

Arduino per la fisica

Giovanni Organtini

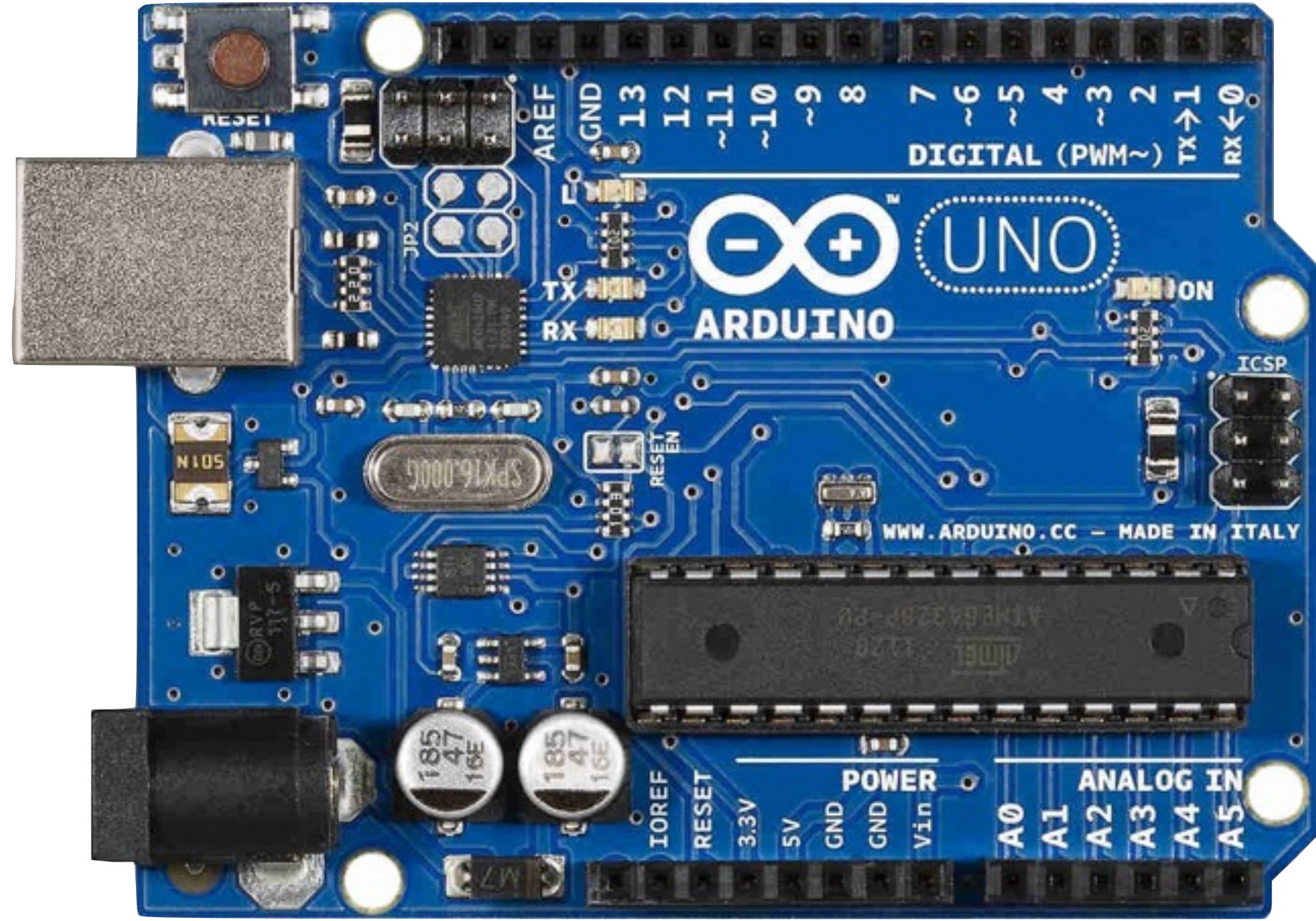
DIPARTIMENTO DI FISICA



SAPIENZA
UNIVERSITÀ DI ROMA

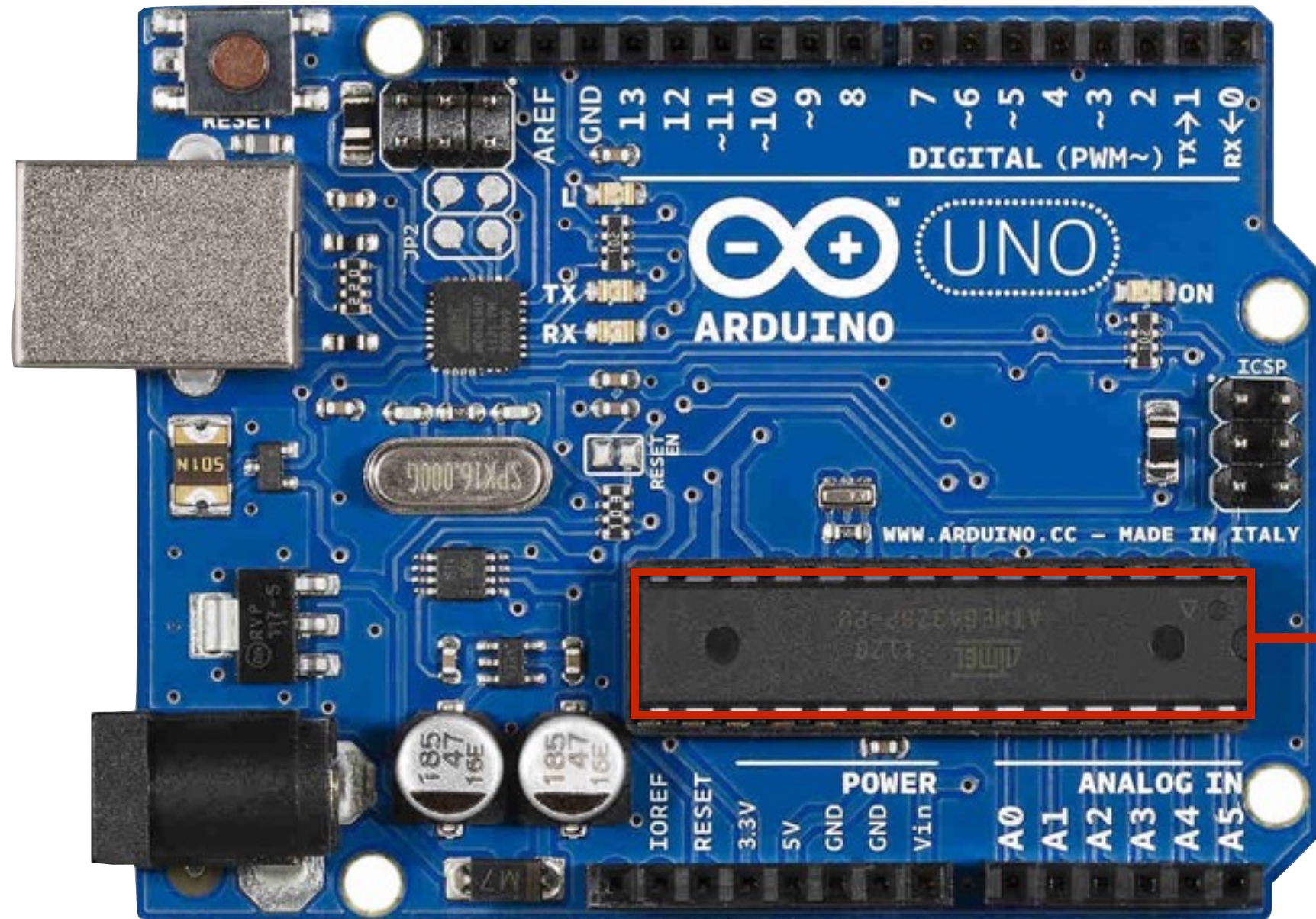
Cos'è Arduino?

