Why MicroPython

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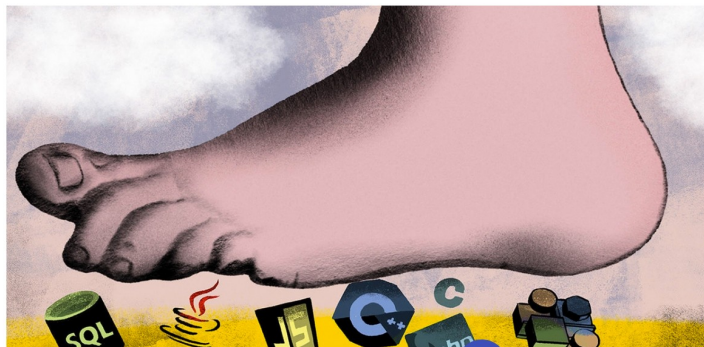ICTP

Python's growth

Python's growth

Biggus uptickus

US, Google searches for coding languages
100=highest annual traffic for any language

Java
Python
JavaScript
C++
PHP
R
Perl

100
80
60
40
20
0

2010 11 12 13 14 15 16 17 18

Source: Google Trends

Economist.com

Python's growth

Most Loved, Dreaded, and Wanted Languages

| Loved | Dreaded | Wanted |

Python	25.1%
JavaScript	19.0%
Go	16.2%
Kotlin	12.4%
TypeScript	11.9%
Java	10.5%
C++	10.2%
Rust	8.3%
C#	8.0%
Swift	7.7%
HTML	7.6%
CSS	7.6%

Most in-demand programming languages 2019
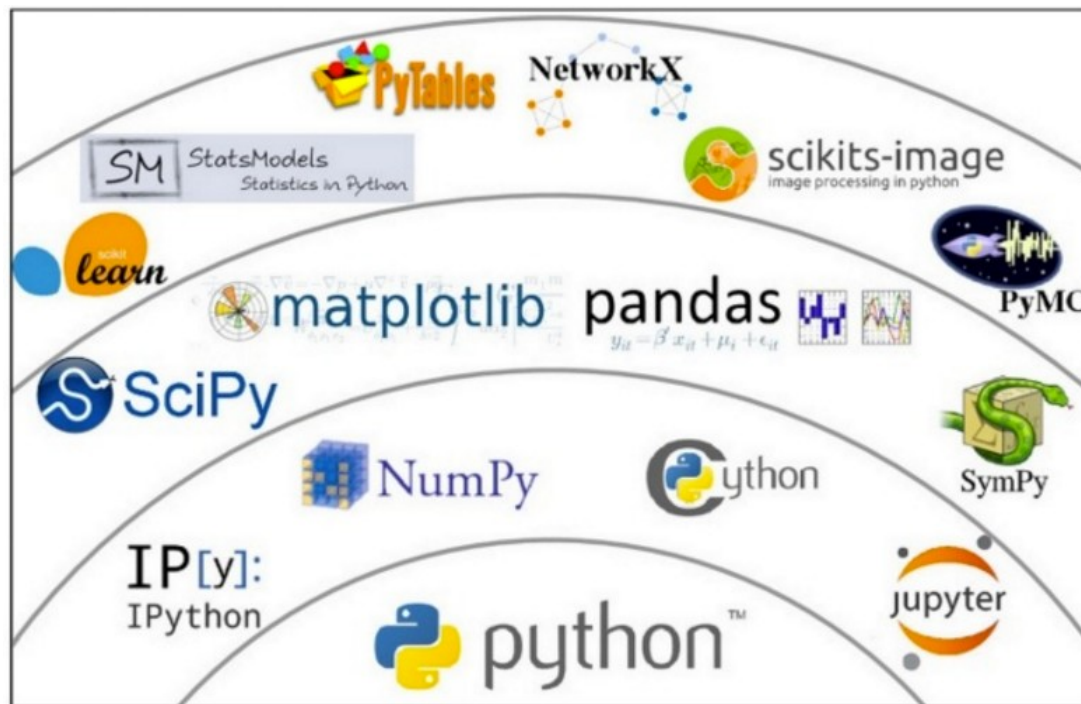
https://insights.stackoverflow.com/survey/2018/#technology
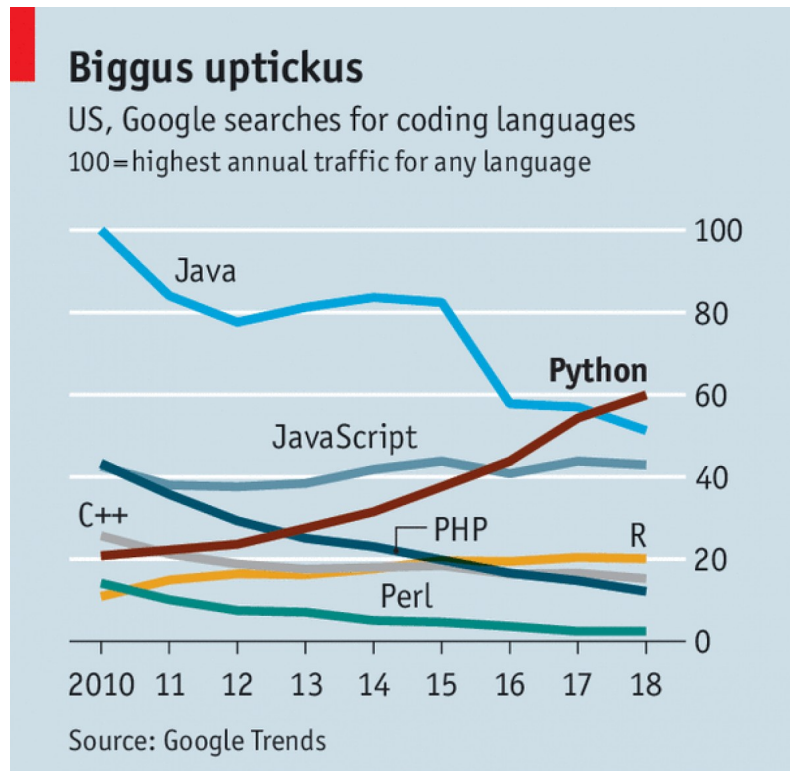
Python's ecosystem

