Getting the Right Tools

Developed by Ludor Engineering

A Trainers Toolkit To Foster STEM Skills Using Microcontroller Applications

Co-funded by the Erasmus+ Programme of the European Union

Project No. 2019-1-RO01-KA202-063965

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Choosing a Motor Controller

Content

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Introduction

- The microcontroller applications can be very different in terms of complexity, components, time (can be temporary or permanent), etc. Accordingly, the necessary tools and equipment will vary from case to case.
- In this section we will describe some tools and equipment commonly used by makers for projects involving microcontrollers.

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Mechanical tools

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Essential mechanical tools

- Screwdrives – several types are needed, including flat/slotted, cross slot/Phillips. Also, both small and regular screwdrivers are required.
- Needle nose pliers are very helpful to handle the tiny electronic components.

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Essential mechanical tools

- Scissors, ruler, pen, marker pencil, handheld cutting tools – all are basic tools any maker shall have around.

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Rotary tools

- Very versatile – they can cut, drill, clean, sand, engrave, polish, etc.

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Drill

- Drills are very useful when in need to make holes or enlarge existing holes. They can also drive fasteners.

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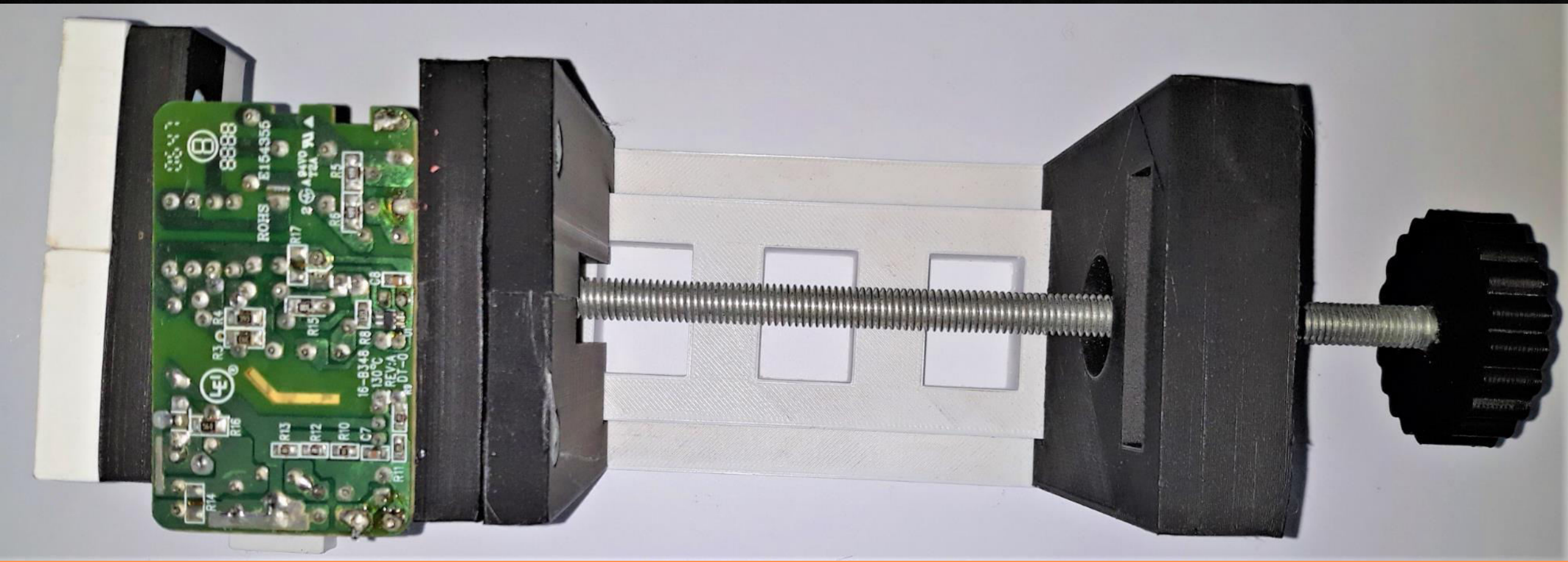
Vise

- Helps holding parts and materials firmly in place while working them, improving precision, quality and reducing risks of damaging.



