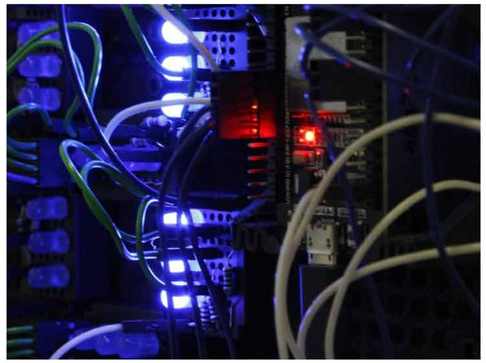
OPEN HARDWARE WORKSHOP

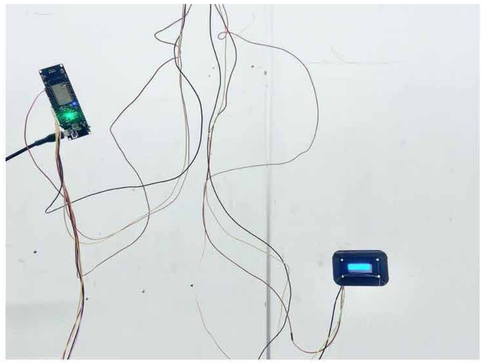
by Silvia Binda Heiserova

BALTAN LABORATORIES

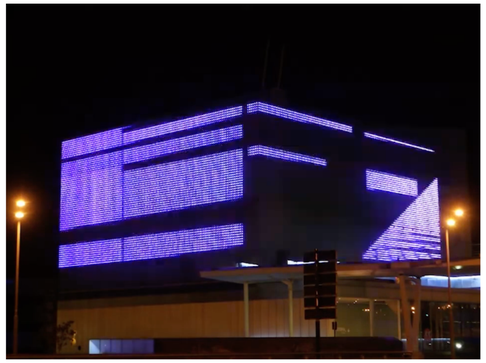
1) INTRODUCTION: Silvia



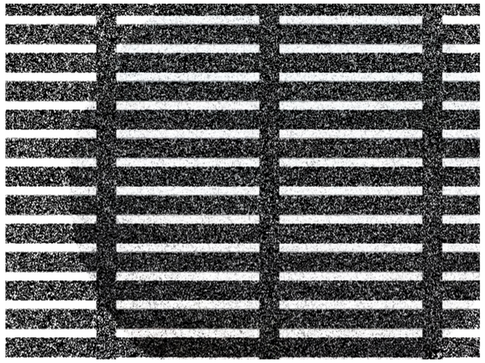
Conversatorio



#Woman Critical Interface

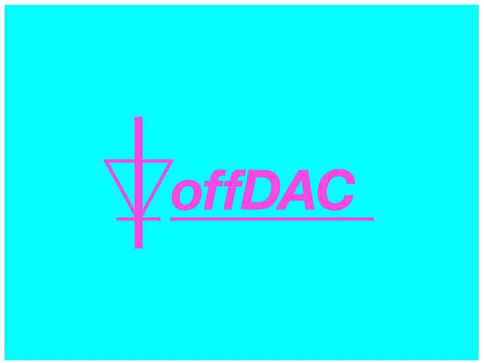


Hyperimage



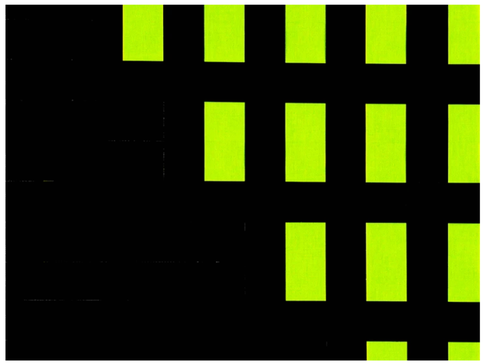
TEXTO

Vending Machine



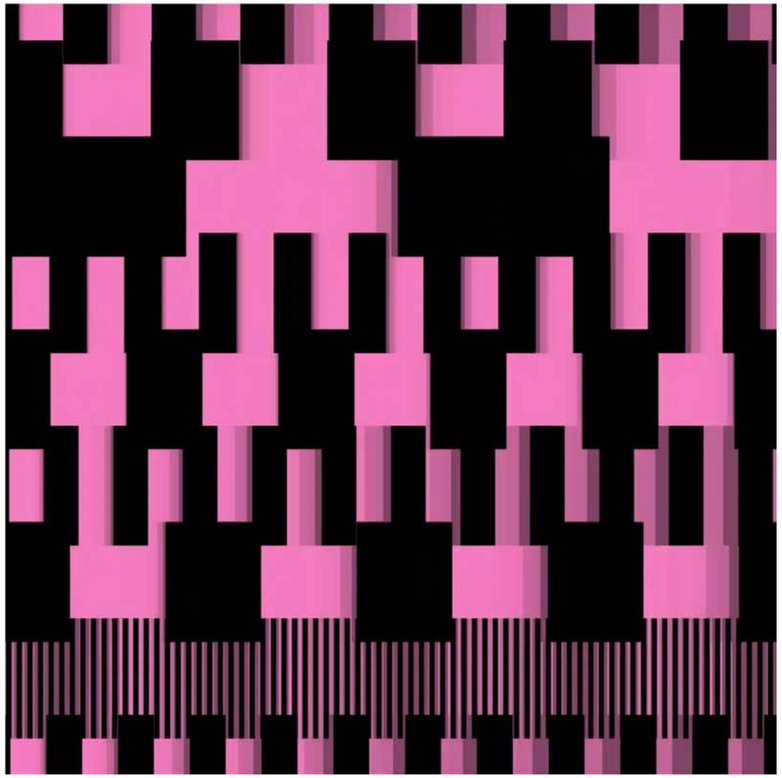
