Arduino

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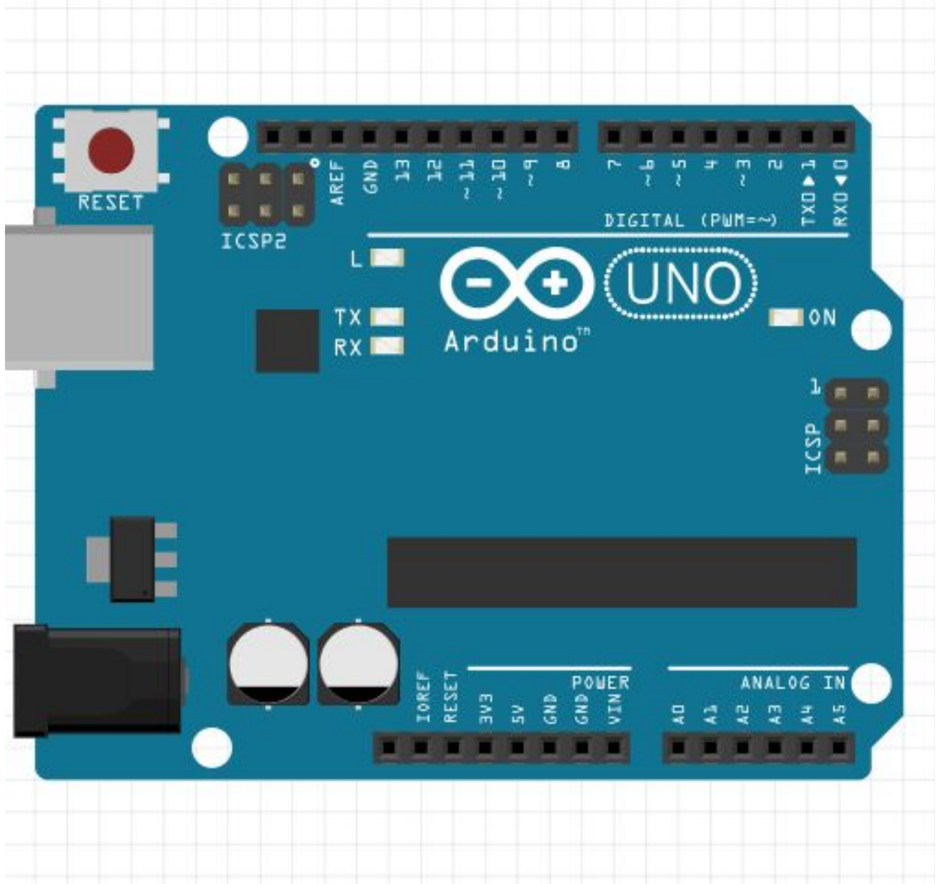
AGENDA



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What is Arduino?

What is an Arduino? Why Arduino? How can I use it and implement it on the lab?

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Hands On

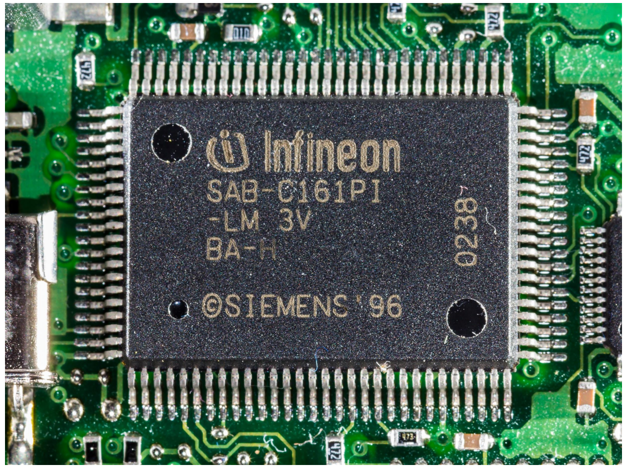
Using Tinkercad simulator

What is a microcontroller

To answer this enter to menti.com
Code: 5829 2707

What is a microcontroller?

A microcontroller (MCU for microcontroller unit) is a small computer on a single metal-oxide-semiconductor (MOS) integrated circuit (IC) chip. A microcontroller contains one or more CPUs (processor cores) along with memory and programmable input/output peripherals.



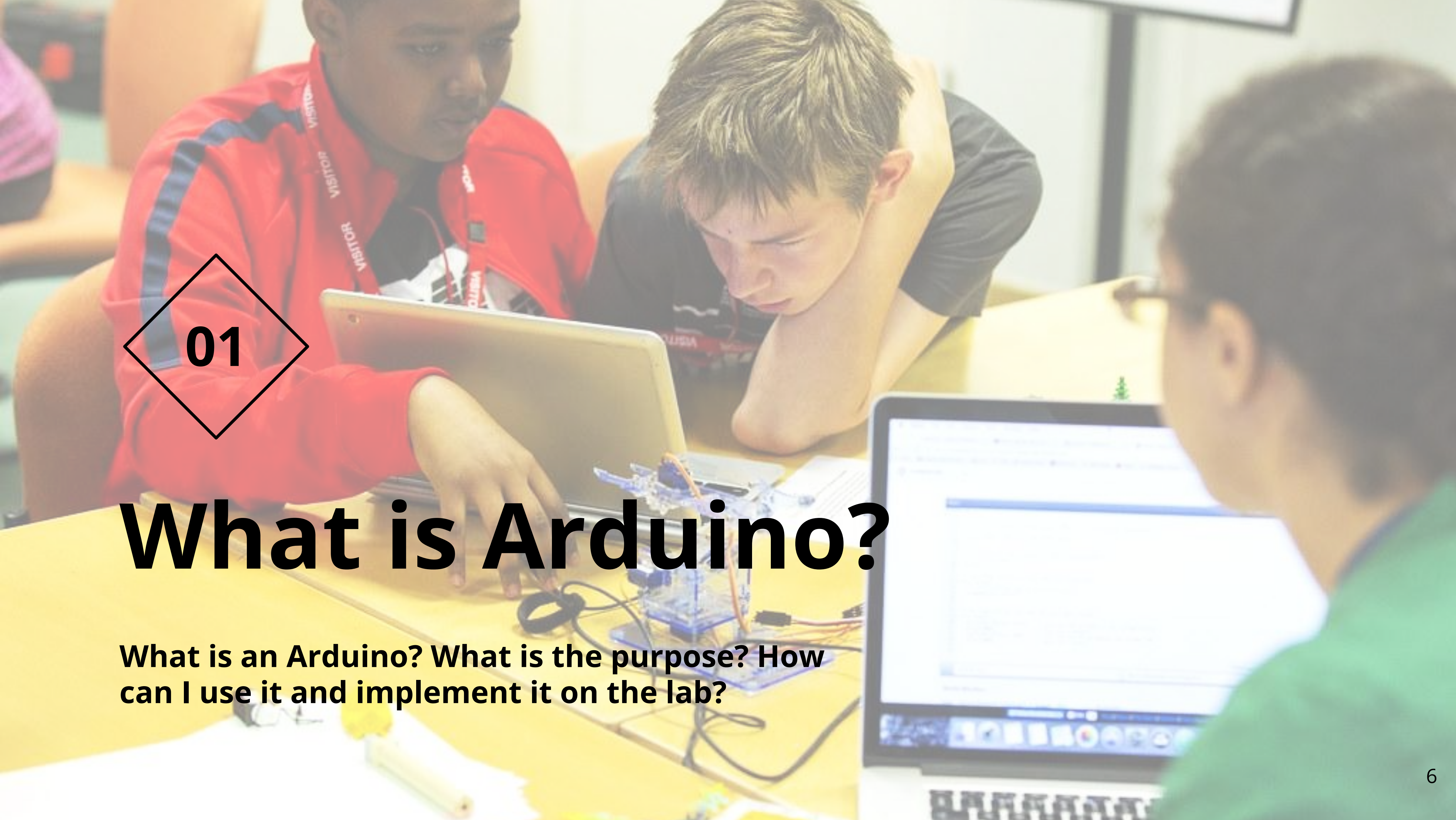
Big computers vs small computers

Dell Precision T1500

- **CPU Speed:** 2.93GHz
  - Quad-core!
- **RAM:** 16GB
- **Storage:** 2TB
- **I/O:**
  - USB, Firewire, Serial, PS/2, RJ-45, Audio, etc.

Atmel ATMEGA328P

- **CPU Speed:** 20MHz
  - Not Quad-core ☺
- **RAM:** 2KB
- **Storage:**
  - 32KB Program Memory
  - 1KB EEPROM
- **I/O:**
  - Up to 23 generic I/O
    - 6 of them ‘analog-capable’
    - UART/SPI/I^{2}C, etc.



01

What is Arduino?

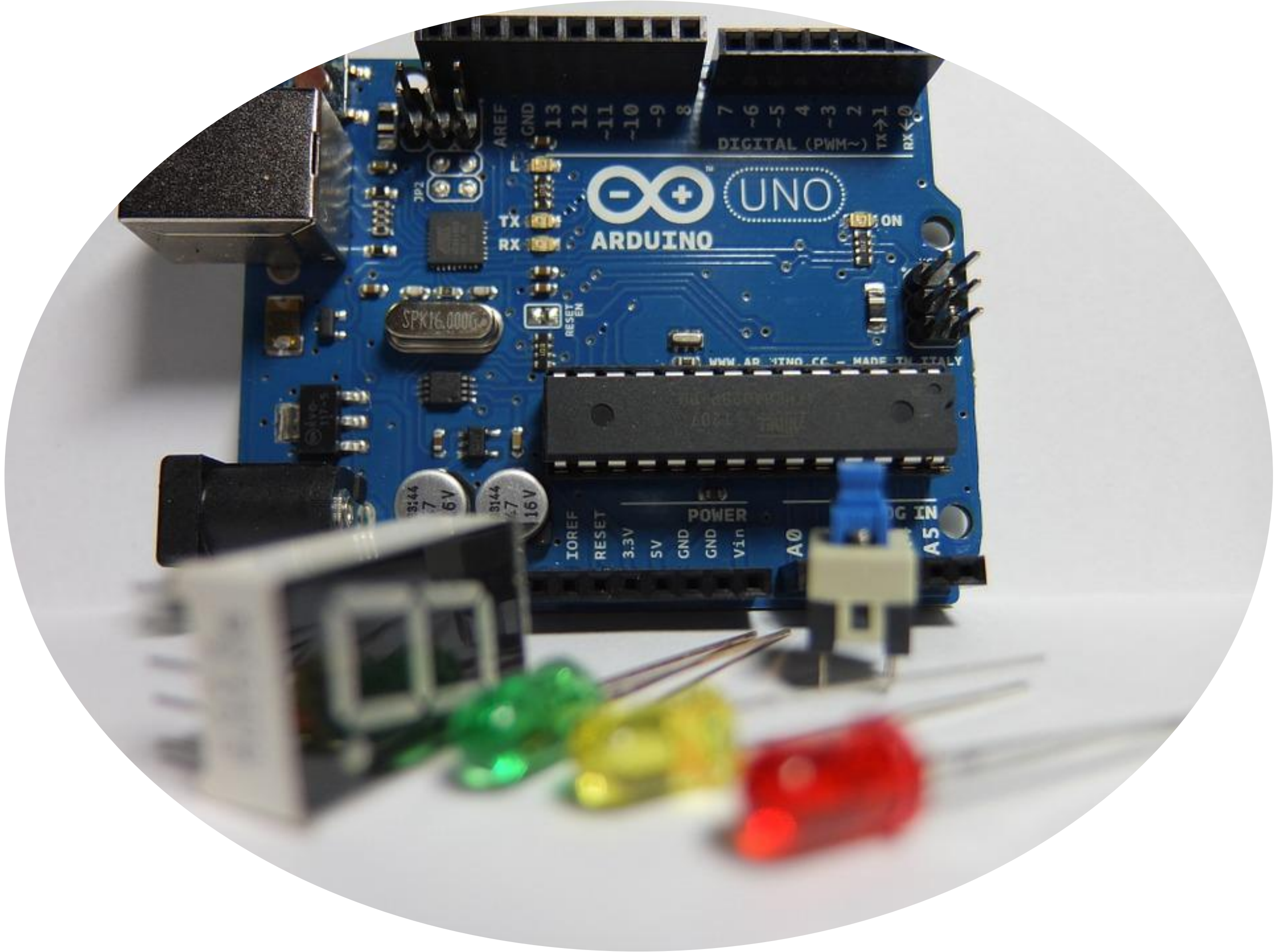
What is an Arduino? What is the purpose? How can I use it and implement it on the lab?

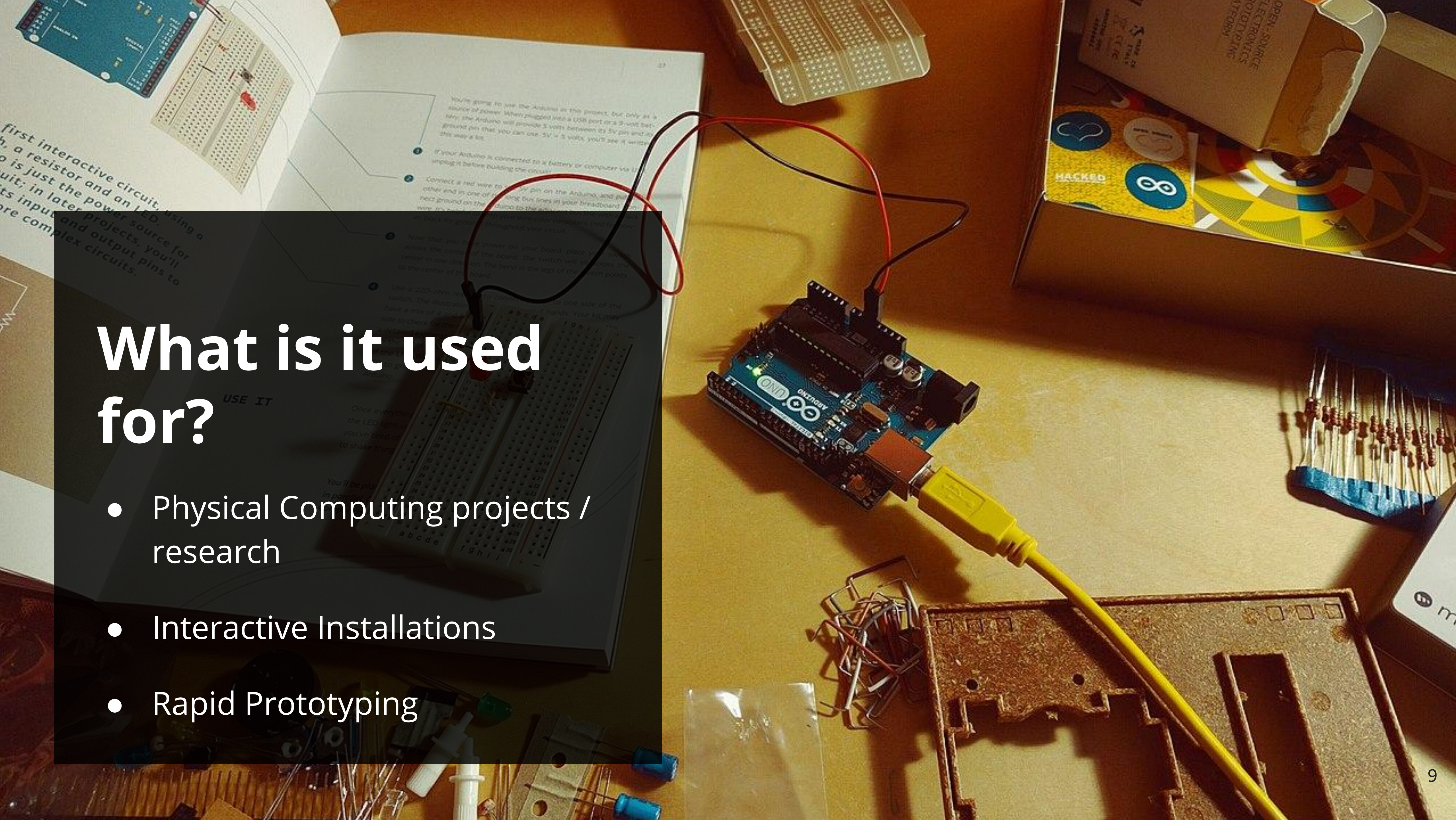
Arduino microcontroller

A brief story. The Arduino project began in 2005 as a tool for students at the Interaction Design Institute Ivrea in Ivrea, Italy, aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators.

