Digital Electronics 101

An introductory course on Electronics, C++ and Arduino-like platforms

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Electronics

What are Electronics?

Fundamental Notions and Laws in Electronics

There are three main notions to be understood in electronics:

- **Current aka I** (SI: Ampere): The ordered flow of electrons, therefore electrical charge per time unit
- **Electrical Tension or Potential Difference aka U** (SI: Volt): The tension applied on said electrons, therefore energy per charge
- **Resistance aka R** (SI: Ohm): The resistance of a medium to the electron flow

Ohm's Law

We can describe the resistance as the tension we have to "apply" to push the electron flow establishing an equality-**Ohm's Law:**

$$R = \frac{U}{I}$$

Or in a funnier way:

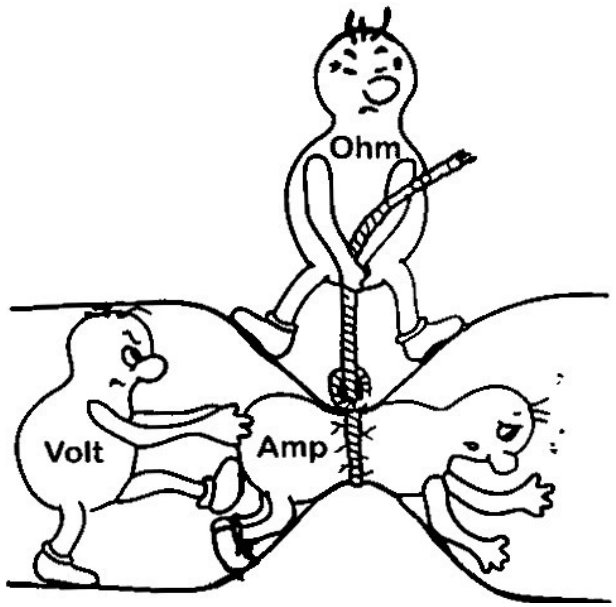

Figure 1: Ohm's Law

Kirchhoff's Voltage Law

The sum of all electrical tensions in a loop

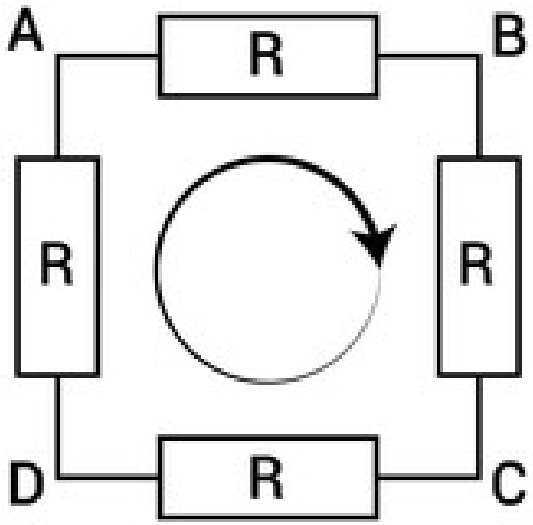

Figure 2: Kirchhoff's Voltage Law

Kirchhoff's Current Law

There can be no residual current in a node!

