

## **IoT Security and Privacy**

EEL 5934

**Class Periods:** Tuesday/Thursday two sessions

**Course Type:** 3-credit hours

**Location:** CSE E118

**Academic Term:** Fall 2019

**Course Hours:** T P8-9 (3PM-4:55PM); Th P9 (4:05PM-4:55PM)

### **Instructor:**

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- Office Phone Number: 352-294-0401
- Office Hours: Tuesday, 1PM-3PM, BEN 325 or by appointment

### **Course Description**

The course will introduce the advanced topics of IoT security and privacy challenges. With IoT being deployed in various applications, IoT security and privacy issues become major concerns. Upon this request, the course will systematically analyze IoT security from hardware, communication, and system perspectives.

### **Course Pre-Requisites / Co-Requisites**

- We request that the students have taken programming courses and have the skill in basic C programming.

### **Course Objectives**

This course is designed to have students become acquainted with IoT security. Students will be able to understand or master IoT security related to hardware, system and networking. The recited topics include introduction to IoT, IoT Application - smart home, attacks against IoT, building IoT devices with Raspberry Pi, lightweight IoT communication protocol - Message Queuing Telemetry Transport (MQTT), other IoT communication protocols - HTTP, HTTPS and Websockets, introduction to Amazon AWS IoT, Secure Bootstrapping for secure IoT system, and IoT System Security and TrustZone.

### **Materials and Supply Fees**

- Raspberry Pi
- USB cable

### **Required Textbooks and Software**

No textbooks are required for this course. Slides will be distributed to all students as learning materials.

### **Recommended Materials**

- (1) Fundamental papers/texts reviewing prerequisite material in crypto and networking;
- (2) Seminal papers in IoT;
- (3) Recent papers from IoT conferences.

**Course Schedule**

<b>MODULES</b>	<b>LEARNING OUTCOMES</b>	<b>MATERIALS</b>
<b>Introduction to Cryptography and Networking</b>	<ul style="list-style-type: none"> <li>• Understand the basic knowledge of cryptography</li> <li>• Understand the basic knowledge of networking</li> </ul>	
<b>Introduction to IoT</b>	<ul style="list-style-type: none"> <li>• Understand different visions of the Internet of Things (IoT) paradigm</li> <li>• Understand the enabling technologies, their advantages and disadvantages</li> <li>• Understand different aspects of IoT security and privacy</li> </ul>	
<b>IoT Application - Smart Home</b>	<ul style="list-style-type: none"> <li>• Understand the concept of smart home</li> <li>• Identify vulnerabilities in home networks</li> <li>• Identify the impact of the vulnerabilities</li> <li>• Risk analyze smart home systems</li> </ul>	
<b>Attacks against IoT</b>	<ul style="list-style-type: none"> <li>• Understand attacks against IoT system (hardware + software)</li> <li>• Understand attacks against IoT network protocols</li> <li>• Understand attacks against industry IoT</li> </ul>	
<b>Building IoT devices with Raspberry Pi</b>	<ul style="list-style-type: none"> <li>• Students will master the use of Raspberry Pi</li> <li>• Students will understand basic circuits interacting with Raspberry Pi</li> <li>• Students will master programming Raspberry Pi</li> </ul>	
<b>Lightweight IoT communication protocol - Message Queuing Telemetry Transport (MQTT)</b>	<ul style="list-style-type: none"> <li>• Understand the IoT communication protocol Message Queuing Telemetry Transport (MQTT)</li> <li>• Be able to install, configure and use the MQTT implementation - Mosquitto</li> <li>• Be able to configure the use of SSL with Mosquitto to secure communication</li> <li>• Be able to configure the use of SSL with Mosquitto for authentication</li> </ul>	
<b>Other IoT communication protocols - HTTP, HTTPS and Websockets</b>	<ul style="list-style-type: none"> <li>• Master the HTTP protocol</li> <li>• Master the HTTPS protocol</li> <li>• Understand websockets</li> </ul>	
<b>Introduction to Amazon AWS IoT</b>	<ul style="list-style-type: none"> <li>• Understand the architecture of Amazon AWS IoT</li> <li>• Master the use of AWS IoT managing IoT devices</li> <li>• Master programming AWS IoT</li> </ul>	
<b>Secure Bootstrapping for secure IoT system</b>	<ul style="list-style-type: none"> <li>• Understand trusted boot</li> <li>• Understand secure boot</li> <li>• Understand TPM and its usages</li> <li>• Understand remote attestation</li> <li>• Understand tamper resistant/proof/response hardware and its usage</li> </ul>	
<b>IoT System Security and TrustZone</b>	<ul style="list-style-type: none"> <li>• Understand the system security</li> <li>• Understand TrustZone hardware architecture</li> <li>• Understand TrustZone software architectures</li> </ul>	

### **Attendance Policy, Class Expectations, and Make-Up Policy**

Excused absences are consistent with university policies in the graduate catalog (<http://gradcatalog.ufl.edu/content.php?catoid=11&navoid=2486#attendance>) and require appropriate documentation.

### **Evaluation of Grades**

Assignment	Percentage of Final Grade
Homework Sets	50%
Quizzes	10%
Midterm Exam	20%
Final Exam (or Project)	20%
TOTAL	100%

### **Grading Policy**

Percent	Grade	Grade Points
90.0 - 100	A	4.00
85.0 - 89.9	A-	3.67
80.0 - 84.9	B+	3.33
75.0 - 79.9	B	3.00
70.0 - 74.9	B-	2.67
60.0 - 69.9	C	2.33
50.0 - 59.9	D	1.33
0 - 59.9	E	0.00

More information on UF grading policy may be found at: <http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020>

### **Students Requiring Accommodations**

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

### **Course Evaluation**

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

### **University Honesty Policy**

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

### ***Software Use***

All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

### ***Campus Resources:***

#### *Health and Wellness*

##### **U Matter, We Care:**

If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) or 352-392-1575 so that a team member can reach out to the student.

**Counseling and Wellness Center:** <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

##### **Sexual Assault Recovery Services (SARS)**

Student Health Care Center, 392-1161.

**University Police Department** at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

#### *Academic Resources*

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu).  
<https://lss.at.ufl.edu/help.shtml>.

**Career Resource Center**, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

**Library Support**, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

**Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.  
<https://teachingcenter.ufl.edu/>.

**Writing Studio, 302 Tigert Hall**, 846-1138. Help brainstorming, formatting, and writing papers.  
<https://writing.ufl.edu/writing-studio/>.

**Student Complaints Campus:** [https://www.dso.ufl.edu/documents/UF\\_Complaints\\_policy.pdf](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

**On-Line Students Complaints:** <http://www.distance.ufl.edu/student-complaint-process>.