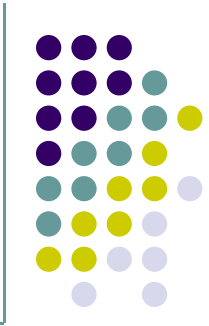
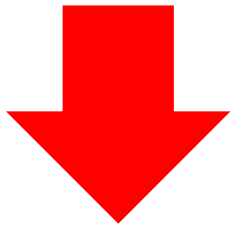


Welcome to SENG 480A / CSC 485A / CSC 586A Self-Adaptive and Self-Managing Systems

Dr. Hausi A. Müller
Professor and Associate Dean Research
Department of Computer Science
University of Victoria



http://courses.seng.uvic.ca/courses/2015/summer/seng/480a
http://courses.seng.uvic.ca/courses/2015/summer/csc/485a
http://courses.seng.uvic.ca/courses/2015/summer/csc/586a

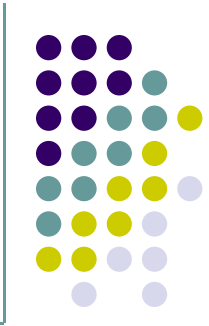
Outstanding TAs

Lorena

Nina

Ron

Deadlines and Course Requirements



Unit	Undergrads Weight	Grads Weight	Remarks
A1	12%	9%	Due Fri, May 29, 2015
A2	12%	9%	Due Fri, June 19, 2015
A3	12%	9%	Due Fri, July 10, 2015
A4	12%	9%	Due Fri, July 31, 2015
Grad Project		12%	Due Sat, July 25, 2015
Participation and presentation	7%	7%	Only graduate students are required to give a presentation towards the end of the course.
Midterm 1	20%	20%	June 4, 2015 in class. Closed books, closed notes, no phones, no computers, no calculators, no gadgets.
Midterm 2	25%	25%	July 16, 2015 in class. Closed books, closed notes, no phones, no computers, no calculators, no gadgets.
Total	100%	100%	Have a great course!

- All materials discussed in class are required for the midterm examinations
- Completing all midterms and assignments is required to pass the course
- Passing the midterms is not absolutely required to pass the course, but of course highly recommended

What Is Class Participation?

- Students should be prepared to **speak** in class—it is completely acceptable, indeed encouraged, for students to give a mini-presentation on a relevant subject
- Class participation does not just mean signing in—attendance will be taken regularly
- Class participation means speaking up in class, both with questions and answers

- Note that 7% class participation almost corresponds to a full letter grade (up or down)

Two Quiz Questions

- Are you sitting next to the same person you did in the last class?
  - This course involves a lot of interaction
  - Hone your communications skills
- Did you look up any term or resource related to this course since last class?
  - This course involves a lot of reading
  - Hone your research skills
- Introduce yourself to your neighbors
  - A1 groups will be formed on Monday

Questions?

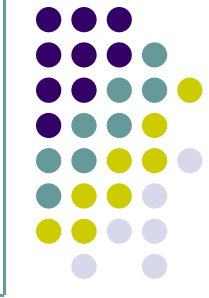
- Organization of the course?
- Evaluation scheme?

- Study course web site carefully
- Visit course web site regularly
  - Web site and materials will change almost daily
- Other questions?!?

Keep in mind …

- **Ask questions at any time ☺ !! ☺**
- **Let’s make this a truly interactive course!!!**
- **Take full advantage of this opportunity to work on your communication skills ☺ !! ☺**

Assignment 1 Part I



Instructions

This assignment consists of three parts. In Part I you are to characterize four feedback systems. In Part II you are to deepen your understanding of ULS systems. In Part III is a group assignment on sensor APIs.

Part I

Identify three (3) feedback systems from different application areas that you encounter in your everyday life. For each system, identify the type of feedback (e.g., positive, negative, or bipolar), identify the sensing and actuation mechanisms as well as the algorithm used in the controller. Describe in detail the underlying model and its assumptions. Describe the uncertainty that the feedback system provides. Describe the dynamics that are controlled through the use of feedback. At least two of the three examples should be software-intensive systems. Graduate students are strongly encouraged to pick at least one system from their research area.

Recommended reading materials

- Murray: Control in an Information Rich World: Report of the Panel on Future Directions in Control, Dynamics, and Systems. SIAM 2003. http://www.cds.caltech.edu/~murray/cdspanel/report/cdspanel-15aug02.pdf
- Chapters 1 & 2

The answer for each feedback system should fit onto approximately one typeset page.

Maximum 3 pages for this part

Do not copy verbatim from any source. Write your own prose.
Cite your sources.

