

Women in Engineering Summer Engineering Academy Day

Environmental Sensing Project

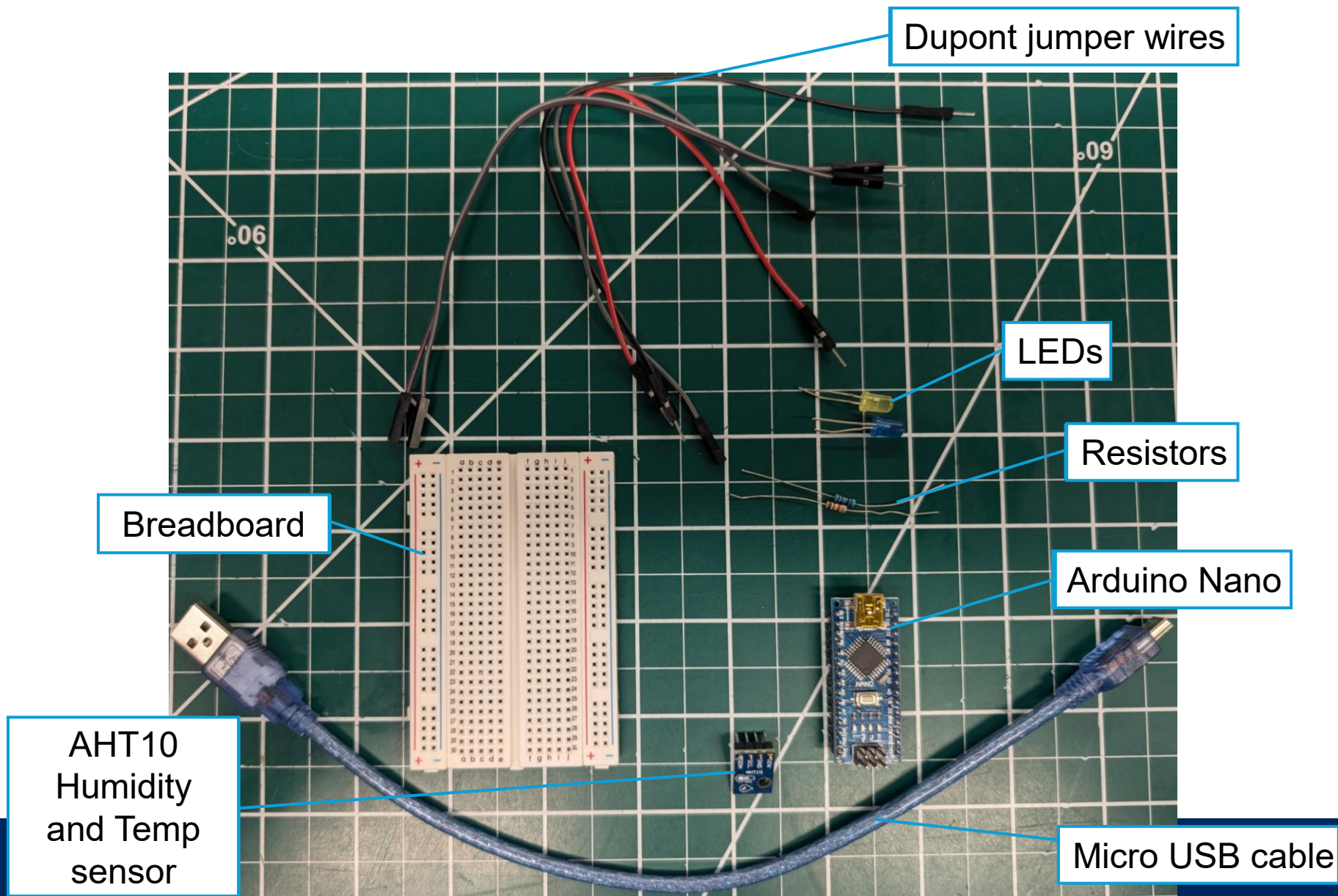
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Armando Barreto Munoz

Kamel Didan

The Vegetation Index and Phenology Lab (vip.arizona.edu)

Project Kit



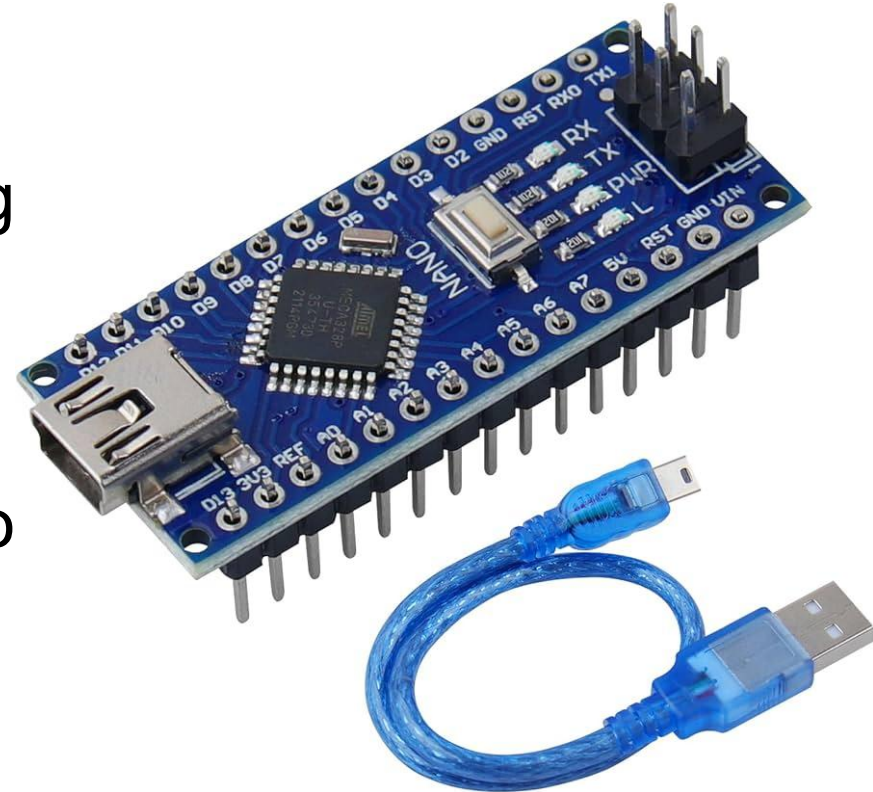
AHT10

- Uses I2C (I²C) protocol
 - I2C (inter-integrated circuit), pronounced I-squared-C, I-two-C, or I-I-C.
 - Serial communications bus invented in 1982 by Phillips Semiconductors (NXP Semiconductors)
- **Specifications**
 - Module size: 16x11 mm.
 - Working voltage: 3.3~5.0 Vdc.
 - Temperature range: -40°C 85°C.
 - Humidity range: 0~100%.
 - Humidity accuracy: typical $\pm 2\%$
 - Humidity resolution: 0.024%
 - Temperature accuracy: typical ± 0.3 ° C
 - Temperature resolution: Typical 0.01 °C
 - Working temperature: -40°C~85°C.



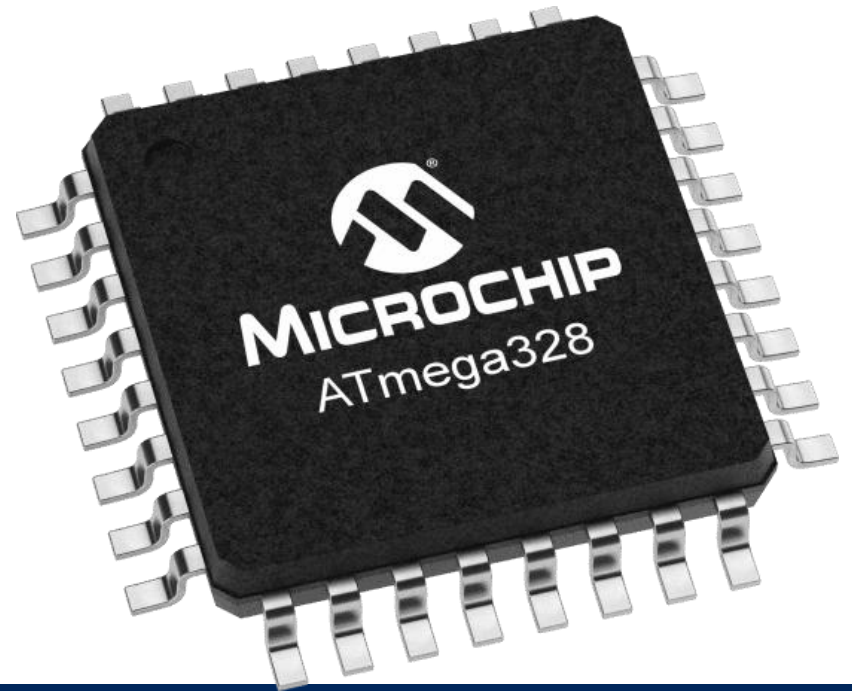
Microcontroller – Arduino Nano

- Arduino® Nano is an intelligent development board designed for building faster prototypes with the smallest dimension.
- Arduino Nano being the oldest member of the Nano family, provides enough interfaces for your breadboard-friendly applications.

