Sharif University of Technology
Department of Computer Engineering

Embedded System Design

Introduction

A. Ejlali

Embedded Systems

- **Information processing systems embedded into a larger product.**
- **Main reason for buying is not information processing.**

Ubiquitous Computing

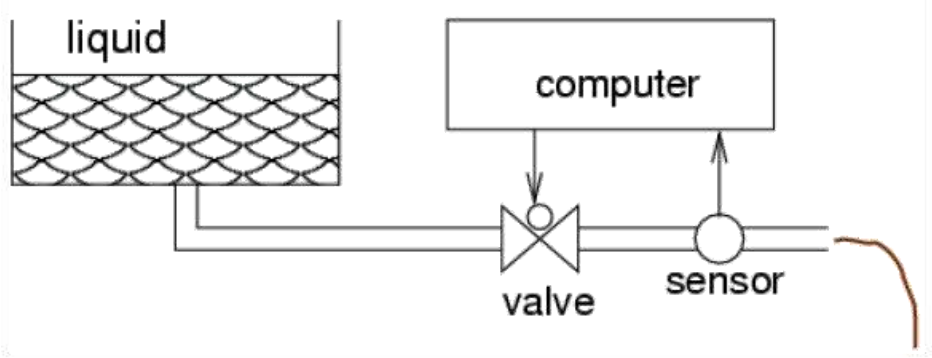
- **Ubiquitous Computing:**
  - **Information anytime, anywhere.**
- **Embedded systems provide fundamental technology.**

Application Areas

- Automotive electronics
- Aircraft electronics
- Trains
- Telecommunication

Application Areas (Cont.)

- Robotics
- Military applications
- Authentication
- Fabrication equipment



Consumer Applications

- MP3 player
- DVD player
- Toys
- Television
- Mobile phone
- Sewing machine

Ubiquitous Computing

- ATM
- Vending Machine
- Smart buildings

Inside Your PCs

- Custom processors
  - Graphics
- Micro-controllers
  - Mouse
  - HDD
  - Network interface

Importance of ES

- **79% of all high-end processors are used in embedded systems.**
- **They are part of almost everything that runs on electricity.**
- **Crucial application in key industries**
  - **Automotive industry: 7% of EU's GNP**

Characteristics of ES

- **Dependability**
  - **Reliability, Maintainability, Availability, Safety, Security**
- **Energy efficiency**
- **Performance**
- **Real-time constraints**
  - **For real-time systems, right answers arriving too late are wrong.**

Characteristics of ES (Cont.)

- Weight efficient, Cost efficient, Code-size efficient.
- Dedicated towards a certain application.
  - Minimize resources, Maximize robustness
- Dedicated user interface
  - no mouse, keyboard and screen

Characteristics of ES (Cont.)

- **Frequently connected to physical environment through sensors and actuators.**
- **Hybrid systems (analog + digital parts).**

- **Not every ES has all of the above characteristics.**

Embedded and Real-Time Synonymous?

- Most embedded systems are real-time
- Most real-time systems are embedded