

Physical Computing

... in the broadest sense, means building active and interactive physical systems by the use of software and hardware that can sense and respond to the analog world.

Physical Computing

Devices and Systems

- Electronic
- Mechanical
- Active
- Interactive

Applications

- Visual Art
- Theater
- Performance
- New Media

What you will Learn

Practical Toolbox

- Basic electronics
- Basic electronic construction techniques
- Basic programming
 - Traditional, sequential, text-based
 - Ideal for standalone, embedded applications
 - Using the **Arduino** and a simplified C programming language
- Use of sensors and transducers
electronics \Leftrightarrow physical world
- Introduction to MaxMSP
 - Graphical programming language (“virtual patch bay”)
 - Running on a PC
 - Higher level media control
- New ways of interfacing to & interacting with computers/electronic media

What you will Learn

- Survey of electronic art
- Approach to Critical Design
- Work creatively in the medium of electronics
- Electronic systems and devices as an aesthetic/expressive medium

Course Format

- Hands-on
- Laboratory-based
- Syllabus/Schedule Flexible
 - Depends upon your abilities, expectations, ideas

Projects & Grading

Grading

Attendance and participation:	25%
Several short technical assignments:	10%
Several short written assignments	10%
Project 1: The Object that Responds...	10%
Final Project Proposal/Prototype	10%
Project 2: Sensor Integration	10%
Final Project	25%

Projects

- Also flexible
- Active → Interactive → Expand/integrate
- Demonstrate technical proficiency
- Conceptual evolution

Materials & Texts

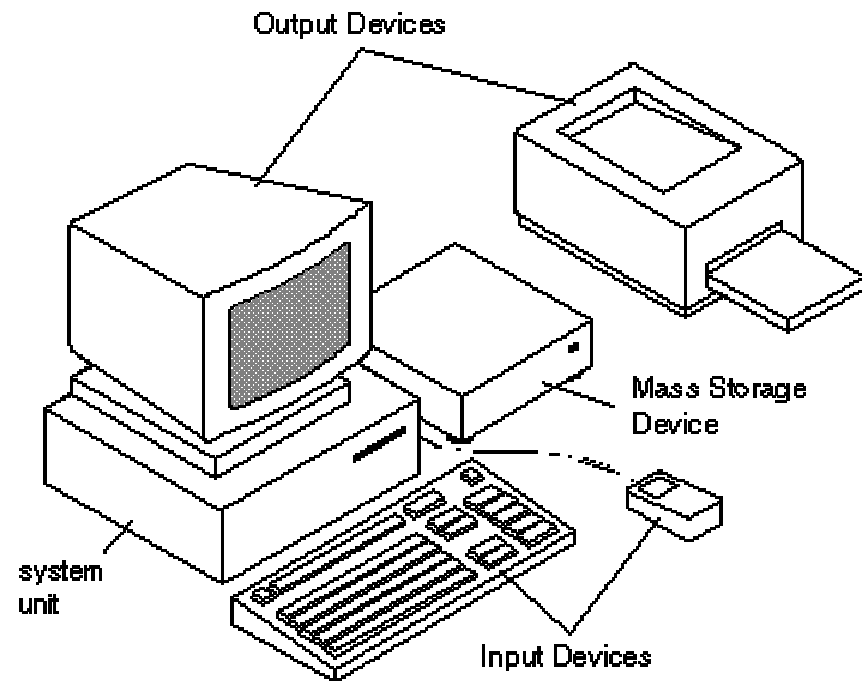
- **Getting Started with Arduino** by Massimo Banzi
O'Reilly Media / Make October 2008, ISBN:978-0-596-15551-3
- **Physical Computing: Sensing and Controlling the Physical World with Computers**,
by Tom Igoe and Dan O'Sullivan. Thompson Course Technology. ISBN 1-59200-346-X.
Available online through the TU library.
- **What's a Microcontroller?** by Andy Lindsay
Parallax Press; Version 2.1 (January 2003), ISBN-10: 1928982026
Available online: http://www.parallax.com/dl/docs/books/edu/wamv2_1.pdf
- Arduino Kit http://www.adafruit.com/index.php?main_page=product_info&cPath=17&products_id=68
- Miscellaneous electronics
- Recommended: tool kit

What is a Computer

A programmable machine.

