ME2130

Embedded LINUX OS (Intel® Atom™) Courseware

dream CATCHER

~Complete Resources for Lecturers~

Teaching slides	Training kit
• Editable Microsoft® PowerPoint® slides with speaker notes • Covers up to 60 hours of teaching	• Intel® Atom™ based platform system • Linux based • Lab sheets & model answers • Problem-based assignments • Covers 24 hours of labs
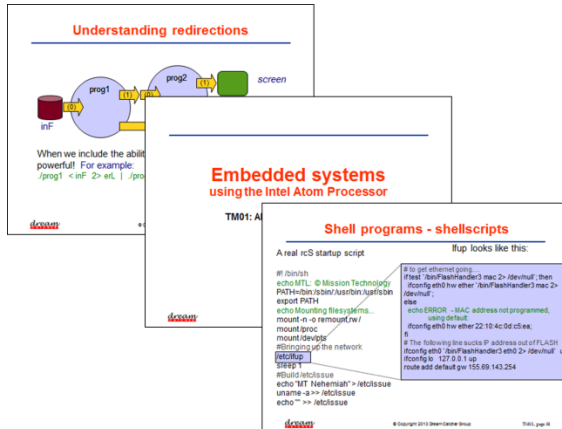
Target university subject	Target year of study	Prerequisite(s)
Embedded System Design, Embedded OS	3rd or Final year undergraduate	Introduction to programming (in C, C++, or similar compiled language)

ME2130 is a ready-to-teach package focused on embedded Linux system applications using the Intel® Atom™ platform. This lecturer resource consists of teaching slides, training kits, problem-based assignments, and lab sheets.

Learning Outcomes

Upon completion of this course, students would be able to:

➢ Appreciate the major elements of a cutting-edge embedded system.

➢ Understand the main aspects of embedded system design choices, development rationales and trade-offs.

➢ Know how to install, customize and optimize the operating system running Atom-based intelligent systems

➢ Able to configure and build a Linux kernel.

➢ Develop low-level character device drivers and loadable kernel modules (LKMs).

➢ Develop applications capable of multitasking, communicating through pipes and network, sharing files and messaging.

➢ Benchmark and debug application software, tune compiler settings, and create efficient and safe software.

Benefits of the ME2130 courseware

➢ The training kit is based on an industry-standard embedded platform and architecture and teaches industry-standard embedded system tools and methods.

➢ It can be used to develop real-life applications for point-of-sales systems, home media, or basic desktop computing.

➢ This comprehensive course spans computer organization, low-level driver development, and modern applications development to give students a unique holistic insight into how embedded systems are designed, developed, and applied in industry.

Teaching Slides

More than 700 editable Microsoft PowerPoint teaching slides are provided, covering up to 60 hours of teaching for one full semester. The slides cover the following topics:

- About embedded systems
- Survey of embedded components
- Programming models & languages
- Introduction to the Atom processor
- Embedded operating systems

- Toolchain
- Linux and the Atom
- Developing embedded applications
- Connectivity
- Efficient embedded solutions

Training Kit

Intel® Atom™ Platform: QBOX Mini-1000 Intelligent System

This platform is the first embedded SOC system powering Windows and Linux operating systems. It is highly portable and lightweight (175g), with WIFI connectivity and outstanding graphic performance using the Tunnel Creek HW accelerator engine. It is a good reference design and building block technology demonstration kit for embedded applications such as home gateway, fitness/medical, digital signage, and media/projector adaptors.

