



TEX-FAB 2015 HOUSTON

Interactive Prototypes Workshop

Andrew Payne, Instructor

Saturday, 3/28/15 (9:00am-1:00pm and 2:00pm-6:00pm) and Sunday, 3/29/15 (9:00am-1:00pm)

Workshop Description

This workshop will focus on hardware and software prototyping techniques; using Grasshopper, Firefly, and Arduino as design and technical tools to create responsive architectural prototypes. Using remote sensors, microcontrollers (Arduino), and actuators, we will build virtual and physical prototypes that can communicate with humans and the world around them. Firefly is a set of software tools dedicated to bridging the gap between Grasshopper - (a free plug-in for Rhino) - the Arduino microcontroller and other input/output devices like web cams, mobile phones, game controllers and more. It allows near real-time data flow between the digital and physical worlds – enabling the possibility to explore virtual and physical prototypes with unprecedented fluidity.

Learning Objectives:

- Identify opportunities for physical computing and computational design in new and traditional workflows.
- Learn fundamental concepts for electronic circuit design and prototyping techniques including an overview of hardware (ie.sensors, actuators, and programmable microcontrollers) and software interfaces.
- Learn how real-time feedback can be applied to create interactive devices that are able to respond to environmental parameters and/or user input.
- Understand larger trends in digital practice.

Software Required:

While there are no prerequisites, some exposure to Grasshopper and/or programming is preferred.

- **Rhino 5.0** [32-bit or 64-bit versions](#)
- **Grasshopper** (version 0.9.0076 or higher) <http://www.rhino3d.com/download/grasshopper/1.0/wip>
- **Arduino IDE 1.6.0** <http://arduino.cc/en/Main/Software> (choose Windows Installer)
- **Firefly 1.0069** <http://fireflyexperiments.com/download/>
- **Weaverbird 0.9.0.1** <http://www.giuliopiacentino.com/weaverbird/>

Hardware Required:

It is expected that each participant will need to purchase certain hardware devices in order to complete the tutorials presented in the workshop. A list of required materials can be found below. A general estimate for materials is approximately \$110.00 USD (before tax and shipping) although discounts can be possible if ordering in bulk.

- **Arduino Uno** <https://www.sparkfun.com/products/11021>
- **USB Cable** <https://www.sparkfun.com/products/512>
- **5V External Power Supply** <https://www.sparkfun.com/products/12889>
- **Small Servo Motor** <https://www.sparkfun.com/products/11884>
- **Small DC Motor** <https://www.sparkfun.com/products/11696>
- **Firefly Interactive Prototyping Shield** <http://www.fireflyexperiments.com/shop/>
- **Breadboard (half size)** <https://www.sparkfun.com/products/9567>

- **Jumper Wires** <https://www.sparkfun.com/products/11026>
- **LED (x2)** <https://www.sparkfun.com/products/9592>
- **Resistor (330 ohm x1)** <https://www.sparkfun.com/products/8377>
- **Resistor (10k ohm x2)** <https://www.sparkfun.com/products/8374>
- **Photocell or Trimpot** <https://www.sparkfun.com/products/8374> or <https://www.sparkfun.com/products/9806>
- **Push Button** <https://www.sparkfun.com/products/9190>

Outline:

First Day – Saturday March 26th

Morning Session (9:00am – 12:00pm) – Introduction to Arduino

- The Arduino Uno and how it works
- Four modes of communication (Input vs. Output, Analog vs Digital)
- The Integrated Development Environment (IDE)
- Writing your first sketch
- Building custom circuits (breadboards, jumper wires, etc.)
- Prototyping conventions (how to read resistors, LED polarization, etc.)
- Voltage divider
- Hands-on demos and tutorials

Lunch Break (12:00pm – 1:00pm)

Second Session (1:00pm – 4:45pm) – Introduction to Firefly

- The interactive prototyping shield
- The firefly firmata
- Sending and receiving data
- Uno Read and Write
- Calibrating and filtering sensor data
- Recording data and how to use it
- Blinkers and faders
- Blending waveforms
- Code Generator
- Hands-on demos and tutorials

Q&A Session (4:45pm – 5:00pm)

Second Day – Sunday March 27th

Morning Session (9:00am – 12:00pm) – Mechanisms, Motor Control, and Networking

- Fundamentals in mechanism design
- Motors and how they work
 - DC Motors
 - Stepper Motors
 - Servo Motors
 - Solenoids
 - Pneumatics
 - Soft Robotics
 - Shape Memory Alloys
- Motor coordination
- Networking (UDP vs. OSC)
- Hands-on demos and tutorials

Show & Tell / Wrap Up Session (12:00pm-1:00pm)