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Electrical tools

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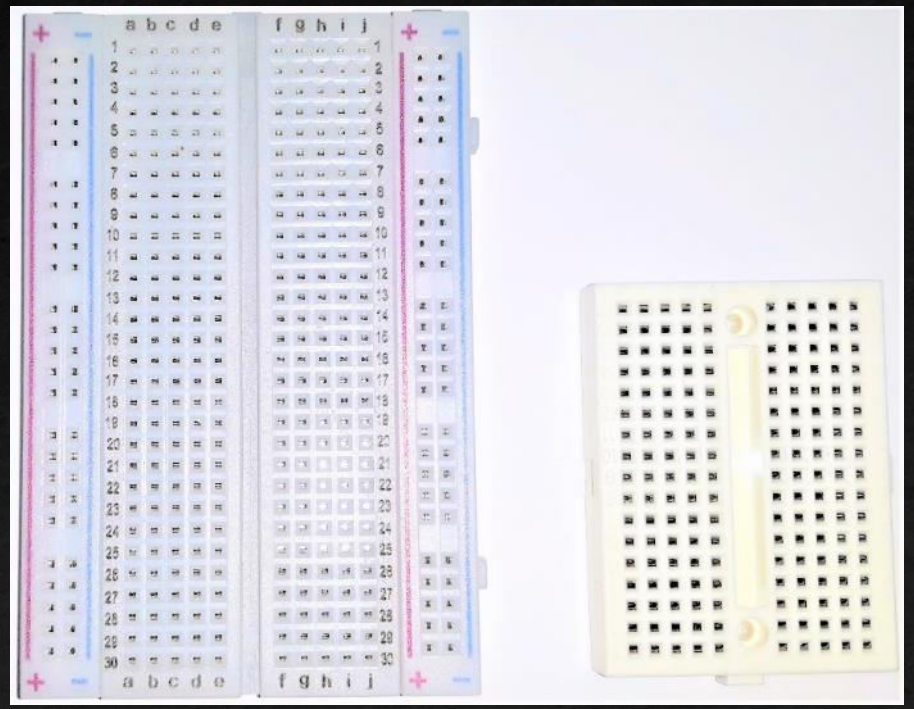
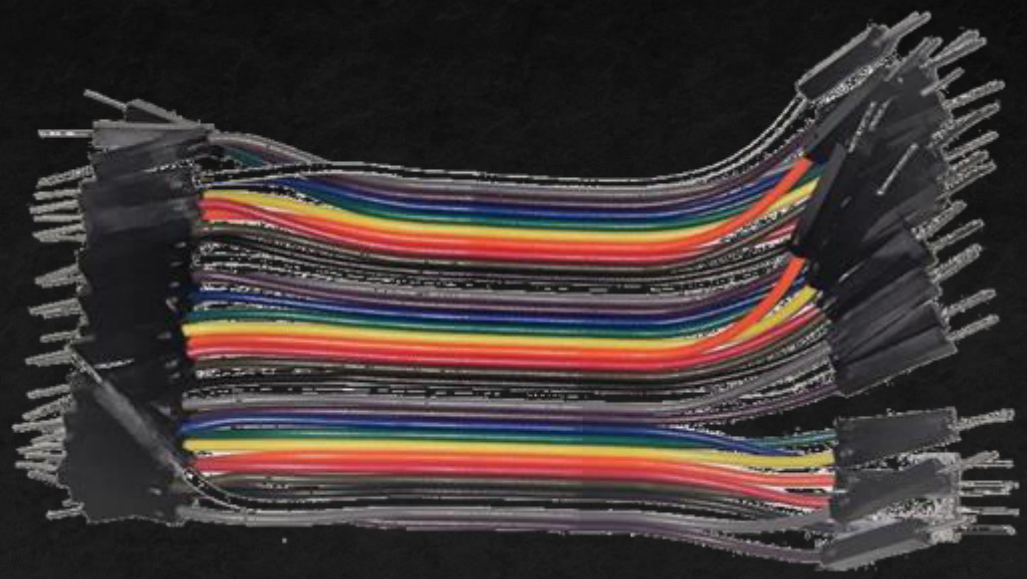
Breadboards and jumper wires

- A breadboard is a rectangular plastic board, designed to allow creating circuits without the need for soldering.
- Jumper wires are wires used for building circuits on a breadboard.





