

Low-Power & Low-Voltage SoC Design

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Tay-Jyi Lin (林泰吉)

* Education

- * Ph. D. in Electronics Engineering, National Chiao Tung University (NCTU)
- * B. S. in Electrical & Control Engineering, NCTU

* Experience

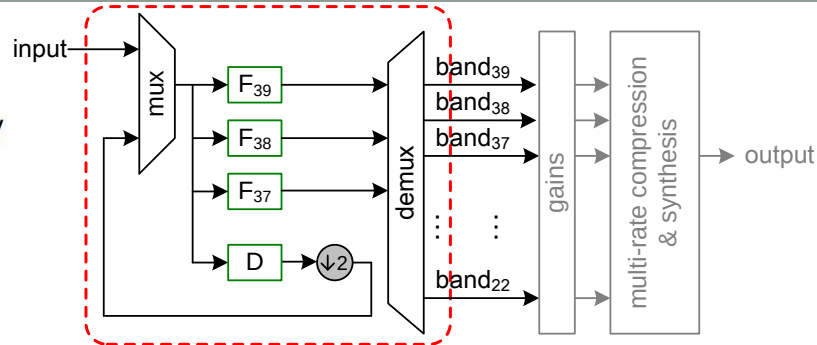
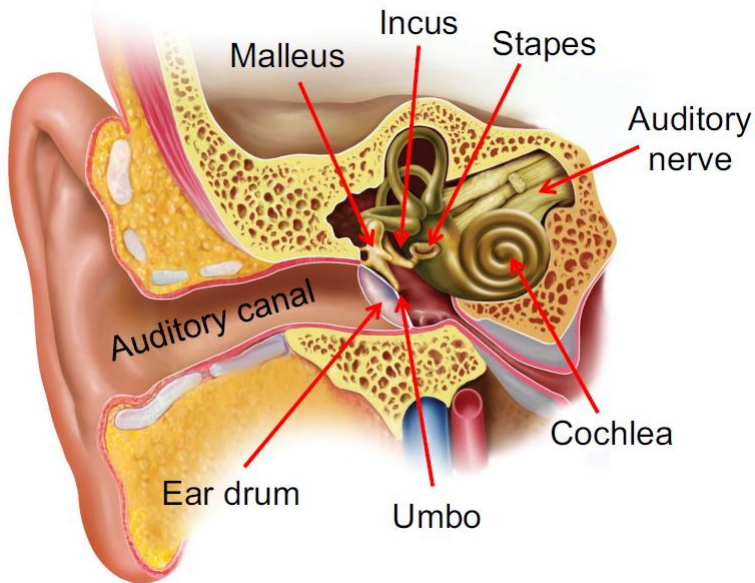
- * Assistant Professor 2010/8 ~
Department of Computer Science & Information Engineering,
National Chung Cheng University (CCU)
- * Research Assistant Professor 2006/1 ~ 2010/7
Microelectronics & Information Systems Research Center, NCTU
- * Adjunct Researcher & Manager 2003/3 ~ 2010/7
SoC Technology Center (STC)
Industrial Technology Research Institute (ITRI)

Taiwan's First Application Processor PAC & PACDSP

- * **DSP architecture developed in NCTU**
- * **DSP commercialized & SoC implemented in ITRI**
- * Toolchain developed by NTHU
- * Android porting, H.264, DVB & various applications collaborated by ITRI & academia

