INTRODUCTION TO ARDUINO

Learning Outcomes

At the end of the session, the students should be able to:

- Explain what Arduino is and its role in electronics and application development.
- Describe the history and development of Arduino boards.
- Identify the different types of Arduino boards and their characteristics.
- Identify the major parts and components of an Arduino board and explain their functions.
- Describe common applications and uses of Arduino in real-world projects.

What is Arduino?

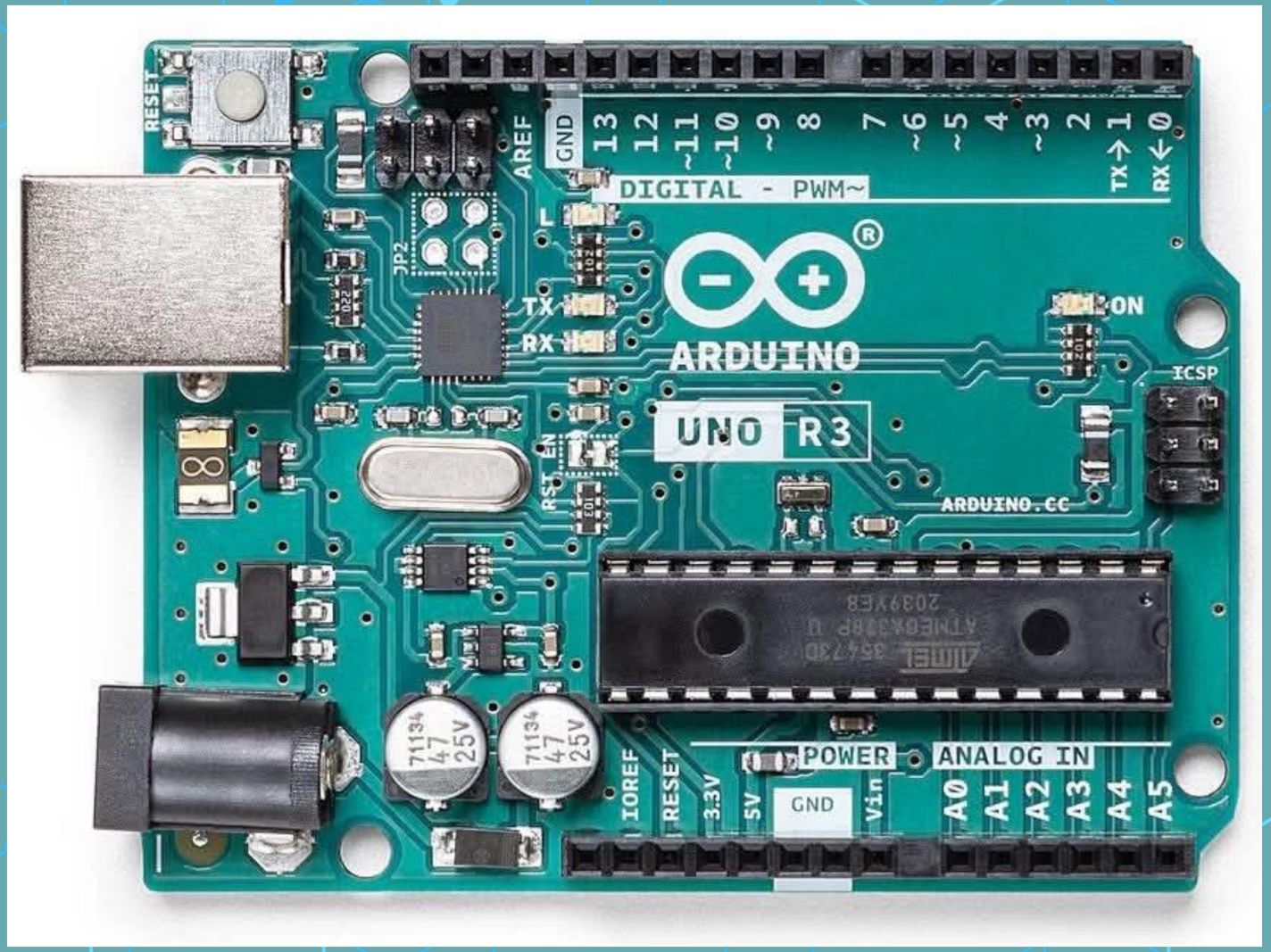
Arduino is a small electronic board that we can program to do different tasks.[SEP] It can control things like LED lights, motors, sensors, and displays.

History and Timeline of Arduino Boards

Arduino was created in 2005 in Italy as an affordable and easy-to-use tool for students. It was designed to help students learn electronics and programming without needing expensive or complicated equipment. After its creation, different Arduino boards were developed and improved to support various types of projects.

During the 2010s, Arduino became more popular among students, hobbyists, teachers, and developers because it was simple to learn and useful for creating electronic projects. Today, Arduino is widely used in robotics, automation, smart devices, and school projects. It continues to be a popular tool for learning and developing new ideas using electronics and programming.

Different Types of Arduino Boards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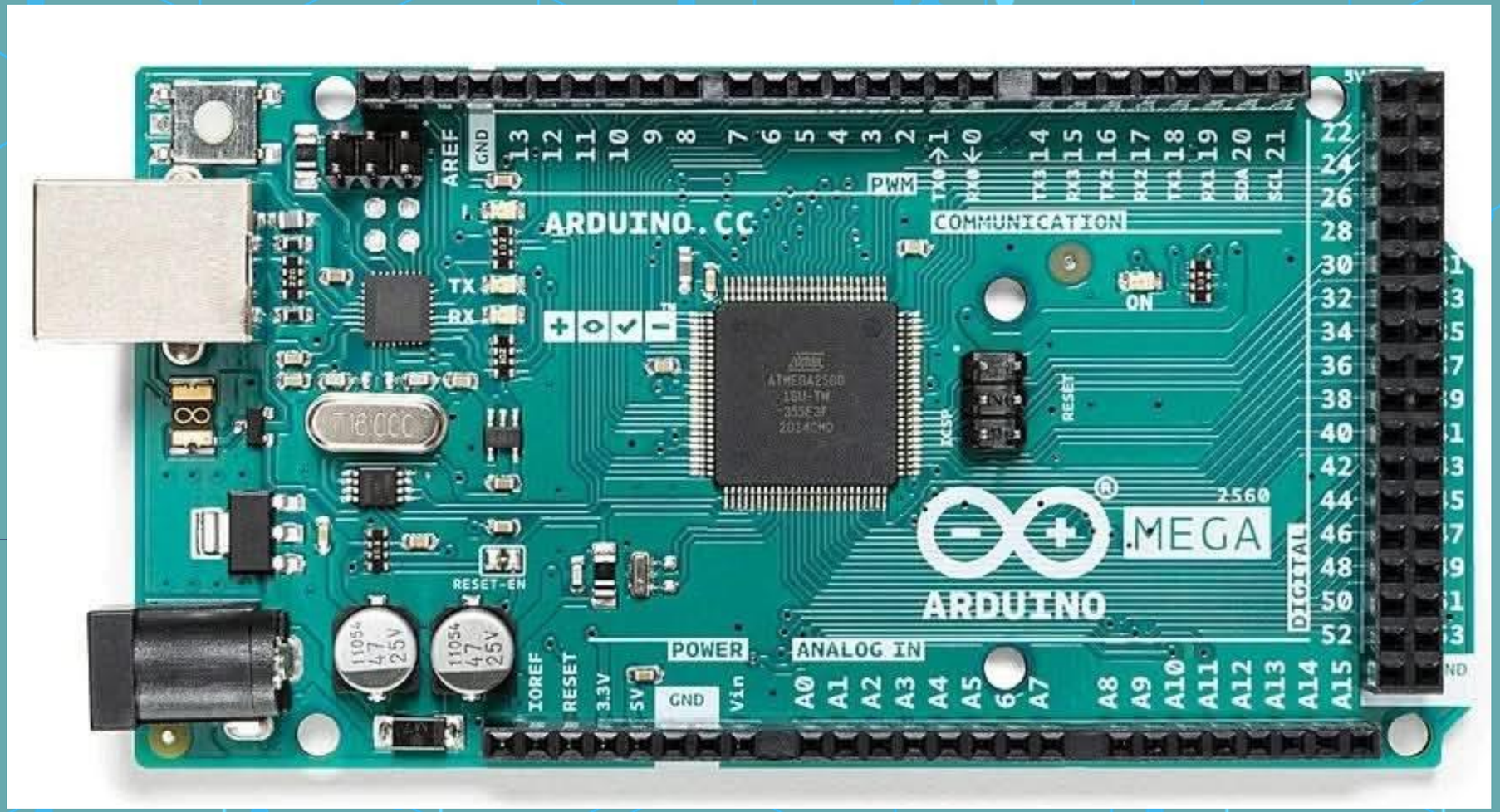
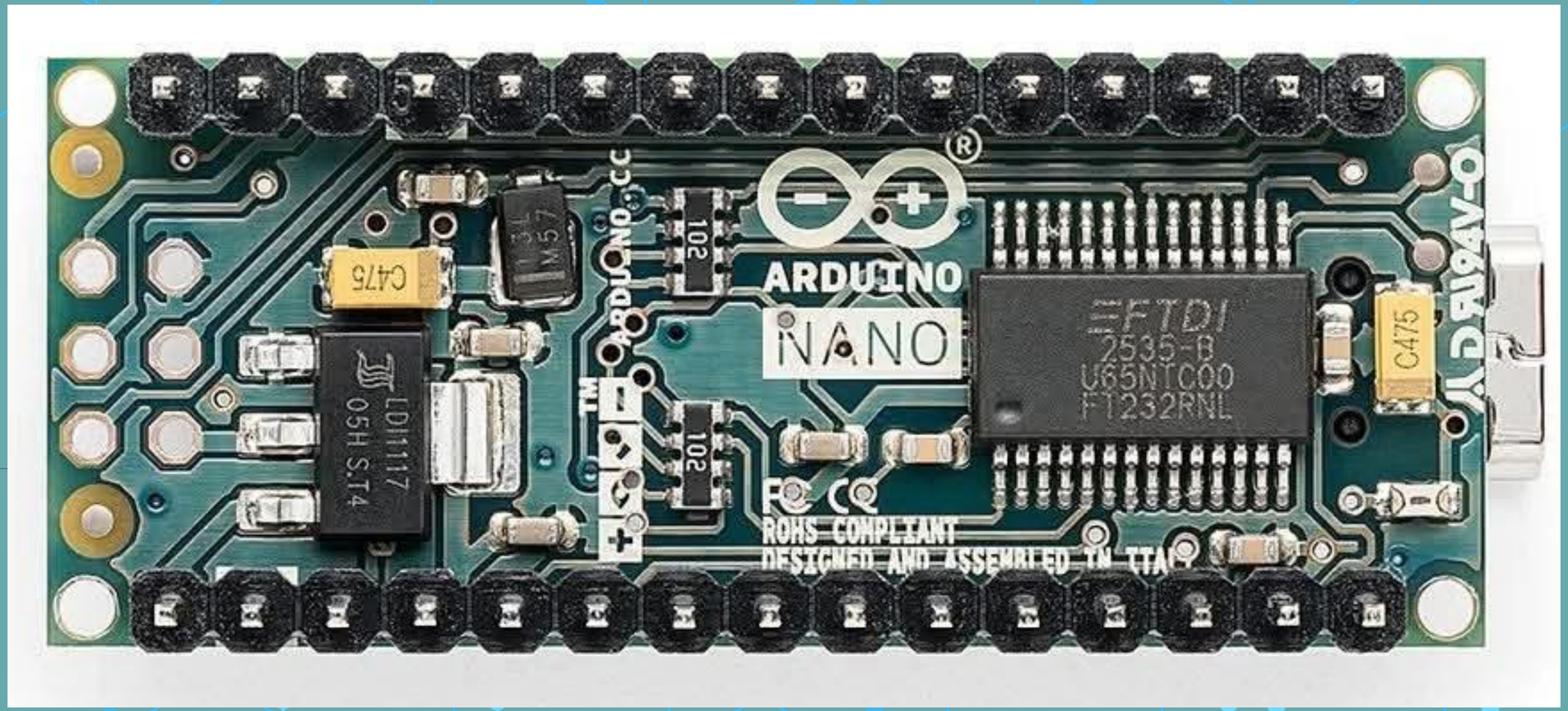
Arduino Uno

The **Arduino Uno** is the most common Arduino board. It is easy to use and best for beginners and simple projects.