CPU Support	Switch & LED
Intel® Atom™ E640T (1GHz, 512KB Cache (TDP: 3.3W))	1x Power On/Off Button (With Power LED) 1x Clear CMOS Switch
Memory	**Watchdog Timer**
Onboard DDR2 Memory (1GB max)	Intel® Atom™ E640T processor integrated WDT 1us to 10mins selectable
BIOS	**Hardware Monitor**
AMI uEFI BIOS 1x 8Mb SPI flash ROM	Temperature & Voltage Monitoring ACPI 3.0 supported
Storage	**Real-Time Clock**
1x mSATA	Intel® Atom™ E640T processor integrated RTC
Audio	**Power**
Realtek ALC662 HD Codec 1x Phone Jack for both Line-Out & Mic-In	DC 12V Input
Expansion	**Environment**
1x mPCIe Socket	Operating: 0°C to 40°C
USB	**Dimensions**
2x internal USB, 1x external USB	130.11 x 83.06 x 19.2 mm (D x W x H)
Certifications	**Weight**
CE, FCC Class A	174. 4 (g)
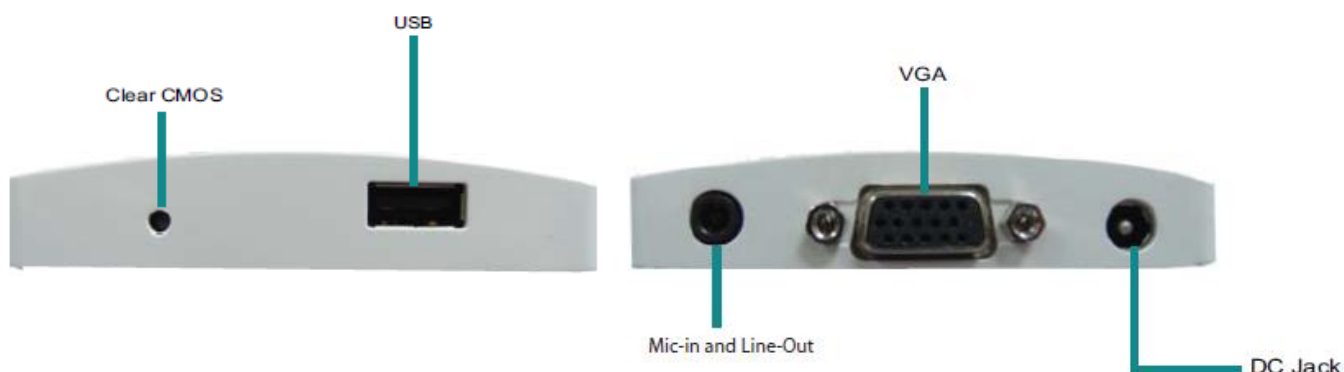
Note: A laptop or desktop PC running a standard version of the Linux operating system is required. Ubuntu 12.04.1 is recommended, but any other sufficiently recent version of Linux should suffice.

Lab sheets

The training kit includes instruction sheets for 7 lab sessions in editable Microsoft Word format. Each lab requires 3 hours to complete. The lab modules reinforce the lecture material with hands-on exercises and development projects. Model answers and sample source codes are provided. The training kit hardware required for the labs is listed below.

Lab Sheet	Hardware Kit
	Qbox Mini-1000
Exploring Programming Models and Languages	
Host and Target 1: develop programs, file handling, signaling, multitasking on the host and connect to Target	√
Exploring the target: BIOS and settings, system setup, connect to the network, share files and directories	√
Host and Target 2: develop performance evaluation software and a new, custom kernel to run on the Target	√
Realistic Embedded Systems: multitasking and device driver development	√
Development Tools Workshop: debugging, use of Eclipse IDE to develop multi-source applications	√
Development of Computer-controlled Advertising Billboard (6 hours): using networking, various scripts, C programs, signaling, client-server communications, threads, and other techniques	√

Note: lab exercises are carried out using Linux OS Ubuntu 12.04.1 on both PC and QBOX Mini-1000 Intelligent System

Problem-based assignments

The problem-based assignments below allow students to enhance their problem-solving skills.

-   Hardware and software requirements of an identified embedded system

-   Create a demonstration computer-controlled advertising billboard (extension of lab session)

About the Author

Professor Ian McLoughlin has more than 25 years of experience in industry and academia across three continents. In his various careers, he has developed mobile radio hardware and software solutions for police and emergency services, won the inaugural international IEE "Innovation in Engineering" award in 2005 for building the world's most spectrally efficient narrowband radio system and led the design teams for the on-board computers in Singapore's first satellite (X-Sat, launched in 2011). Along the way, he has proposed standards for the evaluation of communication system intelligibility for Chinese speech, pioneered a method of regaining voice for laryngectomy patients, spearheaded the adoption of electric transport in Singapore, contributed to the cutting-edge design of future cities, and co-founded research centers worth more than $200 million. He is a founder and director of a technology-related charity in New Zealand. He has published over 130 papers in international conferences and journals, holds 14 patents, and has written 2 popular textbooks: *Computer Architecture* (McGraw-Hill) and *Applied Speech and Audio Processing* (Cambridge University Press).

Currently, Professor McLoughlin leads a research group in the National Engineering Laboratory of Speech and Language Information Processing at the University of Science and Technology of China.

Ordering Information

Description	Package	Product Number
Teaching Slides	1 user license	ME2130-100
Training Kit	1 unit	ME2130-200
Teaching Slides + Training Kit	1 user license + 1 unit	ME2130-300

Note: warranty of 90 days from the date of shipping for the hardware kit, QBOX Mini-1000.

Training courses related to subject matter are available on request. Visit dreamcatcher.asia for details.