Embedded Systems Hardware Interfacing Syllabus

UC San Diego

EXTENSION

Course Number: ECE-40293
Quarter: Fall, Winter, Spring, Summer
Credit: 3-Units

Instructor Information

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Communication Policy

You may contact me via email function at any time. I will respond typically within 24 hours, and no longer than 48 hours.

Often the best and fastest way to get questions answered is by posting them on the Blackboard discussion area. By posting your question on the Blackboard discussion area, both the instructor and other students can help to answer and discuss the question.

Course Information

Course Description (Goals and Objectives)

The goal of this course is to prepare students with hardware interfacing skills. The most commonly used hardware interfaces are covered, including GPIO, ADC, Serial/UART, I2C, SPI, and USB. In addition, the most commonly used RF technologies used in embedded systems are covered, including Wifi, Bluetooth, and NFC. Upon completion of the course, students will be able to:

- Interface GPIO Inputs and Outputs, including pull-up/pull-down/tristate

- Interface ADC devices, including both voltage and current-loop devices

- Interface Serial/UART devices, including TTL, RS-232, and RS-422

- Interface USB, either as USB Host or USB device

- Interface IC2 devices, at both the physical and protocol layer

- Interface SPI devices, at both the physical and protocol layer

- Know how to interface Wifi modules to embedded designs

- Know how to interface Bluetooth modules to embedded designs

- Know how to interface NFC modules to embedded designs

The above topics will be covered using a combination of presentation, demonstration, and coding-focused lab exercises. The lab exercises will use various tools to build, run, and debug code on the STM32 Discovery Kit IoT Node.

Upon completion of the course, students will have gained a solid working knowledge of interfacing the hardware devices to an embedded controller. Students will also gain insight into how to use their new hardware interfacing skills to solve problems in their specific industry.

Course Prerequisites:

You should have already completed ECE-40292 Embedded Systems Hardware Design or equivalent knowledge.

Hardware:

The STM32 IOT Discovery Node 915 MHz - Mfg. Part # B-L475E-IOT01A will be used throughout this course. You can purchase this board from Digi-Key or any other reputable electronics dealer. Since this same STM32 IOT Discovery Node is used in all Embedded Courses, you may already have one.

Student Learning Outcomes

By the end of this course, students will be able to:

- Connect digital inputs to devices such as alarms and push buttons

- Connect digital outputs to devices such as LEDs

- Connect ADC devices, handling correct voltage and/or current translation

- Connect Serial/UART devices, handing correct voltage levels

- Configure embedded design to handle USB, either device or host

- Use I2C devices, connecting proper I/O pins and voltage levels

- Use SPI devices, connecting proper I/O pins and voltage levels

- Add Wifi modules to embedded design

- Add Bluetooth module to embedded design

- Add NFC module to embedded design

Course Schedule

Session	Topic	Reading
1	*GPIO (General Purpose Input/ Output Interfacing*	*1) Course Slides 2) URLs mentioned in course slides*
2	*ADC (Analog to Digital Conversion) Interfacing*	*1) Course Slides 2) URLs mentioned in course slides*
3	*Serial/UART (Universal Async Receiver/Transmitter) Interfacing*	*1) Course Slides 2) URLs mentioned in course slides*
4	*I2C (Inter-Integrated Circuit) Interfacing*	*1) Course Slides 2) URLs mentioned in course slides*
5	*SPI (Serial Peripheral Interface) Interfacing*	*1) Course Slides 2) URLs mentioned in course slides*
6	*USB (Universal Serial Bus) Interfacing*	*1) Course Slides 2) URLs mentioned in course slides*
7	*Wifi Module Interfacing*	*1) Course Slides 2) URLs mentioned in course slides*
8	*Bluetooth Module Interfacing*	*1) Course Slides 2) URLs mentioned in course slides*
9	*NFC Module Intefacing*	*1) Course Slides 2) URLs mentioned in course slides*

Course Materials and Textbooks

There is no textbook for this course. Rather the course slides, videos, and URLs referenced in each lesson provided the needed course materials.