The two principal characteristics of a computer are:

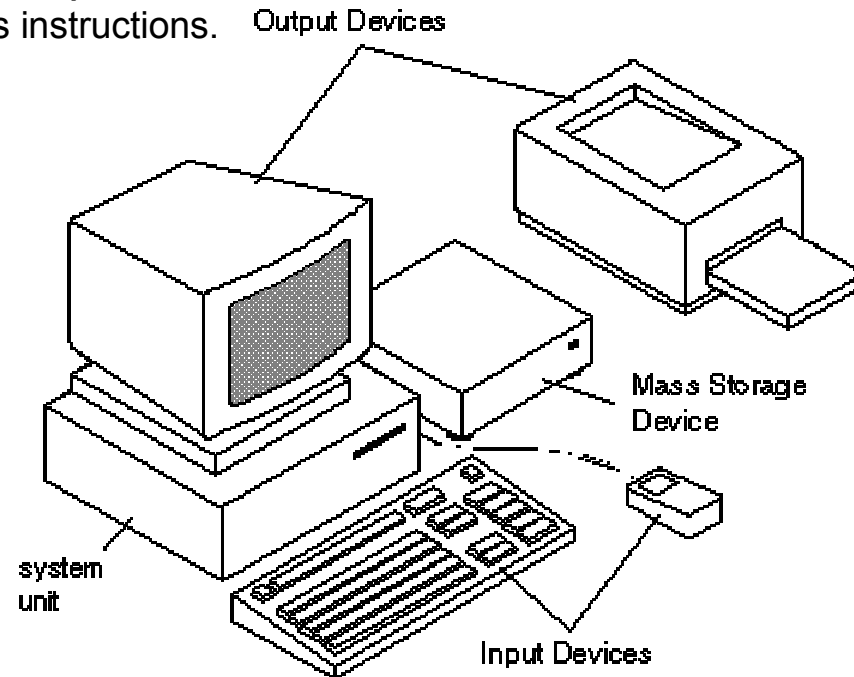
- It responds to a set of instructions in a well-defined manner.
- It can execute a prerecorded list of instructions (a program).



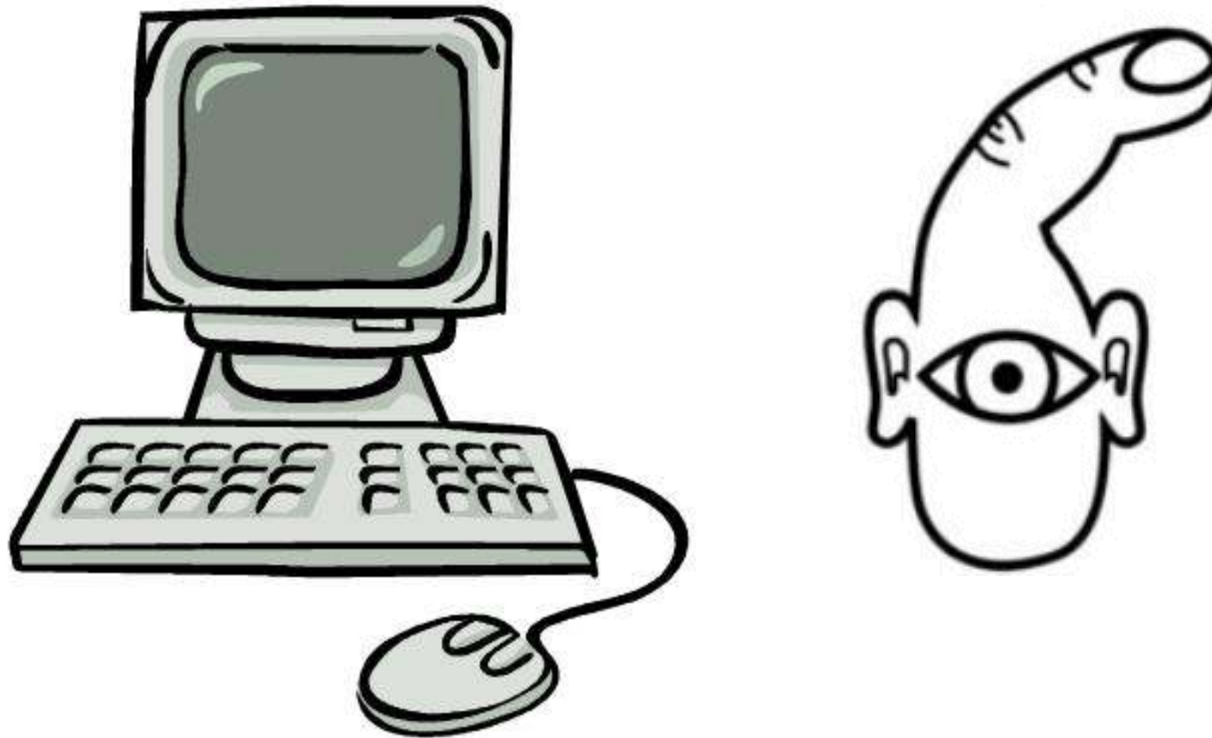
What is a Computer

In general, computers incorporate the following hardware components:

- **memory:** Enables a computer to store data and programs.
- **input device(s):** Usually a keyboard and mouse, the conduit through which data and instructions enter a computer.
- **output device(s):** A display screen, printer, or other device that lets you see what the computer has accomplished.
- **central processing unit (CPU):** The heart of the computer, this is the component that actually executes instructions.