Arduino Microcontroller

- Open-source electronics platform based on easy-to-use hardware and software.
- Are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online.





What is it used for?

- Physical Computing projects / research
- Interactive Installations
- Rapid Prototyping

What can I do?

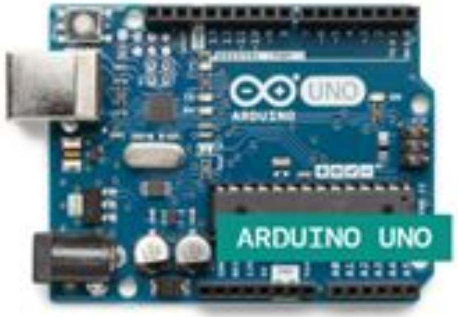
Sensors

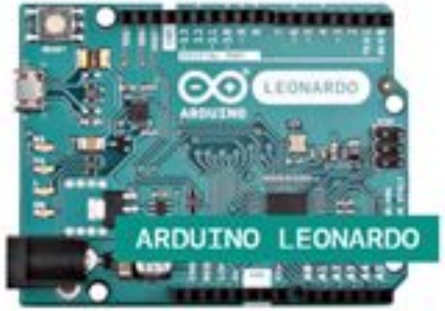
- Push buttons, touchpads, tilt switches
- Variable resistors (Sliders, Volume knobs)
- Photoresistors (sensing light)
- Thermistors (temperature)
- Ultrasound (proximity range finder)

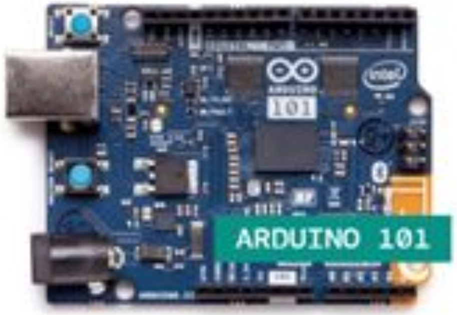
Actuators

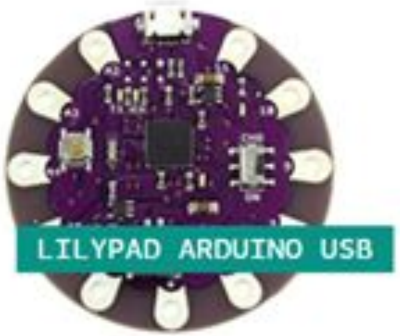
- Lights, LED’s
- Motors
- Speakers
- Displays (LCD’s)

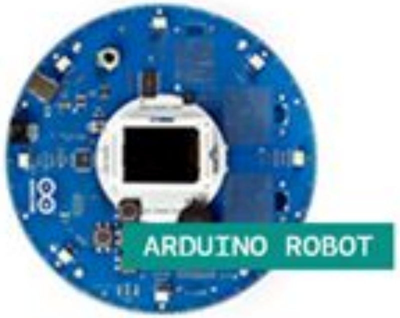
Types of Arduinos

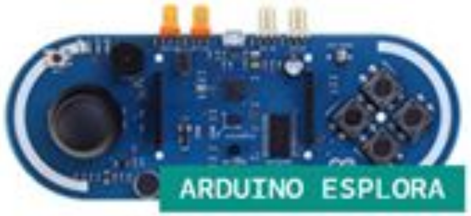


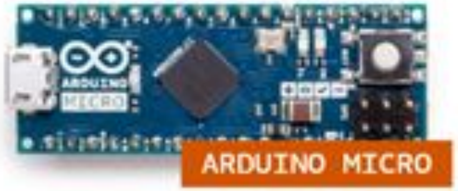


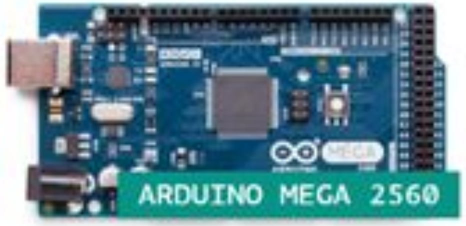


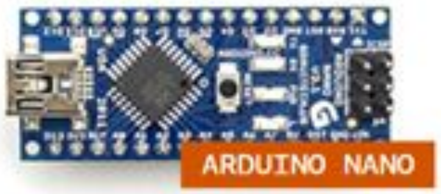


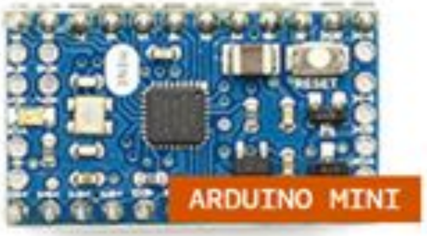


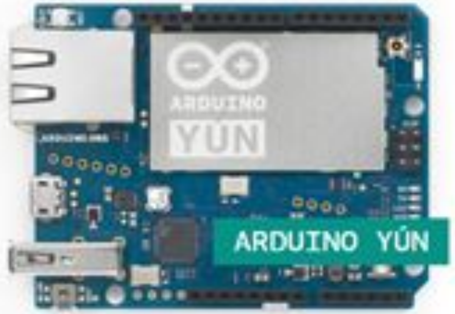


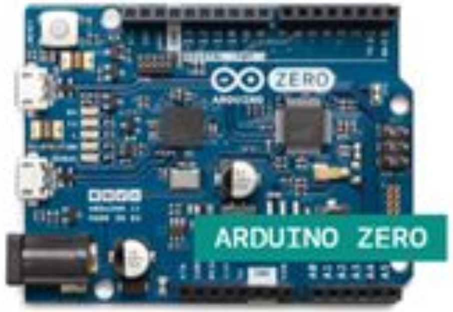










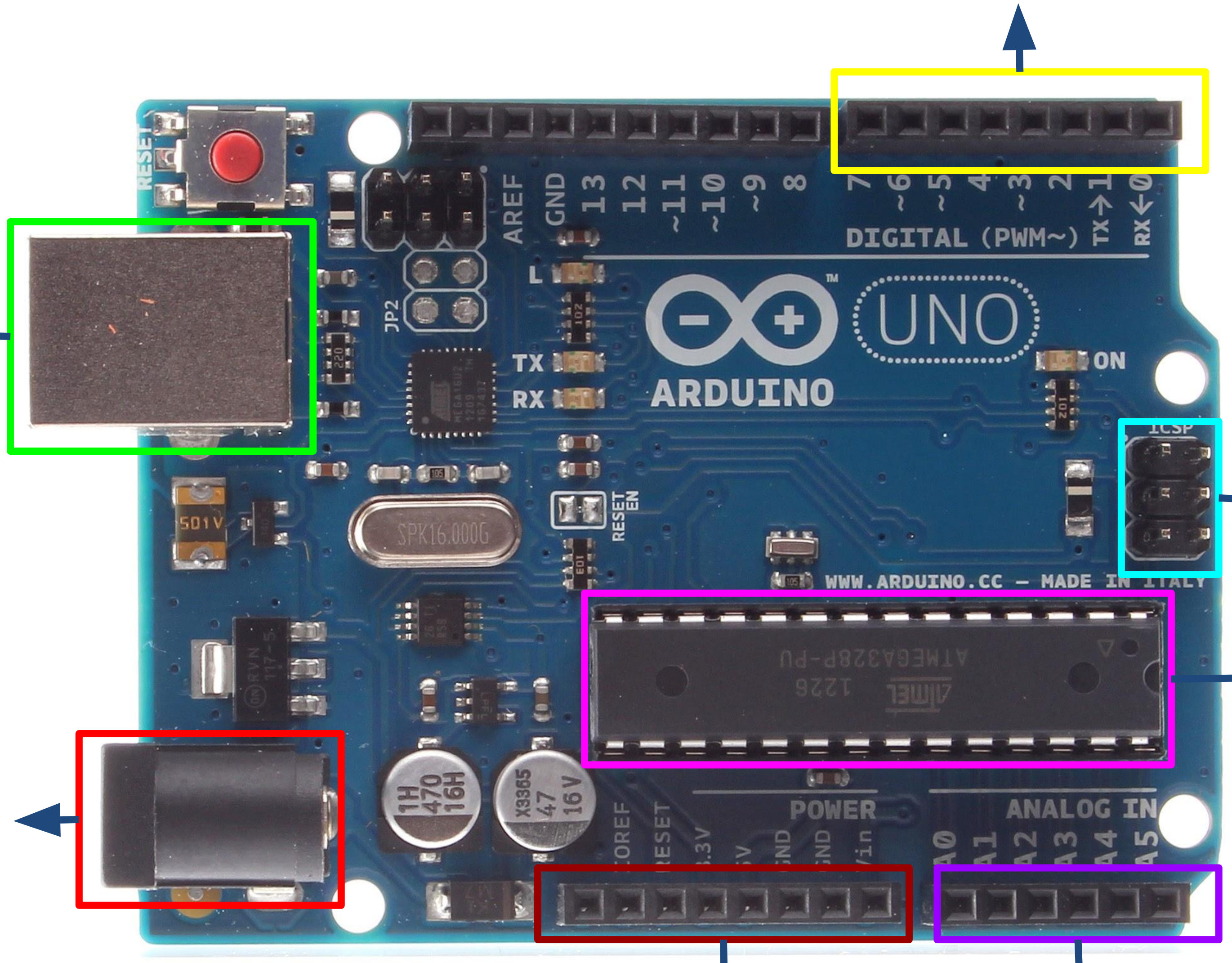


What is the difference between them?

Types of Arduino

Arduino Board	Processor	Memory	Digital I/O	Analogue I/O
Arduino Uno	16Mhz ATmega328	2KB SRAM, 32KB flash	14	6 input, 0 output
Arduino Due	84MHz AT91SAM3X8E	96KB SRAM, 512KB flash	54	12 input, 2 output
Arduino Mega	16MHz ATmega2560	8KB SRAM, 256KB flash	54	16 input, 0 output
Arduino Leonardo	16MHz ATmega32u4	2.5KB SRAM, 32KB flash	20	12 input, 0 output

Arduino Uno



Digital output
0, 1 Serial Port

USB port

In circuit serial
programming

ATMEL
Microcontroller

Power
input

Power supply

Analog input

Analog and digital pins

The Arduino can input and output analog signals as well as digital signals.

An analog signal is one that can take on any number of values, unlike a digital signal which has only two values: HIGH and LOW.

We will talk about this later!

How Arduino is programmed?