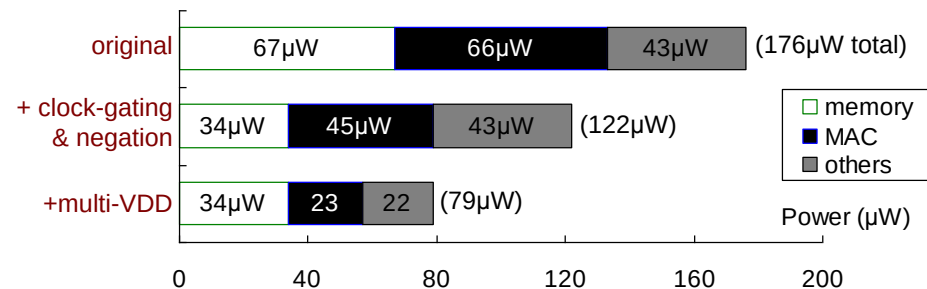
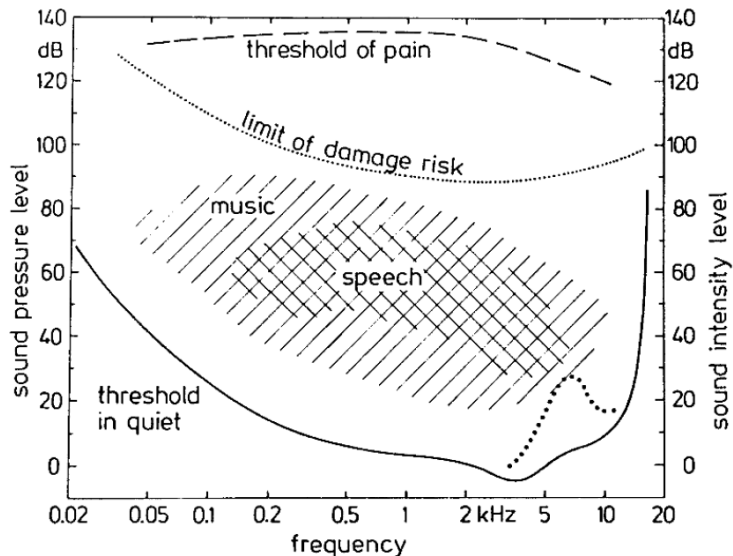
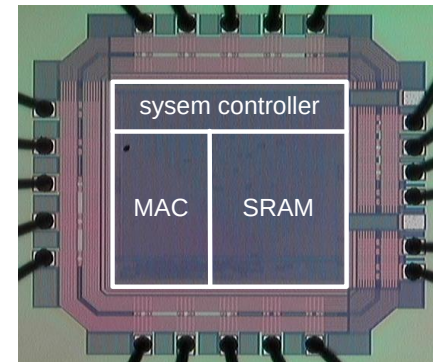


Digital Hearing Aids



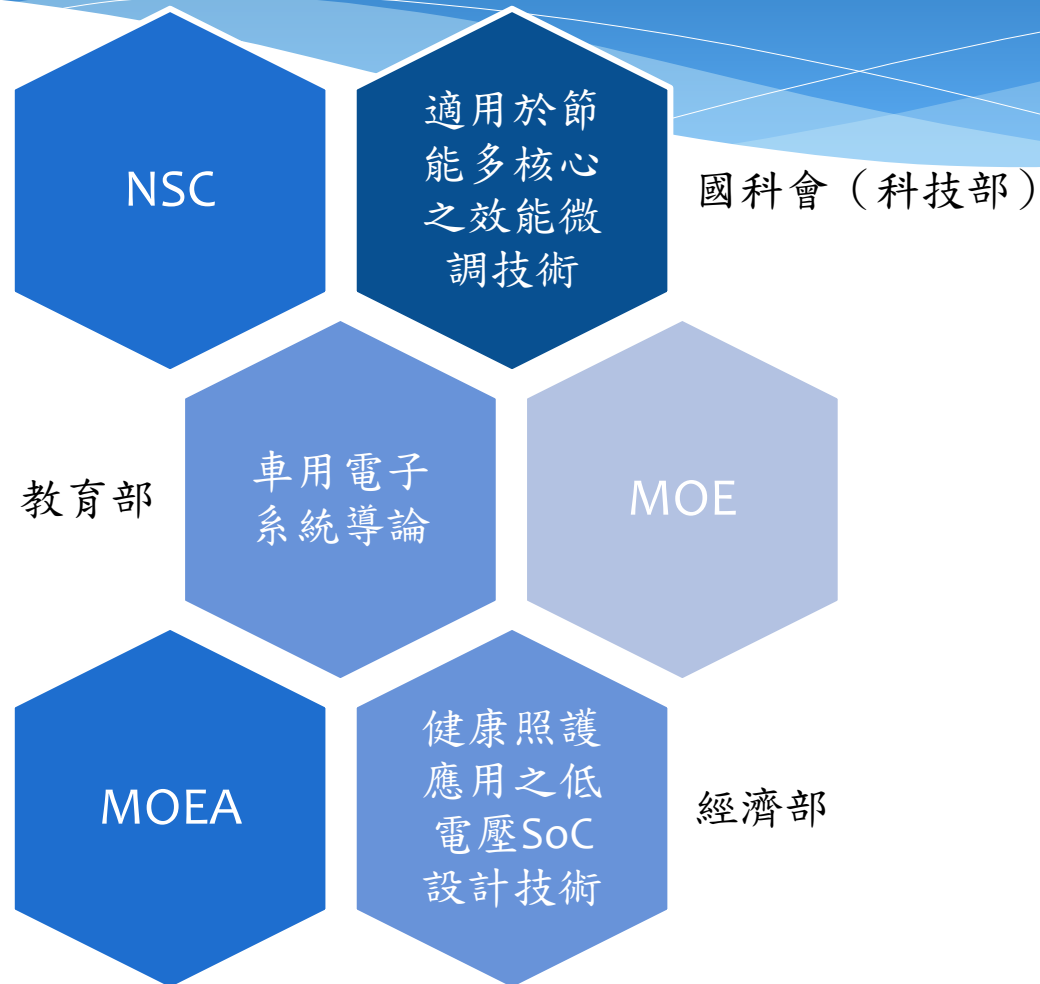
Multirate
ANSI S1.11
filter bank for
the auditory
compensation