offDAC

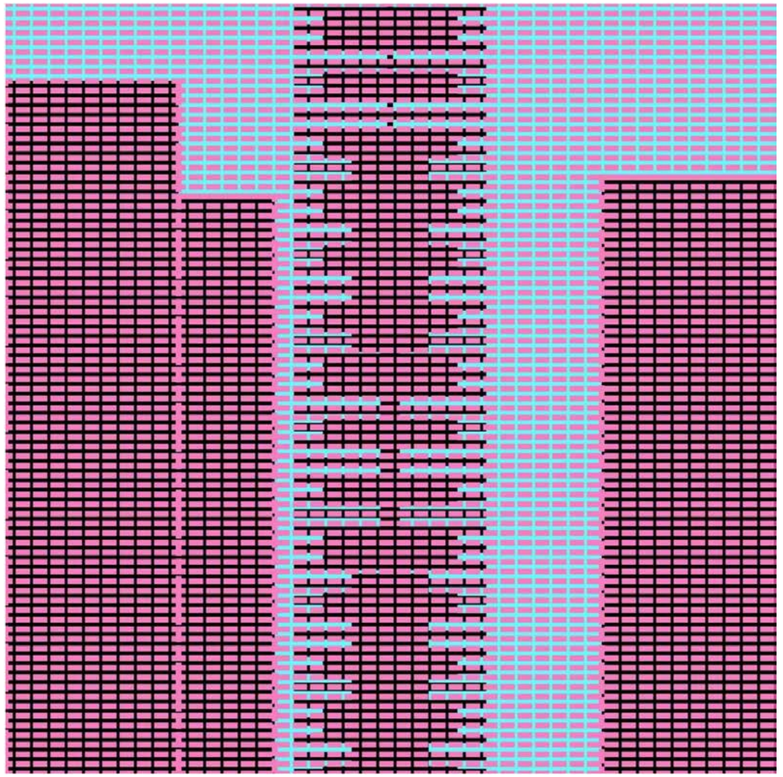
Moving Cityscapes

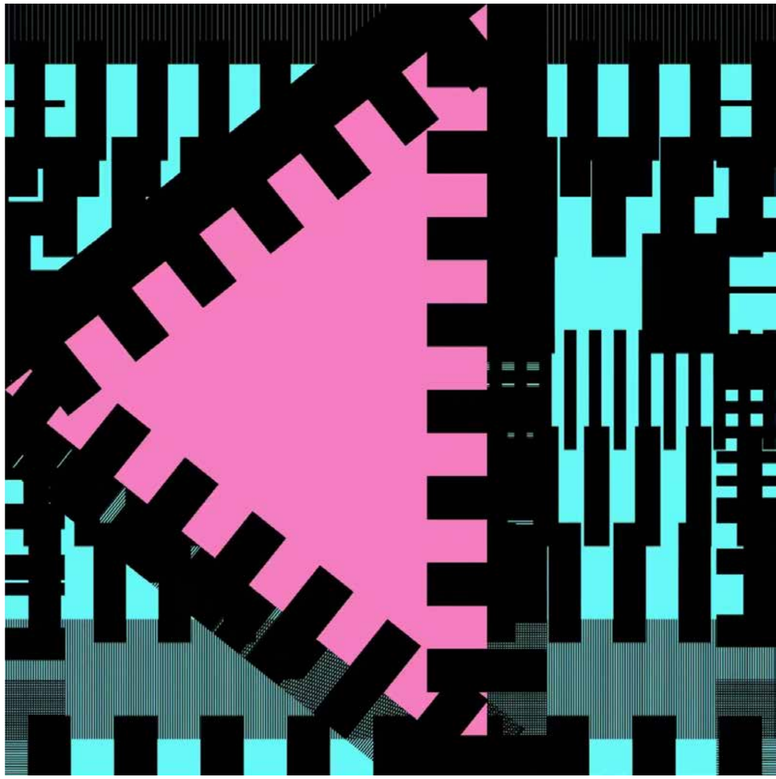


Binary Landscapes

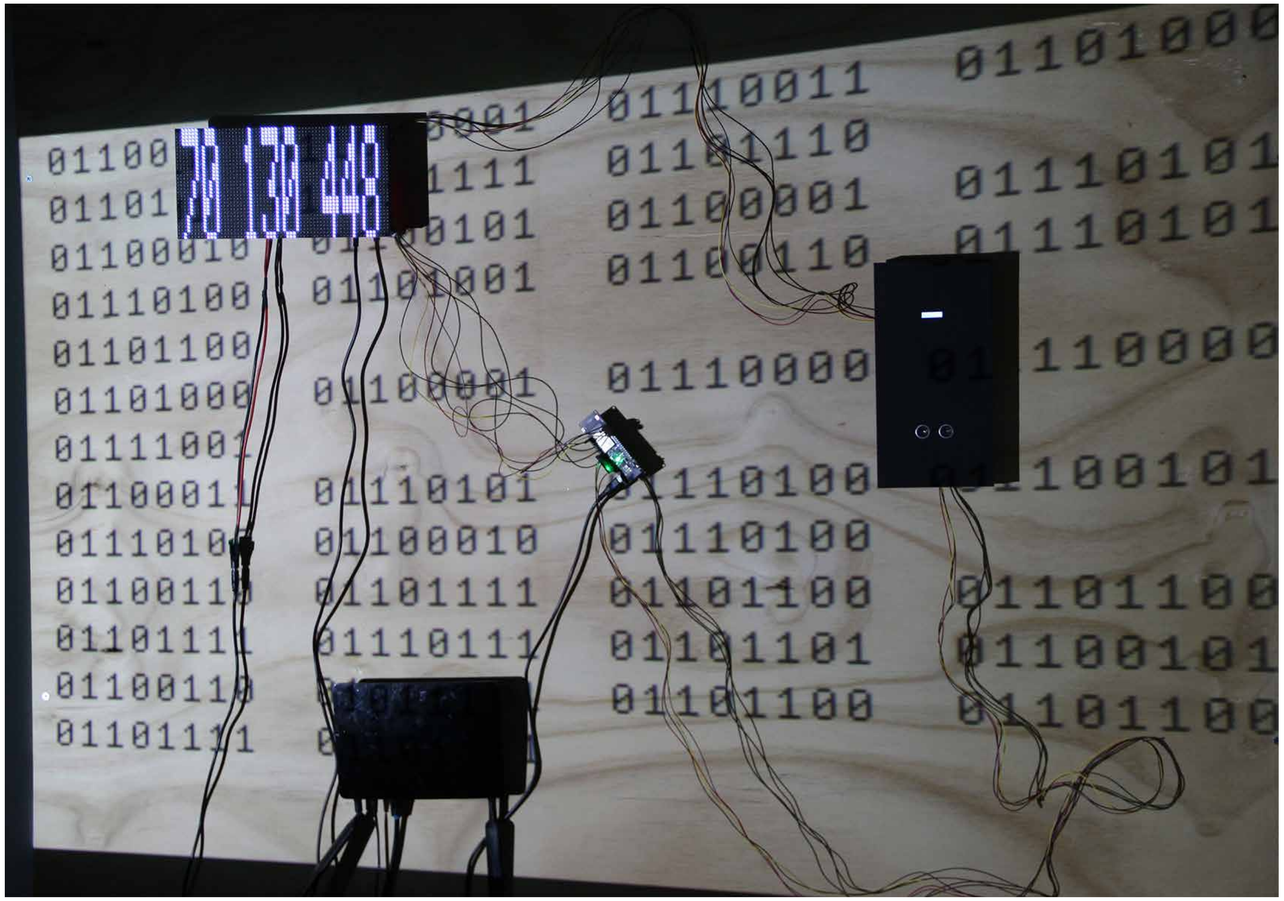
Moving Cityscapes, 2021

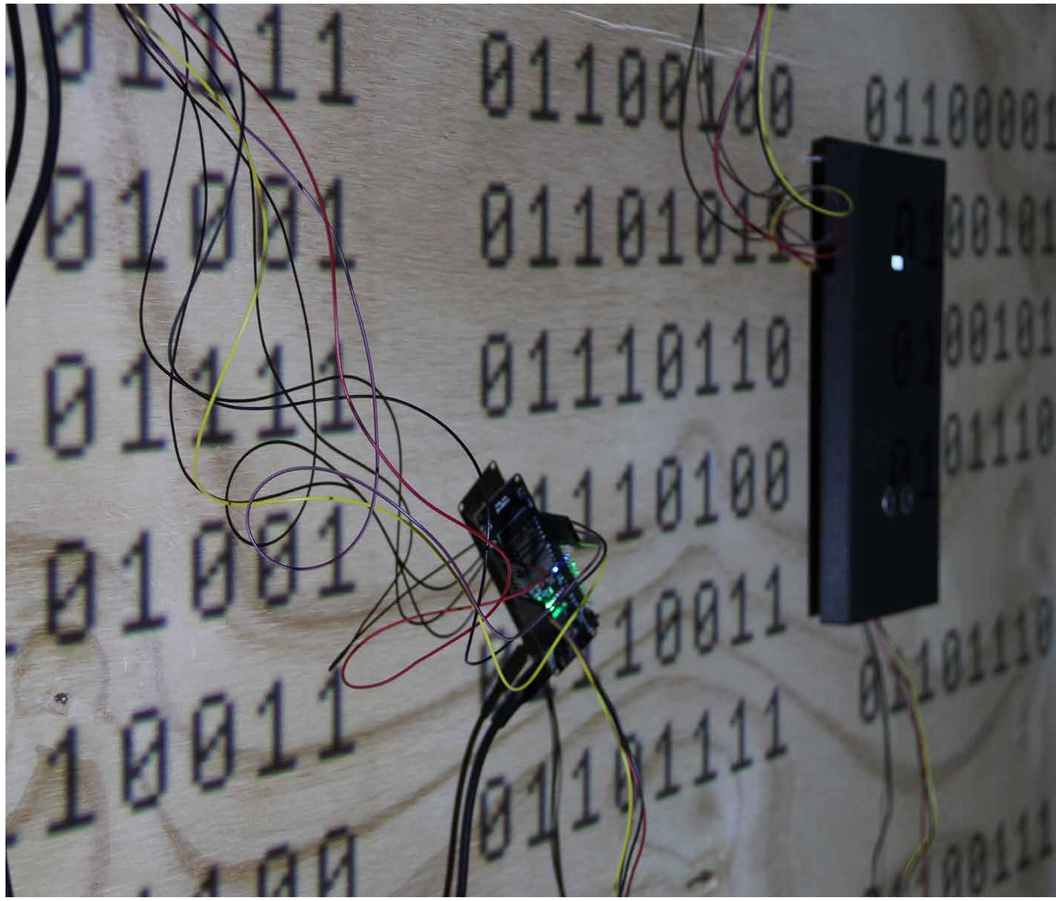






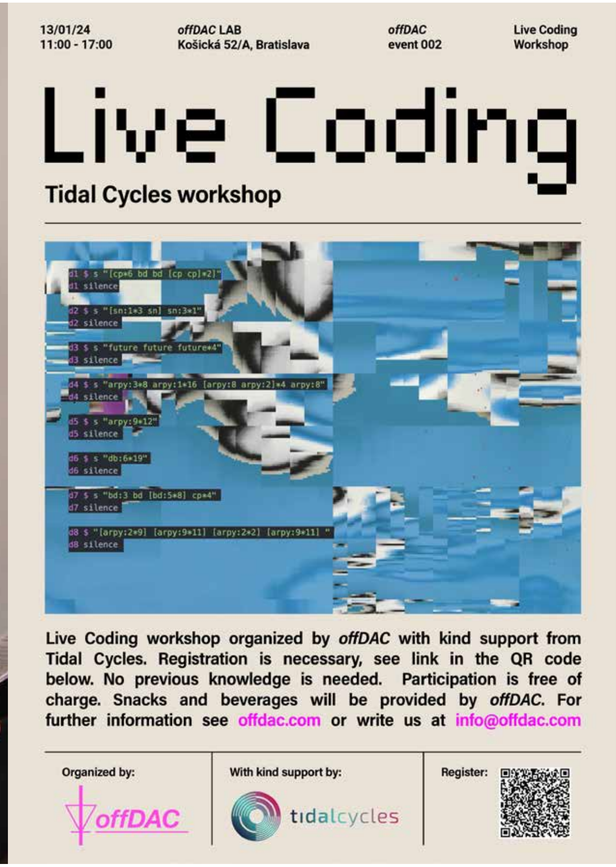
#Woman Critical Interface, 2021-2023

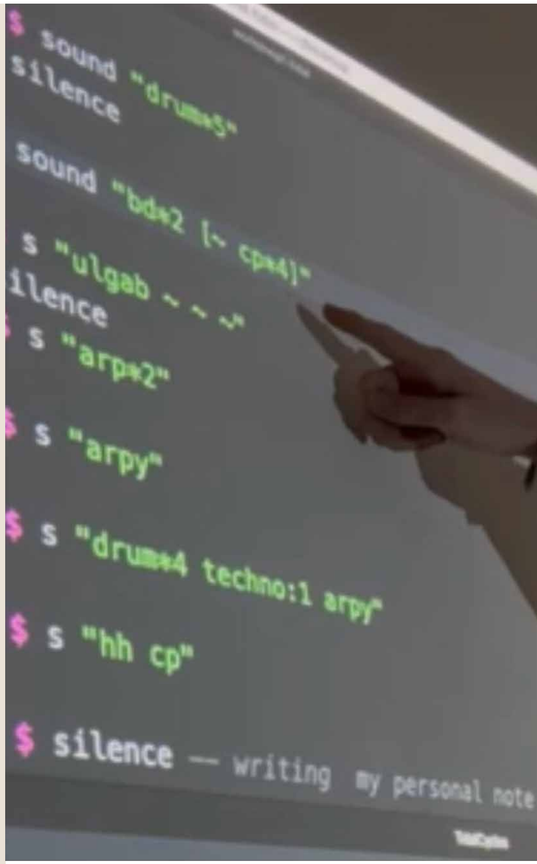




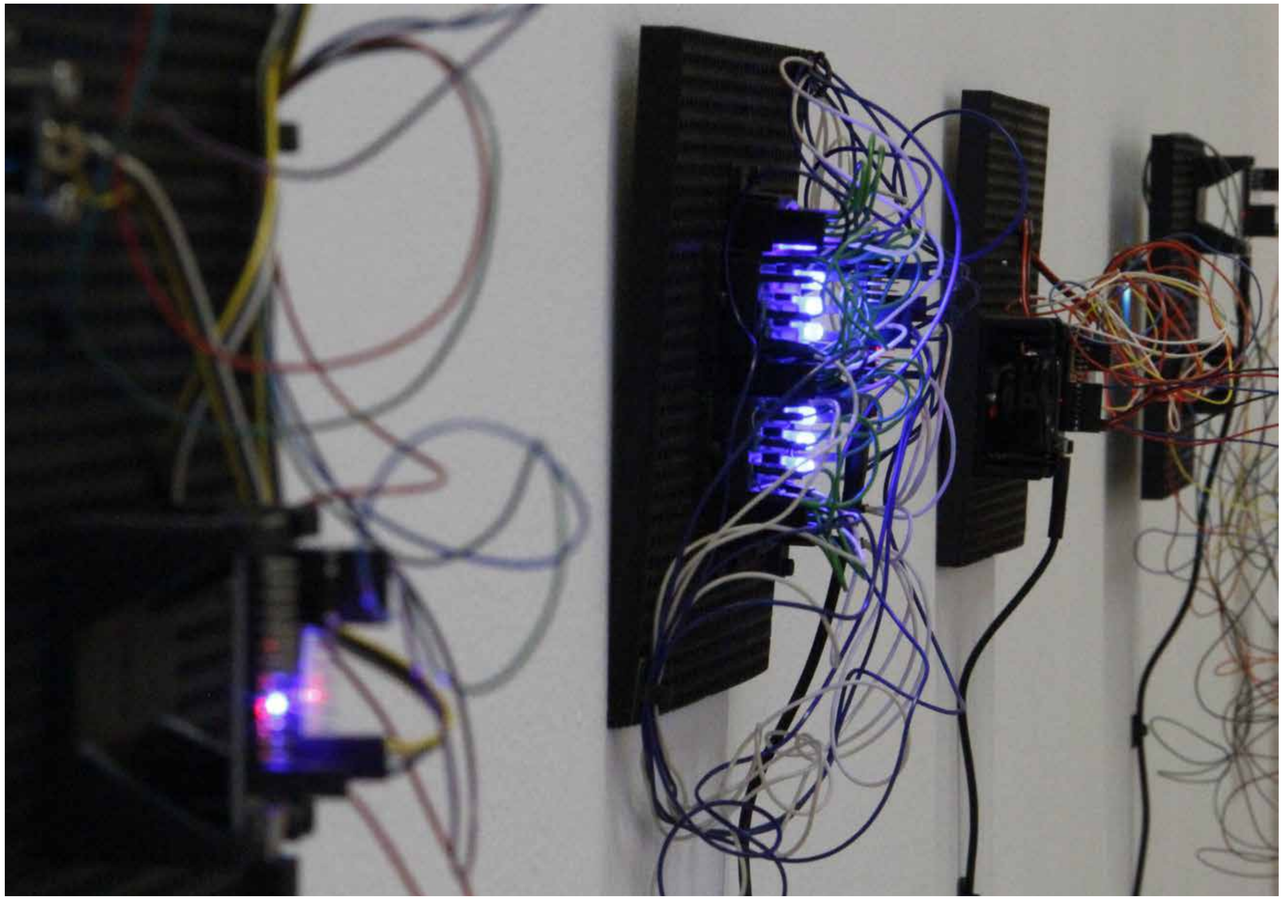
offDAC community (since 2023)

