Embedded System Workshops

0A. Introduction to Arduino and Components

CCA Girls Who Code

Course Expectations

Today's Agenda

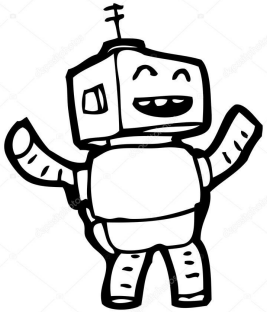
- Program Information
  - GitHub, Registration Form
  - Team and Contact Info
- Overview of Content and Meeting Format
- Introduction to Arduino
- Introduction to components

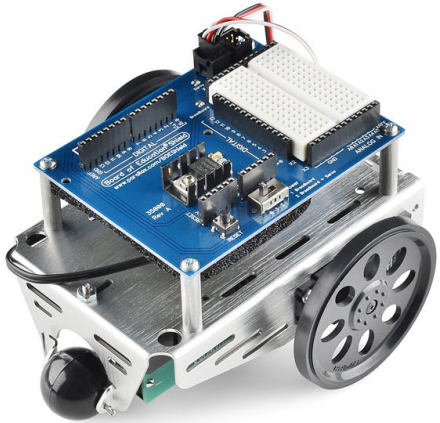
Program Information

- Introduction to Embedded Systems
- Meetings every Friday from 4:00-5:00 PM
- Virtual meetings through Google Meet
- Program Dates: February 5th - early May
- Instructors: Stefan Prestrelski, Sarah Luo
- Materials
  - Computer with internet connection
  - GitHub account
  - Elegoo's Super Starter Kit ($37)

Purpose

- Due to COVID-19, in-person robotics meetings and thus competitions have become less feasible given social distancing restrictions
- Remotely connect with team members and gain relevant mechanical, electrical, and programming experience





Contact Information

- Website: ccagirlswhocode.weebly.com
- Email: ccagirlswhocode@gmail.com
- Join our Discord: discord.gg/FMVmMmh
- Follow us on Instagram: @ccagirlswhocode
- Connect with us on Facebook: @ccagwcravenettes

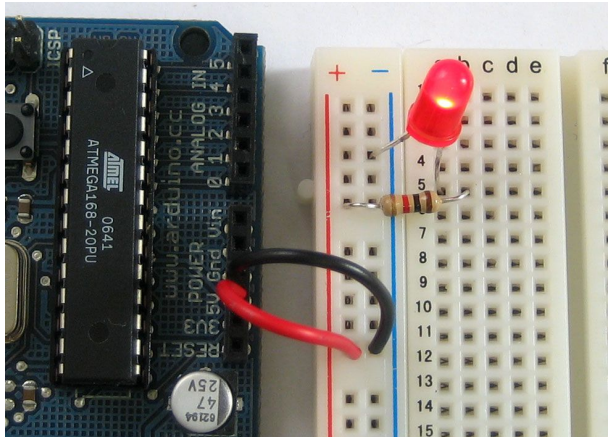


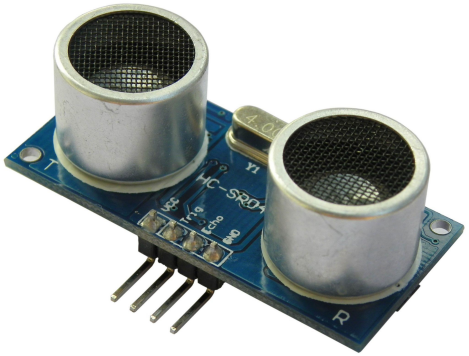
Schedule (link)

#	Date	Lesson Plan/Reference Slides
1	2/5	Workshop 0A: Introduction to Arduino and Components
2	2/12	Workshop 0B: Introduction to C
3	2/19	Workshop 1: Blinking LEDs
4	2/26	Office Hours/Catch-up
5	3/1	Workshop 2: Digital Inputs - Buttons
6	3/12	Office Hours/Catch-up
7	3/19	Workshop 3: LCD
*	3/26 (Fri.)	No Meeting for CCA Finals
8	4/2	Office Hours/Catch-up

Topics

- Blinking LEDs
- Digital Inputs: Buttons
- LCD Display
- Servos
- Ultrasonic Sensor
- DC Motors
- Remote Control
- Temperature and Humidity





