

ECE 5900: Real-Time Operating Systems for IoT

Fall 2020

Class Meetings

Section 001: T 2:45-3:35pm, Th 2:30-4:10pm, CEER 212; Also simulcast via Zoom

Instructor

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Office Hours

By appointment via Email or Zoom

Textbook

“Real-time Operating Systems Book 1: The Theory (The engineering of real-time embedded systems)”, Dr. Jim Cooling, ISBN-13: 978-1795340656

Course Objectives

To understand the basic concepts and usage of a Real Time Operating System in embedded applications; To experimentally verify topics learned in the theory section of the class; To learn about practical real world experience in using a real time operating system.

Grading Policy

Weekly Lab assignments: 100%

Planned Schedule

Week	Week of	Tuesday Theory	Thursday Lab Topic	Points
1	17-Aug	Intro; Requirements; Overview	IDE / SDK installation; Target board; Hello World!; How to submit lab	10
2	24-Aug	Text Chapter 1 – OS and IoT Basics	FreeRTOS Overview; FreeRTOS load; nRF52840 chip;	10
3	31-Aug	Text Chapter 2 – Scheduling	GPIO; Delay; Single Task; Two Tasks; Priority pre-emptive tasks	20
4	7-Sep	Text Chapter 3 – Shared Resources	Contention issues; Suspend scheduler; Semaphore; Mutex	20
5	14-Sep	Text Chapter 4 – Deadlock	Monitor; Show priority inversion; Eliminate priority inversion	20
6	21-Sep	Text Chapter 5 – InterTask Comm	Use flags for comm; Use queues for comm	20
7	28-Sep	Text Chapter 6 – Memory Mgmt	LED control task	20
8	5-Oct	Text Chapter 10 – RTOS Structures		20
9	12-Oct	I2C bus	Interface an I2C peripheral	20
10	19-Oct	SPI bus	Interface an SPI peripheral	20
11	26-Oct	Events, Interrupts, Callbacks	Interface a PWM peripheral	20
12	2-Nov	BLE Overview	Define BLE services	30
13	9-Nov	BLE Services and Characteristics	Define BLE characteristics	30
14	16-Nov	Final Project	Put everything together	40

Inclusive Classroom

We consider this classroom to be a place where you will be treated with respect; and, we welcome individuals of all ages, backgrounds, beliefs, ethnicities, gender, gender identities and expressions, sexual orientation, and other visible and non-visible differences. All members of this class are expected to contribute to a respectful, welcoming, and inclusive environment for every other member of the class.

Attendance

Class and laboratory attendance for first-year students is mandatory. A first-year student will receive a grade of "Y" (failure) whenever the number of unexcused absences in a course exceeds twice the number of weekly class meetings for the course. State here if attendance is mandatory or not for your class. Provide a description of what it means to be present (seated and ready to go, just in the room, camera on if virtual, be explicit). Where possible, students should inform their instructors if they plan to be late or absent from class. In all cases, students should be prepared to provide documentation to petition for excused absences to the Associate Dean for Student and Strategic Programs, Dr. Stephen Jones. Students should use the form for requesting an excused absence. Excused absences do not count toward a failure in the course for first year students. Absence from class does not release the student from work assigned. Students who miss an in-class obligation (exam, presentation, etc.) due to an excused absence will not be penalized - the instructor may offer a make-up test, arrange an alternative time for a presentation, exempt a student from the assignment, or provide another arrangement. In the case of illness or injury, the form must be submitted within 24 hours of missing class.

The University's list of excused absences for all students includes the following:

- participation in NCAA athletic competitions
- participation in special academic events (e.g., conferences, field trips, project competitions)
- participation in official university business (e.g., student representatives attending meetings related to university governance)
- attendance at significant events involving the immediate family (e.g., funerals, weddings)
- religious holidays - see the University's policy on Religious Holidays
- college-approved participation in placement activities (e.g., job interviews, graduate school interviews, attending job fairs)
- legally required absence (jury duty, court appearance, short-term military service)
- documented serious illness, such as COVID, or disability

Academic Integrity

The College of Engineering is committed to creating an environment of academic integrity and ethical decision-making that we hope is reflected in the actions of our students and graduates. As Villanova students, integrity is central to the University mission. As engineers, our code of conduct requires us to place honor and integrity at the forefront of everything we do. As engineering students, it is expected that you will begin

to adopt these values and instill them into your work habits. Students violating the academic integrity policy will receive a zero on that assignment or exam and the violation will be reported to the Associate Dean for Academic Affairs. Students are encouraged to read the University's academic integrity policy. The College of Engineering has adopted the following exam guidelines:

- Students must arrive before the start of the exam. Under exceptional circumstances a student may need to arrive late, but he/she can enter the exam no later than 5 minutes after the start of the exam.
- All cell phones must be turned off and stored away until the student exits the exam room.
- The official Villanova class attendance policy must be followed when requesting excuses for absences or lateness to an exam.
- Each student must write and sign the following statement, "I have neither given nor received any unauthorized assistance in the completion of this exam." If taking an exam remotely, students still need to copy and sign this statement (even if signed for electronically).
- In the case of virtual exams, the instructor may implement video proctoring or other measures to ensure academic integrity. For consent purposes, the instructor will announce ahead of time to students if they plan to use any form of video proctoring during an assessment and whether a recording will take place.

Adherence to the Student Code of Conduct and the CARITAS Commitment

Students are expected to act in a professional and respectful manner to their fellow students, faculty, and staff. Students should become acquainted with and understand the responsibilities set forth in the Student

Handbook, especially those in the sections on Policy and Regulations. Adherence to University regulations is expected and required for successful completion of the program of studies. Enforcement within the classroom of policies regarding classroom behavior is the responsibility of the faculty member. All other discipline problems are to be referred to the Dean of Students.

Students, faculty, and staff are expected to comply with the CARITAS Commitment. Students must wear masks, practice social distancing and good hygiene, wipe down their work area upon arrival and departure, and request an excused absence if they are not feeling well.

Online Expectations

To foster a professional environment, please wear appropriate clothes, mute if you are not talking to cut down on background noise, refrain from eating, and select an appropriate setting when we are meeting online.

Students with Disabilities

It is the policy of Villanova to make reasonable academic accommodations for qualified individuals with disabilities. If you are a person with a disability please contact me after class or during office hours to make arrangements.