Cos'è Arduino?



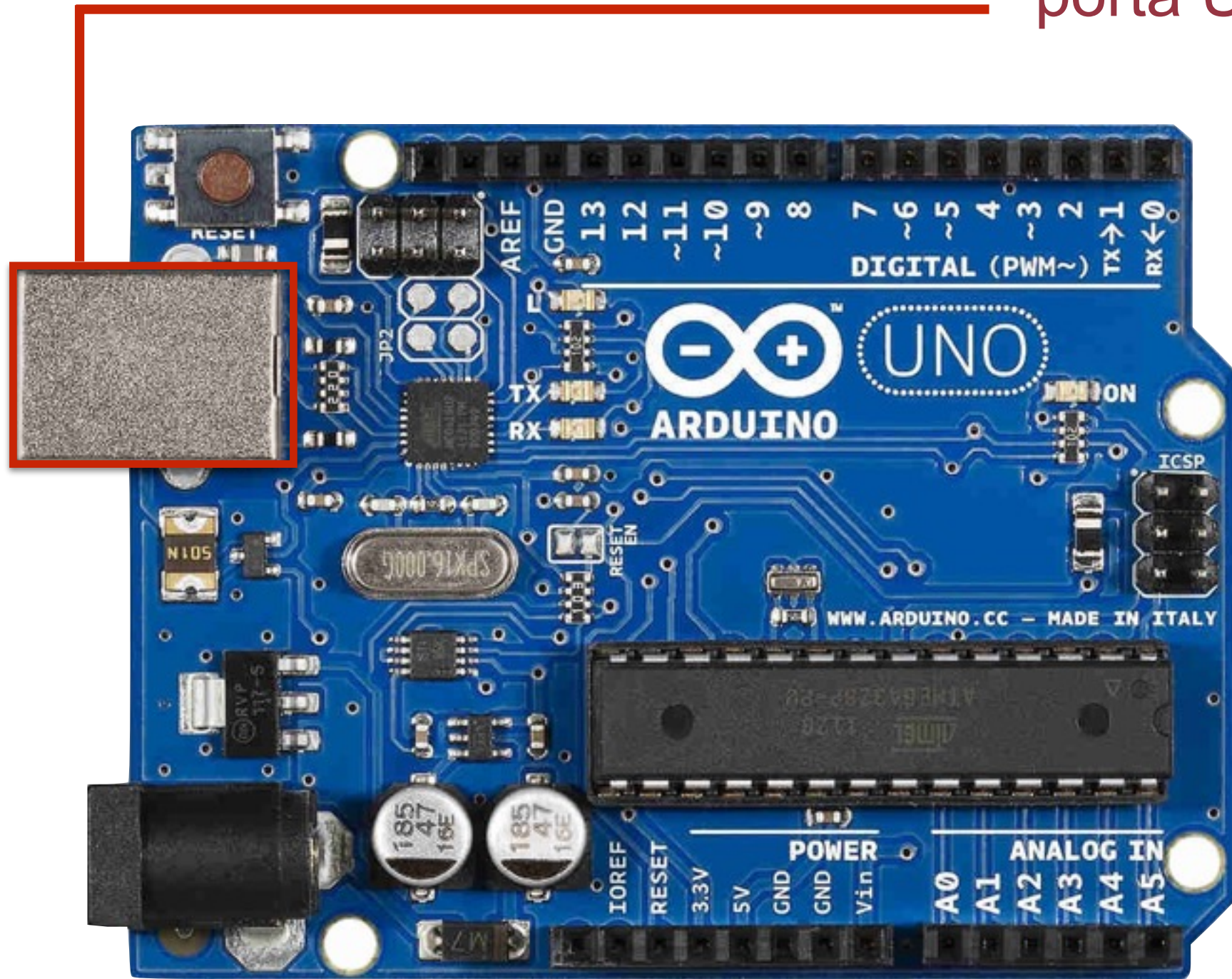
Cos'è Arduino?

