

EEL 4930: Microprocessor Applications 2

INSTRUCTOR

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TEACHING ASSISTANTS

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LECTURES

Periods: T7, R7-8 Location: MAEA 327

LAB SECTIONS (NEB 281)

Monday Periods 11-E1	Wednesday Periods 5-6	Thursday Periods E2-E3
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CATALOG DESCRIPTION

Implementation of a Real-Time Operating System on an ARM Cortex M processor to create more robust and complex microprocessor applications. Introduction to IoT applications.

COURSE OBJECTIVES

To understand the benefits of using an RTOS (Real-Time Operating System) on a microcontroller. They will also learn about the architecture of ARM cortex M based processors. Students will learn the basic components of an RTOS including both background and event threads, thread scheduling algorithms, inter-process communication, thread priority, and synchronization/mutual exclusion via semaphores. Students will also learn how to design embedded C software driver libraries for peripherals such as I2C RGB LEDs drivers and a resistive, pixel-based touchscreen. Students will conclude the course by interfacing with a CC3100 Wi-Fi chip to create an IoT application.

TEXTBOOK (recommended)

Real-Time Operating Systems for ARM Cortex-M Microcontrollers (4th Edition) by Jonathan W Valvano, ISBN-13: 978-1466468863, ISBN-10: 1466468866

TI MSP432 ARM Programming for Embedded Systems by M. Mazidi, S. Chen, S. Naimi, and M. Salmanzadeh, ISBN-13: 978-0997925913, ISBN-10: 0997925914

HARDWARE (included)

- TI MSP432 Launch Pad
- TI CC3100 Wi-Fi Booster Pack
- TI SENSORPACK Booster Pack
- HKN IoT Development Board

REQUIRED SOFTWARE

- TI Code Composer Studio 7
- Some HKN IoT Source Code (provided in class)

REFERENCE MATERIALS (Available on Class Canvas)

- MSP432 Datasheet
- MSP432 Technical Manual
- ARM Cortex M4 Datasheet
- LP3943 Reference Manual
- LCD Datasheet
- CC3100 Reference Manual

COURSE GRADE DETERMINATION

Exam #1	10%
Exam #2	10%
Laboratory	60%
Final Project	20% (+10%)

WORKING TOGETHER

You are encouraged to work together on exam preparations and share ideas on lab assignments. However, you are not allowed to copy or duplicate any lab material (code, drawings, etc.) from another student. This work will be considered cheating and will be dealt with in a severe manner.

LABORATORY RULES

1. No food, drinks, dancing, or smoking in the Lab!
2. Students work ***individually*** on each Lab project except the final project in which you will work in groups.
3. It is the student's responsibility to return all equipment and clean her/his work area before leaving the Lab.
4. Students must attend labs during their assigned time.
5. Students must come prepared to the Lab.
6. Labs are 2 hours long. All lab hardware and software are provided to you so you can continue your lab work after the class.
7. You must show up at the standard lab starting time for check-in. If you are late, you may miss a lab quiz and thus get a zero for the quiz.

EEL 4930 Microprocessor Applications 2
Fall Semester 2018
 Class Schedule (Part 1 of 2)

WEEK/DAY	DATE	LAB #	Status	Lectures
1 W	8/22			
1 Th	23			What is ARM? ARM Cortex M Instruction Set / Intro to CCS
1 F	24			
2 M	27	Workshop		
2 Tu	28			Intro to BSP, ARM CMSIS,
2 W	29	Workshop		
2 Th	30	Workshop		MSP432 Peripherals (I2C), LP3943
2 F	31			
3 M	9/3	Workshop		<i>Labor Day Holiday</i>
3 Tu	4			NVIC, SysTick,
3 W	5	Workshop		
3 Th	6	Workshop		PendSV, MPU
3 F	7			
4 M	10	1		
4 Tu	11			C Data Structures (Linked Lists)
4 W	12	1		
4 Th	13	1		Real-Time Systems, Threads and Schedulers
4 F	14			
5 M	17	Workshop		
5 Tu	18			Integration of SysTick, PendSV to Scheduler
5 W	19	Workshop		
5 Th	20	Workshop		Basic Semaphores (Spin Lock)
5 F	21			
6 M	24	Workshop		
6 Tu	25			Periodic Events
6 W	26	Workshop		
6 Th	27	Workshop		Periodic Events
6 F	28			
7 M	10/1	2		
7 Tu	2			Improved Semaphores, Blocking, and Yielding / Deadlocks
7 W	3	2		
7 Th	4	2		Improved Semaphores, Blocking, and Yielding / Deadlocks
7 F	5			Homecoming
8 M	8	Workshop		
8 Tu	9			FIFO, Inter-process Communication, Sleeping
8 W	10	Workshop		
8 Th	11	Workshop		Midterm 1
8 F	12			
9 M	15	3		
9 Tu	16			LCD Touchscreen
9 W	17	3		
9 Th	18	3		Thread Priority/ Priority Inversion
9 F	19			

EEL 4930 Microprocessor Applications 2 Fall Semester 2018

Class Schedule (Part 2 of 2)

WEEK/DAY	DATE	LAB #	Status	Comments
10	M	22	Workshop	
10	Tu	23		Aperiodic Event Threads
10	W	24	Workshop	
10	Th	25	Workshop	Aperiodic Event Threads
10	F	26		
11	M	29	Workshop	
11	Tu	30		Thread Creation and Destruction
11	W	31	W o r k s h o p	
11	Th	11/1	Workshop	Networking Basics: IPv4 and IPv6
11	F	2		Holiday
12	M	5	4	
12	Tu	6		Networking Basics: TCP and UDP
12	W	7	4	
12	Th	8	4	CC3100
12	F	9		
13	M	12	Workshop	
13	Tu	13		Final Exam
13	W	14	Workshop	
13	Th	15	Workshop	CC3100 (Final Project Discussion)
13	F	16		
14	M	19		
14	Tu	20		Special Topic
14	W	21		Holiday
14	Th	22	No Class	Holiday
14	F	23		Holiday
15	M	26	Workshop	
15	Tu	27	Workshop	Final Project Q/A
15	W	28		
15	Th	29	Workshop	Special Topic / Final Project Presentation
15	F	30		
16	M	12/3	Final Project	
16	Tu	4		Final Project Presentation
16	W	5	Final Project	
16	Th	6	Final Project	No Class Reading Day
16	F	7		Reading Day/End of Semester!