		IIR	FIR
Parallel	# MPY	192	3,270
	# ADD	165	6,520
Multi-rate	# MPY	102	120
	# ADD	90	233



Special Feature Award in ASP-DAC 2009

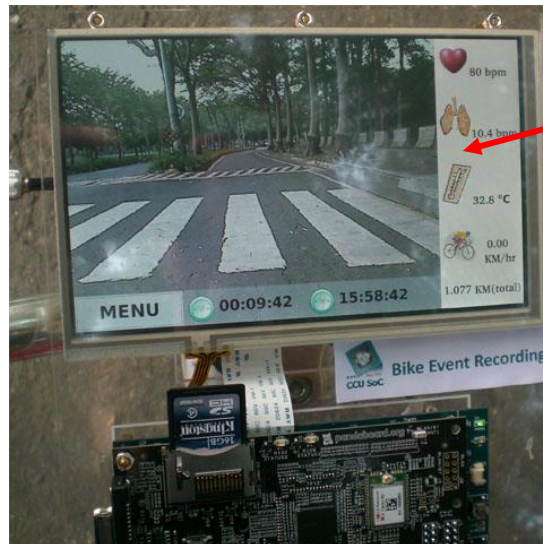
2010/8 in CCU



CCU Body-Bike Event Recorder (B²ER)

In addition to road events, biker's bio-info (ECG, breathing, body temperature) are recorded and analyzed with advanced signal processing to provide:

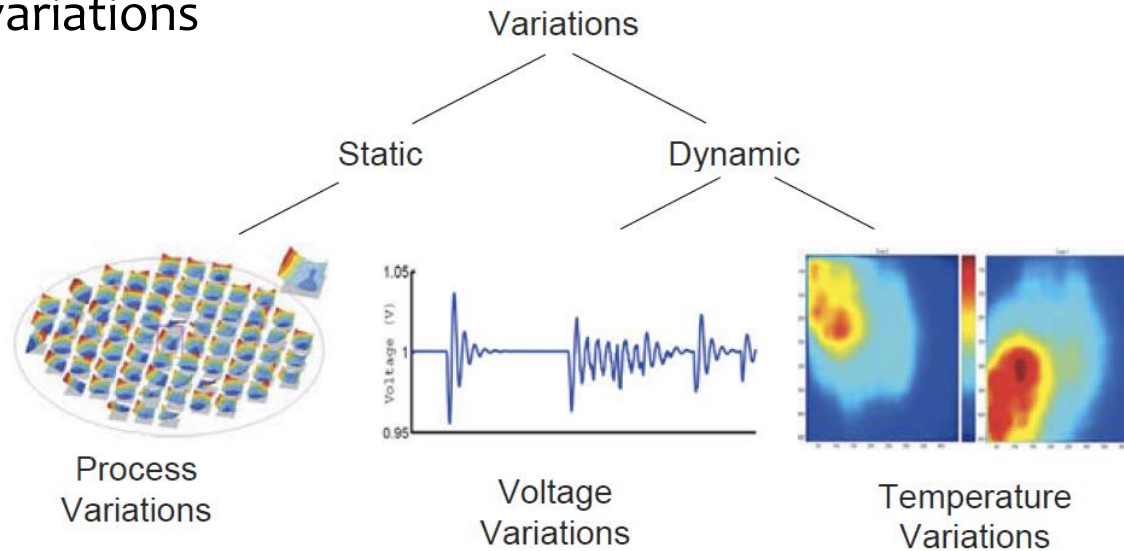
- Rear vehicle warning w/ stereo audio
- Endurance training w/ real-time HRV analysis
- Posture analysis w/ additional camera



