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WORKSHOP

FIRST DAY

Realization of a circuit composed of a LED, a switch button and a current limiting resistor.

How to test the circuit: after giving current by pushing the button, the led must turn on emitting light.

SECOND DAY

Turning on and off the light of three LEDs, With a Bluetooth connection between your telephone and an ESP32 microcontroller.

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What is a LED?

- **LED is the acronym of Light Emitting Diod. A LED is an electric device used both to emit light and allow the current to flow only in one direction**
- Leds are made up of semiconductor elements like Silicon.
- Silicon is alterated by the intentional introduction of (other elements like Boron, Phosphorus, etc..) in his cristalline matrix (a process called “ DOPING of Semiconductors”).
- The introduction of trivalent or pentavalent elements in silicon allows the production of **Positive** and **Negative** Silicon.
- By Jointing the two different doped Silicons, a so called **PN junction is obtained,** which is a very important thing!!
- PN junction is used in LEDs, in Fotovoltaic panel, in Diodes and BJT transistors too.

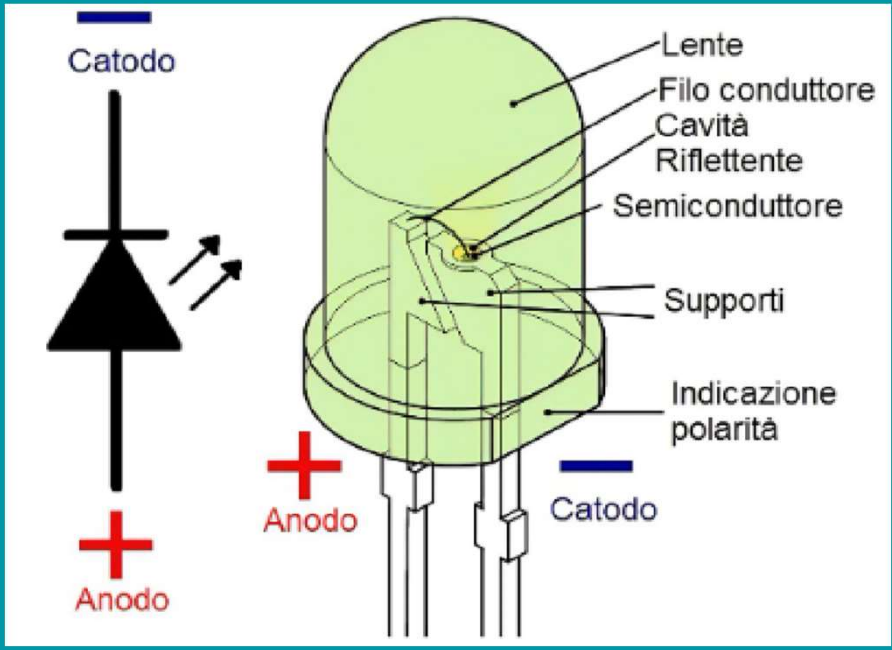
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How do a LED works?

-A Light Emitting Diode works by applying a positive voltage to the terminals.

-Positive voltage >0,7V provides the energy needed by an electron to drop from a lower state energy to a higher one.

the excited electron turns back to his unexcited state soon after and emits a photon.



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LED (Light Emitting Diode)

When a LED is ON, it emits light in a specific wavelenght.

The wavelenght of emission is defined by the kind of elements involved in his semiconductor composition.

In fact a PN junction can be created using different kinds of elements, not only silicon

For example ,red, orange and yellow LEDs are obtained using GaAsP (Gallium phosphure arseniure); blu LEDs are made up of Silicon and Carbon while green and white LEDs are made up of IndiumGalliumNitride.

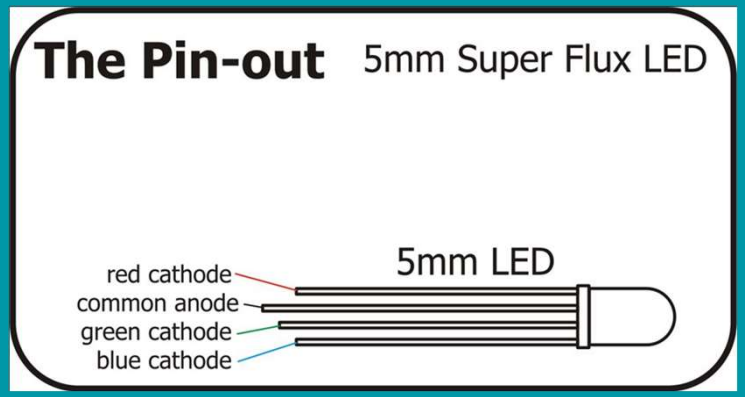
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LED
is the acronym LightEmittingDiode



This device is a light emitter that can assume different colors by mixing Red ,Green and Blue. It can, f course, emit purely red, green or blue lights by charging with an electrical voltage of 3.3V each of the three cathode pins, one at a time.



