

EEL 4745C: Microprocessor Applications 2

INSTRUCTOR

Dr. Yier Jin yier.jin@ece.ufl.edu Office Hours: By appointment
Office: BEN 325 / Zoom

TEACHING ASSISTANTS

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LAB NINJA

None

LECTURES

Periods: T4, R4-5 Location: Online

LAB SECTIONS (Online)

Monday Period E1	Tuesday Periods 7-8	Tuesday Periods E2-E3	Wednesday Periods 7-8	Thursday Periods 9-10	Friday Periods 2-3
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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. 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. Students may also learn artificial intelligence (AI) and deep neural network (DNN) techniques and apply these techniques into embedded and IoT domain. 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 (Sponsored by TI)

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

REQUIRED SOFTWARE

- TI Code Composer Studio 7
- Some Source Code for the IoT Development Board (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	15%
Exam #2	15%
Laboratory	40%
Quizzes	12%
Final Project	18%

Note: Bonus points can be earned either by performing the final project very well or by performing an extra project.

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 (OBSOLETE DUE TO ONLINE SETTING)

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.

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

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

EEL 4930 Microprocessor Applications 2 Fall Semester 2018

Class Schedule (Part 2 of 2)

WEEK/DAY	DATE	LAB #	Status	Comments
10	M	15	Workshop(4)	
10	Tu	16	Workshop(4)	Thread Creation and Destruction
10	W	17	Workshop(4)	
10	Th	18	Workshop(4)	Networking Basics: IPv4 and IPv6
10	F	19	Workshop(4)	
11	M	22	Lab	
11	Tu	23	Lab	Networking Basics: TCP and UDP
11	W	24	Lab	
11	Th	25	Lab	Introduction to AI
11	F	26	Lab	
12	M	29	Demo/Quiz 4	
12	Tu	30	Demo/Quiz 4	CC3100 / Final Exam Prep
12	W	31	Demo/Quiz 4	
12	Th	4/1	Demo/Quiz 4	Final Exam
12	F	2	Demo/Quiz 4	
13	M	5	Lab	
13	Tu	6	Lab	Workshop (5)
13	W	7	Lab	
13	Th	8	Lab	Embedded AI on MSP432, Workshop (6)
13	F	9	Lab	
14	M	12	Demo 5	
14	Tu	13	Demo 5	Audio BoosterPack, Embedded AI
14	W	14	Demo 5	
14	Th	15	Demo 5	Final Project Discussions
14	F	16	Demo 5	
15	M	19	Final Project	
15	Tu	20	Final Project	Exam Week Final Project Presentation (Video Demos)
15	W	21		
15	Th	22	No Class	Reading Days
15	F	23	No Class	Reading Days
16	M	26	No Class	Exam Week
16	Tu	27	No Class	
16	W	28	No Class	Exam Week
16	Th	29	No Class	Exam Week (Video Demo Due)
16	F	30	No Class	Exam Week / End of Semester!

Online Course Recording

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Attendance Policy, Class Expectations, and Make-Up Policy

This class will be presented online using Zoom and requires access to a working webcam and stable internet connection. I prefer that students keep their camera on during the class so that I can see you as I would during normal face-to-face classes. Studies show that if we can see each other's faces then we will have more engagement, more student success, and more faculty success. However, this is not a requirement. I understand if on certain days you can't have your camera on due to internet bandwidth limitations, other family members, health issues, or any other reasons.

Excused absences must be in compliance with university policies in the Graduate Catalog (<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance>) and require appropriate documentation.

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.a.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.a.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.

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 support, 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>.