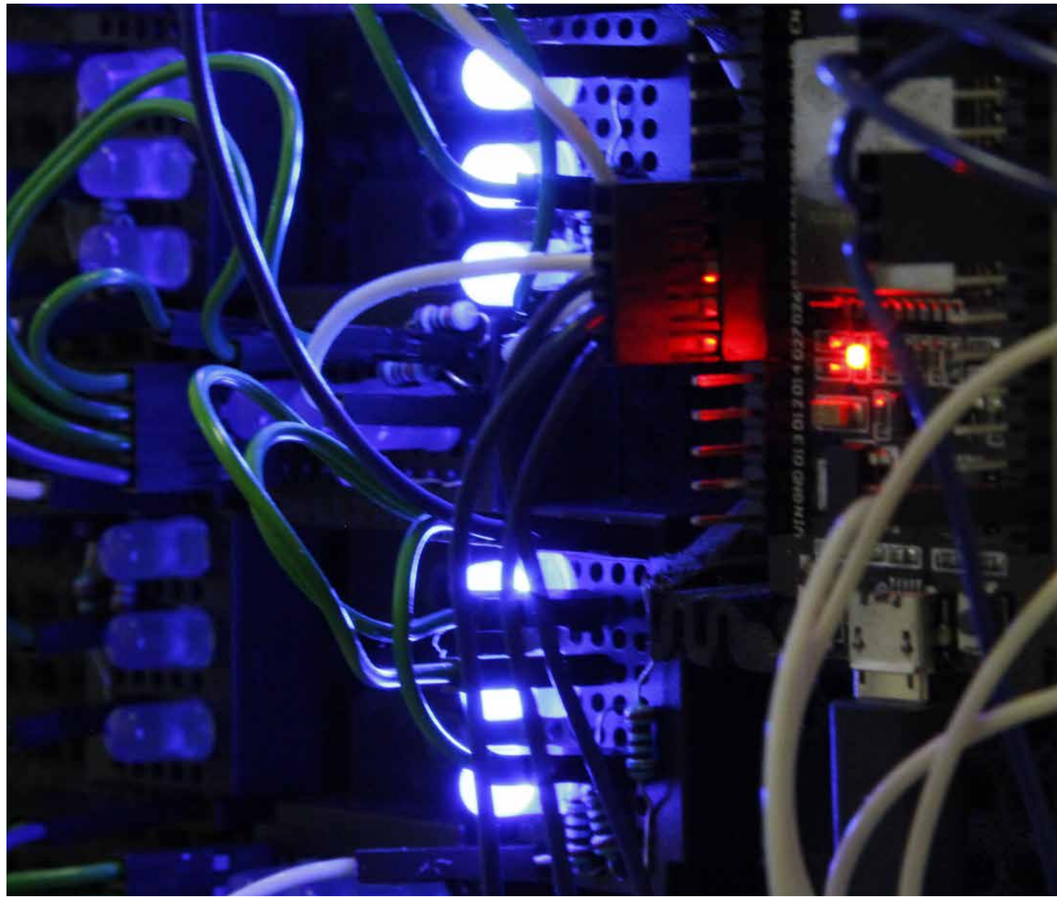
offdac.com



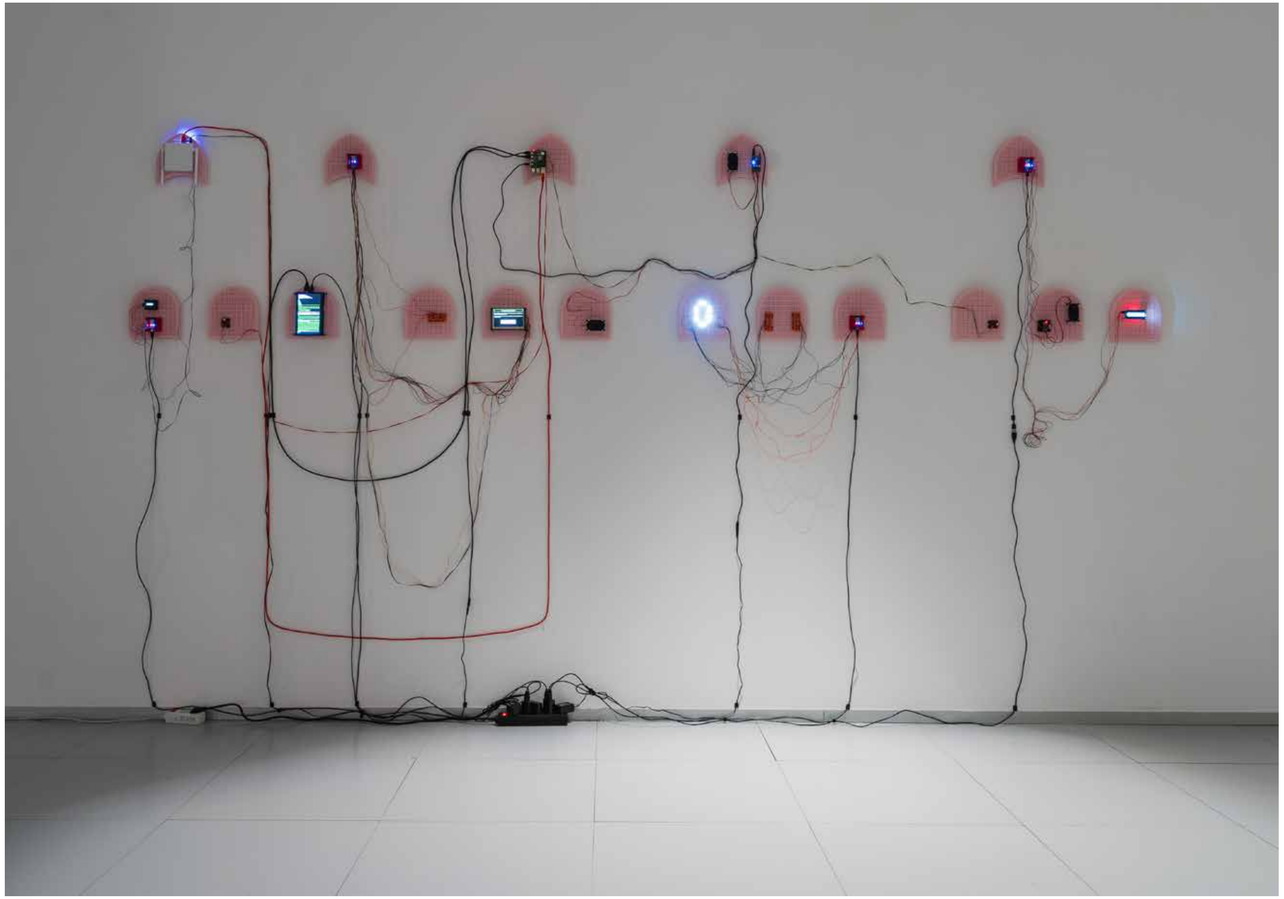


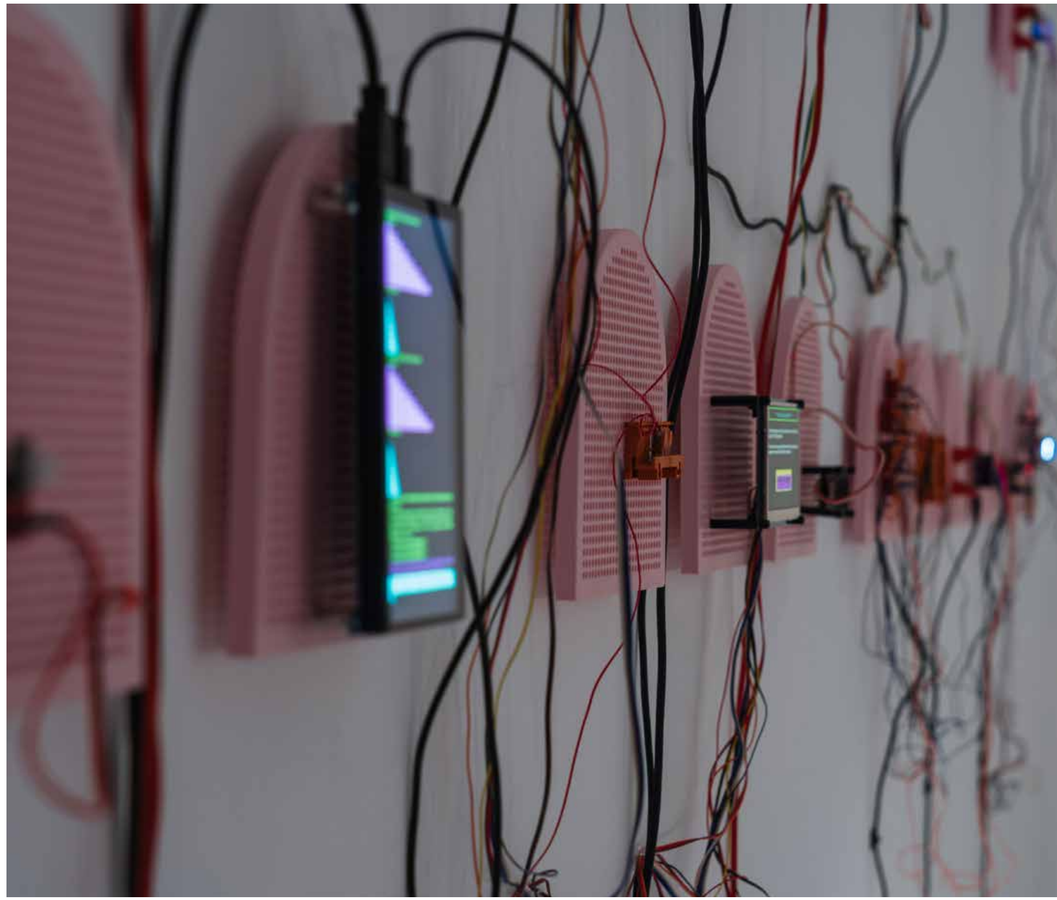
Conversatorio, 2023





Hash Breakdown, 2024





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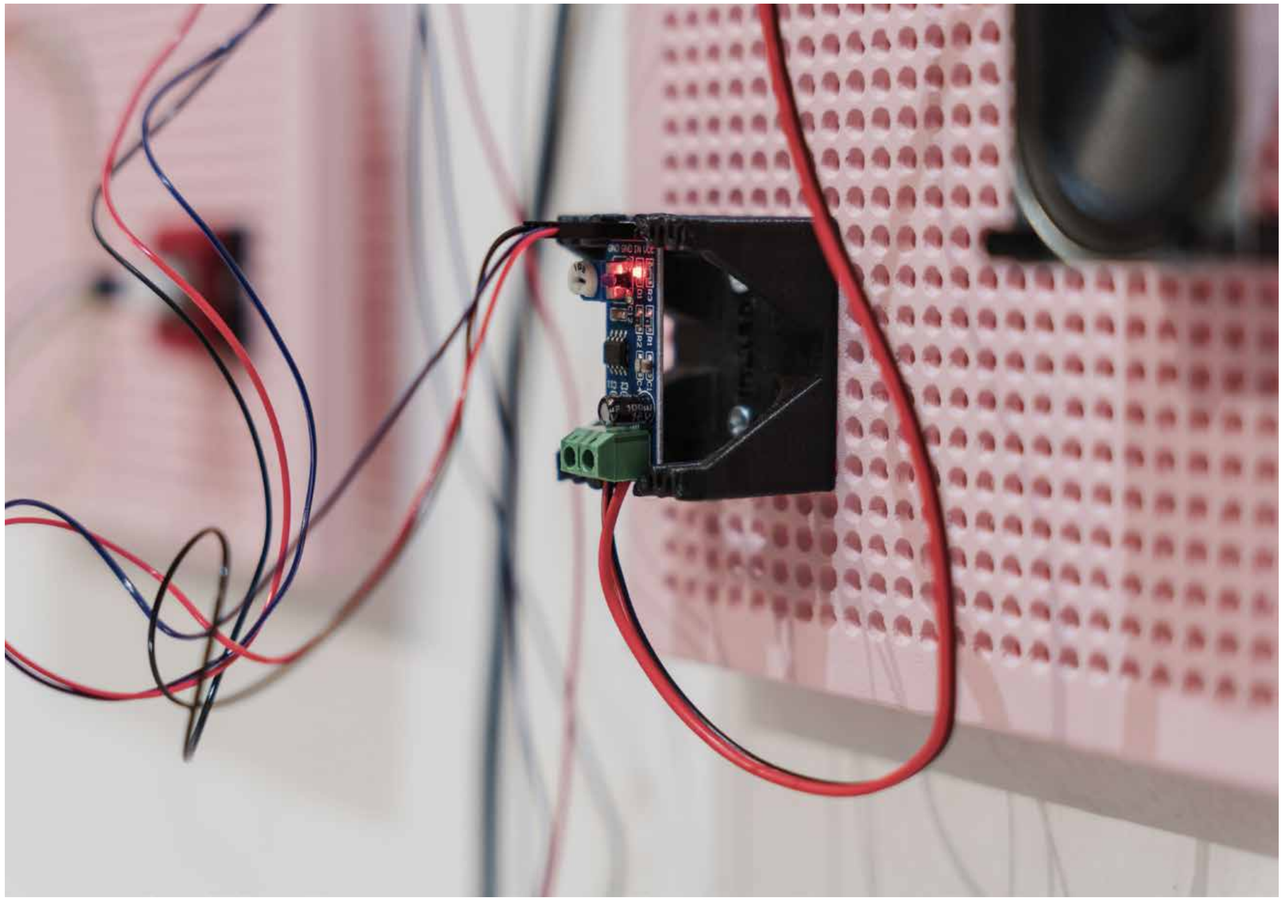
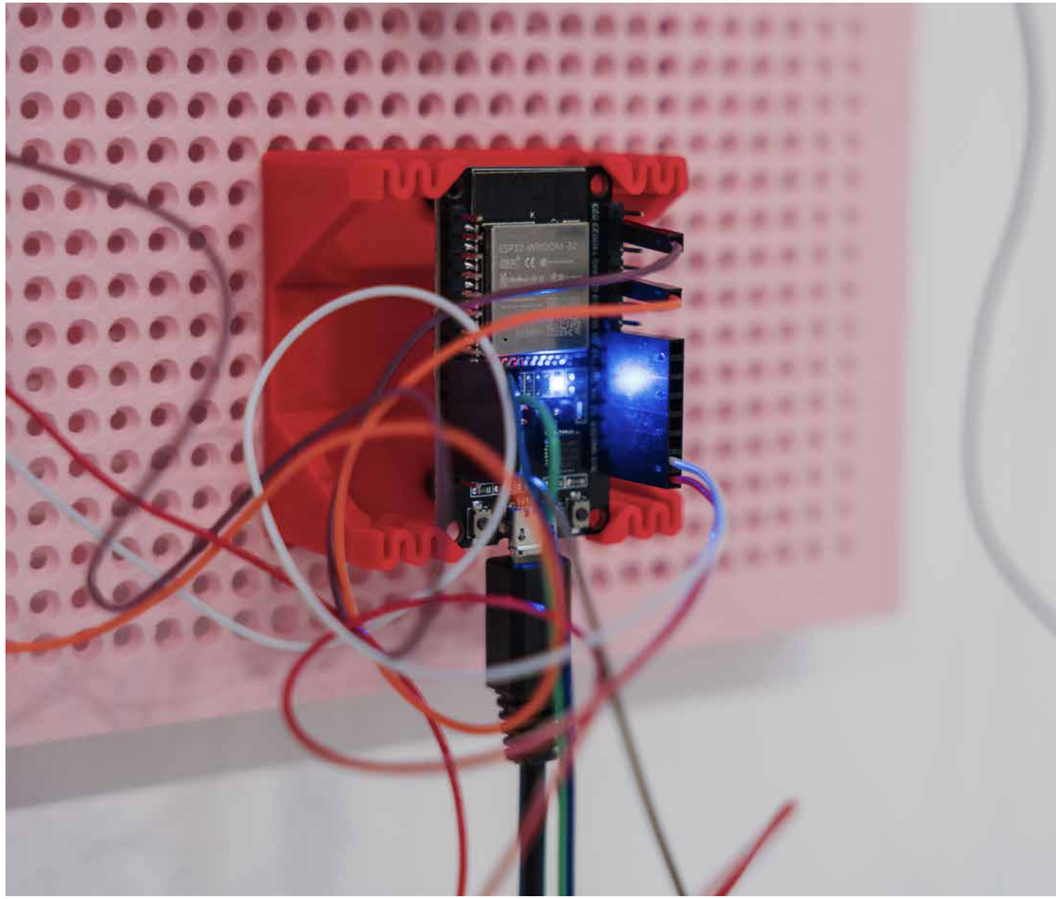




OPEN HARDWARE PRINCIPLES

https://opencourse.com

”Open hardware,” or “open source hardware,” refers to the design specifications of a physical object which are licensed in such a way that said object can be studied, modified, created, and distributed by anyone.

OPEN HARDWARE PRINCIPLES

https://opencourse.com

- the “source code” for open hardware–schematics, blueprints, logic designs, code, etc.–is available for modification by anyone (under permissive licenses, such as MIT license)

