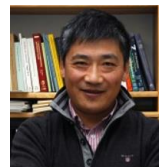


Real Time Systems

-- 5hp & 10hp

People who will help you:

- Lecturers:
 - Philipp Ruemmer, office: 1218
 - Wang Yi, office: 1235
 - Professor of Embedded Systems
- Assistant:
 - Aleksandar Zeljic, office 1217
 - Syed Jakaria Abdullah, office 1316



Wiki's definition

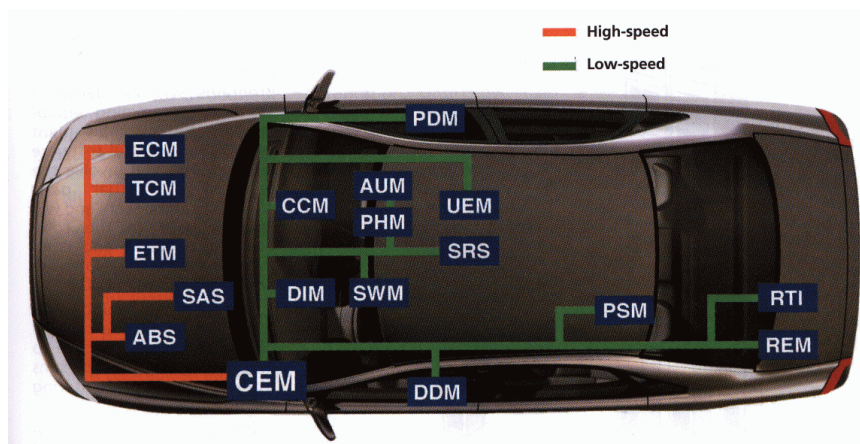
Real time systems will guarantee to give a result within a specified time --- Wiki

Real-Time Systems also known as **"Embedded Systems"**

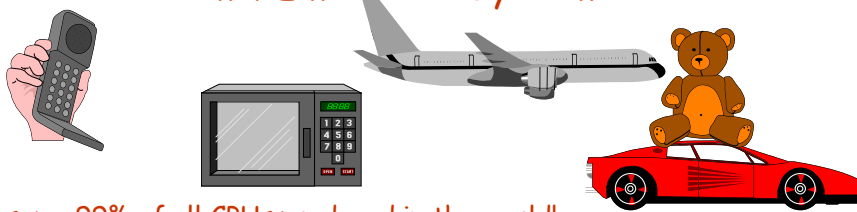
A Real-Time System



65-70 ECU's/micro-processors in some model of S80



Real-Time/Embedded Systems



Consume 99% of all CPUs produced in the world!

Computers that do not look like a computer

- The primary applications are not for “information processing”, but “control”
- Majority of these systems must reply ... **timely**
- Mass production: **a single bug = millions of dollars**

Main Goal of this course:

Study Techniques for constructing **Real-Time/Embedded Systems** that behave as you “wanted” –

- **no bug**
- **no stop**
- **no waste (of resources)**

Course Form

- Lectures
- Lab assignments
- **Playing with Legos!**



- Examination
 - 4 assignments and
 - final written exam

Main Topics

(blue=5hp, + red=10hp)

- Real-Time Operating Systems
 - What are the differences with General purpose OS?
- Real Time Programming (Laungages)
 - What are the differences with general computing?
- Real-Time Scheduling and Timing Analysis
 - What's the execution times of your programs?
- Distributed Systems and Real-Time Communication
 - What are the transmission delays of your messages?
- Multiprocessor real-time systems (advanced topic)
 - Multicore processors ...
- Design and Validation (advanced topic)
 - Design your systems as you wanted ...

Further details ...

- To understand the basic requirements of real-time systems, and how to program such systems so that the requirements are realized
 - Characteristics of RTS
- To understand how these requirements have influenced the design of real-time programming languages and real-time operating systems
 - Support for implementation
- To understand the design, analysis and implementation techniques which guarantee the requirements to be met
 - Support for certification

Lab assignments & Software (blue=5hp, +red=10hp)

- Real Time Programming (Ada)
- Real-Time OS Kernel (C, Lego NXT/OSEK)
- Response Time Analysis (FpsCal)
- Modeling and Analysis (UPPAAL)

Literature

- **On-line materials (slides for lectures)**
- Notes (pdf) by Hanssoon and Tindell
- Real Time Systems, J.W. Liu 2000

- Further readings:
 - Real-Time Systems and Programming Languages, Alan Burns and Andy Wellings, Addison Wesley, 2001.
 - Hard Real Time Computing Systems - Predictable Scheduling Algorithms and Applications, Giorgio Buttazzo, Springer, 2005.

Prerequisites

- **Basic** understanding of Prog. Languages e.g. C
- **Basic** understanding of Computer Architecture.
- **Basic** understanding of Operating Systems

M.Sc Program in Embedded System: Overview

