Introduction to Physical Computing: Week 3

Julia Makivic

Office Hours

Thursday 12pm - 4pm
Friday 12pm - 4pm

Detailed Dive into Devices, Sensors and Example Projects

- Muscle sensors, pulse sensors, EEG waves
- Wearable technologies
- TFT LCD screens
- LED matrices
- Neopixels

Muscle Sensors

‘Sup Brows: https://learn.adafruit.com/heybrows

MyoWare muscle sensor:
https://learn.adafruit.com/getting-started-with-myoware-muscle-sensor

Tutorial: https://www.instructables.com/id/Muscle-EMG-Sensor-for-a-Microcontroller/

Pulse Sensors

Link to pulse sensor: https://pulsesensor.com/

Tutorial: https://create.arduino.cc/projecthub/Ingeimaks/diy-heart-rate-sensor-a96e89

Using EEG Waves With Arduino

Ridge of Sentiment by Yunny Jang:
http://doc.gold.ac.uk/compartsblog/index.php/work/ridge-of-sentiment/

Cheap EEG Machine:
https://www.aliexpress.com/item/32606318948.html?wgu=9271_196673_15747311628552_c08dd4c422&wgexpiry=1582507162&af=196673&dp=9271_196673_15747311628552_c08dd4c422&cn=9271&cv=15095

How to Use EEG Machine with Arduino:
https://www.instructables.com/id/Mini-Arduino-Portable-EEG-Brain-Wave-Monitor-/

Iris Scanning

The Sonic Pharmacy by Sarah Song
https://vimeo.com/359774955

LED Matrices

Some examples by Yours Truly!
https://www.youtube.com/watch?v=HAmOHAw7M5M

https://www.youtube.com/watch?v=coS4lLBMP3I

https://www.youtube.com/watch?v=7ENsdx2dDjQ

Snake on an LED Matrix:
https://www.youtube.com/watch?v=k6CHJ9VKTnY

LED Matrix Cube:
https://www.youtube.com/watch?v=T5Aq7cRc-mU

LED Matrices cont . . .

We Throw Switches Giant LED Matrix
https://twitter.com/WeThrowSwitches/status/1177592244049731585

BMO LED Keychain
https://learn.adafruit.com/3d-printed-led-animation-bmo/led-animations

TFT LCD Screens

Hooking up your Arduino to a TFT Screen:
https://www.arduino.cc/en/Guide/TFT

Examples:

Some examples by Yours Truly:

https://www.youtube.com/watch?v=oe9R97BWq7w
https://www.youtube.com/watch?v=I6FoPU3GPyg

Arduino Tamagotchi:https://www.instructables.com/id/Arduino-Tamagotchi-Clone-Digital-Pet/

Tutorial on setting up an Arduino LCD touchscreen:
https://www.instructables.com/id/Arduino-Touch-Screen-TFT-LCD-Tutorial-First-Review/

A Message From Our Sponsors: http://doc.gold.ac.uk/compartsblog/index.php/work/a-message-from-our-sponsor/

Steampunk Cameo Necklace: https://learn.adafruit.com/steampunk-cameo-necklace/overview

Neopixels

Full list of Neopixel products: https://www.adafruit.com/category/168

Sound to light Neopixel installation:
https://www.programmingelectronics.com/arduino-sound-light-matrix-450-neopixels-student-project/

The Scarf is Lit: http://doc.gold.ac.uk/compartsblog/index.php/work/the-scarf-is-lit/

3D Printed Daft Punk Helmet: https://learn.adafruit.com/3d-printed-daft-punk-helmet

Wearables

- Gemma: https://learn.adafruit.com/introducing-gemma
- FLORA: https://www.adafruit.com/product/659
- Playground Circuit Express: https://www.adafruit.com/product/3333
  - Speakers and microphone
  - Push buttons
  - 10 LEDs
  - Infrared sensor and transmitter
  - Sound sensor, motion sensor, temperature sensor and altimeter
  - Capacitive touch inputs

Wearables cont . . .