Using a software called Arduino IDE

02

Arduino Software

How Arduinos are programmed

```
  This example code is in the public domain.

  http://www.arduino.cc/en/Tutorial/Blink
*/

// the setup function runs once when you press reset or power the board
void setup() {
  // initialize digital pin LED_BUILTIN as an output.
  pinMode(LED_BUILTIN, OUTPUT);
}

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

Arduino Software (IDE)

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

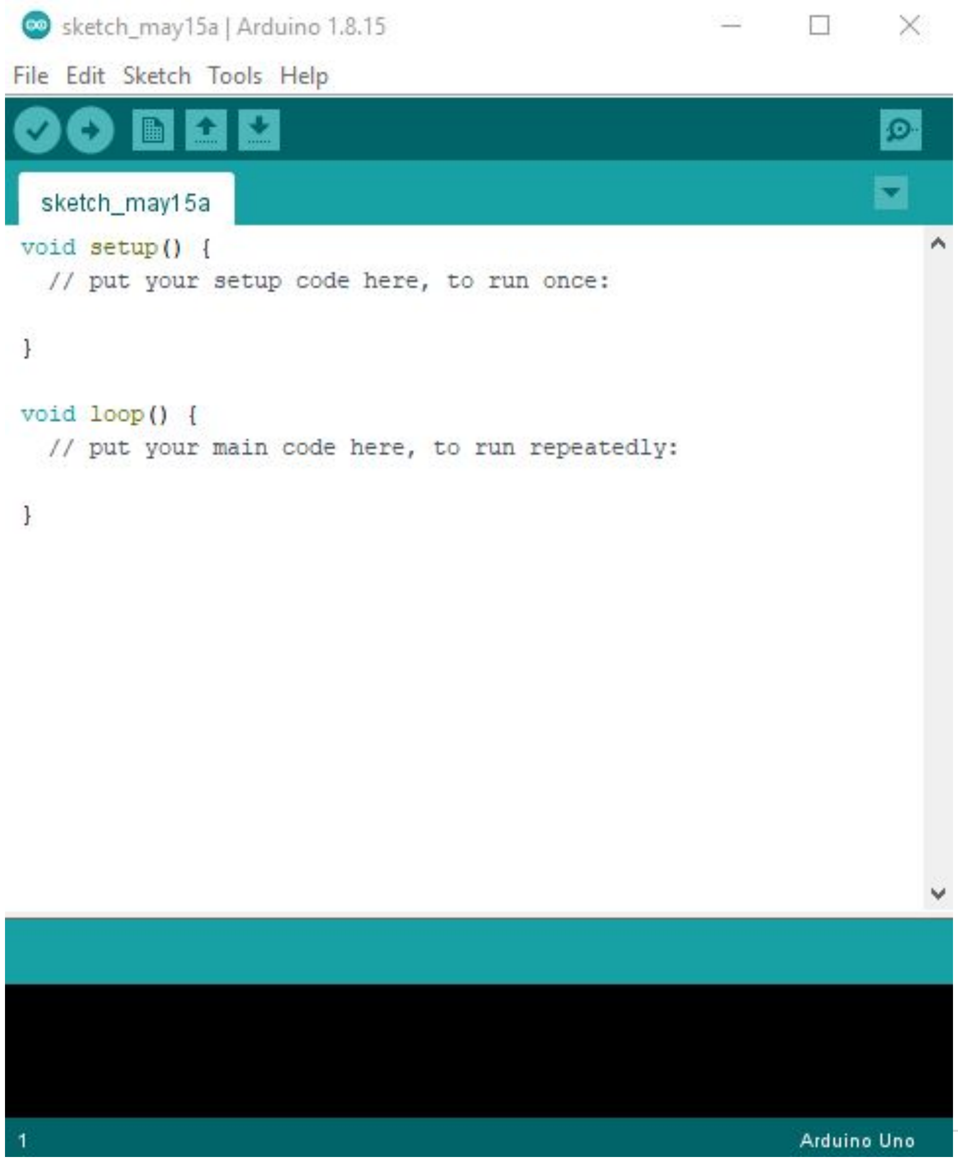
Arduino Language

- Simplified C/C++
- Based on the wiring project
  - http://wiring.org.co
- Peripheral libraries
  - LCD, sensors, 12C, ect.

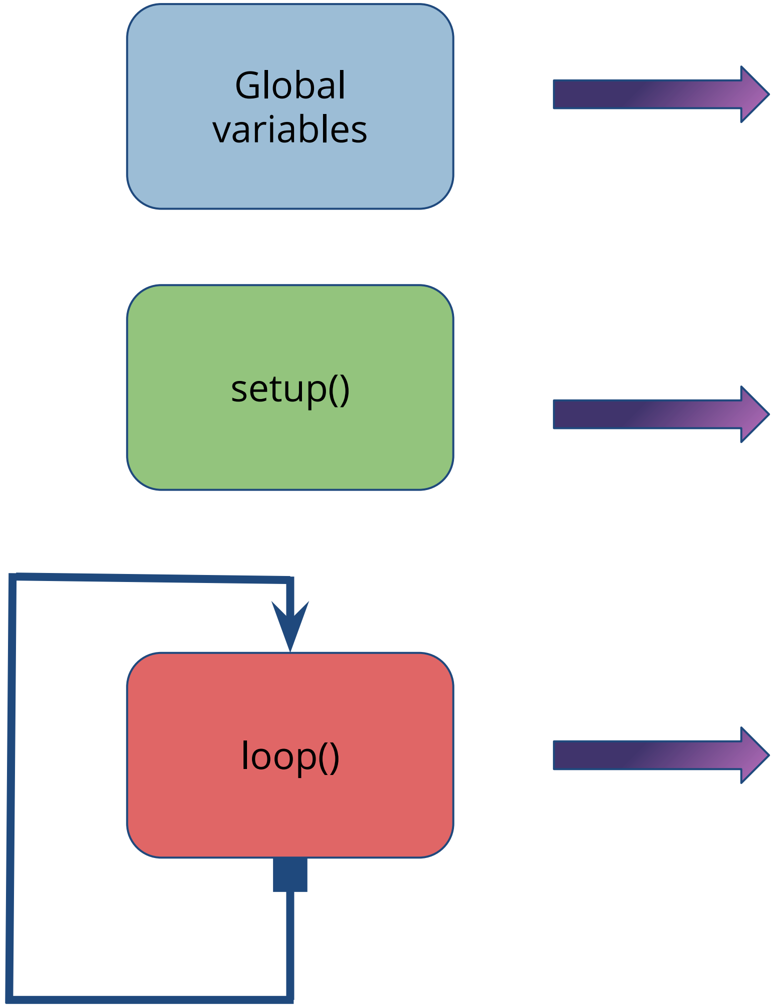
Useful functions

pinMode()	set pin as input or output
digitalWrite()	set a digital pin high/low
digitalRead()	read a digital pin’s state
analogRead()	read an analog pin
analogWrite()	write an “analog” PWM value
delay()	wait an amount of time
millis()	get the current time

Sketch



```
void setup() {
  // put your setup code here, to run once:

}

void loop() {
  // put your main code here, to run repeatedly:

}
```

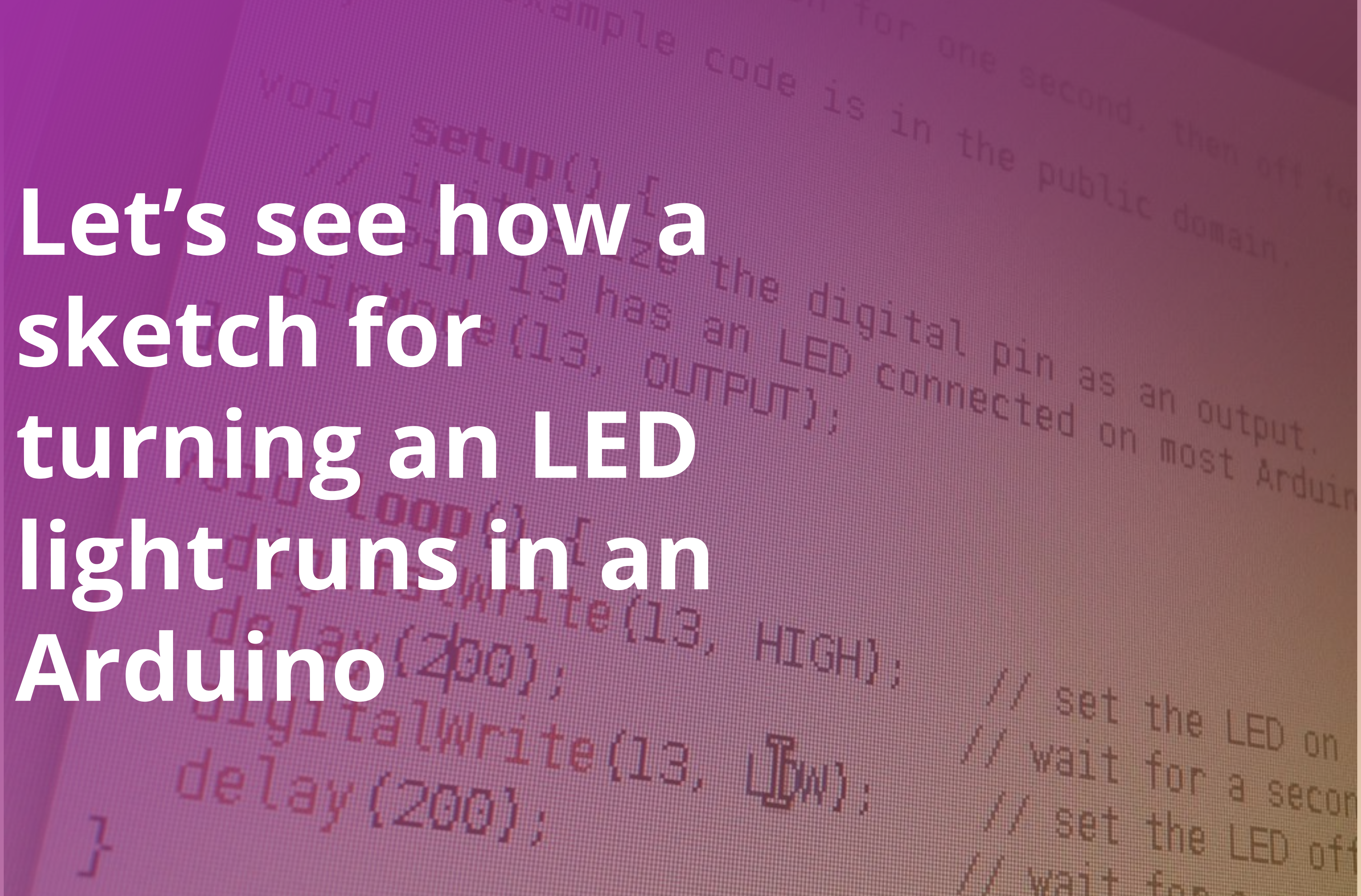


Declare variables at the top

Initialize
setup() - run once at the beginning
set pins

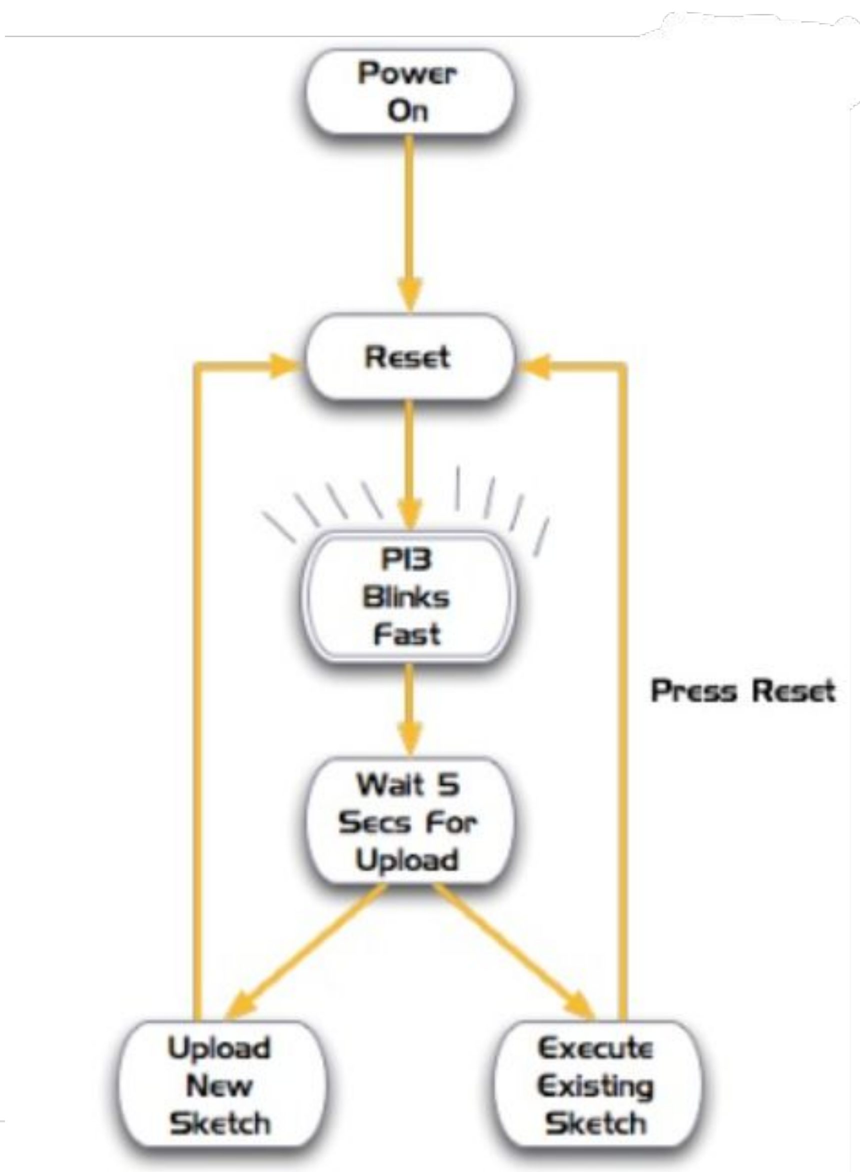
loop() - run repeatedly after setup()

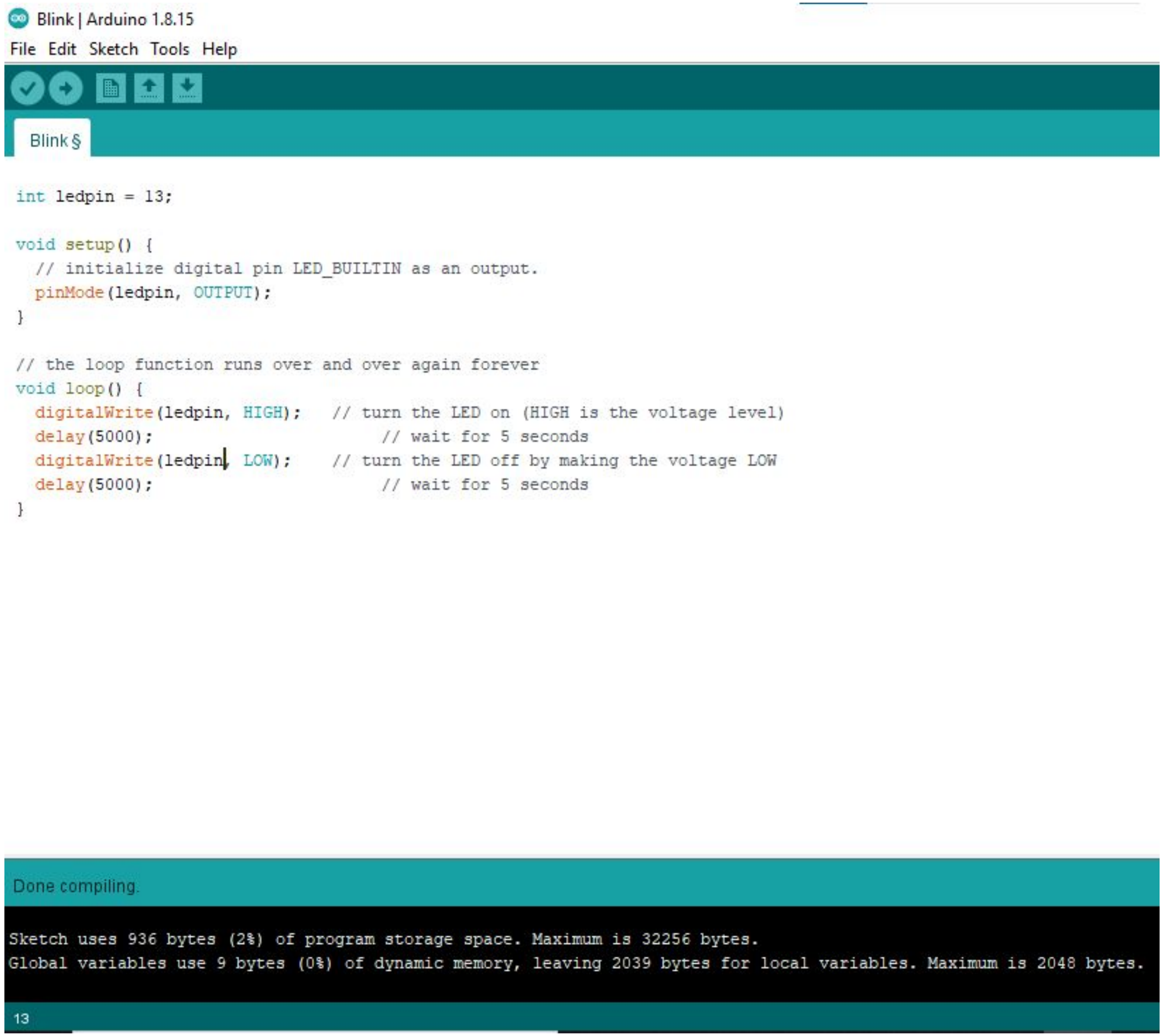
Let’s see how a sketch for turning an LED light runs in an Arduino



