

EMBEDDED SYSTEMS & IOT

LET'S TALK ABOUT

- FUNDAMENTALS OF EMBEDDED SYSTEMS DESIGN & IOT USE CASES..
- FIRST STEPS WITH ARDUINO BOARD, SENSORS & SERVO MOTORS.

01 FEB

15:00-18:00

BIB1,FSEGN



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Some Questions?

- How long does it take for my plants to dry out to the point where they need another watering?
- What is the acceleration rate and top speed of my car?
- How much movement do I make while sleeping?
- How does the air quality of my room [CO2] change over the course of the day?

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IoT use cases

- Smart House
- Smart Agriculture
- Smart Transportation
- Smart Industry 4.0



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Constraints of Embedded Systems Dev.

- Limited resources (Processing Unit, Memory)
- Energy consumption (BLE)
- Connectivity (Lora, MQTT/no HTTP)
- Tough conditions (rain, dust, etc.)
- Embedded size in real projects (ex. Smart Watch)

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What is needed to make it ?

- 1 Programmable Board (Arduino, Raspberry Pi, ESP32, STM32, etc.)
- Some Sensors (Humidity, Gas, Luminosity, Vibration, Ultrasonic, etc.)
- Other components (LEDs, Motors, Servomotors, Stepper motors, Water pump, Buzzers, etc.)
- Wires

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How To Select The Right Development Board For Your Project

Check the Development Board Type

Observe the Board Language & Community

Check the Specification of the Board

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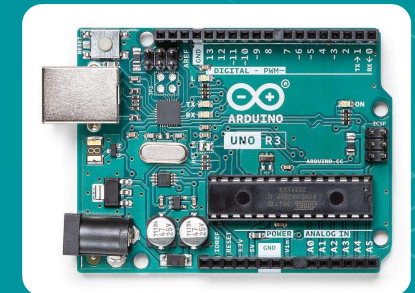
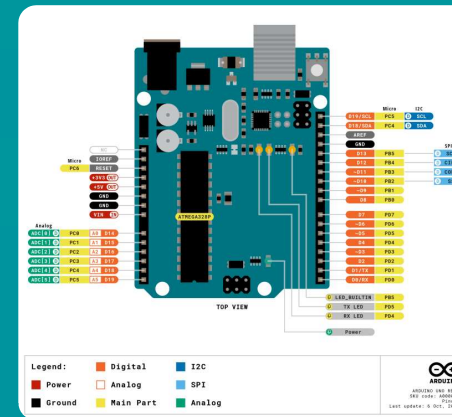
About Raspberry Pi

- A mini PC that can run an Operating System and install programs !
- Raspbian OS (Linux Debian based distribution) is the most used one
- Big Community
- Expensive for small projects (90€ for Raspberry Pi 5 (8GB RAM))



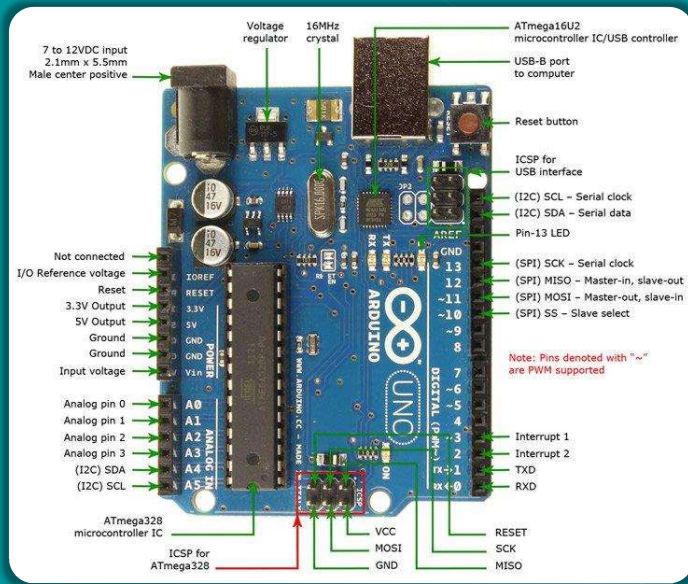
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Arduino is a fun toy *serious tool*



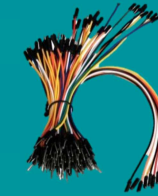
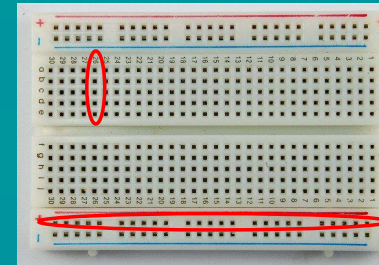
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Arduino Design



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Breadboard, wires can be useful



Jumper wires (get male/male or male/female) plug into breadboards.