AtMega328P



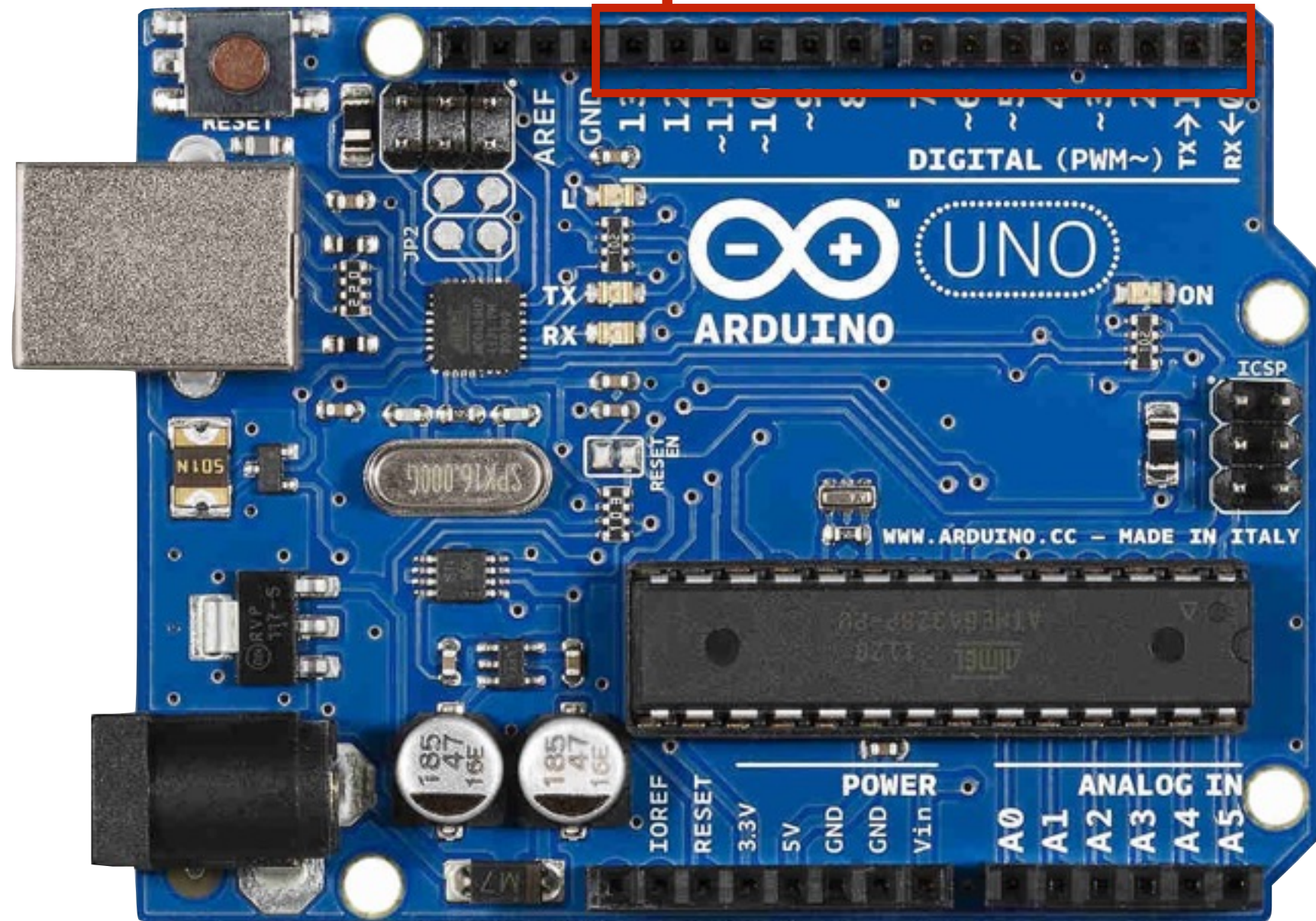
Cos'è Arduino?

porta USB



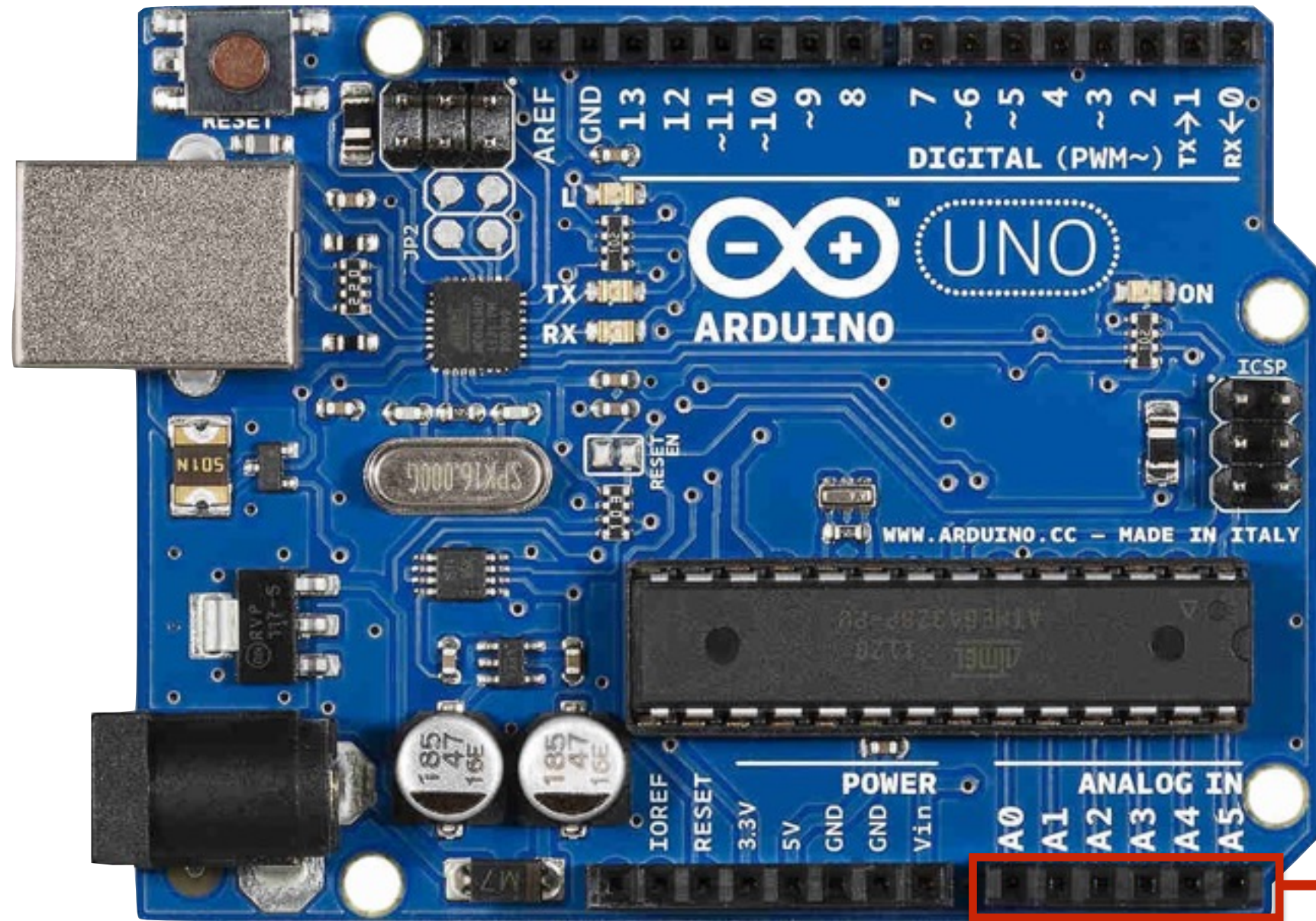
Cos'è Arduino?

