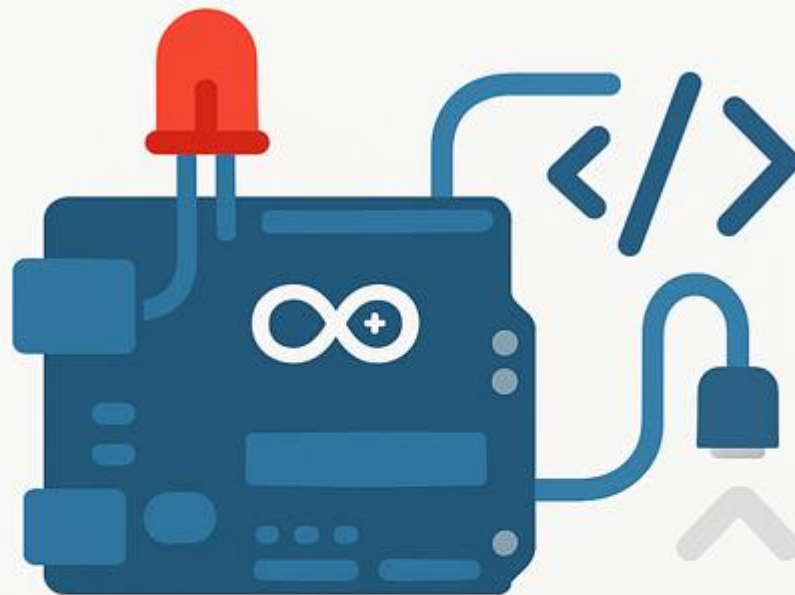
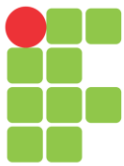


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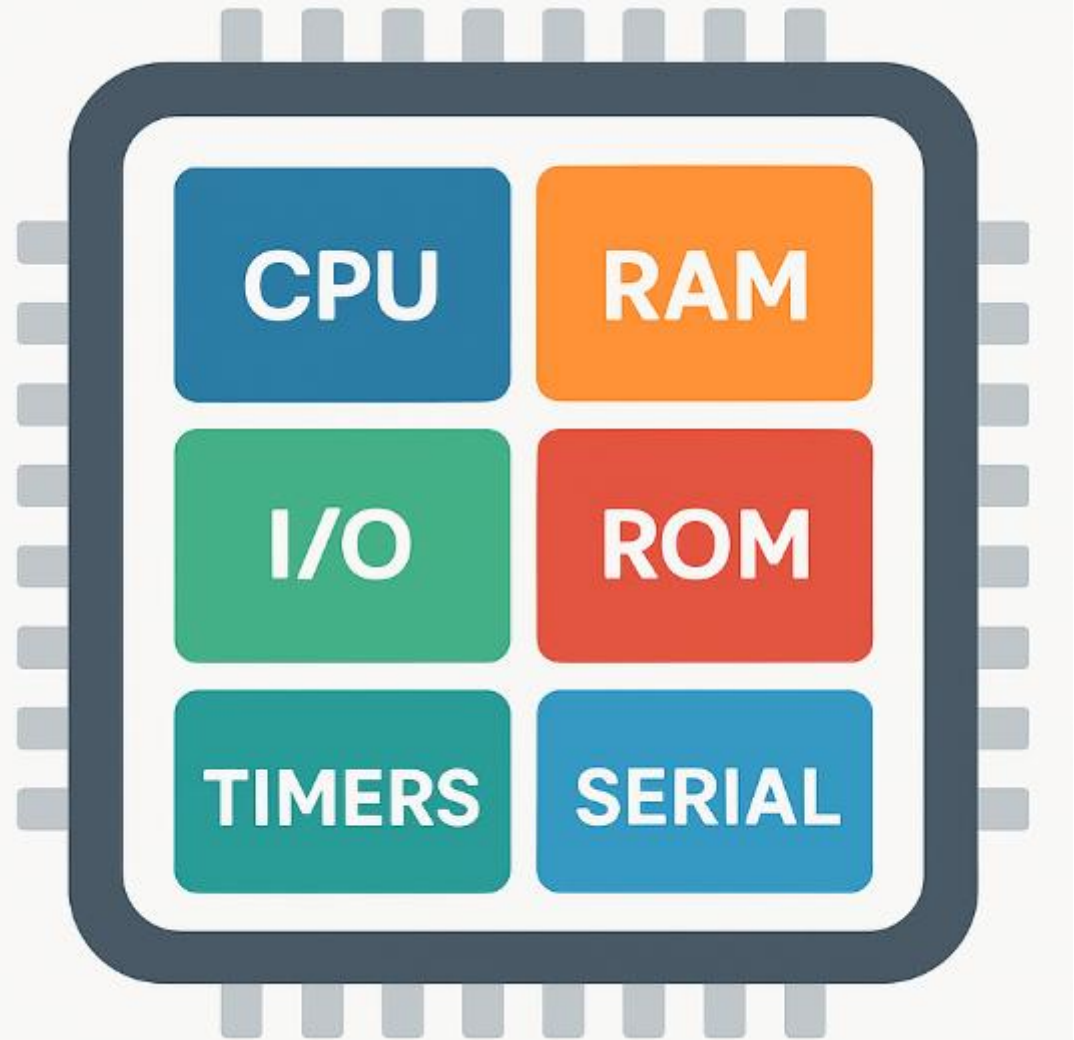
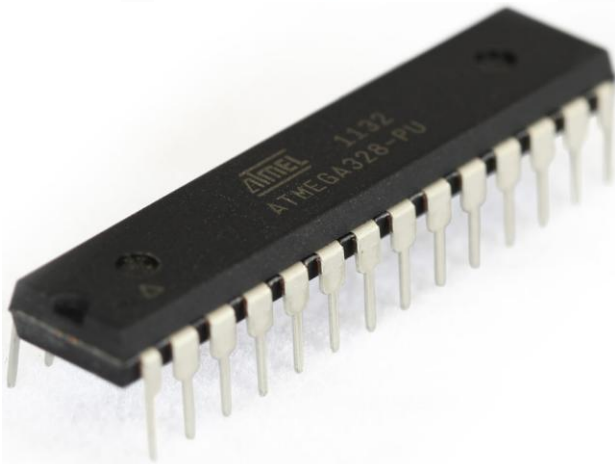
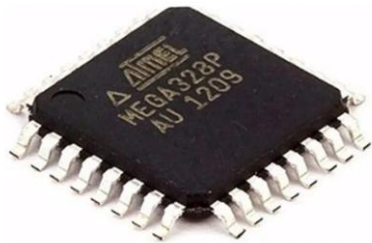
ARDUINO NA PRÁTICA