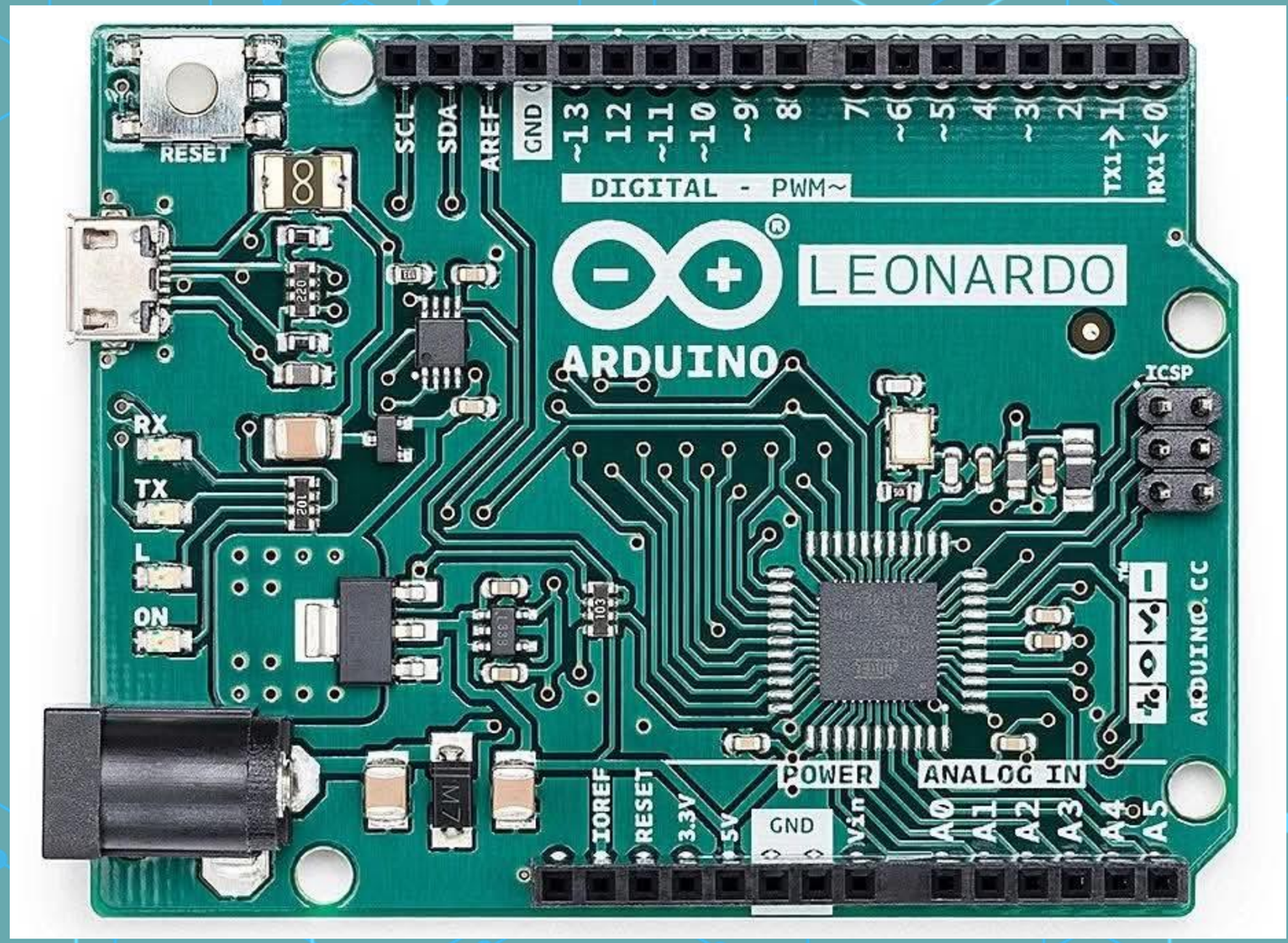
Arduino Mega

The **Arduino Mega** has many input and output pins. It is useful for large projects that need many sensors, lights, or other components.



Arduino Nano

The **Arduino Nano** is a small Arduino board. It is useful for projects where there is not much space.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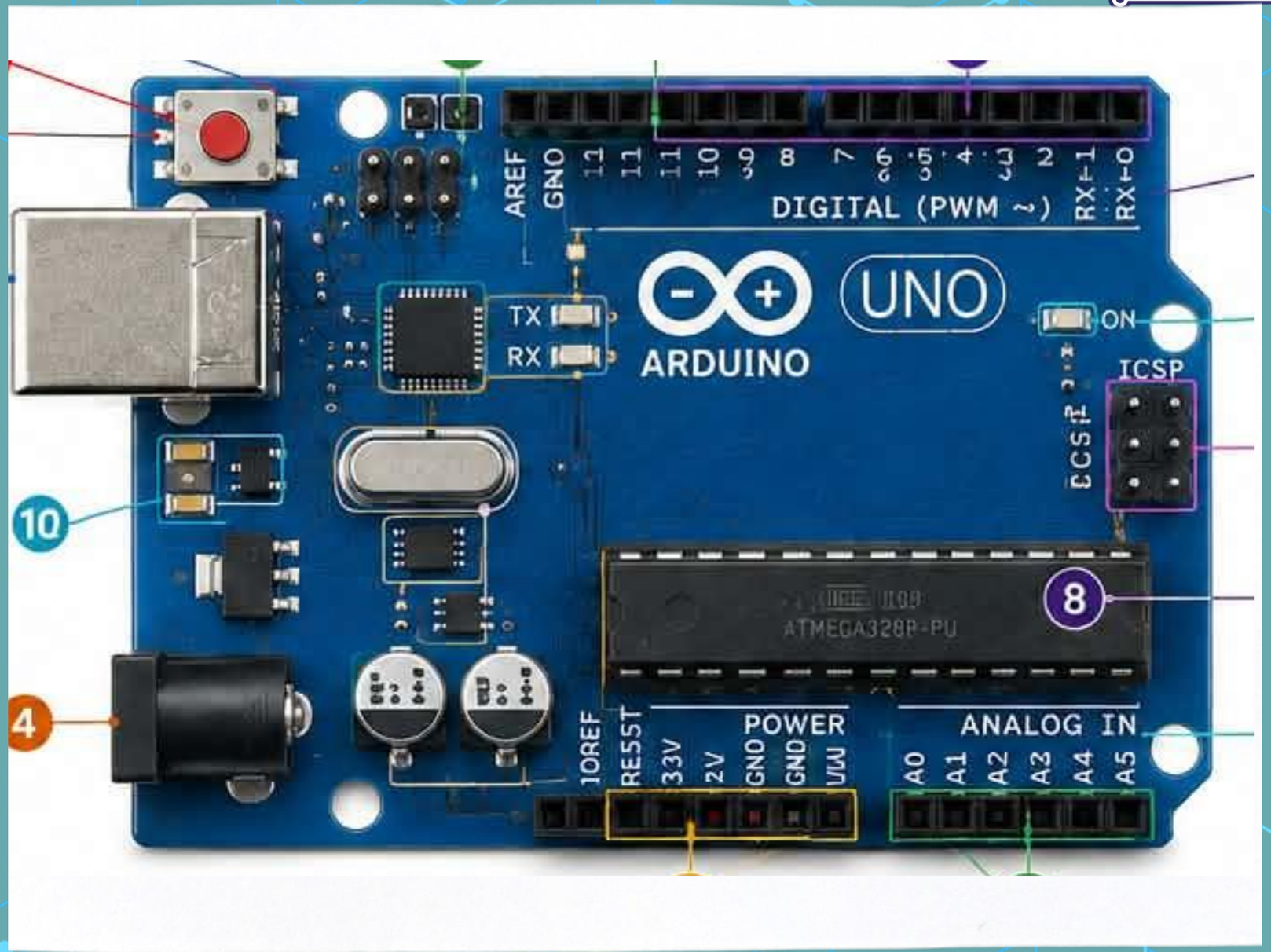
Arduino

The **Arduino Leonardo** can act like a computer keyboard or mouse when connected to a computer. This makes it useful for projects that control a computer.

Arduino Micro

The **Arduino Micro** is another small and compact board. It is good for projects where you need Arduino functions but have limited space.

Parts of Arduino Boards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RESET
3V3
5V
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VIN
POWER
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A5
ANALOG IN

Major Parts

Reset Button: Restarts the arduino and runs the uploaded program again from the beginning.

USB Port: Connects the Arduino to a computer for uploadin code and supplying power.

DC Power Jack: Allows an external power supply (battery or Adoptor) to power the Arduino boards.

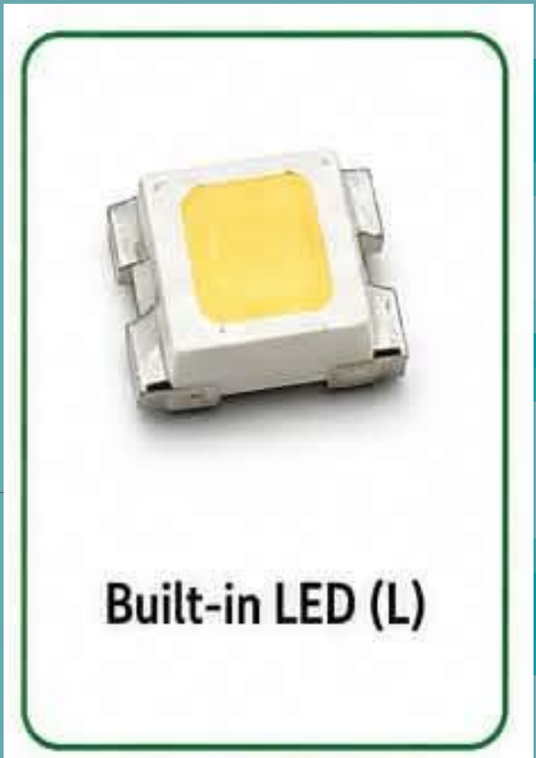
Digital I/O pins: Used to receive digital input (HIGH/LOW) from sensors and sends digital output to devices like LEDs and buzzer.

Power pins: Supply power (5V or 3.3V) and provide ground connections for external components and circuits.

Analog Input pins: Read Analog signals from sensors, such as temperature sensors, light sensors, and potentiometers.

Components
Parts

Voltage Regulator: Controls and stabilizes to voltage supplied to the board to prevent damage from excessive voltage.



Built-in LED: Indicate board status. The “ON” LED shows power, while the “L” LED is connected to Pin 13 for testing programs.

TX/RX LEDs: Used for serial communication. TX sends data, while RX receives data from other devices.

ATmega328P Microcontroller:

The main microcontroller or “brain” of the arduino that executes the uploaded programs.

Crystal Oscillator: Provides a precise 16 MHz clock signal that controls the timing of the microcontroller.

ICSP Header: Used for programming the microcontroller directly and for certain advanced connections.

Usage and Application of Arduino

Usage of Arduino

Is an open-source electronics platform used to build digital devices and interactive objects that can sense and control physicals things.

APPLICATION	USES
1. Home Application	Lights and fans, Air Conditioning and thermostats, Door looks and security cameras, Energy monitoring systems.
1. Health Monitoring	Heart rate monitors, Pulse oximeters (oxygen levels), Fitness Trackers, Portable ECG devices.
1. Agriculture and Smart Farming	Automated irrigation systems, Soil moisture monitoring, Weather stations for temperature and rainfall, Crop health monitoring.

APPLICATION	USES
1. Education and Learning	Simple kits help students learn coding, electronics, and robotics, Hands-on projects make learning fun and practical, Encourages problem-solving creativity, and teamwork.
1. Industrial Automation	Process control systems, Temperature and pressure monitoring, Conveyor belt automation, Quality testing devices.
1. Environmental Monitoring	Air quality monitoring, Water quality testing, Weather data collection, Wildlife tracking devices.

ARDUINO INSTALLATION

Learning Outcomes

At the end of the session, the students should be able to:

- Explain the purpose and features of the Arduino IDE.
- Install the Arduino IDE on a computer.
- Install and configure the required Arduino drivers for Windows OS.
- Configure the Arduino IDE to recognize and communicate with an Arduino board.
- Verify the installation by connecting an Arduino board and uploading a sample program.

What is Arduino Integrated Development Environment?

To program the Arduino, you need software where you can write and upload the code. This task is performed by the Arduino IDE. Due to the variation in the type of operating system installed in Windows, Mac OS X, and Linux, there was a need to develop a platform that could work well for every OS. The IDE which refers to integrated Development Environment is a software used for writing codes that control Arduino in programming languages like C and C++.

The Arduino Integrated Development Environment or Arduino Software (IDE)

Contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

Purpose of the Arduino IDE

Code Creation: Write instructions for hardware using a simplified version of C and C++.

Compilation: Translate human-readable source code into binary machine code that microcontrollers can run.

Deployment: Transfer the compiled program via USB cable straight to the physical board without extra hardware.

Debugging & Testing: Monitor live sensor values and data exchange coming from the hardware.

Key Features of the Arduino IDE

Text Editor: Write and edit code with syntax highlighting and line numbering support.

