

OU CS 5970 Embedded Systems Security

Spring 2021 Syllabus

1. Instructor:

Dr. Song Fang (songf@ou.edu)

Office hour: MW 2:00 pm - 3:00 pm in DEH 232

Class meetings: MW 7:45 pm - 9:00 pm in Sarkeys Energy Ctr, A0235

2. Teaching Assistant:

Edwin Yang (edwiny@ou.edu)

Office hour: TBD

3. Prerequisites:

CS 3113 Operating Systems or permission of instructor.

4. Course Description:

This class covers the theory and practice of secure embedded systems. Students will be exploring security and privacy issues in deployed or emerging embedded systems, such as drones, automobiles, implantable medical devices, or household appliances. The instructor will provide lectures on a set of pre-selected topics. Teams of students will work on a collaborative project for the duration of the semester. Students can form teams, each with up to three members, based on common interests and/or complementary skills. Each team will pick a topic of their interest within the scope of the class, then develop a project to a real-world security issue on embedded systems.

5. Course Objectives:

By the end of this course, students will be able to:

- Understand concepts, issues, principles, and mechanisms in embedded systems security such as embedded security trends, software vulnerabilities, physical attacks and security policies;
- Obtain hands-on skills in securing practical embedded systems;
- Learn recent research advances in embedded systems security and prepare for graduate research in embedded systems security.

6. Student Learning Outcomes:

During the semester, students will have:

- Multiple in-class quizzes;
- Five home assignments or labs;
- Multiple research paper summaries;
- In-class paper presentation(s);

- One semester project.

7. Recommended Textbook:

There is no required textbook for the class. We will use research papers for some of the topics. The following textbooks are suggested.

David Kleidermacher and Mike Kleidermacher, *Embedded Systems Security: Practical Methods for Safe and Secure Software and Systems Development*, 1st Edition, Newnes, 2012.

Wenliang Du. *Computer Security: A Hands-on Approach*. 1st Edition, 2017.

8. Course Outline:

T1. Embracing Embedded Systems Security (1 lecture)

- Introduction to embedded systems
- Embedded system trends

T2. Software Security (6 lecture)

- Set-UID, environment variables
- Buffer overflow exploits, mitigation of buffer overflow attacks
- Return-to-libc attack

T3. Embedded Cryptography (2 lecture)

- Secret key cryptography, public key cryptography, hash functions, authentication techniques, etc.
- Key management for embedded systems

T4. Data Protection Protocols for Embedded Systems

- Data-in-motion protocols: IP-based network security
- Data-at-rest protocols

T5. Hardware Security

- Hardware trojans
- Intellectual property (IP) piracy and integrated circuit (IC) overbuilding
- Side-channel analysis

T6. Smart Home Security and Privacy

- Vulnerability analysis
- Countermeasures

T7. Other Emerging Research Topics

- Implantable medical device security
- Security and privacy vulnerabilities of in-car wireless systems
- RFID security
- GPS spoofing and countermeasures
- Wireless electronic warfare: jamming and anti-jamming techniques
- Smart phone security
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9. Grading:

Quizzes	10%
Homework assignment	20%
Summary of reading papers	20%
In-class paper presentation	20%
Course research project	30%

Homework assignments, paper summaries, and project report must be typed using a text editor.

Grading scale: The scale for final letter grades is as follows, using standard notation for ranges: A ($\infty, 90$]; B (90,80]; C (80,70]; D (70,60]; F (60,0].

10. Policies on Late Assignments:

Homework, paper summaries, project deadlines will be hard. For each day a submission is late - up to a maximum of 3 days, the grade is reduced 15%. For example, if you submit a 90%-correct assignment 2 days late, your overall assignment score will be 60%.

11. Policies on Absences and Scheduling Makeup Work:

There will be no makeups for homework assignments. Make-up exams will not normally be permitted. Exceptions will be made if a student presents a police report or a doctor's note that shows some emergency situation.

12. Student Evaluations:

The College of Engineering utilizes student ratings as one of the bases for evaluating the teaching effectiveness of each of its faculty members. The results of these forms are important data used in the process of awarding tenure, making promotions, and giving salary increases. In addition, the faculty uses these forms to improve their own teaching effectiveness. The original request for the use of these forms came from students, and it is students who eventually benefit most from their use. Please take this task seriously and respond as honestly and precisely as possible, both to the machine-scored items and to the open-ended questions.

13. University Policies:

In this section, include the mandatory University policies.

Copyright Syllabus Statement for In-Person or Online Courses

Sessions of this course may be recorded or live-streamed. These recordings are the intellectual property of the individual faculty member and may not be shared or reproduced without the explicit, written consent of the faculty member. In addition, privacy rights of others such as students, guest lecturers, and providers of copyrighted material displayed in the recording may be of concern. Students may not share any course recordings with individuals not enrolled in the class, or upload them to any other online environment.