ricardo.kerschbaumer@ifc.edu.br
<http://ricardokers.github.io/>



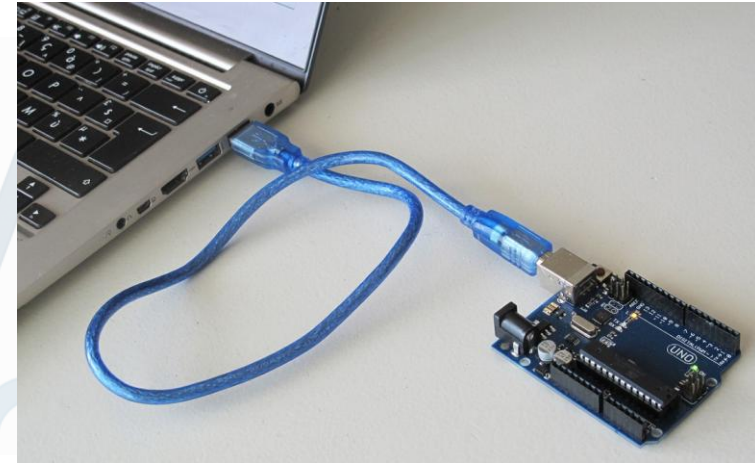
Boas-vindas

- Objetivos do curso
- Motivações
- Microcontroladores

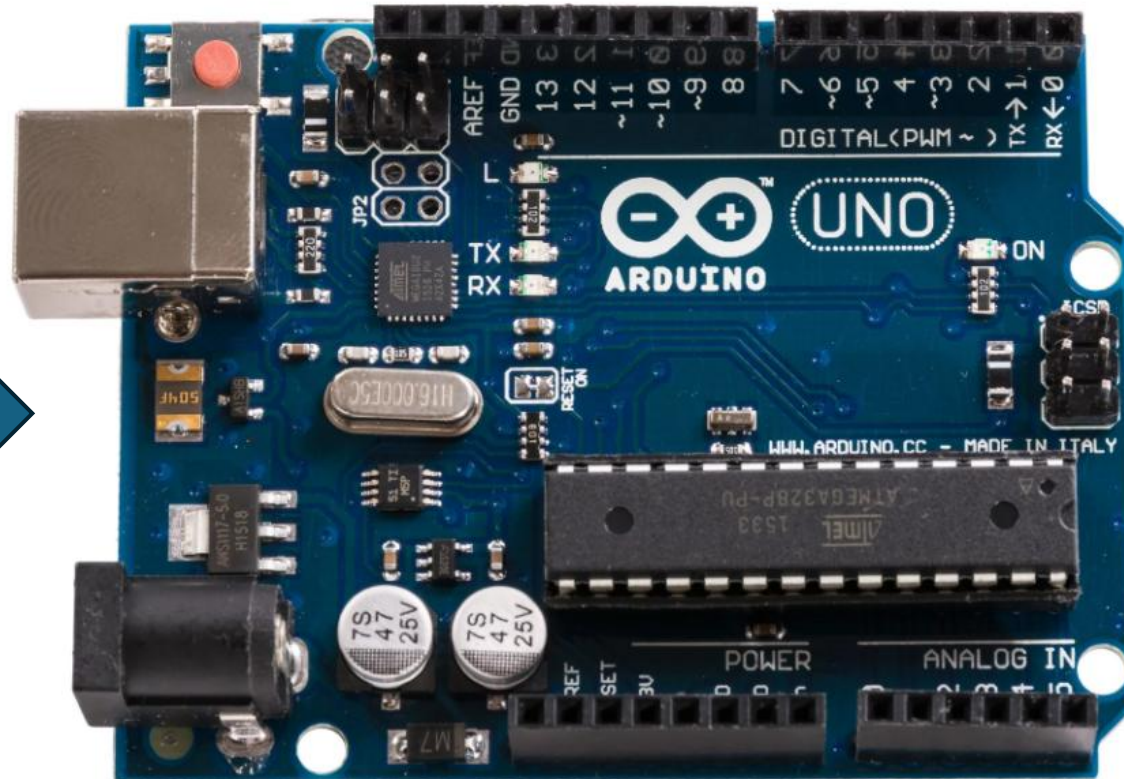


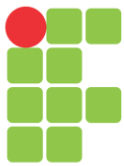
O que é o Arduino?

- Placa com microcontrolador
- Programável por USB
- Entradas e saídas digitais e analógicas
- Simulação no Thinkercad
- Variações: UNO, Nano, Mega etc.

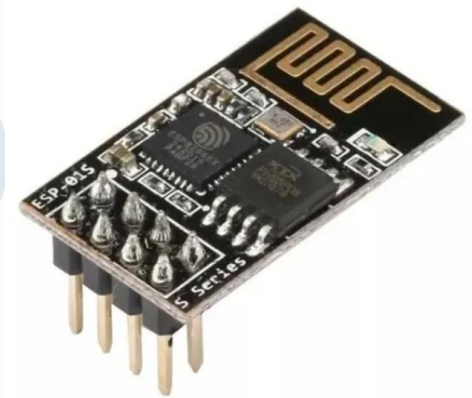
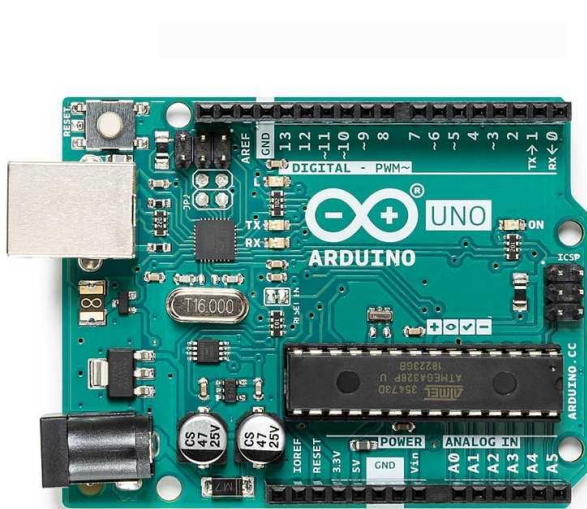


```
void setup() {  
  pinMode(13, OUTPUT);  
}  
  
void loop() {  
  digitalWrite(13, HIGH);  
  delay(1000);  
  digitalWrite(13, LOW);  
  delay(1000);  
}
```