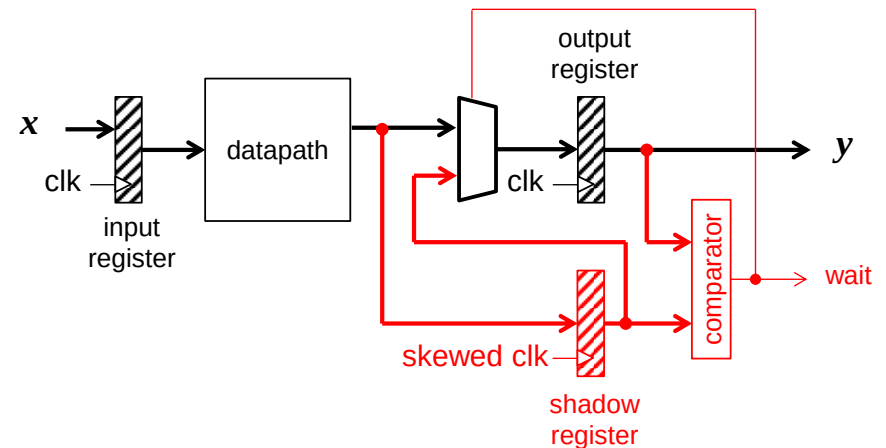
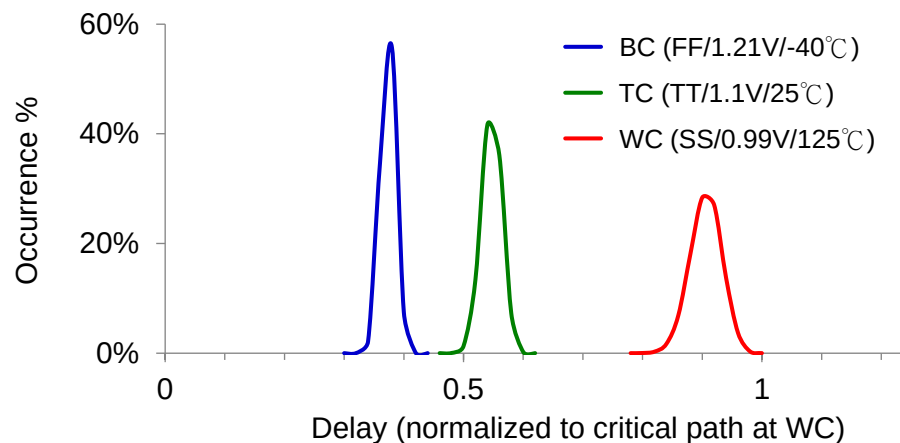
榮獲教育部100學年度
智慧電子系統設計競賽
優等

