Administrivia

- Question about units:
  - The department office did not set Spire up properly
  - We will be adding 1 unit for the lab component of the class
  - If this is a problem: speak to me

Office/Lab Hours

- M/W: 11:20-2:20 (John: first hour; Patrick: last two)
- F: 12:20-2:20 (Patrick)
- T/Th: 1:30-2:30 and 3:45-5:00 (me)

- Full schedule starts after class on September 16th
- Until then: official lab times only
  - M/W/F 12:20-1:20
- Also note: weeks of the 22nd and 29th will be complicated wrt scheduling: watch the web page

Final Notes on Grading

- Participation:
  - Discussion of events of the day (beginning of class)
  - Questions/opinions about class materials
  - Taking a leadership role in the development of widgets or standards
- Licensing IP:
  - Only the IP owner may license IP

Class Resources

- Web page:
  - www-anw.cs.umass.edu/~fagg/classes/503
- Wiki: a remotely editable web page
  - The TWikiGuest password is ...
- Newsgroup:
  - nntp://news.oit.umass.edu/cmpsci.edlab.cs503
  - On-campus access only
- The Lab...

Distinguished Lecture Wednesday

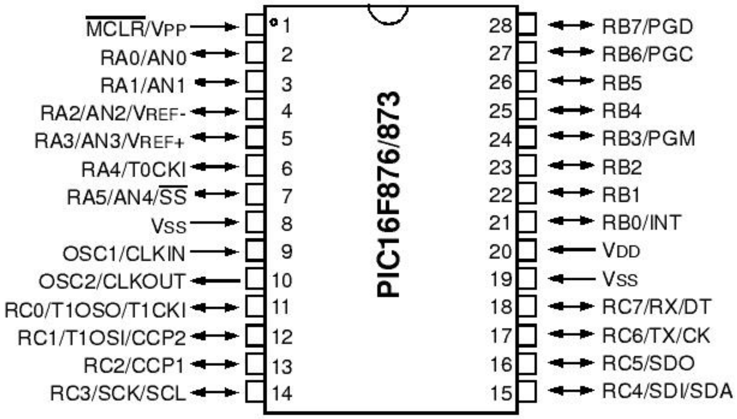
Henry S. Baird
Palo Alto Research Center

“ Image Understanding and Web Security”

CS 151, 4:00

Embedded Systems Lab Space

- LGRT T 212/214
- Anyone may work in the lab while it is open
  - Official lab times: M/W/F 12:20 – 1:10
- Once we get started on widgets, you should try to spend 7-8 hours/week in the lab (really)



PIC16F876/873
MCLR/VPP 1
RA0/AN0 2
RA1/AN1 3
RA2/AN2/VREF- 4
RA3/AN3/VREF+ 5
RA4/T0CKI 6
RA5/AN4/SS 7
VSS 8
OSC1/CLKIN 9
OSC2/CLKOUT 10
RC0/T1OSO/T1CKI 11
RC1/T1OSI/CCP2 12
RC2/CCP1 13
RC3/SCK/SCL 14
28 RB7/PGD
27 RB6/PGC
26 RB5
25 RB4
24 RB3/PGM
23 RB2
22 RB1
21 RB0/INT
20 VDD
19 VSS
18 RC7/RX/DT
17 RC6/TX/CK
16 RC5/SDO
15 RC4/SDI/SDA

What is in the Lab?

- 2 linux-based computers (configured as standard EdLab machines)
  - Each is equipped with a microprocessor programmer
  - More computers may appear later in the semester
- A large set of tools
- Many components for building widgets
  - We plan to be ordering components throughout the semester: ask if you want something specific
  - If you bring in your own components, they must first be cleared with me

Lab Policies
(details on the web site)

- No food or drink
- Clean up after yourself
- Be courteous
- Eye protection must be worn while soldering
- No lab supplies or books leave the room
- Do not handle the projects of other students without permission

Lab Policies (cont)

- Do not play with the AC outlets
- Clear guests with the monitor
- If you break something: report it
- Be aware of the amount of a single resource that you use: please let us know if we are running low on something
- Check your wiring before you power up
- Do not pull chips out of circuit boards with your fingers (really)

Ubiquitous Computing

Readings for today:

- *The Human Experience:* Abowd *et al.*
- *Living laboratories: The future computing environments group at the Georgia Institute of Technology:* Abowd *et al.*

