

# Building Arduino Applications

## Day 1

Welcome to the course! During Day 1, we are going to introduce you to the course (go through the Introduction, that is very important). Then we shall start our work: getting acquainted with Arduino, the development environment and our first components. You will learn how to assemble circuits on a breadboard and will write your first program and assemble your first device.

1.1 Overview of the Day

1.2 How to assemble a circuit on a breadboard circuit?

1.3. Let us get acquainted with Arduino

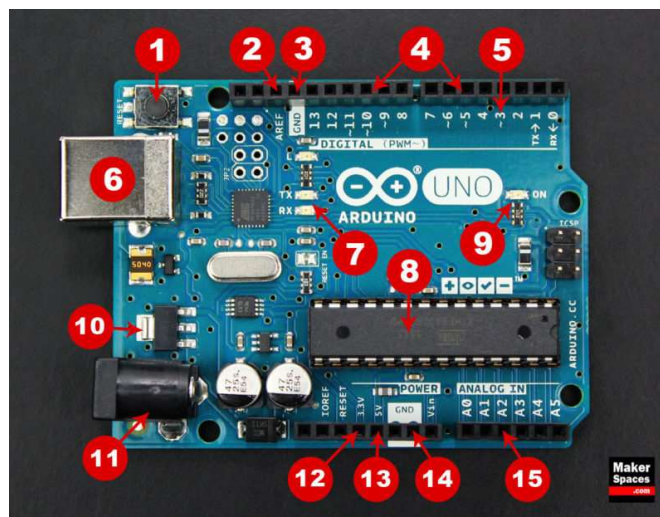
1.4. Development tools for Arduino IDE

1.5. First glance at a program

1.6. First coded material

1.7. Macro definitions, variables, counting loops.

## Arduino Uno

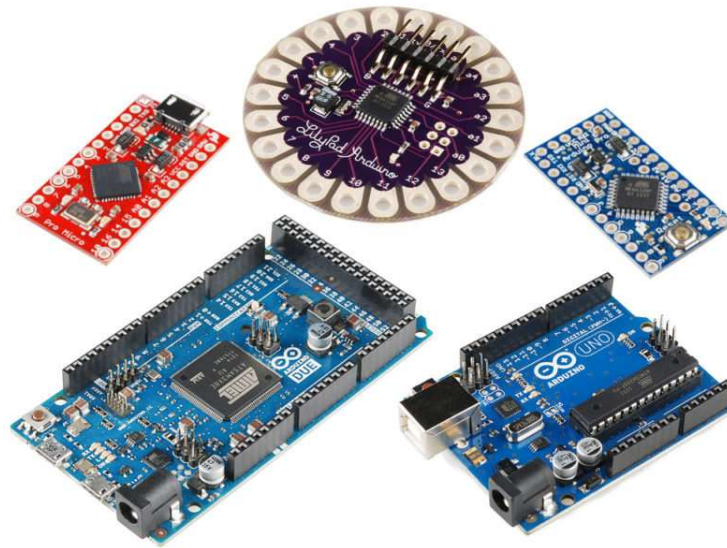


## Board Breakdown

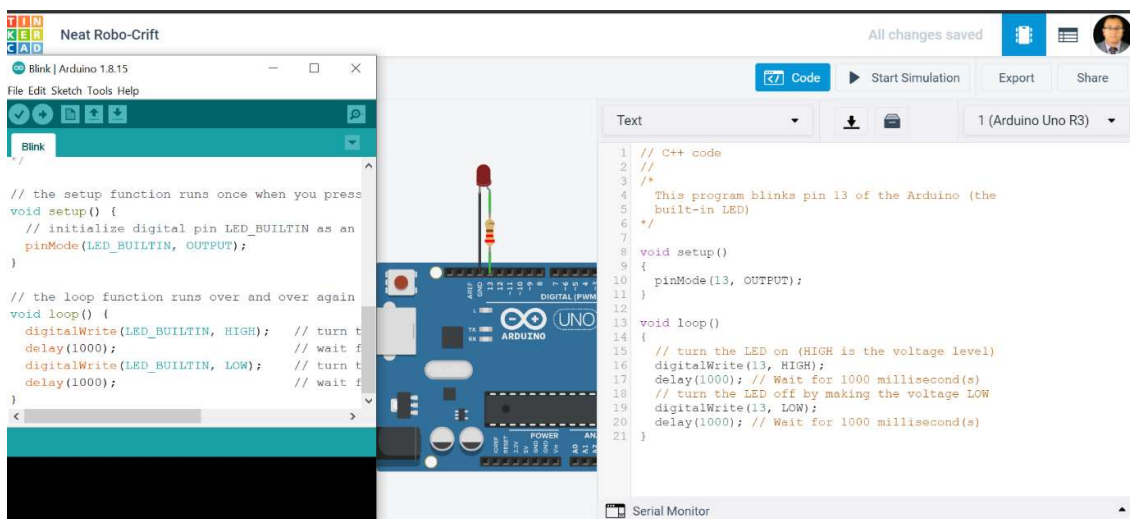
Here are the components that make up an Arduino board and what each of their functions are.

1. **Reset Button** – This will restart any code that is loaded to the Arduino board
2. **AREF** – Stands for “Analog Reference” and is used to set an external reference voltage
3. **Ground Pin** – There are a few ground pins on the Arduino and they all work the same
4. **Digital Input/Output** – Pins **0-13** can be used for digital input or output
5. **PWM** – The pins marked with the (~) symbol can simulate analog output
6. **USB Connection** – Used for powering up your Arduino and uploading sketches
7. **TX/RX** – Transmit and receive data indication LEDs
8. **ATmega Microcontroller** – This is the brains and is where the programs are stored
9. **Power LED Indicator** – This LED lights up anytime the board is plugged in a power source
10. **Voltage Regulator** – This controls the amount of voltage going into the Arduino board
11. **DC Power Barrel Jack** – This is used for powering your Arduino with a power supply
12. **3.3V Pin** – This pin supplies **3.3** volts of power to your projects
13. **5V Pin** – This pin supplies **5** volts of power to your projects
14. **Ground Pins** – There are a few ground pins on the Arduino and they all work the same
15. **Analog Pins** – These pins can read the signal from an analog sensor and convert it to digital

