University *of* New Haven

TAGLIATELA COLLEGE OF ENGINEERING

CSCI 6670-01
ST: IoT Security
Spring 2024
Tuesday: 2 pm – 4:45 pm
Buckman Hall 226
Credit Hours: 3

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COURSE SYLLABUS

This syllabus is informational in nature and is not an express or implied contract. It is subject to change due to unforeseen circumstances, as a result of any circumstance outside the University's control, or as other needs arise. If, in the University's sole discretion, public health conditions or any other matter affecting the health, safety, upkeep or wellbeing of our campus community or operations requires the University to make any syllabus or course changes or move to remote teaching, alternative assignments may be provided so that the learning objectives for the course, as determined by the University, can still be met. The University does not guarantee that this syllabus will not change, nor does it guarantee specific in-person, on-campus classes, activities, opportunities, or services or any other particular format, timing, or location of education, classes, activities, or services.

Course Description:

In the course, we will examine the concept of IoT. We will look at the 'things' that make up the Internet of Things, including how those components are connected together, how they communicate, and how they value add to the data generated. We will also examine cybersecurity and privacy issues, and highlight how IoT can optimize processes and improve efficiencies in your business.

Prequisite: None. (However, knowledge of programming, embedded systems, and computer networks & and communication will be helpful.)

Required Text(s):

Refer to course materials

Course Structure/Course Format:
The course will combine lectures, hands-on activities, group projects, and discussions to provide a comprehensive understanding of IoT security. Each week will consist of

Lecture: Introduces key concepts, technologies, and challenges related to the specific topic of the week.
Activity: Provides an opportunity to apply theoretical knowledge through hands-on projects, design workshops, or group discussions.
Homework: Reinforces learning through assignments that involve research, analysis, design, or implementation tasks.

Extended Course Description:

- **On-Ground:** Fully on-ground course with every student meeting in-person.

Course Objectives:

- Introduction to IoT & Tinkercad
- IoT Architecture
- IoT Communication & Design Thinking
- IoT Platforms & Services
- IoT Security Challenges & Use Cases
- Mini-Project Design & Midterm Exam
- Top 5 Application Areas & System Design
- Encryption Algorithms & Diffie-Hellman
- Hash & MAC Functions, Secure Firmware & RNG
- Protection Methods, Side-Channel Attacks & Chain of Trust
- IoT Cloud Computing & Edge Computing
- Web Browsers, Security Certificates & Blockchains
- Attack Analysis, Unintended Consequences & Ethical Hacking
- Final Project Presentations & Course Wrap-Up

Student Learning Outcomes:

1. Design and prototype a secure IoT system with Cloud (LED blinking, temperature monitoring, smart home defense).
2. Analyze and mitigate potential threats in connected devices using encryption, Diffie-Hellman, and secure coding practices through use-cases.
3. Evaluate critical security considerations like authentication, blockchain, and incident response for responsible IoT development.

Professional Standards Addressed:
If applicable for programs accredited by specialty organizations.

Course Requirements & Assessment:
Please see official University of New Haven Academic Policies located in the links below:
Choose appropriate link(s).
Undergraduate Grading System
Graduate Grading System

Grading:

Grades earned are based on your performance on homework, quizzes, exams and the final exam.

Homework:	30% (regular assignments, reports, project prototypes)
In-class activities:	10% (reports, prototypes)
Midterm Exam:	20% (multiple choice questions)
Mini-Project:	15% (pitch for your IoT device and use-case)
Final-Exam:	25% (mini-term, presentation, working circuit design, security considerations, report)
Total**	100%

**Final Grades are assigned with the following scale:
Choose the scale applicable for your course. You may change the scale to the needs of the course/program.

Typical Undergraduate Scale

93 to 100	A
90 to Less than 93	A-
87 to Less than 90	B+
83 to Less than 87	B
80 to Less than 83	B-
77 to Less than 80	C+
73 to Less than 77	C
70 to Less than 73	C-
67 to Less than 70	D+
63 to Less than 67	D
60 to Less than 63	D-
Less than 60	F

Typical Graduate Scale

93 to 100	A
90 to Less than 93	A-
87 to Less than 90	B+
83 to Less than 87	B
80 to Less than 83	B-

77 to Less than 80	C+
73 to Less than 77	C
70 to Less than 73	C-
Less than 70	F

The calculation of final grades is determined by the faculty member. The calculated grade in the total column in Canvas may or may not be reflective of your final grade.

Expectations:
Students are expected to spend at least two hours on academic studies outside, and in addition to, each hour of class time.

