Micro:bit (An Introduction)

COSC2500 – Introduction to Computer Systems

Week 05

RMIT UNIVERSITY

Lecture Learning Objectives

After attending this lecture, the students should be able to:

- Describe and discuss what a BBC micro:bit is?
- Understand what is needed to use the micro:bit
- Realise why micro:bit is used for learning computer sys …
- Identify different micro:bit application processors
- Identify the different components of a micro:bit computer
- Identify micro:bit edge connector pins and its usage
- Evaluate different programming environment for micro:bits
- Compare microprocessors vs. microcontrollers vs. CPU
- Access useful resources for learning micro:bit

Assessment 2: Micro:bit Project (25%)

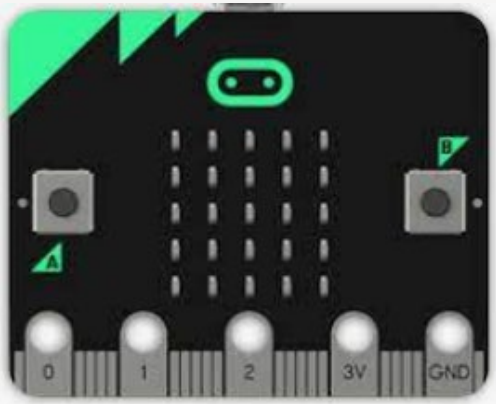
- Due end of Week 08, we are in Week 05 now …
- This week's lecture and tutorial are on micro:bit …
- Register Group: https://rmit.instructure.com/courses/113615/users
- A2 MbP: 56!! - A group project and to be done in a group
- Students can register across tutorial groups, not campus
- Project demonstration, choose one tutorial session
- One micro:bit has been given per group, extra's given …
- One student will provide name and ID, given the micro:bit
- Think of what you can get the micro:bit to do – your project
- Provide your project idea to your Tutor this week (same)
- **Any other questions about Micro:bit Project (25%)?**

What is a Micro:bit?

- The BBC micro:bit is a pocket-sized computer that introduces you to how software and hardware work together.
- LED light display, buttons, sensors and many input/output features, when programmed, enables interaction.

- The new micro:bit with sound adds a built-in microphone and speaker, as well as an extra touch input button and a power button.

- The micro:bit was designed to encourage children to get involved in writing software for computers and building new things.
- After a successful roll-out of the micro:bit across the UK, BBC handed over the micro:bit, and its adoption in other parts of the world.



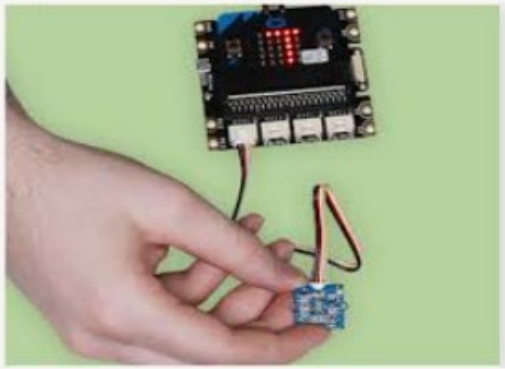
What is Needed to Use the Micro:bit?

- A micro:bit and battery pack with 2 AAA batteries
- A computer, phone or tablet with internet access to load the Microsoft MakeCode or Python code editors
- If you're using a computer, a USB lead to connect your micro:bit

- For building and making projects with your micro:bit, some extra items that are great to have include:
- headphones, crocodile clip leads and conductive materials such as aluminum foil and paper clips.

Micro:bit for Learning Computer Systems

- The micro:bit device helps you understand how computers work (input → process → output).
- When you type on your laptop or touch the screen on your mobile phone or devices, you're using an **input** device to enter data/instruction.



- Inputs allow computers to sense things happening in the real world, so they can act on this and make something happen, usually on an **output** like a screen or headphones.

- In between the input devices and the output devices, there is the **processor** to compute.
- This takes information from inputs like buttons, and makes something happen on outputs, like playing a song in your headphones.

Micro:bit – An Overview

- Micro:bit is a great way to get engaged in STEM projects and computer systems projects.
- Learn about electronics and how to program them?
- Micro:bit is an electronic device that is compact and easy to use and understand?