pin digitali



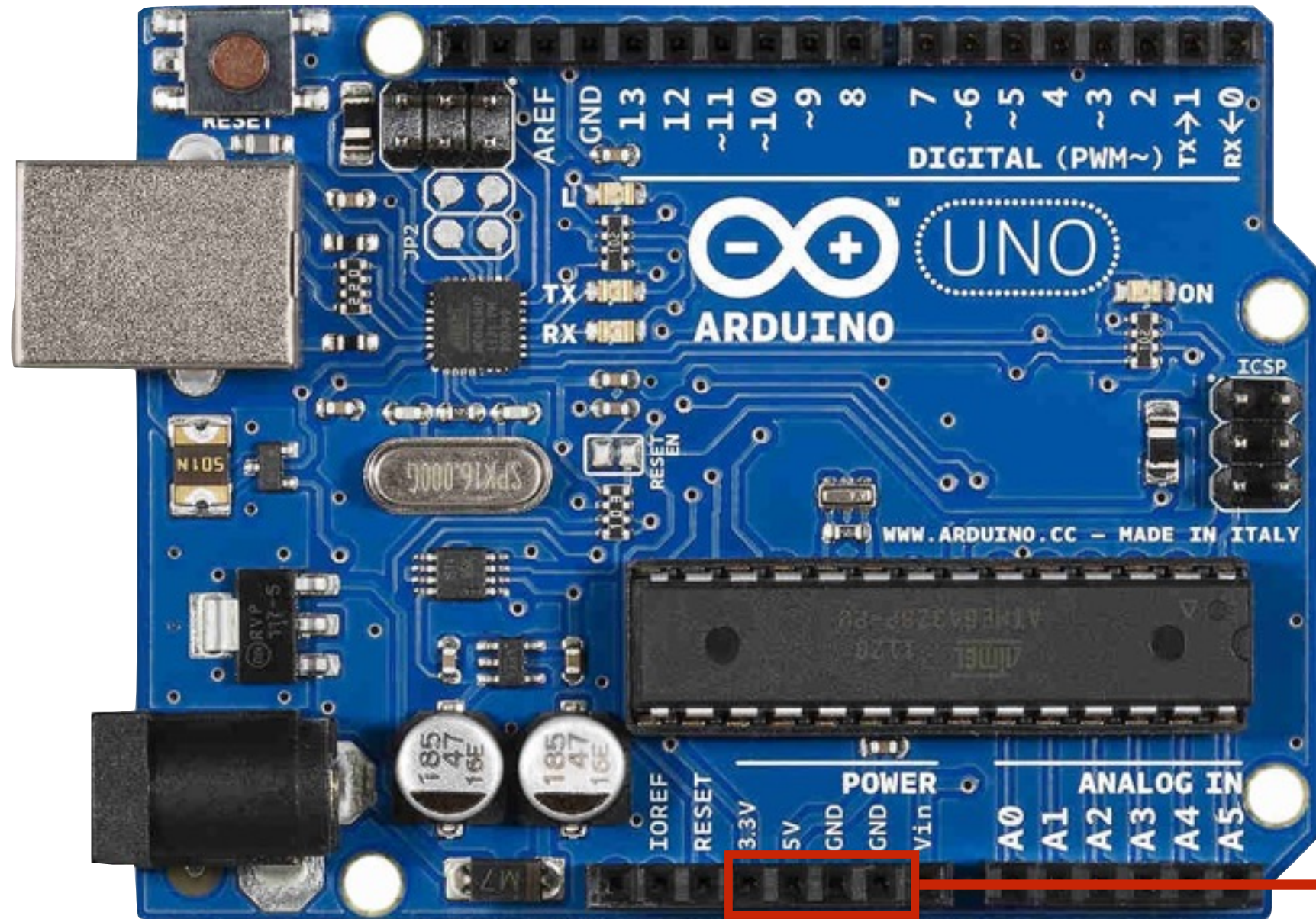
Cos'è Arduino?

pin analogici

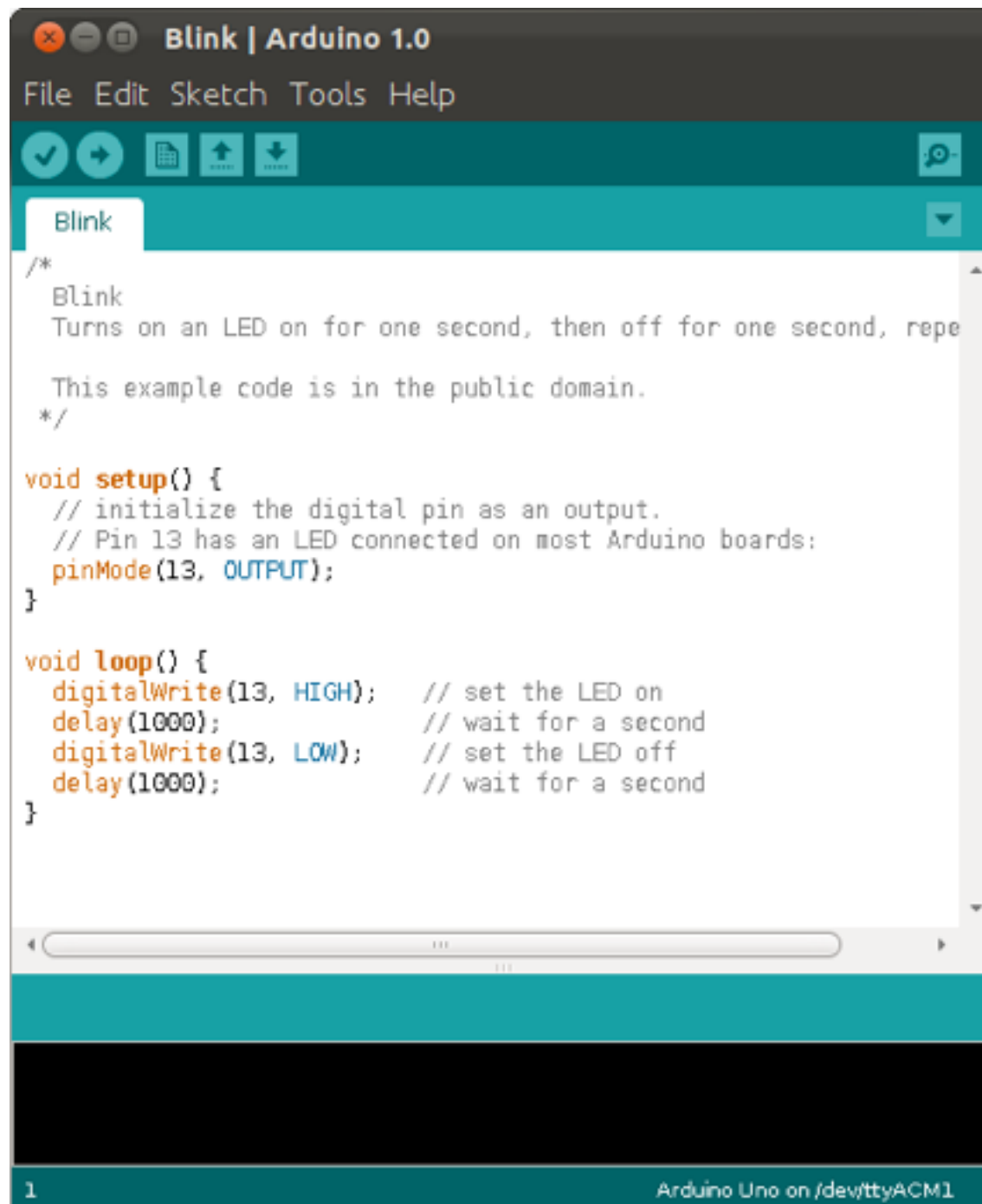


Cos'è Arduino?

