SMART AND SUSTAINABLE

Perchè è fondamentale costruire oggetti intelligenti per essere più sostenibili

ENRICO BASSI

Ricercatore, Designer e Consulente per l'innovazione

IL TUO DOCENTE

- Industrial e product designer
- Docente di fabbricazione digitale
- Coordinatore del primo Fab Lab italiano (Fab Lab Italia)
- Coordinatore di Fab Lab Torino (supportato da Arduino)
- Coordinatore del Fab Lab OpenDot a Milano
- Instructor e global evaluator in FabAcademy

PERCHÉ SMART PUÒ ESSERE PIÙ SOSTENIBILE

L’uso di schede elettroniche programmabili, ad esempio **Arduino**, consente di creare **soluzioni sostenibili** intervenendo in diversi modi: **dalla riduzione dei consumi al riuso dei componenti, dalla riparazione al monitoraggio ambientale.**
Questi progetti possono essere utilizzati sia a livello **educativo che professionale.**

SOSTENIBILE,
IN CHE SENSO?

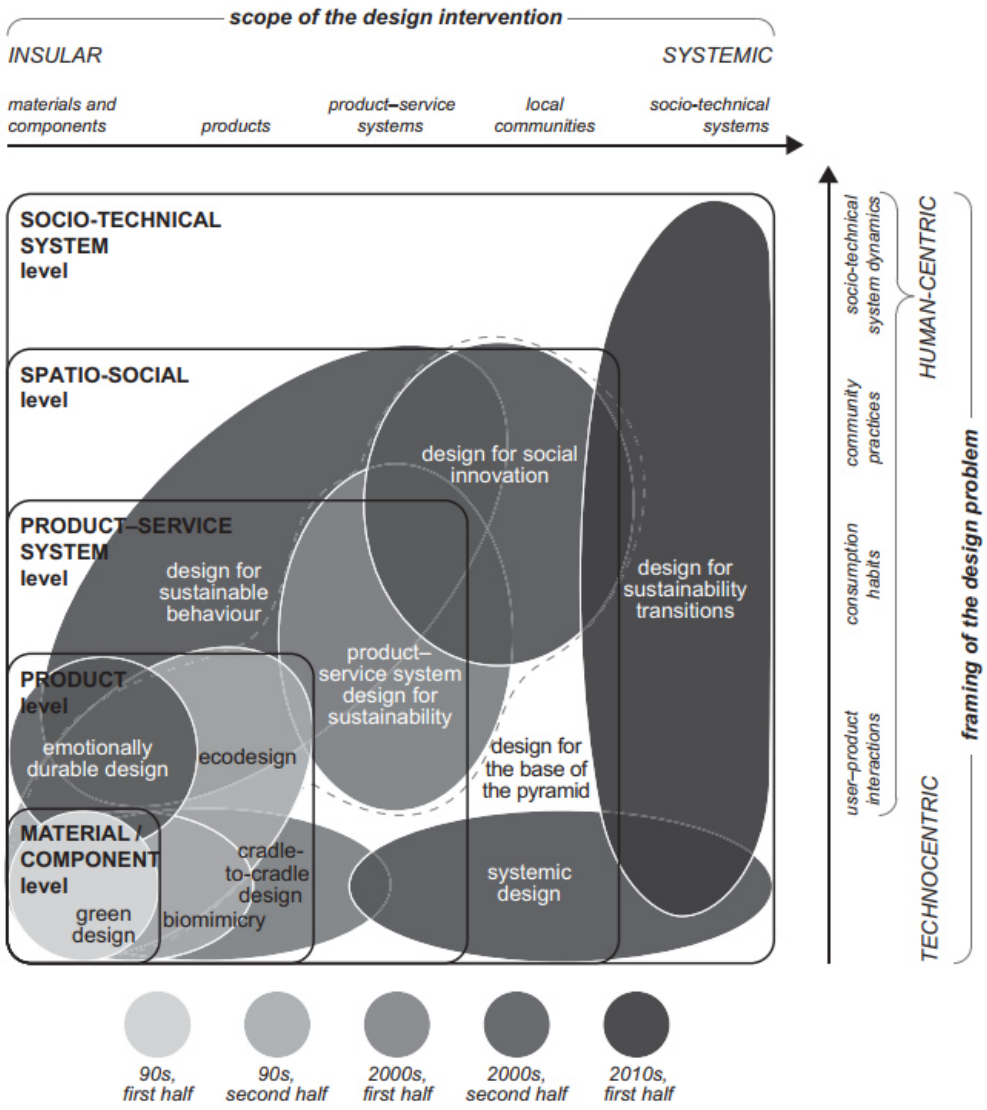
ECODESIGN

ECODESIGN

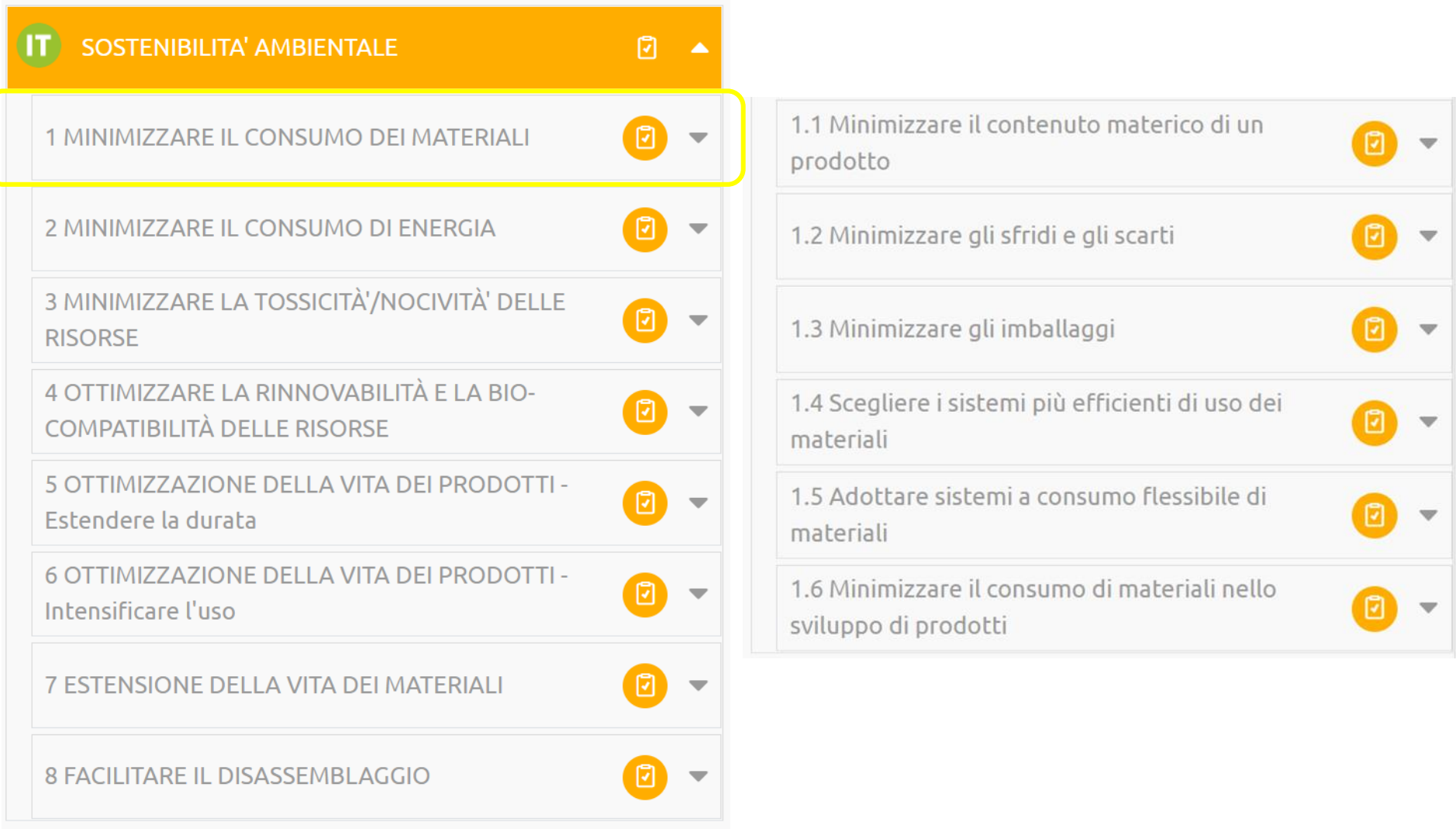
L’ecodesign è un insieme di strategie che migliorano la sostenibilità (l’LCA) di un prodotto-servizio.

Sono strategie che impattano tutto il ciclo di vita del prodotto e sono suddivise in otto diverse categorie che contengono a loro volta, varie sottocategorie

DIVERSI TIPI DI DESIGN SOSTENIBILE



CATEGORIE E SOTTOCATEGORIE



ECONOMIA CIRCOLARE

COS'È LA CIRCULAR ECONOMY

L'Economia Circolare è **un modello di produzione e consumo** che implica **condivisione, prestito, riutilizzo, riparazione, ricondizionamento e riciclo dei materiali e prodotti esistenti il più a lungo possibile.**

Fonte: europarl.europa.eu

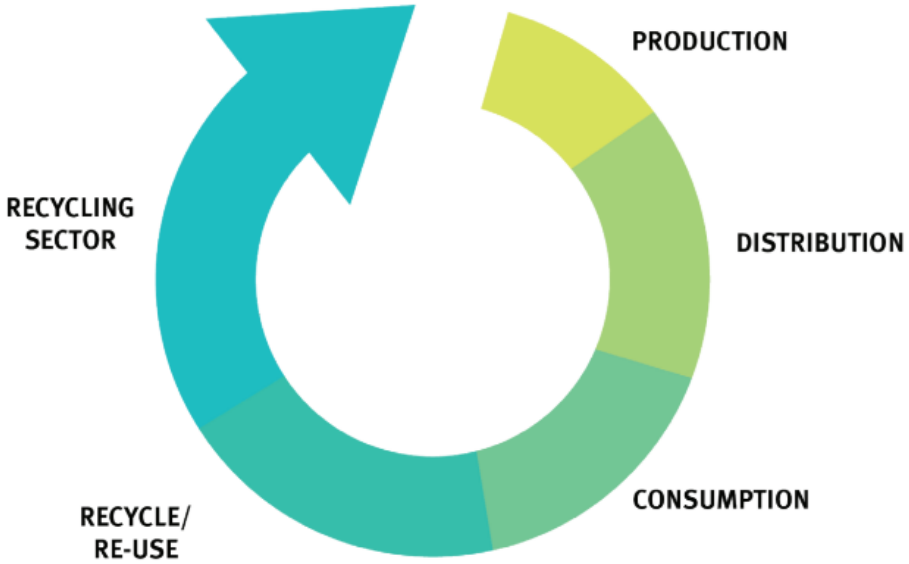
COS'È LA CIRCULAR ECONOMY

In questo modo **si estende il ciclo di vita dei prodotti,** contribuendo a ridurre i rifiuti al minimo. Una volta che il prodotto ha terminato la sua funzione, **i materiali [o i componenti n.d.r.]** di cui è composto vengono infatti reintrodotti, laddove possibile, nel ciclo economico. Così si possono continuamente riutilizzare all'interno del ciclo produttivo **generando ulteriore valore.**

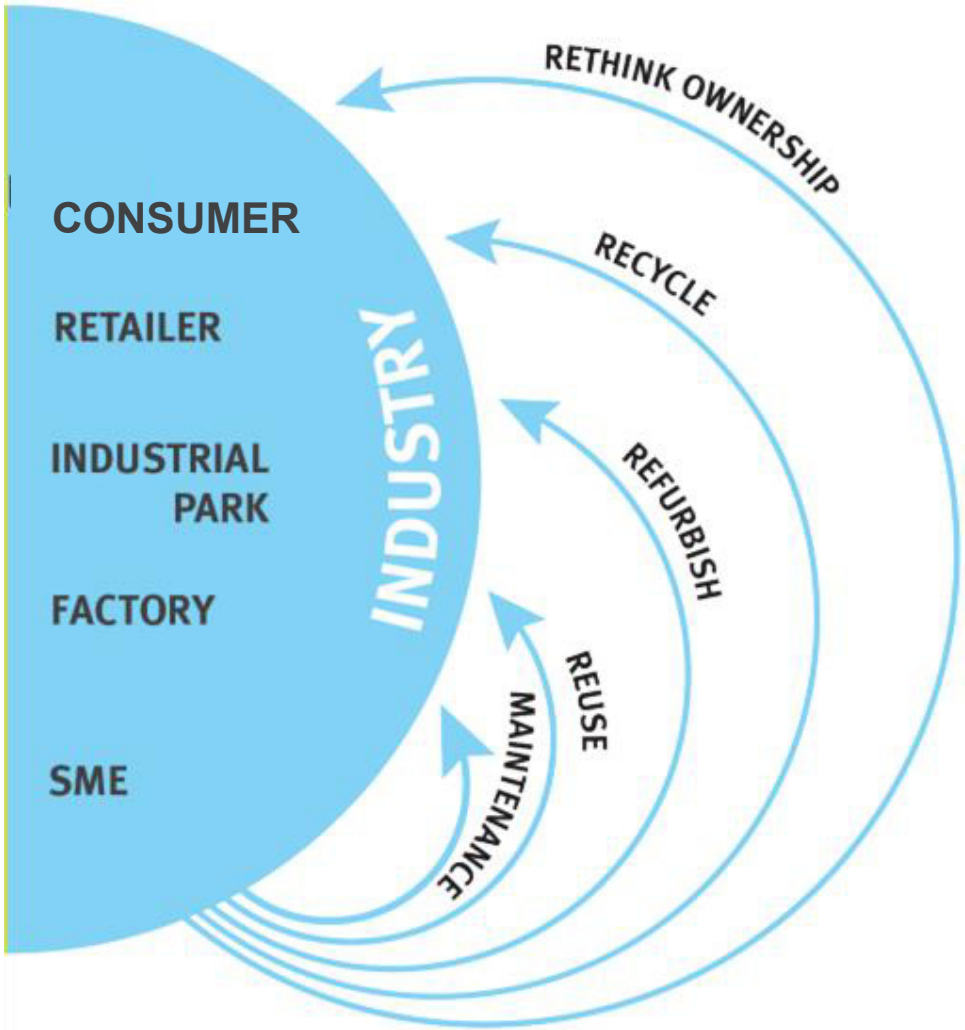
Fonte: europarl.europa.eu

LINEAR ECONOMY

CIRCULAR ECONOMY



STRATEGIE


CONSUMER
RETAILER
INDUSTRIAL PARK
FACTORY
SME
INDUSTRY
MAINTENANCE
REUSE
REFURBISH
RECYCLE
RETHINK OWNERSHIP

LISTA STRATEGIE

Materiali e Componenti

1. **Recover:** come riutilizzare componenti che rischiano di essere gettati
2. **Recycle:** trasformare uno spreco in una risorsa
3. **Reduce:** usare meno materiale o energia
4. **Renewable:** materiali o energia sostenibile e rinnovabile
5. **Monomaterial:** come usare un solo materiale

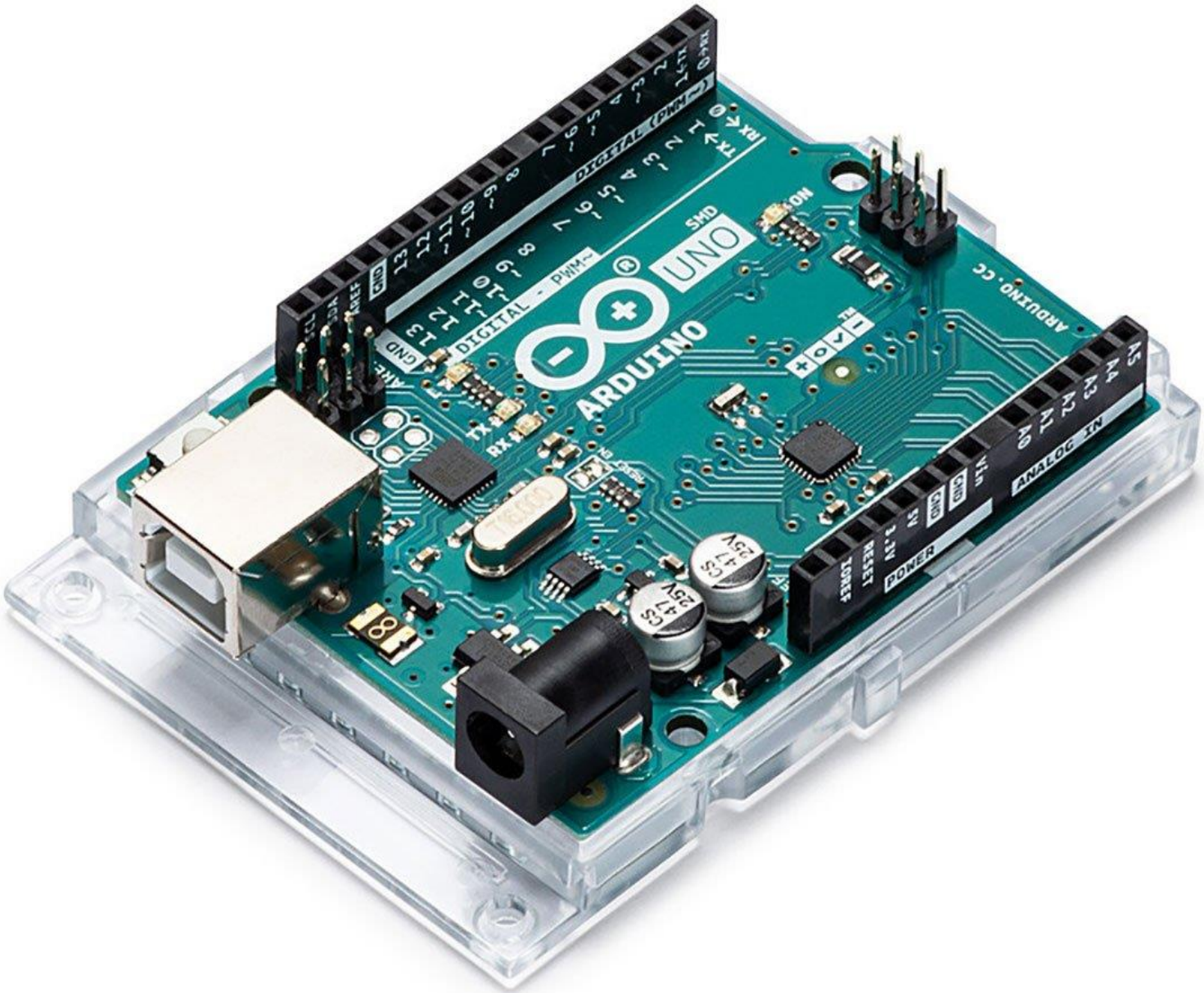
Oggetti e Prodotti

1. **Repair:** come riparare un prodotto e renderlo facilmente manutenibile
2. **Refurbish:** rinnovare e potenziare le caratteristiche di un prodotto
3. **Reuse:** riutilizzare parti o prodotti esistenti in modi creativi
4. **Cascade approach:** riuso “a cascata” di materiali e componenti per creare nuovi prodotti
5. **On demand Production:** produrre solo se serve e quando serve

Sistemi e Servizi

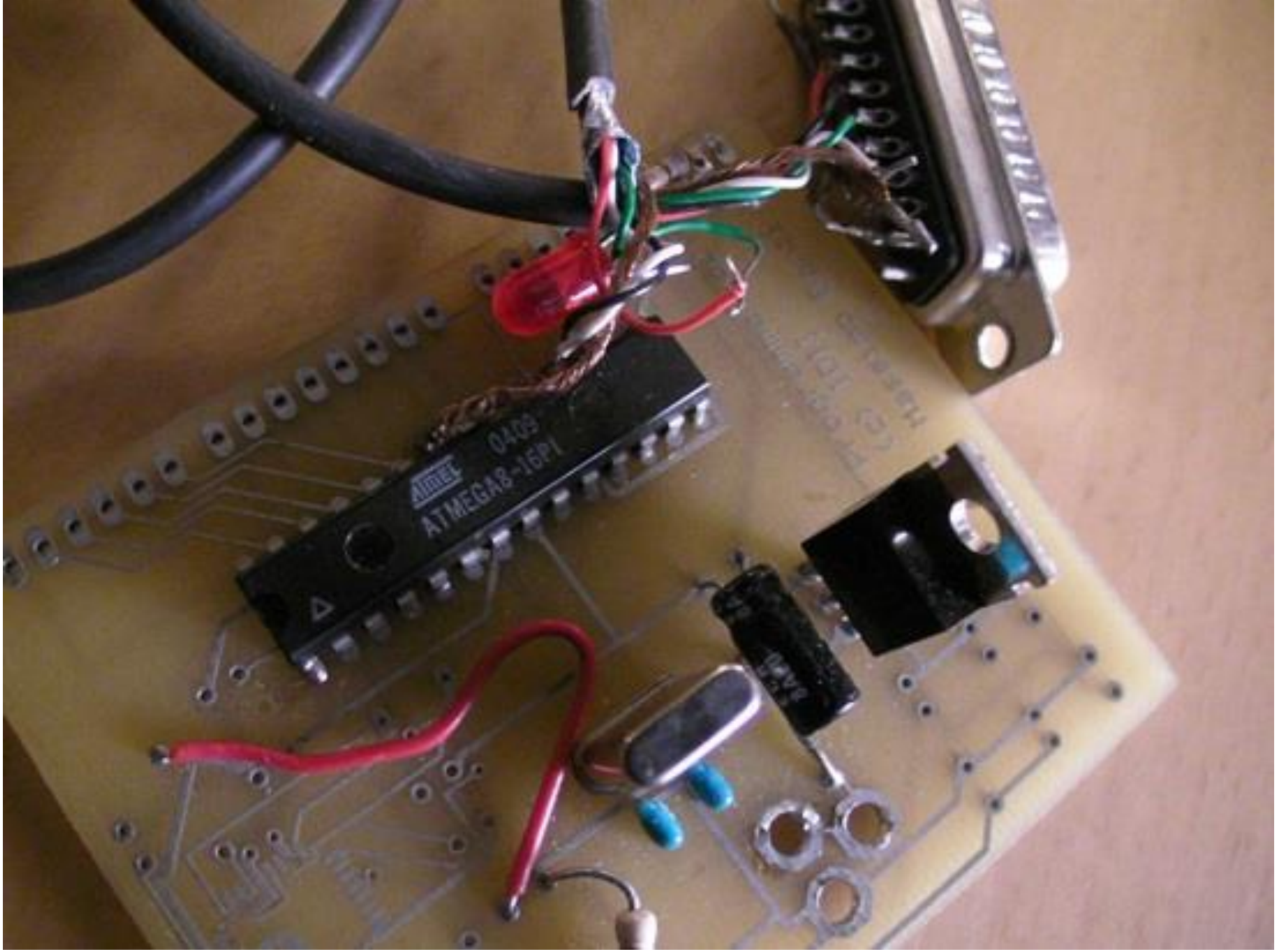
1. **Emotional obsolescence:** evitare di “stancarsi” di un prodotto
2. **Local production:** come distribuire la produzione e avvicinarla agli utenti
3. **Reduce:** come ridurre l’overconsumption di prodotti
4. **Sharing:** facilitare la condivisione
5. **Measuring and Awareness:** come intervenire sui comportamenti delle persone partendo da dati