New Approaches to Interaction

- Move toward models of human-computer interaction that are centered on how humans interact with the real world
- Make computation/networking available everywhere, but as invisible as possible
- “ Assist everyday life instead of overwhelming it”

Major Components of the Approach

- Move toward physical and other “natural” interfaces
- Design of software architectures that support many applications
- New approaches to design and evaluation

Implicit/Natural Input

- Automatic tracking and identification in smart spaces
  - Image processing for extracting who, where, and what
  - GPS, RFID, 802.11 for extracting where
- Handwriting, speech, and gesture as input
  - Multimodal processing: combining input from several modes in order to infer user intent
  - Touch-sensitive surfaces (e.g., capacitive), accelerometers, tilt sensors

Multi-Scale and Distributed Display

- PDAs to standard screens to wall-sized screens
  - " Pixels everywhere" (University of North Carolina)
  - Uniform access to data across the different scales
- Ambient displays: communicating information using physical manifestations:
  - The Orb, the Water Lamp, the Dangling String
  - State of the device reflects the state of some electronic (potentially remote) data source
  - Minimal cognitive attention to extract information

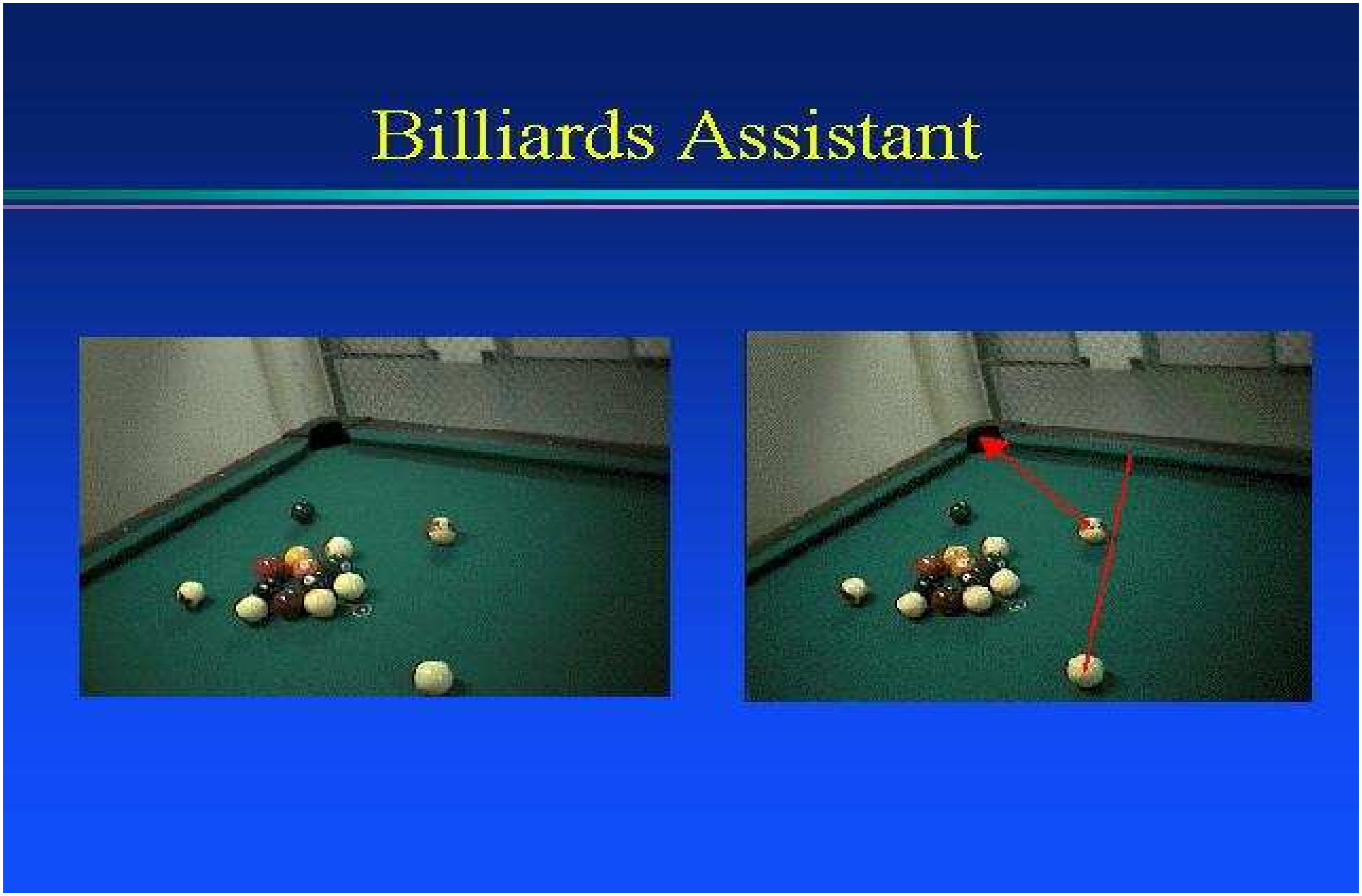
Augmenting the Physical World with Virtual Objects/Devices