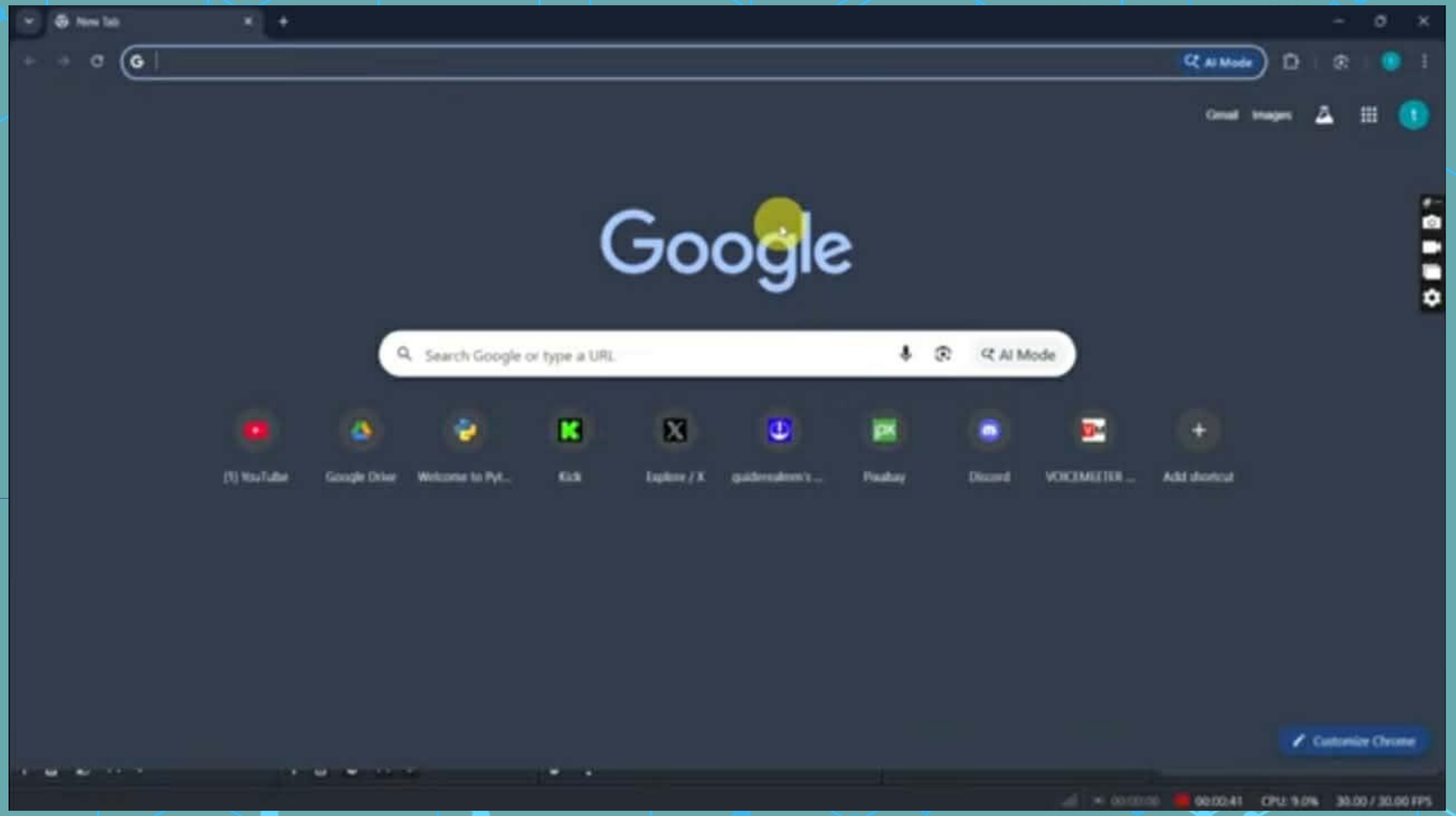
Toolbar Controls: Quick buttons to verify (compile) code and upload it to the board.

Serial Monitor and Plotter: View real-time text and graphs sent from the board to your computer.

Library Manager: Easily download and install pre-written code packages to support sensors, motors, and displays.

Board Manager: Install and switch core files for various hardware chips like AVR, ARM, or ESP32.

