

CSE 118: Applications in Ubiquitous Computing

Instructor: Lisa Cowan

TA: Cynthia Taylor

A Nomadic Information Society

- Distributed work environments, travel, family
 - Maintain contact w/ friends and colleagues
- We depend on good information, and lots
 - Decision making, prioritizing
 - Opportunities emerge anytime, anywhere
 - Information glut, distraction
- How can we make information and knowledge manifest in the physical world?
- How can we (computationally) leverage information about the physical environment?

IN JAPAN, IT IS NOT UNCOMMON TO READ ABOUT AN OLD MAN OR WOMAN DYING ALONE AND NOT BEING DISCOVERED FOR DAYS OR WEEKS. THEIR POPULATION WOES (HIGHER LIFE EXPECTANCY; LOW BIRTH RATE) AND THE CULTURAL SHIFT TOWARDS MORE NUCLEAR FAMILY STRUCTURES, IS CAUSING AN INCREASE IN THE AMOUNT OF ELDERLY LIVING BY THEMSELVES.

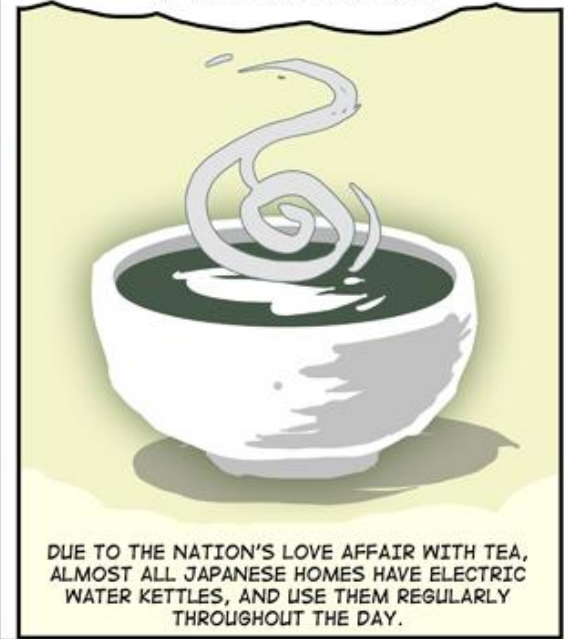


SADDENED BY ONE SUCH INCIDENT, A DOCTOR CALLED UP SEVERAL COMPANIES, WONDERING IF THERE WASN'T ANYTHING THAT COULD BE DONE TO PREVENT THESE "LONELY DEATHS."

ONE OF THESE COMPANIES WAS **ZOJIRUSHI**, A MANUFACTURER OF KITCHEN APPLIANCES SUCH AS RICE COOKERS AND ELECTRIC KETTLES.



THE SOLUTION THEY CAME UP WITH WAS BOTH ELEGANT AND INGENUOUS.



DUE TO THE NATION'S LOVE AFFAIR WITH TEA, ALMOST ALL JAPANESE HOMES HAVE ELECTRIC WATER KETTLES, AND USE THEM REGULARLY THROUGHOUT THE DAY.

SO IN 2001, ZOJIRUSHI LAUNCHED THE **MIMAMORI** ("KEEPING WATCH") **HOTLINE**, A NON-INVASIVE MONITORING SYSTEM THAT ALLOWS PEOPLE TO KEEP TABS ON THEIR ELDERLY RELATIVES THROUGH THE NORMAL USE OF AN I-POT ELECTRIC KETTLE.



USING A WIRELESS TRANSMITTER, THE KETTLE SENDS INFORMATION ABOUT ITS USE (SUCH AS THE MACHINE BEING POWERED ON OR WATER BEING DISPENSED) THROUGH A CELLULAR CARRIER. THESE REPORTS ARE COMPILED INTO DAILY EMAILS THAT ARE FORWARDED TO THE ASSIGNED CAREGIVER.

IF THE KETTLE SUDDENLY BECOMES INACTIVE, AN ALERT GOES OUT FOR SOMEBODY TO CHECK ON THE OWNER.



ALONG WITH ITS PRIMARY BENEFIT, ELDERLY PEOPLE REPORT FEELING HAPPIER AND LESS LONELY KNOWING SOMEBODY IS LOOKING OUT FOR THEM--EVEN IF IT'S JUST A NEIGHBOR STOPPING BY AFTER RECEIVING A FALSE ALARM.

