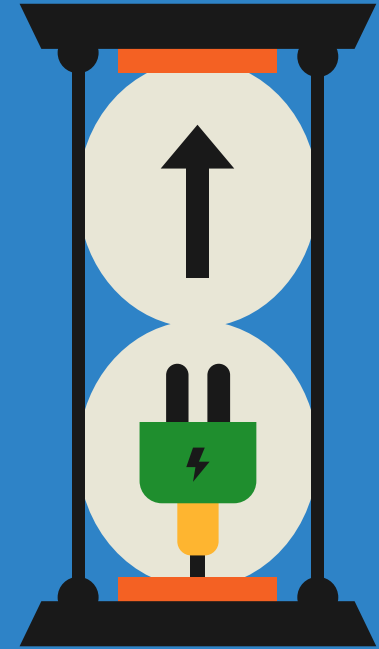
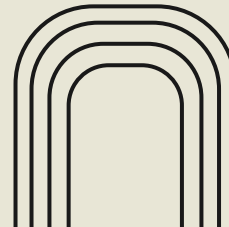
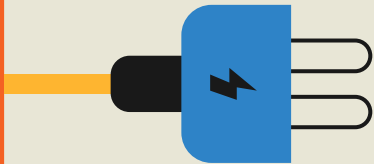
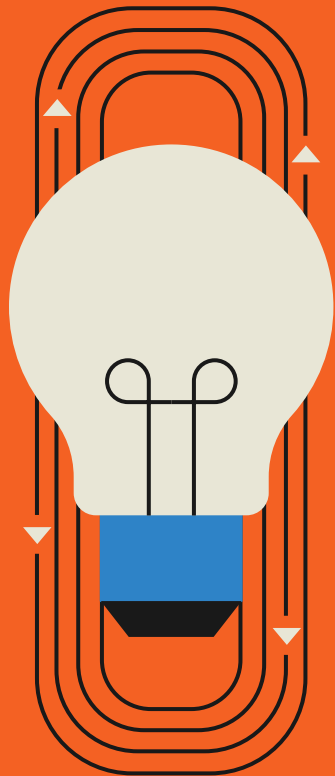


# MEASURING DEVICES & ARDUINO

ELECTRICAL POWER & MACHINES DEPARTEMENT





# TABLE OF CONTENTS

**01**

AMMETER

**02**

VOLTMETER

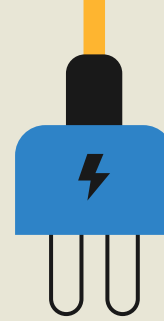
**03**

MULTIMETER

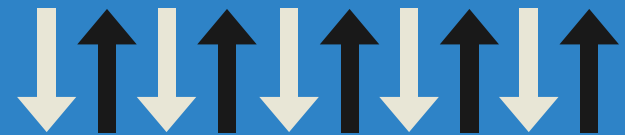
**04**

ARDUINO

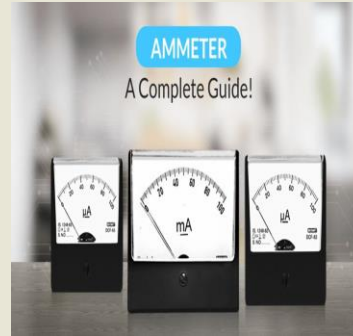
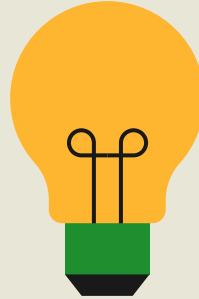
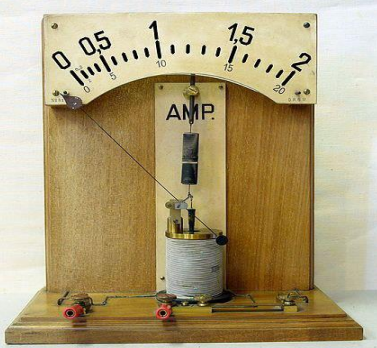
# 1.Ammeter



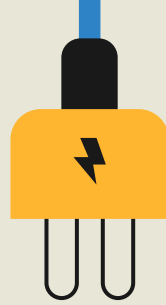
The development of the ammeter has significantly contributed to the field of electrical engineering, enabling accurate current measurement in a wide range of applications. Over time, advancements continue to be made, leading to more sophisticated and versatile ammeter designs.



