嵌入式作業系統分析與實作

成功大學 資訊工程系

張大緯

Outline

- Participants
- Course Introduction
- Class and Office Hours
- Grading

Participants

- Target Audience
  - 研究生，大四
- 先修課程
  - 作業系統，C程式語言，資料結構，微處理機
- Instructor (at 新大樓12F)
  - 張大緯
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- Teaching Assistants (at 新大樓4F 65409)
  - Check on the course moodle

Course Introduction

- This course provides knowledge about implementations of embedded real-time operating systems (RTOS)
- 2 real-time operating systems are discussed
  - FreeRTOS
  - uCOS-II
- Class types
  - Lecture
  - Lab
  - Project Implementation (for your term project)

This Course

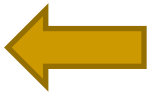
- is a Software-based Course
  - We discuss about the design of embedded real-time operating systems (RTOS)
- still requires some knowledge about Hardware
- **requires code tracing and programming**
  - 5 Labs + 1 Project
  - Languages
    - Assembly (ARM)
    - C

Course Introduction

- You should prepare
  - The development board
    - STM32F407G-DISC1
      - **ARM Cortex M4** 32-bit processor
  - Laptop computer

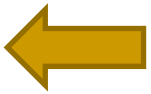
Tentative Course Outline

- Course Introduction
- Introduction to Embedded RTOS
- FreeRTOS Introduction (1)
- FreeRTOS Labs (1)
- FreeRTOS Introduction (2)
- FreeRTOS Labs (2)
- FreeRTOS Labs (3)
- Project Proposals
- FreeRTOS Introduction (3)
- FreeRTOS Labs (4)
- FreeRTOS Labs (5)
- uC/OS-II Introduction
- Project Implementation
- Project Presentation & Demo



Please prepare your development board ASAP !

The schedule is subject to change!



about 3-4 weeks

What's an Embedded System?

- Embedding computing power into specific objects
- Including hardware and software
- Usually, multiple chips on a board
  - To run software, at least one processor chip must be included

Embedded Devices

Picture source: https://www.arcweb.com/blog/embedded-systems-trends-technologies

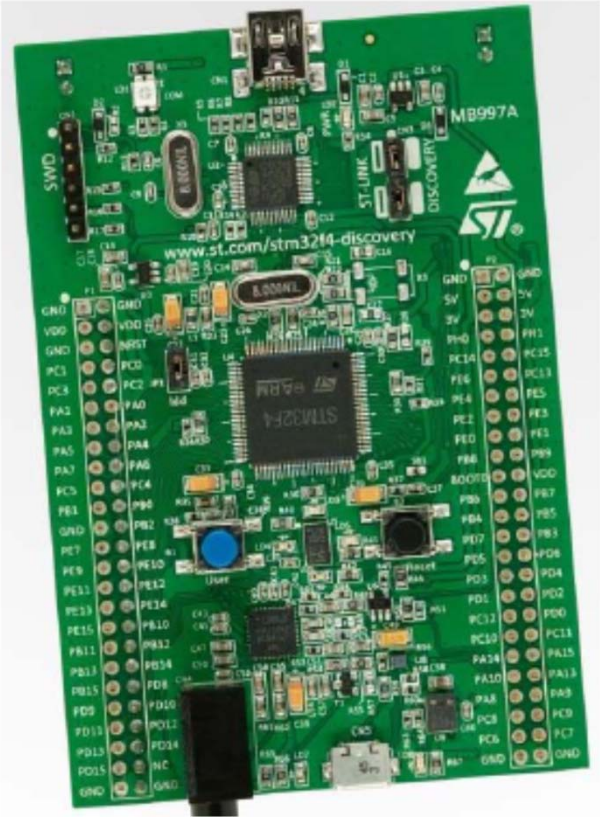
Development Environment

- Host Computer ⟸ **Your Laptop Computer**
  - For development (coding, testing….)
  - Toolchains
    - Compiler, Assembler, Linker, Loader
    - Debugging tools
    - Binary Utilities
  - STM32CubeIDE
    - ***Please install the environment before Lab1!***

- Target Board ⟸ **Your development board**
  - For code execution
  - STM32F407G-DISC1, *see next slide…*

The Target/Development Board

STM32F407G-DISC1



STM32F407VGT6 microcontroller
32-bit ARM® Cortex®-M4 with FPU core
1-Mbyte Flash memory, 192-Kbyte RAM

On-board ST-Link Debugger

3-axis accelerometer
audio sensor omnidirectional digital microphone

LEDs
push-buttons

Lab Items

Lab #	Topics
1	FreeRTOS Basics
2	UART & Multitasking
3	Sensors & Interrupt Handlers …
4	Memory Manager
5	FreeRTOS+ File System

Possible Projects

- RTOS Porting
- Implementing new system components
  - File systems
  - Program loaders
  - Network protocol stacks
- Enhancing RTOS functionality
  - Scheduling
  - Memory management
  - TCP/IP
- …

Course Slides and Reference Information

- Course Slides
  - Download from the course moodle

- Reference Information
  - **MicroC/OS-II documentation**
    - https://micrium.atlassian.net/wiki/spaces/osiidoc/overview
  - **FreeRTOS website**
    - https://www.freertos.org/RTOS.html

Grading

- No Exams
- 5-week Labs + 1 Project
- Grading
  - (per-student) Labs: 40%
    - **lab implementations + lab reports**
    - The form of the lab report can be downloaded from the course moodle
  - Project Presentation/Demo: 15%
  - Project Report: 15%
  - Project Implementation: 30%

- For the project, please form your teams
  - 2-4 students/team
  - *We will announce **deadline** for team registration.*