ARDUINO E CODING

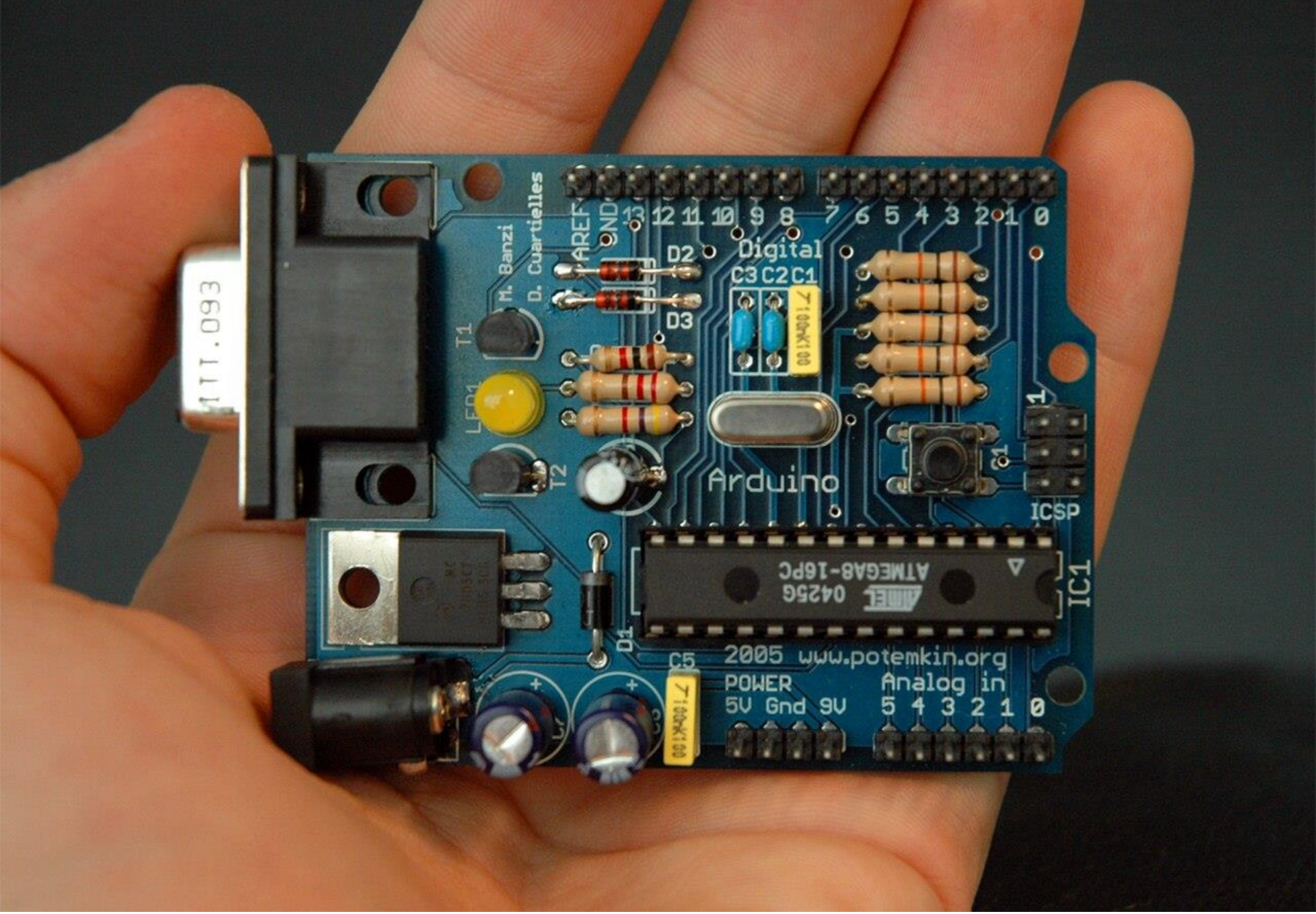

DIGITAL (PWM~)
DIGITAL ~ PWM~
ARDUINO
UNO
SMD
ON
ARDUINO.CC
POWER
ANALOG IN
RESET
3.3V
5V
GND
GND
Vin
A0
A1
A2
A3
A4
A5

LE ORIGINI

The Arduino core team (from left)—David Cuartielles, Gianluca Martino, Tom Igoe, David Mellis, and Massimo Banzi—get together at Maker Faire in New York City. Photo: Randi Silberman Klett



By Phillipptorrone - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=19269741



COMMUNITY E MOVIMENTO


R1


BLACK FRIDAY
CAIXA
EXCLUSIVO
ELETRO
BAZAR e TÊXTIL
HOJE!

COS'È
IL MOVIMENTO MAKER

Il Movimento Maker raccoglie tutte le persone che si appassionano **a costruire nuovi oggetti e modificare quelli esistenti.**
Spesso lo fanno **usando tecnologie di fabbricazione digitale** come la stampa 3D oppure **schede elettroniche programmabili** come Arduino

PERCHÉ È IMPORTANTE

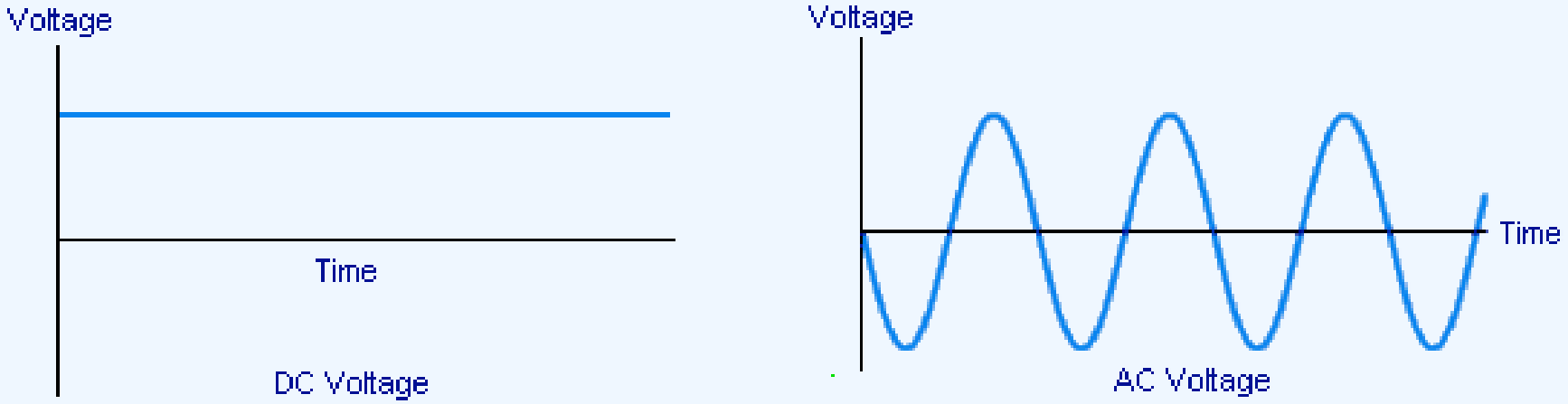
INNOVAZIONE DAL BASSO
I progetti sono fatti in collaborazione con community e associazioni, partendo dal territorio

INCLUSIONE
Tutti hanno un ruolo nei cambiamenti importanti come la circular economy. Soprattutto le persone.

FORMAZIONE
Non c’è cambiamento duraturo se non si impara qualcosa di nuovo. Per questo la formazione è così importante.

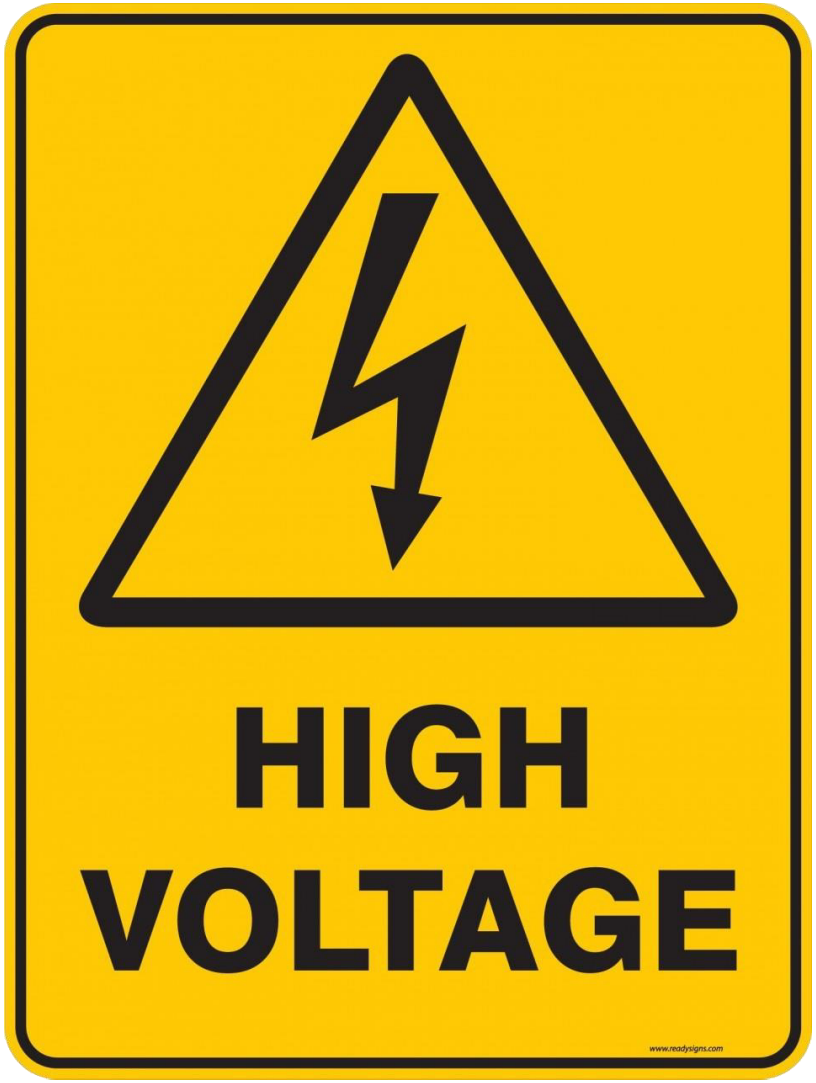
COME FUNZIONA L’ELETTRONICA

AC/DC

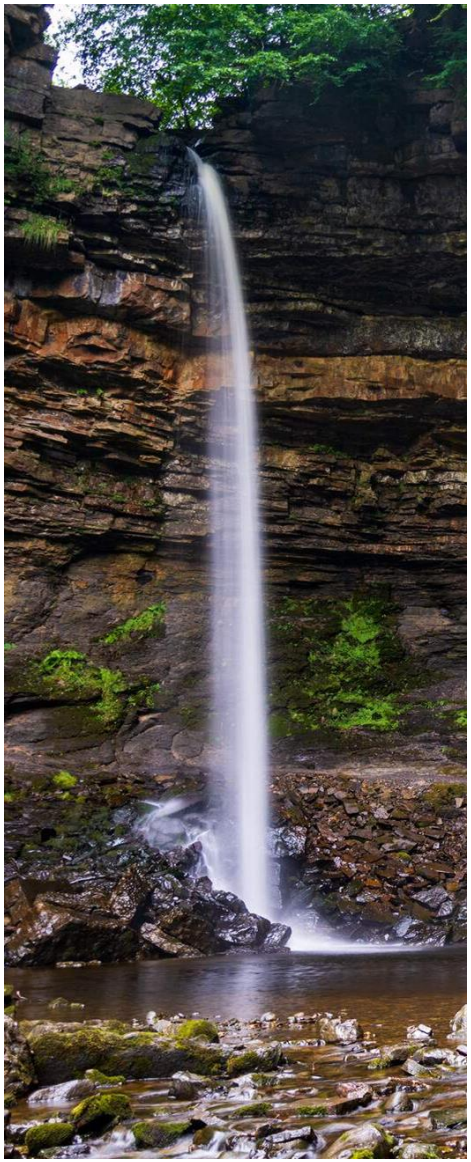


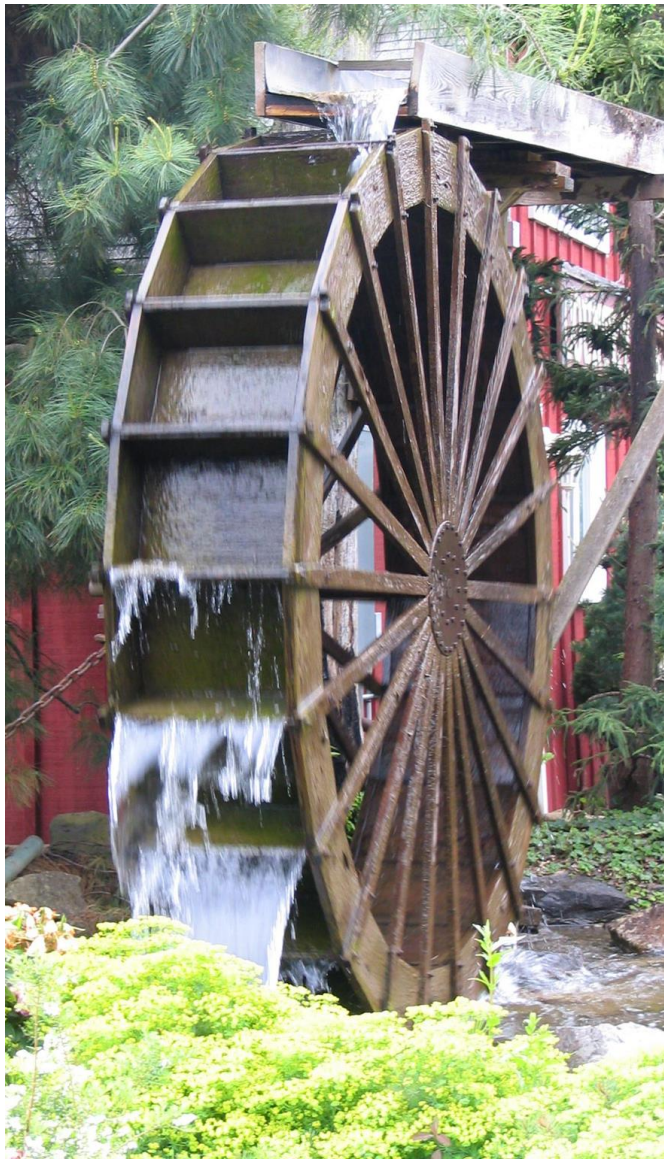
Representation of Visual Difference between DC and AC voltages

TENSIONE, RESISTENZA, CORRENTE

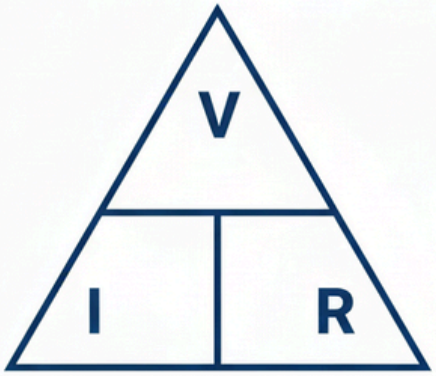


TENSIONE, RESISTENZA, CORRENTE



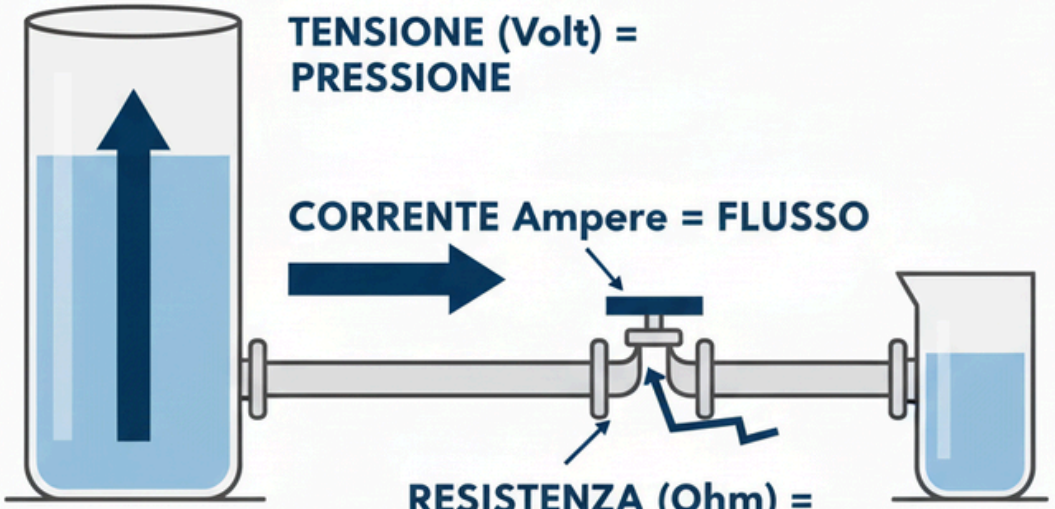


LEGGE DI OHM

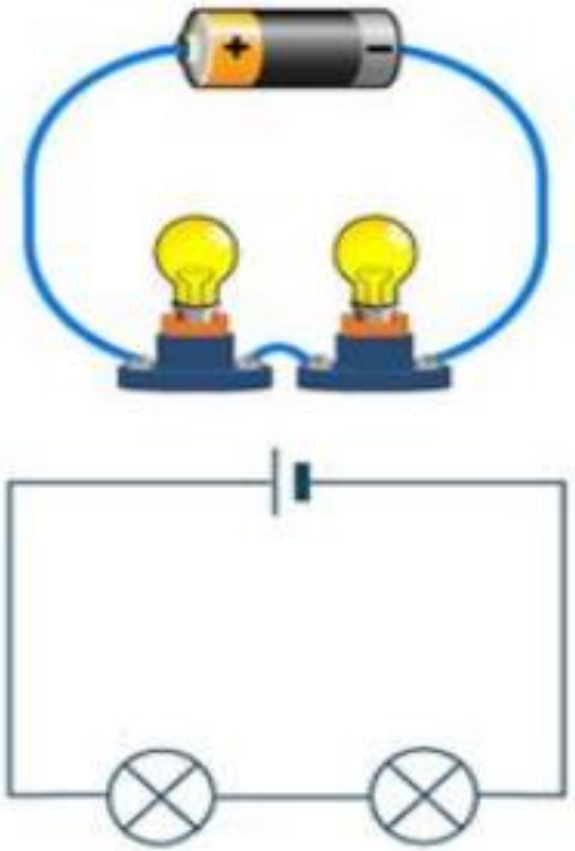


I = V / R
R = V / I
V = I x R

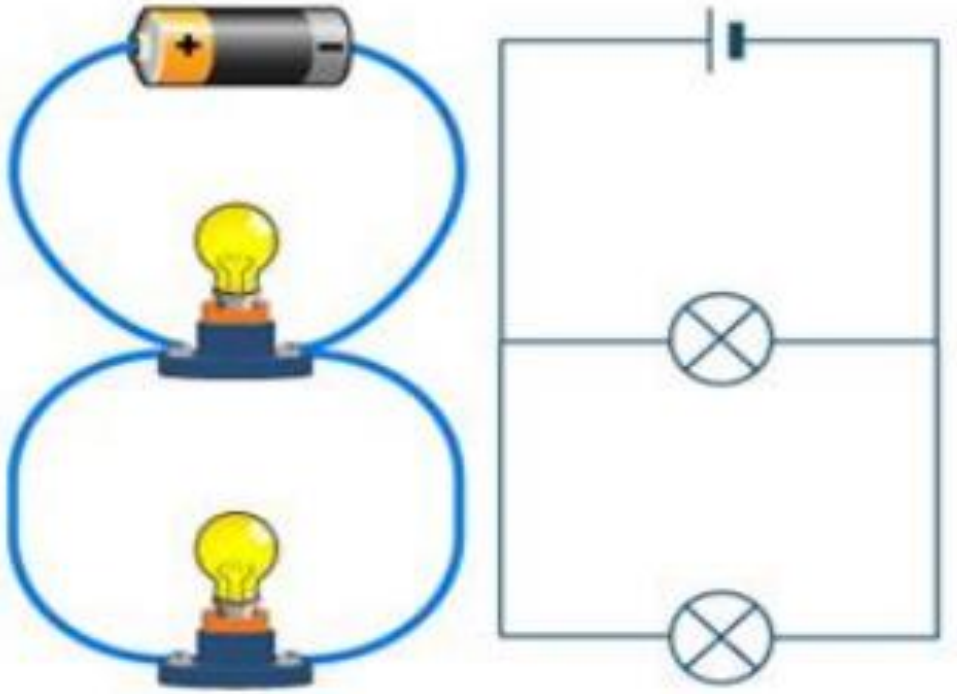
V = Tensione (Volt)
I = Corrente Ampere
R = Resistenza (Ohm)



PARALLEL AND SERIES



Series Circuit



Parallel Circuit

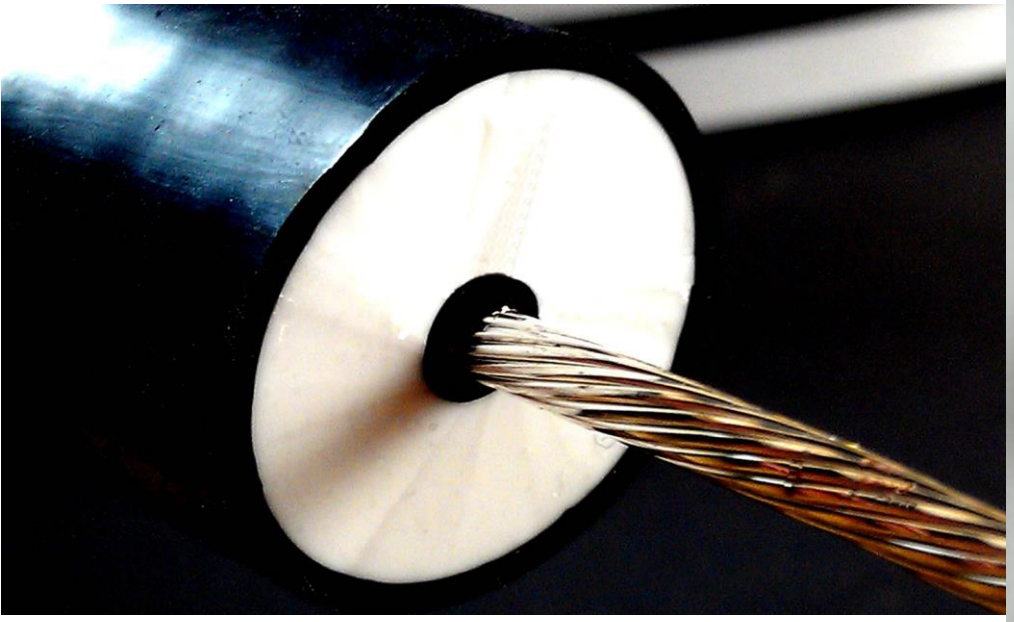
https://www.youtube.com/watch?v=x2EuYqj_0Uk

POWER

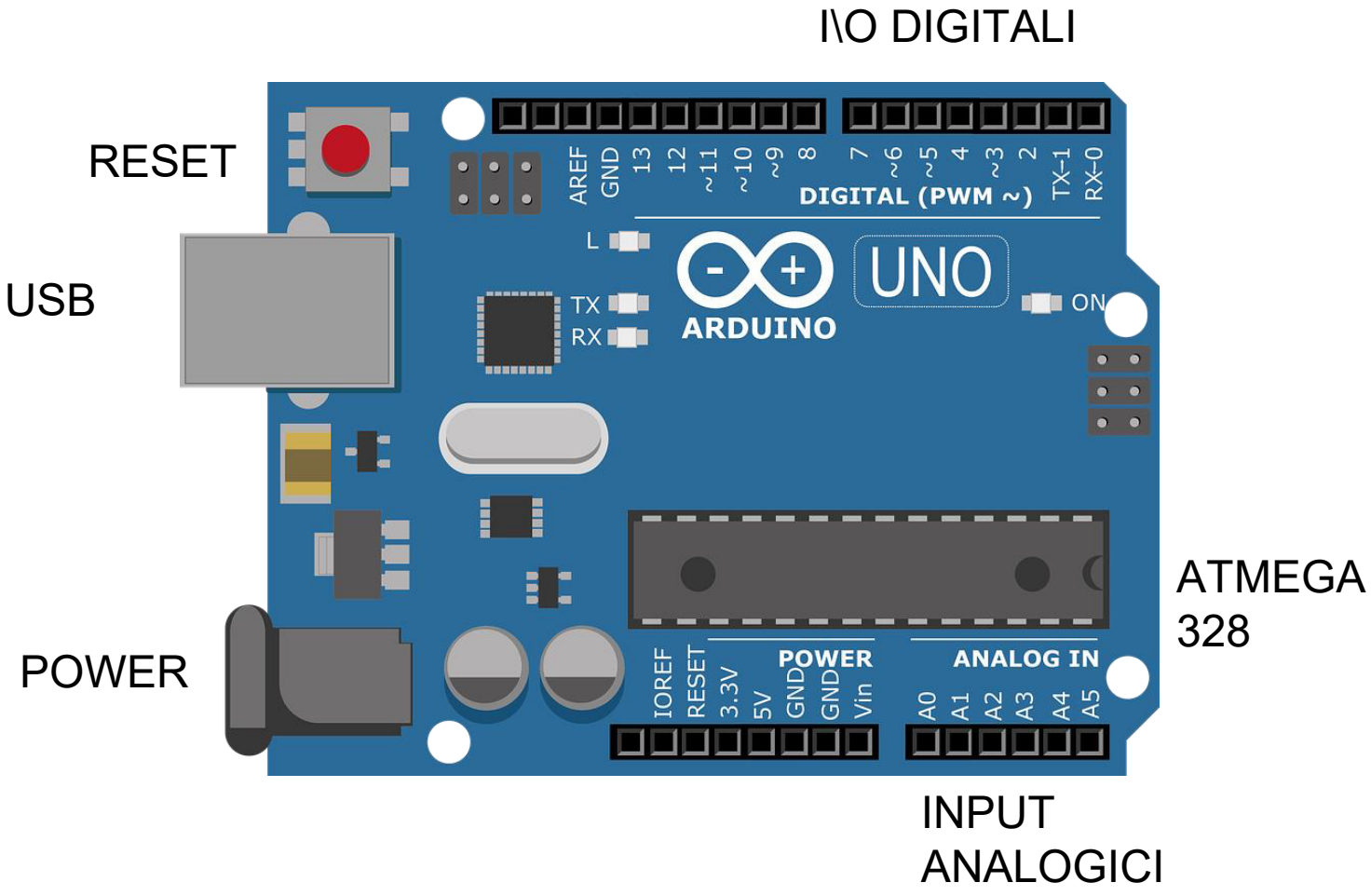
$$P = IV = I^2R = \frac{V^2}{R}$$

Cos'è meglio? 10W a 12V o 10W a 220V?