# Ammeter development



- The precursor to the ammeter was the galvanometer, which was developed in the early 19th century.
- In the early 1820s, he developed a more refined version of the galvanometer, which he used to measure electric current accurately
- In the late 19th century, the French physicist Jacques-Arsène d'Arsonval improved upon the design of the galvanometer by using a moving coil and a permanent magnet.
- Shunt Ammeters are added To measure higher currents, engineers introduced the concept of shunt ammeters.
- With the advent of digital technology, analog ammeters were gradually replaced by digital ammeters. Digital ammeters use electronic circuits to measure current and display the readings on a digital display

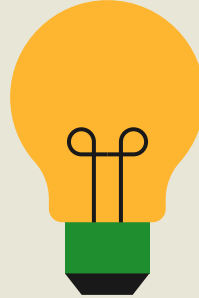


## 2.voltmeter

A voltmeter is an instrument used to measure electric voltage, which is the potential difference between two points in an electrical circuit. It is designed to provide a numerical value or a visual indication of the voltage being measured



# voltmeter development



- The earliest forms of voltmeters date back to the 18th century when scientists began experimenting with electrostatic principles.
- In the mid-19th century, Sir William Thomson (later known as Lord Kelvin) invented the water dropper, which was a significant step forward in voltmeter development. The Kelvin water dropper used water flow and the separation of charged droplets to generate voltage.
- In the late 19th century, advancements in electrochemistry led to the development of electrochemical voltmeters. These instruments used chemical reactions to measure voltage.
- The invention and refinement of moving coil mechanisms, similar to those used in ammeters, also revolutionized voltmeter design.
- The advent of digital technology in the mid-20th century brought about the development of digital voltmeters (DVMs).

# 3.Multimeter

a multimeter or VOM (volt-ohm-milliammeter), is a versatile electronic instrument used to measure various electrical quantities such as voltage, current, and resistance. It combines the functionality of multiple individual meters, including voltmeters, ammeters, and ohmmeters, into a single device.