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.

ICTP

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.

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.
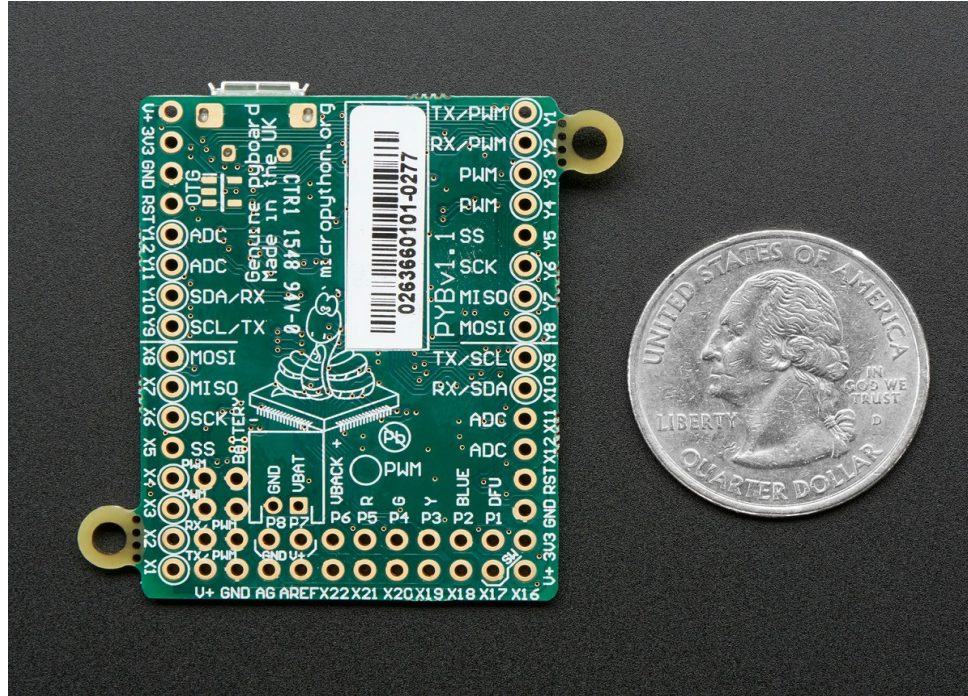
pyBoard