Assignment 1 Part II

Part II

Study the following book on Ultra-Large-Scale Systems (ULS)

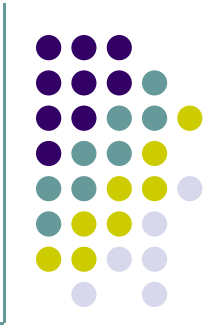
- Northrop, L., Feiler, P., Gabriel, R., Goodenough, J., Linger, R., Longstaff, T., Kazman, R., Klein, M., Schmidt, D., Sullivan, K., Wallnau, K.: Ultra-Large-Scale Systems. The Software Challenge of the Future. Technical Report, Software Engineering Institute, Carnegie Mellon University, 134 pages ISBN 0-9786956-0-7 (2006)
- http://www.sei.cmu.edu/uls

1. What are the main characteristics of a ULS system?
2. Contrast centralized and decentralized control.
3. Describe two selected challenges for the design and evolution of ULS systems in detail.

Maximum 2 pages for this part

Do not copy verbatim from any source.
Cite your sources.

Assignment 1 Part III



Part III - Group Project (4-5 people per group)

1. Identify and describe sensor APIs for different platforms (e.g., different operating systems). Pick an interesting category of sensors or sensor network and describe its API in detail.
2. Design, implement and document a simple application using this API.
3. Describe how this API and your application can be transitioned to a cloud computing environment.

All group members have to work on all three parts together. Learn from each other!
Articulate how the individual group members contributed to Part III.

Submission details:

- **Maximum** 3 pages for this part
- Submit a short video of no more than 5 minutes explaining your implementation and showing a demo of your application. **NOTE**: It is recommended that you upload the video in some external repository (e.g., Dropbox or Google Drive) and submit the access link.

You only need to submit one document and video per group.
Do not copy verbatim from any source.
Cite your sources.

See SensorCloud video later in today's lecture

Groups

G1	
G2	

Self-Adaptive Systems (SAS)

- A SAS can alter its behaviour at runtime (on the fly) in response to its perception of
  - its environment
  - its own state

  by adapting itself

- SAS abilities
  - Assess its own behaviour
  - Observe its context or environment
  - Adapt without shut down

- Oreizy, et al.: An Architecture-Based Approach to Self-Adaptive Software, *IEEE Intelligent Systems,* pp. 54-62 (1999)
- MacManus: Why Software is More Important Than Sensors in the Internet of Things, ReadWriteWeb (2010)

Situational Awareness (SA)

- SA is the perception of environmental and personal context with respect to time and space
- Comprehension of its meaning and its projection into the future
- Critical to decision-making in complex, dynamic situations

- Applications
  - Mars Curiosity
  - Aviation—UAV, drones
  - Military command and control
  - Emergency services

- Applications
  - Driving a car
  - Crossing a street
  - Playing soccer
  - Playing basketball
  - Shopping

Intuitively we know how critical and valuable context is.
But context is complicated.

"Context is the new battleground between
Android, iOS, Windows, Symbian and
Apple, Google, IBM, Microsoft, Nokia, Samsung."

The Age of Context

Simple can be harder than complex. You have to work hard to get your thinking clean to make it simple.

Steve Jobs, BusinessWeek, 1998

Pillars of Context

- The Internet of Things
  - Sensors for location, light, motion, temperature
  - Record, transmit findings to control instruments
- Semantic web, Big data
  - Clouds store massive data on people, places, things
  - Information about everything accessible on the web
- Digital mapping
  - Every square inch of the world is mapped
- Really smart mobile devices
  - Every person has one
  - Highly customized smart applications
- Mature social media
  - Highly personalized virtual networks
- Wearable computers
  - Google glasses, Google driverless car

Highly Dynamical Software Systems

R. Scoble, S. Israel: *The Age of Context: How It Will Change Your Life & Work, 2013.*

Nate Silver

- American statistician, sabermetrician (analysis of baseball), psephologist (scientific analysis of elections and writer
- In 2008 correctly predicted the winner of US presidential election in 49 out of 50 states and all 35 US Senate races
- In 2009 named one of The World's 100 Most Influential People by *Time Magazine*
- In 2010 his *FiveThirtyEight* blog was licensed for publication by *The New York Times*
- Book: The Signal and the Noise: Why Most Predictions Fail – But Some Don't. New York: Penguin, 2012
- In 2012 correctly predicted the winner of all 50 states and 31 out of 35 US Senate races
- On Nov 12*The Signal and the Noise* was named Amazon's #1 Best Book of the Year for 2012

