



Practical Internet of Things Webinar Series:

Basic Arduino Input & Output

1 Jun 2020 (Isnin)
10.00 Pagi





Interaction Design Institute Ivrea



https://en.wikipedia.org/wiki/Interaction_Design_Institute_Ivrea



D.Mellis, USA

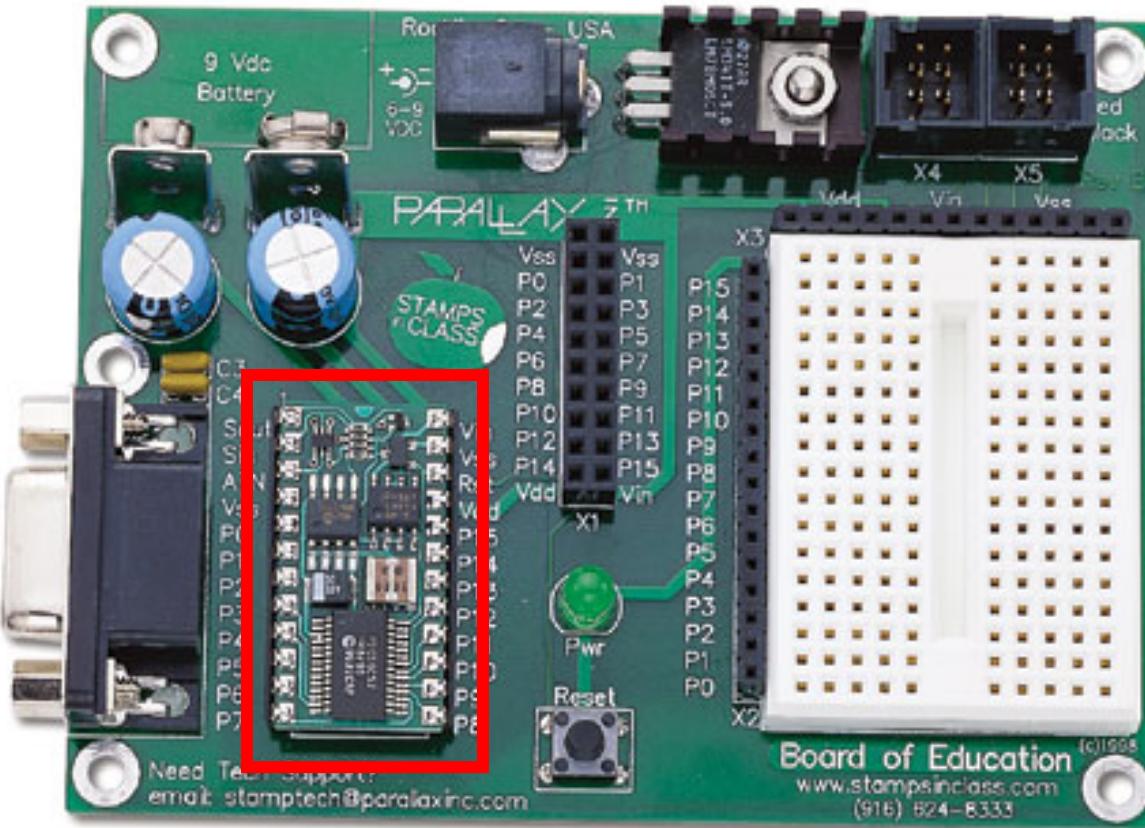
T.Igoe, USA

G.Martino, Italy

D.Cuartielles, Spain

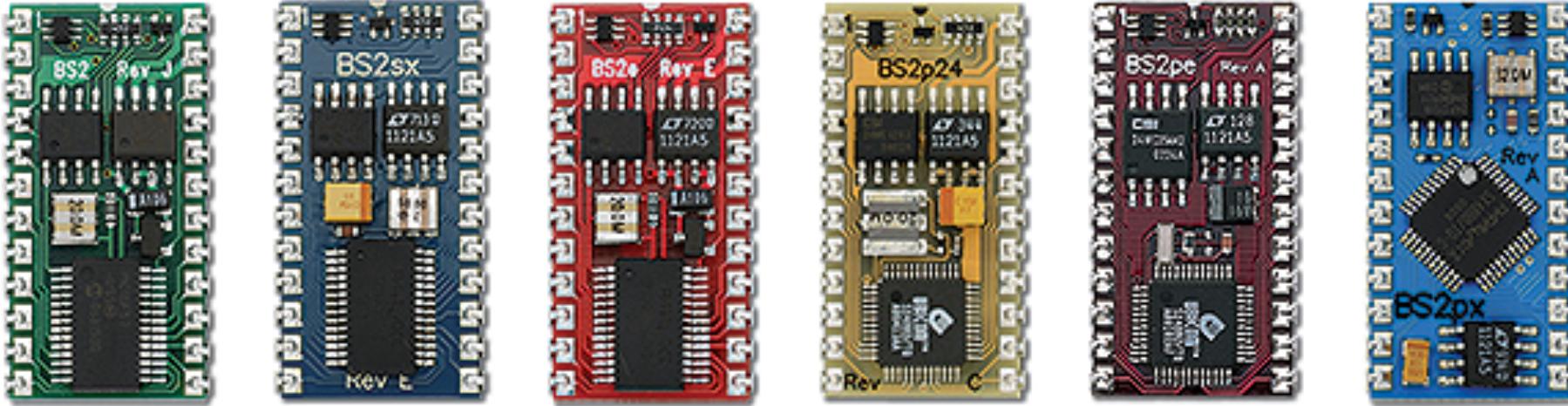
M. Banzi, Italy

Basic Stamp, Parallax



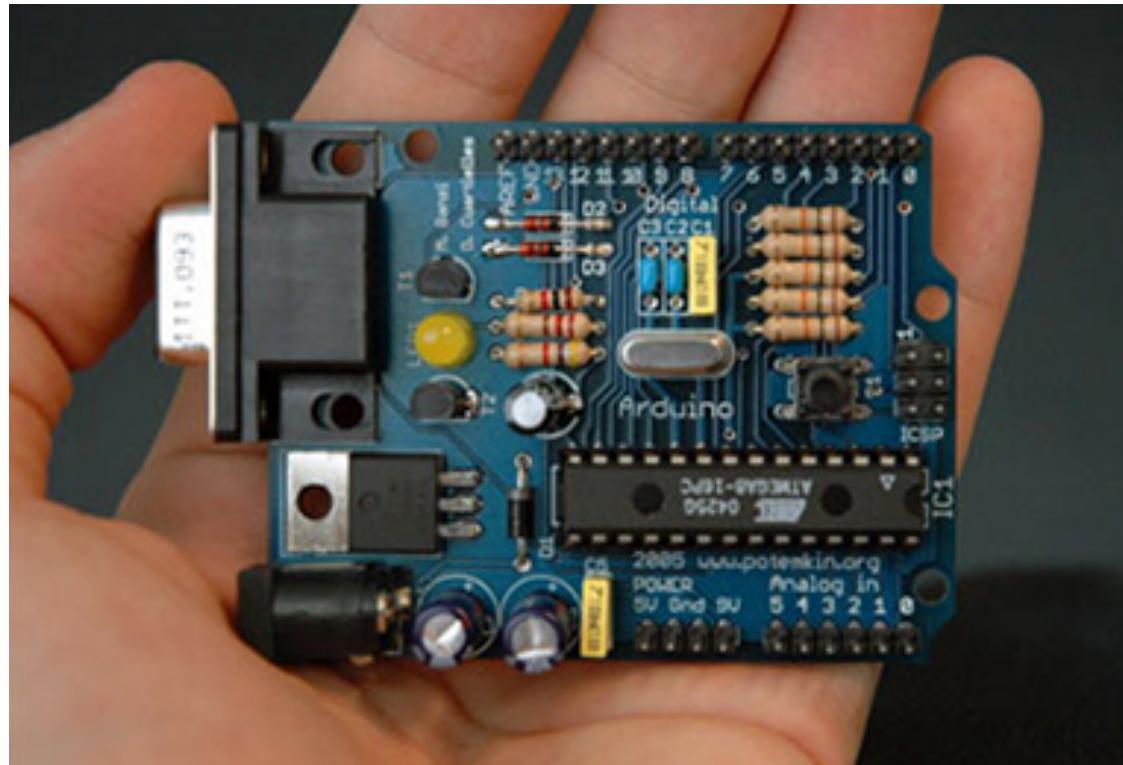
<https://www.parallax.com/product/28850>

Basic Stamp, Parallax



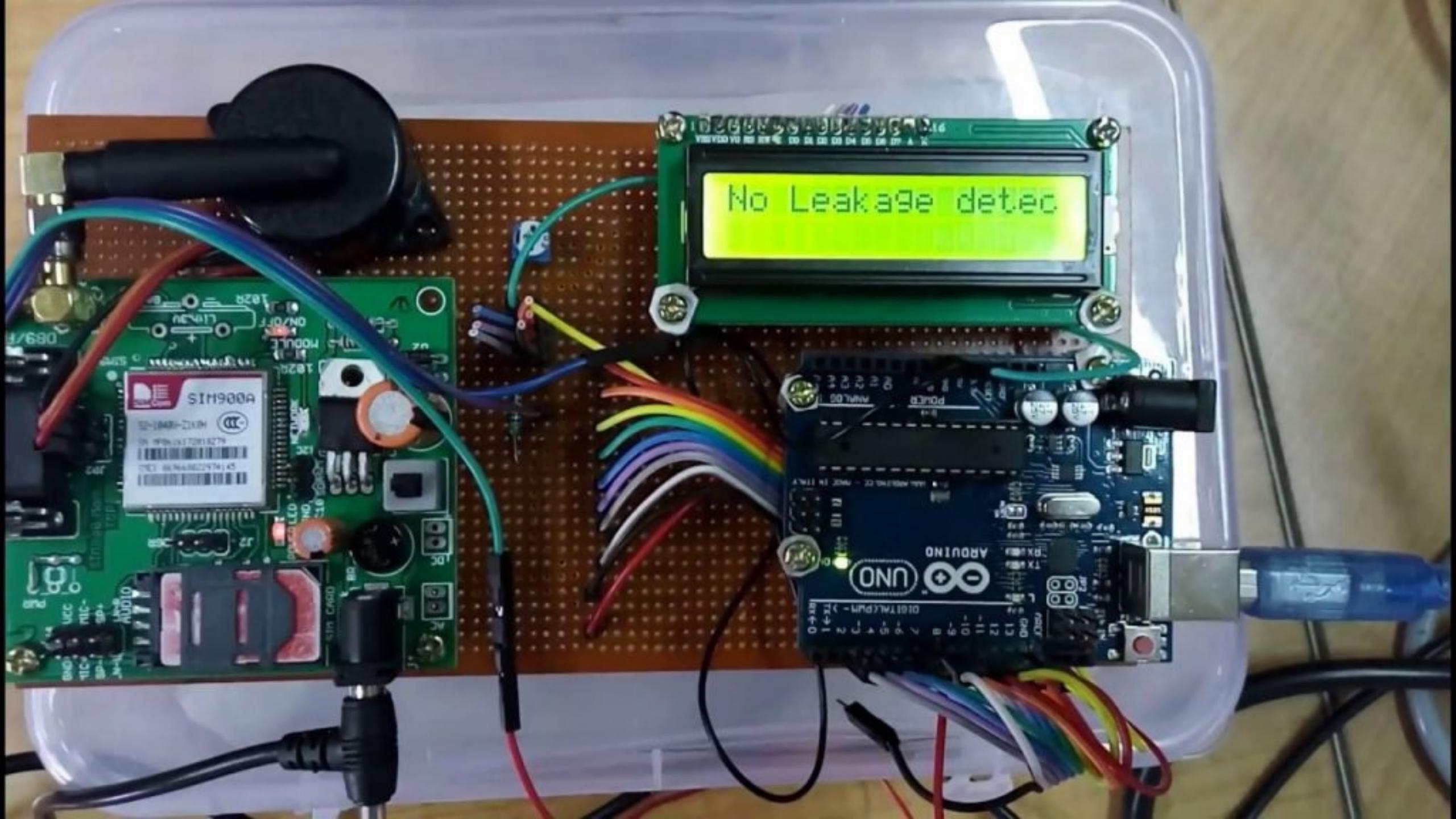
***“Low Floor, High Ceiling
Open Platform”***