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

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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

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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
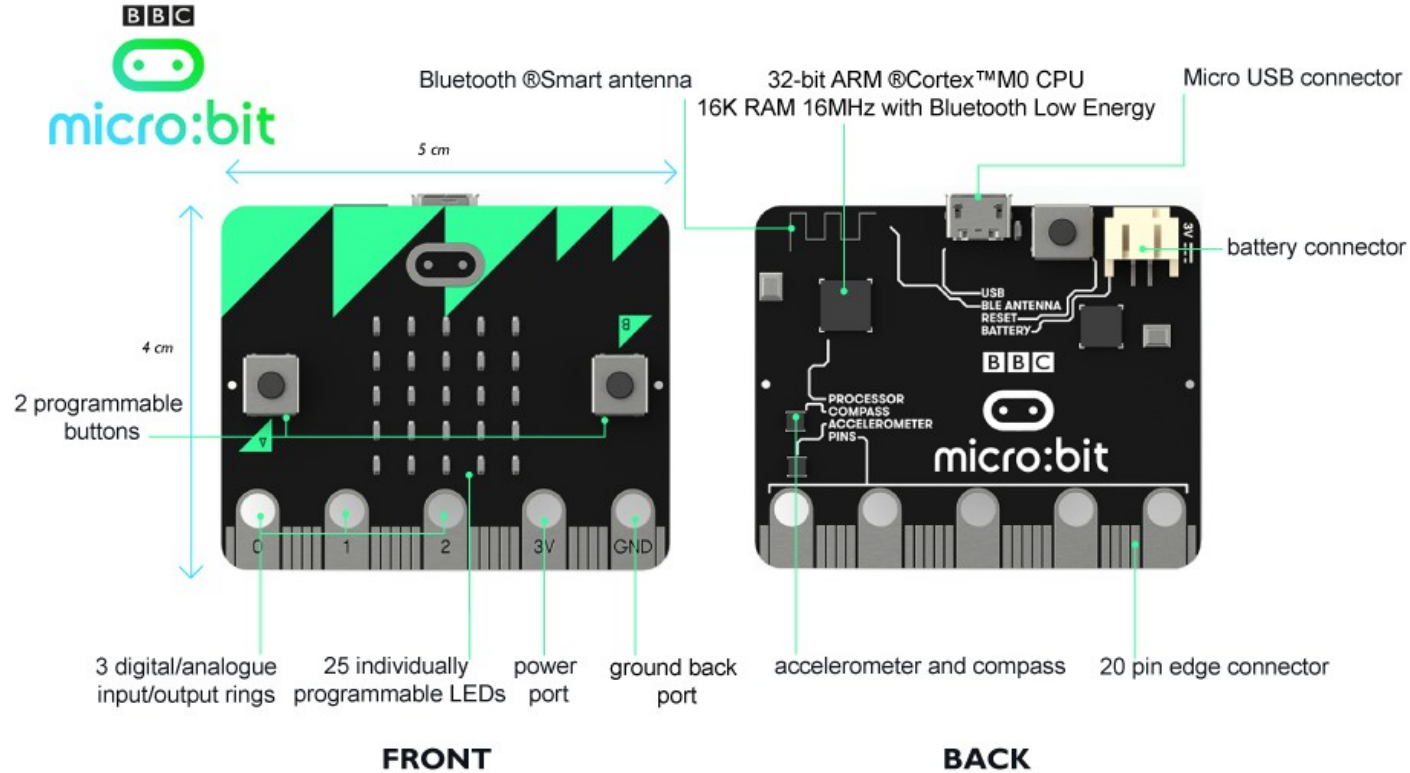Standby power consumption of less than 1.0mW

