Embedded Systems Design
CSCE 3612, Section 021
Spring 2021

Class Timings: Tuesday and Thursday, 10:00 AM – 11:20 AM, Face-to-Face: Discovery Park, D215 and Remote delivery using Zoom: https://unt.zoom.us/j/88217807032

Instructor: Robin Pottathuparambil, Email: rpottath@unt.edu, Zoom Office Hours: Monday and Wednesday 3:00 PM – 5:00 PM or by appointment. Zoom Meeting: https://unt.zoom.us/j/81350877103

Teaching Assistants:

- Anand Kumar Bapatla, Email: anandkumarbapatla@my.unt.edu, Zoom Help Hours: Tuesday and Thursday 11:30 AM – 12:50 PM, Zoom Meeting: https://unt.zoom.us/j/83735836968

Course Webpage: All the course related material will be posted on the course webpage which is available through Canvas (https://unt.instructure.com/)

Course Outcomes:
- Understand the differences between embedded computing systems and general-purpose computing systems, including constraints on performance, energy consumption, memory and physical dimensions.
- Able to specify embedded systems using UML or other high-level abstract models.
- Able to use modern micro-controllers, including programming and interfacing such micro-controllers.
- Understand the use of DSP processors and other Application Specific processors.
- Understand trade-offs associated with using micro-controllers, DSPs, ASICs, and FPGAs to meet embedded system requirements.

Program Outcome Mapping:
- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Text: *Computers as Components: Principles of Embedded Computing System Design* by Marilyn Wolf, Fourth Edition, ISBN: 978-0-12-805387-4.

Catalog Description: Prerequisite: CSCE 2610, EENG 2710 or ENGR 2720, ENGR 2730. Computer systems as embedded computing elements and micro-controllers. System specification using UML or other high-level abstract models. Issues and constraints on embedded computing systems, including power, performance, memory and size. Use of DSP, ASIC and micro-controllers in a single design.

Topics:
- Introduction to Embedded Systems and its design process
- Instruction sets for ARM, PIC, and DSP
- Introduction to CPUs and co-processors
- Computing platforms and its design
- Program design and analysis

- Introduction to processes and operating systems
- System design techniques
- Internet-of-Things (IoT) Systems, Automotive and Aerospace Systems, and Embedded Multiprocessors.

Grading:

Quizzes	12%
Class Activity	5%
Homework	12%
Lab assignments	20%
ePortfolio Design	1%
Midterm Exam (03/02/2021)	20%
Comprehensive Final Exam (04/29/2021)	30%

Quizzes: There will be five to six pop quizzes given throughout the semester. The pop quizzes will be given towards the end of the class. These will be to reward students who consistently attend the class but will be more than just attendance points. **These quizzes can be only taken using a computer/laptop with Respondus LockDown browser, webcam, and a microphone.**

Homework: Homework will be in the form of problem sets with a due date **one week** after it is assigned. Homework will be assigned on Tuesdays as per the schedule. **No late homework will be accepted.** Homework must be done individually (you will learn the most from this). Any evidence of group participation or direct copying from sources like previous year's solutions, textbook, solutions, Wikipedia, websites, and other sources will be interpreted as academic dishonesty. There will be six to seven homework assignments.

Recitations: The recitations are on Tuesdays and Thursdays starting from 11:30 AM to 12:50 PM and it is only mandatory on the days of lab demonstrations. The TA will be available during the recitation hours on Zoom on Thursdays and in F243 on Tuesdays to help you with the labs or to demonstrate your labs.

Experiential Learning: It's a process of learning where you will be learning through hands-on labs and class activities and is designed such a way that you learn through reflection. This is also called as experiential education. To implement this, we will be using Kolb's experiential learning model where you will be given a class activity or a hands-on lab and you will be asked to reflect on the experience and then this experience is used to do similar activities. The two experiential learning assignments that we will be involved are: In-class activity and hands-on labs.

- **Class Activity:** There will be several remote class activities during the class session that will reinforce the concepts that we learned in the class. These remote class activities will be scheduled during the class timing.