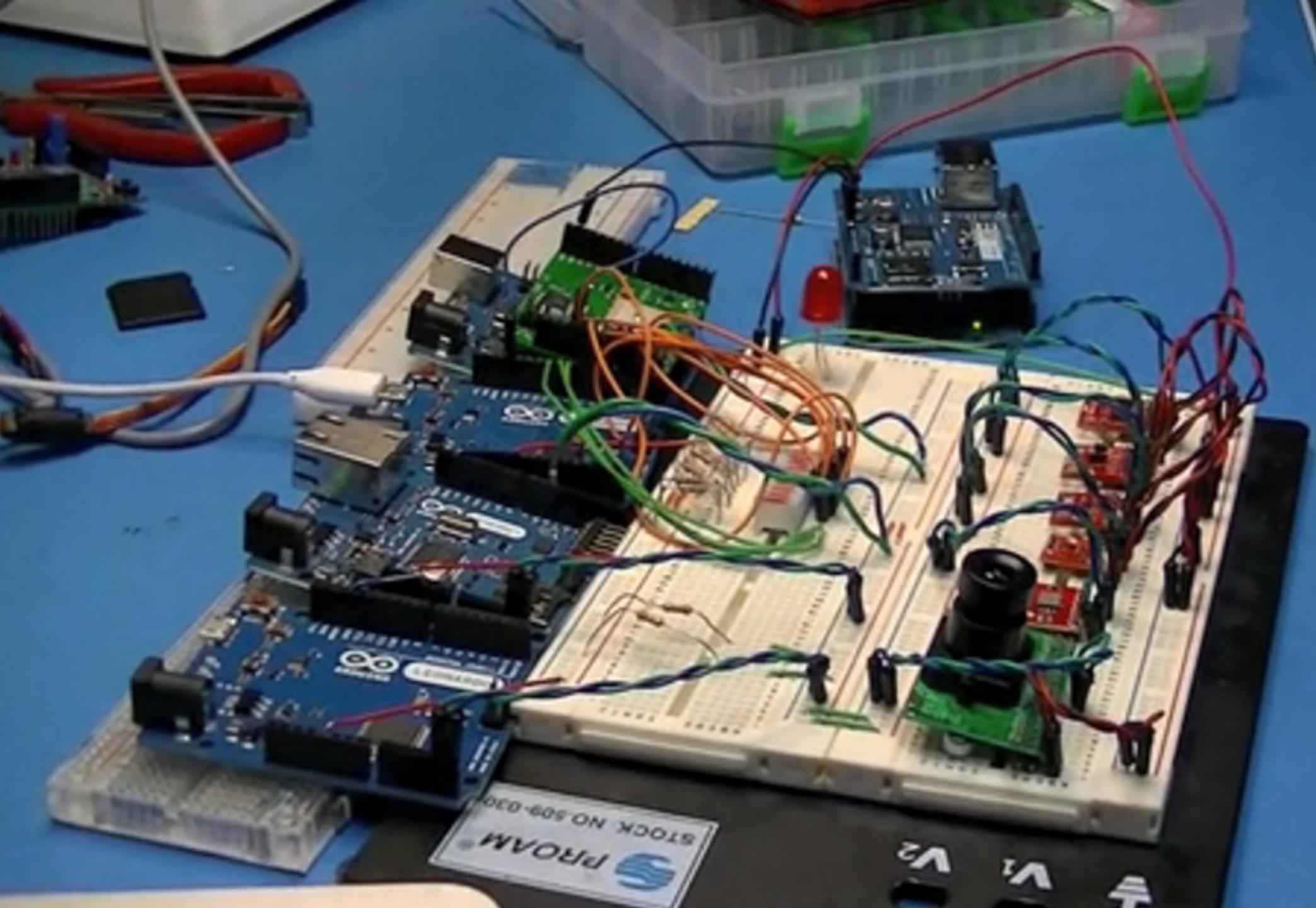
Arduino Serial

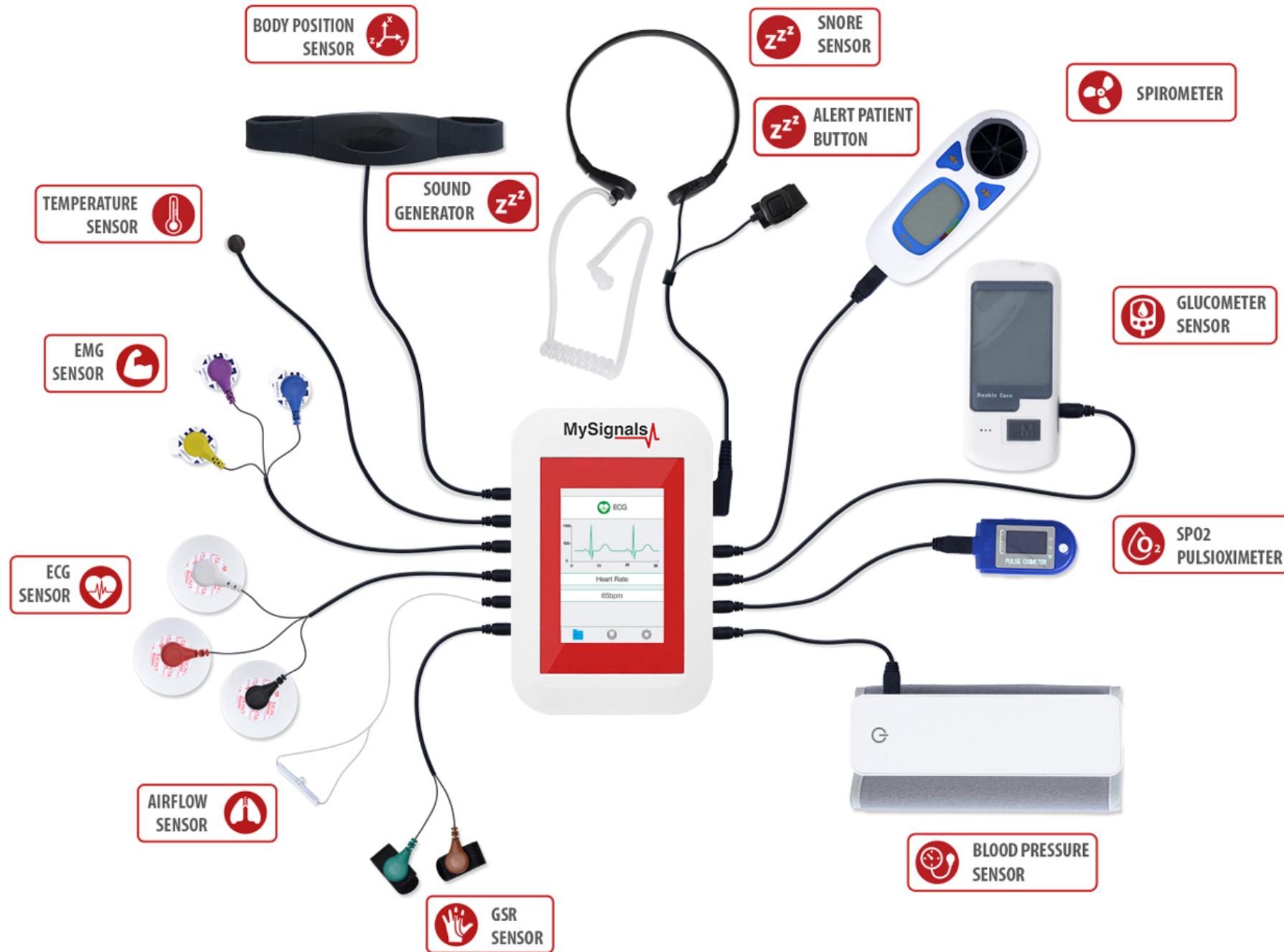


<https://www.arduino.cc/en/main/boards>

No Leakage detected

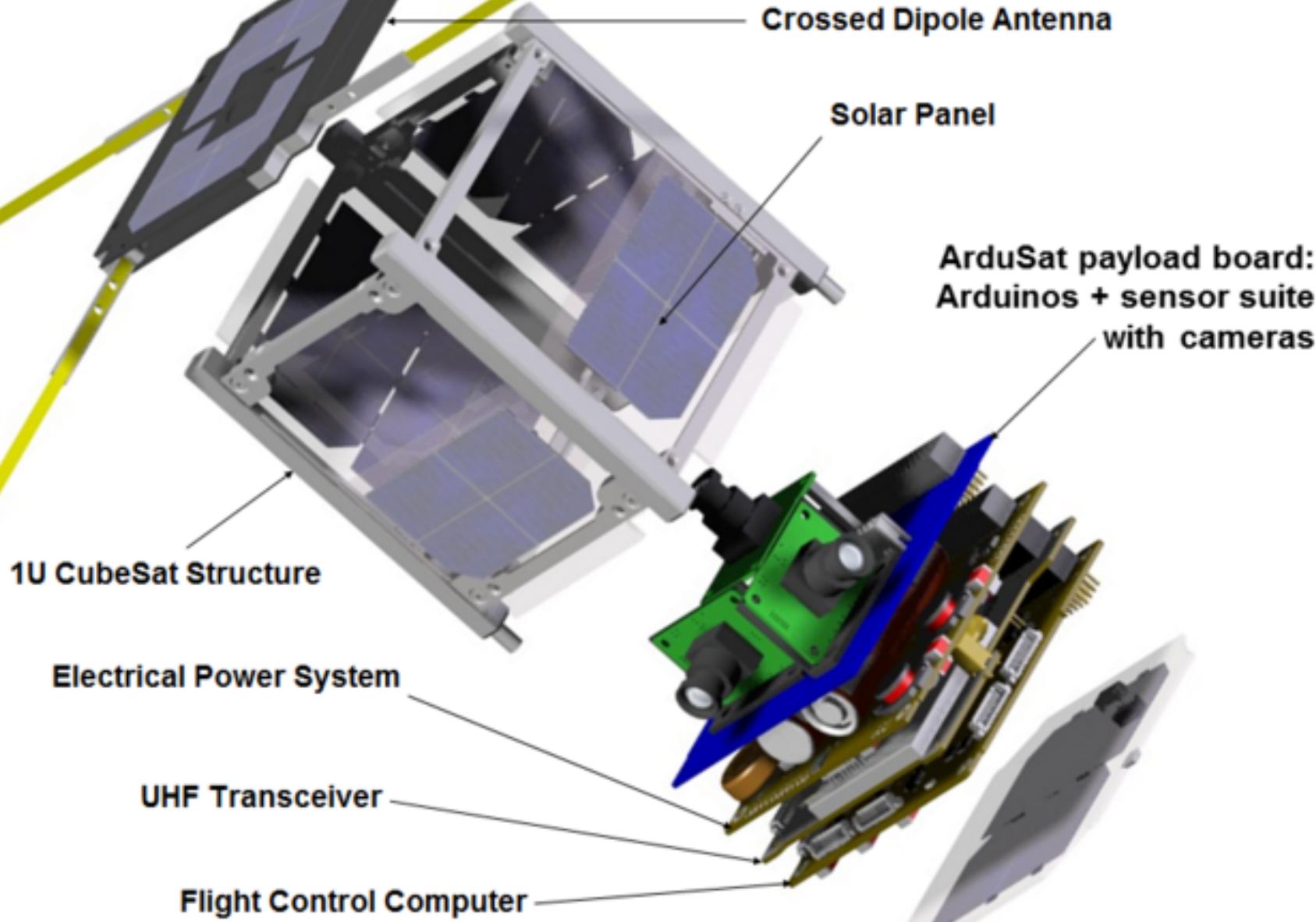






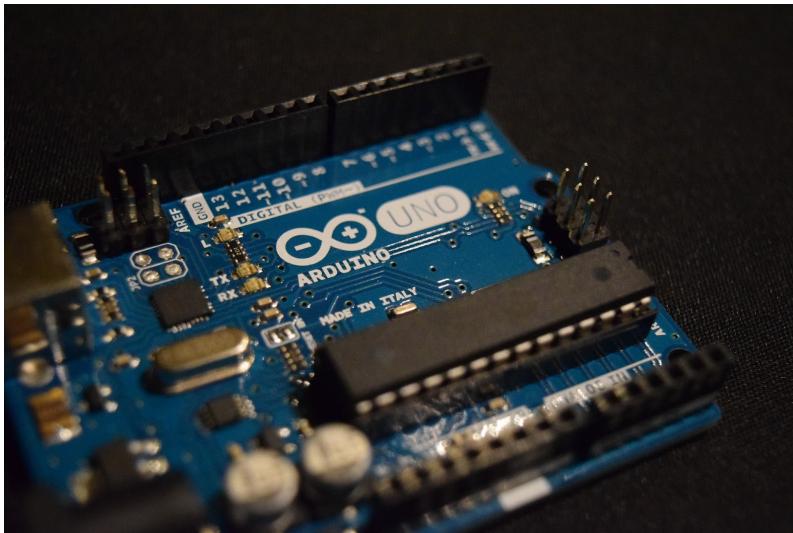




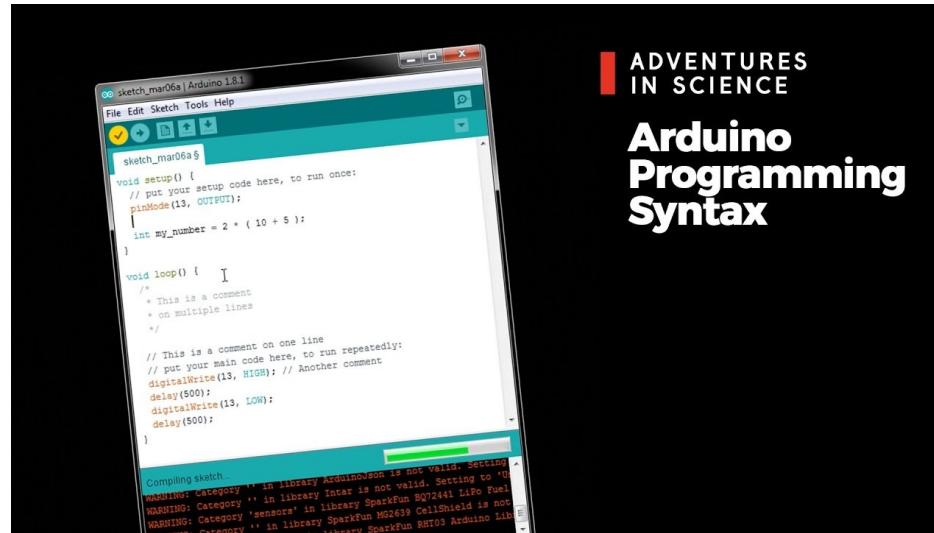




Open-Source Electronic Prototyping Platform



**Hardware
Development Board**



**Software
IDE & Programming**



**Community
Knowledge Sharing**



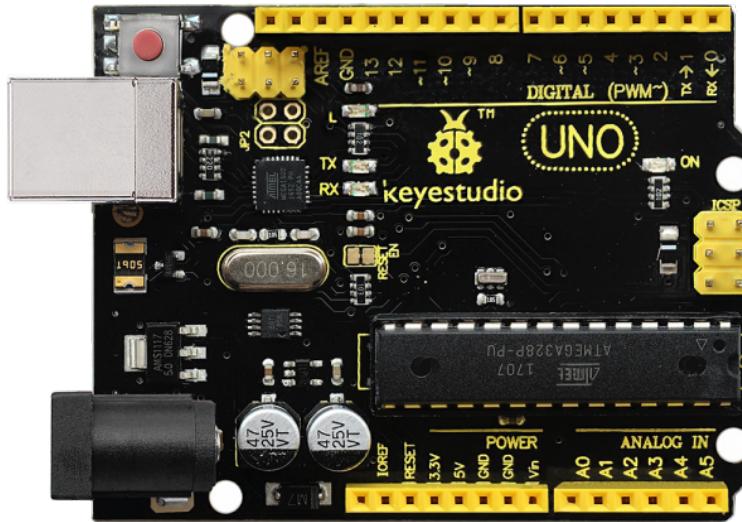
266 EVENTS / 71 COUNTRIES
YOU MADE IT A GREAT DAY!
WWW.ARDUINO.CC