- Graspable interfaces
  - Manipulating physical objects as a form of abstract communication with the computer
  - Embed sensors within objects or employ computer vision to track objects
- Mixed and Augmented Reality: connecting Virtual Reality with the real world

Augmented Reality

- Computer "paints" synthetic imagery over reality

Augmented Reality for Billiards Training



Billiards Assistant

Context-Aware Computing

Context is ...?

Context-Aware Computing

- Building representations of *what*, *who*, *where*, *when*, and *why*
  - Used to interpret the signals being given by the user
  - Production of proactive behavior: providing the user with information and services before he asks for them
- Ultimately need to begin to construct representations of *activity*
  - Requires the synthesis of information from many sources

Determining Context

- Current location: GPS, RFID beacons, etc.
- Currently scheduled meetings
- Whether anyone is speaking
- People with whom the user is speaking
- Currently active documents and applications

Proactive Behavior

- Automatic reminders: “don't forget to pick up the milk...”
- Just-in-time document access: “here are the notes you will need for your next meeting”
- Real-time phone call and email filtering
- Face recognition: “Roger Pollack is approaching you now, his wife's name is...”
- Context is everything: when and how to interrupt?

Building “Life Logs”

- Vanevar Bush: the *memex*
  - Augmentation of human memory
- Recording of many data streams
  - Video, audio, affective inputs (heart rate, respiration, etc.), activity on the computer
- Access recorded data through *associative memory* techniques
  - “ Play the video taken the last time I was in this meeting”
  - “ What documents did I access the last time I answered email from this person”

Continuous Interaction

- Want our ubiquitous computing systems to be able to participate in all aspects of our lives
- Only when the systems are available all (or most) of the time do we come to use these tools in significant ways

Challenges of Continuous Interaction

- Much less clear when one activity ends and another begins
- Activities are often interrupted
- Often performing multiple activities at the same time (or rapidly switching between activities)
- Activity modeling is a generic service that will be used by many applications

Approaches to Design and Evaluation

- Fundamental questions:
  - How do we know when an approach works? (i.e., better than the old way of doing things)
  - How do we design new approaches?
- Need to track how the user makes use of the computing system:
  - How much work is performed over time?
  - How much cognitive effort must the user put forward to perform a task?
  - What does the user take away from the interaction?

Example: Augmented Classrooms

- Primary goal: want to allow students to get the most out of the classroom experience
  - Access to electronic copies of slides and notes
  - Allow note taking on top of provided materials
  - Temporal linking of slides and notes with a record of what is said
- Also: want to improve the learning process for remote students (either physically or temporally)

Example: Smart Homes

- Automated lighting and sound
  - Turn on appropriate lighting as the resident moves from room to room
- Energy efficiency
  - Automatic adjustment of house configuration (e.g., window shades, heating system)
  - When will a substantial amount of hot water be needed next?
- Machine learning techniques that balance user preference against energy usage concerns (University of Colorado)
- Monitoring of at-risk patients

Example: Wearable Computing

- Body-mounted sensors
  - Cameras, GPS, RFID, medical sensors
- Multimodal I/O
  - Speech recognition and generation
  - Keyboard and small display
- Applications at UMass:
  - Augmented reality
  - Automatic, context-dependent retrieval of documents
  - Information agents

Example: Augmented Offices

- Whiteboards as computer interfaces
- Video conferencing including drawing interfaces
- Automated (context-dependent) filtering/forwarding of email and phone calls
- People finding (“where is Bob right now?”)

Other Concerns?

Next Time

- PIC Architecture
- Readings:
  - DEH Chapter 5
  - DwPICM Chapters 1,2