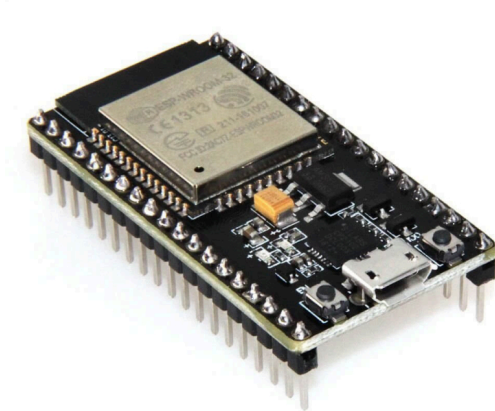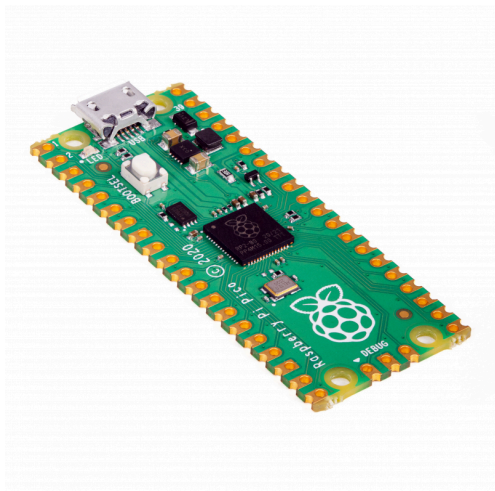# Microcontroller options

**Espressif ESP32**

-   Tensilica Xtensa LX6 32 bit dual-core
-   520KB RAM
-   4MB Flash
-   160-240MHz Clock speed
-   2.2-3.6V Operating voltage
-   Wifi, Bluetooth 4.2, ethernet modules
-   I2C, I2S, UART, SPI, PWM
-   34 GPIO pins
-   -40-125ºC operating temperature
-   £3-6
-   MicroROS compatible
-   55x28mm

Raspberry Pi Pico RP2040

- Arm Cortex-M0+ dual-core
- 264KB RAM
- 2MB Flash
- 133MHz Clock Speed
- 1.8-5.5V Operating voltage
- No Wifi or bluetooth
- UART, I2C, SPI, PWM, PIO
- 26 GPIO pins + 3 Analog pins
- -20-+85ºC operating temperature
- £4-6
- MicroROS compatible
- 21x25mm

Arduino Portenta H7
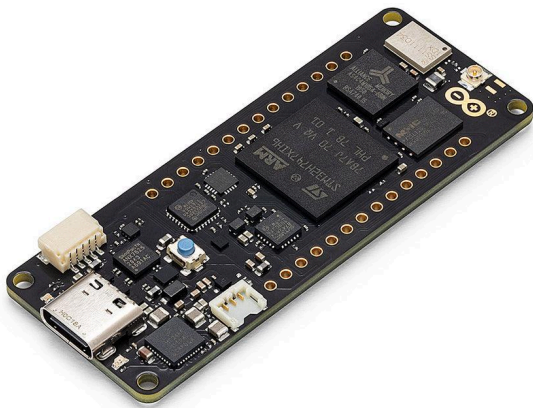
- Dual core STM32H747 (Cortex M7 running at 480 MHz and a Cortex M4 running at 240 MHz)
- 8MB RAM
- 16MB Flash
- 5V board supply, 3.3v circuit supply
- WiFi, Bluetooth 4.2, Ethernet
- I2C, USART, UART, LPUART, SPI, I2S, FMC Quad-SPI Flash memory interface
- A camera interface for CMOS sensors
- An LCD-TFT display controller
- A JPEG hardware compressor/decompressor
- A DSI Host interface
- 2 80 pin connectors
- -40-85ºC operating temperature
- €118.82
- 66x25mm
- MicroROS supported

Arduino Due
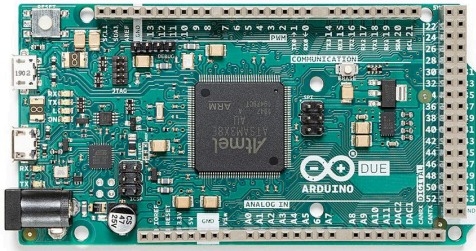
- 32 bit AT91SAM3X8E
- 84MHz Clock speed
- 96kb RAM
- 512kb Flash
- 3.3V operating voltage
- No wifi, bluetooth,
- UART, I2C, TWI, SPI
- 54 GPIO pins
- €40,28
- MicroROS community supported
- 101x53mm

Final choice:

The microcontroller chosen for this project is the Espressif esp32. The Arduino Portenta is way too expensive compared to the other options, and offers too many functions and specifications for the project. The Arduino Due offers more GPIO pins than the other microcontrollers(aside from the portenta), but has less clock speed, RAM, flash storage, doesn't offer wifi or bluetooth modules, and is more expensive. The Espressif esp32 and the Raspberry Pi Pico are very similar in terms of capabilities and price. Both microcontrollers have dual core MCUs, officially support micro ROS, can use languages such as micropython and c/c++, and both have very similar price ranges. The pico has extra PIO pins compared to the esp32, so it is able to be programmed to attach to any peripheral. It is also able to multiplex so that the pins could be used more than once, but does not include wifi, bluetooth, or ethernet. However, the esp 32 has more RAM, more flash memory, and a wider temperature range. The temperature range in earth's orbit ranges from -100-120ºC, while the esp 32 covers the upper limit, the other microcontrollers don't cover either limit. The esp 32 also offers more GPIO pins without multiplexing, as well as wifi and bluetooth modules. In conclusion the esp 32 was chosen over the raspberry pi as it is cheap, could support wireless functions to accommodate stretch goals, and offers higher processing power and GPIO pins.