Examples:

Flamethrower Arms:
https://create.arduino.cc/projecthub/Advanced/punch-activated-arm-flamethrowers-real-firebending-95bb80?ref=tag&ref_id=wearables&offset=5

The Modern Conversation: http://doc.gold.ac.uk/compartsblog/index.php/work/the-modern-conversation/

Bao Bao Bag Concept:
https://create.arduino.cc/projecthub/kimbab-studio/issey-miyake-bao-bao-bag-concept-by-kimbab-d84eaf?ref=tag&ref_id=wearables&offset=16

Hotaru by Kaho Abe:
https://kahoabe.net/portfolio/hotaru/

MIDI Drum Glove
https://learn.adafruit.com/midi-drum-glove

Where to search for these items

Pimoroni
https://shop.pimoroni.com/

Cool Components
https://coolcomponents.co.uk/

Farnell
https://uk.farnell.com/

RS Components
https://uk.rs-online.com/web/

Adafruit
https://learn.adafruit.com/

- Based in the US, so try to use the distributors listed above to shop their components
- User friendly
  - Plenty of libraries and how to guides to use their products in conjunction with Arduino and other devices

==LAB==

Last week's homework

How can you create a new speculative design object using the sensors from lab? What would the object do? What physical, digital and "immaterial" materials would it use? What affordances would its material qualities provide and what sort of interaction would they enable?

Bonus: Research a new type of sensor on your own and create a speculative object that uses it.

Schematics

- Abstract way of showing a circuit diagram
- Doesn’t show where the components are connected, but shows how they are connected
- Many projects will use circuit diagrams to show how components are connected instead of picture of a breadboard
- Circuit diagrams are used to depict electronics in more detail

Schematics cont . . .

- Great way to think about your circuit before putting it together
- If you are having trouble, you can show someone what you were trying to do
- If you ever want to mass produce or print your circuit, you will need to show a schematic to the manufacturer

Schematic and Circuit Design Tools

- Fritzing: https://fritzing.org/home/
  - Beginner friendly
  - Arduino friendly
  - 7 pounds
- Eagle: https://www.autodesk.com/products/eagle/free-download
  - Free
  - Industry standard
  - Scriptable
  - Can be used to print circuit boards
  - Difficult interface

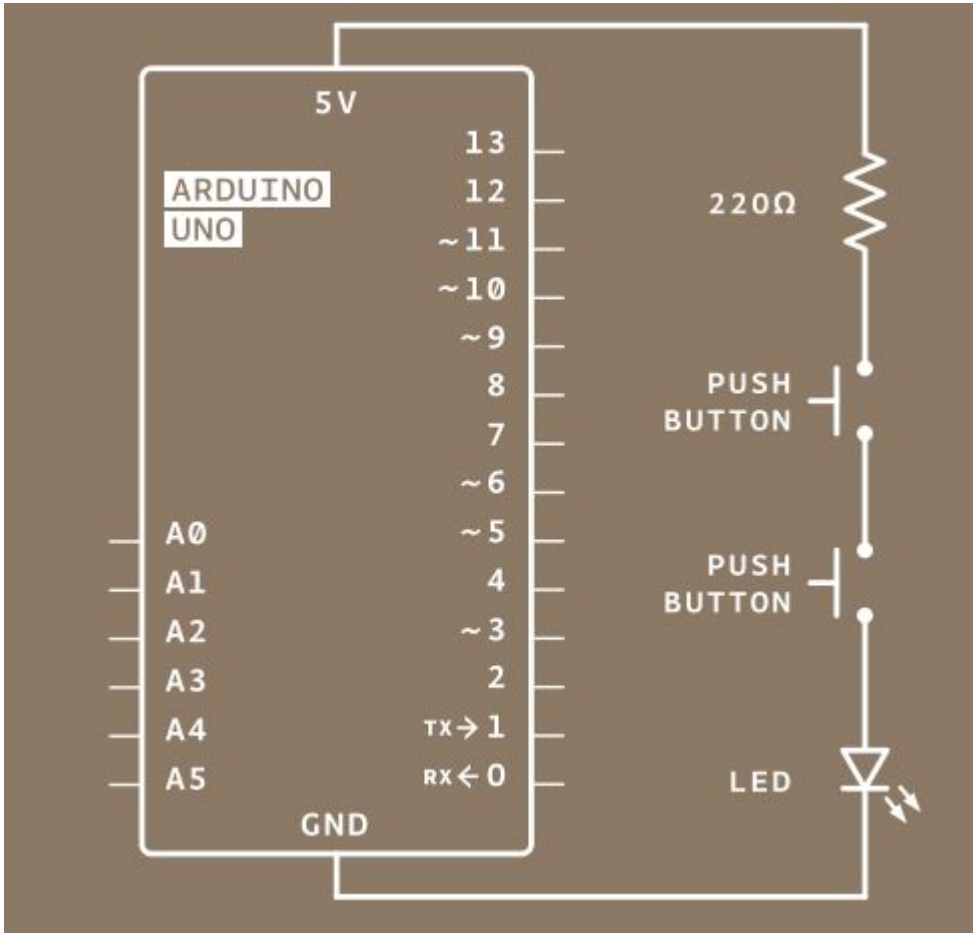
Schematic Examples:

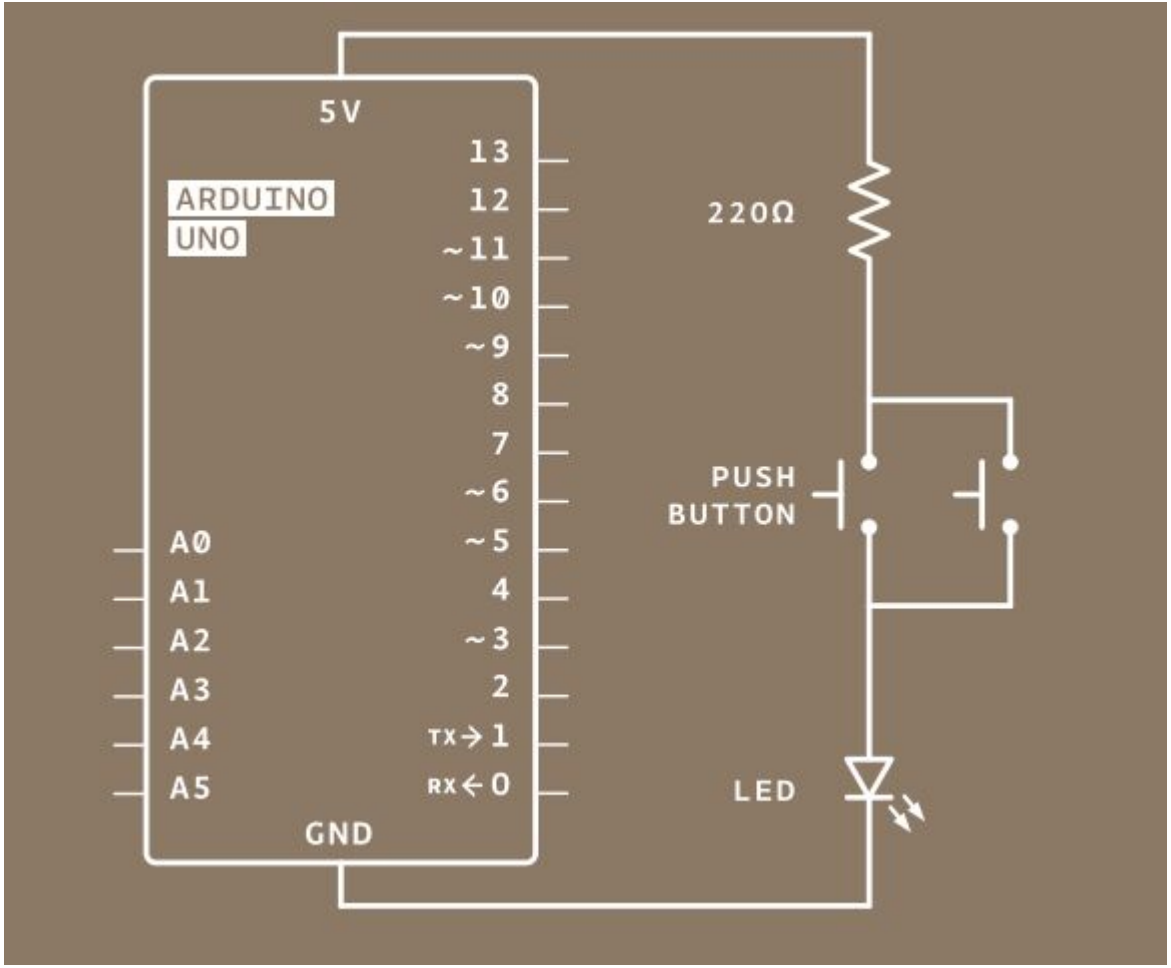
Arduino Project Book: pg. 10

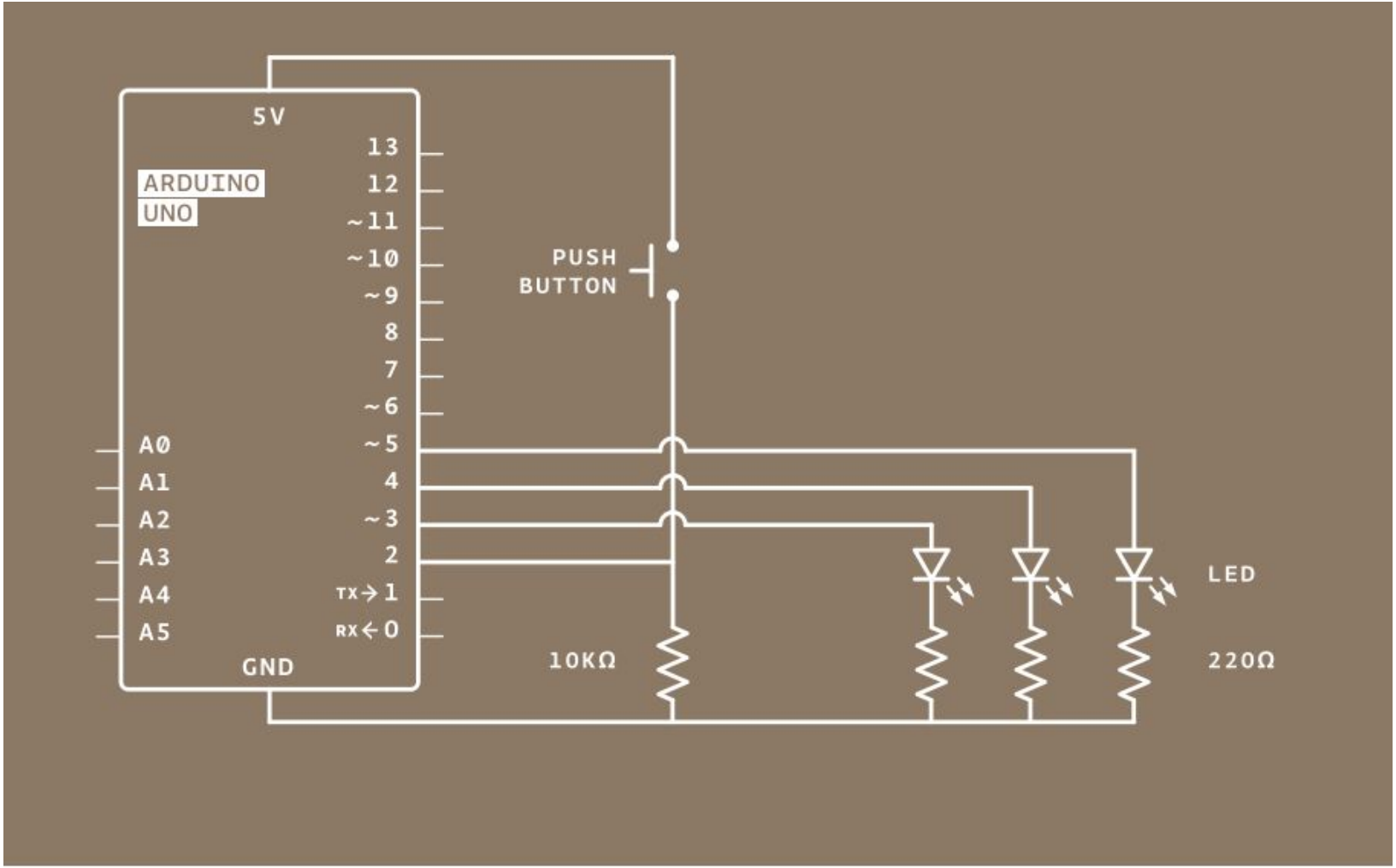
https://bastiaanvanhengel.files.wordpress.com/2016/06/arduino_projects_book.pdf

This page shows a list of schematic symbols for common components.