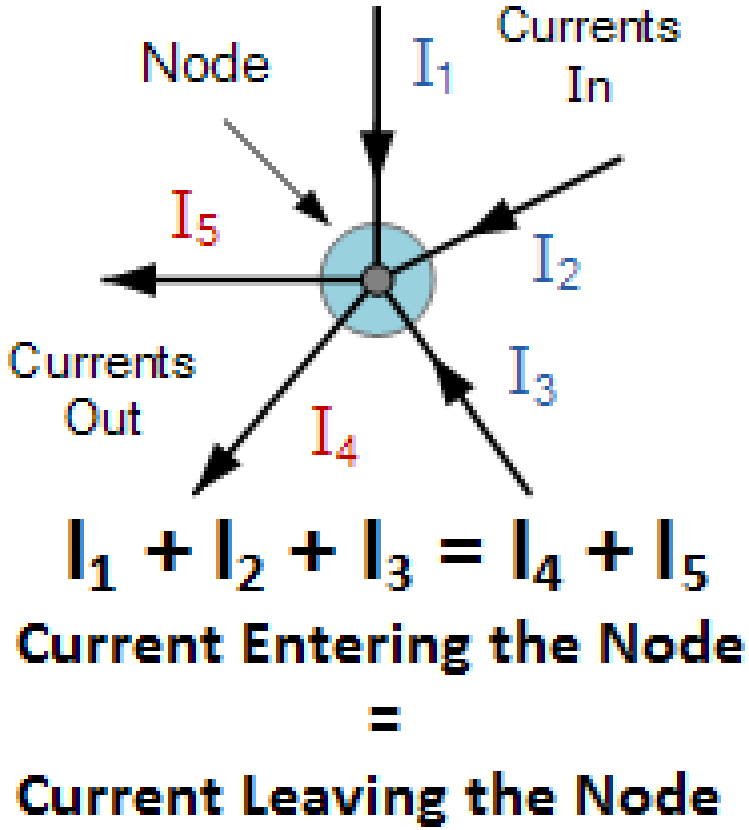

Figure 3: Kirchhoff's Current Law

Additional Notions and Fundamentals

Then we can also add some additional notions

- **Power**(SI: Watt): Rate of transference of electrical energy through a circuit, using the definition of Electrical Tension and current:

$$P = U \times I$$

- **Capacitance**(SI: Farad): The ability of a material to store electrical charge. In a DC circuit:

$$C = \frac{q}{U}$$

Electrical Components

Breadboards and PCBs I

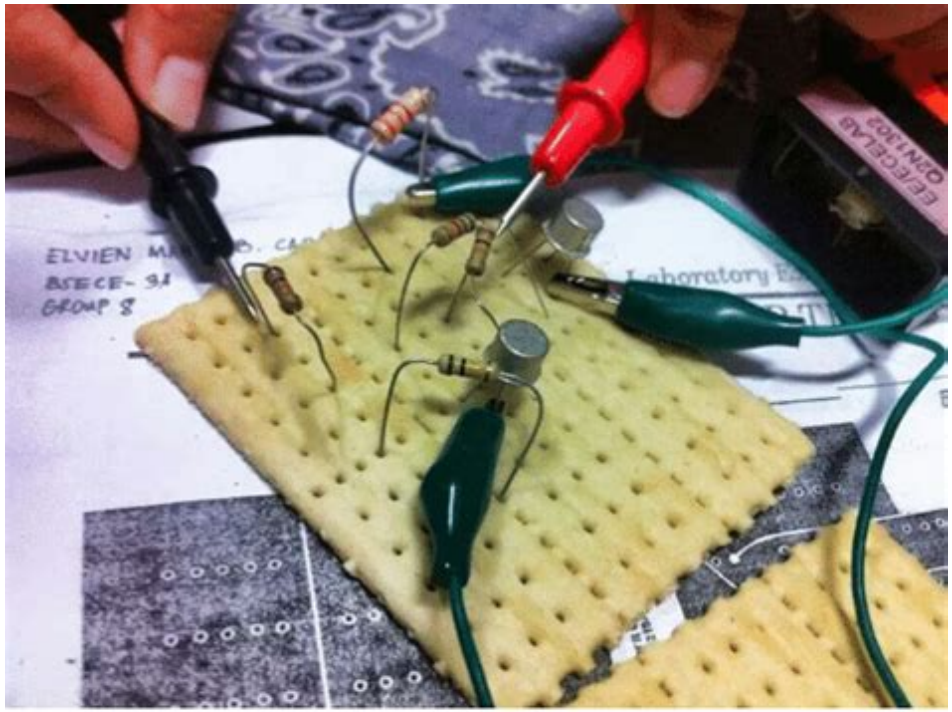

Figure 4: A BREADboard!

