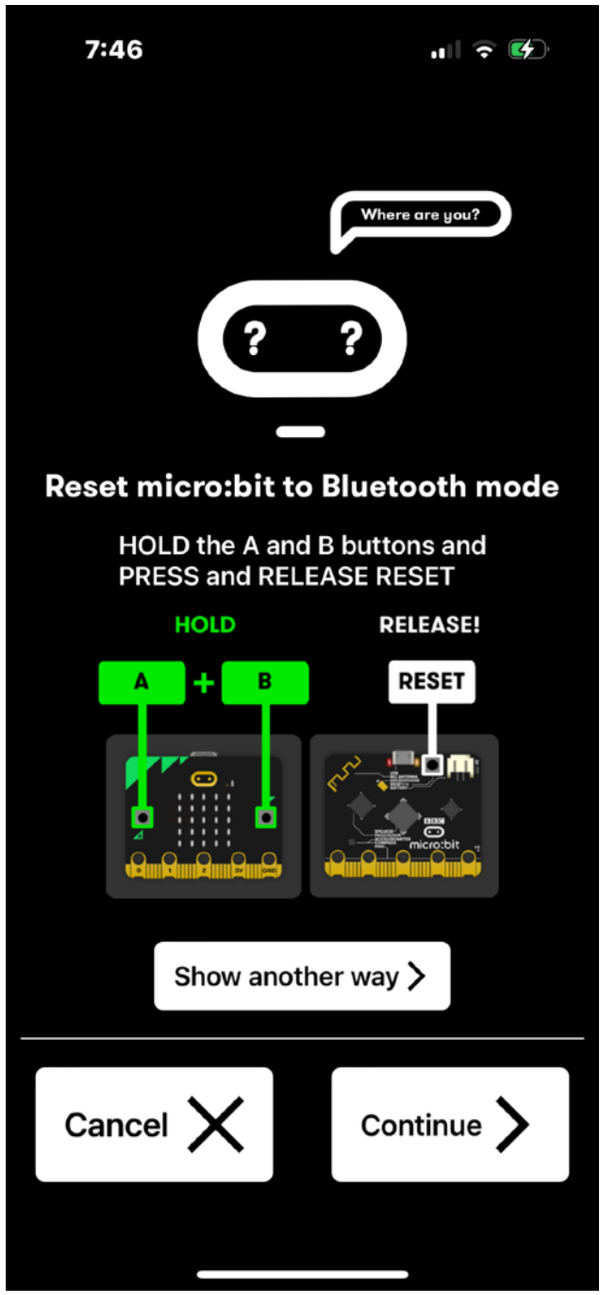
Step 4: Once paired up, hit “Next”.

Step 5: Searching and pairing in process.

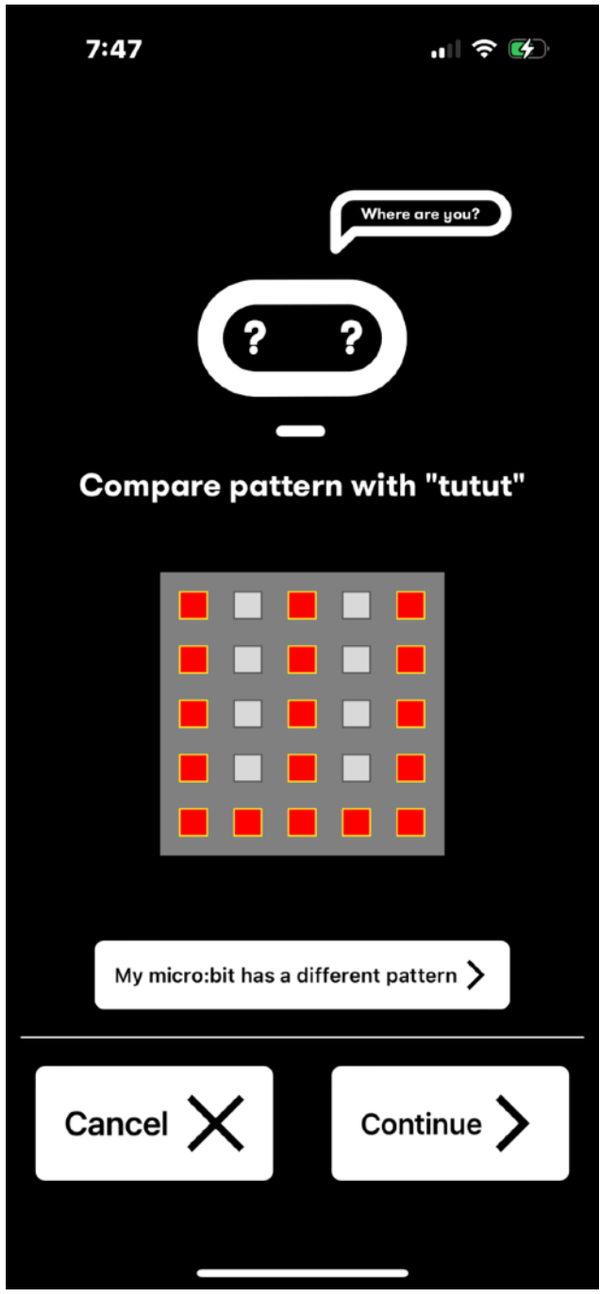
Step 6: Pairing done.

