CSCE 5620-001 – Real-Time Operating Systems

Fall 2023

Class Hours & Location: Tuesday and Thursday, 2:30-3:50pm, NTDP E264
Class Website: Canvas

Instructor: Dr. Beilei Jiang
Office: E245J
Office Hours: Mon and Wed, 10:00am-11:30am, or by appointment
Contact: Beilei.jiang@unt.edu

Instructional Assistant: Arun Tej, Daka
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Textbooks: Real Time Concepts for Embedded Systems by Qing Li

Recommended Readings:
Real-Time Systems by Jane W. S. Liu

Operating System Concepts (10th Ed.) by Abraham Silberschatz

Prerequisites: CSCE 3600: Principals of Systems Programming

Course Objectives: This course is about the design of real-time operating systems. We will learn basic real-time operating systems concepts and services, including interrupt processing, process and thread models, real-time software architectures and development environments. We will also study in detail the design and implementation of real-time applications using real-time operating systems. Commercial real-time operating systems/development environments, including Robot Operating System (ROS), will be discussed in case studies. The outcomes of this course are:

- Understand the differences between general purpose and real-time operating systems.
- Understand multithreading in real-time environment.
• Understand task and thread scheduling in real-time operating systems.
• Understand memory management in real-time system.
• Be able to program using system proved timers, signals, mutual exclusion, semaphores, message queues and exception handlers.
• Be able to program real-time applications to run in a realistic operating environment.

**Tentative Class Schedule (subject to change):**

<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture</th>
<th>Assignments Due</th>
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<tbody>
<tr>
<td>8/22 - 8/24</td>
<td>Introduction to real-time systems and OSes</td>
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<tr>
<td>8/29 – 8/31</td>
<td>RTOS services, real-time tasks</td>
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<tr>
<td>9/5 - 9/7</td>
<td>Periodic, aperiodic and sporadic tasks scheduling</td>
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<td>9/12 - 9/14</td>
<td>Periodic, aperiodic and sporadic tasks scheduling</td>
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<tr>
<td>9/19 – 9/21</td>
<td>Periodic, aperiodic and sporadic tasks scheduling</td>
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<tr>
<td>9/26 – 9/28</td>
<td>Periodic, aperiodic and sporadic tasks scheduling, Review</td>
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<tr>
<td>10/3 – 10/5</td>
<td>Periodic, aperiodic and sporadic tasks scheduling, midterm exam</td>
<td>Midterm Exam</td>
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<tr>
<td>10/10 – 10/12</td>
<td>Multiprocessor Scheduling</td>
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<tr>
<td>10/17 – 10/19</td>
<td>ROS, Semaphores and synchronization</td>
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<td>10/24 – 10/26</td>
<td>Semaphores and synchronization, Energy Efficient RT System</td>
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<td>10/31 – 11/2</td>
<td>RTOS memory management, Exceptions and interrupts, timers</td>
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<tr>
<td>11/7 – 11/9</td>
<td>Exceptions and interrupts, Review</td>
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<tr>
<td>11/14 – 11/16</td>
<td>timers, Final exam</td>
<td>Final Exam</td>
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<td>11/21 – 11/33</td>
<td>Holiday</td>
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<td>11/28 – 11/30</td>
<td>Project Presentation</td>
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<tr>
<td>12/5 – 12/7</td>
<td>Project Presentation</td>
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Grading:

10% - Attendance and class participation
30% - Homework, programming assignments, and quizzes
40% - Midterm and final exams
30% - Project

Every student is expected to attend all lectures, read the assigned reading before class, and participate in class discussions.

Late Policies:

Assignments are due before class on the due date. Late assignments will be penalized 10% per day, up to 3 days. No credit will be given after 3 days. Please try to finish your assignments on time.

Cooperation & Academic Honesty:

Each homework and lab assignment must be worked on individually. A submission carries with it an implicit statement that the submission is your own work. You may discuss the requirements and syntactical issues, but not solutions or designs. Violations may result in failure of the course.

Disability Policy:

The Computer Science Department and this instructor cooperate with the Office of Disability Accommodation to make reasonable accommodations for qualified students (cf. Americans with Disabilities Act and Section 504, Rehabilitation Act) with disabilities. If you have not registered with ODA, we encourage you to do so. If you have a disability for which you will require accommodation please discuss with me after class and present a written accommodation request on or before the 2nd week of class.
Face Coverings: UNT encourages everyone to wear a face covering when indoors, regardless of vaccination status, to protect yourself and others from COVID infection, as recommended by current CDC guidelines. Face covering guidelines could change based on community health conditions.

Attendance: Students are expected to attend class meetings regularly and to abide by the attendance policy established for the course. It is important that you communicate with the professor and the instructional team prior to being absent, so you, the professor, and the instructional team can discuss and mitigate the impact of the absence on your attainment of course learning goals. Please inform the professor and instructional team if you are unable to attend class meetings because you are ill, in mindfulness of the health and safety of everyone in our community.

If you are experiencing any symptoms of COVID-19 (https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html) 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 Team at COVID@unt.edu for guidance on actions to take due to symptoms, pending or positive test results, or potential exposure.