Course Overview
There is a buzz surrounding the internet of things and they say it’s going to make everything in our lives “smart”. The current prediction is that there will be 7 trillion wireless devices for 7 billion people by 2020. Therefore, over the last decade or so, there is a research shift to cope with and facilitate this phenomena. This research shift is from the communication protocols to addressing to architecture to societal impact to privacy/security issues to behavioral changes. This course looks at this phenomena as the general theme of physical/real-world things. Particularly, this course provides a comprehensive understanding of the IoT by (i) looking at a variety of real-world application scenarios, (ii) looking at the variety of existing and new technologies and architectural principles, (iii) looking at some communication protocols and standardization efforts, (iv) looking at the societal impact, behavioral changes, and business models, and finally (v) giving students the opportunity to apply these technologies to tackle some of the real-world problems.

Course Website: blackboard (https://learn.kent.edu/)

Course Topics
1. **Internet of Things**: introduction, characteristics, architecture, evolution, application scenarios, vision, scalability, current solutions, issues, players, research and future challenges, IoC to IoT
2. **Enabling technologies**: RFID, Cellular networks, WLAN, Wireless (ZigBee, NFC, Wireless Hart), WIMAX, Sensor Networks, Mobile and smart phones, robotics, Energy Harvesting, big data and cloud
3. **IoT Architectures**: Layered Architecture, SOA (Service Oriented Architecture), middlewares
4. **IPv6**: introduction, features, packet structure and processing, address architecture, unicast, multicast, and anycast, deployment, IPv6 vs IPv4, interoperability with IPv4
5. **ICMPv6**: introduction, functionalities, neighbor discovery protocol, address autoconfiguration, ICMPv6 vs ICMPv4
6. **IP for smart objects**: motivation and main challenges, smart object architectural considerations

7. Low power and lossy networks (LLN), IEEE 802.15.4

8. **6LoWPAN**: introduction, architecture, issues, IPv6 addressing in 6LoWPAN, 6LoWPAN forwarding: route-over and mesh-under approaches, neighbor discovery

9. **RPL** (the IPv6 Routing Protocol for LLNs): introduction, routing metrics and constraints, topology maintenance, DODAG formation, the trickle algorithm, loop detection and avoidance

10. **CoAP** (the Constrained Application Protocol): introduction, features, packet format, proxying, service and resource discovery. MQTT protocol for machine-to-machine communications

11. Contiki (the open source OS for IoT) and Cooja (the contiki network simulator), TinyOS for IoT

12. Interoperable data encoding, XML, XML Schema, JSON

13. **Web services**: SOAP (Simple Object Access Protocol) and WSDL (Web Service Definition Language), RESTful web services and applications for networked embedded systems

14. **Standardization efforts**: M2M, ROLL, GRIFS, EPCglobal, 6LoWPAN

15. **IoT standards**: the oneM2M standard, OMA LightWeight M2M (LWM2M). Building the environment for the Things-as-a-service

16. Security/Privacy Issues

17. IoT Societal Impact, persuasive technologies and behavioral change

18. Business cases, concepts, issues, and models for IoT

**Prerequisites**

It is desirable for the students to be familiar with C, C++, Java programming (mainly sequential programming) and computer, sensor, wireless, and embedded networks.

**Materials for the Course**

The main study material used in this course is presentation slides, which will be provided to students. For each lecture, the instructor will also provide relevant articles, books, surveys, or conference papers available in the literature. Particularly, students are expected to look at the “required reading” and “recommended reading” material related to the topics provided before/after each lecture on the topics.

**Course Delivery**

We meet remotely through Blackboard Collaborate Ultra, both for lectures and office hours. We will have synchronous lectures on the lecture hours. The lectures will be recorded by the instructor and uploaded in blackboard course page as asynchronous lectures. Students are encouraged to attend synchronous lectures.

**Evaluation and grading**

Project + Report + Demo 25%
Class presentations + Paper reviews + Presentation slides 25%
Midterm Exam 25%  
Final Exam 25%  

Midterm Exam date/time: 11:00am-12:15pm, Tuesday, March 23, 2021  
Final Exam date/time: 12:45pm – 3:00pm, Monday, May 10, 2021  
Midterm/Final Exam Room: Through Blackboard Collaborate Ultra


Grades will be published in Blackboard which can be accessed through your FlashLine account.

