# SE 3250: IoT Programming

## Fall 2024 Syllabus

### Course Description

Students will be introduced to electrical circuits and signals from a computer science perspective, including analog and digital signal processing, serial buses, sensors and actuators, microcontroller programming, front-end and back-end software development, and wireless networking and communication technologies commonly used within IoT applications. Covers electronics prototyping and software engineering processes in a practical, project-oriented course format.

### Prerequisites

CS 1410 (Grade C or higher).

### Course Fees

**Course fee:** $20, used to assist in maintaining computing infrastructure.

### Disability/Accessibility Resources

Utah Tech welcomes all students and strives to make the learning experience accessible. If you are a student with a medical, psychological, or learning disability that may require accommodations for this course, you are encouraged to contact the Disability Resource Center (DRC) as soon as possible. You may request reasonable accommodations at any time during the semester; however, they are not retroactive. The DRC is located next door to the Testing Center in the North Plaza Building. 435.652.7516, drc@utahtech.edu, drcenter.utahtech.edu.

### Title IX Statement

Utah Tech University affirms its commitment to the promotion of fairness and equity in all aspects of the educational institution. Harassment and discrimination—including sex/gender discrimination, gender identity, gender expression, sexual harassment, sexual misconduct, gender-based violence, dating violence, domestic violence, stalking, pregnancy or parental, family or marital status and/or retaliation—not only disrupts our commitment to maintaining an environment in which every member of the University community is treated with respect and dignity, but may also violate University policy and federal, state, and/or local law.

Should you or someone you know experience behavior that is coercive, discriminatory, harassing, and or sexually violent in nature, or if you or someone you know has questions about their rights and options regarding such behavior, you are encouraged to contact: Hazel Sainsbury, Dir. of Equity Compliance, Title IX Coordinator: 435.652.7747 (ext. 7747), Hazel.Sainsbury@utahtech.edu, TitleIX@utahtech.edu.

Incidents may also be reported directly to law enforcement, either separately or in conjunction with any report made to the University's Title IX Coordinator, and the University will aid in making contact if requested. Utah Tech University Police: 435.275.4300 or by calling 9-1-1.

Maintaining a safe and inclusive University community is a shared responsibility. For more information on how Title IX protections can benefit you and help us keep a productive campus environment, visit titleix.utahtech.edu to learn more.

### Sections

One section:

1. TR at 3:00 pm–4:15 pm in Smith 109

   CRN: 43415

   Final exam: Tue, Dec 10 at 3:00 pm–4:50 pm

### Instructor

**Instructor:** DJ Holt

**Email:** dj.holt@utahtech.edu

**Office hours:** see here

# Objectives

At the successful conclusion of this course students will:

1. Understand the fundamentals of the Internet of Things ecosystem, including protocols, architectures, and security considerations.
2. Design IoT systems consisting of microcontrollers, sensors and actuators, and wireless networks that exchange data and information to solve real-world problems.
3. Implement and debug the communication protocols and electrical signals of commonly used serial busses (e.g. I2C, SPI, UART).
4. Analyze and interpret the time and frequency domain characteristics of real-world electrical signals.
5. Utilize prototyping platforms (e.g. Arduino, Raspberry Pi) to develop and test embedded system prototypes.
6. Develop user-facing software applications for interacting with IoT systems via mobile devices or web interfaces.

# Resources

## Computers

You are encouraged to bring a laptop to class every day with a working and sufficiently charged battery. Your laptop must run Windows 10 (with Windows Subsystem for Linux), macOS, or Linux, and should be connected to the university WiFi network. Chromebooks, iPads, and other tablets are NOT acceptable unless they run one of the three listed operating systems. A computer that meets these requirements will be necessary to complete required coursework.

A limited number of laptops are available for students to check out for class in the event that your laptop is unavailable or you are unable to acquire a suitable machine. These laptops are only available during scheduled class time, and are not available to use at any other time. You should only rely on this option as a last resort.

Outside of class, you may use the computers in the Smith computer lab. There will also be lab assistants in this lab. Keep in mind that not all lab assistants will be qualified to assist with this course.

The computers provided within the Smith lab facilities have all necessary software installed and configured as required for the course. Personal computers will require several software components to be correctly installed and configured. While this may not be covered in class, students may request individual help from the instructor.

## Canvas

This course is managed through Canvas. You are responsible for announcements, dates and deadlines, grades, and other resources posted to the Canvas course.

## Course Website

This course has an accompanying website. You are responsible for staying apprised of updates to the website, including assingment materials and related resources.

# Assignments and Exams

## Reading

This course has no required text; however, students will be expected to find and reference online documentation and examples to assist with the completion of assignments. Additional reading resources can be recommended upon request.