Multimeter can be useful to measure voltage, current, and resistance.

Breadboards are for making circuits without soldering.

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Classic Boards

Arduino UNO R4 Minima	Arduino UNO R4 WiFi	Arduino UNO R3	Arduino Leonardo
Arduino UNO Mini Limited Edition	Arduino Micro	Arduino Zero	Arduino UNO WiFi Rev2

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Nano Boards Family

Arduino Nano 33 IoT	Arduino Nano RP2040 Connect	Arduino Nano ESP32	Arduino Nano 33 BLE Sense
Arduino Nano 33 BLE	Arduino Nano Every	Arduino Nano	Arduino Nano Motor Carrier

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Mega Family



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Many Extension Shields



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Buy Arduino & IoT kits in Tunisia

cothings.net

tuni-smart-innovation.com



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Where to Start ?
www.arduino.cc



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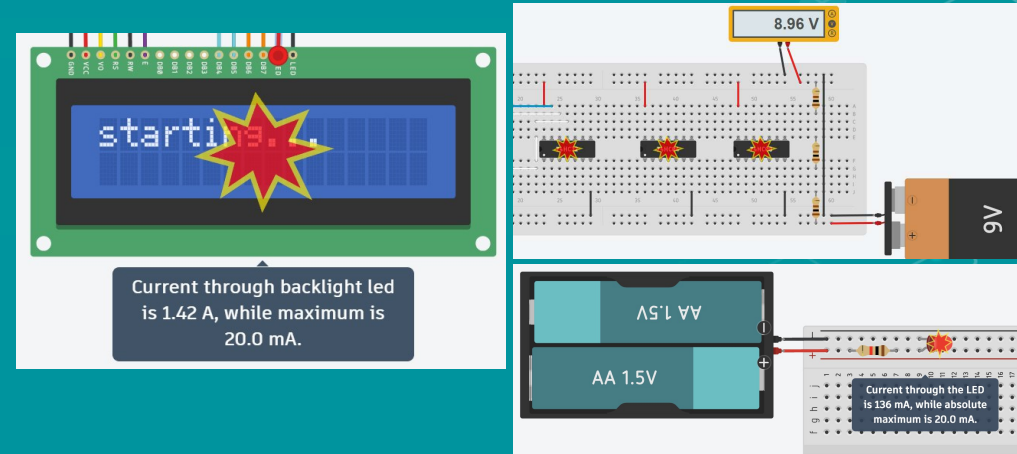
www.tinkercad.com

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Design & Simulate before DIY



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First Hello program using blinking led

```
blink_led.ino
1 int ledPin = 13; //Variable to store the pin number
2
3 void setup()
4 {
5   pinMode(ledPin, OUTPUT); //set ledPin as output
6 }
7
8 void loop()
9 {
10  digitalWrite(ledPin, HIGH); //LED ON
11  delay(1000); //Wait 1000ms (=0,1s)
12  digitalWrite(ledPin, LOW); //LED OFF
13  delay(1000); //Wait 1000ms (=1s)
14 }
```

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Tinkering Time



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Activity 1 : Design traffic lights

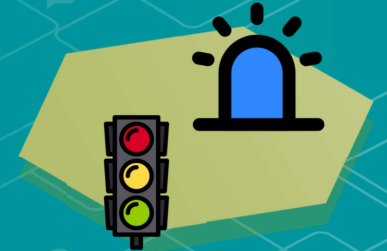
- ✓ Red -> 4 sec
- ✓ Orange -> 2 sec
- ✓ Green -> 5 sec



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Activity 2 : Add a buzzer sound when red is on

- ✓ Buzzer is connected to pin 10
- ✓ Choose the desired frequency (ex: 60)
- ✓ Play sound for 0.5 sec



- ⚠ Choose adapted block (or tone function in text mode)

play speaker on pin 10 with tone 60 for 0.5 sec

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Activity 3 : Make racing lights count down

- ✓ Use 3 buzzer sounds
- ✓ 1 sec for each led
- ✓ Make Green led blinking after start



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Other ideas : Add a servomotor to simulate a racing barrier that will be opened after start signal (rotate to 90°)

Think Outside the Box



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ありがとう شكرا
Thank You 谢谢
Merci ¡gracias!

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