# Arduino for Intro to Physical Computing 60-223

Fall, 2017, J. Eric Townsend

# standard disclaimer

- These slides are based on what I've learned in practice and working with others.
- The content could be wrong.  It could be dangerous.  Don't run with scissors or stick a fork in a wall outlet.
- This presentation is distributed under MIT License (see final slide).

# Overview

# Reaction and Interaction

- Reactions are stateless events where an input and an output are hardwired to one another.
- Interactions require changing states, input is evaluated and a decision is made before output is created.
- Today’s examples are mostly reactions, one needs to understand reactions before creating interactions.

# Arduino

- “Single Board Computer” (SBC) contains logic, inputs, and outputs in a single device

- Outputs and inputs can be digital, analog, or a mixture of both

- Arduino is a hardware definition and an integrated development environment, “IDE”

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# Input vs. Output

- Input: external information used to make a decision
- Output: information or actions based on input

# Digital vs. Analog

- Digital is on or off: 0 or 1, true or false, yes or no
- Analog is a range of values: 0 to 1024, quiet to loud, good to bad, near to far
- Music player: on/off (digital), playlist (analog), volume (analog), mute (digital)

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# Analog can be Digital

- A door can be *open* (off) or *closed* (on) and have an *analog location* between open and closed (analog value).

- You can *pass* (on) or *fail* (off) a class and have a *grade* (analog value between 0 and 100).

- An analog range of values can have end points that map to two arbitrary values for on and off.

# Circuits

# Circuits?

- Originates in Latin, to go around in a circle
- Circuit training: performing a series of exercises in a certain order, then repeat the circuit
- NASCAR circuit: the series of NASCAR tracks used in a season of racing

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# Circuits!

- Electrical circuit: a path electrons take from start to finish
- Flashlight: batteries, switch (digital), light
- Thermostat: thermistor, selection slider (analog), furnace

# Arduino Circuit

- Circuit: connects input and output
- Arduino has a place in the circuit
- Inputs -> Arduino -> logic -> outputs

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# Flashlight

- Draw the circuit.
- Where would an Arduino go in the circuit and what could it do?
- What could replace the light?

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Simple Digital

# Simple Digital

- Input: switches, on or off
- Output: LED, on or off
- Arduino: translates switch on or off to turning LED on or off

# Resistors

- resist voltage in units of Ohms, “Ω”
- motors, speakers, and heaters have resistance
- LED needs a resistor for projection
- ”pull-up” and “pull-down” resistors

# Simple Analog

# Simple Analog

- Input: voltage range from 0 to 255
- Output: voltage range of 0 .. 1023
- Arduino: translates knob (input) to brightness (output)
- Input is based on a change in resistance

# Digital + Analog

# Digital + Analog

- Input: digital switch, temporary on/off for an LED
- Input: knob, from 0 to 255, continually changes brightness of LEDs
- Arduino: translates input combinations to desired output

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# Resources

# Arduino Resources

- Arduino home page: http://arduino.cc/
- Sparkfun Forum: https://forum.sparkfun.com/
- Youtube (warning! quality varies): http://www.youtube.com/results?search_query=arduino+tutorial

# Real World Examples

Thanks for listening.

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