Design Challenges at ULV

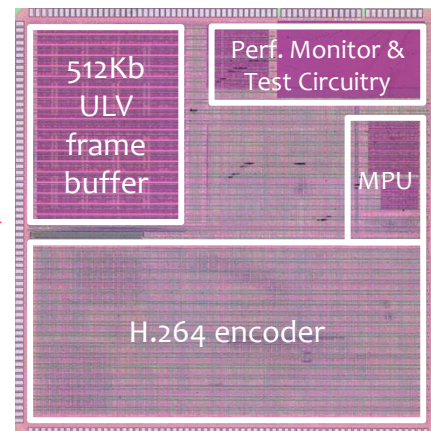
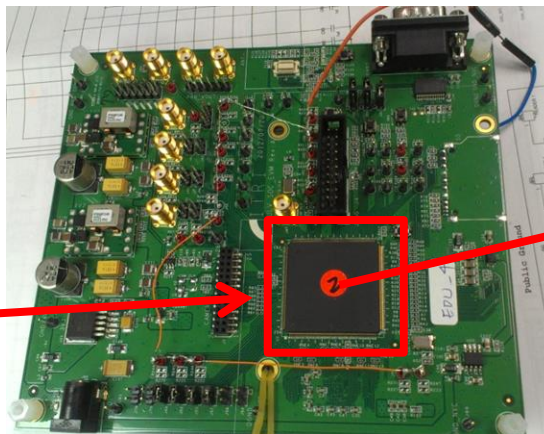
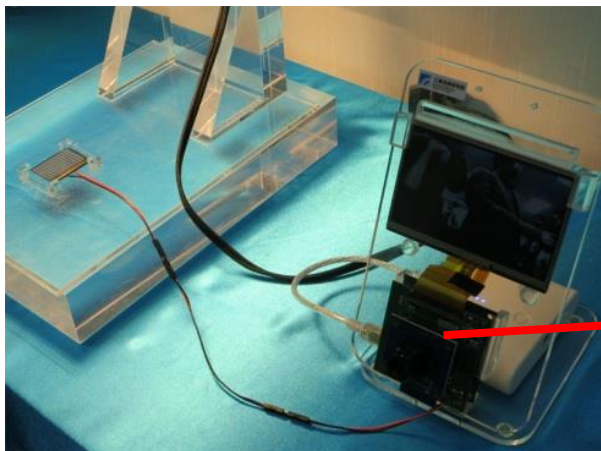
* Parameter variations



* Corner-based design & statistical design



Solar-Powered Video Recording SoC



- * **0.48V** ULV SoC including MPU, H264 encoder, 512Kb frame buffer, and various on-chip peripherals (DRAM/LCD/camera interfaces)
- * Scalable H.264 encoding (30fps HD720@1.0V & QQVGA@0.48V)
- * 24,199,434 transistors in 4.05x4.05mm² (65nm LP CMOS)



國立中央大學



國立交通大學



工業技術研究院
Industrial Technology
Research Institute

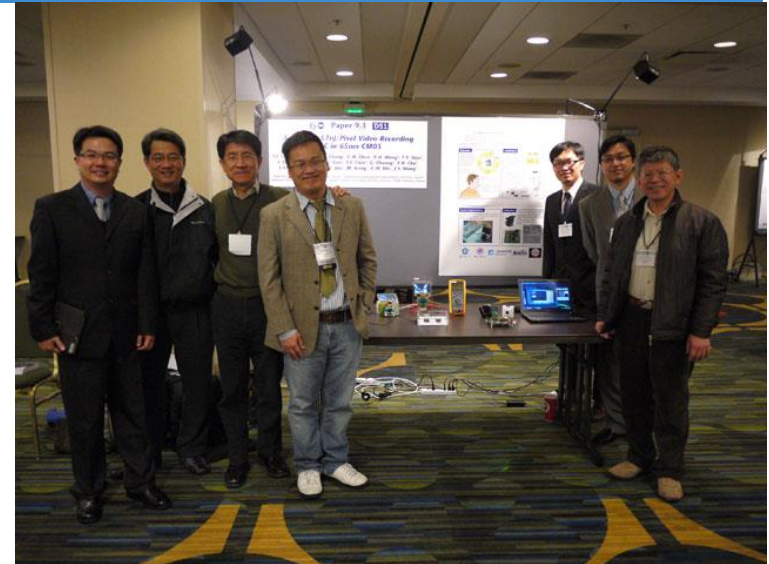
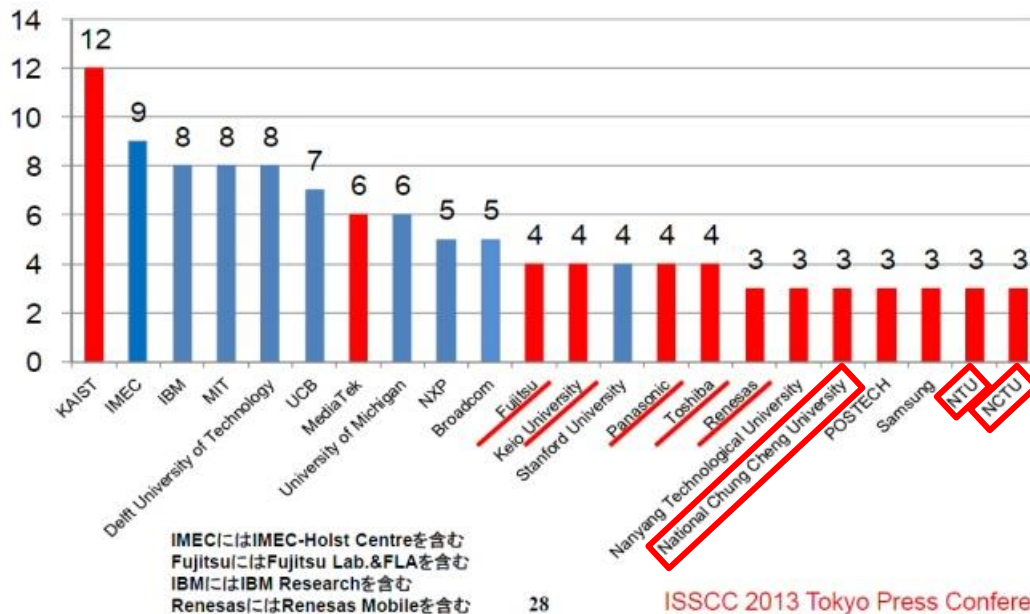