pin di alimentazione



La IDE di Arduino



The screenshot shows the Arduino IDE 1.0 window titled "Blink | Arduino 1.0". The menu bar includes File, Edit, Sketch, Tools, and Help. Below the menu bar is a toolbar with icons for opening files, saving, uploading, and downloading. The main text area displays the Blink sketch code, which is a simple program that turns an LED on and off in a loop. The code is as follows:

```
/*
 * Blink
 * Turns on an LED on for one second, then off for one second, repeatedly.
 *
 * This example code is in the public domain.
 */

void setup() {
  // initialize the digital pin as an output.
  // Pin 13 has an LED connected on most Arduino boards:
  pinMode(13, OUTPUT);
}

void loop() {
  digitalWrite(13, HIGH); // set the LED on
  delay(1000);            // wait for a second
  digitalWrite(13, LOW);  // set the LED off
  delay(1000);            // wait for a second
}
```

At the bottom of the window, there is a status bar showing "1" on the left and "Arduino Uno on /dev/ttyACM1" on the right.

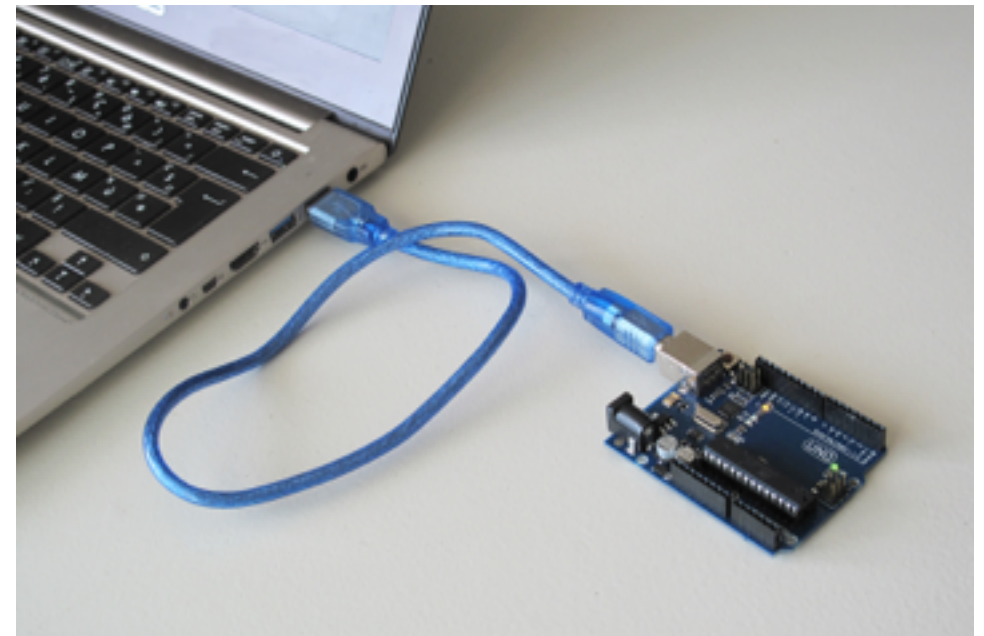
Open Source

Facile da usare

Edit su PC

Compilazione su PC

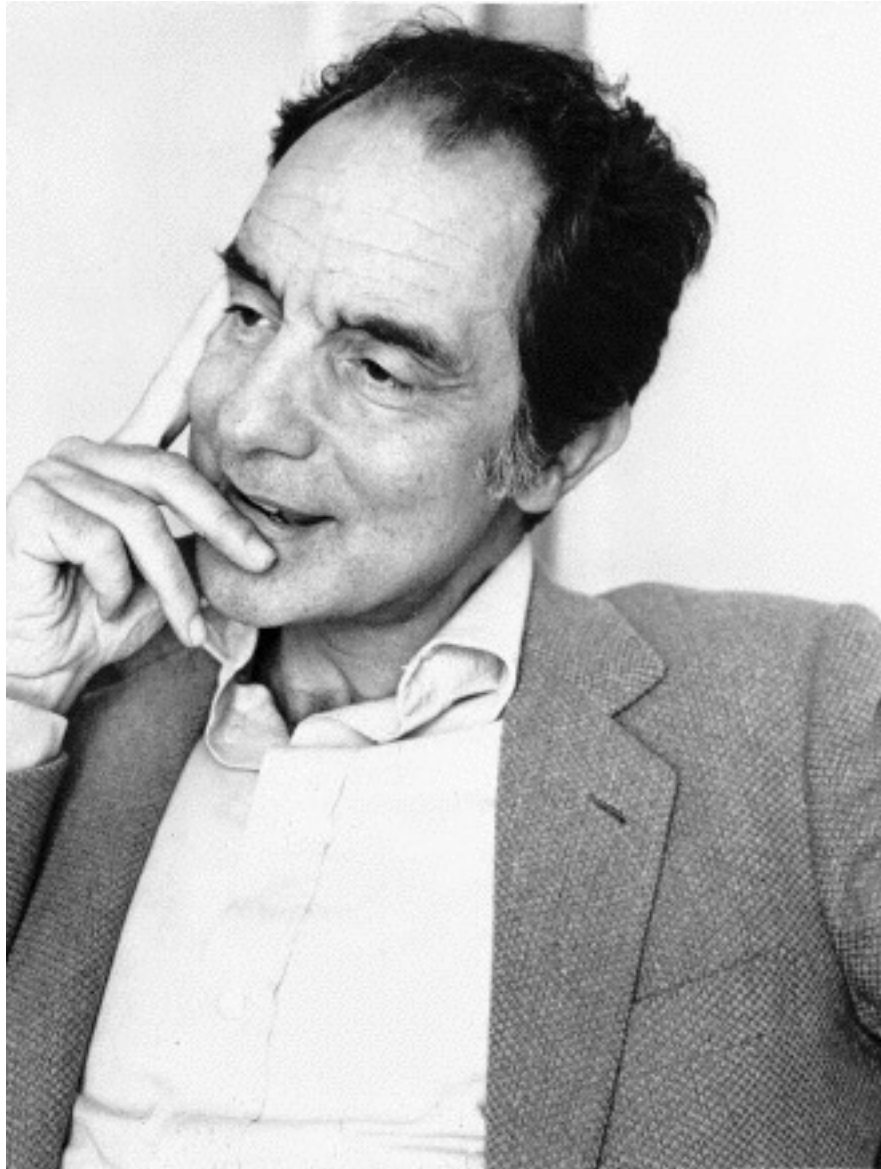
Trasferimento codice ad Arduino via USB



Perché Arduino?