HIGH CURRENT VS. HIGH TENSION



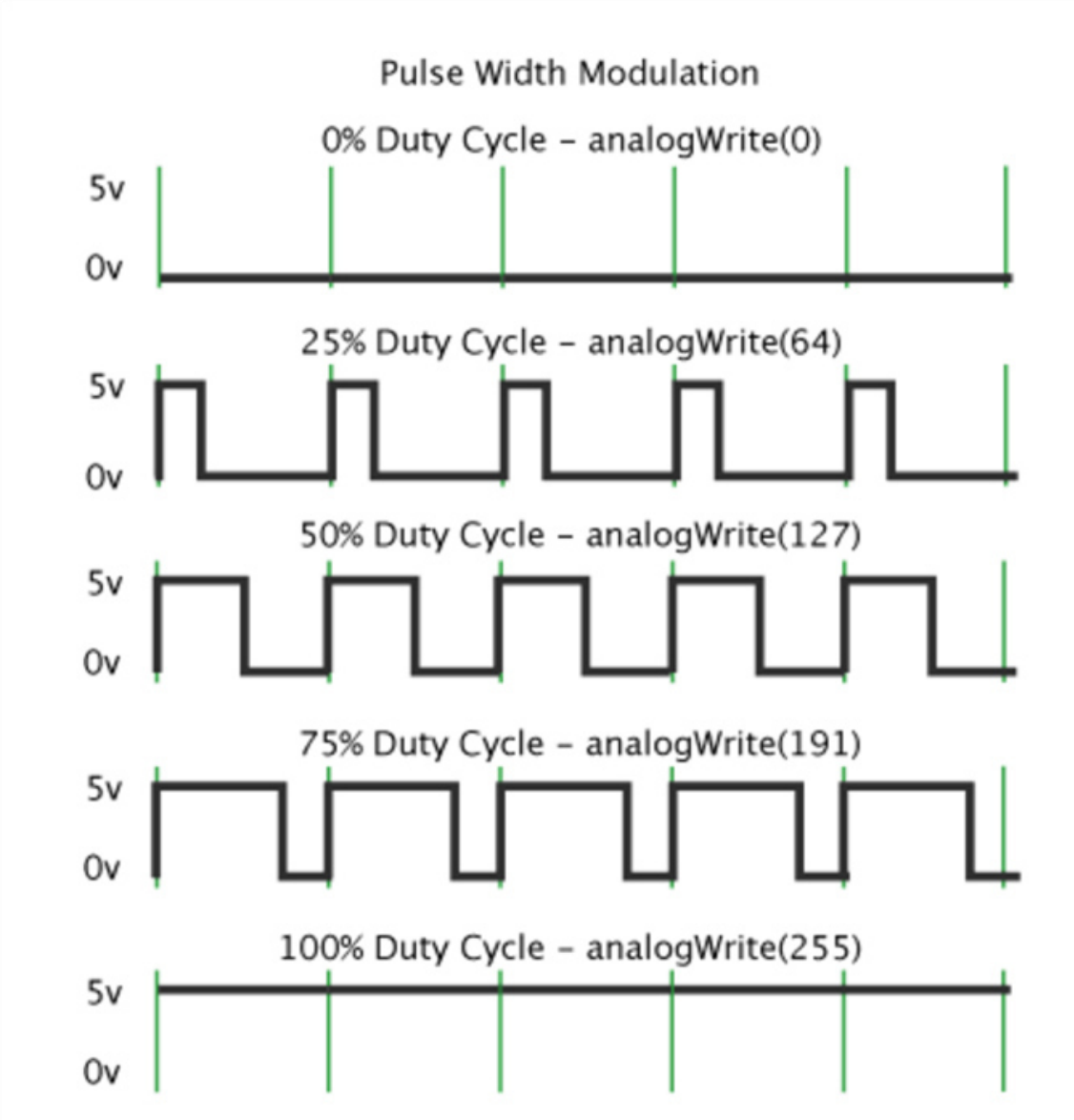
ARDUINO


I\O DIGITALI
RESET
USB
POWER
ATMEGA
328
INPUT
ANALOGICI
AREF
GND
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TX→1
RX←0
DIGITAL (PWM ~)
L
TX
RX
ARDUINO
UNO
ON
POWER
ANALOG IN
IOREF
RESET
3.3V
5V
GND
GND
Vin
A0
A1
A2
A3
A4
A5

ARDUINO

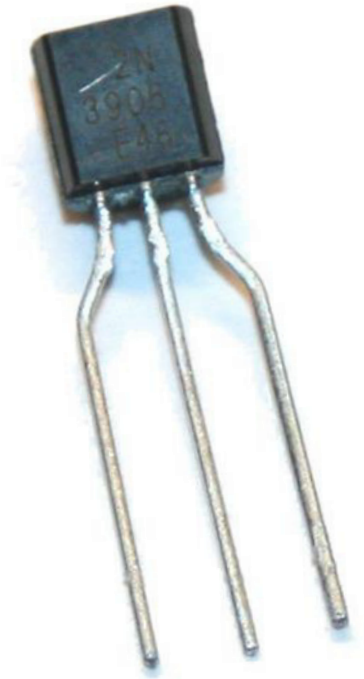
	ANALOGICO	DIGITALE
INPUT	**6 PIN (A0-A5)** (INPUT A 10 BIT → 0-1023)	**14 PIN (0-13)** (HIGH | LOW)
OUTPUT	**SIMULATO!!!** (PWM A 8 BIT → 0-255)	**14 PIN (0-13)** (HIGH | LOW)

COME SIMULARE L'OUTPUT ANALOGICO (PWM)

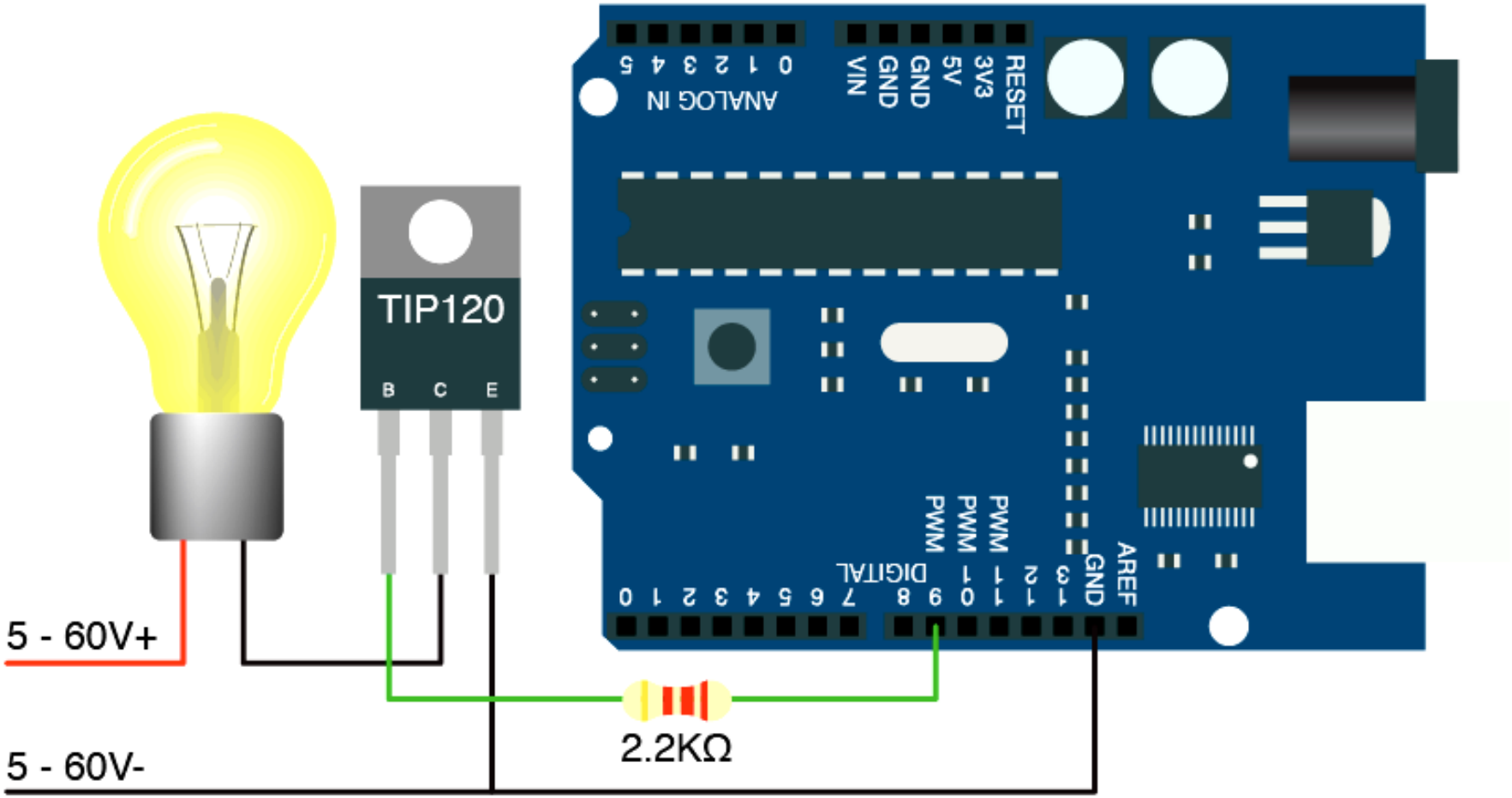


https://www.arduino.cc/en/Tutorial/PWM

COME GESTIRE POTENZE ALTE



BASIC ARDUINO POWER CONTROL



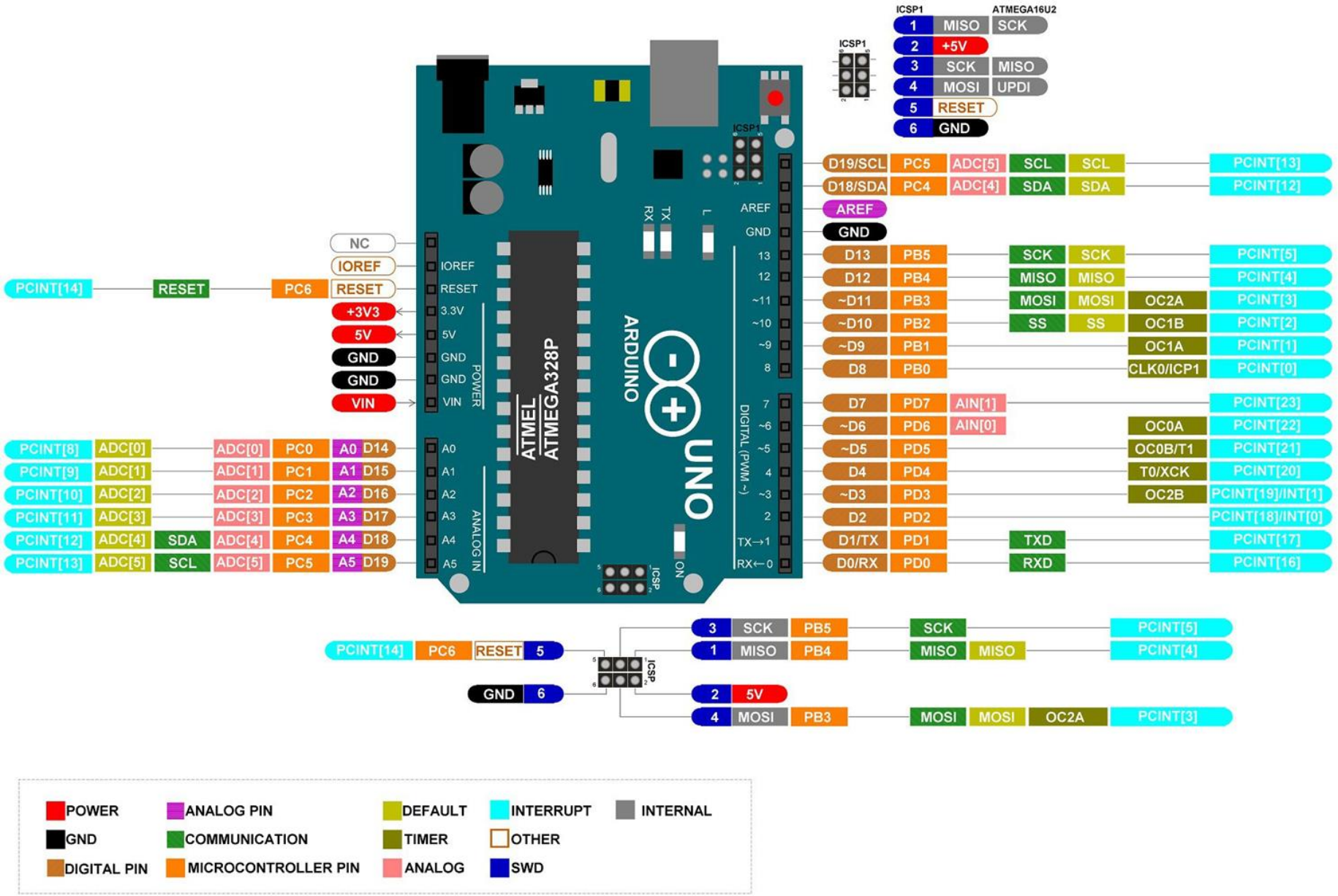
“COMUNICARE” CON I COMPONENTI ELETTRONICI

- digitalWrite → `digitalWrite(pin, HIGH)`
- digitalRead → `digitalRead(pin)`
- analogWrite → `analogWrite(pin, value)`
- analogRead → `analogRead(pin)`

- Comunicazione Seriale - UART (Tx-Rx)
- I2C (SDA | SCL)
- SPI (CLK | MISO | MOSI | SS)

- protocollo specifico (libreria)

“COMUNICARE” CON I COMPONENTI ELETTRONICI



PROTOCOLLI A CONFRONTO

Property	UART	SPI	I2C
Speed	Slow	Very Fast	Moderate
Complexity	Very Simple	More Complex	Simple
Device Support	2	1+ Master, Multiple Slaves	Multiple Masters & Slaves
Signals	Tx, Rx	SCLK, MOSI, MISO + SS Per Slave	SDA, SCL
Distance	Medium	Short	Short
Example Uses	Simple sensors, basic serial comms	SD cards, high bandwidth video	I2C sensors, multi-device automation

LOGICA DI PROGRAMMAZIONE

Control Structure

break
continue
do...while
else
for
goto
if
return
switch...case
while

Comparison Operators

== (equal to)
> (greater than)
>= (greater than or equal to)
< (less than)
<= (less than or equal to)
!= (not equal to)

Bitwise Operators

<< (bitshift left)
>> (bitshift right)
& (bitwise AND)
~ (bitwise NOT)
| (bitwise OR)
^ (bitwise XOR)

Further Syntax

/* */ (block comment)
{} (curly braces)
#define
#include
; (semicolon)
// (single line comment)

Boolean Operators

&& (logical AND)
! (logical NOT)
|| (logical OR)

Compound Operators

+= (compound addition)
&= (compound bitwise AND)
|= (compound bitwise OR)
^= (compound bitwise XOR)
/= (compound division)
*= (compound multiplication)
%= (compound remainder)
-= (compound subtraction)
-- (decrement)
++ (increment)

BASIC ARDUINO LED's CONTROL (BLINK)

```
void setup() {
  // initialize digital pin 13 as an output.
  pinMode(13, OUTPUT);
}

// the loop function runs over and over again forever
void loop() {
  digitalWrite(13, HIGH);   // turn the LED on (HIGH is the voltage level)
  delay(1000);              // wait for a second
  digitalWrite(13, LOW);    // turn the LED off by making the voltage
LOW
  delay(1000);              // wait for a second
}
```

BASIC ARDUINO LED's CONTROL (FADE)

```
int led = 9;           // the pin that the LED is attached to
int brightness = 0;    // how bright the LED is
int fadeAmount = 5;    // how many points to fade the LED by

// the setup routine runs once when you press reset:
void setup() {
  // declare pin 9 to be an output:
  pinMode(led, OUTPUT);
}

// the loop routine runs over and over again forever:
void loop() {
  // set the brightness of pin 9:
  analogWrite(led, brightness);

  // change the brightness for next time through the loop:
  brightness = brightness + fadeAmount;

  // reverse the direction of the fading at the ends of the fade:
  if (brightness == 0 || brightness == 255) {
    fadeAmount = -fadeAmount ;
  }
  // wait for 30 milliseconds to see the dimming effect
  delay(30);
}
```

PROGETTI E CASI STUDIO

Materiali e Componenti

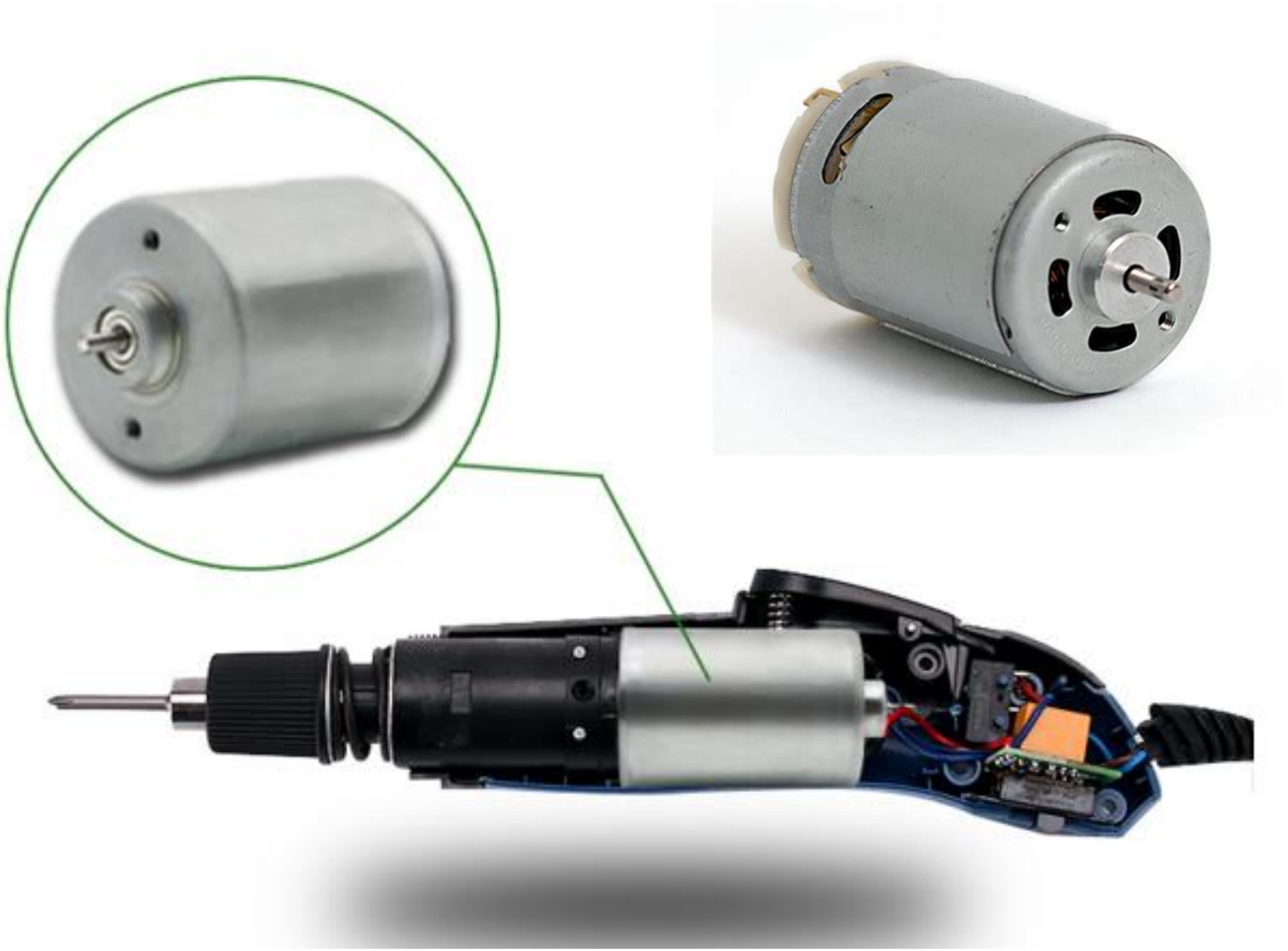
Recover: come recuperare componenti da vecchi prodotti per dargli nuova vita