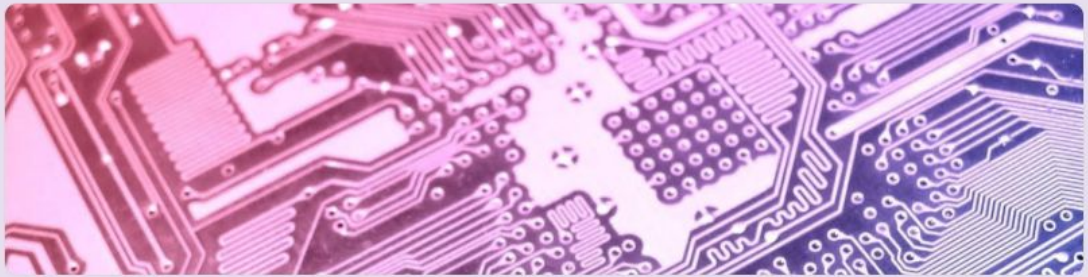
Setting Up

- GitHub repository: https://github.com/FTC9837/embedded-systems-course
  - fork repository and pull starter code/other resources

- Download Arduino IDE: https://www.arduino.cc/en/software
  - able to connect to the Arduino board and upload code

Registration Form

If you haven't already, please fill out our registration form!
(https://forms.gle/vxiEYdHy72gXLzDC9)



2021 Embedded Systems Workshops Registration

Canyon Crest Academy's Girls Who Code club works to inspire and equip girls with the skills necessary to pursue 21st century opportunities. Our club supports all students interested in computer science and engineering by programming lessons and other hands-on activities.

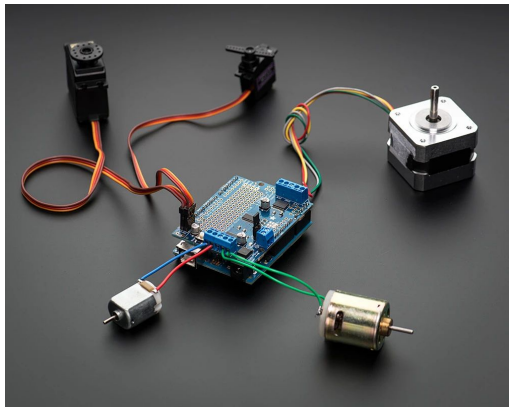
Introduction to Arduino

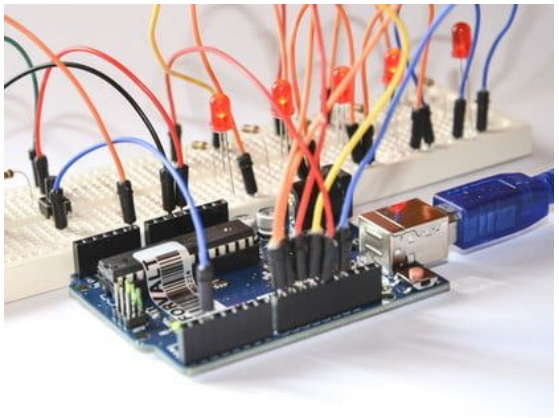
What are embedded systems?

- A computer system (processor, memory, input/output) that has a dedicated function, provide efficiency
- Examples of embedded systems: MP3 players, mobile phones, video game consoles, digital cameras, DVD players, and GPS

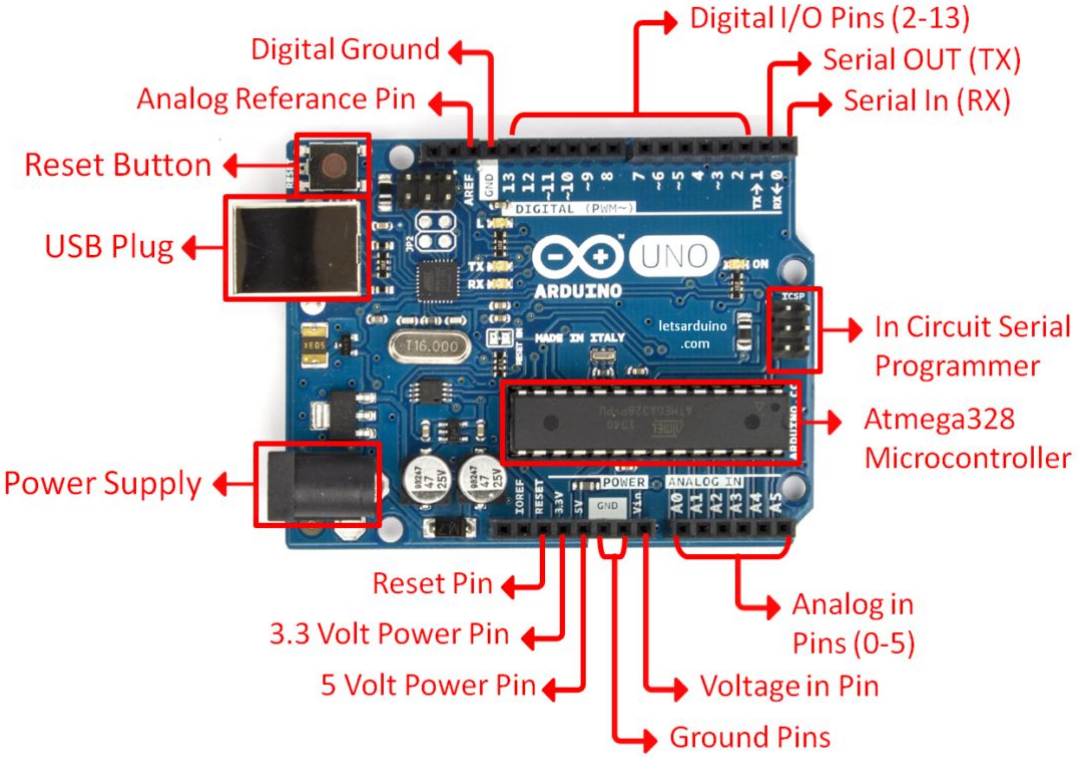
What is Arduino?