THE MIMAMORI HOTLINE IS STILL IN USE TODAY AND HAS MADE GREAT STRIDES IN BRIDGING THE GAP BETWEEN THE YOUNG AND OLD GENERATIONS.

AT LEAST UNTIL OBAASAN GETS ON TWITTER.



Ubiquitous Computing

Embodied Virtuality

Pervasive Computing

Augmented Reality

Cyber-Physical Systems

Sensors, networks, and (mobile) computers
linking the physical and virtual worlds
everywhere, all the time, for everyone.

Emphasis on distributed systems + people

Ubicomp 2011 Call for Papers

“Ubicomp is an interdisciplinary field that includes technologies that bridge the digital and physical worlds, systems and applications that incorporate such technologies, infrastructures that support them, human activities and experiences these technologies facilitate, and conceptual overviews that help us understand – or challenge our understanding of – the impact of these technologies.”

Themes, Applications

- Sensing (temperature, location, emotion, energy)
- Activity recognition (e.g., walking/driving)
- Context-awareness (e.g., smart homes)
- Ambient displays
- Security, privacy
- Social interaction, communication
- Health
- Education
- ICT4D (developing regions)
- Environment

ActiveCampus



exploring mobile context awareness in the campus setting



What should the apps be? The UI?
What effects do they have?

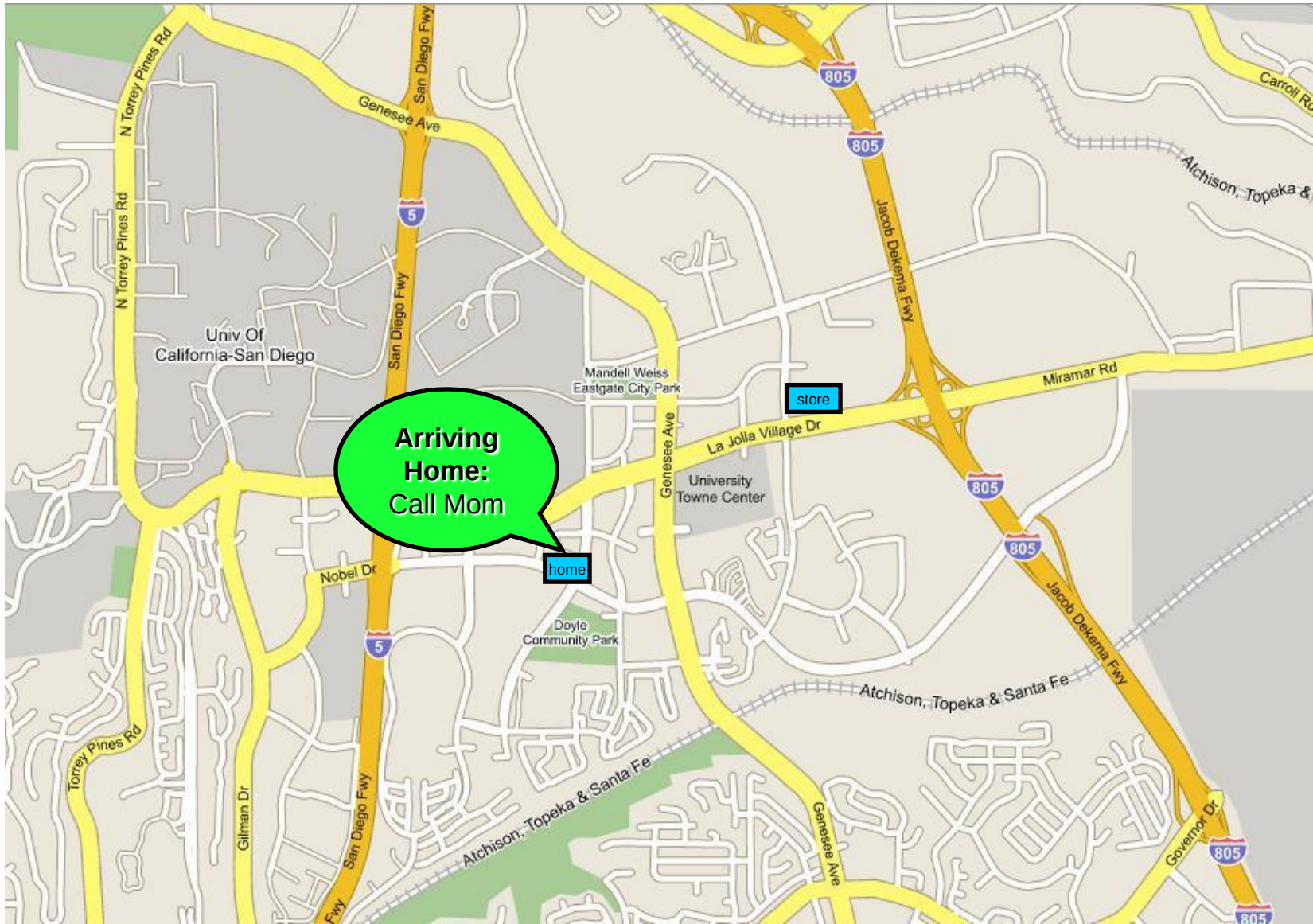
Deployed 500 WiFi PDAs...