Built-in low-power 32-bit CPU: can double as an application processor
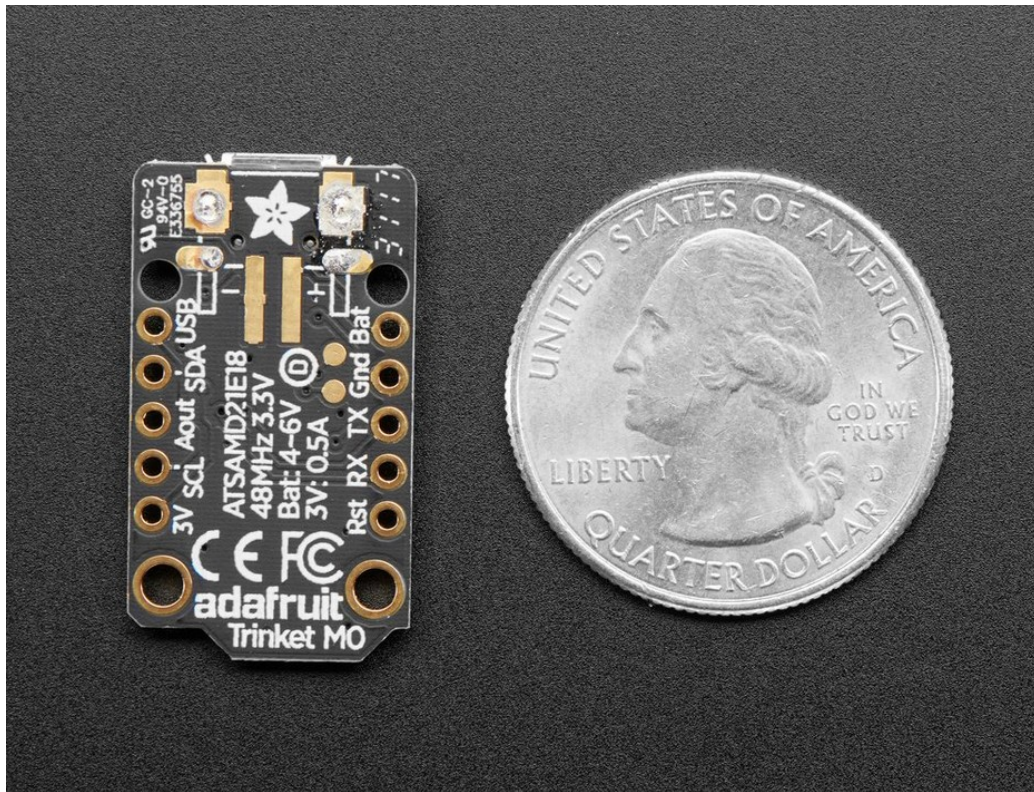SDIO 2.0, SPI, UART