Type	Single-board microcontroller
CPU	Nordic Semiconductor, 16 MHz ARM Cortex-M0 microcontroller, 256 KB Flash, 16 KB RAM.
Features	● 25 red LEDs that light up, flash messages. ● Has two programmable buttons. ● On board motion detector ● Built in compass ● Connectivity: Bluetooth, MicroUSB, edge connect

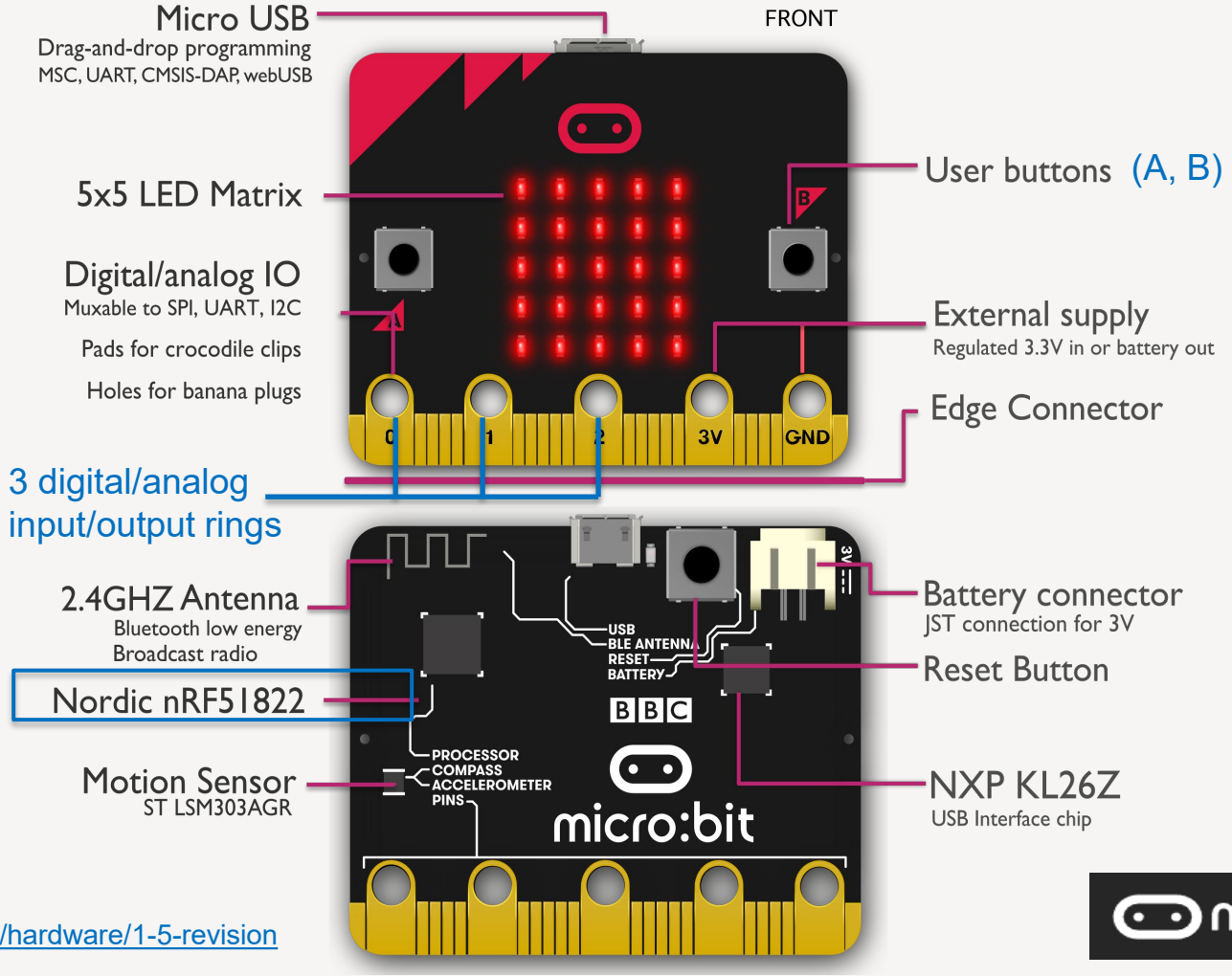
micro:bit

Micro:bit nRF51822 Application Processor

item	details
Model	Nordic nRF51822-QFAA-R rev 3
Core variant	Arm Cortex-M0 32 bit processor
Flash ROM	256KB
RAM	16KB
Speed	16MHz
Debug	SWD, jlink/OB
More Info	Software, NRF51 datasheet