```
                             n for one second, then off fo
  example code is in the public domain.
void setup() {
  // initialize the digital pin as an output.
  // Pin 13 has an LED connected on most Arduin
  pinMode(13, OUTPUT);
void loop() {
  digitalWrite(13, HIGH);   // set the LED on
  delay(200);               // wait for a secon
  digitalWrite(13, LOW);    // set the LED off
  delay(200);               // wait for
}
```

Blinking LED



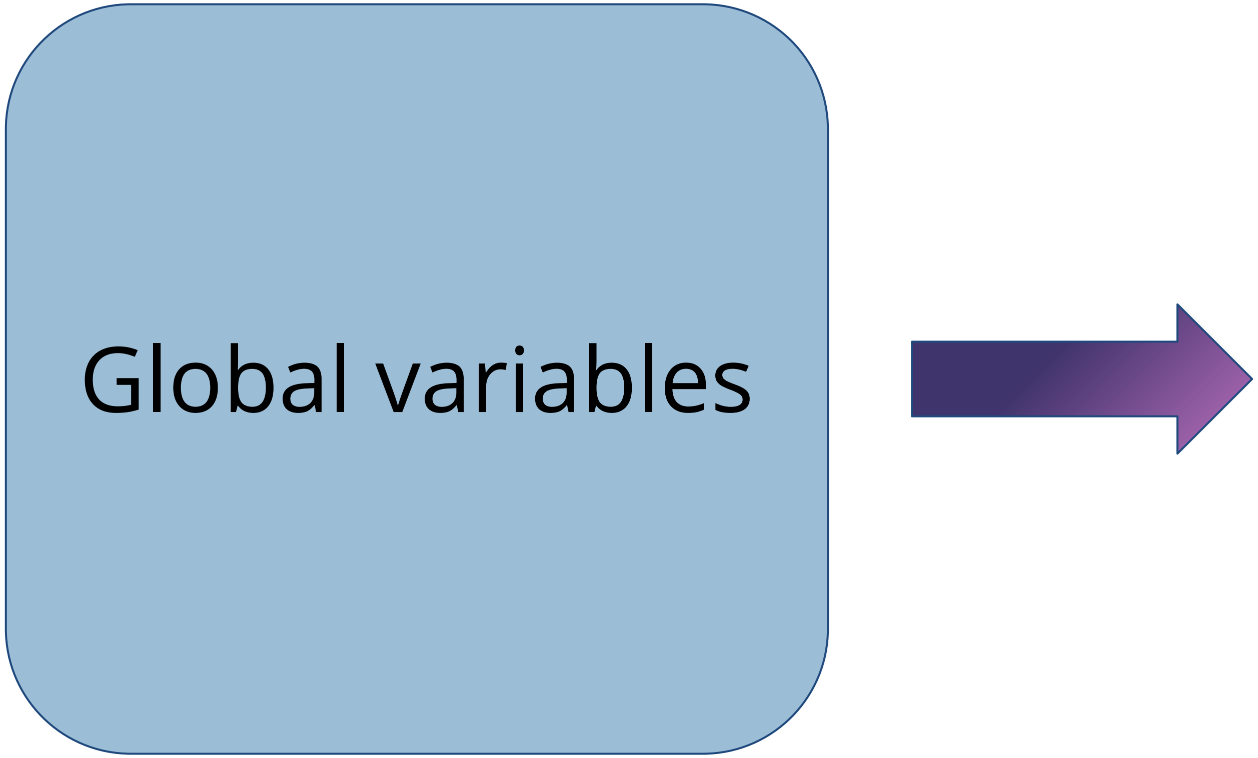


```
int ledpin = 13;

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

// the loop function runs over and over again forever
void loop() {
  digitalWrite(ledpin, HIGH);   // turn the LED on (HIGH is the voltage level)
  delay(5000);                       // wait for 5 seconds
  digitalWrite(ledpin, LOW);    // turn the LED off by making the voltage LOW
  delay(5000);                       // wait for 5 seconds
}
```

Done compiling.

```
Sketch uses 936 bytes (2%) of program storage space. Maximum is 32256 bytes.
Global variables use 9 bytes (0%) of dynamic memory, leaving 2039 bytes for local variables. Maximum is 2048 bytes.
```

Global variables

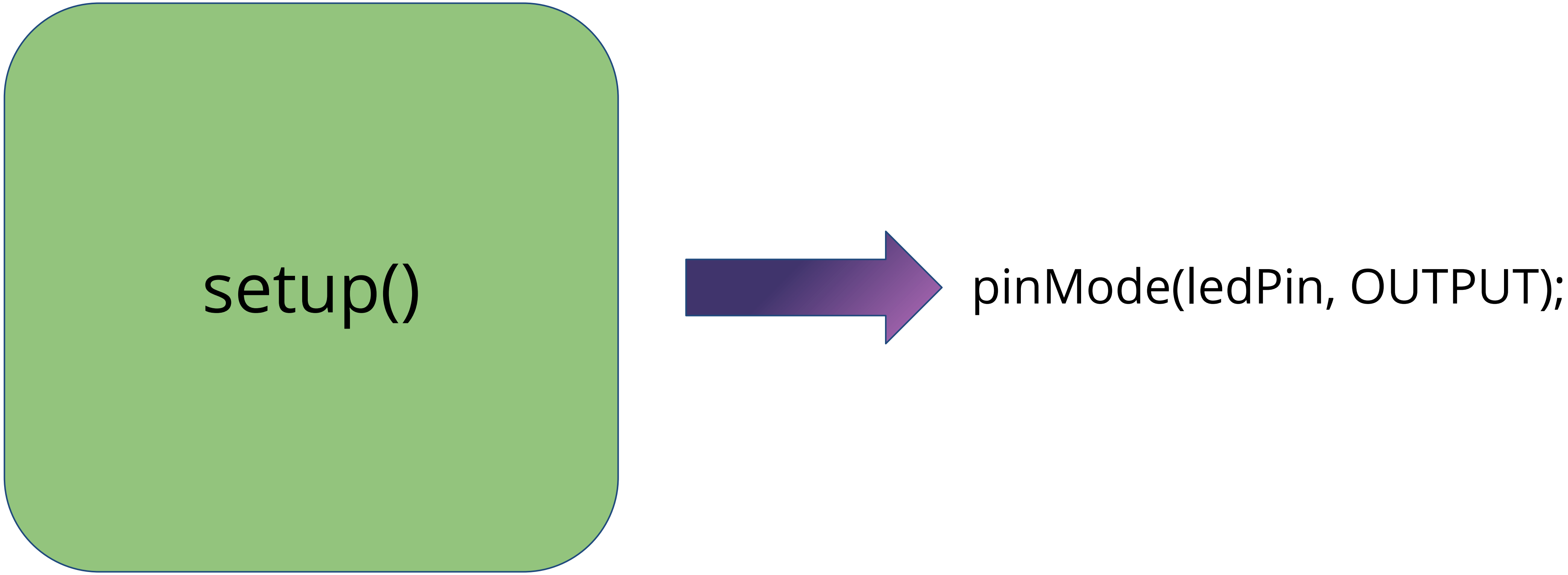


Global variables

int ledPin = 13;

- LED connected to the control pin 13

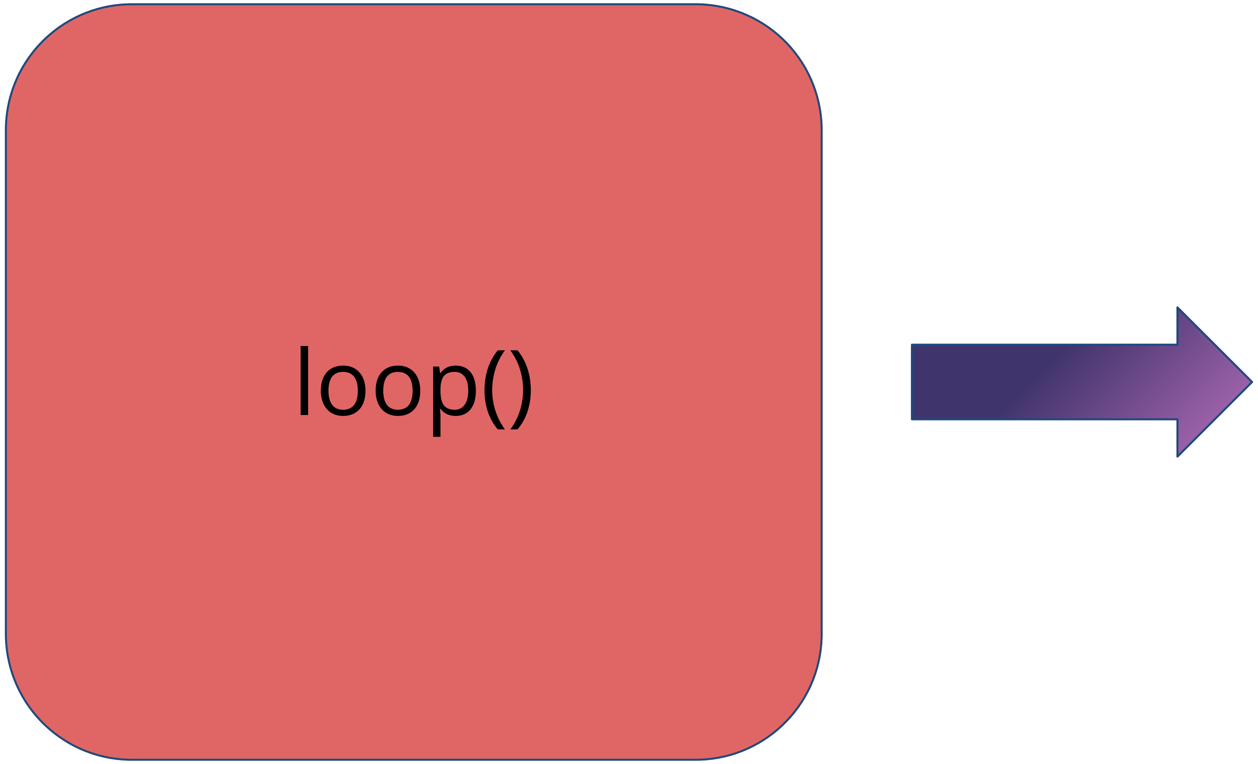
Setup()



setup()

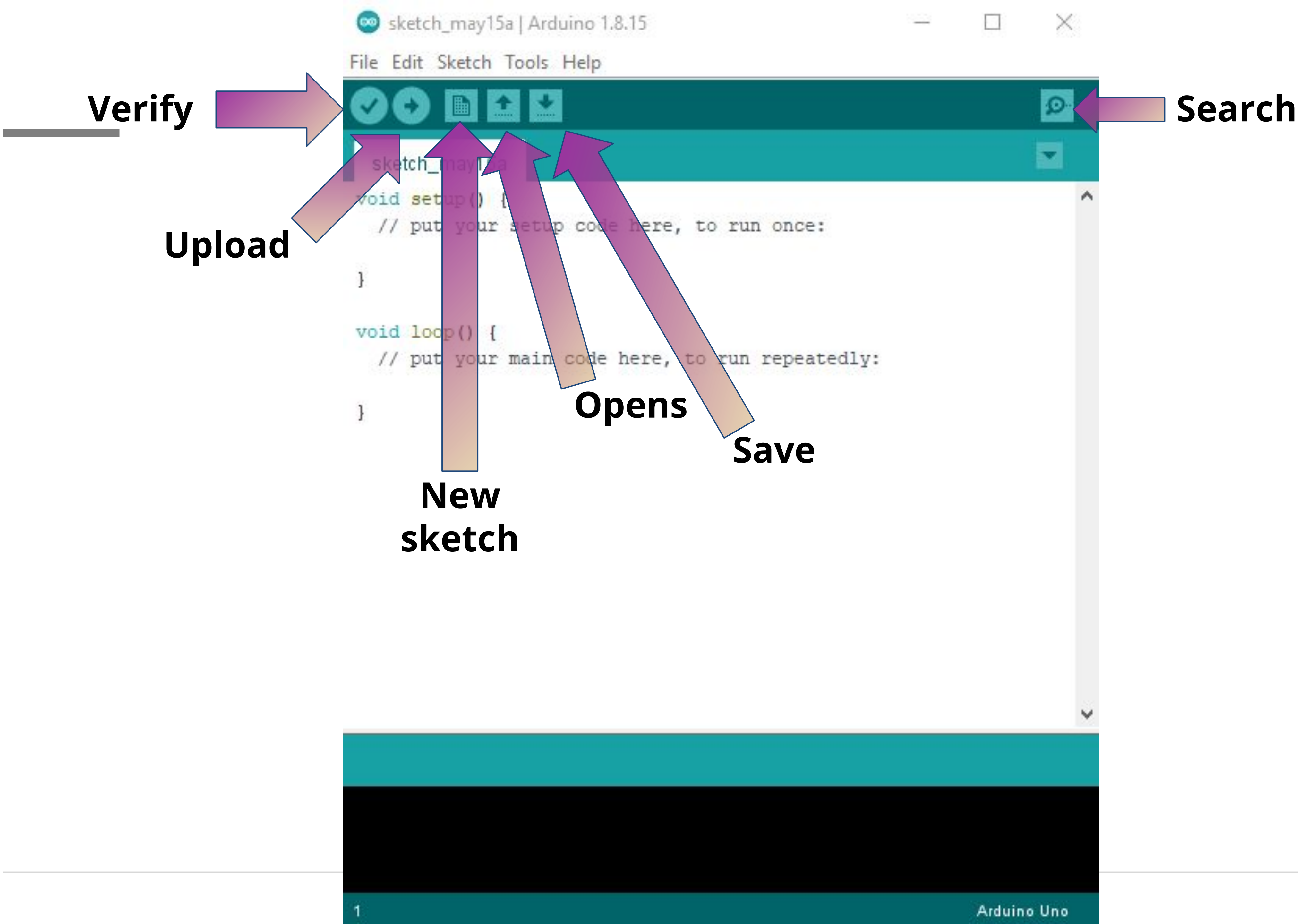
pinMode(ledPin, OUTPUT);

loop()



loop()