Presentation & Demo at ISSCC



ISSCC 2013 組織別採択論文数

プレナリー講演は除く



Session 9.3

A 0.48V 0.57nJ/pixel Video Recording
SoC in 65nm CMOS

Source: techon.nikkeibp.co.jp

Next Step



物聯網



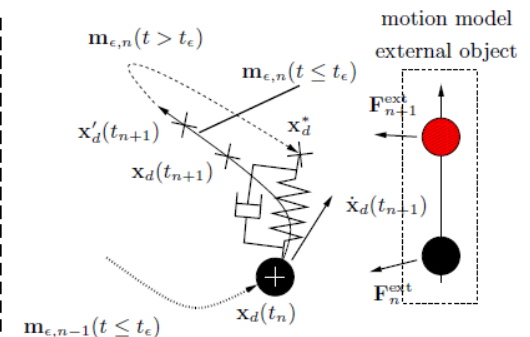
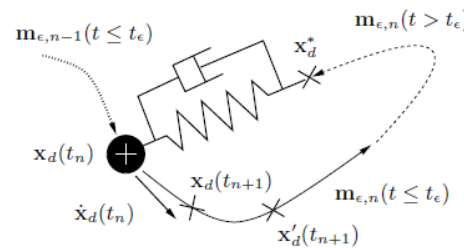
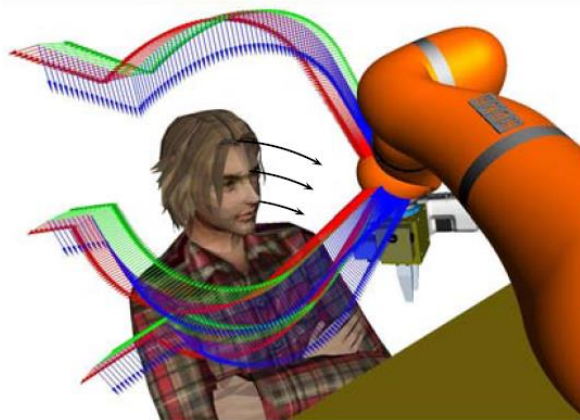
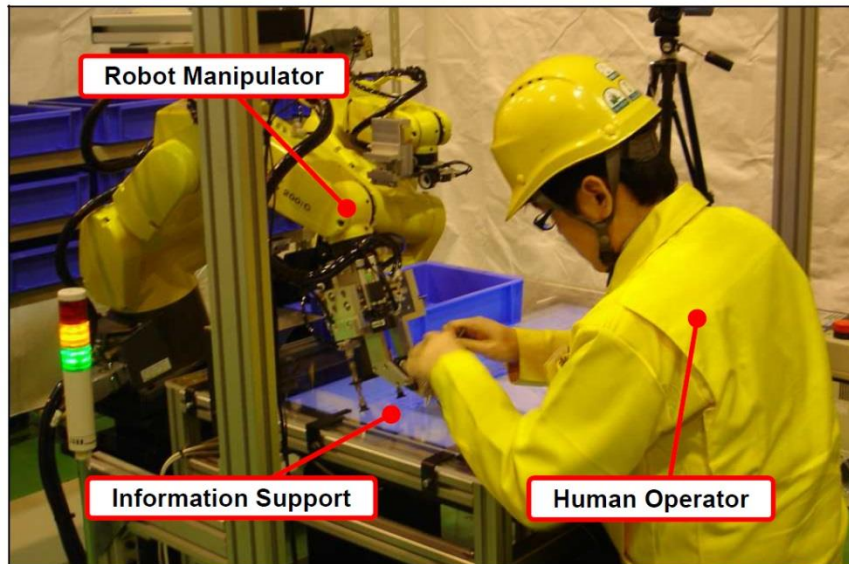
30B Connected Devices
(Gartner)