Reduce: come usare meno energia

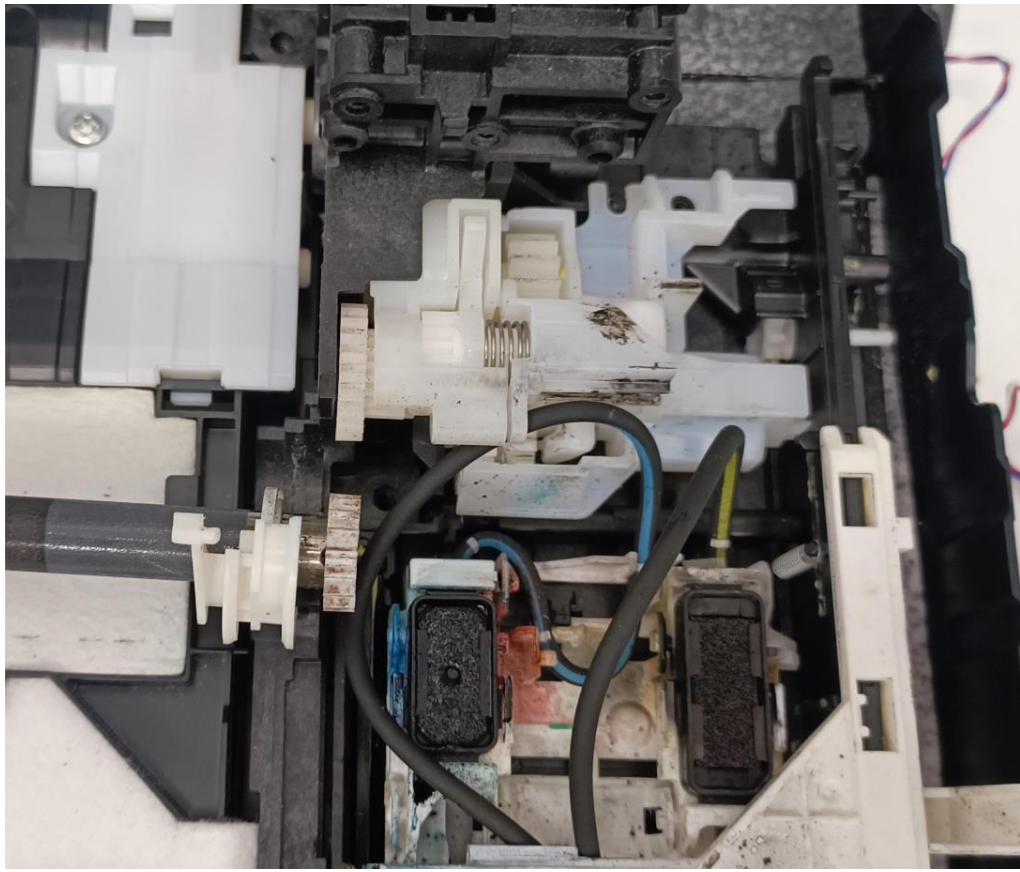
Renewable: come usare energia rinnovabile nei propri progetti

RECOVER

Come recuperare componenti da vecchi prodotti per dargli nuova vita

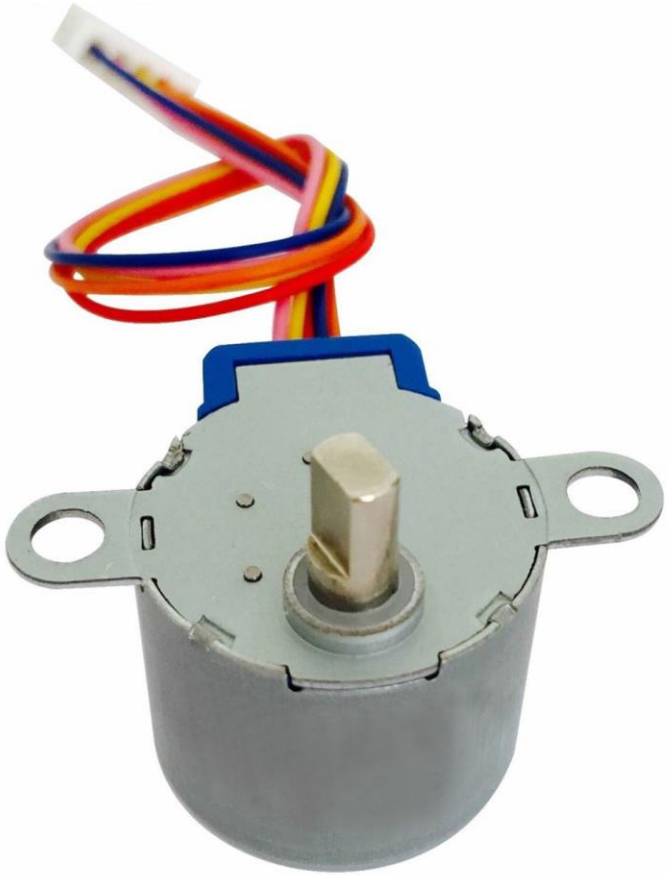


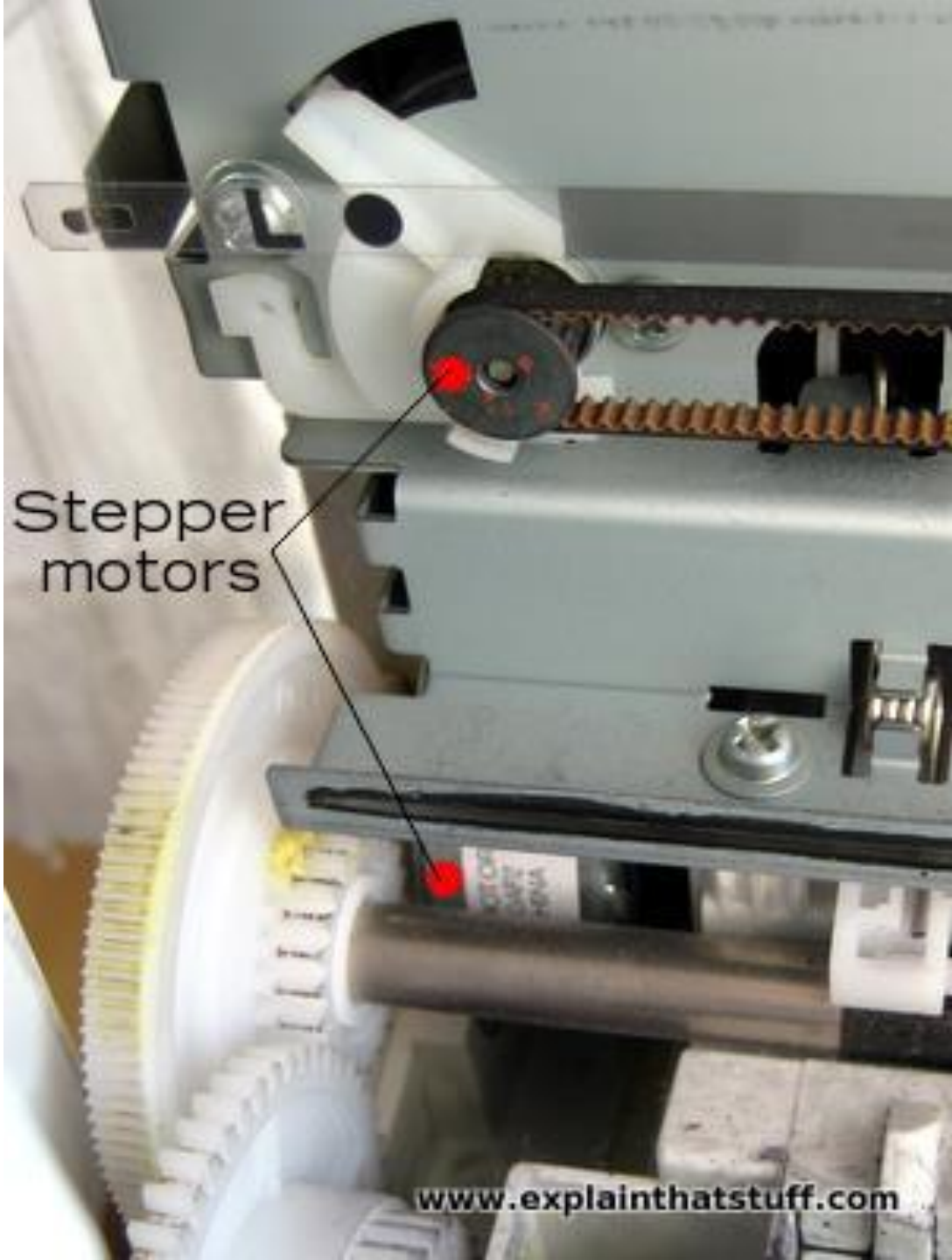
MOTORI (DC)



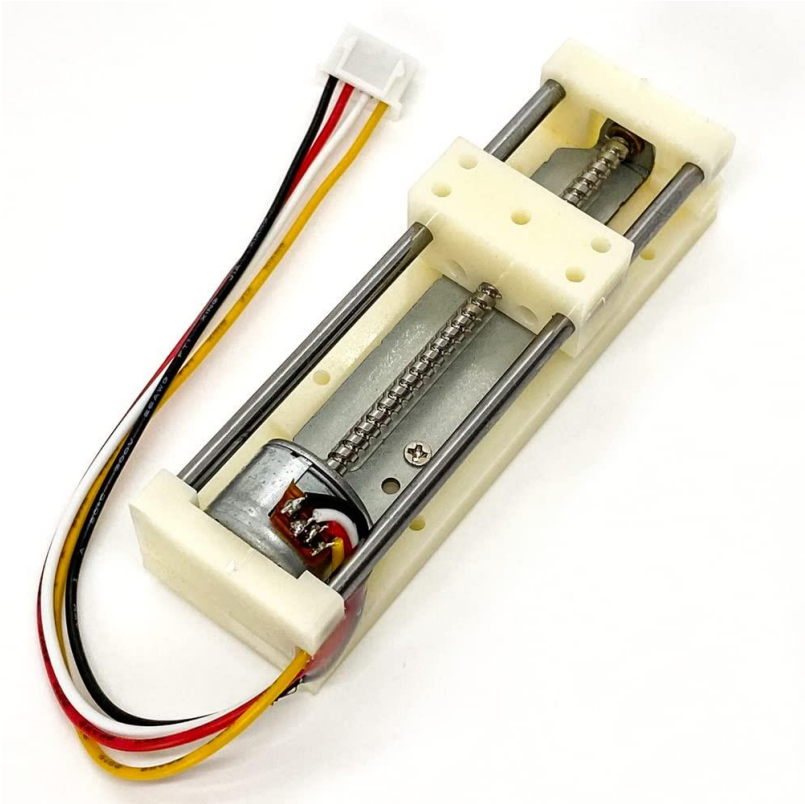
POMPE PERISTALTICHE

ALIMENTATORI





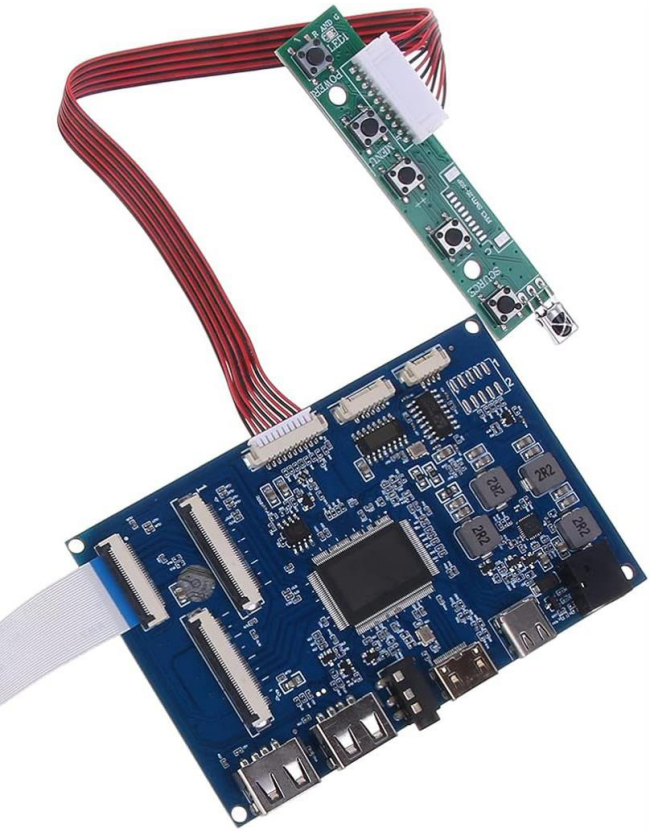
MOTORI STEPPER



(MINI) ATTUATORI LINEARI

VENTOLA

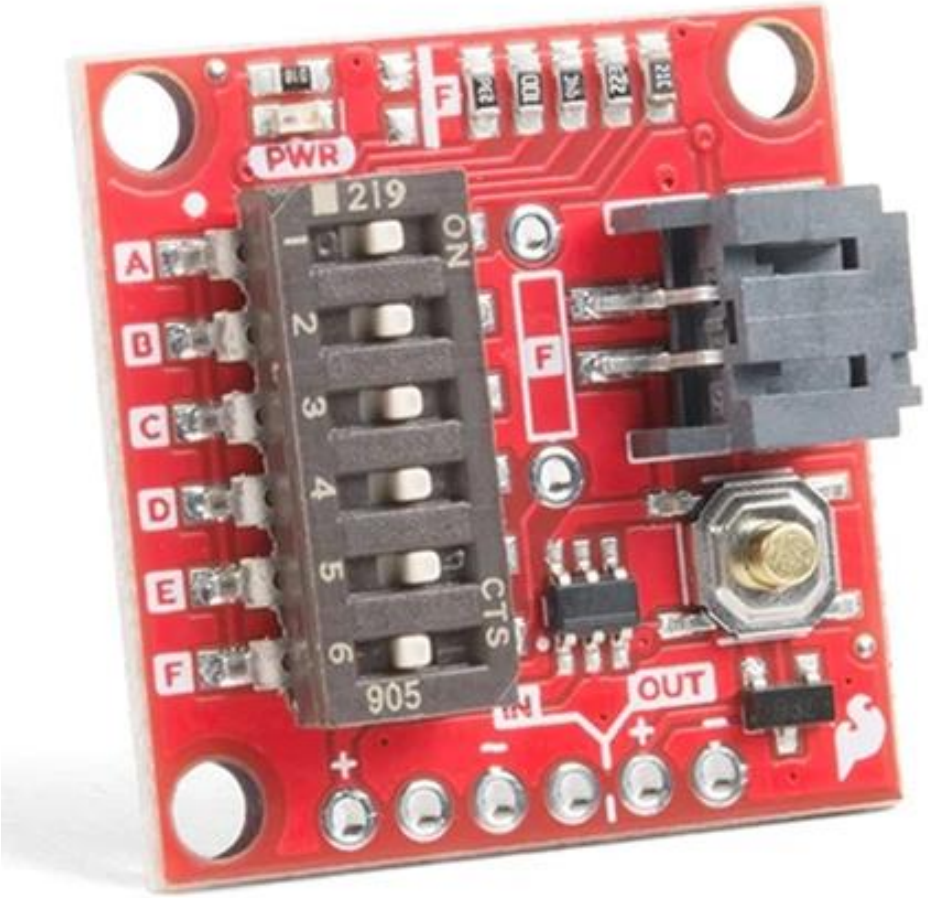
BATTERIE RICARICABILI

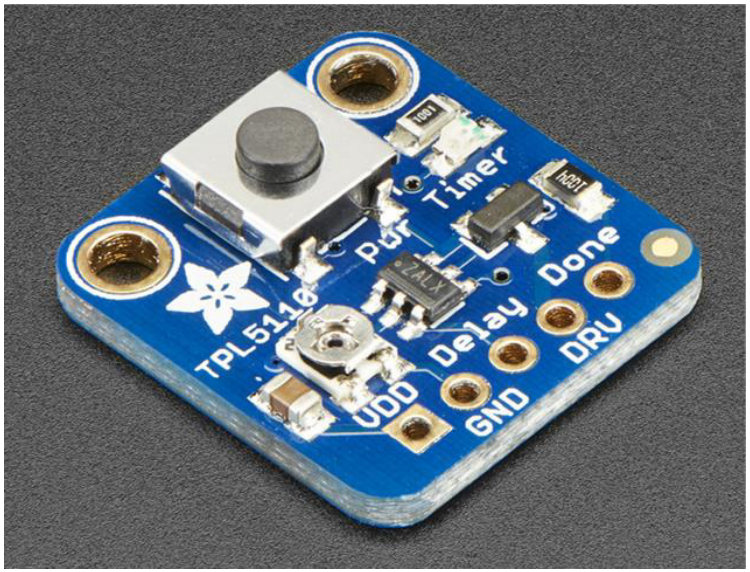


SCHERMI

REDUCE

Come usare meno energia


PWR
219
ON
A
B
C
D
E
F
2
3
4
5
6
CTS
905
F
OUT
+
−


Timer
Pot
Done
TPL5110
Delay
DRV
VDD
GND

TIMERS

The Arduino Guide to Low Power Design

Learn the basics of low-power design using Arduino hardware and software.

Author • Taddy Chung, José Bagur

Last revision • 28/02/2025

The objective of **Low Power** is to reduce the device's power consumption by controlling its behavior to extend its operation lifetime. Electronic devices fed directly from a power source usually do not require the implementation of Low Power or similar techniques to extend their life. On the other hand, it is necessary to save its power consumption to expand its operation lifetime for the devices running from a power source such as batteries.

The present guide for achieving low power system are applicable for every Arduino boards. For example, **Arm Cortex-M0 32-bit SAMD21** processor based Arduino boards can take advantage of low-power features. The Arduino SAMD21 boards with wireless protocol using LoRa® technology, with module as **Murata CMWX1ZZABZ** featured from **MKR WAN 1310**, can be combined with low power features to operate for an extensive period. With advanced techniques, such tools as power source guide and self-discharge rates design applies to every Arduino boards for designing power efficient systems. You can check out **Arduino Documentation Hardware** page to find out about Arduino boards.

Low Power Library

To enable the Low Power feature on Arduino boards, we can download the **Arduino Low Power** library from the libraries manager in the Arduino IDE. This library enables the low power features for MKR family boards.

- The library can be managed by going under **Sketch -> Include Library -> Manage Libraries** in Arduino IDE and searching for **"Arduino Low Power"** choosing the latest version.
- For when board components needs to be updated, it can be managed by going under **Tools -> Board -> Boards Manager** and searching for respective Arduino board family.

You can download the different Arduino IDE version through the link below:

- **Arduino Software Page**
- To learn more about the Arduino IDE, follow the links below:
- **Arduino IDE 1**

DEEP SLEEP

Mode	Current Consumption	Description
Normal Use	~50–55 mA	All peripherals active, LED on, running loop code.
Sleep Mode	~10–15 mA	CPU halted, but peripherals (like timers or serial) may still be running.
Deep Sleep	~0.2–1.5 mA	Power-down mode; most peripherals turned off; only interrupts (like pin change or watchdog) can wake it up.

DEEP SLEEP


RESET
AREF
GND
13
12
~11
~10
~9
8
JP2
TX
RX
ARDUINO
SPK16.000G
RESET
EN
IOREF
RESET
3.3V
5V
GND
GND

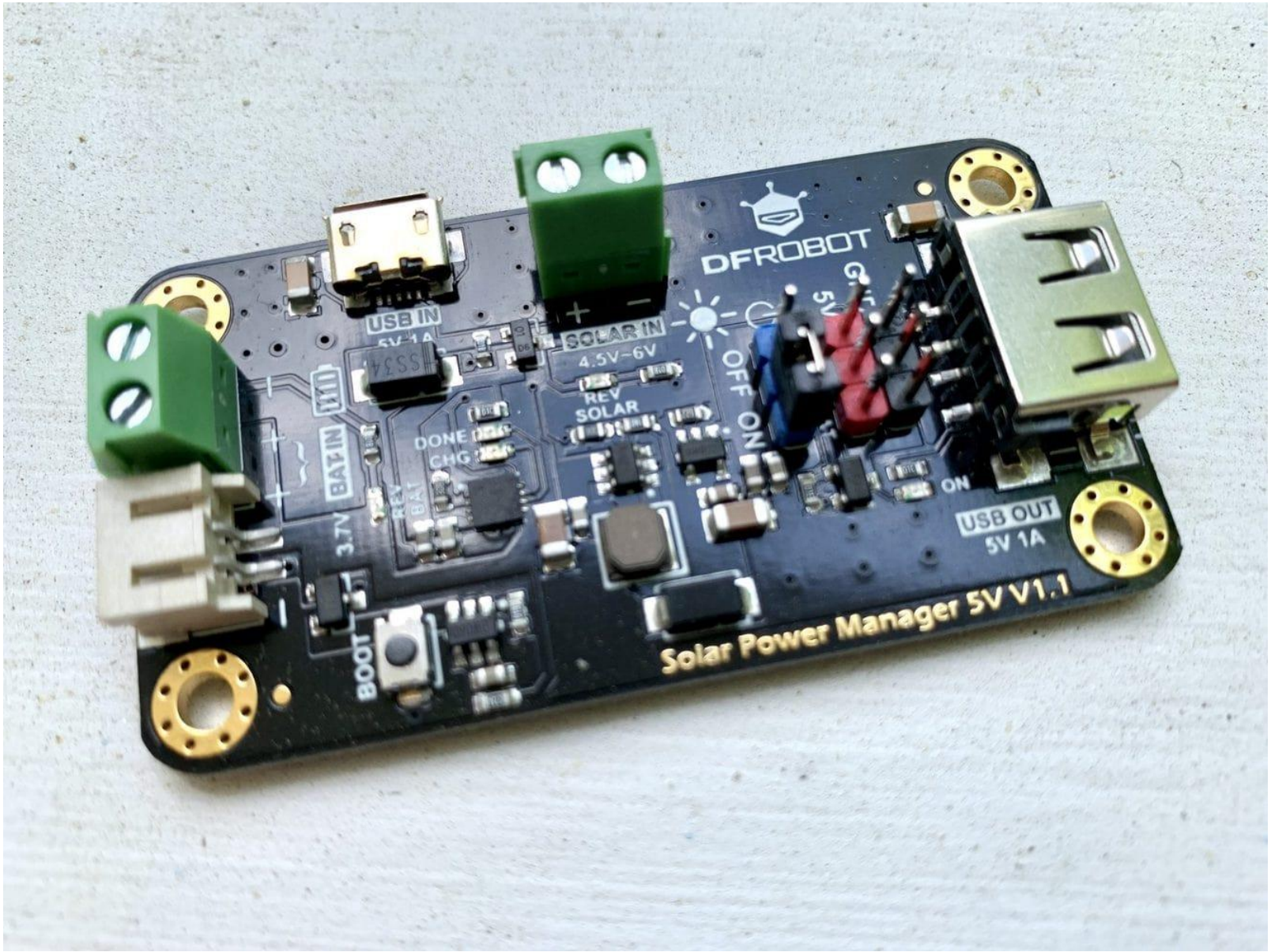
CLOCK

Clock Speed	Voltage	Current Consumption	Power	Notes
16 MHz	5V	~9–12 mA	~45–60 mW	Default on Arduino Uno
8 MHz	3.3 V	~4–5 mA	~13–17 mW	Often used in Pro Mini (3.3V version)
4 MHz	3.3 V	~1.5–2.5 mA	~5–8 mW	Can still run basic functions, slower I/O
1 MHz	3.3 V	~0.3–0.5 mA	~1–1.7 mW	Very low-power operation, ideal for deep sleep + simple wakeups
32 kHz	1.8 V	~15–20 µA	~30–40 µW	Only practical with bare chip and careful setup

