



VG100 Intro to Engineering Lab

VG100 Tech TA Group

University of Michigan - Shanghai Jiaotong University

Joint Institute

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What is Arduino?

WHAT IS ARDUINO?

Arduino is an open-source electronics platform based on easy-to-use hardware and software. It's intended for anyone making interactive projects.



ARDUINO BOARD

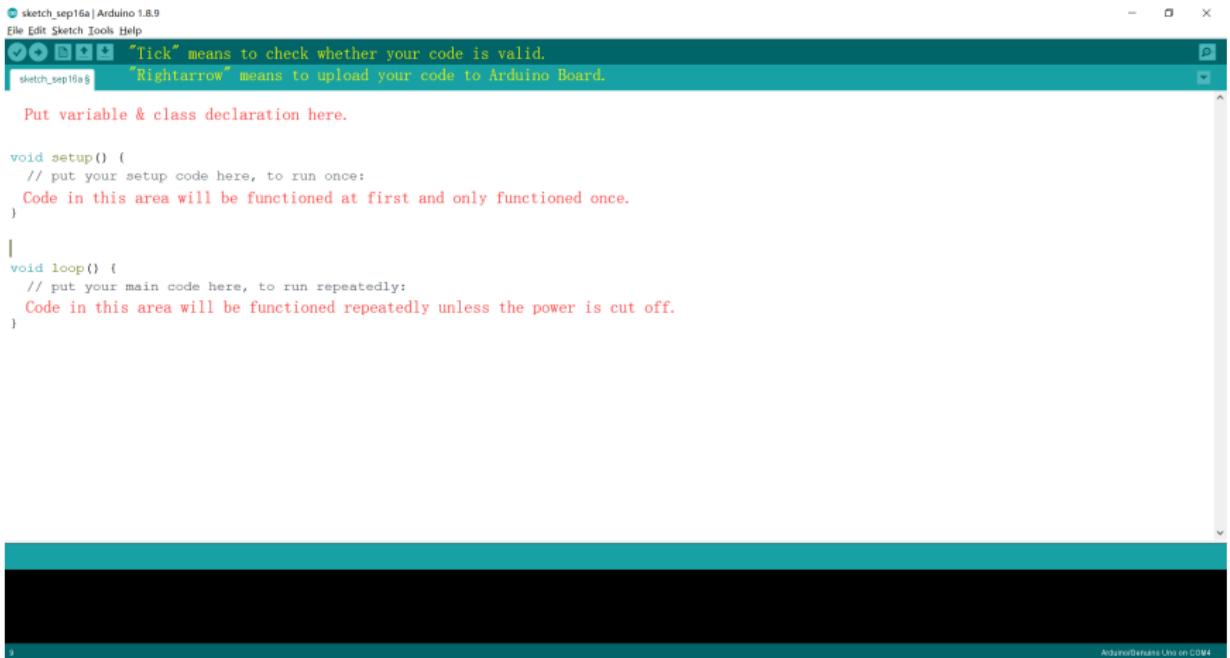
Arduino senses the environment by receiving inputs from many sensors, and affects its surroundings by controlling lights, motors, and other actuators.



ARDUINO SOFTWARE

You can tell your Arduino what to do by writing code in the Arduino programming language and using the Arduino development environment.

Arduino IDE



The screenshot shows the Arduino IDE version 1.8.9. The title bar reads "sketch_sep16a | Arduino 1.8.9". The menu bar includes File, Edit, Sketch, Tools, and Help. A toolbar with icons for file operations is visible above the editor area. The status bar at the bottom right shows "Arduino/Genuino Uno on COM4".