broadened discourse
creative use of location
IM when closer than average
willingness to be “seen”
need “everywhere, all the time”



Place-its: Location-based reminders

- 10-person study revealed phenomena unique to



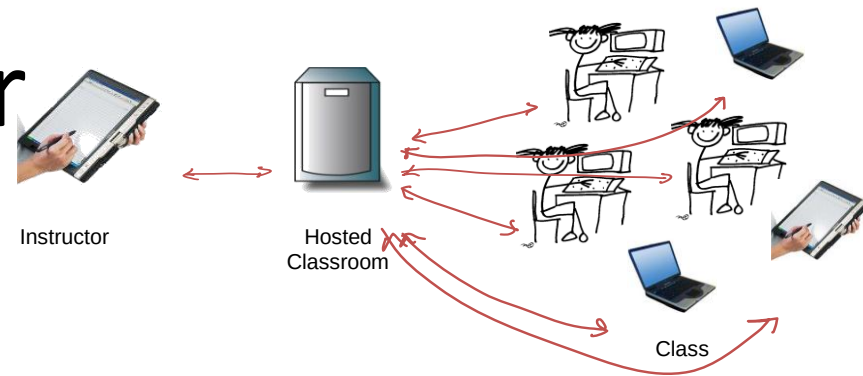
coming
not busy
on the
s on

daring
ally ...

ut,
"

Ubiquitous Presenter

Active Learning for the Large Classroom



- Participatory learning is a superior teaching method
- Hard in large classrooms
- UP supports wireless transmission of student submissions, questions, and polls (in ink or text)
- Now in wide use at UCSD & numerous other campuses

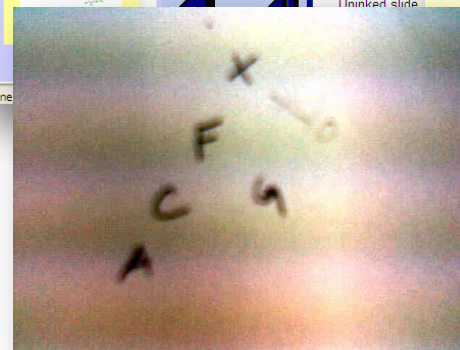
The screenshot shows a web browser window displaying a presentation slide titled "Implication". The slide content includes:

- Implication (also called if-then)**
- $p \rightarrow q$ if p then q or p implies q
- For the formula to be true, if p is true, then q can't be false.
- If p is false, the formula is true
- Example:** p yesterday q did not rain. If it is raining today, the driveway will get wet.

A truth table is shown on the right:

p	q	$p \rightarrow q$
f	f	t
f	t	t
t	f	f
t	t	t

Handwritten notes in green ink are visible on the slide, including "if p then q or p implies q" and "did not rain".



The image shows a handwritten tree diagram and its corresponding Lisp Cons notation. The tree has a root node 'X' with two children 'F' and 'G'. The 'F' node has a child 'A', and the 'G' node has a child 'C'. The letters 'A', 'C', 'F', and 'G' are written in a circular arrangement around the root 'X'. Below the tree, the Lisp Cons notation is written: $(G(C(AF)X))$. The word "Trees" is written at the top, and "Woot!" is written in red on the right.