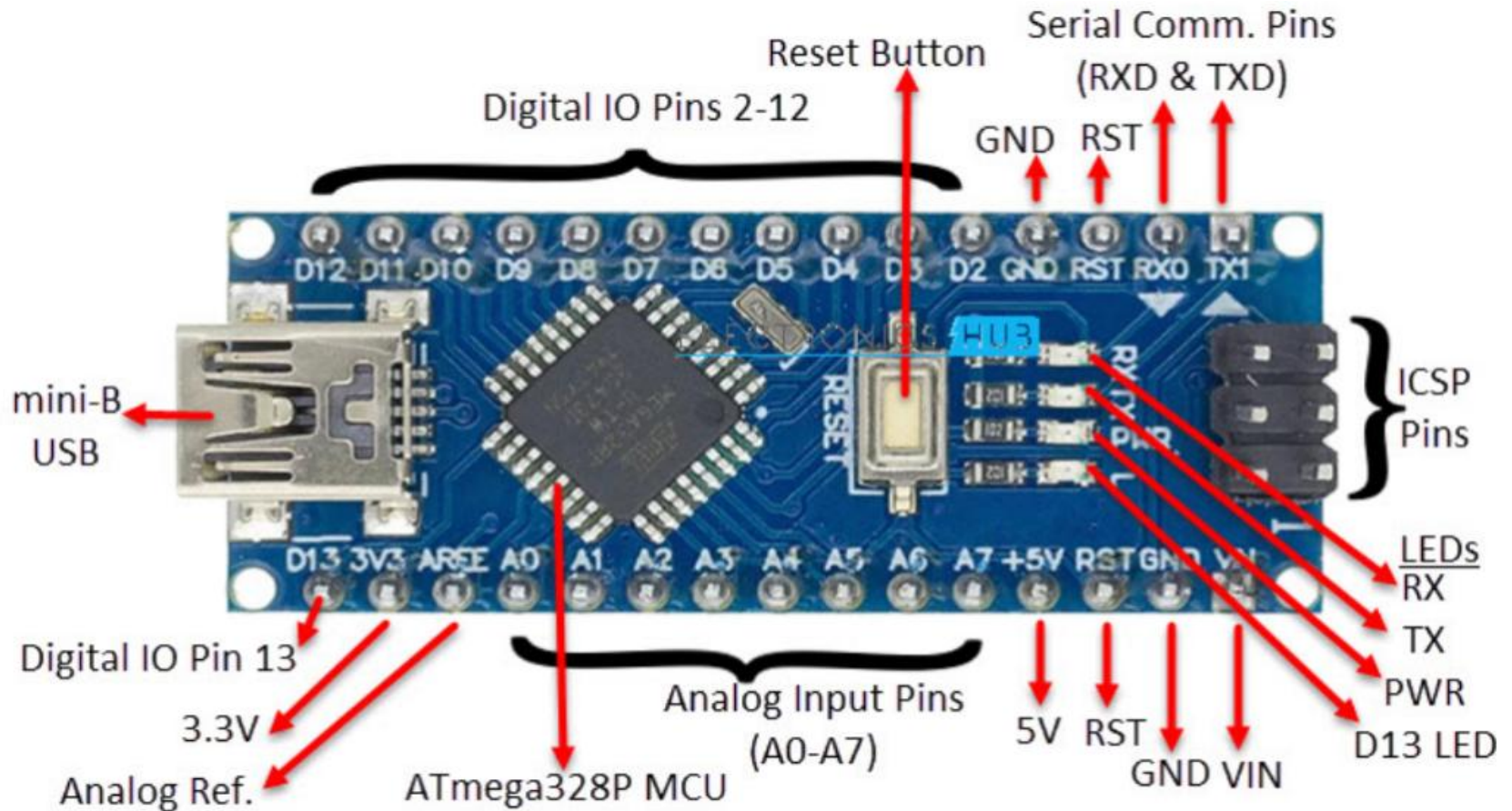


Microcontroller – Arduino Nano

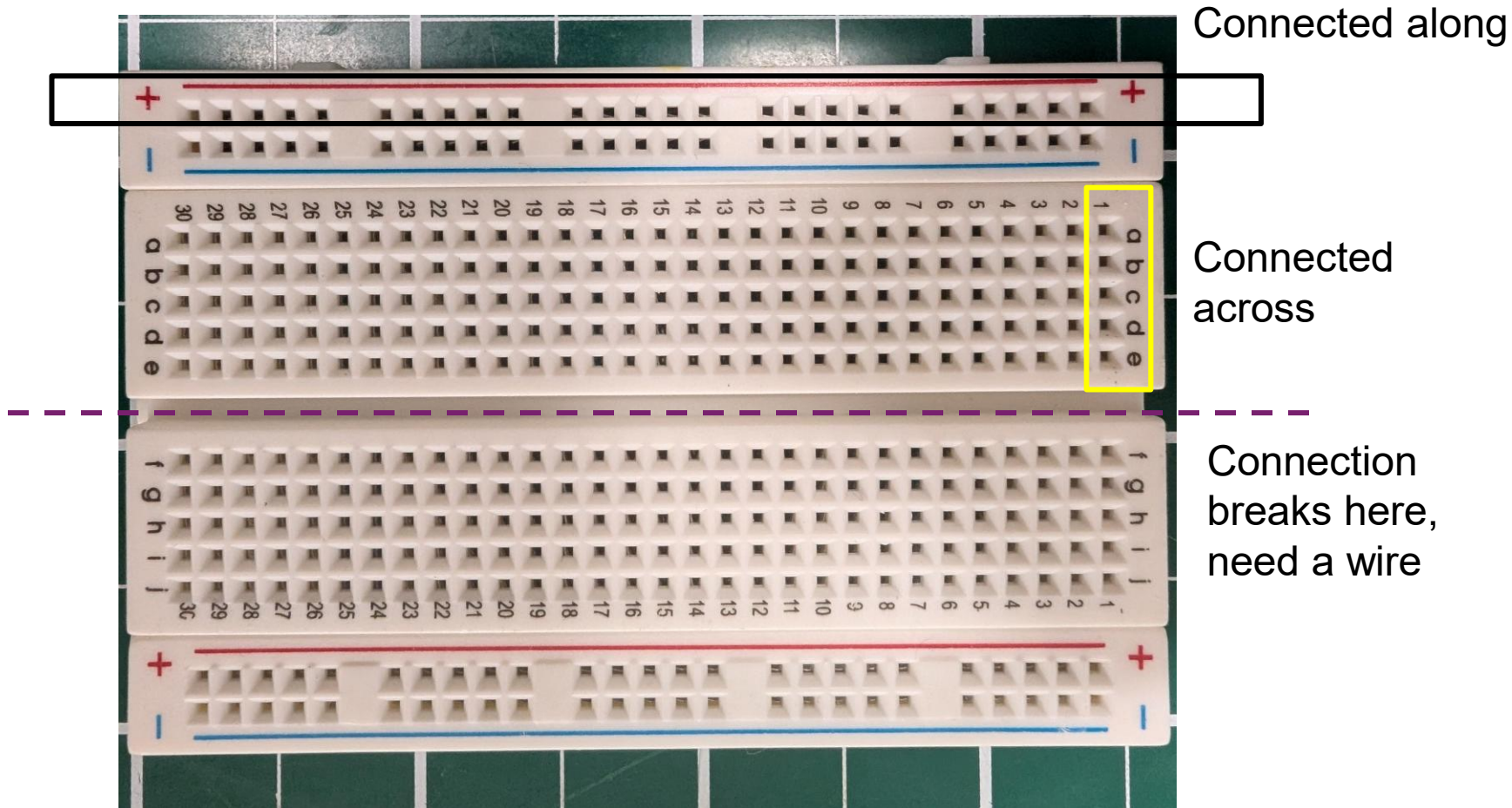
- ATmega328 Microcontroller
 - High-performance low-power 8-bit processor
 - Achieve up to 16 MIPS for 16 MHz clock frequency
- Power
 - Mini-B USB connection
- I/O
 - 20 Digital
 - 8 Analog
 - 6 PWM Output



Arduino NANO pinout

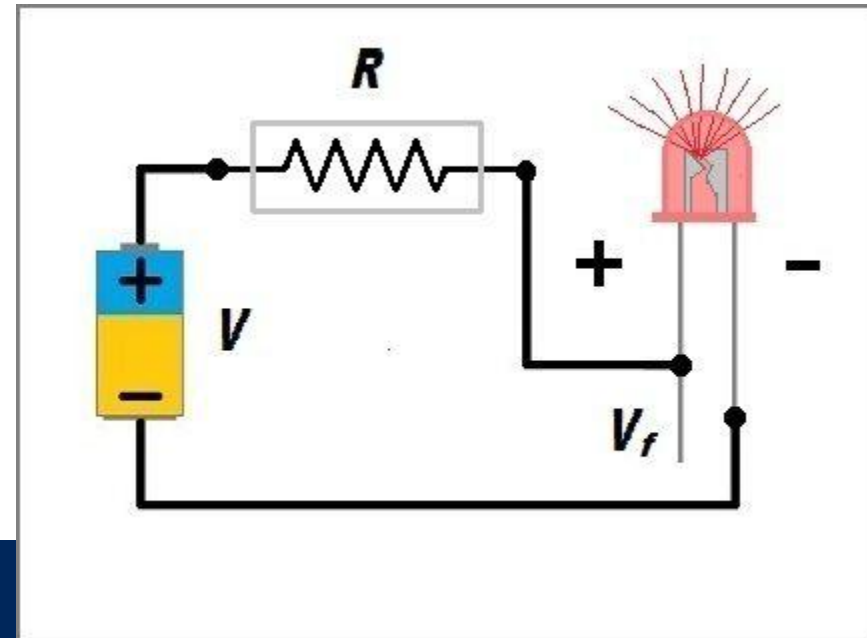
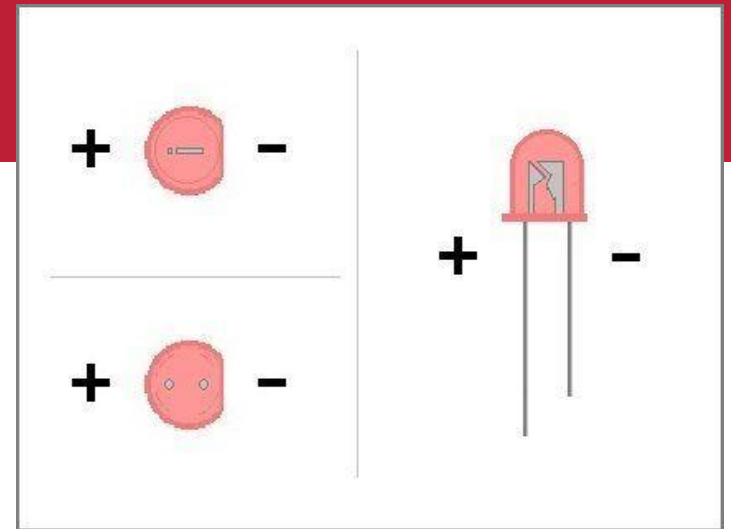