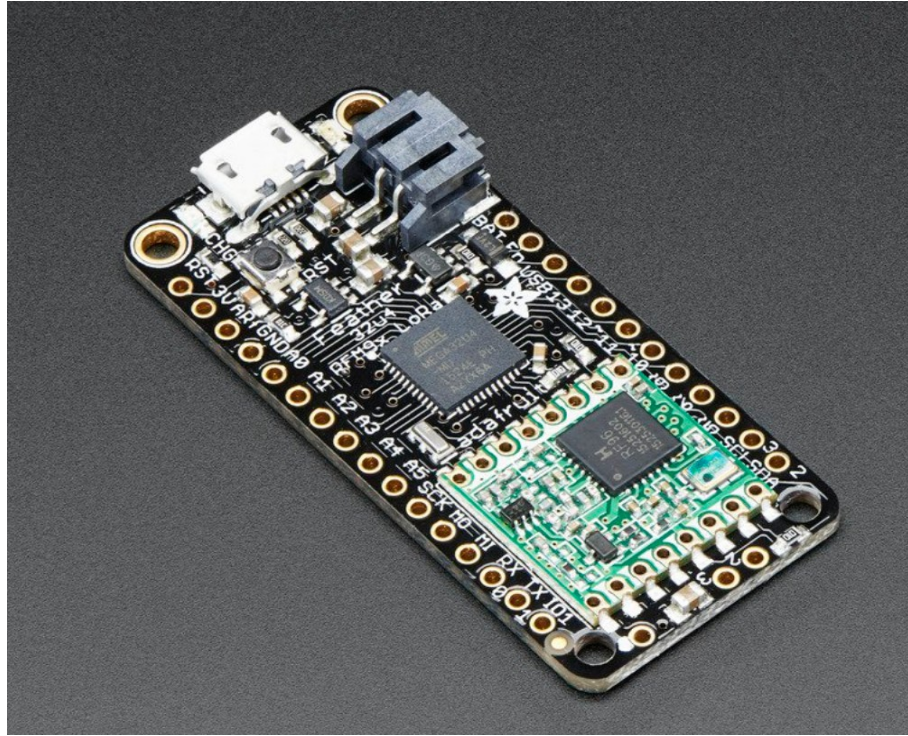# ESP32

BBC Micro:bit

BBC micro:bit

5 cm

4 cm

Bluetooth ®Smart antenna

32-bit ARM ®Cortex™M0 CPU
16K RAM 16MHz with Bluetooth Low Energy

Micro USB connector

battery connector

USB