Download demonstration program to mobile phone to explore Microbit Bluetooth features.

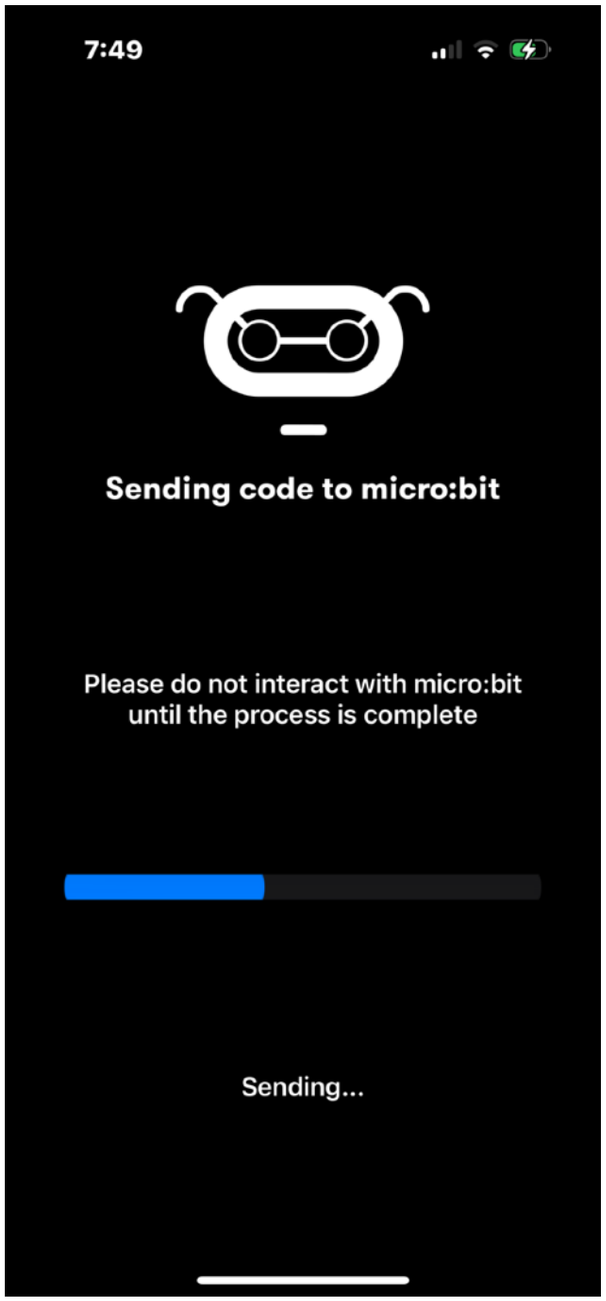
Step 1: Sending demo codes to Microbit.



Step 2: Reset Microbit to receive download codes.

