Mechatronics Systems Design Laboratory

ECE 491

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Today

- Course overview / introduction
- Project description
- Course organization
- Soldering basics
- FRDM-KL25Z
- Logistics/team formation

Course Overview

- ECE 491: (major modification may be required))
  - Senior project-orient class, limited graduate student
  - Multidimensional HW + SW class
  - Intro to Mechatronics for ECE, ME
  - Teaches how to interface with the real world
- Objectives:
  - Ability to design a system given a set of (design) constraints/criteria
  - Communicate and function in teams
  - Have fun !

Academic Dishonesty (EECS)

Copying all or part of another person's work, or using reference material not specifically allowed, are forms of cheating and will not be tolerated. A student involved in an incident of cheating will be notified by the instructor and the following policy will apply:

The instructor may take actions such as:

- require repetition of the subject work,
- assign an F grade or a 'zero' grade to the subject work,
- for serious offenses, assign an F grade for the course.

Lab Safety

- KEY RULES – (handout next time)
  - don't work alone
  - don't let non-491 students in lab
  - don't work late at night
  - **battery safety- grab self destructing battery only with pliers (if safe) and throw in sand bucket**
  - lick finger before touching transistor so don't get burned sharps, hot solder iron
  - wash hands to clean off lead solder before eating

What is Mechatronics ?

- Synergistic integration of mechanics, electronics, and intelligence
  - MEMS
  - Robotics
- Why Mechatronics:
  - Reduce cost
  - Increase reliability, precision, speed
  - Enable new capability

Example of Mechatronic Systems

- Electronic engine control
- Fly-by-wire
- Autofocus camera
- Robotics/prostetics
- 2D/3D printing
- ABS
- Airbags
- MEMS
- Microrobots !

