Fundamentals of Physical Computing

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Introduction

• Physical Computing
  • Physical
  • Computing
• Humans
• Objects
• Rob Faludi
  • Background
Plan for Today

• Introductions

• Syllabus Review

• Physical Computing

• Components

• Arduino

• Readings & Assignments
Introductions

- Name
- Former life
- Imagined super power
- How you ended up in this class, hopes and plans
Syllabus Review

• Syllabus review

• Class schedule & structure

• Assignments

• Documentation

• Grading

• Office Hours aka Lab Hours

• Kit, tools, workshop
Physical Computing

• Your examples of physical computing

• Observation, iteration, thinking about physical action

• Mental models - yours, the embodiment, theirs

• presence / attention

• transduction
Analog vs. Digital
Transduction
Components
LEDs
Resistors
Switches
Breadboard
Breadboard
Wire
Power Supply
Microcontroller
Water Analogy

Poiseuille's Law

\[ F = \frac{\Delta P}{R} \]

Ohm's Law

\[ I = \frac{\Delta V}{R} \]
Arduino Web Site

- reference, learning, playground
- download software
- install drivers
- serial connection
Blink

* Blink
* The basic Arduino example. Turns on an LED on for one second, then off for one second, and so on... We use pin 13 because, depending on your Arduino board, it has either a built-in LED or a built-in resistor so that you need only an LED.
* http://www.arduino.cc/en/Tutorial/Blink
*

```cpp
int ledPin = 13; // LED connected to digital pin 13

void setup() // run once, when the sketch starts
{
    pinMode(ledPin, OUTPUT); // sets the digital pin as output
}

void loop() // run over and over again
{
    digitalWrite(ledPin, HIGH); // sets the LED on
    delay(1000); // waits for a second
    digitalWrite(ledPin, LOW); // sets the LED off
    delay(1000); // waits for a second
}
```
Programming is Easy

```c
int ledPin = 13; // LED connected to digital pin 13

void setup()
{
    pinMode(ledPin, OUTPUT); // sets the digital pin as output
}

void loop()
{
    digitalWrite(ledPin, HIGH); // sets the LED on
    delay(1000); // waits for a second
    digitalWrite(ledPin, LOW); // sets the LED off
    delay(1000); // waits for a second
}
```
digitalWrite()

Description

Write a HIGH or a LOW value to a digital pin. If the pin has been configured as an OUTPUT with pinMode(), its voltage will be set to the corresponding value: 5V (or 3.3V on 3.3V boards) for HIGH, 0V (ground) for LOW.

If the pin is configured as an INPUT, writing a HIGH value will enable an internal 20K pullup resistor (see the tutorial on digital pins). Writing LOW will disable the pullup.

Syntax

digitalWrite(pin, value)

Parameters

pin: the pin number
value: HIGH or LOW

Returns

none

Example

```cpp
int ledPin = 13; // LED connected to digital pin 13

void setup()
{
    pinMode(ledPin, OUTPUT); // sets the digital pin as output
}

void loop()
{
    digitalWrite(ledPin, HIGH); // sets the LED on
    delay(1000);                // waits for a second
    digitalWrite(ledPin, LOW);  // sets the LED off
    delay(1000);                // waits for a second
}  
```
Soldering is Easy

• tin the tip
• heat the components
• apply solder
• clean the tip
• repeat
• practice
Readings and Assignments

• Readings
  • Physical Computing, Chapter 2, 3, 4
  • Getting Started with Arduino, Chapters 1 - 4

• Assignment
  • Digital Output Input Lab
  • Soldering Lab
  • Imagined Physical Computing System