As shown by the pinout of this RGB LED, we can assume that this is a common anode device.
This means that we have to connect the anode to the (+) positive terminal of the power supply, and the (-)negative terminal to the R cathode in order to have a RED light, to the G cathode for green light and BLUE cathode for blue light.

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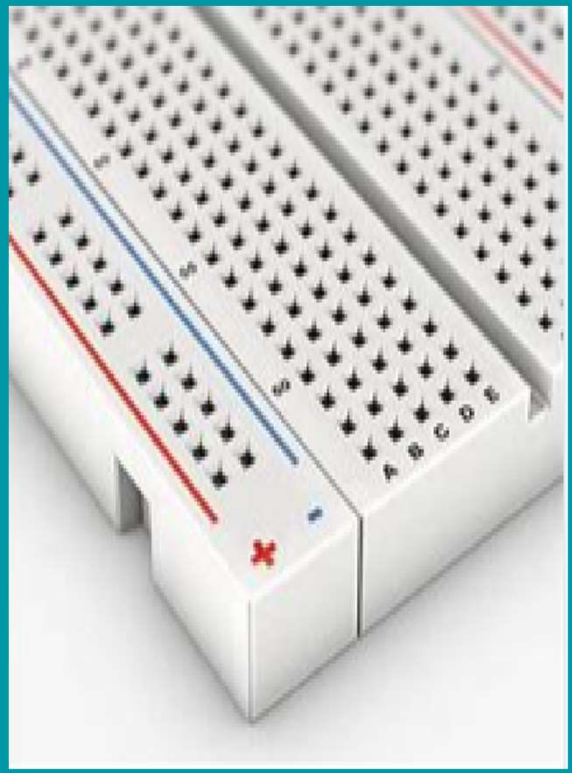
How does a breadboard work?

A breadborad is a plastic board often used to connect different electronic components in order to create a circuit for educational purposes.

It let you to disassemble the circuit after the test.

A breadboard has hundreds of holes in which electrical devices terminals are introduced.

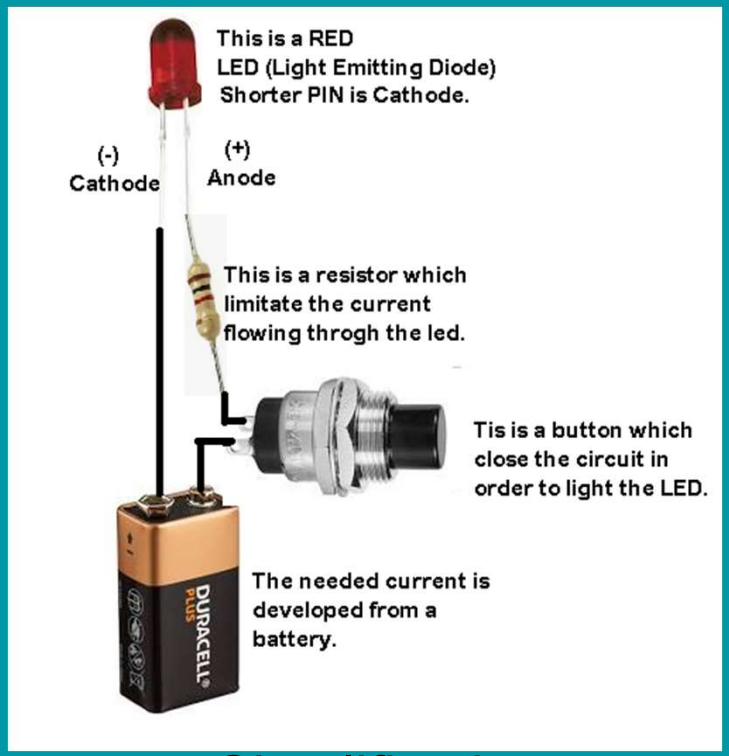
holes in the row + and – are vertically connected to each other , while holes under letters A,B,C,D,E are horizontally connected with an interruption in the middle of the board.



