Carleton University
Department of Systems and Computer Engineering
SYSC 5801 The Internet of Things
Winter 2022

Instructor Information and Office hours

Professor Mohamed Ibnkahla

Office Room ME4484

520-2600 ext. 3224

mohamed.ibnkahla@carleton.ca

Office hours: TBD

Course Number and Calendar Description

SYSC 5801 Advanced topics in Computer Communications – The Internet of Things

This course presents the main concepts of the Internet of Things (IoT) ranging from the physical layer and medium access to the applications and standards. The following topics will be included in the course: Review of the basic principles of computer networks and the layered protocol stack; Internet of Things reference architecture; Sensor integration and sensor platform design; Physical layer challenges and channel propagation models; Medium access and mobility support; IoT networking; Ad hoc and infrastructure less networks; Data analytics for IoT; Cloud and Fog computing for IoT; IoT security; IoT standards; Applications include: Smart cities, intelligent transportation systems, smart grid, and supply chain.

Course Objectives

- To understand the fundamental concepts and challenges of IoT systems
- To develop an in-depth knowledge of IoT protocol stack and reference architecture
- To understand the main requirements of physical layer, networking, computing, analytics and security in IoT systems
- To be exposed to the main IoT standards and applications

Learning Outcomes

- Develop a good understanding of the main concepts and challenges IoT systems
- Know the IoT protocol stack and reference architecture
- Learn the different design requirements of the physical, networking, computing and analytics layers of IoT systems
- Understand the main IoT standards and business models
- Develop a good knowledge of key IoT applications
- Understand the security issues in IoT systems

Textbooks (suggested)

- J. Holler, V. Tsiatsis, C. Mulligan, S. Karnouskos, S. Avesabd and D. Boyle, *From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence*, Academic Press, 2014.
- Recent IEEE papers and surveys in the field.

Evaluation and Grading Scheme

- Final exam: 50% of the final mark
- Project: 50% of the final mark
- Project mark: 50% of the project mark will be on the report and 50% on the oral presentation/demo. The oral presentation/demo mark will take in account the weekly progress discussions.

Breakdown of course requirements

Class attendance and participation are required.

The project is achieved in groups of 2-3. Students will choose the topic for their project from the professor's list of projects with the approval of the professor. Weekly discussions will take place in class where the groups present their weekly project progress. The students are required to use a ppt presentation to present their weekly progress.

Students will provide a written report in MS Word format. All report figures have to be original and saved also in ppt format. The report should follow a typical IEEE Journal paper style. The students will make an oral presentation in class. The presentation should be in ppt. All files (MS Word report, ppt figures, and ppt presentation) have to be uploaded to the course website at least 3 days prior to the oral presentation.

Week-by-Week breakdown

1	**Course outline and expectations** **Introduction – Challenges and Trends of the Internet of Things**
2	**Review of computer networks**
3	**IoT system reference architecture**
4	**IoT devices and sensor integration**
5	**Physical layer challenges and channel models**
6	**Medium access and mobility support**
7-8	**IoT networking, ad hoc and infrastructureless networks**
9	**Security and data analytics for IoT**

10	**Cloud and Fog computing for IoT**
11	**IoT standards**
12	**IoT services and business models**
13	**IoT applications**

General Regulations

Student Responsibility: It is the student's responsibility to remain informed of all rules, regulations and procedures required by their program and by the Faculty of Graduate and Postdoctoral Affairs. Ignorance of regulations will not be accepted as a justification for waiving such regulations and procedures.

Academic Integrity: Students should be aware of their obligations with regards to academic integrity. Please review the information about academic integrity at: https://carleton.ca/registrar/academic-integrity/. This site also contains a link to the complete Academic Integrity Policy that was approved by the University's Senate.

Plagiarism: Plagiarism (copying and handing in for credit someone else's work) is a serious instructional offense that will not be tolerated.

Deferred Term Work : Students who claim illness, injury or other extraordinary circumstances beyond their control as a reason for missed term work are held responsible for immediately informing the instructor concerned and for making alternate arrangements with the instructor and in all cases this must occur no later than three (3.0) working days after the term work was due. The alternate arrangement must be made before the last day of classes in the term as published in the academic schedule. For more information, see the current *Graduate Calendar, Academic Regulations of the University, Section 9.3.*

Academic Accommodation: You may need special arrangements to meet your academic obligations during the term. You can visit the Equity Services website to view the policies and to obtain more detailed information on academic accommodation at http://www.carleton.ca/equity/For an accommodation request, the processes are as follows:

- **Pregnancy obligation**: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details see https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf
- **Religious obligation**: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is

known to exist. For more details see https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

- **Academic Accommodations for Students with Disabilities**: The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult https://carleton.ca/pmc/students/dates-and-deadlines/ for the deadline to request accommodations for the formally-scheduled exam (if applicable).

- **Survivors of Sexual Violence:** As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: https://carleton.ca/sexual-violence-support/.

- **Accommodation for Student Activities:** Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf

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Students from the University of Ottawa: You can request to have access to Brightspace: please see http://gradstudents.carleton.ca/forms-policies/