- to provide as many people as possible the ability to construct, remix, and share their knowledge of hardware design and function

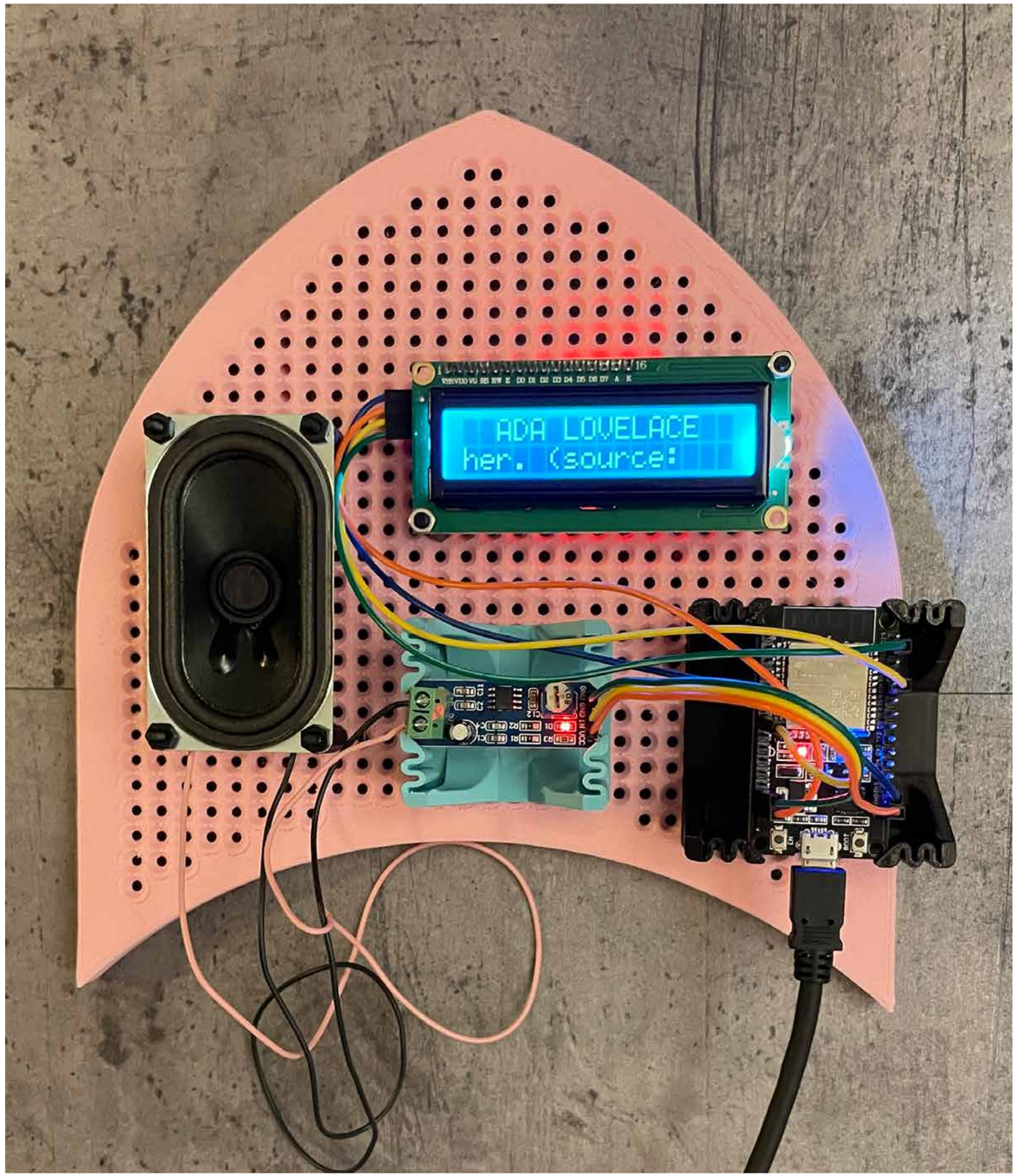
PLATFORM FOR SHARING PROJECTS

GitHub is a cloud-based platform where you can store, share, and work together with others to write code.

https://github.com/silviabinda/open_hardware_workshop_baltan

PLAN FOR TODAY IS:

MAKE OUR VERY OWN HARDWARE ARTEFACT



PLEASE RAISE YOUR HAND WHO:

- EVER SOLDERED SOMETHING

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PLEASE RAISE YOUR HAND WHO:

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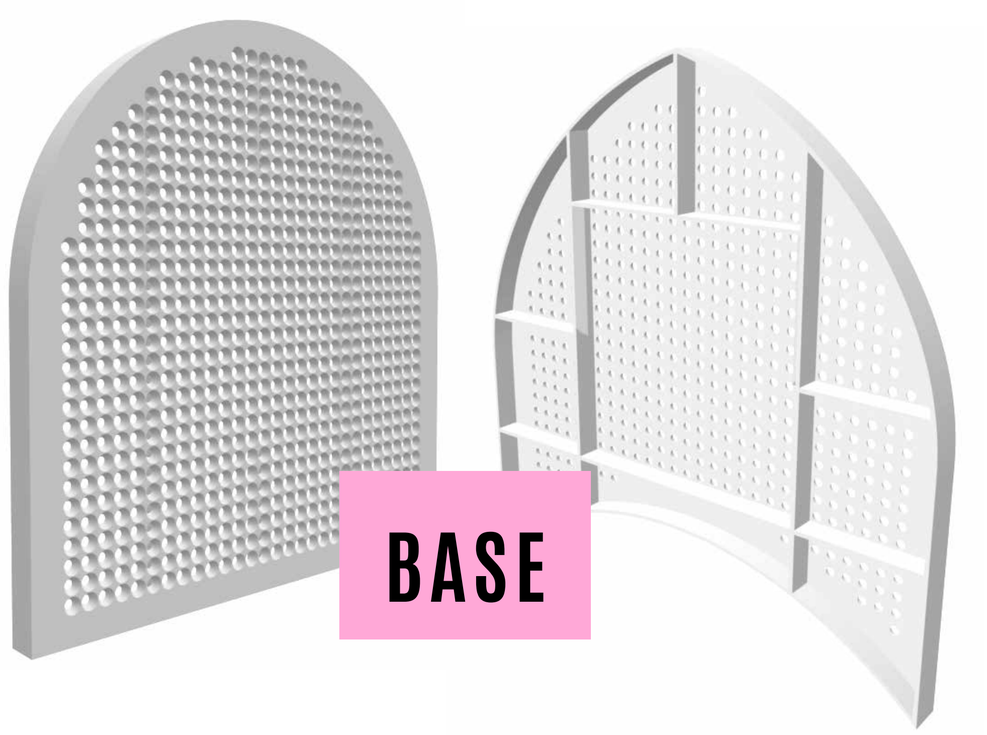
- KNOWS WHAT IS AN “ESP32”
- EVER CODED IN PYTHON
- KNOWS WHAT A DUPONT CONNECTOR IS