## Types of Arduino Boards



## How To Program Arduino



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

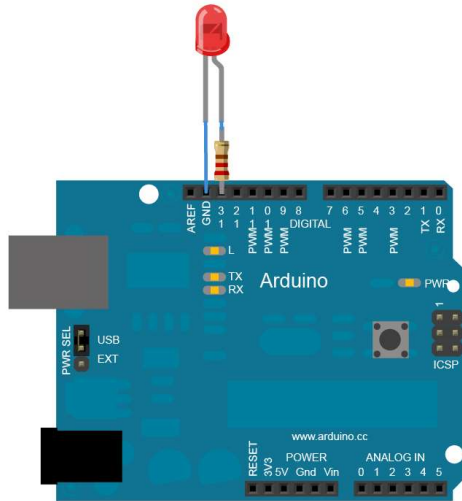
<https://www.tinkercad.com/dashboard>

<https://www.sites.google.com/site/unoardusim/services>

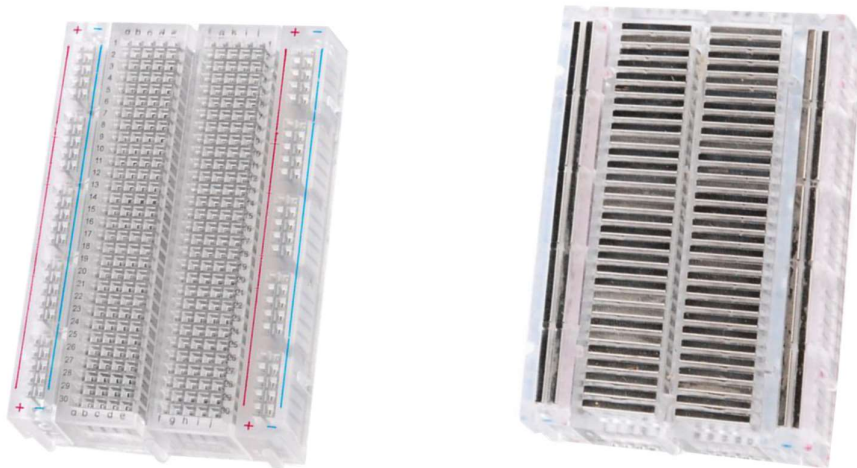
<https://www.makerspaces.com/arduino-uno-tutorial-beginners/>

## List of experiments

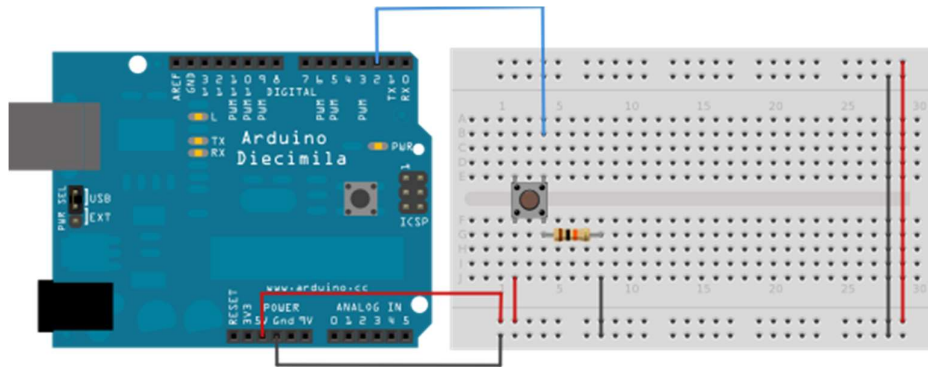
1. TUTORIALS > Built-In Examples > **01.Basics** > Blink
2. TUTORIALS > Built-In Examples > **03.Analog** > Fading



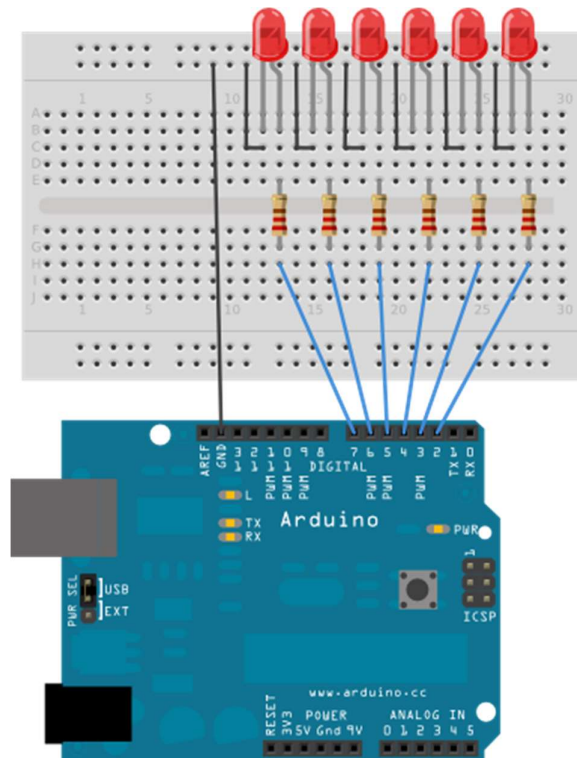
## What's a Breadboard?



3. [TUTORIALS](#) > [Built-In Examples](#) > **02.Digital** > Button
4. [TUTORIALS](#) > [Built-In Examples](#) > **02.Digital** > StateChangeDetection



5. [TUTORIALS](#) > [Built-In Examples](#) > **05.Control** > ForLoopIteration



# Day 2

It's time to learn how to receive data with the help of sensors. During Day 2, we will teach you how to read off digital and analog signals, exchange data with a computer, create more complex algorithms, and use new output devices.