Breadboard

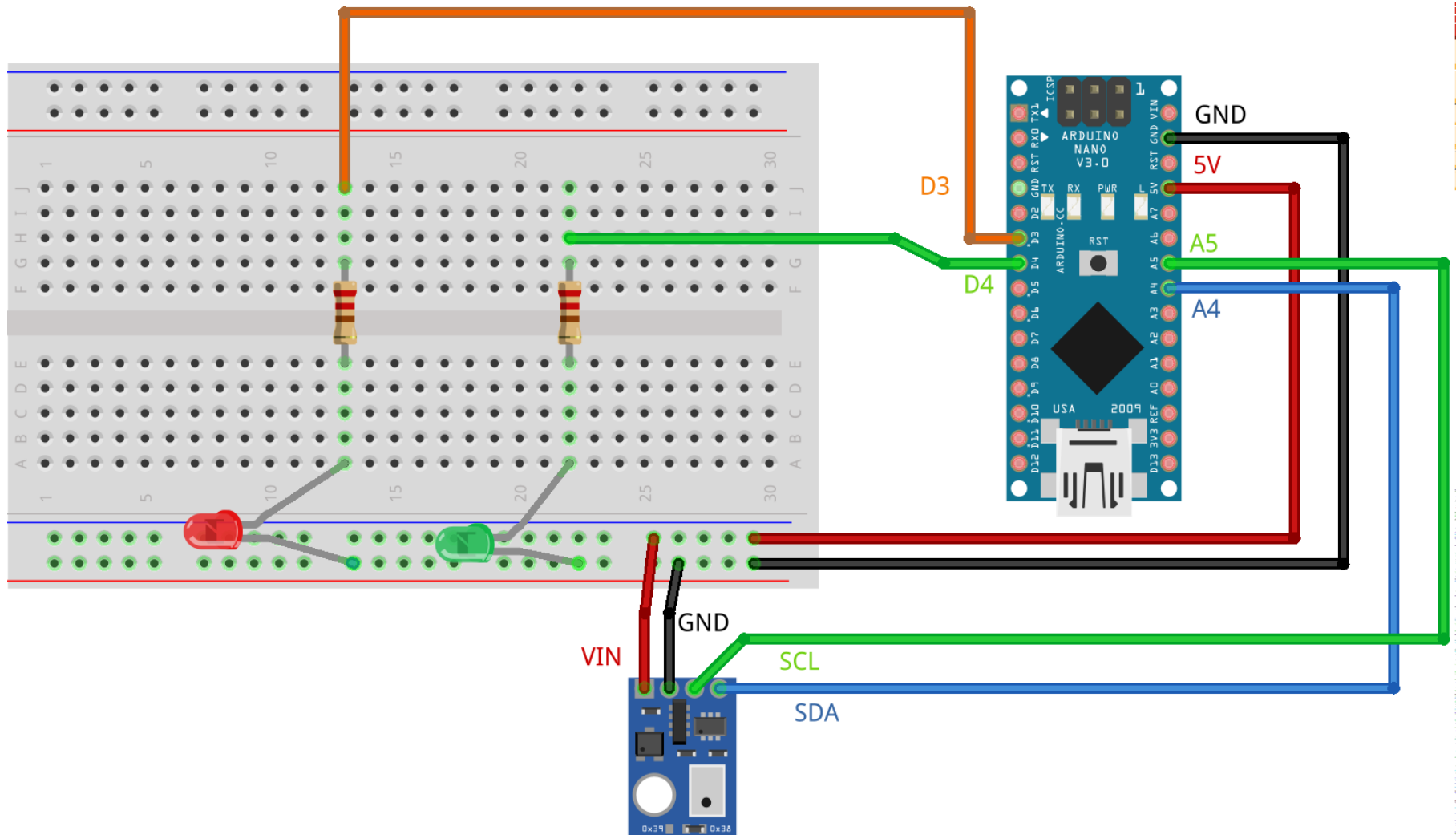


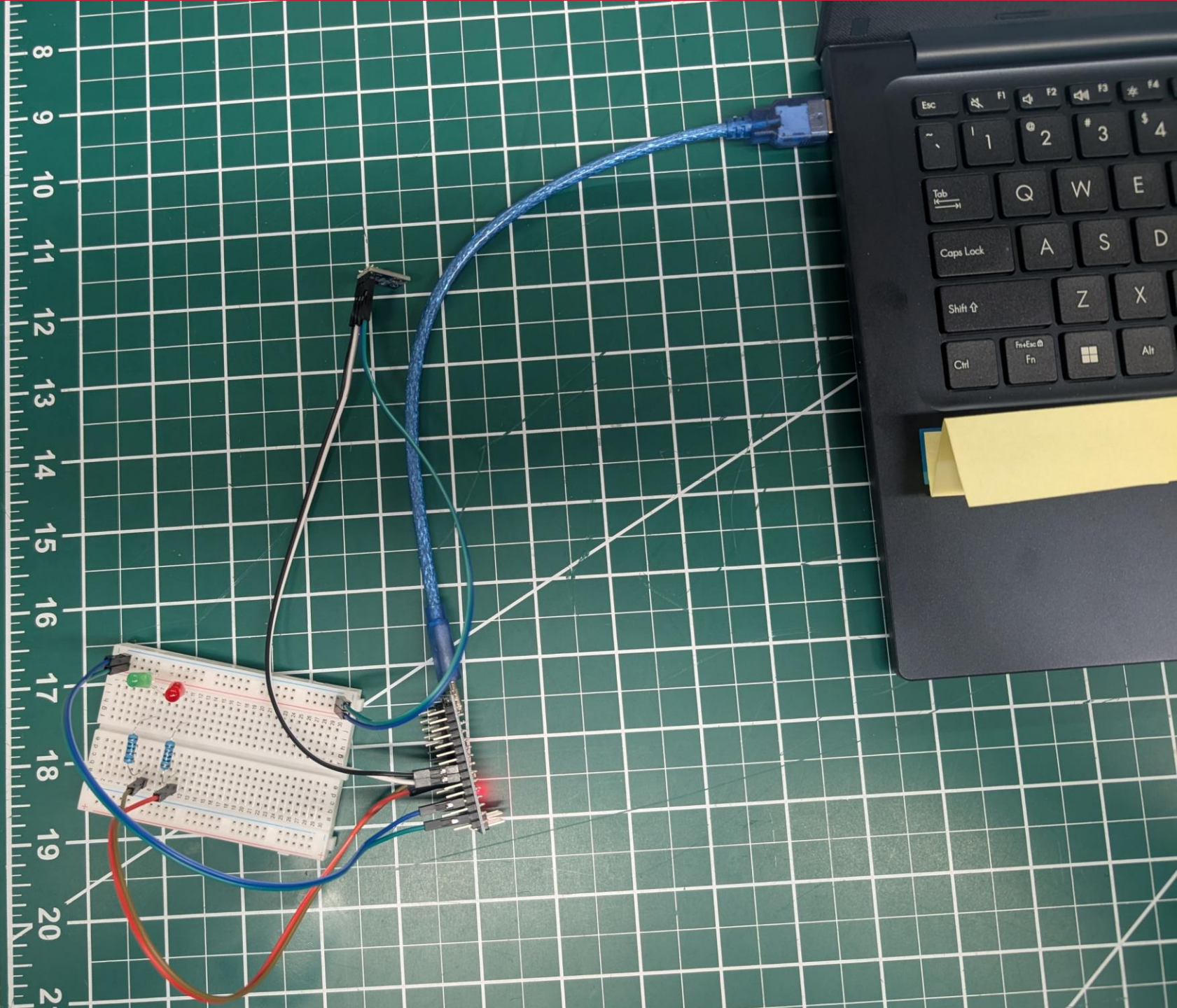
LEDs

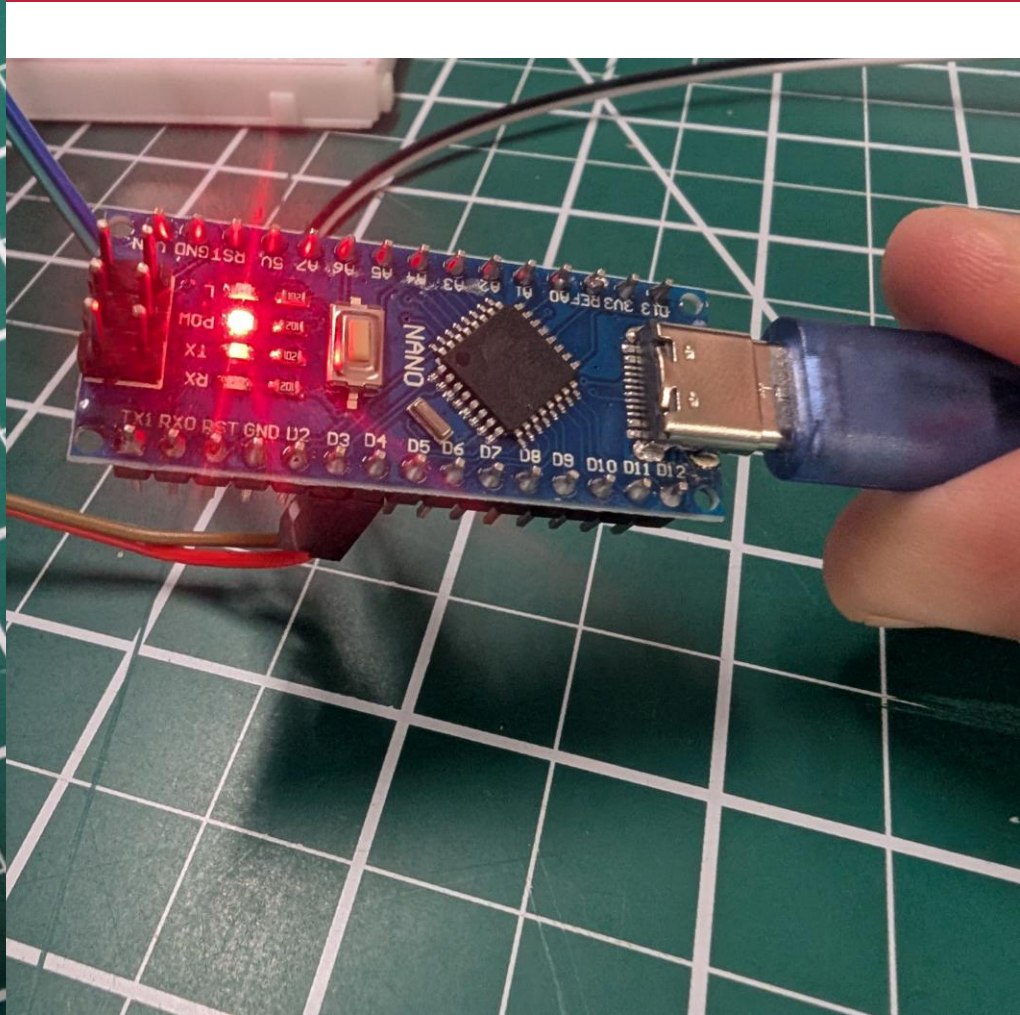
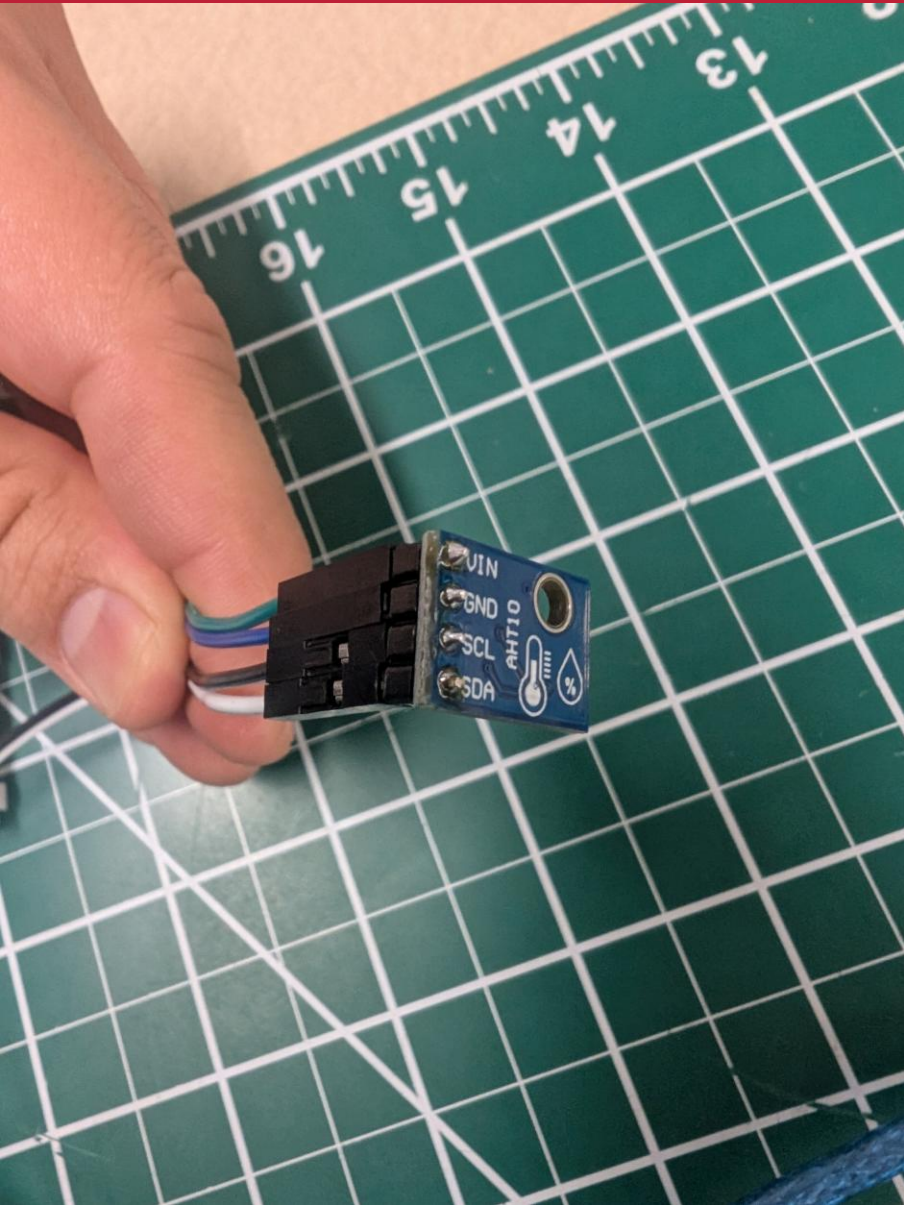
- Light-emitting diode
- LEDs have polarity!
- The voltage supply side of the diode is the positive (+) side, this is called the **anode**. The negative (-) side is called the **cathode**.
- You need a resistor between one of the LED leads and the connection to either GND or the supply voltage