CLOCK

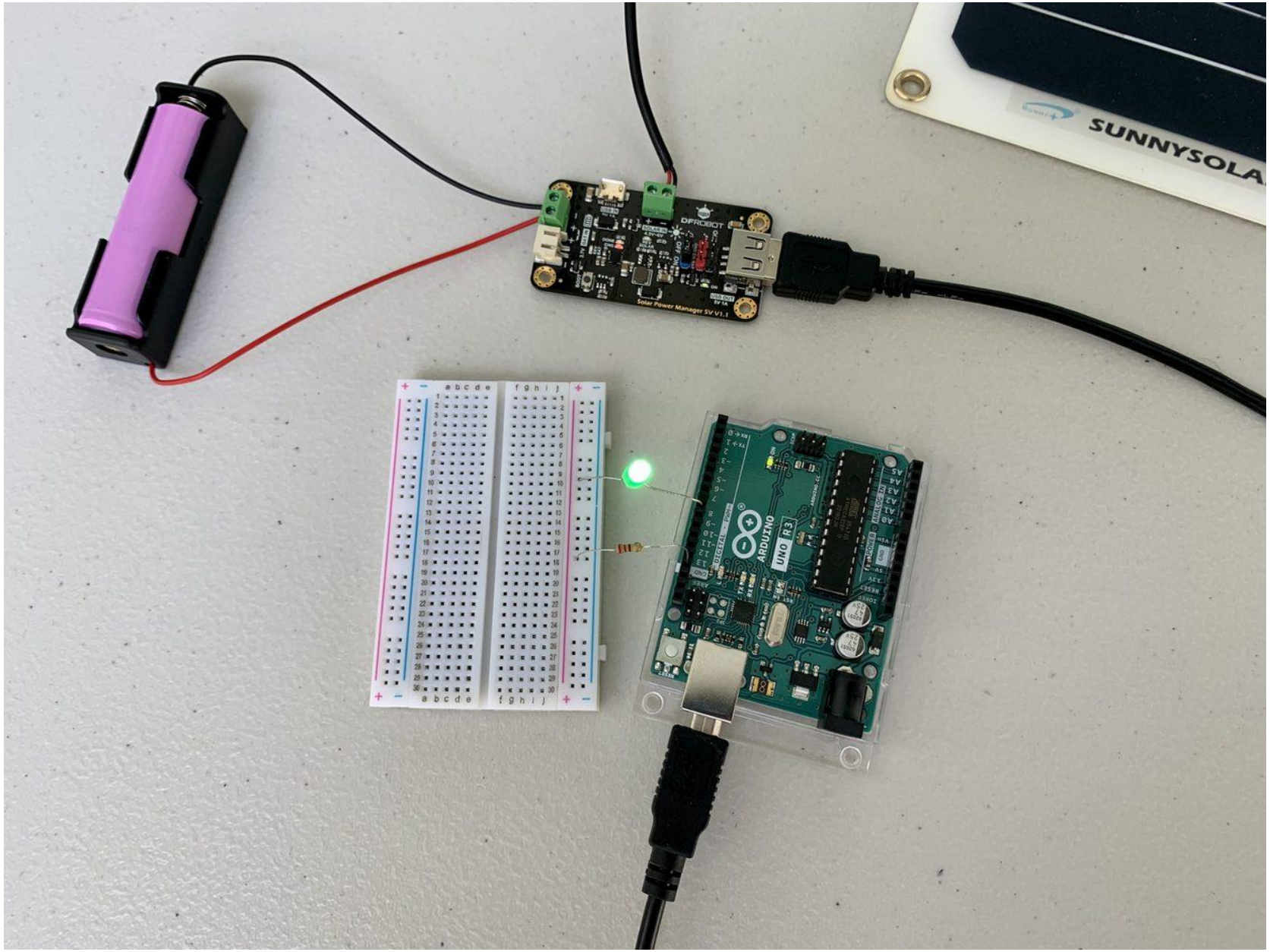
RENEWABLE

Come usare energia rinnovabile nei propri progetti



SOLAR POWERED ARDUINO

https://footprinthero.com/how-to-solar-power-an-arduino



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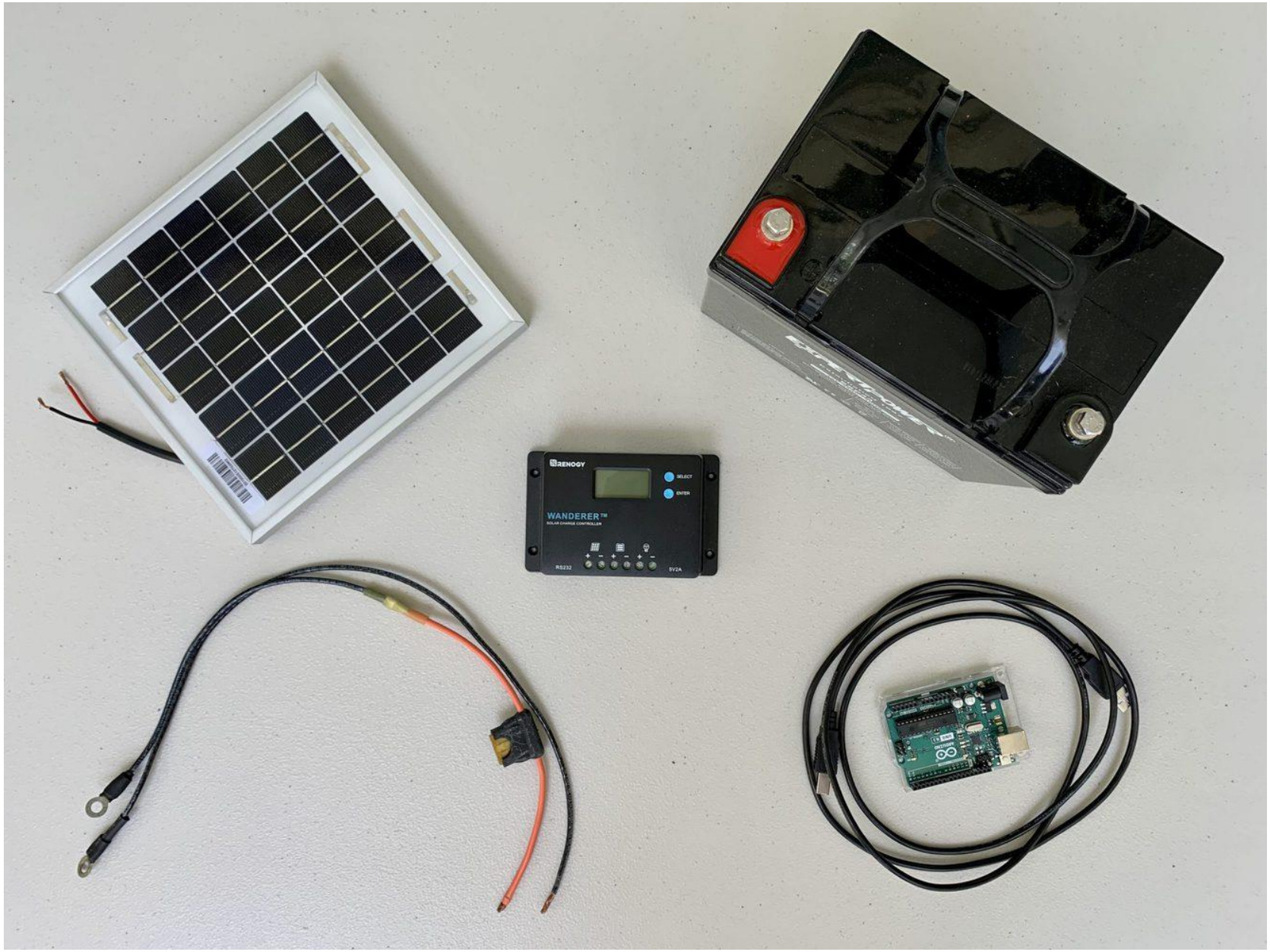

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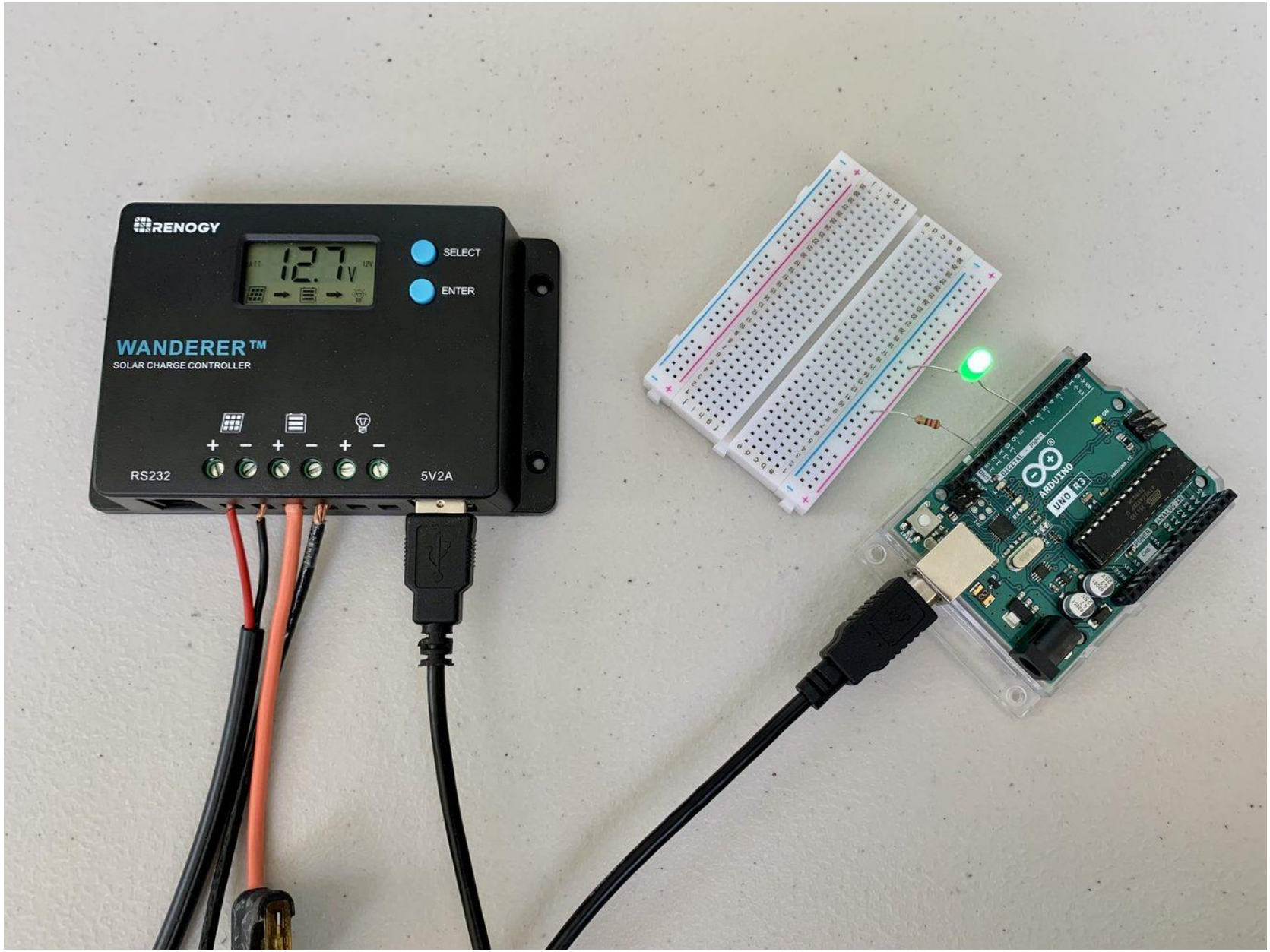


SOLAR POWERED ARDUINO

https://footprinthero.com/how-to-solar-power-an-arduino

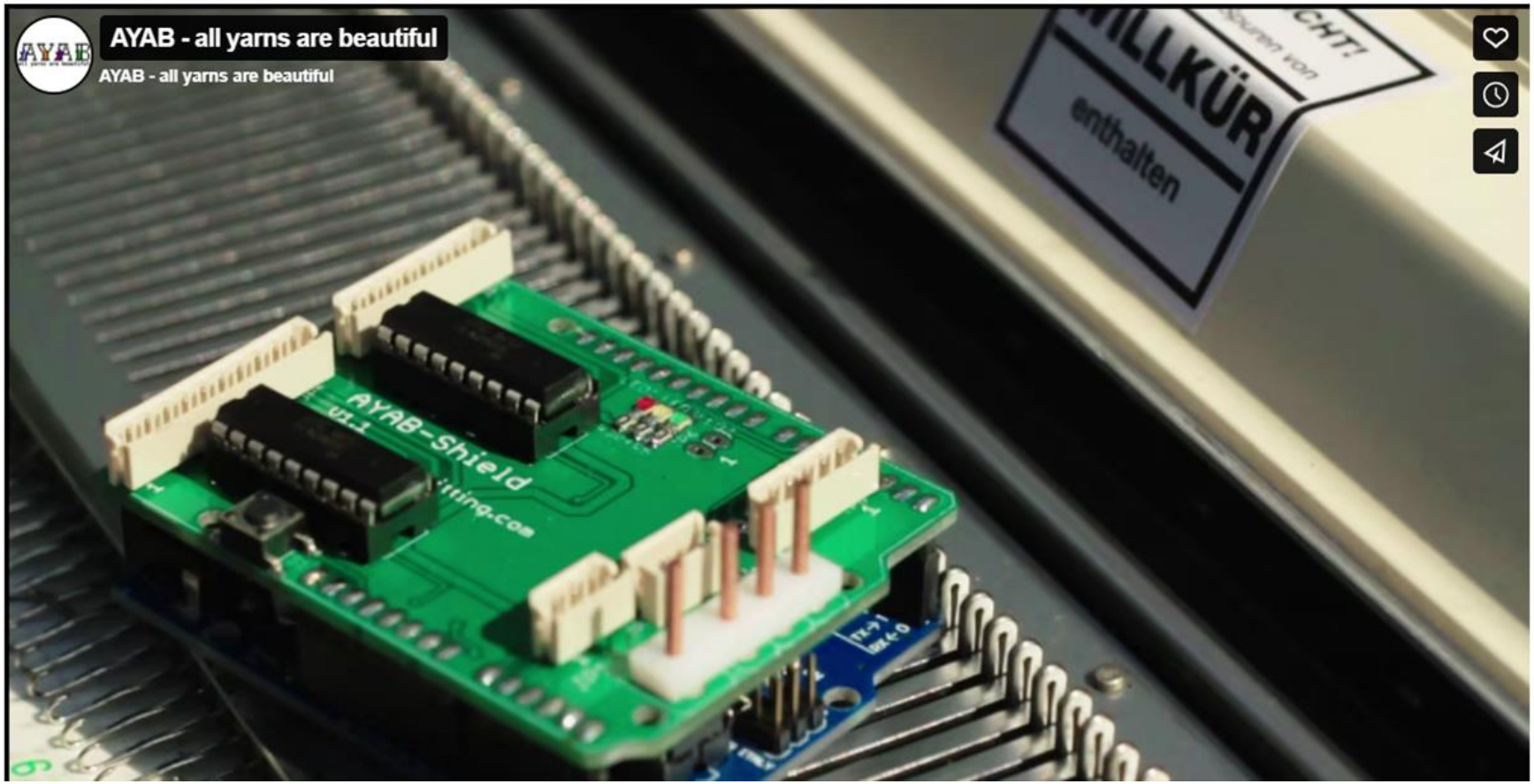
Oggetti e Prodotti

1. **Refurbish:** come ritrasformare un prodotto cambiandogli “il cervello”
2. **Repair:** come riparare prodotti elettronici

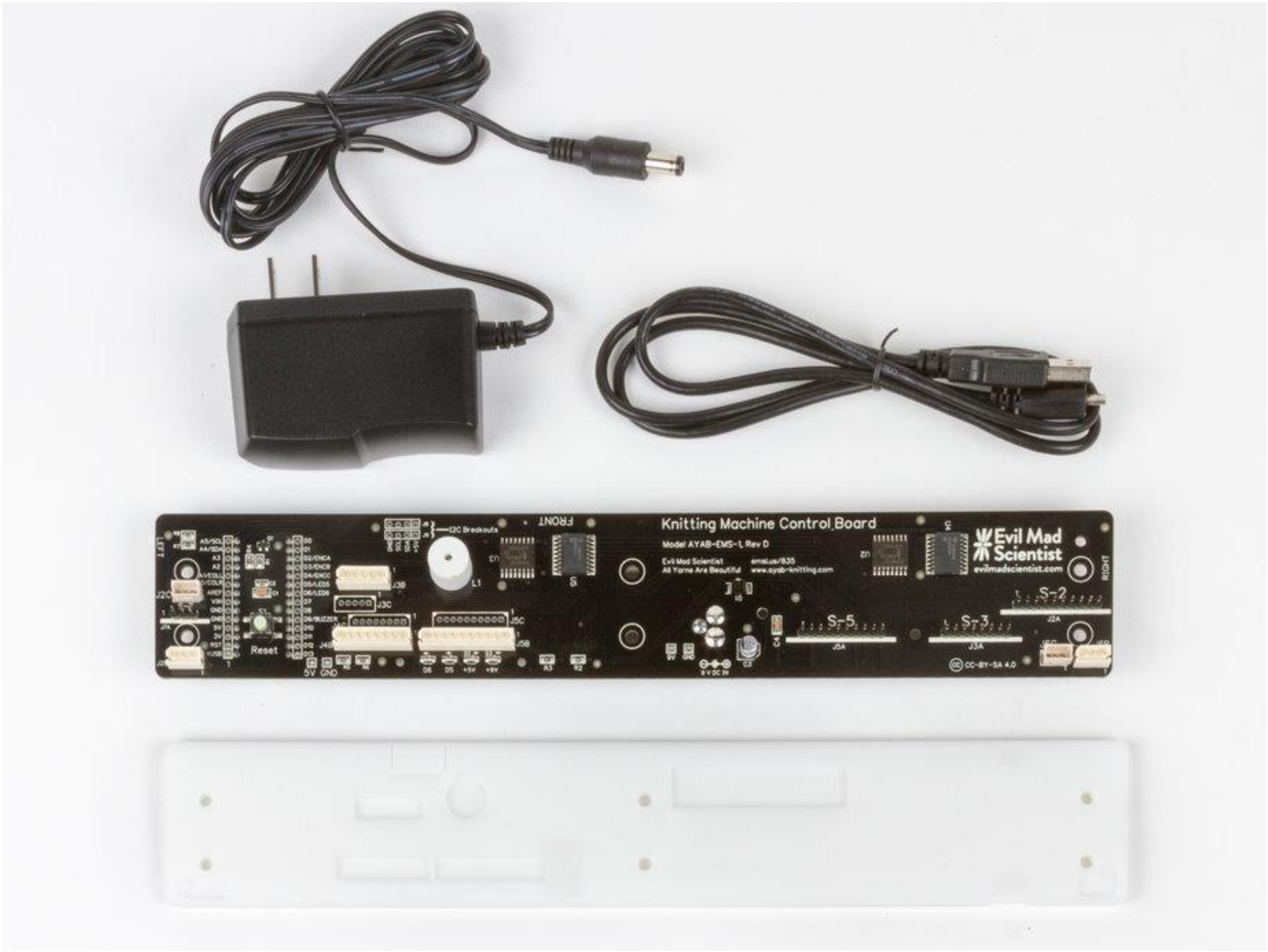
REFURBISH

Come ritrasformare un prodotto cambiandogli “il cervello”

AYAB - all yarns are beautiful



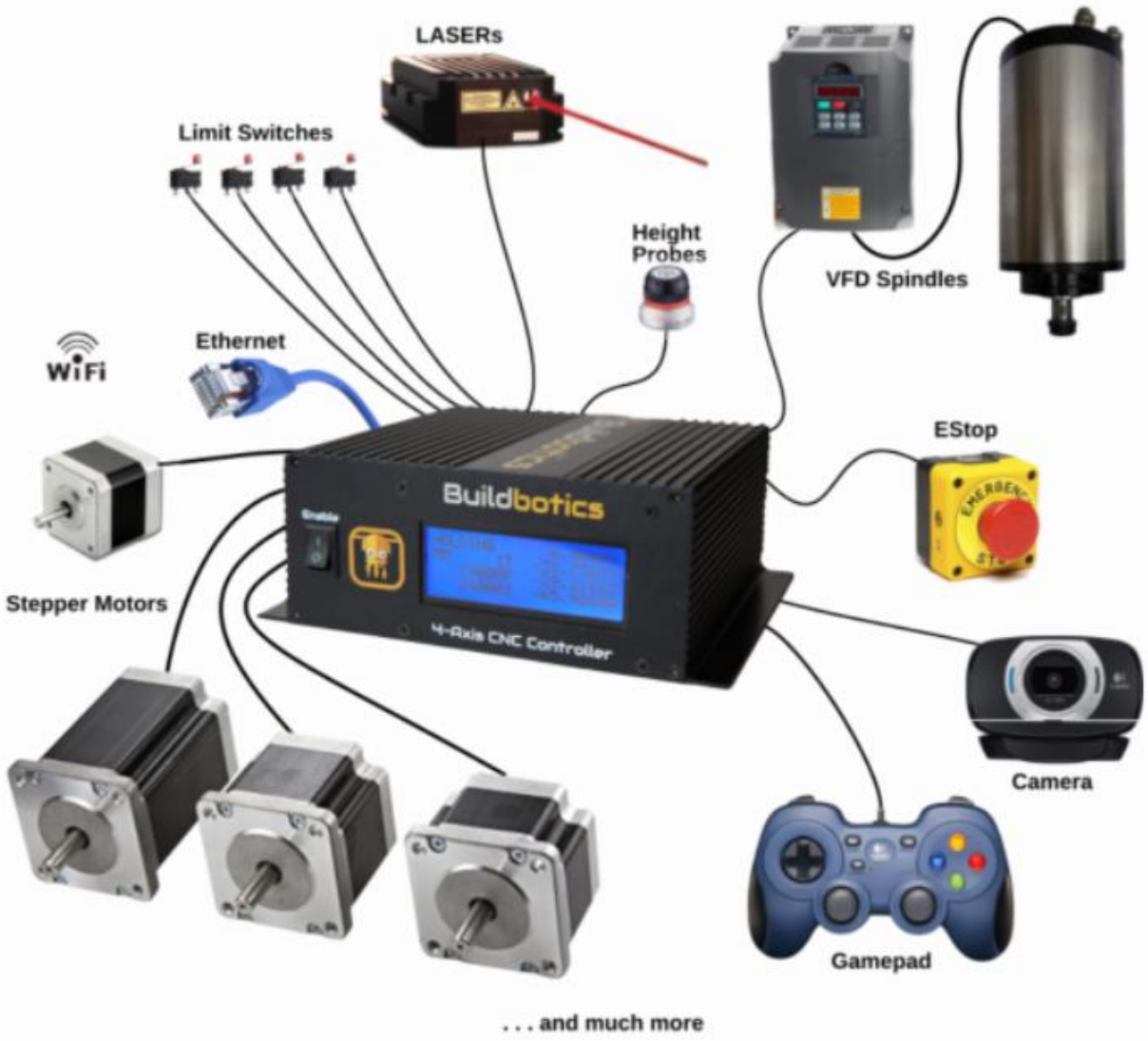
https://www.ayab-knitting.com/



https://www.ayab-knitting.com/

https://www.ayab-knitting.com/

Buildbotics STORE DOCS CONTACT



https://buildbotics.com/

REPAIR

Come riparare prodotti elettronici

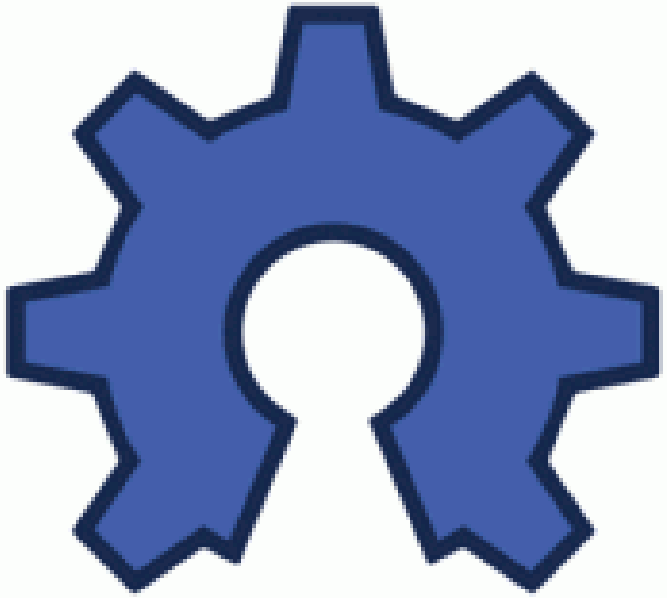
https://youtu.be/BxhyjQBB8Mw?si=mlElqRetXcluypTD

Sistemi e Servizi

1. **Sharing:** Facilitare l'uso condiviso
2. **Open Source:** Come ridurre l'overconsumption di prodotti
3. **Measuring and Awareness:** Come intervenire sui comportamenti delle persone partendo da dati

OPENSOURCE

Come ridurre l’overconsumption di prodotti



open hardware

open source initiative

re:Mix - the circular blender for your own glass jars

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Learn more | Order now

https://www.openfunk.co/

https://www.openfunk.co/

https://www.controllino.com/

INNOVATION BY DESIGN

Revolutionize industrial automation with CONTROLLINO. With our Arduino-compatible PLC you can finally break free from proprietary systems and get rid of vendor lock-ins.