**2.1.** Day overview

**2.2.** First sensor

**2.3.** How to read off analog signals

**2.4.** Reading off digital signals

**2.5.** Boolean expressions and program branching

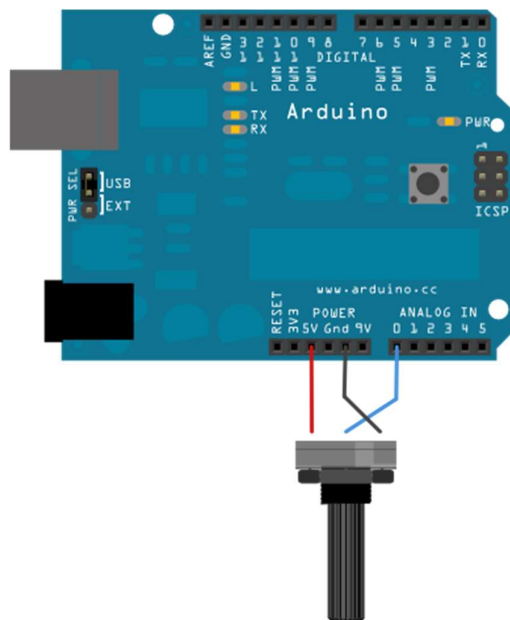
**2.6.** Seven-segment display

**2.7.** Usage of modules

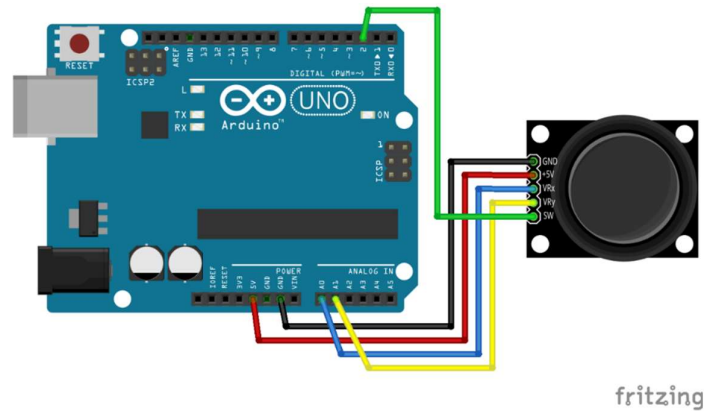
**2.8.** Joystick app and testing

## List of experiments

1. TUTORIALS > Built-In Examples > **03.**Analog > AnalogInput



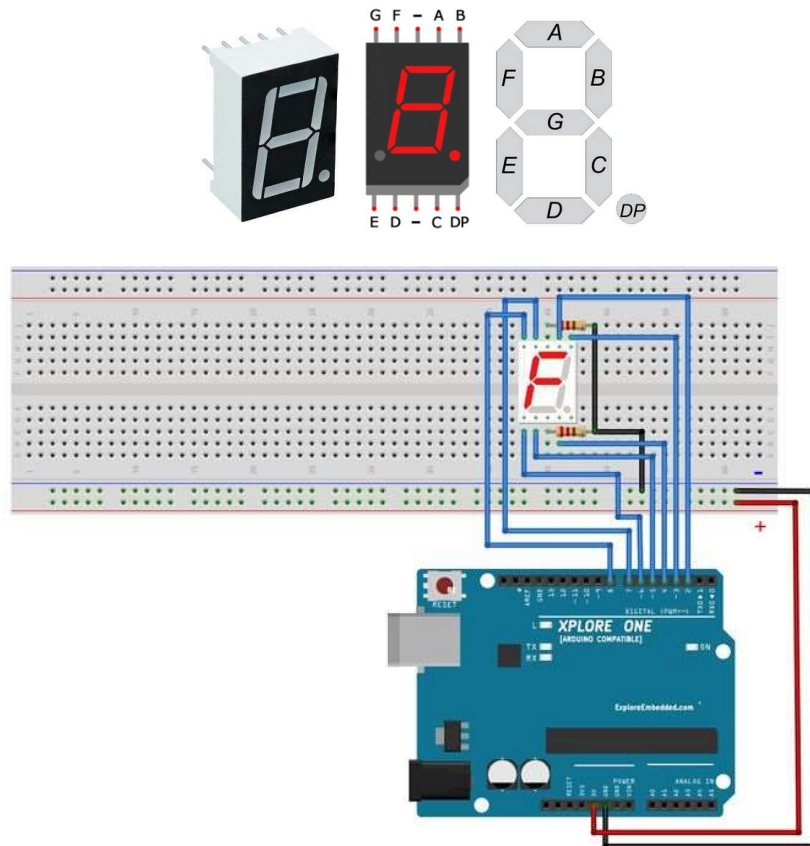
## 2. JOYSTICK Control



Code: Lesson 12 Analog Joystick Module

<https://github.com/afai79/Arduino/blob/main/Books/Elegoo.rar>

## 3. 7 SEGMENT

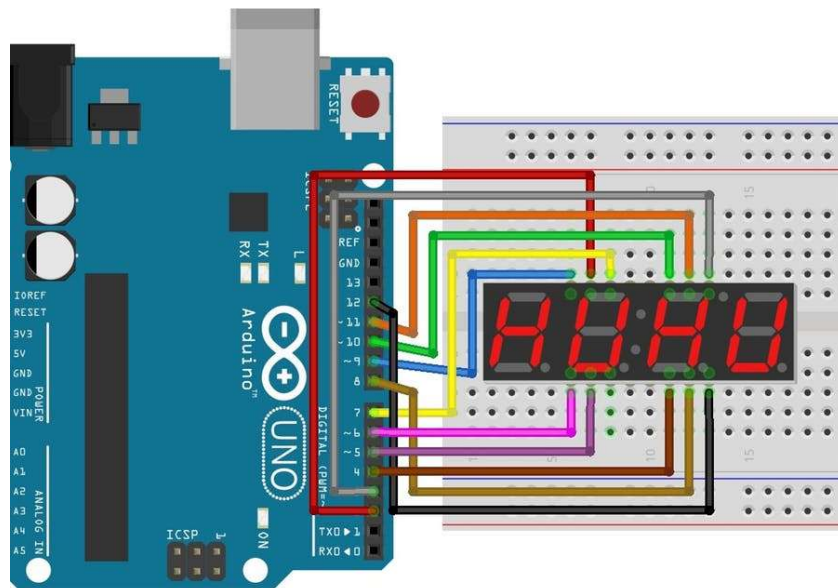
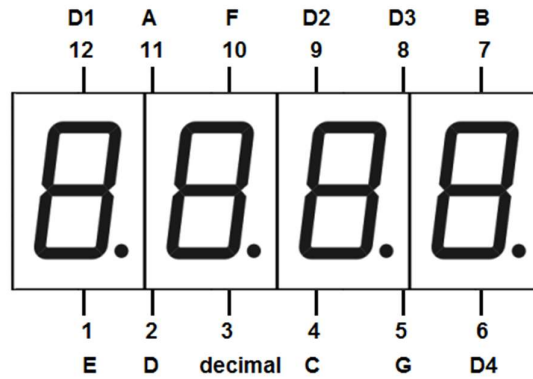
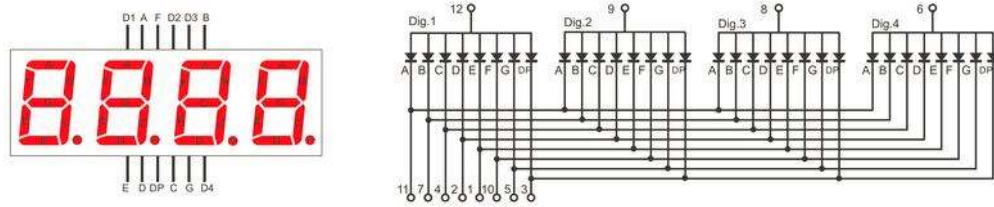