Ink submission

Photo submission

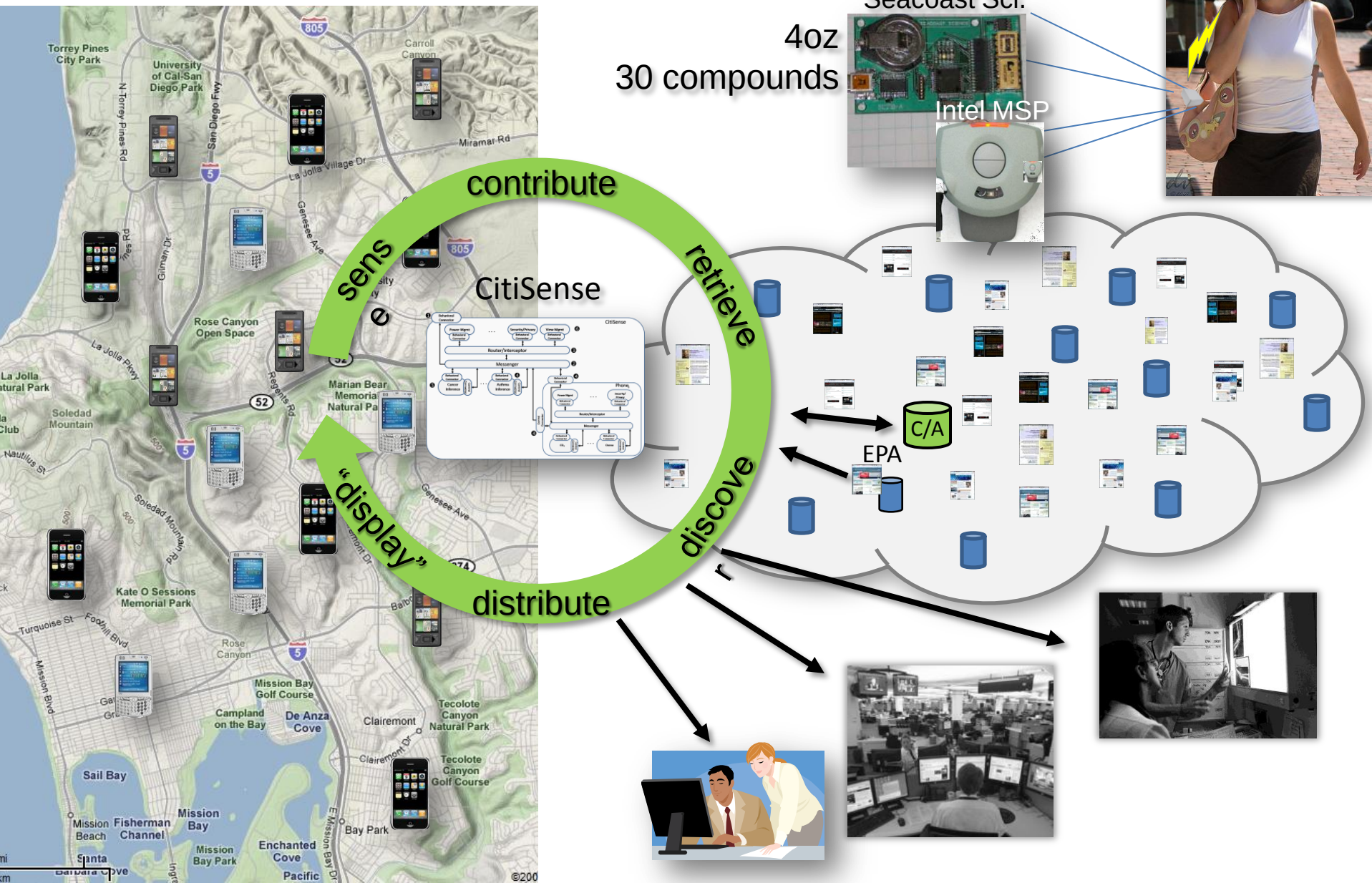
Escaping the Palm Top – Public Facebook



CitiSense – Ubiquitous Personal Sensing



CitiSense - Radical Transparency



Some Research Problems

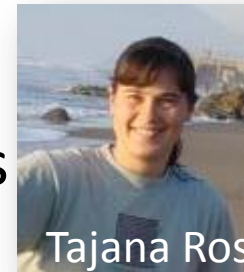
- Software Architecture
 - Citizens, policy makers, & researchers should be able to easily add sensors, displays, & apps
- Inference with noisy commodity sensors
 - Low cost for ubiquity, heterogeneous due to innovation
- Mobile power
 - Resources will be scarce at the fringes
- Security and Privacy
 - Under multiple authorities, sensors not securable
- Use and Efficacy
 - How will people use and how to design for it?



