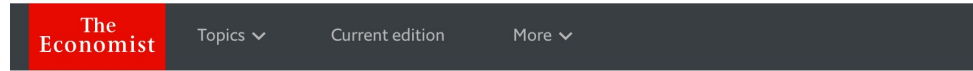


Why MicroPython

Marco Zennaro, PhD
ICTP



Python's growth



Programming languages

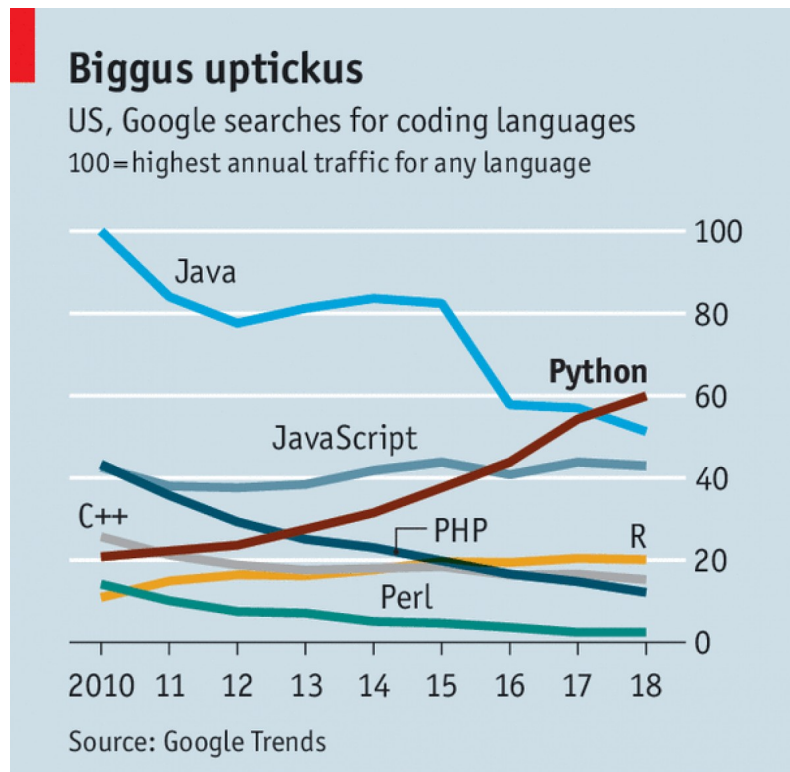
Python has brought computer programming to a vast new audience