- What do you have with your hard drives, RAM & CPU speed in your PC/ Laptop computer?
- As compared to micro:bit

nRF51822 Micro:bit Components



tech.microbit.org/hardware/1-5-revision

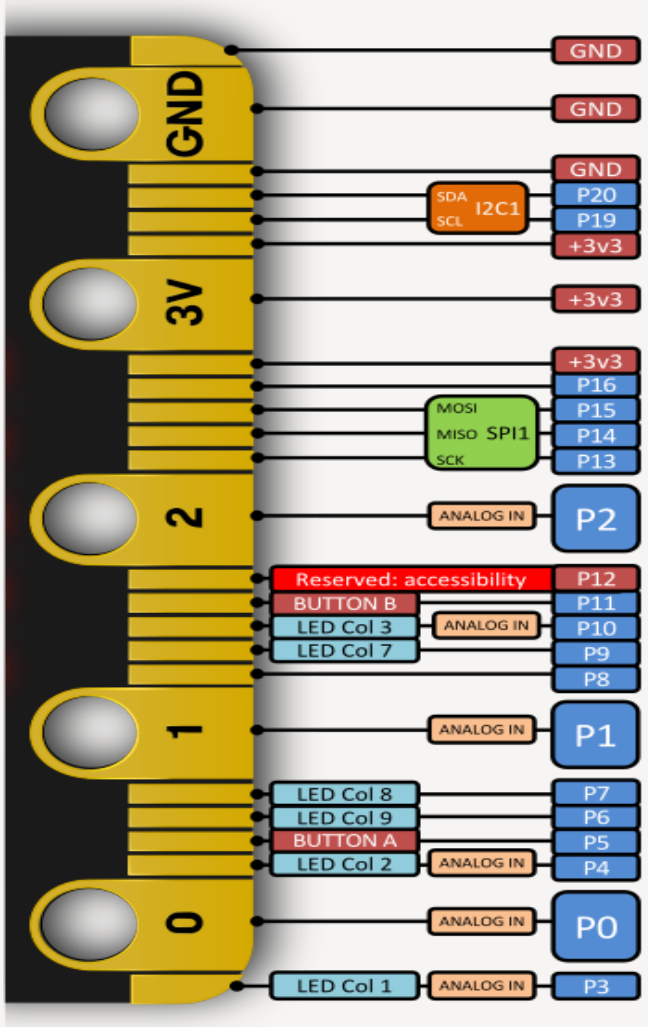
Micro:bit Edge Connector Pins

- There are 25 strips/pins:

- 5 rings for using with 4mm banana plugs or crocodile clips.
  - **3 rings are for general purpose input and output (GPIO)** and are also capable of analog, PWM and touch sensing.
  - 2 rings are connected to the micro:bit power supply.

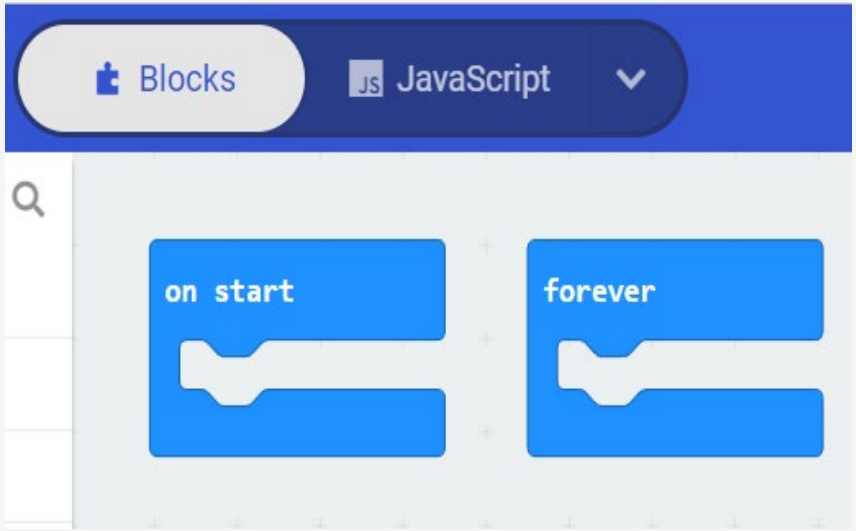
- 20 smaller strips have additional signals, some of which are used by the micro:bit, and others that are free for you to use.