```
digitalWrite(ledPin, HIGH);
delay(5000);
digitalWrite(ledPin, LOW);
delay(5000);
```



Verify

Upload

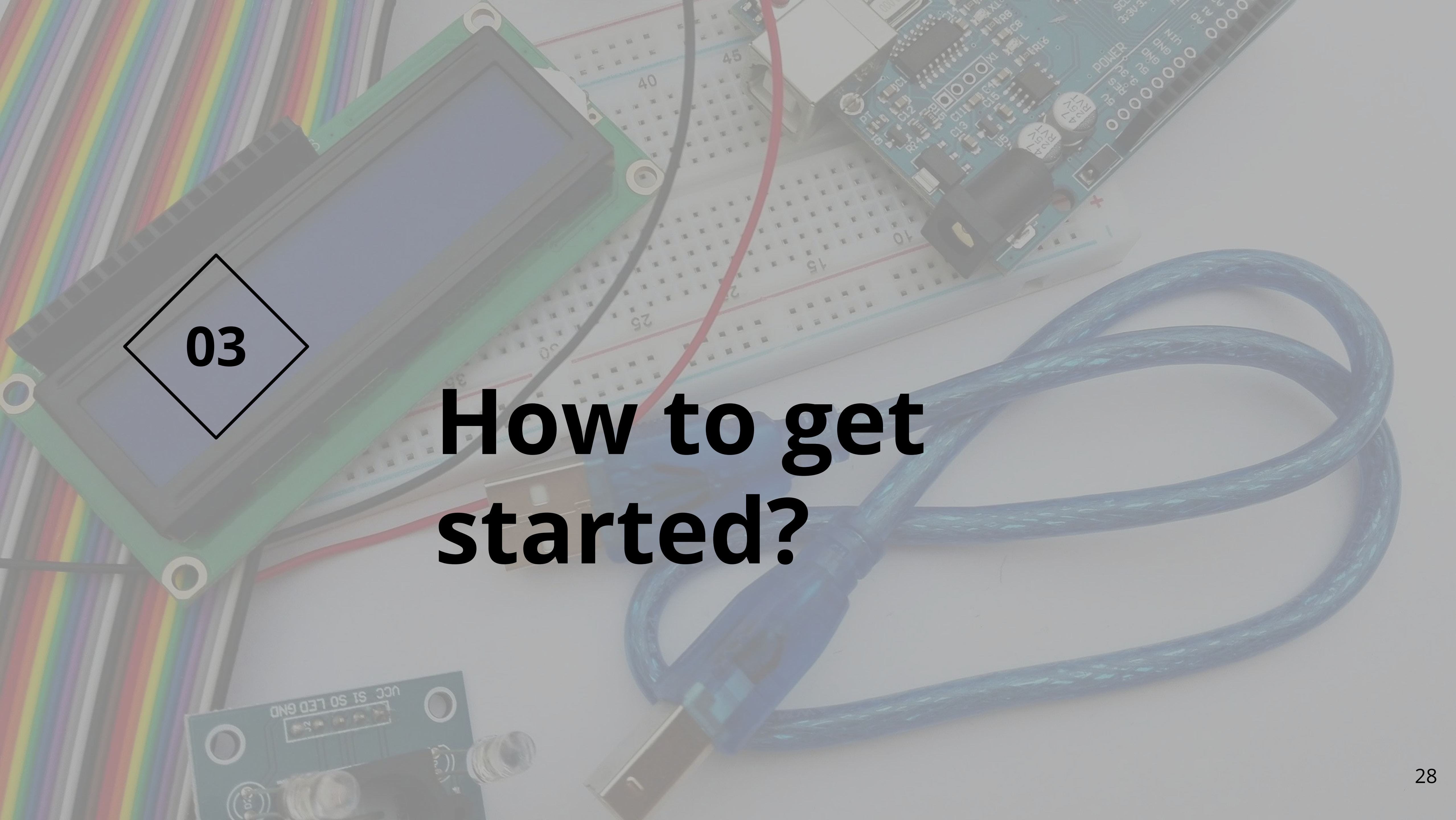
New sketch

Opens

Save

Search

```
void setup() {
  // put your setup code here, to run once:

}

void loop() {
  // put your main code here, to run repeatedly:

}
```



03

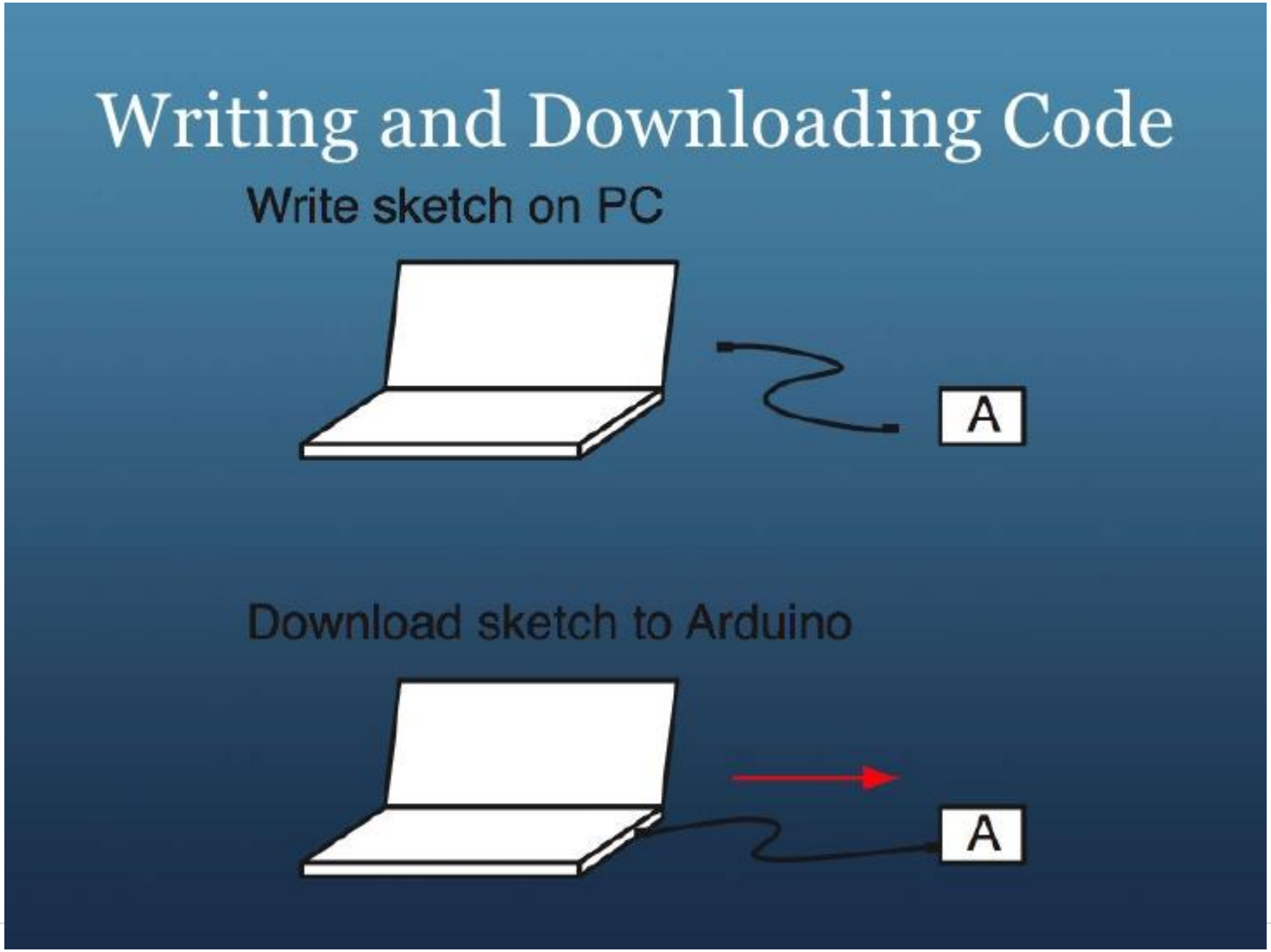
How to get started?

If you have the board

How to get started?

- Arduino board
  - USB cable
  - DC power supplies
- Download the Arduino's software (Arduino IDE)
  - Read carefully
    - Instruccions to install and setup the Arduino board with the computer and software
  - Download the Arduino IDE software
    - http://www.arduino.cc
- Plug it in!

Plug in it into the computer



Writing and Downloading Code

Write sketch on PC

Download sketch to Arduino

Online

Tinkercad is a free, online 3D modeling program that runs in a web browser, known for its simplicity and ease of use. Since it became available in 2011 it has become a popular platform for creating models for 3D printing as well as an entry-level introduction to constructive solid geometry in schools.

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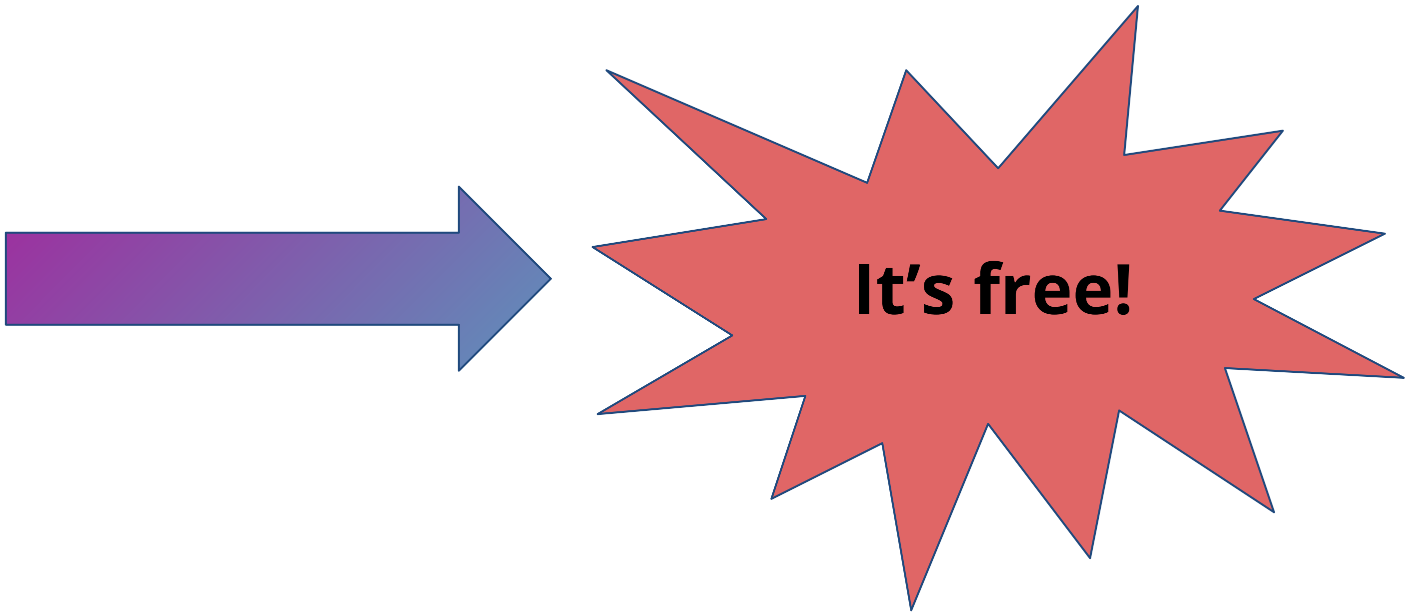
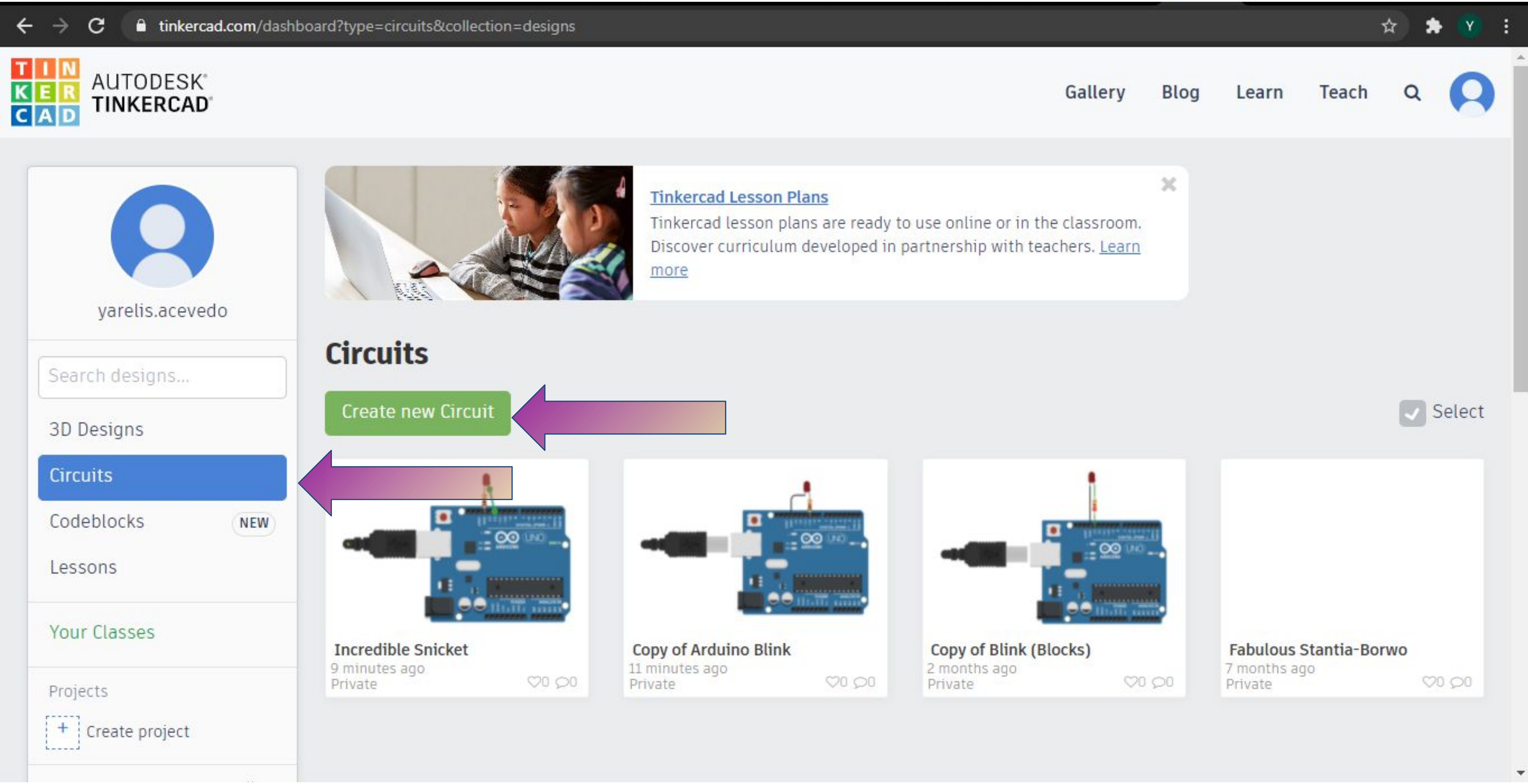
Tinkercad

Make an account in tinkercad

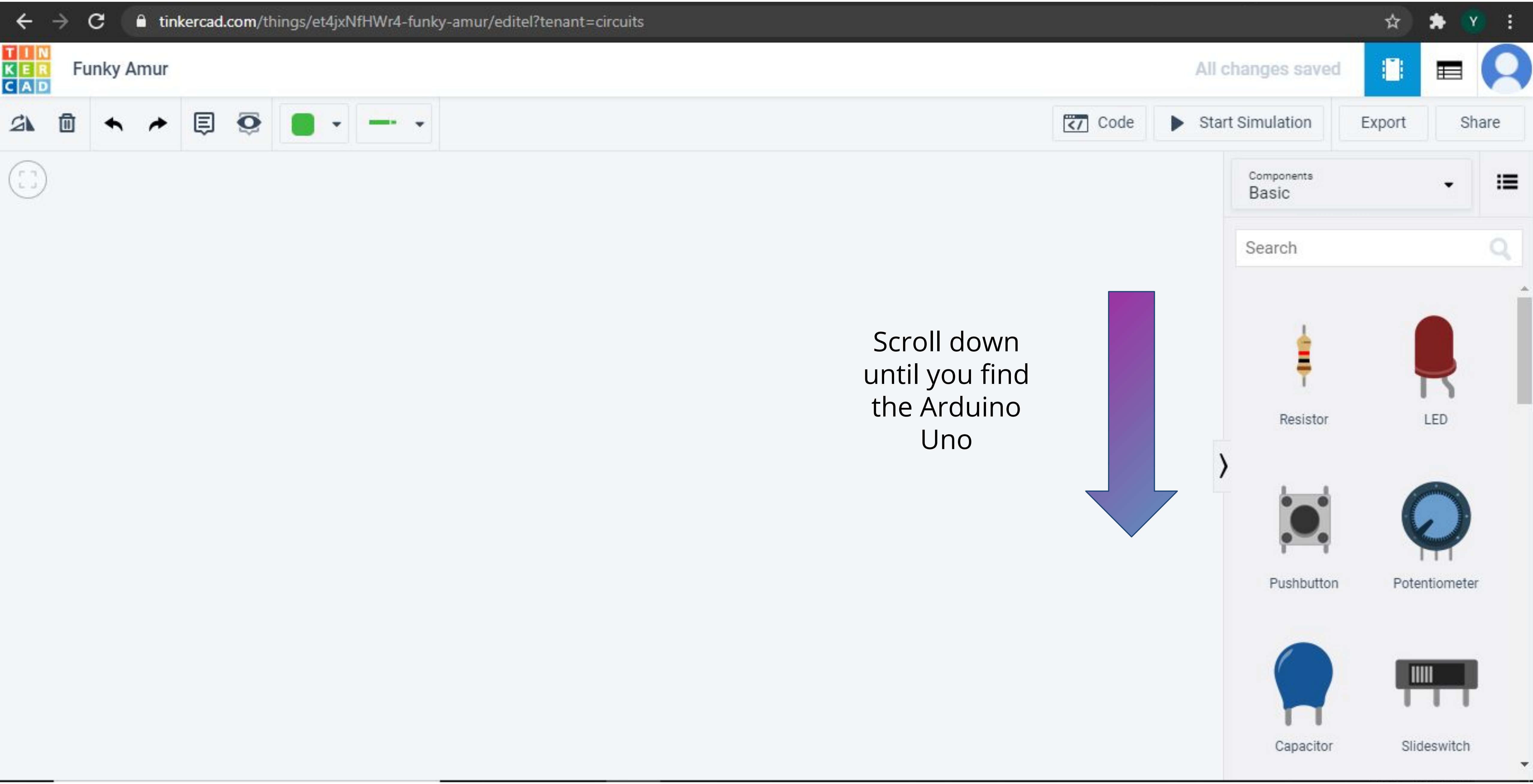


It’s free!

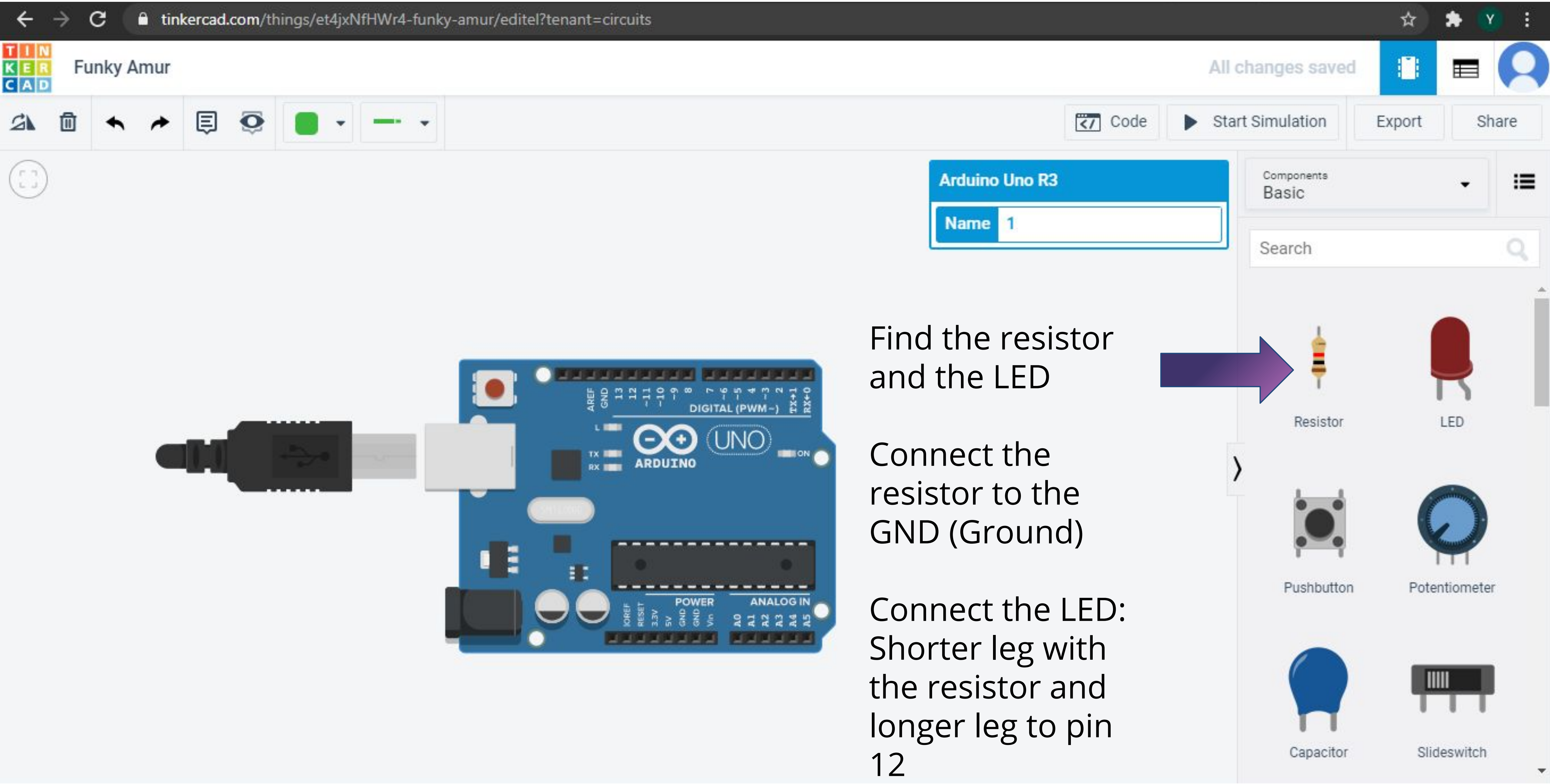


Tinkercad Lesson Plans

Tinkercad lesson plans are ready to use online or in the classroom. Discover curriculum developed in partnership with teachers. Learn more



Scroll down until you find the Arduino Uno



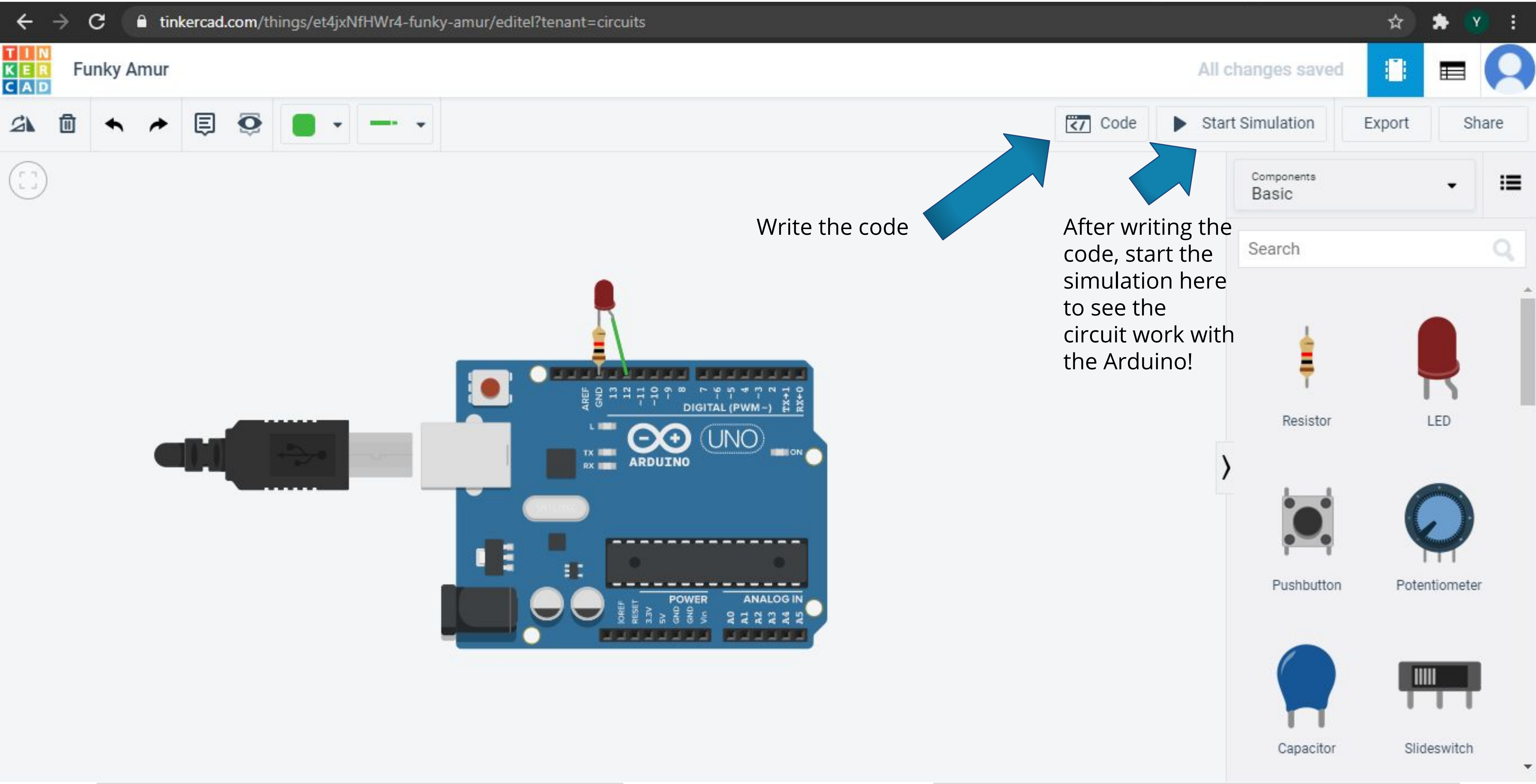
Arduino Uno R3

Name 1

Find the resistor and the LED

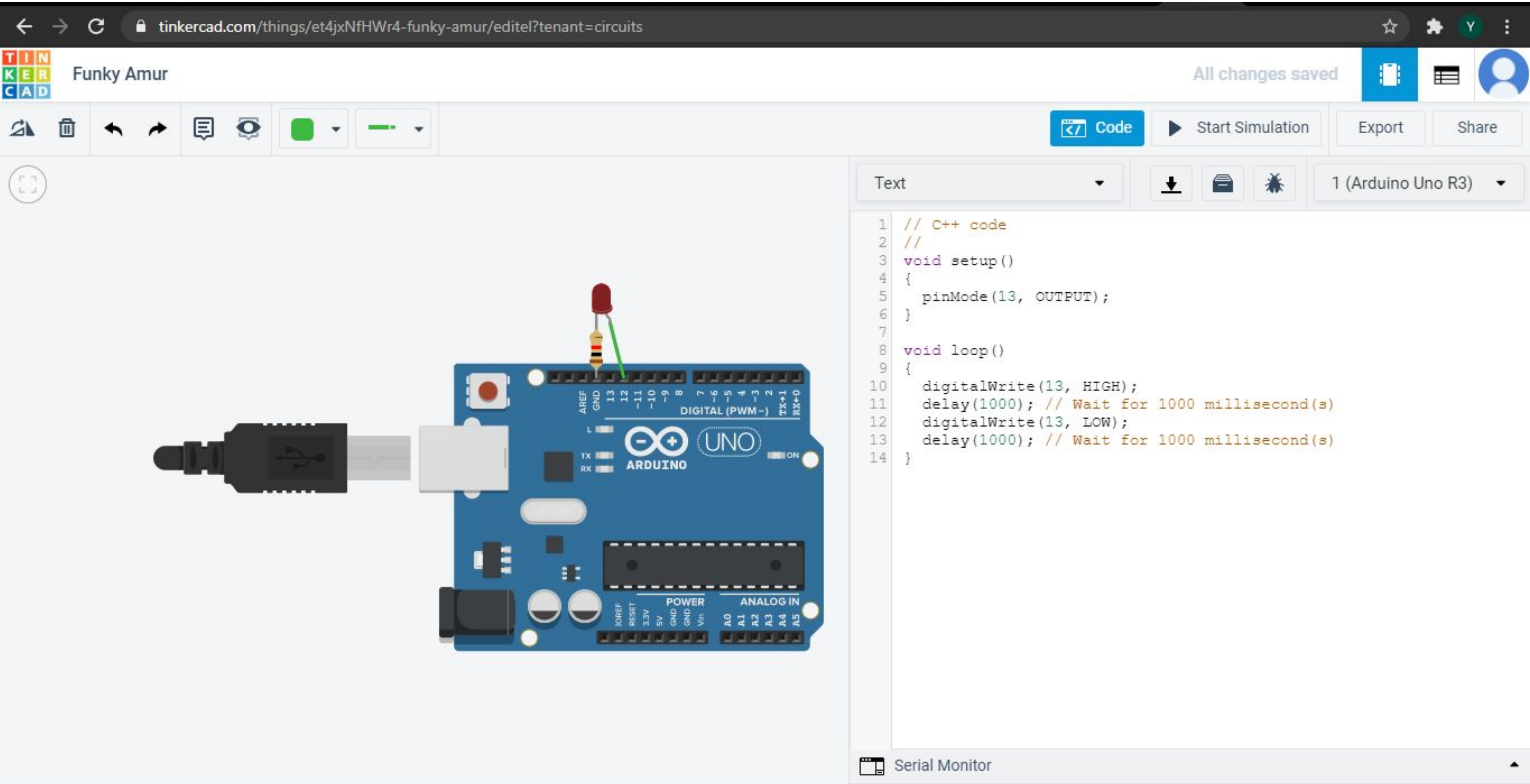
Connect the resistor to the GND (Ground)

Connect the LED: Shorter leg with the resistor and longer leg to pin 12



Write the code

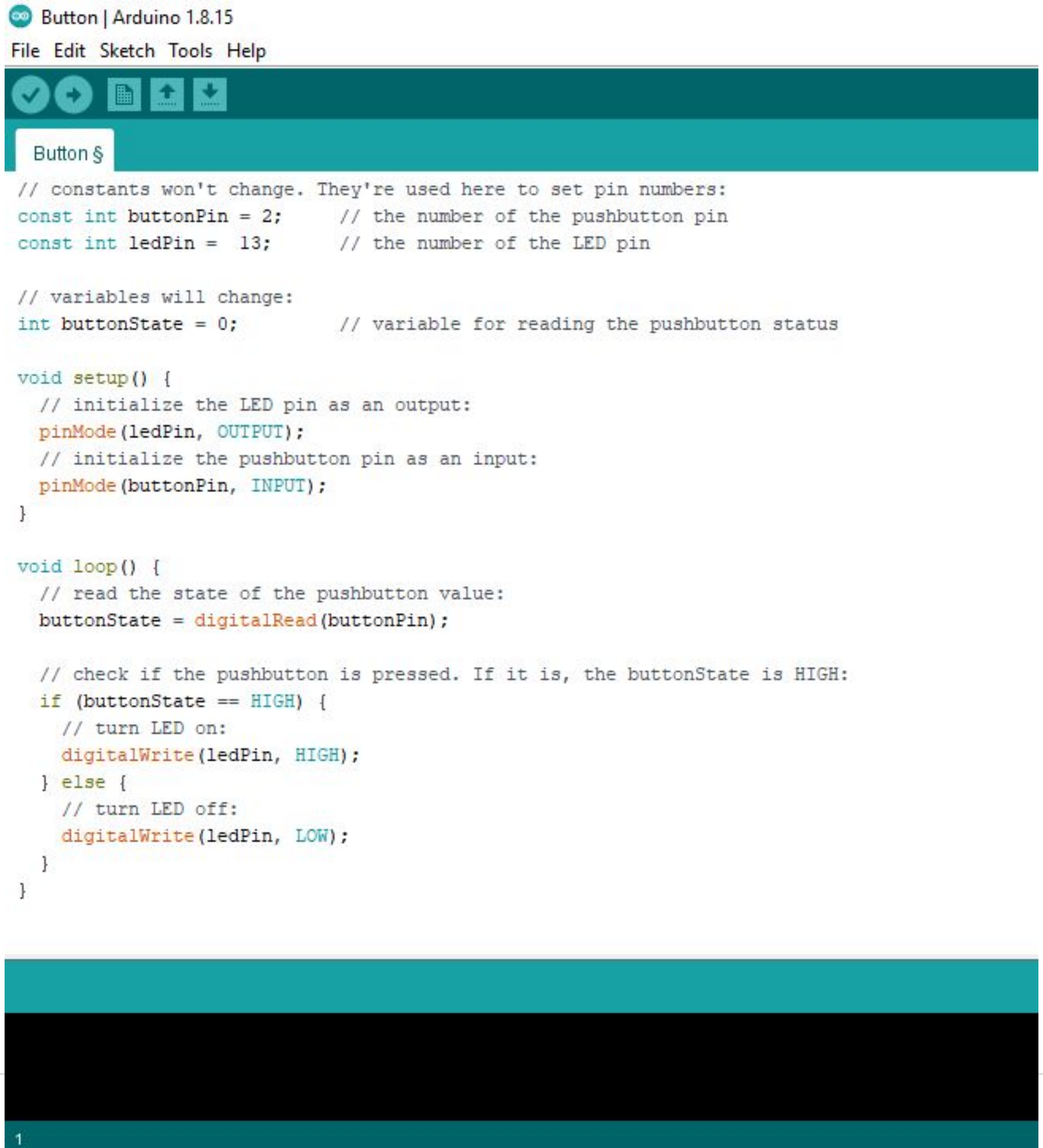
After writing the code, start the simulation here to see the circuit work with the Arduino!