Arduino UNO Development Board in Market



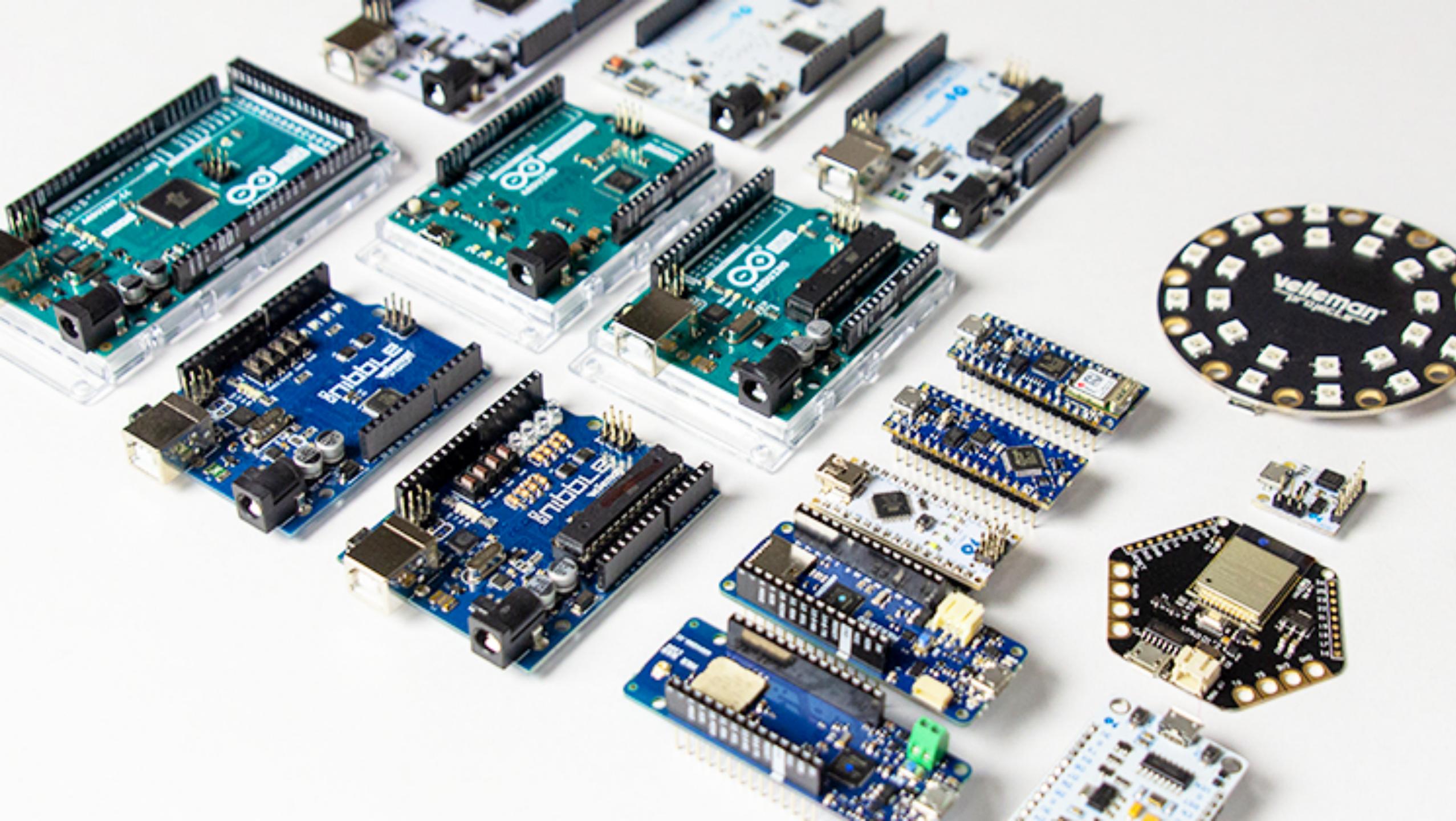
Original

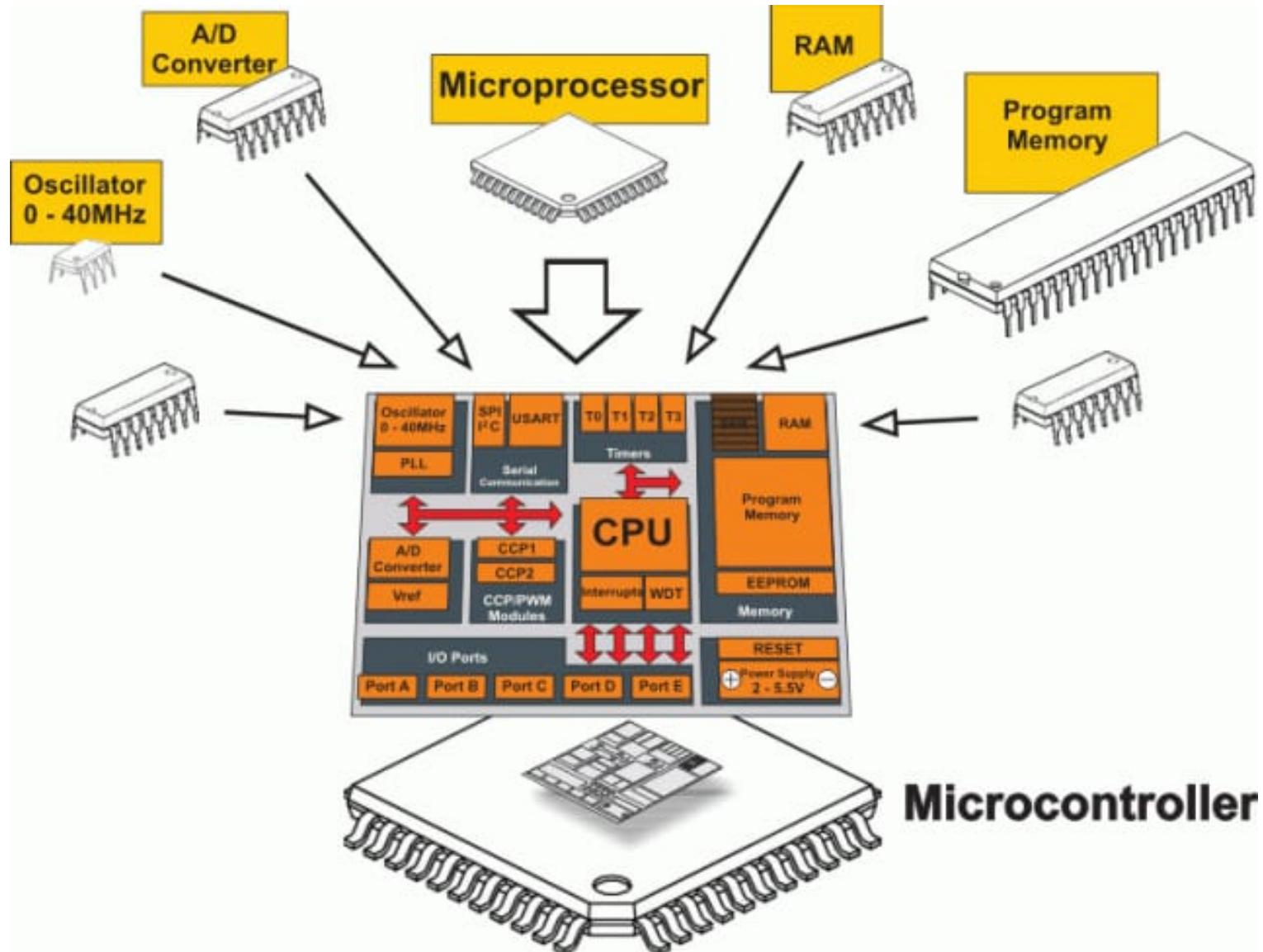


Compatible

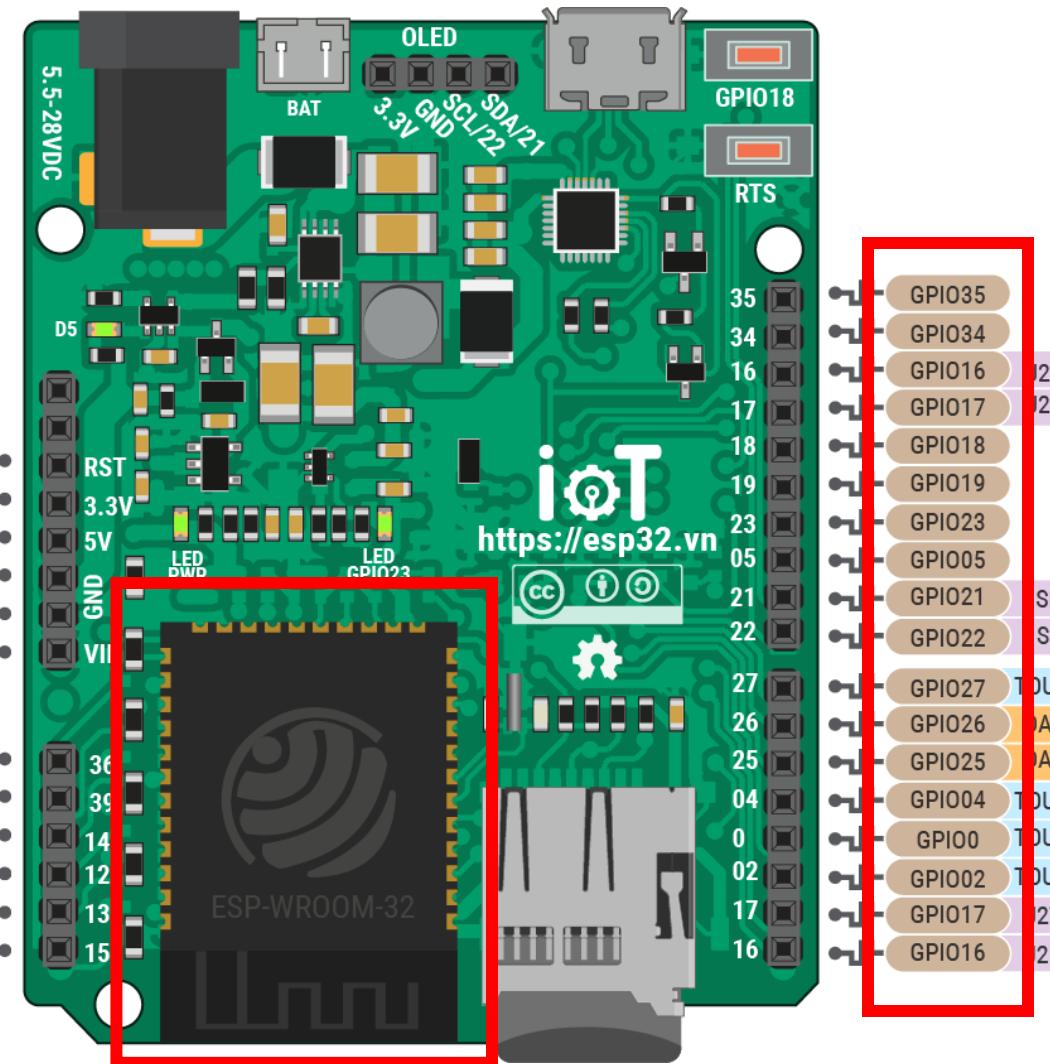
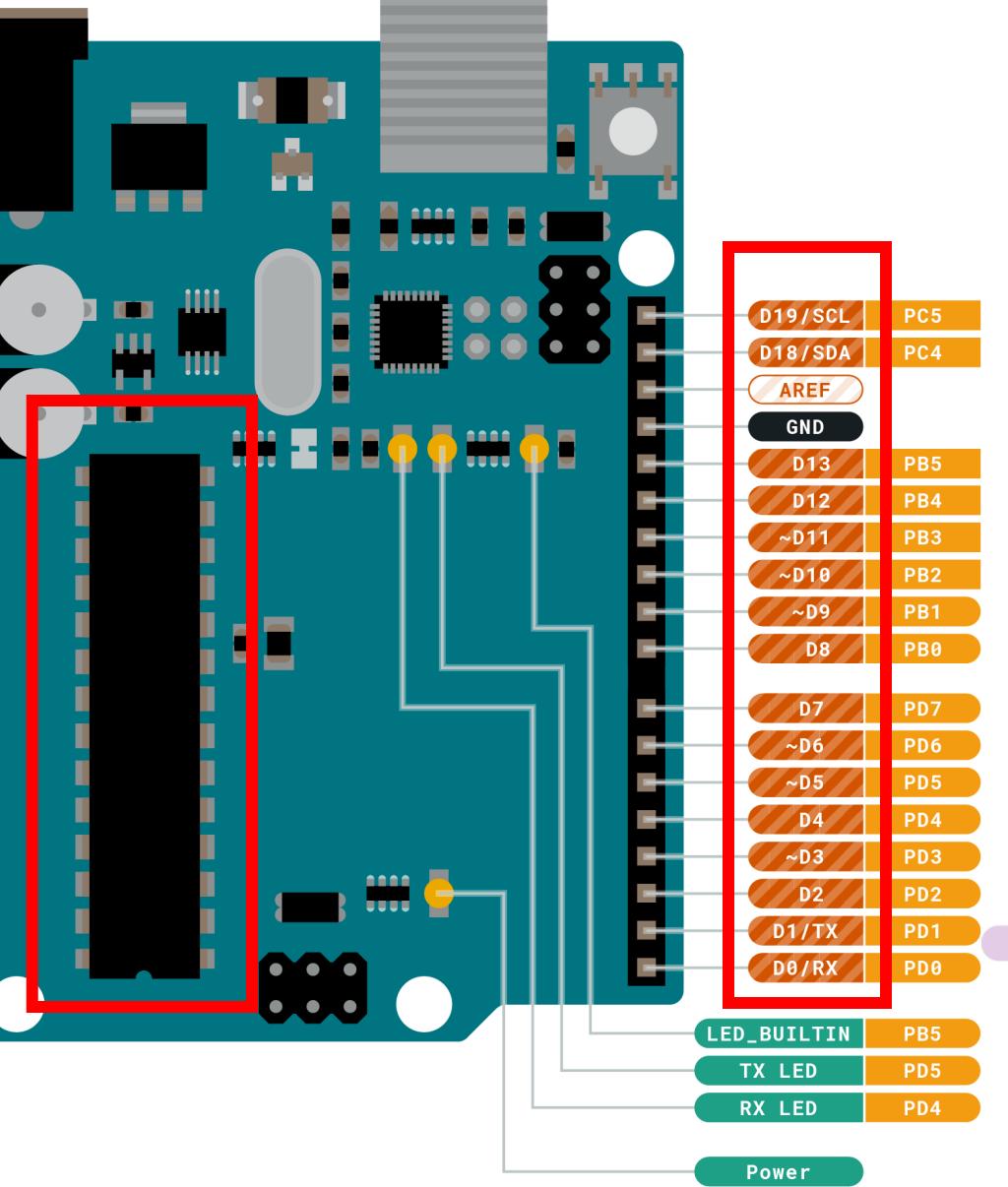


Clone / Counterfeit





ARDUINO UNO REV3



ADVENTURES
IN SCIENCE

Arduino Programming Syntax

The image shows a screenshot of the Arduino IDE interface. The title bar reads "sketch_mar06a | Arduino 1.8.1". The menu bar includes "File", "Edit", "Sketch", "Tools", and "Help". Below the menu is a toolbar with icons for file operations and a magnifying glass. The main area displays the following Arduino sketch:

```
sketch_mar06a.cpp
void setup() {
    // put your setup code here, to run once:
    pinMode(13, OUTPUT);
    int my_number = 2 * ( 10 + 5 );
}

void loop() {
    /*
     * This is a comment
     * on multiple lines
     */
    // This is a comment on one line
    // put your main code here, to run repeatedly:
    digitalWrite(13, HIGH); // Another comment
    delay(500);
    digitalWrite(13, LOW);
    delay(500);
}
```

At the bottom of the code editor, a status bar shows "Compiling sketch...". A progress bar is visible above the status bar, indicating the compilation process. Below the progress bar, several warning messages are listed:

- WARNING: Category '' in library ArduinoJson is not valid. Setting
- WARNING: Category '' in library Intar is not valid. Setting to 'U'
- WARNING: Category 'sensors' in library SparkFun BQ72441 LiPo Fuel
- WARNING: Category '' in library SparkFun MG2639 CellShield is not
- WARNING: Category '' in library SparkFun RHT03 Arduino Lib

- It is a set of C/C++ programming language functions.
- Two (2) main function **setup()** and **loop()**
 - command / instruction in **setup()** will run once
 - command / function and instruction in **loop()** will run repeatedly
- Have several sets of functions, e.g. **digitalRead()** and **digitalWrite()**
 - digitalRead()** - function to read voltage input on specific digital pin
HIGH (5V) / **LOW** (0V)
 - digitalWrite()** - function to provide voltage output on specific digital pin
HIGH (5V) or a **LOW** (0V)