Modern Additions (IDE 2.x): Features like code auto-completion, live debugging, and cloud sketchbook integration.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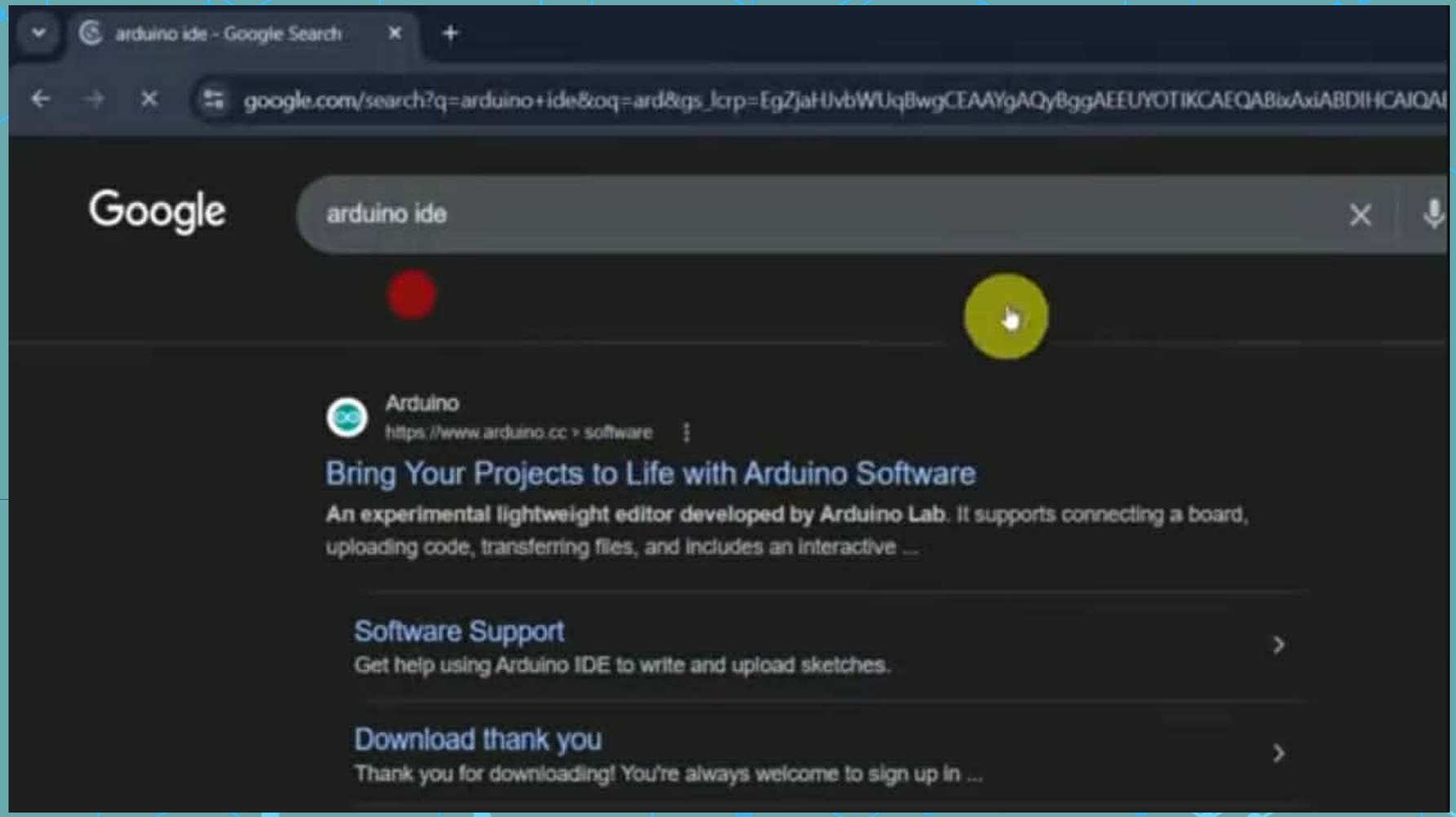
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https://www.arduino.cc › software
Bring Your Projects to Life with Arduino Software
An experimental lightweight editor developed by Arduino Lab. It supports connecting a board, uploading code, transferring files, and includes an interactive ...
Software Support
Get help using Arduino IDE to write and upload sketches.
Download thank you
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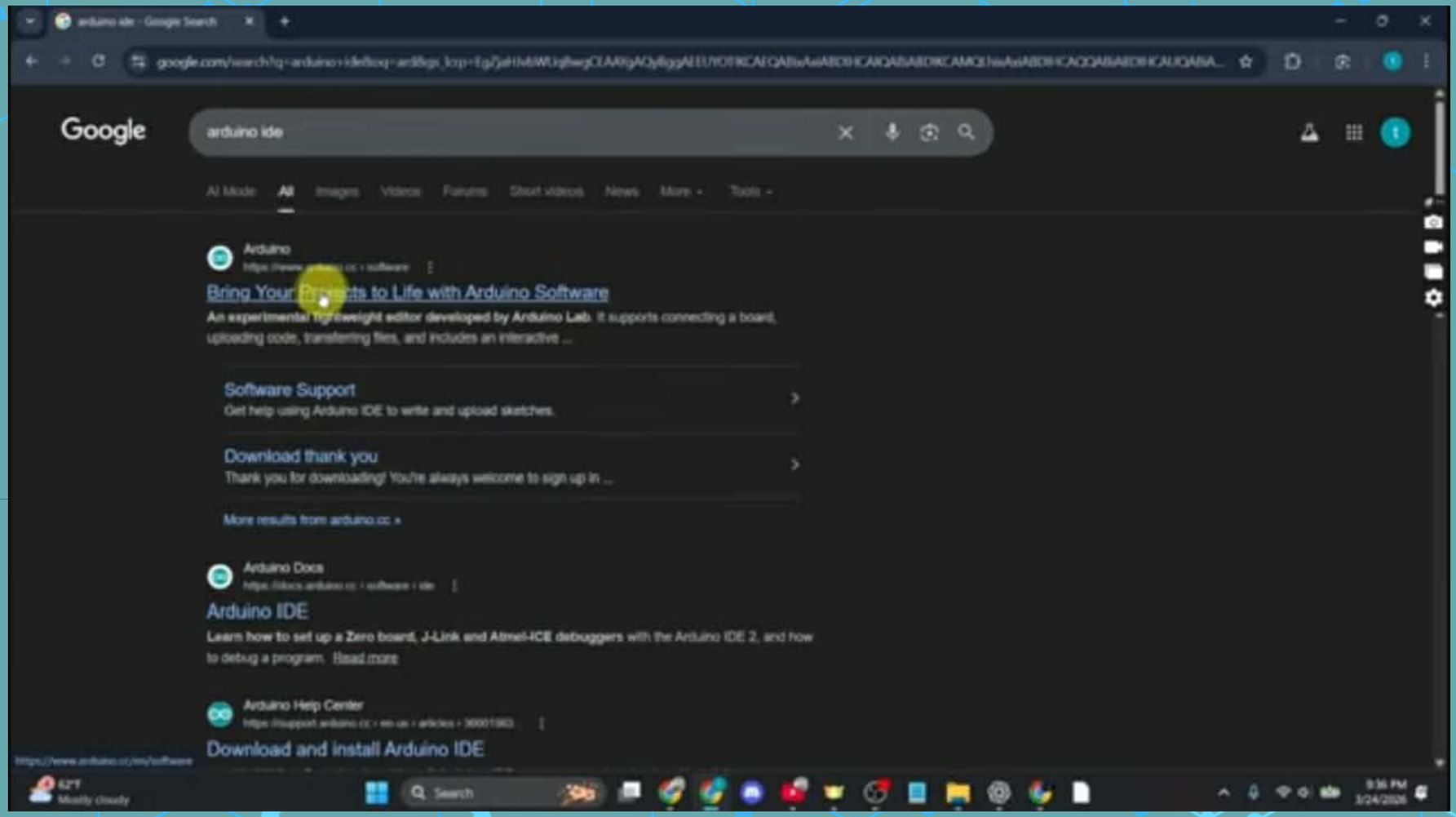
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Bring Your Projects to Life with Arduino Software
An experimental lightweight editor developed by Arduino Lab. It supports connecting a board, uploading code, transferring files, and includes an interactive ...
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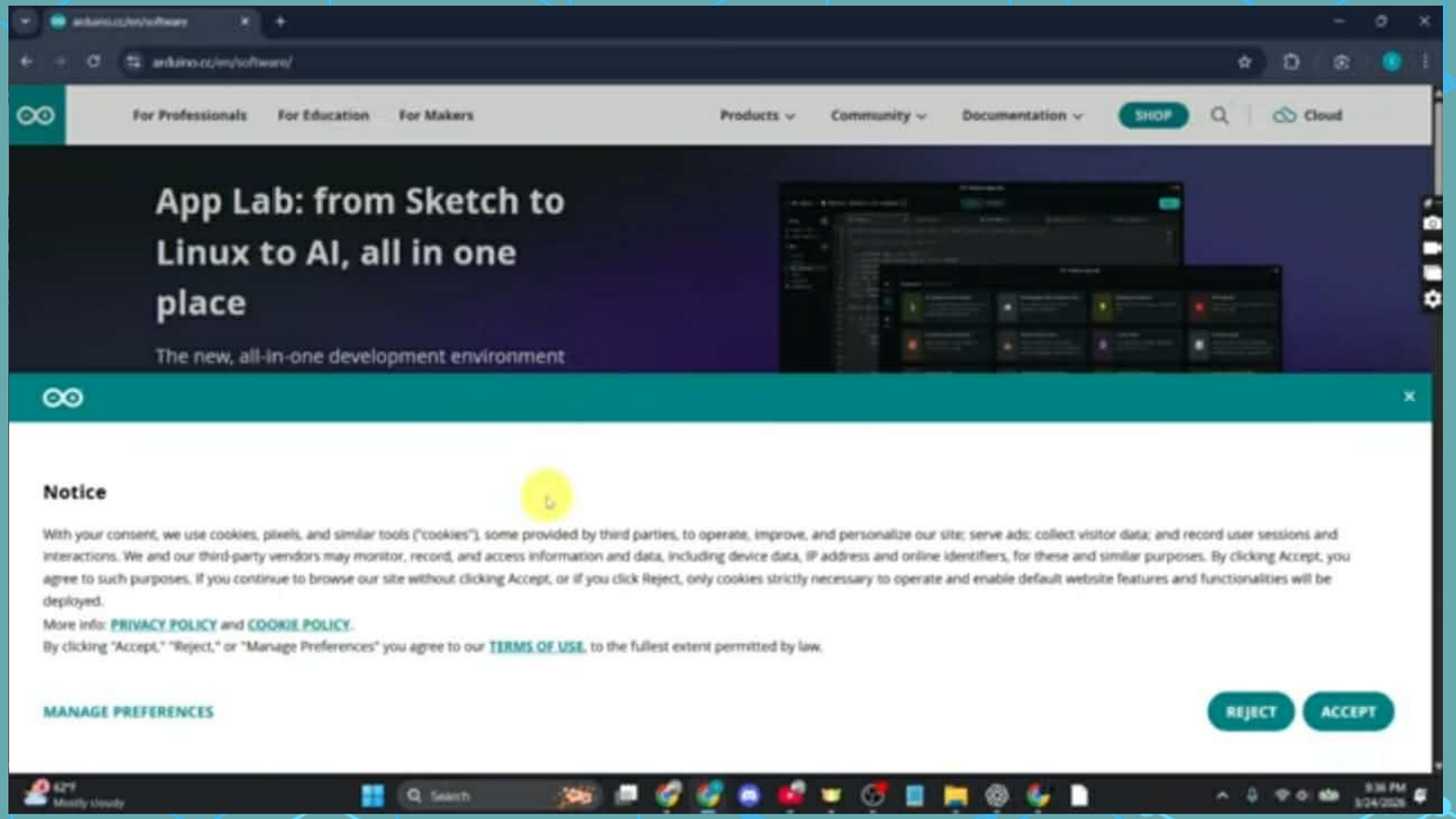
