

CSE3023.1 & 2: Computer Interfacing

What is an Embedded System?

Lecture 0

What is an Embedded System?

- Computing system with a non-standard interface (often no keyboard or screen)
- Often involved in sensing and control (and may not even talk to a human)
- Typically a custom system for a very specific application

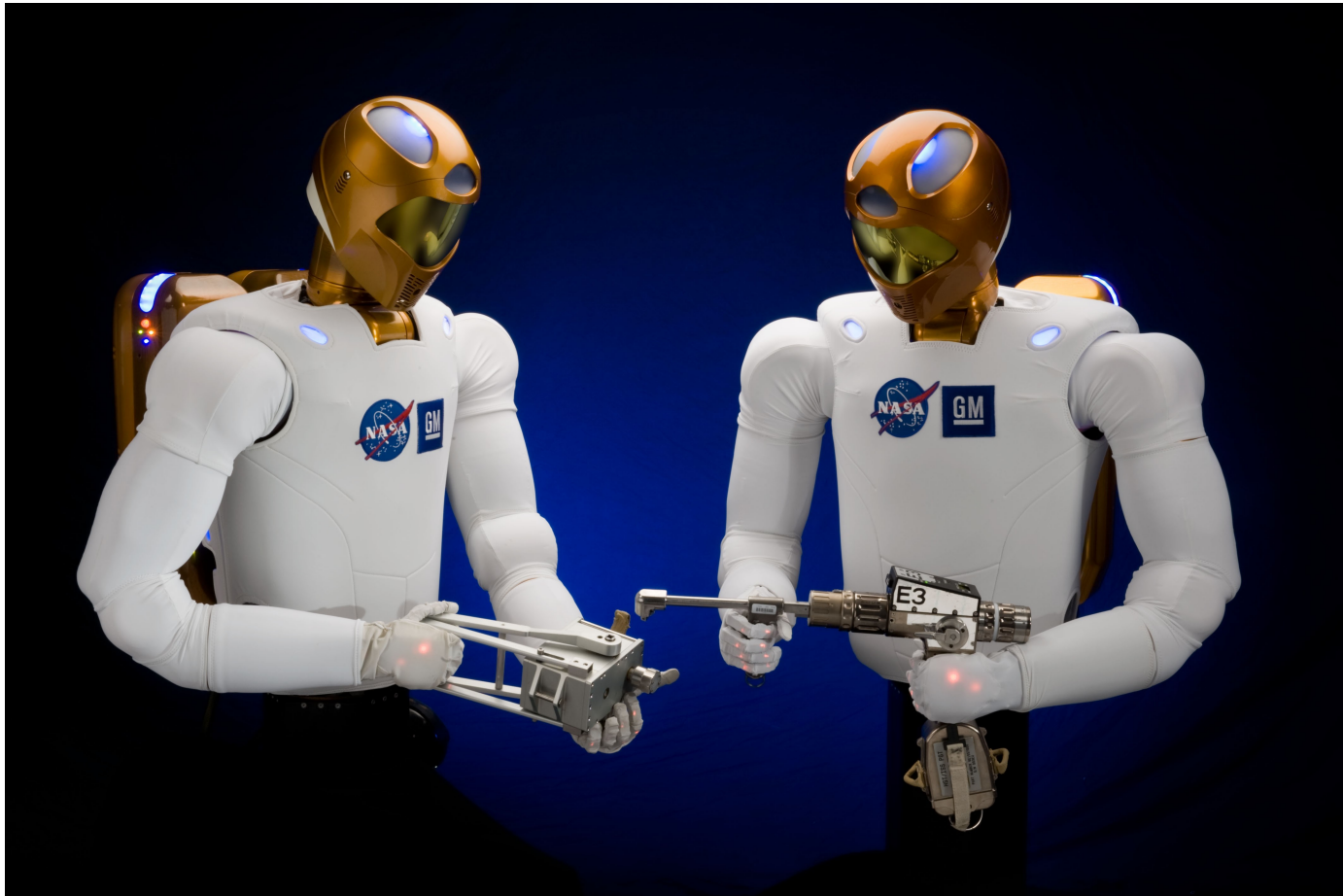
What is an Embedded System? (contd.)