Attendance Policy Statement:
Actively participate in class discussions, ask questions, and collaborate on projects

TCoE Academic Lab reservation form
As a TCoE student, you have access to reserve academic lab spaces for academic purposes where you need access to specific equipment. Example approved uses might include time for a team meeting to finish a team project or a study-session with a TA. For more information or to submit your reservation, please visit: https://forms.office.com/r/EUeJT36ZFr

Course Outline/Schedule:

	Lecture	Activity
16-Jan	Intro to IoT	Intro to tinkercad
23-Jan	No class	No activity
30-Jan	IoT Architecture	group discussion - different things from HW 1 - select 2 & submit by end of class, research on those products & Use-cases
6-Feb	IoT communication	Design thinking for IoT, group - prototype product on tinkercad
13-Feb	IoT platforms, software and services	designs will be shared in class, group - tinkercad smart temp. circuit
20-Feb	IoT security challenges, Security Mindset	use-case
27-Feb	Explain IoT Mini-project	Mid - Term
5-Mar	Top 5 application areas	use case group discussion - identify assisted technologies for your device, add more divices to tinkercad
12-Mar	SpringBreak	SpringBreak
19-Mar	Encryption algo, diffie-hellman	give pitch for your iot device & use-case
26-Mar	Hash and MAC function, secure firmware, random number generation, threat vectors, attacks	add wifi to TinkerCAD + write data to Thingspeak channel

2-Apr	Protection methods, side-channel attacks, chain of trust, eg of poor security implementations, incidents in the news, planning for incidents	Prepare, Aggregate and Vizualize data in Thingspeak, Simulate IoT scenario and collect data
9-Apr	Outlier Detection in IoT Theory	Practical - Act on Data, Outlier detection, data cleaning
16-Apr		
23-Apr	Course-Wrap up - More on attacks, unintended consequences, ethical hacking, US security standards	Final Presentations – Mini-Term
30-Apr	Reading day (no class)	Reading day (no class)

Diversity Statement

The University of New Haven embraces diversity and recognizes our responsibility to foster a diverse, inclusive, and welcoming environment in which all members of the Charger community of all backgrounds and identities can learn, work, and live together. We benefit from the academic, social, and cultural developments that arise from a diverse campus that is committed to equity, inclusion, belonging, and accountability.

We have a responsibility as a community and as individuals to address and remove barriers, achieve success, and sustain a culture of inclusivity, empathy, kindness, and compassion. We encourage, welcome, and embrace participation in ongoing dialogue, engagement, and education to critically examine and thoughtfully respond to the changing realities of our community. Diversity, equity, inclusion, acceptance, and belonging enrich the Charger community and are instrumental to institutional success and fulfillment of the University mission.

Reporting Bias Incidents

At the University of New Haven, there is an expectation that all community members are committed to creating and supporting a climate which promotes civility, mutual respect, and open-mindedness. There also exists an understanding that with the freedom of expression comes the responsibility to support community members' right to live and work in an environment free from harassment and fear. It is expected that all members of the University community will engage in anti-bias behavior and refrain from actions that intimidate, humiliate, or demean persons or groups or that undermine their security or self-esteem.

If you have an immediate safety concern for yourself or others, and/or believe someone poses an immediate threat to themselves or others, please contact University Police at 203-932-7070 or call 911. Community members can report bias-motivated incidents by completing the form at **www.newhaven.edu/biasreporting**. Community members are encouraged to complete this form if they are the target of bias or harassing behaviors, witness such behaviors, or gain knowledge of these behaviors occurring within the University community. All matters

concerning bias and harassment will be handled by the Dean of Students Office and Human Resources Office.

University-wide Academic Policies

A continually-updated list of University-wide academic policies and descriptions of key university student resources, can be found on Canvas. You can access them by simply clicking on the (?) help button.

The University-wide academic policies include (but are not limited to) the University's attendance policy, procedures for both adding / dropping a course and course withdrawals, an explanation for the sorts of circumstances where incomplete (INC) grades could be considered by the faculty, and the academic integrity policy (among others).

The list of key university student resources to enable learning include (but are not limited to) the University's Center for Student Success, Writing Center, Center for Learning Resources, and the Accessibility Resource Center.

Feel free to *include a* statement on *the* use of generative AI (e.g. chatGPT) *in your course. Please refer to the University Academic Integrity Policy, which can be found here: https://issuu.com/university-of-new-haven/docs/student-handbook (search for Academic Integrity), specifying the use of generative AI without instructor approval.*

In this class, you are expected to adhere to the highest standards of academic integrity and make original contributions in every assignment category. Plagiarism or unauthorized use of generative AI tools, such as ChatGPT, will not be tolerated and considered a violation of *the University* academic integrity *policy*. *In the first day of class, I will explain when you may use generative AI tools and when you cannot use those tools.*

University of New Haven

UNIVERSITY STUDENT SUPPORT SERVICES

The University recognizes that students can often use some help outside of class and offers academic assistance through several offices.

Accessibility Resources Center

The University of New Haven seeks to maintain a supportive academic environment for all students inclusive of those with disabilities including chronic health-related conditions and military service-connected disorders. If you feel that you may need reasonable accommodations to enable your full

participation in this course, please provide me with your Verification of Reasonable Accommodations letter through AIM found in MyCharger or contact the Accessibility Resources Center to begin the process to ensure that accommodations can be made available to you. Reasonable accommodations are not required to be provided retroactively and may not be made without written verification from the Accessibility Resources Center. The Accessibility Resources Center is located in Sheffield Hall on the ground floor in the rear of the building, and can be reached by email at ARC@newhaven.edu or by phone at (203) 932-7332.