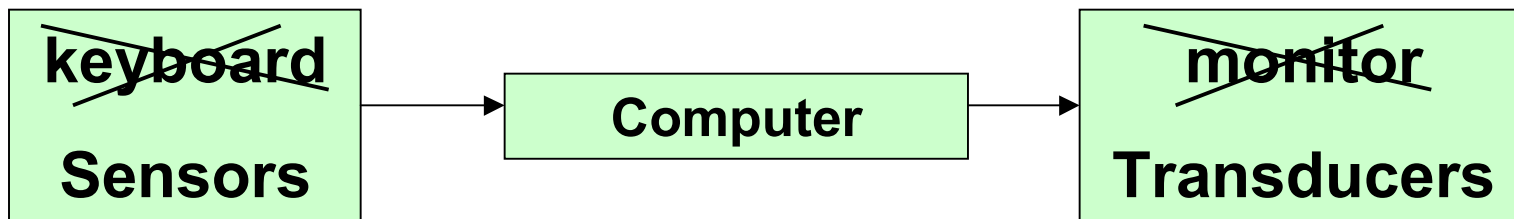


How the computer sees us



The traditional “computer” interacts with the physical world in a very limited manner.

New Interface Paradigms

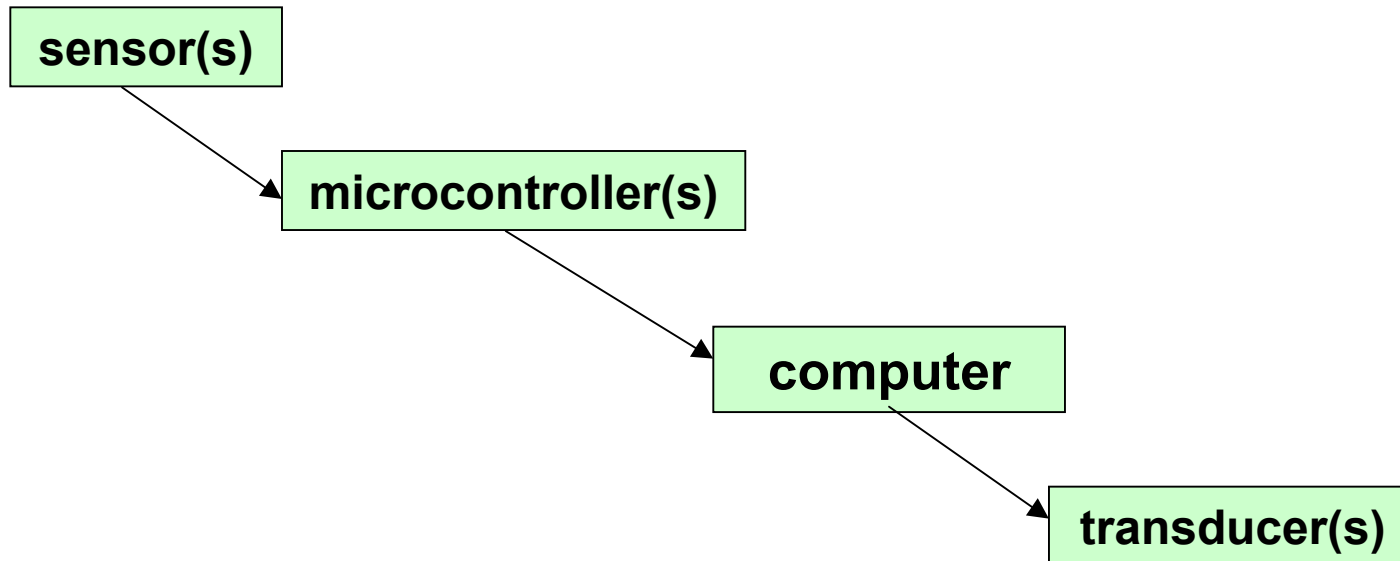


What is a Microcontroller

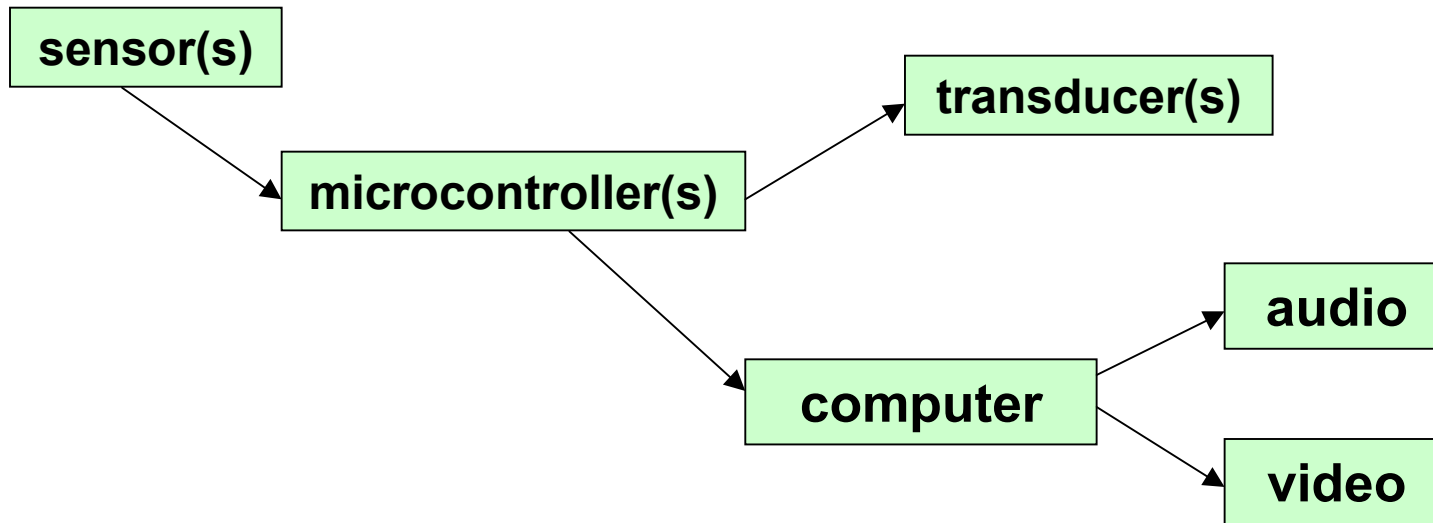
- A (little) computer
 - memory
 - provisions for input
 - provisions for output
 - central processing unit (CPU)
- The Arduino
- Embedded
- Stand-alone
- Ubiquitous
- Ideal platform for interactive design



Physical Computing Architectures



Physical Computing Architectures



Examples and Demo

- Survey of my work
 - Active
 - Interactive/embedded
 - Installation/environmental
- Mixed Body

<http://www.lisamariepatzer.com/collaborations/mixedbody.html>



**“Evolution of Desire”
custom analog electronics**



Handheld interactive device based on
BasicStamp platform



“Supplemental Shrubbery
Sound Source”

Assignment

Assignment for Thursday Jan 28th:

- Order Arduino Kit ! http://www.adafruit.com/index.php?main_page=product_info&cPath=17&products_id=68
- Complete survey
- Read *Physical Computing*, introduction and chapters 1-3
(note info relating to specific microcontrollers and BASIC)
