

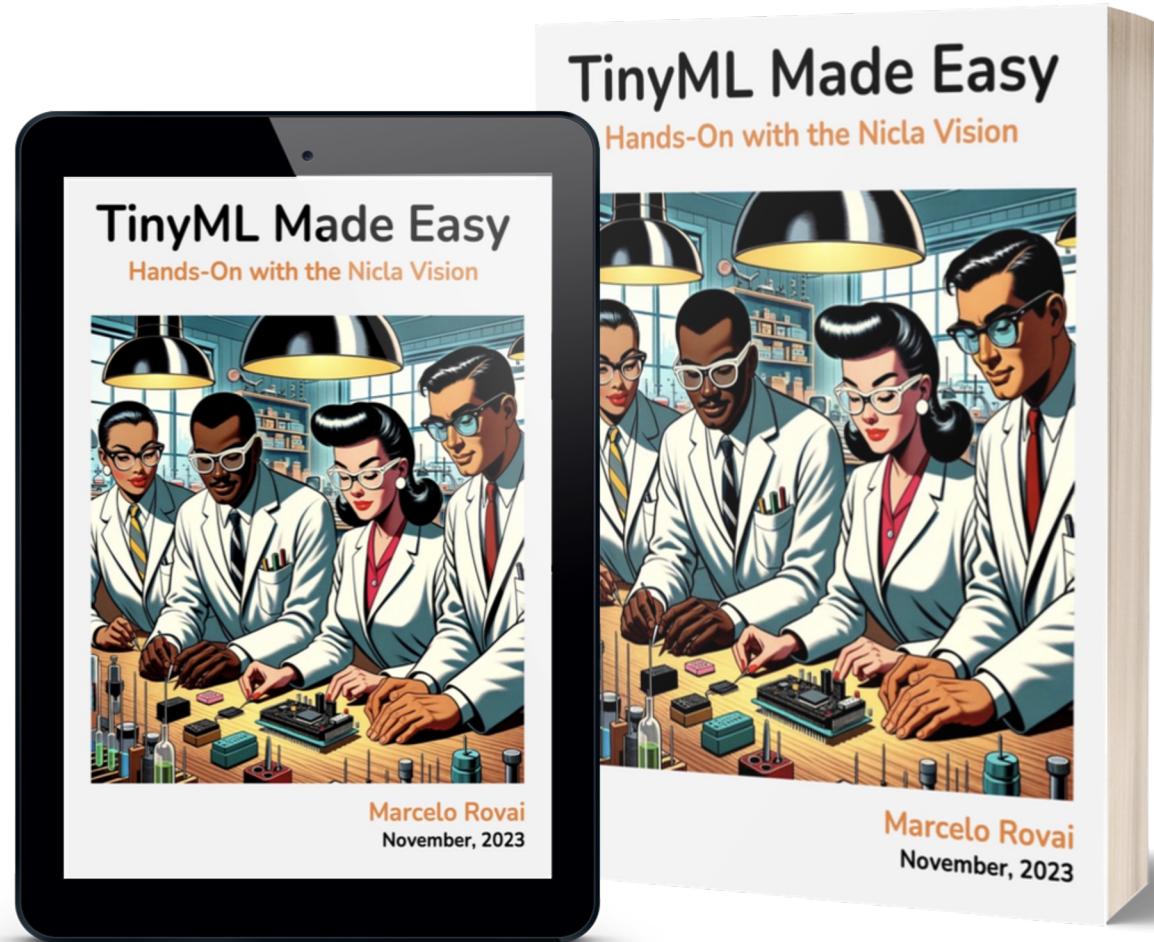
Lab1: getting to know the Nicla Vision



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TinyML4D Academic Network Co-Chair





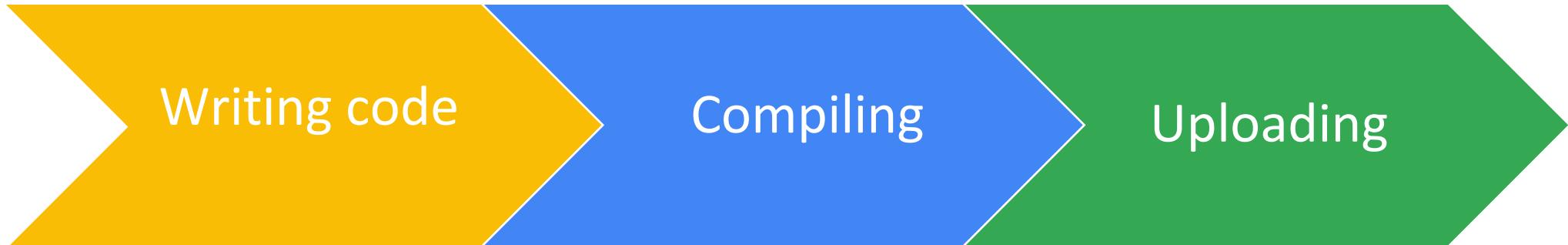
https://mjrovai.github.io/TinyML_Made_Easy_NiclaV_eBook/



What will we learn?

What will we learn?

The workflow of writing and executing code on the Nicla Vision



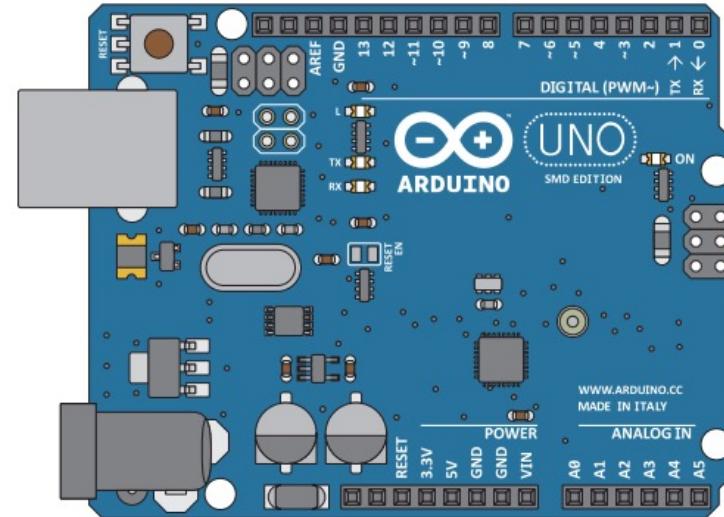
Arduino Microcontroller

A computer for the physical world.

Able to read INPUTS – light on a sensor, a finger on a button, or a Twitter message.

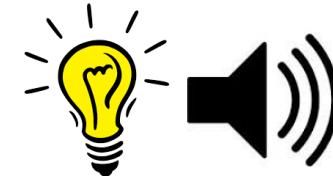
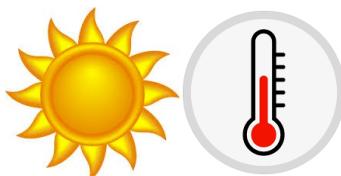
Turn it into OUTPUTS – activating a motor, turning on an LED, publishing something online.

Tell your Arduino what to do using the Arduino programming language.



wwwarduino.cc

Uses information from INPUTS to control various OUTPUTS.