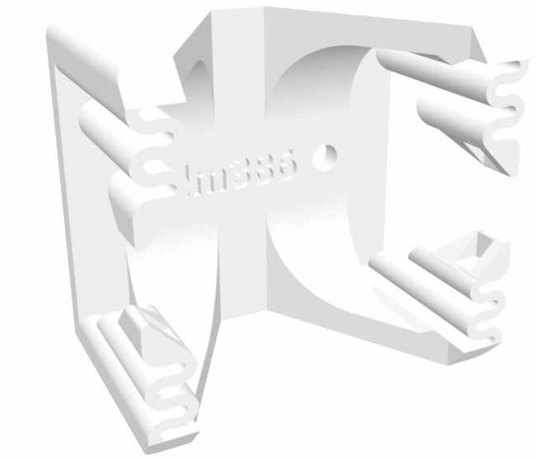
Items we will use:

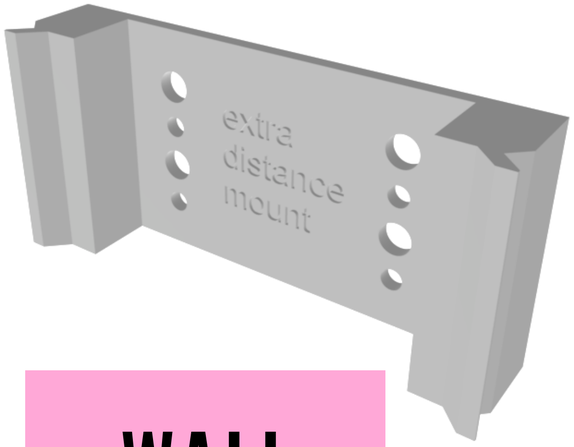
1) 3D prints



BASE

HOLDERS

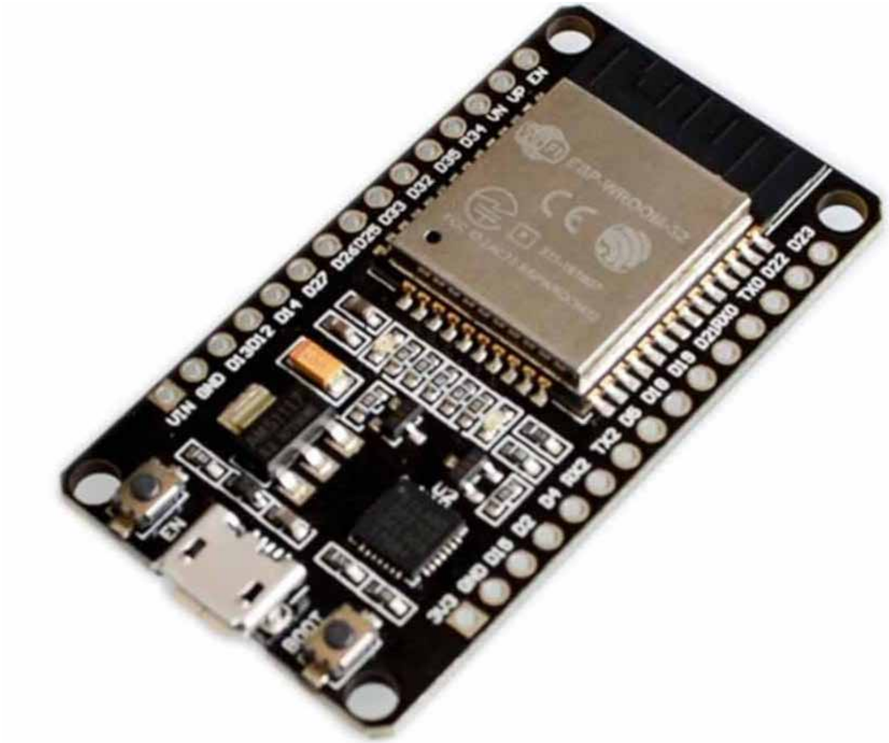




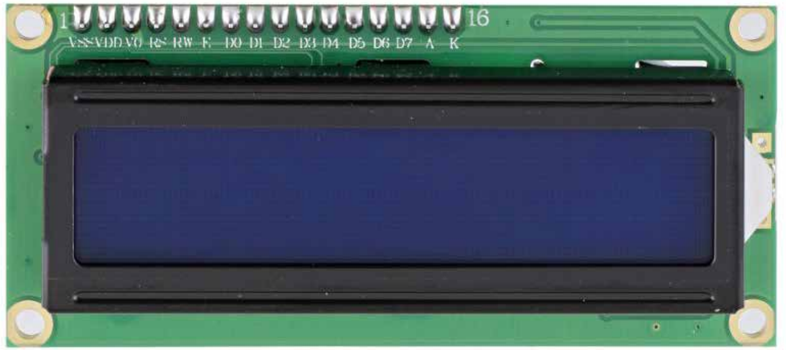
WALL MOUNT

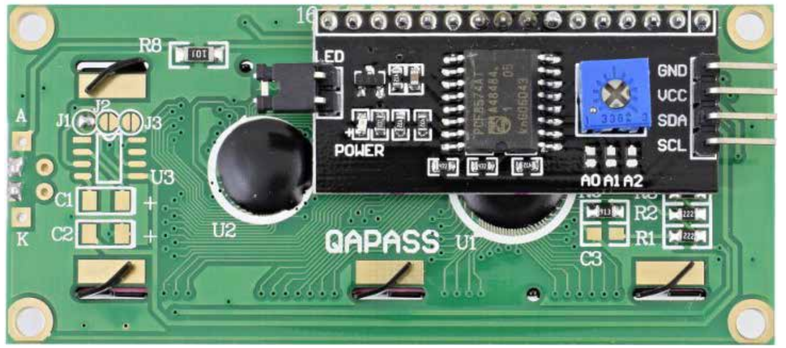
Items we will use:

2) ESP32 microcontroller



3) LCD display (16x2, I2C)

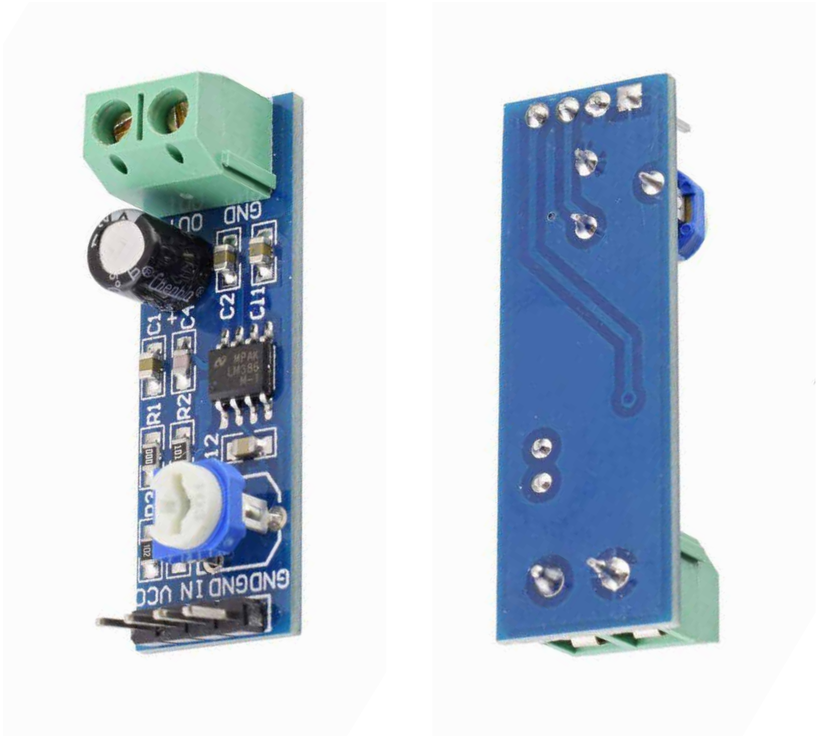




blue
or
yellow

Items we will use:

4) LM386 amplifier



5) mini speaker

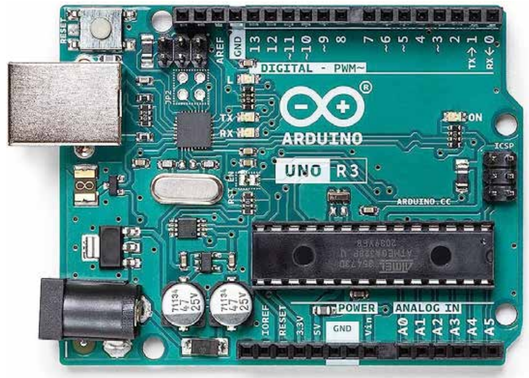
Items we will use:

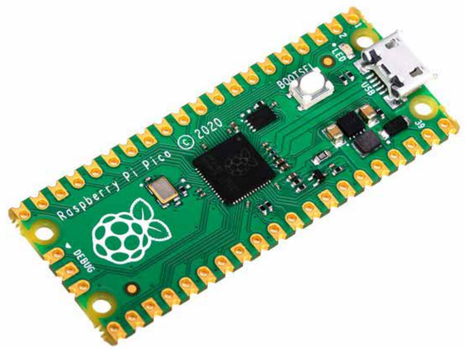
6) wires, spacers, screws, tools

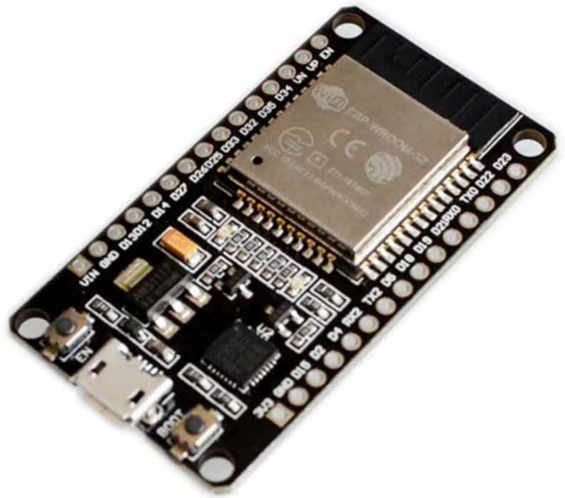
brief introduction to electronics:

MICROCONTROLLERS

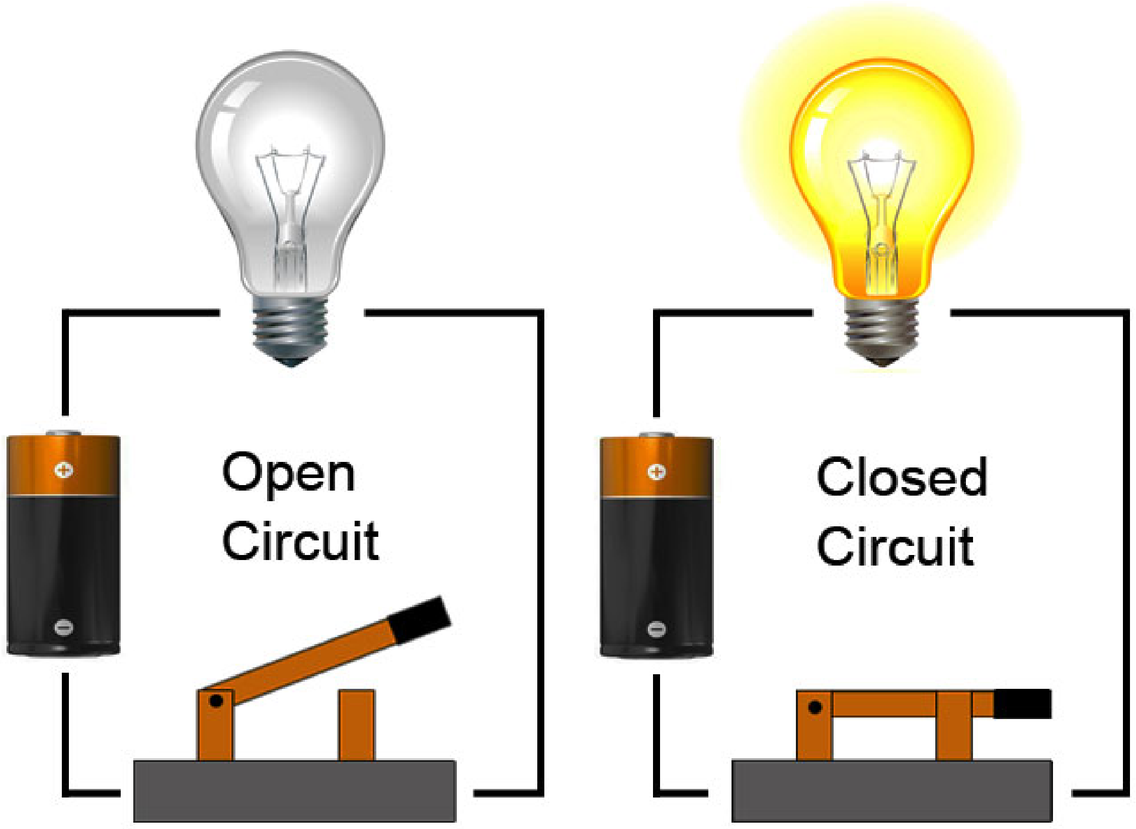
= a small, low-cost computer-on-a-chip
- designed to perform a specific set of tasks
- applications: controlling machines, sensing and monitoring devices, art, IoT
- typically consists of a central processing unit (CPU), memory, input/output (I/O) pin
- common examples = Arduino, Raspberry Pi Pico, ESP 32