Telepathy One
Japan's Answer to Google Glass

Takahito Iguchi
Inventor of Telepathy One

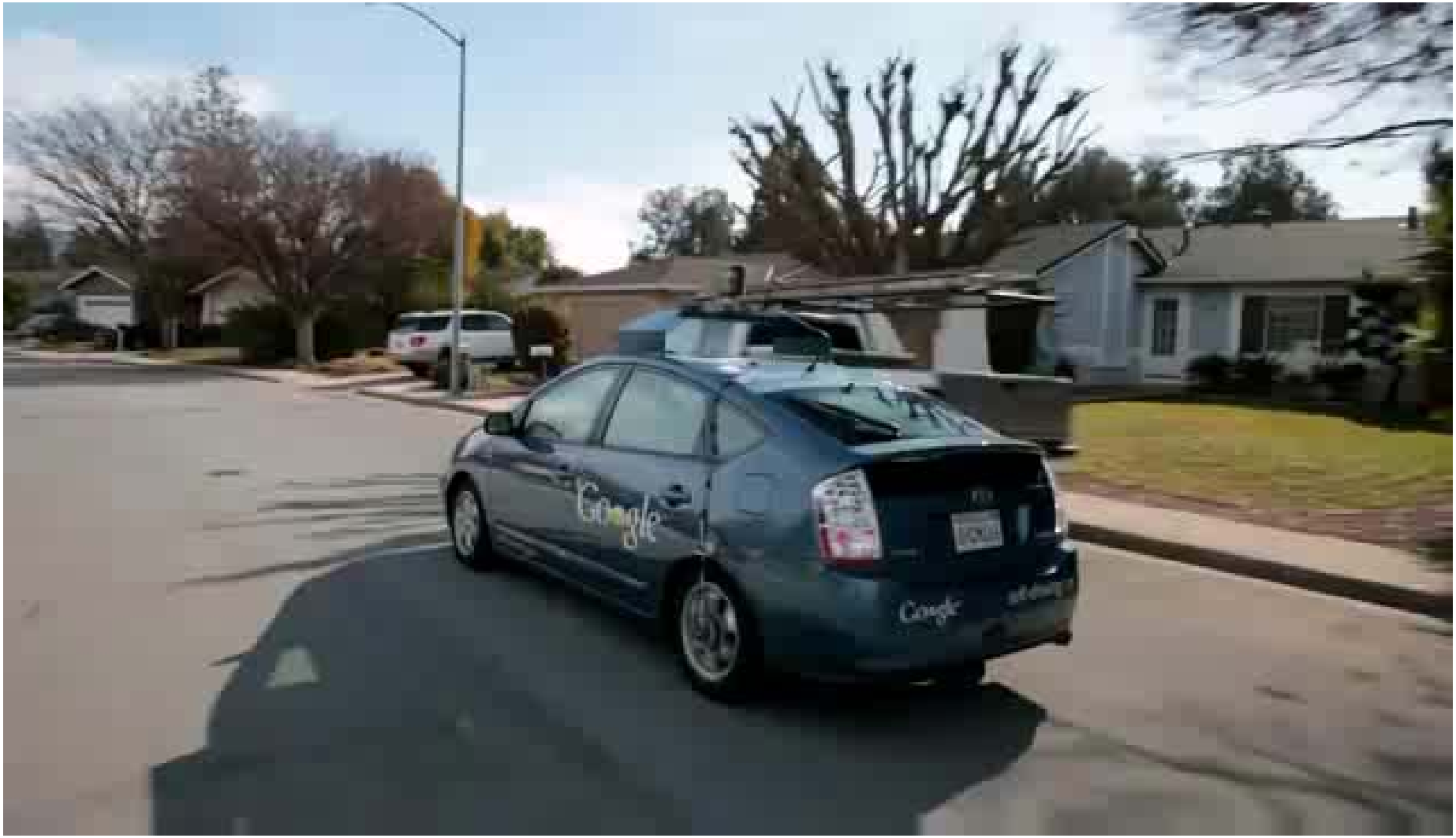
Context through wearable computers

Context is Big Data

Capture Context with Sensors and Wearable Computers

Google

Google Driverless Car
Licensed in Florida, Nevada, California



http://www.youtube.com/watch?v=cdgQpa1pUUE

How does it feel through Google Glass?

http://www.google.com/glass/start/how-it-feels/

SensorCloud®
Powered by LORD MicroStrain®

Sensor Data and the Cloud

http://www.youtube.com/watch?v=Ya9Zu3PGTO0