- Having data types and constants e.g. **String()**, **float()**, **char()**, **byte**, **int**
- Hundreds of libraries available online
- The complete codes writes on Arduino IDE, called as **sketch**

<https://www.arduino.cc/reference/en/>



The Arduino logo consists of a white infinity symbol with a minus sign (-) on the left and a plus sign (+) on the right, enclosed in a circle. Below the symbol, the word "ARDUINO" is written in a bold, sans-serif font.

HOME STORE SOFTWARE EDUCATION RESOURCES COMMUNITY HELP

SIGN IN

Language Reference

Arduino programming language can be divided in three main parts: functions, values (variables and constants), and structure.

◆ LANGUAGE
▶ FUNCTIONS
▶ VARIABLES
▶ STRUCTURE
▶ LIBRARIES
+ GLOSSARY

The Arduino Reference text is licensed under a Creative Commons Attribution-Share Alike 3.0 License.

Find anything that can be improved? Suggest corrections and new documentation via GitHub.

Doubts on how to use GitHub? Learn everything you need to know in this tutorial.

FUNCTIONS

For controlling the Arduino board and performing computations.

Digital I/O

[digitalRead\(\)](#)

[digitalWrite\(\)](#)

[pinMode\(\)](#)

Analog I/O

[analogRead\(\)](#)

[analogReference\(\)](#)

Math

[abs\(\)](#)

[constrain\(\)](#)

[map\(\)](#)

[max\(\)](#)

[min\(\)](#)

[pow\(\)](#)

[sq\(\)](#)

Random Numbers

[random\(\)](#)

[randomSeed\(\)](#)

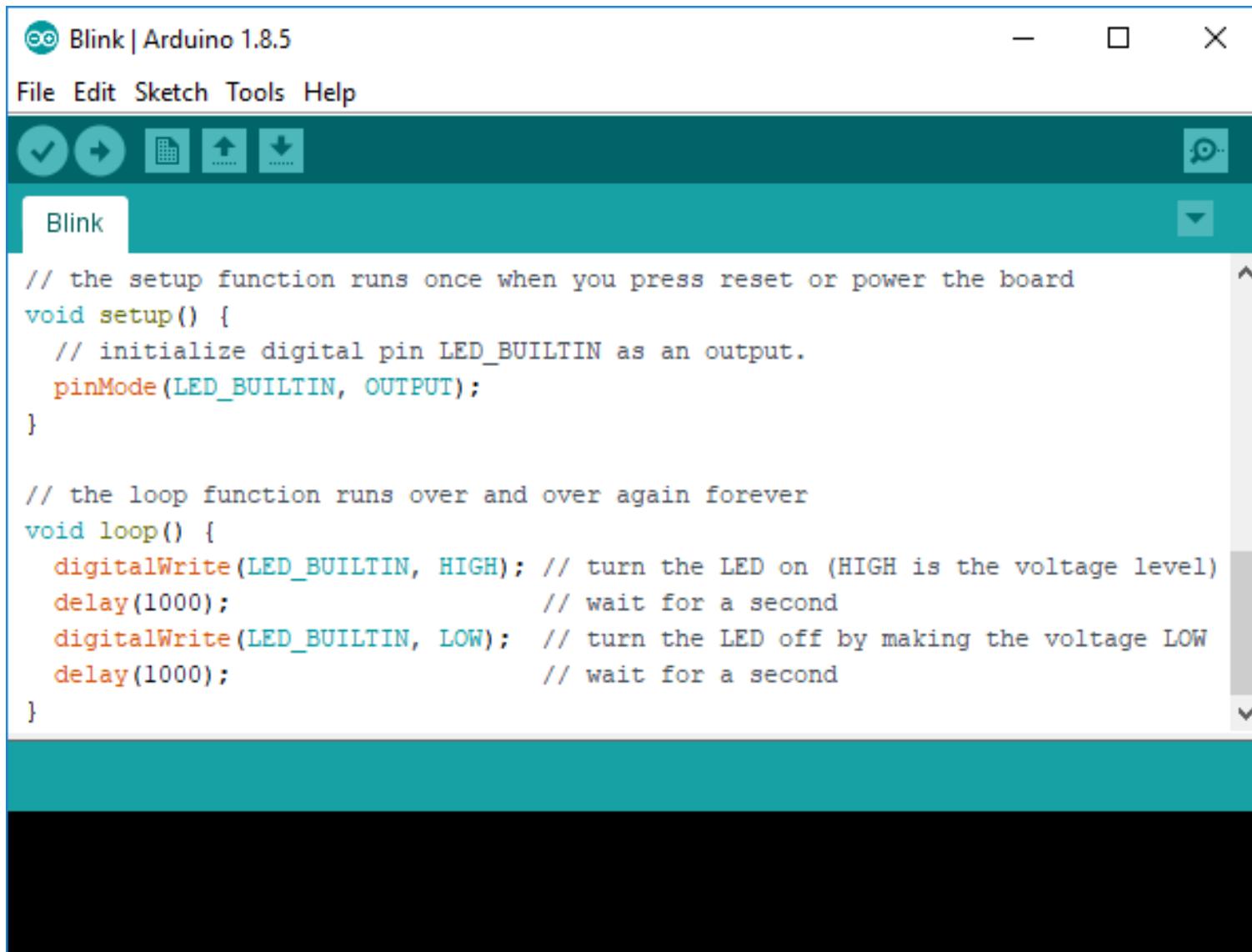
Bits and Bytes

[bit\(\)](#)

[bitClear\(\)](#)

[bitRead\(\)](#)

<https://www.arduino.cc/en/Guide/Environment>



The screenshot shows the Arduino IDE interface with the title bar "Blink | Arduino 1.8.5". The menu bar includes File, Edit, Sketch, Tools, and Help. Below the menu is a toolbar with icons for checkmark, refresh, file, upload, download, and a pin. The main window displays the "Blink" sketch code. The code consists of two functions: setup() and loop(). The setup() function initializes the digital pin LED_BUILTIN as an output. The loop() function alternates the LED between HIGH and LOW states, with a one-second delay between each state change.

```
// 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
}
```

Sketch Title

Menu

Sketch Title

Shortcut Menu

Shortcut Menu:
(from left)