- A small microcontroller used for a variety of applications
- Can be programmed using C and C++ programming languages
- Open source; many Arduino-compatible and Arduino-derived boards exist





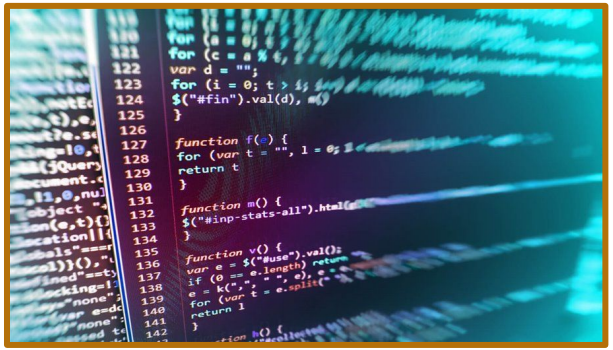
What's on an Arduino Board?



What is C?

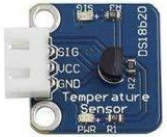
C is a popular programming language used for a variety of things, such as

- Embedded systems
- Developing system and desktop applications
- Developing operating systems such as Apple's OS X and Microsoft's Windows
- Compiler production
- Open source software



Sensors

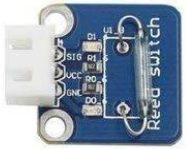
Barometer



DS18B20 Temperature

Active buzzer

Infrared-Receiver

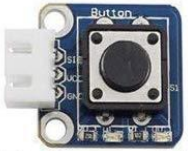


Reed Switch

MQ-2 Gas Sensor

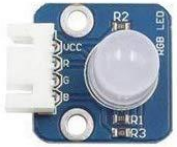
Auto-flash LED

Dual-color LED



Button module

Laser Transmitter



RGB LED

Relay Module


Analog temperature

Flame Sensor

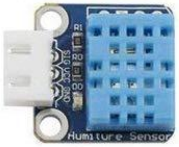
ADDA Converter

Tilt Switch


Rotary Encoder


Tracking sensor


Analog Hall



Humiture sensor

Color Sensor

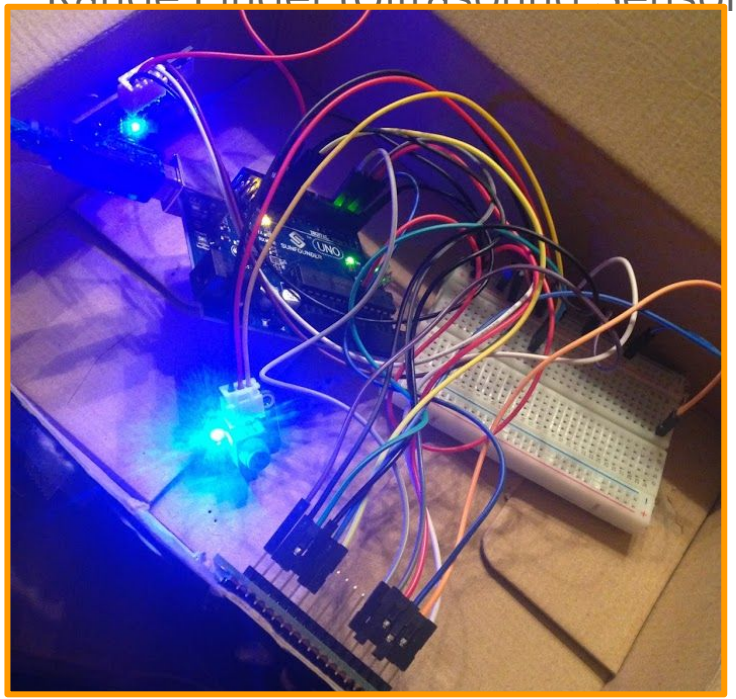

Obstacle Avoidance

RTC-DS1302

Ultrasonic

Demos

Range Finder (Ultrasound Sensor)



Heartbeat Sensor

What’s in the kit?