Ingolf Krueger



Sanjoy Dasgupta



Tajana Rosing

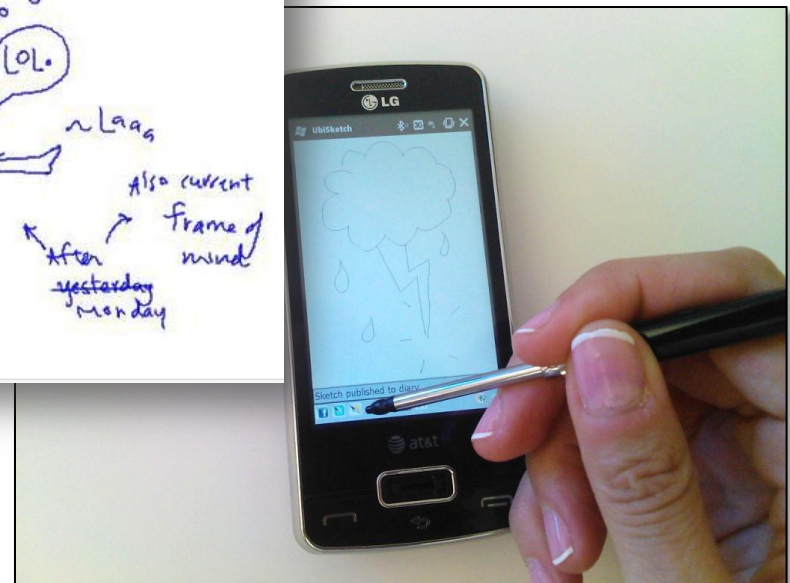
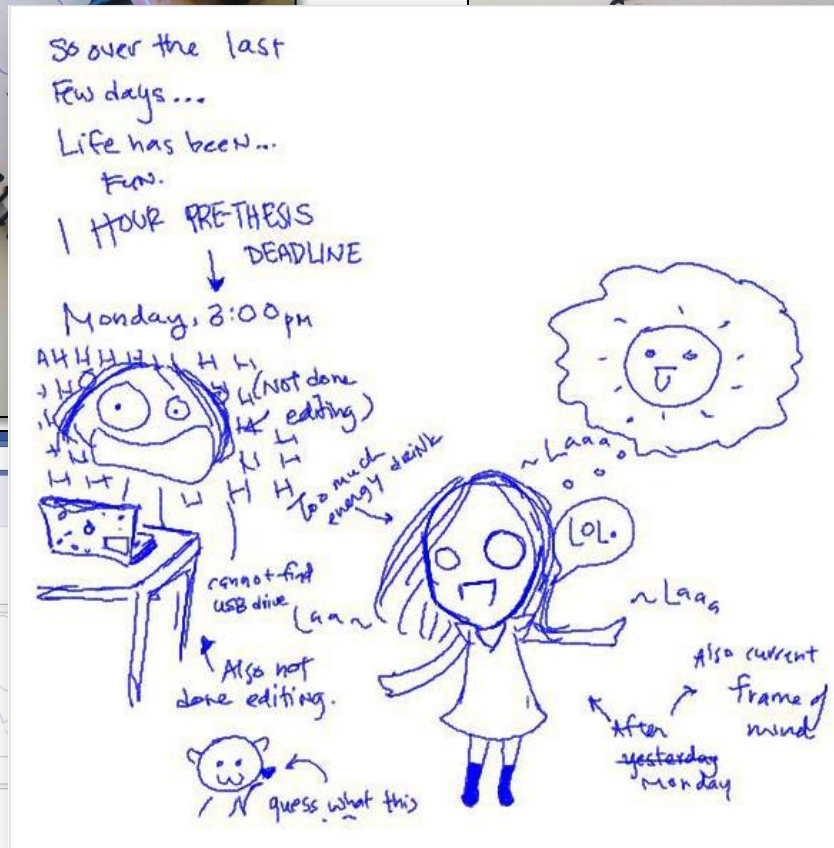
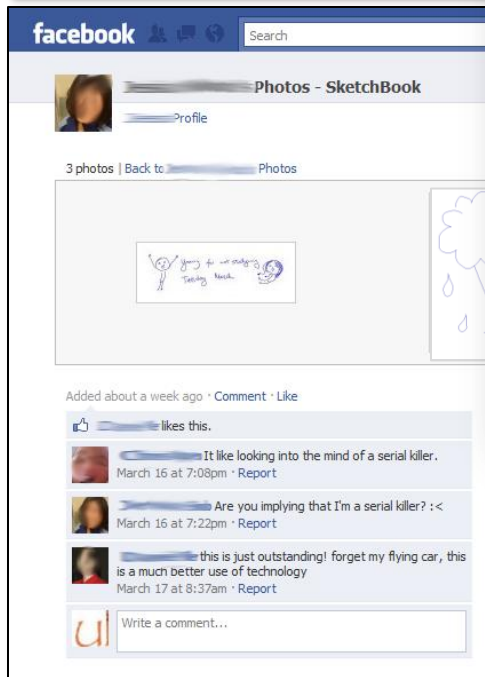
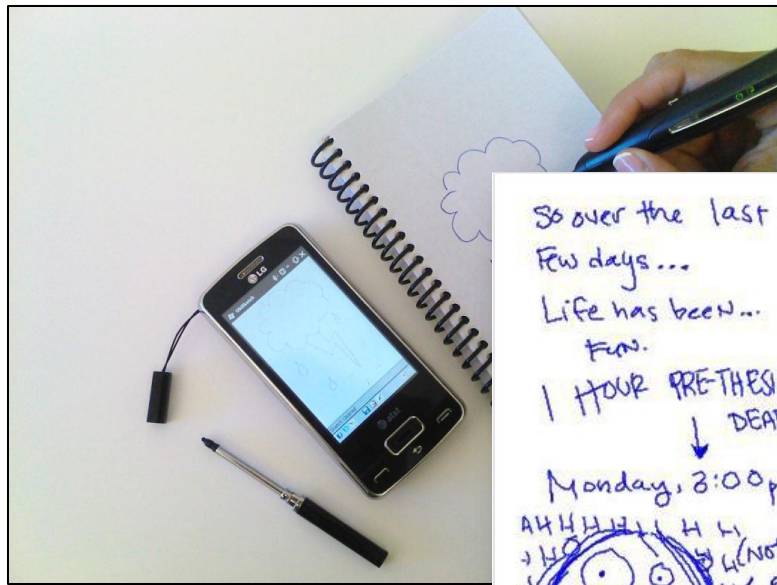