Limitless I/O & connectivity

With up to 61 I/O channels and relays, CONTROLLINO accommodates an almost infinite range of automation and control applications.

Harness the capability of dozens of inputs and outputs, ranging from 5V to 250V at up to 16A, allowing you to connect to a wide variety of sensors and control your assets with maximum flexibility.

100% Arduino-compatible

Experience 100% Arduino compatibility, tapping into the simplicity and flexibility of the Arduino ecosystem.

This drastically speeds up your project's time-to-market, without compromising on reliability and industry-ready performance.

CE, UL & IEC-61131 certified

CONTROLLINO is adhering to the highest industry and electronic safety standards like CE, UL, and IEC 61131 certified.

Fully trust in the reliability of our PLC in any production environment.

https://www.controllino.com/

MEASURING AND AWARENESS

Come intervenire sui comportamenti delle persone partendo da dati

https://www.teachengineering.org/activities/view/ind-2962-arduino-air-quality-monitor-activity

https://www.instructables.com/DIY-Automatic-Shower-Timer/

AREE DI APPLICAZIONE

FOOD

Produzione, trasformazione e smaltimento del cibo

Control and prevention of food spoilage using Arduino

The problem

Food control and spoilage - Reduce

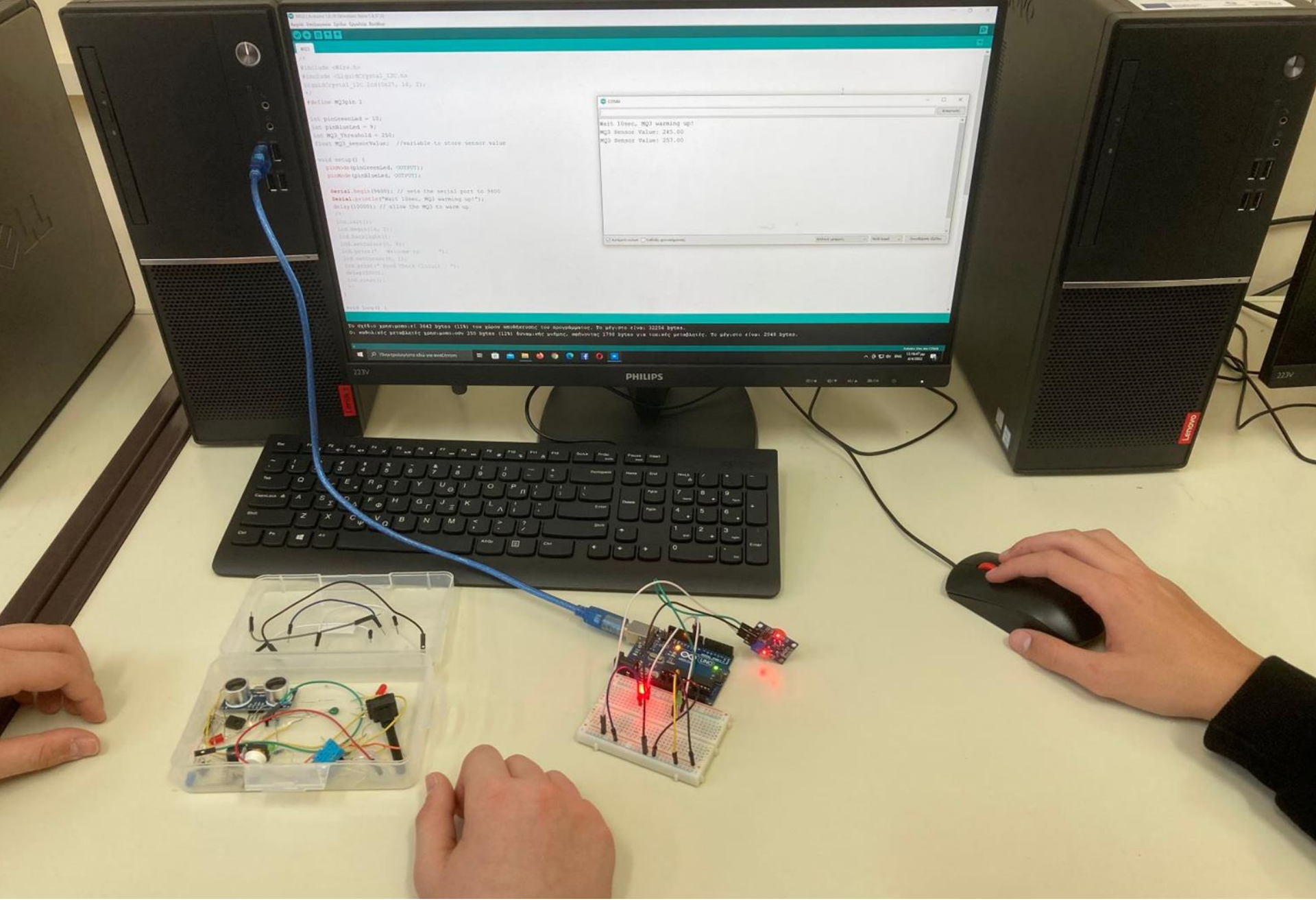
The solution

pH, conductivity, emitted gases and

Updated on

28/05/2022

https://www.schoolofthefuture.eu/en/sall/project/control-and-prevention-food-spoilage-using-arduino



https://www.schoolofthefuture.eu/en/sall/project/control-and-prevention-food-spoilage-using-arduino

FOOD STORAGE MONITORING SYSTEM USING ARDUINO

[1]V. AISHWARYA,[2]G. NAGA SAI KRISHNA CHAITANYA,[3]S. SRIMAN REDDY,
[4]Mr. P. Subrahmanyam
[123]Students,[4] Associate Professor
Department Of Electronics And Communication Engineering
ACE ENGINEERING COLLEGE,Medchal-501301

ABSTRACT

Food safety and hygiene is a major concern in order to prevent the food wastage. The Quality of the food needs to be monitored and it must be prevented from rotting and decaying by the atmospheric factors like temperature, humidity, gas, fire and intruder, etc. Therefore, it is useful to deploy quality monitoring devices at food stores. These quality monitoring devices keep a watch on the environmental factor that cause or pace up decay of the food. Later, the environmental factors can be controlled like by refrigeration, vacuum storage etc. depending on the requirement.

This project work is focused on such a food monitoring system which suggests systematic use of various sensors to perform quality and quantity monitoring and control of food materials. Smart food monitoring is a unit which governs control over various parameters causing decay or rotting of food materials, therefore ensuring appropriate quality of food during various atmospheric changes. This unit also keeps the user notified about the quality and the quantity changes in the unit using the Internet of Things through the Bluetooth technology to the android device and also sends SMS to the authorized mobile through GSM technology.

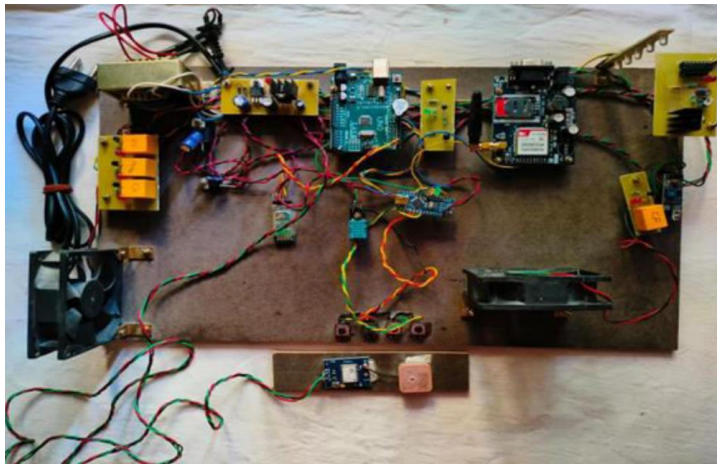
In this project, a food quality monitoring device will be designed that will keep watch of environmental factors like temperature, humidity, gas content, fire intruder, etc. The device is built on Arduino UNO which is a popular prototyping board. The Arduino board is interfaced with various sensors like LM 35 to monitor temperature, MQ2 to detect gas content, IR for intruder and LDR for fire, etc. This is an IoT device and sends the measured sensor data to an android device through its Bluetooth interface as well as a message in the form of SMS through GSM technology. The Bluetooth and GSM Modems are interfaced with the Arduino to transmit the information to the appropriate devices

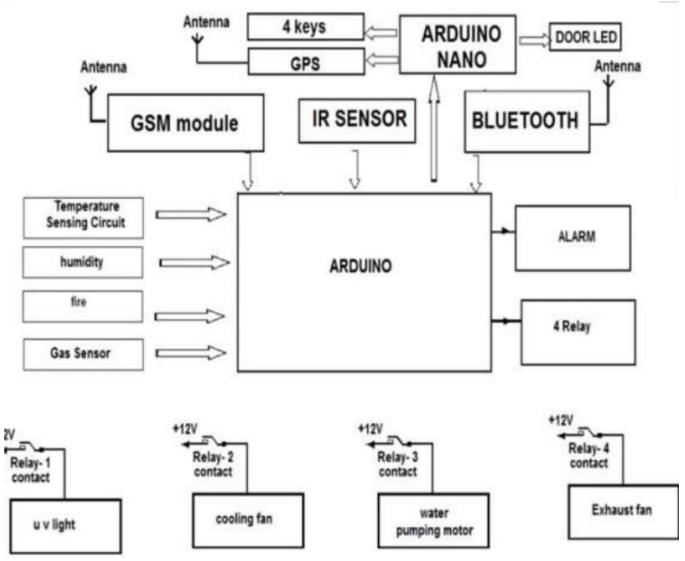
I. INTRODUCTION

monitoring project, we are going to use Arduino Uno board. The Arduino-based system will transmit the data of temperature, humidity gas, fire, intruder etc. sensors to the android device and GSM module.

The job of a control and monitoring systems is to keep an eye on particular thing or activity and to make sure that it stays in the desired manner. Monitoring can be achieved using various electronic sensors. Further these recorded values can be used for the purpose of controlling. The data obtained from sensors can be compared to the desired values. If the sensor readings are found to be unequal to the desired values then the control circuit will come into action to manipulate the assigned activity to keep it in desired manner. We suggest use of this principle for building a system which can preserve raw food. Smart food monitoring system is aimed to monitor and control food materials and prevent it from damages occurring due to atmospheric or climatic changes. But in our project work, only monitoring operation is shown through IoT technology.

Food hygiene and safety is an important issue for human health. There are many factors leading to food poisoning, typically changes in temperature and humidity are important factors. So the monitoring system capable of measuring temperature, humidity and other parameters variability during transport and storage is of prime importance. Today almost everybody is getting affected by the food they consume, it's not only about the junk food, but all the packed foods, vegetables, products consumed and used in daily life, as all of them do not offer quality since their temperature, moisture, oxygen content vary from time to time. Also improper storing of food materials can cause lead to wastage of food. Smart food monitoring system focuses on safe storage of food by monitoring and controlling various parameters affecting food materials. This system makes use of storage units implanted with various electronic sensors which can read those parameters affecting food materials. Design of Control circuits

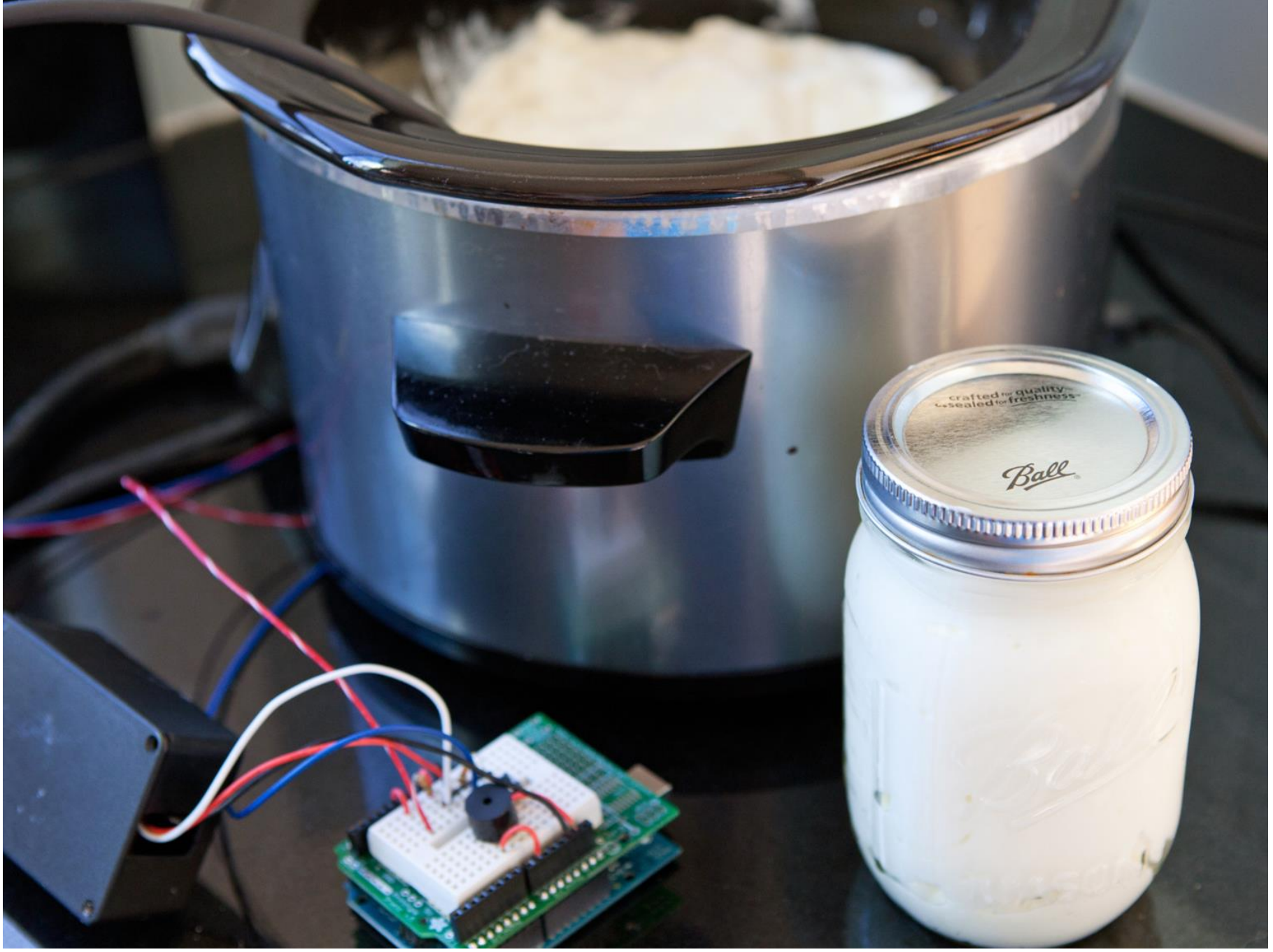




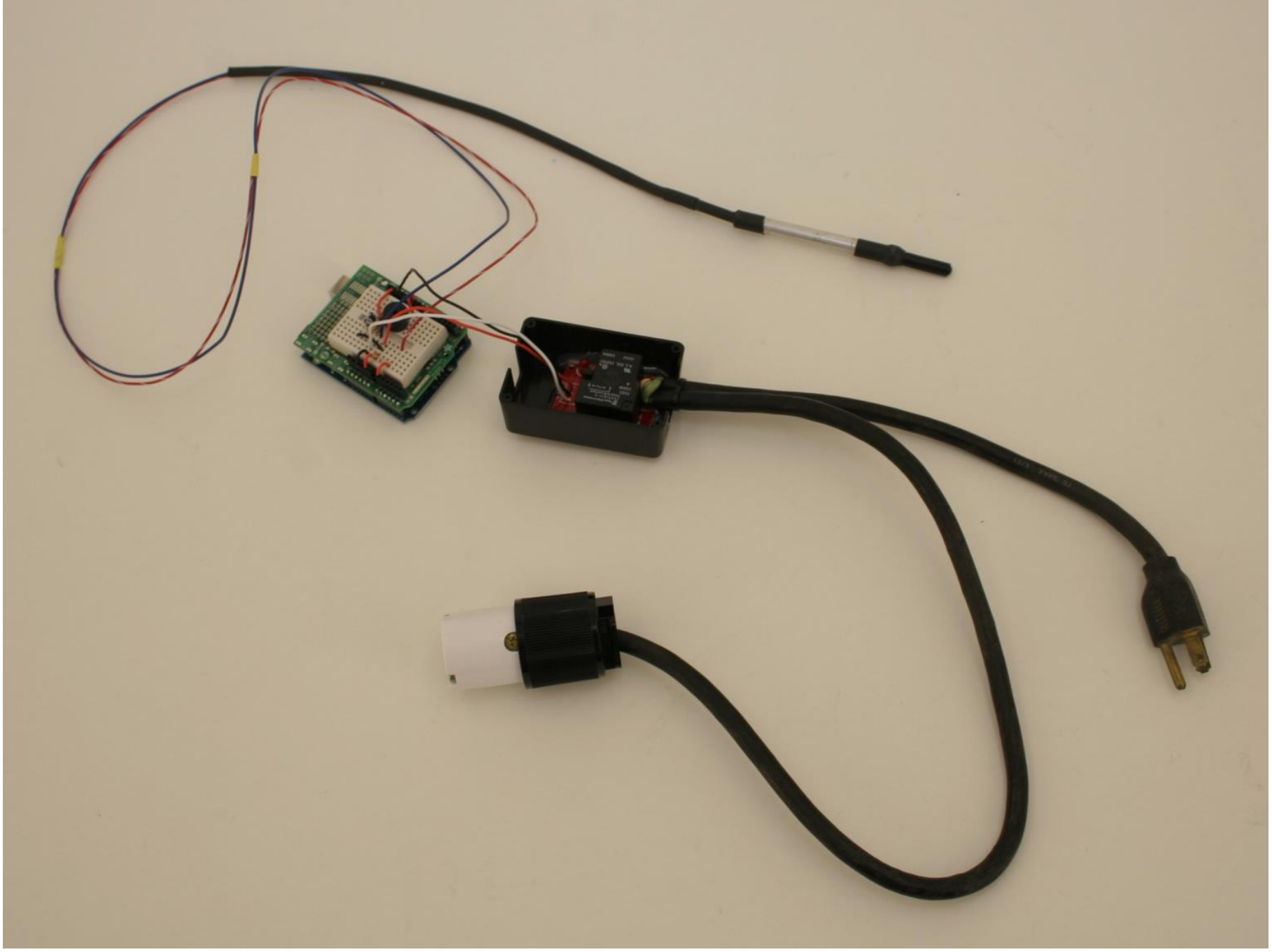
Component
Arduino Uno
DHT11 Sensor
MQ2 Gas Sensor
IR Sensor
LDR
GSM Module
Bluetooth Module
Misc (wires, PCB)

Feature	Arduino-Based Prototype	Commercial System
Temperature Accuracy	±1°C	±0.3°C or better
Humidity Accuracy	±1% (DHT11, uncalibrated)	±2% RH (calibrated)
Gas Detection	General presence	Quantified ppm detection
Connectivity	Bluetooth + GSM (basic)	Cloud, Wi-Fi, LoRa, Cellular
Compliance	❌ None	✅ Often certified (FDA, etc.)
Data Logging	❌ (unless added)	✅
Cost	~$30–40	$300+
Suitability	DIY, small-scale	Professional/industrial use