# Multimeter Development

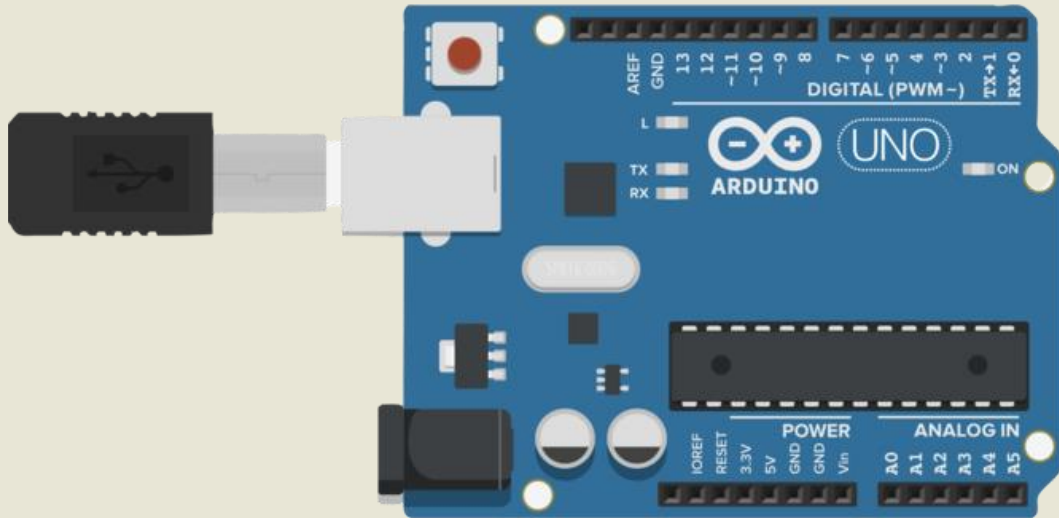




# Multimeter development

- ❑ The earliest multimeters were analog instruments that integrated the functionality of several individual meters. In the 1920s, the first multimeters were introduced, combining ammeter, voltmeter, and ohmmeter functions into a single device
- ❑ With advancements in vacuum tube technology in the mid-20th century, multimeters underwent significant improvements. Vacuum tube-based multimeters
- ❑ The advent of digital technology in the 1970s led to the development of digital multimeters (DMMs)
- ❑ Over the years, multimeters have continued to evolve with advancements in semiconductor technology, display technology, and measurement techniques. Modern multimeters offer a wide range of features , Today, multimeters are indispensable tools used by professionals, technicians, engineers, and hobbyists in different fields

## 4.ARDUINO UNO



# OVERVIEW ARDUINO

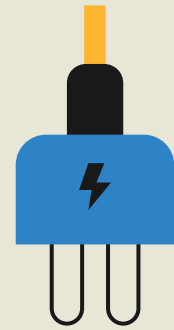
**Arduino is an open-source electronics platform that is based on beginner-level hardware and software.**

**The hardware component of an Arduino board is a programmable circuit board that is also known as a microcontroller. A microcontroller is a small computer with a processor, memory, and other peripherals designed for embedded applications. The software component is called Arduino IDE (Integrated Development Environment) where developers write and upload the code onto the microcontroller, it will be further explained later in the article.**



# Families of arduino

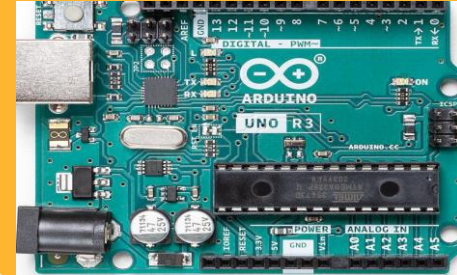
Arduino hardware is classified into three families: Nano, MKR, and Classic