And its inventor has just stepped down

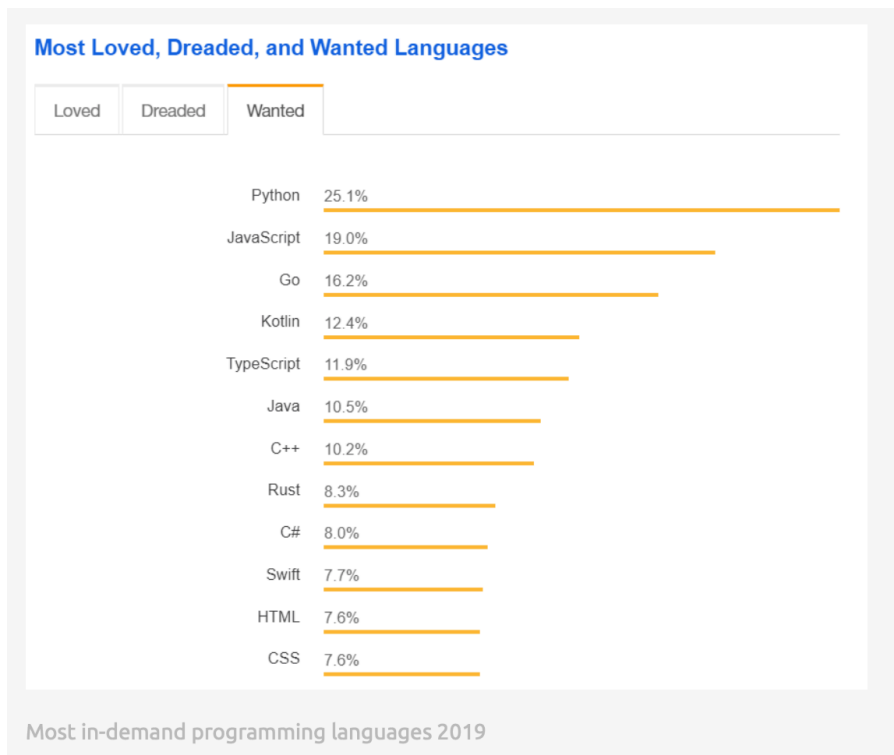


[The Economist](#), July 2018

Python's growth



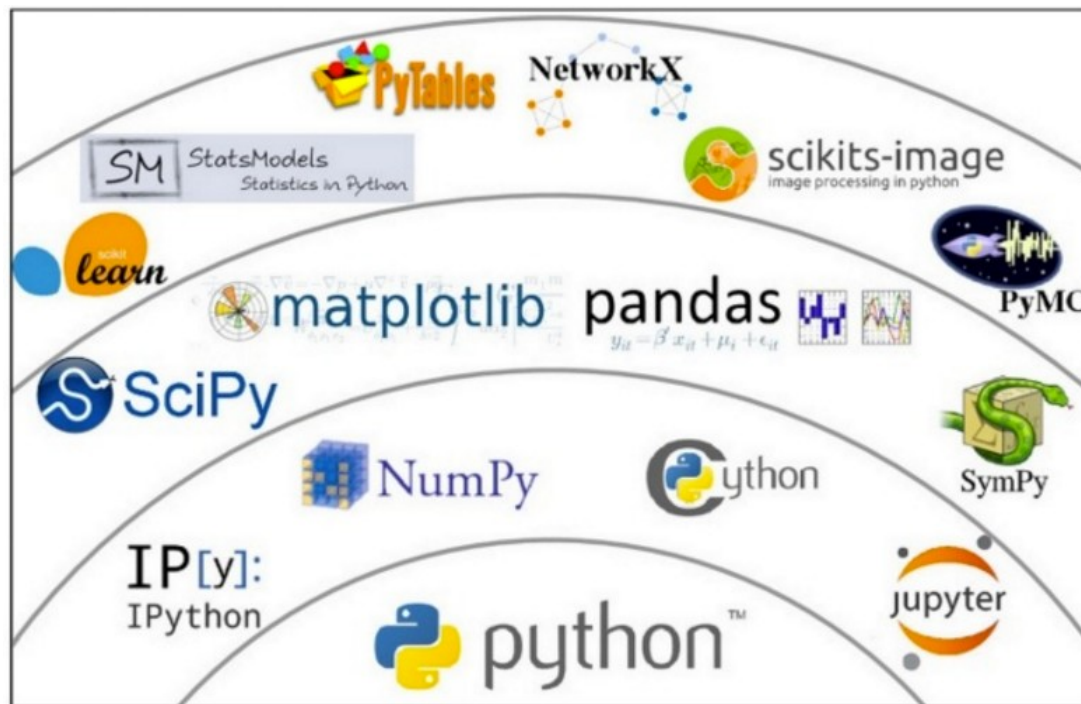
Python's growth



<https://insights.stackoverflow.com/survey/2018/#technology>



Python's ecosystem



MicroPython

MicroPython is a **lean and fast** implementation of the Python 3 programming language that is optimised to run on a microcontroller.

MicroPython was successfully funded via a **Kickstarter campaign** and the software is now available to the public under the MIT open source license.



MicroPython

It ensures that the memory size/microcontroller performance is **optimised** and fit for purpose for the application it serves. Many **sensor** reading and reporting applications do not require a PC based processor as this would make the total application over priced and under-efficient.

15 min exercise

What other microcontrollers do you know?

What operating system do they use?

What is the cost?

MicroPython options



Adafruit MicroPython [webpage](#)

pyBoard

The MicroPython **pyboard** is a compact electronic circuit board that runs MicroPython on the bare metal, giving you a low-level Python operating system that can be used to control all kinds of electronic projects.