Code

[https://github.com/afai79/Arduino/blob/main/7\\_segment.ino](https://github.com/afai79/Arduino/blob/main/7_segment.ino)



#### 4. Four Digital Seven Segment Display

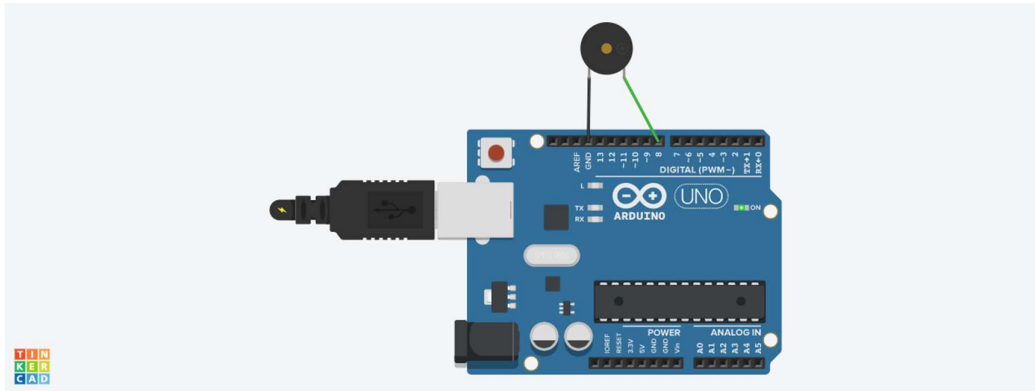


Code

[https://github.com/afai79/Arduino/blob/main/4\\_digit\\_7\\_segment.ino](https://github.com/afai79/Arduino/blob/main/4_digit_7_segment.ino)



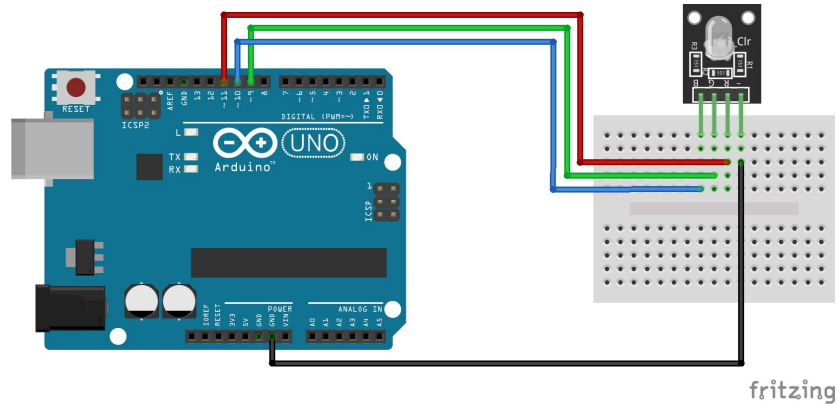
## 5. Tone Melody



<https://www.arduino.cc/en/Tutorial/BuiltInExamples/toneMelody>

<https://github.com/afai79/Arduino/blob/main/Lib/pitches.zip>

## 6. RGB sensor



**Code: Lesson 4 RGB LED**

<https://github.com/afai79/Arduino/blob/main/Books/Elegoo.rar>

## Day 3

Having learnt to create a step motor, you can create devices which can perform very precise actions. It could as well be just messing with your hand with which you are trying to control it.

**3.1.** Day overview

**3.2.** Humidity sensor

**3.3.** Arduino -> I2C

**3.4.** RGB and Water level Sensors

**3.5.** Servo and the library

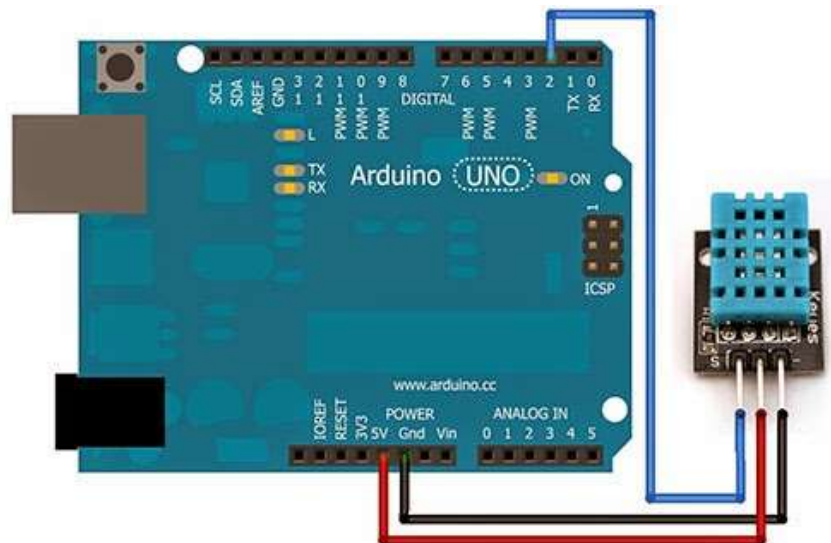
**3.6.** Step motor

**3.7.** Motor control expansion board

**3.8.** Monitoring system

### List of experiments

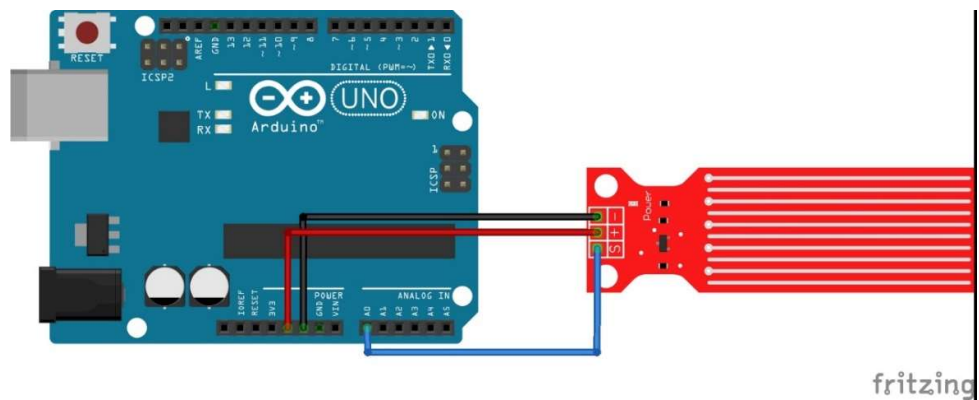
1. Temperature and humidity sensor



Code: [Lesson 11 DHT11 Temperature and Humidity Sensor](#)