- Limited processing capabilities:
 - Can be extremely small.
 - Can require a small amount of power
- Can have significant real-time constraints.
 - Act on inputs very quickly.
 - Generate high-frequency outputs
- Often a higher expectation of reliability

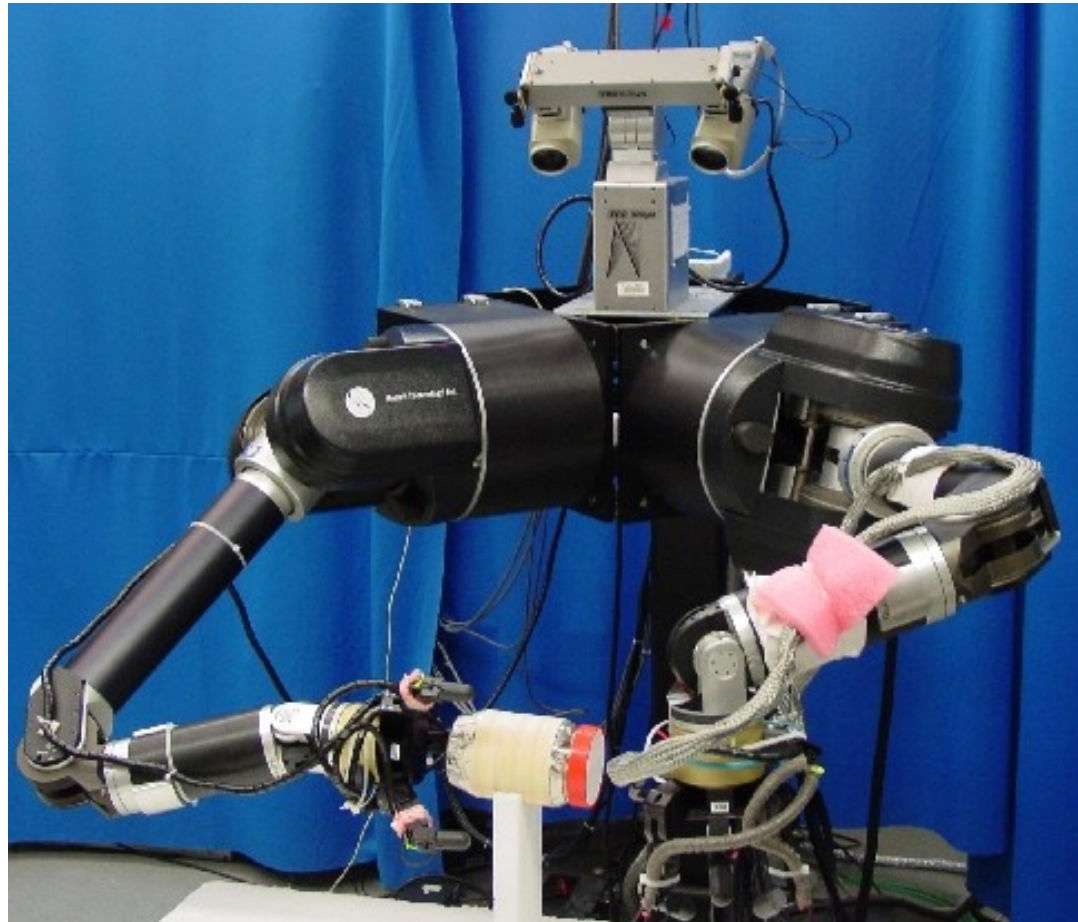
Embedded System applications

- alarm clocks, electric toothbrush
- microwave ovens, automatic electric heaters
- traffic signals
- phones and mobile phones
- automotive – lighting, braking, speed control
- hard disks, pen drives, printers, mouse, cameras, small electronic machines
- day to day applications like washing machines, photocopying machine, elevators, etc
- life saving equipments like pacemaker, dialysis machine etc.
- and the list is endless!