BLE ANTENNA
RESET
BATTERY

BBC micro:bit

2 programmable buttons

PROCESSOR
COMPASS
ACCELEROMETER
PINS

3 digital/analogue input/output rings

25 individually programmable LEDs

power port

ground back port

accelerometer and compass

20 pin edge connector

FRONT

BACK

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.
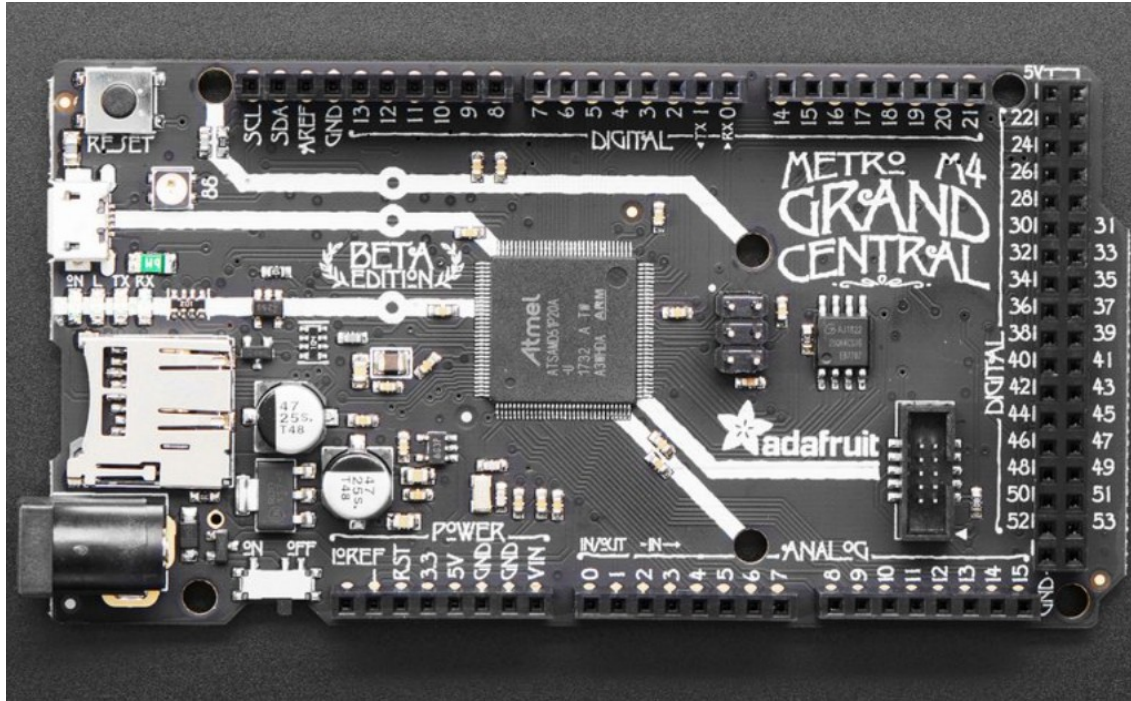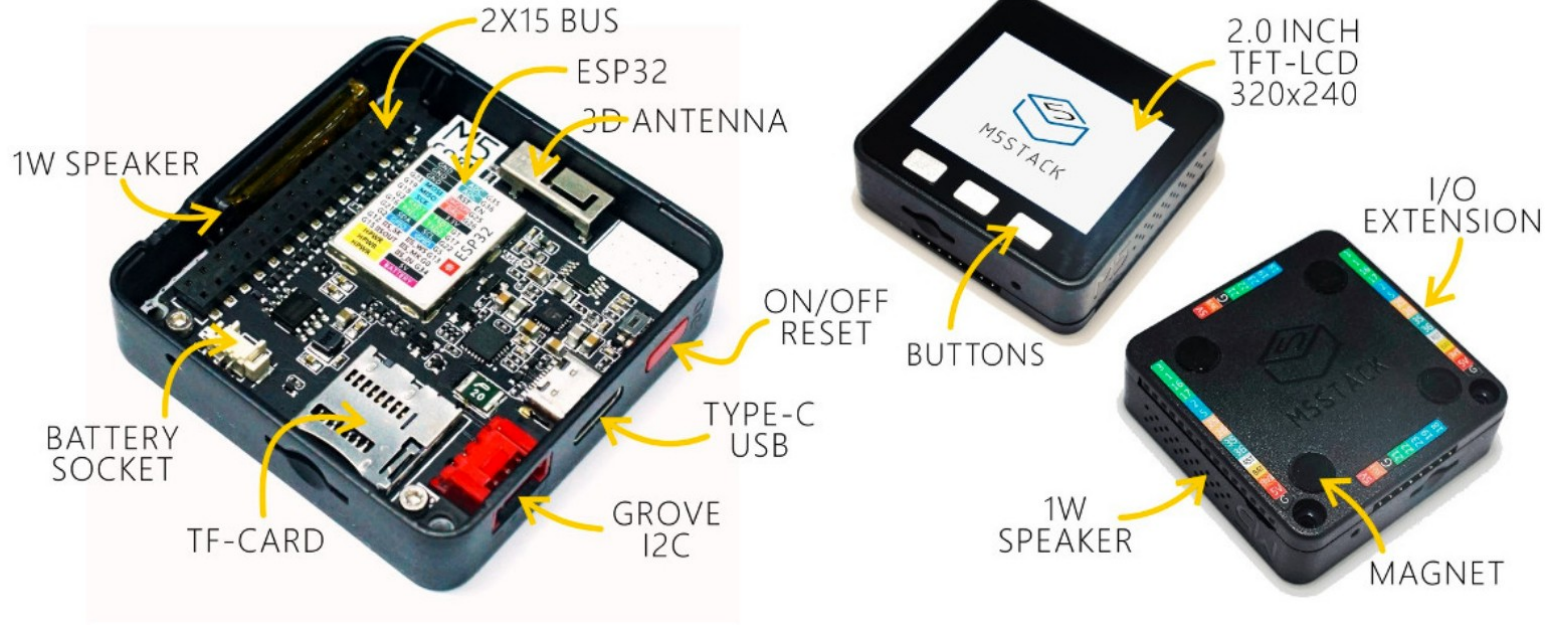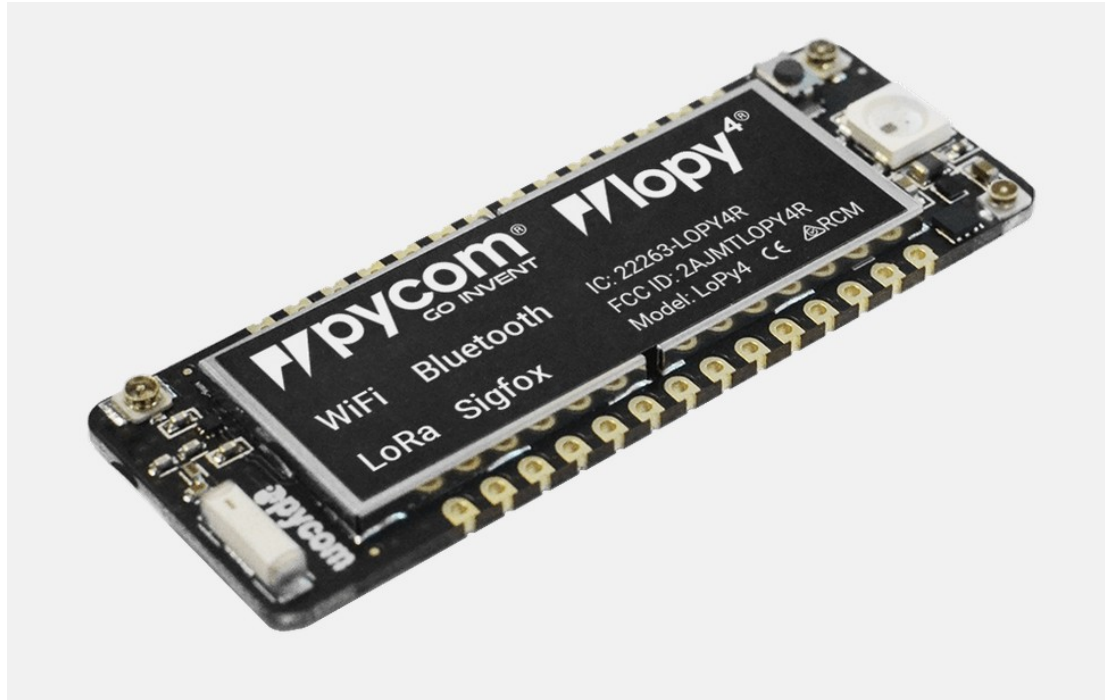
Trinket