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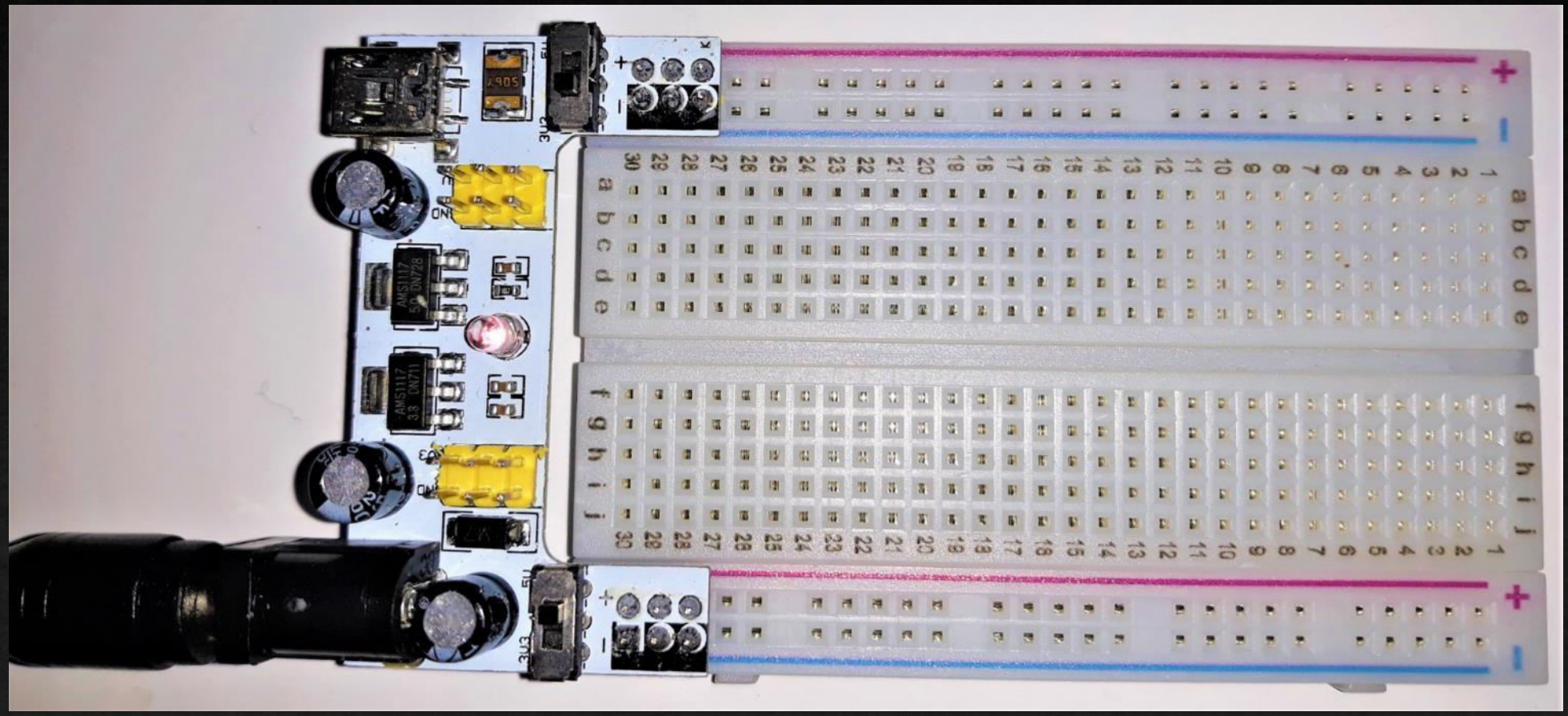
Breadboards power supply

- They are convenient, reliable and easy to use power sources, useful in most microcontroller applications.