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The new, all-in-one development environment
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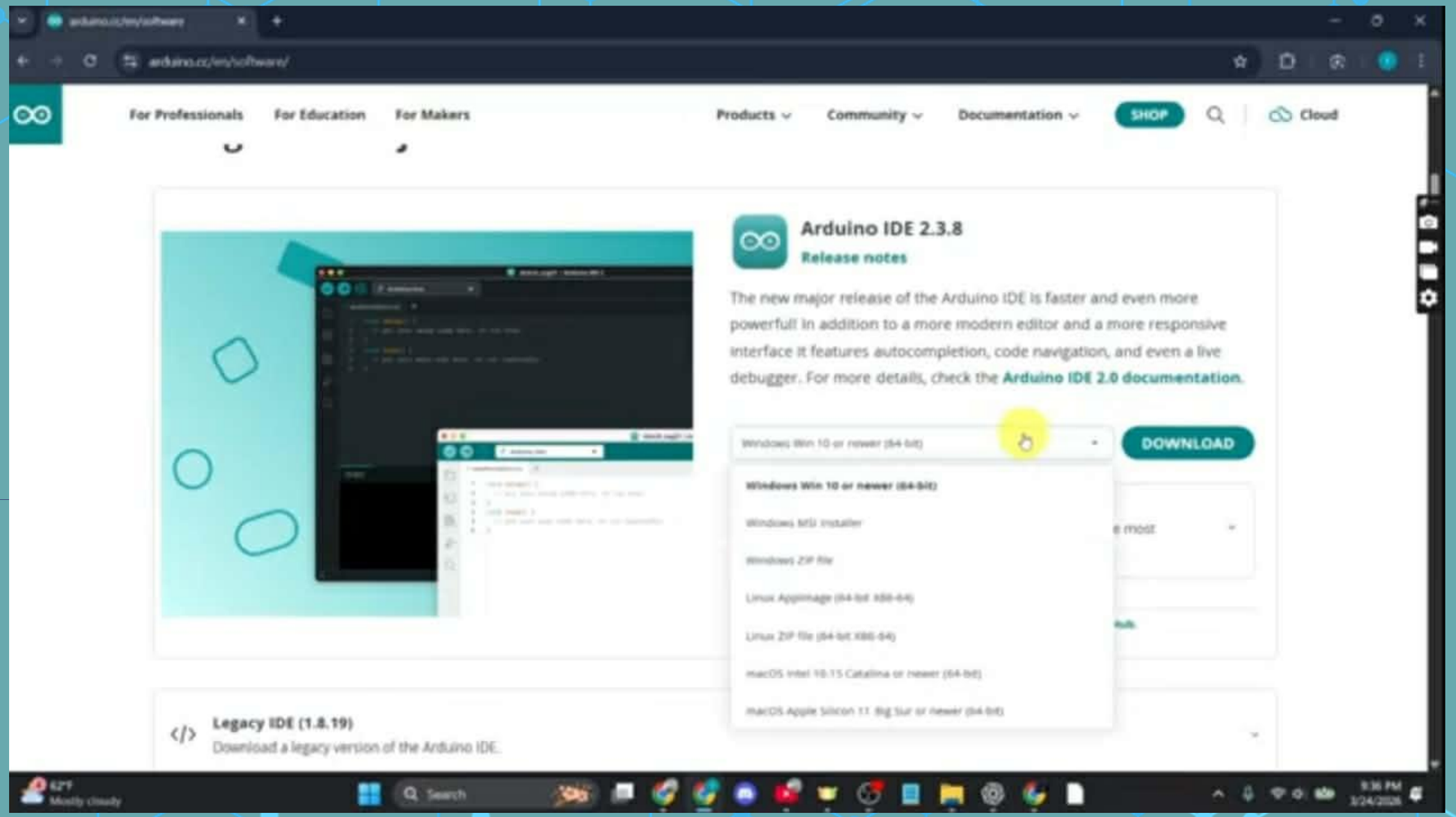
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The new major release of the Arduino IDE is faster and even more powerful! In addition to a more modern editor and a more responsive interface it features autocompletion, code navigation, and even a live debugger. For more details, check the Arduino IDE 2.0 documentation.
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Windows MSI installer
Windows ZIP file
Linux AppImage (64-bit X86-64)
Linux ZIP file (64-bit X86-64)
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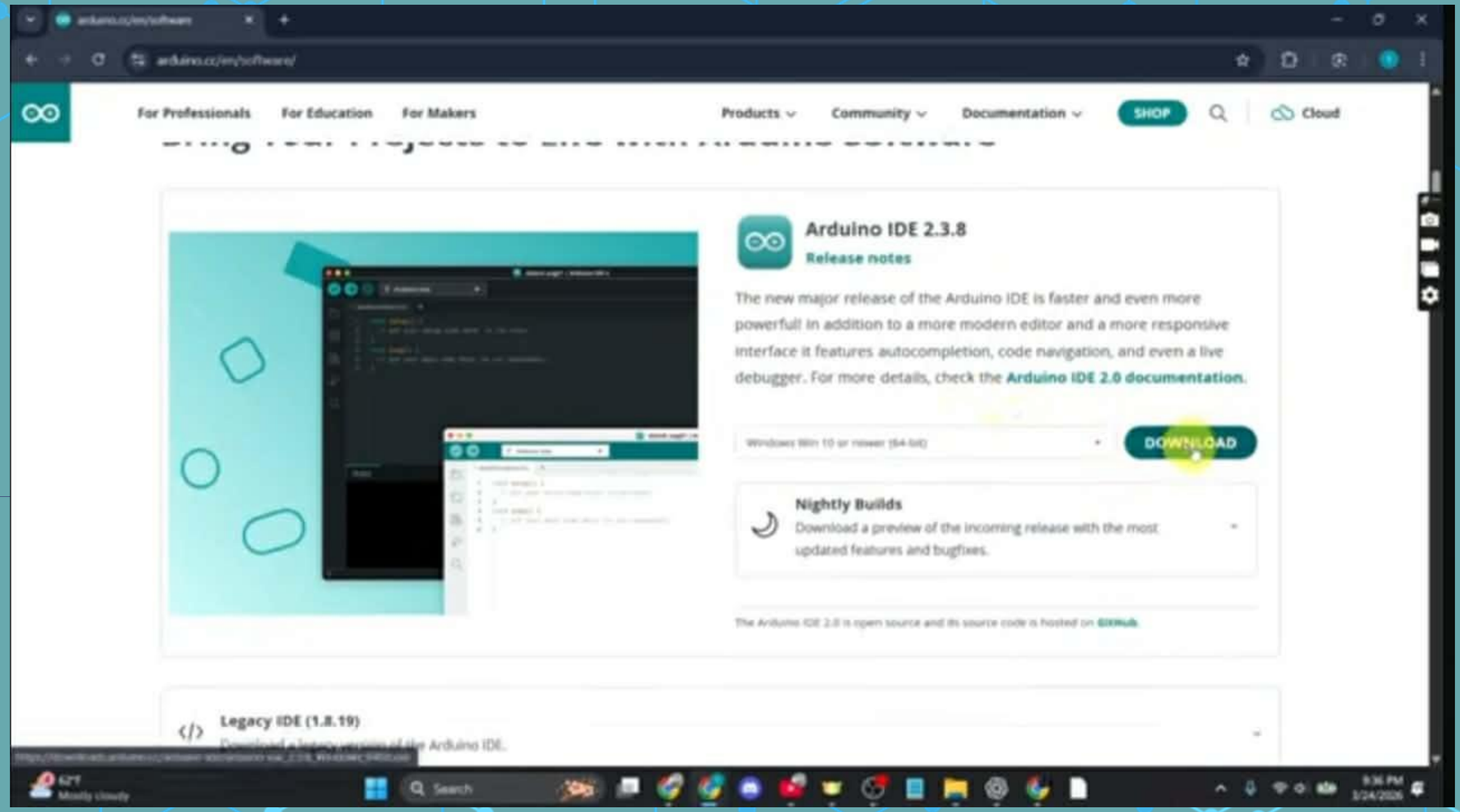
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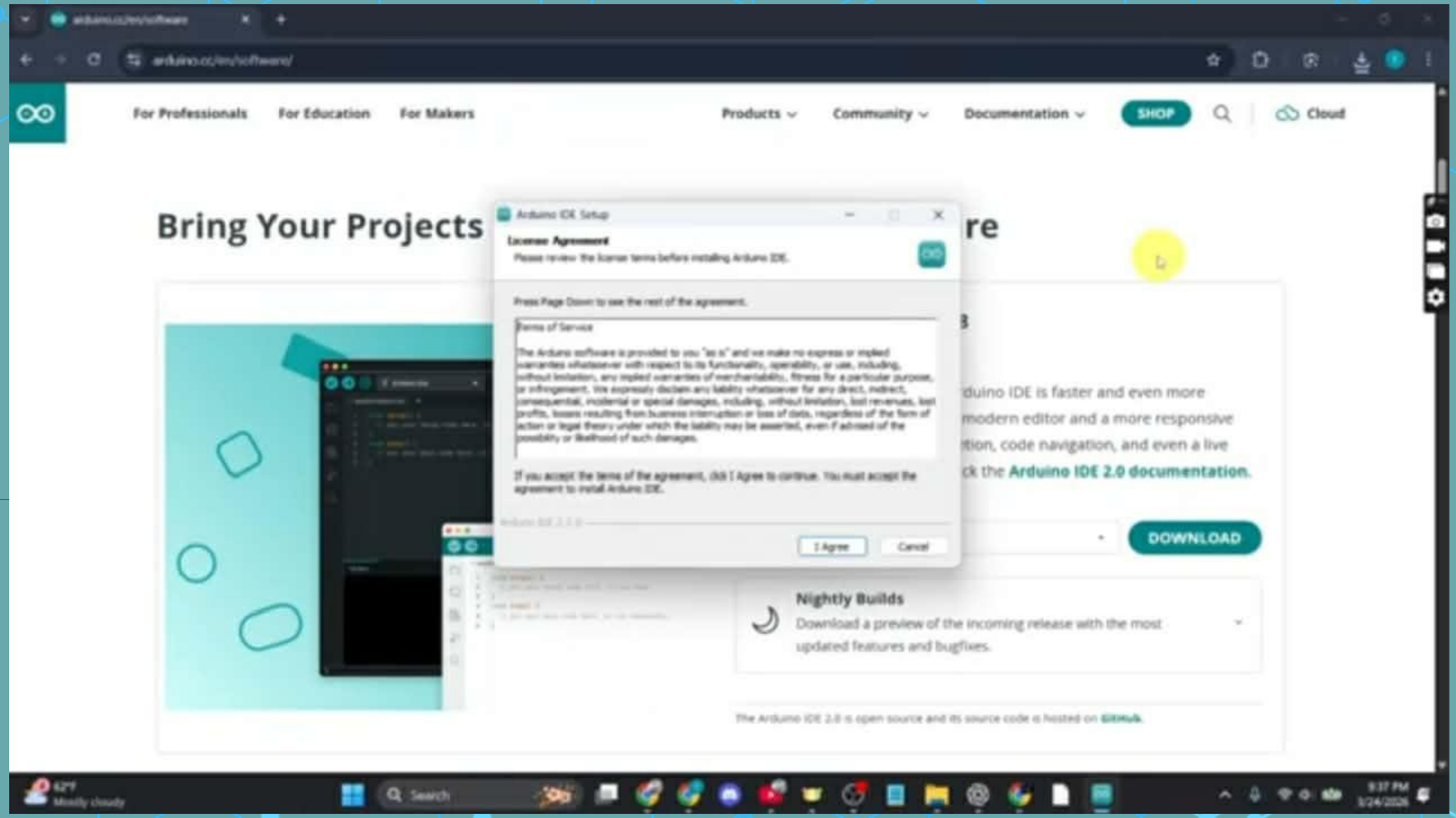
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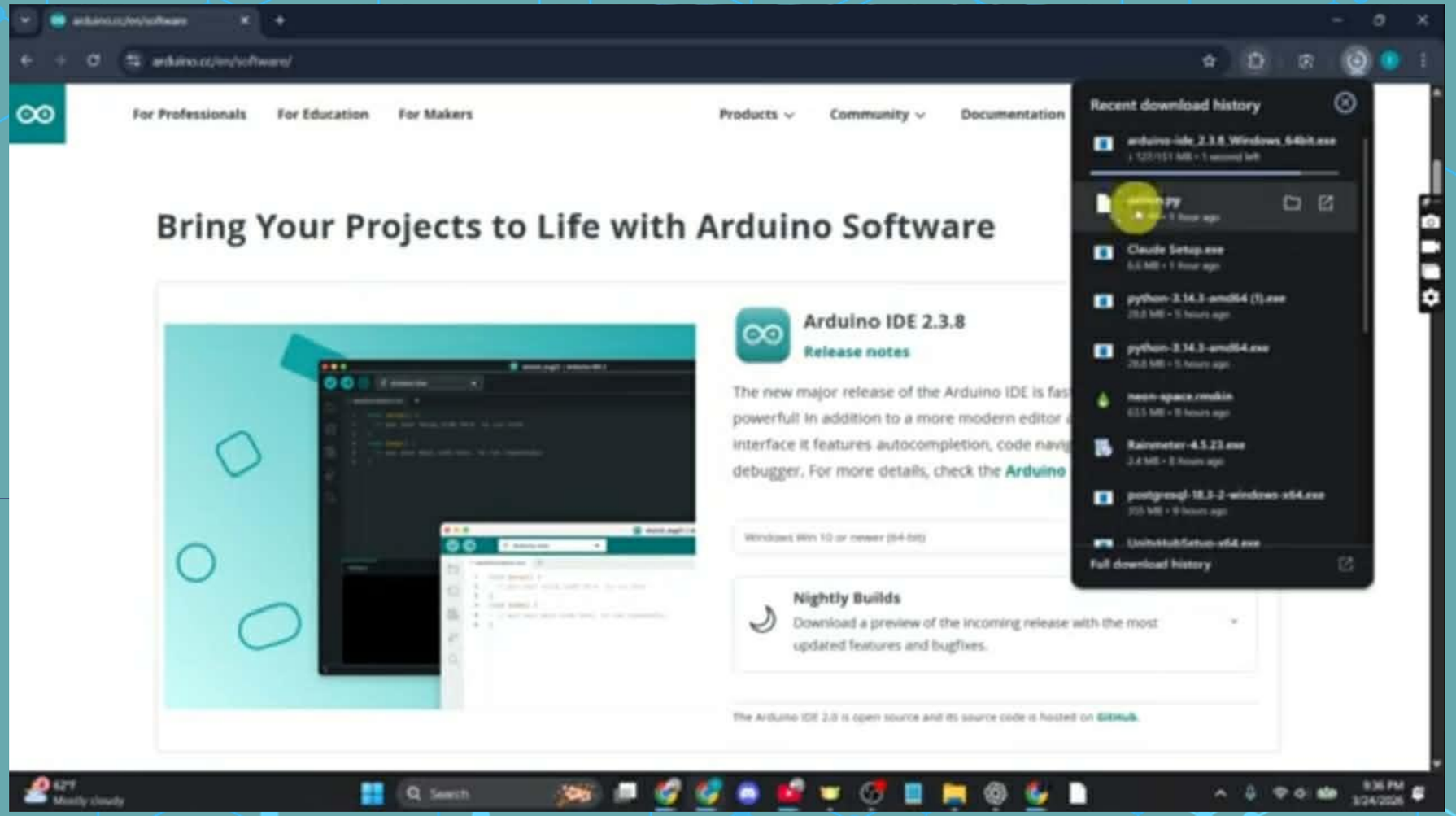
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Claude Setup.exe