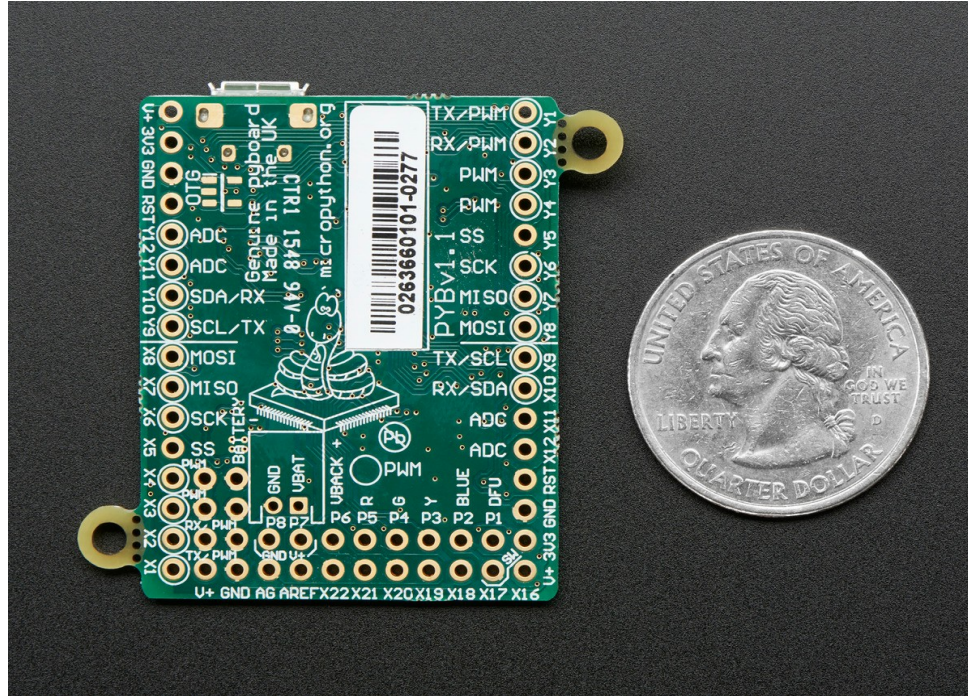
pyBoard

MicroPython is packed full of advanced features such as an interactive prompt, arbitrary precision integers, closures, list comprehension, generators, exception handling and more. Yet it is compact enough to fit and run within just **256k of code space and 16k of RAM.**

pyBoard

MicroPython aims to be as compatible with normal Python as possible to allow you to transfer code with ease from the desktop to a microcontroller or embedded system.

pyBoard



pyBoard

MicroPython pyboard feature table

BOARD

description

The original
pyboard v1.1

Pyboard lite v1.0 with
accelerometer

Pyboard lite v1.0

SKU

PYBv1.1

PYBLITEv1.0-AC

PYBLITEv1.0

PRICE

GBP incl. tax

£28.00

£22.60

£19.60

approx EUR incl. tax

€39.20

€31.60

€27.40

approx USD excl. tax

\$35.00

\$28.25

\$24.50

MICROCONTROLLER

MCU

STM32F405RGT6

STM32F411RET6

STM32F411RET6

CPU

Cortex-M4F

Cortex-M4F

Cortex-M4F

internal flash

1024k

512k

512k

RAM

192k

128k

128k

maximum frequency

168MHz

96MHz

96MHz

hardware floating point

single precision

single precision

single precision



pyBoard

BOARD FEATURES

micro USB connector	yes	yes	yes
micro SD card slot	yes	yes	yes
accelerometer (MMA7660)	yes	yes	no
real time clock	32kHz crystal	internal oscillator; pads to solder 32kHz crystal	internal oscillator; pads to solder 32kHz crystal
switches	USR+RST	USR+RST	USR+RST
leds	R+G+Y+B	R+G+Y+B	R+G+Y+B
hobby servo ports	4	4	4
DFU mode for firmware upgrade	yes	yes	yes

POWER SUPPLY

supply options	USB/V+/VBAT	USB/V+/VBAT	USB/V+/VBAT
input range on V+/VBAT	3.6v-16v	3.6v-16v	3.6v-16v
max output of regulated 3.3v	250mA	250mA	250mA
place for JST connector	yes	yes	yes
backup battery input (VBACK)	yes	yes	yes

pyBoard

POWER CONSUMPTION

running at 168MHz	56mA	-	-
running at 96MHz	37mA	23mA	23mA
running at 48MHz	21mA	13mA	13mA
idling at 168MHz	16mA	-	-
idling at 96MHz	12mA	5mA	5mA
idling at 48MHz	7mA	4mA	4mA
sleep (full RAM retention)	360uA	180uA	180uA
deepsleep (backup retention only)	6uA	6uA	6uA

IO CAPABILITIES

IO pins	30	30	30
pins with PWM	20	18	18
pins with A/D	16 (4 shielded)	16 (4 shielded)	16 (4 shielded)
pins with D/A	2	0	0

pyBoard

PERIPHERALS

independent timers	13	7	7
hardware random number generator	yes	no	no
UART	5	3	3
I2C	2	2	2
SPI	2	2	2
CAN	2	0	0

MICROPYTHON CAPABILITIES

internal flash fs	112k (94k usable)	64k (46k usable)	64k (46k usable)
approx heap size	100k	83k	83k

ADD-ONS

LCD+touch skin compatible (LCD32MKv1.0)	yes	yes	yes
Audio skin compatible (AMPv1.0)	yes	no	no