```
// C++ code
//
void setup()
{
  pinMode(13, OUTPUT);
}

void loop()
{
  digitalWrite(13, HIGH);
  delay(1000); // Wait for 1000 millisecond(s)
  digitalWrite(13, LOW);
  delay(1000); // Wait for 1000 millisecond(s)
}
```

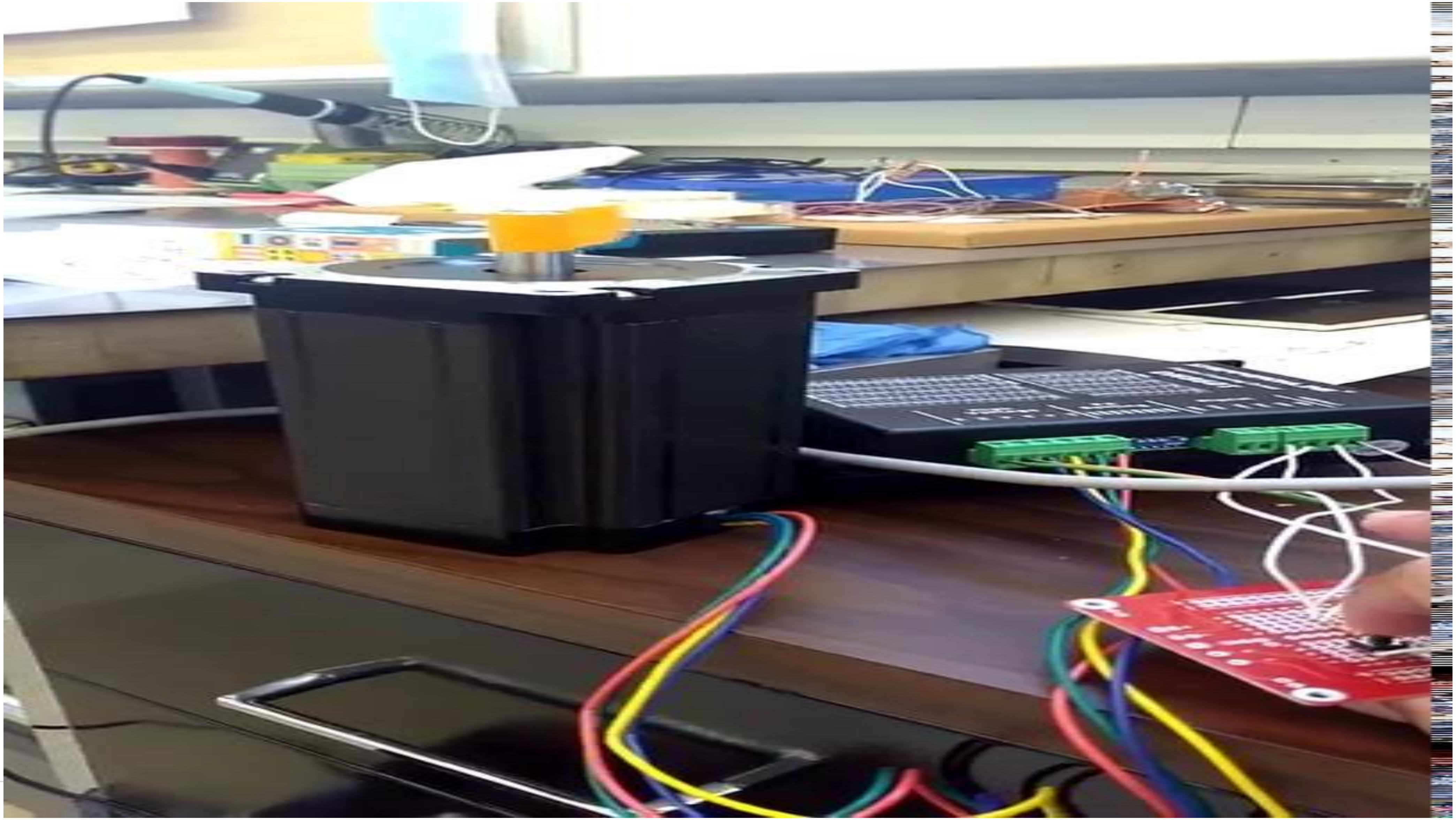
Examples
Shift
PgUp
PgDn
Home
End
Ctrl
Alt Gr

Button

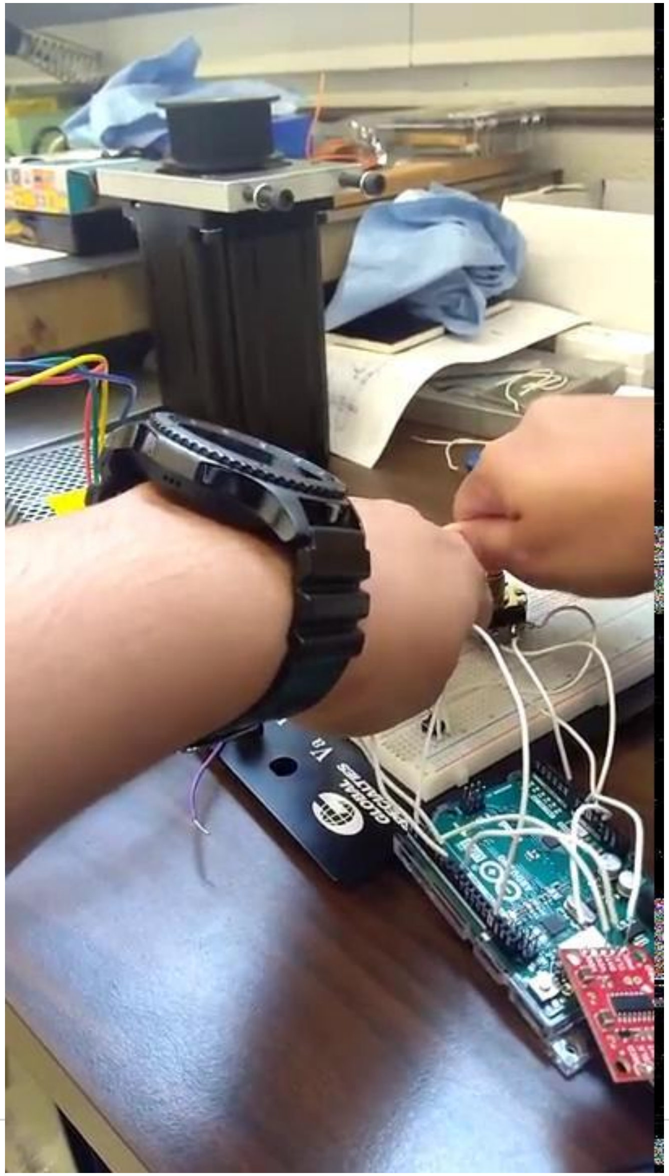


```
// constants won't change. They're used here to set pin numbers:
const int buttonPin = 2;     // the number of the pushbutton pin
const int ledPin =  13;      // the number of the LED pin

// variables will change:
int buttonState = 0;         // variable for reading the pushbutton status

void setup() {
  // initialize the LED pin as an output:
  pinMode(ledPin, OUTPUT);
  // initialize the pushbutton pin as an input:
  pinMode(buttonPin, INPUT);
}

void loop() {
  // read the state of the pushbutton value:
  buttonState = digitalRead(buttonPin);

