

Real-Time and Embedded Systems

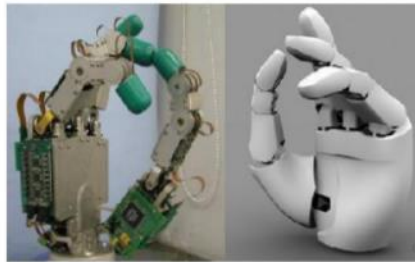
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Course Information

- Real-Time & Embedded Systems
 - 嵌入式即時系統
- Instructor
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 - Send an email for inquiries or appointments

Embedded Systems

- Mission oriented, with highly customized hardware and software
- Constraints
 - Resource: Time (CPU) and space (RAM)
 - Timing (deadline-driven response)



Various Forms of Embedded Systems

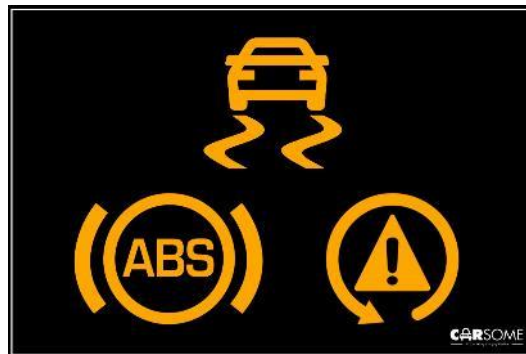
- Mobile phones
- Internet-of-Things
- Wireless sensing nodes
- Edge computers
- Automotive systems
- Cyber-physical systems (CPS)
- ... and many others



Real-Time Systems

- *“A real-time system is a system whose correctness includes its response time as well as its functional correctness”*
 - IEEE Definition on Real-Time Systems

Hard real-time systems



Soft real-time systems



Words of Wisdom

Embedded (practice) + Real Time (theory)

***Theory** is when you know everything but nothing works. **Practice** is when everything works but nobody knows why.*

What You Should Expect

- A successful embedded application =
application ideas +
system knowledge +
theory
- Only system and theory will be covered in this course; no application design will be involved!

Course Organization

- Loop

```
While (1) {  
    Theory;  
    Code Review;  
    Hands-on lab;  
}
```

- “Dual kernel” approach...
 - uC/OS + FreeRTOS

Hands-on Labs

- ucOS-2: 3 Labs
 - Periodic task execution
 - Earliest-deadline first (EDF) scheduling
 - Ceiling-priority protocol (CPP)
- FreeRTOS: 2 Labs
 - EDF for FreeRTOS
 - Checkpointing with FreeRTOS

Remarks on labs

- Do the labs and deliver a demo in lab weeks
 - See the course timetable for lab weeks
 - Make an appointment with TAs
 - Place: EC130A
- Due to availability of evaluation boards, you are supposed to form groups
 - 1 group = 2 people
 - If you cannot find a partner, we will randomly assign one for you
- Sign up with TAs for equipment lending-out

Grading Policy

- First written test: 25%
- Second written test: 25%
- 5 Labs (uCOS2+FreeRTOS) 40%
8% each
- Quizzes and attendance 10%