Breadboards and PCBs II

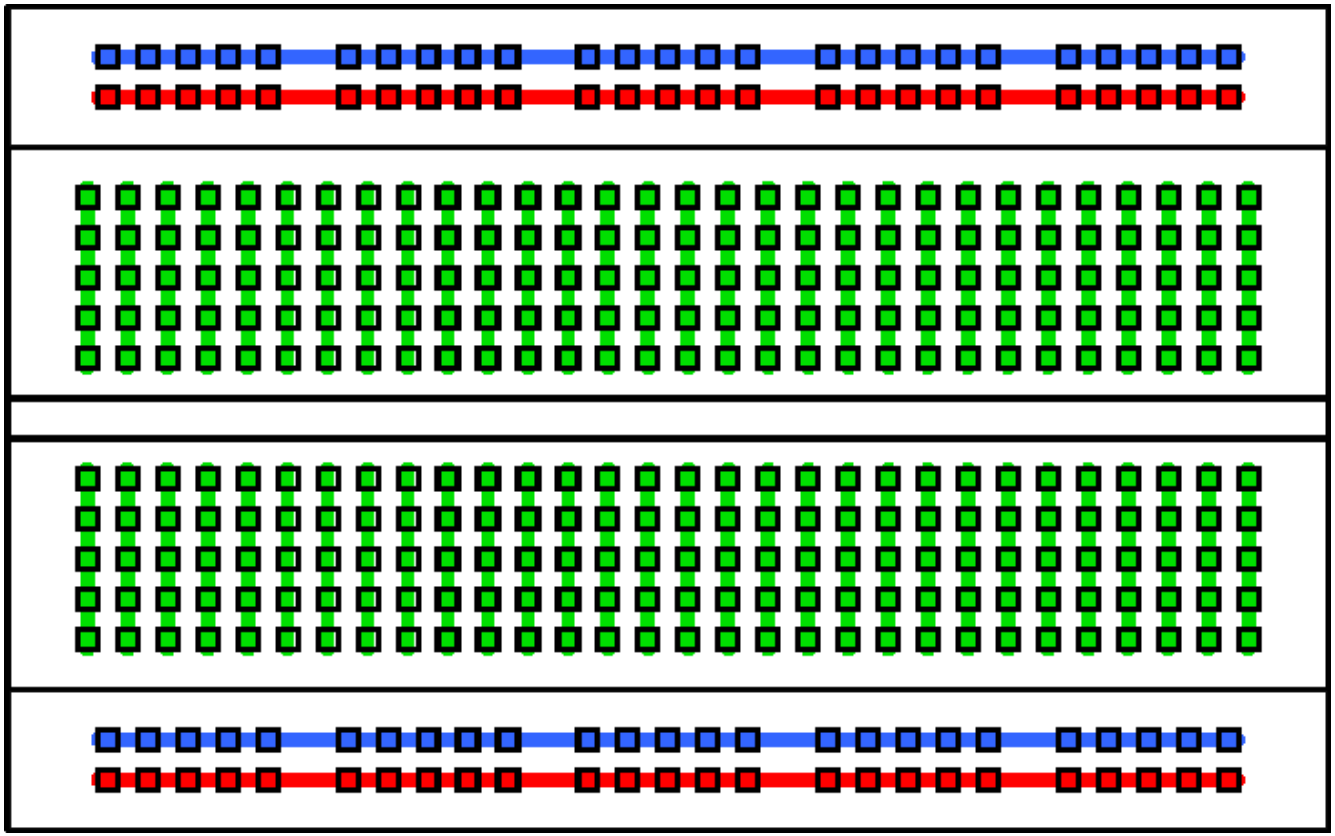

Figure 5: An actual breadboard

Breadboards and PCBs III

After testing our circuit in a breadboard, we might have a very complex and not portable weave of wires and components...

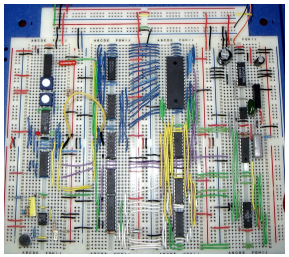

Figure 6: A very confusing weave of wires

We can then use some software tools (like KiCAD) to help us create a pcb schematic.After that we can send it to a manufacturer or do it ourselves!

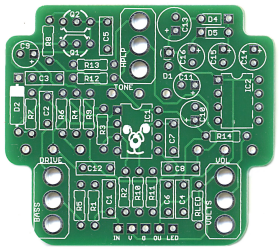

Figure 7: A printable circuit board

Power sources

Resistors

Toggle Components

Capacitors in a DC circuit

Diodes

LEDs

Transistors 101

Arduino

Schematic

Arduino IDE

Controlling your Arduino with C++