Arduino MKR

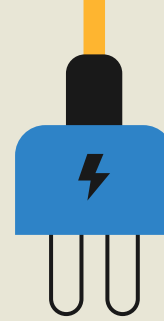


Arduino NANO



Arduino uno

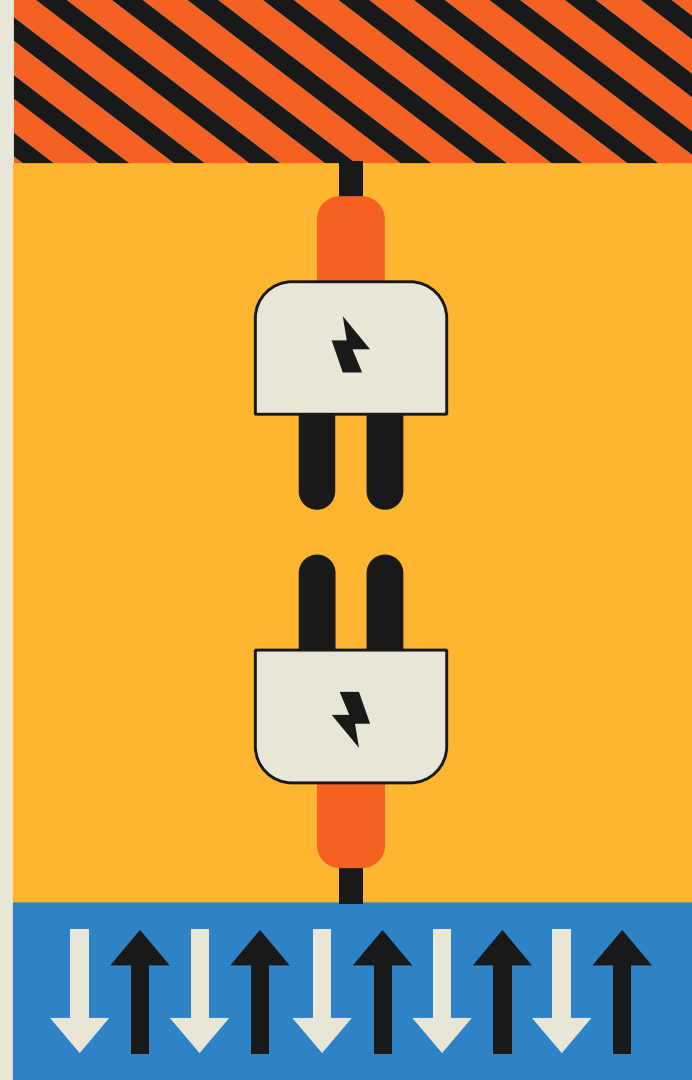
# Project



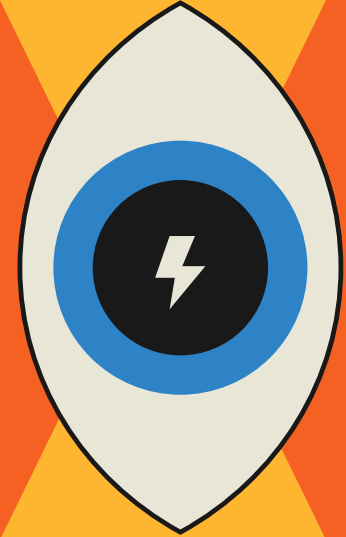
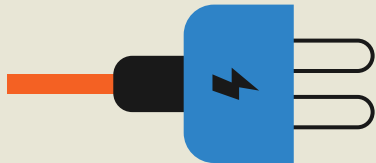
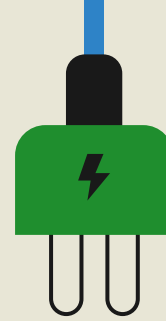
A multimeter is a versatile and essential tool for electronics enthusiasts and professionals alike. It can be used to measure various electrical parameters such as voltage, current, resistance, and capacitance. In this project, we will be building a multimeter that can measure voltage, current, capacitance, and resistance (ohms).