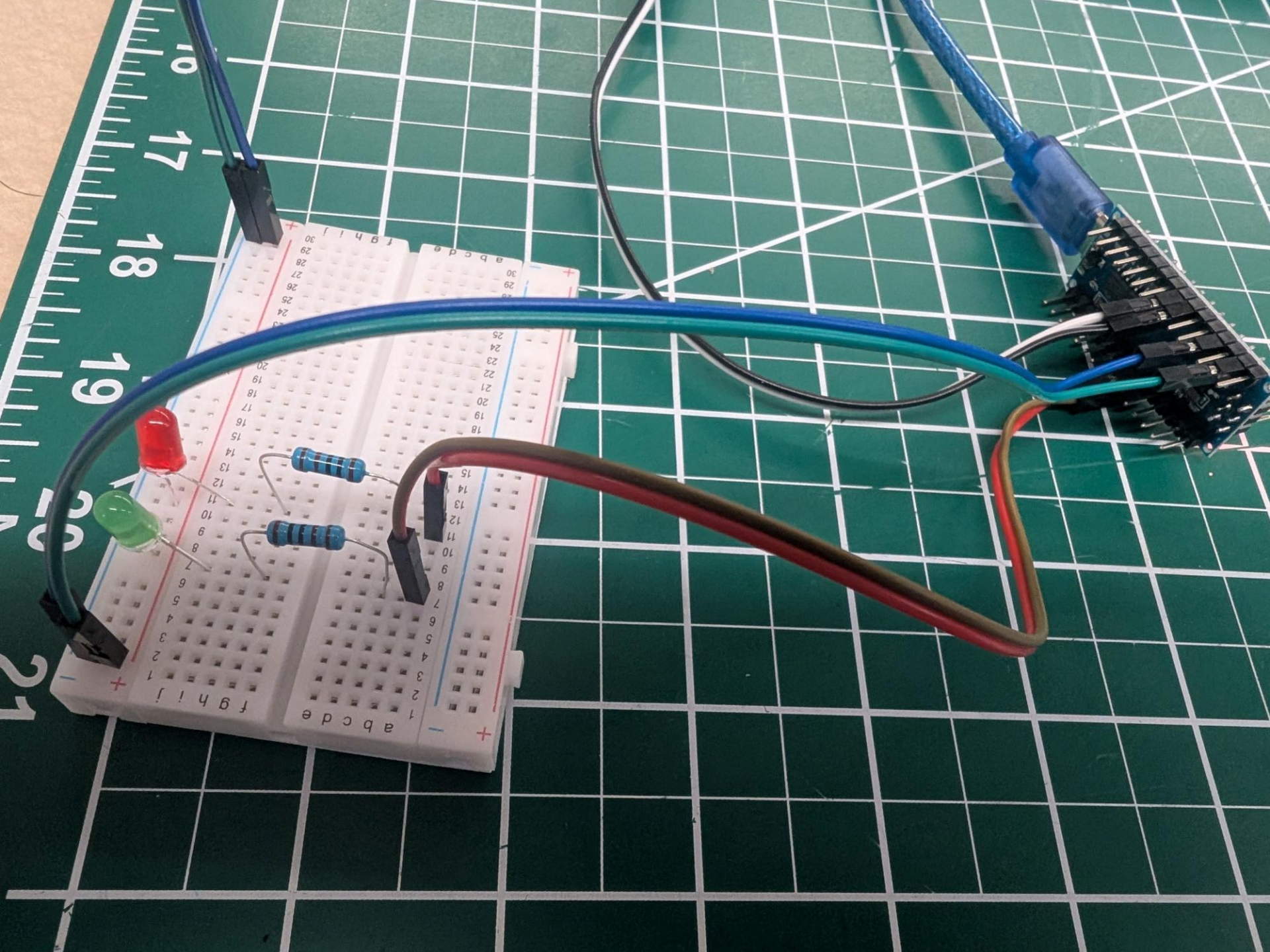


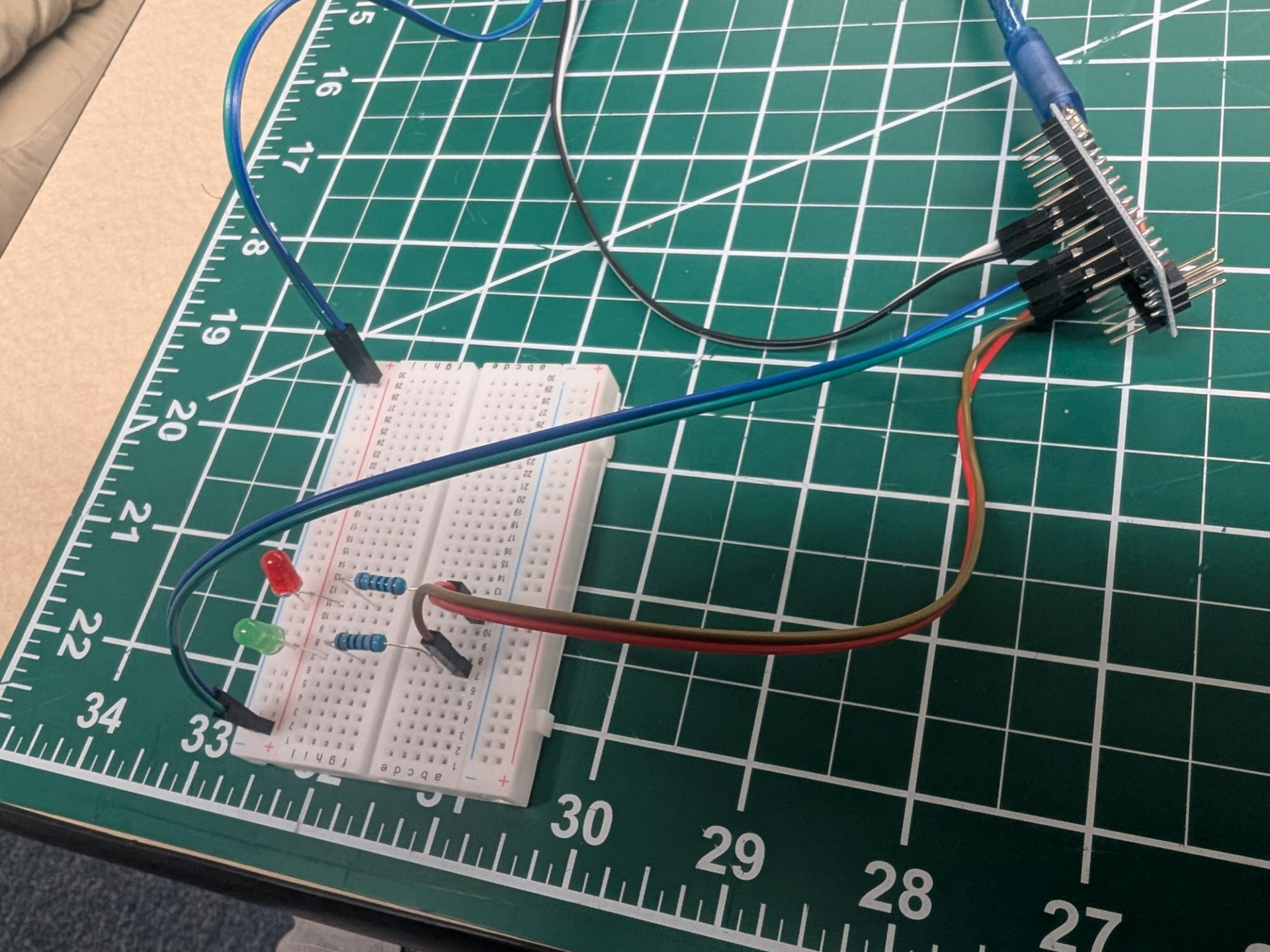
Today's scheme

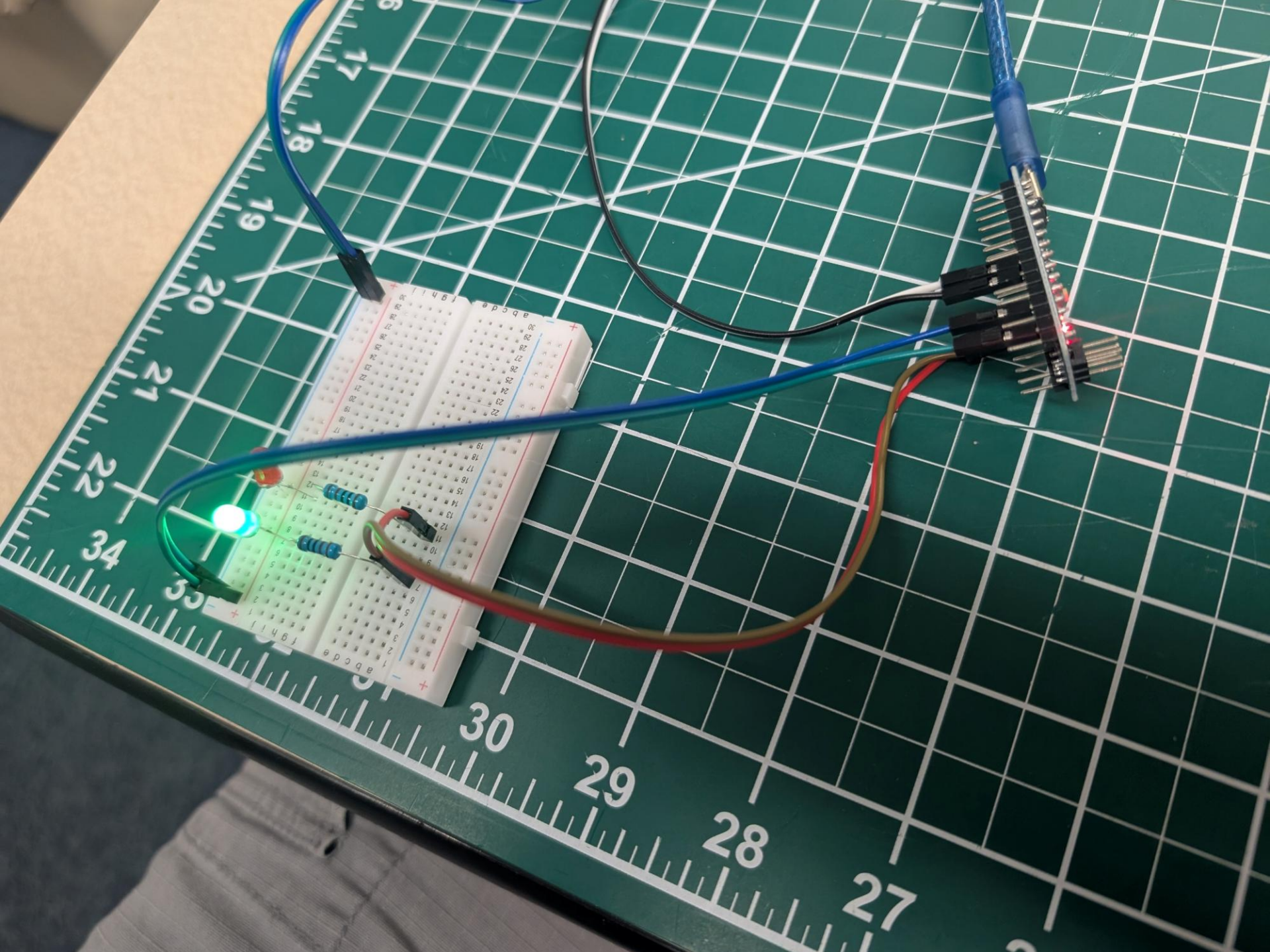












Our objective

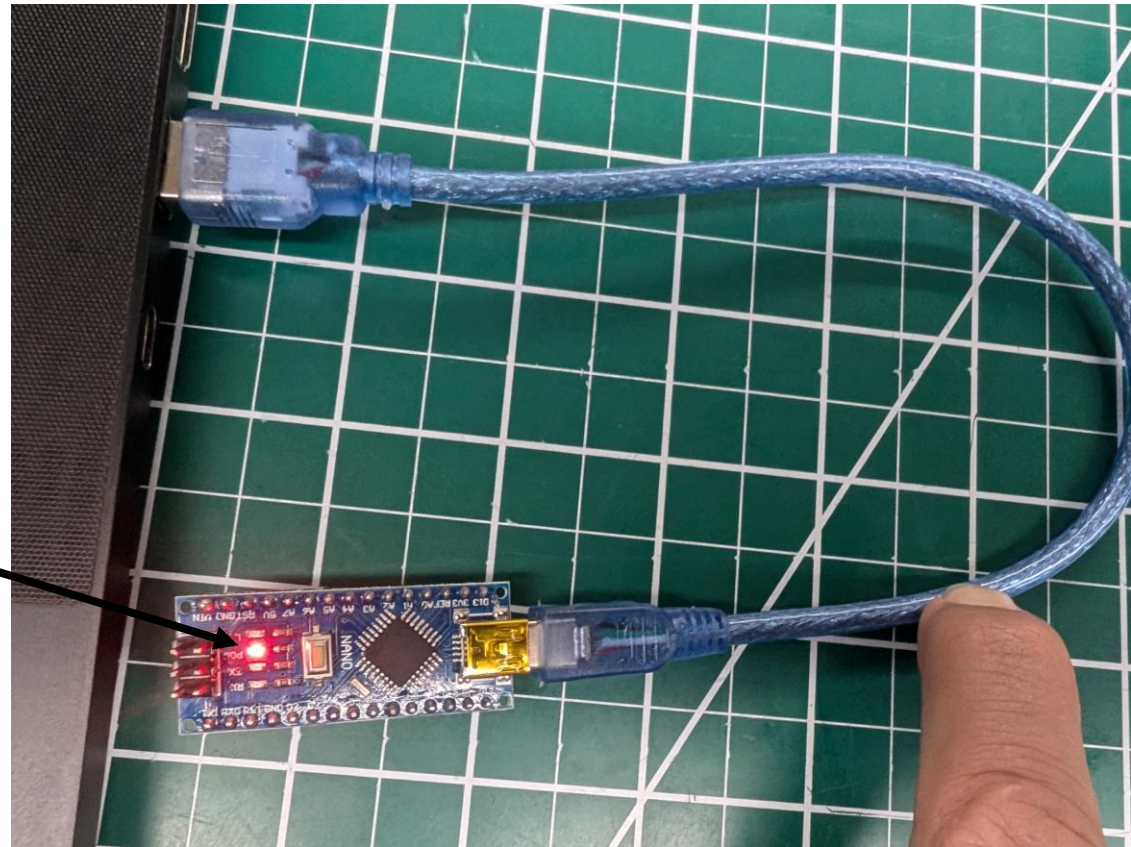
- We are going to program the Arduino Nano (the ATmega328 Microcontroller), to measure temperature and relative humidity using the AHT10 sensor.

Arduino IDE

- Arduino Integrated Development Environment
- Download and install:
 - <https://www.arduino.cc/en/software>
- Use the computer to create a program and upload it into the Arduino microcontroller.
- Once programmed, the Arduino board can work independently (if power is supplied).