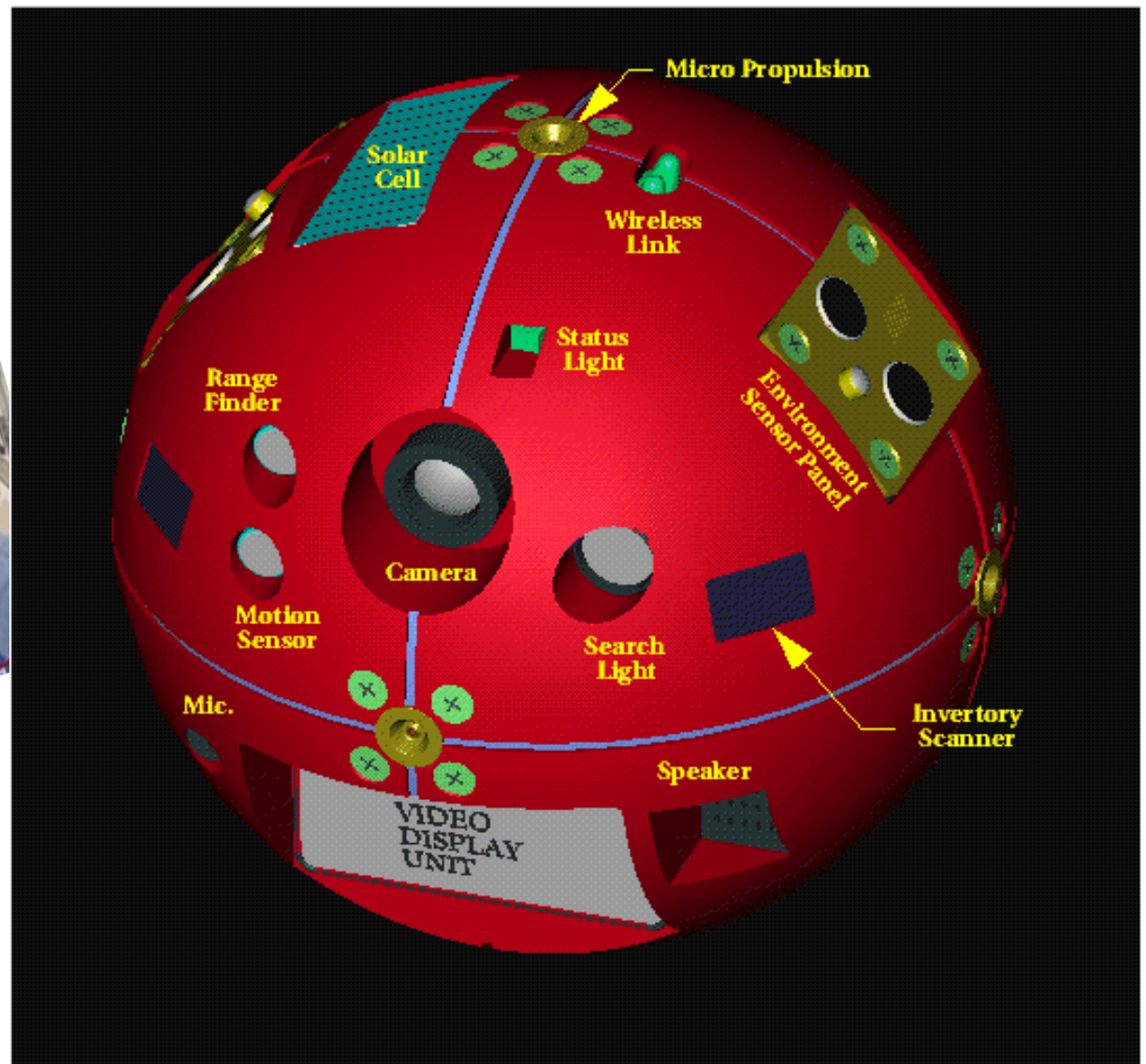
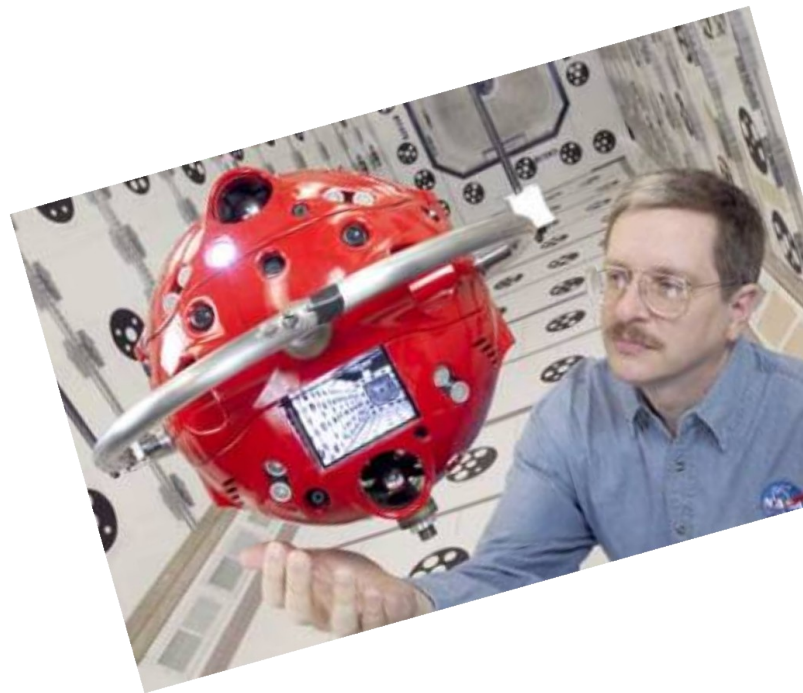
Robonaut 2