Parts Overview

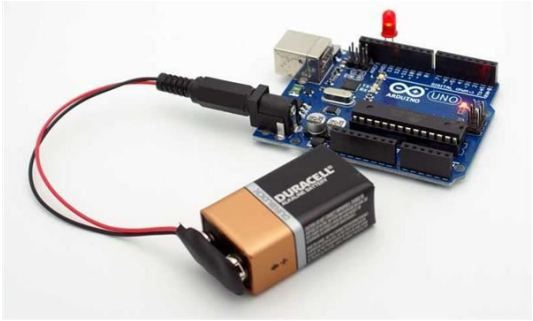
Parts List

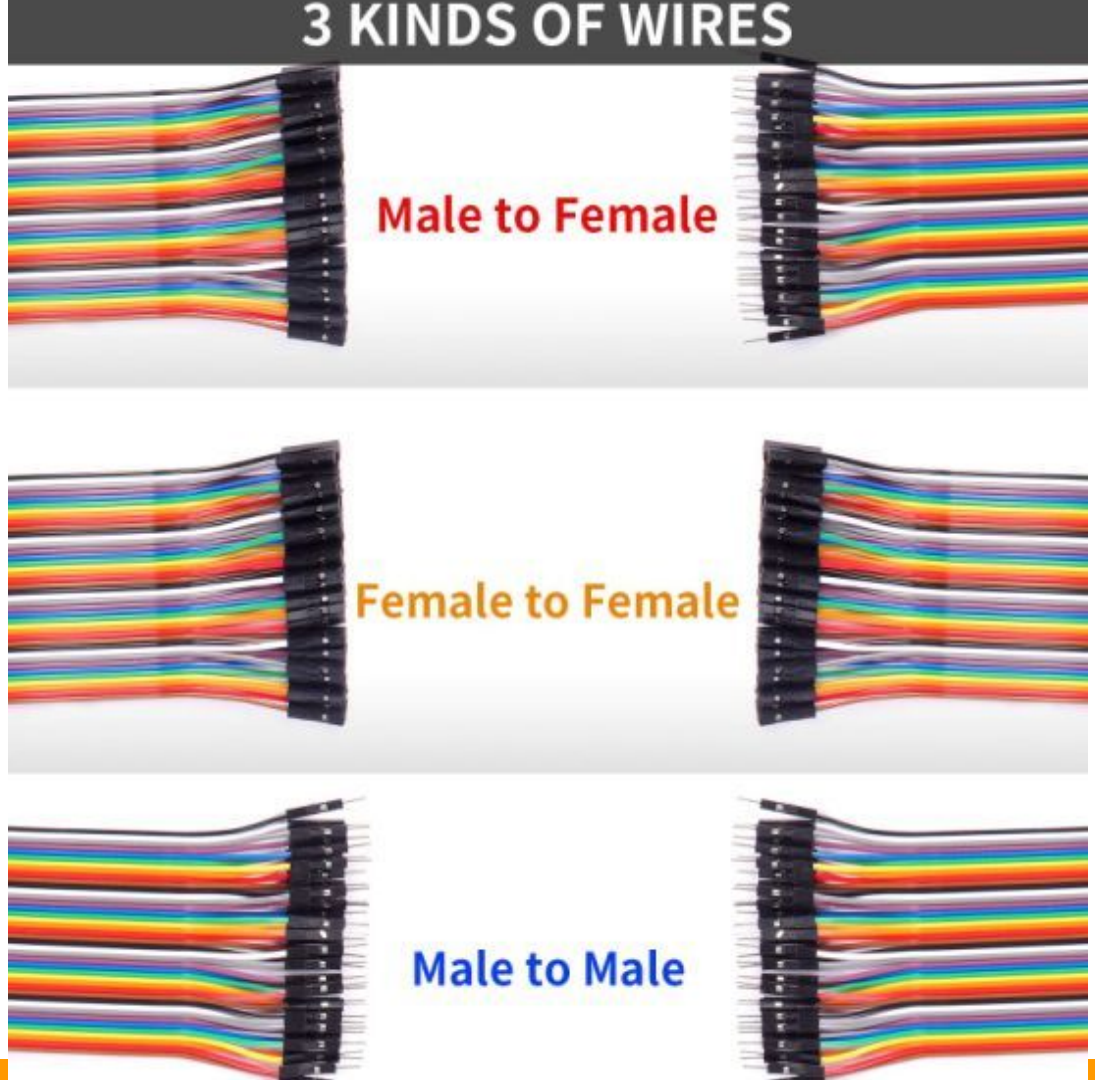
Below is the list of parts we'll be using during this course

- Arduino UNO R3 Controller Board
- USB Cable
- Breadboard
- 9V Battery
- LEDs (all colors!)
- Potentiometer
- Resistors
- Buttons
- LCD1602 Module
- Servo Motor
- Stepper Motor
- Ultrasonic Sensor
- Temperature and Humidity Module
- Fan Blade and 3-6V Motor
- Remote Control
- Many, many jumper wires...