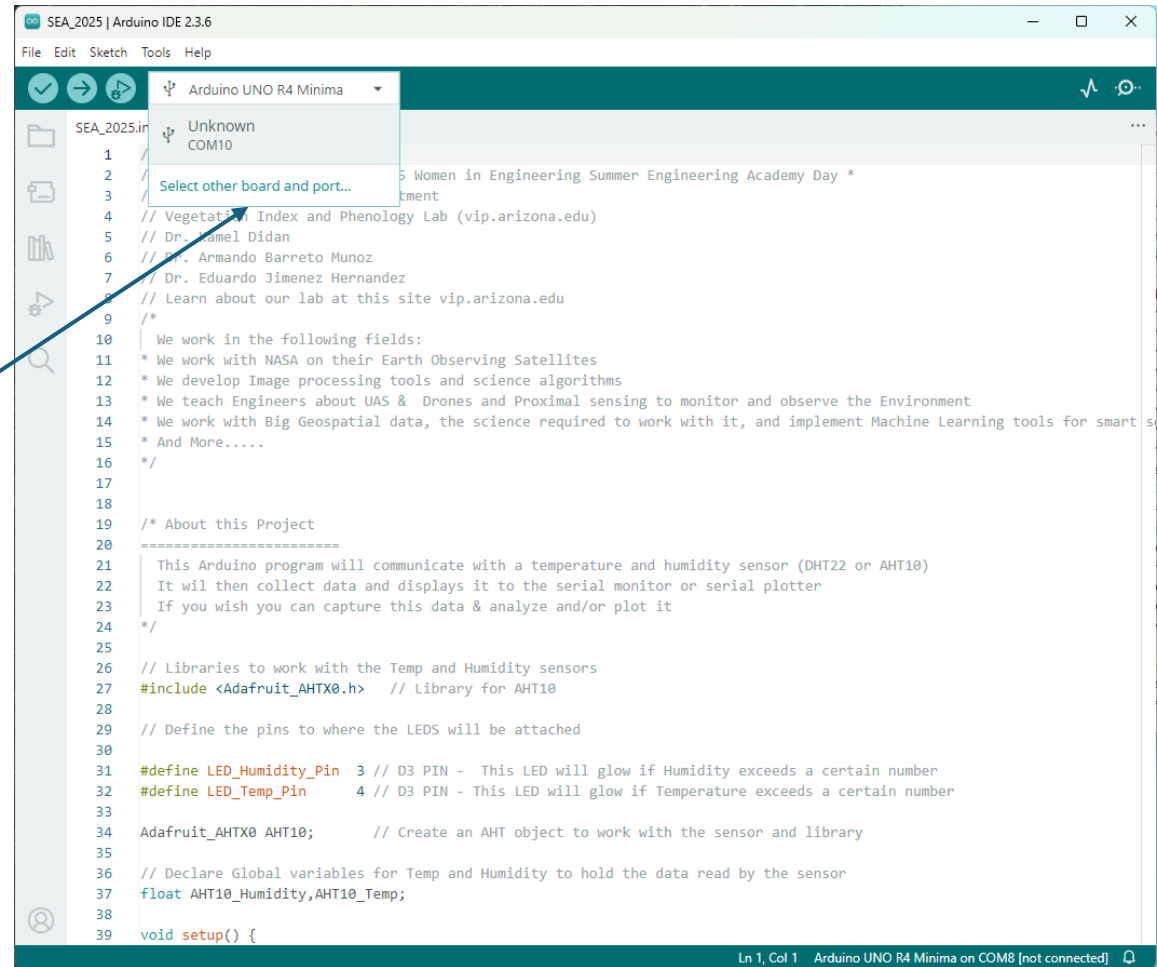
Connect the Arduino to computer

- Connect it via USB cable
- Your Arduino should have the complete circuit
- The POWER LED will turn on



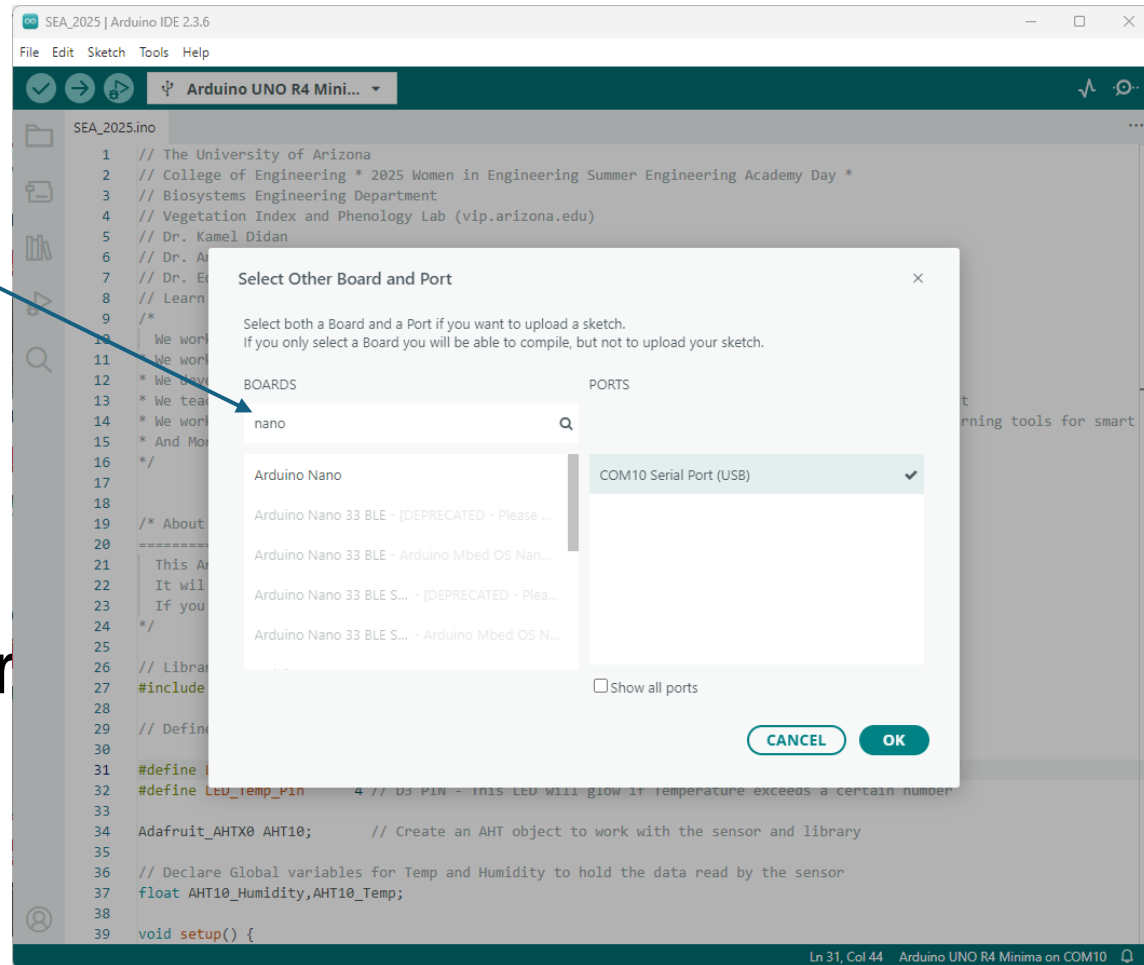
Arduino Nano - Setup

- Make sure you setup your circuit properly
- Click to setup the Arduino board



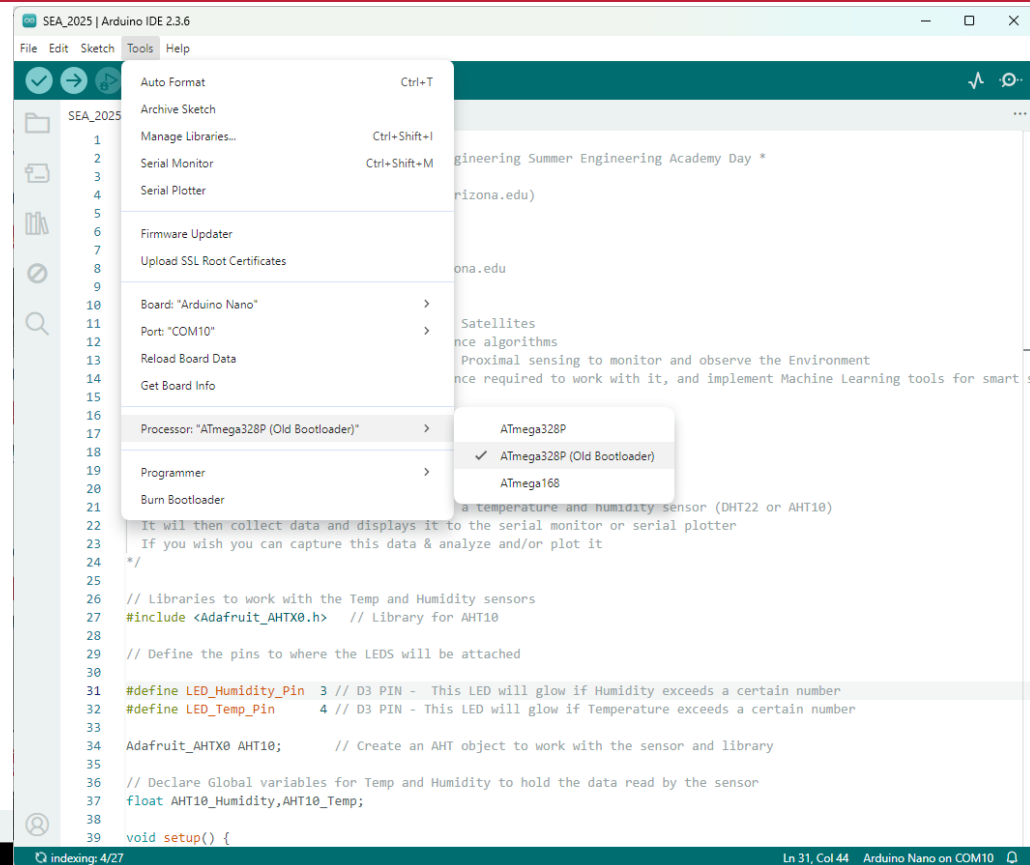
Select the right port & board

- Select/type the Arduino Nano board from the list
- Select the active port, it's called COM# Serial Port



Select ATmega328P Old Bootloader

- From menu:
- Tools -> Processor -> ATmega328P (Old Bootloader)
- If not, you will get errors:



Output

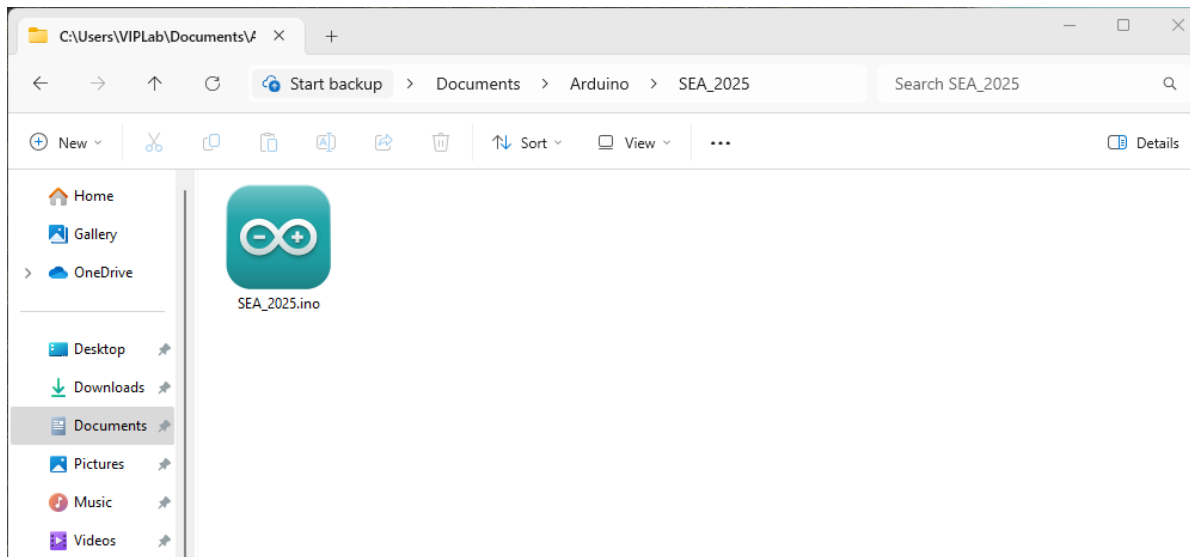
```
avrdude: stk500_recv(): programmer is not responding  
avrdude: stk500_getsync() attempt 5 of 10: not in sync: resp=0x0e  
avrdude: stk500_recv(): programmer is not responding  
avrdude: stk500_getsync() attempt 6 of 10: not in sync: resp=0x0e  
avrdude: stk500_recv(): programmer is not responding  
avrdude: stk500_getsync() attempt 7 of 10: not in sync: resp=0x0e  
avrdude: stk500_recv(): programmer is not responding  
avrdude: stk500_getsync() attempt 8 of 10: not in sync: resp=0x0e  
avrdude: stk500_recv(): programmer is not responding  
avrdude: stk500_getsync() attempt 9 of 10: not in sync: resp=0x0e  
avrdude: stk500_recv(): programmer is not responding  
avrdude: stk500_getsync() attempt 10 of 10: not in sync: resp=0x0e  
Failed uploading: uploading error: exit status 1
```