Verify

Upload

New Document

Open

Save

sketch_mar10a | Arduino 1.8.8

File Edit Sketch Tools Help

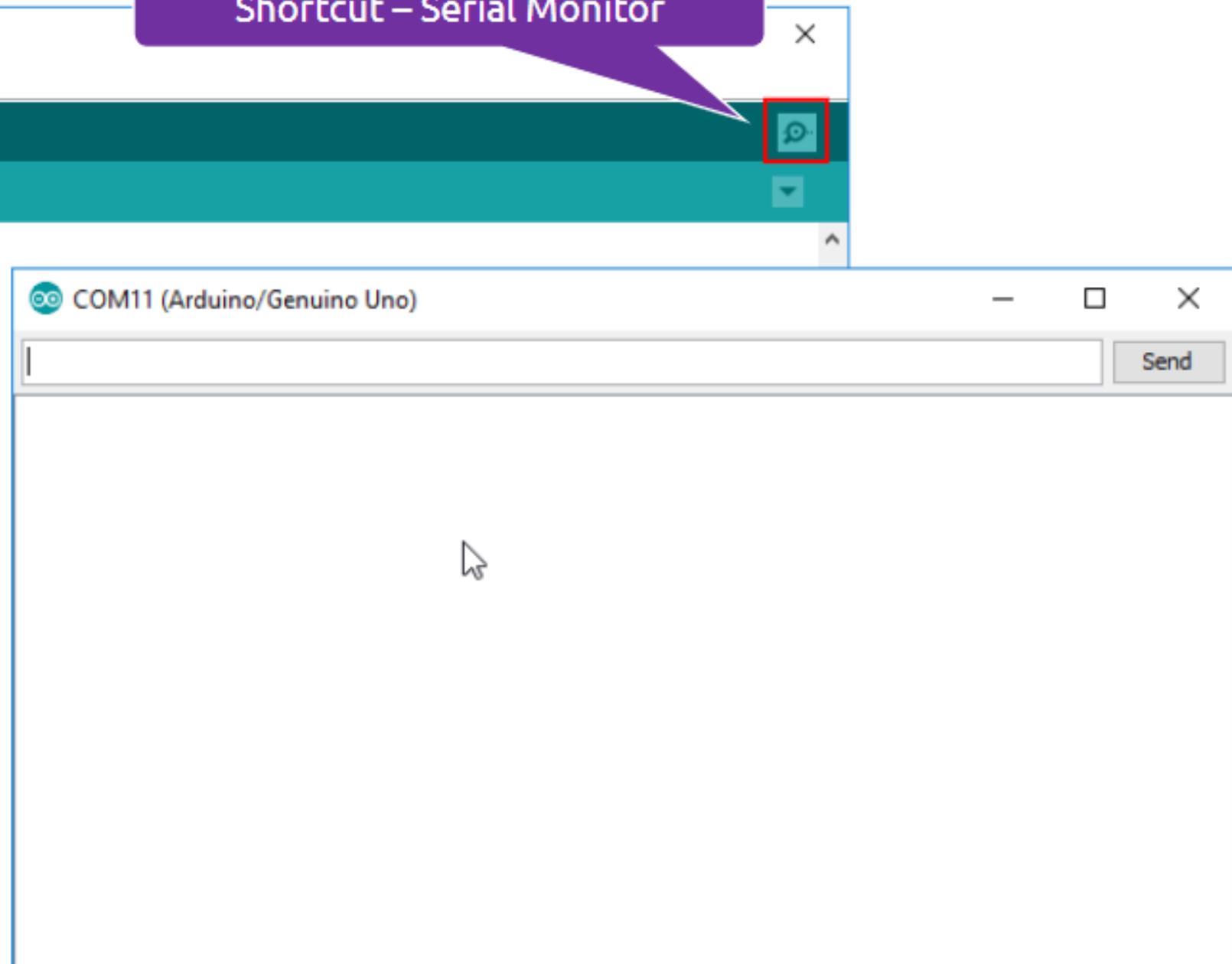


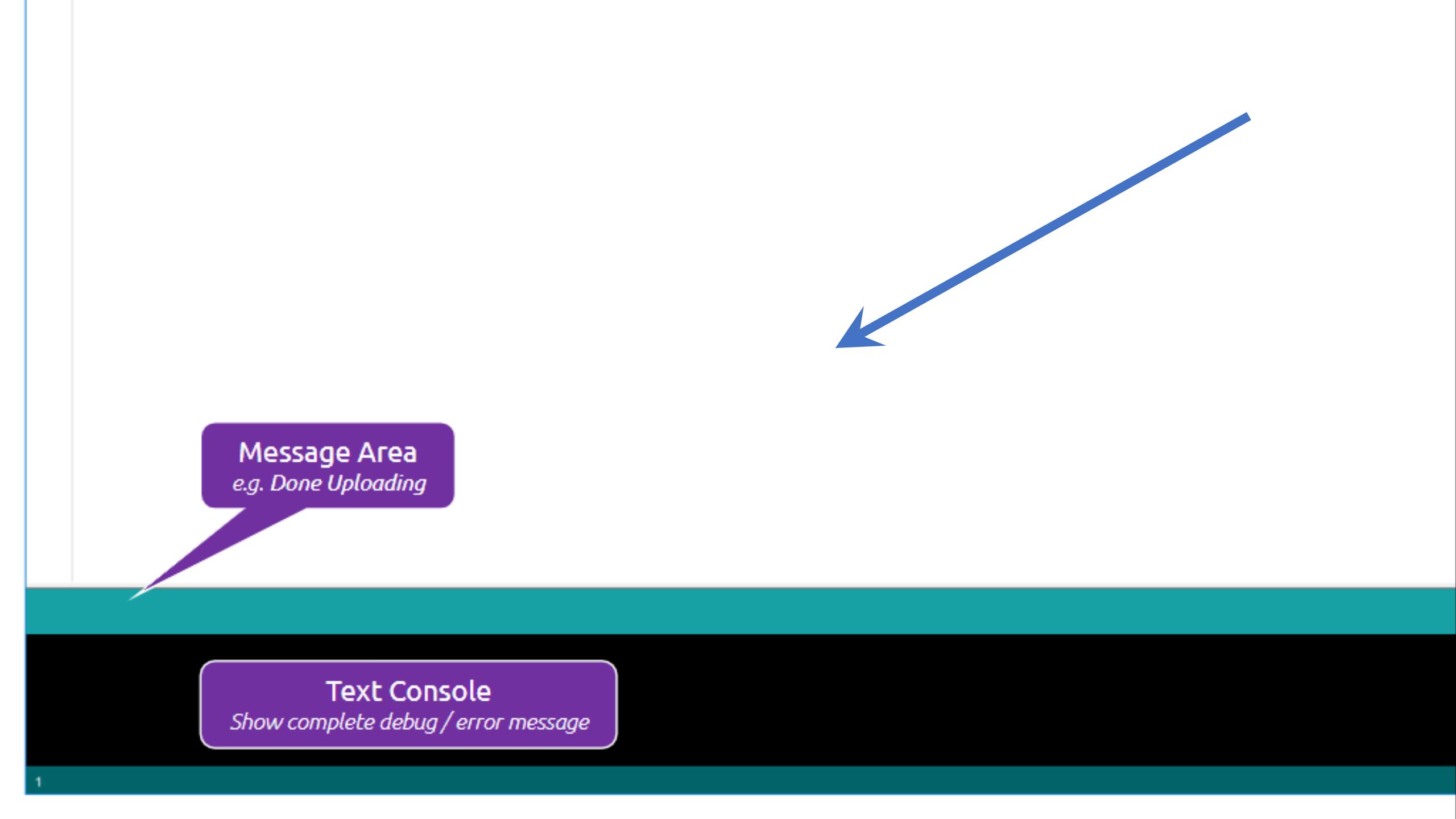
sketch_mar10a

```
1 void setup() {  
2     // put your setup code here, to run once:  
3  
4 }  
5  
6 void loop() {  
7     // put your main code here, to run repeatedly:  
8  
9 }
```

Sketch Area

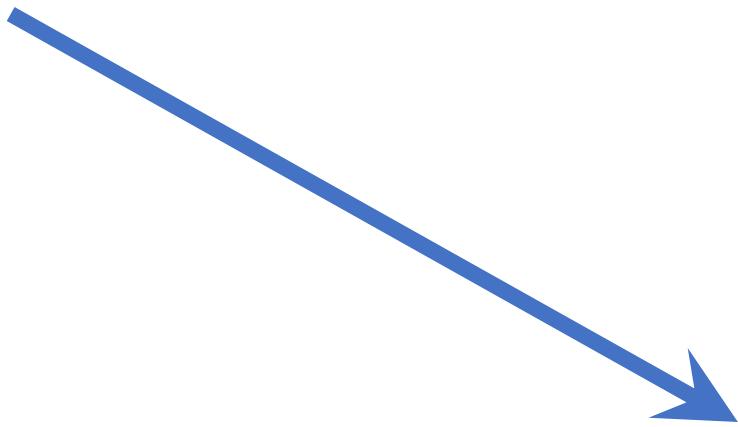
Shortcut – Serial Monitor





Message Area
e.g. Done Uploading

Text Console
Show complete debug / error message



Chosen Board and Port



Asas_Arduino

```
1 void setup() {  
2     // put your setup code here, to run once:  
3  
4 }  
5  
6 void loop() {  
7     // put your main code here, to run repeatedly:  
8  
9 }
```



Asas_Arduino §

```
1 void setup() {  
2     // put your setup code here, to run once:  
3     pinMode(); // Ini adalah line comment  
4  
5 }  
6  
7 void loop() {  
8     // put your main code here, to run repeatedly:  
9 }
```



Asas_Arduino

```
1 /*  
2 Ini adalah block comment  
3 */  
4  
5 void setup() {  
6     // put your setup code here, to run once:  
7     pinMode(); // Ini adalah line comment  
8  
9 }  
10  
11 void loop() {  
12     // put your main code here, to run repeatedly:  
13 }
```



Asas_Arduino

```
1 #include <LiquidCrystal.h>
2
3 #define LED 12
4
5 int led = 11;
6
7 String nama = "Ariffin";
8
9 LiquidCrystal lcd (2, 3, 4, 5, 6, 7);
10
11 void setup() {
12     // put your setup code here, to run once:
13
14 }
15
16 void loop() {
17     // put your main code here, to run repeatedly:
18 }
```

Defining Area

- Subroutine
- Include Library
- Global Variable Declaration

```
1 int LED1 = 11;          // nyatakan pembolehubah LED1 sebagai 11
2 int LED2 = 12;          // nyatakan pembolehubah LED2 sebagai 12
3
4
5 void setup() {
6     pinMode(11, OUTPUT);    // arahan menjadikan pin 11 sebagai OUTPUT
7     pinMode(12, OUTPUT);    // arahan menjadikan pin 12 sebagai OUTPUT
8
9     digitalWrite(LED1, HIGH); // arahan berikan output voltan HIGH / 5V pada pin 11
10}
11
12
13 void loop() {
14     digitalWrite(LED2, HIGH); // arahan berikan output voltan HIGH / 5V pada pin 12
15     delay(500);             // arahan tunggu selama 0.5 saat
16     digitalWrite(LED2, LOW); // arahan berikan output voltan LOW / 0V pada pin 12
17     delay(500);             // arahan tunggu selama 0.5 saat
18}
```

Variable Declaration

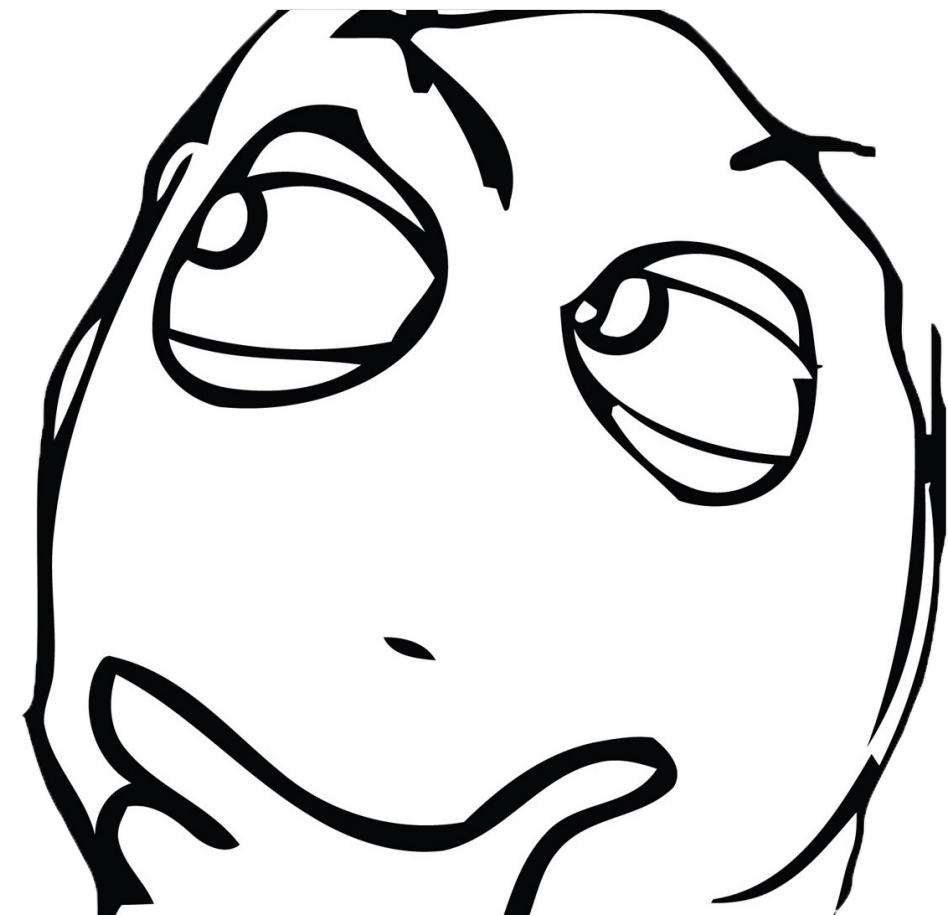
VOID SETUP()

VOID LOOP()