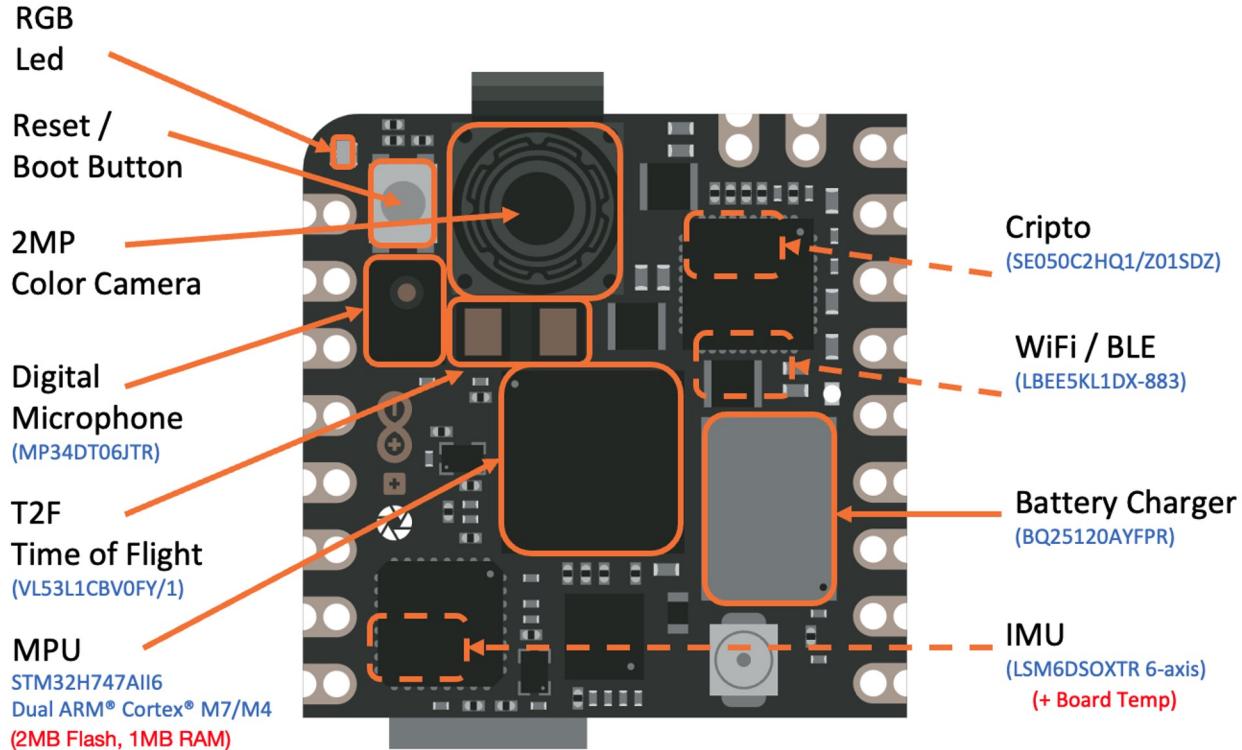


Arduino PRO Nicla Family

Board	Nicla Vision		Nicla ME	Nicla Voice
				
	(Top View)	(Bottom View)	(Top View)	(Bottom View)
MPU	None	None	None	NDP-120
MCU	ST STM32H747AI6	Nordic nRF52832	Nordic nRF52832	
Core1	Arm Cortex-M7 @480MHz	Arm Cortex-M4 @64MHz	Arm Cortex-M4 @ 64MHz	
Core2	Arm Cortex-M4 @240MHz	None	None	
Flash	2MB + QSPI 16MB	512KB + QSPI 2MB	512KB + QSPI 16MB	
SRAM	1MB	64KB	64KB	
PDM	MP34DT05	None	IM69D130	
IMU	LSM6DSOX	BHI260AP	BMI270	
Mag.	None	BMM150	BMM150	
Pressure	None	BMP390	None	
T & H	None	BME688	None	
ToF	VL53L1CBV0FY/1	None	None	
Camera	GC2145 (2MP)	None	None	
Security	NXP SE050C2	None	None	
BLE	BLE 4.2 (1DX-LBEE5KL1DX-883)	BLE 4.2	BLE 5.0 (ANNA-B1112)	
Connect	WiFi / USB	WiFi / USB	USB	
Charger	MAX1726REW	BQ25120AYFPR	BQ25120AYFPR	
Size	22.86 mm x 22.86 mm	22.86 mm x 22.86 mm	22.86 mm x 22.86 mm	

MPU	Syntiant® NDP120 Neural Decision Processor™ (NDP): 1x Syntiant Core 2™ ultra-low-power deep neural network inference engine; 1x HiFi 3 Audio DSP; 1x Arm® Cortex® M0 core up to 48 MHz, 48K SRAM.
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Arduino Nicla Vision

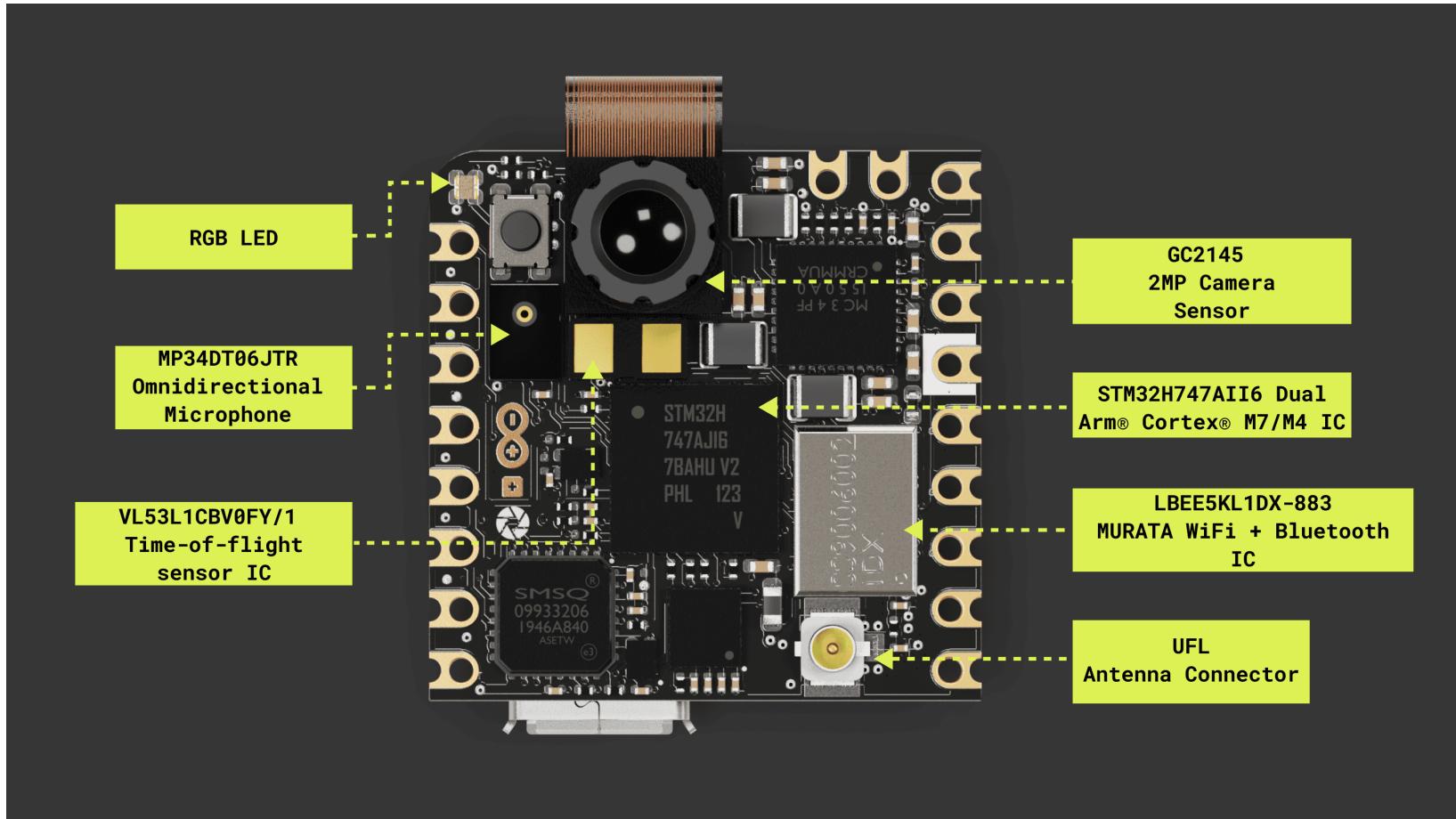


Arduino Nicla Vision

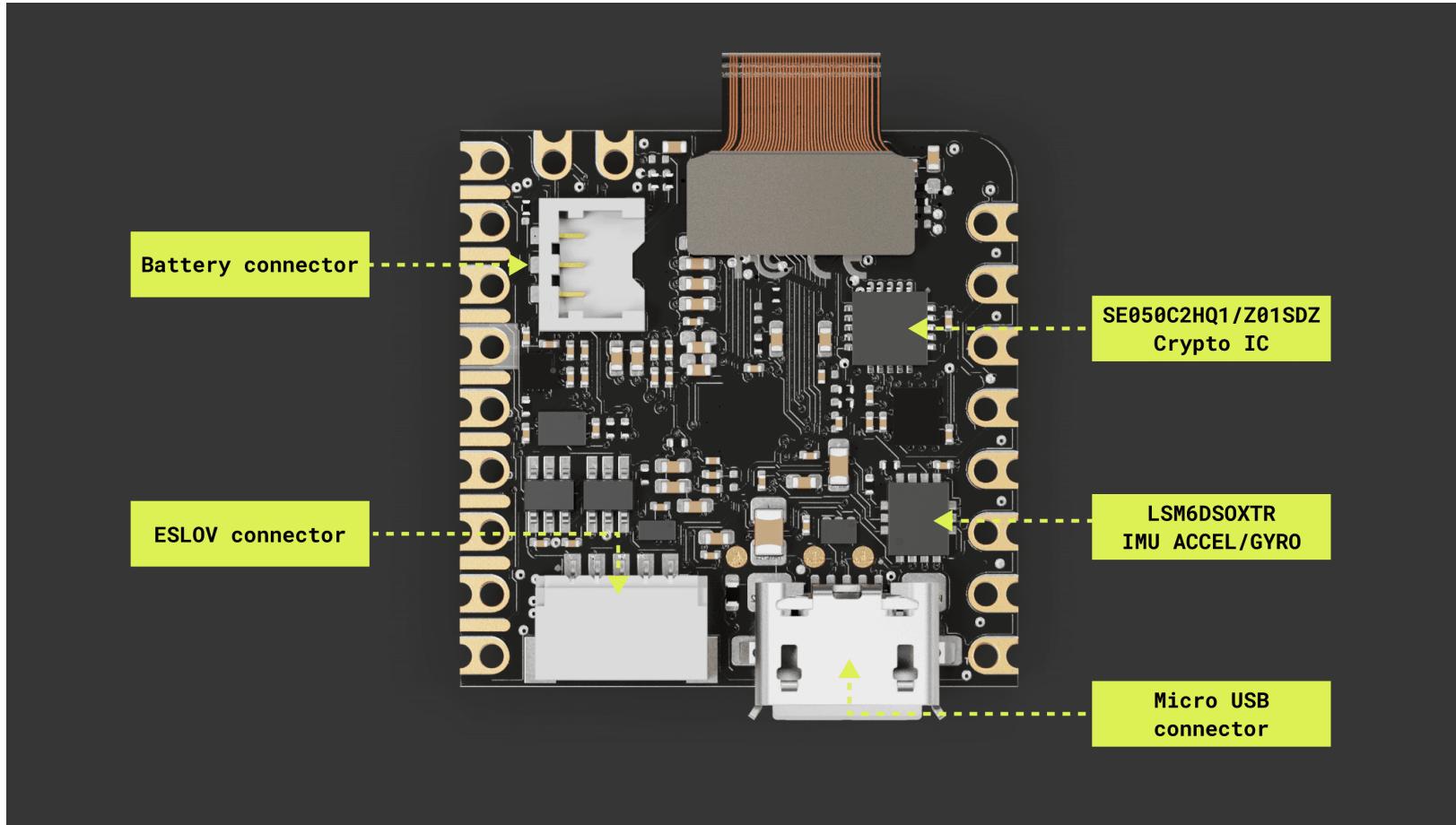
The central processor is the dual-core STM32H747, including a Cortex® M7 at 480 MHz and a Cortex® M4 at 240 MHz.