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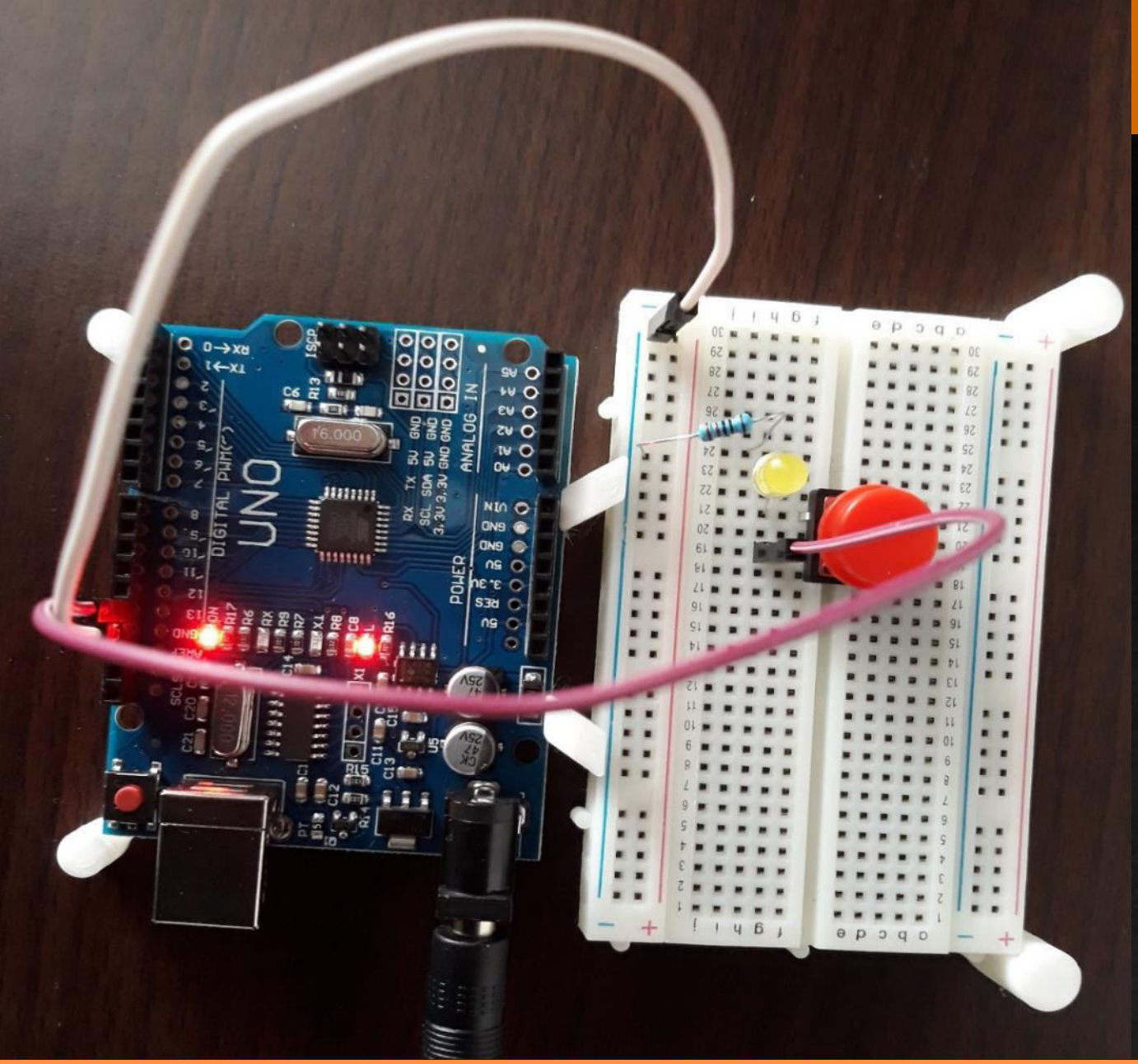

Solderless circuits

- Breadboards and jumper wires are essential for building circuits that don’t require soldering.
- Are a great way to start with the microcontroller applications and their main advantages are:
  - Adjustability – allows for easy modifications and debugging.
  - Flexibility – the components can be easily rearranged, added, removed, reused.
  - Ideal for testing circuits.
  - Best solution for temporary prototypes.

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Soldering tools and materials

- Useful for making permanent circuits that require soldering.

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Multimeter

- A multimeter is very useful when need to measure voltage, current and resistance.

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Power adapters

- A convenient way to obtain the power needed by microcontroller applications.