  // check if the pushbutton is pressed. If it is, the buttonState is HIGH:
  if (buttonState == HIGH) {
    // turn LED on:
    digitalWrite(ledPin, HIGH);
  } else {
    // turn LED off:
    digitalWrite(ledPin, LOW);
  }
}
```

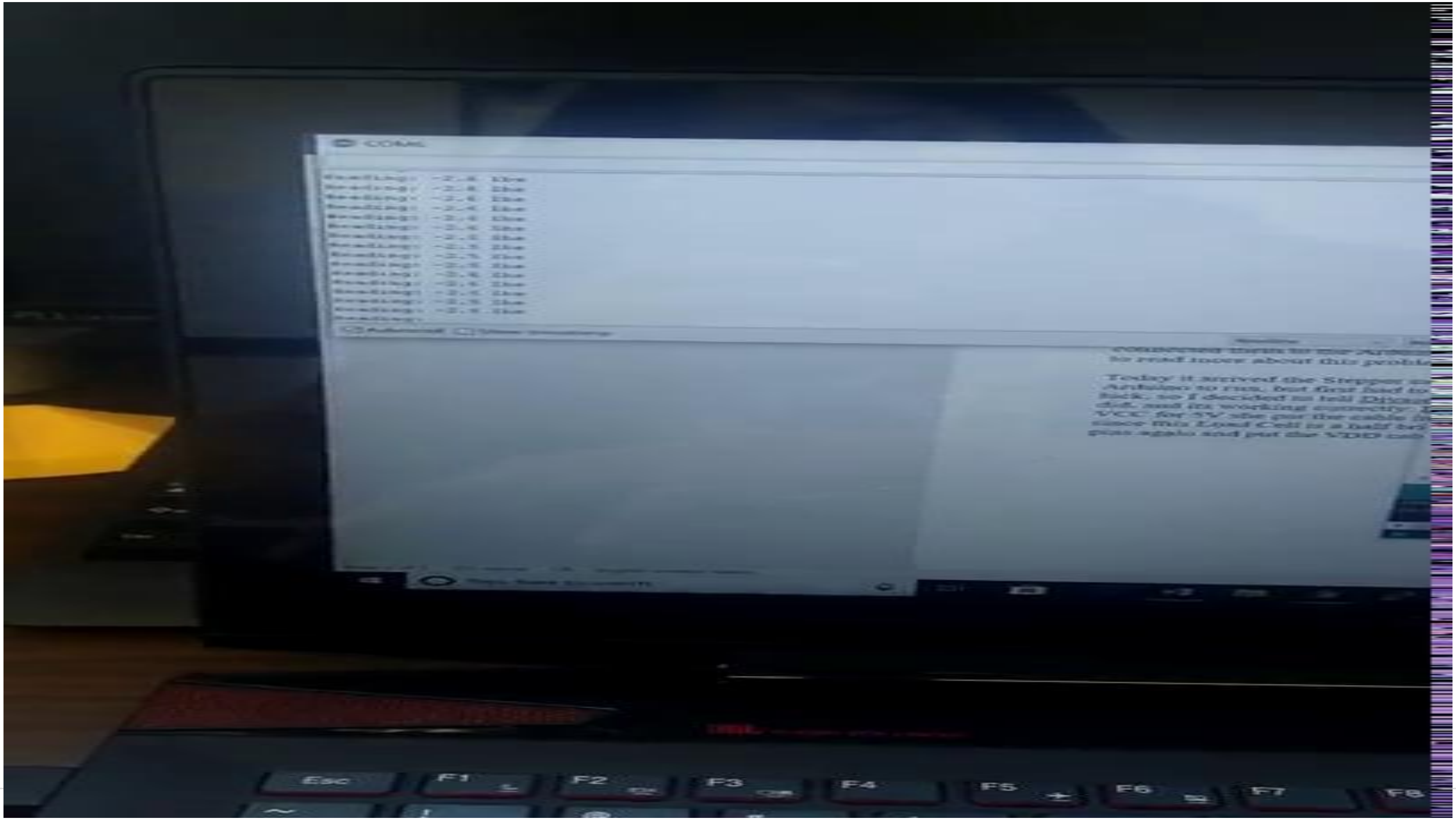
Moving a stepper motor



Moving a stepper motor using a potentiometer



Using a load cell



More projects

You can find more projects at:

https://create.arduino.cc/projecthub

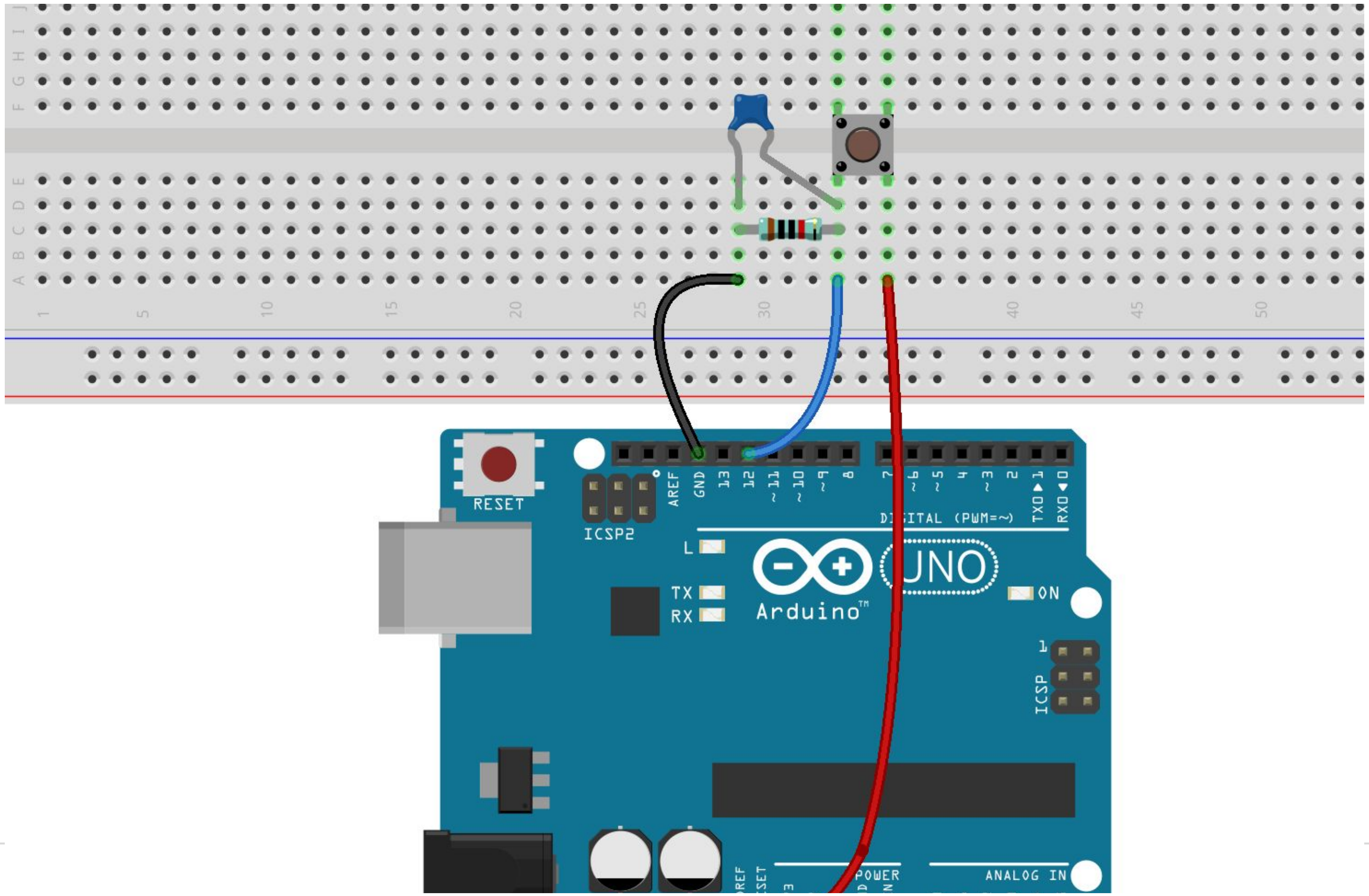
Any
Questions

04

Hands On

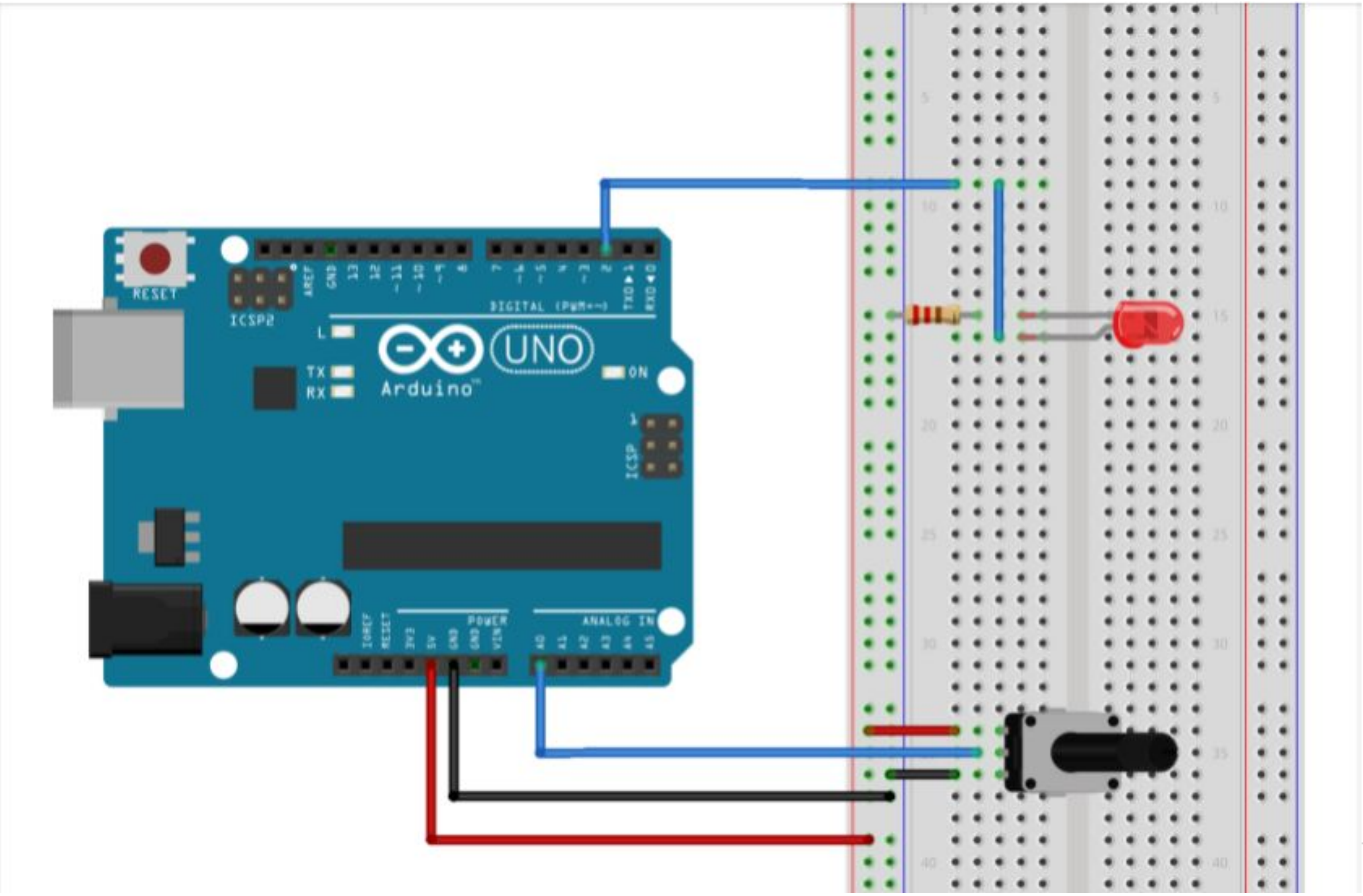
Challenge!!

LED Control Using a button



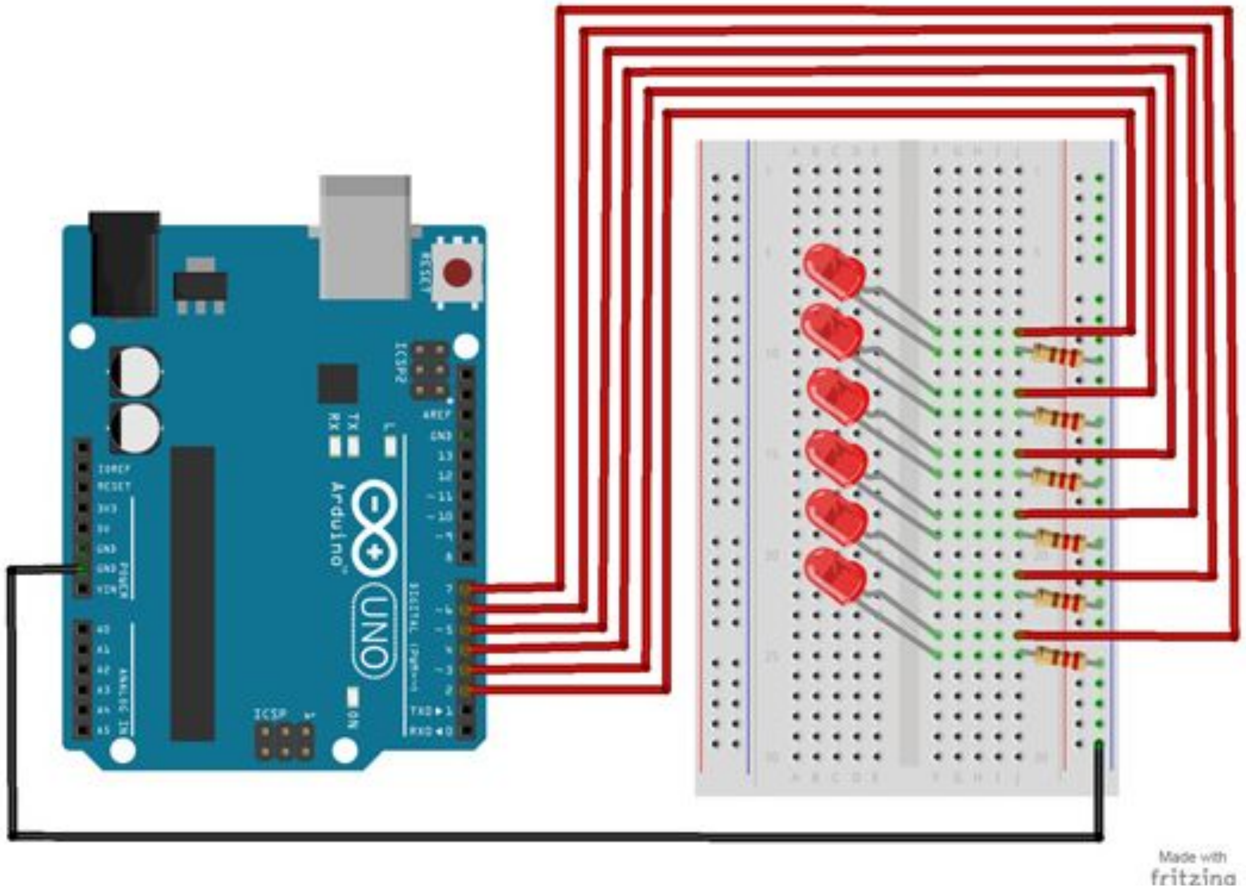
Challenge!!

LED Brightness Control Using a Potentiometer



Challenge!!

Scrolling LED


Arduino
UNO
Made with
fritzing