- fisica a scuola = **formazione complessiva**
- **laboratorio** fondamentale (IBSE)
- **esperimenti** complicati e costosi
- apparati commerciali = "**scatole nere**"
- **coding**
- Sviluppo di competenze

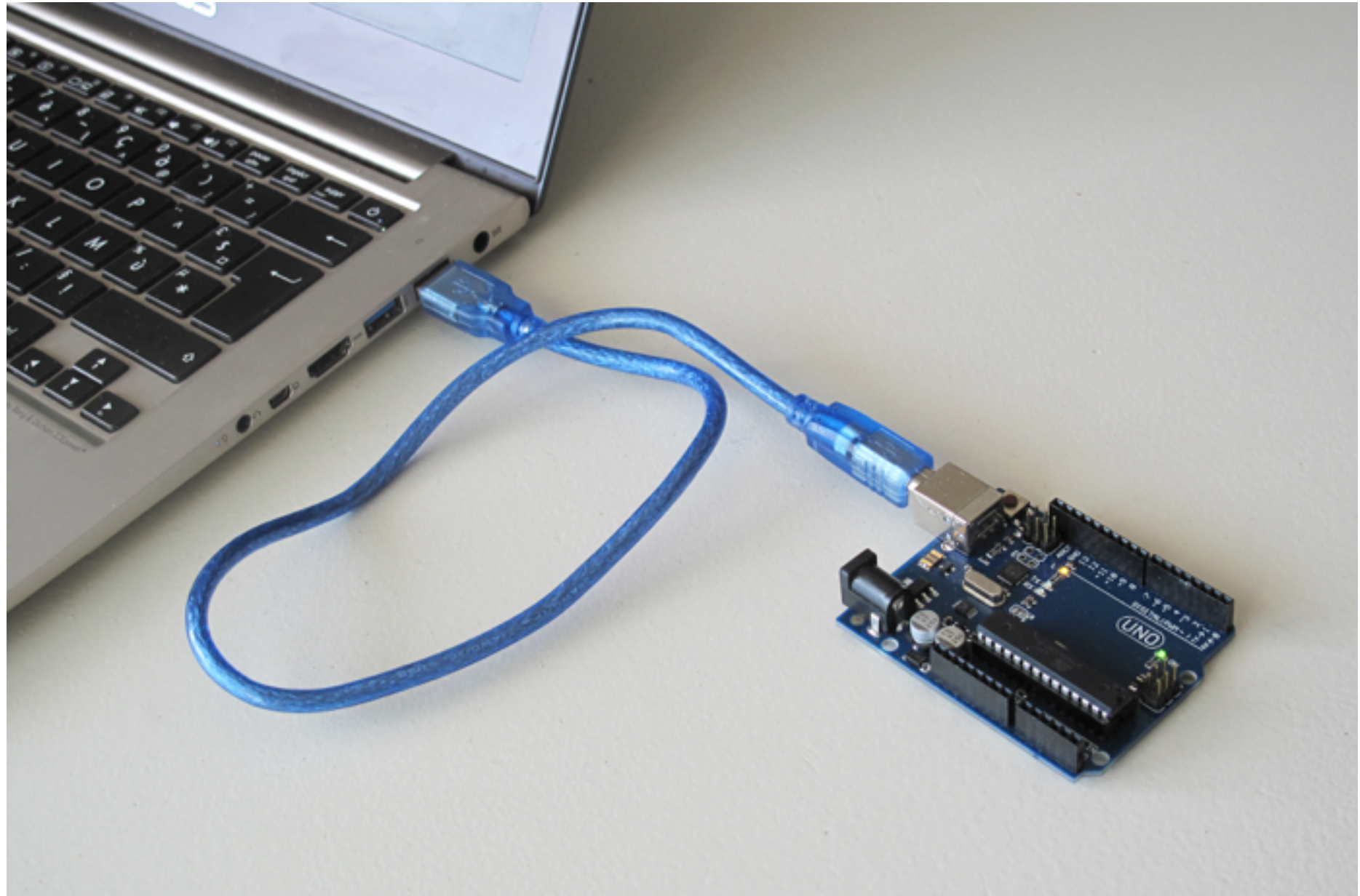
Perché Arduino?



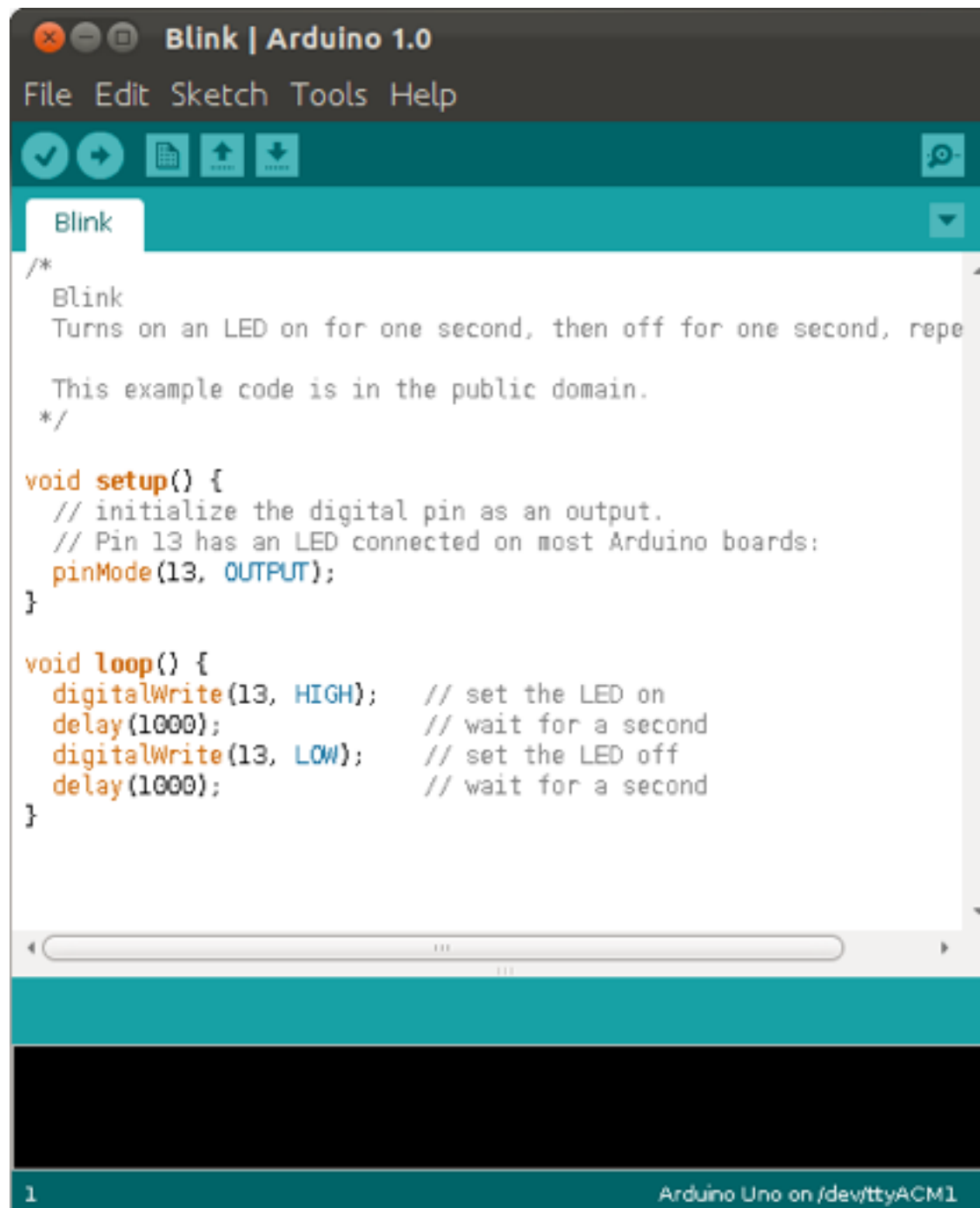
Italo Calvino - Lezioni Americane (1988)

