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University of Florida
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Spring 2020
SYLLABUS
Revision 12/01/19

EEL 4930: Microprocessor Applications 2

INSTRUCTOR
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                                                             Office: NEB 0281

LAB NINJA
Jacob Crain   jcrain@ufl.edu   Office Hours: During ALL Lab Sessions
                                                             Office: NEB 0281

LECTURES
Periods: T4, R4-5   Location: NEB 0202

LAB SECTIONS (NEB 281)

Monday	Monday	Tuesday	Thursday	Friday	Friday
Periods 11-E1	Periods E2-E3	Periods E2-E3	Periods 11-E1	Periods 2-3	Periods 8-9

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. Introduction to AI implementations on IoT devices.

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. In the final project, students may use an Audio Signal Processing BoosterPack Plug-In Module (BOOSTXL-AUDIO) to take voice commander to control the developed IoT systems, with the help from embedded AI algorithms.

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
- BOOSTXL-AUDIO Booster Pack

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

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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

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Exam #1                      15%
Exam #2                      15%
Laboratory                   50%
Quizzes                      20%
Final Project (optional)     20%
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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 Lab 5 and 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 are allowed to attend all lab sessions but are encouraged to attend lab session 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.

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Fall Semester 2018
Class Schedule (Part 1 of 2)

WEEK/DAY		DATE	LAB #	Status	Lectures
1	M	1/6			
1	T	7			Course Introduction. What is ARM?
1	W	8			
1	Th	9			ARM Cortex M Instruction Set, ARM Cortex M Instruction Set
1	F	10			
2	M	13	Workshop(1)		
2	Tu	14	Workshop(1)		Intro to CCS, Intro to BSP, ARM CMSIS
2	W	15			
2	Th	16	Workshop(1)		MSP432 Peripherals (I2C), LP3943
2	F	17	Workshop(1)		
3	M	20		No Lab	*Martin Luther King Holiday*
3	Tu	21	Lab		NVIC, SysTick,
3	W	22			
3	Th	23	Lab		PendSV, MPU C Data Structures (Linked Lists)
3	F	24	Lab		
4	M	27	Demo/Quiz 1		
4	Tu	28	Demo/Quiz 1		*TI Seminar: TI overview of Embedded Systems with IoT*
4	W	29			
4	Th	30	Demo/Quiz 1		Real-Time Systems, Threads and Schedulers
4	F	31	Demo/Quiz 1		
5	M	2/3	Workshop(2)		
5	Tu	4	Workshop(2)		Integration of SysTick, PendSV to Scheduler
5	W	5			
5	Th	6	Workshop(2)		Basic Semaphores (Spin Lock)
5	F	7	Workshop(2)		
6	M	10	Lab		
6	Tu	11	Lab		Periodic Events
6	W	12			
6	Th	13	Lab		Periodic Events
6	F	14	Lab		
7	M	17	Demo/Quiz 2		
7	Tu	18	Demo/Quiz 2		Improved Semaphores, Blocking, and Yielding / Deadlocks
7	W	19			
7	Th	20	Demo/Quiz 2		Deadlocks
7	F	21	Demo/Quiz 2		
8	M	24	Workshop(3/4)		
8	Tu	25	Workshop(3/4)		FIFO, Inter-process Communication, Sleeping / Midterm 1 Prep
8	W	26			
8	Th	27	Workshop(3/4)		Midterm 1
8	F	28	Workshop(3/4)		
9	M	3/2			*Spring Break*
9	Tu	3		No Class	*Spring Break*
9	W	4			*Spring Break*
9	Th	5		No Class	*Spring Break*
9	F	6			*Spring Break*

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Fall Semester 2018

Class Schedule (Part 2 of 2)

WEEK/DAY		DATE	LAB #	Status	Comments
10	M	9	Demo/Quiz 3		
10	Tu	10	Demo/Quiz 3		LCD Touchscreen
10	W	11			
10	Th	12	Demo/Quiz 3		Thread Priority / Priority Inversion / Aperiodic Event Threads
10	F	13	Demo/Quiz 3		
11	M	16	Lab		
11	Tu	17	Lab		Thread Creation and Destruction
11	W	18			
11	Th	19	Lab		Networking Basics: IPv4 and IPv6
11	F	20	Lab		
12	M	23	Demo/Quiz 4		
12	Tu	24	Demo/Quiz 4		Networking Basics: TCP and UDP
12	W	25			
12	Th	26	Demo/Quiz 4		Networking Basics: Cybersecurity
12	F	27	Demo/Quiz 4		
13	M	30	Workshop(5)		
13	Tu	31	Workshop(5)		CC3100 / Final Exam Prep
13	W	4/1			
13	Th	2	Workshop(5)		Final Exam
13	F	3	Workshop(5)		
14	M	6	Demo 5		
14	Tu	7	Demo 5		Special Topic
14	W	8			
14	Th	9	Demo 5		Special Topic
14	F	10	Demo 5		
15	M	13	Final Project		
15	Tu	14	Final Project		Final Project Discussions
15	W	15			
15	Th	16	Final Project		Special Topic
15	F	17	Final Project		
16	M	20	Lab		
16	Tu	21			Final Project Presentation (Video Demos)
16	W	22	Lab		
16	Th	23		No Class	Reading Day
16	F	24			Reading Day/End of Semester!

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Professional Component (ABET):
State the contribution of the course to meeting the professional components of the ABET-accredited degree.
This course consists of 3 credits of Engineering Design;

Relation to Program Outcomes (ABET):
The table below is an example. Please consult with your department's ABET coordinator when filling this out.

Outcome	Coverage*
1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.	High
2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.	High
3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	High
4. An ability to communicate effectively with a range of audiences	Medium
5. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.	Medium
6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.	Medium
7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty	High

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Grading Policy

More information on UF grading policy may be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Students Requiring Accommodations
Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, https://www.dso.ufl.edu/drc) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation
Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

University Honesty Policy
UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

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Commitment to a Safe and Inclusive Learning Environment
The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:
• Your academic advisor or Graduate Program Coordinator
• Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
• Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
• Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy
There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: https://registrar.ufl.edu/ferpa.html

Campus Resources:

Health and Wellness

U Matter, We Care:
Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: http://www.counseling.ufl.edu/cwc, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the Office of Title IX Compliance, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
https://lss.at.ufl.edu/help.shtml.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. https://www.crc.ufl.edu/.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*: https://care.dso.ufl.edu

On-Line Students Complaints*: http://www.distance.ufl.edu/student-complaint-process.