

# Networked Objects

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Spring 2006  
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<http://www.digilutionary.com/classes/netobj>

## Class Hours

- Thursdays 9:30am - 12:00pm

## Office Hours

- Thursdays 1:00pm - 5:00pm
- By Appointment

## Description

This course explores the possibilities and challenges of designing alternate physical network interfaces. In physical computing, we tackle the question of how to make devices that respond to a wide range of human physical actions. In this class, we tackle the question of how to integrate physical devices as interfaces to a larger network. On the physical interface side, students will work with a variety of network interface devices, for computers ranging from micro-controllers to web servers. On the network server side, basic server-side programming techniques in Java will be introduced. Students should be comfortable programming in Java or Processing, and with the basics of physical computing. Topics of investigation include: networking protocols and micro-controllers (doing a lot with a little); network time vs. physical time; coping with network unreliability; planning a network of objects (system design); mobile objects; and embedded wireless ethernet. A paper is required, as well as an online journal; students also undertake a midterm and final project.

## Projects

There are three production projects assigned throughout the semester, and you'll be expected to complete all of them. You'll work in pairs for at least two of the assignments; larger groups are allowed so long as everyone participates equally.

The pair assignment and midterm are exercises to work with basic networking principles. These two assignments are given a limited scope so we can understand how the network works, and how our projects fit into the network.

The final project is a practical application of networking and physical interaction design. The project can utilize any of the technologies we discuss, or other technologies, as appropriate to the project. The goal of the final project is to present a workable prototype of a networked application. If you have an idea for the final project that overlaps with another class talk to me about it, and we can figure out if it is an appropriate overlap.

## Journal & Documentation

The best documentation comes from experience. As an evolving topic and class, some of the best documentation available to you comes from the journals of previous students. In the same way your journals and project documentation will inform the next group to take the class.

You are expected to maintain an online journal of all of your work in the class. The journal doesn't need to be a step by step tutorial on how you accomplished your project, but it should include problems you encountered, ways around those problems, sources for materials, references you utilized, the idea behind the project, photos, schematics, etc.

You will also need to keep journal entries on the readings for the class. The readings will cover theory, application, experiments, and a few interesting products relevant to the class. Write about what impresses you, what you agree or disagree with, what might be confusing, and what ideas you come up with for projects while doing the readings. By the middle of the semester you should have a few final project ideas in your journal.

Your journal doesn't need to be a complex undertaking, no-frills HTML is fine, as are blogs or wikis. Please don't use Flash, Processing, or any other formats that aren't text searchable. Ideally this shouldn't be a one-off blog that you delete at the end of the semester; think of it as the start of a documentation portfolio for future projects and future students. I would suggest that you maintain your journal over the whole semester, rather than leaving it to the last minute.

## Midterm Journal Response

After the midterm, a short response (~1000 words) to another student's journal is due. I'll assign who's reading whose journal a couple of weeks before. Send your response to both me and the person whose journal you read. Comment on whatever aspect of the journal seems most worth discussion. It may be that the person had particularly strong opinions on some readings that you agree or disagree with; it may be that he or she had project ideas that inspire you, or that seem problematic in some way. Your comments or critique should be straightforward and constructive. Whether you think the writer's ideas are brilliant or impenetrable, write the kind of critique that you'd want to receive yourself. Good critique could lead to a useful dialogue or collaboration between you and person whose work you read. Feel free to bring in readings and experiences of your own to these responses, in addition to any other books or works that come up in class.

## Class Schedule

### Week 1

January 19<sup>th</sup>

### Introductions and General Themes

Space Annotation  
Context Awareness  
Remote Displays & Remote Controls  
Location and Identification  
Types of Embedded Processors

### Week 2

January 26<sup>th</sup>

### Calm Technology

Network Layers  
Control Issues  
Intro to Lantronix Devices

**Week 3**

February 2<sup>nd</sup>

**Context Awareness**

Back-end Servers in Java  
Project Planning

- System Diagrams
- Protocol Diagrams
- Flowcharts

*Assignment Due*

- Journal Notes on Readings

**Week 4**

February 9<sup>th</sup>

**Remote Displays**

Lantronix Devices  
Printed Circuit Boards and Soldering

*Assignment Due*

- Journal Notes on Readings

**Week 5**

February 16<sup>th</sup>

**XPort Meets PIC**

**Cellphones**

J2ME, WML  
Intro to J2ME

**Playing Games - The Pair Project**

**Week 6**

February 23<sup>rd</sup>

**Present Pair Projects**

*Assignment Due*

- Pair Assignment & Documentation
- Start Midterm Project
- Journal Notes on Readings