ESP8266: low cost



ESP8266: characteristics

802.11 b/g/n, built-in TCP / IP protocol stack

802.11b mode + 19.5dBm output power

Built-in PLL, voltage regulator and power management components

Built-in temperature sensor

Off leakage current is less than 10uA

Standby power consumption of less than 1.0mW

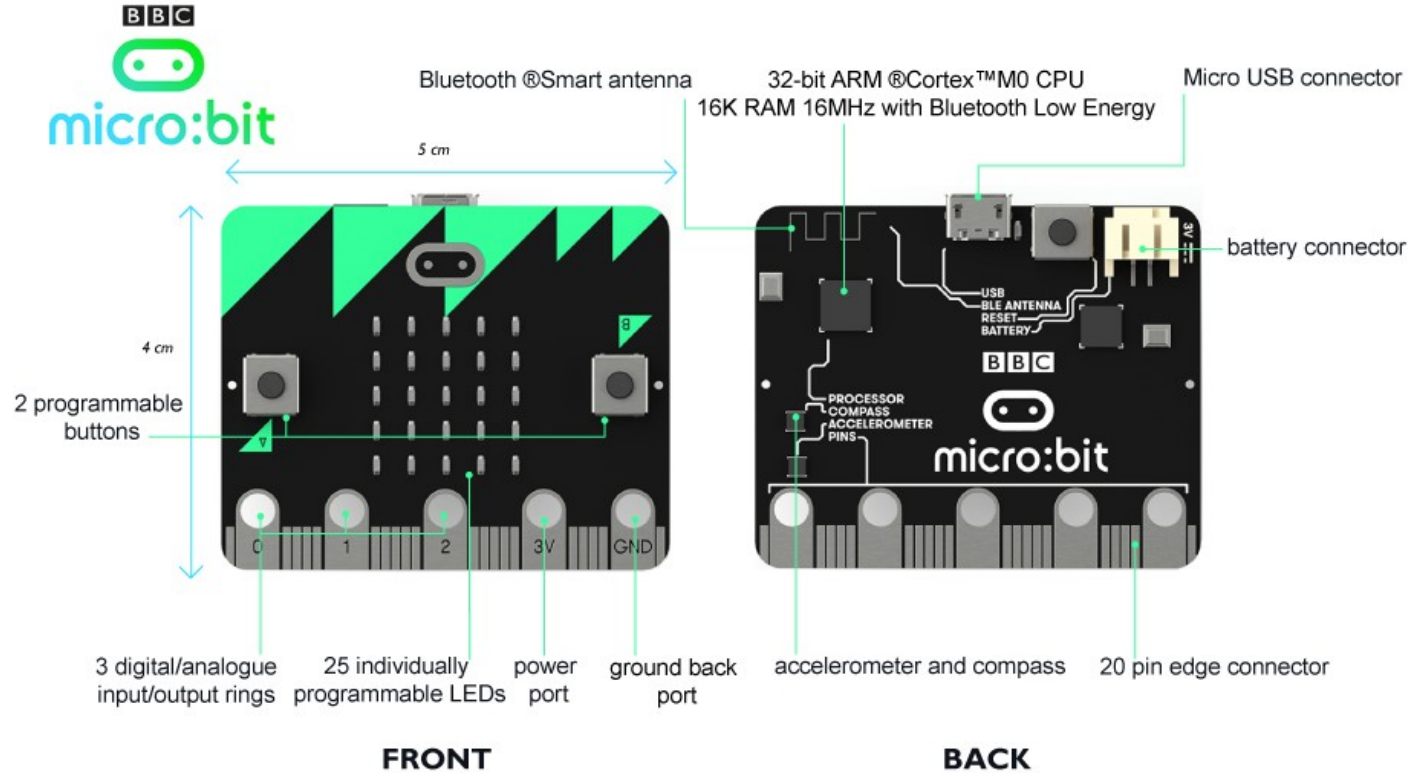
Built-in low-power 32-bit CPU: can double as an application processor