Hovav Shacham



Kevin Patrick
(Preventive
Medicine)

UbiSketch: Ubiquitous Sketching



SLAP widgets: Bridging the Gap Between Virtual and Physical Controls on Tabletops

“Our **Silicone ILluminated Active Peripherals**, or SLAP widgets, are **physical widgets** made from silicone rubber and acrylic that **combine the advantages of physical and virtual devices**: Our SLAP buttons, sliders, knobs and keyboards have the **physical shape** of real devices to provide the right **haptic feedback**, but are still easily **relabeled** using a **tabletop** rear projection. At the same time, they are particularly **low-cost**, and **easy** to use.”

Malte Weiss (RWTH Aachen), Jim Hollan (UCSD) et al.

<http://hci.rwth-aachen.de/slap>



Lighting Choreographer

- Lighting Choreographer: an LED Control System for Dance Performances

Minoru Fujimoto, Naotaka Fujita, Tsutomu Terada, Masahiko Tsukamoto

http://www.dr-popeye.com/lighting_choreographer.html

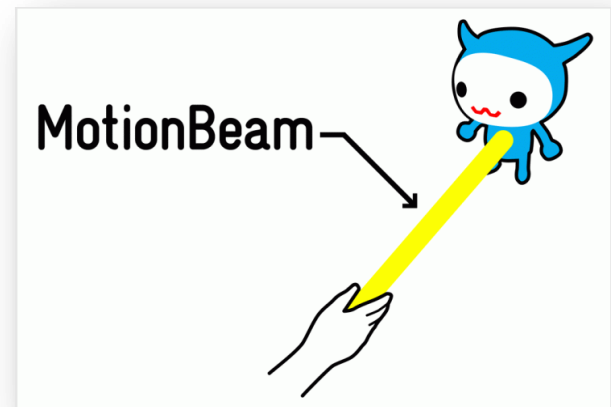


MotionBeam

The *MotionBeam* project explores the use of handheld projectors to interact and control projected characters. Physical movement of the projection device, much like a motion controller, is used to guide and interact with the character. This creates a unified interaction style where sensor input and projector output are tied together within a single device.