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Miscellaneous tools

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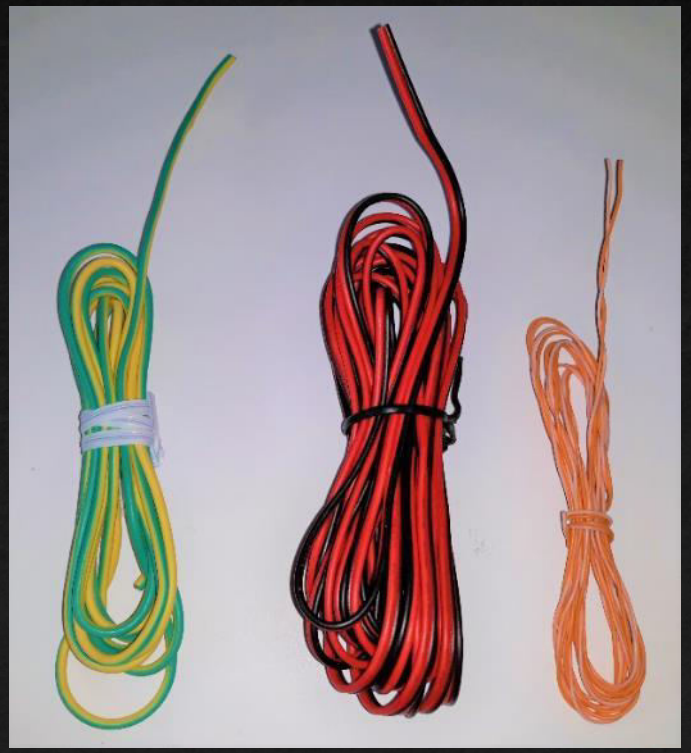
Wire, tape

- Different wire gages are needed – the most common wire diameter used in microcontroller applications is AWG 22 (0.65 mm diameter). Some bigger diameter wires may be needed in applications involving higher current.
- Duct and electrical tape



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Hot glue gun

- Very useful tool, allowing for fixing parts, creating spacers, filling voids, building bridges, etc.

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Vernier caliper

- Allows for more precise measurements of parts dimensions, diameters or depths.

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Software

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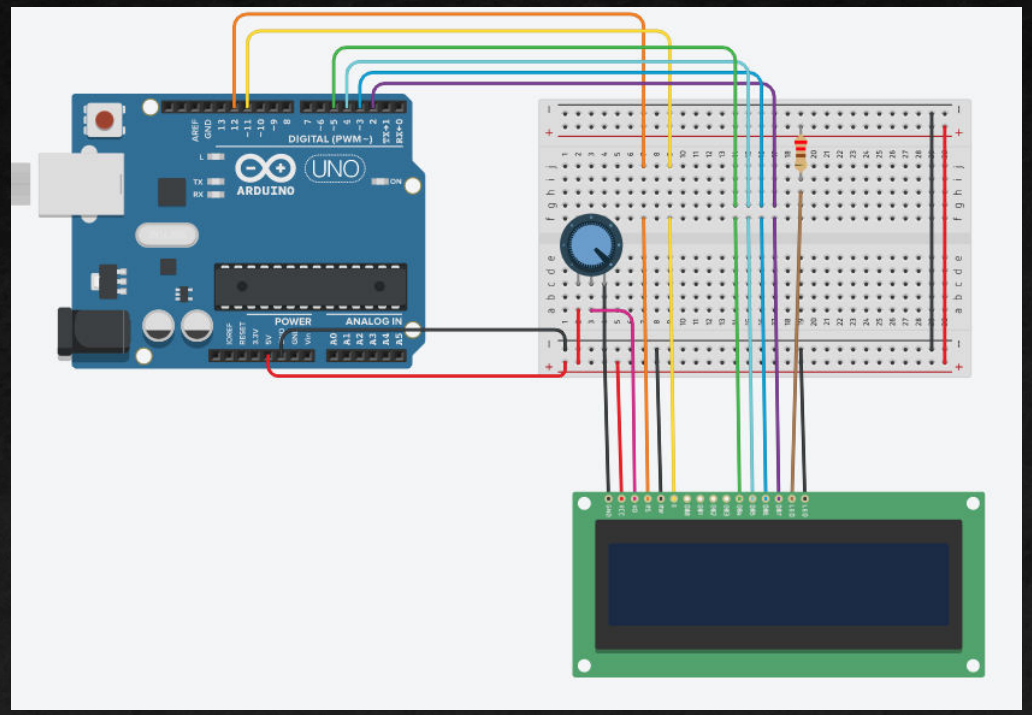
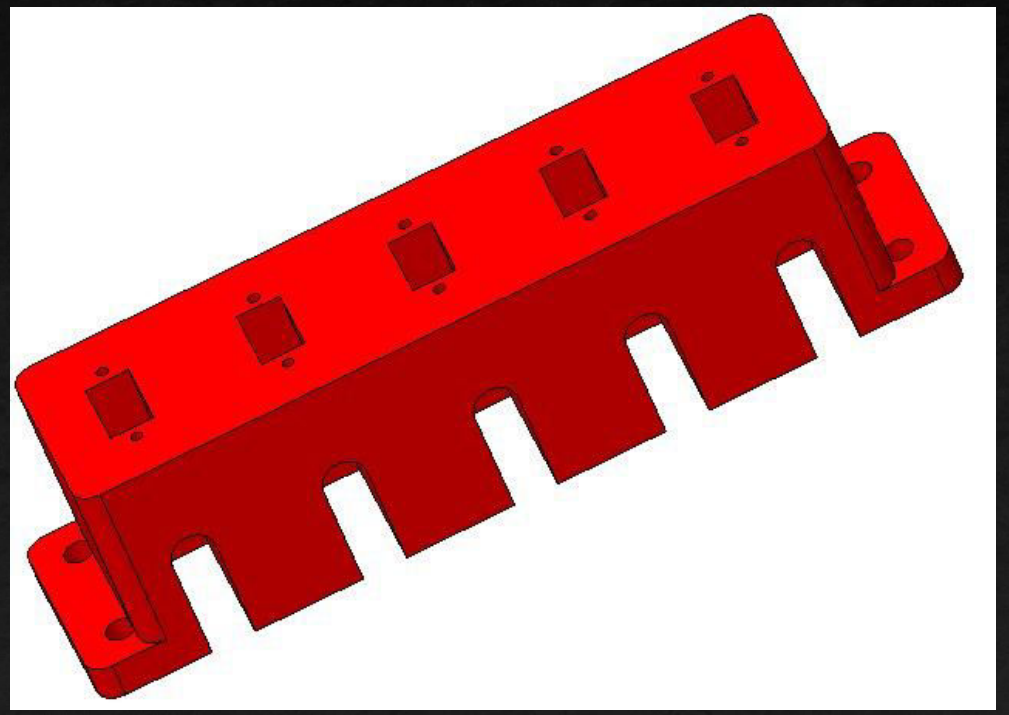
CAD software

