Real Time Systems Design
تصميم منظومات الزمن الحقيقي

Course Introduction

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E-Lectures for Third Level
Real-Time systems design

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Outline of RTS Course

- Definitions of RTS.
- Signals, Systems, Specification.
- Analog computer components, Systems.
- ADC, DAC: [Definition, Types, Specifications, Errors, C/Cs and Interfacing
- choosing].
- Introduction to Digital systems.
- Basic interfacing devices.
- Data Transfer controlling.
- Un programmable interfacing devices.
- Programmable interfacing devices [8-bit compatible, General purpose, Timers,
- Peripheral controller].
- Interrupts [Introduction, Types (hardware & software), Controller 8259A],
- Handshaking and interrupts methods.
- DMA, Serial Interfacing [Introduction, Standards, Types, Controller].

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Reference

Real-Time systems design and analysis

Phillip A. Laplante

Seppo J. Ovaska

IEEE Press, Wiley, A John Wiley & Sons, INC., Publication, 2012

http://1.droppdf.com/files/s2EZM/real-time-systems-design-and-analysis-4th-edition.pdf

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Real Time Systems Design

Lecture (1): Definitions of RTS.

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Fundamentals of Real-Time Systems

The term “ real time ” is used widely in many contexts, both technical and conventional. Most people would probably understand “ in real time ” to mean “ at once ” or “ instantaneously. ” The Random House Dictionary of the English Language (2nd unabridged edition, 1987), however, defines “ realtime ” as pertaining to applications in which the computer must respond as rapidly as required by the user or necessitated by the process being controlled . These definitions, and others that are available, are quite different, and their differences are often the cause of misunderstanding between computer, software and systems engineers, and the users of real - time systems.

Various forms of Real-Time term

Across technical and pedestrian literature, various forms of the term, such as real time , real - time , and realtime may appear. But to computer, software, and systems engineers the preferred form is real - time , and this is the convention that we will follow throughout this text.

Examples on Real-Time systems

Consider a computer system in which data need to be processed at a regular rate. For example, an aircraft uses a sequence of accelerometer pulses to determine its position.

Systems other than avionic ones may also require a rapid response to events that occur at non regular rates, such as handling an over temperature failure in a nuclear power plant.

Even without defining the term “ real - time, ” it is probably understood that those events demand timely or “ real - time ” processing.

Examples on Real-Time systems

Now consider a situation in which a passenger approaches an airline check - in counter to pick up his boarding pass for a certain flight from New York to Boston, which is leaving in five minutes. The reservation clerk enters appropriate information into the computer, and a few seconds later a boarding pass is printed. Is this a real - time system?

Indeed, all three systems — aircraft, nuclear power plant, and airline reservations are real - time, because they must process information within a specified interval or risk system failure.

Real-Time and Non Real-Time

A **real-time** system is one in which the output depends not only on the logical correctness but also on the time at which it is being produced. The system will be time deterministic in nature and output behavior is predictable.

Non-real time system is one in which we cannot guarantee the response time of a task. These systems are non-deterministic in nature and we cannot predict the behavior of the system with respect to time.

Definitions for Real-Time Systems

The hardware of a computer solves problems by repeated execution of machine language instructions, collectively known as software.

Software, on the other hand, is traditionally divided into system programs and application programs.

System programs consist of software that interfaces with the underlying computer hardware, such as device drivers, interrupt handlers, task schedulers, and various programs that act as tools for the development or analysis of application programs.

Software Tools

These software tools include:

- Compilers, which translate high - level language programs into assembly code;
- Assemblers, which convert the assembly code into a special binary format called object or machine code;
- Linkers/locators, which prepare the object code for execution in a specific hardware environment.
- An operating system is a specialized collection of system programs that manage the physical resources of the computer. As such, a real-time operating system is a truly important system program.

Application programs

Application programs are programs written to solve specific problems, such as

- optimal hall - call allocation of an elevator bank in a high - rise building,
- inertial navigation of an aircraft,
- payroll preparation for some industrial company. Certain design considerations play a role in the design of system programs and application software intended to run in real - time environments.

Summary

- ✓ Outline of the RTS course
- ✓ Reference
- ✓ Real-Time term and fundamentals
- ✓ Simple examples on Real-Time systems
- ✓ Definitions of Real-Time and Non Real-Time systems
- ✓ Some basics for hardware and software