“ È vero che il software non può esercitare i poteri della sua leggerezza se non mediante la pesantezza dell'hardware. Ma è il software che comanda... ”

Come si usa



Come si usa

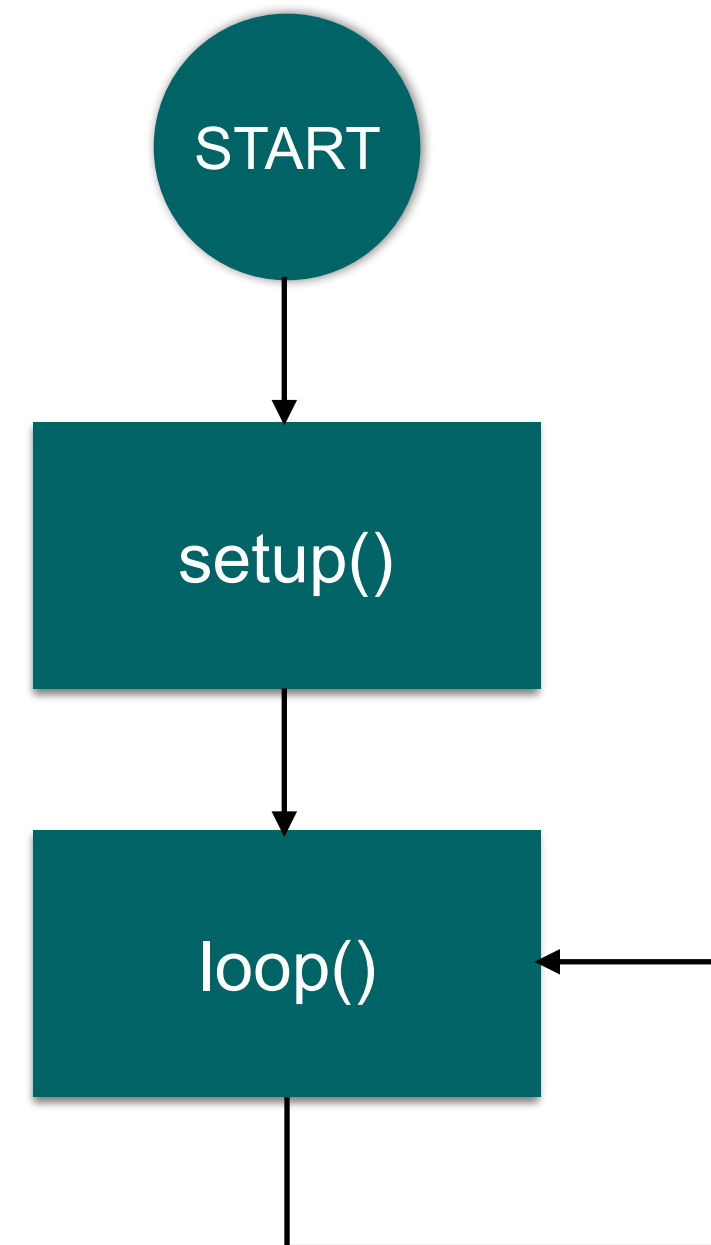


The screenshot shows the Arduino IDE interface with the 'Blink' sketch loaded. The code is as follows:

```
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 * Blink
 * Turns on an LED on for one second, then off for one second, repeatedly.
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 * This example code is in the public domain.
 */

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  digitalWrite(13, HIGH); // set the LED on
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  digitalWrite(13, LOW);  // set the LED off
  delay(1000);            // wait for a second
}
```



setup()

```
void setup() {  
    pinMode(pin, mode);  
}
```

setup()

funzione

```
void setup() {  
    pinMode(pin, mode);  
}
```

setup()

delimitatori

```
void setup() {  
    pinMode(pin, mode);  
}
```

setup()

```
void setup() {  
  pinMode(pin, mode);  
}
```

istruzione

parametri

setup()

```
void setup() {  
    pinMode(10, OUTPUT);  
}
```

setup()

```
void setup() {  
    pinMode(10, INPUT);  
}
```

loop()

```
float V;  
  
void setup() {  
    ...  
}  
  
void loop() {  
    V=analogRead(pin)*5./1024;  
}
```

loop()

le variabili
vanno
dichiarate

```
float V;
```

```
void setup() {  
    ...  
}
```

```
void loop() {  
    V=analogRead(pin)*5./1024;  
}
```

loop()

```
float V;
```

```
void setup() {  
    ...  
}
```

```
void loop() {  
    V=analogRead(pin)*5./1024;  
}
```

