Real Time Systems
Wang Yi, "google Wang Yi"

An Example Real-Time System

What are "Real-Time Systems"?

Course Information

The Evolution of Automotive Electronics

The Evolution of Automotive Electronics

The Evolution of Automotive Electronics

The Evolution of Automotive Electronics

The Evolution of Automotive Electronics

A few meters CAN-bus!

What happened Here and then?
A Real-Time System

Towards a "standard" definition of RTS

- A real-time system is any information processing system which has to respond to externally generated input stimuli within a finite and specified period.
  - the correctness depends not only on the logical result but also the time it was delivered.
  - Failure to respond in time is as bad as the wrong response!

- The computer is a component in a larger engineering system ⇒ EMBEDDED COMPUTER SYSTEM.

Remember:

In RT systems, the correctness of computation depends not only on the results but also on the times when outputs are produced.

- Real Time ≠ Fast
- Real Time ≠ Time Sharing
- Real Time = just in Time (predictable)

Further details ...

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

Main Goal of this course

Study Techniques for constructing
Real-Time Software with predictable response times.
Prerequisites

- Basic understanding of C
- Basic understanding of Computer Architectures.
- Basic understanding of Operating Systems

Course Form

- Lectures
- Programming assignments (Ada, C, OS kernel)
- Playing with Legos!

- Examination
  - 4 assignments and
  - final written exam (week 43: 5 hours)

Software and Lab assignments

- Real Time Programming (Ada)
- Programming with OS Kernel (LegOS)
- Response Time Analysis (FpsCal)
- Modeling and Analysis (UPPAAL/TIMES)

Literature

- On-line materials (appear in real-time 😊)
- Further readings:

People to help you!

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Course Outline (lectures)

- Introduction
  - Characteristics of RTS
- Real Time Operating Systems (RTOS)
  - OS support: scheduling, resource handling
  - Real Time Programming Languages
  - Language support, e.g. Ada tasking
- Scheduling and Timing Analysis of RT Software
  - Worst-case execution and response time analysis
- Design and Validation
  - Modeling, Verification and Testing
- Reliability and Fault-Tolerance
  - Fault tolerance, failure recovery, exception handling
- Distributed real time systems
  - Real Time Communication: CAN Bus