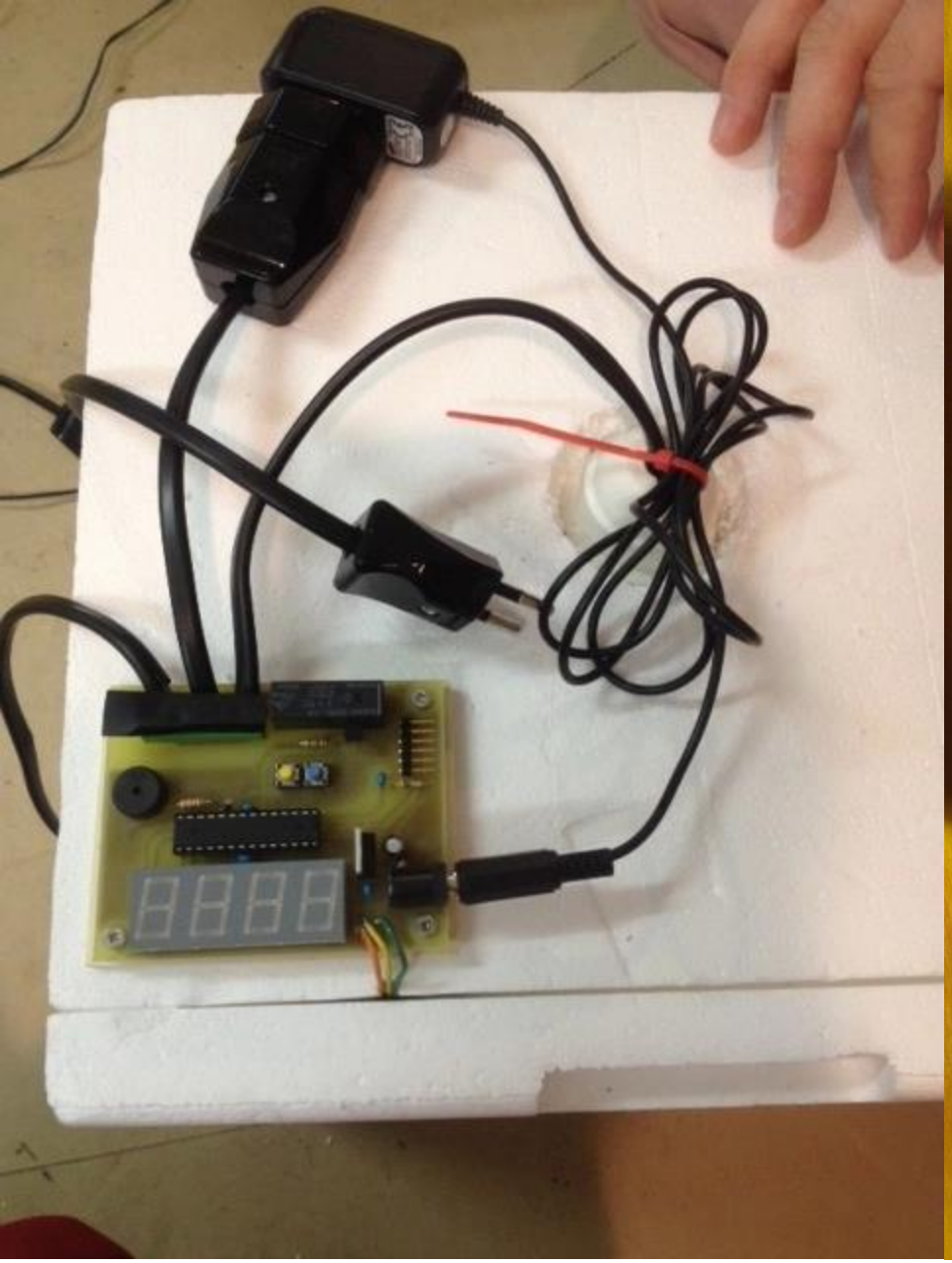
https://jespublication.com/uploads/2023-V14I6063.pdf

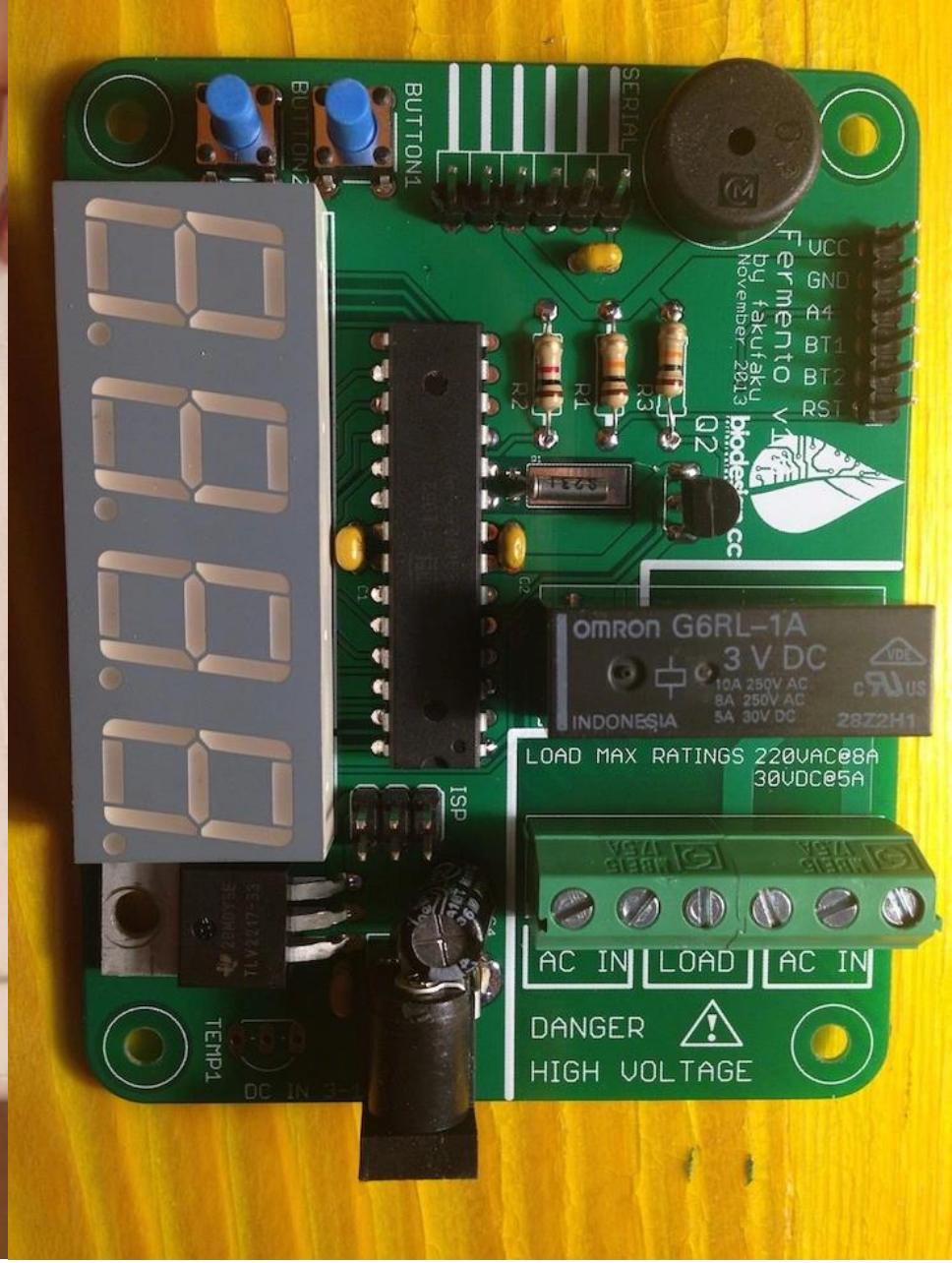


https://makezine.com/projects/yobot-arduino-yogurt-maker/



https://makezine.com/projects/yobot-arduino-yogurt-maker/





https://makezine.com/projects/yobot-arduino-yogurt-maker/

Emmanuel Biketi, Horticulture Manager at Kikaboni Farm in Olooloitikosh, Kenya with an Upande temperature and relative humidity IoT device.

https://d-lab.mit.edu/research/mit-d-lab-cite/internet-things-low-cost-sensors-agriculture

Seeds of Silicon: Internet of Things for Smallholder Agriculture

https://d-lab.mit.edu/sites/default/files/inline-files/MIT%20CITE%20-%202019%20-%20Seeds%20of%20Silicon-%20Internet%20of%20Things%20for%20Smallholder%20Agriculture%203_0.pdf

https://farm.bot/

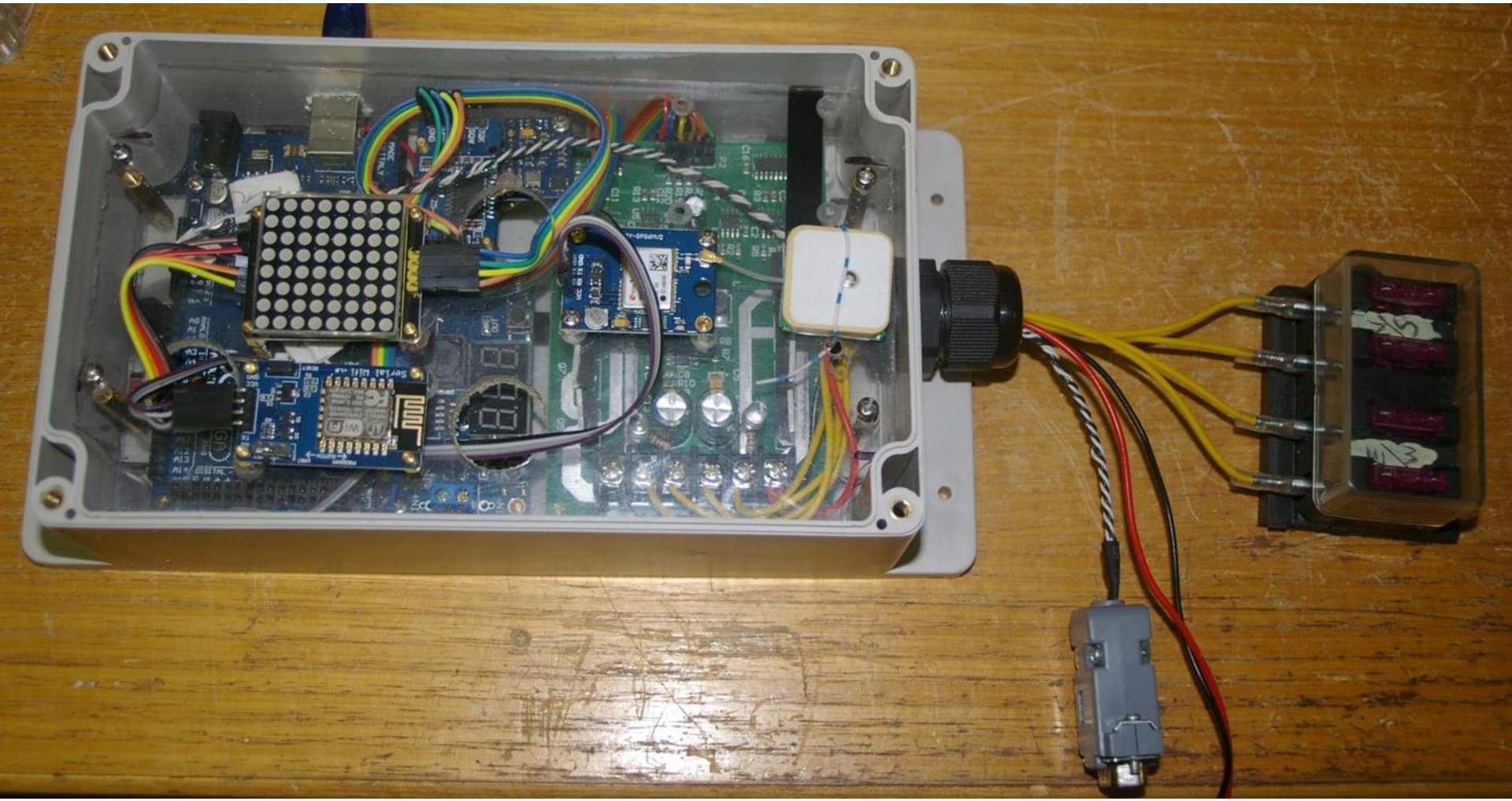
https://www.youtube.com/watch?v=yHy8rJpbxH4&t=1s&ab_channel=FarmBot

https://farm.bot/

ENERGY

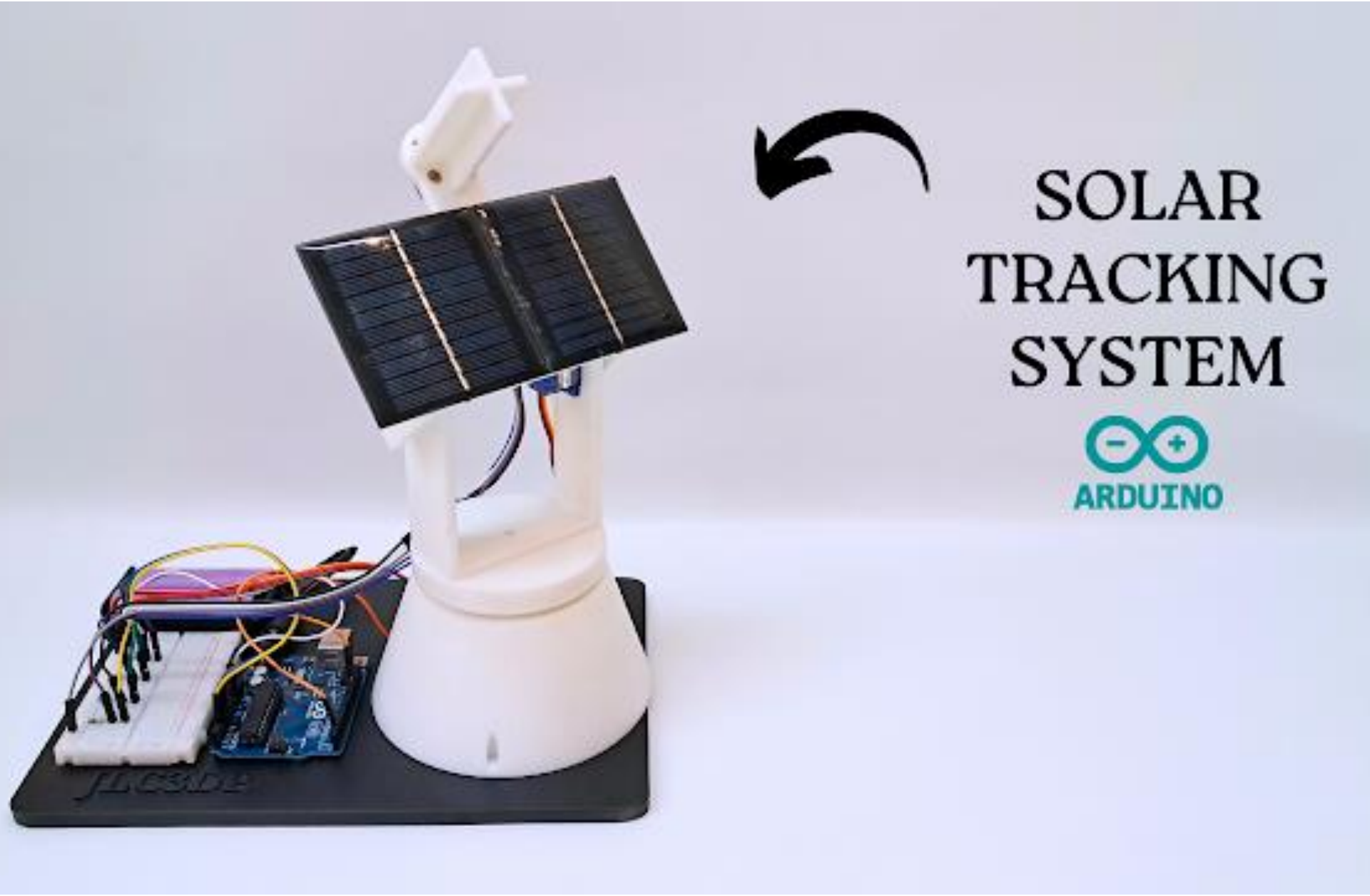
Produrre meglio, misurare i consumi,
usare meno.

https://projecthub.arduino.cc/dougal/mega-solar-tracker-856ab8



https://projecthub.arduino.cc/dougal/mega-solar-tracker-856ab8

https://www.instructables.com/Simple-3-Phase-Arduino-Energy-Meter/



https://simplecircuitslol.blogspot.com/2024/12/solar-tracking-system.html

https://simplecircuitslol.blogspot.com/2024/12/solar-tracking-system.html

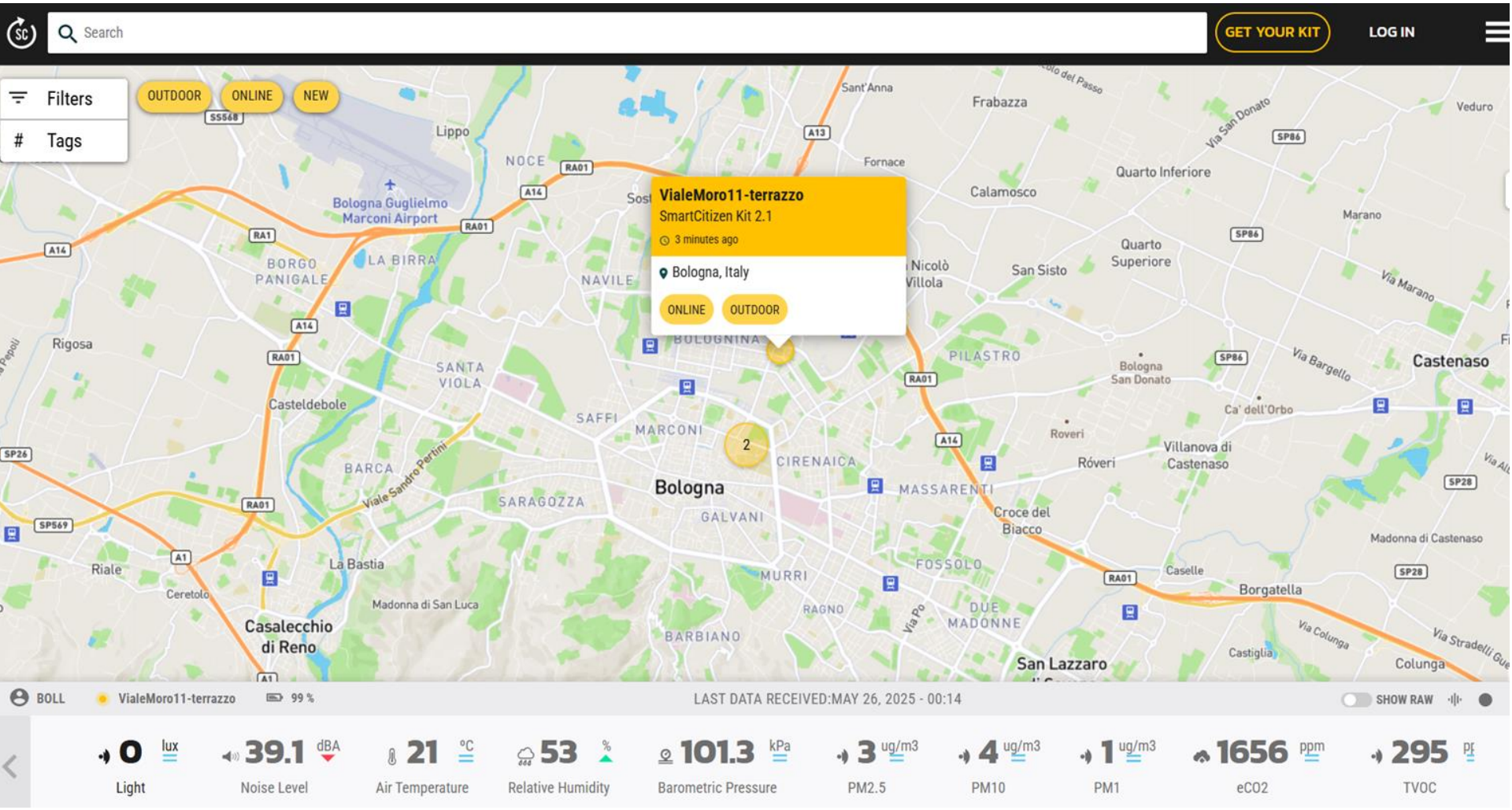
CITIZEN SCIENCE

Intervenire sui comportamenti delle persone partendo da dati

https://smartcitizen.me/

https://smartcitizen.me/

https://smartcitizen.me/



https://smartcitizen.me/

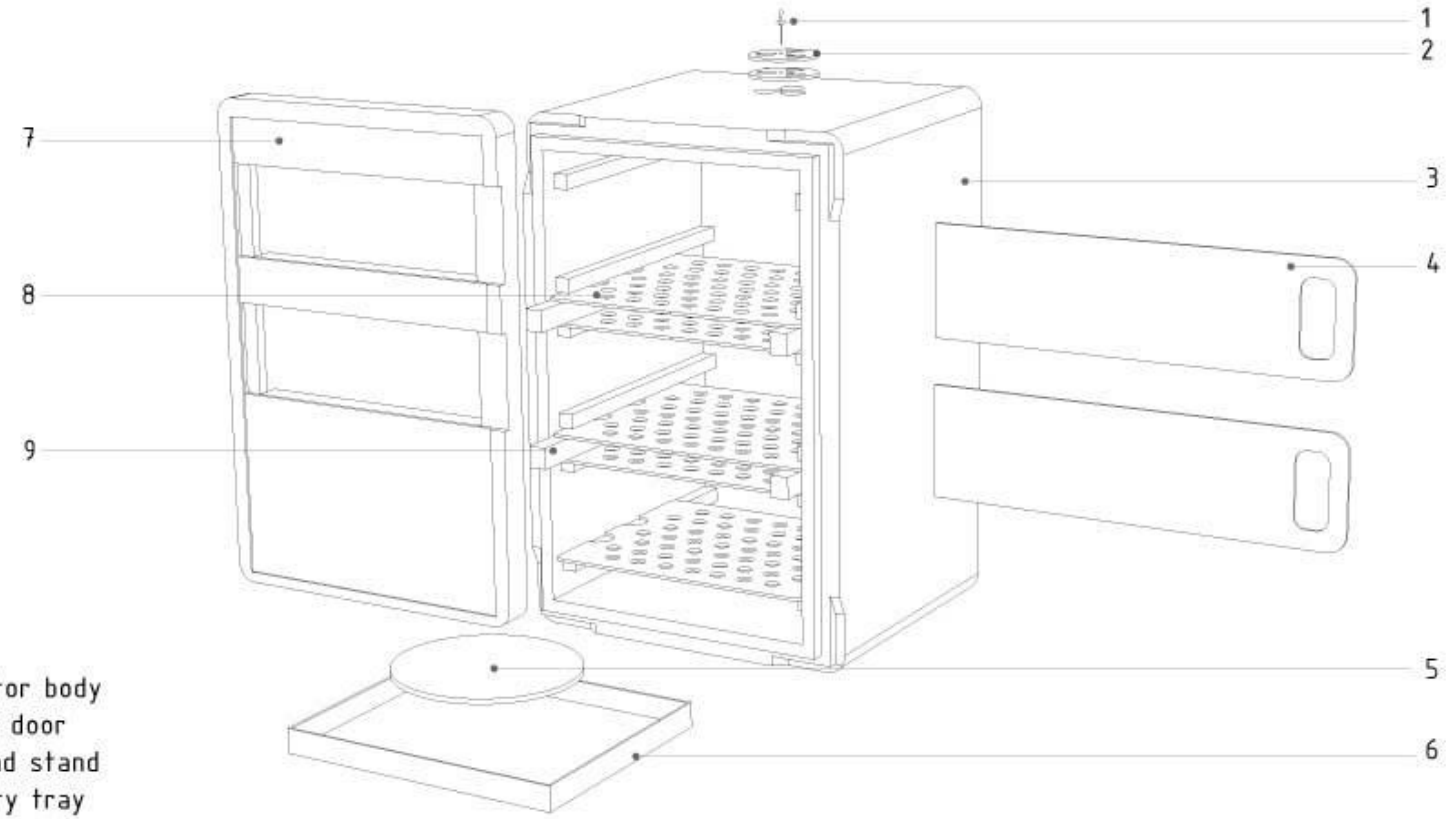
MATERIALI

Realizzare attrezzatura a basso costo che aiuti a sperimentare con nuovi materiali