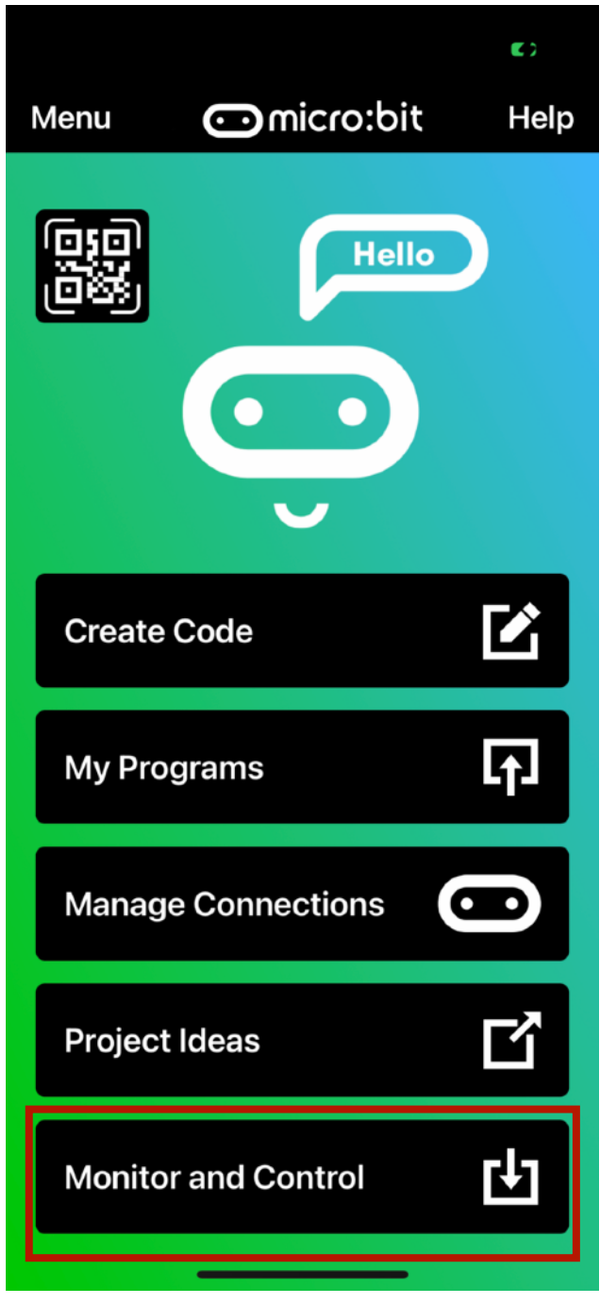


Step 3: Pattern matching to verify pairing.

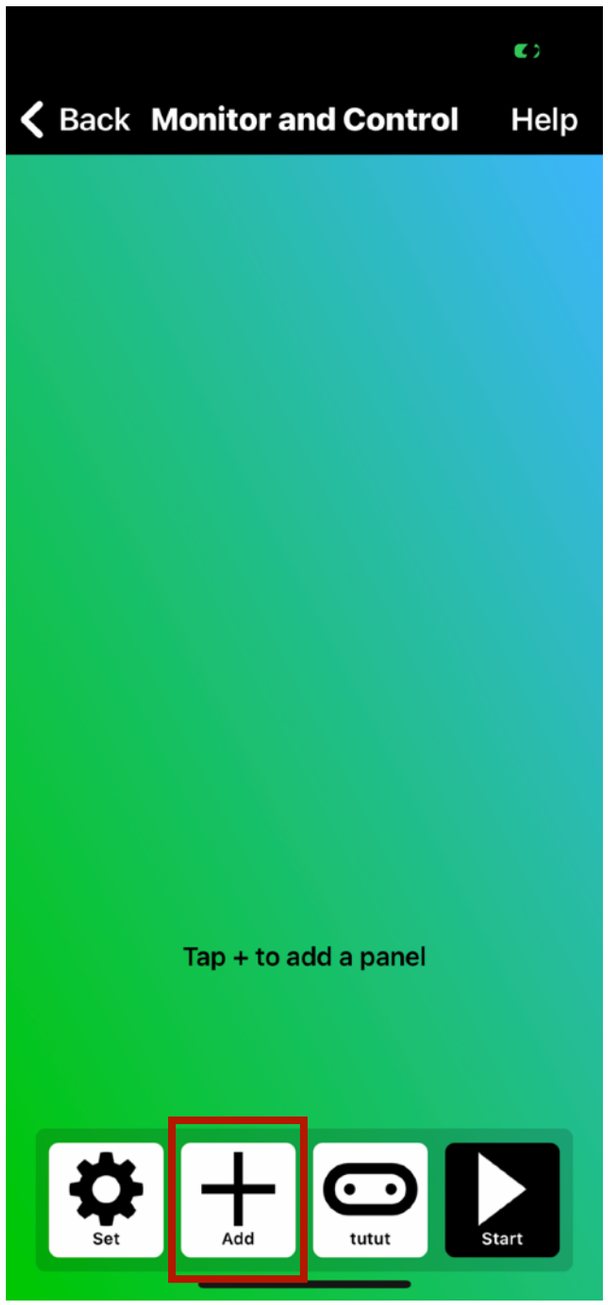


Step 4: Codes in transmission to Microbit.

