ECE 442 – Internet of Things and Cyber Physical Systems

Credits: 3, **Contact Hours:** Two 75 minute lecture session per week.

Coordinator: J. Saniie, Professor of ECE

Textbook: A. Bahga, V. Madisetti, *Internet of Things: A Hands-on Approach*, VPT, 2014
R. Gajjar, *Raspberry Pi Sensors*, Packt Publishing, 2015
J. Saniie and W.-J. Yi, *Course Notes*

Reference: H. Geng, *Internet of Things and Data Analytics Handbook*, John Wiley & Sons, Inc. 2016
R. Buyya and A.V. Dastjerdi, *Internet of Things: Principles and Paradigms*, Morgan Kaufmann, 2016
R. Rajkumar, D. de Niz and M. Klein, *Cyber-physical Systems*, Addison-Wesley, 2016
T. Igoe, *Making Things Talk (3rd edition)*, Maker Media 2017

2019 Catalog Data: ECE 442: Internet of Things and Cyber Physical Systems. Credit 3
To introduce students to the fundamentals of Internet of Things (IoT) and embedded computing. This course covers IoT applications, Wireless protocols, Wearable sensors, Home environment sensors, Behavior detection sensors, Data fusion, processing and analysis, Data communications, Architectural design issues of IoT layers, Security and privacy issues in IoT. Lecture: 3 Lab: 0 Credits: 3 Satisfies: ECE Professional Elective

Prerequisites or co-requisites by topic: ECE 242
General understanding of writing computer programs and embedded computing. Basic knowledge of computer architecture and network data communication system

Enrollment: Elective courses for CPE and EE majors.

Specific outcomes of instruction:
After completing this course, the student should be able to do the following:

1. Describe the fundamentals of Internet of Things and embedded computing
2. Utilize Internet of Things to build Cyber Physical Systems
3. Understand various data communication methods enabling data mobility in real-time
4. Perform data analysis and visualization
5. Comprehensive understanding of Internet of Things by exploring real-world Internet of Things application scenarios
6. Differentiate and select various technologies for Internet of Things implementations
7. Design, implement, and test a system by co-designing hardware and software utilizing embedded computing and system designs with contemporary topics, design tools and standards.
8. Complete an engineering design incorporating engineering standards and realistic constraints.
9. Prepare an informative and organized design project report and presentation
10. Report on contemporary topics in Internet of Things and Cyber Physical Systems

Relationship of ECE 442 specific outcomes of instruction to student outcomes:

	Student Outcomes	Course Goals
1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	1-4
2	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	4-8
3	An ability to communicate effectively with a range of audiences	9
4	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	10
5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	6-9
6	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	6-8
7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	5-8, 10

Topics:

- Introduction to Internet of Things and Cyber Physical Systems (1.5 weeks)
- Domain Specific IoTs and IoT Design Case Studies (1.5 week)
- Introduction to Embedded Systems (2 weeks)
- Design with Arduino and Raspberry Pi (2 weeks)
- Wireless Technology and IoT (1 week)
- RFID and IoT (1 week)
- Sensors and Actuators (1 week)
- IoT DBMS and Development Platform (1 week)
- IoT Network Architecture (1 week)
- Security and Privacy (1 week)
- Cybersecurity Law (1 week)
- Design Project Demonstration and Presentations (2 weeks)

Prepared by: J. Saniie **Date:** February 28, 2020