Karl D. D. Willis, CMU and Disney Research

<http://www.motion-beam.com/>



The Course: Logistics

- **Lecture (paper discussion):**
 - Mon / Wed 11:00am-12:20pm
- **Problem session (research discussion):**
 - Fri 11:00am-11:50am, same room
- Bookmark the **web site**:
<http://cseweb.ucsd.edu/classes/fa11/cse118-a/>
- Sign up for **email list** (cse-cse118@eng.ucsd.edu):
<http://groups.google.com/a/eng.ucsd.edu/group/cse-cse118>
- **Grading:** 50% discussion, 50% project

The Course: Academic Preparation

- Directly engage the research literature
 - A good look at the future – the world's...and yours?
- Participatory, loosely structured
 - Mold this course to your interests
 - Get out of it what you put in
- A peek at what grad school could be like
 - And preparation for it
 - Analytical thinking, communicating ideas, teamwork
 - Even if you're not considering grad school...

The Course: Inquiry-based Learning

- Seminar style, roundtable discussion
 - You must come prepared for class to discuss
 - We will have some visitors give talks, demos
- Research project
 - Small groups (2-4 people)
 - Experimental

The general structure for this course is learning by doing, *with help*

The Course: M/W Paper Discussion

1. Read the papers for class
 - Dig into background reading if need/want
2. Take notes
 - Mark up the paper
 - Fill out the form (see “How to read...” on web)
 - Bring questions to class (more important than answers)
3. Jump into discussion!
 - Volunteer when you’re ready, be polite but assertive
 - Show respect, encourage balanced participation
 - If you’re late, you can’t participate

How will I grade discussion?

- quality, not quantity
- ideas and critique supported by evidence
- helping group perform at high level (teamwork)

The Course: Research Project

- Define a team project to empirically explore ubiquitous computing
 - Usefulness, scalability, cost, how, effects...
- Not necessarily big, but insightful or useful
- Come up with own idea or use someone else's
 - Doesn't have to be implementation, just empirical (experimental)
 - SW resources: Ubiquitous Presenter, S3, Public Facebook, UbiSketch ...
 - HW resources: Phones, TabletPC's, Anoto pens

The Course: Friday Research Discussion

- Orthogonal material designed to dramatically improve your performance in the course...and in life!
 - Research methods
 - Academic life
 - Project management
 - Writing and presentation
 - Creativity
- Group work, mentoring on research project

The Course: Living It

- Live the UbiComp lifestyle
 - Go mobile: laptop, tablet, mobile phone...
 - Web 2.0: facebook, foursquare...
 - Put a small “public display” up at home
- Read about it
 - Subscribe to an RSS feed, mailing list, or magazine
 - ACM TechNews: <http://www.acm.org/technews/>
 - Wired: <http://www.wired.com>
- Observe it, talk about it, bring it into discussion
 - It’s everywhere around you
 - Hear about something cool? Send to the mailing list.

For Wednesday

- Sign up for class mailing list
- Read course website, especially:
 - How to read an engineering paper
 - Structured form for reading a paper
 - Note taking rubric
 - Participation rubric
- Read paper (Weiser), mark up paper, fill out form, prepare ~3 questions

Ubicomp 2011 Call for Papers

- **Devices & techniques** – descriptions of the design, architecture, usage and evaluation of devices and techniques that create valuable new capabilities for ubiquitous computing
- **Systems & infrastructures** – descriptions of the design, architecture, deployment and evaluation of systems and infrastructures that support ubiquitous computing
- **Applications** – descriptions of the design and/or study of applications that leverage UbiComp devices and systems
- **Methodologies & tools** – new methods and tools applied to studying or building UbiComp systems and applications
- **Theories & models** – critical analysis or organizing theory with clear relevance to the design or study of UbiComp systems
- **Experiences** – empirical investigations of the use of new or existing UbiComp technologies with clear relevance to the design and deployment of future UbiComp systems