Asas_Arduino

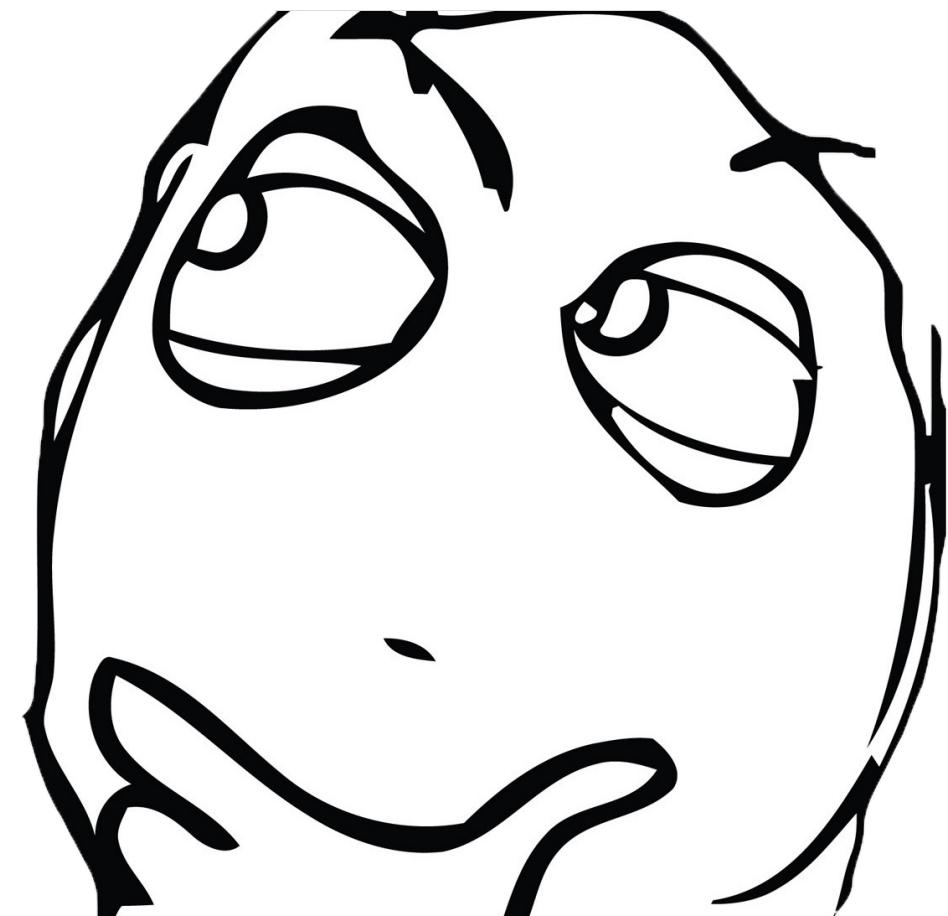
```
1 int LED1 = 11;
2 int LED2 = 12;
3
4
5 void setup() {
6     pinMode(11, OUTPUT);
7     pinMode(12, OUTPUT);
8
9     digitalWrite(LED2, HIGH);
10    digitalWrite(LED2, LOW);
11 }
12
13
14 void loop() {
15
16 }
```





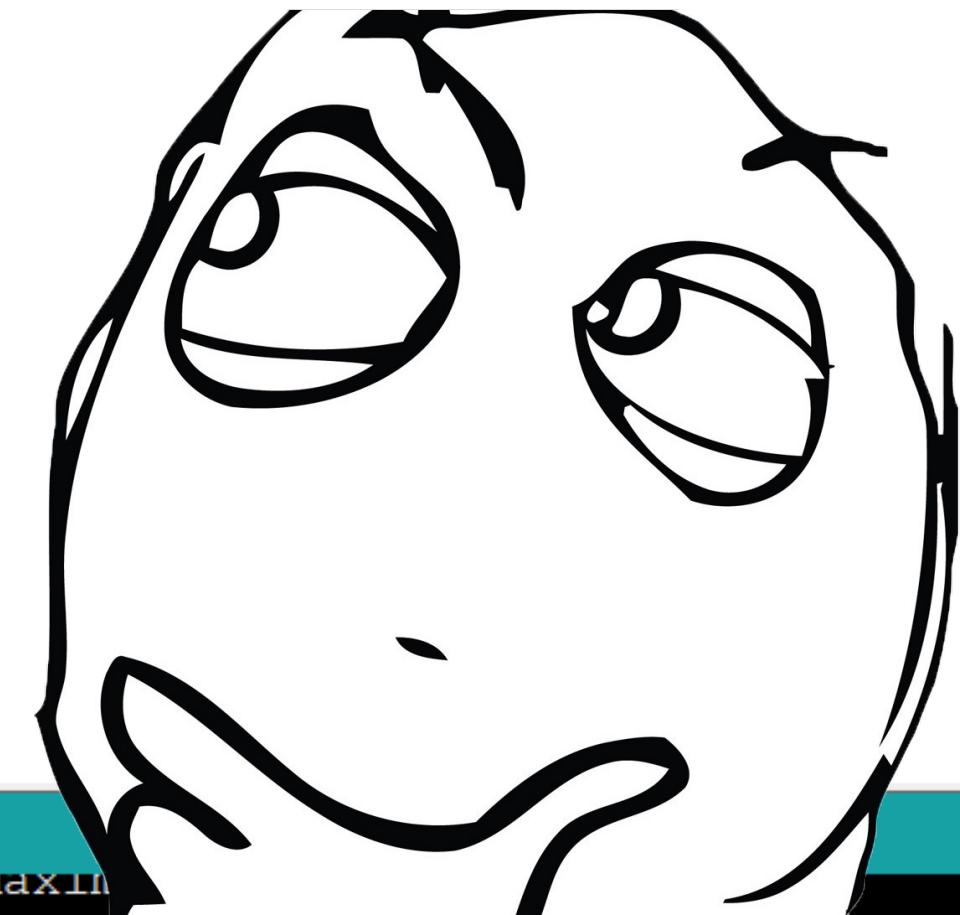
Asas_Arduino

```
1 int LED1 = 11;
2 int LED2 = 12;
3
4
5 void setup() {
6     pinMode(11, OUTPUT);
7     pinMode(12, OUTPUT);
8
9     digitalWrite(LED2, HIGH);
10    delay(500);
11    digitalWrite(LED2, LOW);
12    delay(500);
13 }
14
15
16 void loop() {
17
18 }
```



```
1 int LED1 = 11;
2 int LED2 = 12;
3
4 void setup() {
5     pinMode(11, OUTPUT);
6     pinMode(12, OUTPUT);
7 }
8
9 void loop() {
10    digitalWrite(LED2, HIGH);
11    delay(500);
12    digitalWrite(LED2, LOW);
13    delay(500);
14
15    digitalWrite(LED2, HIGH);
16    delay(500);
17    digitalWrite(LED2, LOW);
18    delay(500);
19 }
```

I



3V3 GND TX RX D8 D7 D6 D5 GND 3V3 D4 D3 D2 D1 D0
D12 D11 D10 D9 D8 D7 D6 D5 D4 D3 D2 GND RST RX0 TX1

D12 D11 D10 D9 D8 D7 D6 D5 D4 D3 D2 GND RST RX0 TX1

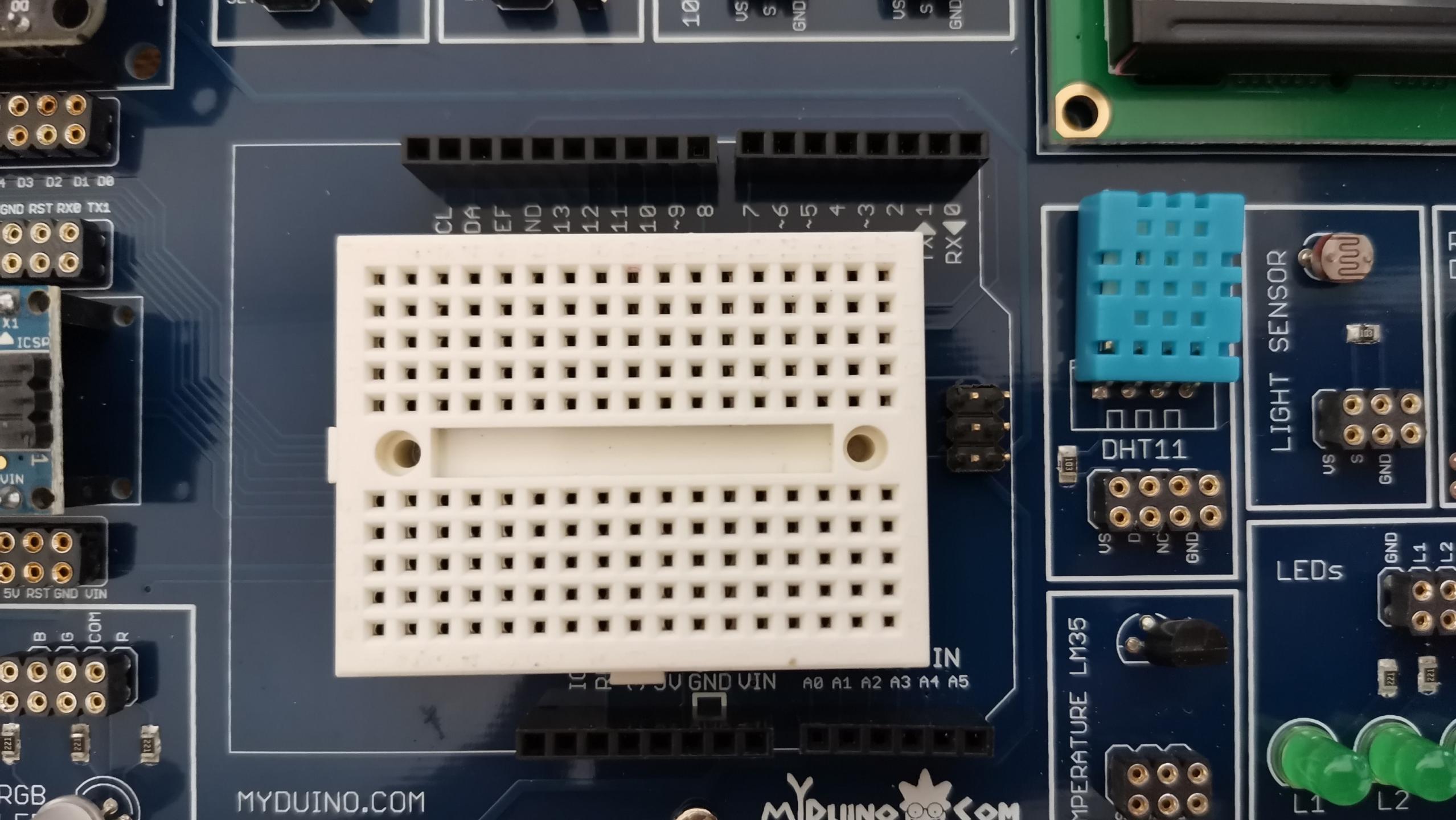
ICSP
ARDUINO
NANO
U3.0
www.arduino.cc
TX
RX
RST
5V
GND
VIN

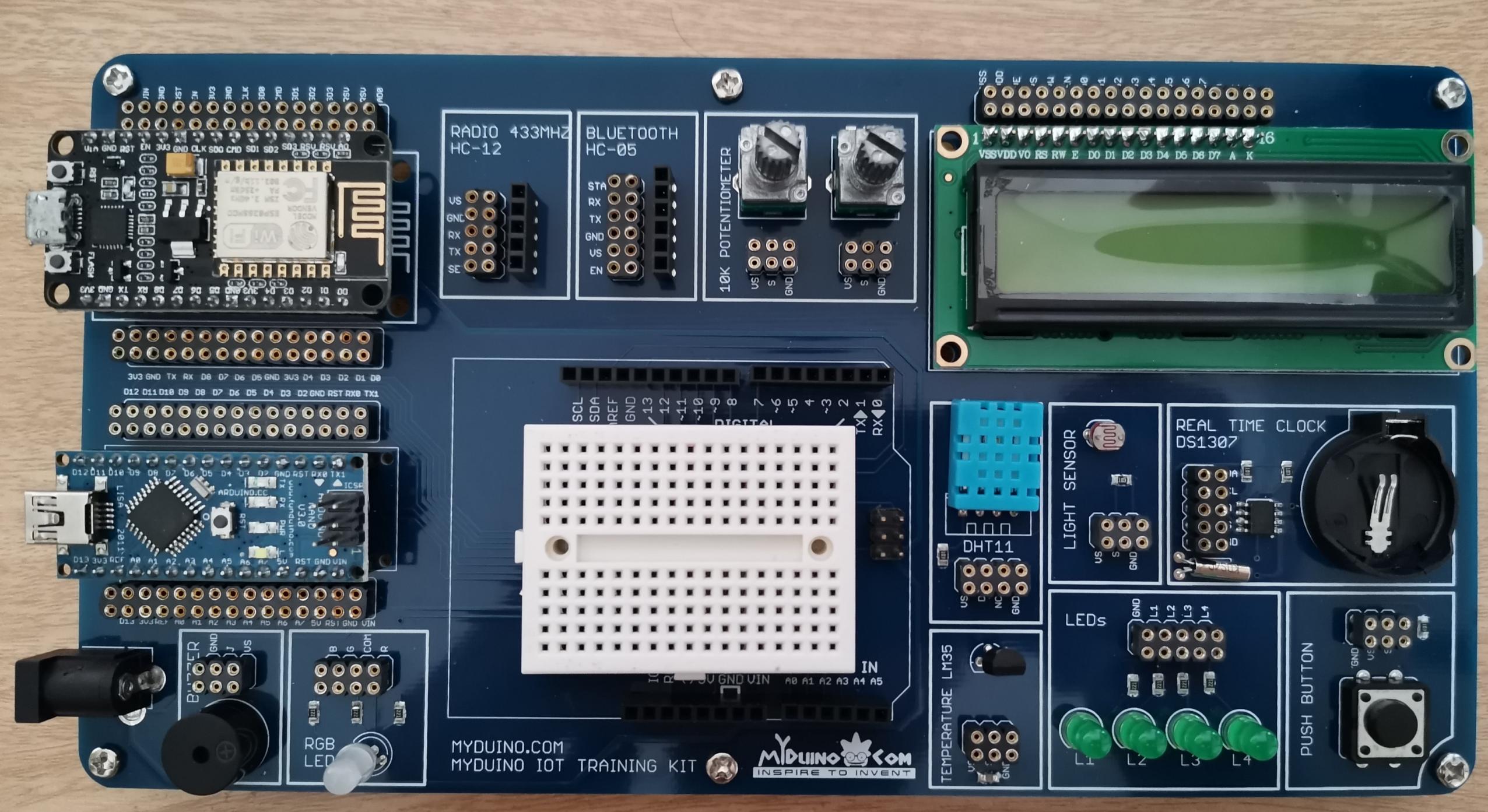
D13 3V3 REF A0 A1 A2 A3 A4 A5 A6 A7 5V RST GND VIN