Late submissions will not be graded. There will be no makeup exams. Any modification in the syllabus will be announced in class.

**Project, Project Report, and Project Demo**

Students must work on a project on a topic relevant to the course. The project work will be in a *group of* 3-5 students. Sample project topics will be provided to students; students are encouraged to come up with the project ideas in their own. The project on the new topics that are not dealt before are particularly encouraged. Students need to write a report on the project work. The report should follow IEEE conference paper format and should be 6-8 pages long. The report must include:

- Title and Student Names
- Abstract
- Introduction
- Literature review
- Model and methodologies
- Algorithm (if designed one) and its analysis for time and memory requirements
- Experimental setting, evaluations, and findings
- Conclusions, open problems, and other issues

Students will also demo the project completed in this course. The projects with potentials (if any) will be invited to participate in university-wide exhibitions and showcases.

**Paper Presentation, Presentation Slides, and Reviews**

Students must prepare several class presentations on different topics relevant to the course. The class presentations will be *individual*– each student needs to make a presentation. Presentations will be generally 15-30 minutes long although this may change depending on what kind of topic the presentation focuses on. Sample topics and relevant articles and conference papers will be provided to students. The presentation must include:

- The problem considered by the work(s)
- The motivation behind the work(s)
- The key technique used by the work(s)
- The results and key findings of the work(s)
- The evaluation of the work(s) including shortcomings
Open problems and issues

Students are encouraged to show their presentations to the instructor before the actual presentation in class, but this is not mandatory to encourage students to judge the quality of their presentation on their own.

Students must also prepare reviews for a couple of papers related to different topics and will be evaluated towards the final grade of this course. Students should email the reviews of papers to instructor. The reviews should be done by the students *individually*. A sample list of papers for review will be provided to students. Students can go beyond the list if they wish and prepare the review but they are encouraged to consult the instructor first about the paper for which they will prepare a review.

The review should include
- Student’s name
- The title of the paper
- Brief summary of the paper (4-5 sentences)
- Strength and weaknesses of the paper (2-3 most important, one sentence each)
- Open problems and whether they have been addressed later

**Academic Requirements**

**Registration:** Students must officially register for the course to receive credit for this course. It is student’s responsibility to confirm enrollment to this course by checking his/her class schedule. Registrar’s calendar at [http://www.kent.edu/registrar/spring-important-dates](http://www.kent.edu/registrar/spring-important-dates) for official dates.

**Students with disability:** University policy 3342-3-01.3 requires that students with disabilities be provided reasonable accommodations to ensure their equal access to course content. If you have a documented disability and require accommodations, please contact the instructor at the beginning of the semester to make arrangements for necessary classroom adjustments. Please note, you must first verify your eligibility for these through Student Accessibility Services (contact 330-672-3391 or visit [www.kent.edu/sas](http://www.kent.edu/sas)) for more information on registration procedures.

**Academic integrity:** Cheating and plagiarism of any kind will not be tolerated and handled according to the Honor code set by the University policy. All written work submitted for evaluation must be done by the student whose name appears on the submission, unless explicitly indicated otherwise in the assignment. Regarding cooperation with other students, students are encouraged to discuss with other students the assignment and other related problems for this course, but the submission must contain student's own solutions. Students are also encouraged to meet their instructor to discuss assignment problems and questions. Any deviation from these guidelines will again be handled as per the University policy. The policy details can be found at [http://www.kent.edu/studentconduct/academic-misconduct](http://www.kent.edu/studentconduct/academic-misconduct), [http://www.kent.edu/studentconduct/code-student-conduct](http://www.kent.edu/studentconduct/code-student-conduct), and [http://www.kent.edu/cs/academic-dishonesty](http://www.kent.edu/cs/academic-dishonesty).
COVID-19: Students please refer this page for things you need to know https://www.kent.edu/coronavirus/flashes-safe-seven. Please also read this link for other related information: https://www.kent.edu/provost/guidance-syllabus-content-address-impact-covid-19-instruction