

COMP 4550 – Real-Time Systems

Calendar Description: An introduction to the theory and practice of real-time systems. Topics include the design of real-time systems, scheduling, event based processing, and real-time control.

Prerequisites: COMP 3370 and COMP 3430

Outline

- 1) Time (1 week)
What is time and why is it important? A discussion of what a real-time system entails, including the difference between soft and hard real-time systems.
- 2) Design and Architecture (2 weeks)
A look at the make-up of common real-time systems (including the hardware/software interface). Includes a discussion of state based design and timing/event diagrams.
- 3) Scheduling (3 weeks)
A look at deterministic scheduling algorithms such as brute force, rate monotonic, and earliest deadline first and the difference between periodic and aperiodic tasks. Will include a discussion on time analysis using rate monotonic analysis (RMA) and potential scheduling problems (i.e. priority inversions).
- 4) Event Driven Processing (3 weeks)
The processing of inputs (from users or sensors) as stimuli that trigger system operations. Topics include the processing of inputs, filtering, event generation, and processing via state machines.
- 5) Control Systems (3 weeks)
Techniques for controlling external devices. Topics include maintaining accurate timing of output and open versus closed loop control systems (including feedback mechanisms). A number of control algorithms will be discussed, from simple count based approaches to the standard PID (proportional, integral, differential) algorithm.
- 6) Safety (1 week)
A look at how real-time systems can impact on the life of individuals. Discussions will include the use of feedback to detect I/O failures, how to manage these failures, and system testing and verification. Don't forget watch dog timers!

Text: none.