

CNT 5108 Embedded Network Sensor Systems

Credits: 3 credits

Textbook, Title, Author, and Year: There are no required textbooks for this course.

Reference materials: N/A

Specific Course Information

Catalog Description: The *Internet of Things* (IoT) represents a futuristic vision of tiny, networked devices seamlessly embedded throughout the world around us. These networked *things* can silently capture, record, and transmit real-time information about their hosting environments, from the flow of our oceans, to the operation of our machines, to the health of our bodies. The resulting information can be used to support improved decision-making, and often, automated control of the sensed environment, vehicle, or object. With an estimated 50 billion connected things by 2020, the Internet of Things is emerging as the next Internet frontier, helping to safeguard our water systems and agricultural resources, manage our growing cities, and support our health and wellness. Tiny computers, tiny radios, and tiny sensors are poised to have a huge impact. The Internet of Everything is changing the world around us and opening doors to a brighter future. *Do you want to build it with us?*

This is a new course on the technical foundations of the Internet of Things, open to advanced undergraduate students and all graduate students. A strong programming foundation is required, preferably in C, but there are no other prerequisites — other than a strong work ethic.

Prerequisites: This course is designed for graduate students and advanced undergraduate students. A strong programming background, preferably in C, is required. Facility with pointers, for example, is assumed.

Specific Goals for the Course:

Upon completing the course, students will

- Understand the concepts that underlie the Internet of Things
- Understand the applications of IoT technology
- Achieve competency in embedded programming using the ARM Cortex-M4
- Achieve competency in using some of the most common embedded peripherals
- Be capable of reasoning about and applying some of the most common sensor networking algorithms
- Have a basic understanding of embedded circuits
- Have a basic understanding of how to develop printed circuit boards using Eagle CAD
- Be capable of integrating IoT devices with upper-tier cloud services

Brief List of Topics to Be Covered:

The content of this course evolves from one semester to the next to keep pace with the current state of the art. The content is also tailored as much as possible to the research interests of the participants. Hence, the syllabus is not fixed. I will do my best to provide a list of upcoming topics on a one-week time horizon, but bear in mind that the list is tentative.

The **Approximate** Ordering of Topics Is As Follows:

Week 1

- Introduction to the Internet of Things
- Introduction to the development tool-chain

Week 2

- Introduction to embedded programming
- Introduction to the ARM Cortex-M4

Week 3

- Programming the ARM Cortex-M4
- **Project deadline**

Weeks 4-5

- Introduction to analog and digital sensing
- Programming embedded sensors

Weeks 6-7

- Programming NAND flash
- Embedded file systems
- **Project deadline**
- **Midterm exam**

Weeks 8-9

- Programming embedded radios
- **Project deadline**

Week 10

- Convergecast routing protocols

Week 11

- Time synchronization protocols
- **Project deadline**

Week 12

- Basic embedded circuits

Weeks 13-14

- Printed circuit board design in Eagle
- **Project deadline**

Week 15

- Cloud integration

Week 16

- **Project deadline**
- **Final exam**