Upload error. Failed uploading: uploading error: exit status 1

COPY ERROR MESSAGES

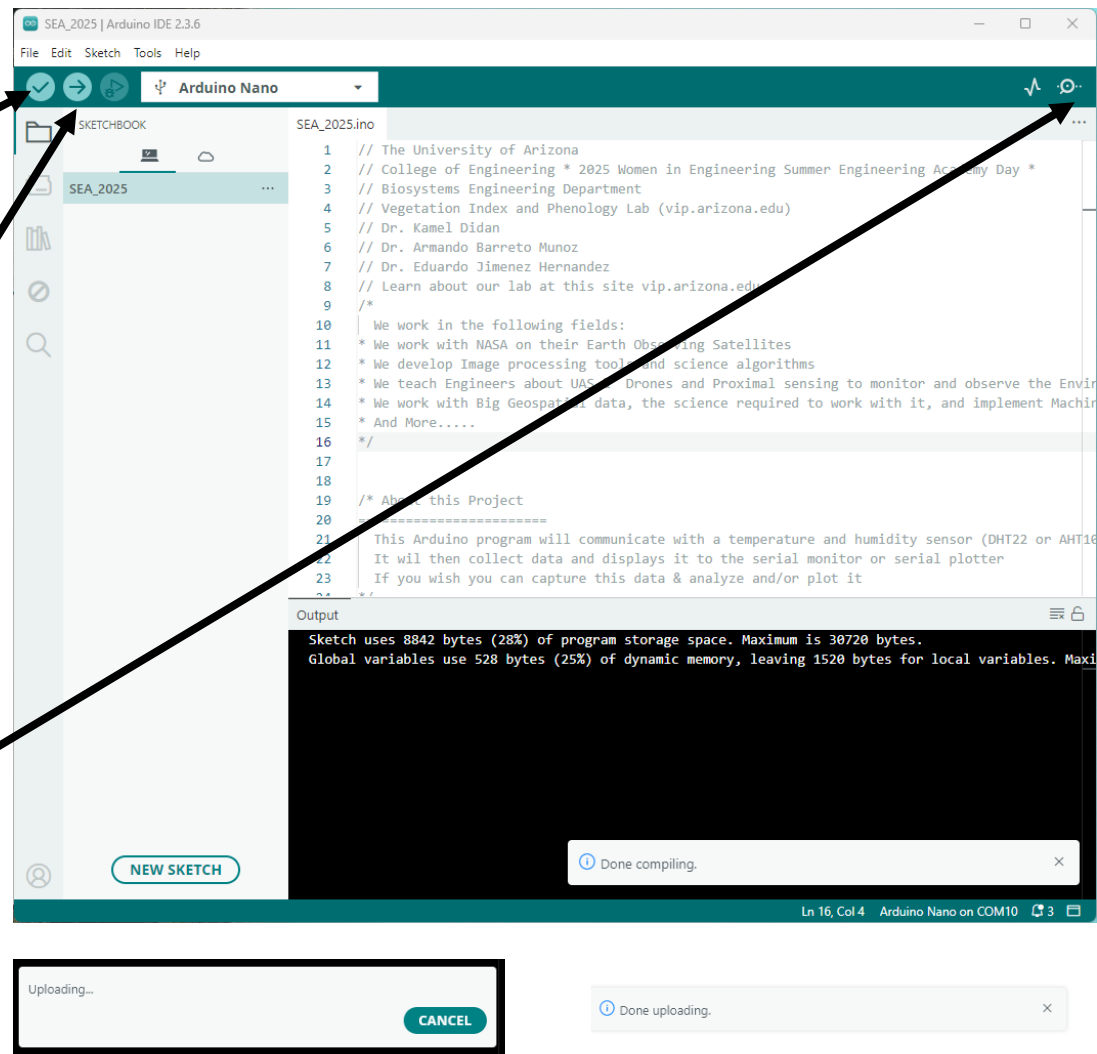
Open this project (SEA_2025)

- You should have this project in the **Documents/Arduino** folder
- If necessary, download the code from:
 - <https://vip.arizona.edu/SEA2025/>
- You will get an **INO** file.
- Click **File > Open** and browse for the file



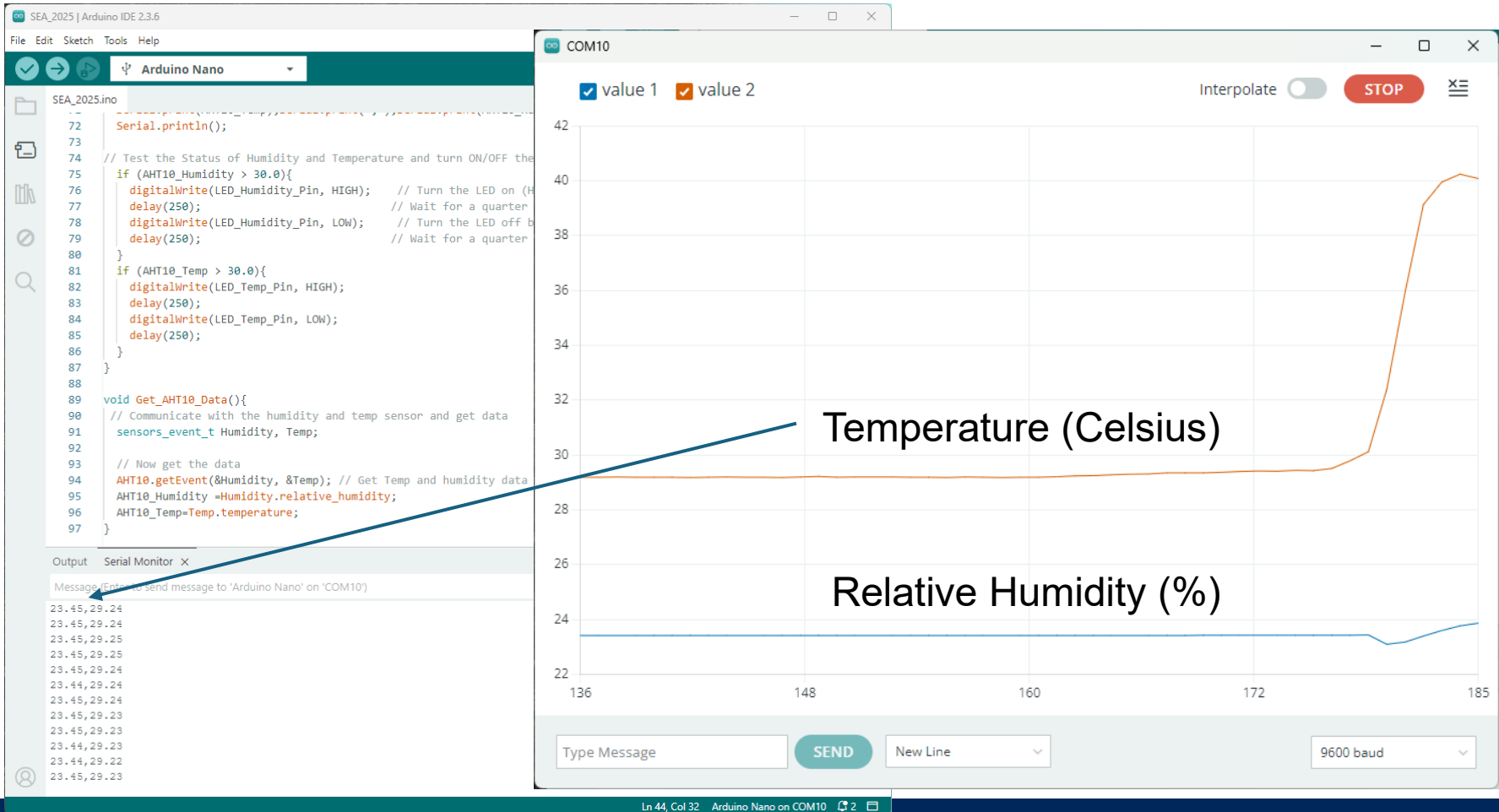
Once your code is ready

- Click **Verify**
- If no errors, then click **Upload**
- Wait for it to finish uploading...
- To see the measurements click on the **Serial Monitor**



Open the Serial plotter

Try blowing at the sensor and see the response!



Sensor response

- Blink the LEDs when reaching a threshold

```
if (AHT10_Humidity > 30.0){  
    digitalWrite(LED_Humidity_Pin, HIGH);    // Turn the LED on (HIGH is the voltage level)  
    delay(250);                               // Wait for a quarter of a second  
    digitalWrite(LED_Humidity_Pin, LOW);     // Turn the LED off by making the voltage LOW  
    delay(250);                               // Wait for a quarter of a second  
}
```

- Try changing these values...

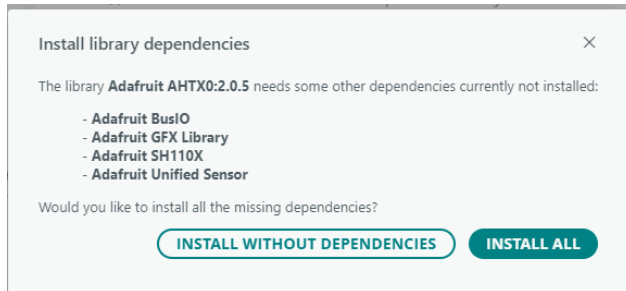
```
if (AHT10_Temp > 30.0){  
    digitalWrite(LED_Temp_Pin, HIGH);  
    delay(250);  
    digitalWrite(LED_Temp_Pin, LOW);  
    delay(250);  
}
```

Now is your turn to
try!

