

EECE 5155

Wireless Sensor Networks and the Internet of Things

Fall Semester 2021

Lecture Time: TF 01:35-03:15PM

Location: East Village 002 (LiveCast from Portland Campus)

TA: Li Wang, Email: wang.li4@northeastern.edu

TA Office Hours: T 3:30-5:30PM (or by appointment)

Course Description

The class will cover design and modeling of architectures, communication protocols and algorithms for Wireless Sensor Networks and the Internet of Things. The first part of the class will cover general aspects of wireless sensor networking, including protocol design, modeling, and simulation at all layers of the communication stack. The second part will cover standardization efforts, including Bluetooth, IEEE 802.15.4/Zigbee, and Sigfox/LoRa, among others. The third part will illustrate applications of sensor networks technology to many challenging problems of our times, including mobile crowdsensing, smart cities, and cyber-physical systems. Grading will be based on two midterms, two assignments and a project. This is a depth course for the CNWS (Computer Networks and Security) concentration and breadth for other concentrations.

Course Objectives

This course will provide the students with the advanced competitive skills required to contribute to the development of the IoT. By the end of the course, students will be able to:

- Identify and describe the main network architectures and device components of IoT systems
- Design and simulate simple network architectures by means of software tools
- Recognize and describe common telecommunication standards and standardization entities
- Participate effectively (and, if needed, remotely) in a team project and assess the strengths and weaknesses of the individual team members (including himself or herself) and the team as a unit
- Find relevant sources of information about a specified topic in the library and on the web
- Write an effective project report to present technical knowledge to a variety of audiences
- Generate an oral presentation on a topic related to class material using electronic tools

Prerequisites

Undergraduate level EECE 2540 Minimum Grade of D- or Undergraduate level CS 3700 Minimum Grade of D- or Graduate Admission.

Instructor

Dr. Francesco Restuccia
Assistant Professor, Department of Electrical and Computer Engineering
Roux Institute
Institute for the Wireless Internet of Things
Northeastern University
Office Hours: On-Demand (via Zoom)
Email: frestuc@northeastern.edu

Textbook

The class will be based on lecture slides from the instructor and on research papers. Suggested (but not required) textbooks are:

- H. Karl, A. Willig, “*Protocols and Architectures for Wireless Sensor Networks*,” Wiley, 2005
- B. Krishnamachari, “*Networking Wireless Sensors*,” Cambridge University Press
- I. Akyildiz, M. Vuran, “*Wireless Sensor Networks*,” Wiley, 2010.

Topics

1. Wireless Sensor Networks: Architectures, Protocols, Algorithms, Modeling

- (a) Applications, Major Design Factors, Architectures, Protocol Stack
- (b) Application Layer, Transport Layer
- (c) Network Layer: Addressing and Routing
- (d) Link Layer: Medium Access Control and Error Control
- (e) Synchronization, Localization and Tracking
- (f) Simulation of Sensor Networks: From Theory to Practice with OMNET++

2. Standards:

- (a) Bluetooth
- (b) IEEE 802.15.4 / Zigbee
- (c) Emerging LP-WAN technologies (Sigfox / LoRa)

3. Applications:

- (a) Cyber-Physical Systems
- (b) Mobile Crowdsensing
- (c) IoT Security
- (d) Smart Cities

Grading Policy

Grades will be assigned according to the following policy:

Class Attendance	5%
Homework Assignments (2)	35%
Midterms (2)	30%
Final Project	30%

Notes: Class attendance will be measured by the Teaching Assistant (TA) at the beginning of each lesson. “Attendance” for a class session is defined as remaining in the classroom for the duration of the class. Each student will receive a grade of “A” in the “Class Attendance” category if the percentage of attended classes will be 90% or more at the end of the course, and “B” otherwise. Students may miss more than 10% of the class meetings with valid excuse(s).

Expectations of Students

- Students are expected to act in a professional manner. A student’s grade may be reduced (up to 5%) due to unprofessional or disruptive behavior. Please
 - Use professional style in all communications, including email, with course instructors and assistants
 - Respect: You are expected to treat your instructor and all other participants in the course with courtesy and respect. Your comments to others should be factual, constructive, and free from harassing statements. You are encouraged to disagree with other students and the instructor, but such disagreements need to be respectful and be based upon facts and documentation (rather than prejudices and personalities). Falling to adhere to this expectation may result in a lower grade. Part of the learning process in this course is the respectful engagement of ideas with others.
- To avoid late penalty deductions, assignments should be submitted on or prior to the due date. *There will be an automatic 10-point per day deduction in homework assignments submitted past the deadline.*
- Students are allowed to share ideas regarding homework problems, but each student must independently write and submit their own solution.
- Makeup exams will be given provided that the two following conditions are simultaneously satisfied:
 - You contact the instructor prior to the exam
 - You have a valid and documented reason to miss the exam
 - * Serious illness or family emergency are acceptable excuses
 - * Sleeping in, lack of preparation, ennui, grogginess, etc. are not acceptable excuses

Academic Integrity

A commitment to the principles of academic integrity is essential to the mission of Northeastern University. The promotion of independent and original scholarship ensures that students derive

the most from their educational experience and their pursuit of knowledge. Academic dishonesty violates the most fundamental values of an intellectual community and undermines the achievements of the entire University. As members of the academic community, students must become familiar with their rights and responsibilities. In each course, they are responsible for knowing the requirements and restrictions regarding research and writing, examinations of whatever kind, collaborative work, the use of study aids, the appropriateness of assistance, and other issues. Students are responsible for learning the conventions of documentation and acknowledgment of sources in their fields. Northeastern University expects students to complete all examinations, tests, papers, creative projects, and assignments of any kind according to the highest ethical standards, as set forth either explicitly or implicitly in this Code or by the direction of instructors. Go to <http://www.northeastern.edu/osccr/academic-integrity-policy/> to access the full academic integrity policy.

Student Accommodations

Northeastern University and the Disability Resource Center (DRC) are committed to providing disability services that enable students who qualify under Section 504 of the Rehabilitation Act and the Americans with Disabilities Act Amendments Act (ADAAA) to participate fully in the activities of the university. To receive accommodations through the DRC, students must provide appropriate documentation that demonstrates a current substantially limiting disability. For more information, visit <http://www.northeastern.edu/drc/getting-started-with-the-drc/>.

Diversity and Inclusion

Northeastern University is committed to equal opportunity, affirmative action, diversity and social justice while building a climate of inclusion on and beyond campus. In the classroom, members of the University community work to cultivate an inclusive environment that denounces discrimination through innovation, collaboration and an awareness of global perspectives on social justice. It is my intention that students from all backgrounds and perspectives will be well served by this course, and that the diversity that students bring to this class will be viewed as an asset. I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, socioeconomic background, family education level, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class. Your suggestions are encouraged and appreciated. Please visit <http://www.northeastern.edu/oidi/> for complete information on Diversity and Inclusion.

Title IX

Title IX of the Education Amendments of 1972 protects individuals from sex or gender-based discrimination, including discrimination based on gender-identity, in educational programs and activities that receive federal financial assistance. Northeastern's Title IX Policy prohibits Prohibited Offenses, which are defined as sexual harassment, sexual assault, relationship or domestic violence, and stalking. The Title IX Policy applies to the entire community, including male, female, transgender students, faculty and staff. In case of an emergency, please call 911. Please visit www.northeastern.edu/titleix for a complete list of reporting options and resources both on- and off-campus.