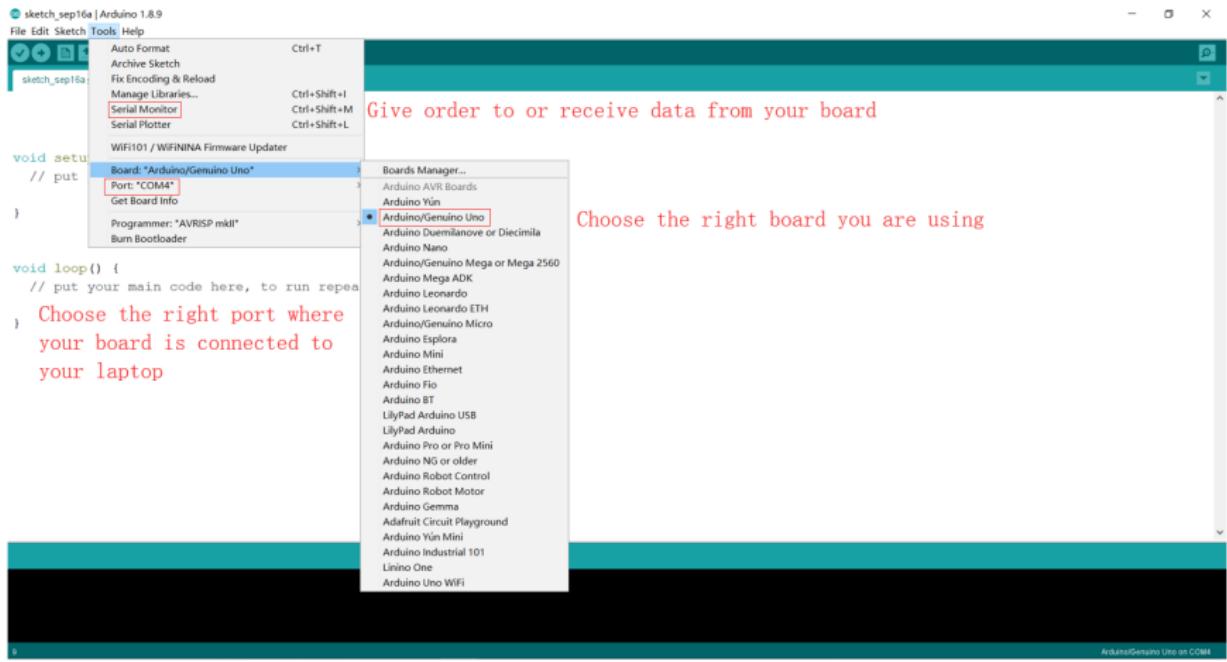
"Tick" means to check whether your code is valid.
"Rightarrow" means to upload your code to Arduino Board.

```
Put variable & class declaration here.

void setup() {
  // put your setup code here, to run once:
  Code in this area will be functioned at first and only functioned once.
}

void loop() {
  // put your main code here, to run repeatedly:
  Code in this area will be functioned repeatedly unless the power is cut off.
}
```

Arduino IDE



The screenshot shows the Arduino IDE interface. The top menu bar includes File, Edit, Sketch, Tools, and Help. The Tools menu is open, showing options like Auto Format, Archive Sketch, Fix Encoding & Reload, Manage Libraries..., Serial Monitor (highlighted with a red box), Serial Plotter, and WiFi101 / WiFiNINA Firmware Updater. Below the menu, a code editor window displays a sketch named "sketch_sep18a" with the following code:

```
sketch_sep18a | Arduino 1.8.9
File Edit Sketch Tools Help
void setup() {
    // put your setup code here, to run
    // once the sketch starts
}
void loop() {
    // put your main code here, to run
    // repeatedly
}

Choose the right port where
your board is connected to
your laptop
```