水平開放市場、少量多樣

軟硬體缺一不可；而硬體為應用服務的載具，其中MCU運算核心，更為IoT創新產業之關鍵

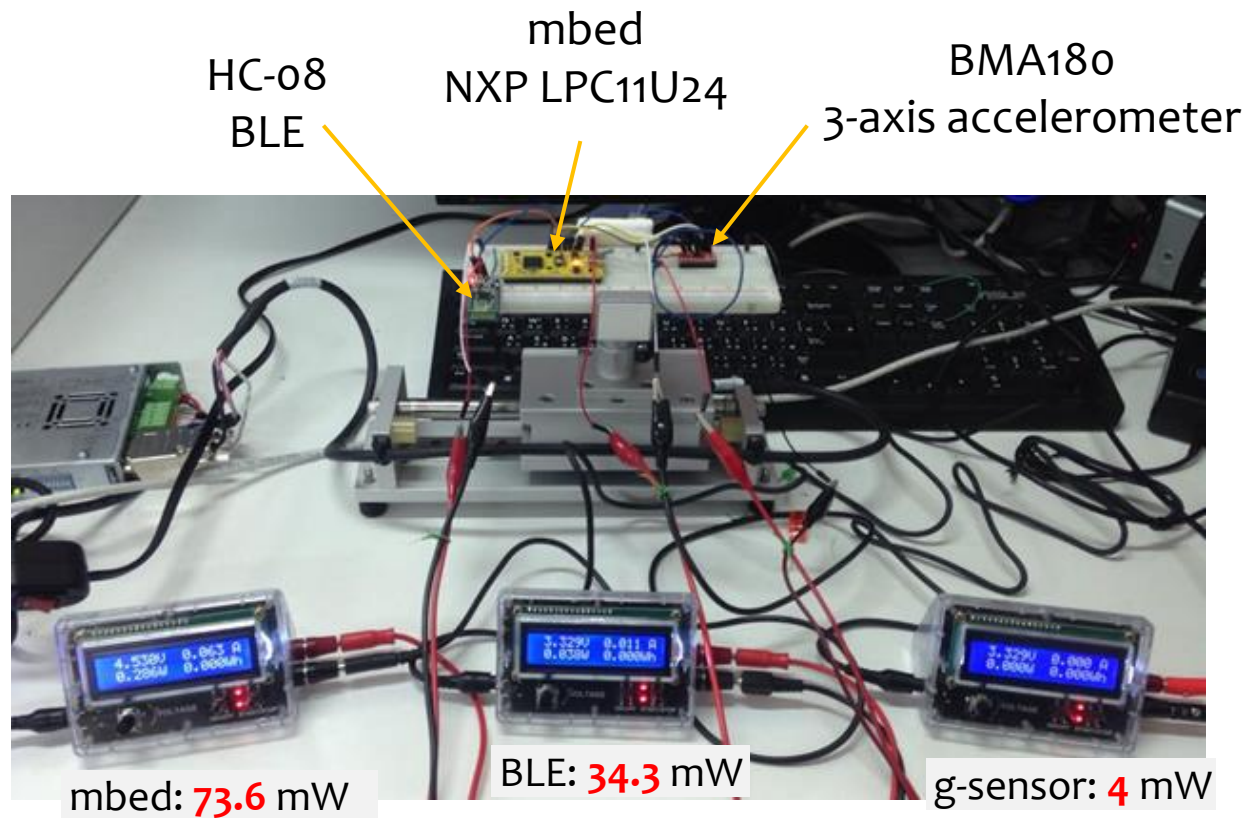
台灣電子資訊產業的新機會

Human-Robot Collaboration in Industry 4.0



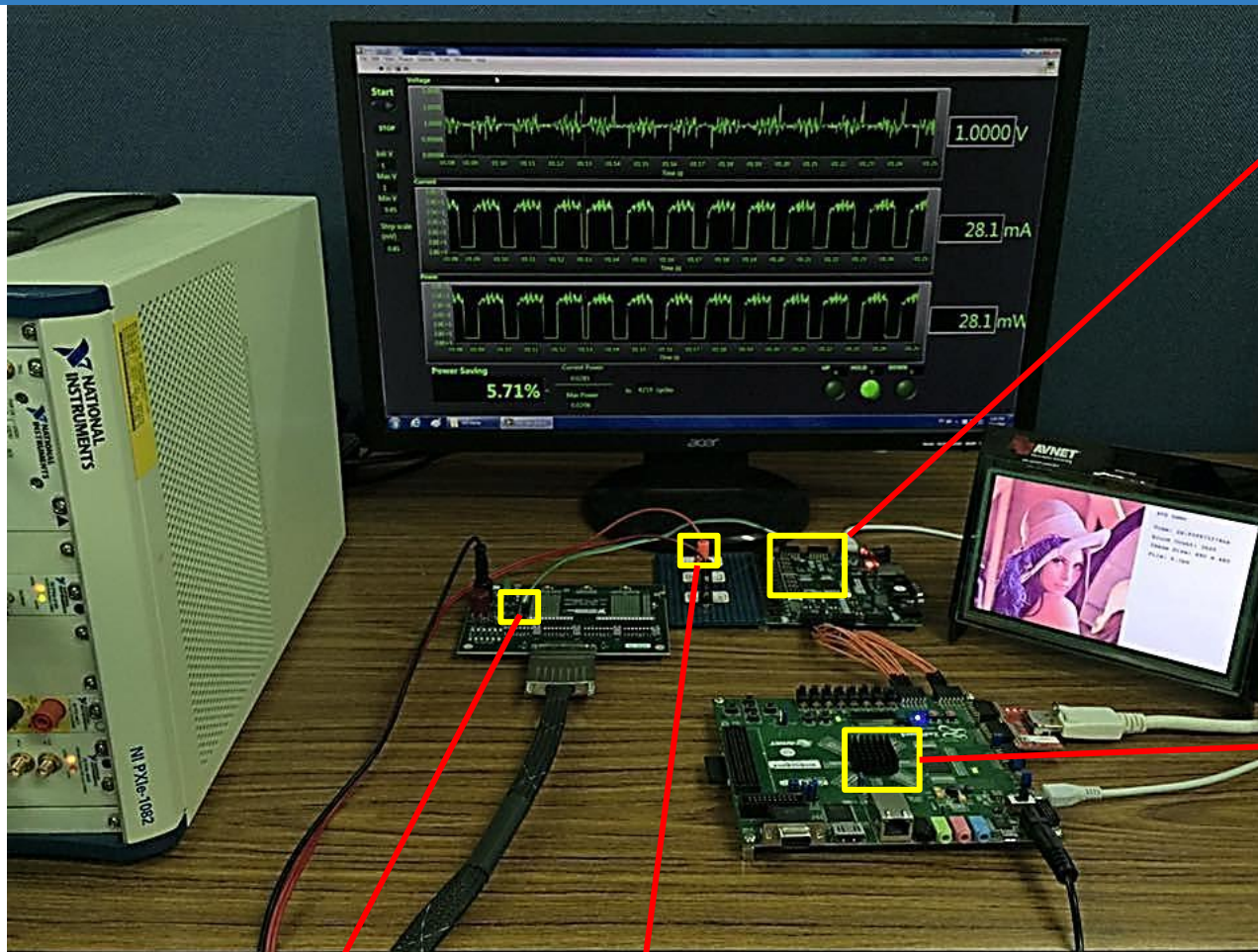
$\sim\mu\text{A}/\text{MHz}$ MCU for IIOT

System-level power profiling on the prototype of a wireless vibration sensing node



AVS Cortex Mo

NI PXI/SMU
for 1mV/step
DC/DC



Cortex Mo for
JPEG decode
on DVS FPGA
with separate
VCCINT

V control
to SMU

VCCINT
from SMU

Cortex A9
(Xilinx Zynq)
for DPF
(Linux/Qt)