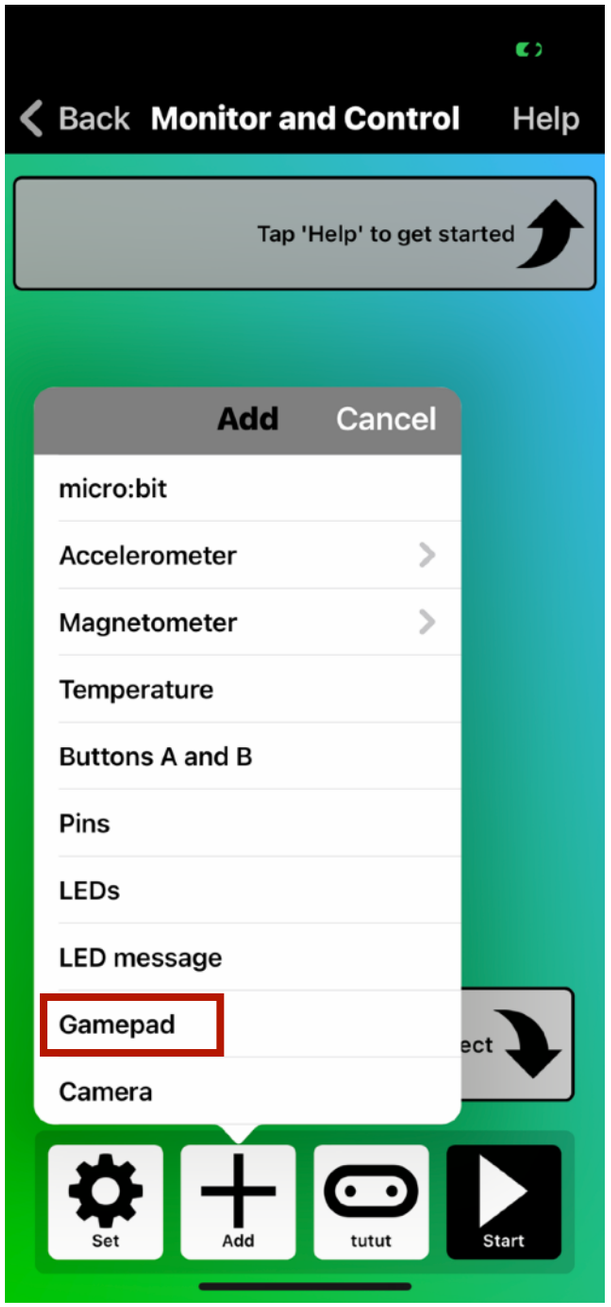
Step 5: Transmission done.