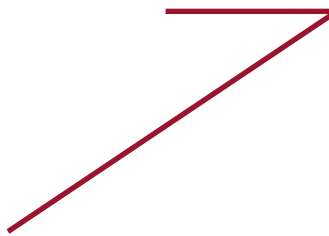
i valori si
assegnano
con
l'operatore =

loop()

```
float V;
```

```
void setup() {  
    ...  
}
```

analogRead(pin)
legge la tensione
sul pin analogico



```
void loop() {  
    V=analogRead(pin)*5./1024;  
}
```

loop()

```
float V;
```

```
void setup() {  
    ...  
}
```

i pin analogici si
indicano con A0-A5

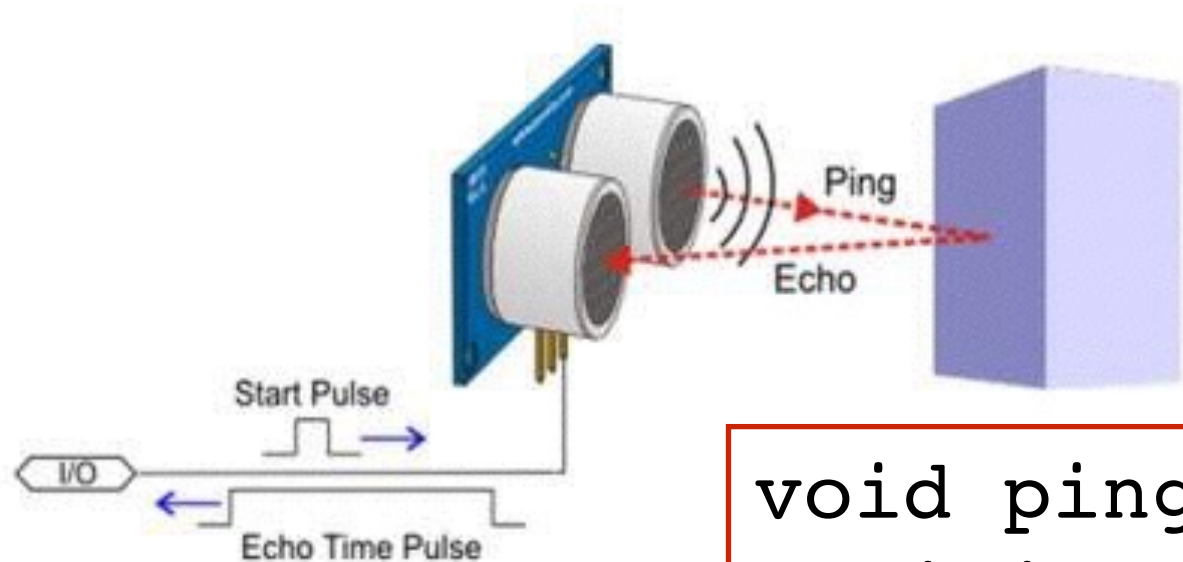
```
void loop() {  
    V=analogRead(A0)*5./1024;  
}
```

loop()

```
float V;  
  
void setup() {  
    ...  
}  
  
void loop() {  
    V=analogRead(pin)*5./1024;  
}
```

fattore di
conversione

What can you do with Arduino?

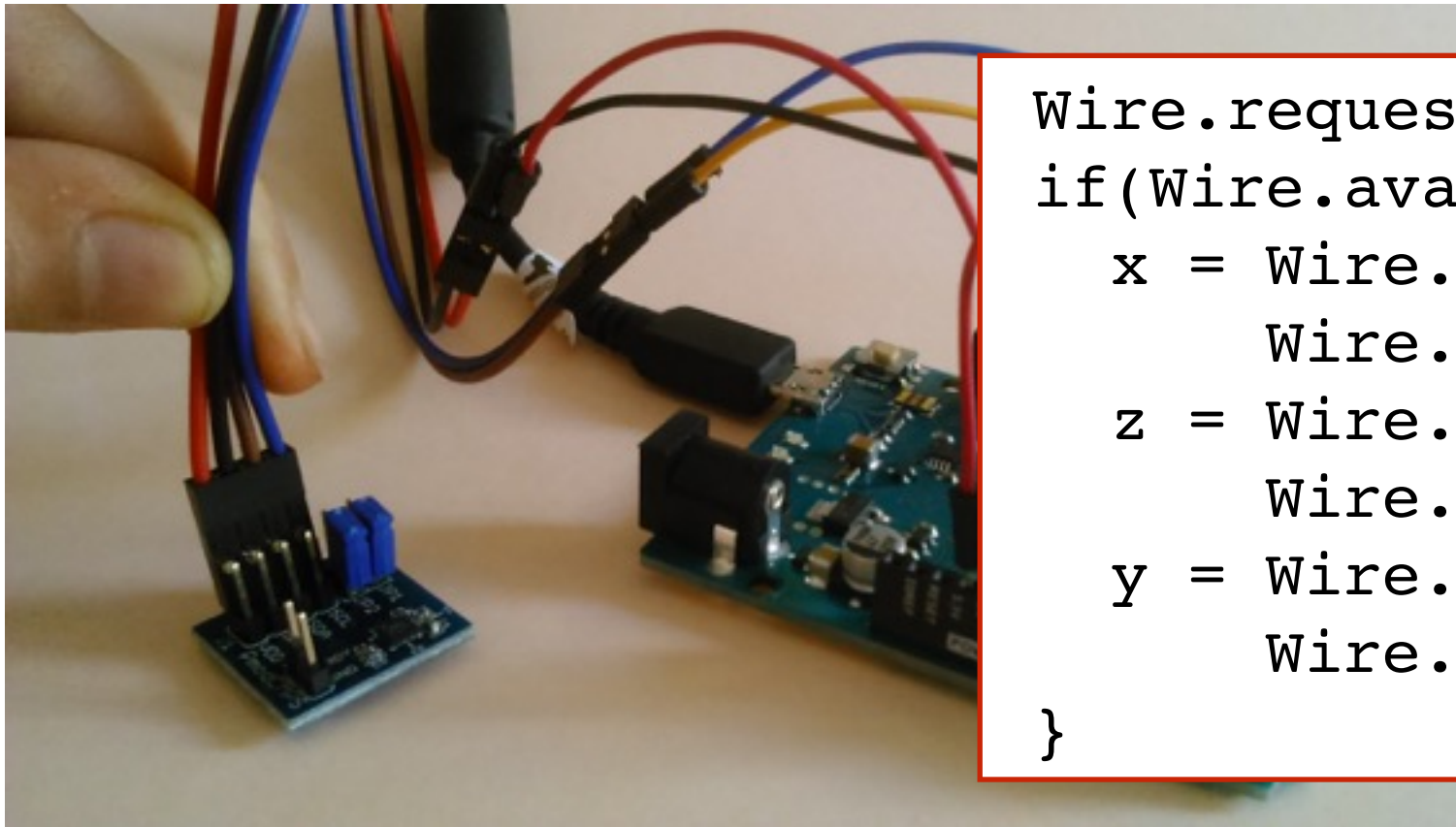


```
void loop(){  
  int x = 0;  
  ping();  
  x = pulseIn(echoPin, HIGH);  
  t = micros();  
}
```

```
void ping(){  
  digitalWrite(trigPin, HIGH);  
  delayMicroseconds(10);  
  digitalWrite(trigPin, LOW);  
}
```

What can you do with Arduino?

Example: mapping magnetic field in 3D



```
Wire.requestFrom(ADDRESS , 6);  
if(Wire.available()) {  
    x = Wire.read()*256+  
        Wire.read();  
    z = Wire.read()*256+  
        Wire.read();  
    y = Wire.read()*256+  
        Wire.read();  
}
```