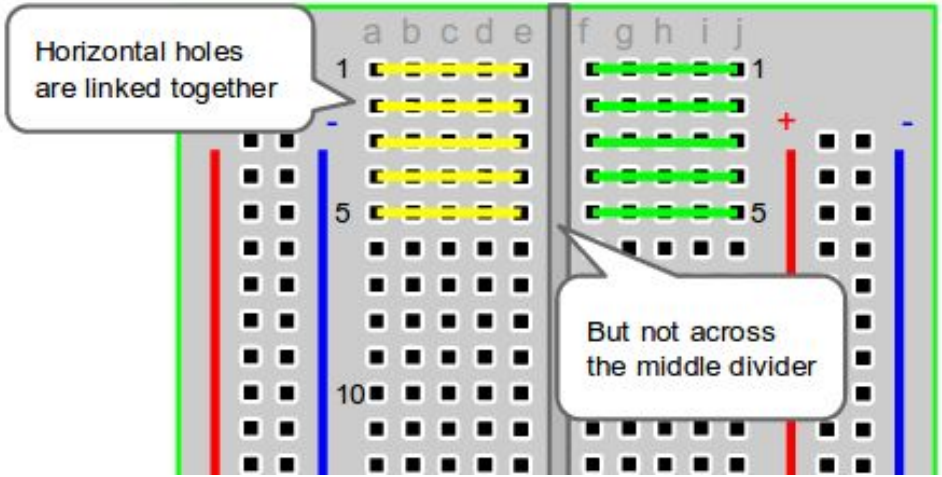
The Necessities

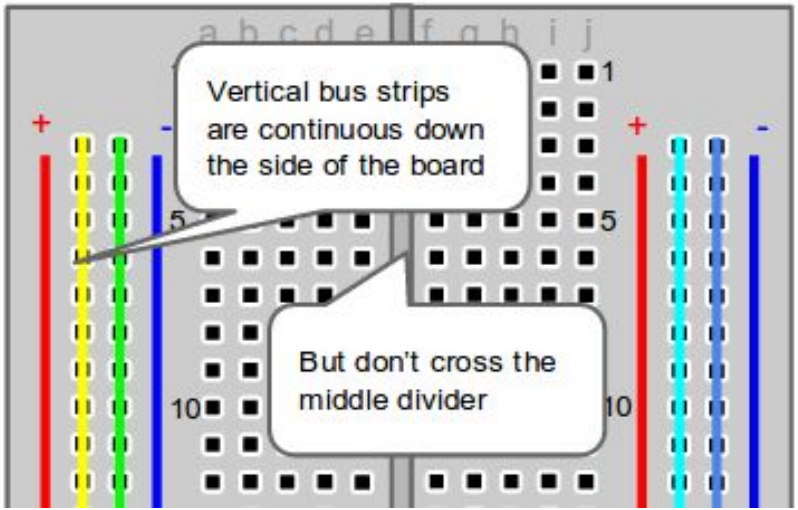
- Arduino UNO
  - The microcontroller!
- USB Cable
  - Used to download code from your computer to the Arduino and provide power
- 9V Battery
  - Used to provide power for an Arduino
- Jumper Wires
  - Wires with connector pins on the end
  - Male-to-male, male-to-female, female-to-female