- **Lab Assignments:** Lab assignments are an integral part of the course and are intended to provide hands-on experience in the application of the concepts discussed in the lecture. Lab assignments will be assigned on Tuesdays as per the schedule and with a due date of **two weeks** after it is assigned. There will be five to six lab assignments assigned. Each of the lab assignment will be used to build the next lab. The last lab will be a final project with most of the pieces completed in the previous labs. Lab assignments must be done individually and can be done on your personal machine. Any evidence of group participation will be interpreted as academic dishonesty.

- **ePortfolio:** All students are required to create a foliotek profile page through Canvas. You will be completing a portfolio page with the details of the final lab. You will be provided with a template of the documentation that is needed. This documentation will be then graded for the aspect of

critical thinking. The evaluation will be made available to you so that you can improve your critical thinking skills. A rubric for grading will also be given to you. You need to complete the ePortfolio assignment to receive credit for it.

Exams: There will be a midterm exam and a final exam. The exams are closed books and closed internet. Mobiles phones are not permitted and browsing the internet is not allowed. **These exams require Respondus LockDown browser, webcam, and a microphone.** Exams will include material from the modules, the readings, homework, and labs and should be taken individually and not as a team. Final exam will be comprehensive.

- **Midterm Exam:** Total time allowed is 80 minutes and will be available on Canvas from Tuesday, March 2nd, 2021 10:00 AM till 12:00 PM
- **Comprehensive Final Exam:** Total time allowed is 2 hours and will be available on Canvas from Thursday, April 29th, 2021 8:00 AM till 11:00 AM.

Missing Classes, Assignments, and Exams: Attendance at all exams, quizzes, and class activities is mandatory. Throughout the semester, a student may miss classes, assignments, quizzes, or exams due to many reasons. Most of the reasons will not be accepted as an "excused" absence. Assignments, quizzes, or exams can be made-up only under extraordinary circumstances and only when notification is given to me before the quiz or exam is administered. A no-show for a quiz or exam without prior notification and a verifiable excuse (appropriate official documentation) results in a grade of 0 for that quiz or exam.

COVID-19 Impact on Attendance: While attendance is expected as outlined above, it is important for all of us to be mindful of the health and safety of everyone in our community, especially given concerns about COVID-19. Please contact me if you are unable to attend class because you are ill, or unable to attend class due to a related issue regarding COVID-19. It is important that you communicate with me prior to being absent so that I can decide about accommodating your request to be excused from class.

If you are experiencing any symptoms of COVID-19 please seek medical attention from the Student Health and Wellness Center (940-565-2333 or askSHWC@unt.edu) or your health care provider PRIOR to coming to campus. UNT also requires you to contact the UNT COVID Hotline at 844-366-5892 or COVID@unt.edu for guidance on actions to take due to symptoms, pending or positive test results, or potential exposure. While attendance is an important part of succeeding in this class, your own health, and those of others in the community, is more important.

Class Materials for Remote and Face-to-Face Instruction: The UNT fall schedule requires this course to have remote and face-to-face instruction. Additional remote instruction may be necessary if community health conditions change or you need to self-isolate or quarantine due to COVID-19. Students will need access to a laptop, calculator, webcam, and microphone to participate in the remote and face-to-face class. Additional required classroom materials for remote learning include access to cse severs. Information on how to be successful in a remote learning environment can be found at https://online.unt.edu/learn.

Statement on Face Covering: Face coverings are required in all UNT facilities. Students are expected to wear face coverings during the face-to-face class. If you are unable to wear a face covering due to a disability, please contact the Office of Disability Access to request an accommodation. UNT face covering requirements are subject to change due to community health guidelines. Any changes will be communicated via the instructor.

Disputing Grades: If you have a dispute with how an assignment, quiz, or exam is graded, you should get the solution to the assignment, quiz, or exam off the course web site and examine it. If you really believe that your answer is correct (matches the answer given in the solution), contact the grader and discuss it with him. The grader will listen to your concern, and act on it, at their discretion. The solutions for labs will not be posted, so contact the grader for disputing the grade if you have met all the

requirements of the labs and you have lost points. Note that instructor or grader addition errors should follow the above procedure. Assignment, quiz, exam, and homework grades are disputable for **one week** from the day the grades were assigned on Canvas.