Pas de Deux avec les Microrobots

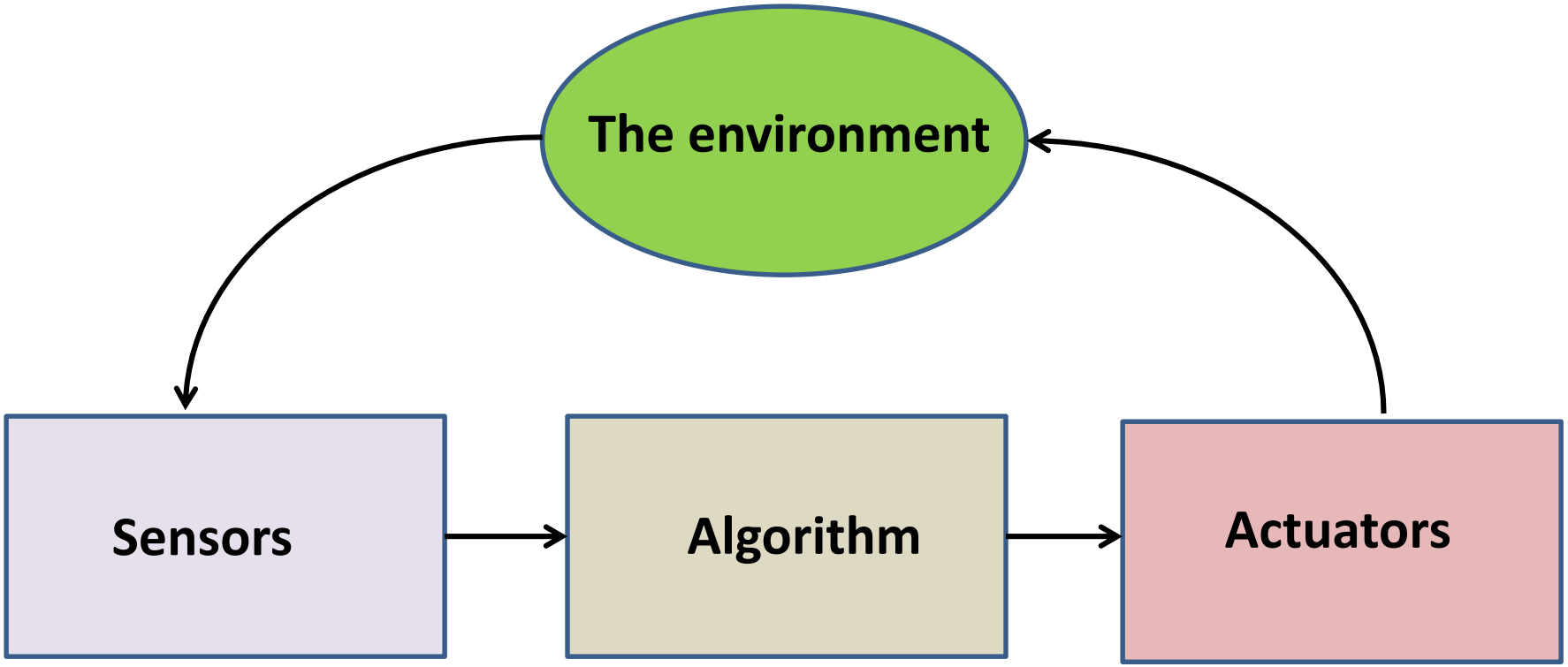
Donald Laboratory

The Department of Computer Science, Duke University

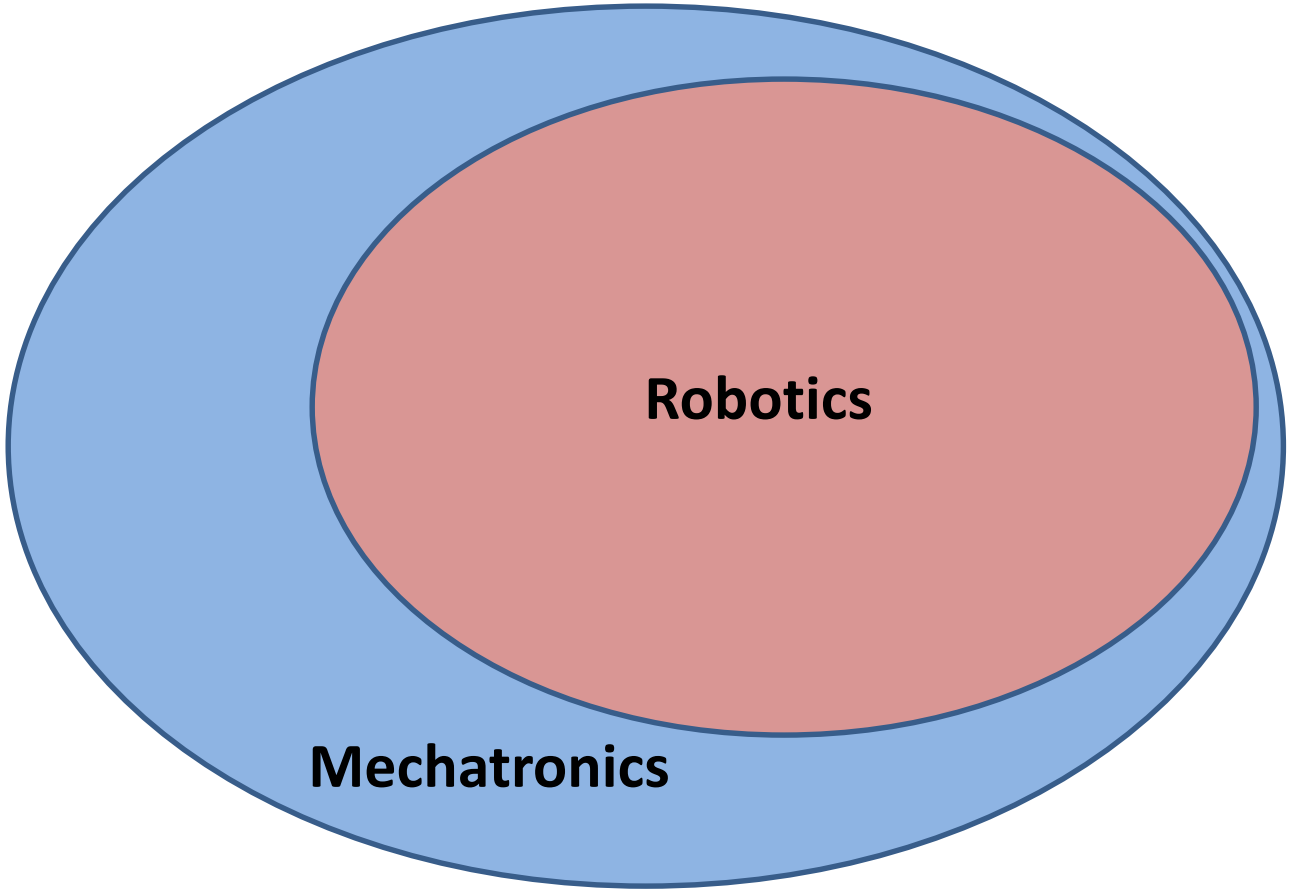
The Department of Computer Science, Dartmouth College