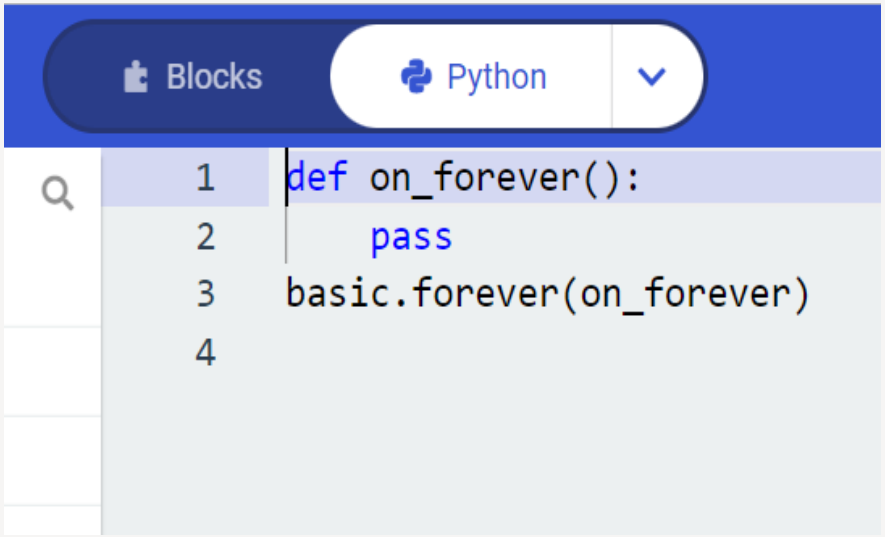
Only the pins on the front are connected to signals. The back rings are connected to the front rings, but the back small strips are unconnected.



Setting Up Your Micro:bit

- Really easy to learn to code the micro:bit microcontroller
- You need to code/program instructions for the micro:bit
- You can program your micro:bit in the online **MakeCode Block** or **Python** text editors.





Connect and Transfer Code to Micro:bit

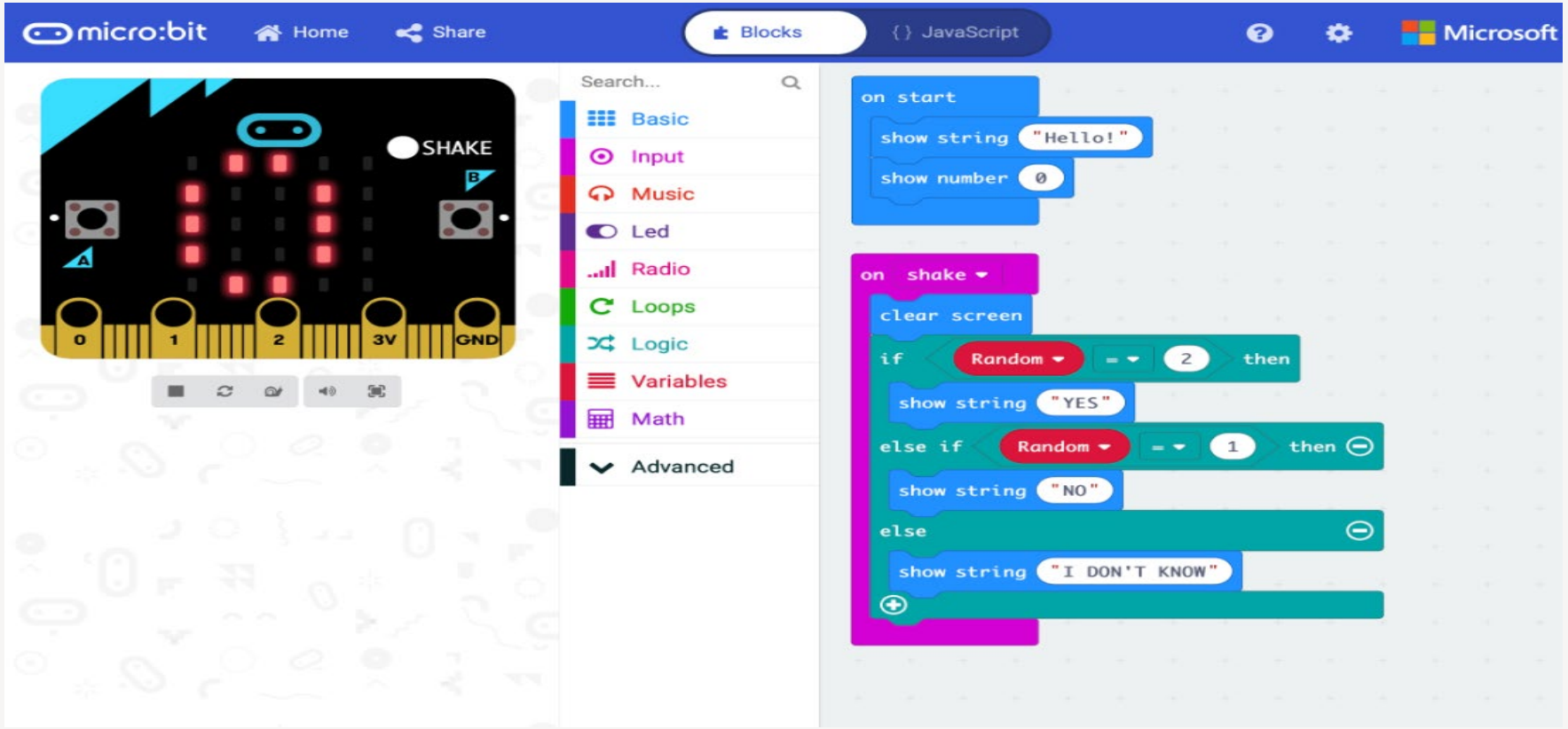
- You will need a computer with a web browser and internet access
- or
- a phone or tablet and the free micro:bit app for MakeCode coding on Android or iOS (iPhone and iPad) mobile devices
- When you've written your code, you'll want to connect (using the USB provided) and transfer it onto the micro:bit.
- If you're using a phone or tablet, use Bluetooth to connect your micro:bit wirelessly
- Connect your micro:bit to your computer or mobile device.

