Welcome

- **Electrical and computer engineering systems**
  - ECE technology can be found everywhere
  - Opportunity to see what ECE looks like "in the wild"
- **What we will do**
  - Explore a few example ECE systems
  - Discuss operation and technical background
  - Learn from good (and bad) examples
- **Course goals**
  - Understand the breadth of ECE discipline
  - Understand societal impact of ECE
  - Understand some technical and scientific “nuggets”
  - Understand how areas relate to courses in ECE curriculum
  - Develop general appreciation of ECE
What Do (ECE) Engineers Do?

- Engineering:
  - Wikipedia: Engineering is the discipline, art and profession of acquiring and applying scientific, mathematical, economic, social, and practical knowledge to design and build structures, machines, devices, systems, materials and processes that safely realize solutions to the needs of society.

- What do ECE engineers do?

21st Century ECE Professionals

- ECE profession often perceived as nerdy
  - Caused by few examples overemphasized in the media

- 21st century ECE engineers are different
  - Societal impact of ECE is very high

From IEEE Spectrum "Dream Jobs 2010":

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Your Instructor

- Prof. Tilman Wolf
- Professor of ECE
- Undergrad degree from University of Stuttgart, Germany
- Ph.D. in computer science from Washington University in St. Louis
- Research area: computer network, embedded systems, cybersecurity
- Other courses: data structures and algorithms, graduate computer networks
- Contact: wolf@umass.edu

About this Course

- Lectures
  - Weekly (here, now)
    » Not in 2 weeks – check online schedule!
  - Attendance taken
- Office hours
  - Thursdays, 1-2 p.m., KEB 211C
- Assignments
  - Online on Moodle: https://moodle.umass.edu/
  - Need to be completed before lecture
  - Binary grading (1=satisfactory; 0=unsatisfactory)
- Labs
  - One lab assignment to be done in M5
- Grading
  - Sum of attendance score and assignment score
  - 26 or 25 = A, 24 or 23 = A-, ...
- Please read entire syllabus on course web page
  - http://www.ecs.umass.edu/ece/wolf/courses/ECE197SA/
Course Topics

- MP3 player (audio signal processing)
- Cell phone (wireless communication)
- Computer (microprocessors)
- Solar cell (power generation)
- Power grid (power distribution)
- Air traffic control (radar)
- Global Positioning System (navigation)
- Digital camera (optical sensors)
- Internet (network protocols)
- Information security (cryptography)
- UMass ECE Senior Design Projects
- Cyber-Physical Systems (identification)

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ECE Systems in Daily Life

- List all the ECE systems that you can think of
  - What ECE systems are in this room?

- How to identify an “ECE system”?
  - Think of ECE component within the system

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ECE Systems in Daily Life

- List all the ECE systems that you can think of
  - What ECE systems do you carry with you?
  - What ECE systems did you encounter getting here?

Electrical Power

- Generators
- Transformers
- Transmission lines
- Electrical power as a utility
Electro-Mechanics

- Electric motors

- Solenoids

Electromagnetic Emissions

- Heat

- Light

- Electromagnetic spectrum
Signals

- Antennas
- Radio / television

Sensors

- Photoresistor
- CCD/cameras
- Accelerometer, gyroscope, compass, etc.
- Instrumentation

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Microelectronics

- Transistors
- Integrated circuits

Computer Systems

- Microcontrollers
- Digital signal processors
- Processors
- Workstations
- Servers
Data Storage

- Magnetic
- Optical
- Semiconductor

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Telecommunication

- Telephony
- Wireless communication
- Networking

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Software

- Microcode / firmware
- Embedded processing
- Applications

Control Systems

- Thermostat
- Segway
- Industrial process
- Nuclear power plant
### System Development Lifecycle

- **Life cycle phases:**

  - Initiation
  - Concept Development
  - Planning
  - Requirements Analysis
  - Design
  - Development
  - Integration and Test
  - Operation & Maintenance
  - Disposition

**Source:** The Department of Justice Systems Development Life Cycle Guidance Document

- **Where are ECE professionals involved?**

### Systems vs. Components

- **“Systems”** consist of components
  - More complex than individual components
  - Combine components from multiple disciplines

- **Systems focus on solving practical problems**

- **Systems are important part of engineering**
  - ABET definition of engineering:
    “The creative application of scientific principles to design or develop structures, machines, apparatus, or manufacturing processes, or works utilizing them singly or in combination; or to construct or operate the same with full cognizance of their design; or to forecast their behavior under specific operating conditions; all as respects an intended function, economics of operation and safety to life and property”

- **In this course, we focus on systems**
  - We explore some components in the process
Upcoming...

- **Wednesday next week: MP3 players**
  - Audio signal processing
- **Moodle “quizzes”**
  - One for today’s lecture
    » Watch 5 minutes of a TV show / movie of your choice and list all ECE systems or components that you can observe.
  - One for next lecture
    » Calculate the approximate memory requirements to store a 1-hour lecture (1) as MP3-coded audio and (2) as MPEG-coded video.