<https://github.com/afai79/Arduino/blob/main/Books/Elegoo.rar>

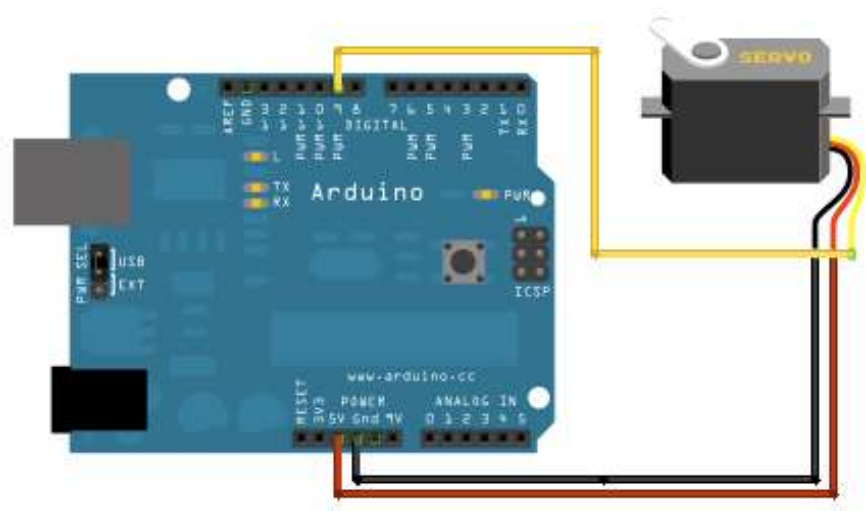
## 2. Water level Sensor



## Code

<https://www.thegeekpub.com/236571/arduino-water-level-sensor-tutorial/>

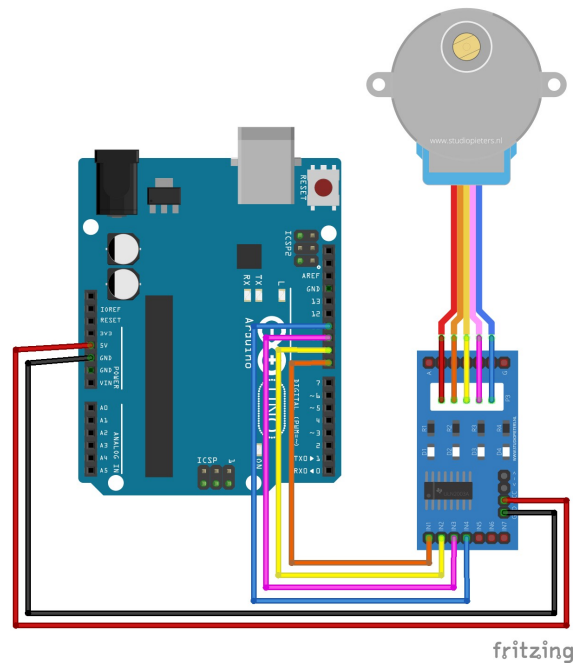
## 3. Servo motor control



## Code: Lesson 9 Servo

<https://github.com/afai79/Arduino/blob/main/Books/Elegoo.rar>

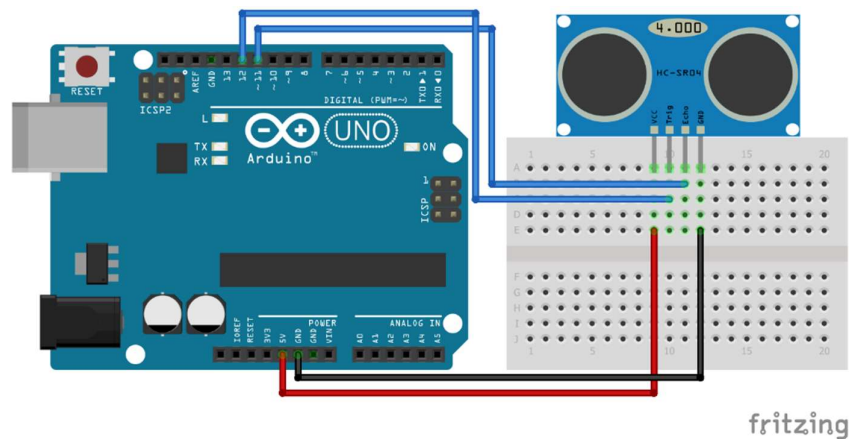
#### 4. Stepper motor



**Code: Lesson 23 Stepper Motor**

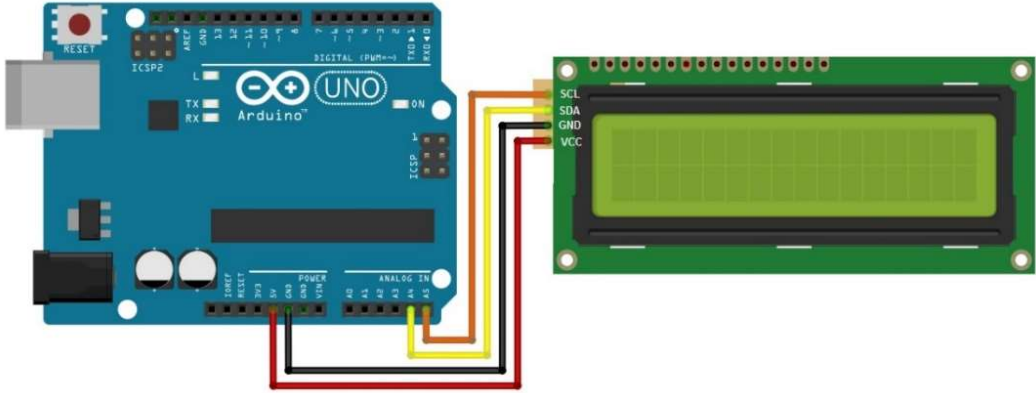
<https://github.com/afai79/Arduino/blob/main/Books/Elegoo.rar>