Flashing and Direct Flashing Micro:bit

- Transferring your program to your micro:bit is called **flashing** because it copies your program into the micro:bit's flash memory.

- Direct flashing sends your program from the code editor direct to your micro:bit.
- It works on any computer in two popular web browsers (Google Chrome and Microsoft edge.

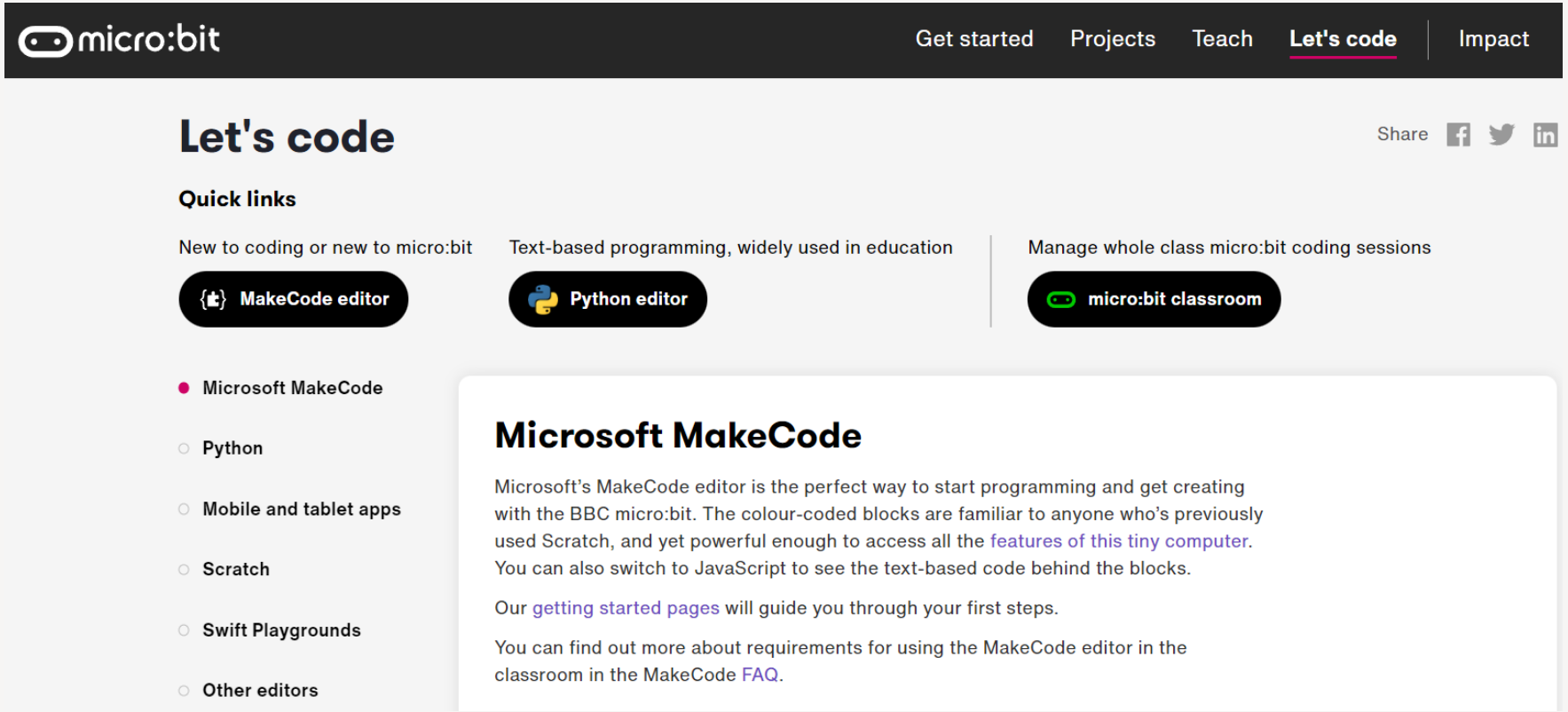
Programming Environment: MS Make Code



Microsoft's Make Code: https://makecode.microbit.org/

Blocks (visual programming), JavaScript, and Python

Programming Environment: microbit.org



Micro:bit Educational Foundation: https://microbit.org/code/

MakeCode Editor (links to MS), Python Editor

Another Platform: Arm Mbed OS

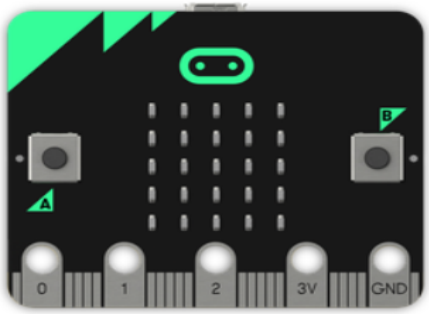
arm MBED

Overview | Hardware | Code | Documentation | Case studies | Community | Blog

Boards » BBC micro:bit

BBC micro:bit

The BBC micro:bit is a pocket-sized, codable computer that allows anyone to get creative with technology. Made possible through a major partnership with 31 organisations, a micro:bit has been given to every 11 or 12 year old child in year 7 or equivalent across the UK, for free.