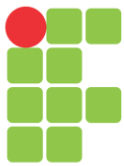
Modelos de Arduino



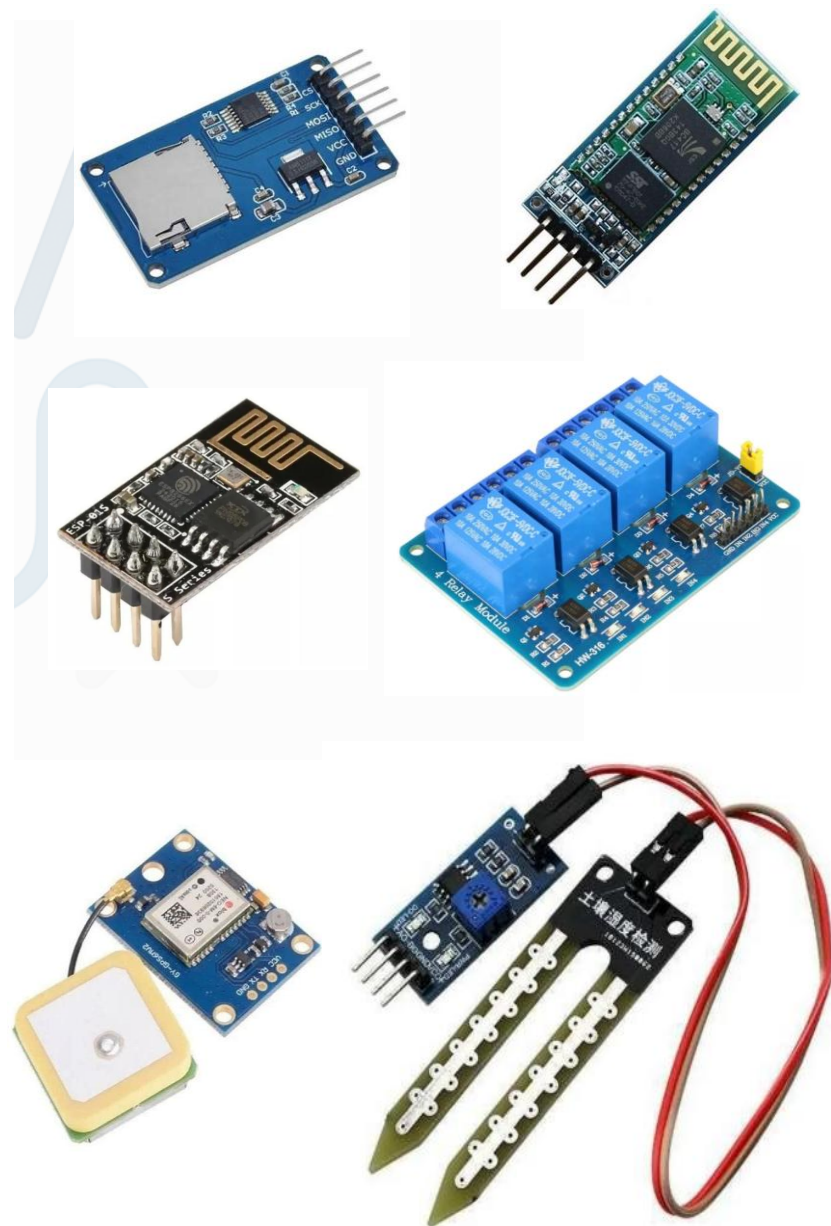
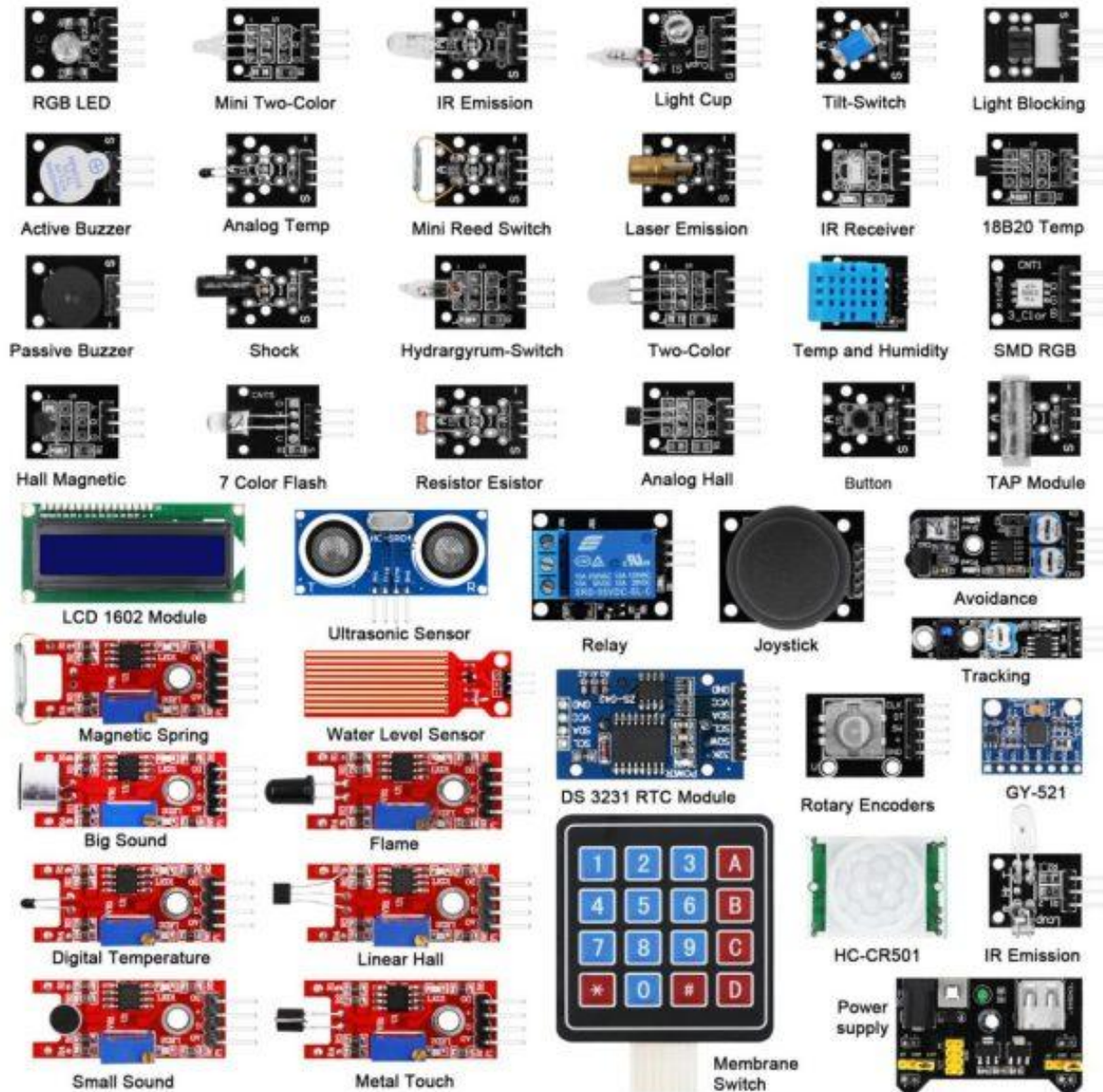
E muitos outros...