- Read soldering tutorial pp. 41-45 of *Physical Computing*.,
- Review online soldering information available at:
<http://www.aaroncake.net/electronics/solder.htm>
<http://itp.nyu.edu/physcomp/Tutorials/SolderingAPerfBoard>

There is also a rather extensive video on soldering available at:

http://blog.makezine.com/archive/2007/01/soldering_tutor_1.html

Basic Electronic Toolkit

for under \$40

- [Multimeter](http://www.mpja.com/prodinfo.asp?number=17191+TE)
- Small [Wire cutters](http://www.mpja.com/prodinfo.asp?number=16761+TL)
- [Wire strippers](http://www.mpja.com/prodinfo.asp?number=11715+TL)
- [Needle nose pliers](http://www.mpja.com/prodinfo.asp?number=15395+TL)
- Xacto knife
- [Soldering iron](http://www.mpja.com/prodinfo.asp?number=15860+TL) and sponge
- Solder
- [Solder sucker](http://www.mpja.com/prodinfo.asp?number=0041+TL) or [desoldering braid](http://www.mpja.com/prodinfo.asp?number=0041+TL)
- Solderless [Breadboard](http://www.mpja.com/prodinfo.asp?number=18103+TE)
- Assorted screw drivers

Also useful:

- [Small vise](http://www.mpja.com/prodinfo.asp?number=17500+TL)
- Hot melt glue gun
- miscellaneous pliers