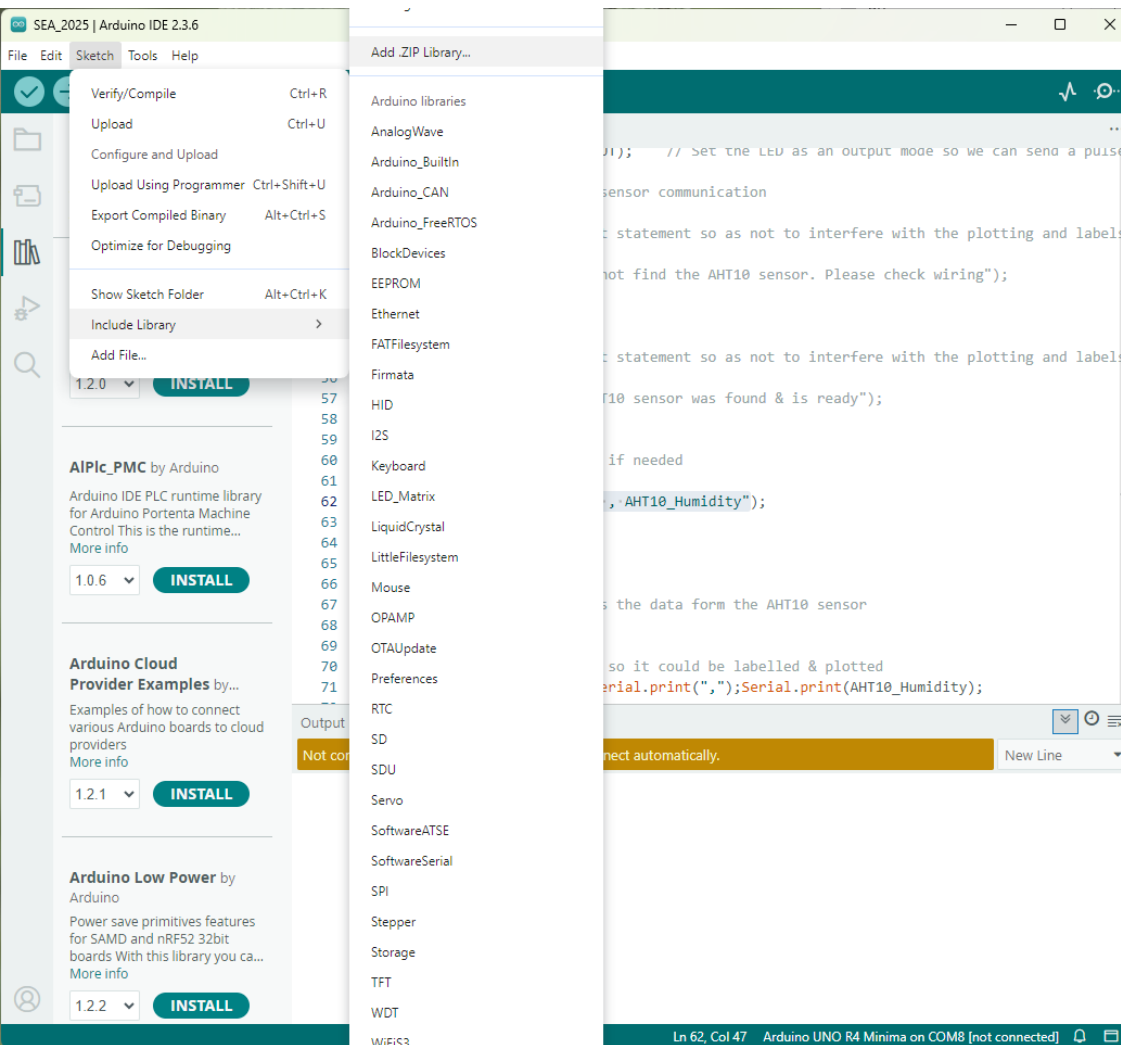
Backup slides

Install libraries (online)

- Click on the Library Manager
- Search for “Adafruit AHTX0”
- Click INSTALL
- When asked, INSTALL ALL dependencies



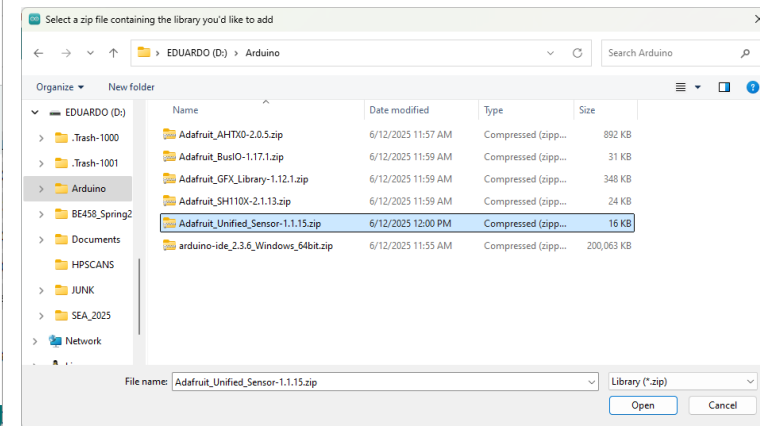
Install libraries (offline)



Follow:

Sketch > Include Library > Add .ZIP library

Select and install libraries one by one



Update the CH340 Driver

- <https://www.catalog.update.microsoft.com/Search.aspx?q=wch.cn>

Microsoft Update Catalog search results for 'wch.cn'. The search returned 54 results. The table below shows the first 15 results.

Title	Products	Classification	Last Updated	Version	Size	Download
wch.cn - Ports - 3.9.2024.9	Windows 11 Client, version 22H2 and later, Servicing Drivers, Windows 11 Client, version 22H2 and later, Upgrade & Servicing Drivers	Drivers (Other Hardware)	9/15/2024	n/a	185 KB	Download
wch.cn - Ports - 3.9.2024.9	Windows 10 and later drivers, Windows Server Drivers, Windows 10 and later upgrade & servicing drivers	Drivers (Other Hardware)	9/15/2024	n/a	185 KB	Download
wch.cn - Ports - 3.9.2024.9	Windows 10 and later drivers, Windows 10 and later upgrade & servicing drivers	Drivers (Other Hardware)	9/15/2024	n/a	185 KB	Download
wch.cn - Ports - 3.9.2024.2	Windows 11 Client, version 22H2 and later, Servicing Drivers, Windows 11 Client, version 22H2 and later, Upgrade & Servicing Drivers	Drivers (Other Hardware)	2/10/2023	n/a	199 KB	Download
wch.cn - Ports - 1.7.2023.2	Windows 11 Client, version 22H2 and later, Servicing Drivers, Windows 11 Client, version 22H2 and later, Upgrade & Servicing Drivers	Drivers (Other Hardware)	2/10/2023	n/a	188 KB	Download
wch.cn - Ports - 1.5.2021.9	Windows 10, version 1803 and later, Servicing Drivers, Windows 10, version 1803 and later, Upgrade & Servicing Drivers	Drivers (Other Hardware)	8/7/2021	n/a	129 KB	Download
wch.cn - Ports - 1.5.2021.8	Windows - Client, version 21H2 and later, Servicing Drivers, Windows - Client, version 21H2 and later, Upgrade & Servicing Drivers	Drivers (Other Hardware)	8/7/2021	n/a	129 KB	Download
wch.cn - Ports - 1.5.2021.8	Windows 10 Creators Update and Later Servicing Drivers, Windows 10 Creators Update and Later Upgrade & Servicing Drivers	Drivers (Other Hardware)	8/7/2021	n/a	129 KB	Download
wch.cn - Ports - 1.5.2021.8	Windows 10 version 1803 and Later Servicing Drivers, Windows 10 Version 1803 and Later Upgrade & Servicing Drivers	Drivers (Other Hardware)	8/7/2021	n/a	129 KB	Download
wch.cn - Ports - 1.5.2021.8	Windows 10 and later drivers, Windows 10 and later upgrade & servicing drivers	Drivers (Other Hardware)	8/7/2021	n/a	129 KB	Download
wch.cn - Ports - 1.5.2021.8	Windows 10, version 1809 and later, Servicing Drivers, Windows 10, version 1809 and later, Upgrade & Servicing Drivers	Drivers (Other Hardware)	8/7/2021	n/a	129 KB	Download
wch.cn - Ports - 1.5.2021.8	Windows 10 Anniversary Update and Later Servicing Drivers, Windows 10 Anniversary Update and Later Upgrade & Servicing Drivers	Drivers (Other Hardware)	8/7/2021	n/a	129 KB	Download
wch.cn - Ports - 1.5.2021.8	Windows 10, Vibraetium and later, Servicing Drivers, Windows 10, Vibraetium and later, Upgrade & Servicing Drivers	Drivers (Other Hardware)	8/7/2021	n/a	129 KB	Download
wch.cn - Ports - 1.5.2021.8	Windows 10 Fall Creators Update and Later Servicing Drivers, Windows 10 Fall Creators Update and Later Upgrade & Servicing Drivers	Drivers (Other Hardware)	8/7/2021	n/a	129 KB	Download

Microsoft Update Catalog - Download Dialog for 'wch.cn - Ports - 3.9.2024.9'. The dialog shows the update ID and download URL.

UpdateID: dbfa2e87-c6a7-433b-9882-1b61b780c866

Download URL: https://www.catalog.update.microsoft.com/DownloadDialog.aspx?d148221c-a049-4521-adab-75f6eeaa9f_a85e9d32bc06688d2addaacef1

SHA1: qf750jaZq5rdqshpQFG0gyVx) (SHA256: 4K1dH7yJpCp6a++sq9xyOMaavtpTabJGFPh5Sx=)

Windows File Explorer window showing the downloaded driver files. The files are located in the 'Downloads' folder.

- CH340M64.sys (System file, 23.9 KB)
- CH340PT.DLL (System file, 62.8 KB)
- CH340PORTS.DLL (System file, 62.8 KB)
- CH341SER.CAT (Security Catalog, 14.1 KB)
- CH341SER.DLL (System file, 62.8 KB)
- CH341SER.INF (Setup Information, 8.11 KB)
- CH341SER.sys (System file, 62.8 KB)

Update the CH340 Driver