OPEN AND CLOSED CIRCUITS



circuit is a complete and closed path through which electric current can flow

closed circuit would allow the flow of electricity between power (+) and ground (-)

open circuit would break the flow of electricity between power (+) and ground (-)

POSITIVE VOLTAGE AND GROUND

Positive Voltage:
“VCC”
“3V3”
“+”

Ground (carries a voltage of 0V):
“GND”
“-”

!!!!! It is very important to prevent short circuits by making sure that the positive voltage (+) is never wired directly to ground (-) !!!!!

INSPECT THE COMPONENTS AND FIND POSITIVE VOLTAGE AND GROUND ON EACH

DIGITAL MULTIMETER

= a device used to measure:
- electric current (amps)
- voltage (volts)
- resistance (ohms)

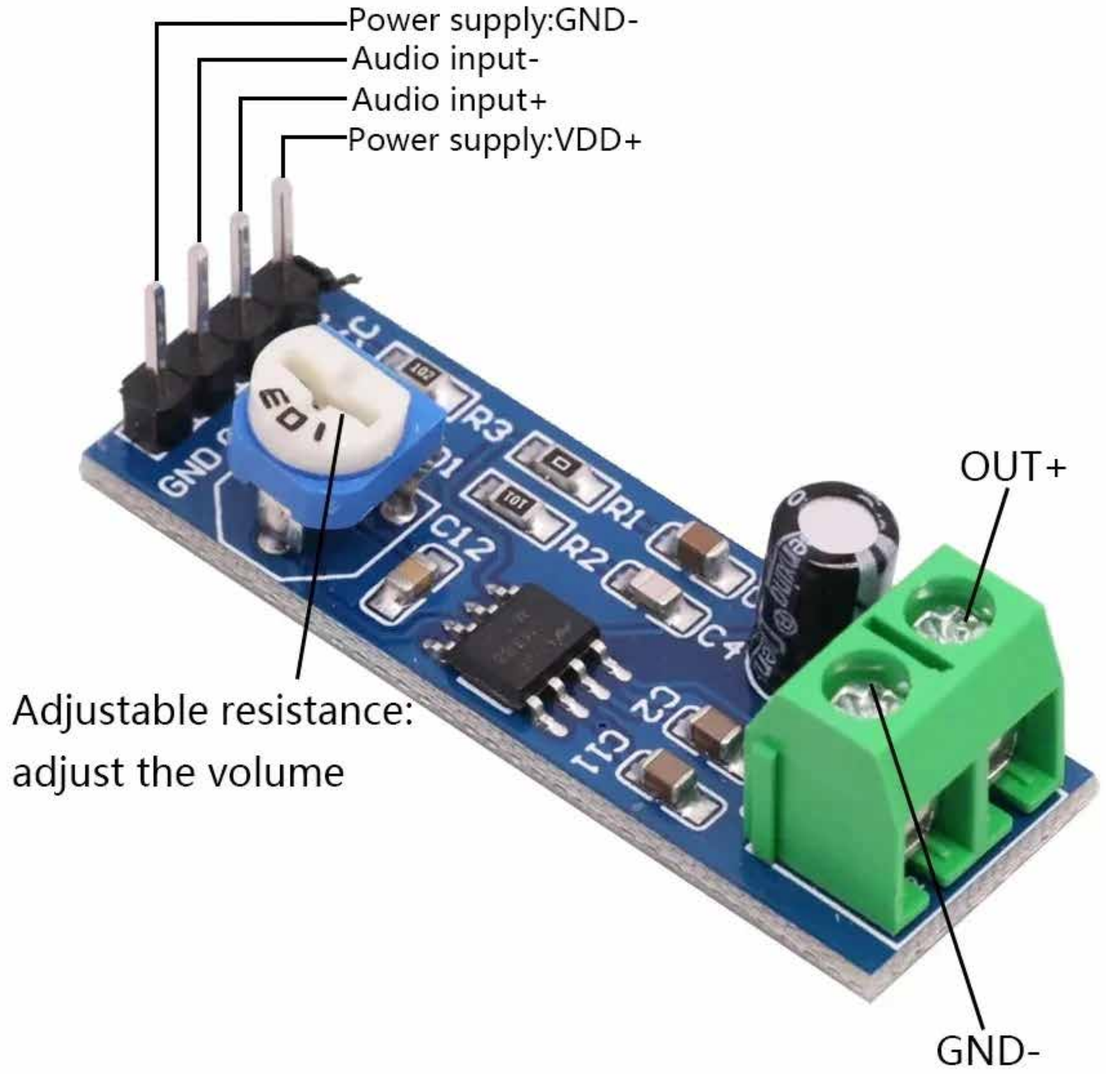
= great for troubleshooting
= capable of measuring both AC and DC voltage

AMPLIFIER MODULE

- on-board LM386 Chip

- on-board speaker wire holder

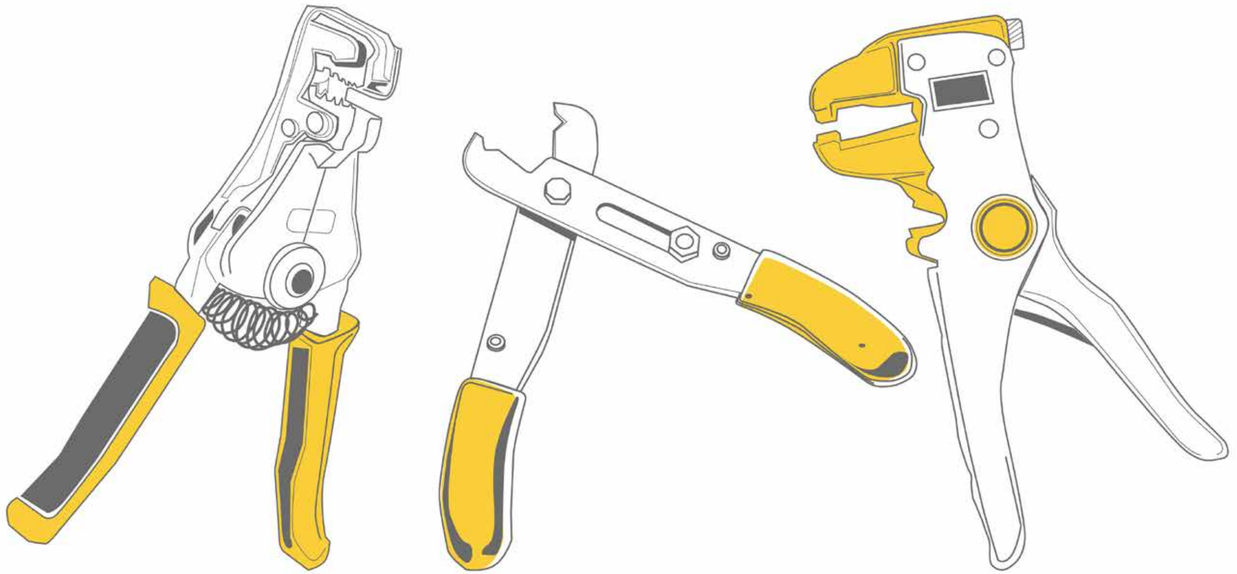
- on-board 10K variable resistor, you can adjust the amplification volume



WIRE CUTTERS & STRIPPERS

= designing your preferred cable length

= essential for stripping off the insulation layer of the wire

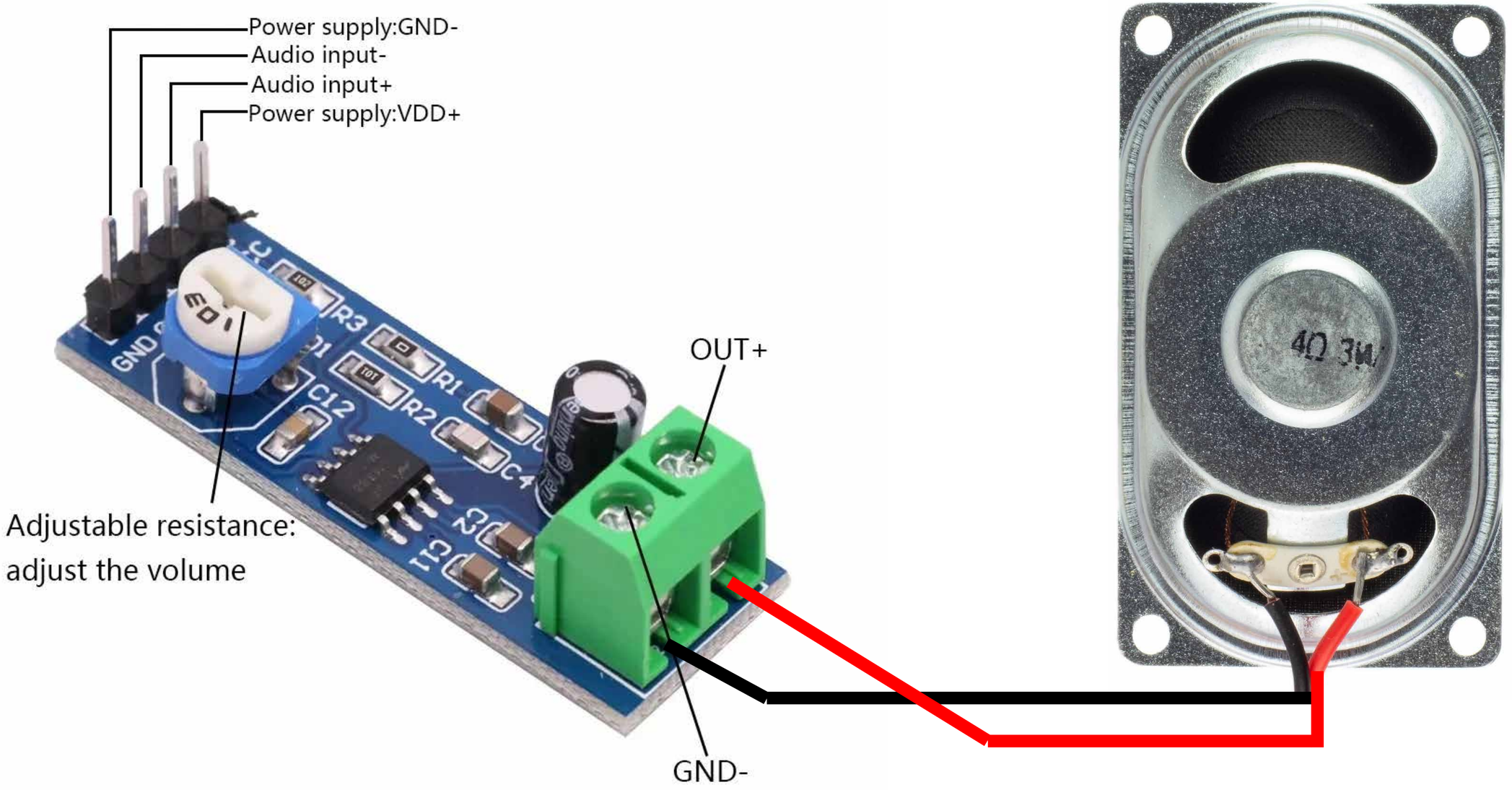


HELPING 3rd HAND

= for holding circuit boards or wire when soldering or tinning

soldering wires to the speaker

connect the speaker to the amplifier



Soldering the PINs on ESP32

solder joint check:

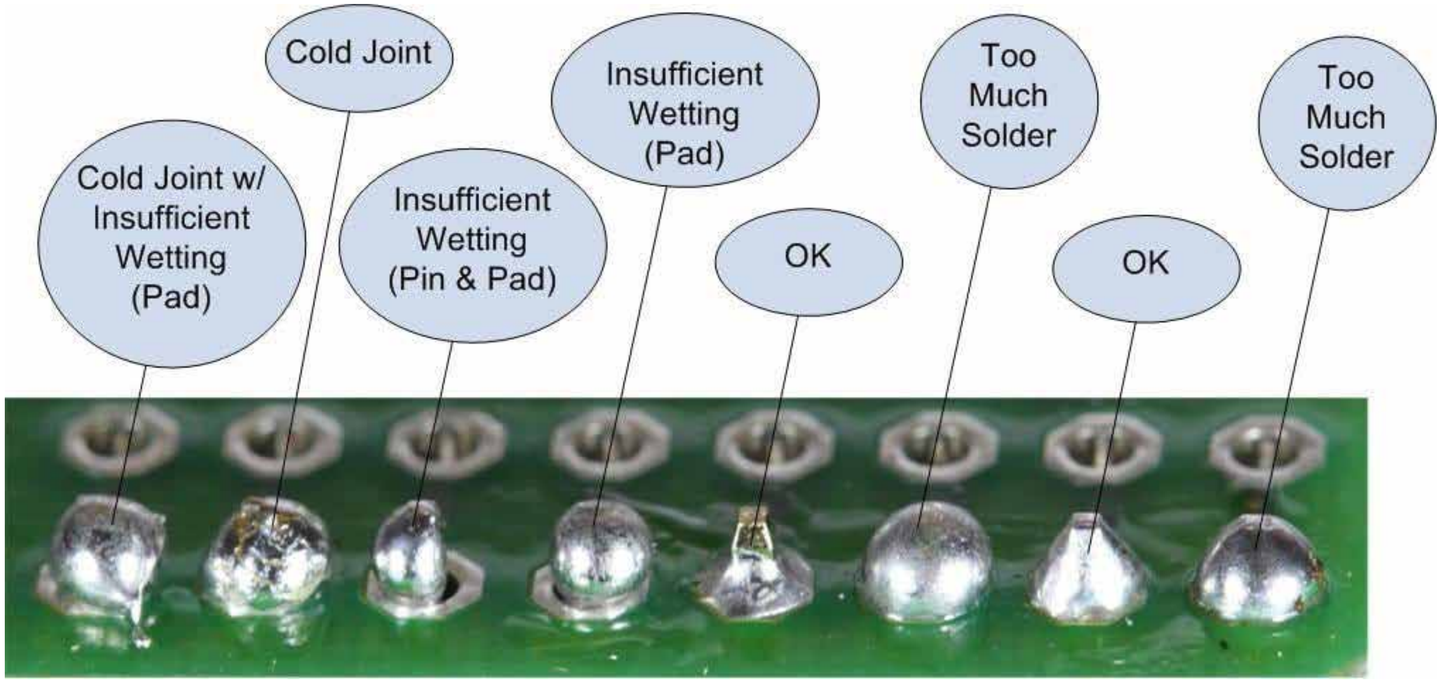
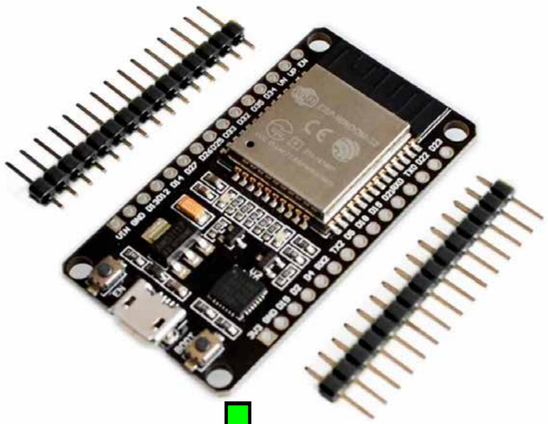
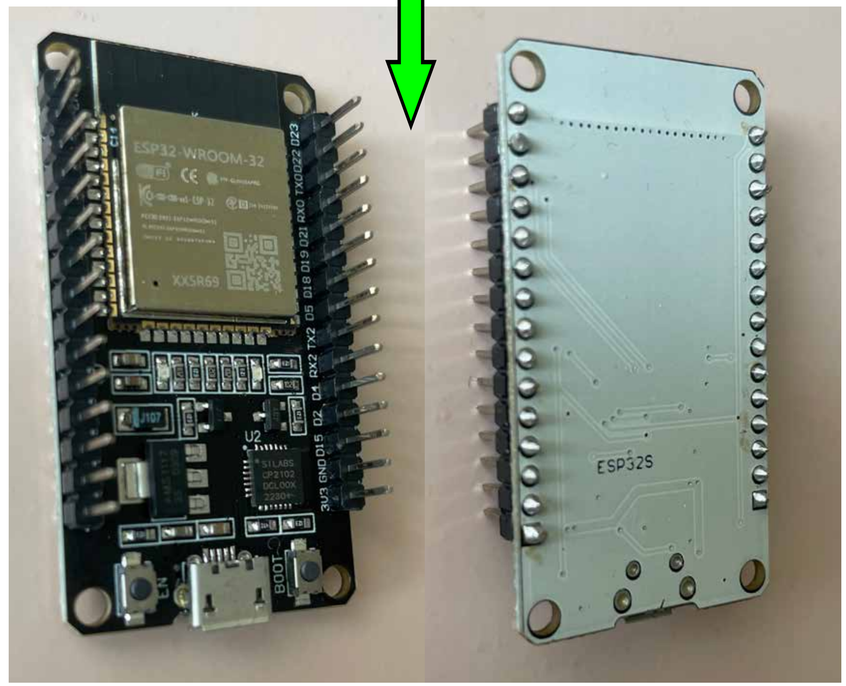


Image source: https://learn.adafruit.com/adafruit-guide-excellent-soldering/common-problems





Installing Thonny IDE

- **Thonny** = IDE for Python and MicroPython

- **IDE** = Integrated Development Environment
  - application that helps coding efficiently

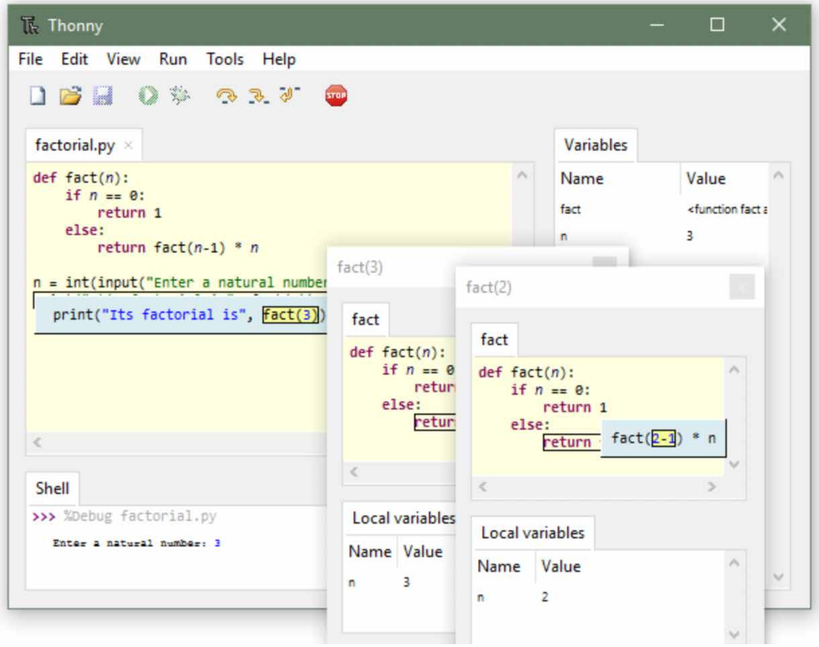
Pyhton = interpreted programming language
- uses significant indentation
- open source, packages https://pypi.org

- **MicroPython** = lightweight version of Python
  - optimized for microcontrollers

thonny.org

Thonny
Python IDE for beginners

Download version 4.1.4 for
Windows • Mac • Linux



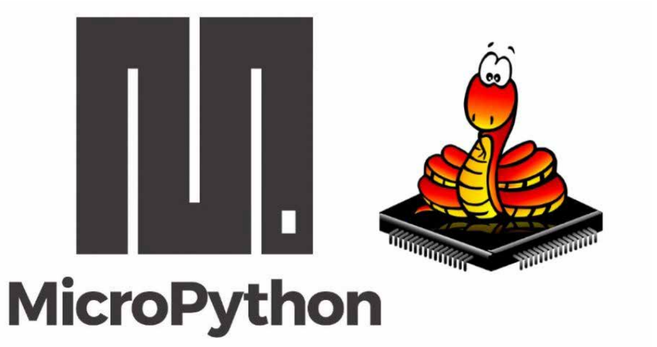
Installing MicroPyhton on ESP32

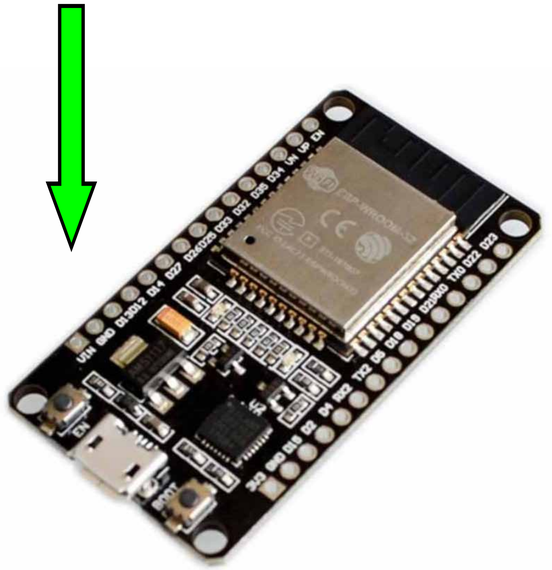
https://micropython.org

1) go to “Downloads”

2) select the ESP32 WROOM board from the list

3) download MicroPython as a .zip file





Installing MicroPyhton on ESP32

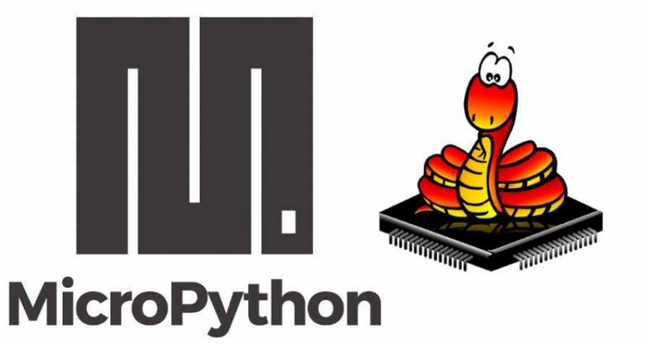
!!!