http://www1.ece.uic.edu/~paprotny/

The Mechatronic System

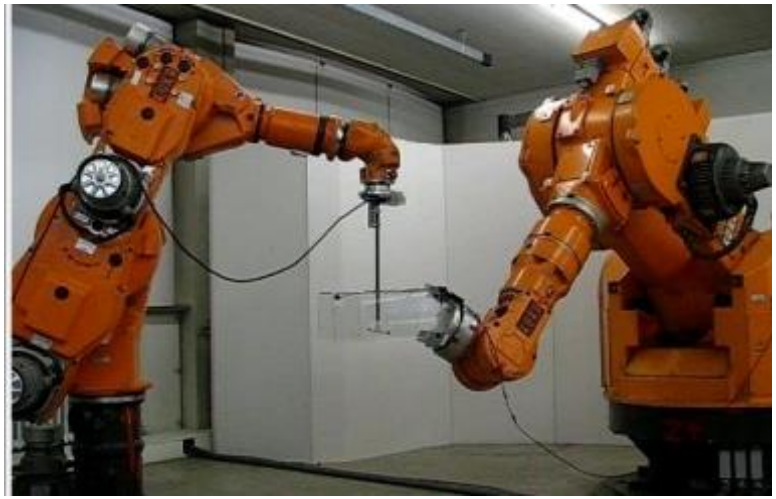


Mechatronics vs. Robotics

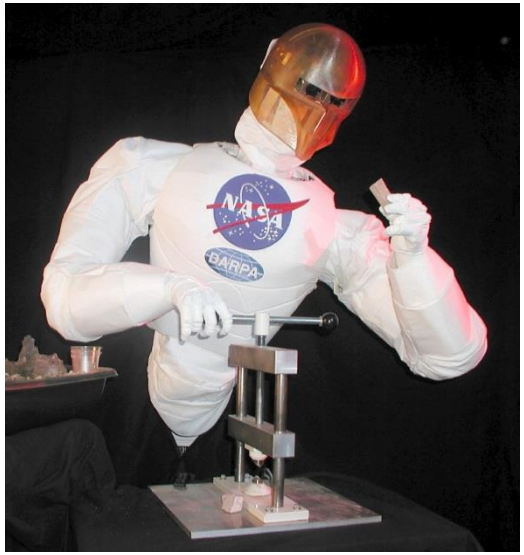


Vague distinction: Inputs provided vs. self-obtained

Mechatronics vs. Robotics



http://www3.ntu.edu.sg/home2009/moha0157/index.html



http://www-robotics.cs.umass.edu/Research/Humanoid/humanoid_index.html

Key Technologies for Mechatronics

- Signal processing
- Sensors
- Actuators
- Control
- Software
- Integration
- Packaging
- Power supply/delivery
- Testing
- Human interface
- AI