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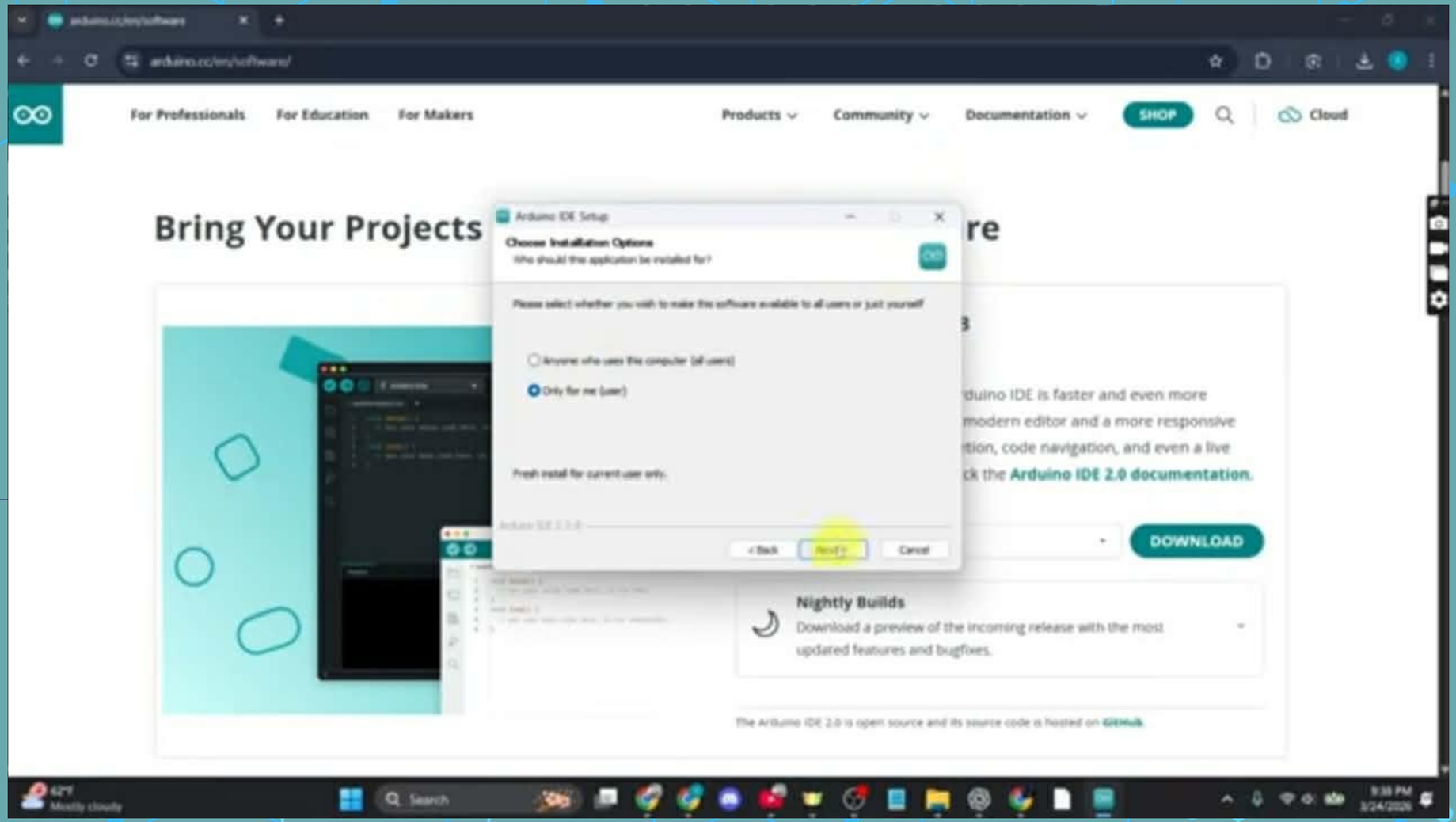
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Choose Installation Options
Who should the application be installed for?
Please select whether you wish to make this software available to all users or just yourself
Anyone who uses this computer (all users)
Only for me (user)
Fresh install for current user only.
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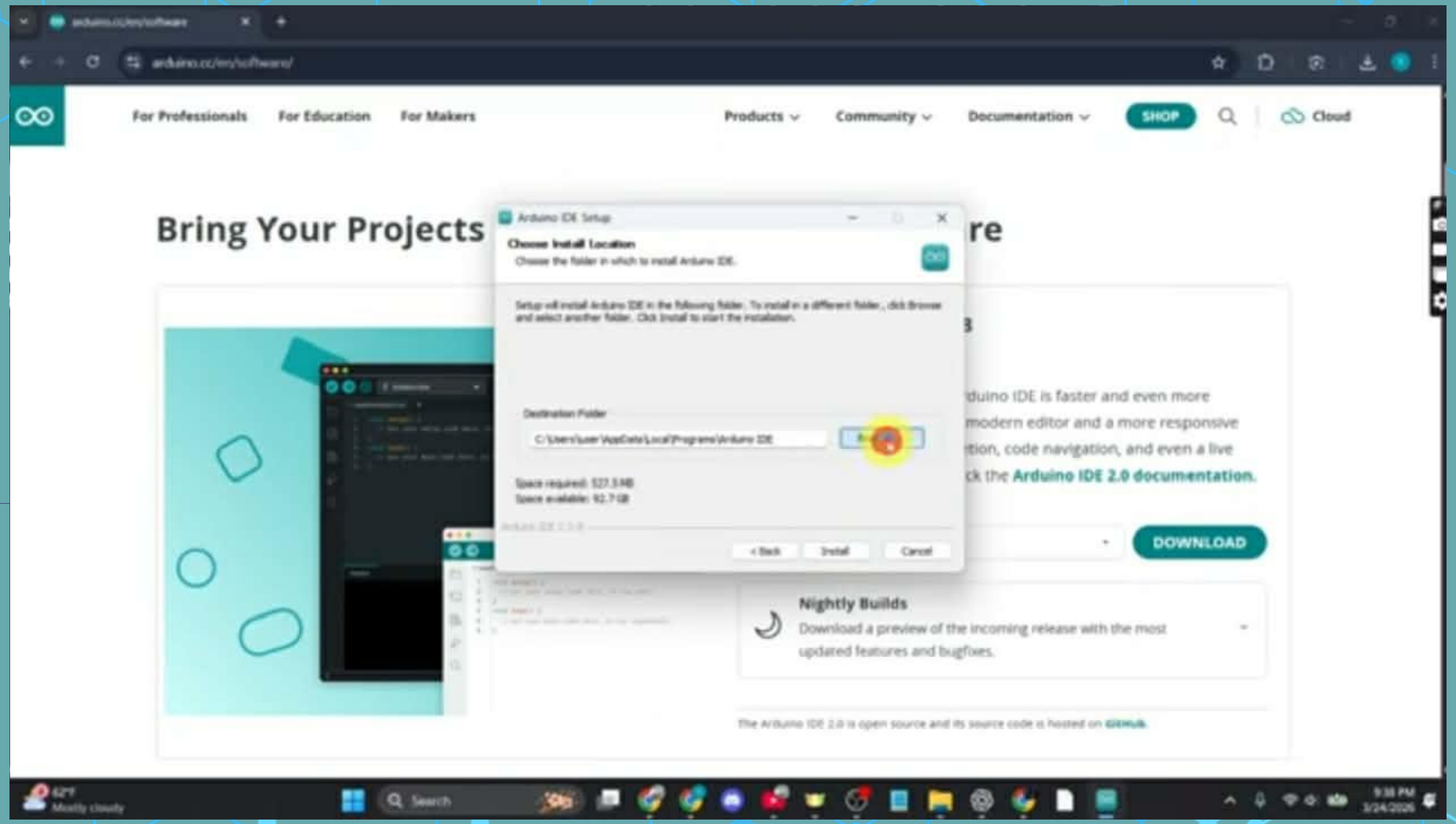
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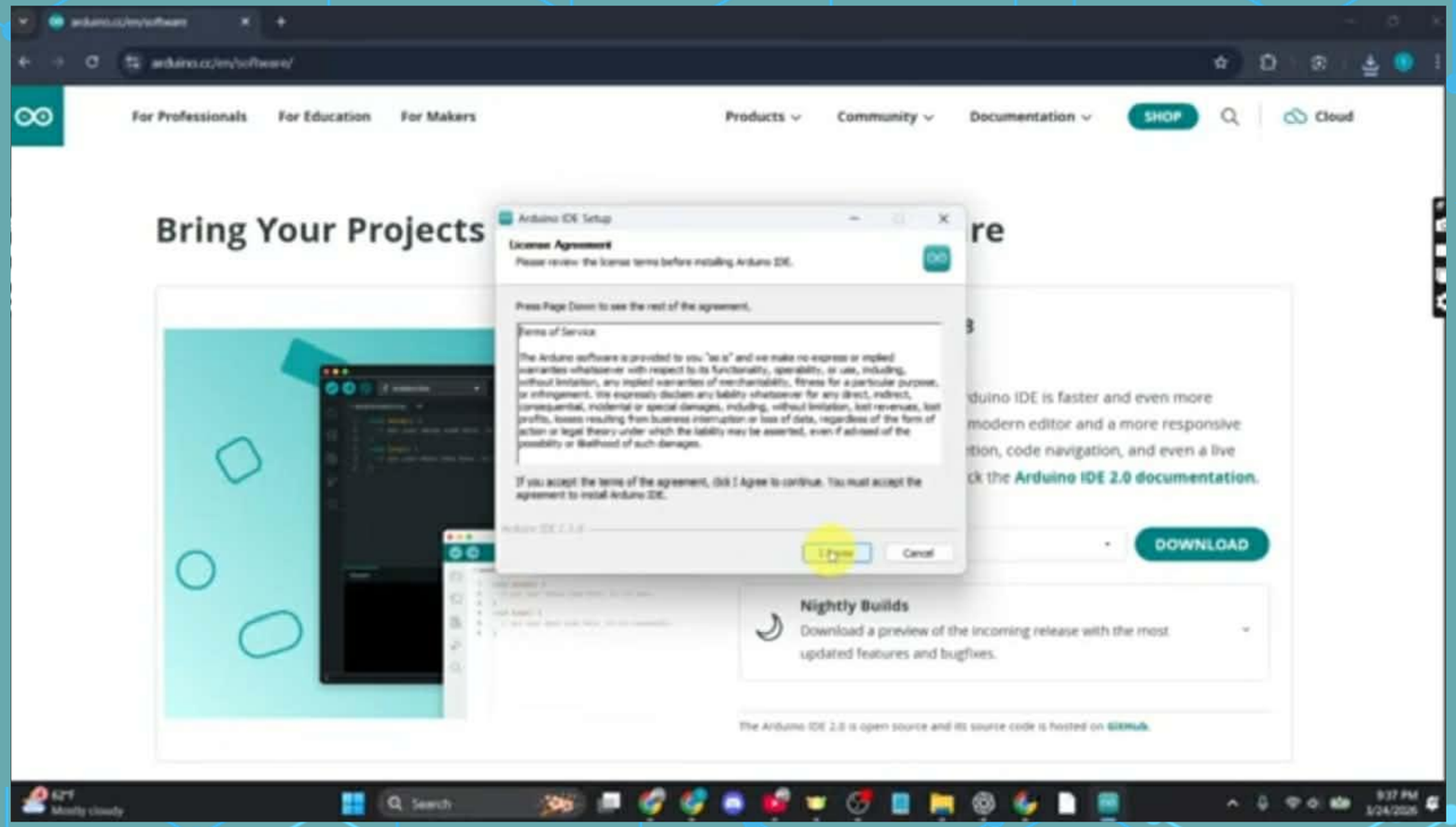
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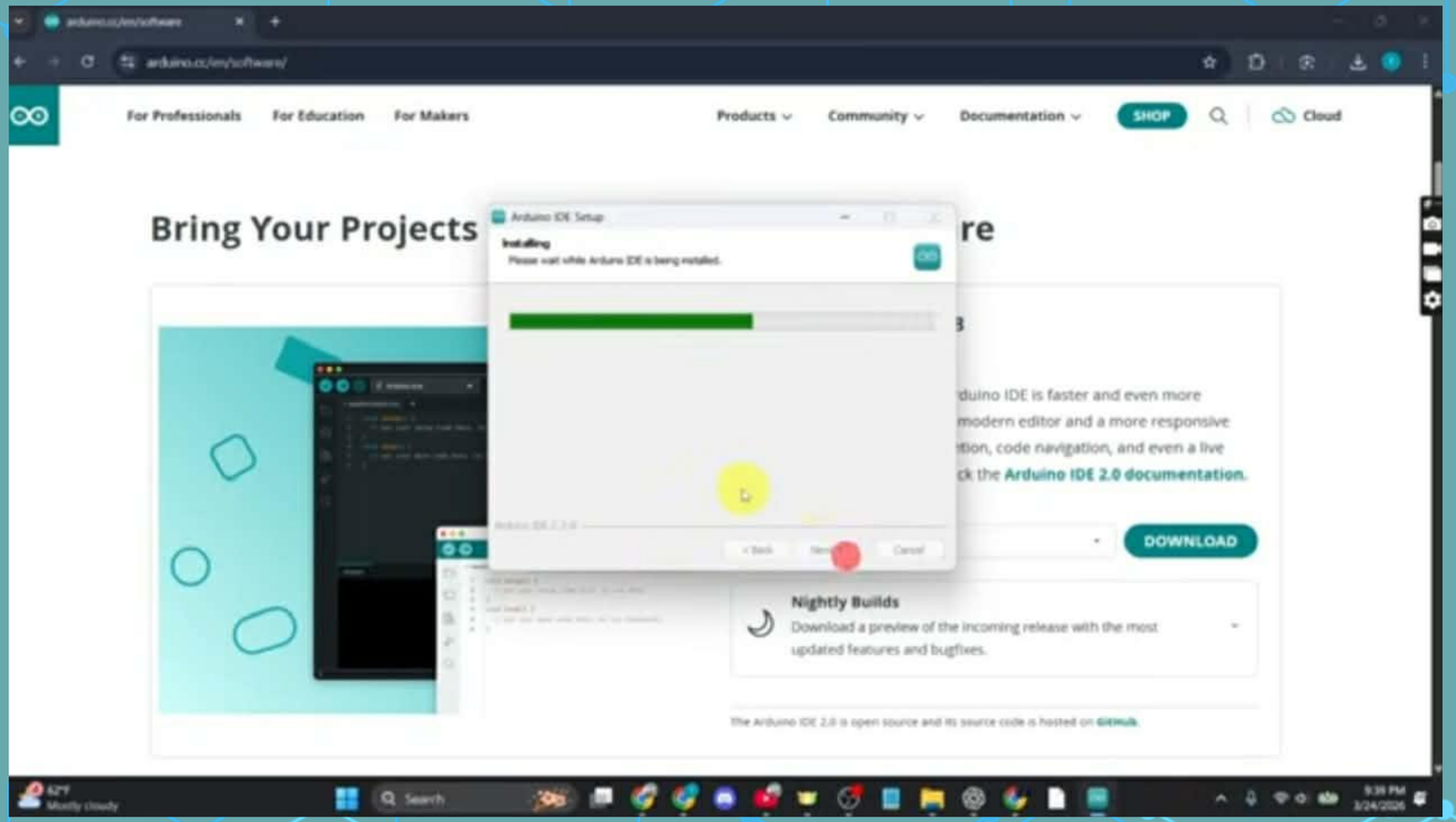
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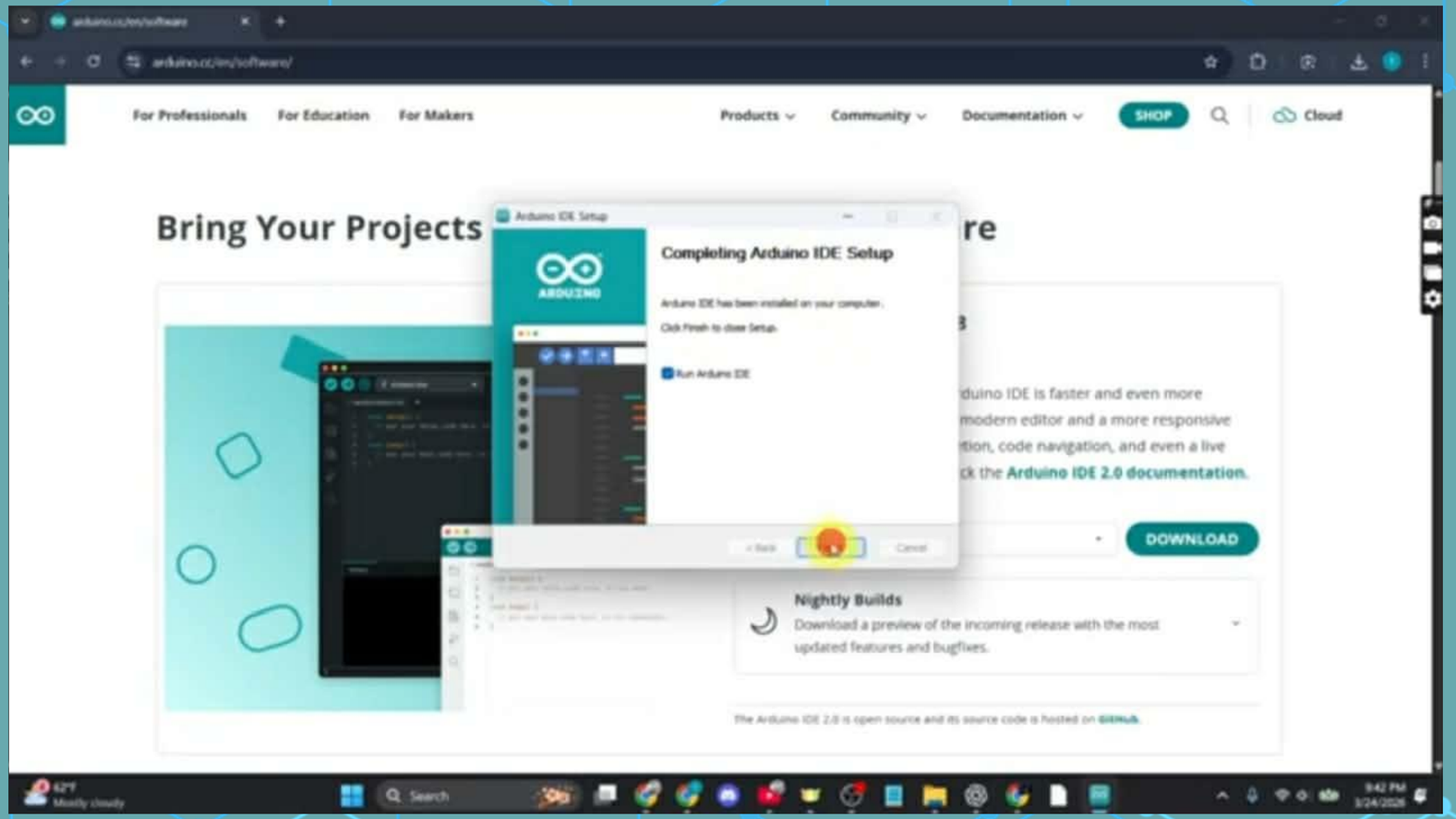
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Run Arduino IDE
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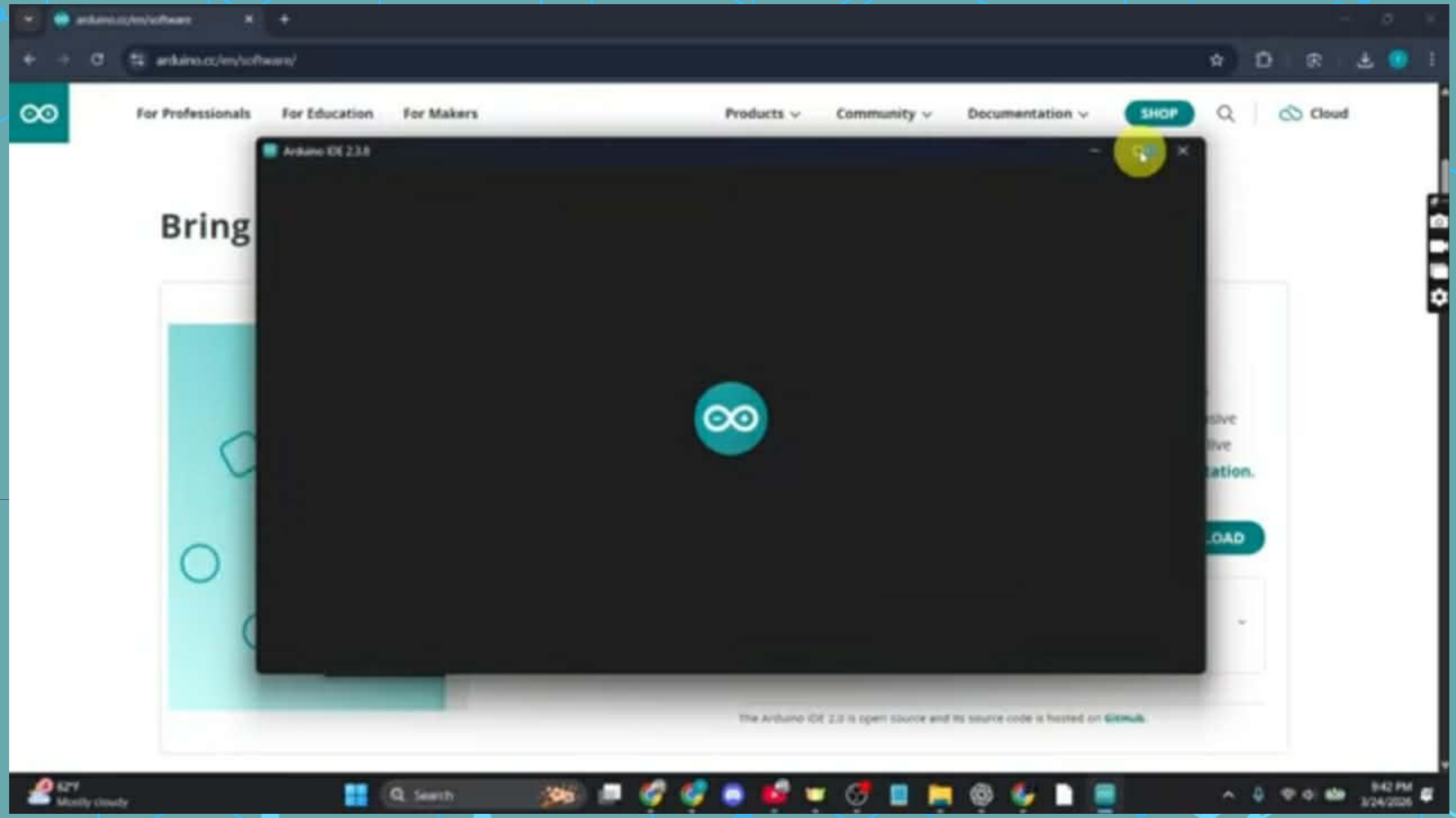
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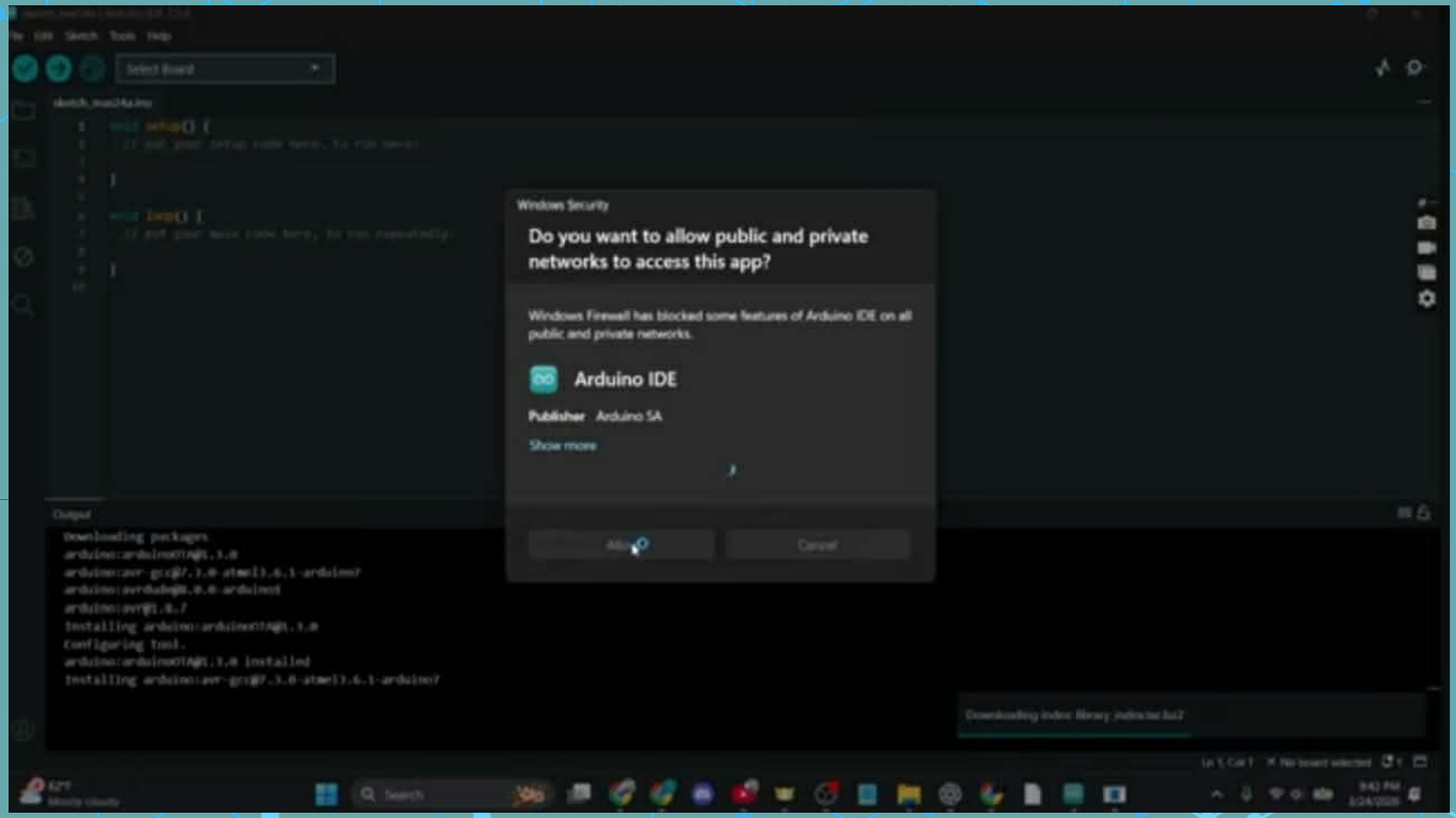
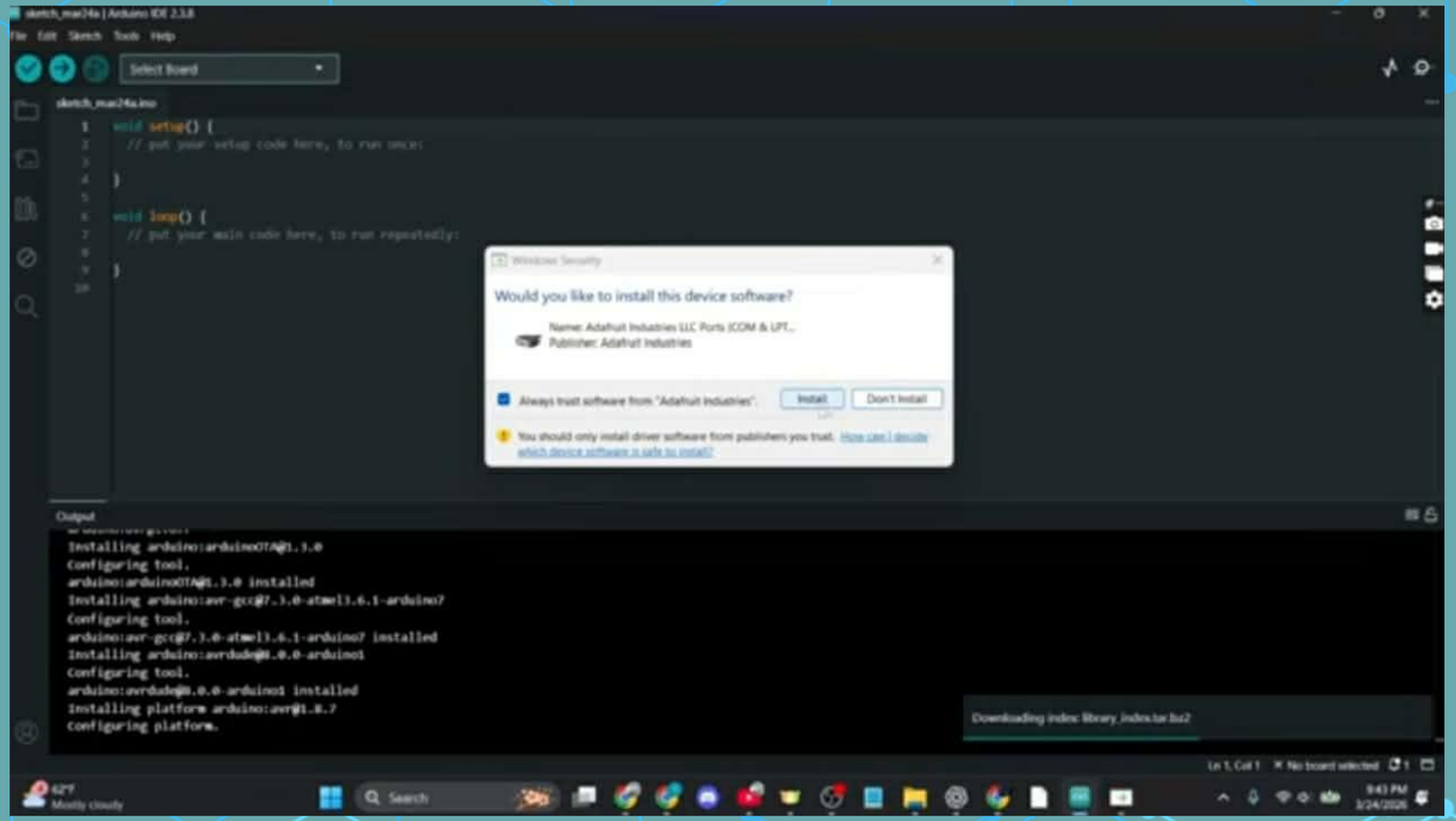