#### 5. Ultrasonic Sensor

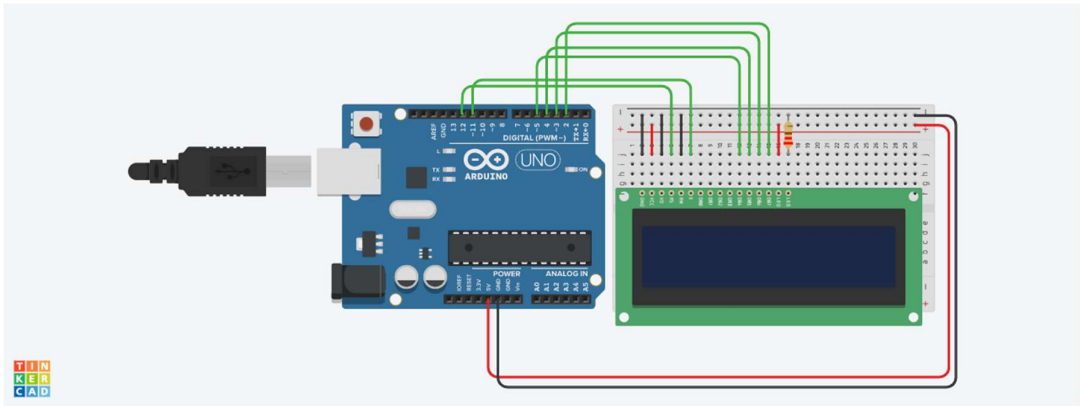


<https://github.com/afai79/Arduino/blob/main/Ultrasonic.ino>

## 6. LCD and LCD with I2C



[https://github.com/afai79/Arduino/blob/main/LCD\\_I2C.ino](https://github.com/afai79/Arduino/blob/main/LCD_I2C.ino)



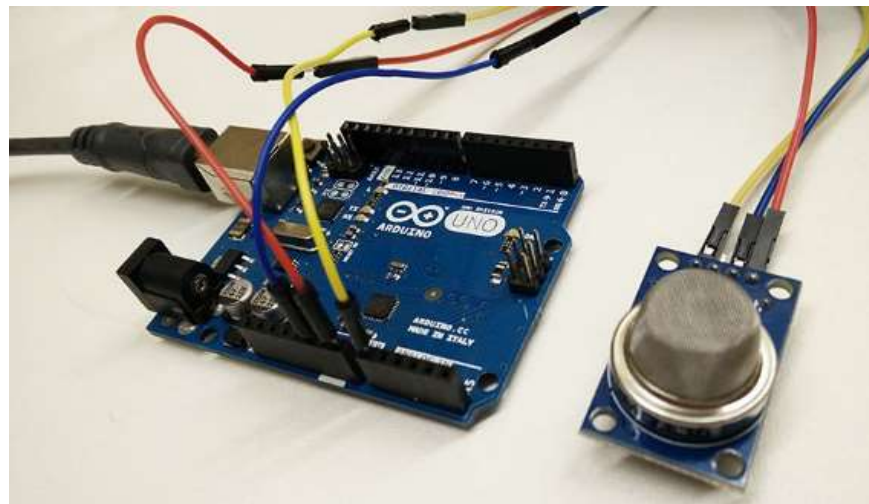
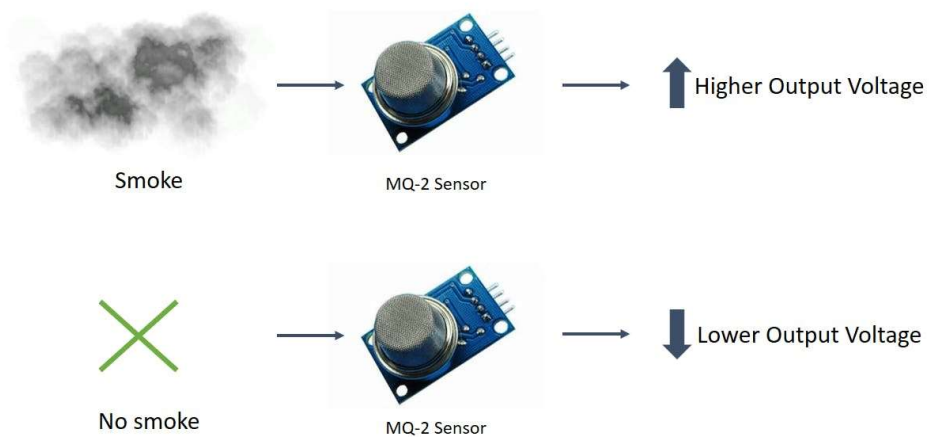
<https://github.com/afai79/Arduino/blob/main/LCD.ino>

## Day 4

Having learnt to use a lot of sensors and devices with Arduino, during Day 4, you are ready to make various small projects based on your skills.

### Small Project 1: Air Quality Detector

#### Gas Sensor

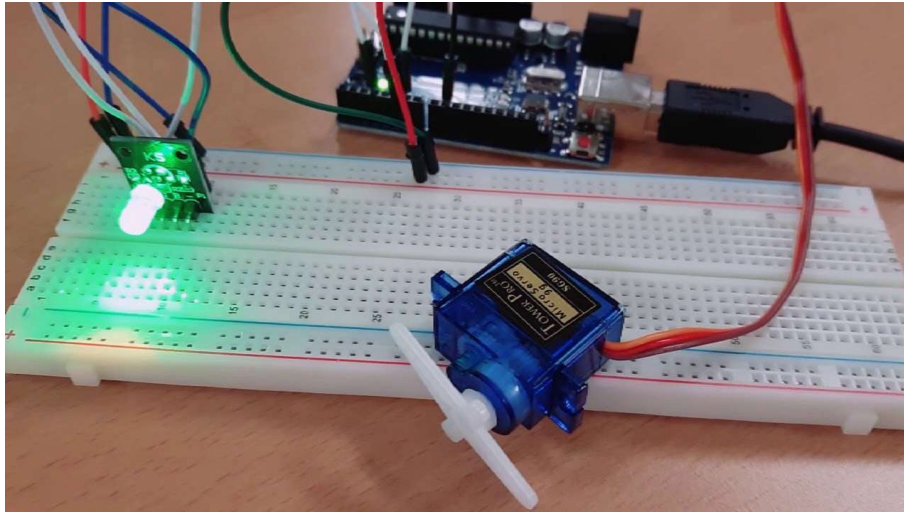


[https://github.com/afai79/Arduino/blob/main/Gas\\_sensor.ino](https://github.com/afai79/Arduino/blob/main/Gas_sensor.ino)