Expansões (Shields) para Arduino

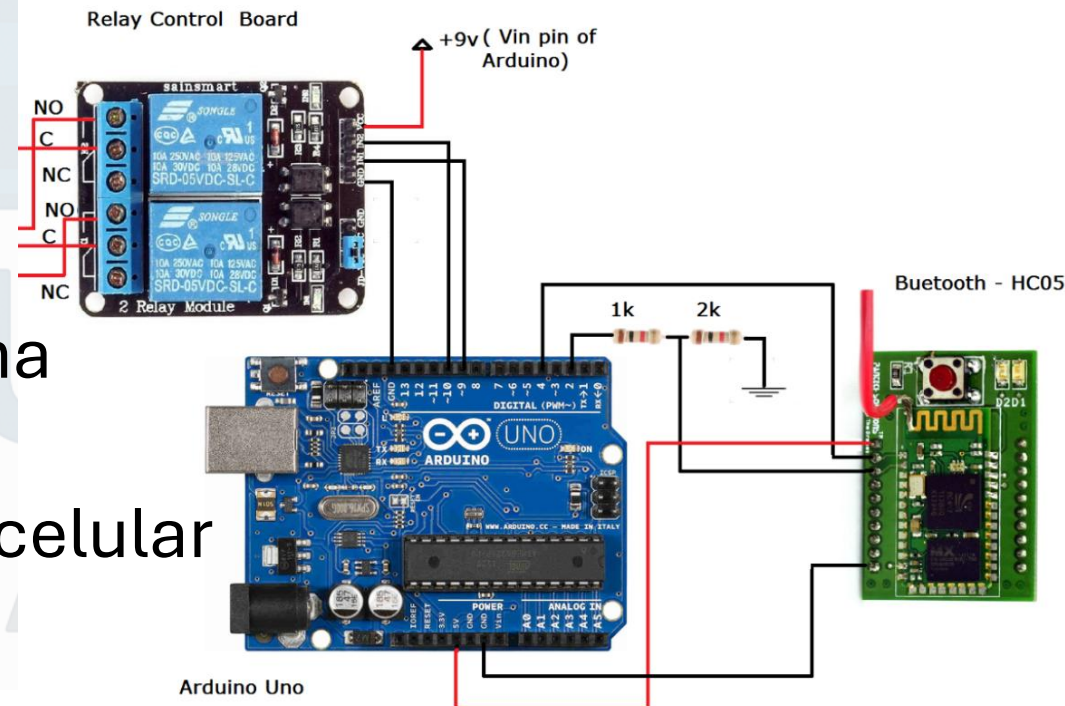
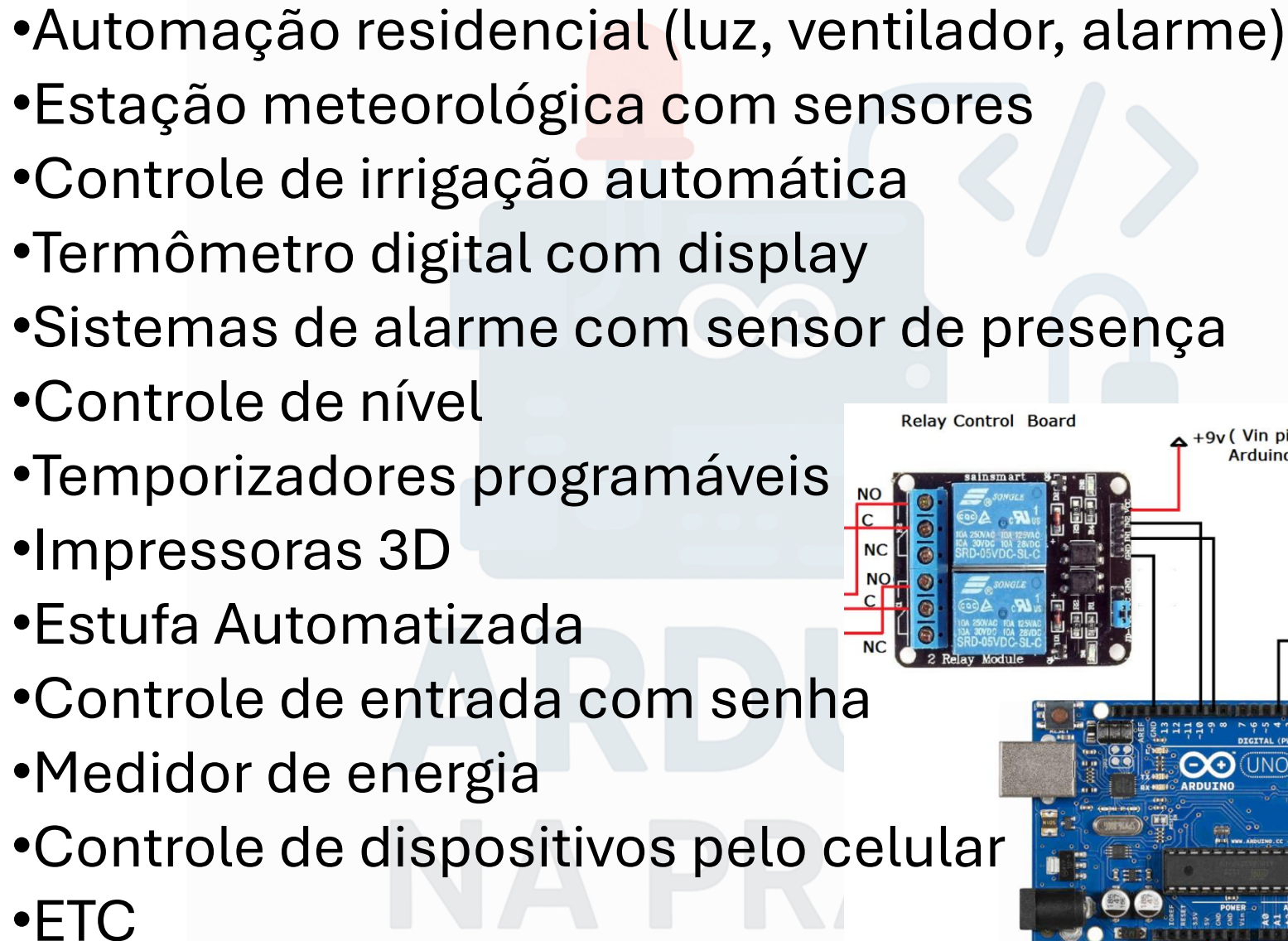