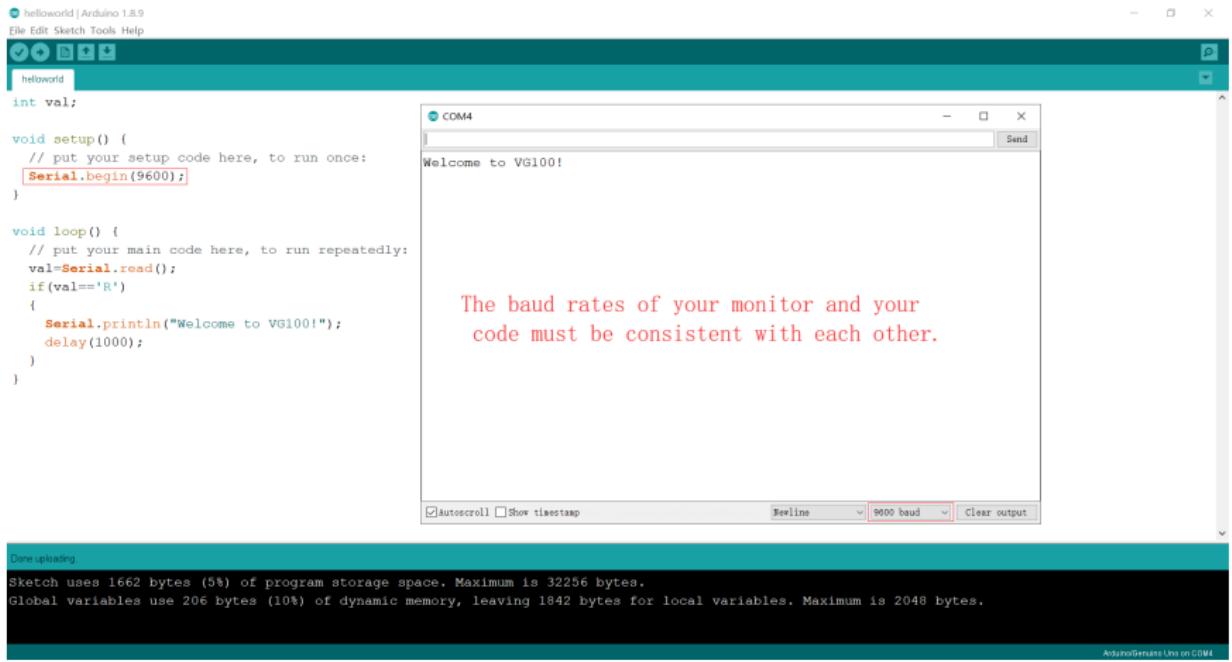
A red box highlights the "Port: "COM4"" option under the Tools menu. A red box also highlights the "Arduino/Genuino Uno" option in the Boards Manager dropdown menu. The Boards Manager list includes:

- Board: "Arduino/Genuino Uno"
- Port: "COM4"
- Get Board Info
- Programmer: "AVRISP mkII"
- Burn Bootloader
- Boards Manager...
- Arduino AVR Boards
- Arduino Yun
- Arduino/Genuino Uno
- Arduino Duemilanove or Diecimila
- Arduino Nano
- Arduino/Genuino Mega or Mega 2560
- Arduino Mega ADK
- Arduino Leonardo
- Arduino Leonardo ETH
- Arduino/Genuino Micro
- Arduino Explora
- Arduino Mini
- Arduino Ethernet
- Arduino Fio
- Arduino BT
- LilyPad Arduino USB
- LilyPad Arduino
- Arduino Pro or Pro Mini
- Arduino NG or older
- Arduino Robot Control
- Arduino Robot Motor
- Arduino Gemma
- Adafruit Circuit Playground
- Arduino Yun Mini
- Arduino Industrial 101
- Linino One
- Arduino Uno WiFi

Below the code editor, a status bar displays "Arduino/Genuino Uno on COM4".

Choose the right board you are using

Arduino IDE



The screenshot shows the Arduino IDE interface. On the left, the code editor displays a sketch named "helloworld". The code contains a setup function that initializes the Serial port at 9600 baud and a loop function that reads from the serial port. If the input is 'R', it prints "Welcome to VG100!" and delays for 1000ms. On the right, the serial monitor window titled "COM4" shows the message "Welcome to VG100!". Below the monitor, a note in red text states: "The baud rates of your monitor and your code must be consistent with each other." At the bottom of the IDE, status messages indicate "Done uploading" and provide memory usage details: "Sketch uses 1662 bytes (5%) of program storage space. Maximum is 32256 bytes." and "Global variables use 206 bytes (10%) of dynamic memory, leaving 1842 bytes for local variables. Maximum is 2048 bytes." A note at the bottom right says "Arduino/Genuine Uno on COM4".

```
helloworld | Arduino 1.8.9
File Edit Sketch Tools Help
helloworld
int val;

void setup() {
  // put your setup code here, to run once:
  Serial.begin(9600);
}

void loop() {
  // put your main code here, to run repeatedly:
  val=Serial.read();
  if(val=='R')
  {
    Serial.println("Welcome to VG100!");
    delay(1000);
  }
}
```

