UNIVERSITY OF CALIFORNIA, DAVIS
Department of Electrical and Computer Engineering

EEC172   **Embedded System Design**   **Winter 2026**

Course Description: This course introduces the fundamentals of embedded system design. The course has a substantial lab component that involves mostly software, but also some hardware interfacing & debugging. The lab projects will use the TI CC3200 Launchpad (see: https://www.youtube.com/watch?v=KEERSpj3Gks) as the hardware platform and will consist of developing software in C/C++ to connect to an external 'thing' (e.g., an infrared (IR) remote controller), connect the 'thing' to the internet via the CC3200's on-chip WiFi module, and use the 'thing' to 'signal' the internet. Our primary connection to the internet will be through Amazon Web Services (AWS) Internet of Things (IoT) cloud platform (see: https://aws.amazon.com/iot).

The lecture portion of the course, various readings and videos will cover several topics in embedded system design, as listed below.

Prerequisites: Computer Architecture (EEC170 or ECS 154A) and Circuits II (EEC 100). No waivers.

Waitlist: Only students who can demonstrate that they must take EEC172 for timely graduation will be considered. No guarantees that such students can be accommodated. Other students are advised to enroll in the next offering (tentatively Spring 2025) of the course.

LAB Website: https://tailailihe.github.io/UCDavis-EEC172-Lab-Manual/

Instructor: Professor Soheil Ghiasi   ghiasi@ucdavis.edu
                 Office Hours: TBA , 3171Kemper

Teaching Assistants:
Office Hour in Lab room 2112
Lambert Lihe   tlihe@ucdavis.edu   OH:TBA
Randall Fowler   rlfowler@ucdavis.edu   OH:TBA

Grading:
In-class quizzes 25%
Labs 50%
Final Project 25%

Learning Management Systems: Canvas
Discussion forum: Piazza https://piazza.com/ucdavis/winter2026/eec172 (Read Etiquette on Piazza FIRST)

Reading, References and Supplies:
1. (Optional) Textbook: Introduction to Embedded Systems, by Lee and Seshia, Second Edition. http://LeeSeshia.org.
Free pdf download or inexpensive hardcopy available online. Coverage: Preface, Chapter 1 and Chapters 7-11.
2. Technical documents, selected readings and some video links posted to the class canvas site
3. One TI CC3200 Launchpad development board per student, one ATT Uverse IR remote per student, Students are expected to have their own logic analyzer
4. Code Composer Studio (CCS) Integrated Development Environment (IDE) for each student.
5. One AWS free developer account per group. Must have a credit card to sign up.

(Tentative) Lecture Topics:

1. **Interfacing and I/O, including**:
   a. Buses & Parallel I/O
   b. Serial Parallel I/O
   c. Timing Specification
   d. Electrical interfacing (A/D, D/A)
   e. Pulse Width Modulation
   f. Optical interfacing
   g. Electrical motor interfacing
2. **Embedded Systems Overview**, including:
   a. Components/Architectures/Systems
   b. Players
   c. Applications
3. **ARM Architecture**
4. **Embedded System Memory**, including:
   a. Types, Structure
   b. Memory Mapping, decoding
   c. Direct Memory Access
5. **Interrupts, Exceptions**, including:
   a. Interrupt service routines
   b. Vectored interrupts
   c. Nested interrupts
   d. Hardware Timers and Counters
6. **Concurrency/Parallelism**
7. **Embedded Networking**, including:
   a. Wired
   b. Wireless
   c. Internet
8. **Power Management**
9. **Embedded/Real Time Operating Systems**
10. **Error Checking and Fault Tolerance**
11. **Embedded System Security**

Lab: (2112 Kemper):

A01	WF	4pm - 6pm	TA: Lambert
A02	TR	9am - 11am	TA: Randall
A03	TR	2pm - 4pm	TA: Rishad
A04	WF	2pm - 4pm	TA: Lambert

- Windows 7 desktops (one per group), campus Kerberos login credentials
- Encouraged to BYOL (bring you own laptop – MAC support only recently added thanks to work done by Ryan Tsang et al.) However, Windows is the official vendor supported platform, so using windows may make your life easier.
- No local disk storage: use a cloud drive or bring a flash drive to save code developed on lab machines
- You may visit the other regular lab section on a space-available basis with the TA's OK
- Room locked outside of scheduled lab hours, or used by another class
- You will have all the equipment needed to work on lab assignments outside of the lab You should expect to do some work outside of the lab (could be most or even all of the work done out the lab).

Project Groups:

All lab projects are done in groups of two students, with students selecting their partner. At the first lab session the TAs will assist in pairing students who have not found a partner.

Collaboration beyond your group of two is not allowed.

If you are unsure about taking the course and might drop the course, drop now! Do not leave a partner hanging!!

Lab Projects:

Series of lab projects:
1. Introduction to TI CC3200 Launchpad and Code Composer Studio IDE (1.5 week)
2. SPI & I2C communication via the CC3200 (2 weeks)
3. Board to board IR remote text messaging using wired serial link (3 weeks)
4. Board to board IR remote text messaging via the internet using AWS (1.5 weeks)
5. Final Project (2 weeks).

Different labs have different points/weights. The points allotted to a lab are generally proportional to its level of difficulty, which correlates with the time allotted to complete the lab.

Final Project Award:
Each session will have 0-2 finalist group entering the Final Project competition. And winning teams will have serval to ALL quizzes rewarded to full credit.

Lab Grading

Attendance (10%)
> Must be present in all lab periods for a particular assignment, or until check off for that lab. Teams are encouraged to start work on the next lab assignment, if the work is verified early.

System Verification (70% points)
> Done by your TA during your lab period – only the TA assigned to your section can check off the work.
> Full credit for a fully working system
> Partial credit if system is partially working

Late verification
> **If late by one lab period: -15% points out of 70%**
> **From one lab period to one week late: -30% points out of 70%**
> **At one-week late, must have system verified as is; no credit after one-week late.**

Lab Report (20% points)
> Description of method used to solve the problem, including description of code structure
> Description of problems encountered/solved during development.
> Softcopy of all code, well documented, uploaded to Canvas
> **Due the following week after the system verification due date**
> **Late lab report by one week: -10% points out of 20%**
> **At one-week late, must submit report as is; no credit after one-week late.**

Creativity/Innovation (bonus points, up to 10)
> Some extension of the assigned project that is interesting, insightful, amazing or amusing.