The STM32H747 is only 1MB, shared by both processors. This MCU also has incorporated 2MB of FLASH, mainly for code storage.

Arduino Nicla Vision



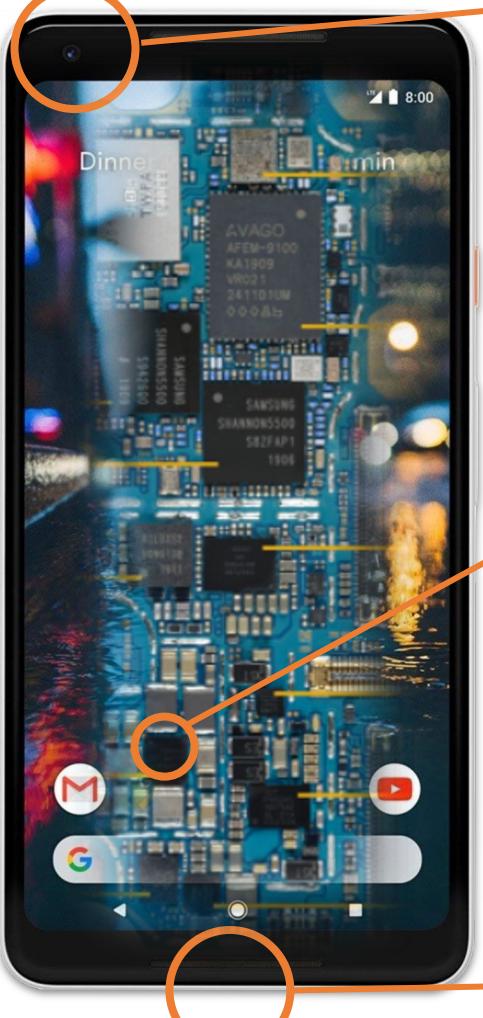
Arduino Nicla Vision



Edge Device



& Sensors



Camera



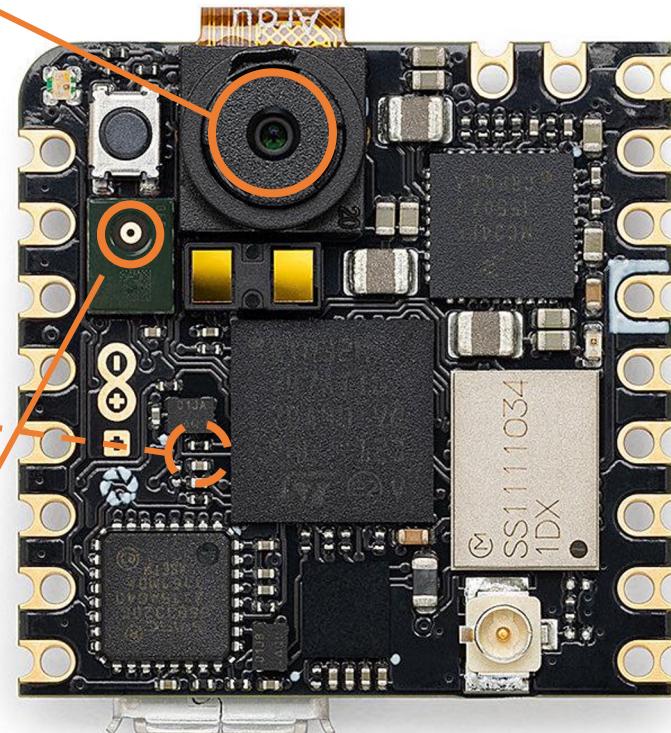
Accelerometer



Gyroscope



Microphone



Arduino programming

The programming language is based on Wiring and in terms of syntax (almost) identical to C++.

This is the template of a basic Arduino program:

```
void setup()
{
    Initialize variables, open USB, open WiFi, etc
}
```

**SETUP
(once)**

```
void loop()
{
    Perform some action

    Wait for a certain number of msecs or wait for an alarm
}
```

**LOOP
(forever)**

Arduino IDE

IDE= Integrated development environment

Arduino IDE is Open Source

Go to: <https://www.arduino.cc/en/software>

Downloads



Arduino IDE 2.1.1

The new major release of the Arduino IDE is faster and even more powerful! In addition to a more modern editor and a more responsive interface it features autocompletion, code navigation, and even a live debugger.

For more details, please refer to the [Arduino IDE 2.0 documentation](#).

Nightly builds with the latest bugfixes are available through the section below.

DOWNLOAD OPTIONS

Windows Win 10 and newer, 64 bits
Windows MSI installer
Windows ZIP file

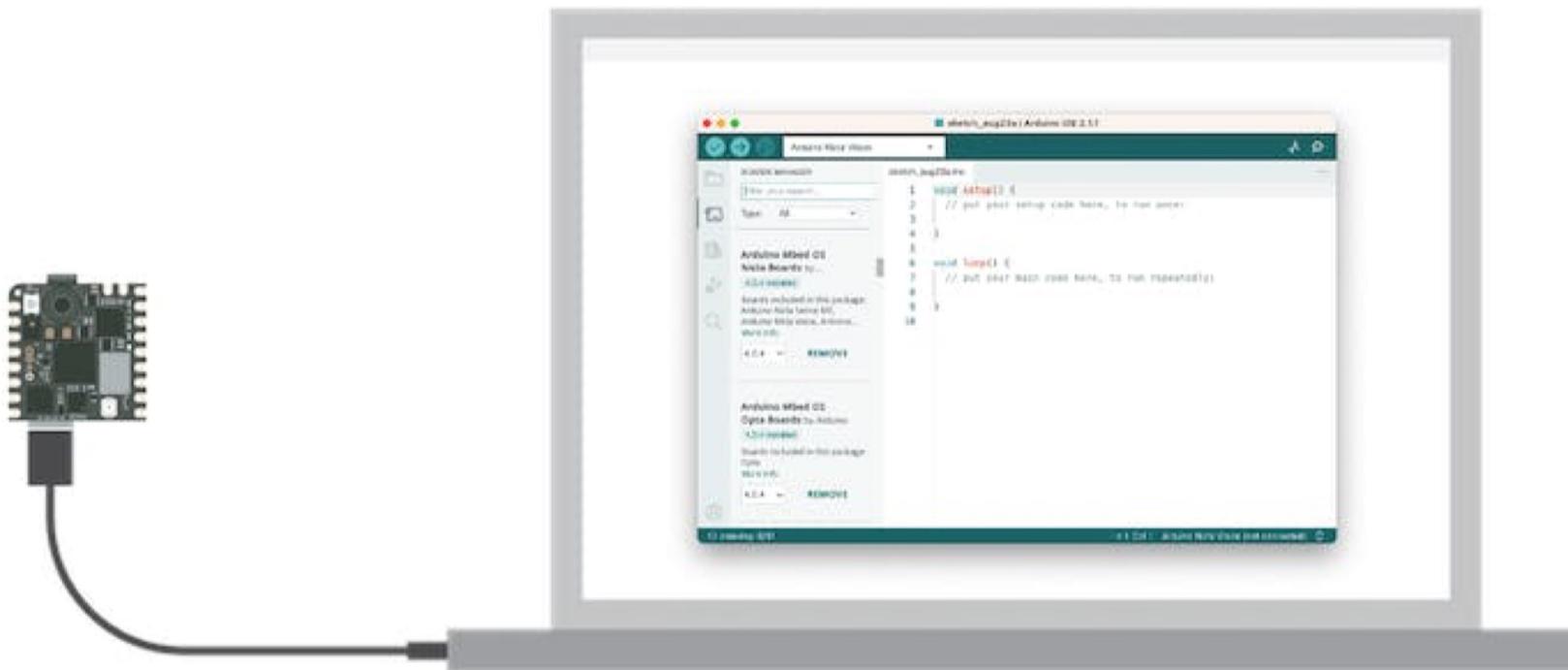
Linux AppImage 64 bits (X86-64)
Linux ZIP file 64 bits (X86-64)

macOS Intel, 10.14: "Mojave" or newer, 64 bits
macOS Apple Silicon, 11: "Big Sur" or newer, 64 bits

[Release Notes](#)

Arduino IDE

Start connecting the board (*microUSB*) to your computer:



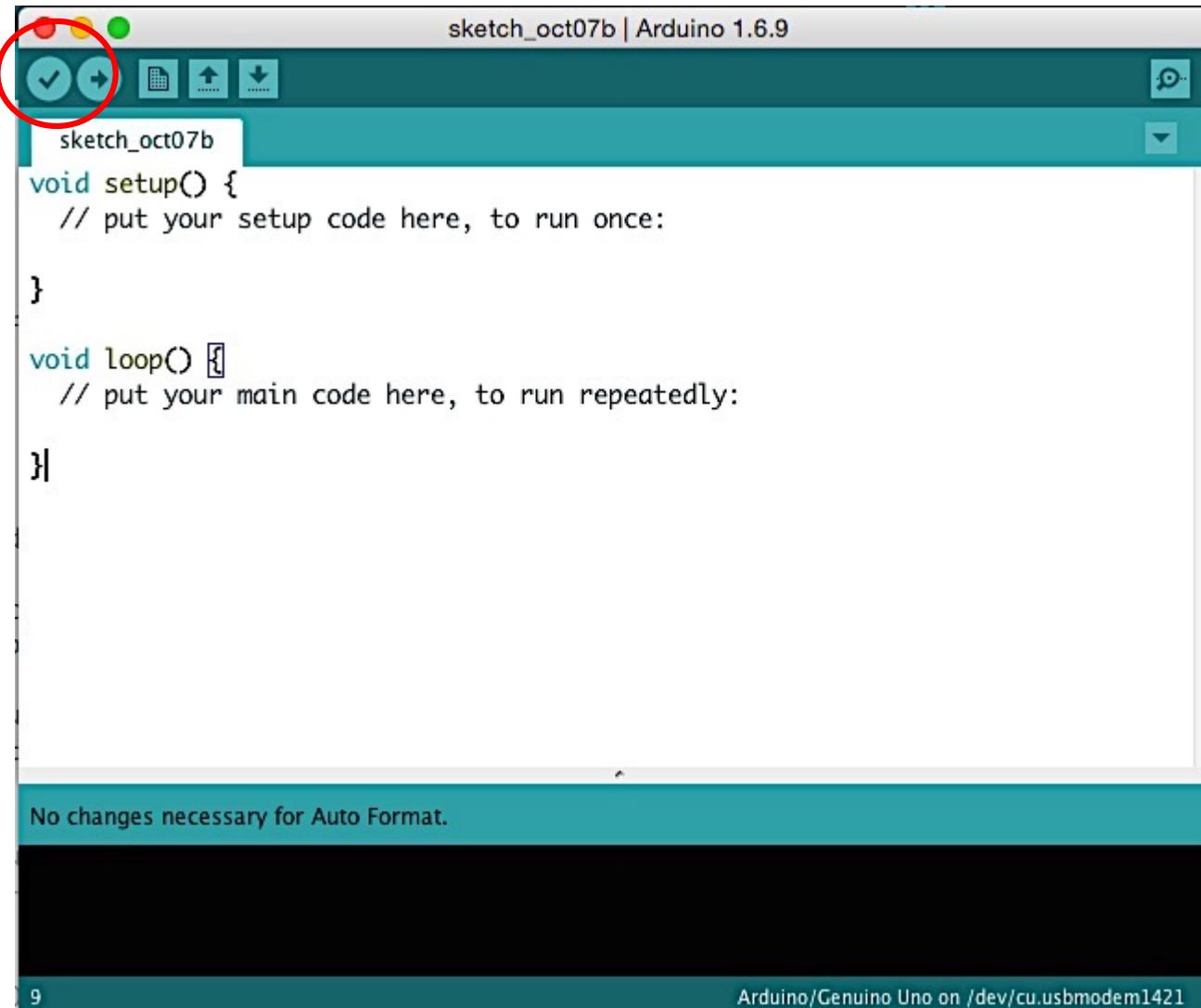
Installing Arduino libraries

Install the Mbed OS core for Nicla boards in the Arduino IDE. Having the IDE open, navigate to Tools > Board > Board Manager, look for Arduino Nicla Vision on the search window, and install the board.

Next, go to Tools > Board > Arduino Mbed OS Nicla Boards and select Arduino Nicla Vision. Having your board connected to the USB, you should see the Nicla on Port and select it.

KNOW the Arduino GUI

Verify:
Compiles and
approves your
code. Will catch
errors in syntax.



The screenshot shows the Arduino IDE interface. The title bar reads "sketch_oct07b | Arduino 1.6.9". Below the title bar is a toolbar with several icons, including a red circle highlighting the first icon which is a checkmark inside a circle. The main area displays the following code:

```
sketch_oct07b
void setup() {
  // put your setup code here, to run once:
}

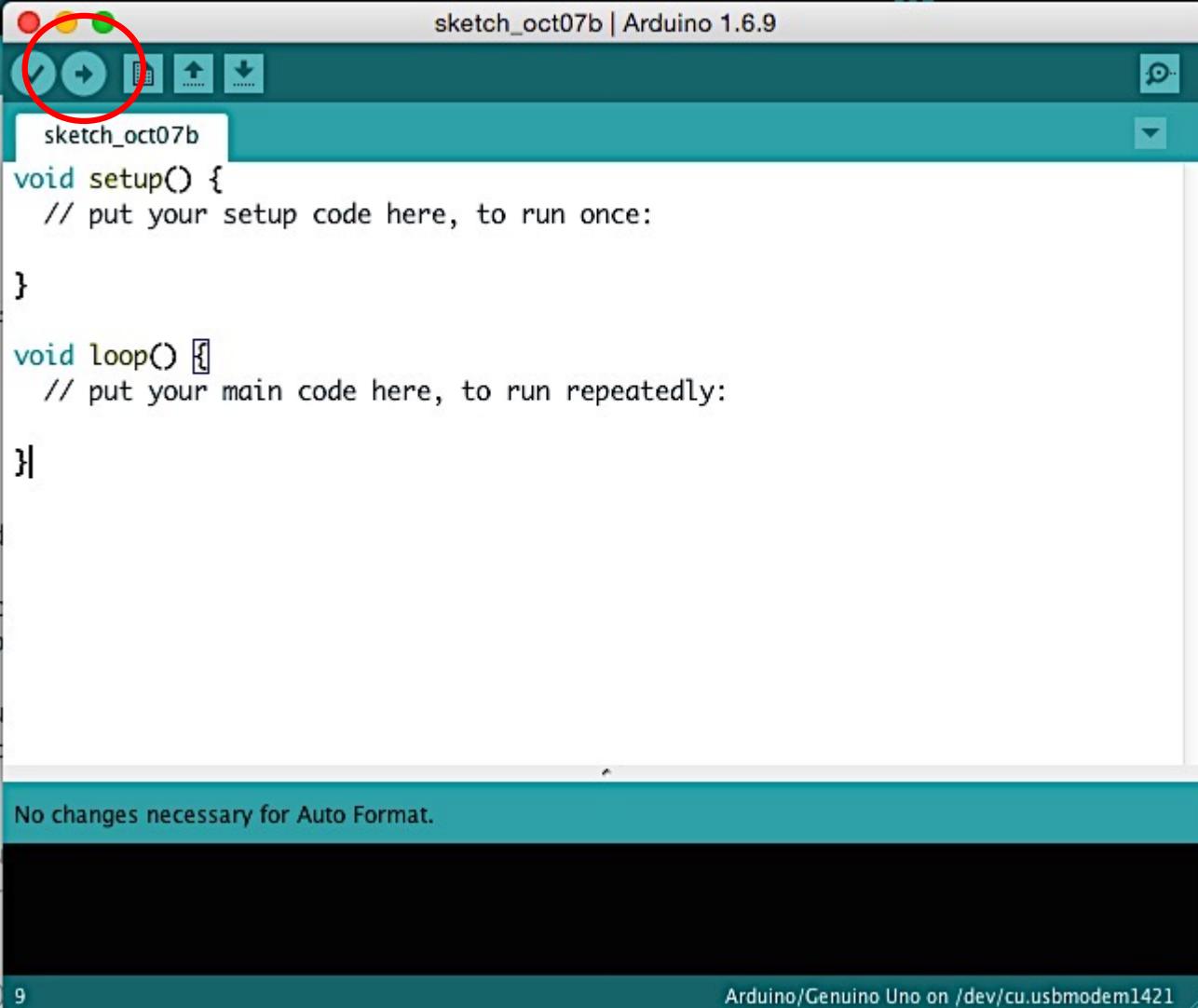
void loop() {
  // put your main code here, to run repeatedly:
}
```

At the bottom of the code editor, a status bar says "No changes necessary for Auto Format." In the bottom right corner, it shows "Arduino/Genuino Uno on /dev/cu.usbmodem1421".

KNOW the Arduino GUI

Upload:

Sends your code to the Arduino Board. When you click it, you should see lights on your board blink rapidly.