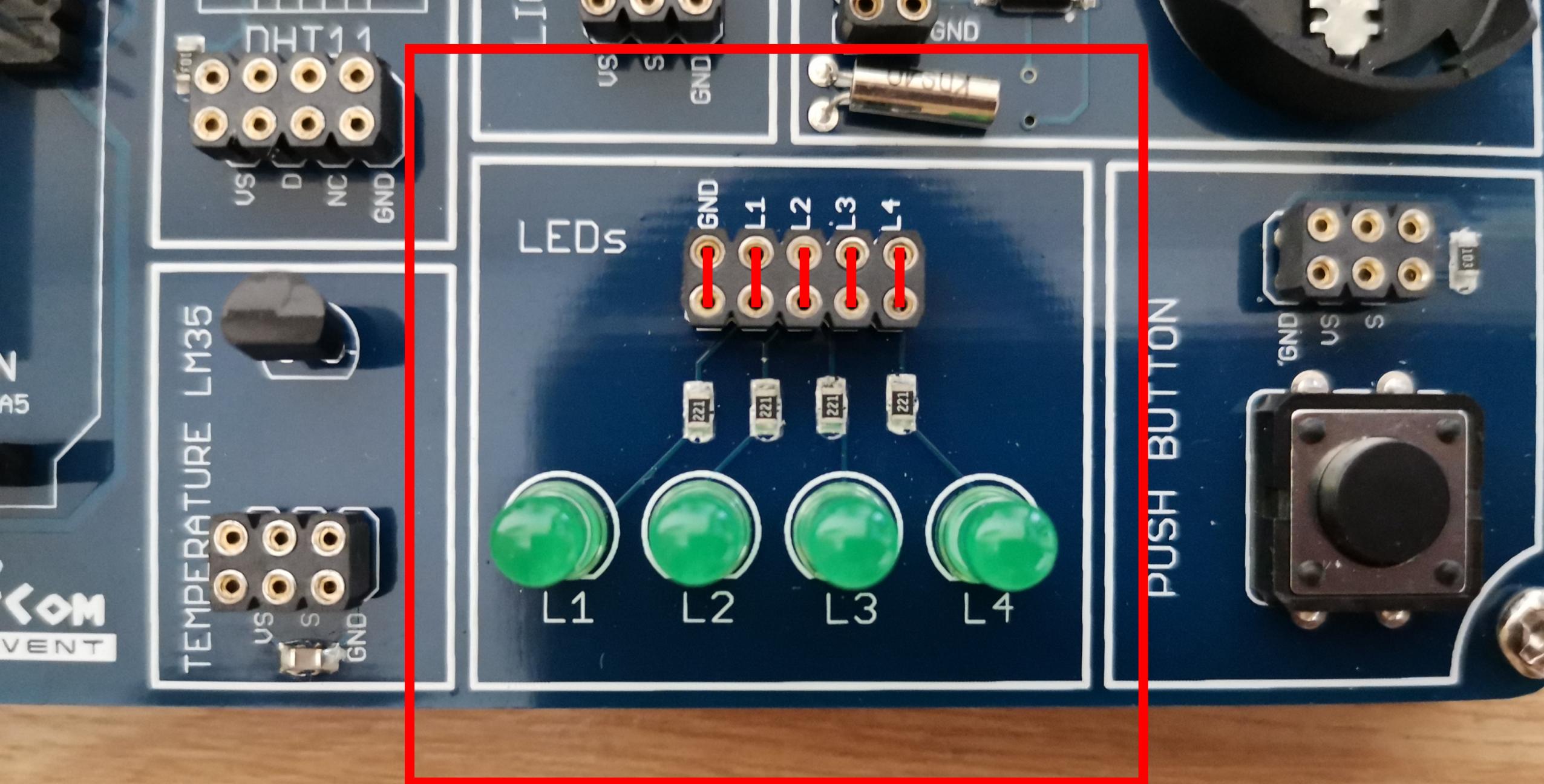
U13 3V3 REF A0 A1 A2 A3 A4 A5 A6 A7 5V RST GND VIN

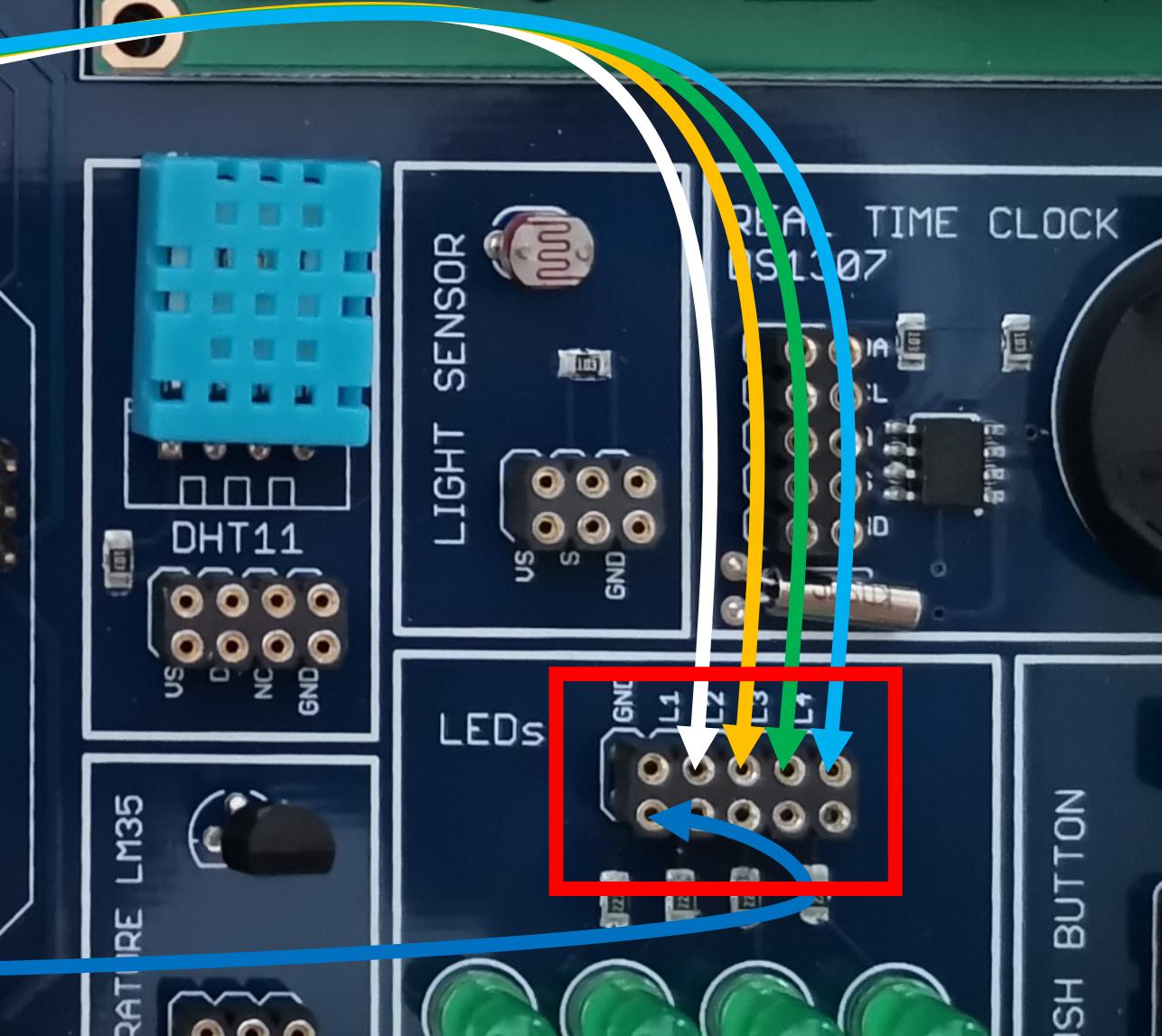
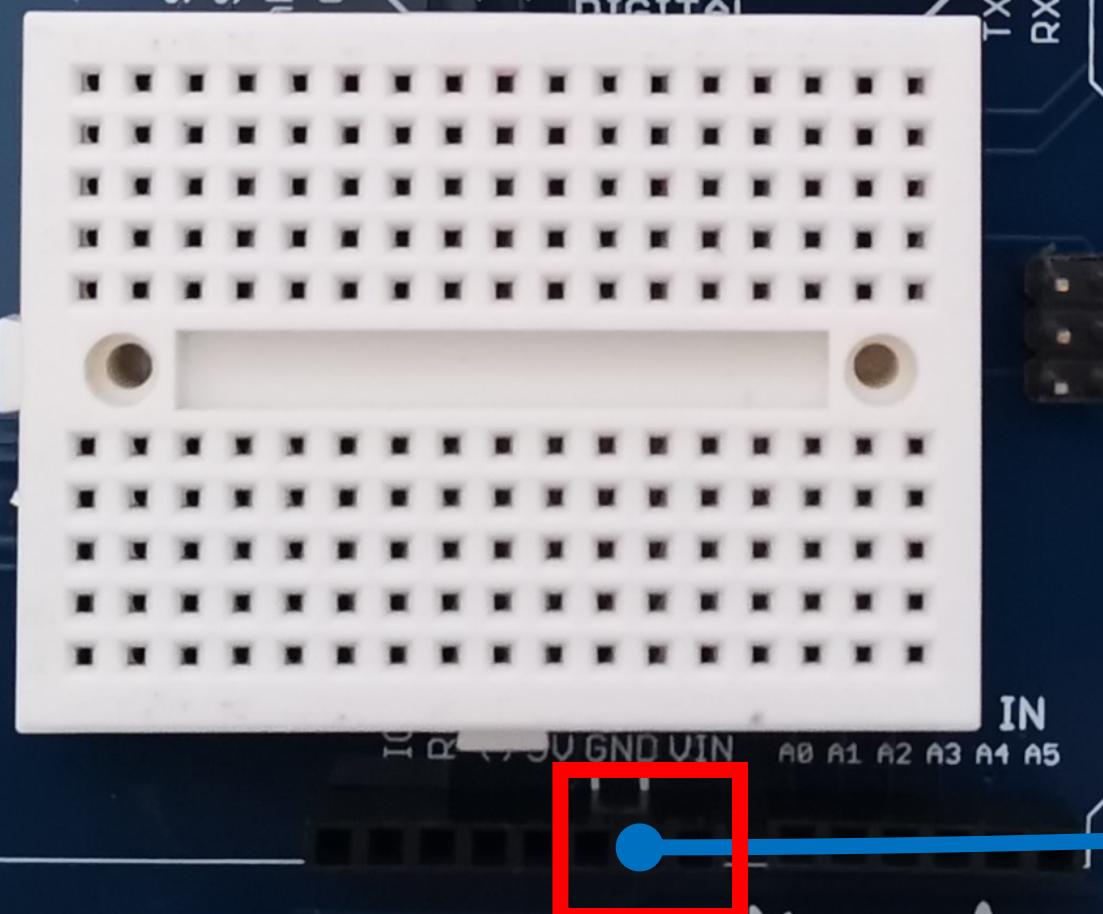
JUZZER
GND
US

B G COM R









File Edit Sketch Tools Help



Auto Format

Ctrl+T

Archive Sketch

Fix Encoding & Reload

Manage Libraries...