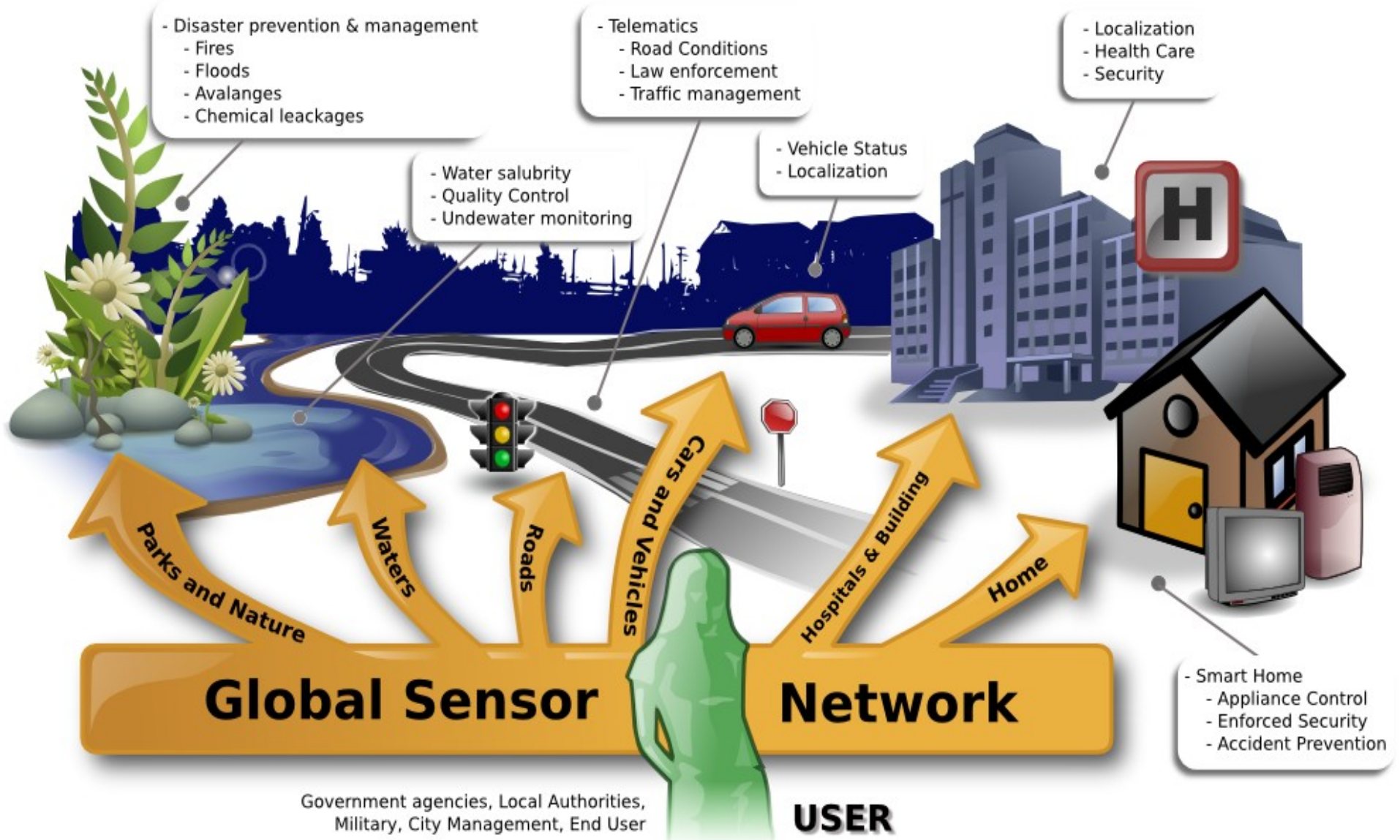
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NASA Satellite Assistant



Sensor Network (IoT)



Embedded Systems Challenges

- Sensing the environment:
 - Sensors are typically far from ideal (noise, nonlinearities, etc.)
 - Sensors/subsystems can fail
- Hard to get a ‘complete’ view of the environment
 - Affecting the environment through “actuators”
 - Application can require fast, precise responses