The screenshot shows the Arduino IDE interface. The title bar reads "sketch_oct07b | Arduino 1.6.9". Below the title bar is a toolbar with several icons, one of which is highlighted with a red circle. The main area displays the following code:

```
sketch_oct07b
void setup() {
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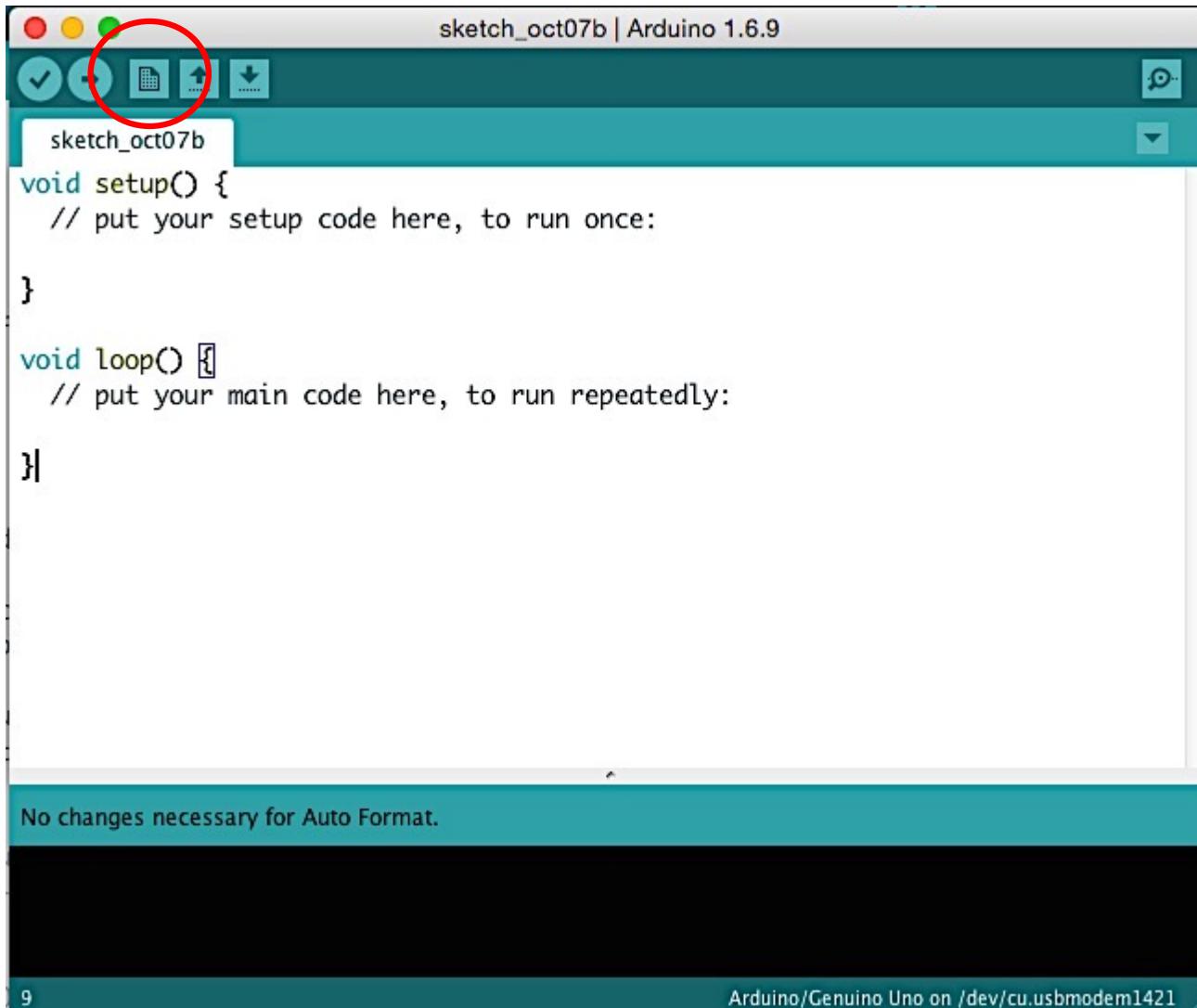
void loop() {
  // put your main code here, to run repeatedly:
}
```

At the bottom of the code editor, a status bar says "No changes necessary for Auto Format." In the bottom right corner, there is a message: "Arduino/Genuino Uno on /dev/cu.usbmodem1421".

KNOW the Arduino GUI

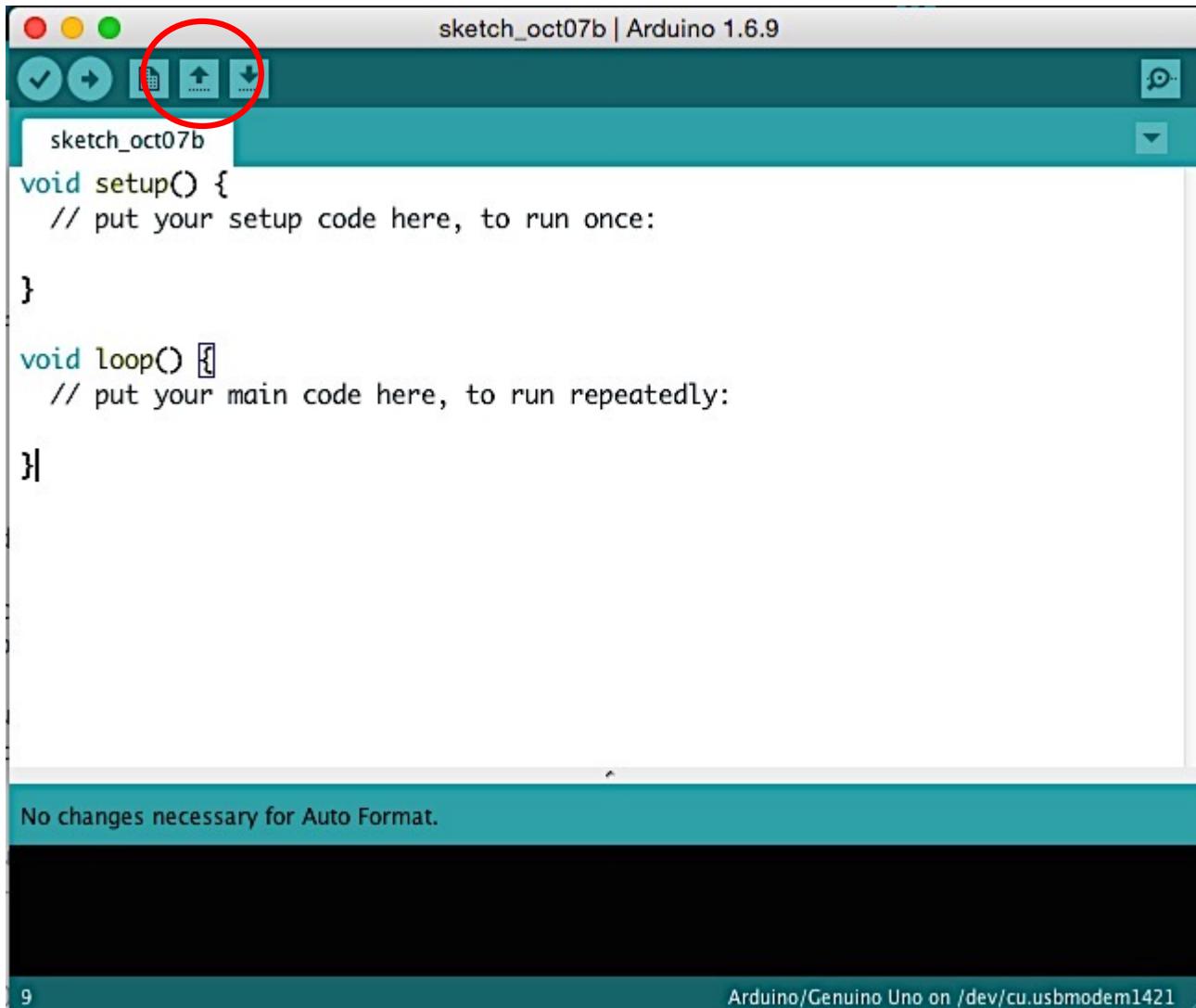
New:

Opens up a new
code window tab.