Módulos para Arduino



Exemplos de aplicações

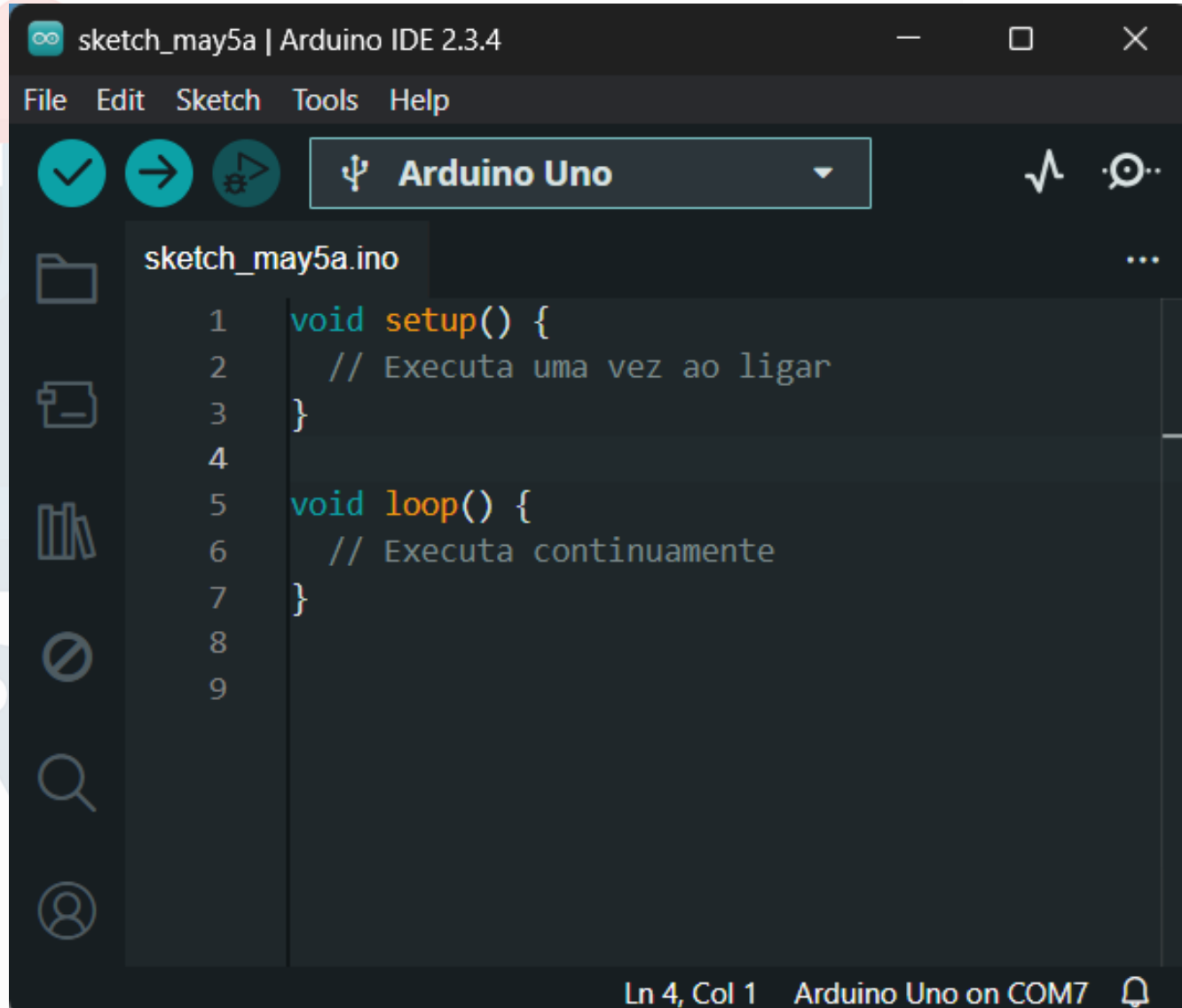


- tação USB ou
 no conector.
 0-5V
 ximo 40mA
 da.
-
- The diagram shows the pin headers of an Arduino Uno board. The pins are labeled as follows:
- Power Pins:** IOREF, RESET, 3.3V, 5V, GND, VIN.
 - Analog Pins:** A0, A1, A2, A3, A4, A5.
 - Digital Pins:** PC0, PC1, PC2, PC3, PC4, PC5, PB0, PB1, PB2, PB3, PB4, PB6, PD0, PD1, PD2, PD3, PD4, PD5, PD6, PD7.
 - I2C Pins:** SDA, SCL.
- Red checkmarks are placed next to the following pins, indicating they are active or used:
- PC0, PC1, PC2, PC3, PC4, PC5
 - PB0, PB1, PB2, PB3, PB4, PB6
 - PD0, PD1, PD2, PD3, PD4, PD5, PD6, PD7

Professor Ricardo Kerschbaumer

Programação do Arduino

- Arduino IDE
- Download e instalação
- Configurar a porta serial
- Configurar a placa
- Alternativa: Tinkercad Circuits
- Teste com Blink



```
sketch_may5a | Arduino IDE 2.3.4
File Edit Sketch Tools Help
[Check] [Run] [Verify] [USB] Arduino Uno
sketch_may5a.ino
1 void setup() {
2   // Executa uma vez ao ligar
3 }
4
5 void loop() {
6   // Executa continuamente
7 }
8
9
Ln 4, Col 1  Arduino Uno on COM7
```

Primeiro código - Blink

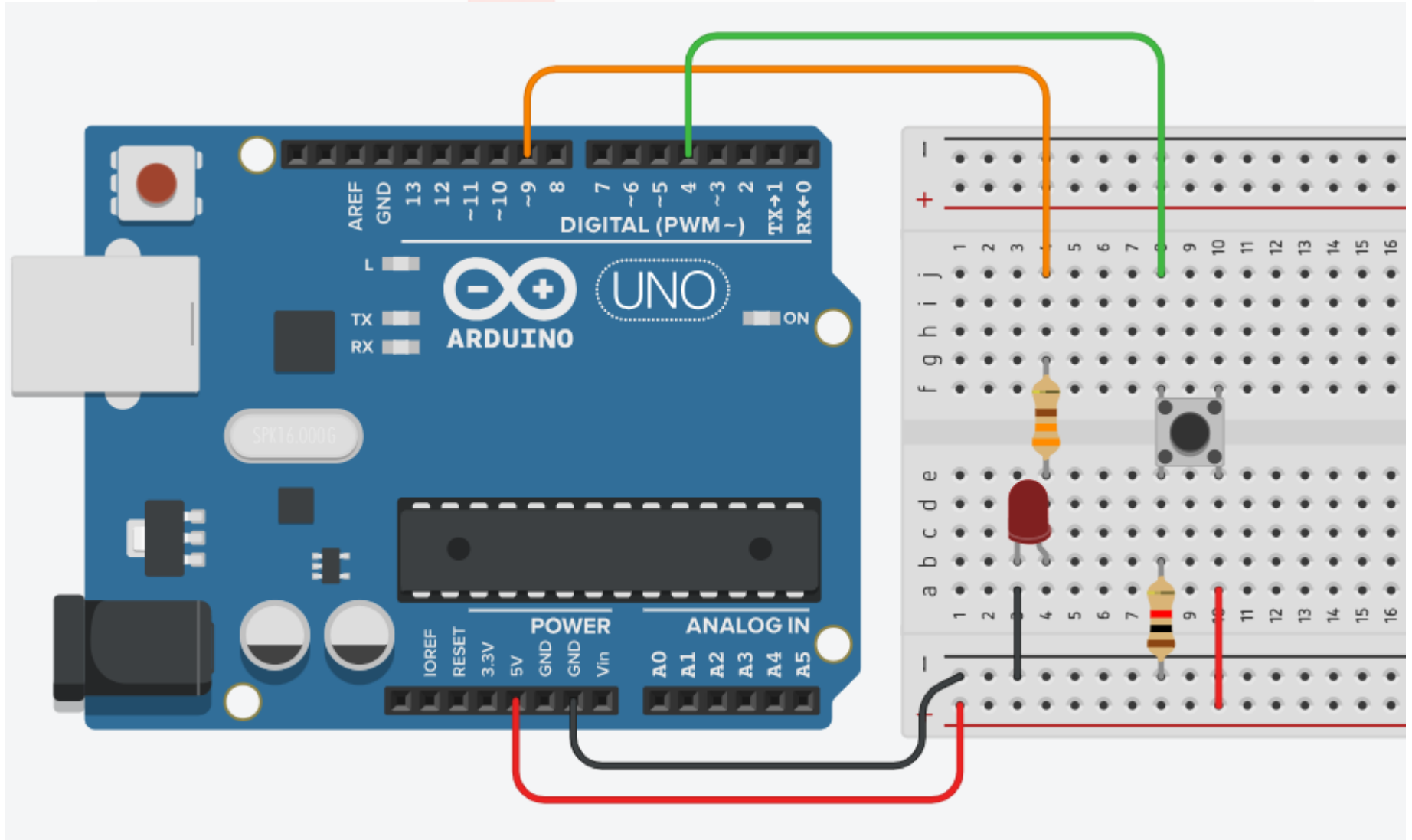
- Exemplo de programa
- Não necessita de conexões
- Pisca o LED da placa (pino 13)
- Use delay para controlar o tempo