Arm Mbed Limited: https://os.mbed.com/platforms/Microbit/

Online IDE at developer.mbed.org, Easy to use C/C++ SDK

Processor/Microprocessor vs Microcontroller

What are the differences between ?

Processor/Microprocessor and CPU

- The central processing unit (CPU) is a chip that functions as the brains of the computer.
- It is made of millions of transistors. Microprocessors are the circuitry that surround the CPU.

Processor/Microprocessor and Microcontroller

- A microcontroller puts the CPU and all peripherals onto the same chip
- A microprocessor houses a more powerful CPU on a single chip that connects to external peripherals.

The CPU vs. Microprocessor

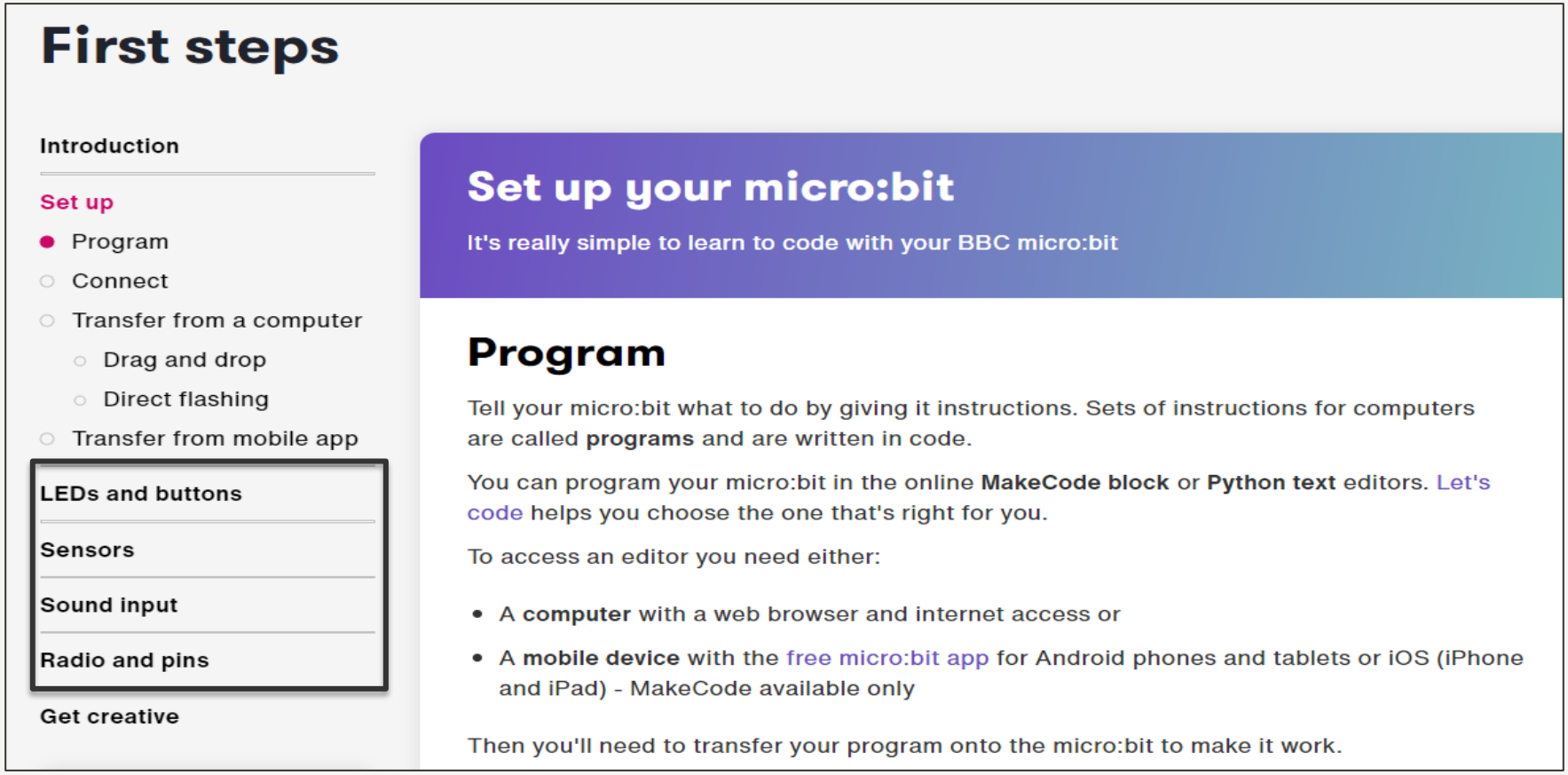
- The Central Processing Unit (CPU) is the brain of a whole computer system that executes programs.
- The microprocessor is an advancement in IC technologies that allow processors to be implemented in a single chip.