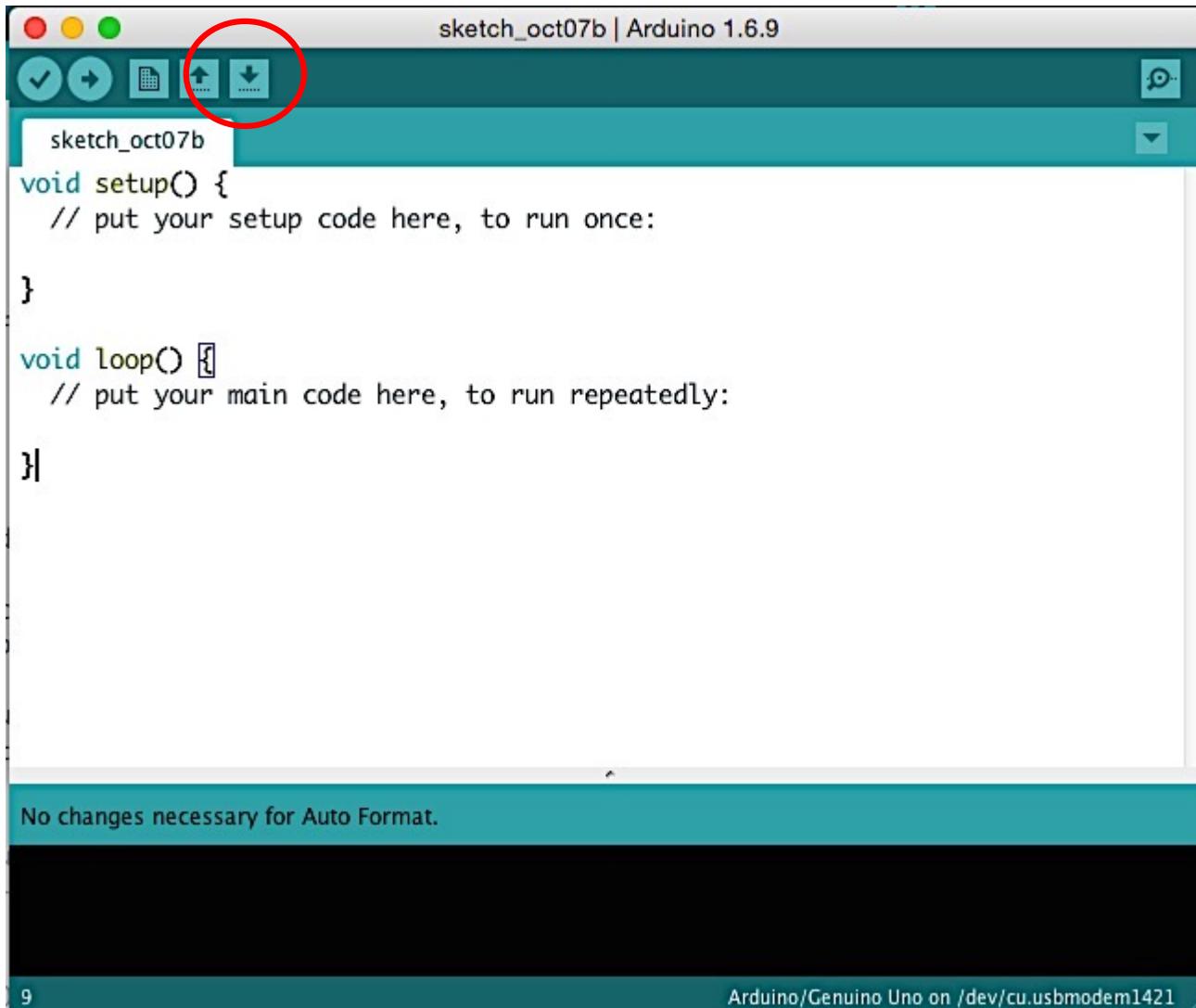
KNOW the Arduino GUI

Open:
Opens an existing sketch, which is where you write your code.



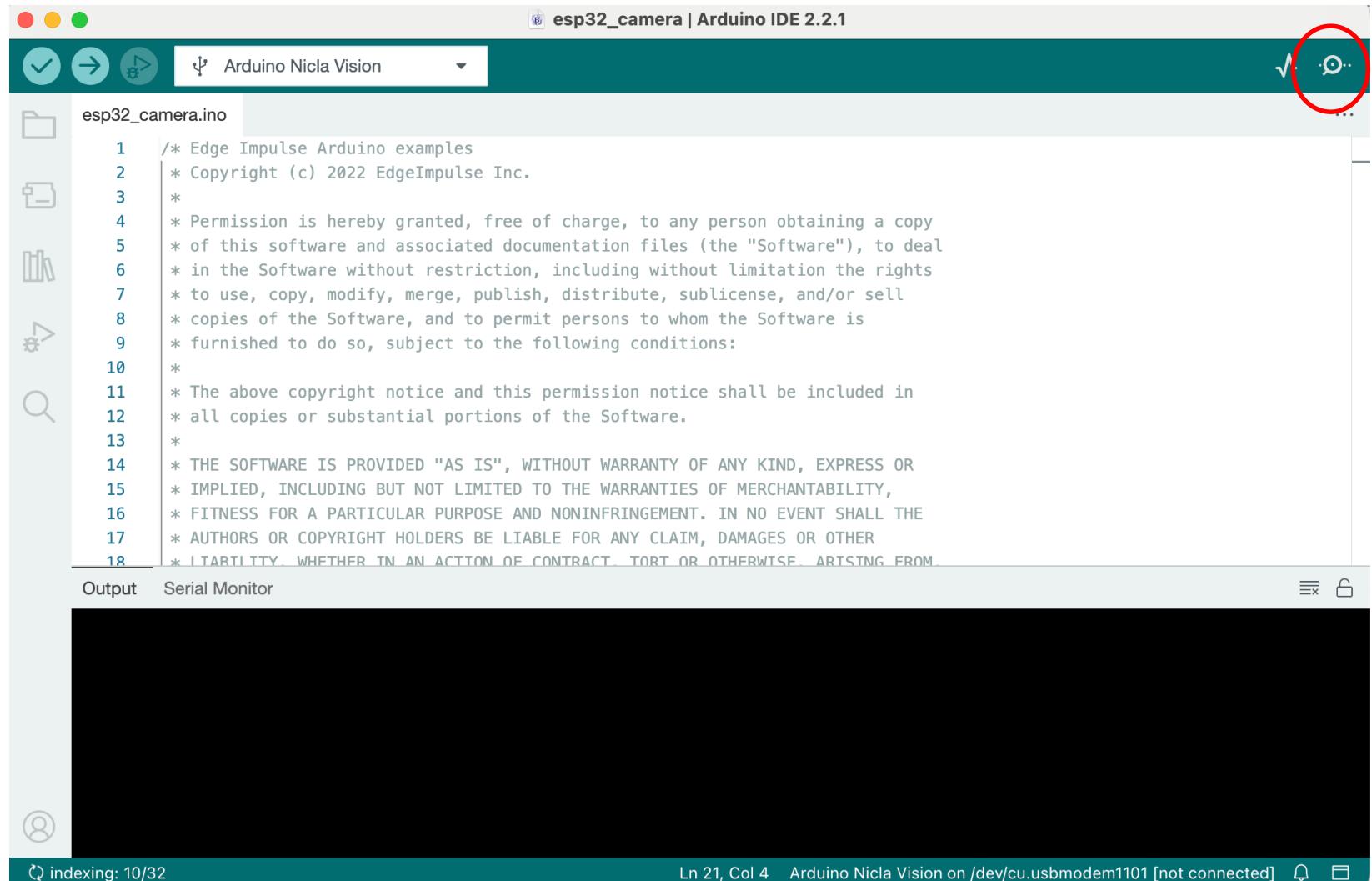
KNOW the Arduino GUI

Save:
Saves the currently open sketch.



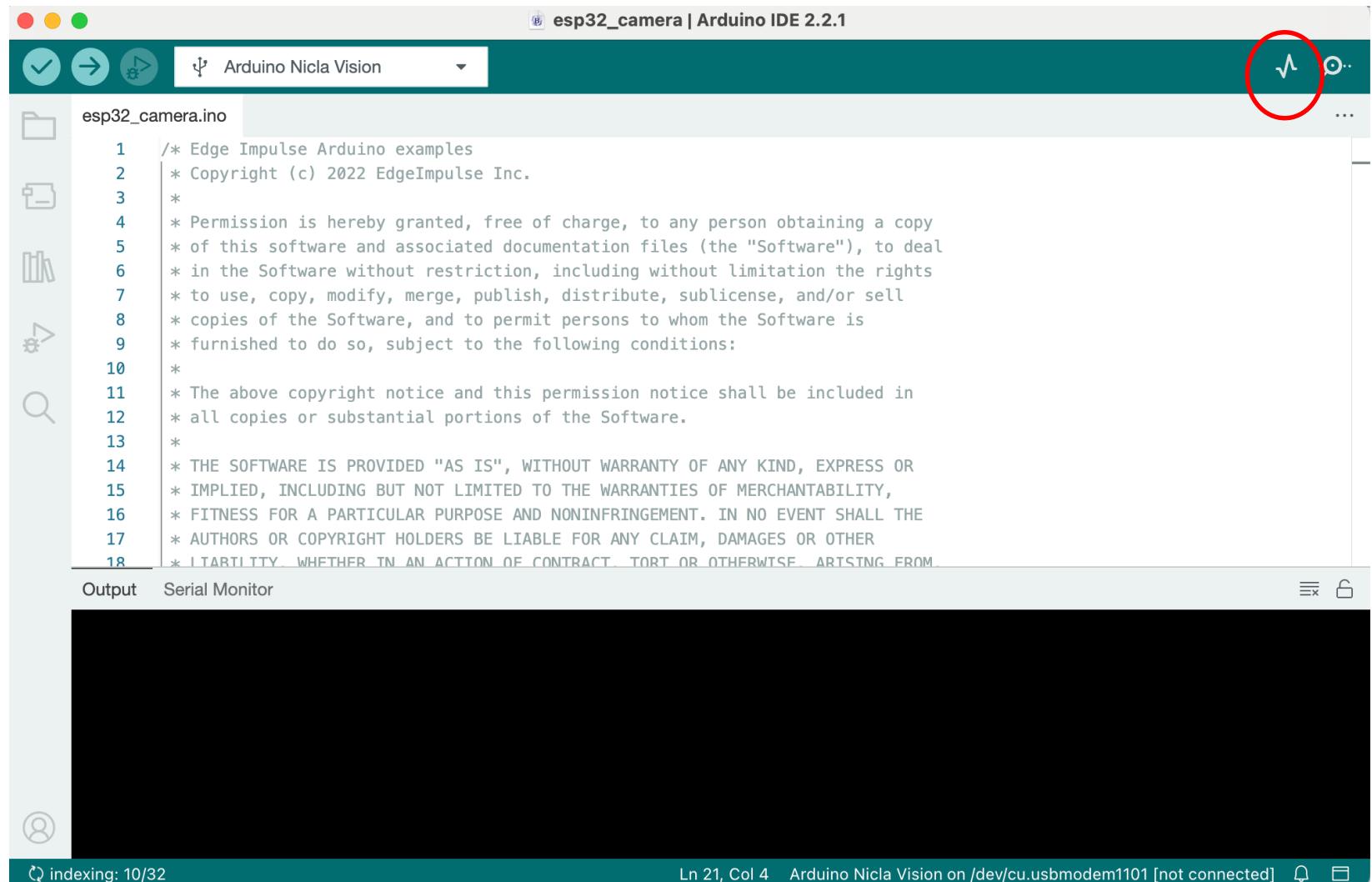
KNOW the Arduino GUI

Serial Monitor:
Opens a window that displays any serial info the Arduino Board is transmitting.
Very useful for debugging.