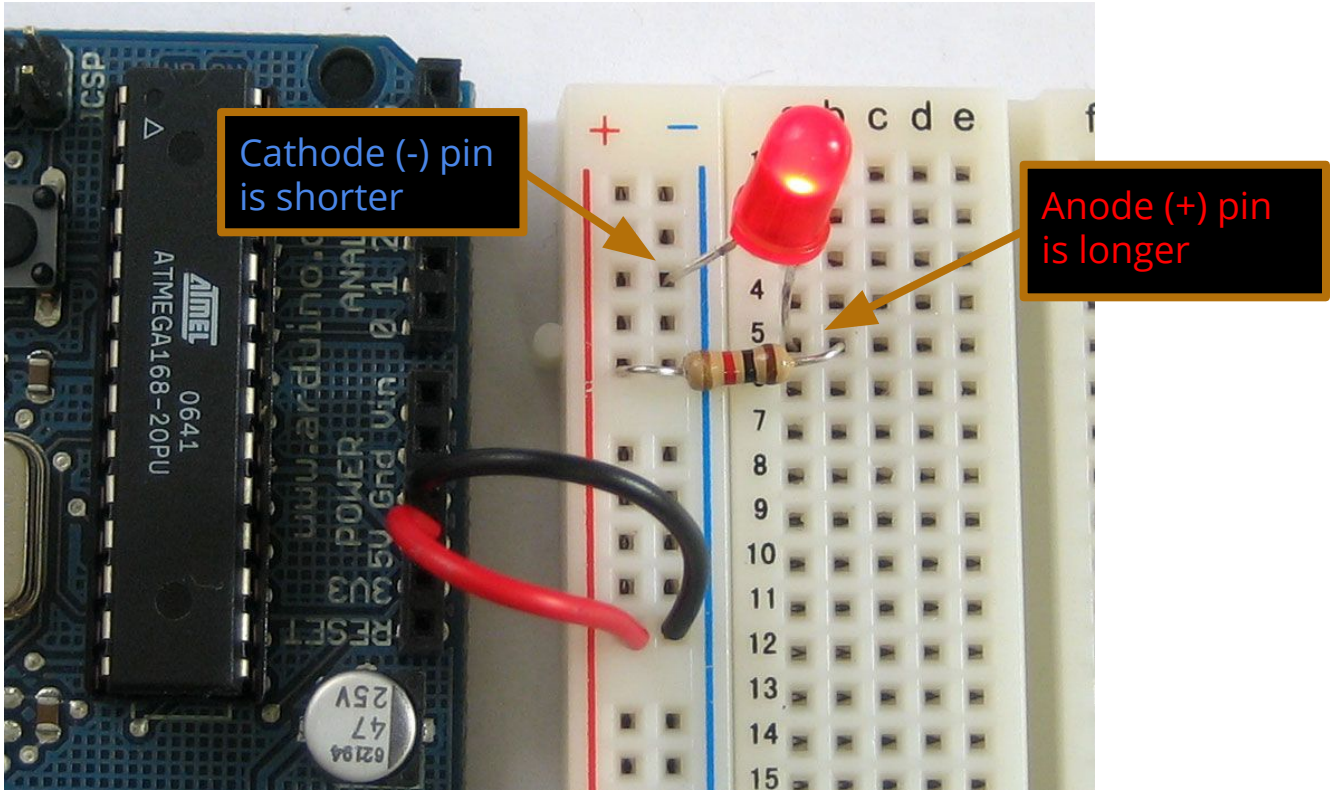

3 KINDS OF WIRES
Male to Female
Female to Female
Male to Male

Breadboards Explained



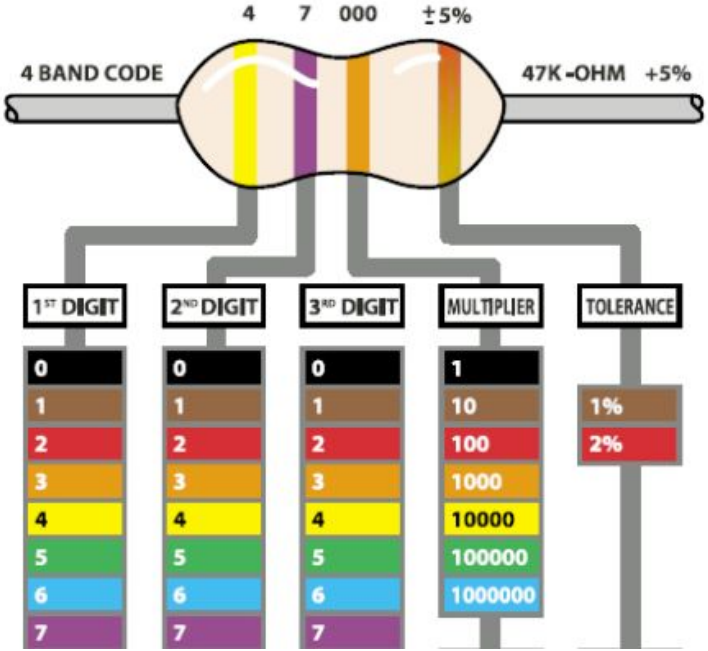


LEDs


Cathode (-) pin is shorter
Anode (+) pin is longer
ATMEGA168-20PU
0641
+
−
a b c d e f
4
5
7
8
9
10
11
12
13
14
15

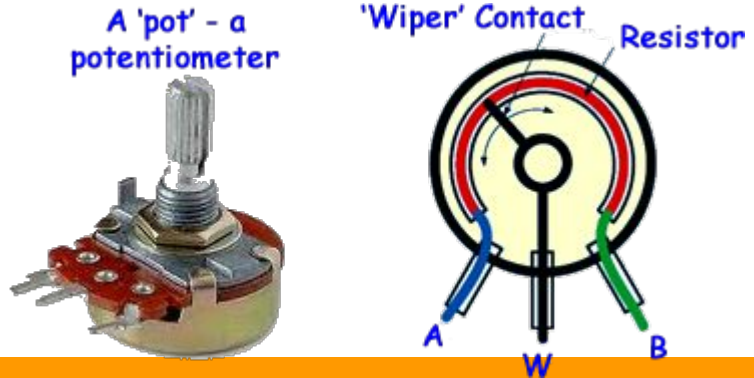
What are Resistors?