- CAD software is very useful to design, 3D model and/or simulate a microcontroller application or when it's necessary to design specific parts for microcontroller applications. These parts can be then mad using 3D printing, laser cutting, CNC machining, etc.
- There are many CAD software available, some of them are free or can be freely used for education (for example TinkerCAD, Google SketchUp, Blender)





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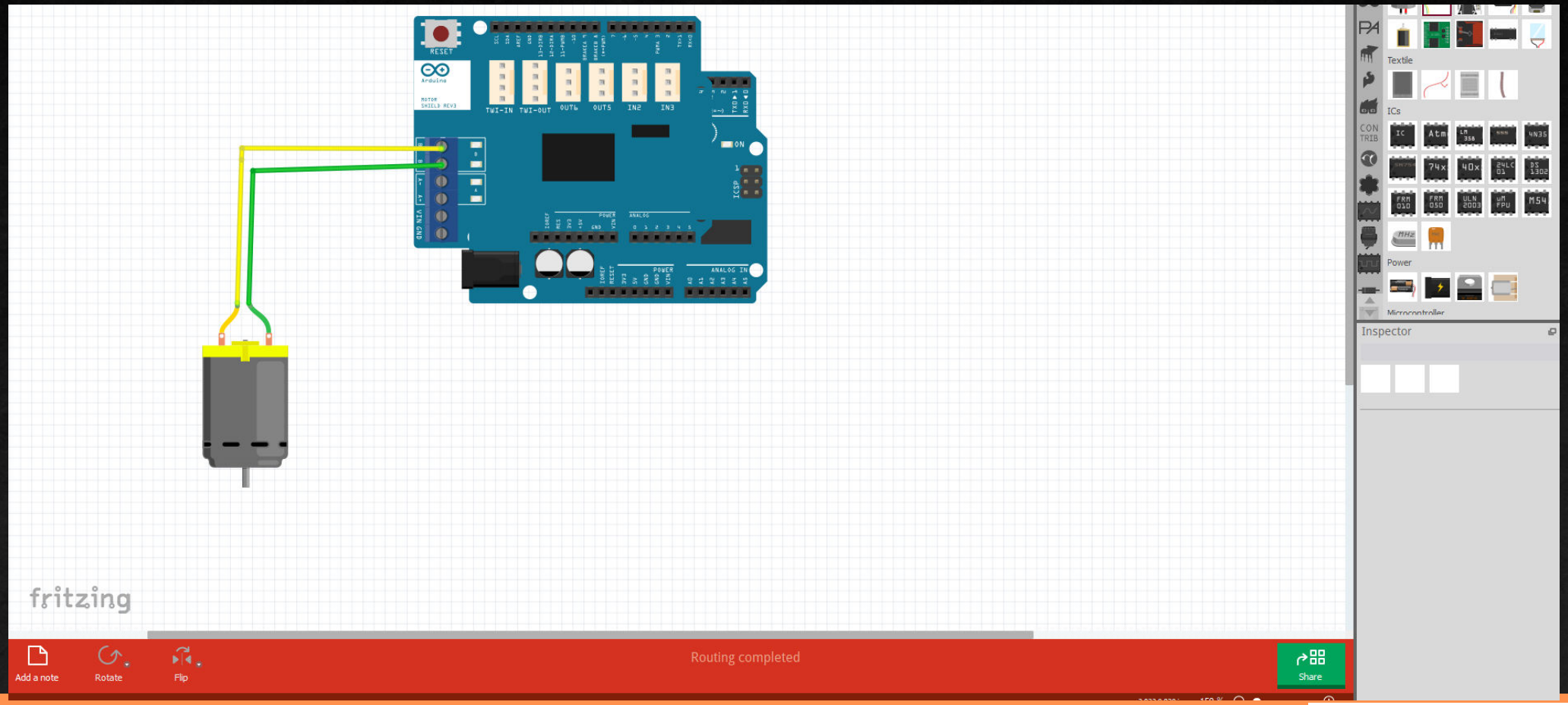
CAD for design of electronics hardware