The Accessibility Resources Center is also "Green Zone Certified" as staff members equipped to assist and support student veterans and military affiliated students and their unique needs. For more information on Green Zone Training please email veteranservices@newhaven.edu

Center for Learning Resources (CLR)

The Center for Learning Resources (CLR), located on the lower level of the Peterson Library, comprises four units: the **Learning Lab**, which provides content tutoring for all undergraduate students; the **Writing Center**, which offers one-on-one writing support; the **Grad Lab**, which provides tutoring and other academic support for graduate students; and the **Learning Assistant Program**, which places high-achieving undergraduate learning assistants in selected sections of challenging courses to help students reach their academic potential.

In addition to course-based tutoring, we offer skills-based tutoring (e.g., for computer programs and programming languages), and we also offer workshops on a wide variety of academic subjects.

The CLR sees between one-third and one-half of the student body in any given year, and we pride ourselves on being an encouraging communal space where all students feel welcome.

This office is also "Green Zone Certified" as staff members equipped to assist and support student veterans and military affiliated students and their unique needs. For more information on Green Zone Training please email veteranservices@newhaven.edu. To make an appointment, call us at 203-932-7215, write to us at clr@newhaven.edu, download the Navigate app, or just walk in and tell us how we can help.

Center for Student Success (CSS)

The Center for Student Success can help you refine your study skills and develop new academic strategies. CSS staff assists with enhancing your time management and organizational skills. They provide understanding of your GPA, degree audit, and transcripts, and can answer general questions about academic policies. They also can connect you to campus resources and assist you with resolving issues as they arise. During registration periods, CSS advisors work in conjunction your faculty advisor to provide assistance with the advising and registration process. Finally, at various points throughout the semester, CSS works to provide students with progress reports from their instructors. Students can make an appointment to see a CSS staff member through Navigate; the Center for Student Success can be reached via email at css@newhaven.edu. CSS is Green Zone Certified as staff members equipped to assist and support student veterans and military affiliated students and their unique needs. For more information on Green Zone Training please email veteranservices@newhaven.edu

Counseling & Psychological Services (CAPS)

CAPS offers confidential, mental health care which is included with tuition in order to support student mental health and wellbeing. The services include individual and group therapy, support groups, consultations, and 24/7 crisis support. We are available in person at Charger Plaza and remotely, and are in the office M-F, 8:30-4:30. Please call us to schedule an appointment or with any questions at 203-932-7333; you can also schedule online. If you experience a mental health crisis after hours, you can call our main number for support.

Counseling & Psychological Services is Green Zone Certified as staff members equipped to assist and support student veterans and military affiliated students and their unique needs. For more information on Green Zone Training please email veteranservices@newhaven.edu

Myatt Center

The Myatt Center for Diversity and Inclusion is committed to creating a multicultural environment through intentional education, campus community engagement, and valuing the unique identities of each member of the Charger Community. Our commitment to diversity is driven by the core values of connection, belonging, inclusivity, equity, acceptance, and accountability. The Myatt Center's focus is to create a respectful and inclusive environment based our awareness and ability to engage with others who are different on many levels including ethnicity, race, sexual orientation, gender, military, religious belief, and life experiences.

Marvin K. Peterson Library

The library is here to support all members of the University with their research needs. We are proud to serve as an academic hub on campus; providing high quality resources, space for study and exploration, and staff expertise to support all stages of the research process.

Library staff can assist in locating relevant sources of information for course assignments and projects from intro courses to graduate level assignments. To work with a librarian, you can stop by the Library Service desk on the main level of the Peterson Library, use our "Ask a Librarian" chat service, or email libraryhelp@newhaven.edu. Appointments for in-person or online consultations can also be made by using the Navigate app or completing the "Research Consultation" form on the library website.

For 24/7 online support, library staff have created LibGuides to assist with research and citation. These guides contain overviews of resources available through the library by subject, as well as tutorials on a variety of research related topics.

The Peterson Library has three floors with a mix of individual quiet study space, collaborative group study space, and bookable study rooms with technology. The main level of the library provides access to scanners, printers, and both Dell and iMac computers.

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Military & Veteran Services

The Military & Veteran Affairs team is here to answer any questions Student Veterans (both current and prospective), active duty/reserve/national guard members, and military family members have regarding transitioning to higher education, VA educational benefits, formal advising, or to listen to issues pertaining to class. The University of New Haven's Military & Veterans Affairs team consists of full-time staff, part time student employees, and VA Work Study students whose aim is to assist and support the student veteran population both on and off campus. These individuals have a dedication to the development, success, and well-being of the student veteran population on campus which includes veterans, active-duty military, service members in the reserves or national guard, and dependents using VA Education Benefits. The office advises, guides, and supports this student population and is available to assist at a moment's notice to address the needs and concerns of this population. This office is also "Green Zone Certified" as staff members equipped to assist and support student veterans and military affiliated students and their unique needs. For more information on Green Zone Training please email veteranservices@newhaven.edu