[https://github.com/afai79/Arduino/blob/main/Gas\\_sensor-LED-Motor.ino](https://github.com/afai79/Arduino/blob/main/Gas_sensor-LED-Motor.ino)



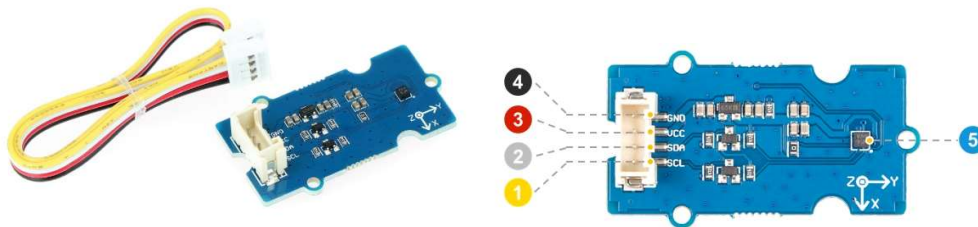
## Small Project 2: Control servo motor by RGB sensor



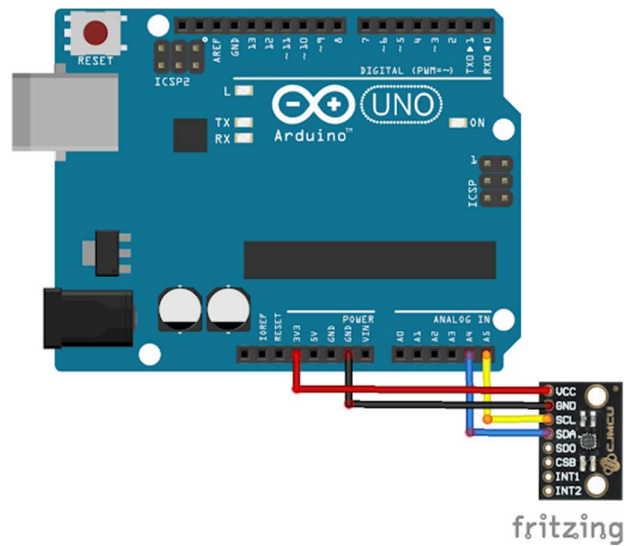
[https://github.com/afai79/Arduino/blob/main/RGB\\_LED-motor.ino](https://github.com/afai79/Arduino/blob/main/RGB_LED-motor.ino)

## Small Project 3: BMA400 and MPU6050 sensors-based projects

**Grove - 3-axis digital accelerometer  $\pm 16$  g low power (BMA400)**



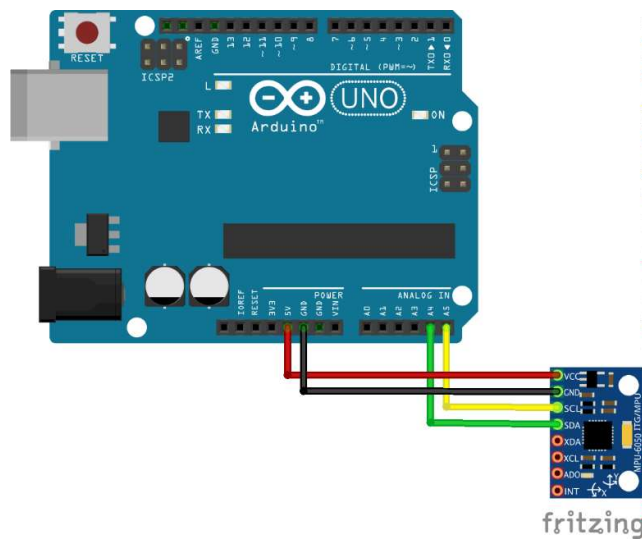
PIN	DESCRIPTION
1.	SCL - clock line I2C
2.	SDA - I2C data line
3.	System power supply from 3.3 V to 5 V
4.	System weight
5.	BMA400 module



[https://github.com/afai79/Arduino/blob/main/Lib/BlueDot\\_BMA400\\_Library-1.0.0.zip](https://github.com/afai79/Arduino/blob/main/Lib/BlueDot_BMA400_Library-1.0.0.zip)

[https://github.com/afai79/Arduino/blob/main/Lib/Grove\\_3Axis\\_Digital\\_Accelerometer\\_BMA400-master.zip](https://github.com/afai79/Arduino/blob/main/Lib/Grove_3Axis_Digital_Accelerometer_BMA400-master.zip)

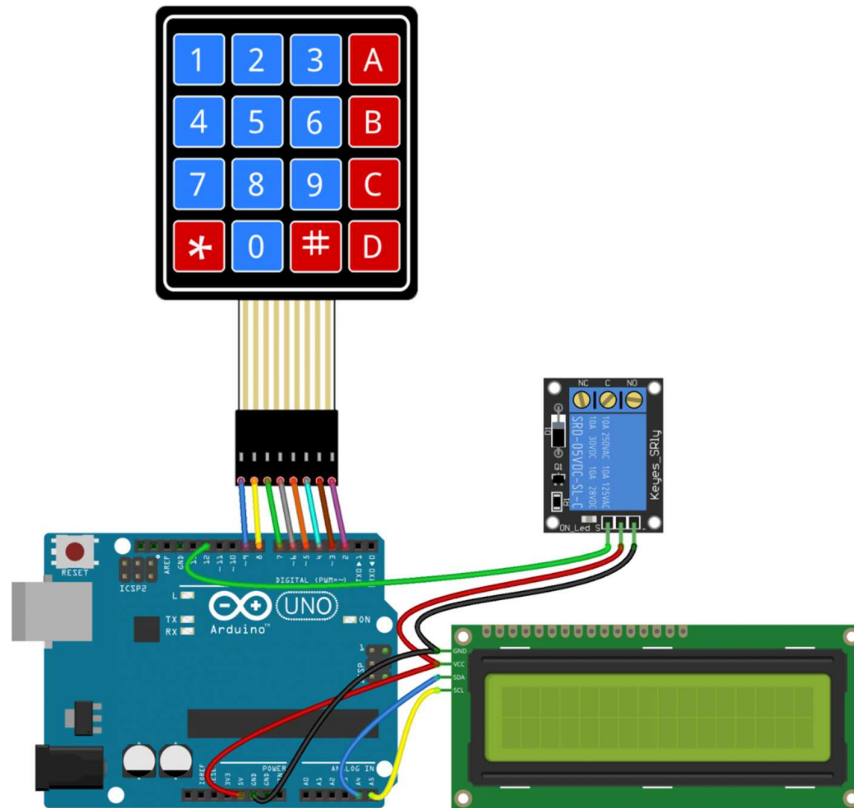
## MPU6050 Triple Axis Gyroscope & Accelerometer