## Assignments

A series of labs and projects will be assigned throughout the course. Assignments are due at 11:59pm on the date specified in Canvas. See below for the course late work policy.

## Exams

A comprehensive final project will be assigned during the second half of the semester.

## Grading

Each assignment, including the final project, will contribute toward your final point total. The number of points for each assignment will vary.

Assignments may involve working collaboratively with other students in the class, where work will be divided equally among all contributors. Your score for such assignments will be based on your own contributions (or lack thereof), and your score may reflect evaluations requested from your peer(s) by the instructor (subject to validation by the instructor).

Letter grades are assigned based on the percentage of possible points attained, according to the following chart:

| Minimum Percentage | Letter Grade | Minimum Percentage | Letter Grade | Minimum Percentage | Letter Grade | Minimum Percentage | Letter Grade |
|---|---|---|---|---|---|---|---|
| 94 | A | 84 | B | 74 | C | 64 | D |
| 90 | A- | 80 | B- | 70 | C- | 60 | D- |
| 87 | B+ | 77 | C+ | 67 | D+ | 0 | F |

# Course Policies

## Attendance

Students are responsible for material covered and announcements made in class. School-related absences may be made up only if prior arrangements are made. The class schedule is approximate and the instructor reserves the right to modify the schedule according to class needs; changes will be announced in class. Exams, quizzes, and other in-class assignments cannot be made up unless prior arrangements are made. In-class quizzes and assignments may or may not be announced in advance.

Occasional absences are acceptable as long as the student maintains current progress on assignments; however, students who miss more than two consecutive weeks of class or who miss more than 20% of scheduled classes during the semester without making prior arrangements will receive a failing grade. Students who miss any scheduled exam or fail to complete a final project without making prior arrangements will receive a failing grade.

This course can only be completed by attending classes and completing all assigned work to a satisfactory level. There is no procedure for testing out of the class.

## Time Commitment

Courses should require about 45 hours of work per credit hour of class. This class will require about 135 hours of work on the part of the student to achieve a passing grade, which is approximately 9 hours per week. If you do not have the time to spend on this course, you should probably rethink your schedule.

## Late Submission Policy

Assignments are due on the date specified in Canvas, for full credit. To earn credit for an assignment after the specified due date, the student may propose a replacement due date for an assignment on a case-by-case basis, subject to instructor approval. The request must be made prior to the original due date. A late penalty may be applied, or a request may not be approved, depending on the lateness of the proposed replacement due date as well as the student’s late submission history during the current semester. Late submissions will not be accepted outside this procedure, except under extenuating circumstances decided by the instructor, if prior arrangements are made with the instructor. No late submissions will be accepted after the last day of class, with absolutely no exceptions. Exams cannot be made up, unless arrangements are made with the instructor prior to the date of the exam. Any assignments that are completed during class cannot be made up and late submissions will not be accepted.

## Collaboration

Limited collaboration with other students in the course is permitted. Students may seek help learning concepts and developing programming skills from whatever sources they have available, and are encouraged

to do so. Collaboration on assignments, however, must be confined to course instructors, lab assistants, and other students in the course. Students are free to discuss strategies for solving programming assignments with each other, but this must not extend to the level of programming code. Each student must code his/her own solution to each assignment. See the section on cheating.

### Cheating

Cheating will not be tolerated, and will result in a failing grade for the students involved as well as possible disciplinary action from the college. Cheating includes, but is not limited to, turning in homework assignments that are not the student's own work. It is okay to seek help from others and from reference materials, but only if you learn the material. As a general rule, if you cannot delete your assignment, start over, and re-create it successfully without further help, then your homework is not considered your own work.

You are encouraged to work in groups while studying for tests, discussing class lectures, discussing algorithms for homework solutions, and helping each other identify errors in your homework solutions. If you are unsure if collaboration is appropriate, contact the instructor. Also, note exactly what you did. If your actions are determined to be inappropriate, the response will be much more favorable if you are honest and complete in your disclosure.

Where collaboration is permitted, each student must still create and type in his/her own solution. Any kind of copying and pasting is *not* okay. If you need help understanding concepts, get it from the instructor or fellow classmates, but never copy another's code or written work, either electronically or visually. The line between collaborating and cheating is generally one of language: talking about solutions in English or other natural languages is usually okay, while discussions that take place in programming languages are usually not okay. It is a good idea to wait at least 30 minutes after any discussion to start your independent write-up. This will help you commit what you have learned to long-term memory as well as help to avoid crossing the line to cheating.

## University Resources

Additional academic resources for students provided by the University can be found at academics.utahtech.edu.

The official academic calendar with important dates and deadlines can be found at: calendar.utahtech.edu.