Syllabus Revisions: This syllabus may be modified as the course progresses. Notice of such changes will be by email or announcement in class.

Class Policies (Remote and In-Person): Please make sure you are always muted during the class session. When you have a question, you can use the 'raise hand' option at end of each topic to ask a question. The instructor will give you a chance to ask your question. The use of cell phones, beepers, or communication devices is disruptive and is therefore absolutely prohibited during the remote class session and exams. Turn off your cell phone during the remote class session and while taking exams. If I catch you using these devices during the remote class or during the exams, the penalty can range from a formal warning to an 'F' for the course and you will be asked to leave the remote class. Except in emergencies, students using such devices must leave the remote class for the remainder of the class period. I know that some of you may wish to take notes directly on your computer and I have no problem with that. If, however, you choose to access your email, search the web, play games, or instant messenger your friends during class, you will have 10% deducted from your final grade for each transgression. If I am arriving late to the remote class, it will be because of circumstances beyond my control. You are expected to remain for 20 minutes past the scheduled remote class start time while I attempt to communicate my situation and relay instructions.

Course Policies: You are expected to spend at least 10 hours per week for this course. Keep all your graded assignments, quizzes, and tests for study and review. You should track your own progress using Canvas and be aware of current grades throughout the term. Final grading will be done as follows. **A**: $\geq$ 90%, **B**: $\geq$ 80% and < 90%, **C**: $\geq$ 70% and < 80%, **D**: $\geq$ 60% and < 70% and **F**: < 60%. Grades will be curved if necessary. Grades cannot be changed after they have been electronically entered into university's system except for instructor error. Any extenuating circumstances that may adversely affect your grade must be brought to my attention before the final course grades are recorded. To be considered, such circumstances must be unusual, unavoidable, and verifiable.

Disability Services/Special Needs: UNT complies with all federal and state laws and regulations regarding discrimination including the Americans with Disability Act of 1990 (ADA). If you have a disability and need a reasonable accommodation for equal access to education or services, please contact the Office of Disability Accommodation. Please initiate this process and inform me during the first two weeks of class.

Academic Dishonesty: All the provisions of the University code of academic integrity apply to this course. In addition, it is my understanding and expectation that your signature on any test or assignment means that you neither gave nor received unauthorized aid. For homework and labs, while discussion is allowed, direct copying is not, and students must turn in individual submissions. All students are required to know, observe and help enforce the UNT Code of Student Academic Integrity. Academic dishonesty will result in disciplinary action according to UNT Policy 06.003. The penalty for a first offense can range from a formal warning to an 'F' for the course. Regardless of the penalty imposed, a record of the offense will be kept in the Office of the Dean of Students.

Student Perceptions of Teaching (SPOT): Student feedback is important and an essential part of participation in this course. The student evaluation of instruction is a requirement for all organized classes at UNT. The short SPOT survey will be made available **April 5 – April 22** to provide you with an opportunity to evaluate how this course is taught.

Tentative Course Schedule:

Week	Lecture	Assignments Due
01/11 – 01/15	Embedded computing	
01/18 – 01/22	Embedded computing	
01/25 – 01/29	Embedded computing	Homework 1
02/01 – 02/05	Instruction set	Lab 1
02/08 – 02/12	Instruction set	Homework 2
02/15 – 02/19	CPUs	Lab 2
02/22 – 02/26	Computing platforms	Homework 3
03/01 – 03/05	Computing platforms/Exam Review	Midterm Exam
03/08 – 03/12	Computing platforms	
03/15 – 03/19	Program design and analysis	Lab 3
03/22 – 03/26	Processes and operating systems	Homework 4
03/29 – 04/02	System design techniques	Lab 4
04/05 – 04/09	Internet-of-Things Systems	Homework 5
04/12 – 04/16	Automotive and Aerospace Systems	Lab 5
04/19 – 04/23	Embedded Multiprocessors/Review	Homework 6
04/26 – 04/30	No Lecture	Comprehensive Final Exam