- All CPUs nowadays are microprocessors, but not all microprocessors are CPUs.

- Graphics Processing Unit (GPU), NIC card and Sound Card are also contained in microprocessors.
- Microcontroller = Microprocessor with Memory and I/O supporting components on single chip.

Useful Resources from microbit.org

Getting Started Guide: https://microbit.org/get-started/first-steps/introduction/

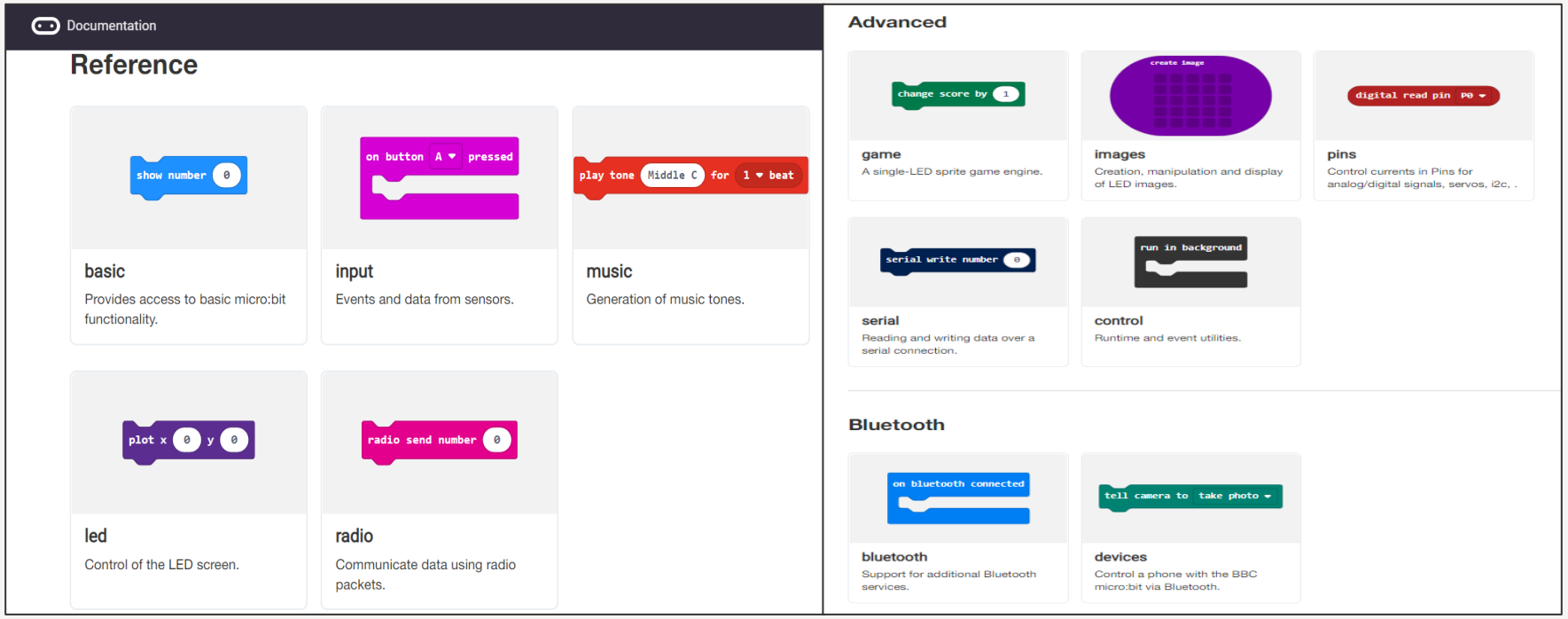


MS Make Code - Useful Resources

Language Reference (Blocks): https://makecode.microbit.org/reference

Documentation → Language and data reference

Micro:bit Device: https://makecode.microbit.org/device



Useful Resources: Language Reference Python

Python: https://microbit.org/get-started/user-guide/python/

Python guide

- Why Python?
- The micro:bit Python editor
- Hello, World!
- Images
- Buttons
- Gestures
- Accelerometer readings
- Random numbers
- Compass
- Light sensor
- Temperature

Hello, World!

Let's start with the basics - making some words and a picture appear on your micro:bit's display. Go to the Python editor and you'll see this program:

```
1 # Add your Python code here. E.g.
2 from microbit import *
3
4
5 while True:
6     display.scroll('Hello, World!')
7     display.show(Image.HEART)
8     sleep(2000)
```

Flash it to your micro:bit by downloading a hex file and transferring it, or flash

Tutorials and Sample Projects

- I have provided a couple of resources, tutorials, sample projects in Week 4 and in Week 5.