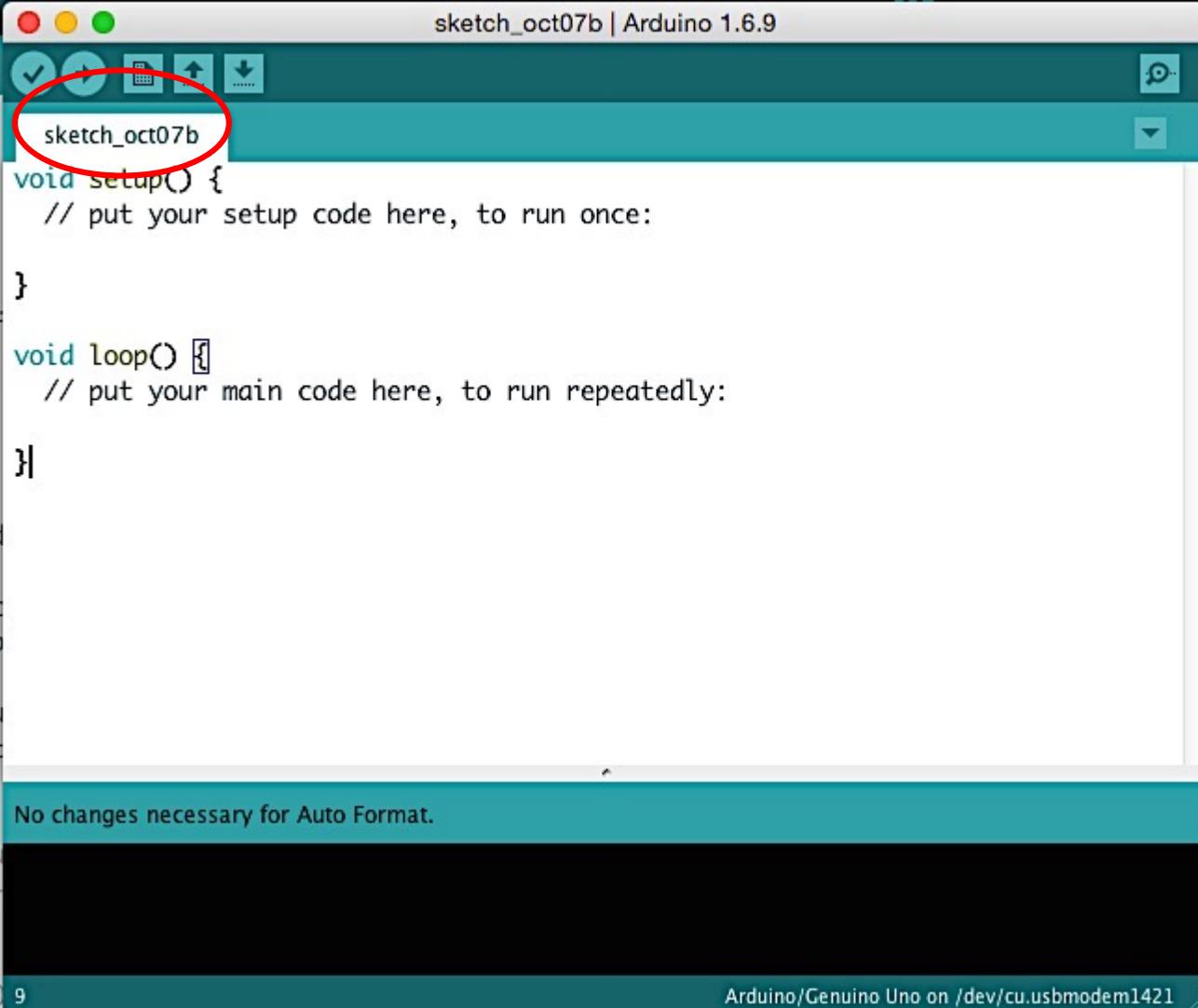
KNOW the Arduino GUI

Serial Plotter: Opens a window that displays in graphical form any serial info the Arduino Board is transmitting



KNOW the Arduino GUI

Sketch Name:
Name of the sketch you are currently working on.



The screenshot shows the Arduino IDE interface. The title bar reads "sketch_oct07b | Arduino 1.6.9". Below the title bar is a toolbar with various icons. A red circle highlights the first icon in the toolbar, which is a small sketchbook-like icon. The main area contains the following code:

```
sketch_oct07b
void setup() {
  // put your setup code here, to run once:
}

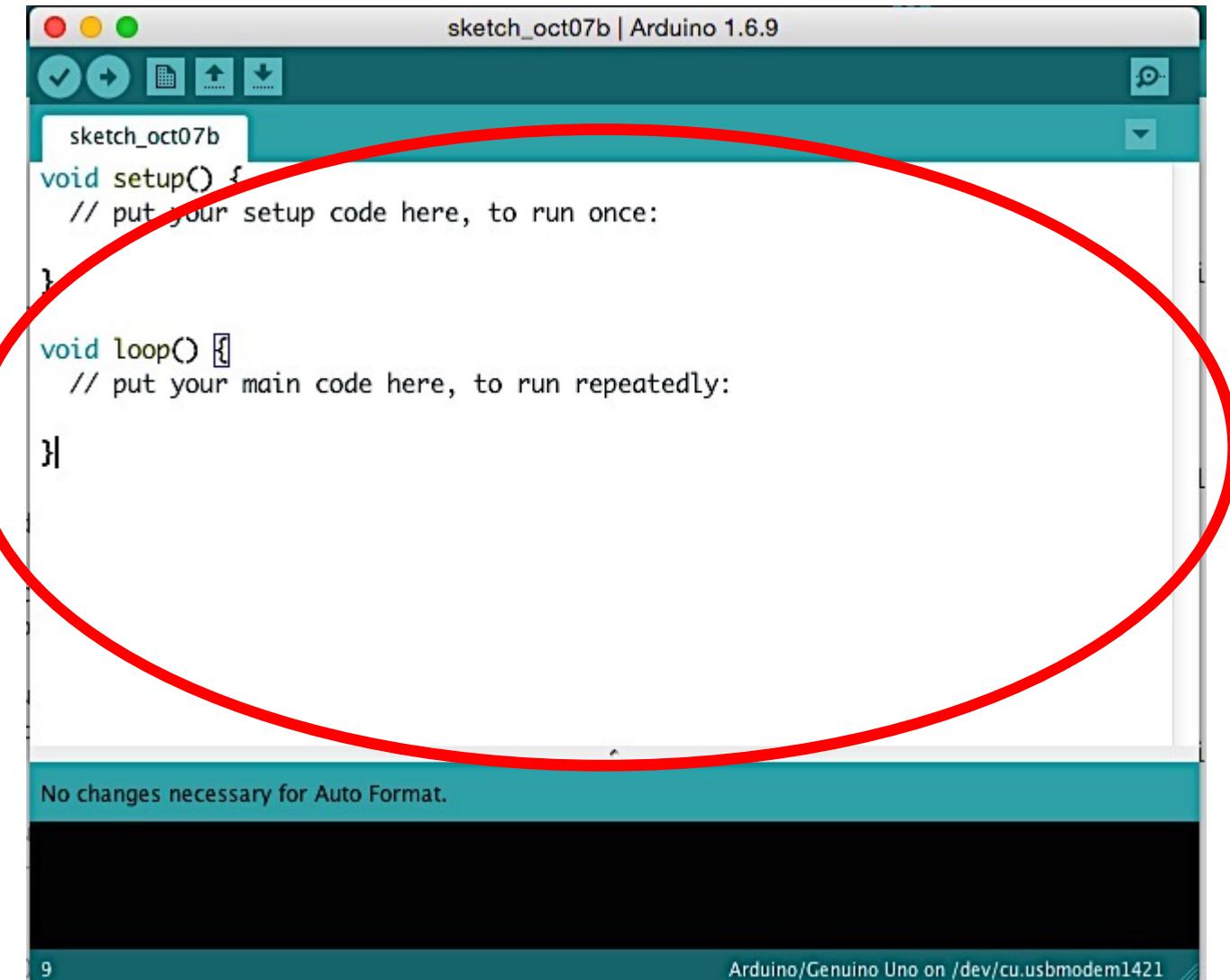
void loop() {
  // put your main code here, to run repeatedly:
}
```

At the bottom of the code editor, there is a status bar that says "No changes necessary for Auto Format." In the bottom right corner of the status bar, it also says "Arduino/Genuino Uno on /dev/cu.usbmodem1421".