**Week 7**

March 2<sup>nd</sup>

**Space Annotation**

**Domestic Applications**

Introduction to Wireless

- 802.11
- Bluetooth
- Simple RF

Wireless and Location Overlap

<b>Week 8</b> March 9 <sup>th</sup>	<b>Location &amp; Identification</b> GPS, Cellular ID, RTLS, etc RFID iButton Fingerprint / Biometrics  <i>Assignment Due</i> <ul style="list-style-type: none"><li>• Midterm Project Update</li><li>• Choose Technical Research Topic (1 Paragraph Outline)</li><li>• Initial Final Project Abstract (1 Paragraph Outline)</li></ul>
<b>Week 9</b> March 23 <sup>rd</sup>	<b>Midterm</b> Brainstorm Final Projects  <i>Assignment Due</i> <ul style="list-style-type: none"><li>• Present Midterm Projects</li><li>• Midterm Project Documentation</li></ul>
<b>Week 10</b> March 30 <sup>th</sup>	<b>Final Project Workshop</b> Final Project Concept Review / Discussion  <i>Assignment Due</i> <ul style="list-style-type: none"><li>• Midterm Journal Review</li><li>• Final Project Idea Presentation</li><li>• Final Project Abstract</li></ul>
<b>Week 11</b> April 6 <sup>th</sup>	<b>Final Project Concept Presentations</b> Guest Review of Final Project Mockup  <i>Assignment Due</i> <ul style="list-style-type: none"><li>• Present Final Project Interface Mockups</li></ul>
<b>Week 12</b> April 13 <sup>th</sup>	<b>Technical Research Presentations</b>  <i>Assignment Due</i> <ul style="list-style-type: none"><li>• Technical Research Project</li></ul>
<b>Week 13</b> April 20 <sup>th</sup>	<b>Final Presentations</b>
<b>Week 14</b> April 27 <sup>th</sup>	<b>Final Presentations</b>

## Reading Materials

The majority of texts for the class will be articles available online, links for which will be posted on the class website. One of the primary resources for information about projects, research and texts pertaining to networked micro-controllers is the Physical Computing and Networked Objects sections of Tom Igoe's website.

The optional materials listed below are intended as inspiration and further reading, and by no means constitutes a definitive list. If you find a book or article that you think should be in this list, let me know.

### *Reference Materials*

- Tom Igoe: <http://tigoe.net/pcomp/index.shtml>

### *Optional Materials*

- **Smart Mobs: The Next Social Revolution**, Howard Rheingold. Perseus Publishing; ISBN 0-7832-0608-3
- **Six Degrees: The Science of a Connected Age**, Duncan J. Watts. W.W. Norton & Company; ISBN 0-3930-4142-5

A nice introduction to the science of networks, with a good bit of focus on the social angle.

- **The Future of Ideas: The Fate of the Commons in a Connected World**, Lawrence Lessig. Vintage Books; ISBN 0-3757-2644-6

An excellent examination of the clash between the open-ended architecture of the early internet and the property-centric legal system in the US. Lessig puts forth the idea of the internet as an "innovation commons", and explains how current attempts to extend copyright and tighten intellectual property law threaten that commons.

- **The Victorian Internet : the remarkable story of the telegraph and the nineteenth century's on-line pioneers** Tom Standage. Walker and Co. ISBN 0-4251-7169-8.

A well-told story about the beginnings of telecommunications. Great inspiration if you're interested in networks.

- **The Social Life of Information** John Seely Brown and Paul Duguid; Harvard Business School Press; ISBN: 1-5785-1708-7; 1st edition.

This book looks at the effects of the "information revolution", and the blinders caused by seeing every problem as one to be solved by more information, or better access to information. The authors argue that information and information design seen out of context lead to blind alleys.

- **The Tipping Point: How Little Things Can Make a Big Difference**, Malcolm Gladwell. Little Brown & Company; ISBN: 0-3163-1696-2
- **The Death and Life of Great American Cities**, Jane Jacobs. Vintage Books; ISBN: 0-6797-4195-X; © 1961, Reissue edition 1992

## Parts

During the first half of the class we'll be working with the embedded network co-processor called the Co-box Micro, or the more recent XPort. Both of these are available from Symmetry Electronics; the Co-box is

available at a student discount price of \$67, or \$62.50 if you buy as a group. The XPort costs \$49. Contact Jennifer Padula at Symmetry:

Phone: (508) 393-9006

Fax: (508) 393-7913

300 W. Main Street

Northboro, MA 01532

USA

You'll also need a micro-controller and the basic physical computing parts for your projects. You can use other network co-processors if you prefer, so long as they meet the specifications and needs of the projects. All of the examples for the class will use the Cobox Micro and XPort. Check with me in advance if you would like to try using a different network processor.

## Grading

Grades will be determined according to the following breakdown:

- Participation and Attendance: 30%
- Pair Assignment: 15%
- Midterm: 15%
- Final Project: 20%
- Journal & Journal Response: 20%

Please turn in assignments on time. For each week an assignment is late, a partial letter grade will be dropped, ie: 1 week late means a maximum possible grade of A-, 2 weeks late is a maximum B+, and so on.