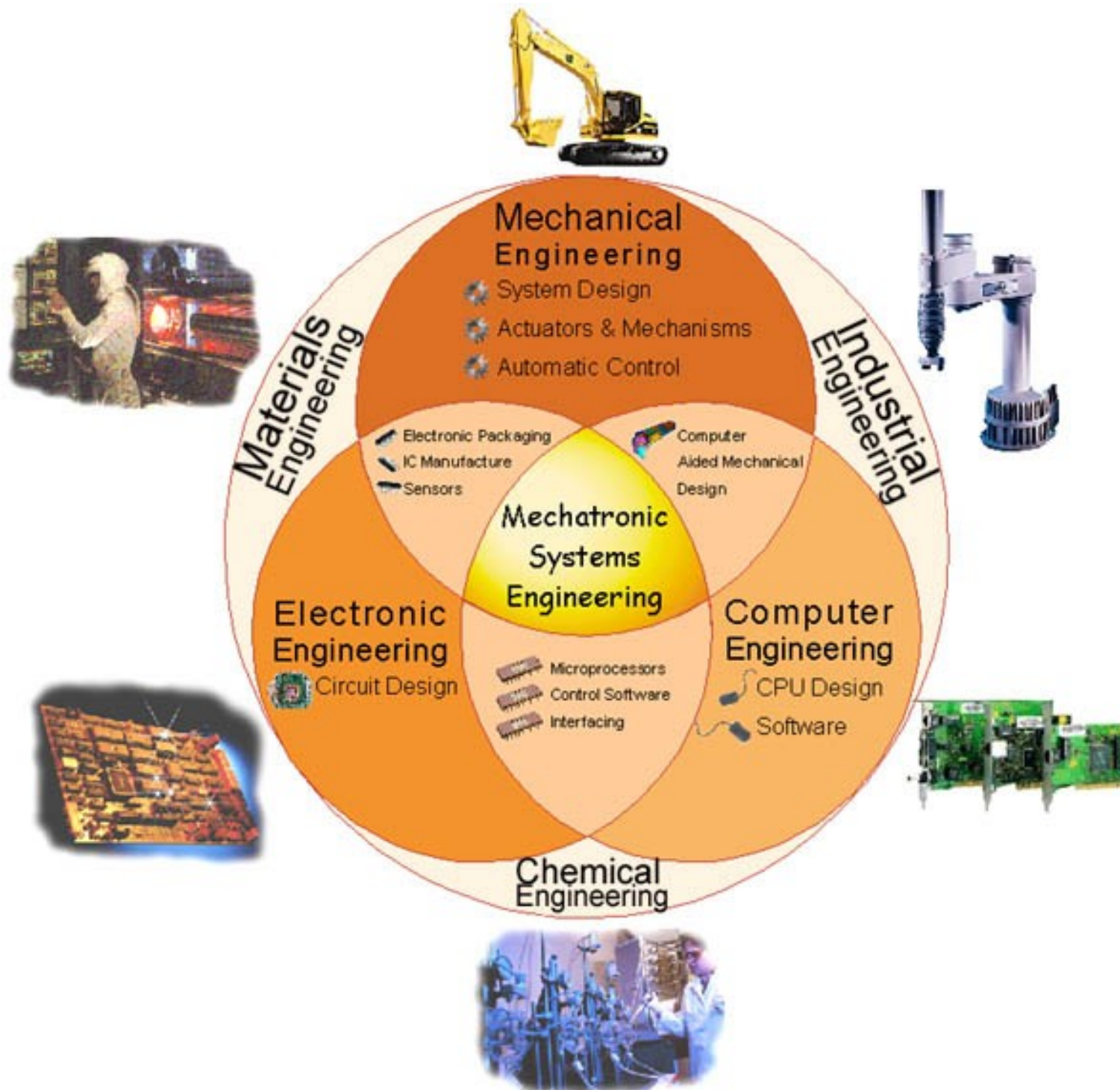
Embedded Systems Challenges (cont)

- Testing/debugging can be very difficult:
 - Hard to identify and replicate all possible situations
 - Often involves the interaction of many different components
 - Often no standard user interface
 - Limited on-board resources with which to record system state
- Competing requirements of cost, complexity, design time, size, power...

- Lack of reliability can be a killerliterally

My Assumptions About You

- Circuits and sensors class (or equivalent):
 - Boolean logic and circuits (AND/OR/NOT gates)
 - Analog circuits (in particular, resistive-capacitive circuits)..and ohm's law
- Background in programming
 - We will be using C, processing, Java and Python for all projects



Course Goals

- By the end of this course, you will be able to:
- design and implement embedded circuits involving micro controllers, sensors and actuators,
- use code and circuit design tools,
- design, program and debug embedded sensing and control software,
- work in collaborative teams to solve system design and implementation challenges, and
- communicate in both oral and written forms.