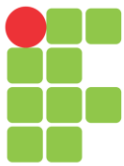
```
void setup() {  
    pinMode(13, OUTPUT);  
}  
  
void loop() {  
    digitalWrite(13, HIGH);  
    delay(1000);  
    digitalWrite(13, LOW);  
    delay(1000);  
}
```




Entradas e saídas digitais

Exemplo com botão e LED:



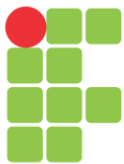


Entradas e saídas digitais

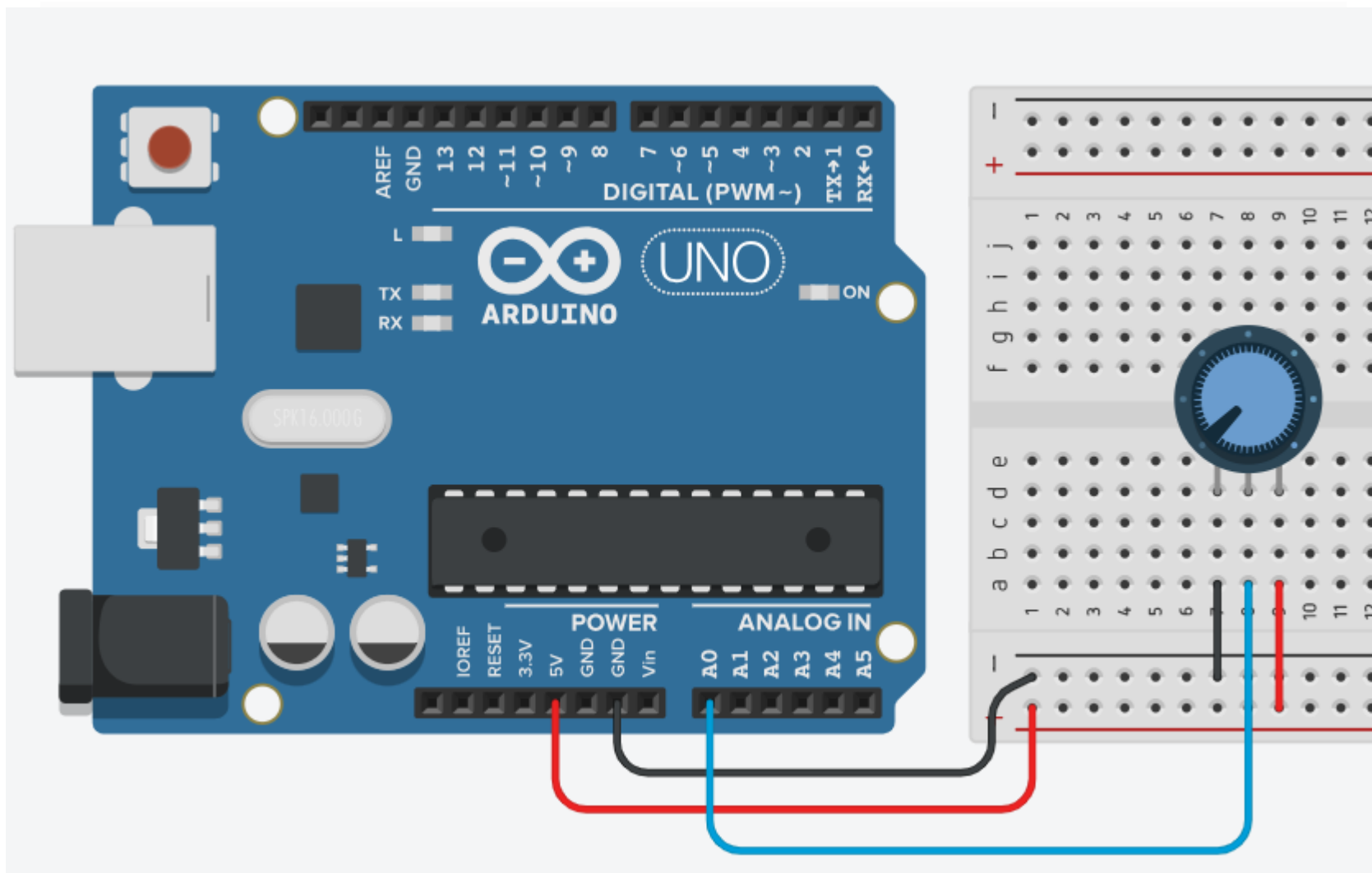
Exemplo com botão e LED:

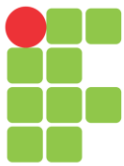
```
pinMode(pino, INPUT/OUTPUT);  
digitalWrite(pino, HIGH/LOW);  
digitalRead(pino);  
  
if (digitalRead(botao) == HIGH/LOW) {  
    // Se for verdadeiro  
    // Executa alguma ação  
} else {  
    // Se for falso  
    // Executa outra ação  
}
```

```
int botao = 4;  
int led = 9;  
  
void setup() {  
    pinMode(botao, INPUT);  
    pinMode(led, OUTPUT);  
}  
  
void loop() {  
    if (digitalRead(botao) == HIGH) {  
        digitalWrite(led, HIGH);  
    } else {  
        digitalWrite(led, LOW);  
    }  
}
```

Entrada analógica





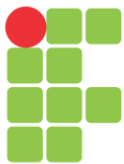
Entrada analógica

- `analogRead(pino)` retorna 0 a 1023 para tensão de 0 a 5V
- Ideal para ler sensores
- `Serial.begin(9600)` ativa a comunicação serial
- `Serial.println(valor)` envia o valor pela serial