- Fritzing is an open source software very useful for designing microcontroller applications https://fritzing.org/home/



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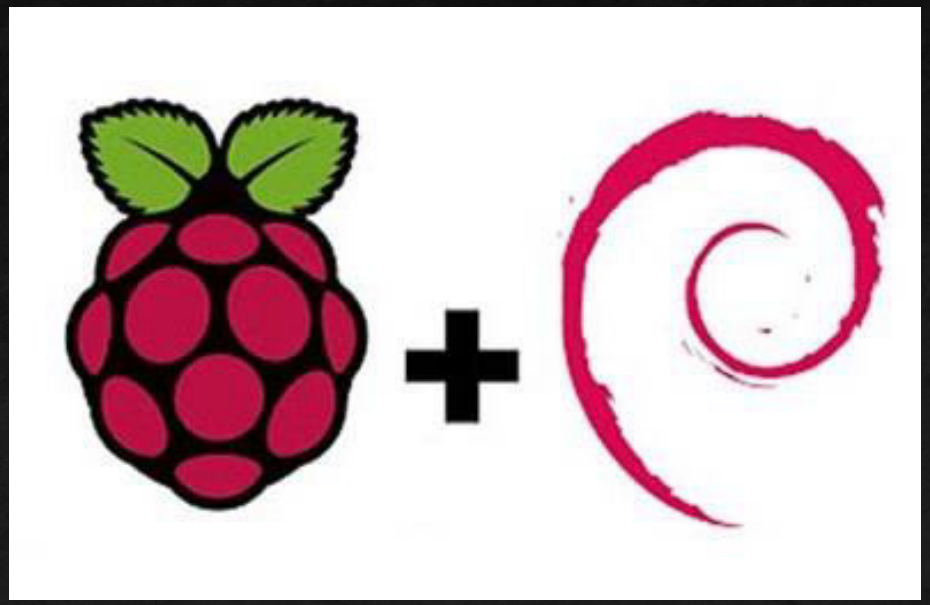
Programming software

- Arduino IDE (www.arduino.cc/en/main/software) is used to write and upload programs to Arduino compatible boards and other development boards.
- Raspbian (www.raspberrypi.org/downloads/) is the official operating system for all models of the Raspberry Pi and has a rich set of tools including some of the most used programming languages.



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Raw materials

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Sheets, PVC tubes, threaded rods

- Sheets of cardboard or thin metal, plastic and wood can be used for making various boxes, frames, parts etc. needed for microcontroller applications.
- PVC tubes and threaded rods can be used for various structures