SDIO 2.0, SPI, UART

ESP32



BBC Micro:bit

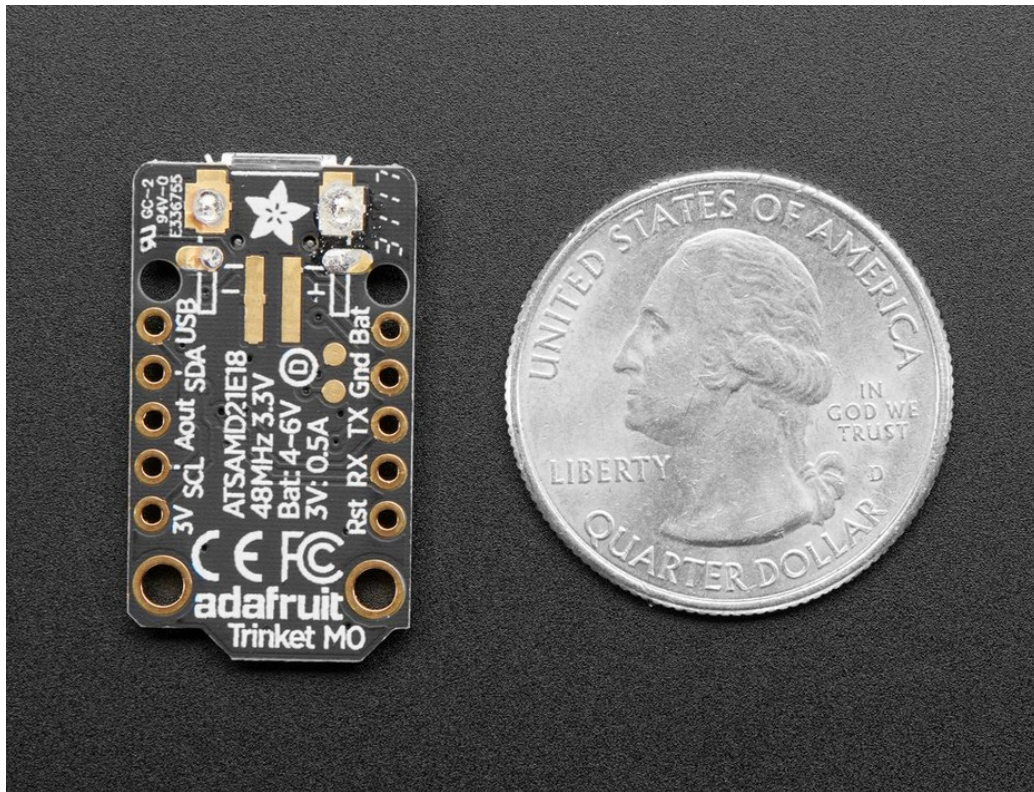


BBC Micro:bit

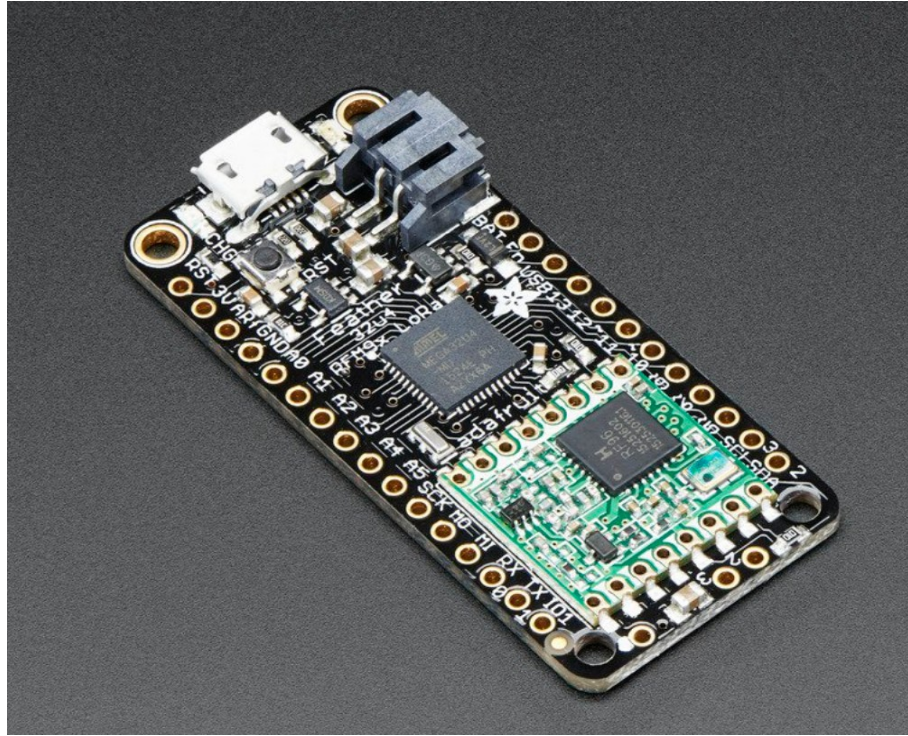
The Micro Bit is an **ARM-based** embedded system designed by the BBC for use in computer education in the UK.

The board has an ARM Cortex-M0 processor, accelerometer and magnetometer sensors, Bluetooth and USB connectivity, a display consisting of 25 LEDs, two programmable buttons, and can be powered by either USB or an external battery pack. The device inputs and outputs are through five ring connectors that are part of the 23-pin edge connector.