Grading and Assignment Information

Letter grades are based on the UC San Diego Extension Grading Scale. Your final course grade is based on the percentage of points you have earned.

Passing Grades	
A	100-90
B	89-80
C	79-70

Non-Passing Grades	
D	79-60
F	59 and below

Weighted Grading Criteria
Quizzes(8): 40 points
Assignments(8): 40 points
Final Assignment: 20 points
_____

You can check your point total through the Course Menu in Blackboard at any time by clicking **Tools>My Grades**.

Grading Policies

This course can be taken as part of the Embedded certificate. In order for the class to count towards your certificate it must be taken for a letter grade or as pass/no pass. Classes that are taken as NFC cannot count towards a certificate. You can change your grading option any time BEFORE the last day of class through My Extension.

Late Policy:

An assignment is considered late if it is posted or sent after the due date/time.
If the assignment is 1-3 days late, 10-percentage will be subtracted from the total score.
If an assignment is submitted more than 72 hours (3 days) after the due date/time. The assignment will receive a score of 0 and no feedback if it is submitted more than one week after the due date/time.

Late assignments will be accepted at the discretion of the instructor and cannot be accepted more than 1 week late

Homework assignments are due on the dates posted on the course schedule and are submitted in class. I am more than willing to work with you on an individual level if extreme difficulties are encountered. Late homework will be accepted via e-mail **only on the next day (by midnight)** after the due date for only 50% max credit, unless e-mail confirmation from the instructor prior to the start of the class allows for another arrangement. If a student is absent and can't physically submit an assignment in person the homework will be accepted via e-mail for full credit if received by the start of the class.

Expect and plan for contingencies and technical problems (they WILL happen!).

Assignments

A total of eight programming assignments will be assigned, one each for modules 1-8 in the course. The programming assignments require writing code and submitting a ZIP file with the completed project.

To earn all points for a given programming assignment:

- Provide all source files inside a single ZIP file

- Program compiles without errors

- Program runs without errors (e.g. no crashing)

- Program performs as specified in the assignment

- Well commented

Quizzes & Tests

Online quizzes will be part of the first 8 modules. The quizzes are short and ask key questions to verify your mastery of skills covered in the relevant section.

UC San Diego Extension Policies and Resources

Academic Policies and Procedures

Please refer to UC San Diego Extension's website (Student Resources tab) for specific details about academic policies and procedures: Student Resources.

MyExtension

Your MyExtension account is your student records portal. Log into MyExtension (https://myextension.ucsd.edu/) to enroll in a course, drop a course, request verification of enrollment, request official transcripts and more.

Campus Emergencies

In the event of an emergency, information will be posted at UC San Diego Extension (http://extension.ucsd.edu/). Extension students must access the website to find out the status of the emergency situation. Email and or phone lines may not be accessible. Information will be updated online as the situation progresses and an ALL CLEAR will be posted once the situation is resolved.

Code of Conduct

All participants in a course at UC San Diego Extension are bound by the University of California, Code of Conduct found at Student Conduct Code.

Academic Integrity Policy

The University is an institution of learning, research, and scholarship predicated on the existence of an environment of honesty and integrity. As members of the academic

community, faculty, students, and administrative officials share responsibility for maintaining this environment. It is essential that all members of the academic community subscribe to the ideal of academic honesty and integrity and accept individual responsibility for their work. Academic dishonesty is unacceptable and will not be tolerated at the University of California. Cheating, forgery, dishonest conduct, plagiarism, and collusion in dishonest activities erode the University's educational, research, and social roles.

If students who knowingly or intentionally conduct or help another student perform dishonest conduct, acts of cheating, or plagiarism will be subject to disciplinary action at the discretion of UC San Diego Extension. Please refer to UC San Diego Extension website to view this policy: Student Conduct Policy.

Access and Accommodations

At UC San Diego Extension, we strive to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, we encourage you to contact the Extension Disability Coordinator to apply for reasonable accommodations. Visit our website: Services for Students with Disabilities. Please note that it is your responsibility to initiate contact with the Disability Coordinator.

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