COM4

Welcome to VG100!

The baud rates of your monitor and your code must be consistent with each other.

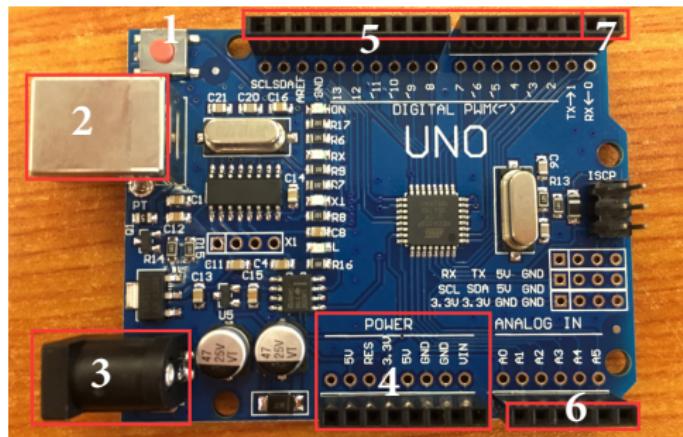
Autoscroll Show timestamp Newline 9600 baud Clear output

Done uploading

Sketch uses 1662 bytes (5%) of program storage space. Maximum is 32256 bytes.
Global variables use 206 bytes (10%) of dynamic memory, leaving 1842 bytes for local variables. Maximum is 2048 bytes.

Arduino/Genuine Uno on COM4

Intro to Arduino Uno Board

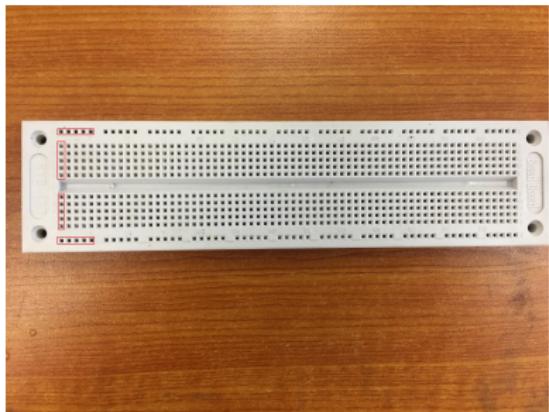


1. Reset Button
2. USB Port
3. 9V DC Voltage Port
4. Power I/O
5. Digital I/O (PWM)
6. Analog I/O
7. Serial Communications

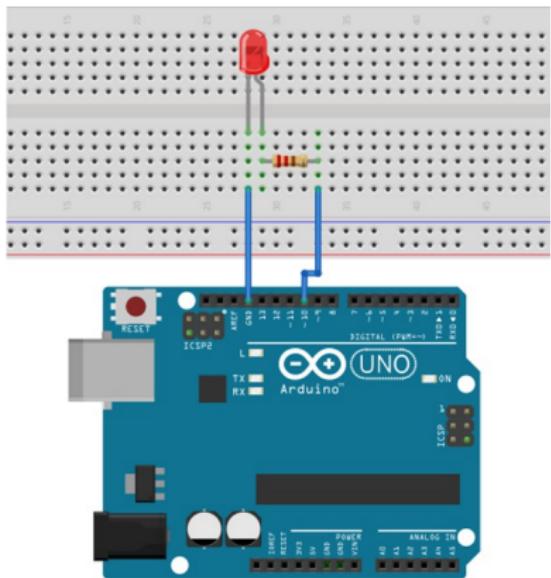
Hello World

```
1 char val;
2 void setup(){
3     Serial.begin(9600);
4 }
5 void loop(){
6     val=Serial.read();
7     if(val=='R'){
8         Serial.println("Hello World!");
9         delay(1000);
10    }
11 }
```