Feather 32u4 RFM95

Grand Central M4 Express

M5stack

1W SPEAKER

2X15 BUS

ESP32

3D ANTENNA

BATTERY SOCKET

TF-CARD

ON/OFF RESET

TYPE-C USB

GROVE I2C

2.0 INCH TFT-LCD 320x240

BUTTONS

I/O EXTENSION

1W SPEAKER

MAGNET

Pycom: LoPy4

Pycom: LoPy4

Espressif ESP32 chipset

Quadruple network MicroPython enabled development board (LoRa, Sigfox, WiFi, Bluetooth)
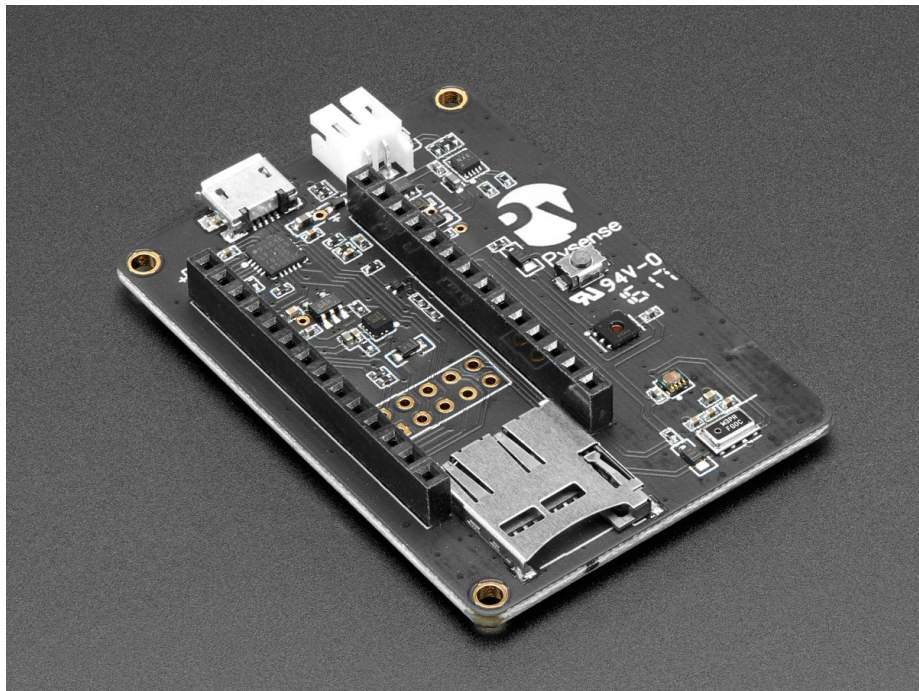
RAM: 4MB

External flash: 8MB

Pycom: Expansion Board

Pycom: PySense

Pycom: PySense

Ambient light sensor

Barometric pressure sensor

Humidity sensor
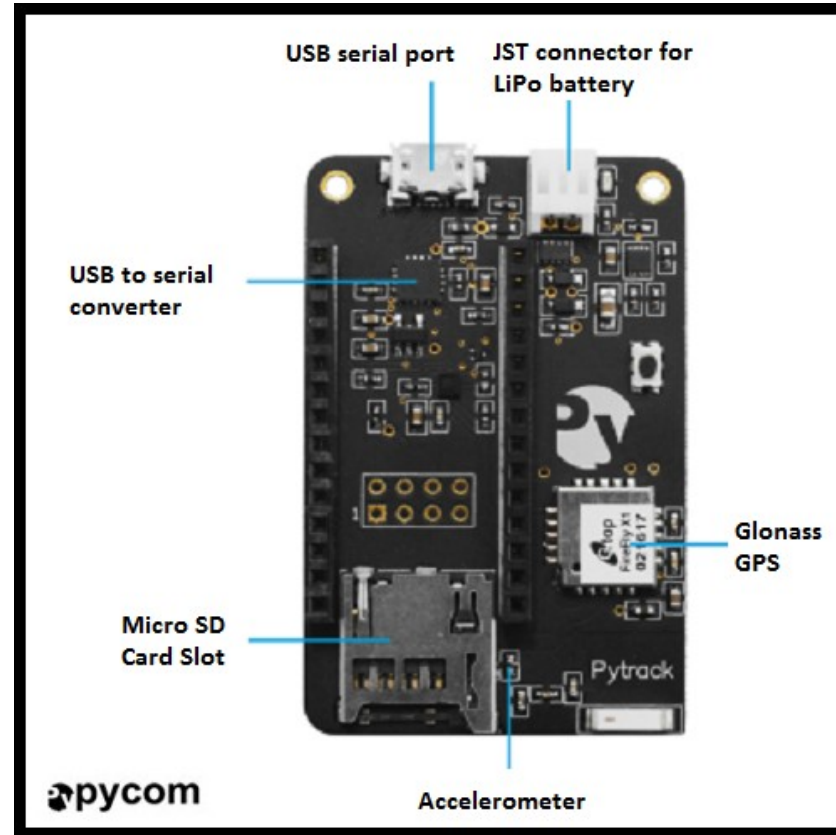
3 axis 12-bit accelerometer

Temperature sensor

USB port with serial access

LiPo battery charger

MicroSD card compatibility

Ultra low power operation (1uA in deep sleep)

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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