Ctrl+Shift+I

Serial Monitor

Ctrl+Shift+M

Serial Plotter

Ctrl+Shift+L

WiFi101 / WiFiNINA Firmware Updater

Board: "Arduino Nano"

Processor: "ATmega328P (Old Bootloader)"

Port

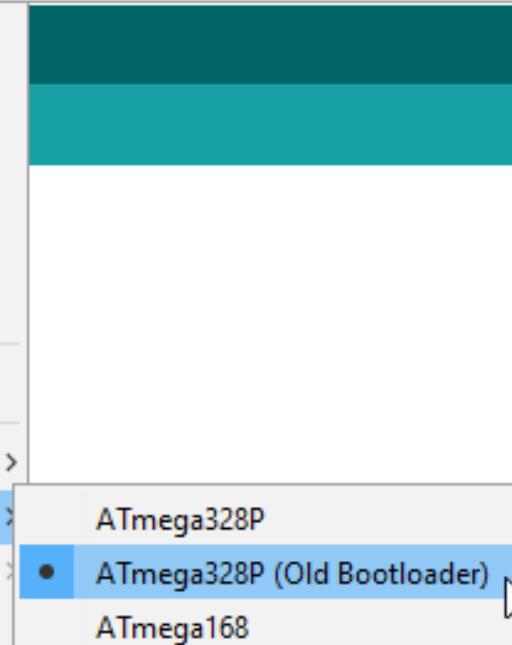
Get Board Info

Programmer: "AVRISP mkII"

Burn Bootloader

```
1 int L
2 int L
3
4 void
5 pin
6 pin
7 }
8
9 void
10 digitalWrite(LED2, HIGH);
11 delay(500);
12 digitalWrite(LED2, LOW);
13 delay(500);

15 digitalWrite(LED2, HIGH);
16 delay(500);
17 digitalWrite(LED2, LOW);
18 delay(500);
```



File Edit Sketch Tools Help



Auto Format

Ctrl+T

Archive Sketch

Fix Encoding & Reload

Manage Libraries...

Ctrl+Shift+I

Serial Monitor

Ctrl+Shift+M

Serial Plotter

Ctrl+Shift+L

WiFi101 / WiFiNINA Firmware Updater

Board: "Arduino Nano"

Processor: "ATmega328P (Old Bootloader)"

Port: "COM3"

Get Board Info

Programmer: "AVRISP mkII"

Burn Bootloader

digitalWrite(LED2, HIGH);

delay(500);

digitalWrite(LED2, LOW);

delay(500);

digitalWrite(LED2, HIGH);

delay(500);

digitalWrite(LED2, LOW);

delay(500);

Serial ports

COM3



Device Manager

File Action View Help



- DESKTOP-PUFQGJP
 - Audio inputs and outputs
 - Batteries
 - Bluetooth
 - Cameras
 - Computer
 - Disk drives
 - Display adapters
 - DVD/CD-ROM drives
 - Human Interface Devices
 - IDE ATA/ATAPI controllers
 - Keyboards
 - Memory technology devices
 - Mice and other pointing devices
 - Monitors
 - Network adapters
 - Other devices
 - Ports (COM & LPT)**
 - USB Serial Port (COM3)**
 - Print queues
 - Processors
 - Software devices
 - Sound, video and game controllers
 - Storage controllers
 - System devices
 - Universal Serial Bus controllers



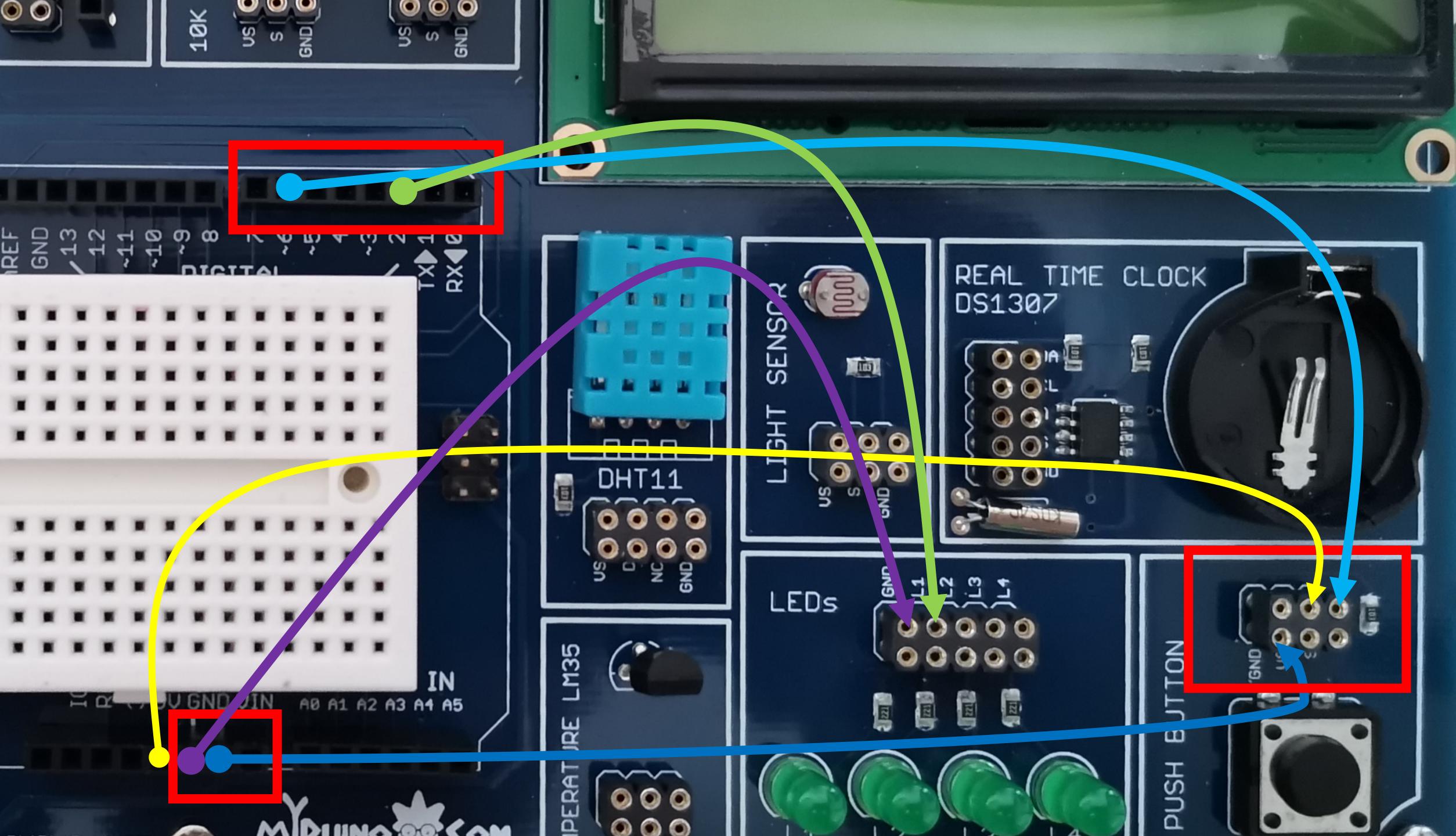
Asas_Arduino

```
1 int LED1 = 2;
2 int LED2 = 3;
3
4 void setup() {
5     pinMode(2, OUTPUT);
6     pinMode(3, OUTPUT);
7 }
8
9 void loop() {
10    digitalWrite(LED1, HIGH);
11    delay(500);
12    digitalWrite(LED1, LOW);
13    delay(500);
14
15    digitalWrite(LED2, HIGH);
16    delay(500);
17    digitalWrite(LED2, LOW);
18    delay(500);
```

```
4 void setup() {  
5   pinMode(2, OUTPUT);  
6   pinMode(3, OUTPUT);  
7 }  
8  
9 void loop() {  
10  digitalWrite(LED1, HIGH);  
11  delay(500);  
12  digitalWrite(LED1, LOW);  
13  delay(500);  
14  
15  digitalWrite(LED2, HIGH);  
16  delay(500);  
17  digitalWrite(LED2, LOW);  
18  delay(500);  
19 }
```

Done uploading.
Sketch uses 980 bytes (2%) of program storage space. Maximum is 50720 bytes.
Global variables use 9 bytes (0%) of dynamic memory, leaving 2039 bytes for local variables.







Asas_Arduino_Input

```
1 int SUIS = 6;
2
3 void setup() {
4     pinMode(6, INPUT);
5
6     Serial.begin(9600);
7 }
8
9 void loop() {
10    int suis = digitalRead(SUIS);
11    Serial.print(suis);
12 }
```

I



Serial Monitor



l(SUIS);



Asas_Arduino_Input

```
1 int SUIS = 6;  
2  
3 void setup() {  
4     pinMode(6, INPUT);  
5  
6     Serial.begin(9600);  
7 }  
8  
9 void loop() {  
10    int suis = digitalRe  
11    Serial.print(suis);  
12 }
```

COM3

Autoscroll Show timestamp Both NL & CR Clear output



Asas_Arduino_Input

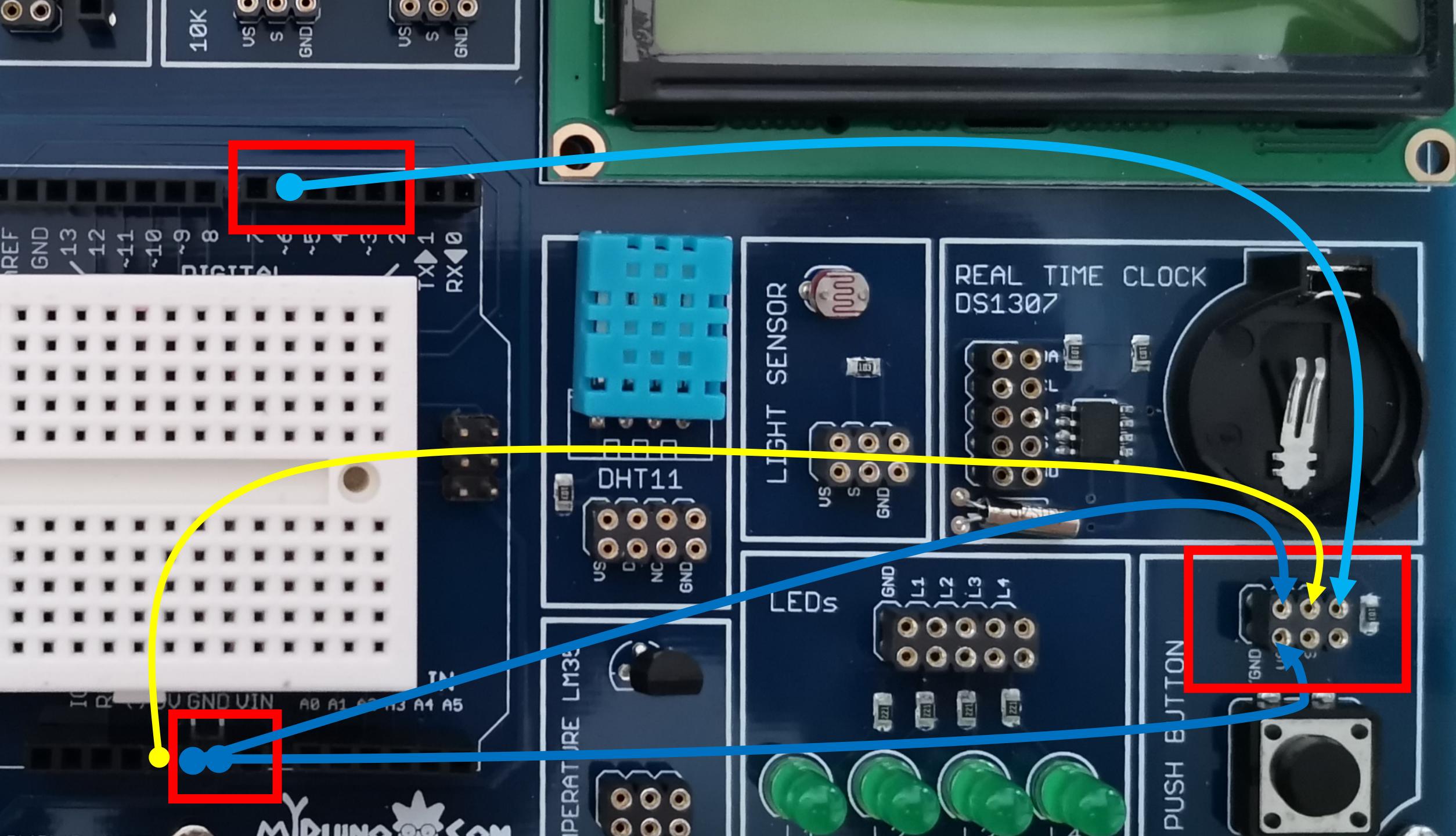
```
1 int SUIS = 6;  
2  
3 void setup() {  
4     pinMode(6, INPUT);  
5  
6     Serial.begin(9600);  
7 }  
8  
9 void loop() {  
10    int suis = digitalRe  
11    Serial.print(suis);  
12 }
```

COM3

gibberish

19200 baud

Autoscroll Show timestamp Both NL & CR Clear output



```
1 int SUIS = 6;
2 int LED = 2;
3
4 void setup() {
5     pinMode(6, INPUT);
6     pinMode(2, OUTPUT);
7     Serial.begin9600();
8 }
9
10 void loop() {
11     int suis = digitalRead(SUIS);
12     Serial.print(suis);
13
14     if(suis == 1){
15         digitalWrite(LED, HIGH);
16     }
17     else{
18         digitalWrite(LED, LOW);
19     }
}
```

Done Saving.

Sketch uses 1812 bytes (5%) of program storage space. Maximum is 30720 bytes.