- Here's a couple more:

https://microbit-challenges.readthedocs.io/en/latest/

- The tutorial sheets are designed to give students an introduction to the features of the micro:bit.
- Short practical examples to design solutions to problems

https://learn.sparkfun.com/tutorials/getting-started-with-the-microbit/all#introduction

- You can code, customize, and control your micro:bit from anywhere!
- You can use your micro:bit for all sorts of unique creations

sparkfun
START SOMETHING

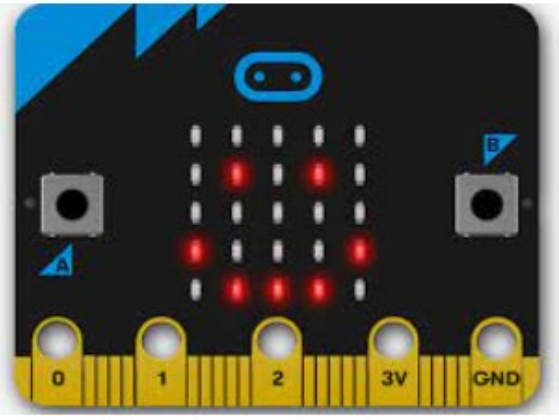
YouTube

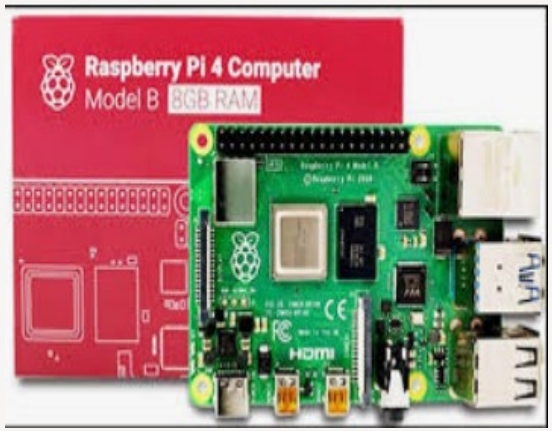
https://www.youtube.com/playlist?list=PLo6KSCBvKXc92f7p8ONiBeWAJKIqNpKIr

- Just search micro:bit tutorials on YouTube

Learning new Computer Platforms

- What is it? (a microcontroller/general-purpose computer)
- What it has? (features, pin functions, working voltage, supported programming languages & tools).





- Resources, Getting Started Guide
- User Guide/ User Manual (if available)
- Programming Language Reference, Tutorials/ Examples

Let’s Explore with Micro:bit

- Looking forward to see some exciting micro:bit projects
- Let’s see your creativity, ingenuity, and innovations

Lecture Learning Summary

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References

- Microbit.org: https://microbit.org/
- Setup Micro:bit:
  https://microbit.org/get-started/first-steps/set-up/
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End of Week 06 Lecture

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