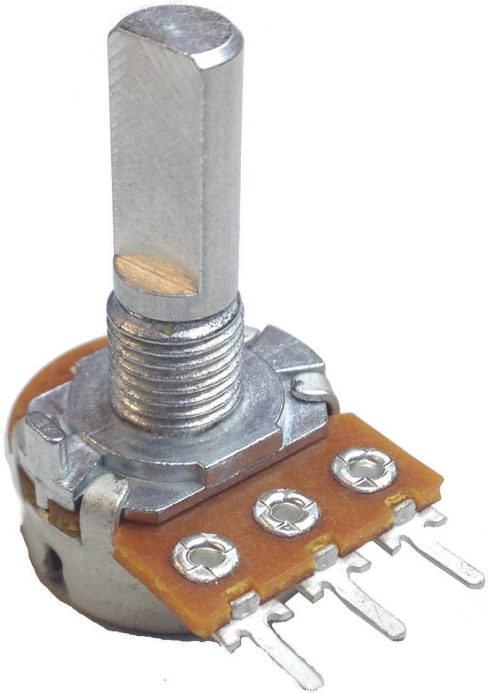
- Resistors slow the electric current, and control where and how fast the current flows
- Resistance value is measured in ohms Ω, which is represented by colored stripes on the body of the resistor
- Each stripe has a different value depending on the color and location as shown in the reference chart
- A potentiometer is a variable resistor



What is a Potentiometer?

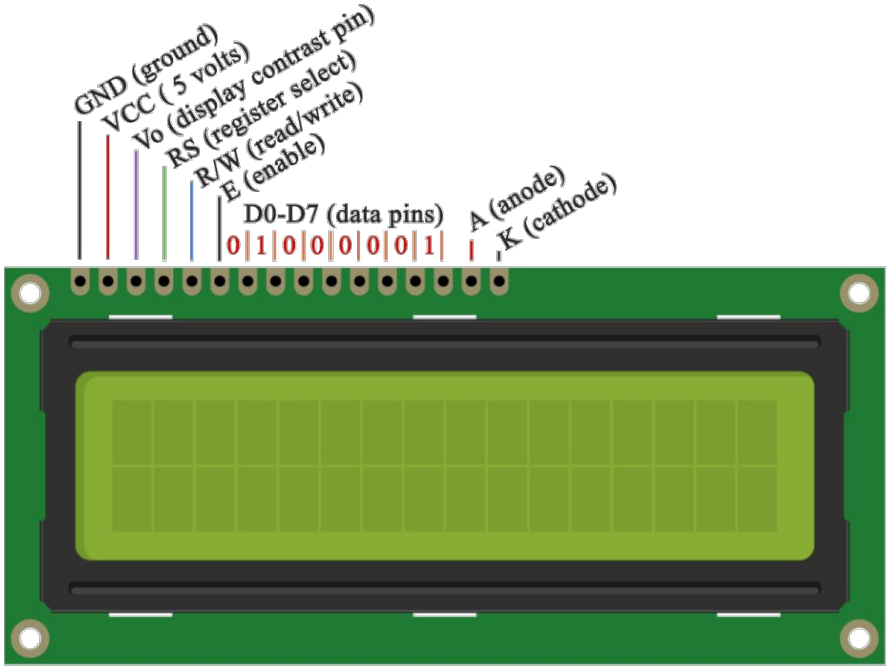
- A potentiometer is essentially a variable resistor: you can change how much resistance is applied by twisting the knob
- This is useful for adjusting brightness, power, etc.
- For our purposes, this will be used to adjust the brightness of the LCD screen