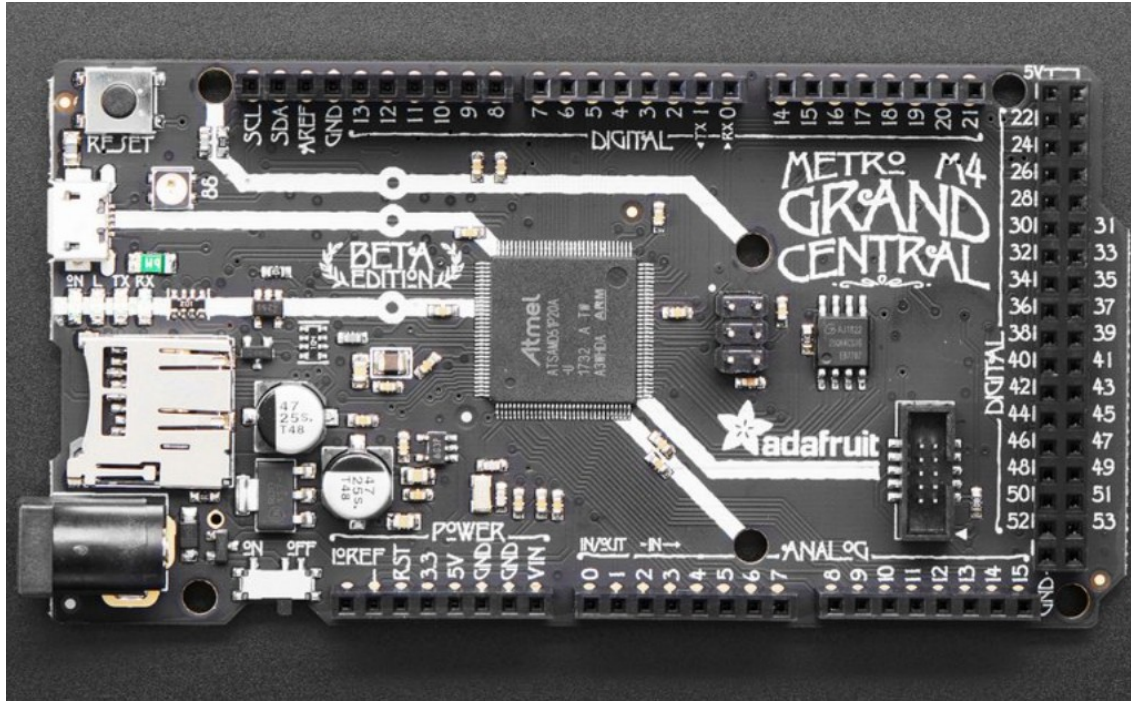
Trinket



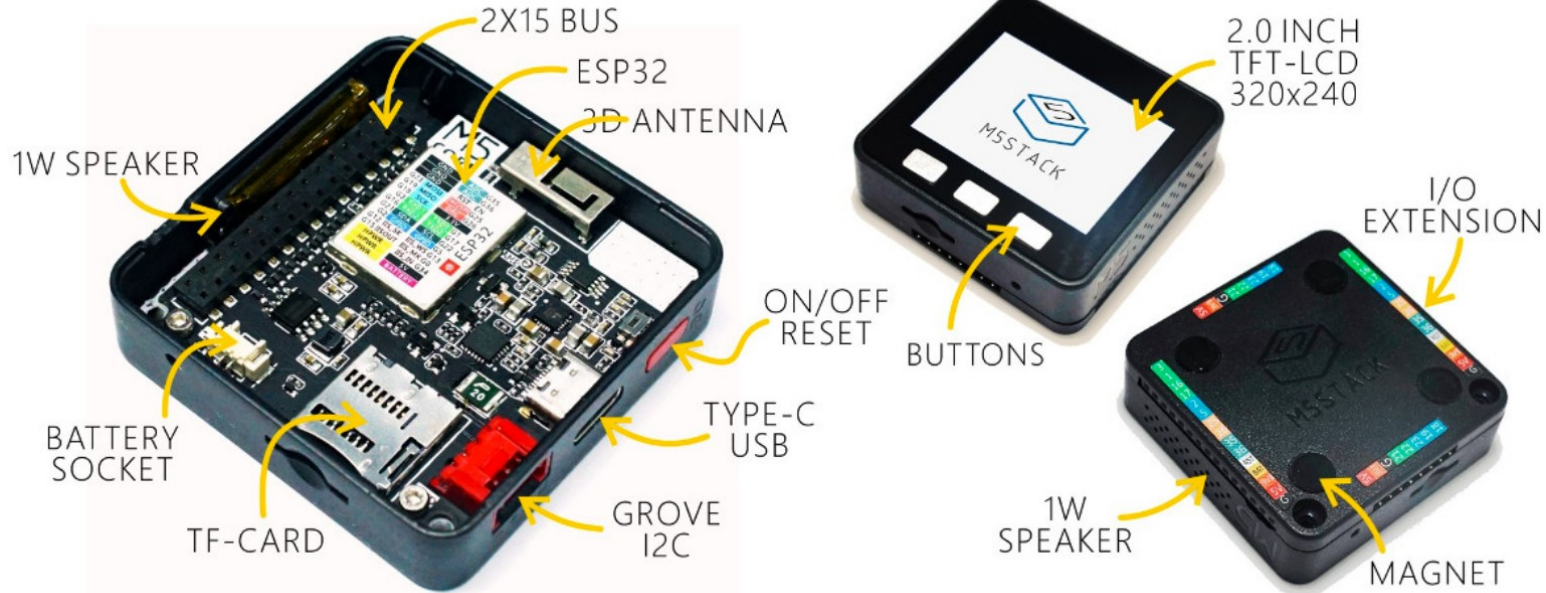
Feather 32u4 RFM95



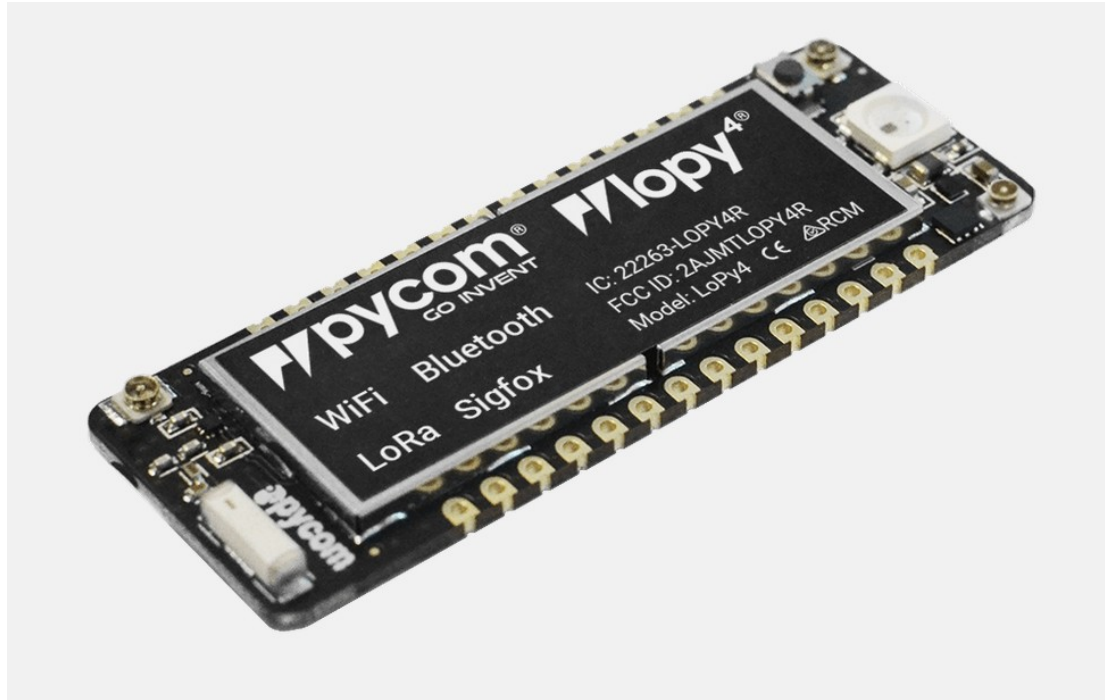
Grand Central M4 Express



M5stack



Pycom: LoPy4



Pycom: LoPy4

Espressif ESP32 chipset

Quadruple network MicroPython enabled
development board (LoRa, Sigfox, WiFi,
Bluetooth)