Intro to Bread Board



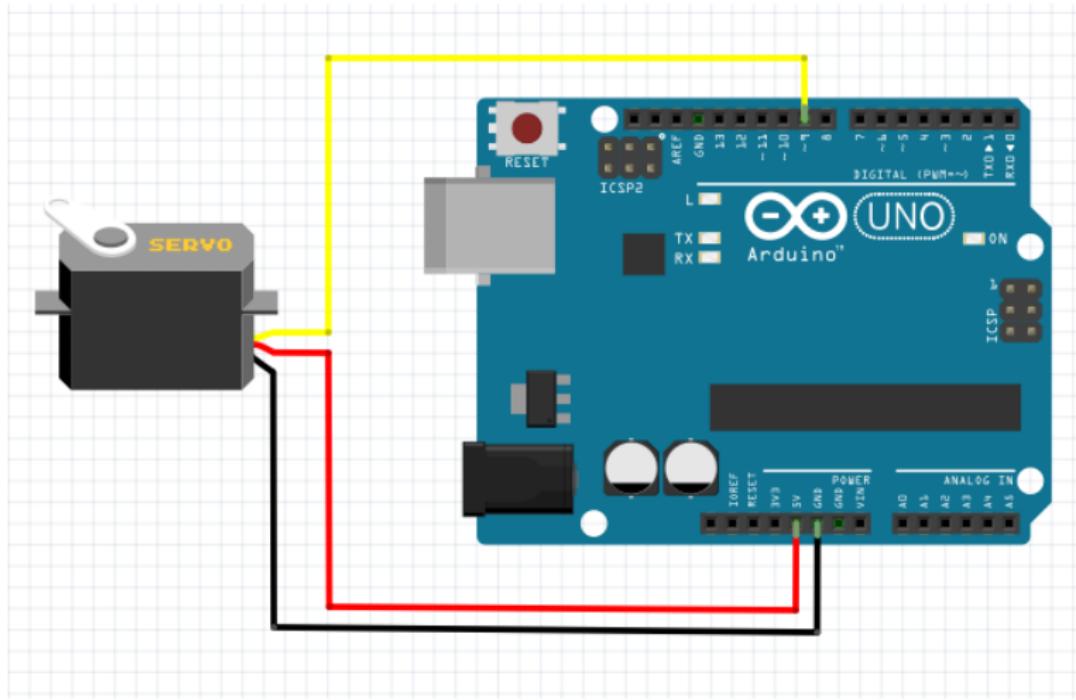
Led Experiment



Led Experiment

```
1 int ledPin = 10;
2 void setup(){
3     pinMode(ledPin, OUTPUT);
4 }
5 void loop(){
6     digitalWrite(ledPin, HIGH);
7     delay(1000);
8     digitalWrite(ledPin, LOW);
9     delay(1000);
10 }
```

Servo Motor



Servo Motor

```
1 #include<Servo.h>
2 Servo myservo;
3 int pos = 15;
4 void setup(){
5     myservo.attach(9);
6 }
7 void loop(){
8     for(pos = 15; pos < 165; pos += 1){
9         myservo.write(pos);
10        delay(15);
11    }
12    for(pos = 165; pos > 15; pos -= 1){
13        myservo.write(pos);
14        delay(15);
15    }
16 }
```

Test Your Knowledge

Develop a system which functions in the following way:

When enter "A", led A will be on and the servo motor will rotate clockwise 90 degrees and after the rotation the led will be off.

When enter "B", led B will be on and the servo motor will rotate counter-clockwise 90 degrees and after the rotation, the led will be off.

Reference

1. <https://www.arduino.cc/>
2. VG100 2018FA Lab Slides