

微算機系統實習

# Embedded Microprocessor Systems Lab.

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Professor

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# Course Administration

- **Instructor : Yen-Lin Chen (陳彥霖)**
  - Office : 科技大樓1522室 分機: 4239
  - Email: [ylchen@csie.ntut.edu.tw](mailto:ylchen@csie.ntut.edu.tw)
  - Office Hours:
  - Friday, 13:10 – 15:00.
- **TA: 賴宏琪、張傑閔**
  - Lab: 科技大樓1323實驗室, 分機 : 4264
  - Office Hours:
  - Friday, 13:10 – 15:00.
  - Email: [t107598024@ntut.edu.tw](mailto:t107598024@ntut.edu.tw), [t107598023@ntut.edu.tw](mailto:t107598023@ntut.edu.tw)
- **Course Time & Place:**
  - Lab & practice, Monday, 15:10-18:00, 科技大樓1222實驗室

- **Reference Books:**

- Jean J. Labrosse, Jack Ganssle, Robert Oshana, Colin Walls, “Embedded Software”, Newnes, 2007.
- B.I. Pawate, “Developing Embedded Software using DaVinci and OMAP Technology”, Morgan and Claypool, 2009.
- Jasmin Blanchette, Mark Summerfield, “C++ GUI Programming with Qt4, 2/e”, Prentice Hall, 2008.
- Bruce P. Douglass, “Real Time UML Workshop for Embedded Systems”, Newnes, 2007.
- Open source Software Libraries (Source Forge, Open Foundry, Google Code...)

- **Pre-request Course:**

- C/C++ Programming Skills, Microprocessor Systems

- **Grading:**

- Lab Practices & Reports: 60%
  - About 6-7 labs and reports
- Midterm On-machine Exam:
- Term Project: 20%
  - To build up a large scale embedded multimedia system project

- **Course Webpage:** 北科I學園

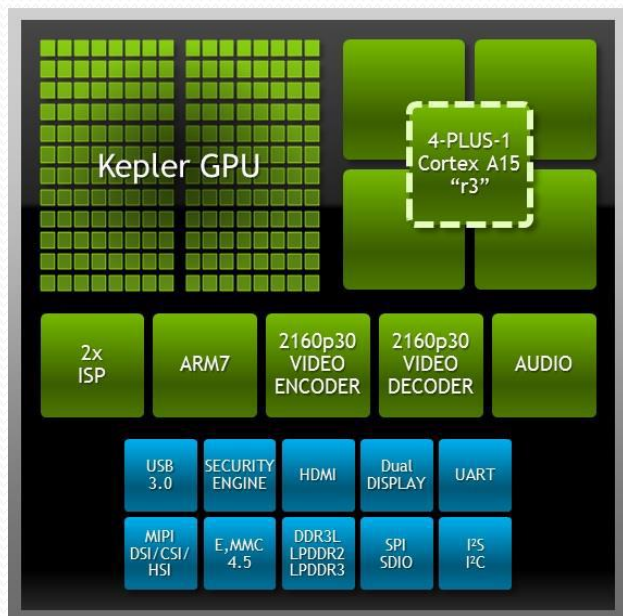
# Rough course outline

- Embedded Software Development Platform and Tool-chains.
- Embedded Operating Systems and Development Tools for Nvidia Tegra K1 platform.
- Developing Embedded Software with opensource GUI and Image Processing Libraries.
- Heterogeneous Multi-core (CPU-GPU) Embedded Platforms.
- Development of Embedded Computer Vision Systems.
- Development of Embedded Human-computer Interactive Systems.

# Rough course outline

1. Introduction of Embedded Software(1 week)
2. NVidia TK1 , NVidia TX2多核心嵌入式平台開發環境建立 (1 week)
3. NVidia TK1 SDK之安裝與編譯(1 week)
4. 學習ARM-Linux跨平台應用程式編譯開發環境 (2 weeks)
5. 嵌入式系統Qt-GUI人機介面開發(2 weeks)
6. 嵌入式GPIO輸出入腳位訊號控制(1 week)
7. Midterm Exam (1 week)
8. 嵌入式系統網路通訊介面開發(2 weeks)
9. Embedded Linux Kernel建立與Device Drivers驅動程式實作(2 weeks)
10. 結合OpenCV進行視覺處理與分析應用(1 week)
11. 視訊內容分析與擷取技術於嵌入式系統之應用程式開發實作(1 week)
12. 視覺人機互動介面技術開發(2 weeks)
13. Final Project

# NVIDIA Jetson TK1



- Tegra K1 SOC
  - NVIDIA Kepler GPU，含 192 個 CUDA 核心 (0.85 GHz)
  - NVIDIA 4-Plus-1™ 四核心 ARM® Cortex-A15 CPU (2.3GHz)
- 2 GB 記憶體
- 16 GB eMMC
- Gigabit 乙太網路
- USB 3.0
- SD/MMC
- miniPCIe
- HDMI 1.4
- SATA
- 線路輸出 / 麥克風輸入
- RS232 序列埠
- 擴充埠，可連接額外的顯示器、GPIO 及高頻寬相機介面
- 電源供應器與連接線
- Micro USB-USB



# NVIDIA Jetson TX2



- 雙核心 Denver 2 64-bit CPU + 四核心 ARM® A57 Complex
- 8 GB L128 bit DDR4 記憶體
- 32 GB eMMC 5.1 Flash 儲存
- 可連接支持802.11ac WLAN 和 藍芽的裝置
- 10/100/1000BASE-T 乙太網路
- USB 3.0 Type A
- USB 2.0 Micro AB (支持recovery 與 host 模式)
- HDMI
- M.2 Key E
- PCI-E x4
- Gigabit Ethernet
- Full-Size SD
- SATA Data and Power
- GPIOs, I2C, I2S, SPI, CAN\*
- TTL UART with Flow Control
- Display Expansion Header
- Camera Expansion Header

# 本課程作業/報告上傳

- 位址：北科i學園
- 請各位同學先將分組的名單上傳至FB社團中，接著我們會將你們分組，你們可以查看你們各自的組別。
- 作業上傳格式，以組別命名，壓縮為rar，例如：組別X.rar
- 其rar裡要包含如下資料夾
  - Code //存放程式碼
  - Report //存放報告
- 請依照此規則上傳，否則會造成助教改作業的困擾，成績有問題要自行負責
- 強烈建議不要使用IOS系統撰寫報告，因為會有亂碼造成助教之困擾，成績有問題要自行負責



# 本課程討論群組

- 本課程課後討論FB社群：
- <https://www.facebook.com/groups/797883477244754/>