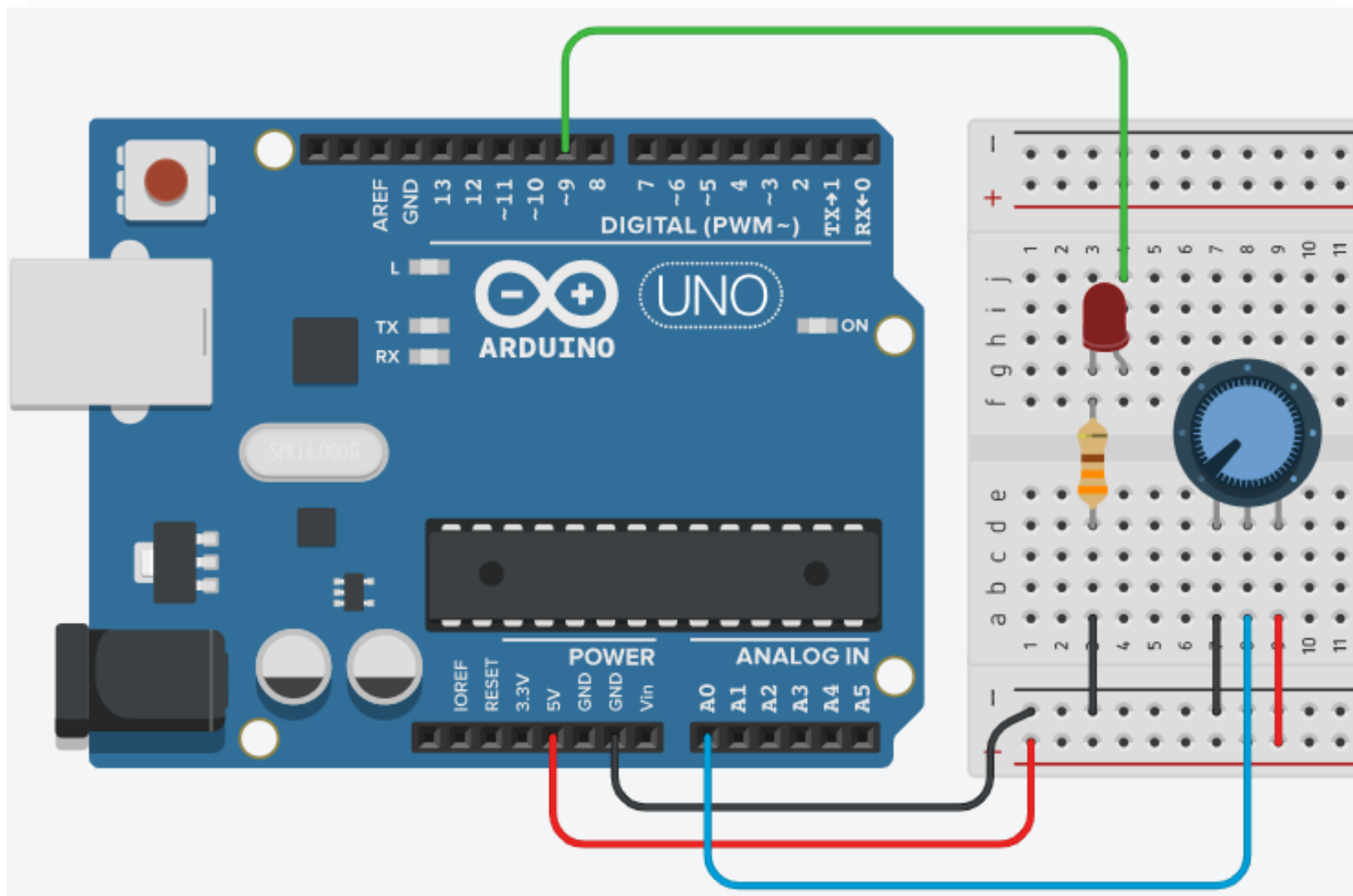
```
int pot = A0;
int valor;

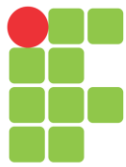
void setup() {
  Serial.begin(9600);
}

void loop() {
  valor = analogRead(pot);
  Serial.println(valor);
  delay(200);
}
```

Saída analógica (PWM)

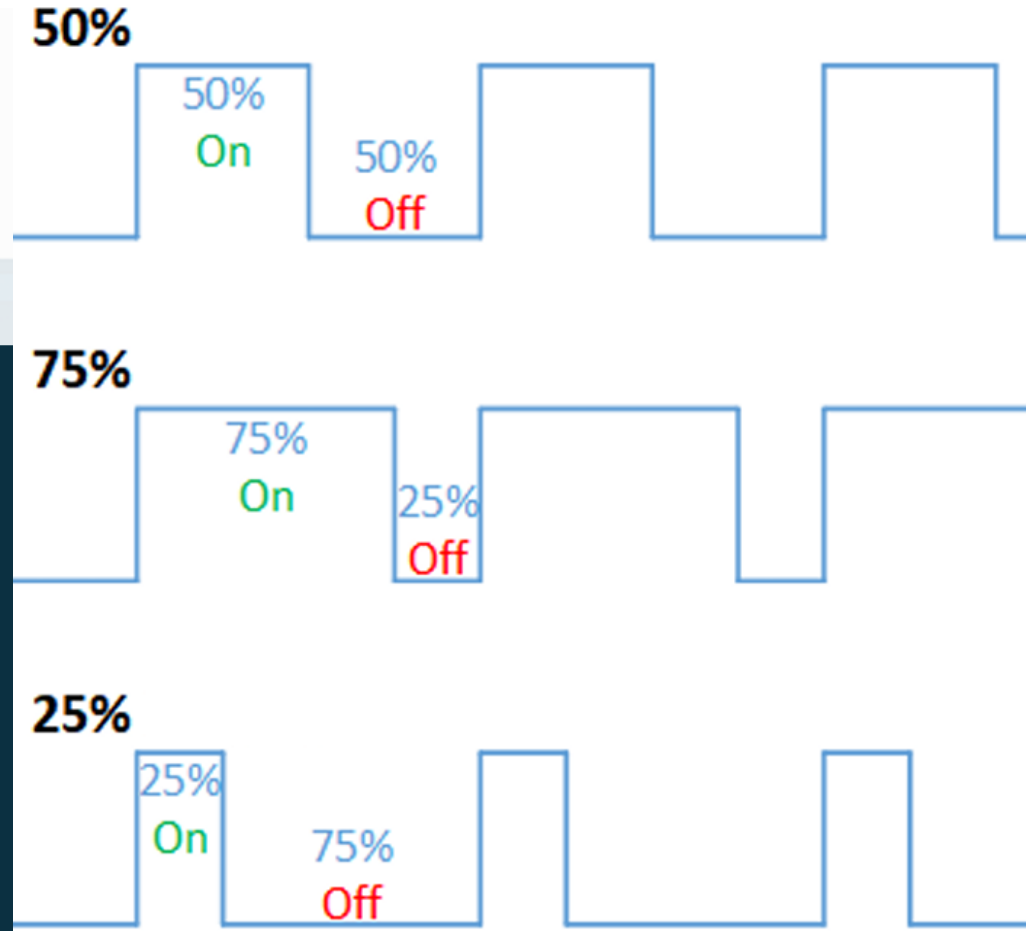


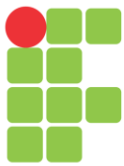


Saída analógica (PWM)

`analogWrite(pino, valor)` de 0 a 255.
Controla razão cíclica da saída.
0 = 0% e 255 = 100%