Windows Security
Do you want to allow public and private networks to access this app?
Windows Firewall has blocked some features of Arduino IDE on all public and private networks.
Arduino IDE
Publisher Arduino SA
Show more
Allow
Cancel


sketch_mar24a | Arduino IDE 2.3.8
File Edit Sketch Tools Help
Select Board
sketch_mar24a.ino
void setup() {
// put your setup code here, to run once:
}
void loop() {
// put your main code here, to run repeatedly:
}
Windows Security
Would you like to install this device software?
Name: Adafruit Industries LLC Ports (COM & LPT...
Publisher: Adafruit Industries
Always trust software from "Adafruit Industries".
Install
Don't Install
You should only install driver software from publishers you trust. How can I decide which device software is safe to install?
Output
Installing arduino:arduinoOTA@1.3.0
Configuring tool.
arduino:arduinoOTA@1.3.0 installed
Installing arduino:avr-gcc@7.3.0-atmel3.6.1-arduino7
Configuring tool.
arduino:avr-gcc@7.3.0-atmel3.6.1-arduino7 installed
Installing arduino:avrdude@6.0.0-arduino1
Configuring tool.
arduino:avrdude@6.0.0-arduino1 installed
Installing platform arduino:avr@1.8.7
Configuring platform.
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Mostly cloudy
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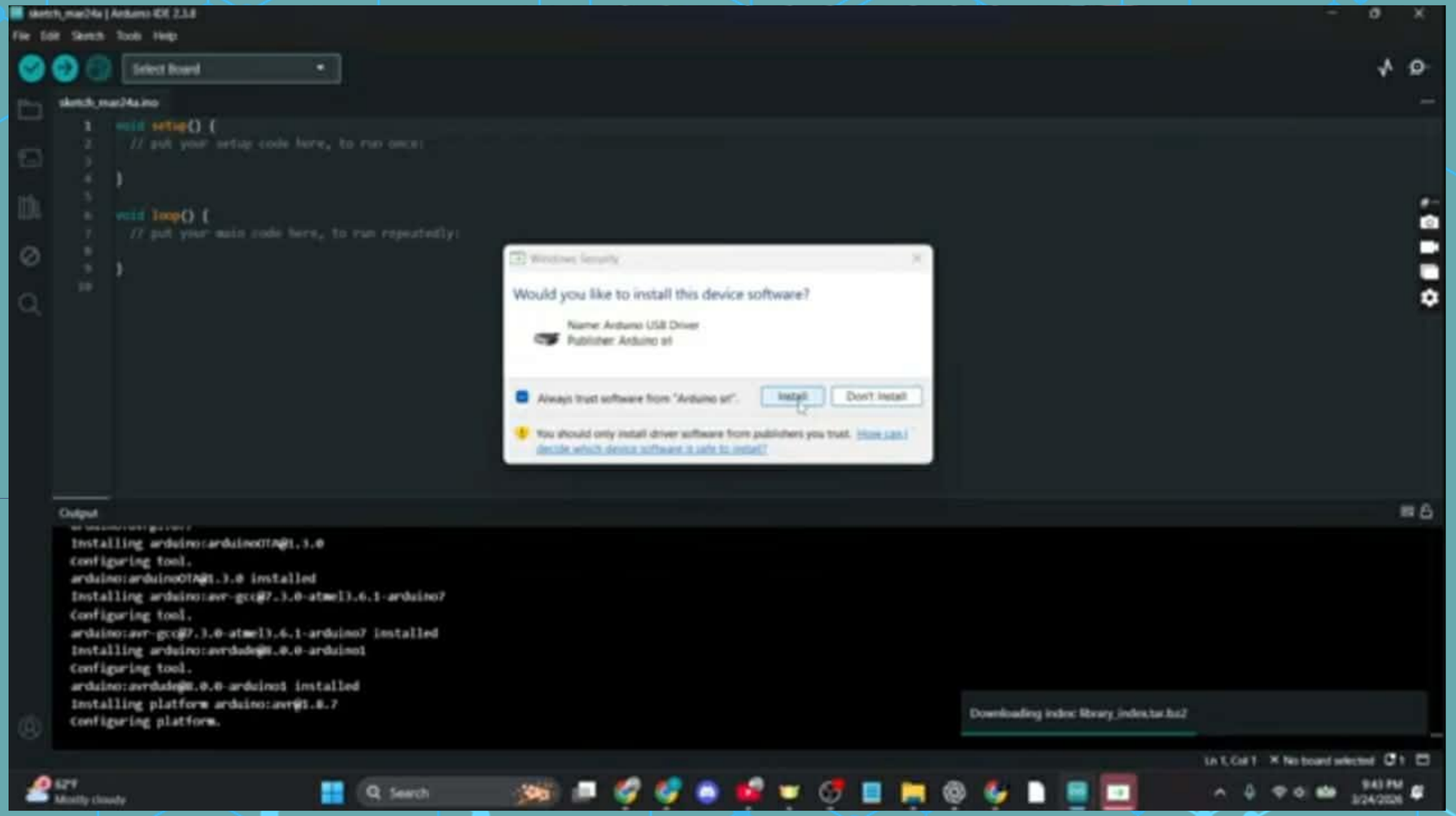
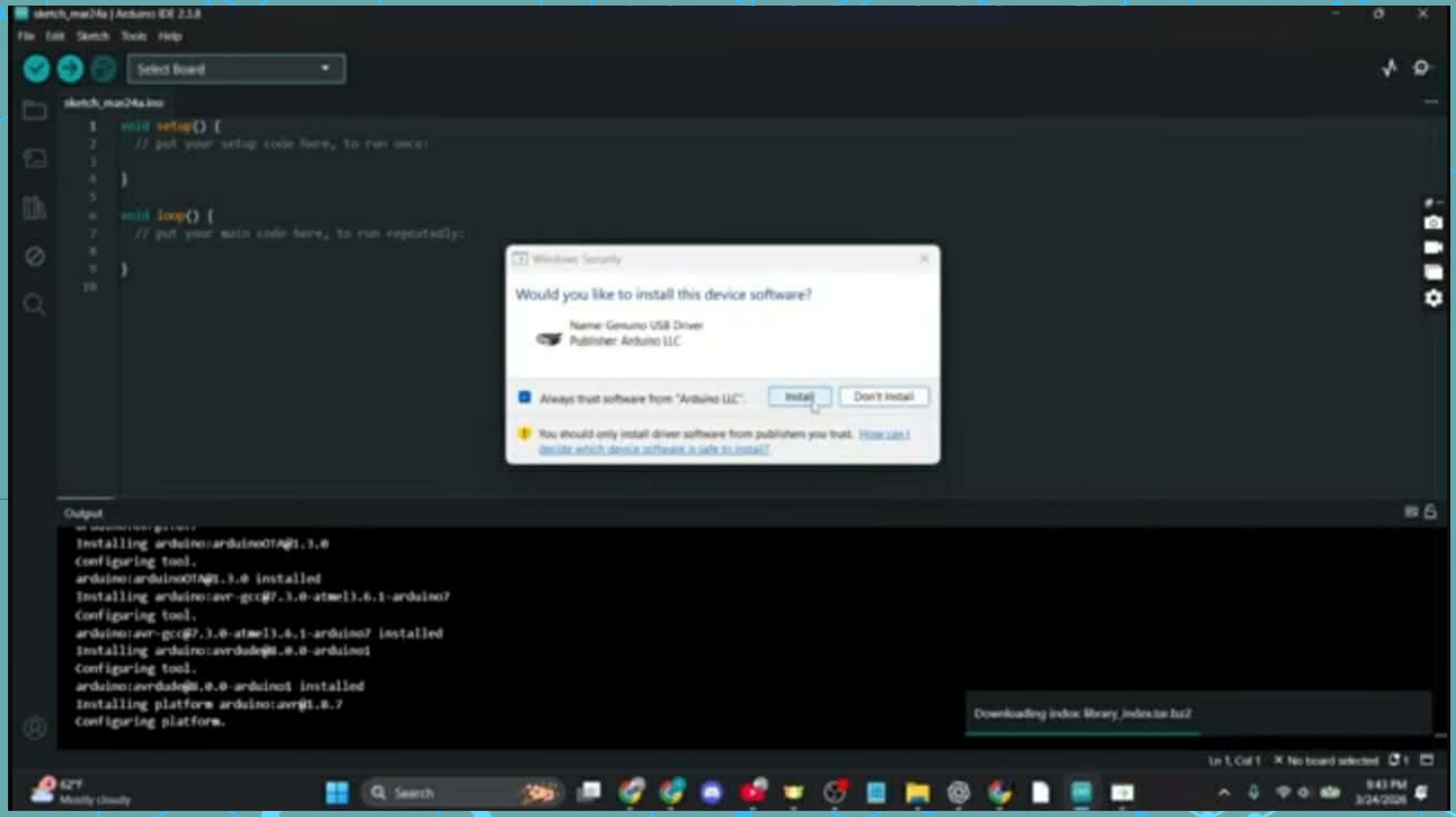