## The results of the project :

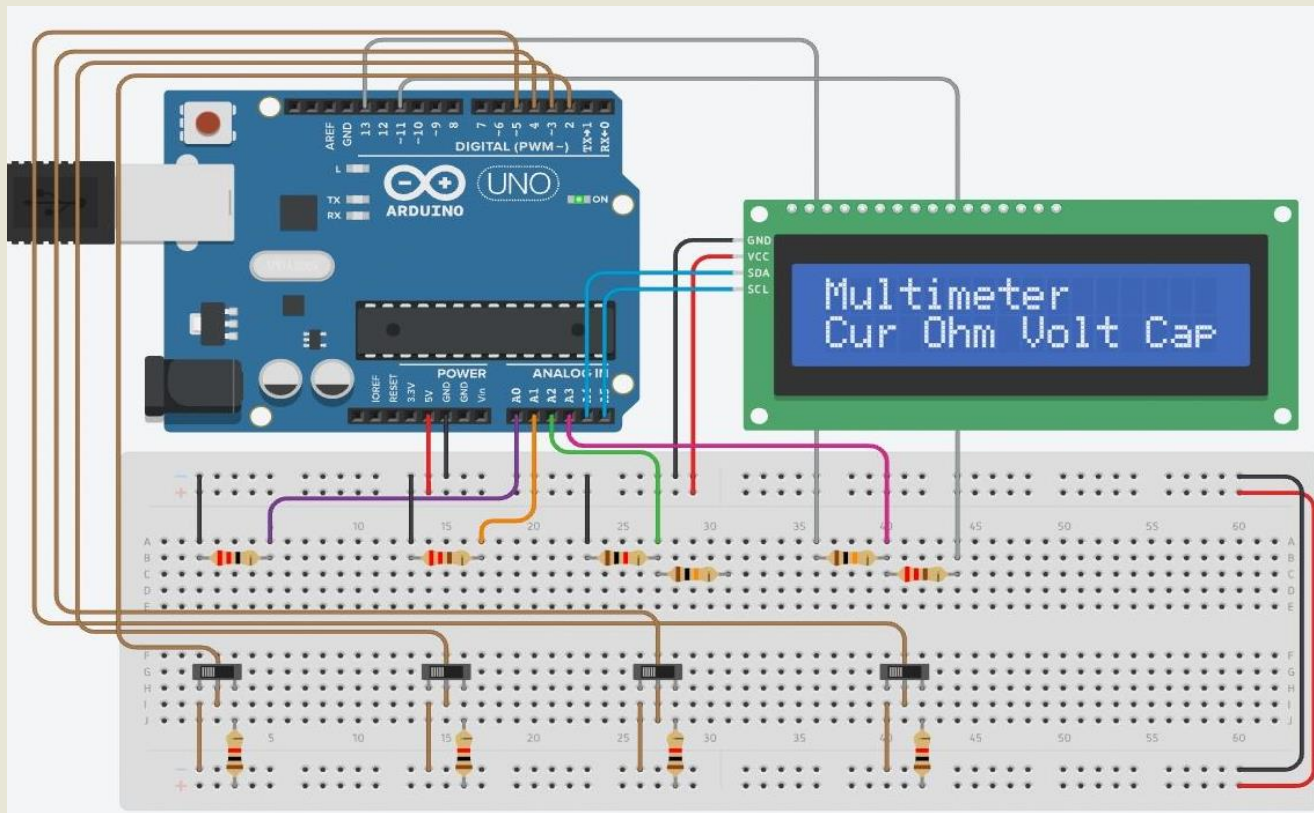
A functional multimeter that can accurately measure voltage, current, capacitance, and resistance. The multimeter is based on an Arduino microcontroller and uses a number of different sensors and modules to perform the various measurements.



# THE CIRCUIT CONNECTION & ITS ANALYSIS



# TINKERCAD SIMULATION





# How the measurements work

1

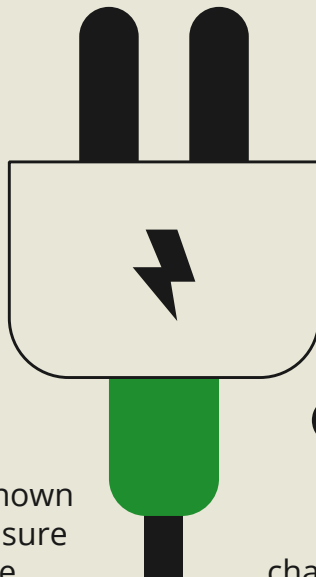
## VOLTAGE

The multimeter will use a voltage divider circuit to reduce the input voltage to a manageable level that can be measured by the microcontroller

3

## RESISTANCE

the multimeter will use a known reference resistor and measure the voltage across it and the unknown resistor to calculate its resistance value using Ohm's law.



## CURRENT

the multimeter will use a shunt resistor in series with the load to measure the voltage drop across the resistor, which can then be converted to current using Ohm's law.

2

## CAPACITANCE

the multimeter will use the charging and discharging characteristics of a capacitor to calculate its capacitance value.

4

**Overall, the project demonstrates the feasibility of building a low-cost, versatile multimeter using readily available components**

## CONCLUSION

the development of a multimeter capable of measuring voltage, current, capacitance, and resistance is a complex yet achievable task. The device must be designed with accuracy, reliability, and user- friendliness in mind.

Overall, designing a multimeter that can accurately measure voltage, current, capacitance, and resistance requires careful consideration of the device's components, circuit design, and calibration. With proper planning and execution, a well-designed multimeter can be a valuable tool for both professionals and enthusiasts in the electronics industry.