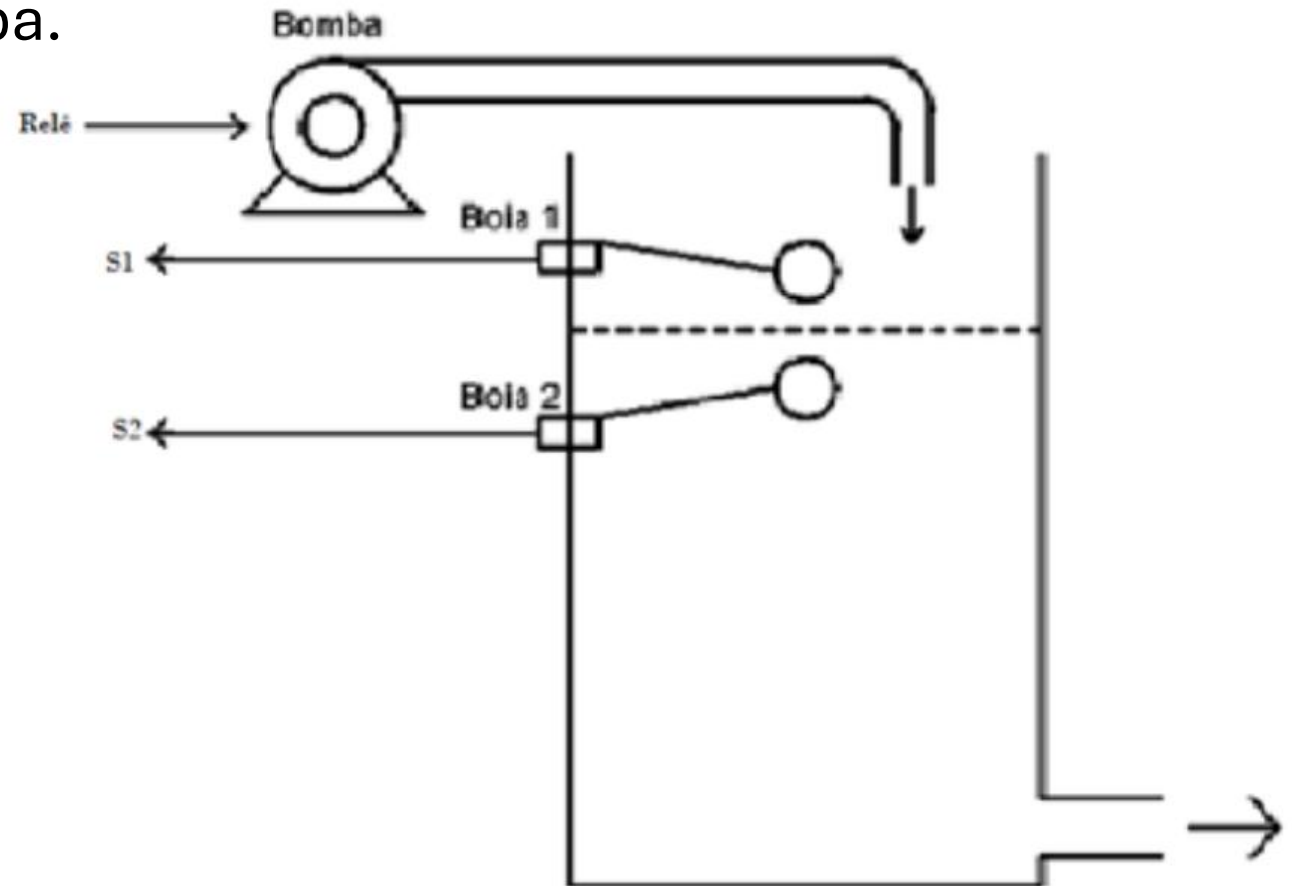
```
int pot = A0;  
int led = 9;  
  
void setup() {  
  pinMode(led, OUTPUT);  
}  
  
void loop() {  
  int valor = analogRead(pot);  
  int pwm = map(valor, 0, 1023, 0, 255);  
  analogWrite(led, pwm);  
}
```



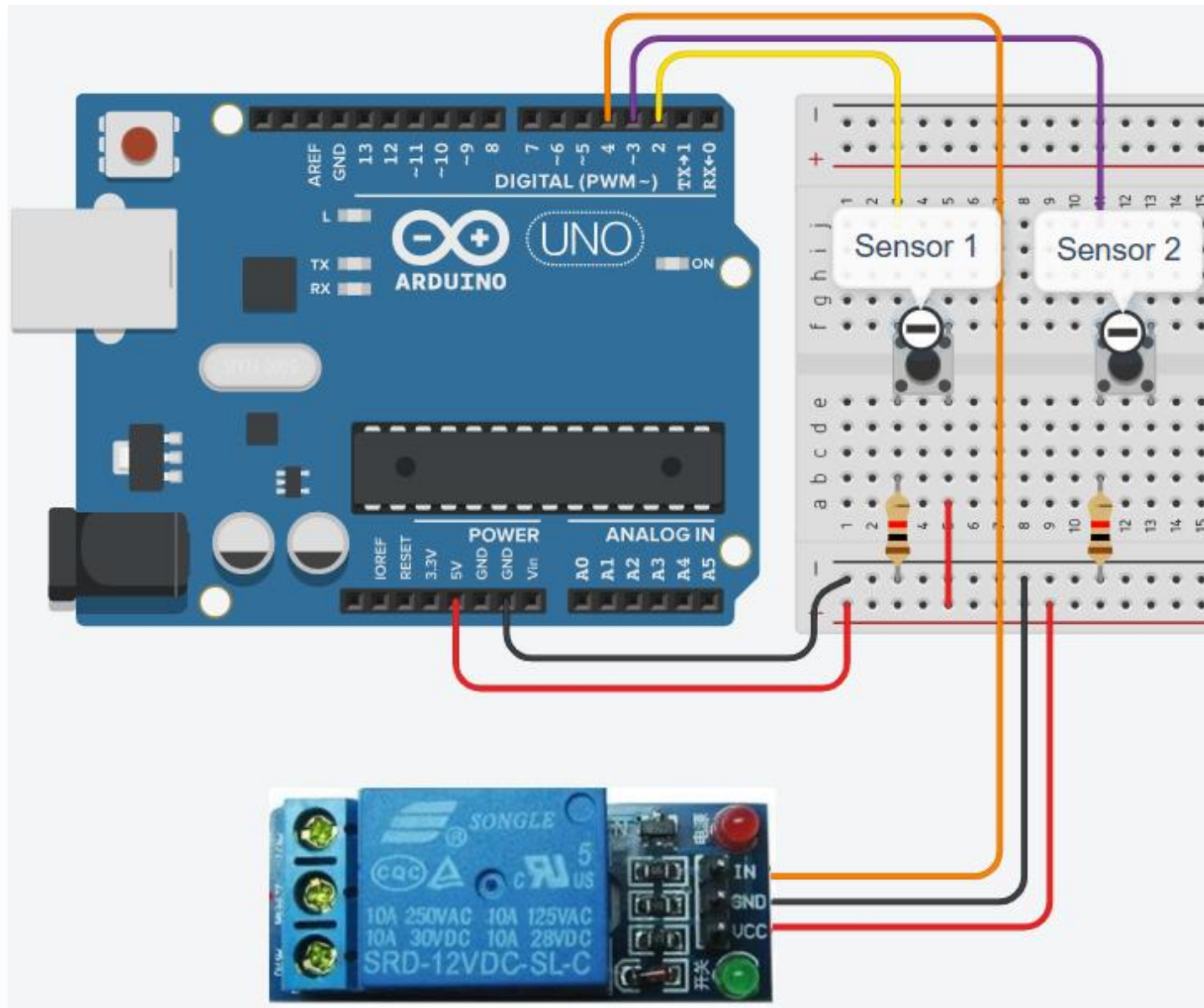


Exercício

Sistema de controle de nível composto por uma bomba e dois sensores. O funcionamento do sistema é simples, quando o tanque está vazio a boia 2 (S2) envia 1 (HIGH) e o controle deve ligar a bomba. Quando o tanque está cheio a boia 1 (S1) envia 1 (HIGH) e o controle deve desligar a bomba.



Sugestão de montagem:



OBS: No Tinkercad não tem módulo de relê, utilize um led para simulação.

Professor Ricardo Kerschbaumer