File Edit Sketch Tools Help
Select Board
sketch_mar24a.ino
void setup() {
// put your setup code here, to run once:
}
void loop() {
// put your main code here, to run repeatedly:
}
Would you like to install this device software?
Name: Arduino USB Driver
Publisher: Arduino srl
Always trust software from "Arduino srl".
Install
Don't Install
You should only install driver software from publishers you trust. How can I decide which device software is safe to install?
Output
Installing arduino:arduinoOTA@1.3.0
Configuring tool.
arduino:arduinoOTA@1.3.0 installed
Installing arduino:avr-gcc@7.3.0-atmel3.6.1-arduino7
Configuring tool.
arduino:avr-gcc@7.3.0-atmel3.6.1-arduino7 installed
Installing arduino:avrdude@6.0.0-arduino1
Configuring tool.
arduino:avrdude@6.0.0-arduino1 installed
Installing platform arduino:avr@1.8.7
Configuring platform.
Downloading index: library_index.tar.bz2
Search


sketch_mar24a | Arduino IDE 2.3.8
File Edit Sketch Tools Help
Select Board
sketch_mar24a.ino
void setup() {
// put your setup code here, to run once:
}
void loop() {
// put your main code here, to run repeatedly:
}
Windows Security
Would you like to install this device software?
Name: Genuino USB Driver
Publisher: Arduino LLC
Always trust software from "Arduino LLC".
Install
Don't Install
You should only install driver software from publishers you trust. How can I decide which device software is safe to install?
Output
Installing arduino:arduinoOTA@1.3.0
Configuring tool.
arduino:arduinoOTA@1.3.0 installed
Installing arduino:avr-gcc@7.3.0-atmel3.6.1-arduino7
Configuring tool.
arduino:avr-gcc@7.3.0-atmel3.6.1-arduino7 installed
Installing arduino:avrdude@6.3.0-arduino1
Configuring tool.
arduino:avrdude@6.3.0-arduino1 installed
Installing platform arduino:avr@1.8.7
Configuring platform.
Downloading index library_index.tar.bz2
Ln 1, Col 1
No board selected
Search
9:43 PM
3/24/2026

Configuring the Arduino IDE to Recognize and Communicate with an Arduino Board

After installing the Arduino IDE and the necessary drivers, the Arduino board must be connected to the computer using a USB cable. The Arduino IDE needs to be configured correctly to communicate with the connected board.

First, connect the Arduino board to the computer. Open the Arduino IDE and select the appropriate Arduino board from the Tools > Board menu. The correct board must be selected because different Arduino boards may use different configurations.

Next, select the correct communication port under Tools > Port. The port is used by the computer to communicate with the Arduino board. If the Arduino is properly connected and its driver is installed, the board should appear as an available port.

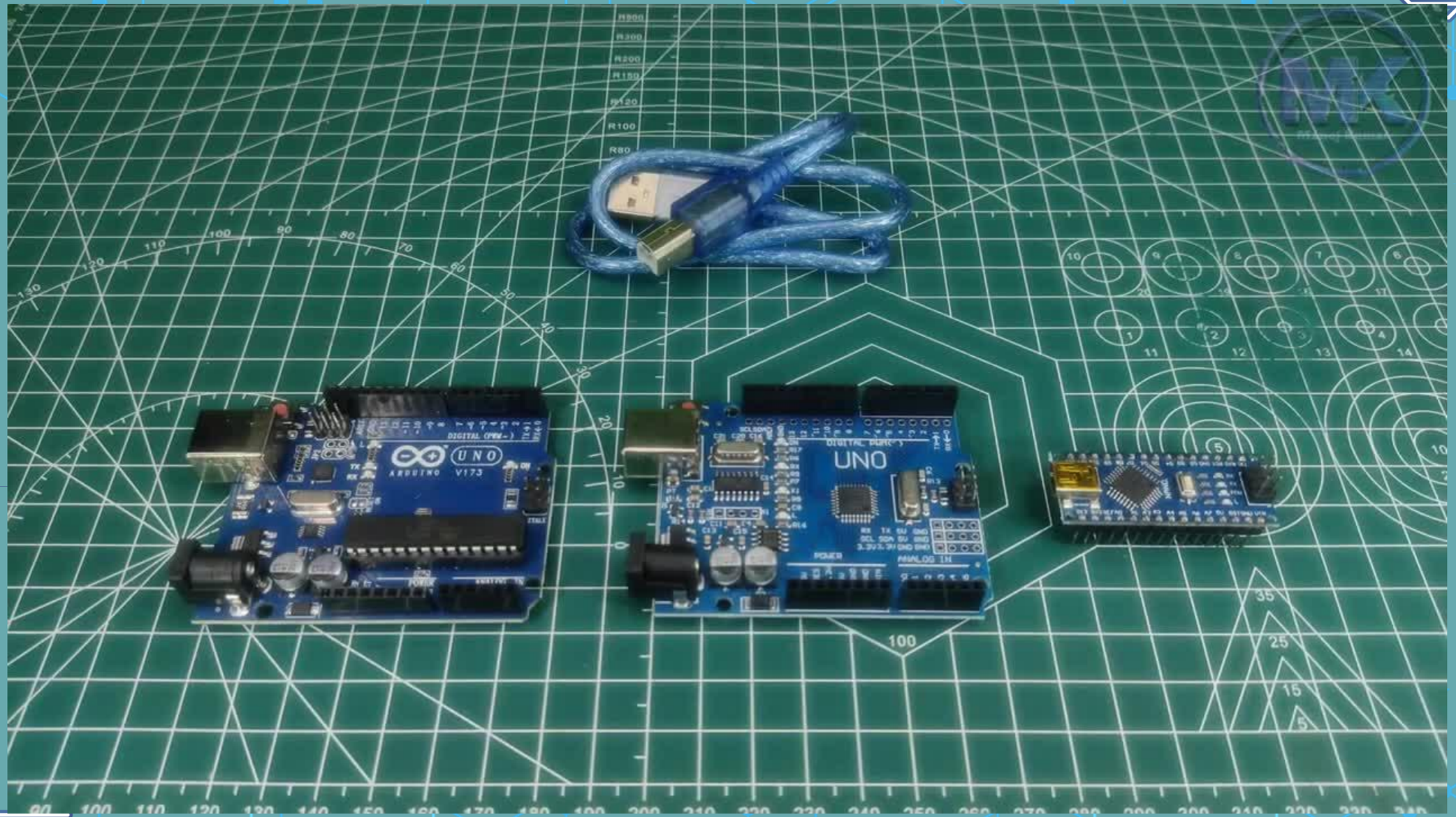
After selecting the board and port, the Arduino IDE is ready to communicate with the Arduino. A simple program can then be compiled and uploaded to check if the configuration is working correctly.

Verifying the Installation by Creating and Uploading a Simple Program

One of the easiest ways to verify an Arduino installation is by using the Blink program. The Blink program makes the built-in LED on the Arduino board turn on and off repeatedly.

A simple Blink program uses the setup() function to configure the LED pin as an output and the loop() function to repeatedly turn the LED on and off. After writing or opening the program, the Verify button can be used to check the code for errors. Once the program successfully compiles, the Upload button can be selected to transfer the program from the computer to the Arduino board.

If the upload is successful, the built-in LED on the Arduino should blink repeatedly. This confirms that the Arduino IDE, drivers, board selection, and communication port are properly configured.


UNO
ARDUINO V173
UNO


Thankyousomuch!