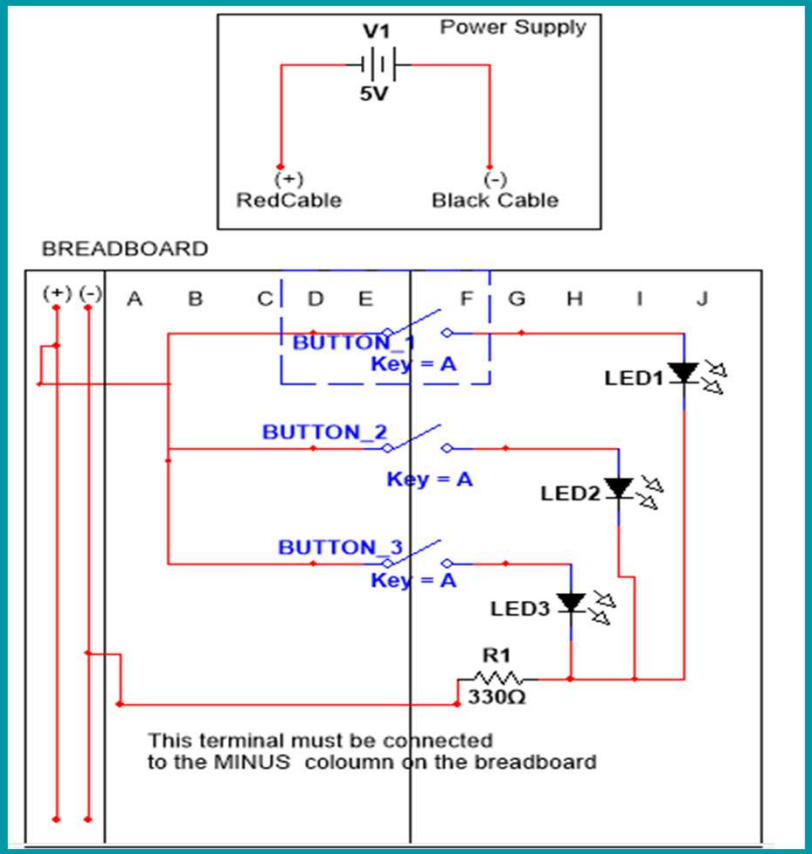
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Let's TRY to MAKE SOMETHING!!

This is a little circuit composed of a LED , a BATTERY that provides the charge to light the LED, a switch to close the circuit and a resistor to limitate the current flowing through the LED.



Simplification



Electrical scheme

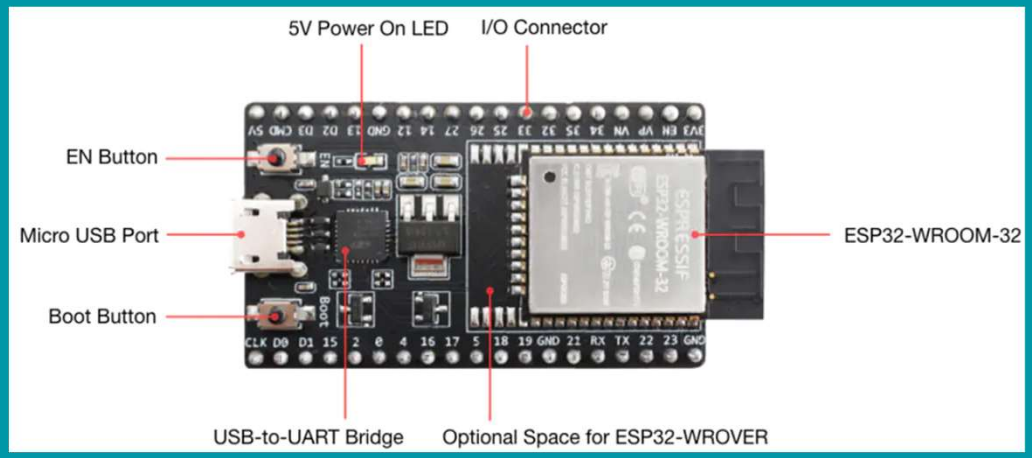
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ESP32 MICROCONTROLLER

What is a Microcontroller?