https://gitlab.fabcloud.org/wendy/multi-processing-machine

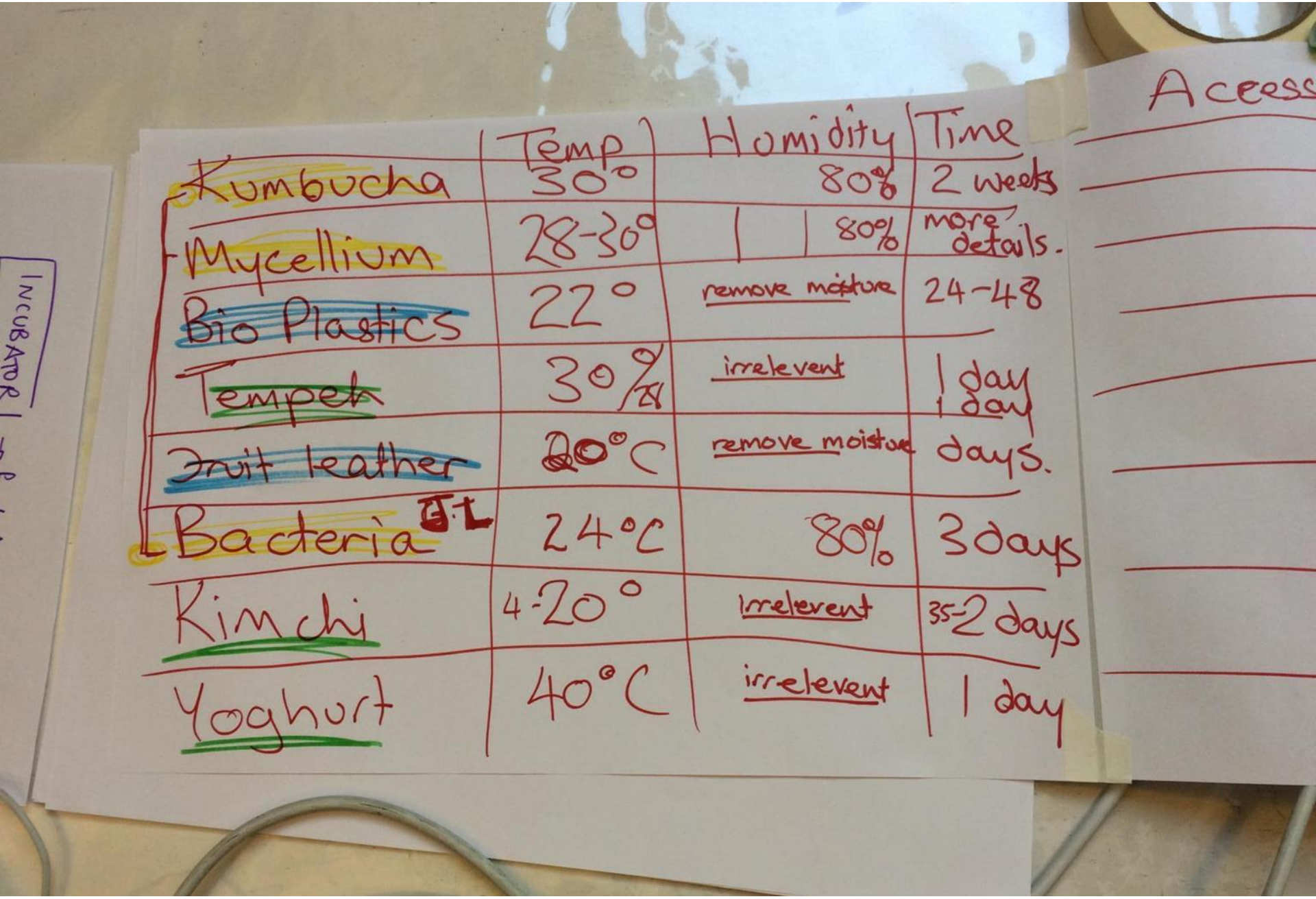
MPM

Multi Processing Machine



1. Rivet
2. Vent
3. Incubator body
4. Sliding door
5. Heatpad stand
6. Humidity tray
7. Incubator lid
8. Shelves
9. Spacers

https://gitlab.fabcloud.org/wendy/multi-processing-machine



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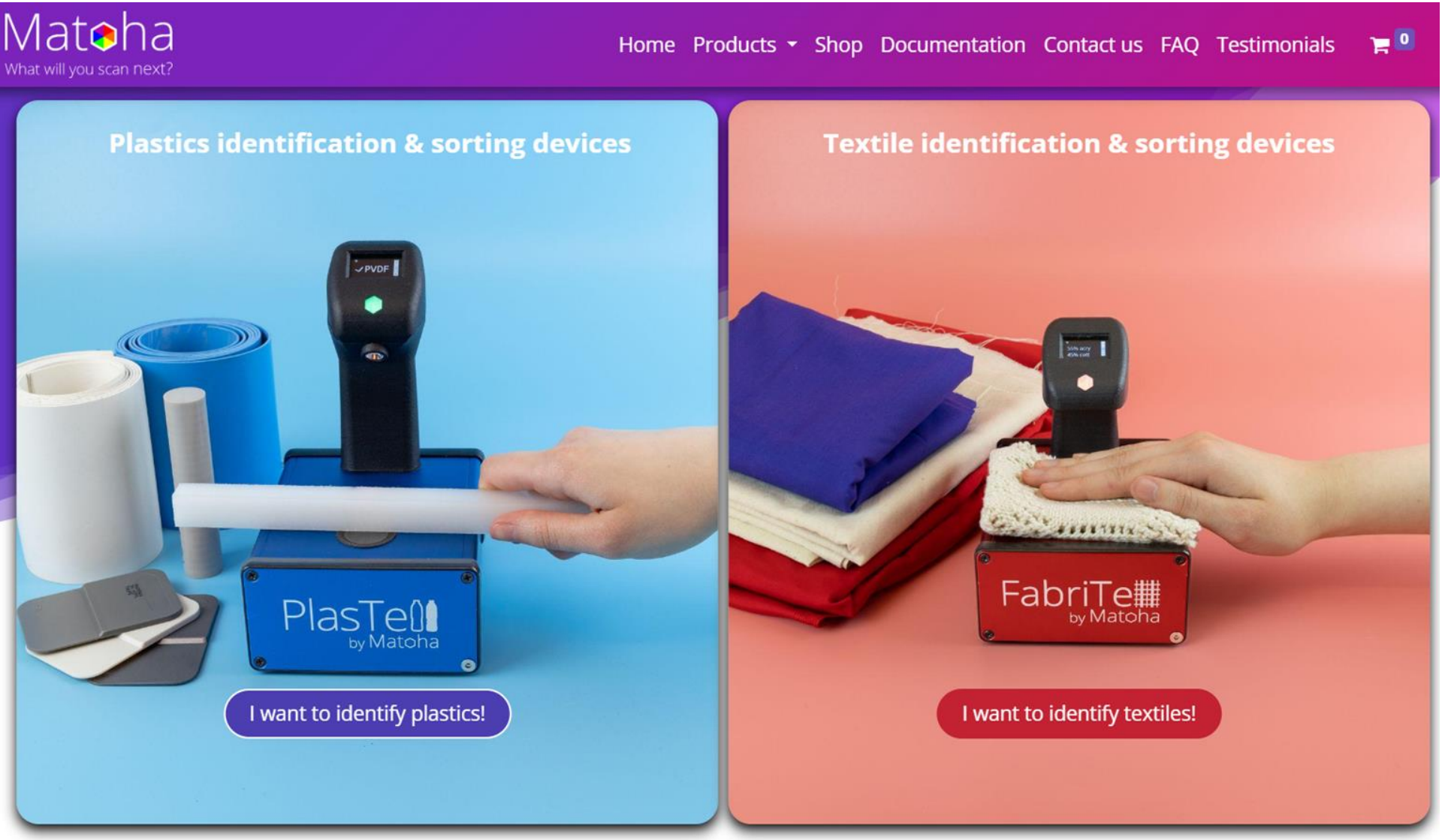
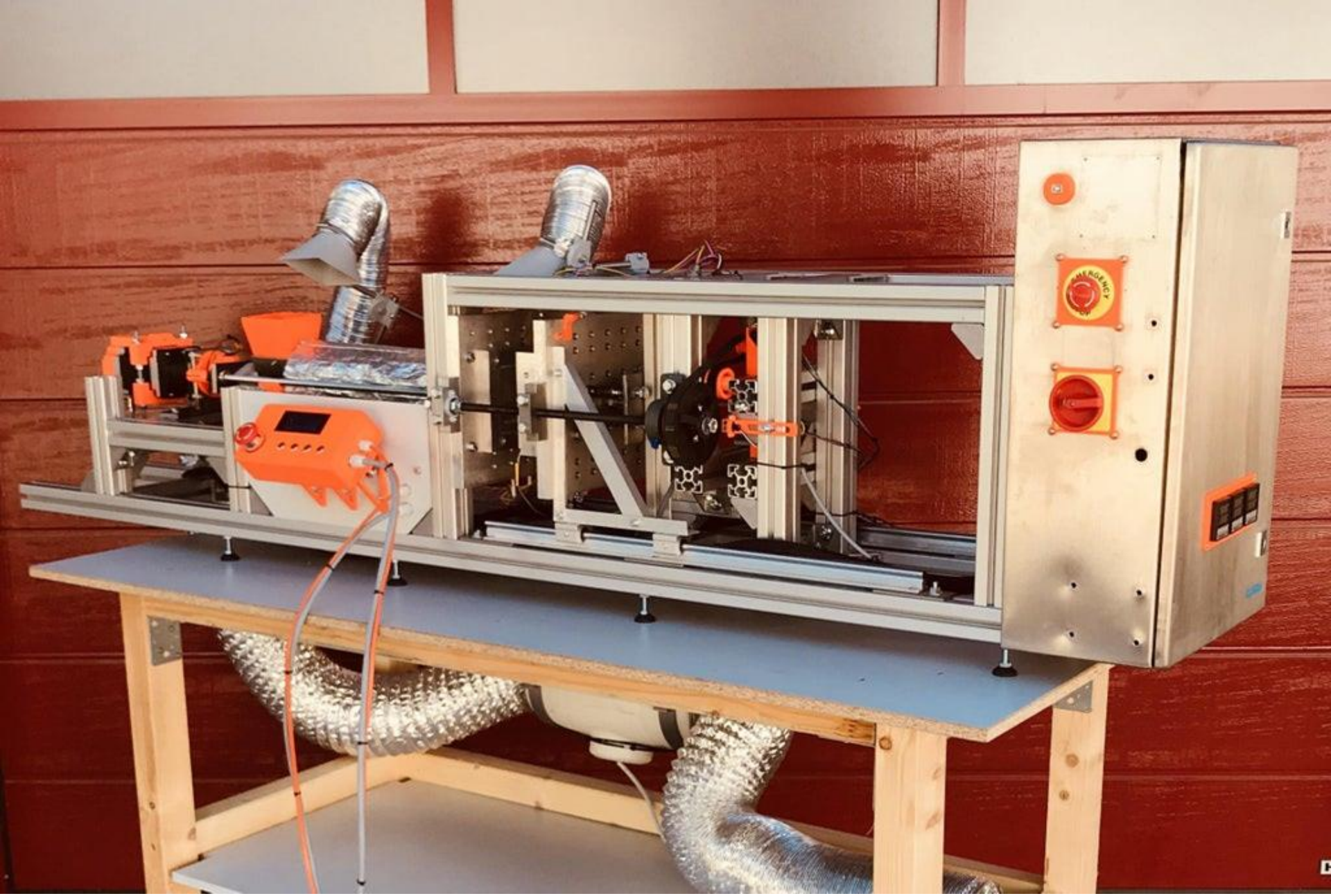


https://matoha.com/

https://matoha.com/

RECYCLING

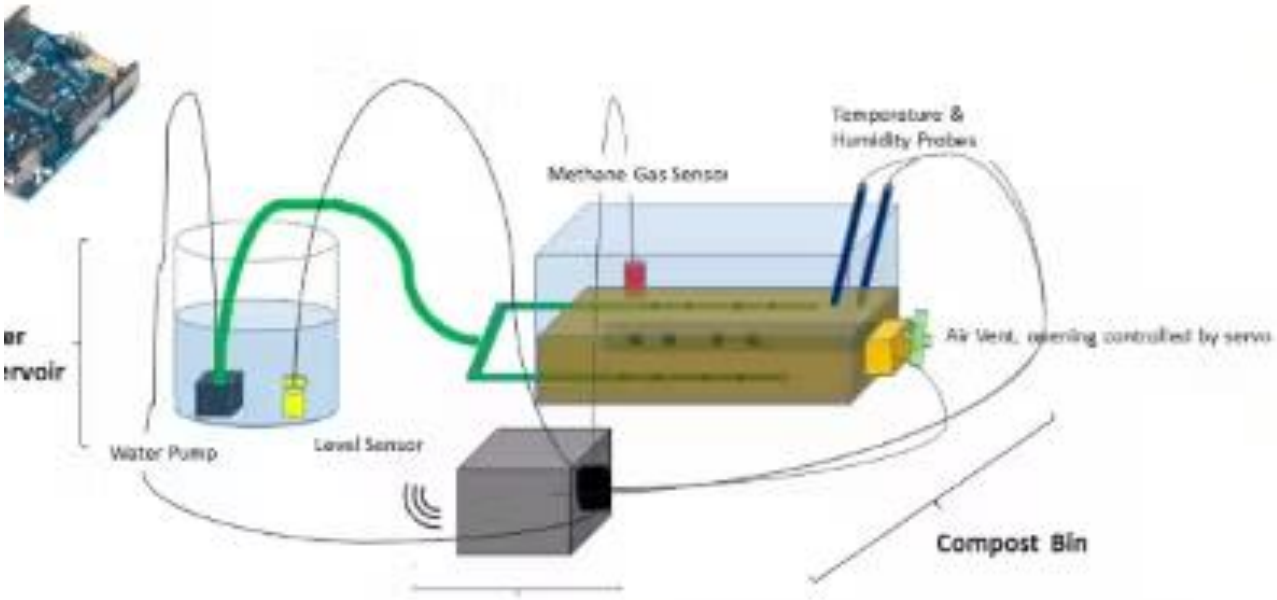
Rigenerare materiali, trasformarli e riusarli



https://blog.arduino.cc/2020/11/24/homemade-recycling-rig-turns-plastic-waste-into-new-products/

https://blog.arduino.cc/2020/11/24/homemade-recycling-rig-turns-plastic-waste-into-new-products/

Smart Composting System



Satellite Station

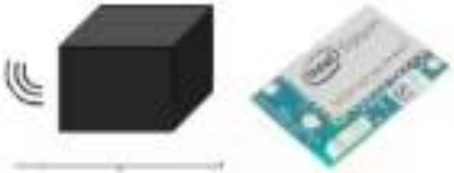
Enclosure houses Arduino 101, measures ambient temperature and communicates via BLE

Kitchen Bin Station

Enclosure houses Arduino with Ultrasonic Distance detector to measure if bin is full

Dashboard

Data either from Base Station

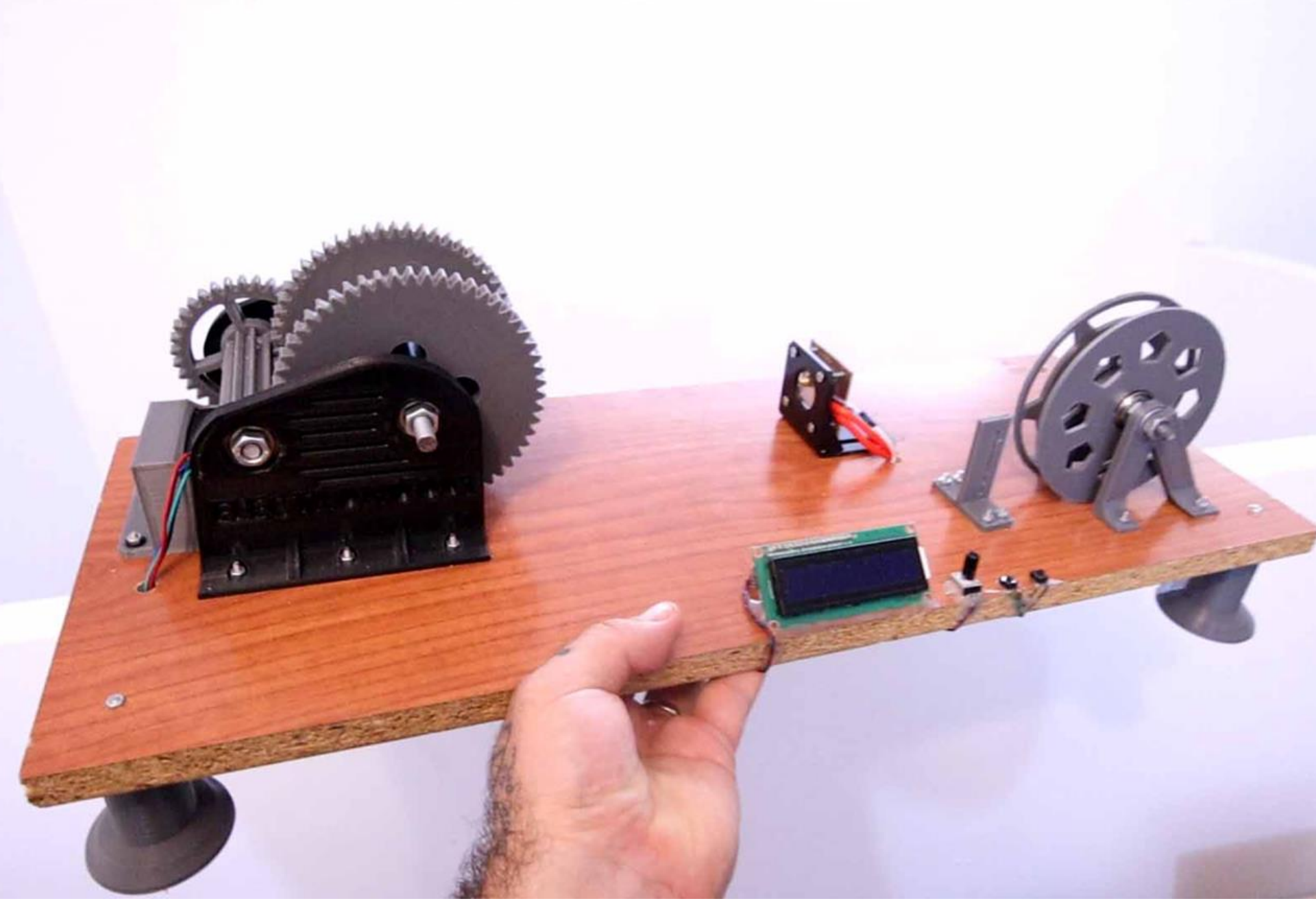


Base Station

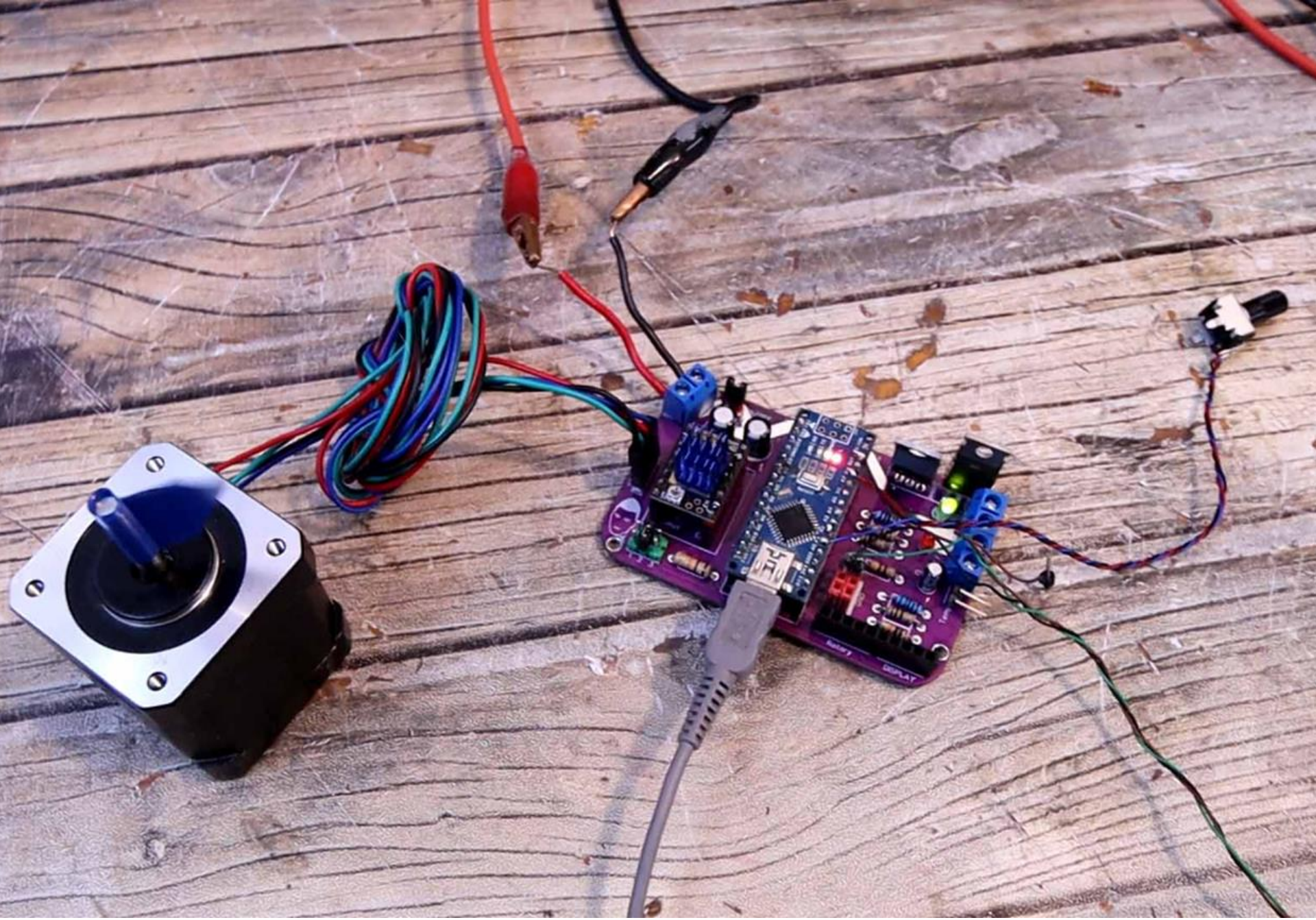
Enclosure houses Intel Edison – analyzes data, persists data, and generates recommendations. Also hosts website.

https://www.hackster.io/team-boomer-sooner/smart-compost-system-0037d7

https://www.hackster.io/team-boomer-sooner/smart-compost-system-0037d7



https://electronoobs.com/eng_arduino_tut174.php



https://electronoobs.com/eng_arduino_tut174.php

IN SINTESI

IN SINTESI

- saper progettare e utilizzare tecnologie digitali opensource può avere un grande impatto per creare soluzioni sostenibili
- i livelli di intervento sono molteplici e hanno approcci e strategie diverse

IN SINTESI

- Il primo livello riguarda i materiali e i componenti dei prodotti
- Recover: come riutilizzare componenti che rischiano di essere gettati
- Reduce: è possibile usare meno energia
- Renewable: si può lavorare con energia sostenibile e rinnovabile

IN SINTESI

- Il secondo livello riguarda i prodotti
- Si può riparare un prodotto (ed eventualmente migliorarlo) usando soluzioni opensource
- Strumenti di produzione possono essere ammodernati e resi più efficienti con strategie di retrofitting

IN SINTESI

- L’ultimo livello è più sistemico, in cui si può lavorare per spingere l’adozione e lo sviluppo di nuove soluzioni opensource
- A volte avere a disposizione dati e informazioni aiuta a capire meglio un problema e a cambiare il proprio comportamento.

GRAZIE!

Enrico Bassi
enrico@enricobassi.com
https://www.linkedin.com/in/enricobassi/