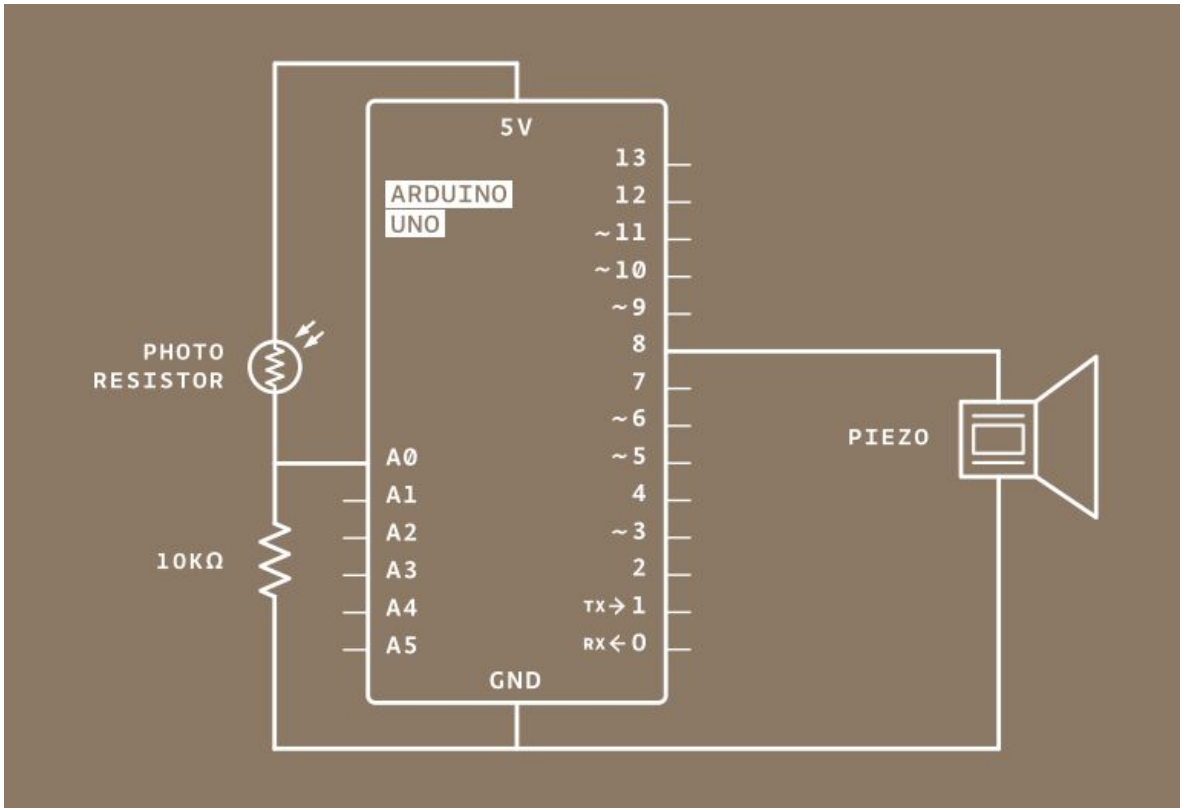
Describe this Schematic:



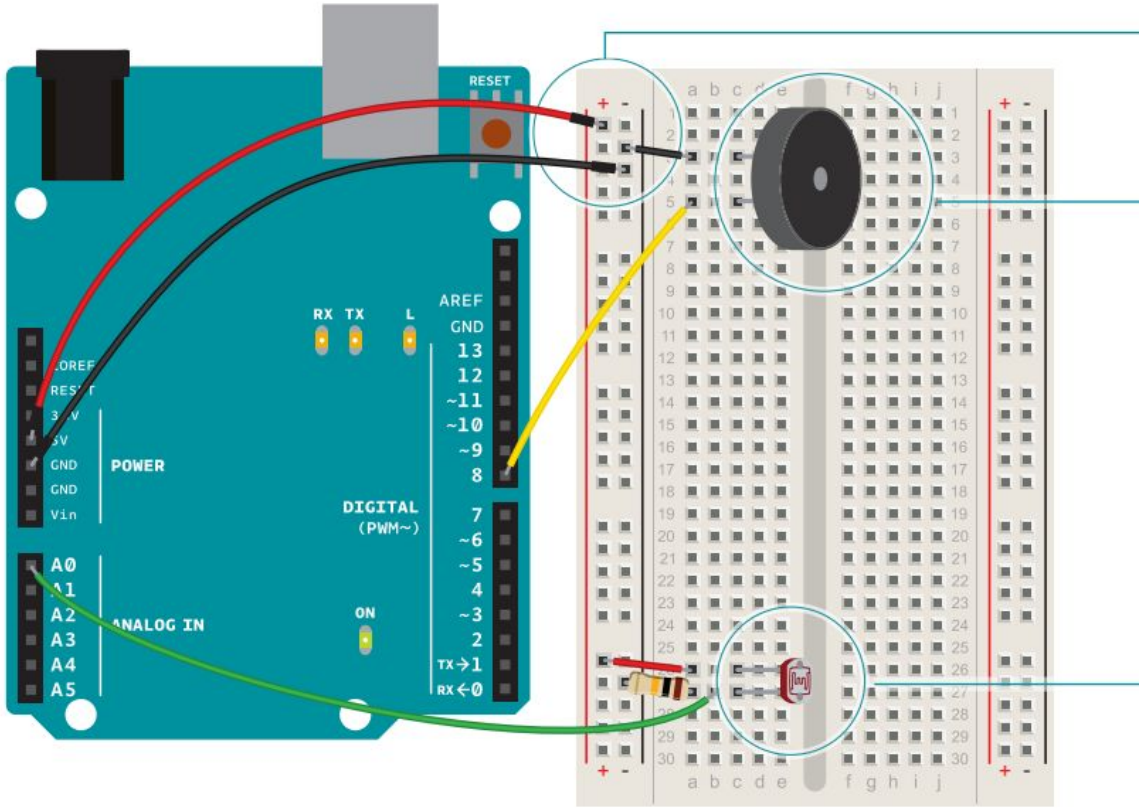

5V
ARDUINO
UNO
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TX→1
RX←0
A0
A1
A2
A3
A4
A5
GND
220Ω
PUSH
BUTTON
LED


5V
ARDUINO
UNO
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TX→1
RX←0
A0
A1
A2
A3
A4
A5
GND
PUSH
BUTTON
10KΩ
LED
220Ω