A microcontroller is a microcomputer. It includes a processor, a RandomAccessMemory in which variables are stored; a ReadOnlyMemory in which the CODE written by the user to perform a task, is stored; some INPUT/OUTPUT pins and a number of accessories circuit like Analog/Digital (and vice versa) converters, PWM signal generator, ecc.



What is an ESP32 Microcontroller?

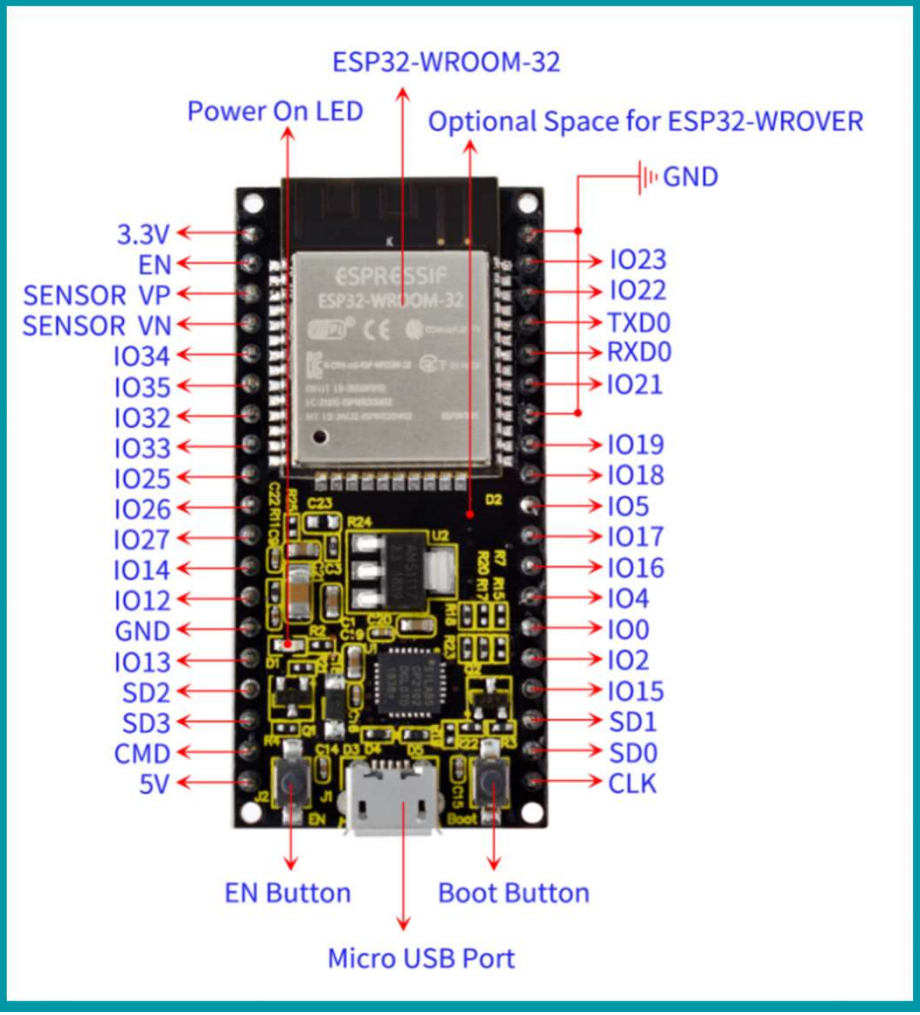
ESP32 is a Microcontroller characterized by the following elements: dual core processor, WIFI and Bluetooth modules for distance communication, temperature and magnetic sensors, Analog to Digital and Digital to Analog converters.

What is a Microcontroller used for?

Microcontrollers are used to control circuits for automation; sensor based application like theft protection system, environmental control/data logger for ecological or agrarian application; actuator control system with the possibilities to read data all over the world thanks to WIFI and Bluetooth / Internet connection. It is also used for IoT (Internet of Things) application.

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ESP32 PINout

This is the so called PINout of ESP32 board that describes the function of each terminal. The figure on the left shows lots of IO terminals followed by a number;
this means that those terminals can be used for input and output as well; we have to specify the code we write in the Arduino IDE software.
If we want to send one terminal as OUTPUT, we have to use the command **pinMode (n,OUTPUT)** in the code;
GND is the ground terminal that has to be connected with the negative pole (Cathode) of the used actuator.

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