CNT4165 - Network Protocols for Internet of Things

Three Credits, Four and a half hours, Engineering Topic.

Instructor: Dr. Mohammad Ashiqur Rahman

Textbook: The Internet of Things, Olivier Hersent, David, Boswarthick, Omar

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Specific Course Information:

This is a graduate-level course that covers the introduces the underlying network protocols for IoT communications. The course presents protocols at the medium access and network layers and perspectives behind these protocol characteristics. The course is intended to serve students with basic knowledge of networking. Topics covered include introduction to Introduction to TCP/IP, wireless communication challenges, radio devices for IoT, routing protocols for IoT (RPL), MAC Layer protocols for IoT (Zigbee, Bluetooth, Wireless HART, 6LowPAN, etc.), low power WAN protocols (LoRA alliance), and cellular options for IoT (narrowband LTE, 5G).

This course will consist of FIVE lecture modules, FOUR tests, FOUR assignments, one presentation, and one term project. Each module includes one or more lecture notes, and its availability is open. There will be ONE technical discussion associated with each module. Assignments and the term project will be completed individually. The presentation will be completed in groups. Each test will be given on one module, while the Final Exam will cover multiple modules. Assignments/presentations will be due approximately every 2 weeks. Tests, assignments, and the presentation will be evaluated within three weeks of submission. The term project and the Final Exam will be graded along with the Final Exam. Communication will take place primarily via email and professor announcements (e.g., weekly Zoom sessions). At the end of the course, you would have learned the key network protocols used in IoT and their characteristics.

Specific Goals for the Course

a. Specific outcomes of instruction

Upon successful completion of this course, the student will:

1.Describe network stack layers, classical protocols, and routing algorithms.

2.Explain wireless challenges regarding IoT protocol design.

3.Define the specifications required for various MAC and network layer IoT protocols.

4.Recognize the similarity and contrast between TCP/IP layers' protocols with IoT MAC/network layer protocols.

5.Identify the differences between MAC and network layer IoT standards.

6.Describe how IoT standards evolve.

7.Evaluate the performance of various IoT protocols.

8.Design new protocols for IoT communications.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

In this course the student will have to show

(a) an ability to apply knowledge of mathematics, science, and engineering (N/A)

(b) an ability to design and conduct experiments (simulations), as well as to analyze, interpret data (N/A)
(c) an ability to design a system, component, or process to meet desired needs (N/A)
(d) an ability to function in multi-disciplinary teams (N/A)
(e) an ability to identify, formulate, and solve engineering problems (homework) (N/A)
(f) an understanding of professional and ethical responsibility (N/A)
(g) an ability to communicate effectively (through project reports) (N/A)
(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context (N/A)
(i) a recognition of the need, and an ability to engage in life-long learning (N/A)
(j) a knowledge of contemporary issues (N/A)
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (N/A)
(l) a knowledge of probability and statistics (N/A)

Brief list of the topics to be covered

1.Introduction to TCP/IP
2.Wireless Challenges
3.Radio Devices for IoT
4.MAC Layer protocols for IoT
5.Zigbee Specifications
6.Bluetooth Specification
7.Wireless HART
8.Routing protocols for IoT
9.6LowPAN Specifications
10.RPL Specifications
11.Cellular options for IoT
12.LoRA Alliance
13.Narrow Band LTE

GRADING:

Course Requirements	Weight
Topic Presentation	10%
Assignments	20%
Term Project	20%
Tests	32%
Final Exams	18%
Overall Grade	100%

Conversion of Numerical Grade to Letter Grad

95<= A <=100	83 <= B< 87	70<= C < 77
90<= A- < 95	80<= B-< 83	60 <= D < 70
87 <= B+ < 90	77<= C+ < 80	F: Below 60