Academic Integrity

Cheating is strictly prohibited at the University of Oklahoma, because it devalues the degree you are working hard to get. As a member of the OU community it is your responsibility to protect your educational investment by knowing and following the rules. For specific definitions on what constitutes cheating, review the Student's Guide to Academic Integrity at

http://integrity.ou.edu/students_guide.html

To be successful in this class, all work on exams and quizzes must be yours and yours alone. You may not receive outside help. On examinations and quizzes you will never be permitted to use your notes, textbooks, calculators, or any other study aids. Should you see someone else engaging in this behavior, I encourage you to report it to myself or directly to the Office of Academic Integrity Programs. That student is devaluing not only their degree, but yours, too. Be aware that it is my professional obligation to report academic misconduct, which I will not hesitate to do. Sanctions for academic misconduct can include expulsion from the University and an F in this course, so don't cheat. It's simply not worth it.

Religious Observance

It is the policy of the University to excuse the absences of students that result from religious observances and to reschedule examinations and additional required classwork that may fall on religious holidays, without penalty.

Reasonable Accommodation Policy

Students requiring academic accommodation should contact the Disability Resource Center for assistance at (405) 325-3852 or TDD: (405) 325-4173. For more information please see the Disability Resource Center website <http://www.ou.edu/drc/home.html>. Any student in this course who has a disability that may prevent him or her from fully demonstrating his or her abilities should contact me personally as soon as possible so we can discuss accommodations necessary to ensure full participation and facilitate your educational opportunities.

Title IX Resources and Reporting Requirement

For any concerns regarding gender-based discrimination, sexual harassment, sexual assault, dating/domestic violence, or stalking, the University offers a variety of resources. To learn more or to report an incident, please contact the Sexual Misconduct Office at 405/325-2215 (8 to 5, M-F) or smo@ou.edu. Incidents can also be reported confidentially to OU Advocates at 405/615-

0013 (phones are answered 24 hours a day, 7 days a week). Also, please be advised that a professor/GA/TA is required to report instances of sexual harassment, sexual assault, or discrimination to the Sexual Misconduct Office. Inquiries regarding non-discrimination policies may be directed to: Bobby J. Mason, University Equal Opportunity Officer and Title IX Coordinator at 405/325-3546 or bjm@ou.edu. For more information, visit <http://www.ou.edu/eoo.html>.

Adjustments for Pregnancy/Childbirth Related Issues

Should you need modifications or adjustments to your course requirements because of documented pregnancy-related or childbirth-related issues, please contact your professor or the Disability Resource Center at 405/325-3852 as soon as possible. Also, see <http://www.ou.edu/eoo/faqs/pregnancy-faqs.html> for answers to commonly asked questions.

Final Exam Preparation Period

Pre-finals week will be defined as the seven calendar days before the first day of finals.

Emergency Protocol

During an emergency, there are official university [procedures](#) that will maximize your safety.

Severe Weather: If you receive an OU Alert to seek refuge or hear a tornado siren that signals severe weather 1. *LOOK* for severe weather refuge location maps located inside most OU buildings near the entrances 2. *SEEK* refuge inside a building. Do not leave one building to seek shelter in another building that you deem safer. If outside, get into the nearest building. 3. *GO* to the building's severe weather refuge location. If you do not know where that is, go to the lowest level possible and seek refuge in an innermost room. Avoid outside doors and windows. 4. *GET IN, GET DOWN, COVER UP*. 5. *WAIT* for official notice to resume normal activities.

[Link to Severe Weather Refuge Areas](#) , [Severe Weather Preparedness - Video](#)

Armed Subject/Campus Intruder

If you receive an OU Alert to shelter-in-place due to an active shooter or armed intruder situation or you hear what you perceive to be gunshots:

1. *GET OUT*: If you believe you can get out of the area WITHOUT encountering the armed individual, move quickly towards the nearest building exit, move away from the building, and call 911. 2. *HIDE OUT*: If you cannot flee, move to an area that can be locked or barricaded, turn off lights, silence devices, spread out, and formulate a plan of attack if the shooter enters the room. 3. *TAKE OUT*: As a last resort fight to defend yourself.

For more information, visit <http://www.ou.edu/emergencypreparedness.html>

[Shots Fired on Campus Procedure - Video](#)

Fire Alarm/General Emergency

If you receive an OU Alert that there is danger inside or near the building, or the fire alarm inside the building activates: 1. *LEAVE* the building. Do not use the elevators. 2. *KNOW* at least two building exits 3. *ASSIST* those that may need help 4. *PROCEED* to the emergency assembly area 5 *ONCE safely outside, NOTIFY first responders of anyone that may still be inside building due to mobility issues*. 6. *WAIT* for official notice before attempting to re-enter the building.

[OU Fire Safety on Campus](#)

Mental Health Support Services

If you are experiencing any mental health issues that are impacting your academic performance, counseling is available at the University Counseling Center (UCC). The Center is located on the second floor of the Goddard Health Center, at 620 Elm Rm. 201, Norman, OK 73019. To schedule an appointment call (405) 325-2911.

**Every part of this syllabus is subject to adjustment as the semester progresses. If you are dissatisfied with the course policies, grading, and assignments, please contact the instructor. Reasonable requests for modifications may be accommodated at the instructor's discretion.*