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AND A PLATFORM TO LEARN THE PRINCIPLES OF ELECTRONICS

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What is an Arduino?

- A circuit board with a <u>microcontroller</u>, (small computer, integrated chip with CPUs, memory, etc), I/O pins, and other peripherals
- Used for building digital devices, e.g. digital clocks, LED controllers, alarm systems, robots, synthesizers, game controllers, etc
- Able to read inputs (e.g. light on a sensor, button press) and programmatically respond with an output (activating a motor, turning on an LED, etc) using I/O pins



Using an Arduino

 Arduino-based devices typically involve a software component (program) and hardware component (Arduino board wired up in a circuit)

<u>Software</u>

- Written in the Arduino IDE
- Simplified C++
- Upload from your computer to board through USB cable
- Every program structured around two functions: void setup() and void loop()
- Read from pins, apply logic, write to pins



Using an Arduino (2)

• <u>Hardware</u>

- It's all about electrical signals
- This simple light bulb circuit helps understand the concept:
- 1. Battery sends electrical signal from + end through the wire
- 2. If switch is down, signal successfully flows through to the light bulb, and the light bulb turns on
- 3. Now imagine you can write a program to apply logical branches to this situation, reading and manipulating the current state of the circuit



Using an Arduino (3)

• <u>Hardware</u>

- It's all about electrical signals
- Connect pins and components with jumper wires

Example: *Turn on LED on button press*

Button connected to pin 1, LED connected to pin 13. In void loop() Arduino reads pin 1 to see if button is pressed -- if pin 1 is ON, button is pressed, so write *(send current)* to pin 13, thus turning on the LED.



Arduino is Open Source

- Arduino board licensed under a CC-BY-SA license (schematics available online, anybody is allowed to make one!)
- Software licensed under the GNU LGPL or the GNU GPL



ARDUINO UNO R3 Compatible US Seller!

Brand New





Learning About Electronics

• Arduino is a great platform to use to learn about electronics in general

Some topics:

- Voltage, current, resistance
- Resistors, capacitors, diodes, transistors
- Units: ohms, volts, amperes, hertz
- Natural laws of electricity
 - Ohm's Law, Kirchhoff's Laws, etc
- Pulse-width modulation (PWM)
- Potentiometers, switches, servos, different types of transistors, breadboards, PCBs
- Schematics
- Soldering



Arduino and the Competition

- Arduino is not the only single board computer on the market
- Raspberry Pi
 - The Raspberry Pi came onto the scene in 2012, 7 years after the Arduino.
 - Unlike Arduino, the Pi needs an operating system to function -- the officially supported OS is Raspbian (a flavor of Linux).
- Beagleboard
 - An open-source single board computer designed by Texas Instruments (the calculator guys)
- <u>https://beagleboard.org/</u>
- <u>https://www.raspberrypi.org/</u>



Resources

- Ben Eater
- Jason Gibson's Electronics Course
- <u>CSCI 267 Embedded Systems</u>
- <u>https://www.arduino.cc/</u>
- Parts:
 - <u>https://www.adafruit.com/</u>
 - <u>https://www.sparkfun.com/</u>
 - <u>https://www.microcenter.com/</u>
 - <u>https://www.digikey.com/</u>
 - <u>https://www.mouser.com/</u>
 - Ebay and Amazon