KNOW the Arduino GUI

Code Area:

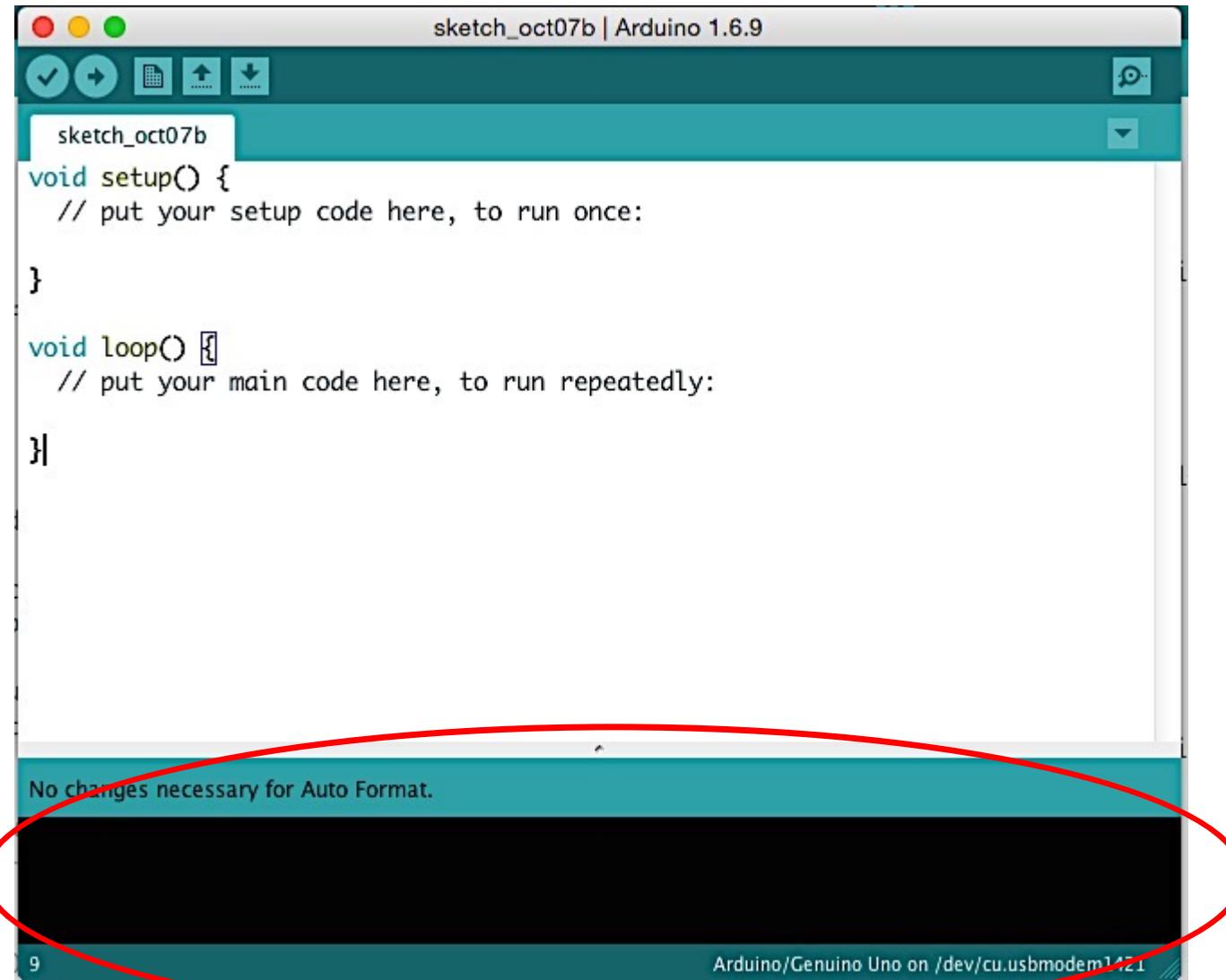
Area where you compose the code for your sketch.



KNOW the Arduino GUI

Message Area:

Where the IDE tells you if there were any errors in your code.



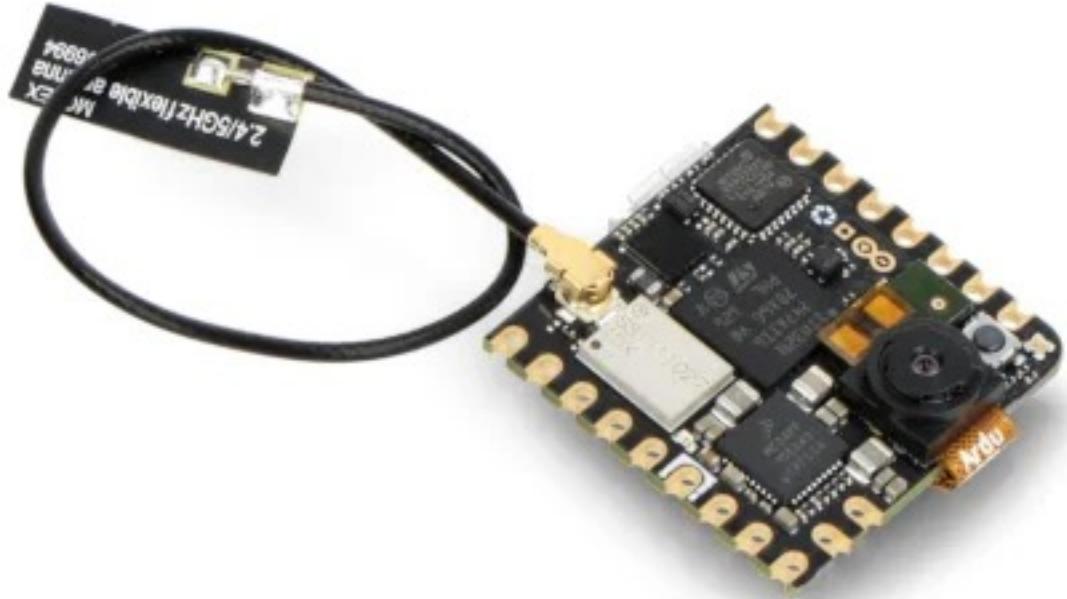
WiFi/BLE antenna

The Nicla Vision ships with an external 2.4/5GHz antenna for BLE and WiFi connectivity.

Install this antenna by carefully aligning the connector and applying sufficient pressure for it to snap into place.

Note that once connected, the antenna should only be removed using a specialised tool, in order not to damage the connector.

Using WiFi without the antenna might damage the board!



Warm-up Task

Hello world for Arduino

Open the Blink sketch on Examples/Basic and run it using the IDE Upload button. You should see the Built-in LED (green RGB) blinking, which means the Nicla board is correctly installed and functional!

Exercise:

Make the LED blink for a different amount of time

Make the LED blink as fast as possible!

Accelerometer test

Before testing the IMU, it will be necessary to install the LSM6DSOX library. For that, go to Library Manager and look for LSM6DSOX. Install the library provided by Arduino:

Next, go to Examples > Arduino_LSM6DSOX > SimpleAccelerometer and run the accelerometer test (you can also run Gyro and board temperature):



Primary Task

Accelerometer data + LED

Read the accelerometer data and print the data in the Serial Monitor

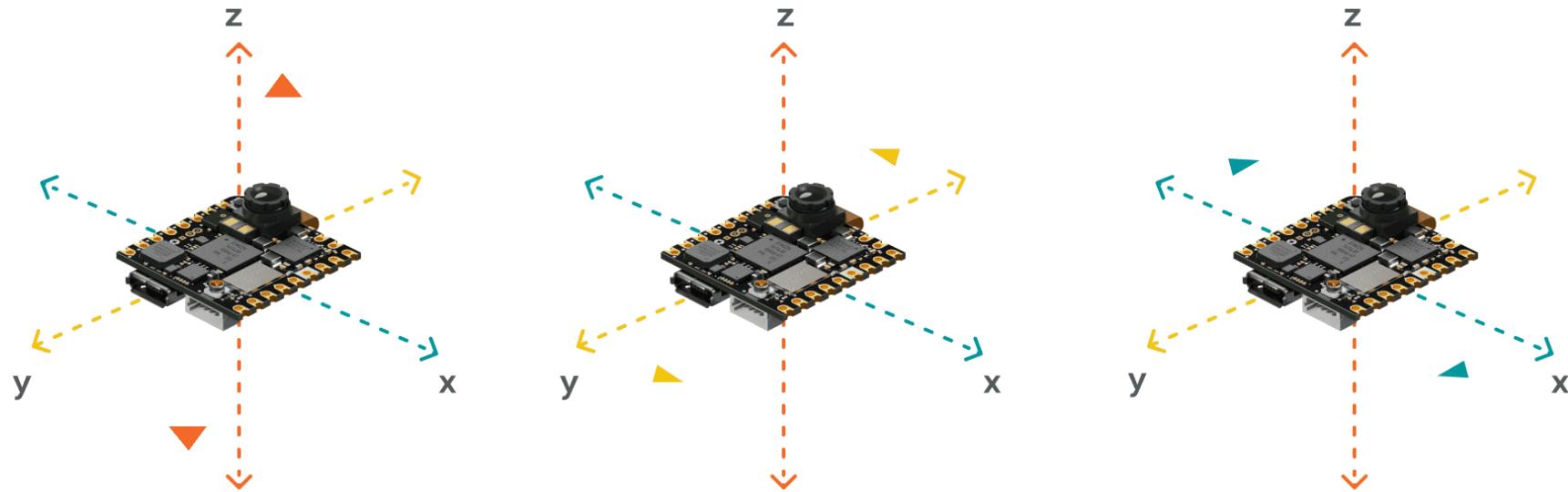
Exercise:

Blink the LED faster if a stronger acceleration is detected

Change the color of the LED according to the axis where the acceleration is stronger(RED for X, Green for Y and Yellow for Z)

Send a message using Serial Monitor when acceleration is stronger than a threshold value.

Read accelerometer data + LED



Proximity Detection+ LED

Read the Time of Flight (ToF) sensor data and print the data in the Serial Monitor

Exercise:

Blink the LED faster if the object is closer

Change the color of the LED according to the distance of the object (from Yellow to Red, for example)

Send a message using Serial Monitor when distance is shorter than a threshold value.

Final Task

Eye Saver



Using the Time of Flight (ToF) sensor, the Eye Saver will check if a person is too close to the laptop screen. If so, a red LED will start blinking.

Door alarm



Using the gyroscope or the accelerometer sensor, the Door alarm will turn an LED to RED if the door is open. The LED will be OFF if the door is closed.

Thanks