Your Mechatronics Project

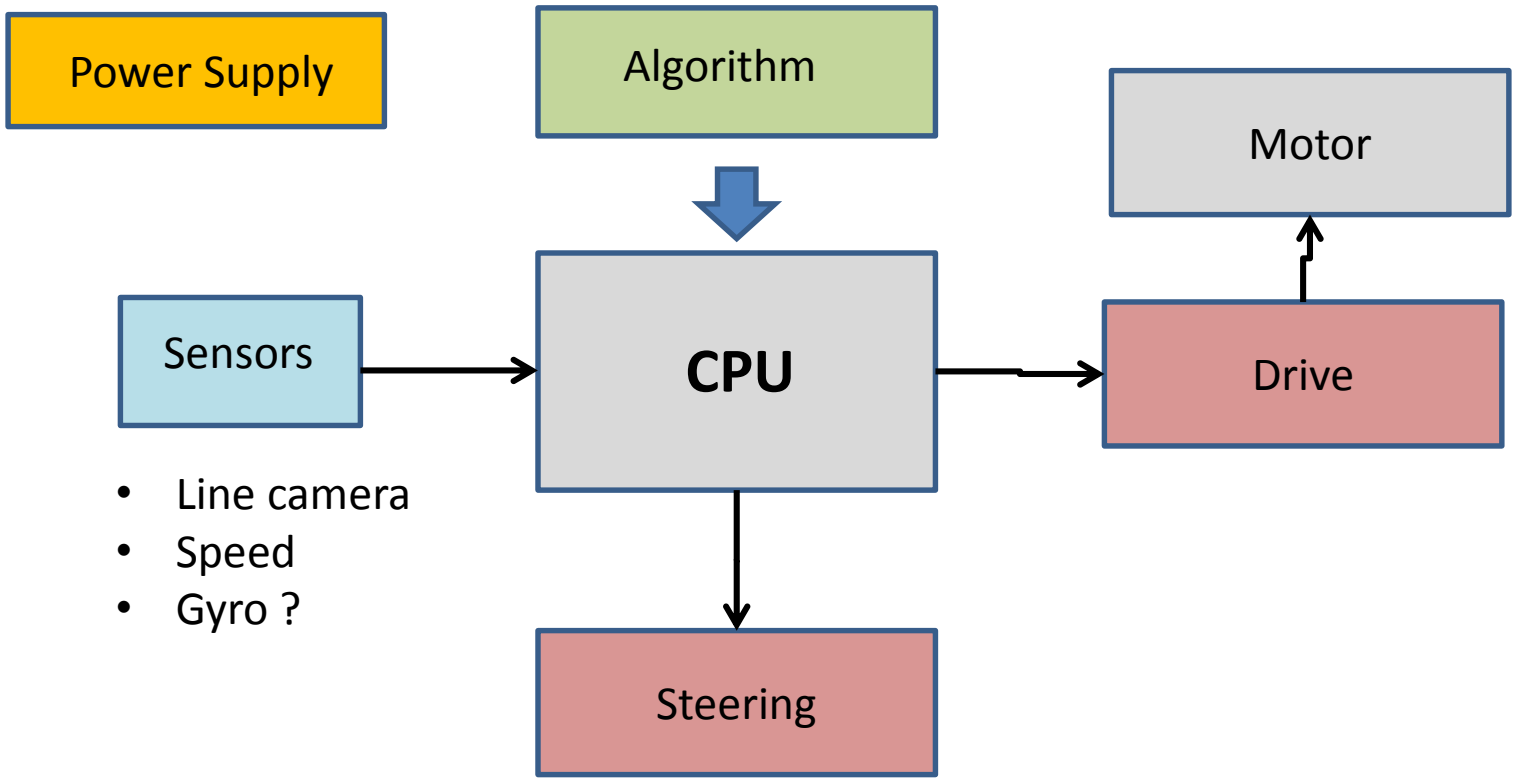
- Design an Autonomous Race Car !
  - Race on an optical track
  - Follow without loosing track
  - Ok to tune for track “repetitive control”
  - Potential for competing at NXP Cup and Natcar

- First stability, then speed.
- Need ~3m/sec. to win

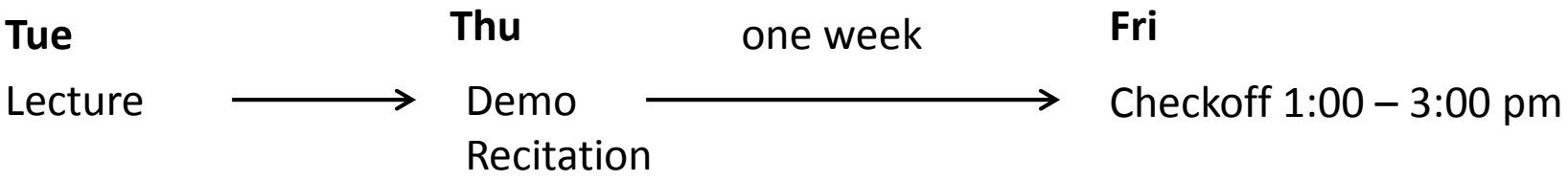
- Important design considerations:

1. Reliability
2. Accuracy
3. Stability/control
4. Sensor quality
5. Motor drive
6. Learning track
7. Design tradeoffs (min (max time))
8. Integration

Components of the Autonomous Car



Course Organization



- Check-offs – demonstrate functionality
- Partners: (8 students)
  - 2x3 students, 1x2 students + grad student

- Lab demo – show techniques you should expect to use
- Checkpoints
  1. CPU
  2. Drive motor
  3. Power supply
  4. Line sense
  5. Line follow/fig8
  6. Speed control
- Emphasis: robust, simple, efficient design
- Key: 100% functional car
- Expected workload: 10h/week/team member

Soldering Basics

- Clean area
- Pre-tin wires and tip
- Clamp your work
- Apply heat to the wire and the pad
- Add solder to the part not the iron
- Apply for ~ 5 sec.
  - Should wet part and pad clearly
- Clear the flux residue

Good !

BAD !

Review this:

http://store.curiousinventor.com/guides/how_to_solder/

FRDM-KL25Z Manual

Todos this Week

- Form your team (at end of class)
  - Check-off next week
- Send me your intro slide
- Think about robotics/mechatronics

Igor Paprotny

Interests: EE, Robotics, MEMS

What I want to get out of ECE 491: Have an awesome time teaching it !

webpage: http://www1.ece.uic.edu/~paprotny/