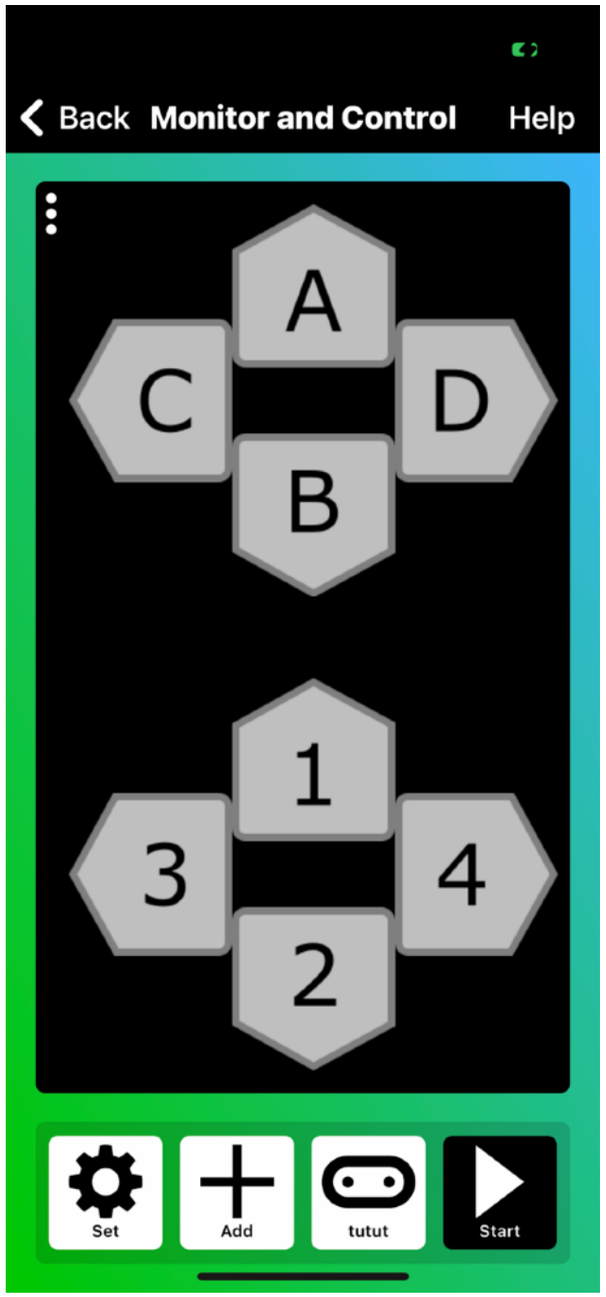
Step 6: Enter monitor and control mode.



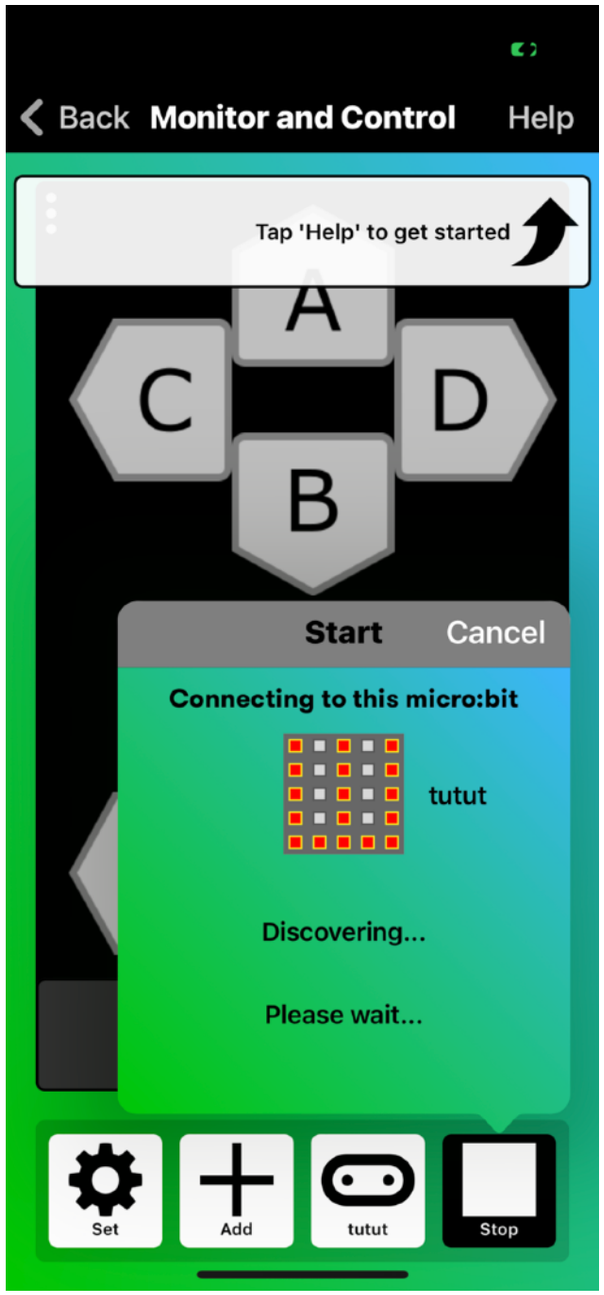
Step 7: Add panel.



Step 8: Pick Gamepad.



Step 9: Add Gamepad panel and press ‘start’ button.



Step 10: Connection to Microbit to start operation.

Thank You!