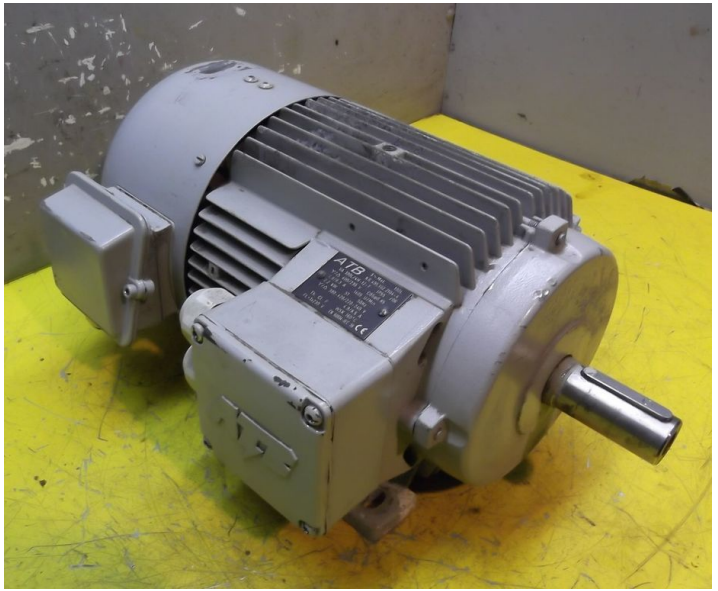
What’s an LCD Screen?

A Liquid Crystal Display screen is used to display images. The one in the Arduino kit can only display letters and numbers on a 16x2 grid.



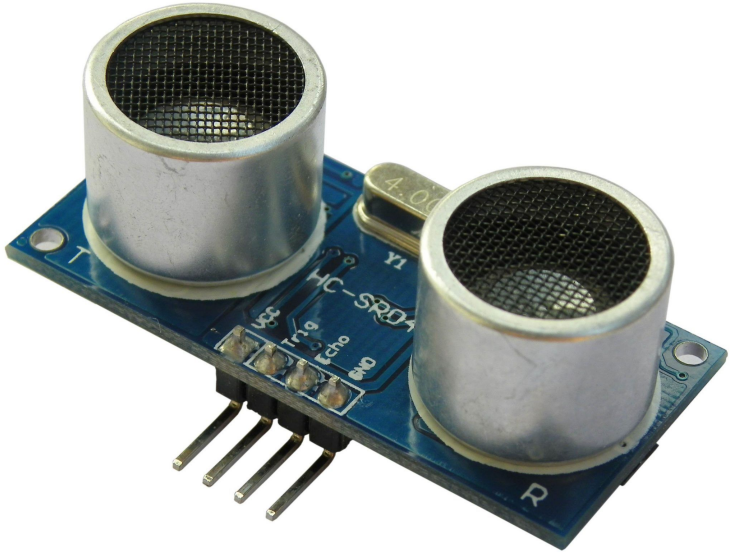
What are Servos and Motors?

Servos and motors take electrical energy and convert it into rotational motion. A servo can only rotate within a certain range (usually a range of 180 degrees), while a motor can rotate continuously in either direction.



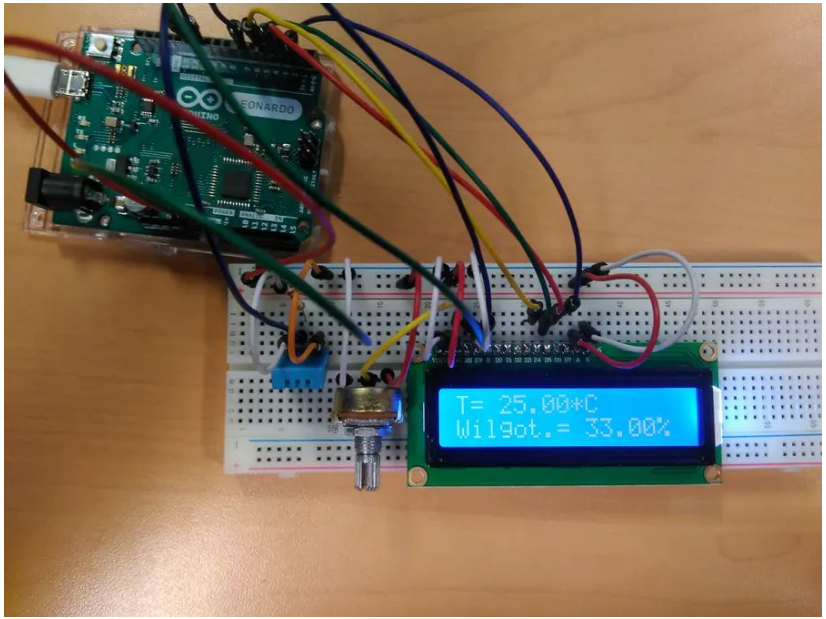
What’s an Ultrasonic Sensor?

The ultrasonic sensor uses sound to measure distance by sending out a soundwave and measuring the time it takes for the wave to return.



What’s a Temperature/Humidity Module?

- Uses humidity sensor and a thermal resistor to measure the surrounding air, and sends a digital signal on the data pin



Thank you!

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Production Team

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