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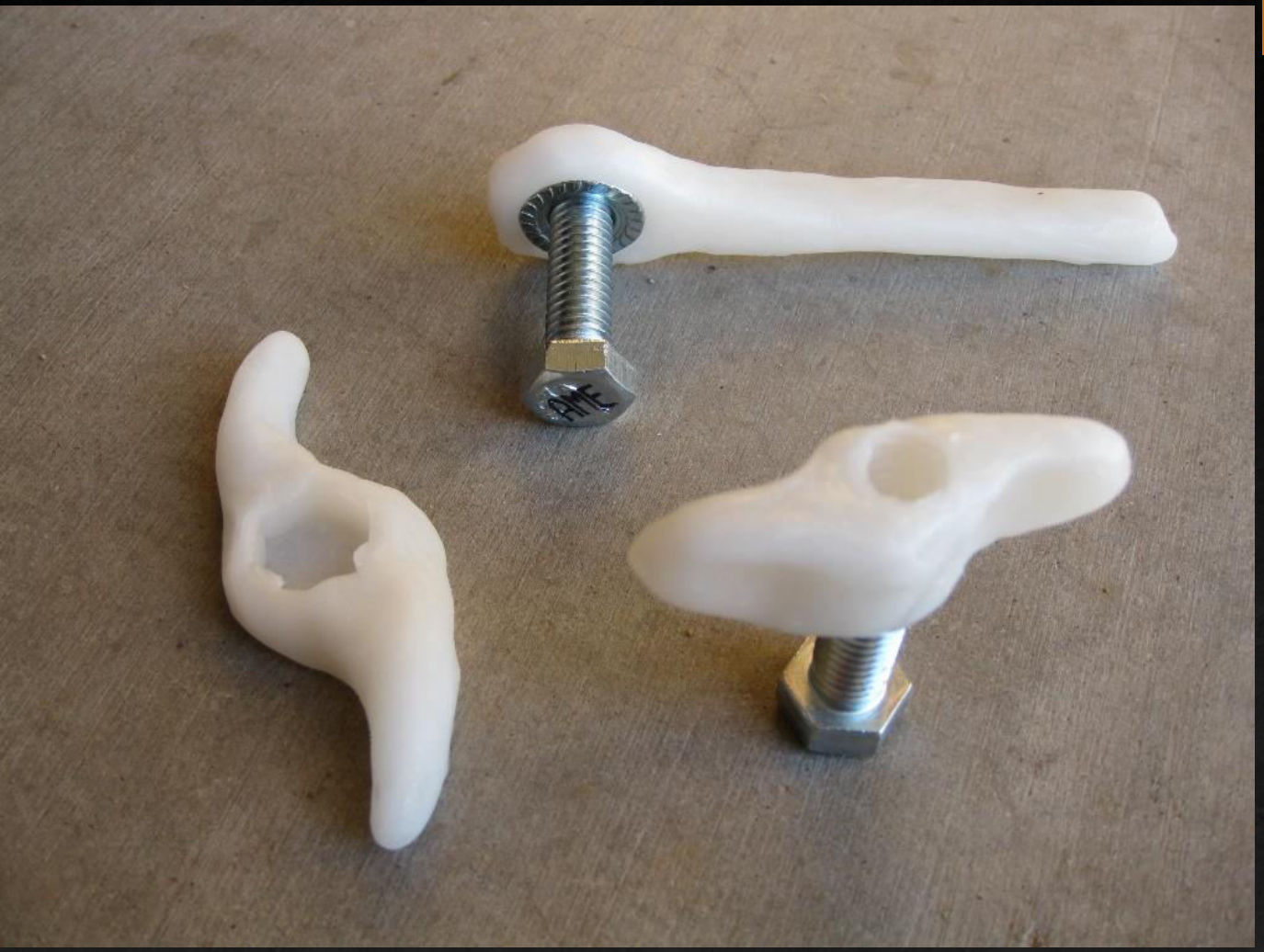
Hand-moldable plastic



Source: *instamorph.com*

- It’s a plastic that can be molded by hand when warm but became a strong plastic when it cools.
- Allows creating plastic parts without creating custom molds.
- Also known as *Friendly Plastic, Instamorph, Polymorph*, etc.

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Useful links

- Breadboards for Beginners https://learn.adafruit.com/breadboards-for-beginners
- How to Use a Breadboard https://www.sciencebuddies.org/science-fair-projects/references/how-to-use-a-breadboard
- Best Free 3d Modeling Software https://www.easyrender.com/3d-rendering/best-free-3d-modeling-software
- Make Your Own Fritzing Parts https://learn.sparkfun.com/tutorials/make-your-own-fritzing-parts/what-is-fritzing

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Topic Summary

Here is what we learned

- **Tools and equipment selection skills:**
  Determine the kind of tools or equipment needed to do a job

- **Knowledge about tools and materials:**
  Which are the most useful, how can be used

- **Software selection skills:**
  Determine the kind of software needed for a microcontroller application

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