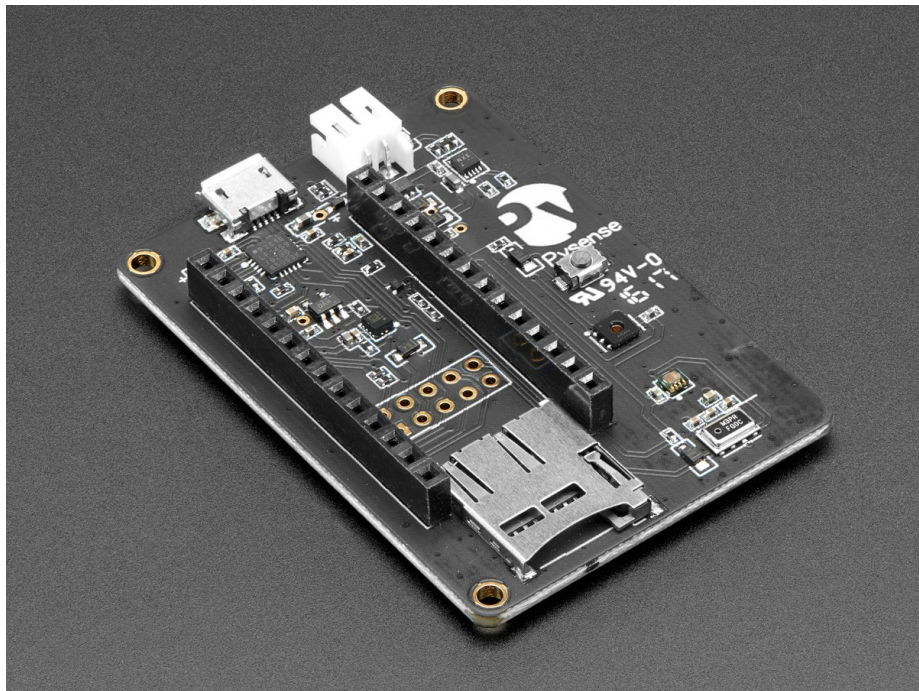
RAM: 4MB

External flash: 8MB

Pycom: Expansion Board



Pycom: PySense



Pycom: PySense

Ambient light sensor

Barometric pressure sensor

Humidity sensor

3 axis 12-bit accelerometer

Temperature sensor

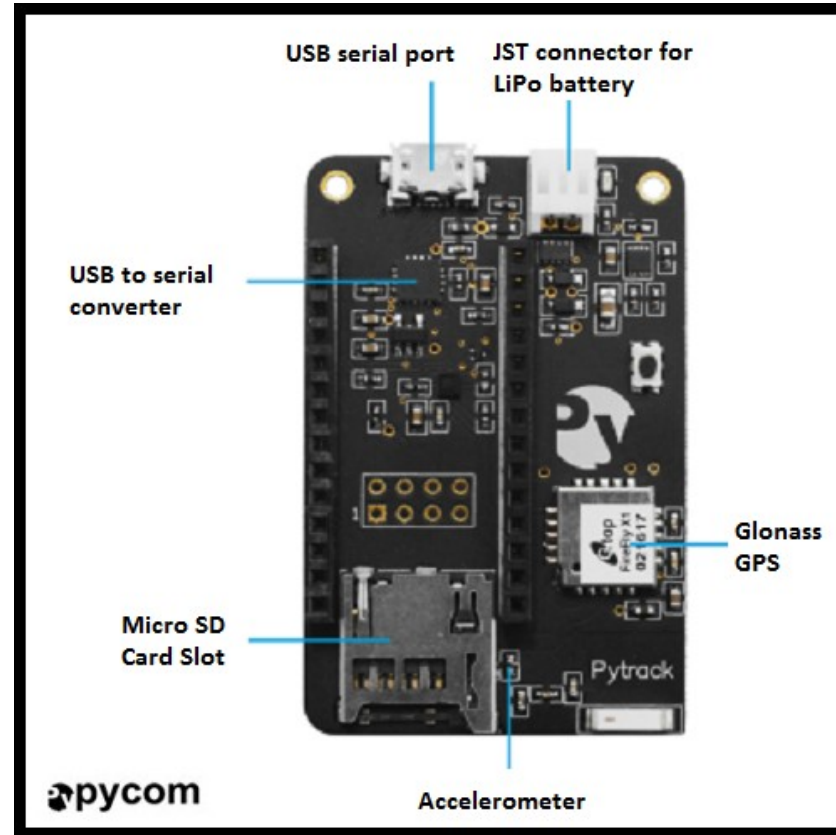
USB port with serial access

LiPo battery charger

MicroSD card compatibility

Ultra low power operation (1uA in deep sleep)

Pycom: PyTrack



Pycom: PyTrack

GNSS + Glonass GPS

3 axis 12-bit accelerometer

USB port with serial access

LiPo battery charger

MicroSD ard compatibility

Ultra low power operation (1uA in deep sleep)

Summary

We introduced MicroPython.

We learned why it's the best 😊

We looked at different boards that support MicroPython.

We learned about Pycom boards.

Feedback?

Email mzennaro@ictp.it