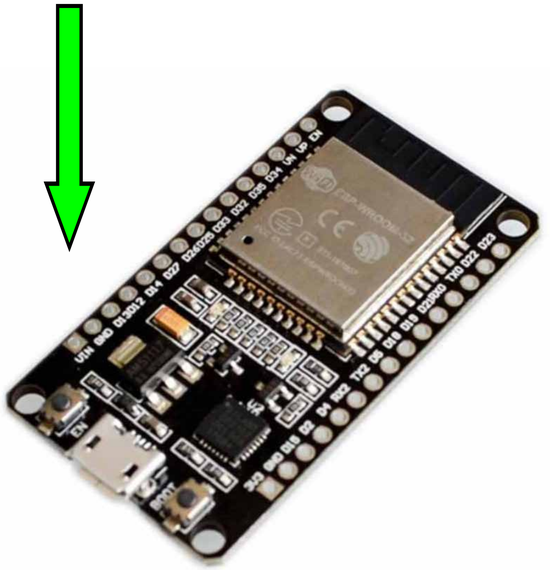
WHEN INSTALLING THE FIRMWARE: DISCONNECT ALL THE WIRES FROM THE ESP32 PINS

!!!

WHEN CONNECTING WIRES / TOUCHING PINS: ALWAYS DISCONNECT ESP32 FROM POWER SOURCE

!!!

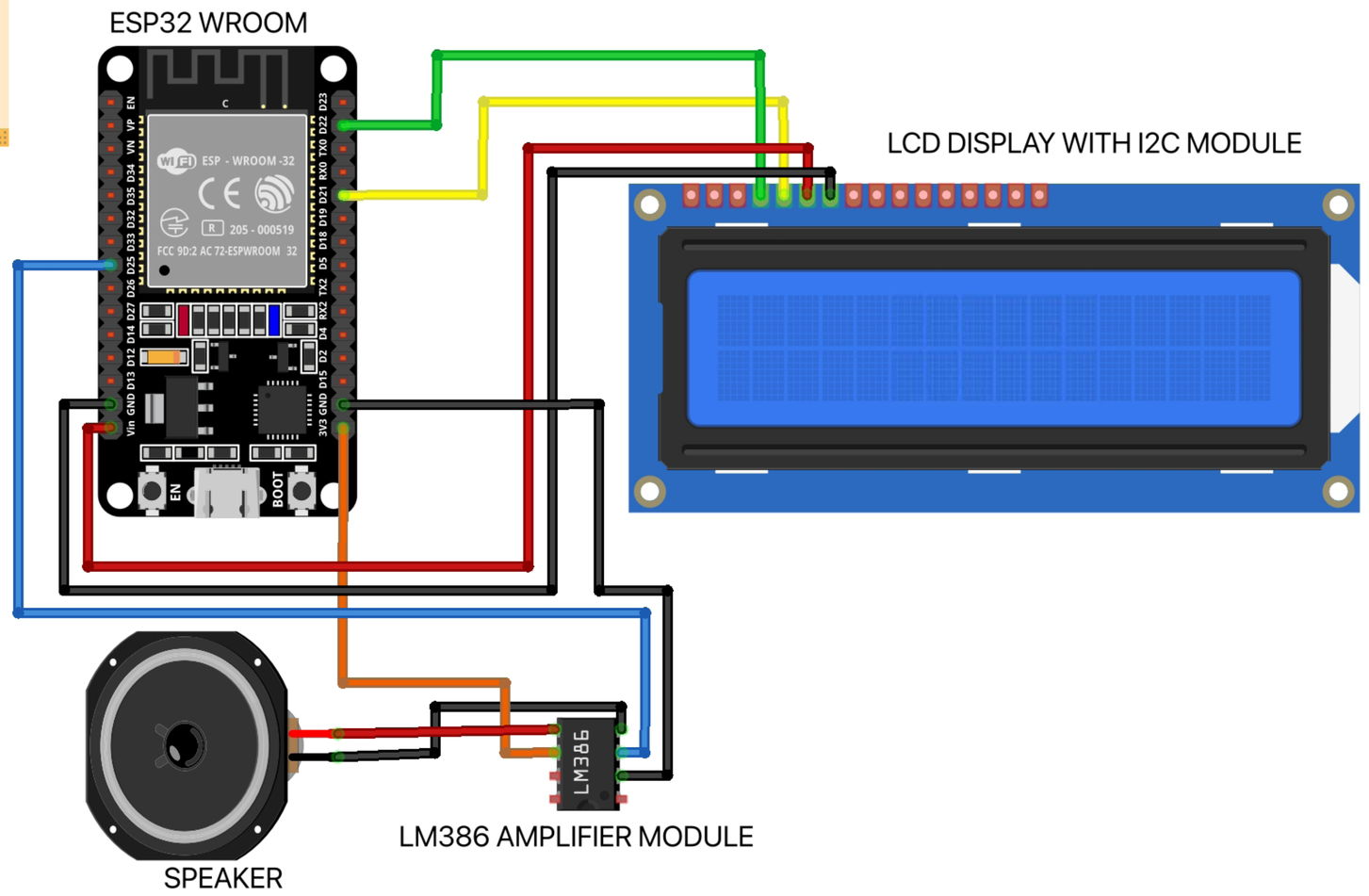




WIRING SCHEMATICS

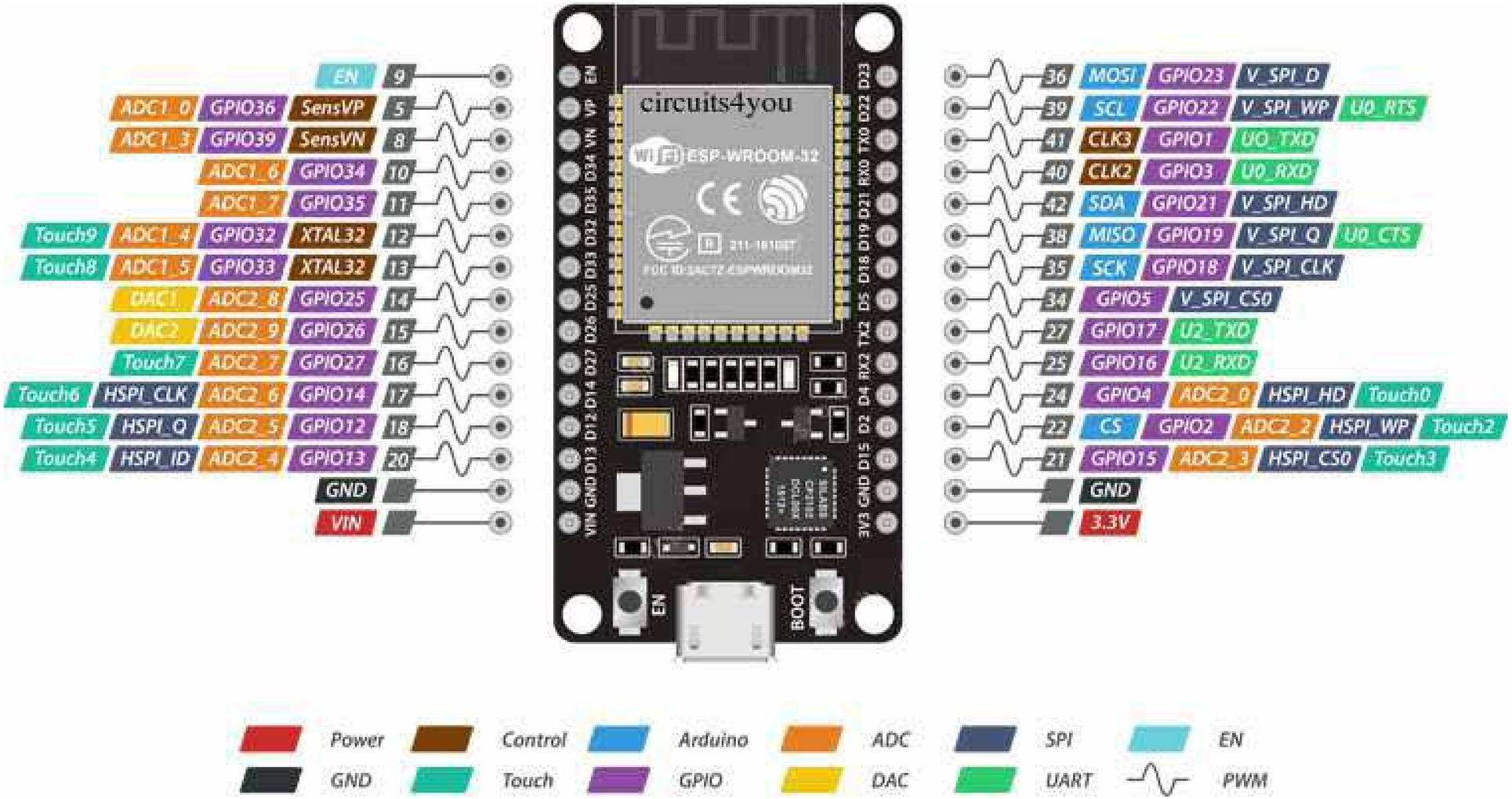
Wiring diagram for
Open Hardware Workshop

2024 by Silvia Binda Heiserova



fritzing

ESP32 PIN OUT



Uploading Libraries to ESP32

LIBRARIES
= collections of pre-written code and functions
- extend the capabilities of Python/MicroPython
- provide a wide range of tools and modules
- making it easier to work on specific tasks without reinventing the wheel.

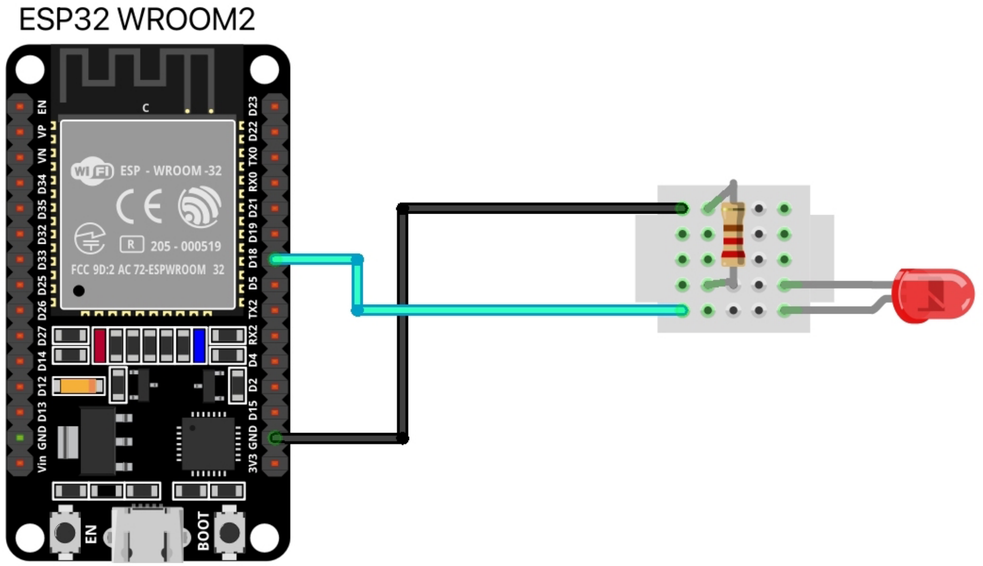
1) “i2c_lcd.py”
= library for running the display
- copy it and save to ESP32)

2) “lcd_api.py”
= api for lcd display
- copy it and save to ESP32

for trying at home:

simple LED (= Light Emitting Diode)

+ 220 ohm resistor !



RESOURCES:

- https://www.makerspaces.com/basic-electronics/
- https://opencourse.com
- https://www.instructables.com/Basic-Electronics/
- https://www.allaboutcircuits.com/technical-articles/an-introduction-to-ground/
- https://www.circuitbasics.com/introduction-to-microcontrolleres/

CONTACT:

silviaheiserova@gmail.com