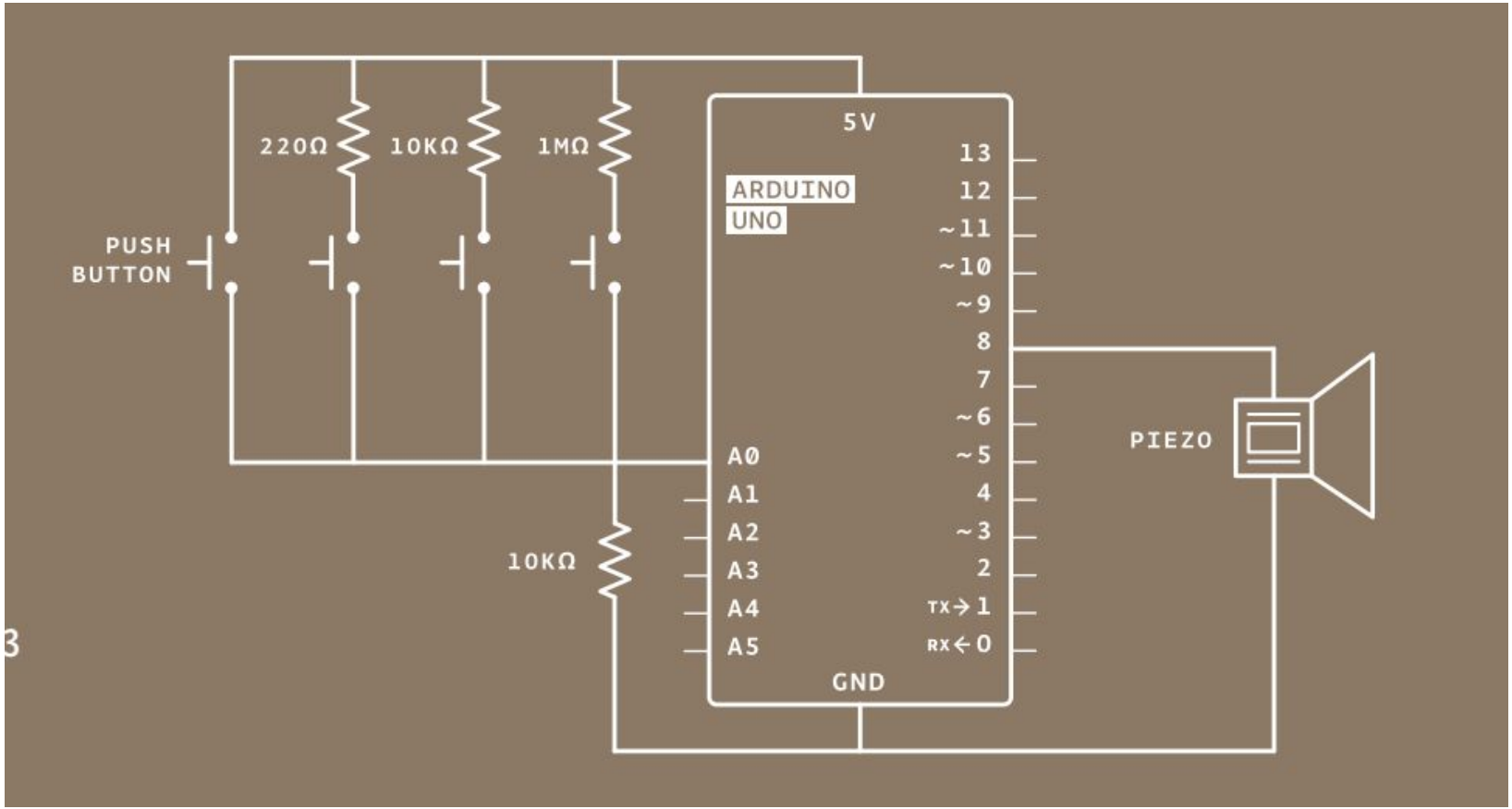
Light Theremin



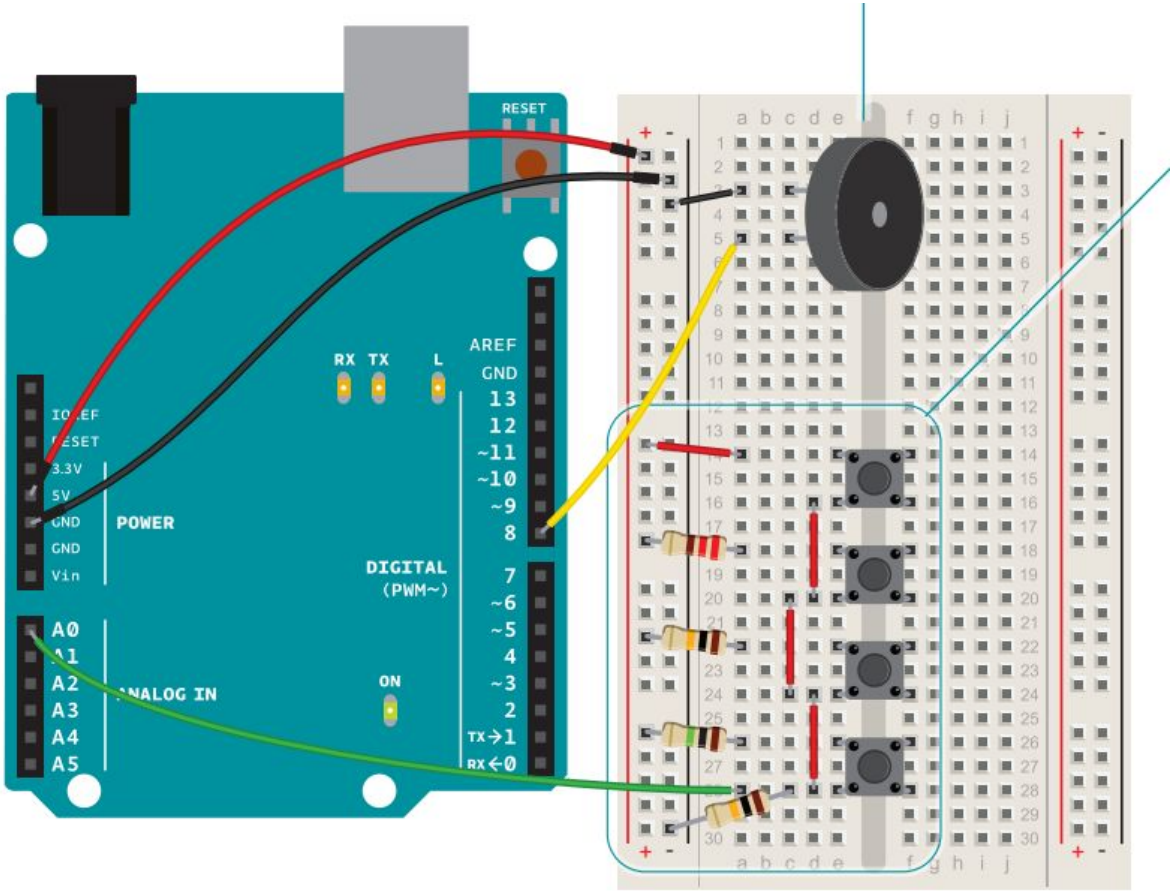
Light Theremin



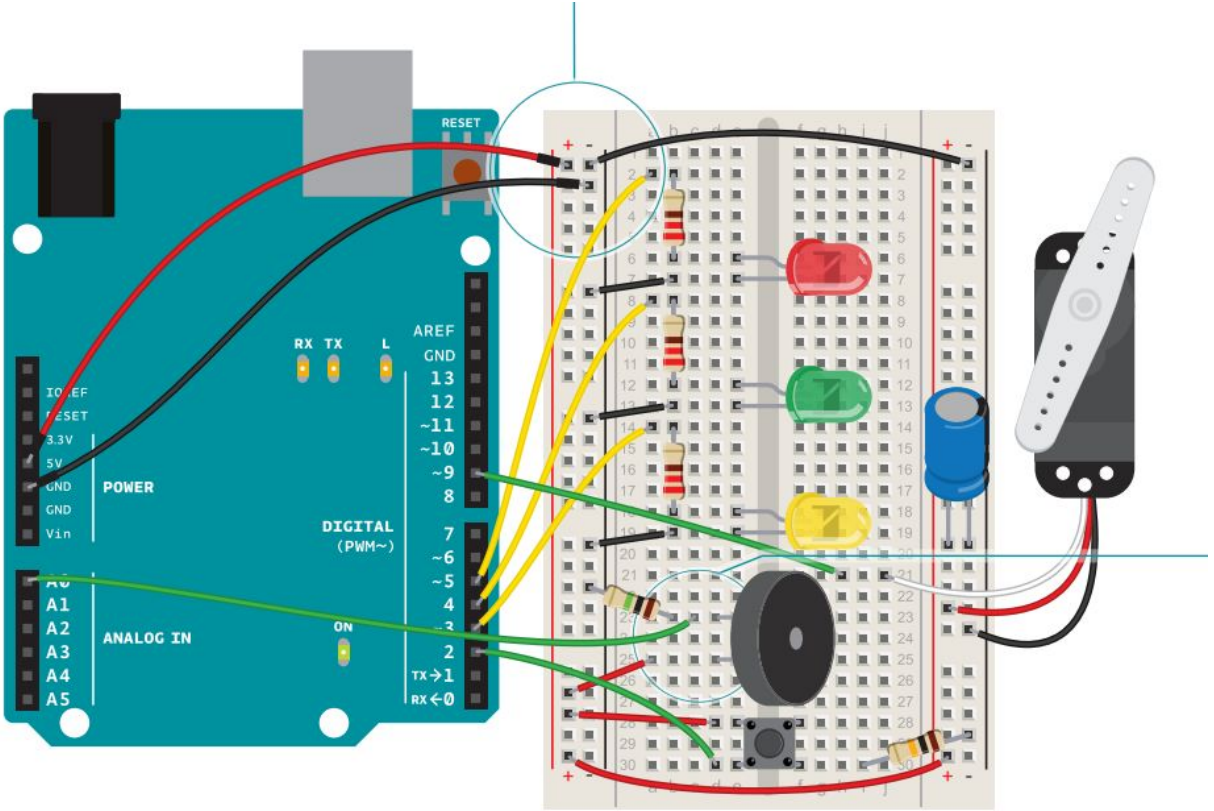
Keyboard Instrument



Keyboard Instrument



Knock Lock


RESET
RX TX L
AREF
GND
13
12
~11
~10
~9
8
7
~6
~5
4
2
TX→1
RX←0
POWER
3.3V
5V
GND
GND
Vin
ANALOG IN
A1
A2
A3
A4
A5
ON

Audio-Visual Improvisation

1. Make a schematic of your circuit
2. You know how to code a piezo and RGB LED. Use an input of your choice such as buttons, capacitive touch, temperature sensor, tilt switch, or piezo to create a piece with both light and sound.
3. Try to coordinate the light and sound. Maybe the sound can be influenced by the RGB values of the LED or vice versa

Homework

1. Study some of the examples I showed today. Take a look at the components and the code used (if provided). Try to understand how it all works together.
2. If you have any questions about the examples and would like a more detailed overview in class, let me know by November Saturday 30th and I will delve into further detail next class.