<https://github.com/afai79/Arduino/blob/main/Lib/Arduino-MPU6050-master.zip>

## Small Project 4: Security system

(USE A PASSWORD TO ACTIVATE A RELAY)



<https://www.circuitbasics.com/how-to-set-up-a-keypad-on-an-arduino/>

[https://github.com/afai79/Arduino/blob/main/Security\\_System.ino](https://github.com/afai79/Arduino/blob/main/Security_System.ino)

# Day 5

## Arduino Robot – An easy DIY project

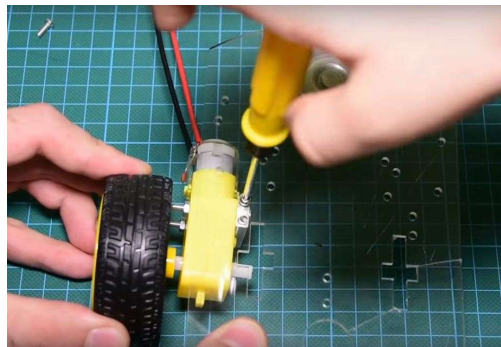
We are going to build an Arduino based robot capable of avoiding obstacles in its path. It is a fun project and a great learning experience, so without any further delay, let us get started!

<https://educ8s.tv/arduino-robot-easy-diy-project/>

<https://github.com/afai79/Arduino/tree/main/ArduinoRobot>

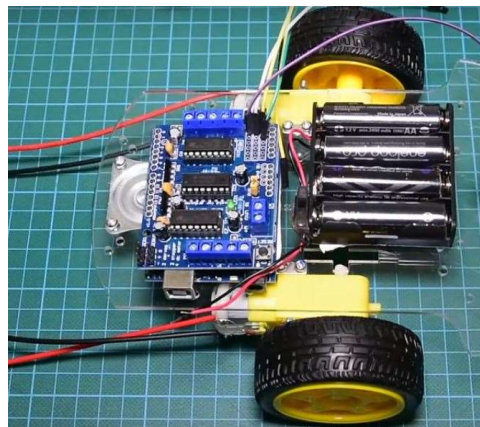
## Building the Robot

**Step 1. Connect the motor and wheels to the chassis.**



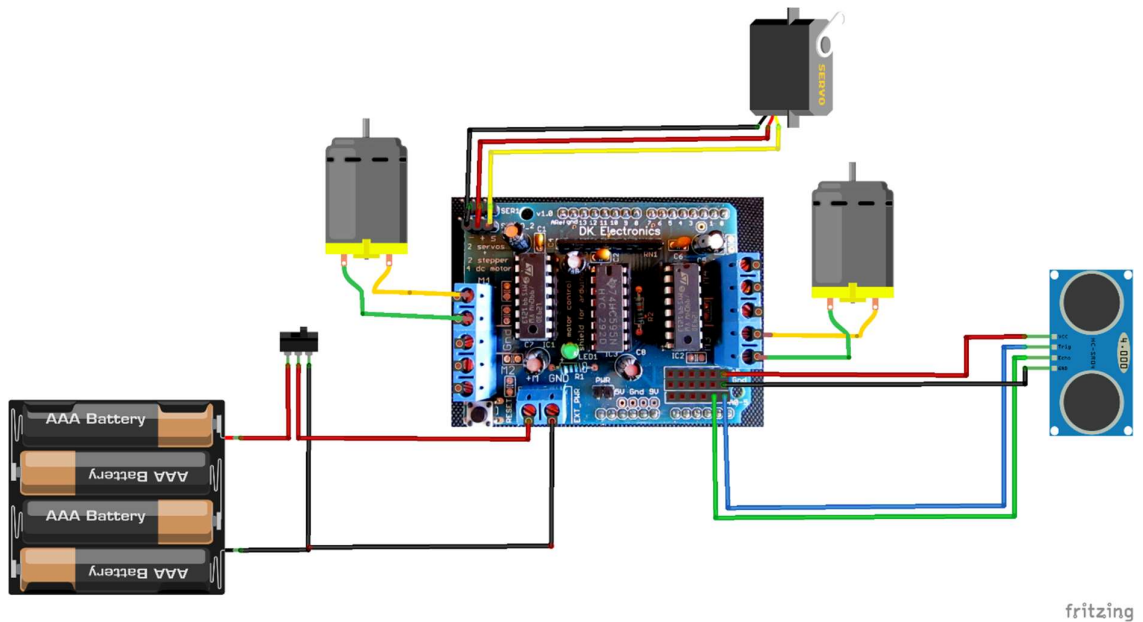
**Step 2: Prepare the Switch and connect the Power Source**

**Step 3: Mount other Parts on the chassis.**



## Schematics

Wire up the components together as shown in the image below.



## Code

The code uses three libraries. Two of them must be downloaded in order for the program to compile. The first one is the motor shield driver from Adafruit. The second library is the NewPing library for the supersonic distance sensor.

<https://github.com/afai79/Arduino/blob/main/ArduinoRobot/ArduinoRobot.ino>

## LIBRARIES

**Motor Shield Library:**

<https://github.com/afai79/Arduino/blob/main/ArduinoRobot/Adafruit-Motor-Shield-library-master.zip>

**New Ping Library:**

[https://github.com/afai79/Arduino/blob/main/ArduinoRobot/NewPing\\_v1.9.1.zip](https://github.com/afai79/Arduino/blob/main/ArduinoRobot/NewPing_v1.9.1.zip)